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6113

DIGITAL RADIO TEST SET

Volume 2 Operator Manual

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AMENDMENT RECORD

Incorporation of amendments to this manual should be recorded on this page

Amendment No.	Incorporated by	Date	Amendment No.	Incorporated By	Date
1			23		
2			24		
3			25		
4			26		
5			27		
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7			29		
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SOFTWARE COMPATIBILITY

This manual contains information compatible with Software Release version 03.01.

SAFETY PRECAUTIONS

SYMBOLS AND HEADINGS

The following symbols and headings are used in this handbook to indicate Safety hazards. Personnel using this equipment must read this handbook and familiarize themselves with each safety requirement <u>before</u> operating the equipment.

<u>WARNING</u>: A WARNING indicates a hazard that affects personnel. The instructions in a WARNING <u>must</u> be observed; if the WARNING is ignored, injury or loss of life may result.

CAUTION: A CAUTION indicates a hazard that affects the equipment. The instructions in a CAUTION <u>must</u> be observed; if the CAUTION is ignored, damage may be caused to the equipment.

This symbol is used on the equipment to indicate that it is necessary to refer to, and comply with, all instructions in this handbook regarding the use of such marked facilities.

GENERAL SAFETY PRECAUTIONS

<u>WARNING</u>:

(1) **THIS IS A SAFETY CLASS 1 PRODUCT PROVIDED WITH A PROTECTIVE EARTHING CONDUCTOR INCORPORATED IN THE POWER CABLE. THE MAINS PLUG MUST ONLY BE INSERTED IN A MAINS SOCKET OUTLET PROVIDED WITH A MATCHING EARTH CONTACT. ANY INTERRUPTION OF THE EARTH CONDUCTOR, INSIDE OR OUTSIDE THE TEST SET, IS LIKELY TO CAUSE THE TEST SET TO BECOME DANGEROUS TO PERSONNEL. DELIBERATE INTERRUPTION OF THE EARTH CONDUCTOR IS FORBIDDEN.**

(2) **THE ENVIRONMENTAL OPERATING CONDITIONS SPECIFIED FOR THE EQUIPMENT MUST BE OBSERVED. DO NOT ALLOW THE EQUIPMENT TO BECOME WET, AND DO NOT ALLOW WATER TO ENTER THE EQUIPMENT. DO NOT OPERATE THE EQUIPMENT WHEN WET BECAUSE IN THIS CONDITION THE SAFETY OF THE EQUIPMENT MAY BE DEGRADED.**

(3) **THIS EQUIPMENT CONTAINS LETHAL VOLTAGES. DO NOT REMOVE THE COVERS. RETURN THE EQUIPMENT TO RACAL INSTRUMENTS LTD OR APPROVED SERVICE AGENT FOR SERVICING.**

(4) **THIS EQUIPMENT MUST BE KEPT CLEAN AND FREE FROM CONTAMINATION. IF NECESSARY, CLEAN THE EQUIPMENT AS DESCRIBED IN THIS HANDBOOK. IF THE EQUIPMENT IS SEVERELY CONTAMINATED, IT SHOULD BE RETURNED TO RACAL INSTRUMENTS LTD OR APPROVED SERVICE AGENT.**

(5) ANY DEVIATION FROM THE INSTRUCTIONS PROVIDED IN THIS HANDBOOK MAY CAUSE THE PROTECTION PROVIDED BY THE EQUIPMENT TO BE IMPAIRED.

(6) THE MAINS FUSES MUST BE REPLACED ONLY WITH THE SAME TYPE AND RATING (SEE SECTION 3). THE USE OF OTHER FUSES OR MATERIAL MAY CAUSE A FIRE HAZARD AND IS FORBIDDEN.

(7) SOME TYPES OF BTS CAN GENERATE RF POWER LEVELS THAT ARE SUFFICIENT TO CAUSE INJURY TO PERSONNEL. ALWAYS ENSURE THAT THE RF OUTPUT IS DISABLED BEFORE CONNECTING OR DISCONNECTING RF CABLES. NEVER USE DAMAGED RF CABLES ON THE RF PORTS.

(8) IN CERTAIN TESTS, THE BTS CAN BE LEFT IN A STATE IN WHICH IT WILL CONTINUE TO TRANSMIT UNTIL THE THE TEST IS ABORTED BY THE OPERATOR. ALL DUE ATTENTION MUST BE PAID TO ENSURING THAT THE TEST IS STOPPED AT AN APPROPRIATE TIME AND THAT THE BTS HAS STOPPED TRANSMITTING.

(9) WHEN CARRYING OUT LIVE TESTING ON A BTS USING A 6113 WITH OPTION 54, IT IS IMPORTANT THAT A SAFE CONNECTION POINT FOR THE 6113 IS PROVIDED. THIS IS PARTICULARLY IMPORTANT WHERE THERE IS A THREAT OF LIGHTNING STRIKING THE SYSTEM UNDER TEST. IT IS THE USER'S RESPONSIBILITY TO PROVIDE THE NECESSARY SAFE CONNECTION POINT.

CAUTION: DO NOT OBSTRUCT THE AIR INLET TO THE FAN, OR THE AIR OUTLETS IN THE SIDE PANELS, IN ANY WAY. RESTRICTING THE FLOW OF AIR COULD CAUSE THE TEST SET TO OVERHEAT AND MAY CAUSE DAMAGE.

SAFETY

Always operate the product in accordance with the instructions in this manual.

ELECTROMAGNETIC COMPATIBILITY (EMC)

To ensure that EMC integrity is retained always follow good EMC practice. In particular:

(1) Use good quality coaxial connections for signal input and output leads.

(2) Use good quality screened data or control cables and connectors.

(3) Ensure that cable screens are properly terminated within the connectors. Do not use cables if the terminations are loose or frayed.

(4) Ensure that the screening is continuous through to the chassis of the equipment.

(5) Ensure that any associated equipment is CE marked or is of good EMC design and performance.

ELECTROSTATIC DISCHARGE (ESD)

Electrostatic discharge may damage or degrade the performance of the Test Set if proper precautions are not taken:

(1) Where they are provided, protective covers must always be fitted on any rear panel connectors that are not in use (i.e. have no cable connected). Replacement protective covers are available from Racal Instruments Ltd or approved Service Agents.

(2) Before connecting free cables (i.e. not connected at either end) to any item of equipment, it is recommended that the cable connector pins are momentarily grounded to discharge any static build up within the cable.

DECLARATION OF CONFORMITY

Ser. No. CE 017

We:

Supplier's Name:	Racal Instruments Ltd.
Supplier's Address:	480 Bath Road Slough Berks. SL1 6BE

declare under our sole responsibility that the following product(s):

Product Name:	Digital Radio Test Set
Product Model Number(s):	6113
Product Options:	All

to which this declaration relates conform(s) with the following standard(s) or other normative document(s):

Safety:	EN 61010-1:1993
EMC:	EN55022:1988, Class B/BSEN 55022:1995, Class B
	IEC 801-2:1991/BSEN 60801-2:1993, 4kV CD, 8kV AD (performance criterion 2) IEC 801-3:1984/IEC 1000-4-3:1995 (performance criterion 2) IEC 801-4:1988/BSEN 61000-4-4:1995 (performance criterion 2) IEC 1000-4-5:1995 IEC 1000-4-11:1994

Supplementary Information:

The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (as amended by EMC Directive 92/31/EEC) and carry the CE mark accordingly. The products were tested in a typical configuration.

Name of Authorised Signatory:
(PRINT) K.J. HESTER

Professional Title of Signatory:
(PRINT) TECHNICAL DIRECTOR

Signature of Authorised Signatory:

Place and Date of Issue: Slough, Berks., England (town,county,country) 12/6/97 (date)

RIL 071C

GLOSSARY OF TERMS AND ABBREVIATIONS

A-bis	Control and data link between the BTS and the network.
ARFCN	**A**bsolute **RF C**hannel **N**umber. A number in the range 1 to 124, or 512 to 885, or 975 to 1023, which defines the absolute radio frequency channel number.
AGCH	**A**ccess **G**rant **CH**annel
BA	**B**CCH **A**llocation. The radio frequency channels allocated in a cell for BCCH transmission.
BBP	**B**ase**B**and **P**rocessor
BCC	**B**ase Station **C**olour **C**ode
BCCH	**B**roadcast **C**ontrol **CH**annel
BCCH_FREQ_NCELL	Frequency of the RF carrier on which the BCCH of a neighbouring cell is transmitted.
BER	**B**it **E**rror **R**atio
BNC	**B**ase Station **N**etwork **C**ode
B.O.S.S.	**B**ase Station **O**n-Air **S**ervice **S**ystem
BS_AG_BLKS_RES	The number of blocks on each common control channel reserved for access grant messages.
BSC	**B**ase **S**tation **C**ontroller
BSIC	**B**ase Transceiver **S**tation **I**dentity **C**ode
BS_PA_MFRMS	The number of multiframes between two transmissions of the same paging message to MSs of the same paging group.
BTS	**B**ase **T**ransceiver **S**tation
Burst	A period of modulated carrier less than one timeslot. The physical content of a timeslot.
CA	**C**ell **A**llocation. The radio frequency channels allocated to a particular cell
CAT	**C**ell **A**llocation **T**able
CBCH	**C**ell **B**roadcast **CH**annel
CCH	**C**ell **C**ontrol **C**hannel
CCCH	**C**ommon **C**ontrol **CH**annel
CCCH_GROUP	Group of MSs in idle mode.
CELL	Geographical area within which a defined set of channels is provided.
CELL_BAR_ACCESS	Cell access barred parameter.

CELL_RESELECT_HYSTERESIS	The RXLEV hysteresis required for cell reselection.
CI	Cell Identity
Class IA, IB, II	Classification of speech encoder bits depending on the degree of protection needed. Class IA and Class IB bits have protection; Class II bits have no protection. Error detection is performed on Class IA bits.
DAI	Digital Audio Interface
DTX	Discontinuous Transmission. Means of saving battery power (e.g. in HPUs) and reducing interference by automatically switching the transmitter off when no speech or data are to be sent.
EFR	Enhanced Full Rate (speech coding format)
EEPROM	Electrically Eraseable Programmable Read Only Memory
FACCH	Fast Associated Control CHannel
FCCH	Frequency Correction CHannel
FER	Frame Erasure Ratio
FTP	File Transfer Protocol
GMSK	Gaussian Minimum Shift Key
GPIB	General Purpose Interface Bus
GSM	Global System for Mobile communications
HPU	Hand Portable Unit
HSN	Hopping Sequence Number
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
LAC	Location Area Code
LAI	Location Area Identity
LAPB	Link Access Protocol B Channel
LAPD	Link Access Protocol D Channel
MAIO	Mobile Allocation Index Offset
MAT	Mobile Allocation Table
MCC	Mobile Country Code
MMI	Man Machine Interface
MNC	Mobile Network Code
MO	Mobile Originated

MS	Mobile Station
MS_TXPWR_MAX_CCH	Maximum allowed transmitted RF power for MSs to access the system until commanded otherwise.
MT	Mobile Terminated
NCC	Network Colour Code
PCH	Paging CHannel
PID	Protocol IDentifier
PIN	Personal Identification Number
PLMN	Public Land Mobile Network
PLMN_PERMITTED	PLMN permitted for handover purposes.
PPP	Point to Point Protocol
PUK	Pin Unblock Key
RACH	Random Access CHannel
RAND	RANDom number used during Authentication
RBER	Residual Bit Error Ratio
RXLEV	Received Signal LEVel parameter. A measure of the mean received signal level.
RXLEV_ACCESS_MIN	The minimum RXLEV at an MS for access to a cell.
SACCH	Slow Associated Control Channel
SACCH_TF	Slow Associated Control Channel - Traffic Full Rate
SAPI	Service Access Point Indicator
SDCCH	Stand Alone Dedicated Control CHannel
SCH	Synchronisation CHannel
SIM	Subscriber Identity Module
SMS	Short Message Service
TCH	Traffic CHannels. Channels that carry user speech or data.
TDMA	Time Division Multiple Access
TEI	Teminal Endpoint Identifier
TMSI	Temporary Mobile Subscriber Identity
TRF	TRaFfic

E-GSM CHART 1 -- DOWNLINK (Base Station To Mobile)

CHANNEL NUMBERS	DOWNLINK FREQUENCIES (MHz)				
0					935.000
1 - 5	935.200	935.400	935.600	935.800	936.000
6 - 10	936.200	936.400	936.600	936.800	937.000
11 - 15	937.200	937.400	937.600	937.800	938.000
16 - 20	938.200	938.400	938.600	938.800	939.000
21 - 25	939.200	939.400	939.600	939.800	940.000
26 - 30	940.200	940.400	940.600	940.800	941.000
31 - 35	941.200	941.400	941.600	941.800	942.000
36 - 40	942.200	942.400	942.600	942.800	943.000
41 - 45	943.200	943.400	943.600	943.800	944.000
46 - 50	944.200	944.400	944.600	944.800	945.000
51 - 55	945.200	945.400	945.600	945.800	946.000
56 - 60	946 200	946 400	946.600	946.800	947.000
61 - 65	947.200	947.400	947.600	947.800	948.000
66 - 70	948.200	948.400	948.600	948.800	949.000
71 - 75	949.200	949.400	949.600	949.800	950.000
76 - 80	950.200	950.400	950.600	950.800	951.000
81 - 85	951.200	951.400	951.600	951.800	952.000
86 - 90	952.200	952.400	952.600	952.800	953.000
91 - 95	953.200	953.400	953.600	953.800	954.000
96 - 100	954.200	954.400	954.600	954.800	955.000
101 - 105	955.200	955.400	955.600	955.800	956.000
106 - 110	956.200	956.400	956.600	956.800	957.000
111 - 115	957.200	957.400	957.600	957.800	958.000
116 - 120	958.200	958.400	958.600	958.800	959.000
121 - 124	959.200	959.400	959.600	959.800	
975 - 979	925.200	925.400	925.600	925.800	926.000
980 - 984	926.200	926.400	926.600	926.800	927.000
985 - 989	927.200	927.400	927.600	927.800	928.000
990 - 994	928.200	928.400	928.600	928.800	929.000
995 - 999	929.200	929.400	929.600	929.800	930.000
1000 - 1004	930.200	930.400	930.600	930.800	931.000
1005 - 1009	931.200	931.400	931.600	931.800	932.000
1010 - 1014	932.200	932.400	932.600	932.800	933.000
1015 - 1019	933.200	933.400	933.600	933.800	934.000
1020 - 1023	934.200	934.400	934.600	934.800	

E-GSM CHART 2 -- UPLINK (Mobile To Base Station)

CHANNEL NUMBERS	UPLINK FREQUENCIES (MHz)				
0					890.000
1 - 5	890.200	890.400	890.600	890.800	891.000
6 - 10	891.200	891.400	891.600	891.800	892.000
11 - 15	892.200	892.400	892.600	892.800	893.000
16 -20	893.200	893.400	893.600	893.800	894.000
21 - 25	894.200	894.400	894.600	894.800	895.000
26 - 30	895.200	895.400	895.600	895.800	896.000
31 - 35	896.200	896.400	896.600	896.800	897.000
36 - 40	897.200	897.400	897.600	897.800	898.000
41 - 45	898.200	898.400	898.600	898.800	899.000
46 - 50	899.200	899.400	899.600	899.800	900.000
51 - 55	900.200	900.400	900.600	900.800	901.000
56 - 60	901.200	901.400	901.600	901.800	902.000
61 - 65	902.200	902.400	902.600	902.800	903.000
66 - 70	903.200	903.400	903.600	903.800	904.000
71 - 75	904.200	904.400	904.600	904.800	905.000
76 - 80	905.200	905.400	905.600	905.800	906.000
81 - 85	906.200	906.400	906.600	906.800	907.000
86 - 90	907.200	907.400	907.600	907.800	908.000
91 - 95	908.200	908.400	908.600	908.800	909.000
96 - 100	909.200	909.400	909.600	909.800	910.000
101 - 105	910.200	910.400	910.600	910.800	911.000
106 - 110	911.200	911.400	911.600	911.800	912.000
111 - 115	912.200	912.400	912.600	912.800	913.000
116 - 120	913.200	913.400	913.600	913.800	914.000
121- 124	914.200	914.400	914.600	914.800	
975 - 979	880.200	880.400	880.600	880.800	881.000
980 - 984	881.200	881.400	881.600	881.800	882.000
985 - 989	882.200	882.400	882.600	882.800	883.000
990 -994	883.200	883.400	883.600	883.800	884.000
995 - 999	884.200	884.400	884.600	884.800	885.000
1000 - 1004	885.200	885.400	885.600	885.800	886.000
1005 - 1009	886.200	886.400	886.600	886.800	887.000
1010 - 1014	887.200	887.400	887.600	887.800	888.000
1015 - 1019	888.200	888.400	888.600	888.800	889.000
1020 - 1023	889.200	889.400	889.600	889.800	

DCS 1800 CHART 1 -- DOWNLINK (Base Station To Mobile)

CHANNEL NUMBERS	DOWNLINK FREQUENCIES (MHz)				
512 - 515		1805.2	1805.4	1805.6	1805.8
516 - 520	1806.0	1806.2	1806.4	1806.6	1806.8
521 - 525	1807.0	1807.2	1807.4	1807.6	1807.8
526 - 530	1808.0	1808.2	1808.4	1808.6	1808.8
531 - 535	1809.0	1809.2	1809.4	1809.6	1809.8
536 - 540	1810.0	1810.2	1810.4	1810.6	1810.8
541 - 545	1811.0	1811.2	1811.4	1811.6	1811.8
546 - 550	1812.0	1812.2	1812.4	1812.6	1812.8
551 - 555	1813.0	1813.2	1813.4	1813.6	1813.8
556 - 560	1814.0	1814.2	1814.4	1814.6	1814.8
561 - 565	1815.0	1815.2	1815.4	1815.6	1815.8
566 - 570	1816.0	1816.2	1816.4	1816.6	1816.8
571 - 575	1817.0	1817.2	1817.4	1817.6	1817.8
576 - 580	1818.0	1818.2	1818.4	1818.6	1818.8
581 - 585	1819.0	1819.2	1819.4	1819.6	1819.8
586 - 590	1820.0	1820.2	1820.4	1820.6	1820.8
591 - 595	1821.0	1821.2	1821.4	1821.6	1821.8
596 - 600	1822.0	1822.2	1822.4	1822.6	1822.8
601 - 605	1823.0	1823.2	1823.4	1823.6	1823.8
606 - 610	1824.0	1824.2	1824.4	1824.6	1824.8
611 - 615	1825.0	1825.2	1825.4	1825.6	1825.8
616 - 620	1826.0	1826.2	1826.4	1826.6	1826.8
621 - 625	1827.0	1827.2	1827.4	1827.6	1827.8
626 - 630	1828.0	1828.2	1828.4	1828.6	1828.8
631 - 635	1829.0	1829.2	1829.4	1829.6	1829.8
636 - 640	1830.0	1830.2	1830.4	1830.6	1830.8
641 - 645	1831.0	1831.2	1831.4	1831.6	1831.8
646 - 650	1832.0	1832.2	1832.4	1832.6	1832.8
651 - 655	1833.0	1833.2	1833.4	1833.6	1833.8
656 - 660	1834.0	1834.2	1834.4	1834.6	1834.8
661 - 665	1835.0	1835.2	1835.4	1835.6	1835.8
666 - 670	1836.0	1836.2	1836.4	1836.6	1836.8
671 - 675	1837.0	1837.2	1837.4	1837.6	1837.8
676 - 680	1838.0	1838.2	1838.4	1838.6	1838.8
681 - 685	1839.0	1839.2	1839.4	1839.6	1839.8
686 - 690	1840.0	1840.2	1840.4	1840.6	1840.8
691 - 695	1841.0	1841.2	1841.4	1841.6	1841.8
696 - 700	1842.0	1842.2	1842.4	1842.6	1842.8
701 - 705	1843.0	1843.2	1843.4	1843.6	1843.8
706 - 710	1844.0	1844.2	1844.4	1844.6	1844.8

DCS 1800 CHART 2 -- DOWNLINK (Base Station To Mobile)(continued)

CHANNEL NUMBERS	DOWNLINK FREQUENCIES (MHz)				
711 - 715	1845.0	1845.2	1845.4	1845.6	1845.8
716 - 720	1846.0	1846.2	1846.4	1846.6	1846.8
721 - 725	1847.0	1847.2	1847.4	1847.6	1847.8
726 - 730	1848.0	1848.2	1848.4	1848.6	1848.8
731 - 735	1849.0	1849.2	1849.4	1849.6	1849.8
736 - 740	1850.0	1850.2	1850.4	1850.6	1850.8
741 - 745	1851.0	1851.2	1851.4	1851.6	1851.8
746 - 750	1852.0	1852.2	1852.4	1852.6	1852.8
751 - 755	1853.0	1853.2	1853.4	1853.6	1853.8
756 - 760	1854.0	1854.2	1854.4	1854.6	1854.8
761 - 765	1855.0	1855.2	1855.4	1855.6	1855.8
766 - 770	1856.0	1856.2	1856.4	1856.6	1856.8
771 - 775	1857.0	1857.2	1857.4	1857.6	1857.8
776 - 780	1858.0	1858.2	1858.4	1858.6	1858.8
781 - 785	1859.0	1859.2	1859.4	1859.6	1859.8
786 - 790	1860.0	1860.2	1860.4	1860.6	1860.8
791 - 795	1861.0	1861.2	1861.4	1861.6	1861.8
796 - 800	1862.0	1862.2	1862.4	1862.6	1862.8
801 - 805	1863.0	1863.2	1863.4	1863.6	1863.8
806 - 810	1864.0	1864.2	1864.4	1864.6	1864.8
811 - 815	1865.0	1865.2	1865.4	1865.6	1865.8
816 - 820	1866.0	1866.2	1866.4	1866.6	1866.8
821 - 825	1867.0	1867.2	1867.4	1867.6	1867.8
826 - 830	1868.0	1868.2	1868.4	1868.6	1868.8
831 - 835	1869.0	1869.2	1869.4	1869.6	1869.8
836 - 840	1870.0	1870.2	1870.4	1870.6	1870.8
841 - 845	1871.0	1871.2	1871.4	1871.6	1871.8
846 - 850	1872.0	1872.2	1872.4	1872.6	1872.8
851 - 855	1873.0	1873.2	1873.4	1873.6	1873.8
856 - 860	1874.0	1874.2	1874.4	1874.6	1874.8
861 - 865	1875.0	1875.2	1875.4	1875.6	1875.8
866 - 870	1876.0	1876.2	1876.4	1876.6	1876.8
871 - 875	1877.0	1877.2	1877.4	1877.6	1877.8
876 - 880	1878.0	1878.2	1878.4	1878.6	1878.8
881 - 885	1879.0	1879.2	1879.4	1879.6	1879.8

DCS 1800 CHART 3 – UPLINK (Mobile to Base Station)

CHANNEL NUMBERS	UPLINK FREQUENCIES (MHz)				
512 - 515		1710.2	1710.4	1710.6	1710.8
516 - 520	1711.0	1711.2	1711.4	1711.6	1711.8
521 - 525	1712.0	1712.2	1712.4	1712.6	1712.8
526 - 530	1713.0	1713.2	1713.4	1713.6	1713.8
531 - 535	1714.0	1714.2	1714.4	1714.6	1714.8
536 - 540	1715.0	1715.2	1715.4	1715.6	1715.8
541 - 545	1716.0	1716.2	1716.4	1716.6	1716.8
546 - 550	1717.0	1717.2	1717.4	1717.6	1717.8
551 - 555	1718.0	1718.2	1718.4	1718.6	1718.8
556 - 560	1719.0	1719.2	1719.4	1719.6	1719.8
561 - 565	1720.0	1720.2	1720.4	1720.6	1720.8
566 - 570	1721.0	1721.2	1721.4	1721.6	1721.8
571 - 575	1722.0	1722.2	1722.4	1722.6	1722.8
576 - 580	1723.0	1723.2	1723.4	1723.6	1723.8
581 - 585	1724.0	1724.2	1724.4	1724.6	1724.8
586 - 590	1725.0	1725.2	1725.4	1725.6	1725.8
591 - 595	1726.0	1726.2	1726.4	1726.6	1726.8
596 - 600	1727.0	1727.2	1727.4	1727.6	1727.8
601 - 605	1728.0	1728.2	1728.4	1728.6	1728.8
606 - 610	1729.0	1729.2	1729.4	1729.6	1729.8
611 - 615	1730.0	1730.2	1730.4	1730.6	1730.8
616 - 620	1731.0	1731.2	1731.4	1731.6	1731.8
621 - 625	1732.0	1732.2	1732.4	1732.6	1732.8
626 - 630	1733.0	1733.2	1733.4	1733.6	1733.8
631 - 635	1734.0	1734.2	1734.4	1734.6	1734.8
636 - 640	1735.0	1735.2	1735.4	1735.6	1735.8
641 - 645	1736.0	1736.2	1736.4	1736.6	1736.8
646 - 650	1737.0	1737.2	1737.4	1737.6	1737.8
651 - 655	1738.0	1738.2	1738.4	1738.6	1738.8
656 - 660	1739.0	1739.2	1739.4	1739.6	1739.8
661 - 665	1740.0	1740.2	1740.4	1740.6	1740.8
666 - 670	1741.0	1741.2	1741.4	1741.6	1741.8
671 - 675	1742.0	1742.2	1742.4	1742.6	1742.8
676 - 680	1743.0	1743.2	1743.4	1743.6	1743.8
681 - 685	1744.0	1744.2	1744.4	1744.6	1744.8
686 - 690	1745.0	1745.2	1745.4	1745.6	1745.8
691 - 695	1746.0	1746.2	1746.4	1746.6	1746.8
696 - 700	1747.0	1747.2	1747.4	1747.6	1747.8
701 - 705	1748.0	1748.2	1748.4	1748.6	1748.8
706 - 710	1749.0	1749.2	1749.4	1749.6	1749.8

DCS 1800 CHART 4 -- UPLINK (Mobile to Base Station)(continued)

CHANNEL NUMBERS	UPLINK FREQUENCIES (MHz)				
711 - 715	1750.0	1750.2	1750.4	1750.6	1750.8
716 - 720	1751.0	1751.2	1751.4	1751.6	1751.8
721 - 725	1752.0	1752.2	1752.4	1752.6	1752.8
726 - 730	1753.0	1753.2	1753.4	1753.6	1753.8
731 - 735	1754.0	1754.2	1754.4	1754.6	1754.8
736 - 740	1755.0	1755.2	1755.4	1755.6	1755.8
741 - 745	1756.0	1756.2	1756.4	1756.6	1756.8
746 - 750	1757.0	1757.2	1757.4	1757.6	1757.8
751 - 755	1758.0	1758.2	1758.4	1758.6	1758.8
756 - 760	1759.0	1759.2	1759.4	1759.6	1759.8
761 - 765	1760.0	1760.2	1760.4	1760.6	1760.8
766 - 770	1761.0	1761.2	1761.4	1761.6	1761.8
771 - 775	1762.0	1762.2	1762.4	1762.6	1762.8
776 - 780	1763.0	1763.2	1763.4	1763.6	1763.8
781 - 785	1764.0	1764.2	1764.4	1764.6	1764.8
786 - 790	1765.0	1765.2	1765.4	1765.6	1765.8
791 - 795	1766.0	1766.2	1766.4	1766.6	1766.8
796 - 800	1767.0	1767.2	1767.4	1767.6	1767.8
801 - 805	1768.0	1768.2	1768.4	1768.6	1768.8
806 - 810	1769.0	1769.2	1769.4	1769.6	1769.8
811 - 815	1770.0	1770.2	1770.4	1770.6	1770.8
816 - 820	1771.0	1771.2	1771.4	1771.6	1771.8
821 - 825	1772.0	1772.2	1772.4	1772.6	1772.8
826 - 830	1773.0	1773.2	1773.4	1773.6	1773.8
831 - 835	1774.0	1774.2	1774.4	1774.6	1774.8
836 - 840	1775.0	1775.2	1775.4	1775.6	1775.8
841 - 845	1776.0	1776.2	1776.4	1776.6	1776.8
846 - 850	1777.0	1777.2	1777.4	1777.6	1777.8
851 - 855	1778.0	1778.2	1778.4	1778.6	1778.8
856 - 860	1779.0	1779.2	1779.4	1779.6	1779.8
861 - 865	1780.0	1780.2	1780.4	1780.6	1780.8
866 - 870	1781.0	1781.2	1781.4	1781.6	1781.8
871 - 875	1782.0	1782.2	1782.4	1782.6	1782.8
876 - 880	1783.0	1783.2	1783.4	1783.6	1783.8
881 - 885	1784.0	1784.2	1784.4	1784.6	1784.8

PCS 1900 CHART 1 -- DOWNLINK (Base Station To Mobile)

CHANNEL NUMBERS	DOWNLINK FREQUENCIES (MHz)				
512 - 515		1930.2	1930.4	1930.6	1930.8
516 - 520	1931.0	1931.2	1931.4	1931.6	1931.8
521 - 525	1932.0	1932.2	1932.4	1932.6	1932.8
526 - 530	1933.0	1933.2	1933.4	1933.6	1933.8
531 - 535	1934.0	1934.2	1934.4	1934.6	1934.8
536 - 540	1935.0	1935.2	1935.4	1935.6	1935.8
541 - 545	1936.0	1936.2	1936.4	1936.6	1936.8
546 - 550	1937.0	1937.2	1937.4	1937.6	1937.8
551 - 555	1938.0	1938.2	1938.4	1938.6	1938.8
556 - 560	1939.0	1939.2	1939.4	1939.6	1939.8
561 - 565	1940.0	1940.2	1940.4	1940.6	1940.8
566 - 570	1941.0	1941.2	1941.4	1941.6	1941.8
571 - 575	1942.0	1942.2	1942.4	1942.6	1942.8
576 - 580	1943.0	1943.2	1943.4	1943.6	1943.8
581 - 585	1944.0	1944.2	1944.4	1944.6	1944.8
586 - 590	1945.0	1945.2	1945.4	1945.6	1945.8
591 - 595	1946.0	1946.2	1946.4	1946.6	1946.8
596 - 600	1947.0	1947.2	1947.4	1947.6	1947.8
601 - 605	1948.0	1948.2	1948.4	1948.6	1948.8
606 - 610	1949.0	1949.2	1949.4	1949.6	1949.8
611 - 615	1950.0	1950.2	1950.4	1950.6	1950.8
616 - 620	1951.0	1951.2	1951.4	1951.6	1951.8
621 - 625	1952.0	1952.2	1952.4	1952.6	1952.8
626 - 630	1953.0	1953.2	1953.4	1953.6	1953.8
631 - 635	1954.0	1954.2	1954.4	1954.6	1954.8
636 - 640	1955.0	1955.2	1955.4	1955.6	1955.8
641 - 645	1956.0	1956.2	1956.4	1956.6	1956.8
646 - 650	1957.0	1957.2	1957.4	1957.6	1957.8
651 - 655	1958.0	1958.2	1958.4	1958.6	1958.8
656 - 660	1959.0	1959.2	1959.4	1959.6	1959.8
661 - 665	1960.0	1960.2	1960.4	1960.6	1960.8
666 - 670	1961.0	1961.2	1961.4	1961.6	1961.8
671 - 675	1962.0	1962.2	1962.4	1962.6	1962.8
676 - 680	1963.0	1963.2	1963.4	1963.6	1963.8
681 - 685	1964.0	1964.2	1964.4	1964.6	1964.8
686 - 690	1965.0	1965.2	1965.4	1965.6	1965.8
691 - 695	1966.0	1966.2	1966.4	1966.6	1966.8
696 - 700	1967.0	1967.2	1967.4	1967.6	1967.8
701 - 705	1968.0	1968.2	1968.4	1968.6	1968.8
706 - 710	1969.0	1969.2	1969.4	1969.6	1969.8

PCS 1900 CHART 2 -- DOWNLINK (Base Station To Mobile) (continued)

CHANNEL NUMBERS	DOWNLINK FREQUENCIES (MHz)				
711 - 715	1970.0	1970.2	1970.4	1970.6	1970.8
716 - 720	1971.0	1971.2	1971.4	1971.6	1971.8
721 - 725	1972.0	1972.2	1972.4	1972.6	1972.8
726 - 730	1973.0	1973.2	1973.4	1973.6	1973.8
731 - 735	1974.0	1974.2	1974.4	1974.6	1974.8
736 - 740	1975.0	1975.2	1975.4	1975.6	1975.8
741 - 745	1976.0	1976.2	1976.4	1976.6	1976.8
746 - 750	1977.0	1977.2	1977.4	1977.6	1977.8
751 - 755	1978.0	1978.2	1978.4	1978.6	1978.8
756 - 760	1979.0	1979.2	1979.4	1979.6	1979.8
761 - 765	1980.0	1980.2	1980.4	1980.6	1980.8
766 - 770	1981.0	1981.2	1981.4	1981.6	1981.8
771 - 775	1982.0	1982.2	1982.4	1982.6	1982.8
776 - 780	1983.0	1983.2	1983.4	1983.6	1983.8
781 - 785	1984.0	1984.2	1984.4	1984.6	1984.8
786 - 790	1985.0	1985.2	1985.4	1985.6	1985.8
791 - 795	1986.0	1986.2	1986.4	1986.6	1986.8
796 - 800	1987.0	1987.2	1987.4	1987.6	1987.8
801 - 805	1988.0	1988.2	1988.4	1988.6	1988.8
806 - 810	1989.0	1989.2	1989.4	1989.6	1989.8

PCS 1900 CHART 3 -- UPLINK (Mobile to Base Station)

CHANNEL NUMBERS	UPLINK FREQUENCIES (MHz)				
512 - 515		1850.2	1850.4	1850.6	1850.8
516 - 520	1851.0	1851.2	1851.4	1851.6	1851.8
521 - 525	1852.0	1852.2	1852.4	1852.6	1852.8
526 - 530	1853.0	1853.2	1853.4	1853.6	1853.8
531 - 535	1854.0	1854.2	1854.4	1854.6	1854.8
536 - 540	1855.0	1855.2	1855.4	1855.6	1855.8
541 - 545	1856.0	1856.2	1856.4	1856.6	1856.8
546 - 550	1857.0	1857.2	1857.4	1857.6	1857.8
551 - 555	1858.0	1858.2	1858.4	1858.6	1858.8
556 - 560	1859.0	1859.2	1859.4	1859.6	1859.8
561 - 565	1860.0	1860.2	1860.4	1860.6	1860.8
566 - 570	1861.0	1861.2	1861.4	1861.6	1861.8
571 - 575	1862.0	1862.2	1862.4	1862.6	1862.8
576 - 580	1863.0	1863.2	1863.4	1863.6	1863.8
581 - 585	1864.0	1864.2	1864.4	1864.6	1864.8
586 - 590	1865.0	1865.2	1865.4	1865.6	1865.8
591 - 595	1866.0	1866.2	1866.4	1866.6	1866.8
596 - 600	1867.0	1867.2	1867.4	1867.6	1867.8
601 - 605	1868.0	1868.2	1868.4	1868.6	1868.8
606 - 610	1869.0	1869.2	1869.4	1869.6	1869.8
611 - 615	1870.0	1870.2	1870.4	1870.6	1870.8
616 - 620	1871.0	1871.2	1871.4	1871.6	1871.8
621 - 625	1872.0	1872.2	1872.4	1872.6	1872.8
626 - 630	1873.0	1873.2	1873.4	1873.6	1873.8
631 - 635	1874.0	1874.2	1874.4	1874.6	1874.8
636 - 640	1875.0	1875.2	1875.4	1875.6	1875.8
641 - 645	1876.0	1876.2	1876.4	1876.6	1876.8
646 - 650	1877.0	1877.2	1877.4	1877.6	1877.8
651 - 655	1878.0	1878.2	1878.4	1878.6	1878.8
656 - 660	1879.0	1879.2	1879.4	1879.6	1879.8
661 - 665	1880.0	1880.2	1880.4	1880.6	1880.8
666 - 670	1881.0	1881.2	1881.4	1881.6	1881.8
671 - 675	1882.0	1882.2	1882.4	1882.6	1882.8
676 - 680	1883.0	1883.2	1883.4	1883.6	1883.8
681 - 685	1884.0	1884.2	1884.4	1884.6	1884.8
686 - 690	1885.0	1885.2	1885.4	1885.6	1885.8
691 - 695	1886.0	1886.2	1886.4	1886.6	1886.8
696 - 700	1887.0	1887.2	1887.4	1887.6	1887.8
701 - 705	1888.0	1888.2	1888.4	1888.6	1888.8
706 - 710	1889.0	1889.2	1889.4	1889.6	1889.8

PCS 1900 CHART 4 -- UPLINK (Mobile to Base Station) (continued)

CHANNEL NUMBERS	UPLINK FREQUENCIES (MHz)				
711 - 715	1890.0	1890.2	1890.4	1890.6	1890.8
716 - 720	1891.0	1891.2	1891.4	1891.6	1891.8
721 - 725	1892.0	1892.2	1892.4	1892.6	1892.8
726 - 730	1893.0	1893.2	1893.4	1893.6	1893.8
731 - 735	1894.0	1894.2	1894.4	1894.6	1894.8
736 - 740	1895.0	1895.2	1895.4	1895.6	1895.8
741 - 745	1896.0	1896.2	1896.4	1896.6	1896.8
746 - 750	1897.0	1897.2	1897.4	1897.6	1897.8
751 - 755	1898.0	1898.2	1898.4	1898.6	1898.8
756 - 760	1899.0	1899.2	1899.4	1899.6	1899.8
761 - 765	1900.0	1900.2	1900.4	1900.6	1900.8
766 - 770	1901.0	1901.2	1901.4	1901.6	1901.8
771 - 775	1902.0	1902.2	1902.4	1902.6	1902.8
776 - 780	1903.0	1903.2	1903.4	1903.6	1903.8
781 - 785	1904.0	1904.2	1904.4	1904.6	1904.8
786 - 790	1905.0	1905.2	1905.4	1905.6	1905.8
791 - 795	1906.0	1906.2	1906.4	1906.6	1906.8
796 - 800	1907.0	1907.2	1907.4	1907.6	1907.8
801 - 805	1908.0	1908.2	1908.4	1908.6	1908.8
806 - 810	1909.0	1909.2	1909.4	1909.6	1909.8

MS/BTS POWER CHARTS

MOBILE POWER CLASSES

POWER CLASS	GSM 900 MAXIMUM PEAK POWER	GSM 900 dBm	DCS 1800 MAXIMUM PEAK POWER	DCS 1800 dBm	PCS 1900 MAXIMUM PEAK POWER	PCS 1900 dBm
1	20 W	+43	1 W	+30	1 W	+30
2	8 W	+39	0.25 W	+24	0.25 W	+24
3	5 W	+37	---	---	2 W	+33
4	2 W	+33	---	---	---	---
5	0.8 W	+29	---	---	---	---

MOBILE POWER CONTROL LEVELS

POWER CONTROL LEVEL	PEAK POWER (dBm) GSM 900	PEAK POWER (dBm) DCS 1800	PEAK POWER (dBm) PCS 1900
0	+43	+30	+30
1	+41	+28	+28
2	+39	+26	+26
3	+37	+24	+24
4	+35	+22	+22
5	+33	+20	+20
6	+31	+18	+18
7	+29	+16	+16
8	+27	+14	+14
9	+25	+12	+12
10	+23	+10	+10
11	+21	+8	+8
12	+19	+6	+6
13	+17	+4	+4
14	+15	+2	+2
15	+13	0	0
16			reserved
17			reserved
18			reserved
19			reserved
20			reserved
21			reserved
22 to 29			reserved
30			+33
31			+32

BTS POWER CLASSES

BTS POWER CLASS GSM	MAXIMUM PEAK POWER	dBm
1	320 - 640 W	+55 to +58
2	160 - 320 W	+52 to +55
3	80 - 160 W	+49 to +52
4	40 - 80 W	+46 to +49
5	20 - 40 W	+43 to +46
6	10 - 20 W	+40 to +43
7	5 - 10 W	+37 to +40
8	2.5 - 5 W	+34 to +37
Micro BTS GSM		
M1	0.08 - 0.25 W	+19 to +24
M2	0.03 - 0.08 W	+14 to +19
M3	0.01 - 0.03 W	+9 to +14

BTS POWER CLASS DCS 1800	MAXIMUM PEAK POWER	dBm
1	20 -40 W	+43 to +46
2	10 - 20 W	+40 to +43
3	5 - 10 W	+37 to +40
4	2.5 - 5 W	+34 to +37
Micro BTS DCS 1800		
M1	0.5 - 1.6 W	+27 to +32
M2	0.16 - 0.5 W	+22 to +27
M3	0.05 - 0.16 W	+17 to +22

BTSPOWER CLASS PCS 1900	MAXIMUM PEAK POWER	dBm
1	20 -40 W	+43 to +46
2	10 - 20 W	+40 to +43
3	5 - 10 W	+37 to +40
4	2.5 - 5 W	+34 to +37
Micro BTS PCS 1900		
M1	0.5 - 1.6 W	+27 to +32
M2	0.16 - 0.5 W	+22 to +27
M3	0.05 - 0.16 W	+17 to +22

REFERENCE SENSITIVITY LEVELS

MS REFERENCE SENSITITVITY	dBm
GSM mobile class 1, 2, 3	-104
GSM handportable class 4 & 5	-102
DCS 1800 class 1 & 2	-100
DCS 1800 class 3	-102
PCS 1900 all classes	-102

BTS REFERENCE SENSITITVITY	dBm
GSM standard BTS	-104
GSM Mini 1	-97
GSM Mini 2	-92
GSM Mini 3	-87
DCS 1800 standard BTS	-104
DCS 1800 Mini 1	-102
DCS 1800 Mini 2	-97
DCS 1800 Mini 3	-92
PCS 1900 standard BTS	-104
PCS 1900 Mini 1	-102
PCS 1900 Mini 2	-97
PCS 1900 Minl 3	-92

CONVERSION FACTORS

To convert between dBμV (emf), dBμV/m and dBm, use the following formulae:

$$dB\mu V(emf) = dBm + 113.0$$

$$dB\mu V/m = dBm + 136.5$$

Note: This assumes 0 dBi antenna gain and a frequency of 925 MHz Ref. GSM Rec. 05.05 Section 5.

Some useful values are given below:

dBm	dBμV (emf)	dBμV/m
-110	3.0	26.5
-104.0	9.0	32.5
-102.0	11.0	34.5
-101.0	12.0	35.5
-99.0	14.0	37.5
-93.0	20.0	43.5
-85.0	28.0	51.5
-64.5	48.5	72.0
-48.0	65.0	88.5
-43.0	70.0	93.5

Rx_LEV Values

The reported Rx_LEV values for received signal level are as follows:

Rx_LEV	Received Signal Level	Rx_LEV	Received Signal Level
0	Less than -110 dBm	40	-71 dBm to -70 dBm
1	-110 dBm to -109 dBm	41	-70 dBm to -69 dBm
2	-109 dBm to -108 dBm	42	-69 dBm to -68 dBm
3	-108 dBm to -107 dBm	43	-68 dBm to -67 dBm
4	-107 dBm to -106 dBm	44	-67 dBm to -66 dBm
5	-106 dBm to -105 dBm	45	-66 dBm to -65 dBm
6	-105 dBm to -104 dBm	46	-65 dBm to -64 dBm
7	-104 dBm to -103 dBm	47	-64 dBm to -63 dBm
8	-103 dBm to -102 dBm	48	-63 dBm to -62 dBm
9	-102 dBm to -101 dBm	49	-62 dBm to -61 dBm
10	-101 dBm to -100 dBm	50	-61 dBm to -60 dBm
11	-100 dBm to -99 dBm	51	-60 dBm to -59 dBm
12	-99 dBm to -98 dBm	52	-59 dBm to -58 dBm
13	-98 dBm to -97 dBm	53	-58 dBm to -57 dBm
14	-97 dBm to -96 dBm	54	-57 dBm to -56 dBm
15	-96 dBm to -95 dBm	55	-56 dBm to -55 dBm
16	-95 dBm to -94 dBm	56	-55 dBm to -54 dBm
17	-94 dBm to -93 dBm	57	-54 dBm to -53 dBm
18	-93 dBm to -92 dBm	58	-53 dBm to -52 dBm
19	-92 dBm to -91 dBm	59	-52 dBm to -51 dBm
20	-91 dBm to -90 dBm	60	-51 dBm to -50 dBm
21	-90 dBm to -89 dBm	61	-50 dBm to -49 dBm
22	-89 dBm to -88 dBm	62	-49 dBm to -48 dBm
23	-88 dBm to -87 dBm	63	Greater than - 48 dBm
24	-87 dBm to -86 dBm		
25	-86 dBm to -85 dBm		
26	-85 dBm to -84 dBm		
27	-84 dBm to -83 dBm		
28	-83 dBm to -82 dBm		
29	-82 dBm to -81 dBm		
30	-81 dBm to -80 dBm		
31	-80 dBm to -79 dBm		
32	-79 dBm to -78 dBm		
33	-78 dBm to -77 dBm		
34	-77 dBm to -76 dBm		
35	-76 dBm to -75 dBm		
36	-75 dBm to -74 dBm		
37	-74 dBm to -73 dBm		
38	-73 dBm to -72 dBm		
39	-72 dBm to -71 dBm		

Rx_QUAL Values

The reported Rx_QUAL values for received signal level are as follows:

Rx_QUAL Value	Bit Error Rate Range	Mean Value
0	< 0.2 %	0.14 %
1	0.2 - 0.4 %	0. 28 %
2	0.4 - 0.8 %	0.57 %
3	0.8 - 1.6 %	1.13 %
4	1.6 - 3.2 %	2.26 %
5	3.2 - 6.4 %	4.53 %
6	6.4 - 12 8 %	9.05 %
7	> 12.8 %	18.10 %

Note: Racal 6113 Test Sets may be fitted with E-GSM-900 and/or DCS 1800 or PCS 1900 facilities.

Performance stated below applies when using the front panel RF connections. Performance when using RF Tests (B.O.S.S.) Mode is also stated where it differs from normal operation.

SIGNAL SOURCE

Frequency

Range		
E-GSM 900	:	880 - 915 MHz
DCS 1800	:	1710 - 1785 MHz
PCS 1900	:	1850 - 1910 MHz
Resolution	:	1 Hz

Level

Range	:	-40 dBm to -120 dBm into 50 ohm (Simplex mode) -47 dBm to -120 dBm into 50 ohm (Duplex mode)
Resolution	:	0.1 dB
Accuracy		
Simplex		
E-GSM 900	:	±1.5 dB (> -110 dBm)
DCS 1800	:	±1.8 dB (> -110 dBm)
PCS 1900	:	±1.8 dB (> -110 dBm)
Duplex		
E-GSM 900	:	±1.5 dB (> -110 dBm) (Note)
DCS 1800	:	±1.8 dB (> -110 dBm) (Note)
PCS 1900	:	±1.8 dB (> -110 dBm) (Note)

Note: Input power ≤ 5 W (+37 dBm)

RF OUT Connector

Impedance	:	50 ohm Nominal
VSWR	:	≤ 1.2:1
Connector	:	TNC female

RF IN/DUPLEX Connector

Impedance	:	50 ohm Nominal
VSWR	:	≤ 1.2:1
Connector	:	N Type female

MEASURING RECEIVER

Frequency Range

E-GSM 900	:	925 - 960 MHz
DCS 1800	:	1805 - 1880 MHz
PCS 1900	:	1930 - 1990 MHz

Level Range	:	+46 dBm to -1 dBm (GSM BTS power classes 5 to 8).
	:	+40 dBm to -1 dBm in RF Tests (B.O.S.S.) Mode. (Range may be extended with an external attenuator).
Max Power	:	50 W (+47 dBm) continuous

A-bis INTERFACE

Format		Option 51 (T1) :	1.544 Mbit/s supporting 24 x 64 kbit/s timeslots
	:	Option 52 (E1) :	2.048 Mbit/s supporting 32 x 64 kbit/s timeslots
Connectors	:	Switchable BNC unbalanced and 4 mm Banana balanced	
Traffic	:	Single 16 kbit/s bi-directional channel	
Signalling	:	Two 16 kbit/s or 64 kbit/s bi-directional links	
Impedance		Option 51 (T1):	100 ohm BNC, or 100 ohm 4 mm Banana
	:	Option 52 (E1):	75 ohm BNC, or 120 ohm 4 mm Banana

MEASUREMENTS

Phase Error

Range	:	10 ° rms, ± 30 ° peak
Accuracy		
rms	:	< 0.3 ° at 5 ° phase error
peak	:	± 7.2 ° ± 7.4 ° in RF Tests (B.O.S.S.) Mode

Frequency Error

Range	:	± 2.5 kHz ± 750 Hz when locking to Cell Control Channel
Accuracy	:	< ± (4.5 Hz ± Internal Frequency Standard) (Note)

Note: 10 bursts averaged, 99 % confidence.

Power Level

Range	:	+46 dBm to -1dBm +40 dBm to -1 dBm in RF Tests (B.O.S.S.) Mode
Absolute Accuracy		
E-GSM 900	:	± 1.0 dB
DCS 1800 ≤ 20 W	:	± 1.0 dB
PCS 1900 ≤ 20 W	:	± 1.2 dB
Relative Accuracy	:	< ± 0.4 dB

Power Profile

Dynamic Range	:	> 48 dB (Note) > 42 dB in RF Tests (B.O.S.S.) Mode (Note)

Note: For 1 dB overshoot.

Modulation Spectrum

Dynamic Range	:	> 52 dB (Note) > 46 dB in RF Tests (B.O.S.S.) Mode (Note)
Frequency Span	:	1 MHz

Note: 10 bursts averaged, non hopping; 99 % confidence.

Frequency Standard

Internal
(1 year, all sources of error)

04E (standard)	:	$\pm 1.2 \times 10^{-7}$ / year (Note)
04F (option)	:	$\pm 3.5 \times 10^{-8}$ / year (Note)

Note: After 30 days continuous operation.

Internal Standard Output Port

Signal	:	10 MHz
Output Level	:	0 dBm ± 2 dB into 50 ohm
Connector Type	:	BNC (female)

Reference Output Port

Connector Type	:	BNC (female)
Frequency	:	Same as frequency standard in use (10 MHz or 13 MHz)
Level	:	+9 dBm nominal into 50 ohm (04E and 04F)

Reference Input Port

Connector Type	:	BNC (female)

An external Reference Input signal that meets the following specification may be applied to the REF. IN connector:

Frequency	:	10 MHz or 13 MHz, ± 2.5 ppm
Input Level	:	0.18 to 2.0 V rms into 50 ohm (-2 to +19 dBm)
Impedance/Coupling	:	50 ohm nominal / a.c.
Harmonics	:	<-25 dBc
Spurious Signals	:	<-90 dBc for offsets <100 kHz (excluding line spurs)

SSB Phase Noise (Max permitted) :

Offset (Hz)	@ 10 MHz dBc/Hz	@ 13 MHz dBc/Hz
1	-85	-83
10	-115	-113
100	-135	-133
1000	-138	-136
≥10000	-138	-136

Line Spurs (Max permitted) :

Offset (Hz)	@ 10 MHz dBc	@ 13 MHz dBc
50	-69	-67
100	-75	-73
150	-79	-77
200 to 500	-81 to -89	-79 to -87

Section 1
TECHNICAL SPECIFICATION

INTERFACES

Memory Cards

Type	:	2 off PC card (PCMCIA v 2.0) Type 2 sockets
Card types	:	SRAM, Flash EEPROM and Hard disk drives complying with PC Card ATA Standard. PC Cards should have a CIS in common or attribute memory.
Number of cards	:	One or two of Type I or Type II, or one Type III
Synchronisation Output	:	TTL signal for synchronising external equipment such as a spectrum analyser.
GPIB	:	ANSI / IEEE 488.2 - 1987
Compatibility Subset	:	SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT0, C0, E1
RS232	:	2 configurable ports for printing and control
Connectors	:	9-way D-Type male
Parallel Printer	:	25-way D-Type female

GENERAL CHARACTERISTICS

Power Supplies

Voltage Ranges	:	85 - 130 V AC and 180 - 264 V AC
Frequency Range	:	45 - 66 Hz
Power Consumption	:	170 VA maximum

Dimensions and Environmental Characteristics

Height	:	210 mm
Width	:	355 mm (excluding the bail arm)
Depth	:	420 mm
Weight	:	14 kg approx. (15 kg approx. when Option 54 is fitted)
Operating Temperature	:	0 ° to 50 °C (0 ° to 45 °C when Option 54 is fitted)
Calibration Period	:	1 year
EMC and RFI	:	As stated on the Declaration of Conformity
Safety	:	As stated on the Declaration of Conformity

TECHNICAL SPECIFICATION - OPTION 54

Performance stated below applies when using B.O.S.S. RF (Option 54) connections on the rear panel.

SIGNAL SOURCE

Frequency

Range: 880-915 MHz (E-GSM)
1710-1785 MHz (DCS1800)
1850-1910 MHz (PCS1900)

Level

Range: -20 dBm to -100 dBm into 50 Ω

Accuracy: (Simplex) ±1.5 dB GSM (>-90 dBm)
±1.8 dB DCS1800 (>-90 dBm)
±1.8 dB PCS1900 (>-90 dBm)

Accuracy: (Duplex) ±1.5 dB GSM (>-90 dBm) (Note)
±1.8 dB DCS1800 (>-90 dBm) (Note)
±1.8 dB PCS1900 (>-90 dBm) (Note)

Note: Input power ≤ 1 mW (0 dBm)
Valid at 23 °C ±5 °C, Simplex or Duplex

B.O.S.S. RF OUT
Connector

Impedance: 50 Ω nominal

Connector: TNC Female (on rear panel)

B.O.S.S. RF IN/DUPLEX
Connector

Impedance: 50 Ω nominal

Connector: SMA Female (on rear panel)

MEASURING RECEIVER

Frequency Range: 925-960 MHz (E-GSM)
1805-1880 MHz (DCS1800)
1930-1990 MHz (PCS1900)

Input Level

Specified Measurement Range: -50 dBm to 0 dBm
Usable Range -70 dBm to 0 dBm

Maximum Input Power: 100 mW RMS (+20 dBm) continuous

Unwanted Signal Tolerance: Up to 30 dBc and ≤ 0 dBm, @ ≥ ±1.2 MHz offset, but measurement accuracy is not specified under these conditions.

MEASUREMENTS

Performance with unwanted signal +30 dBc and ≤0 dBm @ 6 MHz offset, wideband mode

Power Measurements

Absolute Accuracy:

E-GSM:	<±1.6 dB
DCS1800:	<±1.6 dB
PCS1900:	<±1.6 dB
	Valid at 23 °C ± 5 °C

Phase Error

Accuracy RMS:	<0.4 ° at 5 ° phase error
Accuracy Peak:	<±9 °

Frequency Error

Accuracy:	<±(10 Hz + Internal Frequency Standard)

Mod Spectrum

Dynamic Range:	>40 dB spurious free

Power Profile

Dynamic Range:	>30 dB spurious free

Performance with unwanted signal 0 dBc @ 1.2 MHz offset, narrowband mode

Power Measurements

E-GSM:	<±1.6 dB
DCS1800:	<±1.6 dB
PCS1900:	<±1.6 dB
	Valid at 23 °C ± 5 °

Phase Error

Accuracy:	RMS <0.6 ° at 5 ° phase error
	Peak <±10 °

Frequency Error

Accuracy:	<±(10 Hz + Internal Frequency Standard)

Mod Spectrum *Not specified*

Power Profile

Dynamic Range:	>30 dB spurious free

Note: Other parameters are as stated earlier in this Section for the main Specification.

TABLE OF CONTENTS

INTRODUCTION

The Racal Instruments Digital Radio Test Set Model 6113 is designed to test Base Transceiver Stations (BTS) operating on the E-GSM 900 and/or DCS 1800 or PCS 1900 Digital Cellular Radio systems.

Note: In this handbook, "GSM" is also used on its own as a generic term to refer to all these types of radio system.

The Test Set is fully self contained in one portable unit and requires no other external equipment. All functions are available through use of the front panel hard/soft keys and spinwheel.

For production test systems, remote control of all tests and readings can be achieved via the IEEE488 interface.

The 6113 provides a range of test and measurement functions to enable quick and easy testing of E-GSM 900 / DCS 1800 / PCS 1900 BTSs for field commissioning and maintenance purposes, and for final unit testing in a production environment.

The 6113 can be controlled via a GPIB interface from any IEEE-STD-488 Controller. Simple programming commands enable the Test Set to be integrated into a test system for use in a production environment.

The 6113 contains an RF transmitter and receiver, and an A-bis interface. It contains software to provide signalling capability on both the air (RF) interface and the A-bis interface, including manufacturer-specific Operations and Maintenance (O+M) signalling, to control the BTS and to partially emulate a Base Station Controller (BSC) and a mobile station (MS).

A comprehensive range of tests can be performed on the BTS transmitters and receivers: these include Bit Error Ratio (BER) tests on the receiver, and GSM-specific transmitter tests including phase trajectory, power and modulation measurements. In addition, a limited number of signalling tests can be performed to check the functionality of the BTS A-bis interface. For most testing, however, the signalling between the 6113 and the BTS is completely transparent to the user.

An RF Tests mode of operation provides facilities for non-intrusive testing of BTSs in live operational networks, and monitoring of messages on the A-bis link between a BTS and BSC. In addition, two special functions are available: the ability to function as a signal generator for transmitting a variety of GSM structured signals and other signals, and the ability to act as a power meter for monitoring channel transmissions.

The 6113E Test Set includes the encryption option and operates in the same manner as the 6113. Information about encryption in this handbook is not applicable if the encrytion option is not incorporated, and encryption options in any menu on the MMI display will have no effect.

A range of options are available with the 6113 to enable it to work with manufacturer-specific O+M messages. Further information on these can be obtained from Racal Instruments Ltd Help Desk or their local agent.

DESIGN FEATURES

The front panel controls and user interface are particularly easy to use, and are designed to allow operators from a wide skill range to test and fault-find E-GSM 900, DCS 1800 and PCS 1900 BTSs. All the important measurements can be viewed simultaneously, and any reading that is out of limits is highlighted to facilitate rapid repair.

To reduce the complexity of the test procedure, and to keep the processing time to a minimum, special integrated transmitter and receiver tests perform several measurements simultaneously.

An automatic test sequence mode is provided where user-defined sequences are executed. User-written program sequences can be created in RIBASIC, and an explanation of this facility, together with example programs, is given in Section 5 Annex A.

A choice of two precision frequency standards are available, and an external 10 MHz or 13 MHz frequency standard may be used if required.

Two serial RS232 interfaces are provided for driving a printer, controlling external instruments, and facilitating remote interaction such as code download.

The 6113 contains non-volatile storage for the retention of its operating software. If software upgrades are necessary, or when additional facilities become available, this software can be updated via one of the RS-232 interfaces from a PC running the supplied utility, or via the front panel memory card.

G703 (A-bis) and V11 interfaces are fitted as standard. However, these interfaces are used for manufacturer-specific purposes only. See Section 7 Option descriptions for further details.

Enhanced RF performance is available as an Option for use when performing live tests on a BTS.

USING THIS MANUAL

When first using the 6113, the user should read Section 3 Preparation For Use.

For full details of each test that the 6113 can perform, refer to Section 4 together with either Section 5 if the Test Set MMI software is to be used, or Section 6 if the user intends to use the GPIB interface to control the Test Set. Section 7 contains additional information on the use of the 6113 that is applicable only to a particular BTS type; this information is supplied as a series of Option descriptions that are specific to a particular manufacturer, and each Option description is suppled only to users of that BTS type.

Throughout this manual, reference is made to various aspects of the GSM system and to the GSM Recommendations. For a full explanation of the GSM system, the user is referred to the GSM Recommendations.

TEST INFORMATION

The 6113 BTS Test Set performs various RF and functional tests. To test the signalling procedures in a BTS, the 6113 is used to simulate an E-GSM 900, DCS 1800 or PCS 1900 mobile. Many RF tests entail verifying that an acceptably low Bit Error Ratio (BER) is maintained across the RF (air) interface under various signal conditions. Using the 6113 to perform Bit Error Ratio measurements allows each BTS receiver sensitivity to be measured.

BER statistics are gathered from speech frames received from either the RF (air) interface or the A-bis interface. Both the Frame Erasure Ratio (FER) and the Residual Bit Error Ratio (RBER) are evaluated.

Test Modes

There are five basic test modes available:

Single Tests mode
Test Sequences mode
MultiMode
Live Tests mode
Special Functions mode

Single Tests Mode

The single tests mode enables the user to select and perform a single test, either once, or repeatedly. The result of the test can be either a Pass/Fail, the Pass/Fail result of a measured parameter, or a measured parameter only. Before running the test, the user can vary the conditions under which the test is being performed.

During execution of a test the BTS is placed automatically into the correct state by the 6113, using signalling over the A-bis interface.

Test Sequences Mode

In this mode, test sequences can be defined and run from the 6113 front panel. (They can also be user-programmed in RIBASIC -- see Section 5 Annex A). Any test from the Single Tests menu may be used. Each test in a sequence can be programmed to terminate in Hold, Continue, Exit or Repeat, and test results may be printed on a Pass, or Fail, or both conditions. Instrument set-up files are loaded as part of the test sequence. Individual test parameter changes may be made while programming a test sequence. An overall summary of tests Passed or Failed can be displayed at the end of the sequence and printed, if required.

MultiMode

This mode of operation is particularly useful for fault finding and diagnosis. In this mode the Test Set performs all the major GSM measurements, and the cycle of measurements runs continuously. The operator can vary most of the test parameters without terminating the measurements. Measured parameter results are displayed and updated constantly during the course of testing, and can be compared to marked limits. Bargraphs are used to give the user a visual indication of results. If the results exceed the limits, the bars change colour. Pass/Fail indications are given where possible.

The operator can switch the 6113 between four 'zoom' sub-modes, each of which provides a more detailed presentation of results.

The four 'zoom' sub-modes are:

- BER
- Phase Error
- Power Profile
- Modulation Spectrum

Live Tests Mode

Live Tests mode provides facilities for testing a BTS and monitoring channel messages and traffic without taking the BTS off the air. This helps to give advance warning of deterioration in performance, and enables the user to take a BTS off the air for maintenance in a planned and controlled manner, rather than waiting for failures to occur.

Two Live Tests modes are available:

- RF Tests Mode (B.O.S.S.)
- A-bis Protocol Analysis Mode

Special Functions Mode

Two Special Functions are available:

- Signal Generator Mode
- Power Meter Mode

These functions allow the 6113 to perform as an individual signal generator or power meter instrument for use in failure diagnosis procedures.

Remote Operation

Remote control of the 6113 via a GPIB interface can be used when required. The interface protocol allows the full range of parameters and tests to be utilised and monitored. The commands and responses for each test are listed in Section 6.

The GPIB interface messages and responses comply with IEEE 488.2 - 1987 standard Digital Interface for Programmable Instrumentation, "Standard Codes, Formats, Protocols, and Common Commands".

LIST OF TESTS

Note: Additional manufacturer-specific tests are described in Section 7.

The following is a summary of the tests that can be performed by the 6113 Test Set:

Functional Tests

Configure BTS Test	Brings the BTS to a fully 'configured' state, ready for testing.
Reset BTS Test	Resets the BTS to a 'non-configured' state.

Transmitter Tests

Cell Control Channel Generation Test	Checks generation of the Cell Control Channel by the BTS.
Transmitter Test	Checks that the transmitted signal has the GSM-defined GMSK modulation (phase) accuracy and does not exceed the defined frequency error.
	Checks that the average power level of the transmitted pulse is within the GSM-defined tolerance.
	Checks that the power profile of the transmitted pulse conforms to the GSM-defined mask.
	Allows the user to view the modulation spectrum of the transmitted pulse.
Transmitter BER Test	Checks the basic baseband signal processing (Static Layer 1) functions.on the downlink (BTS to MS) side of the BTS.
Static Power Control Test	Checks that the transmitted BCCH signal conforms to the GSM-defined average output power level of the power steps.
Downlink Power Control Test	Checks that the transmitted TCH signal conforms to the GSM-defined average output power level of the downlink power decrements.

Receiver Tests

Receiver BER Test	Checks the basic baseband signal processing (Static Layer 1) functions on the uplink (MS to BTS) side of the BTS, and checks that the BER is acceptable at Reference Input Sensitivity level.
Absolute Sensitivity Test	Measures the actual sensitivity of the transceiver by finding the threshold at which the measured BER deteriorates beyond the limit specified by the operator.
RACH Test	Checks the performance of the BTS in detecting and reporting the presence of Random Access Channel Requests (RACH).
RX Level Test	This test checks the performance of the BTS in measuring and reporting the level of the received signal (RX LEV) on the uplink side of the BTS.
RX Quality Test	This test checks the performance of the BTS in measuring and reporting the quality of the received signal (RX QUAL) on the uplink side of the BTS.

Manufacturer and BTS-Specific Tests

These features provide additional tests and controls for specific BTS types. See Section 7 for details.

Interactive Test Mode

Multimode	This mode is useful for fault finding and diagnosis. All the major GSM measurements are performed, and the test runs continuously. The operator can vary the majority of the test parameters without terminating the test. Test results are displayed simultaneously, and are continuously updated.

Live Tests

RF Tests Mode	Provides facilities for monitoring the performance of a BTS without taking it off the air.
A-bis Protocol Analysis Mode	Provides facilities for monitoring (non-intrusive) and recording the signal and data traffic on the A-bis.

Special Functions Mode

Signal Generator Mode	This mode allows the 6113 to operate as a signal generator that can transmit a variety of GSM structured signals and other signals. No signal monitoring is performed in this mode.
Power Meter Mode	This mode allows the 6113 to operate as a Power Meter to monitor the power on a nominated channel, or to indicate the channel that contains maximum power. No signal monitoring is performed in this mode.

Self-Check Tests

Self Check Burst Analysis	This test analyses the burst parameters and BER of the 6113 Test Set using an internal loopback. The test relates to the RF facilities available at the front panel of the Test Set.
RF Tests Self Check Burst Analysis	This test analyses the burst parameters and BER of the 6113 Test Set using an internal loopback. The test relates to the B.O.S.S. RF facilities available at the rear panel of the Test Set.

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ILLUSTRATIONS

PACKAGING

Unpack the Test Set carefully to avoid unnecessary damage to the factory packaging.

If the Test Set is to be returned for calibration or repair, consult the Service Manager or the local Racal Instruments agent for instructions before shipment.

If the Test Set is returned, the original packaging should be used whenever possible. If this is not available, a strong shipping container, fitted with internal packing capable of preventing movement of the Test Set within the container, must be used.

ACCESSORIES

The following accessories are included with the Test Set at shipment:

Description	Qty
Power lead (2 m) with plug for Country of use	1
Fuse, 3.15 amp (plus 1 spare in Power input connector)	2
6113 Digital Radio Test Set Operator Manual	1
Software Release Note (Note)	1

Note: The software release note contains up-to-date information on new features, possible restrictions etc.

INSTALLATION

The 6113 is a free standing Test Set that is self contained and needs no other test equipment to perform the tests defined in this Handbook.

The Test Set power supply unit is an auto-ranging unit that will automatically adjust itself to the power supply input. See Section 1 for the specified range of power input supply that must be used.

A warm-up time of at least five minutes should be allowed before the unit is operational. After this time, the test set reference oscillator will have stabilised. To make frequency or power measurements to the specified accuracy, a warm-up time of 30 minutes is recommended; alternatively, an external frequency standard that meets the required accuracies as listed in Section 1 Technical Specification may be used. If the Test Set has been stored at a temperature lower than 0 °C then the unit temperature must be allowed to rise above 0 °C before it is powered on.

FRONT PANEL CONNECTIONS

The 6113 front panel layout is shown in Figure 3.1 (early models) and Figure 3.2.

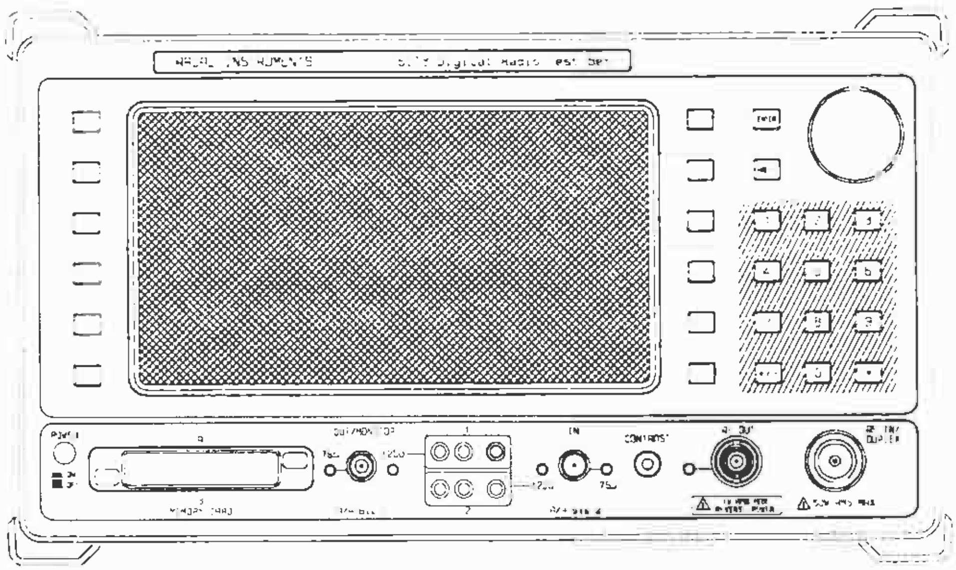


Figure 3.1 6113 Front Panel (early models)

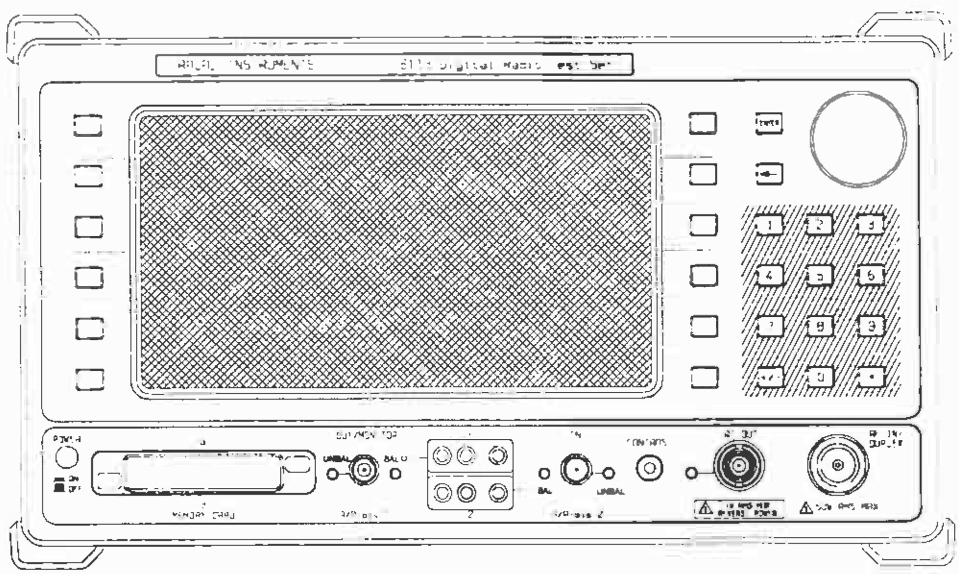


Figure 3.2 6113 Front Panel

RF IN / DUPLEX and RF OUT Connectors

CAUTION: (1) To prevent damage to the Test Set, the maximum power of the BTS applied to the RF IN / DUPLEX connector should be limited by the user to +47 dBm, using an external attenuator. (For example, a Class 4 BTS can have a maximum power of +49 dBm and the user should insert a 3 dB external attenuator).

(2) Damage to the Test Set will result if the BTS transmitter output is connected to the RF OUT connector on the Test Set.

RF IN / DUPLEX connector is N-type female. RF OUT connector is TNC female.

If the BTS has separate transmitter and receiver connections, the BTS transmitter output should be connected to the RF IN / DUPLEX connector on the front panel of the Test Set. The BTS receiver input should be connected to the Test Set RF OUT connector. This is the default (SIMPLEX) mode (see Section 5 for details of selecting SIMPLEX mode at the MMI). The RF OUT LED will be lit.

If the BTS has only one (DUPLEX) Rx / Tx connector, this must be connected to the Test Set RF IN / DUPLEX connector. 'DUPLEX' must be selected at the MMI BTS Information screen (see Section 5) and the RF OUT LED wil be extinguished.

Ensure that connections are correctly made before applying RF power to the 6113.

A-bis (G703) Connectors OUT / MONITOR and IN

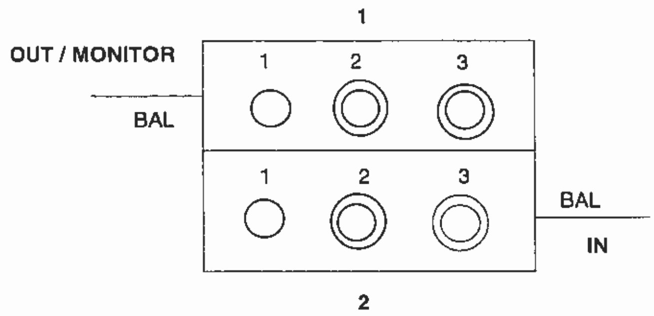
Note: (1) If the E1 (European standard) A-bis board is fitted, the BNC connectors of the OUT / MONITOR and IN ports are 75 ohm impedance and the associated banana sockets are 120 ohm impedance.

(2) If the T1 (US standard) A-bis board is fitted, the BNC connectors of the OUT / MONITOR and IN ports are 100 ohm impedance and the associated banana sockets are 100 ohm impedance.

(3) Only one of the A-bis standards can be fitted to the Test Set. Recognition is automatic.

Connections to the OUT / MONITOR and IN ports of the G703 (A-bis) interface can be made via either the BNC connectors or the banana sockets. Selection between the BNC connections or the banana connections is made at the MMI display by selecting the BTS Information screen and pressing the *Impedance* softkey to select 'Balanced' (banana) or 'Unbalanced' (BNC) options.

The BNC connectors or the banana sockets are used to connect Transmit and Receive signal paths between the 6113 and BTS under test.



PIN	OUT / MONITOR	IN
1	Chassis earth	No connection (Early models) Chassis earth (1996 models onwards)
2	Tip	Tip
3	Ring	Ring

Figure 3.3 Three-Pin Banana Jack Connections (balanced)

The OUT/MONITOR LED (UNBAL or BAL) is continuously illuminated when a 2 Mbit/s (1.544 Mbit/s T1) clock is being generated, and the IN LED (UNBAL or BAL) flashes when a valid 2 Mbit/s (1.544 Mbit/s T1) clock signal is applied (it remains on steady when no input signal is present).

Memory Card Interface

This is a PC Card (PCMCIA) interface version 2.00. The dual socket supports SRAM cards, Flash EEPROM cards or Hard Disk Drive cards (to PC ATA standard), as follows:

One or two Type I cards
One or two Type II cards, or
One Type III card

Insert a Memory Card in one or both of the two Memory Card sockets (A or B) as required.

Note: Due to the general nature of the PCMCIA standard, there is some variation between cards made by different manufacturers. Users are advised to test a particular card for compatibility before bulk purchase. The following PCMCIA Cards are approved for use with the 6113 Test Set and are available from Racal Instruments Ltd:

Option	Description	Manufacturer	Remarks
76	Memory Card (256 kbyte)	Mitsubishi	SRAM type (replaceable lithium battery)
77	Memory Card (2 Mbyte)	Centennial	SRAM type (rechargeable battery - recharges in socket).
78	Flash Memory Card (10 Mbyte)	Sandisk	
79	Removeable Hard Disk (170 Mbyte)	Calluna	

REAR PANEL CONNECTIONS

The 6113 rear panel layout is shown in Figures 3.4 and Figure 3.5.

Note: The output link from INT.STD.OUT connector is shown connected to the REF IN connector. Refer to the heading INT. STD. OUT Connector for information about this connection.

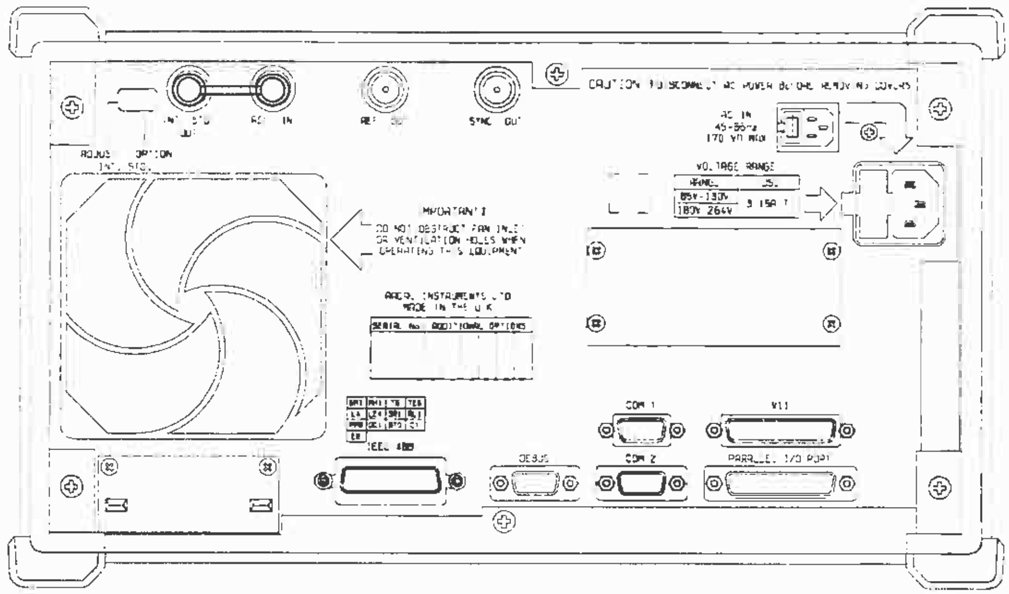


Figure 3.4 6113 Rear Panel (Early Models)

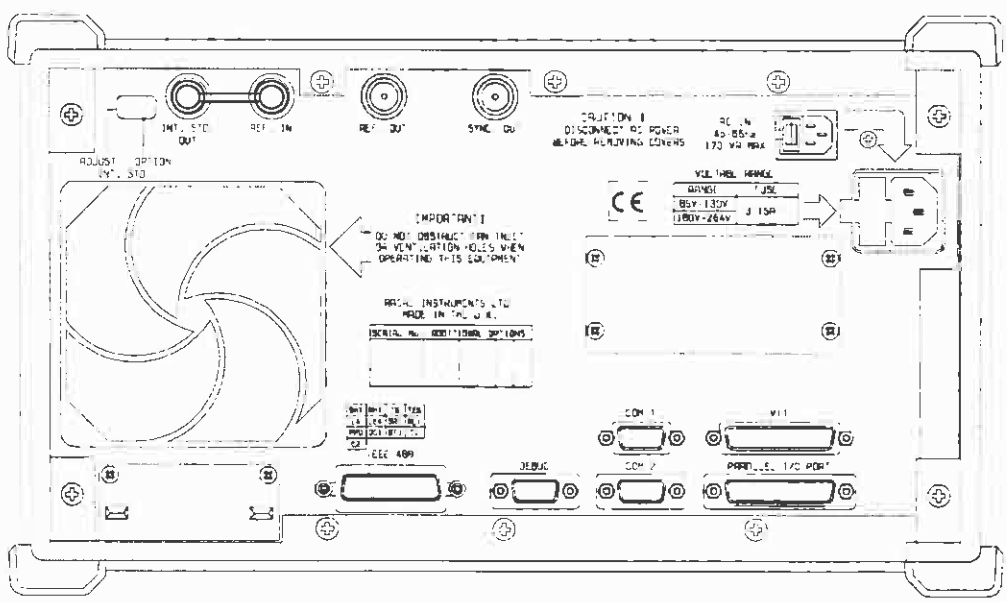


Figure 3.5 6113 Rear Panel

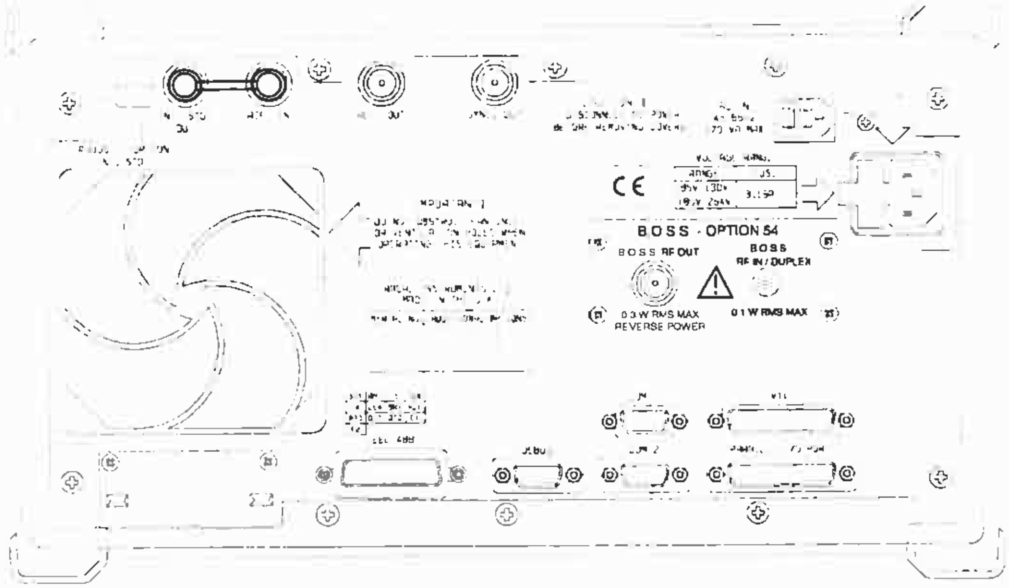


Figure 3.6 6113 Rear Panel Showing Option 54 / 54R / 56R Fitted

SYNC OUT Connector

This output provides a programmable TTL level signal for synchronising an external spectrum analyser or logic analyser. Connection is via a BNC socket.

On and Off times are selectable on any position within a frame (specified by bit positions) with 1/16 bit resolution.

All outputs are active high, i.e. output goes high at start of defined period.

Default state for all outputs:	Low	
Output voltage swing (each output):	Low:	< 0.5 V (max sink current 5 mA)
	High:	> 4.0 V (max source current 5 mA)

The 13 MHz output from the internal frequency standard can also be routed to this output.

RS232 Connectors COM 1 and COM 2

These two connectors provide access to the RS232 interface. They can also be allocated to the following functions:

Printer
Code Download

Both connectors are 9 pin D-type (male). Standard PC RS232 connection cables should be used; these can be ordered from Racal Instruments Ltd:

Option 90	RS232 to PC cable
Option 91	RS232 to Printer

The pinout connections for the connectors are:

COM 1

Pin	Function
1	CD
2	RX
3	TX
4	DTR
5	Ground
6	DSR
7	RTS
8	CTS
9	Spare

COM 2

Pin	Function
1	CD
2	RX
3	TX
4	DTR
5	Ground
6	DSR
7	RTS
8	CTS
9	Spare

Both interfaces are configurable, and the default configuration is the 'three wire' type interface using Xon/Xoff flow control. The following parameters may be selected:

Baud Rate	:	600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200
Number of data bits	:	7, 8
Parity	:	None, even, odd, MARK, SPACE
Number of stop bits	:	0, 1, 2

DEBUG Connector

(Racal Instruments Use Only)

Parallel I/O Connector

This is a standard parallel interface port that is used for attaching a printer to the Test Set.

Connector Type: 25-way D-type (female)

Pinout Connections:

Pin	Signal	Pin	Signal
1	STROBE	10	ACK
2	D0	11	BUSY
3	D1	12	PE
4	D2	13	SLCT
5	D3	14	AUTOFD
6	D4	15	ERROR
7	D5	16	INIT
8	D6	17	SLIN
9	D7	18 to 25	GROUND

A standard parallel printer cable can be used. This is available from Racal Instruments Ltd as Option 92.

V11 Connector

Two standard V11 ports are provided at the V11 connector; they may be used for customer-specific applications. See Section 7 for details relevant to a particular manufacturer-specific Option.

Connector Type: 25-way D-type (male)

Pinout Connections:

CHANNEL 1		CHANNEL 2	
Pin	**Signal**	**Pin**	**Signal**
2	RXN1	8	RXN2
14	RXP1	20	RXP2
16	TXN1	22	TXN2
3	TXP1	9	TXP2
5	FSN1	11	FSN2
17	FSP1	23	FSP2
19	CKN1	25	CKN2
6	CKP1	12	CKP2

Ground: Pins 1, 4, 7, 10, 13, 15, 18, 21, 24

IEEE 488 Connector

This is a standard GPIB interface port which may be used for external control of the Test Set from a GPIB controller.

Connector Type: 24-way IEEE 488 (female)

Pinout Connections:

Pin	Signal	Pin	Signal
1	D1	10	SRQ
2	D2	11	ATN
3	D3	12	GROUND
4	D4	13	D5
5	EOI	14	D6
6	DAV	15	D7
7	NRFD	16	D8
8	NDAC	17	REN
9	IFC	18 to 24	GROUND

Good quality double-screened GPIB cables should be used.

REF IN Connector

The input to this port is either 10 MHz or 13 MHz.

Connector Type: BNC (female)

(See heading Frequency Standard Selection for further details).

REF OUT Connector

The output from this port is a buffered version of the signal received at the REF IN connector (see heading Frequency Standard Selection for further details).

Connector Type: BNC (female)

INT. STD. OUT Connector

The output from this connector is a 10 MHz signal from the internal frequency standard. If this signal is required for internal use it is linked to the RF IN connector using the link supplied. (See heading Frequency Standard Selection for further details).

Connector Type: BNC (female)

B.O.S.S. RF IN / DUPLEX and B.O.S.S. RF OUT Connectors

Note: If Option 54 / 54R or Option 56R is fitted, these connectors should be used instead of the front panel connectors RF IN / DUPLEX and RF OUT when RF Tests Mode (B.O.S.S.) is being used.

CAUTION: (1) For normal specified operation, the BTS signal power applied to the B.O.S.S. RF IN / DUPLEX connector should be no greater than 0 dBm.

(2) To prevent damage to the Test Set, the maximum power of the BTS signal applied to the B.O.S.S. RF IN / DUPLEX connector should be limited by the user to +20 dBm.

(2) Damage to the Test Set will result if the BTS transmitter output is connected to the B.O.S.S. RF OUT connector on the Test Set.

B.O.S.S. RF IN / DUPLEX connector is SMA female. B.O.S.S. RF OUT connector is TNC female.

If the BTS has separate transmitter and receiver connections, the BTS transmitter monitor port should be connected to the B.O.S.S. RF IN / DUPLEX connector on the rear panel of the Test Set. The BTS receiver monitor port input should be connected to the Test Set B.O.S.S. RF OUT connector. This is the default (SIMPLEX) mode (see Section 5 for details of selecting B.O.S.S. SIMPLEX mode at the MMI).

If the BTS has only one (DUPLEX) Rx / Tx monitor connector, this must be connected to the Test Set B.O.S.S. RF IN / DUPLEX connector. 'B.O.S.S. DUPLEX' must be selected at the MMI BTS Information screen (see Section 5).

Ensure that connections are correctly made before applying RF power to the 6113.

FREQUENCY STANDARD SELECTION

There are two frequency standard Options available for the 6113 Test Set:

04E
04F

Unless otherwise specified, Option 04E is supplied as standard. Both options have an on-board precision reference 10 MHz oscillator and a 13 MHz oscillator from which internal 13 MHz signals are derived.

An output from the precision reference 10 MHz oscillator is available at the REF OUT connector on the rear panel.

Note: Reference frequency sources are pre-calibrated and should not be adjusted because this will invalidate the instrument Calibration.

If adjustment of the frequency reference is required, the Test Set should be returned to Racal Instruments Ltd or approved Service Centre for calibration.

The 13 MHz oscillator can be phase-locked to either a 10 MHz reference signal, or a 13 MHz reference signal, which must be connected to the REF IN connector.

(1) To phase lock the 13 MHz oscillator to a 10 MHz signal, use the *Test Set Options* option from the Self Tests / System Menu to select '10 MHz' mode of operation. The 10 MHz signal can be derived from an external customer-supplied source, or from the internal 10 MHz oscillator (by linking REF OUT to REF IN using the link supplied). (Refer to Section 5).

(2) To phase lock the 13 MHz oscillator to a 13 MHz signal, use the *Test Set Options* option from the Self Tests / System Menu to select '13 MHz' mode of operation. The 13 MHz signal must be derived from an external customer-supplied source. (Refer to Section 5).

Note: If an external frequency reference is used, it must conform to the specification defined in Section 1 Technical Specification otherwise the performance of the Test Set may be impaired.

POWER SUPPLY

Voltage Setting

The Test Set power supply unit is an auto-ranging unit that senses the voltage and frequency of the supply input and automatically adjusts the output to the correct voltage. No selection or adjustment by the user is necessary.

A.C. power applied to the Test Set can be in the following ranges:

Voltage:	85 - 130 V a.c.	or	180 - 264 V a.c.
Frequency:	45 - 66 Hz		

The Power ON/OFF switch is on the front panel.

Equipment Power Fuse

The power fuse holder is incorporated in the power input plug unit. Before attempting to remove or fit a fuse, ensure that the Test Set is switched OFF and the power lead is disconnected from the power input plug.

The fuse is a 5 mm x 20 mm glass cartridge, surge-resist type. The fuse rating is:

3.15 A(T) (Racal Instruments part number : 23-0025)

The Test Set is normally supplied fitted with a 3.15 A fuse for use on both ranges. A spare fuse is also stored in the fuse holder. (Instructions for changing a fuse are given under the heading SERVICE AND MAINTENANCE at the end of this Section).

WARNING: **DO NOT USE FUSES OF A DIFFERENT SPECIFICATION.**

Power Lead

A power lead, together with a plug for the Country of use, is supplied for use with the Test Set. If this lead is used in the UK, a 5 A fuse should be fitted in the power plug. The socket connector that mates to the Test Set is a right-angle connector to allow the Test Set to stand on its rear feet.

POWER-ON SELF CHECKS

The POWER ON/OFF switch on the front panel is a two-position button switch. When the switch is set to ON, the Test Set goes through an automatic start-up procedure and automatically runs the start-up self tests. After approximately 2 seconds the display is initialised and the screen displays test information as each test runs. At the end of the test sequence, the GSM logo is displayed and then, after a short pause, the MMI main menu is displayed.

If a failure is detected during start-up, the BITE (built in test equipment) failure indication given to the operator will depend upon the phase of start-up in which it is detected. There are three distinct phases of start-up, before the application software is activated:

Hard Boot
Soft Boot
Self Checks

During the Hard Boot phase, a detected failure is indicated by a series of 'beeps' on the buzzer, as shown below.

Test	Failure Indication
Boot PROM check sum	Buzzer (10 beeps)
SCSI Controller	Buzzer (9 beeps)
Internal Processor Functions	Buzzer (2 beeps)
DRAM checks	Buzzer (3 beeps)
Flash Boot Code check sum	Buzzer (4 beeps)

Note: If one of these failure indications occurs, the unit is unserviceable and should be switched off and returned to Racal Instruments or a Racal Instruments approved Service Centre.

When the Hard Boot phase is completed, the Soft Boot phase commences and carries out an extensive series of self checks before application software is downloaded and initiated.

During the Soft Boot phase, progress of the self checks is shown in two successive tables which appear on the Test Set display, as illustrated below.

Power Up Tests	
Internal QUICC Peripherals	√
PLD Configuration	√
Key Pad	√
Main DRAM Check	√

Power Up Tests Continued....	
Serial EEPROM Checksums	√
Application Code Checksums	√
Base Band Processor Boot Code Self Checks	√
Download of Base Band Processor code	√
A-bis Processor Boot Code Self Checks	√
Download of A-bis Processor Code	√
Initialising Main Processor Code	√

Note: (1) When each test is successfully completed a √ appears in the right hand column.

(2) If a test fails, an X is shown instead in the right hand column. Instructions telling the user what to do are presented as lines of text at the bottom of the table.

When the Self Checks are completed (with no failures), the Main Menu screen is displayed and the operator can begin to use the MMI facilities; however, the warm-up period must be complete (as described above under the heading INSTALLATION) before testing a BTS.

SOFTWARE UPDATES

As additional features become available on the Test Set, new versions of the Software will be distributed to holders of software support contracts. (Users who do not currently have a Racal Instruments Support Contract can purchase one at any time from Racal Instruments Ltd or approved Agent). Each new release will be supplied on floppy discs together with a Software Release Note that gives details of changes since the previous release and instructions on performing the download. A PC and RS232 cable (see heading - RS232 Connectors COM1 and COM2 for cable description), or GPIB cable, to connect the PC to the Test Set are necessary to accomplish the update; a PC Card memory card can be used to to reduce the time taken to transfer the code to the Test Set.

Software Update Using a PC

Use an RS232 cable to connect the PC to the COM1 port on the Test Set, or a GPIB cable to connect the PC to the IEE 488 connector on the Test Set.

A software utility is supplied with the new software to download the software from floppy disc via drive C: to the Test Set. Follow the instructions provided in the Software Release Note.

Note: This procedure can take nearly an hour to perform.

Software Update Using a PC Card

The new software is supplied as BIN files, which may be copied to a DOS or Windows 95 formatted PC Card memory card.

To load the software from the PC Card to the Test Set, insert the PC Card in one of the slots in the front panel and follow the instructions provided in the Software Release Note.

SERVICE AND MAINTENANCE

The 6113 is modular in design to enable ease of servicing to either module or component level. However, users are invited to take advantage of the repair and calibration services offered by Racal Instruments and their worldwide network of support centres.

Routine Maintenance

(1) Every month the fan filter should be checked, and cleaned if necessary (see Repair Procedures).

(2) Every twelve months the fan filter should be replaced (Racal Part No. 24-0262) (see Repair Procedures).

(3) After 5 to 7 years approximately, depending on usage, it may be necessary to replace the LCD backlight in the front panel display. The Test Set must be returned to Racal Instruments or to an approved Service Agent for this work to be done.

(4) After 8 years service it may be necessary to replace the frequency standard if the tuning range becomes too restricted for calibration. The Test Set must be returned to Racal Instruments or to an approved Service Agent for this work to be done.

(5) Every ten years the lithium battery for non-volatile memory should be replaced. The Test Set must be returned to Racal Instruments or to an approved Service Agent for this work to be done.

Calibration Requirements

The 6113 Test Set should be returned to Racal Instruments, or approved Service Agent, for calibration once a year.

Repair Procedures

Fitting a New Power Fuse

<u>WARNING</u>: LETHAL VOLTAGES MAY BE PRESENT. BEFORE REPLACING A FUSE, ENSURE THAT THE TEST SET AND POWER SUPPLY ARE SWITCHED OFF AND THE POWER CABLE IS DISCONNECTED FROM THE TEST SET.

(1) Using a screwdriver or suitable small instrument, prise forward the fuse tray from the power socket assembly, as shown in Figure 3.6 and Figure 3.7.

Note that the first slot in the tray holds a spare fuse (as supplied) and the second slot (nearest the power socket assembly) holds the fuse in use.

(2) Check that the spare fuse is of the correct rating, that is 3.15 A(T). Remove the fuse in use and replace it with the spare fuse, then push the fuse tray back into place.

(3) Ascertain the cause of the failure and repair as necessary <u>before</u> next power-up.

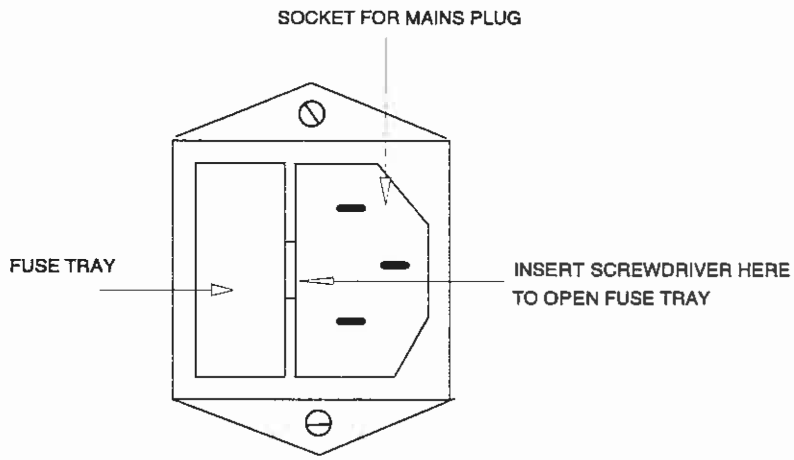


Figure 3.7 Power Socket Assembly - Fuse Tray Closed

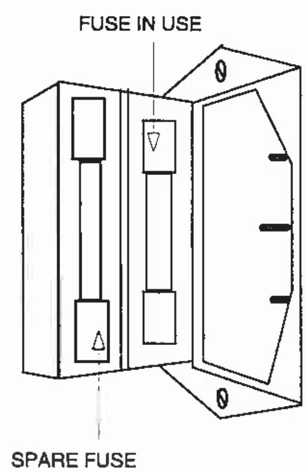


Figure 3.8 Power Socket Assembly - Fuse Tray Open (Side View)

Cleaning The Test Set

The 6113 Test Set should be cleaned as follows:

(1) Ensure that the Test Set is switched OFF and disconnected from the power supply and other equipment.

(2) If the Test Set has recently been used and the case is warm, wait until it cools to approximately ambient temperature.

(3) Using a clean damp cloth, wipe the Test Set carefully and thoroughly to remove dust and grime. Take care to avoid ingress of moisture into connectors, keys, buttons, slots, etc.

(4) Wipe the Test Set dry with a clean dry cloth and/or wait until it is completely dry before reconnecting it to the power supply and other equipment.

Cleaning the Fan Filter

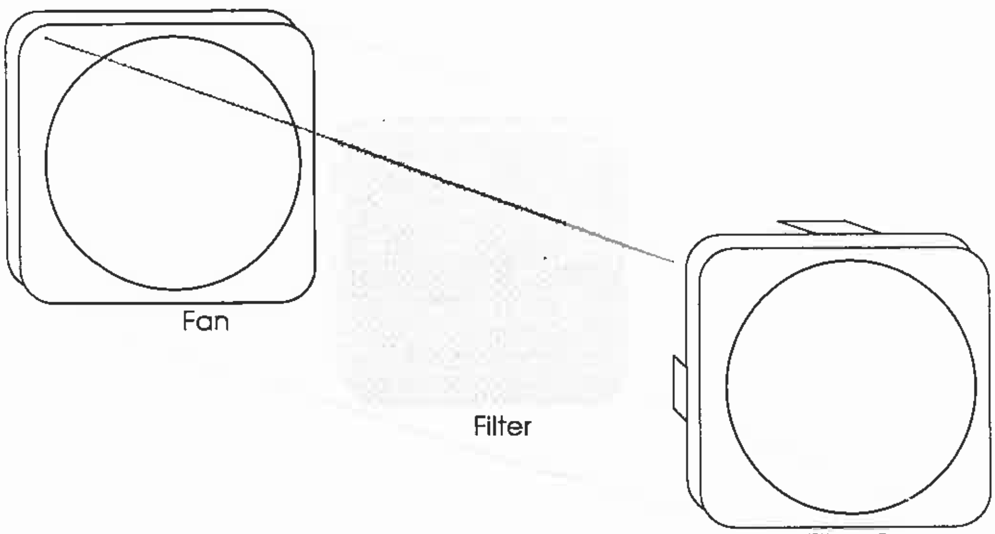


Figure 3.9 Fan/Filter/Filter Cover Assembly

Figure 3.8 illustrates the fan, filter and filter cover assembly. The procedure for cleaning the filter, or fitting a new filter, is as follows:

(1) Ensure that the Test Set is switched OFF and disconnected from the power supply and other equipment.

(2) Release the four clips holding the filter cover on the fan and then carefully remove the filter cover from the fan.

(3) Remove and clean the filter. Wash it in soapy water, rinse, and allow it to dry thoroughly.

(4) Place the filter back inside the filter cover and refit the cover on the fan.

INITIAL FAILURE DIAGNOSIS PROCEDURE

Before reporting problems with the 6113 Test Set, try to answer the following questions. Some of the more common faults can be rectified by working through this procedure.

Hardware Faults

Does The Test Set Power Up OK?

(1) If nothing is displayed on the screen, check that the power fuses are OK.

(2) Vary the display contrast control and check that a control screen is displayed.

(3) Are the boot check screens displayed?

(4) Are all the boot check tests ticked '√' as Pass?

(5) Are any of the boot check tests crossed 'X' as Fail?

(6) If all the boot check tests Pass, is the Main Menu screen displayed?

(7) Do the Self Tests pass? (Operate the *Self Tests* button in the Self Tests / System Menu and then run the Self Tests).

Software Faults

Does The Software Work OK?

(1) Operate the control buttons on the Main Menu - do they all cause a response?

(2) Does the display start OK and then become corrupted?

(3) Are there any error/status messages?.

(4) What are the tests and actions that preceded the problem?.

(5) Is the failure repeatable? If so what are the steps?

(6) Is there a work-around that you have discovered?

FAULT REPORTING

If problems are found with the operation of the 6113 software or hardware (that are not caused by an obvious hardware failure) or with this manual, a Problem Report Sheet should be copied, filled in, and faxed to the Racal Instruments Help Desk at the number quoted on the sheet. A blank Problem Report Sheet can be found at the end of this Manual.

Please ensure that the Problem Report Sheet includes the following information:

(1) Customer Company Name and Location.

(2) Name of person reporting the problem.

(3) Unit serial number (marked on the rear of the Test Set).

(4) Current Software Issue in use
(i.e. Unit Software Version and
Software Versions: MAIN, BBP, DSP, Abis, Hardboot, Softboot).

(5) A full description of the problem, including details of whether the fault is continuous or occasional, what operations preceded the occurrence of the fault, and any other relevant information.

(6) Date.

(7) Severity of the fault (i.e. causes Test Set to become non-functional, causes some tests to become non-functional, causes a test or part test to become non-functional, etc).

When the Problem Report Sheet is received, Racal Instruments will reply as soon as possible with a faxed Response Sheet. If further investigation is required, another Response Sheet will be generated when the problem has been cured.

TABLE OF CONTENTS

ILLUSTRATIONS

TABLES

INTRODUCTION

The 6113 Digital Radio Test Set can perform off-air A-bis controlled tests on a BTS when it is disconnected from the operational network, and on-air live tests when the BTS is connected to the network and processing live traffic.

WARNING: CERTAIN TESTS (E.G CELL CONTROL CHANNEL GENERATION TEST, AND MULTIMODE) CAN LEAVE THE BTS IN A STATE IN WHICH IT WILL CONTINUE TO TRANSMIT UNTIL THE TEST IS ABORTED BY THE OPERATOR. ALL DUE ATTENTION MUST BE PAID TO ENSURING THAT THE TEST IS STOPPED AT AN APPROPRIATE TIME, AND THAT THE BTS HAS STOPPED TRANSMITTING.

DO NOT DISCONNECT ANY RF CABLES UNTIL THE TEST IS COMPLETE OR HAS BEEN ABORTED AND THE BTS HAS STOPPED TRANSMITTING.

A-bis Interface Impedance Control

The Test Set A-bis interface has two modes of operation:

Low impedance mode
High impedance mode.

For A-bis Controlled tests, the interface is automatically set to low impedance (because the BTS is disconnected from the Network and the the Test Set is in complete control of the BTS).

For Live Tests mode, the interface is set to high impedance (because it is used to monitor the link between a BTS and a BSC in an operational Network, without disrupting the link).

On power-up, the Test Set A-bis Interface is internally disconnected and so is in a safe state. The interface is set to high impedance when *Live Tests* mode is selected at the MMI, and it is set to low impedance when *A-bis Controlled Tests* or *Test Sequences* is selected. The impedance is <u>not</u> changed when returning to the Main Menu.

A WARNING message is displayed before the interface is set to low impedance to instruct the operator to disconnect the Test Set A-bis from the BTS to BSC link, to avoid accidental disruption of the link.

A-bis Controlled Tests

The 6113 is designed to test one transceiver in a BTS at a time. All A-bis controlled tests are aimed at verifying correct operation of the BTS hardware.

Before performance testing of the BTS is undertaken, the following actions are performed:

(1) After switching on the 6113, allow at least 5 minutes warm-up before commencing tests. If frequency measurements are to be made, allow at least 30 minutes warm-up before commencing tests.

(2) The parameters of the BTS under test must be entered via the BTS Information screen on the Test Set (see Section 5).

(3) The mapping of A-bis timeslots to the transceivers to be tested and the BCF (if relevant) is defined. (See Section 7).

(4) Certain A-bis Timeslot zero parameters can be set up if required (see Section 7).

(5) Operational software and any other configuration data is downloaded to the BTS. (See Section 7).

When the actions in (1) to (5) above have been performed, then testing can commence. The following actions are performed at the start of each test:

(6) The 6113 establishes A-bis (LAPD) signalling links to the BCF and the Transceiver under test.

(7) The 6113 commands the BTS to activate a Cell Control Channel (CCH) at a defined frequency and level.

(8) The 6113 synchronises to the CCH.

(9) If necessary for the particular test to be performed, the 6113 then clears the CCH configuration and reconfigures the BTS to generate only Traffic Channels.

(10) The 6113 then activates a Traffic Channel (TCH) on a single timeslot at the same frequency and level, and begins to source and sink traffic over the A-bis and Air Interfaces.

(11) The 6113 establishes an Air Interface signalling (LAPDm) link, and verifies that the BTS indicates establishment of an Air Interface link by means of messages sent across the A-bis Interface. Initially, this link is established at a signal level of -40 dBm on the uplink path from 6113 to BTS. Once the link is established, the BTS receiver signal level is reduced to that specified in the test.

The 6113 then performs the required test, by analysing data received over the A-bis Interface and Air Interface.

At the end of each test, the BTS will generally be left in the 'Idle' state.

Live Tests

Live Tests are designed to monitor the performance of a BTS without taking it off the air. If a deterioration is observed, the BTS can then be taken off the air for maintenance in a planned and controlled manner, and the performance verified using the full set of A-bis controlled tests before returning it to operational service. For Live Tests (non-intrusive) mode of testing, the following actions must be performed. All other preparations for Live Tests are described under the heading LIVE TESTS later in this Section.

After switching on the 6113, allow at least 5 minutes warm-up before commencing tests. If frequency measurements are to be made, allow at least 30 minutes warm-up before commencing tests.

Date And Time

Date

Date is displayed and represented in the format DD MMM YY, where DD = day, MMM = month, YY = year. For example:

04 OCT 97

In all instances of a two-digit year, the inference rules are as follows:

Abbreviated Format	Full Format
80 to 99	1980 to 1999
00 to 79	2000 to 2079

Time

Time is displayed and represented in the format HH : MM : SS, where HH = Hour, MM = Minute,
SS = Second. For example:

14 : 23 : 59

A-bis-CONTROLLED TESTING

Channel Modes

Both A-bis and Air Interfaces are capable of supporting the full range of channel modes for Static Layer-1 tests.

Encryption (an optional enhancement) may be specified for all Receiver Tests except Rx Level and Rx Quality.

The Test Set will accommodate either combined or non-combined CCHs; only the FCCH, SCH and BCCH (containing the System Information messages) are required to be present for the 6113 to synchronise. Since these channels appear in identical places for combined and non-combined CCHs, the 6113 will work with either. However, where relevant the combined format is used.

A-bis Interface

Two types of A-bis board may be fitted:

E1 (European standard, 2.048 Mbit/s data rate)
T1 (USA standard, 1.554 Mbit/s data rate)

Note: Only one type of A-bis board may be fitted at any one time.

The test set emulates the BTS-BSC interface, both in order to control the BTS during testing and to transmit, receive and validate traffic.

A-bis Layer 1

The 6113 Test Set supports the A-bis link specified in GSM recommendation 08.54, at a data rate of 2.048 Mbit/s (1.554 Mbit/s for T1).

The Test Set supports sub-multiplexing of 64 kbit/s traffic channels to 4 x 16 kbit/s, as specified in GSM recommendation 08.54. Traffic frame structure and handling is as specified in recommendation GSM 08.60. The Test Set does not support local speech transcoding within the BTS.

Signalling is supported at both 64 kbit/s and 16 kbit/s rates.

The test set supports 2 signalling channels and 1 traffic channel simultaneously on the A-bis interface. The timeslots or sub slots assigned to signalling and those assigned to traffic are selectable to allow individual transceivers within the BTS under test to be addressed.

CRC4 and the static state of bits 3 to 8 transmitted by the 6113 in the non-frame alignment signal frame of timeslot zero can be individually controlled as required (E1 A-bis only).

T1 A-bis frame format can be set to either D3/D4 or ESF mode, as required by the BTS setup.

A-bis Layer 2

Data Link Layer support on the A-bis interface is to GSM recommendation 08.56 (essentially LAPD) with modifications as required by certain BTSs. Terminal end-point identifiers (TEIs) can be used (where required) to address specific transceivers within the BTS.

A-bis Layer 3

Layer 3 support on the A-bis interface is to GSM recommendation 08.58, to the extent necessary for testing of basic BTS functionality.

The values of Rx Level and Rx Quality reported by the BTS on the A-bis interface are displayed to the user on the MMI screen.

Customer-Specific Layer-3 Messages

Certain Layer-3 signalling procedures on the A-bis interface (specifically the use of O + M messages) are specific to the manufacturer of the BTS, and they can also vary depending on the version of the BTS. The 6113 contains the necessary software to accommodate such variations. Details of these variations are given in Section 7 of this Handbook.

All error messages generated by the BTS are received by the Test Set. However, only error messages relevant to the test being run will be displayed on the MMI screen.

Timeslot Mapping

The mapping of traffic and signalling channels on the air interface to timeslots on the A-bis interface is BTS-manufacturer specific.

The A-bis 'mapping table' that is provided for this purpose is checked at the start of testing for consistency.

To assist in the definition of the mapping, each transceiver is allocated an 'identifier' (ID). This (non-GSM defined) parameter acts as a 'label' to point to a particular mapping of A-bis slots.

Other Interfaces

Other interfaces are provided in the 6113 for use with the BTSs of certain manufacturers. For further details, refer to the relevant Option in Section 7.

Air Interface

The test set emulates the basic functions of a Mobile Station (MS) on the MS-BSS air interface.

Only a subset of the normal Mobile Station (MS) functions (those that are required for test purposes) are emulated.

The test set contains one transmitter which is used to generate a traffic channel for the BTS receiver and simulates a MS by generating a pulsed signal on the nominated slot, with other slots disabled.

When tests are being conducted on the BTS transmitter, signals to the BTS receiver are maintained to simulate a normal connection to an MS. Similarly, when testing the BTS receiver, the BTS transmitter is instructed to generate bursts as usual. Uplink and downlink LAPDm signalling links are maintained throughout any tests (the only exception to this is the Cell Control Channel Generation test, where a LAPDm link is not established).

The value of timing advance commanded by the BTS is used and acted on by the 6113.

SACCH Data

The SACCH data transmitted to the BTS by the 6113 mimics that produced by a real mobile, including a 'dummy' measurement report, containing the following information (as defined in GSM Rec. 04.08, section 10.5.2.11):

BA-USED	:	0
DTX-USED	:	0
RXLEV-FULL-SERVING-CELL	:	7
RXLEV-SUB-SERVING-CELL	:	0
MEAS-VALID	:	0
RXQUAL-FULL-SERVING-CELL	:	0
RXQUAL-SUB-SERVING-CELL	:	0
NO-NCELL-M	:	0
RXLEV-NCELL-1..7	:	all 0
BCCH-FREQ-NCELL-1..7	:	all 0
BSIC-NCELL-1..7	:	all 0

Unlike a 'real' mobile, the 6113 transmits a dummy burst during the TCH idle frame.

BTS Power Control

The MAXimum BTS Power Level is defined by the user in the Configure BTS test. It is entered by the user in dBm. All tests allow the BTS Transmitter Power Level to be set in the range MAX and Levels 1 to 6. Power Level 1 is then 2 dB below MAX, Power Level 2 is 4 dB below MAX, etc.

CAUTION: **To prevent damage to the Test Set, the maximum power of the BTS should be limited by the user to +47 dBm, using an external attenuator. For example, a Class 4 BTS can have a maximum power of +49 dBm and the user should insert a 3 dB external attenuator.**

Synchronisation to the BTS

It is essential that the Test Set and BTS are initially synchronised in time to ensure that the BTS and Test Set frame structures are locked. Frequency synchronisation is useful but not essential to assessing the frequency error of the BTS without taking into account the frequency error of the 6113 frequency standard.

For the purpose of initial time synchronisation, the Test Set timebase (i.e. frame structure) must be synchronised to the BTS. At the beginning of each test, therefore, the Test Set emulates a mobile and synchronises to a Cell Control Channel generated by the BTS (under the command of the Test Set). During the test, the 6113 periodically adjusts its timebase to maintain synchronisation.

If required, frequency synchronisation can be easily achieved if the BTS locks to the 2.048 Mbit/s A-bis link from the Test Set (this is phase-locked to the Test Set frequency standard). If this is not possible, the 6113 can be locked to a 10 or 13 MHz signal generated from the BTS.

Note that if a 10 MHz or 13 MHz signal from the BTS does not have adequate phase noise and spurious performance then certain measurements made by the 6113 can be affected. Consult Racal Instruments for more details.

Standard Test Conditions

The majority of tests are performed using a standard set of test conditions.

Functional tests, and any tests that are designed to test the digital or transmitter hardware of the BTS, use a relatively strong signal level on the uplink (i.e. Test Set to BTS) designed to ensure error-free communication between the test set and the BTS (default: -85 dBm).

Tests that are designed to test the receiver section of the BTS use a lower level signal.

Where possible, test conditions and limits follow those defined in the GSM Base Station Equipment Specification, GSM Rec. 11.20.

If a test failure occurs, the MMI indicates the reason for the failure. See Section 6 of this handbook for information on the various failure categories.

General Test Parameters

The user first specifies the BTS manufacturer and the model. These parameters are used to select the appropriate O + M messages, and other necessary parameters (see Section 7).

The following GSM and other parameters may be selected by the operator as 'global' parameters. These parameters will apply to each test, unless specifically overridden by parameters defined in a test.

In all cases, except those identified in Section 7, the values used for these parameters does not normally affect testing and they can all be set to their default values.

Base Station ID

Parameters	Default Value	Range
Network Colour Code	0	0 to 7
Base Station Colour Code	0	0 to 7

Notes:

(1) Network Colour Code (NCC)

This code enables a mobile to determine the country to which the base station belongs. Normally 0 to 3 are used for the 'first' network operator, and 4 to 7 for the 'second' network operator within the country.

(2) Base Station Colour Code (BCC)

This defines the colour code of the base station so that a mobile can distinguish neighbouring base stations.

Control Channel Description

Parameters	Default Value	Range
IMSI Attach/Detach Allowed	1	0 to 1
Blocks Reserved for Access Grant	0	0 to 7
CCCH Configuration	1	0 to 6
Multiframes Between Paging Requests	2	2 to 9
T3212 Timeout Value	0	0 to 255

Notes:

(1) IMSI Attach/Detach Allowed(ATT)

This parameter determines whether IMSI attach and detach procedures are to be used in a cell.

(2) Blocks Reserved for Access Grant

This parameter defines the number of blocks on each common control channel (CCCH) that are reserved for access grant messages.

(3) CCCH Configuration

A CCCH can be assigned several physical channels, in part combined with SDCCHs (stand-alone dedicated control channels).

The value '1' specifies one physical channel for CCCH, with combined SDCCHs.

(4) Multiframes Between Paging Requests

This parameter determines at what intervals (in multiframes of 51 frames) the paging call from the base station is repeated.

(5) T3212 Timeout Value

This timer controls how often the mobile performs a location update when in the idle mode, by specifying the period between location updating. T3212 is sent in the Control Channel Description. A '0' indicates that periodic updating is not used.

Cell Channel Description

Parameters	Default Value	Range
Cell Allocation Number	0	Fixed at 0 by GSM
Cell Allocation Table	Channels 6, 16, 26, 36, 46, 56, 66, 76, 86, 96, 106 and 116 are active (E-GSM 900). Channels 516, 526, 536, 546, 556, 566,576, 586, 596, 606, 612, 622, 632 are active (DCS 1800 and PCS 1900)	Any combination of channels may be selected.

Note: Cell Allocation Table (CAT)

This table defines the channels (ARFCNs) to be used in the cell.

Cell Options

Parameters	Default Value	Range
Power Control Indication	0	0 to 1
DTX Indicator	2	0 to 2
Radio Link Timeout T100	8	4 to 64

Notes:

(1) Power Control Indication

This parameter specifies whether a mobile (when monitoring) is to measure the power on the BCCH carrier and include it in the measurement report. It is sent in the Cell Options element in SYS INFO 3 on the BCCH and SYS INFO 6 on the SACCH. A '0' indicates that the mobile does not measure the power.

(2) DTX Indicator

The code in this field specifies whether a mobile station may, or should, or may not, use discontinuous transmission.

(3) Radio Link Timeout T100

Radio Link Timeout (T100 in the MS) is sent in the Cell Options information element. The mobile uses this value to determine whether there is still good radio contact with the base station. The S counter in the mobile is loaded with this value (in SACCH frames) and the value is

-- decremented by 1 if an SACCH message cannot be decoded, or

-- incremented by 2 if an SACCH message is properly received.

If the value drops to 0, the mobile communicates that it has lost the base station.

Neighbour Cells Description

Parameters	Default Value	Range
BCCH Allocation Number	0	Fixed at 0 by GSM
BCCH Allocation Sequence Number	0	0 to 1
Neighbour Cell Table	Channels 10, 20, 80, 100, 110, 120 (E-GSM 900) Channel 513 (DCS 1800) Channel 513 (PCS 1900)	Up to 31 E-GSM channels, or 44 DCS channels, or 44 PCS channels, may be selected.

Notes:

(1) Neighbour Cell Table

This table defines the CCH frequencies of Neighbouring cells. It is used for Adjacent Cell Monitoring by the mobile and for inter cell handover.

(2) BCCH Allocation Sequence Number

The value 0 indicates that the BCCH is idle.

RACH Control

Parameters	Default Value	Range
Maximum Retransmissions	2	1, 2, 4, 7
Tx Spread Integer	5	3-12, 14, 16, 20, 25, 32, 50
Cell Barred	0	0 to 1
Call Re-Establish	1	0 to 1
PLMN Permitted	255	0 to 255
Cell Identity Value	1	0 to 65535

Notes:

(1) Maximum Retransmissions

This field defines the maximum number of repeated attempts at transmission by the mobile.

(2) Tx Spread Integer

This field defines the number of timeslots for the mobile on which transmission of the RACH is distributed.

(3) Cell Barred

A cell can be barred; that is, a mobile can be denied access to the base station. The codes for this field are:

0 = cell is not barred
1 = cell is barred

(4) Call Re-Establish

The code in this field permits or denies a mobile return to the cell.

0 = Return to cell permitted
1 = Return to cell denied

(5) PLMN Permitted (NCC Permitted)

This field identifies which Public Land Mobile Networks (PLMNs) the mobile is allowed to monitor, with each network uniquely identified by its Network Colour Code (NCC).

The eight NCCs are represented by an 8-digit binary number. The network with colour code 0 is the LSB of this number, and the network with colour code 7 is the MSB. If a '1' is entered at a particular position in this binary number, the mobile is to monitor base stations that belong to this NCC (PLMN). Those NCCs for which a '0' is entered are ignored.

The binary number is then converted to its decimal equivalent. For example, if base stations that belong to the PLMN with the network colour code of 3 are to be monitored, then the PLMN Permitted field has the following value:

8 (2^3)

If all PLMNs are to be monitored, then the PLMN Permitted value entry is:

255 $(2^0 + 2^1 + \ldots\ldots + 2^7)$

(6) Cell Identity Value

This field contains the identity number of the cell. Each identity number is only issued once in a network and permits unique identification of the cell.

Location Area ID

Parameters	Default Value	Range
Access Control Class	0	0 to 65535
Mobile Country Code	1	0 to 999
Mobile Network Code	1	0 to 255
Location Area Code	1	0 to 65535

Notes:

(1) Access Control Class

Each mobile is assigned to one of 16 access groups. One or more of these groups can be denied access to the base station.

The 16 access groups are represented by a 16-digit binary number; access group 0 is LSB of this number, and access group 15 is MSB. If there is a '1' at a particular position in this binary number, then access will be denied to the corresponding group. Where there is a '0', the relevant group is allowed to access the base station.

The number in the Access Control Class field is the decimal equivalent of the 16-digit binary number. For example, if groups 1, 9, 12 and 14 are to be denied access to the base station, then the number in the field is:

20994 $(2^1 + 2^9 + 2^{12} + 2^{14} = 2 + 512 + 4096 + 16384)$

If no groups are to be denied access, then the Access Control Class number is 0.

(2) Mobile Country Code (MCC)

This is a code number that represents the country of origin of a base station or network, and it is sent by the base station to the mobile to convey that information. A selection of the codes are as follows:

Country	Code	Country	Code
Austria	232	Italy	222
Belgium	206	Luxemburg	270
Cyprus	280	Malta	278
Denmark	238	Monaco	212
Germany	262	Netherlands	204
Finland	244	Norway	242
France	208	Portugal	268
Gibralta	266	San Marino	292
Great Britain	234	Spain	214
Greece	202	Sweden	240
Greenland	290	Switzerland	228
Hungary	216	Turkey	285
Iceland	274	Yugoslavia	220
Ireland	272		

(3) Mobile Network Code (MNC)

This is the code of the network to which the base station belongs.

(4) Location Area Code (LAC)

This is an identity number given to the site of a base station. This number is only issued once in a network. In this way, a base station is uniquely identified by the values MCC, MNC,and LAC.

The value '0' is used in this field to show that there is no valid local area identification (LAI).

Cell Selection

Parameters	Default Value	Range
Cell Reselect Hysteresis	12 dB	0 to 14 dB (2 dB steps)
Max Mobile Tx Power Level	15	0 to 31
Min Mobile Rx Signal Level	0	0 to 63

Notes:

(1) Call Reselect Hysteresis

This is the threshold level for a mobile to select a new base station.

When a mobile tries to signal again, starting from its idle mode, it will only call another base station if the reception from it is better (by this threshold level) than from the previous one.

(2) Max Mobile Tx Power Level (MS-TxPWR-MAX-CCH)

This is the maximum permitted transmitting power of the mobile when it first gains access to the system (on the CCH). The power value entered is the GSM mobile control level defined in GSM recommendation 05-05 as follows:

E-GSM 900

Entry	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
dBm	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13

DCS 1800 / PCS 1900

Entry	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
dBm	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0

Values 16 to 29 are allowed in GSM recommendation 04-08 but are not defined by GSM, and so they are assumed to continue according to the same progression.

Value 30 and 31 are defined as +33 dBm and + 32 dBm respectively.

(3) Min Mobile Rx Signal Level (RxLEV-ACCESS-MIN)

The signal from the base station must arrive at the mobile with a certain minimum power level for the mobile to register with the cell. The minimum level, starting from -110 dBm, is increased by this value set. For example, a minimum receive level of -63 dBm is set by entering '47' in this field.

Encryption Kc

Parameters	**Default Value**	**Range**
Encryption Kc	FF FF FF FF FF FF FC 00	(any 16 hex digits)

A-bis Settings

Parameters	**Default Value**	**Range**
CRC-4 bit	OFF	OFF, ON
Slot 0 bits 3 to 8	31	0 to 63 (Note)
T1 (frame format)	ESF	D3/D4, ESF

Note: Expressed as the decimal equivalent of the state of bits. Bit 3 is MSB.

A-bis Mapping Table

See Section 7.

Bit/Frame Error Ratio Measurements

Certain measurements make use of Bit/Frame error ratio measurements to measure the degradation in link performance experienced under various conditions.

The BER of either the uplink (Test Set to BTS) or downlink (BTS to Test Set) may be evaluated.

Uplink BER measurements (on the BTS receiver) are performed by the Test Set transmitting pre-defined traffic (speech) frames to the BTS over the Air Interface. Traffic Frames received back at the Test Set via the A-bis interface are compared with the expected data to evaluate the Bit Error Ratio.

Frame erasure is detected by means of the Bad Frame Indicator (BFI) bit within the received frame (see GSM Rec. 08.60).

Downlink BER measurements (on the BTS transmitter) are performed by sending traffic frames over the A-bis interface, and accumulating bit error ratio statistics using traffic frames received across the Air interface.

Separate counts of both Class II and Class Ib BERs (Note 1), and the FER (Note 2), are made. (Class II and Class Ib speech bits are subject to different degrees of error correction within the BTS: Class Ia bits are not measured since these are heavily error corrected). There are 132 Class Ib bits and 78 Class II bits in a normal burst.

Note: (1) (Residual) Bit Error Ratio, defined as the number of faulty bits divided by total bits, excluding those from frames signalled as having been erased.

(2) Frame Erasure Ratio, defined as the number of erased frames divided by the total number of frames.

Accumulation of Class Ib, Class II and FER events proceeds in parallel - the 'count' for each type normally stops when enough samples have been accumulated. The test continues until the required 'count' for all data types is sufficient, or the number of 'events' (or errors) is exceeded for any of the types.

Under some fault conditions where continuous, or near-continuous, frame erasure is occurring, but the FER samples have been set to zero, the test could 'hang up' whilst the 6113 waits for Class Ib and Class II bits to be received. To overcome this, a timeout is applied, calculated from the maximum measurement time that would be expected plus a small contingency.

BER is measured on traffic channels only.

FER can be measured on Traffic Channels (TCH) and Random Access Channels (RACH).

The number of samples over which the BER/FER is measured must be adequate to guarantee statistically significant results, sufficient to correctly identify a bad BTS but not to fail a good BTS.

To ensure that this constraint is met, the test limits applied are, where possible, those specified in GSM Rec. 11-20. By default, samples are collected for at least the period of a superframe.

A test failure will occur if any of the three BER/FER parameters exceeds the specified maximum.

Test Patterns

A choice of ten standard test patterns (speech frames) is available for BER/FER testing, numbered 0-9, given in Table 4.1. Other tests where the data is selectable also use these patterns.

Each test pattern/speech frame contains 260 bits, formed from the 32½ (hex) bytes listed. The LSB from each byte is output first (for example, for test pattern No.4 [72,C3,..], the binary sequence would be 0100111011000011..).

Two alternatives for test pattern 'C1' (data reversals, as specified in GSM Rec. 11.10) are provided, due to the two possible start states, 0 or 1.

Table 4.1 Standard Test Patterns

Number	Pattern	Remarks
0	AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, AA, 0A	'C1 (01010....)', start 0
1	55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 55, 05	'C1' (10101....), start 1
2	00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00	All 0's
3	FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, 0F	All 1's
4	72, C3, 40, 79, BE, 1F, 6C, 35, CA, 3B, 58, B1, 96, 17, 04, ED, 22, B3, 70, E9, 6E, 0F, 9C, A5, 7A, 2B, 88, 21, 46, 07, 34, 5D, 02	Random
5	A6, E7, 94, 3D, 32, 83, 00, 39, 7E, DF, 2C, F5, 8A, FB, 18, 71, 56, D7, C4, AD, E2, 73, 30, A9, 2E, CF, 5C, 65, 3A, EB, 48, E1, 06	Random

TABLE 4.1 STANDARD TEST PATTERNS (continued)

Number	Pattern	Remarks
6	0B, E8, 01, A6, E7, 94, 3D, 32, 83, 00, 39, 7E, DF, 2C, F5, 8A, FB, 18, 71, 56, D7, C4, AD, E2, 73, 30, A9, 2E, CF, 5C, 65, 3A, 0B	Random
7	E5, BA, 6B, C8, 61, 86, 47, 74, 9D, 12, E3, E0, 99, 5E, 3F, 0C, 55, 6A, 5B, F8, D1, 36, 37, A4, 0D, C2, D3, 10, 09, 0E, 2F, 3C, 05	Random
8	2C, F5, 8A, FB, 18, 71, 56, D7, C4, AD, E2, 73, 30, A9, 2E, CF, 5C, 65, 3A, EB, 48, E1, 06, C7, F4, 1D, 92, 63, 60, 19, DE, BF, 0C	Random
9	99, 5E, 3F, 0C, 55, 6A, 5B, F8, D1, 36, 37, A4, 0D, C2, D3, 10, 09, 0E, 2F, 3C, C5, 1A, 4B, 28, 41, E6, 27, D4, 7D, 72, C3, 40, 09	Random

Note: It is important to remember that Test Pattern 2 is normally interpreted by the Test Set as a series of erased frames. Therefore if it is selected for BER measurements, the 6113 will not accumulate any Class Ib/II samples (if the number of FER samples selected is non-zero, the test will never terminate).

Parameters - General

The 'default values' listed for each parameter in the detailed test descriptions refer to the default value used by the MMI program and stated in the relevant GSM Regulations.

All values are integers, with the following exceptions:

Parameter	Units	Resolution
Power Levels	dB/dBm	0.1 dB
Phase values	degrees	0.01 degree

LIST OF TESTS

The following list details the tests that may be performed: (each is defined in more detail in later sections).

Note: (1) The parameters of the BTS under test must be entered (using the BTS Information screen on the MMI) before commencing tests.

(2) Additional manufacturer-specific tests are described in Section 7.

Functional Tests

Configure BTS Test	Brings the BTS to a fully 'configured' state, ready for testing.
Reset BTS Test	Resets the BTS to a 'non-configured' state.

Transmitter Tests

Cell Control Channel Generation Test	Checks generation of the Cell Control Channel by the BTS.
Transmitter Test	Checks that the transmitted signal has the GSM-defined GMSK modulation (phase) accuracy and does not exceed the defined frequency error.
	Checks that the average power level of the transmitted pulse is within the GSM-defined tolerance.
	Checks that the power profile of the transmitted pulse conforms to the GSM-defined mask.
	Allows the user to view the modulation spectrum of the transmitted pulse.
Transmitter BER Test	Checks the basic baseband signal processing (Static Layer 1) functions.on the downlink (BTS to MS) side of the BTS.
Static Power Control Test	Checks that the transmitted BCCH signal conforms to the GSM-defined average output power level of the power steps.
Downlink Power Control Test	Checks that the transmitted TCH signal conforms to the GSM-defined average output power level of the downlink power decrements.

Receiver Tests

Receiver BER Test BTS)	Checks the basic baseband signal processing (Static Layer 1) functions on the uplink (MS to side of the BTS, and checks that the BER is acceptable at Reference Input Sensitivity level.
Absolute Sensitivity Test	Measures the actual sensitivity of the transceiver by finding the threshold at which the measured BER deteriorates beyond the limit specified by the operator.
RACH Test	Checks the performance of the BTS in detecting and reporting the presence of Random Access Channel Requests (RACH).
RX Level Test	This test checks the performance of the BTS in measuring and reporting the level of the received signal (RX LEV) on the uplink side of the BTS.
RX Quality Test	This test checks the performance of the BTS in measuring and reporting the quality of the received signal (RX QUAL) on the uplink side of the BTS.

Manufacturer and BTS-Specific Tests

These features provide additional tests and controls for specific BTS types.
See Section 7 for details.

Interactive Test Mode

MultiMode	This mode is useful for fault finding and diagnosis. All the major GSM measurements are performed, and the test runs continuously. The operator can vary the majority of the test parameters without terminating the test. Test results are displayed simultaneously, and are continuously updated.

Live Tests

RF Tests Mode	Provides facilities for monitoring the performance of a BTS without taking it off the air.
A-bis Protocol Analysis Mode	Provides facilities for monitoring (non-intrusive) and recording the signal and data traffic on the A-bis.

Special Functions Mode

Signal Generator Mode	This mode allows the 6113 to operate as a signal generator that can transmit a variety of GSM structured signals and other signals. No signal monitoring is performed in this mode.
Power Meter Mode	This mode allows the 6113 to operate as a Power Meter to monitor the power on a nominated channel, or to indicate the channel that contains maximum power.

Self-Check Tests

Self Check Burst Analysis	This test analyses the burst parameters and BER of the 6113 Test Set using an internal loopback. The test relates to the RF facilities available at the front panel of the Test Set.
RF Tests Self Check Burst Analysis	This test analyses the burst parameters and BER of the 6113 Test Set using an internal loopback. The test relates to the B.O.S.S. RF facilities available at the rear panel of the Test Set.

FUNCTIONAL TESTS

Configure BTS Test

Purpose of Test

The test brings the BTS up to a 'configured' state, ready for further testing. It is also used to change the number of the transceiver-under-test, where the BTS-under-test has more than one transceiver fitted.

Test Parameters

The parameters are BTS-type dependent. See Section 7 for details.

Test Method

This is dependent on the BTS type. See Section 7 for details.

Reset BTS Test

Purpose of Test

This test takes the BTS from the 'configured' state to a Reset state.

Test Parameters

These are dependent on the BTS type. See Section 7 for details.

Test Method

This is dependent on the BTS type. See Section 7 for details.

TRANSMITTER TESTS

Cell Control Channel Generation Test

Purpose of Test

This test checks the generation of the Cell Control Channel (CCH) by the BTS.

WARNING: THIS TEST CAN BE LEFT IN A STATE IN WHICH THE BTS TRANSMITS CONTINUOUSLY UNTIL THE TEST IS ABORTED BY THE OPERATOR. ALL DUE ATTENTION MUST BE PAID TO ENSURE THAT THE TEST IS ABORTED AT AN APPROPRIATE TIME AND THE BTS HAS STOPPED TRANSMITTING.

DO NOT DISCONNECT ANY RF CABLES UNTIL THE TEST IS COMPLETE OR HAS BEEN ABORTED AND THE BTS HAS STOPPED TRANSMITTING.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
BTS Output Level	Max	Max, 1 to 6 (Note 1)
Network Colour Code	0	0 to 7 (Note 2)
Base Station Colour Code	0	0 to 7 (Note 2)
Maintain BCCH	Off	Off, On (Note 3)

Notes: (1) Level 1 is 2 dB below Max (defined in Configure BTS test), level 2 is 4 dB below Max, etc.

(2) Network and Base Station Colour Code parameters override 'global' defaults for this test.

(3) When 'On' is selected for the Maintain BCCH parameter, the BTS will continue transmitting indefinitely until the test is aborted by selecting *Abort* at the MMI display.

Test Method

The BTS is instructed to generate a Cell Control Channel by the Test Set, using System Information message information downloaded from the Test Set. The Test Set then synchronises to the BTS.

The content of each of the System Information messages forming the BCCH (i.e. System Information Types 1-4) is checked against that expected. The FCCH and SCH are implicitly tested as part of the synchronisation process - the SDCCH and SACCH (and hence the content of System Information messages Types 5 and 6) are not specifically checked.

Note: The 6113 receiver may correct for some errors in the BTS transmission, hence a 'bit exact' check is not possible.

If Maintain BCCH is set to'Off', then the BCCH is de-activated at the end of the test; if Maintain BCCH is set to 'On' then the BCCH is maintained at the end of the test, and the BTS will continue to transmit indefinitely until *Abort* is selected at the MMI display.

No LAPDm (Air Interface) signalling link is established for this test.

Pass/Fail Criteria

The test will pass if all data elements checked have been found to be correctly transmitted.

Test Results

At the completion of the test, the test set returns a pass/fail indicator.

Transmitter Test

Purpose of Test

Phase/Frequency Error

To establish whether the BTS is transmitting a signal with the prescribed GMSK modulation (phase) accuracy. This test is also used to measure the frequency error of the transmitted signal.

Power Profile

To measure the power profile of bursts transmitted by the BTS, and verify that they conform to a specified power-vs-time mask.

Note that due to dynamic range limitations in the Test Set receiver, the full dynamic range of the pulse for GSM Phase 1 BTSs cannot be measured.

Power Level

To measure the specified BTS Tx power level and check that it is within the defined tolerance.

CAUTION: To prevent damage to the Test Set, the maximum power of the BTS should be limited by the user to +47 dBm, using an external attenuator. (For example, a Class 4 BTS can have a maximum power of +49 dBm and the user should insert a 3 dB external attenuator).

Modulation Spectrum

To measure the spectrum generated by signal modulation.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
Timeslot	4	0 to 7
BTS Output Level	Max	Max, 1 to 6 (Note 1)
BTS Rx Signal Level	-85.0 dBm	-120.0 to -40.0 dBm
Number of Bursts	10	1 to 999
TRX Configuration	TCH	BCCH, TCH
Test Pattern	1	0 to 9
Burst Number	Any	Any, 1, 2, 3, 4
Hopping	Off	Off, On (Note 2)
Encryption	Off	Off, On
Frequency Error Limit	±48.0 Hz	0.0 to ±5000.0 Hz
RMS Phase Error Limit	5.00 deg	0.00 to 10.00 deg
Peak Phase Error Limit	20.00 deg	0.00 to 30.00 deg
Expected Power Level	(Note 3)	0.0 to 100.0 dBm
Power Level Limit (+)	3.0 dB	0.0 to 3.0 dB
Power Level Limit (-)	0.0 dB	0.0 to 3.0 dB
Power Profile Mask Checking	On	Off, On

Notes: (1) Level 1 is 2 dB below Max (defined in Configure BTS test), level 2 is 4 dB below Max, etc.

(2) Not supported by software release version 03.01.

(3) The default value is BTS specific; it is the same value as entered for Maximum BTS Output Power in the Configure BTS test.

Where applicable, this figure should include losses expected in the combiner and any other calculated losses in the BTS between the TRX and the output interface. Allow for the fact that the test may not necessarily start at the maximum power level. Loss in the RF lead between the BTS and the Test Set should not be included because this loss can be compensated by the Level Offset file.

Test Method

Following synchronisation, the test set will activate a traffic channel in the downlink direction (BTS-MS) and speech frames for transmission will be supplied over the A-bis interface.

The 'test pattern' to be transmitted is defined as one of the 10 pre-defined patterns also used for bit error ratio testing (see Table 4.1).

The signal from the BTS is downconverted in the Test Set and the IF signal is sampled at 16 times bit rate, with samples evenly distributed over the burst.

Phase/Frequency Error

The samples are used to generate the demodulated data, and the measured phase trajectory is then compared with the 'ideal' phase trajectory reconstructed from the demodulated data to give the phase error. The rms and peak phase error is calculated over the burst. The regression line of the phase error is a measure of the frequency error.

The largest, smallest and mean values for each measurement are then displayed.

Additional notes are:

(1) The position of the training sequence within the burst is determined by an algorithm that will search over a range of ± 10 bits relative to the position expected.

(2) The Test Set always demodulates the data from the received burst, and no check is made to ensure that the received data matches the transmitted data.

(3) Normally, a new burst is captured as soon as the previous burst has been analysed (i.e. consecutive bursts cannot be measured).

(4) Only traffic bursts from the BTS are analysed. Thus SACCHs and dummy bursts are masked out.

Power Profile

The power profile is evaluated by sampling the power over one burst . (Note: No averaging of bursts is performed by this test).

The power profile will be matched against the power/time template using the method described in the GSM Recommendations. However, the method of specifying the burst timing differs slightly in the 6113 from that used in GSM Recommendations 05.05 and 11.20. The Test Set takes 6 samples per bit, and in consequence the power/time template is rounded to the nearest 1/6 bit increment. Also, the dynamic range of the Test Set limits the lowest measurable level to approximately -52 dBc. Thus, the power/time limits applied are as follows:

Time			Level
-40.62 µs	to	-17.85 µs	< -30 dBc
-17.85 µs	to	-9.85 µs	< -6 dBc
-9.85 µs	to	-0.00 µs	< +4 dBc
+0.00 µs	to	+542.77 µs	-1 dBc to +1 dBc
+542.77 µs	to <	+552.62 µs	< +1 dBc
+552.62 µs	to	+560.62 µs	< - 6 dBc
+560.62 µs	to	+587.08 µs	< -30 dBc

Note: (1) 'Time' is relative to the start of bit 0.

(2) 'Level' is instantaneous power relative to average power in the useful part of the burst.

Power Level

The power output accuracy is evaluated by sampling the power over several bursts (as dictated by the Number of Averages parameter) and then averaging. Low power bursts (e.g. idle frames) are not included in the measurement.

The BTS is ordered to set the transmitted output power to the specified value, and the output is checked against the Positive Limit and Negative Limit parameters.

Modulation Spectrum

The modulation spectrum is evaluated by sampling the power over the number of bursts specified by the user.

Pass/Fail Criteria

Phase/Frequency Error

The test will fail if any of the measured values exceed the limits specified.

Power Profile

The pulse profile must fall within the limits specified.

Power Level

The (averaged) power measured must be within the specified tolerance. The test will fail if the (averaged) measurement exceeds the prescribed limits.

Test Results

Phase/Frequency Error

At the completion of the test, the test set returns a pass/fail indicator (including reason for failure if necessary) and a list of the test results.

Note that the minimum and maximum values do not necessarily relate to the same data burst - minimum value is the lowest measured of all the bursts, maximum value is the highest measured of all the bursts, etc.

In addition, the full data array graph (error vs bit) of the last sample taken is available for diagnostic purposes.

Power Profile

At the completion of the test, the test set returns a pass/fail indicator (including reason for failure if necessary).

Power Level

The MMI Results screen displays the result of the test, including a pass/fail indicator.

Transmitter BER Test

Purpose of Test

This test verifies the basic baseband signal processing (Static Layer 1) functions on the downlink (BTS towards MS) side of the BTS. Baseband signal processing functions include multiplexing and coding/interleaving/encrypting.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
Timeslot	4	0 to 7
TCH Format	0	Fixed at 0
Encryption (Note 2)	Off	Off, On
BTS Output Level	Max	Max, 1 to 6 (Note 1)
BTS Rx Signal Level	-85.0 dBm	-120.0 to -40.0 dBm
Test pattern	1	0 to 9
Sample Time	10 s	1 to 300000 s
FER Limit	0.000 %	0.000 to 100.000 %
Class Ib Limit	0.000 %	0.000 to 100.000 %
Class II Limit	0.000 %	0.000 to 100.000 %

Notes: (1) Level 1 is 2 dB below Max (defined in Configure BTS test), level 2 is 4 dB below Max, etc.

(2) When encryption is specified, the previously specified Encryption Key is used.

Test Method

Following synchronisation, a traffic channel on the specified transceiver, on the specified ARFCN and Air Interface slot, is activated. The BTS is then instructed to transmit a defined bit pattern (as input to the BTS via the A-bis interface).

The signal transmitted by the BTS is received on the Air Interface, and the BER measured. The measured FER/BER under normal conditions should be zero, although alternative limit values are allowed.

Pass/Fail Criteria

A test failure is registered if any of the bit error ratio limits are exceeded.

Test Results

At the completion of the test, the test set returns a pass/fail indicator (including reason for failure if necessary), and a list of the bit error ratio statistics gathered during the measurement process:

(1) FER samples
(2) FER events
(3) Class Ib samples
(4) Class Ib events
(5) Class II samples
(6) Class II events

Static Power Control Test

Purpose of Test

Two combined tests are provided to measure the BTS power output accuracy, and check the ability of the BTS to control its output level in steps. These are:

Test 1 Measurement of 2 dB fixed BCCH power level steps (Power Levels 1 to 6).

Test 2 Measurement of cumulative step deviation.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
Timeslot	4	0 to 7
BTS Rx Signal Level	-85.0 dBm	-120.0 to -40.0 dBm
Number of Steps	6	0 to 15
Number of Averages	10	1 to 10000
First Step Expected Level	(Note 1)	0.0 to 100.0 dBm
Max Power Level (+)	3.0 dB [2.0 dB]	0.0 to 3.0 dB Phase 1 [Phase 2]
Max Power Level (-)	0.0 dB [2.0 dB]	0.0 to 3.0 dB Phase 1 [Phase 2]
Step Accuracy Limit (+/-)	0.5 dB [1.0 dB]	0.0 to 3.0 dB Phase 1 [Phase 2]
Cumulative Error (+/-)	3.0 dB [3.0 dB]	0.0 to 6.0 dB Phase 1 [Phase 2]

Notes: (1) The default value is BTS specific; it is the same value as entered for Maximum BTS Output Power in the Configure BTS test.

Where applicable, this figure should include losses expected in the combiner and any other calculated losses in the BTS between the TRX and the output interface. Allow for the fact that the test may not necessarily start at the maximum power level. Loss in the RF lead between the BTS and the Test Set should not be included because this loss can be compensated by the Level Offset file.

(2) Although some BTS types are capable of 15 BCCH steps, GSM 11-21 only requires 6 steps to be tested.

(3) Where shown, the choice of default values are Phase 1 or Phase 2 according to the selection made at the BTS Information Menu.

Test Method

Following synchronisation, the Test Set activates a traffic channel in the downlink direction (BTS-MS) on the specified transceiver, ARFCN and Air Interface slot. Traffic for transmission is supplied over the A-bis interface.

The power output accuracy is evaluated by sampling the power over several bursts (as dictated by the Number of Averages parameter). Low power bursts (e.g. idle frames) are not included in the measurement.

Test 1

The BTS is ordered to set the transmitted output power to each power control level according to the parameter Number of Steps, and the output is checked against these factors and the Step Accuracy Limit parameter.

Test 2

This test is performed as an additional test within Test 2: the output is checked against the Cumulative Error parameter.

Pass/Fail Criteria

The (averaged) power measured must be within the specified tolerance at each power level.

The test will fail if any one (averaged) measurement exceeds the prescribed limit.

Test Results

The MMI Results screen displays (simultaneously) the results of all tests being performed.

Downlink Power Control Test

Purpose of Test

This test measures the BTS power output accuracy, and checks the ability of the BTS to control its output level in steps by measurement of downlink power control decrements at Power Levels 21 to 7.

Note: This facility is only available when the BTS software supports downlink power control.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900)	0 to 124, 975 to 1023 (E-GSM 900)
	512 (DCS 1800)	512 to 885 (DCS 1800)
	512 (PCS 1900)	512 to 810 (PCS 1900)
Timeslot	4	0 to 7
BTS Rx Signal Level	-85.0 dBm	-120.0 to -40.0 dBm
Number of Steps	15	1 to 15 (Note 1)
Number of Averages	10	1 to 10000
Step Accuracy (+/-)	0.5 dB [1.0 dB]	0.0 to 6.0 dB Phase 1 [Phase 2]
Cumulative Error (+/-)	3.0 dB [3.0 dB]	0.0 to 6.0 dB Phase 1 [Phase 2]

Note: (1) The 'Number of Steps' must not be confused with the Step Number (BCCH Step Numbers are 0 to 6, TCH Step Numbers are 7 to 21).

(2) Where shown, the choice of default values are Phase 1 or Phase 2 according to the selection made at the BTS Information Menu.

Test Method

Following synchronisation, the Test Set activates a traffic channel in the downlink direction (BTS-MS) on the specified transceiver, ARFCN and Air Interface slot. Traffic for transmission is supplied over the A-bis interface.

The step power output accuracy is evaluated by sampling the power over several bursts (as dictated by the Number of Averages parameter). Low power bursts (e.g. idle frames) are not included in the measurement.

Test 1

The BTS is ordered to set the transmitted output power to each power control level according to the parameter Number of Steps, and the output is checked against these factors and the Cumulative Error parameter.

Test 2

The BTS is ordered to set the transmitted output power to each power control level according to the parameter Number of Steps, and the output is checked against these factors and the Step Accuracy parameter.

Pass/Fail Criteria

The (averaged) power measured must be within the specified tolerance at each power level.

The test will fail if any one (averaged) measurement exceeds the prescribed limit.

Test Results

The MMI Results screen displays (simultaneously) the results of all tests being performed.

RECEIVER TESTS

Receiver BER Test

Purpose of Test

This test can be used for two purposes:

(1) Testing baseband signal processing.

(2) Testing sensitivity compliance.

Baseband Signal Processing

This test verifies the basic baseband signal processing (static layer 1) functions on the uplink side of the BTS. Baseband signal processing functions include multiplexing and decoding / deinterleaving / decrypting. In order to perform this test, the test parameter values must be altered as required (see Test Method for details).

Sensitivity Compliance

This test verifies the ability of the BTS to receive a signal, with an acceptably low error ratio, at the specified minimum signal level. The default test parameters are set for this test, but may be changed as required.

Note: This is a compliance test, i.e. it does not establish the limit sensitivity for a given error ratio, but merely checks that the error ratio is sufficiently low for a given input signal. The Absolute Sensitivity test is available for measuring the limit sensitivity.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
Timeslot	4	0 to 7
TCH Format	0	Fixed at 0
Encryption (Note 2)	Off	Off/On
BTS Output Level	Max	Max, 1 to 6 (Note 1)
BTS Rx Signal Level	-104.0 dBm	-120.0 to -40.0 dBm
Test pattern	1	0 to 9
Sample Time	10 s	1 to 300000 s
FER Limit	0.100 %	0.000 to 100.000 %
Class Ib Limit	0.400 %	0.000 to 100.000 %
Class II Limit	2.000 %	0.000 to 100.000 %

Note: (1) Level 1 is 2 dB below Max (defined in Configure BTS Test), level 2 is 4 dB below Max, etc.

(2) When encryption is specified, the previously specified Encryption Key is used.

Test Method

Baseband Signal Processing

The following parameters should be set as shown:

BTS Rx Signal Level	:	-85 dBm or as required
FER Limit	:	0 %
Class Ib Limit	:	0 %
Class II Limit	:	0 %

Following synchronisation, the BTS is instructed to activate a traffic channel on the specified transceiver, at a defined frequency and level. An uplink BER measurement is then made.

Sensitivity Compliance

The default parameters for BTS Rx Signal Level and BER statistics should be used.

Following synchronisation, the Test Set activates a traffic channel on the specified transceiver/ARFCN/timeslot, with the BTS receiver input level set to the prescribed limit value.

The test set then evaluates the bit error ratio for the uplink path (MS-BTS).

Pass/Fail Criteria

Baseband Signal Processing

The test will pass if all FER/BER values, for all levels, are less than the defined limits.

The test will fail if any limit is exceeded.

Sensitivity Compliance

The test will pass if the error ratios for BER/FER are less than the maximum values specified.

The test will fail if any of these values exceed the limits set.

Test Results

Baseband Signal Processing/ Sensitivity Compliance

At the completion of the test, the test set returns a pass/fail indicator (including reason for failure if necessary), and a list of the bit error ratio statistics gathered during the measurement process:

(1) FER samples
(2) FER events
(3) Class Ib samples
(4) Class Ib events
(5) Class II samples
(6) Class II events

Absolute Sensitivity Test

Purpose of Test

This test measures the sensitivity of the transceiver, by finding the threshold at which the measured BER deteriorates beyond the limit specified by the operator.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
Timeslot	4	0 to 7
Encryption	Off	Off, On (Note 3)
Initial Level	-80.0 dBm	-120.0 to -40.0 dBm
Final Step Size	0.5 dB	0.1 to 2.0 dB
Pass/Fail Threshold	-104.0 dBm	-120.0 to -20.0 dBm (Note 2)
BTS Output Level	Max	Max, 1 to 6 (Note 1)
Test pattern	1	0 to 9
Sample Time	10 s	1 to 300000 s
FER Limit	0.100 %	0.000 to 100.000 %
Class Ib Limit	0.400 %	0.000 to 100.000 %
Class II Limit	2.000 %	0.000 to 100.000 %
Hopping	Off	Off, On

Notes: (1) Level 1 is 2 dB below Max (defined in Configure BTS test), level 2 is 4 dB below Max, etc.

(2) Pass/Fail Threshold may be selected with 0.1 dB resolution, but actual sensitivity will be measured to the resolution specified by the final step size.

(3) When encryption is specified, the previously specified Encryption Key is used.

Test Method

Following synchronisation, the Test Set activates a Traffic Channel on the BTS under test.

Initially, the signal level applied to the BTS is set to the Start Level specified by the user (-40 dBm to -120 dBm). The level is then reduced in 5 dB steps, and a quick check is made on the BER at each step to establish the rough position of the 'knee' of the BER curve.

The quick BER check uses pre-defined samples and limits, as follows:

Test Pattern	As specified in test parameters
FER samples	0
FER Events	N/A
Class Ib Samples	3300
Class Ib Events	2
Class II Samples	1950
Class II Events	2

The number of samples is chosen to be a reasonable number, (for accuracy), commensurate with a short measurement time (about 1 second).

From this point, the test decreases the power level in 2 dB steps until the following BER test fails:

Test Pattern	As specified in test parameters
FER samples	50
FER Events	1
Class Ib Samples	6600
Class Ib Events	(Note)
Class II Samples	3900
Class II Events	(Note)

Note: Chosen to be 20 % of the final RBER specified at the start of the test.

When this BER is reached, the step size is reduced to the Final Step Size specified by the user (0.1 dB to 2.0 dB). The level is decreased by this step size and the BER is measured based on the user-specified number of samples until the number of events is reached.

During any phase of this procedure, if the BER recovers to 0 %, the step size is increased to 5 dB and quick BER measurements taken. This is to ensure that the 'knee' of the BER curve is reached as rapidly as possible.

Having determined the absolute sensitivity level, the Test Set compares this value with the threshold given as part of the test parameters, in order to determine whether the test has passed or failed.

Pass/Fail Criteria

The test will pass if measured sensitivity is not higher than the limit value specified.

The test will fail if the measured BER is too high at the maximum input level (-40 dBm) or does not meet the Pass/Fail threshold.

Test Results

At the completion of the test, the test set returns a pass/fail indicator (including reason for failure if necessary), and the measured sensitivity.

RACH Test

Purpose of Test

The 6113 sends a number of Random Access Channel Requests (RACH) over the air interface at a given signal level, and the BTS responses on the A-bis interface are examined to check the ability of the BTS to detect and report on the presence of RACHs.

Note: This is a compliance test and is performed at a single level.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
BTS Output Level	Max	Max, 1 to 6 (Note 1)
BTS Rx Signal Level	-104.0	-120.0 to -40.0 dBm
Number of RACHs	10	0 to 10000 (Note 2)
RACH Delay	Step	Step, 0 to 219 bits (Note 3)
Timing Error	±3 bits	± 1 to 10 bits
Spurious RACH Test Length	3 minutes	1 to 1440 minutes (24 hours) (Note 4)

Note: (1) Level 1 is 2 dB below Max (defined in Configure BTS test), level 2 is 4 dB below Max, etc.

(2) '0' initiates search for spurious RACHs for approximately 1 minute.

(3) Step = sequence through 0 to 63 bits, 1 bit at a time.

(4) The Number of RACHs parameter must be set at '0' to enable the 'listen for RACHs' facility to operate, for the length of time defined by the Length of Spurious RACHs Test parameter.

Test Method

The 6113 sends a number of Random Access Channel Requests (RACH) uplink over the CCH; the Random Reference field is varied in a random sequence and the Establishment Cause field is set to 'Answer to Paging'. The BTS responds with a 'Channel Required' over the uplink A-bis interface. RACHs are sent at a user-defined power level and timing offset (RACH Delay), or at a random timing offset (RACH Delay). A RACH is generated as soon as possible after the previous one has been detected on the A-bis, or every 2 seconds if no correct RACH is detected. The value of the Random Reference and measured Timing Advance is verified in the Channel Required Message on the A-bis.

Setting the number of RACHs to zero will initiate a search for spurious RACHs for the length of time set by the value of the Length of Spurious RACHs Test parameter.

Spurious RACHs can also occur on the A-bis mixed in with 'real' ones, therefore the number of RACHs received in the test results can be greater than the number sent.

Pass/Fail Criteria

The user must make a qualitative assessment of the results to determine whether the test has passed or failed.

Test Results

Test results are given as the number of successful RACHs and the number of failed RACHs. Reasons for failure are listed.

RX Level Test

Purpose of Test

This test verifies the performance of the BTS in measuring and reporting the level of the received signal (RX LEV) on the uplink side of the BTS.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
Timeslot	4	0 to 7
BTS Output Level	Max	Max, 1 to 6 (Note)
Test Pattern	1	0 to 9
Initial Level	-91.5 dBm	-120.0 to -40.0 dBm
Step Size	2 dB	1 to 10 dB
Number of Samples	4	1 to 10
RX Level Error	4	1 to 10
Number of Steps	10	0 to 100
Hopping	Off	Off, On

Note: Level 1 is 2 dB below Max (defined in Configure BTS test), level 2 is 4 dB below Max, etc.

Test Method

A traffic channel is established between the BTS and the 6113 using the defined ARFCN, Transceiver, and Timeslot. The basic principle of the test is to read and display the BTS signal measurement reports using a defined uplink signal level, and then to reduce the uplink signal level and record the new measurement values. The test repeats the measurements for the required number of steps. The step size governs the increment between uplink signal levels. The number of samples defines how many measurement reports are read and stored for each step.

For each step the MMI displays the following:

Requested uplink signal level
Expected RX LEV value
Minimum received RX LEV value
Maximum received RX LEV value
The calculated mean of the received RX LEV values
The number of RX QUAL values received at each of the 8 possible quality levels (0 to 7)

Pass/Fail Criteria

At the completion of the test the MMI displays a PASS or FAIL status based on the reported maximum and minimum RX LEV values for each step. The test will FAIL if the minimum or maximum value for a step exceeds the expected RX LEV value +/- the error limit.

RX Quality Test

Purpose of Test

A traffic channel is established between the BTS and the 6113 using the defined ARFCN, Transceiver, and Timeslot. This test verifies the performance of the BTS in measuring and reporting the quality of the received signal (RX QUAL) on the uplink side of the BTS. The test also reads the Level measurement reports (RX LEV) and displays them as part of the test results for comparison. This test differs from the RX Level test in that a BER test is performed on the traffic channel.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
Timeslot	4	0 to 7
BTS Output Level	Max	Max, 1 to 6 (Note)
Test Pattern	1	0 to 9
Initial Level	-100.0 dBm	-120.0 to -40.0 dBm
Step Size	1.0 dB	0.1 to 10.0 dB
Number of Samples	4	1 to 100
Number of Steps	10	0 to 100
Hopping	Off	Off, On

Note: Level 1 is 2 dB below Max (defined in Configure BTS test), level 2 is 4 dB below Max, etc.

Test Method

The basic principle of the test is to read and display the BTS signal measurement reports using a defined uplink signal level, and then to reduce the uplink signal level and record the new measurement values. The test repeats the measurements for the required number of steps. The step size governs the increment between uplink signal levels. The number of samples defines how many measurement reports are read and stored for each step. For each step a BER test is initiated in the 6113 which continues until the required number of samples have been obtained. When the required number of samples have been obtained, the BER result is calculated.

For each step the MMI displays the following:

Requested uplink signal level
Minimum received RX LEV value
Maximum received RX LEV value
The calculated Class II BER result
The number of RX QUAL values received at each of the 8 possible quality levels (0 to 7)

Pass/Fail Criteria

There is no overall PASS or FAIL status for the test itself. The MMI simply indicates TEST COMPLETE at the end of the test, or FAIL if the procedure was inhibited for some reason.. The user must decide whether or not the calculated BER results correlate correctly with the RX Quality values returned by the BTS.

INTERACTIVE TESTS

Multimode Test

Purpose of Test

The Multimode Test performs continuous measurements on the BTS transmitter and receiver and displays the results of these measurements in real time. The test allows parameters to be changed as the test runs so that the operator can see in real time the effect on the BTS of changing the operating conditions. This test is particularly useful as an aid to fault diagnosis.

WARNING: THIS TEST CAN BE LEFT IN A STATE IN WHICH THE BTS TRANSMITS CONTINUOUSLY UNTIL THE TEST IS ABORTED BY THE OPERATOR. ALL DUE ATTENTION MUST BE PAID TO ENSURE THAT THE TEST IS ABORTED AT AN APPROPRIATE TIME AND THE BTS HAS STOPPED TRANSMITTING.

DO NOT DISCONNECT ANY RF CABLES UNTIL THE TEST IS COMPLETE OR HAS BEEN ABORTED AND THE BTS HAS STOPPED TRANSMITTING.

Test Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
Timeslot	4	0 to 7
Encryption	Off	Off, On
BTS Output Level	Max	1 to 6, Max
BTS Rx Signal Level	-104.0 dBm	-120.0 to -40.0
Test Pattern	6	0 to 9
Burst Number	Any	Any, 1 to 4
Hopping	Off	Off, On
Video Averages	50	1 to 999 (Note 1)
Frequency Offset	0 Hz	-500 to +500 Hz
Expected Power Level	(Note 2)	+0.0 to +100.0 dBm
Timing Advance	0 Bit	0 to 63 Bit

Note: (1) 1 = No averaging.

(2) The default value is BTS specific; it is the same value as entered for Maximum BTS Output Power in the Configure BTS test.

Where applicable, this figure should include losses expected in the combiner and any other calculated losses in the BTS between the TRX and the output interface. Allow for the fact that the test may not necessarily start at the maximum power level. Loss in the RF lead between the BTS and the Test Set should not be included because this loss can be compensated by the Level Offset file.

Test Method

Set the Test Parameters to the required initial values and then press the *Run Test* button on the on the Test : Multimode screen. The Test Set initiates 'dummy' two-way traffic between the Test Set and the BTS and then starts the Multimode test. The test consists of a series of tests which are executed continuously:

Downlink BER
Phase/Frequency Error
BTS Power Measurement
Power Profile
Modulation Spectrum

While the tests are running, the MMI can be used to change the following Test Parameters:

Rx Level
Frequency Offset
BTS Power Level
Test Pattern
Timing Advance

Each time a Test Parameter is changed the test is stopped, the Multimode is reconfigured, and then the test is restarted, automatically.

To stop the test, press the *Abort* button on the Test : Multimode screen.

Video Averaging

Video Averaging of the Modulation Spectrum graph is implemented as follows.

For an averaging value of n the data displayed each burst (the Averaged Data) is calculated by always weighting the New burst data by 1/n and accordingly the old Averaged Data (the Saved Data) by (n-1)/n, so that:

$$\text{Averaged Data} = \frac{((n-1)\text{xSavedData}) + \text{NewBurstData}}{n}$$

and then

$$\text{Saved data} \quad = \quad \text{Averaged data}$$

Until the averaging value is reached, averaging is true, i.e.:

$$\text{Averaged Data} = \frac{\text{1stBurstData} + \text{2ndBurstData} + \ldots + \text{New(nth)BurstData}}{n}$$

The video averaging value (Video Averages parameter) defaults to 50 bursts and ranges from 1 (i.e. no averaging) to 999 bursts. This is in compliance with the GSM recommendations 11.20/11.21 for Base Station testing (11.21 request at least 200 bursts, and 11.20 requests at least 500).

Until the averaging value is reached, the count is displayed in the top left-hand corner of the graph. The averaging is restarted whenever a parameter is edited or when the *Restart Averaging* button is pressed.

Pass/Fail Criteria

Pass/Fail criteria are only applied to the Power Profile test and Modulation Spectrum test and are indicated on the Multimode : Summary screen.

Note: (1) PASS/FAIL criteria for the Power Profile test conform to the GSM Standard.

(2) The PASS/FAIL mask for the Modulation Spectrum test takes into account the performance characteristics of the Test Set in the noise regions.

Test Results

The following (continuously updated) test results are provided on the Multimode : Summary screen; they are presented as bargraphs with upper/lower limit markers, and numeric values.

Rx Class II BER
Tx Class II BER
BTS Tx Power
RMS Phase Error
Peak Phase Error
Frequency Error

The user must apply own PASS/FAIL decision from the evidence of the test results.

A PASS/FAIL indication for the Power Profile test and the Modulation Spectrum test is also given (see Notes 1 and 2 under the heading Pass/Fail Criteria above).

LIVE TESTS

RF Tests (B.O.S.S.) Mode

The purpose of the 6113 RF Tests Mode test is to provide a simple means of regularly monitoring the performance of a BTS without taking it off the air. If a deterioration is observed in the performance of one of the transmitters or receivers then the BTS can be taken off the air, in a controlled and planned manner, and the offending item quickly replaced. The performance of the BTS can then be revalidated using the full set of test procedures (with A-bis control) and returned to service, thus helping to avoid unplanned breaks in service.

RF Tests Mode emulates the action of a mobile when the BTS-under-test is connected to an operational network; it allows the operator to perform measurements on the BTS transmitters and receivers to determine their performance without directly controlling the BTS.

Note: RF Tests Mode facilities are available with Test Set software version 03.01 onwards. On-air BTS transmitter measurements can be performed with standard issue software.

On-air BTS receiver measurements can only be performed when Option 310 software has been installed in the Test Set. The addition of hardware Option 56 improves the performance of the RF Tests Mode (refer to Section 1).

Option 54 includes both Option 310 and Option 56, and provides a complete upgrade for RF Tests Mode.

RF Tests Mode facilities are described in the following paragraphs and in Section 5. Additional information about interconnections is provided in the Manufacturer-Specific options.

Related Documents

(1) GSM 4.08 Mobile radio interface layer 3 specification. (GSM 900 Phase 1 - v3.13.0)
(2) GSM 4.08 DCS Mobile radio interface layer 3 specification. (DCS 1800 Phase 1 - v3.1.0)

Measurement Capability

Measurements on the BTS transmitter are made by synchronising to the BTS control channel and measuring either the control channel or associated traffic channels.

When the Test Set is synchronised to a CCH or TCH, the following measurements are performed on the BTS transmitter signal:

RMS phase error
Peak phase error
Frequency error
Power profile mask pass/fail (when enabled) (only valid when measuring a TCH)
Modulation spectrum mask pass/fail (when enabled).

The Test Set also displays the following information relating to or extracted from the CCH:

CCH channel number
Mobile Country Code (MCC)
Mobile Network Code (MNC)
Cell Identity (CI)
Location Area Code (LAC)
Network Colour Code (NCC)
Base-station Colour Code (BCC)

When the Test Set is in a call and the A-bis connection between the BTS and BSC is being monitored, the BTS receiver RBER is monitored (Option 310 or Option 54 / 54R).

The Test Set can also measure the absolute sensitivity of the BTS by changing the uplink power and noting the point at which the receiver BER passes beyond a pre-defined threshold. (Option 310 or Option 54 / 54R).

Network operator names are decoded from the MNC where known, otherwise they are displayed as decimal numbers.

A-bis Configuration

When the Test Set enters Live Tests Mode the A-bis connections are automatically set to high-impedance to prevent disruption of the A-bis link.

Connections from the Test Set to the BTS vary according to the type of BTS. Refer to Section 7 Manufacturer-Specific Options for a description of the connections required for RF Tests Mode.

Phase 2 Support

In RF Tests Mode the 6113 only supports full-rate speech calls (Option 310 or Option 54 / 54R).

The Test Set is capable of measuring Phase 2 as well as Phase 1 dummy bursts; however, the transmitted Classmark indicates Phase 1 capability only.

In addition to the full E-GSM band, RF Tests Mode can also be used in the DCS 1800 and PCS 1900 bands, depending on which hardware option is fitted.

Dual Band Operation

The Test Set does not indicate dual mode capability to the network. The supported frequency bands indicated in the 'mobile' classmark only indicate the current radio system. (Option 310 or Option 54 / 54R).

During E-GSM 900 operation, the Test Set does not indicate support for the G1 band in the messages sent to the network. (Option 310 or Option 54 / 54R).

Channel Configurations

Both encryption and hopping are supported on the SDCCH and the TCH.

Control Channel

The 6113 automatically supports combined and non-combined control channels.

Traffic Channel

The 6113 only supports full-rate speech on its traffic channel.

Measurement Reports (Option 310 or Option 54 / 54R)

When in a call, the Test Set returns measurement reports as required by the network, except that the values are set as required by the Test Set and not measured from the signal. Under normal operation the Test Set returns RXLEV set to a low value in order to encourage the BTS to transmit at as high a level as possible.

Neighbour cell measurement reports are all set to indicate no measurements available to dissuade the BTS from handing the Test Set over to a different cell.

Uplink Power Control

When in a call, BTS requests for a change in Test Set (mobile) Tx power level are not actioned. However, the Test Set reports that the Tx power level has been changed in accordance with the BTS request.

SIM Handling (Option 310 or Option 54 / 54R)

The Test Set can read and use a live SIM to provide a known identity to the network and also to execute the GSM authentication/encryption algorithm. However it does not update any fields on the SIM.

A check for the presence of a SIM reader and a SIM is made on the first attempt to connect to the network in RF Tests Mode.

The MMI provides facilities for entering a PIN and unlocking a PIN-locked SIM, but there are no facilities for entering a PUK (PIN Unblock Key) for unblocking a SIM following three unsuccessful attempts to enter a PIN.

Note: (1) If a PIN is required, the operator is prompted to enter a PIN.

(2) The PIN entry numbers are displayed as asterisks.

(3) The number of retries available is displayed.

(4) If the SIM being used is blocked (due to 3 PIN entry errors), the operator is informed.

Call Encryption (Option 310 or Option 54 / 54R)

The call setup process automatically supports encryption when requested by the network. If the network requests an encrypted call and the Test Set does not have the encryption Option fitted, the Test Set will terminate the call setup process and notify the operator of the reason.

Parameter Files

The values entered for the RF Tests Mode test parameters, and the RF Tests Mode Absolute Sensitivity Test parameters (Option 310 or Option 54 / 54R), are stored in Parameter files. In addition, the Number to Dial is also stored.

Level Offsets

Level offsets (if selected) are applied to all power values on the receive and transmit side.

Display Hold

This parameter is controlled from the Parameters screen. It allows the operator to control how the Test Set clears measurements from its screen when they are no longer current. With this parameter set to 'Off' (the default condition) the Test Set will keep measurements on screen for approximately 1 second after the signal has been lost; after that they will be cleared. With the parameter set to 'On' the measurements will be held on screen indefinitely, or until the operator resynchronises (locks to a CCH) or changes any parameter.

Measurements will be cleared on the following conditions:

(1) The operator presses the *Clear Min/Max* button in a graph screen or the BER screen.

(2) A different Channel Number, Timeslot, BTS Rx Level or Pattern is entered.

(3) The *Lock to CCH* button is pressed.

(4) Display Hold is parameter is set to 'Off'.

(5) On exit from the RF Tests Parameters screen.

Printing

The printer must be set up <u>before</u> entering RF Tests mode. If this is not done, it is necessary to exit RF Tests mode to set up the printer. Printing in this mode only supports Epson FX-80 type printers. Printing the Summary screen will result in a text table of numeric results being sent to the printer or memory card, printing any other screen will cause a graphical screen dump to be sent to the print device in FX80 graphics format.

Results may be printed manually by pressing the *Print* button in any screen, or automatically by using the 'Print on Fail' parameter in the RF Tests parameters screen. This parameter has three possible values; the values and their effects are listed below:

Print on Fail:	Effect
All	When a limits failure occurs, the Test Set suspends measurements then automatically cycles through the summary and relevant graph screens for the current mode, and prints each screen.
Off	No automatic printing at all.
Failures	When a limits failure occurs, the Test Set suspends measurements then automatically cycles through the summary and relevant graph screens and prints only the screens showing a failure.

RF Tests Mode Test

Purpose of the Test

The purpose of the 6113 RF Tests Mode test is to provide a simple means of regularly monitoring the performance of BTS transmitters, and receivers (Option 310 or Option 54 / 54R), without taking the BTS off the air.

If a deterioration is observed in the performance of one of the transmitters or receivers then the BTS can be taken off the air, in a controlled and planned manner, and the offending item quickly replaced. The performance of the BTS can then be revalidated using the full set of test procedures (with A-bis control) and returned to service, thus helping to avoid unplanned breaks in service.

Test Parameters

Parameter	Default Value	Range
FER Limit	0.100	0.000 to 100.000 % (Note 1)
Class Ib RBER Limit	0.400	0.000 to 100.000 % (Note 1)
Class II RBER Limit	2.000	0.000 to 100.000 % (Note 1)
Expected Power Level	0.0	-100.0 to +100 0 dBm
Power Level Limit (±)	6.0 dBm	0.0 to +100.0 dB
Frequency Error Limit (±)	48.0 Hz	0.0 to 5000.0 Hz (E-GSM 900)
	95.0 Hz	0.0 to 5000.0 Hz (DCS 1800)
	95.0 Hz	0.0 to 5000.0 (PCS 1900)
RMS Phase Error Limit	5.00 deg	0.00 to 10.00 deg
Peak Phase Error Limit	20.00 deg	0.00 to 30.00 deg
Power Profile Mask Checking	OFF	OFF, ON
Modulation Spectrum Mask Checking	OFF	OFF, ON (Note 2)
Power Tracking	ON	OFF, ON
Display Hold	OFF	OFF, ON
Print on Fail	OFF	OFF, ALL, FAILURES
BTS Link Establish Rx Level	-40.0	-40.0 to -120.0 (Simplex)
	-47.0	-47.0 to -120.0 (Duplex)
	-20.0	-20.0 to –100.0 (B.O.S.S. Simplex)
	-20.0	-20.0 to –100.0 (B.O.S.S. Duplex)
BTS In-Call Rx Level	-40.0	-40.0 to -120.0 (Simplex)
	-47.0	-47.0 to -120.0 (Duplex)
	-20.0	-20.0 to –100.0 (B.O.S.S. Simplex)
	-20.0	-20.0 to –100.0 (B.O.S.S. Duplex)
IMEI Number	12345612001000	<NOT APPLICABLE>
Scan Start Channel Number	1	0 to 124, 975 to 1023 (E-GSM 900)
		512 to 885 (DCS 1800)
		512 to 810 (PCS 1900)
Scan Stop Channel Number	124	01 to 124, 975 to 1023 (E-GSM 900)
		512 to 885 (DCS 1800)
		512 to 810 (PCS 1900)

Note: (1) These items are only relevant when Option 310 or Option 54 / 54R is fitted.

(2) The Modulation Spectrum Mask is set to match the performance characteristics of the Test Set.

Test Method

The following diagram shows the sequence of operations. A description of how to perform the RF Tests Mode test is given in Section 5.

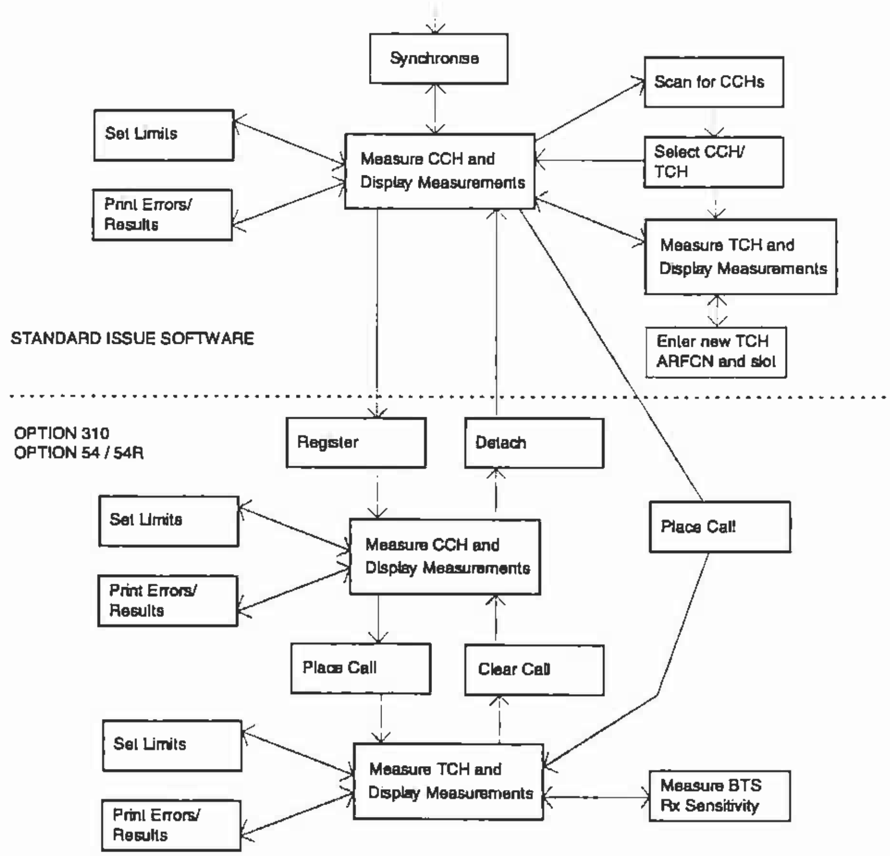


Figure 4.1 RF Tests Operation - Block Diagram

Synchronise

The Test Set attempts to synchronise to the CCH on the currently specified channel. If a valid CCH is found then the measurements screen (RF Tests Summary) becomes 'live' and the Signal status is shown as "Control Channel", otherwise the Signal status is shown as "Synchronising" and the Test Set continues to attempt to synchronise to the CCH until either a channel is found or Re-scan is selected, or the operator exits from RF Tests mode.

Scan for CCHs

The operator can press the *Scan / Channel Table* button to switch to the Scan / Channel Table screen. If the Channel Table contains no existing entries then the Test Set will automatically start the 'Scan for CCH' procedure, otherwise the Test Set will display the results of the previous scan. A new scan can be triggered by pressing the *Rescan* button.

If there are existing entries then the user can select one of them. If this selection is a different CCH from the one being monitored then a 'Synchronise to Cell Control Channel' is triggered. If it is not a CCH the Test Set synchronises to the associated CCH and then measures the TCH.

Scanning Algorithm

The Test Set scans for signals across the frequency band, generating a list of channels suitable for testing. The range of channels to be scanned can be changed by the operator.

If a CCH is found then the Test Set stores the BSIC reported by the 'Synchronise to CCH' function and waits for System Information messages to be received. From this the following elements are extracted and stored:

MCC, MNC, LAC, CI.	(System Information type 3)
TCH allocation	(System Information type 1)

The approximate power level for CCHs is also obtained.

The Test Set indicates its progress as it scans through the frequency band, and the information displayed represents the Channel being checked. Whenever a suitable CCH is found the relevant information on that Channel is entered in the table. If a System Information type 1 message is not received, then only CCH information is displayed.

The operator can halt the scan process at any time.

When the scan is complete or halted, the operator can select a CCH or TCH from a scrolling list; the information presented is:

Channel type (CCH or TCH), channel number.

For CCHs the following additional information is also presented:

Level, MCC, MNC, Cell Identity, Location Area Code.

Network operator names are decoded from the MNC, unknown names are displayed as decimal numbers. Network country codes are not decoded.

If a CCH is selected, the Test Set synchronises to the channel and starts monitoring it. If a TCH is selected the Test Set synchronises to the associated CCH and then starts monitoring the TCH.

Select CCH/TCH

The operator can select a channel from the list presented in the Channel Table. There are two options available:

(1) If the operator selects a CCH from the list presented in the Scan Table the Test Set synchronises to the selected CCH and commences measuring it.

(2) If the operator selects a TCH from the Scan Table the Test Set locks to the associated CCH then moves to the selected TCH and commences measuring it.

Measure CCH

To measure a CCH the operator can either select an entry from the scan table or enter the known CCH ARFCN using the *Channel Number* button, and then use the *Lock to CCH* button to lock to the CCH. The Test Set measures the BCCH carrier, displaying results on the screen. BER measurements are not available.

In the measurement display (RF Tests Mode Summary) the Test Set can be configured to print measured values if they exceed pre-determined limits, as well as 'print on demand'.

Measure TCH

When the Test Set is synchronised, it can be switched to monitor a pure TCH carrier associated with the current CCH, if the channel is known. To do this the (TCH) Channel number and timeslot to be monitored are both entered. The Test Set attempts to perform measurements on this new Channel / Timeslot combination. If no signal is found then the Signal status is shown as "Invalid Measurement", otherwise the status is shown as "Traffic channel" or "Dummy Burst".

To monitor a new CCH carrier, the above procedure is followed but the *Lock to CCH* button is also pressed to tell the Test Set to synchronise to the new CCH. If the Test Set loses synchronisation due to lack of power in the selected channel, the operator must select a new channel as above and then use the *Lock to CCH* option.

In the RF Tests Summary (measurement) display, the Test Set can be configured to print measured values if they exceed pre-determined limits, as well as 'print on demand'.

Register (Option 310 or Option 54 / 54R)

When the Test Set is locked to a CCH, the operator can request the Test Set to register with the network (performing a location update).

The Test Set indicates progress in a separate screen.

If the registration fails then the MMI indicates the reason for the failure and reverts to transmitter measurements on the CCH. The call state remains at 'Not Registered'.

Place Call (Option 310 or Option 54 / 54R)

Using a valid network SIM, the Test Set can place out-going MO (mobile originated) calls. All types of the call set-up procedure (early, late and very early assignment etc.) are supported.

When the Test Set has locked to a control channel the operator can initiate a call. The Test Set then initiates MO call setup. If the Test Set is not registered then registration procedure is automatically invoked.

When the call is connected the Test Set transmits a defined data pattern to the BTS and attempts to locate the pattern on the A-bis link. If the pattern is found then the BTS receiver RBER is measured. If no pattern is found then the RBER measurements boxes are left blank.

When a call is set-up the Test Set automatically switches to measuring the TCH.

The Test Set indicates progress through the call set-up procedure in a separate screen.

If the call set-up fails then the MMI indicates the reason for the call failure and the Test Set reverts to transmitter measurements only. The call state remains at 'Registered' to allow successive call set-up attempts.

If an A-bis pattern is not found during this procedure a message is displayed to warn the user.

Clear Call (Option 310 or Option 54 / 54R)

When a call is in progress the operator can request the call to be cleared. The Test Set initiates the MO call clearing procedure.

The protocol progress is shown on a separate screen.

The Test Set also supports MT call clearing.

If the user exits from RF Tests mode the call is cleared (and the IMSI detached) automatically, following the same procedure as above.

Detach (Option 310 or Option 54 / 54R)

When the Test Set is registered to a BTS the operator can request that it is detached. The Test Set initiates a detach IMSI procedure.

The protocol progress is shown on a separate screen.

If the operator exits from RF Tests mode the IMSI will be detached automatically, following the same procedure as above.

Display Measurements - Receiver BER (Option 310 or Option 54 / 54R)

To measure the BTS receiver BER, the 6113 Test Set places a call with the BTS and monitors the BTS A-bis link connections. The Test Set generates a known data pattern to stimulate the BTS receiver, and BER analysis is performed by comparing this pattern with the data pattern received from the A-bis.

The BTS receiver BER can be monitored when the Test Set is in a call and the A-bis connection between the BTS and BSC is being monitored.

BTS Rx Sensitivity (Absolute) (Option 310 or Option 54 / 54R)

When the Test Set is registered and a call is set up, the user can perform the BTS Rx Sensitivity test. This is initiated from a dedicated button on the MMI, and has its own set of test parameters. It is in effect a test within a test. The BTS Rx Sensitivity test is described later in this Section. The MMI controls are described in Section 5.

Pass/Fail Criteria - RF Tests Mode

No overall pass/fail result is provided for RF Tests Mode. The results of each measurement are displayed, together with the limits set by the operator; the purpose of the test is to display and highlight the measurements that are beyond those limits.

Test Results - RF Tests Mode

The results of all measurements are displayed, and graphs are available where applicable. All results screens can be printed, and a print-on-fail option is also provided.

When a limit failure occurs the Test Set suspends measurements and then automatically switches through the Summary screen and relevant graph screens for the current mode and performs a screen dump for each screen. Optionally, the printing can be restricted to the Summary screen and the screen for the parameter that is failing.

BTS Rx Sensitivity Test

Purpose of the Test

This test measures the absolute sensitivity of a BTS receiver by ramping down the uplink power and noting the point at which the measured receiver RBER on the A-bis deteriorates beyond the limit specified by the operator.

Test Parameters

Parameter	Default Value	Range
Initial Level	-80.0 dBm	-120.0 to -40.0 dBm
Final Step Size	0.5 dB	0.1 to 2.0 dB
Pass/Fail Threshold	-104.0 dBm	-120.0 to -20.0 dBm (Note)
Test pattern	1	0 to 9
Sample Time	10 s	1 to 300000 s
FER Limit	0.200 %	0.000 to 100.000 %
Class Ib RBER Limit	0.400 %	0.000 to 100.000 %
Class II RBER Limit	2.000 %	0.000 to 100.000 %

Note: Pass/Fail Threshold may be selected with 0.1 dB resolution, but actual sensitivity will be measured to the resolution specified by the final step size.

Test Method

This test must be performed during the RF Tests Mode test.

Following registration and call setup, the *Measure BTS Rx Sensitivity* option must be selected at the MMI to cause a Traffic Channel to be activated on the BTS under test.

The test is then performed in a similar manner to the Absolute Sensitivity test in the main Receiver Tests.

Pass/Fail Criteria

The test will pass if measured sensitivity is not higher than the limit value specified.

The test will fail if the measured BER is too high at the maximum input level (-40 dBm) or does not meet the Pass/Fail threshold.

Test Results

At the completion of the test, the Test Set returns a pass/fail indicator (including reason for failure if necessary), and the measured sensitivity.

A-bis Protocol Analysis Mode

Introduction

A-bis Protocol Analysis mode allows users to investigate the A-bis link between a BSC and associated BTS. It provides two main facilities:

(1) Monitoring and logging of signalling and traffic data being carried over a 2.048 Mbit/s (E1) or a 1.54 Mbit/s (T1) A-bis link between a BSC and a BTS, in both Uplink and Downlink directions.

(2) Replay of previously stored log files.

A-bis Protocol Analysis mode uses the E1 or T1 interface, depending on which of the two Options is fitted to the 6113, and supports 4 Signalling channels and 1 Traffic channel simultaneously.

Logging of Layer 2 frames allows the user to examine the link for general fault conditions, i.e. unreliability resulting in multiple retries. The logging of Layer 3 frames allows the user to examine the messages passing between the BSC and BTS to verify the correct sequencing for Call Setups, etc.

When A-bis Protocol Analysis mode is used, the 6113 acts as a high impedance (non-invasive) monitor on the A-bis link. It cannot be used while the 6113 is controlling the BTS in 'normal' mode.

Refer to Section 5 for a description of how to use the MMI to control A-bis Protocol Analysis Mode.

Facilities Provided

The function of A-bis Protocol Analysis mode is to enable a 6113 to monitor the A-bis Signalling and Traffic data flowing between a BSC and a BTS without disrupting the link. The following diagram illustrates the equipment configuration.

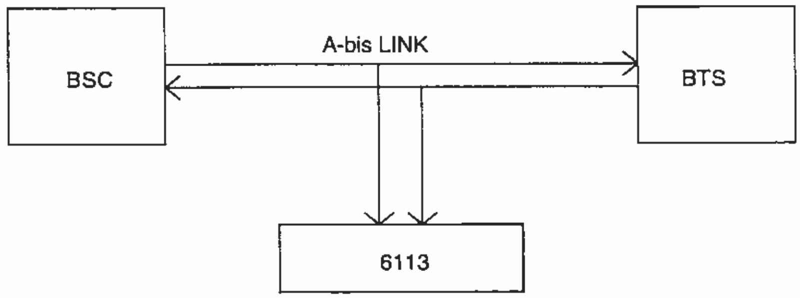


Figure 4.2 A-bis Protocol Analysis Mode Configuration

The following facilities are provided:

(1) The ability to select up to four A-bis slots on which to monitor data, using either 64 kbit/s or 16 kbit/s signalling.

Note: If 16 kbit/s signalling is used, each sub-slot monitored counts as one channel.

(2) The ability to record the Layer 2 and Layer 3 Signalling frames for later review.

(3) The ability to record a Traffic frame for later review.

(4) The ability to filter out certain Signalling messages to minimise data logged.

(5) The ability to replay stored log files.

The 6113 A-bis interface is operated in high impedance mode at all times whilst A-bis Protocol Analysis Mode is selected.

A-bis Connections - OUT/MONITOR, IN

Note: A-bis connectors on the 6113 Test Set are illustrated in Section 3.

To decode data on a link the 6113 requires a clock derived from one of the link directions. It is normal to use the Downlink (BSC to BTS) direction as the master clock; however, the Uplink (BTS to BSC) direction can also be used.

Connection must be made to A-bis Connector 2 (the 'IN' connector) on the 6113 front panel (the 6113 always recovers the clock from this connector when in Live Tests Mode).

Default assigments are Connector 1 to Uplink (BTS to BSC) and Connector 2 to Downlink (BSC to BTS).

Since A-bis Protocol Analysis mode operates in high impedance, the operator may use whichever A-bis connection is most suitable. However, the choice of connection must match the MMI selection for A-bis (i.e. Balanced or Unbalanced) made from the BTS Information screen.

The Balanced connectors are the two three pin banana sockets; the upper socket is Connector 1 and the lower is Connector 2. The Unbalanced connectors are the two coax connectors; the left hand socket is Connector 1 and the right hand socket is Connector 2.

Channel Selection

A-bis Signalling and Traffic frames can be monitored at the following rates:

64 kbit/s, 16 kbit/s Signalling Channels

16 kbit/s (Full Rate) Traffic Channel

In addition Speech and Data are also supported.

(Half Rate Speech and Data on the Traffic channel is not yet supported).

Four Signalling channels and one Traffic channel are provided. Each channel may be selected to monitor one of the physical connectors on the 6113 front panel.

The following parameters must be entered via the MMI display:

A-bis signal direction, Uplink or Downlink.

A-bis Slot.

A-bis Data Rate (64/16 kbit/s).

A-bis Sub-slot for data rates less than 64 kbit/s.

A value for the SAPI, Signalling channels only.

A value for the TEI, Signalling channels only.

The last two parameters will default to ALL. Entering a single value for the SAPI or TEI allows the user to restrict the amount of data recorded.

Up to four Signalling channels and one Traffic channel can be defined and selected for logging as required.

Logging

When the logging channels have been defined, the user can start and stop logging as required. Logging conditions cannot be changed while logging is in progress.

Data can be logged to a memory card in either of the two PCMCIA sockets.

While logging is in progress, Layer 3 messages are displayed in real time on the MMI screen. The Layer 3 message name is displayed together with decoded Layer 2 data and relevant channel information. (The user cannot review the data while logging is in progress).

When logging to memory card, logging will continue as long as there is disk space available.

When logging to memory card, select the name of the log file to be used for storing the data, otherwise a default log file name will be used. The log file selected will stay in use until the operator selects another. Note that the log file chosen will be overwritten with new log data on subsequent monitor sessions. A protocol analysis session is defined as starting when the *Start Monitor* button is pressed on the A-bis Protocol Analysis mode screen, and ends when the *Stop Monitor* button is pressed. One log file is used until the operator saves the data, at which point another log file name must be selected.

The log files are given an automatic file extension of .LOG.

Signalling Channels

Up to 4 signalling channels may be defined for logging. The data received on these channels comprises Layer 2 frames in LAPD format.

Traffic Channel

Only 1 traffic channel may be defined for logging. The data received on this channel will comprise the raw data read from the TRAU frame, including all the control bits.

Timestamping

All received frames are timestamped with the actual time. This timestamp has a resolution of 2 mS.

Log File Format

The data stored in the log file comprises Layer 2 frames, Layer 3 frames and Traffic frames. For each frame stored there is an accompanying timestamp and channel data to identify the source of the data. This allows the log file replay mode to tag the data with the source information.

The data stored is a mix of text strings and Hex data. Header data is stored at the start of the log file, followed by the logged data.

The following table illustrates a typical log file format.

Note: (1) All text strings are NULL terminated.

(2) Only the actual channels with logged data appear in the list of channel definitions.

(3) The Layer 3 Message ID field is not present on a Layer 2 or Traffic frame.

Table 4.2 Log File Format

Field	Format	Example / Comment
Date and Time	ASCII Text	17 May 1996 09:54:00
BTS Manufacturer	ASCII Text	BANJO
BTS Model	ASCII Text	GX 2.0
BTS Software Version	ASCII Text	GX 5.3
Clock Source	ASCII Text	External Uplink
Channel Definition 1	ASCII Text	SIG1 UL 31 64K - 62 0
Channel Definition 2	ASCII Text	SIG2 DL 31 64K - 62 0
Channel Definition 3	ASCII Text	SIG1 UL 15 64K - 0 1
Channel Definition 4	ASCII Text	SIG2 DL 15 64K - 0 1
Channel Definition 5	ASCII Text	TRF UL 2 16K 1
Layer Log ID		0 = L2, 1 = L3, 2 = TRF
Length	Hex	Length of complete log entry
Timestamp		
Channel Code	Hex	0 = SIG1, 1 = SIG2, 2 = SIG3, 3 = SIG4, 4 = TRF
L3 Message ID	Hex	Only relevant to a Layer 3 frame
Frame Data	Hex	Actual frame data.

Decode

For Layer 2 messages, Signalling channel, SAPI and TEI are decoded for log file replay.

For Layer 3 messages, message name and type are decoded (for all BTS types, including the Universal 08.58 type, that support the use of LAPD) in real time and during log file replay.

Note: LAPB, X25, Q703, SS7, FTP, and PPP messages are not supported.

Real Time Display

Layer 3 messages can be displayed during logging mode. This enables the operator to see the progress of any call setups, etc. No timestamp is displayed with this data.

Alternatively the logging status of each channel can be displayed

Log File Replay

Log file replay can be performed on log files stored on a memory card. The log file to be replayed is selected by its filename.

The recorded data may be replayed with various filtering applied to limit the amount of displayed data. Layer 2, Layer 2 + Layer 3, or just Layer 3 data can be displayed.

The frames of data displayed comprise a header and the selected data, followed by a Hex dump of the frame data.

Searching

A search facility allows the operator to locate a particular Layer 3 message on a specific channel. This allows the operator to move quickly to any point in the log file.

Filtering

Logging Mode

In Logging Mode, Measurement Reports can be filtered out. Note that if these messages are enabled for logging, the operator also has the option to suppress them during Log File Replay mode.

Log File Replay Mode

In Log File Replay mode, the operator can select :

-- the channels to be viewed.
-- the Layers to be viewed.
-- viewing of Measurement Reports.

To open a log file for review, the sequence of actions is as follows:

(1) Open the log file.

(2) Select the channels and layers to be viewed.

The contents of the log file are then displayed.

An *Auto Scroll* button allows the user to view the log contents quickly, and a *Pause* button allows the user to stop the scroll.

The view position can be adjusted in small amounts, and a search key can be used to move to a selected position within the file.

Printing

Printing is only available during Log File Replay mode.

The contents of the current buffer, or the current displayed page, can be printed as required. The print output can be directed to the various ports available on the Test Set. Note that the entire log file can be printed: if the file is large and does not fit into the buffer, frames are buffered in from the memory card.

Parameter Files

Relevant A-bis Protocol Analysis mode parameters, together with other general setup parameters, can be stored for later recall. Parameters stored include:

Channel definitions.
Filter definitions.

The parameters related to A-bis Protocol Analysis mode are attached to the main parameter database and hence are saved and recalled together with the normal Parameters file.

SPECIAL FUNCTIONS

Signal Generator Mode

Signal Generator Mode allows the 6113 to act as a signal generator that can transmit a variety of GSM structured signals and other signals from the RF OUT connector. No monitoring of returned signals is performed in this mode and so there are no test procedures, other than those devised by the user. There are no special setting up procedures.

The MMI facilities for controlling the Signal Generator mode are described in SECTION 5 under the heading Special Functions.

Signal Parameters

Parameter	Default Value	Range
Channel Number	90 (E-GSM 900) 512 (DCS 1800) 512 (PCS 1900)	0 to 124, 975 to 1023 (E-GSM 900) 512 to 885 (DCS 1800) 512 to 810 (PCS 1900)
Frequency Offset	0 Hz	-999999 to 999999 Hz
Output Level	-40.0 dBm	-120.0 to -40.0 dBm
Signal Format (Note)	Off	Control Channel Traffic Channel Unmodulated 0000.... 1111.... 0101.... Training Sequence Off
Pulsing	Off	Off, On
Training Sequence	0	0 to 7 (GSM defined)

Note: Available signal formats are described in the following table.

Table 4.3 Signal Formats

Downlink Signal Type	Description
Control Channel	A combined CCH with FCCHs, SCHs and BCCHs, all with information elements as defined in the Parameters / GSM Parameters menu. SDCCHs are replaced by dummy bursts.
Traffic Channel	A single channel with training sequence as defined by Training Sequence parameter. Data is fixed at 01010101010. . . . . . .
Carrier Unmodulated	Transmits a CW signal.
Carrier modulated with 0000....	Transmits a signal modulated with all zeros (i.e. all burst data set to zero).
Carrier modulated with 1111....	Transmits a signal modulated with all ones (i.e. all burst data set to one).
Carrier modulated with 0101....	Transmits a signal with all burst data set to a data pattern of 01.
Training Sequence	Transmits a signal with all burst data set to the (repeated) training sequence determined by the selected parameter value (0 to 7).

Power Meter Mode

Power Meter Mode is provided as an aid to verifying the integrity of the RF path from a BTS to a 6113 Test Set.

Selecting the Power Meter facility enables the Test Set to operate as an independent Power Meter instrument. In this mode it will find and track a single modulated signal or unmodulated continuous wave (CW) signal, power level 0 to 50 dBm, within the downlink frequency range of the GSM / DCS 1800 / PCS 1900 bands. (Any modulated signals must be transmitting in all 8 timeslots).

The Power Meter facility can either scan a selected band to find the signal with maximum power, or it can monitor a single frequency within a selected band. Note that only one signal can be tracked in a band, two close peaks (i.e. less than 10 channels apart) may not be distinguished.

To verify the BTS Tx path, use a modulated carrier from the BTS and check the presence of the received signal using the Test Set Power Meter mode.

To verify the 6113 Rx path, use an unmodulated carrier (CW) from a signal generator and check the presence of the signal using the Test Set Power Meter mode.

To operate the Test Set as a Power Meter, the following procedure must be followed:

Scanning for Maximum Signal

(1) Connect the RF signal path to be monitored to the RF IN / DUPLEX connector on the front panel of the Test Set, as described in Section 3 Preparation For Use and in Section 7 Manufacturer-Specific Information.

(2) In the BTS Information Menu, set the required radio system (only) of the BTS of interest. Note that this will determine the scan frequency range (i.e. GSM 900, DCS 1800 or PCS 1900 band).

(3) Select *Power Meter* option from the Special Functions Menu screen at the MMI.

(4) Toggle the *Scan Type* button to display MAX POWER. This will cause the Power Meter to scan the frequency band (selected in the BTS Information screen) for the channel containing maximum power.

(5) Press the *Rescan* button. Initially, the Signal box will toggle between SEARCHING and NO SIGNAL.

(6) If the Power Meter detects a signal within the selected frequency band, the Signal box will display FOUND. If the signal is tracked successfully, the signal box will display TRACKING (after approximately 10 seconds). The Nearest ARFCN box will display the channel number, and the BTS Tx Power bargraph will indicate the power in the signal. The decimal value of the power level (in dBm) is also displayed.

Note: Until TRACKING is displayed, any readings are unreliable.

Monitoring a Single Channel

(1) Connect the RF signal path to be monitored to the RF IN / DUPLEX connector on the front panel of the Test Set, as described in Section 3 Preparation For Use and in Section 7 Manufacturer-Specific Information.

(2) In the BTS Information Menu, set the required radio system (only) of the BTS of interest. Note that this will determine the scan frequency range (i.e. GSM 900, DCS 1800 or PCS 1900 band).

(3) Select *Power Meter* option from the Special Functions Menu screen at the MMI.

(4) Toggle the *Scan Type* button to display NO SCAN.

(5) Set the number of the ARFCN to be monitored in the *ARFCN* button.

(6) Press the *Rescan* button. Initially, the Signal box will display NO SIGNAL.

(7) If the Power Meter detects a signal within the selected channel, the Signal box will display FOUND. If the signal is tracked successfully, the signal box will display TRACKING (after approximately 10 seconds). The Nearest ARFCN box will display the channel number, and the BTS Tx Power bargraph will indicate the power in the signal. The decimal value of the power level (in dBm) is also displayed.

Note: Until TRACKING is displayed, any readings are unreliable.

SELF-CHECK TESTS

These tests are used to confirm that the Test Set itself is operating correctly. It is recommended that they are run once a week, or when a malfunction is suspected.

If the B.O.S.S. RF Module (Option 54 / Option 56) is not fitted, then use the Self Check Burst Analysis test. If Option 54 or Option 56 is fitted, then the RF Tests Self Check Burst Analysis test should be used as well as the Self Check Burst Analysis test.

If any of the Self Check tests fail, advice should be sought from the Help Desk at Racal Instruments, or from the nearest approved Racal GSM repair and calibration centre.

Self Check Burst Analysis

Purpose of Test

Burst Analysis

This test analyses the burst parameters of the 6113 Test Set using an internal loopback. The RF facilities available at the front panel of the Test Set are the subject of this test.

Bit Error Ratio

This test checks the Bit Error Ratio of the 6113 Test Set using an internal loopback.

Test Parameters

Parameter	Default Value	Range
Self Check frequency	897.500 MHz (GSM 900)	880.000 to 915.000 MHz
	1747.500 MHz (DCS 1800)	1710.000 to 1850.000 MHz
	1880.000 MHz (PCS 1900)	1850.000 to 1910.000 MHz
Self Check slot	4	0 to 7
Test Pattern	1	0 to 9
Sample Time	10 s	1 to 300000 s
FER Limit	0.000 %	0.000 to 100.000 %
Class Ib Limit	0.000 %	0.000 to 100.000 %
Class II Limit	0.000 %	0.000 to 100.000 %
Peak Phase Error Limit	20.00 deg	0.00 to 30.00 deg
RMS Phase Error Limit	5.00 deg	0.00 to 10.00 deg
Frequency Error Limit	±48.0 Hz (GSM)	0.0 to ±5000.0 Hz
	±95.0 Hz (DCS 1800)	0.0 to ±5000.0 Hz
	±95.0 Hz (PCS 1900)	0.0 to ±5000.0 Hz
Power Level Error Limit	±3.0 dB	0.0 to ±10.0 dB
Number of Bursts	10	1 to 999
Burst Number	Any	Any, 1 to 4
Encryption	Off	Off, A5/1, A5/2
Tx Signal Attenuation	0.0 dB	+0.0 to +80.0 dB

Test Method

Select the *Run Test* option from the MMI display after setting the parameters as required.

Pass/Fail Criteria

Note: The Power Level measurement is <u>not shown</u> on the screen. If the final overall result is FAIL and all the individual displayed measurements show PASS, then this is due to the Power Level measurement being FAIL.

Burst Analysis

In each case, the returned mean phase error should be < 5 °, and the maximum phase error should be < 20 °. The power profile of the analysed burst must be within the graphical limits displayed. Specific areas of the graph may be enlarged for closer examination.

Bit Error Ratio

The returned Bit Error Ratios should be zero in all cases, and the measured input level should be approximately +12 dBm ±3 dBm.

RF Tests Self Check Burst Analysis

Purpose of Test

Burst Analysis

This test analyses the burst parameters of the 6113 Test Set using an internal loopback. The B.O.S.S. RF facilities available at the rear panel of the Test Set are the subject of this test.

Bit Error Ratio

This test checks the Bit Error Ratio of the 6113 Test Set using an internal loopback.

Test Parameters

Parameter	Default Value	Range
Self Check frequency	897.500 MHz (GSM 900)	880.000 to 915.000 MHz
	1747.500 MHz (DCS 1800)	1710.000 to 1850.000 MHz
	1880.000 MHz (PCS 1900)	1850.000 to 1910.000 MHz
Self Check slot	4	0 to 7
Test Pattern	1	0 to 9
Sample Time	10 s	1 to 300000 s
FER Limit	0.000 %	0.000 to 100.000 %
Class Ib Limit	0.000 %	0.000 to 100.000 %
Class II Limit	0.000 %	0.000 to 100.000 %
Peak Phase Error Limit	20.00 deg	0.00 to 30.00 deg
RMS Phase Error Limit	5.00 deg	0.00 to 10.00 deg
Frequency Error Limit	±48.0 Hz (GSM)	0.0 to ±5000.0 Hz
	±95.0 Hz (DCS 1800)	0.0 to ±5000.0 Hz
	±95.0 Hz (PCS 1900)	0.0 to ±5000.0 Hz
Power Level Error Limit	±3.0 dB	0.0 to ±10.0 dB
Number of Bursts	10	1 to 999
Burst Number	Any	Any, 1 to 4
Encryption	Off	Off, A5/1, A5/2
Tx Signal Attenuation	0.0 dB	+0.0 to +80.0 dB

Test Method

Select the *Run Test* option from the MMI display after setting the parameters as required.

Pass/Fail Criteria

Note: The Power Level measurement is not shown on the screen. If the final overall result is FAIL and all the individual displayed measurements show PASS, then this is due to the Power Level measurement being FAIL.

Burst Analysis

In each case, the returned mean phase error should be < 5 °, and the maximum phase error should be < 20 °. The power profile of the analysed burst must be within the graphical limits displayed. Specific areas of the graph may be enlarged for closer examination.

Bit Error Ratio

The returned Bit Error Ratios should be zero in all cases.

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INTRODUCTION

This Section describes the graphical Man Machine Interface (MMI) for the 6113 Digital Radio Test Set. The MMI is displayed on a 4 grey scale 640 x 200 pixel LCD, and uses the front panel spinwheel, softkeys (referred to as 'buttons' in this manual) and numeric keys for control and data entry.

The MMI controls are particularly easy to use. In most situations the operator uses either the spinwheel or specially-defined softkey buttons for selecting from the list. Where softkey buttons are displayed with up/down scroll arrows, the spinwheel may also be used.

Some softkey buttons are used to toggle a parameter through a small set of defined states. For example, the *Results* button in the Results Menu screen has two states: 'Off' and 'Printer'. The method chosen for controlling these functions uses buttons which only display the current option in a small box within the button; the option toggles through the list of selections when the button is selected. When there is a larger selection of options, the MMI displays a scrolling list from which an option may be highlighted and selected using either the spinwheel or the up/down arrow buttons.

The MMI uses various different types of file on the memory card, including sequence files, parameter files, and results files. These files all have fixed extensions for use by the system.

File Type	Extension
Downloadable application code	MOT or BIN
Offsets	OFF
Parameter	PRM
Sequence	SEQ
Results	RST

Note: MOT files can be downloaded from a PC; BIN files can be downloaded from a PC Card memory card.

Status Bar

The Status Bar is always displayed at the bottom of every screen. It is used to display status information relevant to the Test Set. Figure 5.1 illustrates a typical Status Bar.

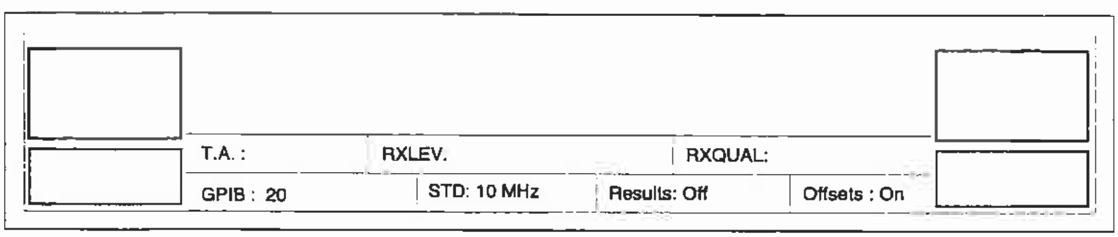


Figure 5.1 Typical Status Bar

GPIB

This box is used to display the GPIB port status.

Std.

The Std box displays the currently selected frequency standard - 10 MHz or 13 MHz; the display is in reverse video if the frequency standard is out of lock.

Results

This box indicates whether or not the results will be printed. Results may be printed or sent to a file or to a device connected to one of the communications ports, or not saved.

Offsets

This box displays the status of the level offsets function, whether is is on or off.

RXQUAL/RXLEV

These boxes display the RXQUAL and RXLEV values reported by the BTS as it monitors the signal transmitted by the Test Set.

Date And Time

Date

Date is displayed and represented in the format DD MMM YY, where DD = day, MMM = month, YY = year. For example:

04 OCT 97

In all instances of a two-digit year, the inference rules are as follows:

Abbreviated Format	Full Format
80 to 99	1980 to 1999
00 to 79	2000 to 2079

Time

Time is displayed and represented in the format HH : MM : SS, where HH = Hour, MM = Minute, SS = Second. For example:

14 : 23 : 59

MENU STRUCTURE

Details of the primary menu structure and the facilities available with each option, together with details of how the displays are controlled and edited, are given in the following paragraphs. Figure 5.2 illustrates the primary structure of the MMI menus and the facilites provided. All the menu descriptions provided in this Section are structured under the same primary facility headings.

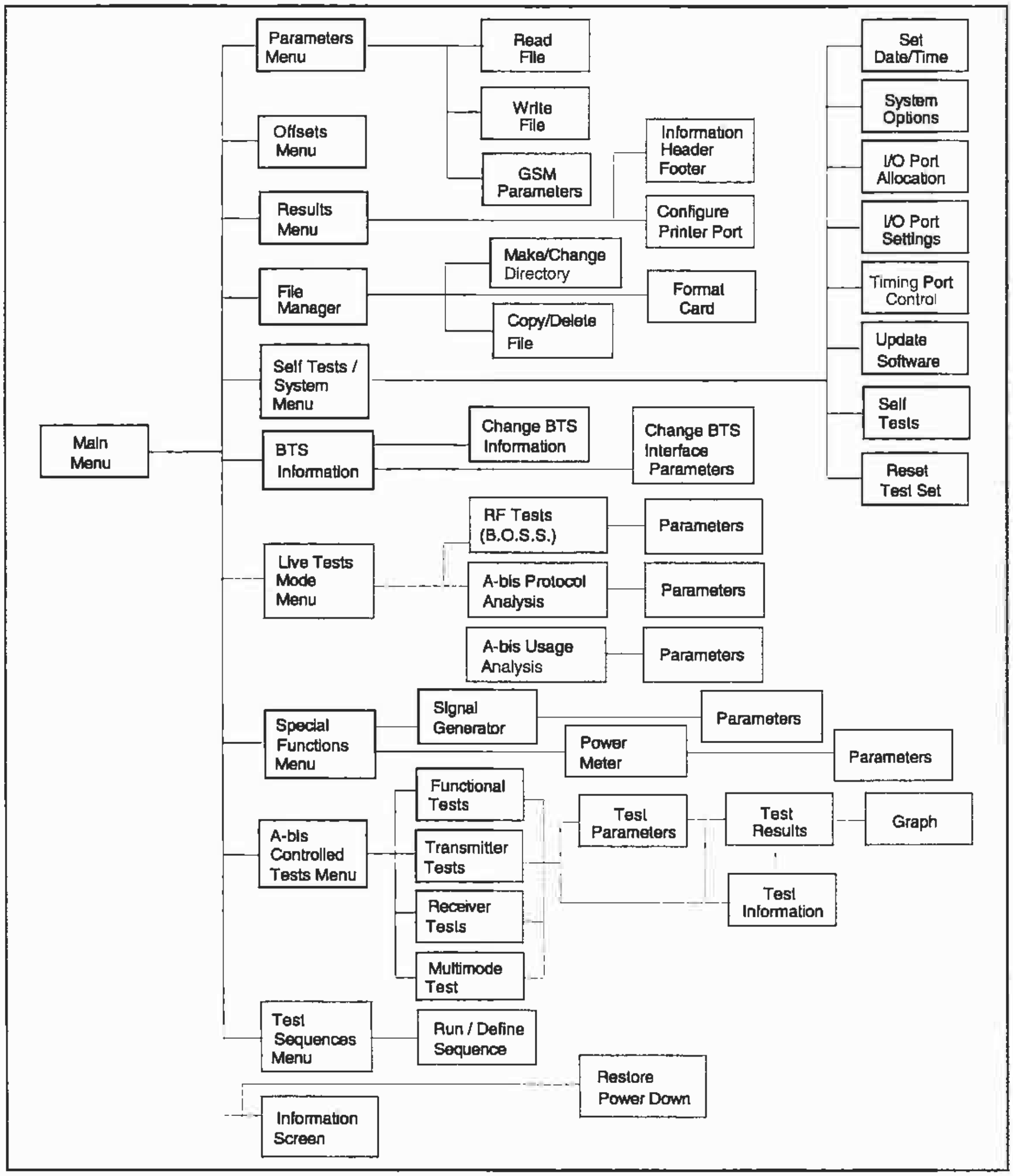


Figure 5.2 MMI Primary Menu Structure and Facilities

MAIN MENU

The main menu is the first menu the operator sees when the instrument is powered up. It gives top-level access to all the facilities. This menu is the only place where the '6113 GSM' logo, '6113 DCS 1800' logo or '6113 PCS 1900' logo is displayed; when an option is selected from the menu the logo is removed.

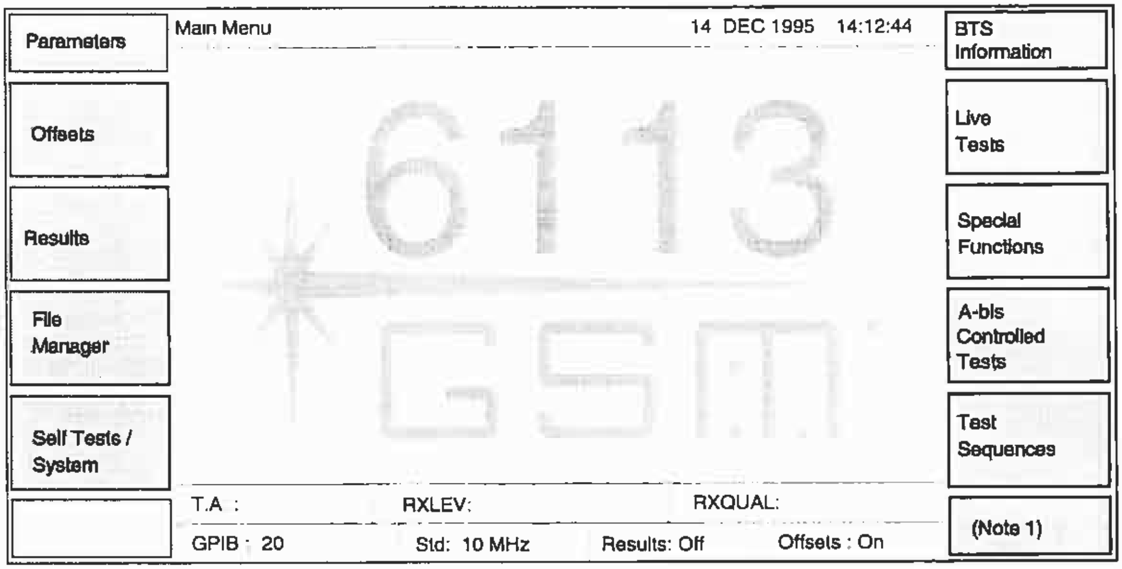


Figure 5.3 Main Menu (GSM)

Menu Options

Option Button	Function
Parameters	This option selects the Parameter Menu which allows control of various system parameters such as the default global GSM parameters and the default Test Set parameters.
Offsets	This option allows the user to edit the Level Offset parameters to compensate for RF losses between the Test Set and BTS under test.
Results	This option selects the Results Menu which allows the user to enter information to be included with the results. If the results are to be printed, the operator is able to select and configure the printer port.
File Manager	This option selects the File Manager function which allows the user to manage the files on the Memory Cards.
Self Tests / System	This option selects the System Menu which allows the user to view and set various Test Set configuration options and to run the Self Test.
BTS Information	This option selects the BTS-specific BTS information screen allowing all BTS dependent options to be set.

Live Tests	This option selects the Live Tests Menu for using non-intrusive test modes to test an operational BTS.
Special Functions	This option selects Special Functions test screen which allows the user to select the Signal Generator mode or Power Meter mode of operation.
A-bis Controlled Tests	This option selects the A-bis Controlled Tests Menu where the user selects a particular test, and sets the parameters, to test the BTS.
Test Sequences	This option selects the Test Sequences Menu which allows the user either to select and run, or to define, a stored sequence of tests.

Notes:

(1) After the first button press the button becomes *Information Screen* which displays a screen of Test Set information (summary screen, non editable) instead of the logo.

(2) The 'GSM' part of the logo changes according to the radio system currently selected.

CAUTION: A-bis Impedance Switching

When the 6113 is powered ON, the A-bis interface connectors are initially open circuit.

Selecting either the *A-bis Controlled Tests* option or the *Test Sequences* option sets the A-bis impedance low (75 or 120 ohms, according to the selection at the *Interface* option of the BTS Information Menu).

Selecting the *Live Tests* option sets the A-bis impedance high.

Once the the A-bis impedance is set either high or low, by pressing the keys as described above, the impedance remains as set until:

(1) When the impedance is low, *Live Tests* option is selected and the impedance is set high.

(2) When the impedance is high, either *A-bis Controlled Tests* option *or Test Sequences* option is selected and the impedance is set low. In this instance, the following warning is also displayed:

WARNING

This operation will cause the
A-bis connectors to revert to low impedance

Where connection is to a live system
disconnect A-bis cables before continuing.

PARAMETERS MENU

The Parameter Control screen is displayed when *Parameters* option is selected at the Main Menu. This option is used to control groups of default parameters that are permanently in effect in the Test Set.

Parameter Control Screen

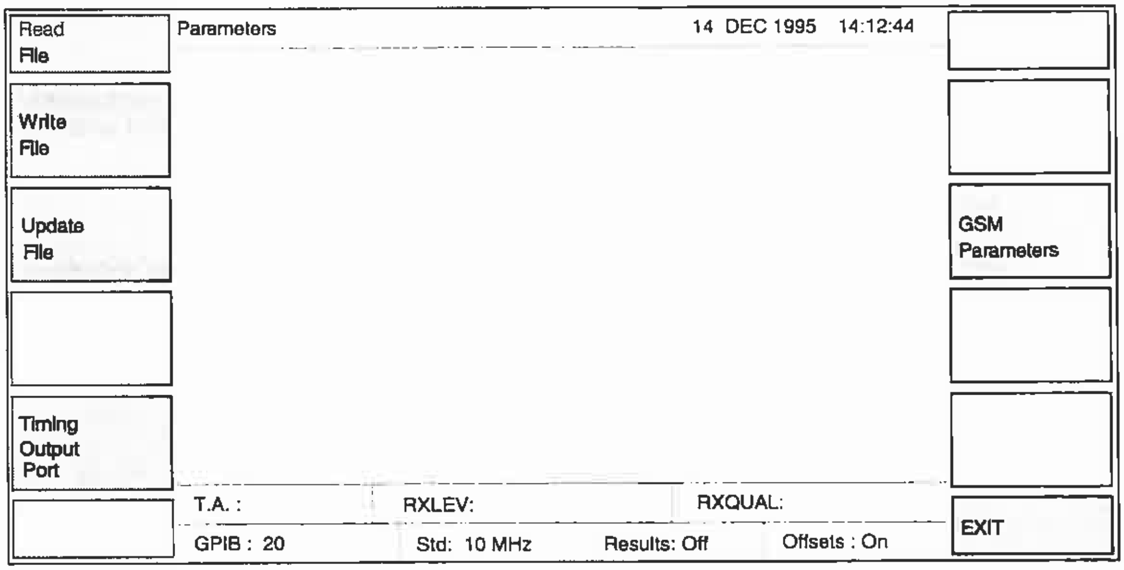


Figure 5.4 Parameter Control Screen

Menu Options

Option Button	Function
Read File	This option displays a File Selection Screen, allowing the user to select a parameter file on the memory card to load into the Test Set as its new parameter state.
Write File	This option displays the File Selection Screen, allowing the user to save the current parameter state in a file on the memory card.
Update File	Displays a Select Parameter File to Read screen for selecting a file on memory card to update.
Timing Output Port	Displays a Configuration Parameter Edit screen for changing the configuration state and start and stop times for the timing port (SYNC OUT).
GSM Parameters	This option displays the GSM Parameter Selection Screen, allowing the user to select a group of GSM parameters to edit (see Table 5.1).
EXIT	This option returns the user to the Main Menu.

TABLE 5.1 GSM PARAMETERS

Parameter Sub-group		Parameter Name	Default Value	Range
Base Station ID		Network Colour Code	0	0 to 7
		Base Station Colour code	0	0 to 7
Control Channel Description		ISMI Attach-Detach	1	0 to 1
		Blocks reserved for access grant	0	0, 1, 2 or 0 to 7
		CCCH Configuration	1	0, 1, 2, 4, 6
		Multiframes between paging requests	2	2 to 9
		T312 Timeout Value	0	0 to 255
Cell Channel Description	E-GSM	Cell Allocation Number	0	Fixed at 0
		Cell Allocation Table	Bitmap	Not Applicable
	DCS 1800 / PCS 1900	Format ID	Variable	Variable
		Orgin ARFCN	513	512 to 885 / 512 to 810
		Cell Allocation Table	Bitmap	Not Applicable
Cell Options		Power Control Indicator	0	0, 1
		DTX indicator	2	0 to 2
		Radio Link Timeout T100	8	4 to 64
Neighbour Cells Description	E-GSM	BCCH Allocation Number	0	Fixed at 0
		BCCH Allocation Sequence Number	0	0, 1
		Neighbour Cell Table	Bitmap	Not Applicable
	DCS 1800 / PCS 1900	Format ID #1	Variable	Variable
		Origin ARFCN #1	513	512 to 885 / 512 to 810
		Format ID #2	Unused	Variable, Unused
		Origin ARFCN #2	513	512 to 885 / 512 to 810
		Neighbour Cell Allocation	Bitmap	Not Applicable
RACH Control		Maximum Retransmissions	2	1, 2, 4, 7
		Tx Spread Integer	5	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 20, 25, 32, 50
		Cell Barred	0	0, 1
		Call Re-establish	1	0, 1
		PLMN Permitted	255	0 to 255
		Cell Identity Value	1	0 to 65535
Location Area ID		Access Control Class	0	0 to 65535
		Mobile Country Code	1	0 to 999
		Mobile Network Code	1	0 to 255
		Location Area Code	1	0 to 65535
Cell Selection		Cell Reselect Hysterisis	12	0, 2, 4, 6, 8, 10, 12, 14
		Max Mobile Tx Power Lvl	15	0 to 31
		Min Mobile Rx Signal Lvl	0	0 to 63
Encryption Kc		Encryption Kc	FFFFFFFF FFFFFC00	00000000 to FFFFFFFF

File Selection Screen - File Read

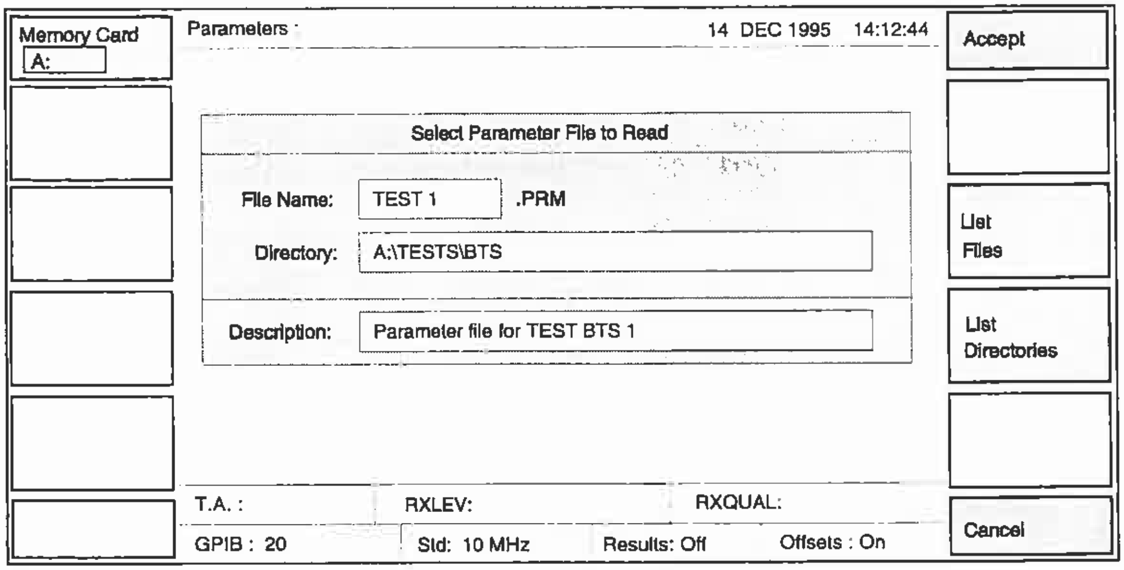


Figure 5.5 File Select - File Read Screen

Menu Options

Option Button	Function
Memory Card	Selection toggles between slot A: and slot B:.
Accept	Accepts the current file selection, reads the information from the file into memory and then returns to the previous menu. No confirmation message is displayed.
List Files	Switches to Select from List screen to select a file from a scrolling list.
List Directories	Switches to Select from List screen to select a directory from a scrolling list.
Cancel	Discards the current file selection and then returns to the Parameters Menu without loading the file.

Notes:

(1) The Description for the currently selected parameter file is read from the file and displayed on the bottom line of the table.

(2) The file extensions are fixed so that only files relevant to the current context are displayed.

(3) Selection of all file names and directories is done from scrolling lists.

File Selection Screen - File Write

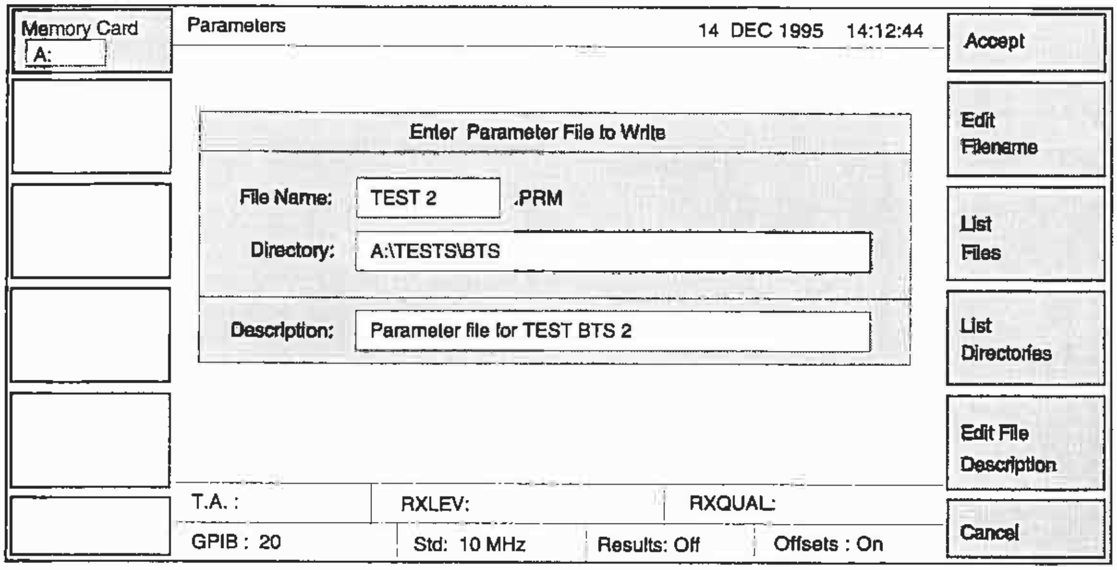


Figure 5.6 File Select - File Write Screen

Menu Options

Option Button	**Function**
Memory Card	Selection toggles between slot A: and slot B:.
Accept	Accepts the current file selection, writes information from memory to the file and then returns to the previous menu. No confirmation message is displayed.
Edit Filename	Switches to Text Edit mode for the user to type in a file name.
List Files	Switches to Select from List screen to select a file from a scrolling list.
List Directories	Switches to Select from List screen to select a directory from a scrolling list.
Edit File Description	Switches to Text Edit mode for the user to type in a file description.
Cancel	Discards the current file selection and then returns to the Parameter Control screen without loading the file.

Notes:

(1) If the selected file already exists, a confirmation message is displayed asking the user to confirm overwriting the existing file.

(2) If an existing file is selected the Description field is refreshed from the selected file.

GSM Parameter Selection Screen

This screen is used to select a GSM parameter group, from a scrolling list of Configuration Parameter Groups which may be selected with the spinwheel or Scroll Soft keys. Selecting an option from the list displays the appropriate Configuration Parameter Edit Screen allowing the user to edit the parameter group selected.

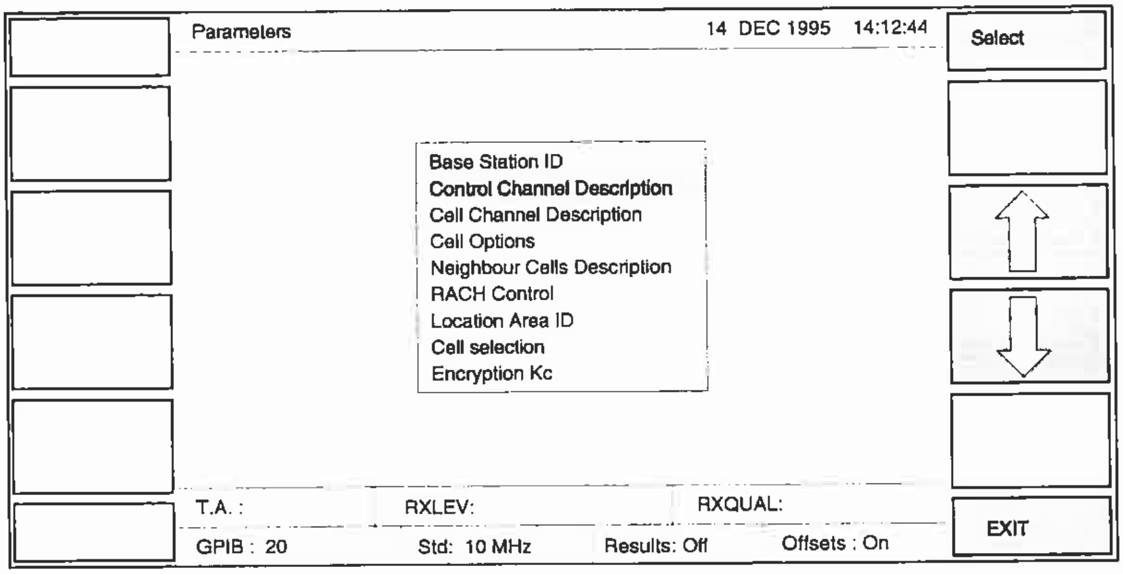


Figure 5.7 GSM Parameter Selection Screen

Menu Options

Option Button	Function
Select	Accepts the current selection and switches to the Configuration Parameter Edit Screen
⇧	Moves the current selection up one item.
⇩	Moves the current selection down one item.
EXIT	Returns to the Parameters Menu.

Configuration Parameter Edit Screen

This screen is used to select and edit parameters. The exact operation is dependent upon the type of parameter selected. The screen has two modes of operation:

(1) Select Parameter

The desired parameter is selected by scrolling the selection bar through the list of items, using either the spinwheel or the up/down arrow keys.

(2) Edit Parameter

The selected parameter is edited by incrementing or decrementing, or entering a number from the numeric keypad, or resetting the parameter to its default value. There are four types of parameter:

Numeric: A parameter which can vary between a range of numeric values.

Toggle: A parameter which can have one of the values from a pre-defined list.

Bitmap: A parameter which has a pictorial bitmap representatiion.

Text: A parameter which has an editable text string associated with it.

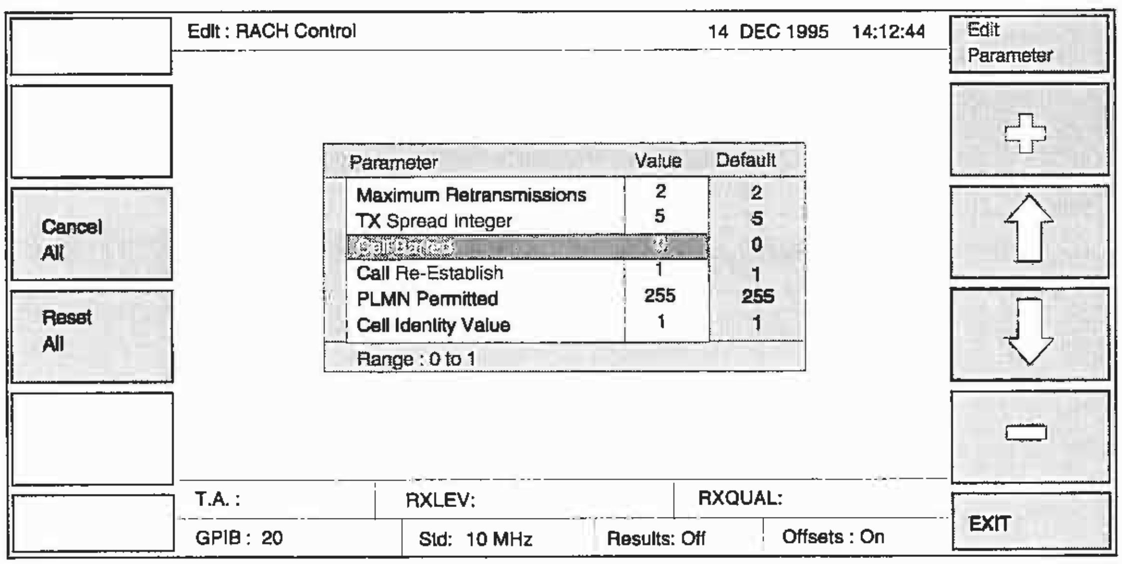


Figure 5.8 Configuration Parameter Edit Screen

Menu Options

Option Button	Function
Cancel All	Discards all the changes made to the set of parameters displayed restoring the previous values, then return to the previous menu.
Reset All	Sets all the parameters displayed to their default values.

Edit Parameter	For toggle or numeric parameters, this button displays the Numeric Parameter Edit Screen 1; for bitmap parameters a bitmap edit screen is displayed; for text parameters a text edit screen is displayed (described under FILE MANAGER MENU).
+	For toggle or numeric parameters, increments the currently selected parameter. For bitmap or text parameters, it displays a bitmap edit screen or text edit screen (described under FILE MANAGER MENU).
⇧	Moves the current parameter selection up one item, accepting any changes made to previous parameter.
⇩	Moves the current parameter selection down one item, accepting any changes made to previous parameter.
–	For toggle or numeric parameters, decrements the currently selected parameter. For bitmap or text parameters it displays a bitmap edit screen, or text edit screen (described under FILE MANAGER MENU).
EXIT	Accepts all the changes made to the set of parameters displayed and sets up the new values in the Test Set, then returns to the previous menu.

Notes:

(1) The screen always starts with the spinwheel in 'Parameter Select' mode. (When the *Edit Parameter* option is selected, then Numeric Parameter Edit Screen 1 is displayed and the spinwheel can be used to change the value of the selected parameter).

(2) The range for the currently selected parameter is displayed on the bottom line of the table.

(3) Pressing numeric keys on the keyboard selects:

-- Numeric Parameter Edit Screen 2 with a numeric or toggle parameter selected.
-- Text Entry / Edit screen with a text parameter selected, or
-- Bitmap Edit screen with a bitmap parameter selected.

(4) The spinwheel may be used to scroll up and down the parameter list.

Numeric Parameter Edit Screen 1

This screen is displayed when the Edit Parameter option is selected at the Configuration Parameter Edit screen.

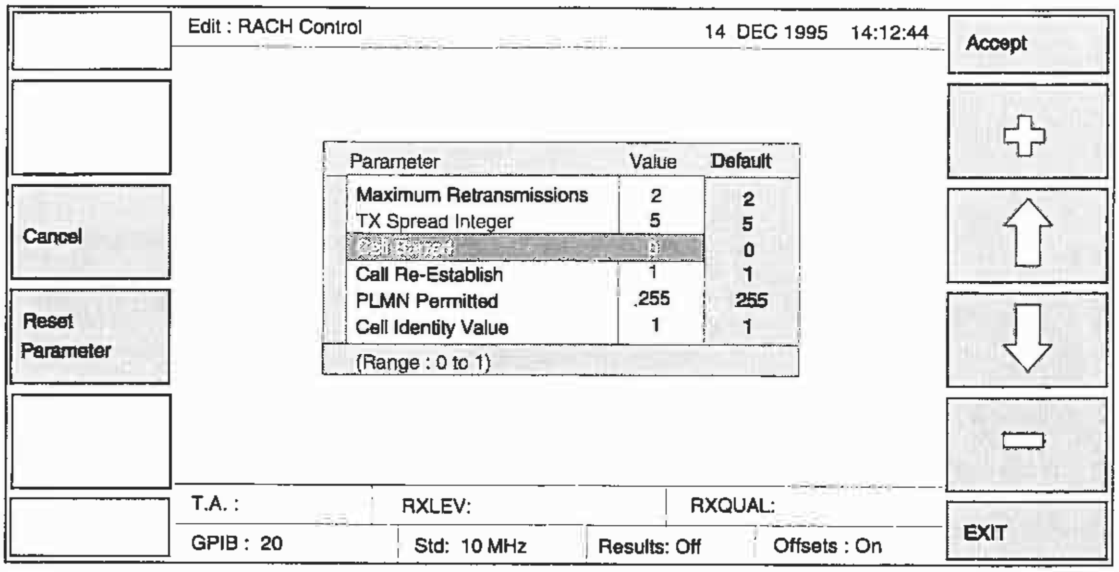


Figure 5.9 Numeric Parameter Edit Screen 1

Menu Options

Option Button	Function
Cancel	Resets the parameter to its previous value.
Reset Parameter	Resets the parameter to its default value..
Accept	Accepts the change made to the parameter and returns to the Configuration Parameter Edit Screen.
✚	For toggle or numeric parameters, increments the currently selected parameter. For bitmap or text parameters, it displays a bitmap edit screen or text edit screen (described under FILE MANAGER MENU).
⇧	Moves the current parameter selection up one item, accepting any changes made to previous parameter, and returns to the Configuration Parameter Edit screen.
⇩	Moves the current parameter selection down one item, accepting any changes made to previous parameter, and returns to the Configuration Parameter Edit screen.
–	For toggle or numeric parameters, decrements the currently selected parameter. For bitmap or text parameters it displays a bitmap edit screen, or text edit screen (described under FILE MANAGER MENU).

EXIT	Accepts the value of the selected parameter and returns to the Configuration Parameter Edit screen.

Notes:

(1) The spinwheel may be used to increment or decrement the value of the selected parameter.

(2) Pressing a numeric key on the keyboard will:

-- edit the parameter selected and display Screen 2.
or
-- display the Bitmap Edit screen if a bitmap parameter is selected
or
-- display the the Text Edit screen (described under FILE MANAGER MENU) if a text
parameter is selected..

(3) In this screen, the spinwheel or +/- softkeys cannot increment or decrement the value of the selected parameter beyond its maximum or minimum values.

Numeric Parameter Edit Screen 2

This screen is displayed when a numeric key on the keypad is pressed in the Configuration Parameter Edit screen or the Numeric Parameter Edit Screen 1.

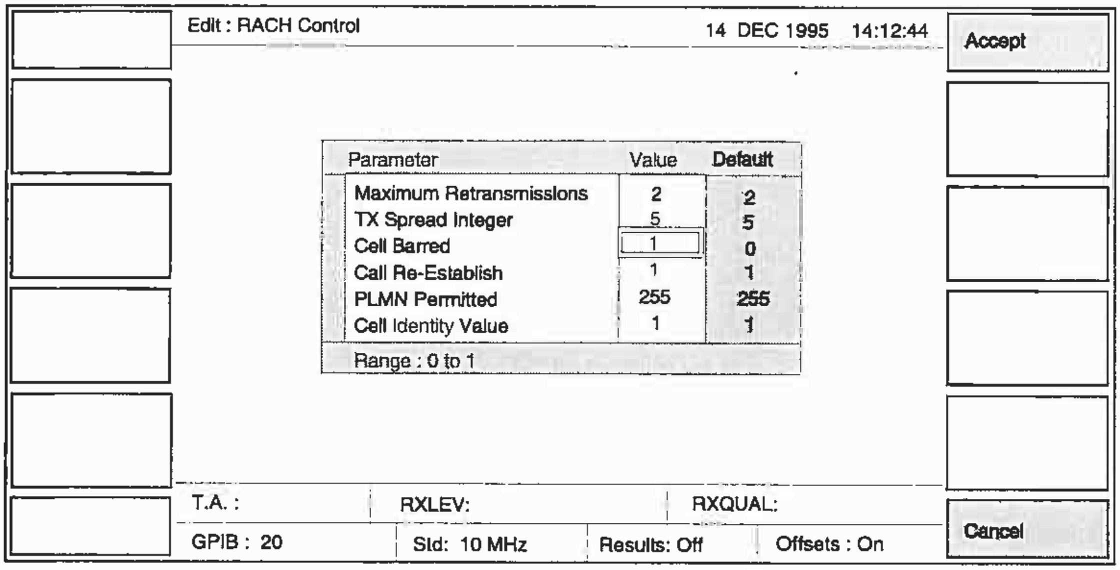


Figure 5.10 Numeric Parameter Edit Screen 2

Menu Options

Option Button	**Function**
Accept	Accepts the change made to the parameter and returns to the Configuration Parameter Edit Screen (Note 2).
Cancel	Discards changes made to the selected parameter and restores the previous value, and returns to the Configuration Parameter Edit screen.

Note: (1) In this screen, only the numeric keys can be used to edit the parameter value. The spinwheel and the ← key can be used to move the cursor to facilitate editing.

(2) If a parameter value is edited beyond its maximum or minimum value, an error message is displayed and the parameter is returned to its previous value, then the screen returns to the Configuration Parameter Edit screen..

Bitmap Edit Parameter Screen

The Bitmap Edit Parameter screen is displayed when the user attempts to change a bitmap parameter.

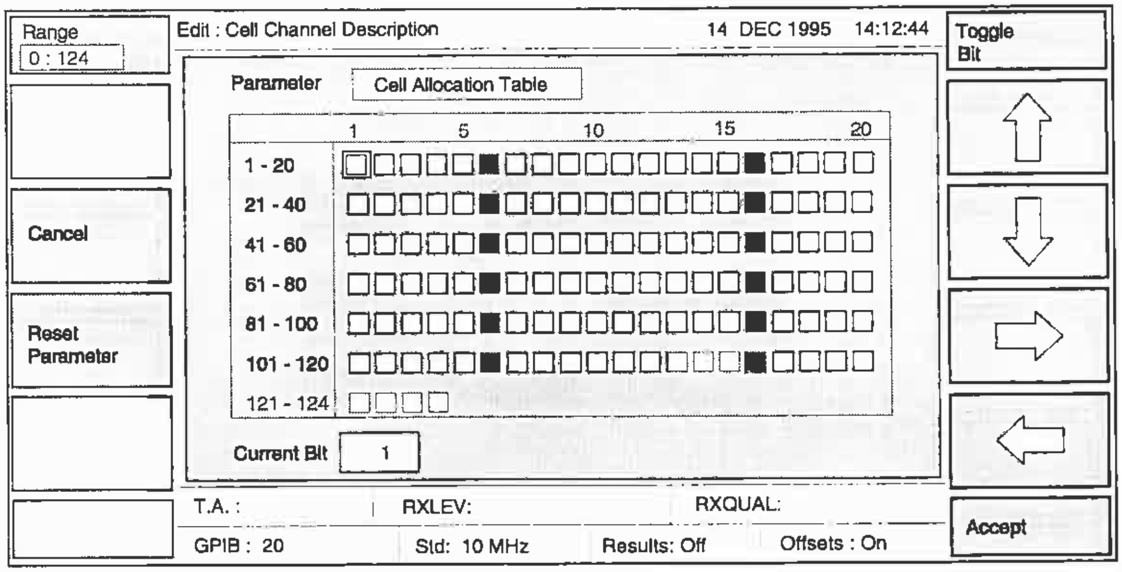


Figure 5.11 Bitmap Edit Parameter Screen

Menu Options

Option Button	Function
Range	Toggles the range between 0 : 124 and 975 : 1023.
Cancel	Discards changes made to the selected parameter and restores the previous value.
Reset Parameter	Resets the parameter to its default value.
Toggle Bit	Toggles the state of the current bit, and moves the selection point to the next bit.
⇧	Moves the current selection point up one item.
⇩	Moves the current selection point down one item.
⇨	Moves the current selection point right one item.
⇦	Moves the current selection point left one item.
Accept	Accepts all the changes made to the displayed bitmap and returns to the previous menu.

Notes:

(1) The currently selected bit number is displayed in the Current Bit box of the table.

(2) The spinwheel may be used to scroll left and right through the bitmap, wrapping round at the edge of lines.

OFFSETS MENU

The Level Offsets screen is displayed when *Offsets* option is selected at the Main Menu. This screen allows the user to apply level offsets to the BTS transmit and receive paths to compensate for path losses. These offsets can be saved as .LEV files on the memory card and recalled for use as necessary.

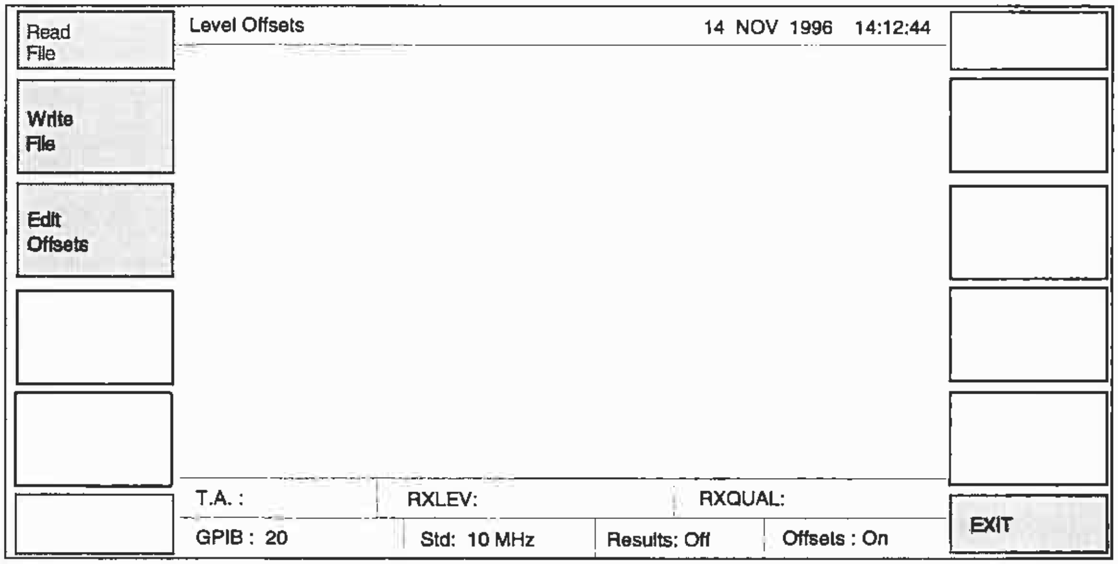


Figure 5.12 Level Offsets Screen

Menu Options

Option Button	Function
Read File	This option displays a File Selection Screen, allowing the operator to select a level offsets file on the memory card to load into the Test Set. When loaded, the offsets are applied if the Level Offsets parameter (in the *Edit Offsets* option) is set to On.
Write File	This option displays the File Selection Screen, allowing the user to save the current level offsets state in a file on the memory card.
Edit Offsets	Displays a standard Parameter Select screen that allows the operator to edit the BTS transmit and receive path offsets (range -99.99 to 99.99 dB), and switch the offsets On or Off.
EXIT	This option returns the user to the Main Menu.

RESULTS MENU

The Results screen is displayed when *Results* option is selected at the Main Menu. This screen allows the user to define how the test results are presented.

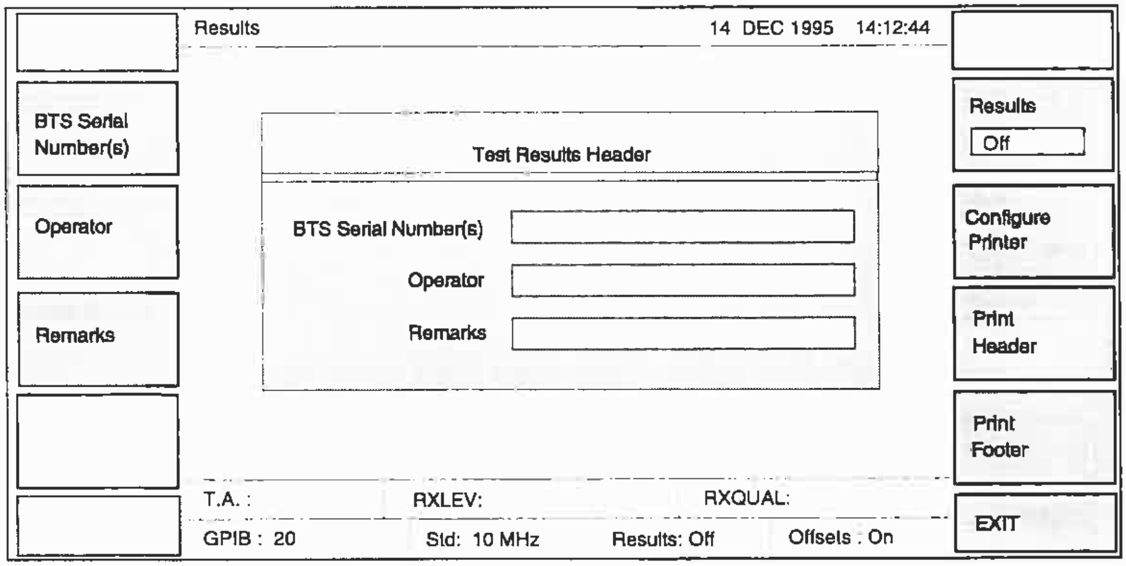


Figure 5.13 Results Screen

Menu Options

Option Button	Function
BTS Serial Number(s)	Switches to Text Edit mode for the user to type in BTS serial number.
Operator	Switches to Text Edit mode for the user to type in operator type.
Remarks	Switches to Text Edit mode for the user to type in remarks type.
Results	Toggles between *Off* and *Printer* to select print option (Note 1).
Configure Printer	Displays the Configure Printer Port screen.
Print Header	Causes the header to be printed with the results (if the printer has been selected, the header is printed immediately).
Print Footer	Causes the footer to be printed with the results (if the printer has been selected, the header is printed immediately).
EXIT	Returns to the Main Menu.

Note: (1) To print results to a file on memory card, the *Results* option must be set to 'Printer' and the *Configure Printer* option used to configure the printer port as 'FILE'.

(2) A typical printout of results, with header and footer, is as follows:

```
*******************************************************************************
* 6113 BTS Test Results Sheet                          17 JUL 1995  13:56:49
*
         *
*        BTS Manufacturer           : Banjo
         *
*        BTS Model                  : XYZ
         *
*        BTS Software Version       : 04/5
         *
*        BTS Serial Number(s)       : 1234, 1235
         *
*
         *
*        BTS Transmit Offset        : Not Set
         *
*        BTS Receive Offset         : Not Set
         *
*
         *
*        Operator                   : Mr  X
         *
*        Remarks                    : AAAA
         *
*
         *
*******************************************************************************
Test finished at                      : 13:56:51
Test Equipment                        : RACAL INSTRUMENTS 6113
                                        Serial Number 1001
                                        Software Version 1.03

*******************************************************************************
```

Saving Results To File

To save results to a file, the file must be established and selected before the test or test sequence is run.

To establish a results file, select the *Results* option at the Main Menu, then select *Configure Printer* option. This will display the Configure Printer Port screen. Press the *Select Port* button, and the following scrolling list is displayed:

UNUSED
FILE
COM1
COM2
DEBUG
PARALLEL
GPIB

(1) Move the highlight to FILE and press the *Select* button. The Configure Printer Port screen is displayed again with the word FILE in the Port box.

(2) Press the *Configure Port* button and the Enter Results File to Write screen is displayed. Edit the Filename, Directory and Description entries as required and then Press the Accept button. (Note that the file name has the extension `.PRT` but this can be changed if required). The results file name and path is then specified as the Configuration entry in the Configure Printer Port box, as shown in the next diagram.

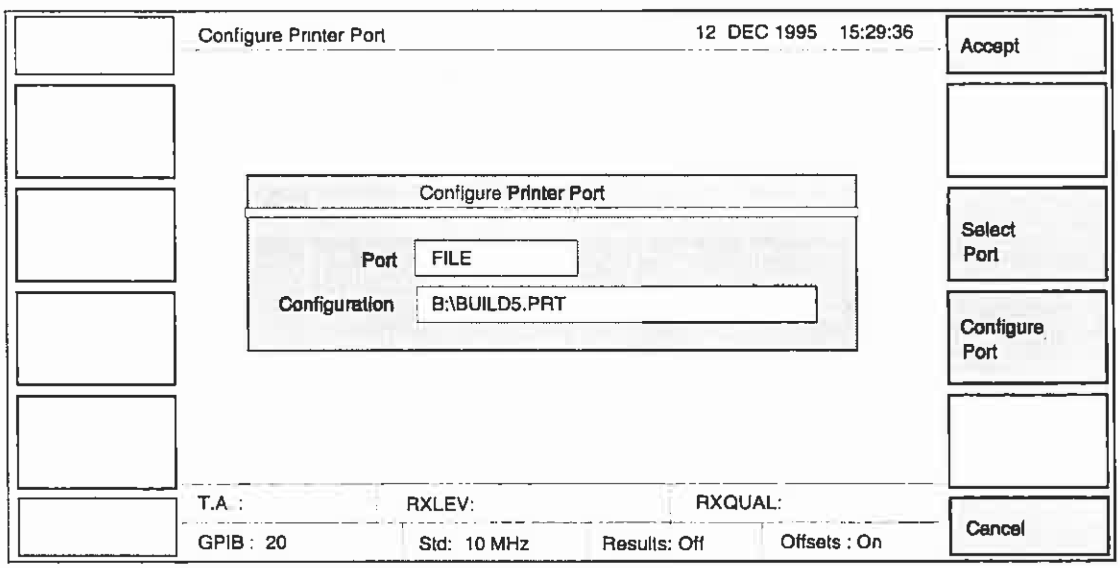


Figure 5.14 Configure Printer Port Screen

(4) Press the *Accept* button and the display returns to the Results screen from where the results header and footer can be entered.

(5) Press the *EXIT* button and the display returns to the Main Menu.

The results file is now established, which can be confirmed by selecting *Results / Configure Printer / Configure Port* and then *List Files*. A scrolling list of the .PRT results files that have been esablished is displayed. If there is more than one, highlight the required file and then press the Select button to select the file. This file will be used for storing results from any tests subsequently performed. The File Manager Menu can then be used to print or delete the file.

FILE MANAGER MENU

Selecting the *File Manager* option at the Main Menu displays the File Manager screen which gives access to all the File Manager facilities.

The File Manager provides facilities for managing files on the two memory card slots. The two memory card slots are referred to as drives A: and B: and are labelled as such on the front panel.

Note: Windows 95 ™ files may be read, but spurious filenames may be displayed.. These files are part are a part of the Windows 95 ™ file and <u>must not be deleted</u>. (A future release of software will prevent these spurious filenames from being displayed).

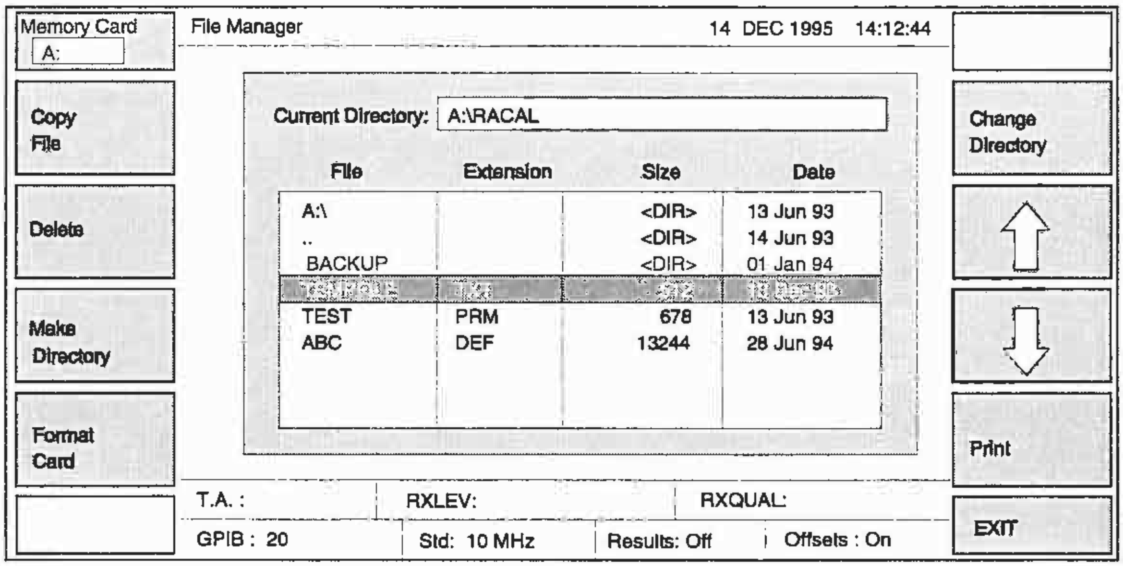


Figure 5.15 File Manager Screen

Menu Options

Option Button	Function
Memory Card	Toggles between the two memory cards (Drives A: and B:) displaying the option currently selected.
Copy File	Displays a File Manager - Copy File screen with the currently selected file as the copy-from file.
Delete	Deletes the currently selected file/directory.
Make Directory	Displays a the Generic text editor to enter the name of the new directory.
Format card	Performs a DOS format on the memory card.
Change Directory	Moves to the highlit subdirectory. If the current item is not a subdirectory then a beep is generated.
⇧	Moves the current steps viewed up one item.

⇩	Moves the current steps viewed down one item.
Print	Sends the selected file to the currently selected printer.
Exit	Returns to the Main Menu.

Notes:

(1) 'Format Card' option is confirmation protected.

(2) 'Delete File' option is confirmation protected.

File Manager - Copy File Screen

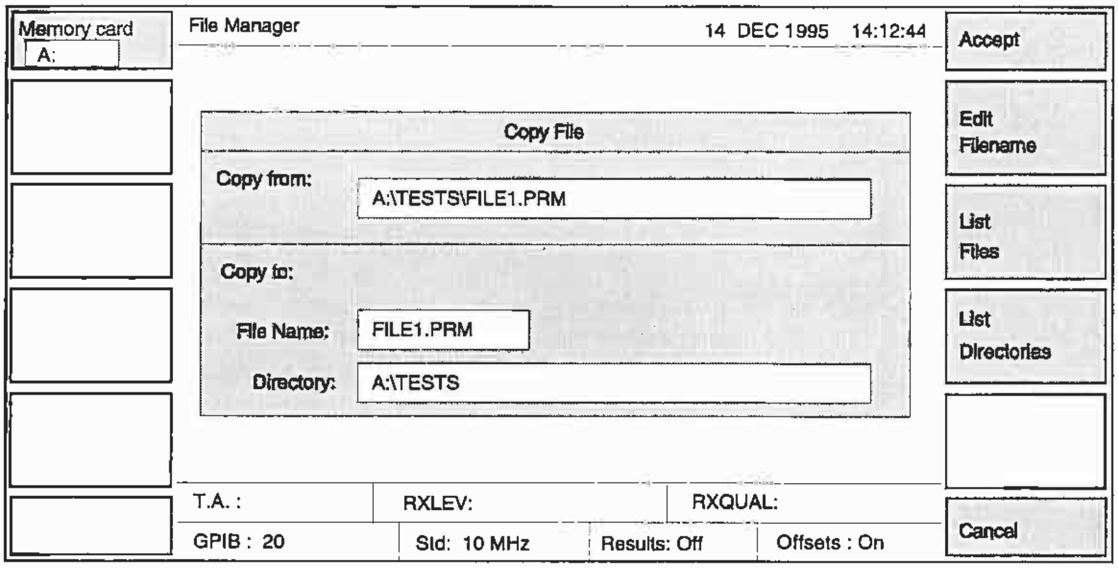


Figure 5.16 File Manager - Copy File Screen

Menu Options

Option Button	Function
Memory Card	Toggles between the two memory card drives *A:* and *B:* displaying the option currently selected.
Accept	Accepts the current file selection, copies file to location specified, and then returns to the previous menu.
Edit Filename	Switches to Text Edit mode for the user to type in a file name.
List Files	Switches to Select from List screen to select a file from a scrolling list.
List Directories	Switches to Select from List screen to select a directory from a scrolling list.
Cancel	Discards the current file selection and then returns to the previous menu without copying the file.

Note: If the selected file already exists, a confirmation message is displayed asking the user to confirm overwriting the existing file.

Select From List Screen

This screen provides facilities for a file to be selected from a scrolling list. Selection of directories from a scrolling list works the same way, with the addition that all parent directories up to the root directory are also present in the list.

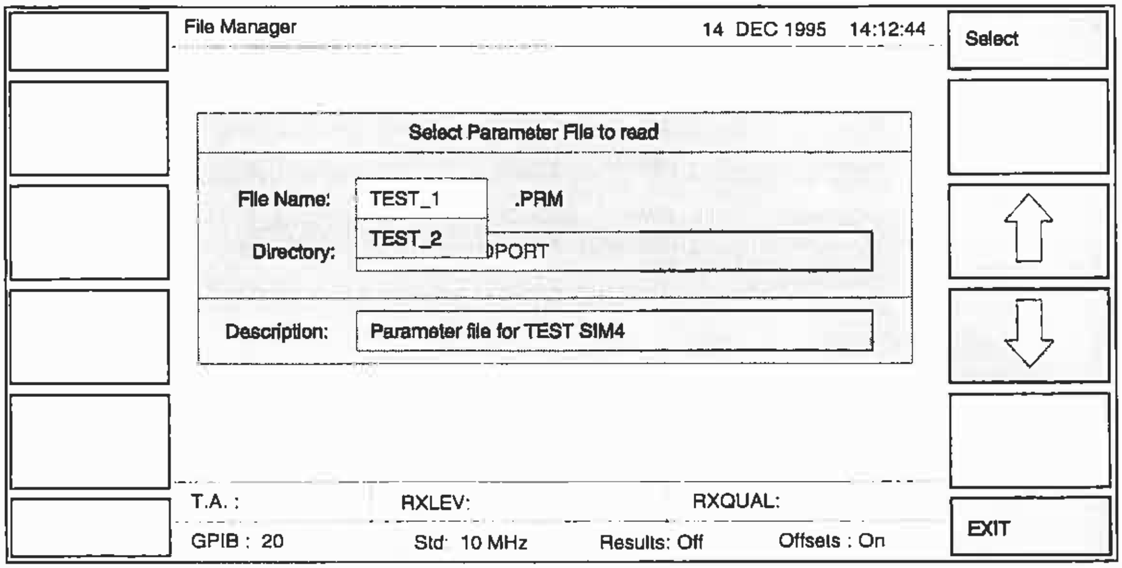


Figure 5.17 Select From List Screen

Menu Options

Option Button	Function
Select	Accepts the current selection, returns to the previous screen and updates the File Name field.
⇧	Moves the current selection up one item.
⇩	Moves the current selection down one item.
EXIT	Returns to the previous screen without updating the File Name field.

Note: The spinwheel may be used to scroll up and down the parameter list.

Generic Text Editing

Editor Presentation

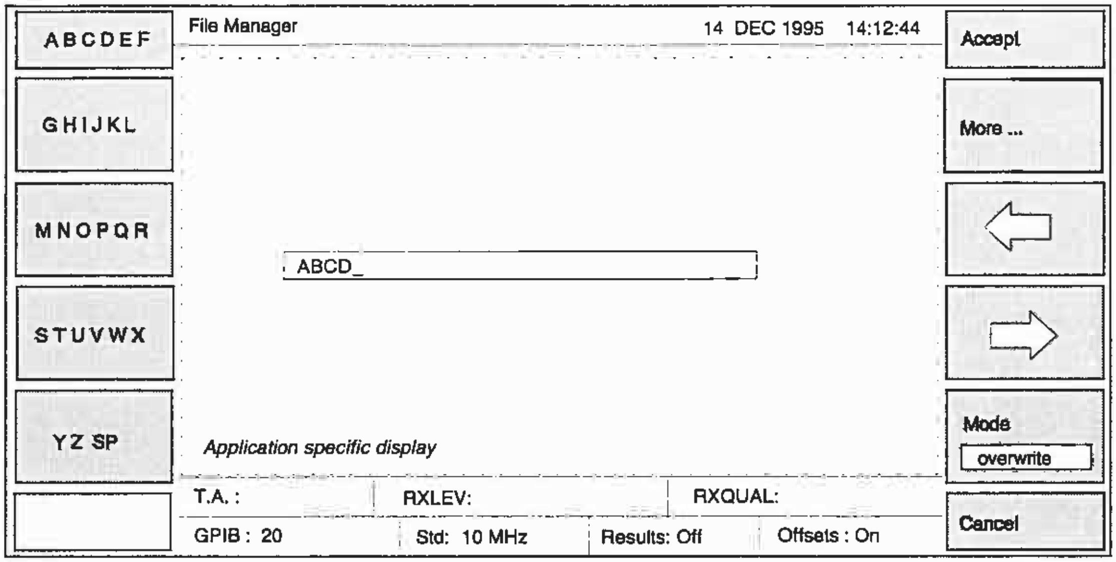


Figure 5.18 Text Editor Screen

Menu Options

Option Button	Function
ABCDEF	Changes menu keys to show upper and lower case A to F.
GHIJKL	Changes menu keys to show upper and lower case G to L.
MNOPQR	Changes the menu keys to show upper and lower case M to R.
STUVWX	Changes the menu keys to show upper and lower case S to X.
Y Z SP	Changes the menu keys to show upper and lower case Y and Z and space.
Accept	Accepts the text and returns to the previous menu.
More	Presents another selection of characters, see next menu drawing.
⇦	Moves the cursor left.
⇨	Moves the cursor right.
Mode	Toggles between 'insert' and 'overwrite' modes.
Cancel	Abandons edits and returns to previous menu.

Notes:

(1) Additional cursor control is provided by the spinwheel.

(2) All keypad keys will function as their legend shows.

The More Screen

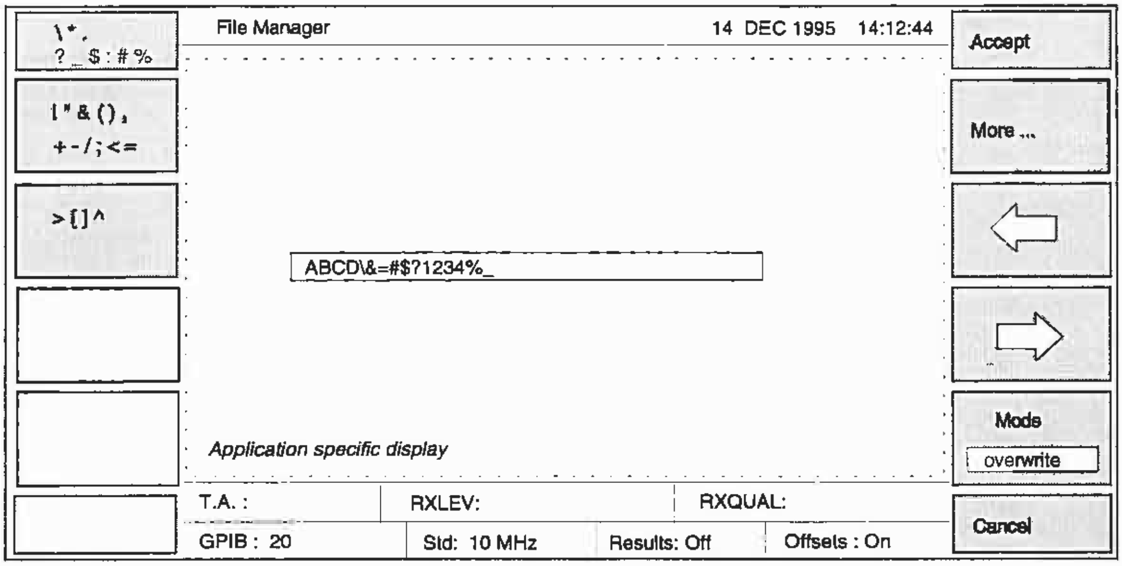


Figure 5.19 Text Editor/More Screen

Menu Options

Option Button	Function
Accept	Returns to the previous menu, using edits.
More	Returns to the Text Editor screen.
⇐	Moves the cursor left.
⇒	Moves the cursor right.
Mode	Toggles between 'insert' and 'overwrite' modes.
Cancel	Abandons edits and returns to the File Manager Menu.

SELF TESTS / SYSTEM MENU

The System Menu allows the operator access to a limited set of the 6113 internal functions.

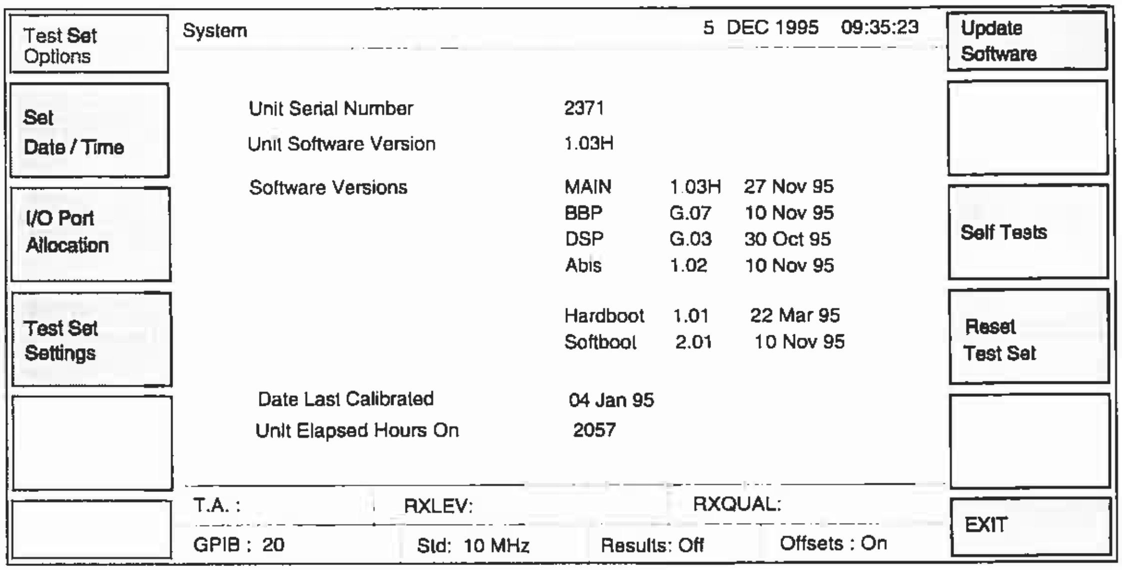


Figure 5.20 System Menu Screen

Menu Options

Option Button	Function
Test Set Options	Displays a list of the software options and hardware options fitted to the Test Set, and a *Change Software Options* option for entering new option facilities.
Set Date / Time	Displays a Configuration Parameter Edit screen with hours, minutes, etc, as the parameters. The defaults are set to the Test Set internal time when the screen is entered.
I/O Port Allocation	Displays a Configuration Parameter Edit screen with the COM ports and DEBUG port allocations as the parameters. Selections from this screen allow the ports to be allocated and configured.
Test Set Settings	Displays a Configuration Parameter Edit screen for changing the GPIB address, buzzer state, frequency standard, etc.
Update Software	Allows the operator to initiate software update from memory card.
Self Tests	Displays a selection list of self tests. Selecting any one of the self tests causes a Configuration Parameter Edit screen to be displayed for editing the parameters.
Reset Test Set	Resets the Test Set. This option is protected by a 'Confirm' function.
Exit	Returns to the Main Menu.

Test Set Options Menu

This screen is displayed when the *Test Set Options* option is selected at the Self Tests / System Menu. It displays the various hardware and software options that are fitted to the Test Set, and allows the software option entries to be changed.

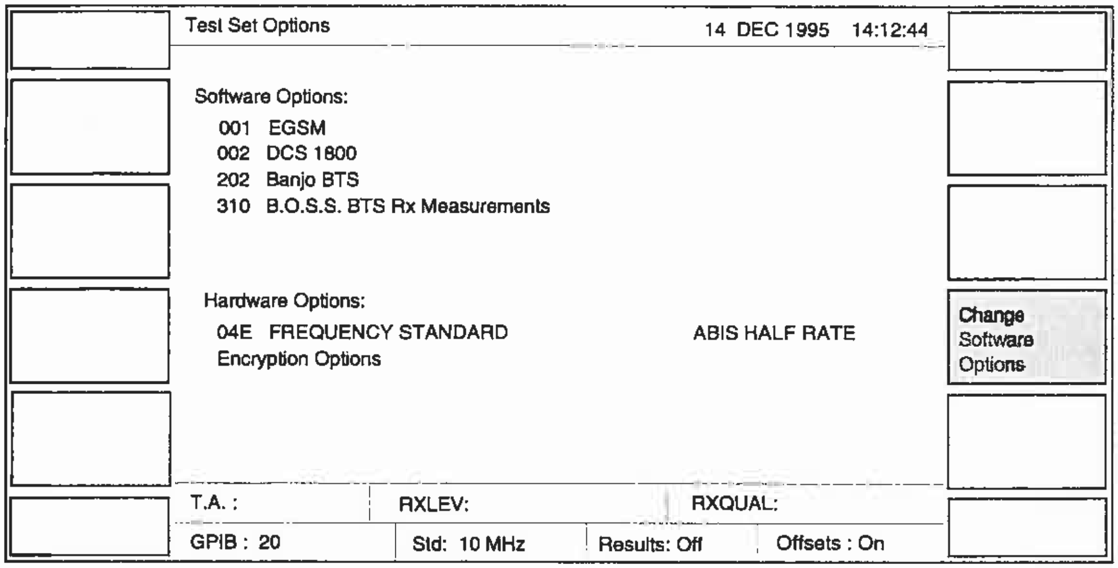


Figure 5.21 Test Set Options Screen

Menu Options

Option Button	Function
Change Software Options	Displays a facility for entering new software options.

Test Set Settings Menu

This screen gives access to various options provided by the Test Set.

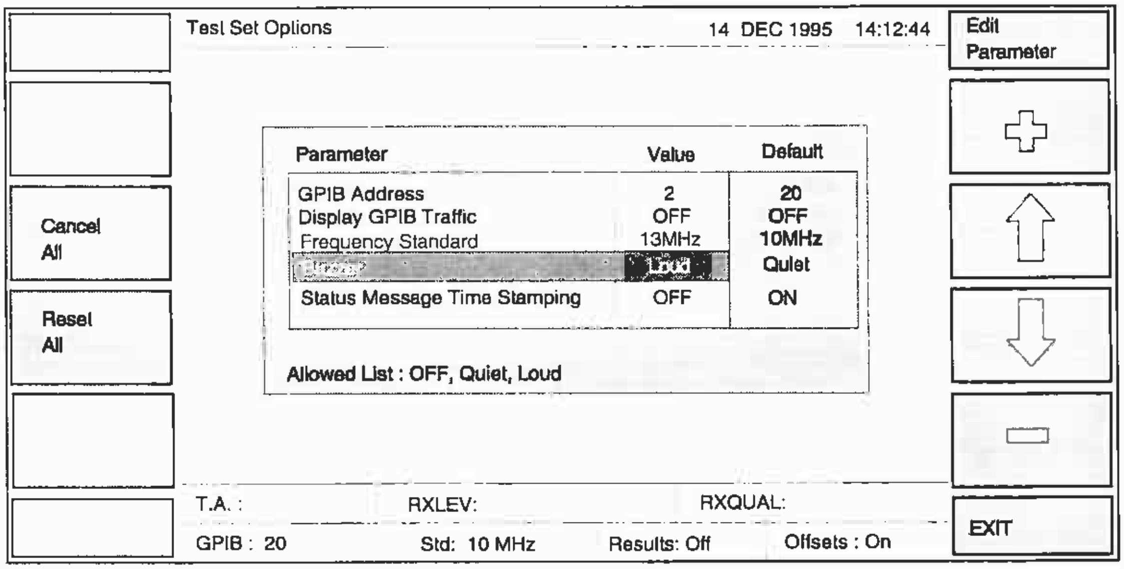


Figure 5.22 Test Set Settings Screen

Menu Options

Option Button	Function
Cancel All	Discards all the changes made to the set of parameters displayed and restores the previous values, then returns to the System menu.
Reset All	Sets all the parameters displayed to their default values.
Edit Parameter	Displays a Configuration Parameter Edit screen for editing the selected parameter..
✚	Increments the currently selected parameter.
⇧	Moves the current parameter selection up one item, accepting any changes made to previous parameter.
⇩	Moves the current parameter selection down one item, accepting any changes made to previous parameter.
–	Decrements the currently selected parameter.
EXIT	Accepts all the changes made to the set of parameters displayed and sets the new values in the Test Set, then returns to the previous menu.

Note: The screen always starts with the spinwheel in 'Parameter Select' mode.

BTS INFORMATION MENU

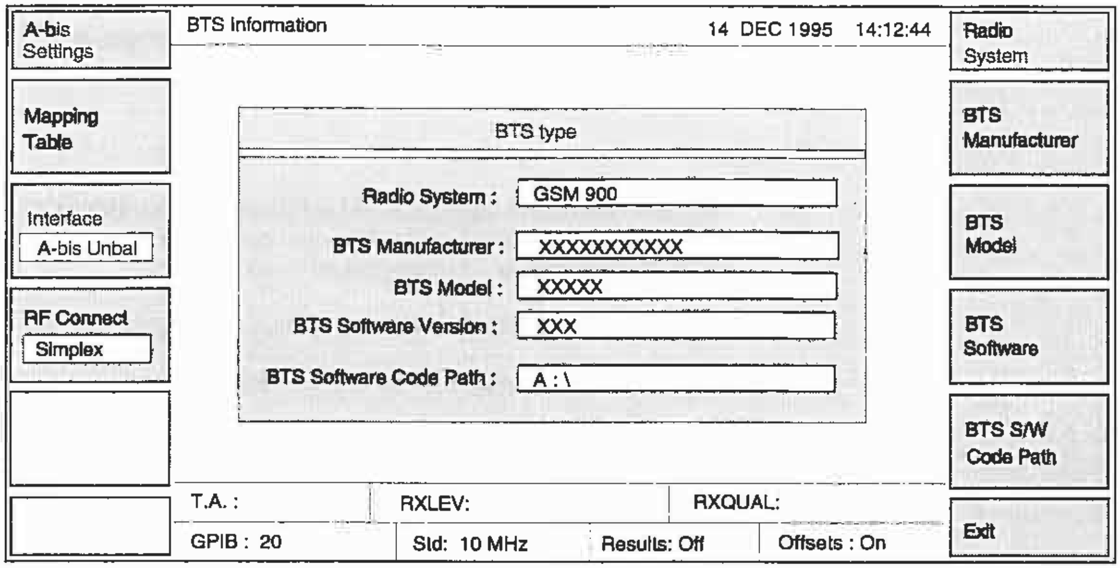


Figure 5.23 BTS Information Screen

Menu Options

Option Button	Function
Abis Settings	This option displays the Configuration Parameter Edit Screen allowing the user to edit the A-bis settings.
Mapping Table	Switches to a BTS-specific A-bis mapping screen. The screen allows the entries to be changed or to be set to default values. (See Note 1). See Section 7.
Interface	This button toggles the selection between 'A-bis Unbal', 'A-bis Bal' and 'V11' for the IN and OUT/MONITOR A-bis ports. See Section 7.
RF Connect	This button toggles the selection between *Simplex* and *Duplex* signalling, and between *B.O.S.S. Simplex* and *B.O.S.S. Duplex* signalling when Option 56R or Option 54 / 54R is fitted.
Radio System	Displays a scrolling list of types of radio system available for selection.
BTS Manufacturer	Displays a scrolling list of BTS Manufacturers available for selection (see Note 1).
BTS Model	Displays a scrolling list of BTS models available for selection (see Note 1).
BTS Software	Displays a scrolling list of BTS Manufacturer software versions available for selection (see Note 1).

BTS S/W Code Path	Displays a scrolling list of paths available for selection and downloading code.
Exit	Accepts the current selections and then returns to the Main Menu.

Notes:

(1) The BTS types that may be selected are enabled by the options fitted to the Test Set. If information for a non-allowed BTS type is then selected, "Not Set" is displayed in the BTS Model box and the information is not displayed.

(2) The BTS directory path cannot be modified if no memory cards are present.

(3) The memory card selected will default to the last card selected if still inserted.

(4) The *Interface* button will toggle between *A-bis* and *V11* regardless of which is relevant. This option should be kept at 'A-bis' (default) unless the V11 interface is being used.

(5) When the Test Set is switched ON, or after a Reset, if the *RF Connect* button is toggled before the BBP (Baseband Processor) board has stabilized, then the selection will toggle but a beep is sounded and the red RF OUT LED remains extinguished -- until the BBP board has stabilised.

Mapping Table Screen.

The A-bis Mapping Table screen is BTS-specific; refer to the relevant Section 7 Option description for details. The button controls, however, are the same for all screens and are described below.

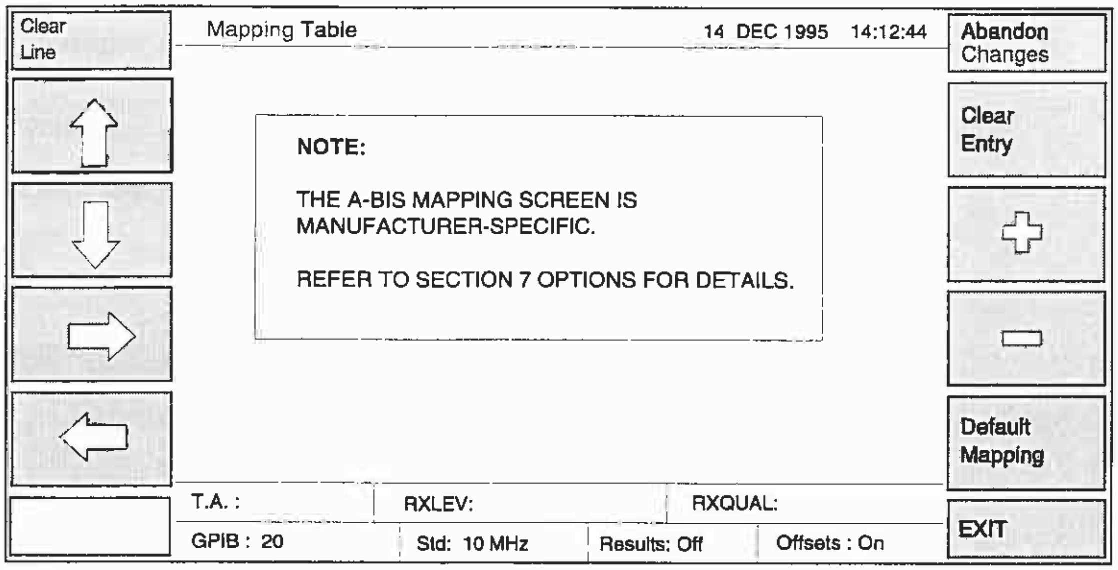


Figure 5.24 Mapping Table Screen

Menu Options

Option Button	Function
Clear Line	Clears all entries on the current selected line.
⇧	Accepts the changes made to the selected entry and moves the current selection up one item.
⇩	Accepts the changes made to the selected entry and moves the current selection down one item.
⇨	Accepts the changes made to the selected entry and moves the current selection right one item.
⇦	Accepts the changes made to the selected entry and moves the current selection left one item.
Abandon Changes	Cancels all changes to the entries and sets them back to their original values.
Clear Entry	Sets the selected entry to "-".
+	Increments the currently selected entry.
–	Decrements the currently selected entry.
Default Mapping	Sets all entries to their default values.
Exit	Accepts the changes made to entries and returns to the BTS Information Menu.

LIVE TESTS MENU

CAUTION: *Live Tests* must be selected on the Main Menu <u>before</u> the Test Set is connected to a BTS-to-BSC A-bis link, otherwise the link may be disrupted. (When *Live Tests* option is selected, the A-bis connections are set to high impedance).

Similarly, disconnect the 6113 from the link <u>before</u> exiting the Live Tests screen.

Note: If the enhanced RF Module (Option 54 / 54R or Option 56R) is fitted, check that the B.O.S.S. RF IN / DUPLEX and B.O.S.S. RF OUT connectors are being used (see Section 3).

Selecting *Live Tests* option at the Main Menu displays the following screen. This screen provides access to two facilities for testing a BTS:

RF Tests (B.O.S.S.)
A-bis Protocol Analysis Mode

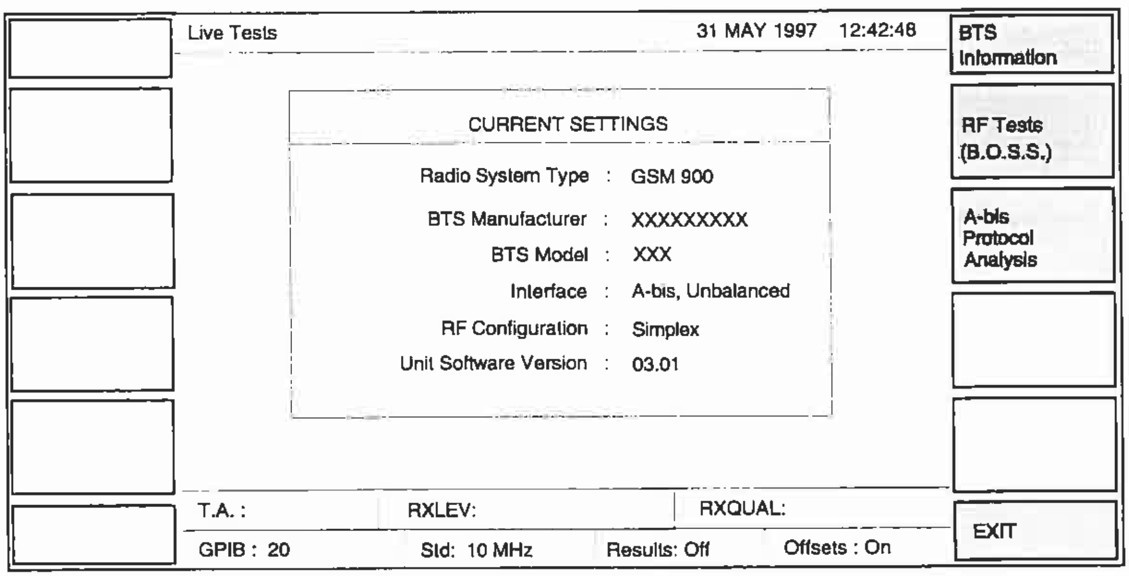


Figure 5.25 Live Tests Mode Screen

Menu Options

Option Button	Function
BTS Information	Displays the BTS Information (Live Tests) screen. (This screen is similar to the BTS Information screen available at the Main Menu, but it excludes facilities that are not applicable) .
RF Tests (B.O.S.S.)	Displays the RF Tests Summary Screen (Not Registered) for performing live testing on an operational BTS.
A-bis Protocol Analysis	Displays the A-bis Protocol Analysis screen. Use this for monitoring (non-intrusive) the A-bis link between a BTS and a BSC in an operational network.
EXIT	Exits the RF Tests screen and returns to the Main Menu.

RF Tests (B.O.S.S.) Menu

Note: RF Tests Mode facilities are available with Test Set software version 03.01 onwards. On-air BTS transmitter measurements can be performed with standard issue software.

On-air BTS receiver measurements can only be performed when Option 310 "RF Tests BTS Rx Measurements" software has been installed in the Test Set. The addition of hardware Option 56R "RF Tests Hardware Upgrade kit" improves the performance of the RF Tests Mode (refer to Section 1).

Option 54 / 54R "Complete RF Tests Capability" includes both Option 310 and Option 56, and so provides a complete upgrade for RF Tests Mode.

Preparations for Testing

Select the SELF TESTS / SYSTEM / Test Set Options menu and check the presence of the following:

(1) If transmitter tests only are to be performed, check that the Test Set software version is 03.01 or later.

(2) If receiver tests are to be performed, check that Option 310 is listed.

(3) If enhanced RF Tests performance is required, check that B.O.S.S. RF Module is listed is listed.

Select *Live Tests* option from the Main Menu.

CAUTION: When *Live Tests* option is selected at the Main Menu, the A-bis connections are set to high impedance.

Connection to the operational A-bis link must not be made until *Live Tests* is selected at the Test Set, otherwise the link will be disrupted.

Similarly, disconnect the Test Set from the operational A-bis link before *selecting A-bis Controlled Tests* option or *Test Sequences* option (both of which will set low impedance A-bis connections).

Select *RF Tests (B.O.S.S.)* option from the Live Tests screen to display the RF Tests Summary screen, and then connect the 6113 Test Set to the BTS as described in the relevant BTS-Specific option description.

Place a SIM reader in the Test Set PCMCIA slot and insert a SIM card that is valid for the network to which the Test Set is connected, or that is covered by a 'roaming' agreement.

Note that as soon as the RF connections are made and the Test Set has been locked to a CCH (indicated by the message "Control Channel" in the Signal status box), the transmitter measurements are performed, and can be observed in the measurement boxes and graphs by selecting the appropriate buttons in the RF Tests Summary screen.

The following diagram shows a block schematic of the RF Tests Mode test operation. The next diagram shows the menu screens used for RF Tests Mode, and the transitions between them.

Refer to the description of the RF Tests Mode facilities in Section 4 before commencing the test procedure.

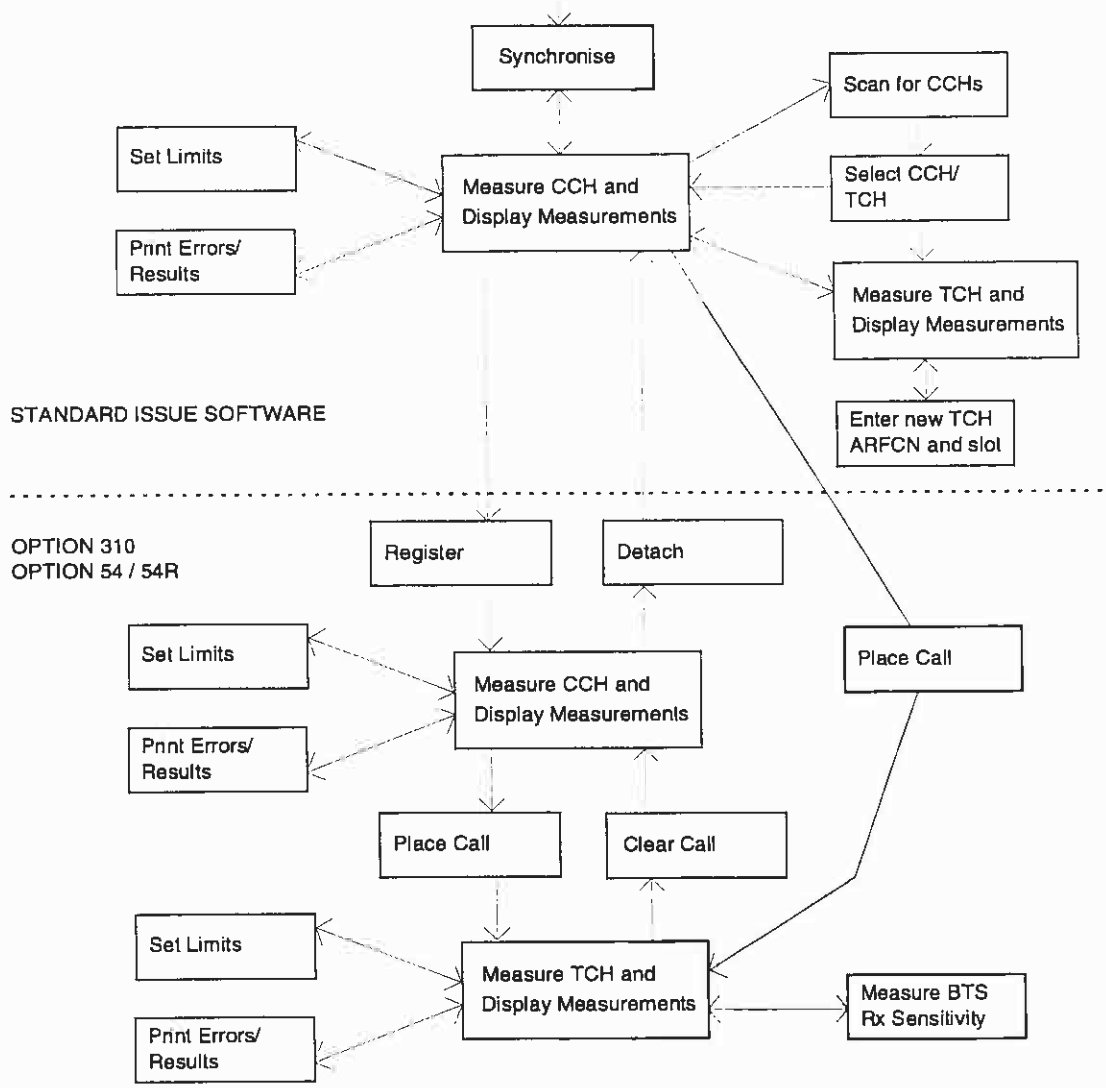


Figure 5.26 RF Tests Test Operation - Block Diagram

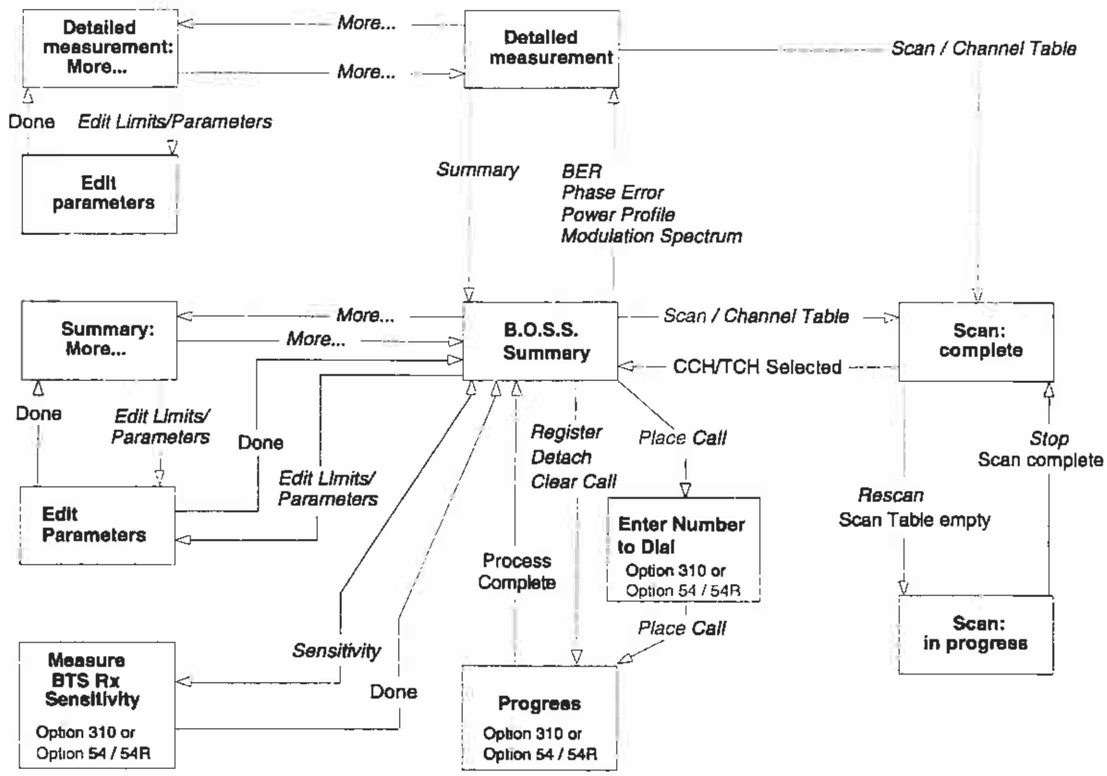


Figure 5.27 RF Tests Mode Menu Structure

RF Tests Summary Screen (Not Registered)

The RF Tests Summary screen is displayed when the *RF Tests* option is selected at the Live Tests screen.

The following diagram illustrates the screen when the 'mobile' (Test Set) is not yet registered and no call is present.

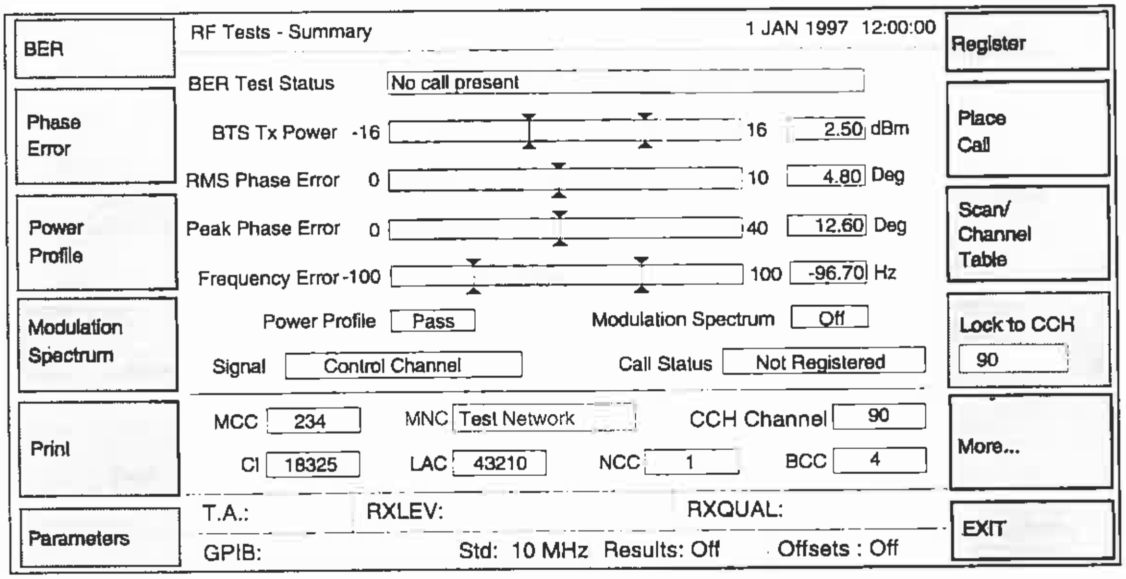


Figure 5.28 RF Tests Summary Screen (Not Registered)

Menu Options

Option Button	Function
BER	Switches to the BER results screen (if Option 310 / 54 / 54R is fitted. See Section 7). If Option 310 or Option 54 / 54R is not fitted, a Warning message is displayed. (The BER Results screen is similar to same in Multimode).
Phase Error	Switches to the RF Tests Phase/Frequency Error results screen (similar to same in Multimode).
Power Profile	Switches to the RF Tests Power Profile results screen (similar to same in Multimode).
Modulation Spectrum	Switches to the RF Tests Modulation Spectrum results screen (similar to same in Multimode).
Print	Prints the measured values to the printer. An error message is displayed if the printer is not selected or is set to print to a file.
Parameters	Displays a parameter edit screen for defining error limits and certain print options.

Register	Initiates the registration procedure (if Option 310 or Option 54 / 54R is fitted. See Section 7). The Registration Progress screen is displayed for the duration of the procedure. The button legend changes to *Detach* when registered. If Option 310 or Option 54 / 54R is not fitted, a Warning message is displayed.
Place Call	Switches to the Call Parameters screen (if Option 310 or Option 54 / 54R is fitted. See Section 7). When a call is in progress, the button legend changes to *Clear Call.* If Option 310 or Option 54 / 54R is not fitted, a Warning message is displayed.
Scan / Channel Table	Switches to the Scan / Channel Table screen. This button is removed when the 'mobile' (Test Set) is registered and a call is setup (Option 310 or Option 54 / 54R).
Lock to CCH	Performs a (manual) Lock to Cell Control Channel on the channel number indicated.
More...	Switches to the RF Tests Summary More screen (Not Registered).
EXIT	Stops the monitoring procedure and returns to Live Tests Menu.

Note: (1) The Signal box displays the measurement state using one of the following messages:

Message	Meaning
Synchronising	The Test Set is attempting to synchronise to the Cell Control Channel.
Control Channel	The Test Set is measuring on timeslot zero of a CCH.
Traffic Channel cn, TS ts	The Test Set is measuring a traffic channel on a TCH. 'cn' is the channel number, 'ts' is the timeslot.
Traffic/Dummy cn, TS ts	The Test Set is measuring one of: -- A traffic channel on a CCH carrier. -- An idle channel filled with Phase 1 dummy bursts on a CCH carrier.
Dummy burst	The Test Set is measuring an idle channel filled with Phase 2 dummy bursts.
No Power	The Test Set cannot find any power on the specified channel and timeslot
Invalid Measurement	An error was encountered when performing the measurement.
No Training	The expected training sequence was not found in the signal.
No BCCH	The Control Channel signal has been lost.

(2) The measurement boxes display dashes when the Signal box displays "Synchronising" or "No Power" or other error conditions.

(3) When the Test Set is attempting to synchronise to a signal, the Signal box alternates between "Synchronising" and an appropriate error message, as follows:

Message	Meaning
Sync fail - no signal	No signal power was found on the channel.
Sync fail - no FCCH	Signal power was found but the FCCH could not be found.
Sync fail - poor FCCH	An FCCH was found but the received signal quality was too low to achieve synchronisation.
Sync fail - no SCH	An FCCH was found but the Test Set could not lock to the SCH.
Sync fail - no BCCH	A control channel was found and the Test Set synchronised to it but the BCCH information could not be decoded.

(4) The Call Status box displays the GSM Layer 3 state as follows (if Option 310 or Option 54 / 54R is fitted):

Not Registered	The Test Set is only monitoring, or attempting to monitor, the Cell Control Channel. If the operator requests a call in this state, the Test Set will register and place a call.
Registered	The Test Set has performed the location update procedure, has registered with the network, and is monitoring the CCH and waiting for the operator to place a call.
Call Ch n, TS x	The Test Set is in a call. The Call Status box also displays the TCH channel number (XXXX or "HOP" when hopping) and the TCH timeslot (YYY), e.g. "Call CH62, TS4.

(5) The Phase Error, Power Profile and Modulation Spectrum screens and their associated 'More...' screens are similar to the Multimode screens except that the right-hand side control buttons are modified to copy the buttons defined for the RF Tests Summary screen, and the *Print* button and *Parameter* buttons have been added. The *Print* button button initiates a screen dump to the configured printer, and the *Parameter* button displays a Configuration Parameter Edit screen for changing associated parameters.

(6) The RBER bargraph and the RF Tests BER screen display dashes until a call is in place and the A-bis function has successfully located the traffic data stream on the BTS A-bis interface.

(7) The BTS Tx Power parameter range is Expected Power Level ± (Power Level Limit + 10 dB).

(8) If *Register* or *Place Call* options are selected when the Test Set has not synchronised to a control channel, a warning message is displayed and the Test Set continues trying to synchronise.

RF Tests Summary More Screen (Not Registered)

Note: The *Channel No* button on this screen allows a channel to be entered manually without using the scan. The *Timeslot* button allows a particular timeslot on the chosen channel to be monitored. However, if there is no power present (i.e. no signal on the selected channel), the measurements will all be blank.

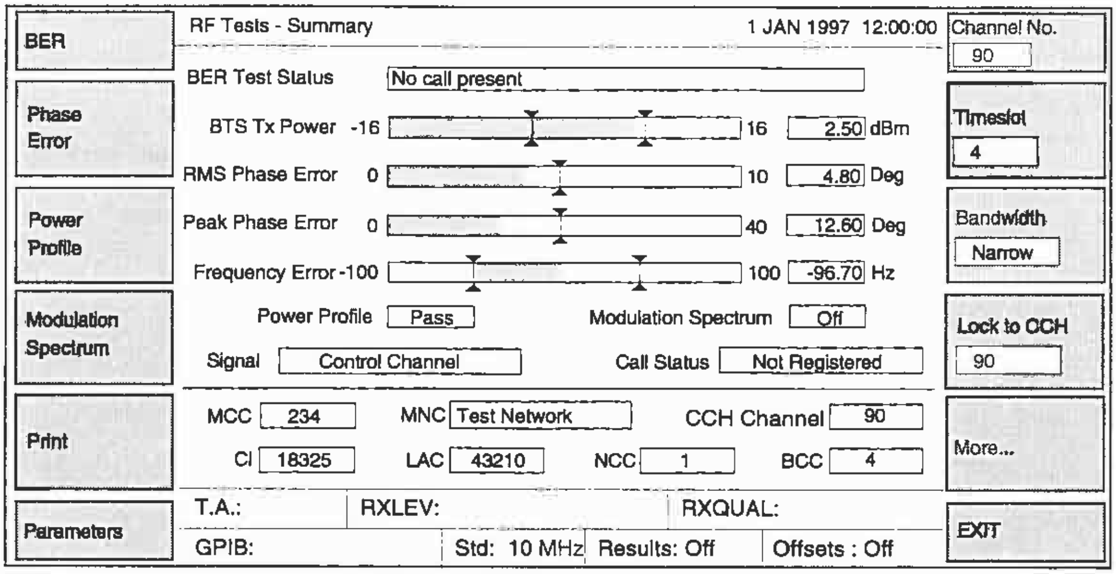


Figure 5.29 RF Tests Summary More Screen (Not Registered)

Menu Options

Option Button	Function
BER	Switches to the BER results screen (if Option 310 / 54 / 54R is fitted. See Section 7). If Option 310 or Option 54 / 54R is not fitted, a Warning message is displayed. (The BER Results screen is similar to same in Multimode).
Phase Error	Switches to the RF Tests Phase/Frequency Error results screen (similar to same in Multimode).
Power Profile	Switches to the RF Tests Power Profile results screen (similar to same in Multimode).
Modulation Spectrum	Switches to the RF Tests Modulation Spectrum results screen (similar to same in Multimode).
Print	Prints the measured values to the printer. An error message is displayed if the printer is not selected or is set to print to a file.
Parameters	Displays a parameter edit screen defining error limits and certain print options.

Channel No.	Edits the number of the Channel (ARFCN) being monitored, or displays the channel number selected in the Channel Table for monitoring.
Timeslot	Edits the number of the timeslot being monitored.
Bandwidth	Toggles the receiver bandwidth between 'Wide' and 'Narrow'. This button is not displayed if Option 56 is not fitted.
Lock to CCH	Performs a Lock to Cell Control Channel on the channel number indicated.
More...	Switches back to the RF Tests Summary screen.
EXIT	Returns to the Live Tests screen.

RF Tests - Parameters Screen

This screen is displayed when the *Parameters* option in one of the RF Tests Summary screens is selected. It allows the user to select the test limits, and whether or not to print the measured values when a test failure occurs. The screen is a standard parameter edit screen.

When a limit failure does occur the Test Set suspends measurements then automatically switches through the summary screen and relevant graph screens for the current mode and performs a screen dump for each screen. Optionally, the printing may be restricted to the Summary screen and the screen for the parameter that is failing.

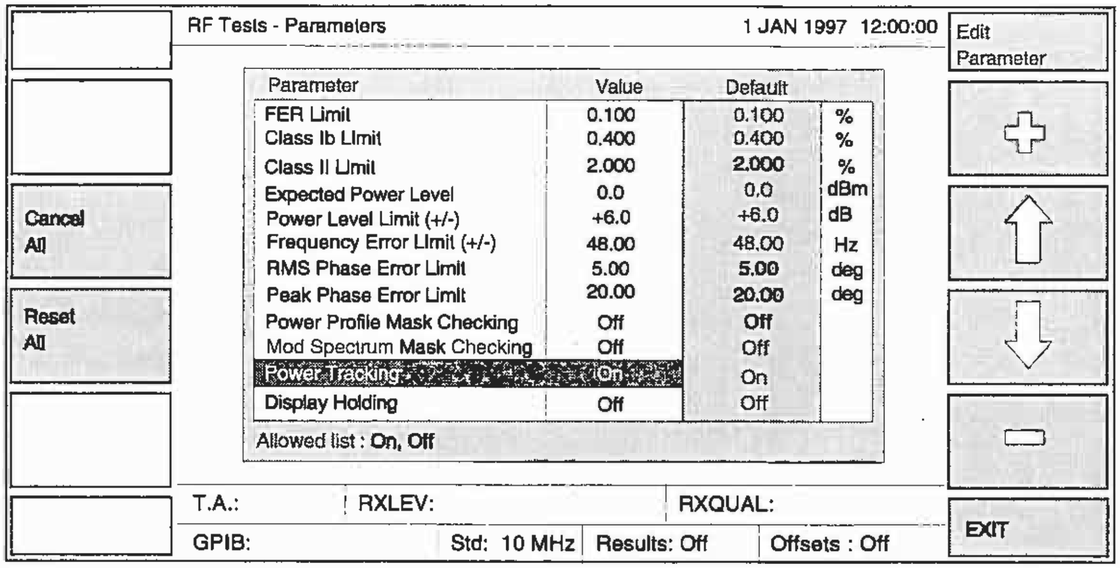


Figure 5.30 RF Tests - Parameters Screen

The following scrollable parameters are 'off the screen':

Parameter	**Default Value**
Print on Fail	All
Link Establish Level	-40.0 (Simplex RF connection selected)
	-47. 0 (Duplex RF connection selected)
	-20.0 (B.O.S.S. Simplex RF connection selected)
	-20.0 (B.O.S.S. Duplex RF connection selected)
In-Call Level	-40.0 (Simplex RF connection selected)
	-47. 0 (Duplex RF connection selected)
	-20.0 (B.O.S.S. Simplex RF connection selected)
	-20.0 (B.O.S.S. Duplex RF connection selected)
IMEI Number	12345612001000
Scan Start Channel Number	1 (GSM 900), 512 (DCS 1800 or PCS 1900)
Scan Stop Channel Number	124 (GSM 900), 885 (DCS 1800), 810 (PCS 1900)

Note: (1) FER Limit, Class Ib RBER Limit , Class II RBER Limit, and IMEI parameters are only relevant when Option 310 or Option 54 / 54R is fitted.

(2) The significance of Print on Fail parameter values are as follows:

Off	=	If any test fails, nothing is printed.
All	=	If any test fails, all RF Tests screens are printed.
Failures	=	Only the screens of tests that failed are printed.

Scan / Channel Table (Scan In Progress) Screen

This screen displays the list of Channels found during a scan, and some values extracted from their System Information messages if the channels are CCHs. The TCH channels shown are extracted from the System Information messages rather than from the scan process.

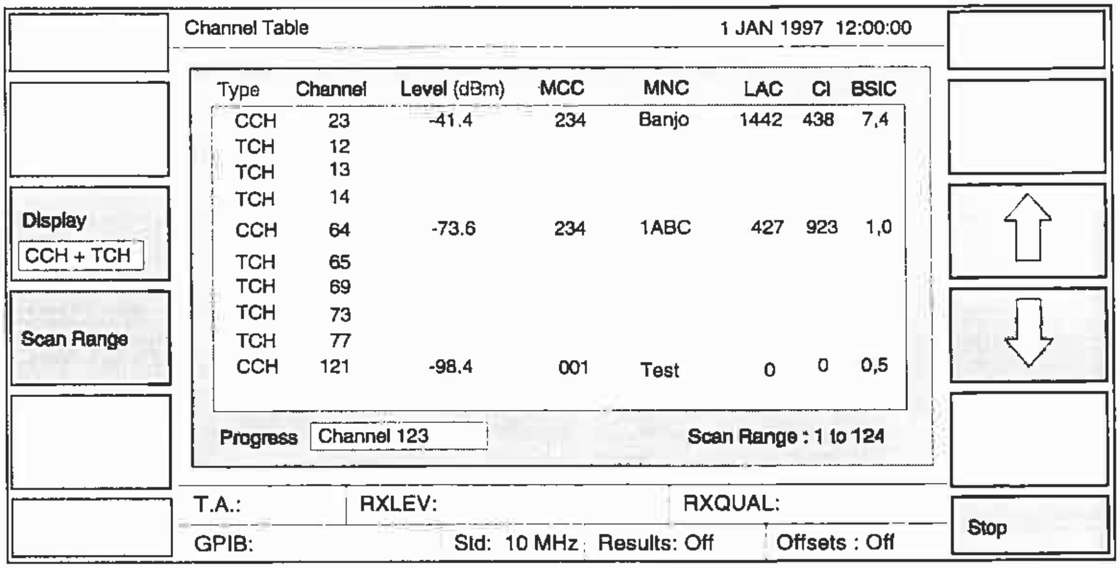


Figure 5.31 Typical Scan / Channel Table (Scan In Progress) Screen

Menu Options

Option Button	Function
Display	Toggles the display (and the legend) between *Display CCH Only* and *Display TCH + CCH*. The default display is *Display CCH + TCH*.
Scan Range	Aborts the scan in progress and switches to the Scan Parameters screen to allow the scan parameters to be edited.
⇧	Moves the table up one item.
⇩	Moves the table down one item.
Stop	Stops the scan and displays the Scan / Channel Table (Scan Complete) Screen.

Note: (1) The Progress box displays the channel numbers as each one is scanned for CCH activity. If activity is detected then the channel number and relevant information (including all TCHs from the Cell Allocation Table) are added to the table above.

(2) The arrow keys are only shown when there are too many items to fit on the screen.

(3) The default display mode is 'CCH + TCH'.

(4) If the network does not transmit System Information message type 1 (containing the Cell Allocation Table) then the Test Set cannot display any lists of TCHs.

Scan / Channel Table (Scan Complete) Screen

This screen is displayed when the scan completes or is halted. It displays the list of Channels found and some values extracted from their System Information messages if the channels are CCHs. The TCH channels shown are extracted from the System Information messages rather than from the scan process, and there are no measurements. (Note that the TCH channels displayed are those set in the Cell Allocation Table).

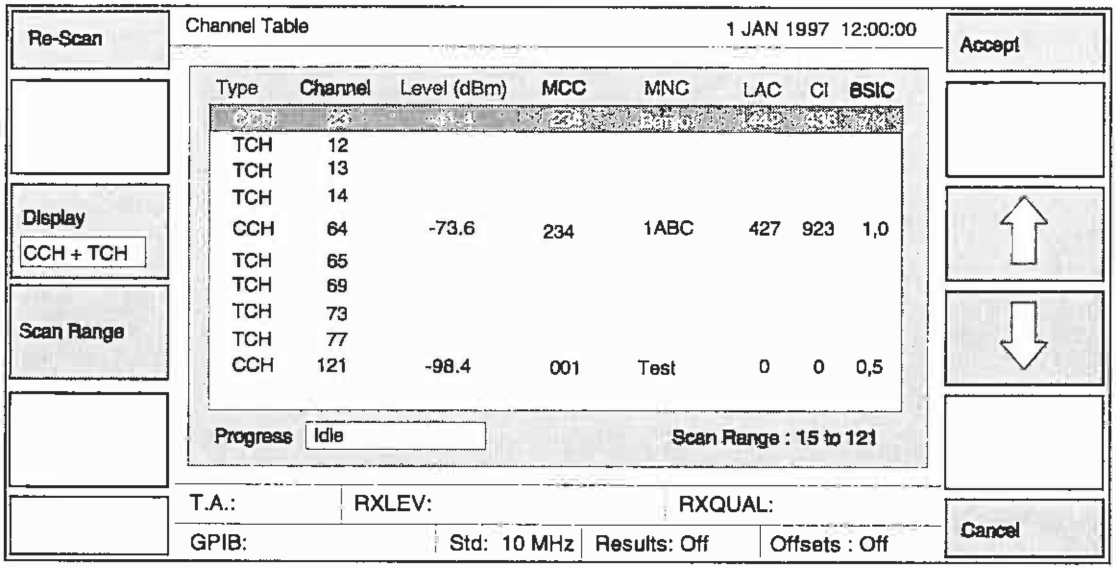


Figure 5.32 Typical Scan/ Channel Table (Scan Complete) Screen

Menu Options

Option Button	Function
Re-scan	Triggers the start of the scanning process. This also clears the contents of the table.
Display	Toggles the display (and the legend) between *Display CCH Only* and *Display TCH + CCH.* Default is *Display CCH + TCH.*
Scan Range	Aborts the scan in progress and switches to the Scan Parameters screen for editing the scan range parameters.
Accept	Accepts the current selection and returns to previous screen. The selected Channel becomes the current Channel in the *Channel No.* button in the RF Tests Summary More screen.
⇧	Move the current selection up one item.
⇩	Move the current selection down one item.
Cancel	Returns to the RF Tests - Summary screen. The current Channel is unchanged.

Note: (1) When no scan is running the Progress box displays '"Idle".

(2) If a CCH is selected the Test Set synchronises to and starts monitoring that channel. If a TCH is chosen the Test Set synchronises to the associated CCH then starts to monitor the TCH.

(3) The arrow keys are always shown.

(4) The default display mode is 'CCH + TCH'.

(5) If the network does not transmit System Information message type 1 (containing the Cell Allocation Table) then the Test Set cannot display any lists of TCHs.

Register (Option 310 or Option 54 / 54R)

When the Test Set has been locked to a CCH (indicated by the message "Control Channel" in the Signal status box) and a valid SIM is inserted, select the *Register* option to cause the 'mobile' (Test Set) to register with the network. A PIN Entry screen is displayed for entering the PIN which the Test Set uses to unlock the SIM. Enter the correct PIN number (3 tries are allowed) and press the *Accept button.*

If the PIN number is correct and the SIM is valid then the network is informed of the presence of the 'mobile' (Test Set), and a location update procedure is initiated; the progress of this procedure is displayed on the Mobile Registration Progress screen.

When the location update has been successfully completed, a Registration Complete message is displayed at the end of the list of progress messages to show that the Test Set is registered as a 'mobile' on the network and ready to make calls. The display then changes to the RF Tests Summary (Registered) screen; the Call Status box displays the message "Registered."

If the registration fails then the MMI indicates the reason for the failure and reverts to the RF Tests Summary screen and transmitter measurements; the Call Status remains at "Not Registered".

Place Call (Option 310 or Option 54 / 54R)

The Test Set can place mobile originated (MO) calls. The Test Set supports all variations of the call setup procedure (early, late and very early assignment, etc).

A call can be placed from the RF Tests Summary (Unregistered) screen or the RF Tests Summary (Registered) screen.

If the call is placed from the Unregistered screen then the Registration process is performed automatically before setting up the call.

To place a call from the RF Tests Summary (Registered) screen, press the *Place Call* button to display the Call Parameters screen and enter the Number to Dial and Test Pattern. Press the *Accept* button and then press the *Place Call* button again. The Call Setup Progress screen is displayed together with a series of progress messages until the Call Status / Setup Complete message box is displayed. Note that the *Place Call* button then becomes *Clear Call.*

When the call is connected the Test Set transmits a defined data pattern to the BTS and tries to locate the same pattern on the A-bis link; all A-bis channels are scanned. If the pattern is found then the BTS receiver BER is measured and the measurements are displayed in the RBER graph at the top of the RF Tests Summary (Registered) screen (it may take some time for the measurements to appear, depending on how many A-bis channels are active). The RF Channel No and Slot No are displayed in the Call Status box. (If no pattern is found then the RBER measurement boxes are left blank).

When a call is set up the Test Set automatically switches to measuring the TCH; the Phase Error, Frequency, etc, measurements are for the Tx TCH.

If the call setup fails then the MMI indicates the reason for the call failure and the Test Set reverts to transmitter measurements only. The Call State remains at "Registered" to allow successive call setup attempts.

Clear Call (Option 310 or Option 54 / 54R)

When a call is in progress the operator can select the *Clear Call* option. This causes the Test Set to initiate the MO (mobile originated) call clearing procedure. The protocol progress is shown (on a separate screen).

When the call has been cleared another channel can be selected and tested. Note that if no traffic is present, then repeated operation of the *Place Call / Clear Call* button will automatically iterate through all the air timeslots (a feature of most BTSs).

Mobile Registration Progress Screen

This screen displays the progress of the 'mobile' (Test Set) registration process.

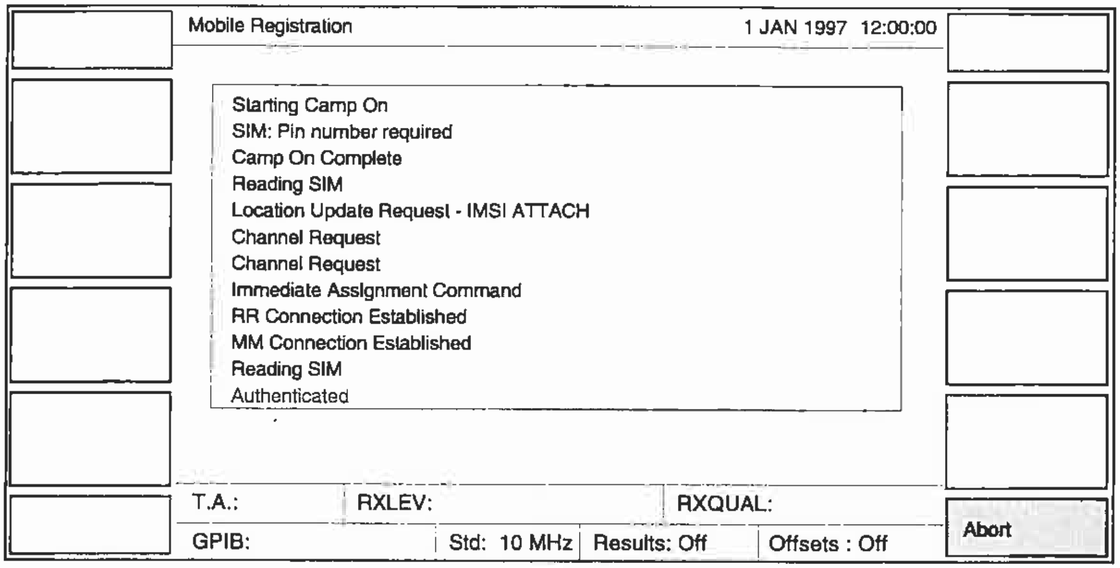


Figure 5.33 Typical Mobile Registration Screen

Menu Options

Option Button	Function
Abort	Aborts the 'mobile' (Test Set) registration procedure and returns to the *RF Tests* Summary menu.

Note: (1) If the SIM is protected by a PIN, the operator is prompted to enter a number using the PIN Entry screen.

(2) After successful registration, a "Registration Complete" message is displayed and the RF Tests Summary screen is displayed.

If restration fails then the *Abort* option changes to *EXIT* and appropriate error messages are displayed.

The list of progress messages is:

"Starting Camp On"
"Camp On complete"
"Reading SIM"
"SIM: PIN number required"
"Authenticated"
"Authentication error"
"RR connection established"
"MM connection established"

"Location updated"
"Location update rejected"
"Location update request"
"Location update request - IMSI ATTACH
"MM Identity request"
"MM Identity request - TMSI"
"MM Identity request - IMSI"
"MM Identity request - IMEI"
"MM Identity response"
"MM Identity response - TMSI"
"MM Identity response - IMSI"
"MM Identity response - IMEI"
"Ciphering started"
"Ciphering not commanded"
"Immediate assignment failure"
"Register Mobile"
"Registration complete"
"Registration failed"
"Detach IMSI"
"IMSI detached"

"SIM Information")
"SIM blocked")
"Please insert SIM") 'Pop-up' messages
"Please enter the PIN code:")
"e.g. 01234567")

"Assignment Command"
"Assignment Failure"
"Channel Request"
"Immediate Assignment Failure"

"Immediate assignment Command"
"Immediate assignment Extended Command"
"Immediate assignment Reject Command"
"Handover Command"

PIN Entry Screen

This screen is displayed automatically at registration or call setup if the Test Set detects that the SIM being used is locked. The screen allows the operator to enter a PIN (using the numeric keypad) which the Test Set will use to unlock the SIM. This is a standard password entry screen for 8 numeric characters.

If the entered PIN is not correct the operator is prompted to try again, and the number of retries remaining (indicated on the screen) is updated. At the third incorrect attempt the operator is advised that the SIM is blocked and call setup / registration is automatically aborted.

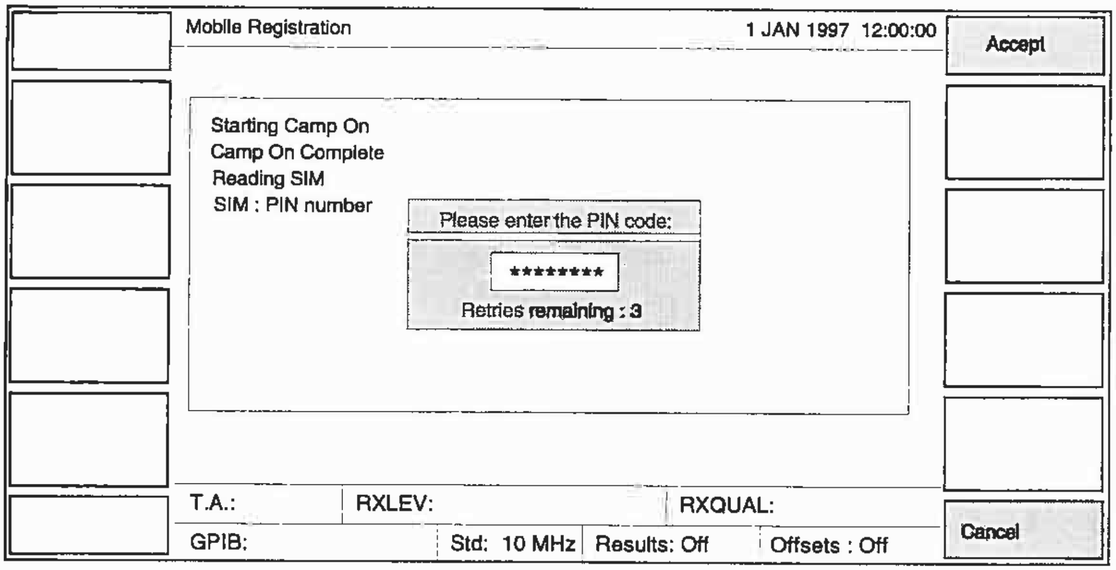


Figure 5.34 PIN Entry Screen

Menu Options

Option Button	Function
Accept	Accepts the entered PIN; this is used to unlock the SIM.
Cancel	Cancels the PIN entry process. This consequently aborts the call setup procedure and returns to the RF Tests Summary screen.

RF Tests Summary Screen (Registered)

This screen is displayed when the 'mobile' (Test Set) is successfuly registered.

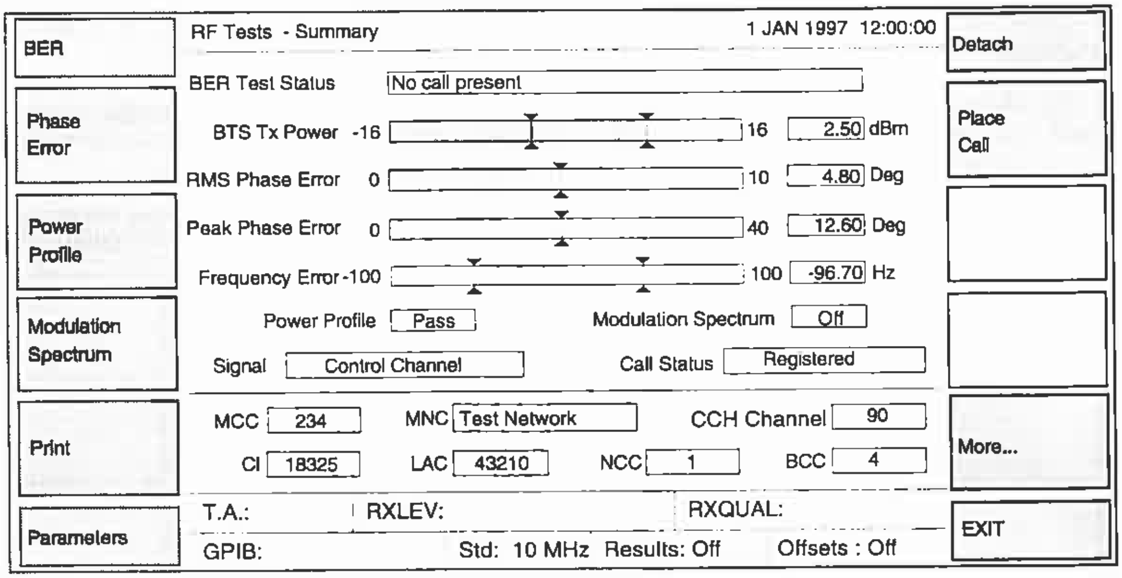


Figure 5.35 RF Tests Summary Screen (Registered)

Menu Options

Option Button	Function
BER	Switches to the BER results screen (if Option 310 / 54 / 54R is fitted. See Section 7). If Option 310 or Option 54 / 54R is not fitted, a Warning message is displayed. (The BER Results screen is similar to same in Multimode).
Phase Error	Switches to the RF Tests Phase/Frequency Error results screen (similar to same in Multimode).
Power Profile	Switches to the RF Tests Power Profile results screen (similar to same in Multimode).
Modulation Spectrum	Switches to the RF Tests Modulation Spectrum results screen (similar to same in Multimode).
Print	Prints the measured values to the printer. An error message is displayed if the printer is not selected or is set to print to a file.
Parameters	Displays a parameter edit screen for defining error limits and certain print options.
Detach	Detaches the Test Set from the network and returns to the RF Tests Summary Screen (Not Registered).
Place Call	Switches to the Call Setup screen to allow parameters relevant to the call to be edited.

More...	Switches to the RF Tests Summary More Screen (Registered).
EXIT	Detaches the IMSI and returns to the Live Tests menu.

Note: The Signal box displays the measurement state with the following set of messages:

No BCCH	The Test Set has lost the Cell Control Channel
Control Channel	The Test Set is measuring on Timeslot zero of a CCH.

The measurement boxes remain empty when the signal box displays "Synchronising" or "No Power" or other error conditions.

The Call Status box displays the GSM Layer 3 state with the message:

Registered	The Test Set has performed the location update procedure, has registered with the network and is monitoring the CCH and waiting for the operator to place a call.

The BER Test Status box displays "No call present" and the RF Tests BER screen measurement fields display dashes until a call is in place and the A-bis function has successfully located the traffic data stream on the BTS' A-bis interface.

The BTS Tx Power range is Expected Power Level ±(Power Level Limit + 10dB).

RF Tests Summary More Screen (Registered)

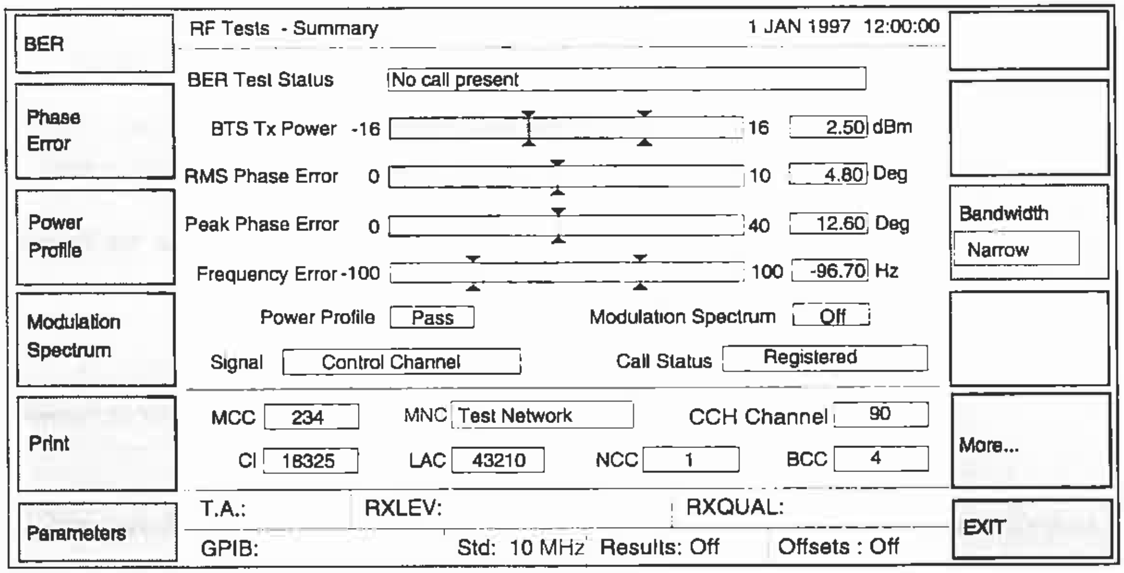


Figure 5.36 RF Tests Summary More Screen (Registered)

Menu Options

Option Button	Function
BER	Switches to the BER results screen (if Option 310 / 54 / 54R is fitted. See Section 7). If Option 310 or Option 54 / 54R is not fitted, a Warning message is displayed. (The BER Results screen is similar to same in Multimode).
Phase Error	Switches to the RF Tests Phase/Frequency Error results screen (similar to same in Multimode).
Power Profile	Switches to the RF Tests Power Profile results screen (similar to same in Multimode).
Modulation Spectrum	Switches to the RF Tests Modulation Spectrum results screen (similar to same in Multimode).
Print	Prints the measured values to the selected printer. An error message is displayed if the printer is not selected or is set to print to a file.
Parameters	Displays a parameter edit screen for defining error limits and certain print options.
Bandwidth	Toggles the receiver bandwidth between 'Wide' and 'Narrow'. This button is not displayed if an Enhanced RF module (Option 56) is not fitted and selected.
More...	Switches to the RF Tests Summary Screen (Registered).
EXIT	Detaches the IMSI and returns to the Live Tests menu.

Call Setup Screen

This screen is displayed when the *Place Call* option is selected at the RF Tests Summary screen. It allows the operator to enter the number to dial and the test pattern, and then proceed with placing a call.

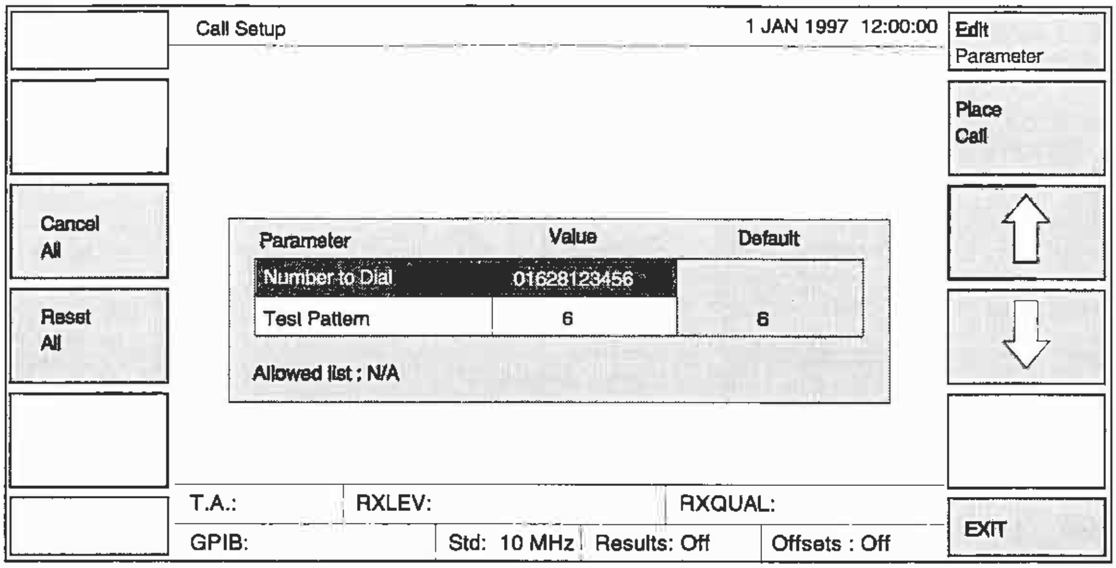


Figure 5.37 Typical Call Setup Screen

Menu Options

Option Button	Function
Cancel All	Discards all changes made to the set of parameters displayed, restoring the previous values, then returns to the previous screen.
Reset All	Sets all the displayed parameters to their default values.
Edit Parameter	Switches to parameter edit mode.
Place Call	Accepts the number to dial and starts the call set up process. The display switches to the Call Setup Progress screen.
⇧	Moves the parameter selection up one item, accepting the changes made to the previous parameter.
⇩	Moves the parameter selection down one item, accepting the changes made to the previous parameter.
Cancel	Rejects the entered number and returns to the *RF Tests* Summary screen.

Call Set Up Progress Screen

This screen displays the progress of the call set up procedure.

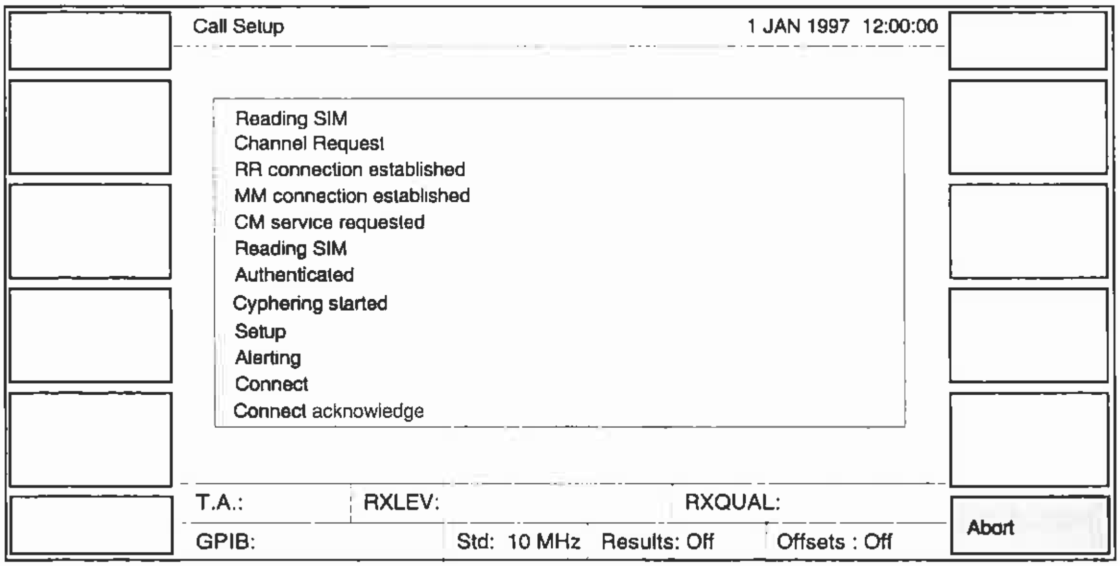


Figure 5.38 Typical Call Set Up Screen

Menu Options

Option Button	Function
Abort	Aborts the call setup procedure and returns to the *RF Tests* Summary menu.

Note: (1) There is a short delay (~ 2 seconds) after successful call set up for the operator to read the 'Call accepted' or equivalent message before control returns to the *RF Tests* Summary screen.

(2) The list of progress messages is:

"Starting Camp On"
"Camp On complete"
"Reading SIM"
"Authenticated"
"Authentication error"
"RR connection established"
"MM connection established"
"Location updated"
"Location update rejected"
"Location update request"
"Location update request - IMSI ATTACH"
"CM service rejected"
"CM service requested"
"CM service accepted"

"MM Identity request"
"MM Identity request - TMSI"
"MM Identity request - IMSI"
"MM Identity request - IMEI"
"MM Identity response"
"MM Identity response - TMSI"
"MM Identity response - IMSI"
"MM Identity response - IMEI"
"Ciphering started"
"Ciphering not commanded"
"Immediate assignment failure"
"Call dropped" ('pop up' message)
"TMSI reallocated"
"Set-up"
"Alerting"
"Call confirmed"
"Call proceeding"
"Connect"
"Connect acknowledge"
"Disconnect"
"Release"
"Release complete"
"CC Status enquiry"
"CC Status"
"Progress message unrecognised"

RF Tests Summary Screen (Call Present)

This screen is displayed when a call is successfully connected.

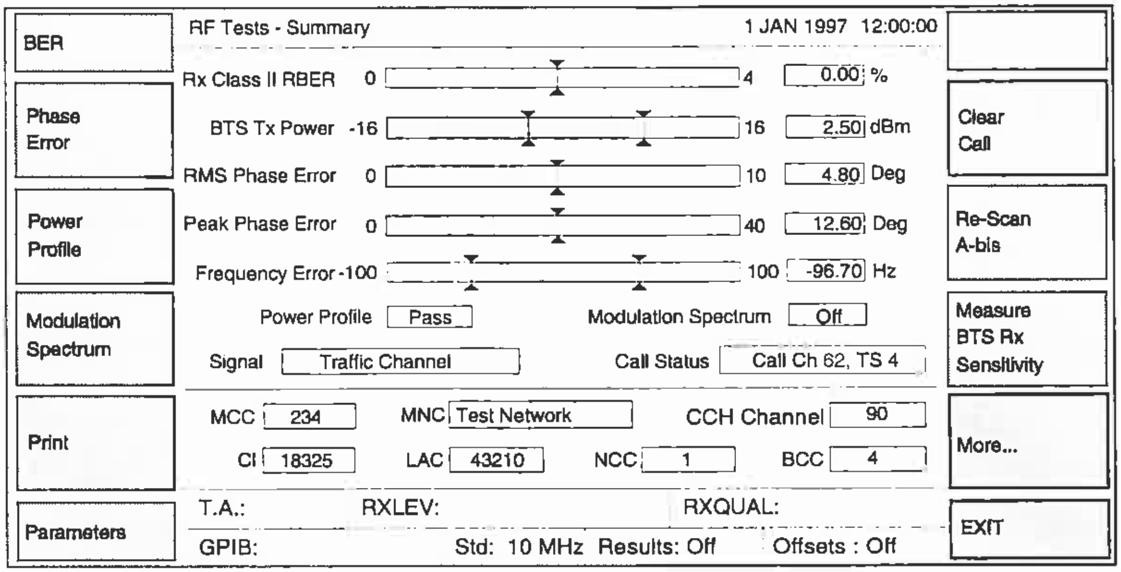


Figure 5.39 RF Tests Summary Screen (Call Present)

Menu Options

Option Button	Function
BER	Switches to the BER results screen (similar to same in Multimode).
Phase Error	Switches to the Phase/Frequency Error results screen (similar to same in Multimode).
Power Profile	Switches to the Power Profile results screen (similar to same in Multimode).
Modulation Spectrum	Switches to the Modulation Spectrum results screen (similar to same in Multimode).
Print	Sends the measured values to the selected printer. An error message is displayed if the printer is not selected or is set to print to a file.
Parameters	Displays a parameter edit screen for changing the RF Tests parameters as required before running the test.
Clear Call	Clears the call and returns the display to the RF Tests Summary screen (Registered).
Re-Scan A-bis	Re-starts scanning the A-bis for the transmitted data pattern in order to start the BTS Receiver BER test.

Measure BTS Rx Sensitivity	Switches to the Sensitivity Parameters edit screen from where the test may be run.
More...	Switches to the RF Tests Summary More (Call Present) screen.
EXIT	Clears the call, detaches the IMSI and returns to the Live Tests Menu.

Note: The Signal box display the measurement state with the following set of messages:

Traffic Channel cn, TS ts	The Test Set is measuring one of: a traffic channel on a TCH a traffic channel on a CCH carrier. cn is the channel number or 'HOP' for a hopping call, ts is the timeslot.
No Power	The Test Set cannot find any power on the specified channel and Timeslot.
Invalid Measurement	An error was encountered when performing the measurement

The measurement boxes remain empty until a valid signal is measured.

The Status box displays the GSM Layer 3 state with the following set of messages:

Call Ch cn, TS ts	The Test Set is in a call. cn is the channel number or 'HOP' for a hopping call, ts is the timeslot.

When a call is first placed the Test Set attempts to locate the transmitted data pattern on the A-bis link; the progress of the scan is displayed in the BER Test Status box. Once the data pattern has been located there is a short delay while the first BER measurement is taken, after which the BER Test Status box is replaced by the Rx Class II RBER bargraph. If the data pattern is not found then the BER Test Status box remains on screen and contains the reason for the BER test not being performed.
The list of messages displayed during the A-bis scan is:

No call present	No call is present, so no scan is attempted.
Scanning A-bis for test pattern	The Test Set is scanning the A-bis link searching for traffic channels.
Checking A-bis TSx, SSy for test pattern	The Test Set is checking a traffic channel on timeslot x and sub-slot y for the test pattern transmitted to the BTS.
Test pattern found on A-bis TSx, SSy	The Test Set has found the test pattern on timeslot x and sub-slot y.
Test pattern not found on A-bis	The Test Set was not able to locate the test pattern on the A-bis.
A-bis Downlnk connected! Please use Uplnk	The Test Set has detected that the A-bis is connected to the wrong link.

The BTS Tx Power range is Expected Power Level ±(Power Level Limit + 10dB)

RF Tests Summary More Screen (Call Present)

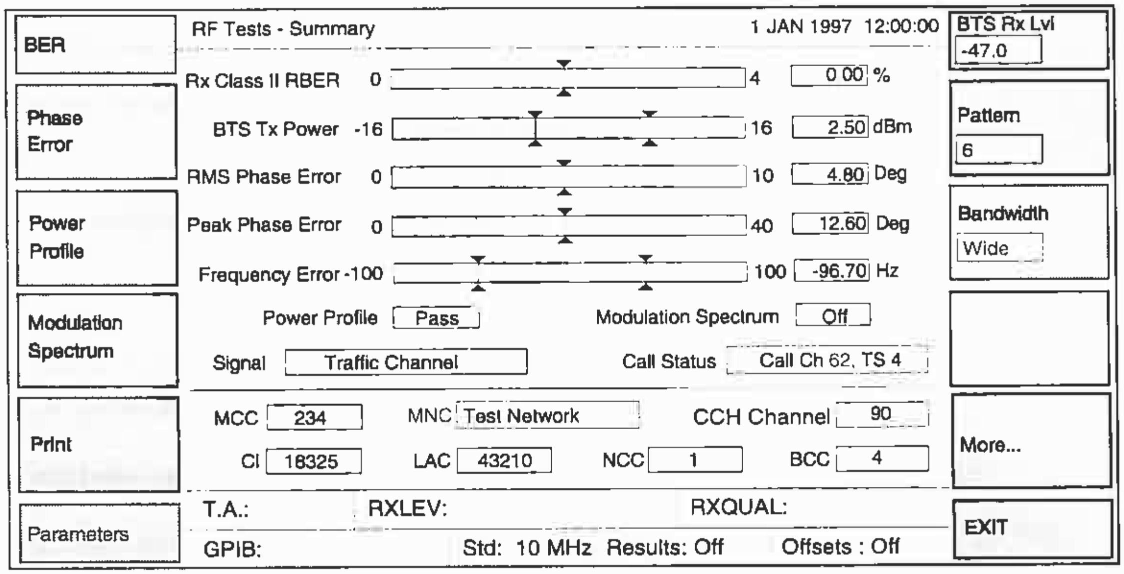


Figure 5.40 Summary More Screen (Call Present)

Menu Options

Option Button	**Function**
BER	Switches to the BER results screen (similar to same in Multimode).
Phase Error	Switches to the Phase/Frequency Error results screen (similar to same in Multimode).
Power Profile	Switches to the Power Profile results screen (similar to same in Multimode).
Modulation Spectrum	Switches to the Modulation Spectrum results screen (similar to same in Multimode).
Print	Sends the measured values to the selected printer. An error message is displayed if the printer is not selected or is set to print to a file.
Parameters	Displays a parameter edit screen for changing the RF Tests parameters as required before running the test.
BTS Rx Level	Edits the level at which the Test Set is transmitting.
Pattern	Edits the number of the data pattern (0 to 9, see Section 4 / Introduction / Test Patterns) that the test set is transmitting.
Bandwidth	Toggles the receiver bandwidth between 'Wide' and 'Narrow'. This button is only displayed if the B.O.S.S. Enhanced RF Module is fitted and selected.

More...	Switches to the RF Tests Summary Screen (Call Present).
EXIT	Clears the call, detaches the IMSI and returns to the Live Tests Menu.

Measure BTS Rx Sensitivity (Option 310 or Option 54 / 54R)

The Test Set performs automatic sensitivity measurements by systematically reducing the Test Set transmit power and monitoring the RBER measured on the A-bis until the RBER degrades beyond a pre-determined threshold.

This absolute sensitivity test is similar to the A-bis Controlled version of the test but with a restricted set of parameters (see Section 4) which specify only the measurement parameters.

The sequence of operations for measuring the BTS absolute sensitivity is as follows:

(1) Select the *Measure BTS Rx Sensitivity* button from one of the RF Tests Summary screens when a call is in progress.

(2) The Test Set displays the list of parameters using the standard parameter edit screen so that they can be modified as necessary.

(3) Select the *Run Test* button to initiate the test procedure.

(4) The Test Set runs the absolute sensitivity algorithm to determine the BTS sensitivity. Progress messages are reported as in the normal mode of operation, and a single result with a Pass/Fail decision is presented at the completion of the test.

BTS Rx Sensitivity Screen

This screen is displayed when the *Measure BTS RX Sensitivity* option is selected at one of the RF Tests Summary screens. It is a standard Parameter Edit screen, and the *Run Test* button starts the test and displays the test progress screen.

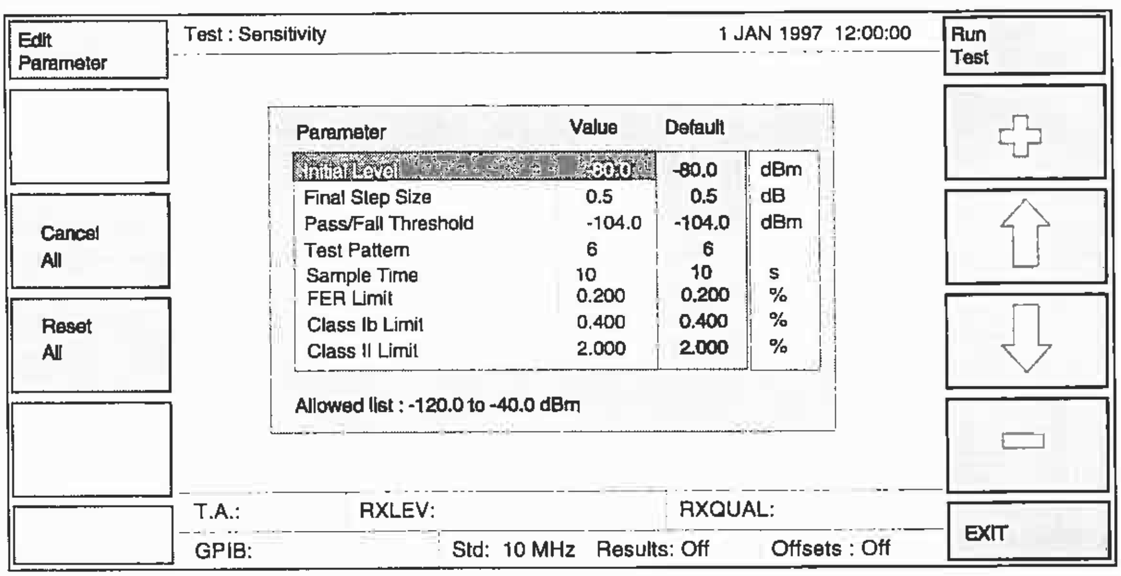


Figure 5.41 BTS Rx Sensitivity Screen

A-bis Protocol Analysis Menu

This section describes how to monitor an A-bis link between a BSC and a BTS, and how to monitor and log the messages detected.

Initial Set Up

BTS Information Menu

Before monitoring can be performed, certain parameters must be initialised. Select the *BTS Information* option from the Main Menu and enter the following parameters:

(1) Select / enter the correct information in the *Radio System*, *BTS Manufacturer*, *BTS Model*, and *BTS Software* options.

(2) The *Mapping Table* option can remain set at default values.

(3) Set the *Interface* option to 'A-bis Bal' (balanced) or 'A-bis Unbal' (unbalanced) as required to match the physical A-bis connections in use.

Self Tests / System Menu

Select the *I/O Port Allocation* option and use the *Printer* option to select and configure the printer port, or select FILE and set the filename.

Live Tests Menu

Select the *A-bis Protocol Analysis* option and define the following parameters:

(1) Toggle the (A-bis) *Connector 1* option button to the required allocation (i.e. Uplink or Downlink). Note that A-bis Connector 2 is automatically set to the opposite allocation.

(2) Use the *Configure Channels* option to define up to 4 Signalling channels and 1 Traffic channel. Enable/disable logging and measurement reports as required, and set the channel direction, data rate, Sub Slot, SAPI and TEI.

(3) Use the *Configure Logging* option to select and configure a logging port, or select FILE and name the log file.

When the above information has been entered, a parameter file can be created in the normal manner to save the settings.

If a suitable parameter file is available it can be loaded and all the above steps omitted.

Starting A-bis Protocol Analysis Mode

When all the initial setup conditions have been defined as above, press the *Start Monitor* button on the A-bis Protocol Analysis screen to begin logging data. Press the *Stop Monitor* button to stop logging data.

Either before or during logging, the *Display Data / Logging Status* button can be used to toggle the display between the logging status for the channels and the actual real time display of data being logged.

Replaying a Log File

If the Printer port has not been configured (as described earlier in Initial Setup / Self Tests/System Menu), then it will be necessary to disconnect the A-bis and then exit Live Tests mode. From the Self Tests / System Menu select the *I/O Port Allocation* option and configure the printer port, and for FILE set the filename.

(All the other important parameter data is stored together with the log file data and used at replay time to manage the data display).

Then from the Main Menu select *Live Tests* and then *A-bis Protocol Analysis.*

To replay log files the following steps are necessary:

A-bis Protocol Analysis Screen

From the A-bis Protocol Analysis screen, select the *Replay Log* option and then use the *Select Log* option to select a log file for replay. The log file is automatically opened and the stored channel header data displayed for the user to view.

Replay Log Screen

(1) From the Replay Log screen, use the *Select Chans / Mode* option to select which channels are to be viewed and to select a particular view mode.

(2) Use the *Define Search Key* option to define a Search key, which will move to a particular message in the log file.

Select a channel and SAPI.

Select a Layer 3 message.

(3) Use the *Start Search* button to move to a specific message, and then the *Find Next* button to move to the next occurance.

(4) Use the *Restart Log File* button to move back to the start of the log file. The channel header data will be displayed again.

(5) Use the *Auto Scroll* opton to start automatic view of the log file

or

Use the Arrow buttons to move up or down through the log file.

A-bis Protocol Analysis Screen

This screen is displayed when *A-bis Protocol Analysis* option is selected at the Live Tests screen.

On entry to the A-bis Protocol Analysis mode the information window shows logging status information.

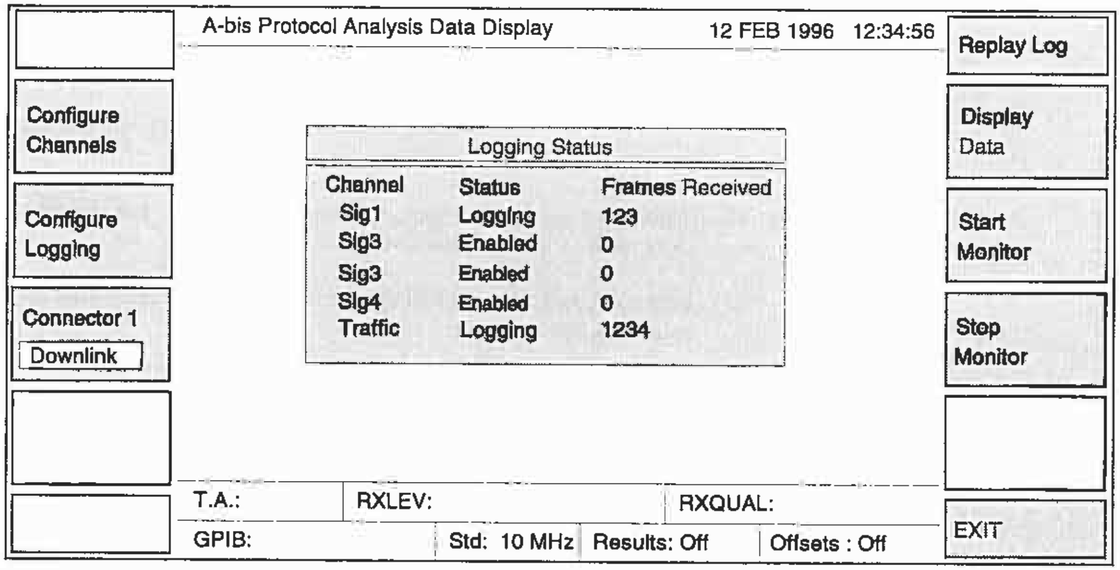


Figure 5.42 A-bis Monitor Mode Screen (Logging Status)

Menu Options

Option Button	Function
Configure Channels	This button displays the Configure Channels screen which allows the operator to define all the required signalling and traffic channels.
Configure Logging	This button displays the Configure Logging screen which allows the operator to define the destination of the logged data. If the log file is to be directed to memory card the operator may select a log file name to be used for the subsequent monitor session. The default log file name is ABISMON.LOG
Connector 1	This button toggles between Uplink and Downlink. The button display indicates the direction selected for (A-bis) Connector 1. Note that Connector 2 is automatically set to the opposite direction.
Replay Logs	This button displays the Replay Logs screen which allows the operator to select a log file for replay and to define the viewing conditions. This button is greyed out when the system is logging.
Display Data	The legend on this button toggles between *Display Data* to display the real time logging display, and *Logging Status* to display logging status information.

Start Monitor	This button starts the process of logging channel data. At this time the log file on the memory card will be opened if the operator has chosen that as the destination. This button is greyed out when monitoring is in progress.
Stop Monitor	This button stops the logging of channel data. At this point the log file on the memory card will be closed if it is the selected destination. The button does not appear until logging is in progress.
EXIT	Exits A-bis Protocol Analysis mode and returns to Live Tests screen.

Note: (1) When the Logging Status window is selected, the Frames Received count will increment as each frame is received on a channel.

(2) When the real time data window is selected, a scrolling view of the Layer 3 messages is displayed.

Example of Real Time Data Window

This screen is displayed when *Display Data* option is selected at the A-bis Protocol Analysis screen. A typical real time data display is illustrated in the following diagram.

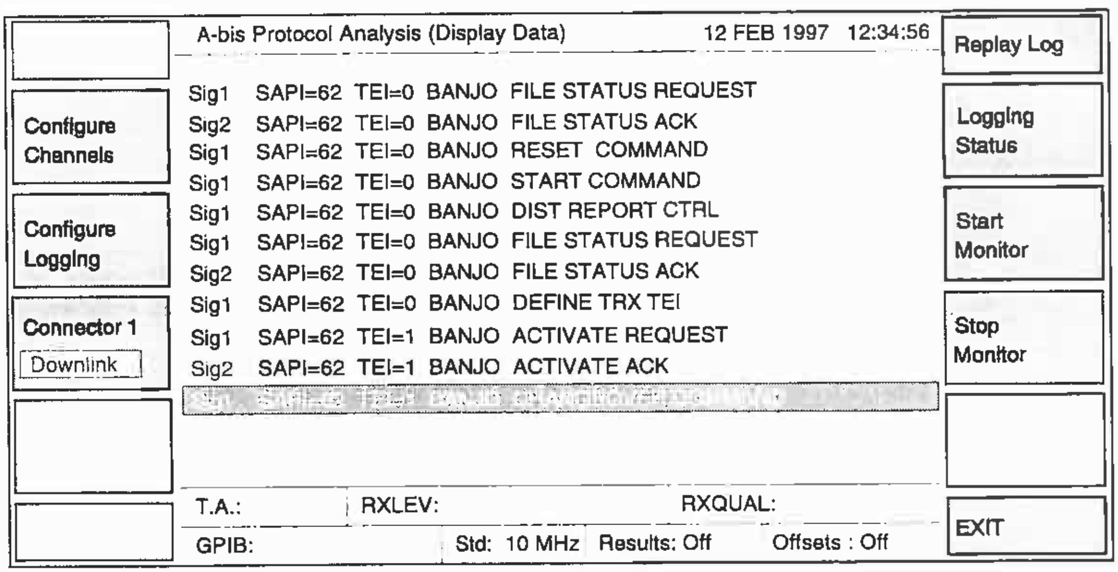


Figure 5.43 Typical A-bis Protocol Analysis (Data Display) Screen

Note: The heading 'Data Display' remains on the screen with the message data scrolling beneath.

Configure Channels Screen

This screen is displayed when *Configure Channels* option is selected at the A-bis Protocol Analysis screen. It allows the operator to configure up to 4 Signalling channels and 1 Traffic channel.

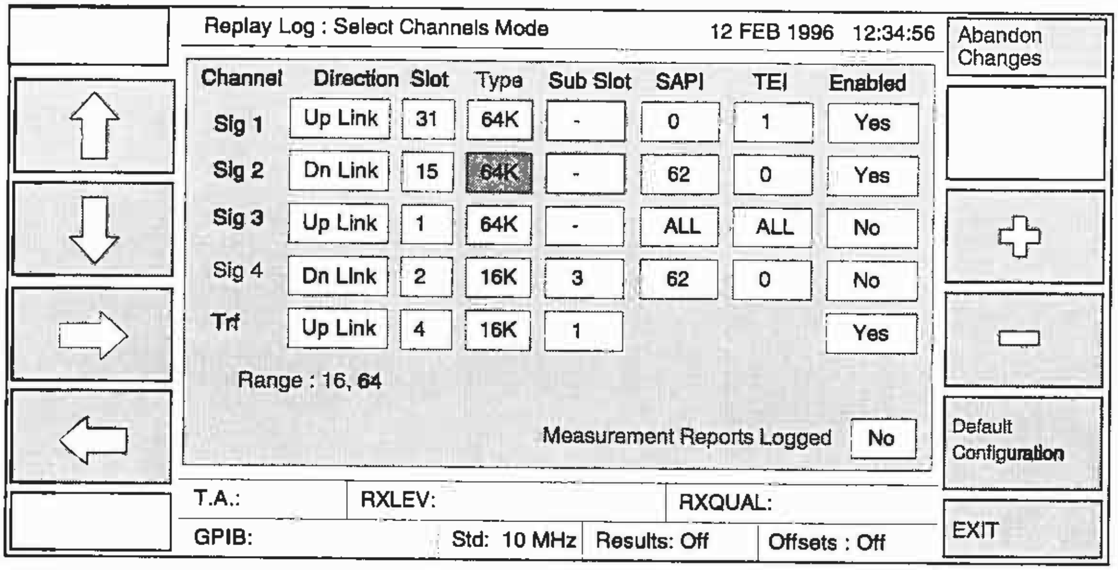


Figure 5.44 Configure Channels Screen

Menu Options

Option Button	Function
⇧	Moves the current parameter selection up one item, accepting any changes made to previous parameter.
⇩	Moves the current parameter selection down one item, accepting any changes made to previous parameter.
⇨	Moves the current parameter selection to the right one item, accepting any changes made to previous parameter.
⇦	Moves the current parameter selection to the left one item, accepting any changes made to previous parameter.
Abandon Changes	Discards all the changes made to the set of parameters displayed and restores the previous values.
+	Increments the currently selected parameter.
-	Decrements the currently selected parameter.
Default Configuration	Sets all the parameters displayed to their default values.
EXIT	Accepts all the changes made to the set of parameters displayed and returns to the previous menu.

Note: (1) The range for the currently selected parameter is displayed at the bottom of the table.

(2) Measurement Reports are logged from all four Signalling channels, if enabled.

(3) If 'NO' is selected in the Enabled column, the channel and settings are ignored.

Configure Logging Screen

This screen is displayed when *Configure Logging* option is selected at the A-bis Protocol Analysis screen. It allows the operator to configure the destination port for the logged data. The default for the logging port is FILE.

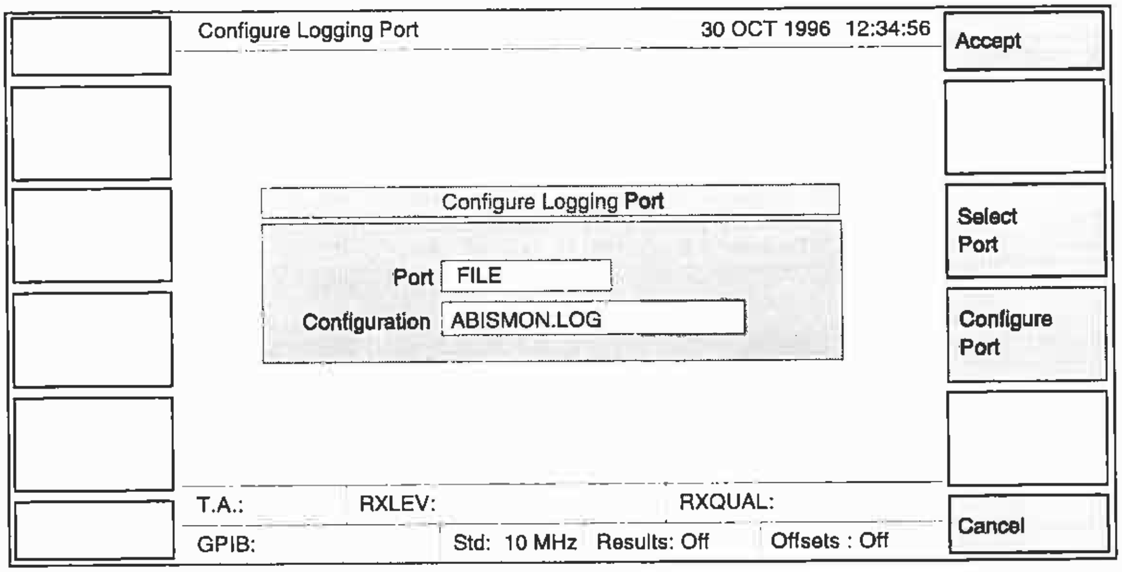


Figure 5.45 Configure Logging Screen

Menu Options

Option Button	Function
Accept	Accepts the entries made by the operator and returns to the previous menu.
Select Port	This button displays a drop down list from which the operator may select the destination for the log output. The default is FILE.
Configure Port	This button displays a screen from which the operator can configure the chosen port. The screen content is a related to the type of port selected. If the operator selects a port then a standard configure port screen is displayed; if FILE is selected, the Define Log File screen is displayed for entering a file name and brief description.
Cancel	Cancels all operator entries, restores the previous values and returns to the previous menu.

Define Log File Screen

This screen is displayed if the operator has selected FILE as the logging destination (from the *Select Port* option in the Configure Logging screen) and then selects the *Configure Port* option. It allows a file name and a destination drive and directory to be specified. In addition a brief description can be included which will form part of the log file.

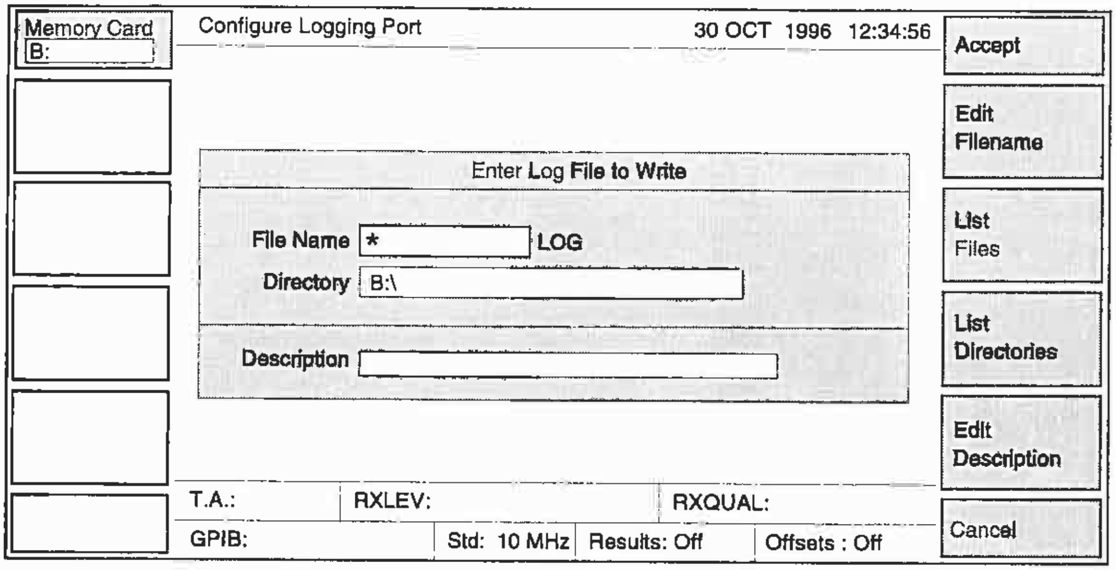


Figure 5.46 Define Log File Screen

Menu Options

Option Button	Function
Memory Card	Displays the current active memory card slot. Pressing this button toggles between A: slot and B: slot.
Accept	Accepts the entries made by the operator and returns to the previous menu.
Edit Filename	This button displays the standard text editor screen allowing the operator to enter the log filename.
List Files	This button displays a drop down list of all the files with the extension .LOG in the currently selected directory, allowing the operator to select a log file for use.
List Directories	This button displays a drop down list of all the directories one level above and below the current directory level, allowing the operator to move to another directory.
Edit Description	Displays a text editor screen allowing the operator to enter a brief description which will be stored with the logging data.
Cancel	Cancels all operator entries, restores the previous values and returns to the previous menu.

Replay Log Screen

This screen is displayed if *Replay Log* option is selected at the A-bis Protocol Analysis screen. It allows log files to be selected, replayed and printed.

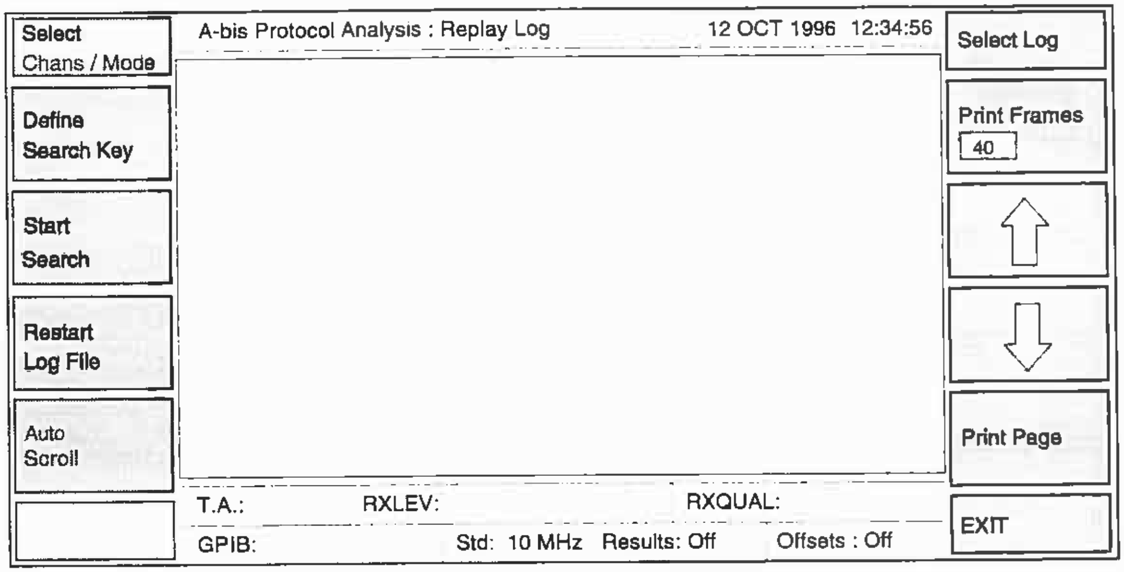


Figure 5.47 Replay Log Screen

Menu Options

Option Button	**Function**
Select Chans / Mode	Displays a screen which allows channels and display mode to be selected. The default setting is for all channels and only Layer 2 data to be displayed.
Define Search Key	Displays a screen which allows a channel, SAPI, and Layer 3 message to be selected for the search process.
Start Search	This button is greyed out until a search key has been defined. The system will search forward only and from the current log file position. The *Restart Log File* button can be used to restart searching from the beginning of the log file. Once a search has been completed the annotation on this button changes to *Find Next*.
Restart Log File	This button allows the display to return to the start of the Log file.
Auto Scroll	This button starts an automatic scroll process that scrolls the data up the display. When the log file is scrolling this button is relabelled *Pause*. Pressing the *Pause* button stops the scrolling and returns to the Page Up / Down view. The button is then relabelled as *Scroll*.

Select Log	This button displays a screen for selecting a specific log file to replay.
Print Frames	This button sends the defined number of frames to the current printer destination. To change the number of frames, press the button once and then use the numeric keypad to enter the required number, and then press the button again to send the frames for printing.
⇧	Displays the previous message of the log file. The button supports auto repeat operation.
⇩	Displays the next message in the log file. The button supports auto repeat operation.
Print Page	This button sends the currently displayed page contents to the current printer destination.
EXIT	Exits the Replay Logs Mode and returns to the previous menu.

Typical Log File Header Display

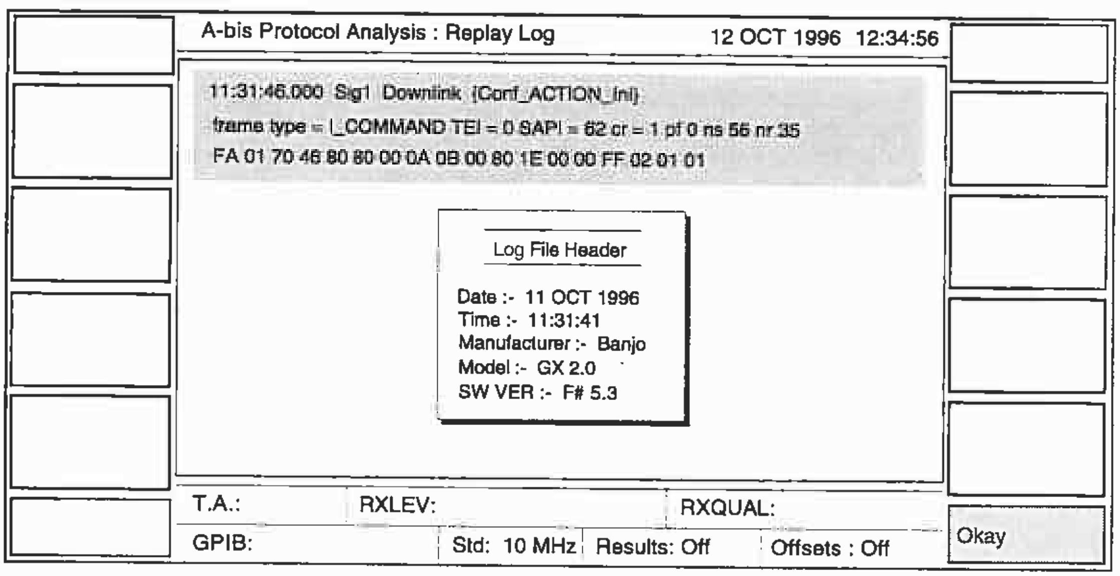


Figure 5.48 Typical Log File Header Display

The screen above shows typical information recorded at the start of the log file and displayed when the log file is first opened. Pressing Okay returns the display to the Replay Log screen with the log file ready for scrolling.

Typical Log File Scroll Display

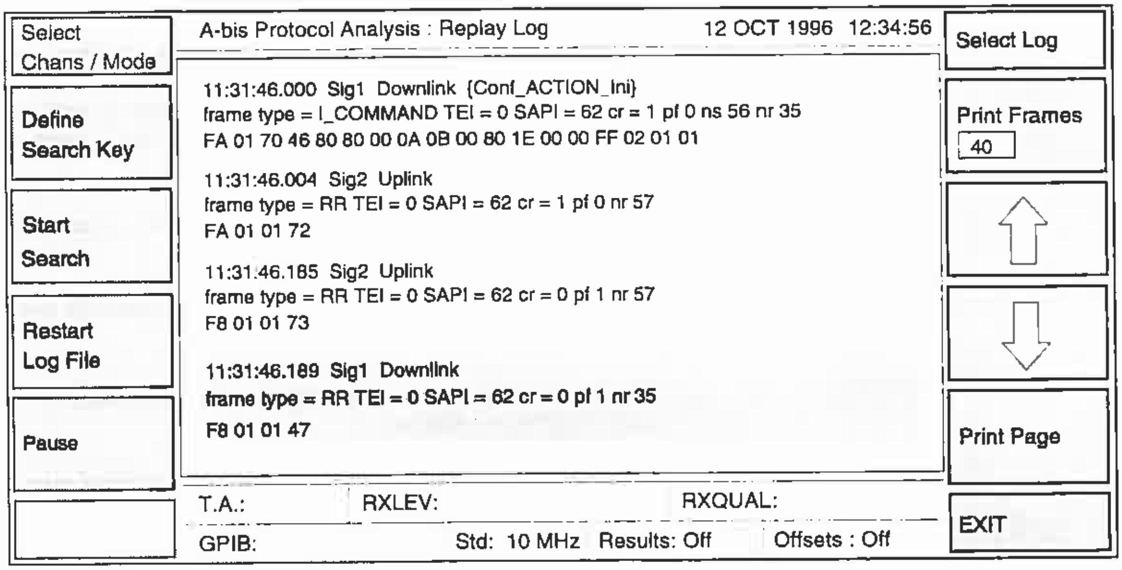


Figure 5.49 Typical Log File Scroll Display

The diagram above illustrates the scroll display and the Layer 2 / Layer 3 message formatting. Note that the highlight moves downwards as the display scrolls upwards, or as dictated by the up/down arrow buttons (after the scroll has been stopped with the *Pause* button).

Note: (1) The data in this screen represents typical frames.

(2) The number of messages displayed varies according to the size of frames.

(3) The Arrow buttons allow the operator to move the display a 'message' at a time either up or down.

Select Channels / Mode Screen

This screen is displayed when *Select Chans / Mode* option is selected at the Log File Scroll Display screen It allows the operator to select the channels to be displayed and the display format. Data contained in the log file determines which channels are present and available for selection. On entry to this screen the available channels are displayed.

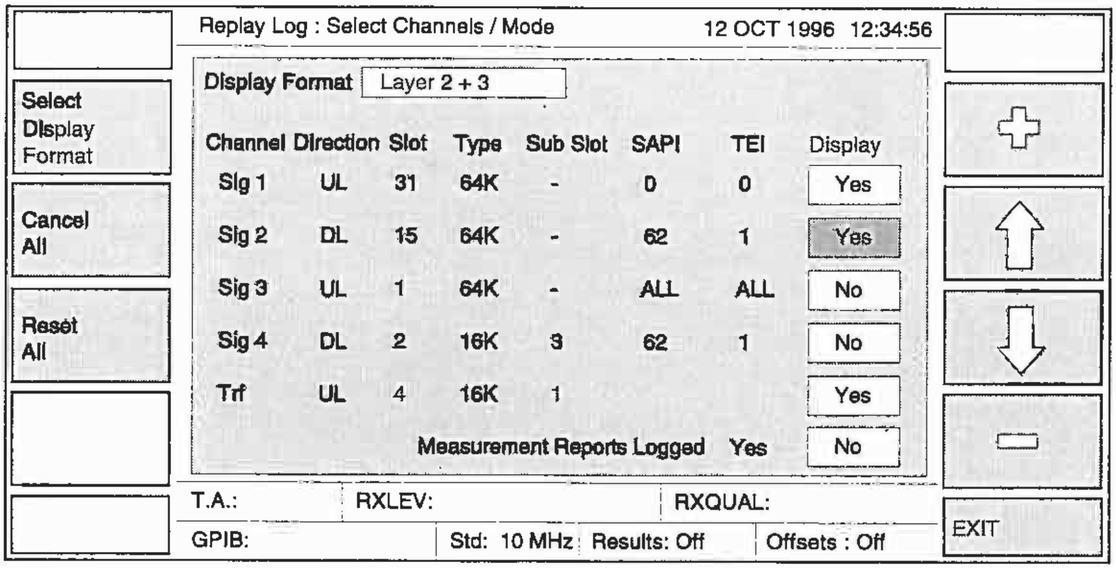


Figure 5.50 Select Channels / Mode Screen

Menu Options

Option Button	Function
Select Display Format	This button displays a drop down list from which the operator can select the required display format.
Cancel All	Discards all the changes made displayed and restores the previous values.
Reset All	Sets all the selections their default values.
+	Increments the value of the currently selected item.
⇧	Moves the current selection up one item, accepting any changes made to previous item.
⇩	Moves the current selection down one item, accepting any changes made to previous item.
-	Decrements the value of the currently selected item.
EXIT	Accepts all the changes made to the items displayed and returns to the previous menu.

Note: (1) The default states for this screen are:

-- All available channels displayed.
-- Only Layer 2 messages displayed.

(2) If no Measurement Reports have been logged the operator cannot modify the display status for that field.

Define Search Key Screen

This screen is displayed when *Define Search Key* option is selected at the Replay Logs screen. It allows the search key to be defined as a Layer 3 message together with a logical channel and SAPI.

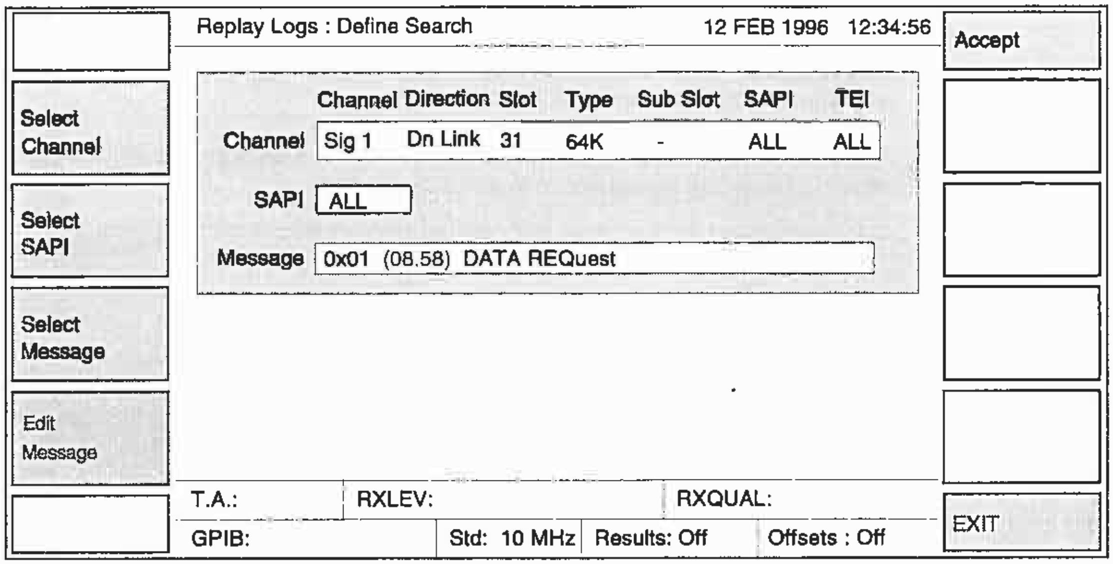


Figure 5.51 Define Search Key Screen

Menu Options

Select Channel — This button displays a drop down list from which the operator may select a channel. The list of channels depends on the channel selection defined in the Select Channels / Mode screen. Only those channels marked for display are included in the list.

Select SAPI — This button displays a drop down list from which the operator may select a SAPI. The list of SAPI values displayed comprises all the possible values. This button is not available if the SAPI in the channel specified is already defined. This screen is only reached if the SAPI value defined in the channel configuration is ALL, specifying all SAPIs to be logged.

Select Message — This button displays a drop down list of messages from which the operator may select a message. The list of messages depends on the current channel selected.

Edit Message — This button displays a screen which can be used with the numeric keypad to enter the Hex number of an 08.58 message to be used.

Accept — Accepts the entries made by the operator and returns to the previous menu.

EXIT — Cancels all operator entries, restores the previous values and returns to the previous menu.

Select Log File Screen

This screen is displayed when the *Select Log* option is selected in the Replay Log screen. It allows the operator to select a particular log file for replaying. A memory card must be available in one of the slots. The operator is warned if there is no memory card present in either slot.

If a log file has been created as part of the A-bis Protocol Analysis session it will be available as the default log file. If no log file had been created in the current session and a log file is not selected, then the default log filename will be ABISMON.LOG.

Following selection, the log file will be opened and the first page of data displayed. The data displayed will be governed by the current settings for the filters.

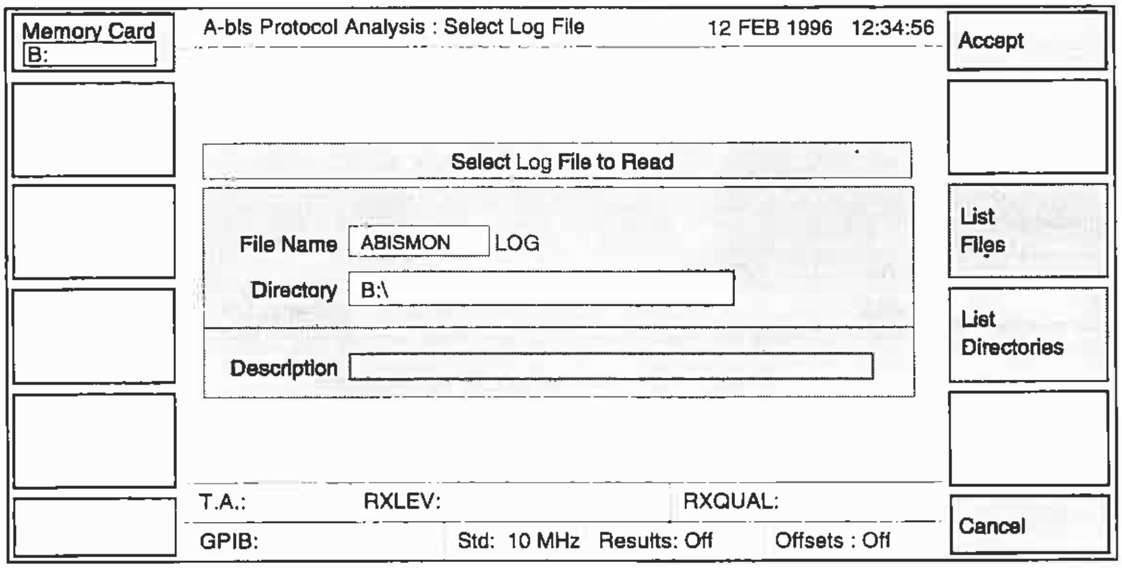


Figure 5.52 Select Log File Screen

Menu Options

Memory Card — Displays the current active memory card slot. Pressing this button toggles between A: drive and B: drive.

Accept — Accepts the entries made by the operator and returns to the previous menu.

List Files — This button displays a drop down list of all files with the extension .LOG in the currently selected directory, allowing the operator to select a log file for use.

List Directories — This button displays a drop down list of all the directories one level above and one level below the current directory level, allowing the operator to select another directory.

Cancel — Cancels all operator entries, restores the previous values and returns to the previous menu.

SPECIAL FUNCTIONS MENU

This menu screen is displayed when the Special Functions option is selected at the Main Menu.

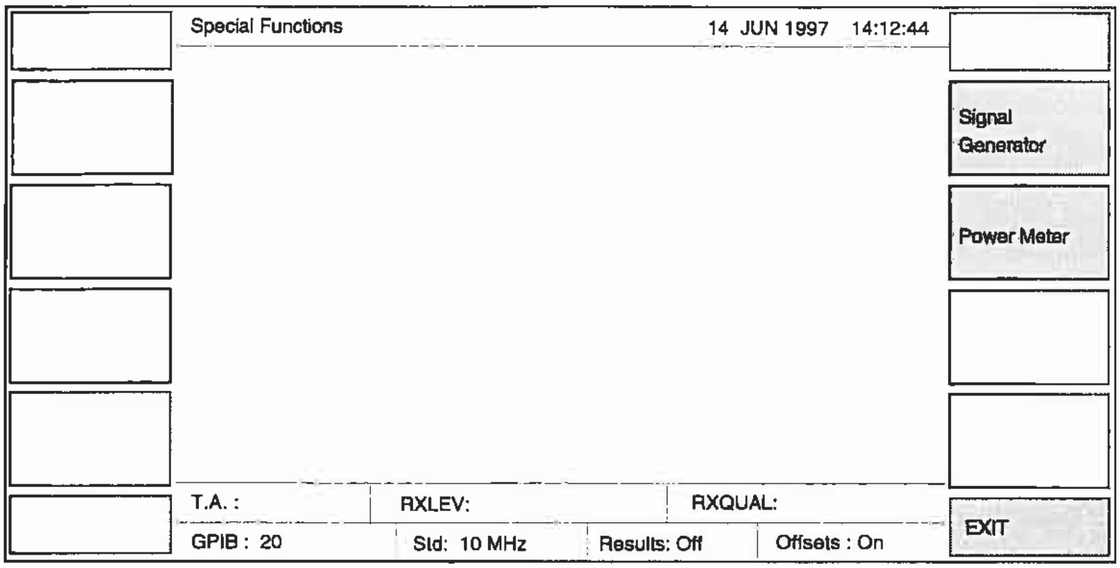


Figure 5.53 Special Functions Screen

Menu Options

Option Button	Function
Signal Generator	Displays the Signal Generator Mode screen for controlling Signal Generator mode. Use this for generating structured GSM signals and other signals as required. No signal monitoring facilities are provided in this mode.
Power Meter	Displays the Power Meter screen for controlling Power Meter mode. Use this for monitoring the downlink power from a BTS.
EXIT	Operating this button returns the display to the Main Menu.

Signal Generator Menu

Signal Generator mode allows the 6113 to act as a signal generator instrument that can transmit a variety of GSM structured signals and other signals from the RF OUT connector on the front panel (refer to Section 3 for connections). The signals can be changed while the signal generator is running. There are no special setting up procedures other than those required by the user.

Additional information is given in Section 4 under the heading Special Functions.

From the Main Menu, select *Special Functions / Signal Generator*. The following screen is displayed.

Set up the signal parameters as required and then press *Run Test* to start the signal. Additional summary screens are then available to change the signal parameters while the signal generator is running.

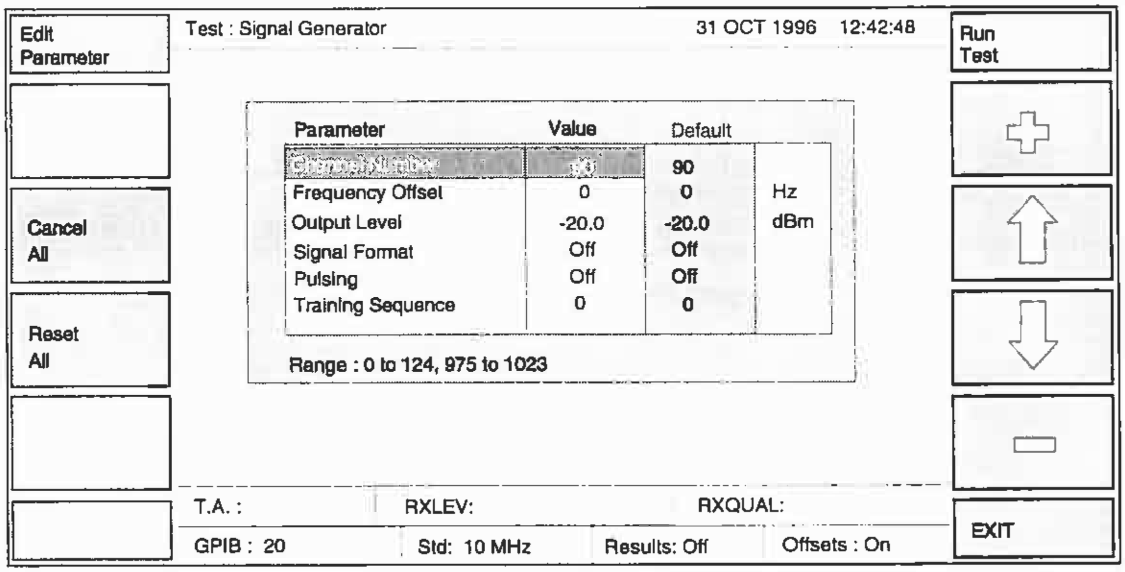


Figure 5.54 Signal Generator Screen

Menu Options

Option Button	Function
Edit Parameter	Pressing this button allows the selected parameter to be edited using the spinwheel. The button legend changes to *Accept* and pressing this accepts the entered value (if it is within the allowed range).
Cancel All	Discards all the changes made to the set of parameters displayed and restores the previous values.
Reset All	Sets all the parameters displayed to their default values.

Run Test	Accepts all the changes made to the set of parameters displayed and sets up the new values in the Test Set, then starts the signal generator. The display then changes to the Summary screens which can be used to change the signal parameters while the signal generator is running.
+	Increments the value of the currently selected parameter.
⇧	Moves the current parameter selection up one item, accepting any changes made to previous parameter.
⇩	Moves the current parameter selection down one item, accepting any changes made to previous parameter.
–	Decrements the value of the currently selected parameter.
EXIT	Accepts all the changes made to the set of parameters displayed and then returns to the Special Functions Menu.

Notes:

(1) The screen always starts with the spinwheel in 'Parameter Select' mode.

(2) The range for the currently selected parameter is displayed on the bottom line of the table.

(3) The spinwheel may be used to scroll up and down the parameter list.

(4) In this screen, the +/- softkeys cannot edit the value of the selected parameter beyond the maximum or minimum values.

(5) With a numeric or toggle parameter selected, pressing numeric keys on the keyboard selects the Numeric Parameter Edit screen. (Note that in this screen, only the numeric keys can be used to change the value of the parameter).

Power Meter Menu

This screen is displayed when the *Power Meter* option is selected at the Special Functions Menu.

In this mode the Test Set can operate as an independent power meter instrument. It can be used to scan a selected downlink frequency band (GSM 900, DCS 1800 or PCS 1900) to find the signal with maximum power, or it can monitor a single frequency within a selected band.

Note: In the BTS Information Menu, set the required radio system (only) of the BTS of interest. This will determine the scan frequency range.

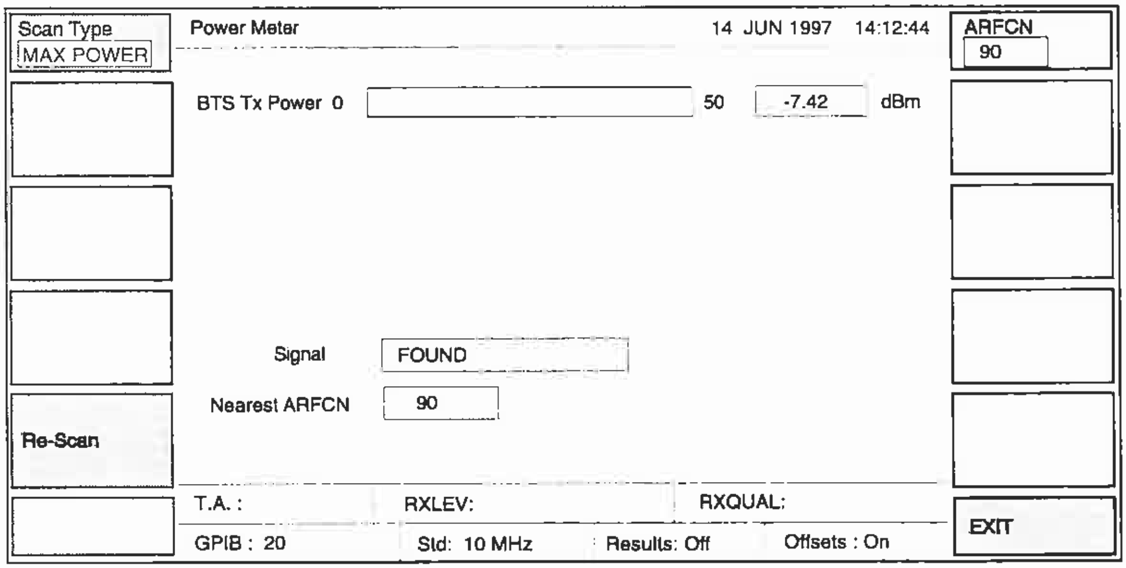


Figure 5.55 Power Meter Screen

Menu Options

Option Button	Function
Scan Type	Toggles between MAX POWER and NO SCAN. MAX POWER will search the selected radio band (GSM 900, DCS 1800 or PCS 1900 as selected in the BTS Information Menu) for the maximum power signal. NO SCAN will monitor the channel set in the *ARFCN* button. In each case the the nearest ARFCN number and the monitored power are displayed on the screen.
Re-Scan	Restarts the scan process. This should always be used after setting the *Scan Type* option.
ARFCN	If a known channel is to be monitored, set the number in this button and then select NO SCAN at the *Scan Type* button.
EXIT	Operating this button returns the display to the Special Functions screen.

A-bis CONTROLLED TESTS MENU

CAUTION: **If the Test Set has previously been used for Live Tests the A-bis connections will be at high impedance, and the following warning will be displayed. Ensure that the 6113 is disconnected from the operational BTS <u>before</u> continuing, otherwise the operational link may be disrupted.**

> WARNING
>
> This operation will cause the
> A-bis connectors to revert to low impedance
>
> Where connection is to a live system
> disconnect A-bis cables before continuing.

The Select Test screen is displayed when *A-bis Controlled Tests* option is selected at the Main Menu. The screen is used to select a particular test. First select *Functional Tests*, *Transmitter Tests*, *Receiver Tests* or *Multimode*.

If *Multimode* is selected, then refer to the heading MULTIMODE MENU later in this Section for a separate description of Multimode facilities.

If *Functional Tests*, *Transmitter Tests* or *Receiver Tests* is selected then use the up/down arrows or the spinwheel to select a test from the scrolling list presented. The following diagram illustrates the Receiver Tests menu, and the RACH Test being selected from it.

Select Test Screen

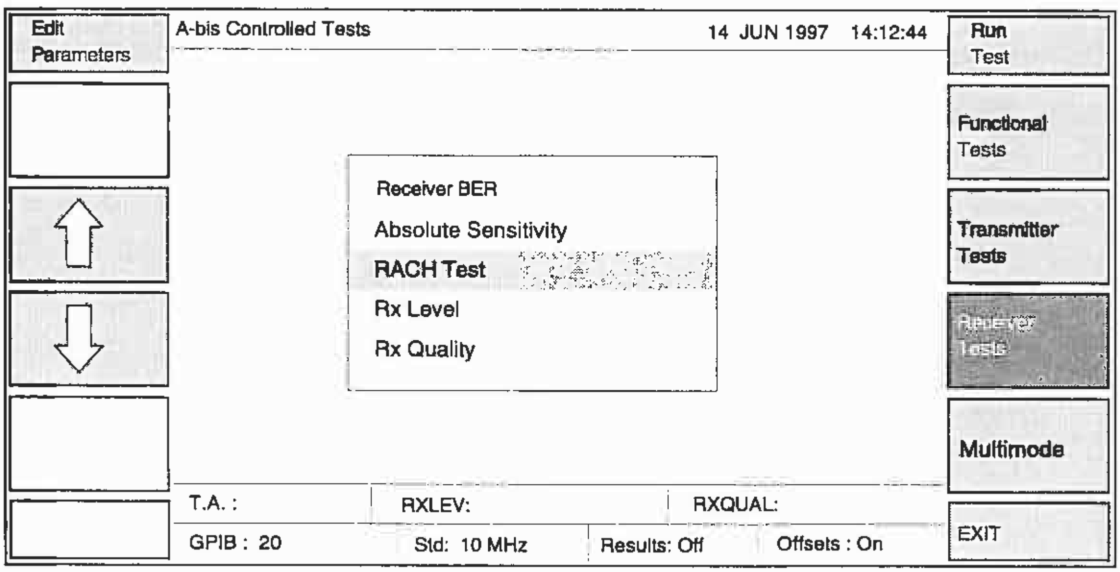


Figure 5.56 Select Test Screen

Menu Options

Option Button	Function
Edit Parameters	Accepts the current test selection and switches to the Test Parameter Edit Screen.
⇧	Move the current selection up one item.
⇩	Move the current selection down one item.
Run Test	Accepts the current test selection and runs the test without displaying the Test Parameter Edit screen.
Functional Tests	Displays a scrolling list of Functional Tests.
Transmitter Tests	Displays a scrolling list of Transmitter Tests.
Receiver Tests	Displays a scrolling list of Receiver Tests.
Multimode	Displays the Multimode screen (refer to the heading MULTIMODE MENU later in this Section).
EXIT	Returns to the Main Menu.

Functional Tests Available

Test	Results Information
Configure BTS	Pass / Fail
Reset BTS	Pass / Fail

Transmitter Tests Available

Test	Results Information
Cell Control Channel Generation	Pass / Fail
Transmitter Test	Pass / Fail Phase Error, graph Frequency Error BTS Power Power Profile, graph Modulation Spectrum, graph
Transmitter BER	Pass/Fail, Samples/Events/Ratio for FER, Class Ib and Class II
Static Power Control	Pass/Fail Expected Power, Measured Power, Step Error, Cumulative Error
Downlink Power Control	Pass/Fail Step Value, Step Error, Cumulative Error

Receiver Tests Available

Test	Results Information
Receiver BER	Pass/Fail, Samples/Events/Ratio for FER, Class Ib and Class II
Absolute Sensitivity	Sensitivity threshold
RACH Test	Successful/failed RACHs, reasons
Rx Level	Pass/Fail, expected Rx level, nominal/minimum/maximum/mean Rx levels
Rx Quality	Test Complete/Fail, expected/minimum/maximum Rx levels, Rx Quality values, Class II BER

Note: Additional manufacturer-specific tests are available for certain BTS types. See Section 7 Manufacturer-Specific Information.

Multimode Tests Available

Test	Results Information
Multimode	Pass/Fail, Samples/Events/Ratio for FER, Class Ib and Class II. Phase Error (graph), Frequency Error, BTS Power, Power Profile (graph), and Modulation Spectrum (graph). Refer to the heading MULTIMODE MENU later in this Section.

Test Parameter Select Screen

The Test Parameter Select screen is displayed when the *Edit Parameters* button on the Test Select screen is pressed. Note that the name of the test is displayed at the top of the screen.

From this screen the selected test can be run, with the parameters as set, by pressing the *Run Test* button.

To change the parameters before running the test, use the up/down arrows or the spinwheel to select a parameter and then press the Edit Parameter button; the Parameter Edit screen is then displayed.

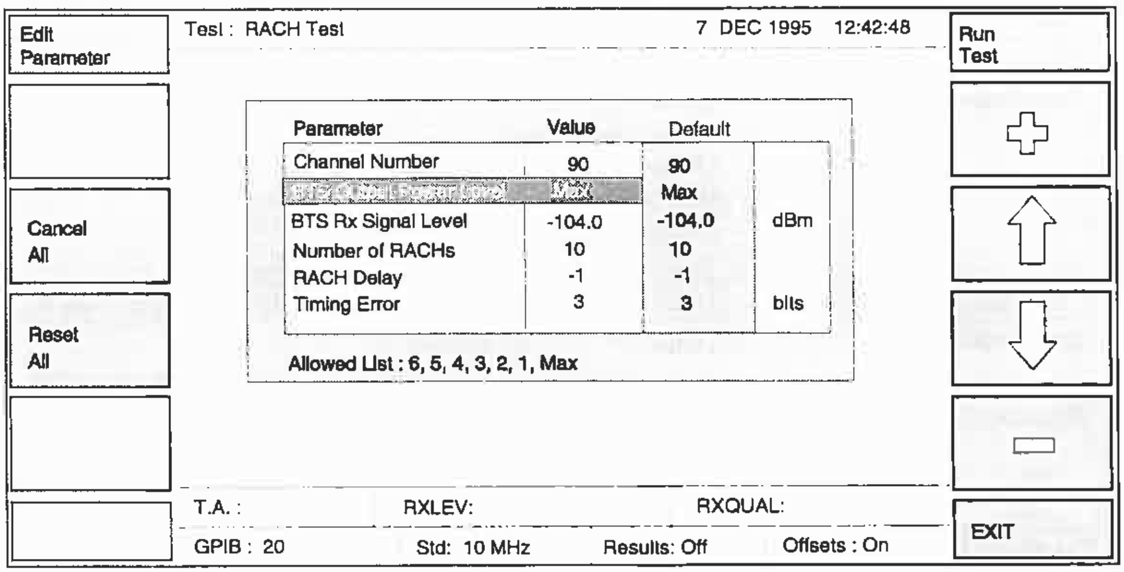


Figure 5.57 Test Parameter Select Screen

Menu Options

Option Button	Function
Edit Parameter	For toggle or numeric parameters this button displays the Parameter Edit screen; for text parameters it displays a text edit screen for editing the parameter type (described under FILE MANAGER MENU).
Cancel All	Discards all the changes made to the set of parameters displayed and restores the previous values.
Reset All	Sets all the parameters displayed to their default values.
Run Test	Accepts all the changes made to the set of parameters displayed and sets up the new values in the Test Set, then runs the test.
+	Increments the value of the currently selected parameter, or for text parameters it displays a text edit screen for editing the parameter type (described under FILE MANAGER MENU).

⇧	Moves the current parameter selection up one item, accepting any changes made to previous parameter.
⇩	Moves the current parameter selection down one item, accepting any changes made to previous parameter.
–	Decrements the value of the currently selected parameter, or for text parameters it displays a text edit screen for editing the parameter type (described under FILE MANAGER MENU).
EXIT	Accepts all the changes made to the set of parameters displayed and then returns to the Single Tests Menu.

Notes:

(1) The screen always starts with the spinwheel in 'Parameter Select' mode.

(2) The range for the currently selected parameter is displayed on the bottom line of the table.

(3) The spinwheel may be used to scroll up and down the parameter list.

(4) Pressing numeric keys on the keyboard selects:

-- Numeric Parameter Edit screen with a numeric or toggle parameter selected. (Note that in this screen, only the numeric keys can then be used to change the value of the parameter.

(5) In this screen, the +/- softkeys cannot edit the value of the selected parameter beyond the maximum or minimum values.

Parameter Edit Screen

This screen is displayed when the *Edit Parameter* button in the Test Parameter Select screen is pressed. Use the spinwheel or the ⇧ and ⇩ buttons to change the displayed value of the parameter. Note that the allowed values are stated in the parameter box, and the controls cannot increase or decrease the value beyond the allowed range of values.

Alternatively, use the numeric keys on the front panel to edit the parameter (see Numeric Parameter Edit screen).

When all the parameters are set as required, press the Accept button. The display returns to the Test Parameter Select screen from where the test may be run. Alternatively, pressing the Run Test button accepts the change to the parameter and then runs the test.

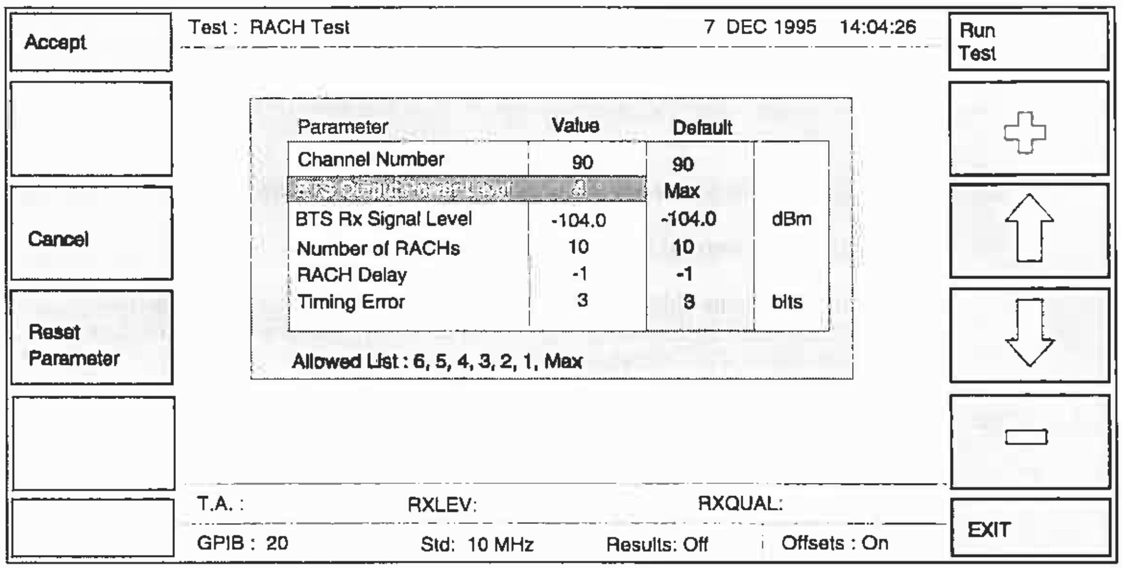


Figure 5.58 Parameter Edit Screen

Menu Options

Option Button	Function
Accept	Accepts the changes made and returns to the Test Parameter Select screen
Cancel	Discards changes made to selected parameter and restores the previous value.
Reset Parameter	Sets the parameter currently selected to default value.
Run Test	Accepts all the changes made to the set of parameters displayed and sets up the new values in the Test Set, then runs the test.
✚	Increments the value of the currently selected parameter.

⇧	Moves the current parameter selection up one item, accepting any changes made to previous parameter, and returns to the Test Parameter Select screen.
⇩	Moves the current parameter selection down one item, accepting any changes made to previous parameter, and returns to the Test Parameter Select screen.
–	Decrements the value of the currently selected parameter.
EXIT	Discards all the changes made to the set of parameters displayed and then returns to the previous screen.

Notes:

(1) The spinwheel may be used to increment or decrement the value of the selected parameter.

(2) Pressing a numeric key on the keyboard will:

-- edit the parameter selected and display the Numeric Parameter Edit screen.
or
-- display the the Text Edit screen (described under FILE MANAGER MENU) if a text
parameter is selected..

(3) In this screen, the spinwheel or +/- softkeys cannot increment or decrement the value of the selected parameter beyond its maximum or minimum values.

Numeric Parameter Edit Screen

This screen is displayed if one of the numeric keys on the front panel is pressed to change the value of a selected Test Parameter. Use the ⇦ and +/- keys on the front panel to correct any error and then use the ENTER key on the front panel, or the *Accept* button on the screen, to enter the value. The display then returns to the Test Parameter Select screen.

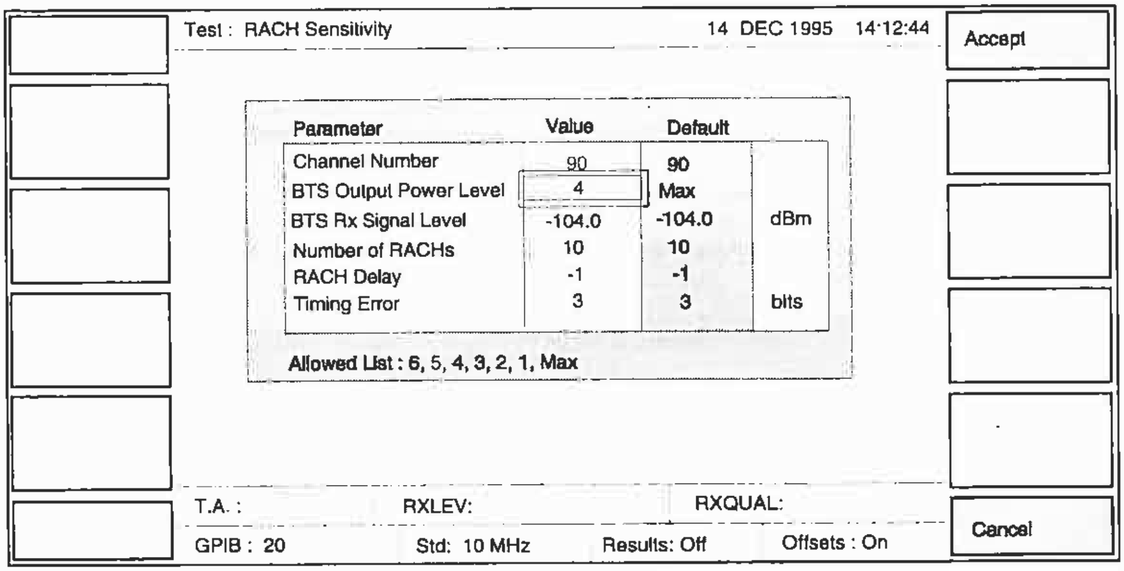


Figure 5.59 Numeric Parameter Edit Screen

Menu Options

Option Button	Function
Accept	Accepts the changes made and returns to the Test Parameter Edit screen
Cancel	Discards changes made to the selected parameter and restores the previous value, then returns to the Test Parameter Select screen.

Note: (1) In this screen, only the numeric keys can be used to edit the parameter value. The spinwheel and the ← key can be used to move the cursor to facilitate editing.

(2) If a parameter value is edited beyond its maximum or minimum value, an error message is displayed and the parameter is returned to its previous value, then the screen returns to the Test Parameter Select screen.

Single Test Execution Screens

When the *Run Test* button is pressed at the Test Select screen, Test Parameter Select screen, or the Test Parameter Edit screen, the test is started and the Single Test Execution Screens are used to present information to the user. The Test Information Screens are used to display information relating to the progress of the test; the Test Results Screens are used to display test results. A Graph Screen is available, where applicable, to provide graphical displays of measured Phase Error, Power Profile and Modulation Spectrum data.

Test Information Screen (Test Running)

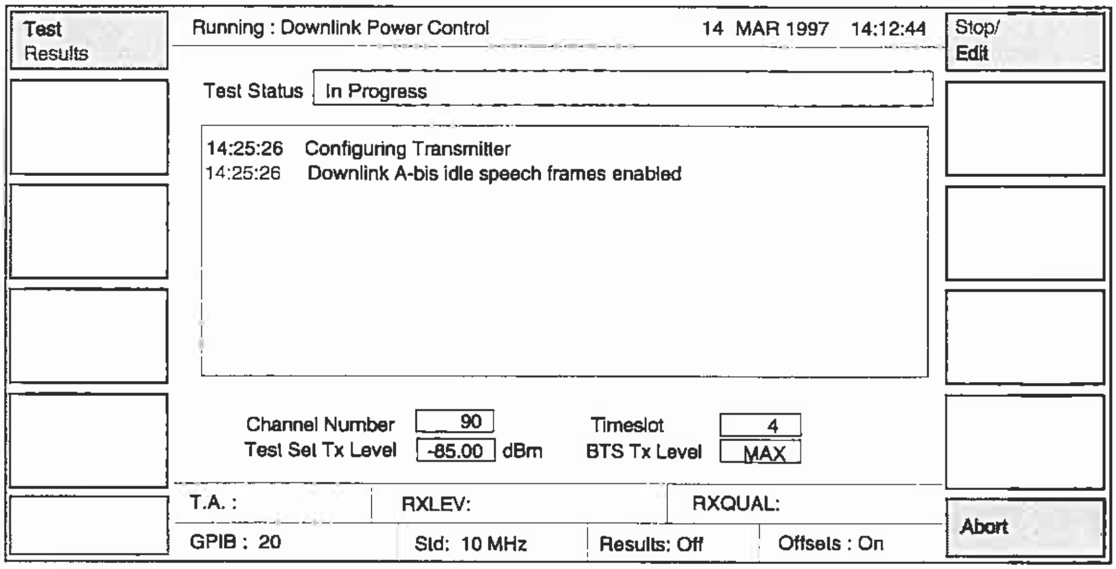


Figure 5.60 Typical Test Information Screen (Test Running)

Menu Options

Option Button	Function
Test Results	Switches to the Test Results screen. Note that the Test Results screen is automatically displayed when the test is completed.
Stop /Edit	Stops the test and displays the Test Parameter Edit screen to allow parameter editing before repeating the test. Note that the key legend will change to *Edit Parameters* when the test is completed.
Abort	Stops the test and displays the Test Results screen.

Test Information Screen (Test Complete)

This screen provides a scrolling list of events that occurred during the test, and enables the operator to edit the parameters and repeat the test.

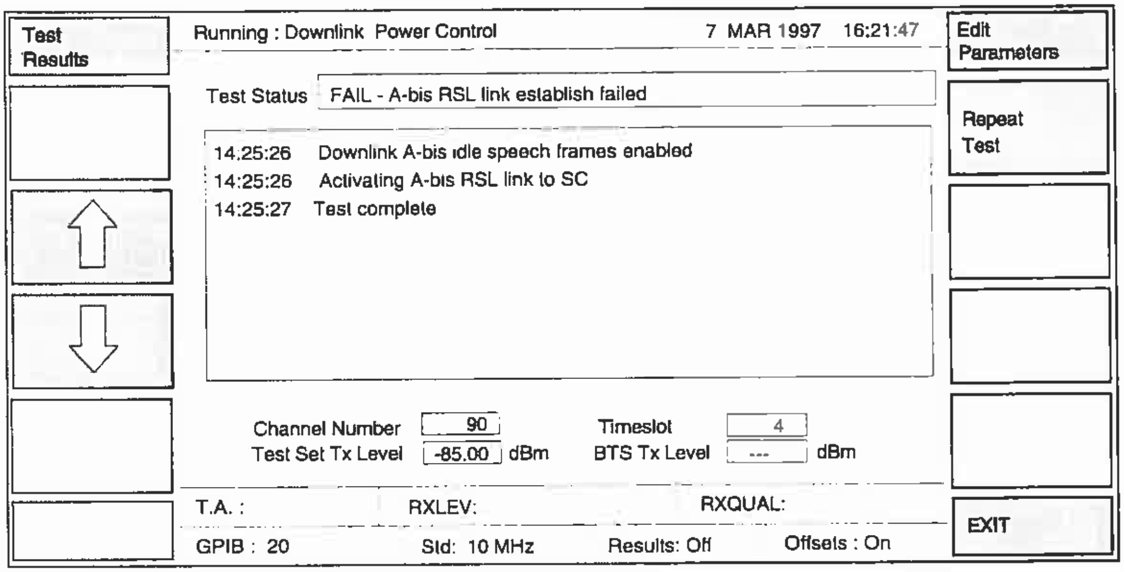


Figure 5.61 Typical Test Information Screen (Test Complete)

Menu Options

Option Button	Function
Test Results	Switches to the Test Results screen. Note that the Test Results screen is automatically displayed when the test is completed.
Edit	Displays the Test Parameter Edit screen to allow parameter editing before repeating the test.
EXIT	Stops the test and displays the Single Tests menu.

Notes:

(1) The test starts with the display at the Test Information (Test Running) screen. When the test completes with the Test Set having taken some valid measurements, the MMI switches to the appropriate Test Results screen. From the results screen the Test Information (Test Complete) screen may be viewed by pressing the *Test Information* button on the Test Results screen..

(2) The spinwheel and the up/down arrows will scroll the list of events if it extends beyond the viewing area.

Test Results Screen - Results Area Format

The following test results screens are shown as typical examples of the information and types of format that are displayed.

Results Area - BER

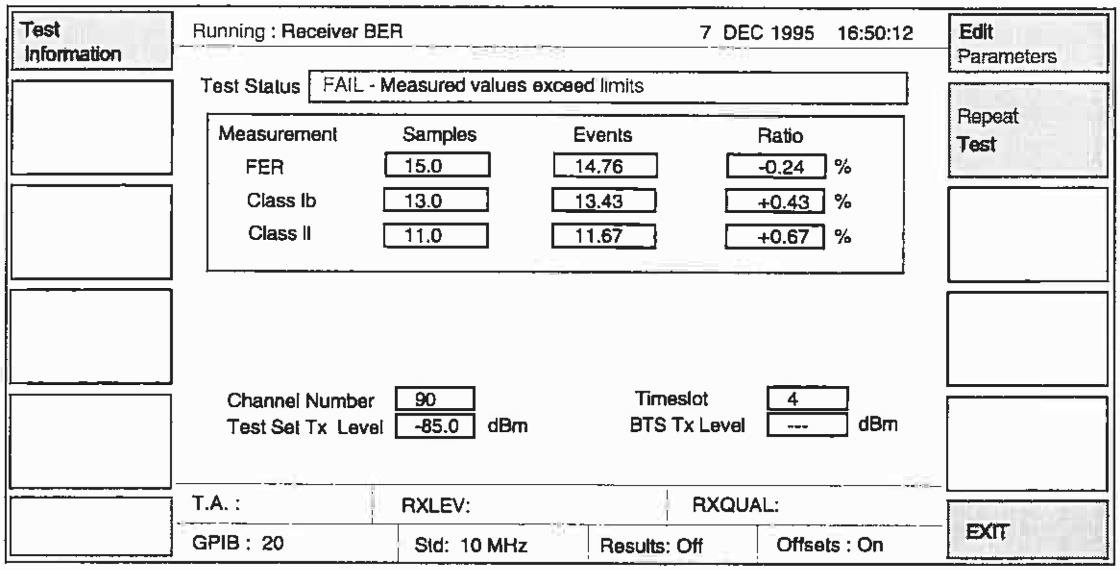


Figure 5.62 Results Area - BER

Results Area - Static Power Control

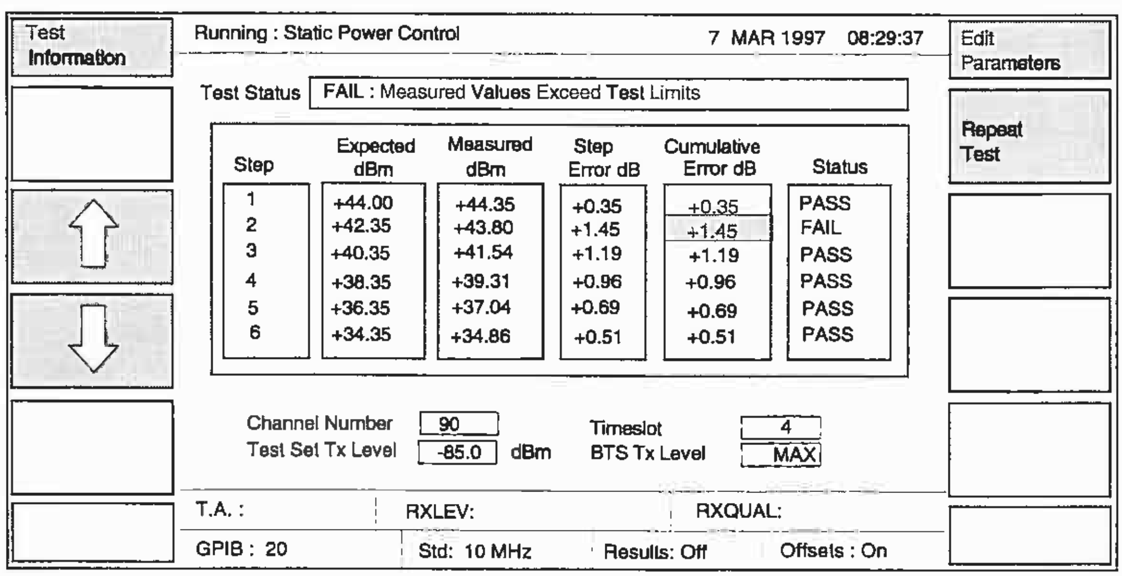


Figure 5.63 Results Area - Static Power Control

Results Area - Rx Absolute Sensitivity

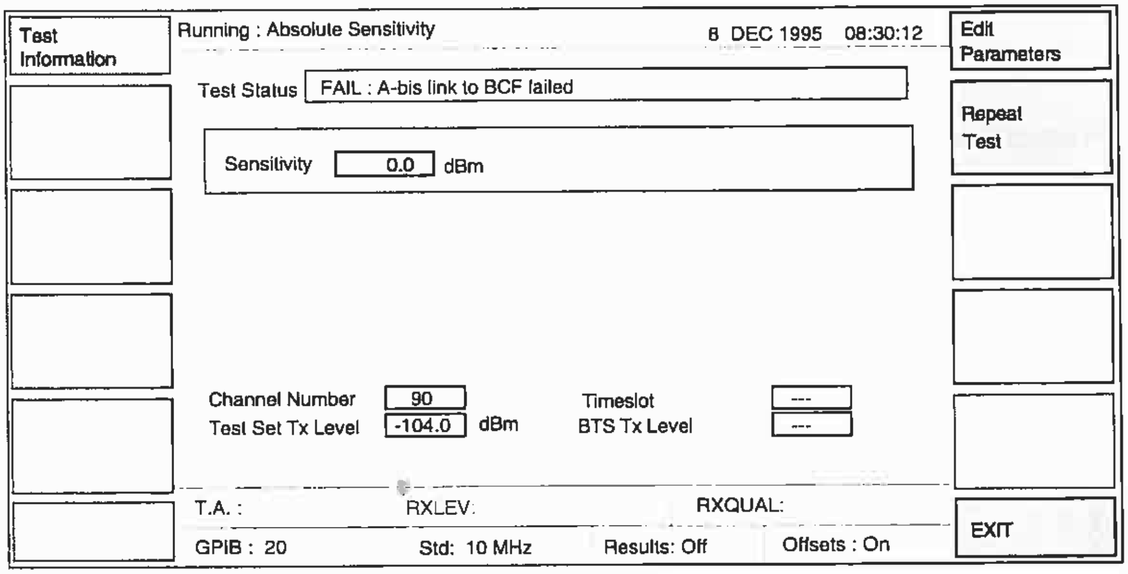


Figure 5.64 Results Area - Rx Absolute Sensitivity

Results Area - RACH

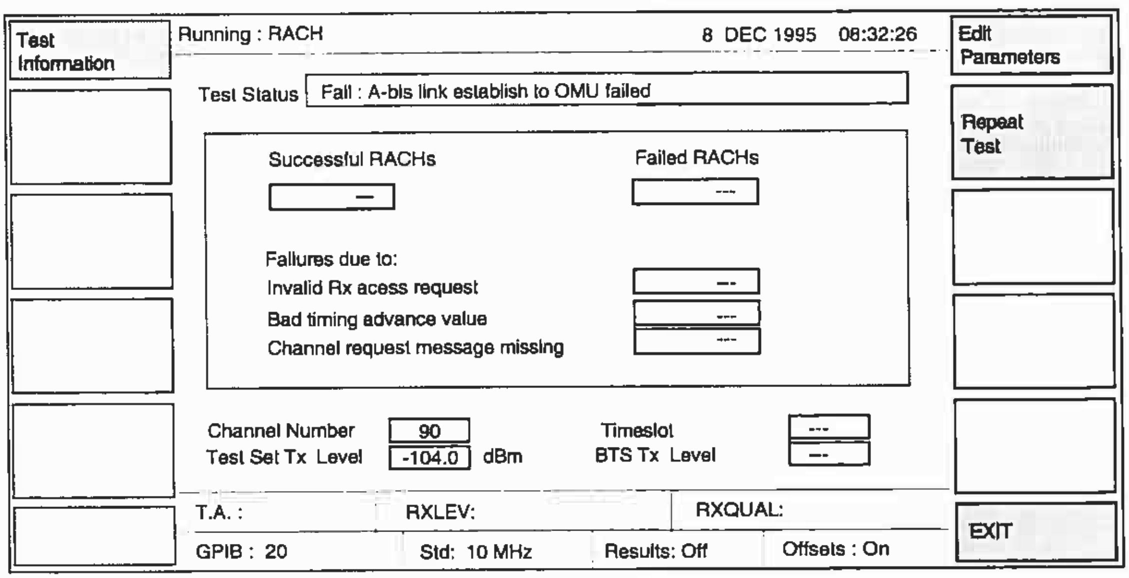
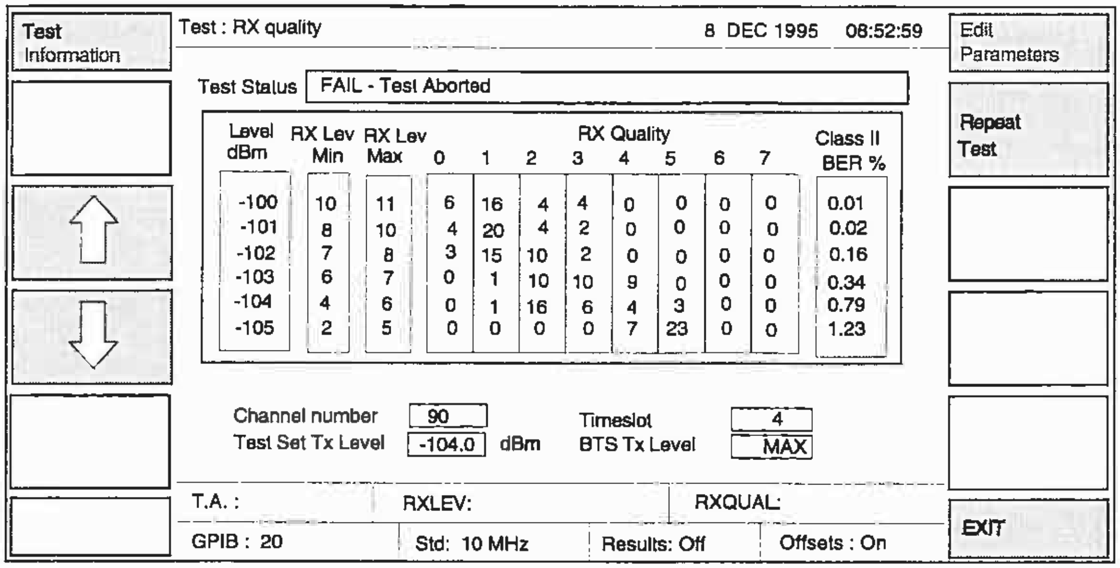


Figure 5.65 Results Area - RACH

Results Area - Rx Quality



Level dBm	RX Lev Min	RX Lev Max	RX Quality 0	1	2	3	4	5	6	7	Class II BER %
-100	10	11	6	16	4	4	0	0	0	0	0.01
-101	8	10	4	20	4	2	0	0	0	0	0.02
-102	7	8	3	15	10	2	0	0	0	0	0.16
-103	6	7	0	1	10	10	9	0	0	0	0.34
-104	4	6	0	1	16	6	4	3	0	0	0.79
-105	2	5	0	0	0	0	7	23	0	0	1.23

Figure 5.66 Results Area - Rx Quality

Transmitter Test Results Screen

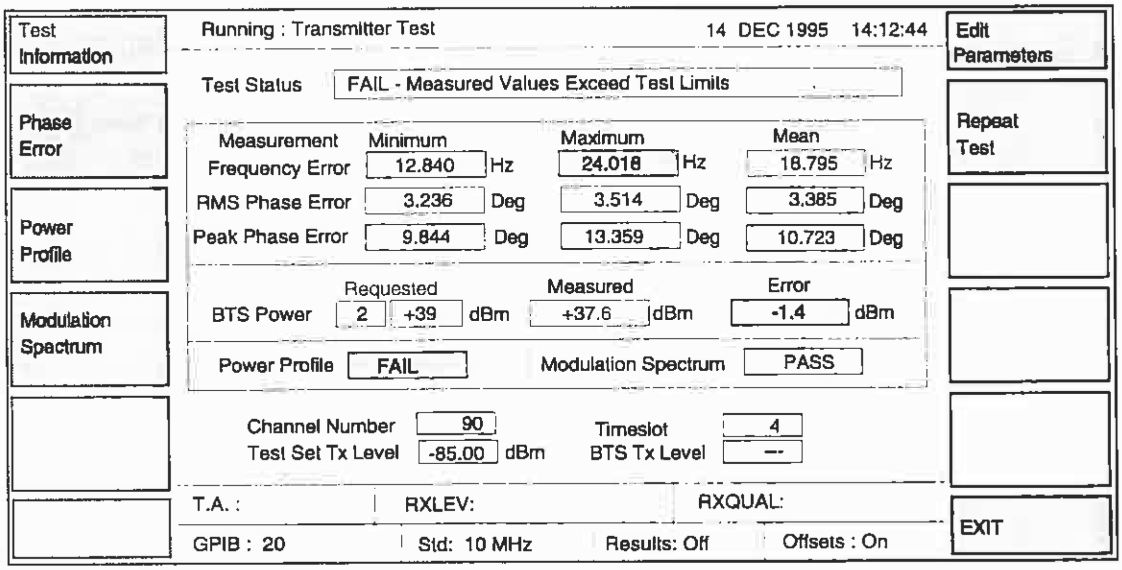


Figure 5.67 Transmitter Test Results Screen

Menu Options

Option Button	Function
Test Information	Switches to Test Information screen.
Phase Error	Displays the Phase Error graph screen.
Power Profile	Displays the Power Profile graph screen.
Modulation Spectrum	Displays the Modulation Spectrum graph scren.
Edit Parameters	Switches to the Test Parameter Select screen. (This button is *Stop / Edit* option while the test is running).
Repeat Test	Repeats the test with the current test parameters.
EXIT	Returns to the Single Tests menu.

Note: When any of *Phase Error*, *Power Profile* or *Modulation Spectrum* buttons is selected, that button becomes *Test Results* option in the related graph screen; operation of the *Test Results* button in that graph screen then returns the display to this screen.

Results Graph Screens

The graph screen is used to display graphs of measured Phase Error, Power Profile and Modulation Spectrum data. The softkeys allow the user to zoom in on various areas of the graph as well as displaying the whole graph.

Phase Error Graph Screen

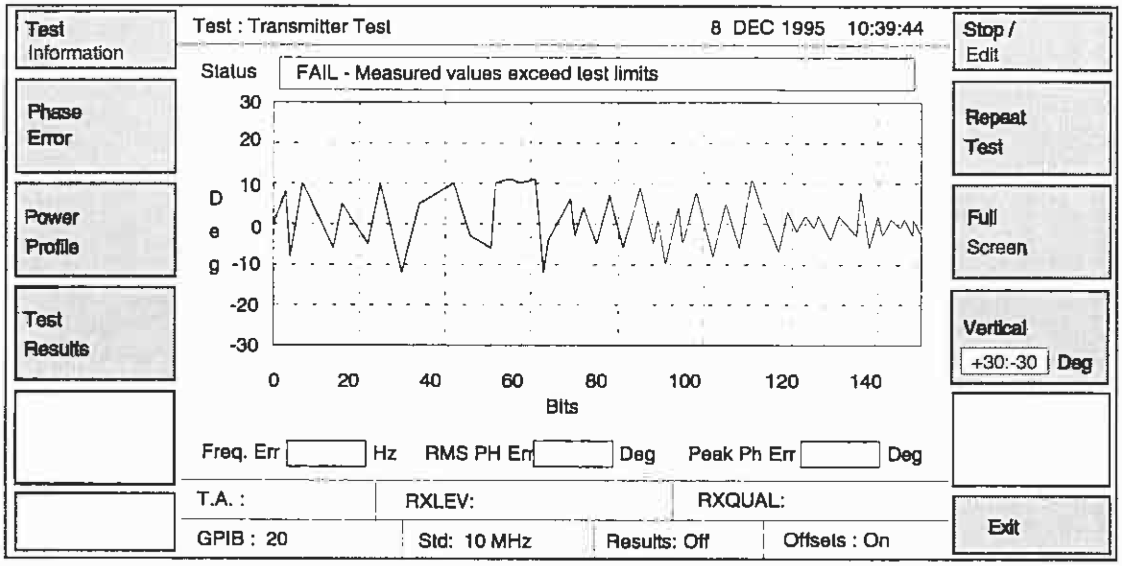


Figure 5.68 Typical Phase Error Graph Screen

Menu Options

Option Button	Function
Test Information	Switches to the Test Information screen.
Test Results	Switches to the Test Results screen.
Power Profile	Switches to the Power Profile graph screen.
Modulation Spectrum	Switches to the Modulation Spectrum screen.
Stop / Edit	Stops the test and/or switches back to the Parameter Edit screen to allow parameter editing before repeating the test.
Repeat Test	Repeats the test with the current test parameters.
Full Screen	This option uses the whole screen to display the current graph, with no space reserved for the status bar or softkeys. Any key press returns to this screen.
Vertical	Toggles the horizontal scaling between -30:+30 Deg and -10:+10 Deg
EXIT	Returns to the Single Tests Menu.

Note: The '*Repeat Test*' option is only present when the test is complete.

Power Profile Graph Screen

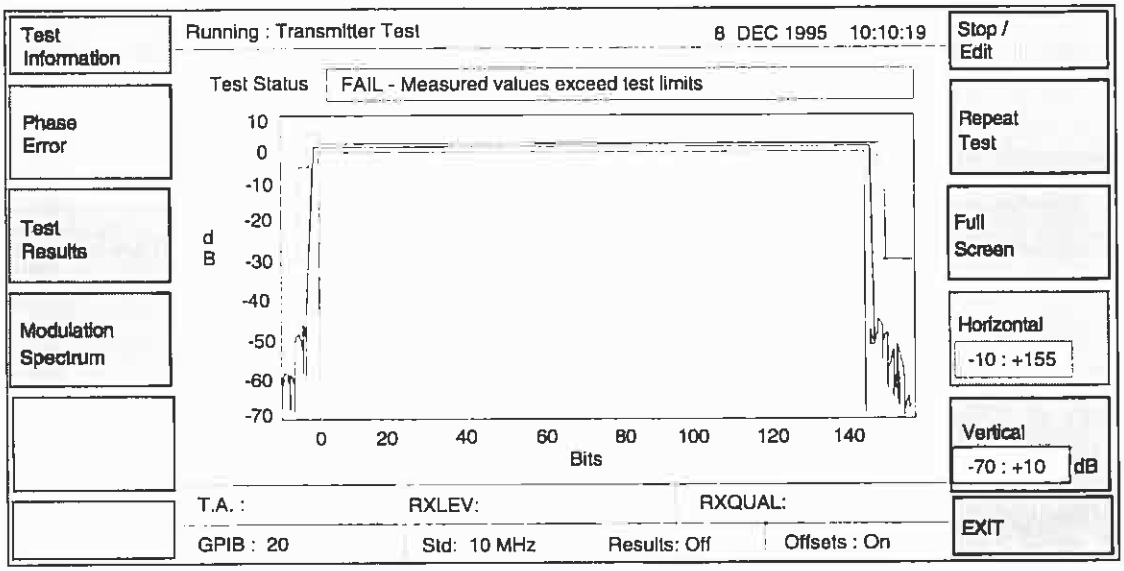


Figure 5.69 Typical Power Profile Graph Screen

Menu Options

Option Button	**Function**
Test Information	Switches to the Test Information screen.
Phase Error	Switches to Phase Error graph screen.
Test Results	Switches to the Test Results screen.
Modulation Spectrum	Switches to Modulation Spectrum graph screen.
Stop / Edit	Stops the test (if it is running) and displays the Test Parameter Select screen.
Repeat Test	Runs the test again (with any new parameter values entered).
Full Screen	This option uses the whole screen to display the current graph, with no space reserved for the status bar or softkeys. Pressing any button then returns the display to this screen.
Horizontal	This option allows the user to toggle the horizontal scaling between -10:+10 bits, -10:155 bits, 135:155 bits.
Vertical	This option allows the user to toggle the vertical scaling between . -70:+10 dB and -5:+5 dB
EXIT	Returns to the Single Tests menu.

Note: The '*Repeat Test*' option is only present when the test is complete.

Modulation Spectrum Graph Screen

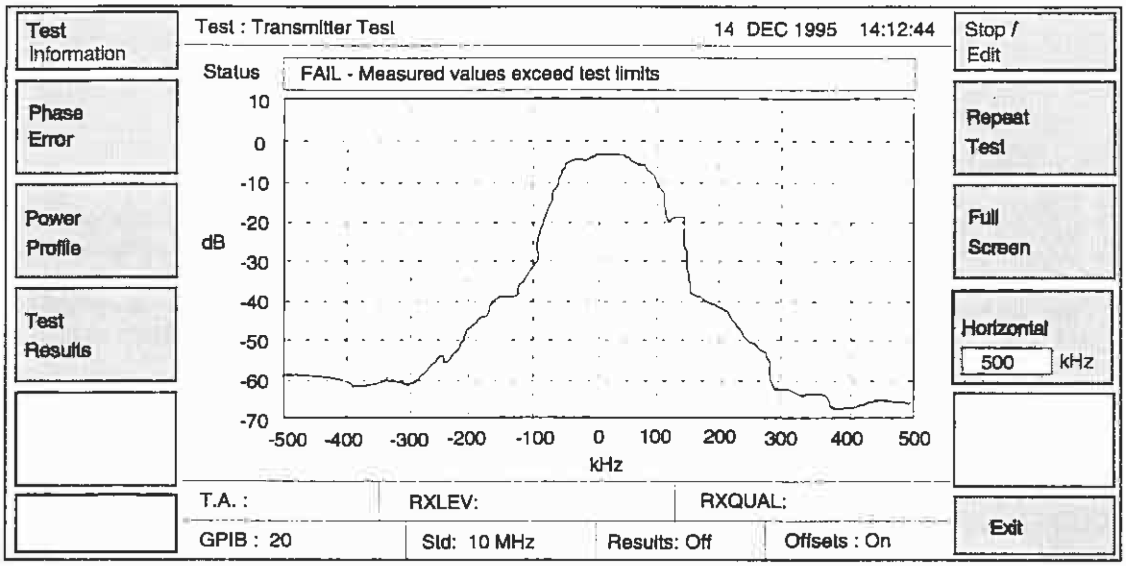


Figure 5.70 Typical Modulation Spectrum Graph Screen

Menu Options

Option Button	Function
Test Information	Switches to the Test Information screen.
Phase Error	Switch to Phase Error graph Screen.
Power Profile	Switch to Power Profile graph screen.
Test Results	Switches to the Test Results screen.
Stop / Edit	Stops the test and/or switches back to the Parameter Edit screen to allow parameter editing before repeating the test.
Repeat Test	Repeats the test with the current test parameters.
Full Screen	This option uses the whole screen to display the current graph, with no space reserved for the status bar or softkeys. Any key press returns to this screen.
Horizontal	Togles the horizontal scaling between -500 : +500 and -200 ; +200.
EXIT	Returns to the Single Tests Menu.

Note: The '*Repeat Test*' option is only present when the test is complete.

MULTIMODE MENU

When *Multimode* option is selected at the A-bis Controlled Tests screen, the Parameter Select and the Parameter Edit screens can be used in a similar manner to those for Single Tests (described earlier in this Section). Multimode is run by selecting the *Run Test* option at either of these screens.

Multimode Summary Results Screen

The Multimode Summary results screen is displayed when *Run Test* is selected at the Parameter Select screen or the Parameter Edit screen to start the test. This screen displays a summary of the Multimode test results, and these are updated in real time as the test progresses. The buttons on the right of the screen enable two parameters to be changed while the test is running, as shown below. (Note that more parameters can be changed from the Multimode : Summary Results More screen).

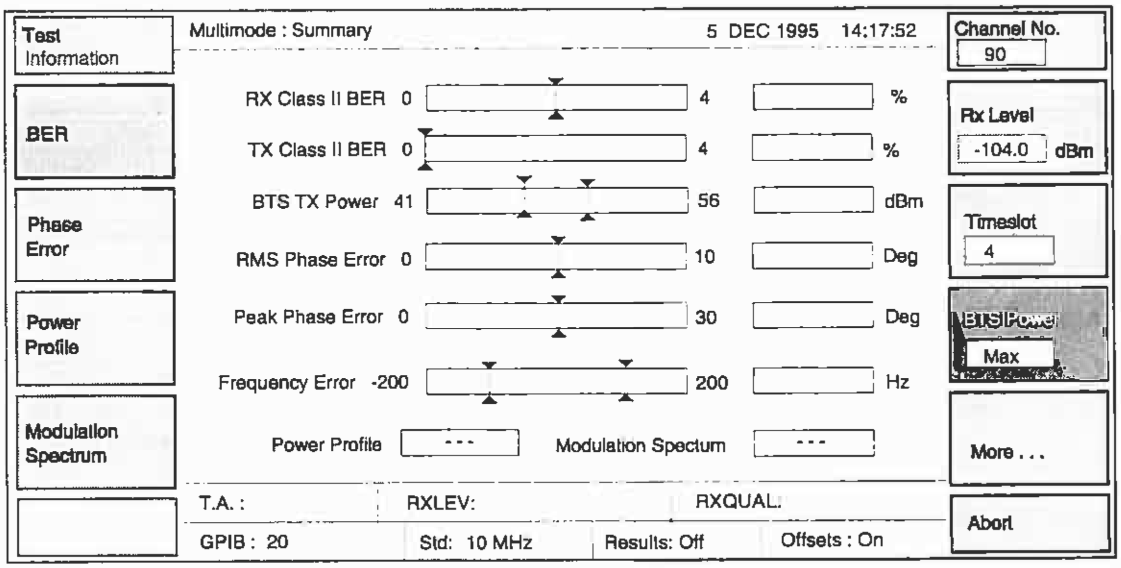


Figure 5.71 Multimode Summary Results Screen

Menu Options

Option Button	**Function**
Test Information	Switches to the Test Information screen.
BER	Switches to the BER Results screen.
Phase Error	Switches to the Phase/Frequency Error Results screen.
Power Profile	Switches to the Power Profile Results screen.
Modulation Spectrum	Switches to the Modulation Spectrum Results screen.
Rx Level	Edits the BTS Rx Signal Level parameter.
BTS Power	Edits the BTS Output Power Level parameter.

More	Switches to the Multimode : Summary More screen where more parameters can be changed in real time.
Abort / EXIT	While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

Notes:

(1) When a measured value exceeds the defined test limits the gauge bar changes from light to dark and the value given after the bar graph is 'highlighted'.

(2) When the test limits define a range of values between non-zero maximum and minimum values, two error markers are shown, each halfway between the centreline and the boundaries.

(3) Selecting one of the 'edit' buttons on the right of the screen causes it to be highlighted. The user can then modify the parameter either by typing a value or using the spinwheel. Error checking is as in the Edit Parameter screen.

(4) Selecting one of the additional-information buttons on the left of the screen displays an additional information screen for the selected type of result (i.e. *BER*, *Phase Error*, *Power Profile* and *Modulation Spectrum*). Note that the full range of 'edit' buttons for changing parameters is still available in these additional screens.

Multimode Summary Results More Screen

The Multimode : Summary More screen is displayed when *More ...* is selected at the Multimode : Summary Results screen. This screen also displays the results in real time as the test progresses, and enables more parameters to be changed in real time. The buttons on the right of the screen enable three more parameters to be changed while the test is running:

Test Pattern
Frequency Offset
Timing Advance

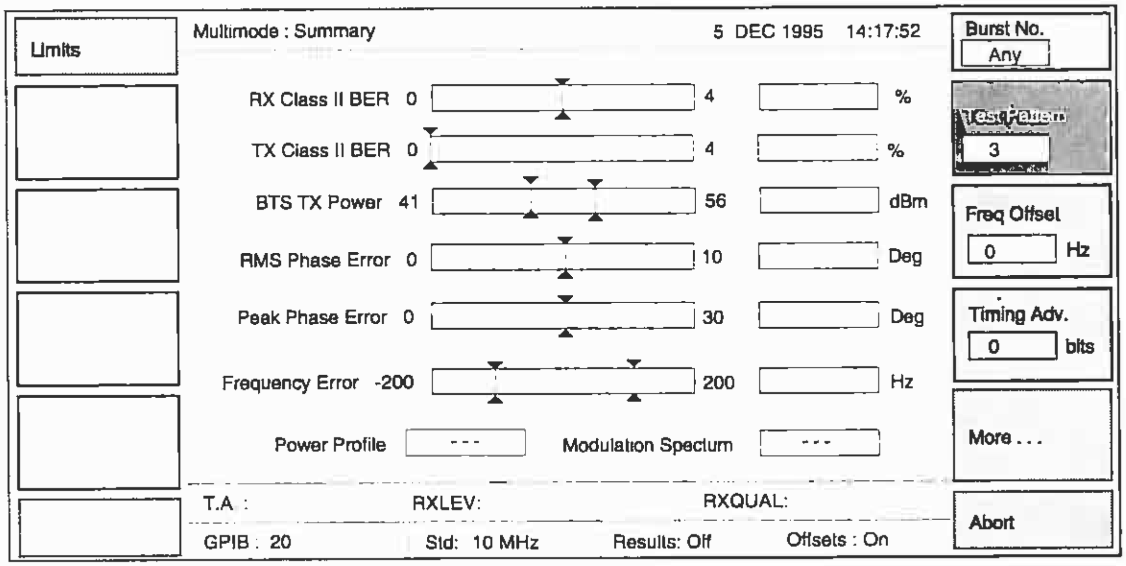


Figure 5.72 Multimode Summary Results More Screen

Menu Options

Option Button	Function
Limits	Displays a form to show the test limits for the measured data.
Test Pattern	Edits the Test Pattern parameter.
Freq. Offset	Edits the Frequency Offset parameter.
Timing Adv.	Edits the Timing Advance parameter.
More	Switches back to the Multimode Summary screen.
Abort / EXIT	While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

Note: Selecting one of the 'edit' keys on the right of the screen causes it to be highlighted. The user can then modify the parameter either by typing a value or using the spinwheel. Error checking is as in the Edit Parameter screens.

Multimode Test Information Screen

This screen is displayed when *Test Information* option is selected at the Multimode Summary Results screen.

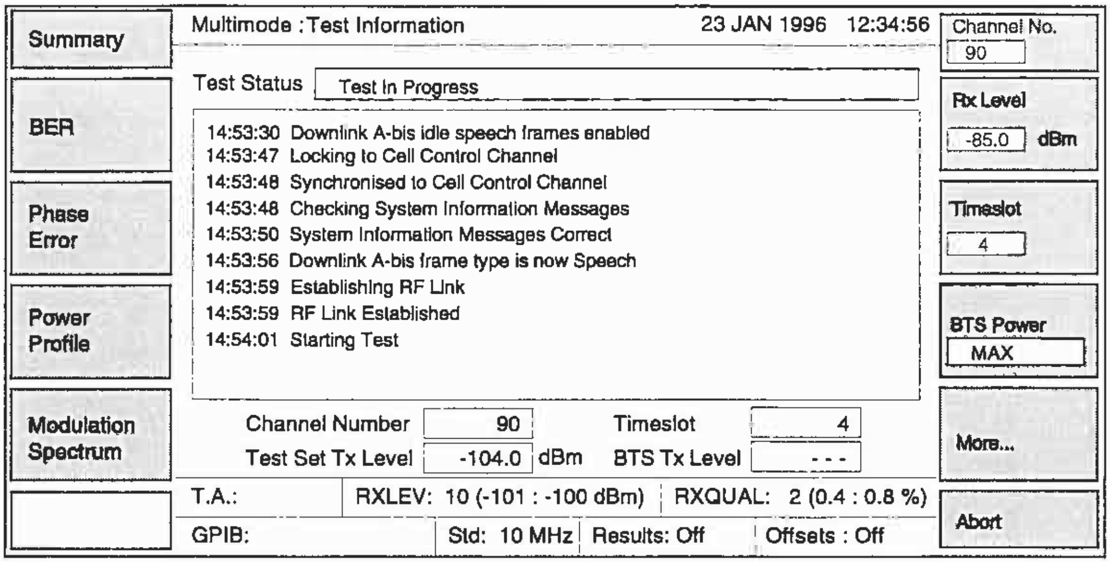


Figure 5.73 Multimode Test Information Screen

Note: (1) Apart from the *Summary* option, the button facilities on this screen are identical to the Multimode Summary Results screen.

(2) When the "Starting Test" message is displayed and the test starts, the display changes automatically to the Multimode Summary Results screen.

Multimode BER Results Screen

This screen is displayed when the *BER* additional information button is selected at the Multimode : Summary Results screen. The results displayed are updated in real time. (Note that the same range of 'edit' buttons for changing parameters in real time is still available from the right of the screen).

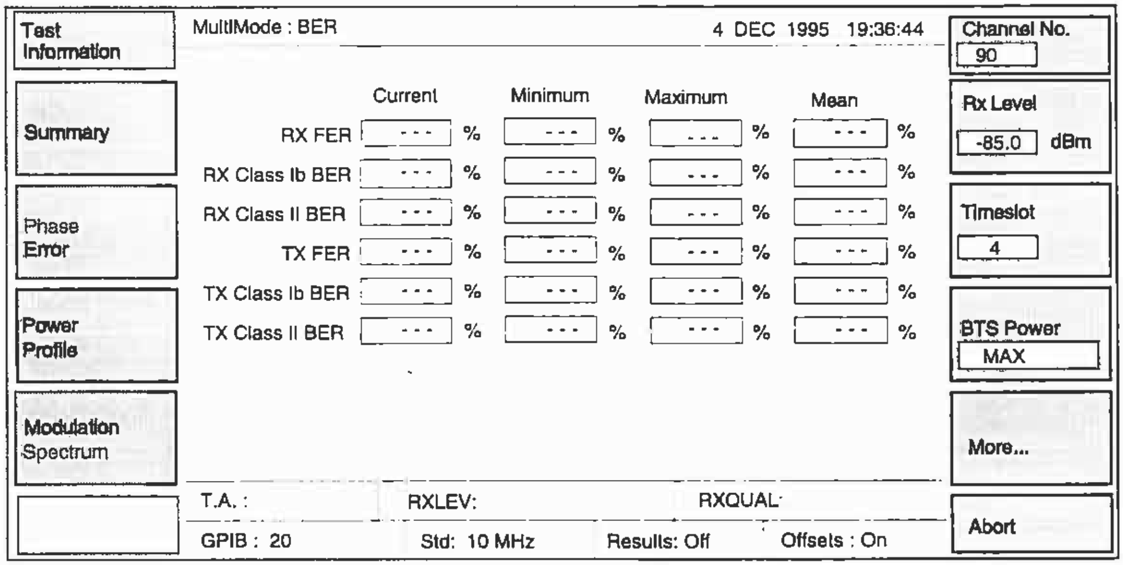


Figure 5.74 Multimode BER Results Screen

Menu Options

Option Button	**Function**
Test Information	Switches to the Test Information screen.
Summary	Switches back to the Multimode : Summary Results screen.
Phase Error	Switches to the Phase Error additional information screen.
Power Profile	Switches to the Power Profile additional information screen.
Modulation Spectrum	Switches to the Modulation Spectrum additional information screen.
Rx Level	Edits the BTS Rx Signal Level parameter.
BTS Power	Edits the BTS Output Power Level parameter.
More	Switches to the Multimode : BER Results More screen.
Abort / EXIT	While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

Notes:

(1) When a measured value exceeds the defined test limits, the value given is 'highlighted'.

(2) All values given in the Samples column are cumulative.

Multimode BER Results More Screen

This screen is displayed when the *More...* additional information button is selected at the Multimode : Summary Results screen. The results displayed are updated in real time. (Note that the same range of 'edit' buttons for changing parameters in real time is still available from the right of the screen).

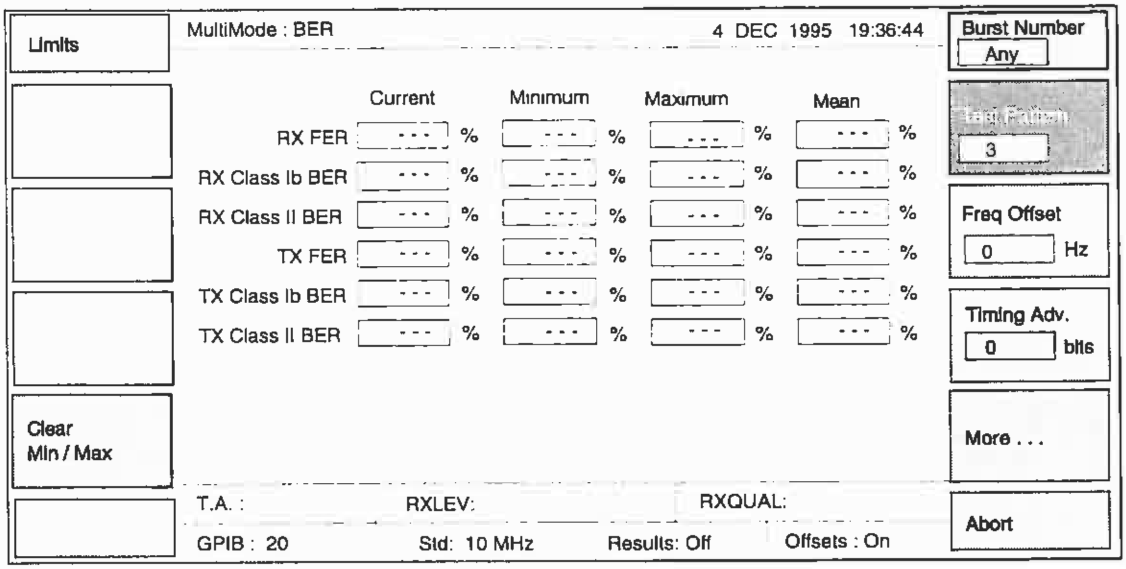


Figure 5.75 Multimode BER Results More Screen

Menu Options

Option Button	**Function**
Limits	Displays the Multimode test limits being applied (these values are preset and cannot be changed).
Clear Min / Max	Resets the Minimum and Maximum values to zero.
Test Pattern	Edits the Test Pattern parameter.
Freq. Offset	Edits the Frequency Offset parameter.
Timing Adv.	Edits the Timing Advance parameter.
More	Switches to the Multimode : BER Results screen.
Abort / EXIT	While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

Note: (1) When a measured value exceeds the defined test limits, the value given is 'highlighted'.

(2) All values given in the Samples column are cumulative.

Multimode : Phase/Frequency Error Results Screen

This screen is displayed when the *Phase Error.* additional information button is selected at the Multimode : Summary Results screen. The results displayed are updated in real time. (Note that the same range of 'edit' buttons for changing parameters in real time is still available from the right of the screen).

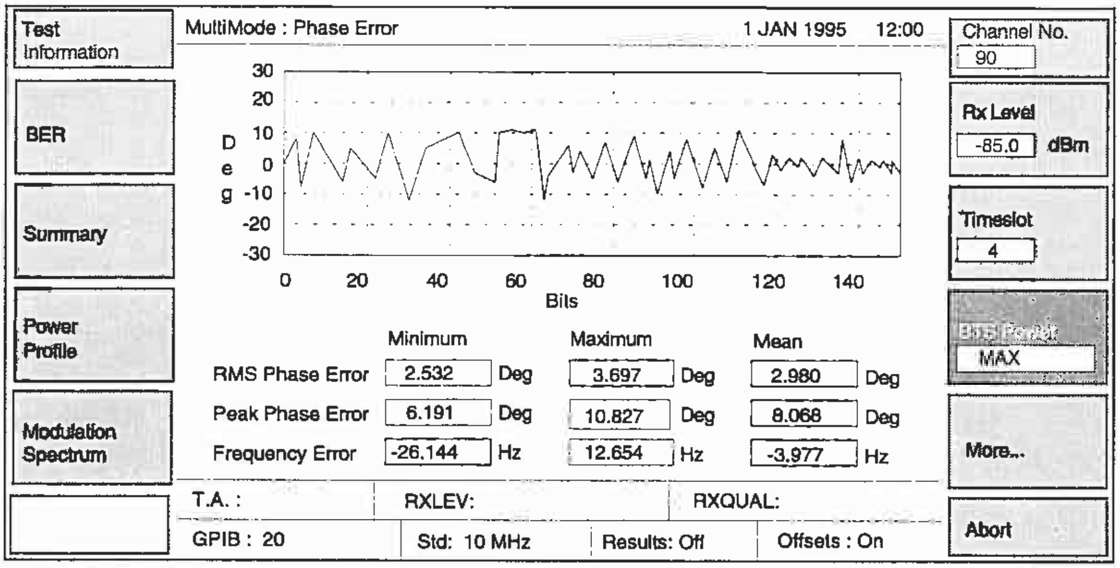


Figure 5.76 Multimode Phase/Frequency Error Results Screen

Menu Options

Option Button	Function
Test Information	Switches to the Test Information screen.
BER	Switches to the Multimode : BER results screen.
Summary	Returns to the Multimode : Summary results screen.
Power Profile	Switches to the Multimode Power Profile results screen.
Modulation Spectrum	Switches to the Multimode Modulation Spectrum results screen.
Rx Level	Edits the BTS Rx Signal Level parameter.
BTS Power	Edits the BTS Output Power Level parameter.
More	Switches to the Multimode : Phase/Frequency Error results More screen
Abort / EXIT	While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

Note: When a measured value exceeds the defined test limits, the value given is 'highlighted'.

Multimode : Phase/Frequency Error Results More Screen

This screen is displayed when the *More...* additional information button is selected at the Multimode : Phase/Frequency Error Results screen. The same results are displayed and updated in real time. However, additional controls are provided to change the scale of the graph displayed. (Note that the same range of 'edit' buttons for changing parameters in real time is still available from the right of the screen).

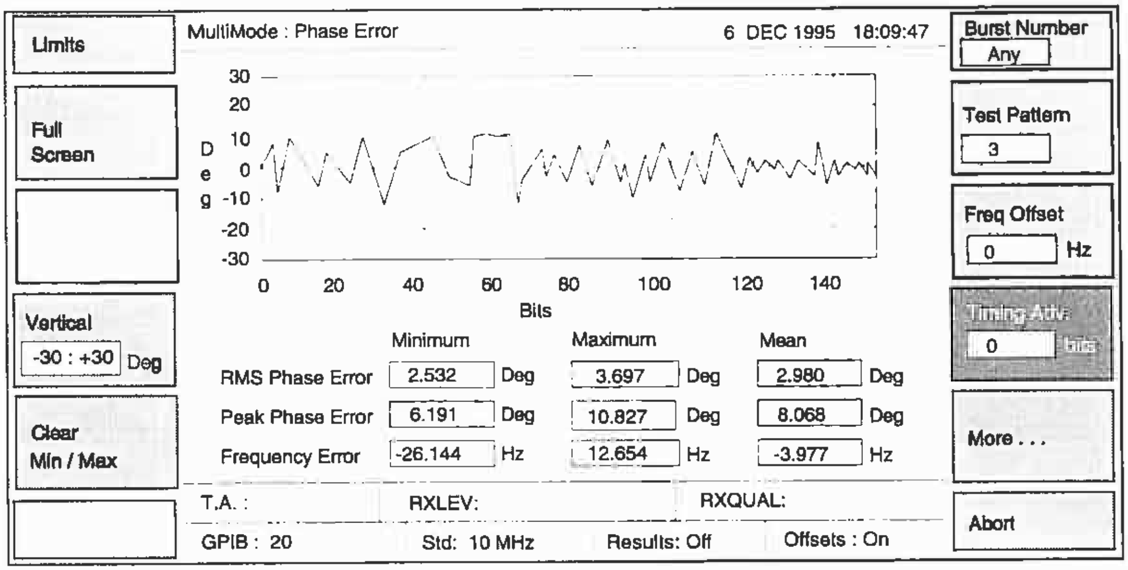


Figure 5.77 Multimode Phase/Frequency Error Results Screen

Menu Options

Option Button	Function
Limits	Displays the Multimode test limits being applied (these values are preset and cannot be changed).
Full Screen	Enlarges the graph display to occupy the full screen. Pressing any button then restores the display to this screen.
Vertical	Toggles the scale of the graph between -30 : +30 Deg, and -10 : +10 Deg
Clear Min / Max	Clears all displayed result values.
Test Pattern	Edits the Test Pattern parameter.
Freq. Offset	Edits the Frequency Offset parameter.
Timing Adv.	Edits the Timing Advance parameter.
More	Switches to the Multimode : Phase/Frequency Error results screen

Abort / EXIT While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

Note: When a measured value exceeds the defined test limits, the value given is 'highlighted'.

Multimode Power Profile Results Screen

This screen is displayed when the *Power Profile* additional information button is selected at the Multimode : Summary Results screen. The results displayed are updated in real time. (Note that the same range of 'edit' buttons for changing parameters in real time is still available from the right of the screen).

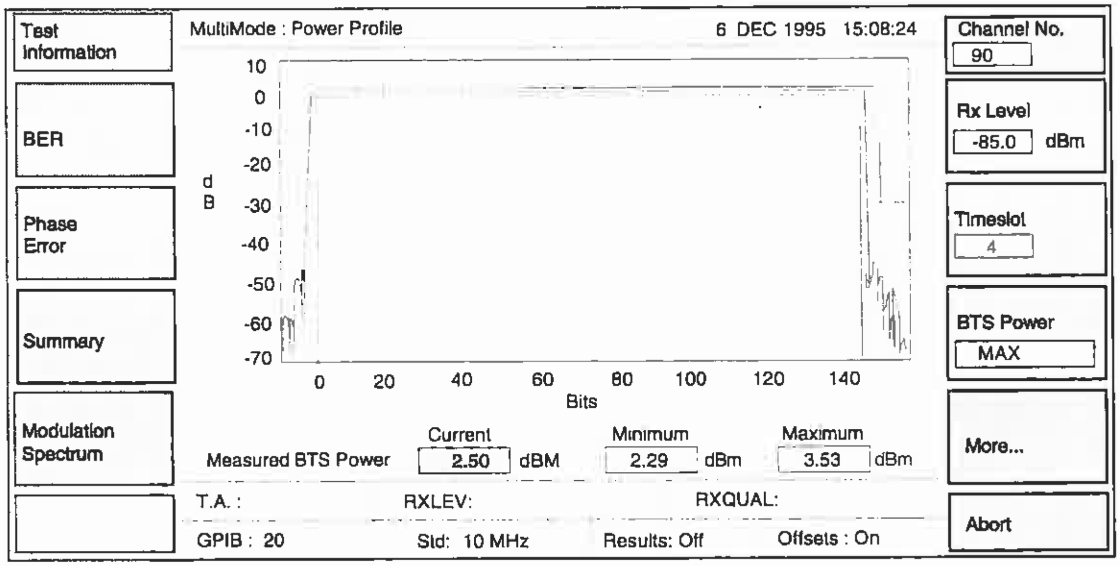


Figure 5.78 Multimode Power Profile Results Screen

Menu Options

Option Button	Function
Test Information	Switches to the Test Information screen.
BER	Switches to the Multimode BER results screen.
Phase Error	Switches to the Multimode Phase Error results screen.
Summary	Switches back to the Multimode : Summary results screen.
Modulation Spectrum	Switches to the Multimode Modulation Spectrum results screen.
Rx Level	Edits the BTS Rx Signal Level parameter.
BTS Power	Edits the BTS Output Power Level parameter.
More	Switches to Switches to the Multimode Power Profile results More screen.
Abort / EXIT	While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

Note: When a measured value exceeds the defined test limits, the value given is 'highlighted'.

Multimode Power Profile Results More Screen

This screen is displayed when the *More...* button is selected at the Multimode : Power Profile results screen. The same results are displayed and updated in real time, but additional controls are provided to vary the size and scale of the graph. (Note that the same range of 'edit' buttons for changing parameters in real time is still available from the right of the screen).

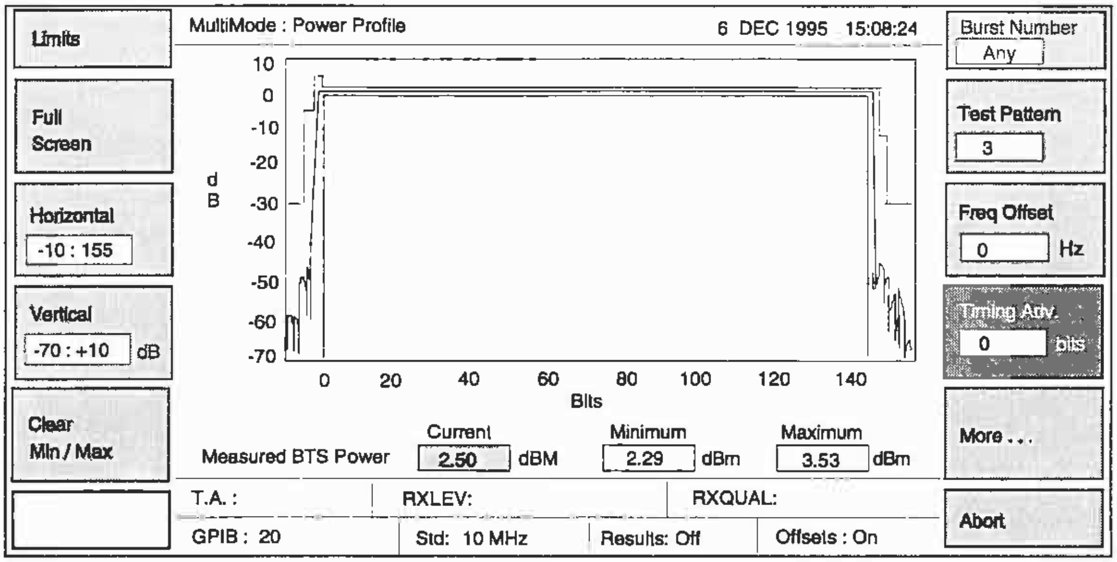


Figure 5.79 Multimode Power Profile Results More Screen

Menu Options

Option Button	Function
Limits	Displays the Multimode test limits being applied (these values are preset and cannot be changed).
Full Screen	Enlarges the graph display to occupy the full screen. Pressing any button then restores the display to this screen.
Horizontal	Toggles the horizontal scale of the graph between -10:155, -10:+10, and 135:155
Vertical	Toggles the vertical scale of the graph between -70:+10 dB, and -5:+5 dB
Clear Min / Max	Clears all displayed result values.
Test Pattern	Edits the Test Pattern parameter.
Freq. Offset	Edits the Frequency Offset parameter.
Timing Adv.	Edits the Timing Advance parameter.
More	Switches back to the Multimode Power Profile results screen.

Abort / EXIT While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

Note: When a measured value exceeds the defined test limits, the value given is 'highlighted'.

Modulation Spectrum Results Screen

This screen is displayed when the *Modulation Spectrum* additional information button is selected at the Multimode : Summary results screen. The results displayed are updated in real time. The mask is not displayed until the count of averages is complete. (Note that the same range of 'edit' buttons for changing parameters in real time is still available from the right of the screen).

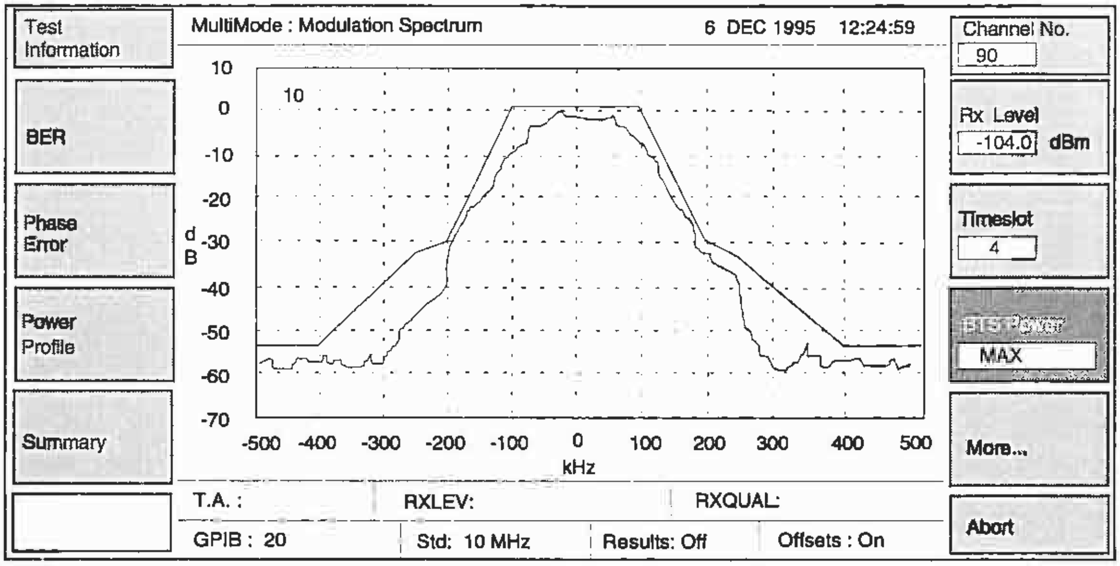


Figure 5.80 Modulation Spectrum Results Screen

Menu Options

Option Button	Function
Test Information	Switches to the Test Information screen.
BER	Switches to the Multimode BER results screen.
Phase Error	Switches to the Multimode Phase Error results screen.
Power Profile	Switches to the Multimode Power Profile results screen.
Summary	Switches back to the Multimode : Summary results screen.
Rx Level	Edits the BTS Rx Signal Level parameter.
BTS Power	Edits the BTS Output Power Level parameter.
More	Switches to the Multimode Modulation Spectrum results More screen.
Abort / EXIT	While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

Modulation Spectrum Results More Screen

This screen is displayed when the *More...* button is selected at the Multimode : Modulation Spectrum Results screen. The same results are displayed and updated in real time, but additional controls are provided to vary the size and scale of the graph. The mask is not displayed until the count of averages is complete. (Note that the same range of 'edit' buttons for changing parameters in real time is still available from the right of the screen).

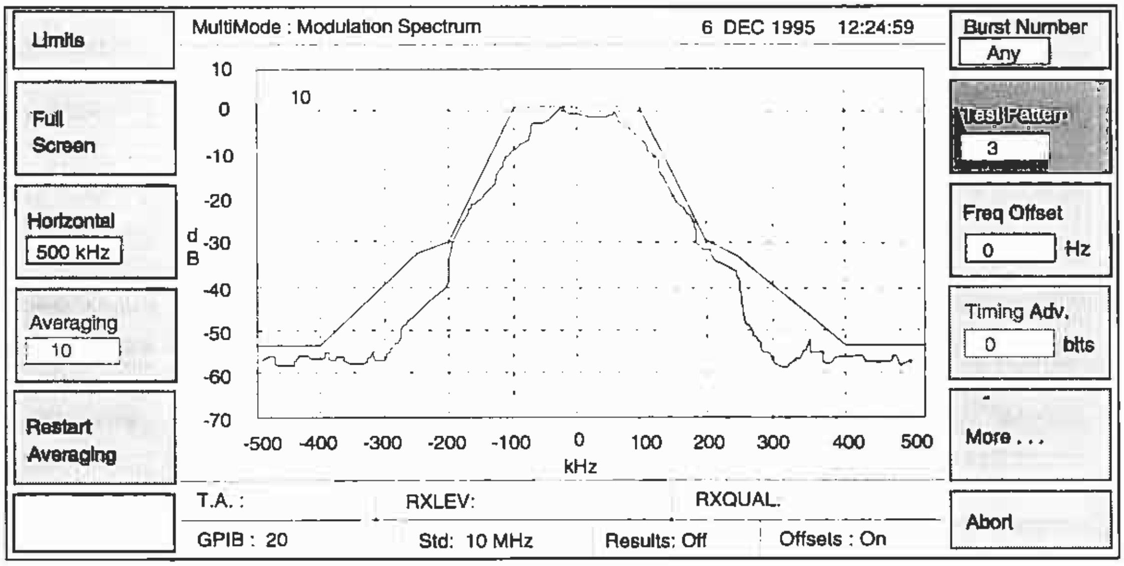


Figure 5.81 Modulation Spectrum Results More Screen

Menu Options

Option Button	**Function**
Limits	Displays the Multimode test limits being applied (these values are preset and cannot be changed).
Full Screen	Enlarges the graph display to occupy the full screen (displays the current burst). Pressing any softkey then restores the display to the button screen.
Horizontal	Toggles the horizontal scale of the graph between (+/-) 500 kHz, and (+/-) 200 kHz
Averaging	Edits the Video Averaging parameter. A count of averages performed is displayed in the top left hand corner of the graph until it reaches the value set for this parameter. Note that the mask is not displayed on the graph, and the Modulation Spectrum value is not displayed on the Summary screen, until the set number of averages is performed.
Restart Averaging	Restarts the video averaging from burst 1.

Test Pattern	Edits the Test Pattern parameter.
Freq. Offset	Edits the Frequency Offset parameter.
Timing Adv.	Edits the Timing Advance parameter.
More	Switches to Switches to the Multimode Modulation Spectrum results More screen.
Abort / EXIT	While the test is running, the legend on this button is *Abort*; pressing it causes the test to abort and the display to change to the Test Information screen. When the test completes, or aborts, the legend changes to *EXIT*; pressing it returns the display to the Main Menu.

TEST SEQUENCES MENU

CAUTION: **If the Test Set has previously been used for Live Tests the A-bis connections will be at high impedance, and the following warning will be displayed. Ensure that the 6113 is disconnected from the operational BTS before continuing, otherwise the operational link may be disrupted.**

WARNING
This operation will cause the A-bis connectors to revert to low impedance
Where connection is to a live system disconnect A-bis cables before continuing.

This option allows the user to select, run, and to define, sequences of tests stored on a memory card.

A sequence is a series of commands carried out by the Test Set, to perform a number of tests. The commands are stored using a BASIC-like language in files on a removable memory card.

Sequences may be set up either by recording a series of test and configuration commands as they are entered from the front panel, or using some form of editor to create a file on memory card which may then be read by the Test Set. The recording method allows simple sequences to be created (with no looping or branching and limited control over results printing).

Defining and Loading Sequences

The Sequence Selection screen is displayed when *Test Sequences* option is selected at the Main Menu. This screen gives the option of defining a new sequence file or loading an existing sequence file from memory card.

The *Load Sequence* option presents a standard File To Read screen, with options to list the sequence files and directories available.

The *Define Sequence* option presents a standard File To Write screen, with options to list directories and files and to edit the file name and description. Note that the default file extension for a sequence file is `.SEQ` but this can be changed if required.

Sequence Selection Screen

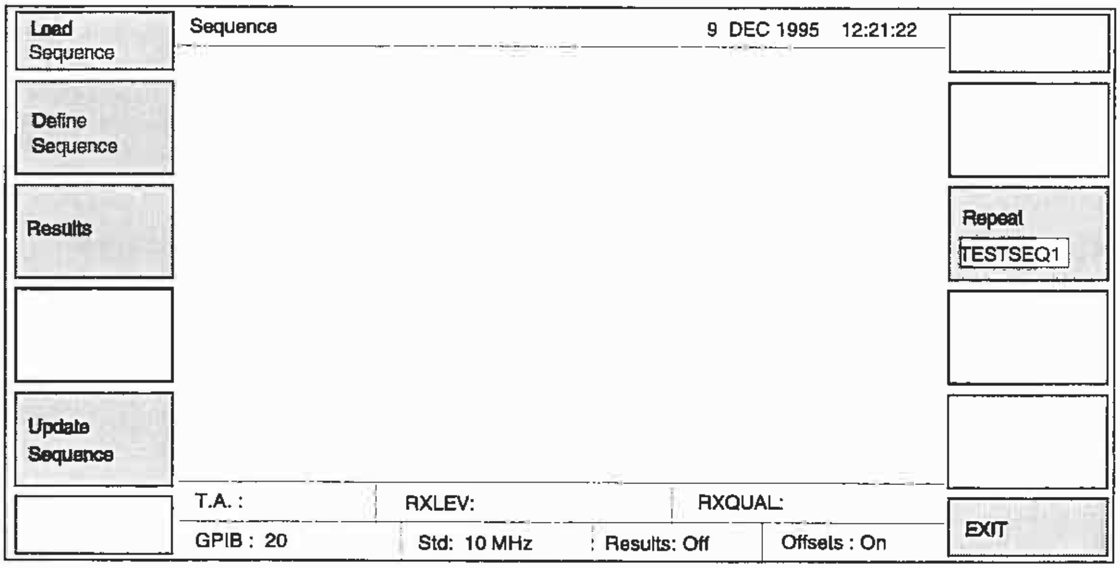


Figure 5.82 Sequence Selection Screen

Menu Options

Option Button	Function
Load Sequence	Switches to a File Selection Screen to select a sequence file from memory card.
Define Sequence	Switches to a File Write Screen to define a sequence file.
Results	Displays the standard Results Menu screen.
Update Sequence	Switches to a file selection screen for updating sequence files to be compatible with the loaded Test Set software. (Files created with major software releases only, version 01.06 onwards. Sequence files are not backwards compatible).
Repeat	Repeats the previous test sequence. (This button is not present if a sequence file has not been run previously
EXIT	Returns to the previous menu.

Sequence File Definition Screen

This screen is presented when the *Accept* button on the Test Sequence File To Write screen is pressed to accept the file information.

Selecting tests for use in the sequence is performed in a similar way to selecting tests from the Single Tests menu. That is, select *Functional Tests*, or *Transmitter Tests*, or *Receiver Tests* option. Then use the up/down arrows or the spinwheel, and the *Select* button, to select one of the tests from the scrolling list. This test is then added to the Sequence being defined.

Note that the Test Parameters of each test can be set to the required values (using the Configuration Parameter Edit screen) before being added to the sequence.

In addition, an End of Test Actions screen is displayed for defining the action to be taken at the end of the selected test; select one of the options and *EXIT* the screen.

The display then returns to the Sequence File Definition screen. Repeat the above procedure to add all the tests required in the sequence. Note that the Test Parameters for each test can be set to the required values when each test is selected. When all required tests have been included, press the EXIT option at the Sequence File Definition screen to return to the Sequence Selection screen. From this screen, the newly defined sequence file, or one defined previously, can be run by loading it from the *Load Sequence* option.

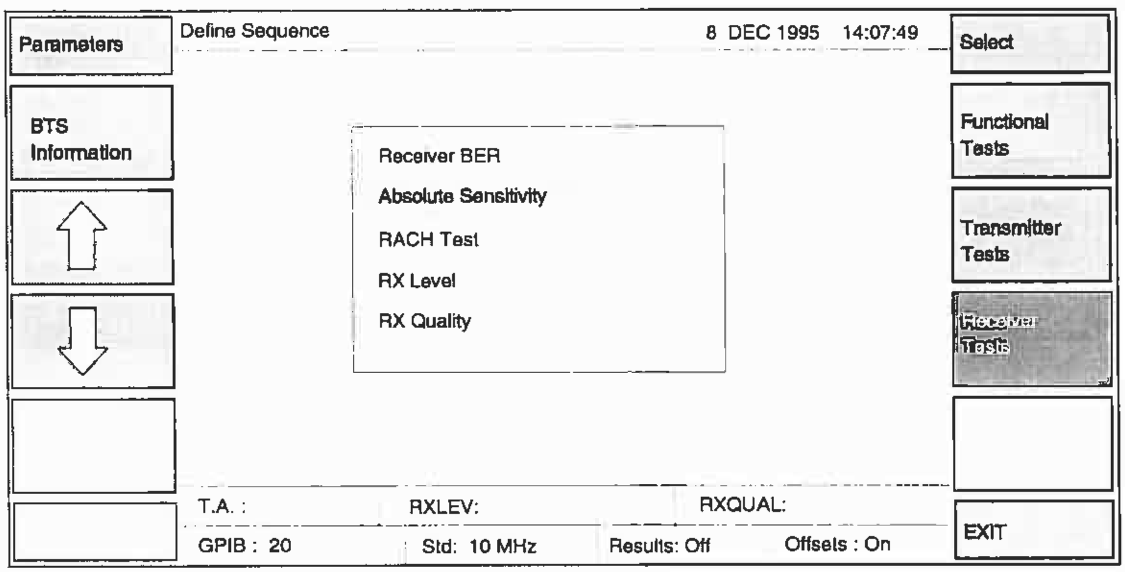


Figure 5.83 Sequence File Definition Screen

Menu Options

Option Button	Function
Parameters	Switches to the Parameters Menu to allow changes to the global parameters (Note: *Write File* button is omitted).
BTS Information	Switches to the BTS Information screen.
⇧	Moves the current selection up one item.

⇩	Moves the current selection down one item.
Select	Accepts the current test selection and switches to the Test Parameter Edit screen.
Functional Tests	Displays a scrolling list of Functional Tests
Transmitter Tests	Displays a scrolling list of Transmitter Tests
Receiver Tests	Displays a scrolling list of Receiver Tests
EXIT	Displays the End of Test Actions screen..

End of Test Actions Screen

This screen is displayed when *EXIT* is selected at the Configuration Parameter Edit screen. Use it to select the actions that are required if the test Passes, and if the test Fails.

Select (in the Value column) the action that is required for both Test Passed and Test Failed, i.e 'Continue', 'Hold', 'Exit' or 'Repeat' where:

'Continue'	=	Start running the next test
'Hold'	=	Allow the operator to *Repeat Test* as many times as required. (*Next Test* then runs the next test in the sequence).
'Exit'	=	Exits the Sequence
'Repeat'	=	Repeats the test

For the Print Results Condition parameter, select (in the Value column) the test result that must prevail to cause the test results to be printed, i.e. 'Both', 'Pass', 'Fail' or "None' where:

'Both'	=	Print results if test Passes or Fails
'Pass'	=	Print results if test Passes
'Fail'	=	Print results if test Fails
'None'	=	No results to be printed for Pass or Fail

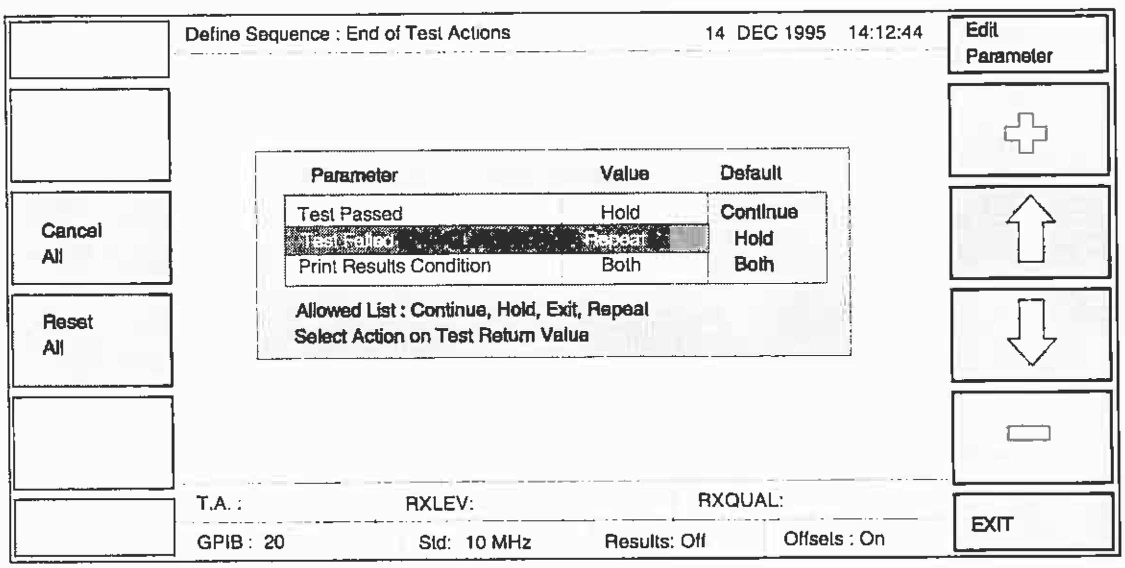


Figure 5.84 End of Test Actions Screen

Menu Options

Option Button	Function
Cancel All	Discards all the changes made to the set of parameters displayed restoring the previous values, then return to the previous menu.
Reset All	Sets all the parameters displayed to their default values.
Edit Parameter	This button displays the Parameter Edit screen.

✚	Toggles the currently selected parameter..
⇧	Moves the current parameter selection up one item, accepting any changes made to previous parameter.
⇩	Moves the current parameter selection down one item, accepting any changes made to previous parameter.
–	Toggles the currently selected parameter.
EXIT	Accepts all the changes made to the set of parameters displayed and sets up the new values in the Test Set, then returns to the Sequence File Definition screen.

Notes:

(1) The screen always starts with the spinwheel in 'Parameter Select' mode. (When the *Edit Parameter* option is selected, then the Parameter Edit screen is displayed and the spinwheel can be used to change the value of the selected parameter).

(2) The range for the currently selected parameter is displayed on the bottom line of the table.

Running Sequences

The 'Load Sequence' option in the Test Sequences Menu gives access to files stored on memory card (referred to as drives A: and B:). Operating the *Load Sequence* button displays the Sequence Selection screen, and a sequence file can then be selected from the 'Select Sequence File to Read' dialogue box. When the sequence file has been selected and the *Accept* button is operated, the Test Set starts running the sequence, carrying out the actions programmed in the file.

When the test sequence starts, the option *Single Step* is presented on the Test Information screen. Setting this option to On causes the sequence to stop at the end of each test and display the results screen for that test. The *Repeat Test* button can be used as required to repeat the test (without being able to modify the parameters) and examine graphical results where appropriate. The test results screens presented for each type of test are identical to the test results screens for each of the Single Tests, described earlier in this Section. The sequence must be restarted each time by operating the *Next Test* button.

During Single Step operation and at the end of a Sequence, the option button *Print Results* will appear (if selected via the *Results / Results/Printer* options in the Main Menu). Operating this button causes the results of the test to be printed via the configured port to either the printer (as hardcopy) or the selected memory card (as a results file).

During the execution of the sequence the Test Set displays the Sequence Test Information screen as the individual tests are run. Summary results of each test and each significant event are displayed in this screen. From this screen, the operator can switch to the Test Results screen while the test is running to watch the progress in detail. It is possible to switch between the Test Results screen and the Test Information screen as required.

On completion of the sequence, whether it has run all the tests or been terminated by the user, the Sequence Results Summary screen is displayed giving a brief summary of the results of all the tests run.

Sequence Test Information Screen

This screen is displayed when the *Accept* button in the Select Sequence File to Read screen is pressed. It indicates that the test sequence is running, and offers the *Single Step* option. It also displays a statement of each significant event in the test sequence. Note that operating the *Test Results* button will switch the display to the Test Results screen for the test in progress.

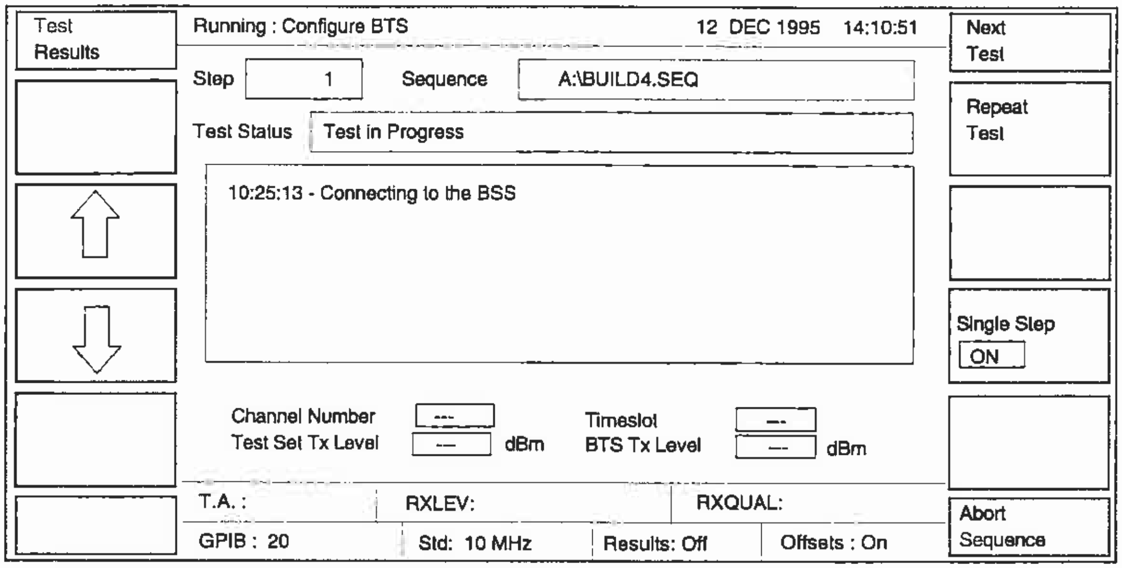


Figure 5.85 Sequence Test Information Screen

Menu Options

Option Button	Function
Test Results	Switches to the current test results screen.
⇧	Moves the current test information viewed up one item. This option is only displayed when the test is complete.
⇩	Moves the current test information viewed down one item. This option is only displayed when the test is complete.
Next Test	If a test is in progress then the test is aborted and the next test in the pre-programmed sequence is started. If the sequence is on hold then the next test is started.
Repeat Test	Repeats the test that has just failed. The Repeat Test key is only available when a test is complete and the sequence is paused.
Print Results	This option only appears if the *Results* option in the Results Menu is set to Printer. It causes the results of the test to be printed via the configured port.

Single Step	Pressing this button toggles the state between 'ON' and 'OFF'. 'ON' - holds the sequence after each test. 'OFF' - does not hold the sequence after each test. Both conditions take effect from the instant they are set.
Abort Sequence	Aborts the current test and ends the sequence at this point.

Notes:

(1) This screen will display any information and status messages concerning the progress of the test currently in progress.

(2) The Abort Sequence key is protected by a 'Confirm' function.

Sequence Summary Results Screen

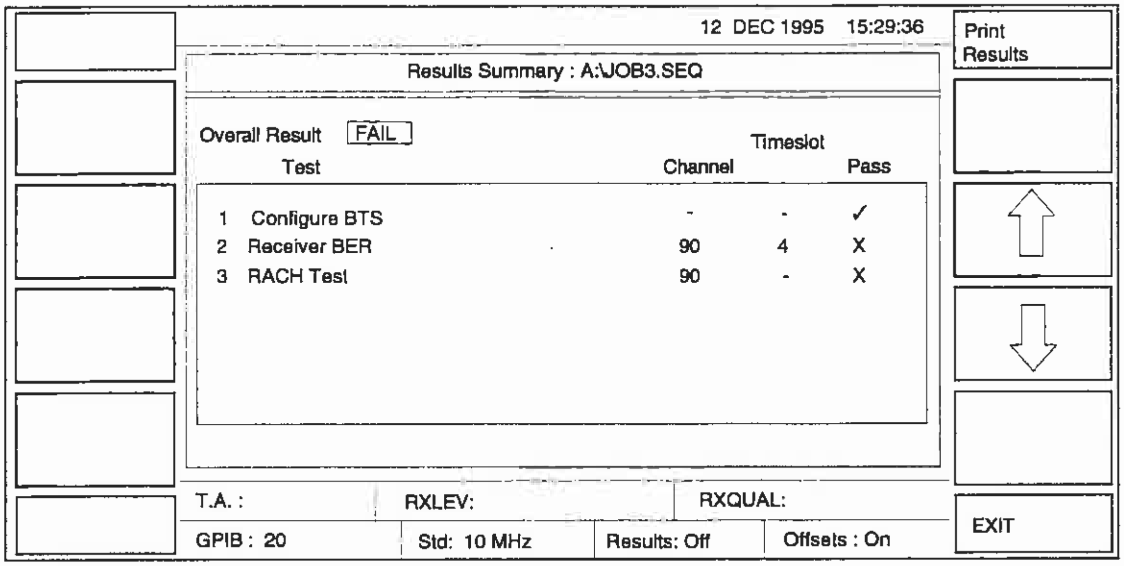


Figure 5.86 Sequence Summary Results Screen

Menu Options

Option Button	Function
⇧	Moves the current steps viewed up one item.
⇩	Moves the current steps viewed down one item.
Print Results	Sends the Summary Results shown to the currently selected printer.
Exit	Returns to the Sequence screen.

Notes:

(1) The spinwheel has the same effect as pressing the up/down arrow buttons.

(2) The *Print Results* control will only be displayed if 'Printer' has been selected at the Results Menu *Printer* option button.

INFORMATION SCREEN MENU

At power up, the hard boot and softboot tests are run and the screen displays test information as each test runs. At the end of the test sequence, the 6103 logo is displayed and then, after a short pause, the Main Menu softkeys are displayed.

On subsequent returns to the Main Menu, the *Information Screen* option is displayed, which may be pressed to obtain the following screen:

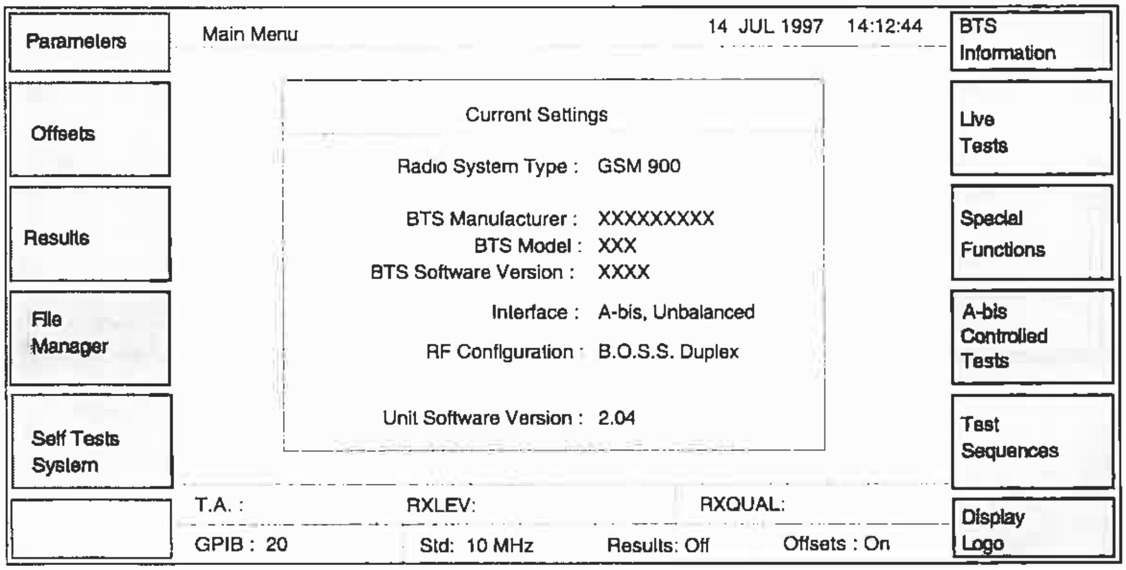


Figure 5.87 Main Menu - Information Screen

Menu Options

Option Button	Function
Display Logo	This option redisplays the logo in the central screen area.

Note: The function of all other buttons is as described for the initial Main Menu screen.

MENU UNDER REMOTE CONTROL

The 6113 Test Set can be controlled remotely via the GPIB interface.

The Test Set automatically enters remote control mode when a valid remote control command is received via the GPIB interface. In this mode, the only control available from the Test Set front panel is the *LOCAL* button to return to 'Local' mode.

Instructions on how to control the 6113 Test Set via the GPIB Interface are given in Section 6, Operating Instructions - GPIB.

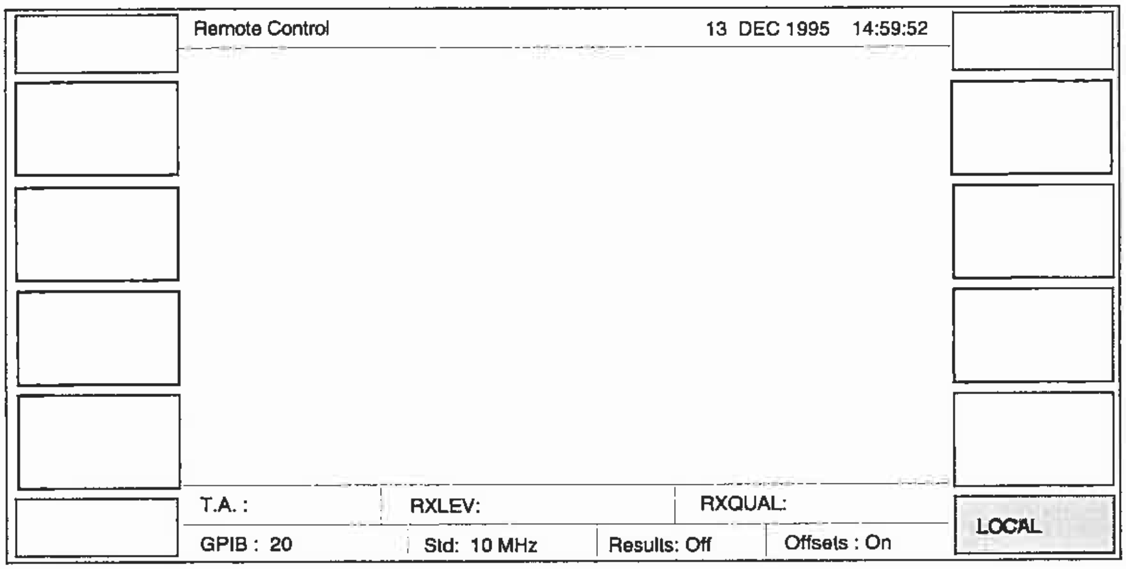


Figure 5.88 Menu Under Remote Control

Menu Options

Option Button	**Function**
LOCAL	Returns the Test Set to local control. The Main Menu is then displayed, irrespective of the menu state when the Test Set was set to 'Remote' control mode. If the Test Set has been set to 'Local' lock-out mode via the GPIB, this button is not displayed.

Section 5 Annex A

PROGRAMMING TEST SEQUENCES

CONTENTS

Page

INTRODUCTION

Sequences of test programs, as created using the 6113 display facilities, are generated as RIBASIC code and stored in DOS-compatible files on the Memory Card. This Annex describes an alternative method of generating such test sequences by making direct use of the RIBASIC language. Using the language itself gives the user more flexibility and greater scope in the functions that can be programmed into a test sequence. Some examples are included at the end of this Annex.

PROGRAMMABLE SEQUENCES

Sequences are read from the memory card one line at a time, each line is interpreted as it is read and the appropriate actions carried out before the next line is read. Sequences are programmed in RIBASIC - a BASIC-like language that supports features such as user-defined variables, looping and conditional constructs. This allows detailed control over the test sequences to be achieved. The language supports the existing pre-defined result sheet printout but also allows the user complete control over what is sent to the printer. The sequence file format and the list of commands available are described in the following paragraphs.

The programmed sequences do not automatically print the results sheet header and footer, these have to be explicitly programmed. The Sequence Summary screen similarly has to be written into the sequence.

The size of the sequence is only limited by the size of space available on the Memory Card.

RIBASIC SEQUENCE LANGUAGE

The following set of instructions forms the basis of the RIBASIC programming language to be used for controlling the 6113. A PC equipped with a standard text editor and a PCMCIA card adaptor is required to create DOS-compatible files of test sequences. These files must then be copied to a PCMCIA card in order to use them in the 6113 Test Set (they can be selected from the Sequence menus just like any other test sequence file). When using a text editor to create and modify programs, the files should be saved as plain ASCII text and not as word processor formatted documents. Any formatting characters would be seen by the Test Set as syntax errors and the program would not run properly.

GENERAL COMMANDS

The following set of instructions forms the basis of a programming language intended to control the 6113 Test Set.

Notes on Syntax Definition:

Words in **BOLD** type are reserved keywords. They may not be used for variable names.

Text enclosed in curly braces {} is optional and may be repeated any number of times.

Text enclosed in square braces [] is optional and may present only once.

The '|' symbol is used to separate two or more mutually exclusive options, one of which must be present.

SEQUENCE FILE FORMAT

The sequence files are formatted as follows:

[Line 1] Optional test set software version and date. Format :
<Code version>, <Date> e.g. : '1.01, 1 JAN 94'
In this release the contents of this line are ignored.

[Line 2] File description which is shown on the file select screen. Maximum length 80 characters

[Line 3 ...] RIBASIC program lines
[...] etc.

GENERAL COMMANDS

ASK *"title", "message"*

"title"	Title for dialogue box.
"message"	Message to be displayed in dialogue box.

Example: ASK "Results Printing", "Do you require a full printout?"

This command displays a dialogue box on the MMI screen with the specified title and message, and waits for the operator to press one of the function keys. The function keys displayed are 'Yes' in the top right key and 'No' in the bottom right key. The system variable Reply is set to 1 if the 'Yes' button is pressed or 0 if the No button is pressed.

CONFIG *config_command_name <parameter list>*

config_command_name = BTSTYPE I BTS CODE I MAPPING I PORTYPE I ABISIMP I RFCONN I DBSIC I DCOCD I GSMCECD I DCSCECD I PCSCECD I DCOPT I GSMNCED I DCSNCED I PCSNCED I DRACH I DLAID I DCSPS I DENCP I TRFCFG I TSOPT I TIMOP

Example: CONFIG DRACH 2, 5, 0, 1, 255, 1

Command Name Mnemonics:

BTSTYPE	Radio System and BTS type
BTSCODE	BTS Code download directory path name
MAPPING	Map the TRF / BCF to TEI / A-bis slot
PORTYPE	BTS / BSC interface
ABISIMP	A-bis port I/O impedance
RFCONN	RF connection type
DBSIC	Base Station ID
DCOCD	Control Channel parameters
GSMCECD	Cell Channel parameters - E-GSM
DCSCECD	Cell Channel parameters - DCS 1800
PCSCECD	Cell Channel parameters - PCS 1900
DCOPT	Cell Option parameters
GSMNCED	Neighbour Cells Description parameters - E-GSM
DCSNCED	Neighbour Cells Description parameters - DCS 1800
PCSNCED	Neighbour Cells Description parameters - PCS 1900
DRACH	RACH Control parameters
DLAID	Location Area ID
DCSPS	Cell Selection parameters
DENCP	Encryption Kc
TRFCFG	A-bis settings
TSOPT	Miscellaneous Test Set parameters
TIMOP	Timing Output parameters

Note: For a description of these commands including parameters, refer to SECTION 6 / DEVICE DEPENDENT COMMANDS / System Configuration Commands / GSM Parameter Configuration Commands.

This command runs the configure command to update the 6113 parameter database using the given parameters.

INTEGER *<argument list>*

<argument list> = variable_name [= <integer_value>]{, variable_name [= <integer_value>]}

Example: INTEGER mob_lev = 15

This parameter declares integer variables and optionally sets their initial values.

[**LET**] *variable* = *<expression>*

expression	Any valid mathematical expression evaluating to a numeric value.

Example: LET sample = step + n

This command assigns the value of *expression* to *variable*. The LET keyword is optional. Integer expressions are converted to floating point if *variable* is REAL, and floating point expressions are converted to integer if *variable* is INTEGER. If *variable* has not been declared then it is declared using the same type of the expression as the variable type.

LOAD "*parameter_file*"

parameter_file	[<file_path>]<file_name>

Example: LOAD "a:\test3\advance8"

This command loads a parameter file from memory card to the Test Set parameter database.

MESSAGE *"title", "message", time*

"title"	Title for dialogue box.
"message"	Message to be displayed in dialogue box.
time	Display time in seconds. If this is zero the display time is indefinite.

Example: MESSAGE "Operator Message", "Please turn the mobile OFF", 0

This command displays a dialogue box on the MMI screen with the specified title and message, and waits for either the operator to press the 'Okay' function key or for the specified time period to expire. The function key displayed is 'Okay' in the bottom right key.

PRINT *<argument list>*

<argument list> = [print_element { , | ; print_element } [, | ;]]
print_element = "<text string>" | variable_name

Example: PRINT "Current value of offset = ", offset

This command sends text to the default printer device. Variables are formatted automatically according to type. If there is no trailing ';' on the end of the argument list, a carriage-return/line-feed pair is printed.

PRINT FOOTER

Sends the sequence results sheet footer to the default printer device using the default format.

PRINT FORMFEED

Sends a formfeed character to the default printer device.

PRINT HEADER

Sends the sequence results sheet header to the default printer device, using the default format.

PRINT RESULTS

Sends results from the last test to the default printer device, using the default format.

PRINT SUMMARY

Sends a pass fail summary of all the tests in the sequence to the default printer device. The format of the summary form is the same as the displayed sequence summary form.

REAL *<argument list>*

<argument list> = variable_name [= <float_value>]{, variable_name [= <float_value>]}

Example: REAL pwrl_limit = 3.0

Declares floating point variables and optionally sets their initial values.

SET AUTOEOT *state*

state = **ON | OFF**

Example: SET AUTOEOT OFF

Default for this command is **ON**.

This command enables or disables the automatic actions taken on test completion. **SET AUTOEOT OFF** is equivalent to **SET EOTACTION OFF, CONTINUE, OFF, CONTINUE**.

SET EOTACTION *pass_print, pass_action, fail_print, fail_action*

pass_print, fail_print = **ON | OFF**
pass_action, fail_action = **CONTINUE | EXIT | HOLD | REPEAT**

Example: SET AUTOEOT ON, CONTINUE, ON, EXIT

Default for this command is **ON, CONTINUE, ON, HOLD**.

This command sets the default actions to be taken when a test completes.

SUMMARY

Runs the Sequence Summary Screen, displaying the results of the tests run during the sequence.

TEST *config_command_name <parameter list>*

config_command_name = RSTBTS | LINKTST | ELEST | CCCG | TXTST | TXL | PWRL | RXL | SENS | CRACH | RXLEV | RXQUAL | MULTMODE | SCBA

Test Mnemonics:

RSTBTS	Reset BTS test
LINKTST	Link test
ELEST	Link test (6111 Compatibility)
CCCG	Cell Control Channel Generation test
TXTST	Transmitter test
TXL	Transmitter BER test
SPWRL	Static Power Control test
DPWRL	Downlink Power Control test
RXL	Receiver BER test
SENS	Absolute Sensitivity test
CRACH	RACH test
RXLEV	RX Level test
RXQUAL	Rx Quality test
MULTMODE	Multimode test
SCBA	Self Check Burst Analysis test

parameter list — List of parameters in the same order as on the MMI test parameters screen. The format is the same as that given in the Section 6.

Note: (1) For a description of these commands including parameters, refer to SECTION 6 / TEST COMMANDS AND PARAMETERS.

(2) Additional Manufacturer-Specific tests are available as listed in Section 7 Manufacturer-Specific Information.

Example:

```
TEST CRACH 90, 0, -104.7, 10, -1, 3
```

Alternatively, use variables and define their values as follows:

```
INTEGER tcn = 90
INTEGER tlvl = 0
REAL rlvl = -104.7
INTEGER nrach = 10
INTEGER rdel = -1
INTEGER terr = 3

TEST CRACH tcn, tlvl, nrach, rdel, terr
```

This command runs the test using the given parameters. If **AUTOEOT** is **ON** then the default actions specified by the **EOTACTION** command are taken, otherwise program execution continues as normal.

STRING HANDLING COMMANDS

Definitions

String Identification

Strings are identified by a variable name ending with a dollar symbol. String variable names are not case sensitive and may contain up to 32 characters including the dollar symbol. The format is:

alpha_char { *alpha_char* | _ } $

alpha_char	any alphanumeric character

In the context of the RIBASIC variable space, the dollar symbol is stored as part of the variable name. This allows string variables to have the same alphanumeric identifier as another variable type.

String Declaration

Strings are declared using the STRING keyword. There is no defined limit for the number of strings that can exist. The number of strings that can be used is only limited by the amount of spare memory available to the RIBASIC environment.

Initialisation may occur during the declaration. The STRING keyword may be omitted for initialisation, by only one declaration may then occur on that line. The format is:

STRING *variable_name* [= "*character_string*"]
{ , variable_name [= "character_string"] }

variable_name	must be terminated with dollar symbol
character_string	any character sequence

Example:

```
STRING Testname$ = "Handover Test", TestID$
TestInfo$ = "Ensure handset is turned on"
```

String Expressions

String variables can be initialised and re-assigned using the optional LET keyword syntax. The LET keyword can be omitted.

[LET] *variable_name* = *string_expression*

string_expression	any valid string expression evaluating to a string

Example:

```
LET   a$ = b$ + c$
d$ = "Hello"
e$ = CHR$(65) + CHR$(66)
```

String expressions are also valid as part of an IF conditional expression. However, the string conditional expressions must return a Boolean result. For example:

IF *string_condition* **THEN** command

string_condition	*string_expression = string_expression*
	string_expression < string_expression
	string_expression > string_expression
	string_expression <> string_expression
string_expression	any valid string expression evaluating to a string

String expressions can also contain string functions.

String Functions

New string functions required for string manipulation are as follows:

ASC *string*	Returns ASCII code for first character in string.
string	String variable or quoted string.
CHR$ *cardinal8*	Returns single character string of ASCII code *cardinal8.*
cardinal8	Cardinal value < 256
LEN *string*	Returns length of *string.*
string	String variable or quoted string.
MID$ *string,start,length*	Returns sub-string of *string*
string	String variable or quoted string
start	Start of sub-string
length	Length of sub-string

String functions must have a single variable or value for a each parameter. Expressions are not allowed as function parameters.

For example:

```
value1 = 48
value2 = 5
PRINT CHR$(value1)             ! Valid function parameter
PRINT CHR$(value1 + value2)    ! Invalid parameter - expression not allowed
```

Strings and Expressions as Keyword Parameters

Some keywords require a quoted string as a parameter. However, as string variables will be available to the RIBASIC programmer, string variables will be valid parameters to keywords.

Example:

```
ASK "Run Test", "Do you want to run Test 1"
ASK "Run Test", ask_test$
```

String expressions will also be valid as keyword parameters.

For example:

```
ASK "Run Test", "Do you want to run Test " + CHR$(ascii_testno)
```

To ensure consistent command formation, all keywords allow expressions as parameters, no matter what parameter type is required.

Commands affected: ASK, CONFIG, LOAD, MESSAGE, PRINT, TEST and WAIT

PROGRAM FLOW COMMANDS

END

Halts the program execution and marks the end of the program.

GOSUB *label*

Example: GOSUB Measure

Transfers program flow to line labelled *label* and continues until a RETURN command is encountered, then program flow resumes at the line following the GOSUB command.

GOTO *label*

Transfers program flow to line labelled *label.*

Example: GOTO test3

IF *condition_expression* **THEN** *command_1* [**ELSE** *command_2*]

Examples:
```
IF TestResult > 10 THEN GOTO exit3 ELSE GOTO test4
IF Reply = NO THEN GOTO Finish ELSE pwrl = 7
```

Evaluates *condition_expression*, if it is TRUE then *command_1* is executed, otherwise if the optional **ELSE** is present *command_2* is executed. The commands may not contain further **IF** statements.

IF *condition_expression*
    if_code
{**ELSE IF** *condition_expression*
    if_code}
[**ELSE**
    else_code]
ENDIF

Example:
```
IF add3 < 10
    PRINT "Unit is OK"
ELSE IF add3 < 30
    IF add3 < 20
        PRINT "Unit can be repaired"
    ELSE
        PRINT "Return to Service Department"
ELSE
    PRINT "Scrap the unit"
ENDIF
```

Evaluates the *condition_expressions* in turn until one evaluates to TRUE, then the following *if_code* block is executed. If none are TRUE and **ELSE** is present then the *else_code* block is executed. The *if_code* and *else_code* blocks may contain further **IF** statements.

RETURN

Returns program flow to the line following the most recent GOSUB command.

STOP

Halts program execution permanently.

WAIT <integer>

Halts program execution for a defined number of seconds.

Example: WAIT 20

Halts the program execution for 20 seconds.

VARIABLES

There are two types of variable currently supported:

> **INTEGER** variables are signed 32-bit quantities, range approximately $\pm 2.1475 \times 10^{9}$
>
> **REAL** variables are single-precision floating-point values, range approximately $\pm 3.4038 \times 10^{38}$

Variable names are not case-sensitive and may contain up to 32 characters. The format is:

alpha_char {alpha_char | digit | _ }

alpha_char	any alphabetic character whose ASCII value is less than 128. This excludes accented characters.
digit	any digit between 0 and 9

RESULTS PRINTING COMMANDS

A virtual text screen is provided to enable text to be positioned as required on a page. The following comands allow text to be positioned on the virtual pad. A print formatting command is also provided.

The 'virtual pad' is a virtual text screen on which the RIBASIC user can prepare text. It has dimensions of 80 characters across by 64 lines down. The programmer can re-assign the printer to the virtual pad to re-direct print output to this virtual text screen. Text can be positioned anywhere on the virtual pad by using the PRINT TAB command. The virtual pad can then be printed by using the DUMPPAD command. The major difference between the virtual pad and standard computer screen output is that the virtual pad does not scroll up if printing past the last line occurs. Any characters printed after the bottom right corner of the virtual pad are discarded.

The PRINT command output can be re-directed to either the normal printer (default) or the virtual pad.

PRINTCMD *device* Directs the print output to the printer or to the pad
device PRINTER | PAD
where PRINTER is the normal printer and PAD is the virtual pad.

Note: This command will only redirect the standard PRINT command output and does not effect other printer commands such as PRINT FOOTER, PRINT FORMFEED, PRINT RESULTS and graphical print commands. These printer commands output straight to the printer.

PRINT TAB(x [, y]); [*expression* {; **TAB(** x [, y]); [*expression*]}]
Positions text anywhere on the pad.

x	x coordinate of print device (integer)
y	y coordinate of print device (integer)
expression	any valid expression

If the y coordinate is omitted from the command then the print position is only adjusted in the x plane. If the print device is set to PRINTER and the y coordinate is included in the command, the print position is shifted down y lines.

DUMPPAD [*from_line* [, *to_line*]]
Dumps the virtual pad to the printer.

from_line	Start print line of virtual pad.
to_line	End print line of virtual pad.

If both parameters are omitted then the whole pad is sent to the printer. If one line is specified as a single parameter, then that single line is sent to the printer. If two parameters are specified, the range of specified lines are printed. The virtual pad cannot be used to store internal pre-defined result summaries and other internal print commands. Therefore a formfeed is not automatically sent to the printer when the DUMPPAD command is used, allowing the user to first print headers and/or other system information. A formfeed can be forced by using a PRINT FORMFEED command.

CLEARPAD This command clears the virtual pad.

This command takes no parameters.

PRINT USING *format_string; expression {, expression} [; | ,]*
This command formats the print output.

format_string string variable or quoted string of format description

The *format_string* controls and defines the format of the *expression* when it is printed. The format string must follow the using keyword, otherwise a syntax error is produced. After the format string, the list of expressions must follow. No other printing formatters (e.g. TAB) are allowed.

The output format is defined with the following list of image specifiers:

(1) < [+ | -] < [*repeat_factor*] D{D} > | < [*repeat_factor*] Z{Z} >
[< . | R > [[*repeat_factor*] D{D}]] [E+ [*repeat_factor*] <Z | D > { Z | D}]]
>
(2) | < [*repeat_factor*] A{A} >
(3) | < " " *literals* " " >

where the *repeat_factor* is a positive integer specifying the number of times the following literal is to be repeated,

and
< > denote grouped specifiers
[ ] denote optional specifiers
{ } denote optional specifiers that can be repeated
| denotes an OR operator

The format string must follow the using keyword, otherwise a syntax error is produced. After the format string, the list of expressions must follow. No other printing formatters (e.g. TAB) are allowed.

Effects of the image specifiers on the PRINT statement are shown in the following table:

TABLE 5A.1 PRINT USING SPECIFIERS

Image Specifier	Description
+	Prints the number's sign (+ or -).
-	Prints the number's sign if negative, a blank if positive. If the sign field is omitted then no sign is printed.
D	Prints one digit character. A leading zero is replaced by a blank.
Z	Prints one digit character. Leading zeros are printed.
.	Prints a decimal-point radix indicator.
R	Prints a comma (European) radix indicator.
E+	Prints an E, a sign followed by the exponent. The exponent size must also be defined.
A	Prints a string character. Trailing blanks are output if the number of characters specified is greater than the number available in the corresponding string. If the number of characters specified is less than the number available, then the string is truncated.
literals	Prints the characters of the string.

Examples:

Money = 72.34
PRINT USING "2D"; Money
will format and print 'Money' as: 72

Money = -2.34
PRINT USING "2D.D"; Money
will format and print 'Money' as: 2.3

Money = 2.34
PRINT USING "+ZZZ.D"; Money
will format and print 'Money' as: +002.3

Money = -2.34
PRINT USING "-2Z.3D"; Money
will format and print 'Money' as: 02.340

Power = -2.34
PRINT USING " ""POWER: "", -2Z.3D"; Power
will print: POWER: -02.340

PRINT USING " "" | "",+ZZ.DD,"" | "",DDR4D,"" | "",5A,"" | "" ": 9, -33, "HELLO TEST"
will print: | +09.00 | 33,0000 | HELLO |

PRINT USING "+4Z.DDD E+ZZ, "" & "", +.3ZE+5D"; 34, 38
will print: +0003.400E+01 & +-.380E+00002

PRINT USING "-3D.DDD E+ZZ, "" & "", 3DE+5D" ; 72, -6.55
will print: 720.000E-01 & 655E-00002

Graphical Results Commands

The graphical results of certain tests can be printed using the following commands. Note that the graphical result output is only valid when the output device is set to an Epson FX80 compatible printer.

Three commands are available for printing graphical results:

PHASEDUMP [*phase_range*] Prints the last phase error graph.
phase_range <u>**WIDE**</u> (± 30°) | **NARROW** (± 10°)

MODSPDUMP [*frequency_range*] Prints the last modulation spectrum graph.
frequency_range <u>**WIDE**</u> (500 kHz) | **NARROW** (200 kHz)

To :

POWERDUMP [*bit_range*] [*power_range*] Prints the last power profile graph.
bit_range <u>**FULL**</u> (-10:+155) | **START** (-10:+10) | **END** (+135:+155)
power_range <u>**WIDE**</u> (-70:+10 dB) | **NARROW** (-5:+5 dB)

Note: All parameters are optional and default parameters are underlined. The range parameters allow printing of the standard zoom areas of the results graphs.

SYSTEM VARIABLES AND CONSTANTS

System variables and constants are pre-defined variable names that are set automatically by the Test Set, and may be examined by the sequence program.

Variable	**Value**
FailCallSetup	1
FailCallLost	2
FailProtocolError	3
FailOutOfBounds	4
FailAborted	5
FailNoCall	6
No	0
Pass	0
Reply	Set to 0 or 1 by **ASK** command.
TestResult	Set to test pass/fail result on completion of **TEST** command.
Yes	1

OPERATORS

Mathematical	+, -, *, /, =.
Conditional	<, <=, >, >=, <>, =.
Logical	**AND**, **NOT**, **OR**

Precedence (highest first):

()
NOT
- (arithmetic negation)
*, /
+, - (subtraction)
<, <=, >, >=, <>, =
AND, **OR**

EXPRESSIONS

Complex mathematical and logical expressions may be evaluated, using both variables and constant values. Standard algebraic operator precedence is observed. Brackets are used to force ordering of operations; they may be nested to a depth of 10 levels.

LABELS

Labels may be defined at the start of lines using the following syntax:

Label: <line of code>

Variable names are not case-sensitive and may contain up to 32 characters. The format is:

alpha_char {alpha_char | digit | _ }

alpha_char	Any alphabetic character whose ASCII value is less than 128. This excludes accented characters.
digit	Any digit between 0 and 9

COMMENTS

Comment lines are preceded by a '!' character. All text after this character to the end of the line is ignored.

ERROR HANDLING

Each line is checked for correct syntax before execution. If a syntax error is encountered, an error message is displayed on the screen giving the error message and the offending line of code. The sequence then terminates.

The list of error messages and their meanings is given below.

"Both values must be numeric for comparison"

An attempt has been made in a comparison expression to compare a value with the result of another comparison.

Example: IF a > (b < c)

"Both values must be numeric for operation"

An attempt has been made in an expression to combine a value with the result of another comparison.

Example: a = (b < c) + d

"Float value too big for integer"

A floating-point value has been used in a **TEST** or **CONFIG** command for an integer parameter, and the value is too great to be represented as an integer.

Example: TEST SYNC "0012234456", 2e22

"Illegal character"

An illegal character has been encountered. This may either be a punctuation character (unused in RIBASIC) or when any character other than 'H' follows '#' in a parameter value string.

"Illegal close-bracket"

A close-bracket character has been encountered in an expression where a value was expected.

Example: a = (b +)c) + d

"Illegal keyword in SET AUTOEOT"

An illegal keyword has been found in a SET AUTOEOT command.

Example: SET AUTOEOT PRINT

"Illegal keyword in SET EOTACTION"

An illegal keyword has been found in a SET EOTACTION command.

Example: SET EOTACTION PRINT, CONTINUE, ON, EXIT

"Illegal keyword in SET"

An illegal keyword has been found in a SET command

Example: SET PRINT

"Illegal nested IF statement"

A second IF command has been found in a single-line IF statement.

Example: IF a=b THEN IF c=d THEN GOTO Error

"Illegal open-bracket"

An open-bracket character has been encountered in an expression where an operator was expected.

Example: a = (b (+ c) + d

"Illegal position for operator"

An operator has been encountered in an expression where a value was expected.

Example: a = (b + * c) + d

"Illegal position for value"

A value has been encountered in an expression where an operator was expected.

Example: a = (b c) + d

"Label already exists"

An attempt has been made to define a label used earlier in the sequence.

Example:

```
start: a = 1
.
.
start: a = 2
```

"Logical operator used on non-logical expression"

A logical operator has been applied to an expression that does not evaluate to a logical value.

Example: a = (b < c) AND (d + 5)

"Maximum depth of GOSUB nesting = 16"

The maximum number of GOSUB commands that may be executed before a RETURN command is 16.

"Missing '=' in assignment"

The '=' character in a **LET** command is missing.

Example: LET a (b - c) + d

"Missing \" at end of string"

The final "" is missing at the end of a string. This may be either in a **TEST** or **CONFIG** parameter or in a **PRINT** command.

Example: PRINT "a = , a

"Missing comma in parameters"

A comma separator is missing in the list of parameters for a command.

Example: SET EOTACTION ON CONTINUE, ON, EXIT

"Missing keyword in SET AUTOEOT"

The **ON** or **OFF** keyword is missing in the **SET AUTOEOT** command.

Example: SET AUTOEOT

"Missing keyword in SET EOTACTION"

A keyword is missing in the **SET EOTACTION** command.

Example: SET EOTACTION ON CONTINUE, ON

"Missing keyword in SET"

The second keyword is missing in a **SET** command.

Example: SET

"Missing message for dialogue box"

The message string for the dialogue box in the **ASK** and **MESSAGE** commands is missing.

Example: ASK "Operator Query"

"Missing title for dialogue box"

The title string for the dialogue box in the **ASK** and **MESSAGE** commands is missing.

Example: MESSAGE

"Missing value for display time"

The display period for the dialogue box in the **MESSAGE** commands is missing.

Example: MESSAGE "Operator Query", "Test Passed ?"

"RETURN when no GOSUB called"

A **RETURN** command has been encountered when no **GOSUB** command has been executed.

"String does not represent a value"

This message is expanded to include the string that is expected to represent a parameter value in a **TEST** or **CONFIG** command but cannot be converted.

Example: TEST TXTST *

"Too many close-brackets"

A close-bracket has been encountered with no corresponding open-bracket.

Example: a = (b + c)) * d

"Too many open-brackets"

A open-bracket has been encountered with no corresponding close-bracket.

Example: a = ((b + c) * d

"Unknown variable"

A variable that has not been previously used or declared has been used in an expression or command.

"Unrecognised CONFIG command name"

The **CONFIG** command name is not recognised. The names for the default commands are the same as the GPIB mnemonics.

Example: CONFIG RACH_CONTROL....

"Unrecognised label"

A label that has not been previously defined has been used in a **GOTO** or **GOSUB** command.

"Unrecognised symbol"

A symbol or string has been found in an expression which is not part of the expression

Example: a = (b < c) + [

"Unrecognised TEST name"

The TEST command name is not recognised. The names for the default commands are the same as the GPIB mnemonics for the Run Test GPIB commands.

Example: TEST PHASE_ERROR ....

"Variable already exists"

An attempt has been made in a **REAL** or **INTEGER** command to declare a variable that already exists.

Example: INTEGER a = 2, b = 4, a = 5

"Variable used without being initialised"

An attempt has been made in an expression to reference a variable that has not been initialised with a value.

SEQUENCE FILE LISTINGS

The following listings are examples of RIBASIC programs. Electronic copies of these and other files are available from Racal Instruments Ltd, Digital Radio Product Support Department.

Note that additional information relating to test commands can be found in SECTION 6 under the heading SINGLE TEST COMMANDS.

EXAMPLE1.SEQ

```
RIBASIC          02/02/94
Example to demonstrate test results handling.
!************************************************************************
!                                                                       *
!       Racal Instruments Ltd, 1994.                                    *
!                                                                       *
!       6113 Sequence File: EXAMPLE1.SEQ                                *
!                                                                       *
!       This sequence is provided as an illustration of the             *
!       capabilities of the 6113's programming language.                *
!************************************************************************
tchl = -85.0
mpwr = 15
step = 0
finished = 0

PRINT "/*****************************************************************"
PRINT "*                                                                *"
PRINT "*        6113 Customized Results Printout: POWER_EG.SEQ          *"
PRINT "*                                                                *"
PRINT "*****************************************************************/"
PRINT
PRINT
PRINT "                Results for Power Level Test"
PRINT "                ----------------------------"

SET AUTOEOT OFF

MESSAGE "Programmable Test Sequences","Press OKAY to continue",0

!...............................LOOP.............................
```

```
loop:
step = step + 1
TEST TXTST 62, tchl, 4, mpwr, 0, 0, 10, 6, 95, 5, 20, 3, 0
! Perform Transmitter Test
GOSUB print_parameters              ! Call subroutine to print results
tchl = tchl - 5                     ! Adjust TCHL Level
mpwr = mpwr + 2                     ! Adjust Mobile Power Level

IF (step < 4) AND (finished = 0) THEN GOTO loop  ! Loop back if required

!..............................................................

SUMMARY                             ! Print results summary to screen

ASK "Print Option","Would you like a summary printout?"
IF REPLY = YES THEN PRINT SUMMARY   ! Print results summary to output device

STOP

! ************************ End of main body *******************

print_parameters:

PRINT
PRINT
PRINT "Test Number : ";step
PRINT "^^^^^^^^^^^ "
PRINT "Parameters  :   TCH level = "; tchl;"    Mobile power level = "; mpwr
PRINT "                TCH ARFCN = 62            TCH Slot = 4"
PRINT
PRINT "->  ";
```

```
IF TestResult = Pass               THEN PRINT "    Test Passed"
IF TestResult = FailCallSetup      THEN PRINT "    Test Failed : Call Setup Failed"
IF TestResult = FailCallLost       THEN PRINT "    Test Failed : Call Lost"
IF TestResult = FailProtocolError THEN PRINT "    Test Failed : Protocol Error"
IF TestResult = FailOutOfBounds    THEN PRINT "    Test Failed : Measurement Out Of Bounds"
IF TestResult = FailAborted        THEN PRINT "    Test Failed : Test Aborted"
IF TestResult = FailNoCall         THEN PRINT "    Test Failed : No Call Present"

IF STEP < 4  !(I.E. Only do this bit if we have not done the last test)
   IF TestResult = FailCallSetup     THEN ASK  "Call Setup Failed","Continue Testing?"
   IF TestResult = FailCallLost      THEN ASK  "Call Lost","Continue Testing?"
   IF TestResult = FailProtocolError THEN ASK  "Protocol Error","Continue Testing?"
   IF TestResult = FailOutOfBounds   THEN ASK  "Measurement Out Of Bounds","Continue Testing?"
   IF TestResult = FailAborted       THEN ASK  "Test Aborted","Continue Testing?"
   IF TestResult = FailNoCall        THEN ASK  "No Call Present","Continue Testing?"
   IF (TestResult <> Pass) AND (REPLY = 0)
      finished = 1
      PRINT
      PRINT
      PRINT "  ****************         Test Aborted          ****************"
   ENDIF
ELSE         !(I.E. If we have just finished the last test)
   IF TestResult = FailCallSetup     THEN MESSAGE "Call Setup Failed","",3
   IF TestResult = FailCallLost      THEN MESSAGE "Call Lost","",3
   IF TestResult = FailProtocolError THEN MESSAGE "Protocol Error","",3
   IF TestResult = FailOutOfBounds   THEN MESSAGE "Measurement Out Of Bounds","",3
   IF TestResult = FailAborted       THEN MESSAGE "Test Aborted","",3
   IF TestResult = FailNoCall        THEN MESSAGE "No Call Present","",3
ENDIF

RETURN

END
```

EXAMPLE2.SEQ

```
RIBASIC       02/02/93
Example: Use of Maths and Branch functions
!***********************************************************************
!                                                                      *
!       Racal Instruments Ltd, 1994.                                   *
!                                                                      *
!       6113 Sequence File: EXAMPLE2.SEQ                               *
!                                                                      *
!       This sequence is provided as an illustration of the           *
!       capabilities of the 6113's programming language.               *
!                                                                      *
!***********************************************************************

!
!   Program to find the number, "x", such that the reciprocal
!   of "x" is "x" minus 1
!                          ->   1/x  =  x - 1
!                          ->   x    =  1 + 1/x

REAL x = 10, old_no, difference
INTEGER count = 0

PRINT "Example program to show use of mathematical and branch functions."
PRINT "^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^"
PRINT "Solution to:   1/x = x - 1.              Solving by iteration..."
PRINT

MESSAGE "Example program showing use of maths and branch functions","1/x = x - 1 ..... Select 'Okay' to
    start iterations",0
```

```
!.........................LOOP.........................

loop:
count = count + 1
PRINT "Iteration ";
IF count < 10 THEN PRINT " ";         ! Extra space to format print evenly
PRINT count;".   Value is: ";x        ! Send value to output

old_no = x                            ! Save old value
x = 1 + 1 / x                         ! Get next iteration for x
difference = old_no - x               ! Compare old value and x

IF difference < 0 THEN difference = difference * -1  ! Get absolute value

IF difference > 0.000001 THEN GOTO loop  ! If difference is not negligible
                                         ! then return to beginning of loop

!.........................................................

PRINT
PRINT "The solution is ";x;"."

MESSAGE "Solution Obtained","The results have been sent to your selected output",0


END
```

EXAMPLE3.SEQ

```
RIBASIC      02/02/94
Example: Use of GOSUB and GOTO in sequences
!***********************************************************************
!                                                                      *
!       Racal Instruments Ltd, 1994.                                   *
!                                                                      *
!       6113 Sequence File: EXAMPLE3.SEQ                               *
!                                                                      *
!       This sequence is provided as an illustration of the            *
!       capabilities of the 6113's programming language.               *
!                                                                      *
!***********************************************************************

INTEGER count = 0   ! ( Declaration is not compulsory )


GOTO label_end

!************************* label_begin ************************

label_begin:

MESSAGE "GOSUB and GOTO example","We start off in the main body of the program",0
GOSUB label_A
MESSAGE "End of example","Finally, we have RETURNed to the main body",0

STOP
```

```
!**************************   label_A   *************************

label_A:

count = count + 1
IF count = 1
    MESSAGE "Progress...","We have GOSUBed to A for the first time",0
    GOSUB label_B
    MESSAGE "Progress...","We have RETURNed to A",0
ELSE
    MESSAGE "Progress...","We have GOSUBed to A for the second time",0
ENDIF

RETURN

!**************************   label_B   *************************

label_B:

MESSAGE "Progress...","We have GOSUBed to B",0
GOSUB label_A
MESSAGE "Progress...","We have RETURNed to B",0

RETURN

!**************************  label_end  *************************

label_end:

GOTO label_begin


END     !     ( END command not compulsory )
```

EXAMPLE4.SEQ

```
RIBASIC      02/02/94
Example: Loading parameters / Using 'AUTOEOT'
!***********************************************************************
!                                                                      *
!       Racal Instruments Ltd, 1994.                                   *
!                                                                      *
!       6113 Sequence File: EXAMPLE4.SEQ                               *
!                                                                      *
!       This sequence is provided as an illustration of the            *
!       capabilities of the 6113's programming language.               *
!***********************************************************************

ASK "","Do you want to load the parameter file 'a:\example4.prm'?"
IF REPLY = YES
    LOAD "a:\example4.prm"     ! Load parameter Files
ELSE
    ASK "Alter parameters","Set the DLAID parameters?"
    IF REPLY = YES THEN CONFIG DLAID 0,1,1,1    ! Alter DLAID parameters is desired
ENDIF

SET AUTOEOT OFF    ! AUTOEOT is off, so sequence program controls
                   ! actions after each test is finished

MESSAGE "Receiver Test","AUTOEOT state is currently off",0
TEST RXTST 62, -100, 4, 7, 0, 0, 0, 2, 6, 0.2, 0.41, 2.44, 6, 2

IF TestResult = PASS
    MESSAGE "Test Result","Pass",0
ELSE
    MESSAGE "Test Result","Fail",0
ENDIF
```

```
SET AUTOEOT ON     ! AUTOEOT is on, which means that various actions
                   ! are taken automatically after each test

        ! These actions are:        pass_print  (ON/OFF)
        ! (see next command)        pass_action (CONTINUE/EXIT/HOLD/REPEAT)
        !                           fail_print  (ON/OFF)
        !                           fail_action (CONTINUE/EXIT/HOLD/REPEAT)

SET EOTACTION OFF,CONTINUE,OFF,REPEAT

MESSAGE "Receiver Test","AUTOEOT now on: Params.. OFF,CONTINUE,OFF,REPEAT",0

TEST RXTST 62, -100, 4, 7, 0, 0, 0, 2, 6, 0.2, 0.41, 2.44, 6, 2

PRINT HEADER
PRINT
PRINT SUMMARY
PRINT "-------------------------------------------------------------------------"
PRINT
PRINT FOOTER
SUMMARY


END
```

TABLE OF CONTENTS

TABLES

INTRODUCTION

The 6113 Digital Radio Test Set can be remotely controlled via the GPIB interface.

This Section defines the commands that can be sent to the 6113 Test Set over the GPIB Interface, and the response messages that are returned. The formats for the parameters required to configure the Test Set and to perform tests on a BTS are defined, together with suggested typical values for the parameters. The messages comply with IEEE 488.2-1987 Standard Digital Interface for Programmable Instrumentation, "Standard Codes, Formats, Protocols, and Common Commands" (see Reference Document 1).

For detailed information on the structure and use of the GPIB Interface, the user is referred to this standard document. However, some further information and examples to assist programming are given at the end of this Section.

A design objective has been to ensure that the GPIB Command set for the 6113 Test Set is compatible (as far as possible) with the GPIB Command set for the 6111/6115 Test Set. Where there are differences, these have been minimised and are highlighted within this document.

Where an inconsistency occurs between a 6113 command and a 6111/6115 command for equivalent functions, then alias commands have been provided as appropriate.

This Section includes only those test details that are necessary for a comprehensive appreciation of operating procedures. For full details of each test and all parameters, refer to Section 4.

For further details see Reference Documents (1) and (2).

Reference Documents

(1) IEEE 488.2-1987 Standard Digital Interface for Programmable Instrumentation, "Standard Codes, Formats, Protocols, and Common Commands"

(2) IEEE 488.1 1987 Standard Digital Interface for Programmable Instrumentation.

IEEE 488.1 STANDARD FORMAT

Interface Function Subsets

The GPIB interface conforms to the following IEEE-488.1 defined 'interface function' subsets:

Subset	Function	Capability
SH1	Source Handshake	Complete
AH1	Acceptor Handshake	Complete
T5	Talker	Complete
L4	Listener	Complete
SR1	Service Request	Complete
RL1	Remote/Local	Complete
PP0	Parallel Poll	None
DC1	Device Clear	Complete
DT0	Device Trigger	None
C0	Controller	None
E1	Electrical Interface	Three-state bus drivers

The subsets are shown on the rear panel adjacent to the bus connector.

Interface Messages

The interface responds to the following IEEE 488.1 interface messages:

Message	Description	Action
GTL	Go To Local	Returns unit to Local State or Local With Lockout State depending on previous state
SDC	Selected Device Clear	Reset GPIB interface to idle state
DCL	Device Clear	Reset GPIB interface to idle state
LLO	Local Lock Out	Inhibit front panel 'return to local' operation

Allowed Primary Address Range

The Test Set allows the primary GPIB address to be set between 0 and 30 only.

Input Buffer

The input buffer length is 2700 bytes.

Query Responses

All query responses are generated when the associated query command has been parsed.

Power On Settings

At power on, the interface is configured as follows:

(1) The input and output buffers are cleared.

(2) All event registers are cleared (Note).

(3) All event enable registers, except for the standard and SRQ event enable registers, are cleared. The initialisation values of the standard event and SRQ registers depend upon the status of the **P**ower **o**n **S**tatus **C**lear flag. If this flag is reset then the contents of these registers are restored to the values last set using the *SRE and *ESE commands.

(4) The primary GPIB address is restored to the value set before the Test Set was powered down. If the area of non-volatile memory where this address is stored is found to be corrupted, then a default address of 20 is used.

Note: When the Test Set is ready to receive Device Dependent Commands an information message is placed in the INF message queue, which causes the OPR status bit in the Status Byte register to be set. At the same time, the PON bit in the Standard Event Status register is also set. Depending on how the interface was configured before power down, this may cause the ESB bit in the Status Byte register to be set.

Primary GPIB Address Setting

The primary GPIB address may be set in the range of 0 to 30. Changing the address causes the IEEE 488.1 Interface to be reset.

COMMON DEVICE COMMANDS AND QUERIES

The common device commands implemented are shown in the table below. The following paragraphs give further details of these commands and queries. For a definition of these commands and queries, refer to the IEEE 488.2 Specification.

Command Mnemonic	Description	Implemented
*ADD	Accept Address Command	No
*DLF	Disable Listener Function Command	No
*IDN?	Identification Query	Yes
*OPT?	Option Identification Query	No
*PUD	Protected user data Command	No
*PUD?	Protected user data Query	No
*RDT	Resource Description Transfer Command	No
*RDT?	Resource Description Transfer Query	No
*CAL?	Calibration Query	No
*LRN?	Learn Device setup Query	No
*RST	Reset Command	Yes
*TST?	Self Test Query	Yes
*OPC	Operation Complete Command	Yes
*OPC?	Operation Complete Query	Yes
*WAI	Wait To Complete Command	Yes
*DMC	Define Macro Command	No
*EMC	Enable Macro Command	No
*EMC?	Enable Macro Query	No
*GMC?	Get Macro Contents Query	No
*LMC?	Learn Macro Query	No
*PMC?	Purge Macro Command	No
*IST?	Individual Status Query	No
*PRE	Parallel Poll Register Enable Command	No
*PRE?	Parallel Poll Register Enable Query	No
*CLS	Clear Status Command	Yes
*ESE	Standard Event Status Enable Command	Yes
*ESE?	Standard Event Status Enable Query	Yes
*ESR?	Standard Event Status Register Query	Yes
*PSC	Power On Status Clear Command	Yes
*PSC?	Power On Status Clear Query	Yes
*SRE	Service Request Enable Command	Yes
*SRE?	Service Request Enable Query	Yes
*STB?	Read Status Byte Query	Yes
*DDT	Define Device Trigger Command	No
*DDT?	Define Device Trigger Query	No
*TRG	Trigger Command	No
*PCB	Pass Control Back Command	No
*RCL	Recall Command	No
*SAV	Save Command	No

Note: (1) No commands from the Auto Configure Group, Macro Group, Trigger Group or Stored Settings Group are supported.

(2) The 6113 Test Set implements the I/O buffer system described by IEEE-488.2 for a buffer length of 2700 bytes.

Common Device Commands

The IEEE 488.2 defined common device commands that can be sent to the 6113 Test Set are described in the following paragraphs.

***SRE** n — sets the **S**tatus **R**egister **E**nable register to n
where:
n = new mask value (byte), range: 0 to 255

Each bit set to 1 enables the corresponding bit in the Status Byte. Bit 6, however, cannot be masked. Power-on default depends on the power on Status Clear flag (see *PSC? and *PSC).

***ESE** n — sets the standard **E**vent **S**tatus **E**nable register to n
where:
n = new mask value (byte), range: 0 to 255

Each bit set to 1 enables the corresponding bit in the Standard Event register.

Power-on default depends on the Power on Status Clear flag (see *PSC? and *PSC).

***CLS** — **CL**ears the Test Set **S**tatus. This command clears:
- all status reporting registers
- all queues except the output queue
- the Operation Complete bit

Note: The Operation Complete bit will <u>not</u> be set by the completion of any commands that were being processed when the *CLS command was sent.

***PSC** — Sets the power-on status clear flag to true or false.

When this flag is set true the Standard Event Status Enable and the SRQ Event Enable registers are cleared on power-up, otherwise the registers are restored to their previous values.

***RST** — **ReSeT** to power-on state.

This command resets the Test Set settings to their power-on values.

***OPC** — causes the Test Set to generate the **OP**eration **C**omplete message in the Standard Event Status register when all pending operations have finished.

***WAI** — **WAI**t to continue.

This command prevents the Test Set from executing any further commands until any pending operations have been completed.

Common Device Queries

***IDN?** returns the IDeNtification string:
RACAL INSTRUMENTS LTD.,6113,SSSS,RR.VV
(Manufacturer, Model No., Serial No., Firmware Issue)

***PSC?** Returns the current status of the Power on Status Clear flag.

***STB?** returns the STatus Byte, range 0 to 255.

Bit 6 will be set if any other unmasked bit in the register becomes set. This byte is the same as that returned by a Serial Poll.

The significance of the bits in the Status Byte is as follows:

Bit		Function
0 (LSB)	ERR	Error Message available
1	EOT	End of Test Report available
2	OPR	Information Message available
3	SAV	Status Message available
4	MAV	Message available (set when the output queue is not empty)
5	ESB	Event Status bit (set when any unmasked bit in the Event Status register is set
6	SRQ	Instrument requests service (SRQ to Controller, cleared if polled, but not if read with *STB?)
7 (MSB)	GAV	Graph data available (set when any unmasked bit in the Graph Data Event register is set)

***ESR?** returns the Standard Event Status register, range 0 to 255. The significance of the bits in this byte is as follows:

Bit	Function
0 (LSB)	Operation Complete
1	Request Control - always 0
2	Query Error
3	Device Dependent Error
4	Execution Error
5	Command Error
6	User Request - always 0
7 (MSB)	Power On

***SRE?** returns the Status Register Enable register. Reads back the value set with *SRE.

***ESE?** returns the Standard Event Status Enable register. Reads back the value set with *ESE.

***TST?** This command initiates the Self-Check Burst Analysis (SCBA) test with the following parameters:

Parameter	Test Value
Self-Check Frequency	Lowest Frequency of the selected Radio System Band
Self-Check Slot	4
Test Pattern	1
Number of Bursts	10
Sample Time	10 s
Burst Number	0
FER Limit	0.000 %
Class Ib Limit	0.000 %
Class II Limit	0.000 %
Peak Phase Error Limit	20.00 deg
RMS Phase Error Limit	5.00 deg
Frequency Error Limit (+/-)	95.0 Hz
Power level Error Limit (+/-)	3.0 dB

An ASCII encoded number in the range of 0 to 31 is returned. The value of zero indicates the test PASSed, for any other value refer to the following bit field:

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	0	0	PWR	MOD	PULSE	PHFQ	BER

Where:

PWR	Power Level Measurement
MOD	Modulation Spectrum Measurement.
PULSE	Power Profile Measurement.
PHFQ	Phase Frequency Measurement.
BER	Bit Error Rate Measurement.

When a bit is set to '1', the associated measurement failed, when a bit is set to '0' the associated measurement passed.

Note: This command should not be used while the Operation Complete flag is not set.

***OPC?** returns an ASCII '1' when all pending **OP**erations have **C**ompleted.

OVERLAPPED COMMANDS

Commands that have a duration of greater than approximately 3 seconds are classified as Overlapped Commands rather than Sequential Commands. The Overlapped or Sequential classification of a GPIB command is specified under the description of such commands later in this document.

While an Overlapped Command is in progress, there are some restrictions on the use of other GPIB commands. This mainly occurs while an in-built test function is running, since tests cannot be run in parallel. The following table lists the GPIB commands that may be used safely while an Overlapped Command is in progress.

Command Mnemonic	Description
*IDN?	Identification Query
*RST	Reset Command
*OPC	Operation Complete Command
*OPC?	Operation Complete Query
*WAI	Wait To Complete Command
*CLS	Clear Status Command
*ESE	Standard Event Status Enable Command
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*PSC	Power On Status Clear Command
*PSC?	Power On Status Clear Query
*SRE	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query
PTMG?	Phase Trajectory Query
PPMG?	Power Profile Data Query
MSMG?	Modulation Spectrum Data Query
MBURST?	Recalls the Burst measurement results
MBER?	Recall the BER results
SCBURST?	Recalls the Self-Check Burst results
SCBER?	Recalls the Self-Check BER results
NTXLVL	Set the BTS Tx Power Level (Multimode Only)
NTPAT	Set the Test Pattern (Multimode Only)
NFOFF	Set the Frequency Offset (Multimode only)
NTADV	Set the Timing Advance (Multimode Only)
NTVAVG	Set the number of Video Averages (Multimode Only)
GSE	Graph available Event Enable Register Setting
GSE?	Graph available Event Event Register Query
TSGRH?	Graph available Event Register Query
TSSTA?	Status message Query
TSEOT?	End of Test message Query
TSINF?	Information message Query
TSERR?	Error message Query
ABORT	Stops the test in progress

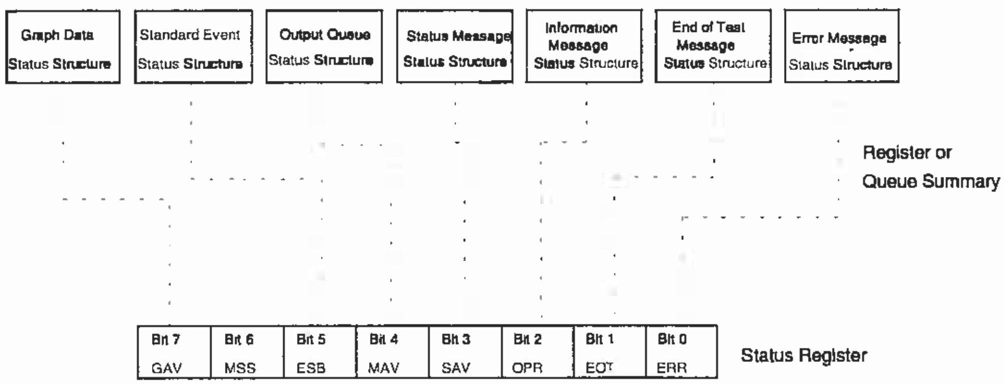
GPIB STATUS REPORTING

When the system GPIB Controller conducts a Serial Poll, the Test Set responds with the Status Byte as defined above. Bits in this register can be masked and unmasked with the Service Request Enable register. The current value of this register in turn can be queried with *SRE?. Bit 6 cannot be masked. If any of the enabled status bits are set, an SRQ will be generated.

Status Reporting Overview

The status byte, as returned by conducting a GPIB serial poll or by the '*STB?' query command, gives a summary of the status of all the event queues and registers contained within the relevant interface (i.e. GPIB or RS232). The operation of this status reporting structure follows that described in the IEEE 488.2 Specification (Reference Document (1)). For a description of the relevant message query commands and the returned message formats, see the heading DEVICE DEPENDENT QUERIES.

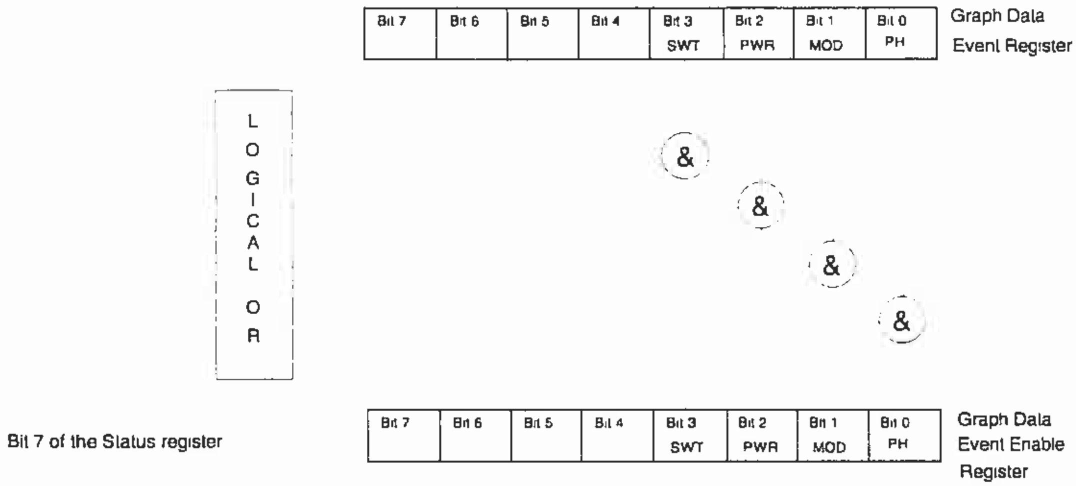
Overal Status Reporting Structure



Graph Data Status Structure Summary Bit GAV

This structure is based on the 488.2 register model and reports the availability of graph or measurement data. A bit set in the Graph Event register indicates that measurement data of the type associated with the set bit, is available and ready for reading. Reading the graph data with the relevant graph data query command will reset this bit in the register. If the data is left unread, the arrival of new measurement data of the same type overwrites the existing data, hence the graph data read is always the most recently generated data.

GAV Summary Status Bit Generation



Where: SWT represents the settling time measurement data.
PWR represents the Power Profile measurement data
MOD represents the Modulation Mask measurement data
PH represents the Phase Error measurement data.

Master Summary Bit MSS

This bit represents the logical OR of all the remaining bits in the Status Register when read by the '*STB?' command and is hence a **Master Summary Bit** of the status byte.

Note: When the Status register is read via a serial poll, the GPIB RQS message is returned in this bit position. See Reference Document (1).

Standard Event Status Structure

This represents the Standard Event Status register model as defined by the IEEE 488.2 specification. See Reference Document (1).

Output Queue Status Structure Summary Bit MAV

This represents the 488.2 defined output queue status. This bit is set when the output queue is not empty. See Reference Document (1).

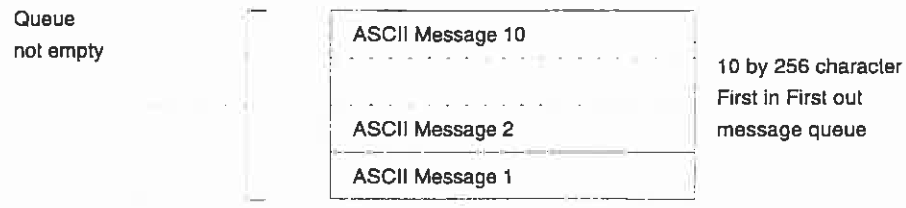
Status Message Status Structure SAV

This structure is based upon the 488.2 defined queue model, representing a queue of ASCII encoded messages. These messages fall into two types:

Call Manager Status messages
Interim Test Results messages.

The queue has been implemented as FIFO (first in / first out) queue, in which all incoming messages overflowing the queue are lost.

SAV Summary Bit Generation

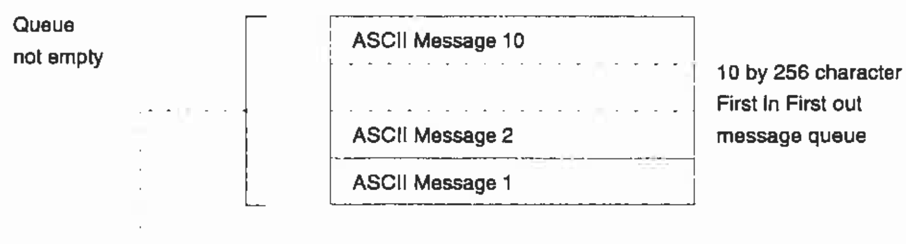


Bit 3 of the Status Register

Information Message Status Structure OPR

This is a structure based upon the 488.2 defined queue model, representing a queue of ASCII encoded operator information messages. The queue has been implemented as a FIFO queue, in which all incoming messages overflowing the queue are lost.

OPR Summary Bit Generation

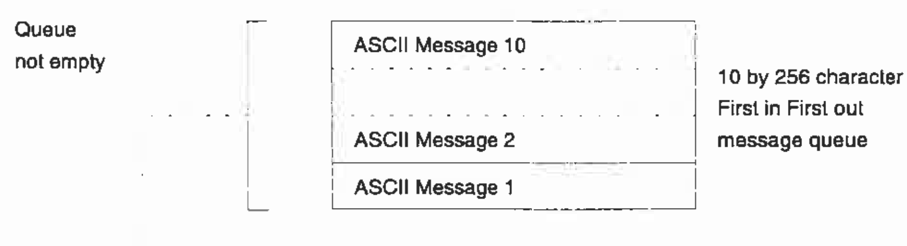


Bit 2 of the Status Register

End of Test Message Status Structure EOT

This is a structure based upon the 488.2 defined queue model, representing a queue of ASCII encoded operator information messages. The queue has been implemented as FIFO queue, in which all incoming messages overflowing the queue are lost.

EOT Summary Bit Generation

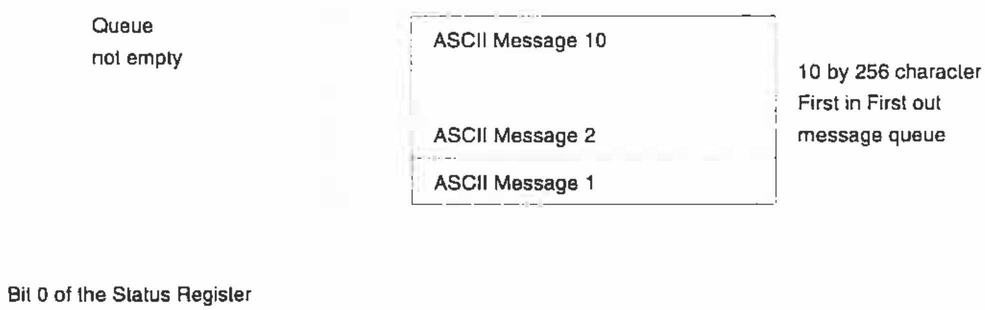


Bit 1 of the Status Register

Error Message Status Structure EER

This is a structure based upon the 488.2 defined queue model, representing a queue of ASCII encoded operator information messages. The queue has been implemented as FIFO queue, in which all incoming messages overflowing the queue are lost.

ERR Summary Bit Generation



DEVICE DEPENDENT COMMANDS

Test procedures and system functions are initiated by sending the commands defined below. A set of commands for setting Test Set related parameters and general GSM parameters are also defined. At the completion of each test, a message which indicates the result of the test is available (signalled by the EOT bit in the Status Byte). This message always starts with the same mnemonic as the test command. All commands implemented by the Test Set are sequential in operation.

Summary of Device Dependent Commands

The following table lists the commands and queries that are available. Note that 'alias' commands have been included to provide compatibility with the 6111 Test Set, and these commands are grouped with their associated commands. Detailed descriptions of the parameters for each command are provided in subsequent paragraphs.

General System Operation Commands

ABORT	Abort Test
BTEST	alias for ABORT. (For compatibility with the 6111 Test Set).
TIMOP	Timing Output control
TIMO	alias for TIMOP. (For compatibility with the 6111 Test Set).
GSE	Graph Available Event Enable Register Set Command
REFSTD	Reference Frequency Standard Source Select.

Global Parameter Configuration Commands

DBSIC	Set the Base Station Control Channel Identification parameters
DCCHP	alias for DBSIC. (For compatibility with the 6111 Test Set).
GSMCECD	Set E-GSM 900 Cell Channel Description parameters
DCECD	alias for GSMCECD. (For compatibility with the 6111 Test Set).
PCSCECD	Set PCS 1900 Cell Channel Description parameters
DCSCECD	Set DCS 1800 Cell Channel Description parameters
DPCECD	alias for DCSCECD. (For compatibility with the 6111 Test Set).
GSMNCED	Set E-GSM 900 Neighbour Cell Description parameters
DNCED	alias for GSMNCED. (For compatibility with the 6111 Test Set).
PCSNCED	Set PCS 1900 Neighbour Cell Description parameters
DCSNCED	Set DCS 1800 Neighbour Cell Description parameters
DPNCED	alias for DCSNCED. (For compatibility with the 6111 Test Set).
ABISIMP	Set the Abis I/O Impedance
BTSCODE	Define the pathname for the BTS download code.
BTSTYPE	Define the BTS Manufacturer, Model and Software

CLRMAP	Clear the Transceiver Mapping Table
DCOCD	Set Control Channel Description parameters
DCOPT	Set Cell Options parameters
DCSPS	Set Cell Selection parameters
DENCP	Set Encryption parameters
DLAID	Set Location Area Identification parameters
DRACH	Set RACH Control parameters
EMAP	Map the Transceiver to TEI and A-bis slots
EMAPBCF	Map the BCF to TEI and A-bis slot
LEVOS	Set Tx / Rx Level Offsets
PORTYPE	Set the BTS / BSC Interface (A-bis or V11)
RADIOSYS	Set the Radio System
RFCONN	Set the RF connection type (Simplex or Duplex)
TRFCFG	Set A-bis Settings

File Commands

FOPEN	Opens a DOS formatted disk file for either read only access or write only access.
FWRITE	Writes a block of data to a disk file previously opened for write access with the command FOPEN.
FCLOSE	Closes a disk file previously opened with the command FOPEN.

Single Tests Commands

Functional Tests

RSTBTS	Reset BTS (see Section 7 for BTS-specific parameter lists)
CHNGTRX	Change TRX (see Section 7 for BTS-specific parameter lists)
CNFGBTS	Configure BTS (see Section 7 for BTS-specific parameter lists)
LINKTST	A-bis Link Test (see Section 7 for BTS-specific parameter lists).
ELEST	alias for LINKTST. (For compatibility with the 6111 Test Set).

Transmitter Tests

CCCG	Cell Control Channel Generation
TXTST	Transmitter Test
TXL	Transmitter BER
SPWRL	Static Power Control
DPWRL	Downlink Power Control

Receiver Tests

RXL	Receiver BER including compliance sensitivity
CSENS	alias for RXL. (For compatibility with the 6111 Test Set).
SENS	Absolute Sensitivity
CRACH	RACH Test
RXLEV	Received Signal Level
RXQUAL	Received Signal Quality

Special Tests

MULTMODE	Multimode

Built-in Self Tests

SCBA	Self-Check Burst Analysis - including BER
BSCBA	RF Tests Self Check Burst Analysis - including BER

Remote / Local Operation

When the GPIB interface is put into the Remote state (as defined in Reference Document 1), the 6113 Test Set automatically enters the Remote mode of operation and will respond to all subsequent messages.

When the 6113 Test Set is in the Remote mode, the central area of the LCD display is blank except for a softkey labelled 'Local'.

If a Local Lockout message has not been sent to the GPIB interface, pressing the 'Local' softkey will return the Test Set to the Local state and restore the Main Menu display, thus enabling local operation using the MMI controls.

Radio System Channel Number Ranges

The Channel Number (ARFCN, Absolute Radio Frequency Channel Number) is dependent upon the selected radio system as follows:

Band	Channel Number Range
GSM 900	1 to 124
E-GSM 900	0 to 124 and 975 to 1023
DCS 1800	512 to 885
PCS 1900	512 to 810

Cell Table Representation

Some of the following GPIB commands require a cell description table as one or more of the command parameters. These tables are input as a binary bit stream expressed in Hex, using the 488.2 non-decimal numeric program data format. The Cell Table parameter is specified in Hex ASCII format and must be in multiples of 8 digits (32 bits).

For the GSM 900 Band, the Cell Table is encoded as 32 hex ASCII digits such that the LSB is bit 0. Thus:

Bit 0 represents Channel Number 1
Bit 123 represents Channel Number 124.

All bit positions more significant than 123 are ignored.

Lowest Range Value	Highest Range Value
#H00000000000000000000000000000000	#HFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

For the E-GSM 900 Band, the Cell Table is encoded as 48 hex ASCII digits such that the LSB is bit 0. Thus:

Bit 0 represents Channel Number 0
Bit 124 represents Channel Number 124
Bit 125 represents Channel Number 975
Bit 171 represents Channel Number 1023

All bit positions more significant than 171 are ignored.

Lowest Range Value	Highest Range Value
#H0000000000000000000000000000000000 000000000	#HFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF FFFFFFFFFFFF

For the DCS 1800 Band, the Cell Table is encoded as 96 hex ASCII digits such that the LSB is bit 0. Thus:

Bit 0 represents Channel Number 512
Bit 373 represents Channel Number 885

All bit positions more significant than 373 are ignored.

Lowest Range Value	Highest Range Value
#H0000000000000000000000000000000000 0000000000000000000000000000000000000 000000000000000000000000	#HFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

For the PCS 1900 Band, the Cell Table is encoded as 80 hex ASCII digits such that the LSB is bit 0. Thus:

Bit 0 represents Channel Number 512
Bit 298 represents Channel Number 810.

All bit positions more significant than 298 are ignored.

Lowest Range Value	Highest Range Value
#H000000000000000000000000000000000 000000000000000000000000000000000000 00000000	#HFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF FFFFFFFFFFF

DEVICE DEPENDENT QUERIES

This section defines the syntax of the Device Dependent Queries that the 6113 Test Set supports. The default parameter values defined are the power-on values for those parameters.

Summary of Device Dependent Queries

During the execution of a test, the Test Set will at times generate one or more of four message types and one or more of four sets of graph data. Both the messages and graph data may be read over the GPIB, the availability of each being indicated by summary bits in the Status Byte Register. The summary bit for the graph data covers four basic graph types (see the heading Status Reporting Overview) and hence the Graph Data Event register should first be read to check that the expected graph data is ready. When the graph data is indicated ready, the data can be read by using one of four query commands. The queries for the four message types are:

Query	Response	488.2 Status Structure	Available
TSERR?	Error Message	Queue Model	When ERR bit set
TSEOT?	End of Test Report	Queue Model	When EOT bit set
TSINF?	Information Message	Queue Model	When OPR bit set
TSSTA?	Status Message (Note)	Queue Model	When SAV bit set

Note: TSSTA? is supported only by the SCBA command.

The queries for the graph data event register and data are:

Query	Response	Available
TSGRH?	Graph Available Event Register	At any time.
PPMG?	Power Profile measurement data	When PWR bit set in the Graph Event register.
PTMG?	Phase Trajectory measurement data	When PH bit set in the Graph Event register.
MSMG?	Modulation Spectrum measurement data	When MOD bit set in the Graph Event register.

Note: These queries are supported only by the SCBA command.

The queries for obtaining file information are:

Query	Response	Available
FREAD?	Recalls data stored in files	When file is opened by FOPEN
FSIZE?	Recalls file size	Anytime

Other general queries are:

Query	Response	Available
SCBURST?	Returns the burst measurement results	Anytime (Note)
SCBER?	Returns the BER results	Anytime (Note)

Note: SCBURST? and SCBER? queries are supported only by the SCBA command.

General System Operation Queries

This section defines the response to the following query messages that is returned by the Test Set (to the GPIB Controller) :

Query	Response
TSERR?	**TSERR** severity, error_code, processor' Recalls **T**est **S**et **ERR**or messages (available when Bit 0 of the Status Byte is set)

where:

Severity	Meaning
0	NONE
1	WARNING
2	SEVERE ERROR
3	SYSTEM FAILURE

Error Code	Meaning
0	No error
1	BIST command not acknowledged by BBP (Racal Instruments only)
2	Test already in progress (Racal Instruments only)
3	Serial EEPROM verify error (Racal Instruments only)
4	Hardware cannot support option
5	Tx phase code not saved. (Racal Instruments only)
6	Synthesiser Calibration factors not saved (Racal Instruments only)
7	IQ calibration factors not saved (Racal Instruments only)
8	Invalid directory path
9	No memory card present
10	Disk file not open
11	Disk write error
12	File handle already in use
13	Card is write protected.
14	File not present

Processor	Meaning
1	MAIN
2	BBP
3	A-bis

Query	Response
TSEOT?	**TSEOT** result_code [, test-specific measurements]'

This query is used to obtain the result of the test, including the results from the built in self tests. The response for each of the tests is detailed after the test command itself. End Of Test messages are available when Bit 1 of the Status Byte is set.

Error Code	Meaning
0	Pass
Non-zero	See Table 6.1

TSINF?

TSINF inf_type, inf_code, "information string"'
Recalls **T**est **S**et **INF**ormation messages (available when Bit 2 of the Status Byte is set)

where:

inf_type : 1 - Power-up message

Inf. Code		Information String
1	Power-up Message	Power-up Complete

inf_type : 2 - Operator Message

Inf. Code	Information String
TBD	TBD

inf_type : 3 - BTS Software Download required

Inf. Code	Information String
TBD	TBD

inf_type : 4 - BTS Code versions

Inf. Code
(See Section 7)

inf_type : 5 - BTS Specific Reports

Inf. Code
(See Section 7)

TSSTA?

<response header> parameter[, parameter2[,.....]]'

This query is supported only by the SCBA command.

Recalls **T**est **S**et **STA**tus messages (available when Bit 3 of the Status Byte is set). Tests that return interim result messages will generate TSINT:aaaaa results messages, where the mnemonic 'aaaaa' uniquely identifies the type of status or interim result message being returned by the Test Set.

Query	Response
PTMG?	#0<294 *phase_error_sample><END>

This query is supported only by the SCBA command.

Recalls the Phase Trajectory Measurement Graph data. The response is sent in the indefinite form of the arbitrary block program data format, which thus requires the <END> terminator.

Where:

phase_error_sample	Measured phase error * 182 / deg (signed 2 byte integer)
<END>	The IEEE 488.2 defined terminator (LF & EOI).

Each of these data items is scaled by a factor of 182 to avoid non-integer results. Two samples per bit are taken for the useful part of the burst (of 147 bits), hence there are 294 samples returned.

PPMG? #0<1020 * power_sample><END>

This query is supported only by the SCBA command.

Recalls the Power Profile Measurement Graph data (available after the Power Profile and Self-Check Burst Analysis tests). This data allows the Controller to plot a graph of the profile of the received burst. The response is sent in the indefinite form of the arbitrary block program data format, which thus requires the <END> terminator.

Where:

power_sample	Measured relative power * 256/dB (signed 2 byte integer).

Power is measured relative to the mean power in the useful part of the burst, i.e over the 147 bits of the measurement slot.

<END>	The IEEE 488.2 defined terminator (LF & EOI).

There are 1020 samples taken when analysing each burst, i.e. 170 bits with 6 samples per bit. (11 bits before the burst, 147 bits during the useful part of the burst, and 12 bits after the burst). To convert the sample data to units of dB, simply divide the data by 256.

Query	Response
MSMG?	#0<201 *power_sample><END>

In Software Release version 01.06, this query is supported only by the SCBA command.

Recalls the **M**odulation **S**pectrum **M**easurement **G**raph data obtained in the MODSP test. The response is sent in the indefinite form of the arbitrary block program data format, which thus requires the <END> terminator.

Where:

power_sample
Measured power * 256/dBm (signed 2 byte integer)

There are 201 frequency samples taken, i.e. 100 equidistant frequency samples either side of a centre frequency that corresponds to the data point or sample number 101. Each sample represents a power level in dBm scaled by 256 to avoid non-integer results. On the frequency axis, each sample is separated by 1.3/256 MHz. This gives an approximate frequency span from the centre frequency of ±507 kHz.

GSE? **GR**ap**H** event **E**nable register contents in the range of 0 to 15

Bit		Mnemonic	Function
0	LSB	PH	Phase Error measurement data available
1		MOD	Modulation Spectrum Measurement data available
2		PWR	Power Profile Measurement data available
3		SWT	Switching Speed or settine time measurement data available
4		-	Always zero
5		-	Always zero
6		-	Always zero
7		-	Always zero

FREAD? Returns : <zero to 2048 bytes>

This command reads a block of data from a disk file that has been previously opened for read access by the command FOPEN. The returned data block is formatted using the 488.2 defined 'definite length arbitrary block program data format' and will contain up to 2048 file data bytes. Any number of these commands may be used sequentially to transfer the contents of a file, with the last available data block containing 0 to 2047 bytes. The response to any further FREAD? query requests will be a zero length data block, i.e. #10. When the file transfer is complete the FCLOSE command must be sent to release the internal file handle.

Example:

For a file named 'EXAMPLE.TXT', containing the characters 'FILE DATA':

(command)	FOPEN "R", "A:\EXAMPLE.TXT"
(query)	FREAD?
(response)	#19FILE DATA
(query)	FREAD?
(response)	#10
(command)	FCLOSE

Query **Response**

FSIZE? "file spec" Returnsthe length in bytes of the specified disk file. If the file does not exist a value of minus one (-1) is returned.

Parameter		**Default**	**Range**
File specification	file spec	N/A	A complete drive, directory path and file name description in a DOS format. If the drive ID is omitted, the drive will default to the first valid drive found starting from drive A.

SCBURST? <frequency>,
<min freq error>, min rms phase error>, <min peak phase error>,
<max freq error>, max rms phase error>, <max peak phase error>,
<mean freq error>, mean rms phase error>,
<mean peak phase error>, <power level> <END>

Used during the **S**elf **C**heck **BURST** Analysis Test, this query returns the results of the most recent burst measurement.

Where:

Frequency is the TX_LO frequency at the time of the measurement.
Frequency error results are in Hz.
Power level is in dB.
Peak and rms phase error results are in degrees.

SCBER? <frequency>,
<fer samples>, <fer events>, <class Ib samples>, <class Ib events>,
<class II samples>, <class II events> <END>

Used during the **S**elf **C**heck Burst Analysis Test, this query returns the results of the most recent **BER** test.

Where:
Frequency is the TX_LO frequency at the time of the measurement.
Samples and events are numbers in the range 0 to 20,000,000.

GENERAL SYSTEM OPERATION COMMANDS

ABORT — **ABORT**s the current test procedure. Termination of the test is confirmed when the Operation Complete flag is set true.
The test PASS/FAIL code will indicate test aborted and any results returned will be undefined.

GSE n — Sets the **Graph Event** enable register to n

Parameter		Typical Value	Range
n	New Mask Value (byte)	0	0 to 15

Each bit set to 1 enables the corresponding bit in the Graph Available Event register. See heading - General System Operation Queries for the companion command GSE? and the bit definitions.

Note: This register is cleared on power-up.

REFSTD frs — Select the **RE**ference Frequency **ST**andar**D** source.
(This command is not available in the 6111 Test Set GPIB Commands).

Parameter		Typical Value	Range
frs	Frequency Reference Standard	0	0 = 10 MHz 1 = 13 MHz

TIMOP op, st_slot, st_bit, st_fract_bit, sp_slot, sp_bit, sp_fract_bit
Select the **TIM**ing **O**ut**P**ut control.
(All parameters are different to the 6111 GPIB Command : TIMO).

Parameter		Typical Value	Range
op	Timing Output	0	0 = Off (Low) 1 = Off (High) 2 = Programmable 3 = 13 MHz
st_slot	Start Slot	0	0 to 7
st_bit	Bit in start slot	0	0 to 156
st_fract_bit	1/16 of a bit in start slot	0	0 to 15
sp_slot	Stop Slot	0	0 to 7
sp_bit	Bit in stop slot	0	0 to 156
sp_fract_bit	1/16 of a bit in stop slot	0	0 to 15

6111 Test Set Compatibility Commands

The following General System Operation commands are included for 6111 Test Set compatibility purposes only.

BTEST — **AB**ort the current **TEST** procedure.
For new test sequences use the command ABORT.

TIMO op, st_slot, st_bit, st_fract_bit, sp_slot, sp_bit, sp_fract_bit

Select the **TIM**ing **O**utput control.

Parameters are as for the 6113 Test Set command TIMOP. For new test sequences use TIMOP.

GLOBAL PARAMETER CONFIGURATION COMMANDS

The following commands are used to establish the system configuration.

BTSTYPE "mnf", "mdl", "sw"

Sends the **BTS TYPE** information to the Test Set.

The parameters are strings and must be enclosed in double quotes. All three parameters must be sent by the GPIB command, regardless of the fact that they may not all be supported. Set the unsupported types as "Not Set".

Note: The parameter strings are not case sensitive.

Parameter		Default Value	Range
mnf	BTS Manufacturer	"Not Set"	See Section 7
mdl	BTS Model	"Not Set"	See Section 7
sw	BTS Software	"Not Set"	See Section 7

(The "sw" parameter has been added to this command and the valid options for the other two parameters have also changed from the 6111 GPIB Command BTSTYPE. See parameter ranges listed in Section 7 BTS-Specific Information).

BTSCODE <full pathname>

Sets the full pathname (drive:\directory) for downloading BTS binary code files from the PC card to the BTS. The full pathname (limited to 80 characters) must end with a backslash (\), e.g. B:\BTSCODE\. This command must be issued <u>after</u> the BTSTYPE command.

DBSIC ncc, bscc

SenDs the **B**ase **S**tation **C**ontrol Channel **I**dentification Parameters to the Test Set.
(This command is identical to the 6111 Test Set GPIB Command DCCHP).

Parameter		Typical Value	Range
ncc	Network Colour Code	0	0 to 7
bscc	Base Station Colour Code	0	0 to 7

DCOCD att, bsag, conf, mfrms, t3212

SenDs the **CO**ntrol **C**hannel **D**escription Parameters to the Test Set.

Parameter		Typical Value	Range
att	IMSI Attach-Detach Allowed	1	0, 1
bsag	Blocks Reserved for Access Grant	0	0 to 7
conf	CCCH Configuration (04.08 defined bits)	1	0, 1, 2, 4, 6
mfrms	Multiframes Between Paging Requests	2	2 to 9
t3212	T3212 Timeout Value	0	0 to 255

GSMCECD can, cat

(E-GSM 900 Radio System Only)
Sends the E-**GSM** 900 **CE**ll **C**hannel **D**escription Parameters to the Test Set.

Parameter		Default Value	Range
can	Cell Allocation Number	0	Fixed
cat	Cell Allocation Table	Active Cells: 6, 16, 26, 36, 46, 56, 66, 76, 86, 96, 106, 116	Cells: 0 to 124 and 975 to 1023 (See heading: Cell Table Representation)

DCSCECD fid, ocn, cat

(DCS 1800 Radio System Only)
Sends the **DCS** 1800 **CE**ll **C**hannel **D**escription Parameters to the Test Set.
(This command is identical to the 6111 Test Set GPIB Command DPCECD but the name change is consistent with the PCS1900 variant of this command).

Parameter (DCS 1800)		Default Value	Range
fid	Format ID	23	23 = Variable
ocn	Origin Channel Number	513	512 to 885
cat	Cell Allocation Table	Active Cells: 516, 526, 536, 546, 556, 566, 576, 586, 596, 606, 612, 622, 632	Cells = 512 to 885 (See heading: Cell Table Representation)

PCSCECD fid, ocn, cat

(PCS 1900 Radio System Only)
Sends the **PCS** 1900 **CE**ll **C**hannel **D**escription Parameters to the Test Set.

Parameter (PCS 1900)		Default Value	Range
fid	Format ID	23	23 : Variable
ocn	Origin Channel Number	513	512 to 810
cat	Cell Allocation Table	Active Cells: 516, 526, 536, 546, 556, 566, 576, 586, 596, 606, 612, 622, 632	Cells: 512 to 810 (See heading: Cell Table Representation)

DCOPT pwrc, dtx, rtmo

SenDs the **Cell OPT**ions to the Test set.

Parameter		**Default Value**	**Range**
pwrc	Power Control Indicator	0	0, 1
dtx	DTX Indicator	2	0 to 2
rtmo	Radio Link Timeout T100 (SACCH Blocks)	8	4 to 64 in steps of 4

GSMNCED ban, baind, nct

(E-GSM 900 Radio System only)
Sends the E-**GSM** 900 **N**eighbour **CE**ll **D**escription parameters to the Test Set.

Parameter (GSM 900)		**Default Value**	**Range**
ban	BCCH Allocation Number	0	Fixed at 0
baind	BCCH Allocation Sequence Number	0	0, 1
nct	Neighbour Cell Table	Active Cells: 10, 20, 80, 100, 110, 120	Cells: 0 to 124 and 975 to 1023 (See heading: Cell Table Representation)

DCSNCED fid1, ocn1, fid2, ocn2, nct

(DCS 1800 Radio System Only)
Sends the **DCS** 1800 **N**eighbour **CE**ll **D**escription parameters to the Test Set.

(This command is identical to the 6111 GPIB Command DPNCED).

Parameter (DCS 1800)		**Default Value**	**Range**
fid1	Format ID #1	23	23 = Variable
ocn1	Origin Channel Number #1	513	512 to 885
fid2	Format ID #2	255	23 = Variable 255 = Unused
ocn2	Origin Channel Number #2	513	512 to 885
nct	Neighbour Cell Table	Active Cells: 513	Cells: 512 to 885 (See heading: Cell Table Representation)

PCSNCED fid1, ocn1, fid2, ocn2, nct

(PCS 1900 Radio System Only)
Sends the **PCS** 1900 Neighbour **CE**ll **D**escription parameters to the Test Set.

Parameter (PCS 1900)		Default Value	Range
fid1	Format ID #1	23	23 = Variable
ocn1	Origin Channel Number #1	513	512 to 810
fid2	Format ID #2	255	23 = Variable 255 = Unused
ocn2	Origin Channel Number #2	513	512 to 810
nct	Neighbour Cell Table	Active Cells: 513	Cells: 512 to 810 (See heading: Cell Table Representation)

DRACH mr, txs, cb, re, plmnp, ci

SenDs the **RACH** Control parameters to the Test Set.

Parameter		Default Value	Range
mr	Maximum Retransmissions	2	1, 2, 4, 7
txs	Tx Spread Integer	5	3 to 12, 14, 16, 20, 25, 32, 50
cb	Cell Barred	0	0, 1
re	Call Re-Establish	1	0, 1
plmnp	PLMN Permitted	255	0 to 255
ci	Cell Identity Value	1	0 to 65535

DLAID accn, mcc, mnc, lac

SenDs the Location **A**rea **ID**entification parameters to the Test Set.

Parameter		Default Value	Range
accn	Access Control Class	0	0 to 65535
mcc	Mobile Country Code	1	0 to 999
mnc	Mobile Network Code	1	0 to 99
lac	Location Area Code	1	0 to 65535

DCSPS crh, mpcch, mpacc

SenDs the **C**ell **S**election **P**arameter**S** to the Test Set.

Parameter		Default Value	Range
crh	Cell Reselect Hysterisis	12	0, 2, 4, 6, 8, 10, 12, 14
mpcch	Max Mobile Tx Power Level	15	0 to 31
mpacc	Min Mobile Rx Signal Level	0	0 to 63

DENCP kc

SenDs the **ENC**ryption **P**arameters to the Test Set.

Parameter		**Default Value**	**Range**
kc	Encryption Kc	#HFFFFFFFF FFFFFC00	Any 16 digit Hex Number.

RADIOSYS radsys

Select the **RADIO SYS**tem.
(This command not available in the 6111 Test Set GPIB Commands).

Parameter		**Default Value**	**Range**
radsys	Radio System	0	0 = E-GSM 900 2 = DCS 1800 3 = PCS 1900

TRFCFG crc4, slot0, t1ff

Sends the **TR**a**F**fic **C**on**F**i**G**uration parameters for the Abis Link.

(The t1ff parameter has been added to the 6111 GPIB Command TRFCFG parameters).

Parameter		**Default Value**	**Range**
crc4	CRC 4 Bit	0	0 : Off 1 : On
slot0	Slot 0 Bits 3 to 8	31	0 to 63
t1ff	T1 Frame Format	0	If T1 Option is fitted: 0 = ESF 1 = D3/D4

Note: t1ff parameter is not used if E1 Option is fitted, but must be supplied as part of the command.

EMAPBCF bcf_tei, bcf_slot, sub_slot

Sends th**E** **MAP**ping parameters for the **BCF** to the Test Set.
See also CLRMAP command.

Parameter		**Default Value**	**Range**
bcf_tei	BCF TEI	BTS specific (Note)	0 to 127
bcf_slot	BCF Sig Slot	BTS specific (Note)	0 to 31
sub_slot	BCF Sub Slot	BTS specific (Note)	16 kbit/s Signalling : 0 to 3 64 kbit/s Signalling : -1

Note: See Section 7 Manufacturer-Specific Information.

EMAP trx, cell, tei, sig_slot, sub_slot, tch_slot1, tch_slot2, arfcn

Sends th**E** transceiver **MAP**ping parameters to the Test Set.
See also CLRMAP command

(The Channel Number parameter has been added to the 6111 Test Set GPIB Command EMAP parameters.

Parameter		**Default Value**	**Range**
Tranceiver Identifier	trx	BTS specific (Note)	0 to 127
Cell Number	cell	BTS specific (Note)	0 to 127
TEI	tei	BTS specific (Note)	0 to 127
Signal Slot	sig_slot	BTS specific (Note)	0 to 31
Sub Slot	sub_slot	BTS specific (Note)	16 kbit/s Signalling : 0 to 3 64 kbit/s Signalling : -1
Traffic Channel Slot 1	tch_slot1	BTS specific (Note)	0 to 31
Traffic Channel Slot 2	tch_slot2	BTS specific (Note)	0 to 31
Channel Number	arfcn	BTS specific (Note)	(See heading Radio System Channel Number Ranges)

Note: See Section 7 Manufacturer-Specific Information.

CLRMAP (no parameters)

CLeaRs the whole **MAP**ping table.

This command must <u>always</u> be sent before the start of any mapping information, i.e. before EMAP or EMAPBCF commands.

PORTYPE port

Select the A-bis Interface **PORT TYPE**.

Parameter		**Default Value**	**Range**
port	Port Type	1	0 = V11 1 = A-bis

ABISIMP ohm

Select the **AbIs** Input / Output **IMP**edance.

(This command is not available in the 6111 Test Set GPIB Commands).

Parameter		**Default Value**	**Range**
ohm	I/O Impedance	0	0 = Unbalanced (Note 1, 2, 3, 4) 1 = Balanced (Note 1, 2, 3, 4)

Note: (1) Unbalanced selects the BNC co-ax connectors on the front panel. Balanced selects the 3-pin in-line connectors on the front panel.

(2) If the E1 board is fitted in the Test Set then:
unbalanced is 75 Ohm and Balanced is 120 Ohm.

(3) If the T1 board is fitted in the Test Set then:
both Unbalanced and Balanced are 100 Ohm.

LEVOS offsets, txoff, rxoff

Select the BTS Rx / Tx **OffSet** option and **LEV**els.

Parameter		**Default Value**	**Range**
offsets	Level Offsets	0	0 = Off 1 = On
txoff	BTS Transmit Offset	0.00	-99.99 to +99.99 dB
rxoff	BTS Receive Offset	0.00	-99.99 to +99.99 dB

RFCONN conn

Select the **RF CONN**ection type.

(This command is not available in the 6111 Test Set GPIB Commands).

Parameter		**Default Value**	**Range**
conn	RF Connection Type	3	2 = Duplex 3 = Simplex

6111 Test Set Compatibility Commands

The following Parameter Configuration commands are included for 6111 compatibility purposes only.

DCCHP ncc, bscc

SenDs the Base Station Control CHannel Identification Parameters to the Test Set.

Parameters are the same as for the command **DBSIC**. For new test sequences use the DBSIC command.

DCECD can, cat

(GSM 900 Radio System only)
SenDs the GSM 900 CEll Channel Description Parameters to the Test Set.

Parameters are the same as for the command **GSMCECD**. For new test sequences use the GSMCECD command.

DPCECD fid, ocn, cat

(DCS 1800 Radio System only)
Sends the DCS 1800 CEll Channel Description Parameters to the Test Set.

Parameters are the same as for the command **DCSCECD**. For new test sequences use the DCSCECD command.

DNCED ban, baind, nct

(GSM 900 Radio System only)
SenDs the GSM 900 Neighbour CEll Description parameters to the Test set.

Parameters are the same as for the command **GSMNCED**. For new test sequences use the GSMNCED command.

DPNCED fid1, ocn1, fid2, ocn2, nct

(DCS 1800 Radio System only)
Sends the DCS 1800 Neighbour Cell Description parameters to the Test set.

Parameters are the same as for the command **DCSNCED**. For new test sequences use the DCSNCED command.

FILE COMMANDS

The following commands are used to open DOS formatted disk files and either write data to them or read data from them.

FOPEN "mode", "file spec"

Parameter		Typical Value	Range	
Read or write access mode	mode	N/A	R :	Read only access
			W :	Write only access
File specification	file spec	N/A	A complete drive, directory path and file name description in a DOS format. If the drive ID is omitted, the drive will default to the first valid drive found starting from drive A.	

The FOPEN command opens a DOS formatted disk file for either read only access or write only access. The command will always position an internal file pointer to point to the start of the given file; therefore, when specifying a write only file, any existing file having the same file specification will be overwritten. Once successfully opened this file may be written to using successive FWRITE commands, or read from using successive FREAD? queries. On completion of the file transfer the disk file should be closed using the FCLOSE command.

Note: Only one file may be open at any given time, irrespective of the access mode. A file can only be opened once at a time (i.e. no second copy made).

FWRITE #<arbitrary block program data>

Parameter		Typical Value	Range
File data	arbitrary block program data	N/A	1 to 2048 bytes, formatted using the definite or indefinite form of the 488.2 defined arbitrary block program block format. E.g. to send "FILE DATA" in definite form use: FDAT #19FILE DATA

This command writes a block of data to a disk file previously opened for write access with the command FOPEN. The block of data is contained within a single parameter, encoded using the 488.2 defined arbitrary block program data format. The maximum number of bytes that may be transferred using a single FWRITE command message is 2048 bytes; if the length of the file to be transferred is greater than this then successive FWRITE commands must be used, ensuring that the data blocks are sent sequentially.

All data transferred to a disk file is buffered in an internal 20 kbyte buffer. At the completion of the file transfer it is important to ensure that the contents of this buffer are flushed using the FCLOSE command before removing the disk from the card slot.

FCLOSE

This command closes a disk file previously opened with the GPIB command FOPEN. If the file was opened for write access, the contents of all internal buffers will be flushed to the disk file.

TEST COMMANDS AND PARAMETERS

This section defines the format of the GPIB commands used to initiate each of the tests provided by the 6113 Test Set, and also the format of the GPIB messages available during, and returned at the end of, each test process.

Note that when a test command is used, all associated parameters must be entered with the command. Consequently no Default values are provided in the test programs, but Typical Values are given in the following test command descriptions and these may be used as required.

Each test described uses a common set of Error Codes. These Error Codes are given in Table 6.1 below.

TABLE 6.1 Test Procedure Error Codes

Common GPIB Error Messages

1	Locking to Cell Control Channel
2	Activating Traffic Channel
3	Starting Test
4	Synchronised to Cell Control Channel
5	Checking System Information Messages
6	System Information Messages Correct
7	Establishing RF Link
8	RF Link Established
9	Releasing RF Link
10	RF Link Released
11	Sending A-bis Cypher Mode Command
12	RF Cypher Mode Command Received
13	Sending RF Cypher Mode Complete
14	A-bis Cypher Mode Complete Received
15	BTS ready to be tested
16	Test complete
17	Error reported during BTS configuration
18	Searching for power
19	Sending access request on RACH
20	Waiting for channel required from BTS
21	Time advance indicates moving away from BTS
22	Time advance indicates moving towards from BTS
23	Waiting for new time advance command from BTS
24	Waiting for spurious RACHs
25	Press 'Abort' to continue
26	Establishing link
27	Link established
28	Disconnecting link
29	Link disconnected

Universal BTS Related GPIB Error Messages

900	Establishing A-bis RSL link to TRX
901	A-bis RSL link to TRX established

Common EOT Messages

1	FAIL - Cannot map TCH TRX
2	FAIL - Cannot map CCH TRX
3	FAIL - System information frames not received
4	FAIL - System information frames not correct
5	FAIL - BER test limits exceeded
6	FAIL - Power profile limits exceeded
7	FAIL - RF in wrong state to send measurement report
8	FAIL - RF in wrong state to establish link
9	FAIL - RF in wrong state to release link
10	FAIL - Failed to establish RF link
11	FAIL - Failed to release RF link
12	FAIL - Receiver BER test failed
13	FAIL - Failed to establish A-bis link
14	FAIL - Failed to release A-bis link
15	FAIL - BTS failed to activate traffic channel
16	FAIL - Test aborted
17	FAIL - Incorrect BSIC received in SCH burst
18	FAIL - Timeout waiting for SCH burst
19	FAIL - No link established on TEI
20	FAIL - No CES is available to establish
21	FAIL - Phase trajectory limits exceeded
22	FAIL - Modulation spectrum limits exceeded
23	FAIL - Power level steps limits exceeded
24	Test Complete
25	FAIL - A-bis link to BCF failed
26	FAIL - A-bis link to TCH TRX failed
27	FAIL - A-bis link to CCH TRX failed
28	FAIL - BTS type not authorised
29	FAIL - Sensitivity limit exceeded
30	FAIL - Link already established
31	FAIL - Link already disconnected
32	FAIL - BTS type not set
33	FAIL - RF cypher mode command not received
34	FAIL - A-bis cypher mode command not received
35	FAIL - V11 loopback test failed
36	FAIL - No channels to monitor
37	FAIL - Rx level limits exceeded
38	FAIL - Channel required message not received
39	FAIL - Access request from BTS not correct
40	FAIL - BTS calculated wrong timing advance
41	FAIL - Timing advanced by incorrect ammount
42	FAIL - Timing advance command not received
43	FAIL - Transmitter measurements limits exceeded

Universal BTS Related EOT Messages

900	FAIL - BTS NACK received
1000	FAIL - A-bis RSL link establish failed

A-bis Related EOT Messages

301	FAIL - A-bis unable to synchronise to traffic frame
302	FAIL - A-bis lost synchronisation with traffic frames
303	FAIL - No valid A-bis traffic frames received
304	FAIL - Too many A-bis frames discarded
305	FAIL - A-bis idle frame type received
306	FAIL - A-bis frame type not recognised
307	FAIL - Receiver BER test timed out

BBP Related EOT Messages

200	FAIL - Unknown error (BBP)
201	FAIL - Parameter error (BBP)
202	FAIL - Timeout - no reason given (BBP)
203	FAIL - No power detected
204	FAIL - No power detected in FCCH
205	FAIL - Excessive phase error in FCCH burst
206	FAIL - No power detected in SCH burst
207	FAIL - Excessive phase error in SCH burst
208	FAIL - No FCCH burst found
209	FAIL - No SCH burst found
210	FAIL - General error during demodulation
211	FAIL - Failed to locate training sequence
212	FAIL - No signal detected during demodulation
228	FAIL - Failed to turn off RACH reports

Functional Tests

Reset BTS (Alcatel, Ericsson, Italtel, Motorola, Nokia, Nortel Matra and PKI BTS types only)

GPIB Command:

RSTBTS (no parameters) Starts the test procedure

GPIB Response:

RSTBTS n Test result in response to the TSEOT? query.

Parameter:

n = 0 Test Passed
= non-zero Test Failed
(See Table 6.1 for Test Procedure Error Codes)

Link Test (Universal, Alcatel and Nokia BTS types only)

(This command is based on the 6111 Test Set GPIB command ELEST, but the test involved is different and does not require the LDIS command to follow).

This A-bis Link Test exercises the physical BTS/BSC terrestrial connection.

GPIB Command:

LINKTST abis_slot, sub_slot, tei, sapi

Starts the test procedure

Parameter		Typical Value	Range
abis_slot	A-bis Signalling Timeslot Number	16	1 to 31
sub_slot	A-bis Signalling Subslot Number	4	16 kbit/s Signalling 0 to 3 64 kbit/s Signalling: 4
tei	Terminal Endpoint Identifier	1	0 to 127
sapi	SAPI	0	0, 62

GPIB Response:

LINKTST n — Test result in response to the TSEOT? query.

Parameter:

n = 0 — Test Passed
= non-zero — Test Failed
(See Table 6.1 for Test Procedure Error Codes)

Link Test (6111 Test Set Compatibility test only)

(Parameters are the same as for the command LINKTST. For new test sequences use LINKTST command).

GPIB Command:

ELEST abis_slot, sub_slot, tei, sapi

Starts the test procedure

Parameter		**Typical Value**	**Range**
abis_slot	A-bis Signalling Timeslot Number	16	1 to 31
sub_slot	A-bis Signalling Subslot Number	4	16 kbit/s Signalling 0 to 3 64 kbit/s Signalling: 4
tei	Terminal Endpoint Identifier	1	0 to 127
sapi	SAPI	0	0, 62

GPIB Response:

ELEST n — Test result in response to the TSEOT? query.

Parameter:

n = 0 — Test Passed
= non-zero — Test Failed
(See Table 6.1 for Test Procedure Error Codes)

Transmitter Tests

Cell Control Channel Generation

WARNING: THIS TEST CAN BE LEFT IN A STATE IN WHICH THE BTS TRANSMITS CONTINUOUSLY UNTIL THE TEST IS ABORTED BY THE OPERATOR. ALL DUE ATTENTION MUST BE PAID TO ENSURE THAT THE TEST IS ABORTED AT AN APPROPRIATE TIME AND THE BTS HAS STOPPED TRANSMITTING.

DO NOT DISCONNECT ANY RF CABLES UNTIL THE TEST IS COMPLETE OR HAS BEEN ABORTED AND THE BTS HAS STOPPED TRANSMITTING.

GPIB Command:

CCCG ccn, tlvel, ncc, bscc,mcch — Starts the test procedure

Parameter		Typical Value	Range
ccn	Control Channel Number	E-GSM 900 = 90 DCS 1800 = 512 PCS 1900 = 512	See heading Radio System Channel Number Ranges
tlvl	BTS Output Power Level	0	0 = Max 1 to 6
ncc	Network Colour Code	0	0 to 7
bscc	Base Station Colour Code	0	0 to 7
mcch	Maintain BCCH	0	0 = Off, 1 = On

GPIB Response:

CCCG n — Test result in response to the TSEOT? query.

Parameter:

n = 0 — Test Passed
= non-zero — Test Failed
(See Table 6.1 for Test Procedure Error Codes)

Transmitter Test

(This command is not available in the 6111 Test Set GPIB commands. It is based on the 6111 Test Set GPIB commands DPHFQ and PHFQ).

GPIB Command:

TXTST tcn, tslt, tlvl, rlvl, nbrst, trxcfg, tpat, bnum, hop, enc, flmt, rph, pph, explvl, plmt, nlmt, ppmsk

Starts the test procedure

Parameter		Typical Value	Range
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 = 512 PCS 1900 = 512	See heading Radio System Channel Number Ranges
tslt	Timeslot	4	0 to 7
tlvl	BTS Output Power Level	0	0 = Max 1 to 6
rlvl	BTS Rx Signal Level	-85.0	-120.0 to -40.0 dBm
nbrst	Number of Bursts	10	1 to 999
trxcfg	TRX Configuration	1	0 = BCCH 1 = TCH
tpat	Test Pattern	1	0 to 9
bnum	Burst Number	0	0 = Any 1 to 4
hop	Hopping	0	0 = Off (Note 1) 1 = On
enc	Encryption	0	0 = Off 1 = A5/1 2 = A5/2
flmt	Frequency Error Limit (+/-)	48.0	0.0 to 5000.0 Hz
rph	RMS Phase Error Limit	5.00	0.00 to 10.00 deg
pph	PeakPhase Error Limit	20.00	0.00 to 30.00 deg
explvl	Expected Power Level	(Note 2)	0.0 to +100.0 dBm
plmt	Power level Limit (+)	3.0	0.0 to 3.0 dB
nlmt	Power level Limit (-)	0.0	0.0 to 3.0 dB
ppmsk	Power Profile Mask Checking	1	0 = Off, 1 = On

Note: (1) Not supported by software Release version 03.01

(2) The default Expected Power Level value is BTS specific; it is the same value as entered for Maximum BTS Output Power in the Configure BTS test.

Where applicable, this figure should include losses expected in the combiner and any other calculated losses in the BTS between the TRX and the output interface. Allow for the fact that the test may not necessarily start at the maximum power level. Loss in the RF lead between the BTS and the Test Set should not be included because this loss can be compensated by the Level Offset file.

GPIB Response:

TXTST n, min_freq_err, min_rms_perr, min_peak_perr, max_freq_err, max_rms_perr, max_peak_perr, ave_freq_err, ave_rms_perr, ave_peak_perr, bts_pwr, req_pwr, meas_pwr, pwr_err, pwr_profile, mod_spec

Test result in response to the TSEOT? query.

Response Element	Description	Range	Units
n	Test Pass / Fail code	0 = Passed Non-zero = Failed (Note)	
min_freq_err	Minimum Frequency Error		dBm
min_rms_perr	Minimum RMS Phase Error		Hz
min_peak_perr	Minimum Peak Phase Error		Hz
max_freq_err	Maximum Frequency Error		dBm
max_rms_perr	Maximum RMS Phase Error		Hz
max_peak_perr	Maximum Peak Phase Error		Hz
ave_freq_err	Average Frequency Error		dBm
ave_rms_perr	Average RMS Phase Error		Hz
ave_peak_perr	Average Peak Phase Error		Hz
bts_pwr	BTS Power Test Pass / Fail code	0 = Passed 1 = Failed	
req_pwr	Requested Power		dBm
meas_pwr	Measured Power		dBm
pwr_err	Power Error		dB
pwr_profile	Power Profile Test Pass / Fail code	0 = Passed 1 = Failed	
mod_spec	Modulation Spectrum Test Pass / Fail code	0 = Passed 1 = Failed	

Note: See Table 6.1 for Test Procedure Error Codes.

Transmitter BER Test

GPIB Command:

TXL tcn, tslt, tfmt, enc, **tlvl**, **rlvl**, **tpat**, **sampt**, **ferl**, **c1bl**, **c2l**
Starts the test procedure

(Parameters in **bold** are new parameters added to the 6111 Test Set GPIB command parameters. The parameter list is based on the 6111 GPIB commands DTXL and TXL.).

Parameter		**Typical Value**	**Range**
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 = 512 PCS 1900 = 512	See heading Radio System Channel Number Ranges
tslt	Timeslot	4	0 to 7
tfmt	TCH Format	0	Fixed at 0
enc	Encryption	0	0 = Off 1 = A5/1 2 = A5/2
tlvl	BTS Output Level	0	0 = Max 1 to 6
rlvl	BTS Rx Signal Level	-85.0	-120.0 to -40.0 dBm
tpat	Test Pattern	1	0 to 9
sampt	Sample Time	10	1 to 300000 s
ferl	FER Limit	0.000	0.000 to 100.000 %
c1bl	Class Ib Limit	0.000	0.000 to 100.000 %
c2l	Class II Limit	0.000	0.000 to 100.000 %

GPIB Response:

TXL n, fer_s, fer_e, c1b_s, c1b_e, c2_s, c2_e
Test result in response to the TSEOT? query.

Response Element	**Description**	**Range**
n	Test Pass / Fail code	0 = Passed Non-zero = Failed (Note)
fer_s	Number of FER samples in BER measurement	
fer_e	Number of FER events in BER measurement	
c1b_s	Number of Class Ib samples in BER measurement	
c1b_e	Number of Class Ib events in BER measurement	
c2_s	Number of Class II samples in BER measurement	
c2_e	Number of Class II events in BER measurement	

Note: See Table 6.1 for Test Procedure Error Codes.

Static Power Control (BCCH) Test

GPIB Command:

SPWRL tcn, tslt, rlvl, nstep, ave, fslvl, plmt, nlmt, staclmt, cerr
Starts the test procedure

Parameter		Typical Value	Range
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 =512 PCS 1900 =512	See heading Radio System Channel Number Ranges
tslt	Timeslot	4	0 to 7
rlvl	BTS Rx Signal Level	-85.0	-120.0 to -40.0 dBm
nstep	Number of Steps	6	0 to 15 (Max is BTS-specific)
ave	Number of Averages	10	1 to 10000
fslvl	First Step Expected Level	(Note 1)	0.0 to +100.0 dBm (BTS-specific)
plmt	Max Power Level (+)	3.0 [2.0] (Note 2)	0.0 to 3.0 dB
nlmt	Max Power Level (-)	0.0 [2.0] (Note 2)	0.0 to 3.0 dB
staclmt	Step Accuracy Limit (+/-)	0.5 [1.0] (Note 2)	0.0 to 3.0 dB
cerr	Cumulative Error (+/-)	3.0 [3.0] (Note 2)	0.0 to 6.0 dB

Note: (1) The default Expected Power Level value is BTS specific; it is the same value as entered for Maximum BTS Output Power in the Configure BTS test.

Where applicable, this figure should include losses expected in the combiner and any other calculated losses in the BTS between the TRX and the output interface. Allow for the fact that the test may not necessarily start at the maximum power level. Loss in the RF lead between the BTS and the Test Set should not be included because this loss can be compensated by the Level Offset file.

(2) Values in [ ] brackets are Phase 2 values.

GPIB Response:

This Test generates two types of messages: interim responses and a final test message.

The interim responses are TSPLT status messages. They are generated by sending the TSPLT command to the Test Set while the test is running. These report the measured data after each step, in the form of the following GPIB report:

TSPLT step_num, status, target_lvl, meas_lvl, step_err, cum_err
Interim response message.

Response Element	Description	Range	Units
step_num	Step Number of the Intermediate Test	0 to 15	
status	Status of Intermediate Test	0 = Pass 1 = Power High 2 = Power Low 4 = Cumulative High 8 = Cumulative Low 16 = Accuracy High 32 = Accuracy Low 255 = No Power	
target_lvl	Target Power Level		dBm
meas_lvl	Measured Power Level		dBm
step_err	Step Error		dB
cum_err	Cumulative Error		dB

If the Test Set is unable to perform a measurement at a particular power level, the value 999 will be returned instead of the corresponding Response Element.

The final Test Result is generated in response to the TSEOT? query :

SPWRL n Test result in response to the TSEOT? query.

Response Element	Description	Range
n	Test Pass / Fail code	0 = Passed Non-zero = Failed (Note)

Note: See Table 6.1 for Test Procedure Error Codes.

Downlink Power Control (TCH) Test

GPIB Command:

DPWRL tcn, tslt, rlvl, nstep, ave, staclmt, cerr

Starts the test procedure

Parameter		Typical Value	Range
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 =512 PCS 1900 =512	See heading Radio System Channel Number Ranges
tslt	Timeslot	4	0 to 7
rlvl	BTS Rx Signal Level	-85.0	-120.0 to -40.0 dBm
nstep	Number of Steps	15	1 to 15 (Max is BTS-specific)
ave	Number of Averages	10	1 to 10000
staclmt	Step Accuracy Limit (+/-)	0.5 [1.0] (Note)	0.0 to 3.0 dB
cerr	Cumulative Error (+/-)	3.0 [3.0] (Note)	0.0 to 6.0 dB

Note: Values in [ ] brackets are Phase 2 values.

GPIB Response:

This Test generates two types of messages: interim responses and a final test message.

The interim responses are TSPLT status messages. They are generated by sending the TSPLT command to the Test Set while the test is running. These report the measured data after each step, in the form of the following GPIB report:

TSPLT step_num, status, target_lvl, meas_lvl, ssize, step_err, cum_err

Interim response message.

Response Element	Description	Range	Units
step_num	Step Number of the Intermediate Test	0 to 15	
status	Status of Intermediate Test	0 = Pass 1 = Power High 2 = Power Low 4 = Cumulative High 8 = Cumulative Low 16 = Accuracy High 32 = Accuracy Low 255 = No Power	
target_lvl	Target Power Level		dBm
meas_lvl	Measured Power Level		dBm
ssize	Step Size		dB
step_err	Step Error		dB
cum_err	Cumulative Error		dB

If the Test Set is unable to perform a measurement at a particular power level, the value 999 will be returned instead of the corresponding Response Element.

The final Test Result is generated in response to the TSEOT? query :

DPWRL n Test result in response to the TSEOT? query.

Response Element	Description	Range
n	Test Pass / Fail code	0 = Passed Non-zero = Failed (Note)

Note: See Table 6.1 for Test Procedure Error Codes.

Receiver Tests

Receiver BER Test

GPIB Command:

RXL tcn, tslt, tfmt, enc, **tlvl**, **rlvl**, **tpat**, **sampt**, **ferl**, **c1bl**, **c2l**, **hop**
Starts the test procedure

(Parameters in **bold** are new parameters added to the 6111 Test Set GPIB command parameters. The parameter list is based on the 6111 GPIB commands DRXL, RXL, DCSENS and CSENS).

GPIB Command (6111 Compatibility only):

CSENS tcn, tslt, **tfmt**, enc, **tlvl**, **rlvl**, **tpat**, **sampt**, **ferl**, **c1bl**, **c2l**. **hop**
(For new test sequences, use the RXL command).

Parameter		Typical Value	Range
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 = 512 PCS 1900 = 512	See heading Radio System Channel Number Ranges
tslt	Timeslot	4	0 to 7
tfmt	TCH Format	0	Fixed at 0
enc	Encryption	0	0 = Off, 1 = A5/1, 2 = A5/2
tlvl	BTS Output Level	0	0 = Max, 1 to 6
rlvl	BTS Rx Signal Level	-104.0	-120.0 to -40.0 dBm
tpat	Test Pattern	1	0 to 9
sampt	Sample Time	10	1 to 300000 s
ferl	FER Limit	0.100	0.000 to 100.000 %
c1bl	Class Ib Limit	0.400	0.000 to 100.000 %
c2l	Class II Limit	2.000	0.000 to 100.000 %
hop	Hopping	0	0 = Off, 1 = On

GPIB Response:

RXL n, fer_s, fer_e, c1b_s, c1b_e, c2_s, c2_e
Test result in response to the TSEOT? query.

Response Element	Description	Range
n	Test Pass / Fail code	0 = Passed Non-zero = Failed (Note)
fer_s	Number of FER samples in BER measurement	
fer_e	Number of FER events in BER measurement	
c1b_s	Number of Class Ib samples in BER measurement	
c1b_e	Number of Class Ib events in BER measurement	
c2_s	Number of Class II samples in BER measurement	
c2_e	Number of Class II events in BER measurement	

Note: See Table 6.1 for Test Procedure Error Codes.

Absolute Sensitivity Test

GPIB Command:

SENS tcn, tslt, enc, **ilvl**, **fstp**, **tlim**, **tlvl**, **tpat**, **sampt**, **ferl**, **c1bl**, **c2l**, **hop**
Starts the test procedure

(Parameters in **bold** are new parameters added to the 6111 Test Set GPIB command parameters. The parameter list is based on the 6111 GPIB command DSENS and SENS).

	Parameter	Typical Value	Range
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 = 512 PCS 1900 = 512	See heading Radio System Channel Number Ranges
tslt	Timeslot	4	0 to 7
enc	Encryption	0	0 = Off 1 = A5/1 2 = A5/2
ilvl	Initial Level	-80.0	-120.0 to -40.0 dBm
fstp	Final Step Size	0.5	0.1 to 2.0 dB
tlim	Pass / Fail Threshold	-104.0	-120.0 to -20.0 dBm
tlvl	BTS Output Level	0	0 = Max 1 to 6
tpat	Test Pattern	1	0 to 9
sampt	Sample Time	10	1 to 300000 s
ferl	FER Limit	0.100	0.000 to 100.000 %
c1bl	Class Ib Limit	0.400	0.000 to 100.000 %
c2l	Class II Limit	2.000	0.000 to 100.000 %
hop	Hopping	0	0 = Off 1 = On

GPIB Response:

This Test generates two types of messages: an interim response and a final test message.

The interim responses are TSSEN status messages. They are generated by sending the TSSEN command to the Test Set while the test is running. These report the current signal level at each step, in the form of the following GPIB report.

TSSEN sens_lvl, ber — Interim response message

Response Element	Description	Units
sens_lvl	Current Sensitivity level	dBm
ber	Bit Error Rate at this level	%

SENS n, level — Test result in response to the TSEOT? query :

Response Element	Description	Range	Units
n	Test Pass / Fail code	0 = Passed Non-zero = Failed (Note)	
level	The lowest BTS Output Power Level at which the specified BER can be maintained.		dBm

RACH Test

GPIB Command:

CRACH tcn, tlvl, rlvl, nrach, rdel, terr, ltest — Starts the test procedure

Parameter		Typical Value	Range
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 = 512 PCS 1900 = 512	See heading Radio System Channel Number Ranges
tlvl	BTS Output Power Level	0	0 = Max, 1 to 6
rlvl	BTS Rx Signal Level	-104.0	-120.0 to -40.0 dBm
nrach	Number of RACHs	10	1 to 10000
rdel	RACH Delay	-1	-1 = Step (Note) 0 to +219
terr	Timing Error (+/-)	3	1 to 10 bits
ltest	Length of Spurious RACHs test	3	1 to 1440 minutes

Note: A RACH Delay of -1 causes the Test to step the Offset through the slot from 0 to 63 bits as the Test proceeds.

GPIB Response:

This Test generates two types of messages: an interim response and a final test message.

The interim responses are TSRACH status messages. They are generated by sending the TSRACH command to the Test Set while the test is running. These report the current intermediate measurement data, in the form of the following GPIB report.

TSRACH npassed, nfailed, invld_rarq, badtim, no_ch_rqd
Interim response message.

Response Element	Description
npassed	Number of Successful tests
nfailed	Number of Failed tests
invld_rarq	Number of tests that failed due to an Invalid Rx Access Request
badtim	Number of tests that failed due to a Bad Timing Advance value
no_ch_rqd	Number of tests that failed due to No Channel Required message being received

CRACH n — Test result in response to the TSEOT? query :

(The response parameter list has changed from the 6111 Test Set GPIB responses TSRACH and CRACH).

Response Element	Description	Range
n	Test Pass / Fail code	0 = Passed Non-zero = Failed (Note)

Note: See Table 6.1 for Test Procedure Error Codes.

Rx Level Test

(The parameters in **bold** are new parameters added to the 6111 Test Set GPIB command/response parameters).

GPIB Command:

RXLEV tcn, tslt, tlvl, tpat, ilvl, ssize, nsam, rxerr, **nstep, hop**
Starts the test procedure

Parameter		**Typical Value**	**Range**
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 = 512 PCS 1900 = 512	See heading Radio System Channel Number Ranges
tslt	Timeslot	4	0 to 7
tlvl	BTS Output Level	0	0 = Max, 1 to 6
tpat	Test Pattern	1	0 to 9
ilvl	Initial Level	-91.5	-120.0 to -40.0 dBm
ssize	Step Size	2	1 to 10 dB
nsam	Number of Samples	4	1 to 10
rxerr	RX Level Error (+/-)	4	1 to 10
nstep	Number of Steps	10	0 to 100
hop	Hopping	0	0 = Off, 1 = On

GPIB Response:

This Test generates two types of messages: an interim response message and a final test message.

The interim responses are TSRXLEV status messages. They are generated by sending the TSRXLEV command to the Test Set while the test is running. These report the current intermediate measurement data, in the following form:

TSRXLEV lvl, **lnom,** lmin, lmax, lmean, q0, q1, q2, q3, q4, q5, q6, q7
Interim response message

Response Element	**Description**
lvl	Requested Signal Level of current step
lnom	Nominal Rx Level value of current step
lmin	Minimum Rx Level value reported
lmax	Maximum Rx Level value reported
lmean	Mean Rx Level value reported
q0	Number of samples of Rx Quality Level 0
q1	Number of samples of Rx Quality Level 1
q2	Number of samples of Rx Quality Level 2
q3	Number of samples of Rx Quality Level 3
q4	Number of samples of Rx Quality Level 4
q5	Number of samples of Rx Quality Level 5
q6	Number of samples of Rx Quality Level 6
q7	Number of samples of Rx Quality Level 7

Note: The responses q0 to q7 are not dispayed by the MMI.

RXLEV n — Test result in response to the TSEOT? query.

Response Element	Description	Range
n	Test Pass / Fail code	0 = Passed Non-zero = Failed (Note)

Note: See Table 6.1 for Test Procedure Error Codes.

Rx Quality Test

(The parameters in **bold** are new parameters added to the 6111 Test Set GPIB command/response parameters).

GPIB Command:

RXQUAL tcn, tslt, tlvl, tpat, ilvl, ssize, nsam, **nstep, hop**
Starts the test procedure

Parameter		Typical Value	Range
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 = 512 PCS 1900 = 512	See heading Radio System Channel Number Ranges
tslt	Timeslot	4	0 to 7
tlvl	BTS Output Level	0	0 = Max, 1 to 6
tpat	Test Pattern	1	0 to 9
ilvl	Initial Level	-100.0	-120.0 to -40.0 dBm
ssize	Step Size	1.0	0.1 to 10.0 dB
nsam	Number of Samples	4	1 to 100
nstep	Number of Steps	10	0 to 100
hop	Hopping	0	0 = Off, 1 = On

GPIB Response:

This Test generates two types of messages: an interim response message and a final test message.

The interim responses are TSRXQUAL status messages. They are generated by sending the TSRXQUAL command to the Test Set while the test is running. These report the current intermediate measurement data, in the form of the following GPIB report.

TSRXQUAL lvl, **lnom**, lmin, lmax, c2_ber, q0, q1, q2, q3, q4, q5, q6, q7
Interim response message

Response Element	Description
lvl	Requested Signal Level of current step
lnom	Nominal Rx Level value of current step
lmin	Minimum Rx Level value reported
lmax	Maximum Rx Level value reported
c2_ber	Result of Class II BER test
q0	Number of samples of Rx Quality Level 0
q1	Number of samples of Rx Quality Level 1
q2	Number of samples of Rx Quality Level 2
q3	Number of samples of Rx Quality Level 3
q4	Number of samples of Rx Quality Level 4
q5	Number of samples of Rx Quality Level 5
q6	Number of samples of Rx Quality Level 6
q7	Number of samples of Rx Quality Level 7

Note: The responses q0 to q7 are not dispayed by the MMI.

RXQUAL n — Test result in response to the TSEOT? query

Response Element	Description	Range
n	Test Complete / Fail code	24 = Test Complete Non-zero (except 24) = Failed (Note)

Note: See Table 6.1 for Test Procedure Error Codes.

Interactive Tests

Multimode Test

(Multimode command is not available in the 6111 Test Set GPIB Commands).

WARNING: **THIS TEST CAN BE LEFT IN A STATE IN WHICH THE BTS TRANSMITS CONTINUOUSLY UNTIL THE TEST IS ABORTED BY THE OPERATOR. ALL DUE ATTENTION MUST BE PAID TO ENSURE THAT THE TEST IS ABORTED AT AN APPROPRIATE TIME AND THE BTS HAS STOPPED TRANSMITTING.**

DO NOT DISCONNECT ANY RF CABLES UNTIL THE TEST IS COMPLETE OR HAS BEEN ABORTED AND THE BTS HAS STOPPED TRANSMITTING.

GPIB command:

MULTMODE tcn, tslt, enc, tlvl, rlvl, tpat, bnum, hop, ave, foff, epwl, ta
Starts the test procedure

Parameter		Typical Value	Range
tcn	Channel Number	E-GSM 900 = 90 DCS 1800 = 512 PCS 1900 = 512	See heading Radio System Channel Number Ranges
tslt	Timeslot	4	0 to 7
enc	Encryption	0	0 = Off, 1 = A5/1, 2 = A5/2
tlvl	BTS Output Level	0	0 = Max, 1 to 6
rlvl	BTS Rx Signal Level	-104.0	-120.0 to -40.0 dBm
tpat	Test Pattern	6	0 to 9
bnum	Burst Number	0	0 = Any, 1 to 4
hop	Hopping	0	0 = Off, 1 = On
ave	Video Averages	50	1 to 999
foff	Frequency Offset	0	-500 to +500 Hz
epwl	Expected Power Level	(Note)	0 to 100 dBm
ta	Timing Advance	0	0 to 63

Note: The default Expected Power Level value is BTS specific; it is the same value as entered for Maximum BTS Output Power in the Configure BTS test.

Where applicable, this figure should include losses expected in the combiner and any other calculated losses in the BTS between the TRX and the output interface. Allow for the fact that the test may not necessarily start at the maximum power level. Loss in the RF lead between the BTS and the Test Set should not be included because this loss can be compensated by the Level Offset file.

During the execution of the Multimode Test, the following commands may be used to change the associated parameters:

NTXLVL	To re-program the BTS Output Power Level
NTPAT	To re-program the Test Pattern
NFOFF	To re-program the Frequency Offset
NTADV	To re-program the Timing Advance
NTVAVG	To re-program the number of Video Averages

This test will run continuously until the **ABORT** command is sent, after which the following message may be queried by the **TSEOT?** query.

MULTMODE <error_code>

The <error_code> value returned is TBD.

During the execution of this test, **RXLEV** and **RXQUAL** report messages are placed on the status queue.

Phase error, power profile and modulation spectrum graph data is also generated and made available during this test.

NTXLVL tlvl — Change the BTS Output Power Level during the Multimode test.

Parameter		**Range**
tlvl	BTS Output Power Level	0 = Max, 1 to 6

NTPAT tpat — Change the Test Pattern during the Multimode test.

Parameter		**Range**
tpat	Test Pattern	0 to 9

NFOFF foff — Change the Frequency Offset during the Multimode test.

Parameter		**Range**
foff	Frequency Offset	-500 to +500 Hz

NTADV ta — Change the Timing Advance during the Multimode test.

Parameter		**Range**
ta	Timing Advance	0 to 63

NTVAVG ave — Change the number of Video Averages during the Multimode test.

Parameter		**Range**
ave	Video Averages	1 to 999

Self Check Tests

Self Check Burst Analysis

GPIB command:

SCBA sfq, attn, sslt, pat, stm, burst, bursts, enc, ferl, lbl, lll, pkerr, rmserr, freqerr, pwrl, tmscb, fss

Starts the test procedure

(The parameters in this command are based on the 6111 Test Set GPIB commands SCBA and SCBE).

Parameter		Typical Value	Range
sfq	Self Check Frequency	E-GSM 900 = 897.500 DCS 1800 = 1747.500 PCS 1900 = 1880.000	880.000 to 915.000 Mhz 1710.000 to 1850.000 Mhz 1850.000 to 1910.000 MHz (Note 1)
attn	Tx Signal Attenuation	0.0	0.0 dB Fixed
sslt	Self Check slot	4	0 to 7
pat	Test Pattern	1	0 to 9
stm	Sample Time	10	1 to 300000 s
burst	Burst Number	0	0 (= ANY), 1, 2, 3, 4
bursts	Number of Bursts	10	1 to 999
enc	Encryption	0	0 = Off, 1 = A5/1, 2 = A5/2 (Note 5)
ferl	FER Limit	0.000	0.000 to 100.000 %
lbl	Class Ib Limit	0.000	0.000 to 100.000 %
lll	Class II Limit	0.000	0.000 to 100.000 %
pkerr	Peak Phase Error Limit	20.00	0.00 to 30.00 deg
rmserr	RMS Phase Error Limit	5.00	0.00 to 10.00 deg
freqerr	Frequency Error Limit	±48.0 GSM 900 ±95.0 DCS 1800 ±95.0 PCS 1900	0.0 to ±5000.0 Hz
pwrl	Power Level Error Limit	±3.0	0.0 to ±10.0 dB (Note 2)
tmscb	Mode of Operation	SINGLE	SINGLE, CONT, STPERR (Note 3)
fss	Frequency Step Size	20	0 to 10000 Mhz (Note 4)

Note: (1) The frequency range accepted by this command depends on the type of radio system supported by the Rx/Tx module of the 6113 Test Set.

(2) Power Level is given in dB relative to a nominal value.

(3) The 'mode' parameter must be one of the following mnemonics:

SINGLE	=	One shot measurement.
CONT	=	Continuous measurements until stopped by the ABORT command.
STPERR	=	Stop on the first detected error.

(4) The frequency step size parameter fss is optional; if it is omitted or set to 0.0, then the frequency given in parameter sfq will be used when the test repeats or loops.

(5) An execution error will occur if encryption is requested and the Encryption Option 10 is not fitted.

(6) To stop the test before the cycle completes, use the GPIB command **ABORT**.

GPIB response :

This Test generates two types of messages: an interim response message and a final test message.

While the test is running, numerical results are generated and made available via the GPIB status queue. The results sent to the status queue are interim results generated during each individual measurement phase; in the case of phase trajectory and power level results, these are a running average of the results thus accumulated. In the case of the BER results, they give the current number of samples taken and the number of events so far detected. For phase error, modulation spectrum and power profile measurements, graphical data is provided on request.

The format of the numerical interim results are as follows:

Interim Power Level Results:

TSINT:I_PWR <power levelDB>, <measurement frequencyMHZ>

Interim Phase Trajectory (Phase Frequency) results:

TSINT:I_PHFQ <measurement frequency in MHZ>, <freq error>, <rms phase error>, <peak phase error>

Interim BER Measurement Results:

TSINT:I_BER <measurement frequency in MHz>, <fers>, <fere>, <c1bs>, <c1be>, <c2s>, <c2e>

Where:
fers = Frame erasure samples
fere = Frame erasure events
c1bs = Class Ib samples
c1be = Class Ib events
c2s = Class II samples
c2e = Class II events

End of Test Message:

On completion of the Self Check Burst Analysis test, the following GPIB EOT message is generated:

SCBA n

Where 'n' is a bit field as follows:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	PWR	MOD	PULSE	PHFQ	BER

Where: PWR Power Level Measurement
MOD Modulation Spectrum Measurement
PULSE Power Profile Measurement
PHFQ Phase Frequency Measurement
BER Bit Error Rate Measurement

When a bit is set to '1' the associated test FAILed.
When a bit is set to '0' the associated test PASSed.

Note: The measurement results can also be obtained by using the queries SCBURST? and SCBER? See DEVICE DEPENDENT QUERIES for a description of these queries.

RF Tests Self Check Burst Analysis

GPIB command:

BSCBA sfq, attn, sslt, pat, stm, burst, bursts, enc, ferl, lbl, lll, pkerr, rmserr, freqerr, pwrl, tmscb, ifom, fss

Starts the test procedure

Parameter		Typical Value	Range
sfq	Self Check Frequency	E-GSM 900 = 897.500 DCS 1800 = 1747.500 PCS 1900 = 1880.000	880.000 to 915.000 Mhz 1710.000 to 1850.000 Mhz 1850.000 to 1910.000 MHz (Note 1)
attn	Tx Signal Attenuation	0.0	0.0 to 80.0 dB Max error ±0.1 dB
sslt	Self Check slot	4	0 to 7
pat	Test Pattern	1	0 to 9
stm	Sample Time	10	1 to 300000 s
burst	Burst Number	0	0 (= ANY), 1, 2, 3, 4
bursts	Number of Bursts	10	1 to 999
enc	Encryption	0	0 = Off, 1 = A5/1, 2 = A5/2 (Note 5)
ferl	FER Limit	0.000	0.000 to 100.000 %
lbl	Class Ib Limit	0.000	0.000 to 100.000 %
lll	Class II Limit	0.000	0.000 to 100.000 %
pkerr	Peak Phase Error Limit	20.00	0.00 to 30.00 deg
rmserr	RMS Phase Error Limit	5.00	0.00 to 10.00 deg
freqerr	Frequency Error Limit	±48.0 GSM 900 ±95.0 DCS 1800 ±95.0 PCS 1900	0.0 to ±5000.0 Hz
pwrl	Power Level Error Limit	±3.0	0.0 to ±10.0 dB (Note 2)
tmscb	Mode of Operation	SINGLE	SINGLE, CONT, STPERR (Note 3)
ifom	IF Operating Mode	Wideband	Wideband, Narrowband
fss	Frequency Step Size	20	0 to 10000 Mhz (Note 4)

Note: (1) The frequency range accepted by this command depends on the type of radio system supported by the Rx/Tx module of the 6113 Test Set.

(2) Power Level is given in dB relative to a nominal value.

(3) The 'mode' parameter must be one of the following mnemonics:

SINGLE = One shot measurement.
CONT = Continuous measurements until stopped by the ABORT command.
STPERR = Stop on the first detected error.

(4) The frequency step size parameter fs is optional; if it is omitted or set to 0.0, then the frequency given in parameter sfq will be used when the test repeats or loops.

(5) An execution error will occur if encryption is requested and the Encryption Option 10 is not fitted.

(6) To stop the test before the cycle completes, use the GPIB command **ABORT**.

GPIB response :

This Test generates two types of messages: an interim response message and a final test message.

While the test is running, numerical results are generated and made available via the GPIB status queue. The results sent to the status queue are interim results generated during each individual measurement phase; in the case of phase trajectory and power level results, these are a running average of the results thus accumulated. In the case of the BER results, they give the current number of samples taken and the number of events so far detected. For phase error, modulation spectrum and power profile measurements, graphical data is provided on request.

The format of the numerical interim results are as follows:

Interim Power Level Results:

TSINT:I_PWR <power levelDB>, <measurement frequencyMHZ>

Interim Phase Trajectory (Phase Frequency) results:

TSINT:I_PHFQ <measurement frequency in MHZ>, <freq error>, <rms phase error>, <peak phase error>

Interim BER Measurement Results:

TSINT:I_BER <measurement frequency in MHz>, <fers>, <fere>, <c1bs>, <c1be>, <c2s>, <c2e>

Where:
fers = Frame erasure samples
fere = Frame erasure events
c1bs = Class Ib samples
c1be = Class Ib events
c2s = Class II samples
c2e = Class II events

End of Test Message:

On completion of the Self Check Burst Analysis test, the following GPIB EOT message is generated:

BSCBA n

Where 'n' is a bit field as follows:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	PWR	MOD	PULSE	PHFQ	BER

Where:
- PWR Power Level Measurement
- MOD Modulation Spectrum Measurement
- PULSE Power Profile Measurement
- PHFQ Phase Frequency Measurement
- BER Bit Error Rate Measurement

When a bit is set to '1' the associated test FAILed.
When a bit is set to '0' the associated test PASSed.

Note: The measurement results can also be obtained by using the queries SCBURST? and SCBER? See DEVICE DEPENDENT QUERIES for a description of these queries.

PROGRAMMING THE TEST SET OVER THE GPIB INTERFACE

This Section describes the control of the 6113 Digital Radio Test Set over the GPIB interface, with examples using C with a National Instruments GPIB interface card, and HP Basic on an HP series 9000 workstation. The topics covered include setting up the interface from a program, setting up the Test Set over the interface, running tests, and receiving the test results. Examples are given for programming the Test Set.

Note: In this document, uppercase text enclosed in angle brackets '<>' refers to items defined in IEEE 488.2, the "IEEE Standard Codes, Formats, Protocols and Common Commands". This document assumes basic knowledge of GPIB programming, and the IEEE 488.2 specification.

GPIB Interface Installation

Ensure that the GPIB Interface card has been installed as described in Section 3 Preparation For Use.

Initialising the Controller GPIB interface

The GPIB interface first needs to be initialised so that communication between the Controller and Test Set can take place. The following examples show the GPIB interface being initialised .

Example: C with National Instruments GPIB

The GPIB interface card must first be set up as detailed in Section 3 Preparation For Use.

```
#define T3s          12              /* Define a timeout code value */

int g_ts6113;

/* Set up unique identifier for Test Set. */
g_ts6113 = ibfind ("TS6113")

ibtmo(g_ts6113,T3s);                        /* Set timeout value for GPIB calls to 3 sec.*/
ibclr (g_ts6113);                    /* Clear specified device. */

/* Wait for Test Set to clear itself */
[ wait 1 s ];

/* Set up data transfer modes : */
ibeos (g_ts6113, (REOS I 0x0A));     /* Terminate on line-feed EOS */
ibeot (g_ts6113, 1);                 /* Set EOI with last byte of write */
```

Note: No error checking is shown here, but it is recommended that the GPIB interface status variable 'ibsta' be checked after each GPIB function call to trap any errors. This will prevent errors not being detected until after the error condition has disappeared.

Example: HP Basic

```
100  Ts_addr=720           ! Set Test Set GPIB address = 20 (Note).
110  CLEAR Ts_addr         ! Clear Test Set interface.
120  WAIT 1                ! Wait for Test Set to clear itself.
```

Note: Must match the setting of the GPIB address parameter in the System Menu.

Handling GPIB timeouts and interface errors

This section describes how to protect against unforeseen GPIB interface problems. The sort of difficulties which occur are usually due to the GPIB interface being incorrectly initialised, and can result in a message apparently being sent by the Controller but not received by the Test Set. There are two classes of problems - timeouts, where there is no response to an interface instruction, and errors where the function call returns an error.

The two examples shown use different ways of handling timeouts.

Example: C with National Instruments GPIB

The GPIB interface sets a bit in its System Status variable 'ibsta' to indicate a timeout has occurred on the most recent GPIB function call. This should be checked after each function call.

```
/* g_ts6113 previously initialised */
ibwrt (g_ts6113, "RESET", 5);            /* Send a string to the Test Set */

if (ibsta & TIMO)                        /* Check for timeout */
{
    /* Timeout-handling code */
}

if (ibsta & ERR)                         /* Check for GPIB errors */
{
    /* Error-handling code */
}
```

Example: HP Basic

```
100 gpib_wait = 3            ! Set  3 second timeout for GPIB
110 ON TIMEOUT 7, gpib_wait GOSUB Gpib_timeout
.
.
200 Gpib_timeout :           ! Timeout-handling code
210
```

Sending Messages to the Test Set

Messages are sent to the Test Set using standard function calls to send command strings, which consist of the command mnemonic followed by parameters as appropriate. The GPIB Commands and Parameters that the Test Set recognises are defined in Section 6 (this Section) and in Section 7.

There are various rules controlling the format of the command strings which are sent to the Test Set.

Note: Uppercase text enclosed in angle brackets '<>' refers to items defined in IEEE 488.2, "IEEE Standard Codes, Formats, Protocols and Common Commands".

The following is a summary of the format rules :

(1) The first element of the string must be the command mnemonic.

(2) The first parameter must be separated from the command mnemonic by at least one space.

(3) Parameters must be separated from each other by a comma, with optional spaces allowed either side of the comma.

(4) String parameters must be sent as a <STRING PROGRAM DATA> element. This means they have to be enclosed between either single quotes or double quotes, for example :

```
BTSTYPE "BANJO", "B320", "B1"
```

(5) Integer parameters greater than 2^{32} (FFFFFFFF hex) must be sent in <NON-DECIMAL NUMERIC PROGRAM DATA> format. For example :

```
DENCP #HFFFFFFFFFFFFFC00
```

This format is indicated by the characters '#H', which are followed by a sequence of hexadecimal characters terminated with a comma or command string terminator. No distinction is made between upper and lowercase characters.

(6) All other parameters are sent in either <DECIMAL NUMERIC PROGRAM DATA> format or <NON-DECIMAL NUMERIC PROGRAM DATA> format. These formats include decimal integer representation and floating point with or without exponent, and binary, octal and hexadecimal integer representation. The following are all valid representations of the same number:

5100	
+5100	
5100.0	
5.1E3	
+5.1 e +3.0	
#H13EC	(Hexadecimal)
#Q11754	(Octal)
#B1001111101100	(Binary)

Note: (1) If a floating point number is sent when the Test Set uses an integer value internally, the floating point value will be rounded to the nearest integer.

(2) The Test Set does not recognise <SUFFIX PROGRAM DATA>. These will cause the Test Set to generate an error message.

(7) Commands may be concatenated using the <PROGRAM MESSAGE UNIT SEPARATOR> which is a semi-colon character ';'. The following would be a valid message string which sends two successive commands :

```
DLAID 0,234,1,1;DCSPS 12,15,0
```

(8) The Test Set requires a terminator on the end of each message string. This terminator can be either the EOI signal line being asserted, or the ASCII carriage-return character (0A hex), or both.

The National Instruments software, configured as above, automatically asserts EOI at the end of the string, but does not append a carriage-return character.

HP Basic automatically appends the carriage-return character to the end of the string being sent and also asserts EOI.

(9) The Test Set input buffer length is 2700 characters. The maximum number of characters allowed for any message string sent to the Test Set is 256 characters.

Receiving Messages from the Test Set

The Test Set does not spontaneously send messages over the interface. When a message is ready to be sent, a bit in the Test Set Status Byte is set indicating the type of message to be sent. The Controller should be programmed to detect the bit being set, either by performing repeated serial polls on the Test Set or by enabling the SRQ bit in the Status Byte and setting up an interrupt handler to process Service Request interrupts.

The significance of the bits in the Status Byte is shown in Table 6.2.

TABLE 6.2 Status Byte Bits

Bit	Mnemonic	Meaning
0	ERR	Error Message ready
1	EOT	End of Test report ready
2	OPR	Information Message ready
3	SAV	Status Message ready
4	MAV	Message Available
5	ESB	Event Status Bit
6	SRQ	Service Request
7	GAV	Graph data available

Note: More than one bit may be set at any time.

To read a message that the Test Set has indicated as being ready, the Controller has first to send the appropriate query message, and then wait for the Message Available bit to be set. For example, the complete sequence of events that occurs to transfer an Error Message is :

(1) Initially the Controller polls the Test Set Status Byte, checking for messages.

(2) The Test Set sets ERR in its Status Byte.

(3) The Controller detects the ERR bit in the Test Set Status Byte and sends the query :

```
TSERR?
```

The Controller then repeatedly polls the Test Set Status Byte, checking for the MAV bit (see Note below).

(4) The Test Set sets MAV in its Status Byte.

(5) The Controller detects the MAV bit and performs a read operation on the Test Set to complete the transfer.

Note: Problems may occur with fast controllers performing tight loops including repeated serial polls. This may cause the Test Set to process only the serial poll and not make the message available; it is therefore advisable to insert waits in the loop. The HP Basic example is taken from an interpreted program, which does not run fast enough to cause problems; for compiled programs, a delay of 1 ms or greater is recommended.

The following examples show the Controller waiting for and reading an OPR (information) message.

Example: C with National Instruments GPIB

```
#define  OPR                  (1 << 2)
#define  MAV                  (1 << 4)
#define INPUT_BUFFER_LEN        2700          /* Same length as Test Set buffer */

int g_ts6113, serial_poll = 0;
char input_buffer [INPUT_BUFFER_LEN);
...
...
g_ts6113 = ibfind ("TS6113");
...
...
while (! (serial_poll & OPR))                 /* Wait for OPR message ready. */
{
      ibrsp (g_ts6113, &serial_poll);
      [ wait 55 ms ];
};

ibwrt (g_ts6113, "TSINF?", 6);                /* Send query */

while (! (serial_poll & MAV))                 /* Wait for message available. */
{
      ibrsp (g_ts6113, &serial_poll);
      [ wait 55 ms ];
};

ibrd (g_ts6113, input_buffer, INPUT_BUFFER_LEN); /* Read response */
```

Note: No error checking is shown here, but it is recommended that the GPIB interface status variable 'ibsta' be checked after each GPIB function call in order to trap any errors that occur. This will ensure that GPIB interface errors are detected <u>before</u> the error condition has disappeared.

Example: HP Basic

```
100     INTEGER Ser_poll, Ts_addr, Opr_bit, Mav_bit
110     DIM Message$ [2700]
120     Ts_addr = 720
130     Opr_bit = 4
140     Mav_bit = 16

920     REPEAT                                  ! Wait for OPR message ready.
930      Ser_poll=SPOLL(Ts_addr)
940     UNTIL BINAND(Ser_poll,Opr_bit)
950     OUTPUT Ts_addr;"TSINF?"                 ! Send query.
960     REPEAT                                  ! Wait for message available.
970      Ser_poll=SPOLL(Ts_addr)
980     UNTIL BINAND(Ser_poll,Mav_bit )
990     ENTER Ts_addr;Message$                  ! Read information message.
```

Test Set Parameters

The Test Set maintains an internal database of the various parameters used for running tests and controlling the link with the equipment under test. There are two types of parameter :

Global Parameters	These control the GSM Control Channel and various Test Set options.
Test Parameters	These specify the GSM Traffic Channel and test conditions for each test.

Global Parameters

These parameters are modified using the set of Parameter Configuration commands. The values set are applied for the complete session and are lost when the Test Set is either switched off or reset. When the Test Set is started up or reset, the parameter values are automatically set to the default values specified in Section 4, Section 6 (this Section) and Section 7.

Note: Parameter Configuration commands should not be sent during a test because the Test Set will ignore the commands.

Test Parameters

Each test has its own exclusive block of test parameters, which specify the E-GSM 900 / DCS 1800 / PCS 1900 Traffic Channel and test conditions for each test. Some tests have parameters that are duplicated in the Global Parameters; in such cases, the Test Parameters override the Global Parameters.

Each test has a command which modifies the associated set of Test Parameters and initiates the test.

Note: All associated Test Parameters in the test command must be entered, and so there are no default values as such for these parameters when tests are run via the GPIB interface.

Initialising The Test Set

The Test Set should always be initialised to a known state when first switched on.

To initialise the Test Set the following steps should be carried out :

(1) Reset the Test Set by sending the command :

```
RESET
```

This process will take about 30 seconds as the Test Set performs its power-up process and self-checks.

Note: Performing a serial poll during the reset process could cause problems because the Test Set is unable to respond to the GPIB interface. It is advisable to wait without any action during this time.

(2) When the Test Set has performed its power up sequence it will make available a number of Information Messages giving the Test Set internal code versions and dates. These should be read to clear the Test Set message queues. Any errors occurring during the self test sequence will be reported as Error Messages.

The final message in the Information Message sequence will be:

```
TSINF 0,6,"Power-up of processors complete - OK".
```

(3) The Test Set global parameters database should then be set up by sending the Parameter Configuration commands to the Test Set, in order to establish the desired operating configuration. If this is not done, the default values as defined in Section 4, Section 6 (this Section) and Section 7 will apply.

Modifying the Test Set Parameters Database

When the Test Set database has been set up as described above. the parameters may be modified at any time **except during a test** by sending the appropriate Parameter Configuration command.

Starting a Test

To start a test running, send the associated test command.

Example - To run the Absolute Sensitivity test, the following command should be sent:

```
SENS 90, 4, 0, -90, 0.5, -104, 0, 1, 10, 0.2, 0.41, 2.44
```

Processing Test Results.

Most tests are 'single-shot' tests which run once when the test command is sent, return a result, and then stop. . However, note that the Multimode Test runs continuously until halted by the Controller:

When a test procedure has been completed, the Test Set makes available an End of Test Report message for the Controller. This message has the following structure:

[Header]<space>[Result Number],[Test Result 1],[Test Result 2],[...],[Test Result N]

Where :

Header	=	The Start Test command mnemonic.
Result Number (Note 1)	=	Code number indicating the test result.
Test Result (Note 2)	=	Either a measured test result or zero.

Notes:

(1) The list of Result Numbers for each test are given in the GPIB Response description for each test.

(2) Some tests do not return any Test Results at all.

Data Precision and Units

The following Test Results require single precision floating point handling :

Measured Phase/Frequency Error results.
Measured Power Levels/Steps results.
Measured Sensitivity (Absolute) result.

The following Test Result requires string handling :

'PDAT?' response (147 characters, plus double quote at start and end).
TSINF? response.
*IDN? response.

All others are integer values.

Status Reports

These reports are made available by the Test Set while it is running a test; they indicate the status of the current test. The Test Set sends the messages as Status Messages using the SAV bit to signal their availability, the Controller sends TSSTA? query to command the Test Set to send them.

There are six classes of message generated :

TSPWR [Measured BTS Power Level],[Preamble Offset] (Note 1);
TSBER [Six BER results] (Note 1);
TSCPS [Configuration Progress Status] (Note 2);
TSSEN [Current Sensitivity Test Level] (Note 3).
TSPLT [Current Power Level Result] (Note 4)
TSRACH [Current RACH Result] (Note 5)

Note: (1) Only generated during Self Check Bit Error Rate and Air Interface Layer 1 Bit Error Rate.

(2) Generated by any test when the Test Set is preparing a BTS for the test.

(3) Only generated during Sensitivity (Absolute).

(4) Only generated during Power Level Steps test.

(5) Only generated during RACH Sensitivity test.

Data Precision and Units

The following message values require single precision floating point handling :

Measured BTS Power Level;
Current Sensitivity Test Level;

All others are integer values.

Reading Burst Analysis Data from the Test Set

When the Test Set has run one of the tests listed below, it is possible to obtain from the Test Set the processed measurement samples for the last measured burst. These can then be displayed in graphical form by the Controller if so desired.

There are three types of data available :

Phase Error	Bits 0 to 147, 2 samples per bit;
Power Profile	Bits -1 to 157, 6 samples per bit;
Modulation Spectrum	201 samples at approximately 5 kHz spacing

They can be obtained from the Test Set after the following End Of Test Report messages :

TXTST 0 or TXTST 39;	[Transmitter Test]
SCBA 0.	[Self Check Burst Analysis Test]

Phase Error

This data type gives the instantaneous phase error measured at each sample point. The measurement is performed on all bits in the burst, there are two samples per bit. The data is sent in response to the command :

```
PTMG?
```

The reply is a block of binary data in the <INDEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA> format.

The format for this message is :

$$\#0<samp_1><samp_2><...><samp_{294}><terminator>$$

where :

$samp_N$ (Note)	2 bytes scaled phase error.
terminator	newline character (0A hex) with EOI asserted.

Note: To maximise the speed of measurement in the Test Set, a small amount of post-processing is required in the Controller as follows:

$$\text{Phase Error} = \frac{samp_N}{182} \text{ degrees}$$

Power Profile

This data type gives the instantaneous power measured at each sample point. The measurement is performed on all bits in the burst, plus the preceding 10 bits and the succeeding 10 bits; there are two samples per bit. The data is sent in response to the command:

```
PPMG?
```

The reply is a block of binary data in the <INDEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA> format.

The format for this message is :

```
#0<samp1><samp2><...><samp1020><terminator>
```

Where :

samp_N (Note)	:	1020 relative power samples in 1/256 dB multiples. Each sample is 2 bytes.
terminator	:	newline character (0A hex) with EOI asserted.

Note: To maximise the speed of measurement in the Test Set, a small amount of post-processing is required in the Controller as follows:

The sample data sent by the Test Set are integers in the range -32767 to +32767 decimal. They are proportional to the received power level. The power at any sample point relative to the mean power level during the burst plateau is given by:

$$[\text{relative power}]_N = \frac{\text{sample}_N}{256} \text{ dB}$$

This data is available following the successful completion of the Power Profile test.
The response is in the indefinite form of the arbitrary block program data format (IEEE 488.2)

Modulation Spectrum

This data type gives the modulation spectrum measurement graph data obtained in the MODSP test. The response is sent in the indefinite form of the arbitrary block program data format, which thus requires the <END> terminator. The data is sent in response to the command:

```
MSMG?
```

The reply is a block of binary data in the <INDEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA> format.

The format for this message is :

```
#0<samp1><samp2>...<samp201><END>
```

Where:

$samp_N$ (Note)	:	201 relative power samples in 1/256 dB multiples. Each sample is 2 bytes.
terminator	:	newline character (0A hex) with EOI asserted.

Note: There are 201 frequency samples taken, i.e. 100 equidistant frequency samples either side of a centre frequency that corresponds to the data point or sample number 101. Each sample represents a power level in dBm scaled by 256 to avoid non-integer results. On the frequency axis, each sample is separated by 1.3/256 MHz. This gives an approximate frequency span from the centre frequency of ±507 kHz.

INTRODUCTION

This section contains information that is specific to the A-bis hardware and software options supplied with the 6113 and 6113E Test Sets used for testing E-GSM 900, DCS 1800 and PCS 1900 Base Transceiver Stations.

Only information on the actual options supplied is provided, and therefore the contents of this Section will vary from user to user.

6113 INITIAL FAILURE DIAGNOSIS PROCEDURE

Before reporting problems with the 6113 Test Set, try to answer the following questions. Some of the more common faults can be rectified by working through this procedure.

HARDWARE FAULTS

Does the Test Set power up OK?

- If nothing is displayed on the screen, check that the power fuses are OK.
- Vary the display contrast control and check that a control screen is displayed.
- Are the boot check screens displayed?
- Are all the boot check tests ticked '√' as Pass?
- Are any of the boot check tests crossed 'X' as Fail?
- If all the boot check tests Pass, is the Main Menu screen displayed?
- Do the Self Tests pass? (Operate the *Self Tests* button in the Self Tests / System Menu and then run the Self Tests).

SOFTWARE FAULTS

Does the Software work OK?

- Operate the control buttons on the Main Menu - do they all cause a response?
- Does the display start OK and then become corrupted?
- Are there any error/status messages?.
- What are the tests and actions that preceded the problem?.
- Is the failure repeatable? If so what are the steps?
- Is there a work-around that you have discovered?

For any unsolved problem, please take a copy of the Problem Report Sheet and fill it in with all relevant information. Then Fax it to Racal Instruments Ltd.

FACSIMILE TRANSMISSION

Sheet ....of ....

TO: Racal Instruments Help Desk **Racal Instruments Ltd** **480 Bath Road, Slough, Berkshire** **SL1 6BE, United Kingdom**	**FAX No : +44 (0) 1628 - 662017** **Telephone: +44 (0) 1753 - 741010** **Date:** ....
PROBLEM REPORT SHEET (To Be Copied)	**Racal Office Use** Log No. . . . . Date Received . . . .
USER DETAILS: Company: . . . . Contact Name: . . . . Telephone: . . . . Fax: . . . . Address:	**PRODUCT DETAILS:** Product: **6113 Digital Radio BTS Test Set** Serial No: . . . . **Software Versions:** UNIT: . . . . MAIN: . . . . BBP: . . . . DSP: . . . . **Firmware Versions:** Hardboot: . . . . Softboot: . . . . **PC OR GPIB CONTROLLER (If used):** Manufacturer: . . . . DOS Version: . . . . Windows™ Version: . . . .

DESCRIPTION OF PROBLEM OR QUESTION: (Please include any supporting documentation)

What error messages were displayed ?

PROBLEM RATING: (please circle one)

A: Major Fault **B:** Minor Fault **C:** Documentation Error **D:** Suggested Enhancement