Manual Supplement

8593E Option E02/E04



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6. 8593E Option E02/E04 Replaceable Parts

1 Purpose of This Manual Supplement

There are additional capabilities with the 8593E Option E02/E04. This supplement updates the 8590 D-Series and E-Series Spectrum Analyzer User's Guide, the 8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide, and the 8590 E-Series Spectrum Analyzer Calibration Guide with the additional capabilities.

How to Use This Manual Supplement

This manual supplement is designed to be inserted into and used with your existing 8590 Series documentation.

Use the following instructions to insert this supplement into the following guides:

- 8590 D-Series and E-Series Spectrum Analyzer User's Guide
- 8590 E-Series Spectrum Analyzer Calibration Guide
- 8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide
- 8590 D-Series and E-Series Spectrum Analyzers Service Guide
- 1. Place the "8593E Option E02/E04 General Information" section in the 8590 E-Series Spectrum Analyzer Calibration Guide.
- 2. Place the "8593E Option E02/E04 Verification Tests" section in the 8590 E-Series Spectrum Analyzer Calibration Guide.
- 3. Place the "8593E Option E02/E04 Operation" section in the 8590 D-Series and E-Series Spectrum Analyzer User's Guide.
- 4. Place the "8593E Option E02/E04 Programming Commands" section in the 8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide.
- 5. Place the "8593E Option E02/E04 Replaceable Parts" section in the 8590 D-Series and E-Series Spectrum Analyzers Service Guide.

2 8593E Option E02/E04 General Information

This section of the 8593E Option E02/E04 Manual Supplement contains the following:

- 1. The Agilent Technologies Software Product License Agreement and Limited Warranty.
- 2. The 8593E Option E02/E04 specifications and characteristics.
- 3. Information about the Option E02/E04 rear-panel connectors (supplements the "Rear-Panel Overview" section in Chapter 2 of the 8590 D-Series and E-Series Spectrum Analyzer User's Guide).
- 4. Information about the 8593E Option E02/E04 tracking generator functions.
- 5. The menus for the different modes.
- **NOTE** This document is designed to supplement the information in the 8590 E-Series Spectrum Analyzer Calibration Guide with information about the 8593E Option E02/E04. Since this manual supplement contains information specific to the 8593E Option E02/E04, we recommend that you refer to the following:
 - The 8590 D-Series and E-Series Spectrum Analyzer User's Guide for general information about the spectrum analyzer in the spectrum analyzer mode.
 - The 8590 E-Series Spectrum Analyzer Calibration Guide for specifications and characteristics and operation verification.
 - The 8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide for additional programming information.
 - The 8590 D-Series and E-Series Spectrum Analyzers Service Guide for additional replacement parts information.

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8593E Option E02/E04 Specifications

These are in addition to the standard 8593E Specifications in Chapter 5 of 8590 E-Series Spectrum Analyzer Calibration Guide. All specifications apply over 0 °C to +55 °C. The analyzer will meet its specifications after 2 hours of storage at a constant temperature within the operating temperature range, 30 minutes after the analyzer is turned on and after CAL FREQ, CAL AMPTD, CAL YTF, and CAL TRK GEN have been run.

SPECTRUM ANALYZER			
Frequency Specifications			
Resolution Bandwidth			
Selectivity of 1 kHz Resolution			
Bandwidth setting			
(60 dB:6 dB Ratio)	<13:1		
Precision Frequency Reference			
Aging	±1 x 10 ⁻⁷ ppm per year		
	$\pm 1.5 \ge 10^{-7}$ ppm per 2 years		
Settability	±1 x 10 ⁻⁸ ppm		
Temperature Stability	< ± 0.01 ppm		
Amplitude Specifications			
Spurious Responses			
3-tone intermodulation distortion	Three –30 dBm tones at input mixer with 2.75 MHz separation.		
10 MHz to 1.5 GHz	<-70 dBc		
1.5 GHz to 12 GHz	<-67 dBc		
Maximum Dynamic Range			
Signal to TOI distortion	70 dB		
–30 dBm input with 0 dB input attenuation			

Table 2-1. 8593E Option E02/E04 Specifications (1 of 5)

IF TRACKING GENERATOR			
The following specifications apply after TRACK PEAK has been run.			
Frequency Range			
Direct	300 kHz to 2.9 GHz		
w/Multipath Fading Simulator	40 MHz to 170 MHz		
Frequency Span Range			
Direct	Zero span, 10 kHz to 2 GHz, full span		
w/Multipath Fading Simulator	Zero span, 10 kHz to 170 MHz		
Frequency Accuracy			
Span > 0	±(frequency readout x frequency reference error ^b + span accuracy + 1% of span + 20% of resolution bandwidth +2 kHz)		
Zero Span (CW)	±3 kHz after 15 minute warm-up		
Dynamic Range			
Direct	>111 dB		
Output Level Range			
Direct	–66 dBm to –1.0 dBm with 50 Ω load		
w/Multipath Fading Simulator	–50 dBm to +10 dBm with 75 Ω load		
Output Attenuator Range	0 to 56 dB in 8 dB steps		
Output Level Resolution			
Direct	0.1 dB		
w/Multipath Fading Simulator	0.1 dB		
Output Level Vernier Accuracy			
	16 dB attenuation, referenced to -20 dBm		
at 300 MHz, 25 °C ±10 °C			
Incremental	±0.20 dB/dB		
Cumulative	±0.50 dB Total		
Output Level Absolute Accuracy			
	16 dB attenuation, referenced to -20 dBm		
at 300 MHz, 25 °C ±10 °C			
Direct	±0.75 dB referenced to 0 dBm at 300 MHz		
w/Multipath Fading Simulator	±2.75 dB		

Table 2-1. 8593E Option E02/E04 Specifications (2 of 5)

b. Frequency Reference Error = (aging rate x period of time since adjustment + initial achievable accuracy + temperature stability).

IF TRACKING GENERATOR (continued)			
Level Flatness, Unnormalized			
Referenced to 300 MHz, –20 dBm			
Direct			
300 kHz to 10 MHz	±3.0 dB		
40 MHz to 300 MHz	±1.5 dB		
10 MHz to 2.9 GHz	±2 dB		
Level Flatness, Normalized			
At constant temperature, excluding errors due to mismatch.			
Direct	±0.2 dB		
w/Multipath Fading Simulator	±0.05 dB per 40 MHz		
Output Level Stability			
At constant temperature			
Direct	±0.05 dB per 15 minutes		
	±0.1 dB per 24 hours		
Power Sweep Range	(-10 dBm to -1 dBm) - (source attenuator setting)		
Spectral Purity (-1 dBm Output Power)			
Residual FM in CW Mode	<500 Hz rms using a 50 Hz to 15 kHz post detection bandwidth		
Residual AM in CW Mode	<-60 dBc using a 50 Hz to 15 kHz post detection bandwidth		
Spurious Output			
Harmonic spurs 300 kHz to 2.9 GHz			
TG output: 300 kHz to ≤400 MHz	≤-25 dBc		
TG output: >400 MHz to 2.9 GHz	≤–15 dBc		
Non-harmonic spurs 300 kHz to 2.9 GHz			
TG output: 300 kHz to ≤400 MHz	≤27 dBc		
TG output: >400 MHz to 2.9 GHz	≤–15 dBc		
LO Feedthrough (-1 dBm ouput power)			
3.9217 GHz to 6.8214 GHz	<-16 dBm		
TG Feedthrough			
400 kHz to 2.9 GHz	<-110 dBm		
RF Power OFF Residuals			
300 kHz to 2.9 GHz	<-120 dBm		
Sweep Time Range	20 ms to 100 s		

Table 2-1. 8593E Option E02/E04 Specifications (3 of 5)

EVENT COUNTER			
Maximum Pulse Rate			
Driven from open collector			
TTL with 1 k Ω pull-up	100 kHz		
Minimum Pulse Width			
Driven from open collector			
TTL with 1 k Ω pull-up	1 μ s negative, 5 μ s positive		
Maximum Input Cable Length	$25 \text{ ft of } 75 \Omega \text{ cable}$		
Gate Time			
Range	10 ms to 163 s in 10 ms steps and totalize (continuous)		
Accuracy	±0.1%		
Event Counter			
Counts negative-going pulses (falling edge followed by rising edge) at EVENT CNTR INPUT			
Maximum Number of Counts	$4 \ge 10^9$		
Resolution	1 count		
Interval Counter			
Counts negative-going pulses (falling edge followed by rising edge) at INTERVAL CNTR INPUT			
Maximum Number of Counts	4 x 10 ⁹		
Resolution	1 count		
Counts total time that INTERVAL CNTR INPUT is low			
Maximum Interval Time	163 s		
Resolution per pulse	2.5 ms		

Table 2-1. 8593E Option E02/E04 Specifications (4 of 5)

FLATNESS ANALYZER			
when used with 8470B Detector			
Frequency Range	10 MHz to 18 GHz		
Flatness	±0.05 dB per 40 MHz (normalize include mismatch errors.	ed) does not	
Input Level	-30 to +20 dBm at diode detecto	r.	
Log Scale	0.1 to 1 dB/div in 0.1 dB steps, 8 divisions displayed.		
Display Scale Fidelity			
Reference Level	Log Incremental Accuracy	Log Maximum Cumulative	
dBm	dB/2 dB step	dB	
-30 to -20.1	0.7	0.7	
– 20 to +15.9	0.4	0.6	
+16 to +20	0.8	1.2	
Return Loss at Diode Detector			
$75 \ \Omega$ system			
10 MHz to 2 GHz	>26 dB when used with 11852B 75 Ω to 50 Ω matching pad.		
$50 \ \Omega$ system			
10 MHz to 4 GHz	>23 dB		
4 GHz to 15 GHz	>18 dB		
15 GHz to 18 GHz	>15 dB		
FREQUEN	ICY COUNTER		
Frequency Range	10 MHz to 2.9 GHz (N=1) ^a		
	2.75 GHz to 6.5 GHz (N=1)		
	6.0 GHz to 12.8 GHz (N=2)		
	12.4 GHz to 19.4 GHz (N=3)		
	19.1 GHz to 22 GHz (N=4)		
Sensitivity	<-40 dBm		
Frequency Measurement Accuracy	asurement Accuracy \pm (frequency readout x frequency reference error ^b + counter resolution + 100 Hz x N) ^a		
Usable Counter Resolution	Usable Counter Resolution 5 Hz, 10 Hz, 10 Hz, 1 kHz, 10 kHz		

Table 2-1. 8593E Option E02/E04 Specifications (5 of 5)

b. Frequency Reference Error= (aging rate x period of time since adjusted + initial achievable accuracy + temperature stability). The frequency reference is the 8593E E02/E04 Spectrum Analyzer Frequency Reference.

a. N = LO harmonic. See "Frequency Range".

8593E Option E02/E04 Characteristics

These are in addition to the standard 8593E Specifications in Chapter 2 of 8590 E-Series Spectrum Analyzer Calibration Guide.

Table 2-2. 8593E E02/E04 Characteristics (1 of 2)

Г

NOTE These are not specifinformation about it	fications. Characteristics provide useful, but non-warranted, nstrument performance.
	EVENT COUNTER
Input Level	TTL, HCMOS, open collector TTL
Maximum Pulse Rate	
Driven from TTL or HCMOS	1.6 MHz
Minimum Pulse Width	
Driven from TTL or HCMOS	300 ns negative or positive
Input Impedance	
AC	$75 \ \Omega$
DC	$2 \text{ k}\Omega$ (pull-up to +5 V)
Maximum Safe Input Level	±15 Vdc
Rear Panel Connectors	
EVENT CNTR INPUT	BNC female
INTERVAL CNTR INPUT	BNC female
	FLATNESS ANALYZER
Rear Panel Connector	
FLATNESS EXT DET IN	BNC female
Maximum Safe Input Level	
at 8470B Detector	200 mW continuous
	1 W for <1 minute
	0 Vdc
Maximum Safe Input Level	
at rear panel connector	
Inner Conductor	±15 Vdc
Outer Conductor	±5 Vdc
Operational Features	"Single button" calibration (normalization)
	Amplitude Track

FREQUENCY COUNTER		
Front Panel Connector ^b		
INPUT 50 Ω	Type N female	
Input Impedance	50 Ω	
IF TRACKING GENERATOR		
RF output		
Connector	Type N Female	
Impedance	50 Ω	
Return Loss	> -13 dB for attenuation ≥ 8 dB	
	> -6 dB for 0 dB attenuation	
Maximum safe reverse level without damage	+30 dBm (1 Watt), 30 Vdc	
SPECTRUM ANALYZER		
Precision Frequency Reference		
Aging	0.005 ppm/day, 7 day average after being turned on for 7 days	
Warm-up	±0.01 ppm within 15 minutes of turn-on	
	±0.1 ppm within 5 minutes of turn-on	
Initial Achievable Accuracy	1±0.022 ppm within 24 hours of turn-on	

Table 2-2. 8593E E02/E04 Characteristics (2 of 2)

b. Uses the INPUT 50 Ω connector of the spectrum analyzer.

Option E02/E04 Rear-Panel Connectors

The Option E02/E04 has three rear-panel connectors in addition to those on the standard 8593E analyzer. See Figure 2-1.





1. **FLATNESS EXT DET IN** is used in the flatness mode. The flatness analyzer measures swept flatness (amplitude versus frequency). Flatness is analyzed with the 8470B Crystal Detector (from the Accessory Kit) connected to the FLATNESS EXT DET IN connector.

CAUTIONThe maximum safe input level of the FLATNESS EXT DET IN connector is
 ± 5 Vdc at the inner connector, and ± 5 Vdc at the outer connector.

2. **EVENT CNTR INPUT (TTL)** is the input for the event counter. The event counter measures the number of negative-going pulses.

CAUTION The maximum safe input level of the EVENT CNTR INPUT and the INTERVAL CNTR INPUT is ±15 Vdc.

3. **INTERVAL CNTR INPUT (TTL)** is the input for the interval counter. The interval counter counts the number of negative-going pulses and also measures the accumulated time interval that the pulse is (low).

Chapter 2

NOTE The LO OUTPUT connector must be terminated with a 50 Ω termination to meet frequency and amplitude specifications.

8593E Option E02/E04 Tracking Generator Functions

Some of the 8593E Option E02/E04 tracking generator functions are different than the 8591E Option 010 or 011 tracking generator. The following table lists the 8591E Option 010 or 011 function and compares it with the 8593E Option E02/E04 function.

8591E Option 010 or Option 011 Function	Corresponding 8593E Function	Comments
ALC MTR INT XTAL	ALC INT EXT ^b	Only internal automatic level control is available for the 8593E. External leveling control is not accessible.
MAN TRK ADJUST	MAN TRK ADJUST	Performs a similar function ^a
PWR SWP ON OFF	PWR SWP ON OFF	Performs a similar function ^a
SRC PWR OFFSET	SRC PWR OFFSET	Performs a similar function ^a
SRC PWR ON OFF	SRC PWR ON OFF	Performs a similar function ^a
SRC PWR STP SIZE	SRC PWR STP SIZE	Performs a similar function
SWP CPLG SR SA	SWP CPLG SR SA $^{\mathrm{b}}$	Performs a similar function
TRACKING PEAK	TRACKING PEAK	Performs a similar function

b. This function is not available when using the scalar analyzer mode.

a. The 8591E Option 010 and 8593E Option E02/E04 functions are not identical because Option E02/E04 has a wider frequency range (300 kHz to 2900 MHz) than the 8591E Option 010 or 011.

Mode Menus

The following section contains the menus for the following 8593E Option E02/E04 (also called DRTS) modes:

Digital Radio Mask	Figure 2-2.
Event Counter	Figure 2-3.
Flatness & Sources	Figure 2-4.
Frequency Counter	Figure 2-5.
Low Frequency Oscilloscope	Figure 2-6.
Scalar Analyzer	Figure 2-7.
-	-

NOTE The functions of some of the front-panel keys may be changed or inaccessible while in a DRTS mode.

Figure 2-2. Digital Radio Mask Mode Menu



DIGITAL RADIO MASKS MODE MENU

Chapter 2

Figure 2-3. Event Counter Mode Menu



8593E OPTION E02/E04 EVENT COUNTER MODE MENU

• Sources accesses the sources menus only if FLATNESS & SOURCES has been loaded into analyzer memory.

ADDITIONAL FRONT-PANEL KEYS THAT ARE REDEFINED BY THE EVENT COUNTER MODE



DSP LINE, ON OFF THRESHLD, ON OFF CHANGE, TITLE CHANGE, PREFIX GRAT, ON OFF The CTRL functions are not

applicable in the EVENT COUNTER mode.

hh26e





8593E OPTION E02/E04 FLATNESS & SOURCES MODE MENU

Chapter 2

Figure 2-5. Frequency Counter Mode Menu

8593E OPTION E02 FREQUENCY COUNTER MODE MENU



The following front-panel keys are not applicable in the FREQUENCY COUNTER mode:



Figure 2-6. Low Frequency Oscilloscope Mode Menu



8593E OPTION EO2 LOW FREQUENCY OSCILLOSCOPE MODE MENU

ADDITIONAL FRONT-PANEL KEYS THAT ARE REDEFINED BY THE LOW FREQUENCY OSCILLOSCOPE MODE



hh227e





hh228e

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3 8593E Option E02/E04 Verification Tests

What You'll Find in This Supplement

This supplement to the "Performance Verification Tests" chapter of the 8590 E-Series Spectrum Analyzer Calibration Guide contains procedures which test the electrical performance of the 8593E Option E02/E04 Spectrum Analyzer.

The 8590 E-Series Spectrum Analyzer Calibration Guide contains procedures which test the electrical performance of the IF tracking generator.

None of the test procedures involve removing the cover of the spectrum analyzer.

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NOTE The tracking generator harmonic and non-harmonic spur specifications in this supplement supersede the specifications in the 8590 E-Series Spectrum Analyzer Calibration Guide.
```

8593E Option E02/E04 Verification Tests

The 8593E Option E02/E04 verification tests verify that the spectrum analyzer performance is within all of the Option E02/E04 specifications. It is time consuming and requires extensive test equipment. Perform the 8593E Performance Verification tests before performing the 8593E Option E02/E04 verification tests. See Table 2-1 the "Performance Verification Tests" chapter of the 8590 E-Series Spectrum Analyzer Calibration Guide for a complete set of 8593E Option E02/E04 verification tests. See Table 3-1 for a complete listing of the 8593E Option E02/E04 verification tests. The IF tracking generator verification tests included here are in addition to or supersede tests in the 8590 E-Series Spectrum Analyzer Calibration Guide.

Test Number	Test Name
1	Resolution Bandwidth Selectivity
2	Three-Tone Intermodulation Distortion
3	Absolute Amplitude and Vernier Accuracy
4	Power Sweep Range
5	Tracking Generator Level and Flatness
6	Tracking Generator Frequency Accuracy
7	Harmonic Spurious Outputs
8	Non-Harmonic Spurious Outputs
9	Tracking Generator Feedthrough
10	RF Power-Off Residuals
11	Tracking Generator LO Feedthrough Amplitude
12	Residual AM and Residual FM
13	Event Counter
14	Flatness Analyzer Log Fidelity

Table 3-1 Verification Tests for the 8593E Option E02/E04

Before You Start the Verification Tests

There are six things you should do before starting a verification test:

- 1. Switch the analyzer on and let it warm up in accordance with the General Specifications listed in Table 2-1.
- 2. Read the "Making Measurements" chapter of the 8590 D-Series and E-Series Spectrum Analyzer User's Guide.
- 3. After the analyzer has warmed up as specified, perform the self-calibration procedure documented in "Improving Accuracy With Self- Calibration Routines" in the "Getting Started" chapter of the 8590 D-Series and E-Series Spectrum Analyzer User's Guide. The performance of the analyzer is only specified after the analyzer calibration routines have been run and if the analyzer is autocoupled.
- 4. Perform the verification tests for the 8593E described in the "Calibration" chapter of the 8590 E-Series Spectrum Analyzer Calibration Guide (prior to this supplement).
- 5. Read the rest of this section before you start any of the tests, and make a copy of the Performance Verification Test Record "Recording the Test Results".
- 6. Load the Frequency Counter, Flatness and Sources, and Event Counter modes with the following procedure.

Loading the Frequency. Counter, Flatness and Sources, and Event

Counter Modes

- 1. Press **[PRESET]** on the 8593E. If **MODE LOADER** is not one of the displayed softkeys, perform *all* of the following steps. If **MODE LOADER** is displayed, perform step 2.
 - a. Press [CONFIG], MORE 1 of 2, DISPOSE USER MEM. The message IF YOU ARE SURE, PRESS KEY AGAIN TO PURGE DATA will be displayed. Press DISPOSE USER MEM again.
 - b. Press [RECALL], INTERNAL CRD (CRD), CATALOG CARD, CATALOG ALL.
 - c. The file name "dLOADME" should be highlighted. If not, rotate the knob until "dLOADME" is highlighted. Press **LOAD FILE**.
- 2. Press **MODE LOADER**. Select number 1 from the menu to load the Frequency Counter, Flatness and Sources, and Event Counter modes, and press **[ENTER]**. Wait until all modes are loaded.

Test Equipment You'll Need

Table 3-2 lists the recommended test equipment for the performance tests. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model(s).

Recording the Test Results

A test results table is provided at the end of each test procedure for your convenience in recording test results as you perform the procedure.

In addition, a complete Performance Verification Test Record, Table 3-15, has been provided at the end of this supplement. We recommend that you make a copy of the table, record the test results on the copy, and keep the copy for your calibration test record. This record could prove valuable in tracking gradual changes in test results over long periods of time.

If the Analyzer Doesn't Meet Specifications

If the analyzer fails a test, rerun the **CAL FREQ & AMPTD** routine, press **CAL STORE**, and repeat the test. If the analyzer still fails one or more specifications, complete any remaining tests and record all test results on a copy of the test record. Then refer to the "Problems and Error Messages" chapter of the 8590 D-Series and E-Series Spectrum Analyzer User's Guide for instructions on how to solve the problem.

Periodically Verifying Operation

The analyzer requires periodic verification of operation. Under most conditions of use, you should test the analyzer at least once a year with either Operation Verification or the complete set of Performance Verification tests.

Instrument	Critical Specifications for Equipment Substitution	Recommended Model
Spectrum	Frequency Range: 300 kHz to 7 GHz	8566A/B
Analyzer	Relative Amplitude Accuracy:	
	300 kHz to 2.5 GHz: <±1.8 dB	
	300 kHz to 2.9 GHz: <±4.0 dB	
	Absolute Amplitude Accuracy:	
	300 kHz to 2.5 GHz: <±1.9 dB	
	2.5 GHz to 2.9 GHz: <±4.1 dB	
	Frequency Accuracy: <±10 kHz at 7 GHz	
Synthesizer/	Frequency Range: 0.1 Hz to 20 MHz	3325B
Function Generator	Frequency Accuracy: <±0.02%	
	Maximum Output Power: >+20 dBm	
	Waveform: Triangle, Sine	
Pulse/ Function	Frequency Range: 50 kHz to 100 kHz	8116A
Generator	Amplitude Range: 0 to 5V peak-to-peak	
	Waveforms: Square, Pulse	
	Duty Cycle: 10% to 90%	
	Burst Mode	
	Maximum Number of Bursts: > 1000	
	Complement Mode	
Measuring/ Receiver	Compatible with Power Sensors	8902A
	dB Relative Mode	
	Resolution: 0.01 dB	
	Power Reference Accuracy: <±1.2%	
	AM and FM Measurement Modes	
	AM Accuracy: <6.5 dB at -60 dBc.	
	FM Accuracy: <42.5 Hz rms	
Power Sensor	Frequency Range: 10 MHz to 80 MHz	8482H
	Power Range: +0 dBm to +20 dBm	
	Maximum SWR: 1.20 (10 MHz to 80 MHz)	
RF Detector	Frequency Range: 10 MHz to 18 GHz	8470B
	Maximum SWR: <1.2 (10 MHz to 80 MHz)	
	Sensitivity: >0.5mV/mW	
	Maximum Input: 200 mW	
Termination	Impedance: 50 Ω (nominal) (2 required)	908A

Table 3-2 Recommended Test Equipment

1. Resolution Bandwidth Selectivity

Specification

1 kHz RES BW Setting, 60 dB:6 dB ratio:<13:1

Related Adjustments

Crystal and LC Bandwidth Filter Adjustments

Description

The output of a frequency-synthesizer/level-generator is applied to the input of the spectrum analyzer. The synthesizer output amplitude is reduced by 6 dB to establish an amplitude reference for the actual 6 dB point. The synthesizer is then increased by 6 dB. A sweep is taken and the markers are used to measure the 6 dB bandwidth.

The synthesizer is then turned to frequencies near the upper and lower 6 dB points and the markers are used to measure the frequency separation. The measured separation is then used to correct the measured 6 dB bandwidth for span errors.

The 60 dB bandwidth is measures in a similar manner. The ratio of the 60 dB to 6 dB bandwidth is calculated.

Figure 3-1 Resolution Bandwidth Selectivity Test Setup



Equipment

Synthesizer/Level Generator	5A
-----------------------------	----

Adapter

BNC (f) to Type N (m)..... 1250-1476

Cable

BNC, 122 cm (48 in) 10503A

Procedure

3.

- 1. Connect the equipment as shown in Figure 3-1.
- 2. Set the 3335A controls as follows:

FREQUENCY	40 MHz
AMPLITUDE	–2 dBm
AMPTD INCR	0.5 dB
On the 8593E, press [PRESET] and set the contr	rols as follows:

CENTER FREQ	40 N	ΛHz
SPAN	100	kHz

Measuring 6 dB Bandwidth

- 4. On the 8593E, press [PEAK SEARCH], [MKR FCTN], MK TRACK ON OFF (ON), [SPAN], 10 [kHz]. Wait for the AUTO ZOOM message to disappear.
- 5. Set the 8593 controls as follows:

LOG dB/DIV	. 1 d	В
VIDEO BW	. 30	Hz

- 6. Press [AMPLITUDE] on the 3335A and use the INCR keys until the 8593E MKR amplitude is between 0 and −0.5 dBm. On the 3335A, press [AMPTD INCR], 6 [+dBm], [AMPLITUDE], INCR [▼].
- 7. On the 8593E, press [MKR FCTN], MKR TRACK ON OFF (OFF), [PEAK SEARCH], MARKER DELTA.
- 8. Press INCR, $[\blacktriangle]$ on the 3335A.
- 9. On the 8593E, press [SGL SWP], [MKR].
- 10. On the 8593E, rotate the knob counterclockwise until the MARKER Δ amplitude reads 0 dB ±0.25 dB. The marker should be on the left-hand skirt of the signal. If the marker cannot be set exactly to 0 dB, note weather the marker is just above or just below the actual 6 dB.
- 11. On the 8593E, press **MARKER DELTA**, **[PEAK SEARCH]**. Rotate the knob clockwise until the MARKER Δ amplitude reads 0 dB ±0.25 dB. The active marker should be in the right-hand skirt of the signal. If the marker was set just above the 6 dB point in step 10, set the marker just below the 6 dB point. If the marker was set just below the 6 dB point in step 10, set the marker just above the 6 dB point.
- 12. Record the MARKER Δ frequency as the Measured 6 dB BW below.

Measured 6 dB BW____Hz

13. Divide the MARKER Δ frequency by two and record as the 3335A FREQ

3335A FREQ INCR_____Hz
- 14. On the 3335A, press [FREQ INCR] and enter the 3335A FREQ INCR recorded in step 13. Press [FREQUENCY], INCR [♥].
- 15. On the 8593E, press [SGL SWP], [PEAK SEARCH], MARKER DELTA.
- 16. On the 8593E, press **[FREQUENCY]**, 40 **[MHz]**, INCR **[▲]**.
- 17. On the 8593E, press [SGL SWP], [PEAK SEARCH]. Record the MARKER Δ frequency as the Measured Separation.

Measured Seperation____Hz

18. Calculate and record the Actual 6 dB BW using the following equation:

Actual 6 dB BW= (Measured 6 dB BW) ²/Measured Separation)

Actual 6 dB BW____Hz

Measuring 60 dB Bandwidth

19. Set the 3335A controls as follows:

FREQUENCY	. 40	MHz
AMPLITUDE	. –2	dBm
AMPTD INCR	. 1 d	lB

20. Set the 8593E controls as follows:

VIDEO BW	AUTO
TRIG	CONT
LOG dB/DIV	10 dB
SPAN	30 kHz

- 21. On the 8593E, press [MKR], MARKER NORMAL, [PEAK SEARCH].
- 22. Press [AMPLITUDE] on the 3335A and use the INCR keys until the 8593E MKR amplitude reading is between 0 and −1 dBm. On the 3335A, press [AMPTD INCR], 60 [+dBm], [AMPLITUDE], INCR [▼].
- 23. On the 8593E, press [BW], [VID BW AUTO MAN] (MAN), 30, [Hz]. Wait for completion of a new sweep. Press [PEAK SEARCH], MARKER DELTA.
- 24. Press INCR [\blacktriangle] on the 3335A.
- 25. On the 8593E, press [BW], VID AVG ON OFF (ON), 10, [Hz]. Wait for AVG 10 to be displayed to the left of the graticule area. Press [SGL SWP] and wait for completion of a new sweep. Press [MKR].
- 26. On the 8593E, rotate the knob counterclockwise until the MARKER Δ amplitude reads 0 dB ±0.50 dB. The marker should be on the left-hand skirt of the signal. If the marker cannot be set exactly to 0 dB, note weather the marker is just above or just below the actual 60 dB point.
- 27. On the 8593E, press MARKER DELTA, [PEAK SEARCH]. Rotate the knob clockwise until the MARKER Δ amplitude reads 0 dB ±0.50 dB. The active marker should be in the right-hand skirt of the signal. If the marker was set just above the 60 dB point in step 10, set the marker just below the 60 dB point. If the marker was set just below the 60 dB point in step 10, set the marker 10, set the marker just above the 60 dB point.

28. Record the MARKER Δ frequency as the Measured 60 dB BW below.
Measured 60 dB BWHz
29. Divide the MARKER Δ frequency by two and record as the 3335A FREQ INCR.
3335A FREQ INCRHz
30. On the 3335A, press [FREQ INCR] and enter the 3335A FREQ INCR recorded in step 29. Press [FREQUENCY] , INCR [♥] .
31. On the 8593E, press [BW], VID AVG ON OFF (OFF), [SGL SWP], [PEAK SEARCH], MARKER DELTA.
32. On the 3335A, press [FREQUENCY], 40 [MHz], INCR [\blacktriangle].
33. On the 8593E, press [SGL SWP], [PEAK SEARCH], Record the MARKER Δ frequency as the Measured Separation.
Measured SeparationHz
34. Calculate and record the Actual 60 dB BW using the following equation:
Actual 60 dB BW= (Measured 60 dB BW) ² /Measured Separation
Actual 60 dB BWHz
35. Divide the Actual 60 dB from step 34 by the Actual 6 dB from step 18 and record the result as the 1 kHz RES BW Selectivity.
1 kHz RES BW Selectivity = Actual 60 dB BW/Actual 6 dB BW
1 kHz RES BW Selectivity:1

2. Three-Tone Intermodulation Distortion

Specification

For three –30 dBm tones at input mixer with 2.75 MHz separation:

10 MHz to 1.5 GHz: $<-70~\mathrm{dBc}$

1.5 GHz to 12 GHz: $<-67~\mathrm{dBc}$

Description

The three-tone intermodulation distortion performance is verified using a two-tone third order intermodulation distortion test. Given three test signals of frequencies Fa, Fb, and Fc, the amplitude of the Fa – Fb + Fc product (three-tone test) is 6 dB higher than the 2Fa –Fb third order product (two-tone test) (1). As a result, the third order distortion products should be –76 dBc for lower frequencies and –73 dBc for higher frequencies.

The two tones are combined in a directional coupler (for isolation) and are applied to the analyzer input. The power level of the two signals is 8 dB higher than specified, so the distortion products should be suppressed by 16 dB less than specified. In this manner, the equivalent Third Order Intercept (TOI) is measured.

With two -30 dBm tones at the input mixer and the distortion products suppressed by 76 dBc, the equivalent TOI is +8 dBm (-30 dBm + 76 dBc/2). However, if two -22 dBm tones are present at the input mixer and the distortion products are suppressed by 60 dBc, the equivalent TOI is also +8 dBm (-22 dBm + 60 dBc/2).

Performing the test with a higher power level maintains the measurement integrity while reducing test time.

The lower frequency range performance is tested at 2 GHz, due to directional coupler frequency limitations. Testing at 2 GHz verifies the performance of the 10 MHz to 2.9 GHz range.

(1) R.C. Heidt, "Three-Tone Nonlinearity Testing-The Intermodulation Coefficient, M" Panel Session on "Nonlinearities in Microwave Devices and Systems," in Digest 1973 IEEE G-MTT International Microwave Symposium. (Boulder, Colorado), June 4-6, 1973, p.113



Figure 3-2 Three-Tone Intermodulation Distortion Test Setup

Equipment

8340A/B
8902A
8485A
0955-0125

Cable

APC 3.5 Cable, 91 cm (36 in) (2 required)...... 8120-4921

Adapter

Type N (m) to APC 3.5 (m)	1250-1743
APC 3.5 (f) to APC 3.5 (f)	5061-5311

Procedure

- 1. Zero and calibrate the 8902A and 8485A combination in log mode (RF power readout in dBm). Enter the power sensor's 2 GHz Cal Factor into the 8902A.
- 2. Connect the equipment as shown in Figure 3-2 with the input of the directional coupler connected to the power sensor.

3. Press [INSTR PRESET] on each 8340A/B. Set each 8340A/B controls as follows:

CW (8340A/B #1)	
CW (8340A/B #2)	z
RFOFF	

4. On the 8593E, press [PRESET] and wait until the preset is finished. Set the controls as follows:

CENTER FREQ	2.0 GHz
SPAN	1 MHz
REF LEVEL	. –10 dBm

Press the following analyzer keys: [PEAK SEARCH], More 1 of 2, PEAK EXCURSN, 3 [dB], [DISPLAY], THRESHOLD ON OFF (ON), 90 [-dBm].

- 5. On 8340A/B #1, set RF on. Adjust the power level until the 8902A reads $-12~\rm dBm$ $\pm 0.05~\rm dB.$
- 6. Disconnect the power sensor from the directional coupler. Connect the directional coupler directly to the 8593E INPUT 50Ω using an adapter (do not use a cable).
- 7. On the 8593E, press [PEAK SEARCH], [MKR FCTN], MKR TRACK ON OFF (ON), [SPAN], 200 [kHz]. Wait for the AUTO ZOOM message to disappear. Press [MKR FCTN], MKR TRACK ON OFF (OFF), [PEAK SEARCH], [MKR ->], MARKER -> REF LVL. Press [FREQUENCY], CF STEP MAN AUTO (MAN), 2.75 [MHz], CENTER FREQ, [▲].
- 8. On 8340A/B #2, set RF on. Adjust the power level until the signal is displayed at the reference level.
- 9. Set the 8593E controls as follows:

RES BW	1 kHz
VIDEO BW	100 kHz

- 10. On the 8593E, press [PEAK SEARCH], MARKER DELTA, [FREQUENCY], [▲], [SGL SWP]. Wait for completion of a new sweep.
- 11. If a distortion product can be seen, proceed as follows:
 - a. On the 8593E, press [PEAK SEARCH].
 - b. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.

- 12. If a distortion product cannot be seen, proceed as follows:
 - a. On each 8340A/B, increase the power level by 5 dB.
 - b. On the 8593E, press [SGL SWEEP] and wait for completion of a new sweep. A distortion product should now be visible with the higher power level. Press [PEAK SEARCH].
 - c. On each 8340A/B, reduce the power level by 5 dB.
 - d. On the 8593E, press [SGL SWEEP] and wait for completion of a new sweep.
 - e. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.
- 13. On the 8593E, press [FREQUENCY], [♥], [♥], [♥], [SGL SWP]. Wait for completion of a new sweep.
- 14. If a distortion product can be seen, proceed as follows:
 - a. On the 8593E, press [PEAK SEARCH].
 - b. Record the MKR Δ amplitude reading in Table 3-3 as the Lower Product Suppression.
- 15. If a distortion product cannot be seen, proceed as follows:
 - a. On each 8340A/B, increase the power level by 5 dB.
 - b. On the 8593E, press [SGL SWEEP] and wait for completion of a new sweep. A distortion product should now be visible with the higher power level. Press [PEAK SEARCH].
 - c. On each 8340A/B, reduce the power level by 5 dB.
 - d. On the 8593E, press [SGL SWEEP] and wait for completion of a new sweep.
 - e. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.
- 16. Enter the power sensor's 2 GHz Cal Factor into the 8902A.
- 17. Connect the equipment as shown in Figure 3-2 with the input of the directional coupler connected to the power sensor.
- 18. Set each 8340A/B controls as follows:

POWER LEVEL	–15 dBm
CW (8340A/B #1)	4.0 GHz
CW (8340A/B #2)	4.00275 GHz
RF	OFF

19. On the 8593E, press **[PRESET]** and wait until the preset is finished. Set the controls as follows:

CENTER FREQ	4.0 GHz
SPAN	1 MHz
REF LEVEL	-10 dBm

Press the following analyzer keys: [PEAK SEARCH], PEAK EXCURSN, 3 [dB], [DISPLAY], THRESHOLD ON OFF (ON), -90 [+dBm].

- 20. On 8340A/B #1, set RF on. Adjust the power level until the 8902A reads $-12~\rm dBm$ $\pm 0.05~\rm dB.$
- 21. Disconnect the power sensor from the directional coupler. Connect the directional coupler directly to the 8593E INPUT 50 Ω using an adapter (do not use a cable).
- 22. On the 8593E, press [PEAK SEARCH], [MKR FCTN], MKR TRACK ON OFF (ON), [SPAN], 200 [kHz]. Wait for the AUTO ZOOM message to disappear. Press [MKR FCTN], MKR TRACK ON OFF (OFF), [PEAK SEARCH], [MKR ->], MARKER -> REF LVL. Press [FREQUENCY], CF STEP MAN AUTO (MAN), 2.75 [MHz], CENTER FREQ, [▲].
- 23. On 8340A/B #2, set RF on. Adjust the power level until the signal is displaced at the reference level.
- 24. Set the 8593E controls as follows:

RES BW	1 kHz
VIDEO BW	$100 \ \mathrm{Hz}$

- 25. On the 8593E, press [PEAK SEACH], MARKER DELTA, [FREQUENCY], [▲], [SGL SWP]. Wait for completion of a new sweep.
- 26. If a distortion product can be seen, proceed as follows:
 - a. On the 8593E, press [PEAK SEARCH].
 - b. Record the MKR Δ amplitude reading in Table 3-3 as the Lower Product Suppression.
- 27. If a distortion product cannot be seen, proceed as follows:
 - a. On each 8340A/B, increase the power level by 5 dB.
 - b. On the 8593E, press [SGL SWEEP] and wait for completion of a new sweep. A distortion product should now be visible with the higher power level. Press [PEAK SEARCH].
 - c. On each 8340A/B, reduce the power level by 5 dB.
 - d. On the 8593E, press [SGL SWEEP] and wait for completion of a new sweep.
 - e. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.
- 28. On the 8593E, press [FREQUENCY], [♥], [♥], [♥], [SGL SWP]. Wait for completion of a new sweep.

- 29. If a distortion product can be seen, proceed as follows:
 - a. On the 8593E, press [PEAK SEARCH].
 - b. Record the MKR Δ amplitude reading in Table 3-3 as the Lower Product Suppression.
- 30. If a distortion product cannot be seen, proceed as follows:
 - a. On each 8340A/B, increase the power level by 5 dB.
 - b. On the 8593E, press [SGL SWEEP] and wait for completion of a new sweep. A distortion product should now be visible with the higher power level. Press [PEAK SEARCH].
 - c. On each 8340A/B, reduce the power level by 5 dB.
 - d. On the 8593E, press [SGL SWEEP] and wait for completion of a new sweep.
 - e. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.

Table 3-3 Three-Tone Intermodulation Distortion

8340A/B #1 Frequency (GHz)	8340A/B #1 Frequency (GHz)	Upper Product Suppression (dB)	Lower Product Suppression (dB)	Measurement Uncertainty (dB)
2.0	2.00275			+2.07/-2.42
4.0	4.00275			+2.07/-2.42

3. Absolute Amplitude and Vernier Accuracy

Specification

Absolute Amplitude Accuracy	<±0.75 dB (–20 dBm setting at 300 MHz, 16 dB attenuation setting)
Vernier Accuracy	$<\pm0.20$ dB/dB, $<\pm0.5$ dB max (referenced to -20 dBm setting at 300 MHz, 16 dB attenuation setting)

Related Adjustments

Tracking Generator Power Level Adjustments

Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. A calibrated power sensor is then connected to the tracking generator output to measure the power level at 300 MHz.

The measuring receiver is then set into RATIO mode so that future power level readings will be in dB relative to the power level at 300 MHz. The output power level setting is decreased in 1 dB steps and the power level is measured at each step. The difference between the ideal and actual power levels is calculated at each step. The step-to-step error is also calculated.

Figure 3-3 Absolute Amplitude and Vernier Accuracy Test Setup



3 - 16

Procedure

- 1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 3-3.
- 2. Press [PRESET] on the spectrum analyzer and set the controls as follows:

CENTER FREQ	300 MHz
SPAN	0 Hz
RES BW	30 kHz

- 3. On the spectrum analyzer, press [MKR], [AUX CTRL], TRACK GEN, SRC POWER ON OFF (ON) -5 [dBm].
- 4. On the spectrum analyzer press **TRACKING PEAK**. Wait for the "PEAKING" message to disappear.
- 5. Zero and calibrate the measuring-receiver/power-sensor combination in log mode (power levels readout in dBm). Refer to the measuring receiver's operation manual. Enter the power sensor's 300 MHz Cal Factor into the measuring receiver.
- 6. Disconnect the Type N cable from the RF OUT 50 Ω and connect the power sensor to the RF OUT 50 Ω . See Figure 3-3.
- 7. On the spectrum analyzer, press SRC POWER ON OFF (ON), -20 [dBm], [SGL SWP].
- 8. Record the power level displayed on the measuring receiver below as the Absolute Amplitude Accuracy.

Absolute Amplitude Accuracy_____dBm

(Measurement Uncertainty: <+0.25/-0.26 dB)

- 9. Press RATIO on the measuring receiver. Power levels will now readout in dB relative to the power level just measured at the -20 dBm output power level setting.
- 10. Set the SRC POWER to the settings indicated in Table 3-4. At each setting, record the power level displayed on the measuring receiver.
- 11. Calculate the Absolute Vernier Accuracy by subtracting the SRC POWER setting from the Measured Power Level for each SRC POWER setting in Table 3-4.

(Measured Power Level – SRC POWER) – 20 dB = Absolute Vernier Accuracy

- 12. Record the Absolute Vernier Accuracy for the -19 dBm SRC POWER setting as the corresponding Step-to-Step Accuracy.
- 13. Calculate the Step-to-Step Accuracy for the -20 dBm to -30 dBm SRC POWER settings by subtracting the previous Absolute Vernier Accuracy from the current Absolute Vernier Accuracy.

14. Locate the most positive and most negative Absolute Vernier Accuracy values in Table 3-4 and record below.

Positive Absolute Vernier Accuracy	_dB
Negative Absolute Vernier Accuracy	_dB

15. Locate the most positive and most negative Step-to-Step Accuracy values in Table 3-4 and record below.

Positive Step-to-Step Accuracy_____dB

Negative Step-to-Step Accuracy_____dB

Table 3-4 Vernier Accuracy

SRC POWER	Measured Power Level (dB)	Absolute Vernier Accuracy (dB)	Step-to-Step Accuracy (dB)	Measurement Uncertainty (dB)
-20	0 (Ref)	0 (Ref)	0 (Ref)	0
-19				±0.033
-20	0 (Ref)	0 (Ref)	0 (Ref)	±0.033
-21				±0.033
-22				±0.033
-23				±0.033
-24				±0.033
-25				±0.033
-26				±0.033
-27				±0.033
-28				±0.033
-29				±0.033
-30				±0.033

4. Power Sweep Range

Specification

Range: (-10 dBm to -1 dBm)-(source power setting)

Related Adjustment

Tracking Generator Power Level Adjustments

Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω through a power splitter and the tracking is adjusted at 300 MHz for a maximum signal level. The other output of the power splitter is connected to a measuring receiver. The tracking generator is set to do a power sweep from -10 dBm to -1 dBm.

The markers are used to measure the displayed amplitude at the beginning and end of the sweep. The power sweep is then turned off and the power level of the tracking generator is adjusted until the displayed amplitude is the same as at the start of the sweep. This power level is measured on the measuring receiver and recorded. The tracking generator is then adjusted until the displayed amplitude is the same as at the end of the sweep. This power level is measured and recorded. The difference between the two measured power levels is calculated and recorded.

Figure 3-4 Power Sweep Range Test Setup



hh212e

Equipment

Measuring Receiver	8902A
Power Sensor	8482A
Power Splitter	11667A

Cable

Type N. 62 cm	n (24 in)	11500B/C
1 ypc 11, 02 cm		1100000/0

Adapter

Type N (m) to T	[ype N (m)	
-----------------	------------	--

Procedure

- 1. Connect the equipment as shown in Figure 3-4. Do not connect the power sensor to the power splitter at this time.
- 2. Press [PRESET] on the spectrum analyzer and set the controls as follows:

CENTER FREQ	300 MHz
SPAN	0 Hz
RES BW	30 kHz

- 3. On the spectrum analyzer, press [MKR], [AUX CTRL], TRACK GEN, SRC PWR ON OFF (ON), -5 [dBm].
- 4. On the spectrum analyzer, press TRACKING PEAK. Wait for the "PEAKING" message to disappear.
- 5. Zero and calibrate the power-sensor/measuring-receiver in log mode (power levels read out in dBm). Refer to the measuring receiver's operation manual. Enter the power sensor's 300 MHz Cal Factor into the measuring receiver. Connect the power sensor to the power splitter. See Figure 3-4.
- 6. On the spectrum analyzer, press SRC PWR ON OFF (ON), 10 [-dBm], PWR SWP ON OFF (ON), 9 [dB]. Press [AMPLITUDE], SCALE LOG LIN (LOG), 2 [dB], REF LVL. Adjust the reference level until the peak of the displayed ramp (along the far-right graticule) is one-half division down from the reference level.
- 7. Press [MKR], MARKER NORMAL. Use the knob to place the marker at the far-left graticule line. The marker should read 0 picosecond. Press MARKER DELTA.
- 8. Press [AUX CTRL], TRACK GEN, PWR SWP ON OFF (OFF) to set power sweep off. The Δ MKR should read 0 dB ±0.1 dB. If it does not, press SRC PWR ON OFF (ON) and adjust the power level until the marker reads 0 dB ±0.1 dB.
- 9. Record the power level displayed on the measuring receiver.

Start Power Level_____dBm

- 10. Press **PWR SWP ON OFF** (ON) to set power sweep on. Wait for completion of a new sweep.
- 11. Press [MKR], MARKER NORMAL. Use the knob to place the marker at the rightmost graticule line. Press MARKER DELTA.

12. Press [AUX CTRL], TRACK GEN, PWR SWP ON OFF (OFF) to set power sweep off. Press SRC PWR ON OFF (ON) and adjust the SRC POWER level until the Δ MKR reads 0 dB ±0.1 dB.

NOTE	Wait for completion of a new sweep after each adjustment of the SRC POWER
	level.

13. Record the power level displayed on the measuring receiver.

Stop Power Level_____dBm

14. Subtract Start Power Level (step 9) from the Stop Power Level (step 13) and record as the Power Sweep Range.

Power Sweep Range = Stop Power Level – Start Power Level

Power Sweep Range _____dB

5. Tracking Generator Level Flatness

Specification

Level Flatness, at -20 dBm output power, referenced to 300 MHz:

300 kHz to 10 MHz: ±3 dB

40 MHz to 300 MHz: ±1.5 dB

10 MHz to 2.9 GHz: $\pm 2~\mathrm{dB}$

Related Adjustment

Tracking Generator Power Level Adjustments

Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. A calibrated power sensor is then connected to the tracking generator output to measure the power level at 300 MHz. The measuring receiver is then set into RATIO mode so that future power level readings will be in dB relative to the power level at 300 MHz.

The tracking generator is then stepped to several frequencies throughout its range. The output power difference relative to the power level at 300 MHz is measured at each frequency and recorded.

Figure 3-5 Level Flatness Test Setup



Cable

Type N, 62 cm (24 in)..... 11500B/C

Procedure

- 1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 3-5.
- 2. Press [PRESET], [SPAN], BANDLOCK, 0–2.9 Gz BAND 0 on the spectrum analyzer and set the controls as follows:

CENTER FREQ	300]	MHz
CF STEP	100	MHz
SPAN	0 Hz	
RES BW	30 k	Hz

- 3. On the spectrum analyzer, press [MKR], [AUX CTRL], TRACK GEN, SRC PWR ON OFF (ON), -5 [dB].
- 4. On the spectrum analyzer, press TRACKING PEAK. Wait for the "PEAKING" message to disappear.
- 5. Zero and calibrate the measuring-receiver/power-sensor combination in log mode (power levels read out in dBm). Enter the power sensor's 300 MHz Cal Factor into the measuring receiver.
- 6. Disconnect the Type N cable from the RF OUT 50 Ω and connect the power sensor to the RF OUT 50 Ω
- 7. On the spectrum analyzer, press SRC PWR ON OFF (ON), 20 [-dBm], [SGL SWP].
- 8. Press RATIO on the measuring receiver. The measuring receiver will now read out power levels relative to the power level at 300 MHz.
- 9. Set the spectrum analyzer CENTER FREQ to 300 kHz. Press [SGL SWP].
- 10. Enter the appropriate power sensor Cal Factor into the measuring receiver as indicated in Table 3-5.
- 11. Record the power level displayed on the measuring receiver as the Flatness in Table 3-5.
- 12. Repeat steps 9 through 11 above to measure the flatness at each CENTER FREQ setting listed in Table 3-5. The [▲] key may be used to tune to center frequencies above 100 MHz.
- 13. Record the most positive Flatness reading in Table 3-5 for frequencies between 40 MHz and 300 MHz as the Maximum Positive Flatness.

Maximum Positive Flatness (40 MHz to 300 MHz)_____dB

14. Record the most negative Flatness reading in Table 3-5 for frequencies between 40 MHz and 300 MHz as the Maximum Negative Flatness.

Maximum Positive Flatness (40 MHz to 300 MHz)_____dB

15. Record the most positive Flatness reading for frequencies between 300 kHz and 10 MHz in Table 3-5 as the Maximum Positive Flatness.

Maximum Positive Flatness (300 kHz to 10 MHz)_____dB

16. Record the most negative Flatness reading for frequencies between 300 kHz and 10 MHz in Table 3-5 as the Maximum Negative Flatness. Maximum Negative Flatness (300 kHz to 10 MHz)______dB
17. Record the most positive Flatness reading for frequencies between 10 MHz and 2.9 GHz in Table 3-5 as the Maximum Positive Flatness. Maximum Positive Flatness (10 MHz to 2.9 MHz)_____dB
18. Record the most negative Flatness reading for frequencies between 10 MHz and 2.9 GHz in Table 3-5 as the Maximum Positive Flatness (10 MHz to 2.9 MHz)_____dB

Maximum Negative Flatness (10 MHz to 2.9 MHz)_____dB

CENTER FREQ	FLATNESS (dB)	CAL FACTOR FREQ (MHz)	MEASUREMENT UNCERTAINTY (dB)
300 kHz		0.3	+0.28/-0.28
$500 \mathrm{ kHz}$		0.3	+0.28/-0.28
1 MHz		1	+0.24/-0.24
$2~\mathrm{MHz}$		3	+0.24/-0.24
$5~\mathrm{MHz}$		3	+0.24/-0.24
10 MHz		10	+0.24/-0.24
20 MHz		30	+0.24/-0.24
40 MHz		50	+0.24/-0.24
50 MHz		10	+0.24/-0.24
80 MHz		100	+0.24/-0.24
100 MHz		100	+0.24/-0.24
200 MHz		300	+0.24/-0.24
300 MHz		300	+0.24/-0.24
400 MHz		300	+0.24/-0.24
$500 \mathrm{~MHz}$		100	+0.24/-0.24
600 MHz		300	+0.24/-0.24
700 MHz		1000	+0.24/-0.24
800 MHz		1000	+0.24/-0.24
900 MHz		1000	+0.24/-0.24
1000 MHz		1000	+0.24/-0.24
1100 MHz		1000	+0.24/-0.24
1200 MHz		1000	+0.24/-0.24
1300 MHz		1000	+0.24/-0.24
1400 MHz		1000	+0.24/-0.24
1500 MHz		2000	+0.24/-0.24
1600 MHz		2000	+0.24/-0.24
1700 MHz		2000	+0.24/-0.24
1800 MHz		2000	+0.24/-0.24
1900 MHz		2000	+0.24/-0.24
2000 MHz		2000	+0.41/-0.41
2100 MHz		2000	+0.41/-0.41
2200 MHz		2000	+0.41/-0.41
2300 MHz		2000	+0.41/-0.41
2400 MHz		2000	+0.41/-0.41
2500 MHz		3000	+0.41/-0.41
2600 MHz		3000	+0.41/-0.41
2700 MHz		3000	+0.41/-0.41
2800 MHz		3000	+0.41/-0.41
2900 MHz		3000	+0.41/-0.41

Table 3-5 Flatness Relative to 300 MHz

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6. Tracking Generator Frequency Accuracy

Specification

Frequency Accuracy

< ±[(frequency readout × frequency reference error) + SPAN
accuracy + 1% of span + 20% of RES BW setting + 2 kHz]</pre>

Related Adjustment

10 MHz Frequency Reference Adjustment

Tracking Oscillator Adjustment

Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω through a power splitter and the tracking is adjusted at 500 MHz for a maximum signal level. The other output of the power splitter is connected to a frequency counter. The frequency displayed on the counter is recorded. This is repeated at several other output frequencies.

The effect of the (frequency readout \times frequency reference error) term is eliminated by locking the spectrum analyzer to the frequency counter's 10 MHz reference. The SPAN accuracy term is also eliminated by setting the SPAN to zero. These terms may be eliminated for the purpose of this test since these are measured in the 10 MHz Reference Accuracy and Frequency Readout Accuracy and Marker Count Accuracy tests.

The remaining terms are a function of the RES BW setting and the tracking adjustment and cannot be eliminated. The RES BW will be held constant for the purposes of this test. It is the effect of these terms which is verified in this test.

Figure 3-6 Frequency Accuracy Test Setup



hh214e

Equipment

Frequency Counter	5343A
Power Splitter	11667A

Cable

Type N, 62 cm (24 in) (2 required)	11500B/C
BNC, 122 cm (48 in)	10503A

Adapter

Type N (m) to Type	e N (m)	1250-1475
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Procedure

- 1. Remove the jumper between the EXT REF IN and 10 MHz REF OUTPUT connectors on the spectrum analyzer rear panel. Connect the equipment as shown in Figure 3-6. The frequency counter provides the frequency reference for the spectrum analyzer.
- 2. Press [PRESET], [SPAN], BAND LOCK, 0–2.9 Gz BAND 0 on the spectrum analyzer and set the controls as follows:

CENTER FREQ	500 MHz
SPAN	0 Hz
RES BW	1 kHz

- 3. On the spectrum analyzer, press [MKR], [AUX CTRL], TRACK GEN, SRC PWR ON OFF (ON), 1 [-dB].
- 4. On the spectrum analyzer, press **TRACKING PEAK** and wait for the "PEAKING" message to disappear (approximately 90 seconds).
- 5. Set the frequency counter controls as follows:

- 6. Wait for the counter to gate two or three times and record the counter reading as the Measured Frequency in Table 3-6 for the 500 MHz CENTER FREQ setting.
- 7. Repeat steps 4 through 6 for the remaining CENTER FREQ settings in Table 3-6.
- 8. Subtract the CENTER FREQ from the Measured Frequency for each CENTER FREQ setting in Table 3-6 and record the result as the Frequency Error.
- 9. Locate in Table 3-6 the greatest Frequency Error, treating negative frequency errors as if they were positive. For example, if the Frequency Errors are -240, +110, -80, and +142, the greatest Frequency Error would be -240 Hz. Record the greatest Frequency Error below.

Frequency Error____Hz

10. Reconnect the jumper between EXT REF IN and 10 MHz REF OUTPUT on the spectrum analyzer's rear panel.

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 Table 3-6 Frequency Accuracy

CENTER FREQ Setting (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Measurement Uncertainty (Hz)
500			±1.0
1000			±1.0
1500			±1.0
2000			±1.0
2500			±1.0
2900			±1.0

7. Harmonic Spurious Outputs

Specification

Harmonics Spurious:

<−25 dBc, 300 kHz to ≤400 MHz (−1 dBm output power)

<-15 dBc, >400 MHz to 2.9 GHz (-1 dBm output power)

Related Adjustment

There is no related adjustment for this performance test

Description

The tracking generator output is connected to the 8593E spectrum analyzer's INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of an 8566A/B spectrum analyzer. The tracking generator is tuned to several different frequencies and the amplitude of the second and third harmonics relative to the fundamental are measured at each frequency.

Figure 3-7 Harmonic Spurious Responses Test Setup



Equipment

Microwave Spectrum Analyzer	. 8566A/B
Cables	
Type N, 62 cm (24 in) BNC, 23 cm (9 in)	. 11500B/C . 10502A
Adapter	
Type N (m) to BNC (f)	. 1250-1476

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Procedure

NO	E The 8566A/B should be allowed to warm up for at least 30 minutes before proceeding.
1.	Perform a front-panel calibration of the 8566A/B as follows:
	a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
	b. Press [2-22 GHz] (INSTR PRESET), [RECALL], 8. Adjust AMPTD CAL for a marker amplitude reading of -10 dBm.
	e. Press [RECALL], 9. Adjust FREQ ZERO for a maximum amplitude response.
	 Press [SHIFT], [FREQUENCY SPAN] to start the 30 second internal error correction routine.
	e. When the CALIBRATING! message disappears, press [SHIFT], [START FREQ] to use the error correction factors just calculated.
2.	Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the 3593E spectrum analyzer. See Figure 3-7.
3.	Press [PRESET], [SPAN] BAND LOCK, 0–2.9, Gz BAND 0, and set the controls as follows:
	CENTER FREQ 300 MHz SPAN 0 Hz RES BW
4.	On the $8593E$, press [MKR], [AUX CTRL], TRACK GEN, SRC PWR ON OFF (ON), -5 [dBm].
5.	On the 8593E press TRACKING PEAK. Wait for the "PEAKING" message to disappear.
6.	On the $8593E$, press SRC PWR ON OFF (ON), 1 [dBm], [FREQUENCY] 300 [kHz], SGL SWP].
7.	Connect the Type N cable from the tracking generator output to the 8566A/B RF NPUT. See Figure 3-7.
8.	Set the 8566A/B controls as follows:
	CENTER FREQUENCY

- 9. On the 8566A/B do the following:
 - a. Press [PEAK SEARCH] and [MKR FCTN], MKR TRACK ON OFF (ON). Wait for the signal to be displayed at center screen. Press [MKR FCTN], MKR TRACK ON OFF (OFF).
 - b. Press [PEAK SEARCH], [MKR/ Δ -> STP SIZE], MARKER [Δ].
 - c. Press [CENTER FREQUENCY], [▲] to tune to the second harmonic. Press [PEAK SEARCH]. If the CENTER FREQUENCY is greater than 2.5 GHz, press [PRESEL PEAK] and wait for the "PEAKING" message to disappear. Record the marker amplitude reading in Table 3-7 as the 2nd Harmonic Level for the 300 kHz Tracking Generator Output Frequency.
 - d. If the tracking generator output frequency is less than 1 GHz, press [CENTER FREQUENCY], [▲] to tune to the third harmonic. Press [PEAK SEARCH]. If the CENTER FREQUENCY is greater than 2.5 GHz, press [PRESEL PEAK] and wait for the "PEAKING" message to disappear. Record the marker amplitude reading in Table 3-7 as the 3rd Harmonic Level for the 300 kHz Tracking Generator Output Frequency.
 - e. Press MARKER [OFF].
- 10. Repeat steps 8 and 9 above for the remaining Tracking Generator Output Frequencies listed in Table 3-7. Note that the 8593E CENTER FREQ is the same as the Tracking Generator Output Frequency.
- 11. Locate the most positive 2nd Harmonic Level in Table 3-7 and record below.

2nd Harmonic Level_____dBc

12. Locate the most positive 3rd Harmonic Level in Table 3-7 and record below.

3rd Harmonic Level_____dBc

TRACKING GENERATOR FREQUENCY	2nd Harmonic Level (dBc)	3rd Harmonic Level (dBc)	MEASUREMENT UNCERTAINTY (dB)
300 kHz			+1.55/-1.80
$100 \mathrm{~MHz}$			+1.55/-1.80
$300 \mathrm{~MHz}$			+1.55/-1.80
$900 \mathrm{~MHz}$			+1.55/-1.80
$1.4~\mathrm{GHz}$		N/A	+3.45/-4.01

Table 3-7 Harmonic Spurious Responses

8. Non-Harmonic Spurious Outputs

Specification

Non-Harmonic Spurious (-1 dBm output power)

300 kHz to ${\leq}400$ MHz: < –27 dBc

>400 MHz to 2.9 GHz $<-15~\mathrm{dBc}$

Related Adjustment

There is no related adjustment for this performance test.

Description

The tracking generator output is connected to the 8593E spectrum analyzer's INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of an 8566A/B spectrum analyzer. The tracking generator is set to several different output frequencies.

For each output frequency, several sweeps are taken on the 8566A/B over different frequency spans and the highest displayed spurious response is measured in each span. Responses at the fundamental frequency of the tracking generator output or its harmonics are ignored; they are tested in the Harmonic Spurious Responses test. The amplitude of the highest spurious response is recorded.

Figure 3-8 Non-Harmonic Spurious Responses Test Setup



Equipment

Cables

Type N, 62 cm (24 in)	11500B/C
BNC, 23 cm (9 in)	10502A

Adapter

Type N (m) to BNC (f)..... 1250-1476

Procedure

NOTE	The 8566A/B should be allowed to warm up for at least 30 minutes before proceeding.
1. Perfo	orm a front-panel calibration of the 8566A/B as follows:
a. Co	onnect a BNC cable between CAL OUTPUT and RF INPUT.
b. Pr an	ress [2-22 GHz] (INSTR PRESET), [RECALL] 8. Adjust AMPTD CAL for a marker nplitude reading of –10 dBm.
c. Pr	ress [RECALL], [9]. Adjust FREQ ZERO for a maximum amplitude response.
d. Pr ro	ress [SHIFT], [FREQUENCY SPAN] to start the 30 second internal error correction utine.
e. W fae	hen the CALIBRATING! message disappears, press to use the error correction ctors just calculated.
2. Conn 8593	lect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the E spectrum analyzer. See Figure 3-8.
3. Press	s [PRESET], [SPAN], BAND LOCK, 2-2.9 Gz BAND 0, set the controls as follows:
CENT SPAN	ER FREQ 300 MHz
RES B	30 kHz
4. On th	ne $8593E$, press [MKR], [AUX CTRL], TRACK GEN, SRC PWR ON OFF (ON) –5, [dBm].
5. On th	ne 8593E, press TRACKING PEAK. Wait for the "PEAKING" message to disappear.
6. On th	ne $8593\mathrm{E},\mathrm{press}$ SRC PWR ON OFF (ON), 1 [-dBm], [SGL SWP].
7. Conn INPU	ect the Type N cable from the tracking generator output to the 8566A/B RF JT. See Figure 3-8.
	Measuring Fundamental Amplitudes
8. Set th	he 8593E CENTER FREQ to the Fundamental Frequency listed in Table 3-8.
9. Set the	he 8566A/B controls as follows:
SPAN REFE ATTE LOG d	
10. Set t Table	the 8566A/B CENTER FREQUENCY to the Fundamental Frequency listed in a 3-8.
11. On t	he 8566A/B, press [PEAK SEARCH]. If the marker frequency is greater than

2.5 GHz, press [PRESEL PEAK] and wait for the "PEAKING!" message to disappear. Press [MKR -> REF LVL]. Wait for another sweep to finish.

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- 12. Record the 8566A/B marker amplitude reading in Table 3-8 as the Fundamental Amplitude.
- 13. Repeat steps 8 through 12 for all Fundamental Frequency settings in Table 3-8.

Measuring Non-Harmonic Responses

- 14. On the 8593E, set the CENTER FREQ to 300 kHz.
- 15. Set the 8566A/B START FREQ, STOP FREQ, and RES BW as indicated in the first row of Table 3-8.
- 16. Press [SINGLE] on the 8566A/B and wait for the sweep to finish. Press [PEAK SEARCH]. If the marker frequency is greater than 2.5 GHz, press [PRESEL PEAK] and wait for the "PEAKING!" message to disappear.
- 17. Verify that the marked signal is not the fundamental or a harmonic of the fundamental as follows:
 - a. Divide the marker frequency by the fundamental frequency (the 8593E CENTER FREQ setting). For example, if the marker frequency is 880 kHz and the fundamental frequency is 300 kHz, dividing 880 kHz by 300 kHz yields 2.933.
 - b. Round the number calculated in step a the nearest whole number. In the example above, 2.933 should be rounded to 3.
 - c. Multiply the fundamental frequency by the number calculated in step b. Following the example, multiplying 300 kHz by 3 yields 900 kHz.
 - d. Calculate the difference between the marker frequency and the frequency calculated in step c above. Continuing the example, the difference would be 20 kHz.
 - e. Due to span accuracy uncertainties in the 8566A/B, the marker frequency might not equal the actual frequency. Given the marker frequency, check if the difference calculated in step d is within the appropriate tolerance:

Marker Frequencies	Tolerance	
< 5 MHz	±200 kHz	
$< 55 \mathrm{~MHz}$	±750 kHz	
< 55 MHz	±10 kHz	

- f. If the difference in step d is within the indicated tolerance, the signal in question is the fundamental signal (if the number in step b = 1) or a harmonic of the fundamental (if the number in step b > 1). This response should be ignored.
- 18. Verify that the marked signal is a true response and not a random noise peak by pressing [SINGLE] to trigger a new sweep and press [PEAK SEARCH]. A true response will remain at the same frequency and amplitude on successive sweeps but a noise peak will not.

- 19. If the marked signal is either the fundamental or a harmonic of the fundamental (see step 17) or a noise peak (see step 18), move the marker to the next highest signal by pressing [SHIFT], [PEAK SEARCH]. Continue with step 17.
- 20. If the marked signal is not the fundamental or a harmonic of the fundamental (see step 17) and is a true response (see step 18), calculate the difference between the amplitude of marked signal and the Fundamental Amplitude as listed in Table 3-8.

For example, if the Fundamental Amplitude for a fundamental frequency of 300 kHz is +1.2 dBm and the marker amplitude is -30.8 dBm, the difference is -32 dBc.

Record this difference as the Non-Harmonic Response Amplitude for the appropriate 8593E CENTER FREQ and 8566A/B START and STOP FREQ settings in Table 3-9.

Non-Harmonic Amplitude = Marker Amplitude – Fundamental Amplitude

- 21. If a true non-harmonic spurious response is not found, record "noise" as the Non-Harmonic Response Amplitude in Table 3-9 for the appropriate 8593E CENTER FREQ and 8566A/B START and STOP FREQ settings.
- 22. Repeat steps 16 through 21 for the remaining 8566A/B settings for START FREQ, STOP FREQ, and RES BW for the 8593E CENTER FREQ setting of 300 kHz.
- 23. Repeat steps 15 through 22 with the 8593E CENTER FREQ set to 1.5 GHz.
- 24. Repeat steps 15 through 22 with the 8593E CENTER FREQ set to 2.9 GHz.
- 25. Locate in Table 3-9 the most-positive Non-Harmonic Response Amplitude for 8566A/B STOP FREQ settings of less than or equal to 2000 MHz. Record this amplitude below.

Non-Harmonic Response Amplitude (≤2000 MHz)_____dBc

26. Locate in Table 3-9 the most-positive Non-Harmonic Response Amplitude for the 8566A/B START FREQ settings greater than or equal to 2000 MHz. Record this amplitude below.

Non-Harmonic Response Amplitude (≥2000 MHz)_____dBc

Table 3-8 Fundamental Response Amplitudes

Fundamental Frequency	Fundamental Amplitudes	
300 kHz	dBm	
1.5 GHz	dBm	
2.9 GHz	dBm	

8566A/B Settings		Non-Harmonic Response Amplitude (dBc)		MEASUREMENT UNCERTAINTY (dB)		
START FREQ (MHz)	STOP FREQ (MHz)	RES BW	At 300 kHz CENTER FREQ	At 1.5 GHz CENTER FREQ	At 2.9 GHz CENTER FREQ	
0.2	5.0	30 kHz				+1.55/-1.80
5.0	55	$100 \mathrm{kHz}$				+1.55/-1.80
55	1240	$1 \mathrm{~MHz}$				+1.55/-1.80
1240	2000	$1 \mathrm{~MHz}$				+1.55/-1.80
2000	2900	$1 \mathrm{~MHz}$				+3.45/-4.01

Table 3-9 Non-Harmonic Responses

hh217e

9. Tracking Generator Feedthrough

Specification

Tracking Generator Feedthrough:

400 kHz to 2.9 GHz: <-110 dBm

Related Adjustment

There is no related adjustment for this performance test.

Description

The tracking generator output is connected to the 8593E spectrum analyzer's INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is terminated and set for -1 dBm output power (maximum levelled output power). The spectrum analyzer's INPUT 50 Ω is also terminated. The displayed average noise level of the spectrum analyzer is then measured over several frequency ranges.

Figure 3-9 Tracking Generator Feedthrough Test Setup



Equipment

Cables

Type N, 62 cm (24 in)	1500B/C
BNC, 23 cm (9 in)	10502A

Adapter

Type N (m) to BNC (f)..... 1250-1476

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Procedure

- 1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the 8593E spectrum analyzer. See Figure 3-8.
- 2. Press [PRESET], [SPAN], BAND LOCK, 0–2.9 Gz BAND 0 on the 8593E and set the controls as follows:

CENTER FREQ	$300 \ \mathrm{MHz}$
SPAN	0 Hz
RES BW	30 kHz

- 3. On the 8593E, press [MKR], [AUX CTRL], TRACK GEN, SRC PWR ON OFF (ON), -5 [dBm].
- 4. On the 8593E, press TRACKING PEAK. Wait for the "PEAKING" message to disappear.
- 5. Connect the CAL OUTPUT to the INPUT 50 Ω Set the 8593E controls as follows:

REF LEVEL	–20 dBm
SPAN	$10 \mathrm{~MHz}$
ATTEN	0 dB

6. Press [PEAK SEARCH], [MKR FCTN], MKR TRACK ON OFF (ON), [SPAN], 100 [kHz]. Wait for the AUTO ZOOM message to disappear. Set the controls as follows:

VIDEO BW	$30 \mathrm{Hz}$
SIGNAL TRACK	OFF

 Press [SGL SWP] and wait for completion of a new sweep. Press [PEAK SEARCH], [AMPLITUDE], MORE 1 of 2, REF LVL OFFSET. Subtract the MKR amplitude reading from -20 dBm and enter the result as the REF LVL OFFSET. For example, if the marker reads -20.21 dBm, enter +0.21 dB.

+0.21 dB = -20 dBm - (-20.21 dBm)

- 8. Connect one 908A 50 Ω termination to the 8593E INPUT 50 Ω and another to the tracking generator's RF OUT 50 Ω
- 9. Press [AUX CTRL], TRACK GEN, SRC PWR ON OFF (OFF).
- 10. Set the 8593E controls as follows:

CENTER FREQ	0 Hz
SPAN	10 MHz
RES BW	–10 dBm
Markers	OFF
VIDEO BW	AUTO
TRIG	CONT

11. Press [PEAK SEARCH], [MKR->], MARKER -> REF LVL, [MKR FCTN], MKR TRACK ON OFF, (ON), [SPAN], 600 [kHz]. Wait for the AUTO ZOOM message to disappear. Press [MKR FCTN], MKR TRACK OFF (OFF). 12. Press **[FREQUENCY]** and adjust the center frequency until the LO feedthrough peak is on the left-most graticule line. Set the control as follows:

SPAN	$50 \mathrm{kHz}$
REF LEVEL	–50 dBm
RES BW	1 kHz
VIDEO BW	30 Hz
DETECTOR	SAMPLE

- 13. Press [AUX CTRL] TRACK GEN, SRC PWR ON OFF (ON), 1 [-dBm].
- 14. Press [SGL SWP] and wait for completion of a new sweep. Press [DISPLAY], DSP LINE ON OFF (ON).
- 15. Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses. Record the display line amplitude setting in Table 3-10 as the noise level at 300 kHz.
- 16. Repeat steps 14 and 15 for the remaining Tracking Generator Output Frequencies (spectrum analyzer CENTER FREQ) listed in Table 3-10.
- 17. In Table 3-10, locate the most positive Noise Level Amplitude over the range from 300 kHz to 1 MHz. Record this amplitude here:

TG Feedthrough (300 kHz to 1 MHz)_____dBm

18. In Table 3-10, locate the most positive Noise Level Amplitude over the range from 1 MHz to 2.0 GHz. Record this amplitude here:

TG Feedthrough (1 MHz to 2.0 GHz)_____dBm

19. In Table 3-10, locate the most positive Noise Level Amplitude over the range from 2.0 GHz to 2.9 GHz. Record this amplitude here:

TG Feedthrough (2.0 GHz to 2.9 GHz)_____dBm

Tracking Generator Output Frequency	Noise Level Amplitude (dB)	Measurement Uncertainty (dB)
400 kHz		+1.74/-1.98
$500 \mathrm{kHz}$		+1.74/-1.98
1 MHz		+1.74/-1.98
20 MHz		+1.74/-1.98
$50 \mathrm{~MHz}$		+1.74/-1.98
100 MHz		+1.74/-1.98
250 MHz		+1.74/-1.98
400 MHz		+1.74/-1.98
$550 \mathrm{~MHz}$		+1.74/-1.98
700 MHz		+1.74/-1.98
850 MHz		+1.74/-1.98
1000 MHz		+1.74/-1.98
$1150 \mathrm{~MHz}$		+1.74/-1.98
1300 MHz		+1.74/-1.98
1450 MHz		+1.74/-1.98
1600 MHz		+1.74/-1.98
1750 MHz		+1.74/-1.98
2000 MHz		+1.74/-1.98
2300 MHz		+1.74/-1.98
2600 MHz		+1.74/-1.98
2900 MHz		+1.74/-1.98

 Table 3-10 Tracking Generator Feedthrough Amplitude

10. RF Power-Off Residuals

Specification

Residuals: <-120 dBm, 300 kHz to 2.9 GHz

Related Adjustment

There is no related adjustment for this performance test.

Description

The tracking generator output is connected to the 8593E spectrum analyzer's INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of an 8566A/B spectrum analyzer and the tracking generator is turned off. Several sweeps are taken on the 8566A/B over different frequency spans and the highest displayed residual is measured in each span. The amplitude of the highest residual is recorded.

Figure 3-10 RF Power-Off Residuals Test Setup



Equipment

Microwave Spectrum	Analyzer	8566A/B
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Cables

Type N, 62 cm (24 in)	11500B/C
BNC, 23 cm (9 in)	10502A

Adapter

Type N (m) to BNC (f) 12	250-1476
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Chapter 3

Procedure

NOT	The 8566A/B should be allowed to warm up for at least 30 minutes before proceeding.
1.]	erform a front-panel calibration of the 8566A/B as follows:
á	Connect a BNC cable between CAL OUTPUT and RF INPUT.
1	Press [2–22 GHz] , (INSTR PRESET), [RECALL] , 8. Adjust AMPTD CAL for a marker amplitude reading of –10 dBm.
(Press [RECALL], 9. Adjust FREQ ZERO for a maximum amplitude response.
(Press [SHIFT], [FREQUENCY SPAN] to start the 30 second internal error correction routine.
(After the CALIBRATING! message disappears, press [SHIFT], [START FREQ] to use the error correction factors just calculated.
2. (onnect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the 593E spectrum analyzer. Figure 3-10.
3.]	ress [PRESET] on the 8593E and set the controls as follows:
) 2 1	ENTER FREQ
4. (In the $8593E$, press [MKR], [AUX CTRL], TRACK GEN, SRC PWR ON OFF (ON), 5 [-dBm].
5. (n the 8593E, press TRACKING PEAK. Wait for the "PEAKING" message to disappear.
6. (in the $8593E$, press SRC PWR ON (OFF), [FREQUENCY], 300 [kHz], [SGL SWP].
7. (onnect the Type N cable from the tracking generator output to the 8566A/B RF NPUT. See Figure 3-10.
8. \$	et the 8566A/B REFERENCE LEVEL to –20 dBm.
9. s	et the 8566A/B START FREQUENCY, STOP FREQUENCY, and RES BW as indicated a the first row of Table 3-11.
10. [Press [SINGLE] on the 8566A/B and wait for the sweep to finish. Press PEAK SEARCH].
11. s	f the marker is on a suspected residual response (as opposed to a noise peak), press SINGLE] again and wait for the sweep to finish. A residual response will persist on accessive sweeps but a noise peak will not. Press [PEAK SEARCH] again.
NOT	If the 8566A/B marker frequency is greater than or equal to 2.5 GHz, press [PRESEL PEAK] and wait for the "PEAKING" message to disappear before recording the marker amplitude.
10	

12. Record the marker amplitude and frequency reading in Table 3-11 as the Residual Amplitude and Frequency.

- 13. Repeat steps 9 through 12 above for the remaining 8566A/B START FREQUENCY, STOP FREQUENCY, and RES BW settings indicated in Table 3-11.
- 14. Locate the residual response in Table 3-11 with the highest amplitude. Record the amplitude and frequency of this residual below.

Residual Response Amplitude_____dBm

Residual Response Frequency_____MHz

8566A/B Settings		Residual Response		Measurement Uncertainty (dB)	
START FREQUENCY	STOP FREQUENCY	RES BW	AMPLITUDE (dBm)	FREQUENCY (MHz)	
300 kHz	1 MHz	3 kHz			$\pm 1.33/-1.56$
1 MHz	$100 \mathrm{~MHz}$	$10 \mathrm{kHz}$			$\pm 1.33/\!-\!1.56$
$100 \mathrm{~MHz}$	$500 \ \mathrm{MHz}$	$10 \mathrm{kHz}$			$\pm 1.33/\!-\!1.56$
$500 \mathrm{~MHz}$	1000 MHz	10 kHz			$\pm 1.33/\!-\!1.56$
1000 MHz	$1500 \ \mathrm{MHz}$	10 kHz			$\pm 1.33/\!-\!1.56$
$1500 \mathrm{~MHz}$	2000 MHz	10 kHz			$\pm 1.33/\!-\!1.56$
2000 MHz	2500 MHz	$10 \mathrm{kHz}$			$\pm 1.33/\!-\!1.56$
2500 MHz	2900 MHz	$10 \mathrm{kHz}$			$\pm 2.02/-2.50$

Table 3-11 Residual Responses
11. Tracking Generator LO Feedthrough Amplitude

Specification

LO Feedthrough (output level set to -1 dBm) 3.9214 GHz to 6.8214 GHz: < -16 dBm

Related Adjustment

There is no related adjustment for this performance test.

Description

The tracking generator output is connected to the 8593E spectrum analyzer's INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of an 8566A/B spectrum analyzer. The tracking generator is tuned to several different frequencies and the LO Feedthrough is measured at the frequency extremes of the LO.

Figure 3-11 LO Feedthrough Amplitude Test Setup



Equipment

Microwave Spectrum Analyzer	3
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Cables

Type N, 62 cm (24 in)	$11500 \mathrm{B/C}$
BNC, 23 cm. (9 in)	10502A

Adapter

Type N (m) to BNC (f)..... 1250-1476

Procedure

NC	DTE	The 8566A/B should be allowed to warm up for at least 30 minutes before proceeding.
1.	Pe	erform a front-panel calibration of the 8566A/B as follows:
	a.	Connect a BNC cable between CAL OUTPUT and RF INPUT.
	b.	Press [2–22 GHz] , (INSTR PRESET), [RECALL] , 8. Adjust AMPTD CAL for a marker amplitude reading of -10 dBm.
	c.	Press [RECALL], 9. Adjust FREQ ZERO for a maximum amplitude response.
	d.	Press [SHIFT], [FREQUENCY SPAN] to start the 30 second internal error correction routine.
	e.	After the CALIBRATING! message disappears, press [SHIFT], [START FREQ] to use the error correction factors just calculated.
2.	Co 85	pnnect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the 693E spectrum analyzer. Figure 3-11.
3.	Pr as	ress [PRESET] , [SPAN] , BAND LOCK , 0–2.9 Gz BAND 0 on the 8593E and set the controls follows:
	CI SI	ENTER FREQ
	RI	ES BW
4.	Oı	n the 8593E, press [MKR], [AUX CTRL],TRACK GEN, SRC PWR ON OFF (ON), 5 [–dBm].
5.	Oı	n the 8593E, press TRACKING PEAK. Wait for the "PEAKING" message to disappear.
6.	01 [S	n the $8593E$, press SRC PWR ON OFF (ON), 1 [–dBm], [FREQUENCY], 300 [kHz], GL SWP].
7.	Co IN	onnect the Type N cable from the tracking generator output to the 8566A/B RF IPUT. See Figure 3-11.
8.	Se	et the 8566A/B controls as follows:
	CI SH RI RI L(ENTER FREQ
9.	O1 for MI	n the 8566A/B, press [PEAK SEARCH] and [MKR FCTN] , MKR TRACK ON OFF (ON). Wait r the signal to be displayed at center screen. Press [MKR FCTN] , KR TRACK ON OFF (OFF).
10	. P	ress [PEAK SEARCH], [PRESEL PEAK]. Wait for the "PEAKING" message to disappear.
11	. R	ecord the 8566A/B marker amplitude in Table 3-12 as the LO Feedthrough Amplitude

11. Record the 8566A/B marker amplitude in Table 3-12 as the LO Feedthrough Amplitude for 3.9217 GHz.

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- 12. Repeat steps 9 through 11 for the remaining 8593E CENTER FREQ and 8566A/B CENTER FREQUENCY settings listed in Table 3-12.
- 13. Locate in Table 3-12 the LO Feedthrough Amplitude with the greatest amplitude and record the amplitude below.

LO Feedthrough Amplitude_____dBm

8593E CENTER FREQ	8566A/B CENTER FREQUENCY	LO Feedthrough Amplitude (dBm)	Measurement Uncertainty (dB)
300 kHz	$3.9217~\mathrm{GHz}$		+2.02/-2.50
70 MHz	$3.9914~\mathrm{GHz}$		+2.02/-2.50
$150 \mathrm{~MHz}$	$4.0714~\mathrm{GHz}$		+2.02/-2.50
1.5 GHz	$5.4214~\mathrm{GHz}$		+2.02/-2.50
2.9 GHz	$6.8214~\mathrm{GHz}$		+2.10/-2.67

 Table 3-12
 LO Feedthrough Amplitude

12. Residual AM and Residual FM

Specification

Residual FM	<500 Hz RMS (CW mode, 50 Hz to 15 kHz post-detection bandwidth)
Residual AM	<-60 dBc (0.2%) at -1 dBm out (CW mode, 50 Hz to 15 kHz post-detection bandwidth)

Related Adjustment

There is no related adjustment for this performance test

Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The output of the tracking generator is then connected to the input of the measuring receiver.

The measuring receiver is used to measure the residual AM and residual FM using the appropriate bandwidth and detector. The measured values of residual AM and residual FM are recorded.

Figure 3-12 Residual AM and Residual FM Test Setup



hh220e

Equipment

Cable

Type N, 62 cm (24 in)..... 11500B/C

Procedure

- 1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 3-12.
- 2. Press [PRESET] on the spectrum analyzer and set the controls as follows:

CENTER FREQ	300 MHz
SPAN	0 Hz
RES BW	30 kHz

- 3. On the spectrum analyzer, press [MKR], [AUX CTRL], TRACK GEN, SRC PWR ON OFF (ON), -5 [dBm].
- 4. On the spectrum analyzer, press TRACKING PEAK. Wait for the "PEAKING" message to disappear.
- 5. Reconnect the Type N cable between the measuring receiver's INPUT 50 Ω and AM/FM connectors.
- 6. On the measuring receiver, press **[AM]**, **[CALIBRATE]**. After several seconds, the AM calibration factor will be displayed. Enter 16.1, **[SPCL]** to enable the AM calibration factor.
- 7. On the measuring receiver, press **[FM]**, **[CALIBRATE]**. After several seconds, the FM calibration factor will be displayed. Enter 17.1, **[SPCL]**, to enable the FM calibration factor.
- 8. Press [CALIBRATE] again to turn off the calibrator.
- 9. Connect the Type N cable between the spectrum analyzer's RF OUT 50 Ω and the measuring receiver's INPUT 50 Ω
- 10. On the spectrum analyzer, press SRC PWR ON OFF (ON), 1 [-dBm].
- 11. Set the spectrum analyzer CENTER FREQ to 300 MHz. Press [SGL SWP].
- 12. On the measuring receiver, press [AUTOMATIC OPERATION], [AM], [SHIFT] (blue key), [AVG]. This tunes the measuring receiver to the input signal and sets the receiver to measure AM with an RMS detector. The measuring receiver will display the residual AM as a percentage.
- 13. On the measuring receiver, set the low pass filter to 50 Hz and the high pass filter to 15 kHz.
- 14. On the measuring receiver, press 200, **[RATIO]**, **[LOG/LIN]**. This sequence sets the measuring receiver to readout AM in dB relative to the carrier.
- 15. Record the amplitude displayed on the measuring receiver as the Residual AM.

Residual AM____dBc

- 16. On the measuring receiver, press **[AUTOMATIC OPERATION]**, **[FM]** (blue key), **[AVG]**. This tunes the measuring receiver to the input signal and sets the receiver to measure FM with an RMS detector.
- 17. On the measuring receiver, set the low pass filter to 50 Hz and the high pass filter to 15 kHz.
- 18. Record the deviation displayed on the measuring receiver as the Residual FM.

Residual FM_____Hz

13. Event Counter

Specifications

Gate Time Accuracy: <±0.1% Input Level: TTL, open collector TTL Maximum Pulse Rate: 100 kHz Minimum. Pulse Width: 1 μ s negative, 5 μ s positive

Related Adjustment

There is no related adjustment for this performance test.

Description

A pulse/function generator is used to apply pulses to the event counter input. The burst function on the pulse/function generator is used to check that the event counter is counting properly. The frequency, output level, and duty cycle of the pulses are varied to ensure that the counter is functioning properly.

The actual output frequency from the pulse/function generator is counted with an external counter. The error between the actual frequency and the number of events counted in a 1 second gate time is calculated to determine the time accuracy.

A functionality check of the Interval Counter is also performed; the accuracy is the same as that for the Event Counter.

Figure 3-13 Event Counter Test Setup



hh221e

Equipment

Pulse/Function Generator	8116A Option 001
Universal Counter	5334A/B
Cable	
BNC, 122 cm (48 in) (2 required)	10503A

Adapters

BNC Tee (m) (f) (f) 1250-0781

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Procedure

- 1. Connect the equipment as shown in Figure 3-13. If a counter without a 50 Ω input impedance is used, connect a 50 Ω feedthrough termination, such as the 10100C, to the input of the counter.
- 2. Set the universal counter controls as follows:

FUNCTION/DATA	FREQ A
AUTO TRIG	ON
100 kHz FILTER A	OFF
INPUT A	
AC	OFF
50 Ω Z	30 kHz

3. Set the pulse/function generator controls as follows:

MODE	. NORM
WAVEFORM	. SQUAREWAVE
FRQ (Frequency)	. OFF
DTY (Duty Cycle)	. 50%
HIL (High Output Level)	. +5.00 V
LOL (Low Output Level)	. 0.0 V
DISABLE	. OFF
COMPL	. ON

Gate Time Accuracy Test

- 4. On the spectrum analyzer, press [PRESET], EVENT COUNTER, Gate Time, 1 s, Main Menu.
- 5. The EVENT CNTR display should read approximately 50,000. Record the EVENT CNTR reading below.

EVENT CNTR Reading_____

6. Record the frequency displayed on the universal counter.

Universal Counter Reading_____Hz

7. Calculate the error between the EVENT CNTR reading and the universal counter reading using the equation below. Record the result as the Gate Time Accuracy

Gate Time Accuracy = $100 \times$

Gate Time Accuracy____%

Input Level Test

8. Set the pulse/function generator controls as follows:

MODE E BUR

BUR (Number of periods in burst)..... 1000

- 9. On the spectrum analyzer, press $\ensuremath{\mathsf{TOTALIZE}}$ ON OFF (ON).
- 10. Press $\left[\text{MAN}\right]$ on the pulse/function generator.
- 11. Record the EVENT CNTR reading on the spectrum analyzer. The EVENT CNTR should read 1000 ± 1 count.

EVENT CNTR Reading (0 V to 5 V input)____

12. Set the pulse/function generator controls as follows. These levels are comparable to TTL input levels:

HIL	+2.2 V
LOL	+0.72 V

- 13. Press **RESET CNTRS** on the spectrum analyzer. Press **[MAN]** on the pulse/function generator.
- 14. Record the EVENT CNTR reading on the spectrum analyzer. The EVENT CNTR should read 1000 ± 1 count.

EVENT CNTR Reading (TTL-Level Input)_____

Maximum Pulse Rate Test

15. Set the pulse/function generator controls as follows:

FRQ 100 kHz

- 16. Press **RESET CNTRS** on the spectrum analyzer. Press **[MAN]** on the pulse/function generator.
- 17. Record the EVENT CNTR reading on the spectrum analyzer. The EVENT CNTR should read 1000 ± 1 count.

EVENT CNTR Reading (at 100 kHz)_____

Minimum Pulse Width Test

18. Set the pulse/function generator controls as follows:

DTY 10%

- 19. Press **RESET CNTRS** on the spectrum analyzer. Press **[MAN]** on the pulse/function generator.
- 20. Record the EVENT CNTR reading on the spectrum analyzer. The EVENT CNTR should read 1000 ± 1 count.

EVENT CNTR Reading (at 1 µs pulse width)_____

Interval Counter Functionality Check

- 21. Connect the BNC cable from the pulse/function generator to the INTERVAL CNTR jack on the spectrum analyzer rear panel.
- 22. Set the pulse/function generator controls as follows:

MODE	NORM
WAVEFORM	
FRQ (Frequency)	50 kHz
DTY (Duty Cycle)	50%
HIL (High Output Level)	+5.00 V
LOL (Low Output Level)	0.0 V
DISABLE	OFF
23. On the spectrum analyzer, press TOTALIZ	E ON OFF (OFF).

24. The INTERVAL CNTR display should read approximately 50,000. The count should be within 0.1% of the frequency displayed on the universal counter.

14. Flatness Analyzer Log Fidelity

Specification

Log Fidelity

Reference Levels

–30 dBm to –20.1 dBm: ±0.7 dB/2 dB step, max. cumulative of 0.7 dB

–20 dBm to +15.9 dBm: ±0.4 dB/2 dB step, max. cumulative of 0.6 dB

+16 dBm to +20 dBm: ± 0.8 dB/2 dB step, max. cumulative of 1.2 dB

Related Adjustment

There is no related adjustment for this performance test.

Description

The output of an amplitude-accurate source is connected to the flatness detector. An amplitude reference is set at the bottom graticule and the output of the source is increased in precise 2 dB steps. The amplitude difference displayed on the spectrum analyzer is recorded.

The data is then corrected to reference the data to the reference level. The bottom-graticule reference is necessary to measure the log fidelity near the bottom of the display. The step-to-step, error is calculated between each step. This process is repeated to cover reference levels of -30 dBm to +15.9 dBm.

For reference levels of +16 dBm to +20 dBm, the output amplitude of another source with higher output power levels is characterized using a power meter. The source amplitude settings for specific output power levels are recorded. The detector is then connected to the source output. An amplitude reference is set on the spectrum analyzer and the output of the source is set to the predetermined settings. The amplitude difference displayed on the spectrum analyzer is recorded. The step-to-step error is calculated between each step.

Figure 3-14 Flatness Detector Log Fidelity Test Setup, Reference Levels –30 dBm to +15.9 dBm



Chapter 3

Equipment

Frequency Synthesizer	3335A
Synthesizer/Function Generator	3325A/B
Measuring Receiver (used as a power meter)	8902A
Power Sensor	8482H
Detector	8470B
Blocking Capacitor	0955-0256

Cable

BNC, 122 cm (4	48 in.)10	503A
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Adapters

Type N (f) to BNC (m)	1250 - 1477
BNC (m) to SMA (f).	1250 - 1700
BNC (f) to SMA (m)	1250 - 1200

Procedure

Reference Levels -30 dBm to +20.1 dBm

- 1. Connect the equipment as shown in Figure 3-14.
- 2. Set the frequency synthesizer controls as follows:

FREQUENCY	$20 \mathrm{~MHz}$
AMPLITUDE	0 dBm
AMPTD INCR	2 dB

3. On the spectrum analyzer, press **[PRESET]**, **FLATNESS & SOURCES**. Set the controls as follows:

CENTER FREQUENCY	$20 \mathrm{~MHz}$
SPAN.	0 Hz
AMPLITUDE	+8 dBm
SCALE LOG	1 dB/DIV

+8 dBm REF LEVEL Setting

- 4. On the spectrum analyzer, press [MKR] [AMPLITUDE]. Adjust the REF LVL as necessary to place the signal (the horizontal line) at the bottom graticule line.
- 5. On the spectrum analyzer, press [MKR], MKR DELTA.
- 6. On the frequency synthesizer, press [AMPLITUDE].
- 7. On the frequency synthesizer, press INCR [\blacktriangle].
- 8. Record the marker amplitude in Table 3-13 as the Actual MKR Δ Reading.
- 9. Repeat steps 7 and 8 for the frequency synthesizer AMPLITUDE settings of +4 dBm to +8 dBm listed in Table 3-13 for the +8 dBm REF LEVEL Setting.

10. Record the Actual MKR∆ reading for the +8 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (+8 dBm)_____dB

11. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the +8 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

 $CLFE = Actual MKR\Delta$ - Ideal MKR Δ - TOS Reading (+8 dBm)

0 dBm REF LEVEL Setting

12. On the spectrum analyzer, press [MKR], MARKER NORMAL.

- 13. Set the frequency synthesizer AMPLITUDE to -8 dBm.
- 14. On the spectrum analyzer, press [AMPLITUDE], 0, [+dBm]. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
- 15. On the spectrum analyzer, press [MKR], MARKER DELTA.
- 16. On the frequency synthesizer, press [AMPLITUDE].
- 17. On the frequency synthesizer, press INCR [\blacktriangle].
- 18. Record the marker amplitude in Table 3-13 as the Actual MKR Δ Reading.
- 19. Repeat steps 17 and 18 for the frequency synthesizer AMPLITUDE settings of -4 dBm to +0 dBm listed in Table 3-13 for the +0 dBm REF LEVEL Setting.
- 20. Record the Actual MKR∆ reading for the +8 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (+0 dBm)_____dB

21. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the 0 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

 $CLFE = Actual MKR\Delta - Ideal MKR\Delta - TOS Reading (+0 dBm)$

-8 dBm REF LEVEL Setting

- 22. On the spectrum analyzer, press [MKR], MARKER NORMAL.
- 23. Set the frequency synthesizer AMPLITUDE to -16 dBm.
- 24. On the spectrum analyzer, press **[AMPLITUDE]**, 8, **[-dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
- 25. On the spectrum analyzer, press [MKR], MARKER DELTA.
- 26. On the frequency synthesizer, press [AMPLITUDE].
- 27. On the frequency synthesizer, press INCR $[\blacktriangle]$.
- 28. Record the marker amplitude in Table 3-13 as the Actual MKR Δ Reading.
- 29. Repeat steps 27 and 28 for the frequency synthesizer AMPLITUDE settings of -12 dBm to -8 dBm listed in Table 3-13 for the -8 dBm REF LEVEL Setting.

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30. Record the Actual MKR∆ reading for the −8 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (–8 dBm)_____dB

31. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the -8 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

 $CLFE = Actual MKR\Delta - Ideal MKR\Delta - TOS Reading (-8 dBm)$

-16 dBm REF LEVEL Setting

- 32. On the spectrum analyzer, press [MKR], MARKER NORMAL.
- 33. Set the frequency synthesizer AMPLITUDE to -24 dBm.
- 34. On the spectrum analyzer, press **[AMPLITUDE]**, 16, **[-dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
- 35. On the spectrum analyzer, press [MKR], MARKER DELTA.
- 36. On the frequency synthesizer, press [AMPLITUDE].
- 37. On the frequency synthesizer, press INCR [\blacktriangle].
- 38. Record the marker amplitude in Table 3-13 as the Actual MKR Δ Reading.
- 39. Repeat steps 37 and 38 for the frequency synthesizer AMPLITUDE settings of -20 dBm to -16 dBm listed in Table 3-13 for the -16 dBm REF LEVEL Setting.
- 40. Record the Actual MKR \triangle reading for the -16 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (–16 dBm)_____dB

41. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the -16 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

 $CLFE = Actual MKR\Delta - Ideal MKR\Delta - TOS Reading (-16 dBm)$

-22 dBm REF LEVEL Setting

- 42. On the spectrum analyzer, press [MKR], MARKER NORMAL.
- 43. Set the frequency synthesizer AMPLITUDE to –30 dBm.
- 44. On the spectrum analyzer, press **[AMPLITUDE]**, 22, **[-dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
- 45. On the spectrum analyzer, press [MKR], MARKER DELTA.
- 46. On the frequency synthesizer, press [AMPLITUDE].
- 47. On the frequency synthesizer, press INCR [\blacktriangle].
- 48. Record the marker amplitude in Table 3-13 as the Actual MKR Δ Reading.
- 49. Repeat steps 47 and 48 for the frequency synthesizer AMPLITUDE settings of -26 dBm to -22 dBm listed in Table 3-13 for the -22 dBm REF LEVEL Setting.

50. Record the Actual MKR Δ reading for the -22 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (–22 dBm)_____dB

51. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the -22 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

 $CLFE = Actual MKR\Delta - Ideal MKR\Delta - TOS Reading (-22 dBm)$

Calculating Incremental Log Fidelity

52. For all entries in Table 3-13, subtract the previous Cumulative Log Fidelity Error (CLFE) from the current Cumulative Log Fidelity Error and record the result as the Incremental Log Fidelity Error.

Incremental Log Fidelity Error = Current CLFE – Previous CLFE

8593E REF LEVEL Setting (dBm)	Frequency Synthesizer AMPLITUDE (dBm)	MKR ∆ Reading		Log Fidel	ity Error
		Ideal (dB)	Actual (dB)	Cumulative (dB)	Incremental (dB)
+8	+8	0 (Ref)		0 (Ref)	0 (Ref)
	+6	-2			
	+4	-4			
	+2	-6			
	+0	-8	0 (Ref)		
+0	+0	0 (Ref)		0 (Ref)	0 (Ref)
	-2	-2			
	-4	-4			
	-6	-6			
	-8	-8	0 (Ref)		
-8	-8	0 (Ref)		0 (Ref)	0 (Ref)
	-10	-2			
	-12	-4			
	-14	-6			
	-16	-8	0 (Ref)		
-16	-16	0 (Ref)		0 (Ref)	0 (Ref)
	-18	-2			
	-20	-4			
	-22	-6			
	-24	-8	0 (Ref)		
-22	-22	0 (Ref)		0 (Ref)	0 (Ref)
	-24	-2			
	-26	-4			
	-28	-6			
	-30	-8	0 (Ref)		

Figure 3-15 Flatness Detector Log Fidelity Test Setup, Reference Levels +10 dBm to +20 dBm



Reference Levels +10 dBm to +20 dBm

- 53. Zero and calibrate the measuring receiver and power sensor in log mode (power levels read out in dBm). Enter the power sensor's 20 MHz Cal Factor into the 8902A.
- 54. Connect the equipment as shown in Figure 3-15, with the power sensor connect to the output of the synthesizer/function generator.
- 55. Set the synthesizer controls as follows:

FREQ) MHz
AMPTD +2	20 dBm
FUNCTIONSI	INE
DC OFFSET OI	\mathbf{FF}

- 56. Adjust the synthesizer amplitude level using the MODIFY keys until the measuring receiver reads $\pm 20 \text{ dBm } \pm 0.02 \text{ dB}$. Record the synthesizer AMPTD setting in Table 3-14 for the $\pm 20 \text{ dBm}$ Input Power Level.
- 57. Repeat step 56 for the remaining Input Power Levels listed in Table 3-14.

+20 dBm REF LEVEL Setting

- 58. Disconnect the power sensor from the synthesizer output. Connect the detector to the synthesizer output.
- 59. On the spectrum analyzer, press [MKR], MARKER NORMAL.
- 60. Set the synthesizer AMPTD as indicated in Table 3-14 for a +12 dBm Input Power Level.

Chapter 3

- 61. On the spectrum analyzer, press **[AMPLITUDE]**, 20, **[+dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
- 62. On the spectrum analyzer, press [MKR], MARKER DELTA.
- 63. Set the synthesizer AMPTD as indicated in Table 3-14 for the +14 dBm Input Power Level.
- 64. Record the marker amplitude in Table 3-14 as the Actual MKR∆ Reading.
- 65. Repeat steps 63 and 64 for Input Power Levels of +16 dBm to +20 dBm for the +20 dBm RE LEVEL Setting.
- 66. Record the Actual MKR∆ reading for the +20 dBm Input Power Level below as the Top of Screen (TOS) Reading for the +20 dBm REF LEVEL Setting.

TOS Reading (+20 dBm)_____dB

67. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the +20 dBm REF LEVEL Setting entries in Table 3-14 using the equation below. Record the results in Table 3-14.

 $CLFEE = Actual MKR\Delta - Ideal MKR\Delta - TOS Reading (+20 dBm)$

+16 dBm REF LEVEL Setting

- 68. On the spectrum analyzer, press [MKR], MARKER NORMAL.
- 69. Set the synthesizer AMPTD as indicated in Table 3-14 for a +10 dBm Input Power Level.
- 70. On the spectrum analyzer, press **[AMPLITUDE]**, 16, **[+dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
- 71. On the spectrum analyzer, press [MKR], MARKER DELTA.
- 72. Set the synthesizer AMPTD as indicated in Table 3-14 for the +10 dBm Input Power Level.
- 73. Record the marker amplitude in Table 3-14 as the Actual MKR∆ Reading.
- 74. Repeat steps 72 and 73 for Input Power Levels of +12 dBm to +16 dBm for the +16 dBm REF LEVEL Setting.
- 75. Record the Actual MKR∆ reading for the +16 dBm Input Power Level below as the Top of Screen (TOS) Reading for the +16 dBm REF LEVEL Setting.

TOS Reading (+16 dBm)_____dB

76. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the +16 dBm REF LEVEL Setting entries in Table 3-14 using the equation below. Record the results in Table 3-14.

 $CLFEE = Actual MKR\Delta - Ideal MKR\Delta - TOS Reading (+16 dBm)$

Calculating Incremental Log Fidelity

77. For all entries in Table 3-14, subtract the previous Cumulative Log Fidelity Error (CLFE) from the current Cumulative Log Fidelity Error and record the result as the Incremental Log Fidelity Error.

Incremental Log Fidelity Error = Current CLFE – Previous CLFE

8593E REF LEVEL Setting (dBm)	Input Power Level (dBm)	Synthesized AMPTD Setting (dBm)	MKR ∆ Reading		Log Fidel	lity Error
			Ideal (dB)	Actual (dB)	Cumulative (dB)	Incremental (dB)
+20	+20		0 (Ref)		0 (Ref)	0 (Ref)
	+18		-2			
	+16		-4			
	+14		-6			
	+12		-8	0 (Ref)		
+16	+16		0 (Ref)		0 (Ref)	0 (Ref)
	+14		-2			
	+12		-4			
	+10		-6			
	+8		-8	0 (Ref)		

Table 3-14 Log Fidelity, +20 dBm to +8 dBm

8593E Option E02/E04 Performance Verification Test Record

Table 3-158593E Option E02/E04 Performance Verification Test Record(Page 1 of 6)

Calibration Entity	
	Report No
	Date
	(e.g. 10 SEP 1989)
Model 8593E Opt. E02/E04	
Serial No	
Options	
Firmware Revision	
Customer	Tested by
Ambient temperature°C	Relative humidity
Power mains line frequency	Hz (nominal)
Notes/Comments	

8593E Option E02/E04		Report No		
Serial No		Date		
Test Equipment Used:				
Description	Model No.	Trace No.	Cal Due Date	
Synthesizer/Function Generator		<u> </u>		
Synthesizer/Level Generator				
Pulse/Function Generator				
Measuring Receiver				
Power Sensor				
High-Power Sensor				
Universal Frequency Counter				
50 Ω Termination #1				
50 Ω Termination #2		<u> </u>		
Microwave Spectrum Analyzer				

8593E Option E02/E04 Performance Verification Test Record (Page 2 of 6)

8593E Option E02/E04 Performance Verification Test Record (Page 3 of 6)

Report No._____

Serial No._____

Date_____

Test No.	Test Description	Min	Results Measured	Max	Measurement Uncertainty
1.	Resolution Bandwidth Selectivity				
	Measured 6 dB BW				
	Measured Separation				
	Actual 6 dB BW				±48.5 Hz
	Measured 60 dB BW				
	Measured Separation				
	Actual 60 dB BW				±142.6 Hz
	1 kHz RES BW Selectivity	10			±1.51%
2.	Three-Tone Intermodulation Distortion				
	2.0 GHz CENTER FREQ				
	Upper Product Suppression			-60 dBc	+2.07/-2–42 dB
	Lower Product Suppression			–57 dBc	+2.07/-2–42 dB
	4.0 GHz CENTER FREQ				
	Upper Product Suppression			$-57 \mathrm{~dBc}$	+2.07/-2–42 dB
	Lower Product Suppression			$-57 \mathrm{~dBc}$	+2.07/-2–42 dB
3.	Absolute Amplitude and Vernier Accuracy				
	Absolute Amplitude				
	Accuracy	–0.75 dB		–0.75 dB	+0.155/–0.161 dB
	Positive Absolute Vernier				
	Accuracy			+0.50 dB	±0.03 dB
	Negative Absolute Vernier				
	Accuracy	–0.50 dB			±0.03 dB
	Positive Step-to-Step Vernier				
	Accuracy			+0.20 dB	±0.03 dB
	Negative Step-to-Step Vernier				
	Accuracy	–0.20 dB			±0.03 dB
4.	Power Sweep Range				
	Start Power Level				
	Stop Power Level				
	Power Sweep Range	9.0 dB			±0.03 dB

8593E Option E02/E04 Performance Verification Test Record (Page 4 of 6)

8593E Option E02/E04

Report No._____

Serial No._____

Date_____

Test No.	Test Description	Min	Results Measured	Max	Measurement Uncertainty
5.	Tracking Generator Level				
	Flatness				
	Maximum Positive				
	Flatness				
	40 MHz to 300 MHz			+1.50 dB	+0.28/–0.28 dB
	300 kHz to 10 MHz			+3.0 dB	
	10 MHz to 2.9 GHz			+2.0 dB	+0.42/–0.45 dB
	Maximum Negative				
	Flatness				
	40 MHz to 300 MHz	1.50 dB			+0.28/–0.28 dB
	300 kHz to 10 MHz	–3.0 dB			
	10 MHz to 2.9 GHz	–2.00 dB			+0.42/–0.45 dB
6.	Tracking Generator				
	Frequency Accuracy				
	Frequency Error	$-2.2 \mathrm{~kHz}$		+2.2 kHz	±1 Hz
7.	Harmonic Spurious Outputs				
	2nd Harmonic Level				
	300 kHz	$-25~\mathrm{dBc}$			+1.55/–1.80 dB
	100 MHz	$-25~\mathrm{dBc}$			+1.55/–1.80 dB
	300 MHz	–15 dBc			+1.55/–1.80 dB
	$900 \mathrm{~MHz}$	–15 dBc			+1.55/–1.80 dB
	1.4 GHz	–15 dBc			+3.45/–1.80 dB
	3rd Harmonic Level				
	300 kHz	–25 dBc			+1.55/–1.80 dB
	100 MHz	$-25~\mathrm{dBc}$			+1.55/–1.80 dB
	300 MHz	–15 dBc			+1.55/–1.80 dB
	900 MHz	-15 dBc			+3.45/-4.01 dB
8.	Non-Harmonic Spurious				
	Outputs				
	Highest Non-Harmonic				
	Response Amplitude				
	300 kHz to ≤400 MHz	-27 dBc			+1.55/–1.80 dB
	>400 MHz to 2.9 GHz	–15 dBc			+3.45/–4.01 dB

Chapter 3

8593E Option E02/E04 Performance Verification Test Record (Page 5 of 6)

8593E	Option	E02/E04
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Report No._____

Serial No._____

Date_____

Test No.	Test Description	Min	Results Measured	Max	Measurement Uncertainty
9.	Tracking Generator Feedthrough				
	400 kHz to 2.9 GHz			–110 dBm	+1.59/–1.70 dB
10.	RF Power-Off Residuals				
	Residual Response Amplitude				
	300 kHz to 2.9 GHz			–120 dBm	+3.50/-4.17 dB
11.	Tracking Generator LO Feedthrough Amplitude				
	300 kHz			-78 dBm	+1.63/–1.97 dB
	70 MHz			-78 dBm	+1.63/–1.97 dB
	$150 \mathrm{~MHz}$			-78 dBm	+1.63/–1.97 dB
	$1.5~\mathrm{GHz}$			–78 dBm	+1.63/–1.97 dB
	2.9 GHz			–78 dBm	+3.50/-4.17 dB
12.	Residual AM and Residual FM				
	Residual AM			-60 dBc	±6.06 dB
	Residual FM			$500~{ m Hz}$	±28.49 Hz
13.	Event Counter				
	Event Counter Reading				
	Universal Counter Reading				±0.18 Hz
	Gate Time Accuracy	-0.1%		+0.1%	$\pm 0.0004\%$
	EVENT CNTR Reading				
	(0V - 5V Input)	999		1001	N/A
	EVENT CNTR Reading				
	(TTL-Level Input)	999		1001	N/A
	EVENT CNTR Reading				
	(TTL-Level Input) (at 100 kHz)	999		1001	N/A
	EVENT CNTR Reading				
	(at 1 μ s pulse width)	999		1001	N/A

8593E Option E02/E04 Performance Verification Test Record (Page 6 of 6)

8593E Option E02/E04

Report No._____

Date_____

Test No.	Test Description	Min	Marker Δ Measured	Max	Measurement Uncertainty
14.	Flatness Analyzer Log Fidelity				
	Cumulative Log Fidelity Error				
	+8 dBm REF LEVEL				
	–2 dB from REF LEVEL	-0.4 dB		+0.4 dB	±0.04 dB
	-4 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	-6 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	–8 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	0 dBm REF LEVEL				
	–2 dB from REF LEVEL	-0.4 dB		+0.4 dB	±0.04 dB
	-4 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	–6 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	–8 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	–8 dBm REF LEVEL				
	–2 dB from REF LEVEL	-0.4 dB		+0.4 dB	±0.04 dB
	-4 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	–6 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	–8 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	–16 dBm REF LEVEL				
	–2 dB from REF LEVEL	-0.4 dB		+0.4 dB	±0.04 dB
	-4 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	-6 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	–8 dB from REF LEVEL	-0.6 dB		+0.6 dB	±0.04 dB
	–22 dBm REF LEVEL				
	–2 dB from REF LEVEL	-0.7 dB		+0.7 dB	±0.04 dB
	-4 dB from REF LEVEL	-0.7 dB		+0.7 dB	±0.04 dB
	-6 dB from REF LEVEL	-0.7 dB		+0.7 dB	±0.04 dB
	–8 dB from REF LEVEL	-0.7 dB		+0.7 dB	±0.04 dB
	+20 dBm REF LEVEL				
	–2 dB from REF LEVEL	-0.8 dB		+0.8 dB	±0.04 dB
	-4 dB from REF LEVEL	–1.2 dB		+1.2 dB	±0.04 dB
	–6 dB from REF LEVEL	–1.2 dB		+1.2 dB	±0.04 dB
	–8 dB from REF LEVEL	–1.2 dB		+1.2 dB	±0.04 dB
	+16 dBm REF LEVEL				
	–2 dB from REF LEVEL	-0.8 dB		+0.8 dB	±0.04 dB
	-4 dB from REF LEVEL	–1.2 dB		+1.2 dB	±0.04 dB
	-6 dB from REF LEVEL	–1.2 dB		+1.2 dB	±0.04 dB
	-8 dB from REF LEVEL	–1.2 dB		+1.2 dB	±0.04 dB
		1	1		

Serial No._____

4 8593E Option E02/E04 Operation

Introduction

This chapter provides operating information for the 8593E Option E02/E04. The purpose of this section is to help you become familiar with spectrum analyzer operation and to help you make some simple Digital Radio Test Set DRTS measurements. For further information on spectrum analyzer operation, please see the 8590 D-Series and E-Series Spectrum Analyzer User's Guide.

Preset

The green **[PRESET]** key presets the complete spectrum analyzer instrument state, including all the modes. It does not alter the instrument states saved by the user, traces saved by the user, or instrument calibration data.

Frequency

The FREQUENCY key is used to set frequency parameters. When the FREQUENCY key is pressed, a group of softkeys is accessed that allow parameter setting. The softkeys allow the user to modify the center frequency, the start and stop frequencies, the center frequency step size, and the offset frequency.

To set the center frequency:

- 1. Press the **[FREQUENCY]** key.
- 2. Enter the desired center frequency using the DATA keys, the [▲] or [▼] keys, or the knob.

Span

The SPAN key allows the user to adjust the frequency span of the display. The amount of span can be manually entered using the DATA keys, or a predetermined span can be selected using the softkeys.

To manually enter a span:

- 1. Press the **[SPAN]** key.
- 2. Enter the desired frequency span using the DATA keys.

To select a predetermined span:

- 1. Press the [SPAN] key.
- 2. For a full span, press the FULL SPAN softkey.
- 3. For a zero span, press the **ZERO SPAN** softkey.
- 4. To limit SPAN to a single band, press the BANDLOCK softkey, then the BAND 0, BAND 1, BAND 2, BAND 3 or BAND 4 softkey.

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Amplitude

The **[AMPLITUDE]** key allows the user to adjust the vertical parameters of the display. When the **[AMPLITUDE]** key is pressed, a group of softkeys is accessed that allows parameter modification. The user can modify the reference level, the scale (log or linear), and input attenuation.

To set the reference level:

- 1. Press the [AMPLITUDE] key.
- 2. Enter the desired reference level using the DATA keys, the $[\blacktriangle]$ or $[\triangledown]$ keys, or the knob.

Preselector Alignment

The spectrum analyzer includes an internal pre-selector to filter out spurious signals from the display. The preselector is automatically adjusted for best tracking at a given frequency by using the **PRESEL PEAK** softkey. The spectrum analyzer must have a microwave input during the procedure. The following procedure will align the preselector.

Preselector peak automatically adjusts the preselector tracking to peak the signal at the active marker. Using preselector peak prior to measuring a signal yields the most accurate amplitude reading at the specified frequency. To maximize the peak response of the preselector and adjust the tracking, tune the marker to a signal and press [AMPLITUDE], **PRESEL PEAK**.

NOTE

 PRESEL PEAK maximizes the peak response of the signal of interest but may degrade the frequency response at other frequencies. Use PRESEL DEFAULT or [PRESET] to clear PRESEL PEAK before measuring another frequency.
 PRESEL DEFAULT provides best full single-band flatness for viewing several signals simultaneously.

2. PRESEL PEAK works in harmonic bands only (bands 1 through 4).

Example: Using the knob, step keys, or **[PEAK SEARCH]**, place the marker on your signal, and press **PRESEL PEAK**. The message CAL: PEAKING appears in the active function block while the routine is working.

If **PRESEL PEAK** has more than a 2 dB effect on signal amplitude when in BAND 1 or above and in a single-band sweep, perform **CAL YTF** with the COMB OUT signal, and store the data with **CAL STORE**. **CAL YTF** improves the **PRESEL DEFAULT** values (8593E only).

CAL YTF

- 1. Press the **[PRESET]** key.
- 2. Connect the 100 MHz COMB OUT connector to the INPUT 50 Ω connector using the special cable supplied.
- 3. Press the **[CAL]** key.
- 4. Press CAL YTF softkey.
- 5. Press the CAL STORE softkey.
- 6. Press the [PRESET] key.

Marker

A diamond-shaped marker can be placed on the signal peak to find the signal's frequency and amplitude. The marker can be placed manually or automatically. The signal's frequency and amplitude appear in the upper right corner of the display.

Placing a marker manually:

- 1. Ensure that the signal to be measured is displayed on the spectrum analyzer's screen.
- 2. Press the [MKR] key.
- 3. Press the MARKER NORMAL softkey.
- 4. Turn the knob to place the marker at the signal peak.

Placing a marker automatically:

- 1. Ensure that the signal to be measured is displayed on the spectrum analyzer's screen.
- 2. Press the [PEAK SEARCH] key.

The marker will be automatically placed on the highest peak of the trace.

Modes

Pressing the [MODE] key on the spectrum analyzer front panel accesses the Mode Menu that provides a selection of the modes currently in the memory of the 8593E spectrum analyzer. Other modes can be loaded in from a Memory Card to replace those that are currently installed in the spectrum analyzer.

Some of these modes make measurements using the spectrum analyzer input, while others make measurements on signals applied to various rear panel inputs. When switching between installed modes, the state of the last mode is automatically saved, and the state of the new mode is automatically recalled. The following modes are included on the Digital Radio Test System Measurement Personality ROM Card:

MODE LOADER FLATNESS & SOURCES EVENT COUNTER FREQUENCY COUNTER DIGITAL RADIO MASKS SCALAR ANALYZER LOW FREQUENCY OSCILLOSCOPE

Mode Loader

The Mode Loader utility provides a convenient way to automatically dispose of and load the various modes that are provided on the DRTS Personality Measurement ROM Card. The total memory size required for these modes is larger than the user memory in the 8593E, so it is necessary to load in the modes in smaller groups. While this may be done manually, it is faster and easier to use the Mode Loader.

Loading the Mode Loader

1. Press [MODE] to bring up the Mode Menu. Alternate presses of the [MODE] key will switch between the Main Menu of the current mode and the Mode Menu.

NOTE The Mode Menu always has **SPECTRUM ANALYZER** as the first softkey.

- 2. If **SPECTRUM ANALYZER** is the only softkey displayed on the Mode Menu, then skip to step number 8.
- 3. If **MODE LOADER** is one of the softkeys, then this utility is already loaded in the spectrum analyzer and the rest of this procedure may be skipped. See "Using the Mode Loader".
- 4. If other modes are present on these softkeys they should be disposed of before loading in the MODE LOADER by doing:
- 5. Press [CONFIG]. Press MORE 1 of 2.
- 6. Press DISPOSE USER MEM (an IF YOU ARE SURE... message appears).
- 7. Press **DISPOSE USER MEM** for a second time.
- 8. To load the MODE LOADER do the following:
- 9. Insert the Digital Radio Test System Personality Measurements ROM Card into the card reader on the front panel of the 8593E spectrum analyzer.
- 10.Press [RECALL].
- 11.Select the memory card by pressing INTRNL CRD to underline CRD.
- 12.Press CATALOG CARD.
- 13.Press CATALOG ALL. The file dLOADME will be highlighted.
- 14.Press LOAD FILE which loads the highlighted file.
- 15.**MODE LOADER** should now be one of the keys on the Mode Menu.
- 16.If a user Down Loadable Program (DLP) is to be used in conjunction with the Event Counter mode, it should be loaded in before the Event Counter mode is loaded.

Using the Mode Loader

1. Insert the Digital Radio Test System Measurement Personality ROM Card into the card reader on the front panel of the 8593E, if not already inserted.

NOTE The Mode Menu always has **SPECTRUM ANALYZER** as the first softkey.

- 2. Press [MODE] to bring up the Mode Menu. (MODE LOADER should be the second softkey.)
- 3. Press MODE LOADER.
- 4. Select the desired mode or mode group by number using the **[DATA]** keys and press **[ENTER]** (**[HZ]** key). Usually, items 1, 2, or 3 would be selected, each of which loads several modes. Other item numbers allow the modes to be loaded in separately; which then leaves more room for user DLP's. It will take 10 to 60 seconds to dispose of the current modes and load in the new ones.
- NOTEWhen an item number is selected, the Mode Loader first automatically
disposes of any other DRTS modes that are resident in the 8593E memory,
before loading in the new mode(s). However, user defined DLPs will not be
disposed (provided that the guidelines for assigning names and keys for user
DLP's was followed as contained in the 8590 D-Series and E-Series
Spectrum Analyzer Programmer's Guide). An Instrument Preset command is
automatically done after the new mode is loaded.

Changing Modes and Presetting Modes

- 1. Once the mode is loaded, a softkey label for that mode will exist in the Mode Menu. Press [MODE] to display the Mode Menu and then press the mode name softkey to change to that mode. If a mode is re-entered it will be in the same state as when it was left, provided [PRESET] has not been pushed.
- 2. To return to the spectrum analyzer mode, press [MODE] to bring up the Mode Menu and then SPECTRUM ANALYZER. The spectrum analyzer will be returned to the same state as when it was left.
- 3. The green **[PRESET]** key may be used to take the instrument back to the spectrum analyzer mode, but this will also preset the instrument, including all modes, to the default state.

NOTE	The green [PRESET] key should seldom need to be used. It is not necessary to
	press [PRESET] before switching to another mode.

4. An individual mode may be preset to its default state without affecting other modes by use of the mode **PRESET** softkey that is in the Main Menu of that mode.

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Accessing the Main Menu of a Mode

- 1. Press [MODE] and then the mode name softkey.
- 2. Or press [MODE] [MODE].

Setting Date and Time

Press [CONFIG], press TIME DATE, press SET DATE or SET TIME.

SET DATE sets the date of the real-time clock. Enter the date in the YYMMDD format using the number keypad and press **[ENTER]**. Valid year (YY) values are 00 through 99. Valid month (MM) values are from 01 to 12, and valid day (DD) values are from 01 to 31.

SET TIME sets the time of the real-time clock. Enter the time in 24-hour, HHMMSS format, using the number keypad and enter the time by pressing **[ENTER]**. Valid hour (HH) values are from 00 to 23. Valid minute (MM) and second (SS) values are from 00 to 59.

Digital Radio Mask Mode

The Digital Radio Mask mode uses the spectrum analyzer to measure spectral occupancy of digital radio signals. The transmitted spectrum of a digital radio is automatically measured and compared to agency or user defined mask limits. Mean power, frequency response, and transient analysis measurements may also be made in this mode. For more information refer to the 85713A Digital Radio Measurements Personality User's Guide.

Event Counter Mode

The event counter operation is independent of the spectrum analyzer operation. There are two TTL compatible inputs for this mode on the spectrum analyzer rear panel. The EVENT CNTR INPUT is used to count negative going pulses (a falling edge followed by a rising edge) occurring during the gate time interval. The INTERVAL CNTR INPUT is used for measuring the accumulated time that a pulse is low during the gate time interval. The number of negative going pulses is also displayed for this input, thus it can also be used as a second event counter. The counters display the count at the end of the gate time and are automatically restarted to do another count. If a continuous count for an indefinite time period is desired, the Totalize function may be used. Note that the gate time, Totalize, and Stop Cntrs functions control all counters together.

Following is a list of the softkeys that are available in the event counter mode.

NOTE For maximum operation speed, the event counter mode needs to be loaded into the spectrum analyzer memory last. The mode loader does this automatically for the DRTS modes. If a user DLP is used, it should be loaded into memory before loading the DRTS modes. This speed issue is primarily of concern for threshold errored second measurements with gate times of less than one second.

PRESET EVNT CNT sets the event counter to a known initial state.

GATE TIME 1 s TOTALIZE OFF STOP CNTRS OFF EVNT THLD 50000 cnt/s Counter Values 0

RESET CNTRS resets all the counters to zero and starts a new count.

STOP CNTRS turns off the counters and holds the last value of each on the display. The counters are reset to zero and restarted by pressing **RESET CNTRS**, changing the gate time, or turning Totalize on or off.

GATE TIME accesses the menu in which the gate time is selected. Keys are provided for 100 ms, 1 s, and 10 s. Or a value may be entered by using any of the data controls.

TOTALIZE ON OFF switches the counter between Totalize and gate time count. In Totalize, the counters keep incrementing until they are manually reset. With Totalize Off, the counters are reset and a new count is started at the end of every gate time interval. With Totalize On, the threshold errored seconds value is also displayed. This value will increase by one gate time interval; if during that gate interval, either the event counter value increases by more than the event threshold value, the interval counter value increases by any amount, or the interval counter time increases by any amount.

For Totalize with gate times less than 300 ms, XX is displayed for the Event and interval counters. To display these values, press **STOP CNTRS**.

DSPLY SA ON OFF turns the spectrum analysis display on and off. When on, this allows simultaneous viewing of both spectrum analyzer and event counter displays.

The spectrum analysis display is set to 15 dB/div, so that its display will not interfere with that of the event counter. The spectrum analyzer operation may be changed in the normal fashion by using the hard keys. The DSPLY SA function is automatically locked-out for Totalize with a gate time of less than one second.

EVENT THRSHLD allows the threshold value for the event counter to be changed. This is used in conjunction with threshold errored seconds measurements when in Totalize.

Sources access the menu that allows control of the IF and RF sources. To have access to this menu, the Flatness & Sources mode needs to be resident in the spectrum analyzer along with the event counter mode. The sources parameters may be changed while the counters are running, except for Totalize with a Gate Time of less than one second; in which case the counters are automatically stopped when the sources menu is accessed. For a description of the operation of the keys in this menu, refer to "Flatness & Sources Mode" section of the manual.

Gate Indicator. A " " is displayed on the CRT during the gate interval and momentarily flashes off at the end of the gate interval.

Frequency Counter Mode

The Frequency Counter mode uses the spectrum analyzer to make highly accurate frequency measurements. The highest level signal applied to the input of the spectrum analyzer's INPUT 50 Ω connector is automatically found and its frequency and amplitude are displayed. The user needs to set just two parameters: the frequency band and the desired resolution. If the input signal is changed, the analyzer will automatically find and measure the new signal, provided it is in the displayed frequency band.

NOTE The frequency of a signal other than the highest can be determined in the spectrum analyzer mode by using the MKR CNT function. The accuracy is the same as when using the Frequency Counter mode.

Following is a list of softkeys that are available in Frequency Counter mode.

PRESET FREQ CNT sets the Frequency Counter to a known initial state.

RESOLN 100 Hz FREQ..... 2.9 DSP HOLD OFF

RESET restarts the search for the highest level signal present in the selected Band. This function seldom needs to be used, as searching automatically commences when no input signal above the threshold level is present.

FREQ 2.9 22 This softkey selects the Frequency Band. The Analyzer will search for the highest level signal only in the selected Band. The 2.9 band is 10 MHz to 2.9 GHz. The 22 band is 2.75 to 22 GHz.

RESOLN accesses the menu in which Frequency Resolution is selected. Keys are provided for 1 Hz, 10 Hz, 100 Hz, 1 kHz, and 10 kHz.

DSP HOLD ON OFF switches the Display Hold function on and off. When it is on, the value displayed on the CRT is held.

Searching. A SEARCHING message is displayed if the counter has not acquired a signal.

Measuring. A MEASURING message is displayed when a frequency counter measurement is being made.

Flatness & Sources Mode

Sensor kit.

Flatness Analyzer

This mode is used to make swept flatness measurements. The source signal, connected to the input of the device under test, may come from either the IF tracking generator or the RF Source. An external 8470B Crystal Detector is connected to the output of the device under test. The output of the 8470B is connected to the FLATNESS EXT DET IN connector on the rear panel of the 8593E E02/E04. Measurements can be made IF to IF, RF to RF, IF to RF, or RF to IF.

CAUTION	Do not apply more than +20 dBm to the detector. Use attenuators from the Power Sensor kit.
NOTE	For IF measurements, use the 11852B Minimum Loss Pad from the Power

Following is a list of softkeys that are available in the Flatness & Sources mode.

PRESET FLATNESS sets the flatness analyzer to a known initial state.

COUDOD	10
SOURCE	. 1F'
SRC PWR (IF)	OFF, 0 dBm
SRC PWR (RF)	OFF, -10 dBm
SRC PWR OFFSET (IF)	0 dB
SRC PWR OFFSET (RF)	0 dB
PWR SWP	OFF
REF LVL	0 dBm
LOG SCALE	1 dB/div
NORM REF POSN	.7
SWEEP TIME	AUTO SCALAR
VBW	1 kHz
TRANS/REFL	TRANS
AMPL TRK	OFF
NORMALIZE	OFF
CENTER FREQ	70 MHz
SPAN	40 MHz

Sources

This section of the Flatness & Sources Mode controls the IF and RF sources. These sources are used with the flatness analyzer and may also be used independently to provide either swept or CW signal sources.

The RF Source output is on the front panel of the 11758B. The RF Source is controlled by the softkeys of the spectrum analyzer. The frequency range is determined by the options configuration. The output level is adjustable from +5 to -15 dBm.

The spectrum analyzer includes a tracking generator that operates from 300 kHz to 2.9 GHz. The output is adjustable from +1 dBm to -10 dBm. The IF tracking generator output is on the front panel of the 8593E Spectrum Analyzer and is labeled RF OUT 50 Ω . For 75 Ω output, use the 11694A Transformer/Adaptor on the RF OUT 50 Ω connector.

The **Sources** softkey or **[AUX CTRL]** hardkey activates the SRC PWR function and accesses the Sources menu. The Sources menu has the following softkeys:

SOURCE IF RF selects either the RF Source or the IF tracking generator. The source must be selected before setting Frequency, Span, or Source Power.

CENTER FREQ is used to set the selected source's frequency using the data keys, the arrow keys, or the knob.

SPAN allows the frequency range to be changed symmetrically about the center frequency.

SRC PWR ON OFF turns the source power on or off, and allows control of the output power level of the source. This separately controls the IF source or RF source, depending upon which is selected by the **SOURCE IF RF** softkey. If this function is active (SRC PWR highlighted), pressing it will toggle the function from on to off or from off to on. If this function is not active, pressing it will make it active.

Src Pwr Menu softkey accesses the source power menu.

RF Src Band softkey accesses the RF source band menu.

3.0–6.8 BAND1 selects RF source frequencies from 3.0 to 6.8 GHz. This is the default range for the RF source.

6.0–13.2 BAND2 selects RF source frequencies from 6.0 to 13.2 GHz when used with the correct option of 11758.

9.0–19.8 BAND3 selects RF source frequencies from 9.0 to 19.8 GHz when used with the correct option of 11758.

12.0–27.2 BAND4 selects RF source frequencies from 12.0 to 27.2 GHz when used with the correct option of 11758.

SRC PWR OFFSET adds in an offset number to the displayed value of the Source Power. This separately controls the IF source or RF source, depending upon which is selected by the **SOURCE IF RF** softkey.

PWR SWP ON OFF turns the power sweep function on or off, and allows control of the power sweep range of the IF source (tracking generator). This function sweeps the power as a function of the horizontal sweep ramp. It is used in Zero Span to make swept power measurements. It may be used with Span to provide slope compensation as a function of frequency.
Calibration

The **[CAL]** or **CAL** softkey accesses the Flatness Calibration menu that has the following softkeys:

CAL TRANS is used to calibrate the measurement setup for transmission measurements. The message Connect THRU, Store when ready is displayed.

STORE THRU performs the actual transmission calibration by adjusting the peak of the response to the Reference Level, storing a reference trace, and then turning the normalization on. After calibration is completed, the message THRU Cal stored, Normalization ON is displayed.

CAL REFL is used to calibrate the measurement setup for reflection measurements. The message Connect SHORT, Store when ready is displayed.

STORE SHORT performs the actual reflection calibration by adjusting the peak of the response to the Reference Level, storing a reference trace, and then turning the normalization on. After calibration is completed, the message SHORT Cal stored, Normalization ON is displayed.

CANCEL stops the calibration without storing a new reference trace.

NORMALIZE ON OFF switches the normalization on and off.

NOTE The normalize reference position is at the seventh graticule line. It is indicated by the ">" and "<" marks. The unnormalized reference position is at the top graticule.

Measure

The **[MEAS/USER]** key or **MEAS** softkey accesses the measurement menu that has the following softkeys.

REFL TRANS selects between reflection and transmission measurements. When switching from one to the other, some of the measurement conditions at the time of calibration are recalled, including the reference trace, Reference Level, and Log Scale. The source power and frequency parameters are not recalled, but must be the same for both reflection and transmission; except they may be different if the IF source is used for one measurement and the RF source for the other.

AMPL TRK ON OFF switches the Amplitude Track function on or off. With this function on, the Ref Level is automatically adjusted on each sweep to keep the maximum value of the trace approximately at the reference position. This is very useful when making flatness adjustments in 0.1 dB/div; as the gain of a device often varies considerably as the flatness is adjusted. Without this function, the user might need to repeatedly adjust the Ref Level to keep the trace on screen.

SCALE LOG sets the vertical graticule scale in dB per div.

Meas Fcns accesses the special functions menus. Refer to the 8590 Series Spectrum Analyzer User's Guide for a description of these functions.

Front Panel Hard Keys

[AMPLITUDE] activates the reference level function and accesses the amplitude menu.

[REF LVL] sets the absolute level at the reference position on the screen. This is the level at the input to the 8470B Crystal Detector. When the calibration is performed, and the normalized trace displayed, both absolute reference and relative reference values are displayed. This differs from the Scalar mode where only the relative values are displayed when normalized. When the Amplitude Track function is on, the Ref Level is automatically adjusted.

[BW] accesses the Bandwidth menu, which has the following softkeys in the flatness analyzer mode.

VID BW sets the amount of post detection filtering. Decreasing this reduces trace noise. As the Video BW is decreased, the sweep time is automatically increased to maintain amplitude calibration.

VID AVG ON/OFF turns the averaging function on and off.

[SWEEP] activates the SWP TIME function and accesses the sweep menu.

Scalar Analyzer Mode

The scalar analyzer mode is used to make swept scalar stimulus-response measurements. The source signal, connected to the input of the device under test, comes from the IF tracking generator's RF OUT 50 Ω connector on the spectrum analyzer. The output of the device under test is applied to the spectrum analyzer's INPUT 50 Ω connector.

PRESET SCALAR sets the scalar analyzer to a known initial state.

Following is a list of softkeys that are available in scalar analyzer mode.

SRC PWR	OFF at 0 dBm
SRC PWR STP SIZE	AUTO
SRC PWR OFFSET	0 dB
PWR SWP	OFF
LOG SCALE	10 dB/div
NORM REF POSN	Top graticule
REF LVL	0 dBm
TRANS/REFL	TRANS
NORMALIZE	OFF
NORM REF LVL	0 dB
SWEEP TIME	AUTO SCALAR
RES BW	10 kHz
VBW	AUTO
DET	SMPL
START FREQ	0 Hz
STOP FREQ	2.9 GHz

Source

The **SOURCE** softkey or **[AUX CTRL]** hardkey activates SRC PWR and accesses the Source menu that has the following softkeys:

NOTE Use the **Source** softkey in the scalar analyzer menu. Do not use the **Sources** softkey in the flatness analyzer menu.

SRC PWR ON OFF turns the source power on or off, and allows control of the output power level of the source. If this function is active (SRC PWR highlighted), pressing it will toggle the function from on to off or from off to on. If this function is not active, pressing it will make it active.

SRC PWR OFFSET adds in an offset number to the displayed value of the Source Power.

PWR SWP ON OFF turns the power sweep function on or off, and allows control of the power sweep range of the tracking generator. This function sweeps the power as a function of the horizontal sweep ramp. It is used in Zero Span to make swept power measurements. It may be used with Span to provide slope compensation as a function of frequency.

Calibration

The **cal** or **[CAL]** hardkey accesses the Scalar Calibration menu which has the following softkeys:

NOTE It is good practice to perform a TRACKING PEAK function at the beginning of each measurement session before performing a calibration.

CAL REFL is used to calibrate the Scalar measurement setup for reflection measurements. The message Connect OPEN, Store When Ready is displayed, followed by Connect SHORT, Store When Ready.

STORE OPEN or **STORE SHORT** performs the actual calibration. A reference trace is stored, normalization is turned on and the normalized trace is displayed on the screen when this key is pressed. The message OPEN/SHORT stored, Normalization, ON is displayed.

NOTE An external directional coupler is required to make reflection (return loss) measurements.

CANCEL stops the calibration without storing a new reference trace.

CAL TRANS is used to calibrate the Scalar measurement setup for thru measurements. The message Connect THRU, Store when ready is displayed.

STORE THRU performs the actual calibration. A reference trace is stored, normalization is turned on, and the normalized trace is displayed on the screen when this key is pressed. The message THRU Cal Stored, Normalization, ON is displayed.

CANCEL stops the calibration without storing a new reference trace.

TRACKING PEAK performs an automatic routine to set the tracking generator frequency to precisely the same frequency as the spectrum analyzer. It is necessary to have a cable or the device under test connected between the tracking generator and spectrum analyzer before pushing this key.

NORMLIZE ON OFF switches the normalization on and off.

Main Menu returns to the SCALAR menu.

Measurement

REFL selects reflection measurement for display on the screen. When switching from TRANS to REFL, the reflection reference trace and reflection amplitude parameters are recalled, and normalization is turned on.

TRANS selects transmission measurement for display on the screen. When switch from REFL to TRANS, the transmission reference trace and transmission amplitude parameters are recalled, and normalization is turned on.

NOTE REFL and **TRANS** have independent reference traces and amplitude parameters that are automatically saved and recalled when switching between the two measurements. The frequency and source power parameters are shared by both.

NORMLIZE ON OFF switches the normalization On and Off.

Meas Fcns accesses the special functions menus. Refer to the 8590 Series Spectrum Analyzer User's Guide for a description of these functions.

Front Panel Hard Keys

Most of the Front Panel hard keys may be used in this mode. Their operation is very similar to that for the spectrum analyzer mode. Some of the softkeys are different to better match the requirements for the scalar analyzer mode. The most important hard keys and related softkeys are described below.

[FREQUENCY] activates the Center Frequency function and allows selection of the frequency at the center of the screen. It also accesses the FREQUENCY menu.

[SPAN] activates the Span function and allows the frequency range to be changed symmetrically about the center frequency. It also accesses the SPAN menu.

[AMPLITUDE] activates the Reference Level function and accesses the amplitude menu.

REF LVL (RANGE) sets the absolute level at the Reference Level Position on the screen (the top horizontal graticule) before calibration. This is the level at the input to the spectrum analyzer.

SCALE LOG sets the vertical graticule scale in dB per div.

NORM REF LVL sets the relative level at the normalized reference position. It can be set either before or after calibration.

NORM REF POSN moves the position at which the normalized reference level applies. This reference level is indicated by ">" and "<" on the display when Normalization is on.

[BW] activates the RES BW function and accesses the BW menu.

RES BW sets the bandwidth of the IF bandpass filters. Narrowing the RES BW gives increased sensitivity, and hence increased dynamic range. As the RES BW is decreased, the sweep time is automatically increased to maintain amplitude calibration. Note that the RES BW does not restrict the bandwidth that can be measured on the device under test.

VID BW sets the amount of post detection filtering. Decreasing this reduces trace noise. As the Video BW is decreased, the sweep time is automatically increased to maintain amplitude calibration.

VID AVG ON/OFF turns the averaging function on and off.

[SWEEP] activates the SWP TIME function and accesses the Sweep menu.

SWP TIME When active (highlighted), the sweep time can be entered from the data control keys. AUTO or MANual operation may also be chosen. In Auto operation, the sweep time is automatically set as a function of RES BW and Video BW to give a correct amplitude display with most devices under test. If the device has unusually sharp skirts or resonances, a slower sweep in the manual mode may be required. Conversely, if the response is very flat a faster sweep time could be used if desired. This can be easily tested: the sweep time is not too fast if increasing it one increment produces no noticeable change (or an acceptable change) on the display.

[MKR] turns on the normal marker and accesses the marker menu. These functions are very useful for the scalar analyzer mode. See the spectrum analyzer operation for detailed description.

Chapter 4

Introduction to Digital Radio Measurements

This section provides operating information for the 8593E Option E02/E04. It includes several simple digital radio measurements. It does not provide an in-depth discussion of all of the features of the 8593E Option E02/E04. The purpose of this section is to help you become familiar with the spectrum analyzer and begin making measurements in a minimum amount of time. For additional information, please refer to 85718A Digital Radio Measurements Personality User's Guide and the 8590 D-Series and E-Series Spectrum Analyzer User's Guide. The following section includes test procedures for:

- Spectral Occupancy
- IF Frequency Measurement
- Flatness Through Upconverter
- Measuring Errors with the Event Counter

Spectral Occupancy

This test measures the spectral occupancy of a transmitter and compares it with predefined masks to see if it falls within qualified bandwidth requirements. The measurement can be taken from an RF monitor port, or from the RF output if it is sufficiently attenuated.

Test Equipment

Spectrum Analyzer	8593A
Type N cable	11500A

- 1. Load the digital radio masks if they are not already loaded.
 - a. Place the DRTS mode card in the mode loader.
 - b. Press: [MODE]
 - c. Press: MODE LOADER
 - d. Select Digital Radio Masks: Press: [6] [ENTER] (ENTER is the shifted HZ key)
 - e. Wait until the masks are loaded.
 - f. Press: Digital Radio
 - g. Press: Agency Masks
 - h. Select the mask appropriate for your radio. The masks are 4 GHz FCC MASK, 6 GHz FCC MASK, 11 GHz FCC MASK, 13 GHz UK MASK, and 13 GHz FRG MASK.

NOTE If you need to define your own mask, or for more detail, refer to the 85713A Digital Radio Measurements Personality User's Guide. Once a mask has been defined, it can be moved to a different center frequency simply by pressing **[CENTER FREQ]** and using the rotary knob or data keys.

2. Connect the test setup as shown in Figure 3-1 below.

Figure 4-1. Spectral Occupancy Setup



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CAUTION	Use the attenuators provided in the accessory kit. Make sure that the high power attenuator is placed closest to the RF output.		
NOTE	It may be necessary to make the spectral occupancy test at the actual RF output instead of the monitor port if there are additional RF filters present in the radio after the monitor port (filters are often responsible for keeping the sidelobes below the required mask).		

3. Press: Compare to Mask

4. The spectrum analyzer display will show the mask and the spectrum of the radio. If the radio spectrum does not fall within the mask, a message will be displayed indicating failure.

Figure 4-2. Display of Relative Mask



Shown in Figure 3-2 is a relative mask. You also have the option of displaying an absolute mask, which references the top of the mask to the peak of the unmodulated carrier level.

IF Frequency Measurement

This measurement checks the IF frequency of a radio. The same technique can be used to measure the local oscillator used in the modulator or upconverter sections of the radio. It may also be used to measure the LO of the demodulator or down converter.

Test Equipment

Spectrum Analyzer	8593A
75 Ω SMB-BNC Adapter	Depends on radio connector
75Ω BNC Cable	11758-60022
Transformer 50 Ω N (m) 75 Ω BNC (f)	9100-4859
1. Set up equipment as shown in Figure 3-3.	

Figure 4-3. IF Frequency Measurement



- 2. Turn off all modulation of the radio.
- 3. Load the frequency counter if it is not already loaded.
 - a. Place the DRTS mode card in the mode loader. If you are not at the main menu that says "MODE LOADER", then press [MODE]
 - b. Press: MOAD LOADER
 - c. Press: [7], [ENTER]

Figure 4-4. Frequency Counter Display



- d. Press: $\ensuremath{\mathsf{FREQ}}$ COUNTER
- 4. Check to make sure 2.9 GHz is underlined in the softkey display (or 22 GHz if the frequency is between 2.9 GHz and 22 GHz). Pressing the softkey toggles between 2.9 GHz and 22 GHz.
- 5. Press: [RESET]
- 6. Read frequency

Flatness through Upconverter

This test checks the upconverter section of the transmitter for flatness of power across the frequency bandwidth.

A similar procedure can be used to measure flatness through any IF subsection. If the overall flatness measurement is not within specification, measure the individual sections until the defective section can be determined.

Test Equipment

Spectrum Analyzer	8593A
Crystal Detector	
75Ω SMB-BNC Adapter	Depends on radio connector
Two 75 Ω BNC Cables	
Type N Cable	11500A
Transformer 50 Ω N (m) 75 Ω BNC (f)	
Attenuator	Depends on RF output power

- 1. Load the flatness analyzer software.
 - a. Place the DRTS mode card in the mode loader.
 - b. Press: [MODE] if at main menu.
 - c. Press: MODE LOADER
 - d. To load FLATNESS ANALYZER & SOURCES
 - i. Press: [4] [ENTER]
 - ii. Wait for data to load.
 - iii. Press: FLATNESS AND SOUCES
- 2. Press: Sources
- 3. Select the desired source frequency range using the $\ensuremath{\mathsf{SOURCE\,IF\,RF}}$ softkey.

NOTE Use IF for source frequencies 300 kHz to 2.9 GHz. Use RF for source frequencies above 3.0 GHz.

4. Press: CENTER FREQ

- 5. Enter the center frequency using the DATA keys.
- 6. Press: SPAN
- 7. Enter the span using the DATA keys. The span should be the bandwidth over which the flatness is specified.
- 8. Press: SRC PWR
- 9. Enter the desired source power level using the DATA keys.

Chapter 4

- NOTE The amplitude range of the IF Tracking Generator can be extended from +10 dBm to -60 dBm using the Multipath Fading Simulator for frequencies between 40–200 MHz.
- 10. Configure the calibration setup as shown in Figure 3-5. If your transmitter's IF input is 75 Ω , attach the transformer/adapter to the IF Tracking Generator Output.

Figure 4-5. Flatness Calibration, 0 to 2.9 GHz



- 11. Press: MAIN MENU
- 12. Press: CAL
- 13. Press: CAL TRANS
- 14. Press: STORE THRU and wait until calibration finishes. A "THRU Cal Stored" message will appear.
- **NOTE** If the frequency parameters or the source power are changed after performing a CAL TRANS, the calibration will be in error and another CAL TRANS will need to be done. Changing the amplitude parameters will not affect the calibration. For 75 Ω output, attach the transformer/ adapter to the RF Out 50 Ω connector.

15. Set up equipment as shown in the Figure 3-6.

Figure 4-6. Flatness through Upconverter



NOTE For levels greater than +20 dBm, use the 30 dB Attenuator before the crystal detector.

- 16. Press: MAIN MENU wait, then press: MEAS
- 17. Set the $\ensuremath{\mathsf{AMPL}}$ TRK softkey to ON.
- 18. Flatness will be displayed on the spectrum analyzer screen.
- 19.Adjust SCALE LOG for the desired vertical scale (dB/div).
- 20. Press Peak-to-peak measurement to read maximum amplitude variation over measured bandwidth. The measurement should be less than the flatness specified.

Measuring Errors with Event Counter

The event counter (and interval counter) are functions independent of the operation of the spectrum analyzer. The event counter is used to count negative going pulses: a falling edge followed by a rising edge. The INTERVAL CNTR INPUT is used to measure the accumulated time that a pulse is low during the gate time interval. The gate time can be set to 100 ms, 1 s, and 10 s, or a value entered using data control keys.

The event counter is useful for counting the number of data errors over a period of time. You can set the instrument to total the number of seconds, or some other period of gate time, that radio produces errors in over a length of time (perhaps all night). The following procedure shows how to set up the event counter and test for errors.

Test Equipment

Spectrum Analyzer	8593A
Two 75 Ω BNC Cables	11758-60022
Bit Error Rate Tester	If needed
1 Load the Event Counter Made if it has not already he	on looded

- 1. Load the Event Counter Mode if it has not already been loaded.
 - a. Insert the DRTS mode card into the mode loader.
 - b. On the 8593A, press: [MODE]
 - c. Press: MODE LOADER
 - d. Press: [5] [ENTER] (the HZ key) $% \left({{{\rm{T}}_{{\rm{T}}}}_{{\rm{T}}}} \right)$
 - e. Wait until the program has loaded before continuing.
 - f. Press: EVENT COUNTER
- 2. Set up the equipment as shown in Figure 3-7.

Figure 4-7. Event Counter Test Setup



- 3. Press: MORE
- 4. Press: EVENT THRESHOLD
- 5. Press: MORE
- 6. Press: GATE TIME

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- 7. Press: **1 SEC**
- 8. Press: MAIN MENU
- 9. Press: **TOTALIZE** so that the ON is underscored.
- 10. Run for a significant period of time (perhaps overnight).
- 11. Read the threshold errored seconds. This value tells you in how many seconds of the test period the error rate exceeded the value set for your radio.

5 8593E Option E02/E04 Programming Commands

This addition to the "Programming Commands" chapter of the Agilent 8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide contains:

- Information about remote operation of the 8593E Option E02/E04 modes.
- A functional index that groups the 8593E Option E02/E04 programming commands by category.
- The language reference for the 8593E Option E02/E04 mode programming commands.

Remote Operation of the 8593E Option E02/E04 Modes

To operate the Option E02/E04 modes remotely you *must* follow these steps:

- 1. Use the LOAD command to load the Mode Loader downloadable program (DLP) into analyzer memory.
- 2. Use the Mode Loader commands to load the selected mode(s) into analyzer memory.
- 3. Use the MODE command to access a mode.

NOTE A mode can be accessed only if it has been loaded into analyzer memory.

The following sections explain these steps.

1. Use the LOAD Command to Load the Mode Loader DLP into Analyzer Memory

To be able to access Mode Loader, the Mode Loader DLP must be in analyzer memory. Execute OUTPUT 718; "LOAD %dLOADME%;" to load the Mode Loader DLP into analyzer memory. (dLOADME is the file name for the Mode Loader DLP.)

2. Use Mode Loader to Load DLP Modes into Analyzer Memory

To use the programming commands for a mode of operation, the downloadable program for that mode *must* be loaded into analyzer memory. Use the Mode Loader command nl_SELECT to load in the downloadable programs for the different modes. The following example demonstrates using nl_SELECT to load the Frequency Counter, Flatness and Sources, and the Event Counter DLPs into analyzer memory.

 OUTPUT 718; "MODE 21;"
 Uses the MODE command to select the mode loader mode. (The MODE command is described in the following section.)

 OUTPUT 718; "nl_SELECT1;"
 Selects menu choice number 1 from the Mode Loader menu. Menu choice number 1 is the Frequency Counter, Flatness and Sources, and Event Counter modes.

3. Use the MODE Command to Access a Mode

The MODE command is used to access a mode. In the previous example, the MODE command accessed the Mode Loader mode with OUTPUT 718; "MODE 21;". In the following example, the event counter mode is accessed by executing OUTPUT 718; "MODE 7; ". See "MODE Command" (later in this manual supplement) for more information.

OUTPUT 718; "MODE 7;"Accesses the Event Counter mode.OUTPUT 718; "ne MP;"Presets the Event Counter mode.

Using Spectrum Analyzer Commands

While in an Option E02/E04 mode, some spectrum analyzer commands should not be used. For example, use ns_FFT while in the scalar analyzer mode instead of FFT. Also, do not use the programming commands of other modes. For example, do not use ns_FFT to do a fast Fourier transform while in the low frequency oscilloscope mode (use np_FFT instead).

Use the preset for the mode instead the IP command. IP changes the mode to spectrum analyzer. See the following example.

OUTPUT 718; "ne_MP;" Presets the event counter mode if the current mode is event counter.

Using the MOV Command

It is recommended that the MOV command be used to execute all programming commands that take a number parameter. Using the MOV command is faster and avoids displaying text on the analyzer screen. For example, use OUTPUT 718; "MOV nt_RL,-10; " instead of OUTPUT 718; "nt_RL-10; ".

Using the Tracking Generator Commands for the 8593E Option E02/E04

Most of the tracking generator commands documented in the "Programming Commands" chapter apply to the 8593E Option E02/E04 (when in the spectrum analyzer mode). Use the following table to determine if the tracking generator command can be used with the 8593E Option E02/E04.

NOTE	The following table is for your information only; we recommend that you use
	the scalar analyzer mode commands to operate the 8593E Option E02/E04
	Tracking Generator.

Command	Description	Available for the 8593 Option E02/E04?
MEASURE	Determines the type of measurement: signal analysis, stimulus response, or signal normalization.	Yes.
NRL	Sets the normalized reference level.	Yes.
RLPOS	Selects the position of reference level.	Yes.
SRCALC	Selects internal or external leveling for the tracking generator.	Only internal leveling (SRCALC INT) is allowed.
SRCAT		Yes.
SRCNORM	Subtracts trace B from trace A, adds the display line, and sends the result to trace A.	Yes.
SRCPOFS	Offsets the source-power level.	Yes (the amplitude range of the command is valid over the specified amplitude range of the 8593E Option E02/E04).
SRCPSTP	Selects the source-power step size.	Yes (the amplitude range of the command is valid over the specified amplitude range of the 8593E Option E02/E04).
SRCPSWP	Selects sweep range of source-output.	Yes (the amplitude range of the command is valid over the specified amplitude range of the 8593E Option E02/E04).
SRCPWR	Selects the source-power level.	Yes (the amplitude range of the command is valid over the specified amplitude range of the 8593E Option E02/E04).
SRCTK	Adjusts tracking of source output with spectrum-analyzer sweep.	Yes.
SRCTKPK	Adjusts tracking of source output with spectrum analyzer sweep.	Yes.
SWPCPL	Selects a stimulus-response (SR) or spectrum-analyzer (SA) auto-coupled sweep time.	Yes.

Table 5-1. Functional Index

8593E Option E02/E04 Functional Index

Table 5-2 is a functional index that categorizes the 8593E Option E02/E04 commands by mode. The modes are listed in alphabetical order. The commands with brief definitions are shown. Use the "Corresponding Softkey" column to identify the command that is similar to the softkey function. Once the desired command is found, refer to the alphabetical listing of commands later in this manual supplement for further definition.

Mode	Command Mnemonic	Corresponding Softkey	Description
DIGITAL RADIO MASKS	KEYEXC 1807	CENTER 99% BW	Centers the 99% power bandwidth on screen.
	KEYEXC 1808	COMPARE TO MASK	Makes a mean power measurement, compares the result to selected mask.
	KEYEXC 1809	MEAN PWR LEVEL	Determines the mean power level of the unmodulated carrier.
	KEYEXC 1810	TRANSIT ANALYSIS	Searches for a signal within a mask's span of the display.
	KEYEXC 1811	FREQ RESPONSE	Compares frequency responses in digital radio systems.
	KEYEXC 1813	4 GHz FCC MASK	Selects the 4 GHz FCC agency mask.
	KEYEXC 1814	6 GHz FCC MASK	Selects the 6 GHz FCC agency mask.
	KEYEXC 1815	11 GHz FCC MASK	Selects the 11 GHz FCC agency mask.
	KEYEXC 1816	13 GHz UK MASK	Selects the 13 GHz UK agency mask.
	KEYEXC 1817	13 GHz FRG MASK	Selects the 13 GHz FRG agency mask.
	KEYEXC 1830	CONTINUE	Continues a COMPARE TO MASK or MEAN PWR LEVEL measurement.
	KEYEXC 1831	EXIT	Exits a TRANSIT ANALYSIS measurement.
	KEYEXC 1837	REFERNCE RESPONSE	Does a reference response for FREQ RESPONSE .
	KEYEXC 1838	COMPARE RESPONSE	Does a compare response for FREQ RESPONSE .
	KEYEXC 1845	AUTO CENTER	Centers a signal on screen.
	KEYEXC 1846	SETUP COMPLETE	Proceeds with the video-averaging after a COMPARE RESPONSE or REFERNCE RESPONSE.
	KEYEXC 1855	DO COMPARE	Allows the user to enter the pass/fail criteria, then compares it to the frequency response.
	KEYEXC 1861	STORE REFERENC	Saves the ref. freq. response in trace 0.
	KEYEXC 1867	EXTERNAL ATTEN	Offsets the amplitude of the reference level without affecting the trace when external attenuation is used in the test setup.
	KEYEXC 1873	ABORT	Aborts the frequency response function.
	KEYEXC 1879	SAVE MASK SET	Saves the current mask set in one of three files on the memory card.
	KEYEXC 1880	RECALL MASK SET	Recalls mask set from memory card.

Table 5-2. Functional Index of Commands Unique to 8593E Option E02/E04

Mode	Command Mnemonic	Corresponding Softkey	Description
EVENT	ne_COUNT		Counts once for a specified gate time.
COUNTER			
	ne_DISPOSE	DISPOSE EVNT CNT	Removes Event Counter DLP from analyzer memory.
	ne_DSA	DSPLY SA ON OFF	Turns simultaneous spectrum analyzer display on or off.
	ne_GTIME	GATE TIME	Sets the gate time.
	ne_MP	PRESET EVNT CNT	Presets the Event Counter mode.
	ne_RST	RESET CNTRS	Resets the counters.
	ne_STOP	STOP CNTRS	Stops the counters.
	ne_THCNT	EVENT THRESHLD	Sets the counter threshold.
	ne_TOT	TOTALIZE ON OFF	Turns the totalize operation on or off.
FLATNESS & SOURCES	nt_ATRACK	AMPL TRK ON OFF	Turns amplitude tracking on or off.
	nt_ATRKEL	AMPL TRK ERR LIM	Sets error limit for amp. track. func.
	nt_BAND	BAND 1,2,3,4	Sets Band for RF Source.
	nt_CALR	CAL REFL	Sets up for reflection calibration.
	nt_CALT	CAL TRANS	Sets up for transmission calibration.
	nt_DISPOSE	DISPOSE FLATNESS	Removes the Flatness and Sources DLP from analyzer memory.
	nt_FFT	FFT MEAS	Performs a fast Fourier transform func.
	nt_FOFST	FREQ OFFSET	Sets frequency offset of the current source (IF or RF).
	nt_MP	PRESET FLATNESS	Presets the Flatness and Sources mode.
	nt_NORM	NORMLIZE ON OFF	Switches the normalization on or off.
	nt_NRP	NORM REF POSN	Sets the normalized reference position.
	nt_REFL	REFL TRANS (REFL)	Recalls the reflection calibration data.
	nt_RL	REF LVL	Sets the reference level.
	nt_SRCIF	SOURCE IF RF (IF)	Selects the IF source.
	nt_SRCOFF	SRC PWR ON OFF (OFF)	Turns off both the IF and RF sources.
	nt_SRCPIF	SRC PWR ON OFF (IF)	Sets the IF source power.
	nt_SRCPIFO	SRC PWR OFFSET	Sets the power offset of the IF source.
	nt_SRCPRF	SRC PWR ON OFF (RF)	Sets the RF source power.
	nt_SRCPRFO	SRC PWR OFFSET (RF)	Sets the power offset of the RF source.
	nt_SRCRF	SOURCE IF RF (RF)	Selects the RF source.
	nt_STREF	STORE THRU (TRANS), STORE SHORT (REFL)	Stores reference trace and settings.
	nt_TRANS	REFL TRANS (TRANS)	Performs a transmission measurement and calibration.

Table 5-2. Functional Index of Commands Unique to 8593E Option E02/E04

Mode	Command Mnemonic	Corresponding Softkey	Description
FREQUENCY	nf BAND	FREO 2 9 22	Sats the frequency hand and begins a new
COUNTER	III_DAI\D		search.
	nf DHLD	DSP HOLD ON OFF	Turns the display hold on or off.
	nf DISPOSE	DISPOSE EBEO CNT	Removes the Frequency Counter
			downloadable program from analyzer
			memory.
	nf_MP	PRESET FREQ CNT	Presets the Frequency Counter mode.
	nf_RESOLN	Resoln	Sets the frequency resolution.
	nf_RST	RESET	Resets the counter and begins a new
			search.
LOW	np_DISPOSE	DISPOSE SCOPE	Removes the Low Frequency Oscilloscope
FREQUENCY			downloadable program from analyzer
OSCILLOSCOPE			memory.
	np_FFT	FFT MEAS	Performs a fast Fourier transform function.
	np_MP	PRESET SCOPE	Presets the Low Frequency Oscilloscope
	THE VOES	OFFRET	Sate the continel effect
	np_vors		Selects the vertical offset relevity
	np_vorsp	OFST POL NEG POS	Selects the vertical onset polarity.
	np_vs	SCALE/div	Sets the vertical scale.
MODE LOADER	nl_UKUKD		Denorment the Made Leader demole deble
	ni_DISPOSE		Removes the Mode Loader downloadable
	nl SFI FCT		Loads the selected mode downloadable
	III_DELECT		program into analyzer memory.
SCALAR	ns CALR	CAL REFL	Sets up for reflection calibration.
ANALYZER	_		*
	ns_CALT	CAL TRANS	Sets up for transmission calibration.
	ns_CAN	CANCEL	Cancels the calibration routine.
	ns_DISPOSE	DISPOSE SCALAR	Removes the Scalar Analyzer
			downloadable program from analyzer
			memory.
	ns_FFT	FFT MEAS	Performs a fast Fourier transform function.
	ns_MP	PRESET SCALAR	Presets the Scalar Analyzer mode.
	ns_NORM	NORMLIZE ON OFF	Switches the normalization on or off.
	ns_NRP	NORM REF POSN	Sets the normalized reference position.
	ns_REFL	REFL	Switches to a reflection measurement.
	ns_RL	REF LVL (RANGE)	Sets the reference level.
	ns_SRCOFF	SRC PWR ON OFF (OFF)	Turns off the tracking generator source.
	ns_SRCPOFS	SRC PWR OFFSET	Sets the source power offset.
	ns_SRC PWR	SRC PWR ON OFF	Sets the source power of the tracking
			generator.
	ns_STO	SIOKE OPEN	Stores the open reference trace.
	ns_STS	SIORE SHORT	Stores the short reference trace and settings.
	ns_STTHRU	STORE THRU	Stores thru reference trace and settings.
	ns_TRANS	TRANS	Switches to a transmission measurement.

Table 5-2. Functional Index of Commands Unique to 8593E Option E02/E04

Chapter 5

Language Reference for the 8593E Option E02/E04 Modes

The language reference section in this manual supplement is similar to the language reference section in the "Programming Commands" chapter of the 8590 D-Series and *E-Series Spectrum Analyzer Programmer's Guide*. The differences between them are as follows:

• This manual supplement contains the 8593E Option E02/E04 programming commands only. See the "Programming Commands" chapter for information about the spectrum analyzer programming commands.

NOTE	The 8593E Option E02/E04 programming commands are listed
	alphabetically.

- This manual supplement includes boxed information with each programming command. The boxed information serves as a reminder of the following:
 - 1. The DLP for that mode needs to be loaded into analyzer memory.
 - 2. The mode needs to be accessed with the MODE command.

The following is an example of the boxed information that accompanies the event counter mode commands:

Mode: Event Counter MODE Parameter: 7

"Mode: Event Counter" indicates that the command nl_SELECT should have been used to load in the Event Counter DLP. "MODE Parameter: 7" indicates that the MODE command should be set to 7 to access the Event Counter mode.

• The syntax for each command in this manual supplement is represented in an abbreviated format. Refer to the following sections "Notation Conventions" and "Syntax Conventions" for an explanation of the abbreviated format.

Notation Conventions

The syntax for the programming commands and query response are shown in an abbreviated format. The abbreviated format uses symbols and type styles to denote the following:

BOLD TYPE	All characters appearing in bold type are key words and must appear exactly as shown.
<>	Characters appearing in angular brackets are considered to be elements of the language being defined. Their meanings can be found in the section "Syntax Conventions" unless otherwise specified with the keyword definition.
[]	Square brackets indicate that whatever occurs within the brackets is optional.
I	"or": Indicates a choice of exactly one element from a list (for example, <a> indicates <a> or but not both).
()	Parentheses are used to clarify which elements are to be chosen from.
-	Indicates that a space must be placed at the indicated location (for example, A_ <a> indicates there must be a space between the keyword A and the element <a>).
NOTE	Do not confuse the notation for a space with the notation for an underscore within a command mnemonic. Most of the programming commands for the Option E02/E04 modes use an underscore as the third character of the mnemonic. The underscore will always be in the place for the third character and bolded. A space will be after the command mnemonic and unbolded.
::=	"Is defined as" (for example, <a>::=<c> indicates that <a> can be replaced by the series of elements <c> in any statement where <a> occurs).</c></c>

Syntax Conventions

<numeric data format>::=

```
<number> <CR> <LF><EOI>.
```

<number>::=

Integer number or real number.

Digital Radio Masks Mode

KEYEXC Key Execution for Digital Radio Masks

The KEYEXC command is used to execute the Digital Radio Masks mode functions.

Mode: Digital Radio Masks MODE Parameter: 5

Syntax: KEYEXC<number>;

<number>::=a valid key number. See the description.

Example

OUTPUT 718; "MODE5; "	Select the Digital Radio Masks mode.
OUTPUT 718; "KEYEXC1808;"	KEYEXC1808 executes COMPARE TO MASK

Description

Unlike the programming commands for the other modes, Digital Radio Mask functions are specified by the KEYEXC command followed by a specific key number; the digital radio mask functions do not have unique command mnemonics. Executing the KEYEXC with the number for a Digital Radio Mask function is equivalent to pressing the softkey for the Digital Radio Masks function.

Use the following table to determine the key number to specify after the KEYEXC command.

Key Number	Corresponding Softkey	Description
1807	CENTER 99% BW	Centers the 99% power bandwidth on screen.
1808	COMPARE TO MASK	Makes a mean power measurement, then compares the result to the selected mask.
1809	MEAN PWR LEVEL	Determines the mean power level of the unmodulated carrier.
1810	TRANSIT ANALYSIS	Searches for a signal within a mask's span of the display.
1811	FREQ RESPONSE	Compares frequency responses in digital radio systems.
1813	4 GHz FCC MASK	Selects the 4 GHz FCC agency mask.
1814	6 GHz FCC MASK	Selects the 6 GHz FCC agency mask.
1815	11 GHz FCC MASK	Selects the 11 GHz FCC agency mask.
1816	13 GHz UK MASK	Selects the 13 GHz UK agency mask.
1817	13 GHz FRG MASK	Selects the 13 GHz FRG agency mask.
1830	CONTINUE	Continues a COMPARE TO MASK or MEAN PWR LEVEL measurement.
1831	EXIT	Exits a TRANSIT ANALYSIS measurement.
1837	REFERNCE RESPONSE	Does a reference response for FREQ RESPONSE .
1838	COMPARE RESPONSE	Does a compare response for FREQ RESPONSE .
1845	AUTO CENTER	Centers a displayed signal on the spectrum analyzer's screen.
1846	SETUP COMPLETE	Proceeds with the video-averaging after a COMPARE RESPONSE or REFERNCE RESPONSE .
1855	DO COMPARE	Allows the user to enter the pass/fail criteria, then compares it to the frequency response.
1861	STORE REFERENC	Stores the reference frequency response in trace 0.
1867 ^a	EXTERNAL ATTEN	Offsets the amplitude of the reference level without affecting the trace when external attenuation is used in the test setup.
1873	ABORT	Aborts the frequency response function.
1879 ^b	SAVE MASK SET	Saves the current mask set in one of three files on the memory card.
1880 ^b	RECALL MASK SET	Recalls mask set from memory card.

Table 5-3. Key Numbers to Operate the Digital Radio Masks Functions

a. Key number 1867 accepts a real number as a parameter. For example, OUTPUT 718; "KEYEXC1867, 1.0; ".

b. Key numbers 1879 and 1880 accept a "l," "2," or "3" as a parameter.

The following variables can be queried for the results of the specified Digital Radio Masks function. For example, to determine the COMPARE TO MASK result, execute the following:

OUTPUT 718; "KEYEXC1808;"	Performs a COMPARE TO MASK.
OUTPUT 718;"na_CTMR?;"	Queries the COMPARE TO MASK result.
ENTER 718;A	Places the result in variable A.
DISP A	Displays A.

Variable Name	Description
na_CRR	Returns the COMPARE RESPONSE result. The result is the pass or fail power level in dB.
na_CTMR	Returns the COMPARE TO MASK result. The result is the pass or fail power level in dB.
na_CT	Returns the current number of transients in last completed sweep.
na_DRGD	Returns the revision date of the Digital Radio Masks DLP. The revision date is returned in a YYMMDD format.
na_EAA	Returns the external attenuation factor in dB.
na_MBP	Returns the number of mask breakpoints.
na_MBW	Returns the mask measurement bandwidth in Hz.
na_MCF	Returns the mask center frequency in Hz.
na_MNM	Returns the current mask number. The current mask number corresponds to the Digital Radio masks as follows:
	1 to 11=user-defined mask
	12 = 4 GHz FCC MASK
	13=6 GHz FCC MASK
	14=11 GHz FCC MASK
	15=13 GHz UK MASK
	16=13 GHz FRG MASK.
na_MSP	Returns the mask frequency span in Hz.
na_PFC	Returns the pass/fail criteria for FREQ RESPONSE in dB.
na_PWR	Mean power level result in dB.
na_RAM	Returns a "1" or a "2." A "1" is returned if the current mask is relative; a "2" is returned if the current mask is absolute.
na_TT	Returns the total number of transients since transient analysis was started, up to the last completed sweep.

MODE Command

MODE Mode

The MODE command specifies the mode.

Syntax: MODE(0|2|5|6|7|8|9|21)|?;

Example

```
OUTPUT 718; "MODE?;"Finds the current mode.ENTER 718; ModePlaces the result in the variable, Mode.IF Mode<>6 THENIf the current mode is not the Frequency Counter mode, change it to the<br/>Frequency Counter mode.OUTPUT 718; "MODE 6;"<br/>WAIT 8UTPUT 718; "mf_MP;"ELSE<br/>OUTPUT 718; "nf_MP;"If the current mode is the Frequency Counter mode, do a mode preset.WAIT 6END IF
```

Description

The number specified as the MODE parameter accesses the mode *if* the mode DLP has been loaded into analyzer memory.

The following table summarizes the MODE command parameters.

Mode Description	MODE Command Parameter
Spectrum Analyzer	0
Scalar Analyzer	2
Digital Radio Masks	5
Frequency Counter	6
Event Counter	7
Low Frequency Oscilloscope	8
Flatness and Sources	9
Mode Loader	21

NOTE Entering the Frequency Counter mode ("MODE 6; ") requires a minimum of 8 seconds to preset the counter and begin searching. Use a WAIT command after executing MODE 6;. See the example.

Query Response: <numeric data format>.

Chapter 5

Event Counter Mode

ne_COUNT Count Once

Mode: Event Counter MODE Parameter: 7

Syntax: ne_COUNT;

Example

```
OUTPUT 718; "ne_MP;"
OUTPUT 718; "ne_GTIME1;"
OUTPUT 718; "DISPOSE ONCYCLE;"
OUTPUT 718; "ne_COUNT;"
OUTPUT 718; "ne_ECNT?;"
ENTER 718; A
DISP A
```

Description

Use ne_COUNT to count once for the gate time specified by ne_GTIME. The results of ne_COUNT are in the ne_ECNT, ne_ICNT, and ne_ITIME variables. ne_COUNT can be used in other modes; you do not have to be in the event counter mode to use ne_COUNT. To use ne_COUNT in the event counter mode, execute DISPOSE ONCYCLE before using ne_COUNT. (See the example.) To resume normal operation of the event counter mode, use ne_MP.

Event Counter Mode Variables

Variable Name	Description
ne_ECNT	Measured event counter count.
ne_ICNT	Measured interval counter count.
ne_ITIME	Measured interval counter time.
ne_TES	Measured threshold errored seconds.

Query the variable to get the result. See the example.

ne_DISPOSE Dispose the Event Counter DLP

The ne_DISPOSE command disposes of the event counter downloadable program in analyzer memory.

Mode: Event Counter MODE Parameter: 7

Syntax: ne_DISPOSE;

Example

```
OUTPUT 718; "ne_DISPOSE;"
```

Description

ne_DISPOSE is equivalent to **DISPOSE EVNT CNT**.

ne_DSA Display Spectrum Analyzer

The ne_DSA command turns the display of spectrum analysis measurements on or off.

Mode: Event Counter MODE Parameter: 7

Syntax: ne_DSA(0|1)|?;

Example

OUTPUT 718; "ne_DSA1;" Turns on spectrum analyzer display.

Description

When ne_DSA1 is executed, it allows simultaneous viewing of both spectrum analyzer and event counter displays. (Note that the spectrum analyzer display is set to 15 dB/div, so that its display does not interfere with that of the event counter.) ne_DSA0 turns off the spectrum analyzer display. ne_MP (event counter mode preset) turns the spectrum analyzer display off.

ne_DSA is equivalent to DSPLY SA ON OFF.

Query Response: (0 | 1)<CR><LF><EOI>.

8593E Option E02/E04 Programming Commands Event Counter Mode

ne_GTIME Gate Time

The ne_GTIME command sets the gate time.

Mode: Event Counter MODE Parameter: 7

Syntax: ne_GTIME<number>1?;

<number>::=0.01 to 163 seconds.

Description

ne_GTIME is equivalent to GATE TIME.

Query Response: <numeric data format>.

ne_MP Event Counter Mode Preset

The ne_MP command presets the event counter mode.

Mode: Event Counter MODE Parameter: 7

Syntax: ne_MP;

Description

ne_MP changes the following settings:

GATE TIME	1 s
TOTALIZE	OFF
STOP CNTRS	OFF
EVNT THLD	50000 cnt/s
Counter Values	0

 ne_MP is equivalent to $\ensuremath{\mathsf{PRESET}}$ EVNT CNT.

ne_RST Reset the Counters

The ne_RST command resets the counters.

Mode: Event Counter MODE Parameter: 7

Syntax: ne_RST;

Description

 ne_RST sets the ne_ECNT, ne_ICNT, ne_ITIME, and ne_TES variables to zero. ne_RST is equivalent to <code>RESET CNTRS</code>.

Variable Name	Description
ne_ECNT	Measured event counter count.
ne_ICNT	Measured interval counter count.
ne_ITIME	Measured interval counter time.
ne_TES	Measured threshold errored seconds.

Event Counter Mode Variables

ne_STOP Stop Counters

The ne_STOP command stops the counters.

Mode: Event Counter MODE Parameter: 7

Syntax: ne_STOP(0|1)|?;

Description

 $Execute \ ne_STOP1 \ to \ stop \ the \ counters \ (equivalent \ to \ \textbf{STOP CNTRS}). \ Execute \ ne_STOP0 \ to \ reset \ the \ counters \ (equivalent \ to \ ne_RST).$

Event Counter Mode Variables

Variable Name	Description
ne_ECNT	Measured event counter count.
ne_ICNT	Measured interval counter count.
ne_ITIME	Measured interval counter time.
ne_TES	Measured threshold errored seconds.

Query the variable to get the result.

Query Response: (0 | 1)<CR><LF><EOI>.

Chapter 5

ne_THCNT Threshold Count

The ne_THCNT command changes the threshold value for the event counter.

Mode: Event Counter MODE Parameter: 7

Syntax: ne_THCNT<number>1?;

<number>::= Any positive integer number.

Description

ne_THCNT allows the threshold value for the event counter to be changed. This is used in conjunction with threshold errored seconds measurements when in Totalize.

The functions of ne_THCNT and **EVENT THRESHLD** are equivalent.

Query Response: <numeric data format>.

ne_TOT Totalize

The ne_TOT command switches the counter between totalize operation and the normal gate time interval count.

Mode: Event Counter MODE Parameter: 7

Syntax: ne_TOT(0|1)|?;

Description

ne_TOT0 turns the totalize operation off. ne_TOT1 turns the totalize operation on. The functions of ne_TOT and **TOTALIZE ON OFF** are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

Frequency Counter Mode

nf_BAND Sets Frequency Band

The nf_BAND command sets the frequency band and begins a new search.

Mode: Frequency Counter MODE Parameter: 6

Syntax: nf_BAND(0|1)|?;

Example

OUTPUT 718; "nf _BAND1;" WAIT 5

Description

nf_BAND0 sets the frequency band from 10 MHz to 2.9 GHz. nf_BAND1 sets the frequency band from 2.7 to 22 GHz. Since nf_BAND requires a minimum of 5 seconds to complete a new search, a WAIT statement should follow the nf_BAND command. See the example.

The functions of nf_BAND and FREQ 2.9 22 are equivalent.

The results of a measurement sweep are stored in variables. See the following table.

Event Counter Mode Variables

Variable Name	Description
nf_FOUND	Returns a "1" if a signal is found, a "0" if a signal is not found.
nf_FREQ	Returns the measured signal frequency in Hz.
nf_AMPL	Returns the measured signal amplitude in dBm.

Query the variable to get the result.

Query Response: (0 | 1)<CR><LF><EOI>.
nf_DHLD Display Hold

The nf_DHLD command turns the display hold on or off.

Mode: Frequency Counter MODE Parameter: 6

Syntax: nf_DHLD(0|1)|?;

Description

nf_DHLD0 turns the display hold off. nf_DHLD1 turns the display hold on. The functions of nf_DHLD and **DSP HOLD ON OFF** are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

nf_DISPOSE Dispose the Frequency Counter DLP

The nf_DISPOSE command deletes the frequency counter downloadable program from analyzer memory.

Mode: Frequency Counter MODE Parameter: 6

Syntax: nf_DISPOSE;

Description

The functions of nf_DISPOSE and **DISPOSE FREQ CNT** are equivalent.

nf_MP Frequency Counter Mode Preset

The nf_MP command presets the frequency counter mode.

Mode: Frequency Counter MODE Parameter: 6

Syntax: nf_MP;

Example

OUTPUT 718;"nf-MP;" WAIT 6

Description

Since nf_MP requires a minimum of 6 seconds to preset the counter and begin a search, a WAIT statement should follow an nf_MP command. See the example. nf_MP sets the frequency band to the 10 MHz to 2.9 GHz range. The functions of nf_MP and **PRESET FREQ COUNT** are equivalent.

NOTE Entering the frequency counter mode (MODE6; ") requires a minimum of 8 seconds to preset the counter and begin searching.

nf_RESOLN Frequency Counter Resolution

The nf_RESOLN command sets the frequency resolution of the frequency counter.

Mode: Frequency Counter MODE Parameter: 6

Syntax: nf_RESOLN<number>!?;

<number>::=1|10|100|1000|10000 (unit is Hz).

Description

The functions of nf_RESOLN and **Resoln** are equivalent.

Query Response: <numeric data-format>.

nf_RST Reset the Frequency Counter

The nf_RST command resets the frequency counter and begins a new search.

Mode: Frequency Counter MODE Parameter: 6

Syntax: nf_RST;

Example

```
OUTPUT 718; "nf-RST;"
WAIT 5
```

Description

Since nf_RST requires a minimum of 5 seconds to complete a new search, a WAIT statement should follow an nf_RST command. See the example. The functions of nf_RST and RESET are equivalent.

The results of a measurement sweep are stored in variables. See the following table.

Frequency Counter Variables

Variable Name	Description
nf_FOUND	Returns a "1" if a signal is found, a "0" if a signal is not found.
nf_FREQ	Returns the measured signal frequency in Hz.
nf_AMPL	Returns the measured signal amplitude in dBm.

Query the variable to get the result.

Mode Loader Mode

nl_CKCRD Check Memory Card

The nl_CKCRD command checks if the DRTS ROM card is inserted into the memory card reader.

Mode: Mode Loader MODE Parameter: 21

Syntax: nl_CKCRD;

Example

OUTPUT 718; "MODE 21; "	Selects the Mode Loader mode.
OUTPUT 718; "nl_CKCRD;"	Checks if the DRTS ROM card is inserted into the memory card reader.
OUTPUT 718;"IF nl_CRDVF,EQ,1 THEN nl_SELECT 5 ENDIF;"	If the DRTS ROM card is inserted, the Event Counter DLP is loaded into analyzer memory.
OUTPUT 718; "nl_CRDVF?;"	<i>Returns the result of nl_CKCRD to the computer.</i>
ENTER 718;A IF A=0 THEN	If the result of nl_CKCRD is zero, the DRTS ROM card is not inserted in the memory card reader.
PRINT "ERROR-PLEASE INSERT DRTS ROM CARD"	Displays an error message if the DRTS ROM card is not inserted.

END IF

Description

The result of nl_CKCRD is stored in the variable nl_CRDVF. If the value of nl_CRDVF is 0, the card is not an DRTS ROM card. If the value of nl_CRDVF is 1, the card is an Option E02/E04 ROM card. See the example.

NOTE The nl_SELECT command also checks if an DRTS ROM card is inserted.

nl_DISPOSE Dispose the Mode Loader DLP

The nl_DISPOSE command deletes the mode loader downloadable program from analyzer memory.

Mode: Mode Loader MODE Parameter: 21

Syntax: nl_DISPOSE;

Example

OUTPUT 718; "nl_DISPOSE;"

Description

The functions of nl_DISPOSE and pressing **[TRIG]** (when the mode loader is the operating mode) are equivalent.

nl_SELECT Select Downloadable Program

The nl_SELECT command checks for the DRTS ROM card, disposes of all the Option E02/E04 DLPs from analyzer Memory (except the mode loader mode), then loads in the selected modes into analyzer memory.

Mode: Mode Loader MODE Parameter: 21

Syntax: nl_SELECT<number>;

<number>::= Any valid menu number. See the description.

Example

OUTPUT 718; "MODE 21;"	Selects the Mode Loader mode. Checks that the DBTS ROM card is inserted into the
OUIPUI /10; HI_SELECI J;	memory card reader. If the DRTS ROM card is inserted, the event counter mode DLP is loaded into analyzer memory.
OUTPUT 718;"MEM?" ENTER 718;B	Determines the amount of available analyzer memory.
IF B>7000 THEN"	If there is more than 7000 bytes of analyzer memory available, the low frequency oscilloscope mode is loaded into analyzer memory.
OUTPUT 718;"nl_SELECT -9;"	Loads in the low frequency oscilloscope mode without disposing the event counter from analyzer memory. See the following description.

END IF

Description

NOTE Mode Loader takes 10 to 60 seconds to dispose of the current modes and load in the new ones.

The nl_SELECT parameter corresponds to the menu selection of **MODE LOADER**. The nl_SELECT parameter specifies the Option E02/E04 modes to be loaded into analyzer memory as follows:

nl_SELECT Parameter	Modes Loaded
1	Frequency Counter, Flatness and Sources, Event Counter
2	Digital Radio Masks and Frequency Counter
3	Scalar Analyzer and Low Frequency Oscilloscope
4	Flatness Analyzer and Sources
5	Event Counter
6	Digital Radio Masks
7	Frequency Counter
8	Scalar Analyzer
9	Low Frequency Oscilloscope
10	Multipath Fading Simulator Calibrate
11	Disposes of all DRTS modes except Mode Loader

nl_SELECT sets nl_CRDVF to "0" if the DRTS ROM card is not inserted in the memory card reader, or to "1" if the DRTS ROM card is inserted.

If necessary, a new DLP can be loaded into analyzer memory without deleting other Option E02/E04 DLPs in analyzer memory. To load a DLP into analyzer memory without deleting the other DLPs, specify a negative nl_SELECT parameter. See the example.

NOTE If nl_SELECT is used with a negative parameter, the other modes are not disposed of and there may not be enough available analyzer memory for loading the DLP. If you use nl_SELECT with a negative parameter, you must check that there is enough available analyzer memory *before* loading in a DLP. Use the MEM command to check if there is enough available analyzer memory. See the example.

Low Frequency Oscilloscope Mode

np_DISPOSE Dispose the Low Frequency Oscilloscope DLP

The np_DISPOSE command deletes the low frequency oscilloscope downloadable program from analyzer memory.

Mode: Low Frequency Oscilloscope MODE Parameter: 8

Syntax: np_DISPOSE;

Description

The functions of np_DISPOSE and **DISPOSE SCOPE** are equivalent.

np_FFT Fast Fourier Transform

The np_FFT command performs a fast Fourier transform on the oscilloscope trace or returns to the low frequency oscilloscope display.

Mode: Low Frequency Oscilloscope MODE Parameter: 8

Syntax: np_FFT(0|1)|?;

Description

np_FFT1 performs a fast Fourier transform on the oscilloscope trace. np_FFT0 returns to the low frequency oscilloscope display.

The results are contained in trace A. The functions of np_FFT and FFT MEAS are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

np_MP Low Frequency Oscilloscope Mode Preset

The np_MP command presets the low frequency oscilloscope mode.

Mode: Low Frequency Oscilloscope MODE Parameter: 8

Syntax: np_MP;

Description

The results are contained in trace A. The marker amplitude is in variable np_MKA.

The functions of np_MP and **PRESET SCOPE** are equivalent.

np_VOFS Vertical Offset

The np_VOFS command sets the vertical offset.

Mode: Low Frequency Oscilloscope MODE Parameter: 8

Syntax: np_VOFS<number>?;

<number>::=Any positive real number, 5 V to 2 mV.

Description

The functions of np_VOFS and **OFFSET** are equivalent.

Query Response: <numeric data format>.

np_VOFSP Vertical Offset Polarity

The up_VOFSP command selects the vertical offset polarity to be positive or negative.

Mode: Low Frequency Oscilloscope MODE Parameter: 8

Syntax: np_VOFSP(0|1)|?;

Description

np_VOFSP1 sets the polarity to negative; np_VOFSP0 sets the polarity to positive. The functions of np_VOFSP and **OFST POL NEG POS** are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

Chapter 5

np_VS Vertical Scale

The np_VS command sets the vertical scale in volts per division.

Mode: Low Frequency Oscilloscope MODE Parameter: 8

Syntax: np_VS<number>1?;

<number>::=Any positive real number, 1 V to 200 μ V.

Description

The functions of np_VS and $\ensuremath{\mathsf{SCALE}}\xspace/\ensuremath{\mathsf{div}}\xspace$ are equivalent.

Query Response: <numeric data format>.

Scalar Analyzer Mode

ns_CALR Calibrate Reflection

The ns_CALR command sets up the reflection calibration.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_CALR;

Description

 $Execute \ ns_STS$ after executing $ns_CALR.$ The functions of ns_CALR and <code>CAL REFL</code> are equivalent.

ns_CALT Calibrate Transmission

The ns_CALT command sets up the transmission calibration.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_CALT;

Description

Execute ns_STTHRU after executing ns_CALT. The functions of ns_CALT and CAL TRANS are equivalent.

ns_CAN Cancel Calibration Routine

The ns_CAN command cancels the calibration routine.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_CAN;

Description

The functions of ns_CAN and CANCEL are equivalent.

Chapter 5

ns_DISPOSE Dispose the Scalar Analyzer DLP

The ns_DISPOSE command disposes of the scalar analyzer downloadable program in analyzer memory.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_DISPOSE;

Description

The functions of ns_DISPOSE and **DISPOSE SCALAR** are equivalent.

ns_FFT Fast Fourier Transform

The ns_FFT command performs a fast Fourier transform on the scalar analyzer trace or returns to the scalar analyzer display.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_FFT(0|1)|?;

Description

The amplitude measurement response is stored in trace A. ns_FFT1 performs a fast Fourier transform. ns_FFT0 returns to the scalar analyzer display. The functions of ns_FFT and **FFT MEAS** are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

ns_MP Scalar Analyzer Mode Preset

The ns_MP command presets the scalar analyzer mode.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_MP;

Description

ns_MP does the following:

ON at 0 dBm
AUTO
0 dB
OFF
10 dB/div
Top graticule
0 dBm
TRANS
OFF
0 dB
AUTO SCALAR
10 kHz
AUTO
SMPL
300 kHz
2.9 GHz

The functions of ns_MP and **PRESET SCALAR** are equivalent.

ns_NORM Normalization

The ns_NORM command turns normalization on or off.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_NORM(0|1)|?;

Description

ns_NORM1 turns normalization on. ns_NORM0 turns normalization off. When normalization is on, arrows appear on the left and right side of the screen graticule to indicate the reference level position. Use ns_NRP to change the reference level position. The normalized amplitude measurement response is contained in trace A.

The functions of ns_NORM and NORMLIZE ON OFF are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

Chapter 5

ns_NRP Normalized Reference Position

The ns_NRP command sets the normalized reference position.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_NRP<number>1?;

<number>::=Any integer number, 0 to 8.

Step Increment: 1.

Description

The ns_NRP command changes the position of the reference level when normalization is used. The top and bottom graticule lines correspond to 8 and 0, respectively. Arrows appear on the left and right side of the screen graticule when the reference level position is changed.

The functions of ns_NRP and NORM REF POSN are equivalent.

Query Response: <numeric data format>.

ns_REFL Reflection Measurement and Calibration

The command ns_REFL switches to a reflection measurement.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_REFL;

Description

ns_REFL recalls the reflection reference trace and amplitude settings and displays the reflection measurement. The functions of ns_REFL and **REFL** are equivalent.

ns_RL Reference Level

The ns_RL command sets the reference level.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_RL<number>1?;

Description

Use ns_RL to change the amplitude level when in the Scalar Analyzer mode, not RL. The functions of ns_RL and **REF LVL (RANGE)** are equivalent.

Query Response: <numeric data format>.

ns_SRCOFF Source Power Off

The ns_SRCOFF command turns off the source power (the tracking generator).

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_SRCOFF;

ns_SRCPOFS Source Power Offset

The command ns_SRCPOFS sets the source power offset for the tracking generator.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_SRCPOFS<number>1?;

Description

The functions of ns_SRCPOFS and SRC PWR OFFSET are equivalent.

Query Response: <numeric data format>.

ns_SRCPWR Source Power

The ns_SRCPWR command sets the power level of the source for the tracking generator.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_SRCPWR<number>1?;

Description

Sending a value with ns_SRCPWR turns on the source. The functions of ns_SRCPWR and SRC PWR ON OFF are equivalent.

Query Response: <numeric data format>.

ns_STO Store Open

The ns_STO command stores the open reference trace.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_STO;

Description

Perform ns_CALR before ns_STO. The functions of ns_STO and **STORE OPEN** are equivalent. The amplitude response is stored in trace A.

ns_STS Store Short

The ns_STS command stores the short reference trace and amplitude settings.

```
Mode: Scalar Analyzer
MODE Parameter: 2
```

Syntax: ns_STS;

Description

Execute ns_STS after executing ns_STO. ns_STS performs the actual calibration. A reference trace and amplitude settings are stored, normalization is turned on, and the normalized trace (trace A) is displayed. The functions of ns_STS and **STORE SHORT** are equivalent.

ns_STTHRU Store Thru Reference Trace

The ns_STTHRU command stores the thru reference trace and amplitude settings.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_STTHRU;

Description

ns_STTHRU performs the actual calibration. A reference trace and amplitude settings are stored, normalization is turned on, and the normalized trace (trace A) is displayed. Perform ns_CALT before ns_STTHRU. The functions of ns_STTHRU and **STORE THRU** are equivalent.

ns_TRANS Transmission Measurement and Calibration

The command ns_TRANS switches to a transmission measurement.

Mode: Scalar Analyzer MODE Parameter: 2

Syntax: ns_TRANS;

Description

ns_TRANS recalls the transmission reference trace and amplitude settings and displays the transmission measurement. The amplitude response is stored in trace A. The functions of ns_TRANS and **TRANS** are equivalent.

Flatness and Sources Mode

nt_ATRACK Amplitude Track

The nt_ATRACK command turns the amplitude tracking function on or off.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_ATRACK(0|1)|?;

Description

nt_ATRACK0 turns the amplitude tracking off; nt_ATRACK1 turns the amplitude tracking on. With amplitude tracking on, the reference level is adjusted automatically for each sweep to keep the maximum value of the trace at the reference position (approximately). Amplitude tracking is useful when making flatness adjustments in 0.1 dB/div since the gain of a device can vary as the flatness is adjusted. Using amplitude tracking avoids the need to readjust the reference level repeatedly to keep the trace on screeen.

The amplitude measurement response is stored in trace A.

The functions of nt_ATRACK and AMPL TRK ON OFF are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

nt_ATRKEL Amplitude Tracking Error Limit

The command nt_ATRKEL sets the error limit for the amplitude tracking function.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_ATRKEL<number> | ?;

<number>::=Any positive integer.

Description

The functions of nt_ATRKEL and AMPL TRK ERR LIM are equivalent.

Query Response: <numeric data format>.

nt_BAND Sets Frequency Band

The command nt_BAND sets the frequency band for the RF source.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_BAND(1|2|3|4|)|?;

Example

OUTPUT 718; "nt-BAND1;"

Description

nt-BAND1 sets the RF source for frequencies from 3.0 to 6.8 GHz. nt_BAND2 sets the RF source for frequencies from 6.0 to 13.2 GHz. nt_BAND3 sets the RF source for frequencies from 9.0 to 19.8 GHz. nt_BAND4 sets the RF source for frequencies from 12.0 to 27.2 GHz. Note that nt_BAND must be used before setting the analyzer to the desired frequency. The parameter used with nt_BAND must correspond to the multiplier (i.e. option) used in the 11758B.

Query Response: (1|2|3|4|)<CR><LF><EOI>.

nt_CALR Calibrate Reflection

The nt_CALR command sets up the reflection calibration.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_CALR;

Description

 $Execute \ nt_STREF \ after \ executing \ nt_CALR.$ The functions of nt_CALR and CAL REFL are equivalent.

nt_CALT Calibrate Transmission

The nt_CALT command sets up the transmission calibration.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_CALT;

Description

Execute nt_STREF after executing nt_CALT. The functions of nt_CALT and CAL TRANS are equivalent.

nt_DISPOSE Dispose the Flatness and Sources DLP

The nt_DISPOSE command disposes of the flatness and sources downloadable program in analyzer memory.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_DISPOSE;

Description

The functions of nt_DISPOSE and DISPOSE FLATNESS are equivalent.

nt_FFT Fast Fourier Transform

The nt_FFT command performs a fast Fourier transform on the flatness analyzer trace or returns to the flatness analyzer display.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_FFT(0|1)|?;

Description

nt_FFT1 performs a fast Fourier transform on the flatness analyzer trace. nt_FFT0 returns to the flatness analyzer display.

The amplitude measurement response is stored in trace A. The functions of nt_FFT and **FFT MEAS** are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

nt_FOFST Frequency Offset of Source

The command nt_FOFST sets the frequency offset of the IF or RF source.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_FOFST<number>1?;

Description

The functions of nt_FOFST and **FREQ OFFSET** are equivalent.

Query Response: <numeric data format>.

nt_MP Flatness and Sources Mode Preset

The nt_MP Command presets the flatness and sources mode.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_MP;

Description

nt_MP does the following:

R

The functions of nt_MP and **PRESET FLATNESS** are equivalent.

Chapter 5

nt_NORM Normalization

The nt_NORM command turns normalization on or off.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_NORM(0|1)|?;

Description

nt_NORM1 turns normalization on, nt_NORM0 turns normalization off. When normalization is on, arrows appear on the left and right side of the screen graticule to indicate the reference level position. Use nt_NRP to change the reference level position. The normalized amplitude measurement response is contained in trace A.

The functions of nt_NORM and NORMLIZE ON OFF are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

nt_NRP Normalized Reference Position

The nt_NRP command sets the normalized reference position.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_NRP<number>!?;

Description

The nt_NRP command changes the position of the reference level when normalization is used. The top and bottom graticule lines correspond to 8 and 0, respectively. Arrows appear on the left and right side of the screen graticule when the reference level position is changed.

Query Response: <numeric data format>.

nt_REFL

The command nt_REFL switches to a reflection measurement.

```
Mode: Flatness and Sources
MODE Parameter: 9
```

Syntax: nt_REFL;

Description

nt_REFL recalls the reflection reference trace and amplitude settings and displays the reflection measurement. The functions of nt_REFL and **REFL TRANS** (REFL) are similar.

nt_RL Reference Level

The nt_RL command sets the reference level.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_RL<number>1?;

Description

Use nt_RL to change the amplitude level when in the Flatness and Sources mode, not RL.

Query Response: <numeric data format>.

nt_SRCIF Source Selection (IF)

The command nt_SRCIF selects the IF source (the tracking generator) and turns off the RF source if it is on.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_SRCIF;

Description

The functions of nt_SRCIF and **SOURCE IF RF** (IF) are equivalent.

nt_SRCOFF Turns Off Sources

The command nt_SRCOFF turns off both the RF and IF sources.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_SRCOFF;

Description

The functions of nt_SRCOFF and SRC PWR ON OFF (OFF) are equivalent.

nt_SRCPIF Source Power of IF Source

The command nt_SRCPIF sets the source power of the IF source. Sending a value turns the IF source on.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_SRCPIF<number>;

<number>::= Any real number.

Description

The functions of nt_SRCPIF and SRC PWR ON OFF (IF) are equivalent. Use nt_SRCIF to select the IF source.

nt_SRCPIFO Source Power Offset of IF Source

The command nt_SRCPIFO sets the source power offset of the IF source.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_SRCPIFO<number>1?;

Description

The functions of nt_SRCPIFO and SRC PWR OFFSET (for the IF source) are equivalent.

Query Response: <numeric data format>.

nt_SRCPRF Source Power of RF Source

The command nt_SRCPRF sets the source power of the RF source. Sending a value turns the RF source on.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_SRCPRF<number>;

<number>::= Any real number.

Description

The functions of nt_SRCPRF and SRC PWR ON OFF (RF) are equivalent. Use nt_SRCRF to select the RF source.

nt_SRCPRFO Source Power Offset of RF Source

The command nt_SRCPRFO sets the source power offset of the RF source.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_SRCPRFO<number>1?;

Description

The functions of nt_SRCPRFO and SRC PWR OFFSET (for the RF source) are equivalent.

Query Response: <numeric data format>.

nt_SRCRF Source Selection (RF)

The command nt_SRCRF selects the RF source and turns off the IF source (the tracking generator) if it is on.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_SRCRF;

Description

The functions of nt_SRCRF and **SOURCE IF RF** (RF) are equivalent.

nt_STREF Store Reference Trace

The command nt_STREF stores a reference trace and amplitude settings.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_STREF;

Description

Execute nt_CALT or nt_CALR *before* nt_STREF. The functions of nt_STREF and **STORE THRU** or **STORE SHORT** are equivalent.

nt_TRANS Transmission Measurement and Calibration

The command nt_TRANS recalls the transmission calibration amplitude data.

Mode: Flatness and Sources MODE Parameter: 9

Syntax: nt_TRANS;

Description

nt_TRANS recalls the transmission reference trace and amplitude settings and displays the transmission measurement.

6 8593E Option E02/E04 Replaceable Parts

This information pertains to the replaceable parts for $8593 \mathrm{E}$ Option E02/E04 spectrum analyzers.

Reference Designator	Description	CD	Part Number
2 00191000			
A3, A15	Tracking Generator		
	8593E for Options E02 and E04	5	5086-7905
	8593E for Options E02 and E04 Prefix 3006A and above	7	75086-7923
	Tracking Generator Exchange		
	8593E for Options E02 and E04	3	5086-6905
	8593E for Options E02 and E04 Prefix 3006A and above	5	15086-6923
A10	Tracking Generator Control		
	8593E for Options E02 and E04	2	5062-8231
	8593E for Options E02 and E04 Prefix 3006A and above	5	5063-0634

 Table 6-1. 8593E E02/E04 Spectrum Analyzer Assembly-Level Replaceable Parts