

# Spectrum Analyzers

## 2397 9 kHz to 3 GHz Spectrum Analyzer

**AEROFLEX**  
A passion for performance.



A spectrum analyzer with a user friendly visual interface simplifying many complex measurements at an affordable price

- 9 kHz to 3 GHz fully synthesized frequency range
- Lightweight, portable and rugged construction at <9.4 kg
- Comprehensive marker facility
- Wide input signal range +30 dBm to -110 dBm
- Optional full range tracking generator
- Semi-automated measurements
- Floppy disk drive
- User friendly MMI reduces risk of operator error
- Auto Tune facility
- AM/FM demodulation
- AC/DC operation (option)

### A Value for Money product

The 2397 is the latest in the range of spectrum analyzers from IFR providing exceptional performance at an exceptional price.

### Frequency Accuracy

The local oscillator system in the 2397 is fully synthesized thus providing accurate frequency measurements with 1 Hz resolution.

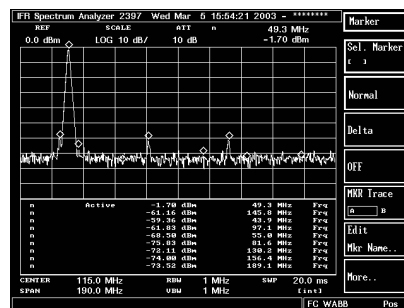
### Portability

With a weight of only 9.4 kg the 2397 is one of the lightest spectrum analyzers available. A truly portable unit!

### Monochrome Display

The 6 inch TFT monochrome LCD in the 2397 provides a clear, bright, sharp display with a 640 x 480 pixel active display area viewable in high ambient light conditions.

### Comprehensive Marker System



Marker table

The marker system allows up to a maximum of 9 markers to be displayed on the screen at any one time. A marker table shows the frequency and level of each marker selected thus allowing multiple signals to be evaluated simultaneously. In addition to the Normal markers 2397 provides Delta, Peak Search, Peak Track, 1/Delta, Marker Track, Marker to Center, and Marker to Reference capabilities.

### Measurement Limits

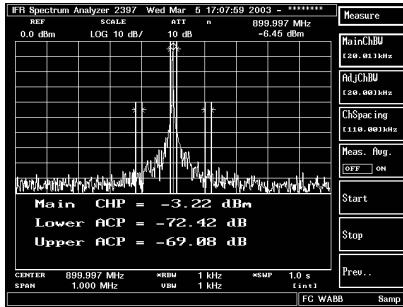
The Limits facility allows an Upper and/or a Lower Limit to be set on the screen of the 2397. Should the signal being displayed fall outside either limit a message will appear on the screen showing which limit has been exceeded and how many times this has happened.

### Wide Signal Measurement Range

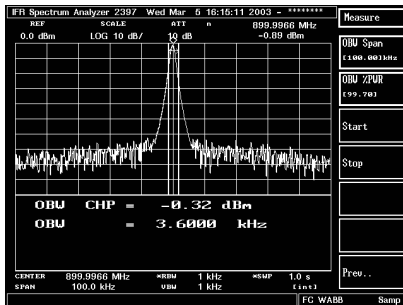
The 50 Ohm input on the 2397 can accept signals between +30 dBm and -110 dBm while providing protection up to 50 Vdc.

## Semi-Automated Measurements

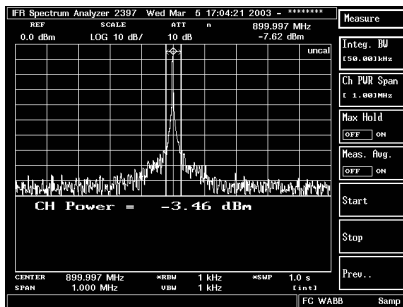
The MMI on the 2397 has been designed to simplify many of the measurements required for the evaluation of today's sophisticated communications systems. These include Adjacent Channel Power, Channel Power, Occupied Bandwidth, Harmonic Distortion, Emission Bandwidth, and X dB Down.



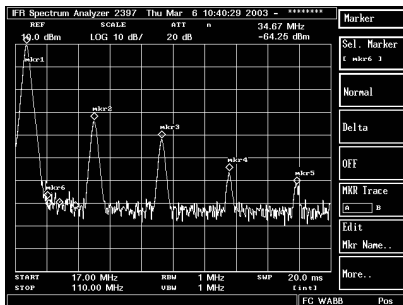
Adjacent Channel Power



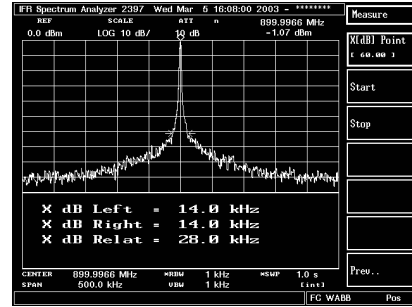
Occupied bandwidth



Channel Power



Marker Label



X dB down

## Signal Demodulation

Demodulation of both AM and FM signals allows full testing on a wide range of communications systems. The demodulated signal can be viewed on the screen and is also available on the internal loud-speaker and on headphones via a connector on the front panel. The FM peak deviation and AM modulation depth can be measured using the markers provided in the 2397.

## Information Storage

The 2397 is provided with the capability of internally storing up to 1,000 screen traces and 2,000 operational states. The spectrum analyzer is also fitted with a 3.5 inch FDD for bulk storage.

## Interfaces

IEEE 488-2, RS-232 and Printer (PCL5) interfaces are provided as standard on the 2397 allowing its integration into automated test systems and the print out of screen displays.

The 2397 has been designed with future flexibility and expansion in mind. The operating system and system memory has the capability to have additional facilities incorporated.

## SPECIFICATION

### FREQUENCY

#### Tuning Range

9 kHz to 3 GHz

#### Resolution

1 Hz

#### Frequency Span

100 Hz/div to 300 MHz/div in 1, 2, 5 step selections (auto -selected)

Zero span and Full span (9 kHz to 3 GHz)

Manual selection of Start, Stop and Span

#### Span Accuracy

± 3% of indicated span width

#### Readout Accuracy

± (Span Accuracy + Frequency Standard Accuracy + 50% of RBW)

#### Stability

Residual FM <100 Hz p-p at 1 kHz RBW, 1 kHz VBW, (p-p in 20 ms)

#### Noise Sidebands

-90 dBc/Hz at 10 kHz offset measured at 2.9 GHz

## FREQUENCY COUNTER

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### Resolution

1 Hz, 10 Hz, 100 Hz and 1 kHz

### Accuracy

$\pm$ (Reference frequency error + marker frequency accuracy + counter resolution  $\pm$  1 count)

### Sensitivity

-70 dBm from 50 kHz to 3 GHz

## AMPLITUDE

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### Measurement Range

+30 dBm to -110 dBm

### DANL

50 kHz to 100 kHz <-95 dBm

100 kHz to 1 MHz <-105 dBm

1 MHz to 3 GHz <-105 dBm, typically -115 dBm

300 Hz RBW, 10 Hz VBW

### Compression Point

-10 dBm minimum for 1 dB gain compression  
100 kHz to 3 GHz at 0 dB attenuation

### Displayed Range

100 dB in 10 dB/div log scale, 50 dB in 5 dB/div log scale

20 dB in 2 dB/div log scale, 10 dB in 1 dB/div log scale

10 divisions with linear amplitude scale

### Amplitude Units

Log scale mode dBm and dBmV

Linear scale mode V ( $\mu$ V, mV, etc.) or dBV (dBmV only)

Quasi Peak mode dB $\mu$ V, dBmV or dBm

### Display Linearity

5 and 10 dB/div,  $\pm$ 0.15 dB/dB,  $\pm$  1.5 dB over 10 divisions

1 and 2 dB/div,  $\pm$ 0.5 dB over 10 divisions

Linear,  $\pm$  10 % of Reference Level over 10 divisions

### Frequency Response (with 10 dB RF attenuation)

-3 dB to +1dB from 9 kHz to 10 MHz

$\pm$  1.5 dB from 10 MHz to 3 GHz

## ATTENUATOR

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### Range

0 dB to 50 dB in 10 dB steps selected manually or automatically coupled to the Reference Level

### Accuracy

$\pm$ 0.5 dB/step up to 1.5 dB maximum

## REFERENCE LEVEL

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### Range

-110 dBm to +30 dBm with 1 kHz filter using 1 dB/div scale

### Accuracy

$\pm$ 1.5 dB (50 kHz to 3 GHz)

### Resolution

0.1 dB steps

### Residual Spurious

-85 dBm, with input terminated and 0 dB attenuation

### Harmonic Distortion

$\leq$ 60 dBc, for -40 dBm input at 0 dB attenuation

### Intermodulation

$\leq$ 60 dBc, 100 MHz to 3 GHz at -30 dBm input

### Other Spurious

$\leq$ 60 dBc, 10 MHz to 3 GHz at -30 dBm

## RESOLUTION BANDWIDTH

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### Selection

300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz

### Accuracy

$\pm$ 20%

### Selectivity

60 dB/3 dB ratio <15:1

60 dB/6 dB ratio <12:1 for 9 kHz and 120 kHz Quasi Peak filters

### Switching Error

$\pm$ 1.0 dB

### Video Selection

10 Hz to 1 MHz in 1-3-10 sequence and Full Bandwidth

## SWEEP

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### Rate

50 ms to 1000 s in 1-2-5 sequence, 25  $\mu$ s to 20 s in Zero Span

### Accuracy

20% for <100 ms, 10 % for all other sweep rates

### Trigger Source

External, Line, Video, Free run

### Trigger Modes

Continuous, Single

### Trigger Level

Internal Trigger: Adjustable over 10 divisions

External Trigger: TTL Level (Rear Panel)

### Trigger Delay

$\pm$  One sweep time

## DISPLAY

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### Type

6 inch TFT Monochrome LCD

### Digital Resolution

640 H x 480 V active display area

## MARKERS

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### Number

Up to 9 Markers available with 9 Delta Markers

### Modes

Normal, Delta, Peak Search, Peak Track, 1/Delta, Marker Track, Marker to Center, Marker to Reference

### Marker

Marker track

Marker to center

Marker to reference

Marker to peak

## MEMORY

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### Trace storage

Up to 1,000 traces stored internally

### Setup Storage

Up to 2,000 operational states stored internally

### External

3.5 inch FDD for bulk storage

### Display Traces

2 maximum

## INPUTS

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### RF Input

Type "N" 50 Ohm female connector

### Input VSWR

< 1.5:1 from 150 kHz to 3 GHz with 10 dB attenuation

### Maximum Input

+30 dBm with 30 dB attenuation, 50 Vdc

### LO Emissions

< -70 dBm with 10 dB attenuation

## OUTPUTS

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IF Output

10.7 MHz nominal

Video Output

0 to 5 VDC, VGA (color) output

### Printer Drivers

PCL5 compatible via standard 25 pin female D-Sub Parallel Printer

### Probe Power

+15 V, -12 V and Ground INPUTS

### RF Input

Type "N" 50 Ohm female connector

### Input VSWR

< 1.5:1 from 150 kHz to 3 GHz with 10 dB attenuation

### Maximum Input

+30 dBm with 30 dB attenuation, 50 Vdc

### LO Emissions

< -70 dBm with 10 dB attenuation

## AM DEMODULATION

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### Demodulation Range

5% to 90% at 1 kHz rate and -20 dBm input level

### Input Level Range

-2 dBm to -75 dBm at 1 kHz rate and 50% depth

### Frequency Response

20 Hz to 30 kHz with -20 dBm input level

### Distortion (at 1 kHz rate)

< 2% at 50% modulation depth and -20 dBm input level

< 5% at 90% modulation depth and -20 dBm input level

## FM DEMODULATION

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### Deviation Range

Up to 100 kHz

### Input Level Range

2 dBm to -75 dBm at 50 kHz deviation

### Frequency Response

20 Hz to 100 kHz with -20 dBm input level

### Distortion (at 1 kHz rate)

< 2% with 5 kHz deviation and -20 dBm input level

< 5% with 20 kHz deviation and -20 dBm input level

## FREQUENCY STANDARD

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### Frequency

10 MHz

### Output Level

+5 dBm nominal

### Stability

$\pm 1$  ppm/year or  $\pm 0.1$  ppm/year with High Stability Option

### Connector

BNC female

### External Input

-5 dBm to +15 dBm

## INTERFACES

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### GPIB

Conforms to IEEE 488.1 - 1987, 488.2 - 1992

### Subsets

SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, CO, LEO, TEO

### RS-232C

Full Duplex

## Baud Rate

110 bps, 300 bps, 600 bps, 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps

## Parity Check

Odd, Even or None

## Data Length

7 bit or 8 bit selectable

## Stop Bits

1 bit or 2 bit

## Protocol

None, Xon-Xoff, RTS-CTS, DTR-DSR

## ENVIRONMENTAL

### Operating

0 to 40°C

### Storage

-20 to +70°C

### Temperature & Humidity

Meets MIL-T-28800E for Type 2, Class 5, non-condensing (85% operating, 90% storage)

### Vibration/Shock

Meets MIL-T-28800E for Type 2, Class 5

### Altitude

Operational up to 3,000 meters, non-operational to 12,200 meters

## PRODUCT SAFETY

Conforms to EN61010-1 for Class 1 portable equipment and is for use in a pollution degree 2 environment. The instrument is designed to operate from an Installation Category II.

## ELECTROMAGNETIC COMPATIBILITY

Complies with the limits specified in the following standards:

EN 55011: Class A and EN 50082-1

## GENERAL CHARACTERISTICS

### Dimensions:

#### Width

350 mm (13.78 in) including handle

#### Height

185 mm (7.28 in)

#### Depth

381 mm (15 in)

#### Weight

<9.4 kg

#### Warm-up Time

15 minutes for specified accuracy

## POWER REQUIREMENTS

### Voltage

100 to 240 Vac  $\pm$  10 %

### Frequency

50-60 Hz

### Power Consumption

90 W maximum with no options fitted

## HARDWARE OPTIONS/TRACKING GENERATOR

### Frequency Range

100 kHz to 3 GHz

### Output Level

0 dBm to -70 dBm

### Output Level resolution

0.1 dB step

### Absolute Level Accuracy

$\leq \pm 1.0$  dB at 0 dB

### Frequency Flatness

$\leq 2.0$  dB @ -10 dBm

### Signal Purity

Harmonics < -15 dBc

Non-harmonics < -25 dBc

Sub-harmonics < -25 dBc

Leakage < -90 dBm

## HIGH STABILITY TIMEBASE (OPTION 03)

### Temperature Stability

$\pm 0.2$  ppm

### Ageing Rate

$\pm 0.1$  ppm/year

## QUASI-PEAK DETECTOR (OPTION 04)

### Quasi-Peak detector and EMC filters

	Band B 9 kHz RBW	Band C 120 kHz RBW
Frequency Range	150 kHz to 30 MHz	30 MHz to 1 GHz
Charge Time (ms)	1 $\pm$ 20%	1 $\pm$ 20%
Discharge Time (ms)	160 $\pm$ 20%	550 $\pm$ 20%
Display Time (ms)	160 $\pm$ 20%	100 $\pm$ 20%

## AC/DC POWER SUPPLY (OPTION 6)

DC Voltage	12 VDC to 21 VDC
External Battery	14.4 VDC @ 7 AH
Operation Time	1 Hour

## SOFTWARE OPTIONS

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### OPTION 11 - DISTANCE TO FAULT (DTF)

DTF Measurement

#### Measurement Range

Up to 99 km (324,720 feet) depending on cable loss

#### Units

Meters or Feet

#### Minimum Resolution

For two discontinuities of equal amplitude using maximum span:

13.24 x Vr cm

Where Vr is the relative velocity factor for the cable.

#### Maximum Measurement Update Rate

20ms for 500 points

#### Dynamic Range

>60 dB

#### Distance Accuracy

0.78 meter (30.7 inches") for a single fault

#### Transmission Line Database

Data for common cables supplied as standard

#### VSWR or Return Loss Measurement

#### Calibration

Open Circuit or Short Circuit

#### Linearity

As spectrum analyzer: <0.15 dB/dB, <1.5 dB over 10 divisions

#### Accuracy

Linearity + Directivity + Test port mismatch

For RF Bridge 59999/170 at frequencies between 50 MHz and 3 GHz:

Accuracy <  $\pm 0.01 + 0.032\rho^2 + \text{linearity}$

Where  $\rho$  is the reflection coefficient of system under test.

### ACCESSORY OPTIONS TO MAKE THE MEASUREMENTS

The user can choose from a range of accessories to suit the test regime required.

In order for the DTF option to operate the 2397 must be fitted with the optional tracking generator (2397/1) and the DTF software, option 011.

## HARDWARE CONFIGURATIONS

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### 1. VSWR (Return Loss) only

Comprises:

RF Bridge (5 MHz to 3 GHz) 59999/170

RF Cable, 0.5m, type N (m) to type N (m) 54351/022

Adapter, type N (m) to type N (m) 54311/175

### 2. DTF only

Comprises:

Power Divider, type N 54311/187

RF Cable, 0.5m, type N (m) to type N (m) 54351/022

Calibration Load, 50 Ohm, type N (m) 54421/023

### 3. VSWR (Return Loss) and DTF

Comprises:

RF Bridge (5 MHz to 3 GHz) 59999/170

RF Cable, 0.5m, type N (m) to type N (m) 54351/022

Adapter, type N (m) to type N (m) 54311/175

Power Divider, type N 54311/187

Calibration Load, 50 Ohm, type N (m) 54421/023

### OPTION 12 - MARKER LABEL EDIT

This software option allows the user to change the marker label from the normal numeric format to a user-defined, 4 digit alpha-numeric label.

### OPTION 13 - EMC

This software option, which must be used in conjunction with option 04 (Quasi-peak detectors and filters) provides the user with some of the facilities required for EMC pre-compliance testing. Features include:

Entry of correction factors for:

Test Antenna

Cable Loss

Transducer Characteristics

Addition of Limit Lines

Choice of Log or Linear frequency scales

Semi-automated operation of quasi-peak functions

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## **VERSIONS AND ACCESSORIES**

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*When ordering please quote the full ordering number information.*

### **Versions**

2397/0	9 kHz to 3 GHz basic spectrum analyzer
2397/1	2397/0 with tracking generator

### **Options**

03	High Stability Timebase
04	Quasi-Peak Detector and Filters
06	AC/DC Power Supply 80015 (Battery not include, see below)
11	Distance to Fault software
12	Marker Label Edit software
13	EMC software

### **Supplied Accessories**

	Front cover
80010	Soft Carry Case
	Operator's manual
	Program manual
	AC supply lead
	RS-232 cable
	2 x 250 V, 3.15 A fuses

### **Optional Accessories**

46882/595	Maintenance manual
AC2621	Rack Mount kit
80009	Battery pack
59999/170	Return loss bridge
AC5008	DC block N type

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

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