2398 9 kHz to 2.7 GHz Spectrum Analyzer

A breakthrough in high performance spectrum analysis, combining cost effectiveness and portability in a new lightweight instrument

- ***9 kHz to 2.7 GHz fully synthesized frequency range***
- ***8.2 kg (18 lb): Lightweight, rugged and portable***
- ***Split screen operation***
- ***Low phase noise***
- ***300 Hz minimum resolution bandwidth***
- ***Wide input range +26 to –105 dBm***
- ***AC/DC/Battery operation***
- ***AM/FM demodulation***
- ***Full range Tracking Generator Option***
- ***EMC measurement capability***
- ***GPIB as standard***
- ***EasySpan software***

The 2398 Spectrum Analyzer is another in the series of quality spectrum analyzers from IFR. It provides exceptional performance in a lightweight, portable unit.

Frequency Accuracy

With a fully synthesized local oscillator system, the 2398 produces highly accurate frequency measurements. The standard 1 Hz frequency counter gives high resolution measurements of any signal above –70 dBm.

Lightweight

Weighing only 8.2 kg (18 lb), the 2398 is one of the lightest spectrum analyzers available. This allows measurements to be made in the lab or in the field on a variety of wireless test, troubleshooting or installation applications.

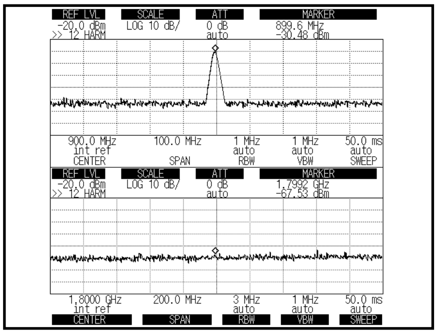
Battery and DC capabilities

An optional AC/DC power supply or external battery allows the analyzer to be used in remote locations. DC operation is possible from anywhere between +13 v to +21 v DC.

Split Screen Operation

The integral "window" or "split screen" feature allows the analyzer to view a signal in the upper zone and an entirely different signal and setup in the lower zone.

This special capability allows interfering signals to be tracked, an application that is becoming more prevalent in cellular CDMA and TDMA systems.



REF LVL –20.0 dBm >> 12 HARM
SCALE LOG 10 dB/
ATT 0 dB auto
MARKER 899.6 MHz –30.48 dBm
CENTER 900.0 MHz int ref
SPAN 100.0 MHz
RBW 1 MHz auto
VBW 1 MHz auto
SWEEP 50.0 ms auto

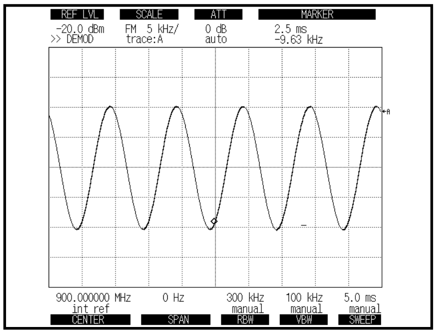
REF LVL –20.0 dBm >> 12 HARM
SCALE LOG 10 dB/
ATT 0 dB auto
MARKER 1.7992 GHz –67.53 dBm
CENTER 1.8000 GHz int ref
SPAN 200.0 MHz
RBW 3 MHz auto
VBW 1 MHz auto
SWEEP 50.0 ms auto

Outstanding Spectral Purity

The 2398 offers phase noise of –90 dBc/Hz at 10 kHz offset for determining the spectral purity of modules or systems.

Standard AM / FM Receiver

A standard AM and FM demodulator allows full testing and troubleshooting of a wide range of wireless radio systems and repeaters. An internal speaker and a headphone connector are provided.



```
 REF LVL     SCALE        ATT        MARKER
 -20.0 dBm   FM  5 kHz/   0 dB       2.5 ms
>> DEMOD     trace:A      auto       -9.63 kHz

900.000000 MHz    0 Hz     300 kHz   100 kHz   5.0 ms
   int ref                 manual    manual    manual
   CENTER         SPAN     RBW       VBW       SWEEP
```

Wide Signal Measurement Range

The 2398 provides an input signal range from +26 dBm to –105 dBm. This, combined with the AC coupled RF input, allows direct testing of RF amplifiers.

With the increased deployment of cellular technologies, the 2398 gives a broad range of tools for finding the source of interfering signals in modern wireless systems.

Versatile Interfaces

The RS-232 interface and a parallel printer port are fitted as standard. The IEEE-488 (GPIB) port offers the additional capability of fully automated testing and data tracking. Hard copies of screen displays can be easily printed.

PCMCIA Memory

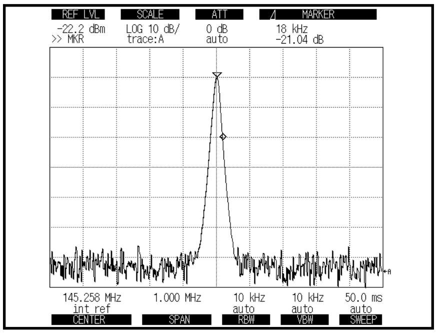
The unit can simultaneously store 20 traces and 10 setups in the internal memory at any one time. It also has an optional PCMCIA memory card slot for mass storage of traces and setups.

Enhanced Measurement Capabilities

The 2398 has user selectable internal measurement features that perform such measurements as occupied bandwidth, channel power, adjacent channel power and X dB down.

Versatile Markers

A full range of marker capabilities such as peak function, delta, marker noise and marker zoom are provided. When combined with the accuracy of the 2398, they allow for faster and more comprehensive measurements of the signals displayed.

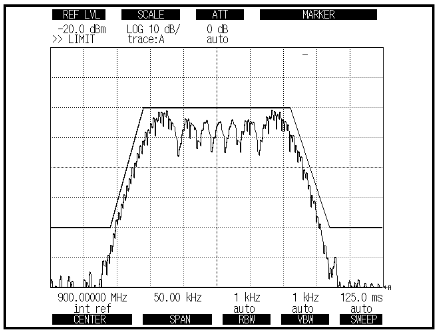


```
 REF LVL     SCALE         ATT       Δ MARKER
 -22.2 dBm   LOG 10 dB/    0 dB      18 kHz
>> MKR       trace:A       auto      -21.04 dB

145.258 MHz    1.000 MHz   10 kHz    10 kHz    50.0 ms
  int ref                  auto      auto      auto
  CENTER       SPAN        RBW       VBW       SWEEP
```

Limits Capability

The 2398 gives a comprehensive limits capability that allows for the setup of a Pass/Fail line on the screen. When a signal exceeds this limit line, FAIL will be displayed on the screen.



```
 REF LVL     SCALE         ATT       MARKER
 -20.0 dBm   LOG 10 dB/    0 dB
>> LIMIT     trace:A       auto

900.00000 MHz   50.00 kHz   1 kHz    1 kHz     125.0 ms
  int ref                   auto     auto      auto
  CENTER        SPAN        RBW      VBW       SWEEP
```

EMC Measurements

There is an optional Quasi-Peak Detector with a 9 kHz and 120 kHz filter. With today's growing demand for EMC compliance, it is necessary to design and test to the new standards and guidelines. The 2398 is ideal for field as well as design lab pre-compliance testing.

Autoset

Autoset is a one-button solution that allows for the instant viewing of an unknown signal. The 2398 will search for the highest signal level and tune the center frequency to that signal. Then the span and resolution bandwidth are set to an optimal state for the best view of the signal.

EasySpan

2398 functionality can be extended by using the IFR EasySpan software application for Windows. This software enables trace data to be transfered to a PC for storage, processing and analysis. EasySpan allows 2398 to be operated remotely via an RS-232 modem and includes a soft front panel instrument control facility ideal for interference monitoring radio networks. EasySpan also enables GPS position and time information to be added to trace data. Coupled with the instruments small size, low weight and DC operation this allows radio mapping measurements to be made with ease.

SPECIFICATION

FREQUENCY

Tuning Range

9 kHz to 2.7 GHz

Tuning Resolution

1 Hz

Frequency Span Width

100 Hz/div to 270 MHz/div in 1, 2, 5 step selections (auto selected) plus ZERO Span, and FULL Span (9 kHz to 2.7 GHz).
Manual selection of start, stop, and span.

Span Accuracy

±3% of the indicated span width

Readout Accuracy

±Span accuracy + frequency standard accuracy + 50% of RBW

Stability

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

Noise Sidebands

-90 dBc/Hz @ 10 kHz offset measured at 2.7 GHz

FREQUENCY COUNTER

Resolution

1 Hz, 10 Hz, 100 Hz and 1 kHz

Accuracy

± (Reference frequency error x marker frequency + counter resolution ± 1 count)

Sensitivity

<-70 dBm

AMPLITUDE

Measurement Range

+26 to -105 dBm

Displayed Average Noise Level

-105 dBm (1 MHz to 2.7 GHz, Resolution bandwidth of 300 Hz, 10 Hz video filter)

1 dB Gain Compression

-10 dBm minimum (0 dB attenuation, ≥10 MHz CF)

Displayed Range

80 dB in 10 dB/div log scale
40 dB in 5 dB/div log scale
16 dB in 2 dB/div log scale
8 dB in 1 dB/div log scale
8 divisions with linear amplitude scale

AMPLITUDE UNITS

Log Scale Mode

dBm, dBmV, dBµV, V, W

Linear Scale Mode

dBm, dBmV, dBµV, V, W

Display Linearity

5 or 10 dB/div, ±0.15 dB/dB, ≤±1.5 dB over 8 divisions
1 or 2 dB/div, ±0.5 dB over 8 divisions.
Linear, ±10% of Reference Level over 8 divisions

Frequency Response

±1.5 dB (≥10 MHz CF)

ATTENUATOR

Range

0 to 50 dB in 10 dB steps, selected manually or automatically coupled to reference level

Accuracy

±0.5 dB/step up to 1 dB maximum

REFERENCE LEVEL

Accuracy

±1.5 dB

Range

-110 dBm to +30 dBm with 300 Hz filter using 1 dB/division scale

Resolution

0.1 dB Steps

Residual Response

≤-85 dBm (input terminated, 0 dB attenuation)

Harmonic Distortion

≤-60 dBc (-40 dBm input 0 dB attenuation)

Intermodulation Distortion

≤-70 dBc (-30 dBm input, 0 dB attenuation 3rd order, ≥100 MHz CF)

Other Input Related Spurious

≤-60 dBc (-30 dBm input)

RESOLUTION BANDWITHS

Selections

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

Accuracy

±20%

Selectivity

300 Hz to 3 MHz <15:1 60 dB/3 dB ratio
9 kHz & 120 kHz (QuasiPeak) <15:1 60 dB/6 dB ratio

Switching Error

±1.0 dB

Video Bandwidth Selection

10 Hz to 1 MHz in 1-3-10 steps plus Full BW

SWEEP

Rate (full screen)

50 ms to 1000 sec	*(in 1-2-5 sequence)*
5 ms to 20 sec	*(in zero span)*

Sweep Rate Accuracy

±10% of Full Scale ≥100 ms

Trigger Source

Internal, External (rear), Line

Trigger Modes

Free Run, Video, Single Sweep, Line

Coupling

DC

External Trigger Bandwidth

5 Hz HPF or 100 kHz LPF

Trigger Level

Internal: Adjustable over 8 divisions
Ext Rear: TTL Level (nominal)

Trigger Delay

± one sweep time

DISPLAY

Type

(7.4 in) Monochrome LCD.

Digital Resolution

640 H x 480 V active display area

Marker Modes

2 Markers, Delta, 1/Delta, Peak Search, Marker Track, Marker to Center, Marker to Reference and Marker Noise

MEMORY

Displayed Traces

2

Trace Storage (Internal)

20 stored traces including user defined traces and test limits

Setup Storage (Internal)

10 operational states

PCMCIA Card

Allows bulk storage of traces and setups

INPUTS

RF INPUT

Connector

Type N Female, 50 Ω nominal.

Impedance

VSWR<1.7:1. (≥10 dB Attenuation)

Maximum Input Level

20 Vdc, +26 dBm (≥30 dB Attenuation)

LO Emissions

≤-70 dBm with 0 dB Attenuation

OUTPUTS

Reference

10 MHz @ +5 dBm (rear panel)

Video

0 to 5 Vdc (rear panel)

IF out (rear panel)

10.7 MHz equivalent to RF input level

FREQUENCY REFERENCE

Temperature Stability

±2 ppm/°c

Ageing

±1 ppm/yr

EXTERNAL REFERENCE INPUT/OUTPUT

Connector

Type BNC female

Input Level

-5 dBm to +15 dBm

Output Level

+5 dBm

RS-232 INTERFACE

Type

Null Modem (Duplex Virtual Hardware Handshake)

Baud Rate

600 bps, 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19.2 kbps

Parity Check

Odd, Even or None

Data Bits per Word

7 or 8

Stop Bits per Word

1 or 2

IEEE-488 (GPIB) INTERFACE

Conforms to IEEE-Standard 488-1987.
Implemented Subsets
SH1, AH1, T6, L4, SR1, RL1, DC1, C0, PP0, LE0, TE0

PRINTER INTERFACE

Drivers

PCL3 compatible

Connection

Standard 25 Pin female D-Sub Parallel Printer

ENVIRONMENTAL

Operating

0 to 40°C

Storage

-20 to 70°C

Temperature and Humidity

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

Vibration/Shock

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

Altitude

Operation up to 3000 m (9843 ft)
Non-operational up to 12200 m (40,000 ft)

ELECTROMAGNETIC COMPATABILITY

Complies with the limits specified in the following standards:
EN 55011: Group 1 Class A EN 50082-1

SAFETY

Conforms with EN 61010-1 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 1 or 2 supply.

GENERAL CHARACTERISTICS

Dimensions

350 mm (13.75 in) W, 185 mm (7.15 in) H, 381 mm (14.75 in) D

Weight

8.2 kg (18.0 lb)

Warm-up Time

15 minutes for specified accuracy

POWER REQUIREMENT

Source Voltage and Frequency

100 to 220 VAC, 50-60 Hz

Power Consumption

100 W Maximum

OPTIONS

AC/DC POWER SUPPLY

Source Voltage and Frequency

100 to 220 VAC, 50-60 Hz

Power Consumption

100 W Maximum

DC Voltage

13 to 21 VDC (6A nominal @ 13 v)

External Battery

14.4 VDC, 7 AH

Operation Time

1 hour

TRACKING GENERATOR

Frequency Range

100 kHz to 2.7 GHz

Output Level Range

0 dBm to -70 dBm

Output Level Resolution

0.1 dB step

Output Flatness

±1.0 dB @ 10 dB attenuation

Harmonics and Sub-Harmonics

<-20 dBc

Non-Harmonics

<-30 dBc

QUASI-PEAK

Quasi-peak detector and EMC filters

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

PCMCIA CARD SLOT

Takes PCMCIA Type 1 cards.
Provides bulk storage of traces, setups and screen dumps.

HIGH STABILITY REF OSCILLATOR

Temperature Stability

±0.1 ppm/°c

Ageing

±0.1 ppm/yr

VERSIONS AND ACCESSORIES

2398	9 kHz to 2.7 GHz Basic Spectrum Analyzer with IEEE-488 (GPIB)
2398-1	2398 with High Stability Time Base (0.1 ppm), Quasi-Peak Detector and Filters, PCMCIA Card Slot
2398-2	2398-1 with Tracking Generator
2398-3	2398-1 with DC Power Supply
2398-4	2398-1 with Tracking Generator, DC Power Supply
2398-5	2398 with PCMCIA
2398-6	2398 with Tracking Generator, PCMCIA
2398-7	2398 with DC power supply, PCMCIA
2398-8	2398 with Quasi-Peak Detector and Filters
2398-9	2398 with Tracking Generator and Quasi-Peak Detector and Filters
2398-10	2398 with Quasi-Peak Detector and Filters, DC power supply

Supplied with

AC2618	Soft Carry Bag
AC2619	Operation Manual
	Programming Manual
	AC Supply Lead
	RS-232 Cable

Accessories

AC0100	Near field probe set
AC1009W	EasySpan© Waveform Transfer Software
AC2388	1 GHz Active Probe supplied with accessory power supply
AC2600	Maintenance Manual
80009	Battery Pack
AC2604	PCMCIA Type I SRAM Card (2 MB)
AC2620	Additional DC power cord for AC2568
AC2621	Rack Mount kit
AC2653	Heavy Duty Ship Case
AC4105	Return Loss bridge (5 MHz to 1.3 GHz)
AC4103	Return Loss bridge (5 MHz to 2 GHz)
AC4250	75 Ω BNC to 50 Ω type N adapter
AC5008	N-type DC Block
AC7800	75 Ω type F to 50 Ω type N adapter
AC8700	UHF Antenna

IFR - "Working together to create solutions for the world of communications."

IFR is a world leader in developing leading edge test and measurement equipment. The priority at IFR is to understand your communications test needs and respond to them. IFR has the flexibility and expertise to create just the right test solution for you. We understand that just as you are the expert in designing wireless products, we are expert in wireless test.

Combining the quality of our test products with their reliability, excellent price/performance ratio and minimal requirements for maintenance, every IFR test system represents an outstanding lifetime value.

IFR - "Working together with our customers to be flexible and innovative in providing effective test solutions for the rapid design, manufacture and maintenance of communications systems."

The added value IFR includes with each and every test set we sell will make you more productive. We offer a two-year standard warranty on all products and we will continue to support your product for five years beyond its final production. Our outstanding Customer Service Department offers calibration, out-of warranty repairs and consulting. Our Sales and Training Departments offer clear and concise product information with realistic performance specifications, technology training and application training. Our experienced engineers will help you develop application software and through continuous improvement programs, upgrades are always available.

IFR will continue to build upon our technology resources with an aggressive commitment that will enable you to excel in some of the world's most dynamic, high growth markets.

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