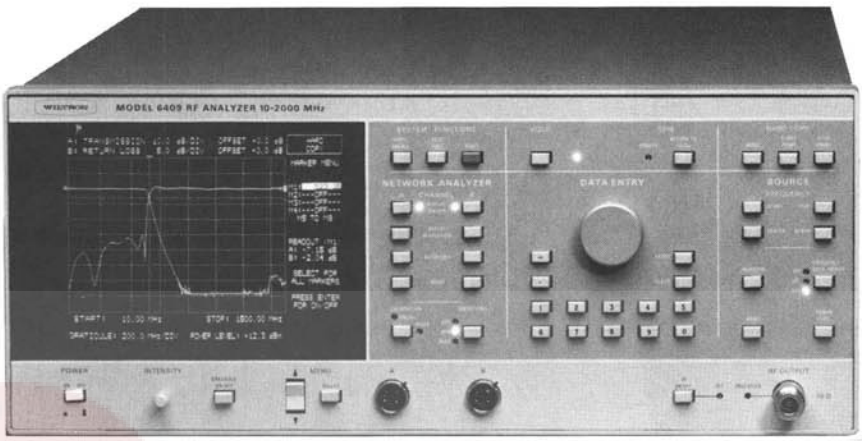
RF Analyzers

Models 6407 and 6409, 1 to 2000 MHz

NEW



6400 RF Analyzer Highlights

- Fast , Accurate Measurement of Transmission, Return Loss, and Absolute Power
- Unmatched, Drift-Free Stability
- Single, Easy-to-Use Unit with an Affordable Price
- 76 dB Dynamic Range (Typical)
- Full GPIB Programmability

Complete, Self-Contained System

The 6400 combines in one instrument a broadband, high-resolution signal source and a precision, two-channel scalar network analyzer. Models 6407 (1 to 1000 MHz) and 6409 (10 to 2000 MHz) make use of thin-film microelectronics technology and microprocessor enhancements to simplify and improve the accuracy of transmission, return loss, and absolute power measurements. A resident microprocessor adds operating convenience, error correction, and the drive for hard copy output of test data.

Signal Source

The microprocessor is also used to monitor internal 25 MHz comb markers with which precise identification of frequency is made automatically. With crystal-derived stability that is virtually free of temperature drift and nonlinearities, ±100 kHz frequency accuracy, and 10 kHz resolution, the instruments make accurate characterization of narrow-band devices with rapidly changing fine-grain structure. The exceptional stability and accuracy are achieved by "locking" the frequency to a crystal marker at the beginning of each sweep. The displays are drift-free, even when tests are made days apart. Up to eight markers and an "intelligent" CRT graticule make identification of frequencies as simple as can be. The frequency and amplitude on both traces are displayed at the position of the last activated marker. Performance that previously required a costly synthesizer is now available at a surprisingly low price.

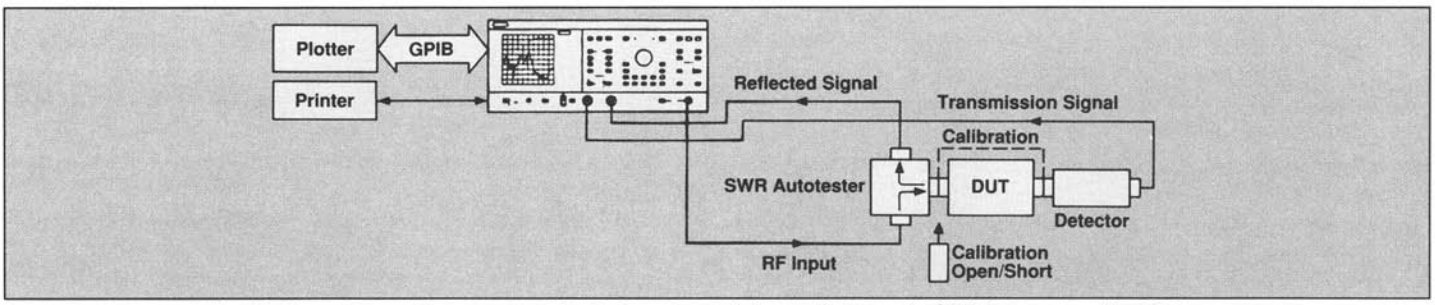
There are two sweep modes: Start/Stop and Symmetrical. In either mode, frequencies can be changed without renormalization, making it easy to zoom in on expanded frequency segments for close scrutiny. In the Alternate Sweep mode, the system displays two frequency ranges "simultaneously."

In standard units, the output power is variable from +12 dBm to +0.1 dBm in 0.1 dB steps, flat within ±0.3 dB. With the addition of the optional 70 dB step attenuator, the output power range becomes +10 dBm to –69.9 dBm, also in 0.1 dB steps. Harmonics are <–30 dBc, spurious signals <–40 dBc.

Network Analyzer

The built-in network analyzer typically has a 76 dB dynamic range and a low level sensitivity of –60 dBm. This range is achieved using accurate, low-drift, dc amplifiers that are automatically corrected for drift during retrace. No error-producing signal modulation is needed.

An unambiguous display of test conditions and data are shown on the large 178 mm (7 in.) diagonal screen. Information provided for each test includes offset, resolution, type of test being performed, reference line position, and trace identification. An "intelligent" graticule automatically spaces the vertical grid to provide an optimum display. Identification of frequencies is clearly evident, even without markers. A composite video output is available for connection to a larger, external screen, reducing, in some applications, the fatigue of monitoring and ad-



In a typical 6400 transmission and return loss measurement setup, the device under test is inserted between the SWR Autotester and the RF Detector.

justing the test device. The data display can be further enhanced by the use of go/no-go data limit lines. With the variable knob control, these lines can be used as cursors to measure peak-to-peak variations in the test device response.

Fast, near-silent, automatic printing of displayed data and test parameters in graphical or tabular format (up to 401 data points) is performed on an optional 2225C Ink Jet Printer—a real convenience in the laboratory or production area

Store and Recall

Up to nine complete front-panel setups can be stored and recalled, reducing substantially test set-up time. Included in the stored data are marker frequencies, data limits, frequency range, and vertical scaling. Also stored is normalization data which provides a 0 dB reference for transmission and return loss measurements. After one-time normalization, tests can be made at any frequency. Normalization data can be retained in memory, even when power is removed.

In addition, Autoscaling speeds testing by automatically selecting scale values and positioning the trace for the best display of the test device's full characteristics.

Quality Measurement Components

Contributing greatly to the overall measurement accuracy are the Wiltron high-performance measurement components. These include the SWR Autotester with 40 dB directivity and the RF Detector with ±0.5 dB flatness and 22 dB return loss.

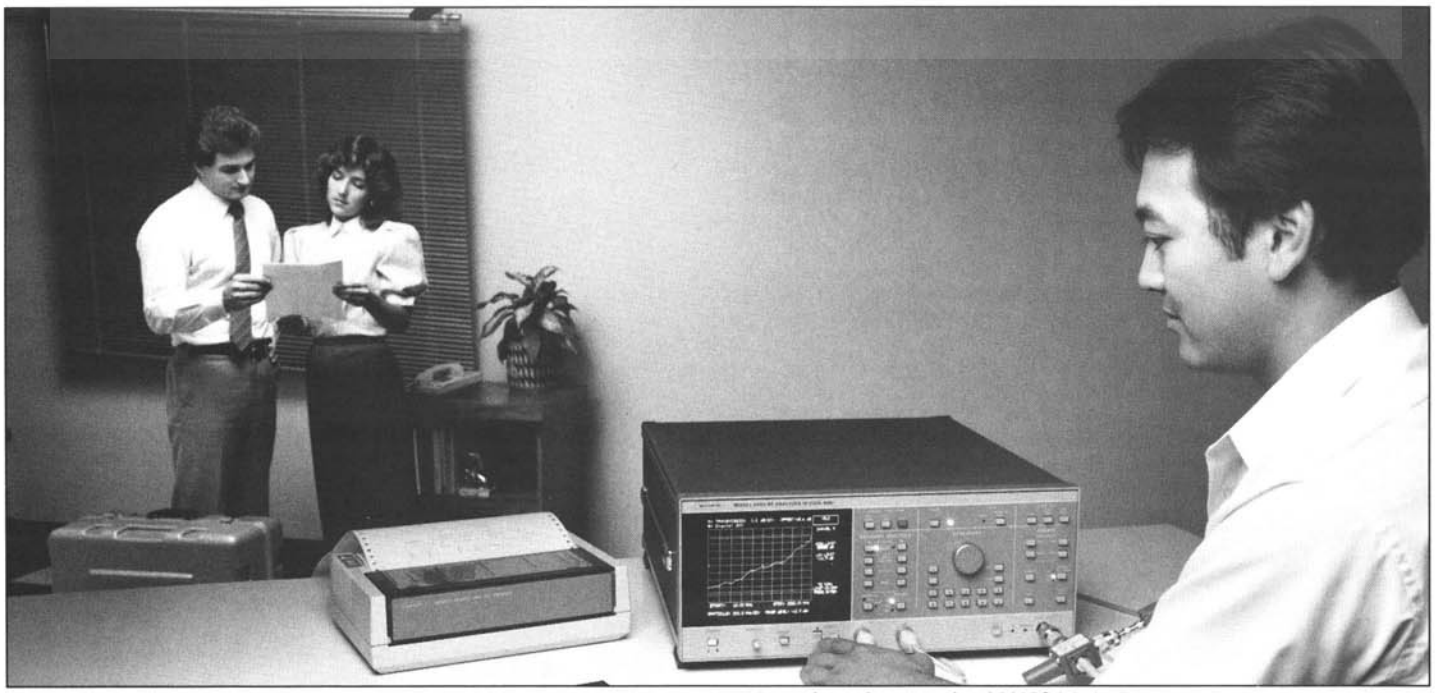
GPIB Programmability

An optional, easy-to-program GPIB interface is available for automated testing. With the addition of a computer, all front panel functions can be controlled via the interface bus.

Applications

TV Systems and Repeaters

The 6400 is the ideal instrument for measuring TV related equipment. VCRs, TV tuners, repeaters, and components can be characterized quickly and accurately. For applications where the 6400 must be located across the bench to make room for a sizable system under test, the composite video output can be used to drive a large external CRT.



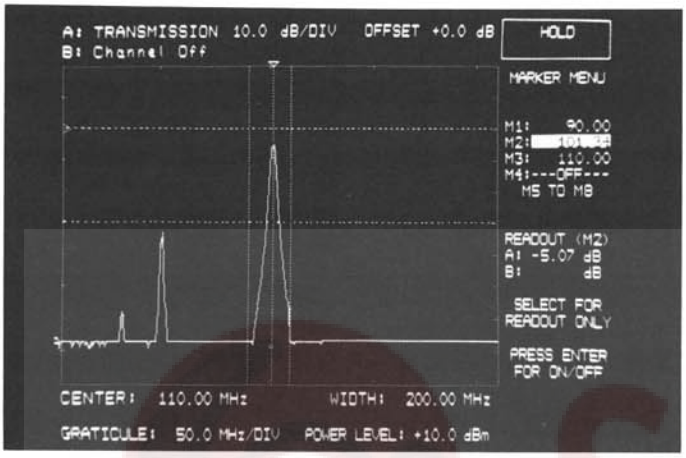
Printing of the 6400's displayed data and test parameters in graphical or tabular format can be performed on an optional 2225C Ink Jet Printer.

RF Analyzers (Cont.)

Models 6407 and 6409

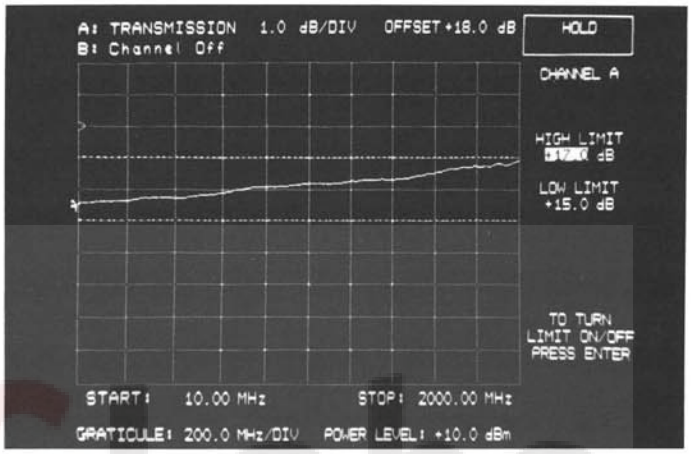
DBS Satellite Equipment

The versatility offered by a symmetrical sweep centered on a frequency and the capability to change frequencies without renormalization make testing of DBS equipment an easy task for the 6400. Frequency ranges, marker frequencies, and data limits can be stored for up to nine test setups. Changing from one channel to another is as simple as changing the center frequency of the sweep.



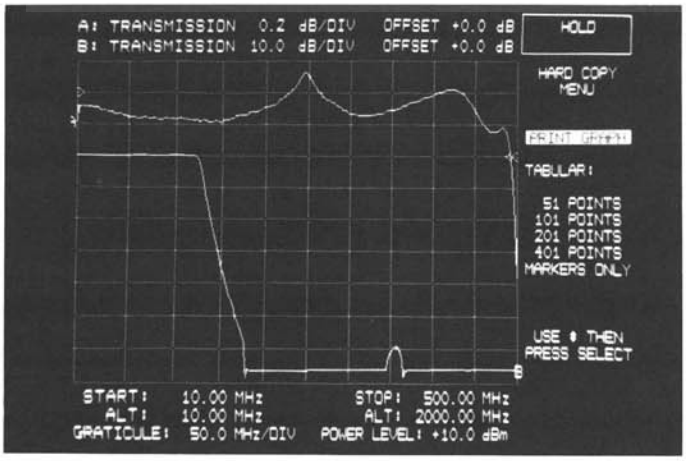
Amplifiers

The 6400's broad frequency range, flat output power, 16 dBm detector capability, and optional 70 dB attenuator make it the best instrument for testing broadband or narrow-band amplifiers. The procedure is simple: 1) normalize the system over the amplifier's full frequency range, 2) connect the amplifier, and 3) read gain directly in dB on the display. One measurement characterizes the amplifier.



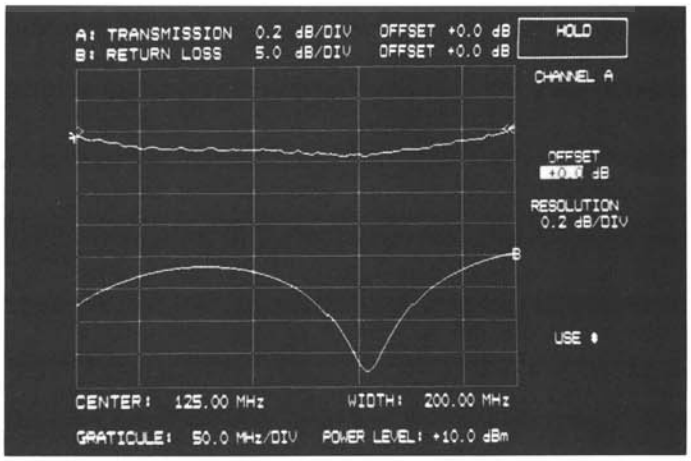
Filters

The accuracy with which filters are characterized is enhanced by the 10 kHz resolution and extremely stable output frequency of the 6400. In some setups, productivity can be improved substantially by using the Alternate Sweep mode. In this mode, a display of broadband and narrow-band characteristics can be viewed simultaneously. For example, tuning a filter whose skirt characteristics are affected by adjustment in the passband response can now be done easily and accurately while observing results on a single display. And the capability to zoom in on frequency segments, such as the passband or 3 dB points, without renormalization reduces test time.



Isolators

Measuring the forward transmission loss of an isolator requires a detector with low reflections and linear response — characterisitics that distinguish Wiltron detectors. With a 76 dB dynamic range, reverse transmission loss can be measured with the confidence that there is ample safety margin above the noise floor. Furthermore, a smoothing circuit that averages the noise at low signal levels takes the ambiguity out of determining the actual low level characterisitics. The accuracy of return loss measurement in either direction is ensured by the 40 dB directivity of the SWR Autotester.



Cellular Radio

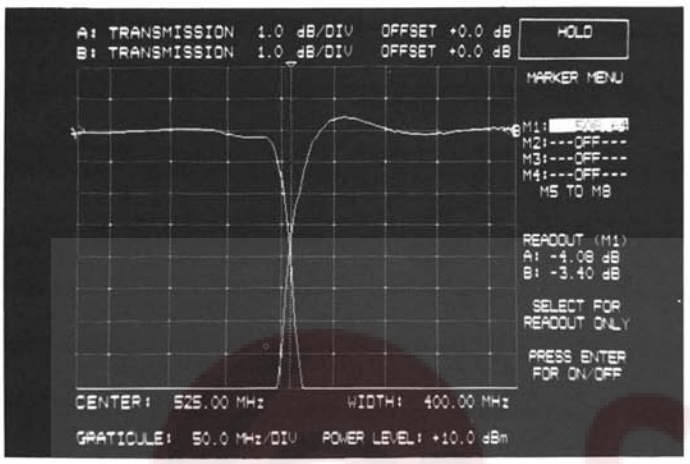
The 6400 is the most cost effective system for testing cellular radio components. From individual devices such as tuners and amplifiers, to full systems including antennas, the 6400 is perfectly suited for measuring sensitivity, conversion loss, gain, power, and other characteristics. There is no longer a need for an expensive, custom-designd test system.

Antennas

The high output power and portability of the 6400 make it particularly well suited to testing antennas in the laboratory or on the range. With ample power and a wide dynamic range, measurements can be made on systems that include high-loss cables. For field applications, a lightweight carrying case is available.

Diplexers and Multiplexers

With the 6400's dual channel display, you can normalize A and B channels for transmission loss measurements and observe both outputs of a diplexer simultaneously. You can use the zoom feature to concentrate on cross-over points or on response variations within the passband. The frequencies of important data points can be identified with up to eight markers.



Specifications

SIGNAL SOURCE

Frequency Range:
6407: 1 to 1000 MHz
6409: 10 to 2000 MHz
Frequency Resolution: 10 kHz
Frequency Accuracy: ±100 kHz
Frequency Drift (<40 MHz sweep width):
With Temperature: <10 kHz/°C
With 10% Change in Line Voltage: <10 kHz
With 3:1 Load SWR: <20 kHz
Leveled Output Power Range:
Without Attenuator: +12 dBm to +0.1 dBm in 0.1 dB steps.
With Optional Attenuator: +10 dBm to –69.9 dBm in 0.1 dB steps.
RF Output Impedance: 50 ohms (Optional 75 ohms is available on 6407, reducing output power by 2 dB).
RF Output Connector: Type N Female.
Source Match: <1.5 SWR
Output Power Flatness: ±0.3 dB
With 75 ohm Output: ±0.5 dB
With Attenuator: ±1 dB plus 0.1 dB/10 dB of attenuation.
Signal Purity:
Harmonics: <–30 dBc (except –25 dBc on 6407 from 1 to 2 MHz)
Nonharmonics: <–40 dBc
Residual AM: <–50 dBc in 100 kHz bandwidth.
Residual FM: <5 kHz peak, 30 Hz to 15 kHz post detection BW.

Sweep Time: Determined by number of data points and smoothing.

Number of Data Points	Smoothing	Typical Sweep Time
101	Off	< 100 ms
201	Off	< 250 ms
401	Off	< 400 ms
101	Min	< 350 ms
201	Min	< 550 ms
401	Min	< 1 s
101	Max	< 3 s
201	Max	< 6 s
401	Max	< 10 s

NETWORK ANALYZER

Display: 178 mm (7 in.) diagonal.
Scale Resolution: 0.1 dB to 10 dB per division in 0.1 dB steps, independent control for each channel.
Offset Range: +99.9 dB to –99.9 dB in 0.1 dB increments.
Display Resolution:
Vertical: 0.003 dB maximum.
Hosizontal: 101, 201, or 401 points, front panel selectable.
Dynamic Range: 76 dB (+16 dBm to –55 dBm), both channels. Usable to –60 dBm
Smoothing: Off, Minimum, or Maximum, front panel selectable. Minimum and Maximum smoothing use digital and analog techniques to reduce noise on low level traces.
Normalization: During normalization sequence, 800 points for each trace are stored with 0.002 dB resolution for the full band of the unit. Normalization data are automatically interprolated for ranges less than the full range.
Graticule: Ten vertical divisions. Horizontal divisions are set automatically in frequency increments of a 1, 2, 5 sequence from 1 to 500 MHz. Graticule ON/OFF control turns all graticule lines off. Tick marks remain on axis to indicate graticule position.
Markers: Up to eight individually controlled markers can be placed with 10 kHz resolution on the display. Amplitude of both traces at active marker is displayed in dB or dBm.

SYSTEM ACCURACY

Transmission Loss Accuracy:
Uncertainties resulting from frequency response of components are automatically subtracted from test data during normalization procedure. Overall accuracy is then:

Transmission Accuracy = Channel Accuracy + Mismatch Uncertainty

Typical mismatch uncertainty using a 6400 Series Detector is ±0.1 dB for a test device with 20 dB return loss and ±0.3 dB for one with 15 dB return loss.

Return Loss Accuracy:
Uncertainties resulting from frequency response of components are automatically subtracted from test data during normalization procedure. Overall accuracy is then:

Return Loss Accuracy = Channel Accuracy + SWR Autotester Accuracy

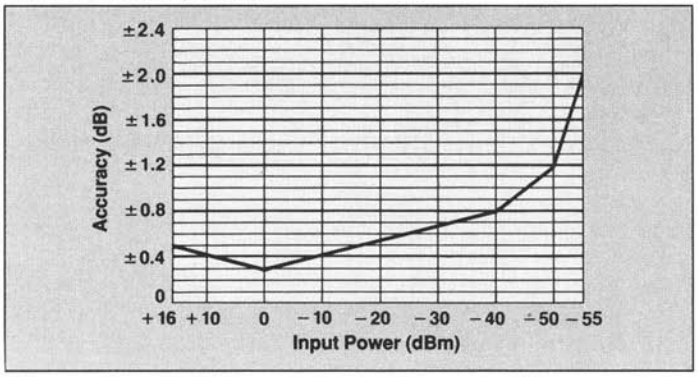
6400 Series SWR Autotester accuracy is $\pm(0.01 + 0.06\rho^2)$, where ρ is the reflection coefficient of the device under test.

Absolute Power Accuracy:

Absolute Power Accuracy = Channel Accuracy + Detector Frequency Response

The 6400 series detector frequency response is ±0.5 dB (±0.2 dB from 1 to 1,000 MHz).

Channel Accuracy (25°C):



RF Analyzers (Cont.)

Models 6407 and 6409

GENERAL

Dimensions: 177 H x 430 W x 495 D mm
(7 H x 17 W x 18-3/4 D in.)
Weight: 16 kg (35 lb)
Power: 100V/110V/220V/240V ±10%, 48–66 Hz, 130 VA maximum.
Operating Temperature: 0°C to 50°C

MEASUREMENT COMPONENTS

SWR Autotesters:
The 6400 Series SWR Autotesters are used to make precision return loss measurements. Fully compatible with the 6400, they are available in a variety of connector types and frequency ranges.

SWR Autotester Model	Frequency Range (MHz)	Test Port Connector	Impedance (Ohms)	Directivity (dB)	Price
6400–6B50 6400–6B75	1 to 1000	BNC Male	50 75	40	$600 $600
6400–6N75 6400–6NF75	1 to 1000	N Male N Female	75	40	$700 $725
6400–6N50 6400–6NF50	1 to 2000	N Male N Female	50	40	$700 $725
6400–6N75–1 6400–6NF75–1	1 to 2000	N Male N Female	75	40, ≤1.8 GHz 38, >1.8 GHz	$800 $825

Maximum Input Power: 27 dBm (500 mW)
Test Port Impedance Match: 1.13 SWR (50Ω); 1.22 SWR (75Ω)
Insertion Loss (input to test port): 6.5 dB nominal.
Open/Short: An Open/Short that mates directly on the test port is supplied with each SWR Autotester.

Detectors:
The 6400 Series Detectors are used to make precision transmission loss or gain and absolute power measurements.

Detector Model	Frequency Range (MHz)	Input Connector	Impedance (Ohms)	Price
6400–71B50 6400–71B75	1 to 1000	BNC Male	50 75	$375 $400
6400–71N75	1 to 1000	N Male	75	$400
6400–71N50 6400–71N75–1	1 to 2000	N Male	50 75	$375 $475

Impedance Match: 1.17 SWR
Maximum Input Power: 20 dBm (100 mW)

Replacement Diode P/N 10–21 for 6400–71 Series Detectors . .$30

Terminations:
Precision Terminations are used to terminate the output of a two-port device for the most accurate return loss measurements.

SWR: 1.002 + 0.003F
(F in GHz)

Termination Model	Frequency Range (MHz)	Connector	Impedance (Ohms)	Price
26N50 26NF50	DC to 18,000	N Male N Female	50	$450 $450
26N75 26NF75	DC to 4,000	N Male N Female	75	$350 $350

Adapters:
These 50 ohm precision adapters are used for calibration or measurement of non-insertable devices. The 12 Series Matching Pads convert from 50 to 75 ohm impedance.

SWR: 1.1

Adapter Model	Frequency Range (MHz)	Connectors	Price
34NN50A 34NFNF50	DC to 18,000	N Male/N Male N Female/N Female	$150 $200
34NFNF75	DC to 18,000	N Female/N Female	$200
34NN75A	DC to 2,000	N Male/N Male	$175

50/75 Ohm MatchingPads:
The 12B50/75 and 12N50/75 pads are used to match 50 to 75 ohm or 75 to 50 ohm circuits.
Frequency Range: DC to 2,000 MHz
SWR: 1.25
Insertion Loss: 6 dB nominal

Minimum Loss Adapter: The 12N75 converts a 50 ohm output to 75 ohms with less than 3 dB loss.

Matching Pad Model	Connectors	Price
12B50/75	BNC Male (50 ohm) BNC Female (75 ohm)	$250
12N50/75	N Male (50 ohm) N Female (75 ohm)	$250
12N75	N Male/N Male (50 to 75 ohm only)	$300

ACCESSORIES

Extender Cables:
Extender Cables are used to make remote measurements and are placed between the SWR Autotester or detector and the 6400. Cables cause no degradation in performance.

Model	Length	Price
800–109	7.6 m (25 ft)	$50
800–110	15.2 m (50 ft)	$75
800–111	30.4 m (100 ft)	$100
800–112	61 m (200 ft)	$180

RF Extender Cable:
Model 800–195, N Male/N Male connectors, 2.4 m (8 ft) long . $1,030

GPIB Cables:
GPIB cables are used to interconnect instruments on IEEE–488 bus.

Model	Length	Price
2100–5	0.5 m (1.6 ft)	$55
2100–1	1 m (3.3 ft)	$60
2100–2	2 m (6.6 ft)	$75
2100–4	4 m (13.2 ft)	$95

RF Limiters:
RF Limiters are used to protect the 6400 detectors against damage from:
1) DC Voltage—blocks voltage up to 50 Vdc.
2) AC Voltage—filters 60 Hz up to 100 Vac and impulse currents of 500 mA.
3) RF Power—provides protection up to 4W over the 1 to 1500 MHz range.

Model	Connectors	Impedance (Ohms)	Price
1B50	BNC Male/BNC Female	50	$250
1B75		75	$300
1N50	N Male/N Female	50	$250
1N75		75	$300

Open/Shorts:
An Open/Short is used to establish a 0 dB return loss reference during the normalization procedure.

Model	Connectors	Impedance (Ohms)	Price
22BF50	BNC Female	50	$100
22BF75		75	$100
22N50	N Male	50	$150
22N75		75	$175
22NF50	N Female	50	$150
22NF75		75	$175

RF Cables:
Frequency Range: DC to 2000 MHz

Model*	Connectors	Impedance (Ohms)	Price
10B50–1, –2, –3	BNC Male to BNC Male	50	$200
10B75–1, –2, –3			
10BN75–1, –2, –3	N Male to BNC Male	75	$200
10N50–1, –2, –3	N Male to N Male	50	$200
10N75–1, –2, –3		75	$200

* Dash numbers equal length in feet.

Signal Dividers:
Frequency Range: 1 to 2000 MHz

Model	Connectors	Impedance (Ohms)	Price
11B50	BNC Female	50	$250
11B75		75	$250
11N50	N Female	50	$250
11N75		75	$250

External Monitor:
An external monitor is used when a remotely located, 260 mm (10.25 in.) diagonal screen (green phosphor) is required. Outside dimensions are 327 W x 284 H x 310 D mm (12.9 x 11.2 x 12.2 in.)
Part Number 2000–216 . . . . . $300

Ordering Information

6407 RF Analyzer (1 to 1000 MHz) $10,925
6409 RF Analyzer (10 to 2000 MHz) $12,365

Options
Rack Mounting, Option 1: Unit supplied with mounting ears and chassis track slide (90° tilt) installed $405
70 dB Step Attenuator, Option 2 . . . . . $635
GPIB Programmability (IEEE–488), Option 3 . . . . . $520
75 Ohm Output Impedance on 6407, Option 4 . . . . . $85
Front Panel Protective Cover, Option 6 . . . . . $90

Transit Cases
6400 Transit Case, Model 760–75 . . . . . $390
6400 Components and Printer Transit Case, Model 760–74 . $450

Printer and Printer Accessories
Model 2225C Ink Jet Printer, Option 5: Supplied with Interface Cable, 50 sheets of paper, and one Ink Jet Cartridge. . $795
Interface Cable, Part Number 2225–1 . . . . . $70
Replacement Ink Jet Cartridges (2 each), Part Number 2225–2 . . . . . $50
Fan Fold Ink Jet Paper (2500 sheets), Part Number 2225–3 . $120