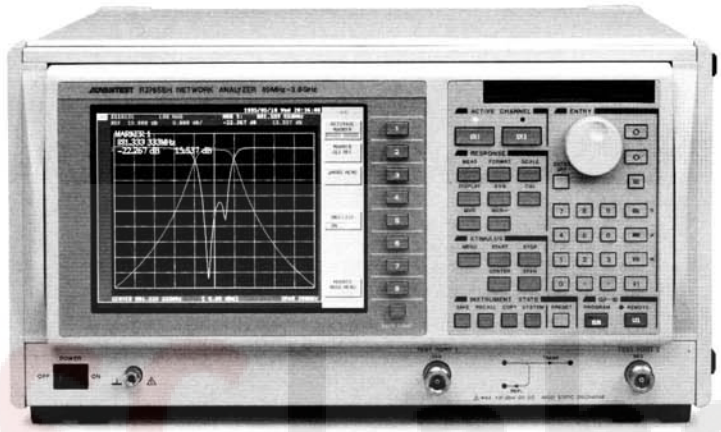
40 MHz to 3.8 GHz

R3764H/3765H Series

- Measurement frequency range
  40MHz to 3.8GHz R3764H/3765H Series
- Three models available for all types of applications
  Type A: Basic Model
  Type B: Built In SWR Bridge Model
  Type C: Built In S-Parameter Test Set Model
- High sweep speed
  0.15ms/point (with normalized calibration)
  0.25ms/point (with 2-port full calibration)
- 4ch,8traces,2devices simultaneous measurement
- 100dB Wide Dynamic Range



(Photo is R3765BH)

R3764H/3765H Series
Network Analyzers

The three models of the R3764H/3765H series can measure the amplitude, phase, group delay and impedance of electronic devices with precision at high speed in the 40 MHz to 3.8 GHz range.
The use of newly developed high-speed signal processing architecture enables measurements of 0.15 ms/point (normalized calibration) or 0.25 ms/point (2-port full calibration) .
The low-cost R3764H's simple structure and fluorescent display is perfect for production line while the full color TFT screen of the R3765H can be used in production or engineering.
The three different models are available : type A (basic model), type B (built-in SWR bridge) or type C (built-in S-Parameter test set).
Each model includes the BASIC controller, RS-232, parallel I/O and barcode inputs .

■ Improvements of H series

- Display can be set to any color. (256 colors).
- BASIC programming memory capacity expandable (1MB)
- Save register capacity expandable (2MB)
- Faster BASIC processing speed
- CDMA IF filter analysis function
- Calibration for 3-port devices

■ Three Models Best Suiting Your Application

The R3764H/3765H series can be categorized into two groups:one accommodates system use (R3764H) and the other stand-alone use (R3765H).
Each of the two series comes in three different models (types A, B and C).
With a built-in signal separator and two inputs, type A can perform simultaneous measurement for two devices.
By connecting the S-parameter test set, it can measure 2-port devices; with the optional duplexer test set ,it can measure a duplexer with three ports (ANT, RX and TX terminals) which is used at the front section of mobile radio equipment.
Type B incorporates a power splitter and a SWR bridge, allowing transmission and reflection characteristics to be measured efficiently simultaneously. In addition, by executing 1-port calibration, measurement with higher accuracy is possible.
Type C incorporates the S-parameter test set mounting two SWR bridges, a power splitter and a semiconductor switch for forward/reverse switching. It can measure forward characteristics ($S_{11}$and S_{21}) and reverse characteristics ($S_{22}$and S_{12}) with high accuracy in auto-reversing mode.

Proposal of Application-Specific and Optimum Quasi-Microwave Band Network Analyzers

R3764H/3765H Series

■ High Throughput Cuts Test Cost

In production lines of electronic devices, reduction of test cost is an essential issue.
The R3764H/3765H series realizes the highest throughput in its class.

■ High Throughput with high speed sweep

0.15ms/point
(with 10 kHz resolution bandwidth and normalized calculation)
0.25ms/point
(with 10 kHz resolution bandwidth and 2-port full calculation)

■ Shortens data transfer time to 1/4

In highly automated production lines of electronic parts, the time necessary to transmit/receive from external computers affects the overall system throughput.
The R3764H/3765H series uses direct memory access (DMA) together with dual port memory, reducing the data transfer time to 1/4 (in in-house comparison).
For example, it takes only 60ms (typ.)to perform data transmission for 1201 points, i.e. transmission speed of 50 µs or less perpoint is realized.

■ Reduces instrument setup time to 1/2

In parts test, a variety of items are tested and therefore the setup time is essential.
With the R3764H/3765H series, software algorithm is remarkably improved and the setup time is reduced to 1/2 (in in-house comparison). For example, the sum of the recall time and single sweep time at 2-port full calibration (with 1 kHz resolution) is only 1.5 seconds.

■ 100dB Dynamic Range for Filter Test

For ripple evaluation in pass band and spurious check in stop band, as is the case with dielectric filters, measurement with a wide dynamic range is crucial.
The R3764H/3765H series realizes 100dB dynamic range with 10Hz resolution bardwidth, making it suitable for testing of high-attenuation devices used in base stations of portable phones.

■ CDMA IF Filter Analysis Function

The H series network analyzers can now accurately and efficiently measure the SAW filter characteristics of the CDMA system.

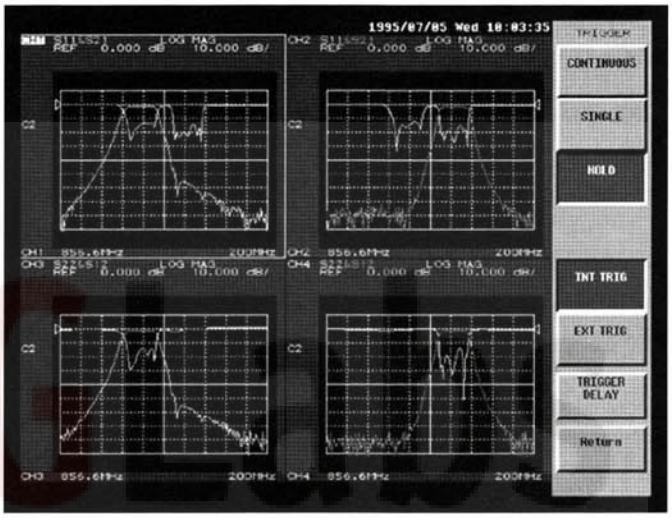
1. Gate function
This removes the effects of multiple reflections in the SAW device for measuring the characteristics of the SAW waves alone.

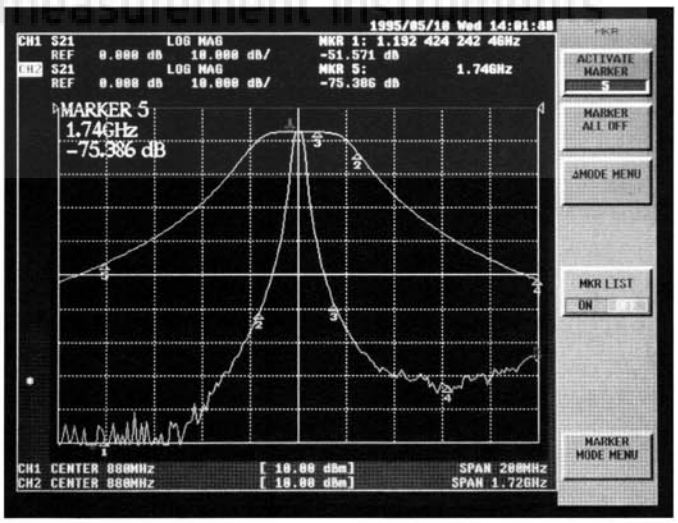
2. Phase linearity
This implements real-time analysis of phase linearity. For instance, changes in phase linearity by gate on/off can be analyzed simultaneously on a multiple-window display.

3. Time domain analysis (option)
The propagation characteristics of the SAW device can be analyzed on the time axis. The time and frequency axes can be displayed simultaneously also.

■ Powerful 4-Channel/8-Trace Function With Simultaneous Display

The R3765H series is provided with the 4-channel/8-trace function and simultaneous display is possible.
For example, when a 3-port test adapter is connected to the R3765CH, simultaneous and realtime measurement of Tx/Rx characteristics of the duplexer is possible. Channels 1 and 3 measure four S-parameters of Tx and channels 2 and 4 measure those of Rx at the same time with a throughput of approx. 250ms (with 201 points and 2-port full calibration). In addition, limit lines and multi marker function can be used for each of the four screens.



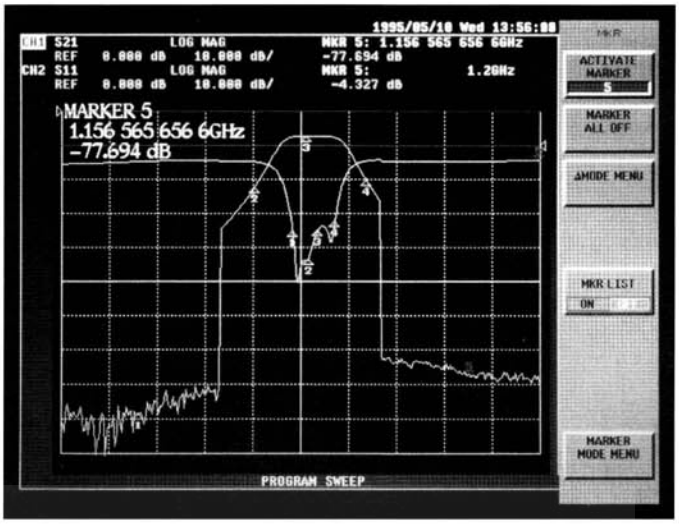


40 MHz to 3.8 GHz

R3764H/3765H Series

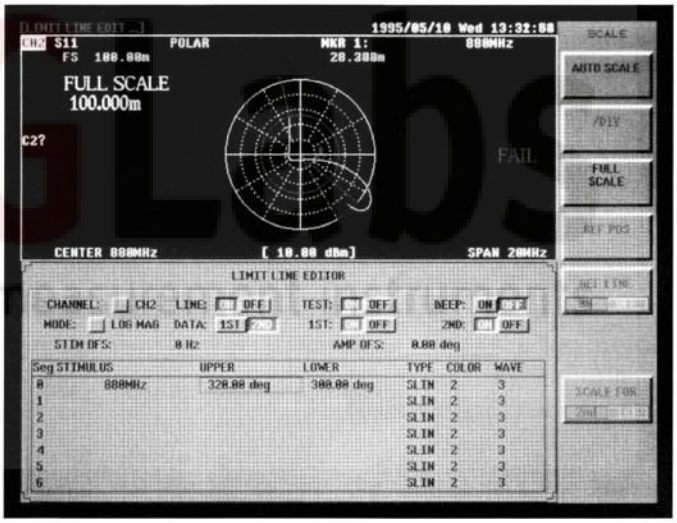
■ Programmed Sweep Realizes High-Speed and High-Resolution Measurement

The R3764H/3765H series is provided with the programmed sweep function as standard which makes it possible to vary output power and resolution bandwidth (RBW) during sweep. In evaluation of filter characteristics for instance, measurement with high speed, high accuracy and high reproducibility can be realized by varying resolution bandwidth and output power in pass or stop band.



■ Limit Line Function for Adjustment and Test

The limit function performs PASS/FAIL test based on the judgement value set by the limit line editor and then displays the test result. In addition, the color of limit lines and waveform data can be specified for each judgement area, allowing the user to make PASS/FAIL judgement at a glance during adjustment on the screen.
In POLAR and Smith chart measurement, the series has the ability to make limit judgement both for amplitude and phase, realizes amplitude/phase adjustment for specified frequency ranges and automatic test result judgement.

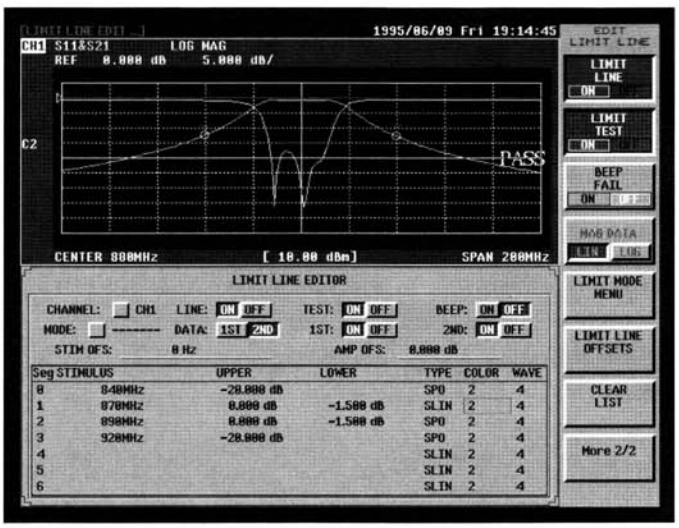


■ Trace Noise Level Is Mentioned in Low-Loss Filter Evaluation

With the latest digital mobile communication systems such as PHS and PDC, the need for developing low-loss filters is increased in order to improve the battery output power.
To measure loss level of several 0.1dBs precisely, it is necessary to decrease trace noise generated in a network analyzer to 0.01dBp-p or less.
The R3764H/3765H series reduces trace noise to 0.007dBp-p or less (typ.), i. e. 1/10 times the conventional level (in in-house comparison with 1kHz resolution bandwidth).

■ New Calibration Function

The measuring efficiency of the duplexers, couplers, and other multiple-port devices has been radically improved. The newly-developed DUPLEX 2PORT FULLCAL, TRIPLEX 2PORT FULLCAL, and 3PORT FULLCAL can be calibrated to the target device when connecting to a R396X series product.



Proposal of Application-Specific and Optimum Quasi-Microwave Band Network Analyzers

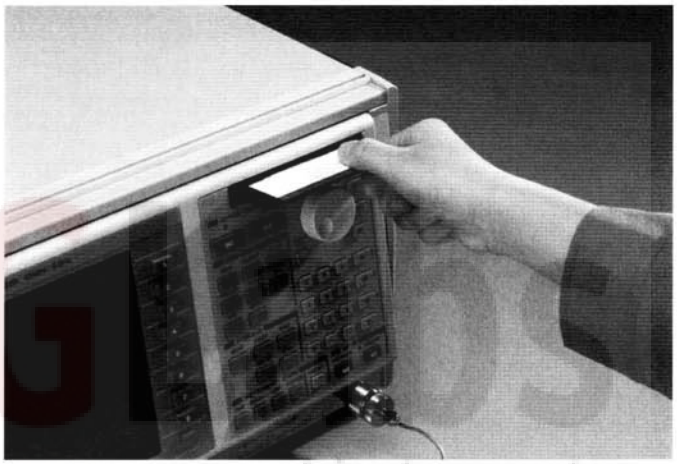
R3764H/3765H Series

■ BASIC Controller Function Realizes ATE System

Testing with high throughput and high reliability is required for production of electronic components and devices. The controller function built in the R3764H/3765H series makes it possible to easily build a high-speed automatic test equipment (ATE) system which covers the adjustment to test processes without using any external computer.
The program for the R3764H/3765H series can be developed by using the optional keyboard or downloading programs from external computers. These programs has software compatibility and can be executed on any model of the series.

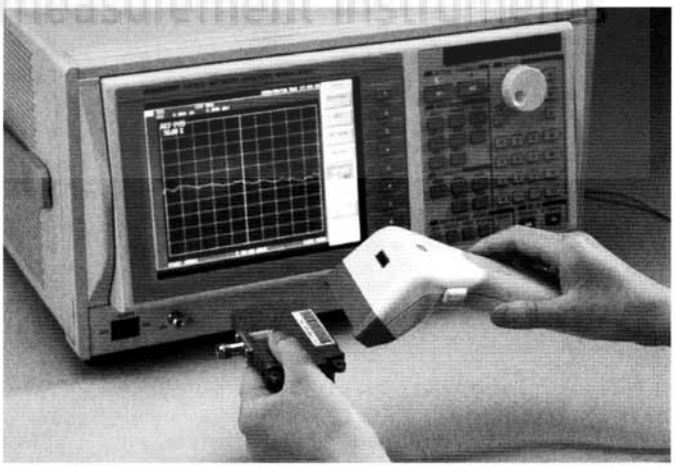
■ Program Editor and FDD Format

The built-in program editor of the R3764H/3765H/3766H/3767H series allows development, modification and execution of programs only with a single unit of the R3764H/3765H series. (As for the R3764H series, an external monitor is required.) The series uses the MS-DOS floppy disk format to accommodate 720K-, 1.2M- and 1.44M-byte types, allowing programs developed by an external computer to be loaded to the series. In addition, the world's standard SCPI commands are employed to realize program compatibility.



■ Parallel I/O and Barcode Input for System Use

The standard parallel I/O function is a communication function which is very useful for controlling the R3764H/3765H series, automatic machine handler and tools. The barcode input function exhibits its power in tailoring an automatic production line ranging from modification of equipment setting conditions to process management for each device product, thus avoiding troubles due to human errors.



Network Analyzers

40 MHz to 3.8 GHz

R3764H/3765H Series

Specifications

Measurement Functions

Sweep channel	2 channels (CH 1 and CH 2)		
Display channel	4 channels (CH 1, CH 2, CH 3, and CH 4)		
Trace	2 traces/channel		
Display parameter	**Type A**	**Type B**	**Type C**
	A/R, B/R	Transmission Reflection Transmission & reflection	S11, S21, S22, S12 S21 & S11, S12 & S22
Format			
Rectangular coordinates	Log/linear amplitude, phase, and group delay or real part + imaginary part of complex parameter |Z|, R, X (at measurement with impedance conversion) |Y|, G, B (at measurement with admittance conversion) Phase extension display function		
Smith chart (R3765H only)	Maker reading : Log/linear amplitude, phase, real part + imaginary part, R+jX, G+jB		
Polar coordinates (R3765H only)	Maker reading : Log/linear amplitude, phase, real part + imaginary part		

Receiver Characteristics

Resolution bandwidth	10kHz to 10Hz (in 1 or 3 steps)	
Amplitude characteristics		
Amplitude resolution	0.001 dB	
Dynamic accuracy	With respect to -20 dB below maximum input level of test port	
	0 to -10 dB	± 0.3 dB (40 MHz ≤ f ≤ 3.8 GHz)
	-10 to -20 dB	± 0.05 dB (40 MHz ≤ f ≤ 3.8 GHz)
	-20 to -50 dB	± 0.05 dB
	-50 to -60 dB	± 0.10 dB
	-60 to -70 dB	± 0.15 dB
	-70 to -80 dB	± 0.40 dB
	-80 to -90 dB	± 1.00 dB
Frequency characteristics	± 1.0 dB (-10 dBm, 25°C ± 5°C)	
Phase characteristics		
Measurement range	± 180° (Display for ± 180° or more is possible by means of display extension function)	
Phase resolution	0.01°	
Frequency characteristics	± 5° (-10 dBm, 25°C ± 5°C)	
Dynamic accuracy	With respect to -20 dB below maximum input level of test port	
	0 to -10 dB	± 5.0°
	-10 to -20 dB	± 0.3° (40 MHz ≤ f ≤ 3.8 GHz)
	-20 to -50 dB	± 0.3°
	-50 to 60 dB	± 0.4° (40 MHz ≤ f ≤ 3.8 GHz)
	-60 to -70 dB	± 1.5°
	-70 to -80 dB	± 4.0°
	-80 to -90 dB	± 8.0°
Group delay time characteristics		
Range	Calculated by the following expression : $r = \frac{\Delta \phi}{360 \times \Delta f}$ Δø : Phase Δf : Aperture frequency (Hz) 1 ps to 250 s	
Measurement range	1 ps	
Group delay time resolution	Is equal to Δf and can be set to A × 2% to A × 100% for	
Aperture frequency	frequency span with a resolution of A × 2%. $A = \frac{100}{\text{measurement points} - 1}$	
Accuracy	$\frac{\text{Phase accuracy}}{360 \times \text{Aperture frequency (Hz)}}$	

Signal Source Characteristics

Measurement frequency				
Range	40MHz to 3.8 GHz			
Set resolution	1 Hz			
Measurement resolution	± 0.005 ppm			
Accuracy	± 20 ppm (25°C ± 5°C)			
Stability	± 5 ppm/day (25°C ± 5°C)			
Output level				
(40 MHz to 3.8 GHz)	Type A		Type B	Type C
Range	+17 to -8 dBm		+7 to -18 dBm	+10 to -15 dBm
Resolution	0.01 dB			
Accuracy	± 0.5 dB (50 MHz, 0dBm, 25°C ± 5°C)			
Linearity	25°C ± 5°C)			
	Type A	±0.4 dB	+12 to -3 dBm	With respect
		±0.7 dB	+7 to -8 dBm	to +7 dBm
	Type B	±0.4 dB	+2 to -13 dBm	With respect
		±0.7 dB	+7 to -18 dBm	to -3 dBm
	Type C	±0.4 dB	+5 to -10 dBm	With respect
		±0.7 dB	+10 to -15 dBm	to 0 dBm
Flatness	2.0 dBp-p (25°C ± 5°C) For type C, at test port			
Output impedance	50 ohms			
Signal purity				
Harmonic distortion	≤ 20 dBc (at maximum output, 40 MHz to 3.8 GHz)			
Non-harmonic spurious	≤ 25 dBc (at maximum output, 40 MHz to 3.8 GHz)			
Phase noise	-85 dBc to 20 log (f/40 MHz) 10 kHz offset, 1 Hz bandwidth, at maximum output			
Sweep function				
Sweep parameter	Frequency, signal level			
Maximum sweep range				
Frequency	40 MHz to 3.8 GHz			
	Type A		Type B	Type C
Signal level	+17 to -8 dBm		+7 to -18 dBm	+10 to -15 dBm
Sweep type	Linear/log frequency sweep, partial and arbitrary frequency sweep, level sweep and CW (single frequency) sweep			
Sweep time	0.15 ms/point (with normalized calibration) 0.25 ms/point (with 2-port full calibration) The minimum sweep time differs according to measurement format, type of error correction, sweep width per point, number of measurement points and IF bandwidth.			
Measurement point	3, 6, 11, 21, 51, 101, 201, 301, 401, 601, 801, or 1201 points			
Sweep trigger	Either "Continuous, hold, single sweep" or "External trigger" can be selected.			
Sweep mode				
Dual Sweep	Sweeps 2 channels (CH 1 and CH 2) with the same frequency range.			
Alternate sweep	Sweeps 2 channels (CH 1 and CH 2) with different sweep types and frequency ranges.			

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Proposal of Application-Specific and Optimum Quasi-Microwave Band Network Analyzers

R3764H/3765H Series

Test Port Characteristics

Test port	25°C ±5°C	
Load matching	18 dB	40 MHz to 2.6 GHz
	16 dB	2.6 GHz to 3.8 GHz
Directivity	25°C ±5°C	
	30 dB	40 MHz to 2.6 GHz
	26 dB	2.6 GHz to 3.8 GHz
Crosstalk	R3764/3765 series 25°C ±5°C	
	Types A and B	**Type C**
	90 dB	90 dB (40 MHz to 2.6 GHz)
		85 dB (2.6 GHz to 3.8 GHz)
Connector	Type N (f), 50 ohms	
Noise level	With respect tp -20 dB below maximum input level of test board	
	-90 dB	3 kHz bandwidth
	-100 dB	10 Hz bandwidth
Maximum input level	**Types A and B**	**Type C**
	0 dBm	+15 dBm (40 MHz to 3.8 GHz)
Input burning level	+21 dBm, ±30 VDC	
Maximum port bias	±30 VDC, 0.5 A (type C only)	

Error Correction Function

Normalized	Corrects frequency response (amplitude and phase) at transmission and reflection measurement.
1-port calibration	Corrects errors due to directivity, frequency response and source matching at reflection measurement. (For error correction, short/open/load calibration tools are required.)
2-port calibration	Corrects errors due to directivity, frequency response, source matching, load matching and isolation at transmission and reflection measurement. (Type C only)
Data averaging	Averages data (vector value) for each sweep. Average factor can be set to 2 to 999.
Data smoothing	Obtains moving average between adjacent measurement points.
Electrical length correction	Adds measured phase, group delay time and equivalent electrical length or delay time.
Phase offset correction	Adds measured phase and a constant phase offset.
Correction by frequency interpolation	In frequency interpolation mode calibration, calculates error coefficient even when frequency and number of horizontal axis points are changed. Changes in frequency range (start/stop) are applied for the frequency range at initial calibration.

Connection of External Equipment

External display signal	15 pin D-SUB connector (VGA)
GPIB data output & remote control	Conforms to IEEE488.
Parallel I/O	TTL level, 8 bit output (2 ports) 4 bit input and output (2 ports)
Serial I/O	Conforms to RS232.
Keyboard I/O	Conforms to IBM PC-AT.
External reference frequency input	Input frequency range : 1, 2, 5, and 10 MHz ±10 ppm 0 dBm (50 ohms) or less
Probe power	±15 V ±0.5 V, 300mA

Display Unit

R3764 series	
Display unit	Fluorescent character display tube, green
Resolution	256 × 64 dots
Display mode	Character display, 32 lines × 8 characters
R3765 series	
Display unit	7.8 inch TFT color LCD
Resolution	640 × 480 dots
Display mode	Log/linear Cartesian coordinate, polar coordinate, and Smith chart (impedance/admittance display)
Display format	Single channel 2 channels (Overlapped display, separated display) 4 channels (Separated display)
Measurement condition display	Start/stop, center/span, scale/DIV reference level, marker value, soft key functions, warning messages
Reference line position	Top (100%) to bottom (0%) of vertical-axis memory
Auto scale	Sets reference value and scale so that measured trace be displayed in the best form.
Brightness	Backlight can be turned ON or OFF.

Marker Function (R3765H only)

Marker display	Marker reading can be converted into display value corresponding to each measurement format.
Multi marker	10 markers can be set independently for each channel.
Delta marker	Each of 10 delta markers can be specified as reference marker and delta value between markers can be measured.
Marker couple	Markers of each channel can be set in coupled or independent manner.
Analysis of specified section	Marker search for section specified with Δ marker can be performed.
MRK search	MAX search, MIN search and NEXT search
Marker tracking	Search operation for each sweep.
Target search	Calculates bandwidth, center frequency and Q for -X dB point. Frequency for phase 0° and frequency width of ±X° can be searched for.
MRK →	MRK→ reference value, MRK → START, MRK→ STOP, MRK→ CENTER
Limit line function	

Programming Function

BASIC controller function	The R3764H/3765H series and any other measuring instruments with GPIB interface can be controlled by means of standard controller function.
Built-in functions	High-speed analysis of measurement data is possible using built-in functions.
FDD function	Conforms to MS-DOS format Accommodates 3 modes (DD 720 kB, HD 1.2 MB/1.4 MB)

General Specifications

Operating environment	
When FDD is used	Temperature range : +5 to +40°C Humidity range : 80% or less (without condensation)
When FDD is not used	Temperature range : 0 to +50°C Humidity range : 80% or less (without condensation)
Storage environment	Storage temperature range : -20 to +60°C
Power voltage	100 to 120 VAC, 220 to 240 VAC, 48 to 66 Hz Automatic switching between 100 VAC and 200 VAC lines
Power consumption	300 VA or less
Dimensions	Approx. 424 (width) × 220 (height) × 400 (depth) mm
Weight	15 kg maximum (R3764H series) 16 kg maximum (R3765H series)