Network Analyzers

40 MHz to 3.8 GHz

R3764H/3765H Series

- Measurement frequency range
  40 MHz to 3.8 GHz 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
  0.15 ms/point (with normalized calibration)
  0.25 ms/point (with 2-port full calibration)
- 4 ch, 8 traces, 2 devices simultaneous measurement
- 100 dB 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 (S11 and S12) and reverse characteristics (S21 and S22) with high accuracy in auto-reversing mode.
Network Analyzers

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

- **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 R3764II/3765II series realizes 100dB dynamic range with 10Hz resolution bandwidth, 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.

R3764H/3765H Series

- **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.
Network Analyzers

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.
Network Analyzers

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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reflection, Transmission &amp;</td>
<td>Reflection, Transmission &amp;</td>
<td>Reflection, Transmission &amp;</td>
</tr>
<tr>
<td></td>
<td>S11, S12, S21, S22</td>
<td>S11, S12, S21, S22</td>
<td>S11, S12, S21, S22</td>
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</table>

Format

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log/Linear amplitude, phase, and group delay or real part + imaginary part of complex parameter</td>
<td>±0.8 dB</td>
<td>±1 dB</td>
<td>±1 dB</td>
</tr>
<tr>
<td>Phase extension display function</td>
<td>±0.7 dB</td>
<td>±0.7 dB</td>
<td>±0.7 dB</td>
</tr>
<tr>
<td>Smith chart</td>
<td>±0.5 dB</td>
<td>±0.5 dB</td>
<td>±0.5 dB</td>
</tr>
<tr>
<td>Rectangular coordinates</td>
<td>-10 to -20 dB</td>
<td>-10 to -20 dB</td>
<td>-10 to -20 dB</td>
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<tr>
<td></td>
<td>-20 to -50 dB</td>
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<td>10 to 100 dB</td>
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<td>100 to 1000 dB</td>
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<td>10 MHz to 3 GHz</td>
<td>10 MHz to 3 GHz</td>
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<td>10 kHz to 10 MHz</td>
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<td>100 GHz to 1 GHz</td>
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<td>100 GHz to 1 GHz</td>
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</tbody>
</table>

Signal Source Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement frequency</td>
<td>40 MHz to 3.8 GHz</td>
<td>40 MHz to 3.8 GHz</td>
<td>40 MHz to 3.8 GHz</td>
</tr>
<tr>
<td>Set resolution</td>
<td>1 Hz</td>
<td>1 Hz</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Measurement resolution</td>
<td>±0.005 ppm</td>
<td>±0.005 ppm</td>
<td>±0.005 ppm</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.5 ppm/20 dB (25°C ± 5°C)</td>
<td>±0.5 ppm/20 dB (25°C ± 5°C)</td>
<td>±0.5 ppm/20 dB (25°C ± 5°C)</td>
</tr>
<tr>
<td>Stability</td>
<td>±5 ppm/day (25°C ± 5°C)</td>
<td>±5 ppm/day (25°C ± 5°C)</td>
<td>±5 ppm/day (25°C ± 5°C)</td>
</tr>
</tbody>
</table>

Receiver Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output level</td>
<td>±17 to -8 dBm</td>
<td>±7 to -18 dBm</td>
<td>±10 to -15 dBm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 dB</td>
<td>0.01 dB</td>
<td>0.01 dB</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.5 dB (50 MHz, 0 dBm, 25°C ± 5°C)</td>
<td>±0.5 dB (50 MHz, 0 dBm, 25°C ± 5°C)</td>
<td>±0.5 dB (50 MHz, 0 dBm, 25°C ± 5°C)</td>
</tr>
<tr>
<td>Linearity</td>
<td>25°C ± 5°C</td>
<td>25°C ± 5°C</td>
<td>25°C ± 5°C</td>
</tr>
<tr>
<td>Response</td>
<td>2.0 dB (25°C ± 5°C)</td>
<td>2.0 dB (25°C ± 5°C)</td>
<td>2.0 dB (25°C ± 5°C)</td>
</tr>
<tr>
<td>Reflected</td>
<td>For Type C, at test port</td>
<td>For Type C, at test port</td>
<td>For Type C, at test port</td>
</tr>
<tr>
<td>Output impedance</td>
<td>50 ohms</td>
<td>50 ohms</td>
<td>50 ohms</td>
</tr>
</tbody>
</table>

Signal Purification

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmonic distortion</td>
<td>±0 dB</td>
<td>±0.5 dB</td>
<td>±0.5 dB</td>
</tr>
<tr>
<td>Non-harmonic spurios</td>
<td>±0.1 dB</td>
<td>±0.5 dB</td>
<td>±0.5 dB</td>
</tr>
<tr>
<td>Phase noise</td>
<td>-95 dB</td>
<td>-95 dB</td>
<td>-95 dB</td>
</tr>
<tr>
<td>40 MHz, 20 kHz, 140 MHz</td>
<td>-95 dB</td>
<td>-95 dB</td>
<td>-95 dB</td>
</tr>
</tbody>
</table>

Sweep Function

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweep parameter</td>
<td>Frequency, signal level</td>
<td>Frequency, signal level</td>
<td>Frequency, signal level</td>
</tr>
<tr>
<td>Maximum sweep range</td>
<td>40 MHz to 3.8 GHz</td>
<td>40 MHz to 3.8 GHz</td>
<td>40 MHz to 3.8 GHz</td>
</tr>
<tr>
<td>Signal level</td>
<td>±17 to -8 dBm</td>
<td>±7 to -18 dBm</td>
<td>±10 to -15 dBm</td>
</tr>
<tr>
<td>Sweep type</td>
<td>Linear-step frequency sweep, partial and arbitrary sweep</td>
<td>Linear-step frequency sweep, partial and arbitrary sweep</td>
<td>Linear-step frequency sweep, partial and arbitrary sweep</td>
</tr>
<tr>
<td>Sweep time</td>
<td>0.15 s/ppm (with normalized calibration)</td>
<td>0.15 s/ppm (with normalized calibration)</td>
<td>0.15 s/ppm (with normalized calibration)</td>
</tr>
<tr>
<td>Measurement point</td>
<td>3, 6, 11, 21, 51, 101, 201, 301, 401, 601, 801, or 1201 points</td>
<td>3, 6, 11, 21, 51, 101, 201, 301, 401, 601, 801, or 1201 points</td>
<td>3, 6, 11, 21, 51, 101, 201, 301, 401, 601, 801, or 1201 points</td>
</tr>
<tr>
<td>Sweep trigger</td>
<td>Either &quot;Continuous, hold, single&quot; or &quot;External trigger&quot; can be selected.</td>
<td>Either &quot;Continuous, hold, single&quot; or &quot;External trigger&quot; can be selected.</td>
<td>Either &quot;Continuous, hold, single&quot; or &quot;External trigger&quot; can be selected.</td>
</tr>
<tr>
<td>Sweep mode</td>
<td>Dual Sweep</td>
<td>Dual Sweep</td>
<td>Dual Sweep</td>
</tr>
<tr>
<td>Alternate sweep</td>
<td>Sweeps 2 channels (CH 1 and CH 2) with the same frequency range.</td>
<td>Sweeps 2 channels (CH 1 and CH 2) with different sweep types and frequency ranges.</td>
<td>Sweeps 2 channels (CH 1 and CH 2) with different sweep types and frequency ranges.</td>
</tr>
</tbody>
</table>
Network Analyzers

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R3764H/3765H Series

Test Port Characteristics

<table>
<thead>
<tr>
<th>Test port</th>
<th>Load matching</th>
<th>25°C ±5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18 dB</td>
<td>40 MHz to 2.6 GHz</td>
</tr>
<tr>
<td></td>
<td>16 dB</td>
<td>2.6 GHz to 3.8 GHz</td>
</tr>
</tbody>
</table>

Directivity

<table>
<thead>
<tr>
<th>25°C ±5°C</th>
<th>30 dB</th>
<th>40 MHz to 2.6 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26 dB</td>
<td>2.6 GHz to 3.8 GHz</td>
</tr>
</tbody>
</table>

Crosstalk

<table>
<thead>
<tr>
<th>R3764/43765 series</th>
<th>25°C ±5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types A and B</td>
<td>Type C</td>
</tr>
<tr>
<td>90 dB</td>
<td>90 dB (40 MHz to 2.6 GHz)</td>
</tr>
<tr>
<td></td>
<td>90 dB (2.6 GHz to 3.8 GHz)</td>
</tr>
</tbody>
</table>

Connector

Type N (f), 50 ohms

Noise level

With respect to -20 dB below maximum input level of test board

-90 dB | 3 kHz bandwidth
-100 dB | 10 kHz bandwidth

Maximum input level

<table>
<thead>
<tr>
<th>Types A and B</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 dBm</td>
<td>+15 dBm (40 MHz to 3.8 GHz)</td>
</tr>
</tbody>
</table>

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.

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 axes 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)

GBR 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 ±10 V, 300mA

Display Unit

**R3764 series**

Display unit Fluorescent character display table, green

Resolution 256 × 64 dots

Display mode Character display, 32 lines × 8 characters

**R3765 series**

Display unit 7.8 inch TFT color LCD

Resolution 480 × 640 dots

Display mode Logarithmic 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 Start/stop, center/span, scale/DIV reference level, marker display, 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 marker can be performed.

MK search MAK search, MW 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.

MK → MAK → reference value, MK → START, MK → STOP, MK → CENTER

Limit line function

Programming Function

**BASIC controller function**

The R3764H/3765H series and any other measuring instruments with GBR 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.

**FDO function**

Conforms to M5-DOS format

Accommodates 3 modes (DD 720 k9, HD 1.2 MB/1.4 MB)

General Specifications

**Operating environment**

Temperature range : -5 to +40°C

Humidity range : 80% or less (without condensation)

When FDO is used

Temperature range : 0 to +50°C

Humidity range : 80% or less (without condensation)

**Storage environment**

Storage temperature range : -20 to -60°C

Power supply

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)