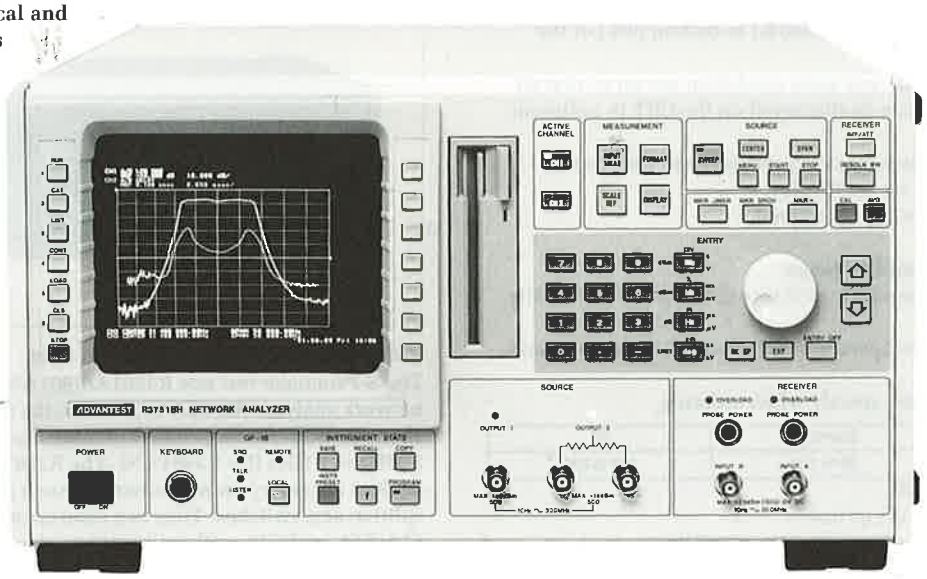
Network Analyzers

10 Hz to 300 MHz

R3751H Series

/NEW/

- 10 Hz to 300 MHz (with 0.01 Hz Resolution)
- High-speed Measurement: 100 ms/span (at 201 points)
- Powerful Analytical and Marker Functions
- FDD Included as Standard
- BASIC Controller Functions



R3751H Series Network Analyzers

The R3751H series VHF-band vector Network Analyzers let you accurately measure amplitude, phase, group delay, and impedance in the 10 Hz to 300 MHz frequency range at high speeds. The R3751H series comes in three models to satisfy your measurement requirements and intended usage. All models provide a wide variety of useful functions and, above all, high-speed measurement capabilities based on Advantest's exclusive RF analog technology and digital signal processing technology. When used for on-line measurement, they let you measure amplitude ripple and group delay ripple values within an arbitrary section, as well as bandwidths and Q = Δf/f0 in the X dB down point of a filter. These measuring functions, combined with a partial variable sweep function, are easy to use and facilitate greatly improved throughput.
The built-in BASIC controller not only lets you analyze measurements, but enables automatic measurement processing by creating data-processing programs from an external keyboard (TR45103). In addition, because sequential measurements using the built-in arithmetic functions permit high-speed measurement and postprocessing, the unit should prove useful when used for high-speed automatic processing on production lines.

• Main differences in R3751H series

	R3751AH	R3751BH	R3751EH
Signal output*	Single & Dual	Dual	Single
Input channel	R, A, B	R, A	A
Connection to S-parameter test set	Possible	Impossible	Impossible

*"Dual" is output from the built-in power splitter.

■ High-Resolution, Highly Accurate Measurements

The R3751H series incorporates a 0.01 Hz high-resolution signal source using a high-speed synthesizer to provide an amplitude measurement accuracy of 0.02 dB with 0.001 dB resolution and a phase measurement accuracy of 0.2° with 0.01° resolution. These superior performance capabilities are made possible by Advantest's exclusive analog circuit technology and powerful digital signal processing technology.

■ High-Impedance Input Enables In-Circuit Testing

For precise amplitude and phase measurements, it is important to minimize adverse effects on the circuit to be measured. The R3751H series allows 1 M-ohm input impedance, as well as 50-ohm input impedance. Therefore, in-circuit testing can be done without any adverse effects. In addition, the built-in power supply lets you use a high-impedance active probe or passive probe.

■ Phase/Group Delay Measurement Function Opens up New Horizons in Analysis

The R3751H series enables precise, phase characteristic measurements with a phase measurement accuracy of 0.2° and resolution of 0.01°. In addition, because the electrical length can be compensated for by a simple, one-touch operation, the phase reference plane can be matched to the measurement object to accurately measure the electrical length of wires and coaxial cables. The aperture can be very conveniently set with span % for optimum measurements based on the measurement frequency/band. One new function of the R3751H series is the phase-zero search function. Since this function automatically searches the frequency at phase zero, it is very convenient when analyzing crystal oscillators.

Perfect for the Automatic Testing of Electronic Component Line

R3751H Series

Specifications

Measuring Functions

Display channel: 2 channels

Display parameter:

R3751AH	R3751BH	R3751EH
R, A, B, A/R, B/R, A/B	R, A, A/R	A

Includes conversion of impedance, admittance, S-parameter (R3571A). Characteristic impedance (Zo) input also possible.

Format:

Orthogonal display Logarithm/linear amplitude, phase, group delay, real number and imaginary number parts of complex parameters.
|Z|, R, X (when impedance conversion measurement)
|Y|, G, B (when admittance conversion measurement)
Phase extension display function

Smith chart Marker read is logarithm/linear amplitude, phase, real number part + imaginary number part, R + jX, G + jB

Polar coordinate display Marker read is logarithm/linear amplitude, phase, real number part + imaginary number part

Signal Source Characteristics

● **Measurement frequency**

Range: 10 Hz to 300 MHz

Resolution: 10 mHz

Accuracy: $\pm 5 \times 10^{-7}$/week, $\pm 2 \times 10^{-6}$/0°C to +40°C

● **Output level**

Level range: +20.0 dBm to –64.9 dBm

Resolution: 0.1 dB

Accuracy: ±1.0 dB (0 dBm, 10 MHz)
At other than 0 dBm, ±0.02 dB/dB or 0.2 dB (whichever is larger) is added.

Flatness: 1.5 dBp-p (–40 dBm or more)
2.0 dBp-p (–40 dBm or more)

Output impedance: 50 ohms, return loss 20 dB or less (however, +10 dBm or less), 13 dB or less (however, +10.1 dBm or less)

● **Signal purity**

Harmonic distortion: ≤ –30 dBc or less (however, +10 dBm or less)

Non-harmonic spurious: –35 dBc or –70 dBm (whichever is larger) (< 150 MHz, ≤ 15 dBm)
–30 dBc or –70 dBm (whichever is larger) (≥ 150 MHz, ≤ 15 dBm)

Phase noise: < –75 dBc/Hz (10 kHz offset)

● **Sweep functions**

Sweep parameters: Frequency, signal level

Maximum sweep range:

Frequency 10 Hz to 300 MHz

Signal level –64.9 dBm to +20 dBm (however, fixed frequency of 10 kHz or more)

Setting range: Start/stop or center/span

Sweep type: Linear, logarithmic frequency sweep, partial and given frequency sweep, level sweep

Sweep time: 0.5 ms/point
Note that the minimum sweep time varies depending on the sweep width per point, number of measuring points, and the IF bandwidth of the measurement.

Measuring points: 3, 6, 11, ... 1201 points. However, the maximum displayed number of points is 601.

Sweep trigger: Continuous, hold, single, line, external

Sweep mode:

Dual sweep Two channels are swept in the same frequency range.

Alternate sweep Two channels can be swept by different sweep types in different frequency ranges.

● **Output format**

Output:

R3751AH	R3751BH	R3751EH
Single/dual	Dual	Single

The built-in power splitter is used for dual output.

Connector: BNC socket connector (50 ohms)

Built-in power splitter:

Insertion loss 6 dB

Output tracking < 0.1 dB, < 1° (≥ –49.9 dBm)

Equivalent output SWR < 1.1

Receiver Characteristics

● **Input characteristics**

Input terminals:

	R3751AH	R3751BH	R3751EH
Channels	3 (Rch, Ach, Bch)	2 (Rch, Ach)	1 (Ach)

Input impedance: 50 Ω, 1 MΩ/20 pF or less

Return loss: 25 dB or less

Connector: BNC socket connector (50 ohms)

Maximum input level:

Input impedance	For 0 dB attenuator	For 10 dB attenuator
50 Ω	–20 dBm	0 dBm
1 MΩ	22.4 mV	224 mV

Input breakdown level:

At 50 Ω +23 dBm, 0 VDC

At 1 MΩ 3 Vrms, 50 VDC

Connector: 95 dB or more (between inputs)

Resolution bandwidth: 1 kHz to 10 Hz (Variable in 1.3 steps)

Noise floor:

Resolution bandwidth	Minimum frequency	With 0 dB attenuator (Maximum input level: –20 dBm)		With 20 dB attenuator (Maximum input level: 0 dBm)	
		(Min. freq.) to 30 kHz	30 kHz to 300 MHz	(Min. freq.) to 30 kHz	30 kHz to 300 MHz
10 Hz	100 Hz	–115 dBm	–130 dBm	–95 dBm	–110 dBm
100 Hz	500 Hz	–110 dBm	–125 dBm	–90 dBm	–105 dBm
1 kHz	5 kHz	–100 dBm	–115 dBm	–80 dBm	–95 dBm

Automatic offset compensation:

Normalize function Frequency characteristics in the measuring system are eliminated.

Electrical length compensation Equivalent electrical length or delay time is added to the measured phase and group delay time.

Range -3×10^8 m to $+3 \times 10^8$ m or +1 s to –1 s

● **Amplitude characteristics**

Measuring range:

Absolute amplitude –20 dBm to –130 dBm at 0 dB attenuator
0 dBm to –110 dBm at 20 dB attenuator

Amplitude ratio 0 ±130 dB

Amplitude resolution: 0.001 dB

Accuracy: At 10 MHz, 25°C ±5°C, maximum input level

Absolute value measurement (R, A, B) ±0.5 dB

Ratio measurement (A/R, B/R, A/B) ±0.5 dB

Frequency response: For input of 50 Ω impedance,

Input impedance	Absolute value measurement (R, A, B)	Ratio measurement (A/R, B/R, A/B) (For the same attenuation)
50 Ω input	1 dBp-p (10 Hz to 100 MHz) 2 dBp-p (100 MHz to 300 MHz)	0.5 dBp-p (10 Hz to 100 MHz) 1.5 dBp-p (100 MHz to 300 MHz)
1 MΩ input	1.5 dBp-p (10 Hz to 100 MHz)	1.0 dBp-p (10 Hz to 100 MHz)

10 Hz to 300 MHz

R3751H Series

Dynamic accuracy: Input level with respect to maximum input level

	R3751AH/3751BH	R3751EH	
		100 Hz to 500 kHz	500 kHz to 300 MHz
0 to –10 dB	±0.04 dB	±0.5 dB	±0.10 dB
–10 to –50 dB	±0.02 dB	±0.5 dB	±0.05 dB
–50 to –60 dB	±0.05 dB	±0.5 dB	±0.15 dB
–60 to –70 dB	±0.15 dB	±0.5 dB	±0.40 dB
–70 to –80 dB	±0.40 dB	±1.0 dB	±0.80 dB
–80 to –90 dB	±0.80 dB	±2.0 dB	±1.50 dB

- **Phase measurement**

Measuring range: ±180° (Can be continuously displayed in ±180° or more by display extension function)
Phase resolution: 0.01°
Accuracy: ±2° (At 1 MHz, 25°C, maximum input level)
Frequency response: When the attenuation quantity is the same (except for R3751EH)
50 Ω input 5°p-p (10 Hz to 100 MHz)
15°p-p (100 MHz to 300 MHz)
1 MΩ input 10°p-p (10 Hz to 100 MHz)
Dynamic accuracy: Input level with respect to maximum input level

	R3751AH/3751BH	R3751EH	
		100 Hz to 500 kHz	500 kHz to 300 MHz
0 to –10 dB	±0.4°	±5.0°	±1.0°
–10 to –50 dB	±0.2°	±5.0°	±0.5°
–50 to –60 dB	±0.5°	±5.0°	±1.5°
–60 to –70 dB	±1.5°	±5.0°	±4.0°
–70 to –80 dB	±4.0°	±10°	±8.0°
–80 to –90 dB	±8.0°	–	–

- **Group delay time characteristic (Linear, logarithmic frequency sweep and sweep with arbitrary frequency)**

Range: Calculated by the following equation

$$\tau = \frac{\Delta\phi}{360 \times \Delta f}$$

$\Delta\phi$: Phase
Δf : Aperture frequency (Hz)

Measuring range: 1 ps to 250 s
Group delay time resolution: 1 ps
Aperture frequency: Equivalent to Δf: Can be set to any desired frequencies up to 100% of frequency span.
Accuracy:

$$\frac{\text{Phase accuracy}}{360 \times \text{aperture frequency (Hz)}}$$

Other Functions

- **Marker function**

Marker display, multi-marker, delta marker, fixed marker, correction marker, marker couple, analysis in arbitrary specified section, marker search, marker tracking, target search, marker → and auto zoom.

- **Error compensation function**

Normalize, 1-port calibration, data averaging and auto offset compensation

- **Instrument state function**

Save and recall

- **Programming Functions**

BASIC controller function: The standard, built-in controller function enables the unit to control itself and other measuring instruments equipped with the GPIB interface.
Built-in arithmetic functions: The built-in arithmetic functions provide high-speed analysis of measured data.
FDD functions:
Disk capacity 1 M byte (unformatted)
750 K bytes (formatted)
Type of media 3.5-inch, double-sided, double-density floppy disk

- **Connection with External Equipment**

COPY: Graphs displayed on CRT and data lists can be output to a GPIB-compatible plotter or printer without requiring an external controller.
Video plotter output signals: Separate signal (DIN 8-pin), Composite signal (BNC)
GPIB data output and remote control: Based on IEEE488
S-parameter test set control: 14-pin
Parallel I/O output: TTL level, 8-bit output (2 ports), 4-bit input/output (2 ports)
RS-232C: Serial output based on RS-232C standards
External trigger: BNC socket connector, TTL level, LOW enable
External reference frequency input:
Frequency 1, 2, 5, 10 MHz
Connector BNC socket connector
Reference frequency output:
Frequency 10 MHz, 0 dB or more
Connector BNC socket connector

Display Section

CRT: 7-inch solenoid-deflected display (amber)
Resolution: 800 × 512 dots
Display mode: Orthogonal log/linear coordinates, polar coordinates, Smith chart (impedance/admittance display)
CRT format: Single-channel display, 2-channel superimposed display, 2-channel isolated display, enlarged scale display
Display data: Currently measured data, or simultaneous display of currently measured data and data in memory
Measuring conditions display: Start/stop, Center/span, Scale/DIV, Reference level, Marker value, Soft key function, alarm message
Reference line position: From top (100%) to bottom (0%) of the vertical axis scale
Auto scale: Reference value and scale resolution are set so that all traces being measured can be displayed on the CRT in optimum form.
Time display: Calendar date (year/month/day) and time (hour/minute/second) can be set for display.
Label: Up to 45 characters can be entered.
Brightness: The CRT brightness can be adjusted.

General Specifications

Ambient temperature/humidity range:
When using FDD Temperature +5°C to +40°C, Relative humidity 85% or less
When not using FDD Temperature 0°C to +40°C, Relative humidity 85% or less
Storage temperature range: –20°C to +60°C
Power supply: Please specify when ordering.

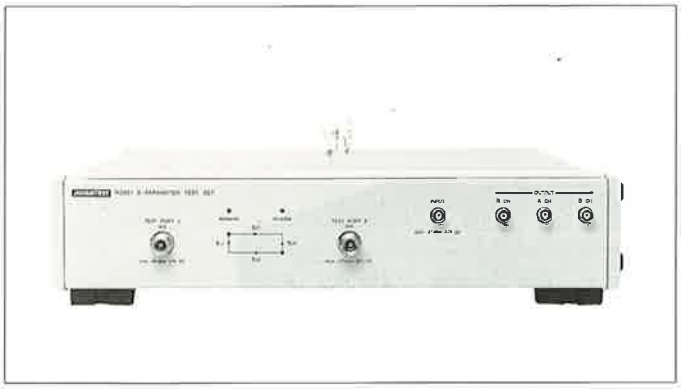
Option No.	Standard	32	42	44
Supply voltage (V)	90 to 110	103 to 132	198 to 242	207 to 250

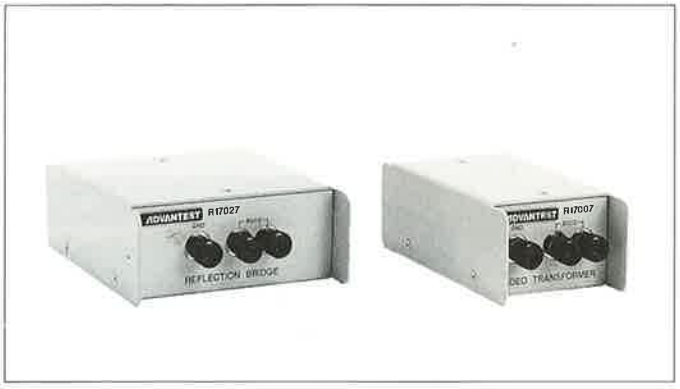
48 Hz to 66 Hz

Power consumption: 400 VA or less
Dimensions: Approx. 424 (W) × 221 (H) × 500 (D) mm
Weight: 30 kg max.

Accessories

Product name	Type	Remarks
Power cable	A01402	
Input cable	MI-78	BNC-BNC cable 30 cm
Input cable	A01233	BNC-BNC cable 60 cm
Connector	BNC-A-JJ	BNC thru connector





R3951A S-Parameter Test Set

The R3951A S-Parameter Test Set is designed for use with the R3751AH Network Analyzers to measure the transmission and reflection characteristics of two-port devices. It lets you measure transmission and reflection characteristics in the forward and reverse directions simultaneously without having to disconnect the device from the test ports.

Specifications

Frequency range: 100 kHz to 300 MHz
Test port impedance: 50 Ω
Direction: 30 dB
Frequency response:
Transmission (amplitude/phase) 1.5 dBp-p/±15°
Reflection (amplitude/phase) 2.0 dBp-p/±15°
Effective source match:
Test ports 1, 2 26 dB
Test ports isolation: 100 dB
Insertion loss:
RF input → test ports 1, 2 13 dB (Typ.)
RF input → output ports A, B, R 19 dB (Typ.)
Damage level +27 dBm or ±30 VDC (ports 1, 2)
Terminals:
Input port, output ports A, B, R 50 Ω BNC connector
Test ports, 1, 2 50 Ω N-type (f) connector
DC bias input Reverse side BNC connector
DC bias range: ±30 Vdc. ±20 mA, damage level 200 mA

Programming: All functions are controlled from the R3751AH. Also, the GPIB interface of the R3751AH is commonly used for remote control.
Power supply: Power is supplied from the R3751AH.
Weight: Approx. 6 kg
Dimensions: Approx. 424 (W) × 87(H) × 500 (D) mm

R17000 Series Impedance Conversion Transformer

Network analyzers normally have an input impedance of 50 ohms or 75 ohms, and generally accommodate unbalanced types of input. The R17000 Series Impedance Conversion Transformer is used to measure devices having different input impedances, and to measure circuit networks while the object is not grounded to earth. It can also be used to measure equipment or devices having imbalanced inputs/outputs.

R17020 Series Reflection Bridge

This unit is used to measure return loss, impedance, and other items in various devices having different S-Parameters by using a network analyzer. The R17020 series is specifically designed for measuring the input/output characteristics of AV equipment and wired communications equipment (such as telephones), as well as the characteristics of cables and connectors.

R17000 Series Specifications

Item \ Type	R17001	R17002	R17003	R17004	R17005	R17006	R17007
Impedance	50 Ω balanced	75 Ω balanced	110 Ω balanced	135 Ω balanced	150 Ω balanced	300 Ω balanced	600 Ω balanced
Connector	DUT terminal: Conforms to M-214. IN: BNC connector						
Frequency	100 Hz to 1 MHz						
Frequency response	2 dBp-p or less						
Mismatching attenuation	15 dB (100 Hz to 200 Hz), 20 dB (200 Hz to 1 MHz)						
Dimensions	Approx. 105 (W) × 44.5 (H) × 100 (D) mm						
Weight	Approx. 600 g						

R17020 Series Specifications

Item \ Type	R17021	R17022	R17023	R17024	R17025	R17026	R17027
Impedance	50 Ω balanced	75 Ω balanced	110 Ω balanced	135 Ω balanced	150 Ω balanced	300 Ω balanced	600 Ω balanced
Connector	DUT terminal: Conforms to M-214. IN/OUT: BNC connector						
Frequency	100 Hz to 1 MHz						
Direction	50 dB						
Open/short ratio	1 dB, 10°or less						
Insertion loss	16 dB or less						
Dimensions	Approx. 105 (W) × 44.5 (H) × 100 (D) mm						
Weight	Approx. 800 g						
Standard terminator	50Ω (A07021) 0Ω (A07020)	75Ω (A07022) 0Ω (A07020)	110Ω (A07023) 0Ω (A07020)	135Ω (A07024) 0Ω (A07020)	150Ω (A07025) 0Ω (A07020)	300Ω (A07026) 0Ω (A07020)	600Ω (A07027) 0Ω (A07020)