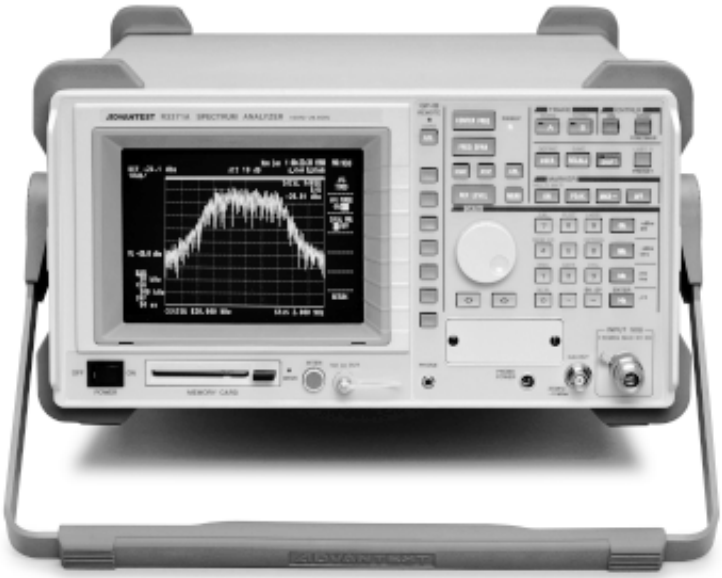
Spectrum Analyzers

100 Hz to 26.5 GHz (60 GHz)

R3271A/3371A

- **Excellent Spectrum Purity: –110 dBc/Hz (10 kHz offset from Carrier)**
- **Resolution Bandwidth of 10 Hz to 3 MHz**
- **Continuous Sweeps for All Bandwidths**
- **BASIC Controller Function**
- **Digital Radio Evaluation Measurement**
- **Internal Tracking Generator (R3371A)**



R3271A/3371A
Spectrum Analyzers

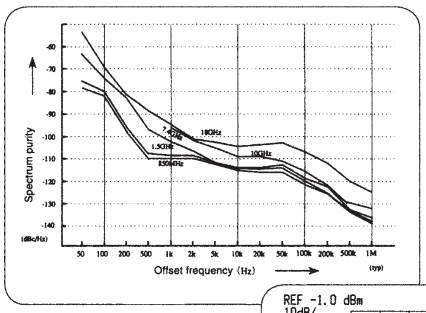
The R3271A/3371A spectrum analyzers are designed to analyze pulse RF signals used for radar or to analyze the spectrums of microwaves and quasi-millimetric waves used for satellite broadcasting, satellite communications or mobile communication. These spectrum analyzers can measure the ultra-broad bandwidth of 100 Hz to 26.5 GHz in one sweep operation. They can also perform the continuous sweeps and repeatedly. A newly developed high-purity synthesizer enables a high signal purity of –110 dBc/Hz (10 kHz offset frequency) in a frequency band of 2.5 GHz. The R3271A Series is thus ideally suited for mobile radio communications, for which narrower bandwidths and digitalization are being advanced.
The series features a BASIC controller which allows measured data or set conditions to be stored and free construction of automatic measurement systems without the need for external controllers. The R3371A has a built–in tracking generator and is suitable for frequency measuring when setting up or maintaining digital radio base stations.

■ 8–Point Max. Multimarker and List Functions

As well as having a Δ marker and peak marker, the R3271A Series can display multimarkers for up to 8 points. A list of these multimarkers can also be displayed. By using a definition function, this multimarker list not only improves operability, but also greatly improves measurement speed.

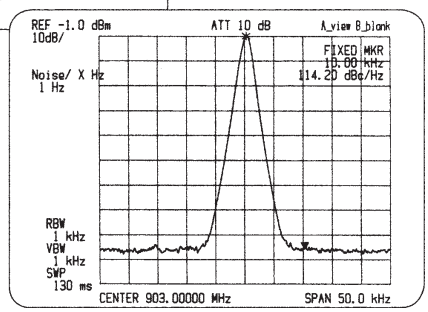
■ Highest Spectrum Purity

In a frequency band lower than 2.6 GHz, a high signal purity of –110 dBc/Hz (10 kHz offset frequency) can be attained by means of a newly developed high-purity synthesizer. This enables measurement of nearby spurious emissions over a wide dynamic range. At offset frequencies of 23 GHz and 10 kHz, a signal purity of –110 dBc/Hz can also be obtained.



◀ Excellent signal purity

Signal purity at offset frequency of 10 kHz ▶

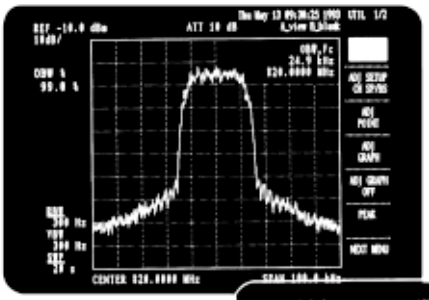


For Research and Development of the Next Generation of Radar and Microwaves

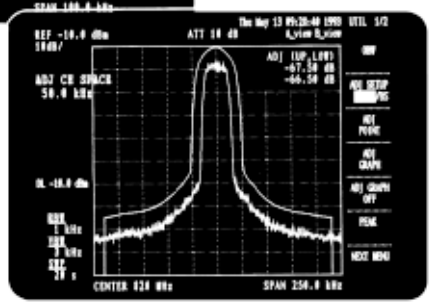
R3271A/3371A

■ Occupied Bandwidth and Adjacent Channel Leakage Power Measurement

By performing calculations on the measured spectrum data, the R3271A Series can easily measure occupied bandwidth and adjacent channel leakage power, the characteristics of radio transmitter signals. When measuring occupied bandwidth, carrier frequencies are also displayed. When measuring adjacent channel leakage power, a dynamic range of 70 dB (typical value) can be obtained due to the excellent signal purity.
The R3271A Series can also make measurements of adjacent channel leakage power using a root Nyquist filter.
This filter conforms with PDC and NADC standards. The symbol rate which decides the filter form and the roll factor which can be set arbitrarily enable measurements other than PDC and NADC.



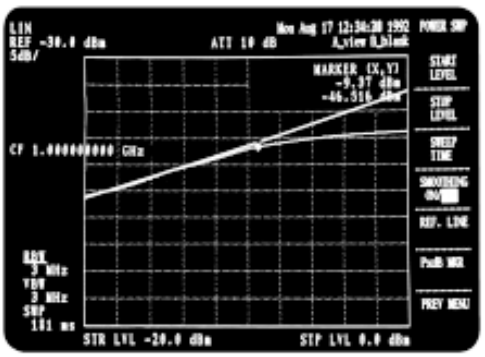
◀ ADJ (adjacent channel leakage power) display PDC 800 MHz



OBW (occupied bandwidth) display PDC 800 MHz band ▶

■ Power Sweep Function Ideal For Measuring Amplifier Linearity and Saturation Point

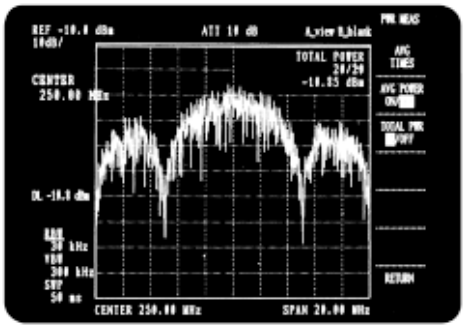
The R3371A Series has a Power Sweep Function which sweeps the output level. This function has been made possible through a newly developed attenuator in the tracking generator output section which uses a semiconductor switch. The level sweep with a 30 dB/0.1 dB step sweep range provides high precision measurements of amplifier input/output characteristics.



Amplifier 1 dB gain compression point measurement

■ Total Power Measurement

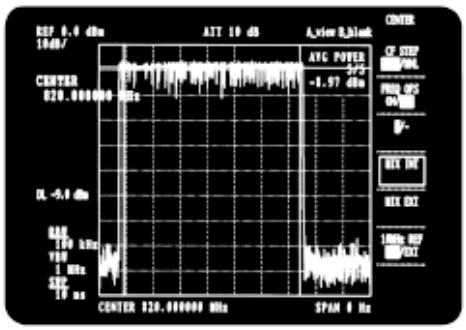
With the spread spectrum system used in radio LANs and other applications, the spectrum occupies a wide waveband area and the signal power measurement function of conventional spectrum analyzers has been inadequate. The R3271A Series does RBW calibration (power compensating of resolution bandwidth) to achieve more accurate total power measurement.



Total power measurement of spread spectrum

■ Average Power Measurement (AVG POWER)

Signal power and leakage power during carrier off time in digital mobile communications are measured with average power measurement. Conventional signal power measurements were generally done using power meters. However, digital mobile communications use the TDMA (Time Division Multiple Access) system, so measurements of average power in burst signals or during carrier off time are difficult using a power meter. In these cases, average power measurement using a spectrum analyzer is an effective measuring method.
The average power measurement function of the R3271A Series uses a measuring window, allowing measurement only within a specified range and measurement of average power density.



Measurement using a window

Selection Guide

	R3271A	R3371A
Measurement frequency range	100 Hz to 26.5 GHz	
Tracking generator	–	❍
Preselector	❍	❍
External mixer connection	❍	–

❍ Internal preselector from 500 Hz

R3271A/3371A (Continued From Previous Page)

Specifications

Frequency

Frequency range: 100 Hz to 26.5 GHz
18 to 60 GHz (with external mixers)

Frequency band

R3271A/3371A	Harmonic mode (N)
100 Hz to 3.6 GHz	1
	1
3.5 to 7.5 GHz	1
7.4 to 15.4 GHz	2
15.2 to 23.3 GHz	3
23 to 26.5 GHz	4

Preselector: 3.5 to 26.5 GHz using internal YIG tuned preselector

Frequency readout accuracy (Start, Stop, CF, Marker): ± (freq. readout × freq. reference accuracy + span × span accuracy + 0.15 × RBW + 10 Hz)

Span accuracy: ± 3% (span > 2MHz), ± 5% (span ≤ 2 MHz)

Marker frequency counter:

Resolution: 1 Hz to 1 kHz

Count accuracy (S/N ≥ 25 dB): ± (marker freq × freq reference accuracy + 5 Hz × N + 1 LSD)

Delta marker count accuracy: ± (delta marker freq × freq reference accuracy + 10 Hz × N + 2 LSD)

Frequency reference accuracy: ± 2×10^{-8}/day, ± 1×10^{-7}/year, (± 5×10^{-9}/day (Opt. 21))

Frequency stability:

Residual FM (zero span): <3 Hz × $N_{p\text{-}p}$/0.1s

Drift (after warm up 1 hr.**):**

<2.5 kHz × sweep time (minute) × N (50 kHz < span ≤ 2 MHz)

<60Hz × sweep time (minute) × N (span ≤ 50 kHz)

Spectral purity:

Offset	f≤2.6 GHz	f>2.6GHz
1 kHz	<–100 dBc/Hz	<(–95 + 20 logN)dBc/Hz
10 kHz	<–110 dBc/Hz	<(–108 + 20 logN)dBc/Hz
20 kHz	<–110 dBc/Hz	<(–108 + 20 logN)dBc/Hz
100 kHz	<–114 dBc/Hz	<(–110 + 20 logN)dBc/Hz

Frequency span:

Linear span: Range 200 Hz to 26.5 GHz, zero span
Accuracy ± 3% (span > 2 MHz), ± 5% (span ≤ 2 MHz)

Log span: Range 1 kHz to 1 GHz, 1, 2, 3 decades selectable
Accuracy ± (10% + stop freq × 0.1%)

Resolution bandwidth (3dB):

Range 10 Hz to 3 MHz 1, 3, 10 sequence

Accuracy ± 15% 100Hz to 1 MHz,
± 20% 30 Hz,3 MHz
± 50% 10 to 100 Hz (digital IF)

Bandwidth (6dB): 200 Hz, 9 kHz, 120 kHz, 1MHz (Accuracy 10%)
Conformed to CISPR standard

Video bandwidth range: 1 Hz to 3 MHz 1, 3, 10 sequence

Amplitude

Amplitude range: +30 dBm to average display noise level

Maximum input:

Average continuous power +30 dBm (1W) (Input atten ≥ 10 dB)

DC input 0 V

Display range:

Scale caliblation 10 × 10 division graticule

Log 10, 5, 2, 1, 0.5, 0.2, 0.1 dB/div

Linear 10% of reference level/div

QP log 40 dB (5 dB/div)

Input attenuator range: 0 to 70 dB (10 dB step)

Dynamic Range

Maximum dynamic range:

1 dB gain compression to noise level

Frequency range	R3271A/3371A
10 MHz to 3.6 GHz	130 dB - 1.55 × f(GHz)

Displayed average noise level:

10 Hz RBW (digital IF), 0 dB input atten, 20 times avg.

Frequency range	R3271A/3371A
1 kHz	–100 dBm
10 kHz	–110 dBm
100 kHz	–111 dBm
1 MHz to 3.6 GHz	–(135 – 1.55 × f (GHz)) dBm
3.5 to 7.5 GHz	–130 dBm
7.5 to 15.4 GHz	–123 dBm
15.2 to 23.3 GHz	–116 dBm
23 to 26.5 GHz	–110 dBm

1 dB gain compression:

Frequency range	R3271A/3371A
>10 MHz	–5 dBm (mixer level)

Spurious response:

Second harmonic distortion

R3271A/3371A	Reference frequency input range	Mixer level
<–70 dBc	10 MHz to 1.8 GHz	–30 dBm
<–100 dBc	>1.75 GHz	–10 dBm

Residual response:

(no input signal, input atten 0 dB, 50 Ω termination)

<–100 dBm (1 MHz to 3.6 GHz)

<–90 dBm (300 kHz to 26.5 GHz)

Amplitude Accuracy

Frequency response:

In band flatness (10 dB input atten)

R3271A/3371A	Frequency range
±1.5 dB	100 Hz to 3.6 GHz
±1.0 dB	50 MHz to 2.6 GHz
±1.5 dB	3.5 to 7.5 GHz
±3.5 dB	7.4 to 15.4 GHz
±4.0 dB	15.4 to 23.3 GHz
±4.0 dB	23 to 26.5 GHz

Additional uncertainty due to band switching: ± 0.5 dB

Frequency response referenced to CAL signal (10 dB input atten) ± 5 dB (100 Hz to 26.5 GHz)

IF gain uncertainty: After automatic calibration
< ± 0.5 dB (0 to –50 dBm), < ± 0.7 dB (0 to –80 dBm)

Scale fidelity: After automatic calibration

Log ± 0.2 dB/1 dB, ± 1 dB/10 dB, ± 1.5 dB/90 dB

Linear ± 5% of reference level

QP mode log ± 1.0 dB/30 dB, ± 2 dB/40 dB, ± 1.0 dB/40 dB (25°C ± 10°C)

Input attenuator switching accuracy:

20 to 70 dB settings referenced to 10 dB

±1.1 dB/10 dB step	2.0 dB max.	0 to 12.4 GHz
±1.3 dB/10 dB step	2.5 dB max.	12.4 to 18 GHz
±1.8 dB/10 dB step	3.5 dB max.	18 to 26.5 GHz

Resolution bandwidth switching uncertainty:
(At reference BW 300 kHz, after automatic calibration)
≤ ± 0.3 dB 100 Hz to 3 MHz
≤ ± 1dB 30 Hz
≤ ± 1.5 dB 10 to 100 Hz (digital IF)
Pulse digitization uncertainty: (Pulse response mode PRF > 700/ sweep time) Peak to Peak
Log 1.2 dB (RBW ≤ 1 MHz), 3 dB (RBW: 3 MHz)
Linear 4% of ref level (RBW ≤ 1 MHz), 12% of ref level (RBW: 3 MHz)

Sweep

Sweep time:
Zero Span 50 µs to 1000s and manual sweep
Span ≥ 200 Hz 20 ms to 1000s and manual sweep
Accuracy: ± 3%
Sweep trigger: Free run, line, single, video, TV-H, TV-V, external

Demodulation

Spectrum demod:
Modulation type AM and FM
Audio output Speaker and phone jack with volume control
Marker pause time 100 ms to 1000 s

Inputs/Outputs

RF Input:
Connector type N type female (adaptable to SMA type)
Impedance 50Ω (nominal)
VSWR (input atten ≥ 10 dB, at set frequency)
< 1.5 : 1 for ≤ 3.6 GHz (nominal)
< 2.5 : 1 for > 3.6 GHz (nominal)
LO emission level (average):
<–80 dBm (typical) 10 dB input atten, 0 to 26.5 GHz
Video output:
Connector BNC female, rear panel
Impedance (AC coupled) 75Ω (nominal)
Amplitude Approx. 1 V_{p-p} (Composite video signal), 75Ω termination
External trigger input:
Connector BNC female, rear panel
Impedance 10 k Ω (nominal), DC coupled
Trigger level TTL level
Gate input:
Connector BNC female, rear panel
Impedance 10 k Ω (nominal)
Sweep stop TTL level LOW
Sweep TTL level HIGH
Probe power: 4 pin connector front panel
Voltage +15V, –15V
Current 150 mA max, each
Sound output: (Demodulated audio)
Connector Subminiature Monophonic jack, front panel
Output power 0.2 watt, 8 Ω (nominal)
GPIB interface: A standardly provided GPIB function enables remote operation and data input/output.
Connector: IEEE-488 bus Connector rear panel
Direct plotter output:
Connector Uses GPIB interface
Displays output of directly connected plotter on CRT display

Delayed Sweep Specifications

Trigger signal source: External trigger, VIDEO trigger, TV–V trigger (rising/falling slope can be selected)
Delay time: 200 ns to 1.5 s with a resolution of 100 ns
Delayed sweep time: 50 µs to 1000 s (the resolution is the same as that set in the sweep time.)

Gated Sweep Specifications

Trigger signal source:
Frequency domain analysis
External trigger input (TTL level)
Gate input (TTL level)
IF DET trigger
Trigger level variable at IF DET monitor
Span 7 MHz max.
Usable input pulse width 100 µs min.
Through or lowpass filter selectable
Time domain analysis
External trigger input (TTL level)
Gate input (TTL level)
IF DET trigger
Trigger level variable at IF DET monitor
Usable input pulse width 100 µs min.
Through or lowpass filter selectable
Gate position: 300 ns to 100 ms with resolution of 100 ns
Gate width: 1 µs to 1.5 s with a resolution of 100 ns

Tracking Generator (R3371A)

Frequency range: 100 kHz to 3.6 GHz
Output level: –3 to –30 dBm in 0.1 dB steps
Output level flatness: ± 3.0 dB (100 kHz to 3.6 GHz)
Output level accuracy: ± 0.5 dB (25 MHz, –10 dBm output, 25°C ± 10°C)
Vernier accuracy: ± 0.5 dB (25 MHz, –10 dBm output, 25°C ± 10°C)
Output spurious:
Harmonic –15 dBc max.
Non–harmonic –25 dBc max. (with 3 dBm output)
Dynamic range: –110 dBm (1 MHz to 3 GHz)
–100 dBm (3 to 3.6 GHz)
Power sweep range: 30 dB (0.1 dB steps)

General Specifications

Environment temperature:
Operating temperature 0 to 50°C
Storage temperature –20 to +60°C
Humidity RH 85% max.
Power supply:
Automatically selects between 100 VAC and 220 VAC
100 VAC
Voltage 90 to 132V
Power consumption Max. 400 VA
Frequency 48 to 440 Hz
220 VAC
Voltage 198 to 250V
Power consumption Max. 400 VA
Frequency 48 to 66 Hz
Mass: 22 kg (nominal, excluding options, front cover and accessories)
Dimensions: 177 (H) × 353 (W) × 450 (D) mm (without handle, feet and front cover)

Accessories

Product	Model	Remarks
Power cable	**A01412**	
Input cable	**MC-61**	Connector UG-88/U
Input cable	**MI-09**	Connector 3DW-P2
Converter adaptor	**JUG-201A-U**	N-BNC converter
IC memory card	**A09505**	One card (32 K bytes)
Front cover		

Options

Option 07: Interface for R3553 Preselector
Option 10: Level calibration
Option 16: External mixer (26.5 to 40 GHz)
Option 17: External mixer (40 to 60 GHz)
Option 21: 5×10^{-9}/day crystal