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 communications. 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.

- High spectral purity
- 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.

High spectral 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.
Spectrum Analyzers

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.

- **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.

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- **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.

- **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.

**Selection Guide**

<table>
<thead>
<tr>
<th></th>
<th>R3271A</th>
<th>R3371A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured frequency range</td>
<td>100 Hz to 52.5 GHz</td>
<td></td>
</tr>
<tr>
<td>Tracking generator</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Preselector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External mix connector</td>
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</tr>
</tbody>
</table>

-3 internal preselector from 500 Hz
## Spectrum Analyzers

### 100 Hz to 26.5 GHz (60 GHz)

#### Specifications

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

**Frequency Band**

<table>
<thead>
<tr>
<th>R3271A/3371A</th>
<th>In Band Flatness (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hz to 3.6 GHz</td>
<td>±3% (span &gt; 2 MHz), ±5% (span ≤ 2 MHz)</td>
</tr>
<tr>
<td>3.5 to 7.5 GHz</td>
<td>±5% (span &gt; 2 MHz), ±3% (span &gt; 2 MHz)</td>
</tr>
<tr>
<td>7.4 to 15.4 GHz</td>
<td>±5% (span &gt; 2 MHz), ±3% (span &gt; 2 MHz)</td>
</tr>
<tr>
<td>15.2 to 23.3 GHz</td>
<td>±5% (span &gt; 2 MHz), ±3% (span &gt; 2 MHz)</td>
</tr>
<tr>
<td>23 to 26.5 GHz</td>
<td>±5% (span &gt; 2 MHz), ±3% (span &gt; 2 MHz)</td>
</tr>
</tbody>
</table>

**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 > 2 MHz), ±5% (span ≤ 2 MHz)

**Marker Frequency Counter:**
- Accuracy: ±0.1% (50 kHz < span ≤ 2 MHz)
- ±5% (2 MHz < span ≤ 20 MHz)
- ±10% (20 MHz < span ≤ 1 GHz)
- ±15% (1 GHz < span ≤ 3 GHz)
- ±20% (3 GHz < span ≤ 10 GHz)

**Resolution Bandwidth (3dB):**
- 1 Hz to 3 MHz: ±100 kHz to ±100 kHz
- 3 MHz to 10 MHz: ±100 kHz to ±2 MHz
- 10 MHz to 20 MHz: ±100 kHz to ±4 MHz
- 20 MHz to 50 MHz: ±100 kHz to ±8 MHz
- 50 MHz to 100 MHz: ±100 kHz to ±16 MHz

**Marker Frequency Range:**
- 1 Hz to 1 kHz: ±100 MHz
- 1 kHz to 3 MHz: ±300 MHz
- 3 MHz to 10 MHz: ±600 MHz
- 10 MHz to 20 MHz: ±1 GHz
- 20 MHz to 50 MHz: ±2 GHz
- 50 MHz to 100 MHz: ±4 GHz
- 100 MHz to 200 MHz: ±8 GHz
- 200 MHz to 1 GHz: ±16 GHz
- 1 GHz to 2 GHz: ±32 GHz
- 2 GHz to 5 MHz: ±64 GHz
- 5 MHz to 10 MHz: ±128 GHz
- 10 MHz to 20 MHz: ±256 GHz
- 20 MHz to 50 MHz: ±512 GHz
- 50 MHz to 100 MHz: ±1024 GHz
- 100 MHz to 200 MHz: ±2048 GHz
- 200 MHz to 1 GHz: ±4096 GHz

**Spurious Response:**
- Second harmonic distortion

**Amplitude Accuracy**
- In band flatness (10 dB input attenu)

### Dynamic Range

**Maximum Dynamic Range:**
- 1 dB gain compression to noise level

<table>
<thead>
<tr>
<th>Frequency range</th>
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<tbody>
<tr>
<td>1 MHz to 3 MHz</td>
<td>≤50 dB</td>
</tr>
<tr>
<td>3 MHz to 10 MHz</td>
<td>≤40 dB</td>
</tr>
<tr>
<td>10 MHz to 20 MHz</td>
<td>≤30 dB</td>
</tr>
<tr>
<td>20 MHz to 50 MHz</td>
<td>≤20 dB</td>
</tr>
<tr>
<td>50 MHz to 100 MHz</td>
<td>≤15 dB</td>
</tr>
</tbody>
</table>

**Displayed Average Noise Level:**
- 10 Hz RBW (digital IF), 0 dB input attenu, 20 times avg.

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</tr>
<tr>
<td>20 MHz to 50 MHz</td>
<td>≤20 dB</td>
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</table>

**1 dB Gain Compression:**
- ≤10 MHz
- ≤7.5 MHz

**Residual Response:**
- (no input signal, input attenu 0 dB, 50 Ω termination)
- ≤100 dBm (1 MHz to 3.6 GHz)
- ≤90 dBm (100 kHz to 26.5 GHz)

### Additional Uncertainty due to Band Switching
- ±0.5 dB

**Frequency Response:**
- In band flatness (10 dB input attenu)

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<tr>
<td>20 MHz to 50 MHz</td>
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</table>

**Gain Uncertainty:**
- After automatic calibration
- ±0.5 dB from ±0.5 dB to ±0.5 dB
- ±1.5 dB from ±1.5 dB to ±1.5 dB
- ±3.5 dB from ±3.5 dB to ±3.5 dB
- ±5.5 dB from ±5.5 dB to ±5.5 dB

**Scale Fidelity:**
- After automatic calibration
- ±0.2 dB/1 dB, ±1 dB/10 dB, ±1.5 dB/90 dB
- ±0.5 dB/20 dB, ±1.5 dB/90 dB

**Input Attenuator Switching Accuracy:**
- 20 to 70 dB settings referenced to 10 dB

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>±1.1 dB/10 dB step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 dB to 10 dB</td>
<td>2.0 dB max.</td>
</tr>
<tr>
<td>1.1 dB/10 dB step</td>
<td>±0.2 dB/10 dB</td>
</tr>
<tr>
<td>±1.1 dB/10 dB step</td>
<td>10 dB max.</td>
</tr>
</tbody>
</table>
Resolution bandwidth switching uncertainty:
- At reference BW 300 kHz, after automatic calibration:
  - ≤ ±0.3 dB 100 Hz to 3 MHz
  - ≤ ±1 dB 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 (BWB ≤ 1 MHz), 3 dB (BWB: 3 MHz)
- Linear 4% of ref level (BWB ≥ 1 MHz), 12% of ref level (BWB: 3 MHz)

Sweep
- Sweep time:
  - Zero Span: 50 μs to 1000s and manual sweep
  - Span: 2.000 Hz 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

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 Vp-p (Composite video signal), 75Ω (nominal)
- Termination: Linear, Log

External trigger input:
- Connector: BNC female, rear panel
- Impedance: 10 kΩ (nominal), DC coupled
- Trigger level TTL level
- Gate time: 50 μs to 1.5 ms with a resolution of 100 ns
- 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: Sub miniature Monophonic jack, front panel
- Output power: 0.2 watt, 8Ω (nominal)
- GPIB Interface: A standardly provided GPIB function enables remote operation and data input/output.
- Connector: IEEE-488 bus Connector rear panel
- Direct 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: 100 ns to 1000s 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:
  - Non-harmonic: –25 dBc max. (with 3 dBm output)
- Dynamic range: –110 dBm (1 MHz to 3 GHz)
- Input:
  - 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 132 V
    - Power consumption Max. 400 VA
    - Frequency 48 to 440 Hz
    - 220 VAC
    - Voltage: 198 to 250 V
    - 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

<table>
<thead>
<tr>
<th>Product</th>
<th>Model</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power cable</td>
<td>AE0112</td>
<td></td>
</tr>
<tr>
<td>Input cable</td>
<td>MG-81</td>
<td>Connector DB plug</td>
</tr>
<tr>
<td>Input cable</td>
<td>MG-95</td>
<td>Connector BNC-P2</td>
</tr>
<tr>
<td>Converter adapter</td>
<td>AE0321A/H</td>
<td>B-BNC converter</td>
</tr>
<tr>
<td>IC memory card</td>
<td>AE0556</td>
<td>32K bit (8 K Bytes)</td>
</tr>
<tr>
<td>Front cover</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 66 GHz)
- Option 21: 5 × 10⁻⁹/°day crystal