Spectrum Analyzers

Measurement For Digital Mobile Communications

R3465/3463

- For PHS, PDC and NADC Standards (GSM/DCS1800/DCS1900/DECT/CDMA Measurement Optional)
- Dual Mode Analysis
  - Spectrum Analyzer Mode
  - Digital Transmission Tester Mode
- Built-In Digital Modulation Analysis Function
- Menu Operation
  Automatically Set Standard Parameters, STD Mode and Measurement Function Keys
- Compact, Lightweight (17 kg), 6.5 Inch TFT Color LCD
- 2 Slots Memory Card Drive

R3465/3463 Modulation Spectrum Analyzers

Recently, digital mobile communication systems have been the focus of much attention. The R3465/3463 are new modulation spectrum analyzers for testing these new communication systems. In addition to the functions offered by conventional spectrum analyzers, the R3465/3463 have functions for analyzing digital modulated signals such as modulation accuracy and transmission speed. The units have an easy-to-use ‘one key solutions’ design that anyone can use. There are independent keys for STD mode which automatically sets PHS, PDC and NADC standard parameters and OBW, ACP and harmonic distortion measurement.

DDS (Direct Digital Synthesizer) technology enables the R3465/3463’s excellent basic specifications to fit into a compact size 17 kg. These specifications include a frequency range of 9 kHz to 8 GHz (R3465) or 9 kHz to 3 GHz (R3463), highly stable narrow band sweep and high–speed measuring made possible by the newly–developed high speed settling synthesizer.

The R3465/3463 provide total support for digital mobile communication equipment in applications ranging from radio systems development to production line adjustment and testing.

Automatic Setting of Standard Parameters
The cumbersome parameter settings required for measuring digital radio system standards such as PHS, PDC and NADC (GSM, DCS1800, DCS1900, DECT and CDMA optional), are set automatically for each measurement item. See the options table for each standard measurement.

Dual Mode Analysis
As well as CW mode, for conventional spectrum analysis, the R3465/3463 have a TRANSIENT mode for digital transmission analysis of modulation accuracy and transmission speed. The unit also employ the FAST function, a newly–developed measuring algorithm which greatly reduces the measurement time.

Menu Operation
The R3465/3463 have a ‘one key solutions’ design for simple operation. Basic measurement and analysis functions can be easily started by selecting the desired measurement item.

High Performance Spectrum Analyzer Functions
The R3465/3463 are high performance spectrum analyzers with ample basic functions for waveform analysis in minute detail. The newly–developed high speed settling synthesizer has greatly improved blanking time during narrow–band sweep (span ≤ 5 MHz), providing high speed measurement. The units have a frequency span accuracy of 1% or less, residual FM 3 Hz p-p or less /0.1 sec, and drift 20 Hz or less (span ≤ 5 MHz). The R3465 also enables high frequency measurements with a dynamic range of 90 dBc using a 1.7 GHz (min.) built–in preselector.
1. **Selection of Digital Radio Systems**
   The R3465/3463 can easily switch between radio systems such as PHS, PDC and NADC (CSM, DCS1800, DCS1900, DECT and CMDA optional).

2. **Selection of Measurement Items:**
   **Menu Operation**
   The operation of R3465/3463 is simple. Measurement can be simply started by selecting the desired measurement items.

3. **Executing Measurement**
   **START**
   **REPEAT**
   **SINGLE**

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**NADC Standard Measurements**

<table>
<thead>
<tr>
<th>Measured Item</th>
<th>NADC (IS-55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency stability</td>
<td>Yes</td>
</tr>
<tr>
<td>Transient transmission</td>
<td>Yes</td>
</tr>
<tr>
<td>characteristics</td>
<td>Yes</td>
</tr>
<tr>
<td>RF power output</td>
<td>Yes</td>
</tr>
<tr>
<td>Power transition</td>
<td>Yes</td>
</tr>
<tr>
<td>time</td>
<td>Yes</td>
</tr>
<tr>
<td>Carrier on state</td>
<td>Yes</td>
</tr>
<tr>
<td>Modulation accuracy</td>
<td>Yes</td>
</tr>
<tr>
<td>Adjacent channel leakage power</td>
<td>Yes</td>
</tr>
<tr>
<td>Out of band power due to</td>
<td>Yes</td>
</tr>
<tr>
<td>switching</td>
<td></td>
</tr>
<tr>
<td>Spurious emissions, conducted</td>
<td>Yes</td>
</tr>
<tr>
<td>(at antenna terminal)</td>
<td></td>
</tr>
<tr>
<td>Spurious emissions, radiated</td>
<td>Available option²</td>
</tr>
</tbody>
</table>

Notes:
*1. The gated sweep function and the trigger detector necessary for measurement are built in the R3465/3463.
*2. A wideband antenna and a standard signal generator (SG) are required.

**Modulation Accuracy/Frequency Error (Phase Tracking Method) Measurement**

High speed modulation accuracy function is provided as standard. It enables highly stable measurements.

**Constellation and Other Waveform Analysis Functions (Options 75, 76)**

Powerful support of PHS, PDC and NADC digital modulation analysis such as constellation display, EYE pattern display and demodulated data display...etc.
Spectrum Analyzers

Measurement For Digital Mobile Communications

R3465/3463

R3465/3464 Options Table

<table>
<thead>
<tr>
<th>Option</th>
<th>Measurement For Digital Mobile Communications</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDC/PHS/NADC Tx Analysis</td>
<td>Available option</td>
</tr>
<tr>
<td>PDC/PHS/NADC Constellation (option 75)</td>
<td>Available option</td>
</tr>
<tr>
<td>PDC/PHS/NADC Graphics (option 76)</td>
<td>Available option</td>
</tr>
<tr>
<td>Rx Control (for R3560, option 08)</td>
<td>Available option</td>
</tr>
<tr>
<td>GSM/DCS1800/DCS1900 Tx Analysis (options 51, 56, 58)</td>
<td>Available option</td>
</tr>
<tr>
<td>DECT Tx Analysis (options 62, 67, 58)</td>
<td>Available option</td>
</tr>
<tr>
<td>CDMA Tx Analysis (option 61)</td>
<td>Available option</td>
</tr>
<tr>
<td>FM Deviation (option 73)</td>
<td>Available option</td>
</tr>
<tr>
<td>Program Loader (option 15)</td>
<td>Available option</td>
</tr>
<tr>
<td>5 × 10^-9/Day Crystal (option 21)</td>
<td>Available option</td>
</tr>
</tbody>
</table>

GSM/DCS1800/DCS1900 Tx Analysis (Options 51, 56, 58, R3465 Only)

The GSM Option (options 51, 56, 58) provides a burst envelope function for measurement of the ON/OFF characteristics of TDMA format digital modulated signals and a burst spectrum function, enabling spectrum analysis in the burst ON interval. GMSK signal frequency error, phase error and power measurement can be done at the touch of a button.

Applicable Communication Systems

GSM, DCS1800 (PCN), DCS1900 (PCS) (MS/BTS)

Measurement Items

- Burst envelope measurement (1 burst/1 frame/Zoom mode)
- Power measurement
- Power vs time measurement
- Frequency error/Phase error measurement
- Burst spectrum measurement
- Modulation spectrum measurement
- Switching spectrum measurement
- Spurious emission intensity (in-band)

GSM Graphics Option (option 77)

Analysis Functions

- Bit frequency display
- Phase error display
- Phase error of FFT display
- Trellis display
- Demodulated data display

GSM setting screen

Modulation spectrum measurement
DECT Tx Analysis (Options 52, 57, 58, R3465 Only)

The DECT Option (options 52, 57, 58) enables burst envelope measurement and burst spectrum measurement, conforming to various physical packets at the touch of a button. The GFSK modulation analysis function also enables measurements ofTx power, power vs time and FM deviation.

- Applicable Communication Systems
  DECT: RFP (Radio fixed part)/PP (Portable part)

- Measurement Items
  - Burst envelope measurement
  - Power measurement
  - Power vs time measurement
  - FM deviation measurement
  - Emission due to modulation measurement
  - Emission due to transient measurement
  - Timing jitter measurement
  - Spurious emission measurement
  - Graphics display

CDMA Tx Analysis (Option 61)

The CDMA option (option 61) enables measurements of the CDMA transmitter characteristics including waveform quality analysis (such as RHO) and code domain power measurements as specified by IS-95/J-STD-008. US/KOREA-cellular, US/KOREA-PCS, Japan-cellular and China-cellular base and mobile stations can be covered by a single unit.

- Measurement Items
  - Burst envelope measurement
  - Gated output power measurement
  - Channel power measurement
  - ON/OFF ratio measurement
  - OBW measurement
  - Waveform quality measurement (Rho, t, others)
  - Code domain power measurement
  - Spurious emission measurement
  - Graphics display
Spectrum Analyzers

Measurement For Digital Mobile Communications

R3465/3463

Specifications

Measuring Functions:
- CW mode: Spectrum measurement, OBW, ACP, HARM measurement
- Digital modulation analysis

Frequency

Frequency range:
- 9 kHz to 8 GHz (R3465)
- 9 kHz to 3 GHz (R3463)
Built-in YIG synchronous preselector at 1.7 to 8 GHz (R3465)

Frequency reading accuracy:
(Start, stop, center frequency, marker frequency) ± (frequency read × frequency reference accuracy + span × span accuracy + 0.15 × RBW + 10 Hz)

Marker frequency counter:
Resolution: 1 Hz to 1 kHz
Accuracy (S/N ≥ 25 dB): ± (marker frequency × frequency reference accuracy + 5 Hz + 1 LSD)*
Delta counter: ± (A frequency × frequency reference accuracy + 10 Hz + 2 LSD)*
* LSD: Least significant digit

Frequency reference accuracy:
± 2 × 10⁻⁹/°(day), ± 1 × 10⁻⁷/year

Frequency stability:
Residual FM (zero span) < 20 Hz × (sweep time (minutes))

Spectral purity:
< 100 dBc/Hz (10 kHz offset)
< 110 dBc/Hz (100 kHz offset)

Frequency span:
Linear span Range: 2 kHz to 8 GHz, zero span
Accuracy: ± 4% (span > 5 MHz)
± 1% (span ≤ 5 MHz)

Resolution bandwidth (3 dB):
Range: 300 Hz to 3 MHz, 5 MHz (1, 2, 3, 10 sequence)
Accuracy: ± 20% (RBW 1 kHz to 1 MHz)
± 30% (RBW 300 Hz, 3 MHz, 5 MHz)
Selectivity: < 50 kHz (300 Hz to 5 MHz)

Video bandwidth:
Range: 1 Hz to 3 MHz, 5 MHz (1, 2, 3, 10 sequence)

Frequency sweep:
Sweep time: 20 ms to 1000 s (CW mode, spectrum measurement)
Accuracy: ± 5%
Sweep trigger: Free run, line, single, video, external
Trace speed: 10 times/sec

Gate sweep:
Gate position/resolution 1 µs to 65 ms/1 µs
Gate width/resolution 2 µs to 65 ms/1 µs
Trigger: Internal IF detection, external

Amplitude

Measurement range: ± 30 dBm to avg. display noise level
Maximal safe input:
Avg. continuous power (input ATT ≥ 10 dB): ± 30 dBm (1 W)
DC input: 0 V
Display range: 10 × 10 div
Log: ±0, 5, 1, 1.5, 0.5/div
Linear: 10% of reference range/div
Reference level range:
Log: ±0.15 dBm to ±60 dBm (0.1 dB steps)
Linear: ± 1.25 µV to 223 V (approx. 1% of full-scale steps)
Input attenuator range: 0 to 70 dB (10 dB steps)

Dynamic Range

Average display noise level:

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>Frequency band</th>
<th>Displayed average noise level</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 MHz</td>
<td>0</td>
<td>70 dBm</td>
</tr>
<tr>
<td>100 kHz</td>
<td>0</td>
<td>80 dBm</td>
</tr>
<tr>
<td>1 MHz to 3 MHz</td>
<td>0</td>
<td>(115 ± 1.55 × (RBW) dBm)</td>
</tr>
<tr>
<td>1.7 to 7 MHz</td>
<td>1</td>
<td>(115) dBm</td>
</tr>
<tr>
<td>8 MHz to 1.8 GHz</td>
<td>±</td>
<td>115 dBm</td>
</tr>
</tbody>
</table>

1 dB gain compression: 10 MHz
-5 dBm (input mixer level)

Spurious response:

Second harmonic distortion:

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>Second harmonic distortion</th>
<th>Mixer level</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 MHz to 3.5 GHz</td>
<td>±50 dBm</td>
<td>-50 dBm</td>
</tr>
<tr>
<td>1 MHz to 7.5 MHz</td>
<td>±150 dBm</td>
<td>-50 dBm</td>
</tr>
</tbody>
</table>

Third order distortion (12.5 kHz separation, 300 Hz resolution bandwidth, video bandwidth 3 Hz max.):

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>Third order distortion</th>
<th>Mixer level</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 MHz to 3.5 GHz</td>
<td>±75 dBm</td>
<td>-50 dBm</td>
</tr>
<tr>
<td>1 MHz to 7.5 MHz</td>
<td>±175 dBm</td>
<td>-50 dBm</td>
</tr>
</tbody>
</table>

Image/multiple out of band response:
10 MHz to 8 GHz < -70 dBc
Residual response (no input signal, input ATT 0 dB, 50 Ω termination)
1 MHz to 3.0 GHz < -100 dBm
300 kHz to 8 GHz < -90 dBm

Amplitude Accuracy

Frequency response (10 dB input ATT):

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>Frequency response</th>
<th>Frequency band</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 500 kHz</td>
<td>± 1.5 dB</td>
<td>0</td>
</tr>
<tr>
<td>500 kHz to 3.5 MHz</td>
<td>± 10 dB</td>
<td>0</td>
</tr>
<tr>
<td>10 MHz to 3.5 GHz</td>
<td>± 1.5 dB</td>
<td>1</td>
</tr>
<tr>
<td>6 MHz to 8 GHz</td>
<td>± 1.5 dB</td>
<td>2</td>
</tr>
</tbody>
</table>

Band switching error (calibration signal reference):
± 3 dB (9 kHz to 8.0 GHz)

Calibration signal accuracy (30 MHz):
± 0.3 dB

IP gain uncertainty (after automatic calibration, at 1 kHz to 5 MHz RBW):
0 to 50°C ± 0.3 dB
50 to 90°C ± 0.4 dB

Scale display accuracy (after automatic calibration):

<table>
<thead>
<tr>
<th>Temperature</th>
<th>± 0.5 dB</th>
<th>± 0.04 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 10°C</td>
<td>± 0.3 dB</td>
<td>± 0.03 dB</td>
</tr>
<tr>
<td>10 to 50°C</td>
<td>± 0.6 dB</td>
<td>± 0.06 dB</td>
</tr>
</tbody>
</table>

Linear
± 1% of reference level (within 8 div)
± 20% (within 8 div)

Input attenuator switching error (with 10 dB input reference, at 20 to 70 dB):
Frequency range: 9 kHz to 8.0 GHz, ± 1.1 dB/10 dB steps, maximum 2.0 dB

RBW switching error (RBW: 300 kHz reference, after automatic calibration, 3 x RBW 2 span):

<table>
<thead>
<tr>
<th>RBW</th>
<th>+2.3 dB</th>
<th>≥ 0.15 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hz to 3 MHz</td>
<td>+2.3 dB</td>
<td>≥ 0.15 dB</td>
</tr>
</tbody>
</table>

Contents
Pulse quantization error
(PRF > 500/sweep time in pulse measurement mode):
Log: 1.2 dBp-p (RBW ≤ 1 MHz)
Linear: 4% of reference level (RBW ≤ 1 MHz)
12% of reference level (RBW = 3 MHz)

Temperature:
- Operating temperature: 0 to 50°C, 85% RH max.
- Power supply: AC 100/220 V, 220 to 240 V
- Power consumption: 300 VA (max.)
- Frequency: 50/60 Hz
- Weight: 17 kg max. (R3465), 16.5 kg (R3463), (excluding options, front cover and accessories)
- External dimensions: Approx. 177 (H) x 350 (W) x 420 (D) mm (excluding handle, feet and front cover)
- Memory card drive: 2 slots, front panel
- Connector: JEIDA Ver. 4.2/PCMCIA 2.1

Digital Modulation Analysis Function Provided Standard

<table>
<thead>
<tr>
<th>ACP</th>
<th>( transient (frequency)/CW mode)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHS</td>
<td>0 to -72 dB (600 kHz offset)</td>
</tr>
<tr>
<td></td>
<td>0 to -62 dB (100 kHz offset)</td>
</tr>
<tr>
<td>PDC</td>
<td>0 to -88 dB (50 kHz offset)</td>
</tr>
<tr>
<td></td>
<td>0 to -78 dB (10 kHz offset)</td>
</tr>
<tr>
<td>NADC</td>
<td>0 to -92 dB (5 MHz offset)</td>
</tr>
</tbody>
</table>

Spurious: -20 to -65 dBc (-70 dBm or more, Transient mode)

Modulation analysis:
- Frequency error: ± 13 kHz (in PHS, PDC, NADC bands, 0 to 15 kHz)
- Reference accuracy: ± 1 kHz (in PHS, PDC, NADC bands, 0 to 15 kHz)
- Modulation accuracy: ± 0.002% ± measured value
- Transmission measurement: ± 1 ppm ± measured value

GPIB: IEEE 488 bus connector, rear panel
PS/2: D-SUB 9 pin, rear panel
P-1/O: D-SUB 25 pin, rear panel
EXT key: DIN, front panel

General Specifications

Power fuse: Converter adapter: JUG-201 A/U
Power fuse: 21806.3 (6.3 A)

Options
- Option 09 Rx Control Option (for R3560)
- Option 09 CDMA Test Source Control Option (for R3561L)
- Option 35 Program Loader Option
- Option 21 ± 10×/Day Xtal Option
- Option 53 GSM Option
- Option 52 DECT Option
- Option 56 GSM Only Option
- Option 57 DECT Only Option
- Option 58 GSM/DECT Only Option
- Option 61 CDMA Option
- Option 73 FM Deviation Measurement Option
- Option 75 Constellation Option (for PDC/PHS/NADC)
- Option 76 Graphics Option (for PDC/PHS/NADC)
- Option 77 GSM Graphics Option
- Option 85 RS Rack Mount Set
- Option 86 EIA Rack Mount Set

**Note:** When this option is mounted, functions for measuring PHS, PDC, and NADC standards are not available.

**options:**
- **GSM option includes:** GSM, DC1800, and DC1900 (PCS1900 in the U.S.)
- **DC1800 option includes:** 1900 (PCS1900 in the U.S.)

**Application Software**
- **Option 09 Rx Control Option**
- **Option 09 CDMA Test Source Control Option**
- **Option 35 Program Loader Option**
- **Option 21 ± 10×/Day Xtal Option**
- **Option 53 GSM Option**
- **Option 52 DECT Option**
- **Option 56 GSM Only Option**
- **Option 57 DECT Only Option**
- **Option 58 GSM/DECT Only Option**
- **Option 61 CDMA Option**
- **Option 73 FM Deviation Measurement Option**
- **Option 75 Constellation Option**
- **Option 76 Graphics Option**
- **Option 77 GSM Graphics Option**
- **Option 85 RS Rack Mount Set**
- **Option 86 EIA Rack Mount Set**