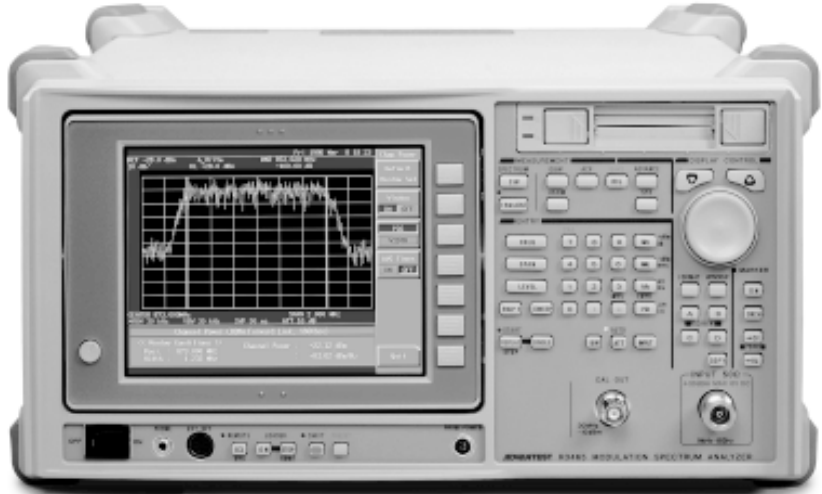


Spectrum Analyzers

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 \leq 5MHz), providing high speed measurement. The units have a frequency span accuracy of 1% or less, residual FM 3Hz_{p-p} or less /0.1 sec, and drift 20Hz or less (span \leq 5MHz). The R3465 also enables high frequency measurements with a dynamic range of 90 dBc using a 1.7 GHz (min.) built-in preselector.

1. **STD** Selection of Digital Radio Systems

The R3465/3463 can easily switch between radio systems such as PHS, PDC and NADC (GSM, DCS1800, DCS1900, DECT and CMDA optional).

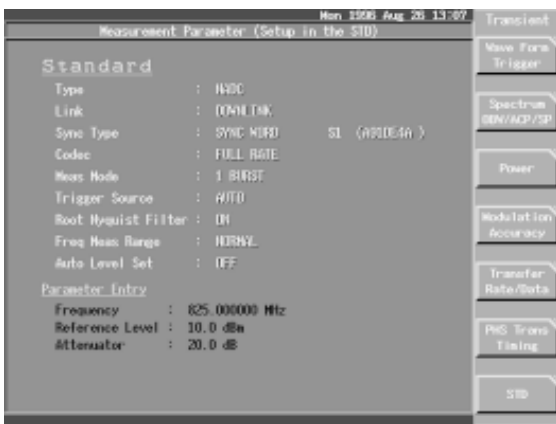


▲ NADC setting screen

2. **TRANSIENT** Selection of Measurement Items:

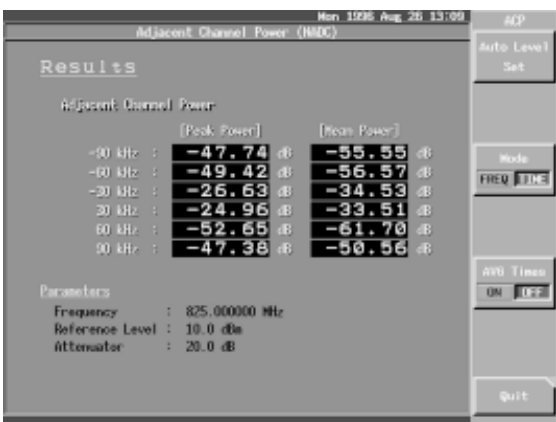
Menu Operation

The operation of R3465/3463 is simple. Measurement can be simply started by selecting the desired measurement items.



▲ TRANSIENT menu screen

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



▲ TRANSIENT ACP (NADC) measurement

■ NADC Standard Measurements

| Measured item | NADC (IS-55) |
|---|--------------------|
| Frequency stability | Yes |
| Transient transmission characteristics | Yes |
| RF power output | Yes |
| Power transition time | Yes |
| Carrier on state | Yes |
| Modulation accuracy | Yes |
| Adjacent channel leakage power | Yes*1 |
| Out of band power due to switching | Yes |
| Spurious emissions, conducted (at antenna terminal) | Yes |
| Spurious emissions, radiated | Available option*2 |

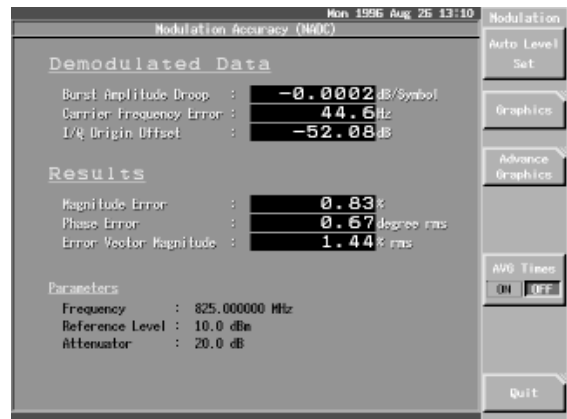
Notes:

*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.

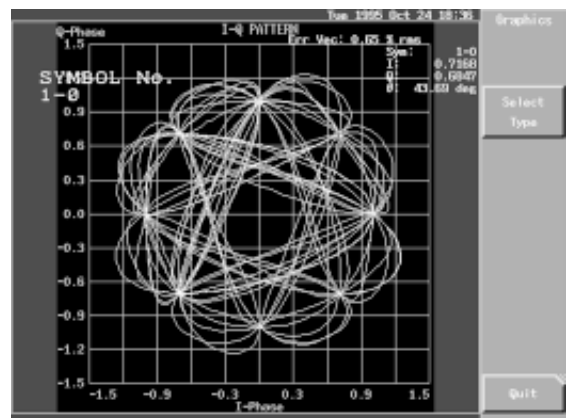
■ Modulation Accuracy/Frequency Error (Phase Tracking Method) Measurement

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

| Option | Model | R3465/R3463 | R3465+51 | R3465+52 | R3465+56 | R3465+57 | R3465+58 | R3465+61/R3463+61 | R3465+56+61 | R3465+57+61 |
|--|-------|--|------------------|------------------|------------------|----------|------------------|-------------------|------------------|------------------|
| PDC/PHS/NADC Tx Analysis | | Yes | Yes | Yes | No | No | No | Yes | No | No |
| PDC/PHS/NADC Constellation (option 75) | | Available option | Available option | Available option | No | No | No | Available option | No | No |
| PDC/PHS/NADC Graphics (option 76) | | Available option | Available option | Available option | No | No | No | Available option | No | No |
| Rx Control (for R3560, option 08) | | Available option | Available option | Available option | No | No | No | Available option | No | No |
| GSM/DCS1800/DCS1900 Tx Analysis (options 51, 56, 58) | | No | Yes | No | Yes | No | Yes | No | Yes | No |
| GSM/DCS1800/DCS1900 Graphics (option 77) | | No | Available option | No | Available option | No | Available option | No | Available option | Yes |
| DECT Tx Analysis (options 52, 57, 58) | | No | No | Yes | No | Yes | Yes | No | No | Yes |
| CDMA Tx Analysis (option 61) | | No | No | No | No | No | No | Yes | Yes | Available option |
| CDMA Test Source Control (for R3561L, Option 09) | | No | No | No | No | No | No | Available option | Available option | Available option |
| FM Deviation (option 73) | | ← Can be set for all combinations → | | | | | | | | |
| Program Loader (option 15) | | ← Can be set for all combinations → | | | | | | | | |
| $\pm 5 \times 10^{-9}$ Day Crystal (option 21) | | ← Can be set for all combinations (R3465 only) → | | | | | | | | |

OPT3465+51 GSM Addition
 OPT3465+52 DECT Addition
 OPT3465+61 CDMA Addition
 OPT3463+61 CDMA Addition
 OPT3465+56 GSM Only
 OPT3465+57 DECT Only
 OPT3465+58 GSM/DECT Only

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)

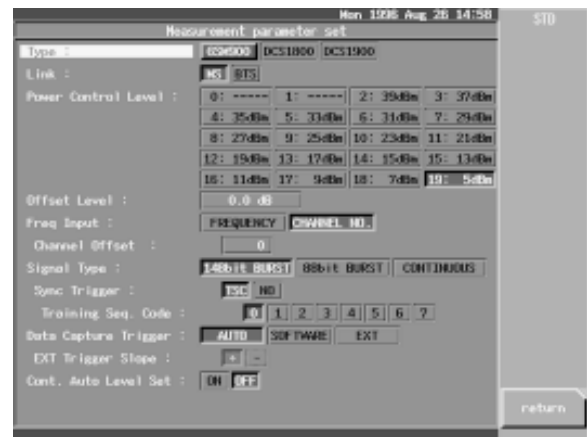
■ Measurement Items

- 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)

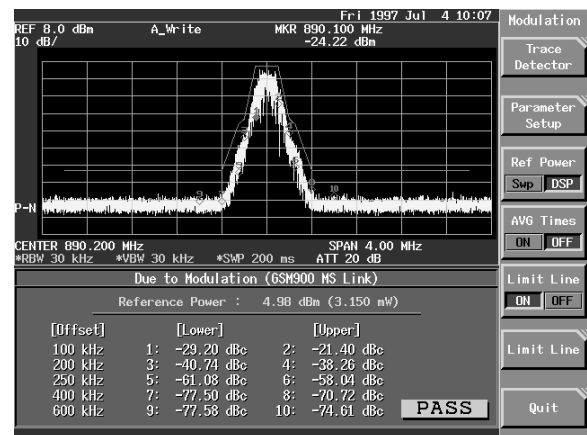
■ GSM Graphics Option (option 77)

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)

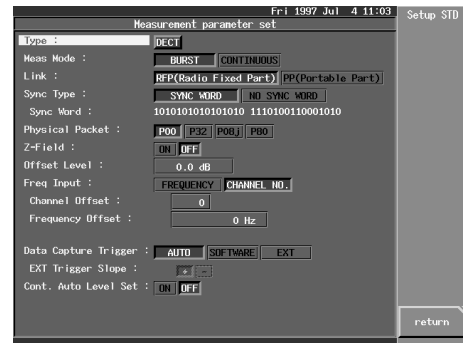
The DECT Option (options 52, 57, 58) enables burst envelope measurement and burst spectrum measurement, conforming to various physical packets at the touch of a button. The GFSK modulation analysis function also enables measurements of Tx power, power vs time and FM deviation.

■ Applicable Communication Systems

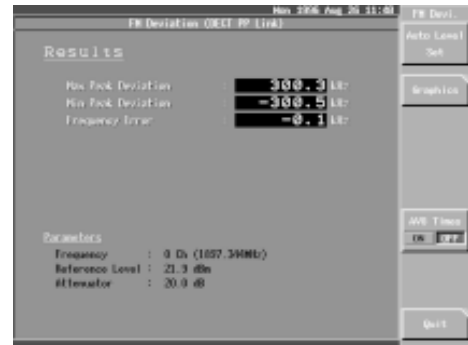
DECT: RFP (Radio fixed part)/PP (Portable part)

■ 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



▲ DECT setting screen



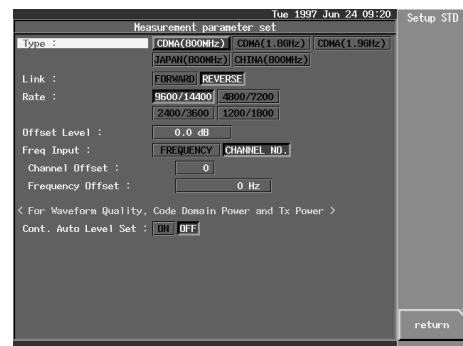
▲ DECT FM deviation measurement

CDMA Tx Analysis (Option 61)

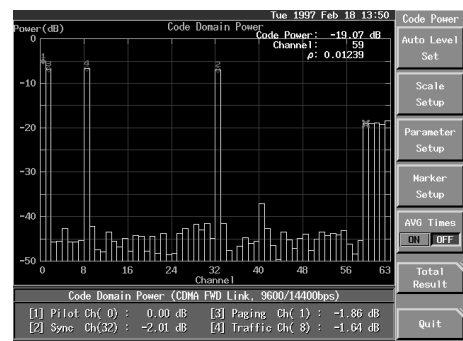
The CDMA option (option 61) enables measurements of the CDMA transmitter characteristics including waveform quality analysis (such as RHO) and code domain power measurements as specified by IS-95/J-STD-008. US/KOREA-cellular, US/KOREA-PCS, Japan-cellular and China-cellular base and mobile stations can 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, τ , others)
- Code domain power measurement
- Spurious emission measurement
- Graphics display



▲ CDMA setting screen



▲ CDMA code domain power measurement

Spectrum Analyzers

Measurement For Digital Mobile Communications

R3465/3463

Specifications

Measuring Functions:

CW mode: Spectrum measurement, OBW, ACP, HARM measurement
 Transient mode: Time domain 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) \pm (frequency read \times frequency reference accuracy + span \times span accuracy + $0.15 \times$ RBW + 10 Hz)

Marker frequency counter:

Resolution; 1 Hz to 1 kHz
 Accuracy (S/N \geq 25 dB); \pm (marker frequency \times frequency reference accuracy + 5 Hz + 1 LSD)*
 Delta counter; \pm (Δ frequency \times frequency reference accuracy + 10 Hz + 2 LSD)*

* LSD: Least significant digit

Frequency reference accuracy:

$\pm 2 \times 10^{-9}$ /day, $\pm 1 \times 10^{-7}$ /year
 $\pm 5 \times 10^{-9}$ /day (OPT. 21)

Frequency stability:

Residual FM (zero span); $< 3 \text{ Hz} \times N_p - p / 0.1 \text{ s}$
 Drift (after 1 hour warm-up); span $\leq 5 \text{ MHz}$,
 $< 20 \text{ Hz} \times$ (sweep time (minutes))

Spectral purity:

$< -100 \text{ dBc/Hz}$ (10 kHz offset)
 $< -110 \text{ dBc/Hz}$ (100 kHz offset)

Frequency span:

Linear span Range; 2 kHz to 8 GHz, zero span
 Accuracy; $\pm 4\%$ (span $> 5 \text{ MHz}$)
 $\pm 1\%$ (span $\leq 5 \text{ MHz}$)

Resolution bandwidth (3 dB):

Range; 300 Hz to 3 MHz, 5 MHz (1, 3, 10 sequence)
 Accuracy; $\pm 20\%$ (RBW 1 kHz to 1 MHz)
 $\pm 30\%$ (RBW 300 Hz, 3 MHz, 5 MHz)
 Selectivity; $< 15:1$ (300 Hz to 5 MHz)

Video bandwidth

Range; 1 Hz to 3 MHz, 5 MHz (1, 3, 10 sequence)

Frequency sweep:

Sweep time: 50 ms to 1000 s (CW mode, spectrum measurement)
 Accuracy; $\pm 5\%$
 Sweep trigger: Free run, line, single, video, external
 Trace speed: 10 times/sec

Gated 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

Maximum safe input:

Avg. continuous power (input ATT $\geq 10 \text{ dB}$): +30 dBm (1 W)
 DC input: 0 V

Display range:

Log; 10, 5, 2, 1, 0.5/div
 Linear; 10% of reference range/div

Reference level range:

Log; -105 dBm to $+60 \text{ dBm}$ (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:

(Resolution bandwidth 1 kHz, 0 dB input atten, video bandwidth 1 Hz)

| Frequency range | Frequency band | Displayed average noise level |
|------------------|----------------|-------------------------------|
| 10 kHz | 0 | -70 dBm |
| 100 kHz | 0 | -80 dBm |
| 1 MHz to 3.0 GHz | 0 | - {115 - 1.55 x f (GHz)} dBm |
| 1.7 to 7.0 GHz | 1 | -115 dBm |
| 6.9 to 8.0 GHz | 2 | -115 dBm |

1 dB gain compression:

$> 10 \text{ MHz}$
 -5 dBm (input mixer level)

Spurious response:

Second harmonic distortion;

| Frequency range | Second harmonic distortion | Mixer level |
|---------------------|----------------------------|-------------|
| 10 MHz to 3.0 GHz | $< -70 \text{ dBc}$ | -30 dBm |
| $> 1.7 \text{ GHz}$ | $< -90 \text{ dBc}$ | -10 dBm |

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

| Frequency range | Third order distortion | Mixer level |
|---------------------|------------------------|-------------|
| 10 MHz to 3.0 GHz | $< -75 \text{ dBc}$ | -30 dBm |
| $> 1.7 \text{ GHz}$ | $< -75 \text{ dBc}$ | -30 dBm |

Image/multiple out of band response;

10 MHz to 8 GHz $< -70 \text{ dBc}$

Residual response; (no input signal, input ATT 0 dB, 50 Ω termination)

1 MHz to 3.0 GHz $< -100 \text{ dBm}$

300 kHz to 8 GHz $< -90 \text{ dBm}$

Amplitude Accuracy

Frequency response (10 dB input ATT):

In-band flatness;

| Frequency range | Frequency response | Frequency band |
|-------------------|----------------------|----------------|
| 9 kHz to 3.0 GHz | $\pm 1.5 \text{ dB}$ | 0 |
| 50 MHz to 3.0 GHz | $\pm 1.0 \text{ dB}$ | 0 |
| 1.7 to 7.0 GHz | $\pm 1.5 \text{ dB}$ | 1 |
| 6.9 to 8.0 GHz | $\pm 1.5 \text{ dB}$ | 2 |

Band switching error (calibration signal reference);

$\pm 3 \text{ dB}$ (9 kHz to 8.0 GHz)

Calibration signal accuracy (30 MHz): -10 dBm $\pm 0.3 \text{ dB}$

IF gain uncertainty (after automatic calibration, at 1 kHz to 5 MHz RBW):

| | 15 to 35°C | 0 to 50°C |
|--------------|----------------------|----------------------|
| 0 to -50 dBm | $\pm 0.5 \text{ dB}$ | $\pm 0.6 \text{ dB}$ |

Scale display accuracy (after automatic calibration):

| | 15 to 35°C | 0 to 50°C |
|--------|--|---------------------------|
| Log | $\pm 0.2/1 \text{ dB}$ | $\pm 0.3/1 \text{ dB}$ |
| | $\pm 1/10 \text{ dB}$ | $\pm 1.2/10 \text{ dB}$ |
| | $\pm 1.5/80 \text{ dB}$ | $\pm 1.5/80 \text{ dB}$ |
| Linear | $\pm 15\%$ of reference level (within 8 div) | $\pm 20\%$ (within 8 div) |

Input attenuator switching error (with 10 dB reference, at 20 to 70 dB):

Frequency range: 9 kHz to 8.0 GHz, $\pm 1.1 \text{ dB}/10 \text{ dB}$ steps,
 maximum 2.0 dB

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

| RBW | 15 to 35°C | 0 to 50°C |
|-----------------|---------------------------|---------------------------|
| 300 Hz to 3 MHz | $\leq \pm 0.3 \text{ dB}$ | $\leq \pm 0.5 \text{ dB}$ |

Pulse quantization error

(PRF > 500/sweep time in pulse measurement mode):

Log: 1.2 dBp-p (RBW ≤ 1 MHz)

3 dBp-p (RBW = 3 MHz)

Linear: 4% of reference level (RBW ≤ 1 MHz)

12% of reference level (RBW = 3 MHz)

Time Domain Measurement

Amplitude resolution: 12 bits

Sweep time: 50 μs to 2 s

Trigger: Free run, single, video, IF detection, external

Hold time: 200 ns to 650 ms

Analog Demodulation

Spectrum demodulation:

Modulation type: AM and FM

Audio output: Internal speaker, earphone jack, adjustable volume

Marker pause time: 100 ms to 1000 s

Digital Modulation Analysis

Applicable modulation system: π/4QPSK (PHS, PDC, NADC)

Input range: 10 MHz to 7.5 GHz, at -30 to +30 dBm

Average power: (after calibration, automatic setting)

Measurement accuracy; (Transient mode)

± 0.8 dB (in PHS, PDC, NADC bands, 15 to 35°C)

± 1.0 dB (in PHS, PDC, NADC bands, 0 to 50°C)

OBW: Standards measurement possible

ACP: (Transient (frequency)/CW mode)

| PHS | PDC | NADC |
|---------------------------------|---------------------------------|--------------------------------|
| 0 to -57 dB (600 kHz offset) | 0 to -60 dB (50 kHz offset) | 0 to -55 dB (30 kHz offset) |
| 0 to -62 dB (900 kHz offset) | 0 to -64 dB (100 kHz offset) | 0 to -60 dB (60 kHz offset) |
| | | 0 to -60 dB (90 kHz offset) |

(NADC RBW = 1 kHz)

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

Modulation analysis:

| | PHS | PDC/NADC |
|--------------------------|--|--|
| Frequency error | | |
| Range | normal ± 13 kHz expand ± 100 kHz (± 500 kHz) | ± 1.4 kHz ± 5 kHz (± 50 kHz) |
| Accuracy | Reference accuracy × carrier frequency ± 5 Hz | Reference accuracy × carrier frequency ± 5 Hz |
| Modulation accuracy | | |
| Range | 0 to 30% | 0 to 30% |
| Accuracy | ± 1% ± measured value × ± 2% | ± 0.5% ± (measured value) × ± 2% |
| Transmission measurement | | |
| Accuracy | ± 1 ppm | ± 1 ppm |

(): Frequency error measurement only in wide mode

GPIO: IEEE-488 bus connector, rear panel

RS232: D-SUB 9 pin, rear panel

P-I/O: D-SUB 25 pin, rear panel

EXT key: DIN, front panel

General Specifications

Temperature: Operating temperature 0 to 50°C, 85% RH max.

Power supply: AC 100/220V, switched automatically

Voltage: 100 to 120 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) × 350 (W) × 420 (D) mm (excluding handle, feet and front cover)

Memory card drive: 2 slots, front panel

Connector ; JEIDA Ver. 4.2/PCMCIA 2.1

Accessories

Power cable: A01412

Input cable: MC-61

Converter adapter: JUG-201 A/U

Power fuse: 21806.3 (6.3 A)

Options

Option 08 Rx Control Option (for R3560)

Option 09 CDMA Test Source Control Option (for R3561L)

Option 15 Program Loader Option

Option 21 ±5 × 10⁻⁹/Day X'tal Option *2

Option 51 GSM Option *2,*3

Option 52 DECT Option *2

Option 56 GSM Only Option *1, *2, *3

Option 57 DECT Only Option *1, *2

Option 58 GSM/DECT Only Option *1, *2, *3

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 *2

Option 85 JIS Rack Mount Set

Option 86 EIA Rack Mount Set

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

*2: Option can only be set on R3465.

*3: GSM option includes GSM, DCS1800, and DCS1900 (PCS1900 in the U.S.)

Application Software

PR34650440-IC PHS Auto Test (Tx, manual mode)

PR34650441-IC PHS Remote Test (Tx, remote mode)

PR34650442-IC PHS Auto/Remote Test (Tx, manual/remote)

PR34650450-IC PHS TRx Auto Test (manual mode)*1

PR34650451-IC PHS TRx Remote Test (remote mode)*1

PR34650452-IC PHS TRx Auto/Remote Test (manual/remote mode)*1

PR34650120-IC PDC-MS TRx Auto Test (manual mode)*1

PR34650121-IC PDC-MS TRx Remote Test (remote mode)*1

PR34650122-IC PDC-MS TRx Auto/Remote Test (manual/remote mode)*1

PR34650710-IC CDMA-BS Tx Auto Test (manual mode)*2

PR34650711-IC CDMA-BS Tx Remote Test (remote mode)*2

PR34650712-IC CDMA-BS Tx Auto/Remote Test (manual/remote mode)*2

PR34650160-IC PDC-MS Technical Conformance Measurement Software *3

PR34650460-IC PHS Technical Conformance Measurement Software (for PS, low power CS)*3

PR34650470-IC PHS Technical Conformance Measurement Software (for high power CS)*3

PR34650770-IC CDMA-BS Technical Conformance Measurement Software*4

PR32630300-IC GSM/DCS1800-MS Software (manual mode)*5

PR32630310-IC GSM/DCS1900-BS Software (manual mode)*5

PR32630500-IC DCS1900-MS Software (manual mode)*5

PR32630510-IC DCS1900-BS Software (manual mode)*5

*1: Requires the R3560 Test Receiver. Earlier versions of the R3465/3463 firmware may not support this software. Inquire for details.

*2: Earlier versions of the R3465/3463 firmware may not support this software. Inquire for details.

*3: This software is for both manual and remote mode. The software requires additional measurement instruments and system calibration. Inquire for details.

*4: This software is for manual mode. This software requires additional measurement instruments and system calibration. Inquire for details.

*5: Requires GSM Option. Measurement range is to 3GHz. This Software can only be set on R3465.

All application software requires the R3465/3463 program loader (option 15) be installed.