ADVANTEST

OPT.01+OPT.61/62/63/64/65/66/73 (for R3264/3267/3273)
Digital Modulation Analysis Option

For Transmission Characteristics Measurement
of Current Mobile Communication Systems
to 3rd-generation Mobile Communications

R3264/3267/3273 Digital Modulation Analysis Options


ADVANTEST
R3267 SPECTRUM ANALYZER

Current Mobile Communication Systems to Next-generation Mobile Communications

Installing the digital modulation analysis option (OPT.01) and the modulation analysis software option in the R3264/3267/3273 enables measuring communication system transmission characteristics of current digital mobile communications to the third-generation mobile communications represented by W-CDMA/cdma2000. Combining with an analysis software option allows modulation analysis and Standard Item measurements of communication systems including W-CDMA (3GPP), cdma2000, PDC, PHS, IS-136, GSM/GPRS/EDGE, DECT, cdmaOne (IS-95), and Bluetooth™. It is possible for a single unit of the R3264/3267/3273 to accommodate multiple communication systems (up to three options can be installed per unit). In addition, the I/Q base band input can be selected as well as the RF input so that a variety of processing can be implemented from modulation analysis on the module level to measurement evaluation on the development/manufacture line or in the field.

* Bluetooth™ is a trademark owned by Telefonaktiebolaget LM Ericsson, Sweden.

Dual Mode Analysis

Fast transmission characteristics can be measured with the high-performance spectrum analyzer to evaluate/analyze the wide bands, high frequencies, and digital modulation signals demanded for next-generation communications.

- **Spectrum analyzer mode**
  R3264: 9 kHz to 3.5 GHz
  R3267: 100 Hz to 8 GHz
  R3273: 100 Hz to 26.5 GHz
- **Tx tester mode for mobile communication systems**

Quick and Simple Measurement

Primary parameters are easily selected on the STD setup window for both the current communication systems and the next-generation communication systems. Conditions are automatically set for Standard Item measurement that is easily conducted by simply selecting the target measurement item. In addition to the modulation accuracy and waveform quality measurement, the following Standard Items are also quickly measured; code domain power, graphic analysis, and high-stability Tx Power measurement.

Limit Test Function for Standards

The limit test function is provided for Standard Items. The measurement result display and the PASS/FAIL judgement are carried out at the same time upon starting measurement. It is also possible to perform the PASS/FAIL judgement with user-defined limit values and the measurement under user-defined conditions.

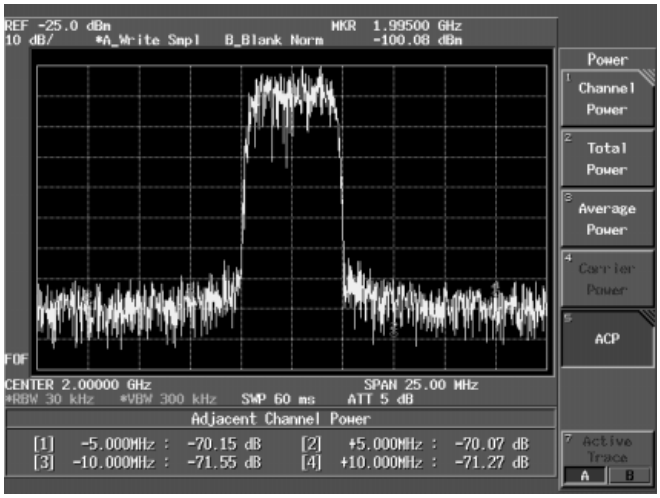
High-performance Spectrum Analyzer

Wide frequency range:	**R3264; 9 kHz to 3.5 GHz** **R3267; 100 Hz to 8 GHz** **R3273; 100 Hz to 26.5GHz**
Wide dynamic range:	**-145 dBc/Hz (2 GHz band, typ.)** **70 dBc or more** **(5 MHz offset, typ.) in ACP measurement of W-CDMA**
Average noise level:	**-154 dBm/Hz (2 GHz band)**
Input attenuator:	**5 dB-step 75 dB (R3264/3267)**
1 dB gain compression:	**0 dBm (typ. +3 dBm)**
2-signal 3rd-order distortion:	**-90 dBc or less** **(2 GHz band, R3267)**
Span accuracy:	**Within ±1%** **(typ. ±0.2%,** **compatible with all spans)**
Refresh rate:	**20 times/sec.**

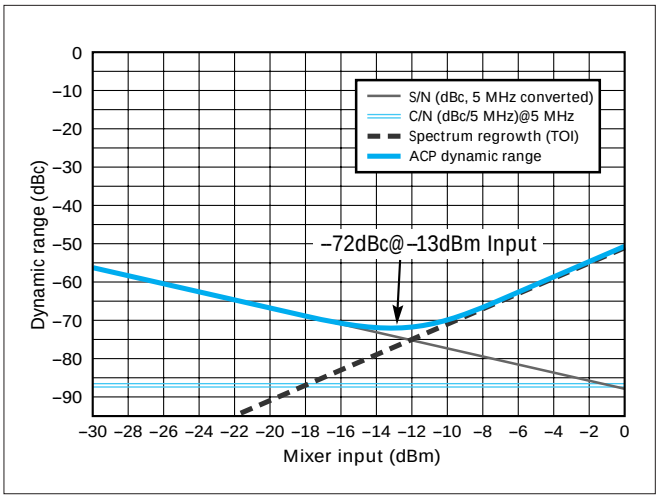
** For details, see the R3264/3267/3273 catalog.*

High Performance Spectrum Analyzer Mode

Wide Dynamic Range ACP Measurement

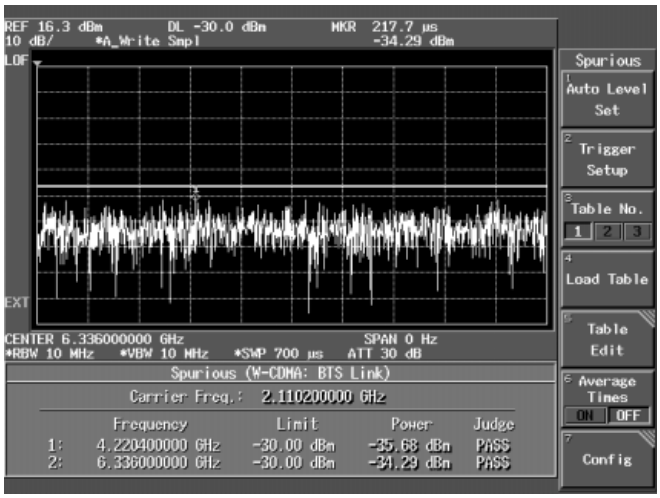


Sample of ACP measurement with 70 dBc or more in W-CDMA

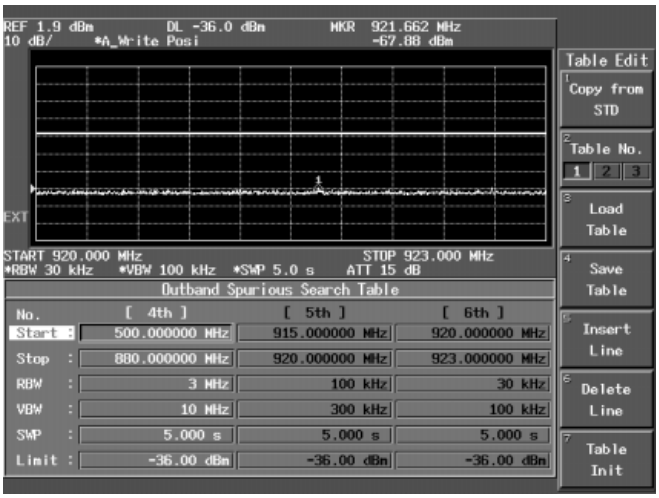


Sample of dynamic range values in W-CDMA measurement (TYP.)

Fast/Batch Measurement with the Spurious Table



Sample of fast time domain spurious measurement



Sample of frequency domain spurious measurement table settings

Digital Modulation Analysis Options

OPT.01	Digital modulation analysis option (hardware)
OPT.61	cdmaOne (IS-95) analysis software
OPT.62	W-CDMA (3GPP) analysis software
OPT.63	GSM/DECT analysis software
OPT.64	PDC/PHS/IS-136 analysis software
OPT.65	cdma2000 analysis software
OPT.66	Bluetooth analysis software
OPT.73	AMPS/JTACS/NTACS analysis software

R3264	R3267	R3273

- *OPT.61 to 66, and OPT.73 always require OPT.01.*
- *Up to five units of OPT.61/62/63/64/65/66/73 can be installed in a single unit of the R3264/3267/3273.*

Versatile Options which go with High Performance Spectrum Analyzer

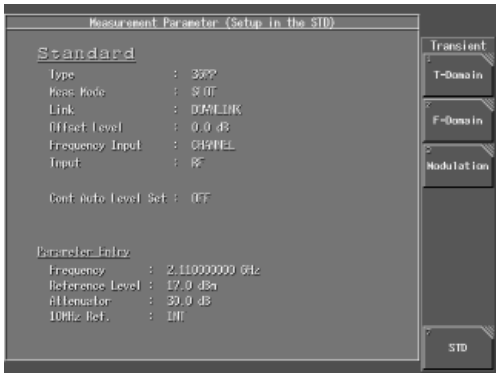
- OPT.02 Memory Card Drive (Exchangeable with Floppy Disk Drive)
- OPT.08 Rx Control (for R3560/3561/3562)
- OPT.09 CDMA Test Source Control (for R3561L and R3264/3267 only)
- OPT.10 Level Tuning (for PDC-BS)
- OPT.11 3GPP Level Calibration (Power Meter Function)
- OPT.16 External Mixer (26.5 to 40 GHz for R3273 only)
- OPT.17 External Mixer (40 to 60 GHz for R3273 only)
- OPT.21 High Stability Frequency Reference Source (±5 x 10^{-9}/day)
- OPT.22 High Stability Frequency Reference Source (±3 x 10^{-10}/day)
- OPT.23 Rubidium Frequency Reference Source (±1 x 10^{-10}/month)
- OPT.25 Reference Converter
- OPT.74 Tracking Generator

- *Probe power cannot be used when installing the OPT.22/23.*
- *OPT.25 and OPT.74 can not be installed at a same time.*
- *For details, see the R3264/3267/3273 catalog.*

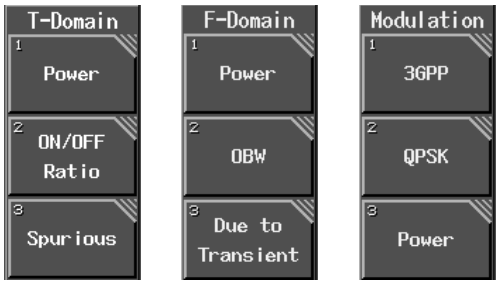
Tx Tester Mode for Mobile Communication Systems

1 TRANSIENT Select the standard item measurement mode.

Spectrum mode and Tx tester mode are toggled by a single button.

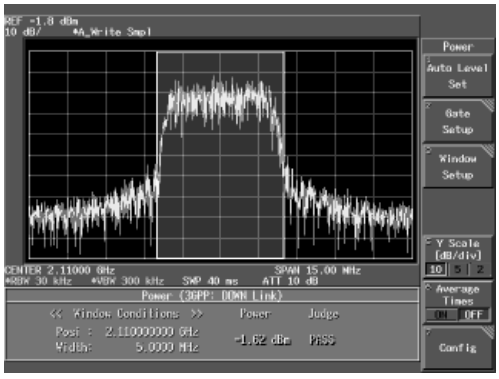


2 Select the measurement item.



Select a desired measurement item from the on-screen menu to automatically set the necessary conditions to measure the Standard Item. The limit test function is also available for the standards.

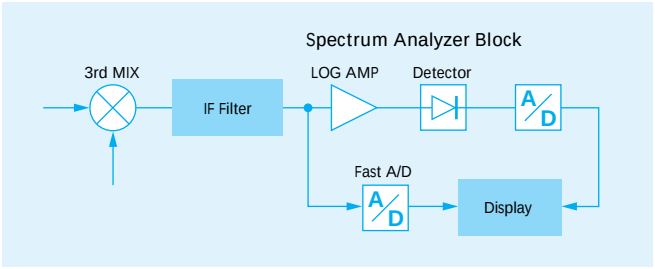
3 REPEAT SINGLE Start the measurement.

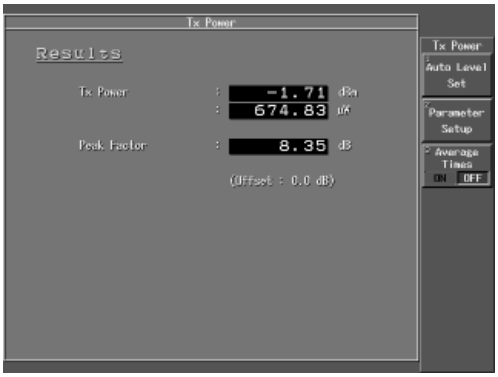


Sample of F-Domain Power measurement

High-stability Tx Power Measurement by Fast A/D

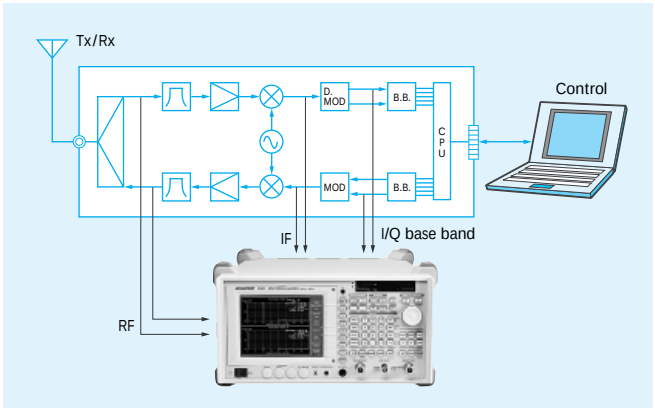
High-speed, high-stability RMS power measurement is enabled by use of the fast linear sampling A/D unit synchronous with the rate of each communication system. Sync word synchronization and peak factor measurement are also possible depending on the communication system.





Sample of Tx Power measurement

I/Q Base Band, IF, and RF Measurements Covered by a Single Unit



- **Measurement frequency range**
  Modulation analysis: 30 MHz to 3 GHz (RF input)/ I/Q base band
  Spectrum analysis: 9 kHz to 3.5 GHz, 100 Hz to 8 GHz/26.5 GHz
- **Multi-band base/mobile stations are covered by a single unit.**

RF system test and I/Q base band signal measurement in base stations and mobile stations can be conducted with a single unit of the R3264/3267/3273. Since multiple communication systems are covered at the same time, it is possible with a single unit to perform measurement of dual-mode or triple-mode machines.

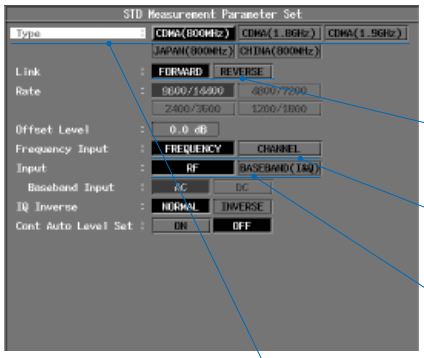
OPT.61 ····· cdmaOne Analysis Software

Addition of the cdmaOne analysis software option (OPT.61) to the digital modulation analysis option (OPT.01) enables modulation signal analysis and Standard Item measurement for cdmaOne (cellular/PCS)-BS/MS. In addition, the I/Q base band input can be selected as well as the RF input so that modulation analysis can be performed on the module level. Measurement is conducted by simply selecting the measurement item, thus enabling accommodation of a wide range of applications from development to production, maintenance and field use.

Features

- **Transmission characteristics measurement of cdmaOne (cellular/PCS)-BS/MS is covered by a single unit.**
- **cdmaOne (IS-95B) parameters are automatically set internally.**
- **Measurement is conducted by the simple operation of item selection only.**
- **Limit values for the standards linked with the power values are provided.**
- **Multi-carriers can be made effective for BS measurement during operation.**
- **Rho (ρ) and CDP measurements are possible when the EVEN SEC trigger signal is not provided.**
- **Detailed modulation signals are analyzed graphically.**

cdmaOne System Selection



Covers BS/MS test by a single unit.

Allows channel input and direct frequency input.

Accommodates I/Q base band input in addition to RF input.

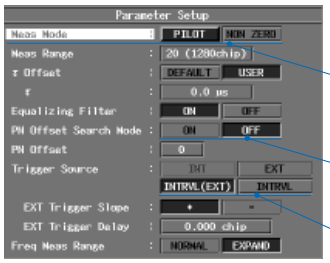
Accommodates multiple bands (US-cellular/PCS, Korea-PCS, Japan-cellular, and China-cellular) by a single unit.

Applicable Measurement Items

- **Channel (F-Domain) Power**
- **Gated Output (T-Domain) Power**
- **Tx Power (DSP method)**
- **On/Off Ratio**
- **OBW**
- **Due to Transient (Spectrum mask)**
- **Waveform Quality (ρ)**
- **Time Alignment Error (τ)**
- **Carrier Frequency Error**
- **Carrier Feedthrough**
- **Magnitude Error**
- **Phase Error**
- **Error Vector Magnitude**
- **Code Domain Power/ ρ/τ/θ (graph/list)**
- **In-Band Spurious**
- **Out-Band Spurious**
- **T-Domain Spurious**
- **Graphics Analysis**

Waveform Quality (ρ) Measurement

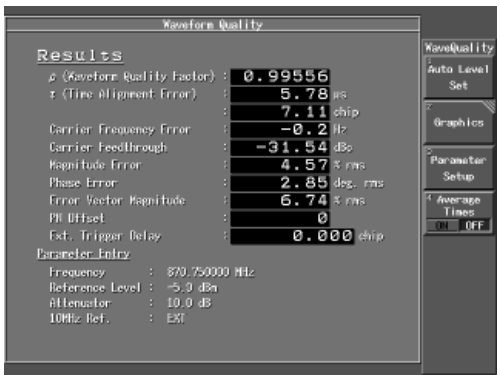
"ρ" measurement, an essential test item of the cdmaOne system, is conducted at high speed as a result of the enhanced internal algorithm.



Activates NON ZERO mode which enables Traffic signal measurement.

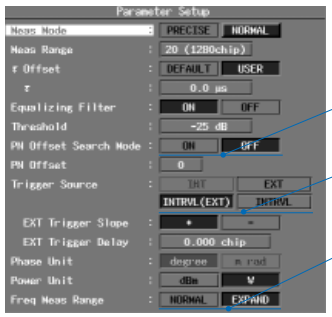
Enables measurement without EVEN SEC trigger signal and PN offset value measurement.

Selects a trigger function enabling high-speed measurement.



Code Domain Power Measurement

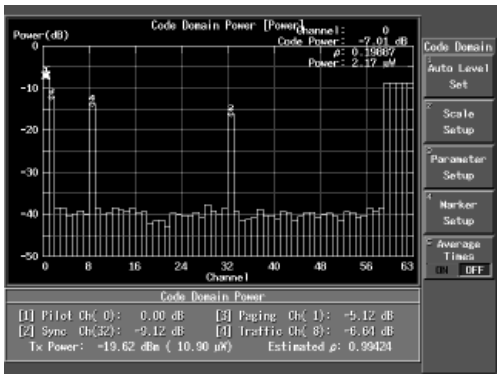
The power (absolute/relative value), waveform quality (ρ), time alignment (τ), and phase error (θ) can be measured for each code in batch with high accuracy. In addition, measurement results can be displayed in graphics or list form.



Enables measurement without EVEN SEC trigger signal and PN offset value measurement.

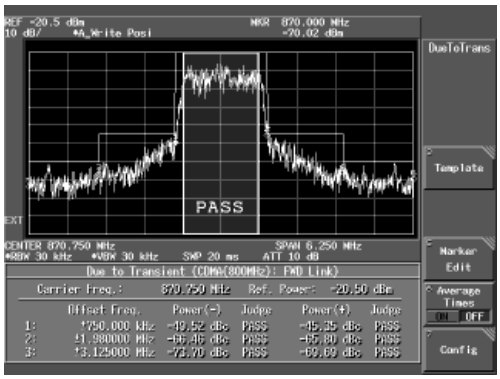
Selects a trigger function enabling high-speed measurement.

Enables measurement with multiple carriers.



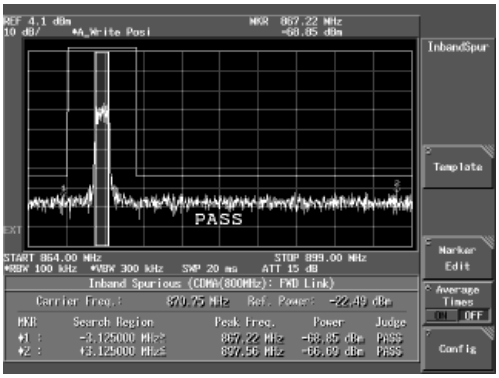
Due to Transient (Spectrum Mask)

The template linked with the power is applied to carry out PASS/FAIL judgement. In addition, measurement level values at each offset frequency are listed.



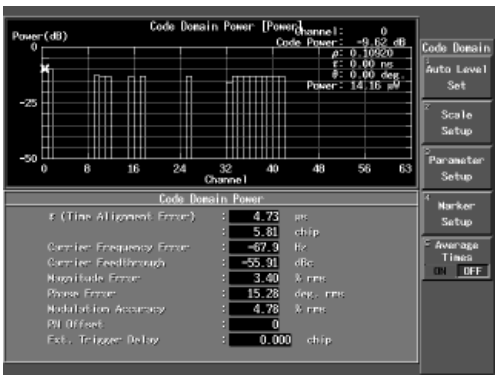
In-Band Spurious Measurement

The In-Band frequency of each system is automatically set and measured. In addition, the template linked with the power is applied to carry out PASS/FAIL judgement.



Code Domain Power (Total Result) Measurement

During CDP measurement, it is also possible to conduct estimated ρ, pilot time alignment, and carrier frequency error measurements as well as the power measurement. Effective for the BS measurement during operation.

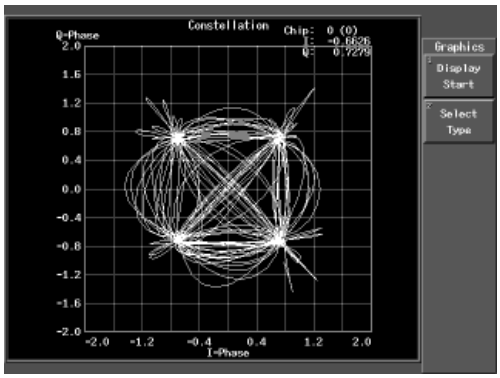


Graphics Analysis

This option is provided with the detailed graphics analysis function in addition to the Standard Item measurement function.

- Constellation
- Constellation (Line)
- Constellation (Dot)
- Constellation (Line & Dot)
- EYE Diagram
- E.V.M. vs. Chip
- Mag. Error vs. Chip
- Phase Error vs. Chip

(Measurement can be carried out with offset canceled in MS mode.)



Performance Specification

RF Input

Waveform quality measurement

Frequency range:	**30 MHz to 3.0 GHz**
Input level:	**-30 to +30 dBm (total power in ATT AUTO mode)**
Forward Link	
Waveform quality ρ:	**Accuracy; <±0.0015**
Time alignment error τ:	**Accuracy; <±300 nsec.**
Carrier frequency error:	**<± (Reference frequency accuracy x Carrier frequency + 10 Hz) (in Expand mode within Carrier frequency ±4 kHz)**
Reverse Link	
Waveform quality ρ:	**Accuracy; <±0.003**
Time alignment error τ:	**Accuracy; <±300 nsec.**
Carrier frequency error:	**<± (Reference frequency accuracy x Carrier frequency + 10 Hz) (within Carrier frequency ±4 kHz)**

Code domain power measurement
In IS-97 "Base Station Test Model" measurement

Frequency range:	**30 MHz to 3.0 GHz**
Input level:	**-30 to +30 dBm (total power in ATT AUTO mode)**
Precise Mode (measured with 64*20 chips)	
Power *i* :	**Accuracy; <±0.1 dB (however, τ *i* =0)**
Carrier frequency error:	**<± (Reference frequency accuracy x Carrier frequency + 10 Hz) (in Expand mode within Carrier frequency ±4 kHz)**
τ *i* :	**Accuracy; <±10 nsec.**
Δθ *i* :	**Accuracy; <±10 mrad**
Normal Mode (measured with 64*20 chips)	
Power *i* :	**Accuracy; <±0.1 dB (however, τ *i* =0)**
Carrier frequency error:	**<± (Reference frequency accuracy x Carrier frequency + 10 Hz) (in Expand mode within Carrier frequency ±4 kHz)**

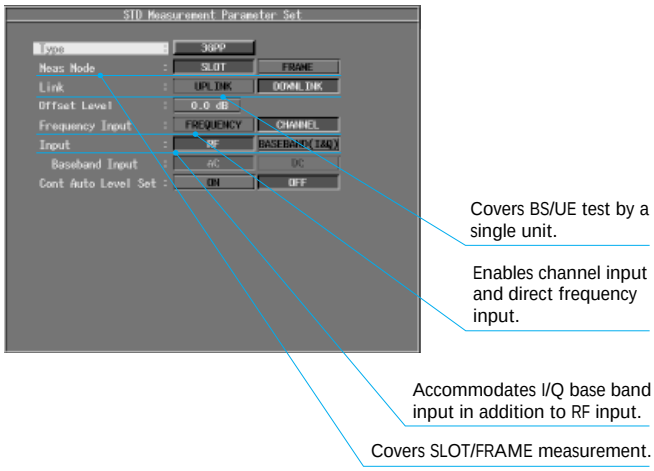
OPT.62 W-CDMA (3GPP) Analysis Software

Addition of the W-CDMA (3GPP) analysis software option (OPT.62) to the digital modulation analysis option (OPT.01) enables modulation signal analysis and Standard Item measurement for 3GPP-BS/UE. In addition, the I/Q base band input can be selected as well as the RF input so that modulation analysis can be performed on the module level. Measurement is conducted by simply selecting the measurement item, thus enabling accommodation of a wide range of applications from development to production, maintenance and field use.

Features

- **W-CDMA (3GPP) parameters are automatically set.**
- **Measurement is conducted by the simple operation of item selection only.**
- **ACP measurement with 70 dBc or more (5 MHz offset, typ.).**
- **BS/UE transmission test is covered by a single unit.**
- **Standard Items are measured including modulation analysis.**
- **Diverse Code Domain Power measurements (graph/list/multi-rate/time).**
- **Detailed modulation signals are analyzed with the graphics analysis function.**
- **High-speed measurement in QPSK mode.**

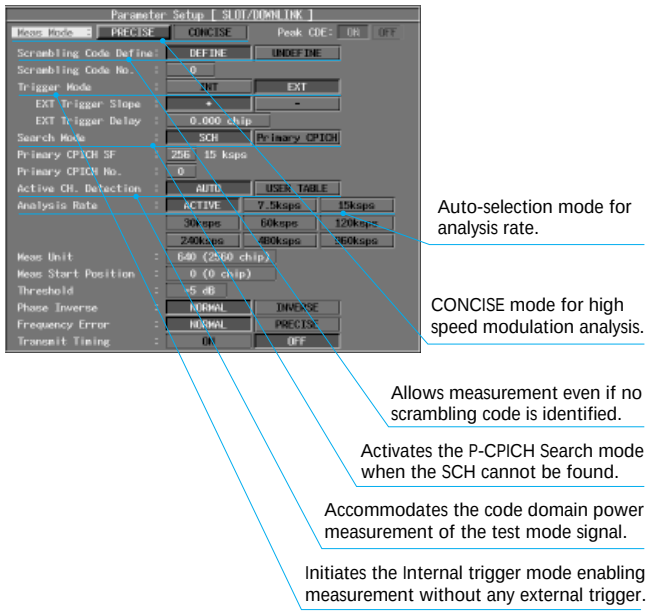
3GPP STD Parameter Setting



Applicable Measurement Items

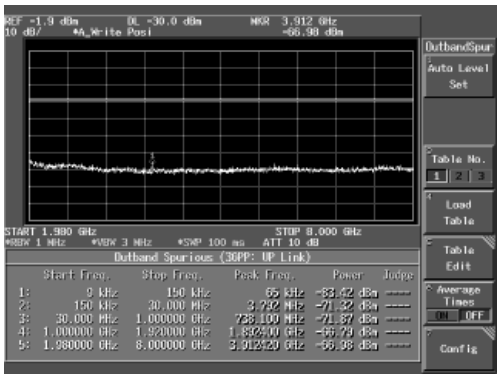
- **Power**
- **Due to Transient (ACLR)**
- **OBW**
- **Spurious**
- **Spectrum Emission Mask**
- **Waveform Quality (ρ)**
- **Time Alignment Error (τ)**
- **Carrier Frequency Error**
- **I/Q Origin offset**
- **Magnitude Error**
- **Phase Error**
- **Error Vector Magnitude**
- **Peak Code Domain Error**
- **Code Domain Power/ρ (graph/list/multi-rate)**
- **Time Code Domain Power**
- **Tx Power (DSP method)**
- **Power vs Time**
- **CCDF**
- **Graphics Analysis**

Modulation Analysis Measurement (Parameter Setup Screen BS)



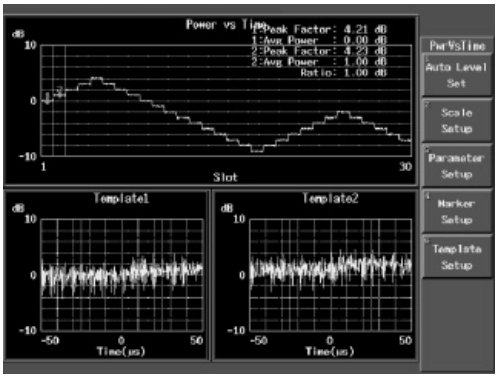
Out-Band Spurious Measurement

Realized simple operation for out-band spurious measurement of 3GPP which needs different RBW set up for each frequency band.



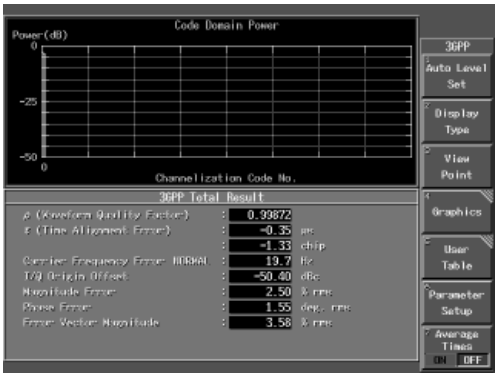
Power vs Time Measurement

Maximum 62 slots measurement possible. It is effective for Inner Loop Power Control combining with R3562 (3GPP test source).

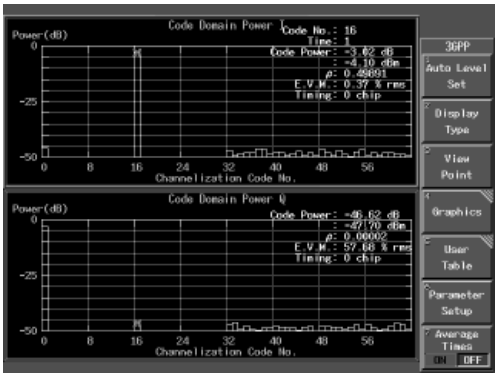


Code Domain Power Measurement (Graph)

CDP of the BS/UE signal can be measured. The list display and the multi-rate signal CDP measurement are also available.



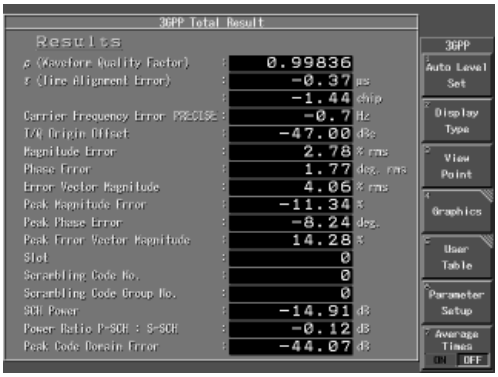
BS dual display



UE graphics display

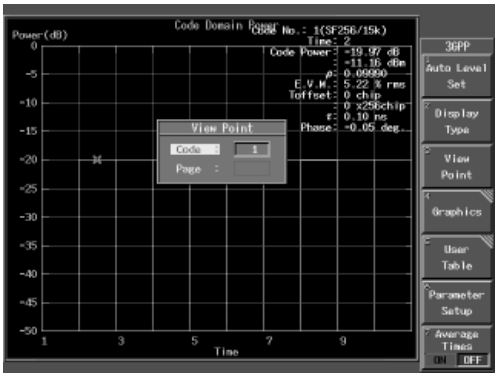
Modulation Analysis Measurement

Various items including the waveform quality (ρ), time alignment (τ), carrier frequency error, and E.V.M. can be measured at high accuracy in batch.



Time-CDP Measurement

Power measurement in I symbol units can be performed for a given channelization code. This is effective for analysis with a multi-code signal.



Graphics Analysis

This option is provided with the detailed graphics analysis function in addition to the Standard Item measurement function.

- **Constellation**
- **EYE Diagram**
- **E.V.M. vs. Chip**
- **Mag. Error vs. Chip**
- **Phase Error vs. Chip**

Performance Specification

RF Input

Frequency range:	**30 MHz to 3.0 GHz**
Input level:	**-30 to +30 dBm (total power in ATT AUTO mode)** **-40 to +30 dBm (total power in ATT MNL mode)**
Carrier frequency error accuracy:	**QPSK modulation analysis mode;** **<± (Reference accuracy x Carrier frequency + 30 Hz)** **3GPP modulation analysis mode (PRECISE mode);** **<± (Reference accuracy x Carrier frequency + 10 Hz)** **(within Carrier frequency ±1 kHz)**
Modulation accuracy:	**Residual vector error; <3%** **Measurement range; 0 to 17.5%** **Accuracy; <2%**
Chip rate:	**3.84 Mcps**
Rolloff factor:	**0.22**

QPSK modulation analysis mode

Waveform quality:	**Accuracy; <0.001**

3GPP modulation analysis mode (DOWN LINK)

Waveform quality:	**Accuracy; <0.002**
Code domain power:	**Accuracy; <±0.1 dB**

** Level ratio: Primary CPICH: P-CCPCH: SCH: DPCH x 3-ch = 1: 0.9: 0.1: 2: 2: 2*

3GPP modulation analysis mode (UP LINK)

Waveform quality:	**Accuracy; <0.001**

** Level ratio: I-ch (DPDCH):Q-ch (DPCCH) = 0.82: 0.18*

I/Q Input

Connector:	**BNC female, Rear panel**
Impedance:	**50 Ω (nominal)**
Coupling:	**DC or AC**
Amplitude range:	**0.25 to 0.9 Vp-p (DC; <±0.47 V)**
Modulation accuracy:	**Residual vector error; <3%**

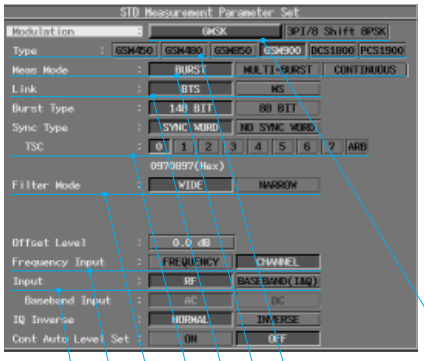
OPT.63 ····· GSM/DECT(/GPRS/EDGE) Analysis Software

Addition of the GSM/DECT analysis software option (OPT.63) to the digital modulation analysis option (OPT.01) enables modulation signal analysis and Standard Item measurement for GSM/DCS1800/PCS1900 (/GPRS/EDGE)-BTS/MS, and DECT-REP/PP. In addition, the I/Q base band input can be selected as well as the RF input so that modulation analysis can be performed on the module level. Measurement is conducted by simply selecting the measurement item, thus enabling accommodation of a wide range of applications from development to production, maintenance and field use.

Features

- **Transmission characteristics measurement of GSM/DCS1800/PCS1900(/GPRS/EDGE)-BTS/MS, and DECT-RFP/PP is covered by a single unit.**
- **GSM/DECT(/GPRS/EDGE) parameters are automatically set internally.**
- **Measurement is conducted by the simple operation of item selection only.**
- **The limit test function for the standards linked with the power values is provided.**
- **Multi-carrier/multi-burst compatibility is effective for BTS measurement during operation.**
- **High precision measurement is possible with the Sync word.**
- **Detailed modulation signal is analyzed with the graphics analysis function.**

GSM/DCS1800/PCS1900 System Selection



Allows GMSK/8PSK modulation analysis.

Accommodates multiple bands (GSM/ DCS1800/PCS1900) by a single unit.

Compatible with multiple bursts so that modulation analysis is possible with only one slot if multiple slots are ON.

Covers the BTS/MS test by a single unit.

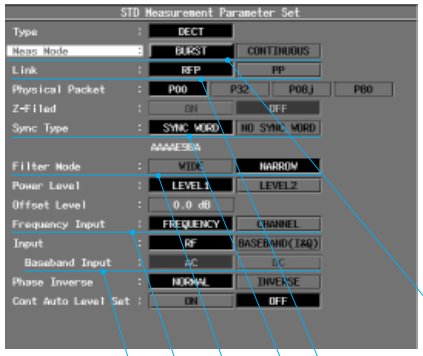
Allows high precision measurement with the Sync word.

Compatible with multiple carriers so that modulation analysis is possible with only one carrier if multiple carries are output.

Enables channel input and direct frequency input.

Accommodates the I/Q base band input in addition to RF input.

DECT System Selection



Enables the RF module test in Continuous mode as well as Burst mode.

Covers the RFP/PP test by a single unit.

Allows high precision measurement with the Sync word.

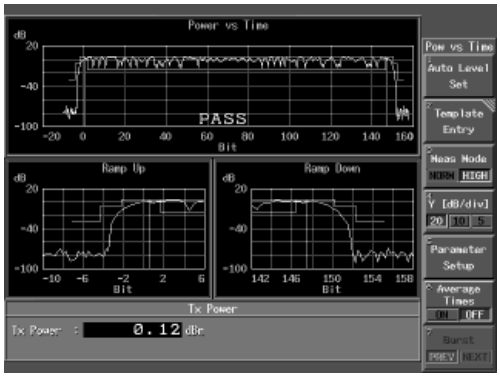
Compatible with multiple carriers so that the modulation analysis is possible with only one carrier if multiple carriers are output.

Enables channel input and direct frequency input.

Accommodates the I/Q base band input in addition to RF input.

Power vs. Time Measurement (EDGE)

Measurement is possible with the Sync word. PASS/FAIL judgement is also performed simultaneously using the limit line linked with the power value. (Templates are available for GSM/DECT/GPRS/EDGE.)



Applicable Measurement Items

- **Power (T/F Domain)**
- **On/Off Ratio**
- **Spurious (T/F Domain)**
- **Due to Transient**
- **Due to Modulation**
- **Power vs. Time**
- **Tx Power (DSP method)**
- **Frequency Error**
- **Graphics Analysis**

GSM/DCS1800/PCS1900

- **Phase Error**

EDGE

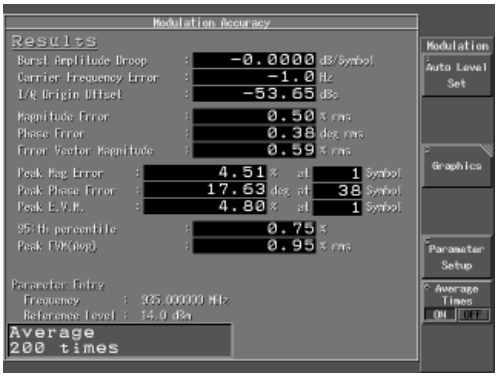
- **Modulation Accuracy (I/Q Origin Offset/ EVM/Peak EVM/95:th percentile)**

DECT

- **Frequency Deviation**
- **Timing Jitter**

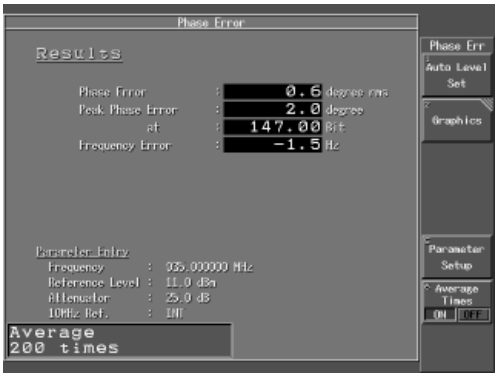
Modulation Accuracy Measurement (EDGE)

Standard Items of 8PSK modulation signals can be measured. Multi-burst measurement compatible with 200-burst AVG and GPRS is also possible.



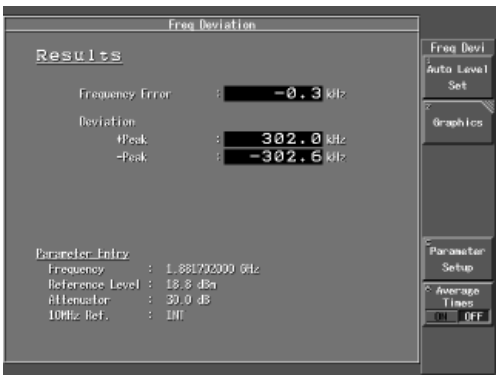
Phase Error Measurement (GSM)

Measurement is possible with the Sync word. This measurement function accommodates multiple bursts allowing GPRS signal measurement as well as BTS signal measurement during operation.



Frequency Deviation Measurement (DECT)

Maximum/minimum frequency deviations are calculated with demodulated data. Frequency error = (Max. frequency deviation + Min. frequency deviation)/2



Graphics Analysis

This option is provided with the detailed graphics analysis function in addition to the Standard Item measurement function.

GMSK Modulation

- Constellation
- EYE Diagram
- Trellis
- Demodulated Data
- Phase Error vs. Bit
- FFT of Phase Error
- Frequency vs. Bit
- Frequency EYE

8PSK Modulation

- Constellation
- EYE Diagram
- EVM vs. Symbol
- Mag. Error vs. Symbol
- Phase Error vs. Symbol
- Demodulated Data

DECT

- Frequency vs. Bit
- Frequency EYE
- Demodulated Data

Performance Specification

RF Input

GSM measurement

Applicable modulation system:	GMSK (GSM450, GSM480, GSM850, GSM900, DCS1800, PCS1900)
Frequency range:	30 MHz to 3.0 GHz
Input level:	-30 to +30 dBm
Frequency/Phase Error	
Frequency error:	Range; <±10 kHz Accuracy; <± (Reference frequency accuracy x Carrier frequency + 5 Hz)
Phase error:	Range; ≤±30° (peak) Accuracy; ≤±5° (peak), ≤±1° (rms)

EDGE measurement

Applicable modulation system:	3 π/8 shift 8 PSK (GSM450, GSM480, GSM850, GSM900, DCS1800, PCS1900) (Baseband Filter: Linearized Gaussian Filter)
Frequency range:	30 MHz to 3.0 GHz
Input level:	-30 to +30 dBm
Frequency error:	Accuracy; <± (Reference frequency accuracy x Carrier frequency + 10 Hz)
Modulation accuracy:	Residual vector error; <±1.8% (rms)

DECT measurement

Applicable modulation system:	GFSK (DECT)
Frequency range:	30 MHz to 3.0 GHz
Input level:	-30 to +30 dBm
Frequency deviation:	Accuracy; <± (Reference frequency accuracy x Carrier frequency + 10 kHz) for Max./Min. deviation
Frequency error:	Accuracy; <± (Reference frequency accuracy x Carrier frequency + 10 kHz)
Jitter measurement:	Accuracy; <±0.1 usec., the jitter between bursts (PP->PP, RFP->RFP, RFP->PP) is measured.

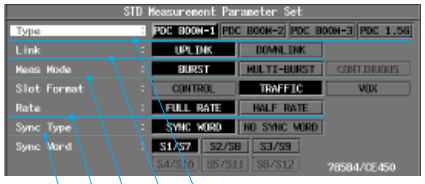
OPT.64 PDC/PHS/IS-136 Analysis Software

Addition of the PDC/PHS/IS-136 analysis software option (OPT.64) to the digital modulation analysis option (OPT.01) enables modulation signal analysis and standard item measurement for PDC/IS-136-BS/MS and PHS-CS/PS. In addition, the I/Q base band input can be selected as well as the RF input so that modulation analysis can be performed on the module level. Measurement is conducted by simply selecting the measurement item, thus enabling accommodation of a wide range of applications from development to production, maintenance and field use.

Features

- **Transmission characteristics measurement of PDC/IS-136-BS/MS and PHS-CS/PS is covered by a single unit.**
- **PDC/PHS/IS-136 parameters are automatically set internally.**
- **Measurement is conducted by the simple operation of item selection only.**
- **High precision measurement is possible with the Sync word.**
- **High speed measurement is achieved with the batch measurement function.**
- **Detailed modulation signal is analyzed with the graphics analysis function.**
- **Filter function compatibility is effective for BS measurement during operation.**

PDC System Selection



Accommodates multiple bands (PDC800M/PDC1.5 G) by a single unit.

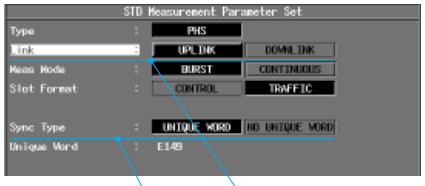
Covers BS/MS test by a single unit.

Compatible with multiple bursts so that modulation analysis is possible with only one slot if multiple slots are ON.

Also accommodates the half rate.

Allows high precision measurement with the Sync word.

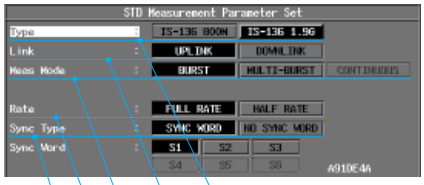
PHS System Selection



Covers CS/PS test by a single unit.

Allows high precision measurement with the unique word.

IS-136 System Selection



IS-136 System Selection Accommodates multiple bands (PDC800M/PDC1.5 G) by a single unit.

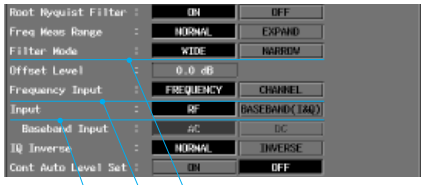
Covers BS/MS test by a single unit.

Compatible with multiple bursts so that modulation analysis is possible with only one slot if multiple slots are ON.

Also accommodates the half rate.

Allows high precision measurement with the Sync word.

PDC/PHS/IS-136 System Common Measurement Functions



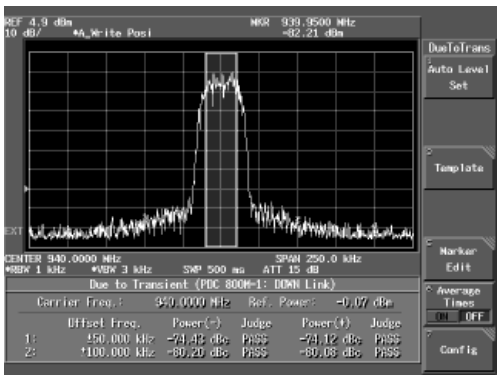
Compatible with multiple carriers so that the modulation analysis is possible with only one carrier if multiple carriers are output.

Enables channel input and direct frequency input.

Accommodates the I/Q base band input in addition to RF input.

ACP Measurement

Necessary parameters are automatically set so that multi-order ACPs can be simultaneously measured by a single-touch operation.



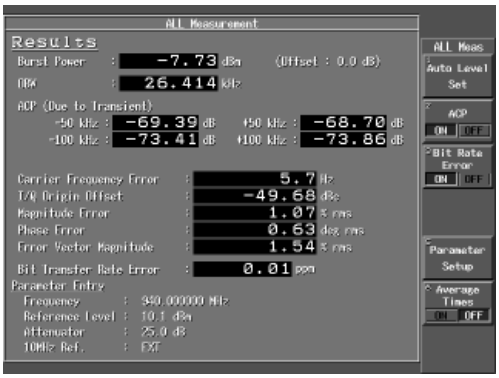
Sample of PDC measurement

Applicable Measurement Items

- **Power**
- **On/Off Ratio**
- **ACP**
- **OBW**
- **Spurious**
- **Modulation Accuracy**
- **Carrier Frequency Error**
- **I/Q Origin offset**
- **Bit Rate Error**
- **Power vs. Time**
- **Tx Power (DSP method)**
- **Graphics Analysis**

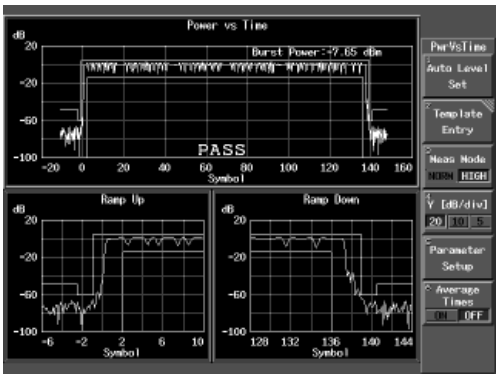
High Speed Batch Measurement

Standard Item tests for transmission characteristics can be conducted in batch by high speed measurement. In addition, measurement ON/OFF can be selected for ACP and Bit Rate Error measurements.



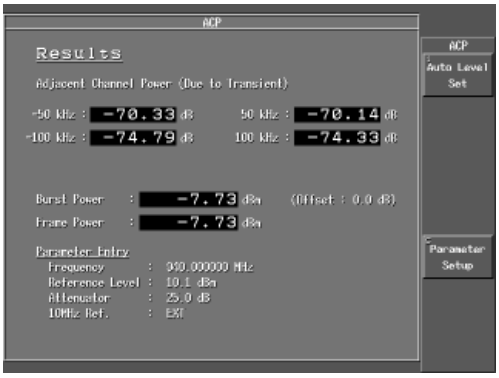
Power vs. Time Measurement

Measurement is possible with the Sync word. PASS/FAIL judgement is also performed simultaneously using the limit line linked with the power value.



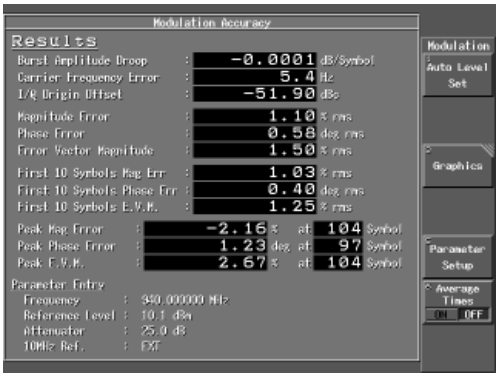
Fast ACP Measurement

In addition to the ACP measurement function in Spectrum Analyzer mode, the Fast ACP Measurement mode is provided enabling high speed measurement of the TDMA signal.



Modulation Accuracy Measurement

In addition to the normal Magnitude Error, Phase Error, and E.V.M. measurements, error measurements can be conducted with the first 10 symbols or at peak.



Graphics Analysis

This option is provided with the detailed graphics analysis function in addition to the Standard Item measurement function.

PDC/PHS/IS-136

- **Constellation**
- **Constellation (Line)**
- **Constellation (Dot)**
- **Constellation (Line & Dot)**
- **I EYE Diagram**
- **Q EYE Diagram**
- **I/Q EYE Diagram**
- **Demodulated Data**
- **E.V.M. vs. Symbol**
- **Mag. Error vs. Symbol**
- **Phase Error vs. Symbol**

Performance Specification

RF Input

PDC/IS-136 measurement

Frequency range:	**30 MHz to 3.0 GHz**
Input level:	**-30 to +30 dBm**
Frequency error:	**Accuracy; ± (Reference frequency accuracy x Carrier frequency + 5 Hz) Range; <±1.4 kHz (Normal) <±5 kHz (Expand)**
Modulation accuracy:	**Accuracy;<± (1% + Measured value x 2%)**
Transfer speed:	**<1 ppm**

PHS measurement

Frequency range:	**30 MHz to 3.0 GHz**
Input level:	**-30 to +30 dBm**
Frequency error:	**Accuracy; ± (Reference frequency accuracy x Carrier frequency + 20 Hz) Range; <±13 kHz (Normal) <±50 kHz (Expand)**
Modulation accuracy:	**Accuracy;<± (1% + Measured value x 2%)**

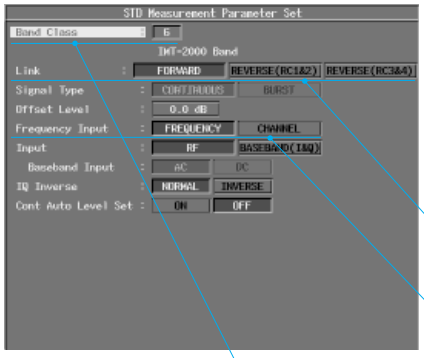
OPT.65 ····· cdma2000 Analysis Software

Addition of the cdma2000 analysis software option (OPT.65) to the digital modulation analysis option (OPT.01) enables modulation signal analysis and Standard Item measurement for cdma2000 1X system-BS/MS. In addition, the waveform quality (Rho) analysis and code domain power measurement can be performed for multiple codes/multiple rates. Measurement is conducted by simply selecting the measurement item, thus enabling accommodation of a wide range of applications from development to production, maintenance and field use.

Features

- **Transmission characteristics measurement of BS/MS of each band class is covered by a single unit.**
- **cdma2000 parameters are automatically set internally.**
- **Measurement is conducted by the simple operation of item selection only.**
- **The limit test function for the standards is provided.**
- **Multi-carrier/multi-code/multi-rate compatibility is effective for BS measurement during operation.**
- **Rho (ρ)and CDP measurements are possible when the EVEN SEC trigger signal is not provided.**
- **Detailed modulation signal is analyzed with the graphics analysis function.**

cdma2000 System Selection



Covers BS/MS test by a single unit.

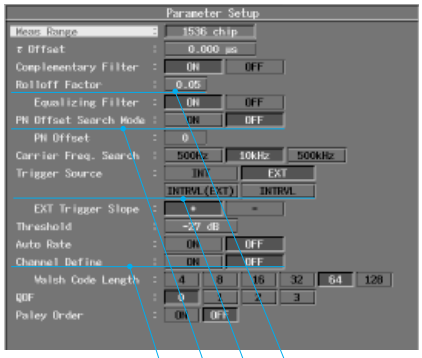
Allows channel input and direct frequency input.

Accommodates multiple bands (cellular/PCS and IMT-2000 band) by a single unit.

Applicable Measurement Items

- **Channel (F-Domain) Power**
- **Gated Output (T-Domain) Power**
- **Tx Power (DSP method)**
- **On/Off Ratio**
- **OBW**
- **Due to Transient (Spectrum mask)**
- **Waveform Quality (Multiple ρ)**
- **Time Alignment Error (τ)**
- **Carrier Frequency Error**
- **I/Q Origin Offset**
- **Magnitude Error**
- **Phase Error**
- **Error Vector Magnitude**
- **Code Domain Power/ ρ/τ/θ, CDE**
- **In-Band Spurious**
- **Out-Band Spurious**
- **T-Domain Spurious**
- **Graphics Analysis**
- **CCDF**

Modulation Analysis Measurement (Parameter Setup Screen BS)



Enables measurement with multiple carriers.

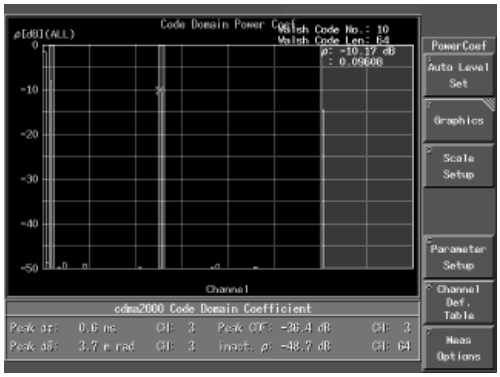
Selects a trigger function enabling high-speed measurement.

Enables measurement without EVEN SEC trigger signal and PN offset value measurement.

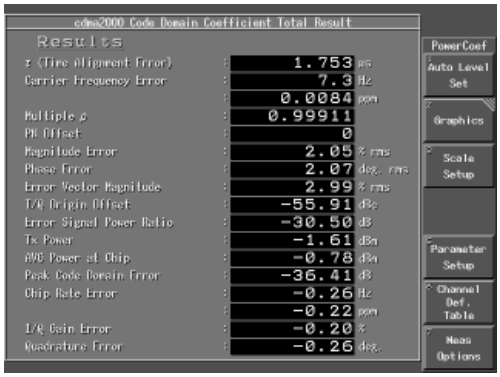
Activates the channel definition table allowing multi-code measurement.

Code Domain Power Coefficient (BS) Measurement

The power (absolute/relative value), waveform quality (ρ), time alignment (τ), and phase error (θ) can be measured for each code in batch with high accuracy. In addition, measurement results can be displayed in graphic or list form.

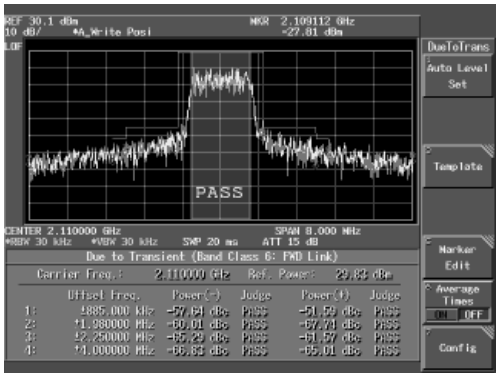


Total Result Display



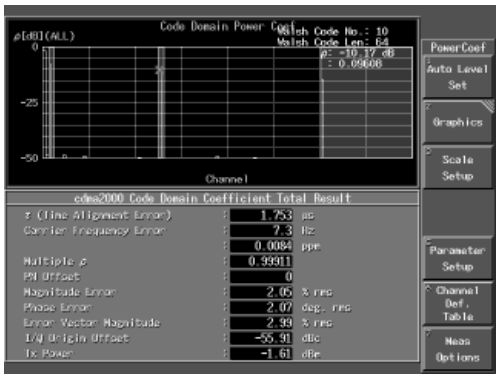
Due to Transient (Spectrum Mask)

The template linked with the power is applied to carry out PASS/FAIL judgement. In addition, measurement level values at each offset frequency are listed.



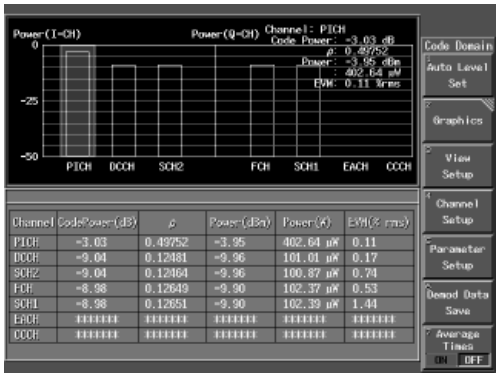
Code Domain Power (Total Result) Measurement

During CDP measurement, it is also possible to conduct multiple ρ, pilot time alignment, and carrier frequency error measurements as well as the power measurement. Effective for the BS measurement during operation.



Code Domain Power (MS) Measurement

Code Domain Power/ρ/EVM of the code-multiplexed cdma2000-MS (RC3&4) signal can be measured. In addition, demodulated data can be displayed.



Graphics Analysis

This option is provided with the detailed graphics analysis function in addition to the Standard Item measurement function.

- **Constellation**
- **Constellation (Line)**
- **Constellation (Dot)**
- **Constellation (Line & Dot)**
- **EYE Diagram**
- **E.V.M. vs. Chip**
- **Mag. Error vs. Chip**
- **Phase Error vs. Chip**

Performance Specification

RF Input

FORWARD LINK

Code domain power measurement
In IS-97 "Base Station Test Model" measurement

Frequency range:	**30 MHz to 3.0 GHz**
Input level:	**-30 to +30 dBm (total power in ATT AUTO mode)**
(Measured with 1280 chips)	
Power *i*:	**Accuracy; <±0.1 dB (however, $\Delta\tau i$ =0)**
Carrier frequency error:	**Accuracy; <± (Reference frequency accuracy x Carrier frequency + 10 Hz) (within Carrier frequency ±4 kHz, at Carrier Freq. Search 10 kHz)**
$\Delta\tau i$:	**Accuracy; <±10 nsec.**
$\Delta\theta i$:	**Accuracy; <±10 mrad**

REVERSE LINK

Code domain power measurement
In the following specified signal measurement

Reverse Traffic Channel Long Code Mask: ALL0		
Channel	**Walsh Function**	**Amplitude**
PICH	**W_0^{32}**	**-6.99 dB**
DCCH	**W_8^{16}**	**-6.99 dB**
SCH2	**W_6^{8} (M=2)**	**-6.99 dB**
FCH	**W_4^{16}**	**-6.99 dB**
SCH1	**W_2^{4} (M=4)**	**-6.99 dB**

** M: Walsh Function Repetition Factor*

Frequency range:	**30 MHz to 3.0 GHz**
Input level:	**-30 to +30 dBm (total power in ATT AUTO mode)**
Precise Mode (measured with 1536 chips)	
Power *i*:	**Accuracy; <±0.1 dB**
Carrier frequency error:	**<± (Reference frequency accuracy x Carrier frequency + 10 Hz) (in Expand mode within Carrier frequency ±4 kHz)**

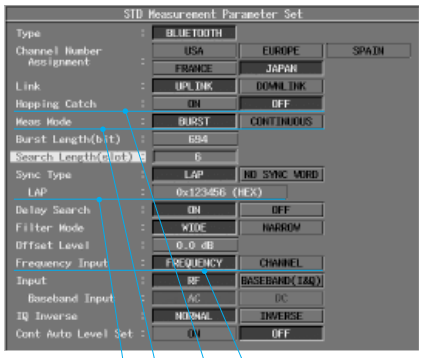
OPT.66 ····· Bluetooth Analysis Software

Addition of the Bluetooth analysis software option (OPT.66) to the digital modulation analysis option (OPT.01) enables modulation signal analysis and Standard Item measurement for Bluetooth. Measurement is conducted by simply selecting the measurement item, thus enabling accommodation of a wide range of applications from development to production.

Features

- **Transmission characteristics measurement of Bluetooth is covered by a single unit.**
- **Measurement compatibility is provided for the standards specific to Bluetooth including the carrier frequency, FM deviation, and frequency drift.**
- **Modulation analysis of the frequency hopping signal is possible.**
- **Detailed modulation signal is analyzed with the graphics analysis function.**

Measurement Condition Setup Screen



Allows channel input and direct frequency input.

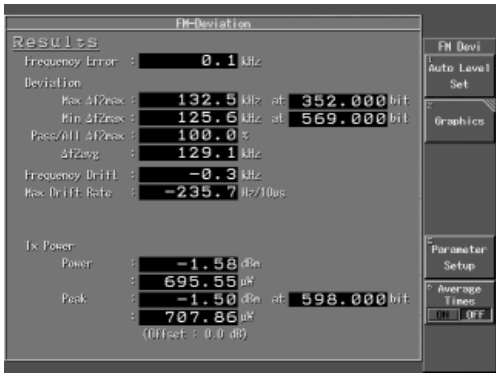
Activates the Hopping Catch function enabling the hopping signal analysis.

Provided with Continuous mode for measurement of the RF module and such.

Position of preamble start bit can be detected by LAP pattern.

Sample FM Deviation Measurement

- Frequency Error is calculated in the Preamble 4-bit section.
- Deviation is calculated in the Payload section.
- Frequency Drift is calculated in the Payload section.
- Max Drift Rate calculates the maximum frequency deviation in the Payload section.



FM Deviation Parameter Setup Screen

Allows FM deviation standard measurements corresponding to the Payload bit patterns.
- STD (0 x F0) = 11110000 pattern
- STD (0 x AA) = 10101010 pattern
- RANDOM calculates Frequency Error and FM Deviation using all sampled data.

Allows calculating FM Deviation by specifying the Payload target section.

Enables arbitrary setting the limit value for ⊿F1max/⊿F2max and displaying the PASS ratio against the limit value.

Applicable Measurement Items

- **Output Power**
- **Power Density**
- **Power Control**
- **Tx Output Spectrum Freq. Range**
- **Tx Output Spectrum 20 dB Bandwidth**
- **Adjacent Channel Power**[*1]
- **Modulation Characteristics**[*2]
- **Initial Carrier Freq. Tolerance**[*2]
- **Carrier Freq. Drift**[*2]
- **Out-of-Band Spurious**

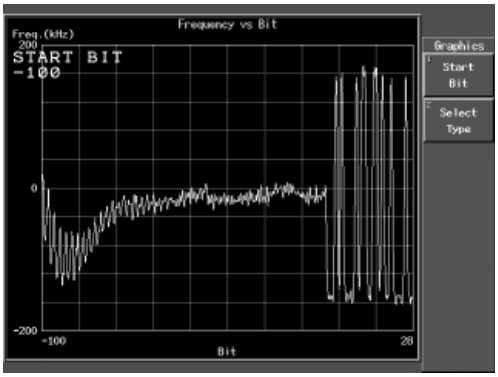
**1: [Detector Mode: Average] is not supported.*

**2: Measured with the modulation analysis function.*

Other items are measured with the Spectrum Analyzer function.

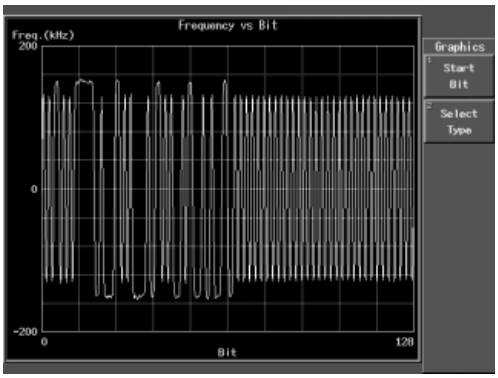
Frequency vs. Bit Graphics Screen

200 bits before and after the set sampling data length can be displayed.



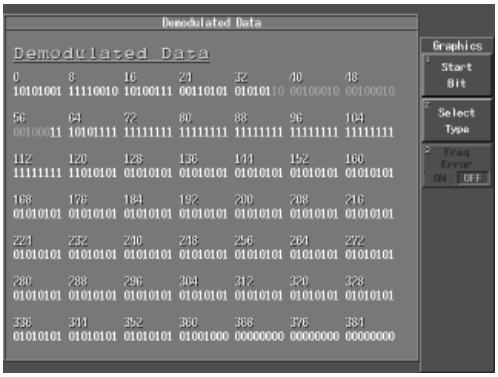
Frequency vs. Bit Graphics Screen

Example of Payload [0101] pattern measurement.



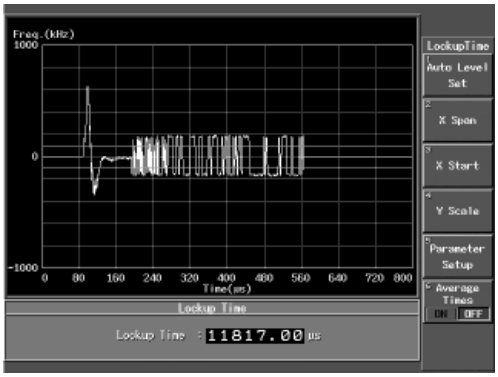
Demodulated Data Graphics Screen

Frequency deviation is converted to a value consisting of 0 and 1. In addition, the LAP locations are indicated by colors.



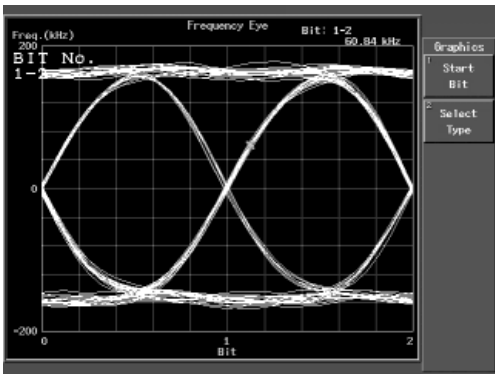
Lockup Time Graphics Screen

Sampling of 0.1 to 20 ms is possible. In addition, an arbitrary section of sampling data can be displayed by X Start and X Span.



Frequency Eye Diagram Screen

It is possible to verify the Eye opening and measure the Zero Crossing Error.



Performance Specification

RF Input

Frequency range:	**30 MHz to 3.0 GHz**
Input level:	**-10 to +30 dBm**
Frequency deviation accuracy:	**Filter Wide; <6.0 kHz** **Filter Narrow; <+10.0 kHz**
Frequency error accuracy:	**Filter Wide;** **<± (Reference frequency accuracy + 6.0 kHz)** **Filter Narrow;** **<± (Reference frequency accuracy + 10.0 kHz)**

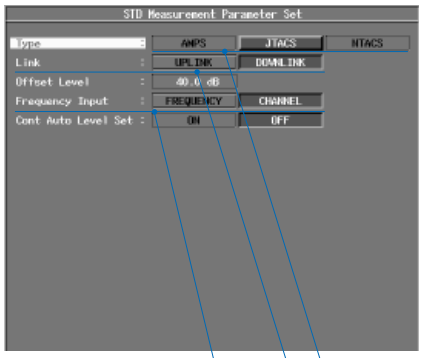
OPT.73 ····· AMPS/JTACS/NTACS Analysis Software

Addition of the AMPS/JTACS/NTACS analysis software option (OPT.73) to the digital modulation analysis option (OPT.01) enables modulation signal analysis and Standard Item measurement for AMPS, JTACS, and NTACS UPLINK/DOWNLINK. Measurement is conducted by simply selecting the measurement item, thus enabling accommodation of a wide range of applications from development to production, maintenance and field use.

Features

- **Transmission characteristics measurement of AMPS, JTACS, and NTACS UPLINK/DOWNLINK is covered by a single unit.**
- **AMPS/JTACS/NTACS parameters are automatically set internally.**
- **Measurement is conducted by the simple operation of item selection only.**
- **Standard Items can be measured including ACP, OBW, and FM Deviation.**
- **PASS/FAIL judgement function is provided.**
- **Detailed modulation signal is analyzed with the graphics analysis function.**

System Selection



Accommodates multiple bands (AMPS/JTACS/NTACS) by a single unit.

Covers the UPLINK/DOWNLINK test by a single unit.

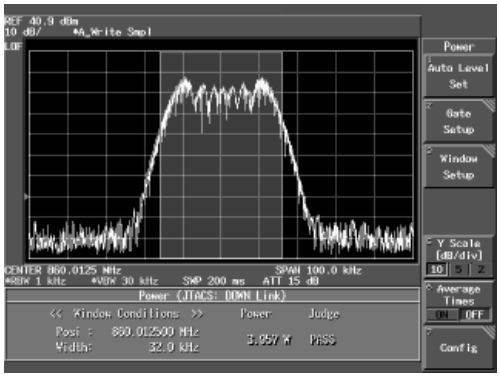
Enables channel input and direct frequency input.

Applicable Measurement Items

- **Antenna power (Power)**
- **Occupied Bandwidth (OBW)**
- **Adjacent Channel Power (ACP)**
- **Carrier frequency error (Frequency Error)**
- **Frequency deviation (FM Deviation)**
- **Spurious emissions intensity**
- **Modulation signal frequency/level**
- **Modulation signal harmonic distortion/level**

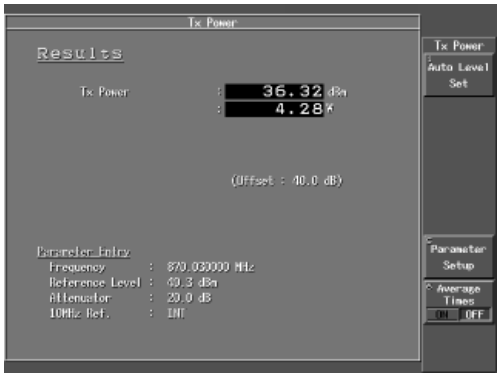
F-Domain Power Measurement

Wide dynamic range Power measurement is possible with the spectrum analyzer.



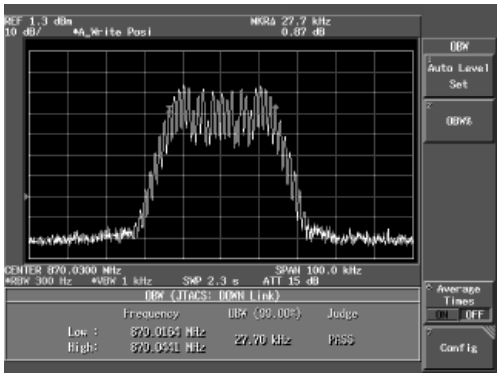
Tx Power Measurement

High stability Power measurement can be conducted in the DSP method.



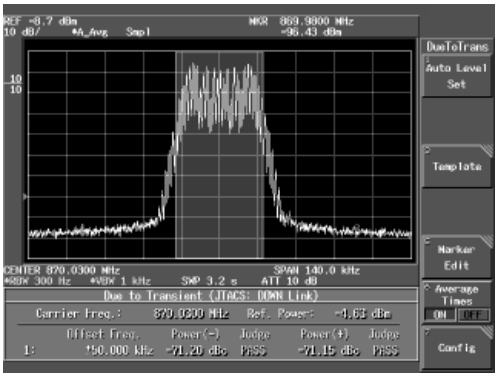
Occupied Bandwidth (OBW) Measurement

Necessary parameters are automatically set internally to start the measurement by the simple operation of item selection only. In addition, the parameters can be changed if necessary.



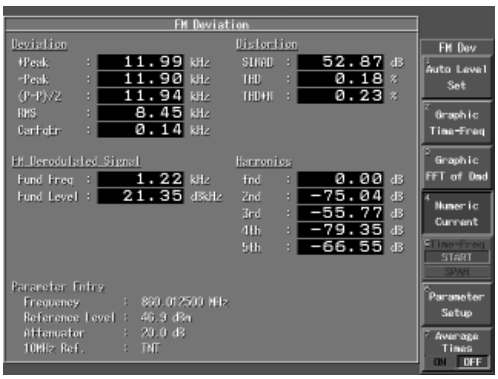
Adjacent Channel Power (ACP) Measurement

It is possible to automatically set the necessary parameters and measure the ACP of multiple offset frequency channels by a single operation.



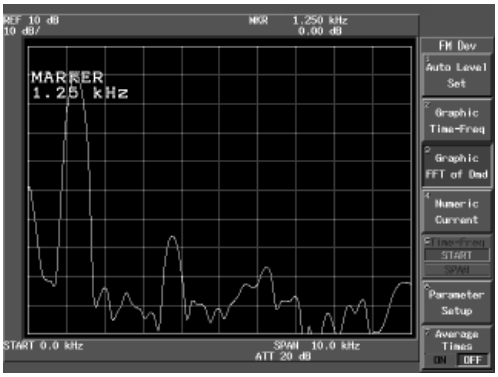
FM Deviation Measurement

The modulation analysis function can be used to measure the FM Deviation, Frequency Error, SINAD, and THD of the modulation signal.



Graphics (FFT of Dmd.) Display

Detailed analysis of the FM-demodulated signal can be displayed in graphics. Time-Freq. and FFT of Dmd. can be selected for the display mode.



Performance Specification

Measurement range:	**Maximum 50 kHz**
FM deviation measurement accuracy:	**±5% or less**
Measurement frequency range:	**10/20/50 kHz**
De-Emphasis Filter time constant:	**OFF/25/50/75/750 µsec.**
Audio measurement:	**Measuring THD, SINAD, THD+N, and Harmonics by transforming the FM-demodulated signals using FFT (Fast Fourier Transformation)**
Audio L.P.F.:	**OFF/3/15 kHz**
Audio H.P.F:	**OFF/50/300 Hz**

Technical Description

FM Deviation Numeric Result:	Displayed result is calculated as follows.
+Peak:	**Maximum frequency of the FM-demodulated signal**
-Peak:	**Minimum frequency of the FM-demodulated signal**
(p-p)/2:	**Average of +Peak and -Peak absolute values**
RMS:	**Root Mean Square of the FM-demodulated signal**
CarFqEr:	**Carrier Frequency Error** $\text{CarFqEr} = \frac{1}{N}\sum_{i=0}^{N-1} fm[i]$ **fm [i]: FM-demodulated signal**
SINAD:	**Signal Noise and Distortion SINAD [dB] = 20 log [(S+N+D)/(N+D)]**
THD:	**Total Harmonic Distortion (distortion ratio) THD (%) = D/S x 100**
THD+N:	**Total Harmonic Distortion and Noise THD + N (%) = (D+N)/S x 100 S: RMS of the fundamental wave element D: RMS of the harmonic frequency element N: RMS of the noise element**
Harmonics:	**Displays up to fifth harmonic level of the FM demodulated signal. The level of the fundamental wave is normalized to 0 dB.**

De-Emphasis Filter Time Constant:
The following shows the time constants and their primary applications.

Time Constant	3 dB point (Hz)	Application
25	6366	FM broadcast (Dolby-B compression used)
50	3183	FM broadcast (JIS)
75	2122	FM broadcast (FCC old standard), Satellite broadcast
750	212.2	MIRS

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