User Manual

Tektronix

RSA3303B, RSA3308B, & RSA3408B Option 30 3GPP Release 99 and Release 5 Uplink and Downlink Analysis Software

071-2396-00

This document supports firmware version 4.0 and above.

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RSA3303B, RSA3308B, & RSA3408B Option 30 User Manual

Preface

This manual provides operating instructions for the RSA3303B, RSA3308B, and RSA3408B Real-Time Spectrum Analyzer Option 30 3GPP Release 99 and Release 5 uplink and downlink analysis software.

This manual supports the following instruments:

- RSA3303B Option 30
- RSA3308B Option 30
- RSA3408B Option 30

About This Manual

The manual consists of the following sections:

- *Getting Started* describes the overview of the 3GPP Release 5 analysis.
- *Operating Basics* explains the menu functions and measurement procedures.
- *Appendices* provide additional information about default settings and scale setting ranges.

The analyzer uses Microsoft Windows XP as the operating system. This manual does not describe common usage of Windows XP. Refer to your Windows manuals as necessary.

Related Manuals

The following documents are also available for the analyzer:

■ *RSA3303B & RSA3308B User Manual*
(Standard accessory; Tektronix part number 071-2363-XX)
RSA3408B User Manual
(Standard accessory; Tektronix part number 071-2364-XX)
Describes how to install the analyzer and how to work with the menus, and
details the standard functions. It also provides the specifications.

■ *RSA3000B Series Programmer Manual*
(Standard accessory; PDF, Tektronix part number 071-2382-XX)
Contains an alphabetical listing of the programming commands and other
information related to controlling the analyzer over the GPIB interface.

PDF Manual   The *RSA3000B Series Programmer Manual* (PDF only) is included in the
Documents CD (Tektronix part number 063-4089-XX).

Getting Started

Getting Started

The RSA3303B, RSA3308B, and RSA3408B Option 30 3GPP Release 99 and Release 5 Uplink and Downlink analysis software enables spectrum and modulation analyses of W-CDMA signals defined in 3GPP (3rd Generation Partnership Project) Release 99 ("3GPP-R99") and HSDPA (High Speed Downlink Packet Access) signals defined in 3GPP Release 5 ("3GPP-R5"). Measurements are performed on downlink QPSK and 16QAM or uplink BPSK signals.

Table 1-1 summarizes the functions added by Option 30 by the measurement modes of the analyzer.

Table 1-1: Additional functions in Option 30

Measurement mode	Additional measurement items	3GPP-R99 uplink	3GPP-R5 downlink	3GPP-R5 uplink
S/A (spectrum analysis)	Channel power	✓	✓	✓
	ACLR (Adjacent Channel Leakage Power Ratio)	✓	✓	✓
	MC-ACLR (Multi-Carrier ACLR)	-	✓	-
	Spectrum emission Mask	-	✓	✓
	OBW (Occupied Bandwidth)	✓	✓	✓
	EBW (Emission Bandwidth)	✓	✓	✓
	Carrier frequency	✓	✓	✓
Demod (modulation analysis)	Code domain power	✓	✓	✓
	Power codogram	✓	✓	✓
	Code power versus Time slot	✓	✓	✓
	Code power versus Symbol	✓	✓	✓
	Symbol constellation	✓	✓	✓
	Symbol EVM (Error Vector Magnitude)	✓	✓	✓
	Symbol eye diagram	✓	✓	✓
	Symbol table	✓	✓	✓
	Modulation accuracy	✓	✓	✓
	ACK/NACK analysis	-	-	✓
Time (time analysis)	None	-	-	-

Analysis Definition

The analyzer performs measurements according to 3GPP specifications.

3GPP-R99 (W-CDMA) Uplink Analysis

The analyzer supports three types of W-CDMA uplink signals:

■ DPDCH (Dedicated Physical Data Channel) / DPCCH (Dedicated Physical Control Channel)

■ PRACH (Physical Random Access Data Channel)

■ PCPCH (Physical Common Packet Channel)

The analyzer covers the W-CDMA uplink parameters listed in Table 1-2.

Table 1-2: Uplink parameters

Item	DPDCH/DPCCH		PRACH		PCPCH	
	DPDCH	DPCCH	Data part	Control part	Data part	Control part
Chip rate	3.84 Mcps					
Symbol rate	15, 30, 60, 120, 240, 480, 960 ksps	15 ksps	15, 30, 60, 120 ksps	15 ksps	15, 30, 60, 120, 240, 480, 960 ksps	15 ksps
Maximum number of channels	6	1	1	1	1	1
Frame structure	15 time-slots, 10 ms					
Time slot	2560 chips, 667 μs					
Scrambling code	Long or short Number: 0 to 16,777,215		Long Number: 0 to 8,191		Long Number: 8,192 to 40,959	
Preamble	--		4096 chips, 1.067 ms		4096 chips, 1.067 ms	
Modulation method	BPSK for each channel					
Baseband filter	Root-cosine with $\alpha = 0.22$ (default), $0.0001 \leq \alpha \leq 1$					

NOTE. *The analyzer despreads DPCCH and the control part of the incoming signal, using the frequency and phase to establish synchronization. If the level of DPCCH or the control part is much lower than the level of the other channels, accurate analysis may not be performed.*

Measurement Functions. The analyzer has the following measurement functions:

- *Code domain power*
  Measures power relative to the total power for each channel.

- *Time vs. Code domain power*
  Measures the relative power at symbol points for each channel in time series.

- *Code domain power spectrogram*
  Measures the code domain power continuously for up to 150 slots
  (0.1 sec) and displays spectrogram for each slot.

- *Vector/Constellation*
  Measures the vector loci and chip points for entire signals, as well as
  constellation at symbol points for each channel.

- *Modulation accuracy*
  Measures EVM (Error Vector Magnitude), amplitude and phase errors,
  waveform quality, and origin offset for each channel.
  Measures PCDE (Peak Code Domain Error), amplitude, Frequency, and phase
  errors, waveform quality, and origin offset for a time slot.

Measurement Process. The analyzer processes the input signals internally as shown
in Figure 1-1.
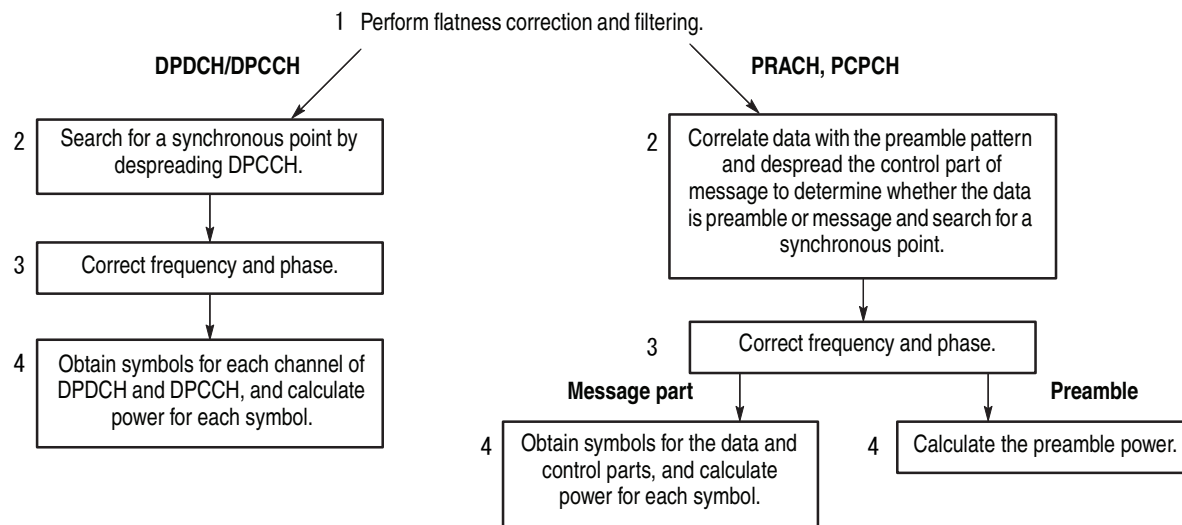
Figure 1-1: Internal process for W-CDMA uplink analysis

3GPP-R5 Downlink Analysis

Table 1-3 shows the 3GPP-R5 downlink transmission parameters for the analyzer.

Table 1-3: 3GPP-R5 downlink transmission parameters

Item	Description
Chip rate	3.84 Mcps
Symbol rate	7.5, 15, 30, 60, 120, 240, 480, and 960 ksps
Maximum number of channels	512
Frame structure	Time slot: 666.7 µs
Scrambling code	Gold code using M series by generator polynomial 18 bits
Channelization code	Hierarchical orthogonal code series based on the combination of chip rate and symbol rate
Modulation method for each channel	QPSK or 16QAM
Baseband filter	Root-cosine with $\alpha = 0.22$ (default) Can be set in the range of $0.0001 \leq \alpha \leq 1$

Measurement Functions. The analyzer has the following measurement functions:

- *Code domain power:* Measures the power relative to the total power for each channel. Multi-rate is supported and up to 512 channels can be measured.

- *Code domain power versus Time:* Measures the relative power at symbol points for each channel in time series.

- *Power codogram:* Measures the code domain power continuously for up to 150 slots (0.1 sec) and displays a spectrogram for each slot.

- *Vector/Constellation:* Measures the vector loci and chip points for all signals as well as constellation at symbol points for each channel.

- *Modulation accuracy:* Measures EVM (Error Vector Magnitude), amplitude and phase errors, waveform quality, and origin offset for each channel. Measures PCDE (Peak Code Domain Error), amplitude, frequency, and phase errors; waveform quality; and origin offset for each time slot.

Measurement Process. The following steps show the internal process for the 3GPP-R5 downlink analysis:

1. Perform flatness correction and filtering.

2. Establish the synchronization with P-SCH.

3. Determine the range of scrambling code numbers with S-SCH.

4. Fix the scrambling code number and the phase.

5. Correct the frequency and the phase.

6. Perform high-speed Hadamard transformation.

7. Calculate the power for each symbol on all channels.

3GPP-R5 Uplink Analysis

The analyzer supports the following types of 3GPP-R5 uplink signals:

- DPDCH (Dedicated Physical Data Channel)

- DPCCH (Dedicated Physical Control Channel)

- HS-DPCCH (Dedicated Physical Control Channel for High-Speed Downlink Shared Channel (HS-DSCH))

The analyzer covers the 3GPP-R5 uplink transmission parameters listed in Table 1-4.

Table 1-4: 3GPP-R5 uplink transmission parameters

Item	DPDCH	DPCCH	HS-DPCCH
Chip rate	3.84 Mcps		
Symbol rate	15, 30, 60, 120, 240, 480, and 960 ksps	15 ksps	15 ksps
Maximum number of channels	6	1	1
Frame structure	15 time-slots, 10 ms	15 time-slots, 10 ms	5 sub-frames, 10 ms
Time slot	2560 chips, 667 µs		
Scrambling code	Long or short. Number: 0 to 16,777,215		
Modulation method for each channel	BPSK		
Baseband filter	Root-cosine with α = 0.22 (default). Can be set in the range of 0.0001 $\leq \alpha \leq 1$		

Measurement Functions. The analyzer has the following measurement functions:

- *ACK/NACK analysis:* Measures the HS-DPCCH to detect and display the ACK/NACK indicator, DTX (Discontinuous Transmission), and CQI (Channel Quality Indicator).

- *Code domain power:* Measures the power relative to the total power for each channel. Multi-rate is supported and up to 512 channels can be measured.

- *Power codogram:* Measures the code domain power continuously for up to 150 slots (0.1 sec) and displays spectrogram for each slot.

NOTE. The code domain power and the power codogram can be displayed in the subview only.

Measurement Process. The following steps show the internal process for the 3GPP-R5 uplink analysis:

1. Perform flatness correction and filtering.

2. Search for a synchronous point by despreading DPCCH.

3. Correct the frequency and phase.

4. Obtain symbols for each channel of DPDCH and DPCCH, and calculate power for each symbol.

NOTE. The analyzer despreads DPCCH and the control part of an input signal, using the frequency and phase to establish synchronization. If the level of DPCCH or the control part is much lower than (about $1/10^{th}$) the level of the other channels (DPDCH or the data part), the analysis may not be performed accurately.

Measurement Menu

Figure 1-2 shows the measurement menus related to the 3GPP-R99/R5 analysis.
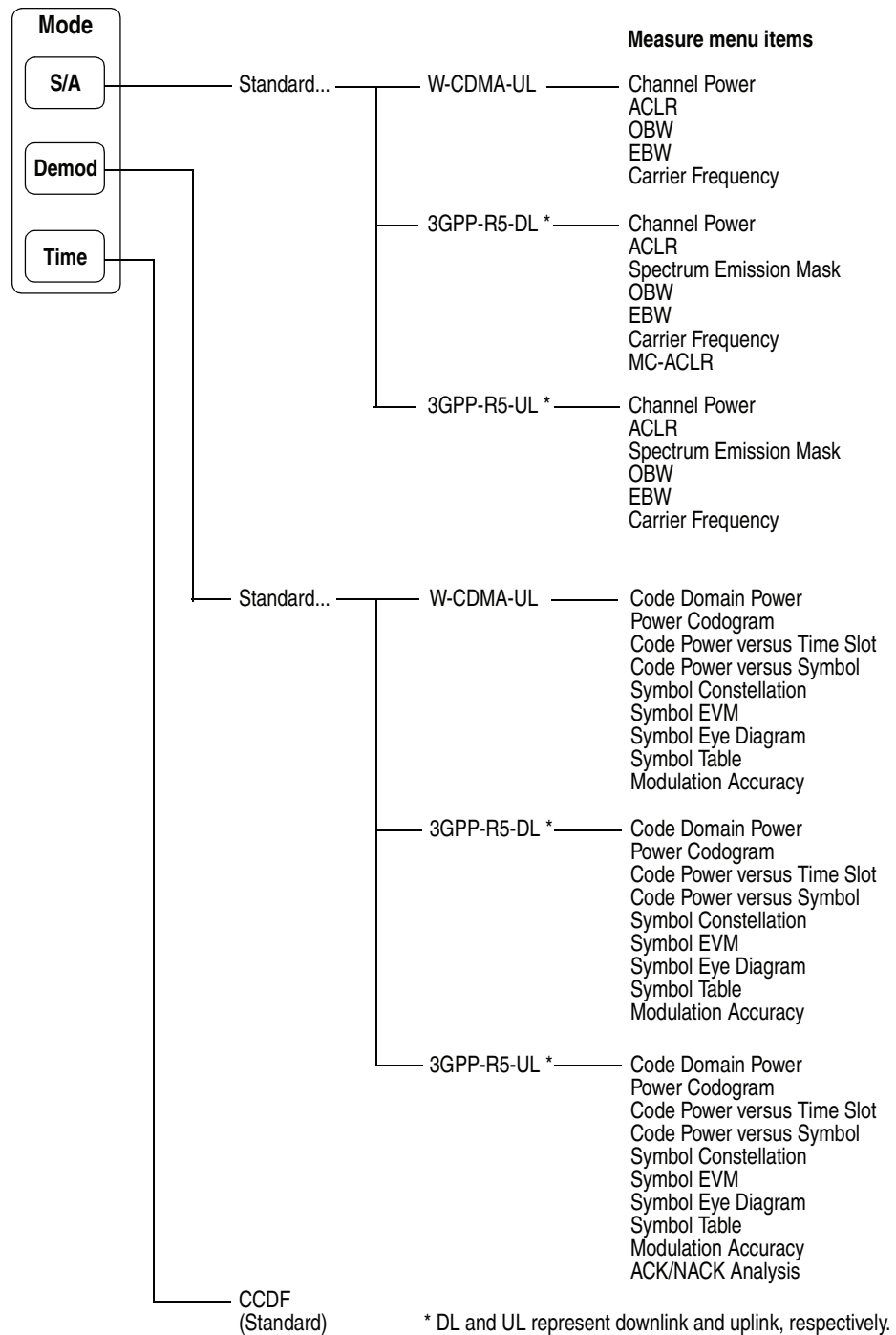
Figure 1-2: Measurement menus for the 3GPP-R99/R5 analysis

For the CCDF (Complementary Cumulative Distribution Function) analysis in Time mode, refer to your instrument user manual.

NOTE. If you are not familiar with the operation of the analyzer, refer to your instrument user manual.

Operating Basics

3GPP-R99/R5 Spectrum Analysis

This section describes the basic operation of 3GPP-R5 uplink/downlink analysis in the S/A (Spectrum Analysis) mode. You can access the measurement items by pressing **S/A** → **Standard...** → **W-CDMA-UL** (3GPP-R99 uplink), **3GPP-R5-DL** (3GPP-R5 downlink), or **3GPP-R5-UL** (3GPP-R5 uplink) as shown in Figure 2-1.
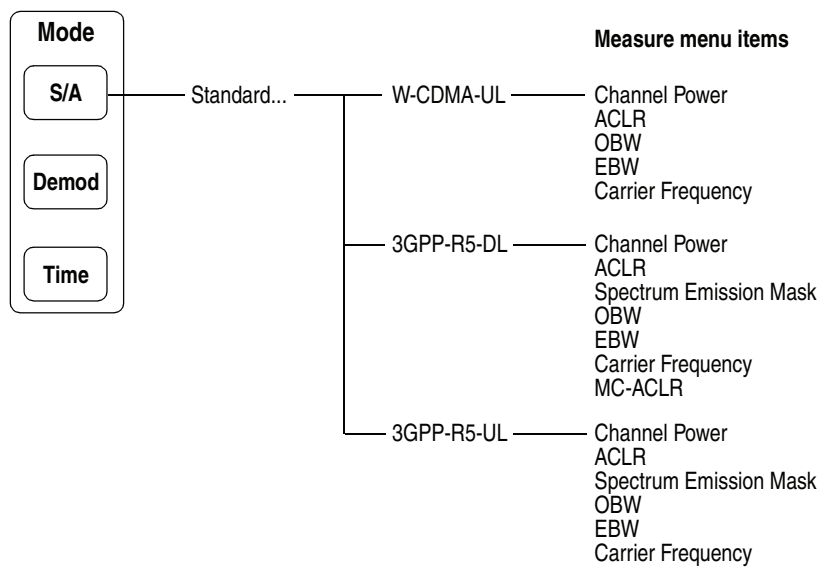
Figure 2-1: Measurement menu in the S/A mode

Measurement Procedure

Use the following procedure to take a spectrum measurement in S/A mode.

> **NOTE.** *For details on basic operation of the analyzer, refer to your instrument user manual.*

1. Press the **S/A** key on the front panel.

2. Press the side key: **Standard...** →**3GPP-R5-DL** (for downlink) or **3GPP-R5-UL** (for uplink).

3. Press the **Frequency/Channel** key on the front panel to set frequency.

   If you use the channel table, do these steps:

   ■ Press the **Channel Table...** side key and select **W-CDMA-DL** (for downlink) or **W-CDMA-UL** (for uplink).

   ■ Press the **Channel** side key and select a channel by turning the general purpose knob.

   The center frequency is set to the value corresponding to the channel.

4. Press the **Span** key on the front panel and set span.

5. Press the **Amplitude** key on the front panel and set amplitude appropriately.

> **NOTE.** *If the input level is too high, "Overrange - increase RefLev or Atten" displays in the red box at the center top of the screen. If this occurs, raise the reference level.*

6. Press the **Measure** key on the front panel and select a measurement item:

   ■ Channel Power

   ■ ACLR (Adjacent Channel Leakage Power Ratio)

   ■ Spectrum Emission Mask (3GPP-R5 only)

   ■ OBW (Occupied Bandwidth)

   ■ EBW (Emission Bandwidth)

   ■ Carrier Frequency

   ■ MC-ACLR (Multi-Carrier ACLR, 3GPP-R5 downlink analysis only)

The following sections explain each measurement.

Channel Power Measurement

The channel power measurement measures the channel power within a specified bandwidth and the power spectral density in dBm/Hz.

After selecting Channel Power in the procedure described on page 2-2, set the parameters in the Meas Setup menu as follows.

Measurement Setup Menu   The Meas Setup menu for the channel power measurement contains the following controls:

Channel Bandwidth. Sets the frequency range for the measurement using the band power marker (see Figure 2-2). Range: 50 kHz to 20 MHz (default: 3.84 MHz).

Measurement Filter Shape... Selects the filter to be used for the measurement:

- Rect (Rectangular, default)
- Gaussian
- Nyquist
- Root Nyquist

Rolloff Ratio. Sets the roll-off ratio when the **Measurement Filter Shape** is Nyquist or Root Nyquist. Range: 0.0001 to 1 (default: 0.5).

Limits... Sets the pass/fail limit for the channel power measurement.
When pressing this side key, the measurement limits editor appears. Refer to *Editing the Measurement Limits* on page 2-14 for more information.

Figure 2-2 shows an example of the channel power measurement.
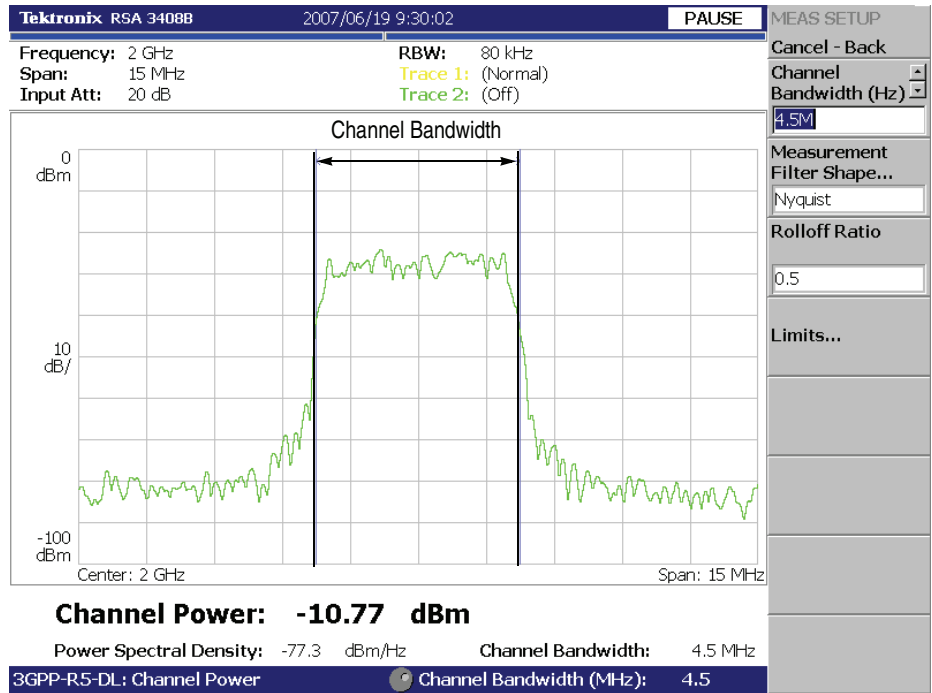
Figure 2-2: Channel power measurement

ACLR Measurement

The ACLR (Adjacent Channel Leakage Power Ratio) measurement according to the 3GPP-R5 standard is based on the ACPR measurement function in the normal spectrum analysis. For the basics, refer to ACPR Measurement in your instrument user manual.

The following settings are fixed according to the 3GPP-R5 standard:

Span: 25 MHz
Main channel measurement bandwidth (Main Chan BW): 3.84 MHz
Adjacent channel measurement bandwidth (Adj Chan BW): 3.84 MHz
Channel spacing (Chan Spacing): 5 MHz

After selecting ACLR in the procedure described on page 2-2, set the parameters in the Meas Setup menu as follows.

Measurement Setup Menu   The Meas Setup menu for the ACLR measurement contains the following controls:

Sweep. Selects how to scan the 25 MHz span for acquiring an input signal.

- **On.** *Default.* Acquires an input signal with five scans by the channel spacing (5 MHz).

- **Off.** Acquires an input signal with a single scan in the 25 MHz span.

Noise Correction. Determines whether to subtract the noise level from the signal level to obtain the measurement results.

- **On.** Measures noise level first, and then subtracts the noise level from the signal level to calculate ACLR measurement values.

- **Off.** *Default.* Calculates ACLR measurement values directly from the input signal level.

Measurement Filter Shape... Selects a filter shape:
Rect (rectangle) or RootNyquist (Root Nyquist, default)

Rolloff Ratio. Sets the roll-off value when the filter is Root Nyquist.
Range: 0.0001 to 1 (default: 0.22)

Limits... *3GPP-R5 only.* Sets the pass/fail limit for the ACLR measurement.
When you press this side key, the measurement limits editor appears. Refer to *Editing the Measurement Limits* on page 2-14 for more information.

NOTE. *The ACLR measurement and the multi-carrier ACLR measurement use the same limits setting.*

Figure 2-3 shows an example of the ACLR measurement. Measured values are displayed in the lower part of the screen.
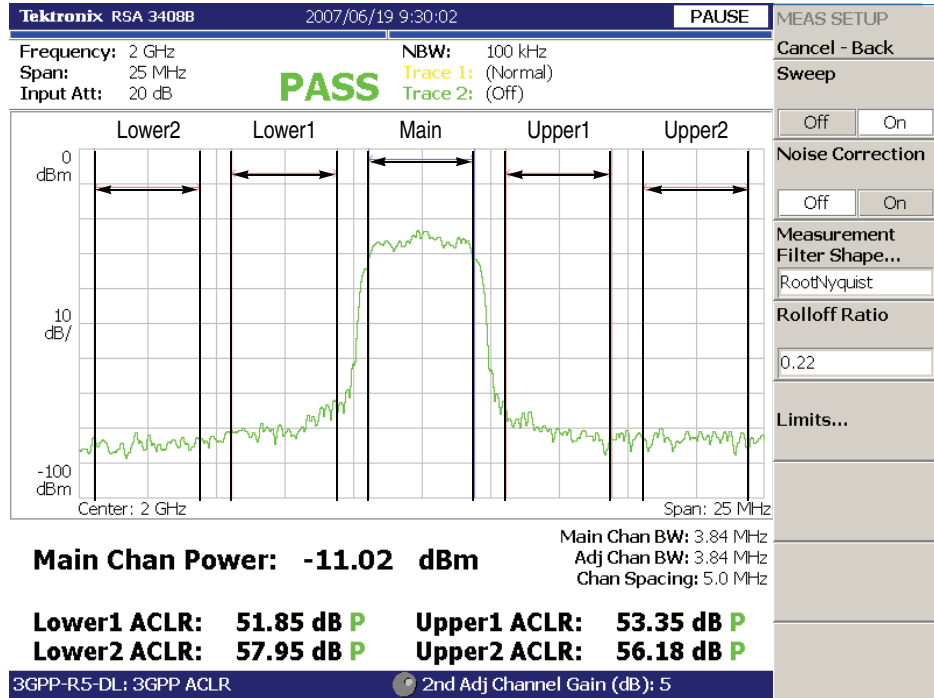
Figure 2-3: 3GPP-R5 ACLR measurement

Multi-Carrier ACLR Measurement

3GPP-R5 Downlink Only

The multi-carrier ACLR (Adjacent Channel Leakage Power Ratio) measurement is performed according to the 3GPP-R5 standard. You can measure the power levels of up to four carriers and the ratio of each adjacent channel (a total of four channels) to the power of the main channel. The measurement is based on the ACPR measurement function in the normal spectrum analysis. For the basics, refer to ACPR Measurement in your instrument user manual.

The following settings are fixed according to the 3GPP-R5 standard:

Span: 55 MHz
Main channel measurement bandwidth (Main Chan BW): 3.84 MHz
Adjacent channel measurement bandwidth (Adj Chan BW): 3.84 MHz
Channel spacing (Chan Spacing): 5 MHz

After selecting MC-ACLR in the procedure described on page 2-2, set the parameters in the Meas Setup menu as follows.

Measurement Setup Menu
The Meas Setup menu for the multi-carrier ACLR measurement contains the following controls:

Carrier Threshold. Sets the threshold level to detect the carrier. The threshold level is indicated by a horizontal line in blue as shown in Figure 2-4.
Range: −30 to −1 dBc relative to the power of the main channel (default: −10 dBc).

Noise Correction. Determines whether to subtract the noise level from the signal level to obtain the measurement results.

■ **On.** Measures noise level first, and then subtracts the noise level from the signal level to calculate ACLR measurement values.

■ **Off.** *Default.* Calculates ACLR measurement values directly from the input signal level.

Measurement Filter Shape... Selects a filter shape.

■ Rect (Rectangular)

■ Root Nyquist (default)

Rolloff Ratio. Sets the roll-off value when the filter is Root Nyquist.
Range: 0.0001 to 1 (default: 0.22)

Limits... Sets the pass/fail limit for the multi-carrier ACLR measurement. When you press this side key, the measurement limits editor appears. Refer to *Editing the Measurement Limits* on page 2-14 for more information.

NOTE. The ACLR measurement and the multi-carrier ACLR measurement use the same limits setting.

Figure 2-4 shows an example of the multi-carrier ACLR measurement. There are four carriers. On the bottom of the screen, the measurement results of the channel power and ACLR are displayed. The channel at the center frequency (Ch 2 in this case) is the main channel, which is indicated as "Main" in green in the measurement results. The all channels are located at 5 MHz intervals according to the standard.
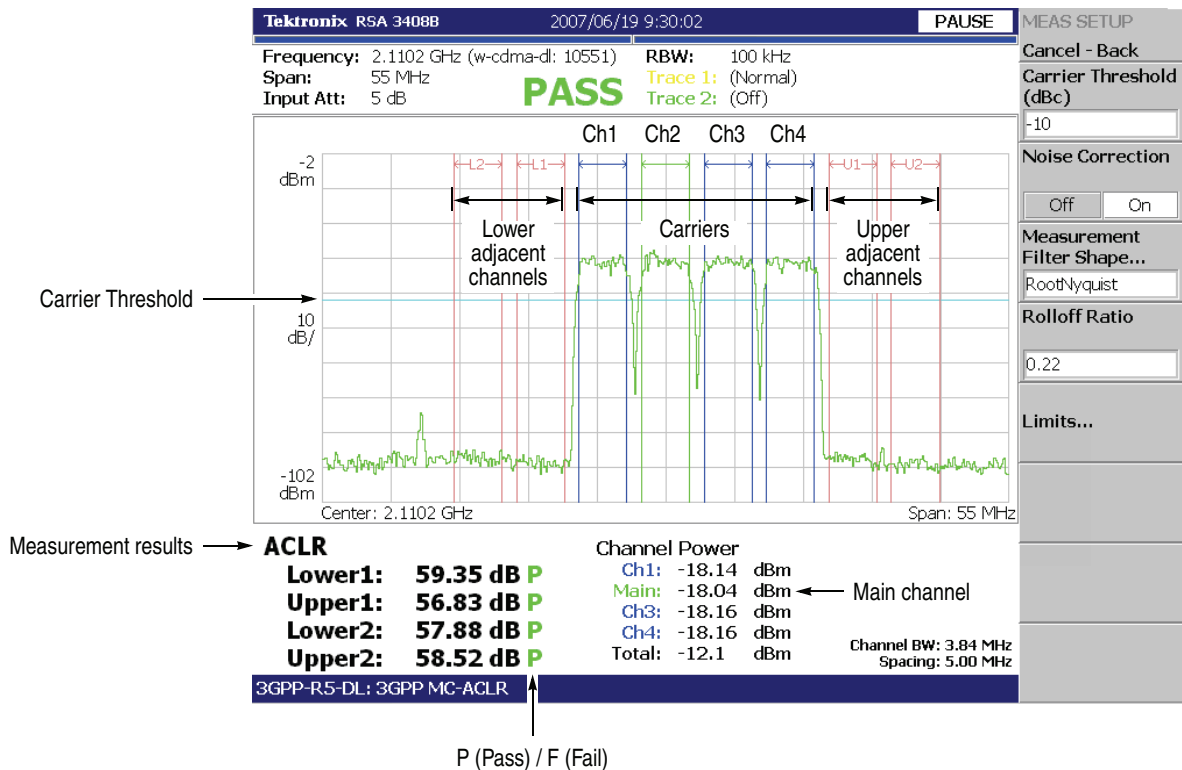
Figure 2-4: 3GPP-R5 multi-carrier ACLR measurement

NOTE. If there is no carrier in the main channel, the error message "No carrier" appears.

If there are more than four carriers in the span, the error message "Too many carriers" appears.

Spectrum Emission Mask Measurement

3GPP-R5 Only

The spectrum emission mask measurement verifies that the base station is not transmitting excessive power outside of its designated channel.

NOTE. *When performing this measurement, be sure to apply a continuous active slot signal or a continuous idle slot signal.*

After selecting Spectrum Emission Mask in the procedure described on page 2-2, set the parameters in the Meas Setup menu as follows:

Measurement Setup Menu
 The Meas Setup menu for the spectrum emission mask measurement contains the following controls:

Ref. Channel Select. Selects how to determine the reference channel level.

- ■ **Auto.** The level is determined automatically by evaluating the spectrum trace.
- ■ **Man.** The level is set by the **Ref. Channel Level**.

Ref. Channel Level. Sets the reference channel level to be used by the measurement when **Ref. Channel Select** is set to Man. Range: −150 to 30 dBm (default: 0 dBm).

Channel Bandwidth. Defines the frequency window occupied by the reference channel. Range: 1 to 10 MHz (default: 3.84 MHz).

Measurement Filter Shape... Selects the filter shape to be used when measuring the reference channel when **Ref. Channel Select** is set to Auto.

- ■ Rect (Rectangular, default)
- ■ Gaussian
- ■ Nyquist
- ■ Root Nyquist

Rolloff Ratio. Sets the rolloff ratio when **Measurement Filter Shape** is set to Nyquist or Root Nyquist. Range: 0.0001 to 1 (default: 0.5).

Limits... Sets the pass/fail limit for the spectrum emission mask measurement. When pressing this side key, the measurement limits editor appears. Refer to *Editing the Measurement Limits* on page 2-14 for more information.

Scroll Table. Scrolls the results table on screen using the general purpose knob.

Step Size. Sets the step size for the **Channel Bandwidth** setting.

Figure 2-5 shows an example of the spectrum emission mask measurement.
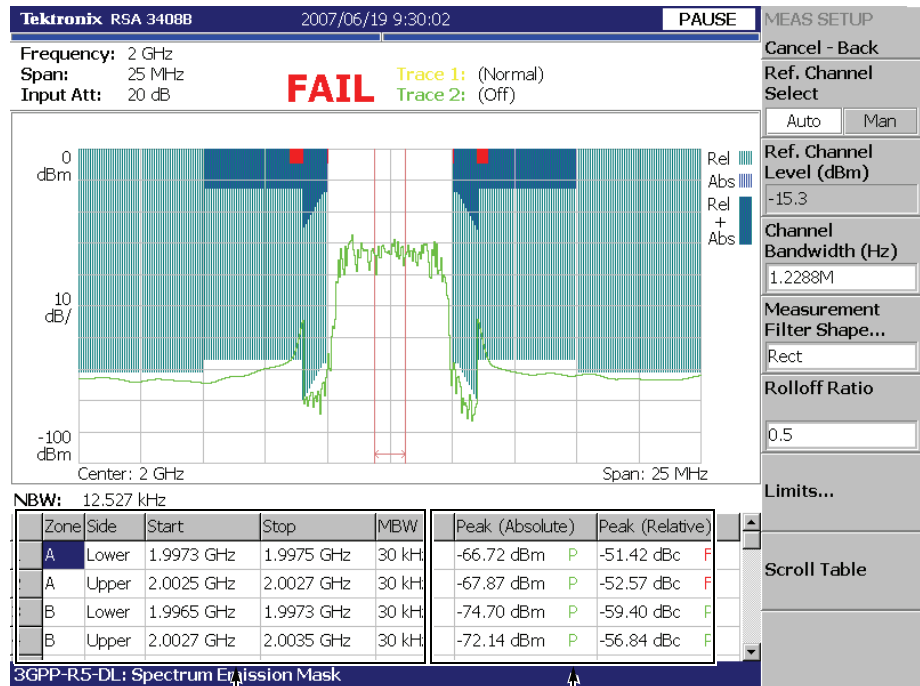
Defined by the measurement limits editor
(from the left)
- Zone (A to E)
- Side (upper or lower)
- Start frequency of the zone
- Stop frequency of the zone
- MBW (Measurement Bandwidth (RBW))

Measurement results (P: Pass; F: Fail)
(from the left)
- Absolute peak value and Pass/Fail
- Relative peak value and Pass/Fail

Figure 2-5: Spectrum emission mask measurement

OBW Measurement

The OBW (Occupied Bandwidth) measurement measures the frequency bandwidth using the ratio you specify for carrier signal power over power within the set span.

After selecting OBW in the procedure described on page 2-2, set the parameters in the Meas Setup menu as follows:

Measurement Setup Menu

The Meas Setup menu for the OBW measurement contains the following controls:

Power Ratio. Specifies the power ratio of the carrier and span regions for calculating OBW. Range: 80 to 99.99% (default: 99%).

Limits... Sets the pass/fail limits for the OBW measurement.
When pressing this side key, the measurement limits editor appears. Refer to *Editing the Measurement Limits* on page 2-14 for more information.

Figure 2-6 shows an example of the OBW measurement.
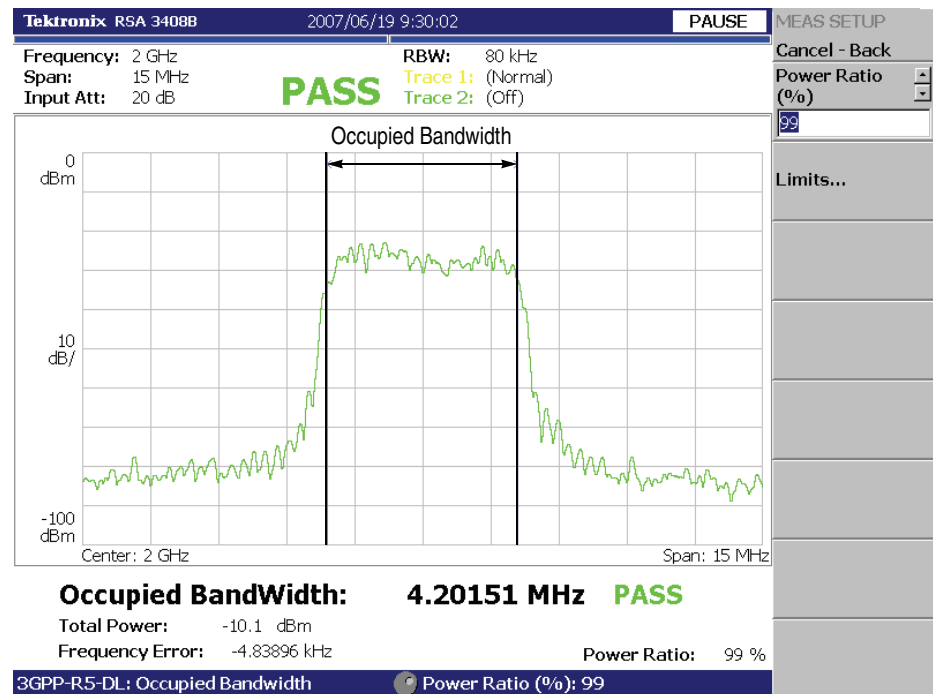
Figure 2-6: OBW measurement

EBW Measurement

The frequency bandwidth between the maximum peak of spectrum and the specified dB value is measured in EBW (Emission Bandwidth).

After selecting EBW in the procedure described on page 2-2, set the parameters in the Meas Setup menu as follows:

Measurement Setup Menu
The Meas Setup menu for the EBW measurement contains the following controls:

Measurement Level. Specifies how far down from the peak level the bandwidth is measured (see Figure 2-7). Range: -100 to -1 dB (default: -30 dB).

Figure 2-7 shows an example of the EBW measurement.
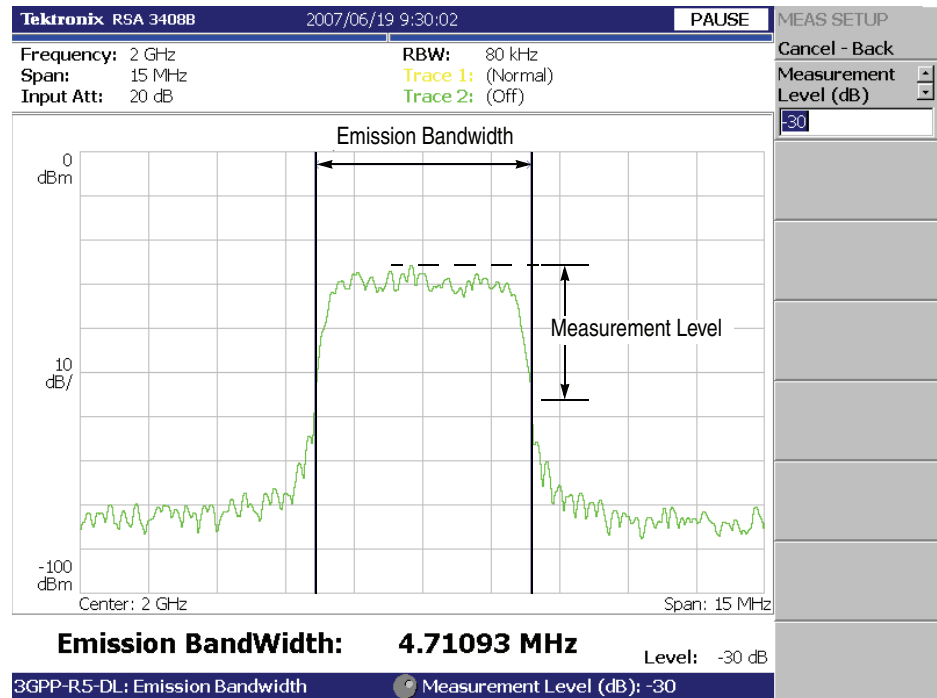
Figure 2-7: EBW measurement

Carrier Frequency Measurement

Carrier frequency is accurately measured using the counter function.

NOTE. *The carrier frequency measurement function should be used to estimate roughly the frequency of a 3GPP signal. Use the modulation analysis function (Demod mode) to measure accurately the 3GPP signal.*

After selecting Carrier Frequency in the procedure described on page 2-2, set the parameters in the Meas Setup menu as follows:

Measurement Setup Menu   The Meas Setup menu for the carrier frequency measurement contains the following controls:

Counter Resolution. Sets the counter resolution. The measurement result is displayed on the bottom of the view with this resolution.
Range: 1 mHz to 1 MHz in a tenfold sequence (default: 1 Hz).

Figure 2-8 shows an example of the carrier frequency measurement.
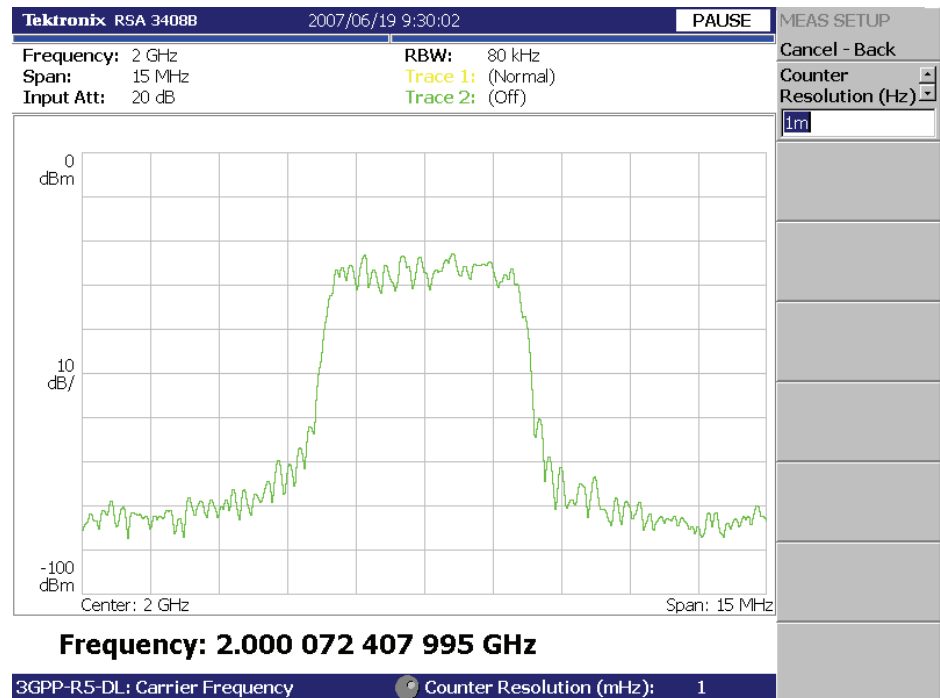
Figure 2-8: Carrier frequency measurement

Editing the Measurement Limits

3GPP-R5 Only

This section describes how to set measurement limits that can be used to perform pass/fail testing for the following measurements in the S/A mode:

■ Channel power

■ ACLR

■ Spectrum emission mask

■ OBW

Refer to *Appendix A: Measurement Limit Defaults* for information about the default settings of each measurement limit.

Using the Measurement Limits Editor

All of the measurement limits are set in the measurement limits editor. You can access it from the **Limits...** side key on the Meas Setup menu. Figure 2-9 shows the measurement limits editor for the 3GPP-R5 downlink analysis in the S/A mode.

Figure 2-9: Measurement limits editor

Table 2-1 describes all of the measurement limit items available in the measurement limits editor.

Table 2-1: Measurement limits settings

Limit item	Description	Lower limit range	Upper limit range
Channel Power	Sets the lower and upper limits for the Channel Power measurement.	−200 to +200 dBm	−200 to +200 dBm
SEM Offset From Channel	Select this item to access another measurement limits editor to edit SEM offset from channel limits.	Refer to page 2-16 for the details.	
OBW	Sets the upper and lower limits for the OBW measurement.	0 to 30 MHz	0 to 30 MHz
ACLR 1st Lower Channel	Sets the upper limit for the first lower channel in the ACLR measurement.	-	0 to 70 dB
ACLR 1st Upper Channel	Sets the upper limit for the first upper channel in the ACLR measurement.	-	0 to 70 dB
ACLR 2nd Lower Channel	Sets the upper limit for the second lower channel in the ACLR measurement.	-	0 to 70 dB
ACLR 2nd Upper Channel	Sets the upper limit for the second upper channel in the ACLR measurement.	-	0 to 70 dB

Setting Measurement Limits

Perform the following procedure to set measurement limits:

1. Press the **Meas Setup** menu key to open the Meas Setup menu.

2. Press the **Limits...** side key to open the measurement limits editor with the LIMITS menu.

3. Press the **Select row to edit** side key.

4. Turn the general purpose knob (or press the arrow keys just above the knob) to select the row that you want to edit.

5. Press the **Enable Limit** side key to enable or disable the Pass/Fail testing for the specified limit(s).

6. Press the **Lower Limit** side key and set the lower limit for the selected measurement item, if applicable.

7. Press the **Upper Limit** side key and set the upper limit for the selected measurement item.

8. If you want to use a given measurement limit set for the frequency band of Band I, II, or III defined in 3GPP-R5, press the **Default all limits to...** side key and then select the band. Refer to *Appendix A: Measurement Limit Defaults* for information about the default settings of each measurement limit.

When you set limits for the spectrum emission mask measurement, perform the following steps to open another limits editor:

1. Press the **Select row to edit** side key.

2. Turn the general purpose knob (or press the arrow keys just above the knob) to select the **SEM Offset From Channel** row in the table.

3. Press the **Edit SEM Offset Limits...** side key.

This opens the measurement limits editor to specify the detail of the limits for the spectrum emission mask measurement. For more information, refer to the following section, *Setting the Spectrum Emission Mask Limits*.

Setting the Spectrum Emission Mask Limits

When you select the SEM Offset From Channel row in the measurement limits editor and then press the **Edit SEM Offset Limits...** side key, another limits editor for the spectrum emission mask measurement is displayed as shown in Figure 2-10.

Zone	A	B	C	D	E
Enable	Yes	Yes	Yes	Yes	No
Beginning Frequency	2.5 MHz	2.7 MHz	3.5 MHz	7.5 MHz	12.5 MHz
Ending Frequency	2.7 MHz	3.5 MHz	7.5 MHz	12.5 MHz	8 GHz
Measurement Bandwidth	30 kHz	30 kHz	1 MHz	1 MHz	1 MHz
Offset from Carrier	Both	Both	Both	Both	Both
Fail if signal exceeds	Rel OR Abs	Rel OR Abs	Rel OR Abs	Relative	Absolute
Beginning Absolute Limit	-14 dBm	-14 dBm	-13 dBm	-13 dBm	-13 dBm
Ending Absolute Limit	-14 dBm	-26 dBm	-13 dBm	-13 dBm	-13 dBm
Beginning Relative Limit	-53 dBc	-53 dBc	-52 dBc	-56 dBc	0 dBc
Ending Relative Limit	-53 dBc	-65 dBc	-52 dBc	-56 dBc	0 dBc

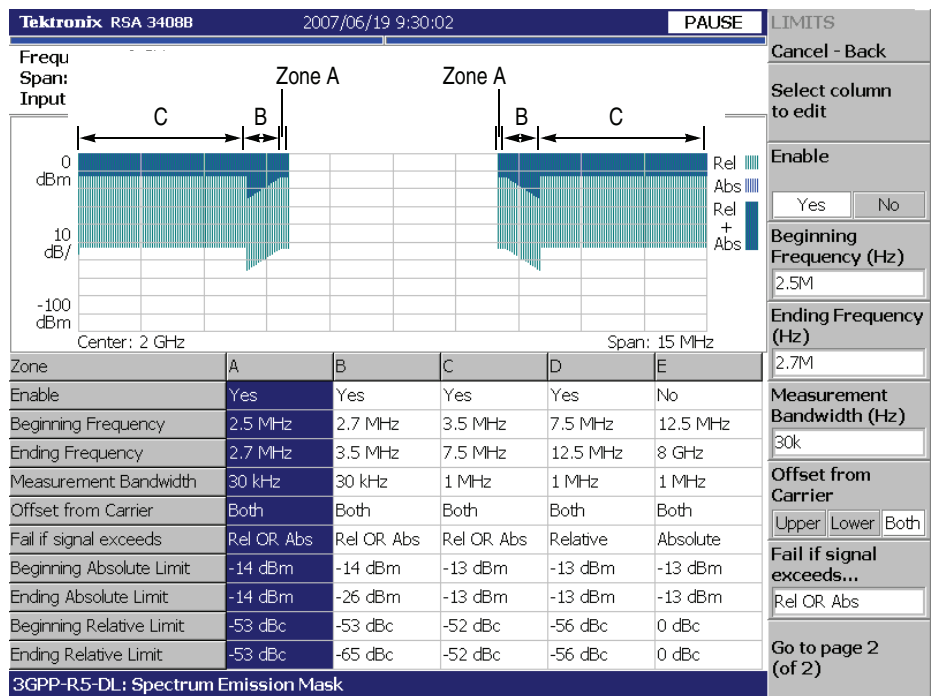3GPP-R5-DL: Spectrum Emission Mask

Figure 2-10: Spectrum emission mask measurement limits editor

Table 2-2 lists the measurement limit items that can be set in the measurement limits editor.

Table 2-2: Limit settings for the spectrum emission mask measurement

Item	Description	Limit ranges
Enable	Enables or disables use of the mask in the specified zone (A, B, C, D, or E).	-
Beginning Frequency	Sets the beginning frequency relative to the center frequency for the zone.	–8 to 8 GHz
Ending Frequency	Sets the ending frequency relative to the center frequency for the zone.	–8 to 8 GHz
Measurement Bandwidth	Sets the measurement RBW (Resolution Bandwidth) for the zone.	–8 to 8 GHz
Offset from Carrier	Specifies which offset side is to be measured. You can select Upper (positive), Lower (negative), or Both.	-
Fail if signal exceeds	Selects the fail mode to detect failure conditions between the measurement results and the test limits. The choices are: ■ Absolute: Failure is detected when one of the absolute measurement results is larger than the Beginning Absolute Limit and/or Ending Absolute Limit. ■ Relative: Failure is detected when one of the relative measurement results is larger than the Beginning Relative Limit and/or Ending Relative Limit. ■ Rel OR Abs: Failure is detected when one of the absolute measurement results is larger than the Beginning Absolute Limit and Ending Absolute Limit OR one of the relative measurement results is larger than the Beginning Relative Limit and Ending Relative Limit. ■ Rel AND Abs: Failure is detected when one of the absolute measurement results is larger than the Beginning Absolute Limit and Ending Absolute Limit AND one of the relative measurement results is larger than the Beginning Relative Limit and Ending Relative Limit.	-
Beginning Absolute Limit	Sets an absolute level limit at Beginning Frequency.	–200 to 200 dBm
Ending Absolute Limit	Sets an absolute level limit at Ending Frequency.	–200 to 200 dBm
Beginning Relative Limit	Sets a relative level limit at Beginning Frequency.	–200 to 200 dBc
Ending Relative Limit	Sets a relative level limit at Ending Frequency.	–200 to 200 dBc

Perform the following steps to set measurement limits in the limits editor:

1. Press the **Select column to edit** side key.

2. Turn the general purpose knob (or press the arrow keys just above the knob) to select the column that you want to edit.

3. Press the **Enable** side key to enable or disable use of the limits for the zone.

4. Press the side key corresponding to the limit item, and then use the general purpose knob or the arrow keys to set the value.

5. If you want to use a given measurement limit set for the frequency band of Band I, II, or III defined in 3GPP-R5, press the **Default limits to...** side key and then select the band. Refer to *Appendix A: Measurement Limit Defaults* for information about the default settings of each measurement limit.

6. When you press the **Rescale Graph** side key, the graph is rescaled to match the set limits.

Saving and Loading Measurement Limits

Measurement limits that set in the limits editor can be saved to a file and loaded from a file. This section describes how to save and load measurement limits.

Refer to your instrument user manual for further information about file operation including how to enter a file name and how to delete a file.

Saving the Limits. Perform the following steps to save the current limits to a file:

1. When you open the spectrum emission mask measurement limits editor, press the **Cancel-Back (MENU)** side key to return the measurement limit editor (see Figure 2-9 on page 2-14).

2. Press the **Save Limits** side key to open the **Save to File** menu.

   You can save the limits by using the preset file name or by entering a new file name.

3. To use the preset file name, press one of the following side keys: **Save to LimitsA**, **Save to LimitsB**, or **Save to LimitsC**.

4. To enter a new file name, type a file name in the text box at the top of the menu, and then press the **Save File Now** side key.

The file extension *.lmt is automatically added to the limits file.

Loading the Limits. Perform the following steps to load the limits from a file:

1. When you open the spectrum emission mask measurement limits editor, press the **Cancel-Back (MENU)** side key to return the measurement limit editor (see Figure 2-9 on page 2-14).

2. Press the **Load Limits** side key to open the Load From File menu.

3. To load limits from the preset file, press one of the following side keys: **Load from LimitsA**, **Load from LimitsB**, or **Load from LimitsC**.

4. To load limits from an existing file, select the file from the file list, and then press the **Load File Now** side key.

3GPP-R99 Uplink Modulation Analysis

This section describes the basic operation for the 3GPP-R99 uplink analysis in the Demod (modulation analysis) mode. You can access the measurement item by pressing **Demod** → **Standard...** → **W-CDMA-UL** as shown in Figure 2-11.
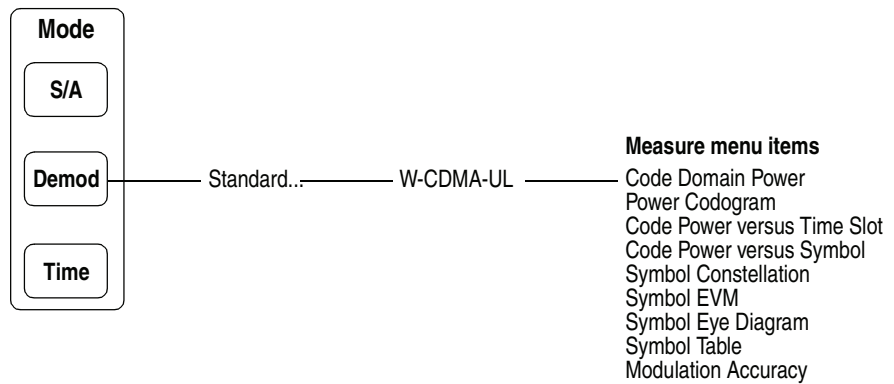

Figure 2-11: 3GPP-R99 uplink modulation analysis measurement menu

The measurement in the Demod mode is based on the digital modulation analysis function. For the digital modulation analysis, refer to your instrument user manual.

Measurement Procedure

The following procedure shows you how to acquire data of multiple slots in advance, measure continuous data, and obtain continuous code domain power:

NOTE. For details on basic operation of the analyzer, refer to your instrument user manual.

1. Press the **Demod** key on the front panel.

2. Press the side key **Standard...** → **W-CDMA-UL**.

3. Press the **Frequency/Channel** key on the front panel to set the frequency.

    If you use the channel table, do these steps:

    ■ Press the **Channel Table...** side key and select **W-CDMA-UL**.

    ■ Press the **Channel** side key and select a channel by rotating the general purpose knob.

    The center frequency is set to the value corresponding to the channel.

4. Press the **Span** key on the front panel to set the span.

5. Press the **Amplitude** key on the front panel to set the amplitude appropriately.

NOTE. If the input level is too high, "Overrange - increase RefLev or Atten" displays in the red box at the center top of the screen. If this occurs, raise the reference level.

6. Press the **Acquisition/Analysis** key on the front panel and then the **Acquisition Length** side key to set the time length to acquire one block.

    Suppose that one block contains M frames; the acquisition length is calculated with this equation:

    (One block acquisition length) = M × (One frame acquisition length)

    One frame acquisition length is determined by span and indicated on the **Spectrum Length** side key.

    The number of frames M required for measuring N slots must meet the following condition:

    $M > K \times (N + 1.2) + 1$

    where
    K = 16.7 (for span 20 MHz and 15 MHz)
        8.34 (for span 10 MHz)
        4.17 (for span 5 MHz)

7. After acquiring measurement data, stop the acquisition.
   If you are acquiring data in the continuous mode, press the **Run/Stop** key.

8. Press the **Measure** key on the front panel and select measurement items. For example, press the **Power Codogram** side key to observe the code domain power spectrogram.

9. Press the **Meas Setup** key on the front panel and set the measurement parameters. Refer to page 2-24 for details of the Meas Setup menu.

   a. Press the side key **Modulation Parameters...** →**Measurement Mode...** and select the type of signal: DPDCH/DPCCH, PRACH, or PCPCH.

   b. Perform the following procedure based on the type of signal.

      For DPDCH/DPCCH
      Press the **Scrambling Code Type** side key to select the type of scrambling code: Long or Short.

      For PRACH or PCPCH
      Press the **Threshold** side key to set the threshold for judging an input signal as burst. The setting range is -100 to 10 dB relative to the reference level.

   c. Press the **Scrambling Code** side key to input the scrambling code number.

10. Set the analysis range in the overview.
    Refer to your instrument user manual for the details.

11. Press the **Meas Setup** key on the front panel and then the Analyze side key to perform measurement for the frames in the analysis range. The measurement results and waveform are displayed in the main view.

    Change the scale and format of view as needed. Refer to page 2-27 for information about setting the views specific to W-CDMA uplink analysis.

Figure 2-12 shows an example of the code domain power measurement.
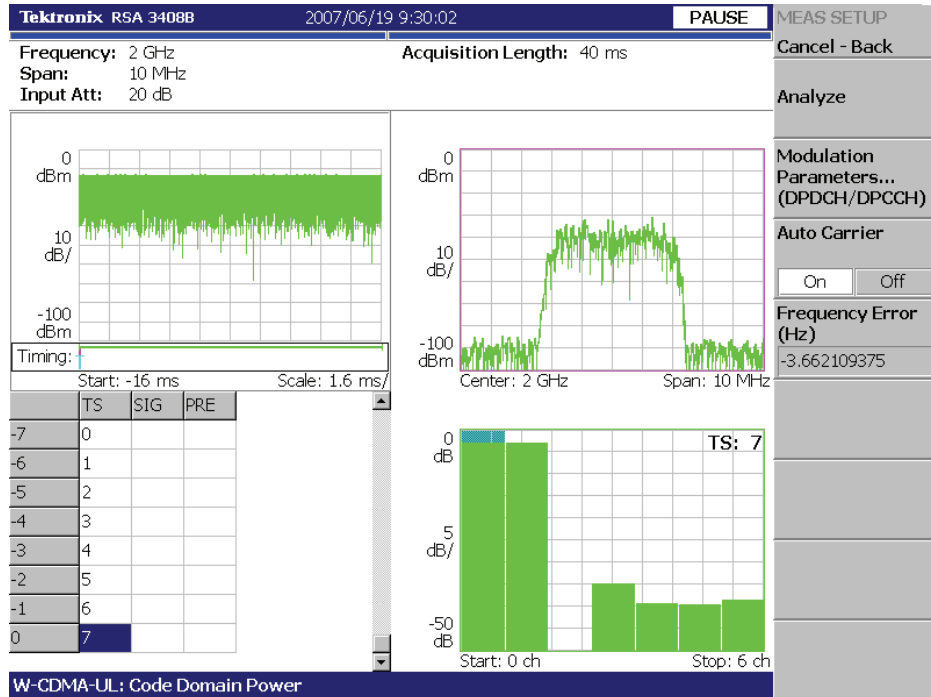
Figure 2-12: Code domain power measurement example

Meas Setup Menu

The Meas Setup menu for the W-CDMA uplink analysis contains the following controls:

Analyze   Performs analysis for time slots in the analysis range.

Modulation Parameters...   Sets a measurement parameter to a nonstandard value.
The following setting items are provided:

Measurement Mode... Selects the type of uplink signal.

- DPDCH/DPCCH
- PRACH
- PCPCH

Scrambling Code Type. Selects the scrambling code type when the Measurement Mode is DPDCH/DPCCH:

- Long
- Short

Scrambling Code. Sets the scrambling code number.
Range: 0 to 16777215.

Threshold. Sets the threshold level to detect a burst when the Measurement Mode is PRACH/PCPCH.
Range: −100 to 10 dB relative to the reference level (default: −30 dB).

Measurement Filter... Selects a filter for demodulating digitally modulated signals:

- None (no filter)
- RootRaisedCosine (default)

Reference Filter... Selects a filter for creating reference data:

- None (no filter)
- RaisedCosine (default
- Gaussian

For the filters, refer to *Process Flow of Digitally Modulated Signal* in your instrument user manual.

Filter Parameter. Sets an α/BT value for Measurement Filter and Reference Filter described above. Range: 0.0001 to 1 (default: 0.22)

Auto Carrier Selects whether to detect the carrier automatically.

- **On.** *Default.* Automatically detects the carrier for every frame.
  The error from the center frequency is shown on the **Freq Error** side key.
- **Off.** Sets the carrier frequency using **Frequency Offset**.

Frequency Offset Sets the carrier frequency when Off is selected in **Auto Carrier**.
Input the carrier offset from the center frequency.

Determining the Symbol Rate

If the symbol rate of the analysis data is unknown, use the following steps to determine the rate.

1. Press **Demod** →**Standard...** →**W-CDMA-UL**.

2. Press **Measure** →**Code Domain Power**.

3. Referring to the basic measurement procedure described just above, set the measurement parameters and display the measurement results and graph on the main view.

4. Press the View: **Define** key and then **Symbol Rate...** side key.

5. Select **15k** (the minimum value).

   Check the amplitude of the data part adjacent to the control part.

6. Set the symbol rate to the next higher value (initially 30k).

   Check whether the amplitude of the data part is larger than the previous one.

Repeat step 6 until the amplitude remains unchanged. The symbol rate of the analysis data is determined to the value immediately before the one for which the amplitude does not change (see Figure 2-13).
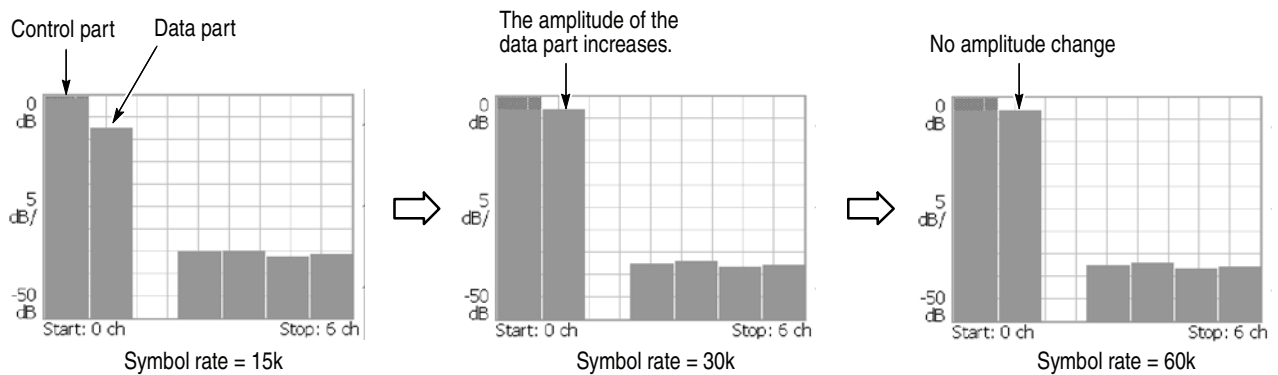
In this example, the symbol rate of the analysis data is 30k.

Figure 2-13: Determining the symbol rate

Scale and Format of View

The following main views are specific for the measurement items of the W-CDMA uplink analysis.

- Code domain power

- Power codogram

- Code power versus Time slot

- Code power versus Symbol

- Symbol constellation

- Symbol EVM

- Symbol eye diagram

- Symbol table

- Modulation accuracy

Each view (and its specific menu) is described on the following pages. In the main view, the time slot table shown in Figure 2-14 is displayed in addition to waveform and measurement results.

Figure 2-14: Time slot table

View: Define Menu The View: Define menu is common to all main views of the W-CDMA uplink measurement items, and contains the following controls:

Show Views. Selects the view style:

- **Single.** Displays only the view selected by the View: **Select** key.

- **Multi.** Displays the overview, subview, and main view (default).

Overview Content... Selects a view to display in the overview:

■ Waveform (power versus time)

■ Spectrogram

Subview Content... Selects a view to display in the subview:

■ Spectrum

■ Code Domain Power

■ Power Codogram

■ Code Power versus Time Slot

■ Code Power versus Symbol

■ Symbol Constellation

■ Symbol EVM

■ Symbol Eye Diagram

■ Symbol Table

■ Modulation Accuracy

Time Slot. Sets a time slot number to position the marker.
Range: 0 to the number of slots −1

Symbol Rate... Sets the symbol rate for displaying symbol constellation:

■ 15 k

■ 30 k

■ 60 k

■ 120 k

■ 240 k

■ 480 k

■ 960 k (default)

Short Code. Sets a short code number to position the marker.
Range: 0 to 6 channels.

Code Domain Power

If you select Code Domain Power in the Measure menu, the code domain power is displayed for each short code. See the display in Figure 2-15.

Figure 2-15: Code domain power versus Short code

Scale Menu   Use the following menu items to set the scale:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to display the waveform.

Horizontal Scale. Sets the scale of the horizontal axis. Range: 1.75 to 7 channels.

Horizontal Start. Sets the start channel number of the horizontal axis.

Vertical Scale. Sets the scale of the vertical axis. Range: 1 to 100 dB.

Vertical Stop. Sets the maximum value (top edge) of the vertical axis. Range: −100 to 100 dB.

Full Scale. Sets the scale of the vertical axis to the default full-scale value.

Y Axis. Selects whether to represent the vertical axis (amplitude) with relative or absolute values.

■ **Relative.** The vertical axis represents power relative to the total power of all channels.

■ **Absolute.** The vertical axis represents absolute power of each channel.

Power Codogram

If you select **Power Codogram** in the Measure menu, the code domain power is displayed with spectrogram. See the power codogram in Figure 2-16.
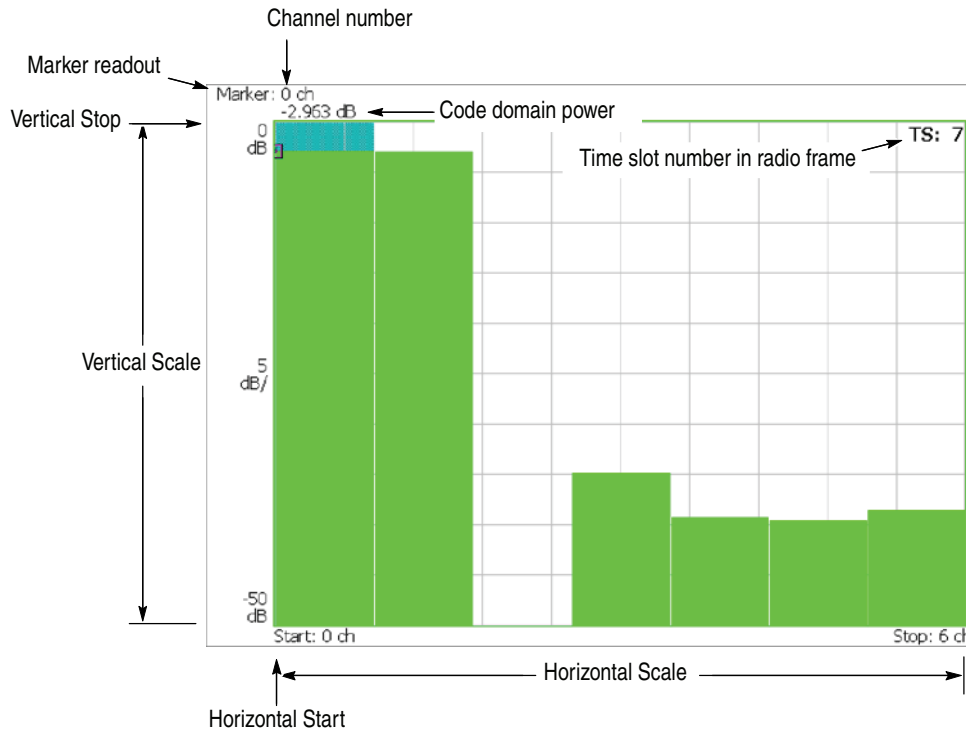

Figure 2-16: Power codogram

Scale Menu   Use the following menu items to set the scale:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to display the entire waveform.

Horizontal Scale. Sets the scale of the horizontal axis. Range: 1.75 to 7 channels.

Horizontal Start. Sets the start channel number of the horizontal axis.

Vertical Size. Sets the full scale of the vertical axis in frames.
Range: 58 to 59392 frames.

Vertical Start. Sets the start frame number of the vertical axis.

Color Scale. Sets the scale (the value subtracting the minimum power value from the maximum) of the color axis:

- 10 dB
- 20 dB
- 50 dB
- 100 dB

The spectrogram is displayed in 100 steps (100 colors) from the minimum value (blue) to the maximum value (red) in the default state.

Color Stop. Sets the maximum value (top edge) of the color axis.
Range: −50 to 50 dB.

Full Scale. Sets the maximum value of the color axis to the reference level and the height to 100 dB.

Y Axis. Selects whether to represent the Y (color) axis with relative or absolute values.

- **Relative.** Y axis shows power relative to the total power of all channels.
- **Absolute.** Y axis shows absolute power of each channel.

Stop
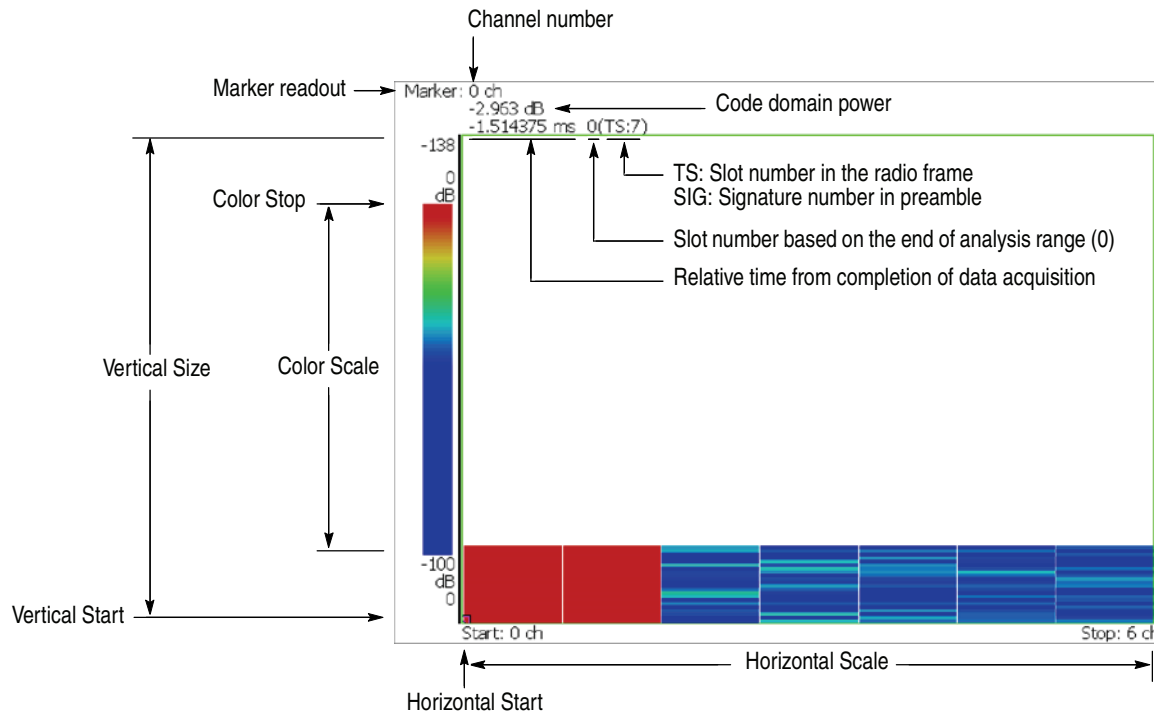
Scale Menu   Use the following menu items to set the scale:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to display the entire waveform.

Horizontal Scale. Sets the scale of the horizontal axis (number of slots).

Horizontal Start. Sets the start slot number of the horizontal axis.

Vertical Scale. Sets the scale of the vertical axis. Range: 1 to 100 dB.

Vertical Stop. Sets the maximum value (top edge) of the vertical axis. Range: −100 to 100 dB.

Full Scale. Sets the scale of the vertical axis to the default full scale value.

Y Axis. Selects whether to represent the vertical (amplitude) axis with relative values or absolute values.

- **Relative.** The vertical axis represents the power relative to the total power of all channels.
- **Absolute.** The vertical axis represents the absolute power of each channel.

Total Power. Determines whether to display the total power of time slots.

- **On.** Displays total power of time slots.
- **Off.** Displays power of the short code specified with Short Code (refer to page 2-28) for each time slot.

Code Power versus Symbol

If you select **Code Power versus Symbol** in the Measure menu, the code domain power is displayed for each symbol. See the display in Figure 2-18.
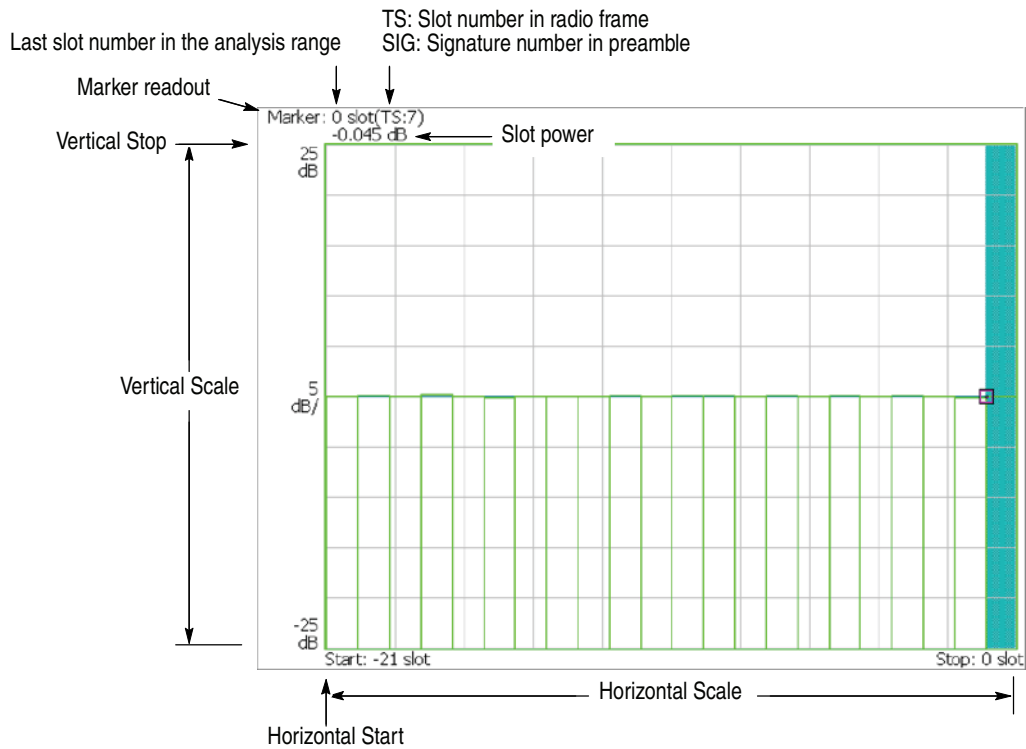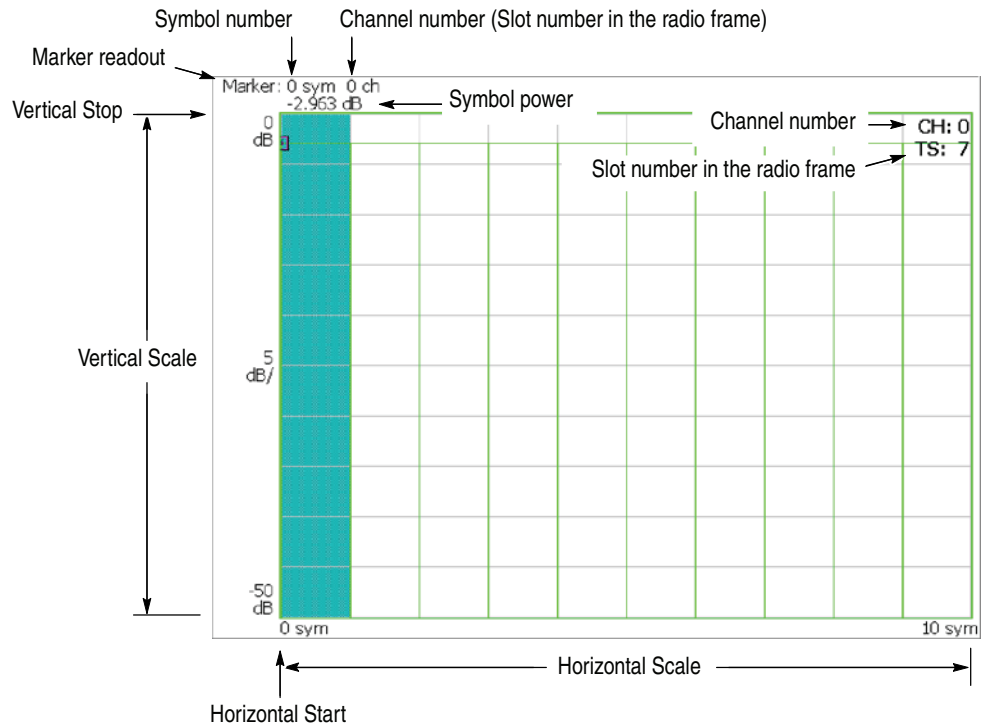

Figure 2-18: Code domain power versus Symbol

Scale Menu   Use the following menu items to set the scale:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to display the entire waveform.

Horizontal Scale. Sets the scale of the horizontal axis (number of symbols).

Horizontal Start. Sets the start symbol number of the horizontal axis.

Vertical Scale. Sets the scale of the vertical axis. Range: 1 to 100 dB.

Vertical Stop. Sets the maximum value (top edge) of the vertical axis. Range: −100 to 100 dB.

Full Scale. Sets the scale of the vertical axis to default full-scale value.

Y Axis. Selects whether to represent the vertical (amplitude) axis with relative values or absolute values.

- **Relative.** The vertical axis represents power relative to the total power of all channels.
- **Absolute.** The vertical axis represents absolute power of each channel.

Symbol Constellation

The symbol constellation is displayed when you select **Symbol Constellation** in the Measure menu. See the display in Figure 2-19.
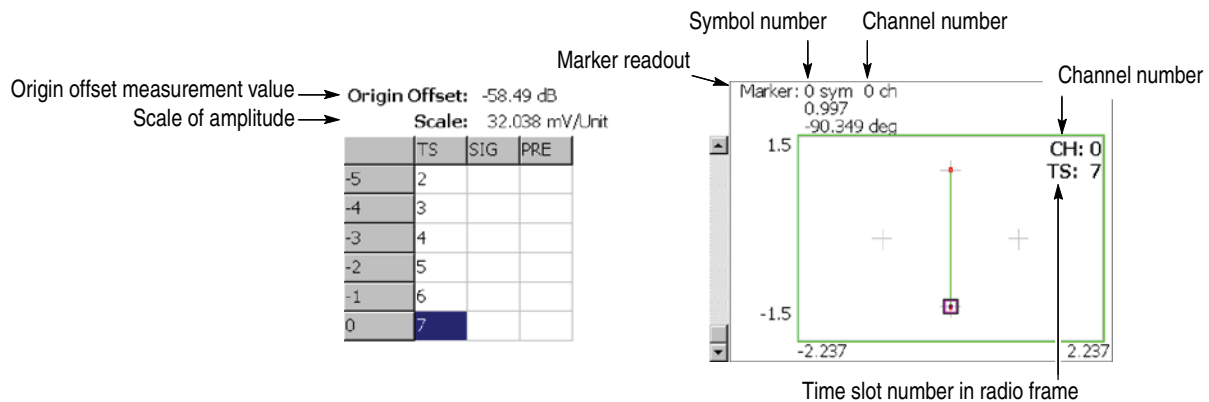
Figure 2-19: Symbol constellation

Scale Menu   Use the following menu items to set the scale:

Measurement Content... Selects vector or constellation display.

■ **Vector.** Selects vector display. A signal represented with phase and amplitude is displayed in polar coordinate or IQ diagram. The red point indicates the symbol position of the measured signal, and the yellow trace indicates the locus of the signal between symbols.

■ **Constellation.** Selects constellation display. It is the same as the vector display, except that only symbols of the measured signal are indicated in red, and the locus between symbols is not shown. The cross marks indicate the symbol positions of an ideal signal.

Symbol EVM

When you select **Symbol EVM** in the Measure menu, EVM is displayed for each symbol. See the display in Figure 2-20.
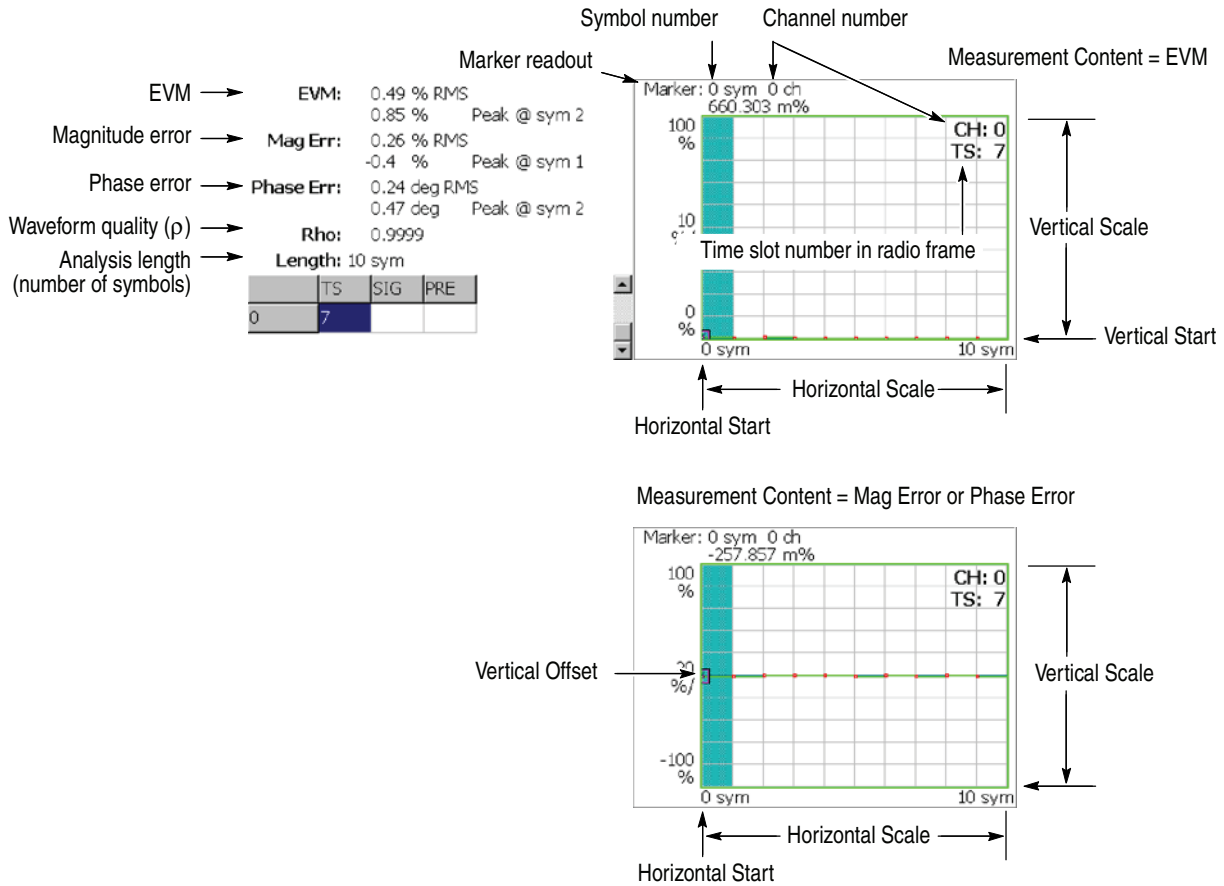
Figure 2-20: Symbol EVM

Scale Menu   Use the following menu items to set the scale:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to display the entire waveform.

Horizontal Scale. Sets the scale of the horizontal axis (number of symbols).

Horizontal Start. Sets the start symbol number of the horizontal axis.

Vertical Scale. Sets the scale of the vertical axis. Range: 100m to 100% (EVM), 200m to 200% (Mag Error), 450m to 450_ (Phase Error)

Vertical Start. When the measurement content is EVM, sets the minimum value (bottom edge) of the vertical axis. Range: -100 to 100% (EVM)

Vertical Offset. When the measurement content is Mag Error or Phase Error, sets the center value ((maximum + minimum) / 2) of the vertical axis.
Range: -200 to 200% (Mag Error), -450 to 450F (Phase Error)

Full Scale. Sets the scale of vertical axis to the default full-scale value.

Measurement Content... Selects a parameter of the vertical axis.

- **EVM.** Displays EVM on the vertical axis (Error Vector Magnitude).
- **Mag Error.** Displays magnitude error on the vertical axis.
- **Phase Error.** Displays phase error on the vertical axis.

Symbol Eye Diagram

The symbol eye diagram is displayed when you select **Symbol Eye Diagram** in the Measure menu. See the display in Figure 2-21.
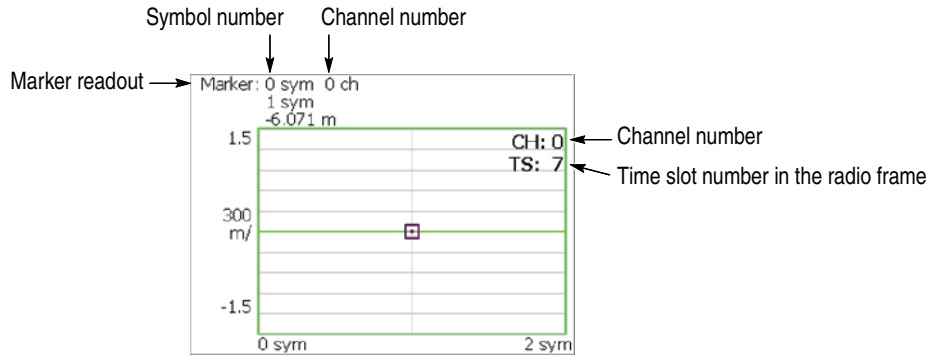
Figure 2-21: Symbol eye diagram

Scale Menu   Use the following menu items to set the scale:

Measurement Content... Selects the vertical axis of the eye diagram.

- **I.** Displays I data on the vertical axis (default).
- **Q.** Displays Q data on the vertical axis.
- **Trellis.** Displays phase on the vertical axis.

Eye Length. Enters the number of display symbols on the horizontal axis. Range: 1 to 16 (default: 2)

Symbol Table

When you select **Symbol Table** in the Measure menu, a symbol table is displayed. See Figure 2-22.
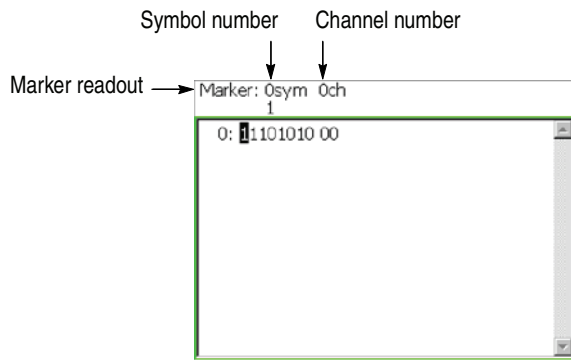
Figure 2-22: Symbol table

Scale Menu   Use the following menu items to set the scale:

Radix. Selects the radix for displaying the table:

- ■ **Hex.** Hexadecimal digit
- ■ **Oct.** Octal digit
- ■ **Bin.** Binary digit (default)

Rotate. Sets value start position. Range: 0 to 3.

Modulation Accuracy

The constellation of all channels before the despread is displayed when you select **Modulation Accuracy** in the Measure menu.

When you press the View: **Select** key on the front panel to select the constellation view, the measurement results for the time slot are shown instead of the overview (see Figure 2-23).

Measurement results
■ EVM (Error Vector Magnitude) (RMS and peak)
■ Magnitude error (RMS and peak)
■ Phase error (RMS and peak)
These values are displayed when you select the constellation view.

EVM (rms):	3.01 %
EVM (peak):	6.34 %
Mag Error (rms):	2.27 %
Mag Error (peak):	6.11 %
Phase Error (rms):	0.92 deg
Phase Error (peak):	3.5 deg

Time at the marker position
(relative to the end of data acquisition)

Marker readout

Measurement results
■ PCDE (Peak Code Domain Error) @ channel
■ Magnitude error (RMS)
■ Phase error (RMS)
■ Waveform quality (ρ)
■ Frequency error
■ Origin offset (IQ feedthrough)

PCDE:	-44.91 dB @ 1
EVM (rms):	3.01 %
Mag Error (rms):	2.27 %
Phase Error (rms):	0.92 deg
Rho:	0.9991
Frequency Error:	-3.662 Hz
Origin Offset:	-60.38 dB

	TS	SIG	PRE
-1	6		
0	7		

Marker: -1.601171875 ms
0.932
-80.02 deg

TS: 7

Constellation view

Time slot number in radio frame

Figure 2-23: Modulation accuracy

The view settings are the same as for Symbol Constellation. Refer to *Symbol Constellation* on page 2-37.

3GPP-R5 Downlink Modulation Analysis

This section describes the basic operation of the 3GPP-R5 downlink analysis in the Demod (Modulation Analysis) mode. You can access the measurement items by pressing **Demod** → **Standard...** → **3GPP-R5-DL** as shown in Figure 2-24.
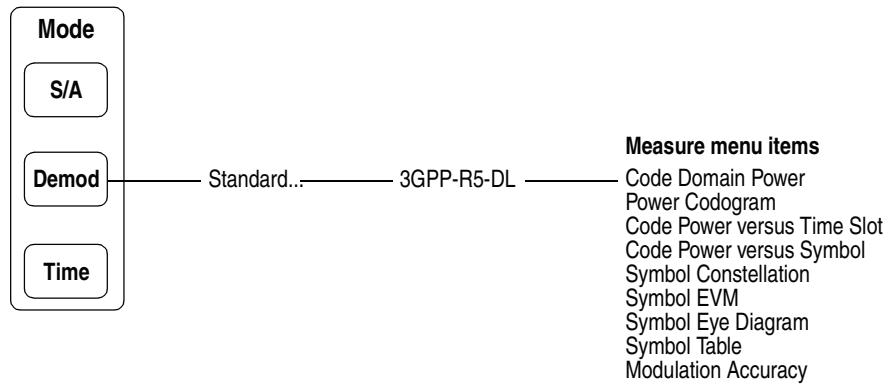
Figure 2-24: 3GPP-R5 downlink modulation analysis measurement menu

The measurement in the Demod mode is based on the digital modulation analysis function. For the digital modulation analysis, refer to your instrument user manual.

Measurement Procedure

The following procedure shows you how to acquire data of multiple slots in advance, measure continuous data, and obtain continuous code domain power:

NOTE. For details on basic operation of the analyzer, refer to your instrument user manual.

1. Press the **Demod** key on the front panel.

2. Press the side key **Standard...** → **3GPP-R5-DL**.

3. Press the **Frequency/Channel** key on the front panel to set frequency.

   If you use the channel table, perform these steps:

   a. Press the **Channel Table...** side key and select **W-CDMA-DL**.

   b. Press the **Channel** side key and select a channel by rotating the general purpose knob.

   The center frequency is set to the value corresponding to the channel.

4. Press the **Span** key on the front panel to set the span.

5. Press the **Amplitude** key on the front panel to set the amplitude appropriately.

NOTE. If the input level is too high, "Overrange - increase RefLev or Atten" displays in the red box at the center top of the screen. If this occurs, raise the reference level.

6. Press the **Acquisition/Analysis** key on the front panel and then the **Acquisition Length** side key to set the time length to acquire one block.

   Suppose that one block contains M frames; the acquisition length is calculated with this equation:

   (One block acquisition length) = M $\times$ (One frame acquisition length)

   One frame acquisition length is determined by span and indicated on the **Spectrum Length** side key.

   The number of frames M required for measuring N slots must meet the following condition:

   $$M > K \times (N + 1.2) + 1$$

   where
   K = 16.7 (for the span of 20 MHz and 15 MHz)
     8.34 (for the span of 10 MHz)
     4.17 (for the span of 5 MHz)

7. After acquiring measurement data, stop the data acquisition. If you are acquiring data in the continuous mode, press the **Run/Stop** key.

8. Press the **Measure** key on the front panel and select measurement items. For example, press the **Power Codogram** side key to observe the code domain power spectrogram.

9. Press the **Meas Setup** key on the front panel and set the measurement parameters. Refer to page 2-47 for details of the Meas Setup menu.

10. Set the analysis range in the overview. Refer to your instrument user manual for the details.

11. Press the **Analyze** side key to perform measurement for the frames in the analysis range. The measurement result and waveform are displayed in the main view.

    Change the scale and format of the view as needed. Refer to page 2-50 for setting views specific to the 3GPP-R5 downlink analysis.

12. If the level of input signals is low, the waveform may not be displayed correctly. In this case, perform the following procedure:

NOTE. *The 3GPP-R5 downlink signal analysis may not be performed correctly if the P-SCH, S-SCH, and PCPICH channels are too low to be detected. An error occurs when one of these channel levels is lower than several tenths the sum of other channel levels. In this case, set Scrambling Code Search to Off and specify the scrambling code with the Scrambling Code side key.*

---

    a. Press the **Meas Setup** key on the front panel.

    b. Press the **Modulation Parameters...** side key.

    c. Press the **Scrambling Code Search** side key to select **Off**.

    d. Press the **Scrambling Code** side key and enter the scrambling code.

    The analyzer performs the measurement with the value set here in place of detecting the scrambling code.

    e. Press the **Meas Setup** key on the front panel.

    f. Press the **Analyze** side key to perform measurement for the frames in the analysis range.

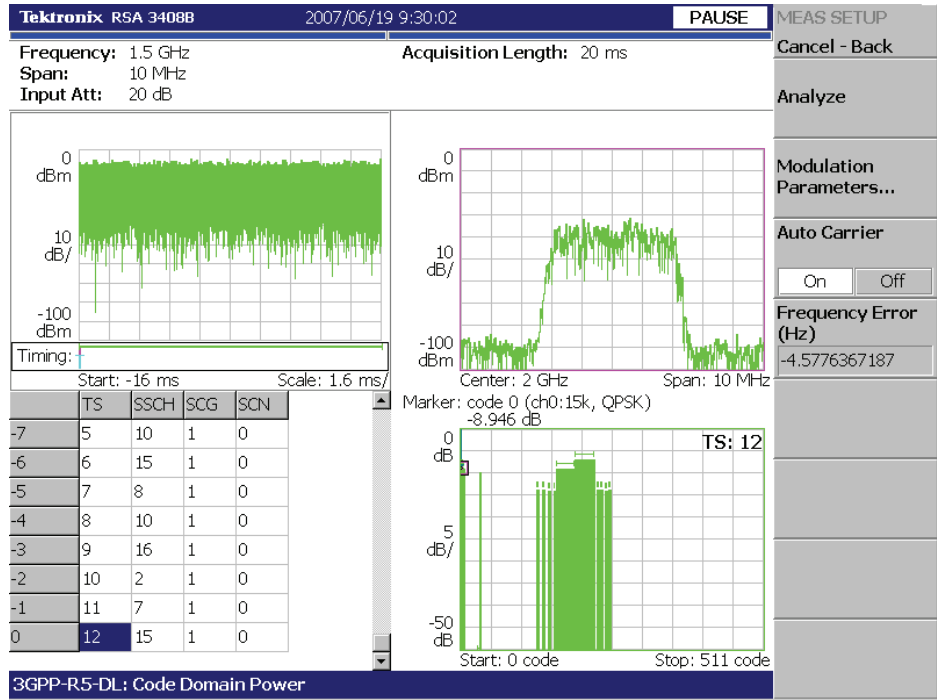Figure 2-25 shows an example of the code domain power measurement.

Figure 2-25: Example of the code domain power measurement

Change the scale and format of the view as needed. Refer to page 2-50 for setting views specific to the 3GPP-R5 uplink analysis.

Measurement Setup Menu

The Meas Setup menu for the 3GPP-R5 downlink modulation analysis contains the following controls:

Analyze   Performs measurements for time slots in the analysis range.

NOTE. When you change settings of the parameters in the Meas Setup menu described below, press the **Analyze** *side key to perform the measurement for the modified settings.*

Modulation Parameters...   Sets a measurement parameter to a non-standard value. The following controls are provided:

Scrambling Code Search. Selects whether to perform analysis by detecting a scrambling code from input signals.

■   **On.** Detects a scrambling code automatically from the input signal to perform the measurement.

■   **Off.** *Default*. Performs measurement using the scrambling code that has been set manually with **Scrambling Code** described below.

NOTE. The manual mode (Scrambling Code Search Off) should be used with the appropriate scrambling code for reliable detection when either multiple code channels are active or the sync channels have low power.

Also refer to *Note* on page 2-45.

Scrambling Code. Sets the scrambling code number when you select Off in Scrambling Code Search. The analyzer performs measurement using the set scrambling code. Range: 0 to 24575 (default: 0).

The 3GPP standard defines the scrambling code with the following formulas. Input the n value to set the code.

Primary scrambling code: $n = 16 * i$ where $i = 0$ to 511
Secondary scrambling code: $n = 16 * i + k$ where $k = 1$ to 15

Use Alternative Scramb. Code... Selects the despread method to display the measurement results:

- **Not Used.** *Default*. Uses the primary scrambling code only (without the left and the right alternative scrambling codes) to despread the input signal.

- **Primary.** Uses the primary scrambling with the left and the right alternative scrambling codes to despread the input signal.

- **Left Alternative.** Uses the left alternative scrambling code to despread the input signal.

- **Right Alternative.** Uses the right alternative scrambling code to despread the input signal.

Primary, **Left Alternative** and **Right Alternative** use the proprietary algorithm to enhance the sensitivity by approximately 20 to 30 dB compared to **Not Used**. **Not Used** does not use the alternative scrambling codes, providing faster measurements.

Use SCH Part. Selects whether to include or exclude the SCH portion when calculating the code domain power.

- **On.** Calculates the code domain power by including the SCH portion.

- **Off.** *Default*. Calculates the code domain power by excluding the SCH portion.

Composite. Determines whether to perform the composite analysis (automatic detection of symbol rate).

- **On.** *Default*. Specifies that the composite analysis is performed.

- **Off.** Specifies that the composite analysis is not performed.

NOTE. You should usually specify that composite analysis is performed. If a normal analysis does not result, select Off in this command and select a specific symbol rate with Symbol Rate in the View: Define menu.

16QAM Detection. Selects whether to detect the QPSK or 16QAM code channel automatically.

- **On.** *Default*. Automatically detects whether the code channel is QPSK or 16QAM.

- **Off.** Assumes that all code channels are QPSK.

Measurement Filter... Selects a filter for demodulating digitally-modulated signals:

- None (no filter)
- RootRaisedCosine (default)

Reference Filter... Selects a filter for creating reference data:

- None (no filter)
- RaisedCosine (default)
- Gaussian

For the filters, refer to *Process Flow of Digitally-Modulated Signal* in the your instrument user manual.

Filter Parameter. Sets the α/BT value for Measurement Filter and Reference Filter described above. Range: 0.0001 to 1 (default: 0.22).

Auto Carrier Selects whether to detect the carrier automatically.

- **On.** *Default.* Automatically detects the carrier for every frame. The error from the center frequency is shown on the **Freq Error** side key.
- **Off.** Sets the carrier frequency using **Frequency Offset** described below.

Frequency Offset Sets the carrier frequency when **Auto Carrier** is selected to Off. Input the carrier offset from the center frequency.

EVM IQ Origin Offset Determines whether to include or exclude the I/Q origin offset in the EVM, Rho, and PCDE calculation.

- **Include.** *Default.* Includes the I/Q origin offset in the EVM, Rho, and PCDE calculation.
- **Exclude.** Excludes the I/Q origin offset from the calculation.

Scale and Format of View

The following main views are specific for the measurement items of the 3GPP-R5 downlink analysis in Demod mode:

- Code domain power

- Power codogram

- Code power versus Time slot

- Code power versus Symbol

- Symbol constellation

- Symbol EVM

- Symbol eye diagram

- Symbol table

- Modulation accuracy

Each view (and its specific menu) is described on the following pages. In the main view, the time slot table shown in Figure 2-26 is displayed in addition to waveform and measurement results.

Figure 2-26: Time slot table

View: Define Menu   The View: Define menu is common to all main views of the 3GPP-R5 downlink measurement items. It contains the following controls:

Show Views. Selects the view style:

■ **Single.** Displays only the view selected by the View: **Select** key.

■ **Multi.** *Default.* Displays the overview, subview, and main view.

Overview Content... Selects a view to display in the overview:

■ Waveform (power versus time)

■ Spectrogram

Subview Content... Selects a view to display in the subview:

■ Spectrum

■ Code Domain Power

■ Power Codogram

■ CDP vs Time Slot (code domain power versus time slot)

■ CDP vs Symbol (code domain power versus symbol)

■ Symbol Constellation

■ Symbol EVM

■ Symbol Eye Diagram

■ Symbol Table

■ Modulation Accuracy

Time Slot. Sets a time slot number to position the marker.
Range: 0 to the number of slots −1

Channelization Code. Sets a channelization code number to position the marker.
Range: Channel 0 to 511.

Multi Slot. Selects whether to display single slot or multiple slots in the main view. This selection affects only the code domain power versus symbol view and the symbol EVM view. In the other views, it has no effect.

■ **Off.** Displays one time-slot selected by the **Time Slot** side key.

■ **On.** Displays up to 15 time-slots in the main view.

Menu Off. Removes the side menu from the screen to expand the waveform and measurement result area. Press the **MENU** side key when you return to the original display.

Show SCH Part. Determines whether to display SCH at the beginning of data.

- **Off.** Hides the SCH part.
- **On.** Displays the SCH part.

Symbol Rate... Sets the symbol rate for displaying symbol constellation:

- 960 k
- 480 k
- 240 k
- 120 k
- 60 k
- 30 k
- 15 k
- 7.5 k
- Composite

The default is Composite for multi-rate.

Code Domain Power

When you select Code Domain Power in the Measure menu, the code domain power is displayed for each channelization code, as shown in Figure 2-27.
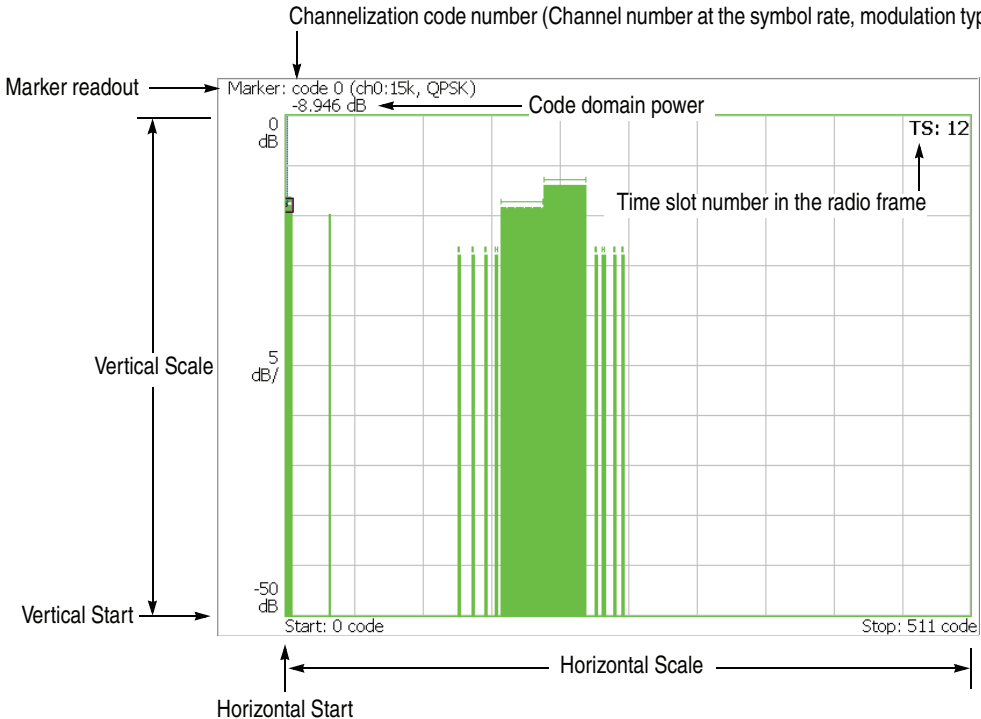

Figure 2-27: Code domain power

Scale Menu Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to fit the waveform to the screen.

Horizontal Scale. Sets the scale of the horizontal axis.
Range: 16 to 512 channels.

Horizontal Start. Sets the start channel number of the horizontal axis.
Range: 0 to [512 −(Horizontal Scale)].

Vertical Scale. Sets the scale of the vertical axis.
Range: 50 μ to 50 dB.

Vertical Stop. Sets the maximum value (top edge) of the vertical axis.
Range: −50 to Vertical Scale [dB].

Full Scale. Sets the scale of the vertical axis to the default full scale value.

Y Axis. Selects whether to represent the vertical axis (amplitude) with relative or absolute values.

- **Relative.** The vertical axis represents power relative to the total power of all channels.
- **Absolute.** The vertical axis represents absolute power of each channel.

Power Codogram

When you select Power Codogram in the Measure menu, the code domain power is displayed in spectrogram, as shown in Figure 2-28.
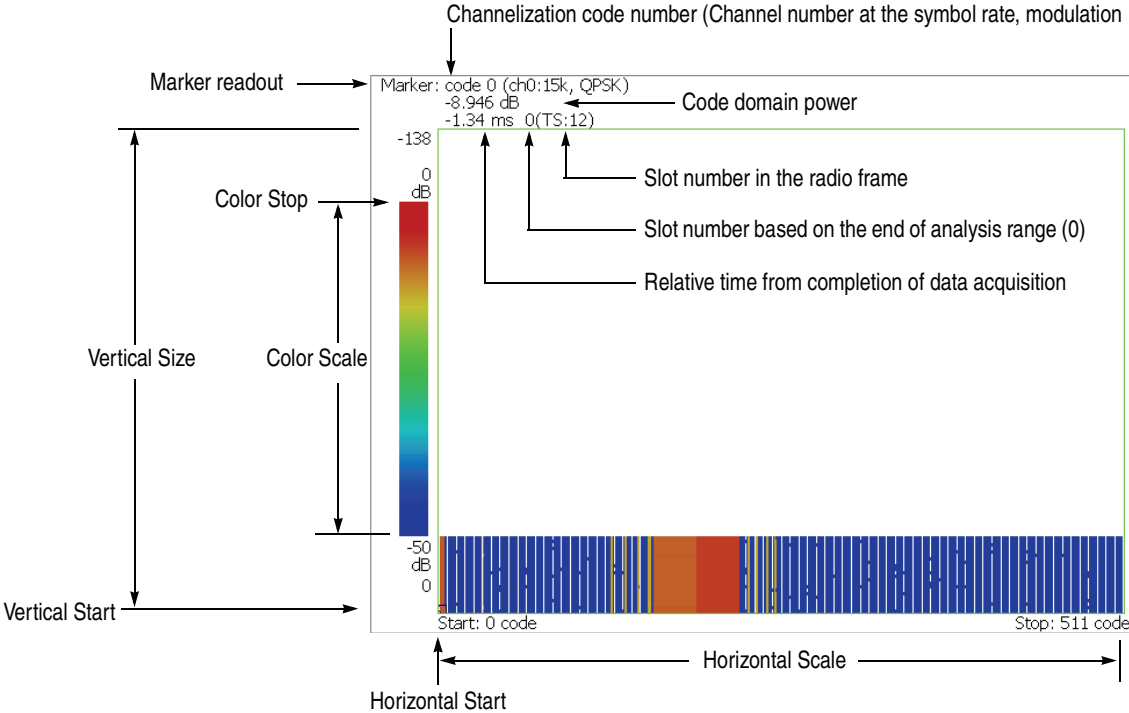

Figure 2-28: Power codogram

Scale Menu   Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to fit the waveform to the screen.

Horizontal Scale. Sets the scale of the horizontal axis.
Range: 16 to 512 channels.

Horizontal Start. Sets the start channel number of the horizontal axis.
Range: 0 to [512 − (Horizontal Scale)].

Vertical Size. Sets the full scale of the vertical axis in frames.
Range: 58 to 59392.

Vertical Start. Sets the start frame number of the vertical axis.

Color Scale. Sets the scale of the color axis (the value obtained by subtracting the minimum value from the maximum power).

- 5 dB

- 10 dB

- 20 dB

- 50 dB

The spectrogram is displayed in 100 steps (100 colors) from the minimum value (blue) to the maximum value (red) in the default state.

Color Stop. Sets the maximum value (top edge) of the color axis.
Range: −50 to Color Scale [dB].

Full Scale. Sets Color Stop to 0 (zero) and Color Scale to 50 dB.

Y Axis. Selects whether to represent the Y (color) axis with relative or absolute values.

- **Relative.** The Y axis represents power relative to the total power of all channels.

- **Absolute.** The Y axis represents absolute power of each channel.

Code Power versus Time Slot

When you select Code Power versus Time Slot in the Measure menu, the code domain power is displayed for each slot, as shown in Figure 2-29.
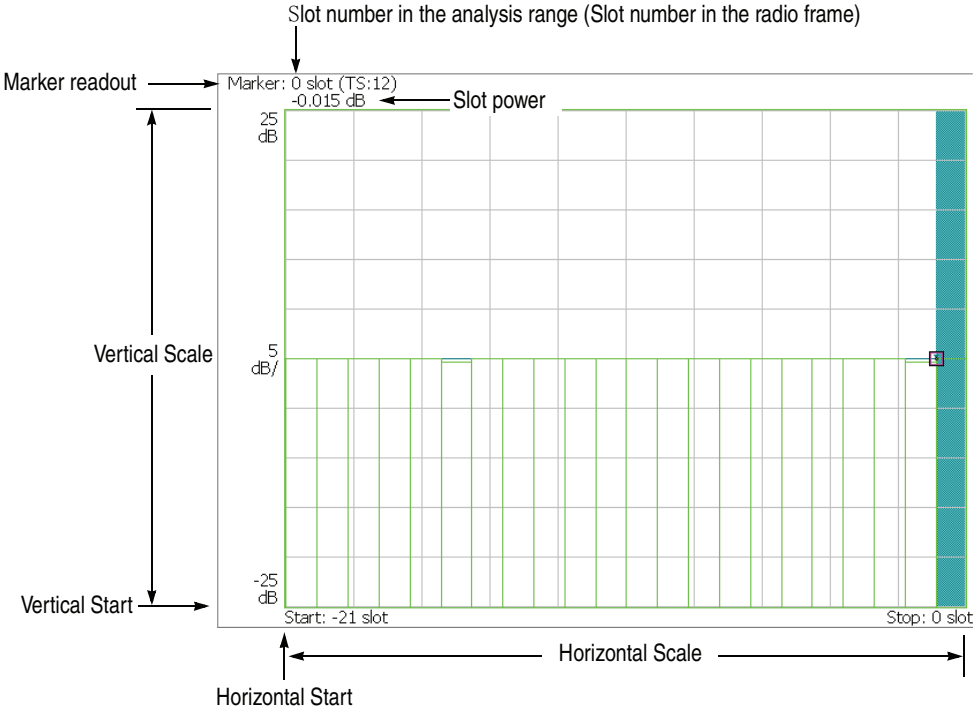

Figure 2-29: Code domain power versus Time slot

Scale Menu Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to display the entire waveform.

Horizontal Scale. Sets the scale of the horizontal axis (number of slots). Range: N/8 to N slots (N: the number of slots in the analysis range.)

Horizontal Start. Sets the start slot number of the horizontal axis. Range: $-(N-1)$ to $[1-$ (Horizontal Scale)].

Vertical Scale. Sets the scale of the vertical axis. Range: 50 µ to 50 dB.

Vertical Stop. Sets the maximum value (top edge) of the vertical axis. Range: -25 to [(Vertical Scale) $+25$] dB.

Full Scale. Sets the scale of the vertical axis to the default full scale value.

Y Axis. Selects whether to represent the vertical (amplitude) axis with relative or absolute values.

- **Relative.** The vertical axis represents time slot power relative to the power of the first time slot in the analysis range.

- **Absolute.** The vertical axis represents absolute power of time slots.

Select Power. Selects the channel to show the power for each time slot.

- **Code.** Shows the power of all channels or the specified channel depending on the setting of Total Power described below.

- **PSCH.** Shows the power of the PSCH (Primary Synchronization Channel).

- **SSCH.** Shows the power of the SSCH (Secondary Synchronization Channel).

Total Power. Determines whether to display the total power for each time slot when you select Code with Select Power described above.

- **On.** *Default.* Displays the total power of all channels for each time slot.

- **Off.** Displays power of the channel specified with Channelization Code in the View: Define menu (refer to page 2-51).

Code Power versus Symbol

When you select Code Power versus Symbol in the Measure menu, the code domain power is displayed for each symbol, as shown in Figure 2-30.
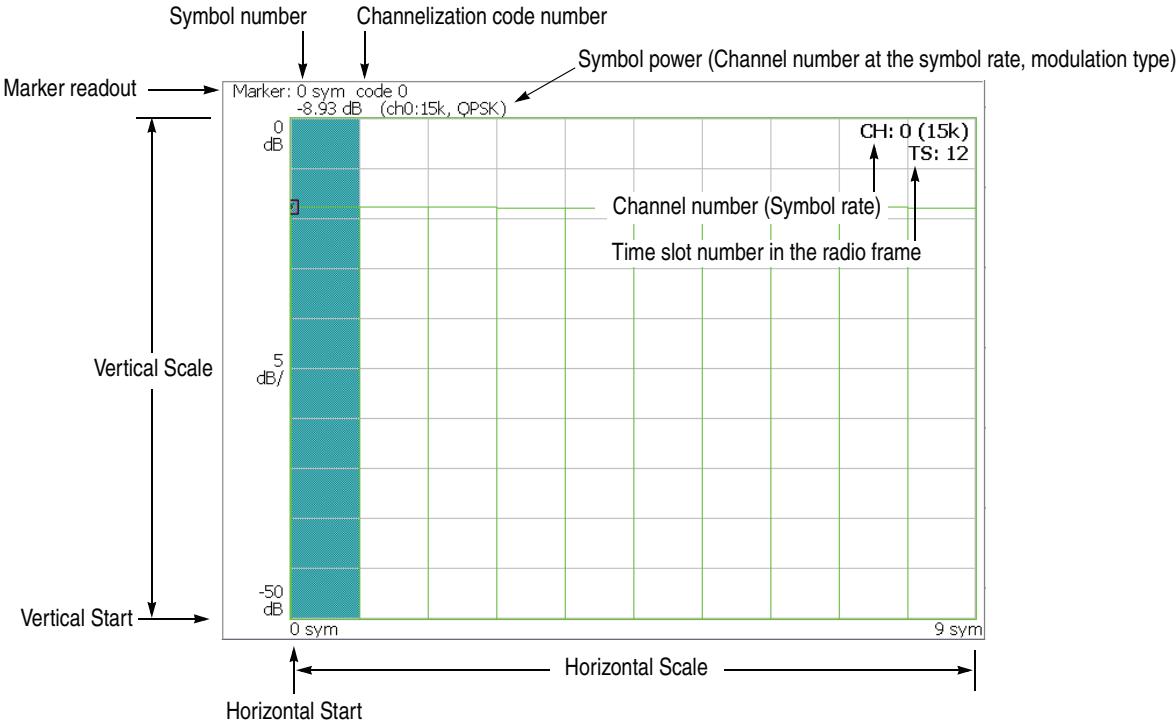

Figure 2-30: Code domain power versus Symbol

Scale Menu   Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to fit the waveform to the screen.

Horizontal Scale. Sets the scale of the horizontal axis (number of symbols). Range: 0 to 320 symbols.

Horizontal Start. Sets the start symbol number of the horizontal axis. Range: 0 to [(initial value of Horizontal Scale) − (set value of Horizontal Scale)].

Vertical Scale. Sets the scale of the vertical axis. Range: 50 μ to 50 dB.

Vertical Stop. Sets the maximum value (top edge) of the vertical axis. Range: −50 to Vertical Scale [dB].

Full Scale. Sets the scale of the vertical axis to the default full-scale value.

Y Axis. Selects whether to represent the vertical (amplitude) axis with relative or absolute values.

■ **Relative.** The vertical axis represents power relative to the total power of all channels.

■ **Absolute.** The vertical axis represents absolute power of each channel.

Symbol Constellation

The symbol constellation is displayed when you select Symbol Constellation in the Measure menu, as shown in Figure 2-31.
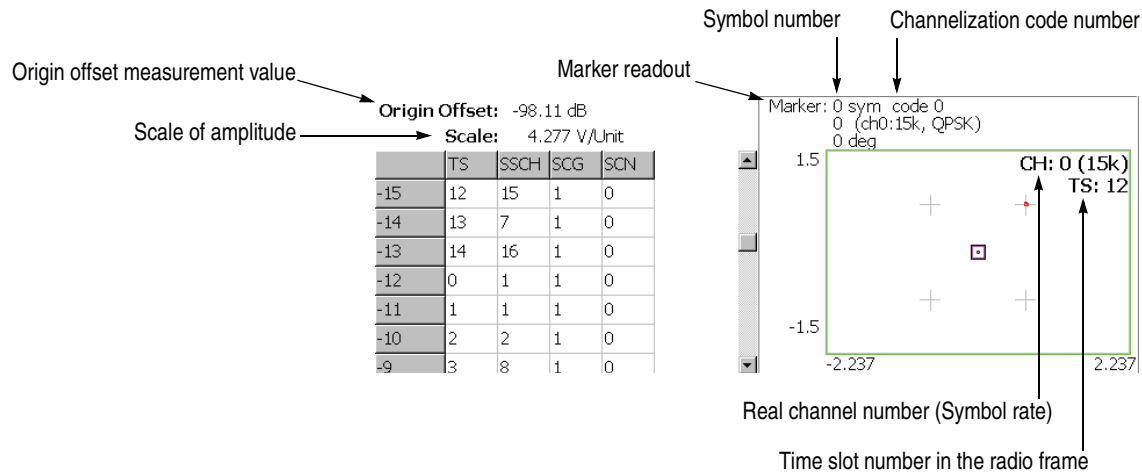

Figure 2-31: Symbol constellation

Scale Menu   Use the following controls to set the scale:

Measurement Content... Selects vector or constellation display.

- **Vector.** Selects vector display. A signal represented by phase and amplitude is displayed in polar coordinate or IQ diagram. The red point indicates the symbol position of the measured signal, and the yellow trace indicates the locus of the signal between symbols.

- **Constellation.** Selects constellation display. It is the same as the vector display, except that only symbols of the measured signal are indicated in red, and the locus between symbols is not shown. The cross marks indicate the symbol positions of an ideal signal.

You can select degree or radian for the angular unit by pressing **System →
Instrument Setup... → Angular Units...**

Symbol EVM

When you select Symbol EVM in the Measure menu, EVM (Error Vector Magnitude) is displayed for each symbol, as shown in Figure 2-32.
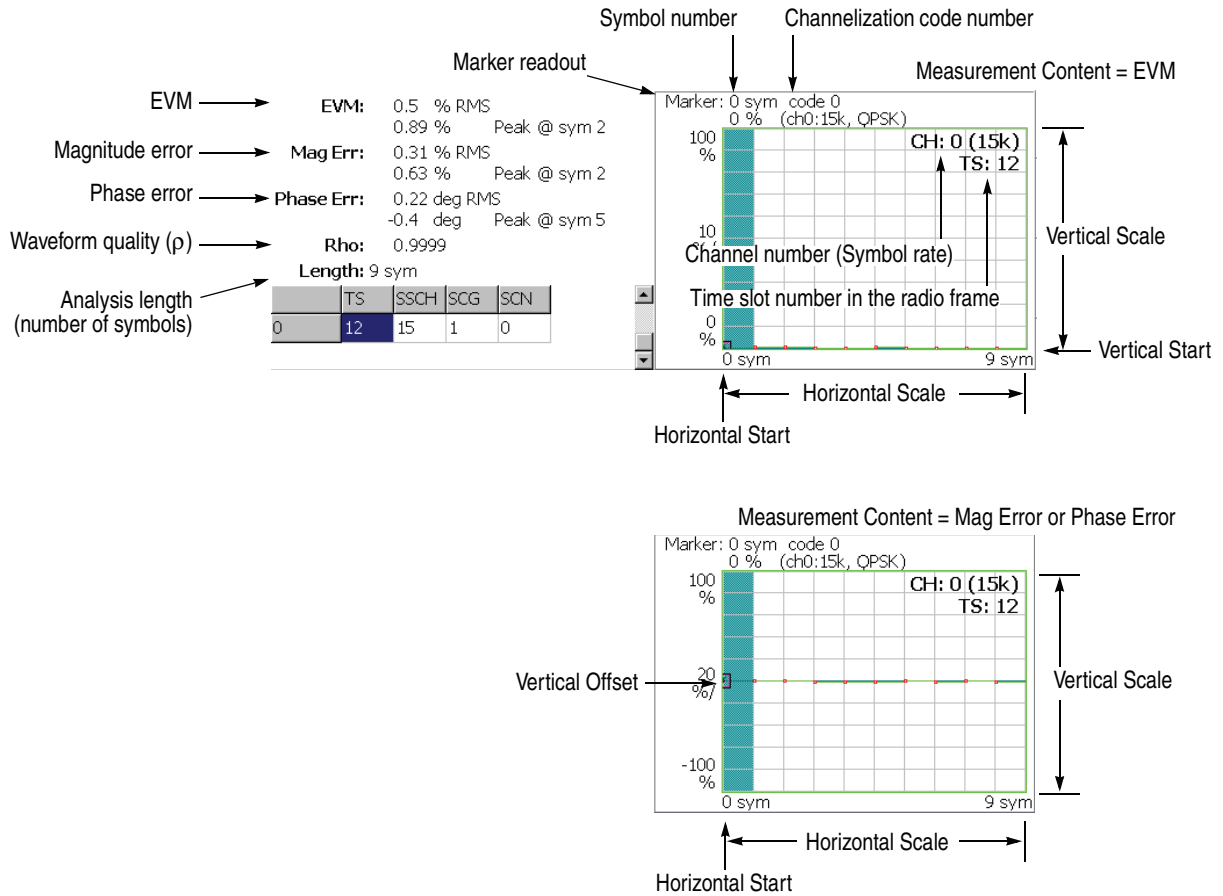

Figure 2-32: Symbol EVM

Scale Menu   Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to fit the waveform to the screen.

Horizontal Scale. Sets the scale of the horizontal axis (number of symbols). Range: 0 to 320 symbols.

Horizontal Start. Sets the start symbol number of the horizontal axis. Range: 0 to [(initial value of Horizontal Scale) − (set value of Horizontal Scale)].

Vertical Scale. Sets the scale of the vertical axis. Refer to Table 2-3 for the setting range.

Vertical Start. Sets the minimum value (bottom edge) of the vertical axis when the measurement content is EVM. Refer to Table 2-3 for the setting range.

Vertical Offset. Sets the center value ((maximum + minimum) / 2) of the vertical axis when the measurement content is Mag Error or Phase Error. Refer to Table 2-3 for the setting range.

Full Scale. Sets the scale of vertical axis to the default full-scale value.

Measurement Content... Selects how to display the vertical axis:

- **EVM.** Represents the vertical axis with EVM.

- **Mag Error.** Represents the vertical axis with magnitude error.

- **Phase Error.** Represents the vertical axis with phase error.

Table 2-3: Vertical scale setting range

Measurement Content...	Vertical Scale	Vertical Start	Vertical Offset
EVM	100µ to 100%	−100 to 100%	-
Mag Error	200µ to 200%	-	−200 to 200%
Phase Error	450µ to 450°	-	−450 to 450°

You can select degree or radian for the angular unit by pressing **System** → **Instrument Setup...** → **Angular Units...**

Symbol Eye Diagram

The symbol eye diagram is displayed when you select Symbol Eye Diagram in the Measure menu, as shown in Figure 2-33.
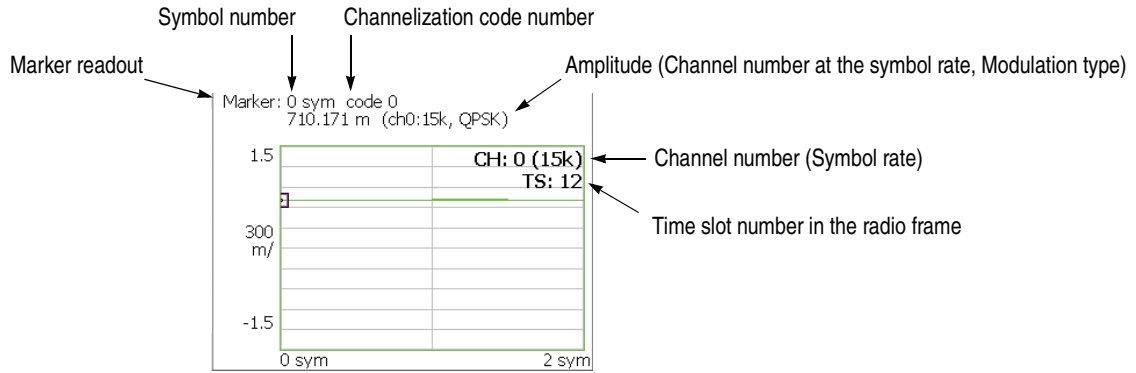

Figure 2-33: Symbol eye diagram

Scale Menu   Use the following controls to scale the view.

Measurement Content... Selects the vertical axis of eye diagram.

- **I.** *Default*. Displays I data on the vertical axis.

- **Q.** Displays Q data on the vertical axis.

- **Trellis.** Displays phase on the vertical axis.

Eye Length. Enters the number of display symbols on the horizontal axis. Range: 1 to 16 (default: 2)

Symbol Table

The symbol table is displayed when you select Symbol Table in the Measure menu, as shown in Figure 2-34.
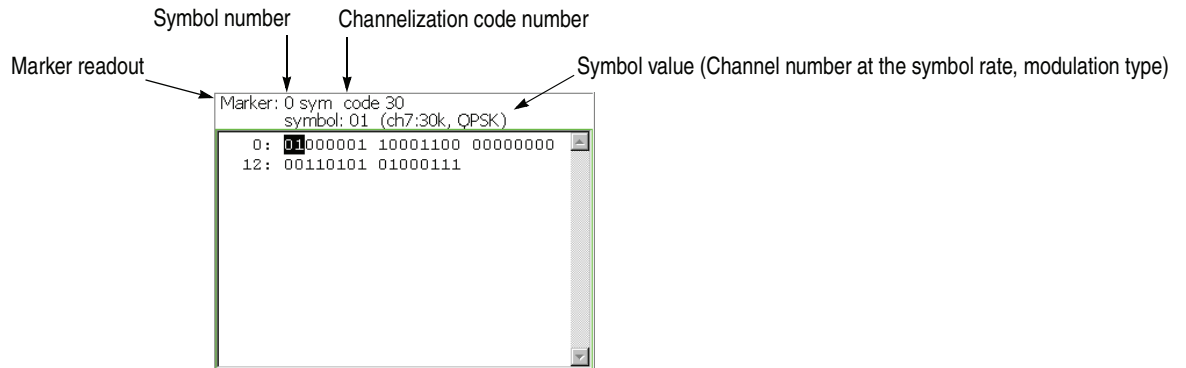

Figure 2-34: Symbol table

Scale Menu Use the following controls to scale the view:

Radix. Selects the radix for displaying the table:

- ■ **Hex.** Hexadecimal digit
- ■ **Oct.** Octal digit
- ■ **Bin.** *Default.* Binary digit

Hex and Oct indicate values of binary data string in units of modulation symbol.

Rotate. Sets the start position. Range: 0 to 3.

Modulation Accuracy

The constellation of all channels before the despread is displayed when you select Modulation Accuracy in the Measure menu.

When you press the View: **Select** key on the front panel to select the constellation view, the measurement results for the time slot are displayed instead of the overview, as shown in Figure 2-35.
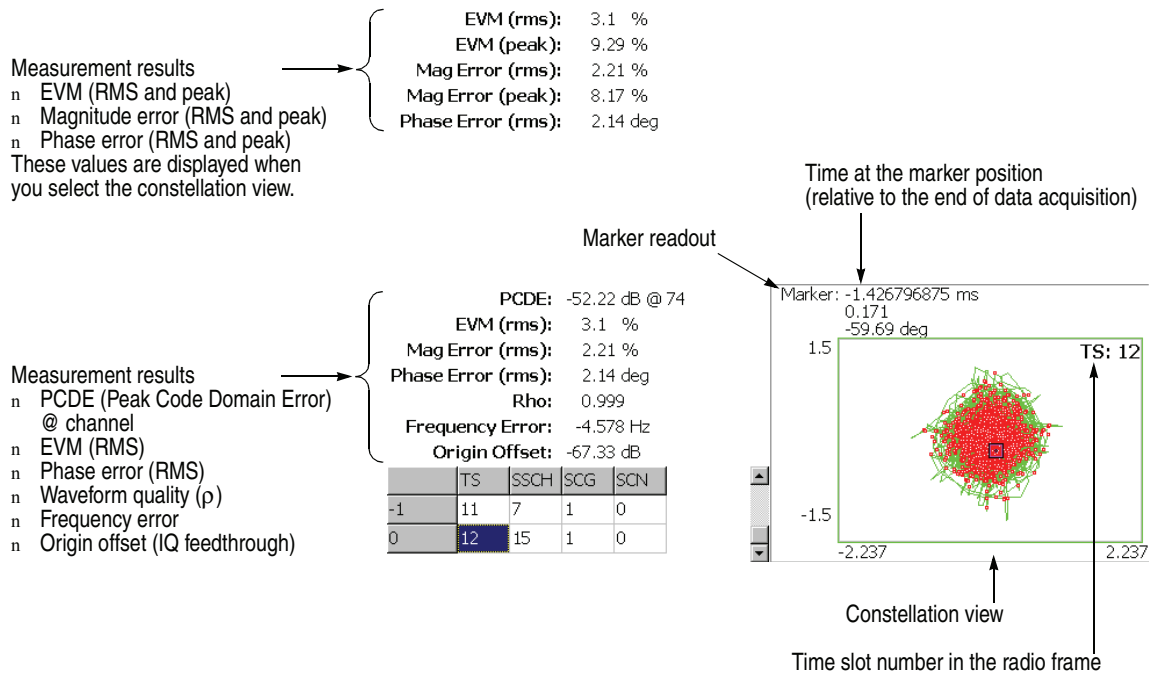
Measurement results
n EVM (RMS and peak)
n Magnitude error (RMS and peak)
n Phase error (RMS and peak)
These values are displayed when you select the constellation view.

EVM (rms):	3.1 %
EVM (peak):	9.29 %
Mag Error (rms):	2.21 %
Mag Error (peak):	8.17 %
Phase Error (rms):	2.14 deg

Time at the marker position
(relative to the end of data acquisition)

Marker readout

Measurement results
n PCDE (Peak Code Domain Error) @ channel
n EVM (RMS)
n Phase error (RMS)
n Waveform quality (ρ)
n Frequency error
n Origin offset (IQ feedthrough)

PCDE:	-52.22 dB @ 74
EVM (rms):	3.1 %
Mag Error (rms):	2.21 %
Phase Error (rms):	2.14 deg
Rho:	0.999
Frequency Error:	-4.578 Hz
Origin Offset:	-67.33 dB

	TS	SSCH	SCG	SCN
-1	11	7	1	0
0	12	15	1	0

Marker: -1.426796875 ms
0.171
-59.69 deg

TS: 12

1.5

-1.5

-2.237   2.237

Constellation view

Time slot number in the radio frame

Figure 2-35: Modulation accuracy

The view settings are the same as for Symbol Constellation.
Refer to *Symbol Constellation* on page 2-61.

3GPP-R5 Uplink Modulation Analysis

This section describes the basic operation for the 3GPP-R5 uplink analysis in the Demod (modulation analysis) mode. You can access the measurement item by pressing **Demod** → **Standard...** → **3GPP-R5-UL** as shown in Figure 2-36.
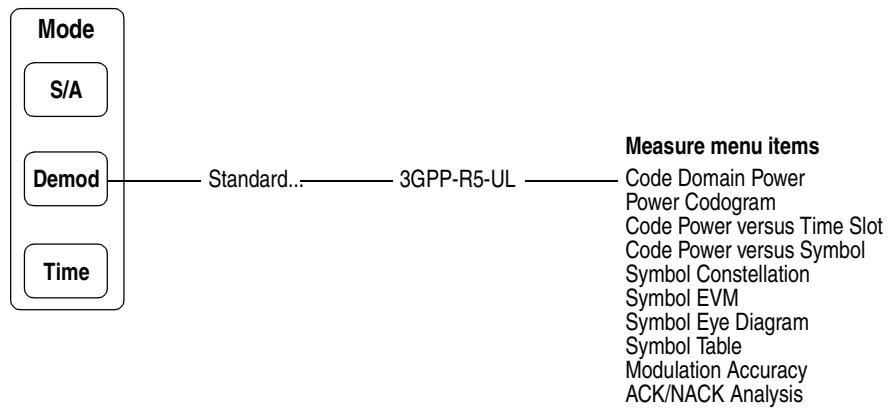

Figure 2-36: 3GPP-R5 uplink modulation analysis measurement menu

The measurement in the Demod mode is based on the digital modulation analysis function. For the digital modulation analysis, refer to your instrument user manual.

Measurement Procedure

The following procedure shows you how to acquire data of multiple slots in advance, measure continuous data, and obtain continuous code domain power:

NOTE. For details on basic operation of the analyzer, refer to your instrument user manual.

1. Press the **Demod** key on the front panel.

2. Press the side key **Standard...** $\rightarrow$ **3GPP-R5-UL**.

3. Press the **Frequency/Channel** key on the front panel to set frequency.

   If you use the channel table, do these steps:

   - Press the **Channel Table...** side key and select **W-CDMA-UL**.

   - Press the **Channel** side key and select a channel by rotating the general purpose knob.

   The center frequency is set to the value corresponding to the channel.

4. Press the **Span** key on the front panel to set the span.

5. Press the **Amplitude** key on the front panel to set the amplitude appropriately.

NOTE. If the input level is too high, "Overrange - increase RefLev or Atten" displays in the red box at the center top of the screen. If this occurs, raise the reference level.

6. Press the **Acquisition/Analysis** key on the front panel and then the **Acquisition Length** side key to set the time length to acquire one block.

   Suppose that one block contains M frames; the acquisition length is calculated with this equation:

   (One block acquisition length) = M $\times$ (One frame acquisition length)

   One frame acquisition length is determined by span and indicated on the Spectrum Length side key.

   The number of frames M required for measuring N slots must meet the following condition:

   $M > K \times (N + 1.2) + 1$

   where
   K = 16.7 (for span 20 MHz and 15 MHz)
       8.34 (for span 10 MHz)
       4.17 (for span 5 MHz)

7. After acquiring measurement data, stop the acquisition.
   If you are acquiring data in the continuous mode, press the **Run/Stop** key.

8. Press the **Measure** key on the front panel and select measurement items. For example, press the **Power Codogram** side key to observe the code domain power spectrogram.

9. Press the **Meas Setup** key on the front panel and set the measurement parameters. Refer to page 2-70 for details of the Meas Setup menu.

10. Set the analysis range in the overview using the Acuisition and Analysis menu. Refer to your instrument user manual for the details.

11. Press the **Analyze** side key to perform measurement for the frames in the analysis range. The measurement result and waveform are displayed in the main view.

Figure 2-37 shows an example of the code domain power measurement.

Figure 2-37: Example of the code domain power measurement

Change the scale and format of the view as needed. Refer to page 2-76 for setting views specific to the 3GPP-R5 uplink analysis.

Measurement Setup Menu

The Meas Setup menu for the uplink analysis contains the following controls:

Analyze Performs measurements for time slots in the analysis range.

NOTE. When you change settings in the Meas Setup menu, press the **Analyze** *side key to perform the measurement for the modified settings.*

Modulation Parameters... Sets a measurement parameter to a non-standard value.
The following setting items are provided:

Measurement Mode... Selects the type of uplink signal.
(Not available for the ACK/NACK analysis.)

- DPDCH/DPCCH (default)
- PRACH
- PCPCH

Scrambling Code Type. *Available for the DPDCH/DPCCH measurement mode.*
Selects the scrambling code type:

- Long (default)
- Short

Scrambling Code. Sets the scrambling code number.
Range: 0 to 16777215 (default: 0).

Threshold. *Available for the PRACH measurement mode.*
Sets the threshold level to detect a burst.
Range: −100 to 10 dB relative to the reference level (default: −30 dB).

Measurement Filter... Selects a filter for demodulating digitally-modulated signals:

- None (no filter)
- RootRaisedCosine (default)

Reference Filter... Selects a filter for creating reference data:

- None (no filter)
- RaisedCosine (default
- Gaussian

For the filters, refer to *Process Flow of Digitally-Modulated Signal* in your instrument user manual.

Filter Parameter. Sets an α/BT value for Measurement Filter and Reference Filter described above. Range: 0.0001 to 1 (default: 0.22)

Auto Carrier   Selects whether to detect the carrier automatically.

- **On.** *Default.* Automatically detects the carrier for every frame.
  The error from the center frequency is shown on the **Freq Error** side key.

- **Off.** Sets the carrier frequency using **Frequency Offset**.

Frequency Offset   Sets the carrier frequency when Off is selected in **Auto Carrier**.
Input the carrier offset from the center frequency.

EVM IQ Origin Offset   Determines whether to take into account the I/Q origin offset for the EVM, Rho and PCDE measurement results.

- **Include.** *Default.* Takes into account the I/Q origin offset for the results.

- **Exclude.** Ignores the I/Q origin offset for the results.

ACK/NACK Analysis Measurement Menu. The following controls are only for ACK/NACK analysis.

Subframe Offset Select   Selects how to specify the subframe offset.

- **Auto.** *Default.* The symbol table is displayed for any offset.
- **STO.** Sets the Subframe to Time-Slot Offset (STO) using the **Subframe to TS Offset** side key.
- **DTO.** Sets the Downlink Time Offset (DTO) using the **Downlink Time Offset** side key.

Subframe to TS Offset   Specifies the subframe to time-slot offset when you select **STO** with the **Subframe Offset Select** side key. Range: 0 to 9 symbols (default: 0).

The subframe to time-slot offset is the time offset between the start of the DPDCH time slot and the start of the HS-DPCCH subframe (see Figure 2-38).

Downlink Time Offset   Specifies the downlink time offset when you select **DTO** with the **Subframe Offset Select** side key. Range: 0 to 149 symbols (default: 1).

The downlink time offset is the time offset between the start of HS-SCCH and the start of DPCH (see Figure 2-38).
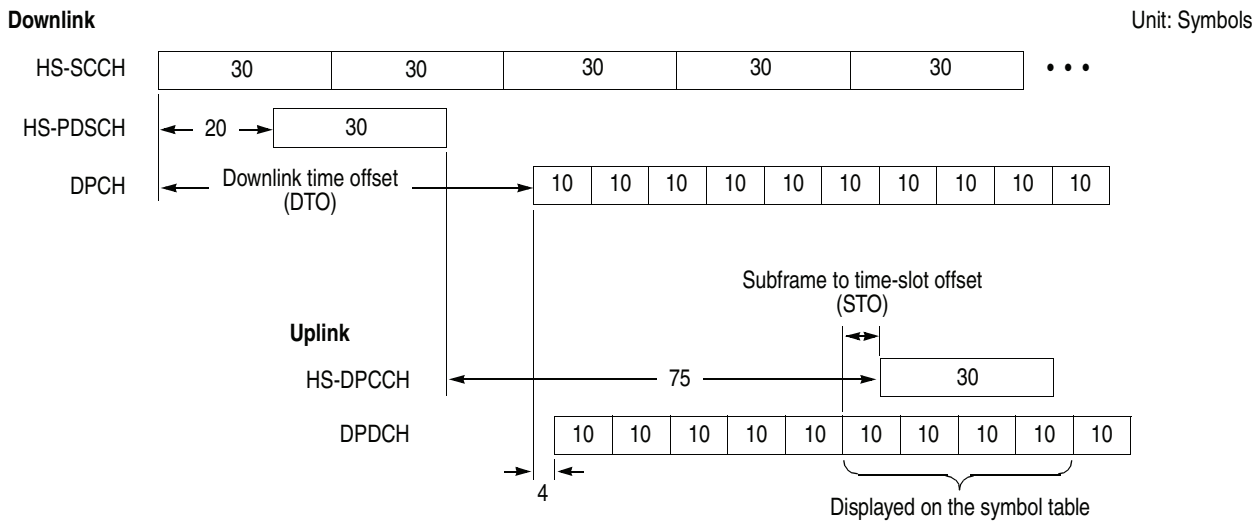
Downlink   Unit: Symbols

| HS-SCCH | 30 | 30 | 30 | 30 | 30 | • • • |

HS-PDSCH | ← 20 → | 30 |

DPCH | ← Downlink time offset (DTO) → | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

Subframe to time-slot offset (STO)

Uplink

HS-DPCCH | ← 75 → | 30 |

DPDCH | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

4

Displayed on the symbol table

Figure 2-38: Subframe offset

Update ACK/NACK Results   Redetects ACK and NACK indications on the existing time slot data to update the measurement result display after you change the subframe offset manually or abort the Analyze (top side key) operation.

Display Method for HS-DPCCH

The measurement results for each channel are normally displayed in the view for each time slot. But HS-DPCCH has the different display methods for the settings of Subframe Offset Select in the Meas Setup menu. This section describes how to display HS-DPCCH in each view.

Code Domain Power

■ *When Subframe Offset Select is set to AUTO*
Each time slot is displayed without offset as the other channels (see the upper part of Figure 2-39).

■ *When Subframe Offset Select is set to STO (Subframe to Time slot Offset)*
Each time slot is displayed with offset specified by Subframe to TS Offset in the Meas Setup menu. Also in the total power calculation for the relative value display, only HS-DPCCH is offset in the same way. But the last time slot is displayed without offset (see the lower part of Figure 2-39).

■ *When Subframe Offset Select is set to DTO (Downlink Time Offset)*
Each time slot is displayed in the same manner as when Subframe Offset Select is set to STO. But the number of offset symbols is determined by this formula: $[151 - (\text{Downlink Time Offset})] \bmod 10$ (see the lower part of Figure 2-39).
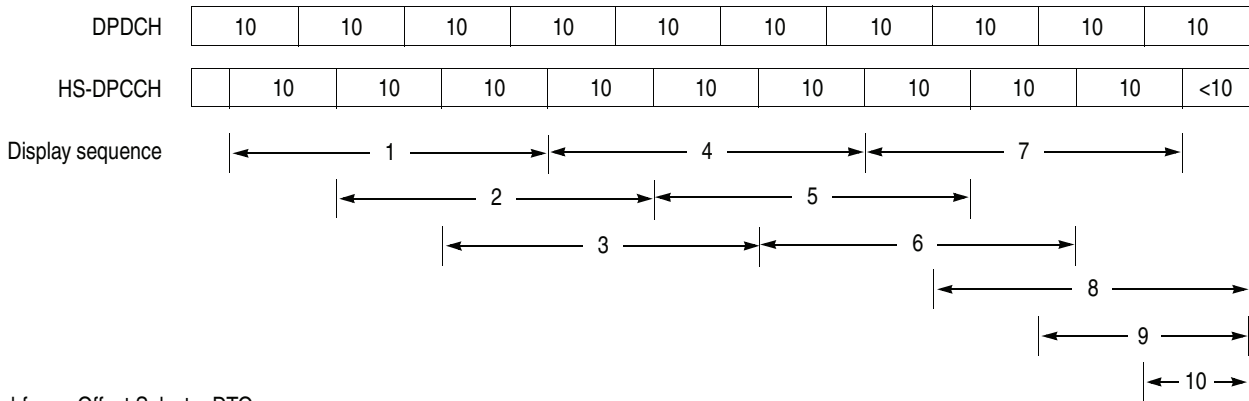

NOTE. "10" in the box represents the number of symbols in a time slot.

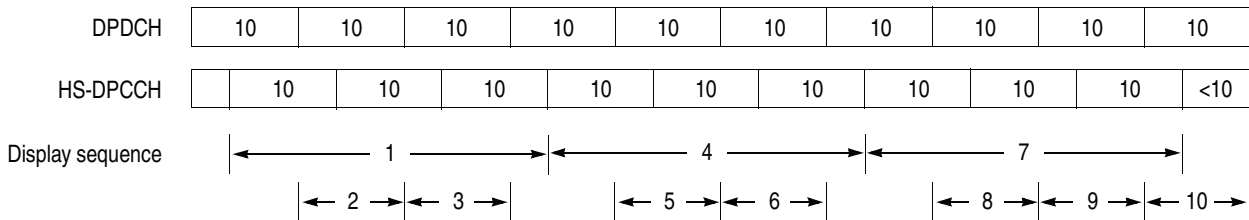**Figure 2-39: HS-DPCCH display method (Code domain power)**

Code Power versus Symbol

■ *When Subframe Offset Select is set to AUTO*
10 symbols are displayed for each time slot without offset as the other channels (see the upper part of Figure 2-39 on page 2-73).

■ *When Subframe Offset Select is set to STO (Subframe to Time slot Offset)*
30 symbols are displayed for each time slot with offset specified by Subframe to TS Offset in the Meas Setup menu. Also in the total power calculation for the relative value display in the Code power versus Symbol view, only HS-DPCCH is offset in the same way (see the upper part of Figure 2-40). But when there are not enough symbols in the last part of the analysis range, 30, 20, and 10 symbols are displayed without offset as shown in the upper part of Figure 2-40, the display sequence 8, 9, and 10, respectively.

■ *When Subframe Offset Select is set to DTO (Downlink Time Offset)*
If the specified time slot is the first one in the subframe, symbols are displayed in the same manner as when Subframe Offset Select is set to STO. Otherwise symbols are displayed in the same manner as when Subframe Offset Select is set to AUTO (see the lower part of Figure 2-39).
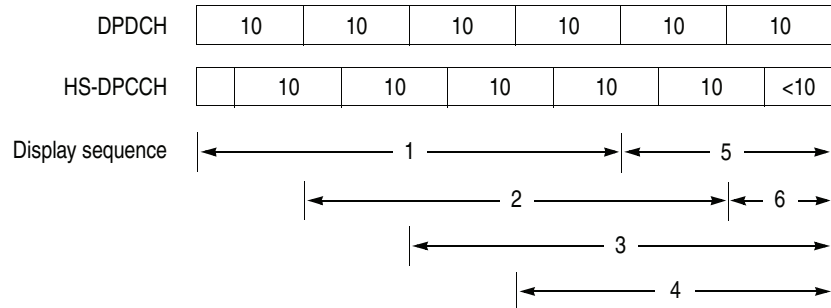

NOTE. "10" in the box represents the number of symbols in a time slot.

Figure 2-40: HS-DPCCH display method (Code power versus Symbol)

ACK/NACK Analysis

Symbols of four time slots (40 symbols) are displayed without offset (see the upper part of Figure 2-41). But for the last three time slots, 30, 20, and 10 symbols are displayed without offset as shown in the Figure 2-41, the display sequence 4, 5, and 6, respectively.

NOTE. "10" in the box represents the number of symbols in a time slot.

Figure 2-41: HS-DPCCH display method (ACK/NACK analysis)

Power Codogram, Code Power versus Time Slot, Symbol Constellation, Symbol EVM, Symbol Eye Diagram, and Symbol Table

Each time slot is displayed regardless HS-DPCCH.

Scale and Format of View

The following main views are specific for the measurement items of the 3GPP-R5 downlink analysis in Demod mode:

- Code domain power

- Power codogram

- Code power versus Time slot

- Code power versus Symbol

- Symbol constellation

- Symbol EVM

- Symbol eye diagram

- Symbol table

- Modulation accuracy

- ACK/NACK analysis

Each view (and its specific menu) is described on the following pages. In the main view, the time slot table shown in Figure 2-42 is displayed in addition to waveform and measurement results. Only the ACK/NACK analysis has its own time slot table, which is shown in Figure 2-52 on page 2-93.

Figure 2-42: Time slot table

View: Define Menu   The View: Define menu is common to all main views of the 3GPP-R5 downlink measurement items. It contains the following controls:

Show Views. Selects the view style:

- **Single.** Displays only the view selected by the View: **Select** key.

- **Multi.** *Default.* Displays the overview, subview, and main view.

Overview Content... Selects a view to display in the overview:

- Waveform (power versus time)

- Spectrogram

Subview Content... Selects a view to display in the subview:

- Spectrum

- Code Domain Power

- Power Codogram

- CDP vs Time Slot (code domain power versus time slot)

- CDP vs Symbol (code domain power versus symbol)

- Symbol Constellation

- Symbol EVM

- Symbol Eye Diagram

- Symbol Table

- Modulation Accuracy

Time Slot. Sets a time slot number to position the marker.
Range: 0 to the number of slots −1

Symbol Rate... Sets the symbol rate for displaying symbol constellation:

- 960 k (default)

- 480 k

- 240 k

- 120 k

- 60 k

- 30 k

- 15 k

Channel Number. Sets a channel number to position the marker.
Range: Channel 0 to 7.

Menu Off. Removes the side menu from the screen to expand the waveform and measurement result area. Press the **MENU** side key when you return to the original display.

Code Domain Power

When you select Code Domain Power in the Measure menu, the code domain power is displayed for each channel, as shown in Figure 2-43.
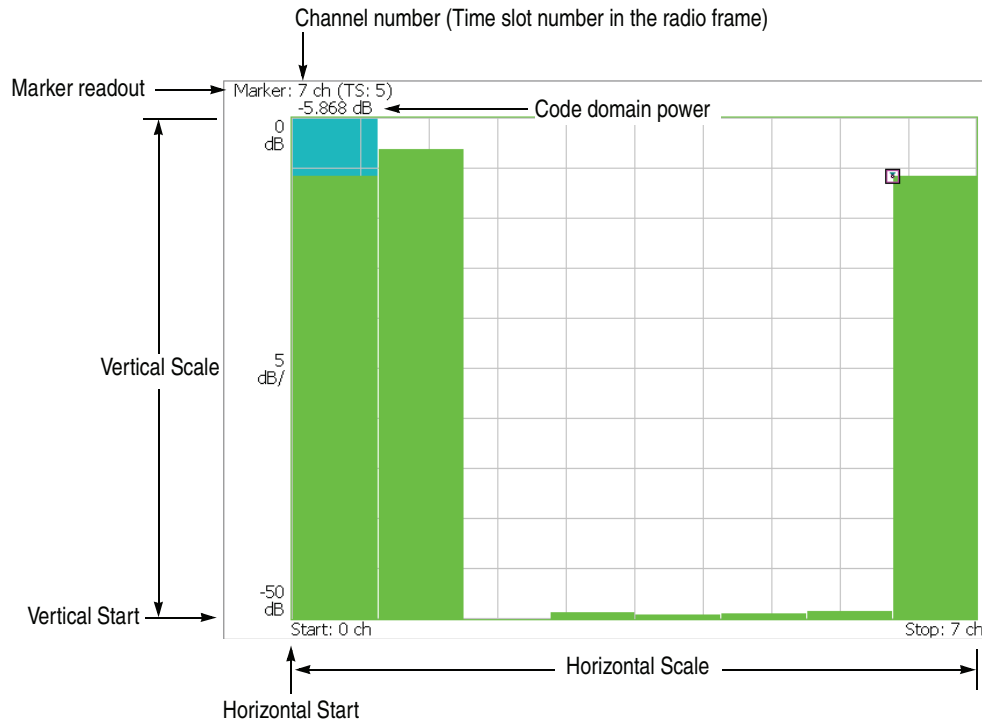

Figure 2-43: Code domain power

Scale Menu   Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to fit the waveform to the screen.

Horizontal Scale. Sets the scale of the horizontal axis.
Range: 1 to 8 channels.

Horizontal Start. Sets the start channel number of the horizontal axis.
Range: 0 to [8 − (Horizontal Scale)].

Vertical Scale. Sets the scale of the vertical axis.
Range: 50 μ to 50 dB.

Vertical Stop. Sets the maximum value (top edge) of the vertical axis.
Range: −50 to Vertical Scale [dB].

Full Scale. Sets the scale of the vertical axis to the default full-scale value.

Y Axis. Selects whether to represent the vertical axis (amplitude) with relative or absolute values.

- **Relative.** The vertical axis represents power relative to the total power of all channels.

- **Absolute.** The vertical axis represents absolute power of each channel.

Power Codogram

When you select Power Codogram in the Measure menu, the code domain power is displayed in spectrogram, as shown in Figure 2-44.
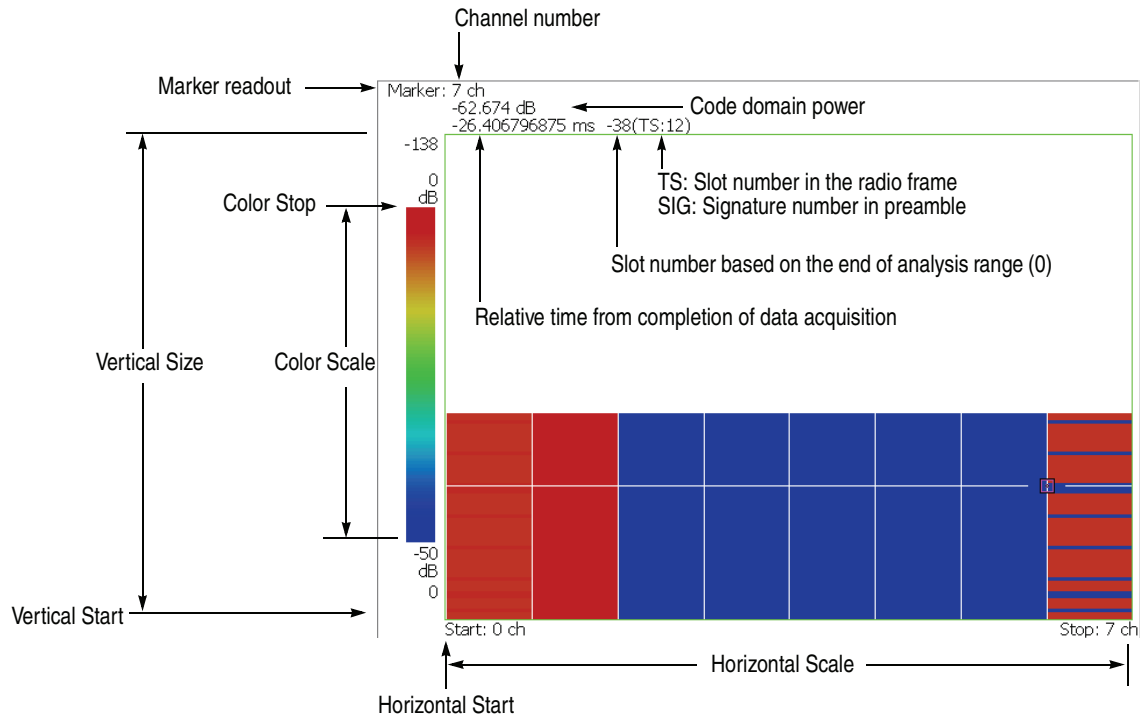

Figure 2-44: Power codogram

Scale Menu   Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to fit the waveform to the screen.

Horizontal Scale. Sets the scale of the horizontal axis.
Range: 1 to 8 channels.

Horizontal Start. Sets the start channel number of the horizontal axis.
Range: 0 to [8 − (Horizontal Scale)].

Vertical Size. Sets the full scale of the vertical axis in frames.
Range: 58 to 59392 frames.

Vertical Start. Sets the start frame number of the vertical axis.

Color Scale. Sets the scale (the value subtracting the minimum power value from the maximum) of the color axis:

- 5 dB

- 10 dB

- 20 dB

- 50 dB

The spectrogram is displayed in 100 steps (100 colors) from the minimum value (blue) to the maximum value (red) in the default state.

Color Stop. Sets the maximum value (top edge) of the color axis.
Range: −50 to Color Scale [dB].

Full Scale. Sets Color Stop to 0 (zero) and Color Scale to 50 dB.

Y Axis. Selects whether to represent the Y (color) axis with relative or absolute values.

- **Relative.** The Y axis represents power relative to the total power of all channels.

- **Absolute.** The Y axis represents absolute power of each channel.

Code Power versus Time Slot

When you select Code Power versus Time Slot in the Measure menu, the code domain power is displayed for each slot, as shown in Figure 2-45.
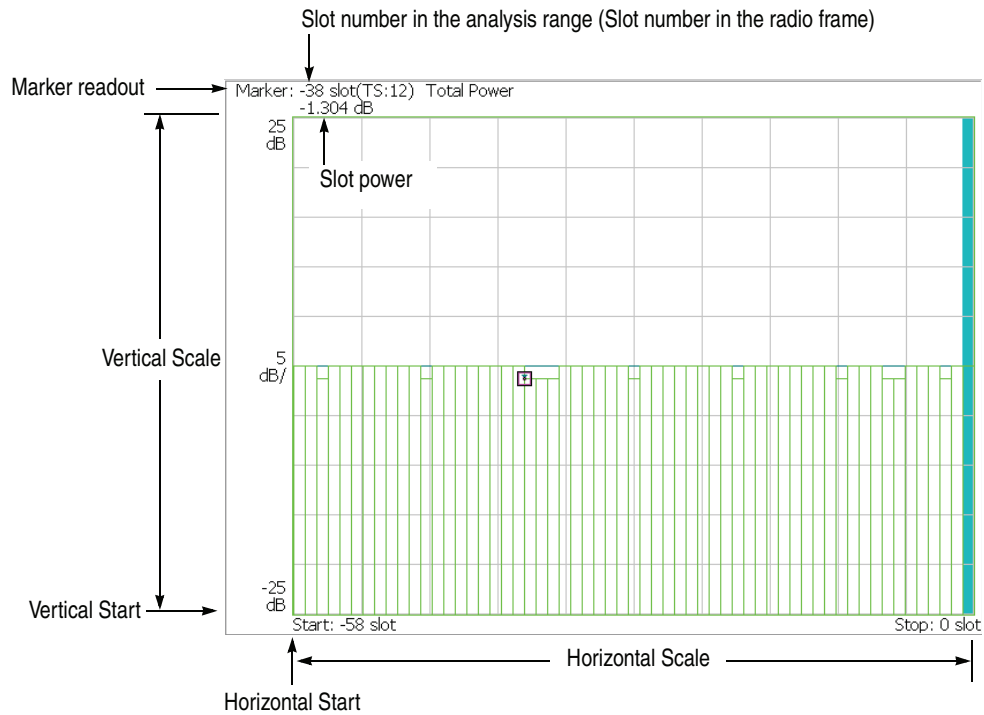

Figure 2-45: Code domain power versus Time slot

Scale Menu   Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to display the entire waveform.

Horizontal Scale. Sets the scale of the horizontal axis (number of slots). Range: N/8 to N slots (N: the number of slots in the analysis range.)

Horizontal Start. Sets the start slot number of the horizontal axis. Range: $-(N - 1)$ to $[1 - (\text{Horizontal Scale})]$.

Vertical Scale. Sets the scale of the vertical axis. Range: 50 μ to 50 dB.

Vertical Stop. Sets the maximum value (top edge) of the vertical axis. Range: -25 to $[(\text{Vertical Scale}) + 25]$ dB.

Full Scale. Sets the scale of the vertical axis to the default full scale value.

Y Axis. Selects whether to represent the vertical (amplitude) axis with relative or absolute values.

- **Relative.** The vertical axis represents time slot power relative to the power of the first time slot in the analysis range.

- **Absolute.** The vertical axis represents absolute power of time slots.

Select Power. Selects the channel to show the power for each time slot.

- **Code.** Shows the power of all channels or the specified channel, depending on the setting of Total Power described below.

- **PSCH.** Shows the power of the P-SCH (Primary Synchronization Channel).

- **SSCH.** Shows the power of the S-SCH (Secondary Synchronization Channel).

Total Power. Determines whether to display the total power for each time slot when you select Code with Select Power described above.

- **On.** *Default.* Displays the total power of all channels for each time slot.

- **Off.** Displays power of the channel specified with Channel Number in the View: Define menu (refer to page 2-78).

Code Power versus Symbol

When you select Code Power versus Symbol in the Measure menu, the code domain power is displayed for each symbol, as shown in Figure 2-46.
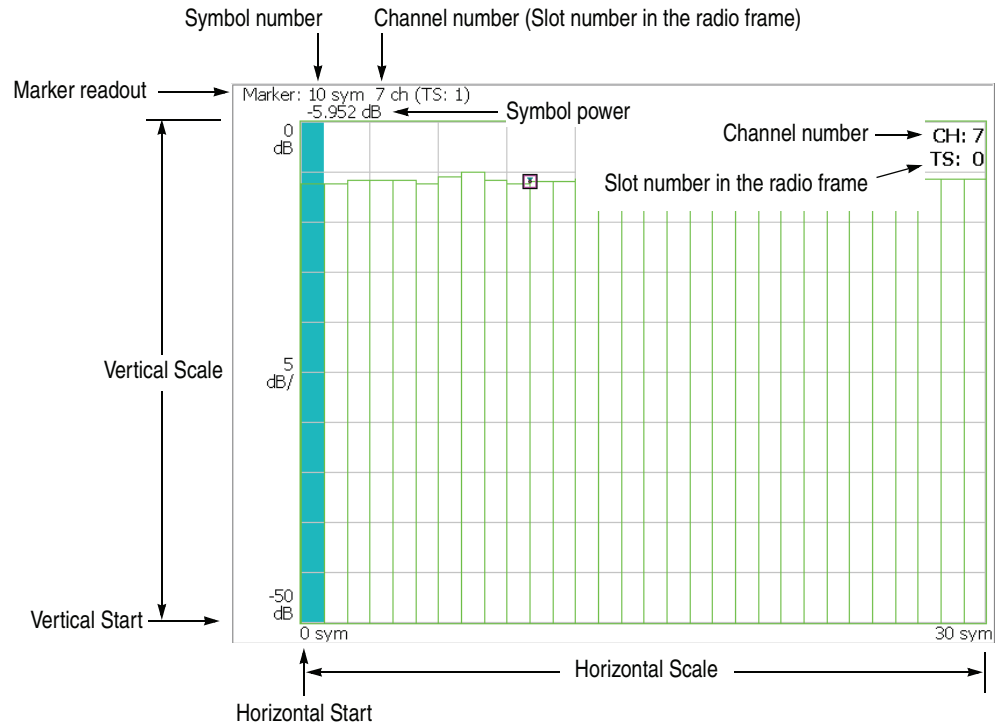

Figure 2-46: Code domain power versus Symbol

Scale Menu   Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to fit the waveform to the screen.

Horizontal Scale. Sets the scale of the horizontal axis (number of symbols).
Range: 0 to 640 symbols.

Horizontal Start. Sets the start symbol number of the horizontal axis.
Range: 0 to [(initial value of Horizontal Scale) − (set value of Horizontal Scale)].

Vertical Scale. Sets the scale of the vertical axis.
Range: 50 μ to 50 dB.

Vertical Stop. Sets the maximum value (top edge) of the vertical axis.
Range: −50 to Vertical Scale [dB].

Full Scale. Sets the scale of the vertical axis to the default full-scale value.

Y Axis. Selects whether to represent the vertical (amplitude) axis with relative or absolute values.

- **Relative.** The vertical axis represents power relative to the total power of all channels.
- **Absolute.** The vertical axis represents absolute power of each channel.

Symbol Constellation

The symbol constellation is displayed when you select Symbol Constellation in the Measure menu, as shown in Figure 2-47.
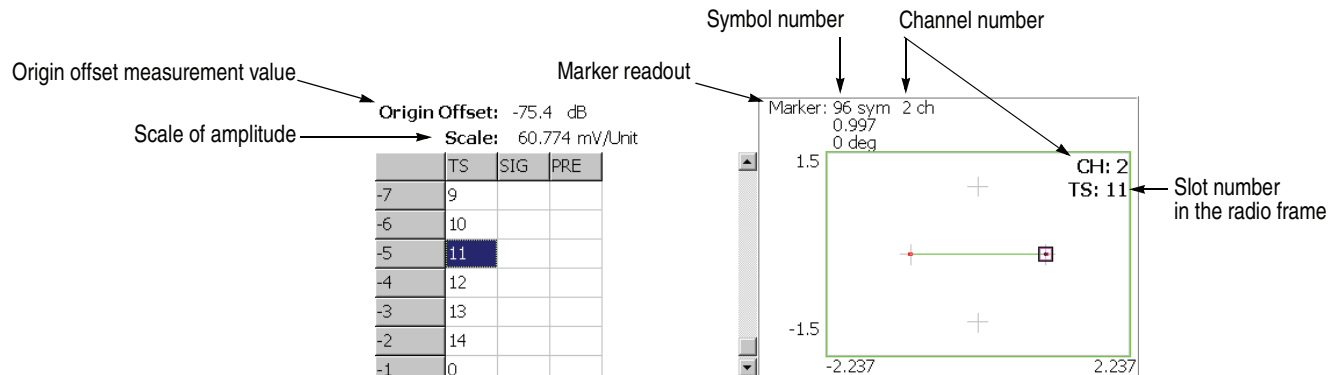

Figure 2-47: Symbol constellation

Scale Menu   Use the following controls to set the scale:

Measurement Content... Selects vector or constellation display.

- **Vector.** Selects vector display. A signal represented with phase and amplitude is displayed in polar coordinate or IQ diagram. The red point indicates the symbol position of the measured signal, and the yellow trace indicates the locus of the signal between symbols.

- **Constellation.** Selects constellation display. It is the same as the vector display, except that only symbols of the measured signal are indicated in red, and the locus between symbols is not shown. The cross marks indicate the symbol positions of an ideal signal.

You can select degree or radian for the angular unit by pressing **System** →**Instrument Setup...** →**Angular Units...**

Symbol EVM

When you select Symbol EVM in the Measure menu, EVM (Error Vector Magnitude) is displayed for each symbol, as shown in Figure 2-48.
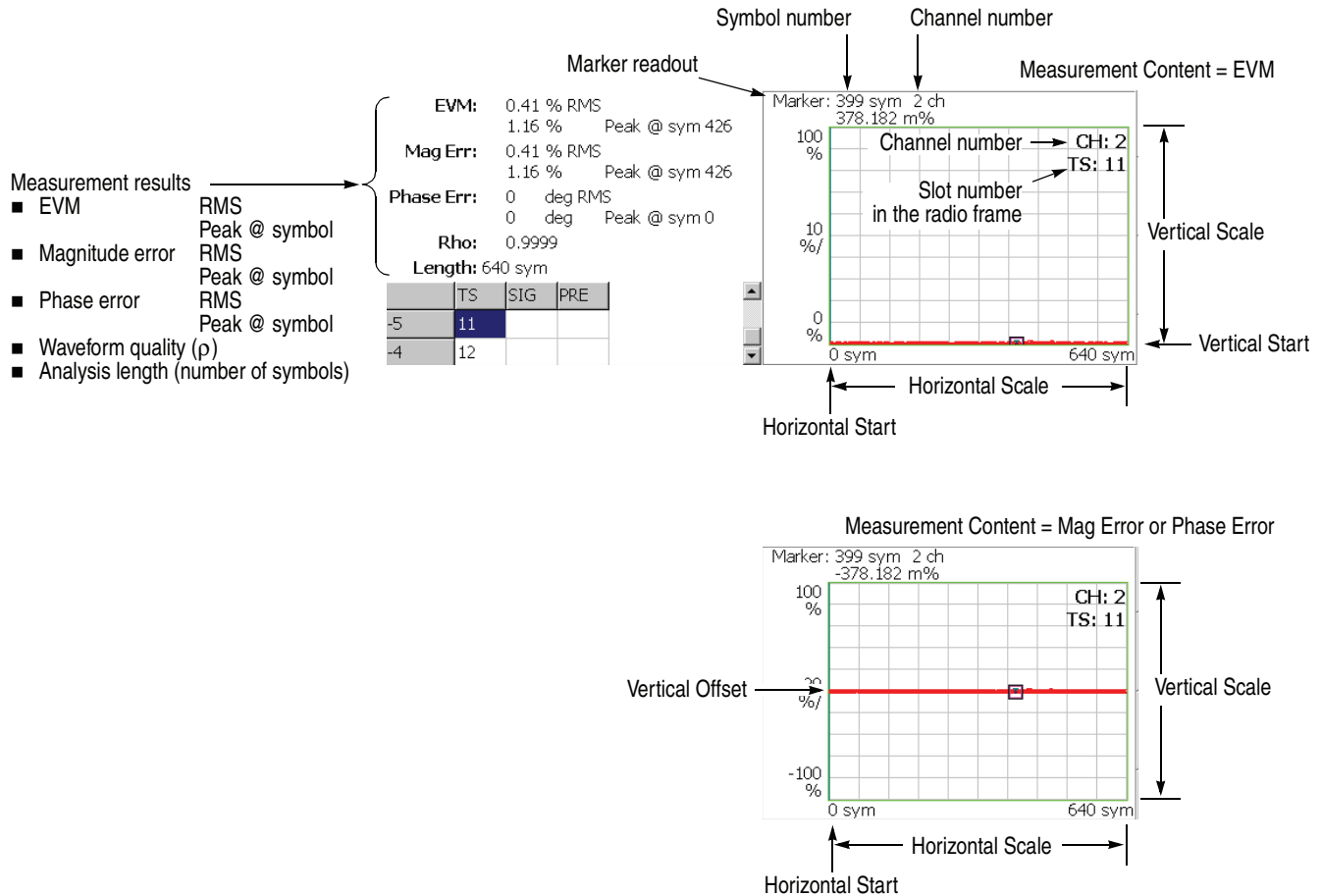

Figure 2-48: Symbol EVM

NOTE. The uplink signals are BPSK modulated and all channels are mapped on either I or Q axis, so the Symbol EVM view does not show the phase error measurement result. Also, when you set the Measurement Content *(refer to page 2-89) to* Phase Error, *the measurement waveform is not displayed.*

Scale Menu   Use the following controls to scale the view:

Auto Scale. Sets the start value and the scale of the vertical axis automatically to display the entire waveform.

Horizontal Scale. Sets the scale of the horizontal axis (number of symbols). Range: 0 to 640 symbols.

Horizontal Start. Sets the start symbol number of the horizontal axis. Range: 0 to [(initial value of Horizontal Scale) − (set value of Horizontal Scale)].

Vertical Scale. Sets the scale of the vertical axis.

Vertical Start. Sets the minimum value (bottom edge) of the vertical axis when the measurement content is EVM. Refer to Table 2-4 for the setting range.

Vertical Offset. Sets the center value ((maximum + minimum) / 2) of the vertical axis when the measurement content is Mag Error or Phase Error. Refer to Table 2-4 for the setting range.

Full Scale. Sets the scale of vertical axis to the default full-scale value.

Measurement Content... Selects how to display the vertical axis:

■ **EVM.** Represents the vertical axis with EVM (Error Vector Magnitude).

■ **Mag Error.** Represents the vertical axis with magnitude error.

■ **Phase Error.** Represents the vertical axis with phase error.

Table 2-4: Vertical scale setting range

Measurement Content...	Vertical Scale	Vertical Start	Vertical Offset
EVM	100μ to 100%	−100 to 100%	-
Mag Error	200μ to 200%	-	−200 to 200%
Phase Error	450μ to 450°	-	−450 to 450°

You can select degree or radian for the angular unit by pressing **System → Instrument Setup... → Angular Units...**

Symbol Eye Diagram

The symbol eye diagram is displayed when you select Symbol Eye Diagram in the Measure menu, as shown in Figure 2-49.
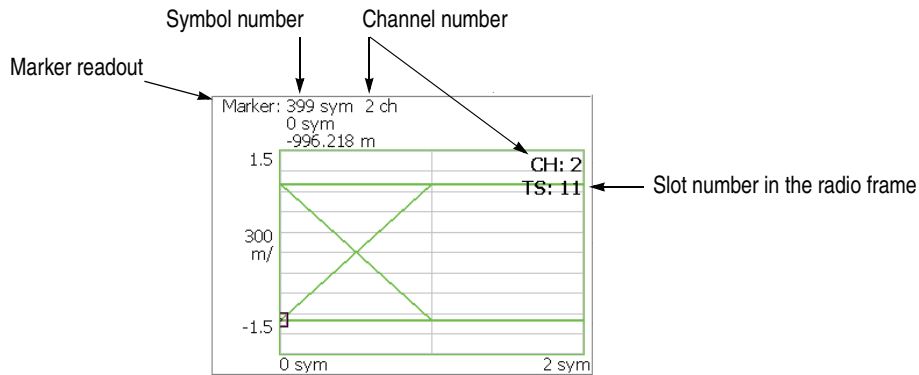

Figure 2-49: Symbol eye diagram

Scale Menu   Use the following controls to scale the view:

Measurement Content... Selects the vertical axis of eye diagram.

■ **I.** *Default*. Displays I data on the vertical axis.

■ **Q.** Displays Q data on the vertical axis.

■ **Trellis.** Displays phase on the vertical axis.

Eye Length. Enters the number of display symbols on the horizontal axis.
Range: 1 to 16 (default: 2)

Symbol Table

The symbol table is displayed when you select Symbol Table in the Measure menu, as shown in Figure 2-50.

Symbol number

Marker readout

```
Marker: 399 sym
            1
144: 11111111 11111111 00000000
168: 00000000 11111111 11111111
192: 11111111 11111111 11111111
216: 11111111 11111111 11111111
240: 00000000 00000000 00000000
264: 00000000 11111111 11111111
288: 00000000 00000000 11111111
312: 11111111 11111111 11111111
336: 11111111 11111111 00000000
360: 00000000 11111111 11111111
384: 11111111 11111111 11111111
408: 11111111 00000000 00000000
```

Figure 2-50: Symbol table

Scale Menu   Use the following controls to scale the view:

Radix. Selects the radix for displaying the table:

- **Hex.** Hexadecimal digit
- **Oct.** Octal digit
- **Bin.** *Default.* Binary digit

Hex and Oct indicate values of binary data string in units of modulation symbol.

NOTE. The BPSK modulation signal contains one-bit data in a symbol, so the symbol table has the same values for all the radices.

Rotate. Sets the start position. Range: 0 to 3.

Modulation Accuracy

The constellation of all channels before the despread is displayed when you select Modulation Accuracy in the Measure menu.

When you press the View: **Select** key on the front panel to select the constellation view, the measurement results for the time slot are displayed instead of the overview, as shown in Figure 2-51.
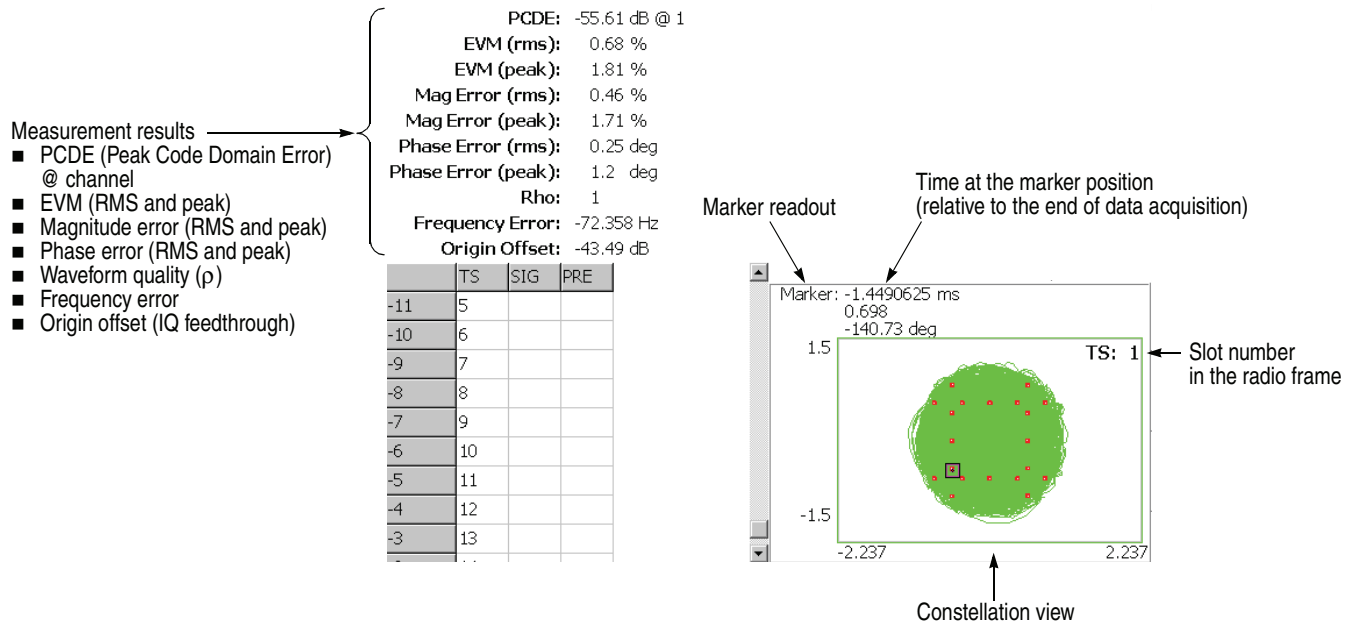
Measurement results
- PCDE (Peak Code Domain Error) @ channel
- EVM (RMS and peak)
- Magnitude error (RMS and peak)
- Phase error (RMS and peak)
- Waveform quality (ρ)
- Frequency error
- Origin offset (IQ feedthrough)

PCDE: -55.61 dB @ 1
EVM (rms): 0.68 %
EVM (peak): 1.81 %
Mag Error (rms): 0.46 %
Mag Error (peak): 1.71 %
Phase Error (rms): 0.25 deg
Phase Error (peak): 1.2 deg
Rho: 1
Frequency Error: -72.358 Hz
Origin Offset: -43.49 dB

TS	SIG	PRE
-11	5	
-10	6	
-9	7	
-8	8	
-7	9	
-6	10	
-5	11	
-4	12	
-3	13	

Marker readout

Time at the marker position (relative to the end of data acquisition)

Marker: -1.4490625 ms
0.698
-140.73 deg

1.5

TS: 1 — Slot number in the radio frame

-1.5

-2.237   2.237

Constellation view

Figure 2-51: Modulation accuracy

The view settings are the same as for Symbol Constellation. Refer to *Symbol Constellation* on page 2-87.

ACK/NACK Analysis

The ACK/NACK analysis detects and displays the arrival of ACK and NACK indications, DTX (Discontinuous Transmission), and CQI (Channel Quality Indicator) from the UE (User Equipment). Also, measures the power versus time against a mask and display other contents of the indications.

Figure 2-52 shows an example of the ACK/NACK analysis measurement display.
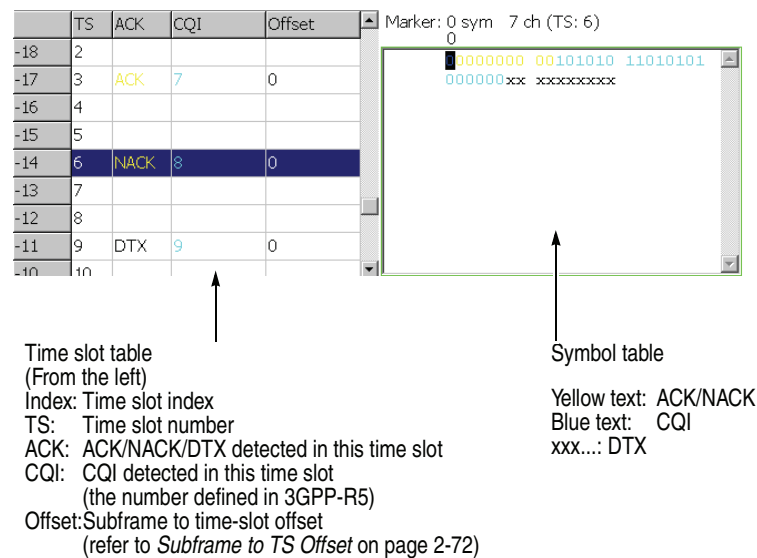
Figure 2-52: ACK/NACK

When the TS index is changed to a time slot that does not contain the beginning of an HS-DPCCH subframe, the symbol table text is all white. When an ACK or NACK time slot is selected, the symbol table text color changes to show the position of the ACK/NACK symbols (yellow) and the CQI symbols (blue).

Appendices

Appendix A: Measurement Limit Defaults

This section provides the measurement limit defaults. Tables A-1, A-2, and A-3 list the default limit settings used to perform the pass/file testing for the 3GPP-R5 downlink measurements. Refer to *Using the Measurement Limits Editor* on page 2-14 for procedures to edit the measurement limits.

Common Limits Table A-1 lists the default values of the common measurement limits that can be used for the channel power, ACLR, and OBW measurements for Band I, II, and III defined in 3GPP-R5.

Table A-1: Common limits (Band I, II, and III)

Limit	Enable	Lower	Upper	Units
Channel Power	No	21.5	26.5	dBm
OBW	Yes	N.A	5 M	Hz
ACLR 1st Lower Channel	Yes	N.A	45	dB
ACLR 1st Upper Channel	Yes	N.A	45	dB
ACLR 2nd Lower Channel	Yes	N.A	50	dB
ACLR 2nd Upper Channel	Yes	N.A	50	dB

SEM Offset from Channel Limits

Tables A-2 and A-3 list the default values of the measurement limits that can be used for the spectrum emission mask measurement for Band I, II, and III defined in 3GPP-R5.

Table A-2: SEM limits in Band I and III

Zone	A	B	C	D	E
Enable	Yes	Yes	Yes	Yes	No
Beginning Frequency	2.5 MHz	2.7 MHz	3.5 MHz	7.5 MHz	12.5 MHz
Ending Frequency	2.7 MHz	3.5 MHz	7.5 MHz	12.5 MHz	8 GHz
Measurement Bandwidth	30 kHz	30 kHz	1 MHz	1 MHz	1 MHz
Offset from Carrier	Both	Both	Both	Both	Both
Failure if signal exceeds	Rel OR Abs	Rel OR Abs	Rel OR Abs	Relative	Absolute
Beginning Absolute Limit	−14 dBm	−14 dBm	−13 dBm	−13 dBm	−13 dBm
Ending Absolute Limit	−14 dBm	−26 dBm	−13 dBm	−13 dBm	−13 dBm
Beginning Relative Limit	−53 dBc	−53 dBc	−52 dBc	−56 dBc	0 dBc
Ending Relative Limit	−53 dBc	−65 dBc	−52 dBc	−56 dBc	0 dBc

Table A-3: SEM limits in Band II

Zone	A	B	C	D	E
Enable	Yes	Yes	Yes	Yes	No
Beginning Frequency	2.5 MHz	2.7 MHz	3.5 MHz	7.5 MHz	12.5 MHz
Ending Frequency	2.7 MHz	3.5 MHz	7.5 MHz	12.5 MHz	8 GHz
Measurement Bandwidth	30 kHz	30 kHz	1 MHz	1 MHz	1 MHz
Offset from Carrier	Both	Both	Both	Both	Both
Failure if signal exceeds	Rel OR Abs	Rel OR Abs	Rel OR Abs	Relative	Absolute
Beginning Absolute Limit	−15 dBm	−15 dBm	−13 dBm	−13 dBm	−13 dBm
Ending Absolute Limit	−15 dBm	−26 dBm	−13 dBm	−13 dBm	−13 dBm
Beginning Relative Limit	−53 dBc	−53 dBc	−52 dBc	−56 dBc	0 dBc
Ending Relative Limit	−53 dBc	−65 dBc	−52 dBc	−56 dBc	0 dBc

Appendix B: Scale Setting Range

This section lists the setting ranges of the horizontal and the vertical scales for the views used in the 3GPP-R5 analysis.

Table B-1: Display format and scale

Display format	Horizontal range	Vertical range
Spectrum	0 Hz to 8 GHz	−200 to +100 dBm
Spectrogram	0 Hz to 8 GHz	Frame −15999 to 0 Frame −63999 to 0 (Option 02)
Time domain view	$-(Tf \times Nf)$ to 0 s [1]	−200 to +100 dBm (Amplitude) −30 to +30 V (I/Q level) −300 to +300% (AM) −38.4 to +38.4 MHz (FM/FVT) −675 to +675 degrees (PM)
CDP spectrogram [2]	0 to 511 channels (downlink) 0 to 7 channels (uplink)	Slot −3999 to 0 Slot −15999 to 0 (Option 02)
CDP vs. Channel [2]	0 to 511 channels (downlink) 0 to 7 channels (uplink)	−200 to +100 dB/dBm
CDP vs. Symbol [2]	0 to 319 symbols (downlink) 0 to 639 symbols (uplink)	−200 to +100 dB/dBm
CDP vs. Time slot [2]	Slot −3999 to 0 Slot −15999 to 0 (Option 02)	−200 to +100 dB/dBm
Symbol constellation [3]	Fixed	Fixed
Symbol EVM	0 to 319 symbols (downlink) 0 to 639 symbols (uplink)	−100 to +200% (EVM) −300 to +300% (amplitude error) −675 to +675 degrees (phase error)
Symbol eye diagram	0 to 319 symbols (downlink) 0 to 639 symbols (uplink)	Fixed
Symbol table	0 to $(1024 \times Nf)$ symbols	NA

1. **Tf: Frame time; Nf: Frame number**

2. **CDP: Code Domain Power**

3. **The maximum number of symbols: 320 (downlink) / 640 (uplink)**

This section lists the setting ranges of the horizontal and the vertical scales for the views used in the W-CDMA analysis.

Table B-2: Display format and scale

Display format	Horizontal range	Vertical range
Spectrum	0 Hz to 8 GHz	−200 to +100 dBm
Spectrogram	0 Hz to 8 GHz	Frame −15999 to 0 Frame −63999 to 0 (Option 02)
Time domain view	$-(Tf \times Nf)$ to 0 s[1]	−200 to +100 dBm (Amplitude) −30 to +30 V (I/Q level) −300 to +300% (AM) −38.4 to +38.4 MHz (FM/FVT) −675 to +675 degrees (PM)
Constellation	$-(Tf \times Nf)$ to 0 s[1]	fixed
EVM	$-(Tf \times Nf)$ to 0 s[1]	−100 to +200% (EVM) −300 to +300% (amplitude error) −675 to +675 degrees (phase error)
Eye diagram	$-(Tf \times Nf)$ to 0 s[1]	fixed
Symbol table	0 to $(1024 \times Nf)$ symbols	NA
CDP spectrogram [2]	0 to 511 channels	Slot −3999 to 0 Slot −15999 to 0 (Option 02)
CDP vs. Channel [2]	0 to 511 channels	−200 to +100 dB/dBm
CDP vs. Symbol [2]	0 to 639 symbols	−200 to +100 dB/dBm
CDP vs. Time slot [2]	Slot −3999 to 0 Slot −15999 to 0 (Option 02)	−200 to +100 dB/dBm
Symbol constellation	0 to 639 symbols	Fixed
Symbol EVM	0 to 639 symbols	−100 to +200% (EVM) −300 to +300% (amplitude error) −675 to +675 degrees (phase error)
Symbol eye diagram	0 to 639 symbols	Fixed

1. Tf: Frame time; Nf: Frame number

2. CDP: Code Domain Power

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