SPECTRUM ANALYZERS

3250 Series

WLAN Measurement
User Manual

Document part no. 47090/005

SPECTRUM ANALYZERS
3250 SERIES

WLAN Measurement
User Manual

Longacres House
Six Hills Way
Stevenage SG1 2AN
UK

Manual part no. 47090/005 (PDF)

Issue 2

24 November 2015

About this manual

This manual explains how to use the WLAN measurement option for the 3250 Series Spectrum Analyzers.

Intended audience

People carrying out work relating to the design and manufacture of RF and microwave sub-systems and modules, or the installation and maintenance of those systems.

Familiarity with the terms used in RF and microwave measurements is assumed.

Document conventions

The following conventions apply throughout this manual:

CAPS Capitals are used to identify names of controls and panel markings.

[CAPS]	Capitals in square brackets indicate hard key titles.
[Italics]	Italics in square brackets indicate soft key titles.

Associated publications

- **3250 Series Operating Manual**
  (PDF version 46892/974, printed version 46882/974)

Contents

General

This option provides a total solution to performing OFDM and DSSS power, spectrum and modulation quality measurements in accordance with WLAN standards IEEE 802.11a, b PMD 1999 and 'IEEE 802.11g PMD 2003.

You can make the following measurements:

- Power versus Time
- Spectral Flatness (802.11a / 802.11g only)
- Occupied Bandwidth (802.11a only)
- Modulation Accuracy (Constellation, EVM)
- Power Statistics CCDF
- Numerical result:

  System type, Data rate, Frequency error, Modulation type, Chip clock error (802.11b), Number of PSDU Bits/Symbol, Carrier Leakage, EVM RMS, EVM Data (802.11a), EVM Pilot (802.11a), EVM Peak (802.11b), Symbol Clock Error

Specifications

The instrument includes a wide-band RF digitizer, which is optimized for complex signal analysis applications in communications system test.

Frequency

Frequency range	3 Hz to 3 GHz / 8 GHz / 13.2 GHz / 26.5 GHz
Bandwidth	30 MHz
Resolution	1 Hz

Dynamic range and accuracy

Intermodulation free dynamic range Adjacent Channel Leakage Ratio (ACLR)	Typically 80 dB
Residual EVM	<1% (nominal)

A/D converter

Resolution	14 bits
ADC clock	Fixed 85.6 MHz
Sample rate control	IF: 21.4 MHz; IQ: variable 541.666ks/s to 42.8 Ms/s
Amplitude flatness	Typically 0.5 dB to 30 MHz
Phase flatness	0.05 radians pk-pk to 30 MHz

Storage

Data output	Sampled digital I/Q data is stored in the digitizer's internal memory. Its resolution is 32 bits. It is transferred to the CPU over the PCI

	bus.
Sample memory	128 Mb (32 Msample)

Installing the WLAN measurement option

To license your WLAN measurement option, use the following procedure.

***Note**: when you add a new option, or update an existing option, you receive the updated version of all your current options because they are reloaded simultaneously. This process may also require you to update the signal analyzer program so that it is compatible with the new option.*

If your analyzer came with the WLANmeasurement licensed, you can skip the licensing.

Keep a copy of your license key number in a secure location. If you lose your license key number, call your nearest service or sales office for assistance.

If you bought the digitizer with this option, it must be sent to manufacturer. All hardware and software installations will be completed by manufacturer and the instrument returned to you.

1 Connect keyboard and mouse to the PS2 ports or the USB ports.

2 Turn on the instrument. Wait until the instrument completes its power-up sequence.

3 Press [System], *[Option Info.]*, *[Option Activate]*.

4 Select the *WLAN* field in the license active dialog window.

***Note**: all purchased options must be selected.*

5 Enter the letters/digits of your 32-character license code using the mouse or the keyboard. The license key number is a hexadecimal number.

6 Press *[Activate]*.

7 If licensing completes successfully then the *Activation Success* dialog window displays. If *Invalid License!* is displayed, enter the correct license code again.

8 Press *OK* or press any keypad, then exit from the license menu.

Measurement guide

This section provides a guide to making measurements of mobile WLAN signals. Using the procedures specified in this section, you can get WLAN signal analysis results.

Preparation for measurement

Before connecting a signal to the instrument, make sure the instrument can safely accept the signal level provided. The maximum RF input level is +30 dBm. If the RF input attenuator level is set to 10 dB, the input level can be increased to +40 dBm. Connect a 10 MHz reference input to synchronize the analyzer with a signal source. Fig. 1 shows the instrument set up for testing a device.

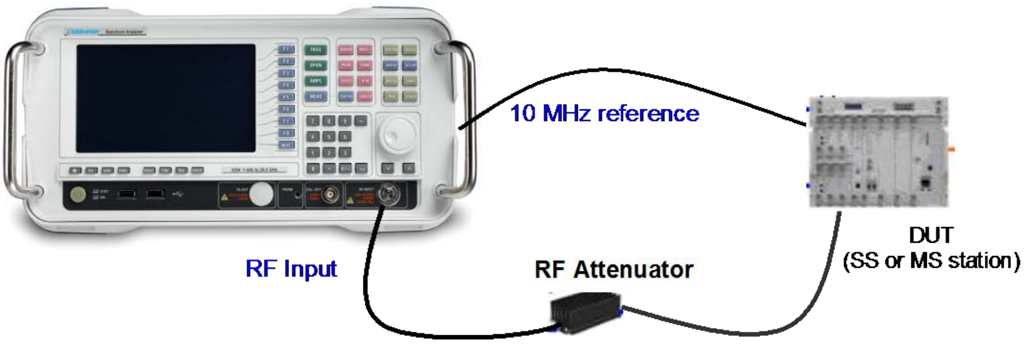


Fig. 1 WiMAX measurement setup

General steps in making a measurement

All measurements performed in 'WLAN options' can be performed with the following steps.

1 Select the WLAN measurement option

Press [MODE]. All of the installed and licensed options become available and are shown.

Press *[WLAN]* or *[Vector Analyzer]*. Analyze the signal in WLAN standard format or in non-standard format(see the Vector Analyzer mode).

Press [MODE], [Setup]. Select the standard from the WLAN standards 802.11a, 802.11b and 802.11g.

2 Select measurement to be performed

Press [MEASURE]. There are various measurement menu related to the WLAN standards. Use this menu to select the specific measurement to be performed. When the trigger conditions are satisfied, digitized WLAN signals are acquired and analyzed instantly.

Press [MEASURE], [CONTROL]. Set up the specific parameters relating to the selected WLAN measurement item.

3 Analyze displayed analysis results

Depending on the measurement selected, you can adjust the way results are displayed using the [Trace], [Display] menu. Use the [SPAN] and [AMPL] menus to set the scales of the X and Y axes.

802.11b signal measurement guide

The 802.11b standard operates at 2.4 GHz and uses DSSS techniques to spread the energy in a single carrier over a wider spectrum. Two coding schemes are used in 802.11b to spread the spectrum of a single carrier. Complementary code keying (CCK) is mandatory, while packet binary convolutional coding (PBCC) is optional. CCK is used to increase the 802.11b peak data rate to 11 Mbps using QPSK modulation. PBCC makes use of forward error correction to improve the link performance when noise is the limitation.

802.11b allows 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps operation using various modulation schemes. The 1 and 2 Mbps rates use DBPSK and DQPSK modulation schemes. For 5.5 and 11 Mpbs operation, CCK modulation is used.

Fig. 2 shows the 802.11b signal format, which includes the High Rate PLCP preamble, the High Rate PLCP header, and the PSDU. The PLCP preamble contains the following fields: synchronization (Sync) and start frame delimiter (SFD). The PLCP header contains the following fields: signaling (SIGNAL), service (SERVICE), length (LENGTH), and CCITT CRC-16.

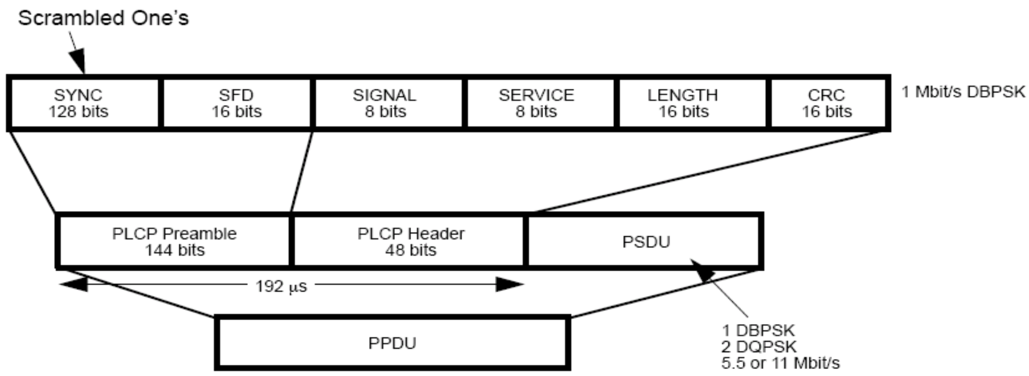


Fig. 2 PPDU data format in 802.11b standard

Power versus time

Test purpose

The Power vs. time measurement is used to test power-on and power-down transitions for 802.11b. To prevent interference caused by bursting the RF carrier, the associated standard specifies a power versus time regulation to which a device must conform. This regulation defines the burst length, the rising and falling edges, and the masks for regions of power on and power off.

Test procedure

From the steps below you can measure the power versus time of a 802.11b WLAN signal. This measurement includes burst length and rise and fall times (µs).

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure transmit power in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11b std.

3 Press [MEASURE] and select *[Power vs Time]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

5 Capture at least one burst data to analyze the signal.

Set the following parameters in WLAN mode to adjust analysis:

6 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

7 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test results

This measurement indicates whether the timing of the transmission of the 802.11b/g signal is consistent with the WLAN 802.11b/g standard. The transmit power-up ramp for 10% to 90% of maximum power shall be no greater than 2 µs as specified in 802.11b/g. The transmit power-down ramp for 90% to 10% maximum power shall be no greater than 2 µs. The transmit power-up ramp is shown in Fig. 3, and the power-down ramp is shown in Fig. 4.

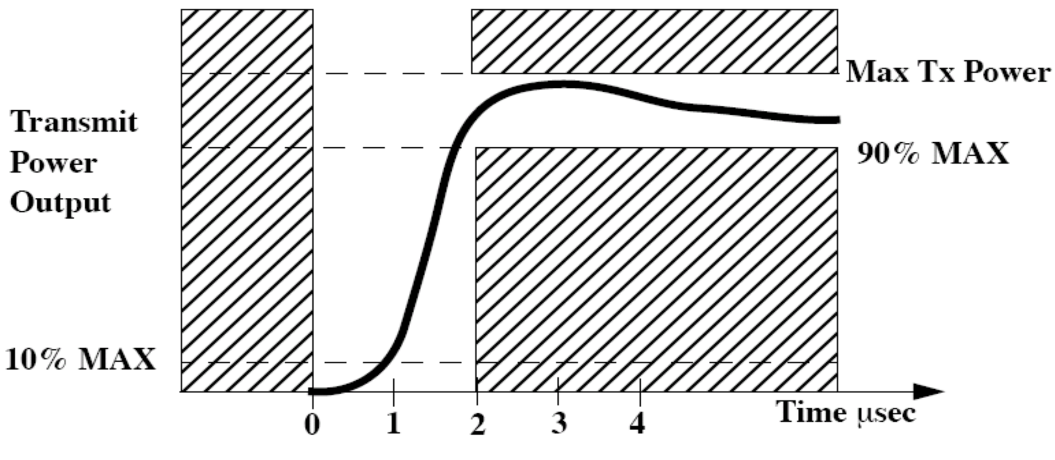


Fig. 3 Transmit power-up ramp

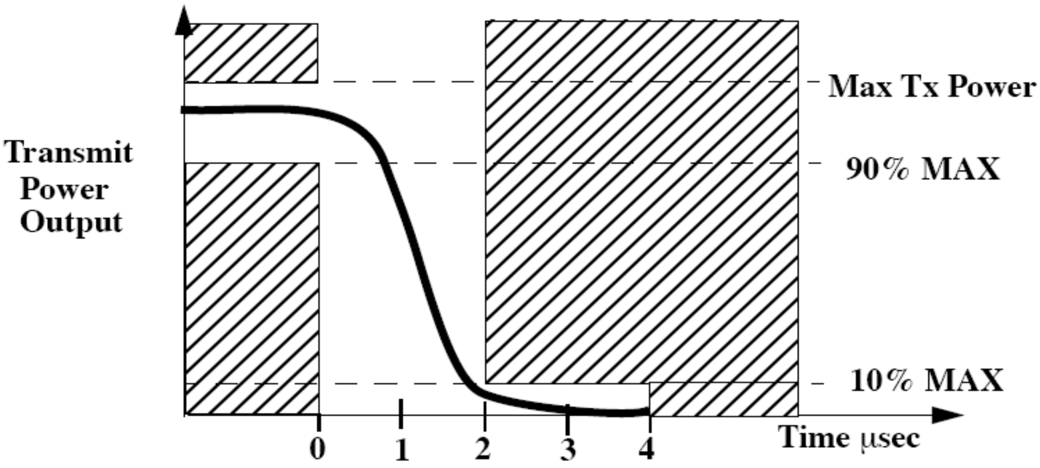


Fig. 4 Transmit power-down ramp

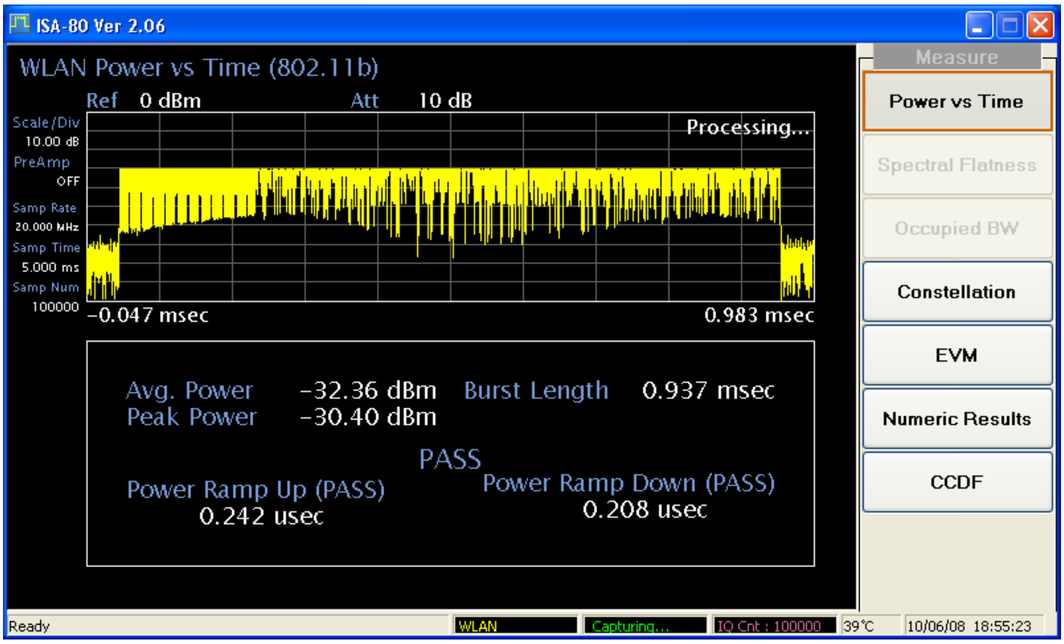


Fig. 5 Result of measuring power vs time for 802.11b signal

CCDF (Complementary Cumulative Distribution Function)

Test purpose

Many of the digitally modulated signals now look noise-like in the time and frequency domain. This means that statistical measurements of the signals can be a useful characterization. Power Complementary Cumulative Distribution Function (CCDF) curves characterize the higher-level power statistics of a digitally modulated signal. The curves can be useful in determining design parameters for digital communications systems.

Test procedure

Perform the steps below to measure the CCDF of an 802.11b WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure CCDF in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11b std.

3 Press [MEASURE] and select *[CCDF]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

Set the following parametes in WLAN mode to adjust analysis:

5 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

6 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test result

The Power Complementary Cumulative Distribution Function (CCDF) curve characterizes the higher-level power statistics of a digitally modulated signal. The results are displayed graphically as well as in a metrics window.

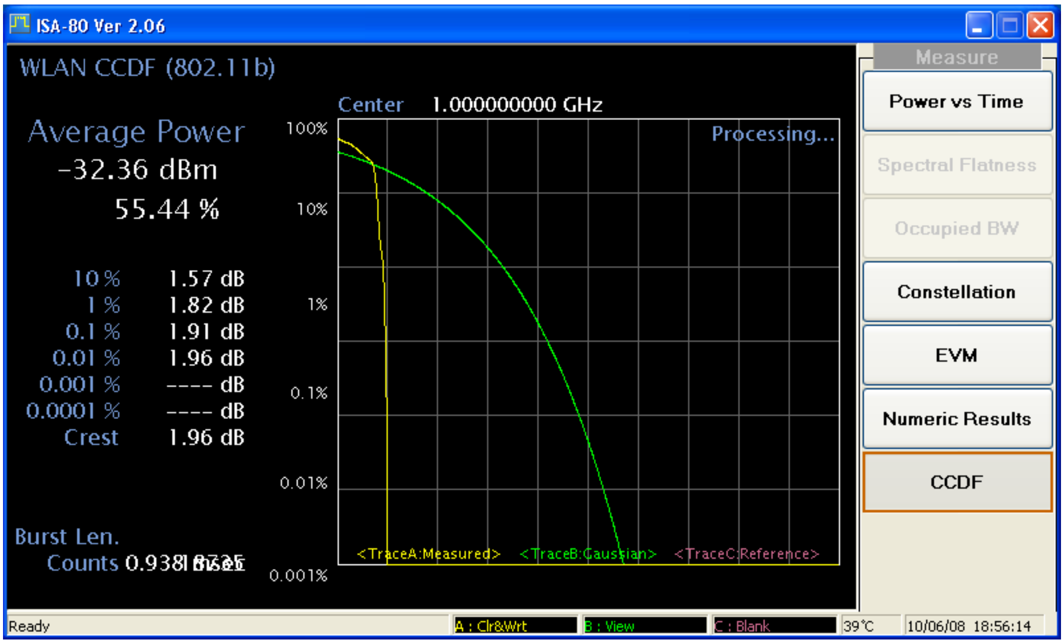


Fig. 6 Result of measuring CCDF for a 802.11b signal

Modulation analysis

Constellation

Test purpose

WLAN signals use the following modulation formats from the IEEE 802.11a,b,g standards. The constellation menu shows the modulation format and modulation quality graphically.

Table 1 List of modulation formats in WLAN signals

WLAN standard	Carrier type	Modulation format
802.11a	OFDM	BPSK
		QPSK
		16 QAM
		64 QAM
802.11b	DSSS	DSSS(DPBSK) 1 Mbps
		DSSS(DQPSK) 2 Mbps
		CCK 5.5 Mbps
		CCK 11 Mbps
		PBCC 5 Mbps
		PBCC 11 Mbps
802.11g	DSSS	DSSS(DPBSK) 1 Mbps
		DSSS(DQPSK) 2 Mbps
		CCK 5.5 Mbps
		CCK 11 Mbps
		PBCC 5 Mbps
		PBCC 11 Mbps
		PBCC 22Mbps, PBCC 33 Mbps
	OFDM	BPSK
		QPSK
		16 QAM
		64 QAM

Test procedure

Perform the steps below to measure the constellation of a WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure constellation in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11b std.

3 Press [MEASURE] and select *[Mod.Analysis..]*, then select *[Constellation]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

The capture time required to analyze a WLAN signal differs with the modulation type.

Set the following parameters in WLAN mode to adjust analysis:

5 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

6 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test result

The figure below displays the constellation diagram of a WLAN 802.11b signal with 11 Mbps CCK. The left side displays the numerical results related to modulation accuracy.

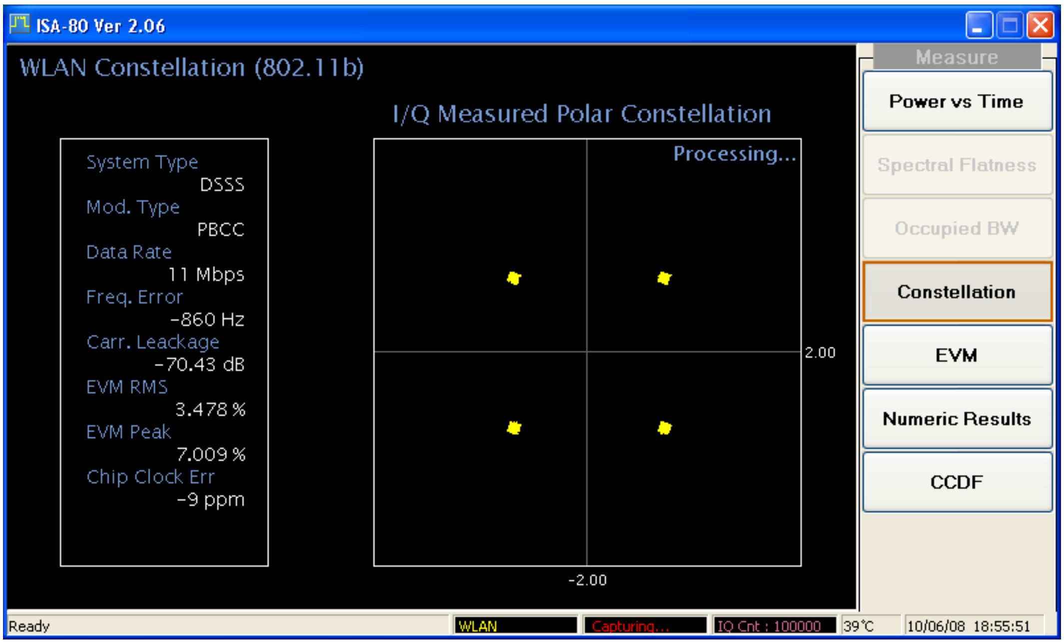


Fig. 7 Result of measuring constellation for 802.11b signal

EVM (Error Vector Magnitude)

Test purpose

Error Vector Magnitude (EVM) is a very common modulation quality metric widely used in digital communication systems. EVM is the scalar distance between the measured signal and the time-aligned reference signal. In most standards, EVM is defined as the root-mean-square of error values at the symbol decision positions. Fig. 18 describes the physical meaning of EVM in a digital communication system.

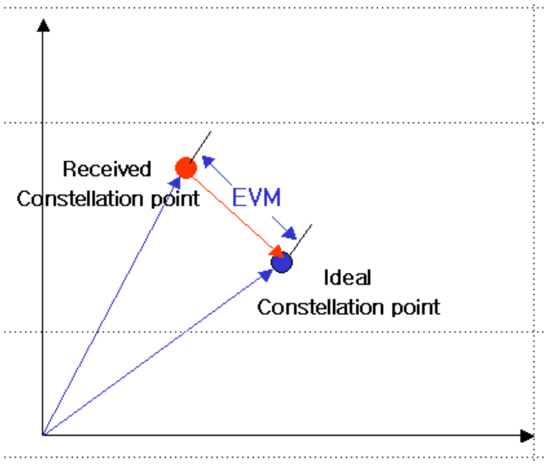


Fig. 8 EVM description for general digitally modulated signal

Test procedure

Perform the steps below to measure the EVM of an 802.11b WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure EVM in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11b std.

3 Press [MEASURE] and select *[Mod Analysis..]*, then select *[EVM]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

Set the following parameters in WLAN mode to adjust analysis:

5 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

6 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test results

The figure below displays EVM vs chip, constellation diagram and numerical results. *[Numeric Results]* shows the results of modulation accuracy.

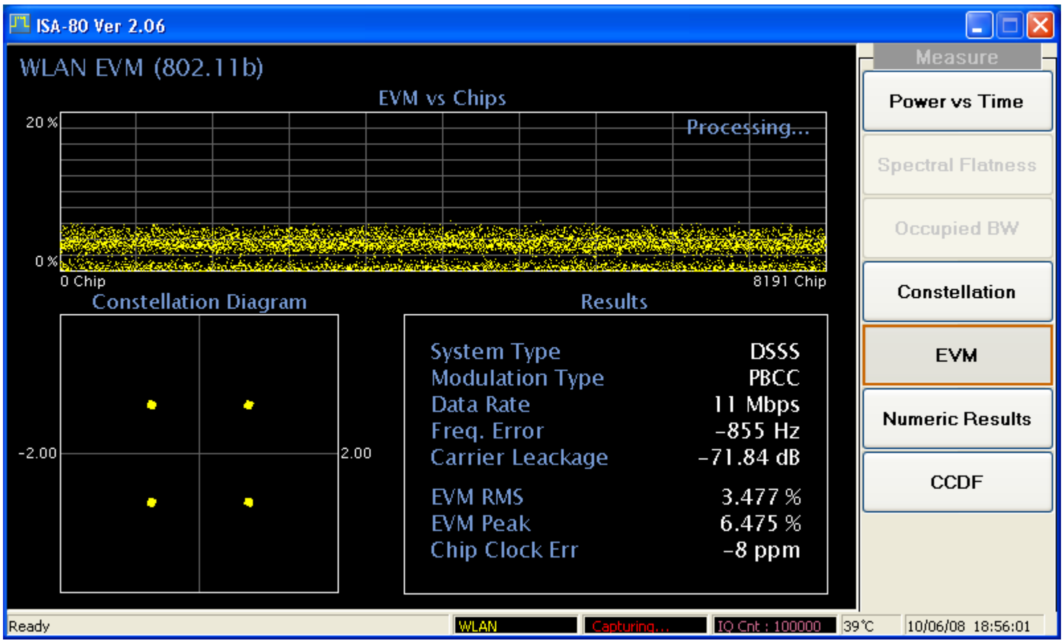


Fig. 9 Result of measuring EVM vs chips for 802.11b signal

Numerical results

Test purpose

Analyzing an 802.11b burst signal provides various numerical results:

System Type

Signal that uses the DSSS (Direct Sequence Spread Spectrum) spreading technique of 802.11b.

Modulation type: depending on the data transfer rate of the signal, the modulation type of WLAN signal changes.

Data rate: data rate has a subordinate relationship to the modulation type.

Frequency error: the transmit carrier frequency error should be within be ± 25 ppm maximum relative to the center frequency. This is equivalent to a maximum error of 71.2 kHz for the highest assigned 802.11b transmission frequency (2.848 GHz).

Number of PSDU bits/symbols.

Fig. 10 shows the format for the PPDU (long and short), including the high rate PLCP preamble, the high rate PLCP header, and the PSDU. The number of PSDU bits differs depending on the modulation method, and is defined in the SIGNAL field.

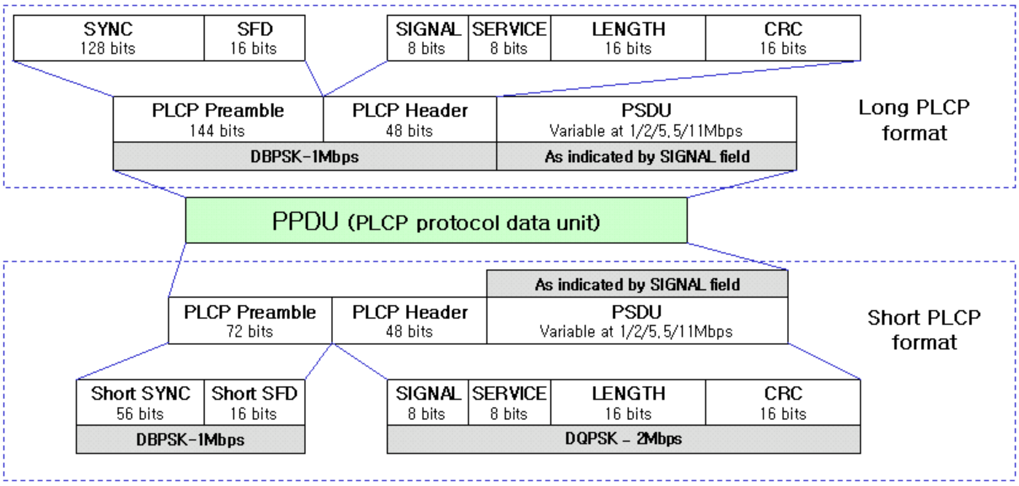


Fig. 10 802.11b packet format

Carrier leakage: the average signal power with modulation vs average signal power without modulation (dB). This result comes up in the modulation process and uses a gated spectrum method.

EVM RMS/peak: shows the numerical result of the EVM RMS/peak value (scaled to percentage).

Chip clock error: The PN code chip clock frequency error shall be better than ±25ppm maximum. This is equivalent to a maximum error of 275 Hz for the highest assigned 802.11b symbol clock frequency (11 MHz). It is highly recommended that the chip clock and the transmit frequency be locked (coupled) for optimum demodulation performance.

Test procedure

Perform the steps below to measure the numerical results of an 802.11b WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure numerical results in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11b std.

3 Press [MEASURE] and select *[Mod Analysis..]*, then select *[Numerical Results]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

Set the following parameters in WLAN mode to adjust analysis:

5 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

6 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test results

The figure below shows the modulation analysis result of an 802.11b signal. From these numerical results, you can investigate the modulation quality of the signal at a glance.

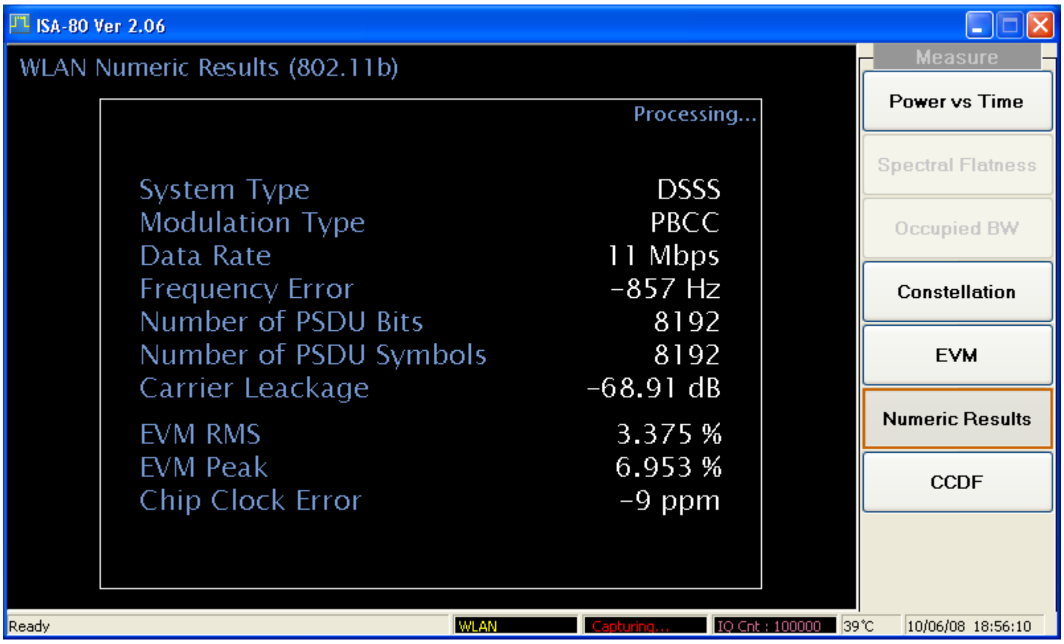


Fig. 11 Result of measuring numerical results for 802.11b signal

802.11a measurement guide

802.11a operates in the 5 GHz band and uses OFDM as its transmission scheme. 802.11a offers 6, 12 and 24 Mbps and optionally 9, 18, 36, 48 and 54 Mbps bit-rates. The OFDM physical layer uses 52 sub-carriers with 0.3125 MHz spacing, of which 48 are used to carry data and 4 are used as pilots. The occupied bandwidth is 16.6 MHz. Forward error correction coding (convolutional coding) is used with a coding rate of 1/2, 2/3, or 3/4. The modulation of the individual carriers in OFDM depends on the data rates. For 6 and 9 Mbps BPSK is used, 12 and 18 Mbps use QPSK, 24 and 36 Mbps use 16 QAM, and 48 and 54 Mbps operation uses 64 QAM.

OFDM uses a fixed modulation formats for its preamble. Varying data rates are achieved by changing the modulation for the data transmission portion of a packet. The modulation format changes during the data transmission. Simpler modulation formats (such as BPSK) are often used in the early part of the burst, which contains important information such as frequency and burst length, because these formats are less prone to bit errors.

Fig. 12 shows the format for the PPDU including the OFDM PLCP preamble, OFDM PLCP header, PSDU, tail bits, and pad bits. The PLCP header contains the following fields: LENGTH, RATE, a reserved bit, an even parity bit, and the SERVICE field. In terms of modulation, the LENGTH, RATE, reserved bit, and parity bit (with 6 'zero' tail bits appended) constitute a separate single OFDM symbol, denoted SIGNAL, which is transmitted with the most robust combination of BPSK modulation and a coding rate of R = 1/2. The SERVICE field of the PLCP header and the PSDU (with 6 'zero' tail bits and pad bits appended), denoted as DATA, are transmitted at the data rate described in the RATE field and may constitute multiple OFDM symbols. The tail bits in the SIGNAL symbol enable decoding of the RATE and LENGTH fields immediately after the reception of the tail bits. The RATE and LENGTH are required for decoding the DATA part of the packet. In addition, the CCA mechanism can be augmented by predicting the duration of the packet from the contents of the RATE and LENGTH fields, even if the station does not support the data rate.

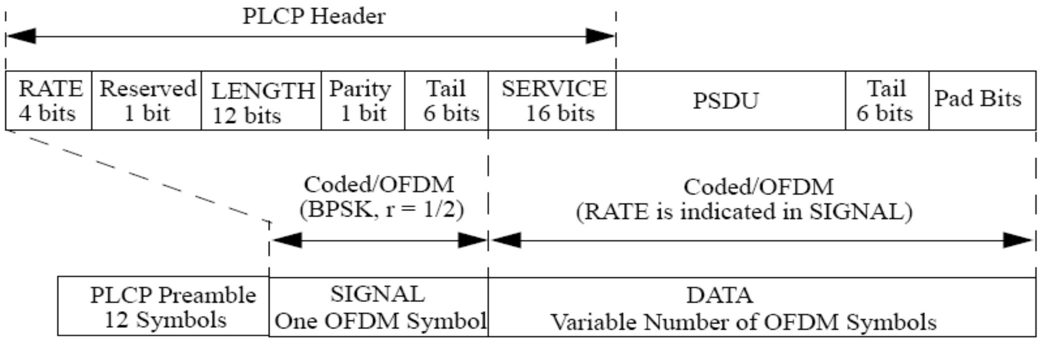


Fig. 12 Data format in 802.11a Std.

Power versus time

Test purpose

It is necessary to investigate a signal's power in the time domain to see the burst characteristics of a 802.11a signal.

Test procedure

Perform the steps below to measure the Power vs Time of a WLAN 802.11a signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameter to measure transmit power in WLAN mode:

Set the following parameters to measure numerical results in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11b std.

3 Press [MEASURE] and select *[Power vs Time]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

5 Capture at least one burst to analyze the signal.

Set the following parameter in WLAN mode to adjust analysis:

6 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

Test result

Fig. 13 shows the result of signal power analysis in the time domain. From this function you can see the average power, peak power and burst length.

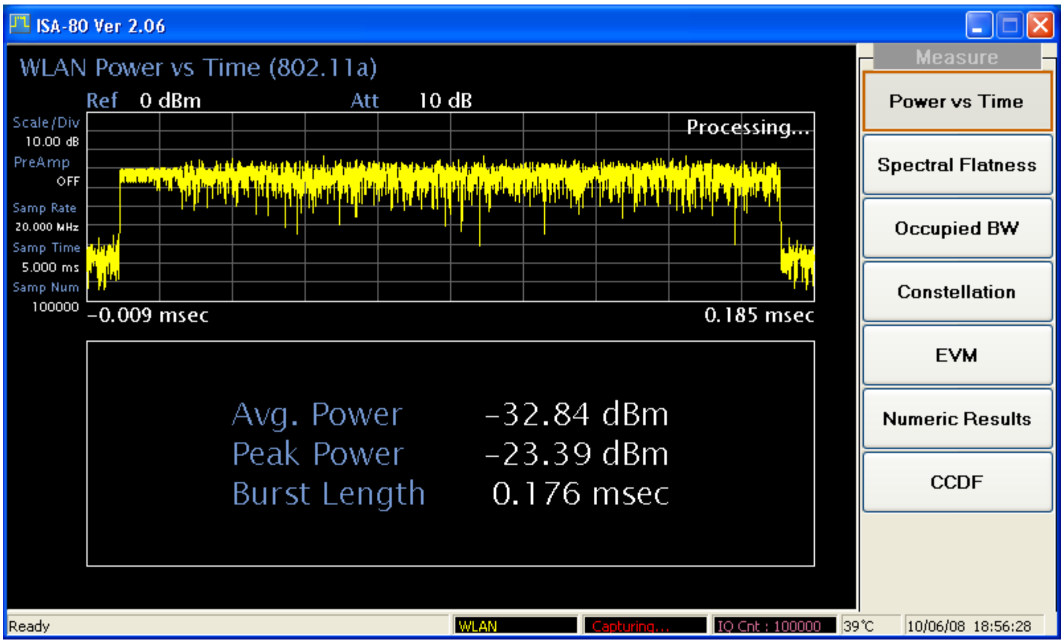


Fig. 13 Result of measuring power vs time for 802.11a signal

Spectral flatness

Test purpose

Variation in the carrier flatness of OFDM signals in IEEE 802.11a/g reduces demodulation margins and degrade link performance. This measurement tests carrier flatness of OFDM signals in IEEE 802.11a/g.

Test procedure

From the steps below you can measure the spectral flatness of an 802.11a/g WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure spectral flatness in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11a std.

3 Press [MEASURE] and select *[Spectral Flatness]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

5 Capture at least one burst data to analyze the signal.

Set the following parameters in WLAN mode to adjust analysis:

6 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

7 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test result

The spectrum flatness measurement measures energy flatness of sub-carriers in OFDM system. The average energy of the constellations in each of the spectral lines –16... –1 and +1... +16 will deviate no more than ± 2 dB from their average energy. The average energy of the constellations in each of the spectral lines –26... –17 and +17... +26 will deviate no more than +2/–4 dB from the average energy of spectral lines –16... –1 and +1... +16. The average energy can be computed by averaging energy on the sub-carriers from –16 to 16 and zero sub-carrier is not included in this computation phase.

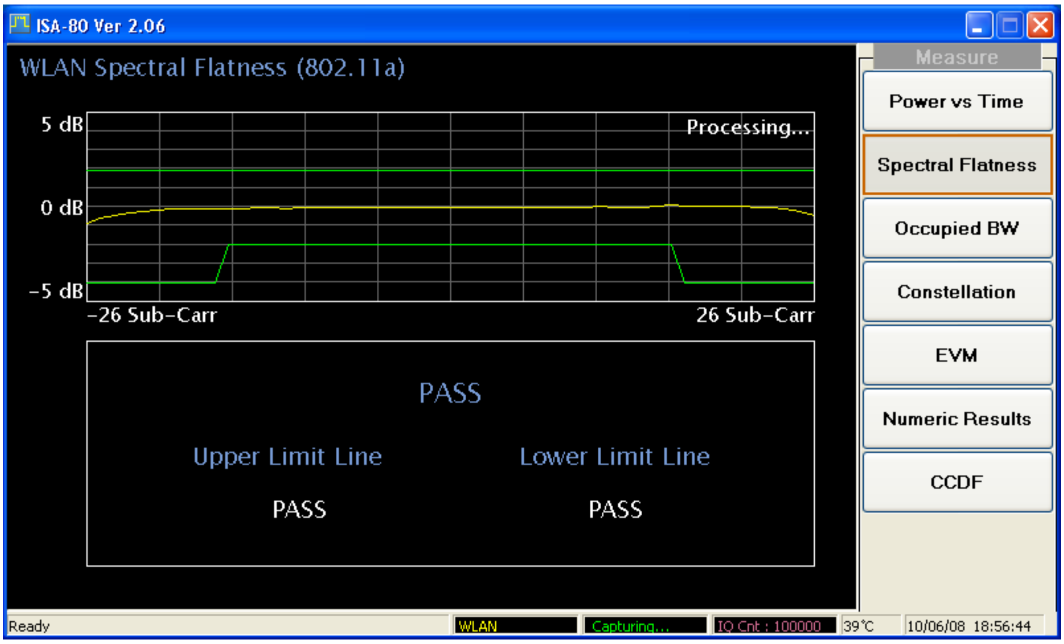


Fig. 14 Result of measuring spectral flatness for 802.11a signal

Occupied bandwidth

Test purpose

This test ensures that the transmitter filter is well designed and the clock of the DUT is working properly. If the clock rate is too high, this may result in a wide occupied bandwidth (OBW) and malfunction of the DUT.

Test procedure

From the steps below you can measure the occupied bandwidth of an 802.11a WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure occupied bandwidth in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11b std.

3 Press [MEASURE] and select *[Occupied BW]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

5 Capture at least one burst data to analyze the signal.

Set the following parameters in WLAN mode to adjust analysis:

6 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

7 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test result

Fig. 15 shows the result of measuring occupied bandwidth for an 802.11a signal. This is the bandwidth occupied by 99% of the total power in the 34 MHz band where the signal resides.

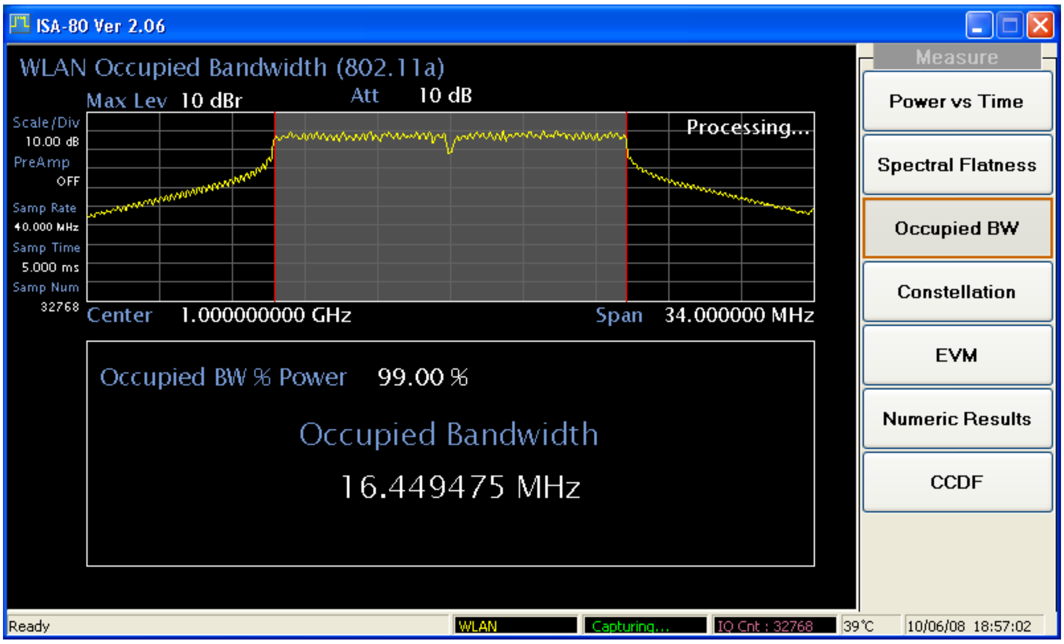


Fig. 15 Result of measuring occupied BW for 802.11a signal

CCDF (Complementary Cumulative Distribution Function)

Test purpose

Many of the digitally modulated signals now look noise-like in the time and frequency domain. This means that statistical measurements of the signals can be a useful characterization. Power Complementary Cumulative Distribution Function (CCDF) curves characterize the higher-level power statistics of a digitally modulated signal. The curves can be useful in determining design parameters for digital communication systems.

Test procedure

From the steps below you can measure the CCDF of an 802.11a WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure CCDF in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11b std.

3 Press [MEASURE] and select *[CCDF]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

Set the following parameters in WLAN mode to adjust analysis:

5 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

6 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test result

The Power Complementary Cumulative Distribution Function (CCDF) curve characterizes the higher-level power statistics of a digitally modulated signal. The results are displayed graphically as well as in the metrics window.

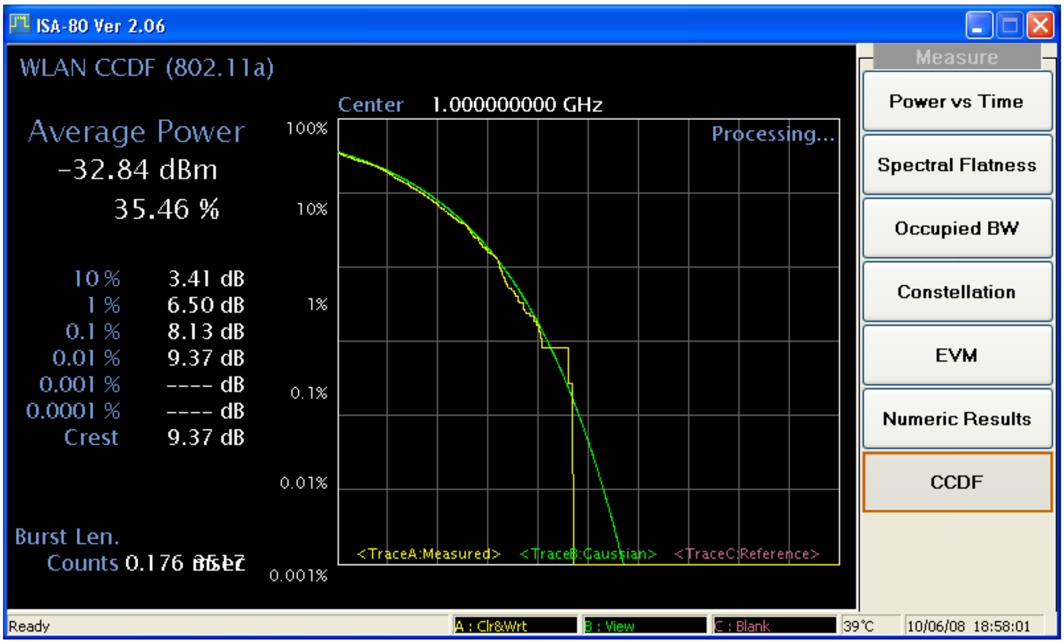


Fig. 16 Result of measuring CCDF for 802.11a signal

Modulation analysis

Constellation

Test purpose

The constellation menu shows the modulation format and modulation quality graphically (refer to Table 1).

Test procedure

From the steps below you can measure the constellation of an 802.11a WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure constellation in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11b std.

3 Press [MEASURE] and select *[Mod.Analysis..]*, then *[Constellation]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*. The capture time required to analyze a WLAN signal differs with the modulation type.

Set the following parameters in WLAN mode to adjust analysis:

5 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

6 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test result

Fig. 17 displays the constellation diagram of a WLAN 802.11a signal with 54 Mbps and 64QAM. The left side displays the numerical results related to modulation accuracy.

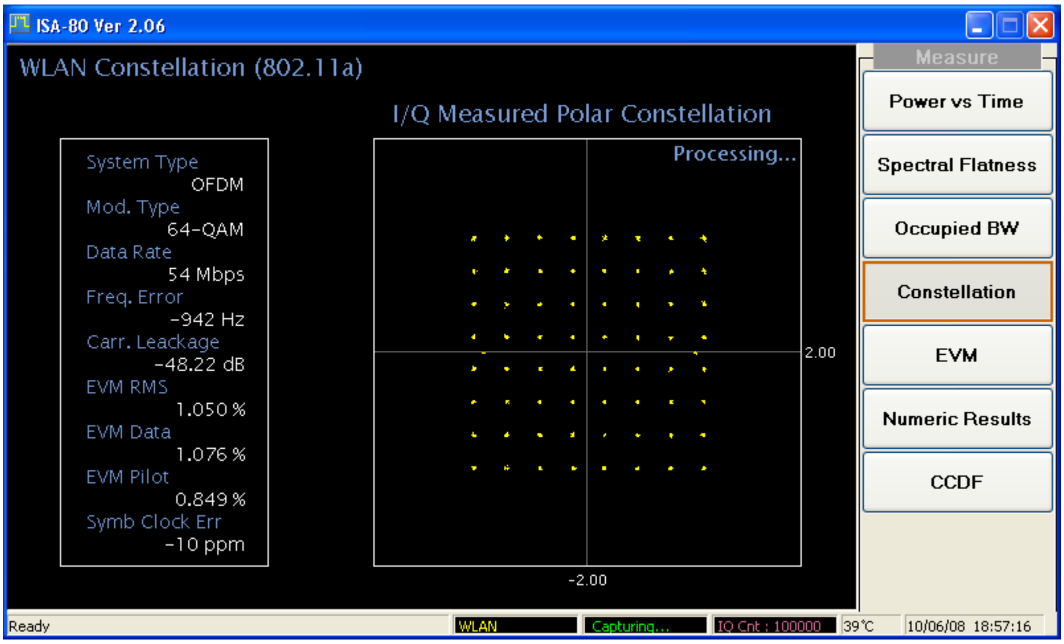


Fig. 17 Result of measuring constellation for 802.11a signal

EVM (Error Vector Magnitude)

Test purpose

Error Vector Magnitude (EVM) is a very common modulation quality metric widely used in digital communication systems. EVM is the scalar distance between the measured signal and the time-aligned reference signal. In most standards, EVM is defined as the root-mean-square of error values at the symbol decision positions.

Test procedure

From the steps below you can measure the EVM of a WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure EVM in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select 802.11a std.

3 Press [MEASURE] and select *[Mod.Analysis..]*, then *[EVM]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

Set the following parameters in WLAN mode to adjust analysis:

5 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

6 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test result

Fig. 18 displays the results of EVM vs symbols & sub-carriers, constellation diagram and numerical result. *[Numerical results*] shows the test results related to modulation accuracy.

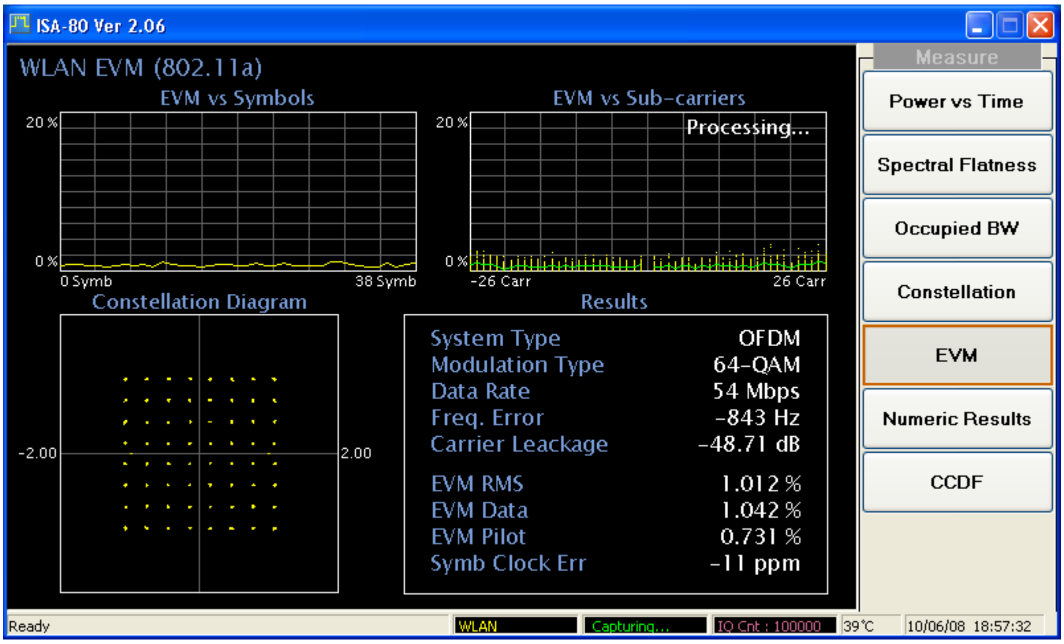


Fig. 18 Result of measuring EVM vs symbols & sub-carrier for 802.11a signal

Numerical results

Test purpose

By analyzing an 802.11a burst signal, you can get various numerical results. The following list shows the analysis results:

System Type: signal that adopts the 802.11a standard uses the OFDM (Orthogonal Frequency Division Multiplexing) technique for its signal transmission.

Modulation Type: depending on the data transfer rate of the signal, the modulation type of WLAN (802.11a signal) changes.

Data Rate: data rate has a subordinate relationship to the Modulation Type. In the case of 802.11a, the data rate changes from 6 Mbps to 54 Mbps.

Frequency Error: the transmitted center frequency tolerance is ± 20 ppm maximum. The transmit center frequency and the symbol clock frequency are derived from the same reference oscillator. This is equivalent to a maximum error of +/-100 kHz for the 802.11a carrier frequency of 5 GHz.

Number of PSDU bits/symbols: Fig. 19 describes the signal frame structure of an 802.11a signal. The number of PSDU varies with the data rate and what is specified in the SIGNAL field.

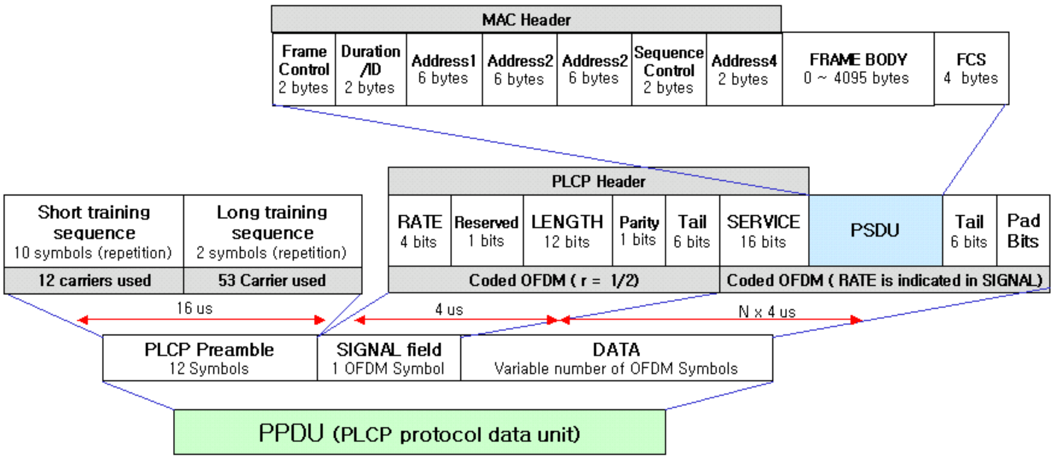


Fig. 19 Data format of 802.11a signal

Table 2 Rate-dependent parameters

Data rate (Mbits/s)	Modulation	Coding rate (R)	Coded bits per subcarrier (N_{BPSC})	Coded bits per OFDM symbol (N_{CBPS})	Data bits per OFDM symbol (N_{DBPS})
6	BPSK	1/2	1	48	24
9	BPSK	3/4	1	48	36
12	QPSK	1/2	2	96	48
18	QPSK	3/4	2	96	72
24	16-QAM	1/2	4	192	96
36	16-QAM	3/4	4	192	144
48	64-QAM	2/3	6	288	192
54	64-QAM	3/4	6	288	216

Carrier Leakage: the OFDM system is more sensitive to phase noise compared to other communication techniques. Phase noise is an additional modulation that modifies the sin(x)/x spectrum, reducing the depth of the nulls, and creating interference to other carriers. Carrier leakage occurs from this interference.

EVM RMS, EVM Data, EVM Pilot: show the numerical result of EVM RMS , EVM Data and EVM Pilot (scaled to percentage).

Symbol Clock Error: the symbol clock frequency tolerance is ± 20 ppm maximum. The transmit center frequency and the symbol clock frequency are derived from the same reference oscillator. This is equivalent to a maximum error of +/-5 Hz for the 802.11a clock frequency of 250 kHz (4 µs).

Test procedure

Perform the steps below to measure the numerical results of an 802.11a WLAN signal.

Confirm the input signal level is below the maximum allowed input level (+16 dBm with no RF input attenuator).

Set the following parameters to measure numerical results in WLAN mode:

1 Press [Mode] and select *[WLAN]* mode.

2 Press [Mode], *[Setup]* and select *802.11a Std*.

3 Press [MEASURE] and select *[Mod Analysis..]*, then select *[Numerical Results]*.

4 Press [MEASURE], [CONTROL] and set the *[Capture Time]*.

Set the following parameters in WLAN mode to adjust analysis:

5 Press [FREQ] and select *[Center]*. Set the center frequency to the same value as the RF input frequency.

6 Press [AMPL] and select *[Ref.Level]*. Set the reference level to the maximum expected RF level.

Test results

Fig. 20 shows the modulation analysis results of an 802.11a signal. From this numerical result, the modulation quality of the signal can be investigated at a glance.

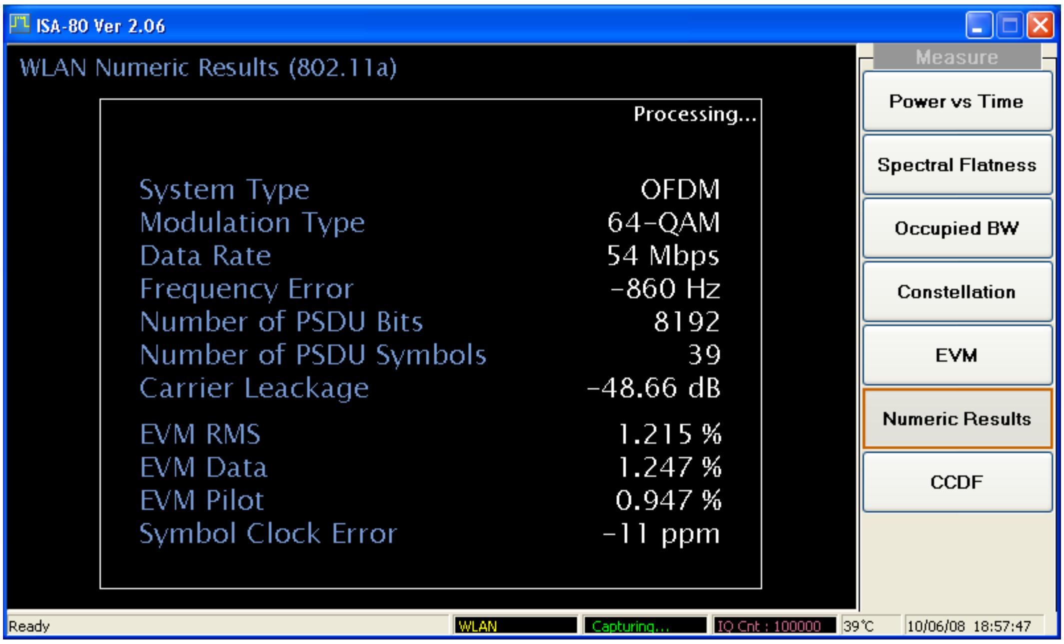


Fig. 20 Result of measuring numerical results for 802.11a signal

802.11g measurement guide

IEEE 802.11g is an extension of the 802.11b standard. so the 802.11g system can interoperate with the 802.11b system. 802.11g adds 802.11a OFDM transmission modes to the 802.11b standard, providing the 802.11a throughput improvement in the 2.4 GHz band. In addition to the 802.11a OFDM modes, 802.11g also defines optional modes of increased throughput PBCC utilizing 8PSK and an optional CCK-OFDM mode, which combines the 802.11b preamble with an OFDM packet.

In addition to the data rates that 802.11b supports, 802.11g also allows different data rates using various modulation schemes, such as 11 Mbps using PBCC-11, 22 Mbps using PBCC-22 or CCK-PBCC, 33 Mbps operation using PBCC-33. For 54 Mpbs operation, CCK-OFDM modulation is used.

Similarly to 802.11a, 802.11g OFDM modes map data symbols using BPSK and QPSK for lower data rates and QAM for faster bit rates.

Table 3 shows the list of supported parts from the 802.11g standard. This measurement option provides only the 802.11a part, 802.11b part and PBCC 22 Mbps from its new part.

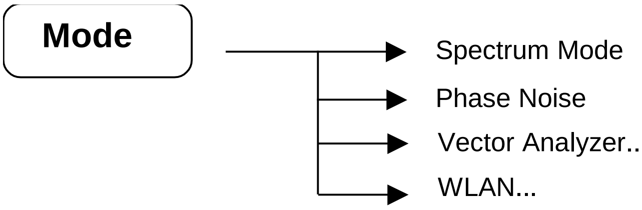
Table 3 Available data formats for 802.11g

802.11g Std family	Modulation	Data rate	Possible to measure
802.11a part	OFDM	6 ~ 54 Mbps	Supported
802.11b part	DSSS	1 , 2 Mbps	Supported
	CCK	5.5 Mbps, 11 Mbps	Supported
	PBCC	5.5 Mbps, 11 Mbps	Supported
New part	PBCC	22 Mbps	Supported
		33 Mbps	Not supported
	DSSS-OFDM	1 ~ 54 Mbps	Not supported

Menu descriptions

WLAN measurement mode

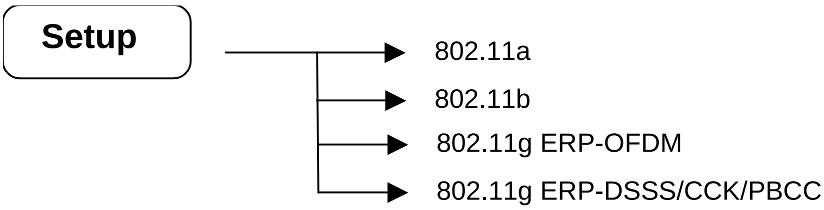
To use WLAN measurement options, first set the system to WLAN mode:



Select [Mode], then press *[WLAN..]* mode at the right side of the screen.

Mode setup

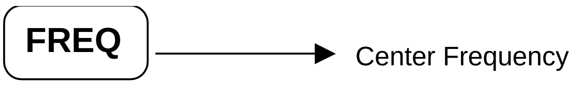
Press [Setup] in WLAN mode:



802.11a	Select IEEE 802.11a std for WLAN analysis mode.
802.11b	Select IEEE 802.11b std for WLAN analysis mode.
802.11g ERP-OFDM	Select IEEE 802.11g ERP-OFDM std for WLAN analysis mode (has the same menu structure as 802.11a)
802.11g ERP-DSSS /CCK/PBCC	Select IEEE 802.11g ERP-DSSS /CCK/PBCC std for WLAN analysis mode (has the same menu structure as 802.11b)

Frequency menu

Press [FREQ] in WLAN mode:

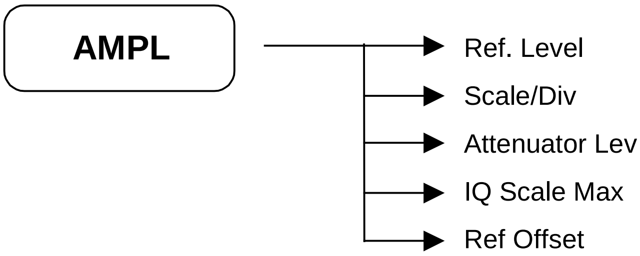


You can access frequency functions from this menu.

Center Frequency	Set to center frequency: 3 Hz to 3 / 8 / 13.2 / 26.5 GHz. For 802.11b, the default frequency is 2.4 GHz; for 802.11a, the default frequency is 5 GHz.

Amplitude menu

Press [AMPL] in WLAN mode:

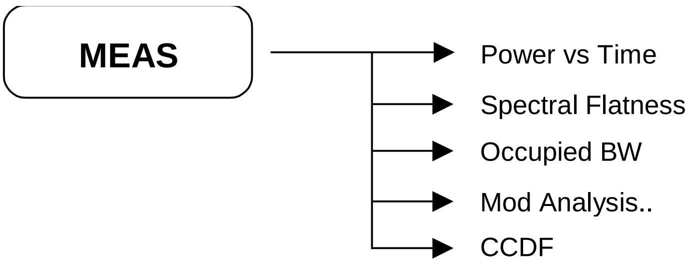


Amplitude menu keys are used for setting functions that affect the way data on the vertical axis is displayed or corrected.

Ref. Level	This allows you to set the value in dBc/Hz of a specified position on the graticule display.
Scale/Div	This allows you to set the value of scale in dB for each division of Y-axis.
Attenuator Lev	This allows you to set the internal attenuator level in dB.
IQ Scale Max	This allows you to set the value of I/Q scale of Y-axis.
Ref Offset	Sets the offset value for the displayed signal.

Measure menu

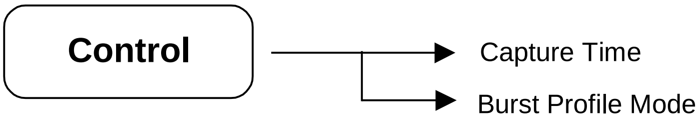
Press [MEAS] in WLAN mode:



Power vs Time	Measures power vs time of a WLAN signal. For an 802.11b/g signal, the Pass/Fail result for power up/down ramp is measured and displayed, based on the 802.11b std.
Spectral Flatness	Measures the spectral flatness of an 802.11a/g WLAN signal for its sub-carrier. The Pass/Fail result for carrier flatness is measured and displayed (refer IEEE 802.16a/g std).
Occupied BW	Measure the adjacent channel power of an 802.11a/g WLAN signal. This is the bandwidth occupied by 99% of the total power in a 34 MHz band where the signal resides.
Mod. Analysis	Measures the parameters related to modulation accuracy as shown in the submenu below:
	Constellation: measures the constellation diagram for a WLAN input signal. The modulation-related numerical results are shown on the left side of the window.
	EVM: measures the error vector magnitude for a WLAN input signal. In 802.11a std the ‘EVM vs Symbols’ and ‘EVM vs Sub-carriers’ are shown, and in 802.11b std the ‘EMM vs Chips’ is shown.
	Numeric Results: shows the numerical results related to modulation accuracy (in IEEE 802.11a/b/g std).
CCDF	Measures the CCDF (Complementary Cumulative Distribution Function) of the WLAN signal (in IEEE 802.11a/b/g std).

Measure control menu (except FFT analysis)

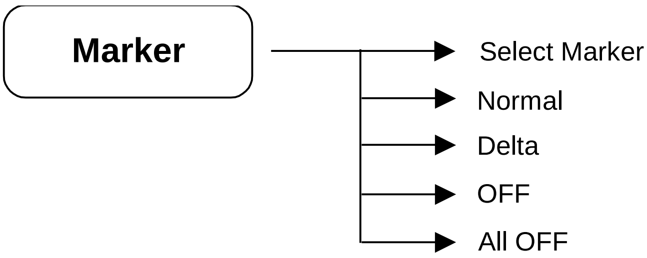
Press [CONTROL] in WLAN mode:



Capture Time	Specifies the time to be captured for WLAN signal analysis. The maximum capture time is 26.182 ms and the minimum is 0.1 ms.
Burst Profile Mode	When the spectrum analyzer performs the 'Power vs Time' function in WLAN mode, you can set the Burst profile mode (activated only in 'Power vs Time' measurement in WLAN mode). It determines the value used to calculate the 10% and 90% power levels when measuring the burst's rising and falling edge times. Peak: use Burst Peak Power for calculating burst rise & fall times. Average: use Burst Average Power for calculatimg burst rise & fall times.

Marker menu

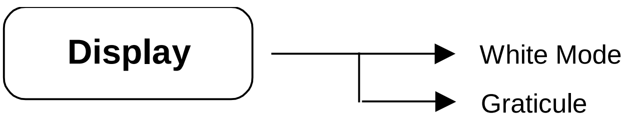
Press [MARKER] in WLAN mode:



Select Marker	Allows you to select one of the four possible markers. Having selected one of the markers, use the other soft keys on this menu to specify the type of marker or measurement.
Normal	Sets the specified marker to be a normal marker.
Delta	A delta marker is actually a pair of markers. By pressing Delta, you set a pair of markers at your current frequency offset. One of this pair of markers is fixed while the second of the pair can be moved using the scroll knob or the numeric keys. The frequency difference and the amplitude difference between these two points is displayed.
OFF	Switches the specified marker off.
All OFF	Switches all markers off. All markers are removed from the graticule display, and if the marker table is also being displayed, all entries are removed from it.

Display menu

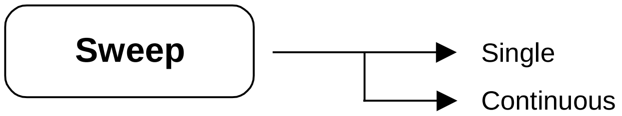
Press [Display] in WLAN mode:



White Mode	Changes the screen background to white.
Graticule	Allows you to display or hide the graticule lines on the display.

Sweep menu

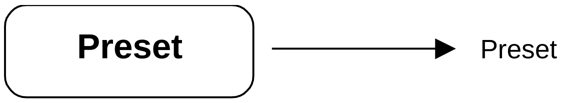
Press [Sweep] in WLAN mode:



Single	The analyzer performs one single measurement and then stops. You have to press [Restart] every time you want to make another measurement.
Continuous	The analyzer continuously measures the signal it is receiving and repeatedly updates the plots and the measurements.

Preset menu

Press [Preset] in WLAN mode:



The sub menus of [Preset] have the same function as in the basic spectrum analysis mode. Please refer to the Spectrum Analyzer Operating Manual (part number 46892/974) for other soft key functions.

Detailed description of commands

General

This section gives detailed descriptions of the device messages for the spectrum analyzer in functional order. The following example shows the command format.

Note that '∆' = 'blank' throughout this document.

SA command

SCPI command

	Command Name
Function	The explanation of the command.
Remote Command	SA Command∆sw
	SA Command∆f
	SA Command?
	SCPI Command∆sw
	SCPI Command∆f
	SCPI Command?
Response Message	sw or f
	(Depending on command)
Value of f	Range of sw or f
	(Depending on command)
Suffix code	Unit of f
	(Depending on command)
Initial setting	Initial value for SA System
Example	SA Command sw;
	SA Command f;
	SA Command?;
	SCPI Command sw;
	SCPI Command f;
	SCPI Command?;

Amplitude

RL

:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel

	Reference Level
Function	Sets the reference level value.
Remote Command	RL△f
	RL?
	:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel△f
	:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel?
Response Message	Reference Level (dBm)
Value of f	−170 dBm to 30 dBm (Step : 0.01 dBm)
Suffix code	None : dBm
	DBM : dBm
Initial setting	0 dBm
Example	RL 10;
	RL 30DBM;
	RL ?;
	DISP:WIND:TRAC:Y:RLEV 10;
	DISP:WIND:TRAC:Y:RLEV 30DBM;
	DISP:WIND:TRAC:Y:RLEV?;

AT

[:SENSE]:POWer[:RF]:ATTenuation

	Attenuation
Function	Sets the amount of attenuation for the input attenuator.
Remote Command	AT△f
	AT?
	[:SENSe]:POWer[:RF]:ATTenuation△f
	[:SENSe]:POWer[:RF]:ATTenuation?
Response Message	amount of attenuation (dB)
Value of f	0 dB to 55 dB (Step : 5 dB)
Suffix code	None : dB
	DB : dB
Initial setting	10 dB
Example	AT 10;
	AT 10DB;
	AT?;
	POW:ATT 10;
	POW:ATT 10DB;
	POW:ATT?;

SD

:DISPlay:LPLot:WINDow:TRACe:Y[:SCALe]:PDIVision

	Scale/Divide
Function	Sets the scale/divide value.
Remote Command	SD△f
	SD?
	:DISPlay:LPLot:WINDow:TRACe:Y[:SCALe]:PDIVision△f
	:DISPlay:LPLot:WINDow:TRACe:Y[:SCALe]:PDIVision?
Response Message	Scale/Divide (dB/div)
Value of f	0.01 dB to 20 dB (step : 0.01 dB)
Suffix code	None : dB/div
	DB : dB/div
Initial setting	10 dB/div
Example	SD 5;
	SD 10DB;
	SD?;
	DISP:LPL:WIND:TRAC:Y:PDIV 5;
	DISP:LPL:WIND:TRAC:Y:PDIV 10DB;
	DISP:LPL:WIND:TRAC:Y:PDIV?;

Display

GRAT

:DISPlay:WINDow:TRACe:GRATicule:GRID[:STATe]

	Graticule	
Function	Sets the display graticule to Type1 or Type2 or OFF.	
Remote Command	GRAT△sw	
	GRAT?	
	:DISPlay:WINDow:TRACe:GRATicule:GRID[:STATe]△sw	
	:DISPlay:WINDow:TRACe:GRATicule:GRID[:STATe]?	
Response Message	TYPE1	: Type1
	TYPE2	: Type2
	OFF	: OFF
Value of sw	TYPE1	: Type1
	TYPE2	: Type2
	OFF	: OFF
Initial setting	TYPE1	
Example	GRAT TYPE1;	
	GRAT?	
	DISP:WIND:TRAC:Y:GRAT:GRID TYPE1;	
	DISP:WIND:TRAC:Y:GRAT:GRID?;	

WH

:DISPlay:WINDow:WHITe

	White Mode
Function	Turns the white mode ON or OFF.
Remote Command	WH△n
	WH△sw
	WH?
	:DISPlay:WINDow:WHITe△n
	:DISPlay:WINDow:WHITe△sw
	:DISPlay:WINDow:WHITe?
Response Message	1 : ON
	0 : OFF
Value of n	1 : ON
	0 : OFF
Value of sw	ON : ON
	OFF : OFF
Initial setting	0
Example	WH 1;
	WH ON;
	WH?
	DISP:WIND:WHIT 1;
	DISP:WIND:WHIT ON;
	DISP:WIND:WHIT?;

File

FREAD

:MMEMory:CATalog

	File Read
Function	Reads files in the selected folder.
Remote Command	FREAD?△'file_folder'
	:MMEMory:CATalog?△'file_folder'
Value of file_folder	File Folder
Response Message	File Name,,File Size.
Example	FREAD? 'C:';
	FREAD? 'D:\Temp';
	MMEM:CAT? 'C:';
	MMEM:CAT? 'D:\Temp';

FSAVE

:MMEMory:STORe

	File Save	
Function	Saves the file, type defined by the extension.	
Remote Command	FSAVE△'file_name'	
	:MMEMory:STORe△'file_name'	
Value of file_name	File Path + File Name	
Supported Extension	csv	: I/Q data
	bmp	: Bitmap
	jpg	: jpeg
	png	: png
	zon	: Zone/Burst
Example	FSAVE 'C:\demo.zon';	
	MMEM:STRO 'C:\demo.zon';	

FDEL

:MMEMory:DELete

	File Delete
Function	Deletes the selected file.
Remote Command	FDEL△'file_name'
	:MMEMory:DELete△'file_name'
Value of file_name	File Path + File Name
Example	FDEL 'C:\demo.bmp';
	MMEM:DEL 'C:\demo.bmp';

FCOPY

:MMEMory:COPY

	File Copy
Function	Copies the selected file.
Remote Command	FCOPY△'src_file_name', 'dest_file_name'
	:MMEMory:COPY△'src_file_name', 'dest_file_name'
Value of src_file_name, dest_file_name	File Path + File Name
Example	FCOPY 'C:\demo.bmp','D:\demo.bmp';
	MMEM:COPY 'C:\demo.bmp','D:\demo.bmp';

FRENAME

:MMEMory:MOVE

	File Rename
Function	Renames the selected file.
Remote Command	FRENAME△'src_file_name','dest_file_name'
	:MMEMory:MOVE△'src_file_name','dest_file_name'
Value of src_file_name, dest_file_name	File Path + File Name
Example	FRENAME 'C:\demo.bmp','C:\demo1_1.bmp';
	MMEM:MOVE 'C:\demo1.bmp','C:\demo1_1.bmp';

FMOVE

MMEMory:DATA

	File Move
Function	Sends or receives binary data of the selected file. The maximum size of the sent file is 2 Mbyte, and the maximum size of the received file is 30 Mbyte.
Remote Command	FMOVE△'file_name',definite_length_block
	FMOVE?△'file_name'
	MMEMory:DATA△'file_name',definite_length_block
	MMEMory:DATA?△'file_name'
Value of file_name	File Path + File Name
Value of definite_length_block	# + number of file size + file size + file data
Example	FMOVE 'C:\Sended_Sample.txt',#14abcd; cf) #+1+4+abcd
	FMOVE? 'C:\Received_Sample.txt';
	MMEM:DATA 'C:\ Sended_Sample.txt',#14abcd;
	MMEM:DATA? 'C:\ Received_Sample.txt';

Frequency

CF

[:SENSe]:FREQuency:CENTer

	Center Frequency
Function	Sets the center frequency.
Remote Command	CF△f
	CF?
	[:SENSe]:FREQuency:CENTer△f
	[:SENSe]:FREQuency:CENTer?
Response Message	Center Frequency (Hz)
	(Range : 1 kHz to 3 / 8 / 13.2 / 26.5 GHz)
Value of f	1 kHz to 3 / 8 / 13.2 / 26.5 GHz
Suffix code	None : Hz (10^0)
	HZ : Hz (10^0)
	KHZ : kHz (10^3)
	MHZ : MHz (10^6)
	GHZ : GHz (10^9)
Initial setting	1.5 / 4 / 6.6 / 12.25 GHz
Example	CF 123456;
	CF 50MHZ;
	CF?;
	FREQ:CEN7T 123456;
	FREQ:CENT 50MHZ;
	FREQ:CENT?;

REF

:INPut:REFerence

	Reference
Function	Sets to 10 MHz Reference.
Remote Command	REF△sw
	REF?
	:INPut:REFerence△sw
	:INPut:REFerence?
Response Message	INT : Internal
	EXT : External
Value of sw	INTernal: Internal
	EXTernal: External
Initial setting	INT
Example	REF INT;
	RFC?
	INP:REF INT;
	INP:REF?

Marker

MS[1˜9]

:CALCulate:MARKer[1˜9]:STATe

	Marker State	
Function	Sets the selected marker state.	
Remote Command	MS[1˜9]△n	
	MS[1˜9]△sw	
	MS[1˜9]?	
	:CALCulate:CCDF:MARKer[1˜9]:STATe△n	
	:CALCulate:CCDF:MARKer[1˜9]:STATe△sw	
	:CALCulate:CCDF:MARKer[1˜9]:STATe?	
Response Message	1	: ON
	0	: OFF
Value of n	1	: ON
	0	: OFF
Value of sw	ON	: ON
	OFF	: OFF
Initial setting	0	
Example	MS 1;	
	MS5 1;	
	MS5?;	
	CALC:CCDF:MARK:STAT 1;	
	CALC:CCDF:MARK5:STAT ON;	
	CALC:CCDF:MARK5:STAT?	

MM[1~9]

:CALCulate:MARKer[1~9]:MODE

	Marker Mode	
Function	Sets the selected marker to Normal, Delta Mode.	
Remote Command	MM[1~9]△sw	
	MM[1~9]?	
:	CALCulate:MARKer[1~9]:MODE△sw	
	:CALCulate:MARKer[1~9]:MODE?	
Response Message	POS	: Normal
	DELT	: Delta
	OFF	: OFF
Value of sw	POSition	: Normal
	DELTa	: Delta
	OFF	: OFF
Initial setting	OFF	
Example	MM POS;	
	MM5?;	
	CALC:CCDF:MARK:MODE POS;	
	CALC:CCDF:MARK5:MODE?	

MF[1˜9]

:CALCulate:MARKer[1˜9]:X

	Marker Frequency
Function	Sets the marker frequency of the selected marker. If the marker mode is the delta mode, sets the difference value of the marker frequency and the delta marker frequency.
Remote Command	MF[1˜9]∆f
	MF[1˜9]?
	:CALCulate:MARKer[1˜9]:X∆f
	:CALCulate:MARKer[1˜9]:X?
Response Message	Marker Frequency (Hz)
Value of f	Start Frequency to Stop Frequency
Suffix code	None : Hz (10ˆ0)
	HZ : Hz (10ˆ0)
	KHZ : kHz (10ˆ3)
	MHZ : MHz (10ˆ6)
	GHZ : GHz (10ˆ9)
Initial setting	Center Frequency
Example	MF 123456;
	MF5.1GHZ;
	MF5?;
	CALC:MARK:X 123456;
	CALC:MARK5:X 1GHZ;
	CALC:MARK5:X?

MA[1~9]

:CALCulate:MARKer[1~9]:Y

	Marker Amplitude
Function	Returns the amplitude data.
Remote Command	MA[1~9]?
	:CALCulate:MARKer[1~9]:Y?
Response Message	Marker Amplitude
Example	MA?;
	MA5?
	CALC:MARK:Y?
	CALC:MARK5:Y?

MAO

:CALCulate:LPLot:MARKer:AOFF

	Marker All OFF
Function	Turns off all markers.
Remote Command	MAO
	:CALCulate:LPLot:MARKer:AOFF
Example	MAO;
	CALC:LPL:MARK:AOFF;

Measurement

MEA

:MEASure:STARt

	Measure Start	
Function	Starts the measurement.	
Remote Command	MEA△sw	
	MEA?	
	:MEASure:STARt△sw	
	:MEASure:STARt?	
Response Message	PVT	: Power vs Time
	FLAT	: Spectral Flatness
	OBW	: Occupied Bandwidth
	CCDF	: CCDF
	CONST	: Constellation
	EVM	: EVM
	NUME	: Numeric Results
Value of sw	PVT	: Power vs Time
	FLAT	: Spectral Flatness
	OBW	: Occupied Bandwidth
	CCDF	: CCDF
	CONST	: Constellation
	EVM	: EVM
	NUME	: Numeric Results
Example	MEA EVM;	
	MEA?;	
	MEAS:STAR EVM;	
	MEAS:STAR?;	

PVTOUT

:FETCh|MEASure|READ:PVTime

	Power vs Time Output
Function	Return results of Power vs Time.
Remote Command	PVTOUT?
	:FETCh|MEASure|READ:PVTime?
Response Message	Average Power (dBm), Peak Power (dBm), Length (s), Pass/Fail State, Rise Pass/Fail State, Rise Time (s), Fall Pass/Fail State, Fall Time (s)
Example	PVTOUT?;
	MEAS:PVT?;

FLATOUT

:FETCh|MEASure|READ:FLATness

	Spectral Flatness
Function	Returns results of Spectral Flatness.
Remote Command	FLATOUT?
	:FETCh|MEASure|READ:FLATness?
Response Message	Pass/Fail State, Upper Pass/Fail State, Lower Pass/Fail State
Example	FLATOUT?;
	MEAS:FLAT?;

OBWOUT

:FETCh|MEASure|READ:OBWidth

	Occupied Bandwidth Output
Function	Returns the output of Occupied Bandwidth measurement
Remote Command	OBWOUT?
	:FETCh|MEASure|READ:OBWidth?
Response Message	Occupied bandwidth (Hz)
Example	OBWOUT?;
	MEAS:OBW?;

CONSTOUT

:FETCh|MEASure|READ:CONSTellation

	Constellation output
Function	Returns the output of Constellation measurement.
Remote Command	CONSTOUT?
	:FETCh|MEASure|READ:CONSTellation?
Response Message	System Type, Modulation Type, Data Rate (bps), Frequency Error (Hz), Carrier Leakage (dB), EVM RMS (%), EVM Data (%), EVM Pilot (%), Symbol Clock Error (ppm): 802.11a/g
Response Message	System Type, Modulation Type, Data Rate (bps), Frequency Error (Hz), Carrier Leakage(dB), EVM RMS (%), EVM Peak (%), Chip Clock Error (ppm): 802.11b/g
Example	CONSTOUT?;
	MEAS:CONST?;

EVMOUT

:FETCh|MEASure|READ:EVM

	EVM output
Function	Return the output of EVM measurement.
Remote Command	EVMOUT?
	:FETCh|MEASure|READ:EVM?
Response Message	System Type, Modulation Type, Data Rate (bps), Frequency Error (Hz), Carrier Leakage (dB), EVM RMS (%), EVM Data (%), EVM Pilot (%), Symbol Clock Error (ppm): 802.11a/g
Response Message	System Type, Modulation Type, Data Rate (bps), Frequency Error (Hz), Carrier Leakage (dB), EVM RMS (%), EVM Peak (%), Chip Clock Error (ppm): 802.11b/g
Example	EVMOUT?;
	MEAS:EVM?;

NUMEOUT

:FETCh|MEASure|READ:NUMEric

	Numeric Results output
Function	Returns the output of Numeric Results measurement.
Remote Command	NUMEOUT?
	:FETCh|MEASure|READ:NUMEric?
Response Message	System Type, Modulation Type, Data Rate (bps), Frequency Error (Hz), Number of PSDU Bits, Number of PSDU Symbols, Carrier Leakage (dB), EVM RMS (%), EVM Data (%), EVM Pilot (%), Symbol Clock Error (ppm): 802.11a/g
Response Message	System Type, Modulation Type, Data Rate (bps), Frequency Error (Hz), Number of PSDU Bits, Number of PSDU Symbols, Carrier Leakage (dB), EVM RMS (%), EVM Peak (%), Chip Clock Error (ppm): 802.11b/g
Example	NUMEOUT?;
	MEAS:NUME?;

CCDFOUT

:FETCh|MEASure|READ:CCDF

	CCDF output
Function	Returns the output of CCDF measurement.
Remote Command	CCDFOUT?
	:FETCh|MEASure|READ:CCDF?
Response Message	Average Power (dBm), Average Power Percent (%), 10% Level Difference (dB), 1% Level Difference (dB), 0.1% Level Difference (dB), 0.01% Level Difference (dB), 0.001% Level Difference (dB), 0.0001% Level Difference (dB), Crest Level Difference (dB), Burst Length (s), Counts
Example	CCDFOUT?;
	MEAS:CCDF?;

Measurement control

MEAT

:MEASure:TIME

	Capturing Time	
Function	Sets to Capturing Time.	
Remote Command	MEAT△f	
	MEAT?	
	:MEASure:TIME△f	
	:MEASure:TIME?	
Response Message	Capturing Time (s)	
Value of f	1 ms to max (max changes according to sampling rate)	
Suffix	None	: s (10^0)
	kSEC	: ks (10^3)
	SEC	: s (10^0)
	MSEC	: ms (10^-3)
Initial setting	5 ms	
Example	MEAT 0.001;	
	MEAT 1MSEC;	
	MEAT?;	
	MEA:TIME 0.001;	
	MEA:TIME 1MSEC;	
	MEA:TIME?;	

Mode

MODE

:INSTrument[:SELect]

	Mode	
Function	Sets Current Mode.	
Remote Command	MODE△sw	
	MODE?	
	:INSTrument[:SELect]△sw	
	:INSTrument[:SELect]?	
Response Message	SA	: Spectrum Mode
	VECTOR	: Vector Analyzer Mode
	WLAN	: WLAN mode
Value of sw	SA	: Spectrum Mode
	VECTOR	: Vector Analyzer Mode
	WLAN	: WLAN Mode
Initial setting	SA	
Example	MODE SA;	
	MODE?;	
	INST SA;	
	INST?;	

Mode setup

RADIOSTD

	Radio Standard
Function	Sets to Radio Standard.
Remote Command	RADIOSTD△sw
	RADIOSTD?
Response Message	802.11A : 802.11a
	802.11B : 802.11b
	802.11A/G : 802.11a/g
	802.11B/G : 802.11b/g
Value of sw	802.11A : 802.11a
	802.11B : 802.11b
	802.11A/G : 802.11a/g
	802.11B/G : 802.11b/g
Initial setting	802.11A/G
Example	RADIOSTD 802.11A/G;
	RADIOSTD?;

Preset

PRST

:SYSTem:PRESet

	Preset
Function	Executes preset. All instrument parameters are set to default values.
Remote Command	PRST
	:SYSTem:PRESet
Example	PRST;
	SYST:PRES;

Printer

HCOPY

:HCOPy[:IMMediate]

	Hard Copy
Function	Prints entire screen image.
Remote Command	HCOPY
	:HCOPy[:IMMediate]
Example	HCOPY;
	HCOP;

Sweep

CO

:INITiate:CCDF:CONTinuous

	Continuous Sweep
Function	Sets the continuous sweep mode. Repeats active sweep.
Remote Command	CO
	:INITiate:CONTinuous
Example	CO;
	INIT:CONT;

SI

:INITiate[:IMMediate]

	Single Sweep
Function	Sets the single sweep mode. After activating sweep, stops sweep repeating.
Remote Command	SI
	:INITiate[:Immediate]
Example	SI;
	INIT;

System

BEEP

	Beep	
Function	Turns Beep to ON or OFF when pressing key pad..	
Remote Command	BEEP△n	
	BEEP△sw	
	BEEP?	
Response Message	1	: ON
	0	: OFF
Value of n	1	: ON
	0	: OFF
Value of sw	ON	: ON
	OFF	: OFF
Initial setting	0	
Example	BEEP 1;	
	BEEP ON;	
	BEEP?;	

ECHO

	Echo	
Function	Turns Echo to ON or OFF when controlled by hyper teminal.	
Remote Command	ECHO△n	
	ECHO△sw	
	ECHO?	
Response Message	1	: ON
	0	: OFF
Value of n	1	: ON
	0	: OFF
Value of sw	ON	: ON
	OFF	: OFF
Initial setting	1	
Example	ECHO 1;	
	ECHO ON;	
	ECHO?;	

GPIB common commands

*CLS

	Clear Status Command
Function	Clears the status byte register.
Remote Command	*CLS
Example	*CLS;

*ESE

	Standard Event Status Enable
Function	Sets the standard event status enable register.
Remote Command	*ESE△n
	*ESE?
Response Message	Register Value
Value of n	0 to 255 : Represents the sum of the bit-weighted values.
Example	*ESE 20:
	*ESE?;

*ESR?

	Standard Event Status Register Query
Function	Returns the current value in the standard event status register.
Remote Command	*ESR?
Response Message	Register Value
Example	*ESR?;

*IDN?

	Identification Query
Function	Returns the model name, etc of the equipment
Remote Command	*IDN?
Response Message	Company, Model, Serial, Version
Example	*IDN?;

*OPC

	Operation Complete Command
Function	Sets the standard event register bit 0 to 1 when the requested action is complete.
Remote Command	*OPC
Example	*OPC;

*OPC?

	Operation Complete Query
Function	Sets the output queue to 1 to generate a MAV summary message when all pending select device operations have completed.
Remote Command	*OPC?
Response Message	1
Example	*OPC?;

*RST

	Rest Command
Function	Resets the device.
Remote Command	*RST
Example	*RST;

*SRE

	Service Request Enable Command
Function	Sets the bits in the service request enable register.
Remote Command	*SRE△n
	*SRE?
Response Message	Register Value
Value of n	0 to 255 : Represents the sum of the bit-weighted values.
Example	*SRE 32;
	*SRE?;

*STB?

	Returns Status Byte Command
Function	Returns the current values of the status bytes including the MSS bit.
Remote Command	*STB?
Response Message	Register Value

Bit	Bit Weight	Bit Name	Condition of status byte register
7	128	----	0 = Not used
6	64	MSS	0 = Service not requested 1 = Service requested
5	32	ESB	0 = Event status not generated 1 = Event status generated
4	16	MAV	0 = No data in output queue 1 = Data in output queue
3	8	ESB2	0 = Event status not generated 1 = Event status generated
2	4	----	0 = Not used
1	2	----	0 = Not used
0	1	----	0 = Not used

Example	*STB?;

GPIB common commands — others

ESE2

	Event Status Enable (End)
Function	Allows the End Event Status Enable Register to select which bit in the corresponding Event Register cause a TRUE ESB summary message bit 3 when set.
Remote Command	ESE2△n
	ESE2?
Response Message	Register Value
Value of n	0 to 255 : Represents the sum of the bit-weighted values.
Example	ESE2 1;
	ESE2?;

ESR2?

	Event Status Register (End) Query
Function	Allows the sum of binary-weighted event bit values of the End Event Status Register to be read out by converting them to decimal. After readout, the End Event status Register is reset to 0.
Remote Command	ESR2?
Response Message	Register Value

Bit	Bit Weight	Event	Description
7	128	Not used	Not used
6	64	Not used	Not used
5	32	Not used	Not used
4	16	Measurement completed	Measurement has completed (Peak search, OBW, X dB, Noise marker, Freq. Counter, Limit Pass/Fail..)
3	8	AUTO TUNE completed	AUTO TUNE has completed.
2	4	Averaging completed	Sweeping according to the specified AVERAGE number has completed.
1	2	Calibration completed	Temp Cal, Pre-Filter Cal, ZNC Cal,. Level Cal.. has completed.
0	1	Sweep completed	A single sweep has completed or is in standby.

Example	ESR2?;

ERR

:SYSTem:ERRor[:NEXT]

	Error Code
Function	Returns the error code of the current function. The error code is cleared.
Remote Command	ERR?
Response Message	Error code
Example	ERR?;

Remote commands

< Catalog order >

Index	Description	SA Command	SCPI Command	Suffix
Amplitude	Ref. Level	RL	:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel	<amplitude>I?
Amplitude	Attenuation	AT	[:SENSe]:POWer[:RF]:ATTenuation	<amplitude>I?
Amplitude	Scale/Div	SD	:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision	<amplitude>I?
Display	Graticule	GRAT	:DISPlay:WINDow:TRACe:GRATicule:GRID[:STATe]	OFFIONI0I1I?
Display	White Mode	WH	:DISPlay:WINDow:WHITe	OFFIONI0I1I?
File	Read	FREAD	:MMEMory:CATalog	? <`directory_name'>
File	Save	FSAVE	:MMEMory:STORe	<`file_name'>
File	Delete	FDEL	:MMEMory:DELete	<`file_name'>
File	Copy	FCOPY	:MMEMory:COPY	<`file_name1',<`file_name2' >
File	Rename	FRENAME	:MMEMory:MOVE	<`file_name1',<`file_name2' >
File	Move	FMOVE	:MMEMory:DATA	<`file_name',definite_ length_blockI? <'file_name>
Frequency	Center Frequency	CF	[:SENSe]:FREQuency:CENTer	<frequency>I?
Frequency	Reference	REF	:INPut:REFerence	INTernalIEXTernalI?
Marker	Marker State	MS[1~9]	:CALCulate:MARKer[1~9]:STATe	OFFIONI0I1I?
Marker	Marker Mode	MM[1~9]	:CALCulate:MARKer[1~9]:MODE	POSitionIDELTaIOFFI?
Marker	Marker Freq	MF[1~9]	:CALCulate:MARKer[1~9]:X	<frequency>I?
Marker	Marker Amplitude	MA[1~9]	:CALCulate:MARKer[1~9]:Y	?
Marker	Marker All Off	MAO	:CALCulate:LPLot:MARKer:AOFF	none
Measurement	Meas. Start	MEA	:MEASure:STARt	PVTIFLATIOBWICCDF ICONSTIEVMINUMEI?
Measurement	Power vs Time Output	PVTOUT	:FETChIMEASureIREAD:PVTime	?
Measurement	Spectral Flatness	FLATOUT	:FETChIMEASureIREAD:FLATness	?
Measurement	Occupied Bandwidth	OBWOUT	:FETChIMEASureIREAD:OBWidth	
Measurement	Constellation Output	CONSTOUT	:FETChIMEASureIREAD:CONSTellation	
Measurement	EVM OUTPUT	EVMOUT	:FETChIMEASureIREAD:EVM	?
Measurement	Numeric Results Output	NUMEOUT	:FETChIMEASureIREAD:NUMEric	
Measurement	CCDF Output	CCDFOUT	:FETChIMEASureIREAD:CCDF	
Meas. Control	Meas Time	MEAT	:MEASure:TIME	<time>I?
Mode	Mode	MODE	:INSTrument[:SELect]	SAIVECTORIWLANI?
Mode Setup	Radio Standard	RADIOSTD		802.11AI802.11B I802.11A/G I802.11B/GI?
Preset	Preset	PRST	:SYSTem:PRESet	none
Printer	Hard Copy	HCOPY	:HCOPy[:IMMediate]	none
Sweep	Single	SI	:INITiate:LPLot[:IMMediate]	none
Sweep	Continuous	CO	:INITiate:LPLot:CONTinuous	OFFIONI0I1I?
System	Beep	BEEP		OFFIONI0I1I?
System	Echo	ECHO		OFFIONI0I1I?
Common	*CLS	*CLS	*CLS	none
Common	*ESE	*ESE	*ESE	<integer>I?
Common	*ESR	*ESR	*ESR	?
Common	*IDN	*IDN	*IDN	?
Common	*OPC	*OPC	*OPC	?
Common	*RST	*RST	*RST	none
Common	*SRE	*SRE	*SRE	<integer>I?

Common	*STB	*STB	*STB	?
Others	ESE2	ESE2		<integer>|?
Others	ESR2	ESR2		?
Others	Error Code	ERR	:SYSTem:ERRor[:NEXT]	?

< SA command order >

<table>
<tr><th>Index</th><th>Description</th><th>SA Command</th><th>SCPI Command</th><th>Suffix</th></tr>
<tr><td>Common</td><td>*CLS</td><td>***CLS**</td><td>*CLS</td><td>none</td></tr>
<tr><td>Common</td><td>*ESE</td><td>***ESE**</td><td>*ESE</td><td><integer>|?</td></tr>
<tr><td>Common</td><td>*ESR</td><td>***ESR**</td><td>*ESR</td><td>?</td></tr>
<tr><td>Common</td><td>*IDN</td><td>***IDN**</td><td>*IDN</td><td>?</td></tr>
<tr><td>Common</td><td>*OPC</td><td>***OPC**</td><td>*OPC</td><td>?</td></tr>
<tr><td>Common</td><td>*RST</td><td>***RST**</td><td>*RST</td><td>none</td></tr>
<tr><td>Common</td><td>*SRE</td><td>***SRE**</td><td>*SRE</td><td><integer>|?</td></tr>
<tr><td>Common</td><td>*STB</td><td>***STB**</td><td>*STB</td><td>?</td></tr>
<tr><td>Amplitude</td><td>Attenuation</td><td>**AT**</td><td>[:SENSe]:POWer[:RF]:ATTenuation</td><td><amplitude>|?</td></tr>
<tr><td>System</td><td>Beep</td><td>**BEEP**</td><td></td><td>OFF|ON|0|1|?</td></tr>
<tr><td>Measurement</td><td>CCDF Output</td><td>**CCDFOUT**</td><td>:FETCh|MEASure|READ:CCDF</td><td>?</td></tr>
<tr><td>Frequency</td><td>Center Frequency</td><td>**CF**</td><td>[:SENSe]:FREQuency:CENTer</td><td><frequency>|?</td></tr>
<tr><td>Sweep</td><td>Continuous</td><td>**CO**</td><td>:INITiate:LPLot:CONTinuous</td><td>OFF|ON|0|1|?</td></tr>
<tr><td>Measurement</td><td>Constellation Output</td><td>**CONSTOUT**</td><td>:FETCh|MEASure|READ:CONSTellation</td><td>?</td></tr>
<tr><td>System</td><td>Echo</td><td>**ECHO**</td><td></td><td>OFF|ON|0|1|?</td></tr>
<tr><td>Others</td><td>Error Code</td><td>**ERR**</td><td>:SYSTem:ERRor[:NEXT]</td><td>?</td></tr>
<tr><td>Others</td><td>ESE2</td><td>**ESE2**</td><td></td><td><integer>|?</td></tr>
<tr><td>Others</td><td>ESR2</td><td>**ESR2**</td><td></td><td>?</td></tr>
<tr><td>Measurement</td><td>EVM OUTPUT</td><td>**EVMOUT**</td><td>:FETCh|MEASure|READ:EVM</td><td>?</td></tr>
<tr><td>File</td><td>Copy</td><td>**FCOPY**</td><td>:MMEMory:COPY</td><td><`file_name1'>,<`file_name2'></td></tr>
<tr><td>File</td><td>Delete</td><td>**FDEL**</td><td>:MMEMory:DELete</td><td><`file_name'></td></tr>
<tr><td>Measurement</td><td>Spectral Flatness</td><td>**FLATOUT**</td><td>:FETCh|MEASure|READ:FLATness</td><td>?</td></tr>
<tr><td>File</td><td>Move</td><td>**FMOVE**</td><td>:MMEMory:DATA</td><td><`file_name'>,definite_length_block|? <'file_name></td></tr>
<tr><td>File</td><td>Read</td><td>**FREAD**</td><td>:MMEMory:CATalog</td><td>? <`directory_name'></td></tr>
<tr><td>File</td><td>Rename</td><td>**FRENAME**</td><td>:MMEMory:MOVE</td><td><`file_name1'>,<`file_name2'></td></tr>
<tr><td>File</td><td>Save</td><td>**FSAVE**</td><td>:MMEMory:STORe</td><td><`file_name'></td></tr>
<tr><td>Display</td><td>Graticule</td><td>**GRAT**</td><td>:DISPlay:WINDow:TRACe:GRATicule:GRID[:STATe]</td><td>OFF|ON|0|1|?</td></tr>
<tr><td>Printer</td><td>Hard Copy</td><td>**HCOPY**</td><td>:HCOPy[:IMMediate]</td><td>none</td></tr>
<tr><td>Marker</td><td>Marker Amplitude</td><td>**MA[1~9]**</td><td>:CALCulate:MARKer[1~9]:Y</td><td>?</td></tr>
<tr><td>Marker</td><td>Marker All Off</td><td>**MAO**</td><td>:CALCulate:LPLot:MARKer:AOFF</td><td>none</td></tr>
<tr><td>Measurement</td><td>Meas. Start</td><td>**MEA**</td><td>:MEASure:STARt</td><td>PVT|FLAT|OBW|CCDF|CONST|EVM|NUME|?</td></tr>
<tr><td>Meas. Control</td><td>Meas Time</td><td>**MEAT**</td><td>:MEASure:TIME</td><td><time>|?</td></tr>
<tr><td>Marker</td><td>Marker Freq</td><td>**MF[1~9]**</td><td>:CALCulate:MARKer[1~9]:X</td><td><frequency>|?</td></tr>
<tr><td>Marker</td><td>Marker Mode</td><td>**MM[1~9]**</td><td>:CALCulate:MARKer[1~9]:MODE</td><td>POSition|DELTa|OFF|?</td></tr>
<tr><td>Mode</td><td>Mode</td><td>**MODE**</td><td>:INSTrument[:SELect]</td><td>SA|VECTOR|WLAN|?</td></tr>
<tr><td>Marker</td><td>Marker State</td><td>**MS[1~9]**</td><td>:CALCulate:MARKer[1~9]:STATe</td><td>OFF|ON|0|1|?</td></tr>
<tr><td>Measurement</td><td>Numeric Results Output</td><td>**NUMEOUT**</td><td>:FETCh|MEASure|READ:NUMEric</td><td>?</td></tr>
<tr><td>Preset</td><td>Preset</td><td>**PRST**</td><td>:SYSTem:PRESet</td><td>none</td></tr>
<tr><td>Measurement</td><td>Power vs Time Output</td><td>**PVTOUT**</td><td>:FETCh|MEASure|READ:PVTime</td><td>?</td></tr>
<tr><td>Mode Setup</td><td>Radio Standard</td><td>**RADIOSTD**</td><td></td><td>802.11A|802.11B|802.11A/G|802.11B/G|?</td></tr>
<tr><td>Frequency</td><td>Reference</td><td>**REF**</td><td>:INPut:REFerence</td><td>INTernal|EXTernal|?</td></tr>
<tr><td>Amplitude</td><td>Ref. Level</td><td>**RL**</td><td>:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel</td><td><amplitude>|?</td></tr>
<tr><td>Amplitude</td><td>Scale/Div</td><td>**SD**</td><td>:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision</td><td><amplitude>|?</td></tr>
<tr><td>Sweep</td><td>Single</td><td>**SI**</td><td>:INITiate:LPLot[:IMMediate]</td><td>none</td></tr>
<tr><td>Display</td><td>White Mode</td><td>**WH**</td><td>:DISPlay:WINDow:WHITe</td><td>OFF|ON|0|1|?</td></tr>
</table>

< SCPI command order >

Index	Description	SA Command	SCPI Command	Suffix
Common	*CLS	*CLS	***CLS**	none
Common	*ESE	*ESE	***ESE**	<integer>|?
Common	*ESR	*ESR	***ESR**	?
Common	*IDN	*IDN	***IDN**	?
Common	*OPC	*OPC	***OPC**	?
Common	*RST	*RST	***RST**	none
Common	*SRE	*SRE	***SRE**	<integer>|?
Common	*STB	*STB	***STB**	?
Marker	Marker All Off	MAO	**:CALCulate:LPLot:MARKer:AOFF**	none
Marker	Marker Mode	MM[1~9]	**:CALCulate:MARKer[1~9]:MODE**	POSition|DELTa|OFF|?
Marker	Marker State	MS[1~9]	**:CALCulate:MARKer[1~9]:STATe**	OFF|ON|0|1|?
Marker	Marker Freq	MF[1~9]	**:CALCulate:MARKer[1~9]:X**	<frequency>|?
Marker	Marker Amplitude	MA[1~9]	**:CALCulate:MARKer[1~9]:Y**	?
Display	Graticule	GRAT	**:DISPlay:WINDow:TRACe:GRATicule:GRID[:STATe]**	OFF|ON|0|1|?
Amplitude	Scale/Div	SD	**:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision**	<amplitude>|?
Amplitude	Ref. Level	RL	**:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel**	<amplitude>|?
Display	White Mode	WH	**:DISPlay:WINDow:WHITe**	OFF|ON|0|1|?
Measurement	CCDF Output	CCDFOUT	**:FETCh|MEASure|READ:CCDF**	?
Measurement	Constellation Output	CONSTOUT	**:FETCh|MEASure|READ:CONSTellation**	?
Measurement	EVM Output	EVMOUT	**:FETCh|MEASure|READ:EVM**	?
Measurement	Spectral Flatness	FLATOUT	**:FETCh|MEASure|READ:FLATness**	?
Measurement	Numeric Results Output	NUMEOUT	**:FETCh|MEASure|READ:NUMEric**	?
Measurement	Occupied Bandwidth	OBWOUT	**:FETCh|MEASure|READ:OBWidth**	?
Measurement	Power vs Time Output	PVTOUT	**:FETCh|MEASure|READ:PVTime**	?
Printer	Hard Copy	HCOPY	**:HCOPy[:IMMediate]**	none
Sweep	Continuous	CO	**:INITiate:LPLot:CONTinuous**	OFF|ON|0|1|?
Sweep	Single	SI	**:INITiate:LPLot[:IMMediate]**	none
Frequency	Reference	REF	**:INPut:REFerence**	INTernal|EXTernal|?
Mode	Mode	MODE	**:INSTrument[:SELect]**	SA|VESTOR|WLAN|?
Measurement	Meas. Start	MEA	**:MEASure:STARt**	PVT|FLAT|OBW|CCDF |CONST|EVM|NUME|?
Meas. Control	Capturing Time	MEAT	**:MEASure:TIME**	<time>|?
File	Read	FREAD	**:MMEMory:CATalog**	? <`directory_name'>
File	Copy	FCOPY	**:MMEMory:COPY**	<`file_name1'>,<`file_name2'>
File	Move	FMOVE	**:MMEMory:DATA**	<`file_name'>,definite_length_ block|? <'file_name>
File	Delete	FDEL	**:MMEMory:DELete**	<`file_name'>
File	Rename	FRENAME	**:MMEMory:MOVE**	<`file_name1'>,<`file_name2'>
File	Save	FSAVE	**:MMEMory:STORe**	<`file_name'>
Others	Error Code	ERR	**:SYSTem:ERRor[:NEXT]**	?
Preset	Preset	PRST	**:SYSTem:PRESet**	none
Frequency	Center Frequency	CF	**[:SENSe]:FREQuency:CENTer**	<frequency>|?
Amplitude	Attenuation	AT	**[:SENSe]:POWer[:RF]:ATTenuation**	<amplitude>|?

Error codes

Code	Description
990	Not supported in current mode
991	Not installed (option)
992	System is busy
993	Execution error (EXE)
994	Query error (QYE)
995	Suffix error
996	Input data size over error
997	Undefined command
998	Unnecessary suffix insertion
999	Undefined suffix

For further information please contact:

Cobham Wireless
info-test@aeroflex.com
www.cobham.com/wireless