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Anritsu MS2690A Signal Analyzer and Built in Vector Signal Generator User Guide

**Anritsu MS2690A Signal Analyzer and Built in Vector Signal Generator**

Contents

Introduction

This manual explains examples of the Capture & Playback Function using the Signal Analyzer MS2690A series (MS269xA hereafter) and the MS2830A and MS2840A with installed Vector Signal Generator option.

When using the Capture & Playback function, the RF signal captured using the signal analyzer*1 is used to generate an IQ data file (capture hereafter) for generating the waveform pattern using the built-in vector signal generator*2 to output the RF signal (playback hereafter).

Capture RF Signal

Output from Signal Generator (Playback)

Receiver
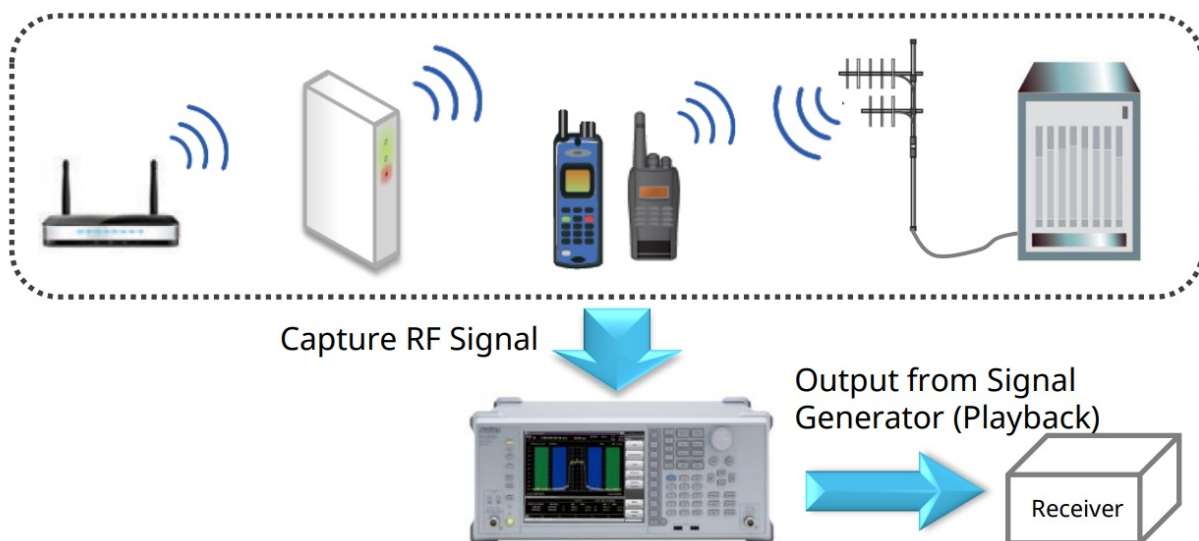
For example, it is better to use the Capture & Playback function to generate RF signals from playback from the captured data in the following cases:

✔ Although we want to evaluate actual wireless equipment signals, it is difficult to create and playback waveforms using general-purpose signal generators and software.
✔ When using wireless equipment (golden unit hereafter) as a signal source, fine adjustment of the output level is difficult and the output is unstable.
✔ If many golden units (e.g. base stations) are required, the cost is much higher than using a measuring instrument.

Since this function automatically calculates the average power (rms) when generating the waveform pattern, the output level set at the signal generator after generation equals the average power.

1. Signal Analyzer

The MS269xA and MS2840A have a built-in signal analyzer with an Analysis Bandwidth of 31.25 MHz as standard.

The MS2830A can be installed as an option.

2. Built-in Vector Signal Generator Option for MS269xA, MS2840A, and MS2830A

This manual introduces examples of operation method for the following sample signal as the Capture & Playback function target.
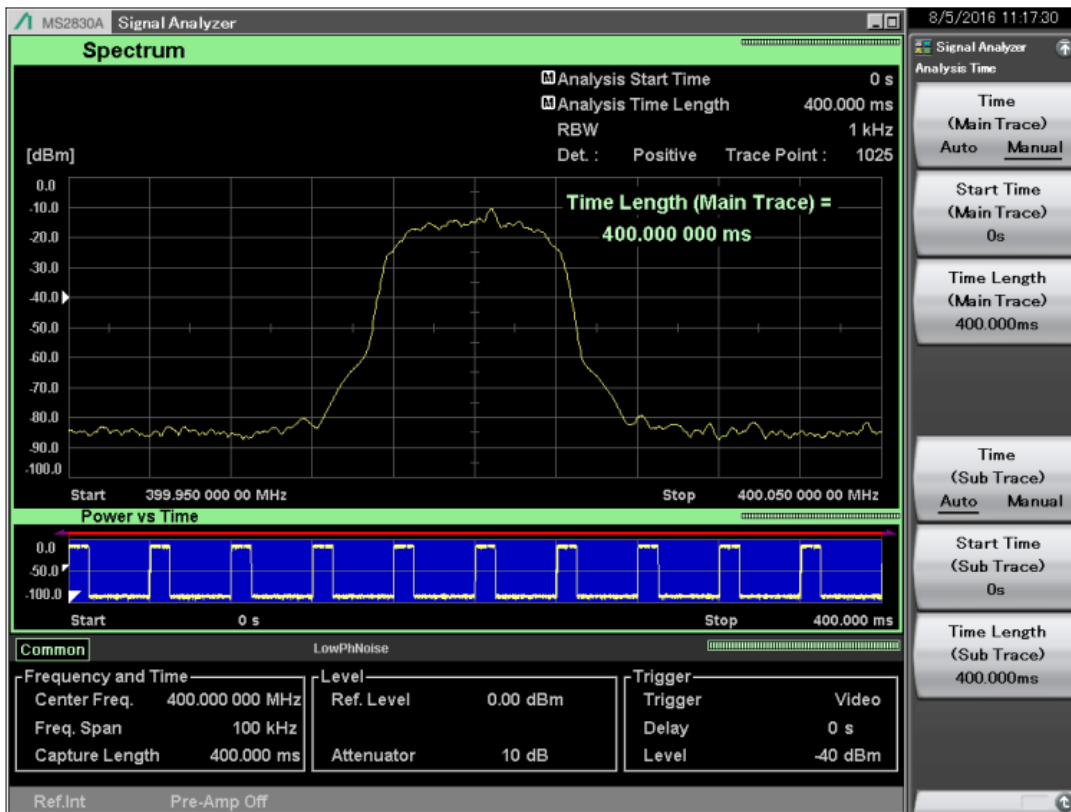
Sample Signal

✔ Frequency: 400 MHz
✔ Level: –10 dBm
✔ Channel spacing: 25 kHz
✔ Burst Signal Repetition Conditions:

- Burst Period: 40 ms

  On Time: 10 ms

  Off Time: 30 ms

- Stationary (repeat)

At actual measurement, it is important to pre-confirm the target signal frequency, level, channel spacing, and repetition rate using a spectrum analyzer or signal analyzer.

Refer to the procedure on the following page for how to confirm the target signal.

Applications for Capture & Playback

Validation/Production Test
Captured signals can be used to initiate a communications link and perform receiver sensitivity testing with a device under test (DUT) using signals captured from a Golden Unit.

Device Characterization
Actual baseband signals ca ptured from an RFIC can be used as simulation for characterizing amplifiers and other downstream devices or modules.

Electromagnetic Compatibility Test
Problematic RF environments or discrete signals – such as cellular or Wi -Fi – can be captured and used to evaluate a device's susceptibility to RF interference, debug any problems found and validate the solution
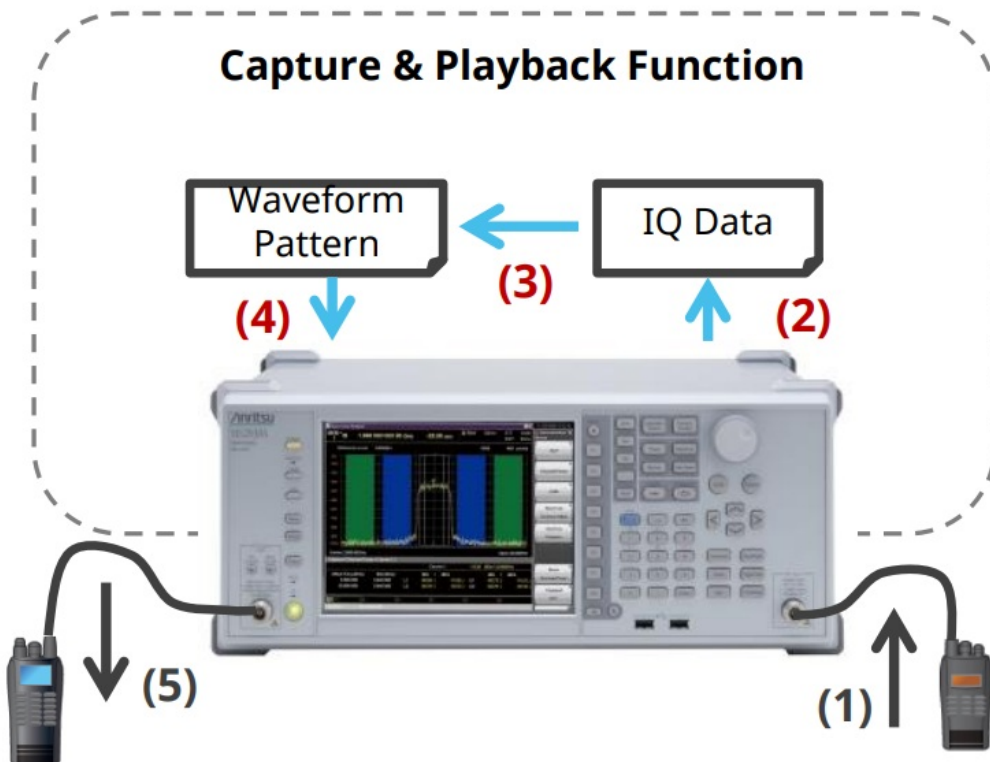
[Image of Capture & Playback function operation]

1. Input the reference RF signal to the signal analyzer.

   *Sets best parameters for capture
2. Obtain the IQ data by capturing the RF signal.
3. Generate the signal generator waveform pattern based on the IQ data.

   Executed automatically by Capture & Playback function
4. Load the waveform pattern into the signal generator waveform memory.
5. Output the recovered RF signal from the signal generator

   *sets best frequency and level

Confirming Signal 1/2

Checking Spectrum: Span Setting

Use the signal analyzer to check the spectrum of the target signal.

- Switching signal analyzer mode

  > [Application Switch] > [F2: Signal Analyzer] *The application button layout may change arbitrarily.
- Executing preset

  > [Preset] > [F1: Preset]
- Setting frequency (Example: 400 MHz) *Set to the center frequency of the target signal.

  > [Frequency] > [F1: Center] = [400] [F2: MHz]
- Setting span (Example: 100 kHz) *Set to the observed full span of the entire target signal spectrum

  > [Span] = [100] [F3: kHz] *This can be set using the Up and Down keys.
- Setting sub-trace screen *Power vs Time is displayed at the bottom of the screen.

  > [Trace] > [F8: Sub Trace Setting] > [F1: Trace Mode] > [F2: Power vs Time]
- Setting analysis time (Example: 100 ms) *Set a longer time than the target signal burst period. (Example: 40 ms × 2 + margin)

  > [Time/Sweep] > [F3: Time Length] = [100] [F2: ms] *This can be set using the Up and Down keys.
- Setting trace (Example: Positive)

  > [Trace] > [F7: Time Detection] =Select "Positive" [F7: Set] When the confirmation target is a burst signal, set Trace to Positive and set the analysis time to longer than the burst period to confirm the spectrum during the On period.
- Adjusting reference level

  > [Amplitude] > [F1: Reference Level] *Adjust so that the "Level Over" warning dialog is not displayed. *This can be set using the Up and Down keys.

  *Aim to set so there is about one scale of empty space above the spectrum.
- Setting Marker to OFF

  > [Marker] > [F5: Off]

Confirm that the Frequency Span setting is about twice the channel width or twice the spectrum waveform.
If it is not, adjust Span to the optimum setting. **https://manual-hub.com/**

Example of Spectrum Confirmation Screen
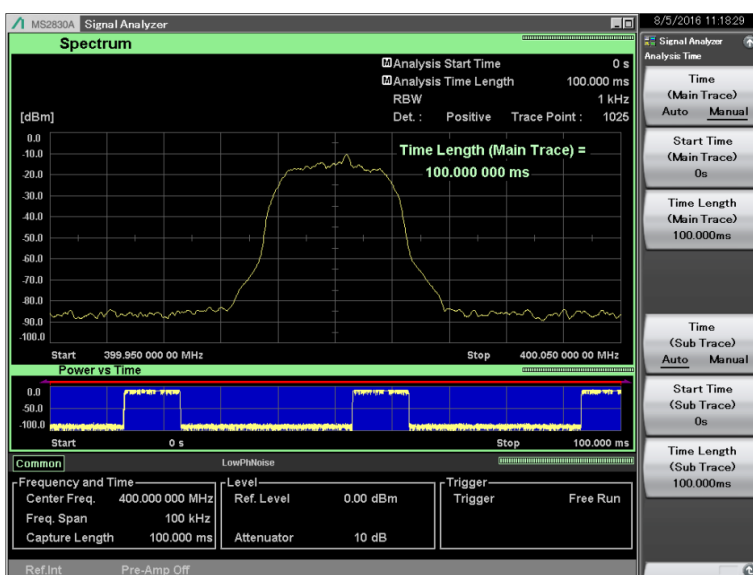
Confirming Signal 2/2

Checking Power vs Time: Burst Period

- Use the signal analyzer to check the burst period of the target signal. (Continued)
- Setting main trace screen *Power vs Time settings at screen top
  > [Trace] > [F1: Trace Mode] > [F2: Power vs Time]
- Setting single sweep (Single)
  > [→]
- Checking burst signal period with markers
  > [Marker] > [F2: Marker1] = Shifts marker to first burst signal rise *Fine-adjust using Left/Right keys and rotary knob
  > [F4: Marker2] = Shifts marker to second burst signal rise *Fine-adjust using Left/Right keys and rotary knob
  > Check "⊿(2-1)" at screen top

This sample signal has a period of 40 ms per burst that can be also checked with a signal analyzer.

When the burst signal period is very short (fast), check the time for a longer period of 10 bursts if there is a risk of error when checking just one burst period.
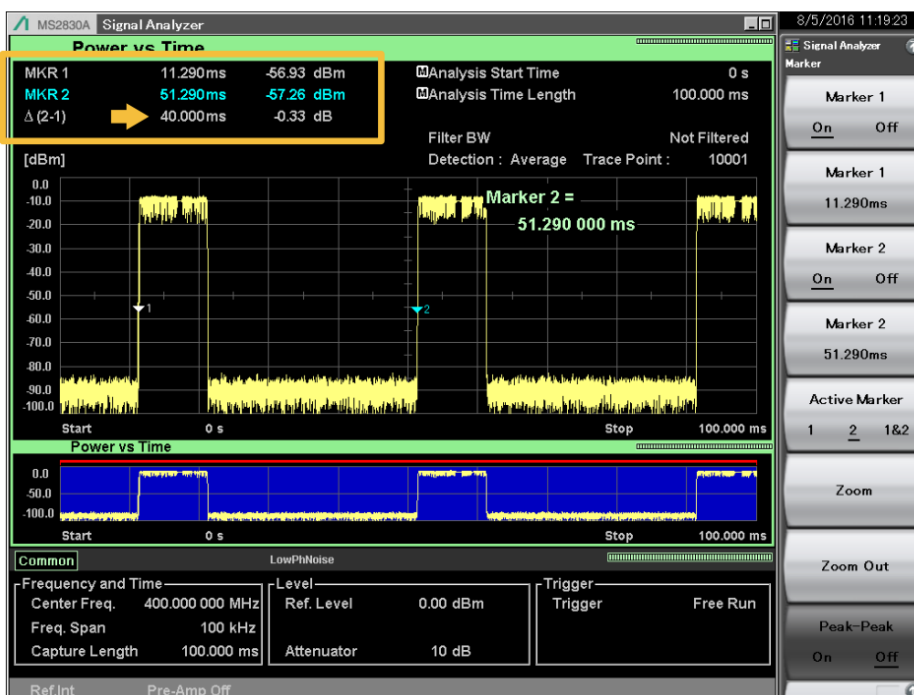

Example of Power vs Time confirmation Screen

Capture & Playback

Case ①: Capturing One Burst Signal Only 1/3

- This explains capture of only one burst of the target signal by the signal analyzer and playback from the signal generator.
- At playback, the single burst signal is output repeatedly from the signal generator.
- This can be used for tests that do not require continuous data, such as evaluation of the adjacent channel

leakage power at tests of transmitter characteristics, and PER* measurements of receiver characteristics. However, there are some cases where this evaluation cannot be performed due to signal specifications.
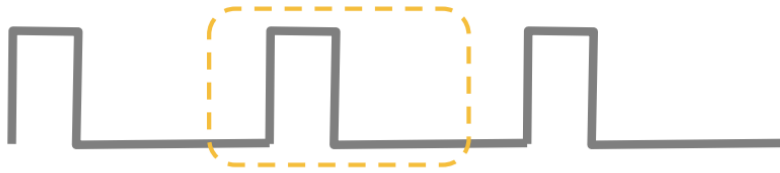
Capturing One Burst Only

- Switching to signal analyzer mode

  > [Application Switch] > [F2: Signal Analyzer] *The application button layout may change arbitrarily.

- Executing preset

  > [Preset] > [F1: Preset]

- Setting frequency (Example: 400 MHz) *Set to the center frequency of the target signal.

  > [Frequency] > [F1: Center] = [400] [F2: MHz]

- Setting span (Example: 100 kHz) *Set to the observed full span of the entire target signal spectrum

  > [Span] = [100] [F3: kHz] *This can be set using the Up and Down keys.

- Setting sub-trace screen *Power vs Time is displayed at the bottom of the screen.

  > [Trace] > [F8: Sub Trace Setting] > [F1: Trace Mode] > [F2: Power vs Time]

- Setting capture time (Example: 40 ms)

  *Set to burst period of target signal (Example: 40 ms)

  > [Menu] > [F7: Capture] > [F2: Capture Time Length] = [40] [F2: ms]

- Adjusting reference level

  > [Amplitude] > [F1: Reference Level] = Adjust so that the "Level Over" warning dialog is not displayed.

  *This can be set using the Up and Down keys.

  *Aim to set so there is about one scale of empty space above the spectrum.

- Setting trigger

  > [Trigger/Gate] > [F1: Trigger Switch] = On

  > [F4: Trigger Level (Video)] = Best Adjustment

  > [F8: Trigger Delay] = [-10] [F2: ms]

- Setting single sweep (Single)

  > [→] *This completes signal capture.

At signal capture, if the capture start time is set to the burst signal On period, the recorded IQ data becomes discontinuous. (Refer to page 10.)
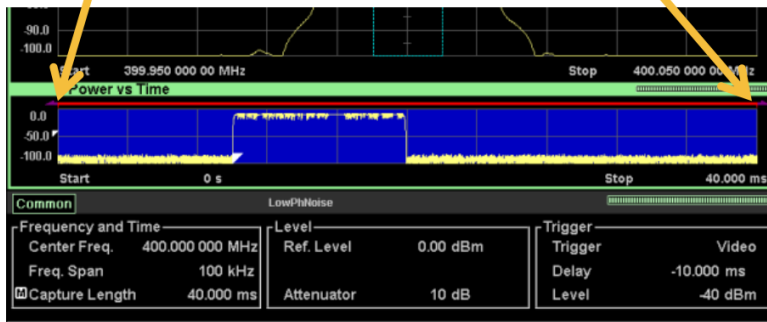In this example, the period of one burst is 40 ms.
Since the capture start time and end time are each set to the burst signal Off period, set –10 ms at Trigger Delay.
*A positive value such as 30 ms can also be set, but the opposite value of –10 ms is set here.

Capture start time   Capture end time

Trigger Delay Confirmation Screen

Case ①: Capturing One Burst Signal Only 2/3

- Playing back signal from captured data (Playback)

  > [Menu] > [F7: Capture] > [F6: Capture & Playback] > Set the following.

Optimum Setting

- Set waveform pattern package name

  *Default: Playback

- Set waveform pattern pattern name

  *Default: Digitize+ YYYMMDD+_addition number; Example: Digitize20160805_004

- Set burst signal to On

  *Generates waveform pattern as non-signal on Off period.

- Set burst signal Off evaluation level

  *Can only be set at Burst = On

- Set burst signal Off evaluation time

  *Can only be set at Burst = On

Execute After Making Above Settings

- Execute Capture & Playback

The following icons are displayed at the top right of the screen during Capture & Playback
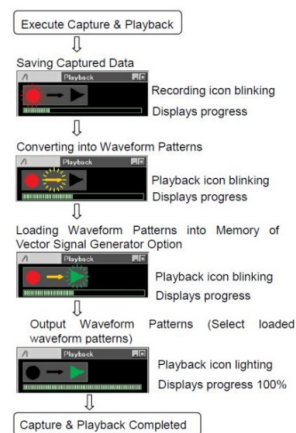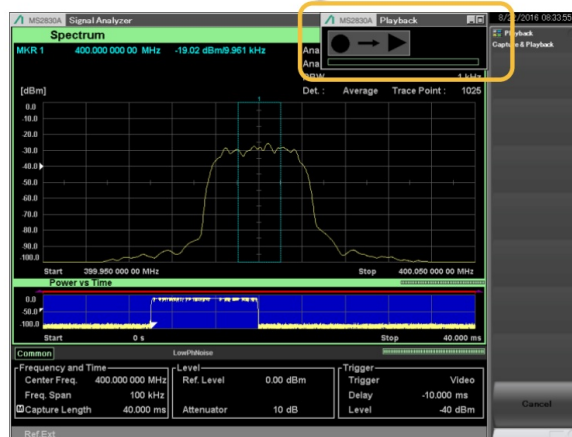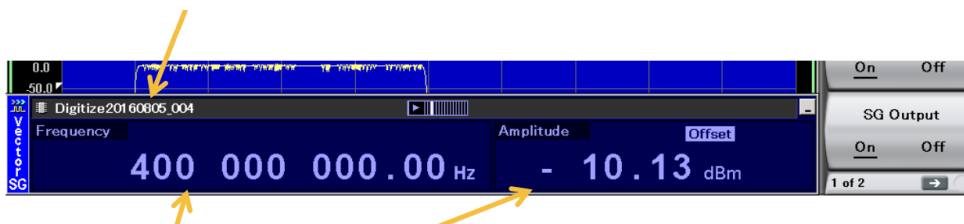
Icon transitions

- This completes waveform pattern generation.

## Case ①: Capturing One Burst Signal Only 3/3

- Checking waveform pattern selected at signal generator

  > [SG] Example: Digitize20160805_004

- Fine-adjust the frequency and level when the pattern is output from the signal generator

Case ②: Capturing Multiple Burst Signals 1/2

- This explains capture of multiple bursts (511 bursts hereafter) of the target signal by the signal analyzer and playback from the signal generator.
- At playback, the multiple burst signals (waveform pattern) are output repeatedly from the signal generator.
- This can be used for tests requiring continuous data, such as evaluation of Rx BER measurements*. However, there are some cases where this evaluation cannot be performed due to signal specifications. (*There are some cases where this evaluation cannot be performed due to signal specifications.) [Supplementary Explanation] 29-1 = 511 bits of data are output repeatedly for the PN9 PRBS pattern. Consequently, to maintain the PN9 data continuity, it is necessary to capture 511 burst signals. However, there are different cases depending on the communications system, such as when there are multiple slots in one frame.
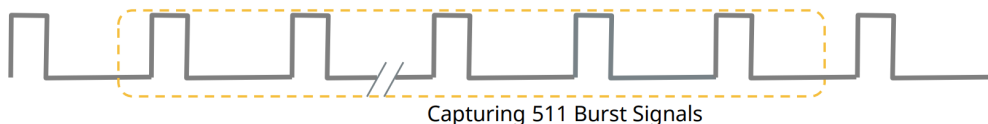
Capturing 511 Burst Signals

- Switching to signal analyzer mode

  > [Application Switch] > [F2: Signal Analyzer] *The application button layout may change arbitrarily.
- Executing preset

  > [Preset] > [F1: Preset]
- Setting frequency (Example: 400 MHz) *Set to the center frequency of the target signal.

  > [Frequency] > [F1: Center] = [400] [F2: MHz]
- Setting span (Example: 100 kHz) *Set to the observed full span of the entire target signal spectrum

  > [Span] = [100] [F3: kHz] *This can be set using the Up and Down keys.
- Setting sub-trace screen *Power vs Time is displayed at the bottom of the screen.

  > [Trace] > [F8: Sub Trace Setting] > [F1: Trace Mode] > [F2: Power vs Time]

First, set the capture time to 40 ms and set the capture start time to the Off period.

- Setting capture time (Example: 40 ms)

  *Set to burst period of target signal (Example: 40 ms)

  > [Menu] > [F7: Capture] > [F2: Capture Time Length] = [40] [F2: ms]
- Adjusting reference level

  > [Amplitude] > [F1: Reference Level] = Adjust so that the "Level Over" warning dialog is not displayed.

  *This can be set using the Up and Down keys.

  *Aim to set so there is about one scale of empty space above the spectrum.
- Setting trigger

  > [Trigger/Gate] > [F1: Trigger Switch] = On

  > [F4: Trigger Level (Video)] = Best Adjustment

  > [F8: Trigger Delay] = [-10] [F2: ms]

At signal capture, if the capture start time is set to the burst signal On period, the recorded IQ data becomes discontinuous. (Refer to page 10.)
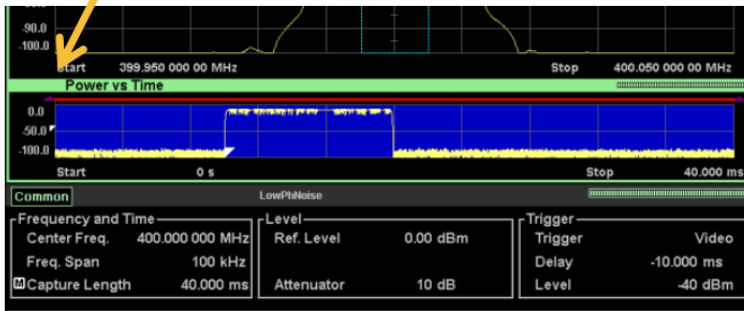
In this example, the period of one burst is 40 ms.
Since the capture of start time and end time are each set to the burst signal Off period, set −10 ms at Trigger Delay.

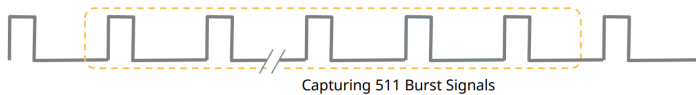*A positive value such as 30 ms can also be set, but the opposite value of −10 ms is set here.

Capture start time

Capture end time set at next page

Trigger Delay Confirmation Screen

**Case ②: Capturing Multiple Burst Signals 2/2**

Capturing 511 Burst Signals

Set the total time for capture over again.

- Setting capture time *Set time for 511 bursts of target signal Example: 40 × 511 = 20440 ms

  > [Menu] > [F7: Capture] > [F2: Capture Time Length] = [20440] [F2: ms]
- Setting single sweep (Single)

  > [→] *This completes signal capture.

The procedure from here is the same as for case 1.
See pages 6 to 7 for details.

Example of 40 × 511 = 20440 ms Capture Screen
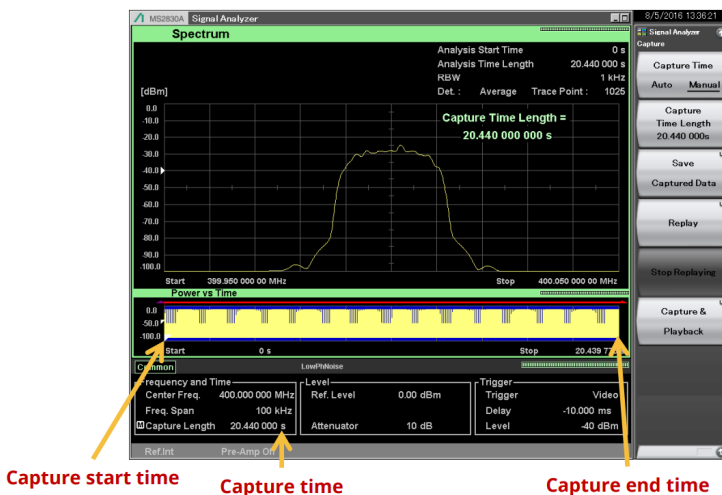
Capture start time   Capture time   Capture end time

Maximum Signal Analyzer Capture Function Capture Times

The maximum capture time differs with the Span setting. Refer to the table on the right for details.

For example, the maximum capture time is 500 s when the span is 100 kHz.

In addition, the upper limit of the frequency span that can be set for the MS269xA, MS2830A, and MS2840A differs with the installed Analysis Bandwidth option.

Span	Sampling Rate	Capture Time	Max. Sampling Data
1 kHz	2 kHz	2000 s	4M
2.5 kHz	5 kHz	2000 s	10M
5 kHz	10 kHz	2000 s	20M
10 kHz	25 kHz	2000 s	50M
25 kHz	50 kHz	2000 s	100M
50 kHz	100 kHz	1000 s	100M
100 kHz	200 kHz	500 s	100M
250 kHz	500 kHz	200 s	100M
500 kHz	1 MHz	100 s	100M
1 MHz	2 MHz	50 s	100M
2.5 MHz	5 MHz	20 s	100M
5 MHz	10 MHz	10 s	100M
10 MHz	20 MHz	5 s	100M
25 MHz	50 MHz	2 s	100M
31.25 MHz	50 MHz	2 s	100M
50 MHz	100 MHz	500 ms	50M
62.5 MHz	100 MHz	500 ms	50M
100 MHz	200 MHz	500 ms	100M
125 MHz	200 MHz	500 ms	100M

Supplementary Explanation

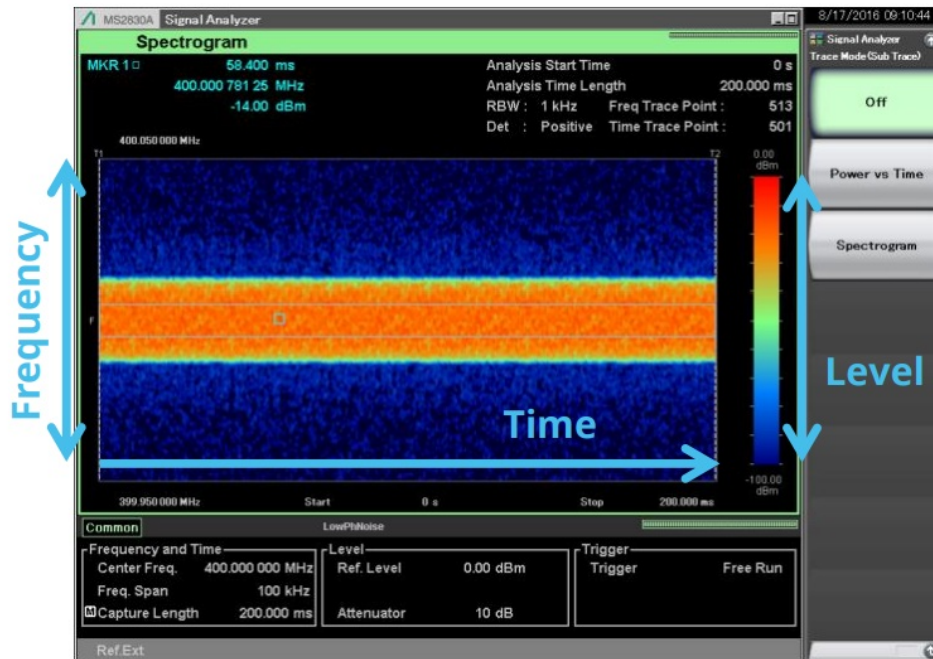### Capture & Playback of Continuous Signal 1/2

When capturing a continuous signal, the capture start time cannot be set in the signal Off period. The capture start must always be in the On period.
Consequently, at playback (output from the signal generator), the IQ data is discontinuous at the point where it returns from the end of the waveform pattern to the start. This discontinuous IQ data causes the following phenomena.
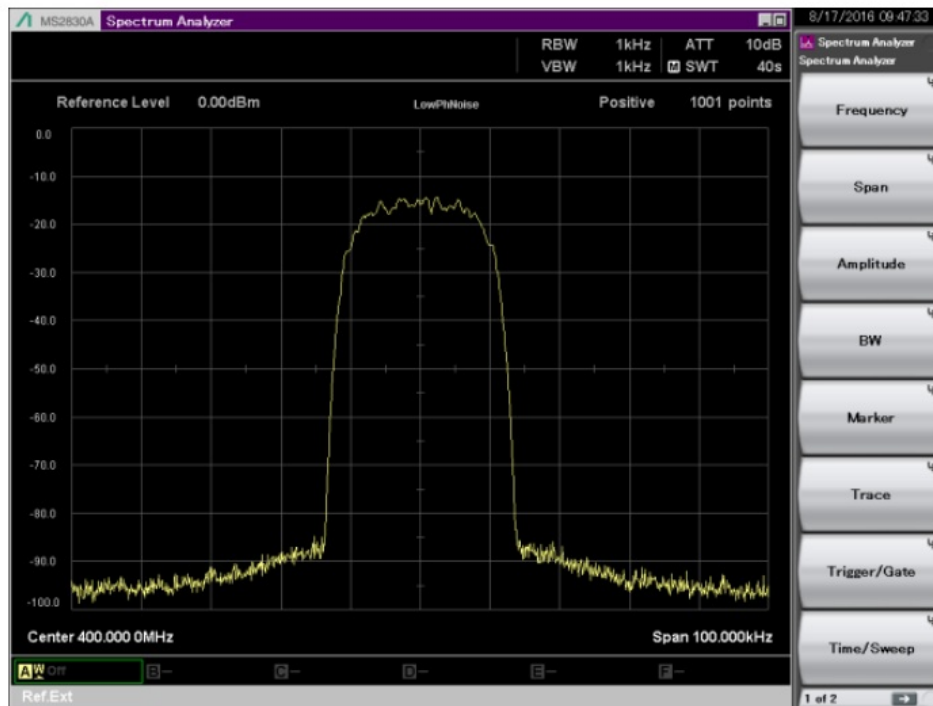
[Phenomena]

✔ Distortion over a wide spectrum range; at Tx evaluation, the adjacent channel leakage power and modulation accuracy suffer large deterioration.
✔ Errors or sync loss may occur at Rx evaluations, such as BER measurement, due to the discontinuous signal data.

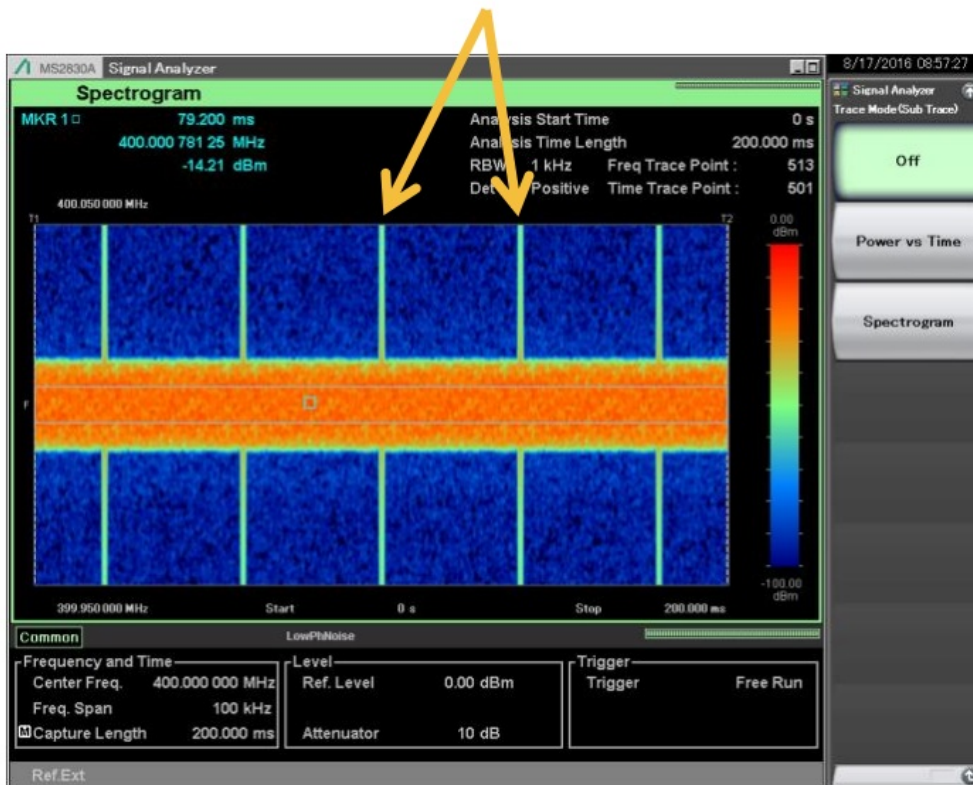### Signal Before Capture & Playback
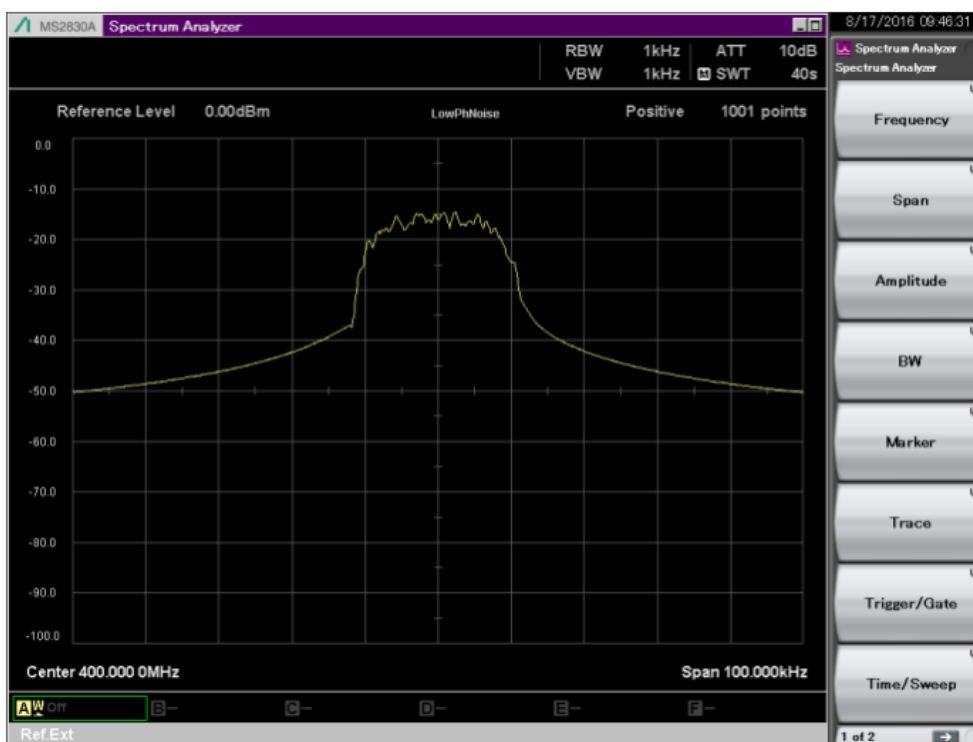
Example of Spectrogram Measurement Screen

Example of Spectrum Measurement Screen

Signal After Capture & Playback

The IQ data is discontinuous at the point where it returns from the end of the waveform pattern to the start, causing distortion over a wide spectrum range.

Example of Spectrogram Measurement Screen

Example of Spectrum Measurement Screen

Capture & Playback of Continuous Signal 2/2

[Workaround Case 1] Setting analysis range (time) to avoid distortion timing

Any analysis range (time) can be set using the signal analyzer functions. For example, at adjacent channel leakage power measurement, the timing performance with distortion (lower left figure) is greatly degraded whereas the timing performance without distortion (lower right figure) shows almost no degradation.

Example of Adjacent Channel Leakage Power Measurement Screen
Analysis Range: With Distortion
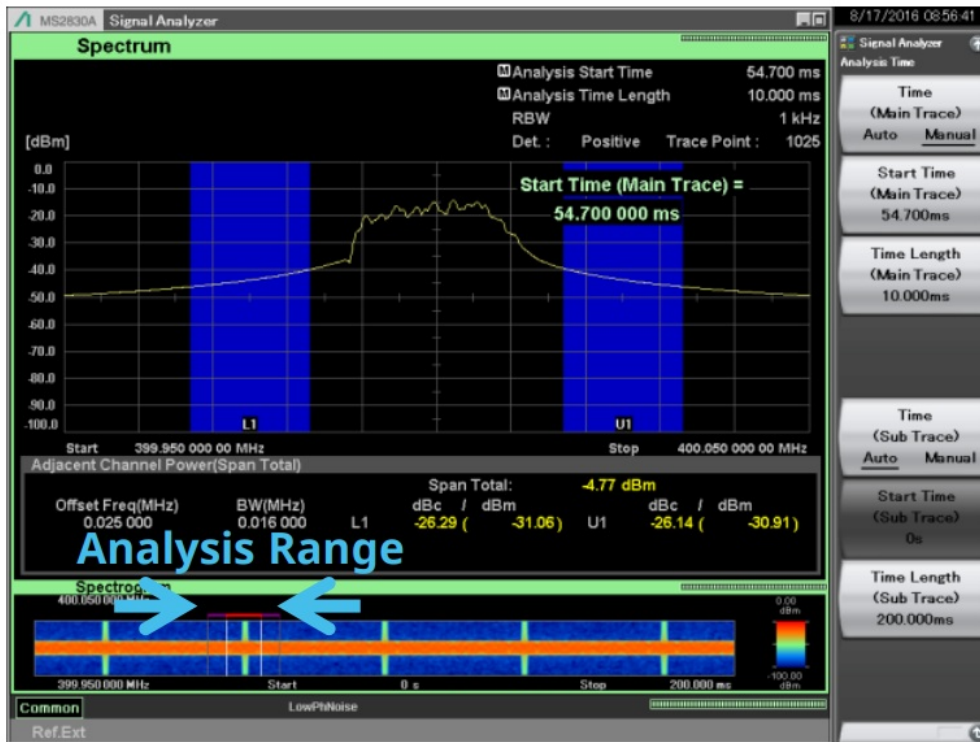
Example of Adjacent Channel Leakage Power Measurement Screen
Analysis Range: Without Distortion
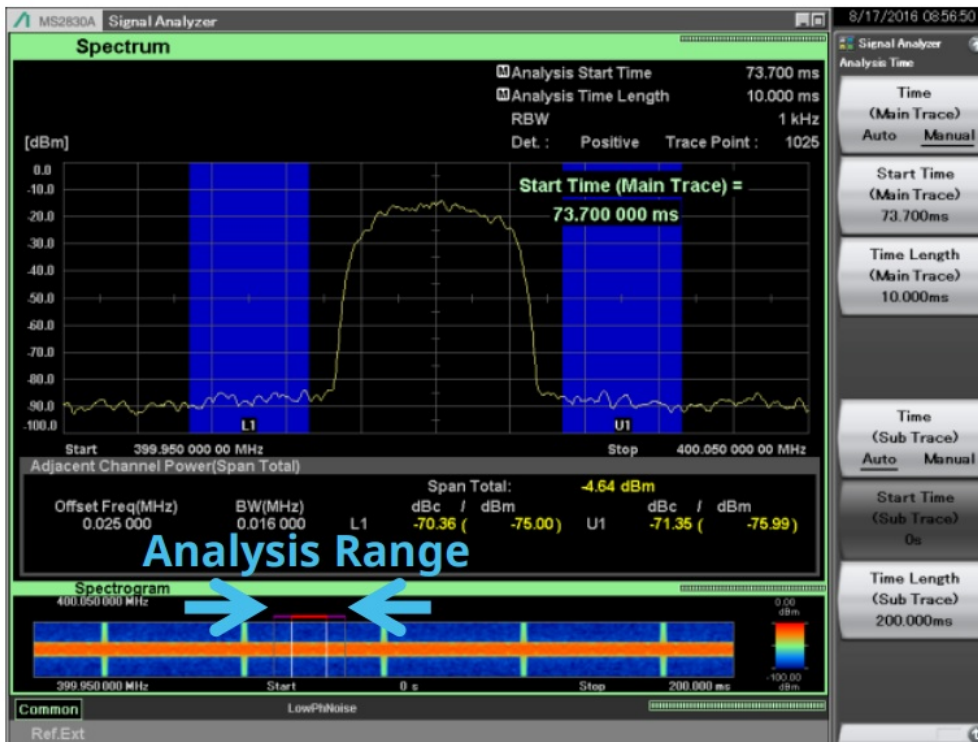
[Workaround Case 2] Setting longer capture time

As an example, sometimes setting a capture time with a sufficiently longer margin than the required time at the DUT (wireless equipment) and then playing back is used for sensitivity measurements, such as BER. In this case, sometimes it is necessary to set the DUT to the standby status for Rx evaluation and output the signal (waveform pattern) only once instead of repeatedly to perform BER measurement in this period.

Refer to page 9 for the maximum capture times of the signal analyzer capture function.

The function for outputting this signal (waveform pattern) once only is set at the vector signal generator option for the MS2830A/MS2840A. It cannot be set using the MS269xA. Refer to the following operation manual for more details.

- MS2830A/MS2840A Operation Manual

  Vector Signal Generator Operation

  2.6.2 Setting Start/Frame trigger

Note: Even using these workarounds, it is not possible to capture issues where the IQ data is discontinuous at the point of return from the end of the waveform pattern to the start.

When wanting to evaluate a signal with stable quality, consider using the waveform pattern and waveform generation software (IQproducer) for vector signal generator.

Playback using Capture & Playback 1/3

This section explains an example of playback of the waveform pattern generated using the Capture & Playback function.

Equipment Setup

1. First, output the following modulation signal from the vector signal generator option installed in the Signal Analyzer MS2830A and confirm the level and modulation accuracy (EVM) at the MS2830A.
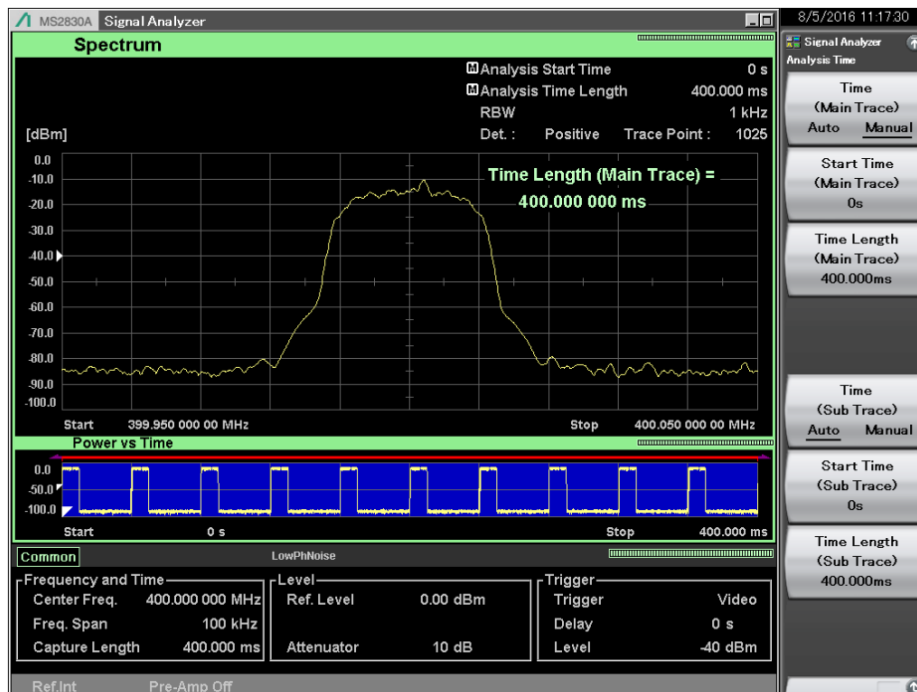

2. Second, confirm the level and modulation accuracy (EVM) at the MS2830A for the modulation signal played back using the Capture & Playback function.

Capture & Playback Function
(Executed automatically internally)

Waveform Pattern ← IQ Data
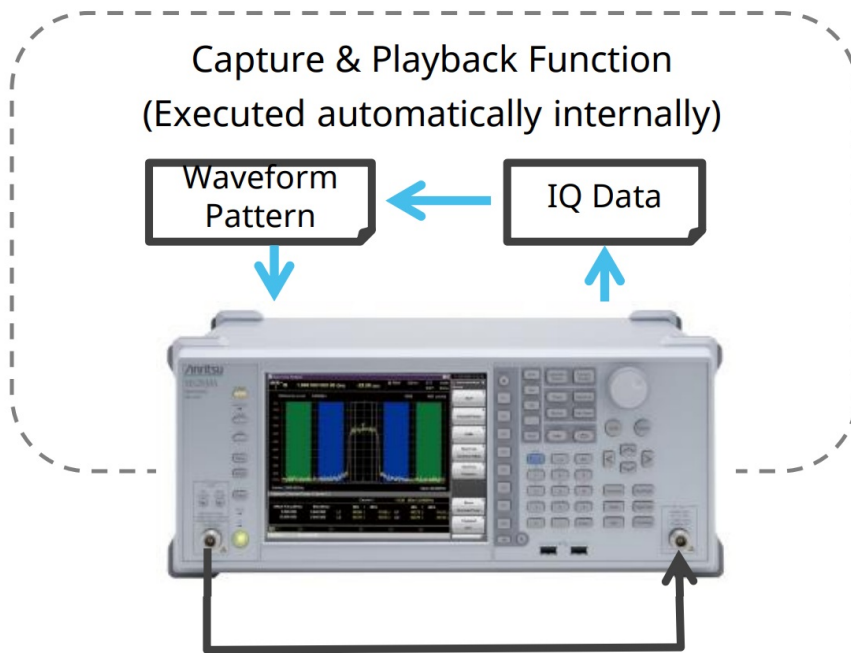
Confirmation Items

✔ Level Refer to page 13.
✔ Modulation Accuracy (EVM) Refer to page 14.

Modulation Signal

Sample Signal

✔ Frequency: 400 MHz
✔ Level : –10 dBm
✔ Channel spacing: 25 kHz
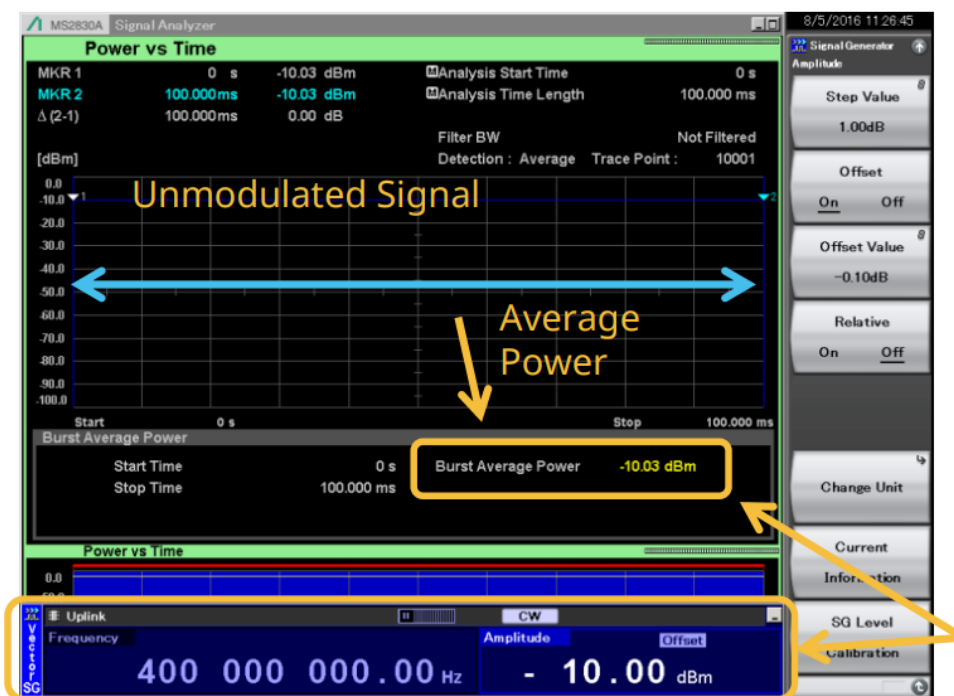✔ Burst Signal Repetition Conditions:

- Burst Period 40 ms

  On Time 10 ms

  Off Time 30 ms

- Stationary (repeat)

Playback using Capture & Playback 2/3

First, output an unmodulated signal from the signal generator and adjust the offset for cable loss, etc.

Check that the signal generator level setting and the signal analyzer level (power) measurement result are about the same.
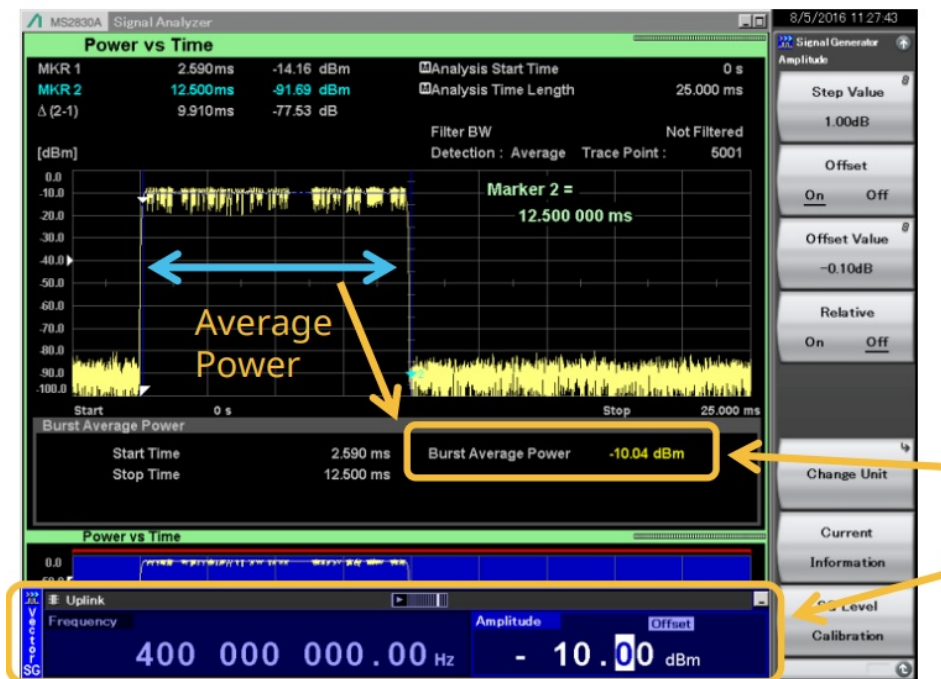

Next, output the modulation signal to be captured from the signal generator.
Check that the signal generator level setting and the signal analyzer measurement result are about the same.

*Measure the average power of burst signal On period with the signal analyzer.
*The signal generator level setting at this sample signal is the average power of burst signal On period.

Finally, output the modulation signal generated by the Capture & Playback function from the signal generator. Check that the signal generator level setting and the signal analyzer measurement result are about the same.
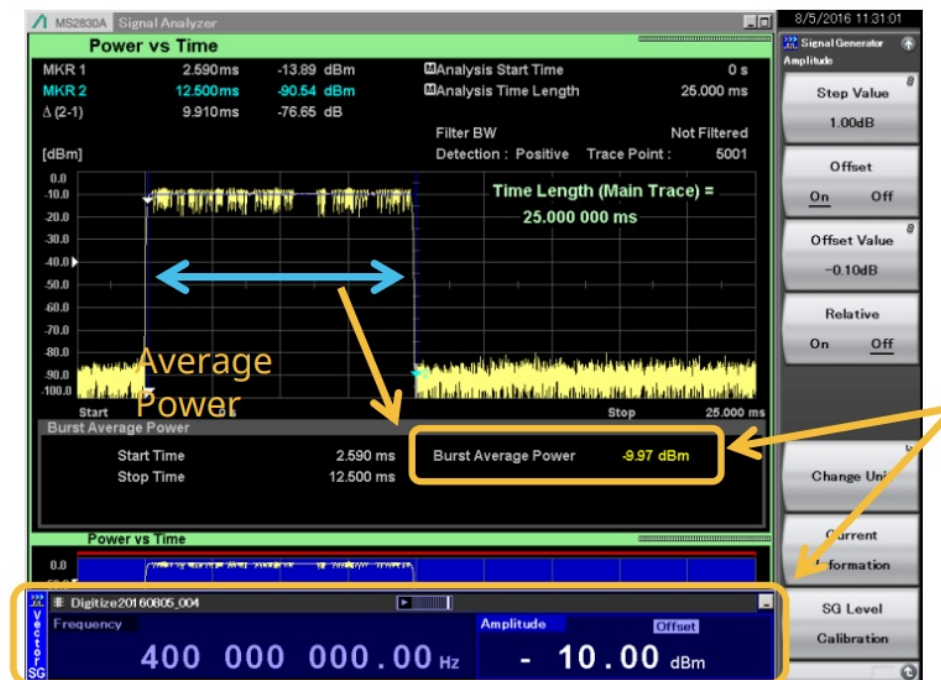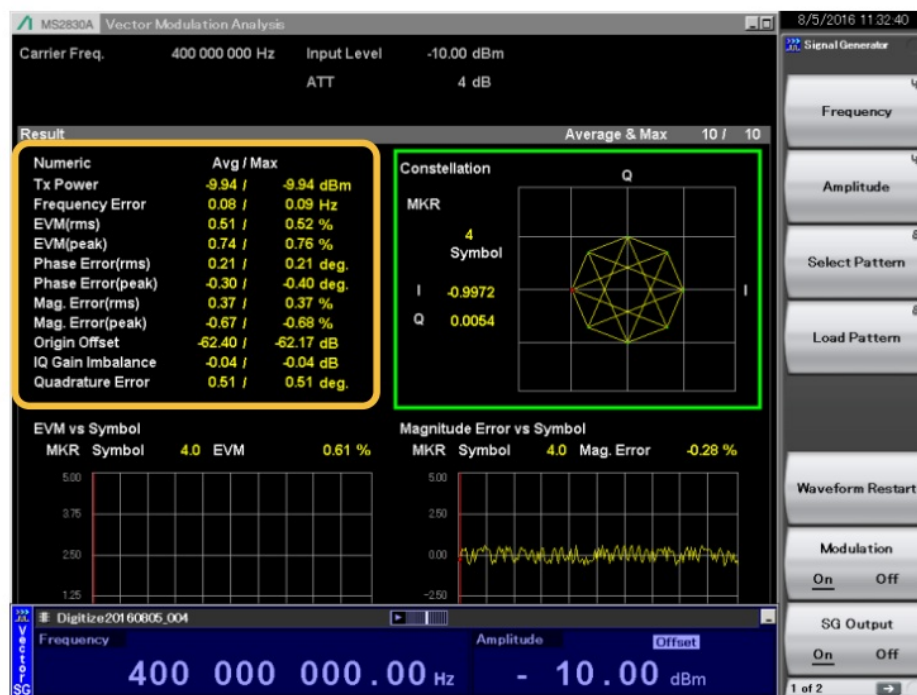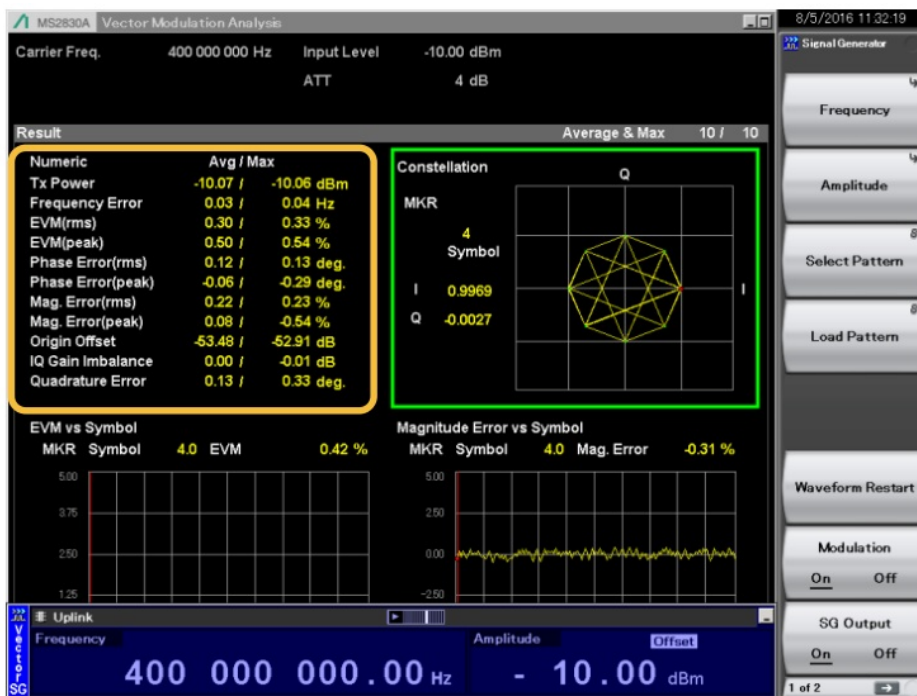

Since the average power of burst signal On period of the waveform pattern generated by the Capture & Playback function like this is the same as the signal generator setting, it can be used for evaluation while fine-adjusting the output level.

Playback using Capture & Playback 3/3

<Modulation Accuracy (EVM)>

Vector Modulation Analysis Software MX269017A

Before Capture & Playback, output the modulation signal to be captured from the signal generator.

Numeric	Avg /	Max
Tx Power	-10.07 /	-10.06 dBm
Frequency Error	0.03 /	0.04 Hz
EVM(rms)	0.30 /	0.33 %
EVM(peak)	0.50 /	0.54 %
Phase Error(rms)	0.12 /	0.13 deg.
Phase Error(peak)	-0.06 /	-0.29 deg.
Mag. Error(rms)	0.22 /	0.23 %
Mag. Error(peak)	0.08 /	-0.54 %
Origin Offset	-53.48 /	-52.91 dB
IQ Gain Imbalance	0.00 /	-0.01 dB
Quadrature Error	0.13 /	0.33 deg.

Then, output the modulation signal generated by the Capture & Playback function from the signal generator.

Numeric	Avg /	Max
Tx Power	-9.94 /	-9.94 dBm
Frequency Error	0.08 /	0.09 Hz
EVM(rms)	0.51 /	0.52 %
EVM(peak)	0.74 /	0.76 %
Phase Error(rms)	0.21 /	0.21 deg.
Phase Error(peak)	-0.30 /	-0.40 deg.
Mag. Error(rms)	0.37 /	0.37 %
Mag. Error(peak)	-0.67 /	-0.68 %
Origin Offset	-62.40 /	-62.17 dB
IQ Gain Imbalance	-0.04 /	-0.04 dB
Quadrature Error	0.51 /	0.51 deg.

Waveform patterns generated using Capture & Playback like this are slightly degraded by the effect of sampling processing at capture. However, playback is possible with a modulation accuracy close to that of the original signal.

Note: When the frequency, level and modulation of the signal to be captured are unstable, the Capture & Playback function may not be able to playback a signal with the same quality as above.

When wanting to evaluate a signal with stable quality, please consider using our waveform pattern and waveform generation software (IQproducer) for vector signal generator.
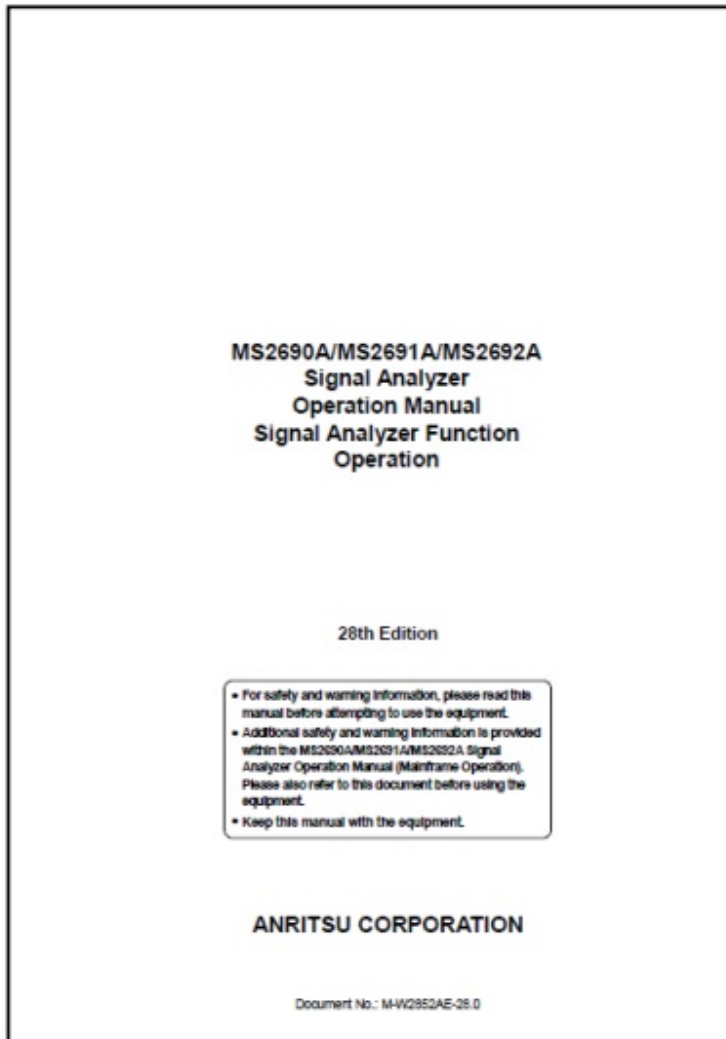
Related Documents

For details of functions and specifications not described in this User Guide, refer to the following documents.

The latest version of the operation manual can be downloaded from the Anritsu website at **http://www.anritsu.com**.

*To search, input the function name using the Search function at the top right of the web page.

MS269xA Operation Manual Signal Analyzer Function Operation
Related Documents

MS2690A/MS2691A/MS2692A
Signal Analyzer
Operation Manual
Signal Analyzer Function
Operation

28th Edition

- For safety and warning information, please read this manual before attempting to use the equipment.
- Additional safety and warning information is provided within the MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation). Please also refer to this document before using the equipment.
- Keep this manual with the equipment.

ANRITSU CORPORATION

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MS2830A/MS2840A Operation Manual Signal Analyzer Function Operation
Refer to Chapter 5 Digitize Function.

MS2830A/MS2840A
Signal Analyzer
Operation Manual
Signal Analyzer Function
Operation

15th Edition

- For safety and warning information, please read this
  manual before attempting to use the equipment.
- Additional safety and warning information is provided
  within the MS2830A Signal Analyzer Operation Manual
  (Mainframe Operation) or MS2840A Signal Analyzer
  Operation Manual (Mainframe Operation). Please also
  refer to this document before using the equipment.
- Keep this manual with the equipment.

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MS269xA Operation Manual Vector Signal Generator Operation

MS2690A/MS2691A/MS2692A
Signal Analyzer
Option 020: Vector Signal Generator
Operation Manual
Operation

Eighth Edition

- For safety and warning information, please read this manual before attempting to use the equipment.
- Additional safety and warning information is provided within the MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation). Please also refer to this document before using the equipment.
- Keep this manual with the equipment.

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MS2830A/MS2840A Operation Manual Vector Signal Generator Operation

MS2830A/MS2840A
Signal Analyzer
Vector Signal Generator
Operation Manual
Operation

Seventh Edition

* For safety and warning information, please read this manual before attempting to use the equipment.
* Additional safety and warning information is provided within the MS2830A Signal Analyzer Operation Manual (Mainframe Operation) or MS2840A Signal Analyzer Operation Manual (Mainframe Operation). Please also refer to this document before using the equipment.
* Keep this manual with the equipment.

ANRITSU CORPORATION

Document No.: M-W3337AE-7.0

Customers Support

Documents / Resources

Anritsu MS2690A Signal Analyzer and Built in Vector Signal Generator [pdf] User Guide
MS2690A Signal Analyzer and Built in Vector Signal Generator, MS2690A, Signal Analyzer and Built in Vector Signal Generator, Built in Vector Signal Generator, Vector Signal Generator, Signal Generator

References

- **Anritsu Home | Anritsu America**
- **Manual-Hub.com – Free PDF manuals!**
- **User Manual**