



## Signal Analyzer MSA500

### «Operation and Examples of Trigger Function»

MSA500 series Signal Analyzer offers strong trigger functions on real-time mode.

On this document, the way to operate and some examples are introduced.

#### 1. Trigger Source Selection

At first the trigger source described below should be selected when the trigger function is used.

**Free Run:** The waveform is updated without any condition.

**IF Level:** Trigger condition is defined as the ratio between the instantaneous signal level and the full scale of IF signal path.

If the signal level exceeds the trigger level, the waveform is updated.

**Power:** Trigger condition is defined as the total power within the span.

Trigger level is described as the relative value against the reference level.

When the trigger slope is set to "RISE", if the signal power exceeds the trigger level, the waveform is updated.

When the trigger slope is set to "FALL", if the signal power is lower than the trigger level, the waveform is updated.

**Channel Power:** Trigger condition is defined as the total power within the channel.

The span is divided into 5 then each piece is defined as the channel.

Trigger level is described as the relative value against the reference level.

The trigger slope setting works as same as Power trigger.

**External:** Trigger condition is defined as the external trigger input voltage.

When the trigger slope is set to "RISE", if the input level exceeds the fixed threshold (0.56V), the waveform is updated.

When the trigger slope is set to "FALL", if the input level is lower than the fixed threshold(0.56V), the waveform is updated.

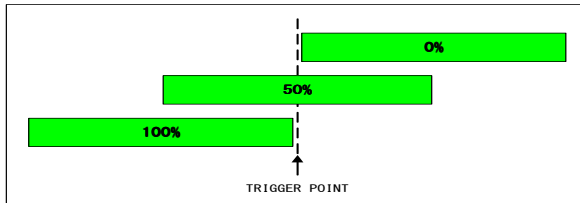
The comparison table is shown in below. Please refer to the table at section 7 for the sample time.

Trigger Source	Time Resolution	Slope	Level Range
IF Level	14.7 ns	RISE only	1 to 100 % (1% Step)
Power	1 sample	RISE/FALL	-40 to 0 dB (1dB Step)
Channel Power	5 sample	RISE/FALL	-40 to 0 dB (1dB Step)
External	14.7 ns	RISE/FALL	0.56V Fixed

2. Pre-Trigger Setting

Pre-Trigger defines how many data is captured before the trigger event.

It is available to choose 0/25/50/75/100 %.



3. Trigger Slope Setting

This is the choice of the trigger slope “RISE” or “FALL”. Please refer to “1” for the operation.

4. Scan Setting

This is the choice of the waveform update is one time (Single) or repeatable (Continuous).

5. Trigger Level Setting

IF Level: Set as the ratio against the full-scale. 1 to 100 % at 1% step.

Power: Set as the relative value against the reference level.

0 to -40 dB at 1 dB step.

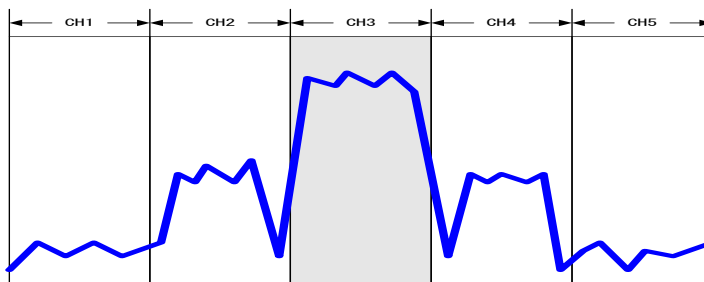
Channel Power: Set as the relative value against the reference level.

0 to -40 dB at 1 dB step

6. Trigger Channel Setting

Channel Power: Choice of the one of 5 channels to be used as the trigger source.

1 is the lowest frequency, 3 is the center and 5 is the highest frequency



## 7. Acquisition Frame Setting

It sets the acquisition length as the frame count.

The setting menu is available with pressing "OPERATION MODE" button.

Press "ACQ FRAME" (F3) then set the frame count by the encoder.

"ENC STEP"(F6) offers the step size setting of the encoder.

1 frame consists of 1024 sample on time domain.

Sample/Frame time and maximum acquisition time depends on the span setting as follows.

Span	Sample Time	Frame Time	Maximum Acquisition Time
20 MHz	29.4 ns	30.1 us	0.4935 s
10 MHz	58.8 ns	60.2 us	0.9869 s
5 MHz	118 ns	120.5 us	1.973 s
2 MHz	294 ns	301.2 us	4.935 s
1 MHz	588 ns	602.3 us	9.869 s
500 kHz	1.18 us	1.205 ms	19.73 s
200 kHz	2.94 us	3.012 ms	49.35 s
100 kHz	5.88 us	6.023 ms	98.69 s
50 kHz	11.8 us	12.05 ms	197.3 s
20 kHz	29.4 us	30.12 ms	493.5 s

## 8. Main Analysis Setting

Main Analysis can be set on the menu of "ANALYSIS MAIN"(F1) under "OPERATION MODE" key.

Spectrum: Spectrum Analysis is set. Analysis frame count is fixed to 1.

Spectrogram: Spectrogram Analysis is set.

Overwrite: Overwrite Analysis is set. Trigger source is fixed to Free Run.

Time Domain: Time Domain Analysis is set. Further selection is shown in below.

Power vs. Time: Y axis is set to Power [dBm]

Phase vs. Time: Y axis is set to Phase [degree]

Frequency vs. Time: Y axis is set to Frequency [Hz]

IQ vs. Time: Y axis is set to I/Q voltage [V]

Q vs. I: Y axis is set to Q voltage and X axis is set to I voltage. It is polar display.

## 9. Sub Analysis Setting

Sub Analysis can be set on the menu of "ANALYSIS SUB"(F2) under "OPERATION MODE" key.

Power vs. Time: Y axis is set to Power [dBm]

Spectrogram: Spectrogram Analysis is set.

Off: Sub Analysis is disabled.

## 10. Start of Acquisition

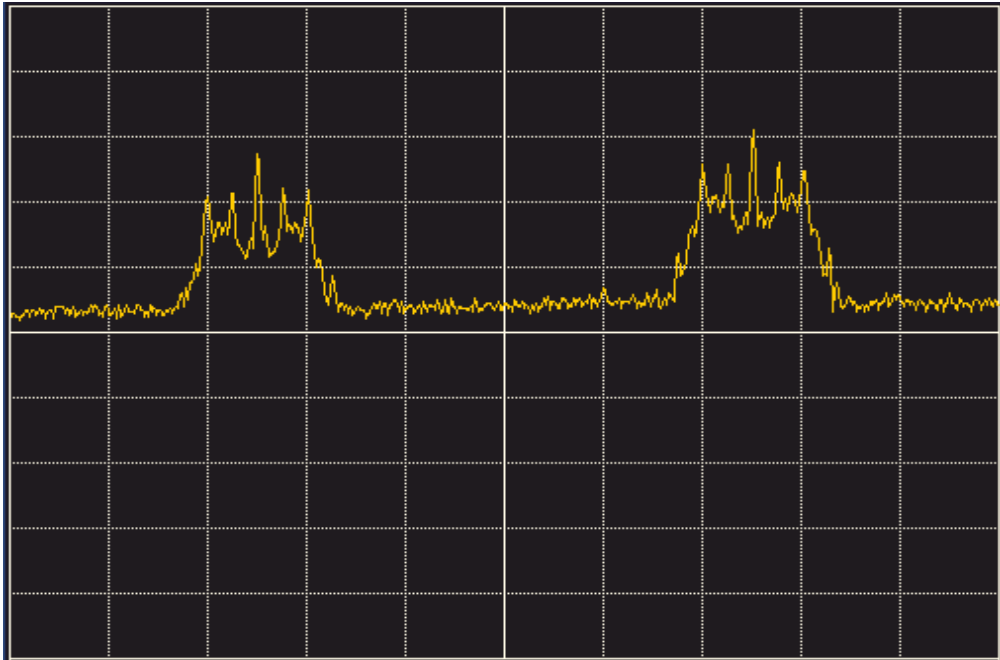
Press "HOLD/RUN" to start. Press "HOLD/RUN" again to stop.

### Example 1. Intermittent Spectrum Capturing

At this example, MSA500 captures the intermittent signal generated by the transmitter

[Setting Procedure]

- 1) On Real-time mode, Center Frequency, Span and Reference Level is set as desired.
- 2) Press "TRIG" - "TRIG SRC SELECT"[F1] - "IF LEVEL"[F4] then set IF LEVEL to 5%
- 3) Press "RETURN"[F6] - "SCAN"[F4] then set to "CONTINUE"
- 4) Press "OPERATION MODE" - "ANALYSIS MAIN"[F1] then select "SPECTRUM"
- 5) Press "RETURN"[F6] - "ANALYSIS SUB"[F2] then select "OFF"[F3]
- 6) Press "CALC" - "MAX HOLD"[F2] the set hold count to "\*\*\*"
- 7) Press "HOLD/RUN" to start acquisition
- 8) When the signal is captured, Press "HOLD/RUN" to stop the acquisition

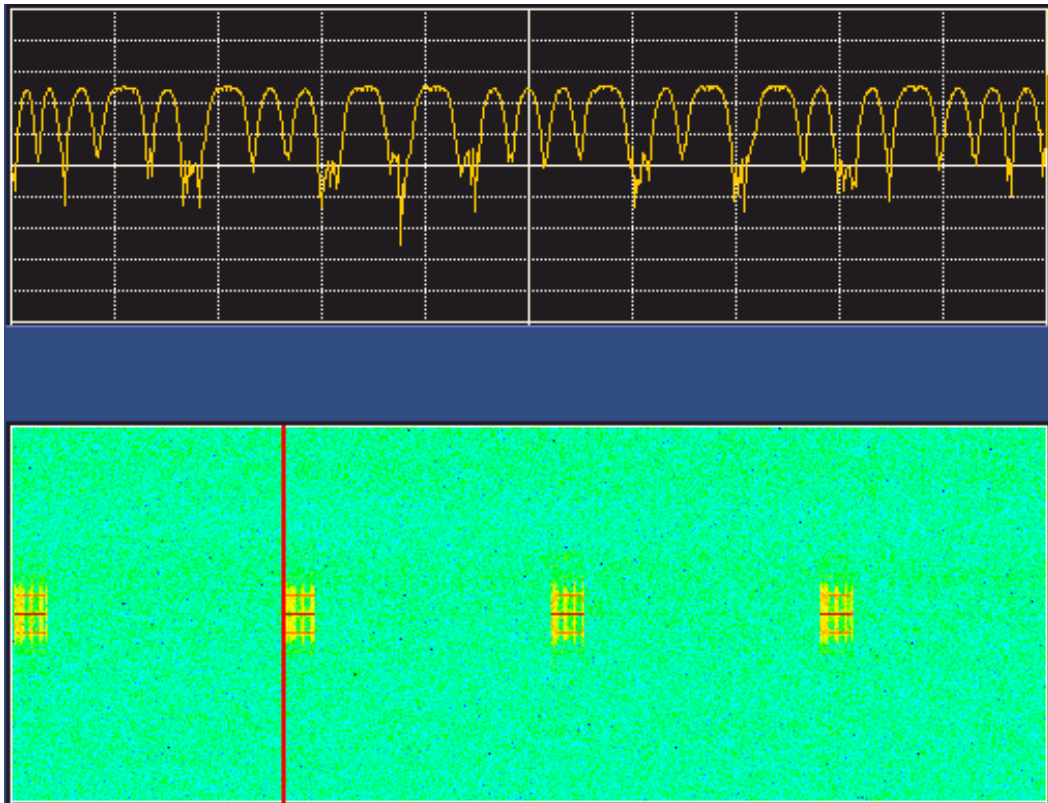


### Example 2. ASK signal analysis generated by ETC roadside unit

We analyze ASK signal with split phase coding on this example.

[Setting Procedure]

- 1) On Real-time mode, Center Frequency, Span and Reference Level is set as desired.
- 2) Press "TRIG" - "TRIG SRC SELECT"[F1] - "POWER"[F2] then set POWER to -35dB
- 3) Press "RETURN"[F6] - "SLOPE"[F3] RISE, "SCAN"[F4] then set to "SINGLE"
- 4) Press "OPERATION MODE" - "ANALYSIS MAIN"[F1] - "T DOMAIN"[F4] - "POWER-T"[F1]
- 5) Press "RETURN"[F6] - "ANALYSIS SUB"[F2] - "SPECTROGM"[F2]
- 6) Press "RETURN"[F6] - "ACQ FRAME"[F3] then set to 500
- 7) Press "HOLD/RUN" to start acquisition
- 8) When acquisition is completed, adjust "STT FRAME"[F4], and "ANL FRAME"[F5] to set the analysis window for Main analysis.



### Example 3: Transmit time measurement of Smartmeter signal

We measure the transmit time of the GFSK signal generated by Smartmeter.

By the measurement below,

Frame time: 301[us] @2M スパン

Transmit Frame count: 754

Transmit Time:  $0.301 \times 754 = 226.9$  [ms]

[Setting Procedure]

- 1) On Real-time mode, Center Frequency, Span and Reference Level is set as desired.
- 2) Press "TRIG" - "TRIG SRC SELECT"[F1] - "POWER"[F2] then set POWER to -35dB
- 3) Press "RETURN"[F6] - "PRE TRIG"[F2] 0% , "SLOPE"[F3] "RISE", "SCAN"[F4] to "SINGLE"
- 4) Press "OPERATION MODE" - "ANALYSIS MAIN"[F1] - "T DOMAIN"[F4] - "POWER-T"[F1]
- 5) Press "RETURN"[F6] - "ANALYSIS SUB"[F2] - "SPECTROGM"[F2]
- 6) Press "RETURN"[F6] - "ACQ FRAME"[F3] then set to 2000
- 7) Press "HOLD/RUN" to start acquisition
- 9) When acquisition is completed, adjust "STT FRAME"[F4], and "ANL FRAME"[F5] to set the analysis window for Main analysis.

