Relationship between oscilloscope and spectrum analyzer amplitude

◇This note explains the relationship between oscilloscope and spectrum analyzer amplitude.

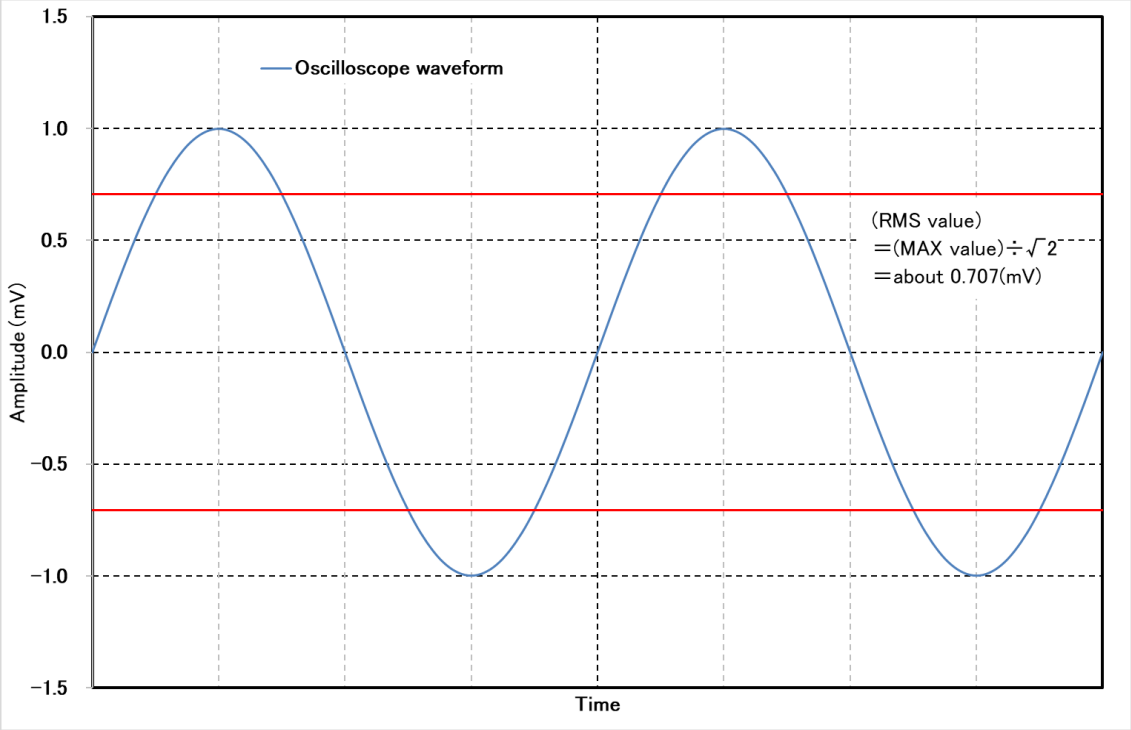
*[～*Application*～]*

Both oscilloscopes and spectrum analyzers measure electrical signals.

The oscilloscope measurement results are displayed on the screen as horizontal axis: time, vertical axis: amplitude.

On the other hand, the measurement result of the spectrum analyzer is displayed on the screen as horizontal axis: frequency, vertical axis: amplitude.

This note describes the relationship between the amplitude of a sine wave signal measured with an oscilloscope and a spectrum analyzer.



The graph above shows the waveform (blue line) when a sine wave signal with a maximum value of 1 mV (Peak-to-peak = 2 mV) is measured with an oscilloscope.

When this signal is measured with a spectrum analyzer, the amplitude is displayed as an rms value and the sine wave (rms value) = (maximum value) ÷ √ 2, so it is about 0.707mV.

The notation in logarithmic units, decibels (dB), is often used in spectrum analyzers, so in that case, 0.707mV becomes 20 * log (0.707mV) = about −3dBmV = about −63dBV = about 57dB μ V .

(Conversion from dBmV to dBV is minus 60 dB, and conversion from dBmV to dB μ V is plus 60 dB.)

Also, considering the impedance at 50Ω, 0.707mV is about 1 × 10^{-5} mW, and 10 * log (1 × 10^{-5} mW) = −50dBm.

These relationships are summarized below.

Oscilloscope		Spectrum analyzer					
MAX	Peak-to-peak	Voltage				Power (impedance 50Ω)	
1mV	2mV	0.707mV	−3dBmV	−63dBV	57dB μ V	1×10^{-5} mW	−50dBm

↑ This is for an oscilloscope input impedance of 50Ω. When the input impedance is 1MΩ, the maximum value is about 2mV.

*[～*System constitution*～]*

- Handheld signal analyzer MSA500 series
- Handheld spectrum analyzer MSA400 series

※MICRONIX Corporation reserves the right to make changes in design, specification and other information without prior notice.

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