



Handheld Signal Analyzer

(Sweep plus Real Time Spectrum Analyzer)

MSA500 series



MICRONIX
MICRONIX Corporation



What's spectrum analyzer ?



Basic instruments for
signal observation

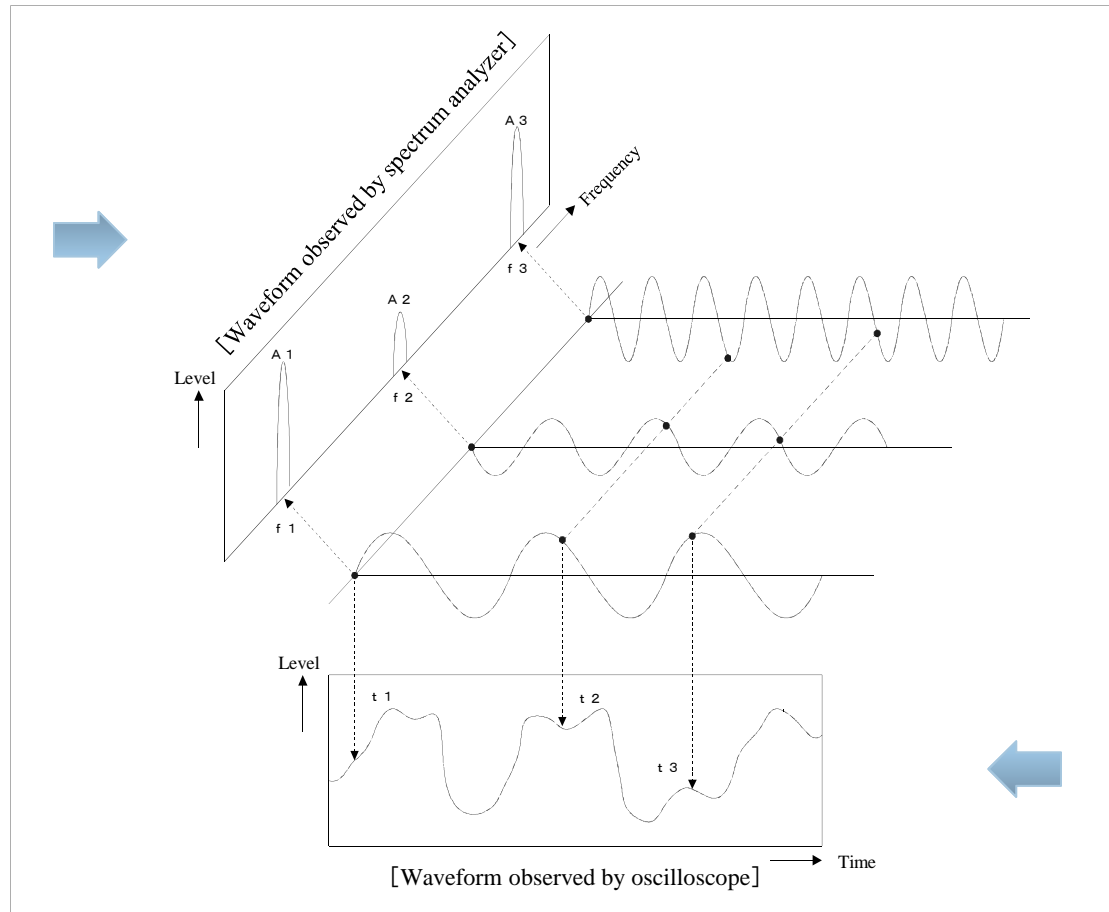


Spectrum analyzer
Oscilloscope



Either is selected based on
observation signal.

Wireless communication



Analog & digital signal



Appeal points of MSA500 (1/2)

<1> Offering conventional sweep system and real time system based on Fast Fourier Transform (FFT)

- By using the strong point of each system, the application range spreads markedly.
- **The world's first handheld signal analyzer with two systems.**

<2> Four analysis functions in real time system

- Spectrum analysis
- Spectrogram analysis
- OverWrite analysis
- **Time domain analysis** ▪ ▪ **Power vs Time** ▪ **Frequency vs Time** ▪ **Phase vs Time** ▪ **IQ vs Time** ▪ **Q vs I**

<3> Powerful trigger function (real time system)

- Channel power trigger
- Power trigger
- IF level trigger
- External trigger

<4> Measurement and data collection in field

- Compact 162(W) × 71(H) × 265(D)mm
- Lightweight 1.8kg (including battery)
- Four-hour battery operation
- Storage into USB memory



Appeal points of MSA500 (2/2)



<5> **Minimization of analog circuit, low power consumption design and digital circuit by FPGA**

- Solving heat problem
- Four-hour battery operation
- Compact and Lightweight

<6> **FFT operation speed for about 1 ms per screen (1024 points)**

- Achieved by a digital signal processing circuit and DSP (Digital Signal Processor)

<7> **The simultaneous development of the five models according to frequency bands and applications.**

- Reduction of development cost
- Expansion of application

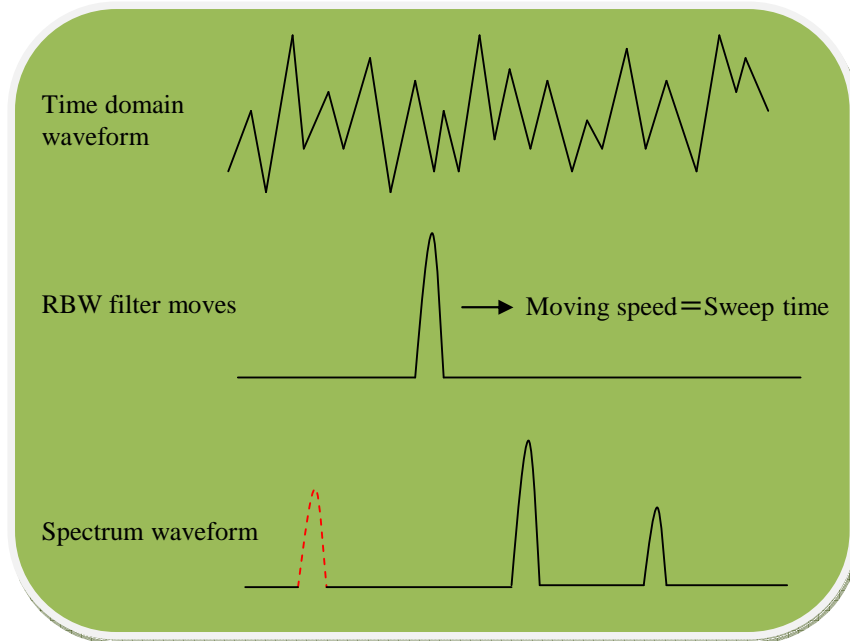
<8> **Low price**

- JPY 748,000 to 1,300,000 (5 models)
- Competitor (Sweep + Real time model) → Bench top (Handheld doesn't exist.)
Rohde & Schwarz FSVR7 JPY 6,473,000
Agilent N9030A PXA+RT1 JPY 5,858,000



Sweep system and Real time system

Sweep system



If a spectrum doesn't exist the moment RBW filter comes to a position because the spectra change, that spectrum won't be observed like **the red dotted line of the above figure**.

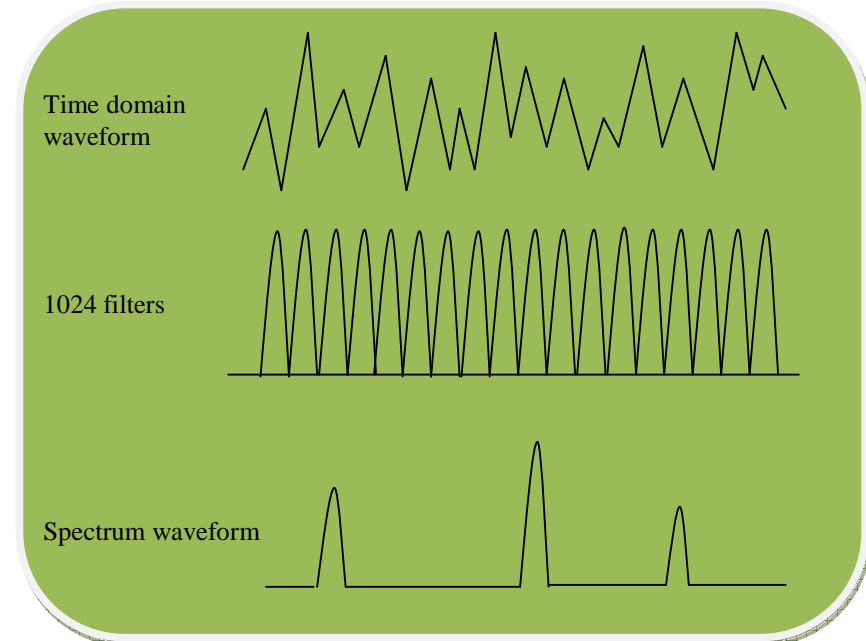


Therefore, the sweep system basically treats a signal that **spectrum does not change with time**.



This is called "**steady signal**".

Real time system



Since the filters equal to the frequency resolution are arranged in parallel, **the signal in a certain period is processed at the same time**.



The spectra won't be missed at all even if **those change with time**.



Any "**unsteady signal**" such as modulation signal can be treated.



Strong and weak points of real time system and sweep system



Real time system	Sweep system
<p>Strong points</p> <ul style="list-style-type: none">①The spectrum analysis of unsteady signal such as burst signal and noise is available.②The time domain analysis such as power vs. time, frequency vs. time, phase vs. time, IQ vs. time and Q vs. I is available.③Since the trigger function is substantial, the spectrum which rarely occurs can be also captured certainly.④Compared with OverWrite function in sweep mode, the spectra which are missed are much less. Especially, any spectrum isn't missed in the span narrower than 200kHz.⑤How frequency and power of spectrum change over time can be observed in spectrogram analysis.⑥Since the measured data is separated into I and Q data, modulation analysis of complicated signals such as phase modulation is possible.⑦The frequency accuracy is very high as $\pm 0.5\text{ppm} \pm 1$ dot at all points of screen. <p>Weak point</p> <ul style="list-style-type: none">①The maximum frequency span is as narrow as 20MHz.	<p>Strong points</p> <ul style="list-style-type: none">①The wide frequency range can be observed at a glance because the wide frequency span can be set.②The tracking generator can be equipped.③The EMI measurement conforming to the standard is possible.④Since the sweep mode is a system of the conventional spectrum analyzer, users are familiar with it and applications are also abundant. <p>Weak points</p> <ul style="list-style-type: none">①It is difficult to observe an unsteady signal, and even when it can be observed by using a MaxHold, it takes time to measure.②The analysis in time domain is only at the zero span mode.③The modulation analysis is impossible.④The frequency accuracy on the screen is inferior compared to real time mode.

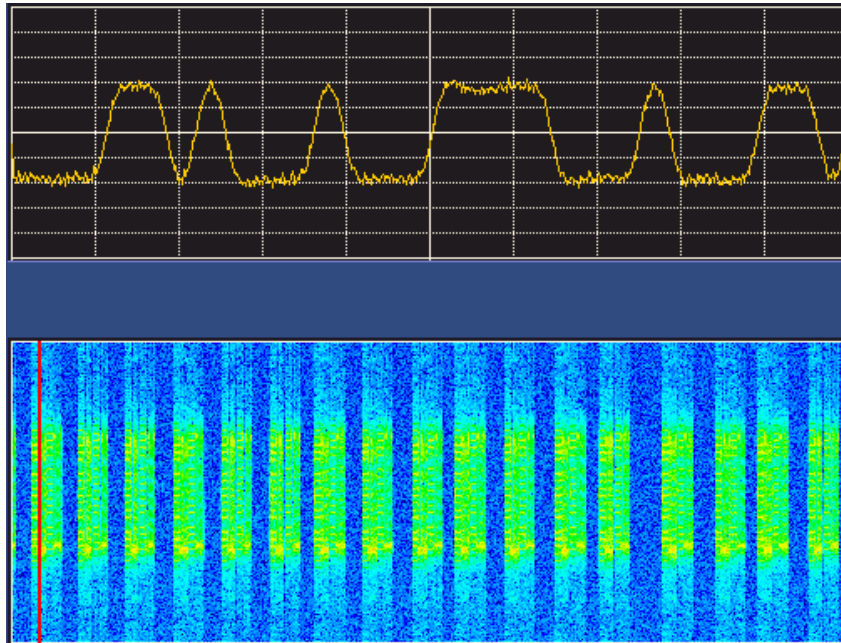


Applications of real time system

Application 1

Smart meter
[920MHz, FSK modulation]

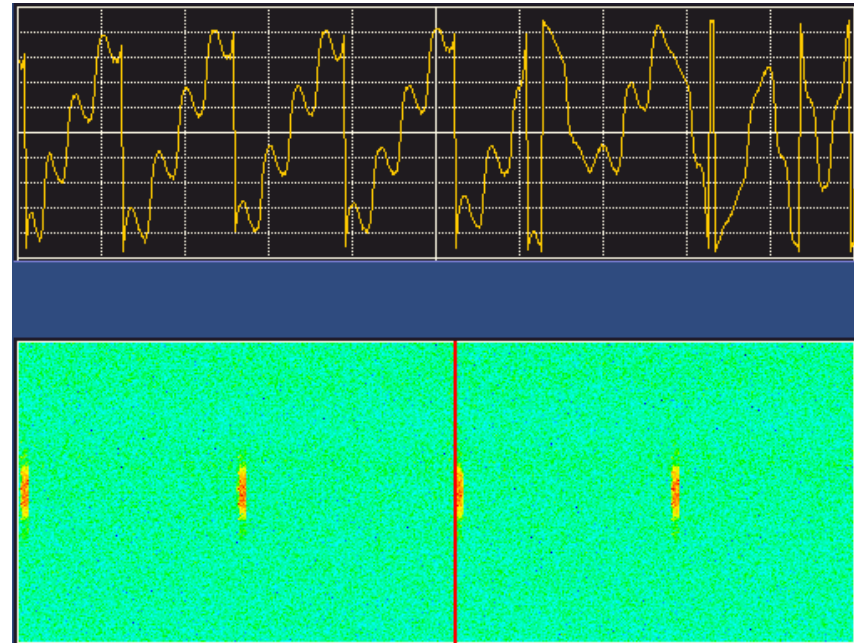
Frequency vs Time (upper), Spectrogram (lower)



Application 2

ETC/DSRC
[5795MHz, $\frac{\pi}{4}$ QPSK modulation]






Phase vs Time (upper), Spectrogram (lower)





Performance Comparison



Characteristics	MSA538(E)/558(E)	SA2500	MS2712E/13E	FSH4/8	N9912
manufacturer	MICRONIX	Tektronix	Anritsu	Rohde & Schwarz	Agilent
					
Real-time Function	YES	YES (No Sweep Mode)	NO	NO	NO
Frequency Range	20 kHz to 3.3 GHz (538) 20 kHz to 8.5 GHz (558)	10 kHz to 6.2 GHz	100 kHz to 4 GHz (2712E) 100 kHz to 6 GHz (2713E)	9 kHz to 3.6 GHz (FSH4) 9 kHz to 8 GHz (FSH8)	100 kHz to 4 GHz (Op. 104) 100 kHz to 6 GHz (Op. 106)
Frequency Span	0 Hz, 100 kHz to 3.3/8.5 GHz (Sweep Mode) 20 kHz to 20 MHz (Real-time Mode)	5 kHz to 20 MHz	0 Hz, 1-2-5 Sequence	0 Hz, 10 Hz to 3.6/8 GHz	0 Hz, 10 Hz to 4/6 GHz
Reference Level	+10 to -60 dBm (1 dB Step)	+20 to -160 dBm	+30 to -120 dBm (1 dB Step)	+30 to -80 dBm	+30 to -170 dBm
RBW	300 Hz to 3 MHz (1-3 Sequence)	10 Hz to 3 MHz	10 Hz to 3 MHz (1-3 Sequence)	1 Hz to 3 MHz (1-3 Sequence)	10 Hz to 2 MHz
VBW	100 Hz to 3 MHz (1-3 Sequence)	N/A	1 Hz to 3 MHz (1-3 Sequence)	1 Hz to 3 MHz (1-3 Sequence)	1 Hz to 2 MHz
Sweep Time	10 ms to 30 s (1-3 Sequence)	N/A	100 ms (Min) 10 ms ~ 600 s (Zero Span)	20 ms to 1000 s 200 us to 100 s (Zero Span)	1 us to 2.54 s (Zero Span)
DANL (1 Hz BW)	-162 dBm/Hz	-163 dBm/Hz	-157 dBm/Hz	-161 dBm/Hz	-153 dBm/Hz
Phase Noise	-95 dBc/Hz @100 kHz Offset	-97 dBc/Hz @100 kHz Offset	-105 dBc/Hz @100 kHz Offset	-100 dBc/Hz @100 kHz Offset	-95 dBc/Hz @100 kHz Offset
Amplitude Accuracy	+/-1.8 dB	+/-1.75 dB	+/-1.25 dB	+/-1.4 dB	+/-1.5 dB
Detectors	Sample, Positive Peak, Negative Peak, QP, Average (E Only)	N/A	Sample, Positive Peak, Negative Peak, QP, RMS	Sample, Positive Peak, Negative Peak, Auto Peak, RMS	Sample, Positive Peak, Negative Peak, Average, Normal
Trigger Function	IF Level, Power, Channel Power, External	IF Level, External	External	Video, External	Video, External
Max Record Length (Continuous)	16383 spectrums	1000 spectrums	1 spectrum	1 spectrum	1 spectrum
Min Frame Time for 1 Spectrum	30.1 us	36.5 us	100 ms	20 ms	Not Specified
Spectrum Processing Rate (Overwrite Mode)	720 spectrums/sec	2500 spectrums/sec	Not Specified	Not Specified	Not Specified
Battery Operating Time	4 hours	5 hours	3 hours	3 hours	4 hours
Weight	1.8 kg	5.56 kg	3.45 kg	3.0 kg	2.8 kg
Price (In Japan)	748,000 yen (MSA538) 1,130,000 yen (MSA558)	2,96,000 yen	726,000 yen (MS2712E) 1,035,000 yen (MS2713E)	980,000 yen (FSH4) 1,280,000 yen (FSH8)	1,230,000 yen (Op.104) 1,636,000 yen (Op.106)