



# USB REAL-TIME SPECTRUM ANALYZER

SAM SERIES  
6.3/8.5 GHz

## Key facts

Frequency range: 9 kHz - 6.3/8.5 GHz

1 GHz DANL: -163 dBm/Hz

1 GHz phase noise: -110 dBc/Hz@10 kHz

Analysis bandwidth: up to 100 MHz

USB3.0/2.0 type C interface

Highly compatible API interface

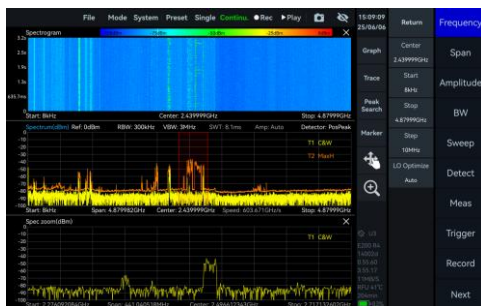
Windows 11/10/8/7 (x86, x64) are supported

Debian 12/11/10 (x64, AArch64) are supported

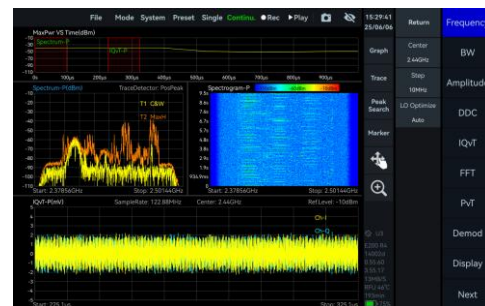
Ubuntu 24.04/22.04/20.04/18.04 (x64, AArch64) are supported

## Applications

### Standard spectrum sweep



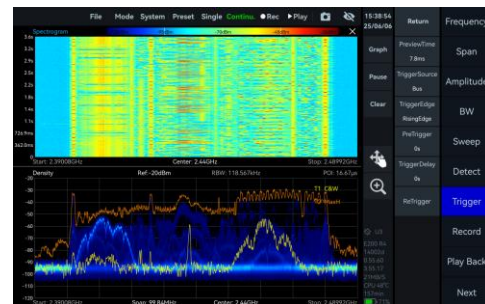
### IQ streaming and analysis



### Power vs time analysis



### Real-time analysis



## Specifications\*

### FREQUENCY

| Frequency range                 | SAM-60                             | SAM-80                                 |
|---------------------------------|------------------------------------|----------------------------------------|
|                                 | 9 kHz - 6.3 GHz                    | 9 kHz - 8.5 GHz                        |
| Reference clock                 | Internal or external               |                                        |
| Frequency accuracy              | TCXO (std.)                        | <1 ppm, manual correction is available |
|                                 | OCXO (opt01)                       | <1 ppm, manual correction is available |
|                                 | Ext. GNSS disciplined OCXO (opt23) | <0.05 ppm, when locked to GNSS         |
| Aging and temperature stability | TCXO (std.)                        | <1 ppm/year, <1 ppm                    |
|                                 | OCXO (opt01)                       | <1 ppm/year, <0.15 ppm                 |
|                                 | Ext. GNSS disciplined OCXO (opt23) | <1 ppm/year, <0.05 ppm                 |

### SPECTRUM PURITY

| SSB phase noise (dBc/Hz) |        |         |        |         |
|--------------------------|--------|---------|--------|---------|
|                          | SAM-60 |         | SAM-80 |         |
| Carrier frequency        | 1 GHz  | 6.3 GHz | 1 GHz  | 8.5 GHz |
| 1 kHz                    | -107.5 | -92.7   | -110.3 | -93.5   |
| 10 kHz                   | -114.2 | -99.7   | -120.0 | -100.5  |
| 100 kHz                  | -112.5 | -98.6   | -120.1 | -100.8  |
| 1 MHz                    | -132.8 | -120.1  | -131.4 | -116.9  |

Residual response (dBm)

Spur reject = enhanced

RBW =1 kHz

PosPeak detector

|                        | SAM-60 |         | SAM-80 |         |
|------------------------|--------|---------|--------|---------|
| Reference level (R.L.) | 0 dBm  | -50 dBm | 0 dBm  | -50 dBm |
| 100 kHz - 100 MHz      | -101   | -123    | -99    | -122    |
| 100 MHz - 6.3 GHz      | -87    | -116    | -88    | -119    |
| 6.3 GHz - 8.5 GHz      | -      | -       | -84    | -113    |

Image rejection

>90 dBc (typ.) for spur reject = enhanced  
>35 dBc (typ.) for spur reject = bypass

IF rejection

Low IF architecture

|                                   |                                                                                      |
|-----------------------------------|--------------------------------------------------------------------------------------|
| Local oscillator related spurious | <-65 dBc<br>Center frequency $\pm (N/M) * 125 \text{ MHz}$ , N, M = 1, 2, 3, 4, 5... |
|-----------------------------------|--------------------------------------------------------------------------------------|

| IIP3 / IIP2 (dBm) |           |           |           |           |
|-------------------|-----------|-----------|-----------|-----------|
|                   | SAM-60    |           | SAM-80    |           |
| Carrier frequency | 1 GHz     | 6.3 GHz   | 1 GHz     | 8.5 GHz   |
| R.L. = 20 dBm     | 51.0/84.9 | 43.4/65.9 | 49.6/87.5 | 41.0/57.4 |
| R.L. = 0 dBm      | 40.1/85.1 | 25.3/94.6 | 35.6/84.3 | 25.5/44.8 |
| R.L. = -20 dBm    | 10.0/66.4 | 4.7/17.7  | 11.5/67.4 | 2.4/34.2  |

## AMPLITUDE

|                        |                                            |                                                  |
|------------------------|--------------------------------------------|--------------------------------------------------|
| Max. input power (CW)  | 23 dBm                                     | 30 MHz - 6.3/8.5 GHz and the preamplifier is off |
|                        | 10 dBm                                     | 9 kHz - 30 MHz or preamplifier is on             |
| Max. DC voltage        | $\pm 10 \text{ VDC}$                       |                                                  |
| Display range          | DANL - 23 dBm                              |                                                  |
| Amplitude accuracy     | $\pm 2.0 \text{ dB}$                       |                                                  |
| IF in-band flatness    | $\pm 2.0 \text{ dB}$                       |                                                  |
| Reference level (R.L.) | -50 dBm - 23 dBm                           |                                                  |
| RF preamplifiers       | Automatically turn on or forcibly turn off |                                                  |
| VSWR                   | R.L. = 10 dBm                              | <1.7:1                                           |
| 30 MHz to Max.Freq.    | R.L. = 0 dBm                               | <2.0:1                                           |
|                        | R.L. = -40 dBm                             | <2.5:1                                           |

Display average noise level  
(DANL) (dBm/Hz)  
RBW=1 kHz

|                   | SAM-60  |         | SAM-80  |         |
|-------------------|---------|---------|---------|---------|
| Reference level   | -20 dBm | -50 dBm | -20 dBm | -50 dBm |
| 9 kHz - 1 MHz     | -135.9  | -148.5  | -141.4  | -151.7  |
| 1 MHz - 30 MHz    | -140.7  | -162.8  | -154.2  | -161.6  |
| 30 MHz - 3.0 GHz  | -152.1  | -163.9  | -150.8  | -167.1  |
| 3.0 GHz - 6.3 GHz | -151.3  | -162.0  | -155.6  | -164.7  |
| 6.3 GHz - 8.5 GHz | -       | -       | -144.0  | -157.2  |

## STANDARD SPECTRUM ANALYSIS

|              |                                                                        |
|--------------|------------------------------------------------------------------------|
| Detector     | PosPeak, NegPeak, Sample, Average, RMS, MaxPower                       |
| RBW          | 0.1 Hz - 10 MHz                                                        |
| VBW          | 0.1 Hz - 10 MHz                                                        |
| Data chart   | SASudio4 software provides spectrum, spectrogram, and historical trace |
| Measurements | Channel power, OBW, XdB bandwidth, Adjacent channel power ratio, IM3   |

| Sweep speed                                  | SAM-60            | SAM-80            |
|----------------------------------------------|-------------------|-------------------|
| RBW = 250kHz FPGA<br>Spur reject = standard  | about 378.6 GHz/s | about 355.2 GHz/s |
| RBW = 250 kHz FPGA<br>Spur reject = enhanced | about 191.1 GHz/s | about 176.9 GHz/s |
| RBW = 50 kHz FPGA<br>Spur reject = enhanced  | about 59.9 GHz/s  | about 58.2 GHz/s  |
| RBW = 1 kHz CPU<br>Spur reject = enhanced    | about 1.0 GHz/s   | about 1.0 GHz/s   |

## IQ RECORDING

|                                |                                                                                                                                      |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Burst recording bandwidth      | Maximum: 100 MHz<br>The built-in memory depth is 128 Mbytes                                                                          |
| Continuous recording bandwidth | Maximum: 50 MHz<br>Limited by the bandwidth of USB interface and hard disk<br>The storage depth is limited by the hard disk capacity |
| IQ sample rate                 | Maximum: 125 MSPS<br>decimate factor: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096                                        |
| External trigger response      | Maximum response frequency 500 times/s                                                                                               |

## DETECTION ANALYSIS

|                         |                                                  |
|-------------------------|--------------------------------------------------|
| Lowest time resolution  | 8 ns                                             |
| Max. analysis bandwidth | 100 MHz                                          |
| Detector                | PosPeak, NegPeak, Sample, Average, RMS, MaxPower |

## REAL TIME SPECTRUM ANALYSIS

### FFT analysis

FFT engine is implemented in FPGA  
Frame compression and trace detection are supported  
No missing samples between FFT frames.

FFT frame update rate =  $10^9 \text{ ns} / (N * D * 8 \text{ ns})$ ; POI =  $N * D * 8 \text{ ns}$   
N for FFT points (2048, 1024, 512, 256, 128, 64, 32)  
D for decimate factor (1, 2, 4, 8...)

| Typical settings | FFT refresh rate  | POI       |
|------------------|-------------------|-----------|
| N = 2048, D = 1  | 61,035 times/s    | 16.384 us |
| N = 32, D = 1    | 3,906,250 times/s | 0.256 us  |

|                         |                                                                                                      |
|-------------------------|------------------------------------------------------------------------------------------------------|
| Max. analysis bandwidth | 100 MHz                                                                                              |
| RBW                     | 14.73 MHz - 3.59 kHz (Flat-top)<br>7.81 MHz - 1.90 kHz (B-Nuttall)<br>13 grades for each window type |
| Window function         | B-Nuttall, Flat-top, LowSideLobe                                                                     |
| Amplitude resolution    | 0.75 dB                                                                                              |

## GENERAL

### Input and output

|                                |                                                                                                                                                     |  |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Power                          | Type-C, power supply dedicated port, please provide 5V2A peak power supply capacity Allowable voltage range 4.75 - 5.25 V, ripple less than 200mVpp |  |
| Data                           | Type-C, USB 3.0 (USB 2.0 available but bandwidth limited)<br>Device will fetch up to 1 A current from this port                                     |  |
| RF input                       | SMA (F), Input impedance 50 $\Omega$                                                                                                                |  |
| RF output                      | SMA (F), output impedance 50 $\Omega$                                                                                                               |  |
| External reference clock input | MCX (F), amplitude $\geq 1.5 \text{ Vpp}$ , input impedance is 330 $\Omega$                                                                         |  |
| Reference clock output         | Unavailable                                                                                                                                         |  |
| External trigger input         | Type-C, 3.3 V CMOS, input: high impedance                                                                                                           |  |
| Trigger output                 | Type-C, 3.3 V CMOS                                                                                                                                  |  |
| Analog IF output               | Unavailable                                                                                                                                         |  |

|                   |                  |          |
|-------------------|------------------|----------|
| Power consumption | SAM-60           | SAM-80   |
|                   | 7 - 10 W         | 9 - 12 W |
| Size (D * W * H)  | 156 * 62 * 22 mm |          |

|                                                 |                                                      |                           |
|-------------------------------------------------|------------------------------------------------------|---------------------------|
| <b>Weight</b>                                   | 290 g                                                |                           |
| <b>GNSS synchronization</b>                     | External GNSS (opt21)                                | ±100 ns                   |
|                                                 | External GNSS (opt22)                                | ±75 ns                    |
|                                                 | External GNSS (opt23)                                | ±50 ns                    |
| <b>System requirements</b>                      | Windows 11/10/8/7                                    | x86, x64                  |
|                                                 | Debian 12/11/10                                      | x64, AArch64              |
|                                                 | Ubuntu 24.04/22.04/20.04/18.04                       | x64, AArch64              |
| <b>Operating temperature<br/>(ambient/core)</b> | T0 class (std.)                                      | 0 - 50 °C / 0 - 70 °C     |
|                                                 | T1 class (opt40)                                     | -20 - 65 °C / -20 - 85 °C |
|                                                 | T2 class (opt41)                                     | -40 - 65 °C / -40 - 85 °C |
| <b>Storage temperature<br/>(ambient)</b>        | T0 class (std.)                                      | -20 - 70 °C               |
|                                                 | T1 class (opt40)                                     | -40 - 85 °C               |
|                                                 | T2 class (opt41)                                     | -40 - 85 °C               |
| <b>Operating Relative Humidity</b>              | 0 - 40 °C                                            | 5 - 75%                   |
|                                                 | >40 °C                                               | 5 - 45%                   |
| <b>Packaging and accessories</b>                | Flash disk * 1, USB 3.0 cable * 2, power adapter * 1 |                           |

\*Specification applies under the following conditions:

(1) Start up and warm up for 10 minutes

(2) Ambient temperature 25 °C (core temperature 50 °C)

(3) Standard spectrum analysis mode-spurious rejection enhance on.

(4) Necessary heat dissipation is provided to ensure the ambient and core temperature within the rated range at the same time

(5) Sweep speed and display average noise level test conditions: MCU:0.55.57,FPGA:0.55.22,API:0.55.61

## OPTIONS

| Code |                                                          |                   |
|------|----------------------------------------------------------|-------------------|
| 01   | Built-in OCXO reference clock                            | built-in hardware |
| 02   | Built-in signal generator                                | built-in hardware |
| 20   | MUXIO IO Expansion board                                 | accessory         |
| 21   | External GNSS                                            | accessory         |
| 22   | External high precision GNSS                             | accessory         |
| 23   | External GNSS disciplined OCXO reference clock           | accessory         |
| 34   | External omnidirectional antenna, 400-8000MHz, Gain<2dBi | accessory         |
| 40   | T1 temperature class                                     | built-in hardware |
| 41   | T2 temperature class, only available for core            | built-in hardware |
| 71   | Basic digital demodulation                               | software          |
| 72   | Pulse detection                                          | software          |

## BUILT-IN SIGNAL GENERATOR (opt02)

|                    |                                        |        |
|--------------------|----------------------------------------|--------|
| Frequency range    | 100 kHz - 6.3 GHz, step 10 Hz          |        |
| Power range        | -50 dBm - 0 dBm, 0.25 dB for each step |        |
| VSWR               | 30 MHz - 6.3 GHz                       | <2.0:1 |
| Non-harmonic spurs | <-50 dBc                               |        |

### Harmonics

| Frequency range   | Second harmonic | Third harmonic and above |
|-------------------|-----------------|--------------------------|
| 100 kHz - 30 MHz  | <-10 dBc        | <-10 dBc                 |
| 30 MHz - 1.6 GHz  | <-10 dBc        | <-10 dBc                 |
| 1.6 GHz - 3 GHz   | <-20 dBc        | <-20 dBc                 |
| 3 GHz - 3.2 GHz   | <-20 dBc        | <-20 dBc                 |
| 3.2 GHz - 6.3 GHz | <-20 dBc        | <-20 dBc                 |

### Leakage to receiver

|                  |         |
|------------------|---------|
| 100 kHz - 30 MHz | >90 dBc |
| 30 MHz - 3 GHz   | >80 dBc |
| 3 GHz - 6.3 GHz  | >70 dBc |

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