

40 GHz Compact USB Real-Time Spectrum Analyzer

SAN-400

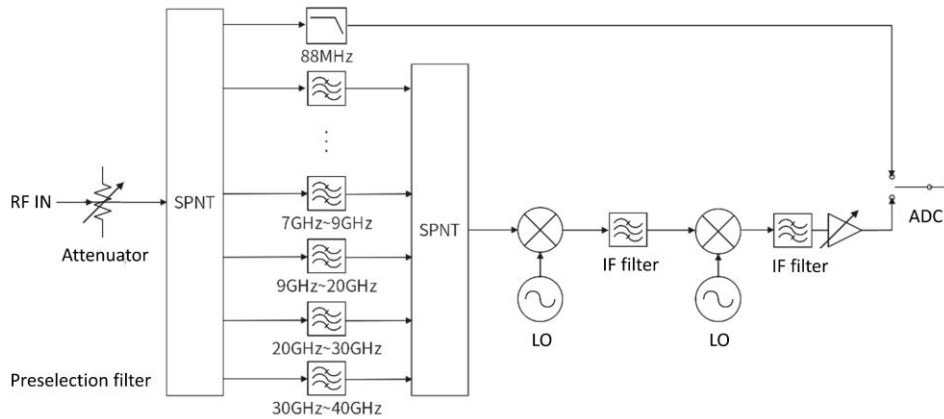
Product Brochure V0.6

2023-10-18

- 9 kHz~40 GHz real-time spectrum analyzer
- Superheterodyne digital receiver architecture, 14 segments pre-selected filter
- 100 MHz analysis bandwidth with adjustable sampling rate, 400 GHz/sec spectrum sweep speed
- FPGA based digital signal processing
- 9 kHz~40 GHz typical image suppression and IF rejection >75 dBc (Spurious rejection on)
- 40 GHz/10 GHz DANL = -141/-146 dBm/Hz
- 40 GHz/10 GHz phase noise = -86/-99 dBc/Hz@10 kHz
- Core module supported, weight 185 g, size: 125×60×17 mm, power consumption: 10-14 W
- Highly compatible API interfaces and SASudio4 GUI
- Compatible with ARM and x86 processors, Linux and Windows operating systems
- Built-in OCXO (option), temperature drifting ≤0.15 ppm
- Operating temperatures range from -20 °C/-40 °C to 65 °C (option)
- USB3.0/2.0 Type-C interface supported

Technical Characteristics

The SAN-400 uses a direct sampling channel at 88 MHz and below, and a superheterodyne mixing channel at 88 MHz to 40 GHz. Within 7.8 GHz, enough preselected filter is distributed. Above 7.8 GHz, the number of preselected filters is limited and can only provide partial anti-jamming capability with very limited image suppression. SAN-400 provides additional image suppression by turning on the spurious suppression algorithm in standard spectrum sweep mode (not valid in other analysis modes). The image suppression and intermediate frequency suppression of each frequency band are given below.



SAN-400 RF section simplified block diagram

| Frequency range | Spurious rejection on | | Spurious rejection off | |
|------------------|-----------------------|----------------|--|----------------|
| | image suppression | IF suppression | image suppression | IF suppression |
| 9 kHz~88 MHz | ≥65 dBc | ≥80 dBc | ≥65 dBc | ≥75 dBc |
| 88 MHz~0.35 GHz | ≥80 dBc | ≥80 dBc | ≥75 dBc | ≥75 dBc |
| 0.35 GHz~2.6 GHz | ≥80 dBc | ≥80 dBc | ≥60 dBc | ≥40 dBc |
| 2.6 GHz~5.6 GHz | ≥80 dBc | ≥80 dBc | ≥30 dBc | ≥40 dBc |
| 5.6 GHz ~7.8 GHz | ≥75 dBc | ≥80 dBc | ≥20 dBc | ≥75 dBc |
| 7.8 GHz~9 GHz | ≥65 dBc | ≥80 dBc | No suppression or only suppress minority component | ≥75 dBc |
| 9 GHz~12 GHz | ≥65 dBc | ≥80 dBc | | ≥75 dBc |
| 12 GHz~14 GHz | ≥65 dBc | ≥80 dBc | | ≥75 dBc |
| 14 GHz~19 GHz | ≥70 dBc | ≥80 dBc | | ≥75 dBc |
| 19 GHz~22 GHz | ≥65 dBc | ≥80 dBc | | ≥75 dBc |
| 22 GHz~24 GHz | ≥65 dBc | ≥80 dBc | | ≥75 dBc |
| 24 GHz~30 GHz | ≥65 dBc | ≥80 dBc | | ≥75 dBc |
| 30 GHz~33 GHz | ≥60 dBc | ≥80 dBc | | ≥75 dBc |
| 33 GHz~35 GHz | ≥80 dBc | ≥80 dBc | | ≥75 dBc |
| 35 GHz~40 GHz | ≥80 dBc | ≥80 dBc | | ≥75 dBc |

*Reference Level = 0 dBm

SAN-400 Technical Specifications * (typical value)

Indicator test basis Hardware Version: 0 API: 0.54.9 FPGA: 0.54.0 MCU: 0.54.8 SAS4: 1.54.42

| Frequency | | | | | |
|--|---|------------------------|-----------------------|------------------------|-----------------------|
| Frequency Range | 9 kHz~40 GHz | | | | |
| Initial Frequency Accuracy | <1 ppm, Supporting program manual correction | | | | |
| Reference Clock | Internal or external, program-controlled switching Internal TCXO aging<1 ppm/year, temperature drift<1 ppm; Internal OCXO (option), temperature drift<0.15 ppm | | | | |
| Spectrum Purity | | | | | |
| SSB Phase Noise | dBc/Hz | | | | |
| Carrier Frequency | 1 GHz | 3 GHz | 10 GHz | 20 GHz | 40 GHz |
| 1 kHz | -95.2 | -97.2 | -92.6 | -86.2 | -80.5 |
| 10 kHz | -104.2 | -101.8 | -98.5 | -96.5 | -86.5 |
| 100 kHz | -106.5 | -103.6 | -99.5 | -95.3 | -86.3 |
| 1 MHz | -120.7 | -121.2 | -116.4 | -111.3 | -103.3 |
| 10MHz | -130.8 | -134.3 | -132.5 | -128.1 | -123.6 |
| Residual Response Spurious rejection off dBm RBW =1 kHz Positive Peak Detector | Frequency Range | R.L.=0 dBm | | R.L.=-20 dBm | |
| | | Spurious rejection off | Spurious rejection on | Spurious rejection off | Spurious rejection on |
| | 9 kHz~10 GHz | -73 | -84 | -79 | -90 |
| | 10 GHz~20 GHz | -87 | -90 | -101 | -110 |
| | 20 GHz~30 GHz | -74 | -88 | -92 | -107 |
| 30 GHz~40 GHz | -83 | -89 | -95 | -105 | |
| Image Frequency Suppression (Spurious rejection on) | > 60 dBc; refer to technical characteristics for details | | | | |
| IF rejection (Spurious rejection off) | > 75 dBc; excluding 0.35 GHz~5.6 GHz, > 40 dBc | | | | |
| IF rejection (Spurious rejection on) | > 80 dBc | | | | |
| Local Oscillator Related Spurious | <-65 dBc (Offset Center Frequency +/- (N/M)*125 MHz, N,M = 1,2,3,4,5...) | | | | |
| Input Related Spurious (Spurious rejection on) | <-60 dBc; refer to technical characteristics for details | | | | |
| Signal Processing | | | | | |
| Analysis Bandwidth | Maximum 100 MHz | | | | |
| IQ Data | 122.88 MSPS, supporting 120 MSPS-125 MSPS program adjustable, 1 Hz step 1,2,4,8,16,32,64,128,256,512,1024,2048,4096 supported. | | | | |
| Storage Depth | The built-in memory depth is 128 Mbytes | | | | |
| | Supports continuous and uninterrupted storage when the data generation rate is less than the bus bandwidth, and the storage depth is only limited by the hard disk capacity | | | | |
| External Trigger Response | Maximum response frequency 500 times/sec | | | | |
| Analog IF Output | Supporting 307.2 MHz +/-50 MHz | | | | |
| Amplitude | | | | | |
| Maximum safe input power (CW) | 23 dBm | 88 MHz~40 GHz | | | |
| | 10 dBm | 100 kHz~88 MHz | | | |
| Maximum DC Voltage | +/-12 VDC | | | | |
| Display Range | DANL~23 dBm | | | | |

| | | | |
|---|---|---|--|
| Amplitude Accuracy | +/- 2.0 dB (9 kHz~9 GHz); +/- 3.0 dB (> 9 GHz) | | |
| IF in-band spectrum ripple | +/- 1.75 dB (Analog IF bandwidth 40 MHz); +/- 2.0 dB (Analog IF bandwidth 100 MHz) | | |
| Reference level (R.L.) | -50 dBm~23 dBm | | |
| RF Preamplifiers | No pre-amplifier as standard | | |
| Display Average Noise Level (DANL) dBm/Hz RBW=10 kHz RMS detector | Frequency Range | R.L.= 0 dBm | R.L.=-20 dBm |
| | 9 kHz | -119 | -139 |
| | 100 kHz~88 MHz | -131 | -149 |
| | 88 MHz~9 GHz | -133 | -139 |
| | 9 GHz~19 GHz | -131 | -146 |
| | 19 GHz~30 GHz | -127 | -144 |
| 30 GHz~40 GHz | -129 | -141 | |
| Standard Spectrum Analysis | | | |
| Detector | Positive peak, Negative peak, Sampling, Average, RMS, Max Power | | |
| RBW | 0.1 Hz~10 MHz | | |
| VBW | 0.1 Hz~10 MHz | | |
| Trace Function | Sample, Positive Peak, Negative Peak, Local average, Maximum hold, Minimum hold, Average | | |
| Data Chart | SAStudio4 software provides regular spectrum, waterfall chart, and historical trace | | |
| Measurements | Phase noise, Channel power, Occupied bandwidth, X dB bandwidth, Adjacent channel suppression, IM3 | | |
| Sweep speed - Standard Spectrum Analysis | 303.3 GHz/s | FPGA | RBW≥1 MHz, B-Nuttal window, spurious rejection: Standard |
| | 404.2 GHz/s | FPGA | RBW = 250 kHz, B-Nuttal window, spurious rejection: Standard |
| | 61.4 GHz/s | FPGA | RBW=30 kHz, B-Nuttal window, spurious rejection: Standard |
| | 2.8 GHz/s | CPU | RBW=1 kHz, B-Nuttal window, spurious rejection: Standard |
| Detection Analysis/Zero Span | | | |
| Highest Time Resolution | 8 ns | | |
| Maximum Analysis Bandwidth | 100 MHz | | |
| Detector | Positive peak, Negative peak, Sampling, Average, RMS, Max Power | | |
| Real Time Spectrum Analysis | | | |
| FFT Analysis | Variable point FFT engine implemented by FPGA. frame rate compression and trace detection are supported. There is strictly no gap and overlap between FFT frames | | |
| | FFT refresh rate= 10^9 ns/(N * D * 8 ns); POI = 2*N*D*8ns N is the number of FFT points (2048, 1024,512,256,128,64,32), and D is the decimate factor (1, 2, 4, 8...) | | |
| | Typical Settings | FFT Refresh Rate | POI |
| | N = 2048, D = 1 | 61,035 times /second | 32.768 us |
| | N = 32, D = 1 | 3,906,250 times /second | 0.512 us |
| Real-time Analysis Bandwidth | 100 MHz | | |
| Window Function | B-Nuttall, FlatTop | | |
| RBW | 14.73MHz-3.59kHz (Flatop window);7.81MHz~1.90kHz (B-Nuttall); 13 grades for each window type | | |
| Amplitude Resolution | 0.75dB | | |
| General | | | |
| Input and Output | Power Supply | Type-C (1), dedicated power supply port, please provide 5 V2 A peak power supply capacity | |

| | | |
|--|---|---|
| | | Allowable voltage range: 4.75~5.25 V, ripple less than 200 mVpp |
| | Data | Type-C (2), USB3.0 (USB2.0 Available but bandwidth limited) |
| | RF input | 2.92 mm (F), Input impedance 50 Ω |
| | External reference clock input | MMCX (F) (1), amplitude ≥ 1.5 Vpp, input impedance 330 Ω |
| | External reference clock output | Integrated in MUXIO, 3.3 V CMOS, programmable on/off |
| | External trigger input | Integrated in MUXIO, 3.3 V CMOS, input: high impedance |
| | External trigger output | Integrated in MUXIO, 3.3 V CMOS |
| | Analog IF Output | MMCX (F) (2), maximum output power –25 dBm, output impedance 50 Ω |
| Weight and Size | Size: 125x60x17 mm, Weight:185 g (core modular) | |
| Power Consumption | Peak: 14 W, typical: 10 W~14 W | |
| Operating Temperature (ambient temperature /core temperature) | 0~50 °C/0~70 °C (Standard temperature class) | |
| | -20~65 °C/-20~85 °C (Extended Temperature Class Option) (plastic enclosure and fan not included) | |
| | -40~65 °C/-40~85 °C (Wide Temperature Class Option) (plastic enclosure and fan not included) | |
| Storage Temperature (ambient temperature) | -20~70 °C (Standard temperature class) | |
| | -40~85 °C (Extended temperature class and wide temperature options) (plastic enclosure and fan not included) | |
| Size (D * W * H) and weight | 125 x60 x17 mm, 185 g (excluding protective shell and structural fittings, including joint length); 139 x69 x29 mm, 390 g (including protective shell and structural fittings, including joint length) | |
| Packaging and Accessories | Flash disk *1, USB 3.0 cable * 2, Power adapter * 1 | |

*The typical values of the indicators are applicable for the following conditions: (1) Start up and warm up for 10 minutes; (2) Ambient temperature 25 °C (core temperature 50 °C); (3) Spurious suppression off; (4) 100MHz analog IF and IFGainGrade=4;(5) The user shall provide the necessary heat dissipation conditions to ensure that the ambient temperature and the core temperature of the equipment are within the rated range at the same time.

| Code Name | Option | Explanation |
|-----------|--|--|
| 01 | Built-in OCXO reference clock (hardware) | Providing a reference clock with better stability than the standard configuration, with a temperature drift of<0.15 ppm, increasing the overall power consumption by 0.8 W |
| 10 | MUXIO IO extended board (accessory) | Converting the MUXIO interface into multiple MMCX and board to wire connector to facilitate the connection of trigger input, output, and other signals |
| 11 | External GNSS (accessory) | Standard GNSS module connected to MUXIO |
| 12 | External high precision GNSS (accessory) | High precision GNSS module connected to MUXIO |
| 13 | External GNSS disciplined OCXO reference clock (accessory) | Providing GNSS disciplined reference clock and 1PPS, increasing the overall power consumption by 1.1W. |
| 20 | Extended temperature class (hardware) | - 20~65 °C/- 20~85 °C(Extended temperature class opt.) |
| 21 | Wide temperature class (hardware) | - 40~65 °C/- 40~85 °C(Wide temperature class opt.) |

Welcome to **HAROGIC**® Official website <http://en.harogic.com/> to know more

Email: info@harogic.com

Telephone: +86-13912971535

SAN-400 Product Brochure

WhatsApp

