Preliminary Data Sheet

**MS4022**

# High Performance Frequency Synthesizer

## FEATURES

- Ultra-Low Jitter (12 KHz to 20 MHz)
  - 22 fs at 10.8 GHz
- Output Frequency Range: 675 MHz to 22 GHz
- Frequency Stability: ±1ppm (Internal source)
- Dual Phase-coherent Outputs
- Jitter Cleaning Functionality
- USB-C Interface
- Optional SPI Interface
- Built-in Internal Reference Oscillator and External Reference Input
- Low Power Consumption
- Temperature Range: -40°C to 70°C
- Output Power: +10dBm
- Power Supply: 6 Vdc

## APPLICATIONS

- Broadband Microwave Signal Generation
- Wideband LO Generation for Transceivers
- High-Speed ADC/DAC Sampling Clock Generation
- MIMO, Phased Array, and Beamforming
- Electronic Warfare and Signal Intelligence
- Radar
- Agile LO Source for Electronic Warfare
- Laboratory Test & Measurement Signal Source

## GENERAL DESCRIPTION

MS4022 is the industry's highest-performance frequency synthesizer, offering advanced reference selection and ultra-low phase noise signal generation. Engineered to meet the most stringent phase noise requirements, it is ideal for demanding applications across a wide range of systems.

Housed in a compact, all-metal enclosure, the MS4022 delivers robust performance in a portable form factor. It is fully programmable via a USB-C cable or an optional SPI interface, allowing users to configure key functions such as frequency, output power level, sweep mode, and step size. This flexibility enables seamless integration into complex systems and supports a wide range of operational requirements.

**Table 1. Electrical Specifications**

Typical values are specified at $T_A$= 25°C, $V_{DD}$=6 Vdc unless otherwise specified. All Min and Max limits are specified over the operating temperature range and voltage range with standard termination.

| Parameter | Symbol | Test Condition/Comment | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Input Frequency Range** | | | | | | |
| Frequency Range | $F_{in}$ | | 1 | | 750 | MHz |
| Reference Level | | | | 0 | | dBm |
| **Operating Voltage/Temperature Range** | | | | | | |
| Supply Voltage | $V_{DD}$ | | | 6 | | Vdc |
| Supply Current | $I_{DD}$ | | | 1.2 | | A |
| Standby Current | $I_{STB}$ | | | 0.3 | | mA |
| Operating Temperature | $T_A$ | | -40 | | 70 | ° C |
| **Clock Output Jitter Characteristics** | | | | | | |
| RMS Phase Jitter (12 KHz – 20 MHz) | $\Phi_{JITTER}$ | Frequency=10.8 GHz | | 22 | | fs |
| **Note**: Phase jitter measured on Agilent 5052B Signal Source Analyzer | | | | | | |

## Output Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| Frequency Range | | | 0.675 | | 22 | GHz |
| Frequency Accuracy | | Using Internal Reference, 0.675-22 GHz | | 1 | | ppm |
| Frequency Resolution | | 0.675-11 GHz | | 1 | | MHz |
| | | 11-22 GHz | | 1 | | MHz |
| Power Maximum | | 0.675 – 5 GHz | | 16 | | dBm |
| | | 5-10 GHz | | 16 | | dBm |
| | | 10-15 GHz | | 15 | | dBm |
| | | 15-22 GHz | | 12 | | dBm |
| Power Steps | | | | 0.5 | | dB |
| Return Loss | | 0.675 – 5 GHz | | 10 | | dB |
| | | 5-10 GHz | | 10 | | dB |
| | | 10-15 GHz | | 10 | | dB |
| | | 15-22 GHz | | 10 | | dB |
| Port VSWR | | | | 1:11.9 | | |
| Port Isolation | | RFOUT1 to RFOUT2 | | 22 | | dB |
| RF Off Output Level | | 0.675-11 GHz | | 22 | | dBm |
| | | 11-22 GHz | | 22 | | dBm |
| SSB Phase Noise | | 11 GHz @1 kHz | | -73 | | dBc |
| | | 11 GHz @10 kHz | | -101 | | dBc |
| | | 11 GHz @100 kHz | | -119 | | dBc |
| | | 11 GHz @1 MHz | | -128 | | dBc |
| | | 11 GHz @10 MHz | | -153 | | dBc |
| | | 11 GHz @20 MHz | | -157 | | dBc |

### Harmonics

| | | | | | | |
|---|---|---|---|---|---|---|
| Harmonics | | 1 GHz | H2 | | 10 | dBc |
| | | | H3 | | 3 | dBc |
| | | 2 GHz | H2 | | 12 | dBc |
| | | | H3 | | 10 | dBc |
| | | 5 GHz | H2 | | 16 | dBc |
| | | | H3 | | 17 | dBc |
| | | 7 GHz | H2 | | 15 | dBc |
| | | | H3 | | 24 | dBc |
| | | 11 GHz | H2 | | 19 | dBc |
| | | | H3 | | 25 | dBc |
| Subharmonics | | 15.0 GHz fund | f/2 | | 86 | dBc |
| | | | f/3 | | 75 | dBc |
| | | 17.0 GHz fund | f/2 | | 89 | dBc |
| | | | f/3 | | 113 | dBc |
| | | 19.0 GHz fund | f/2 | | 76 | dBc |
| | | | f/3 | | 106 | dBc |
| Non-harmonic Spurious | | 0.675 – 5 GHz | | 72 | | dBc |
| | | 5 – 10 GHz | | 77 | | dBc |
| | | 0.675 – 22 GHz | | 70 | | dBc |

**Table 2. Typical Output Phase Noise Characteristics**

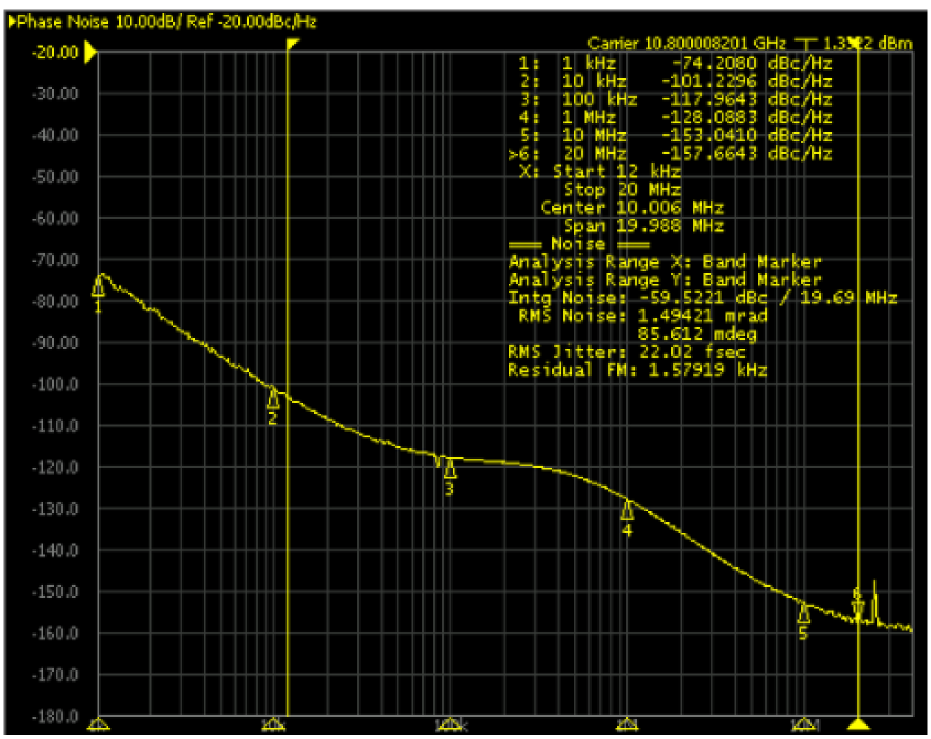
Note: Signal power is attenuated by 10dB.

| Offset frequency | 10.8 GHz | Unit |
|---|---|---|
| 1 KHz | -74 | dBc/Hz |
| 10 KHz | -101 | dBc/Hz |
| 100 KHz | -118 | dBc/Hz |
| 1 MHz | -128 | dBc/Hz |
| 10 MHz | -153 | dBc/Hz |
| 20 MHz | -158 | dBc/Hz |
| RMS Jitter<br>(12 KHz – 20 MHz) | 22 | fs |

## Typical Output Measured Phase Noise Plots

This section shows MS4022 performance plots.
Measurement parameters are: VDD = 6 Vdc, TA = 25°C
The plots were captured using an Agilent E5052B Signal Source Analyzer.

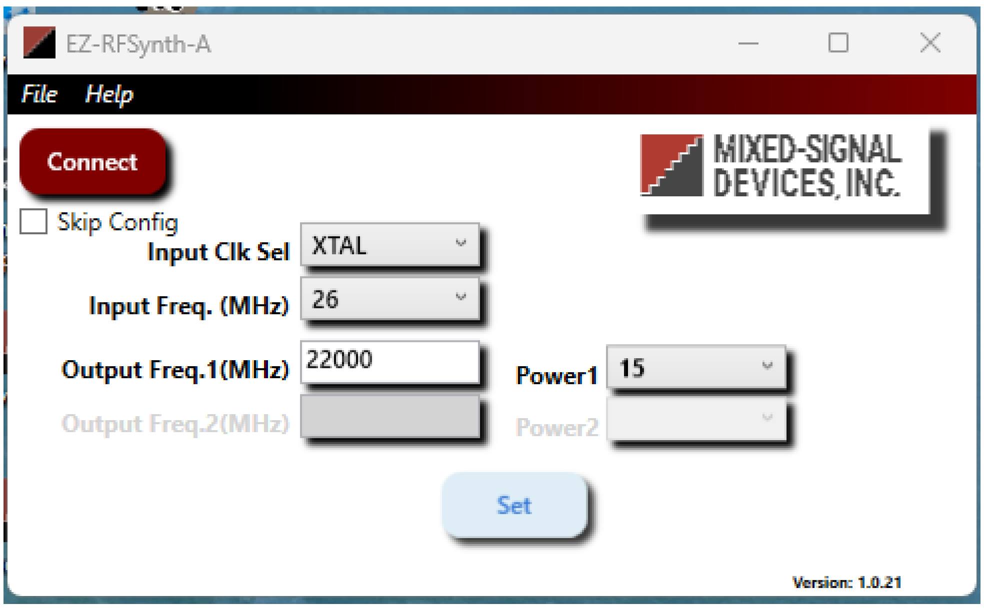
Output Frequency: 10.8 GHz



## SYSTEM REQUIREMENTS

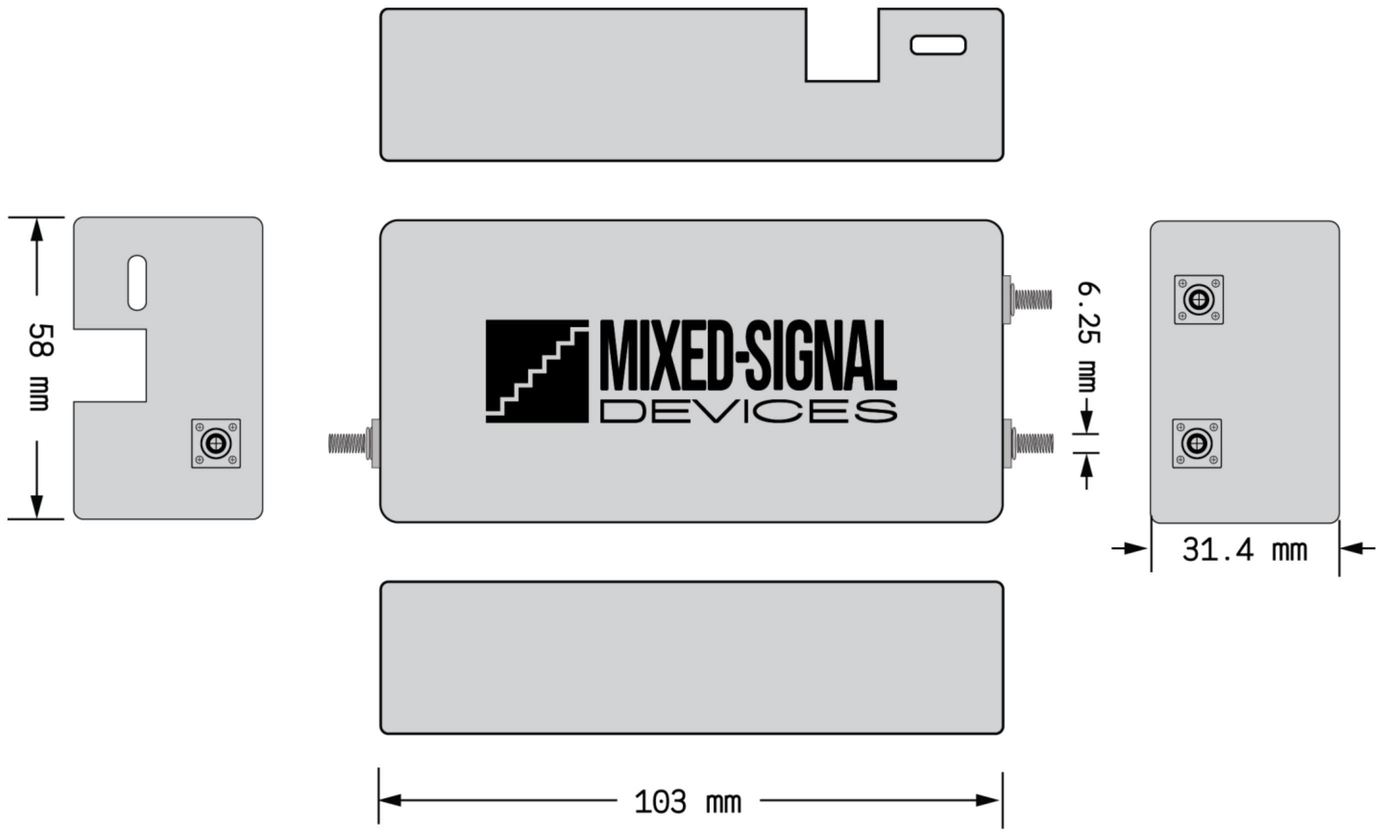
| | |
|---|---|
| **GUI** | Windows 10 or later |
| **USB API DLL** | Windows 10 or later |
| **USB Control** | USB C |

## GUI - GRAPHICAL USER INTERFACE FOR WINDOWS




**Devise Enclosure**

Mechanical Dimensions



# REVISION HISTORY

## Revision 1.0

January 13, 2026

- Initial Release

## IMPORTANT NOTICE AND DISCLAIMER



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