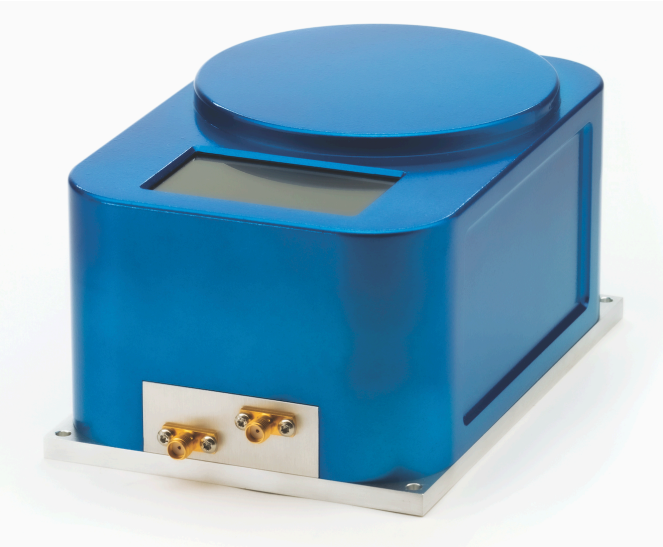
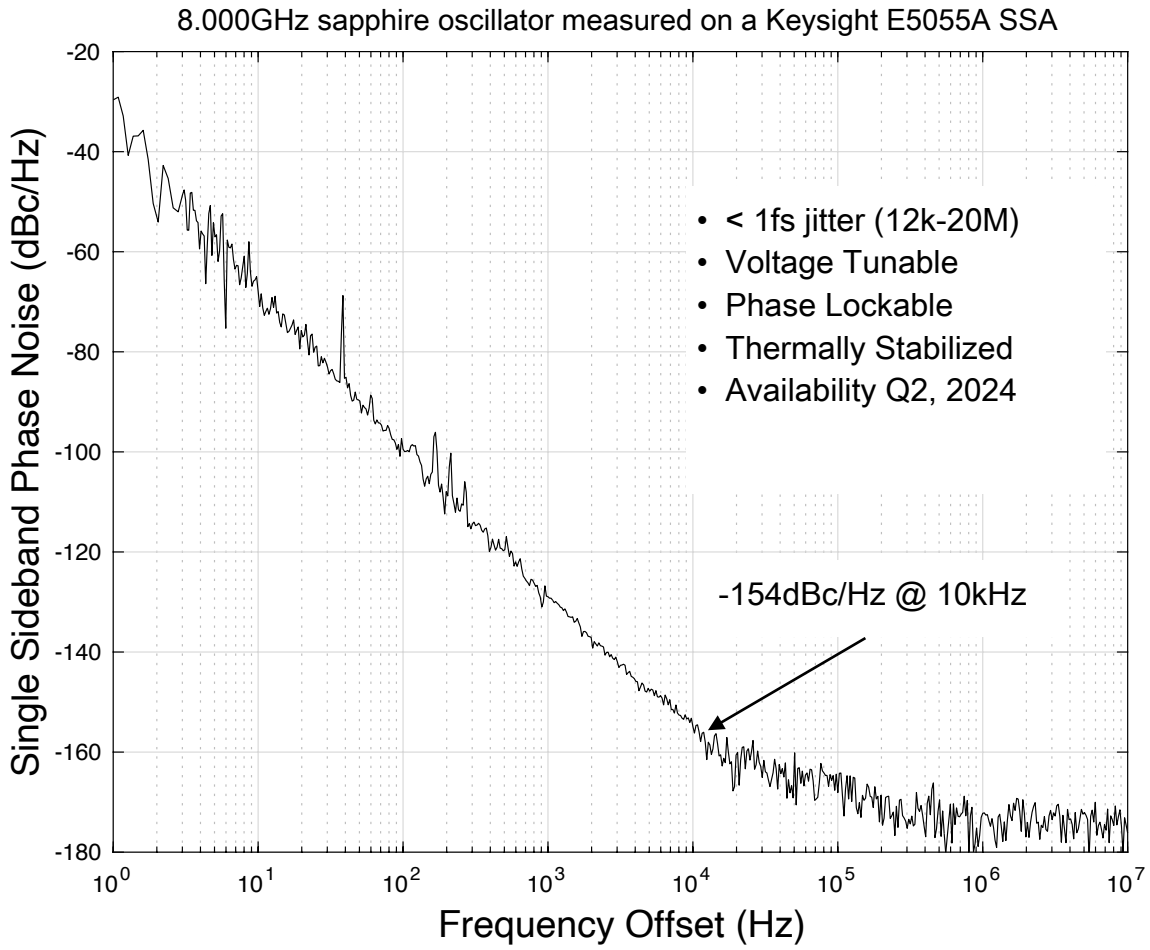
saetta labs

Sapphire Loaded Cavity Oscillator

datasheet

- State of the art ultra low phase noise ‘whispering-gallery’ mode oscillators.
- Fundamental operation at 8.0-12.0GHz. Phase noise improvement of 20-40dB compared to the best multiplied quartz-based oscillators.
- Integrated phase locking to external 10MHz with lock-detect.
- Voltage Tune Port.





Specifications

Frequency	8.00, 10.00, 10.24, 12.00 GHz (std) Inquire about additional frequencies
Accuracy	±1ppm (free running) Accuracy matches reference when phase locked
Output Power	13dBm ±2dBm, 50Ω, SMA Connector
Phase Noise @ 8.000GHz	-70dBc/Hz @10Hz -100dBc/Hz @100Hz -130dBc/Hz @1kHz -154dBc/Hz @10kHz -170dBc/Hz @100kHz -175dBc/Hz @1MHz
Voltage Tune	±1ppm, 0V to 10V (5V Nominal) 5kΩ Input Impedance
Reference Input	10MHz External Input -5dBm to +10dBm, 50Ω input, SMA Connector
Operating Temp	0C to +40C (case temp)
DC Power	+12V DC, SMB connector ~6W nominal (0.5Amps), ~30W Warmup (2.5Amps)
Dimension	158mm (L) x 108mm (W) x 81mm (H) @ 8GHz
Weight	1kg

Overview

Sapphire loaded cavity oscillators were first developed in the late 1990's. Most applications to date have been laboratory designs at cryogenic temperatures where Q-factor and stability are optimized for frequency transfer standards. Saetta Labs has developed a thermally stabilized sapphire cavity oscillator for use at room temperatures (0C to 40C). The unique design prioritizes unparalleled low phase noise, unit to unit repeatability and ease of integration. The case is an integrated thermal management system. It is designed to fit within a 2U chassis.

Sapphire is the lowest loss dielectric available. The 'whispering-gallery' mode bounds the microwave resonance to within the dielectric only, removing the Q-factor limitations of a traditional air or dielectrically loaded metal cavity. The fundamental microwave frequency design simplifies the architecture and need for complex frequency multiplication from lower frequency quartz based sources and the necessary filters and additional phase locked loops. The SLCO simply outperforms any other oscillator technology when phase noise is the critical specification.

Operational Modes

There are two modes of operation, auto-detected.

Free-running The oscillator is stabilized to within 1ppm of the internal 10MHz and the reference input is a voltage input for fine electrical tuning. Two SLCO's can be phase locked to each other in this mode for phase noise characterization.

Phase locked When a 10MHz reference is applied with the correct power and frequency, the oscillator will stabilize then lock to the external reference automatically.

The reference input is a multiplexed port. It is internally duplexed to a DC input of 5kΩ for the voltage tune and 10MHz AC coupled to 50Ω. The duplexed port used depends on the mode of operation. The mode of operation is selected automatically by the presence of an in-spec 10MHz external reference.

Digital IO

A 6 pin digital header is available with the following pinout.

Pin	Signal	Description
1	/RST	Active low reset of the oscillator, will power down the entire oscillator
2	+3.3V	VDD of internal processor and digitally IO, limited power available
3	GND	Connected to chassis GND
4	TX	Internal UART TX, connect to host RX
5	RX	Internal UART RX, connect to host TX
6	/LD	PLL Lock detect, active low. Open drain. Unlocked = 3.3V, locked = 0V

Display

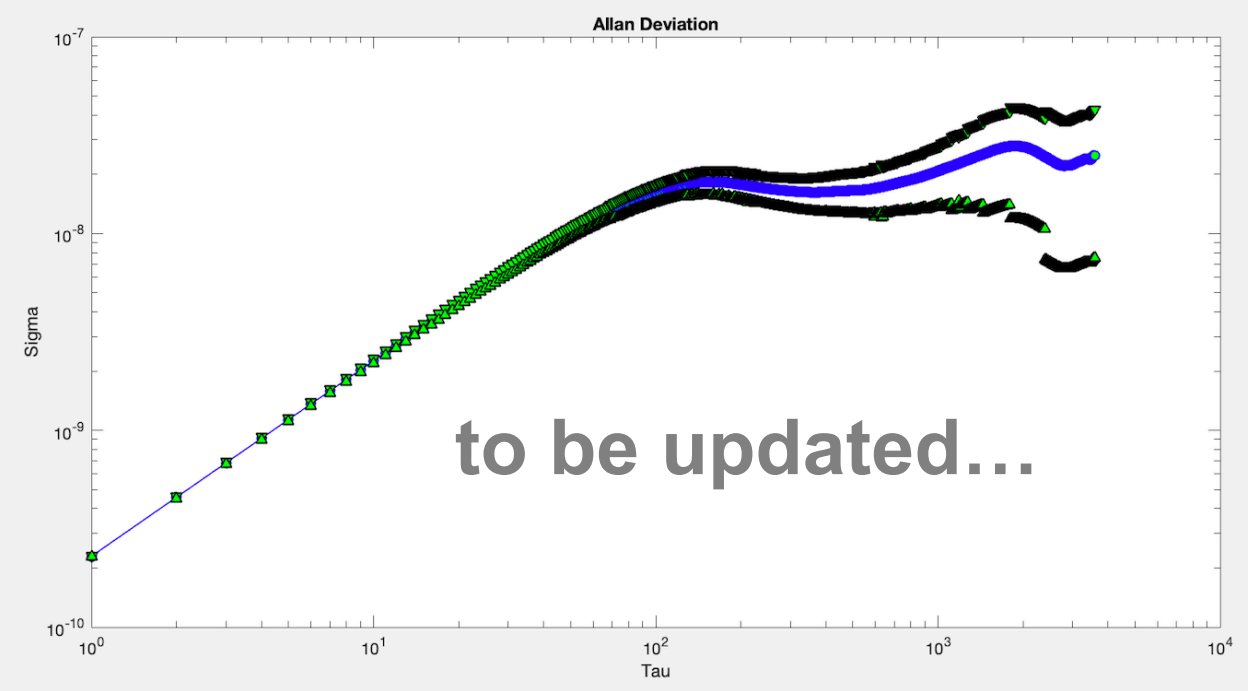
A 240x400 graphic display shows the oscillator status including frequency tracking, mode of operation and lock status.

Calibration

The SLCO-8.000 requires no annual calibration unless specifically required by a customer. The calibration process is a ‘performance check’ only, no adjustment is required. The internal 10MHz may be ‘calibrated’ by the customer if required and is accessed via the UART interface. When phase locking the SLCO to an external 10MHz, the unit dynamically tracks the reference and any errors will be displayed.

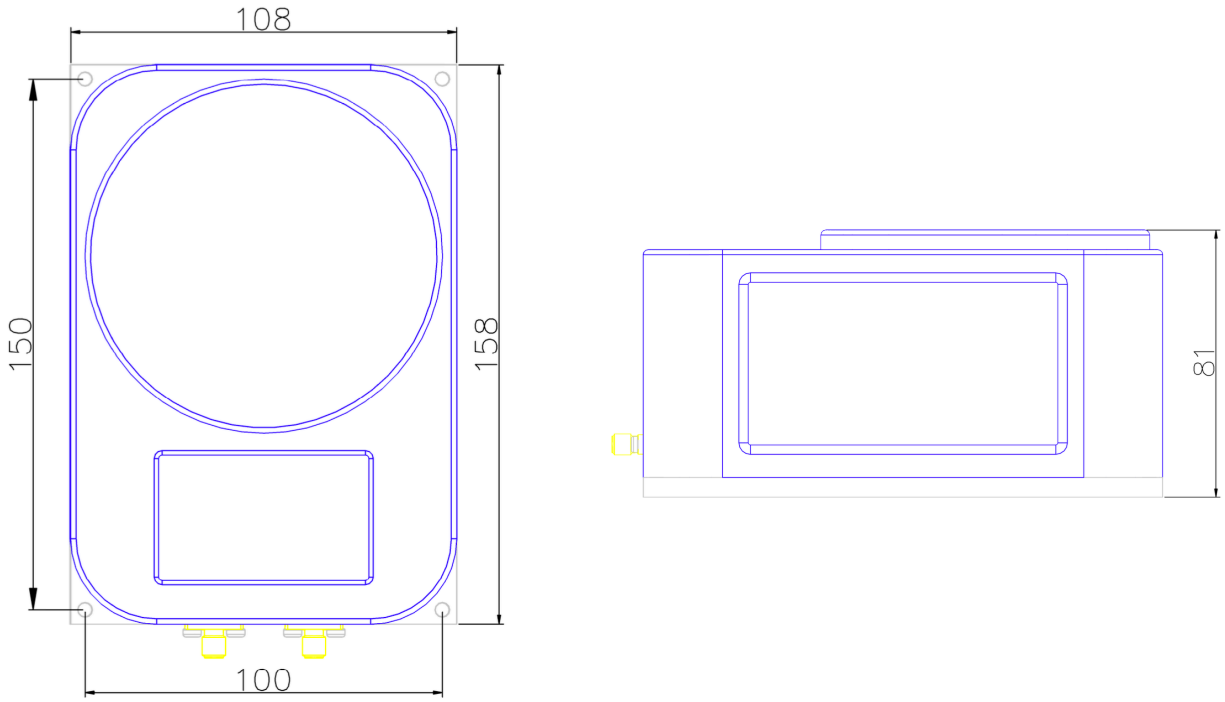
Stability - free running

The long term stability matches to within 1ppm of the internal 10MHz reference, holding typically to within about 100ppb.



8.00GHz sapphire oscillator measured on a Keysight E53230A Frequency Counter.
Free running - unlocked.

External Dimensions



All units in mm

Mounting holes are M4, 6.25mm tall

Oscillator should be thermally mounted for heat dissipation.

Warranty

Saetta Labs warranties all Sapphire Loaded Cavity Oscillators for 3 years from manufacturing defects.