FT-RCM-VPX

The FT – RCM VPX is the Rugged Conduction Cooled VPX 1.1" Module of the Dual Frequency Ultra-LowPhase-Noise 10MHz/100MHz Ref. board. Used as a local oscillator for RADAR & COMINT applications requiring ultra-low phase noise.

The RCM module offers dual isolated 100MHz Ultra-Low Phase-Noise outputs with +20.5dBm output power with a Phase Noise of only -100dBc/Hz at 10Hz offset from the 100MHz carrier, and a phase noise floor of -172dBc/Hz. The RCM module also offers an ultra-stable10MHz CMOS output, and complete handling of external 1PPS, 10MHz, and NMEA Time/Date signals making it perfect for Radar and synchronized EW applications and for phase-noise-filter applications for Rubidium or Cesium references.

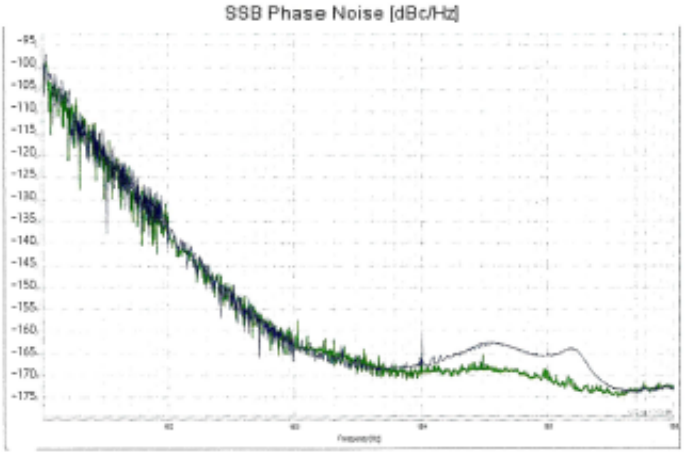
The RCM module allows external 10MHz or 1PPS signals to tightly phase-lock the internal oscillators to the optional external reference, filtering-out the phase noise in the process. The phase lock to an external 10MHz reference is near instantaneous, and allows generating 1PPS and 100MHz output signals with better than 2.5ns uncertainty and less than 250 Picoseconds rms wander on the 1PPS output versus the 10MHz reference input.

The RCM module contains a Double Oven SC-cut crystal oscillator (DOCXO) with ultra-low-g sensitivity (less than 0.3ppb per g per axis) which provides both low-tilt as well as low-vibration sensitivity, and a very low drift when an external reference is not connected. Drift rates of better than 0.5ppb per day are standard, and holdover drift performance of better than 4 microseconds for 24 hours can be achieved. Allan Deviation (ADEV) of 2E-012 for one second averages is typical.

The low-g 100MHz crystal oscillator is phase-locked to the 10MHz DOCXO and thus provides extremely good phase noise performance while also being disciplined by the high-stability 10MHz oscillator for improved close-in phase noise and ADEV performance.

This setup allows exceptional typical performance of down to -75dBc/Hz at 1Hz, -100dBc/Hz at 10Hz, and -130dBc/Hz at 100Hz offset from the 100MHz carrier as well as a **phase noise floor of -172dBc/Hz**.

The high-isolation/high-output power of the dual 100MHz outputs allows direct connection to typical Harmonic Comb Generators without requiring external amplifiers, or directly driving external passive splitters.



The RCM module provides complete handling of 1PPS signals with 2.5ns resolution allowing 1PPS generation phase-locked to the 100MHz output even in the absence or failure of the external 1PPS or 10MHz references. In the event of an external 10MHz reference failure the RCM module provides auto-switching from the external 10MHz to the external 1PPS reference, and finally into a crystal-compensated holdover flywheel state should both external references fail.

GPS receivers can be directly connected to the RCM module for disciplining via the 1PPS input. The RCM module contains a Real Time Clock driven by the ultra-stable DOCXO that can maintain time and date with typically better than 4us precision per day in holdover mode, and generates 1PPS signals in NMEA format for easy integration into legacy systems. SCPI commands controls the RCM module via the internal RS-232 port. The RCM module runs from a +12V power supply, operates from -40C to +85C.

RCM SPECIFICATION:

- Long-Term Oscillator Aging (without ext. reference - zero aging with ref): Less than 0.3ppb per month in Holdover without GPS
- Frequency Stability Over Temperature (in holdover): Better than ±0.25E-09 -25°C to +75°C)
- 1 PPS input to output capture resolution: ±2.5ns
- Frequency Accuracy to external 1 PPS reference:Better than ±3E-010 after 15 minutes after power-on
- Holdover Drift (after 7 days with external reference): <±5us over 24 Hour Period @+25°C
- Auto Reference-switchover and Holdover: 10MHz priority, 1PPS auto-fallback or manual, OCXO Flywheel Holdover
- 100MHz ADEV (versus external 10MHz reference): 1s: <1E-12, 10s: <2E-13, 100s <3E-14
- 100MHz ADEV (versus external 1 PPS reference): 1s: <5E-12, 10s: <3E-11, 100s <3E-11, 1Ks: <8E-12, 10Ks: <1E-12
- 10UMHz to 10MHz phase jitter/wander: <200ps rms
- 1 PPS Outputs (OCXO Flywheel Generated): Two outputs, 3.3V CMOS synchronized to 100MHz phase
- 1 PPS output to 100MHz uncertainty: <±250ps rms
- External to internal 1PPS synchronization counter resolution: ±2.5ns
- 1 PPS Output unit to unit uncertainty with common 10MHz ext reference: ±2.5ns
- 10MHz Output: 1x 5V CMOS 10MHz [Optional feature of the VPX module]
- 100MHz Outputs: 2x Sine Wave +20.5dBm ±1dbm
- RS-232 Control: Full SCPI-99 Control Commands at 9.6K, 19.2K, 38.4K, 57.6K, 115.2K
- RS-232 NMEA Output Sentences (with time/date preset): NMEA 0183 rev. 2.3, Sentences: GGA, RMC, ZDA, PASHR
- TTL Alarm and Built-In Self-Test (BIT) Output: Oscillator Unlock, Soft- and Hard-Alarm, and Power Supply Failure Alarm
- Warm Up Time / Stabilization Time Without ext. reference: <7 min at +25°C to <1ppb accuracy Typ.
- Lock time to external 10MHz reference: <3 seconds warm, <5 minutes cold-start at +25°C

- Phase Noise :
- g-sensitivity: <0.3ppb per-g per-axis
- MTBF: > 500,000 Hours (at +60°C)
- Supply Voltage (Vdd): 11.0V to 14VDC (12V nominal)
- Power Consumption: <5.8W at +25°C at 12V VDD, 12W warmup for less than 5 min.

Offset	10MHz	100MHz
1Hz	<-90dBc/Hz	<-70dBc/Hz
10Hz	<-125dBc/Hz	<-98dBc/Hz
100Hz	<-145dBc/Hz	<-128dBc/Hz
1KHz	<-150dBc/Hz	<-153dBc/Hz
10kHz	<-150dBc/Hz	<-160dBc/Hz
100kHz	<-150dBc/Hz	<-165dBc/Hz

RCM – RUGGED ENVIRONMENTAL SPEC.

Temp - Conduction cooled at card lock surface Operating –full performance Fully operating, slightly degraded performance Operating, no damage conditions Storage	 +30°C to +70°C 0°C to +80°C -20°C to +85°C -40°C to +85°C
VIBRATION	MIL-STD-167-1, max. frequency of 33 Hz.
MECHANICAL SHOCK	MIL-STD-810F, Method 516.5, Procedures I, V. 20 g, 11 mSec, saw tooth wave form
THERMAL SHOCK	MIL-STD-810, Method 503, Procedure II. Temperature changes from -20°C to +85°C.
HUMIDITY	MIL-STD-810F, Method 507.4. up to 95% relative humidity condensing
SALT SPRAY	In accordance with MIL- STD-810F, Method 509.4 5% Salt, 35°C, 24 hours exposure
FUNGUS	Fungus inert materials shall be used per Guideline 4 of MIL-HDBK-454
Prohibited Material	Prohibited materials shall be in accordance with MIL-HDBK-2036 section 4.12.1.
EMC	MIL-STD-461E. CE102; CE106, CS114; CS115, CS116, RE102; RS101, RS103, and CS101.

- **Connectors:**
  - J1 – MDM multi-pin connector, DC & BIT
  - J2 – 100MHz output signal
  - J3 – 1PPS input signal
  - J4 – 10MHz input signal
  - J5 – 100MHz output signal
- **BIT indication (pulling)**
  - 10MHz input
  - 1PPS input
  - 1PPS output (Buffer sampling)
  - Power BIT (wired or for all power voltages)
  - 100MHz PLL Lock BIT
- **Mechanical Construction:**
  3U module: outline dimensions:
  161.7 x 100 x 27.9 mm including connectors

Ordering No.	Description
PSAGOT-G---XO—1P-M-N	G=internal GPS ; ----XO =type of Oscillator; -1P=type of 1PPS output: T1P for TTL, R1P for RS422, C1P for CMOS; M=10Mhz output; N=100MHz output
PSAGOT-DOCXO-T1P-N	High stability DOCXO, TTL 1PPS interface, 100MHs Low phase noise output
Additional options are available upon request	