

Master Reference Oscillator - NewSpace

The NewSpace Master Reference Oscillator (MRO) is a unit which generates and distributes highly stable and reliable frequency signals. It is specifically designed for telecommunications, navigation and earth observation applications where frequency stability, ultra-low phase noise and low power consumption are crucial. This MRO is suitable for LEO (Low Earth Orbit) and MEO (Medium Earth Orbit) constellations as well as small GEO (Geostationary Earth Orbit) satellites with a lifetime up to 12 years.

It provides up to 16 outputs with highly stable frequencies from 10 MHz to 240 MHz. These signals are generated from an ultra-stable oscillator, allowing the MRO to achieve a long-term stability of ± 200 ppb over a 12-year lifetime. This stability can be improved to ± 20 ppb over 12 years by using the optional Pulse Per Second (PPS) input, which disciplines the oscillator with GNSS signals. Advanced algorithms are implemented to ensure smooth synchronisation while avoiding any glitches or jumps in the frequency.

The unit is Single Point Failure (SPF) free, with nominal and redundant functions fully isolated from each other. It can be used in cold and hot redundancy. The MRO includes a DC/DC converter, On/Off telecommands, PPS input, a UART/CAN communication bus and all telemetry necessary for reliable monitoring. The MRO is based on a modular architecture to ease assembly and integration. It also allows easy customisation to answer specific needs.

Product assurance is implemented according to the highest NewSpace quality standards. Each component is selected based on AECQ-100/200. Active components are tested in radiation for each lot. PCBs are manufactured and assembled by a qualified EMS with experience in mega constellations.

The NewSpace MRO is part of Rakon's NewSpace Equipment portfolio which includes timing and frequency distribution products, GNSS receivers and S-Band communication devices for NewSpace constellations.

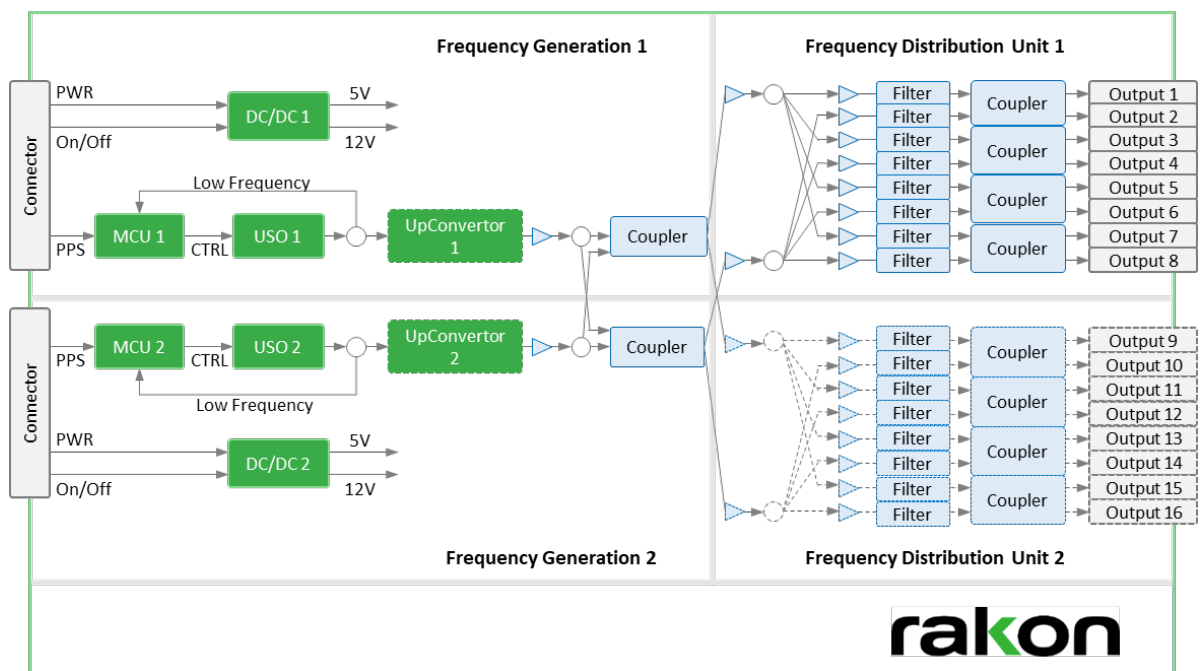
Key Features

- Output frequency: 10 MHz to 240 MHz
- Overall frequency stability:
 - ±200 ppb for 12 years (free run)
 - ± 20 ppb for 12 years (disciplined)
 - Output power: 0 - 10 dBm
- Typical phase noise @100 MHz:
 - 105 dBc/Hz (@10Hz)
 - 125 dBc/Hz (@100Hz)
 - 145 dBc/Hz (@1kHz)
 - 160 dBc/Hz (@floor)
- Up to 16 outputs
- Power bus: 28 V
- Communication interface: UART / CAN
- Mass: 3 - 3.5 kg
- Power consumption: 13 – 16 W
- Connectors:
 - Frequency output: SMA
 - Power & TM/TC: SubD

226 x 120 x 105 mm



Block Diagram



Environmental Conditions

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Non-operating temperature		-55		85	°C
Operating temperature	Qualification	-35	25	65	°C
	Acceptance	-30		60	°C
Random vibration	20 Hz - 100 Hz:		+9		dB/octave
	100 Hz - 500 Hz:		0.5		g ² /Hz
	500 Hz - 700 Hz:		-3		dB/octave
	700 Hz - 2000 Hz:		-9		dB/octave
	Overall:		20.16		grms
Sine vibration	20Hz – 100Hz:		20		g
Mechanical shock	SRS (Q=10)				
	100 Hz:		20		g
	2000 Hz:		2000		g
	10000 Hz:		2000		g
Radiation	Total Total Ionizing Dose (TID):		50		kRad
	Linear Energy Transfer (LET):		43		MeV·cm ² /m g
Lifetime	Up to 12 years				

Performances

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Nominal frequency F_N		-	100		MHz
Overall frequency drift	EOL (12 years / including aging, radiation, initial accuracy, temperature) free run	-	±300	±500	ppb
Frequency variation vs. temperature	Temperature slope 0.3°C/min & Under vacuum	-	±1	±5	ppb
Frequency warm up	At low temperature, low supply voltage & under vacuum	-	-	20	min
Output waveform	-	Sine			-
Output power level	EOL (12 years)	+10	-	+12	dBm
Harmonics level	DC to 10x F_N	-	-	-40	dBc
Spurious level	100 Hz to 5 GHz	-	-	-100	dBc
Phase noise @100 MHz	1 Hz offset		-85	-80	dBc/Hz
	10 Hz offset		-105	-100	
	50 Hz offset		-105	-100	
	100 Hz offset		-130	-125	
	1 kHz offset		-155	-155	
	10 kHz offset		-160	160	

Physical Parameters

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Dimensions	8 outputs: 226 x 121 x 115 mm 16 outputs: 226 x 137 x 115 mm				
Mass	8 outputs 16 outputs		3 3.5		kg
Power consumption	Cold redundancy, 8 outputs		13	15	W
	Cold redundancy, 16 outputs		16	18	W
	Hot redundancy, 8 outputs		22	25	W
	Hot redundancy, 16 outputs		25	28	W

Testing

Test	Condition / Remarks	Qualification testing	Acceptance testing
Functional		✓	✓
Vibration		✓	✓
Mechanical shocks		✓	–
Thermal cycling		✓	✓
Thermal vacuum		✓	–

Product Outline

