

NewSpace MRO

The NewSpace MRO (Master Reference Oscillators) is a piece of modular equipment for applications requiring high stability and reliable signal. It is a part of Rakon's NewSpace Equipment series suitable for Low Earth Orbit (LEO), Small GEO satellites and satellite constellations with a lifetime guarantee of up to 12 years.

The NewSpace MRO is specifically designed for LEO broadband, GNSS and Earth Observation applications where precision frequency stability, ultra-low phase noise and low power consumption are crucial. It achieves a highly stable long-term frequency stability of ± 200 ppb over 12 years. Frequencies are available from 10 MHz to 1 GHz with up to two different output frequencies. For applications need higher frequencies from 1 up to 30 GHz, our Master Local Oscillators (MLOs) are compatible with the high-end frequency spectrum.

The current baseline includes an integrated DC/DC converter, which allows the clock to be powered directly from the primary satellite bus, an ON & OFF TM/TC and two outputs @10 and 100 MHz. The key functions of synchronising to a GNSS 1PPS signal, frequency distribution and electronic frequency control have been qualified. These features can be optionally integrated to customise the MRO according to application configurations. Testing and screening flows can be tailored according to customer requirements to reduce cost and lead-time.

Key Features

- Output frequency: 10 MHz to 1 GHz
- Power bus: 28 or 50/75 V
- Typical phase noise @10 MHz
 - 110 dBc/Hz (@1Hz)
 - 137 dBc/Hz (@10Hz)
 - 150 dBc/Hz (@100Hz)
 - 158 dBc/Hz (@1kHz)
 - 160 dBc/Hz (@floor)
- Overall frequency stability: ± 200 ppb for 12 years

Baseline

- 4 outputs: 2x10 and 2x100 MHz
- Primary power bus: 28 V
- Integrated DC/DC converter
- On & Off TM/TC
- Connectors
 - SMA: output frequency
 - Micro-D 9: Power & TM/TC
- Output power: 0 – 2.5 dBm
- Isolation between: 2 outputs > 30 dB

Options

- Power bus: 50/75 V
- Up to 4 outputs per FDU
- Digital electronic frequency control
- Overall frequency stability: ± 20 ppb for 12-year via sync. to the 1PPS

190 x 120 x 85 mm



Environmental Conditions

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Operating temperature	TO _P	-25	25	60	°C
Non-operating temperature	Qualification	-30		63	°C
Random vibration	Level as per MIL-STD-202, Method 214, Condition K (46.3 grms)				
Sine vibration	Level as per MIL-STD-202 Method 204, Condition D (20G)				
Mechanical shock	Level as per MIL-STD-202, Method 213, Conduction F: Half sine with a peak acceleration of 1500 g for a duration of 0.5 ms				
Radiation	Total Ionizing Dose (TID) of 40 kRad, low dose rate (36 to 360 rad/h) No SEL up to LET = 43 MeV/mg/cm ²				
Lifetime	Up to 12 years				

Budgets and Package

Parameter	Condition / Remarks
Mass	3 000 g (about 900 g per module)
Package	W x L x H: 190 x 120 x 85 mm for 4 outputs
Power	10 W (MRO configuration with 4 outputs)

Typical Performance Characteristics

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Nominal frequency			10		MHz
Steady state input current power	Vacuum @+20°C			7	W
Warm up supply power	Vacuum, EOL @-30°C			10	W
Overall frequency drift	EOL (12 years)			±0.2	ppm
Frequency variation vs. temperature				±TBC	ppb
Frequency warm up				10	mn
Output waveform	Sine				
Output power level	EOL (12 years)	0		+2.5	dBm
Harmonics level				-40	dBc
Spurious level	100 Hz to 5 GHz			-110	dBc

Phase Noise

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Phase noise @10 MHz	1 Hz offset		-110		dBc/Hz
	10 Hz offset		-137		
	100 Hz offset		-147		
	1 kHz offset		-155		
	10 kHz offset		-160		

Product Outline

TOP VIEW

FRONT VIEW

SIDE VIEW

Note:

- Unit = mm; Tolerance = ±5 mm
- Component selection according to Rakon standard and approved by CNES, based on AECQ-100/200 components
- The PCB assembly performed by EMS is already qualified for mega constellations
- Active components guaranteed against radiation before assembly