

RK409RBNS

The RK409RBNS is a high-reliable NewSpace Ultra-Stable Oscillator (USO) specifically designed for applications that require Rubidium (Rb) Atomic Clock level performance. Designed for mission-critical environments, it ensures exceptional performance in spacecraft systems, telecommunications, Low Earth Orbit (LEO) missions, and Precision Navigation and Timing (PNT) payloads.

The RK409RBNS USO serves as a master reference at Rubidium clock level, ensuring precise timing and phase error control. It delivers exceptional short-term and long-term stability:

- Ultra-low Allan Deviation (ADEV), ppt-class short-term stability: $1.5\text{E-}13$ ($\tau = 1\text{s}$), $3\text{E-}12$ ($\tau = 10,000\text{s}$)
- Frequency vs. Temperature (FvT): ± 0.25 ppb across -20°C to $+50^\circ\text{C}$ operating range
- Long-term ageing stability: ± 100 ppb over 5 years

Engineered for robustness, the oscillator employs discrete component technology, with all parts surface-mounted except for the crystal, which uses lead connections to enhance mechanical integrity and vibration resistance. This design ensures reliability under the harsh conditions of space deployment. The RK409RBNS supports output frequencies from 4.5 to 20 MHz, operating as a standalone unit powered directly by the spacecraft bus. It provides a highly stable RF output without requiring additional conditioning electronics.

Features

- Frequency (F_n): 4.5 to 20 MHz
- Allan Deviation (ADEV): $2\text{E-}13$ at $\tau = 1\text{s}$, $3\text{E-}12$ $\tau = 10,000\text{s}$
- Frequency stability (FvT): $\leq \pm 0.25$ ppb
- Long-term ageing: $\leq \pm 100$ ppb over 5 years at 10 MHz
- Warm-up consumption: ≤ 8 W
- Supply voltage: 12 V
- Output waveform: sine 50 Ω
- Output level from 3 to 6 dBm
- Weight: 250 g max.
- TID Limit: 30 krad
- Latch-up free up to LET: $43 \text{ MeV.cm}^2/\text{mg}$

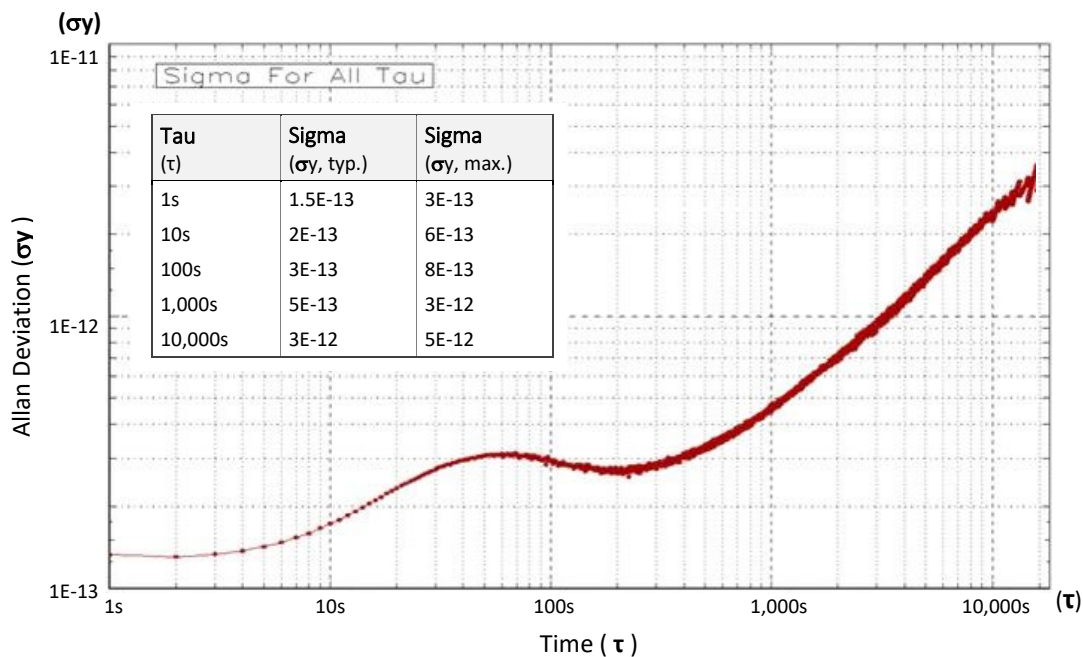
Applications

- Spacecraft systems
- PNT
- Earth Observation
- Navigation

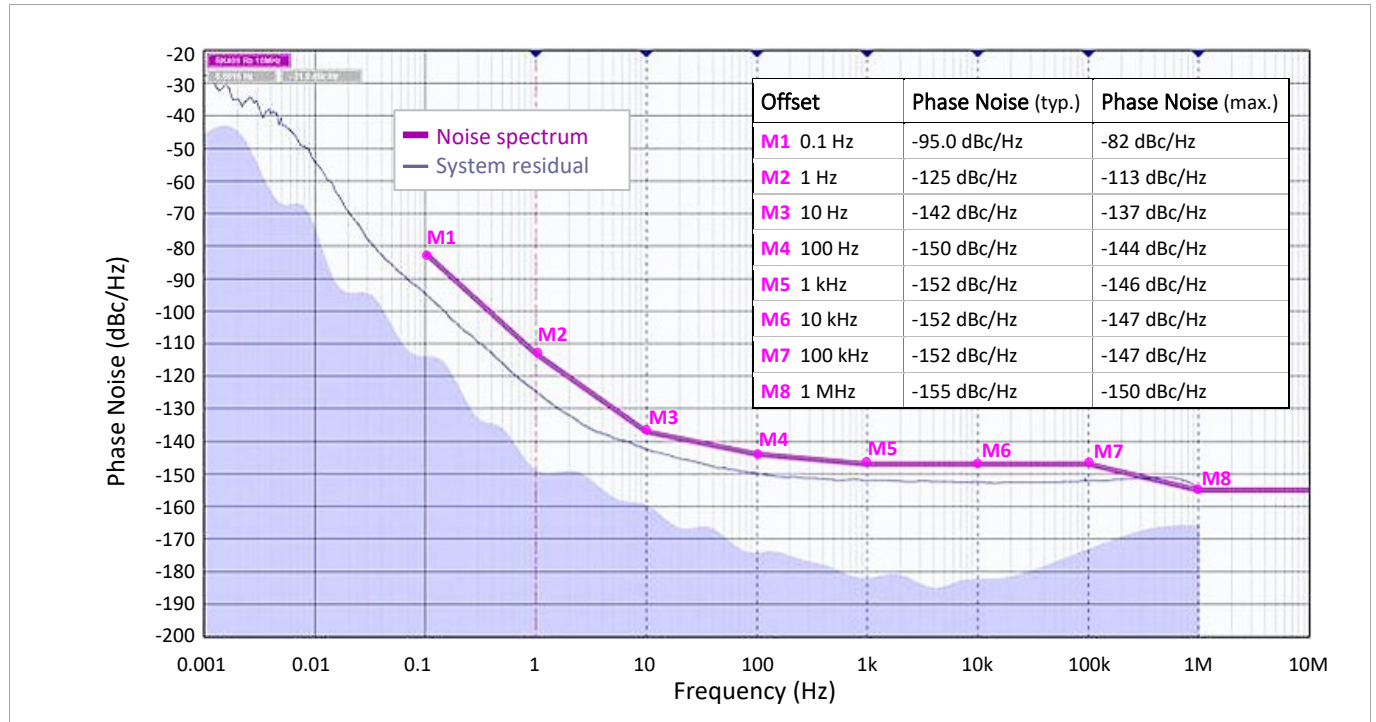
60 x 60 x 32 mm



Allan Deviation (ADEV)



Phase Noise



Environmental Conditions

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Operating temperature (TOP)	-	-20	25	+50	°C
Switch-on temperature (Tso)	-	-35	25	+70	°C
Qualification temperature (TQOP)	-	-25	25	+55	°C
Non-operating temperature (TNOP)	-	-40	25	+85	°C
Sine vibration	MIL-STD-202 Method 204. Acceptance level:	- 5Hz: 0.55 g (11 mm) - 21-200Hz: 20 - Sweep rate: 20 oct/min up & down			
Random vibration	MIL-STD-202 Method 214. Acceptance level:	- 20Hz: 0.14 g ² /Hz (+3 dB/oct) - 100-400Hz: 1 g ² /Hz - 2000Hz: 0.14 g ² (-3 dB/oct) - Global level: 26.35 grms - Duration: 60 s/axis			
Mechanical shock	MIL-STD-202 Method 213. Test conditions:	- Waveform: Half-sine - Acceleration: 1200 g - 2000Hz: 0.14 g - Duration: 0.3 ms - Number of shocks: 1 per direction			
Radiation	Total Ionizing Dose (TID) is 30 krad, with a low dose rate 36-360 rad/h. No SEL up to LET = 43 MeV.cm ² /mg				

Electrical Interface

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Power supply (V_{CC})	-	11.4	12.0	12.6	V
Reference voltage (V_{REF})	-	7.5	8	8.5	V
Reference voltage load current (I_{REF})	-			1	mA
Telemetry (TM)	-			8.5	V
Telemetry load current (TM_{LOAD})	-			1	mA
RF output load impedance	VSWR ≤ 1.1	45	50	55	Ω

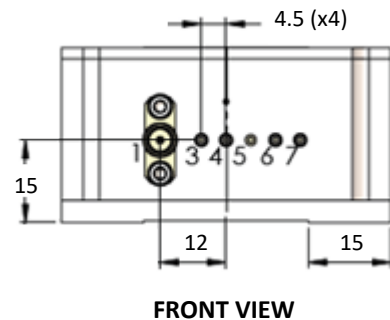
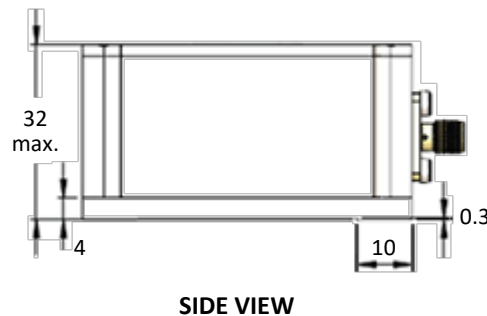
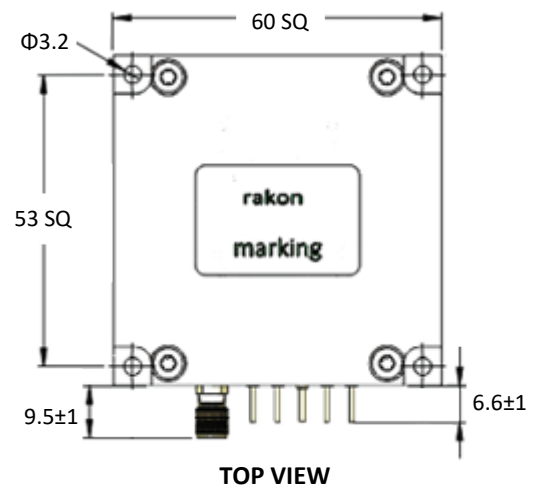
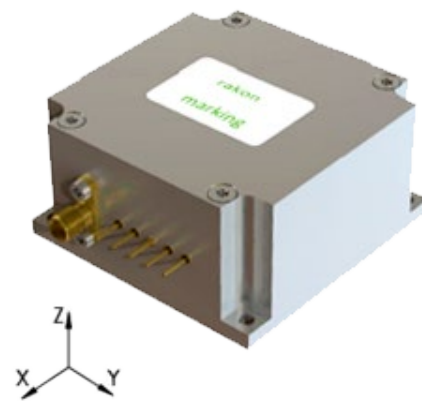
Frequency Characteristics

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Standard frequency (F_n)	Custom option available on request	4.5	5, 10	20	MHz
Steady-state input current power	Vacuum @ -20°C	-	-	5	W
Warm-up supply power	-	-	-	8	W
Initial frequency accuracy	-	-	-	± 100	ppb
Frequency stability over temperature	-	-	± 0.1	± 0.25	ppb
Supply voltage stability	Over operating temperature	-	-	± 0.1	ppb
Load sensitivity	Over operating temperature	-	-	± 0.1	ppb
Pressure	-	-	-	± 40	ppb
Ageing	Over 1 year Over 5 years	-	-	± 20 ± 100	ppb
Allan deviation (ADEV)	$\tau = 1$ s $\tau = 10$ s $\tau = 100$ s $\tau = 1\,000$ s $\tau = 10\,000$ s	-	2.5 3.5 6 20 30	3 6 8 30 50	E-13
Frequency warm-up	Vacuum @ -20 °C	-	-	30	mn
Output waveform	Sine	-	-	-	-
Output level	EOL	3	-	6	dBm
Harmonics / Sub-harmonics level	From DC to 500 MHz	-	-	-40	dBc
Non-harmonics level	From DC to 3 GHz	-	-	-90	dBc
Phase noise	0.1 Hz offset	-	-85	-82	dBc
	1 Hz offset	-	-117	-113	dBc
	10 Hz offset	-	-140	-137	dBc
	100 Hz offset	-	-146	-144	dBc
	1 kHz offset	-	-148	-146	dBc
	10 kHz offset	-	-150	-147	dBc
	100 kHz offset	-	-150	-147	dBc

Model Outline and Pin Connections package

Parameter	Package	Pin #	Connections	
Package and pin connection	Pin-through hole (PTH) Size: 60 x 60 x 32 mm	1	SF	RF output
		3	TM	Telemetry
		4	VREF	Reference voltage
		5	VCCOVEN	Oven supply voltage
		6	GND	Electrical & mechanical ground
		7	VCCRF	RF supply voltage

Model outline



NOTE: All dimensions are in mm, and have a general tolerance of ± 0.1 mm.

3D Step File

Parameter	Package
Net weight	Typical: 250 g max.
STEP file	RK409RBNS 3D model To open or view the STP file, you will need to import it into one of the following software programs: Autodesk Fusion 360, CATIA, SolidWorks, Solid Edge, TurboCAD, Kubotek KeyCreator, FreeCAD, ABViewer, ShareCAD, or eMachineShop.

Ordering Part Example

