

Space Passive Component Days - 2016



Frequency Control Solutions for Space

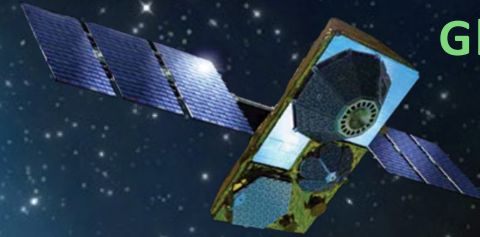
Long History of High Reliability Solutions for Space

rakon

Sentinel



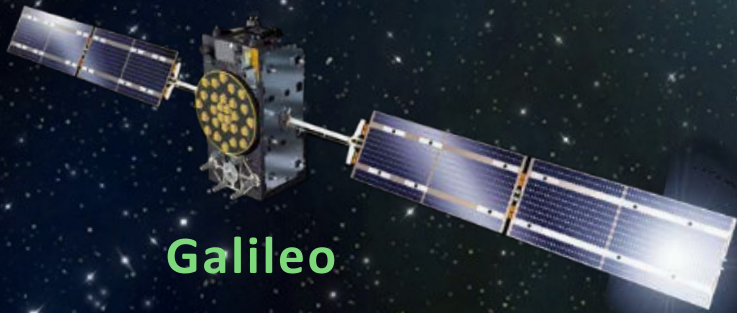
Globalstar



Rosetta



Galileo



ATV



Images: ESA

RAKON PRODUCTS CAN BE FOUND IN MANY INTERNATIONAL PROGRAMMES

Alphabus, AMOS, ATV, BepiColombo, CBERS, Cryosat, Chandrayaan, DORIS, ELISA, ENVISAT, Galileo, Globalstar, Herschel-Planck, Himawari, HTV, Iridium, Jason, JUNO, LEOStar, Mars Express, METOP, MTG, O3B, PARASOL, PLEIADES, Rosetta, SARAL, SAR-Lupe, Syracuse, Sentinel, Spacebus, SPOT, SWARM, KOMPSAT, Spacebus, EarthCARE, EgyptSat, PRISMA, SATCOM, SeoSar, TanDEM-X, THEOS and Venus Express

Space Solutions



CRYSTAL RESONATORS	CRYSTAL FILTERS	XO	VCXO	TCXO	OCXO	USO
						

APPLICATIONS: SATELLITES (NAVIGATION, TELECOM, SCIENTIFIC, OBSERVATION), EXPLORATION PROBES, TRANSPORTATION VEHICLES AND GROUND STATIONS

Rakon Space Product Advantages



RAKON OFFERS THE FULL LINE OF SPACE PRODUCTS FROM CRYSTALS TO XO, VCXO, OCXO AND USO

◀ Rakon space grade oscillators (FMs) are designed to meet

- ◻ High-end radiation requirements (Radiation Tolerant)
 - TID of 100 kRad
 - Low dose rate (36 to 360 rad/h) as per ESCC22900
 - Latch-up free up to LET of 60 MeV/mg/cm²
- ◻ Low-end radiation requirements (Radiation Hardened)
 - TID < 72kRad
 - Low dose rate (36 to 360 rad/h) as per ESCC22900
 - Latch-up free up to LET of 32 MeV/mg/cm²

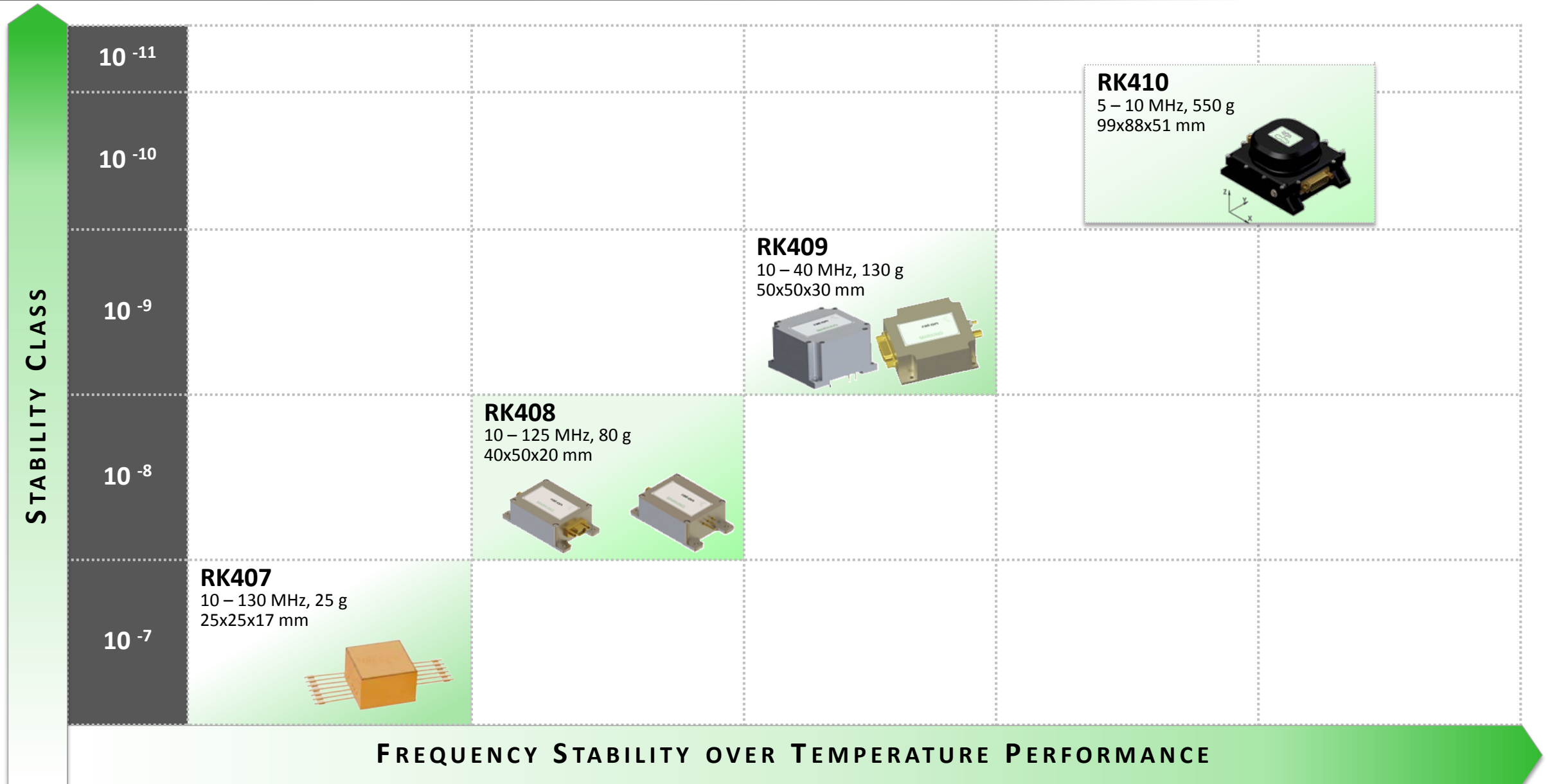
◀ Rakon is among the top worldwide suppliers of ultra stable OCXO for Space

- ◻ And the only one to supply it in package as small as 99 x 88 x 51 mm (3.898"x3.465"x2") and as light as 550 g max. (lightest competitor: 794 g)

◀ Rakon's mini-USO (Ultra Stable Oscillator)

- ◻ Provides frequency stability vs. temperature of ± 0.1 ppb (from -20 to +50 °C)
- ◻ Short-term stability (Allan variance) of below 2E-13 from 1 to 100 seconds

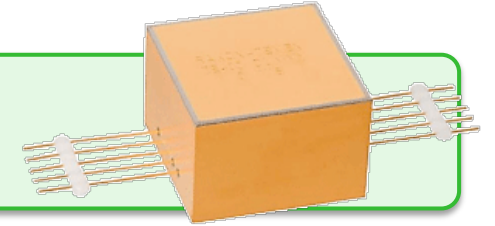
Space Grade OCXO Overview



RK407 – Space OCXO in 10^{-7} Stability Class



Reduces the gap between the performance of a TCXO and an OCXO



Customer Benefits

- ❑ Low consumption
- ❑ Compact
- ❑ Wide frequency range
- ❑ Tolerant to high level of shocks and vibrations
- ❑ Strong heritage
- ❑ Low noise

Application Benefits

- ❑ Where low consumption is required and TCXO stability is not sufficient
- ❑ Frequency conversion due to its low noise
- ❑ Where frequency is known at the last minute

Key Specifications

Parameters	Values
Frequency	10 to 130 MHz
FvsT	±0.25 ppm (-40 to 70 °C)
Consumption EOL	0.7 W
Ageing	±1 ppm / 18 years
Guaranteed Phase Noise @ 100 MHz	-90 dBc/Hz @ 10 Hz -150 dBc/Hz @ 10 kHz
Package Size	25 x 25 x 17 mm

RK408 – Space OCXO in 10^{-8} Stability Class



State of the art high frequency Ultra Low Noise reference



< Customer Benefits

- ❑ Compact
- ❑ Tolerant to high level of shocks and vibrations
- ❑ Wide frequency range
- ❑ Ultra Low Noise oscillator

< Application Benefits

- ❑ Where the lowest phase noise is required
- ❑ Radars
- ❑ Frequency conversion
- ❑ Very precise measurement

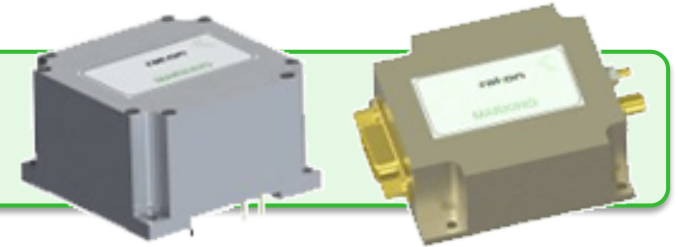
< Key Specifications

Parameters	Values
Frequency	10 to 125 MHz
FvsT	$\pm 30 - 60$ ppb (-40 to 70 °C)
Allan Variance	1×10^{-11} (1s)
Ageing	± 300 ppb / 18 years
Guaranteed Phase Noise @ 10 MHz	-130 dBc/Hz @ 10 Hz -165 dBc/Hz @ 10 kHz
Package Size	40 x 50 x 20 mm

RK409 – Space OCXO in 10^{-9} Stability Class



Entry-level USO: Very stable and compact reference



< Customer Benefits

- ❑ Compact and light
- ❑ Strong heritage
- ❑ High stability

< Application Benefits

- ❑ Where high stability is required
- ❑ Compact reference for MRO/FGU
- ❑ Precise measurement instruments

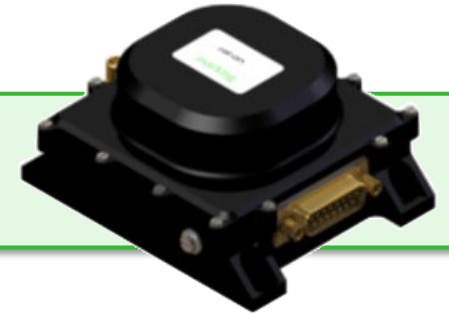
< Key Specifications (GP)

Parameters	Values
Frequency	10 to 40 MHz
FvsT	± 1 ppb (-20 to 70 °C)
Allan Variance	1×10^{-12} (1s)
Ageing	± 150 ppb / 15 years
Guaranteed Phase Noise @ 10 MHz	-135 dBc/Hz @ 10 Hz -155 dBc/Hz @ 10 kHz
Package Size	50 x 50 x 30 mm

RK410 – Space OCXO in 10^{-10} Stability Class



Mini-USO: State of the art in the short term stability domain



< Customer Benefits

- ❑ Compact and light
- ❑ Strong heritage with the previous generation in DORIS instrument
- ❑ Strong process heritage
- ❑ Joint development with CNES

< Application Benefits

- ❑ Where the highest short-term stability is required
- ❑ Reference for Highly stable FGU
- ❑ Very precise measurement

< Key Specifications

Parameters	Values
Frequency	5 to 10 MHz
FvsT	± 0.1 ppb (-20 to 50°C)
Allan Variance	Below $\pm 2 \times 10^{-13}$ (1 – 100s)
Ageing	± 100 ppb / 18 years
Guaranteed Phase Noise @ 10 MHz	-135 dBc/Hz @ 10 Hz -145 dBc/Hz @ 10 kHz
Mass	550 g max.
Package Size	99 x 88 x 51 mm

Thank you

rakon