

### Introduction

Rakon is one of the world's largest solutions providers of high reliability frequency control products. Its high reliability solutions are found in Space, Defence and Industrial applications which require the most stringent performance criteria. This is why many government and commercial programmes use Rakon oscillators across the globe, in systems where high performance is required under the most demanding conditions. Rakon continuously develops state of the art frequency control products at the cutting edge of innovative technology.

### Industry Contribution

- ◆ Rakon has a proven record of taking Space specifications and creating high reliability and cost effective solutions in order to meet the most demanding requirements.
- ◆ Rakon is involved in most of the scientific programmes managed by the European Space Agency (ESA), and has supplied ESA qualified crystals since the 1980s. Rakon develops new products & technologies under funding from ESA and CNES (French National Centre for Space Studies).
- ◆ As your strategic frequency control partner, Rakon can provide standard products or customised solutions, ranging from high performance crystals, all the way through to complex sub-systems.

### Space Product Advantages

- ◆ Rakon space grade oscillators (Flight Models) are designed to meet TID of 100 kRad, low dose rate (36 – 360 rad/h) as per ESCC22900 and latch-up free up to LET of 60 MeV/mg/cm<sup>2</sup>.
- ◆ Rakon is the top worldwide supplier of Ultra Stable OCXO for Space and ground applications. The mini Space USO (Ultra Stable Oscillator) offers a guaranteed frequency stability vs. temperature of 5E-11 (-20 to +50°C) and a short-term stability (Allan Standard Deviation) below 2E-13 from 1 to 100 seconds and below 8E-14 for the ground version.

### Space Product Range and Heritage

Rakon has a long history of providing high reliability products with some customers having an association with Rakon for 30 years or more. Rakon offers a complete range of ITAR-free frequency control products based on Space grade crystal technology.



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



# Hi-Reliability Products for Space



## Space Solutions

Rakon has an extensive portfolio of products with extreme capabilities. We have frequency control solutions for all types of spacecraft including: Navigation, Observation, Telecommunication Satellites, Transportation Vehicles and Exploration Probes.

| Crystal Resonators   | ESA/SCC 3501, MIL-PRF-3098 qualified | Crystal Filters  | Hi-Rel Space               |
|--|--------------------------------------|--|----------------------------|
| <b>Custom</b><br> <ul style="list-style-type: none"> <li>Crystals for ultra stable TCXOs and OCXOs in harsh environments.</li> <li>Frequency up to 140 MHz</li> <li>High stability and low ageing</li> <li>Low phase noise and low <i>g</i>-sensitivity</li> <li>Swept HQ crystal premium</li> </ul>  |                                      | <b>Custom</b><br> <ul style="list-style-type: none"> <li>A series of custom design crystal filters.</li> <li>Fundamental mode or overtone 3 and 5</li> <li>Frequency range: 3 to 150 MHz</li> <li>Relative bandwidth: from 0.001 up to 1 %</li> <li>Insertion loss: 2 to 8 dB depending on frequency, number of poles and width</li> </ul>  |                            |
| XO   | Hi-Rel Space and New Space           | VCXO   | Hi-Rel Space and New Space |
| <b>RK105</b><br><br><b>RK115</b><br><br><b>RK135</b><br> <ul style="list-style-type: none"> <li>Space grade products for MEO/GEO/HEO satellites, and radiation tolerant COTS products for LEO satellites/mega-constellations.</li> <li>RK105: 8 to 1500 MHz</li> <li>RK115: 10 kHz to 100 MHz. Following the guidelines of MIL-PRF-55310</li> <li>RK135: 10 kHz to 100 MHz. ESA standard</li> <li>Package: SMD, flat pack or DIP</li> <li>Size as small as 5.0 x 3.2 x 1.2 mm</li> </ul> |                                      | <b>RK205</b><br><br><b>TE200</b><br> <ul style="list-style-type: none"> <li>Space grade products for MEO/GEO/HEO satellites, and radiation tolerant COTS products for LEO satellites/mega-constellations.</li> <li>RK205: 8 to 1500 MHz</li> <li>TE200: 10 to 40 MHz</li> <li>Package: SMD or flat pack</li> <li>Pulling range: Up to <math>\pm 70</math> ppm</li> </ul>  |                            |
| TCXO   | Hi-Rel Space                         | OCXO   | Hi-Rel Space and New Space |
| <b>TE300</b><br><br><b>TE310</b><br> <ul style="list-style-type: none"> <li>Space grade products for Transponders, GPS Receivers, Converters, Synthesizers, FGU and Digital Boards.</li> <li>Frequency: 10 to 40 MHz</li> <li>Package size: 20.6 x 20.6 x 13 mm<br/>25.4 x 25.4 x 13 mm</li> <li>FvsT: <math>\pm 1</math> ppm (-20 to +70°C)</li> <li>Radiation hardness: 100 kRad</li> <li>Low weight: 20 g</li> <li>Low power consumption: 0.15 W</li> </ul>   |                                      | <b>RK406</b><br><br><b>RK407</b><br><br><b>RK408</b><br><br><b>RK409</b><br><br><b>RK410</b><br> <ul style="list-style-type: none"> <li>A wide range of Space grade OCXO with stability classes from <math>10^{-6}</math> to <math>10^{-10}</math>.</li> <li><math>10^{-6}</math> class: Overall FvsT <math>\pm 0.5</math> ppm (5y, -40 to +70°C). 25.4 x 25.4 x 127 mm, low power consumption 400 mW EOL</li> <li><math>10^{-7}</math> class: FvsT <math>\pm 0.25</math> ppm (-40 to +70°C), 25 x 25 x 17 mm, low weight 25g, low consumption 0.7 W EOL</li> <li><math>10^{-8}</math> class: FvsT <math>\pm 30</math> ppb (-40 to +70°C), guaranteed phase noise (for 10 MHz): -165 dBc/Hz @ 10 kHz</li> <li><math>10^{-9}</math> class: FvsT <math>\pm 1</math> ppb (-20 to +70°C), Allan Variance of <math>1 \times 10^{-12}</math> or better, ageing of <math>\pm 150</math> ppb / 15 years</li> <li><math>10^{-10}</math> class: FvsT <math>\pm 0.1</math> ppb (-20 to +60°C), Allan Variance of <math>5 \times 10^{-13}</math> or better, ageing of <math>\pm 100</math> ppb / 18 years</li> </ul> |                            |

## Ground Station Solutions

Rakon's Ground USO is ideally suited for the high stability frequency requirements of calibration and metrology laboratories, as well as other applications requiring high performance reference oscillators.

| High Stability OCXO  | $10^{-13}$ Short Term Stability | High Stability OCXO  | $10^{-14}$ Short Term Stability – State of the art |
|--|---------------------------------|--|--|
| <b>HSO13</b><br> <ul style="list-style-type: none"> <li>Frequency: 5 to 10 MHz</li> <li>Package size: 67 x 60 x 40 mm</li> <li>FvsT: <math>\pm 5 \times 10^{-11}</math> (0 to 50°C)</li> <li>Allan Deviation: <math>2 \times 10^{-13}</math> (3 – 30 s)</li> <li>Guaranteed phase noise @ 5 MHz: -125 dBc/Hz @ 1 Hz offset</li> </ul> |                                 | <b>HSO14</b><br> <ul style="list-style-type: none"> <li>Frequency: 5 to 10 MHz</li> <li>Package size: 73 x 135 x 84 mm</li> <li>FvsT: <math>\pm 5 \times 10^{-11}</math> (0 to 50°C)</li> <li>Allan Deviation: <math>8 \times 10^{-14}</math> (3 – 30 s)</li> <li>Guaranteed phase noise @ 5 MHz: -130 dBc/Hz @ 1 Hz offset</li> </ul> |  |

