

For this product, full and detailed specifications can be delivered on request.

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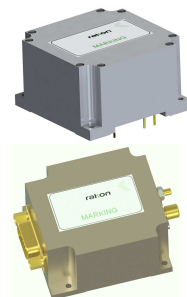
#### Product Description

This stable oscillator is designed for Space Clocks, Navigation and Positioning Systems and is used in such applications as GPS receivers, digital cards, board calculators, down and up converters, synthesizers.

The AV (Allan Variance) variant of the RK409 has a short term stability of  $6.10^{-13}$  at 1 s.

This frequency source is featured by remarkable overall frequency stability vs. temperature range up to  $\pm 0.5$  ppb under vacuum and  $\pm 20$  ppb per year.

The RK409 is available with different packages, in a small format (50x50x30mm) and is manufactured in accordance with MIL-PRF-55310 (Class 1, type 4 or type 6, level S or B).



#### Features

- Frequency Range: 10 MHz to 40 MHz
- Allan Variance @ 1s:  $6.10^{-13}$
- Supply Voltage: +12V or +15V
- Warm up consumption: 7 Watt
- Steady state consumption: 3 W under vacuum and 4W under atmospheric pressure
- Frequency stability vs. operating temperature range:  $\pm 0.5$  ppb under vacuum
- Ageing :  $\pm 150$  ppb over 15 years at 10MHz
- Output wave form: sine 50 Ohms
- Output level: from 2 to 10 dBm
- Component selected as per ECSS-Q-ST-60C
- Materials selected as per ECSS-Q-70
- Manufacturing in accordance with:
  - MIL-PRF-55310 (Class 1, type 4, level S or B)
  - ECSS-Q-ST-70-08C and ECSS-Q-ST-70-38C
- Weight: 125g (GP variant)/170g (AV variant)

#### Applications

- Transponders
- GPS receivers
- Navigation
- Converters

#### Heritage

- SPACEBUS 4000
- SATCOM
- HTV
- HIMAWARI

#### Specifications

##### 1. Environmental conditions

| Parameters                | Conditions/remarks  | Min | Nom | Max | Unit |
|---------------------------|---|-----|-----|-----|------|
| Operating Temperature     | Option A  | -5  | 25  | 60  | °C   |
|                           | Option B  | -20 | 25  | 70  | °C   |
|                           | Option C  | -40 | 25  | 70  | °C   |
| Switch-on Temperature     | TSo   | -40 |     | 85  | °C   |
| Non-Operating Temperature | TNOp  | -55 |     | 125 | °C   |
| Random Vibration          | Level as per MIL-STD-202, Method 214, condition I-J (46.30 Grms)  |     |     |     |      |
| Sine Vibration            | Level as per MIL-STD-202, Method 214, condition D (20 G)  |     |     |     |      |
| Shocks                    | Mechanical shock as per MIL-STD-202, Method 213, Condition E (half sine with a peak acceleration of 1000g for duration of 0.5 msec) |     |     |     |      |
| Radiation                 | TID : 100 kRad, low dose rate<br>No SEL up to LET=60 MeV/mg/cm <sup>2</sup>   |     |     |     |      |

## 2. Electrical interface

| Parameters        | Conditions/remarks | Min   | Nom | Max   | Unit |
|-------------------|--------------------|-------|-----|-------|------|
| Power supply      | Option 12          | 11.4  | 12  | 12.6  | V    |
|                   | Option 15          | 14.25 | 15  | 15.75 | V    |
| Load Impedance    |                    | 45    | 50  | 55    | Ω    |
| Reference voltage |                    | 6.6   | 6.9 | 7.2   | V    |
| Control voltage   | Vc                 | 0     |     | Vref  | V    |

## 3. Performances @ 10 MHz

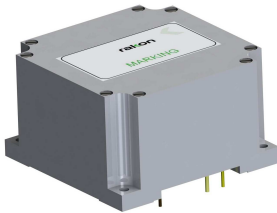
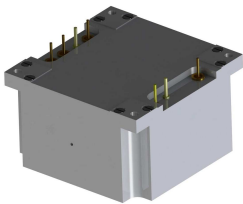

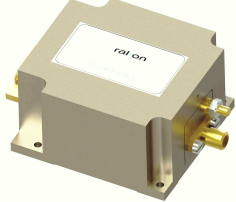
### 3.1. Option AV (Allan Variance)

| Parameters                             | Conditions/Remarks            | Min  | Typ | Max    | Unit   |
|--|-------------------------------|------|-----|--------|--------|
| Nominal Frequency                      |                               | 10   |     | 40     | MHz    |
| Steady state input current power       | Vacuum @ -20°C                |      |     | 4      | W      |
| Warm up supply power                   |                               |      |     | 8      | W      |
| Initial frequency accuracy             | Frequency pulling<br>Option 2 |      |     | ± 10   | ppb    |
| Frequency adjustment                   | Positive slope                |      |     | ± 500  | ppb    |
| Frequency stability vs temperature     | Option A                      |      |     | ± 0.5  | ppb    |
|  | Option B                      |      |     | ± 1    | ppb    |
|  | Option C                      |      |     | ± 5    | ppb    |
| Frequency variation vs. supply voltage | Over Operating Temperature    |      |     | ± 0.1  | ppb    |
| Frequency variation vs. load           | Over Operating Temperature    |      |     | ± 0.1  | ppb    |
| Frequency variation vs pressure        |                               |      |     | ± 50   | ppb    |
| Frequency ageing (10 MHz)              | Over 1 year                   |      |     | ± 20   | ppb    |
|  | Over 15 years                 |      |     | ± 150  | ppb    |
| Allan variance                         | 1s                            |      |     | 6.E-13 |        |
|  | 10s                           |      |     | 1.E-12 |        |
| Frequency warm up                      |                               |      |     | 30     | mn     |
| Output waveform                        |                               | Sine |     |        |        |
| Output level                           | EOL                           | 2    |     | 10     | dBm    |
| Harmonics level and subharmonics       |                               |      |     | -30    | dBc    |
| Non harmonics level                    |                               |      |     | -85    | dBc    |
| Phase noise @ 10 MHz                   | 1 Hz                          |      |     | -110   | dBc/Hz |
|  | 10 Hz                         |      |     | -135   | dBc/Hz |
|  | 100 Hz                        |      |     | -145   | dBc/Hz |
|  | 1kHz                          |      |     | -150   | dBc/Hz |
|  | 10 kHz                        |      |     | -155   | dBc/Hz |

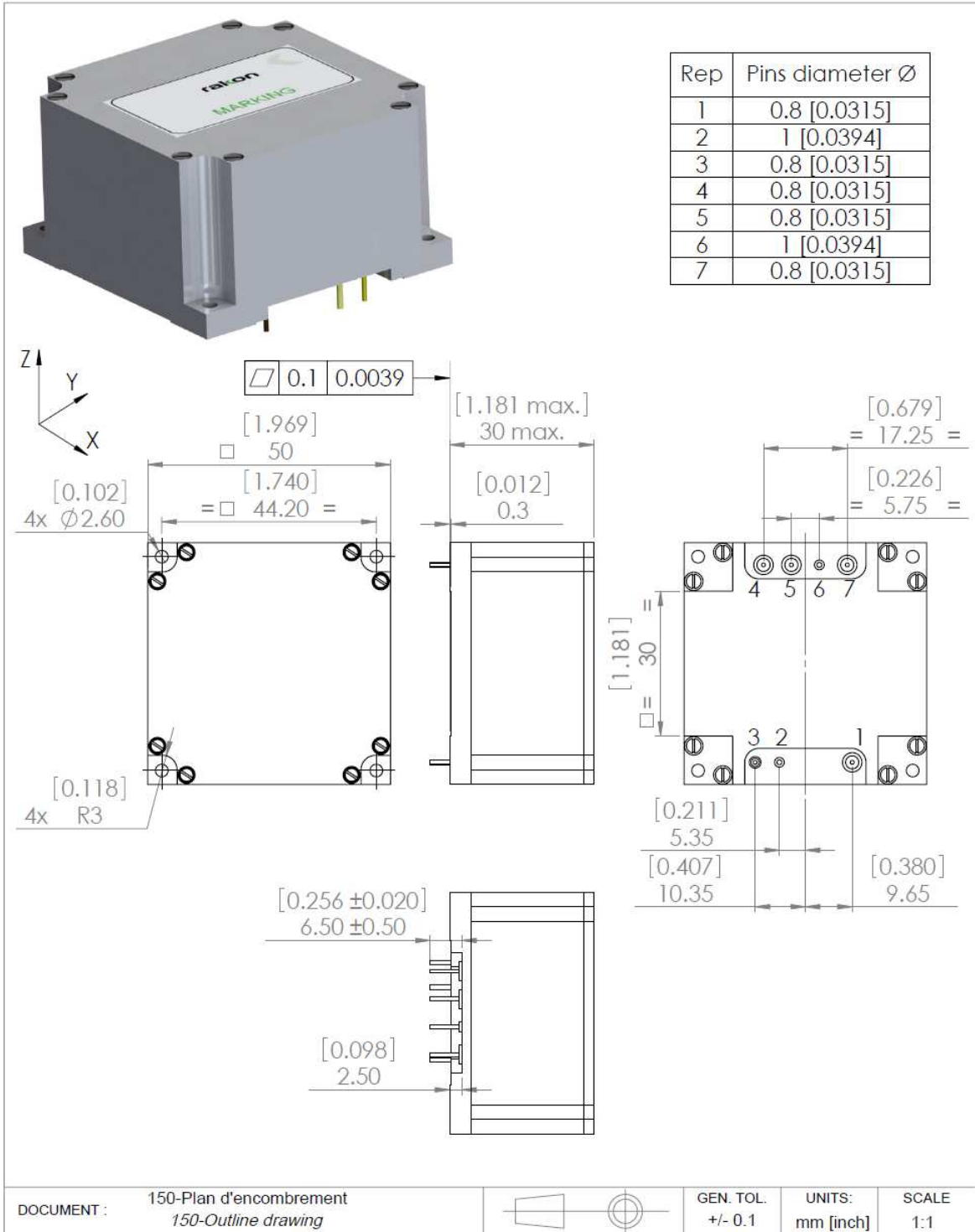
### 3.2. Option GP (General Purpose)

| Parameters                             | Conditions/Remarks            | Min  | Typ | Max    | Unit   |
|--|-------------------------------|------|-----|--------|--------|
| Nominal Frequency                      |                               | 10   |     | 40     | MHz    |
| Steady state input current power       | Vacuum @ -20°C                |      |     | 3      | W      |
| Warm up supply power                   |                               |      |     | 7      | W      |
| Initial frequency accuracy             | Frequency pulling<br>Option 2 |      |     | ± 10   | ppb    |
| Frequency adjustment                   | Positive slope                |      |     | ± 500  | ppb    |
| Frequency stability vs temperature     | Option A                      |      |     | ± 0.5  | ppb    |
|  | Option B                      |      |     | ± 1    | ppb    |
|  | Option C                      |      |     | ± 10   | ppb    |
| Frequency variation vs. supply voltage | Over Operating Temperature    |      |     | ± 0.1  | ppb    |
| Frequency variation vs. load           | Over Operating Temperature    |      |     | ± 0.1  | ppb    |
| Frequency variation vs pressure        |                               |      |     | ± 50   | ppb    |
| Frequency ageing (10 MHz)              | Over 1 year                   |      |     | ± 20   | ppb    |
|  | Over 15 years                 |      |     | ± 150  | ppb    |
| Allan variance                         | 1s                            |      |     | 1.E-12 |        |
|  | 10s                           |      |     | 2.E-12 |        |
| Frequency warm up                      |                               |      |     | 30     | mn     |
| Output waveform                        |                               | Sine |     |        |        |
| Output level                           | EOL                           | 2    |     | 10     | dBm    |
| Harmonics level and subharmonics       |                               |      |     | -30    | dBc    |
| Non harmonics level                    |                               |      |     | -85    | dBc    |
| Phase noise                            | 1 Hz                          |      |     | -105   | dBc/Hz |
|  | 10 Hz                         |      |     | -135   | dBc/Hz |
|  | 100 Hz                        |      |     | -145   | dBc/Hz |
|  | 1kHz                          |      |     | -150   | dBc/Hz |
|  | 10 kHz                        |      |     | -155   | dBc/Hz |

### 4. Mechanical features

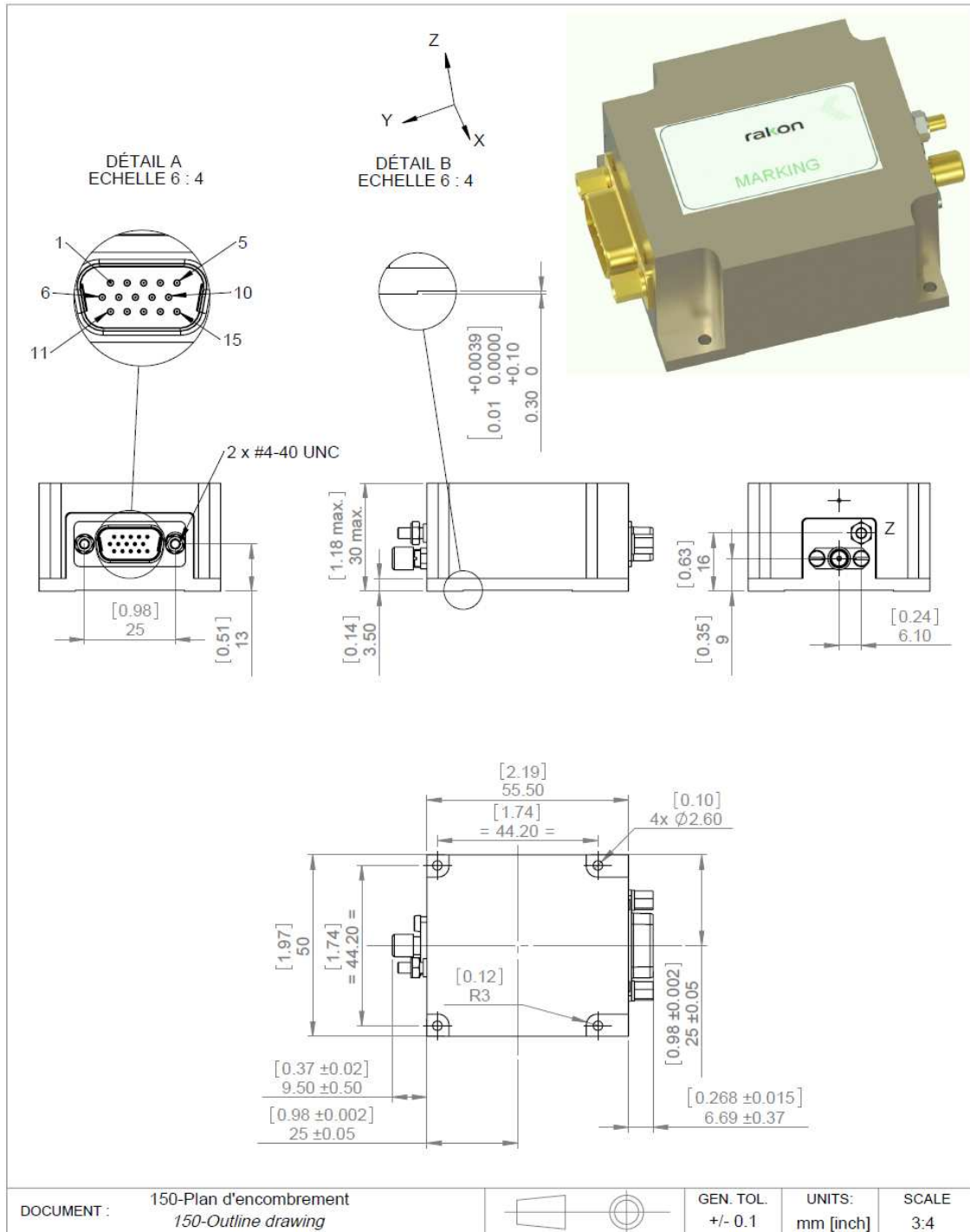
| Package name | Description      | Dimensions<br>Wheight |  |   |
|--------------|------------------|-----------------------|--|---|
| PT1          | Pin Through Hole | 50x50x30 mm           |  |  |
| SS1          | Sub-D+SMA        | 50x55x30 mm           |  |  |

#### 4.1. Package PT1 (Pin Through hole)



| Pin number | Name           | Function          |
|------------|----------------|-------------------|
| 1          | Alarm option 0 | Not connected     |
|            | Alarm option 1 | Oven alarm        |
| 2,6        | GND            | Ground            |
| 3          | Fout           | Frequency output  |
| 4          | Vc             | Voltage control   |
| 5          | Vref           | Reference voltage |
| 7          | Vcc            | Power supply      |

#### 4.2. Package SS1 (Sub-D+SMA)



| Pin number     | Name           | Function          |
|----------------|----------------|-------------------|
| 1              | Vc             | Voltage control   |
| 2,4,12         |                | Not connected     |
| 3              | Alarm option 0 | Not connected     |
|                | Alarm option 1 | Oven alarm        |
| 6,7,8,13,14,15 | GND            | Ground            |
| 5,9,10         | Vcc            | Power supply      |
| 11             | Vref           | Reference voltage |
| SMA connector  | Fout           | Frequency output  |

### 5. Model philosophy

| Representativeness          | Engineering Model  | Engineering Qualification Model                                    | Qualification Model                         | Flight Model                             | Flight Model + Lot Acceptance test            |
|-----------------------------|--|--|---|--|---|
| Options                     | A  | B, C   | D   | E, F, G, H                               | I   |
| <b>Components</b>           | Passive commercial parts, Active parts from the same manufacturer of HiRel parts | Mil Grade parts procured from the same manufacturer of HiRel parts | HiRel Parts                                 | HiRel Parts                              | HiRel Parts                                   |
| <b>Crystal material</b>     | Swept quartz stabilized  | Swept quartz stabilized  | ESCC3501 Swept quartz stabilized            | ESCC3501 Swept quartz stabilized         | ESCC3501 Swept quartz stabilized              |
| <b>Mechanical interface</b> | Flight representative in form-fit-function                                       | Flight representative in form-fit-function                         | Flight design                               | Flight design                            | Flight design                                 |
| <b>Electrical interface</b> | Flight design  | Flight design  | Flight design                               | Flight design                            | Flight design                                 |
| <b>Tests</b>                | Acceptance testing   | Qualification testing  | Qualification testing (including screening) | Acceptance testing (including screening) | Acceptance testing (including screening)+ LAT |

### 6. Options for Engineering Qualification Model

- Option B: production manufacturing, qualification flow including qualification mechanical tests
- Option C: production manufacturing, electrical tests only

### 7. Flight Model Screening according to MIL-PRF-55310

- Option E: full level S
- Option F: level S with combined burn in aging of 480 hours
- Option G: full level B
- Option H: level B with combined burn in aging of 480 hours
- Option I: level S with 1 pc/batch
- Lot Acceptance test could be performed on all screening options

### 8. Deliverable documentation

- Test data
- Full specification
- Certificate of Conformity (CoC)

#### 9. Ordering part number definition

The part number breakdown is defined as follows:

