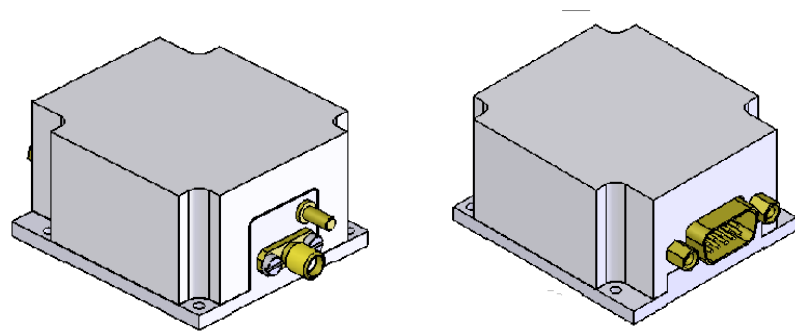




# SPACE OCXO Series 420

Space qualified OCXO – Oven controlled Crystal Oscillator  
 General Specification (rev 18 January 2010)



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## ▣ Features

- Frequency Range : 5 MHz to 40 MHz
- Supply Voltage : +10V , +12V or +15V
- Warm up Consumption : 7 Watt max
- Steady state Consumption : 2W under vacuum and 4W under atmospheric pressure
- Frequency Stability vs. Operating Temperature Range: +/- 1ppb under vacuum
- Ageing : +/- 0.2 ppm over 15 years typical at 10MHz
- Output Wave Form : sine 50 Ohms
- Output Level : from 0 to 10 dBm
- Manufacturing in accordance with:
  - MIL-PRF-55310 (Class 1, type 4, level S,B)
  - ECSS-Q-ST-70-08C and ECSS-Q-ST-70-38C

## ▣ Applications

- Transponders
- GPS receivers
- Navigation
- Converters
- Board calculators
- Synthesizers
- FGU

## ▣ Environmental conditions

| Parameters                  | Unit | Minimum   | Typical | Maximum |
|-----------------------------|------|---|---------|---------|
| Operating temperature range | °C   | - 40  |         | + 70    |
| Storage temperature range   | °C   | - 55  |         | + 125   |
| Shocks (half sine)          |      | 1500g, 0.35ms   |         |         |
| Sine vibration              |      | 20g as per MIL-STD-202, Method 204, Condition D         |         |         |
| Random vibration            |      | 37.8 grms as per MIL-STD-202, Method 214, Condition I-J |         |         |
| Radiation                   |      | Up to 100 krad total dose                               |         |         |



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## ▣ Mechanical characteristics

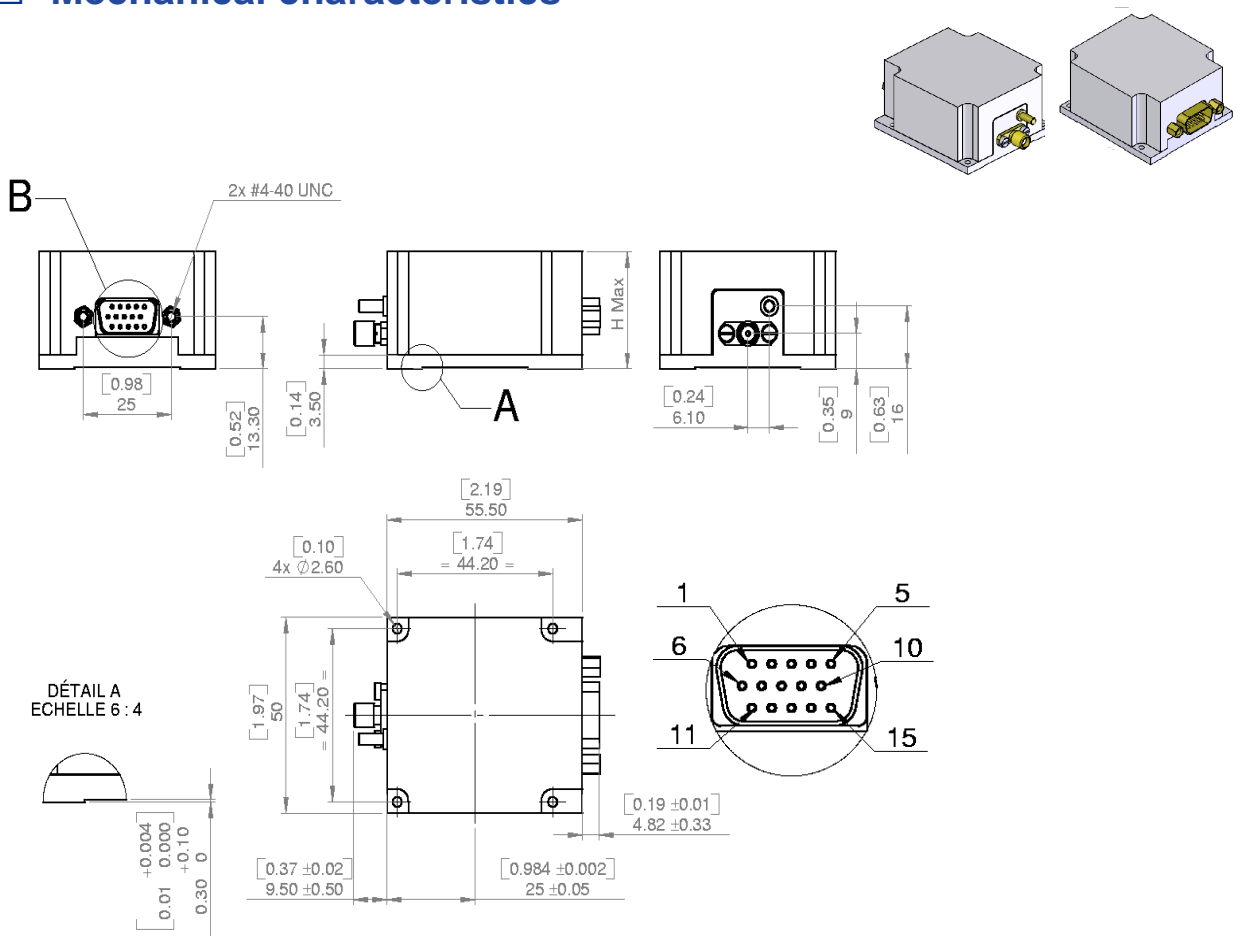


Figure 1 : Oscillator outline 1

### Pin description

| Pin number               | Name | Function                              |
|--------------------------|------|---------------------------------------|
| 1                        | Vc   | Voltage control for electrical tuning |
| 2 – 3 – 4 - 12           | NC   | Electrical & mechanical ground        |
| 6 – 7 – 8 – 13 – 14 – 15 | GND  | Electrical & Mechanical ground        |
| 9 – 10 - 5               | Vcc  | Power supply                          |
| 11                       | Vref | Reference voltage                     |
| SMA connector            | Fout | Frequency output                      |



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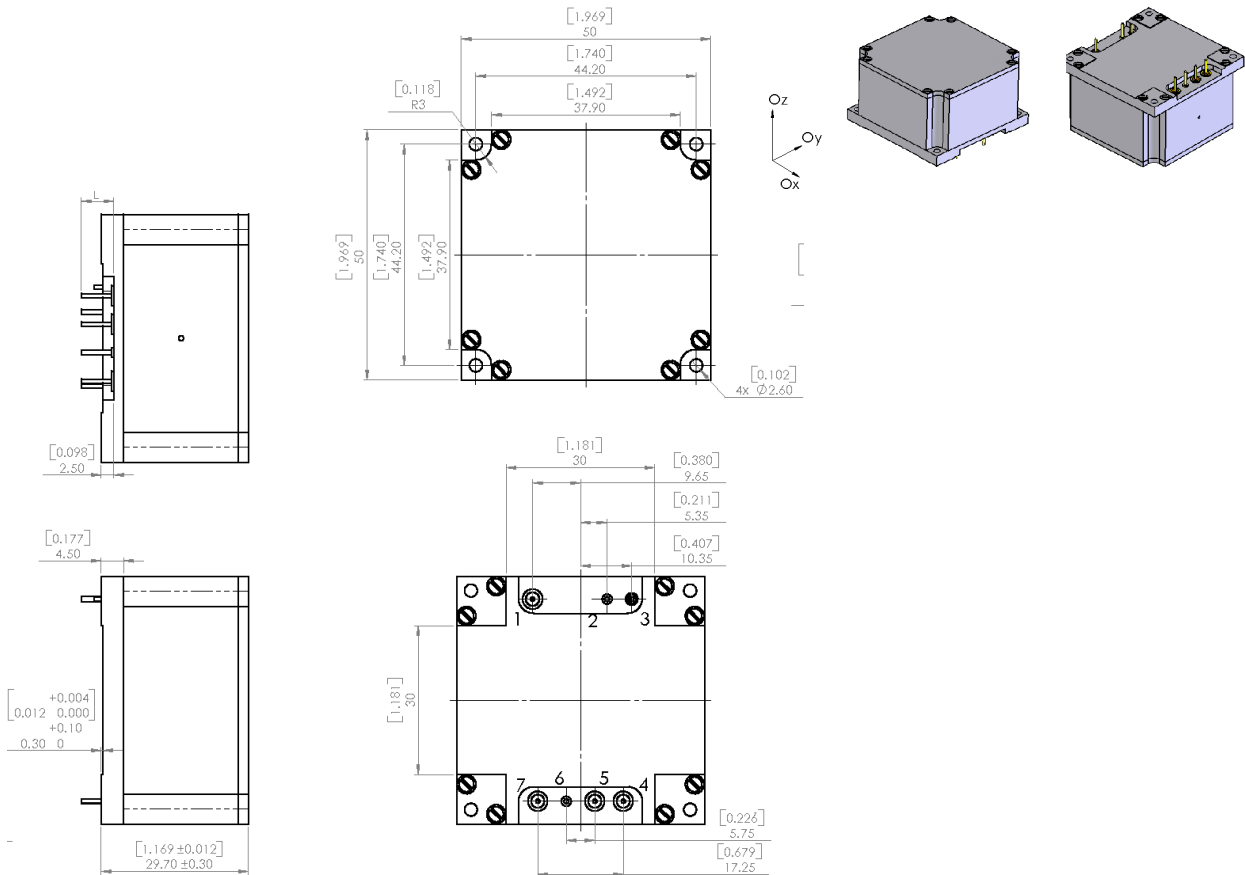


Figure 2: Oscillator outline 2

### Pin description

| Pin number | Name | Function                              |
|------------|------|---------------------------------------|
| 1          |      | Oven Alarm                            |
| 2 – 6      | GND  | Electrical & mechanical ground        |
| 3          | Fout | Frequency output                      |
| 4          | Vc   | Voltage control for electrical tuning |
| 5          | Vref | Reference voltage                     |
| 7          | Vcc  | Supply voltage                        |



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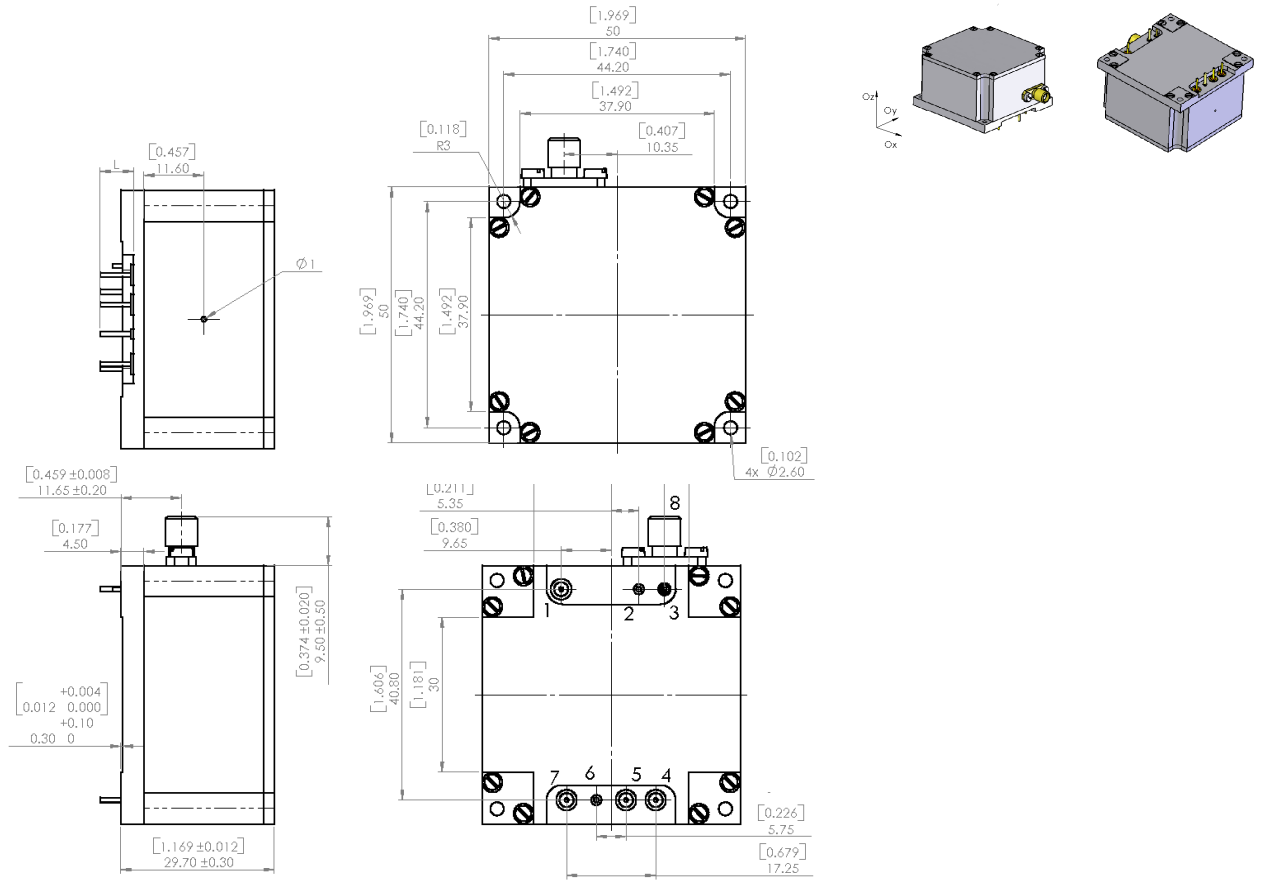


Figure 3 Oscillator outline 3

## Pin description

| Pin number | Name | Function                              |
|------------|------|---------------------------------------|
| 1          |      | Oven Alarm                            |
| 2 – 6      | GND  | Electrical & mechanical ground        |
| 8          | Fout | Frequency output                      |
| 4          | Vc   | Voltage control for electrical tuning |
| 5          | Vref | Reference voltage                     |
| 7          | Vcc  | Supply voltage                        |
| 3          |      | Not connect                           |



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## ▣ Performance Characteristics

| Electrical Parameters                            | Unit            | Minimum | Typical | Maximum |
|--|-----------------|---------|---------|---------|
| <b>Frequency output</b>                          |                 |         |         |         |
| Nominal frequency range                          | MHz             | 5       | 10      | 40      |
| Output level (50 Ω load)                         | dBm             | 0       |         | 10      |
| Harmonics level                                  | dBc             |         |         | - 40    |
| Spurious (offset > 50 Hz)                        | dBc             |         |         | - 80    |
| <b>Phase noise in static conditions @ 10 MHz</b> |                 |         |         |         |
| @ 1 Hz offset                                    | dBc/Hz          |         | - 110   |         |
| @ 10 Hz offset                                   | dBc/Hz          |         | - 135   |         |
| @ 100 Hz offset                                  | dBc/Hz          |         | - 145   |         |
| @ 1 kHz offset                                   | dBc/Hz          |         | - 150   |         |
| @ 10 kHz offset or greater                       | dBc/Hz          |         | - 155   |         |
| <b>Allan variance</b>                            |                 |         |         |         |
| @ 1s   | ppb             | 0.0005  | 0.001   | 0.002   |
| <b>Free running mode (Vctrl pin NC)</b>          |                 |         |         |         |
| Initial setting                                  | ppb             |         |         | ±10     |
| Stability vs. temperature                        | ppb             | ±0.5    | ±1      | ±2      |
| Stability vs. 5 % supply voltage variation       | ppb             |         |         | 0.1     |
| Stability vs. 10 % load variation                | ppb             |         |         | 0.1     |
| Aging over first year                            | ppb             |         |         | 20      |
| Aging over 15 years                              | ppb             |         | 100     | 200     |
| <b>Electrical tuning (Vctrl pin)</b>             |                 |         |         |         |
| Relative pulling frequency range                 | ppb             | ± 200   |         | ± 500   |
| Input impedance                                  | Ω               | 10k     |         |         |
| Bandwidth  | Hz              | 1k      |         |         |
| Voltage range                                    | V               | 0       |         | 10      |
| <b>Supply voltage (Vcc pin)</b>                  |                 |         |         |         |
| Voltage range ( ±5%)                             | V <sub>DC</sub> | 10      | 12      | 15      |
| Supply power @ -20 °C under vacuum               | W               |         | 2       | 3       |
| Supply power @ warm up                           | W               |         | 6       | 7       |
| Warm up time                                     | mn              |         |         | 10      |



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## ▣ Proposed Components quality levels

- Full ESA ECSS-Q-ST-60C components
- Full ESA ECSS-Q-ST-60C components with specific radiation test
- ESA ECSS-Q-ST-60C components with only LVT 3

## ▣ Screening options according to MIL PRF55310

- Full Level S
- Level S with combined burn in aging of 480 hours
- Full Level B
- Level B with combined burn in aging of 480 hours



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## □ Model philosophy

| Representativeness          | DM  | EM   | EQM  | QM                                     | FM                                     | FM-C                                   |
|-----------------------------|---|--|--|--|--|--|
| <b>Component</b>            | Commercial parts                            | Passive commercial parts<br>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>     | HiQ   | HiQ  | HiQ  | Swept ESA-SCC3501                      | Swept ESA-SCC3501                      | Swept ESA-SCC3501                      |
| <b>Resonator stabilized</b> | Not stabilized                              | Stabilized   | Stabilized   | Stabilized & Aged as per specification | Stabilized & Aged as per specification | Stabilized & Aged as per specification |
| <b>Mechanical interface</b> | Size & shape could not be representative    | Flight representative in form-fit-function   | Flight representative in form-fit-function                         | Flight design                          | Flight design                          | Flight design                          |
| <b>Electrical interface</b> | Total conformity with functional electrical | Flight design without HiRel parts  | Flight design without HiRel parts                                  | Flight design                          | Flight design                          | Flight design                          |
| <b>Other tests</b>          | Development testing                         | Partial functional qualification testing   | Functional Qualification testing & Environment                     | Qualification testing                  | Acceptance testing                     | Acceptance testing + group C           |
| <b>Workmanship</b>          | IPC610                                      | IPC610   | ECSS-Q-70-08 & 70-38   | ECSS-Q-70-08 & 70-38                   | ECSS-Q-70-08 & 70-38                   | ECSS-Q-70-08 & 70-38                   |





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## Standard Tests

| DOCxxxFM<br>S520-A1        | SN/YYWW |                               | Initial Tests | Pre-Burn-In Measurements | Frequency aging group B | Final tests Group A | Visual tests group A |
|----------------------------|---------|-------------------------------|---------------|--------------------------|-------------------------|---------------------|----------------------|
| CONDITIONS                 |         | PARAMETERS                    | GO<br>NO-GO   | GO<br>NO-GO              | GO<br>NO-GO             | GO<br>NO-GO         | GO<br>NO-GO          |
| 24°C ±2°C                  |         | Frequency                     | GO            | GO                       | GO                      | GO                  | NA                   |
| ±24°C ±2°C                 |         | Pressure drift                | GO            | NA                       | NA                      | GO                  | NA                   |
| 24°C ±2°C                  |         | Reference voltage             | GO            | NA                       | NA                      | GO                  | NA                   |
| 24°C ±2°C                  |         | Output level                  | GO            | GO                       | NA                      | GO                  | NA                   |
| -20°C ±2°C                 |         | Output level                  | GO            | NA                       | NA                      | GO                  | NA                   |
| 70°C ±2°C                  |         | Output level                  | GO            | NA                       | NA                      | GO                  | NA                   |
| -20°C to +70°C             |         | Output level vs. Temperature  | GO            | NA                       | NA                      | GO                  | NA                   |
| under vacuum<br>-20°C ±2°C |         | Warm up Consumption           | GO            | NA                       | NA                      | GO                  | NA                   |
| under vacuum<br>-20°C ±2°C |         | Warm up Time                  | GO            | NA                       | NA                      | GO                  | NA                   |
| under vacuum<br>24°C ±2°C  |         | Steady state consumption      | GO            | GO                       | NA                      | GO                  | NA                   |
| under vacuum<br>-20°C ±2°C |         | Steady state consumption      | GO            | NA                       | NA                      | GO                  | NA                   |
| 24°C ±2°C<br>Vadj=0V       |         | Harmonics                     | GO            | NA                       | NA                      | GO                  | NA                   |
| 24°C ±2°C<br>Vadj=0V       |         | Non Harmonics                 | GO            | NA                       | NA                      | GO                  | NA                   |
| 24°C ±2°C<br>Vadj init     |         | Phase noise                   | GO            | NA                       | NA                      | GO                  | NA                   |
| 24°C ±2°C<br>Vadj=0V       |         | Frequency vs. load variation  | GO            | NA                       | NA                      | GO                  | NA                   |
| 24°C ±2°C<br>Vadj=0V       |         | Frequency vs. power variation | GO            | NA                       | NA                      | GO                  | NA                   |
| 24°C ±2°C                  |         | Frequency Adjustment          | GO            | NA                       | NA                      | GO                  | NA                   |
| -40°C                      |         | Cold start                    | GO            | NA                       | NA                      | GO                  | NA                   |
|                            |         | Dimensions                    | NA            | NA                       | NA                      | NA                  | GO                   |
|                            |         | Marking                       | NA            | NA                       | NA                      | NA                  | GO                   |
|                            |         | Weight                        | NA            | NA                       | NA                      | NA                  | GO                   |
| -20°C to 70°C<br>Vadj=0V   |         | Frequency vs. Temperature     | GO            | NA                       | NA                      | GO                  | NA                   |



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## Ordering part number definition

The part number breakdown is defined as follows:

