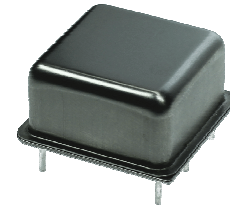


Specification	AXIOM75SL	Rev.: 1	Date: 2018-02-16
---------------	-----------	---------	------------------

**Oscillator type: Low Phase Noise 10 MHz OCXO with Sine wave output for Space Application (COTS)**

**Features:**

- Lower cost Commercial Off-The-Shelf version (COTS)
- Dedicated for Cubesat applications
- Qualified according to MIL-PRF-55310 Level "S"
- Radiation hardened – 10 krad(Si) total dose (TID)
- ITAR Free – Manufactured in Germany
- Low Phase Noise
- Very Low Aging
- High Frequency Stability
- Hermetical sealed THD package
- Short lead time



**Models:**

Item	Engineering Model (EM)	Flight Model (FM)	Lot Acceptance Test Model (LAT)
Quartz Crystal	Synthetic HiQ Quartz, SC-cut, HC-43/U	Synthetic HiQ Quartz, SC-cut, HC-43/U	Synthetic HiQ Quartz, SC-cut, HC-43/U
Electrical Components	COTS	COTS Capacitors: AEC-Q200	COTS Capacitors: AEC-Q200
Mechanical Components	Stainless steel package with Ni finish	Stainless steel package with Ni finish	Stainless steel package with Ni finish
Workmanship (Soldering)	IPC610 Class 3	ECSS-Q-ST-70-08C and ECSS-Q-ST-70-38C	ECSS-Q-ST-70-08C and ECSS-Q-ST-70-38C
Rad Hard	-	10 krad(Si) TID	10 krad(Si) TID
Acceptance Testing			
Screening	Testing according to IEC60679-1 and MIL-PRF-55310	X	X
Group-A		X	X
Group-B		X	X
Group-C		-	X

**Ordering Code:**

Model	Product category	Revision	Frequency [MHz]
AXIOM75SL	EM FM LAT	Rev.1	10.000

Example: AXIOM75SL-FM\_Rev.1 – 10.000 MHz

## **0. Contents:**

- 1. Electrical specification**
- 2. Mechanical specification**
- 3. Applicable documents**
- 4. General flow of manufacturing**
- 5. Acceptance Testing**
  - 5.1 Screening**
  - 5.2 Group A inspection**
  - 5.3 Group B inspection**
  - 5.4 Group C inspection**
  - 5.5 Electrical measurements**
- 6. Radiation**
- 7. Components, Materials and Processes**
- 8. Marking**
- 9. Data Documentation**
- 10. Handling, Packaging and Delivery**
- 11. Specification History**

## 1. Electrical specification

Parameter	Min.	Typ.	Max.	Unit	Condition
<b>Nominal frequency</b>	10.000			MHz	
<b>Frequency stability</b>					
Initial tolerance @ +25°C			±200	ppb	V <sub>c</sub> @ VREF/2
vs. operating temperature range			±25	ppb	
vs. supply voltage variation			±5	ppb	V <sub>s</sub> ±5%
vs. load change			±5	ppb	R <sub>L</sub> ±10%
Long term (aging) per day		±0.1	±1	ppb	after 30 days operation
Long term (aging) 1 <sup>st</sup> year		±20	±50	ppb	after 30 days operation
<b>Frequency adjustment range</b>					
Electronic Frequency Control (EFC)	±0.5	±0.8		ppm	
EFC voltage V <sub>c</sub>	0	VREF/2	VREF	V	
EFC slope (Δf / ΔV <sub>c</sub> )	Positive				
EFC input impedance	100			kΩ	
<b>RF output</b>					
Signal waveform	Sine wave				
Load R <sub>L</sub>	50			Ω	±10%
Output level	+7			dBm	
Harmonics			-30	dBc	
Spurious			-90	dBc	
Warm-up time @ +25°C			3	min	Δf/f <sub>0</sub> < ±100 ppb
Phase noise		-105 -135	-100 -130 -150 -155 -155	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz	@ 1 Hz @ 10 Hz @ 100 Hz @ 1 kHz @ ≥10 kHz
<b>Short term stability (Allan deviation)</b>		2·10 <sup>-12</sup>			τ = 1~10 s
<b>Reference voltage VREF output</b>		5.0		V	Load ≥ 10 kΩ
<b>Supply voltage V<sub>s</sub></b>	11.4	12.0	12.6	V	
<b>Current consumption (steady state)</b>			150	mA	@ +25°C
<b>Current consumption (warm-up)</b>			350	mA	
<b>Operating temperature range</b>	-20		+70	°C	

Table 1 – Electrical Performance and Characteristics

### Notes:

- Terminology and test conditions are according to IEC60679-1 and MIL-PRF-55310 unless otherwise stated
- Classification (MIL-PRF-55310): Type 4 (OCXO), Class 1 (Discrete Technology), Product Level "S"

## Absolute Maximum Ratings

Parameter	Min.	Max.	Unit	Condition / Remark
<b>Supply Voltage V<sub>s</sub></b>	-0.5	V <sub>s</sub> + 10%	V	V <sub>s</sub> to GND
<b>Control Voltage V<sub>c</sub></b>	-0.5	15	V	V <sub>s</sub> to GND
<b>Load R<sub>L</sub></b>	0	∞	Ω	Must not cause any damage
<b>Operable temperature range</b>	-40	+80	°C	Operation of unit without any damage
<b>Storage temperature range</b>	-55	+125	°C	-

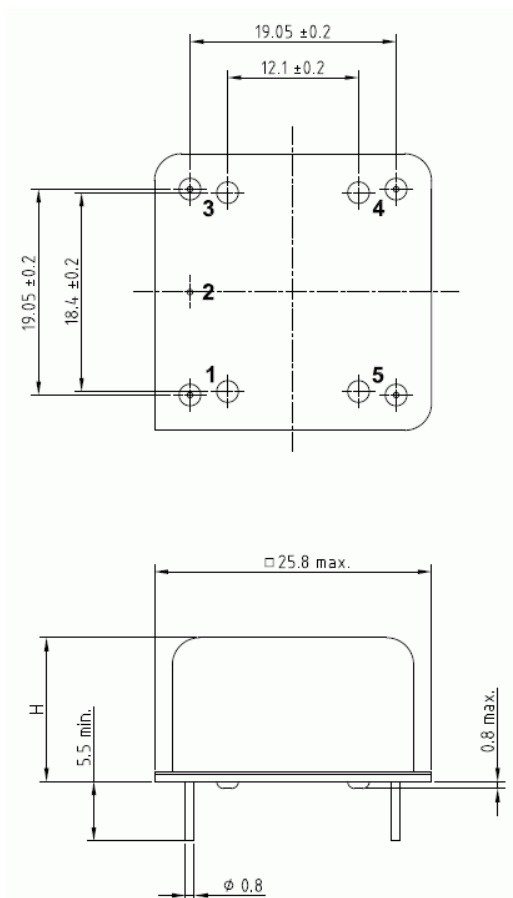
Table 2 – Maximum Ratings

## 2. Mechanical specification

Parameter	Min.	Typ.	Max.	Unit	Condition
Enclosure (see drawing) (LxWxH)	25.8x25.8x12.7 max.			mm	IEC 60679-3 CO 43
Weight			20	g	
Case material	Stainless steel			-	
Case finish	Cover: Stainless steel blank Header: Ni 8 μm			-	
Pins	Glass / Kovar SnPb solder dipped			-	

Table 3 – Mechanical specification

## Enclosure drawing



## Pin connections

Pin #	Symbol	Function
1	RF OUT	RF Output
2	GND	Ground
3	V <sub>c</sub>	Control Voltage (EFC)
4	VREF	Reference Voltage
5	V <sub>s</sub>	Supply Voltage

### 3. Applicable documents

The following specifications and standards are part of this specification:

ECSS-Q-ST-70-08C	The manual soldering of high-reliability electrical connections
ECSS-Q-ST-70-38C	High-reliability soldering for surface-mount and mixed technology
ESCC21300	Terms, Definitions, Abbreviations, Symbols and Units
ESCC21700	General Requirements for the marking of ESCC components
MIL-STD-55310	General specification for crystal controlled oscillators
MIL-STD-202	Test Method Standard for electronic and electrical component parts
MIL-STD-883	Test Method Standard for Microcircuits
IEC 60679-1	Quartz crystal controlled oscillators of assessed quality Part 1: Generic specification

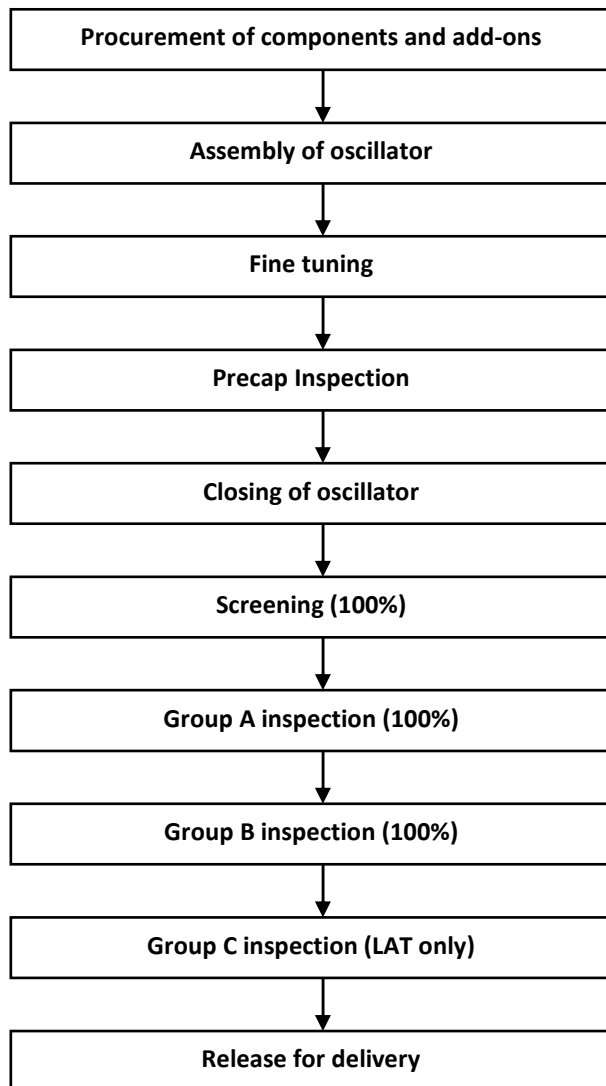
### Order of precedence

In the event of a conflict between the text of this specification and the references cited herein, the order of precedence shall be as follows:

- (1) Purchase order
- (2) Oscillator detail specification AXIOM75SL
- (3) Generic specification MIL-PRF-55310
- (4) Other documents

#### 4. General flow of manufacturing

The figure below shows the overall flow for manufacturing:



## 5. Acceptance Testing

### 5.1 Screening

Table 4 shows the screening procedure according to MIL-PRF-55310 Product level "S".

#	Test	Reference
1	Electrical measurements at room temperature (Initial)	IEC 60679-1 (see Table 1)
2	Random Vibration	MIL-STD-202, Method 214, Condition 1-B
3	Thermal Shock	MIL-STD-202, Method 107, Condition A-1
4	Electrical measurements at room temperature (Interim)	IEC 60679-1 (see Table 1)
5	Burn-in (load)	MIL-PRF-55310
6	Electrical measurements at room temperature (Final)	IEC 60679-1 (see Table 1)
7	Electrical measurements at high and low temperature	IEC 60679-1 (see Table 1)
8	Seal Test – Gross Leak	MIL-STD-202, Method 112, Condition D
9	Radiographic Inspection (Note 1)	MIL-STD-202, Method 209
10	External Visual Inspection	ESCC20500 / MIL-STD-883 Method 2009

**Table 4 – Screening procedure**

**Notes:**

1. May be performed at any point during the test sequence

Table 5 shows the detailed test conditions for each step in table 4.

#	Test	Test Condition
1	Electrical measurements at room temperature (Initial)	@ T <sub>amb</sub> = 25°C±3°C (unless otherwise stated) Table 11
2	Random Vibration	50~100 Hz +6 dB/Oct, 100~1000 Hz 0.04 g <sup>2</sup> /Hz, 1~2 kHz -6 dB/Oct RMS = 7.56 g, 5 minutes per axis
3	Thermal Shock	-40 to +80°C, 25 cycles, max. 5 minutes transfer time, 15 minutes dwell time
4	Electrical measurements at room temperature (Interim)	@ T <sub>amb</sub> = 25°C±3°C (unless otherwise stated) Table 11
5	Burn-in (load)	@ T = +85°C for 10 days (nominal V <sub>s</sub> and Load) Drift: Δf/f < ±1 ppm and ±5 % current consumption (steady state)
6	Electrical measurements at room temperature (Final)	@ T <sub>amb</sub> = 25°C±3°C (unless otherwise stated) Table 11
7	Electrical measurements at high and low temperature	@ T = -30°C, +25°C, +70°C with ±1°C tolerance Limits: See Table 1
8	Seal Test – Gross Leak	No bubbles allowed
9	Radiographic Inspection	1 view Y-direction (perpendicular to largest surface) 1 view 90° to Y-direction
10	External Visual Inspection	ESCC20500 / MIL-STD-883 Method 2009

**Table 5 – Detailed test conditions for screening procedure**

## 5.2 Group A inspection

Table 6 shows the Group A inspection procedure.

Test	Reference	Test condition
Group A inspection	MIL-PRF-55310, Clause 4.7.1.4	Table V, Product level "S"

Table 6 – Group A inspection procedure

**Notes:**

1. Electrical measurements performed during screening are not repeated during Group A inspection

## 5.3 Group B inspection (Aging)

Table 7 shows the Group B inspection procedure.

#	Test	Reference
1	Aging test	MIL-PRF-55310, Clause 4.7.1.5 Product level "S"
2	Electrical measurements at room temperature (Final)	IEC 60679-1 (see Table 1)

Table 7 – Group B inspection procedure

Table 8 shows the detailed test conditions for each step in table 7.

#	Test	Test Condition
1	Aging test	@ $T_{amb} = 30^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 30 days (nominal $V_s$ and Load) Frequency measurement every hour Limits Aging: See Table 1
2	Electrical measurements at room temperature (Final)	@ $T_{amb} = 25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ (unless otherwise stated) Table 11

Table 8 – Detailed test conditions for Group B inspection procedure



## 5.4 Group C inspection

Table 9 shows the Group C inspection procedure.

#	Test	Reference
1	Random Vibration	MIL-STD-202, Method 214, Condition G
2	Mechanical Shock	MIL-STD-202, Method 213, Condition C
3	Thermal Shock	MIL-STD-202, Method 107, Condition B-1
4	High Temperature Storage	Detail specification
5	Electrical measurements at room temperature (Final)	IEC 60679-1 (see Table 1)
6	Seal Test – Gross Leak	MIL-STD-202, Method 112, Condition D
7	External Visual Inspection	ESCC20500 / MIL-STD-883 Method 2009

**Table 9 – Group C inspection procedure**

**Notes:**

1. Group C inspected LAT parts are end of life and shall not be used as flight models

Table 10 shows the detailed test conditions for each step in table 9.

#	Test	Test Condition
1	Random Vibration	50~100 Hz +6 dB/Oct, 100~1000 Hz 0.4 g <sup>2</sup> /Hz, 1~2 kHz -6 dB/Oct RMS = 23.9 g, 3 minutes per axis
2	Mechanical Shock	100 g, 6 ms, half sine, 3 shocks per axis
3	Thermal Shock	-55 to +125°C, 25 cycles, max. 5 minutes transfer time, 15 minutes dwell time
4	High Temperature Storage	24 hours at +85°C, min. 2 hours at T <sub>amb</sub>
5	Electrical measurements at room temperature (Final)	@ T <sub>amb</sub> = 25°C±3°C (unless otherwise stated) Table 11
6	Seal Test – Gross Leak	No bubbles allowed
7	External Visual Inspection	ESCC20500 / MIL-STD-883 Method 2009

**Table 10 – Detailed test conditions for Group C inspection procedure**

## 5.5 Electrical measurements

Table 11 shows all electrical measurements with its respective conditions and limits, which are performed for all models. If not otherwise stated all measurements are performed at  $T_{amb} = 25^{\circ}\text{C} \pm 3^{\circ}\text{C}$  and after a sufficient stabilization time.

#	Parameter	Test Method	Conditions	Initial / Interim	Final	Limits
1	Initial frequency	IEC 60679-1	$V_S = 12\text{ V}, R_L = 50\ \Omega$	X	X	Table 1
2	Output level	IEC 60679-1	$V_S = 12\text{ V}, R_L = 50\ \Omega$	X	X	Table 1
3	Current consumption (steady state)	IEC 60679-1	$V_S = 12\text{ V}, R_L = 50\ \Omega$	X	X	Table 1
4	Current consumption (warm-up)	IEC 60679-1	$V_S = 12\text{ V}, R_L = 50\ \Omega$	X	X	Table 1
5	Tuning range	IEC 60679-1	$V_S = 12\text{ V}, R_L = 50\ \Omega$	-	X	Table 1
6	Phase noise	IEC 60679-1	$V_S = 12\text{ V}, R_L = 50\ \Omega$	-	X	Table 1
7	Harmonics	IEC 60679-1	$V_S = 12\text{ V}, R_L = 50\ \Omega$	-	X	Table 1
8	Spurious	IEC 60679-1	$V_S = 12\text{ V}, R_L = 50\ \Omega$	-	X	Table 1
9	Warm-up @ +25°C	IEC 60679-1	$V_S = 12\text{ V}, R_L = 50\ \Omega$	-	X	Table 1

**Table 11 – Electrical measurements**

## 6. Radiation

The oscillator is capable of meeting all electrical performance requirements after exposure to a total ionizing dose (TID) of 10 krad(Si). The radiation performance can be verified by a radiation test (Co 60) on request.

## 7. Components, Materials and Processes

The FM and LAT models are built on the basis of the following requirements for components, materials and processes:

- All add-on components are commercial off-the-shelf (COTS) versions. Capacitors are compliant with the requirements of AEC-Q200.
- The quartz crystal has a hermetically sealed package.
- All active components are radiation tolerant. The crystal is made of synthetic high Q quartz material with low inclusion density and low etch channel density (according to IEC 60758).
- Soldering is done by ESA approved personal in accordance with ECSS-Q-ST-70-08C (manual soldering) and ECSS-Q-ST-70-38C (surface mount and mixed technology).
- No pure tin is used inside the oscillator, as package or lead finish.
- The printed circuit board (PCB) is commercially procured.
- The marking is resistant to Zestron VD, Isopropyl alcohol (99% pure) and Ethyl alcohol (99.5% pure), tested in accordance with ESCC24800.

## 8. Marking

The marking of the parts is accordance with ESCC21700. The content is as follows:

- (1) Company Logo AXTAL
- (2) Part number AXTAL (according to order code)
- (3) Part number Customer (on request)
- (4) Nominal frequency
- (5) Serial number
- (6) Date Code

## 9. Data Documentation

### General

With each delivery the following data documentation package is supplied:

- (1) Cover sheet
- (2) Certificate of Conformity (CoC)
- (3) Test data (full report of all inspections)
- (4) Failed component list and failure analysis report (if applicable)

For the first delivery the following additional documents can be delivered on request:

- Product Technical Description
- Equipment list (Testing & Measuring)
- Parts Stress Analysis
- Product Reliability Analysis
- Radiation Report

### Cover sheet

The cover sheet includes the following content:

- Full company information (Logo, Name, Address)
- Type and specification (part number and revision)
- Nominal frequency
- Number of purchase order
- Lot identification
- Range of serial numbers
- Number of delivered parts
- List of delivered documents

## Certificate of Conformity

The certificate includes the following content:

- Full company information (Logo, Name, Address)
- Type and specification (part number and revision)
- Nominal frequency
- Number of purchase order
- Lot identification
- Range of serial numbers
- Number of delivered parts
- Authorized signature in behalf of manufacturer (including stamp and date)

## 10. Handling, Packaging and Delivery

- Some add-ons are susceptible to damage by electrostatic discharge. Therefore suitable ESD precautions for handling during use and manufacturing must be employed.
- In order to minimize the risk of damage, all kinds of shock during handling and manufacturing must be avoided.
- The parts are packaged in a way to ensure adequately safeguarding against mechanical and electrical injury and deterioration due to humidity.
- The primary package is labeled as ESD sensitive component.

## 11. Specification History

Rev.	Drawing	Date [dd.mm.yyyy]	Remarks	Author	Checked
1	D0	16.02.2018	First issue	HH	BN