



**THE DATASHEET OF  
SIT8225AI-G2-28E-25.000625T**



# SiT8225

## 0.3 ps Jitter Oscillator for Networking



### Features

- 25 MHz, 25.001200 MHz and 25.000625 MHz for Ethernet applications
- 100% pin-to-pin drop-in replacement to quartz-based oscillators
- Ultra low phase jitter: 0.3 ps
- Frequency stability as low as  $\pm 10$  PPM
- Industrial or extended commercial temperature range
- LVC MOS/LVTTL compatible output
- Standby or output enable modes
- Standard 4-pin packages: 2.5 x 2.0, 3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0 mm<sup>2</sup>
- Outstanding silicon reliability of 2 FIT or 500 million hour MTBF
- Pb-free, RoHS and REACH compliant
- Ultra short lead time

### Applications

- SATA, SAS, Ethernet, 10Gb Ethernet, XAUI
- Computing, storage, networking, telecom, industrial control



### Electrical Characteristics

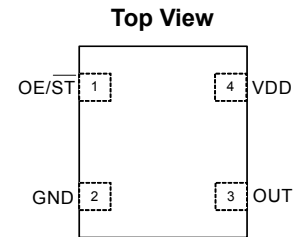
Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Output Frequency Range</b>	f	25.000000	25.001200	25.000625	MHz	
<b>Frequency Stability</b>	F_stab	-10	–	+10	PPM	Inclusive of Initial tolerance at 25 °C, and variations over operating temperature, rated power supply voltage and load
		-20	–	+20	PPM	
		-25	–	+25	PPM	
		-50	–	+50	PPM	
<b>Operating Temperature Range</b>	T_use	-20	–	+70	°C	Extended Commercial
		-40	–	+85	°C	Industrial
<b>Supply Voltage</b>	Vdd	1.71	1.8	1.89	V	Supply voltages between 2.5V and 3.3V can be supported. Contact SiTime for additional information.
		2.25	2.5	2.75	V	
		2.52	2.8	3.08	V	
		2.97	3.3	3.63	V	
<b>Current Consumption</b>	Idd	–	31	33	mA	No load condition, Vdd = 2.5V, 2.8V or 3.3V
		–	29	31	mA	No load condition, Vdd = 1.8V
<b>OE Disable Current</b>	I_OD	–	–	31	mA	Vdd = 2.5V, 2.8V or 3.3V, OE = GND, output is Weakly Pulled
		–	–	30	mA	Vdd = 1.8 V. OE = GND, output is Weakly Pulled Down
<b>Standby Current</b>	I_std	–	–	70	µA	Vdd = 2.5V, 2.8V or 3.3V, ST = GND, output is Weakly Pulled
		–	–	10	µA	Vdd = 1.8 V. ST = GND, output is Weakly Pulled Down
<b>Duty Cycle</b>	DC	45	–	55	%	
<b>Rise/Fall Time</b>	Tr, Tf	–	1.2	2	ns	15 pF load, 10% - 90% Vdd
		–	2.2	–	ns	30 pF load, 10% - 90% Vdd
		–	3.4	–	ns	45 pF load, 10% - 90% Vdd
<b>Output Voltage High</b>	VOH	90%	–	–	Vdd	I <sub>OH</sub> = -6 mA, I <sub>OL</sub> = 6 mA, (Vdd = 3.3V, 2.8V, 2.5V)
<b>Output Voltage Low</b>	VOL	–	–	10%	Vdd	I <sub>OH</sub> = -3 mA, I <sub>OL</sub> = 3 mA, (Vdd = 1.8V)
<b>Input Voltage High</b>	VIH	70%	–	–	Vdd	Pin 1, OE or ST
<b>Input Voltage Low</b>	VIL	–	–	30%	Vdd	Pin 1, OE or ST
<b>Input Pull-up Impedance</b>	Z_in	–	100	250	kΩ	Pin 1, OE logic high or logic low, or ST logic high
		2	–	–	MΩ	Pin 1, ST logic low
<b>Startup Time</b>	T_start	–	7	10	ms	Measured from the time Vdd reaches its rated minimum value
<b>OE Enable/Disable Time</b>	T_oe	–	–	150	ns	
<b>Resume Time</b>	T_resume	–	6	10	ms	In standby mode, measured from the time ST pin crosses 50% threshold. Refer to Figure 5.
<b>RMS Period Jitter</b>	T_jitt	–	1.5	2	ps	Vdd = 2.5V, 2.8V or 3.3V
		–	2	3	ps	Vdd = 1.8V
<b>RMS Phase Jitter (random)</b>	T_phj	–	0.25	0.3	ps	IEEE802.3-2005 10GbE jitter measurement specifications
<b>First year Aging</b>	F_aging	-1.5	–	+1.5	PPM	25°C
<b>10-year Aging</b>		-5	–	+5	PPM	25°C

**Note:**

1. All electrical specifications in the above table are specified with 15 pF output load and for all Vdd(s) unless otherwise stated.
2. Contact SiTime for custom drive strength to drive higher or multiple load, or SoftEdge™ option for EMI reduction.

### Pin Configuration

Pin	Symbol	Functionality	
1	OE/ $\overline{ST}$	Output Enable	H or Open <sup>[3]</sup> : specified frequency output L: output is high impedance. Only output driver is disabled.
		Standby	H or Open <sup>[3]</sup> : specified frequency output L: output is low (weak pull down). Device goes to sleep mode. Supply current reduces to I_std.
2	GND	Power	Electrical ground
3	OUT	Output	Oscillator output
4	VDD	Power	Power supply voltage



**Note:**

3. A pull-up resistor of <10 kΩ between OE/  $\overline{ST}$  pin and Vdd is recommended in high noise environment

### Absolute Maximum

Attempted operation outside the absolute maximum ratings of the part may cause permanent damage to the part. Actual performance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

Parameter	Min.	Max.	Unit
Storage Temperature	-65	150	°C
VDD	-0.5	4	V
Electrostatic Discharge	–	2000	V
Soldering Temperature (follow standard Pb free soldering guidelines)	–	260	°C

### Thermal Consideration

Package	$\theta_{JA}$ , 4 Layer Board (°C/W)	$\theta_{JA}$ , 2 Layer Board (°C/W)	$\theta_{JC}$ , Bottom (°C/W)
7050	191	263	30
5032	97	199	24
3225	109	212	27
2520	117	222	26

### Environmental Compliance

Parameter	Condition/Test Method
Mechanical Shock	MIL-STD-883F, Method 2002
Mechanical Vibration	MIL-STD-883F, Method 2007
Temperature Cycle	JESD22, Method A104
Solderability	MIL-STD-883F, Method 2003
Moisture Sensitivity Level	MSL1 @ 260°C

### Test Circuit and Waveform

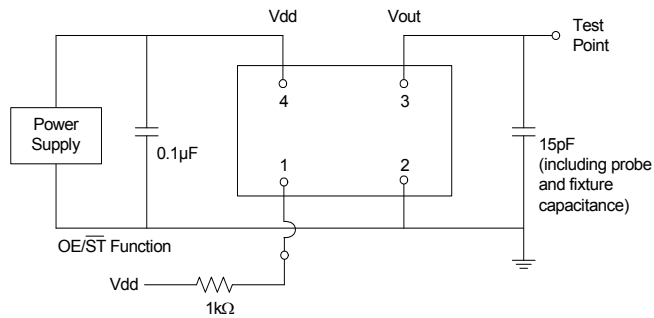


Figure 1. Test Circuit

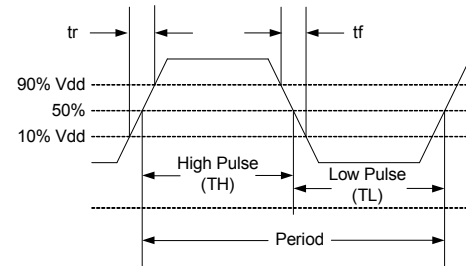


Figure 2. Waveform

**Note:**

- 4. Duty Cycle is computed as  $Duty\ Cycle = TH/Period$ .
- 5. SiT8225 supports the configurable duty cycle feature. For custom duty cycle at any given frequency, contact [SiTime](http://www.sitime.com).

### Timing Diagram

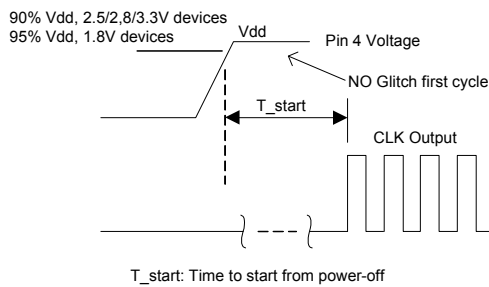


Figure 3. Startup Timing (OE/ST Mode)

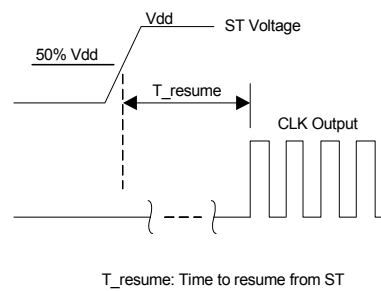


Figure 4. Standby Resume Timing (ST Mode Only)

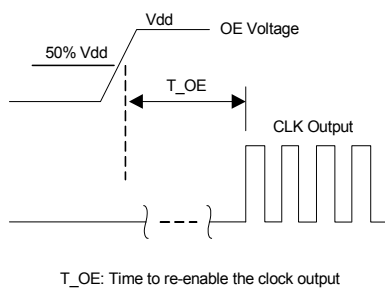


Figure 5. OE Enable Timing (OE Mode Only)

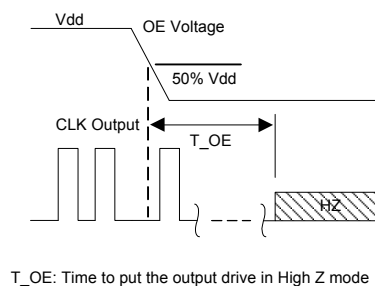
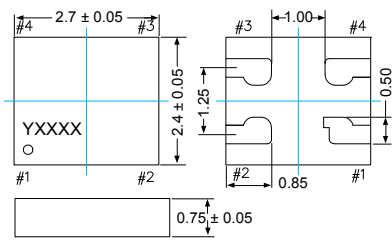
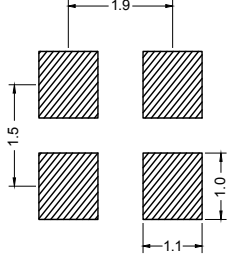
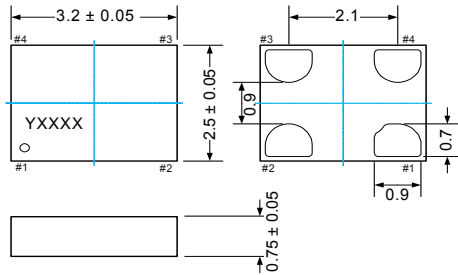
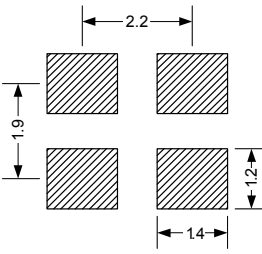
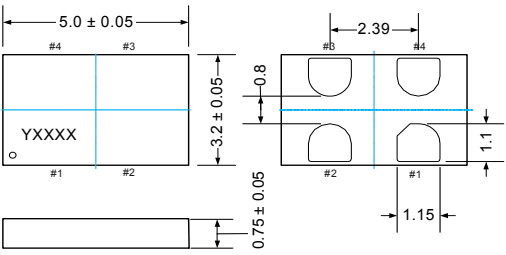
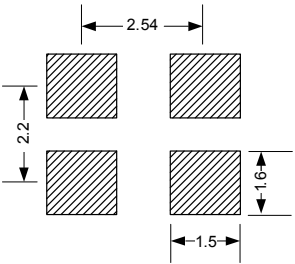
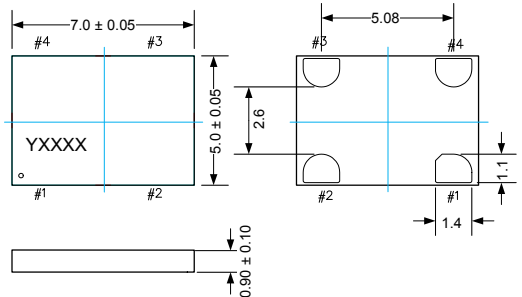
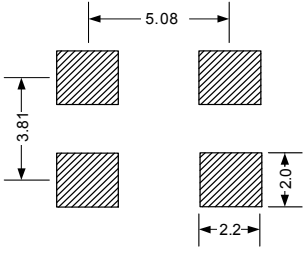


Figure 6. OE Disable Timing (OE Mode Only)

**Note:**

- 6. SiT8225 supports NO RUNT pulses and No glitches during startup or resume.
- 7. SiT8225 supports gated output which is accurate within rated frequency stability from the first cycle.

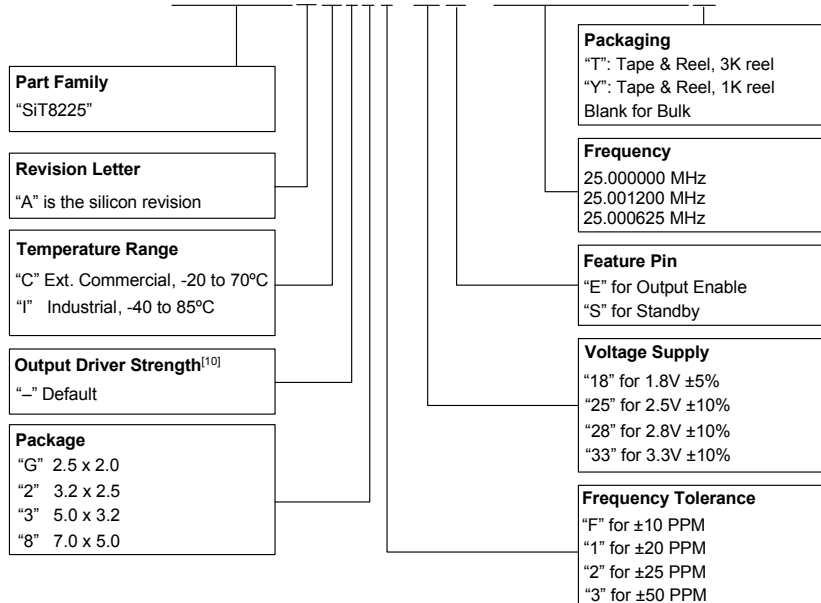
### Dimensions and Patterns

Package Size – Dimensions (Unit: mm) <sup>[8]</sup>	Recommended Land Pattern (Unit: mm) <sup>[9]</sup>
<p><b>2.7 x 2.4 x 0.75 mm (100% compatible with 2.5 x 2.0 mm footprint)</b></p> 	
<p><b>3.2 x 2.5 x 0.75 mm</b></p> 	
<p><b>5.0 x 3.2 x 0.75 mm</b></p> 	
<p><b>7.0 x 5.0 x 0.90 mm</b></p> 	

**Notes:**  
 8. Top marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of “Y” will depend on the assembly location of the device.  
 9. A capacitor of value 0.1 μF between Vdd and GND is recommended.

### Ordering Information

#### SiT8225AC-23-25E -25.000625 T



**Note:**

10. Contact [SiTime](#) for custom drive strength to drive higher or multiple load, or SoftEdge™ option for EMI reduction.

### Additional Information

Document	Description	Download Link
<b>Manufacturing Notes</b>	Tape & Reel dimension, reflow profile and other manufacturing related info	<a href="http://www.sitime.com/component/docman/doc_download/85-manufacturing-notes-for-sitime-oscillators">http://www.sitime.com/component/docman/doc_download/85-manufacturing-notes-for-sitime-oscillators</a>
<b>Qualification Reports</b>	RoHS report, reliability reports, composition reports	<a href="http://www.sitime.com/support/quality-and-reliability">http://www.sitime.com/support/quality-and-reliability</a>
<b>Performance Reports</b>	Additional performance data such as phase noise, current consumption and jitter for selected frequencies	<a href="http://www.sitime.com/support/performance-measurement-report">http://www.sitime.com/support/performance-measurement-report</a>
<b>Termination Techniques</b>	Termination design recommendations	<a href="http://www.sitime.com/support/application-notes">http://www.sitime.com/support/application-notes</a>
<b>Layout Techniques</b>	Layout recommendations	<a href="http://www.sitime.com/support/application-notes">http://www.sitime.com/support/application-notes</a>

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# Supplemental Information

The Supplemental Information section is not part of the datasheet and is for informational purposes only.

# Silicon MEMS Outperforms Quartz

## Best Reliability

Silicon is inherently more reliable than quartz. Unlike quartz suppliers, SiTime has in-house MEMS and analog CMOS expertise, which allows SiTime to develop the most reliable products. Figure 1 shows a comparison with quartz technology.

### Why is SiTime Best in Class:

- SiTime’s MEMS resonators are vacuum sealed using an advanced Epi-Seal™ process, which eliminates foreign particles and improves long term aging and reliability
- World-class MEMS and CMOS design expertise

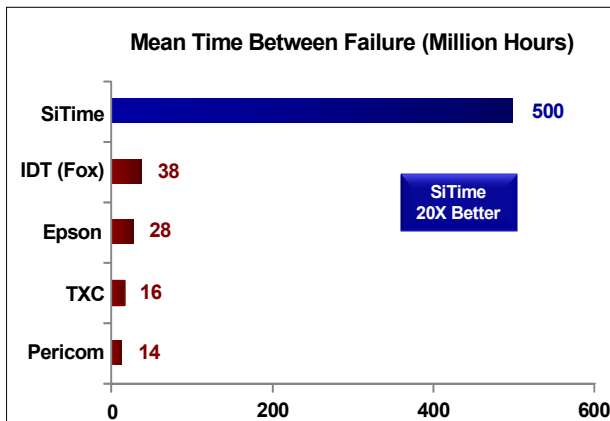


Figure 1. Reliability Comparison<sup>[1]</sup>

## Best Aging

Unlike quartz, MEMS oscillators have excellent long term aging performance which is why every new SiTime product specifies 10-year aging. A comparison is shown in Figure 2.

### Why is SiTime Best in Class:

- SiTime’s MEMS resonators are vacuum sealed using an advanced Epi-Seal™ process, which eliminates foreign particles and improves long term aging and reliability
- Inherently better immunity of electrostatically driven MEMS resonator

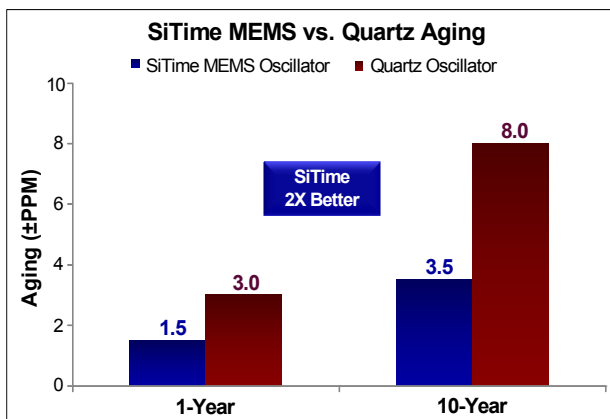


Figure 2. Aging Comparison<sup>[2]</sup>

## Best Electro Magnetic Susceptibility (EMS)

SiTime’s oscillators in plastic packages are up to 54 times more immune to external electromagnetic fields than quartz oscillators as shown in Figure 3.

### Why is SiTime Best in Class:

- Internal differential architecture for best common mode noise rejection
- Electrostatically driven MEMS resonator is more immune to EMS

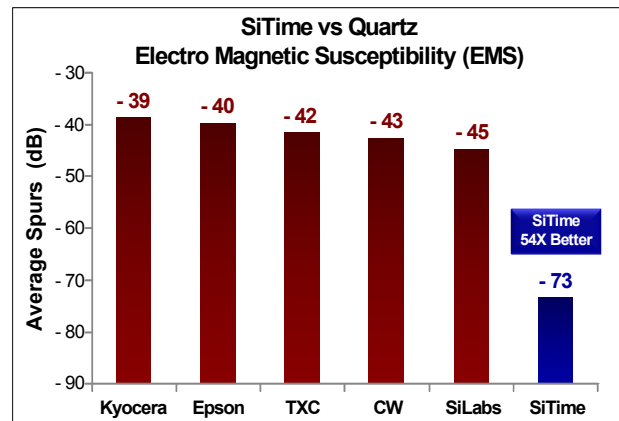


Figure 3. Electro Magnetic Susceptibility (EMS)<sup>[3]</sup>

## Best Power Supply Noise Rejection

SiTime’s MEMS oscillators are more resilient against noise on the power supply. A comparison is shown in Figure 4.

### Why is SiTime Best in Class:

- On-chip regulators and internal differential architecture for common mode noise rejection
- Best analog CMOS design expertise

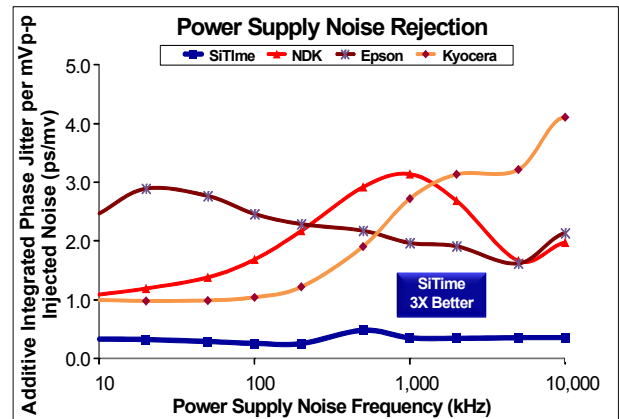


Figure 4. Power Supply Noise Rejection<sup>[4]</sup>

## Best Vibration Robustness

High-vibration environments are all around us. All electronics, from handheld devices to enterprise servers and storage systems are subject to vibration. Figure 5 shows a comparison of vibration robustness.

### Why is SiTime Best in Class:

- The moving mass of SiTime’s MEMS resonators is up to 3000 times smaller than quartz
- Center-anchored MEMS resonator is the most robust design

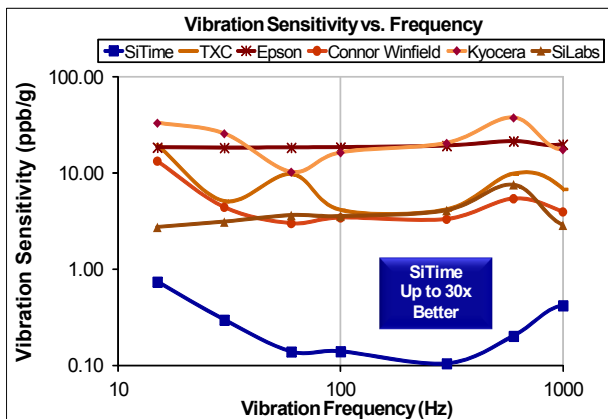


Figure 5. Vibration Robustness<sup>[5]</sup>

## Best Shock Robustness

SiTime’s oscillators can withstand at least 50,000 g shock. They all maintain their electrical performance in operation during shock events. A comparison with quartz devices is shown in Figure 6.

### Why is SiTime Best in Class:

- The moving mass of SiTime’s MEMS resonators is up to 3000 times smaller than quartz
- Center-anchored MEMS resonator is the most robust design

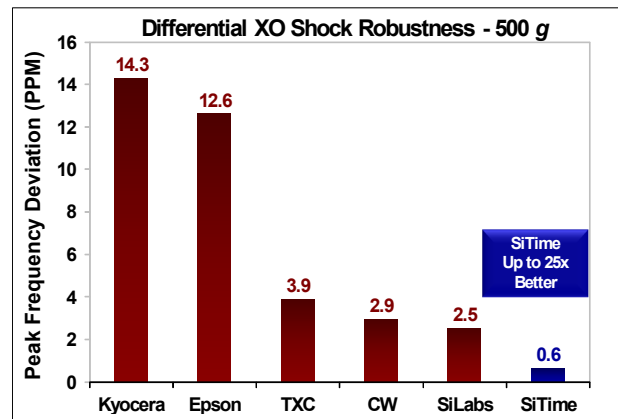


Figure 6. Shock Robustness<sup>[6]</sup>

### Notes:

1. Data Source: Reliability documents of named companies.
2. Data source: SiTime and quartz oscillator devices datasheets.
3. Test conditions for Electro Magnetic Susceptibility (EMS):
  - According to IEC EN61000-4.3 (Electromagnetic compatibility standard)
  - Field strength: 3V/m
  - Radiated signal modulation: AM 1 kHz at 80% depth
  - Carrier frequency scan: 80 MHz – 1 GHz in 1% steps
  - Antenna polarization: Vertical
  - DUT position: Center aligned to antenna

**Devices used in this test:**

  - SiTime, SiT9120AC-1D2-33E156.250000 - MEMS based - 156.25 MHz
  - Epson, EG-2102CA 156.2500M-PHPAL3 - SAW based - 156.25 MHz
  - TXC, BB-156.250MBE-T - 3rd Overtone quartz based - 156.25 MHz
  - Kyocera, KC7050T156.250P30E00 - SAW based - 156.25 MHz
  - Connor Winfield (CW), P123-156.25M - 3rd overtone quartz based - 156.25 MHz
  - SiLabs, Si590AB-BDG - 3rd overtone quartz based - 156.25 MHz
4. 50 mV pk-pk Sinusoidal voltage.
 

**Devices used in this test:**

  - SiTime, SiT8208AI-33-33E-25.000000, MEMS based - 25 MHz
  - NDK, NZ2523SB-25.6M - quartz based - 25.6 MHz
  - Kyocera, KC2016B25MOC1GE00 - quartz based - 25 MHz
  - Epson, SG-310SCF-25M0-MB3 - quartz based - 25 MHz
5. **Devices used in this test:** same as EMS test stated in Note 3.
6. Test conditions for shock test:
  - MIL-STD-883F Method 2002
  - Condition A: half sine wave shock pulse, 500-g, 1ms
  - Continuous frequency measurement in 100 μs gate time for 10 seconds

**Devices used in this test:** same as EMS test stated in Note 3
7. Additional data, including setup and detailed results, is available upon request to qualified customers. Please contact [productsupport@sitime.com](mailto:productsupport@sitime.com).

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---

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