Compliance Testing, LLC
Previously Flom Test Lab
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Test Report

Prepared for: ICOMS Detections SA

Model: V1 REV3

Description: TMA Radar Sensor

Serial Number: 1702016

FCC ID: TRQ-TMA

To

FCC Part 15.245
RSS 210, Issue 9

Date of Issue: January 8, 2019

On the behalf of the applicant:	**ICOMS Detections SA** **Avenue Albert Einstein, 11/B** **1348 Louvain-la-Neuve** **Belgium**
Attention of:	**André van den Bogaert** **Ph: +32 10 45 41 02** **Email: a.vandenbogaert@icomsdetections.com**

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Project No: p1790016

Poona Saber
Project Test Engineer

Revision	Date	Revised By	Reason for Revision
1.0	November 5, 2017	Poona Saber	Original Document
2.0	October 29, 2018	Poona Saber	-Changed model on page 1 and page 6 -Added RSS standard number on page 1 -Revised table on page 9 with reference to rss 310 to 210 -Added measurement uncertainty to page 17
3.0	December 21,2018	Poona Saber	Added Frequency Stability per RSS 210 RSS Gen

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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

ACCREDITED
TESTING CERT
#2152.01

FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21: Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator the responsible part may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices
Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10:2013 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (°C)	**Humidity (%)**	**Pressure (mbar)**
25.1	36.4	970.6

EUT Description
Model: V1 REV3
Description: TMA Radar Sensor
Firmware: N/A
Software: N/A
Serial Number: N/A
Additional Information: Antenna gain is 10.47 dBm and the maximum clock/ processor is 120 MHz. Device is 12V DC power operated. It's using FMCW (frequency modulation with a continuous wave) modulation technique. For testing purposes, the sweeping function is stopped, and device is put on Low, Mid and High channels. Peak measurements of the signal are made with CW signal and it is compared with the limits from 15.245.

EUT Operation during Tests
Normal

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	DC power supply	GW	GPS-3030D	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	9 pin to rs-232 cable	<3	N/A	N/A	N/A

Modifications: None

15.203: Antenna Requirement:

X	The antenna is permanently attached to the EUT
	The antenna uses a unique coupling
	The EUT must be professionally installed
	The antenna requirement does not apply

Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.245(b)	Fundamental Field Strength	Pass	
15.249(b)	Out of Band Spurious Emissions	Pass	
RSS-210	Fundamental Field Strength	Pass	
RSS-210	Out of Band Spurious Emissions	Pass	

Fundamental Field Strength

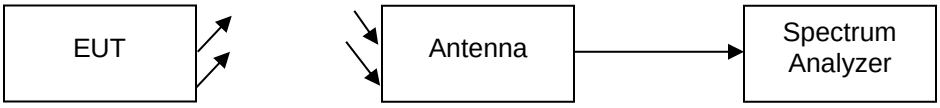
Engineer: Poona Saber

Test Date: 10/23/2017

Test Procedure

The EUT was tested on site in a semi- anechoic chamber at a distance of 1 meter away from the receiving antenna and corrected to the 3 meter limit**.** A spectrum analyzer was used to verify that the EUT meet the requirements for Fundamental Field Strength. The antenna correction and distance correction factors were summed with the peak measurement to ensure correct readings. The following table indicates the highest emission in each of the indicated bands.

Test Setup



Spectrum Analyzer Settings

Detector Settings	RBW	VBW
Peak	1 MHz	3 MHz

Sample Calculations:

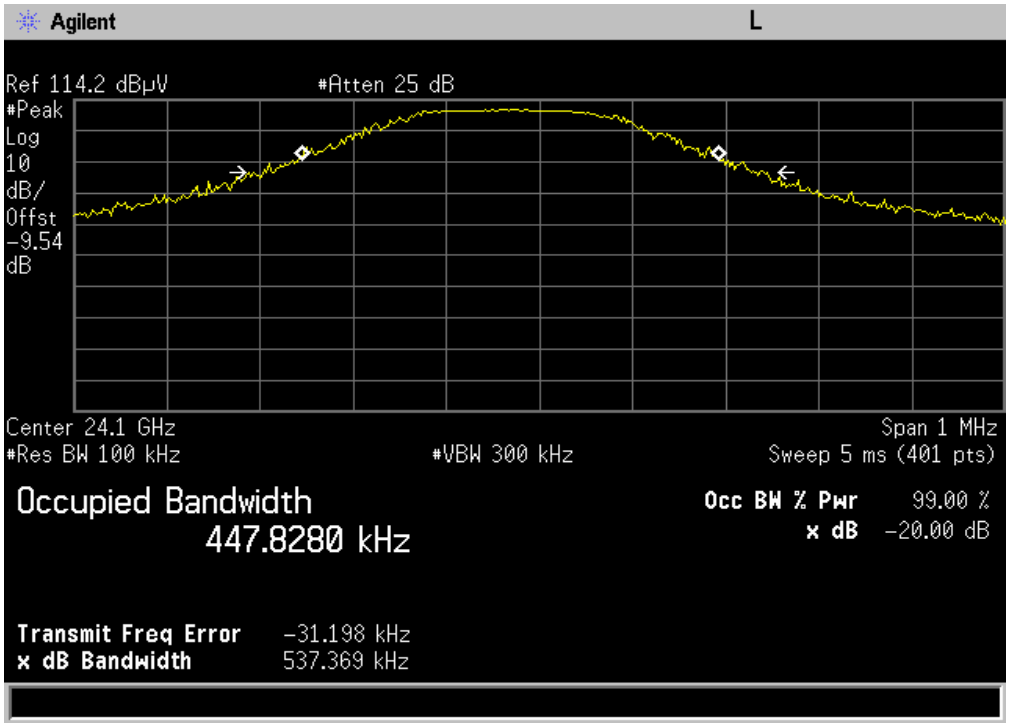
Correction Factors include Antenna, preamp and cable insertion loss.

Measured Level includes correction factors that were entered into the spectrum analyzer before recording test data.

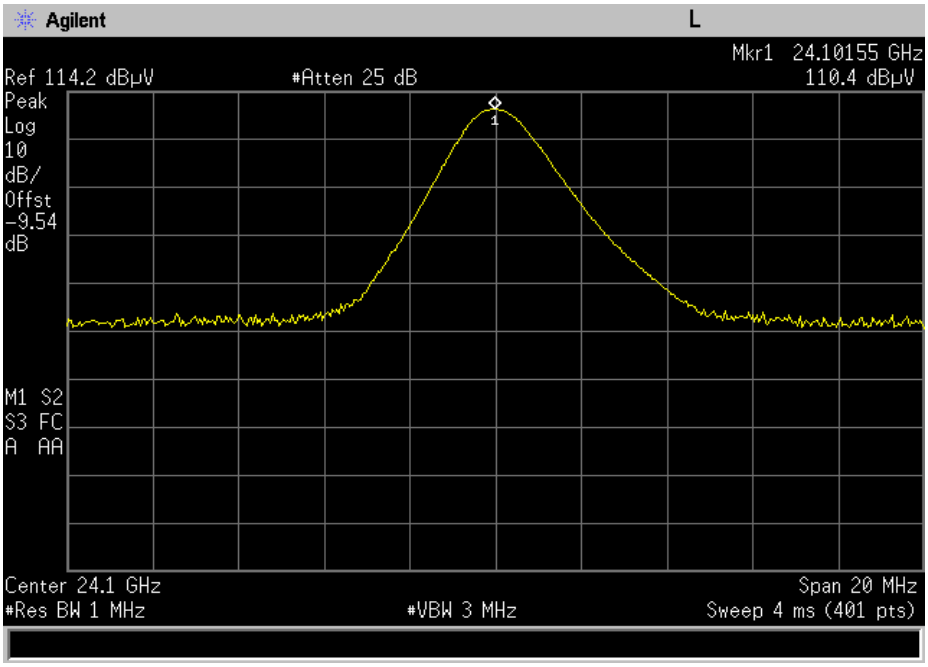
Fundamental Field Strength

Channel	Tuned Frequency (GHz)	Peak Measured Level (dBuV/m)	Average Limit (dBuV/m)	Result
Low	24.106	110.4	127.95	Pass
Mid	24.131	110.2	127.95	Pass
High	24.156	110.6	127.95	Pass

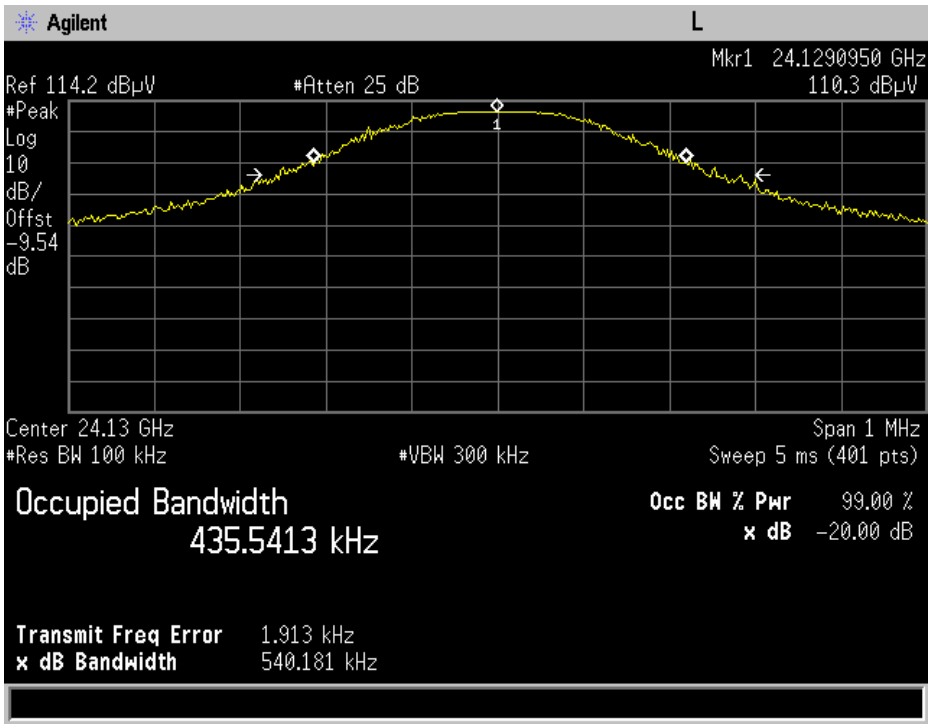
OBW Low channel



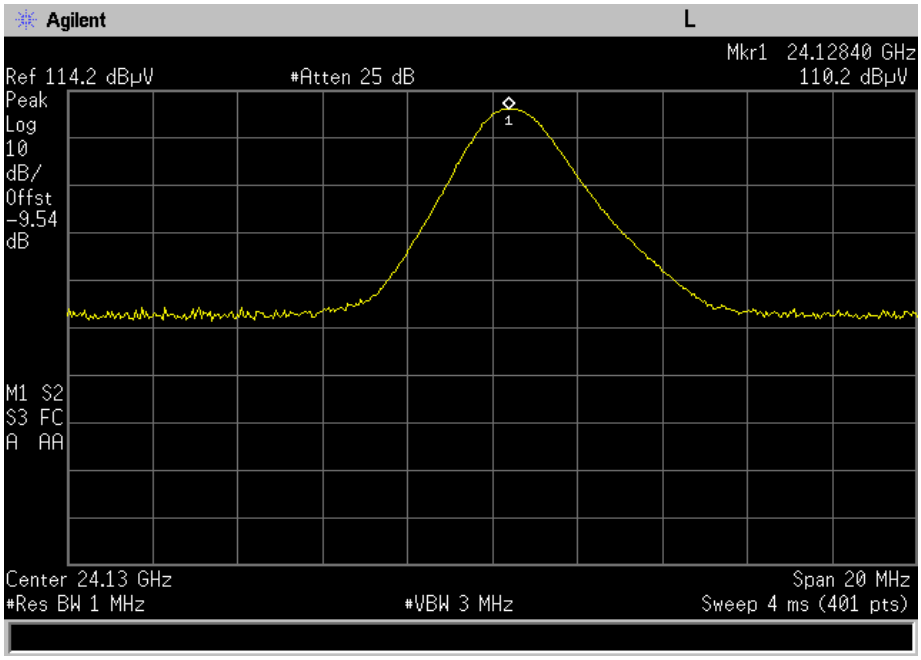
Peak measurement of the fundamental Low channel



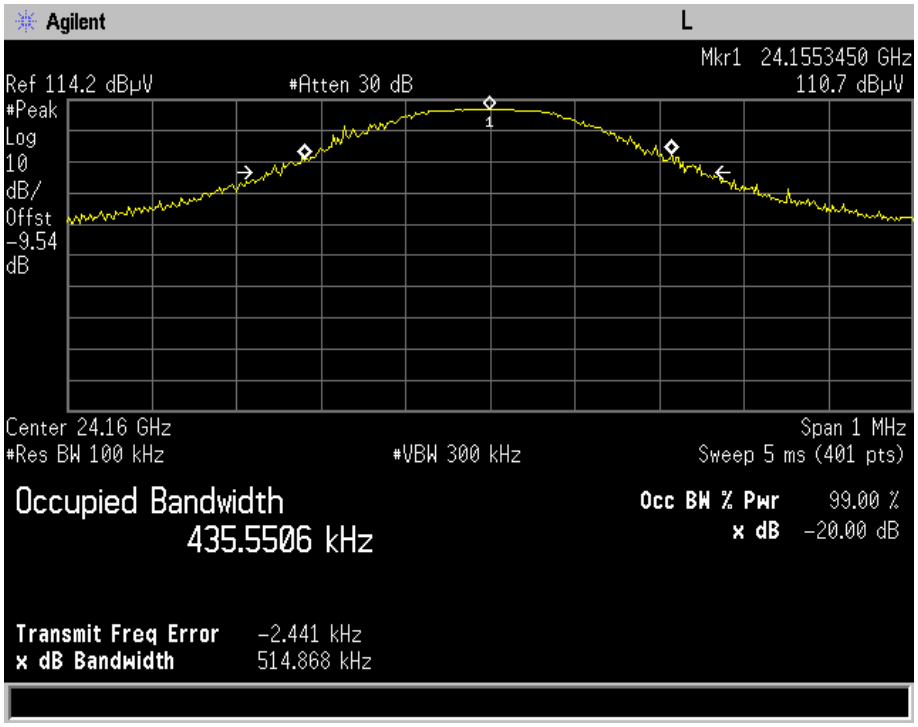
OBW Mid channel



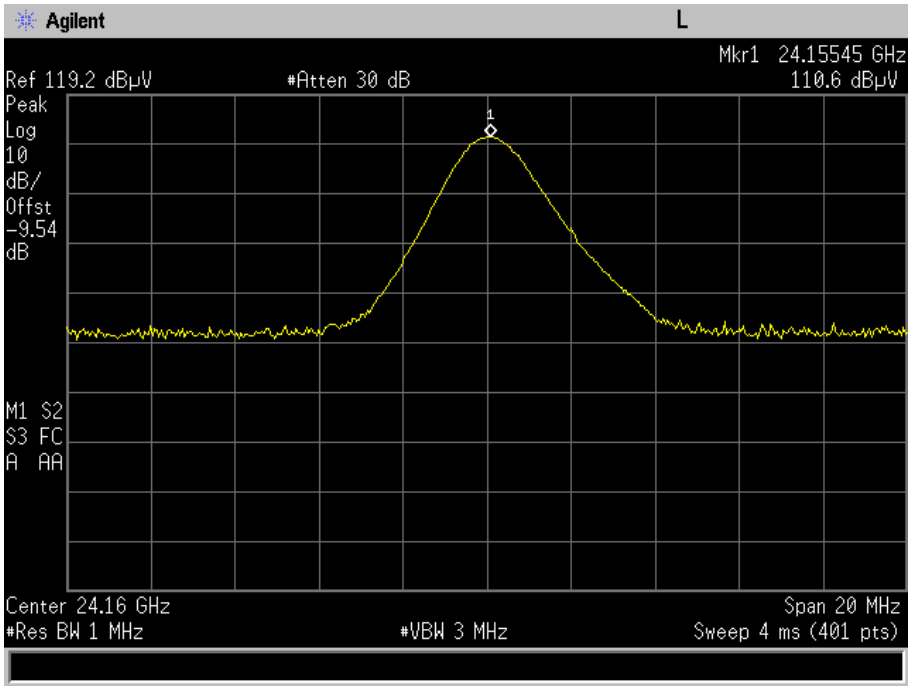
Peak measurement of the fundamental Mid channel



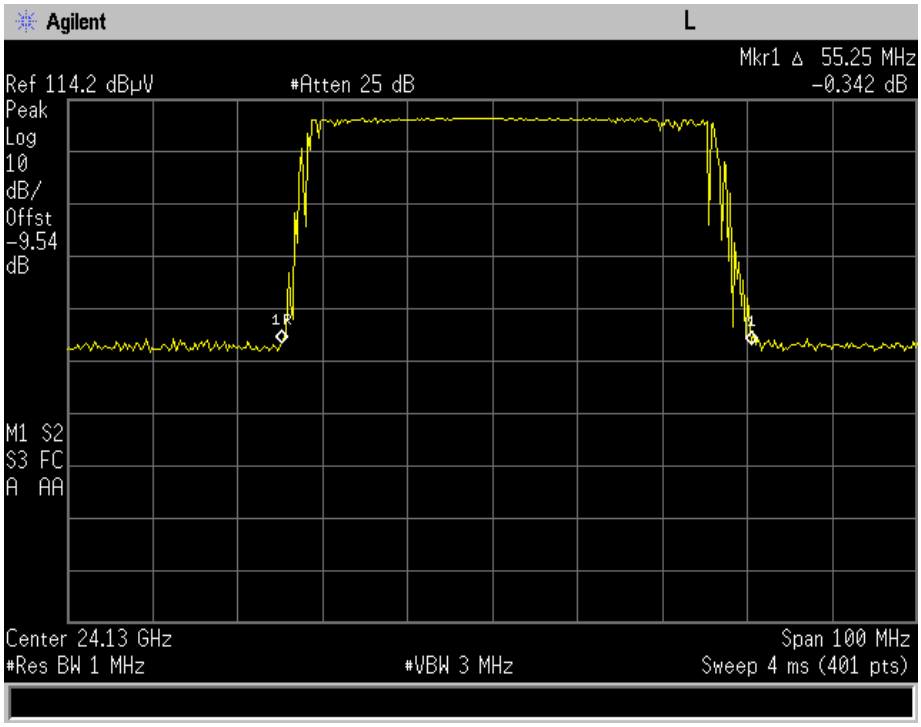
OBW High Channel



Peak measurement of the fundamental High channel



Sweep frequency Span of the signal



Radiated Spurious Emissions

Engineer: Poona Saber

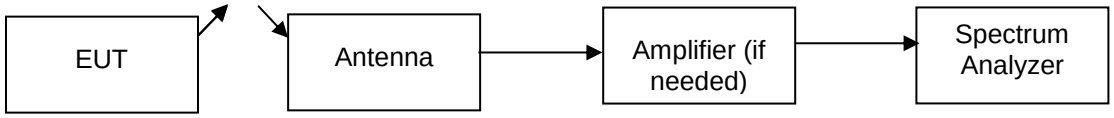
Test Date: 10/24/2017

Test Procedure

The EUT was tested in a semi-anechoic chamber on a 1.5m support for frequencies above 1GHz and 80 cm support for frequencies below 1GHz at mentioned distances from receiving antenna as below. A spectrum analyzer was used to verify that the EUT met the limits for Radiated Spurious Emissions. Harmonic Mixers were used to extend the measurement frequency range of the spectrum analyzer beyond 26.5 GHz and their factors were put into the amplifier before recording data. The same was done for receive antennas, pre-amplifier and cable correction factors.
The spectrum for each channel was examined up to 5th harmonic of the carrier or 100GHz whichever is less.

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation. Field strength of harmonics shall be below 87.9 dBuV/m.
Harmonic emissions in restricted bands and below 17.7 GHz shall not exceed the field strength limits shown in §15.209.

Test Setup



Analyzer Settings

Detector Settings	RBW	VBW
Peak	1 MHz	3 MHz

Measurement distances:

30 MHz- 18 GHz: 3 meters
18 GHz- 40 GHz: 1 meters
40 GHz- 100 GHz: 30 Centimeters

Sample Calculations:

Correction Factors include Antenna, Harmonic mixers and cable insertion loss correction factors.
Measured Level includes correction factors that were input to the spectrum analyzer before recording test data

Measurement distances that are not taken at 3 meters are corrected to 3 meters by following formula and compensated in spectrum analyzer by an offset.

Distance correction factor = 20 log (distance1/distance2)

Note: for above 26.5 GHz different mixers were used for different frequency bands and correction factors of those mixers were included in spectrum analyzer as well

Radiated Spurious Emissions

Please Refer to Annex A for spurious emission plots

Note: No emission beyond noise floor was seen above 40 GHz.

Note: all the spurious emissions (from 26.5-40 GHz) were captured originally with the signal identity capability of the spectrum analyzer off and it was observed that most of them disappear after the signal iden capability is turned on which indicates that those emissions which disappeared were image signal and not real emissions.
Plots that are included in Annex A are with signal iden capability on and peak measurements of highest emission is taken

Frequency Stability

Engineer: Poona Saber

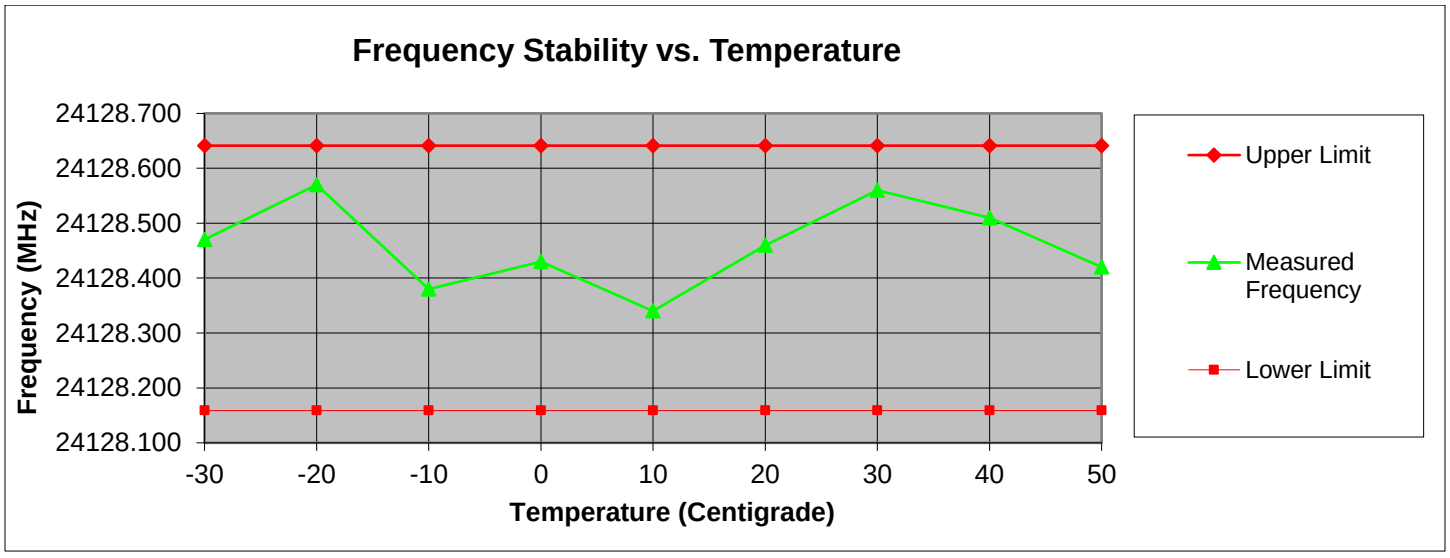
Test Date: 10/25/2017

Test Procedure

The frequency drift due to temperature and voltage variations in reference to frequency measured at nominal voltage and temperature was done on the low channel fundamental per RSS GEN and RSS 210 limit of 0.001%.

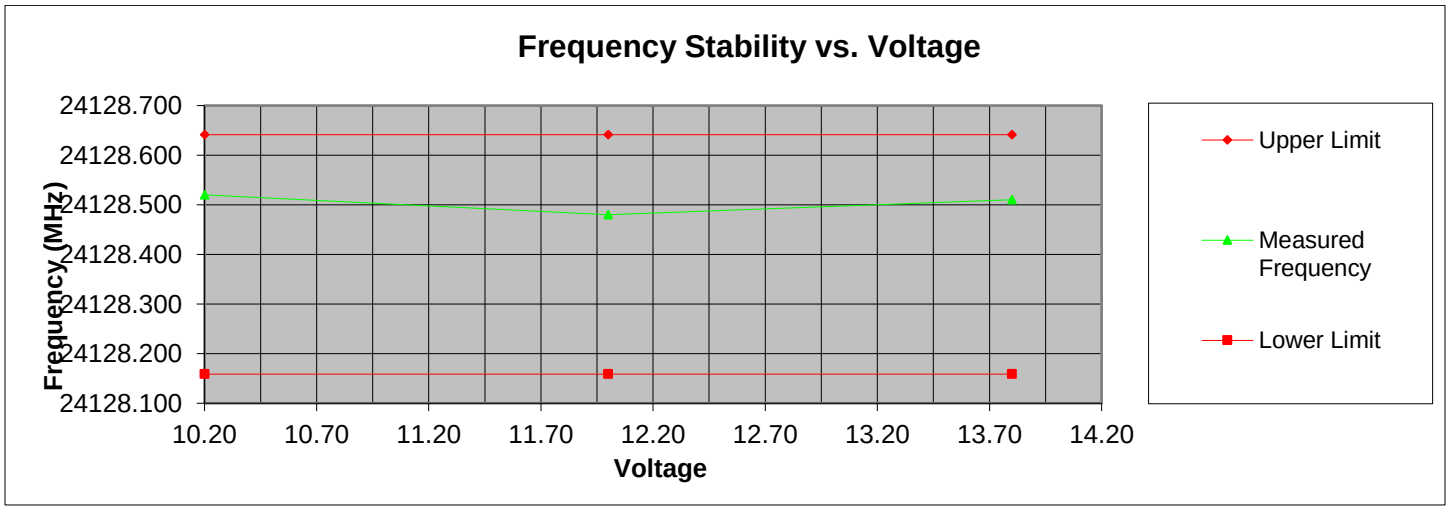
Frequency versus temperature

Tuned Frequency (MHz)	Frequency Tolerance %	Upper Limit (MHz)	Lower Limit (MHz)	Temperature centigrade	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
24128.40	0.0010	24128.6413	24128.1587	-30	24128.4700000	0.1713	0.3113
		24128.6413	24128.1587	-20	24128.5700000	0.0713	0.4113
		24128.6413	24128.1587	-10	24128.3800000	0.2613	0.2213
		24128.6413	24128.1587	0	24128.4300000	0.2113	0.2713
		24128.6413	24128.1587	10	24128.3400000	0.3013	0.1813
		24128.6413	24128.1587	20	24128.4600000	0.1813	0.3013
		24128.6413	24128.1587	30	24128.5600000	0.0813	0.4013
		24128.6413	24128.1587	40	24128.5100000	0.1313	0.3513
		24128.6413	24128.1587	50	24128.4200000	0.2213	0.2613



Frequency versus voltage

Tuned Frequency (MHz)	Frequency Tolerance %	Upper Limit (MHz)	Lower Limit (MHz)	Nominal Voltatge	Voltage	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
24128.40	0.0010	24128.6412840	24128.1587160	12.00	10.20	24128.5200000	-0.1212840	0.3612840
		24128.6412840	24128.1587160		12.00	24128.4800000	-0.1212840	0.3612840
		24128.6412840	24128.1587160		13.80	24128.5100000	-0.1212840	0.3612840



Test Equipment Utilized

Description	MFG	Model Number	CT Asset #	Last Cal Date	Cal Due Date
Spectrum Analyzer	Agilent	4407B	i00331	11/19/16	11/19/17
Harmonic mixer 26.5-40 GHz	HP	11970 A	i00193	6/4/15	6/4/18
Waveguide Adapter	HP	R281A	NA	Functional Verification	
Harmonic mixer 33-50 GHz	HP	11970 Q	i00465	6/4/15	6/4/18
Harmonic mixer 50-75 GHz	HP	11970 V	i00463	6/20/15	6/20/18
Harmonic mixer 75-110 GHz	HP	11970 W	i00464	6/4/15	6/4/18
High gain WR22 waveguide Horn Antenna (33-50 GHz)	cmi	HO22R	i00484	N/A	N/A
High gain WR22 waveguide Horn Antenna (50-75 GHz)	cmi	HO15R	i00477	N/A	N/A
High gain WR22 waveguide Horn Antenna (75-110 GHz)	cmi	HO10R	i00476	N/A	N/A
Horn Antenna (18-40 GHz)	EMCO	3116	i00085	2/6/17	2/6/18
Preamp 18-40 GHz	MITEQ	AMF-18004000-29-8P	i00461	Verified on 10/23/17	
Horn Antenna (1-18GHz)	ARA	DRG-118/A	i00271	6/16/16	6/16/18

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

Measurement Uncertainty

Measurement Uncertainty (U_{lab}) for Compliance Testing is listed in the table below.
The reported expanded uncertainty U_{lab}(dB) has been estimated at a 95% confidence level (k=2)

Measurement	U_{lab}
Radio Frequency	$\pm$ 1.0 x10^{-12}
RF Power, conducted	$\pm$ 0.43 dB
RF Power Density, conducted	$\pm$ .98 dB
Spurious Emissions, Conducted	$\pm$ 2.49 dB
All Emissions, radiated	$\pm$ 5.7 dB
Temperature	$\pm$ 1.0 deg C
Humidity	$\pm$ 4.3 %
Dc voltage	$\pm$ .12 %
Low Frequency voltages	$\pm$ 2.3 %

The reported expanded uncertainty +/- U_{lab}(dB) has been estimated at a 95% confidence level (k=2)

U_{lab} is less than or equal to U_{CISPR} therefore

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit

END OF TEST REPORT