RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC IC_SL17072501-TRB-019 Rev 1.0
Supersede Report No.: FCC IC_SL17072501-TRB-019

Applicant	Trimble, Inc.
Product Name	Alloy
Model No.	Alloy
Test Standard	47 CFR 15.247 RSS-247 Issue 2, February 2017
Test Method	ANSI C63.10: 2013 RSS Gen Iss 4: Nov 2014 558074 D01 DTS Meas Guidance v04
Date of test	10/06/2017
Issue Date	10/25/2017
Test Result	Pass Fail

Equipment complied with the specification	[x]
Equipment did not comply with the specification	[ ]

	
Rachana Khanduri	Chen Ge
Test Engineer	Engineer Reviewer

This test report may be reproduced in full only
Test result presented in this test report is applicable to the tested sample only

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ilac-MRA
A2LA ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & Radio Equipment Directive (RED)
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC IC_SL17072501-TRB-019	None	Original	10/17/2017
FCC IC_SL17072501-TRB-019 Rev 1.0	1.0	Updated per customer	10/25/2017

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: Trimble, Inc
Product: Alloy
Model: Alloy

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	Trimble, Inc
Applicant Address	935 Stewart Drive, Sunnyvale, CA 94085, USA
Manufacturer Name	Trimble, Inc
Manufacturer Address	935 Stewart Drive, Sunnyvale, CA 94085, USA

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name:	Alloy
Model No.:	Alloy
Trade Name:	Trimble, Inc.
Serial No.:	1673890050
Input Power:	100-240VAC 50-60Hz
Date of EUT received:	08/31/2017
Equipment Class/ Category:	Class B
Remark:	---
AC Power Cord Type:	ATS065T-A190 (Adapter Tech.)
DC Power Cable Type:	N/A

6.2 Radio Description

Radio Type	Wi-Fi
Operating Frequency	2412-2462
Channel Spacing	20MHz
Antenna Type	Rubber Whip
Antenna Gain	2dBi
Antenna Connector Type	Reverse SMA
Note	N/A

Radio Type	BT
Operating Frequency	2402-2480
Channel Spacing	1MHz
Antenna Type	Dipole
Antenna Gain	2dBi
Antenna Connector Type	Reverse SMA
Note	N/A

Radio Type	UHF
Operating Frequency	403~473MHz
Channel Spacing	25KHz ,12,5KHz
Antenna Type	5" whip antenna
Antenna Gain	-2 dBi
Antenna Connector Type	TNC connector
Note	N/A

6.3 EUT test modes/configuration Description

Test mode

Test Mode		Note
Pre_test_mode_1	Continuous Transmit	-
Pre_test_mode_2	Normal Operation Mode (duty cycle transmit power)	-
Pre_test_mode_3	-	-

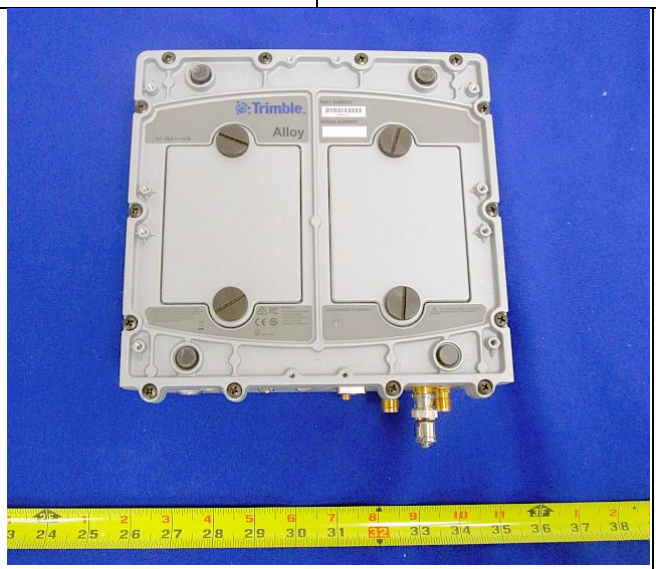
6.4 EUT Photos - External

EUT – Front and Top View

EUT – Rear View

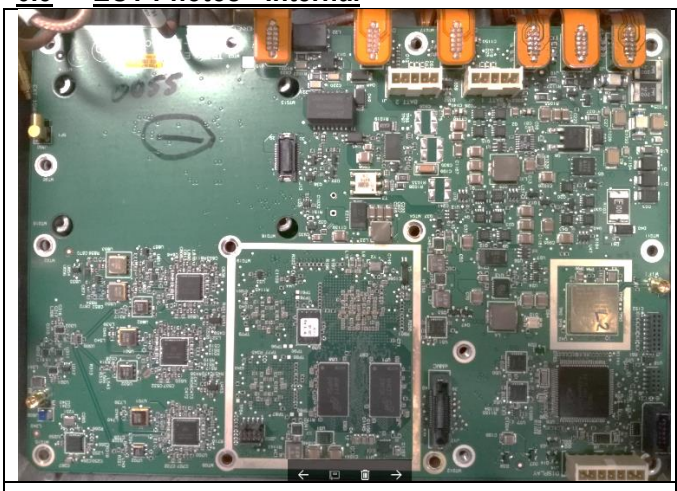
EUT – Left View

EUT– Right View

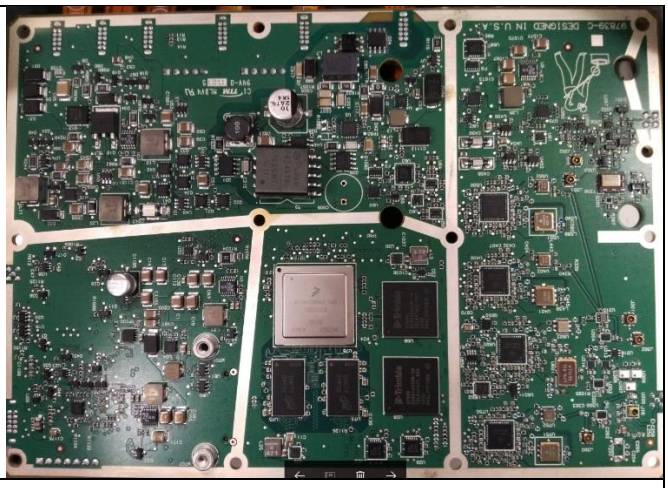


EUT– Bottom View

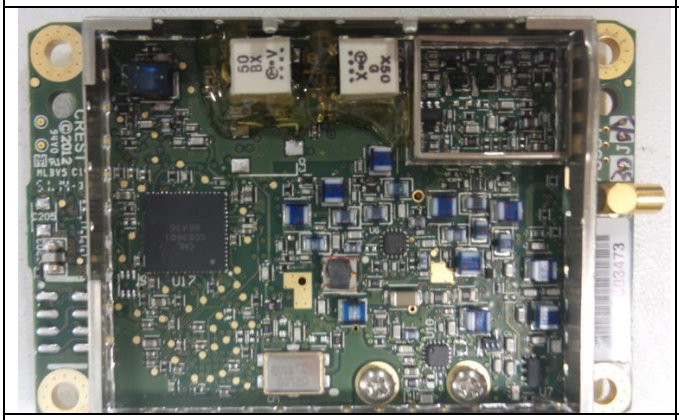
6.5 EUT Photos - Internal



EUT – PCB 1 – Top View

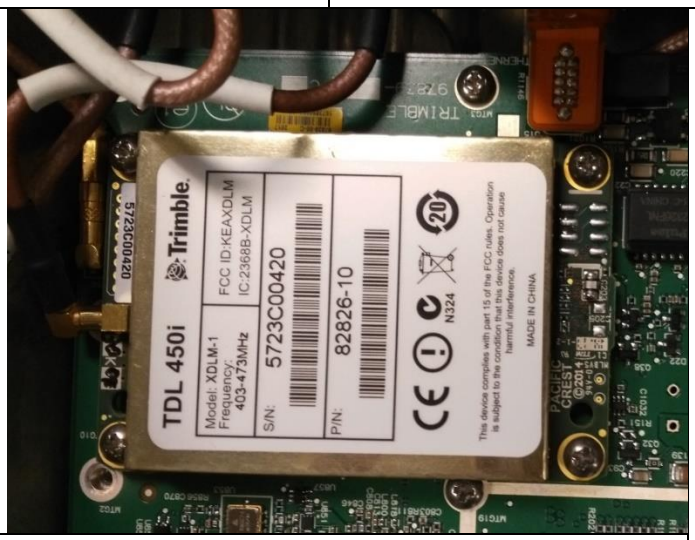


EUT – PCB 1 Bottom



EUT – PCB 2 – Top View

EUT– PCB 2 - Bottom View

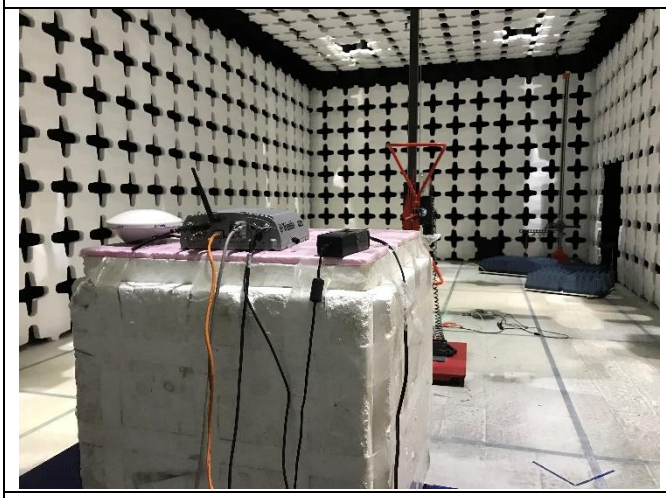


EUT – PCB 3

6.6 EUT - Test Setup Photos

Radiated Emissions above 1GHz – Front View

Radiated Emissions above 1GHz – Rear View



Radiated Emissions below 1GHz – Front View

Radiated Emissions below 1GHz – Rear View

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Support Equipment Description	Model	Serial Number	Manufacturer	Notes
1	Laptop	PP04X	N/A	Dell	-
2	Cable - Data, DB9(F) to DB9(F), null modem	59043	N/A	Cable connection	
3	Cable - 1.5m, DB9(F) Y to 0S/7P/M to Power Jack	590-44	N/A	SINBON ELECTRONICS CO., LTD	
4	Zephyr 3 antenna (GNSS antenna)	105000-10	N/A	Trimble, Inc.	
5	DC power insertion block	T10609-1-N	N/A	Panatron	
6	UHF antenna 5'' whip	44085-60	N/A	Laird	
7	Coaxial Cable 20 feet	N/A	N/A	N/A	
8	Ethernet Cable 10 feet	N/A	N/A	N/A	
9	Laird/LSR BT/WiFi rubber-whip antenna	001-0001	N/A	Laird	

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	

7.3 Test Software Description

Test Item	Software	Description
RF Testing	N/A	Set the EUT to transmit continuously in different test modes and channels

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013 RSS Gen Issue 4: 2014 558074 D01 DTS Meas Guidance v03r05	☒ Pass ☐ N/A
	IC	RSS247 (5.5)	IC		
Remark	1. All measurement uncertainties do not take into consideration for all presented test results. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.				

9 Measurement Uncertainty

9.1 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.
Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
NSA Calibration	4.0	U-Shape	1.414	1	2.8288543
Combined Standard Uncertainty					3.0059131
Expanded Uncertainty (K=2)					**6.0118262**

The total derived measurement uncertainty is +/- 6.00 dB.

9.2 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.0692840
Cable Insertion Loss	0.21	Normal	2	1	0.1050000
Filter Insertion Loss	0.25	Normal	2	1	0.1250000
Antenna Factor	0.65	Normal	2	1	0.3250000
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.8660508
PRF Response	1.5	Rectangular	1.732	1	0.8660508
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
VSWR Calibration	2.0	U-Shape	1.414	1	1.4144272
Combined Standard Uncertainty					4.2363
Expanded Uncertainty (K=2)					**8.4726**

The total derived measurement uncertainty is +/- 8.47 dB.

9.3 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.476087
Expanded Uncertainty (K=2)					**0.952174**

The total derived measurement uncertainty is +/- 0.95 dB.

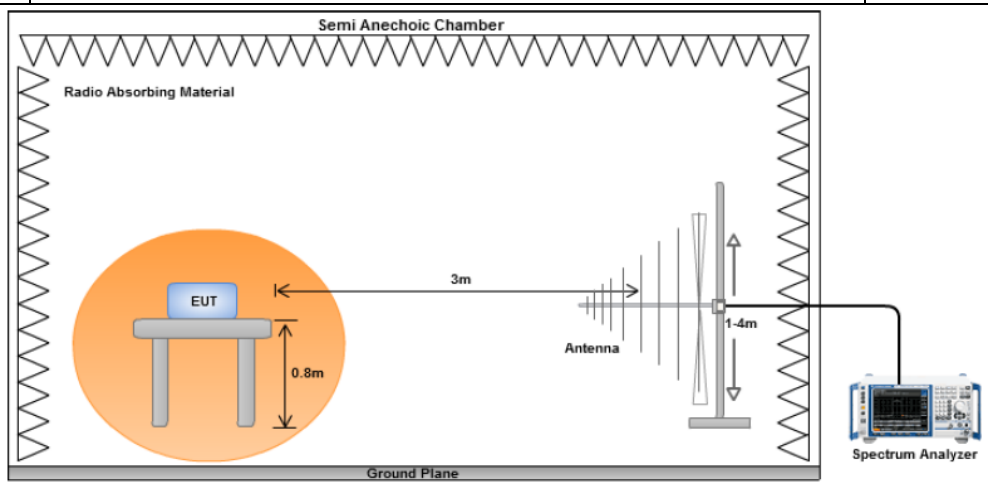
10 Measurements, Examination and Derived Results

10.1 Radiated Spurious Emissions below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d) RSS247 (5.5)	a)	Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges	☒

Frequency range (MHz)	Field Strength (uV/m)
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

Test Setup	
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. A Quasi-peak measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.
Remark	The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.
Result	☒ Pass ☐ Fail

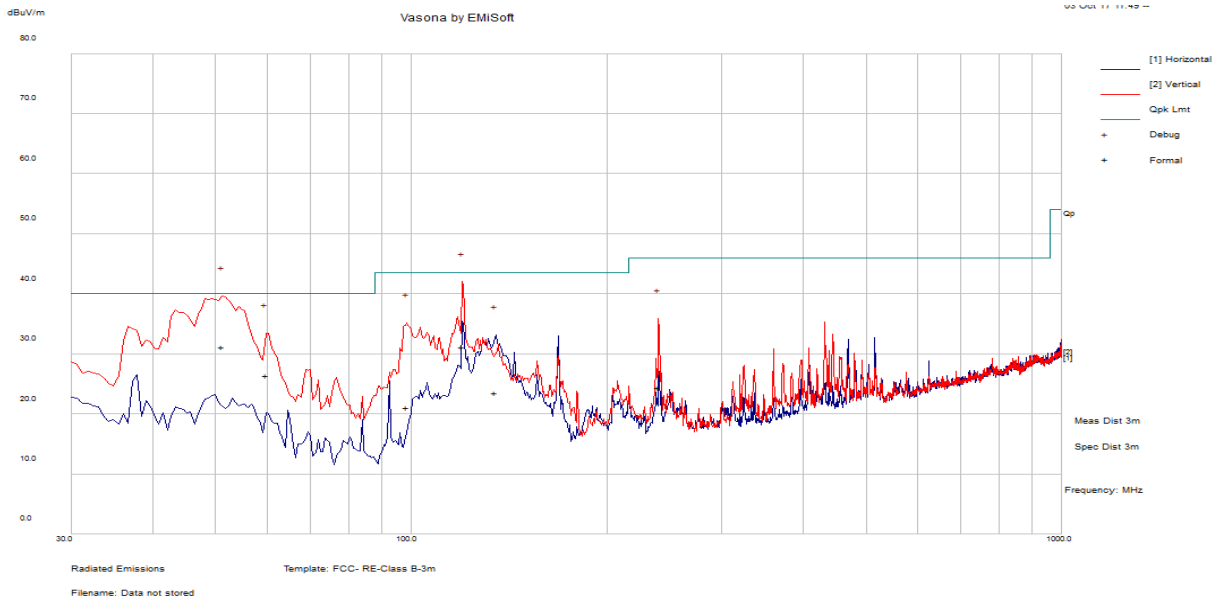
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Shuo Zhang at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	23	Result	Pass
	Humidity (%)	46		
	Atmospheric (mbar):	1018		
Mains Power:	120VAC, 60Hz			
Tested by:	Shuo Zhang			
Test Date:	10/06/2017			
Remarks:	Wi-Fi/BT and UHF radio co-location			

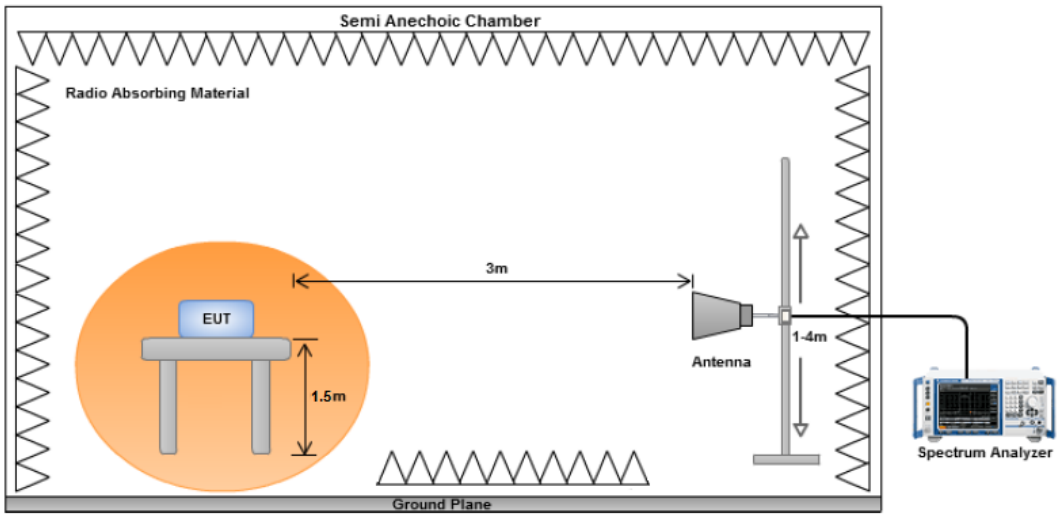


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
395.96	40.88	14.01	-21.15	33.74	Quasi Max	V	139	153	46	-12.26	Pass
84.04	30.96	11.85	-28.45	14.36	Quasi Max	V	266	226	40	-25.64	Pass
53.77	42.68	11.61	-28.18	26.12	Quasi Max	V	102	275	40	-13.88	Pass
30.01	22.69	11.29	-13.88	20.11	Quasi Max	V	219	273	40	-19.89	Pass
850.01	21.48	16.3	-14.16	23.62	Quasi Max	H	100	179	46	-22.38	Pass
55.22	22.29	11.63	-28.47	5.45	Quasi Max	V	180	60	40	-34.55	Pass

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

10.2 Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS247(A8.5)	a)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required ☐ 20 dB down ☒ 30 dB down	☒
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	☒
Test Setup			
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. An average measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.		
Remark	The EUT was scanned up to 40GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. There isn't outstanding emission found at the edge of restricted frequency.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Shuo Zhang at 10m chamber.

Radiated Emission Test Results (Above 1GHz)

Wi-Fi/BT and UHF radio co-location

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1595.43	56.09	2.52	-9.07	49.55	Peak Max	V	99	213	74	-24.45	Pass
2435.42	49.47	3.05	-5.93	46.59	Peak Max	V	106	121	74	-27.41	Pass
8320.05	39.13	5.89	1.1	46.12	Peak Max	V	296	97	74	-27.88	Pass
6844.21	38.15	5.19	0.73	44.07	Peak Max	V	317	212	74	-29.93	Pass
4788.41	39.73	4.15	-2.08	41.8	Peak Max	V	180	114	74	-32.2	Pass
3211.17	40.04	3.48	-3.91	39.61	Peak Max	V	137	91	74	-34.39	Pass
1595.43	43.91	2.52	-9.07	37.36	Average Max	V	99	213	54	-16.64	Pass
2435.42	27.82	3.05	-5.93	24.94	Average Max	V	106	121	54	-29.06	Pass
8320.05	26.98	5.89	1.1	33.96	Average Max	V	296	97	54	-20.04	Pass
6844.21	26.38	5.19	0.73	32.3	Average Max	V	317	212	54	-21.7	Pass
4788.41	27.17	4.15	-2.08	29.24	Average Max	V	180	114	54	-24.76	Pass
3211.17	27.32	3.48	-3.91	26.89	Average Max	V	137	91	54	-27.11	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
Agilent Spectrum Analyzer	N9010A	10SL0219	11/20/2016	1 Year	11/20/2017	☑
Pre-Amplifier (1-40GHz)	SAS-474	579	05/04/2017	1 Year	05/04/2018	☑
Preamplifier (100KHz-7GHz)	LPA-6-30	11170602	02/09/2017	1 Year	02/09/2018	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	01/13/2017	1 Year	01/13/2018	☑
Horn Antenna (1-26.5GHz)	3115	100059	08/11/2017	1 Year	08/11/2018	☑
Horn Antenna (18GHz~40GHz)	PA-840	181251	06/23/2017	1 Year	06/23/2018	☑
10 Meters SAC	10M	N/A	09/05/2017	1 Year	09/05/2018	☑

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio Equipment: EN45011:** EN ISO/IEC 17065
		Electromagnetic Compatibility: EN45011 – EN ISO/IEC 17065
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio**: A1. Terminal equipment for purpose of calling **Telecom**: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI **EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measuremet
Australia CAB Recognition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radiocommunications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2