RF TEST REPORT

SIEMIC
GLOBAL TESTING & CERTIFICATIONS
YOUR CHOICE FOR- TCB FCB CB NB CAB RCB

Report No.: FCC_IC_RF_SL15081101-CPC-009_DTS_2.4G_Rev1.2
Supersede Report No.: FCC_IC_RF_SL15081101-CPC-009_DTS_2.4G_Rev1.1

Applicant	:	ChargePoint, Inc
Product Name	:	Network Communication / RFID Reader
Model No.	:	28010077/ 28010087
Host Model No.	:	CPF12 & CPF25
Test Standard	:	47 CFR 15.247 RSS-247 Issue 1.0, May 2015
Test Method	:	ANSI C63.10:2013 RSS-Gen Issue 4, Nov 2014 558074 D01 DTS Meas Guidance v03r02
FCC ID	:	W38-28010077/ W38-28010087
IC ID	:	8854A-28010077/ 8854A-28010087
Dates of test	:	August 4th, 8th, September 21st – 23rd of 2015
Issue Date	:	11/4/2015
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification [ ]		

This Test Report is Issued Under the Authority of:	
Osvaldo Casorla	**Chen Ge**
Test Engineer	Engineer Reviewer

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

ilac-MRA
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 & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

CONTENTS

1 REPORT REVISION HISTORY 4
2 EXECUTIVE SUMMARY 5
3 CUSTOMER INFORMATION 5
4 TEST SITE INFORMATION 5
5 MODIFICATION 5
6 EUT INFORMATION 6
6.1 EUT Description 6
6.2 Radio Description 6
6.3 EUT test modes/configuration Description 7
6.4 EUT Photos 8
6.5 Host External Photos 9
6.6 Host Internal Photos 10
6.7 EUT Test Setup Photos 12
7 SUPPORTING EQUIPMENT/SOFTWARE AND CABLING DESCRIPTION 13
7.1 Supporting Equipment 13
7.2 Cabling Description 13
7.3 Test Software Description 13
8 TEST SUMMARY 14
9 MEASUREMENT UNCERTAINTY 15
10 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS 16
10.1 Radiated Measurements 16
10.2 Radiated Spurious Emissions in restricted band 25
10.3 Peak Output Power 28
ANNEX A. TEST INSTRUMENT 30
ANNEX B. SIEMIC ACCREDITATION 31

1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_IC_RF_SL15081101-CPC-009_DTS_2.4G	None	Original	09/31/2015
FCC_IC_RF_SL15081101-CPC-009_DTS_2.4G_Rev1.0	Rev 1.0	Updated EUT information.	10/01/2015
FCC_IC_RF_SL15081101-CPC-009_DTS_2.4G_Rev1.1	Rev 1.1	Included enclosure photos	10/27/2015
FCC_IC_RF_SL15081101-CPC-009_DTS_2.4G_Rev1.2	Rev 1.2	Updated page 28.	11/4/2015

2 Executive Summary

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

Company: ChargePoint, Inc.
Product: Network Communication / RFID Reader
Model No.: 28010077/ 28010087
Host Model No. CPF12 & CPF25

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	ChargePoint, Inc.
Applicant Address	254 E. Hacienda Ave Campbell, CA 95148
Manufacturer Name	ChargePoint, Inc.
Manufacturer Address	254 E. Hacienda Ave Campbell, CA 95148

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	Network Communication / RFID Reader
Model No.	28010077/ 28010087
Serial No.	Prototype 1
Trade Name	ChargePoint, Inc.
Host Model No.	CPF12 & CPF25
Input Power	100-240VDC, 50/60Hz
Product Hardware version	28-010087
Product Software version	4.0.1.100
Radio Hardware version	28-010087
Radio Software version	4.0.1.100
Date of EUT received	08/21/2015
Equipment Class/ Category	DTS
Operating Frequencies	13.56MHz , 2412-2462MHz
Port/Connectors	N/A

6.2 Radio Description

Specifications for Radio:

Radio Type	802.11b	802.11g	802.11n-20M
Operating Frequency	2412-2462MHz	2412-2462MHz	2412-2462MHz
Modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (BPSK, QPSK, 16QAM,64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Channel Spacing	5MHz	5MHz	5MHz(2.4GHz)
Number of Channels	11	11	11(2.4GH)
Antenna Type	Prestta WLAN Embedded Antenna		
Antenna Gain (Peak)	2.5dBi (for 2.4GHz)		
Antenna Connector Type	On Board		

Radio Type	RFID
Operating Frequency	13.56MHz
Modulation	ASK
Channel Spacing	None
Antenna Type	PCB loop antenna
Antenna Gain	0.5dBi
Antenna Connector Type	N/A

EUT Power level setting:

Mode	Frequency (MHz)	Power setting
802.11-b	2412	20
802.11-b	2437	20
802.11-b	2462	20
802.11-g	2412	20
802.11-g	2437	20
802.11-g	2462	20
802.11-n-20	2412	20
802.11-n-20	2437	20
802.11-n-20	2462	20

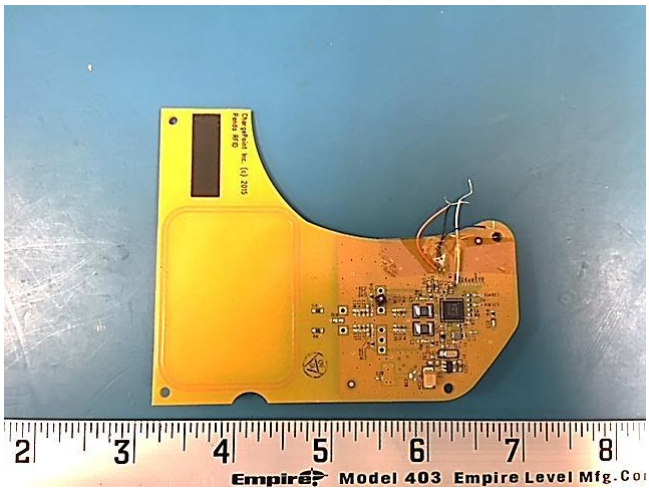
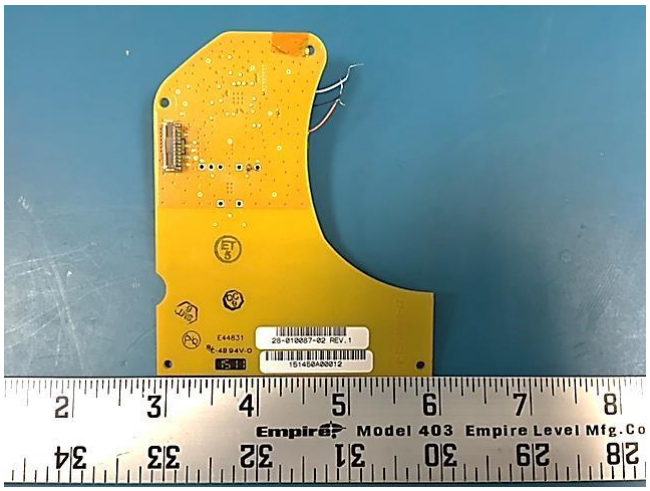
Channel List:

Type	Mode	Channel No.	Frequency (MHz)	Available (Y/N)
RFID	13.56MHz	1	13.56	Y

6.3 EUT test modes/configuration Description

Mode	Note
802.11-b	DSSS
802.11-g	OFDM-CCK
802.11-n-20	OFDM
RF test	EUT is set to continuously transmit at 13.56MHz when powered on.

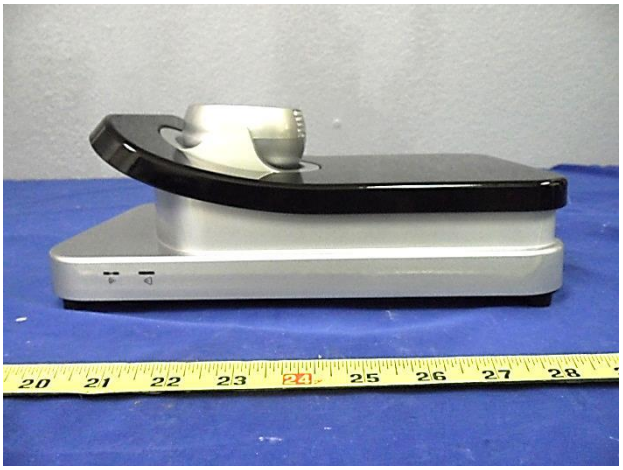
6.4 EUT Photos

	
PCBA1 RFID - View 1	**PCBA1 RFID - View 2**

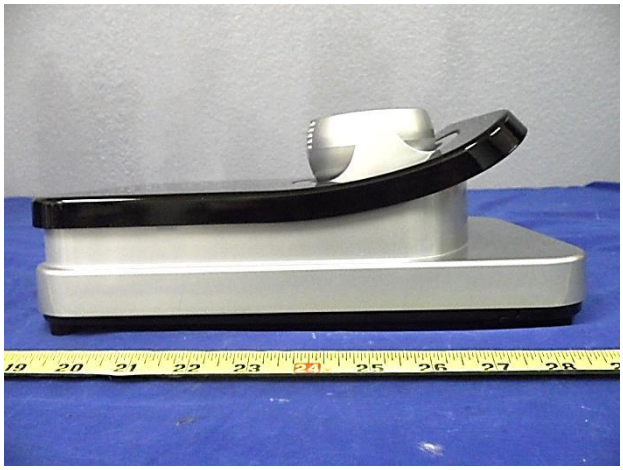
6.5 Host External Photos

EUT – Front View

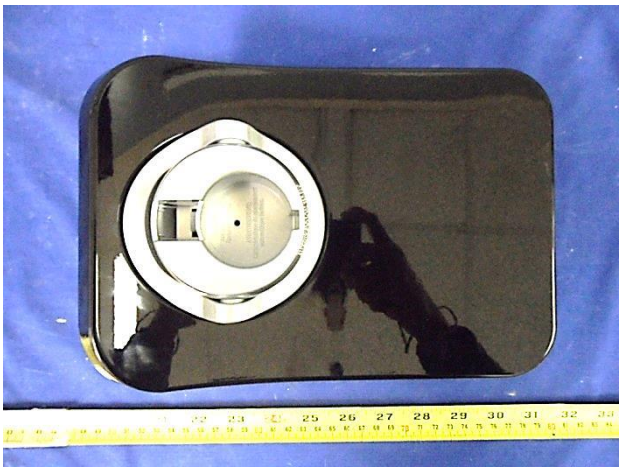
EUT – Rear View



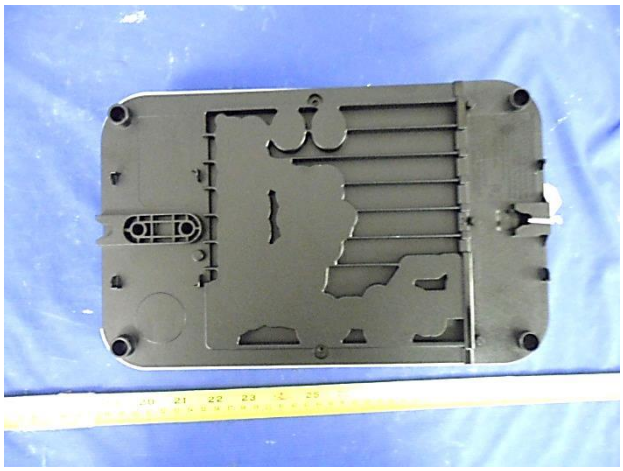
EUT – Left View



EUT – Right View

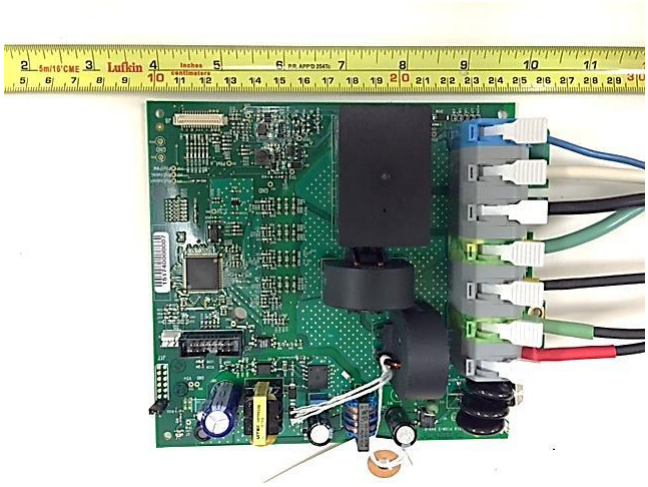


EUT – Top View

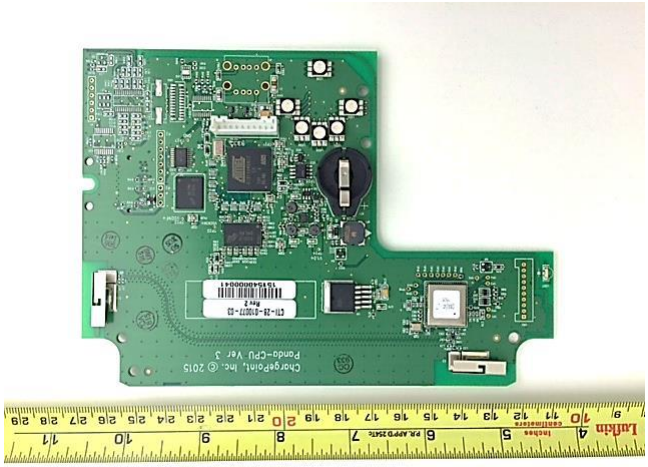


EUT – Bottom View

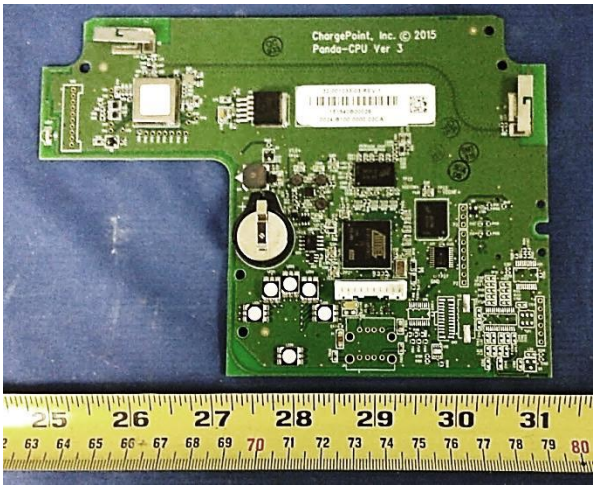
6.6 Host Internal Photos



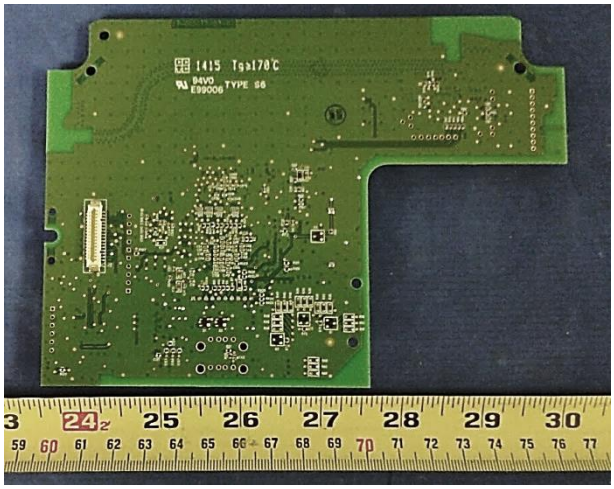
PCB Main Board- Top View



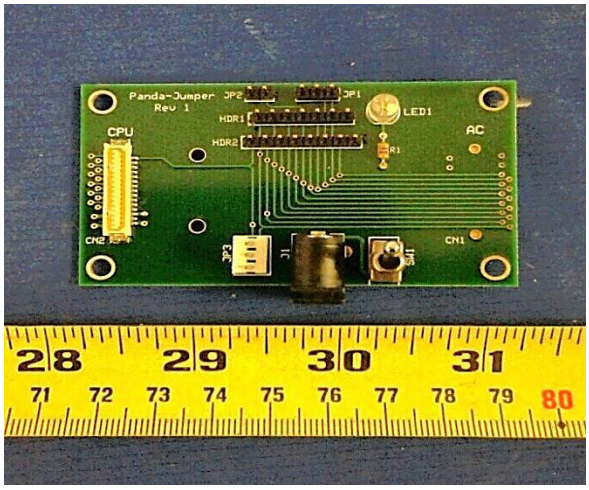
PCB Main Board- Bottom View



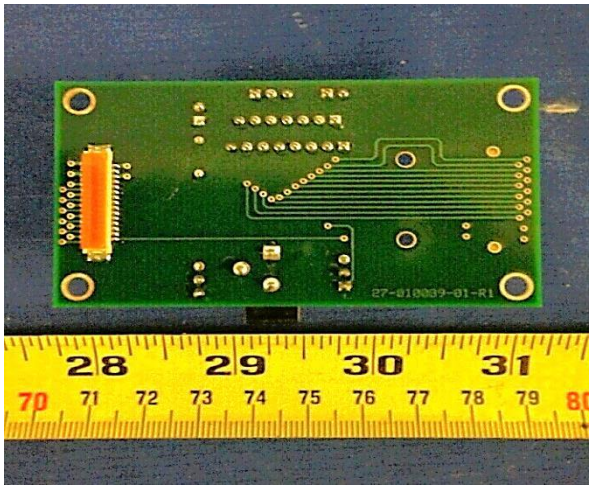
PCBA1 –Top View



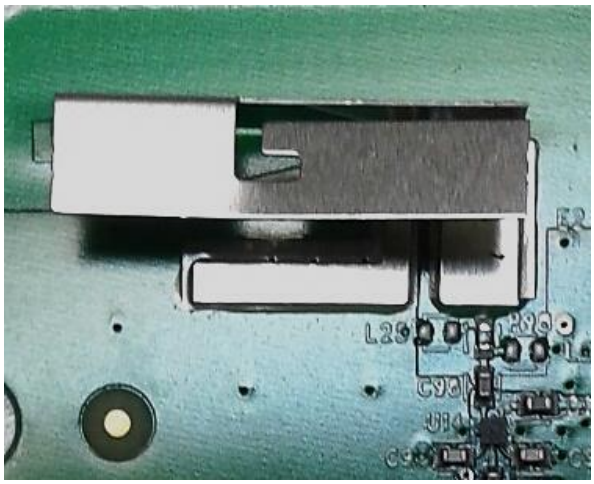
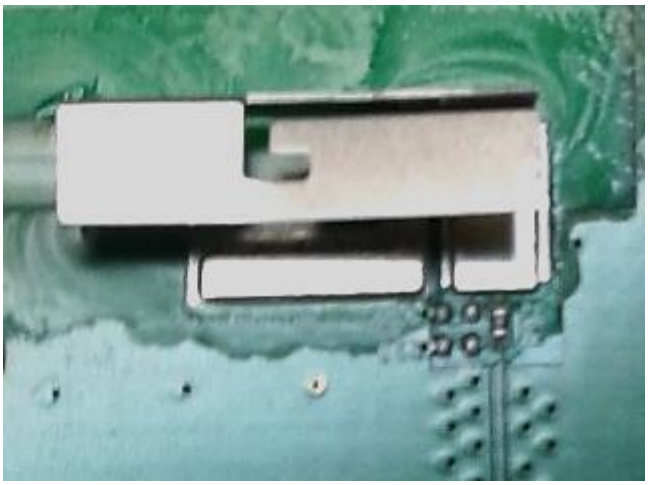
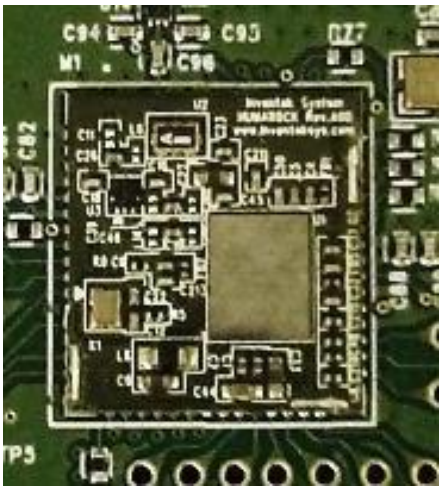
PCBA1 –Bottom View



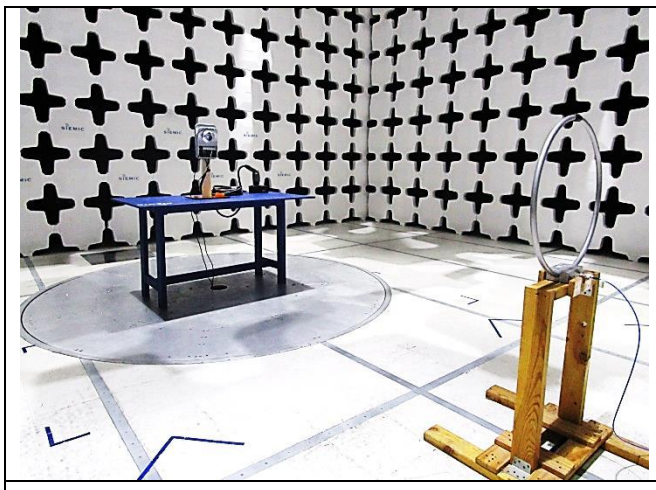
PCBA2 –Top View



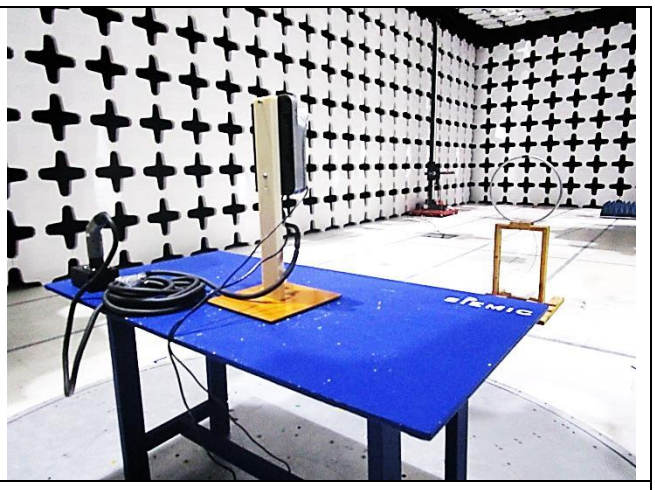
PCBA2 –Bottom View

	
Antenna 1	**Antenna 2**
	
EUT Radio with shielding	**EUT Radio without shielding**

6.7 EUT Test Setup Photos

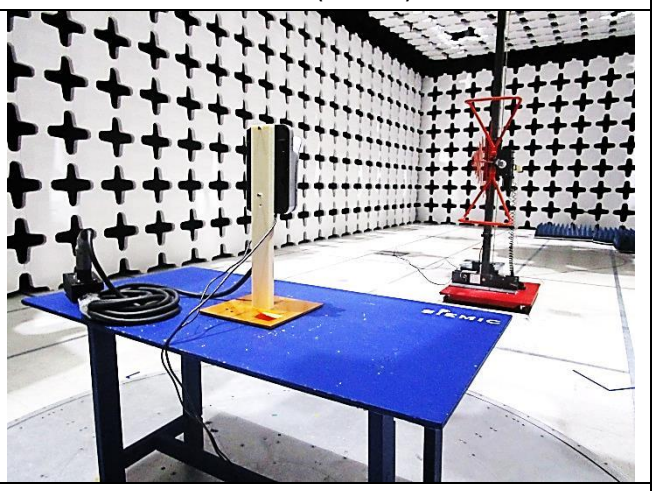


Radiated Emissions (<30MHz) – Front View

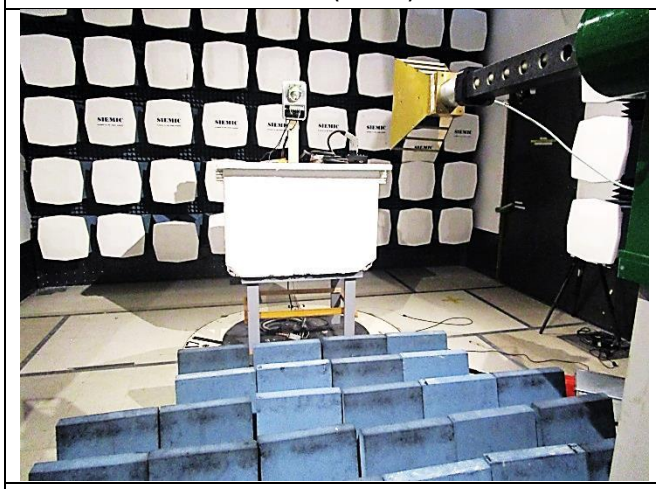


Radiated Emissions (<30MHz) – Rear View

Radiated Emissions (<1GHz) – Front View



Radiated Emissions (<1GHz) – Rear View



Radiated Emissions (>1GHz) – Front View

Radiated Emissions (>1GHz) – Rear View

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	P05F Latitude E5510	N/A	Dell	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
USB	EUT	I/O Port	Laptop	USB	2	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Tera Term	Set the EUT to transmit continuously in diferent test mode

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v03r02	☐ Pass ☒ N/A
	IC	RSS Gen 8.10	IC		
AC Conducted Emissions	FCC	15.207(a)	FCC	ANSI C63.10:2013	☐ Pass ☒ N/A
	IC	RSS Gen 8.8	IC	RSS Gen Issue 4: 2014	

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
99% Occupied Bandwidth	FCC	15.247(a)(1)	FCC	-	☐ Pass ☒ N/A
	IC	RSS Gen 6.6	IC	RSS Gen Issue 4: 2014 -	
6dB Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 DTS Meas Guidance v03r01	☐ Pass ☒ N/A
	IC	RSS247 (5.2.1)	IC		
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v03r02	☒ Pass ☐ N/A
	IC	RSS247 (5.5)	IC		
Output Power	FCC	15.247(b)	FCC	558074 D01 DTS Meas Guidance v03r02	☒ Pass ☐ N/A
	IC	RSS247 (5.4.4)	IC		
Receiver Spurious Emissions	IC	RSS Gen (4.8)	IC	RSS Gen Issue 4: 2014	☐ Pass ☒ N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	-	☐ Pass ☒ N/A
	IC	-	IC	-	
Power Spectral Density	FCC	15.247(e)	FCC	558074 D01 DTS Meas Guidance v03r02	☐ Pass ☒ N/A
	IC	RSS247 (5.2.2)	IC		
RF Exposure requirement	FCC	15.247(i)	FCC	-	☐ Pass ☒ N/A
	IC	RSS Gen(5.5)	IC	RSS Gen Issue 4: 2014	
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. 3. Reference the report FCC_IC_RF_SL15060501-CPC-006_DTS_2.4G, for more information.				

9 Measurement Uncertainty

Emissions			
Test Item	**Frequency Range**	**Description**	**Uncertainty**
Band Edge and Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
Band Edge and Radiated Spurious Emissions	1GHz – 40GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+4.3dB/-4.1dB

10 Measurements, Examination and Derived Results

10.1 Radiated Measurements

10.1.1 Radiated Measurements below 30MHz

Requirement(s):

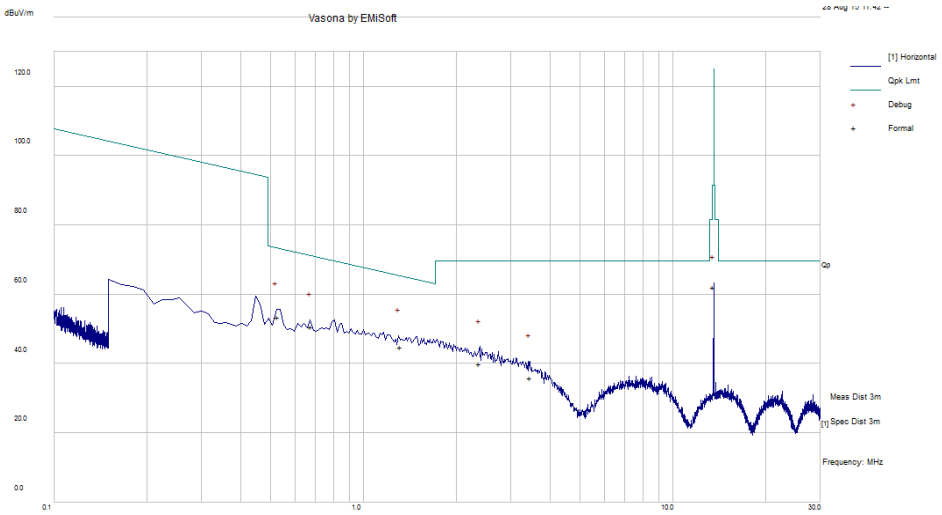
Specification(s)	Requirement			Applicable
47 CFR §15.225 RSS Gen 6.4	Operation within the band 13.110–14.010 MHz (a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters. (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.			☒
Test Setup	1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table. 2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable. 3. The relevant loop antenna was set at the required test distance away from the EUT and supporting equipment boundary.			
Procedure	For < 30MHz, Radiated emissions were measured according to ANSI C63.10. The EUT was set to transmit at the highest output power. The EUT was set 3 meter away from the measuring antenna. The loop antenna was positioned 1 meter above the ground from the centre of the loop. The measuring bandwidth was set to 10 kHz. The limit is converted from microvolt/meter to decibel microvolt/meter.			
Test Date	08/28/2015	Environmental conditions	Temperature Relative Humidity Atmospheric Pressure	22°C 40% 1026mbar
Remark	-			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test Plots for LMA Module/s and CPF12 & CPF25 below 30MHz

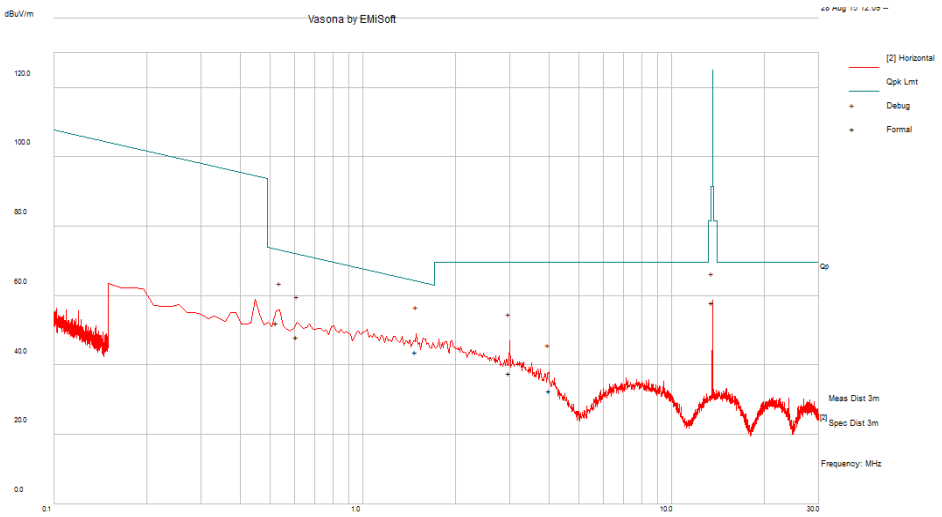
f= 100kHz – 30MHz plot, and loop antenna at 0 degree at 3m distance



f= 100kHz – 30MHz Measurements

Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Degree	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
0.53	35.78	-0.18	17.71	53.32	Quasi Max	0.00	100.00	262.00	73.12	-19.80	Pass
0.68	35.19	-0.19	15.72	50.72	Quasi Max	0.00	100.00	123.00	70.95	-20.23	Pass
1.32	34.57	-0.23	10.52	44.86	Quasi Max	0.00	100.00	123.00	65.19	-20.33	Pass
2.37	34.20	-0.30	6.16	40.06	Quasi Max	0.00	100.00	66.00	69.54	-29.48	Pass
3.46	32.47	-0.31	3.69	35.85	Quasi Max	0.00	100.00	167.00	69.54	-33.70	Pass
13.56	62.84	-0.62	-0.16	62.07	Quasi Max	0.00	100.00	184.00	123.99	--61.92	Pass

f= 100kHz – 30MHz plot, and loop antenna at 90 degree at 3m distance



f= 100kHz – 30MHz Measurements

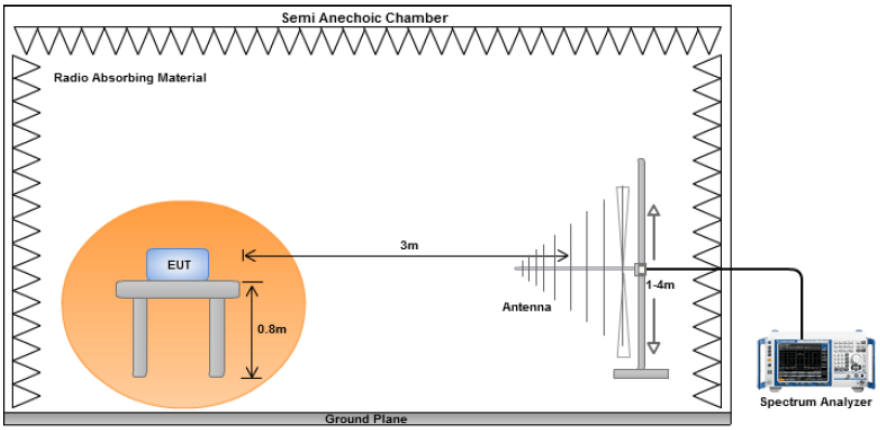
Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Degree	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
0.53	34.57	-0.18	17.77	52.17	Quasi Max	90.00	100.00	283.00	73.12	--20.95	Pass
0.61	31.67	-0.19	16.52	48.00	Quasi Max	90.00	100.00	171.00	71.90	-23.90	Pass
1.48	34.34	-0.24	9.62	43.73	Quasi Max	90.00	100.00	117.00	64.20	-20.47	Pass
2.99	33.33	-0.31	4.54	37.56	Quasi Max	90.00	100.00	176.00	69.54	-31.99	Pass
4.01	30.08	-0.30	2.83	32.61	Quasi Max	90.00	100.00	354.00	69.54	-36.93	Pass
13.56	58.67	-0.62	-0.16	57.89	Quasi Max	90.00	100.00	93.00	123.99	-66.10	Pass

10.1.2 Radiated Spurious Emissions below 1GHz

Requirement(s):

Specification(s)	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.

Test Date	08/04/2015	Environmental conditions	Temperature 25.5°C Relative Humidity 44.4% Atmospheric Pressure 1026mbar
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		

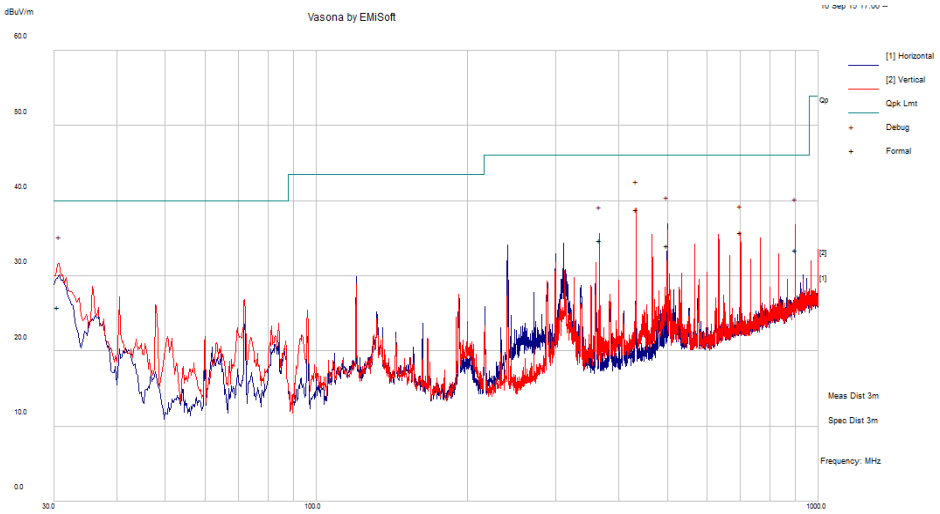
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Radiated Emission Test Results (Below 1GHz)

Test specification:	Radiated Spurious Emissions			
Environmental Conditions:	Temp(°C):	25.5 °C	Result:	☒ Pass ☐ Fail
	Humidity (%):	44.4 %		
	Atmospheric(mbar):	1016 mbar		
Mains Power:	208V_{AC}, 60Hz			
Tested by:	Osvaldo Casorla			
Test Date:	08/04/2015			
Remarks:	802.11b 2412MHz			

f=30MHz – 1000MHz plot at V= 208V_{AC}, 60Hz and 3 meter distance

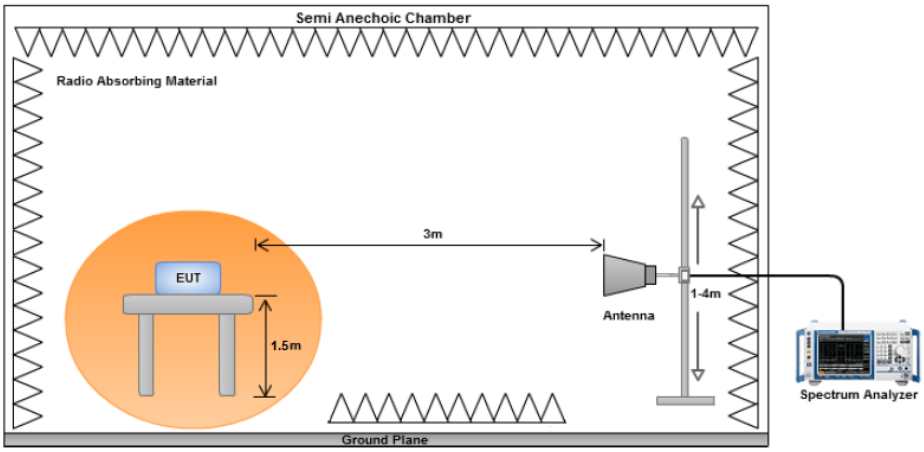


f=30MHz – 1000MHz Measurements

Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
30.55	39.88	0.81	-14.90	25.79	Quasi Max	V	147.00	223.00	40.00	-14.21	Pass
366.65	54.85	3.41	-23.51	34.75	Quasi Max	V	100.00	287.00	46.02	-11.27	Pass
433.33	57.30	3.67	-22.09	38.88	Quasi Max	V	181.00	225.00	46.02	-7.14	Pass
499.99	51.15	4.01	-21.08	34.08	Quasi Max	H	254.00	357.00	46.02	-11.94	Pass
699.98	49.59	4.68	-18.42	35.85	Quasi Max	V	100.00	8.00	46.02	-10.17	Pass
899.99	43.64	5.54	-15.77	33.41	Quasi Max	V	152.00	220.00	46.02	-12.61	Pass

10.1.3 Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

Specification(s)	Item	Requirement	Applicable
47CFR§15.247(d), RSS247 (5.5)	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.		

Test Date	09/21/2015 - 09/23/2015	Environmental conditions	Temperature 25.5°C Relative Humidity 44.4% Atmospheric Pressure 1027mbar
Remark	The EUT was scanned up to 25GHz. 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

Radiated Emission Test Results (Above 1GHz)

Above 1GHz-25GHz – 802.11b – 2412MHz

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
4149.39	22.18	5.96	11.57	39.71	Average Max	V	278.00	251.00	54.00	-14.29	Pass
14628.88	26.41	13.33	8.07	47.81	Average Max	V	237.00	237.00	54.00	-6.19	Pass
17675.80	24.25	13.00	10.58	47.83	Average Max	H	229.00	266.00	54.00	-6.17	Pass
4149.39	35.45	5.96	11.57	52.98	Peak Max	V	278.00	251.00	74.00	-21.02	Pass
14628.88	39.62	13.33	8.07	61.02	Peak Max	V	237.00	237.00	74.00	-12.98	Pass
17675.80	37.59	13.00	10.58	61.17	Peak Max	V	218.00	132.00	74.00	-12.83	Pass

Above 1GHz-25GHz- 802.11b - 2437MHz

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
4065.94	35.61	5.89	11.94	53.44	Peak Max	H	184.00	93.00	74.00	-20.56	Pass
14744.90	39.14	13.53	7.77	60.44	Peak Max	V	208.00	152.00	74.00	-13.56	Pass
17949.49	36.77	13.00	10.86	60.62	Peak Max	H	179.00	62.00	74.00	-13.38	Pass
4065.94	22.39	5.89	11.94	40.21	Average Max	H	184.00	93.00	54.00	-13.79	Pass
14744.90	26.16	13.53	7.77	47.46	Average Max	V	208.00	152.00	54.00	-6.54	Pass
17949.49	23.97	13.00	10.86	47.83	Average Max	H	179.00	62.00	54.00	-6.17	Pass

Above 1GHz-25GHz – 802.11b – 2462MHz

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
4119.18	35.34	5.93	11.70	52.98	Peak Max	V	201.00	15.00	74.00	-21.02	Pass
14594.00	39.07	13.27	8.17	60.51	Peak Max	H	275.00	305.00	74.00	-13.49	Pass
17930.10	37.03	13.00	10.84	60.87	Peak Max	V	161.00	133.00	74.00	-13.13	Pass
4119.18	22.01	5.93	11.70	39.65	Average Max	V	201.00	15.00	54.00	-14.35	Pass
14594.00	26.45	13.27	8.17	47.88	Average Max	H	275.00	305.00	54.00	-6.12	Pass
17930.10	23.98	13.00	10.84	47.82	Average Max	V	161.00	133.00	54.00	-6.18	Pass

Above 1GHz-25GHz- 802.11g - 2412MHz

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
4220.19	35.65	6.02	11.27	52.94	Peak Max	H	283.00	264.00	74.00	-21.06	Pass
14695.96	39.26	13.45	7.90	60.61	Peak Max	H	154.00	341.00	74.00	-13.39	Pass
17726.52	37.07	13.00	10.63	60.70	Peak Max	H	235.00	67.00	74.00	-13.30	Pass
4220.19	22.61	6.02	11.27	39.90	Average Max	H	283.00	264.00	54.00	-14.10	Pass
14695.96	26.40	13.45	7.90	47.74	Average Max	H	154.00	341.00	54.00	-6.26	Pass
17726.52	24.64	13.00	10.63	48.27	Average Max	H	235.00	67.00	54.00	-5.73	Pass

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

Above 1GHz-25GHz – 802.11g – 2437MHz

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
4047.32	35.08	5.87	12.02	52.97	Peak Max	H	286.00	135.00	74.00	-21.03	Pass
14575.36	39.70	13.23	8.22	61.16	Peak Max	V	274.00	219.00	74.00	-12.84	Pass
17915.05	36.90	13.00	10.82	60.73	Peak Max	V	159.00	34.00	74.00	-13.27	Pass
4047.32	22.37	5.87	12.02	40.26	Average Max	H	286.00	135.00	54.00	-13.74	Pass
14575.36	26.77	13.23	8.22	48.22	Average Max	V	274.00	219.00	54.00	-5.78	Pass
17915.05	24.18	13.00	10.82	48.00	Average Max	V	159.00	34.00	54.00	-6.00	Pass

Above 1GHz-25GHz- 802.11g - 2462MHz

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
4118.35	36.25	5.93	11.71	53.89	Peak Max	V	178.00	335.00	74.00	-20.11	Pass
6468.87	40.90	8.28	9.96	59.14	Peak Max	V	259.00	76.00	74.00	-14.86	Pass
17981.37	36.76	13.00	10.89	60.65	Peak Max	V	226.00	344.00	74.00	-13.35	Pass
4118.35	22.56	5.93	11.71	40.20	Average Max	V	178.00	335.00	54.00	-13.80	Pass
6468.87	28.04	8.28	9.96	46.28	Average Max	V	259.00	76.00	54.00	-7.72	Pass
17981.37	23.99	13.00	10.89	47.88	Average Max	V	226.00	344.00	54.00	-6.12	Pass

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

Above 1GHz-25GHz- 802.11n20 - 2412MHz

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
4150.07	35.97	5.96	11.57	53.50	Peak Max	H	252.00	270.00	74.00	-20.50	Pass
14012.29	40.74	12.70	7.38	60.82	Peak Max	H	166.00	22.00	74.00	-13.18	Pass
17848.01	37.44	13.00	10.75	61.19	Peak Max	H	197.00	355.00	74.00	-12.81	Pass
4150.07	22.51	5.96	11.57	40.04	Average Max	H	252.00	270.00	54.00	-13.96	Pass
14012.29	27.12	12.70	7.38	47.20	Average Max	H	166.00	22.00	54.00	-6.80	Pass
17848.01	24.04	13.00	10.75	47.80	Average Max	H	197.00	355.00	54.00	-6.20	Pass

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

Above 1GHz-25GHz – 802.11n20 – 2437MHz

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
4118.47	36.38	5.93	11.71	54.02	Peak Max	V	201.00	177.00	74.00	-19.98	Pass
14730.91	39.01	13.51	7.80	60.32	Peak Max	V	215.00	360.00	74.00	-13.68	Pass
17709.00	36.94	13.00	10.61	60.55	Peak Max	H	193.00	350.00	74.00	-13.45	Pass
4118.47	22.53	5.93	11.71	40.17	Average Max	V	201.00	177.00	54.00	-13.83	Pass
14730.91	26.35	13.51	7.80	47.67	Average Max	V	215.00	360.00	54.00	-6.33	Pass
17709.00	24.45	13.00	10.61	48.06	Average Max	H	193.00	350.00	54.00	-5.94	Pass

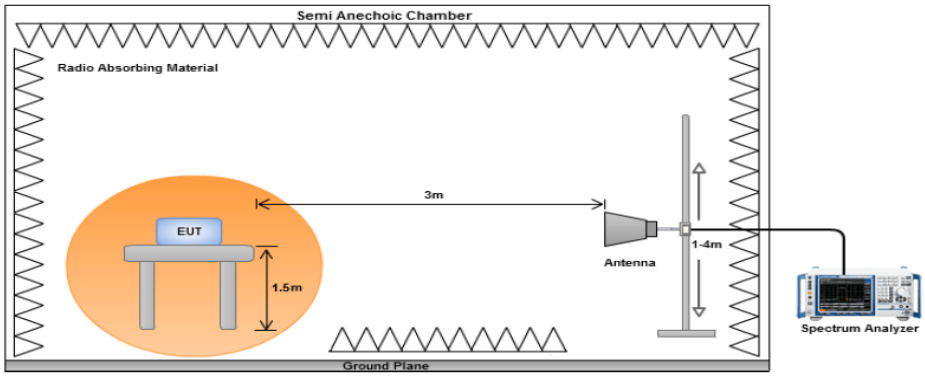
Above 1GHz-25GHz- 802.11n20 - 2462MHz

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
4151.02	35.71	5.96	11.57	53.24	Peak Max	H	201.00	327.00	74.00	-20.76	Pass
14779.66	39.66	13.60	7.67	60.93	Peak Max	H	211.00	50.00	74.00	-13.07	Pass
17744.25	38.10	13.00	10.65	61.75	Peak Max	H	160.00	342.00	74.00	-12.25	Pass
4151.02	22.69	5.96	11.57	40.22	Average Max	H	201.00	327.00	54.00	-13.78	Pass
14779.66	26.62	13.60	7.67	47.89	Average Max	H	211.00	50.00	54.00	-6.11	Pass
17744.25	24.33	13.00	10.65	47.97	Average Max	H	160.00	342.00	54.00	-6.03	Pass

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

10.2 Radiated Spurious Emissions in restricted band

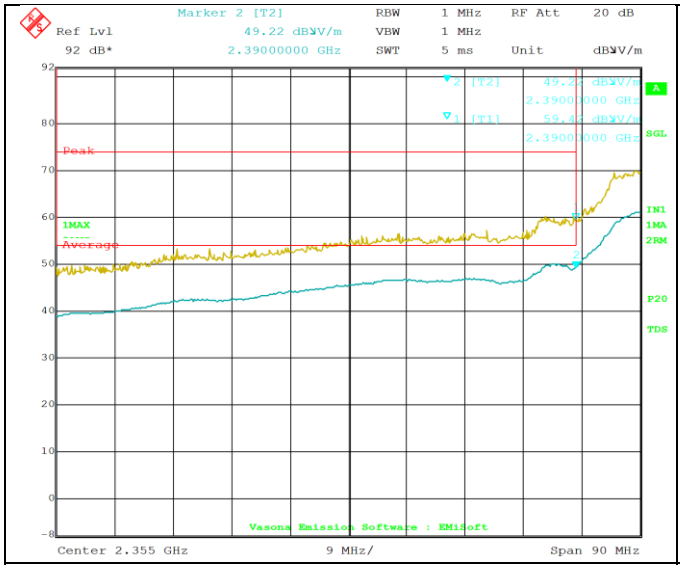
Requirement(s):

Specification(s)	Item	Requirement	Applicable
47CFR§15.247(d), RSS Gen 8.10	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 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. Radiated measurement was measured with antenna port terminated, there isn't outstanding emission found at the edge of restricted frequency, within x dB margin		
Result	☒ Pass ☐ Fail		

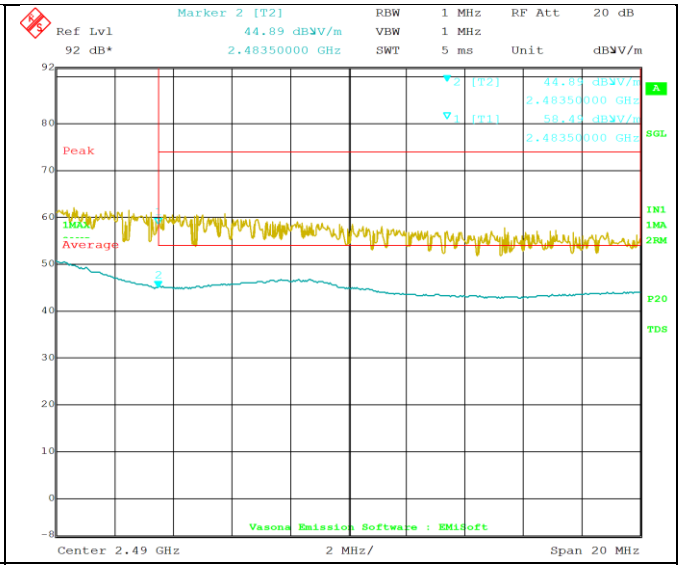
Test Data ☐ Yes (See below) ☒ N/A

Test Plot ☒ Yes (See below) ☐ N/A

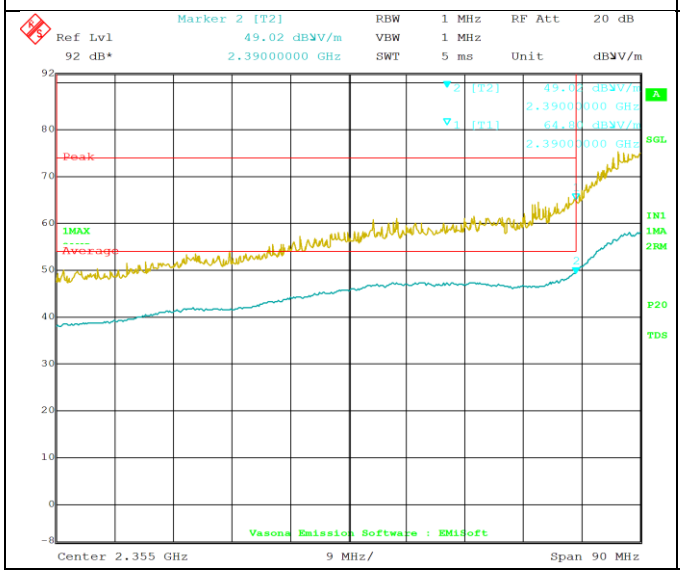
Restricted Band Measurement Plots:



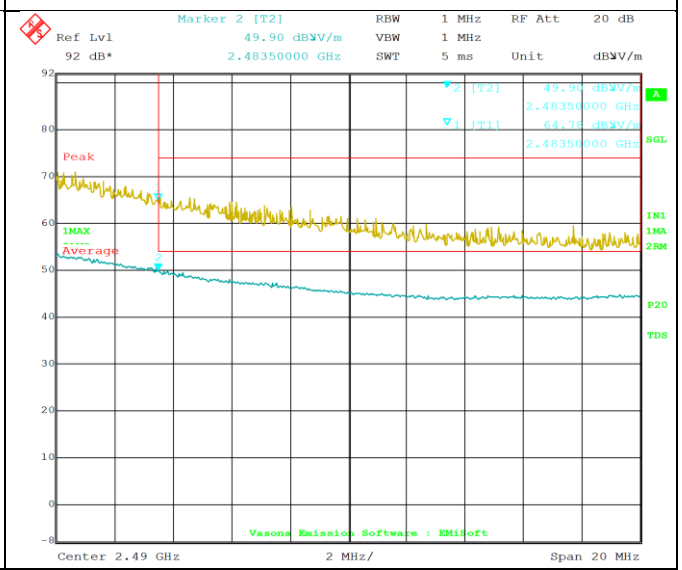
802.11b 2412M-Restriced Band 2310-2390MHz



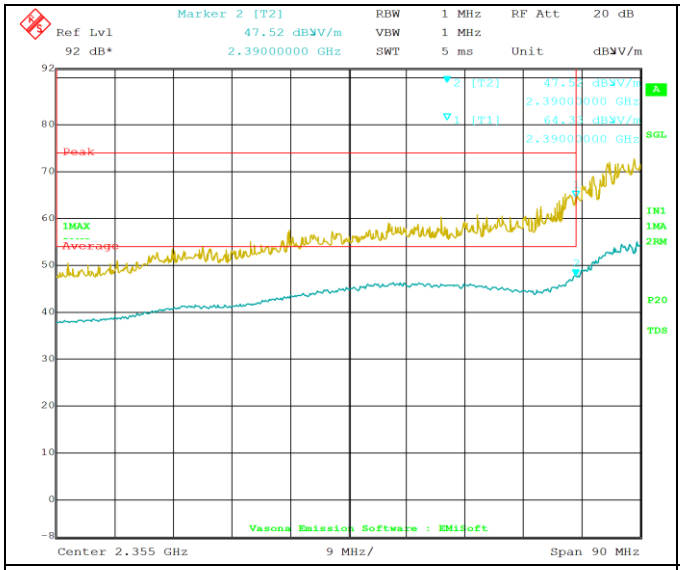
802.11b 2462M-Restriced Band 2483.5-2500MHz



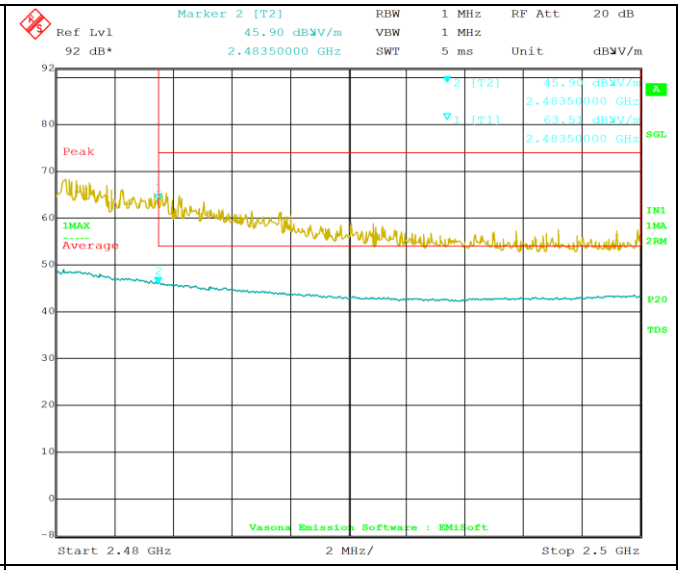
802.11g 2412M-Restriced Band 2310-2390MHz



802.11g 2462M-Restriced Band 2483.5-2500MHz



802.11n20 2412M-Restriced Band 2310-2390MHz

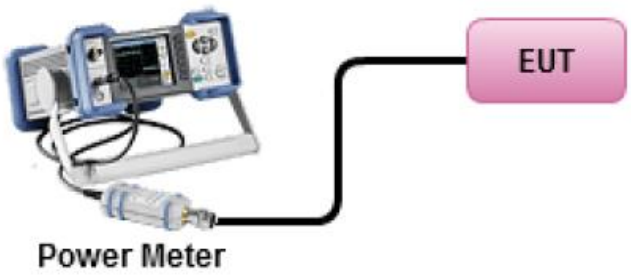


802.11n20 2462M-Restriced Band 2483.5-2500MHz

10.3 Peak Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS210 (A8.4)	a)	FHSS in 2400-2483.5MHz with ≥ 75 channels: ≤1 Watt	☐
	b)	FHSS in 5725-5850MHz: ≤1 Watt	☐
	c)	For all other FHSS in the 2400-2483.5MHz band: ≤0.125 Watt.	☐
	d)	FHSS in 902-928MHz with ≥ 50 channels: ≤1 Watt	☐
	e)	FHSS in 902-928MHz with ≥ 25 & <50 channels: ≤0.25 Watt	☐
	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: ≤1 Watt	☒

Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v03r02, 9.2.2.2 Measurement using a Power Meter (PM) Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required. - Connect EUT's RF output power to power meter - Set EUT to be continuous transmission mode - Measurement the average output power using power meter and record the result Repeat above steps for different test channel and other modulation type.			
Test Date	09/21/2015 - 09/23/2015	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	25.5°C 44.4% 1027mbar
Remark				
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Output Power measurement result

Type	Test mode	Freq (MHz)	CH	Output Power (dBm)	Limit (dBm)	Result
Output power	802.11b	2412	Low	15.74	30	Pass
Output power	802.11b	2437	Mid	15.61	30	Pass
Output power	802.11b	2462	High	15.14	30	Pass
Output power	802.11g	2412	Low	12.44	30	Pass
Output power	802.11g	2437	Mid	12.35	30	Pass
Output power	802.11g	2462	High	12.30	30	Pass
Output power	802.11n-20M	2412	Low	11.23	30	Pass
Output power	802.11n-20M	2437	Mid	11.28	30	Pass
Output power	802.11n-20M	2462	High	11.01	30	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Cycle	Cal Due	In use
Conducted Emissions					
R & S Receiver	ESHS10	830223/0009	1 Year	06/24/2016	☐
Spectrum Analyzer	FSIQ7	825555/013	1 Year	08/04/2016	☐
Schwarzbeck LISN	NNLK 8129	8129-190	1 Year	08/21/2016	☐
CHASE LISN	MN2050B	1018	1 Year	08/07/2016	☐
Radiated Emissions					
EMI Test Receiver	ESL6	100178	1 Year	05/27/2016	☒
ETS-Lingren Loop Antenna	6512	00049120	1 Year	08/20/2016	☒
Antenna - Biconlog (30 MHz – 2 GHz)	JB1	A030702	1 Year	08/15/2016	☐
DoubleRidged Waveguide Horn Antenna (1-18 GHz)	3115	10SL0059	1 Year	08/25/2016	☒
Horn Antenna (18 GHz - 40 GHz)	AH-840	101013	1 Year	08/28/2016	☒
RF Pre-Amplifier	LPA-6-30	11140711	1 Year	02/19/2016	☒
Microwave Preamplifier (18 GHz - 40 GHz)	PA-840	181251	1 Year	02/19/2016	☒
3 Meters SAC	3M	N/A	1 Year	10/30/2016	☒
10 Meters SAC	10M	N/A	1 Year	05/06/2016	☒
RF Conducted Measurement					
Spectrum Analyzer	N9010A	MY50210206	1 Year	08/20/2016	☒
Power Sensor	EMPower7002-006	159814	1 Year	09/03/2016	☒

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 & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
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 Measurement
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
		Radio communications: 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