RF TEST REPORT

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

Report No.: FCC_ RF_SL14020601-GEO-002 Rev1.0
Supersede Report No.: FCC_ RF_SL14020601-GEO-002

Applicant	:	Geospace Technologies Corporation
Product Name	:	Geospace Seismic Record (GSX-LF)
Model No.	:	GSX-LF
Test Standard	:	47 CRF 15.247: 2013 RSS-210 Issue 8: 2010
Test Method	:	ANSI C63.4: 2009 558074 D01 DTS Meas Guidance v03r02
FCC ID		WAOGSXLF
IC ID		7733A-GSXLF
Dates of test	:	June 13, 2014 to June 19, 2014
Issue Date	:	7/25/2014
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:	
Teody Manansala	Nima Molaei
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

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 6
6.4 EUT Photos - External 7
6.5 EUT Photos - Internal 9
6.6 EUT Test Setup Photos 11
7 SUPPORTING EQUIPMENT/SOFTWARE AND CABLING DESCRIPTION 12
7.1 Supporting Equipment 12
7.2 Cabling Description 12
7.3 Test Software Description 12
8 TEST SUMMARY 13
9 MEASUREMENT UNCERTAINTY 14
10 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS 15
10.1 Conducted Emissions 15
10.2 6dB Bandwidth 16
10.3 Peak Output Power 19
10.4 Band Edge 22
10.5 Peak Spectral Density 25
10.6 Radiated Emissions below 1GHz 28
10.7 Radiated Spurious Emissions above 1GHz 31
ANNEX A. TEST INSTRUMENT 34
ANNEX B. USER MANUAL, BLOCK & CIRCUIT DIAGRAM 35
ANNEX C. SIEMIC ACCREDITATION 36

1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_ RF_SL14020601-GEO-002	None	Original	06/30/2014
FCC_ RF_SL14020601-GEO-002 Rev1.0	Rev1.0	Add 99% plot at 10.2 Add table for spectrum setting at 10.7 Change 18GHz to 25 GHz at 10.7 Replaced top and bottom EUT photo	7/18/2014

2 Executive Summary

The purpose of this test program was to demonstrate compliance of the Geospace Seismic Record (GSX-LF), model GSX-LF against the current Stipulated Standards. The GSX-LF has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	:	Geospace Technologies Corporation
Applicant Address	:	7007 Pine Drive, Huston, TX 77040 USA
Manufacturer Name	:	Geospace Technologies Corporation
Manufacturer Address	:	7007 Pine Drive, Huston, TX 77040 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	:	Geospace Seismic Record (GSX-LF)
Model No.	:	GSX-LF
Trade Name	:	Geospace
Serial No.	:	00019838
Input Power	:	16VDC
Power Adapter Manu/Model	:	N/A
Power Adapter SN	:	N/A
Hardware version	:	N/A
Software version	:	N/A
Date of EUT received	:	June 05, 2014
Equipment Class/ Category	:	2.4GHz Zigbee
Clock Frequencies	:	N/A
Port/Connectors	:	DC input

6.2 Radio Description

Spec for Radio -

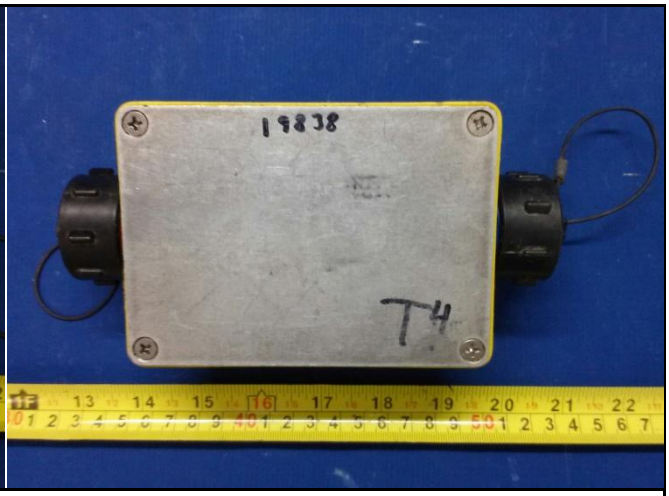
Radio Type	Zigbee
Operating Frequency	2405MHz-2480MHz
Modulation	O-QPSK
Channel Spacing	5MHz
Antenna Type	Internal F Antenna
Antenna Gain	3.3 dBi
Antenna Connector Type	N/A

6.3 EUT test modes/configuration Description

Test Item	Operating mode	Tested antenna port	Test frequencies
Frequency	Continuous Transmitting	TX port	Low, Mid, High
Occupied Bandwidth (99%)	Continuous Transmitting	TX port	Low, Mid, High
Spread spectrum Bandwidth (90%)	Continuous Transmitting	TX port	Low, Mid, High
Spurious emission Intensity	Continuous Transmitting	TX port	Low, Mid, High
Antenna Power	Continuous Transmitting	TX port	Low, Mid, High
Secondary Radiated Emissions	Continuous Transmitting	RX port	Low, Mid, High
Note: None			

6.4 EUT Photos - External

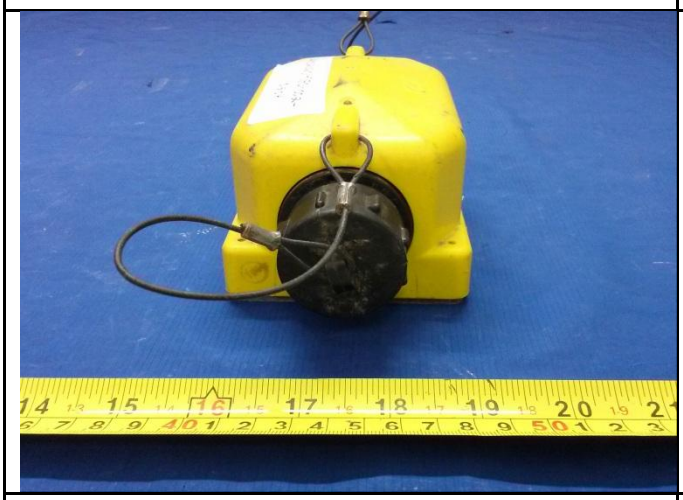
Top View



Bottom View

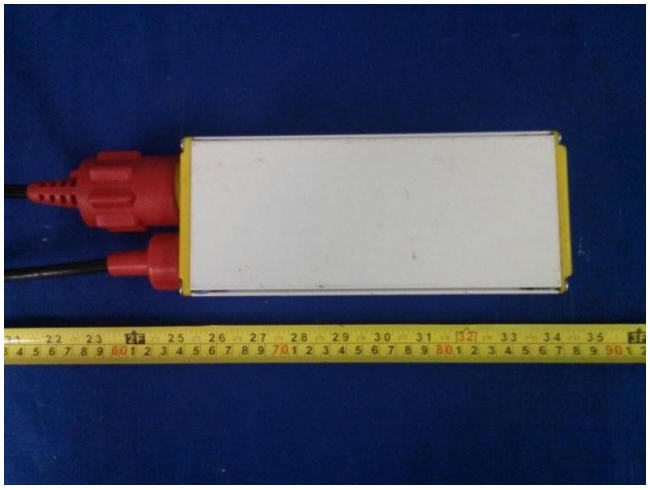
Front View

Rear View

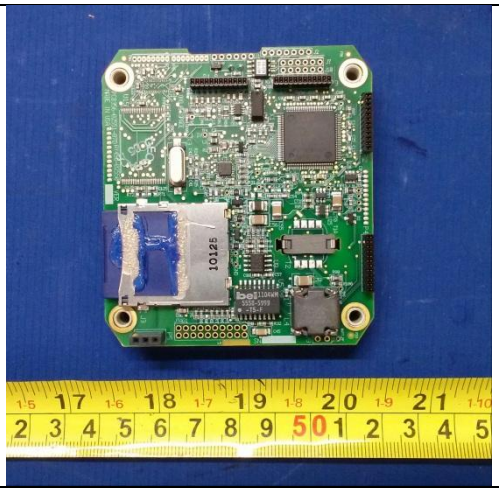
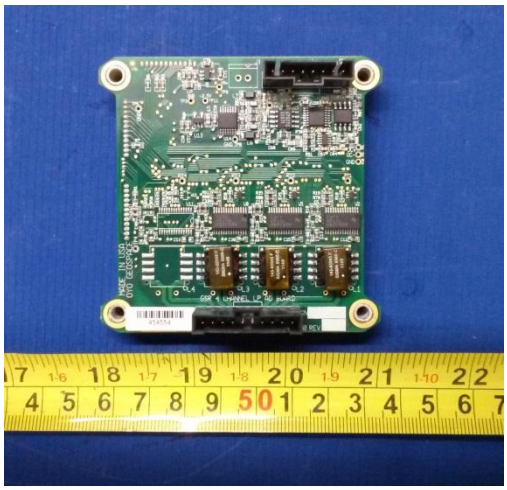
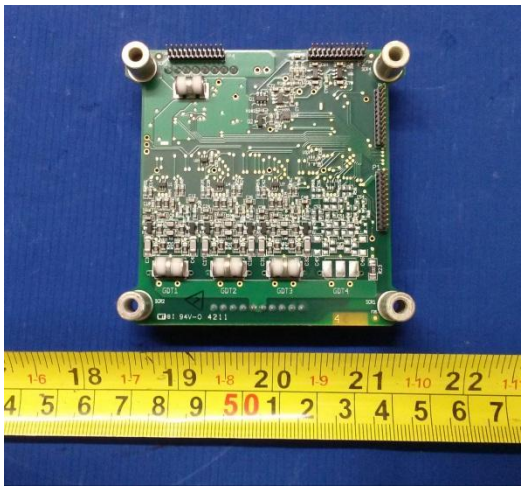
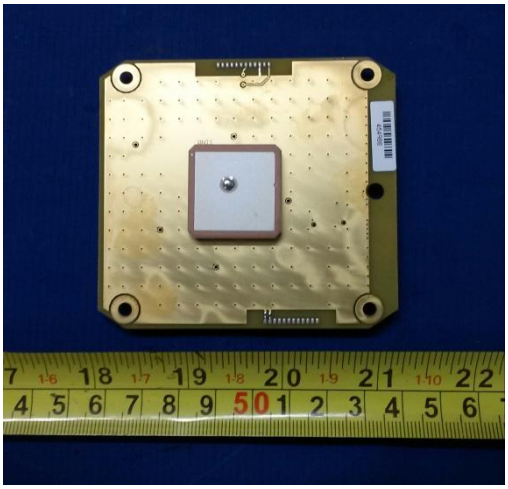


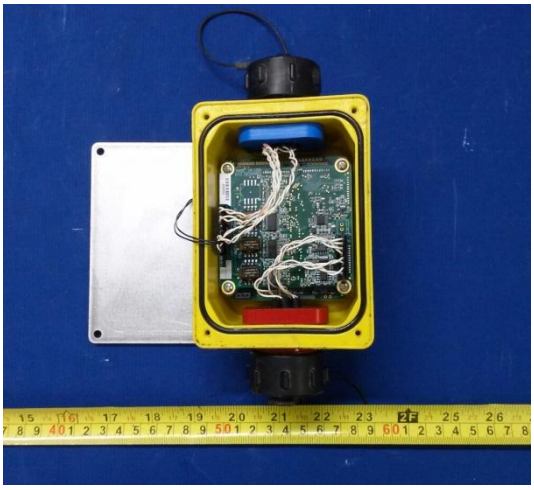
Left View

Right View

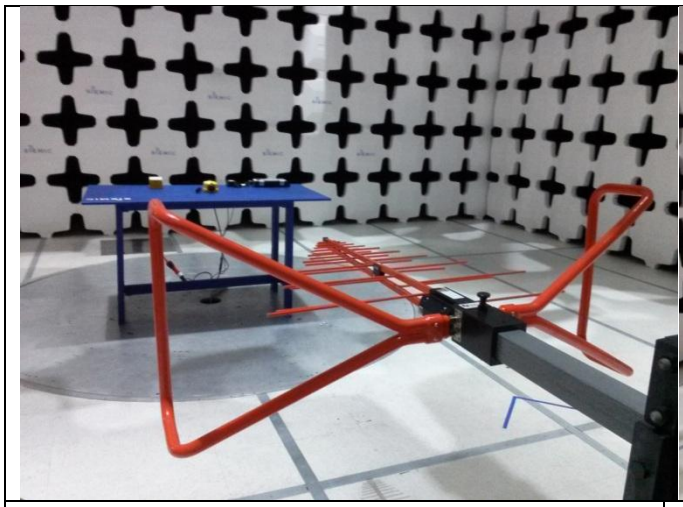
	
Battery Pack – Top View	**Battery Pack – Bottom View**

6.5 EUT Photos - Internal

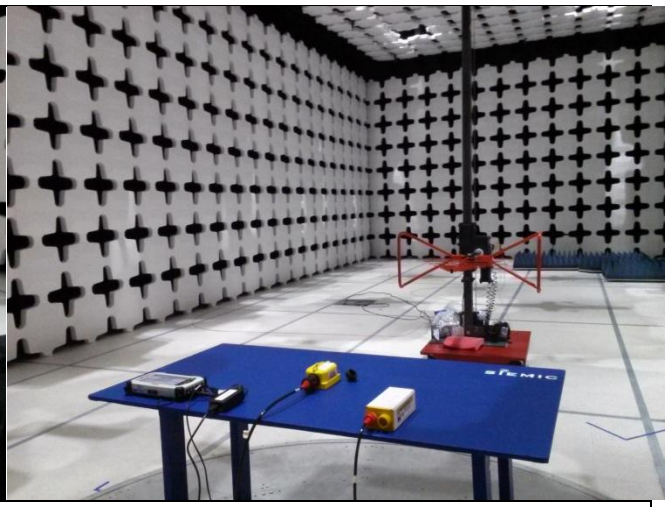
	
EUT –PCBA1 Component Side	**EUT – PCBA1 Solder Side**
	
EUT –PCBA2 Component Side	**EUT – PCBA2 Solder Side**
	
EUT –PCBA3 Component Side	**EUT – PCBA3 Solder Side**

	
EUT –without cover	

6.6 EUT Test Setup Photos



Radiated Emissions (<1GHz) – Front View

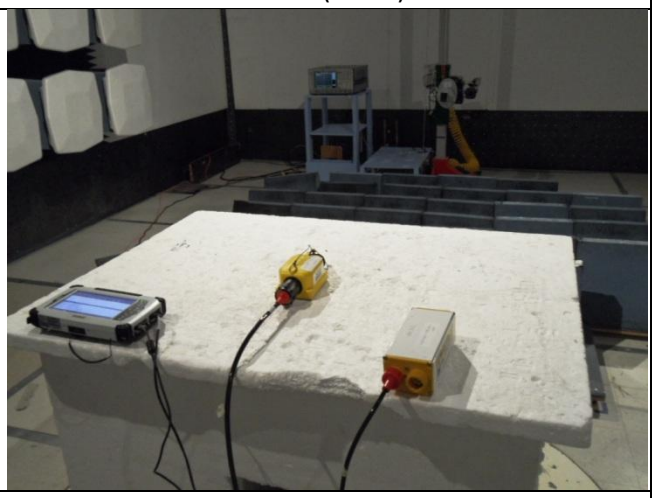


Radiated Emissions (<1GHz) – Rear View

Radiated Emissions (>1GHz) – Front View

Radiated Emissions (>1GHz) – Rear View

Radiated Emissions (>18GHz) – Front View



Radiated Emissions (>18GHz) – Rear View

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Handheld Computer	ALGIZ7	OBX KIT 1010A	Geospace	-
2	DC Power Supply	EA10521D-120	124300517	EDACPOWER ELEC	-
3	AYCBL, GSR Data Retrieval	453-03150-01 B	N/A	Geospace	

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
AYCBL, GSR Data Retrieval	EUT	Power input	Handheld	Ethernet Port	<1m	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	GSR Tester 32 99.1.24.5	Set the EUT to transmit continuously

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.4 – 2009 558074 D01 DTS Meas Guidance v03r02	☒ Pass ☐ N/A
	IC	RSS 210 (2.2)	IC	-	
AC Conducted Emissions Voltage	FCC	15.207(a)	FCC	ANSI C63.4 – 2009	☐ Pass ☒ N/A
	IC	RSS Gen (7.2.2)	IC	-	

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Channel Separation	FCC	15.247 (a)(1)	FCC	-	☐ Pass ☒ N/A
	IC	RSS210 (A8.1)	IC	-	
Occupied Bandwidth	FCC	15.247(a)(1)	FCC	-	☐ Pass ☒ N/A
	IC	RSS210(A8.1)	IC	-	
Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 DTS Meas Guidance v03r02	☒ Pass ☐ N/A
	IC	RSS210 (A8.2)	IC	-	
Number of Hopping Channels	FCC	15.247(a)(1)	FCC	-	☐ Pass ☒ N/A
	IC	RSS210(A8.1)	IC	-	
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.4 – 2009, 558074 D01 DTS Meas Guidance v03r02	☒ Pass ☐ N/A
	IC	RSS210(A8.5)	IC	-	
Time of Occupancy	FCC	15.247(a)(1)	FCC	-	☐ Pass ☒ N/A
	IC	RSS210(A8.1)	IC	-	
Output Power	FCC	15.247(b)	FCC	558074 D01 DTS Meas Guidance v03r02	☒ Pass ☐ N/A
	IC	RSS210 (A8.4)	IC	-	
Receiver Spurious Emissions	FCC	15.247(d)	FCC	-	☒ Pass ☐ N/A
	IC	RSS Gen (4.8)	IC	-	
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	-	☐ Pass ☒ N/A
	IC	RSS210(A8.4)	IC	-	
Power Spectral Density	FCC	15.247(e)	FCC	558074 D01 DTS Meas Guidance v03r02	☒ Pass ☐ N/A
	IC	RSS210(A8.3)	IC	-	
Hybrid System Requirement	FCC	15.247(f)	FCC	-	☐ Pass ☒ N/A
	IC	RSS210(A8.3)	IC	-	
Hopping Capability	FCC	15.247(g)	FCC	-	☐ Pass ☒ N/A
	IC	RSS210(A8.1)	IC	-	
Hopping Coordination Requirement	FCC	15.247(h)	FCC	-	☐ Pass ☒ N/A
	IC	RSS210(A8.1)	IC	-	
RF Exposure requirement	FCC	15.247(i)	FCC	-	☐ Pass ☒ N/A
	IC	RSS Gen(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

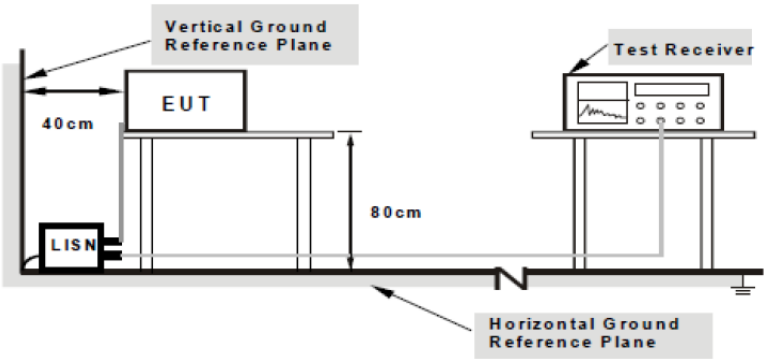
Emissions			
Test Item	**Frequency Range**	**Description**	**Uncertainty**
Band Edge and Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
Band Edge and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

Conducted Emission Limit

Frequency ranges (MHz)	Limit (dBuV)	
	QP	Average
0.15 ~ 0.5	66 – 56	56 – 46
0.5 ~ 5	56	46
5 ~ 30	60	50

Spec	Item	Requirement	Applicable
47CFR§15.207, RSS210(A8.1)	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	☐
Test Setup	 Note: 1.Support units were connected to second LISN. 2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.	
Procedure	- The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B. - The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains. - The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. - All other supporting equipment was powered separately from another main supply.	
Remark	EUT tested with Handheld computer and Battery Pack.	
Result	☐ Pass ☐ Fail	

Test Data ☐ Yes ☒ N/A

Test Plot ☐ Yes (See below) ☒ N/A

10.2 6dB Bandwidth

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(a)(2)	a)	6dB BW≥500KHz;	☒
RSS Gen(4.6.1)	b)	99% BW: For FCC reference only; required by IC.	☒

Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v03r02, 8.1 DTS bandwidth 6dB Emission bandwidth measurement procedure - Set RBW = 100 kHz. - Set the video bandwidth (VBW) ⩾ 3 RBW. - Detector = Peak. - Trace mode = max hold. - Sweep = auto couple. - Allow the trace to stabilize. - Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. EUT tested with Handheld computer and battery Pack.			
Test Date	06/14/2014	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	22ºC 42% 1021mbar
Remark	EUT tested with Handheld computer and Battery Pack.			
Result	☒ Pass ☐ Fail			

Equipment Setting

TEST	RBW	VBW	SPAN	Detector	SWEEP	Trace	NOTES
6 dB DTS Bandwidth	1-5% of DTS BW (≤100KHz)	3 x RBW	>EBW	PK	Auto	Max hold	-

Test Data ☒ Yes ☐ N/A
Test Plot ☒ Yes ☐ N/A

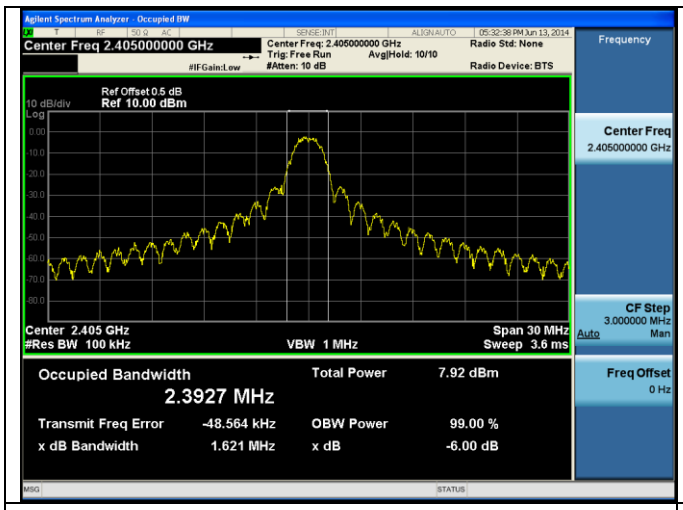
6dB Bandwidth measurement result

Type	Freq (MHz)	CH	Result (MHz)	Limit (MHz)	Result
6dB BW	2405	Low	1.621	≥0.5	Pass
6dB BW	2440	Mid	1.542	≥0.5	Pass
6dB BW	2480	High	1.488	≥0.5	Pass

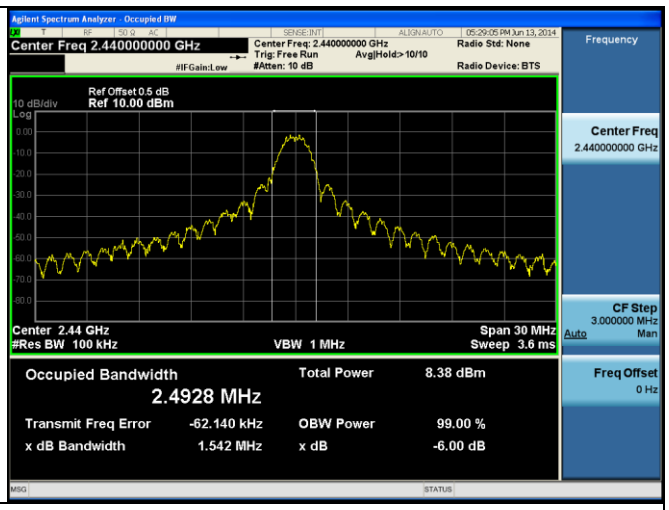
99% Bandwidth measurement result

Type	Freq (MHz)	CH	Result (MHz)	Limit (MHz)	Result
99% OBW	2405	Low	2.5652	-	-
99% OBW	2440	Mid	2.5449	-	-
99% OBW	2480	High	2.6205	-	-

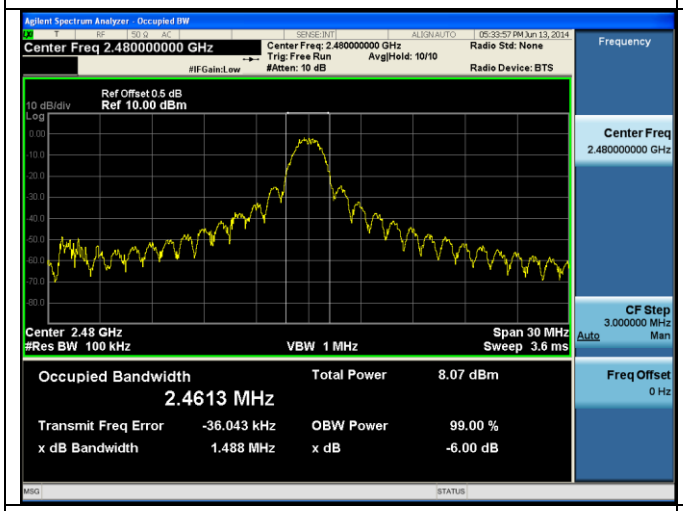
Test Plots



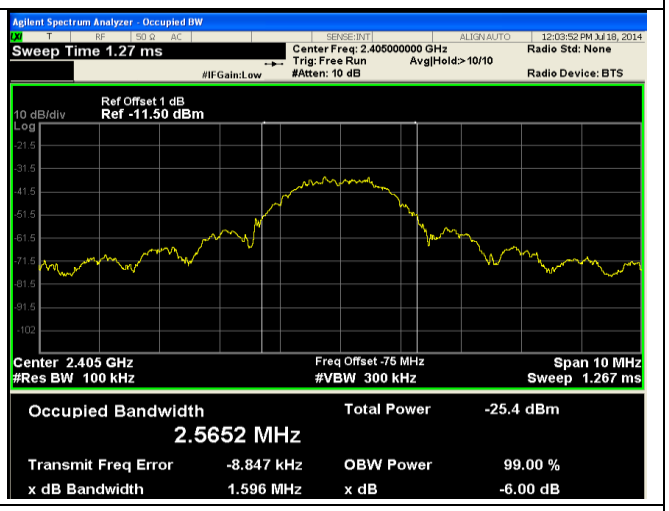
6dB BW TX-Zigbee 2405



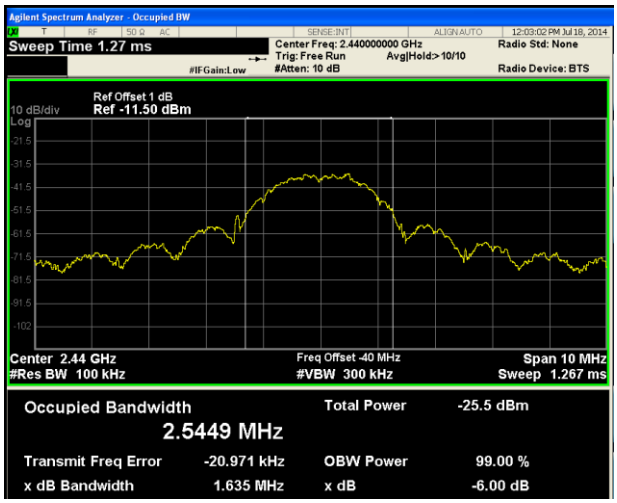
6dB BW TX-Zigbee 2440



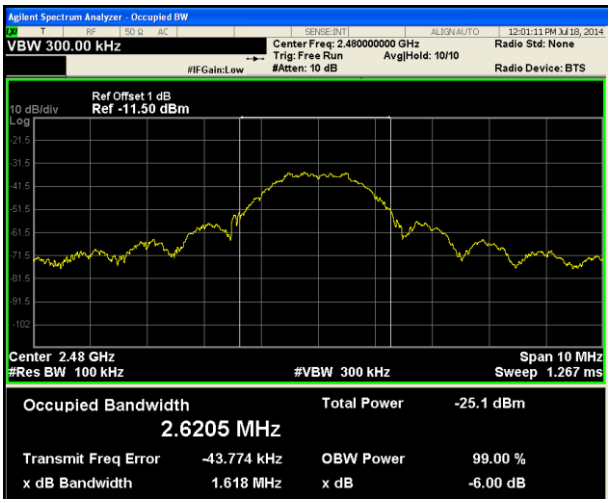
6dB BW TX-Zigbee 2480



99% BW TX-Zigbee 2405



99% BW TX-Zigbee 2440



99% BW TX-Zigbee 2480

10.3 Peak Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(b) (2) ,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, 9.1.1 Maximum output power measurement procedure - Set the RBW ⩾DTS bandwidth - Set the VBW ⩾ 3x RBW - Set the span ⩾ 1.5 x DTS bandwidth. - Detector = peak. - Sweep time = auto couple. - Trace mode = max hold. - Allow trace to fully stabilize. - Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.			
Test Date	06/14/2014	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23ºC 44% 1021mbar
Remark	EUT tested with Handheld computer and Battery Pack.			
Result	☒ Pass ☐ Fail			

Equipment Setting

TEST	RBW	VBW	SPAN	Detector	SWEEP	Trace	NOTES
PK output power	≥DTS bandwidth	≥3 X RBW	≥3 X RBW	Peak	Auto	Max hold	-

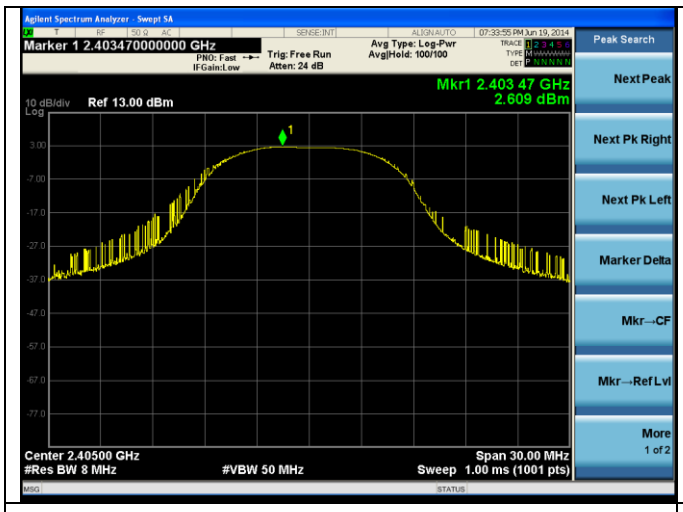
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

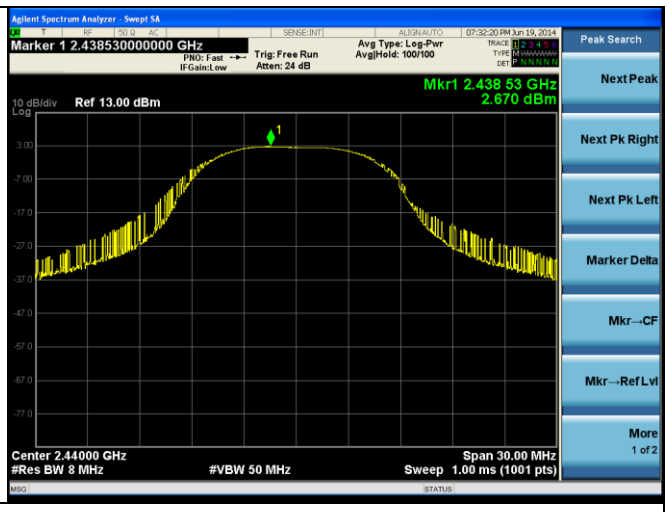
Output Power measurement result

Type	Freq (MHz)	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	2405	Low	2.609	30	Pass
Output power	2440	Mid	2.670	30	Pass
Output power	2480	High	2.561	30	Pass

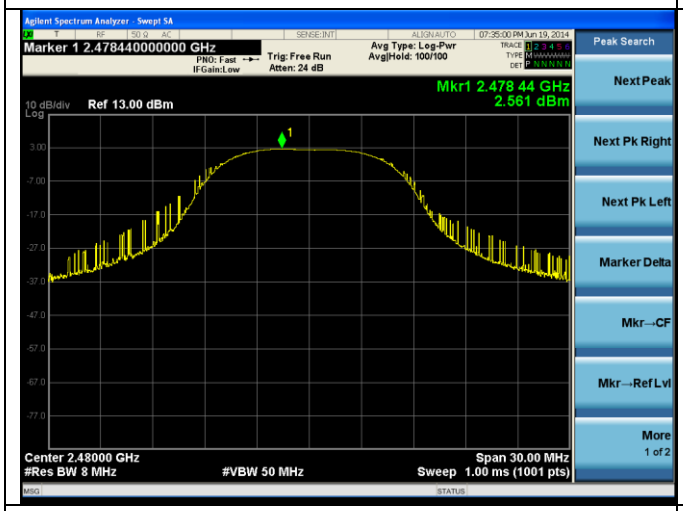
Test Plots



PWR-Zigbee 2405



PWR TX-Zigbee 2440



PWR-Zigbee 2480

10.4 Band Edge

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(d), RSS210 (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	☒

Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v03r02, 13.3 Method Band Edge measurement procedure - Set analyzer center frequency to the frequency of the emission to be measured. - Set the span to 2 MHz. - Set the RBW to: 100 kHz. - Set the VBW ⩾ 1/T. - Detector = peak. - Sweep time = auto couple. - Trace mode = max hold. - Allow trace to fully stabilize. - Use the peak marker function to determine the maximum amplitude level within the RBW. - If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.			
Test Date	06/19/2014	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	22ºC 46% 1020mbar
Remark	EUT tested with Handheld computer and Battery Pack.			
Result	☒ Pass ☐ Fail			

Equipment Setting

TEST	RBW	VBW	SPAN	Detector	SWEEP	Trace	NOTES
Band Edge	100KHz	≥1/T	2MHz	Peak	Auto	Max hold	-

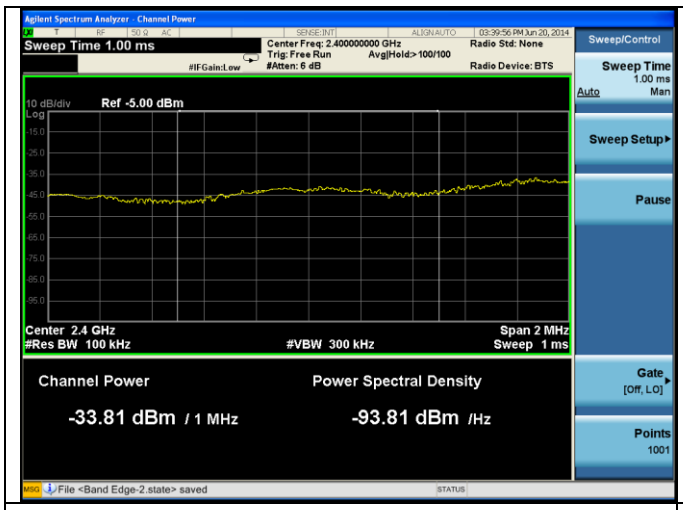
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

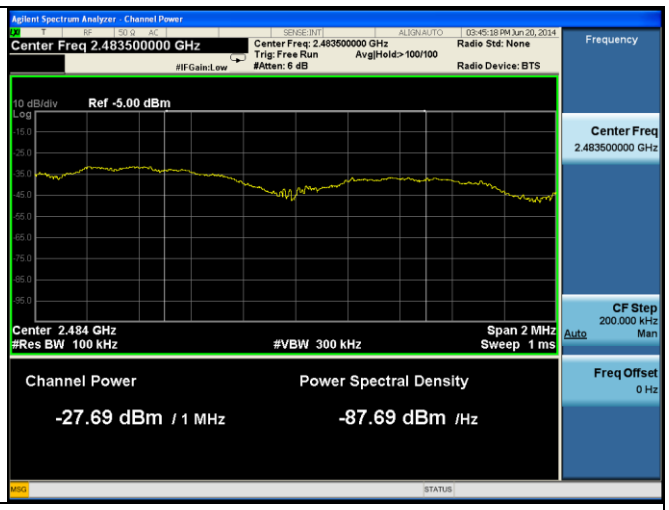
Band Edge measurement result

Type	Freq (MHz)	CH	Conducted Band Edge (dBm/MHz)	PSD (dBm/MHz)	Difference (dB)	Limit (dB)	Result
Band Edge	2400	Low	-33.81	-1.66	32.15	≥20	Pass
Band Edge	2483.5	High	-27.69	-1.55	26.14	≥20	Pass

Test Plots



Band Edge-Low



Band Edge-High

10.5 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e), RSS210 (A8.3)	a)	DSSS: ≤8dBm/3KHz	☒
	b)	DSSS in hybrid sys with FH turned off: ≤8dBm/3KHz	☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v03r01, 10.2 Method PKPSD (peak PSD) Peak spectral density measurement procedure - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: 3 kHz ⩽ RBW ⩽ 100 kHz. - Set the VBW ⩾ 3 x RBW. - Detector = peak. - Sweep time = auto couple. - Trace mode = max hold. - Allow trace to fully stabilize. - Use the peak marker function to determine the maximum amplitude level within the RBW. - If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.		
Test Date	06/14/2014	Environmental condition	Temperature 22ºC Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	EUT tested with Handheld computer and Battery Pack.		
Result	☒ Pass ☐ Fail		

Equipment Setting

TEST	RBW	VBW	SPAN	Detector	SWEEP	Trace	NOTES
PSD	100KHz	≥3x RBW	1.5x DTS BW	Peak	Auto	Max hold	-

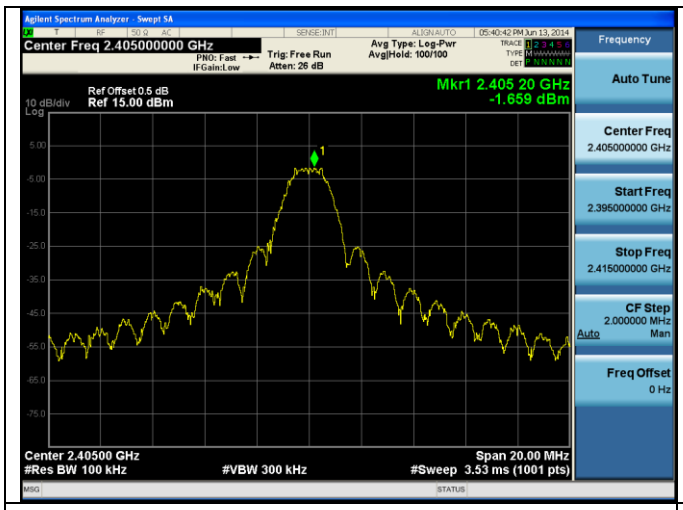
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

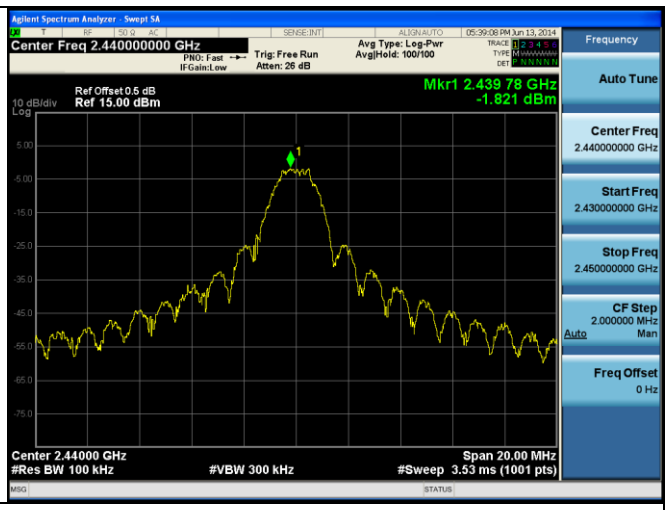
PSD measurement result

Type	Freq (MHz)	CH	Conducted PSD (dBm/MHz)	Limit (dBm/MHz)	Result
Maximum PSD	2405	Low	-1.659	≤8	Pass
Maximum PSD	2440	Mid	-1.821	≤8	Pass
Maximum PSD	2480	High	-1.554	≤8	Pass

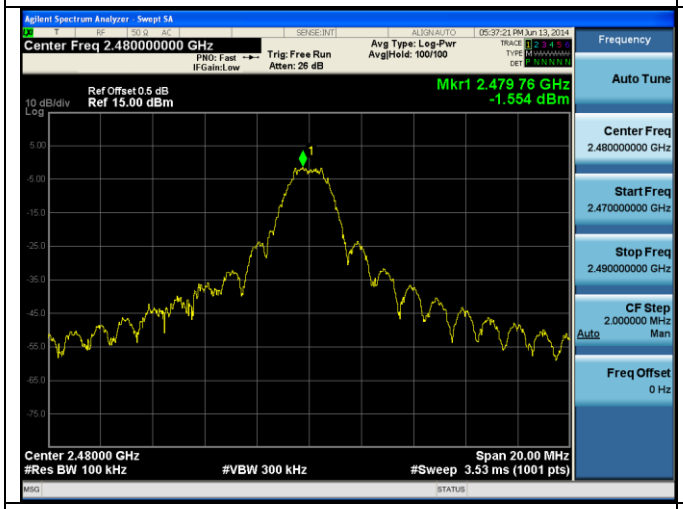
Test Plots



PSD-Zigbee 2405



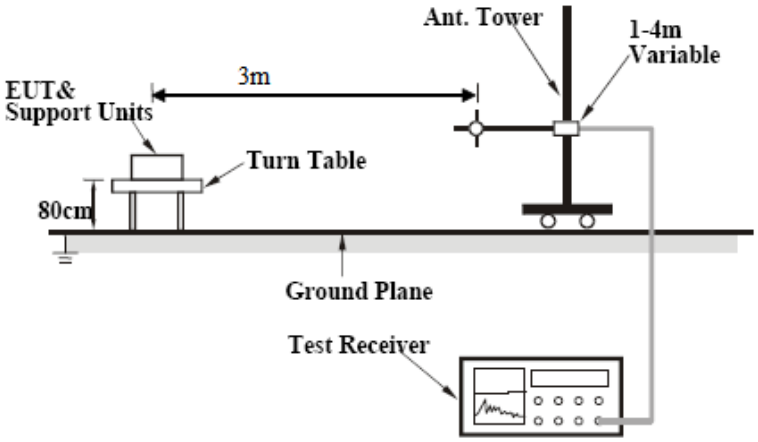
PSD-Zigbee 2440



PSD-Zigbee 2480

10.6 Radiated Emissions below 1GHz

Requirement(s):

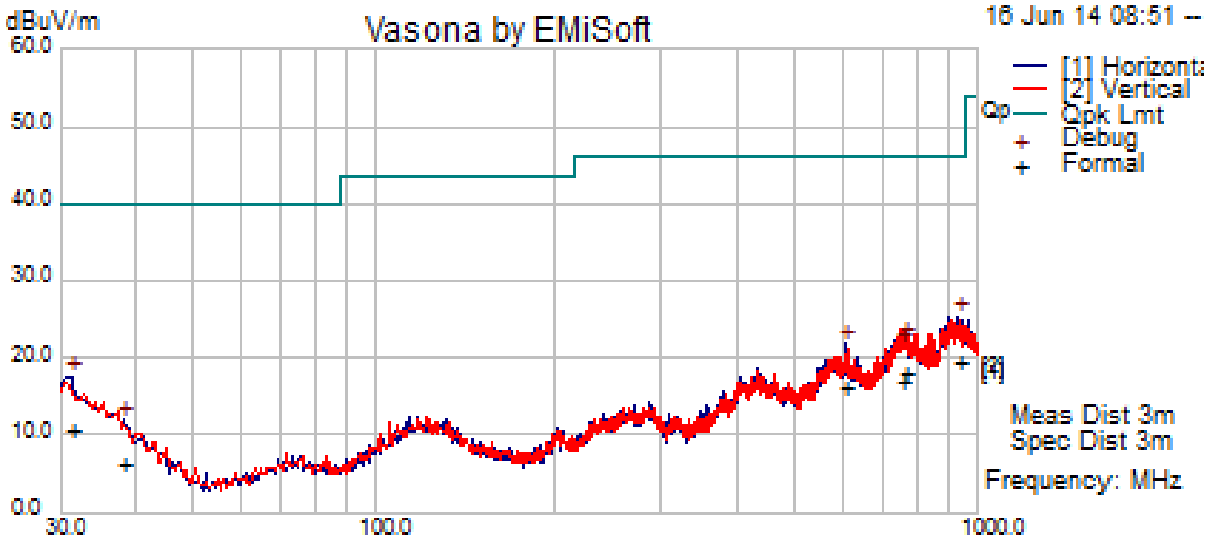
<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>47CFR§15.247(d), RSS210(A8.5)</td><td>a)</td><td>Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels 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
<table>
<tr><th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr>
<tr><td>30 – 88</td><td>100</td></tr>
<tr><td>88 – 216</td><td>150</td></tr>
<tr><td>216 960</td><td>200</td></tr>
<tr><td>Above 960</td><td>500</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="3"> 
</td></tr>
<tr><td>Procedure</td><td colspan="3">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.</td></tr>
<tr><td>Remark</td><td colspan="3">The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.</td></tr>
<tr><td>Result</td><td colspan="3">☒ Pass ☒ Fail</td></tr>
</table>

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Radiated Emission Test Results (Below 1GHz)

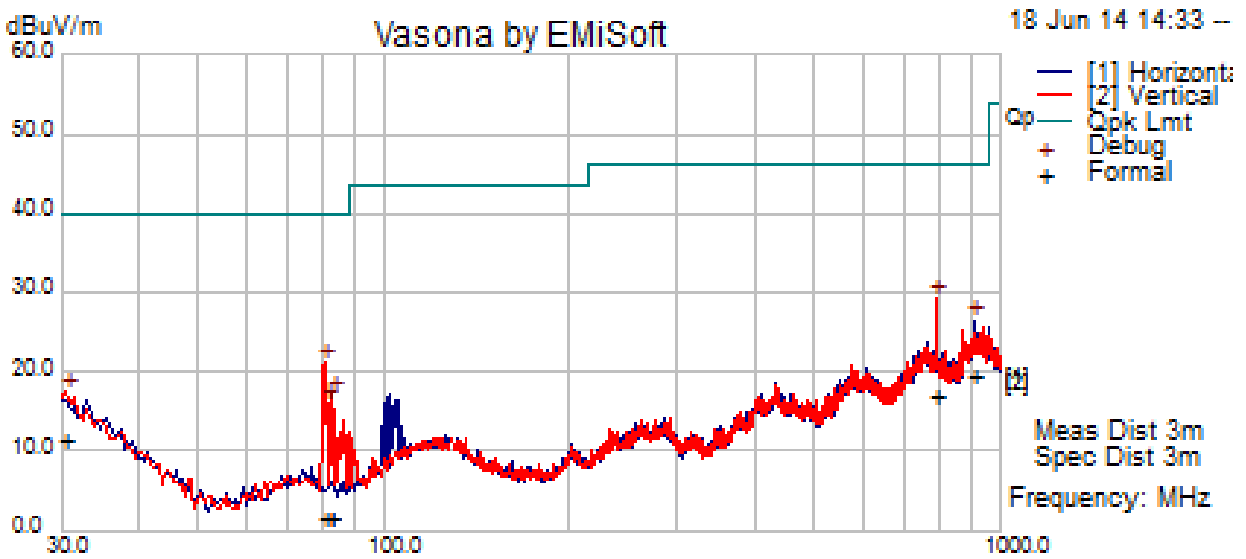
Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	21.3	Result	Pass
	Humidity (%)	50.6		
	Atmospheric (mPa):	1010		
Mains Power:	110VAC, 60Hz			
Tested by:	Teody Manansala			
Test Date:	16-Jun-14			
Remarks:	Zigbee 2405			



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
31.40	26.87	1.16	-17.31	10.72	Quasi Max	H	186.00	246	40	-29.28	Pass
38.18	27.81	1.16	-22.79	6.18	Quasi Max	H	377.00	342.00	40.00	-33.82	Pass
605.96	33.85	4.19	-21.71	16.33	Quasi Max	H	183	52.00	46.00	-29.67	Pass
748.18	31.91	4.67	-19.55	17.03	Quasi Max	H	211.00	302.00	46.00	-28.97	Pass
762.00	32.44	4.72	-18.98	18.17	Quasi Max	H	280.00	76.00	46.00	-27.83	Pass
934.15	31.94	5.06	-17.66	19.34	Quasi Max	H	232.00	109.00	46.00	-26.66	Pass

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

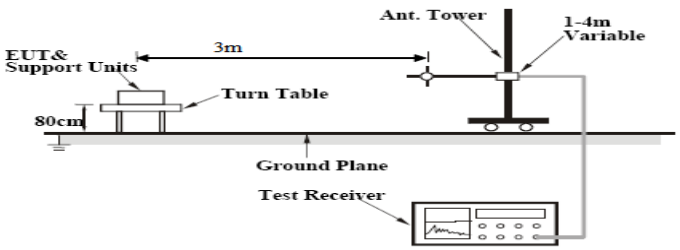
Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	21.3	Result	Pass
	Humidity (%)	50.6		
	Atmospheric (mPa):	1010		
Mains Power:	110VAC, 60Hz			
Tested by:	Teody Manansala			
Test Date:	18-Jun-14			
Remarks:	Zigbee Receiver Mode			



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
30.38	26.71	1.16	-16.45	11.42	Quasi Max	V	196.00	291.00	40.00	-28.58	Pass
80.43	31.89	1.51	-31.86	1.54	Quasi Max	V	376.00	44.00	40.00	-38.46	Pass
81.56	31.89	1.53	-32.00	1.42	Quasi Max	V	258.00	10.00	40.00	-38.58	Pass
82.21	31.94	1.54	-32.05	1.42	Quasi Max	V	234.00	276.00	40.00	-38.58	Pass
785.20	31.27	4.79	-19.27	16.79	Quasi Max	V	130.00	164.00	46.00	-29.21	Pass
906.07	32.49	5.01	-17.95	19.55	Quasi Max	H	245.00	275.00	46.00	-26.45	Pass

10.7 Radiated Spurious Emissions above 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS210(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 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.		
Result	☒ Pass ☐ Fail		

Equipment Setting

TEST	RBW	VBW	SPAN	Detector	SWEEP	Trace	NOTES
Radiated Spurious Emission	1MHz	3MHz	1GHz - 25 GHz	Peak	Auto	Max hold	PK Measurement
Radiated Spurious Emission	1MHz	10Hz	1GHz - 25 GHz	Peak	Auto	Max hold	Ave Measurement

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Radiated Emission Test Results (Above 1GHz)

Above 1GHz-25GHz – Zigbee 2405

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
17946.91	41.17	7.01	14.29	62.46	Peak Max	H	213.00	73.00	74.00	-11.54	Pass
3939.62	40.85	2.85	-0.29	43.42	Peak Max	H	199.00	80.00	74.00	-30.58	Pass
4567.16	40.58	3.10	-0.20	43.47	Peak Max	V	173.00	259.00	74.00	-30.53	Pass
1619.91	40.38	1.56	-5.81	36.12	Peak Max	V	233.00	92.00	74.00	-37.88	Pass
17946.91	27.90	7.01	14.29	49.20	Average Max	H	213.00	73.00	54.00	-4.80	Pass
3939.62	27.55	2.85	-0.29	30.12	Average Max	H	199.00	80.00	54.00	-23.88	Pass
4567.16	26.92	3.10	-0.20	29.82	Average Max	V	173.00	259.00	54.00	-24.18	Pass
1619.91	27.38	1.56	-5.81	23.12	Average Max	V	233.00	92.00	54.00	-30.88	Pass

Restricted Band - Low CH

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
2390.00	41.54	2.12	-3.53	40.12	Peak Max	H	297.00	205.00	74.00	-33.88	Pass
2390.00	40.97	2.12	-3.53	39.55	Peak Max	V	294.00	270.00	74.00	-34.45	Pass
2390.00	27.92	2.12	-3.53	26.50	Average Max	H	297.00	205.00	54.00	-27.50	Pass
2390.00	27.82	2.12	-3.53	26.40	Average Max	V	294.00	27.00	54.00	-27.60	Pass

Above 1GHz-25GHz- Zigbee 2440

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
17981.63	40.76	7.01	14.40	62.17	Peak Max	H	198.00	307.00	74.00	-11.83	Pass
14474.84	43.55	6.60	10.92	61.07	Peak Max	H	222.00	256.00	74.00	-12.93	Pass
3928.14	41.27	2.85	-0.31	43.80	Peak Max	V	246.00	278.00	74.00	-30.20	Pass
1509.45	41.61	1.44	-6.24	36.80	Peak Max	H	289.00	248.00	74.00	-37.20	Pass
17981.63	27.82	7.01	14.40	49.23	Average Max	H	198.00	307.00	54.00	-4.77	Pass
14474.84	29.78	6.60	10.92	47.30	Average Max	H	222.00	256.00	54.00	-6.70	Pass
3928.14	27.76	2.85	-0.31	30.29	Average Max	V	246.00	278.00	54.00	-23.71	Pass
1509.45	28.21	1.44	-6.24	23.41	Average Max	H	289.00	248.00	54.00	-30.59	Pass

Above 1GHz-25GHz- Zigbee 2480

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
17906.92	41.04	7.00	14.15	62.20	Peak Max	V	233.00	297.00	74.00	-11.80	Pass
14475.07	43.15	6.60	10.92	60.67	Peak Max	H	209.00	227.00	74.00	-13.33	Pass
3937.67	40.85	2.85	-0.30	43.41	Peak Max	V	276.00	325.00	74.00	-30.59	Pass
17906.92	27.87	7.00	14.15	49.03	Average Max	V	233.00	297.00	54.00	-4.97	Pass
14475.07	29.75	6.60	10.92	47.27	Average Max	H	209.00	227.00	54.00	-6.73	Pass
3937.67	27.58	2.85	-0.30	30.14	Average Max	V	276.00	325.00	54.00	-23.86	Pass
17906.92	41.04	7.00	14.15	62.2	Peak Max	V	233.00	297.00	74.00	-11.80	Pass
14475.07	43.15	6.60	10.92	60.67	Peak Max	H	209.00	227.00	74.00	-13.33	Pass

Restricted Band - High CH

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
2483.50	73.61	2.15	-3.32	72.44	Peak Max	H	123.00	332.00	74.00	-1.56	Pass
2483.50	69.15	2.15	-3.32	67.99	Peak Max	V	299.00	159.00	74.00	-6.01	Pass
2483.50	52.88	2.15	-3.32	51.71	Average Max	H	123.00	332.00	54.00	-2.29	Pass
2483.50	48.80	2.15	-3.32	47.64	Average Max	V	299.00	159.00	54.00	-6.36	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
R & S Receiver	ESIB 40	100179	04/20/2014	1 Year	04/20/2015	☐
R&S LISN	ESH2-Z5	861741/013	05/18/2014	1 Year	05/18/2015	☐
CHASE LISN	MN2050B	1018	07/24/2013	1 Year	07/24/2014	☐
Sekonic Hygro Hermograph	ST-50	HE01-000092	05/25/2014	1 Year	05/25/2015	☐
Radiated Emissions						
R & S Receiver	ESL6	100178	03/01/2014	1 Year	03/01/2015	☑
R & S Receiver	ESIB 40	100179	04/20/2014	1 Year	04/20/2015	☑
ETS-Lingren Loop Antenna	6512	00049120	05/13/2014	1 Year	05/13/2015	☐
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	07/03/2014	1 Year	07/03/2015	☑
Horn Antenna (1-26.5GHz)	3115	10SL0059	04/26/2014	1 Year	04/26/2015	☑
Horn Antenna (18-40 GHz)	AH-840	101013	04/23/2014	1 Year	04/23/2015	☑
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	05/30/2014	1 Year	05/30/2015	☑
Microwave Preamplifier (18-40 GHz)	PA-840	181251	05/30/2014	1 Year	05/30/2015	☑
3 Meters SAC	3M	N/A	10/13/2013	1 Year	10/13/2014	☑
10 Meters SAC	10M	N/A	06/05/2014	1 Year	06/05/2015	☑
Sekonic Hygro Hermograph	ST-50	HE01-000092	05/25/2014	1 Year	05/25/2015	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	MY50210206	05/30/2014	1 Year	05/30/2015	☑
Spectrum Analyzer	E4407B	US88441016	05/31/2014	1 Year	05/31/2015	☑
R & S Receiver	ESIB 40	100179	04/20/2014	1 Year	04/20/2015	☑

Annex B. USER MANUAL, BLOCK & CIRCUIT DIAGRAM

Please see attachment

Annex C. 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