

EMC Test Report

Project Number: 3710195

Report Number: 3710195EMC03 **Revision Level:** 1

Client: ISA-Intelligent Sensing Anywhere

Equipment Under Test: ISM Band Module

Model Number: EXC5_YYX1

Applicable Standards: FCC 15.249 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

ANSI C63.10: 2009

Report issued on: 22 April 2015

Test Result: Compliant

Tested by:



Jeremy O. Pickens, Senior EMC Engineer

Reviewed by:



David Schramm, EMC/RF/SAR/HAC Manager

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Summary of Test Results

Test Description	Test Specification	Test Result
Field strength of fundamental	15.249(a)	Compliant
Field strength of spurious radiation	15.249 (a) and 15.209	Compliant
Fixed, point-to-point	15.249(b)	Not applicable
20 dB bandwidth	15.215(c)	Report data only

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name: ISA-Intelligent Sensing Anywhere
Address: Instituto Pedro Nunes, Rua Pedro Nunes- Edificio D
City, State, Zip, Country: Coimbra, Portugal, 3030199

2.2 *Test Laboratory*

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

2.3 *General Information of EUT*

Product Name: ISM Band Module
Model Number: EXC5_YYX1
Rated Voltage: 3.6 Vdc, battery (Host)
Test Voltage: Fully charge 3.6 Vdc, battery (installed in Host device)

FCC ID: 2AEAU-ISMTI-V1

Sample Received Date: 09 March 2015
Dates of testing: 17-19 March 2015, 15 April 2015

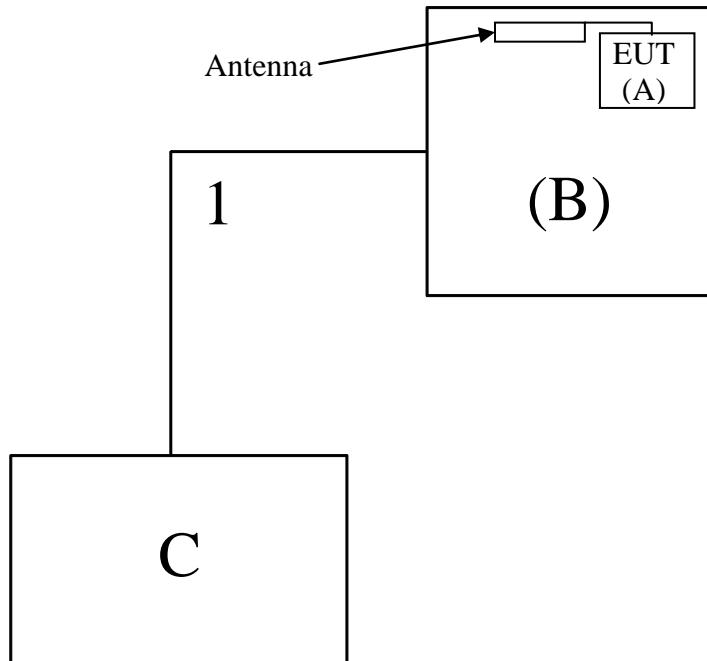
2.4 Ratings and declarations

Operation Frequency Range (OFR) TX Mode:	916.8Mhz
TX Channels:	1
Operation Frequency Range (OFR) RX Mode:	916.8Mhz
RX Channels:	1
Channel Bandwidth:	104.2kHz
Effective radiated power:	0.46 mW (-3.4dBm)
Communication technique:	Zigbee (IEEE 802.15.4)
Data rate:	250kbps
Modulation:	PSK
Antenna type and gain:	PCB

2.5 Operating Modes and Conditions

The device was configured to transmit continuously with a modulated signal.

2.6 EUT Connection Block Diagram



2.7 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	ISA	ISM Band Module	EXC5_YYX1	Not labeled
B	ISA	Multipurpose autonomous remote management System	EX.C5_0001	N/A
C	Lenovo	Laptop	T430	N/A

2.8 Cable List

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
1	USB	EUT	Laptop	6.0m	Yes	Yes

Note: The USB cable was only attached to allow continuous transmission

3 Field Strength of Fundamental

3.1 Test Result

Test Description	Test Specification	Test Result
Field strength of fundamental	15.249(a)	Compliant

3.2 Test Method

The test data was measured using a Quasi-Peak detector below 1GHz and a Peak detector above 1GHz. Average measurements were made by correcting the peak value with the duty cycle correction factor. The receivers resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHz and higher. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Fundamental Frequency	Average Limits			Peak Limits dBuV/m
	Millivolts/meter	Microvolts/m	dBuV/m	
902 - 928 MHz	50	50000	94	114
2400 - 2483.5 MHz	50	50000	94	114
5725 - 5875 MHz	50	50000	94	114
24 - 24.25 GHz	250	250000	108	128

3.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C
Relative Humidity: 34.8 %
Atmospheric Pressure: 98.15 kPa

3.4 Test Equipment

Test Date: 19-Mar-2015		Tester: FL		
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079689	3-Sep-2015
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2016
RF CABLE - 12000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079714	4-Aug-2015
ULTRAFLEX COAXIAL CABLE	LMR-240	TIMES MICROWAVE SYSTEMS	B091046	5-Aug-2015

Note: The calibration period equipment is 1 year.

3.5 Test Data

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
916.81	64.9	V	237.0	100.0	23.1	2.8	0.0	90.8	94.0	-3.2
916.81	62.7	H	142.9	240.4	23.1	2.8	0.0	88.6	94.0	-5.4
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

4 Field Strength of Spurious Radiation

4.1 Test Result

Test Description	Test Specification	Test Result
Field strength of spurious radiation	15.249 (a) and 15.209	Compliant

4.2 Test Method

Exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector below 1GHz and a Peak detector above 1GHz. For harmonics of the fundamental, Average measurements were made by correcting the peak value with the duty cycle correction factor. For emissions other than harmonics of the fundamental, the Average measurements were made using the Average detector. The receivers resolution bandwidth was set to 1kHz for measurements taken between 9kHz and 150kHz, 9kHz for measurements between 150kHz and 30MHz, 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements above 1GHz. Below 30MHz measurements were recorded with a loop antenna positioned both coplanar to the EUT and again positioned co-axial to the EUT. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Frequency	Limits		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
0.009-0.490 MHz	2400/F(kHz) @300m	128.5 to 93.8 @3m (1)	--
0.490-1.705 MHz	24000/F(kHz) @30m	73.8 to 63.0 @3m (1)	--
1.705-30.0 MHz	30 @30m	69.5 @3m (1)	--
30 - 88 MHz	100	40 (1)	--
88 - 216 MHz	150	43.5 (1)	--
216 - 960 MHz	200	46 (1)	--
960 - 1000 MHz	500	54 (1)	--
1 - 40 GHz	500	54 (2)	74

(1) Quasi-peak limit

(2) Average limit

4.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.3 °C
Relative Humidity: 34.8 %
Atmospheric Pressure: 98.15 kPa

4.4 Test Equipment

Test Date: 17-Mar-2015

Tester: FL

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079691	24-Jun-2015
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2016
RF CABLE - 12000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079714	4-Aug-2015
ULTRAFLEX COAXIAL CABLE	LMR-240	TIMES MICROWAVE SYSTEMS	B091046	5-Aug-2015

Test Date: 15-Apr-2015

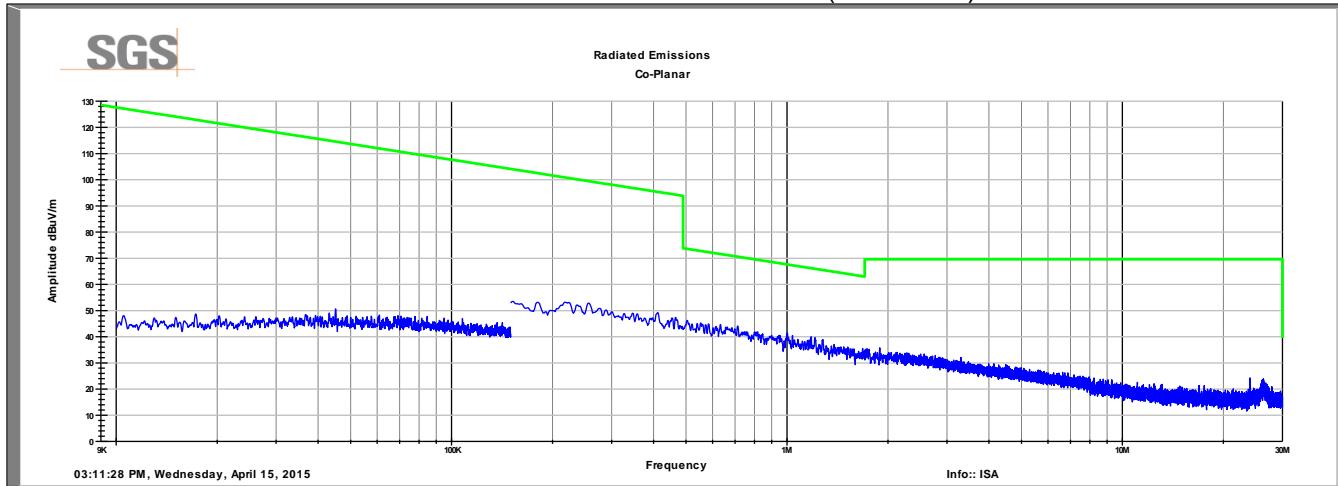
Tester: JOP

EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	26-Jun-2015
LOOP (ACTIVE)	6502	EMCO	B085752	24-Jun-2015
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079712	4-Aug-2015
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079713	4-Aug-2015
RF CABLE	SF106	HUBER&SUHNER	B085892	5-Aug-2015

Note: The calibration period equipment is 1 year.

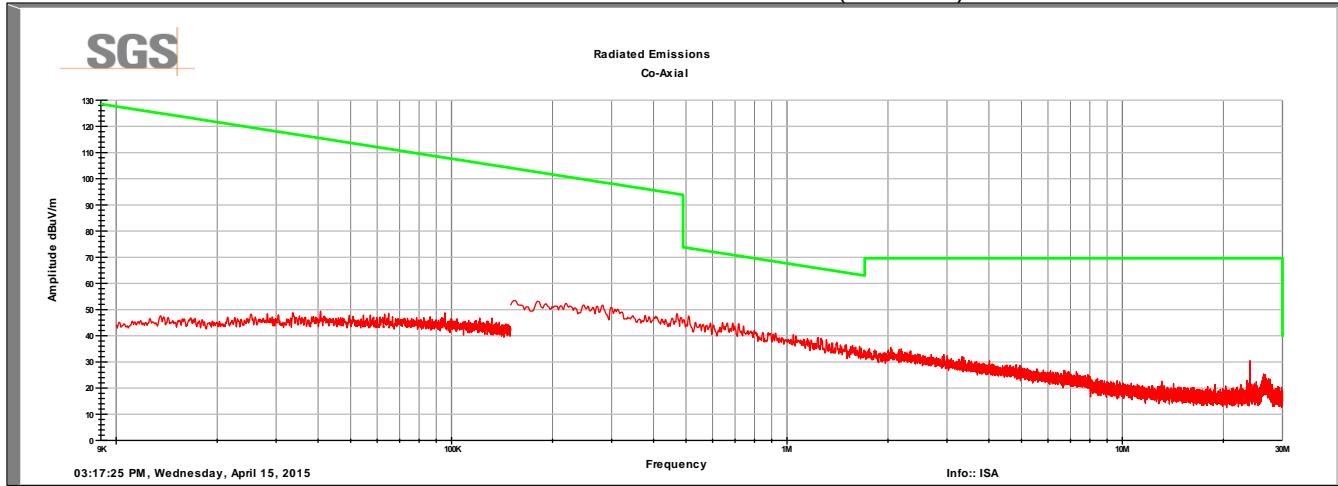
4.5 Test Data

Radiated Emissions 9kHz-30MHz (Co-Planar)



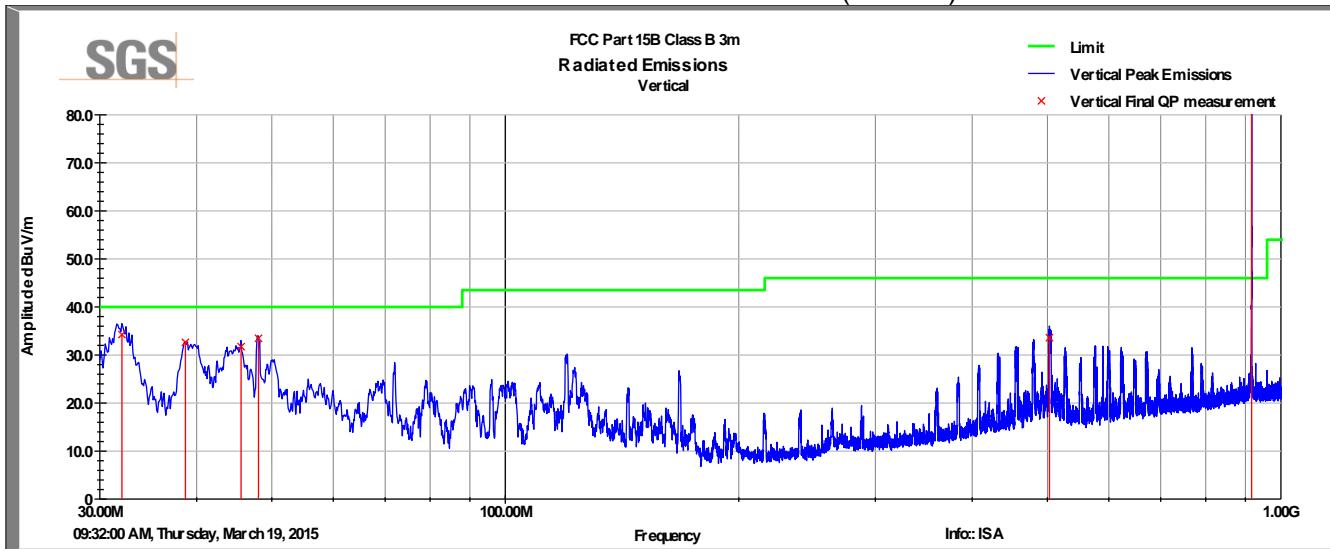
No peak emissions detected within 20dB of the limit

Radiated Emissions 9kHz-30MHz (Co-Axial)

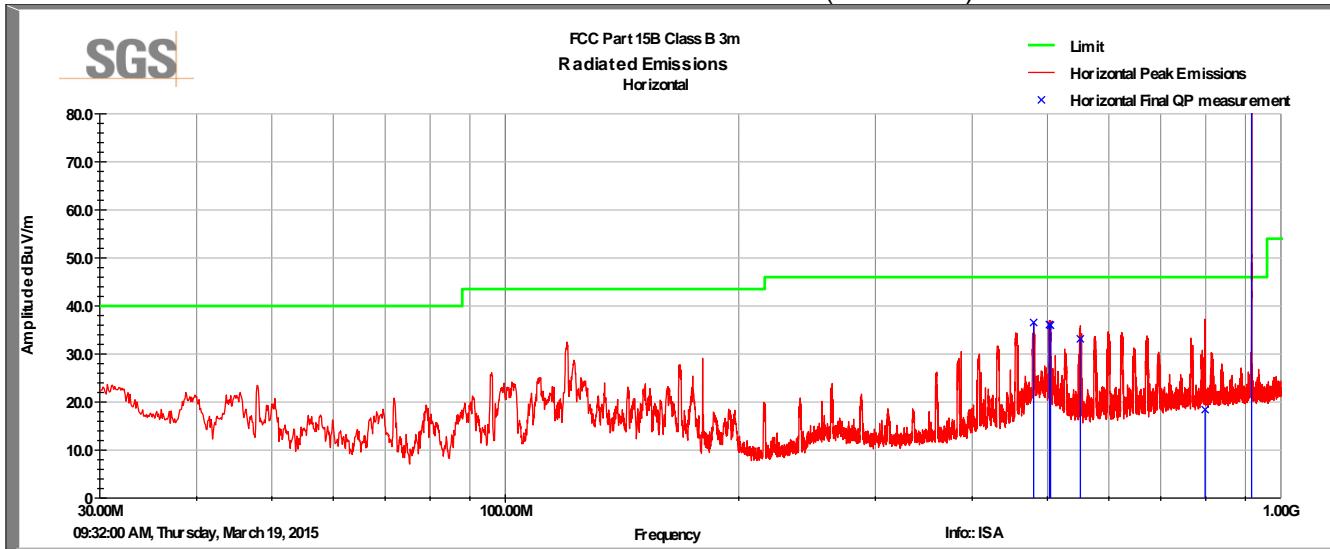


No peak emissions detected within 20dB of the limit

Radiated Emissions 30-1000MHz (Vertical)



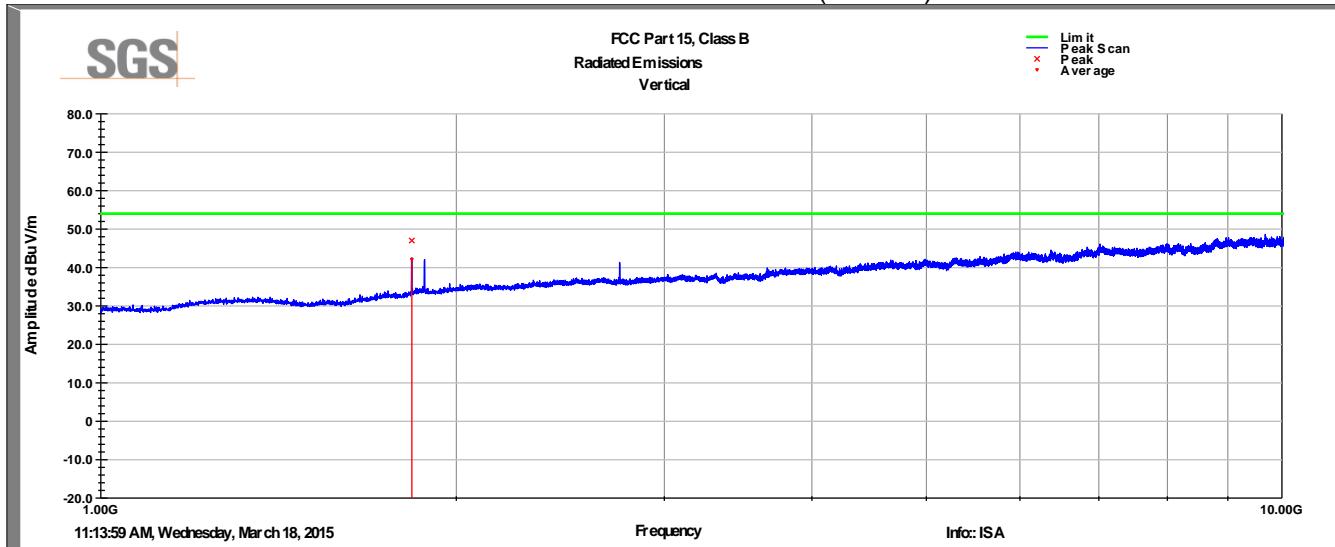
Radiated Emissions 30-1000MHz (Horizontal)



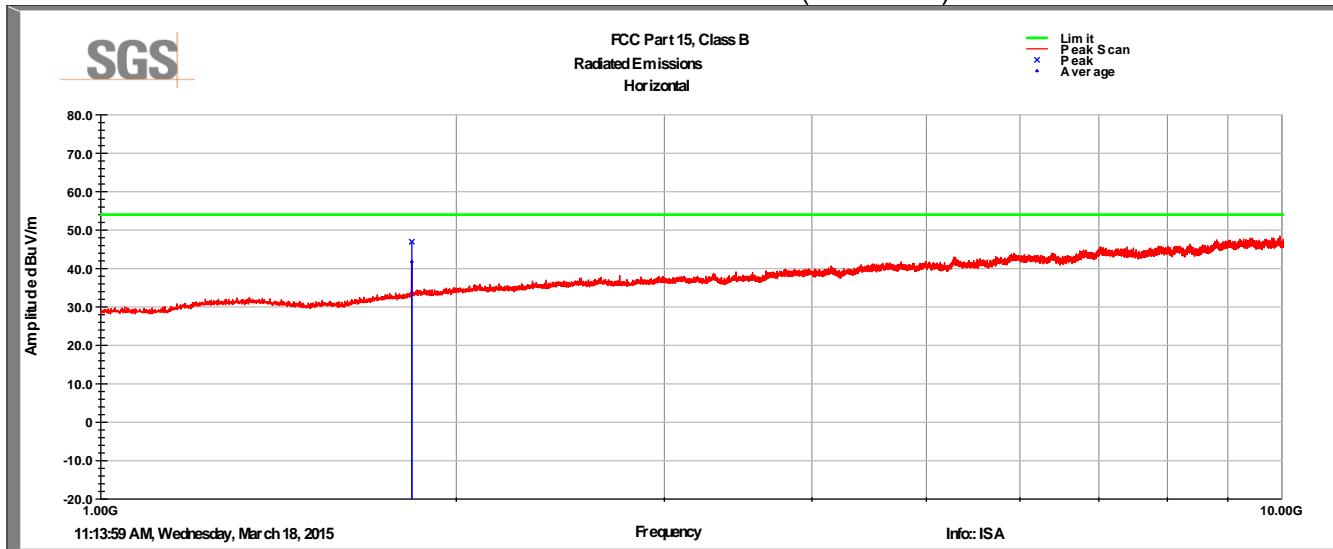
Tabular Data - Spurious Emissions 30-1000MHz

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
32.04	45.3	V	290.0	100.0	20.5	0.5	32.1	34.2	40.0	-5.8
38.68	49.5	V	322.0	100.0	15.1	0.6	32.6	32.6	40.0	-7.4
45.64	53.0	V	31.0	100.0	10.6	0.7	32.5	31.7	40.0	-8.3
48.07	55.8	V	10.0	100.0	9.5	0.7	32.4	33.5	40.0	-6.5
479.99	49.8	H	346.0	175.0	17.9	2.0	33.2	36.5	46.0	-9.5
503.05	49.0	H	305.0	139.0	18.2	2.0	33.1	36.1	46.0	-9.9
503.06	46.5	V	50.0	177.0	18.2	2.0	33.1	33.6	46.0	-12.4
504.64	48.9	H	286.0	138.0	18.2	2.0	33.1	36.0	46.0	-10.0
551.29	45.4	H	320.0	137.0	18.7	2.1	33.1	33.1	46.0	-12.9
798.65	26.7	H	204.0	186.0	22.2	2.6	33.0	18.4	46.0	-27.6
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Radiated Emissions 1-10GHz (Vertical)



Radiated Emissions 1-10GHz (Horizontal)



Tabular Data - Spurious Emissions 1-10GHz

Frequency MHz	Raw Avg (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)
1833.57	40.7	V	17.0	239.0	30.3	4.0	32.9	42.1	54.0	-11.9
1833.57	40.4	H	294.0	116.0	30.3	4.0	32.9	41.8	54.0	-12.2
Avg Value = Level + AF + CL - Amp										
Margin = Avg Value - Limit										

5 20 dB Bandwidth

5.1 Test Result

Test Description	Basic Standards	Test Result
20 dB bandwidth	15.215(c)	Report data only

5.2 Test Method

The procedures from ANSI C63.10 (2009) clause 6.9 were used to determine the 20 dB bandwidth.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.3 °C
Relative Humidity: 30.8 %
Atmospheric Pressure: 98.7 kPa

5.4 Test Equipment

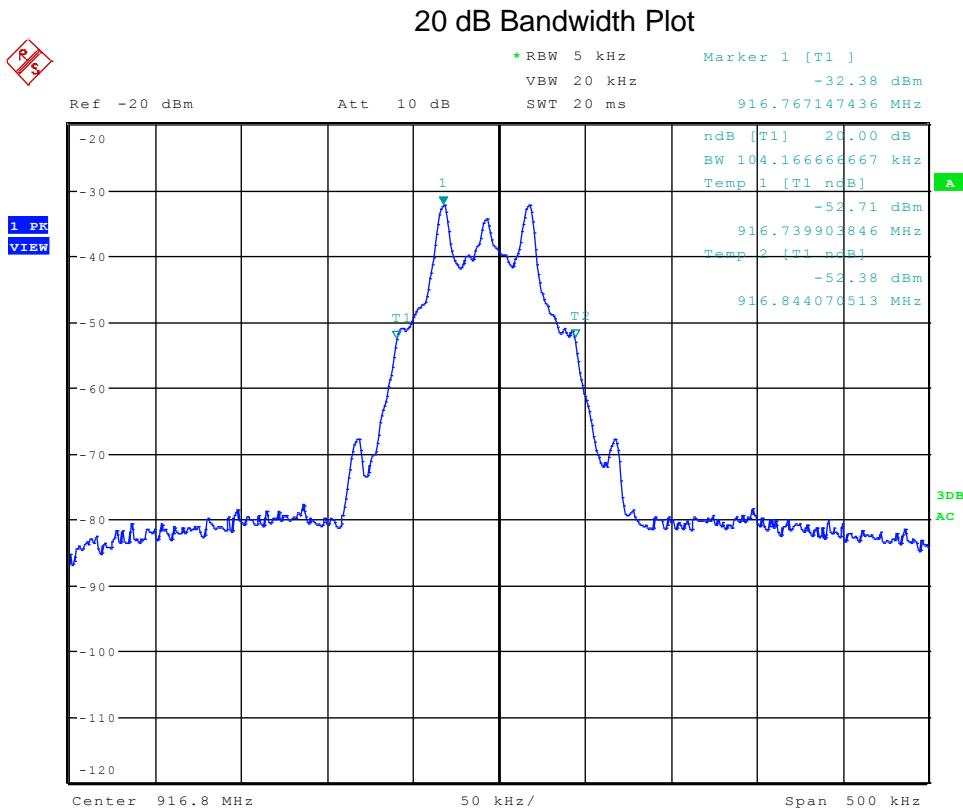
Test Date: 24-Mar-2015

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	26-Jun-2015

Note: The calibration period equipment is 1 year.

5.5 Test Data



Date: 24.MAR.2015 08:41:03

6 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	08 April 2015
1	<ul style="list-style-type: none">Added test results for 9kHz to 30MHz radiated emissions.Added limits and test methodology for measurements below 30MHz.	22 April 2015