

Certification Test Report

FCC ID: SDBZIGMOD20
IC: 2220A-ZIGMOD20

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 11-0215.W06.11.A

Manufacturer: Sensus Metering Systems, Inc.
Model: ZigMod20

Test Begin Date: June 20, 2011
Test End Date: June 21, 2011

Report Issue Date: July 26, 2011



FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Reviewed by:

A handwritten signature in black ink, appearing to read 'Kirby Munroe', is written over a horizontal line.

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This test report shall not be reproduced except in full. This report may be reproduced in part with prior written consent of ACS, Inc. The results contained in this report are representative of the sample(s) submitted for evaluation.

This report contains 22 pages

TABLE OF CONTENTS

1	GENERAL	3
1.1	PURPOSE.....	3
1.2	GENERAL.....	3
1.3	TEST METHODOLOGY AND CONSIDERATIONS	3
2	TEST FACILITIES	4
2.1	LOCATION	4
2.2	LABORATORY ACCREDITATIONS/RECOGNITIONS/CERTIFICATIONS	4
2.3	RADIATED EMISSIONS TEST SITE DESCRIPTION	5
2.3.1	<i>Semi-Anechoic Chamber Test Site</i>	5
2.3.2	<i>Open Area Tests Site (OATS)</i>	6
2.4	CONDUCTED EMISSIONS TEST SITE DESCRIPTION	7
3	APPLICABLE STANDARD REFERENCES	7
4	LIST OF TEST EQUIPMENT	8
5	SUPPORT EQUIPMENT	9
6	EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM	9
7	SUMMARY OF TESTS	10
7.1	ANTENNA REQUIREMENT – FCC: SECTION 15.203	10
7.2	POWER LINE CONDUCTED EMISSIONS – FCC: SECTION 15.207 IC: RSS-GEN 7.2.4.....	10
7.2.1	<i>Measurement Procedure</i>	10
7.2.2	<i>Measurement Results</i>	10
7.3	6dB / 99% BANDWIDTH – FCC: SECTION 15.247(A)(2) IC: RSS-210 A8.2(A)	12
7.3.1	<i>Measurement Procedure</i>	12
7.3.2	<i>Measurement Results</i>	12
7.4	PEAK OUTPUT POWER REQUIREMENT - FCC SECTION 15.247(B)(3) IC: RSS-210 A8.4(4)	14
7.4.1	<i>Measurement Procedure</i>	14
7.4.2	<i>Measurement Results</i>	14
7.5	BAND-EDGE COMPLIANCE AND SPURIOUS EMISSIONS-FCC 15.247D IC:RSS-210 2.2, A8.5	15
7.5.1	<i>Band-Edge Compliance</i>	15
7.5.1.1	<i>Measurement Procedure</i>	15
7.5.1.2	<i>Measurement Results</i>	15
7.5.2	<i>RF Conducted Spurious Emissions</i>	17
7.5.2.1	<i>Measurement Procedure</i>	17
7.5.2.2	<i>Measurement Results</i>	17
7.5.3	<i>Radiated Spurious Emissions (Restricted Bands)</i>	19
7.5.3.1	<i>Measurement Procedure</i>	19
7.5.3.2	<i>Duty Cycle Correction</i>	19
7.5.3.3	<i>Measurement Results</i>	19
7.5.3.4	<i>Sample Calculation:</i>	20
7.6	PEAK POWER SPECTRAL DENSITY- FCC SECTION 15.247(E) IC: RSS-210 A8.2(B).....	21
7.6.1	<i>Measurement Procedure</i>	21
7.6.2	<i>Measurement Results</i>	21
8	CONCLUSION	22

1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210 for a single modular approval.

1.2 General

The Sensus ZigBee Module ZigMod20 is a self contained Modular Transmitter. This module is designed to interface between the Electric Meter and the Home Area Network (HAN) and will reside within the Electric Meter.

Technical Information:

Band of Operation: 2405 – 2480 MHz

Number of Channels: 16

Modulation Format: O-QPSK

Antenna Type/Gain: Printed Monopole Antenna – 0dBi Gain

Operating Voltage: 26 VDC (Host Supplied)

Manufacturer Information:

Sensus Metering Systems, Inc.

400 Perimeter Park Drive, Suite K

Morrisville, NC 27560

Test Sample Serial Number(s): ABCDE324, ABCDE322, ABCDE326

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology and Considerations

For radiated emissions, including band edge, multiple orientations of the EUT were evaluated. Data representing the worst case orientation is provided in this report. AC power line conducted emissions testing was performed with the module installed in a representative host device.

For the purpose of RF conducted measurements, the module was modified with a temporary 50 ohm antenna port.

The EUT can be collocated with Sensus Metering Systems module model IDTB002 FCC ID: SDBIDTB002, IC: 2220A-IDTB002 when integrated in electric utility meters. Radiated inter-modulation testing was performed with both modules simultaneously transmitting when integrated in a representative host utility meter. All spurious emission levels were below the specified limit.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200612-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 511277

Industry Canada Lab Code: IC 4175A-1

VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

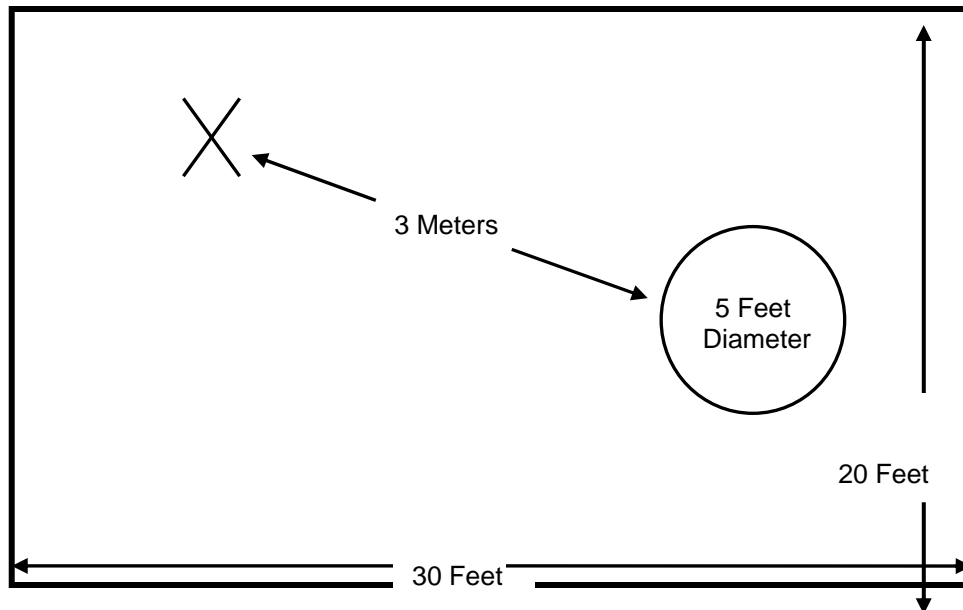


Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

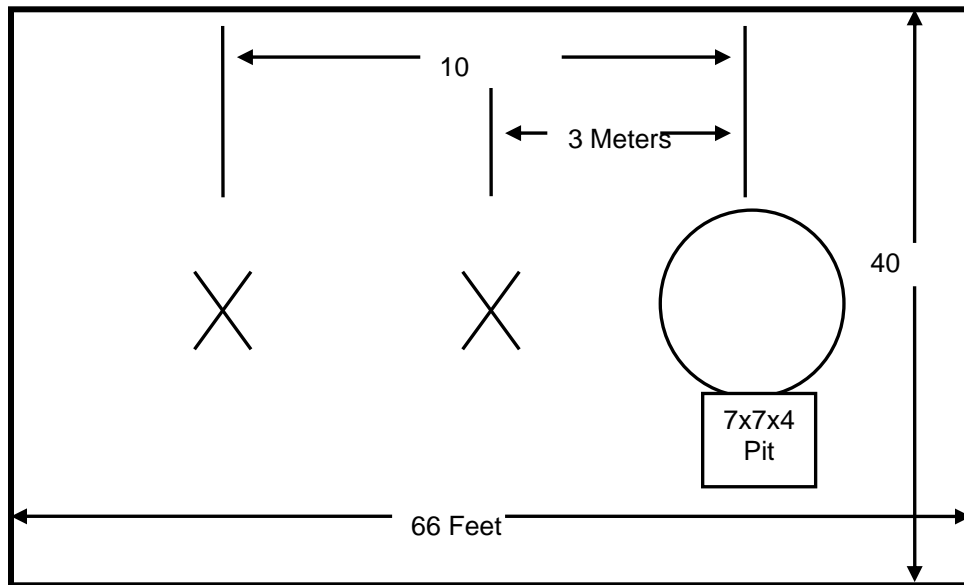


Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

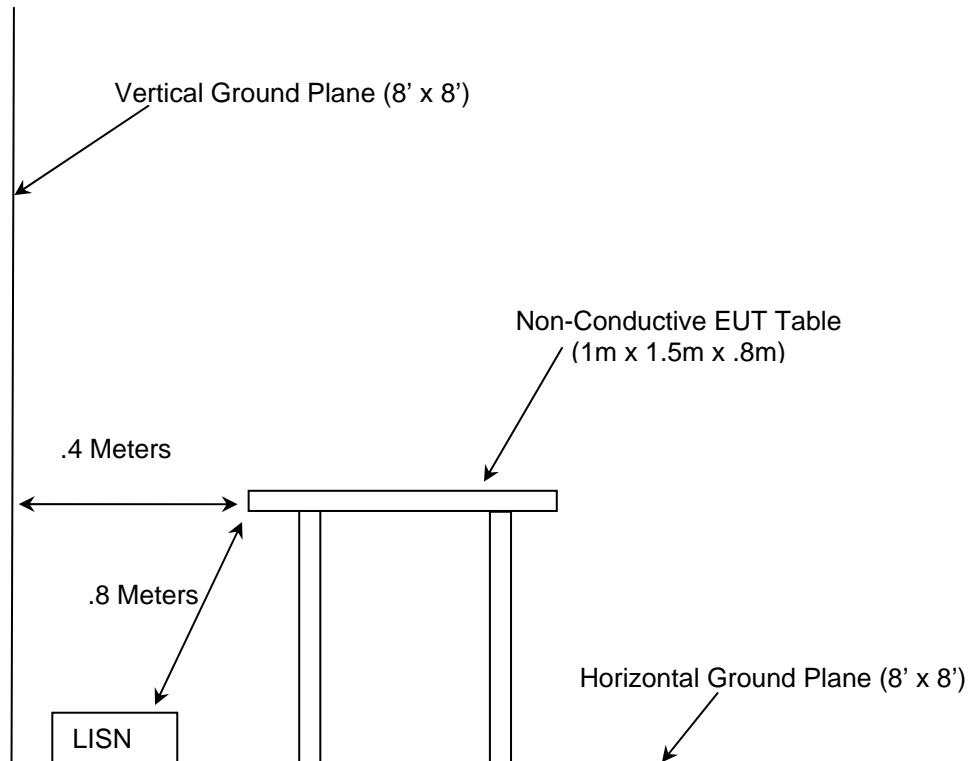


Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2010
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2010
- ❖ FCC KDB Publication No. 558074 - Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247), March 2005
- ❖ Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8 Dec 2010
- ❖ Industry Canada Radio Standards Specification: RSS-GEN - General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, Dec 2010.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

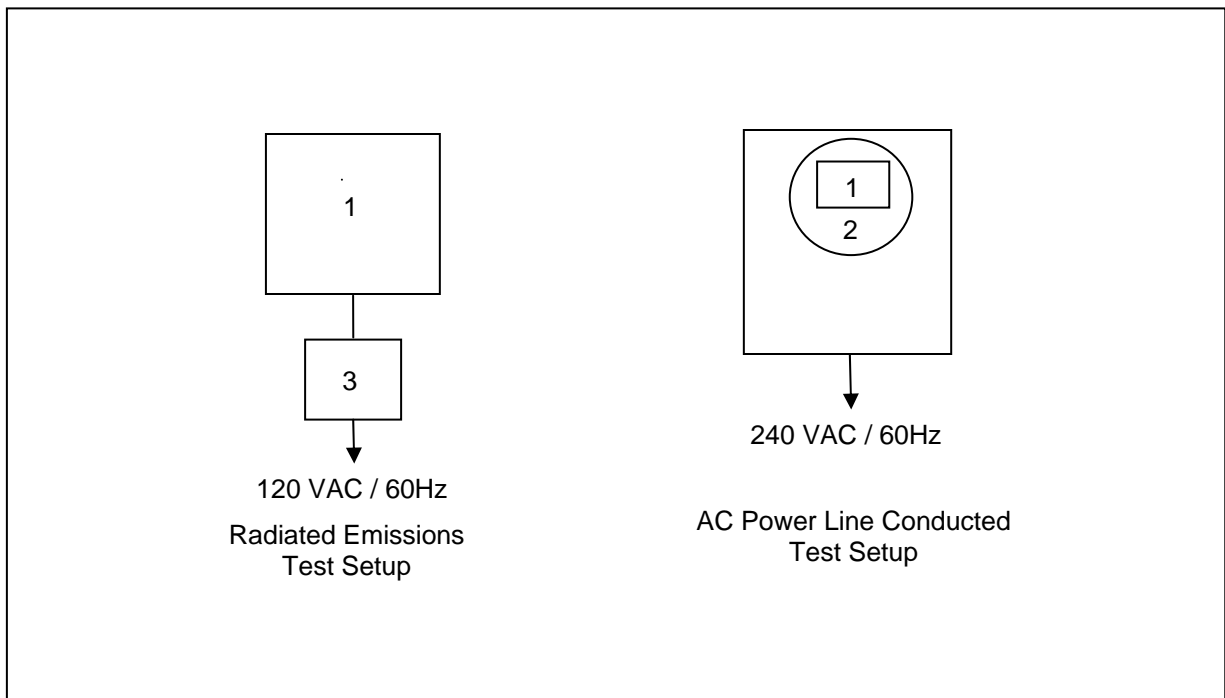
AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	9/23/2010	9/23/2012
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	9/23/2010	9/23/2012
3	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	839379/011	5/26/2011	5/26/2013
4	Rohde & Schwarz	ESMI - Receiver	Spectrum Analyzers	833827/003	5/26/2011	5/26/2013
25	Chase	CBL6111	Antennas	1043	9/13/2010	9/13/2012
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/27/2011	4/27/2013
73	Agilent	8447D	Amplifiers	2727A05624	3/21/2011	3/21/2012
153	EMCO	3825/2	LISN	9411-2268	1/13/2011	1/13/2012
167	ACS	Chamber EMI Cable Set	Cable Set	167	1/26/2011	1/26/2012
168	Hewlett Packard	11947A	Attenuators	44829	2/4/2011	2/4/2012
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	8/31/2010	8/31/2011
291	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	None	12/7/2010	12/7/2011
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	4/11/2011	4/11/2012
324	ACS	Belden	Cables	8214	7/9/2010	7/9/2011
329	AH Systems	SAS-571	Antennas	721	8/4/2009	8/4/2011
334	Rohde&Schwarz	3160-10	Antennas	45576	11/4/2010	NCR
335	Suhner	SF-102A	Cables	882/2A	10/29/2010	10/29/2011
338	Hewlett Packard	8449B	Amplifiers	3008A01111	3/24/2011	3/24/2012
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	10/5/2010	10/5/2011
345	Suhner Sucoflex	102A	Cables	1077/2A	10/29/2010	10/29/2011
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	12/29/2010	12/29/2011

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	Sensus Metering Systems, Inc.	ZIGMOD20	ABCDE324, ABCDE322, ABCDE326
2	Electric Meter	Sensus Metering Systems, Inc.	CL200 FM2S	29 388 962
3	Power Supply	TryGon Electronics	DL40-1	489512

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The antenna used for the ZigMod20 is a printed monopole antenna with 0dBi gain, and therefore meets the requirements of Section 15.203.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.4

7.2.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss

Margin = Applicable Limit - Corrected Reading

7.2.2 Measurement Results

Results of the test are shown below in and Tables 7.2.2-1 to 7.2.2.2.

Table 7.2.2-1: Line 1 Conducted EMI Results

Frequency (MHz)	Detector	Level (dBuV)	Correction Factor (dB)	Limit (dBuV)	Margin (dB)
0.192000	QP	45.60	9.9	64	18.4
0.240000	QP	40.10	9.9	62	22.0
0.426000	QP	16.20	10.0	57	41.1
0.480000	QP	18.70	10.0	56	37.6
1.458000	QP	40.10	10.0	56	15.9
1.782000	QP	23.50	10.0	56	32.5
3.612000	QP	22.40	9.9	56	33.6
4.986000	QP	22.40	10.0	56	33.6
7.158000	QP	28.20	10.0	60	31.8
20.592000	QP	21.00	9.7	73	39.0
0.192000	AV	41.90	9.9	54	12.0
0.240000	AV	39.40	9.9	52	12.7
0.414000	AV	23.80	10.1	48	23.7
0.480000	AV	14.10	10.0	46	32.2
1.458000	AV	36.20	10.0	46	9.8
1.818000	AV	15.60	10.0	46	30.4
3.558000	AV	17.40	9.9	46	28.6
4.992000	AV	17.60	10.0	46	28.4
7.158000	AV	24.90	10.0	50	25.1
20.640000	AV	16.30	9.7	50	33.7

Table 7.2.2-2: Line 2 Conducted EMI Results

Frequency (MHz)	Detector	Level (dBuV)	Correction Factor (dB)	Limit (dBuV)	Margin (dB)
0.192000	QP	40.00	9.9	64	23.9
0.240000	QP	36.40	9.9	62	25.7
0.390000	QP	25.40	10.1	58	32.7
1.458000	QP	36.70	10.0	56	19.3
3.522000	QP	22.30	9.9	56	33.7
4.272000	QP	24.10	9.9	56	31.9
4.308000	QP	24.30	9.9	56	31.7
4.944000	QP	21.50	10.0	56	34.5
20.682000	QP	24.00	9.6	60	36.0
20.802000	QP	27.30	9.5	60	32.7
0.192000	AV	38.40	9.9	54	15.6
0.240000	AV	35.90	9.9	52	16.2
0.396000	AV	16.60	10.1	48	31.3
1.458000	AV	32.40	10.0	46	13.6
3.534000	AV	18.00	9.9	46	28.0
4.290000	AV	19.00	9.9	46	27.0
4.368000	AV	18.20	10.0	46	27.8
4.956000	AV	17.00	10.0	46	29.0
20.574000	AV	15.70	9.7	50	34.3
20.640000	AV	16.40	9.7	50	33.6

7.3 6dB / 99% Bandwidth – FCC: Section 15.247(a)(2) IC: RSS-210 A8.2(a)

7.3.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with the FCC KDB Publication No. 558074 “Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)”. The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the entire emissions and >> RBW.

The occupied bandwidth measurement function of the analyzer was used for the 99% bandwidth.

7.3.2 Measurement Results

Results are shown below in table 7.3.2-1 and figure 7.3.2-1 to 7.3.2-6:

Table 7.3.2-1: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth [MHz]
2405	1.64	2.75
2440	1.62	2.75
2480	1.62	2.73

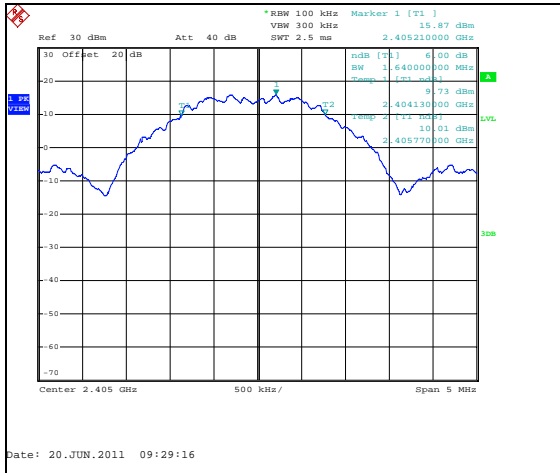


Figure 7.3.2-1: 6dB Bandwidth Plot – 2405MHz

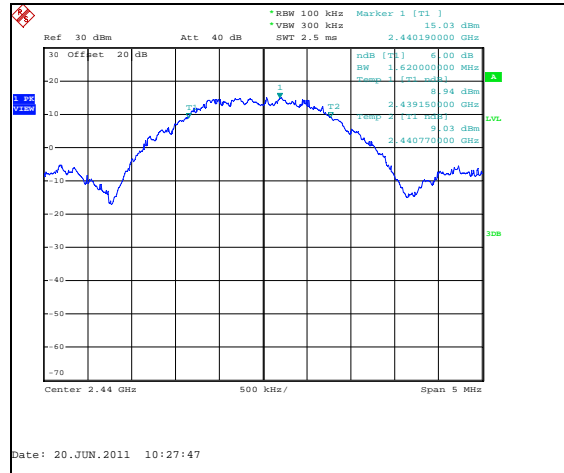


Figure 7.3.2-2: 6dB Bandwidth Plot – 2440MHz

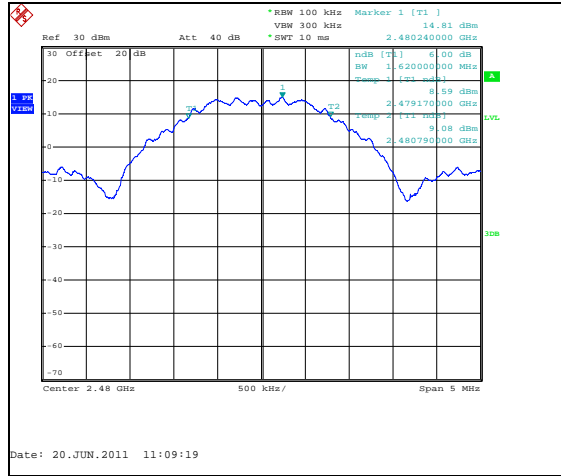


Figure 7.3.2-3: 6dB Bandwidth Plot – 2480MHz

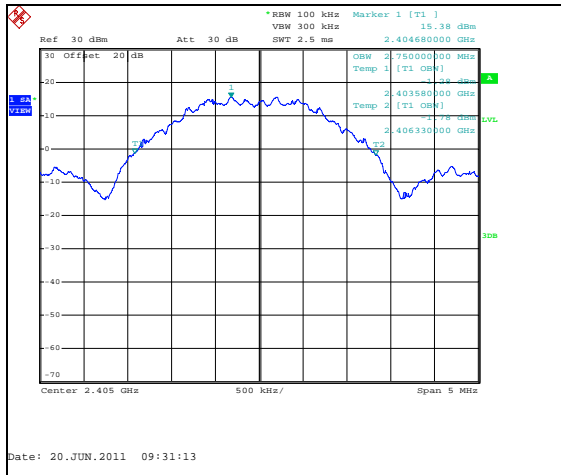


Figure 7.3.2-4: 99% Bandwidth Plot – 2405MHz

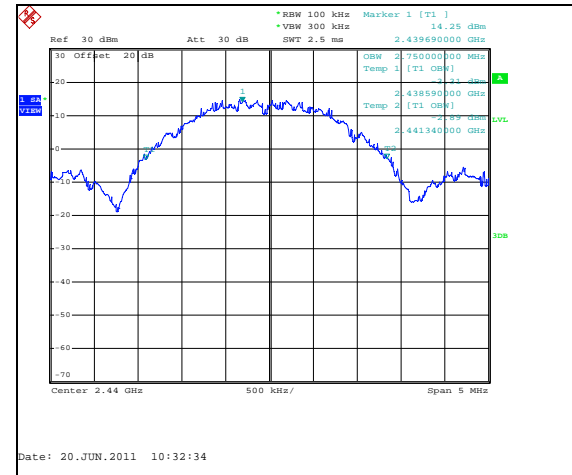


Figure 7.3.2-5: 99% Bandwidth Plot – 2440MHz

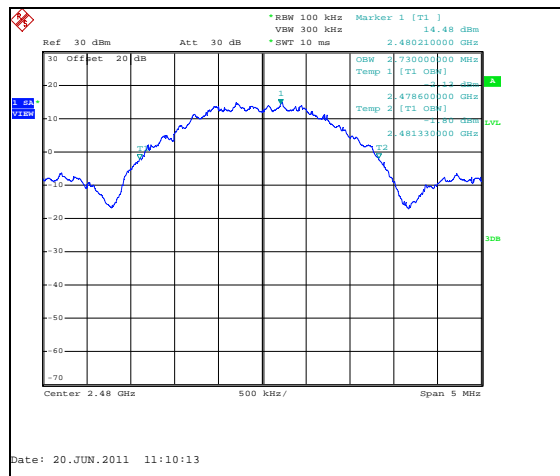


Figure 7.3.2-6: 99% Bandwidth Plot – 2480MHz

7.4 Peak Output Power Requirement - FCC Section 15.247(b)(3) IC: RSS-210 A8.4(4)

7.4.1 Measurement Procedure

The Peak Output Power was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)" Power Option 1. The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. Data was collected with the EUT operating at maximum power per channelization.

7.4.2 Measurement Results

Results are shown below in Table 7.4.2-1 and Figures 7.4.2-1 to 7.4.2-3.

Table 7.4.2-1: Peak Output Power

Frequency (MHz)	Output Power (dBm)
2405	19.45
2440	19.11
2480	18.47

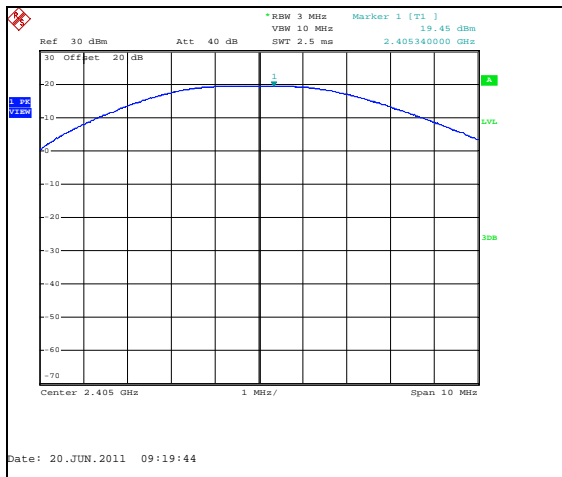


Figure 7.4.2-1: Output power – 2405MHz

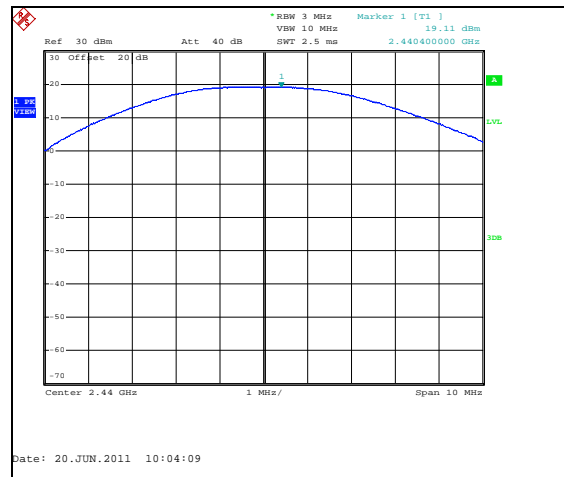


Figure 7.4.2-2: Output power – 2440MHz

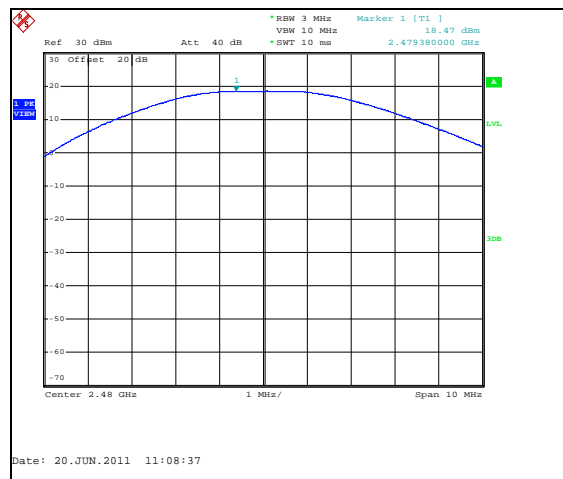


Figure 7.4.2-3: Output power – 2480MHz

7.5 Band-Edge Compliance and Spurious Emissions-FCC 15.247d IC:RSS-210 2.2, A8.5

7.5.1 Band-Edge Compliance

7.5.1.1 Measurement Procedure

The EUT was investigated at the low and high channels of operation to determine band-edge compliance. Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined based on the marker-delta method.

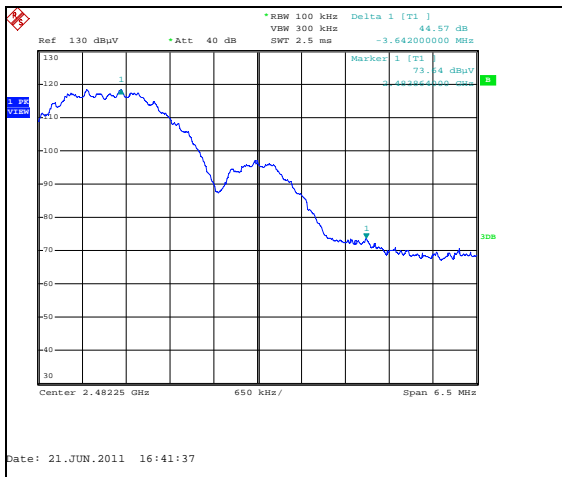
The lower band-edge compliance was determined using the conducted marker-delta method in which the radio frequency power that is produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power.

7.5.1.2 Measurement Results

Band-edge compliance is displayed in Table 7.5.1.2-1 and Figures 7.5.1.2-1 to 7.5.1.2-3.

Table 7.5.1.2-1: Upper Band-edge Radiated Emissions - 2480MHz

Frequency (MHz)	Uncorrected Level (dBuV)		Antenna Factor (H/V)	Correction Factors (dB)	Fundamental Level (dBuV/m)		Marker-Delta (dB)	Band-Edge Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg		pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2480	121.75	119.11	H	-5.06	116.69	96.20	44.57	72.12	51.63	74.0	54.0	1.88	2.37
2480	117.25	114.61	V	-5.06	112.19	91.70	45.48	66.71	46.22	74.0	54.0	7.29	7.78



7.5.1.2-1: Upper Band-edge - HPol

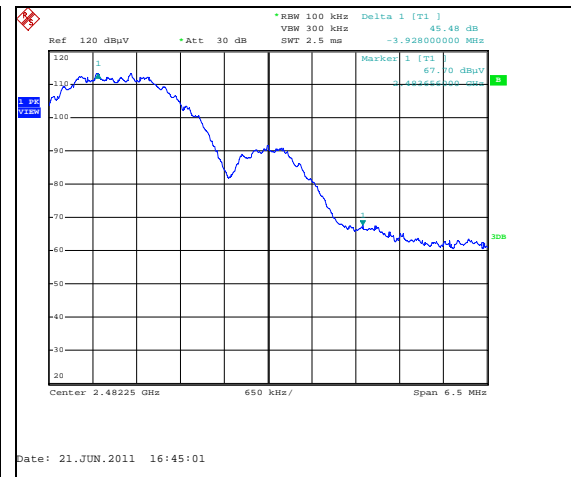


Figure 7.5.1.2-2: Upper Band-edge - VPol

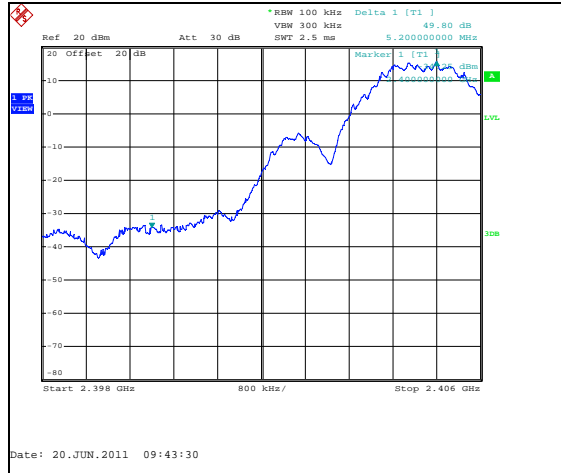


Figure 7.5.1.2-3: Lower Band-edge (Conducted)

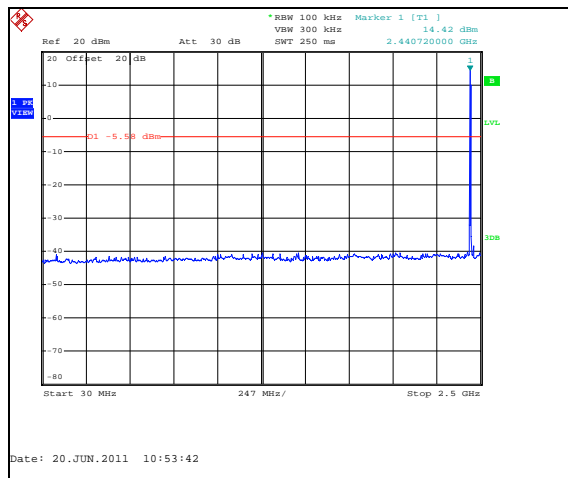
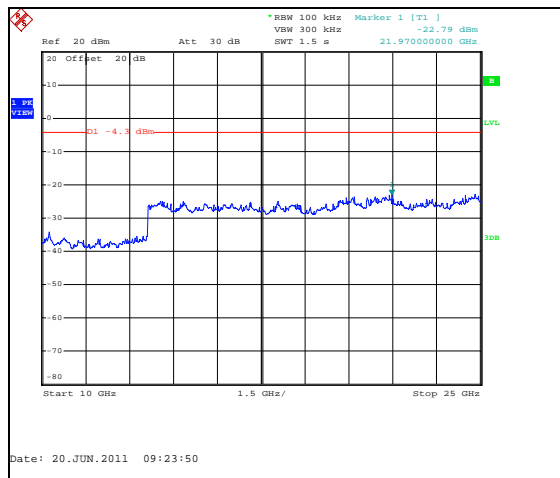
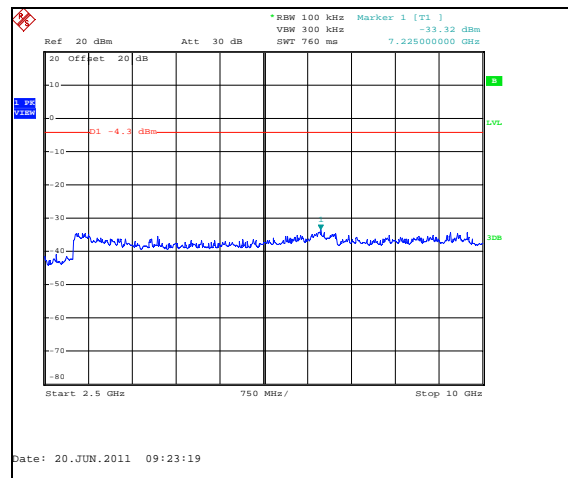
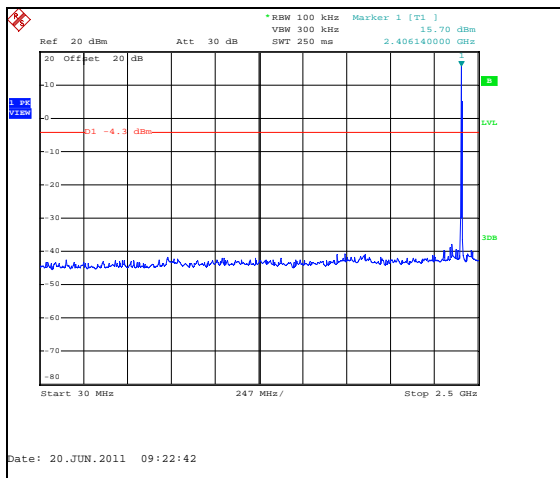
7.5.2 RF Conducted Spurious Emissions

7.5.2.1 Measurement Procedure

The RF Conducted Spurious Emissions were measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 25GHz, 10 times the highest fundamental frequency. For each measurement, the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak detector and Max Hold function of the analyzer were utilized.

7.5.2.2 Measurement Results

RF Conducted Emissions are displayed in Figures 7.5.2.2-1 through 7.5.2.2-9.



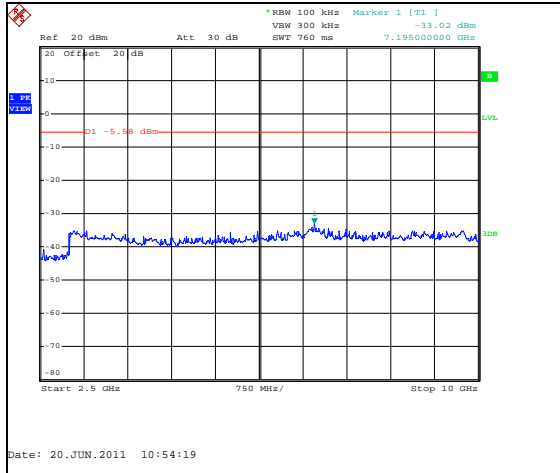


Figure 7.5.2.2-5: 2.5 GHz – 10 GHz – 2440MHz

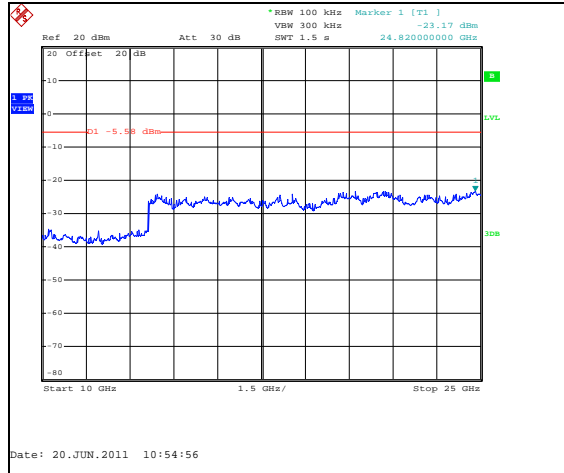


Figure 7.5.2.2-6: 10 GHz – 25 GHz – 2440MHz

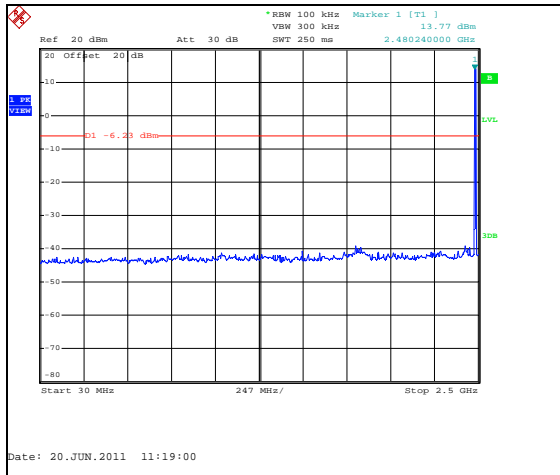


Figure 7.5.2.2-7: 30 MHz – 2.5 GHz – 2480MHz

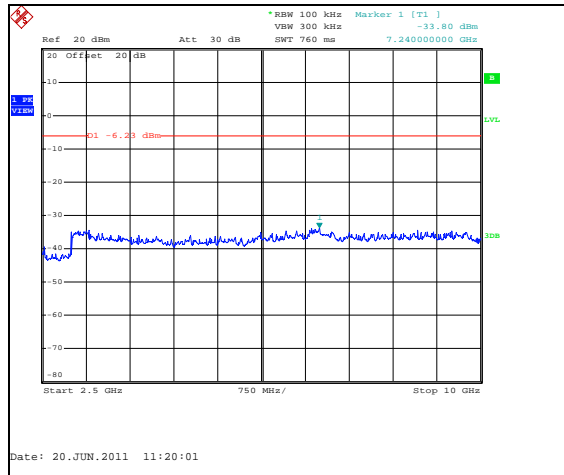


Figure 7.5.2.2-8: 2.5 GHz – 10 GHz – 2480MHz

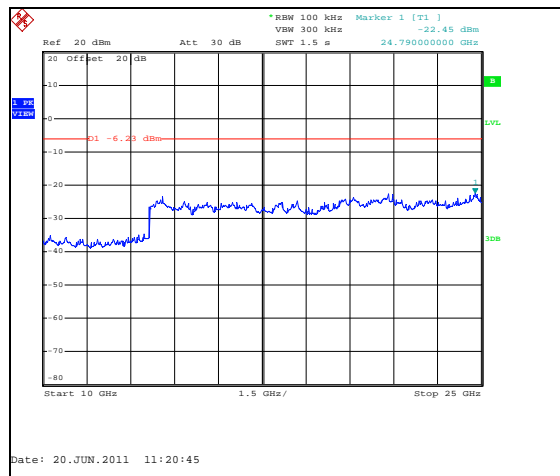


Figure 7.5.2.2-9: 10 GHz – 25 GHz – 2480MHz

7.5.3 Radiated Spurious Emissions (Restricted Bands)

7.5.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 25 GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively. The average emissions were further corrected by applying the duty cycle correction of the EUT for comparison to the average limit.

Each emission found to be in a restricted band was compared to the applicable radiated emission limits.

7.5.3.2 Duty Cycle Correction

For average radiated measurements, using a 12.8% duty cycle, the measured level was reduced by a factor -17.85dB. The duty cycle correction factor is determined using the formula: $20\log(12.8/100) = -17.85\text{dB}$.

A detailed analysis of the duty cycle timing is provided in the Theory of Operation accompanying this report.

7.5.3.3 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 25GHz are reported in the tables below.

Table 7.5.3.3-1: Radiated Spurious Emissions Tabulated Data – 2405MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
4810	53.16	45.03	H	1.93	55.09	29.10	74.0	54.0	18.9	24.9
4810	54.38	47.16	V	1.93	56.31	31.23	74.0	54.0	17.7	22.8
12025	50.19	40.54	H	14.29	64.48	36.97	83.5	63.5	19.0	26.6
12025	51.13	40.51	V	14.29	65.42	36.94	83.5	63.5	18.1	26.6

* Note: All emissions above 12025 MHz were attenuated below the permissible limit.

Table 7.5.3.3-2: Radiated Spurious Emissions Tabulated Data – 2440MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
4880	55.01	48.34	H	2.09	57.10	32.58	74.0	54.0	16.9	21.4
4880	55.06	47.93	V	2.09	57.15	32.17	74.0	54.0	16.8	21.8
7320	55.06	43.92	H	7.57	62.63	33.63	74.0	54.0	11.4	20.4
7320	57.40	46.74	V	7.57	64.97	36.45	74.0	54.0	9.0	17.5
12200	54.76	43.03	H	15.59	70.35	40.76	83.5	63.5	13.2	22.8
12200	55.78	44.58	V	15.59	71.37	42.31	83.5	63.5	12.1	21.2

* Note: All emissions above 12200 MHz were attenuated below the permissible limit.

Table 7.5.3.3-3: Radiated Spurious Emissions Tabulated Data – 2480MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
4960	53.16	44.90	H	2.28	55.44	29.32	74.0	54.0	18.6	24.7
4960	52.41	44.12	V	2.28	54.69	28.54	74.0	54.0	19.3	25.5
7440	54.30	45.72	H	7.57	61.87	35.44	74.0	54.0	12.1	18.6
7440	58.12	49.91	V	7.57	65.69	39.63	74.0	54.0	8.3	14.4
12400	51.68	41.70	H	17.07	68.75	40.91	83.5	63.5	14.8	22.6
12400	53.26	43.74	V	17.07	70.33	42.95	83.5	63.5	13.2	20.6

* Note: All emissions above 12400 MHz were attenuated below the permissible limit.

7.5.3.4 Sample Calculation:

$$R_C = R_U + CF_T$$

Where:

- CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
 R_U = Uncorrected Reading
 R_C = Corrected Level
 AF = Antenna Factor
 CA = Cable Attenuation
 AG = Amplifier Gain
 DC = Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: $53.16 + 1.93 = 55.09 \text{ dBuV/m}$

Margin: $74 \text{ dBuV/m} - 55.09 \text{ dBuV/m} = 18.9 \text{ dB}$

Example Calculation: Average

Corrected Level: $45.03 + 1.93 - 17.85 = 29.1 \text{ dBuV}$

Margin: $54 \text{ dBuV} - 29.1 \text{ dBuV} = 24.9 \text{ dB}$

7.6 Peak Power Spectral Density- FCC Section 15.247(e) IC: RSS-210 A8.2(b)

7.6.1 Measurement Procedure

The power spectral density was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The emission peaks within the pass band were located and zoomed in on. The spectrum analyzer RBW was set to 3 kHz and VBW 10 kHz. Span was adjusted to 500 kHz and the sweep time was calculated to be 167s ~ (Span/3 kHz).

7.6.2 Measurement Results

Results are shown below in table 7.6.2-1 and figures 7.6.2-1 – 7.6.2-3:

Table 7.6.2-1: Peak Power Spectral Density

Frequency (MHz)	PSD Level (dBm)
2405	6.97
2440	6.21
2480	3.50

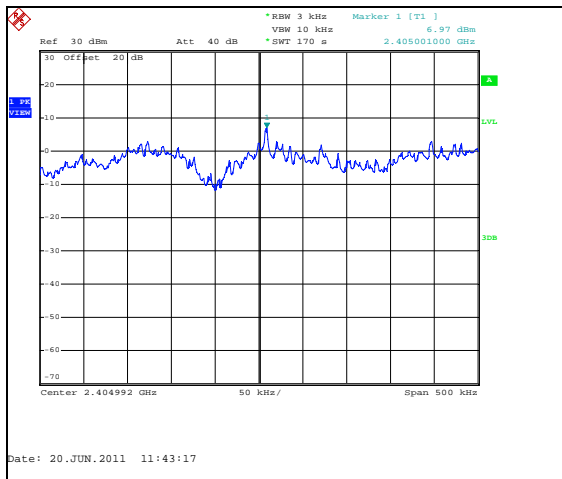


Figure 7.6.2-1: Power Spectral Density Plot – 2405MHz

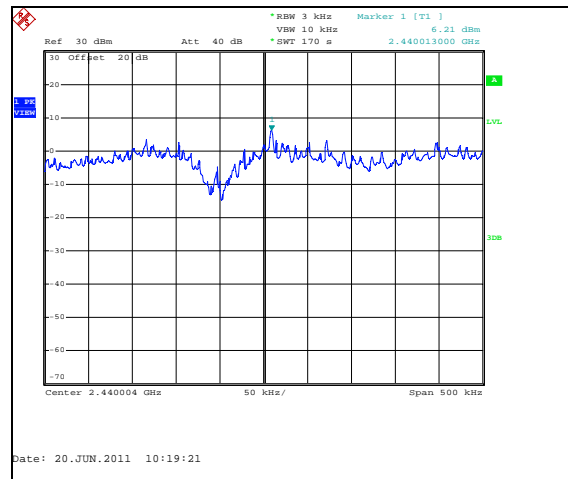


Figure 7.6.2-2: Power Spectral Density Plot – 2440MHz

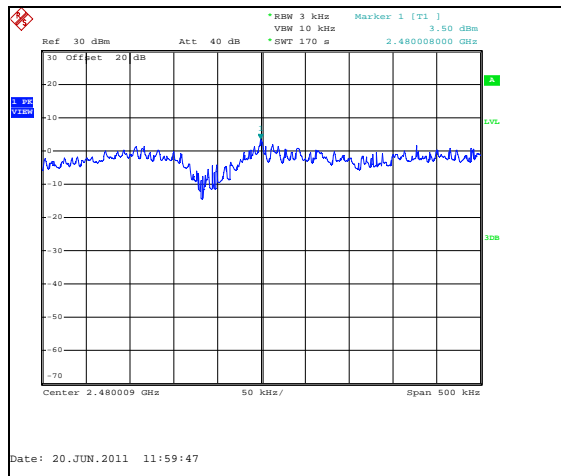


Figure 7.6.2-3: Power Spectral Density Plot – 2480MHz

8 CONCLUSION

In the opinion of ACS, Inc. the ZigMod20, manufactured by Sensus Metering Systems, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT