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## Certification Test Report

**FCC ID: SK9AMI-4  
IC: 864G-AMI4**

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

**ACS Report Number: 08-0431-15C-DTS**

Manufacturer: Itron Electricity Metering, Inc.  
Model: AMI4

Test Begin Date: November 5, 2008  
Test End Date: November 12, 2008

Report Issue Date: November 17, 2008



FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

Prepared by:

**Ken Rivers  
Wireless Certifications Technician  
ACS, Inc.**

Reviewed by:

**Kirby Munroe  
Director, Wireless Certifications  
ACS, Inc.**

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**This report contains 25 pages**

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## Additional Exhibits Included In Filing

**Internal Photographs**

**External Photographs**

**Test Setup Photographs**

**Product Labeling**

**RF Exposure – MPE Calculations**

**Installation/Users Guide**

**Theory of Operation**

**System Block Diagram**

**Schematics**

## 1.0 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.

### 1.2 Product Description

#### 1.2.1 General

The AMI4 module is a utility meter register board designed to be integrated into a variety of electric meter form factors. The AMI4 contains (1) 900 MHz LAN frequency hopping spread spectrum radio and (1) 2.4 GHz direct sequence spread spectrum Zigbee radio.

Manufacturer Information:

Itron Electricity Metering, Inc.  
313 North Highway 11  
West Union, SC 29696

Test Sample Serial Number(s):

4110000453 (RF Conducted Measurements)  
4110000454 (Radiated & AC Power line Conducted Emissions)  
4110000647 (Radiated & AC Power line Conducted Emissions)

Test Sample Condition:

The test samples were provided in good working order with no visible defects.

Detailed photographs of the EUT are filed separately with this filing.

#### 1.2.2 Intended Use

The AMI4 module is intended to be used in electric utility meters to provide automated meter reading capabilities.

### 1.3 Test Methodology and Considerations

This AMI4 is considered a composite device by definition. The 900 MHz LAN radio and the 2.4 GHz Zigbee radio operate under CFR 47 Part 15.247 and IC RSS-210. Line conducted, unintentional and intentional radiated emissions were measured in 2S and 12S meter types. This report addresses the 2.4 GHz Zigbee radio only. A separate report will be issued to address the 900 MHz LAN radio.

For the purpose of RF conducted measurements, the AMI4 module was modified with a temporary 50 ohm antenna port.

## 2.0 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

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. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 894540

Industry Canada Lab Code: IC 4175

VCCI Member Number: 1831

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

NVLAP Lab Code: 200612-0

## 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:

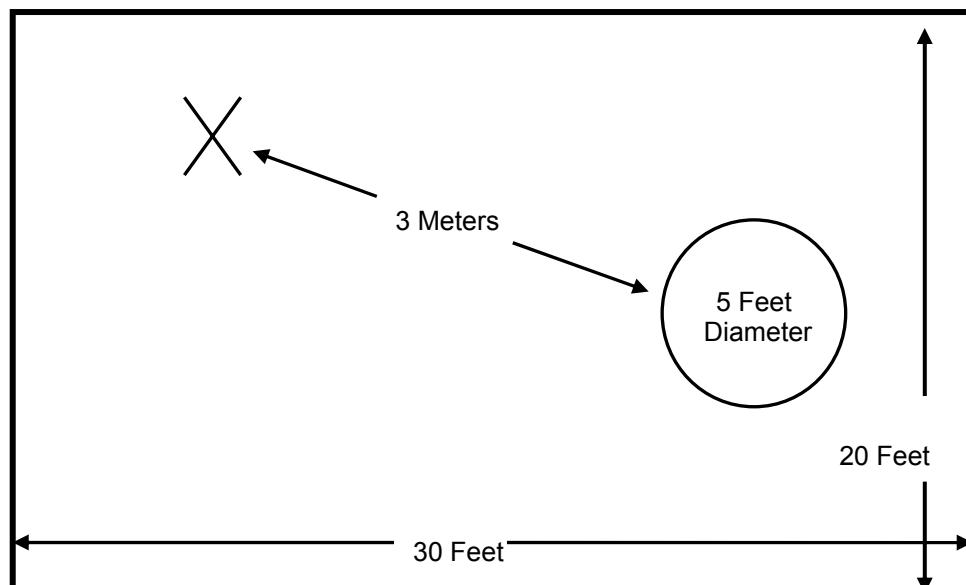


Figure 2.3-1: Semi-Anechoic Chamber Test Site

### 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:

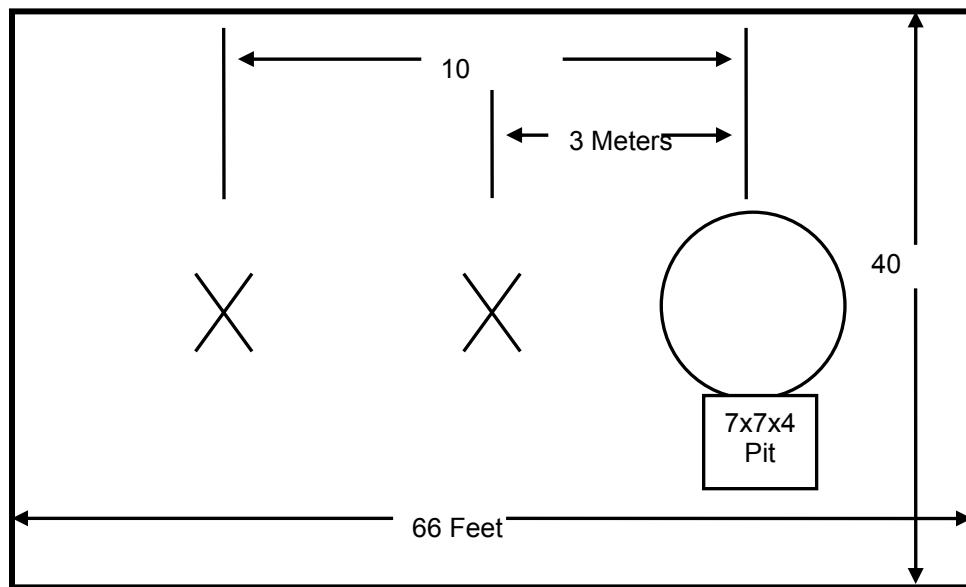


Figure 2.3-2: Open Area Test Site

## 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:

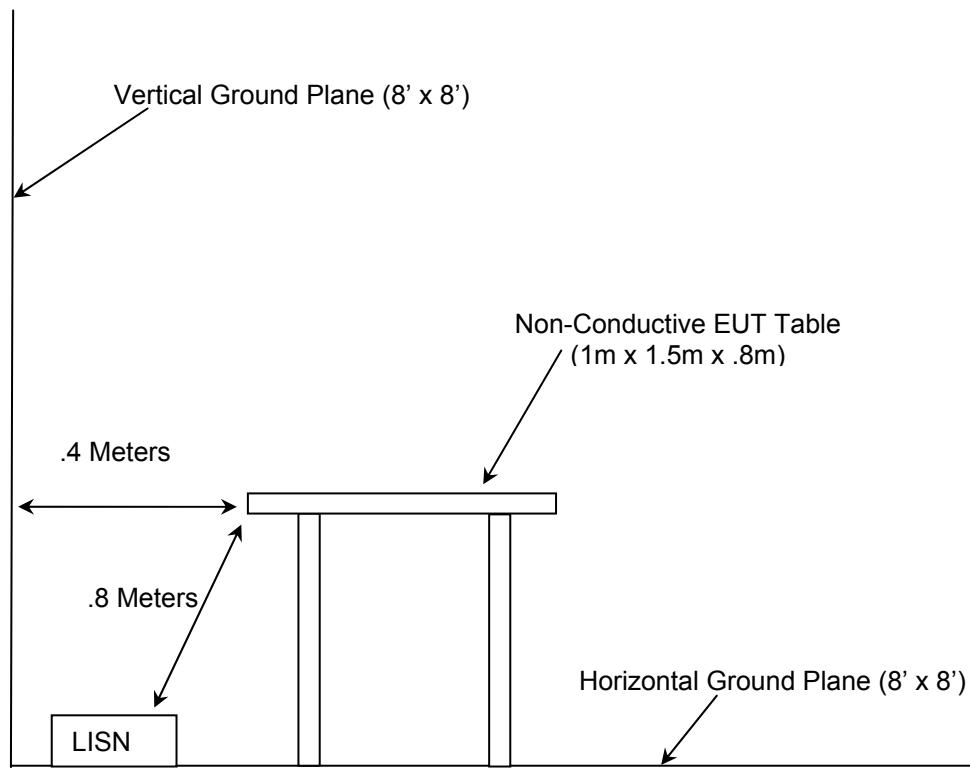


Figure 2.4-1: AC Mains Conducted EMI Site

## 3.0 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, 2008
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2008
- ❖ 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 7 June 2007
- ❖ Industry Canada Radio Standards Specification: RSS-GEN - General Requirements and Information for the Certification of Radiocommunication Equipment, Issue2, June 2007.

**4.0 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**

Equipment Calibration Information					
ACS#	Mfg.	Eq. type	Model	S/N	Cal. Due
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	09-19-2009
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	09-19-2009
22	Agilent	Amplifiers	8449B	3008A00526	10-22-2009
25	Chase	Antennas	CBL6111	1043	08-22-2009
30	Spectrum Technologies	Antennas	DRH-0118	970102	05-07-2009
40	Electro-Metrics	Antennas	3104	3211	01-10-2009
152	EMCO	LISN	Feb-25	9111-1905	03-26-2009
167	ACS	Cable Set	Chamber EMI Cable Set	167	01-04-2009
168	Hewlett Packard	Attenuators	11947A	44829	02-18-2009 (See Note2)
193	ACS	Cable Set	OATS cable Set	193	01-04-2009
211	Eagle	Filters	C7RFM3NFM	HLC-700	01-04-2009
213	TEC	Amplifiers	PA 102	44927	12-19-2008
277	Emco	Antennas	93146	9904-5199	09-09-2009
282	Microwave Circuits	Filters	H2G020G4	74541	02-25-2009 (See Note1)
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	09-19-2009
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	11-21-2008 (See Note1)
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	11-21-2008 (See Note1)
321	Hewlett Packard	Amplifiers	HPC 8447D	1937A02809	10-08-2009
324	ACS	Cables	Belden	8214	07-28-2009
331	Microwave Circuits	Filters	H1G513G1	31417	07-28-2009 (See Note1)
337	Microwave Circuits	Filters	H1G513G1	282706	04-08-2009 (See Note1)
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10-22-2009
339	Aeroflex/Weinschel	Attenuators	AS-18	7142	07-08-2009 (See Note2)
422	Florida RF	Cables	SMS-200AW-72.0-SMR	805	02-25-2009 (See Note1)

**Note1:** Items characterized on an annual cycle. The date shown indicates the next characterization due date.

**Note2:** Items verified on an annual cycle. The date shown indicates the next verification due date.

## 5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Meter Base Enclosure	Durham Company	UT-RS101B-SQD	NA
2	CENTRON II meter	Itron Electricity Metering	C2SOD (2S)	57 906 168
3	CENTRON II meter	Itron Electricity Metering	C2SOD (2S)	57 906 185
4	CENTRON II meter	Itron Electricity Metering	CN2SOD (12S)	58 034 947
5	Transformer	Sagamo Weston	Type T-6A	325827 002

## 6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

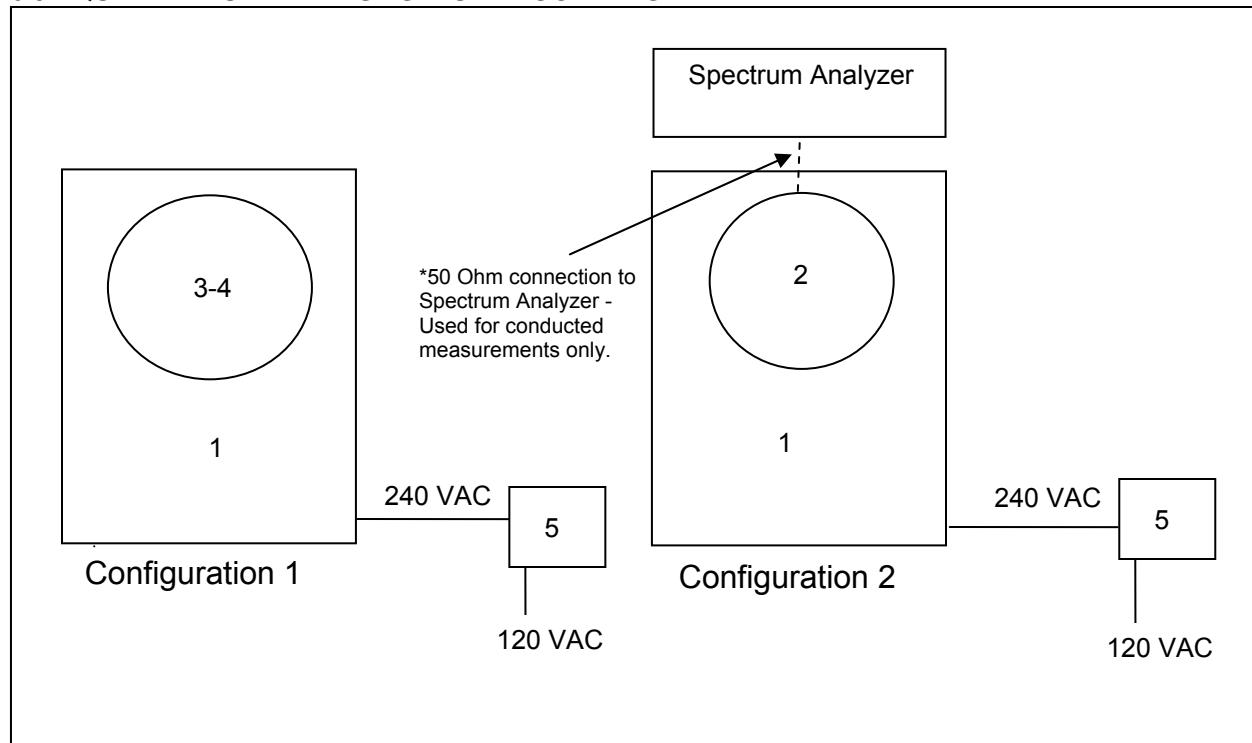


Figure 6-1: EUT Test Setup

Note1: The 2S and 12S meter forms were utilized to power the AMI4 modules for RF conducted measurements. The AMI4 was also integrated into the 2S and 12S meter forms for showing compliance for radiated emissions and AC power line conducted emissions.

Note2: 12S meter form connects directly to 120vAC and did not use a transformer.

## 7.0 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 is a quarter wave embedded slot antenna in the ground plane with a measured gain of 4.4dBi.

### 7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.2

#### 7.2.1 Test Methodology

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 Test Results

Results of the test are shown below in and Tables 7.2-1 and 1.2-2.

**Table 7.2-1: Line 1 Conducted EMI Results - 2S**

Frequency (MHz)	Uncorrected Reading (dBuV)		Total Correction Factor (dB)	Corrected Level (dBuV)		Limit (dBuV)		Margin (dB)		Line
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
Line 1										
0.15	37.1	6.3	9.81	46.91	16.11	66.00	56.00	19.1	39.9	GND
0.28	27.2	2.5	9.82	37.02	12.32	60.82	50.82	23.8	38.5	GND
0.49	14.5	5.7	9.90	24.40	15.60	56.17	46.17	31.8	30.6	GND
2.55	17.8	16.8	9.90	27.70	26.70	56.00	46.00	28.3	19.3	GND
4.19	26.9	24.6	9.90	36.80	34.50	56.00	46.00	19.2	11.5	GND
20.97	22.2	22.5	10.33	32.53	32.83	60.00	50.00	27.5	17.2	GND
Line 2										
0.15	36.8	6.4	9.81	46.61	16.21	66.00	56.00	19.4	39.8	GND
0.28	27	2.3	9.82	36.82	12.12	60.82	50.82	24.0	38.7	GND
0.5	14.5	6.1	9.90	24.40	16.00	56.00	46.00	31.6	30.0	GND
4.39	0.5	-2.5	9.90	10.40	7.40	56.00	46.00	45.6	38.6	GND
5.61	1.3	-2	9.91	11.21	7.91	60.00	50.00	48.8	42.1	GND
20.97	21.8	22.2	10.33	32.13	32.53	60.00	50.00	27.9	17.5	GND

**Table 7.2-2: Line 1 Conducted EMI Results - 12S**

Frequency (MHz)	Uncorrected Reading (dBuV)		Total Correction Factor (dB)	Corrected Level (dBuV)		Limit (dBuV)		Margin (dB)		Line
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
Line 1										
0.18	24.7	21.8	9.82	34.52	31.62	64.49	54.49	30.0	22.9	GND
0.29	8.9	-0.9	9.82	18.72	8.92	60.52	50.52	41.8	41.6	GND
0.42	7.4	3.8	9.90	17.30	13.70	57.45	47.45	40.1	33.7	GND
1.02	2	-1.3	9.90	11.90	8.60	56.00	46.00	44.1	37.4	GND
1.2	22.4	19	9.90	32.30	28.90	56.00	46.00	23.7	17.1	GND
4.19	32.4	26.8	9.90	42.30	36.70	56.00	46.00	13.7	9.3	GND
Line 2										
0.18	22.5	14.2	9.82	32.32	24.02	64.49	54.49	32.2	30.5	GND
0.28	12.8	0.6	9.82	22.62	10.42	60.82	50.82	38.2	40.4	GND
0.53	1.2	-1.2	9.90	11.10	8.70	56.00	46.00	44.9	37.3	GND
0.71	5.7	0.7	9.90	15.60	10.60	56.00	46.00	40.4	35.4	GND
4.2	32.4	25.9	9.90	42.30	35.80	56.00	46.00	13.7	10.2	GND
12.58	16.1	12.2	10.02	26.12	22.22	60.00	50.00	33.9	27.8	GND

### 7.3 Radiated Emissions – FCC: Section 15.109(Unintentional Radiation) IC: RSS-210 2.6

#### 7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 12.5GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements above 30MHz and below 1GHz were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz using a Quasi-peak detector. Above 1GHz, peak and average measurements are taken with the RBW and VBW were set to 1MHz.

#### 7.3.2 Test Results

Results of the test are given in Tables 7.3-1 and 7.3-2 below:

**Table 7.3-1: Radiated Emissions Tabulated Data – 2S**

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
35.9492	-----	44.11	V	-13.46	-----	30.65	-----	40.0	-----	9.35
138.4137	-----	25.23	V	-10.70	-----	14.53	-----	43.5	-----	28.97
146.8086	-----	22.55	V	-9.55	-----	13.00	-----	43.5	-----	30.50
257.6862	-----	22.57	H	-9.66	-----	12.91	-----	46.0	-----	33.09
478.1472	-----	33.05	V	-4.08	-----	28.97	-----	46.0	-----	17.03
494.0005	-----	42.00	H	-3.32	-----	38.68	-----	46.0	-----	7.32
546.0005	-----	32.96	V	-3.30	-----	29.66	-----	46.0	-----	16.34

\* Note: All emissions above 546.0005 MHz were attenuated below the permissible limit.

**Table 7.3-2: Radiated Emissions Tabulated Data – 12S**

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
230.46	-----	33.31	V	-13.66	-----	19.65	-----	46.0	-----	26.35
236.93	-----	40.07	V	-13.15	-----	26.92	-----	46.0	-----	19.08
267.11	-----	39.56	H	-11.48	-----	28.08	-----	46.0	-----	17.92
306.98	-----	40.01	H	-10.93	-----	29.08	-----	46.0	-----	16.92
316.68	-----	35.90	H	-10.50	-----	25.40	-----	46.0	-----	20.60
332.85	-----	39.94	H	-9.89	-----	30.05	-----	46.0	-----	15.95
342.55	-----	37.53	H	-9.47	-----	28.06	-----	46.0	-----	17.94
499.91	-----	39.86	V	-5.80	-----	34.06	-----	46.0	-----	11.94
840.48	-----	20.77	V	0.88	-----	21.65	-----	46.0	-----	24.35
848.03	-----	24.58	V	0.58	-----	25.16	-----	46.0	-----	20.84

\* Note: All emissions above 848.03 MHz were attenuated below the permissible limit.

## 7.4 6dB / 99% Bandwidth – FCC: Section 15.247(a)(2) IC: RSS-210 A8.2(a)

### 7.4.1 Test Methodology

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  $\gg$  RBW.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to  $\geq 1\%$  of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The occupied bandwidth measurement function of the analyzer was used for the 99% bandwidth.

### 7.4.2 Test Results

Results are shown below in table 7.4.2-1 and figure 7.4.2-1 to 7.4.2-6:

Table 7.4.2-1: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [kHz]	99% Bandwidth [kHz]
2405	1.65	2.40
2440	1.63	2.41
2475	1.63	2.42

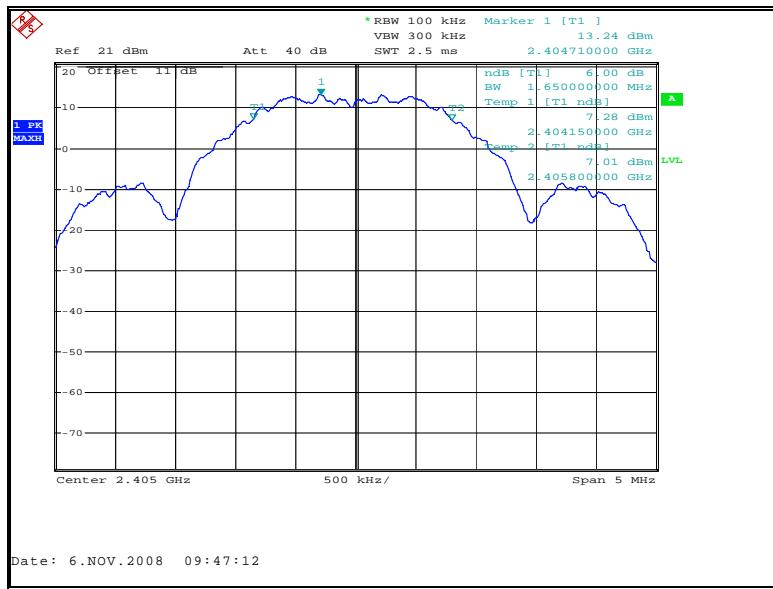


Figure 7.4.2-1: 6dB Bandwidth Plot – Low Channel

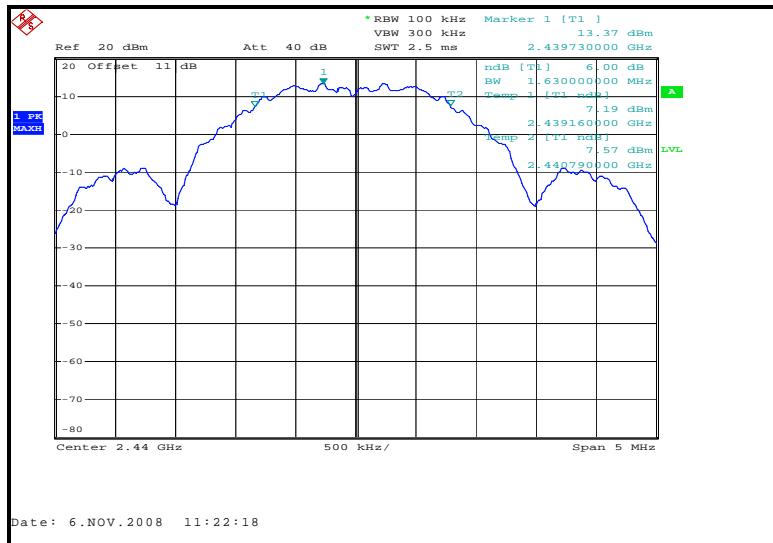


Figure 7.4.2-2: 6dB Bandwidth Plot – Mid Channel

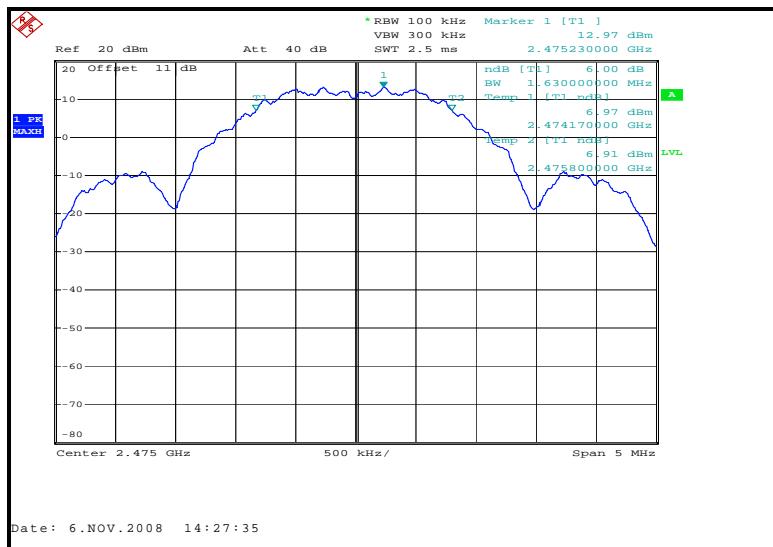


Figure 7.4.2-3: 6dB Bandwidth Plot – High Channel

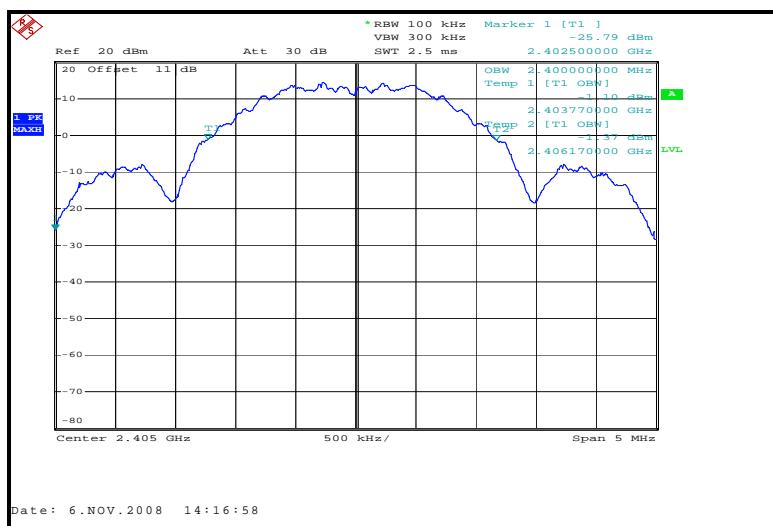


Figure 7.4.2-4: 99% Bandwidth Plot – Low Channel

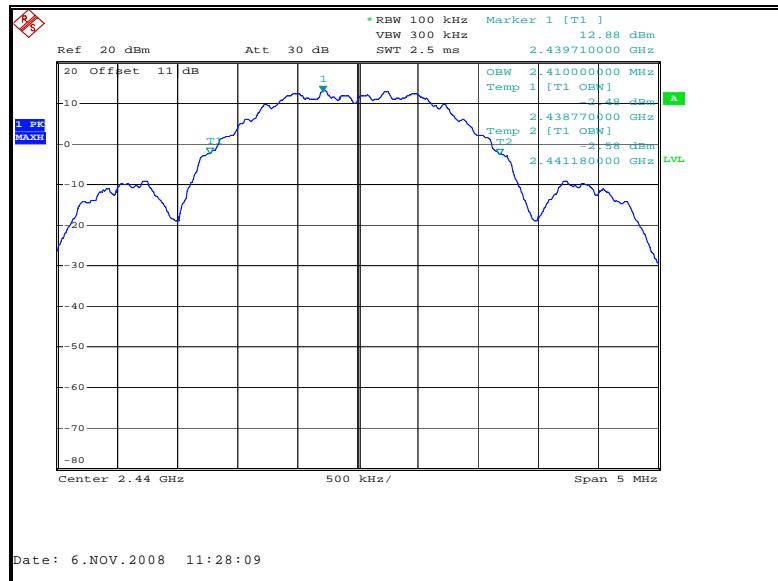


Figure 7.4.2-5: 99% Bandwidth Plot – Mid Channel

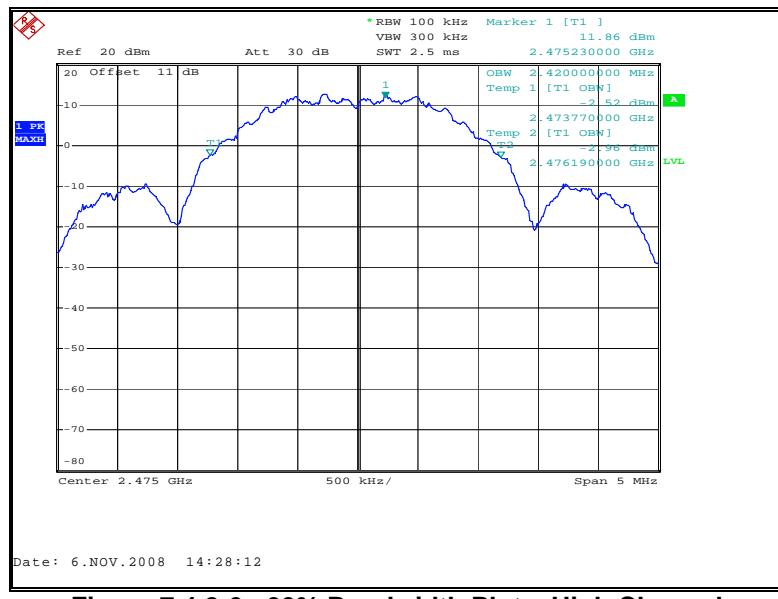


Figure 7.4.2-6: 99% Bandwidth Plot – High Channel

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

### 7.5.1 Test Methodology

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.

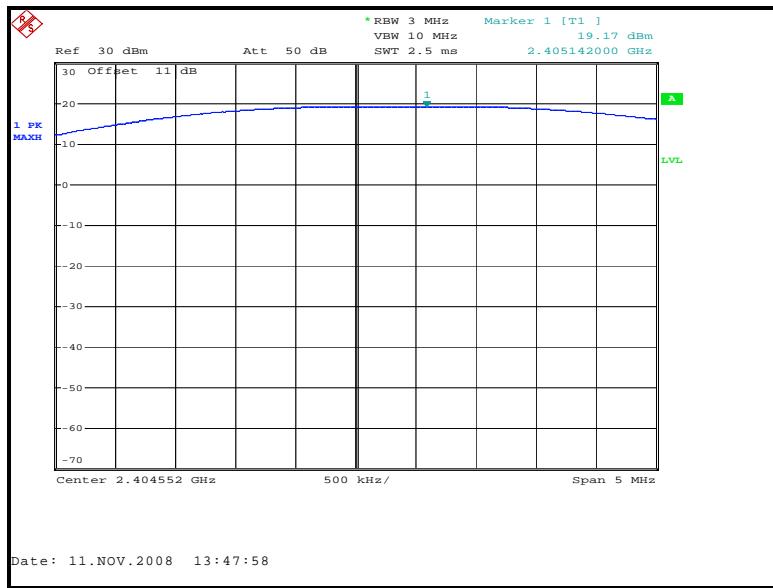
Data was collected with the EUT operating at maximum power.

### 7.5.2 Test Results

Results are shown below in Table 7.5.2-1 and Figures 7.5.2-1 to 7.5.2-3.

**Table 7.5.2-1: Peak Output Power**

Frequency (MHz)	Output Power (dBm)
2405	19.17
2440	18.47
2475	17.92



**Figure 7.5.2-1: Output power – Low Channel**

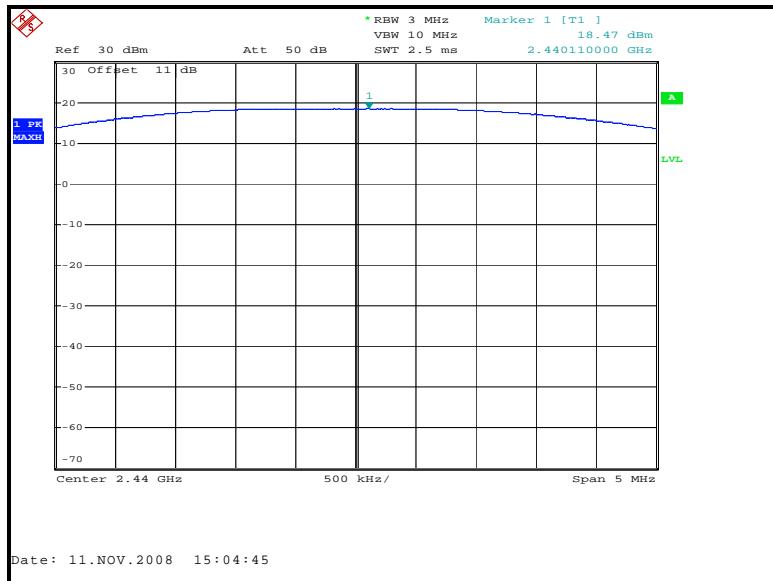


Figure 7.5.2-2: Output power – Mid Channel

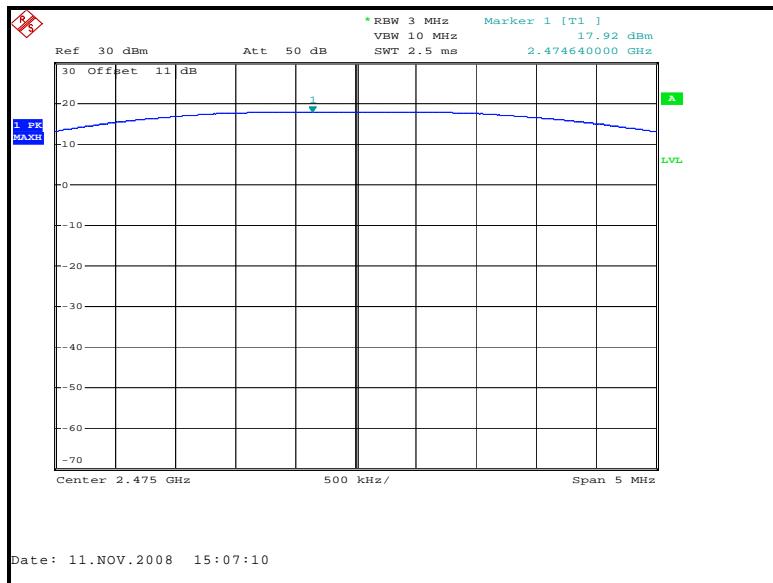


Figure 7.5.2-3: Output power – High Channel

7.6 Band-Edge Compliance and Spurious Emissions - FCC Section 15.247(d) IC: RSS-210 2.6, A8.5

### 7.6.1 Band-Edge Compliance of RF Emissions

### 7.6.1.1 Test Methodology

The EUT was investigated at the low and high channels of operation to determine band-edge compliance. All antenna types were evaluated. Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined using the radiated mark-delta method as outlined in FCC DA 00-705. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions.

The lower band-edge compliance was determined using the 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.

### 7.6.1.2 Test Results

Band-edge compliance is displayed in Tables 7.6.1.2-1 - 7.6.1.2-2 and Figure 7.6.1.2-1 - 7.6.1.2-3.

**Table 7.6.1.2-1: Upper Band-edge Marker Delta Method – 2S**

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Fundamental Field Strength (dBuV/m)		Delta- Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m)	
	pk	avg			pk	avg		pk	avg	74	54
Fundamental Frequency											
2475	85.15	82.77	V	33.18	118.33	104.58	50.8	67.53	53.78	6.47	0.22

**Table 7.6.1.2-2: Upper Band-edge Marker Delta Method – 12S**

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m)		
	pk	avg			pk	avg		pk	avg	74	54	
Fundamental Frequency												
2475	82.83	80.53	V		33.18	116.01	102.34	48.78	67.23	53.56	6.77	0.44

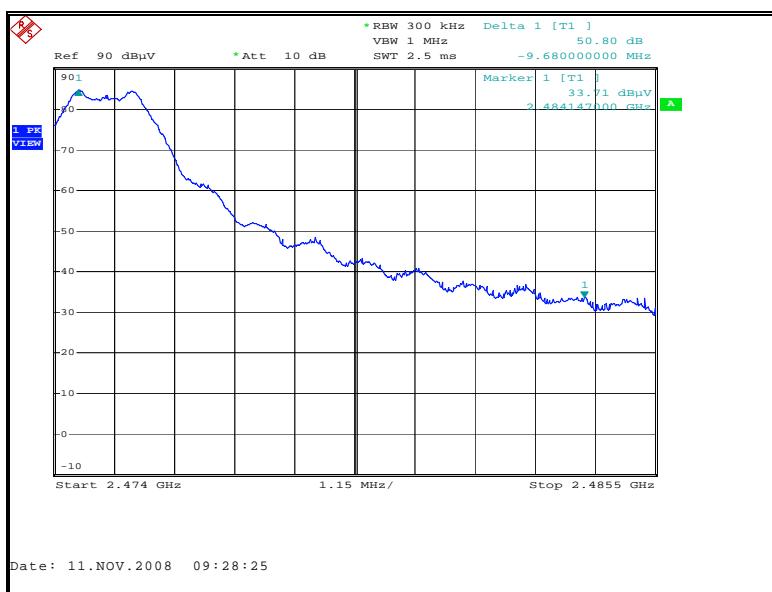


Figure 7.6.1.2-1: Upper Band-edge (Radiated) – 2S

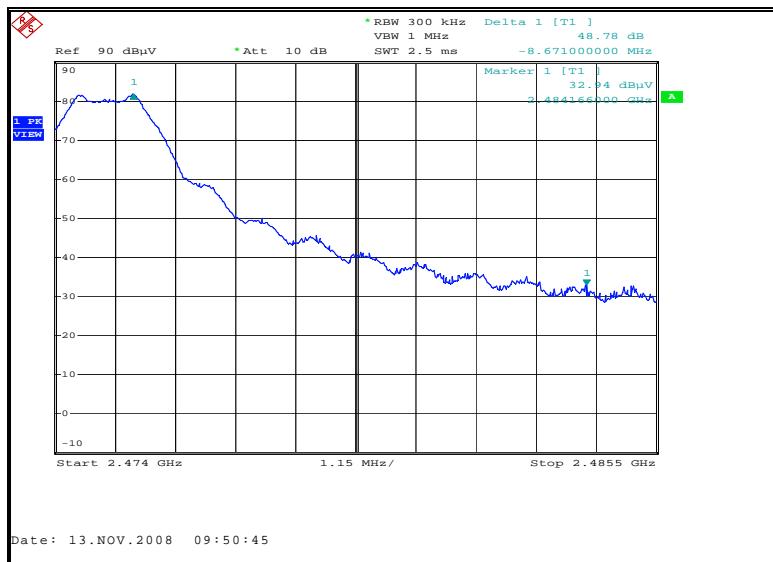


Figure 7.6.1.2-2: Upper Band-edge (Radiated) – 12S

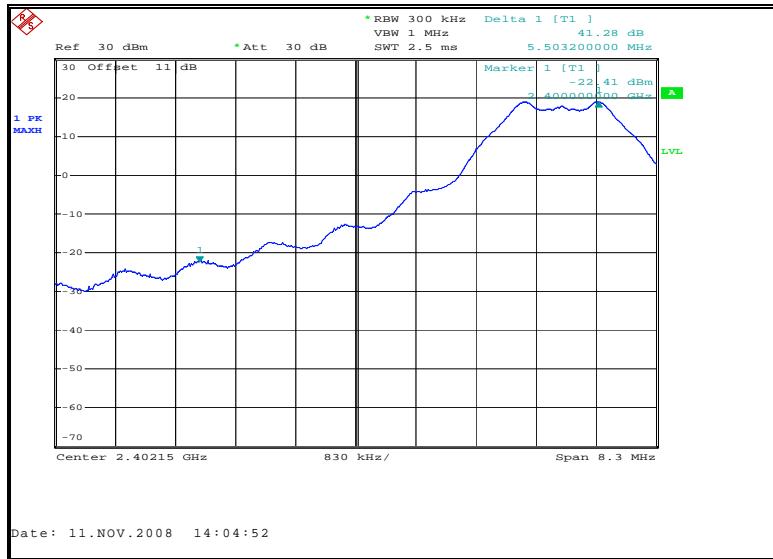


Figure 7.6.1.2-3: Lower Band-edge (Conducted)

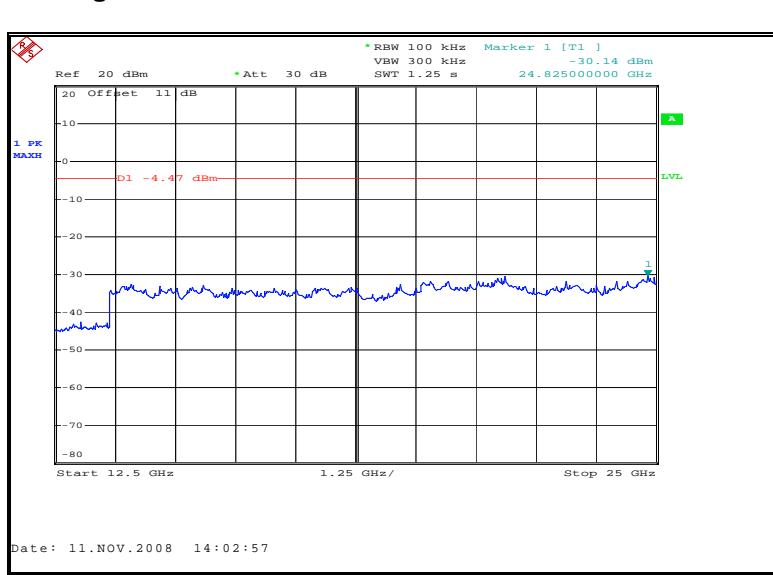
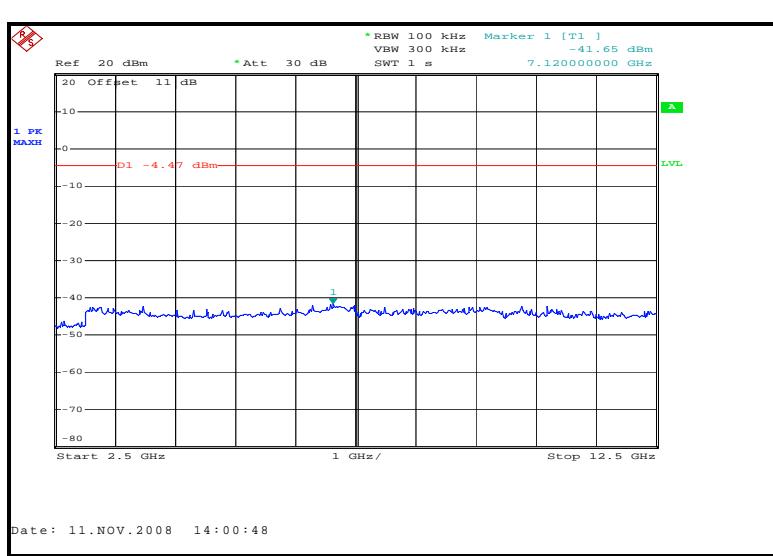
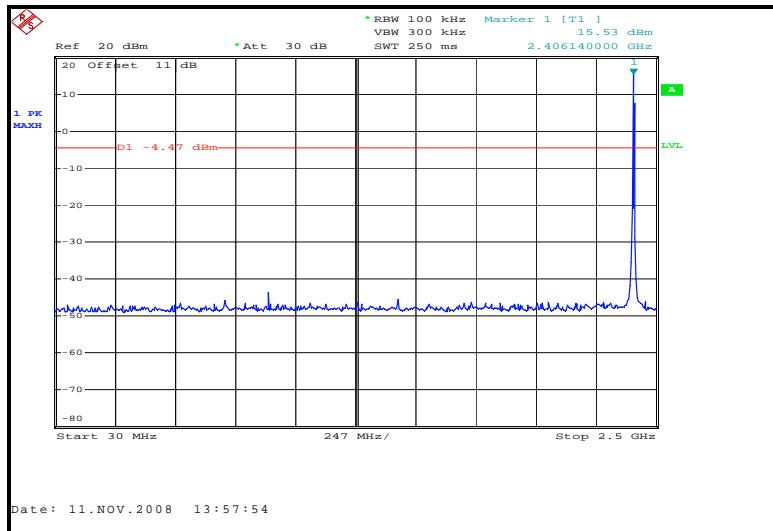
## 7.6.2 RF Conducted Spurious Emissions

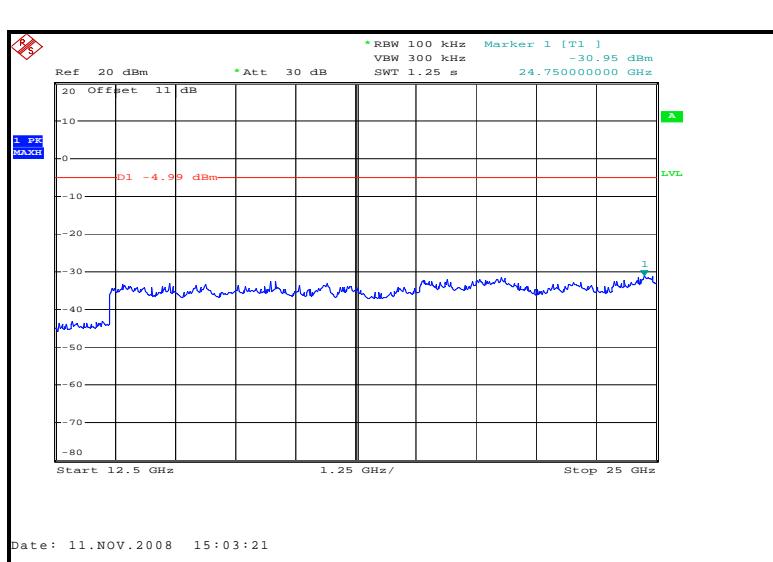
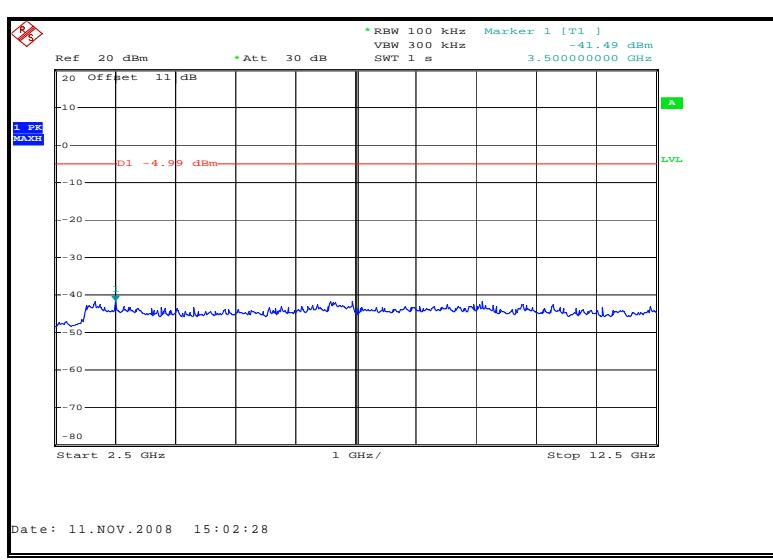
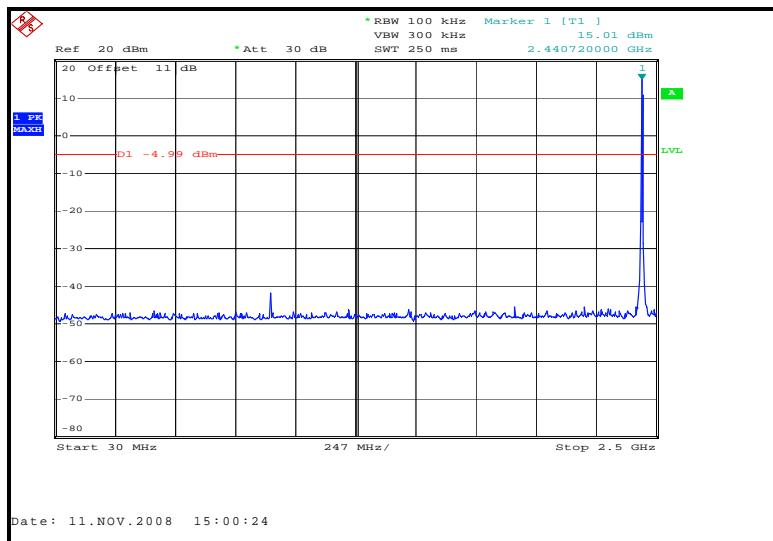
### 7.6.2.1 Test Methodology

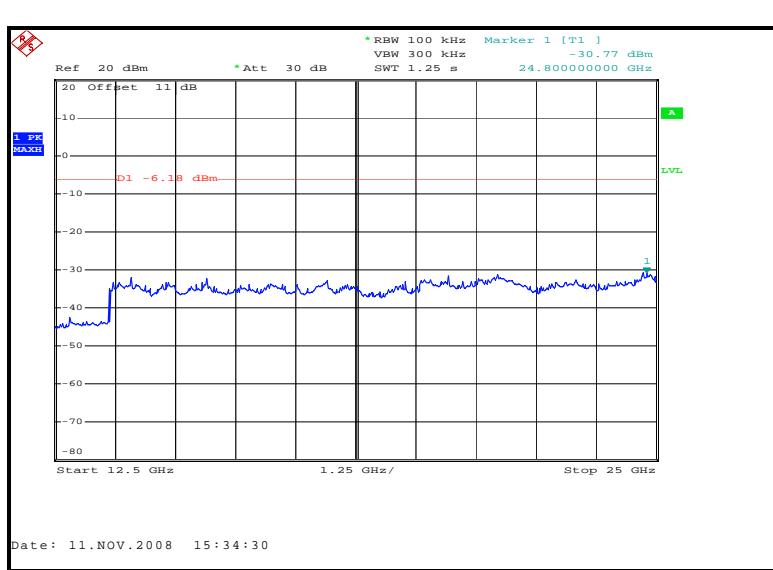
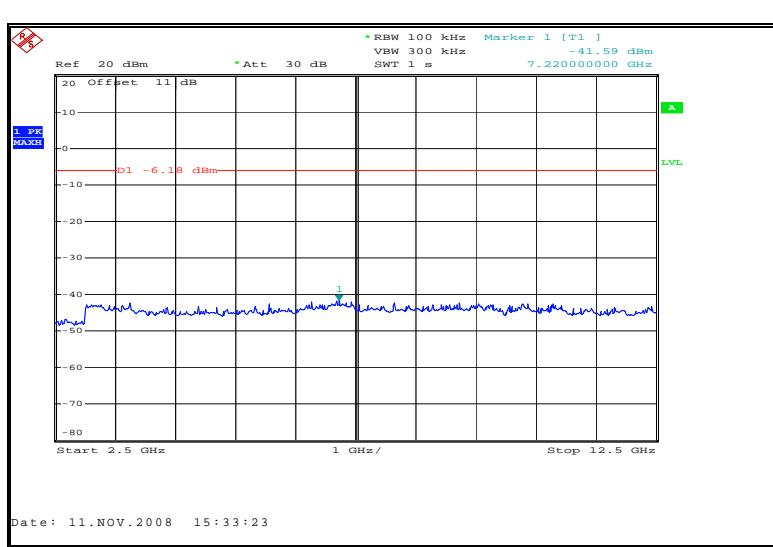
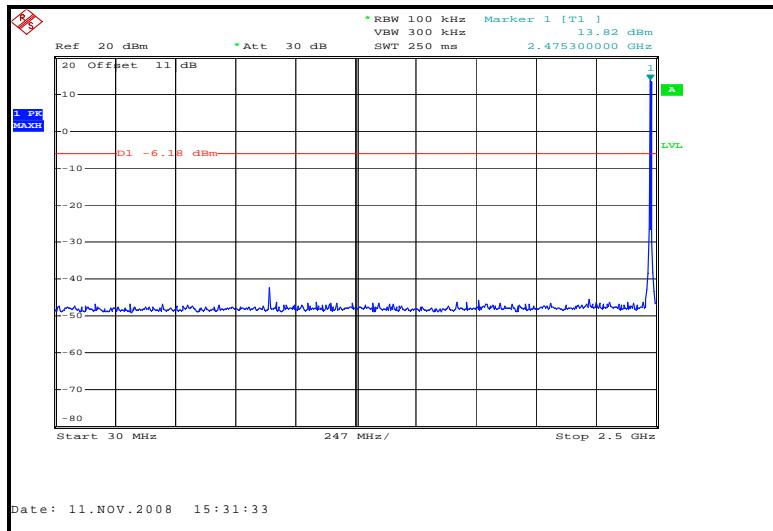
The RF Conducted Spurious Emissions were measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The EUT was investigated 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.

### 7.6.2.2 Test Results

In a 100 kHz bandwidth, the radio frequency power that was produced by the EUT emissions is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. RF Conducted Emissions are displayed in Figures 7.6.2.2-1 through 7.6.2.2-9.







### 7.6.3 Radiated Spurious Emissions (Restricted Bands) - FCC Section 15.205 IC: RSS-210 2.6

#### 7.6.3.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 25GHz, 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 made with RBW and VBW of 1 MHz. The average emissions were further corrected by applying the duty cycle correction of the EUT to the average measurements for comparison to the average limit.

Each emission found to be in a restricted band as defined by section 15.205, was compared to the radiated emission limits as defined in section 15.209.

#### 7.6.3.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 11.37dB to account for the duty cycle of the EUT. The packet transmissions length is 27ms. The duty cycle correction factor is determined using the formula:  $20\log (.27/100) = 11.37\text{dB}$ . A detailed analysis of the duty cycle timing is provided in the Theory of Operation.

#### 7.6.3.3 Test Results

Radiated spurious emissions found in the band of 30MHz to 25GHz for Meter Forms 2S and 12S are reported in Tables 7.6.3.3-1 and 7.6.3.3-2.

**Table 7.6.3.3-1: Radiated Spurious Emissions – 2S**

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
<b>Low Channel</b>										
4810	53.50	46.79	H	6.96	60.46	42.37	74.0	54.0	13.54	11.63
4810	54.49	47.91	V	7.06	61.55	43.59	74.0	54.0	12.45	10.41
12025	51.16	42.90	H	21.54	72.70	53.06	83.5	63.5	10.85	10.48
12025	53.09	44.63	V	21.55	74.64	54.80	83.5	63.5	8.91	8.74
<b>Middle Channel</b>										
4880	52.56	45.24	H	7.18	59.74	41.04	74.0	54.0	14.26	12.96
4880	53.19	46.25	V	7.28	60.47	42.15	74.0	54.0	13.53	11.85
7320	56.57	48.67	H	11.98	68.55	49.27	74.0	54.0	5.45	4.73
7320	60.61	53.21	V	12.04	72.65	53.88	74.0	54.0	1.35	0.12
12200	47.66	38.10	H	22.57	70.23	49.30	83.5	63.5	13.31	14.25
12200	49.20	40.77	V	22.65	71.85	52.05	83.5	63.5	11.69	11.50
<b>High Channel</b>										
4950	50.83	43.00	H	7.39	58.22	39.02	74.0	54.0	15.78	14.98
4950	54.99	48.29	V	7.49	62.48	44.41	74.0	54.0	11.52	9.59
7425	57.53	49.71	H	12.10	69.63	50.43	74.0	54.0	4.37	3.57
7425	58.59	50.93	V	12.18	70.77	51.74	74.0	54.0	3.23	2.26

\* Note all other emissions were below the permissible limit

**Table 7.6.3.3-2: Radiated Spurious Emissions – 12S**

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
<b>Low Channel</b>										
4810	49.33	40.36	H	6.96	56.29	35.94	74.0	54.0	17.71	18.06
4810	53.60	46.25	V	7.06	60.66	41.93	74.0	54.0	13.34	12.07
12025	44.35	33.38	H	21.54	65.89	43.54	83.5	63.5	17.66	20.00
12025	44.73	34.47	V	21.55	66.28	44.64	83.5	63.5	17.27	18.90
<b>Middle Channel</b>										
4880	49.18	40.84	H	7.18	56.36	36.64	74.0	54.0	17.64	17.36
4880	50.83	43.06	V	7.28	58.11	38.96	74.0	54.0	15.89	15.04
7320	54.06	46.59	H	11.98	66.04	47.19	74.0	54.0	7.96	6.81
7320	57.56	50.27	V	12.04	69.60	50.94	74.0	54.0	4.40	3.06
<b>High Channel</b>										
4950	50.37	42.17	H	7.39	57.76	38.19	74.0	54.0	16.24	15.81
4950	54.51	47.73	V	7.49	62.00	43.85	74.0	54.0	12.00	10.15
7425	53.60	45.39	H	12.10	65.70	46.11	74.0	54.0	8.30	7.89
7425	57.76	50.27	V	12.18	69.94	51.08	74.0	54.0	4.06	2.92

\* Note all other emissions were below the permissible limit

#### 7.6.3.4 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:  $53.50 + 6.96 = 60.46$  dBuV/m

Margin:  $74$  dBuV/m –  $60.46$  dBuV/m =  $13.54$  dB

#### Example Calculation: Average

Corrected Level:  $46.79 + 6.96 - 11.37 = 42.38$  dBuV

Margin:  $54$  dBuV –  $42.38$  dBuV =  $11.63$  dB

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

### 7.7.1 Test Methodology

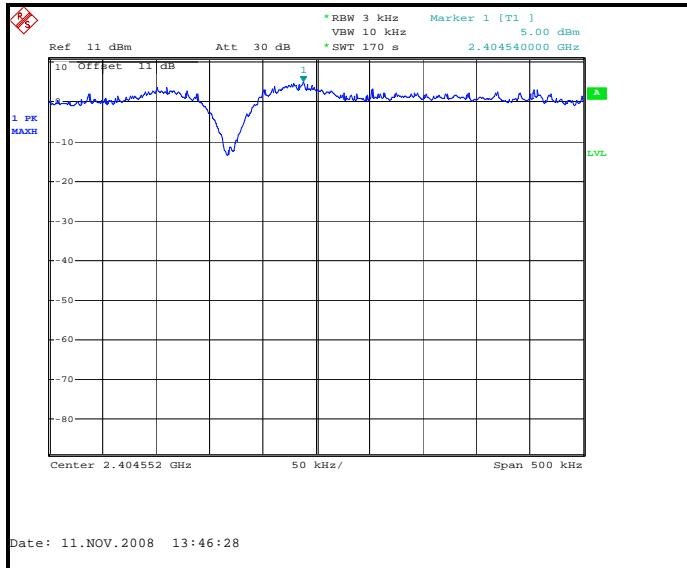
The power spectral density was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The emission peaks within the pass band were located and zoomed in on. The spectrum analyzer RBW was set to 3 kHz and VBW 10 kHz. Span was adjusted to 500 kHz and the sweep time was calculated to be 168s (Span/3 kHz).

### 7.7.2 Test Results

Results are shown below in table 7.7.2-1 and figures 7.7.2-1 – 7.7.2-3:

**Table 7.7.2-1: Peak Power Spectral Density**

Frequency (MHz)	PSD Level (dBm)
2405	5.00
2440	4.15
2475	2.93



**Figure 7.7.2-1: Power Spectral Density Plot – Low Channel**

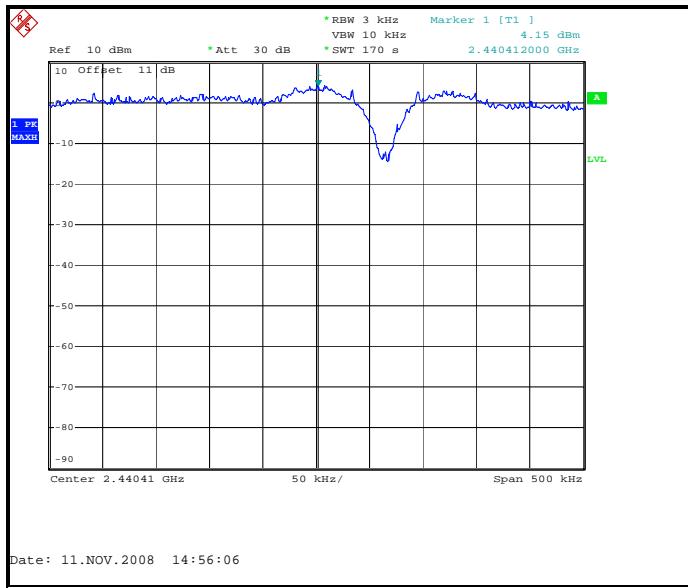


Figure 7.7.2-2: Power Spectral Density Plot – Mid Channel

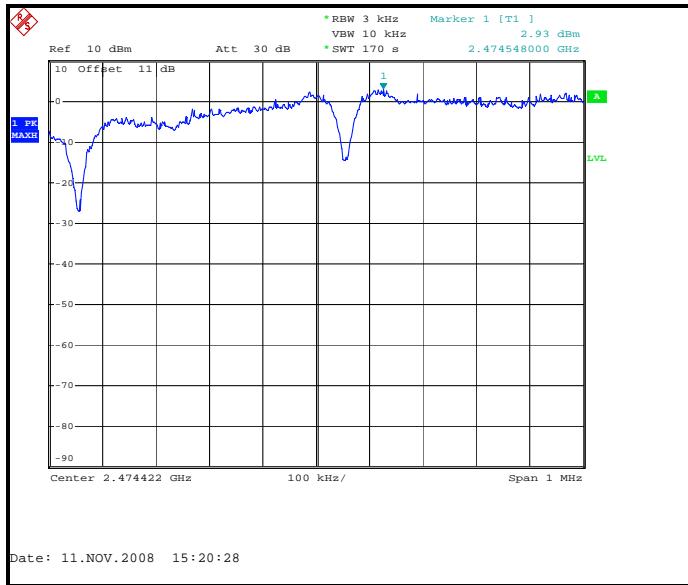


Figure 7.7.2-3: Power Spectral Density Plot – High Channel

## 8.0 CONCLUSION

In the opinion of ACS, Inc. the AMI4, manufactured by Itron Electricity Metering, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

## END REPORT