Excellence in Compliance Testing

Certification Test Report

FCC ID: SK9ITR9002
IC: 864G-ITR9002

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

ACS Report Number: 11-0462.W04.11.A

Manufacturer: Itron Electricity Metering, Inc.
Model: ITR9002

Test Begin Date: December 13, 2011
Test End Date: December 15, 2011

Report Issue Date: January 12, 2012

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: _____

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 20 pages

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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 Class II Permissive Change.

This permissive change is to add a new mode of operation which includes an extended frequency range, additional data rate, new channel separation and new number of hopping channels. There are no changes to the hardware or power settings.

1.2 Product description

The Itron ITR9002 is a transmitter module that operates in the 902 MHz to 928 MHz unlicensed band. The module operates on direct current voltage which is supplied by a host device.

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

Technical details:

Modulation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
FSK	902.25 - 927.75	52	500	19.2
FSK	902.25 - 927.75	52	500	152.3
*FSK	902.4 – 927.6	64	400	150.0

* Applicable to this class II permissive change only. All other frequency ranges and data rates are covered under the original certification.

Test Sample Serial Number(s): 8200000265

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

1.3 Test Methodology and Considerations

For the purpose of RF conducted measurements, the ITR9002 module was modified with a temporary 50 ohm antenna port.

For radiated emissions, three different orientations were evaluated; X-Position, Y-Position, and Z-Position.

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:

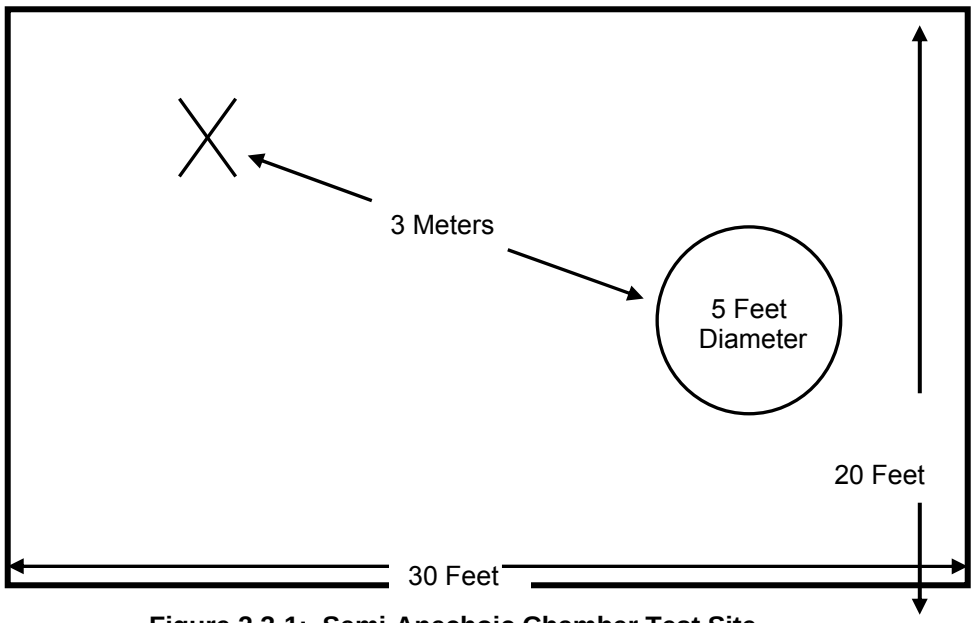

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

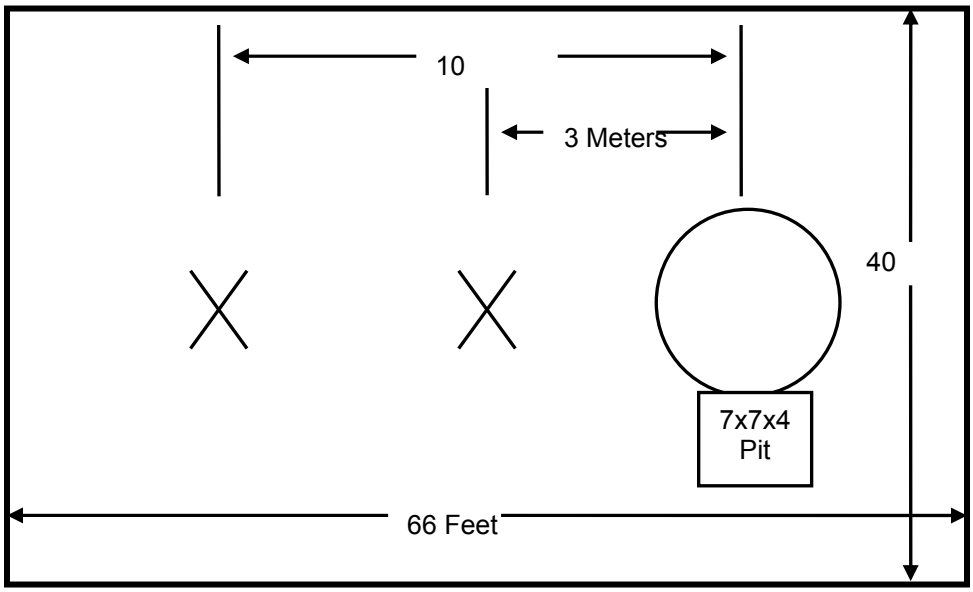

Figure 2.3-2: Open Area Test Site

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, 2011
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2011
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8 December 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3 December 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
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/27/2011	4/27/2013
73	Agilent	8447D	Amplifiers	2727A05624	9/30/2011	9/30/2012
90	Electro-Metrics	LPA25	Antennas	1476	11/15/2011	11/15/2013
167	ACS	Chamber EMI Cable Set	Cable Set	167	1/26/2011	1/26/2012
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	8/26/2011	8/26/2012
291	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	None	12/2/2011	12/2/2012
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	4/11/2011	4/11/2012
331	Microwave Circuits	H1G513G1	Filters	31417	7/11/2011	7/11/2012
338	Hewlett Packard	8449B	Amplifiers	3008A01111	3/24/2011	3/24/2012
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	8/29/2011	8/29/2012
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	12/2/2011	12/2/2012
544	ETS Lindgren	3110B	Antennas	3361	11/15/2011	11/15/2013

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	Itron	ITR9002	8200000265
2	Laptop	Dell	PP18L	N/A
3	Laptop Power Supply	Dell	LA90PS0-00	CN-0DF266-71615-7A5-627A

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

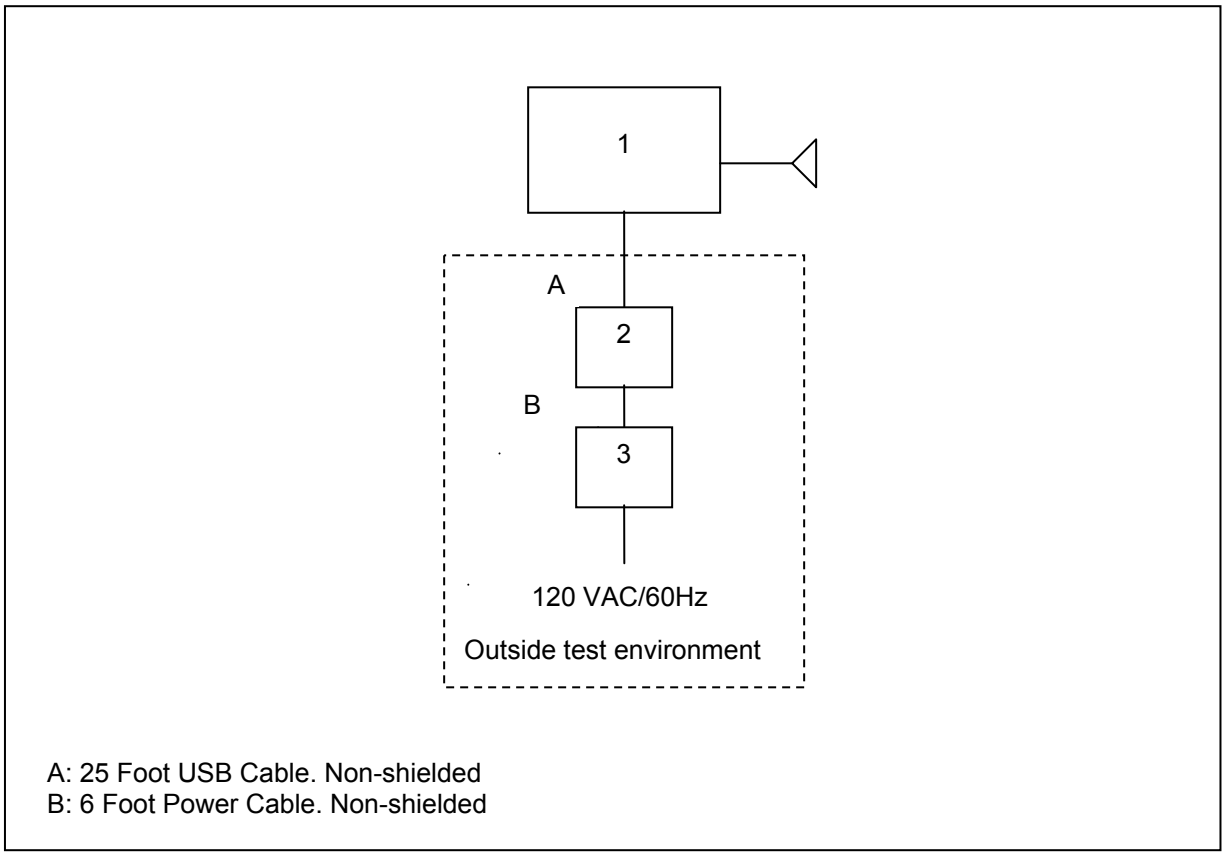

Figure 6-1: EUT Test Setup

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 is an omni-directional detachable antenna with gain of 5.1dBi. The EUT utilizes a standard SMA connector. Professional installation required.

7.2 Peak Output Power - FCC Section 15.247(b)(2) IC: RSS-210 A8.4(1)

7.2.1 Measurement Procedure (Conducted Method)

The 20dB bandwidth of the EUT was within the resolution bandwidth of spectrum analyzer, therefore the power measurement was made using the spectrum analyzer method. The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The resolution and video bandwidth were set to > 20 dB bandwidth of the emission measured. The device employs >50 channels therefore the power is limited to 1 Watt.

7.2.2 Measurement Results

Results are shown in Table 7.2.2-1 and Figures 7.2.2-1 to 7.2.2-3 below.

Table 7.2.2-1: RF Output Power

Frequency [MHz]	Level [dBm]
902.4	26.39
915.2	26.29
927.6	26.29

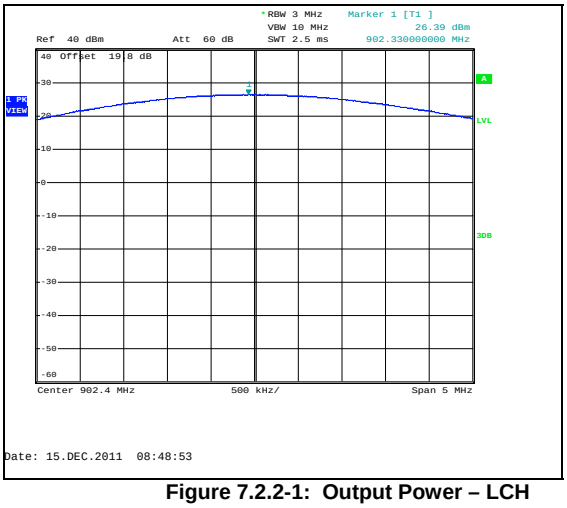

Figure 7.2.2-1: Output Power – LCH

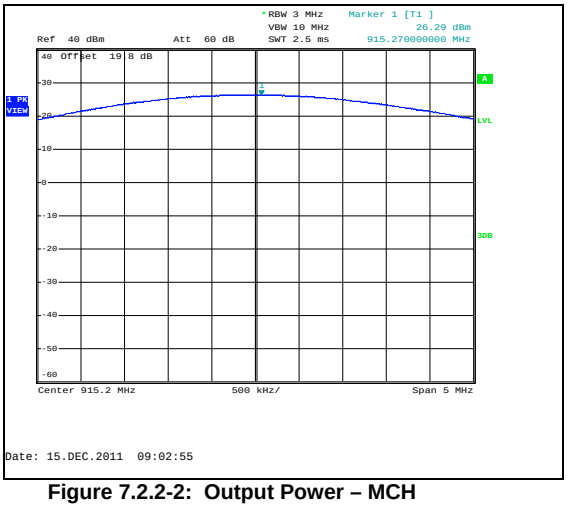

Figure 7.2.2-2: Output Power – MCH

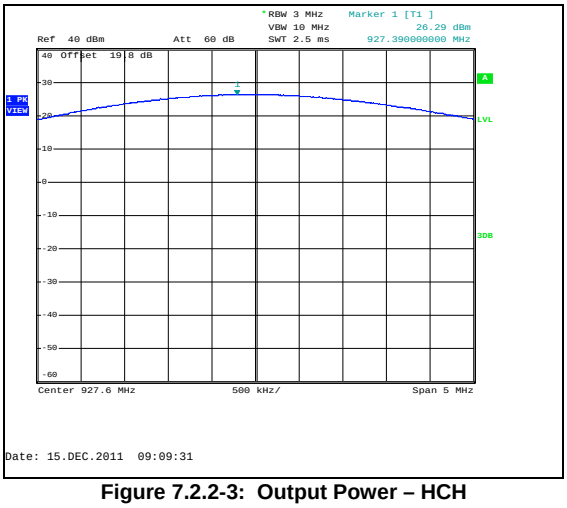

Figure 7.2.2-3: Output Power – HCH

7.3 Channel Usage Requirements

7.3.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1) IC: RSS-210 A8.1(b)

7.3.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to ≥ 1% of the span.

7.3.1.2 Measurement Results

The adjacent channel separation was measured to be 400 kHz. Results are shown below in Figure 7.3.1.2-1.

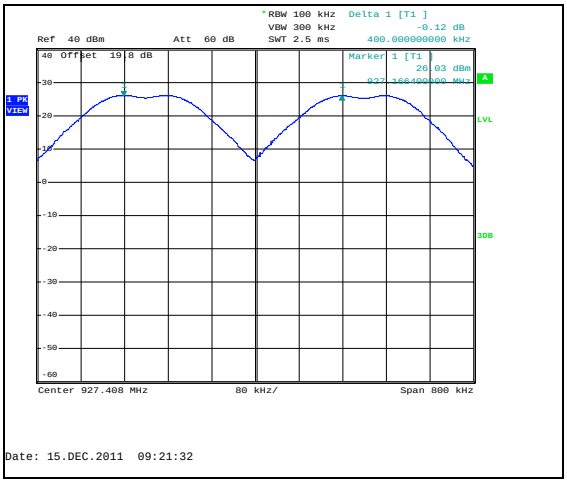

Figure 7.3.1.2-1: Channel Separation - FSK Modulation 150kbps

7.3.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

The device employs 64 hopping channels. Results are shown below in Figure 7.3.2-1.

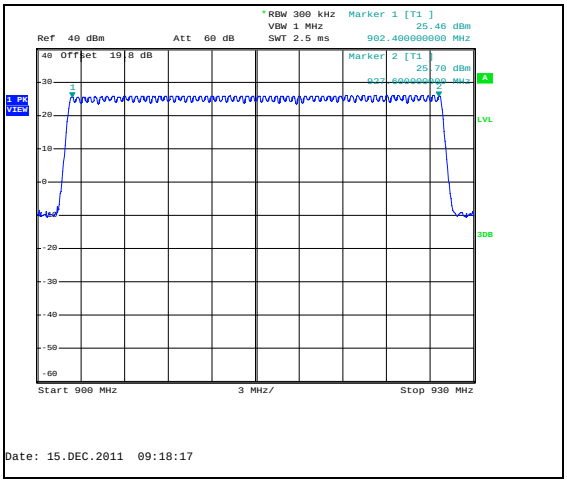

Figure 7.3.2-1: Hopping Channels - FSK 150kbps

7.3.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

7.3.3.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The hopping channel is centered on the analyzer and the span set to 0 Hz. The RBW was set to 1 MHz and the VBW to 3 MHz. Sweep time was adjusted to capture the burst duration of the emission. The marker–delta function of the analyzer was employed to measure the burst duration.

7.3.3.2 Measurement Results

The duration of the RF transmission was measured as 87.2 ms for FSK modulation using 150kbps data rate. Justification with the channel dwell time is provided in the theory of operation accompanying this report.

A single transmission is shown in figure 7.3.3.2-1 below.

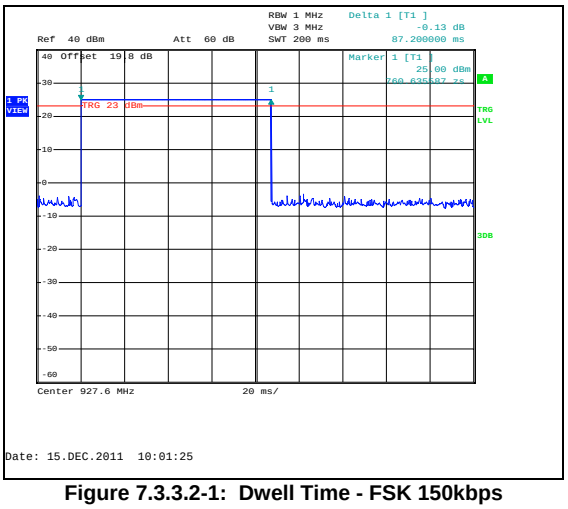

Figure 7.3.3.2-1: Dwell Time - FSK 150kbps

7.3.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

7.3.4.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer display was set between two times and five times the occupied bandwidth (OBW) of the emission. The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The occupied bandwidth measurement function of the analyzer was used for the 99% bandwidth. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. A sampling detector was used.

7.3.4.2 Measurement Results

Results are shown below in Table 7.3.4.2-1 and Figures 7.3.4.2-1 through 7.3.4.2-6.

Table 7.3.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]	Modulation
902.4	199.2	192	FSK (150 kbps)
915.2	200.4	189.6	FSK (150 kbps)
927.6	252	195.6	FSK (150 kbps)

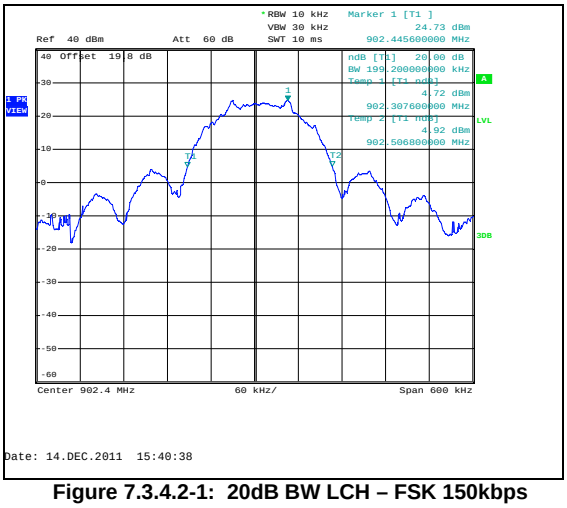

Figure 7.3.4.2-1: 20dB BW LCH – FSK 150kbps

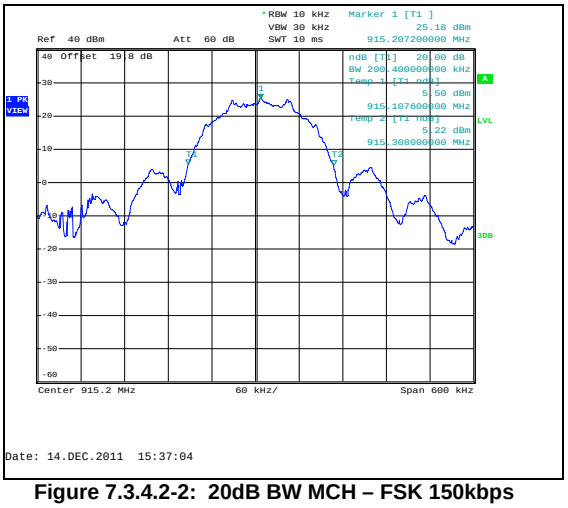

Figure 7.3.4.2-2: 20dB BW MCH – FSK 150kbps

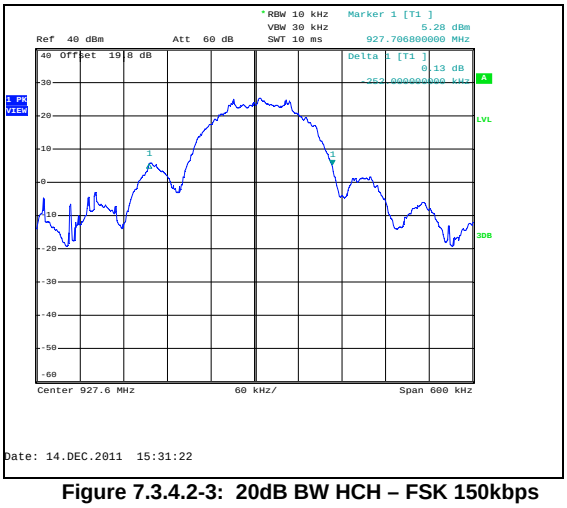

Figure 7.3.4.2-3: 20dB BW HCH – FSK 150kbps

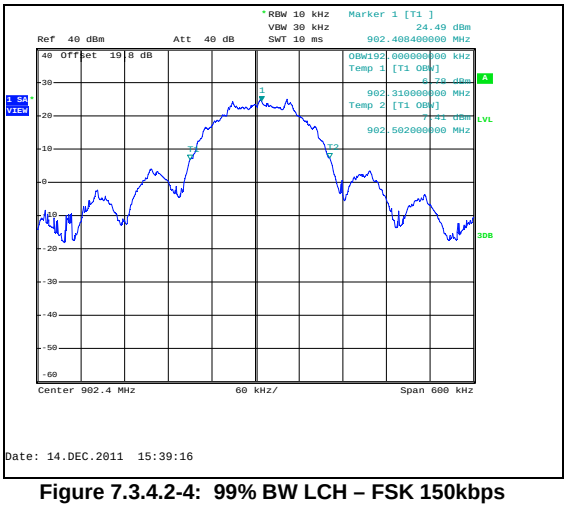

Figure 7.3.4.2-4: 99% BW LCH – FSK 150kbps

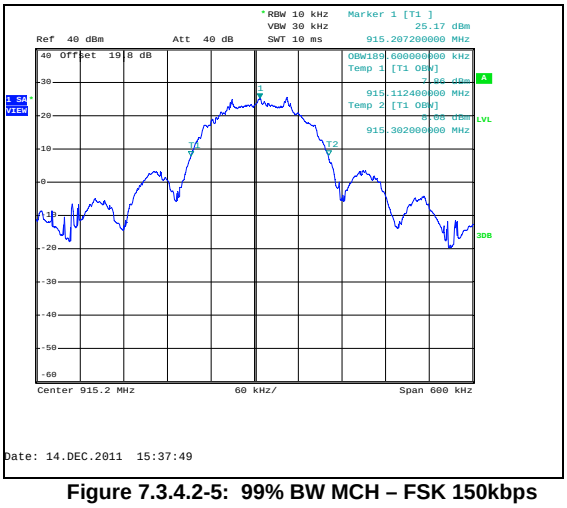

Figure 7.3.4.2-5: 99% BW MCH – FSK 150kbps

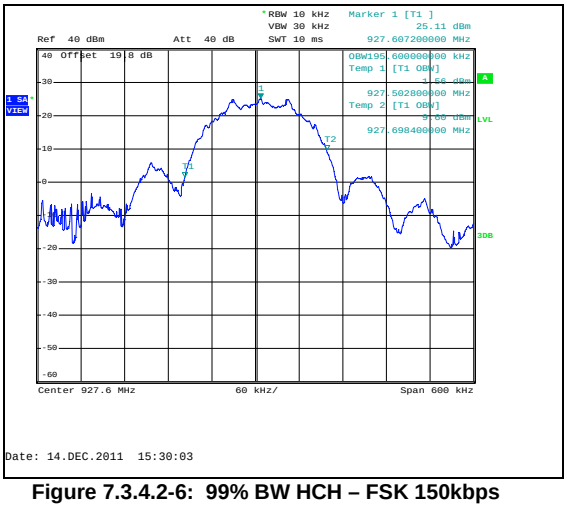

Figure 7.3.4.2-6: 99% BW HCH – FSK 150kbps

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

7.4.1 Band-Edge Compliance of RF Conducted Emissions

7.4.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to ≥ 1% of the span, and the VBW was set to ≥ 3 times RBW.

7.4.1.2 Measurement Results

Results are shown in the figures 7.4.1.2-1 to 7.4.1.2-4 below.

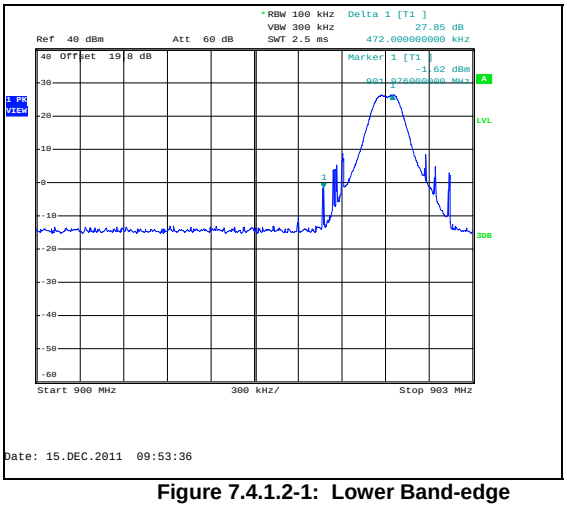

Figure 7.4.1.2-1: Lower Band-edge

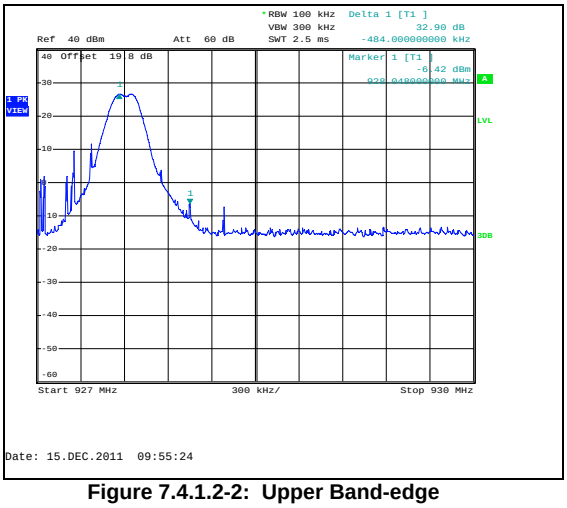

Figure 7.4.1.2-2: Upper Band-edge

HOPPING MODE:

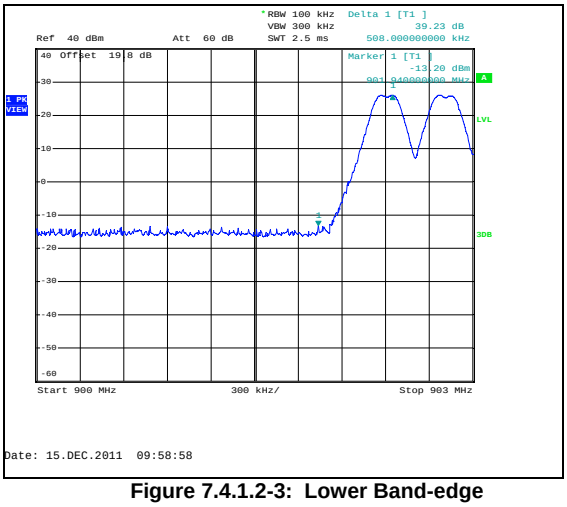

Figure 7.4.1.2-3: Lower Band-edge

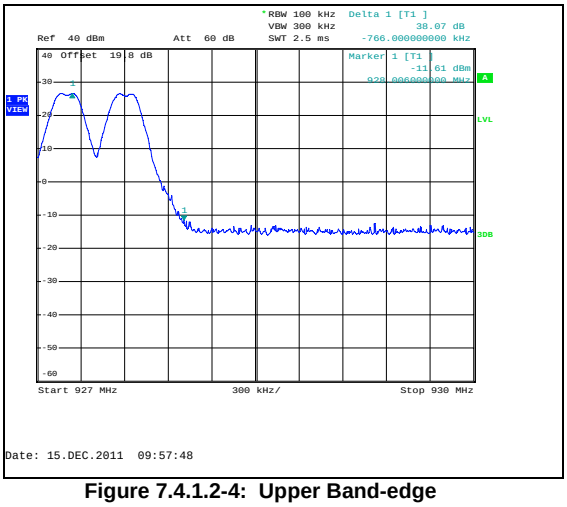

Figure 7.4.1.2-4: Upper Band-edge

7.4.2 RF Conducted Spurious Emissions

7.4.2.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 10GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100kHz. A peak detector function was used with the trace set to max hold.

7.4.2.2 Measurement Results

Results are shown below in Figures 7.4.2.2-1 to 7.4.2.2-6:

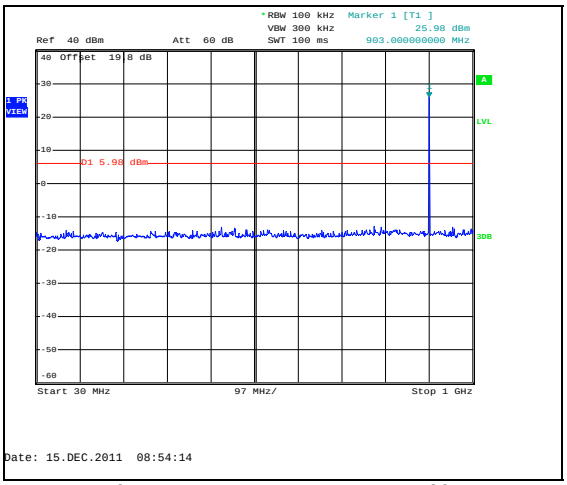

Figure 7.4.2.2-1: LCH – FSK 150kbps

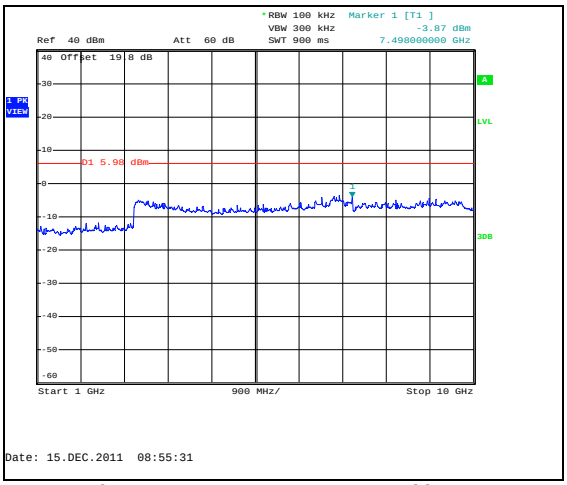

Figure 7.4.2.2-2: LCH – FSK 150kbps

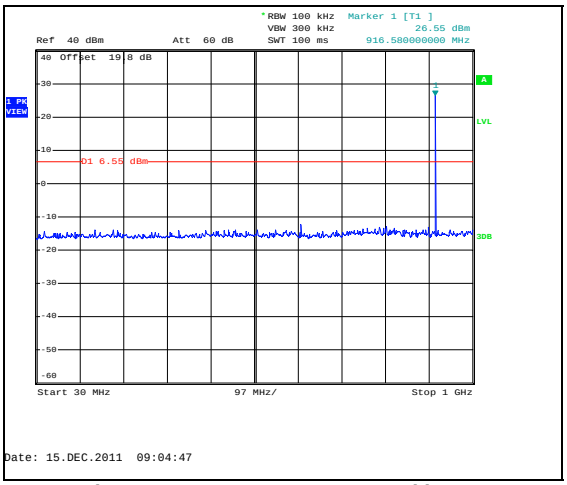

Figure 7.4.2.2-3: MCH – FSK 150kbps

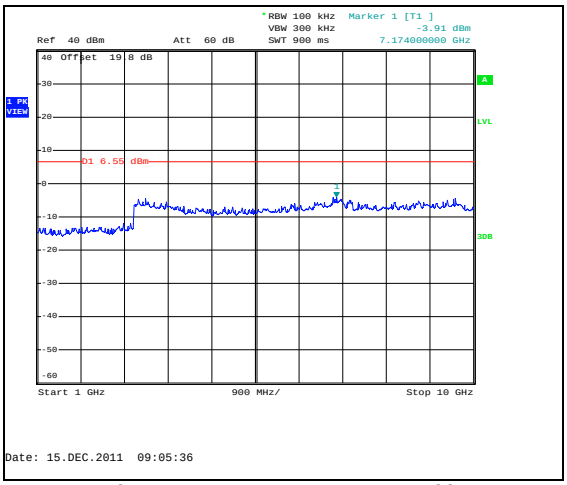

Figure 7.4.2.2-4: MCH – FSK 150kbps

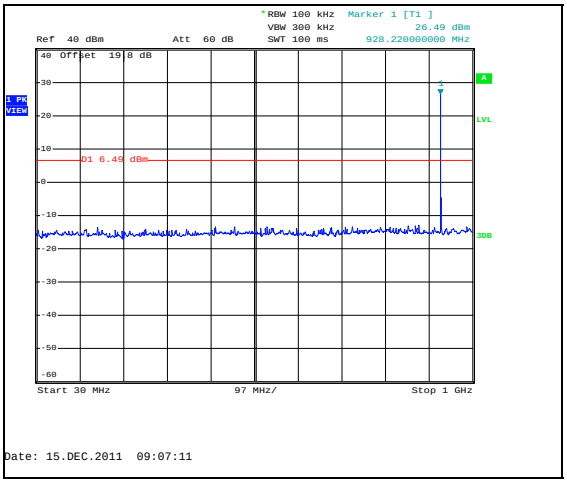

Figure 7.4.2.2-5: HCH – FSK 150kbps

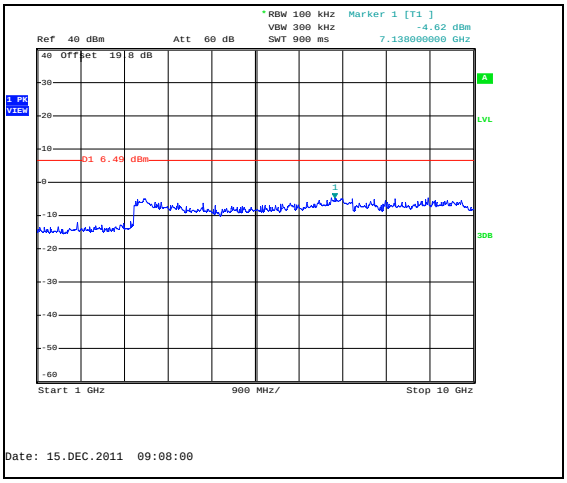

Figure 7.4.2.2-6: HCH – FSK 150kbps

7.4.3 Radiated Spurious Emissions - FCC Section 15.205 IC: RSS-210 2.2

7.4.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 10GHz, 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 EUT was caused to generate a continuous carrier signal on the hopping channel.

7.4.3.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in the tables 7.4.3.2-1 to 7.4.3.2-3 below.

Table 7.4.3.2-1: Radiated Spurious Emissions – XPOS

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
902.4MHz										
2707.2	49.58	41.25	H	-4.10	45.48	37.15	74.0	54.0	28.5	16.8
2707.2	53.16	48.59	V	-4.10	49.06	44.49	74.0	54.0	24.9	9.5
4512	48.60	38.48	V	1.30	49.90	39.78	74.0	54.0	24.1	14.2
5414.4	47.21	38.74	V	3.77	50.98	42.51	74.0	54.0	23.0	11.5
915.2MHz										
2745.6	47.17	38.36	H	-4.00	43.17	34.36	74.0	54.0	30.8	19.6
2745.6	52.25	47.35	V	-4.00	48.25	43.35	74.0	54.0	25.8	10.7
4576	48.11	38.21	H	1.42	49.53	39.63	74.0	54.0	24.5	14.4
4576	50.09	41.89	V	1.42	51.51	43.31	74.0	54.0	22.5	10.7
7321.6	48.26	39.65	V	7.61	55.87	47.26	74.0	54.0	18.1	6.7
927.6MHz										
2782.8	47.37	38.03	H	-3.91	43.46	34.12	74.0	54.0	30.5	19.9
2782.8	51.04	45.45	V	-3.91	47.13	41.54	74.0	54.0	26.9	12.5
4638	48.11	38.84	H	1.54	49.65	40.38	74.0	54.0	24.4	13.6
4638	51.21	43.54	V	1.54	52.75	45.08	74.0	54.0	21.3	8.9
7420.8	46.14	36.38	V	7.57	53.71	43.95	74.0	54.0	20.3	10.0

Table 7.4.3.2-2: Radiated Spurious Emissions – YPOS

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
902.4MHz										
2707.2	55.70	51.74	H	-4.10	51.60	47.64	74.0	54.0	22.4	6.4
2707.2	51.36	45.93	V	-4.10	47.26	41.83	74.0	54.0	26.7	12.2
4512	50.15	41.38	V	1.30	51.45	42.68	74.0	54.0	22.5	11.3
5414.4	48.37	39.81	H	3.77	52.14	43.58	74.0	54.0	21.9	10.4
915.2MHz										
2745.6	53.74	49.56	H	-4.00	49.74	45.56	74.0	54.0	24.3	8.4
2745.6	49.40	41.89	V	-4.00	45.40	37.89	74.0	54.0	28.6	16.1
4576	51.12	43.56	V	1.42	52.54	44.98	74.0	54.0	21.5	9.0
7321.6	48.30	38.36	H	7.61	55.91	45.97	74.0	54.0	18.1	8.0
927.6MHz										
2782.8	53.11	49.48	H	-3.91	49.20	45.57	74.0	54.0	24.8	8.4
2782.8	48.16	39.81	V	-3.91	44.25	35.90	74.0	54.0	29.8	18.1
4638	50.32	43.06	V	1.54	51.86	44.60	74.0	54.0	22.1	9.4

Table 7.4.3.2-3: Radiated Spurious Emissions – ZPOS

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
902.4MHz										
2707.2	52.56	47.12	H	-4.10	48.46	43.02	74.0	54.0	25.5	11.0
2707.2	52.12	46.54	V	-4.10	48.02	42.44	74.0	54.0	26.0	11.6
4512	48.49	39.63	H	1.30	49.79	40.93	74.0	54.0	24.2	13.1
4512	48.27	37.77	V	1.30	49.57	39.07	74.0	54.0	24.4	14.9
5414.4	46.11	35.72	H	3.77	49.88	39.49	74.0	54.0	24.1	14.5
5414.4	47.07	38.46	V	3.77	50.84	42.23	74.0	54.0	23.2	11.8
915.2MHz										
2745.6	50.45	43.29	H	-4.00	46.45	39.29	74.0	54.0	27.6	14.7
2745.6	50.87	44.53	V	-4.00	46.87	40.53	74.0	54.0	27.1	13.5
4576	49.11	40.14	H	1.42	50.53	41.56	74.0	54.0	23.5	12.4
4576	49.08	39.53	V	1.42	50.50	40.95	74.0	54.0	23.5	13.0
7321.6	46.15	36.25	H	7.61	53.76	43.86	74.0	54.0	20.2	10.1
927.6MHz										
2782.8	47.56	38.71	H	-3.91	43.65	34.80	74.0	54.0	30.4	19.2
2782.8	51.17	45.22	V	-3.91	47.26	41.31	74.0	54.0	26.7	12.7
4638	51.19	43.74	H	1.54	52.73	45.28	74.0	54.0	21.3	8.7
4638	49.28	41.71	V	1.54	50.82	43.25	74.0	54.0	23.2	10.8
7420.8	47.40	38.05	H	7.57	54.97	45.62	74.0	54.0	19.0	8.4

7.4.3.3 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: 49.58 - 4.10 = 45.48dBuV/m
Margin: 74dBuV/m – 45.48dBuV/m = 28.5dB

Example Calculation: Average
Corrected Level: 41.25 - 4.1 – 0 = 37.15dBuV
Margin: 54dBuV – 37.15dBuV = 16.8dB

8 CONCLUSION

In the opinion of ACS, Inc. the ITR9002, manufactured by Itron Electricity Metering, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210 as applicable to this Class II Permissive Change.

END REPORT