

## **Certification Test Report**

**FCC ID: SM6-LMXR  
IC: 9235A-LMXR**

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

**ACS Report Number: 15-0005.W06.1A**

Manufacturer: Mueller Systems, LLC  
Model: Repeater Plus Module

Test Begin Date: January 20, 2015  
Test End Date: March 4, 2015

Report Issue Date: March 17, 2015



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.

A handwritten signature in black ink, appearing to read "Kirby Munroe".

Reviewed by:  
**Kirby Munroe**  
Director, Wireless Certifications  
ACS, Inc.

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**This report contains 28 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 Certification for modular approval.

### 1.2 Product description

The Mueller Systems Repeater Plus Module is an ISM band 902 to 928 MHz transceiver module with a maximum output power of +30dBm used in a data collection system connected to a device such as a standard water meter register.

#### Technical Information:

The 2 modes of operation are detailed as follows. Only mode 1 is addressed in this report.

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)	Modulation
1	912.310059 - 927.012451	50	300	4557.3bps and 2604.2bps	FHSS, DSSS
2	903.649963 - 915.725525	24	525	10416.7bps	DTS, DSSS

Antenna Type / Gain: Dipole / 6dBi (Antenna 1)

Printed Inverted F Antenna / 4.8dBi (Antenna 2)

Operating Voltage: 3.6Vdc

#### Manufacturer Information:

Mueller Systems, LLC  
1200 Abernathy Road, NE  
Suite 1200  
Atlanta, GA 30328

EUT Serial Number: 45000321

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

### 1.3 Test Methodology and Considerations

All modes of operation, including all available data rates, were evaluated. The data presented in this report represents the worst case where applicable.

For radiated emissions three orientations of the EUT were evaluated to determine worst case. The worst case orientation was determined to be the Z orientation.

AC power line conducted emissions was tested in a typical compliant host.

Multiple antenna types are available for use with the EUT. The highest gain of each antenna type was evaluated for compliance.

Software power setting during test: TXP9=11, TXPS2=156

Software version number during test: LFM Release 4.0.8+FCCL

## 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

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:

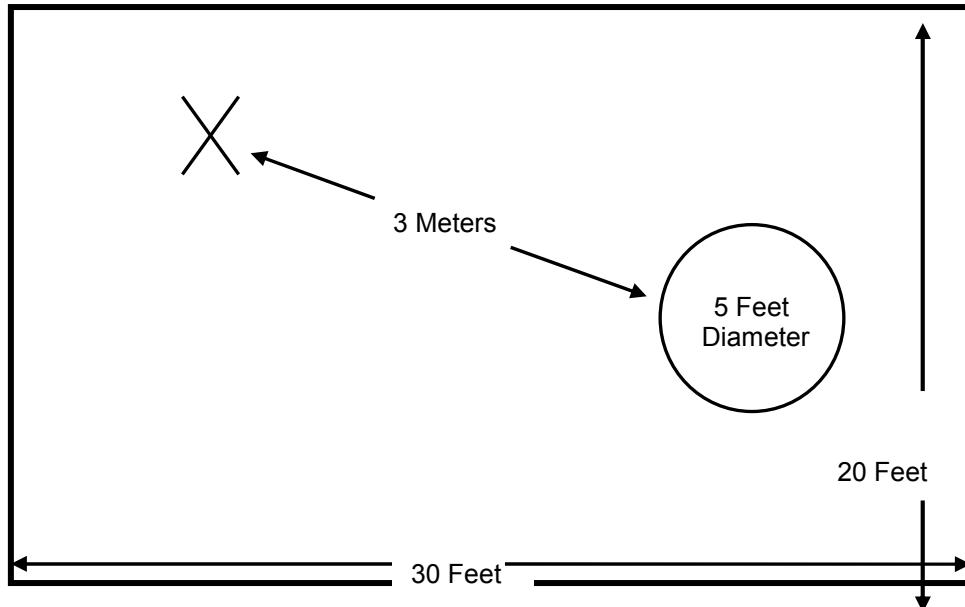


Figure 2.3-1: Semi-Anechoic Chamber Test Site

### 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:

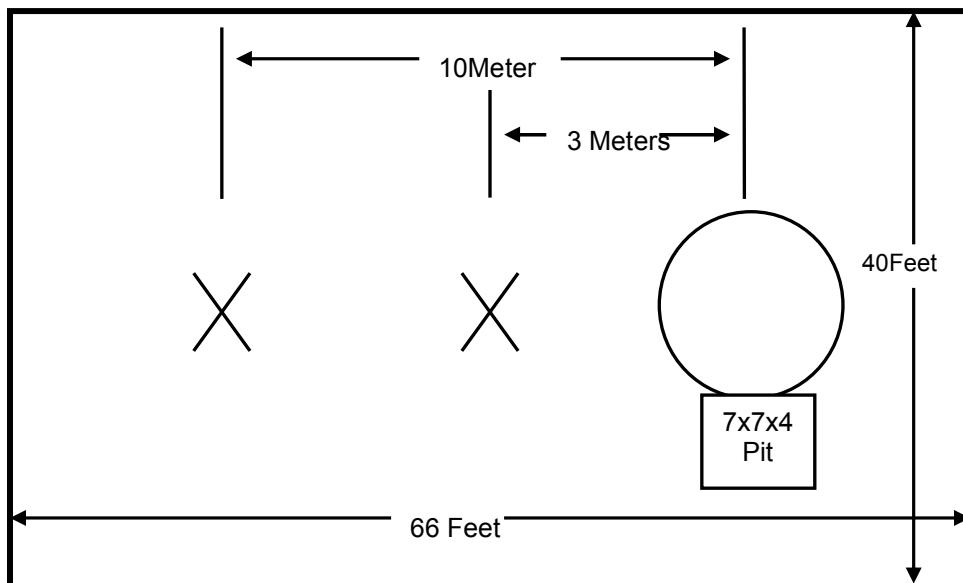


Figure 2.3-2: Open Area Test Site

## 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 ground 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 2.4-1:

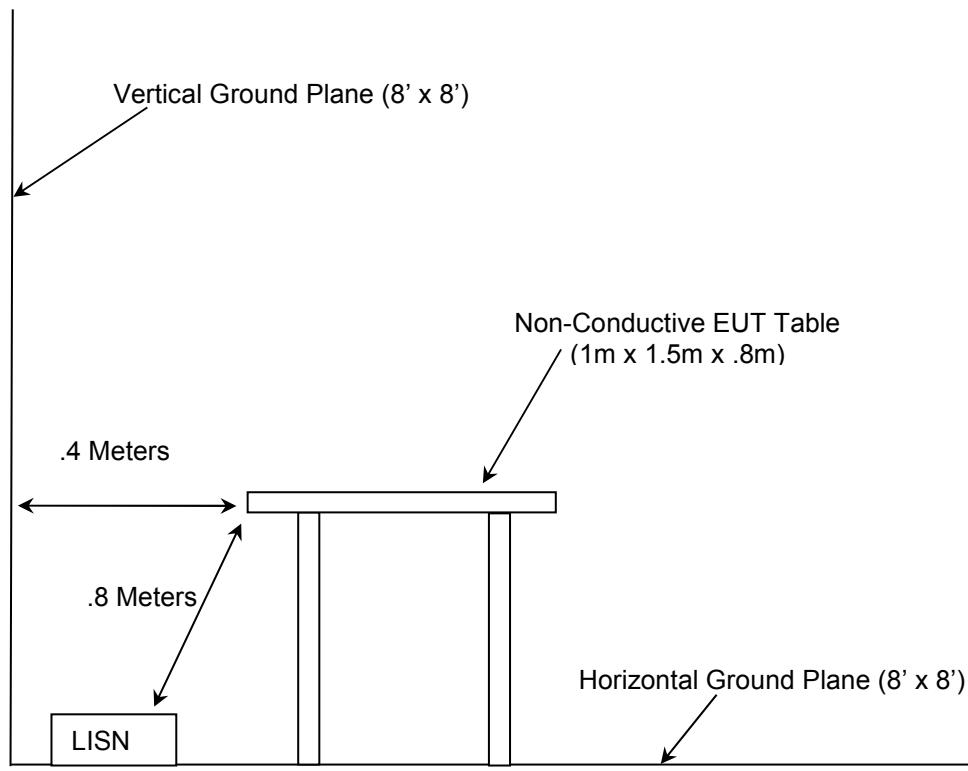


Figure 2.4-1: AC Mains Conducted EMI Site

## 3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2015
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2015
- ❖ 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 4, Nov 2014.

#### 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	7/11/2014	7/11/2015
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	7/11/2014	7/11/2015
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/23/2013	4/23/2015
40	EMCO	3104	Antennas	3211	2/14/2013	2/14/2015
40	EMCO	3104	Antennas	3211	2/10/2015	2/10/2017
73	Agilent	8447D	Amplifiers	2727A05624	7/15/2014	7/15/2015
	ACS	Chamber EMI Cable Set	Cable Set	167	10/28/2014	10/28/2015
168	Hewlett Packard	11947A	Attenuators	44829	1/19/2015	1/19/2016
267	Agilent	N1911A	Meters	MY45100129	7/30/2013	7/30/2015
268	Agilent	N1921A	Sensors	MY45240184	7/30/2013	7/30/2015
	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	3/17/2014	3/17/2015
316	Rohde Schwarz	ESH3-Z5	LISN	861189-010	10/30/2014	10/30/2015
324	ACS	Belden	Cables	8214	6/4/2014	6/4/2015
331	Microwave Circuits	H1G513G1	Filters	31417	6/2/2014	6/2/2015
338	Hewlett Packard	8449B	Amplifiers	3008A01111	7/30/2013	7/30/2015
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	7/14/2014	7/14/2015
412	Electro Metrics	LPA-25	Antennas	1241	7/24/2014	7/24/2016
	Florida RF	SMS-200AW-72.0-SMR	Cables	805	11/5/2014	11/5/2015
422	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	N/A	9/10/2014	9/10/2015
616	Rohde & Schwarz	FSV40	Analyzers	101338	7/12/2014	7/12/2015
622	Agilent	AT/E7405A	Analyzers	MY42000089	5/30/2014	5/30/2015
RE361						

## 5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	DC Power Supply	Agilent	6286A	2109A-06095
2	Mobile Field Radio	Mueller Systems	MS-G-mHUB	12006211
3	AC-DC Power Supply	ICCNexergy	FWC5012F	007050

## 6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

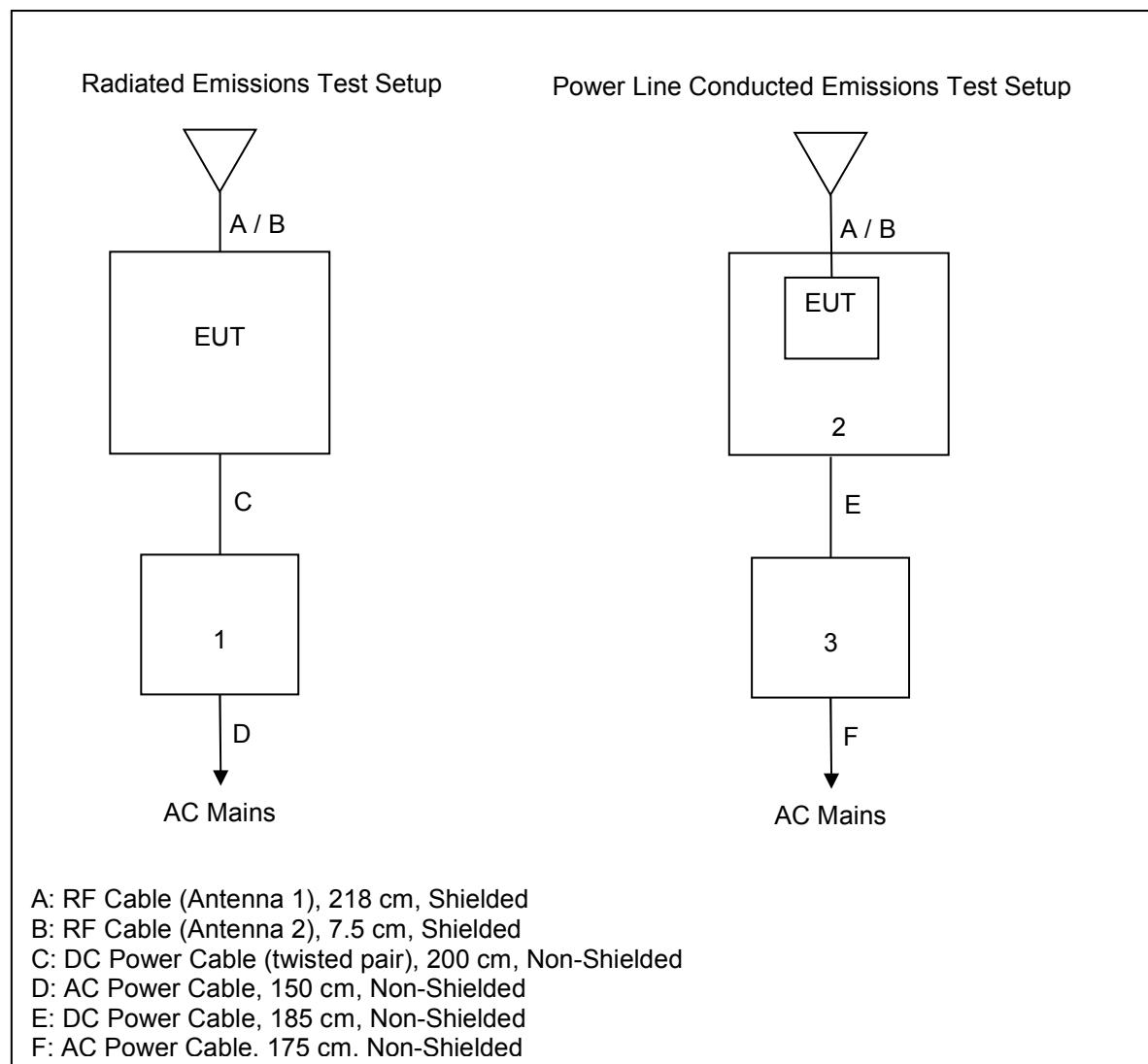


Figure 6-1: Test Setup Block Diagram

## 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 antennas used are a Dipole with 6dBi gain and a Printed Inverted F Antenna with 4.8dBi gain. These antennas are detachable utilizing MMCX coupling to the EUT, therefore satisfying the requirements of Section 15.203.

### 7.2 Power Line Conducted Emissions – FCC 15.207, IC: RSS-Gen 8.8

#### 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 Tables 7.2.2-1 through 7.2.2-4.

**Table 7.2.2-1: Conducted EMI Results Line 1 – Antenna 1**

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
24.0179	20.844	17.784	12.017	32.861	29.801	60	50	27.139	20.199
21.9978	21.854	19.861	11.968	33.821	31.829	60	50	26.179	18.171
17.3186	21.313	20.389	11.656	32.968	32.045	60	50	27.032	17.955
15.4854	22.494	21.005	11.512	34.005	32.516	60	50	25.995	17.484
0.5079	16.801	16.009	10.241	27.041	26.25	56	46	28.959	19.75
0.190294	33.808	26.874	10.22	44.028	37.094	64.849	54.849	20.821	17.755

**Table 7.2.2-2: Conducted EMI Results Line 2 – Antenna 1**

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
18.022	22.056	19.965	11.41	33.466	31.375	60	50	26.534	18.625
16.2502	23.842	21.702	11.295	35.137	32.997	60	50	24.863	17.003
15.3635	23.639	21.923	11.249	34.887	33.172	60	50	25.113	16.828
15.3007	23.509	22.242	11.247	34.756	33.489	60	50	25.244	16.511
13.6553	22.58	20.871	11.34	33.92	32.212	60	50	26.08	17.788
0.632313	24.558	24.845	10.24	34.798	35.085	56	46	21.202	10.915

Table 7.2.2-3: Conducted EMI Results Line 1 – Antenna 2

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi- Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
25.0569	19.795	16.322	12.1	31.895	28.422	60	50	28.105	21.578
22.6124	14.763	9.301	11.952	26.715	21.253	60	50	33.285	28.747
21.7253	19.807	15.06	11.92	31.727	26.98	60	50	28.273	23.02
15.2379	21.324	18.748	11.506	32.829	30.254	60	50	27.171	19.746
0.566899	26.004	25.088	10.247	36.25	35.335	56	46	19.75	10.665
0.251175	27.305	6.99	10.22	37.525	17.21	63.109	53.109	25.585	35.9

Table 7.2.2-4: Conducted EMI Results Line 2 – Antenna 2

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi- Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
17.5558	6.666	2.757	11.401	18.067	14.159	60	50	41.933	35.841
15.8128	23.233	21.21	11.26	34.492	32.47	60	50	25.508	17.53
15.688	23.447	21.94	11.257	34.703	33.197	60	50	25.297	16.803
14.6785	23.416	21.778	11.281	34.696	33.058	60	50	25.304	16.942
14.1749	23.037	21.114	11.344	34.381	32.458	60	50	25.619	17.542
0.190494	31.48	25.11	10.22	41.7	35.33	64.843	54.843	23.143	19.513

**7.3 Peak Output Power - FCC 15.247(b)(2) IC: RSS-210 A8.4(1)****7.3.1 Measurement Procedure (Conducted Method)**

The RF output port of the EUT was directly connected to the input of a peak power meter. The device employs  $\geq 50$  channels therefore the power is limited to 1 Watt.

All data rates were evaluated and worst case reported.

**7.3.2 Measurement Results****Table 7.3.2-1: RF Output Power**

Frequency [MHz]	Level [dBm]
912.310059	29.80
919.511230	29.95
927.012451	29.98

## 7.4 Channel Usage Requirements

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

#### 7.4.1.1 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. The RBW was initially set to 30% of the channel spacing, but adjusted to best identify the center of each channel. The RBW and VBW were set to 1 kHz and 3 kHz respectively for the data presented in section 7.4.1.2 below.

#### 7.4.1.2 Measurement Results

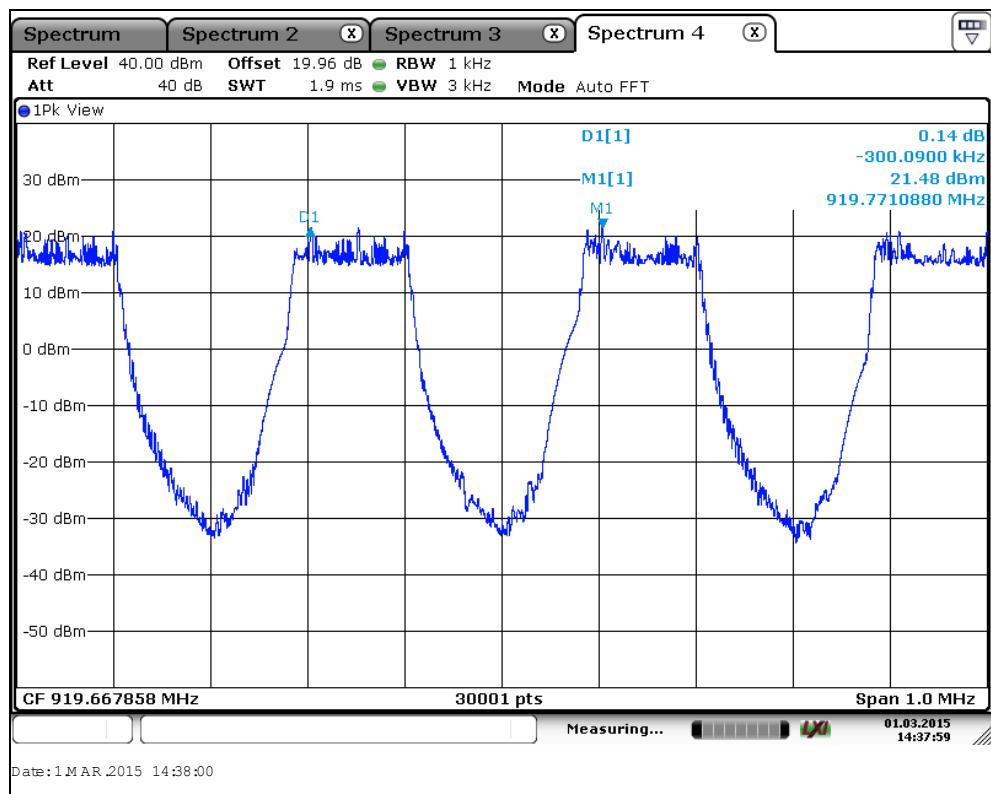


Figure 7.4.1.2-1: Carrier Frequency Separation 2604.2bps

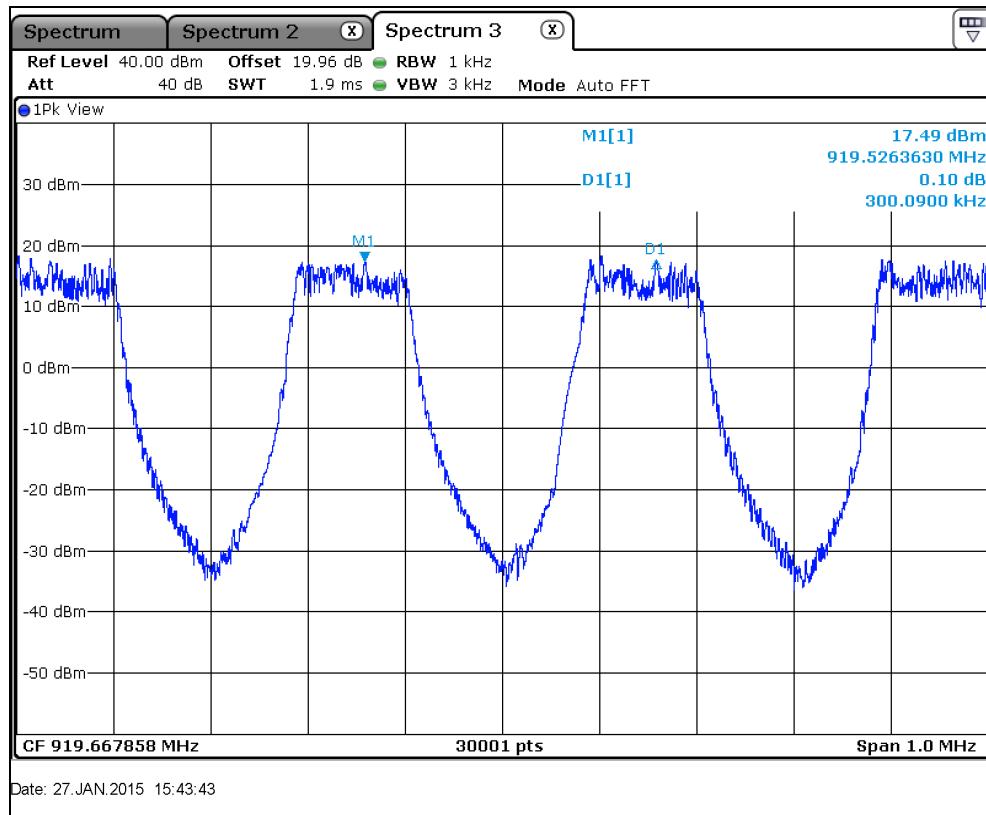
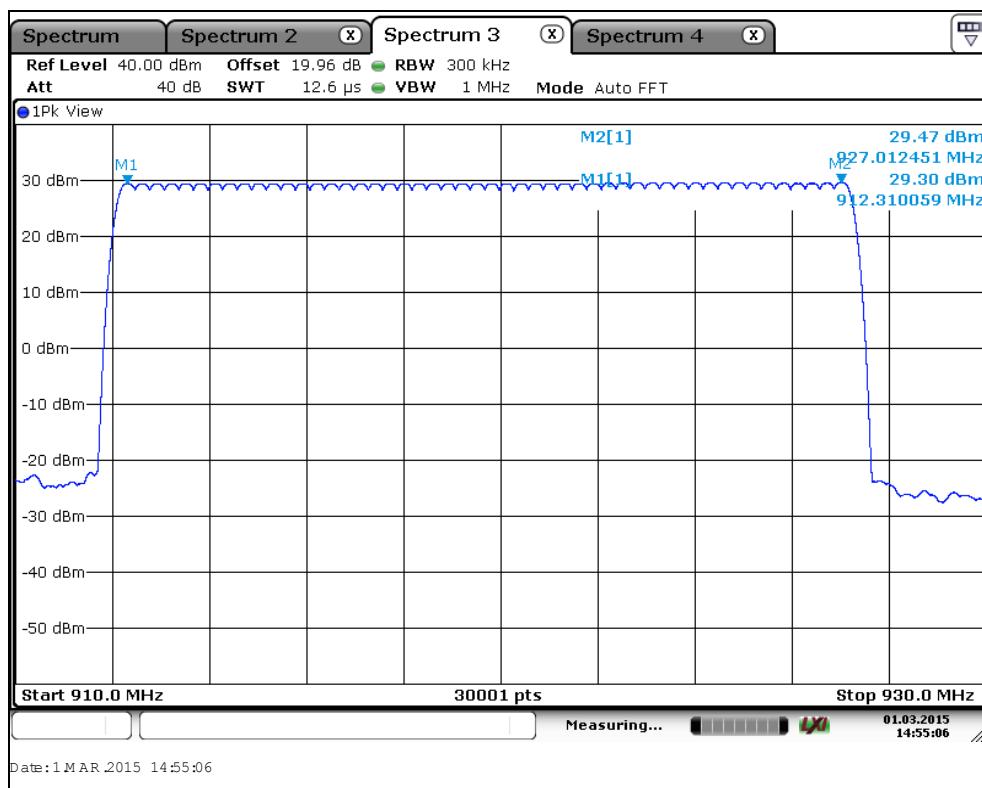


Figure 7.4.1.2-2: Carrier Frequency Separation 4557.3bps

**7.4.2 Number of Hopping Channels – FCC 15.247(a)(1)(i) IC: RSS-210 A8.1(c)****7.4.2.1 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 the frequency band of operation. The RBW was set to  $\geq 1\%$  of the span and VBW set to  $\geq$  RBW.

The number of hopping channels was measured on all data rates and data presented in section 7.4.2.2 below.

**7.4.2.2 Measurement Results****Figure 7.4.2.2-1: Number of Hopping Channels 2604.2bps**

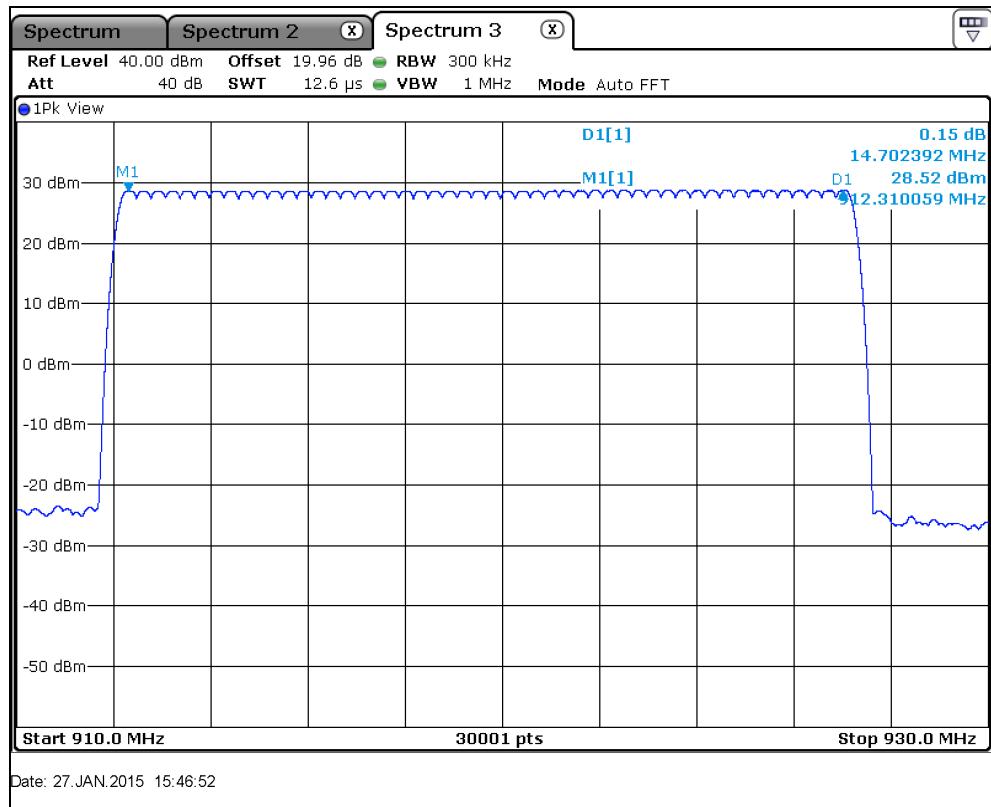


Figure 7.4.2.2-2: Number of Hopping Channels 4557.3bps

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

#### 7.4.3.1 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 0 Hz centered on a hopping channel. The RBW of the spectrum analyzer was set to  $\leq$  the EUT channel spacing and VBW set to  $\geq$  RBW. The Marker Delta function of the analyzer was utilized to determine the dwell time.

The channel dwell time was measured on all data rates and data presented in section 7.4.3.2 below.

#### 7.4.3.2 Measurement Results

Table 7.4.3.2-1: Channel Dwell Time

Data Rate (bps)	Single Occurrence (ms)	Number of Occurrences / 20s	Total Dwell Time (ms)
2604.2	379.17	1	379.17
4557.3	226.47	1	226.47

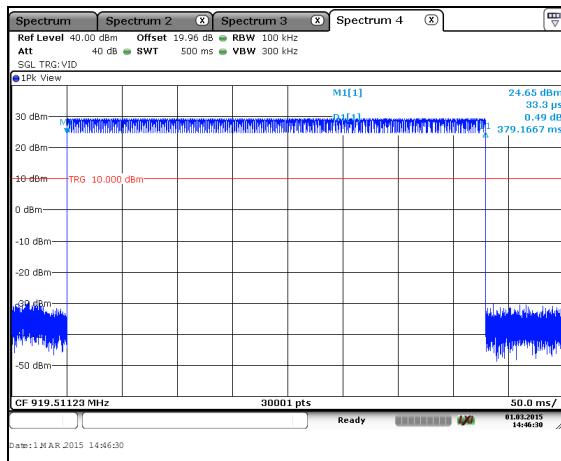


Figure 7.4.3.2-1: Dwell Time 2604.2bps

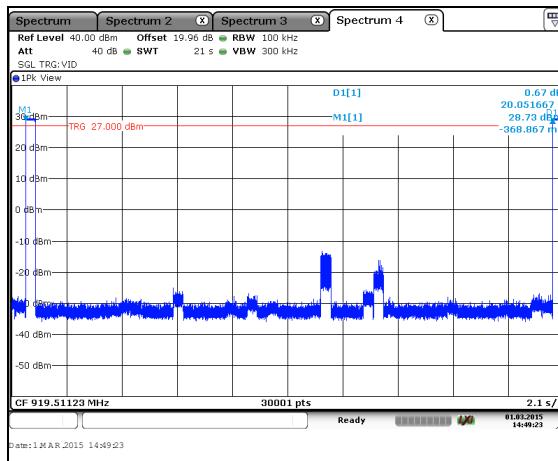


Figure 7.4.3.2-2: Dwell Time 2604.2bps

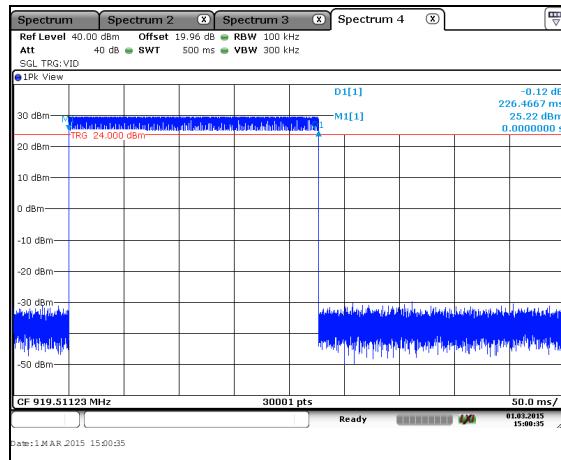


Figure 7.4.3.2-3: Dwell Time 4557.3bps

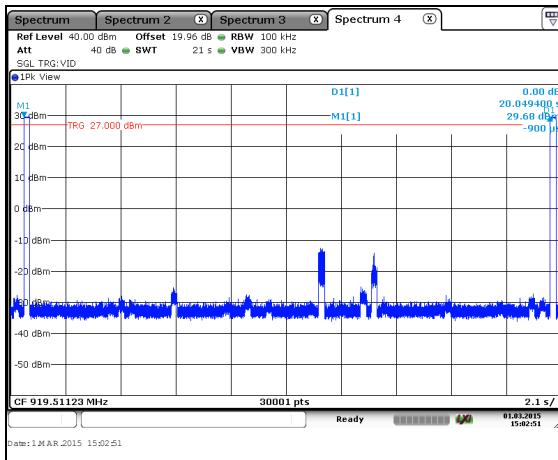


Figure 7.4.3.2-4: Dwell Time 4557.3bps

#### 7.4.4 20dB / 99% Bandwidth - FCC 15.247(a)(1)(i) IC: RSS-210 A8.2(a)

##### 7.4.4.1 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 and ndB down functions of the analyzer were utilized to determine the 20 dB bandwidth of the emission.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set to 1% to 5% of the occupied bandwidth. The video bandwidth was set to 3 times the resolution bandwidth. A peak detector was used.

The 20dB / 99% bandwidth was measured on all data rates and data presented in section 7.4.4.2 below.

##### 7.4.4.2 Measurement Results

Table 7.4.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]	Data Rate (bps)
912.310059	141.90	126.07	2604.2
912.310059	144.10	125.61	4557.3
919.511230	142.10	125.80	2604.2
919.511230	144.70	124.58	4557.3
927.012451	141.31	125.34	2604.2
927.012451	142.11	123.83	4557.3

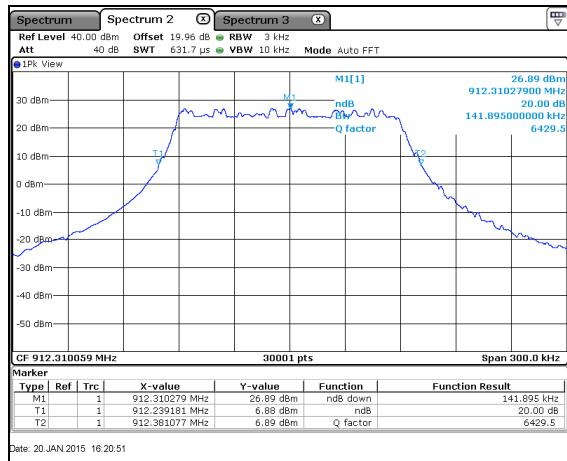


Figure 7.4.4.2-1: 20dB BW Low Channel - 2604.2bps

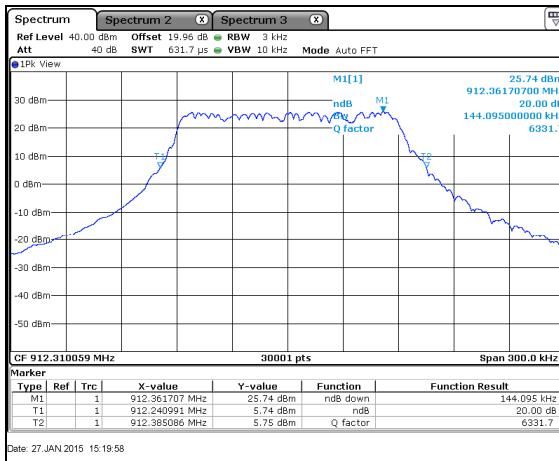
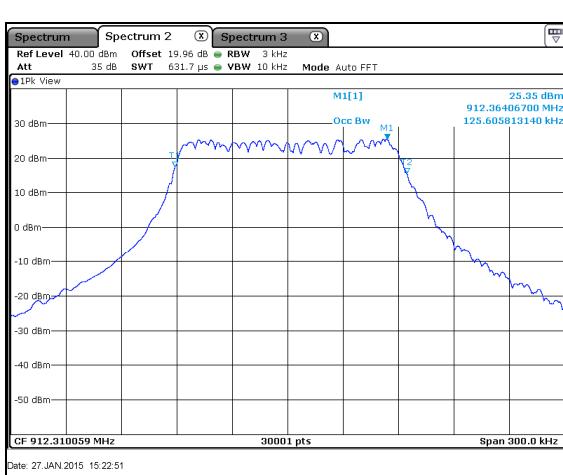
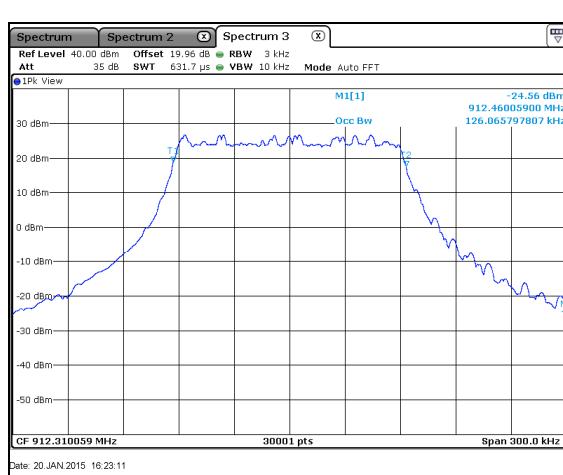
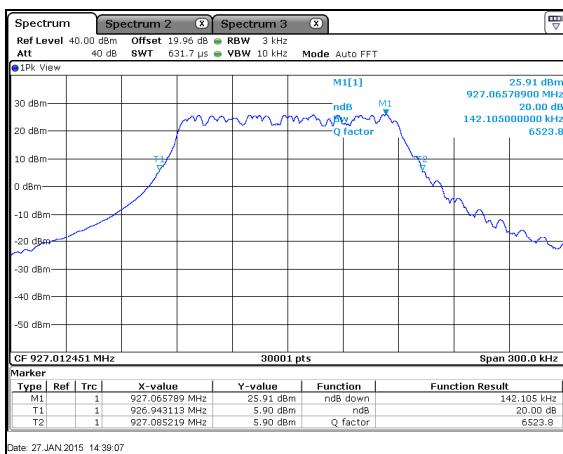
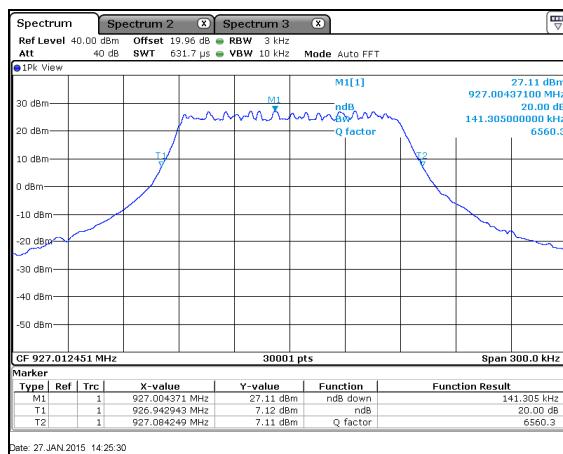
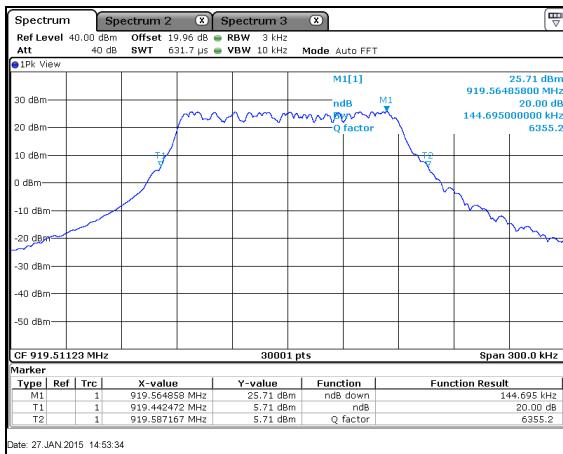
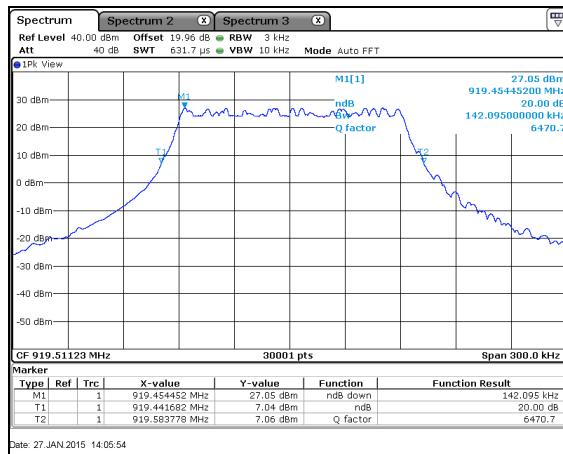


Figure 7.4.4.2-2: 20dB BW Low Channel - 4557.3bps



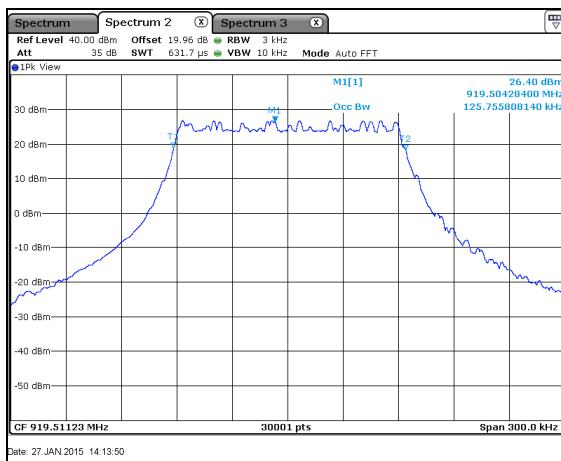


Figure 7.4.4.2-9: 99% BW Mid Channel - 2604.2bps

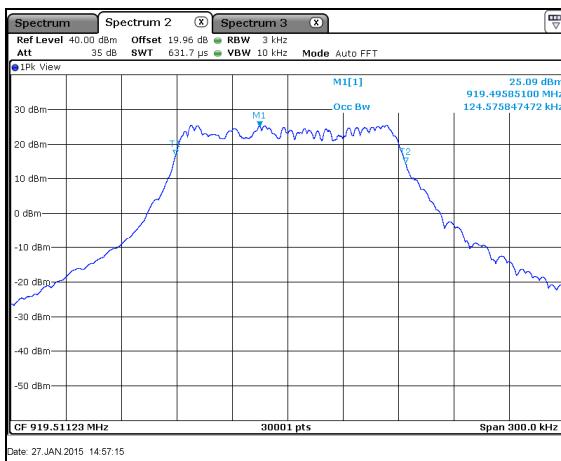


Figure 7.4.4.2-10: 99% BW Mid Channel – 4557.3bps

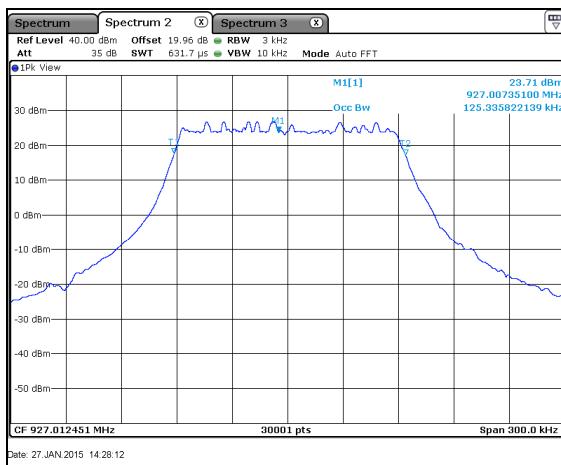


Figure 7.4.4.2-11: 99% BW High Channel - 2604.2bps



Figure 7.4.4.2-12: 99% BW High Channel – 4557.3bps

## 7.5 Band-Edge Compliance and Spurious Emissions

### 7.5.1 Band-Edge Compliance of RF Conducted Emissions - FCC 15.247(d); IC RSS-210 A8.5

#### 7.5.1.1 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 100 kHz, and the VBW was set to 300 kHz.

The band-edges were measured on all data rates and data presented in section 7.5.1.2 below.

#### 7.5.1.2 Measurement Results

##### NON-HOPPING MODE:

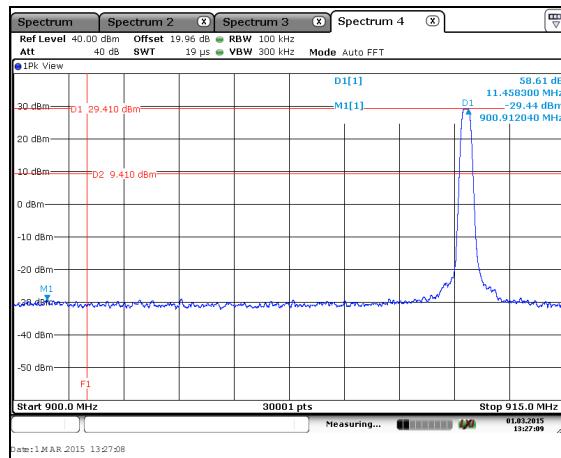


Figure 7.5.1.2-1: Lower Band-edge – 2604.2bps

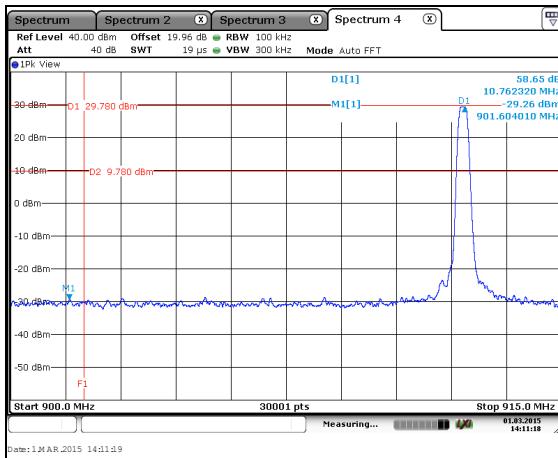


Figure 7.5.1.2-2: Lower Band-edge – 4557.3bps

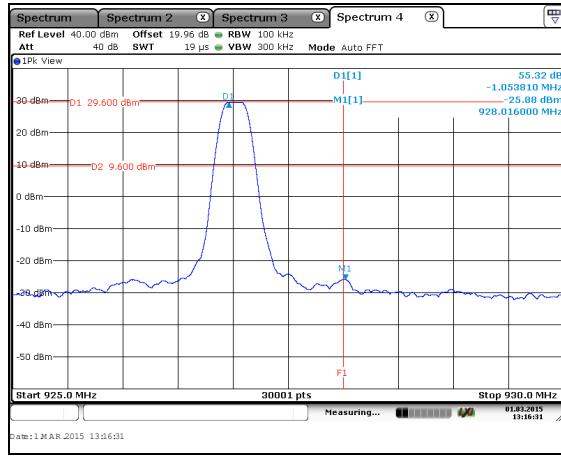


Figure 7.5.1.2-3: Upper Band-edge – 2604.2bps

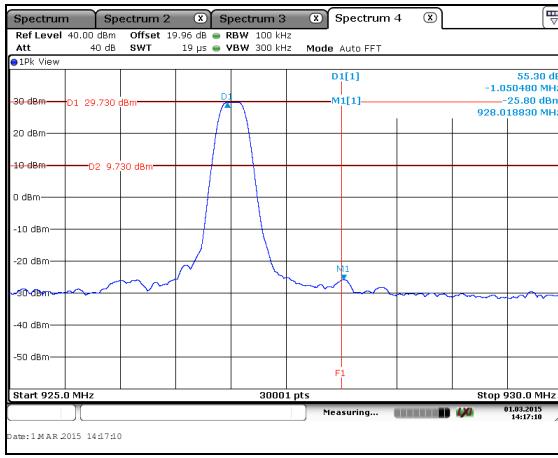


Figure 7.5.1.2-4: Upper Band-edge – 4557.3bps

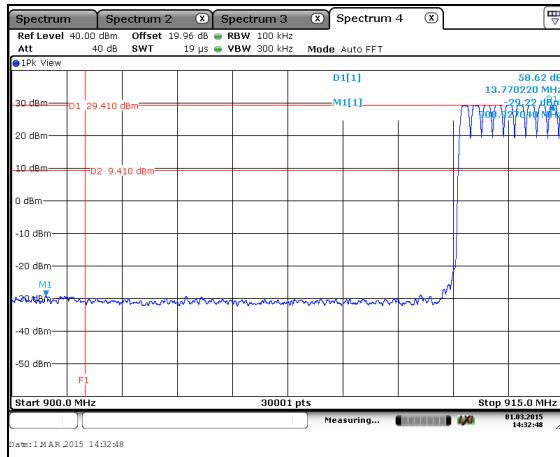
**HOPPING MODE:**

Figure 7.5.1.2-5: Lower Band-edge – 2604.2bps

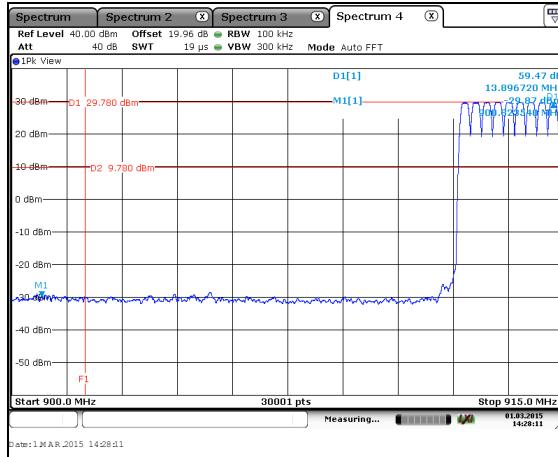


Figure 7.5.1.2-6: Lower Band-edge – 4557.3bps

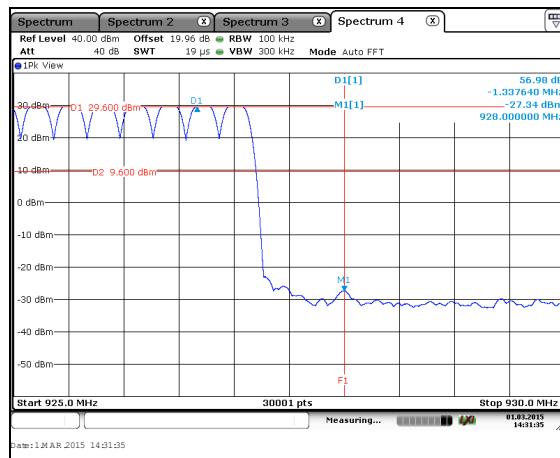


Figure 7.5.1.2-7: Upper Band-edge – 2604.2bps

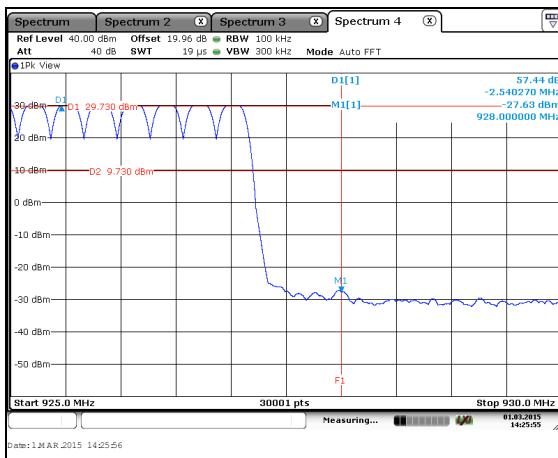


Figure 7.5.1.2-8: Upper Band-edge – 4557.3bps

## 7.5.2 RF Conducted Spurious Emissions - FCC 15.247(d); IC RSS-210 A8.5

### 7.5.2.1 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 and VBW were set to 100kHz and 300kHz respectively. A peak detector function was used with the trace set to max hold.

RF conducted spurious emissions were measured on all data rates and data presented in section 7.5.1.2 below.

### 7.5.2.2 Measurement Results

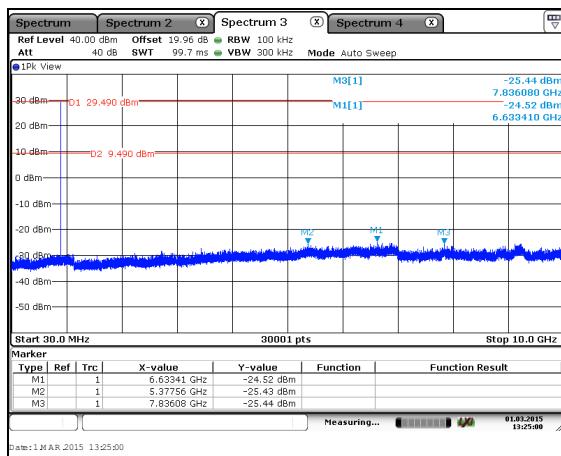


Figure 7.5.2.2-1: 30 MHz – 10 GHz – LCH 2604.2bps

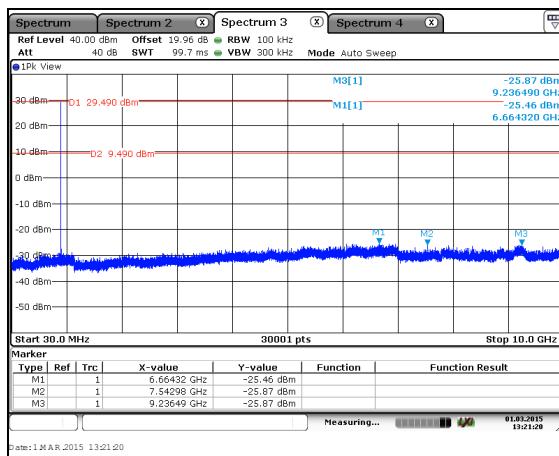


Figure 7.5.2.2-2: 30 MHz – 10 GHz – MCH 2604.2bps

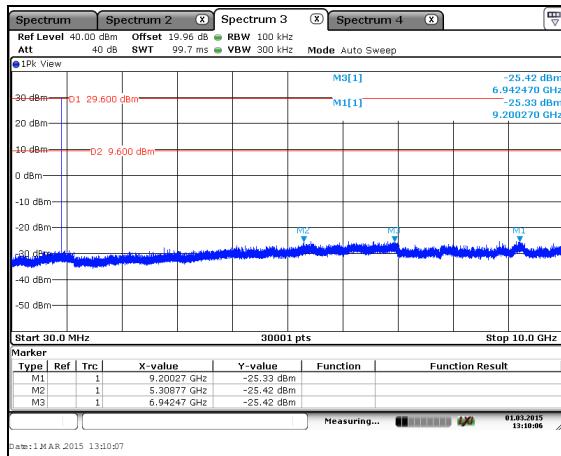


Figure 7.5.2.2-3: 30 MHz – 10 GHz – HCH 2604.2bps

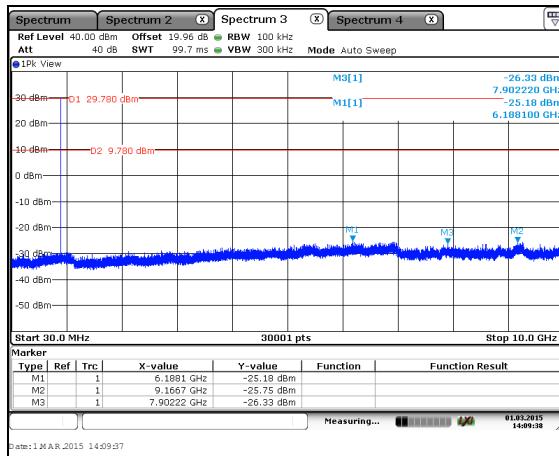


Figure 7.5.2.2-4: 30 MHz – 10 GHz – LCH 4557.3bps

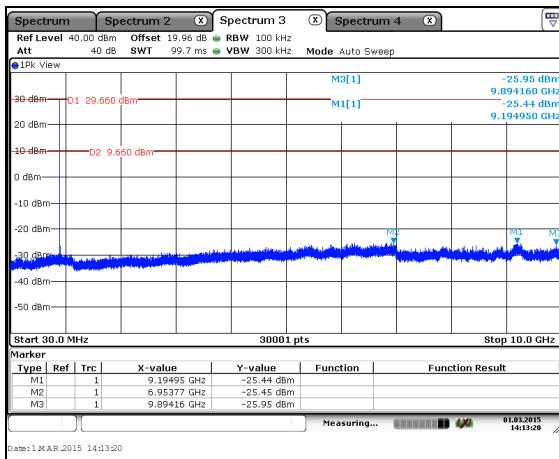


Figure 7.5.2.2-5: 30 MHz – 10 GHz – MCH 4557.3bps

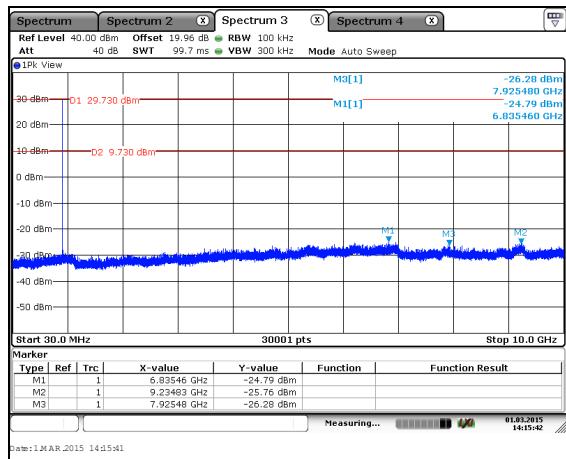


Figure 7.5.2.2-6: 30 MHz – 10 GHz – HCH 4557.3bps

**7.5.3 Radiated Spurious Emissions - FCC 15.205, 15.209; IC RSS-210 2.2, RSS-Gen  
8.9/8.10**

**7.5.3.1 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 RBW of 120 kHz and a VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3MHz respectively.

The EUT was caused to generate a continuous modulated carrier on the hopping channel.

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

Radiated spurious emissions were evaluated for all data rates with worst case data provided in section 7.5.3.2 below.

**7.5.3.2 Measurement Results**

**Table 7.5.3.2-1: Radiated Spurious Emissions Tabulated Data – Antenna 1**

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>										
2736.930177	51.34	46.23	H	-4.55	46.79	41.68	74.0	54.0	27.2	12.3
2736.930177	52.26	47.07	V	-4.55	47.71	42.52	74.0	54.0	26.3	11.5
3649.240236	51.12	43.89	H	-1.24	49.88	42.65	74.0	54.0	24.1	11.4
3649.240236	54.15	49.07	V	-1.24	52.91	47.83	74.0	54.0	21.1	6.2
4561.550295	47.48	37.42	H	0.77	48.25	38.19	74.0	54.0	25.7	15.8
<b>Middle Channel</b>										
983.47	-----	31.94	H	1.20	-----	33.14	-----	54.0	-----	20.9
983.47	-----	32.15	V	1.20	-----	33.35	-----	54.0	-----	20.6
992.02	-----	27.40	H	1.66	-----	29.06	-----	54.0	-----	24.9
992.02	-----	31.36	V	1.66	-----	33.02	-----	54.0	-----	21.0
2758.53369	51.41	45.77	H	-4.46	46.95	41.31	74.0	54.0	27.1	12.7
2758.53369	54.15	50.29	V	-4.46	49.69	45.83	74.0	54.0	24.3	8.2
3678.04492	51.14	43.84	H	-1.14	50.00	42.70	74.0	54.0	24.0	11.3
3678.04492	55.19	51.13	V	-1.14	54.05	49.99	74.0	54.0	20.0	4.0
4597.55615	48.21	38.54	H	0.85	49.06	39.39	74.0	54.0	24.9	14.6
4597.55615	48.37	39.12	V	0.85	49.22	39.97	74.00	54.00	24.80	14.00
8275.60107	45.47	35.21	H	8.08	53.55	43.29	74.00	54.00	20.40	10.70
<b>High Channel</b>										
2781.037353	50.93	45.19	H	-4.37	46.56	40.82	74.0	54.0	27.4	13.2
2781.037353	50.83	45.19	V	-4.37	46.46	40.82	74.0	54.0	27.5	13.2
3708.049804	50.22	43.44	H	-1.04	49.18	42.40	74.0	54.0	24.8	11.6
3708.049804	54.61	50.75	V	-1.04	53.57	49.71	74.0	54.0	20.4	4.3
4635.062255	53.67	49.35	H	0.93	54.60	50.28	74.0	54.0	19.4	3.7
4635.062255	48.77	41.25	V	0.93	49.70	42.18	74.0	54.0	24.3	11.8
7416.099608	47.15	38.97	H	7.82	54.97	46.79	74.0	54.0	19.0	7.2
7416.099608	48.29	41.23	V	7.82	56.11	49.05	74.0	54.0	17.9	5.0

Table 7.5.3.2-2: Radiated Spurious Emissions Tabulated Data – Antenna 2

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
Low Channel										
2736.930177	51.73	46.03	H	-4.55	47.18	41.48	74.0	54.0	26.8	12.5
2736.930177	49.20	42.37	V	-4.55	44.65	37.82	74.0	54.0	29.4	16.2
3649.240236	51.26	45.47	H	-1.24	50.02	44.23	74.0	54.0	24.0	9.8
3649.240236	49.15	41.46	V	-1.24	47.91	40.22	74.0	54.0	26.1	13.8
Middle Channel										
2758.53369	49.18	42.50	H	-4.46	44.72	38.04	74.0	54.0	29.3	16.0
2758.53369	50.63	43.51	V	-4.46	46.17	39.05	74.0	54.0	27.8	15.0
3678.04492	51.13	43.82	H	-1.14	49.99	42.68	74.0	54.0	24.0	11.3
3678.04492	49.11	40.26	V	-1.14	47.97	39.12	74.0	54.0	26.0	14.9
High Channel										
989.15	-----	44.44	H	1.37	-----	45.81	-----	54.0	-----	8.2
2781.037353	49.20	42.24	H	-4.37	44.83	37.87	74.0	54.0	29.2	16.1
2781.037353	51.24	45.44	V	-4.37	46.87	41.07	74.0	54.0	27.1	12.9
3708.049804	50.18	41.30	H	-1.04	49.14	40.26	74.0	54.0	24.9	13.7
3708.049804	49.52	40.85	V	-1.04	48.48	39.81	74.0	54.0	25.5	14.2
4635.062255	47.02	36.58	H	0.93	47.95	37.51	74.0	54.0	26.1	16.5
7416.099608	46.32	34.85	H	7.82	54.14	42.67	74.0	54.0	19.9	11.3
7416.099608	46.23	36.84	V	7.82	54.05	44.66	74.0	54.0	20.0	9.3

**Sample Calculation:**

$$R_C = R_U + CF_T$$

Where:

CF<sub>T</sub> = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)R<sub>U</sub> = Uncorrected ReadingR<sub>C</sub> = Corrected Level

AF = Antenna Factor

CA = Cable Attenuation

AG = Amplifier Gain

DC = Duty Cycle Correction Factor

**Example Calculation: Peak (Antenna 1)**

Corrected Level: 51.34 - 4.55 = 46.79dBuV/m

Margin: 74dBuV/m – 46.79dBuV/m = 27.2dB

**Example Calculation: Average (Antenna 1)**

Corrected Level: 46.23 - 4.55 - 0 = 41.68dBuV

Margin: 54dBuV – 41.68dBuV = 12.3dB

**8 CONCLUSION**

In the opinion of ACS, Inc. the Repeater Plus Module, manufactured by Mueller Systems, LLC meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

**END REPORT**