Excellence in Compliance Testing

Certification Test Report

FCC ID: SM6-MINODE-WATER4
IC: 9235A-MINODE4

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

ACS Report Number: 15-0006.W06.1B

Manufacturer: Mueller Systems, LLC
Model: MiNODE-WATER4

Test Begin Date: January 19, 2015
Test End Date: January 30, 2015

Report Issue Date: March 6, 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.

Reviewed by:

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 29 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 MiNODE-WATER4 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: ¼ Monopole / 0dBi (Antenna 1)
¼ Helical / -1dBi (Antenna 2)
Operating Voltage: 3.6Vdc

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

EUT Serial Numbers: 4000665 NT:14; 4000664 NT:14

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.

The EUT is designed for battery operation only therefore AC power line conducted emissions is not applicable.

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: DCOM4 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:

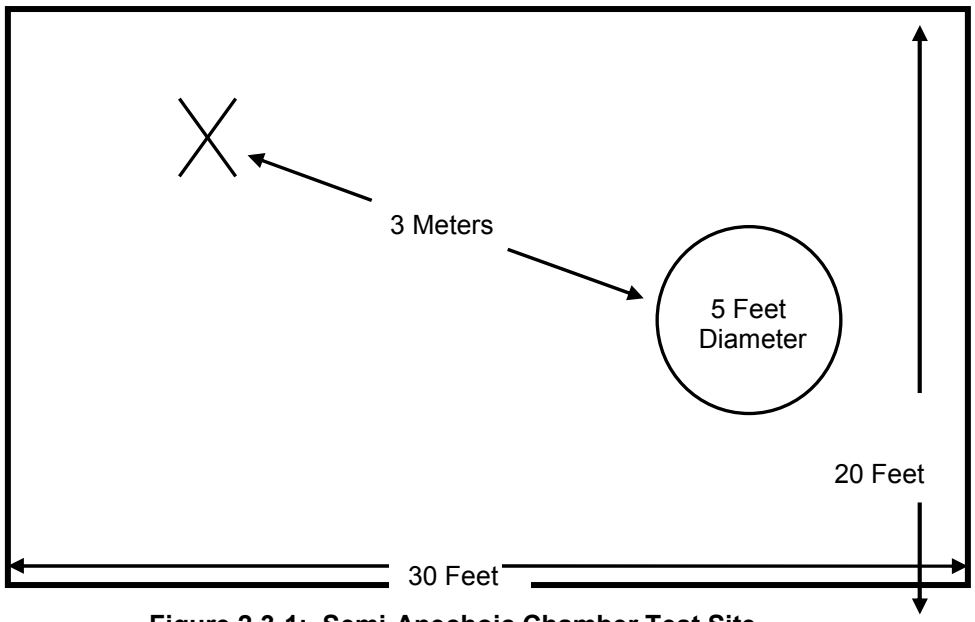

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

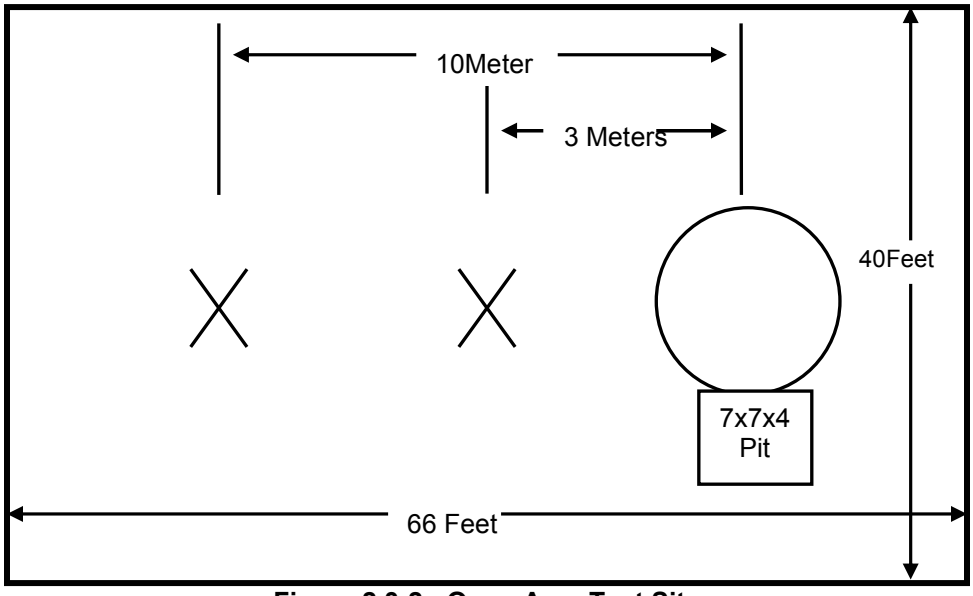

Figure 2.3-2: Open Area Test Site

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:

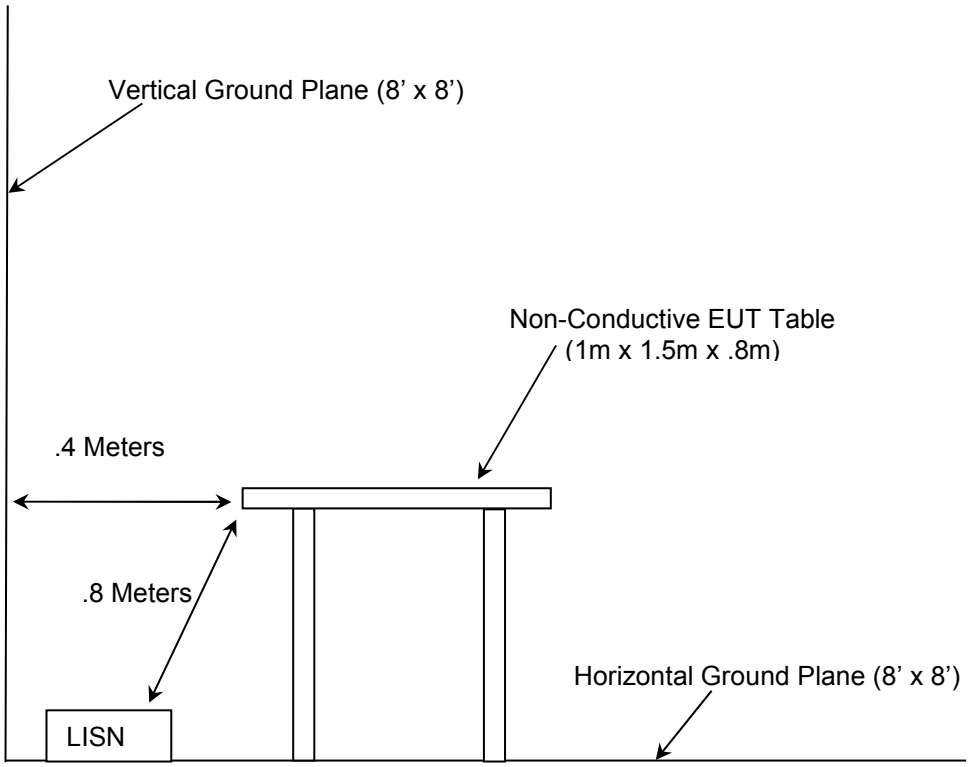

Figure 2.4-1: AC Mains Conducted EMI Site

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
73	Agilent	8447D	Amplifiers	2727A05624	7/15/2014	7/15/2015
167	ACS	Chamber EMI Cable Set	Cable Set	167	10/28/2014	10/28/2015
267	Agilent	N1911A	Meters	MY45100129	7/30/2013	7/30/2015
268	Agilent	N1921A	Sensors	MY45240184	7/30/2013	7/30/2015
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	3/17/2014	3/17/2015
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
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	11/5/2014	11/5/2015
616	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	N/A	9/10/2014	9/10/2015
622	Rohde & Schwarz	FSV40	Analyzers	101338	7/12/2014	7/12/2015

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	DC Power Supply	Agilent	6286A	2109A-06095

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

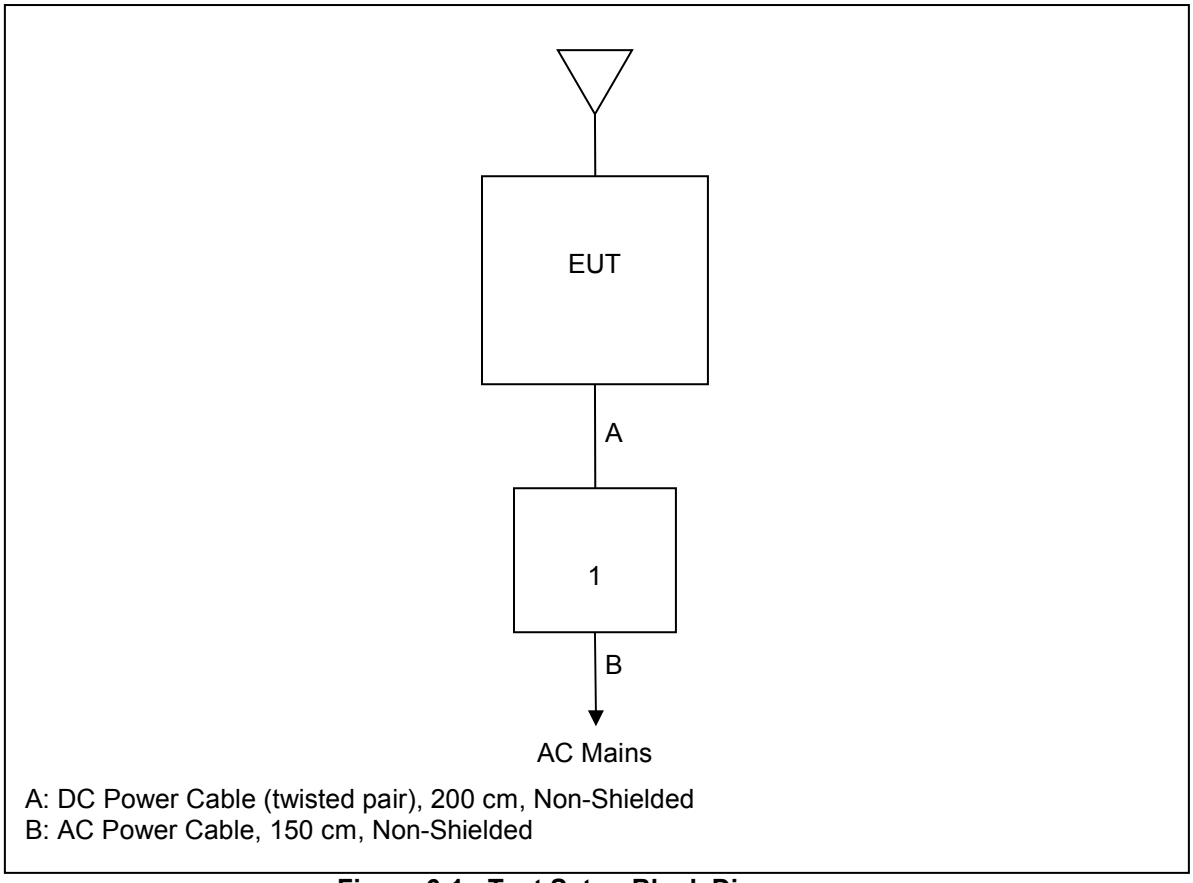

Figure 6-1: Test Setup Block Diagram

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 ¼ Monopole with 0dBi gain and a ¼ Helical with -1dBi gain. Theses antennas are either detachable utilizing unique coupling to the EUT or soldered directly to the module, 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

The EUT is battery operated therefore power line conducted emissions is not applicable.

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 ≥ 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	28.83
919.511230	29.08
927.012451	29.26

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 and RBW and VBW were set to 1 kHz and 3 kHz respectively.

7.4.1.2 Measurement Results

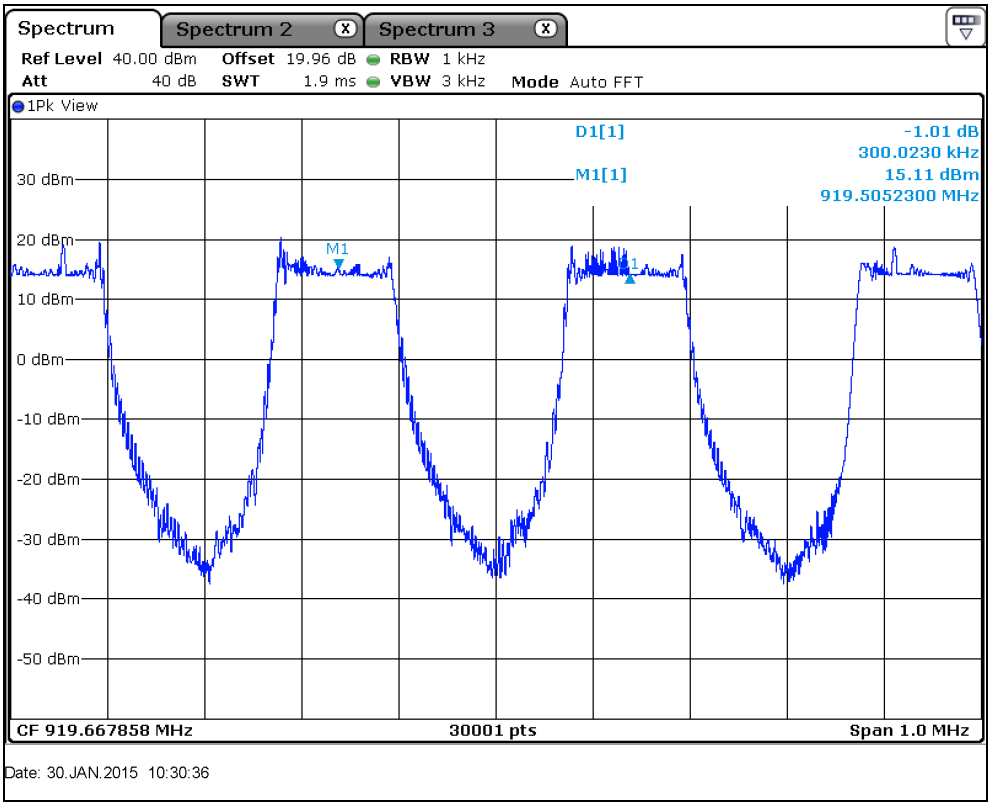

Figure 7.4.1.2-1: Carrier Frequency Separation 2604.2bps

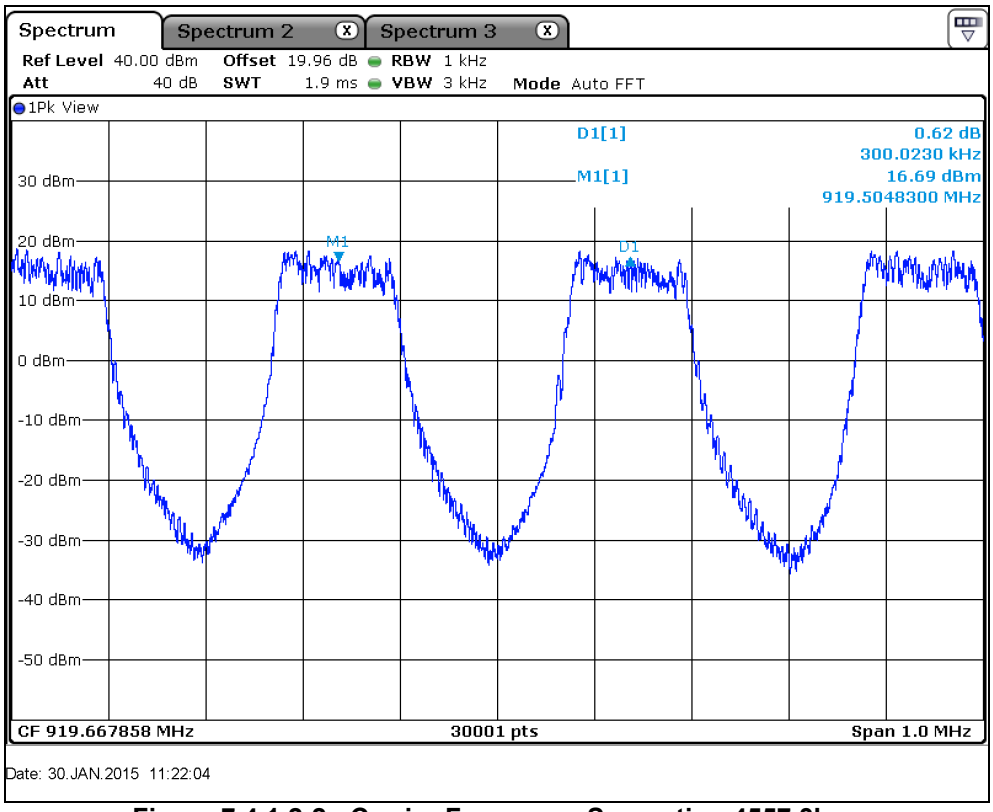

Figure 7.4.1.2-2: Carrier Frequency Separation 4557.3bps

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 ≥ 1% of the span and VBW set to ≥ RBW.

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

7.4.2.2 Measurement Results

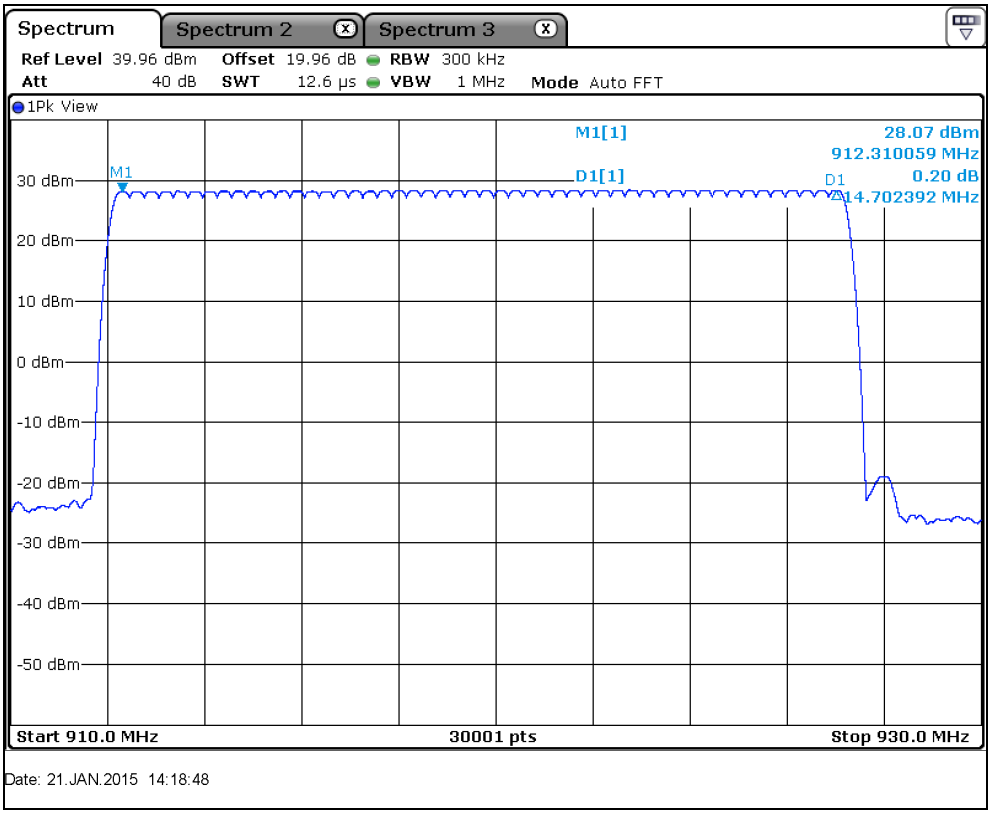

Figure 7.4.2.2-1: Number of Hopping Channels 2604.2bps

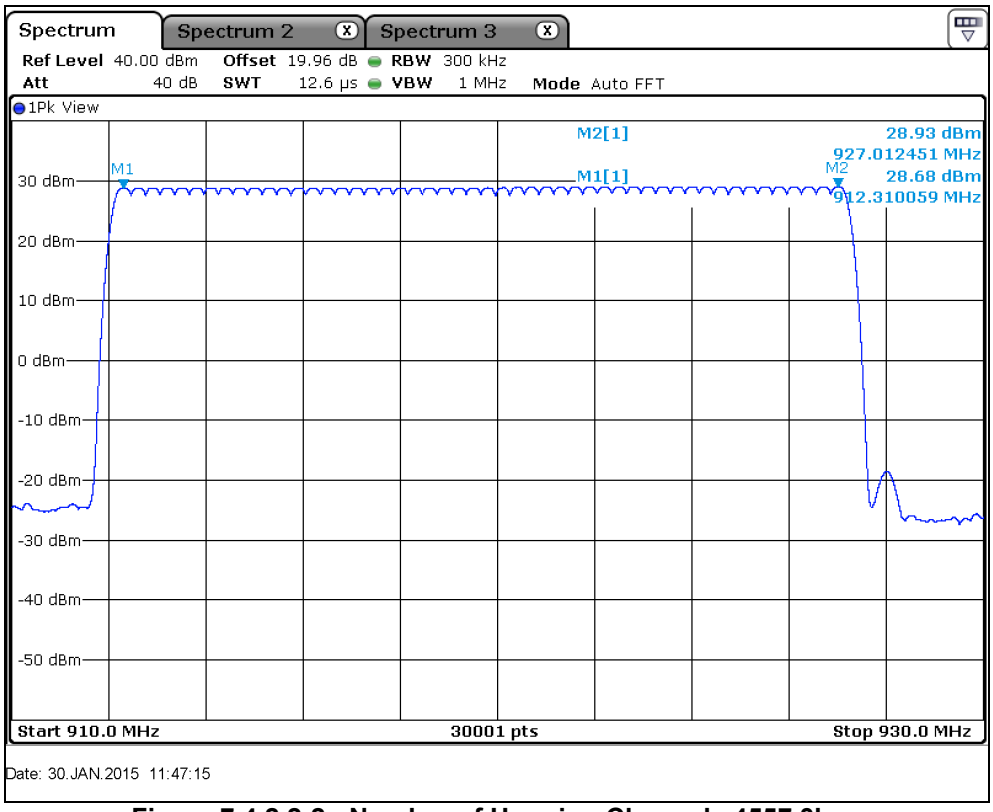

Figure 7.4.2.2-2: Number of Hopping Channels 4557.3bps

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 ≤ the EUT channel spacing and VBW set to ≥ RBW. The Marker Delta function of the analyzer was utilized to determine the dwell time.

7.4.3.2 Measurement Results

Table 7.4.3.2-1: Channel Dwell Time

Data Rate (bps)	Single Occurrence	Number of Occurrences / 20s	Total Dwell Time (ms)
2604.2	378.85	1	378.85
4557.3	226.38	1	226.38

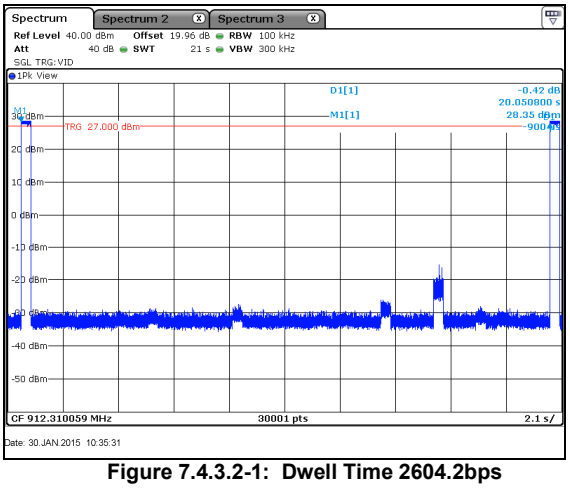

Figure 7.4.3.2-1: Dwell Time 2604.2bps

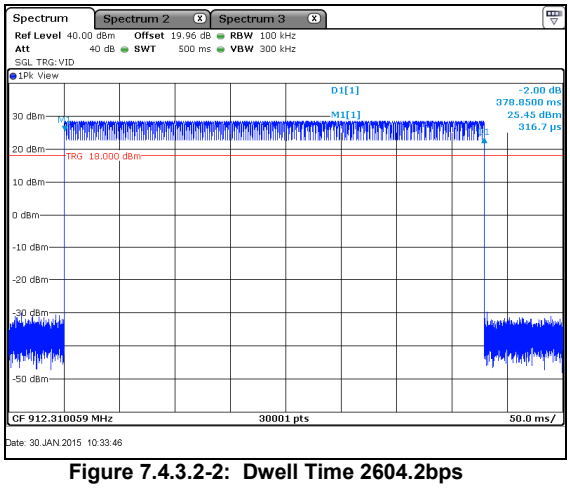

Figure 7.4.3.2-2: Dwell Time 2604.2bps

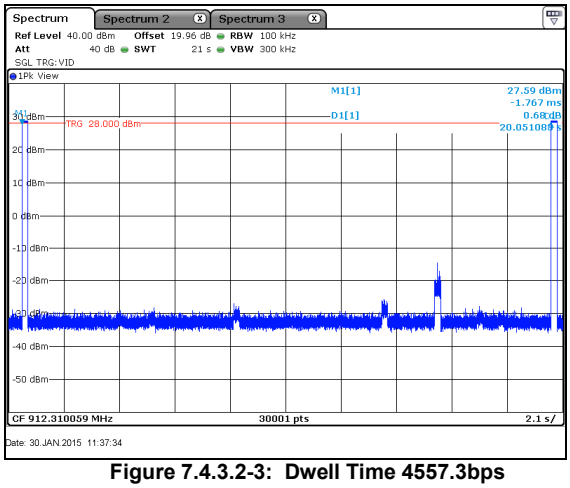

Figure 7.4.3.2-3: Dwell Time 4557.3bps

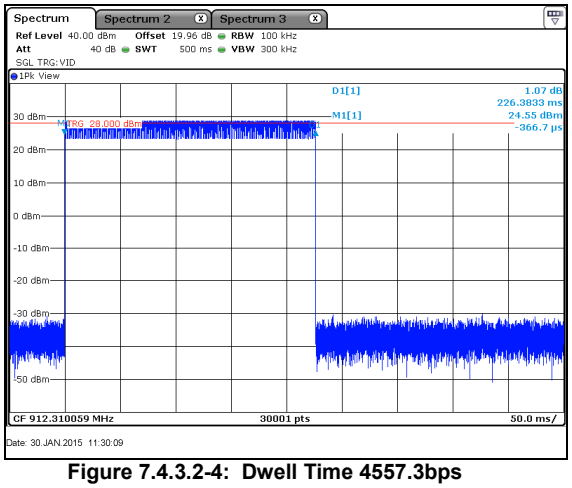

Figure 7.4.3.2-4: Dwell Time 4557.3bps

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.

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	141.49	125.93	2604.2
912.310059	144.74	124.68	4557.3
919.511230	145.85	125.62	2604.2
919.511230	141.97	125.30	4557.3
927.012451	142.43	125.35	2604.2
927.012451	144.56	124.59	4557.3

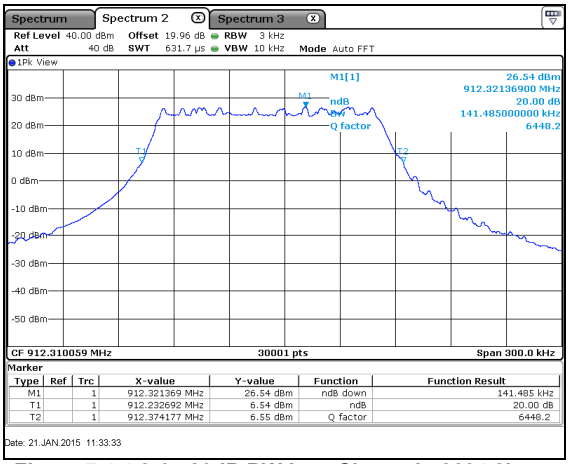

Figure 7.4.4.2-1: 20dB BW Low Channel - 2604.2bps

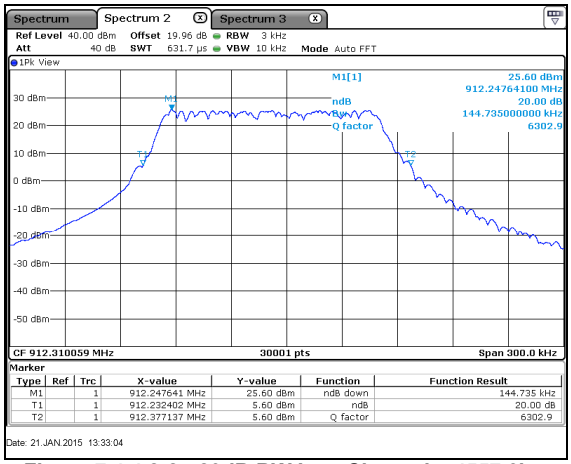

Figure 7.4.4.2-2: 20dB BW Low Channel – 4557.3bps

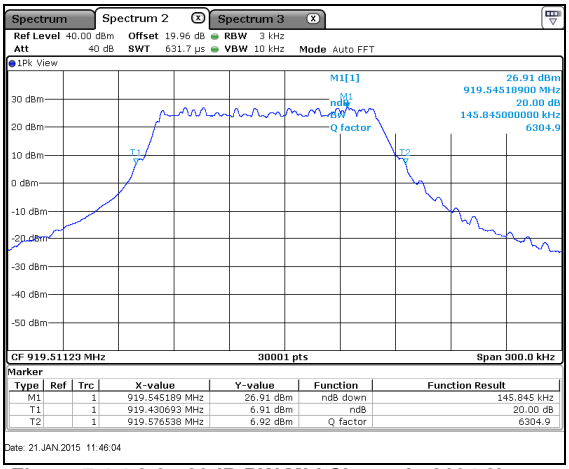

Figure 7.4.4.2-3: 20dB BW Mid Channel - 2604.2bps

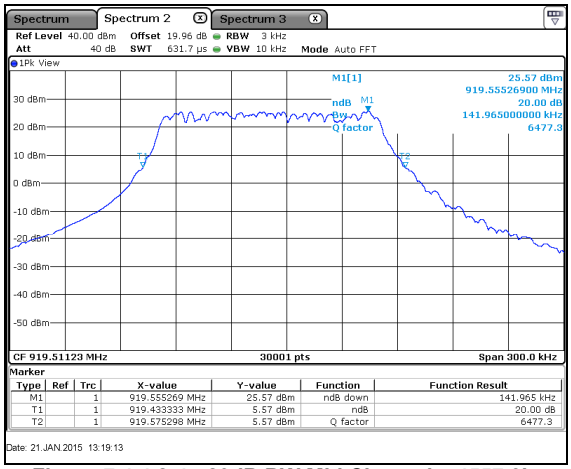

Figure 7.4.4.2-4: 20dB BW Mid Channel – 4557.3bps

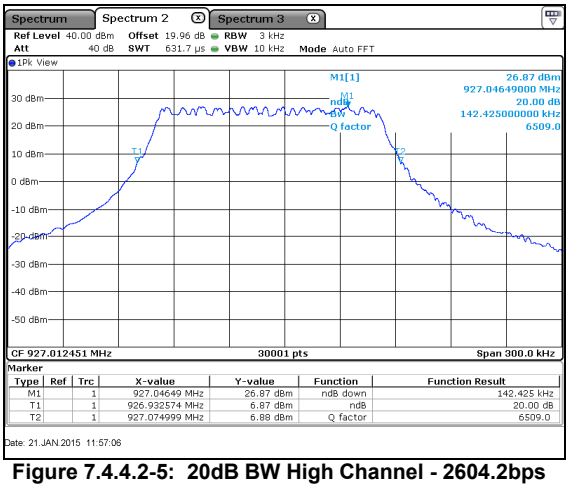

Figure 7.4.4.2-5: 20dB BW High Channel - 2604.2bps

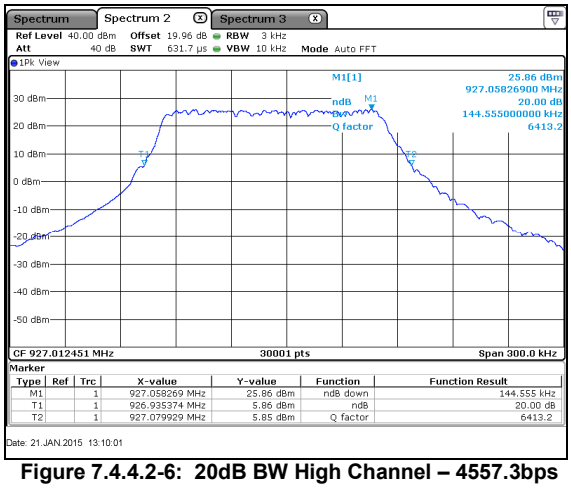

Figure 7.4.4.2-6: 20dB BW High Channel – 4557.3bps

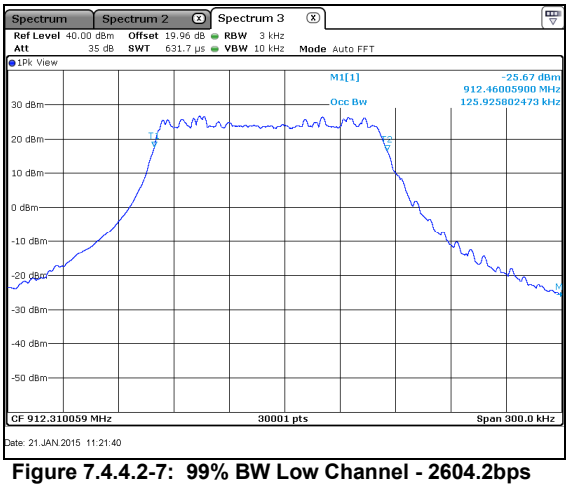

Figure 7.4.4.2-7: 99% BW Low Channel - 2604.2bps

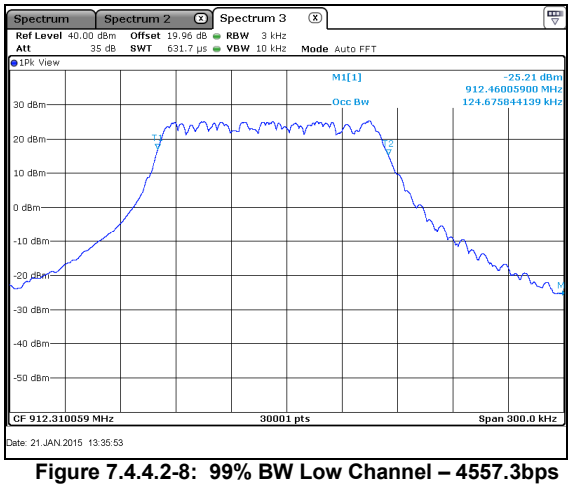

Figure 7.4.4.2-8: 99% BW Low Channel – 4557.3bps

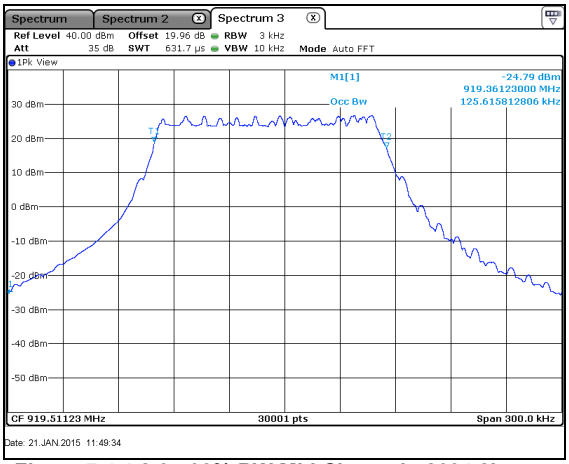

Figure 7.4.4.2-9: 99% BW Mid Channel - 2604.2bps

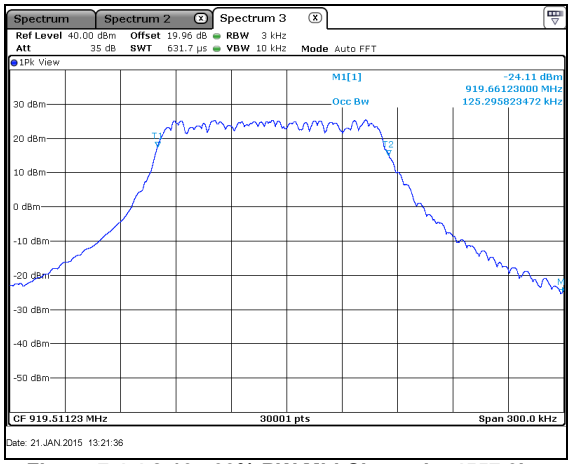

Figure 7.4.4.2-10: 99% BW Mid Channel – 4557.3bps

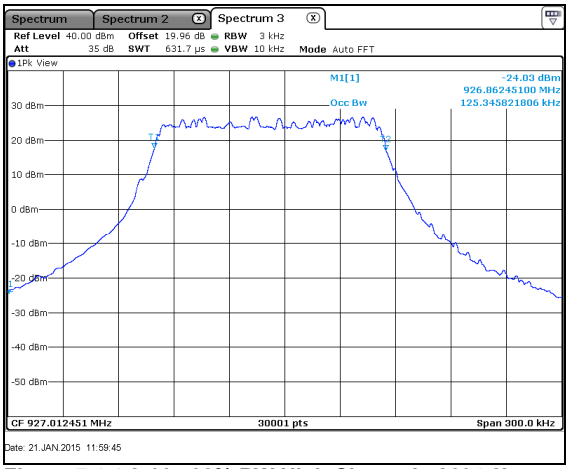

Figure 7.4.4.2-11: 99% BW High Channel - 2604.2bps

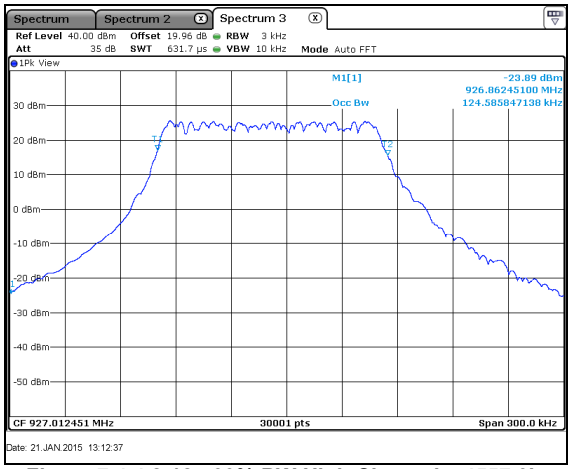

Figure 7.4.4.2-12: 99% BW High Channel – 4557.3bps

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.

Band-edge was evaluated for all data rates.

7.5.1.2 Measurement Results

NON-HOPPING MODE:

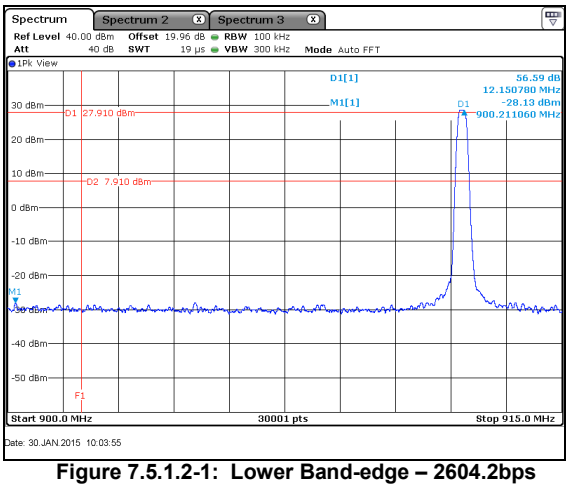

Figure 7.5.1.2-1: Lower Band-edge – 2604.2bps

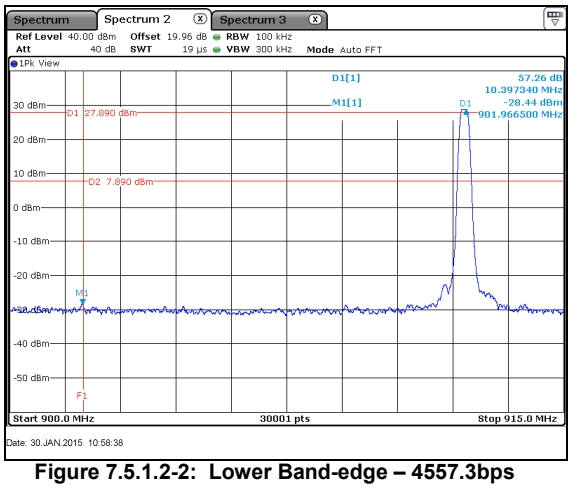

Figure 7.5.1.2-2: Lower Band-edge – 4557.3bps

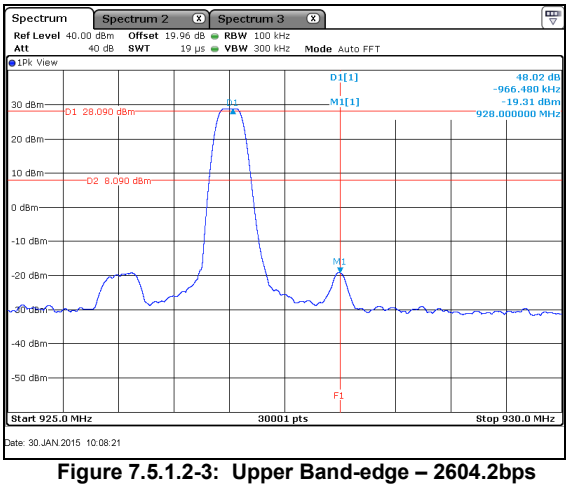

Figure 7.5.1.2-3: Upper Band-edge – 2604.2bps

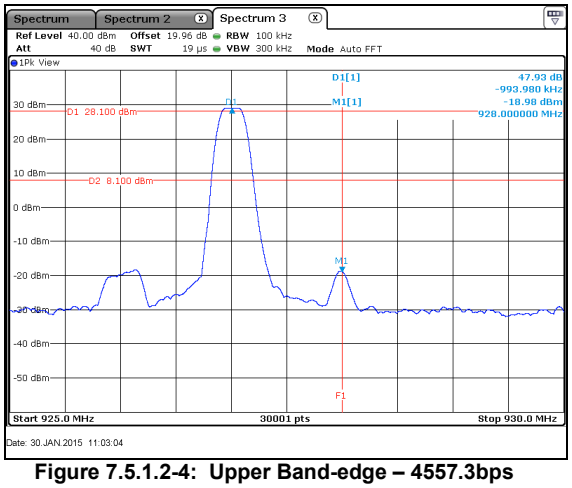

Figure 7.5.1.2-4: Upper Band-edge – 4557.3bps

HOPPING MODE:

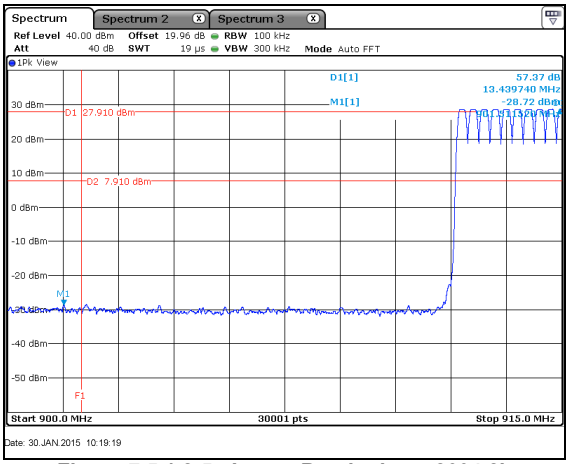

Figure 7.5.1.2-5: Lower Band-edge – 2604.2bps

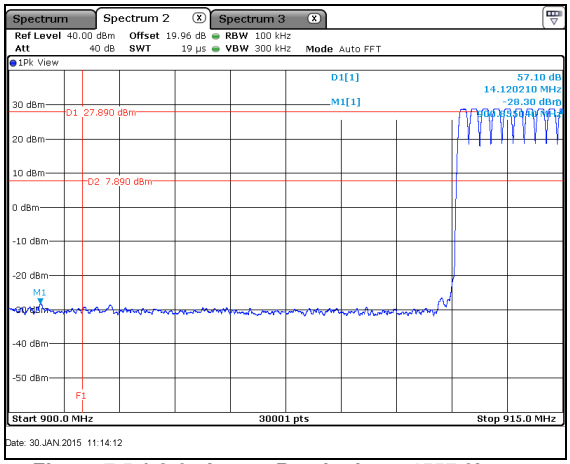

Figure 7.5.1.2-6: Lower Band-edge – 4557.3bps

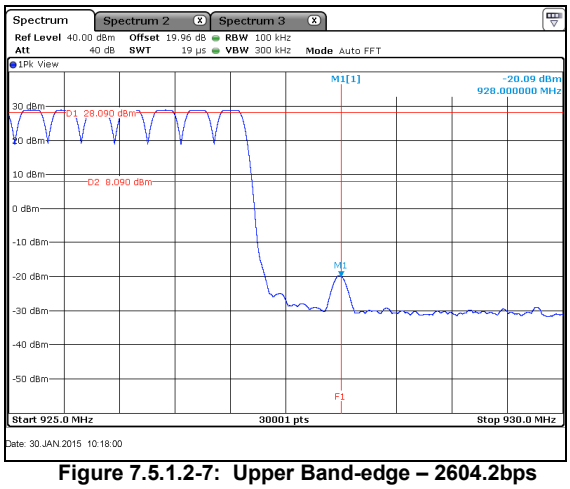

Figure 7.5.1.2-7: Upper Band-edge – 2604.2bps

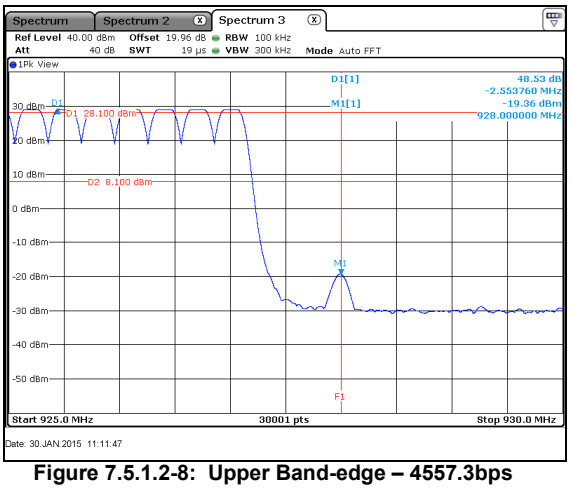

Figure 7.5.1.2-8: Upper Band-edge – 4557.3bps

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 was set to 100kHz. A peak detector function was used with the trace set to max hold.

7.5.2.2 Measurement Results

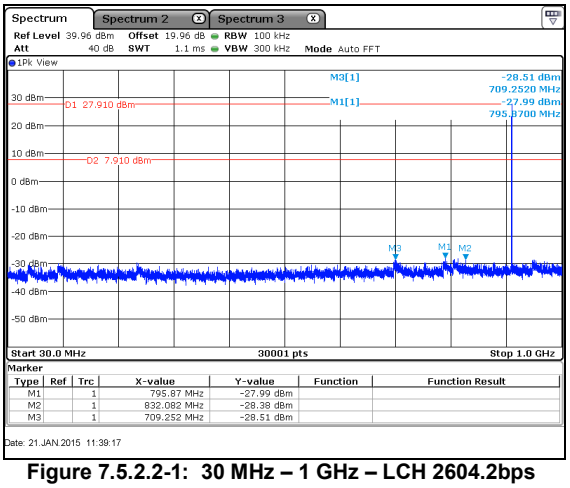

Figure 7.5.2.2-1: 30 MHz – 1 GHz – LCH 2604.2bps

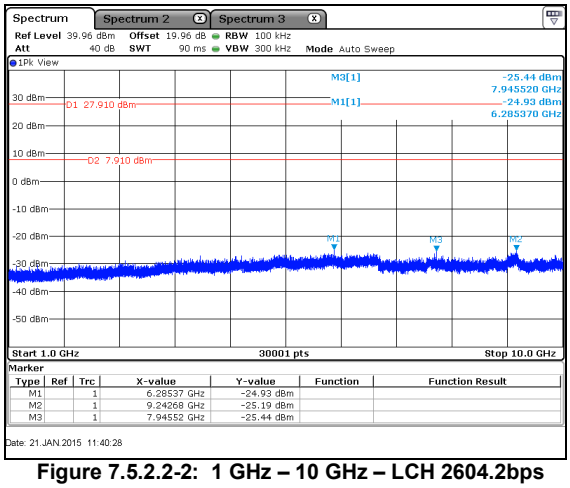

Figure 7.5.2.2-2: 1 GHz – 10 GHz – LCH 2604.2bps

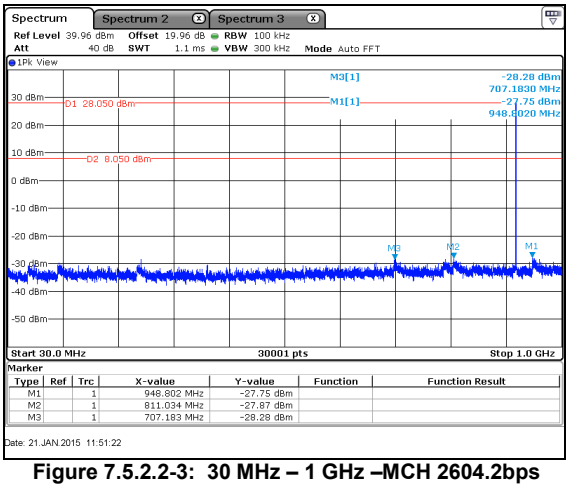

Figure 7.5.2.2-3: 30 MHz – 1 GHz –MCH 2604.2bps

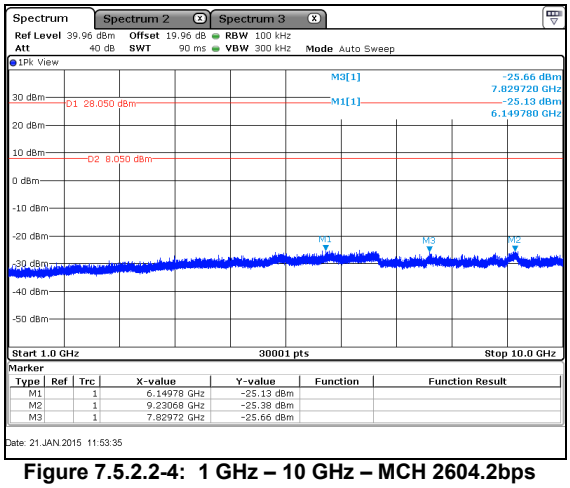

Figure 7.5.2.2-4: 1 GHz – 10 GHz – MCH 2604.2bps

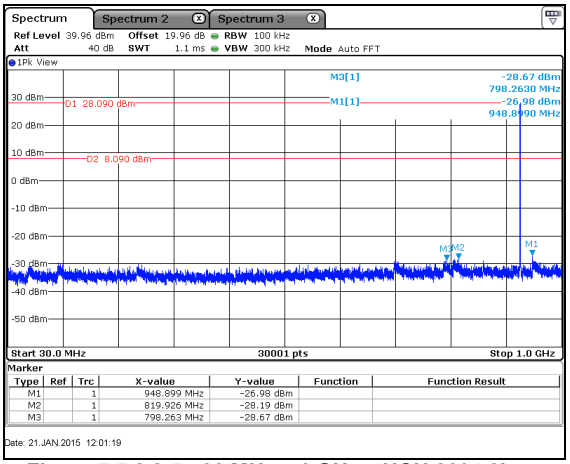

Figure 7.5.2.2-5: 30 MHz – 1 GHz – HCH 2604.2bps

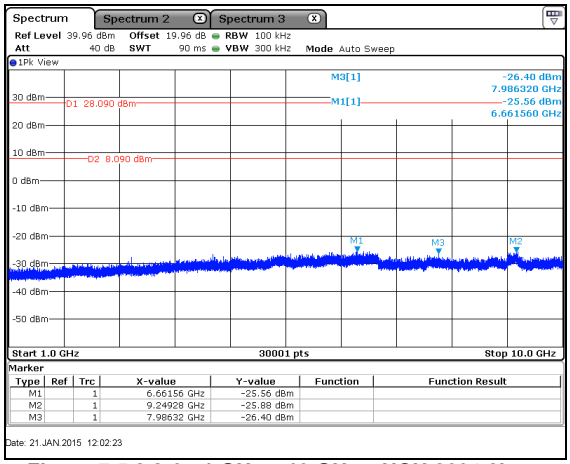

Figure 7.5.2.2-6: 1 GHz – 10 GHz – HCH 2604.2bps

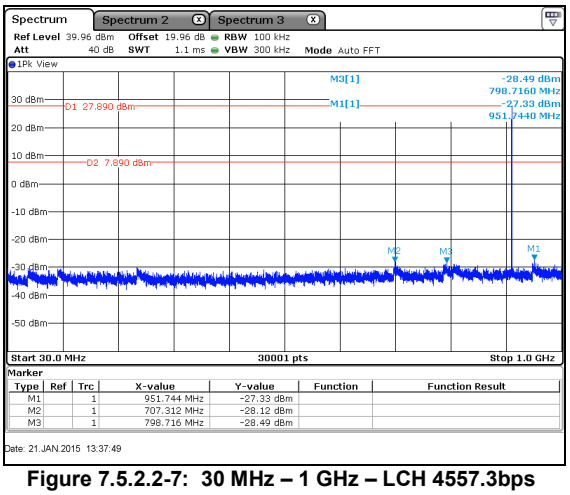

Figure 7.5.2.2-7: 30 MHz – 1 GHz – LCH 4557.3bps

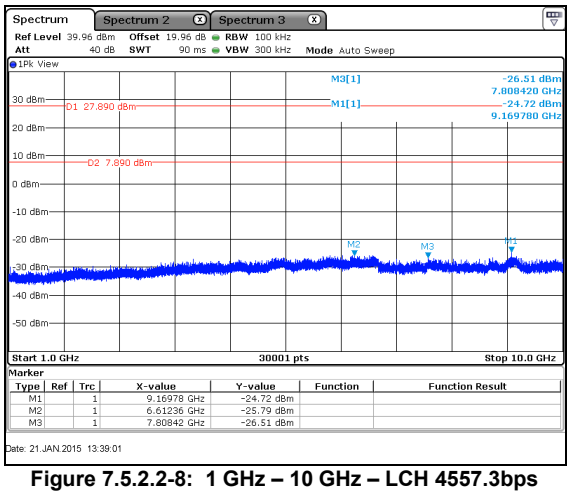

Figure 7.5.2.2-8: 1 GHz – 10 GHz – LCH 4557.3bps

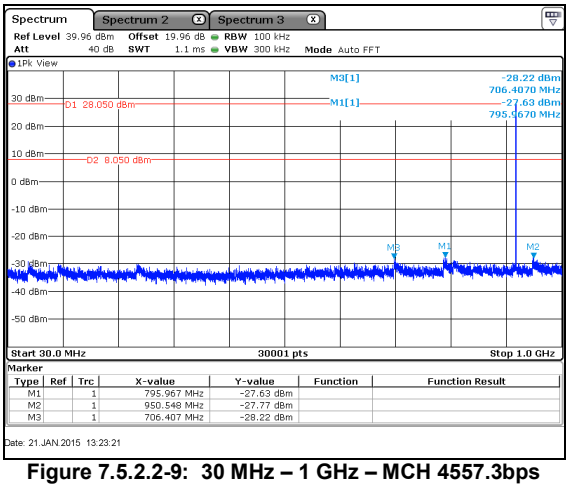

Figure 7.5.2.2-9: 30 MHz – 1 GHz – MCH 4557.3bps

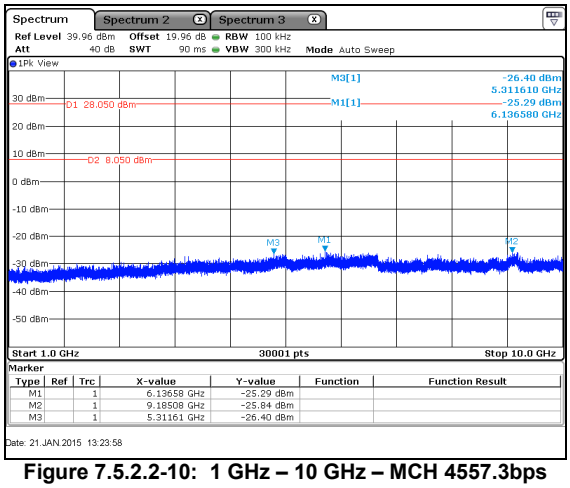

Figure 7.5.2.2-10: 1 GHz – 10 GHz – MCH 4557.3bps

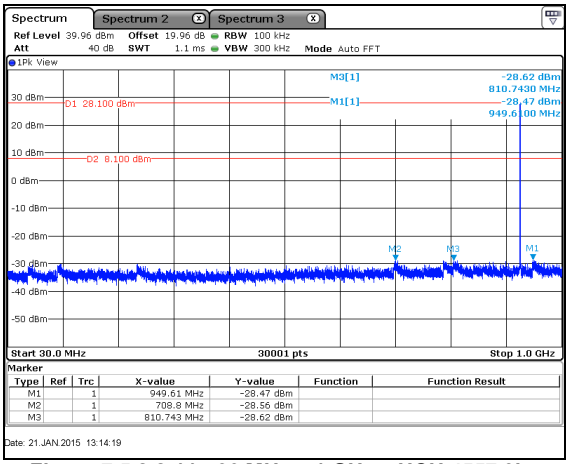

Figure 7.5.2.2-11: 30 MHz – 1 GHz – HCH 4557.3bps

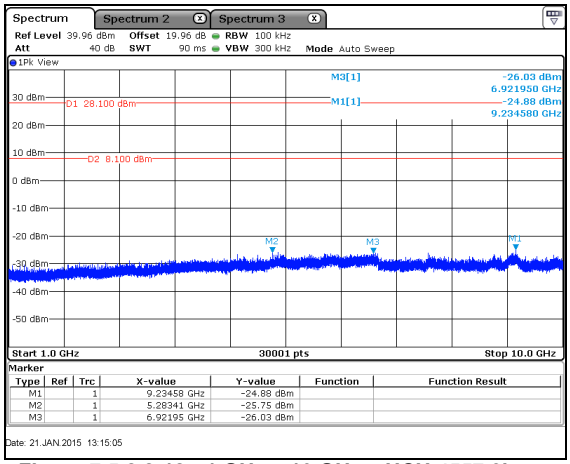

Figure 7.5.2.2-12: 1 GHz – 10 GHz – HCH 4557.3bps

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 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 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.

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	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
Low Channel										
976.29	---------	51.65	H	1.14	---------	52.79	--------	54.0	---------	1.2
976.29	---------	45.04	V	1.14	---------	46.18	--------	54.0	---------	7.8
2736.930177	51.90	46.43	H	-4.55	47.35	41.88	74.0	54.0	26.7	12.1
2736.930177	50.61	43.87	V	-4.55	46.06	39.32	74.0	54.0	27.9	14.7
3649.240236	50.12	42.57	H	-1.24	48.88	41.33	74.0	54.0	25.1	12.7
3649.240236	48.81	39.07	V	-1.24	47.57	37.83	74.0	54.0	26.4	16.2
4561.550295	50.42	43.62	H	0.77	51.19	44.39	74.0	54.0	22.8	9.6
4561.550295	49.52	40.80	V	0.77	50.29	41.57	74.0	54.0	23.7	12.4
7298.480472	47.26	38.92	H	7.65	54.91	46.57	74.0	54.0	19.1	7.4
7298.480472	47.35	38.23	V	7.65	55.00	45.88	74.0	54.0	19.0	8.1
Middle Channel										
983.51	---------	49.46	H	1.21	---------	50.67	--------	54.0	---------	3.3
983.51	---------	43.65	V	1.21	---------	44.86	--------	54.0	---------	9.1
2758.53369	52.66	48.08	H	-4.46	48.20	43.62	74.0	54.0	25.8	10.4
2758.53369	50.71	42.93	V	-4.46	46.25	38.47	74.0	54.0	27.8	15.5
3678.04492	49.39	40.34	H	-1.14	48.25	39.20	74.0	54.0	25.8	14.8
3678.04492	49.16	39.12	V	-1.14	48.02	37.98	74.0	54.0	26.0	16.0
4597.55615	51.83	45.49	H	0.85	52.68	46.34	74.0	54.0	21.3	7.7
4597.55615	49.33	41.41	V	0.85	50.18	42.26	74.0	54.0	23.8	11.7
7356.08984	47.15	38.77	H	7.73	54.88	46.50	74.0	54.0	19.1	7.5
7356.08984	46.10	36.96	V	7.73	53.83	44.69	74.0	54.0	20.2	9.3
High Channel										
992	---------	43.01	H	1.66	---------	44.67	--------	54.0	---------	9.3
992	---------	39.05	V	1.66	---------	40.71	--------	54.0	---------	13.3
2781.037353	53.21	49.56	H	-4.37	48.84	45.19	74.0	54.0	25.2	8.8
2781.037353	51.13	45.85	V	-4.37	46.76	41.48	74.0	54.0	27.2	12.5
3708.049804	50.01	41.79	H	-1.04	48.97	40.75	74.0	54.0	25.0	13.2
3708.049804	48.91	38.44	V	-1.04	47.87	37.40	74.0	54.0	26.1	16.6
4635.062255	48.52	41.13	H	0.93	49.45	42.06	74.0	54.0	24.6	11.9
4635.062255	50.55	44.02	V	0.93	51.48	44.95	74.0	54.0	22.5	9.1
7416.099608	46.10	36.43	H	7.82	53.92	44.25	74.0	54.0	20.1	9.8
7416.099608	44.94	34.02	V	7.82	52.76	41.84	74.0	54.0	21.2	12.2

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

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
Low Channel										
985.9		48.62	H	1.28	---------	49.90	--------	54.0	---------	4.1
985.9		42.84	V	1.28	---------	44.12	--------	54.0	---------	9.9
2736.930177	49.94	43.69	H	-4.55	45.39	39.14	74.0	54.0	28.6	14.9
2736.930177	52.04	47.27	V	-4.55	47.49	42.72	74.0	54.0	26.5	11.3
3649.240236	51.61	45.80	H	-1.24	50.37	44.56	74.0	54.0	23.6	9.4
3649.240236	50.12	43.44	V	-1.24	48.88	42.20	74.0	54.0	25.1	11.8
4561.550295	51.72	45.98	H	0.77	52.49	46.75	74.0	54.0	21.5	7.2
4561.550295	48.92	41.66	V	0.77	49.69	42.43	74.0	54.0	24.3	11.6
7298.480472	47.86	40.09	H	7.65	55.51	47.74	74.0	54.0	18.5	6.3
7298.480472	48.03	41.28	V	7.65	55.68	48.93	74.0	54.0	18.3	5.1
8210.790531	46.89	37.60	H	8.04	54.93	45.64	74.0	54.0	19.1	8.4
8210.790531	45.93	35.95	V	8.04	53.97	43.99	74.0	54.0	20.0	10.0
Middle Channel										
992.35		48.62	H	1.71	---------	50.33	--------	54.0	---------	3.7
992.35		41.21	V	1.71	---------	42.92	--------	54.0	---------	11.1
2758.53369	50.74	44.76	H	-4.46	46.28	40.30	74.0	54.0	27.7	13.7
2758.53369	53.42	49.33	V	-4.46	48.96	44.86	74.0	54.0	25.0	9.1
3678.04492	52.66	47.45	H	-1.14	51.52	46.31	74.0	54.0	22.5	7.7
3678.04492	52.66	47.73	V	-1.14	51.52	46.59	74.0	54.0	22.5	7.4
4597.55615	51.36	45.70	H	0.85	52.21	46.55	74.0	54.0	21.8	7.5
4597.55615	49.68	42.98	V	0.85	50.53	43.83	74.0	54.0	23.5	10.2
7356.08984	47.04	39.07	H	7.73	54.77	46.80	74.0	54.0	19.2	7.2
7356.08984	47.48	39.63	V	7.73	55.21	47.36	74.0	54.0	18.8	6.6
8275.60107	46.48	37.01	H	8.08	54.56	45.09	74.0	54.0	19.4	8.9
8275.60107	47.12	38.66	V	8.08	55.20	46.74	74.0	54.0	18.8	7.3
9195.1123	47.63	38.77	H	8.90	56.53	47.67	74.0	54.0	17.5	6.3
9195.1123	48.11	39.37	V	8.90	57.01	48.27	74.0	54.0	17.0	5.7
High Channel										
995.3		46.01	H	2.09	---------	48.10	--------	54.0	---------	5.9
995.3		39.36	V	2.09	---------	41.45	--------	54.0	---------	12.6
2781.037353	50.83	45.72	H	-4.37	46.46	41.35	74.0	54.0	27.5	12.7
2781.037353	52.73	48.80	V	-4.37	48.36	44.43	74.0	54.0	25.6	9.6
3708.049804	52.71	47.98	H	-1.04	51.67	46.94	74.0	54.0	22.3	7.1
3708.049804	52.43	47.55	V	-1.04	51.39	46.51	74.0	54.0	22.6	7.5
4635.062255	51.23	45.75	H	0.93	52.16	46.68	74.0	54.0	21.8	7.3
4635.062255	48.77	41.84	V	0.93	49.70	42.77	74.0	54.0	24.3	11.2
7416.099608	48.06	41.03	H	7.82	55.88	48.85	74.0	54.0	18.1	5.2
7416.099608	48.69	42.22	V	7.82	56.51	50.04	74.0	54.0	17.5	4.0
8343.112059	45.67	36.38	H	8.13	53.80	44.51	74.0	54.0	20.2	9.5
8343.112059	44.50	34.40	V	8.13	52.63	42.53	74.0	54.0	21.4	11.5

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 (Antenna 1)

Corrected Level: 51.90 - 4.55 = 47.35dBuV/m
Margin: 74dBuV/m – 47.35dBuV/m = 26.7dB

Example Calculation: Average (Antenna 1)

Corrected Level: 46.43 - 4.55 - 0 = 41.88dBuV
Margin: 54dBuV – 41.88dBuV = 12.1dB

8 CONCLUSION

In the opinion of ACS, Inc. the MiNODE-WATER4, 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