Excellence in Compliance Testing

Certification Test Report

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

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-247

ACS Report Number: 15-0147.W04.1A

Manufacturer: Mueller Systems, LLC
Model: Repeater Plus Module

Test Begin Date: May 12, 2015
Test End Date: May 29, 2015

Report Issue Date: June 15, 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 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-247 Certification for a class II permissive change.

The purpose of this permissive change is to add two antennas, a new shield height, and output filter value changes to the originally certified 900MHz radio.

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)
1/2λ Monopole / 2.5dBi (Antenna 3)
Whip / 5.0dBi (Antenna 4)

Operating Voltage: 3.6Vdc

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

EUT Serial Number: 37000362

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.

Preliminary measurements were performed and only those characteristics affected by the modifications were evaluated and reported. RF power output was provided for reference only.

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

AC power line conducted emissions was tested in a typical 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=166
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:

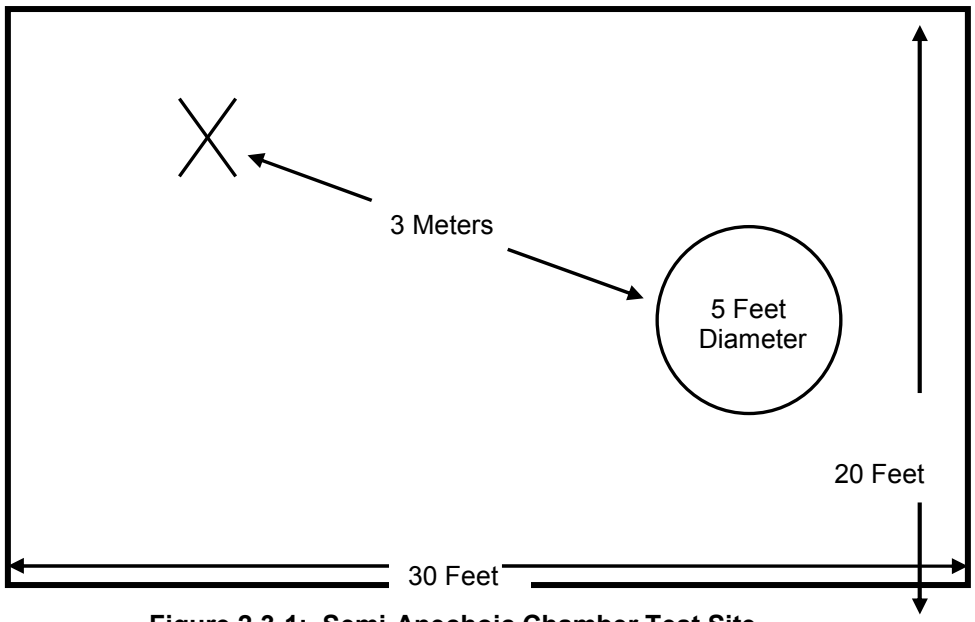


Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

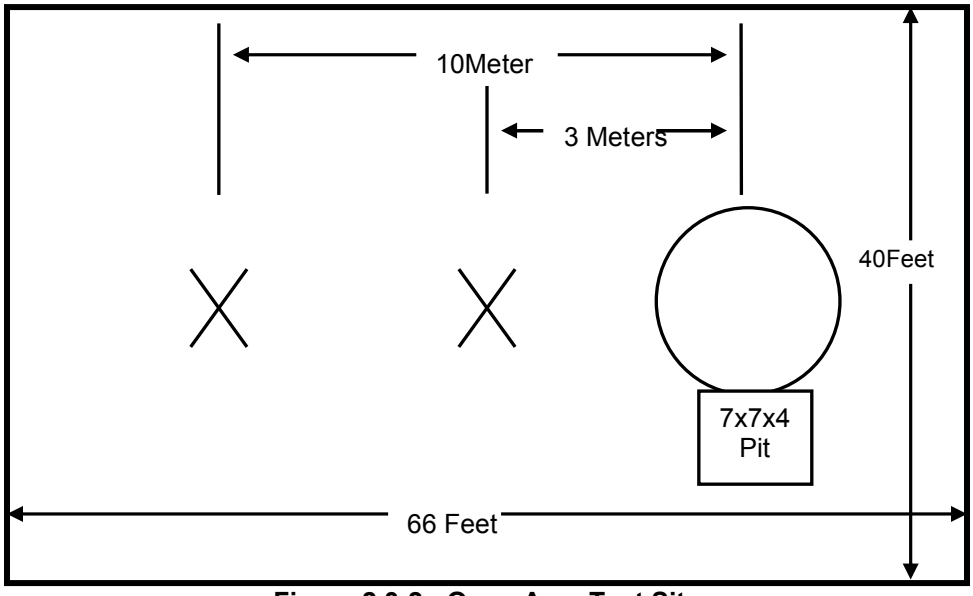


Figure 2.3-2: Open Area Test Site

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:

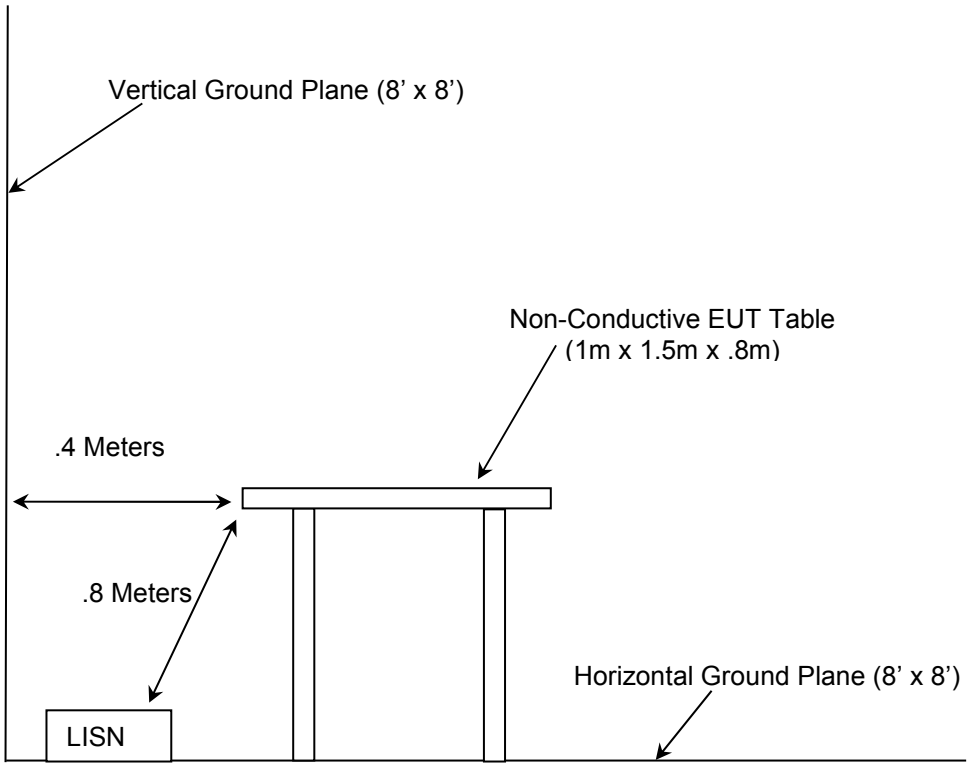


Figure 2.4-1: AC Mains Conducted EMI Site

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 – Industry Canada reference only
- ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices – FCC reference only
- 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
- Industry Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 1, May 2015.
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, 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

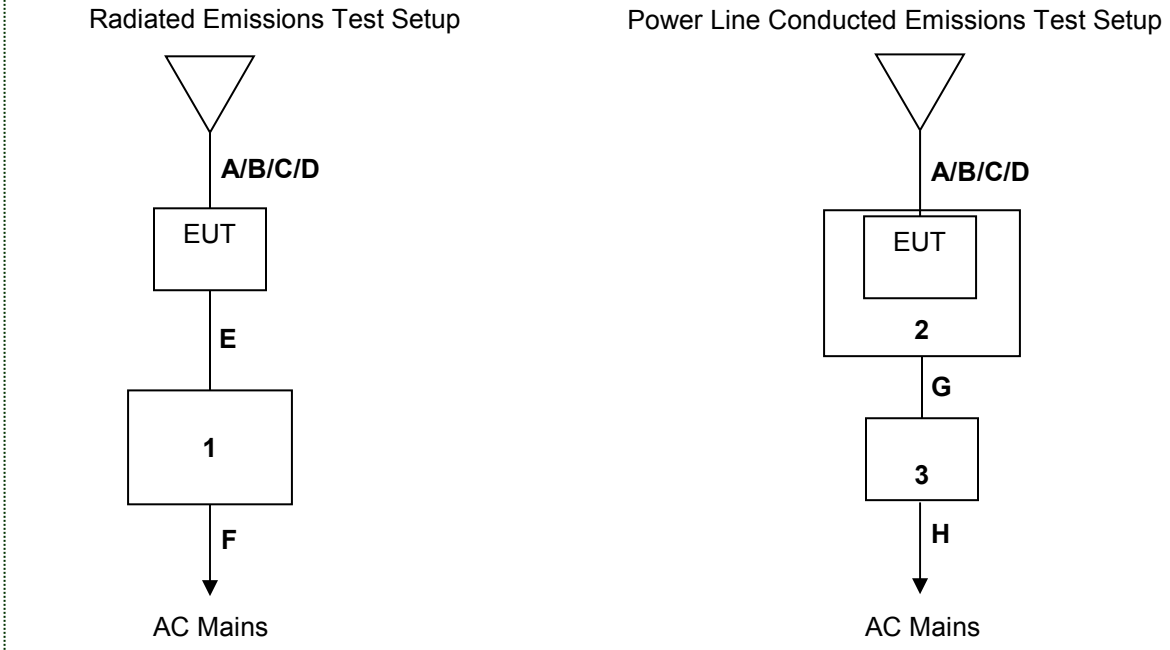
AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	7/11/2014	7/11/2015
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	7/11/2014	7/11/2015
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/30/2015	4/30/2017
40	EMCO	3104	Antennas	3211	2/10/2015	2/10/2017
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
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
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	3/3/2015	3/3/2016
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
337	Microwave Circuits	H1G513G1	Filters	282706	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
RE112	Rohde & Schwarz	ESIB26	Receiver	836119/012	10/30/2014	10/30/2015

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

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



A: RF Cable, 220 cm, Shielded – Used with Antenna 1.
B: RF Cable, 7 cm, Shielded – Used with Antenna 2.
C: RF Cable, 25 cm, Shielded – Used with Antenna 3.
D: RF Cable, 360 cm, Shielded – Used with Antenna 4.
E: DC Power Cable (Twisted Pair), 280 cm, Non-Shielded
F: AC Power Cable, 200 cm, Non-Shielded
G: DC Power Cable, 190 cm, Non-Shielded
H: AC Power Cable, 180 cm, Non-Shielded

Note: RF cable lengths represent the worst case cable lengths for each antenna in final installation.

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, Printed Inverted F Antenna with 4.8dBi gain, 1/2λ monopole with 2.5dBi gain, and a Whip with 5dBi 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

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

Frequency (MHz)	Corrected Reading		Limit (dBuV)	Margin (dB)	Line	Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)				
0.190570	---	31.47	53.85	22.38	L1	10.1
0.190570	42.02	---	63.88	21.86	L1	10.1
0.568938	---	35.20	46.00	10.80	L1	10.1
0.568938	36.38	---	56.00	19.62	L1	10.1
0.631563	---	31.00	46.00	15.00	L1	10.1
0.631563	33.14	---	56.00	22.86	L1	10.1
3.987792	---	26.73	46.00	19.27	L1	10.3
3.987792	28.49	---	56.00	27.51	L1	10.3
4.490681	---	25.66	46.00	20.34	L1	10.4
4.490681	27.66	---	56.00	28.34	L1	10.4
4.934770	---	26.67	46.00	19.33	L1	10.4
4.934770	28.65	---	56.00	27.35	L1	10.4

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

Frequency (MHz)	Corrected Reading		Limit (dBuV)	Margin (dB)	Line	Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)				
0.187659	---	29.85	53.99	24.14	N	10.1
0.187659	39.37	---	64.01	24.64	N	10.1
0.570040	---	34.54	46.00	11.46	N	10.1
0.570040	35.01	---	56.00	20.99	N	10.1
0.632364	---	29.44	46.00	16.56	N	10.1
0.632364	30.51	---	56.00	25.49	N	10.1
14.685872	---	28.34	50.00	21.66	N	11.2
14.685872	32.44	---	60.00	27.56	N	11.2
15.125752	---	28.49	50.00	21.51	N	11.2
15.125752	32.71	---	60.00	27.29	N	11.2
15.571042	---	28.35	50.00	21.65	N	11.2
15.571042	32.96	---	60.00	27.04	N	11.2

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

Frequency (MHz)	Corrected Reading		Limit (dBuV)	Margin (dB)	Line	Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)				
0.189842	---	32.43	53.89	21.46	L1	10.1
0.189842	43.50	---	63.91	20.41	L1	10.1
0.567435	---	32.31	46.00	13.69	L1	10.1
0.567435	33.94	---	56.00	22.06	L1	10.1
0.631864	---	35.89	46.00	10.11	L1	10.1
0.631864	37.43	---	56.00	18.57	L1	10.1
3.287074	---	27.98	46.00	18.02	L1	10.3
3.287074	29.77	---	56.00	26.23	L1	10.3
4.550000	---	28.22	46.00	17.78	L1	10.4
4.550000	29.86	---	56.00	26.14	L1	10.4
4.992285	---	28.24	46.00	17.76	L1	10.4
4.992285	29.89	---	56.00	26.11	L1	10.4

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

Frequency (MHz)	Corrected Reading		Limit (dBuV)	Margin (dB)	Line	Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)				
0.568336	---	33.87	46.00	12.13	N	10.1
0.568336	34.41	---	56.00	21.59	N	10.1
0.632765	---	27.10	46.00	18.90	N	10.1
0.632765	28.39	---	56.00	27.61	N	10.1
14.516333	---	28.82	50.00	21.18	N	11.2
14.516333	32.43	---	60.00	27.57	N	11.2
15.146193	---	27.95	50.00	22.05	N	11.2
15.146193	32.94	---	60.00	27.06	N	11.2
16.979860	---	28.88	50.00	21.12	N	11.2
16.979860	32.39	---	60.00	27.61	N	11.2
17.923147	---	29.03	50.00	20.97	N	11.3
17.923147	32.35	---	60.00	27.65	N	11.3

Table 7.2.2-5: Conducted EMI Results Line 1 – Antenna 3

Frequency (MHz)	Corrected Reading		Limit (dBuV)	Margin (dB)	Line	Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)				
0.568838	---	35.16	46.00	10.84	L1	10.1
0.568838	36.27	---	56.00	19.73	L1	10.1
0.632164	---	28.76	46.00	17.24	L1	10.1
0.632164	31.00	---	56.00	25.00	L1	10.1
0.693487	---	28.77	46.00	17.23	L1	10.1
0.693487	29.75	---	56.00	26.25	L1	10.1
4.046196	---	23.42	46.00	22.58	L1	10.3
4.046196	26.67	---	56.00	29.33	L1	10.3
4.674850	---	23.45	46.00	22.55	L1	10.4
4.674850	25.68	---	56.00	30.32	L1	10.4
23.510521	---	15.44	50.00	34.56	L1	12.0
23.510521	24.52	---	60.00	35.48	L1	12.0

Table 7.2.2-6: Conducted EMI Results Line 2 – Antenna 3

Frequency (MHz)	Corrected Reading		Limit (dBuV)	Margin (dB)	Line	Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)				
0.194754	---	23.66	53.66	30.00	N	10.1
0.194754	32.92	---	63.69	30.77	N	10.1
0.568838	---	34.36	46.00	11.64	N	10.1
0.568838	34.78	---	56.00	21.22	N	10.1
15.299499	---	28.97	50.00	21.03	N	11.2
15.299499	33.24	---	60.00	26.76	N	11.2
16.188076	---	25.88	50.00	24.12	N	11.2
16.188076	31.12	---	60.00	28.88	N	11.2
16.308717	---	25.03	50.00	24.97	N	11.2
16.308717	30.99	---	60.00	29.01	N	11.2
23.074649	---	21.70	50.00	28.30	N	11.7
23.074649	29.49	---	60.00	30.51	N	11.7

Table 7.2.2-7: Conducted EMI Results Line 1 – Antenna 4

Frequency (MHz)	Corrected Reading		Limit (dBuV)	Margin (dB)	Line	Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)				
0.246894	---	18.11	51.62	33.51	L1	10.1
0.246894	27.01	---	61.66	34.65	L1	10.1
0.306914	---	11.53	49.82	38.29	L1	10.1
0.306914	16.87	---	59.86	42.99	L1	10.1
0.571443	---	32.41	46.00	13.59	L1	10.1
0.571443	33.57	---	56.00	22.43	L1	10.1
2.339779	---	27.44	46.00	18.56	L1	10.2
2.339779	29.21	---	56.00	26.79	L1	10.2
23.065230	---	25.58	50.00	24.42	L1	12.0
23.065230	32.90	---	60.00	27.10	L1	12.0
24.835170	---	23.49	50.00	26.51	L1	12.1
24.835170	31.00	---	60.00	29.00	L1	12.1

Table 7.2.2-8: Conducted EMI Results Line 2 – Antenna 4

Frequency (MHz)	Corrected Reading		Limit (dBuV)	Margin (dB)	Line	Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)				
0.569840	---	33.66	46.00	12.34	N	10.1
0.569840	34.14	---	56.00	21.86	N	10.1
15.169038	---	21.75	50.00	28.25	N	11.2
15.169038	29.34	---	60.00	30.66	N	11.2
15.801503	---	30.21	50.00	19.79	N	11.2
15.801503	33.72	---	60.00	26.28	N	11.2
15.929359	---	30.53	50.00	19.47	N	11.2
15.929359	33.21	---	60.00	26.79	N	11.2
21.558216	---	21.89	50.00	28.11	N	11.5
21.558216	29.44	---	60.00	30.56	N	11.5
23.010120	---	24.89	50.00	25.11	N	11.7
23.010120	32.12	---	60.00	27.88	N	11.7

7.3 Peak Output Power - FCC 15.247(b)(2) IC: RSS-247 5.4(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 with suitable attenuation. 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	29.80
919.511230	29.62
927.012451	29.35

7.4 Radiated Spurious Emissions - FCC 15.205, 15.209; RSS-Gen 8.9/8.10

7.4.1.1 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.

7.4.1.2 Measurement Results

Table 7.4.1.2-1: 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										
2736.930177	52.87	47.70	H	-4.44	48.43	43.26	74.0	54.0	25.6	10.7
2736.930177	49.54	41.99	V	-4.44	45.10	37.55	74.0	54.0	28.9	16.5
3649.240236	48.61	38.81	H	-1.16	47.45	37.65	74.0	54.0	26.6	16.4
3649.240236	49.58	41.15	V	-1.16	48.42	39.99	74.0	54.0	25.6	14.0
4561.550295	48.37	38.58	H	0.86	49.23	39.44	74.0	54.0	24.8	14.6
Middle Channel										
2758.53369	53.31	49.17	H	-4.36	48.95	44.81	74.0	54.0	25.1	9.2
2758.53369	50.53	43.33	V	-4.36	46.17	38.97	74.0	54.0	27.8	15.0
3678.04492	48.27	37.82	H	-1.06	47.21	36.76	74.0	54.0	26.8	17.2
3678.04492	49.44	40.49	V	-1.06	48.38	39.43	74.0	54.0	25.6	14.6
4597.55615	49.18	39.50	H	0.89	50.07	40.39	74.0	54.0	23.9	13.6
4597.55615	48.14	37.44	V	0.89	49.03	38.33	74.0	54.0	25.0	15.7
High Channel										
2781.037353	53.36	49.17	H	-4.28	49.08	44.89	74.0	54.0	24.9	9.1
2781.037353	48.56	40.67	V	-4.28	44.28	36.39	74.0	54.0	29.7	17.6
3708.049804	49.36	39.22	H	-0.95	48.41	38.27	74.0	54.0	25.6	15.7
3708.049804	49.30	40.77	V	-0.95	48.35	39.82	74.0	54.0	25.7	14.2
4635.062255	49.16	40.11	H	0.93	50.09	41.04	74.0	54.0	23.9	13.0
4635.062255	47.14	35.92	V	0.93	48.07	36.85	74.0	54.0	25.9	17.2

Table 7.4.1.2-2: 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										
2736.930177	52.09	46.91	H	-4.44	47.65	42.47	74.0	54.0	26.4	11.5
2736.930177	48.01	38.30	V	-4.44	43.57	33.86	74.0	54.0	30.4	20.1
3649.240236	49.01	39.14	H	-1.16	47.85	37.98	74.0	54.0	26.2	16.0
3649.240236	50.91	43.61	V	-1.16	49.75	42.45	74.0	54.0	24.3	11.6
4561.550295	47.37	37.67	H	0.86	48.23	38.53	74.0	54.0	25.8	15.5
4561.550295	47.22	37.16	V	0.86	48.08	38.02	74.0	54.0	25.9	16.0
Middle Channel										
2758.53369	52.74	47.83	H	-4.36	48.38	43.47	74.0	54.0	25.6	10.5
2758.53369	48.68	39.42	V	-4.36	44.32	35.06	74.0	54.0	29.7	18.9
3678.04492	48.93	39.24	H	-1.06	47.87	38.18	74.0	54.0	26.1	15.8
3678.04492	49.59	41.05	V	-1.06	48.53	39.99	74.0	54.0	25.5	14.0
High Channel										
2781.037353	51.79	46.56	H	-4.28	47.51	42.28	74.0	54.0	26.5	11.7
2781.037353	48.29	39.57	V	-4.28	44.01	35.29	74.0	54.0	30.0	18.7
3708.049804	49.57	40.21	H	-0.95	48.62	39.26	74.0	54.0	25.4	14.7
3708.049804	49.12	39.65	V	-0.95	48.17	38.70	74.0	54.0	25.8	15.3
4635.062255	48.56	39.02	H	0.93	49.49	39.95	74.0	54.0	24.5	14.1
4635.062255	48.35	39.62	V	0.93	49.28	40.55	74.0	54.0	24.7	13.5

Table 7.4.1.2-3: Radiated Spurious Emissions Tabulated Data – Antenna 3

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										
2736.930177	52.17	47.55	H	-4.44	47.73	43.11	74.0	54.0	26.3	10.9
2736.930177	48.03	38.79	V	-4.44	43.59	34.35	74.0	54.0	30.4	19.7
3649.240236	48.12	38.03	H	-1.16	46.96	36.87	74.0	54.0	27.0	17.1
3649.240236	50.04	41.71	V	-1.16	48.88	40.55	74.0	54.0	25.1	13.5
4561.550295	47.04	36.53	H	0.86	47.90	37.39	74.0	54.0	26.1	16.6
7298.480472	45.16	34.01	H	7.85	53.01	41.86	74.0	54.0	21.0	12.1
7298.480472	44.69	33.02	V	7.85	52.54	40.87	74.0	54.0	21.5	13.1
Middle Channel										
2758.53369	52.55	47.80	H	-4.36	48.19	43.44	74.0	54.0	25.8	10.6
2758.53369	51.03	45.26	V	-4.36	46.67	40.90	74.0	54.0	27.3	13.1
3678.04492	48.02	37.49	H	-1.06	46.96	36.43	74.0	54.0	27.0	17.6
3678.04492	50.01	41.73	V	-1.06	48.95	40.67	74.0	54.0	25.1	13.3
4597.55615	47.62	37.19	H	0.89	48.51	38.08	74.0	54.0	25.5	15.9
High Channel										
2781.037353	53.80	49.66	H	-4.28	49.52	45.38	74.0	54.0	24.5	8.6
2781.037353	51.94	46.76	V	-4.28	47.66	42.48	74.0	54.0	26.3	11.5
3708.049804	48.18	37.62	H	-0.95	47.23	36.67	74.0	54.0	26.8	17.3
3708.049804	50.02	41.35	V	-0.95	49.07	40.40	74.0	54.0	24.9	13.6
4635.062255	48.16	38.56	H	0.93	49.09	39.49	74.0	54.0	24.9	14.5

Table 7.4.1.2-4: Radiated Spurious Emissions Tabulated Data – Antenna 4

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										
2736.930177	52.86	47.98	H	-4.44	48.42	43.54	74.0	54.0	25.6	10.5
2736.930177	51.08	45.39	V	-4.44	46.64	40.95	74.0	54.0	27.4	13.1
3649.240236	49.03	39.09	H	-1.16	47.87	37.93	74.0	54.0	26.1	16.1
3649.240236	50.02	41.61	V	-1.16	48.86	40.45	74.0	54.0	25.1	13.6
4561.550295	49.06	38.76	H	0.86	49.92	39.62	74.0	54.0	24.1	14.4
4561.550295	47.04	35.11	V	0.86	47.90	35.97	74.0	54.0	26.1	18.0
7298.480472	45.02	33.28	H	7.85	52.87	41.13	74.0	54.0	21.1	12.9
Middle Channel										
2758.53369	53.04	47.95	H	-4.36	48.68	43.59	74.0	54.0	25.3	10.4
2758.53369	51.10	44.81	V	-4.36	46.74	40.45	74.0	54.0	27.3	13.6
3678.04492	48.46	38.99	H	-1.06	47.40	37.93	74.0	54.0	26.6	16.1
3678.04492	48.21	38.84	V	-1.06	47.15	37.78	74.0	54.0	26.9	16.2
4597.55615	48.45	40.11	H	0.89	49.34	41.00	74.0	54.0	24.7	13.0
4597.55615	48.59	39.80	V	0.89	49.48	40.69	74.0	54.0	24.5	13.3
High Channel										
2781.037353	53.87	49.83	H	-4.28	49.59	45.55	74.0	54.0	24.4	8.5
2781.037353	49.30	41.89	V	-4.28	45.02	37.61	74.0	54.0	29.0	16.4
3708.049804	48.16	38.46	H	-0.95	47.21	37.51	74.0	54.0	26.8	16.5
3708.049804	49.15	40.44	V	-0.95	48.20	39.49	74.0	54.0	25.8	14.5
4635.062255	48.39	40.06	H	0.93	49.32	40.99	74.0	54.0	24.7	13.0
4635.062255	47.24	36.88	V	0.93	48.17	37.81	74.0	54.0	25.8	16.2

7.4.1.3 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 (Antenna 1)

Corrected Level: 52.87 - 4.44 = 48.43dBuV/m
Margin: 74dBuV/m – 48.43dBuV/m = 25.6dB

Example Calculation: Average (Antenna 1)

Corrected Level: 47.70 - 4.44 - 0 = 43.26dBuV
Margin: 54dBuV – 43.26dBuV = 10.7dB

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-247.

END REPORT