



Certification Test Report

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

**FCC Rule Part: 15.247
ISED Canada's Radio Standards Specification: RSS-247**

Report Number: BO72126877.200

Applicant: Mueller Systems

Model(s): MiHUB-TTU

**Test Begin Date: April 19, 2017
Test End Date: June 14, 2017**

Report Issue Date: August 24, 2017



FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

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This report contains 31 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 Section 15.247 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein.

1.2 Applicant Information

Mueller Systems
48 Leona Drive, Suite C
Middleboro, MA 02346

1.3 Product Description

The MIHUB-TTU is intended for use as an unattended data collector for automatic meter monitoring and control applications. The device contains a 900 MHz ISM transceiver which operates in both FHSS and DTS modes. The device incorporates a MutiTech MTSMC-H5 cellular modem (FCC ID: RI7HE910/ IC: 5131A-HE910) which provides wireless 3G network connectivity. This test report documents the compliance of the 900 MHz DTS transceiver.

Technical Details

Mode of Operation:	DTS
Frequency Range:	903.65 MHz - 915.73 MHz
Number of Channels:	24
Channel Separation:	525 kHz
Modulations:	DSSS
Antenna Type/Gain:	Omnidirectional Dipole, LCom Model HGV-906U / 6 dBi Omnidirectional Dipole, LCom Model HG908U-PRO / 8 dBi
Input Power:	120V/60 Hz, 15 VDC

Model Number: MiHUB-TTU

Test Sample Serial Number(s): 42000351

Test Sample Condition: The EUT was in good condition without any physical damage.

1.4 Test Methodology and Considerations

The equipment RF output power was not configurable during the evaluation. The EUT was configured to the maximum RF output power per the manufacturer. The RF conducted emissions were measured at the output of the external amplifier.

The device was evaluated in the orientation of typical installation. The radiated spurious and power line conducted emissions evaluations were performed using the two antenna models. Where applicable the worst case results are reported.

The device was also evaluated for unintentional emissions. The results are documented in a separate test report.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

TÜV SÜD America, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
<http://www.tuv-sud-america.com>

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD AMERICA, INC. is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ANAB program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

FCC Test Firm Registration #: 475089
Innovation, Science and Economic Development Canada Lab Code: 4175A

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which can support a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

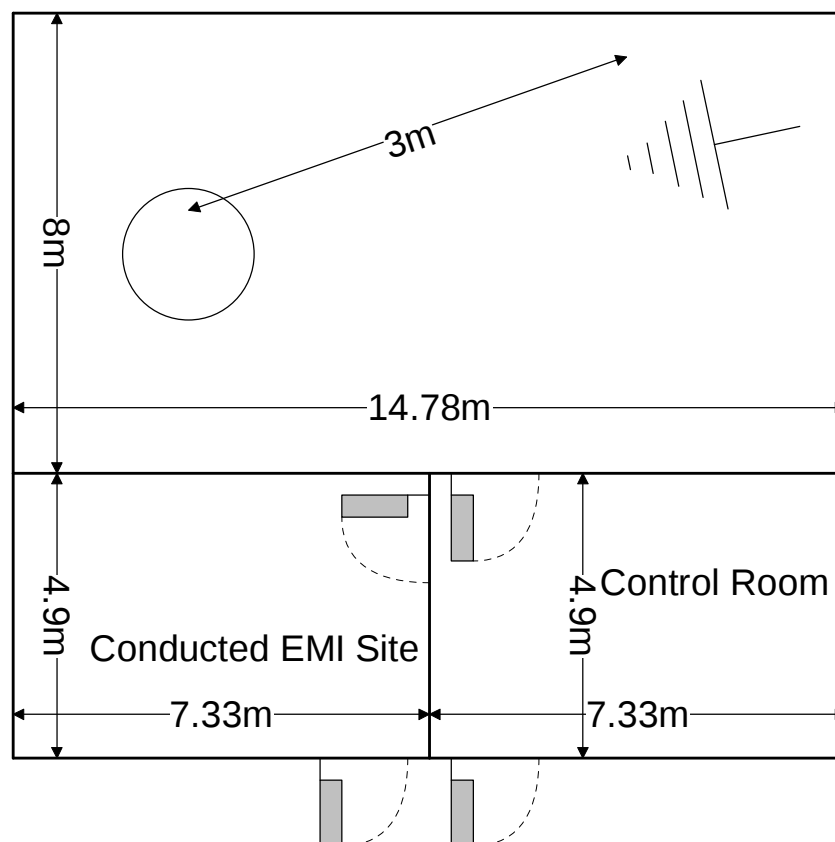


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m³. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω /50 μ H and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

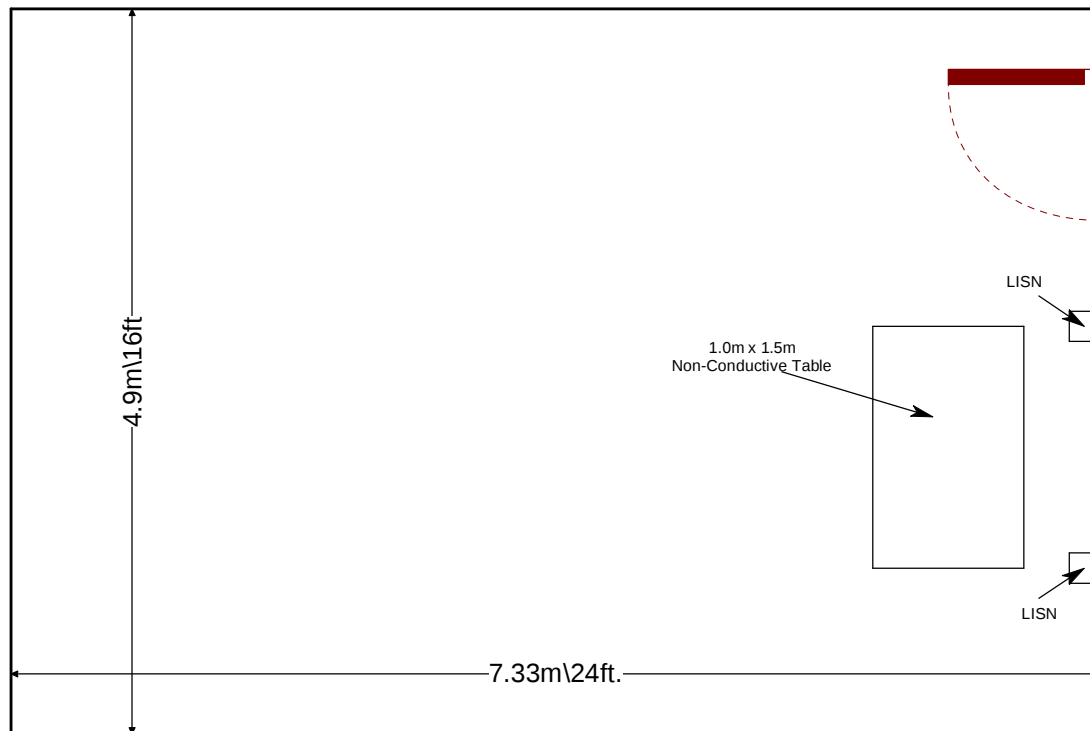


Figure 2.3.2-1: AC Mains Conducted EMI Site

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, 2017.
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2017
- ❖ FCC KDB 558074 D01 DTS Meas Guidance v04 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247, April 5, 2017.
- ❖ Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-247 — Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
- ❖ Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 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 List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
78	EMCO	6502	Antennas	9104-2608	5/11/2016	5/11/2018
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	7/21/2016	7/21/2018
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/9/2016	12/9/2018
2002	EMCO	3108	Antennas	2147	11/19/2015	11/19/2017
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2006	EMCO	3115	Antennas	2573	4/7/2017	4/7/2019
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/2/2016	11/2/2017
2022	EMCO	LISN3825/2R	LISN	1095	9/14/2015	9/14/2017
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	10/31/2016	10/31/2017
2071	Trilithic, Inc.	4HC1400-1-KK	Filter	9643263	11/1/2016	11/1/2017
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	11/2/2016	11/2/2017
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/2/2016	12/2/2017
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/20/2016	7/20/2017
2112	Teledyne Storm Products	921-0101-036	Cables	12-06-698	11/2/2016	11/2/2017
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	8/1/2016	8/1/2017
3004	Teseq	CFL 9206A	Attenuators	34720	9/14/2016	9/14/2017

Note: NCR=No Calibration Required

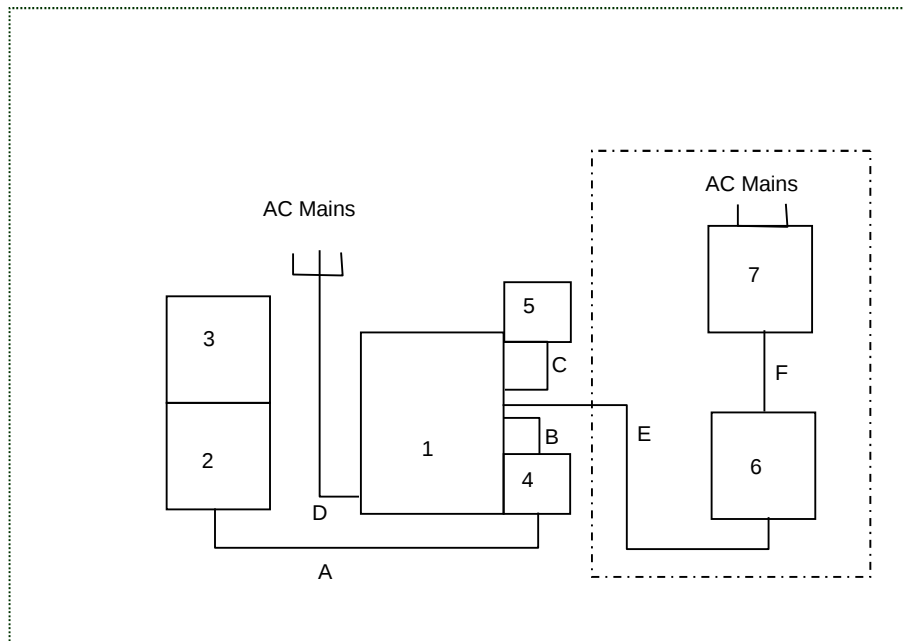
5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Mueller Systems	MiHUB-TTU	42000351
2	EUT (PA)	Mueller Systems	MS-G-EX-TTU-KIT-R	#2
3	Antenna	L-Com HyperLink Technologies	HG908U-PRO	#3
			HGV-906U	#4
4	Surge Protector	PolyPhaser	CGX+15NFNF-A	DL2013000023087
5	Cellular Antenna	Taoglas	FW.91.TNC.M	N/A
6	Ethernet Switch	NetGear	GS108	2162463553EED
7	Power Supply	Sagemcom	MSP-C0500IC12.0-6W-US	021308070448920

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	Coaxial	1.83 m	Yes	Surger Protector to Power Amplifier
B	Coaxial	1.83 m	Yes	Control Unit to Surge Protector
C	Coaxial	1.83 m	Yes	Control Unit to Cell Antenna
D	Power	3.25 m	No	Control Unit to Power Source
E	Ethernet	2.07m / 10 m	No	Control Unit to Ethernet Switch
F	Power	2.2 m	No	Ethernet Switch to Power Supply

6 EQUIPMENT UNDER 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 EUT is marketed with a 8 dBi and a 6 dBi omnidirectional dipole antenna as described in Section 1.3. The EUT uses an N-type connector at the antenna port for the 900 MHz transceiver. The device is professionally installed by trained Mueller technicians only and therefore satisfies the requirements of FCC Section 15.203.

7.2 6 dB Bandwidth - FCC: Section 15.247(a)(2); ISSED Canada: RSS-247 5.2(a); 99% Bandwidth ISSED Canada: RSS-GEN 6.6

7.2.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v04 Section 8.1 Option 1. The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the emissions and >> RBW. A peak detector was used for the measurements.

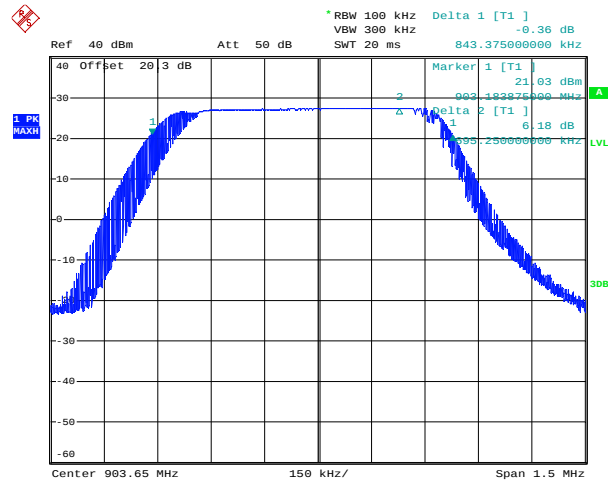
The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission. The RBW was set to 1% to 5% of the approximated bandwidth. The occupied 99% bandwidth was measured by using 99% bandwidth equipment function of the spectrum analyzer using a peak detector.

7.2.2 Measurement Results

Performed by: Thierry Jean-Charles

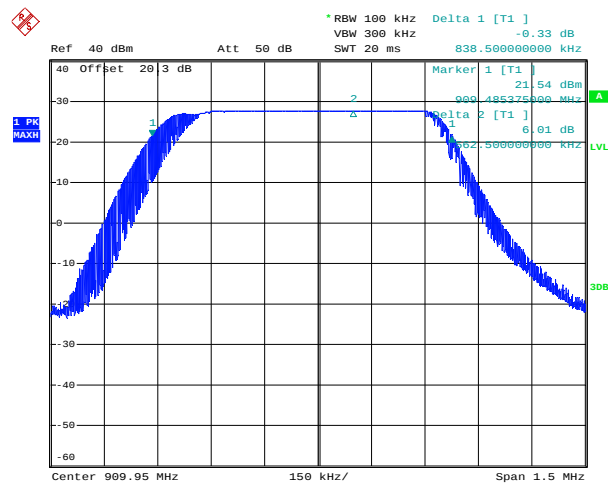
Table 7.2.2-1: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [kHz]	99% Bandwidth [kHz]
903.65	843.375	648.000
909.95	838.500	660.000
915.73	839.625	657.000



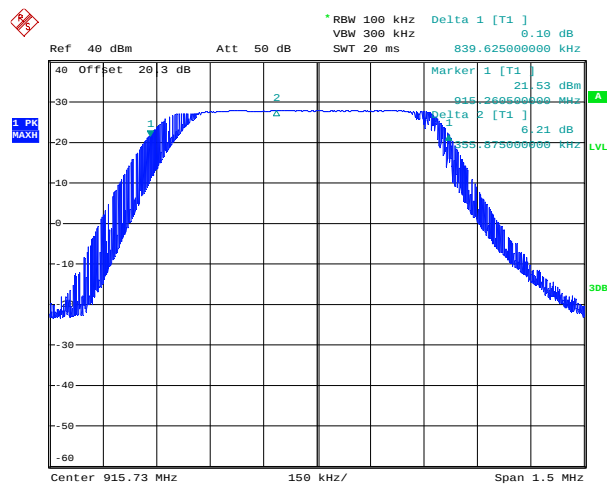
Date: 13.JUN.2017 17:06:18

Figure 7.2.2-1: 6dB BW - Low Channel



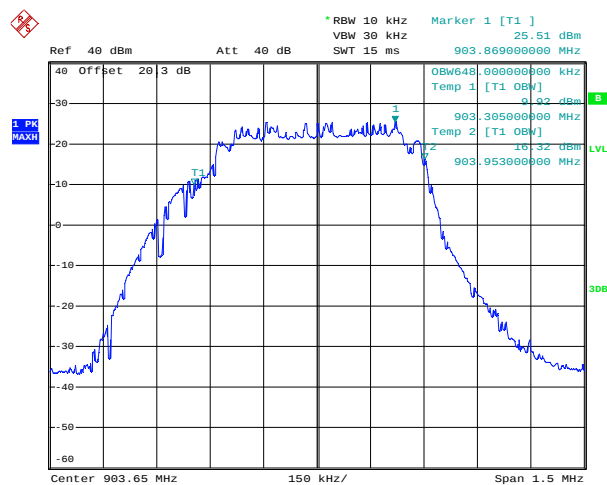
Date: 13.JUN.2017 18:16:09

Figure 7.2.2-2: 6dB BW - Middle Channel



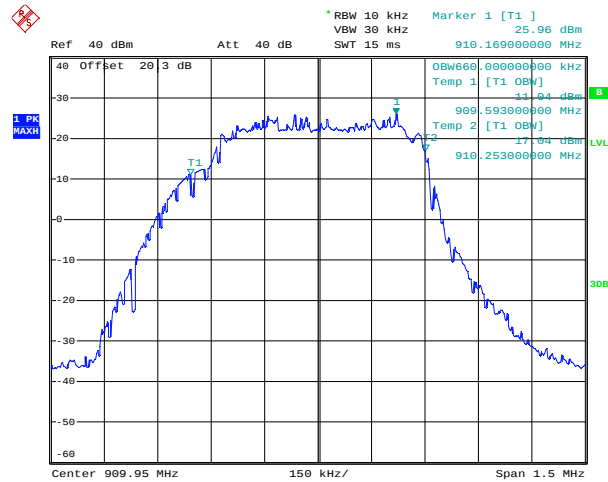
Date: 13.JUN.2017 18:04:49

Figure 7.2.2-3: 6dB BW - High Channel



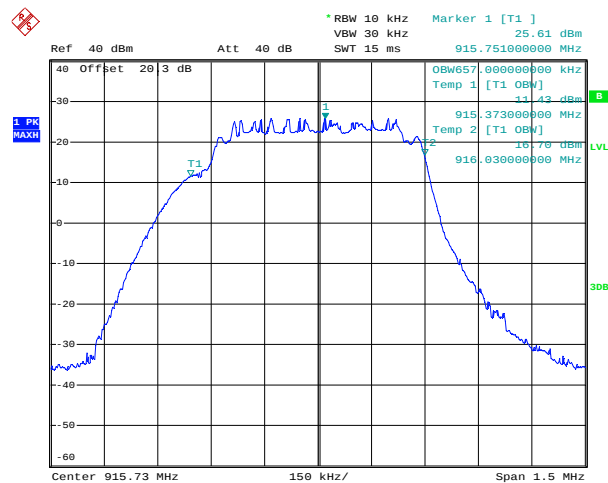
Date: 13.JUN.2017 17:16:15

Figure 7.2.2-4: 99% OBW - Low Channel



Date: 13.JUN.2017 17:46:41

Figure 7.2.2-5: 99% OBW - Middle Channel



Date: 13.JUN.2017 17:56:18

Figure 7.2.2-6: 99% OBW - High Channel

7.3 Peak Output Power – FCC: Section 15.247(b)(3); ISED Canada: RSS-247 5.4(d)

7.3.1 Measurement Procedure (Conducted Method)

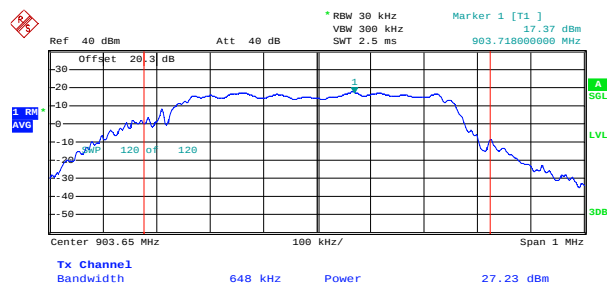
The fundamental emission output power was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v04 Section 9.2.2.2 Method AVGSA-1. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer through suitable attenuation.

7.3.2 Measurement Results

Performed by: Thierry Jean-Charles

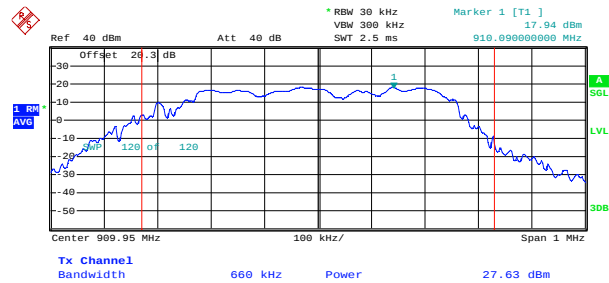
Table 7.3.2-1: RF Output Power

Frequency [MHz]	Level [dBm]
903.65	27.23
909.95	27.63
915.73	27.54



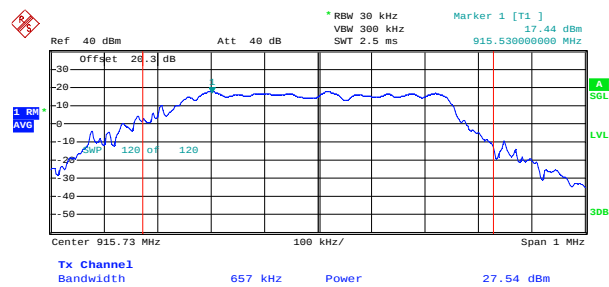
Date: 13.JUN.2017 17:42:14

Figure 7.3.2-1: RF Output Power - Low Channel



Date: 13.JUN.2017 17:48:43

Figure 7.3.2-2: RF Output Power - Middle Channel



Date: 13.JUN.2017 17:58:04

Figure 7.3.2-3: RF Output Power - High Channel

7.4 Band-Edge and Spurious Emissions

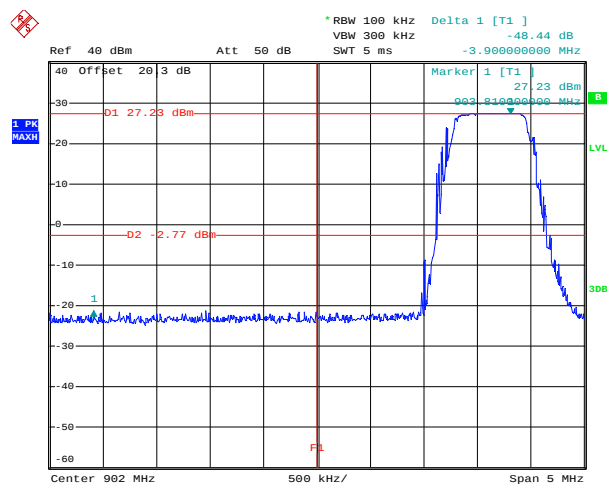
7.4.1 Band-Edge Compliance of RF Conducted Emissions – FCC: Section 15.247(d); ISCED Canada: RSS-247 5.5

7.4.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer via suitable attenuation. 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.

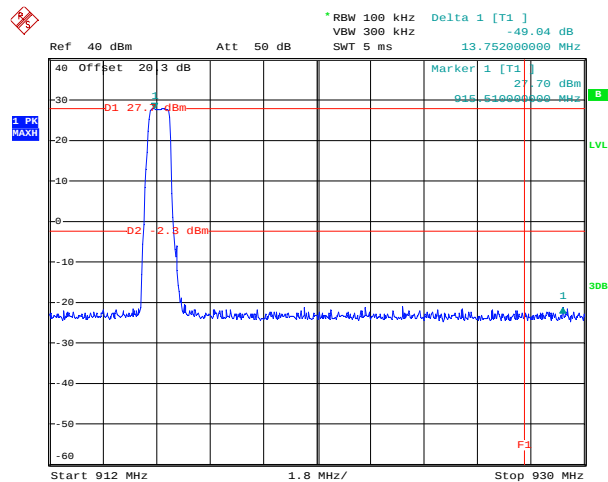
7.4.1.2 Measurement Results

Performed by: Thierry Jean-Charles



Date: 13.JUN.2017 19:00:33

Figure 7.4.1.2-1: Lower Band-edge



Date: 13.JUN.2017 18:52:19

Figure 7.4.1.2-2: Upper Band-edge

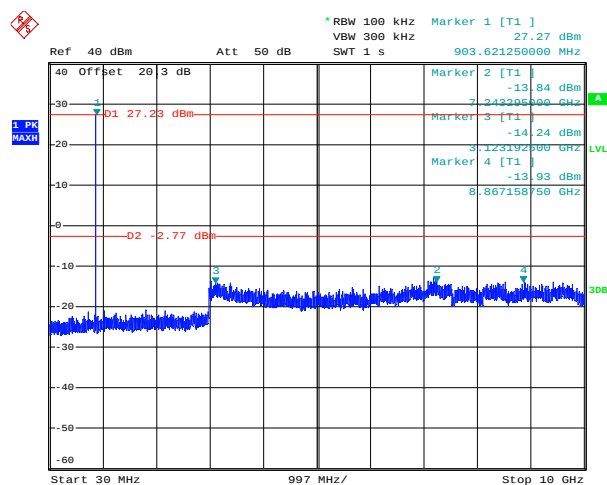
7.4.2 RF Conducted Spurious Emissions – FCC: Section 15.247(d); ISSED Canada: RSS-247 5.5

7.4.2.1 Measurement Procedure

The RF Conducted Spurious Emissions were measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v04 Section 11.3 Emission level measurement. The RF output port of the equipment under test was directly connected to the input of the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30 MHz to 10 GHz, 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 100 kHz and the VBW was set to 300 kHz. The peak Max Hold function of the analyzer was utilized. The reference level was determined by measuring the Peak PSD level in any 100-kHz bandwidth within the DTS channel bandwidth.

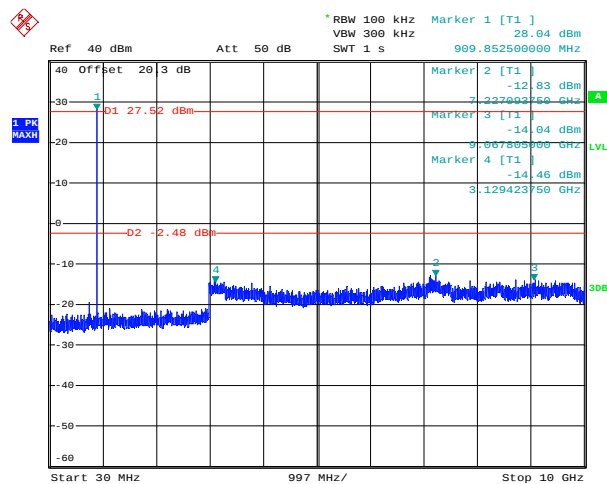
7.4.2.2 Measurement Results

Performed by: Thierry Jean-Charles



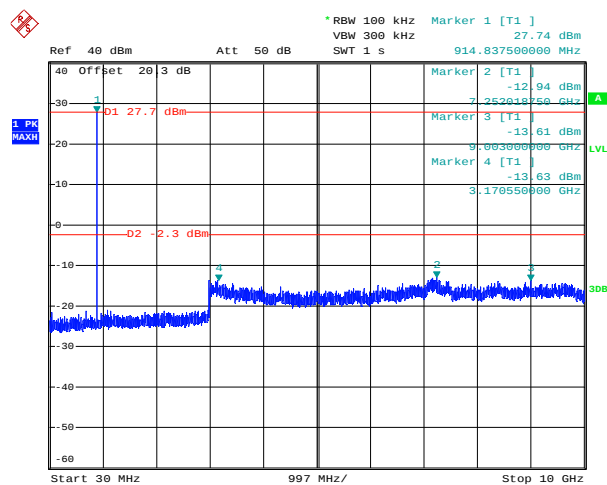
Date: 13.JUN.2017 18:57:17

Figure 7.4.2.2-1: 30 MHz – 10 GHz – Low Channel



Date: 13.JUN.2017 18:55:21

Figure 7.4.2.2-2: 30 MHz – 10 GHz –Middle Channel



Date: 13.JUN.2017 18:47:51

Figure 7.4.2.2-3: 30 MHz – 10 GHz – High Channel

7.4.3 Radiated Spurious Emissions into Restricted Frequency Bands – FCC: Sections 15.205, 15.209; ISED Canada: RSS-Gen 8.9, 8.10**7.4.3.1 Measurement Procedure**

Radiated emissions tests were made over the frequency range of 9 kHz to 10 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in Section 15.209.

For measurements below 30 MHz, the receive antenna height was set to 1m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

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 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz.

7.4.3.2 Measurement Results

Performed by: Jean Rene

Radiated band-edge and spurious emissions found in the restricted frequency bands of 9 kHz to 10 GHz are reported in the tables below.

Table 7.4.3.2-1: Radiated Spurious Emissions Tabulated Data - HG908U-PRO Antenna

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										
2710.95	49.81	39.58	H	-3.48	46.33	36.10	74.0	54.0	27.7	17.9
2710.95	48.77	37.32	V	-3.48	45.29	33.84	74.0	54.0	28.7	20.2
3614.6	46.75	34.22	H	0.05	46.80	34.27	74.0	54.0	27.2	19.7
3614.6	47.82	36.29	V	0.05	47.87	36.34	74.0	54.0	26.1	17.7
4518.25	44.44	30.88	H	2.33	46.77	33.21	74.0	54.0	27.2	20.8
4518.25	43.59	30.18	V	2.33	45.92	32.51	74.0	54.0	28.1	21.5
5421.9	44.08	30.68	H	5.17	49.25	35.85	74.0	54.0	24.7	18.1
5421.9	44.18	30.38	V	5.17	49.35	35.55	74.0	54.0	24.6	18.4
Middle Channel										
2729.85	49.56	39.68	H	-3.39	46.17	36.29	74.0	54.0	27.8	17.7
2729.85	47.58	36.51	V	-3.39	44.19	33.12	74.0	54.0	29.8	20.9
3639.8	46.77	33.93	H	0.16	46.93	34.09	74.0	54.0	27.1	19.9
3639.8	47.92	36.74	V	0.16	48.08	36.90	74.0	54.0	25.9	17.1
4549.75	43.96	30.63	H	2.45	46.41	33.08	74.0	54.0	27.6	20.9
4549.75	43.37	29.90	V	2.45	45.82	32.35	74.0	54.0	28.2	21.6
5459.7	43.76	30.35	H	5.27	49.03	35.62	74.0	54.0	25.0	18.4
5459.7	43.66	30.12	V	5.27	48.93	35.39	74.0	54.0	25.1	18.6
7279.6	45.63	31.41	H	9.15	54.78	40.56	74.0	54.0	19.2	13.4
7279.6	46.60	33.05	V	9.15	55.75	42.20	74.0	54.0	18.2	11.8
High Channel										
2747.175	50.08	40.52	H	-3.31	46.77	37.21	74.0	54.0	27.2	16.8
2747.175	49.06	37.39	V	-3.31	45.75	34.08	74.0	54.0	28.3	19.9
3662.9	46.48	34.01	H	0.25	46.73	34.26	74.0	54.0	27.3	19.7
3662.9	48.58	37.31	V	0.25	48.83	37.56	74.0	54.0	25.2	16.4
4578.625	44.31	30.82	H	2.56	46.87	33.38	74.0	54.0	27.1	20.6
4578.625	43.94	30.14	V	2.56	46.50	32.70	74.0	54.0	27.5	21.3
7325.8	45.91	32.18	H	9.21	55.12	41.39	74.0	54.0	18.9	12.6
7325.8	47.36	33.67	V	9.21	56.57	42.88	74.0	54.0	17.4	11.1

Notes:

All emissions above 7.33 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.4.3.2-2: Radiated Spurious Emissions Tabulated Data – HGV-906U Antenna

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										
2710.95	49.78	39.17	H	-3.48	46.30	35.69	74.0	54.0	27.7	18.3
2710.95	48.61	36.83	V	-3.48	45.13	33.35	74.0	54.0	28.9	20.7
3614.6	46.22	33.59	H	0.05	46.27	33.64	74.0	54.0	27.7	20.4
3614.6	47.49	36.09	V	0.05	47.54	36.14	74.0	54.0	26.5	17.9
4518.25	44.69	30.81	H	2.33	47.02	33.14	74.0	54.0	27.0	20.9
4518.25	43.35	30.15	V	2.33	45.68	32.48	74.0	54.0	28.3	21.5
5421.9	44.17	30.58	H	5.17	49.34	35.75	74.0	54.0	24.7	18.2
5421.9	43.55	30.20	V	5.17	48.72	35.37	74.0	54.0	25.3	18.6
Middle Channel										
2729.85	49.67	39.68	H	-3.39	46.28	36.29	74.0	54.0	27.7	17.7
2729.85	47.82	36.00	V	-3.39	44.43	32.61	74.0	54.0	29.6	21.4
3639.8	46.23	33.93	H	0.16	46.39	34.09	74.0	54.0	27.6	19.9
3639.8	48.05	37.00	V	0.16	48.21	37.16	74.0	54.0	25.8	16.8
4549.75	43.50	30.65	H	2.45	45.95	33.10	74.0	54.0	28.0	20.9
4549.75	43.08	30.09	V	2.45	45.53	32.54	74.0	54.0	28.5	21.5
5459.7	44.79	30.60	H	5.27	50.06	35.87	74.0	54.0	23.9	18.1
5459.7	43.96	30.30	V	5.27	49.23	35.57	74.0	54.0	24.8	18.4
7279.6	45.15	31.06	H	9.15	54.30	40.21	74.0	54.0	19.7	13.8
7279.6	46.06	32.47	V	9.15	55.21	41.62	74.0	54.0	18.8	12.4
High Channel										
2747.175	50.39	40.81	H	-3.31	47.08	37.50	74.0	54.0	26.9	16.5
2747.175	48.29	37.68	V	-3.31	44.98	34.37	74.0	54.0	29.0	19.6
3662.9	46.57	34.10	H	0.25	46.82	34.35	74.0	54.0	27.2	19.6
3662.9	48.30	37.04	V	0.25	48.55	37.29	74.0	54.0	25.4	16.7
4578.625	44.52	30.90	H	2.56	47.08	33.46	74.0	54.0	26.9	20.5
4578.625	43.52	30.25	V	2.56	46.08	32.81	74.0	54.0	27.9	21.2
7325.8	46.19	32.26	H	9.21	55.40	41.47	74.0	54.0	18.6	12.5
7325.8	47.72	33.73	V	9.21	56.93	42.94	74.0	54.0	17.1	11.1

Notes:

All emissions above 7.33 GHz were attenuated below the limits and the noise floor of the measurement equipment.

7.4.3.3 Sample Calculation:

$$R_C = R_U + CF_T$$

Where:

CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)

R_U = Uncorrected Reading

R_C = Corrected Level

AF = Antenna Factor

CA = Cable Attenuation

AG = Amplifier Gain

DC = Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: $49.81 + (-3.48) = 46.33 \text{ dB}\mu\text{V/m}$

Margin: $74 \text{ dB}\mu\text{V/m} - 46.33 \text{ dB}\mu\text{V/m} = 27.7 \text{ dB}$

Example Calculation: Average

Corrected Level: $39.58 + (-3.48) = 36.1 \text{ dB}\mu\text{V/m}$

Margin: $54 \text{ dB}\mu\text{V/m} - 36.1 \text{ dB}\mu\text{V/m} = 17.9 \text{ dB}$

7.5 Power Spectral Density – FCC: Section 15.247(e); ISED Canada: RSS-247 5.2(b)

7.5.1 PSD Measurement Procedure (Conducted Method)

The power spectral density was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v04 Section 10.3 Method AVGPS-1. The RF output port of the EUT was directly connected to the input of the spectrum analyzer. Offset values were input for cable and external attenuation. The spectrum analyzer RBW was set to 3 kHz and VBW 10 kHz. Span was adjusted to 1.5 times the 99% bandwidth and the sweep time was set to auto.

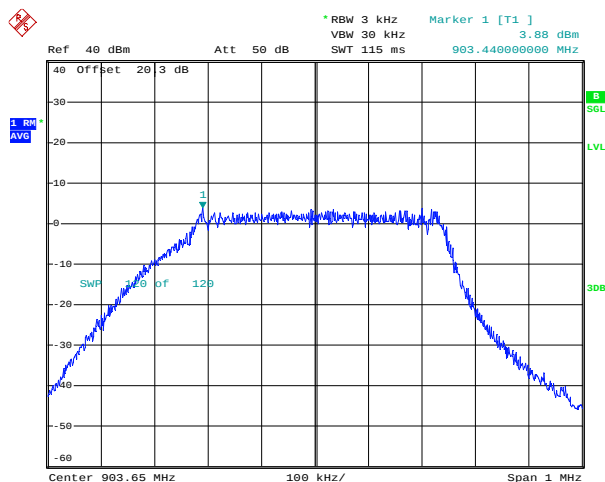
7.5.2 Measurement Results

Performed by: Thierry Jean-Charles

Results are shown below.

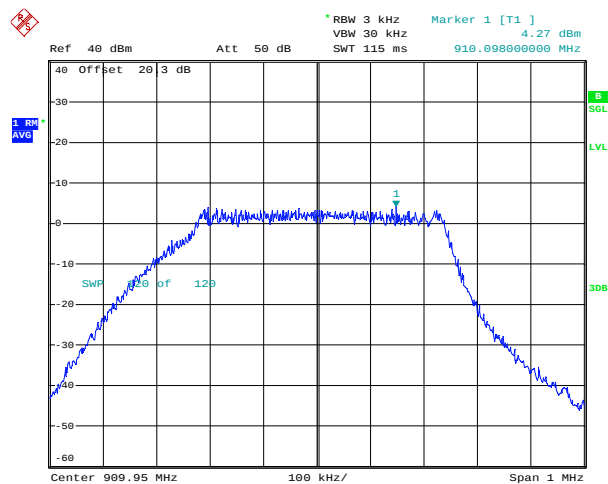
Table 7.5.2-1: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Limit [dBm]	Margin [dB]
903.65	3.88	8.0	4.12
909.95	4.27	8.0	3.73
915.73	4.07	8.0	3.93



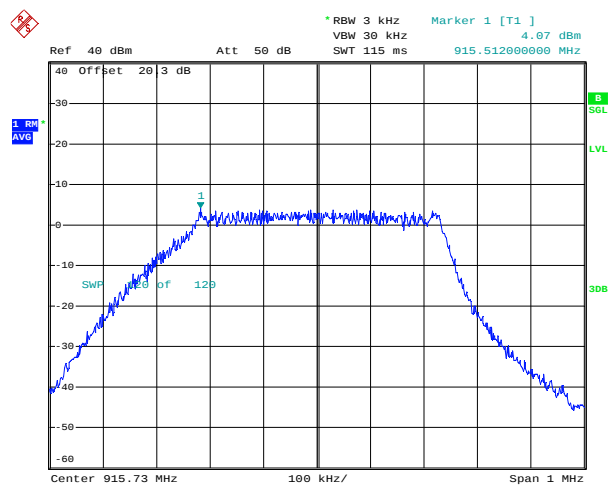
Date: 13.JUN.2017 18:27:42

Figure 7.5.2-1: Power Spectral Density - Low Channel



Date: 13.JUN.2017 18:25:09

Figure 7.5.2-2: Power Spectral Density - Middle Channel



Date: 13.JUN.2017 18:45:17

Figure 7.5.2-3: Power Spectral Density – High Channel

7.6 Power Line Conducted Emissions – FCC: Section 15.207; ISED Canada: RSS-Gen 8.8

7.6.1 Measurement Procedure

ANSI C63.10 section 6.2 was the guiding document for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss

Margin = Applicable Limit - Corrected Reading

7.6.2 Measurement Results

Performed by: Jean Rene

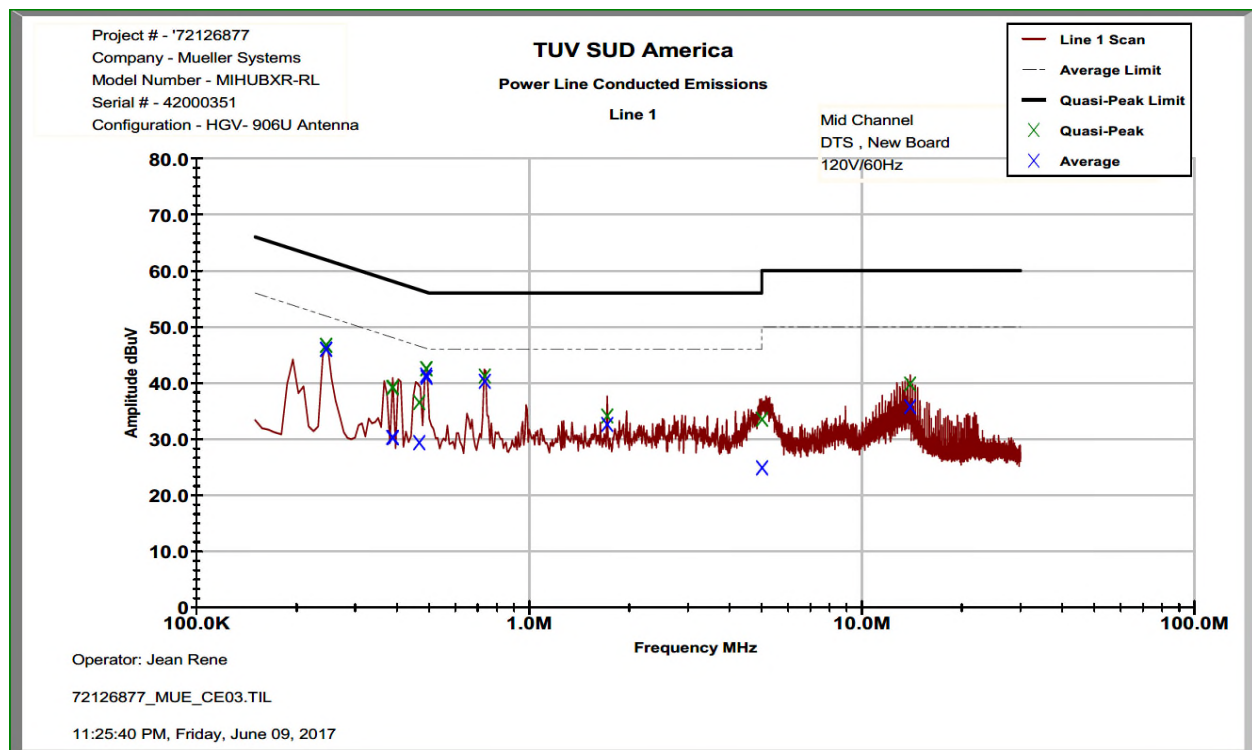


Figure 7.6.2-1: Conducted Emissions Results – Line 1

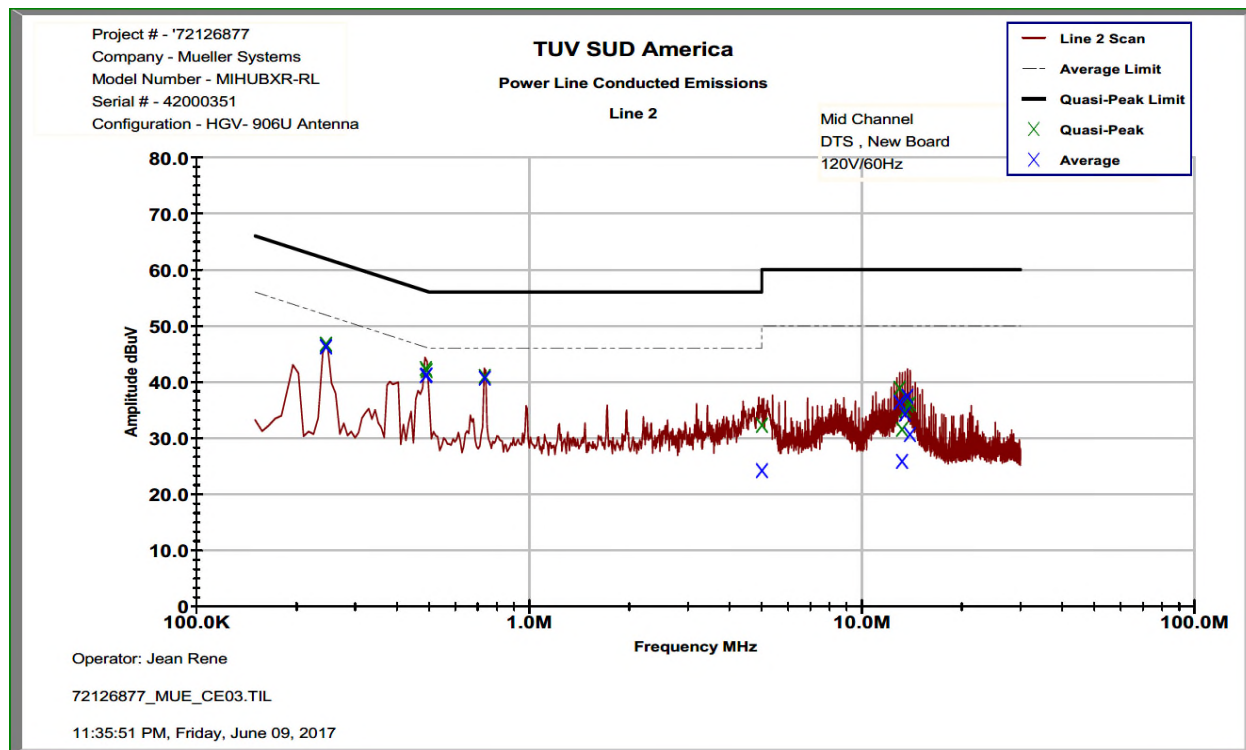


Figure 7.6.2-2: Conducted Emissions Results – Line 2

Table 7.6.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3 ☐ Line 4 ☒ To Ground ☐ Floating ☐ Telecom Port _____ ☒ dBµV ☐ dBµA Plot Number: 72126877 MUE CE03 Power Supply Description: <u>N/A</u>									
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
Line 1									
0.245163	36.403	35.725	10.27	46.67	45.99	61.92	51.92	15.2	5.9
0.387425	28.883	20.016	10.26	39.14	30.27	58.12	48.12	19.0	17.8
0.389749	28.905	19.988	10.26	39.16	30.25	58.07	48.07	18.9	17.8
0.467413	26.221	19.094	10.28	36.50	29.38	56.56	46.56	20.1	17.2
0.490299	32.27	31.123	10.28	42.55	41.41	56.16	46.16	13.6	4.8
0.491175	32.233	30.727	10.28	42.52	41.01	56.15	46.15	13.6	5.1
0.734675	30.952	29.988	10.27	41.22	40.25	56.00	46.00	14.8	5.7
1.71563	23.745	22.216	10.29	34.03	32.50	56.00	46.00	22.0	13.5
5.0122	22.944	14.291	10.55	33.50	24.85	60.00	50.00	26.5	25.2
13.9644	28.83	24.792	10.91	39.74	35.70	60.00	50.00	20.3	14.3
Line 2									
0.244963	36.502	36.05	10.21	46.71	46.26	61.93	51.93	15.2	5.7
0.488949	32.165	30.914	10.23	42.39	41.14	56.19	46.19	13.8	5.0
0.491263	31.782	31.005	10.23	42.01	41.23	56.15	46.15	14.1	4.9
0.735225	30.747	30.423	10.22	40.97	40.65	56.00	46.00	15.0	5.4
5.00855	21.742	13.678	10.53	32.27	24.21	60.00	50.00	27.7	25.8
12.9854	27.96	25.499	10.84	38.80	36.34	60.00	50.00	21.2	13.7
13.2136	20.657	14.928	10.85	31.51	25.78	60.00	50.00	28.5	24.2
13.4791	24.064	23.378	10.86	34.92	34.24	60.00	50.00	25.1	15.8
13.7192	24.948	26.516	10.87	35.81	37.38	60.00	50.00	24.2	12.6
13.9572	25.168	19.727	10.87	36.04	30.60	60.00	50.00	24.0	19.4

8 MEASUREMENT UNCERTAINTIES

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) $k = 1.96$ which provide confidence levels of 95%.

Parameter	U_{lab}
Occupied Channel Bandwidth	$\pm 0.009 \%$
RF Conducted Output Power	$\pm 0.349 \text{ dB}$
Power Spectral Density	$\pm 0.372 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 1.264 \text{ dB}$
Radiated Emissions $\leq 1\text{GHz}$	$\pm 3.93 \text{ dB}$
Radiated Emissions $> 1\text{GHz}$	$\pm 5.814 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	$\pm 2.93 \text{ dB}$

9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the model MiHUB-TTU, manufactured by Mueller Systems, meets the requirements of FCC Part 15.247 and Industry Canada's Radio Standards Specification RSS-247 for the tests documented herein.

END REPORT