



Certification Test Report

**FCC ID: AU792U13A16861
IC: 125A-0058**

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

TÜV SÜD Report Number: RD72129187.200

**Manufacturer: Multi-Tech Systems LLC
Model: MTCAP-LNA3**

**Test Begin Date: June 26, 2017
Test End Date: August 31, 2017**

Report Issue Date: August 25, 2017



FOR THE SCOPE OF ACCREDITATION UNDER LAB Code AT-1921

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 22 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 Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-247 Certification.

1.2 Product Description

The MTCAP-LNA3 is a gateway operating in the ISM band (902-928 MHz). It contains a LoRa transceiver and an LTE/WCDMA bands module. The TELIT LTE/WCDMA is a pre-approved module, FCC ID RI7LE910NAV2. The current evaluation covers the LoRa transceiver only, and focuses on the downlink band 923.3-927.5 MHz.

Technical Information:

Detail	Description
Frequency Range	923.3 – 927.5
Number of Channels	8
Modulation Format	LoRa
Data Rates	SF7-SF12
Number of Inputs/Outputs	1T/1R
Operating Voltage	5 VDC
Antenna Type / Gain	Stamped Metal SMT Antenna /1dBi

Manufacturer Information:

Multi-Tech Systems LLC
2205 Woodales Drive
Mounds View, MN 55122

EUT Serial Numbers: Radiated Emissions: 0007, Conducted Emissions: 0008

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

1.3 Test Methodology and Considerations

The EUT was programmed for testing using Linux commands provided by the client and passed to the device via an IP terminal. The command lines include settings for maximum power level, the desired frequency, the LoRa bandwidths and data rates, also called spread factors. The spread factors SF7-SF12 have been evaluated and the data for the worse-case spread factor is presented in this report.

The radiated emissions evaluation covers two orientations XY plane that are representative of typical field installation. The final results presented in this report are based on Y-plane determined as worst case.

Radiated intermodulation products due to simultaneous transmission of the TELIT module and the LoRa Transceiver were investigated and no intermodulation products were found above the limits.

The EUT was set to transmit continuously during all test measurements. The RF conducted unit was modified with a SMA connector in the place of the antenna, which allows direct connection to the measuring receiver after adding suitable attenuation.

2 TEST FACILITIES

2.1 Location

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

TÜV SÜD America Inc.
2320 Presidential Drive, Suite 101
Durham, NC 27703
Phone: (919) 381-4235

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-1921 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 Registered Test Site Number: 637011
ISED Canada Test Site Registration Number: 20446

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 18' x 28' x 18' shielded enclosure. The chamber is lined with Samwha Electronics Co. LTD Ferrite Absorber, model number SFA300 (HSN-1). The ferrite tile is 10cm x 10 cm and weighs approximately 1.4lbs. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber. On top of the ferrite tiles is DMAS HT-45 (Dutch Microwave Absorber Solutions) hybrid absorber on all walls except the wall behind the antenna mast which has a shorter DMAS HT-25 absorber.

The turntable is 1.50m in diameter and is located 150cm 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 short #6 copper wire. 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 turntable. 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.

Behind the turntable is a 2' x 6' x 1.5' deep shielded pit used for support equipment if necessary. The pit is equipped with 2 - 4" PVC chase 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:

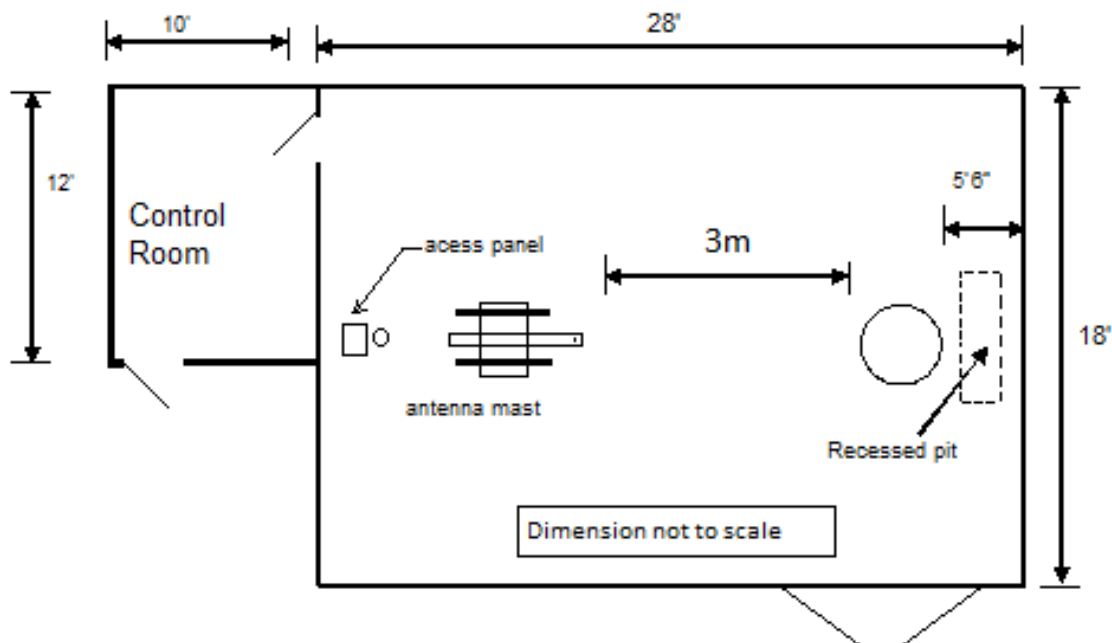


Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 10' sheet galvanized steel horizontal ground reference plane (GRP) bonded every 6" to an 8' X 8' aluminum vertical ground plane.

A diagram of the room is shown below in figure 2.4-1:

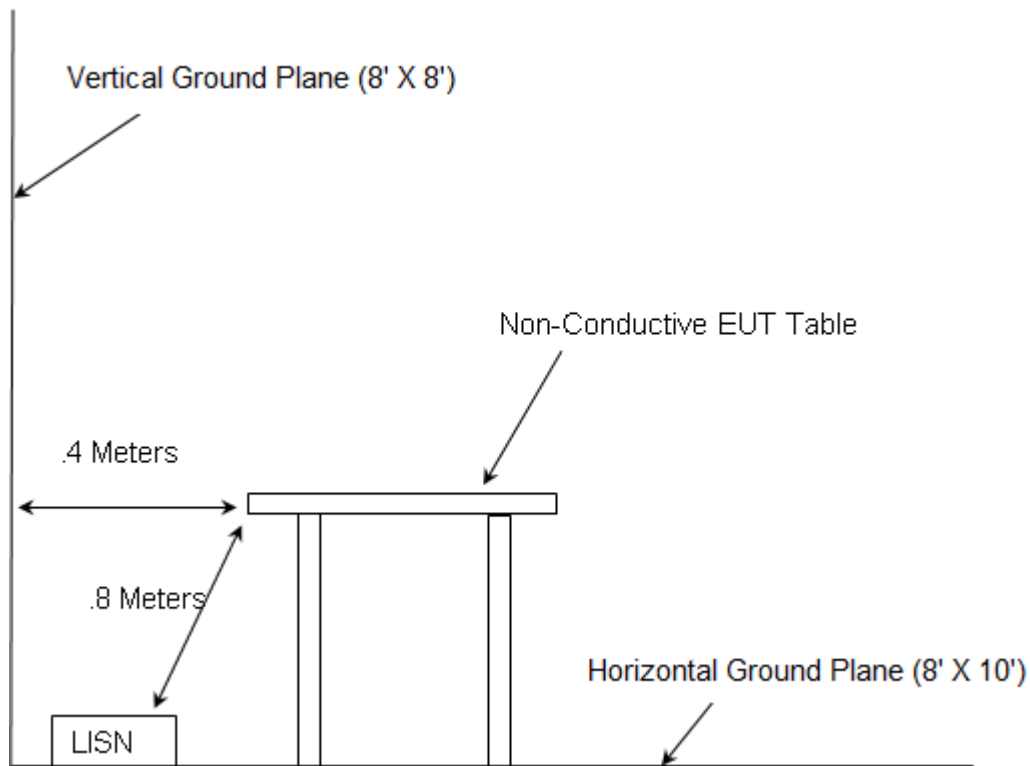


Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.4-2014: American National Standard for Methods of Measurement of Radio-Noise Emissions from low-voltage electrical and electronic equipment in the range of 9kHz to 40 GHz.
- ❖ 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
- ❖ ISED 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
- ❖ ISED 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

Asset ID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
277	EMCO	93146	Antennas	9904-5199	9/12/2016	9/12/2018
626	EMCO	3110B	Antennas	9411-1945	3/21/2017	3/21/2019
3002	Rohde & Schwarz	ESU40	Receiver	100346	1/12/2017	1/12/2018
3006	Rohde & Schwarz	TS-PR18	Amplifiers	122006	1/11/2017	1/11/2018
3008	Rohde & Schwarz	NRP2	Meter	103131	2/6/2017	2/6/2018
3009	Rohde & Schwarz	NRP-Z81	Meter	102397	2/6/2017	2/6/2018
3011	Rohde & Schwarz	ENV216	LISN	3011	1/12/2017	1/12/2018
3012	Rohde & Schwarz	EMC32-EB	Software	100731	NCR	NCR
3016	Fei Teng Wireless Technology	HA-07M18G-NF	Antennas	2013120203	1/26/2016	1/26/2018
3029	Micro-Tronics	HPM50108	Filter	134	1/13/2017	1/13/2018
3036	Hasco, Inc.	HLL142-S1-S1-24	Cables	2450	1/11/2017	1/11/2018
3038	Florida RF Labs	NMSE-290AW-60.0-NMSE	Cable Set	1448	1/3/2017	1/3/2018
3039	Florida RF Labs	NMSE-290AW-396.0-NMSE	Cable Set	1447	1/3/2017	1/3/2018
3051	Mountain View Cable	BMS-RG400-264.0-BMS	Cables	3051	1/3/2017	1/3/2018
3055	Rohde & Schwarz	3005	Cables	3055	1/3/2017	1/3/2018
3085	Rohde & Schwarz	FSW43	Spectrum Analyzer	103997	6/9/2017	6/9/2018

NCR = No Calibration Required

DMAS MT-25 RF absorber material was used on the floor for all final measurements above 1 GHz.

Asset 3002: Firmware Version: ESU40 is 4.73 SP4

Asset 3012: Software Version: EMC32-B is 9.15

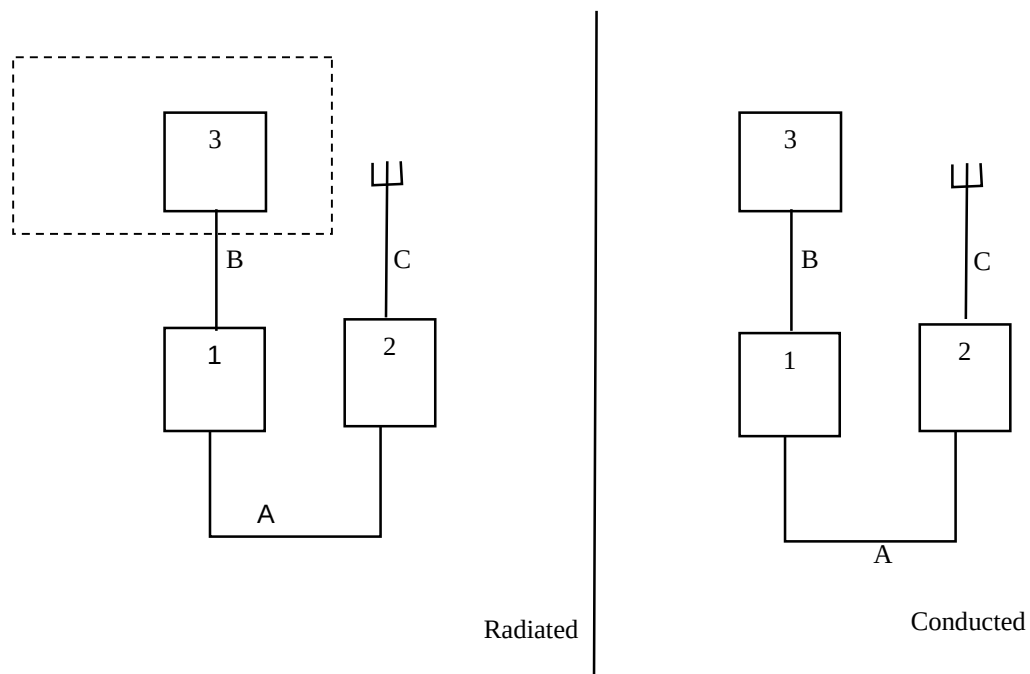
Asset 3085: Instrument Firmware 2.41 SP1

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	Multi-Tech Systems	MTCAP-LNA3	(RE) 0007 (CE) 0008
2	5VDC power Supply	GlobTek, Inc.	GT-41052-1305	N/A
3	Laptop	Dell	Latitude D630	G03F3F1

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



Note: The accessories inside the dotted box were setup outside of the chamber.

Figure 6-1: Test Setup Block Diagram

Table 6-1: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	Power cable	1.75 m	No	1 to 2
B	Ethernet Cable	2 m	No	1 to 3
C	Power Extension	1.8 m	No	2 to AC Mains

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: 15.203

The antenna is integral to the device and cannot be removed or replaced by the end user. Therefore, the antenna requirement of FCC section 15.203 is met.

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

7.2.1 Measurement Procedure

ANSI C63.10-2013 section 6 was the guiding document 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

Performed by: Jean Tezil

Table 7.2.2-1: Conducted EMI Results – Line 1

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	---	31.39	56.00	24.61	2000.0	9.000	L1	OFF	9.7
0.150000	39.80	---	66.00	26.20	2000.0	9.000	L1	OFF	9.7
0.196000	---	22.54	53.61	31.07	2000.0	9.000	L1	OFF	9.7
0.196000	32.37	---	63.63	31.26	2000.0	9.000	L1	OFF	9.7
0.488000	---	22.33	46.18	23.85	2000.0	9.000	L1	OFF	9.7
0.488000	26.90	---	56.19	29.29	2000.0	9.000	L1	OFF	9.7
0.640000	---	19.98	46.00	26.02	2000.0	9.000	L1	OFF	9.7
0.640000	24.81	---	56.00	31.19	2000.0	9.000	L1	OFF	9.7
1.084000	---	17.69	46.00	28.31	2000.0	9.000	L1	OFF	9.7
1.084000	23.20	---	56.00	32.80	2000.0	9.000	L1	OFF	9.7
2.156000	---	16.74	46.00	29.26	2000.0	9.000	L1	OFF	9.7
2.156000	22.49	---	56.00	33.51	2000.0	9.000	L1	OFF	9.7
2.408000	---	18.74	46.00	27.26	2000.0	9.000	L1	OFF	9.7
2.408000	25.21	---	56.00	30.79	2000.0	9.000	L1	OFF	9.7
3.944000	---	12.62	46.00	33.38	2000.0	9.000	L1	OFF	9.8
3.944000	18.37	---	56.00	37.63	2000.0	9.000	L1	OFF	9.8
29.962000	---	11.32	50.00	38.68	2000.0	9.000	L1	OFF	10.2
29.962000	17.60	---	60.00	42.40	2000.0	9.000	L1	OFF	10.2

Table 7.2.2-2: Conducted EMI Results – Line 2

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	---	29.63	56.00	26.37	2000.0	9.000	N	OFF	9.6
0.150000	39.70	---	66.00	26.30	2000.0	9.000	N	OFF	9.6
0.196000	---	21.54	53.61	32.07	2000.0	9.000	N	OFF	9.6
0.196000	32.17	---	63.63	31.46	2000.0	9.000	N	OFF	9.6
0.440000	---	22.81	46.97	24.16	2000.0	9.000	N	OFF	9.7
0.440000	26.79	---	56.99	30.20	2000.0	9.000	N	OFF	9.7
1.240000	---	15.01	46.00	30.99	2000.0	9.000	N	OFF	9.7
1.240000	22.29	---	56.00	33.71	2000.0	9.000	N	OFF	9.7
1.616000	---	16.98	46.00	29.02	2000.0	9.000	N	OFF	9.7
1.616000	22.63	---	56.00	33.37	2000.0	9.000	N	OFF	9.7
2.568000	---	18.03	46.00	27.97	2000.0	9.000	N	OFF	9.7
2.568000	23.81	---	56.00	32.19	2000.0	9.000	N	OFF	9.7
4.304000	---	12.37	46.00	33.63	2000.0	9.000	N	OFF	9.8
4.304000	18.34	---	56.00	37.66	2000.0	9.000	N	OFF	9.8
7.982000	---	5.33	50.00	44.67	2000.0	9.000	N	OFF	9.8
7.982000	11.80	---	60.00	48.20	2000.0	9.000	N	OFF	9.8
15.918000	---	3.58	50.00	46.42	2000.0	9.000	N	OFF	10.0
15.918000	9.34	---	60.00	50.66	2000.0	9.000	N	OFF	10.0
25.358000	---	-2.41	50.00	52.41	2000.0	9.000	N	OFF	10.1
25.358000	3.68	---	60.00	56.32	2000.0	9.000	N	OFF	10.1

7.3 6dB / 99% Bandwidth – FCC: 15.247(a)(2); ISD Canada: RSS-247 5.2(a)

7.3.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v04. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 3 times the RBW. The trace was set to max hold with a peak detector active. The marker-delta function of the spectrum analyzer was utilized to determine the 6 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.

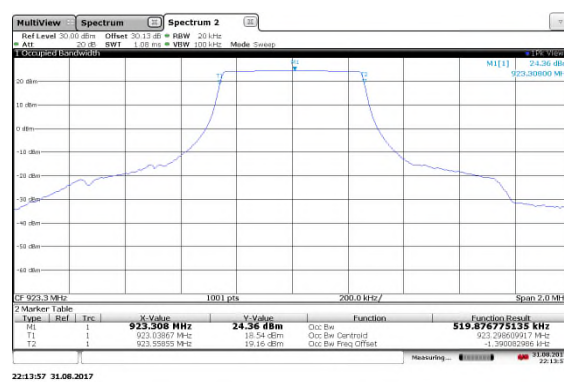
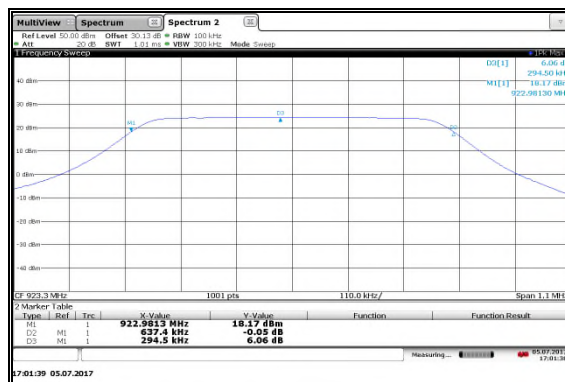
The widest DTS (6dB) bandwidth was determined based on the worse case data rate, which is SF10.

7.3.2 Measurement Results

Performed by: Jean Tezil

Table 7.3.2-1: 6dB / 99% Bandwidth

Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
923.3	0.6374	0.5199
925.1	0.6352	0.5195
927.5	0.6352	0.5190



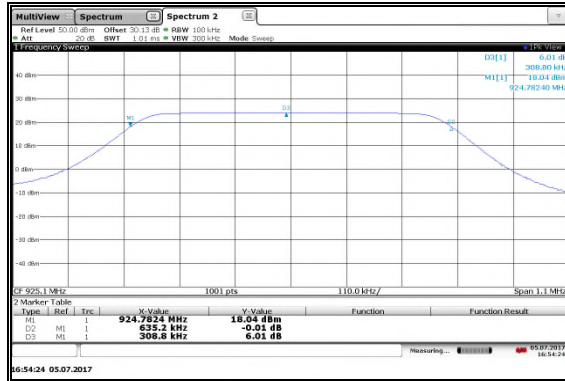


Figure 7.3.2-3: 6dB Bandwidth Mid Channel

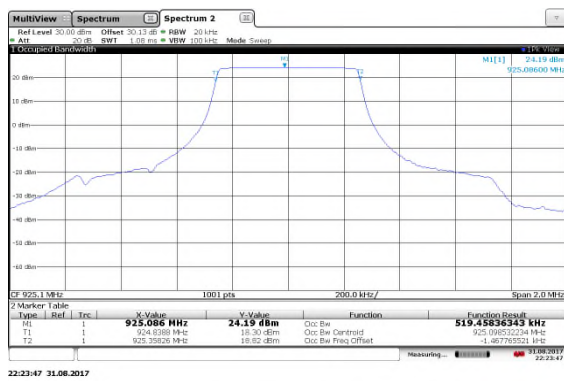


Figure 7.3.2-4: 99% Bandwidth Mid Channel

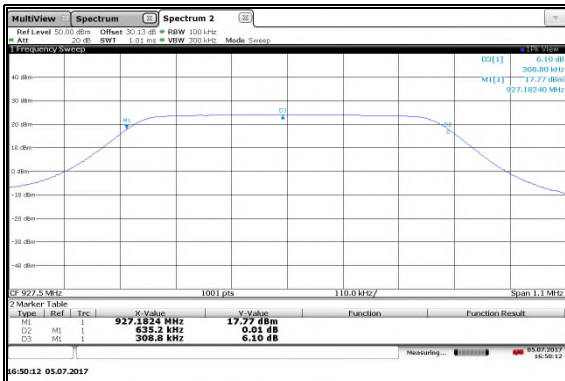


Figure 7.3.2-5: 6dB Bandwidth High Channel

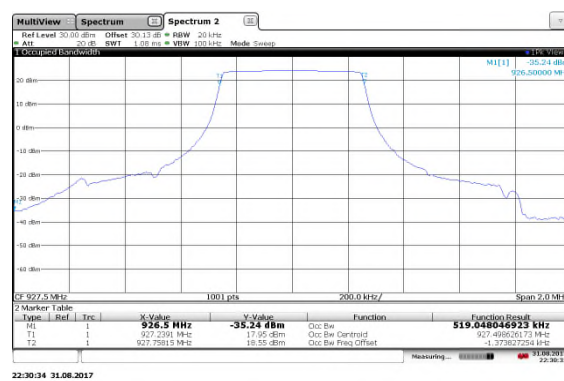


Figure 7.3.2-6: 99% Bandwidth High Channel

7.4 Fundamental Emission Output Power – FCC: 15.247(b)(3); ISCED Canada: RSS-247 5.4(d)

7.4.1 Measurement Procedure

The maximum conducted output power was measured in accordance with FCC KDB 558074 D01 DTS Measurement Guidance v04 utilizing the AVGSA-1 integrated method. The RF output of the equipment under test was directly connected to the input of the Spectrum analyzer applying suitable attenuation. The trace was set to average with a RMS detector active, averaged over 100 sweeps. Then the band power measurement function of the spectrum analyzer was used with the OBW set as the channel bandwidth.

7.4.2 Measurement Results

Performed by: Jean Tezil

Table 7.4.2-1: Maximum Peak Conducted Output Power

Frequency (MHz)	Output Power (dBm)
923.3	24.44
925.1	24.32
927.5	24.02

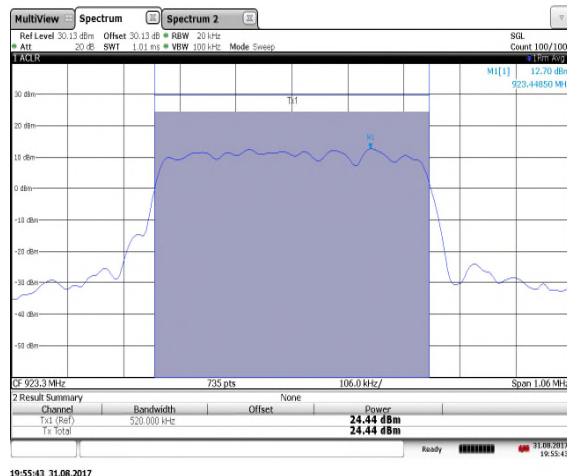


Figure 7.4.2-1: Low Channel

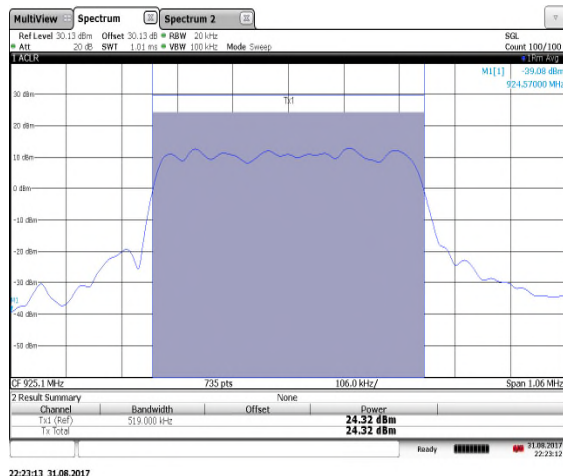


Figure 7.4.2-2: Mid Channel

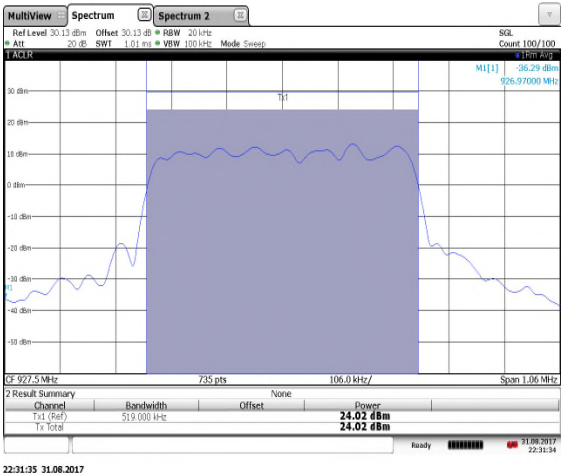


Figure 7.4.2-3: High Channel

7.5 Emission Levels – FCC: 15.247(d), 15.205, 15.209; ISED Canada RSS-247 5.5, RSS-Gen 8.9/8.10

7.5.1 Emissions into Non-restricted Frequency Bands

7.5.1.1 Measurement Procedure

The unwanted emissions into non-restricted bands were measured conducted in accordance with FCC KDB 558074 D01 DTS Measurement Guidance v04. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 300 kHz. Span was set to 1.5 times the DTS bandwidth. The trace was set to max hold with a peak detector active. The resulting spectrum analyzer peak level was used to determine the reference level with respect to the 30 dBc limit. The spectrum span was then adjusted for the measurement of spurious emissions from 30 MHz to 25GHz, 10 times the highest fundamental frequency. Additionally, a prescan was performed from 9 kHz or the lowest frequency generated to 30 MHz.

Band-edge compliance was determined using the conducted marker-delta method in which the radio frequency power that is produced by the EUT is at least 30 dBc below that in the 100 kHz bandwidth within the band that contains the highest level of desired power.

7.5.1.2 Measurement Results

Performed by: Jean Tezil

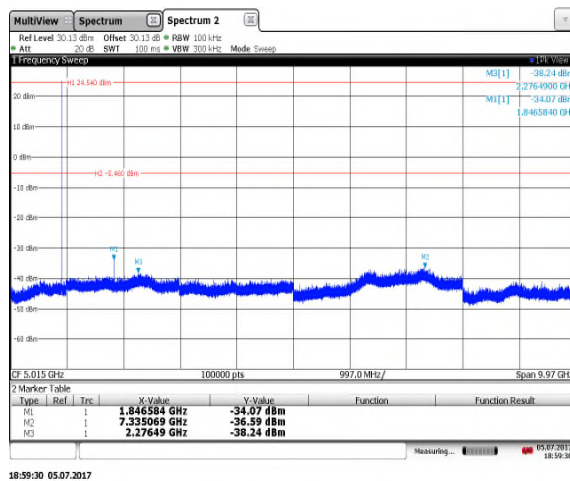


Figure 7.5.1.2-1: 30 MHz – 10 GHz – LCH

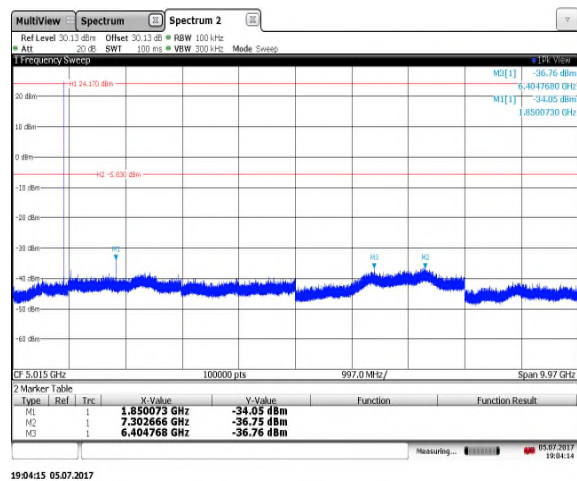


Figure 7.5.1.2-2: 30 MHz – 10 GHz – MCH

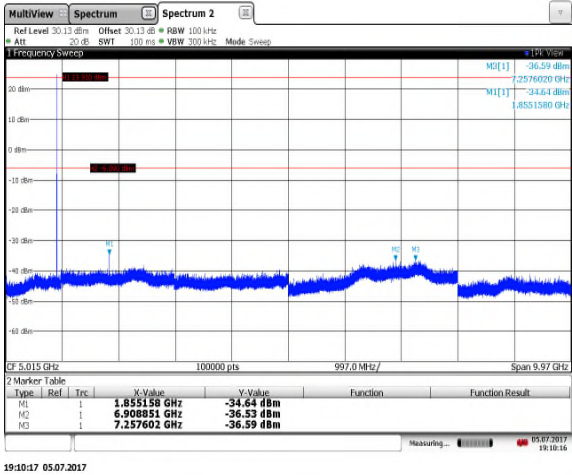


Figure 7.5.1.2-3: 30 MHz – 10 GHz – HCH

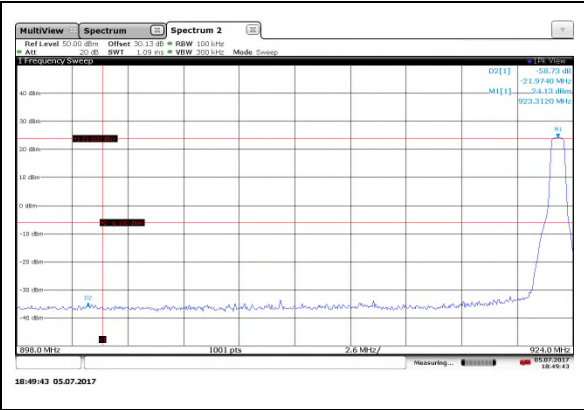


Figure 7.5.1.2-4: Lower Band-edge - LCH

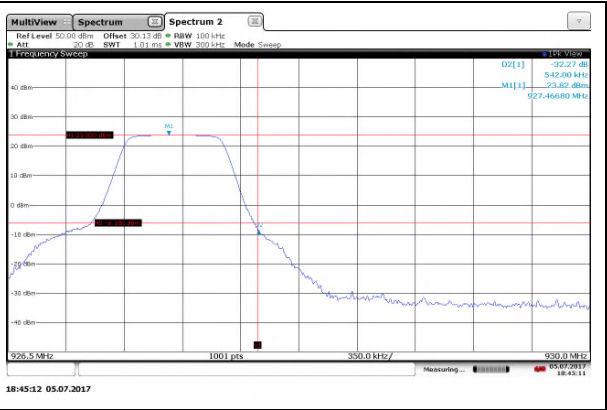


Figure 7.5.1.2-5: Upper Band-edge - HCH

7.6 Emissions into Restricted Frequency Bands

7.6.1.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated over the frequency range of 30MHz to 25GHz, 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 3 MHz respectively.

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.

7.6.1.2 Duty Cycle Correction

The Duty Cycle Correction was not required.

7.6.1.3 Measurement Results

Performed by: Jean Tezil

Table 7.5.2.3-1: Radiated Spurious Emissions Tabulated Data

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 = 923.3 MHz										
2769.9	44.00	32.90	H	-2.28	41.72	30.62	74.0	54.0	32.3	23.4
2769.9	46.30	37.40	V	-2.28	44.02	35.12	74.0	54.0	30.0	18.9
3693.2	43.10	30.00	H	1.18	44.28	31.18	74.0	54.0	29.7	22.8
3693.2	45.70	34.30	V	1.18	46.88	35.48	74.0	54.0	27.1	18.5
4616.5	44.3	31.1	V	3.53	47.83	34.63	74.0	54.0	26.2	19.4
7386.4	44.40	30.10	H	8.01	52.41	38.11	74.0	54.0	21.6	15.9
7386.4	43.70	30.40	V	8.01	51.71	38.41	74.0	54.0	22.3	15.6
8309.7	47.20	33.70	H	10.56	57.76	44.26	74.0	54.0	16.2	9.7
8309.7	48.90	35.40	V	10.56	59.46	45.96	74.0	54.0	14.5	8.0
Middle Channel = 925.1 MHz										
2775.3	42.90	33.50	H	-2.26	40.64	31.24	74.0	54.0	33.4	22.8
2775.3	45.70	38.20	V	-2.26	43.44	35.94	74.0	54.0	30.6	18.1
3700.4	42.50	30.80	H	1.20	43.70	32.00	74.0	54.0	30.3	22.0
3700.4	43.00	32.50	V	1.20	44.20	33.70	74.0	54.0	29.8	20.3
4625.5	46.4	36	H	3.53	49.93	39.53	74.0	54.0	24.1	14.5
4625.5	55.2	47.9	V	3.53	58.73	51.43	74.0	54.0	15.3	2.6
7400.8	42.00	28.40	H	8.08	50.08	36.48	74.0	54.0	23.9	17.5
7400.8	42.80	29.90	V	8.08	50.88	37.98	74.0	54.0	23.1	16.0
8325.9	45.40	32.10	H	10.63	56.03	42.73	74.0	54.0	18.0	11.3
8325.9	47.30	34.20	V	10.63	57.93	44.83	74.0	54.0	16.1	9.2
High Channel = 927.5 MHz										
2782.5	43.30	33.90	H	-2.24	41.06	31.66	74.0	54.0	32.9	22.3
2782.5	45.70	38.00	V	-2.24	43.46	35.76	74.0	54.0	30.5	18.2
3710	40.40	28.40	H	1.23	41.63	29.63	74.0	54.0	32.4	24.4
3710	43.40	32.90	V	1.23	44.63	34.13	74.0	54.0	29.4	19.9
4637.5	40.1	26.9	H	3.52	43.62	30.42	74.0	54.0	30.4	23.6
4637.5	41.3	29	V	3.52	44.82	32.52	74.0	54.0	29.2	21.5
7420	41.20	27.70	H	8.18	49.38	35.88	74.0	54.0	24.6	18.1
7420	42.20	29.40	V	8.18	50.38	37.58	74.0	54.0	23.6	16.4
8347.5	45.90	32.70	H	10.72	56.62	43.42	74.0	54.0	17.4	10.6
8347.5	45.30	31.70	V	10.72	56.02	42.42	74.0	54.0	18.0	11.6

7.6.1.4 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: $44.00 - 2.28 = 41.72$ dBuV/m

Margin: $74\text{dBuV/m} - 41.72\text{dBuV/m} = 32.28\text{dB}$

Example Calculation: Average

Corrected Level: $32.90 - 2.28 = 30.62$ dBuV

Margin: $54\text{dBuV} - 30.62\text{dBuV} = 23.38\text{dB}$

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

7.7.1 Measurement Procedure

The power spectral density was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v04 utilizing the AVGSA-1 (Average PSD) method. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 3 kHz. The Video Bandwidth (VBW) was set to 10 kHz. Span was set to 1.5 times the DTS bandwidth. The trace was set to average with a RMS detector active, averaged over 100 sweeps.

7.7.2 Measurement Results

Performed by: Jean Tezil

Table 7.6.2-1: Peak Power Spectral Density

Frequency (MHz)	PSD Level (dBm)
923.3	5.97
925.1	6.07
927.5	5.43

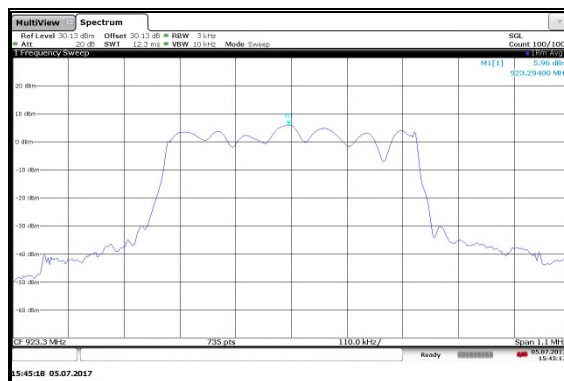


Figure 7.6.2-1: PSD Plot –LCH

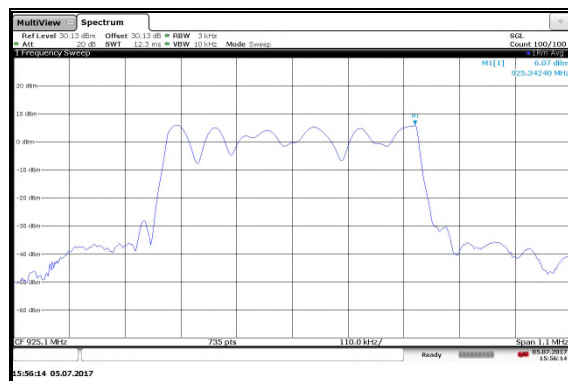


Figure 7.6.2-2: PSD Plot – MCH

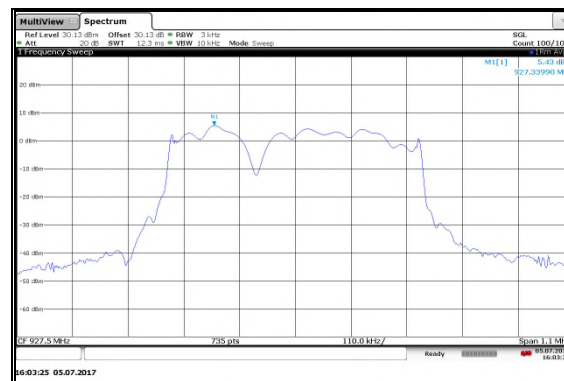


Figure 7.6.2-3: PSD Plot – HCH

8 MEASUREMENT UNCERTAINTY

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	$\pm 0.004\%$
RF Conducted Output Power	$\pm 0.689 \text{ dB}$
Power Spectral Density	$\pm 0.5 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 2.717 \text{ dB}$
Radiated Emissions	$\pm 5.877 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	± 2.85

9 CONCLUSION

In the opinion of TÜV SÜD America Inc. the MTCAP-LNA3, manufactured by Multi-Tech Systems LLC meets the requirements of FCC Part 15 subpart C and ISED Canada Radio Standards Specification: RSS-247 for the tests documented herein.

END REPORT