

August 28, 2022

Pivot International, Inc.
Ryan Konen
11030 Strang Line Road
Lenexa, KS 66215

Dear Ryan Konen,

Enclosed is the Wireless test report compliance testing of the Rooster, LLC, Hub M736 as tested to the requirements of Title 47 of the CFR, , Part 15 Subpart C, RSS 247 for Intentional Radiators.

Thank you for using the services of Eurofins Electrical and Electronic Testing NA, Inc. If you have any questions regarding these results or if Eurofins Electrical and Electronic Testing NA, Inc. can be of further service to you, please feel free to contact me.

Gary Chou

Documentation Department
Eurofins Electrical and Electronic Testing NA, Inc.

Reference: WIR108236-PIVOT_FCC_ISED-LORA_Rev 1.0



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FCC/ ISED Test Report

Applicant name: Rooster, LLC

Product: HUB

Report: WIR108236-PIVOT_FCC_ISED-LORA_HUB_Rev 1.0

Applicant Address:

**7500 College Blvd Suite 775
Overland Park, KS 66210**

Manufacturer Address:

**Unit 1-3 Lot 3-D Greenfield Automotive Park SEZ,
Brgy, Don Jose, Santa Rosa, 4026 Laguna, Philippines**

Prepared By:
Eurofins Electrical and Electronic Testing NA, Inc.
3162 Belick St.
Santa Clara CA, 95054

FCC/ ISED Test Report

Applicant name: Rooster, LLC

Product: HUB

Standard

47 CFR FCC Part 15, Subpart C (Section 15.247)

558074 D01 15.247 Meas Guidance v05r02

RSS 247 Issue2, February 2017

RSS Gen Issue5, March 2019

ANSI C63.10: 2013

Christopher Martin

Christopher Martin

Test Engineer, Wireless Laboratory

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements FCC Rules under normal use and maintenance.

Gary Chou

Gary Chou

Wireless Engineering Manager, Wireless Laboratory

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	August 28, 2022	Initial Issue.
1.0	October 13, 2022	Updated Firmware Information/ Occupied Bandwidth Value

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I. Executive Summary

A. Executive Summary

47 CFR FCC Part 15, Subpart C (SECTION 15.247) RSS 247 Issue2, RSS Gen Issue5				
FCC/ IC Cluse	ISED	Test Item	Result	Remarks
15.207	RSS Gen 8.8	AC Power Conducted Emission	PASS	Meet the requirement of limit.
15.205 & 15.209 & 15.247(d)	RSS Gen 8.8	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	RSS 247 5.5C	6dB bandwidth & 99% bandwidth	PASS	Meet the requirement of limit.
15.247(b)	RSS 247 5.2.1 RSS Gen 6.7	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	RSS 247 5.4.4	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	RSS 247 5.2.2	Antenna Requirement	PASS	Embedded Helical Monopole Antenna (without connector) meet the requirement.

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

II. Equipment Information

A. Overview

EUT Summary Table

Product:	HUB		
Brand:	PIVOT		
Model(s) Tested:	M736		
Series Model:	N/A		
Sample Status:	Original		
EUT Specifications:	Primary Power:		14Vdc powered by Adaptor/ 7.6Vdc powered by battery
	Voltage Frequency:		N/A
	Technology / Type of Modulations:		DTS
	Operating Frequency :		904.5 ~ 927.5GHz
	FCC ID:		2A2TKHUB01
	ISED ID:		28419-2A2TKHUB01
	Antenna Brand/ Model		TAOGLAS/ HA.31.A
	Antenna Type:	Embedded Helical Monopole Antenna	915 MHz: 2.09dBi
	Antenna connector:		N/A
Analysis:	The results obtained relate only to the item(s) tested.		
Environmental Test Conditions:	Temperature: 20.3° C		
	Relative Humidity: 47.5%		
	Barometric Pressure: 860-1060 mbar		
Evaluated by:	Christopher Martin		
Issue Date(s):	August 17, 2022		

NOTE: The following modules can be chosen to be configured in the EUT.

	Model No.	FCC ID	Note
-	-	-	-
-	-	-	-

FCC/ ISED RF Testing Units Setting

Model	Hardware Rev	Firmware (FW) Rev.	FW operation verification and Instruction
M736	G	1.01.003	Verify by Spectrum Analyzer  Hub_LoRa_FCC_Test Instructions_06_07

B. Description of Operator Modes

Channel List:

Channel	Frequency (MHz)	Channel	Frequency
0	904.5	12	916.5
1	905.5	13	917.5
2	906.5	14	918.5
3	907.5	15	919.5
4	908.5	16	920.5
5	909.5	17	921.5
6	910.5	18	922.5
7	911.5	19	923.5
8	912.5	20	924.5
9	913.5	21	925.5
10	914.5	22	926.5
11	915.5	23	927.5

Power setting is as below:

Lora	Power Setting
Channel	
0	11
12	11
23	9

C. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
-	-	-	-	-	-	-

Note: (Describe the outline of a simulator, if used for the tests, as a note under the table.)

Insert Cable Connections to/from EUT provided by test team.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
	-	-	-	-	0	-

Note: The core(s) is(are) originally attached to the cable(s).

General Description of Applied Standards

D. References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

- o 47 CFR FCC Part 15, Subpart C (Section 15.247)
- o 558074 D01 15.247 Meas Guidance v05r02
- o RSS 247 Issue2
- o RSS Gen Issue5
- o ANSI C63.10:2013

E. Test Site

All testing was performed at Eurofins Electrical and Electronic Testing NA, Inc., 3162 Belick St. Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Eurofins Electrical and Electronic Testing NA, Inc. has been accredited by the American Association for Laboratory Accreditation (A2LA) (Certificate #: 0591.02) in accordance with ISO/IEC 17025:2017.

Eurofins Electrical and Electronic Testing NA, Inc. is part of the Eurofins Electrical & Electronics (E&E) global compliance network.

F. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.32 dB	2	95%
RF Power Conducted Spurious Emissions	±2.25 dB	2	95%
RF Power Radiated Emissions	±3.01 dB	2	95%

Uncertainty Calculations Summary

G. Modifications**a) Modifications to EUT**

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

H. Disposition of EUT

The test sample including all support equipment (if any), submitted to the Electromagnetic Compatibility Lab for testing was returned to Rooster.LLC upon completion of testing.

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Radiated Emission and Bandage Measurement

Limits of Radiated Emission and Bandage Measurement:

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

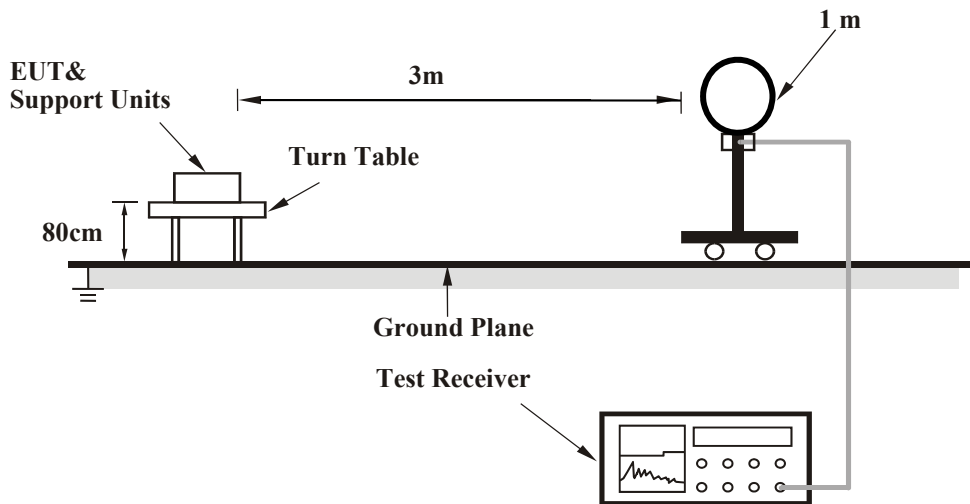
Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Test Procedures:

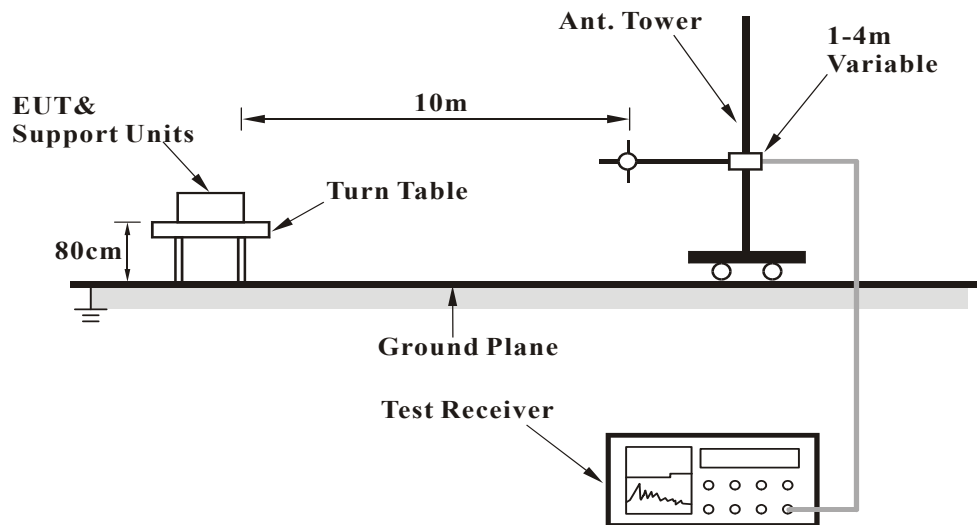
The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

Test Setup

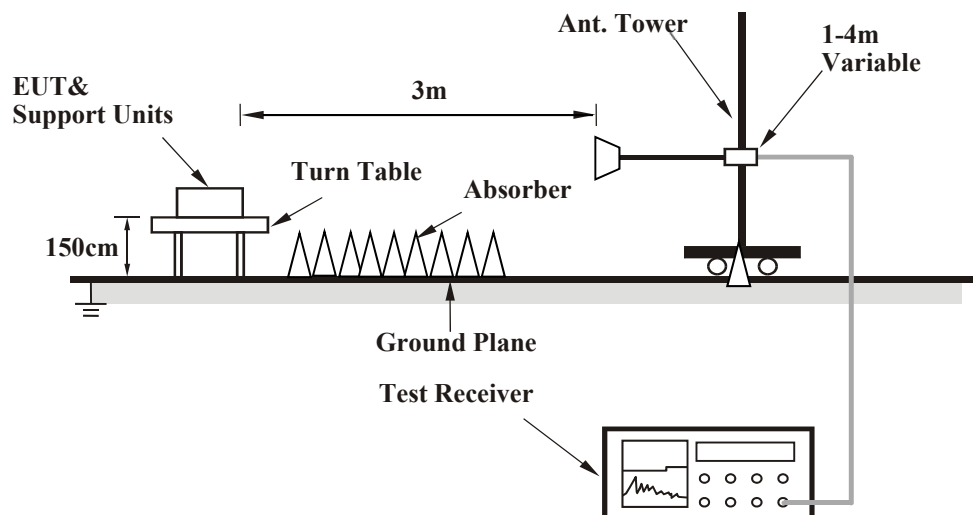
For Radiated Emission Below 30MHz



For Radiated emission 30 MHz to 1GHz



For Radiated emission 1GHz to 40GHz



Test Results: The EUT was tested is **compliant** with Radiated Spurious Emissions Requirements.

Test Equipment List

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2003	EMI Test Receiver	Keysight	N9030B	10/08/2021	10/08/2022
1S2399	Turntable Controller	SUNOL SCIENCE	SC99V	Not Required	Not Required
1S2486	5 Meter Chamber Control Room	Panashield	5 Meter Control Room	Not Required	Not Required
1S2435	Horn Antenna	ETS-LINDGREN	3117	03/03/2021	03/09/2023
N/A	Preamplifier	EMC Instrument	EMC118A45SE	Note 1	Note 1
1S2668	Preamplifier	Sonoma Instrument	310N	Note 1	Note 1
1S2600	Antenna	TESEQ GmbH	D-12623	05/ 11/ 2021	05/ 11/ 2023
1S3983	Loop Antenna	ETS-LINDGREN	6512	10/ 14 /2021	10/ 14 /2023
Note 1: Verified by calibrated instrumentation at the time of testing					

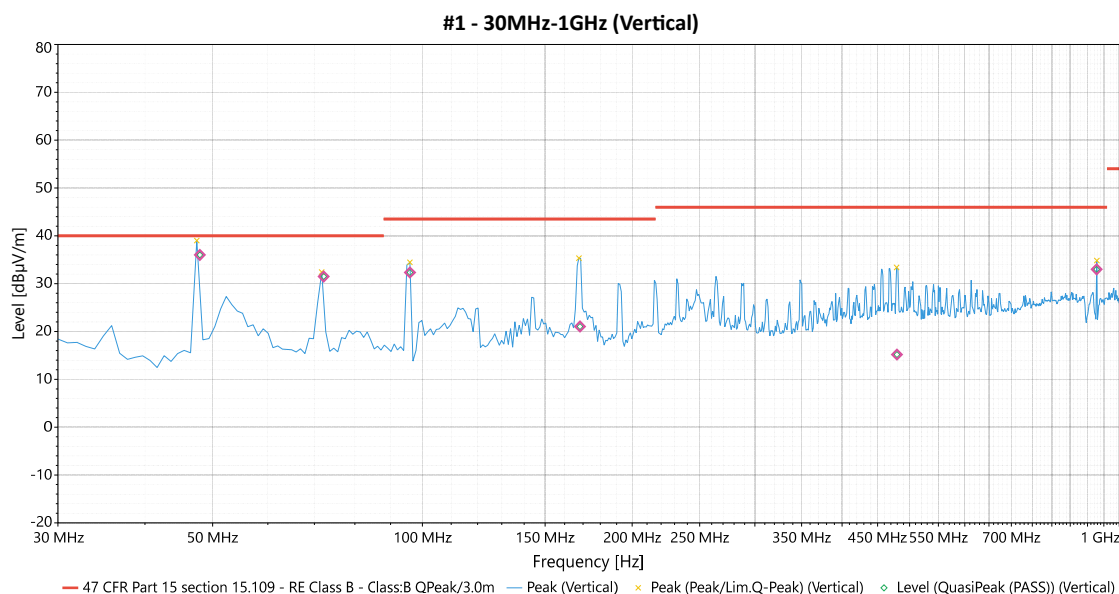
Test Engineer: Christopher Martin

Test Date(s): 07/28/2022

Test Data

Radiated Emissions (30 MHz~1000 MHz)

EUT Test Condition		Measurement Detail	
Input Power	7.6Vdc	Frequency Range	30MHz-1GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldivar
Test Mode	TX MODE 916.5 MHz		

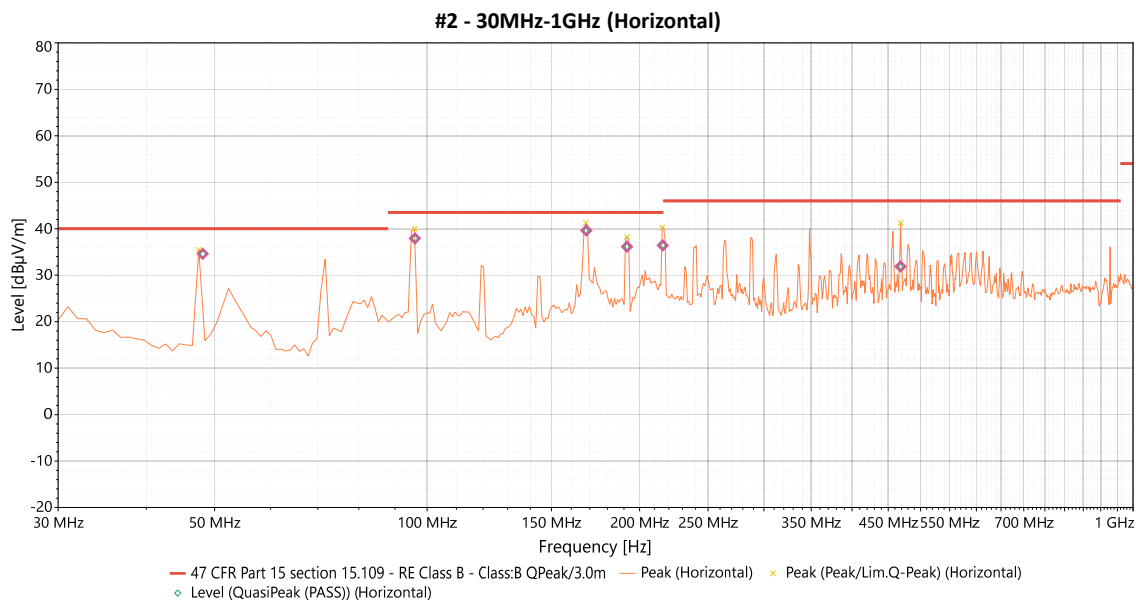


Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level [dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Height (cm)	Angle (Deg)	Factor [dB(1/m)]	Pass/Fail
1	47.94	Vertical	35.998	40	-4.002	2.75	353	-17.29	Pass
2	72.166	Vertical	31.485	40	-8.515	1.42	141	-19.99	Pass
3	95.984	Vertical	32.339	43.5	-11.161	2.12	138	-14.57	Pass
4	168.316	Vertical	21.041	43.5	-22.459	1.18	326	-14.23	Pass
5	479.554	Vertical	15.171	46	-30.829	2.86	356	-5.89	Pass
6	927.68	Vertical	32.992	46	-13.008	1.12	353	-0.75	Pass

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	7.6Vdc	Frequency Range	30MHz-1GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldivar
Test Mode	TX MODE 916.5 MHz		



Antenna Polarity & Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Polarization	Level Peak[dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (cm)	Angle (Deg)	Factor [dB(1/m)]	Pass/Fail
1	48.084	Horizontal	34.597	40	-5.403	3.69	97	-15.96	Pass
2	96.068	Horizontal	37.922	43.5	-5.578	1.67	61	-14.85	Pass
3	168.064	Horizontal	39.625	43.5	-7.675	2.02	350	-14.94	Pass
4	191.894	Horizontal	36.144	43.5	-7.356	1.2	329	-15.24	Pass
5	215.642	Horizontal	36.434	43.5	-7.066	1.81	28	-14.65	Pass
6	468.476	Horizontal	31.883	46	-14.117	2	216	-5.74	Pass

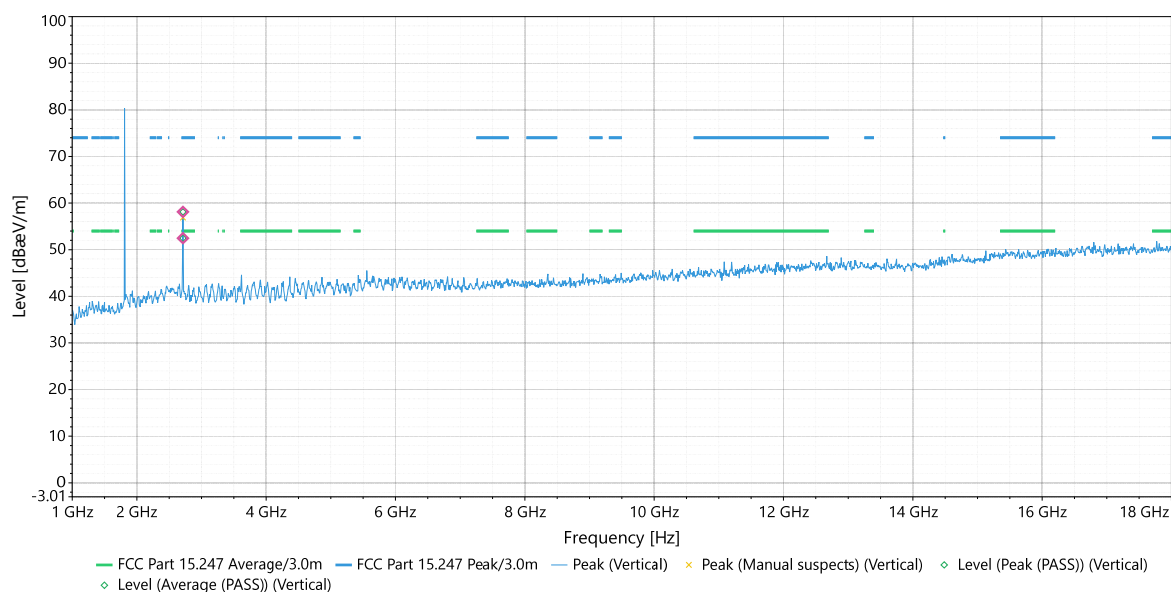
REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

Radiated Emissions (Above 1GHz)

EUT Test Condition		Measurement Detail	
Input Power	7.6Vdc	Frequency Range	1GHz-18GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldivar
Test Mode	TX MODE 904.5 MHz		

Vertical



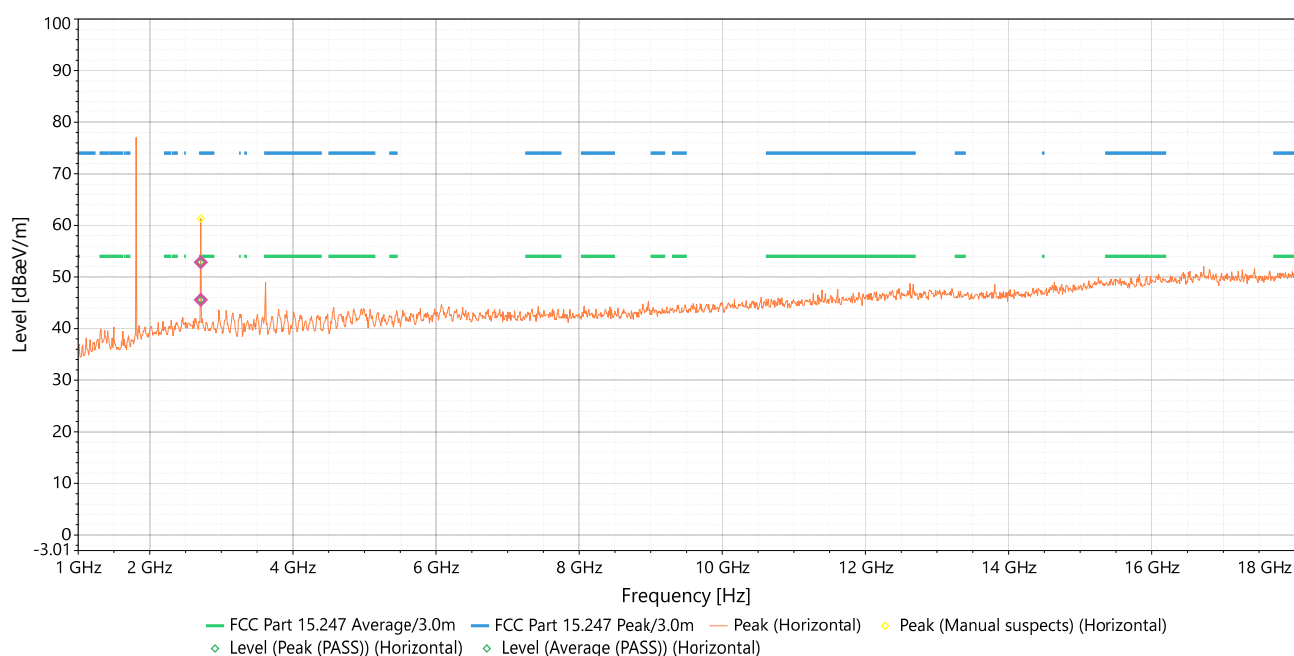
Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level [dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	2713.6	Vertical	58.106	74	-15.894	1.33	161	-1.14	Peak (PASS)
2	2713.6	Vertical	52.474	54	-1.526	1.33	161	-1.14	Average (PASS)

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	7.6Vdc	Frequency Range	1GHz-18GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldivar
Test Mode	TX MODE 904.5 MHz		

Horizontal



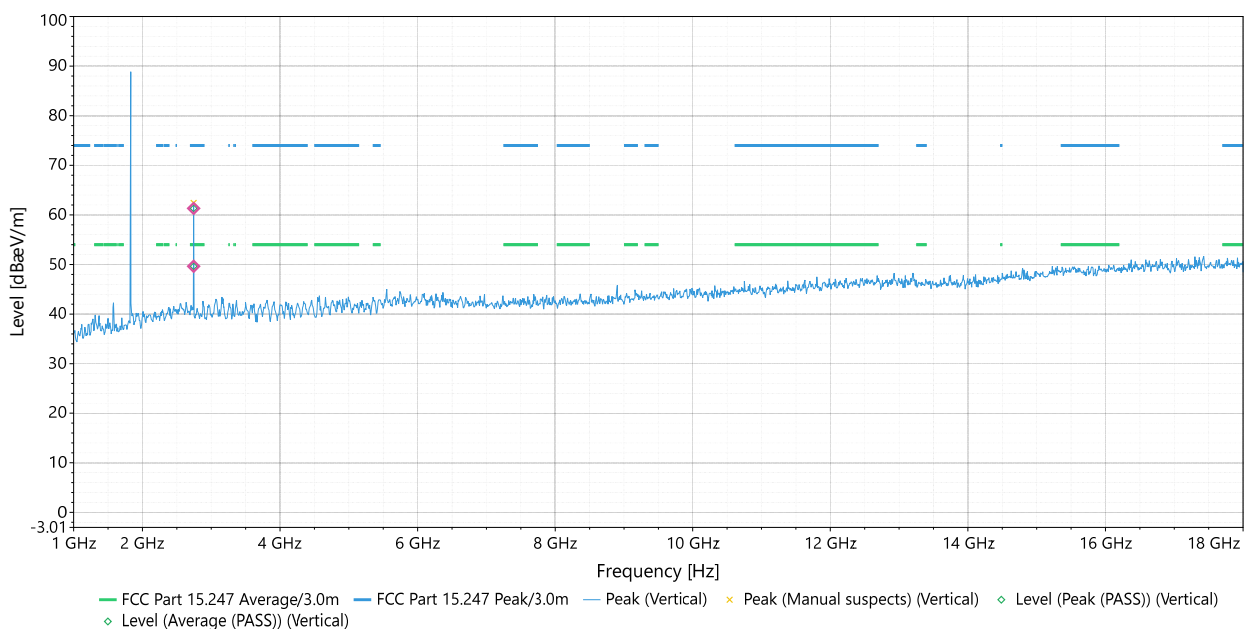
Antenna Polarity & Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Polarization	Level Peak[dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	2713.7	Horizontal	52.863	74	-21.137	2.41	8	-0.63	Peak (PASS)
2	2713.7	Horizontal	45.586	54	-8.414	2.41	8	-0.63	Average (PASS)

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	7.6Vdc	Frequency Range	1GHz-18GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldivar
Test Mode	TX MODE 916.5 MHz		

Vertical



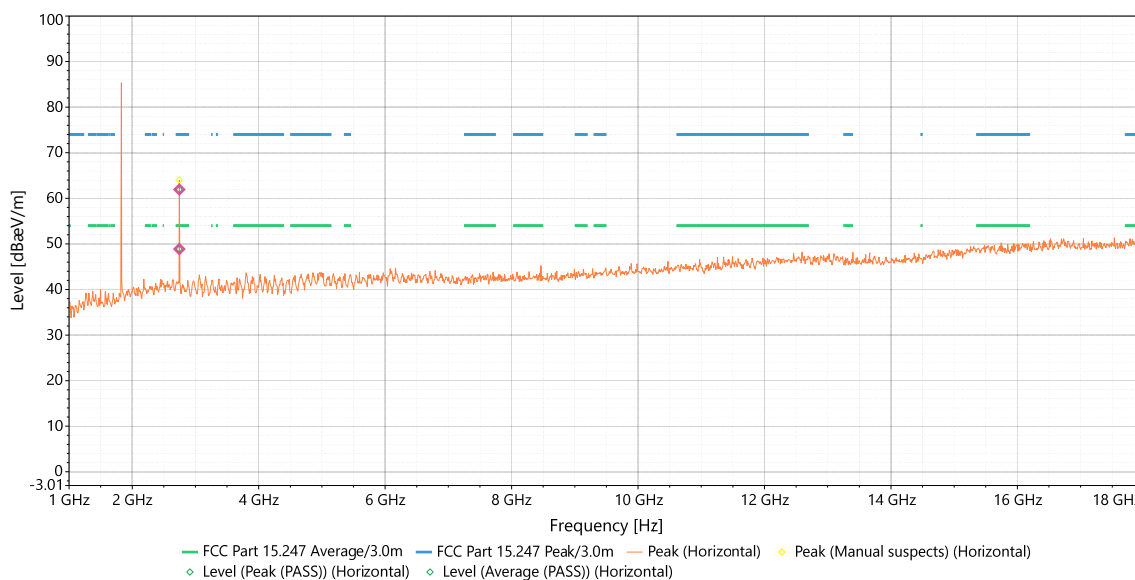
Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level [dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	2744.2	Vertical	61.298	74	-12.702	1.89	150	-1.28	Peak (PASS)
2	2744.2	Vertical	49.628	54	-4.372	1.89	150	-1.28	Average (PASS)

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	7.6Vdc	Frequency Range	1GHz-18GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldivar
Test Mode	TX MODE 916.5 MHz		

Horizontal



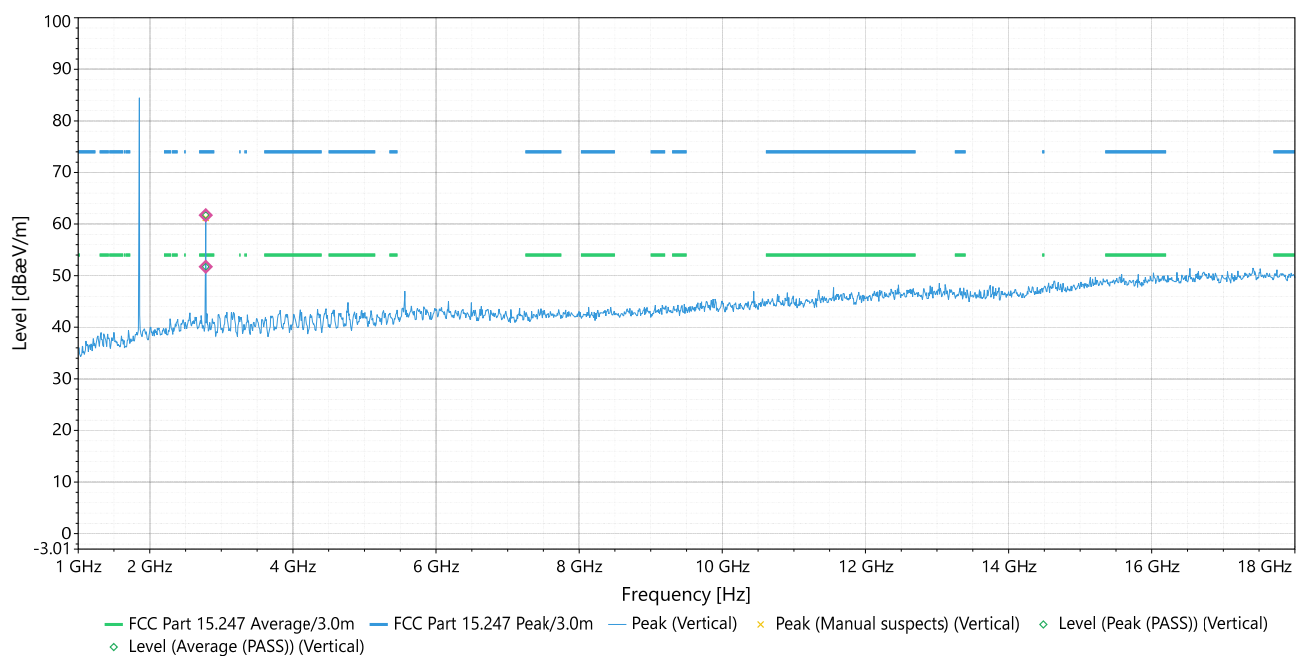
Antenna Polarity & Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Polarization	Level Peak[dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	2744.3	Horizontal	61.924	74	-12.076	3.39	170	-0.72	Peak (PASS)
2	2744.3	Horizontal	48.877	54	-5.123	3.39	170	-0.72	Average (PASS)

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	7.6Vdc	Frequency Range	1GHz-18GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldivar
Test Mode	TX MODE 927.5 MHz		

Vertical



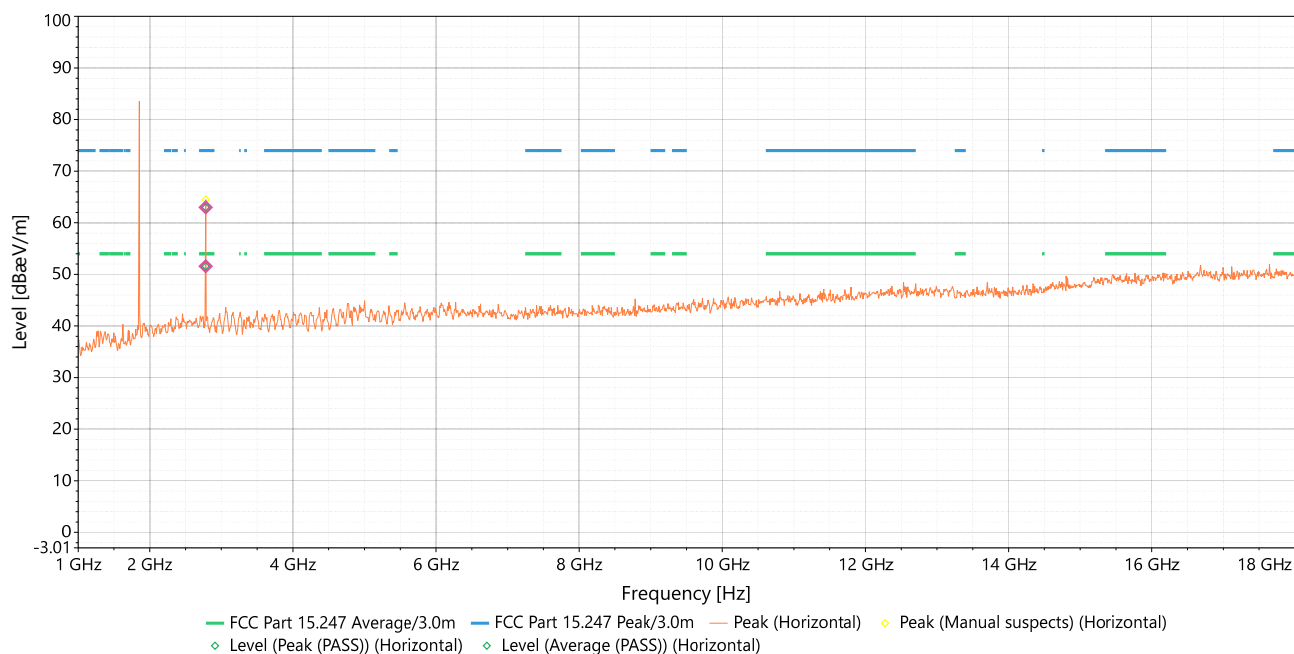
Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level [dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	2781.6	Vertical	61.714	74	-12.286	1.51	183	-1.36	Peak (PASS)
2	2781.6	Vertical	51.74	54	-2.26	1.51	183	-1.36	Average (PASS)

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	7.6Vdc	Frequency Range	1GHz-18GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldivar
Test Mode	TX MODE 927.5 MHz		

Horizontal



Antenna Polarity & Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Polarization	Level Peak[dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	2781.5	Horizontal	62.978	74	-11.022	3.41	178	-1.03	Peak (PASS)
2	2781.5	Horizontal	51.557	54	-2.443	3.41	178	-1.03	Average (PASS)

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier

3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

Conducted Emission Measurement**Limits of Conducted Emission Measurement :**

The following standards specified below are covered in the scope of this section of the test report:

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

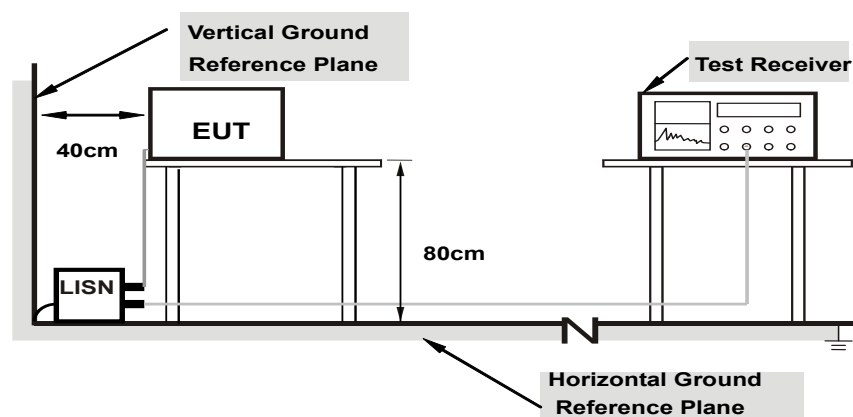
Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Conducted Emissions - Test Procedure

- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency ranges from 150 kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

Conducted Emissions - Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo)

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

Test Name: CE Voltage – AC Power Port			Test Date(s): 07/21/2022		
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1U0337	LISN	Com-Power	LI-215A	10/07/2021	10/07/2022
1U0304	EMI Receiver	Narda	PMM 9010	10/07/2021	10/07/2022
Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.					

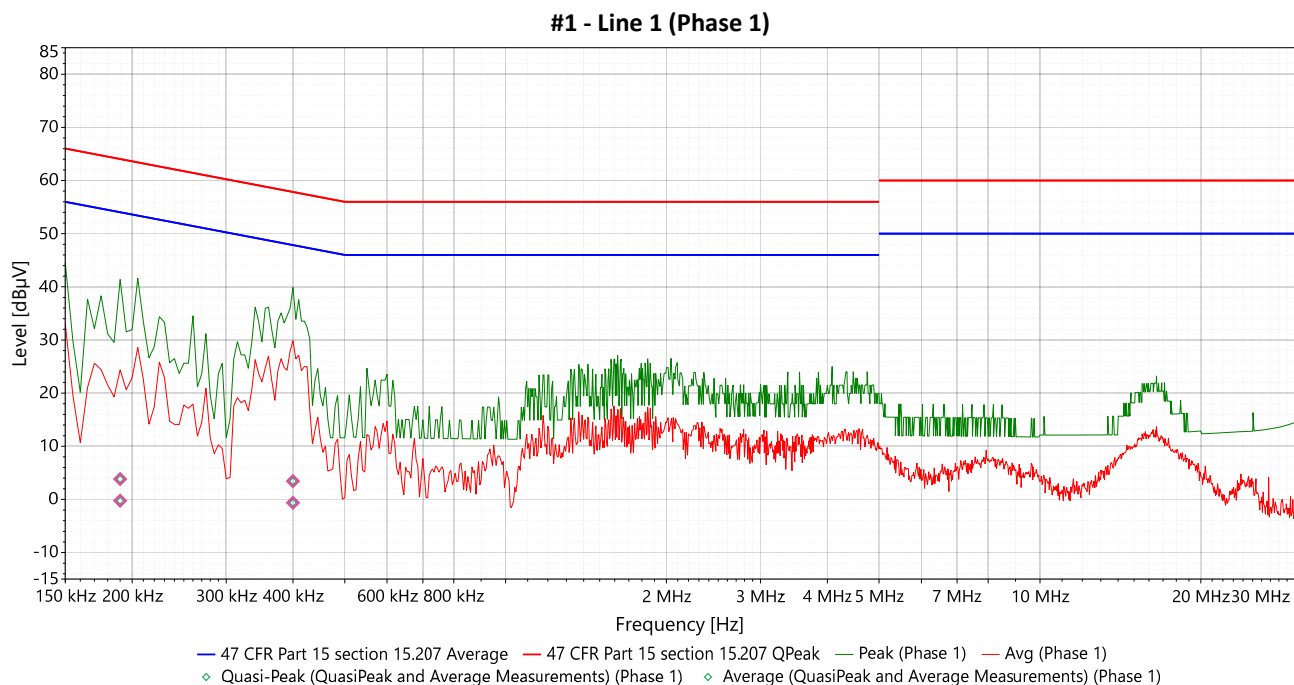
Table 1. Conducted Emissions, Test Equipment

Test Results:

Phase	Line (L)	Detector Function	Quasi-Peak / Average
-------	----------	-------------------	----------------------

Conducted Emission									
No.	Frequency (MHz)	Polarization	Level QP[dB(uV/m)]	Level Average[dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Source	Factor [dB(1/m)]	Result
1	0.19	Line	-0.237	NaN	64.037	-64.273	QuasiPeak	0.31	Pass
2	0.19	Line	NaN	3.833	54.037	-50.203	Average	0.31	Pass
3	0.4	Line	-0.64	NaN	57.853	-58.494	QuasiPeak	0.23	Pass
4	0.4	Line	NaN	3.43	47.853	-44.424	Average	0.23	Pass

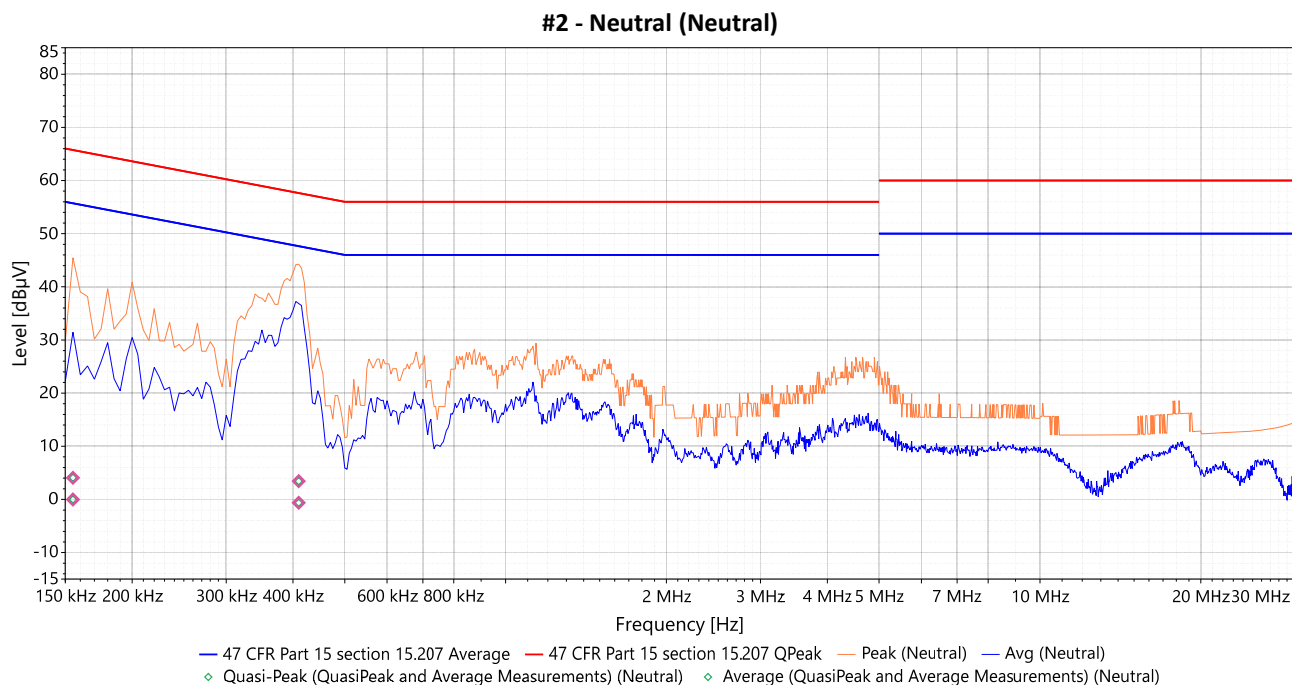
Test Plot:



Phase	Neutral (N)	Detector Function	Quasi-Peak / Average
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Conducted Emission									
No.	Frequency (MHz)	Polarization	Level QP[dB(uV/m)]	Level Average[dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Source	Factor [dB(1/m)]	Result
1	0.155	Neutral	-0.013	NaN	65.728	-65.74	QuasiPeak	0.33	Pass
2	0.155	Neutral	NaN	4.057	55.728	-51.67	Average	0.33	Pass
3	0.41	Neutral	-0.635	NaN	57.648	-58.283	QuasiPeak	0.22	Pass
4	0.41	Neutral	NaN	3.435	47.648	-44.213	Average	0.22	Pass

Test Plot:



6dB Bandwidth Measurement & 99% Bandwidth Measurement

Limits of Conducted Emission Measurement :

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

Test Procedure

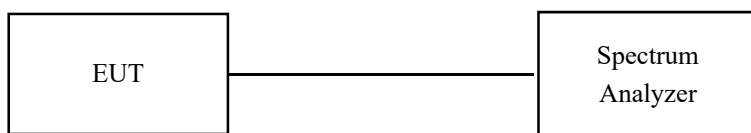
99% Bandwidth Measurement

Refer to ANSI C63.10 section 6.9.3

-6dB Bandwidth Measurement

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

Conducted Emissions - Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo)

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

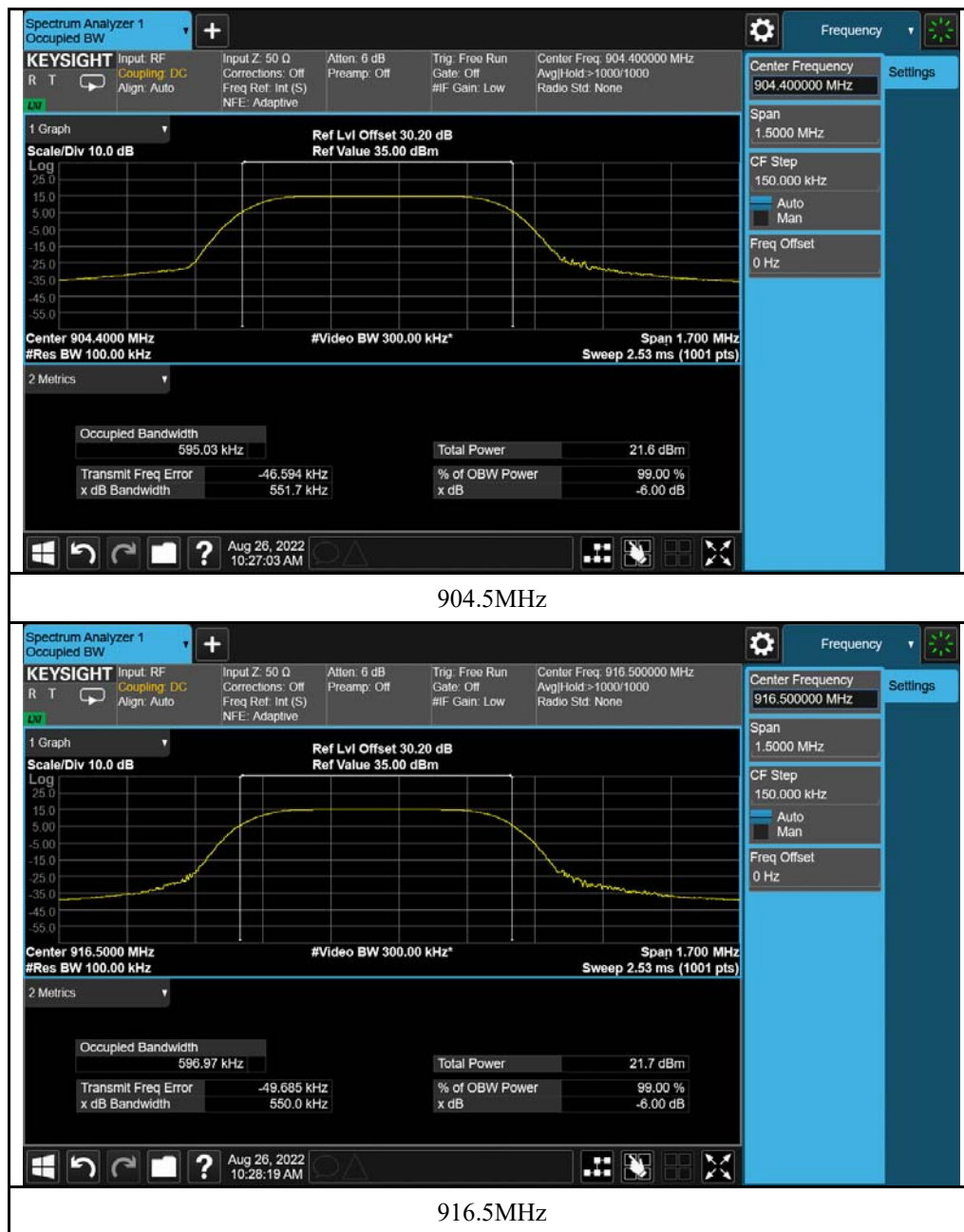
Test Name: 6dB Bandwidth Measurement & 99% Bandwidth Measurement			Test Date(s): 07/17/2022		
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2003	EMI Test Receiver	Keysight	N9030B	10/08/2021	10/08/2022
Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.					

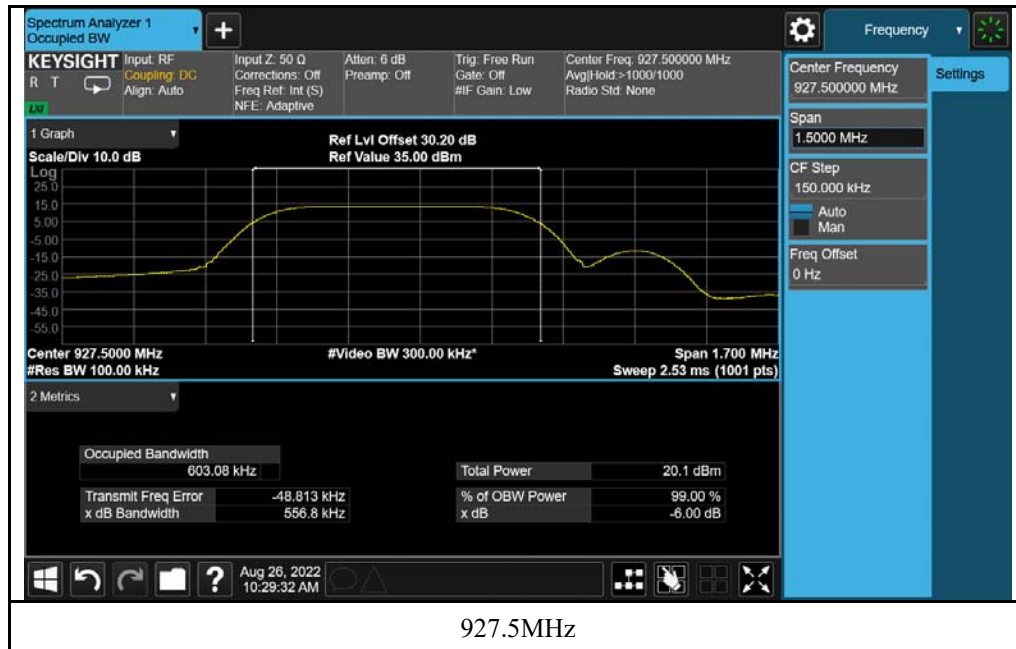
Test Result:

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	904.5	0.5570	0.50777	0.5	PASS
12	916.5	0.5500	0.50475	0.5	PASS
23	927.5	0.5568	0.50261	0.5	PASS

Test Plots:

-6dB Bandwidth:





99% Bandwidth:





Conducted Output Power Measurement

Limits of Output Power Measurement :

FCC 15.247/ RSS 247

conducted power for systems using digital modulation in the 902–928 MHz bands: 1 Watt (30dBm)

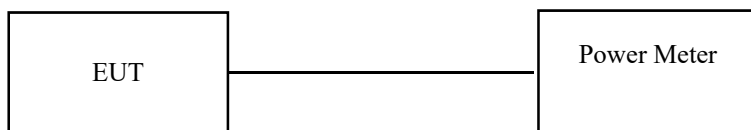
RSS 247

E.I.R.P for systems using digital modulation in the 902–928 MHz bands: 4 Watt (36.02dBm)

Test Procedure

A power meter sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo)

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

Test Name: Conducted Output Power Measurement			Test Date(s): 07/16/2022		
Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
N/A	Power Meter	ROHDE & SCHWARZ	NRQ6	06/22/2022	06/22/2023

Test Result:

LORA

FCC:

Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Pass/Fail
902.5	21.38	30	Pass
916.5	21.58	30	Pass
927.5	18.06	30	Pass

ISED:

Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	EIRP (dBm)	Limit (dBm)	Pass/Fail
902.5	21.38	30	23.47	36.02	Pass
916.5	21.58	30	23.67	36.02	Pass
927.5	18.06	30	20.15	36.02	Pass

Power Spectral Density Measurement

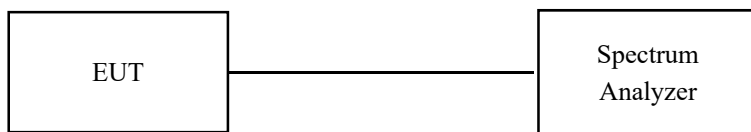
Limits of Power Spectral Measurement :

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

Test Procedure

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq 3 \times \text{RBW}$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.

Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo)

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

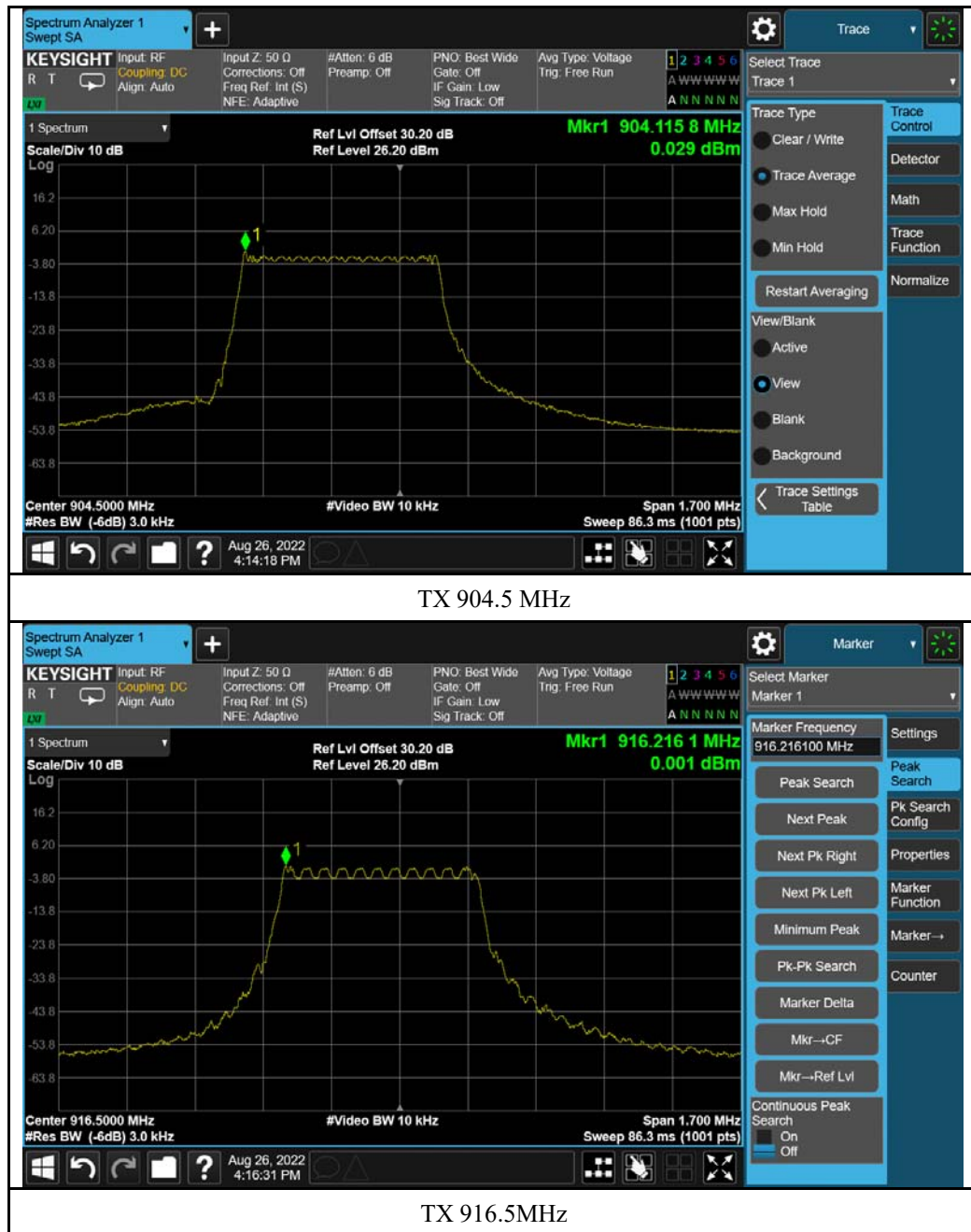
Test Name: Power Spectral Density Measurement			Test Date(s): 07/26/2022		
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2003	EMI Test Receiver	Keysight	N9030B	10/08/2021	10/08/2022
Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.					

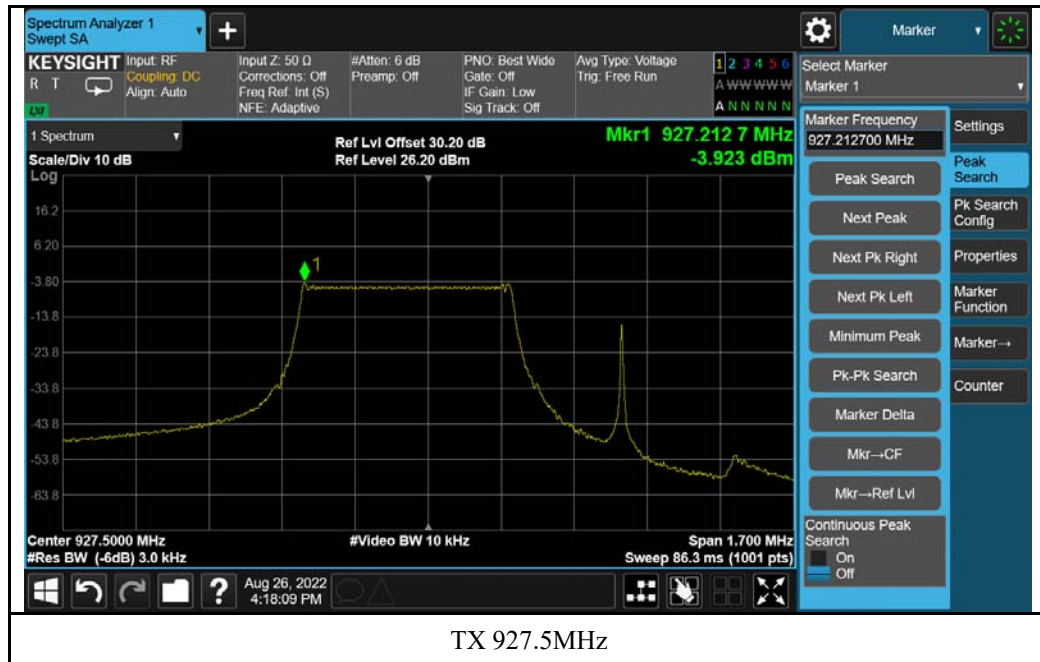
Test Result:

Lora:

Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass/Fail
904.5	0.029	8	Pass
916.5	0.001	8	Pass
927.5	-3.923	8	Pass

Test Plots:





Conducted Out of Band Emission Measurement

Limits of Conducted Out of Band Emission Measurement:

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth)

Test Procedure

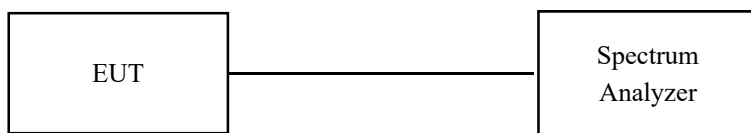
MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo)

Test Equipment

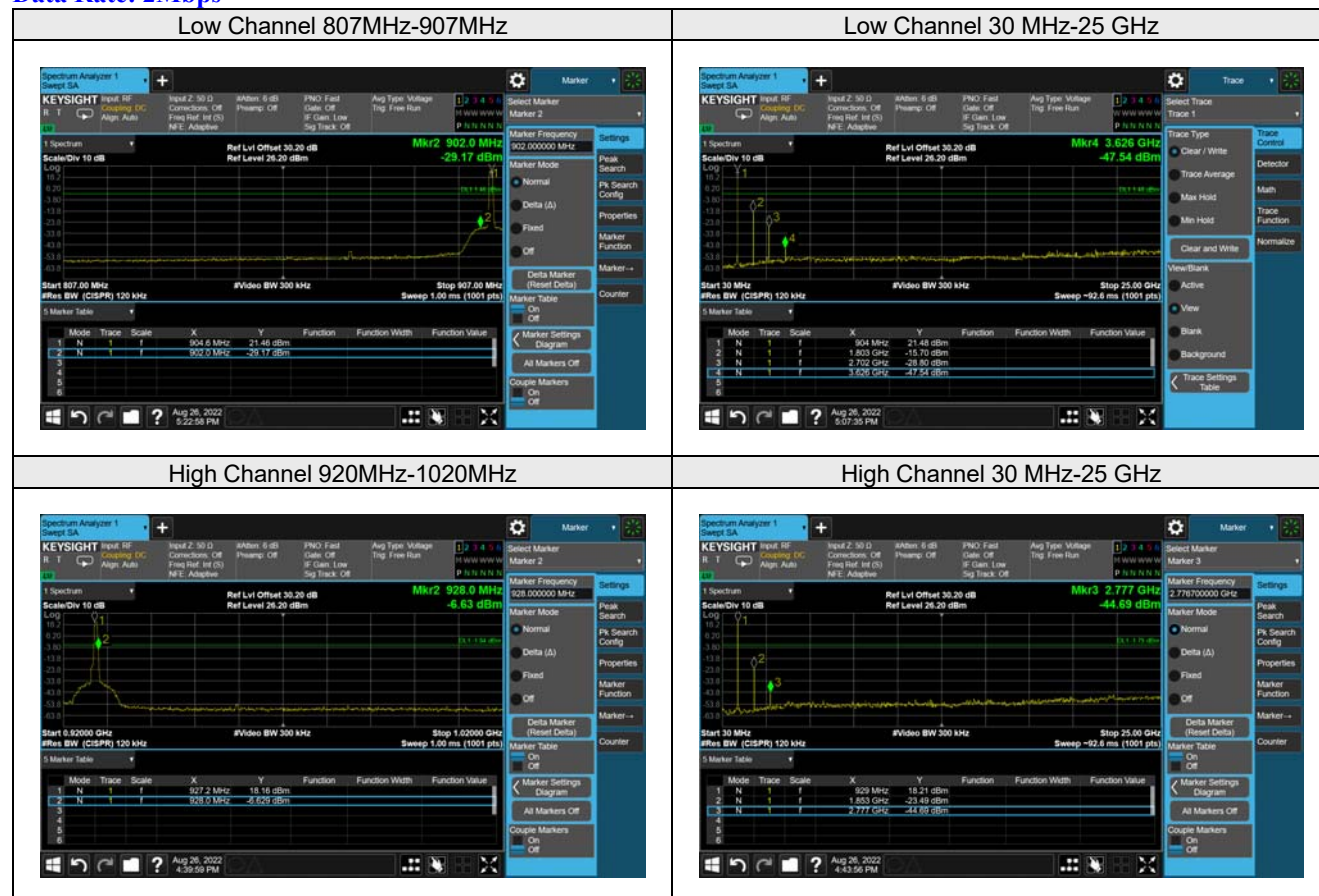
Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

Test Name: Conducted Out of Band Emission Measurement			Test Date(s): 07/26/2022		
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2003	EMI Test Receiver	Keysight	N9030B	10/08/2021	10/08/2022
Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.					

Test Result:

Data Rate: 2Mbps



IV. Pictures of test Arrangements

Please see setup photo file

END OF REPORT