

FCC Part 15.247

TEST REPORT

For

M2Communication Inc.

17F-3, No.32, Gaotie 2nd Rd., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)

FCC ID: 2AFXU-ES27RS

Report Type: Original Report	Product Name: Electronic Shelf Label
Report Producer : <u>Coco Lin</u>	
Report Number : <u>RXZ220526001RF02</u>	
Report Date : <u>2022-08-11</u>	
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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ220526001	RXZ220526001RF02	2022-08-11	Original Report	Coco Lin

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	M2Communication Inc.
	17F-3, No.32, Gaotie 2nd Rd., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)
Manufacturer	M2Communication Inc.
	17F-3, No.32, Gaotie 2nd Rd., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)
Brand(Trade) Name	M2COMM
Product (Equipment)	Electronic Shelf Label
Main Model Name	ES27-RS
Series Model Name	N/A
Frequency Range	903 ~ 927 MHz
Conducted Peak Output Power	11.57 dBm
Modulation Technique	LoRa (500KHz)
Power Operation(Voltage Range)	3Vdc from Battery*2
Received Date	May 30, 2022
Date of Test	Jun. 28, 2022 ~ Aug. 10, 2022

*All measurement and test data in this report was gathered from production sample serial number:

RXZ220526001-01 (Assigned by BACL, New Taipei Laboratory).

1.2 Objective

This report is prepared on behalf of *M2Communication Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.4 Statement of Compliance

Decision Rule: No, (The test results do not include MU judgment)

It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

The determination of the test results does not require consideration of the uncertainty of the measurement, unless the assessment is required by customer agreement, regulation or standard document specification.

Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is not responsible for the authenticity of the information provided by the applicant that affects the test results.

1.5 Measurement Uncertainty

Parameter		Uncertainty
RF output power, conducted		+/- 0.93 dB
Power Spectral Density, conducted		+/- 0.93 dB
Occupied Bandwidth		+/- 0.35 MHz
Unwanted Emissions, conducted		+/- 1.69 dB
Emissions, radiated	30 MHz~1GHz	+/- 5.22 dB
	1 GHz~18 GHz	+/- 6.12 dB
	18 GHz~40 GHz	+/- 4.99 dB
Temperature		+/- 1.27 °C
Humidity		+/- 3 %

1.6 Environmental Conditions

Test Site	Test Date	Temperature (°C)	Relative Humidity (%)	ATM Pressure (hPa)	Test Engineer
Radiation Spurious Emissions	2022/06/28~2022/07/14	22.8~23.8	61~66	1010	Aaron
Conducted Spurious Emissions	2022/08/10	25.1	43	1010	David Hsu
6 dB Emission Bandwidth	2022/07/07	27.2	51	1010	David Hsu
Maximum Output Power	2022/07/07	27.2	51	1010	David Hsu
100 kHz Bandwidth of Frequency Band Edge	2022/07/07	27.2	51	1010	David Hsu
Power Spectral Density	2022/07/07	27.2	51	1010	David Hsu

1.7 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) to collect test data is located on

☒ 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3732) and the FCC designation No.TW3732 under the Mutual Recognition Agreement (MRA) in FCC Test.

2 System Test Configuration

2.1 Description of Test Configuration

For LoRa (500kHz) mode, 97 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	903	21	908	41	913	61	918	81	923
2	903.25	22	908.25	42	913.25	62	918.25	82	923.25
3	903.5	23	908.5	43	913.5	63	918.5	83	923.5
4	903.75	24	908.75	44	913.75	64	918.75	84	923.75
5	904	25	909	45	914	65	919	85	924
6	904.25	26	909.25	46	914.25	66	919.25	86	924.25
7	904.5	27	909.5	47	914.5	67	919.5	87	924.5
8	904.75	28	909.75	48	914.75	68	919.75	88	924.75
9	905	29	910	49	915	69	920	89	925
10	905.25	30	910.25	50	915.25	70	920.25	90	925.25
11	905.5	31	910.5	51	915.5	71	920.5	91	925.5
12	905.75	32	910.75	52	915.75	72	920.75	92	925.75
13	906	33	911	53	916	73	921	93	926
14	906.25	34	911.25	54	916.25	74	921.25	94	926.25
15	906.5	35	911.5	55	916.5	75	921.5	95	926.5
16	906.75	36	911.75	56	916.75	76	921.75	96	926.75
17	907	37	912	57	917	77	922	97	927
18	907.25	38	912.25	58	917.25	78	922.25	/	/
19	907.5	39	912.5	59	917.5	79	922.5	/	/
20	907.75	40	912.75	60	917.75	80	922.75	/	/

Were tested with channel 1, 49 and 97.

The system was configured for testing in engineering mode, which was provided by manufacturer.

2.2 Equipment Modifications

No modification was made to the EUT.

2.3 EUT Exercise Software

The test software was used “teraterm-4.94”

Test Frequency		Low	Middle	High
Power Level Setting	LoRa (500kHz)	15	15	15

2.4 Support Equipment List and Details

Description	Manufacturer	Model
NB	DELL	E6410
Fixture	Waveshare	FT232

2.5 External Cable List and Details

Cable Description	Length (m)	From	To
Data Cable	0.3	EUT	Fixture

2.6 Test Mode

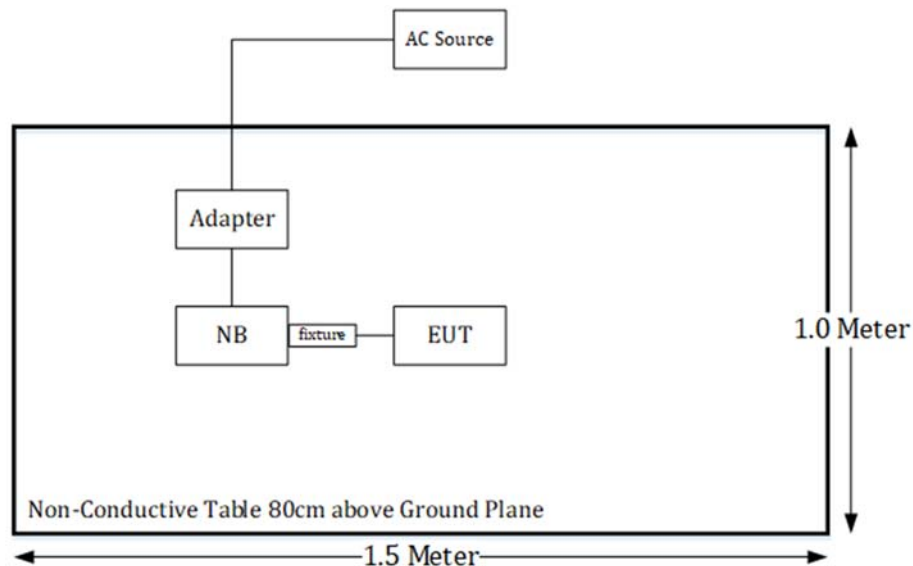
Full System (model: Electronic Shelf Label) for all test item.

2.7 Block Diagram of Test Setup

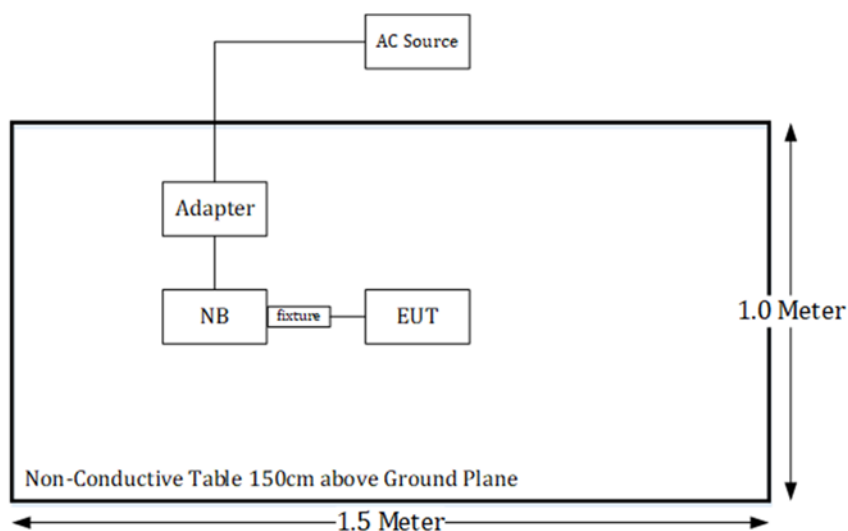
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

Radiation

Below 1GHz:



Above 1GHz:

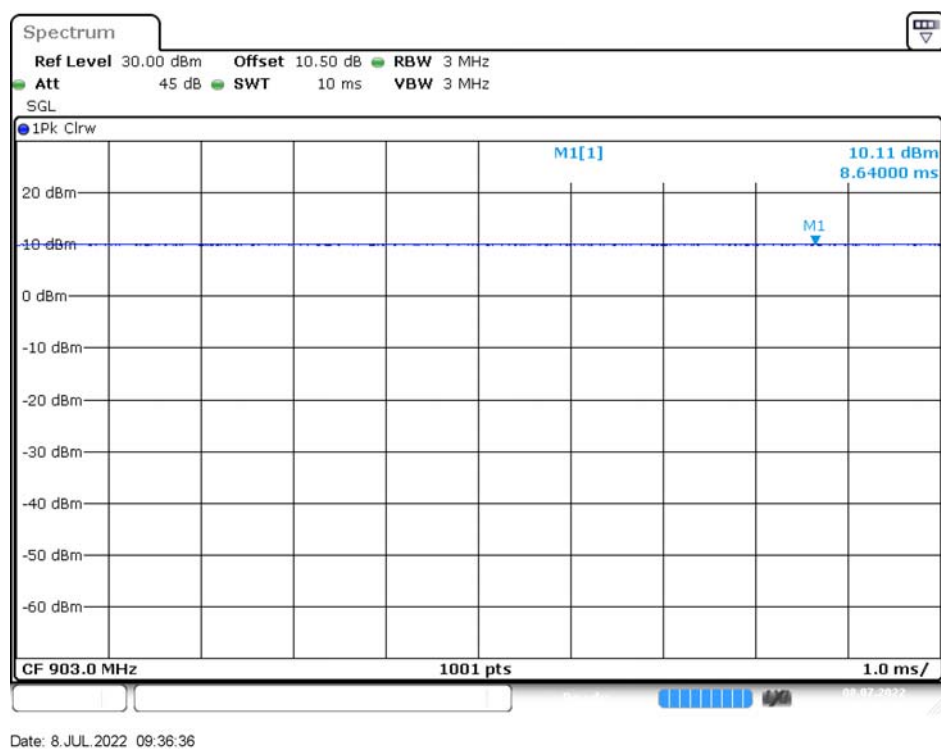


2.8 Duty Cycle

The duty cycle as below:

Radio Mode	On Time (ms)	Off Time (ms)	Duty Cycle (%)
LoRa	/	/	100

Please refer to the following plots.



3 Summary of Test Results

FCC Rules	Description of Test	Results
§15.247(i), §1.1307(b)(3)(i)	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Not applicable
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Average Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

Not applicable: The EUT is powered by batteries.

4 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Radiation 3M Room (966-A)					
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2022/02/14	2023/02/13
Horn Antenna	EMCO	SAS-571	1020	2022/5/25	2023/5/24
Horn Antenna	ETS-Lindgren	3116	62638	2021/8/11	2022/8/10
Preamplifier	Sonoma	310N	130602	2022/6/8	2023/6/7
Preamplifier	A.H. system Inc.	PAM-0118P	466	2021/11/4	2022/11/3
Microwave Preamplifier	EM Electronics Corporation	EM18G40G	60656	2021/12/27	2022/12/26
Spectrum Analyzer	Rohde & Schwarz	FSV40	101435	2021/12/27	2022/12/26
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2021/11/9	2022/11/8
Micro flex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2022/1/24	2023/1/23
Coaxial Cable	COMMATE	PEWC	8Dr	2021/12/24	2022/12/23
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2022/1/24	2023/1/23
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2021/12/24	2022/12/23
Cable	EMC	EMC105-SM-SM-10000	201003	2022/1/24	2023/1/23
Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2022/1/24	2023/1/23
Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-50CM	15120-1	2022/1/18	2023/1/17
Software	Audix	e3	18621a bacl	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101435	2022/1/13	2023/1/12
Cable	UTIFLEX	UFA210A	9435	2021/10/5	2022/10/4
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2022/01/24	2023/01/23
Attenuator	MINI-CIRCUITS	BW-S10W5+	1419	2022/2/11	2023/2/10

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements

5 FCC §15.247(i), §1.1307(b)(3)(i) - RF Exposure

5.1 Applicable Standard

According to subpart 15.247(i) and subpart §1.1307(b)(3)(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

For single RF sources (*i.e.*, any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

5.2 RF Exposure Evaluation Result

Project info

Band	Freq (MHz)	Tune-up Power (dBm)	Ant Gain (dBi)	Distances (mm)	Duty (%)	Tune-up Power (mW)	ERP (dBm)	ERP (mW)
LoRa	927	12	-2.62	200	100%	15.85	7.23	5.28

Option A

The available maximum time-averaged power is no more than 1 mW

Band	Freq (MHz)	Result Option A
LoRa	927	not exempt

Option B

The available maximum time-averaged power or effective radiated power (ERP), whichever is greater.

This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive).

Band	Freq (MHz)	Pth (mW)	X	ERP 20cm (mW)	Ratio	Result Option B
LoRa	927	1891.08	1.482	1891.08	0.01	exempt

Result: The device meets the exemption requirement.

6 FCC §15.203 – Antenna Requirements

6.1 Applicable Standard

According to § 15.203,

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.2 Antenna Information

Function	Manufacturer	Antenna Gain
PIFA antenna	M2Comm	-2.62 dBi

Result: Compliance

7 FCC §15.209, §15.205 , §15.247(d) – Spurious Emissions

7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function.

Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	608 – 614	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	960 – 1240	5. 35 – 5. 46
2.1735 – 2.1905	16.80425 – 16.80475	1300 – 1427	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1435 – 1626.5	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1645.5 – 1646.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1660 – 1710	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1718.8 – 1722.2	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	2200 – 2300	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2310 – 2390	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2483.5 – 2500	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2690 – 2900	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	3260 – 3267	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3.332 – 3.339	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3 3458 – 3 358	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3.600 – 4.400	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4		Above 38.6
13.36 – 13.41	399.9 – 410		

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/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

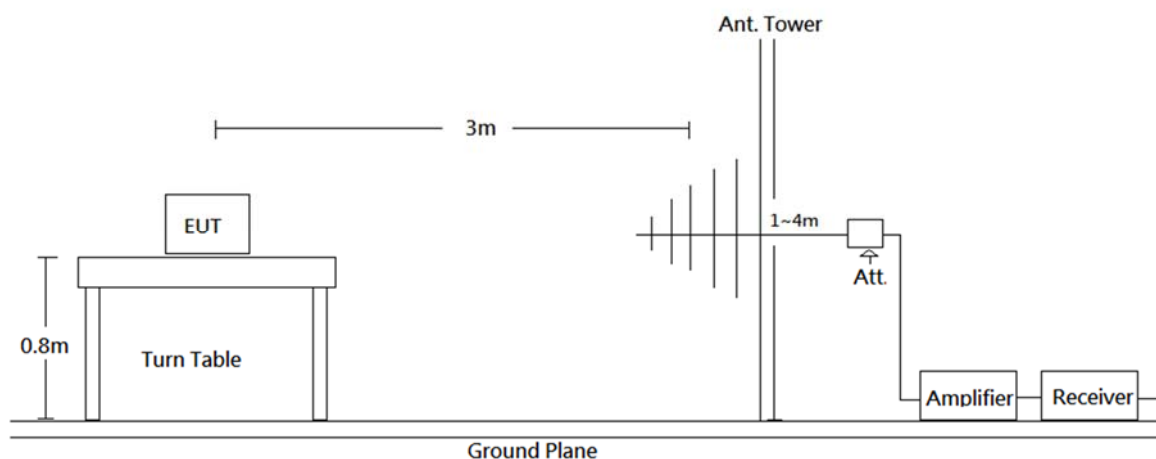
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level

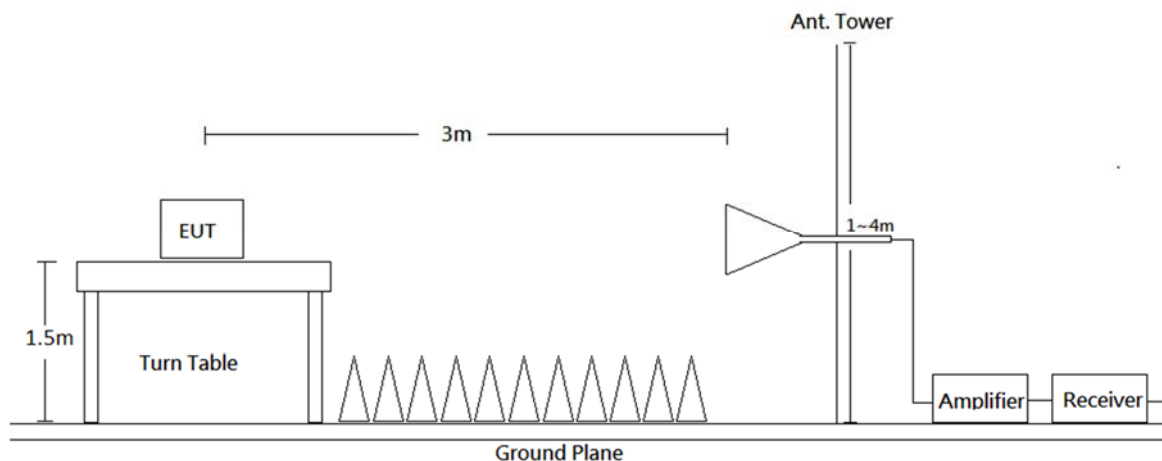
of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

7.2 EUT Setup

Below 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

7.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 10 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Duty cycle	Measurement method
30-1000 MHz	120 kHz	300 kHz	/	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10Hz	>98%	Ave
	1 MHz	1/T	<98%	Ave

Note: T is minimum transmission duration

7.4 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

7.5 Corrected Factor & Margin Calculation

The Correct Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Correct Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Result} - \text{Limit}$$

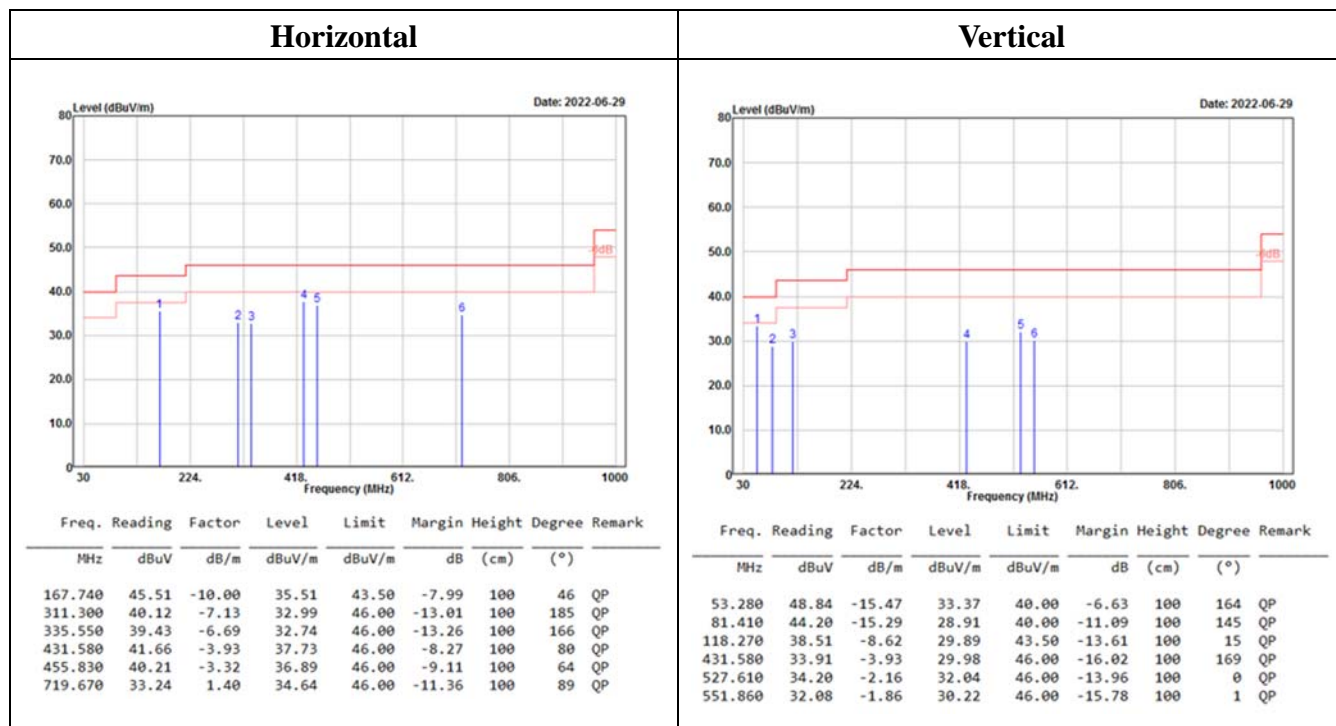
7.6 Test Results

Test Mode: Transmitting

(Pre-scan with three orthogonal axis, and worse case as Y axis.)

(worst case is high channel)

30MHz-1GHz:



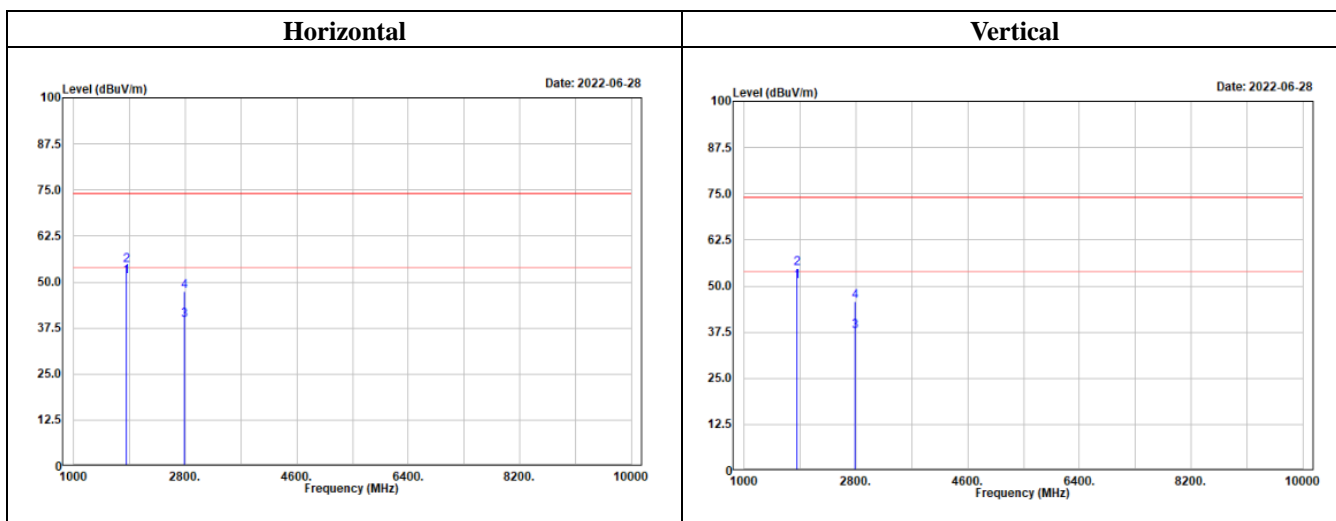
Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

1GHz-10GHz:



Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.
(New Taipei Laboratory)

Horizontal

Low channel								
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
902.000	52.70	5.33	58.03	84.12	-26.09	101	352	QP
903.000	101.33	5.40	106.73			101	352	Peak
903.000	98.72	5.40	104.12			101	352	QP
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
1806.000	57.87	-12.73	45.14	54.00	-8.86	151	29	Average
1806.000	61.44	-12.73	48.71	74.00	-25.29	151	29	Peak
2709.000	43.06	-8.16	34.90	54.00	-19.10	168	85	Average
2709.000	52.19	-8.16	44.03	74.00	-29.97	168	85	Peak
Middle channel								
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
915.000	102.76	5.61	108.37			105	349	Peak
915.000	100.02	5.61	105.63			105	349	QP
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
1830.000	62.08	-12.48	49.60	54.00	-4.40	166	22	Average
1830.000	65.23	-12.48	52.75	74.00	-21.25	166	22	Peak
2745.000	45.00	-8.20	36.80	54.00	-17.20	148	239	Average
2745.000	53.36	-8.20	45.16	74.00	-28.84	148	239	Peak
High channel								
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
927.000	104.63	6.15	110.78			103	100	Peak
927.000	101.69	6.15	107.84			103	100	QP
928.000	46.04	6.22	52.26	87.84	-35.58	103	100	QP
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
1854.000	63.73	-12.23	51.50	54.00	-2.50	137	35	Average
1854.000	66.69	-12.23	54.46	74.00	-19.54	137	35	Peak
2781.000	47.77	-8.20	39.57	54.00	-14.43	150	239	Average
2781.000	55.65	-8.20	47.45	74.00	-26.55	150	239	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Low channel								
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
902.000	53.50	5.33	58.83	85.27	-26.44	142	96	QP
903.000	102.21	5.40	107.61			142	96	Peak
903.000	99.87	5.40	105.27			142	96	QP
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
1806.000	63.72	-12.73	50.99	54.00	-3.01	163	21	Average
1806.000	66.82	-12.73	54.09	74.00	-19.91	163	21	Peak
2709.000	45.31	-8.16	37.15	54.00	-16.85	169	338	Average
2709.000	53.73	-8.16	45.57	74.00	-28.43	169	338	Peak
Middle channel								
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
915.000	103.69	5.61	109.30			137	95	Peak
915.000	101.44	5.61	107.05			137	95	QP
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
1830.000	62.78	-12.48	50.30	54.00	-3.70	117	352	Average
1830.000	65.85	-12.48	53.37	74.00	-20.63	117	352	Peak
2745.000	45.21	-8.20	37.01	54.00	-16.99	164	212	Average
2745.000	53.51	-8.20	45.31	74.00	-28.69	164	212	Peak
High channel								
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
927.000	103.82	6.15	109.97			138	88	Peak
927.000	100.88	6.15	107.03			138	88	QP
928.000	45.26	6.22	51.48	87.03	-35.55	138	88	QP
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
1854.000	63.44	-12.23	51.21	54.00	-2.79	176	21	Average
1854.000	67.06	-12.23	54.83	74.00	-19.17	176	21	Peak
2781.000	45.81	-8.20	37.61	54.00	-16.39	195	0	Average
2781.000	54.08	-8.20	45.88	74.00	-28.12	195	0	Peak

Level (Result) = Reading + Factor.

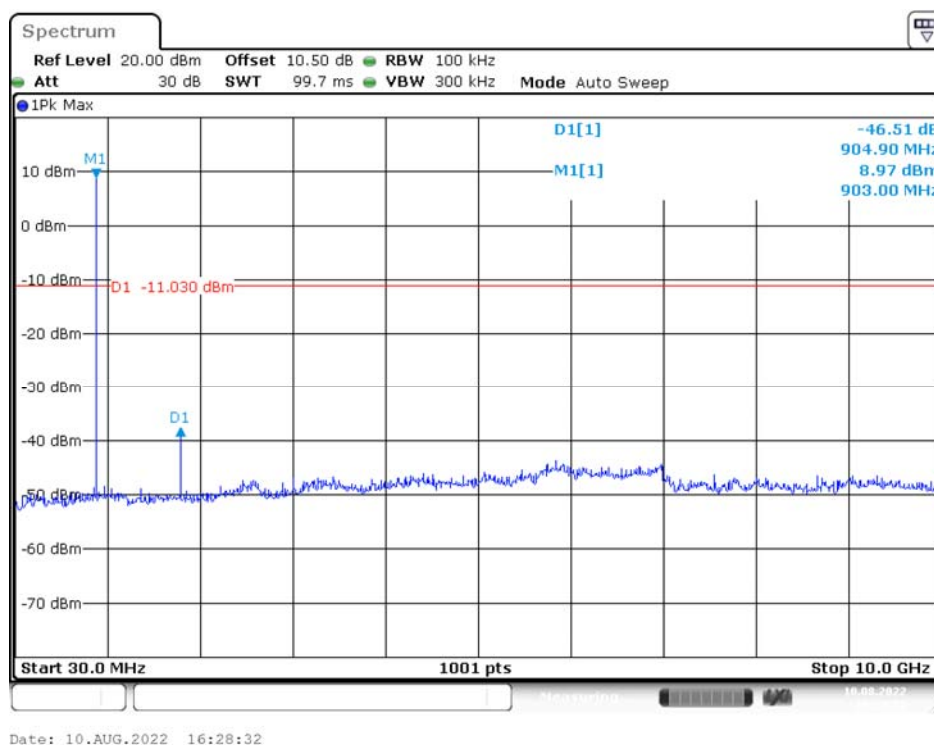
Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
Low	903	45.51	≥ 20	PASS
Middle	915	46.99	≥ 20	PASS
High	927	46.36	≥ 20	PASS

Low Channel

Spectrum

Ref Level 20.00 dBm Offset 10.50 dB RBW 100 kHz
Att 30 dB SWT 99.7 ms VBW 300 kHz Mode Auto Sweep

1Pk Max

10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm

M1
D1[1]
M1[1]
D1

-46.99 dBm
912.80 MHz
10.06 dBm
915.00 MHz

D1 -9.940 dBm

Start 30.0 MHz 1001 pts Stop 10.0 GHz

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Spectrum

Ref Level	20.00 dBm	Offset	10.50 dB	RBW	100 kHz
Att	30 dB	SWT	99.7 ms	VBW	300 kHz
Mode Auto Sweep					

1Pk Max

M1 -46.36 dB
930.70 MHz
9.93 dBm
927.00 MHz

M1[1]

D1 -10.070 dBm

D1

Start 30.0 MHz 1001 pts Stop 10.0 GHz

Measuring...

10.08.2022

Date: 10.AUG.2022 16:24:37

8 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

8.1 Applicable Standard

According to FCC §15.247(a)(2).

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.2 Test Procedure

The steps for the first option are as follows:

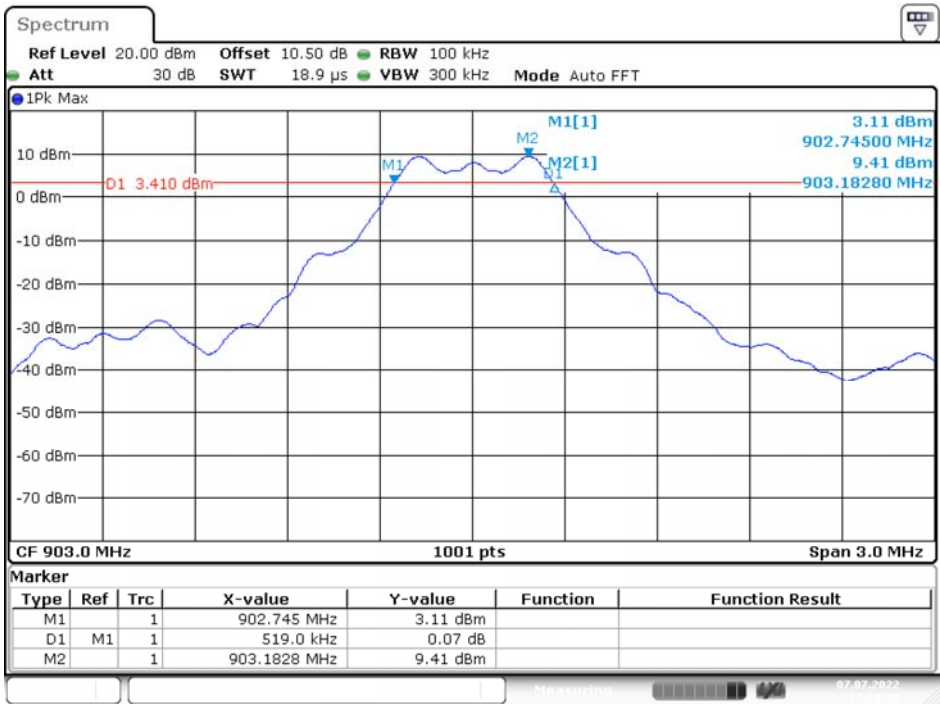
- a) Set RBW = 100 kHz.
- b) Set the VBW $\geq [3 \times \text{RBW}]$.
- c) Detector = peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

8.3 Test Results

Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	Limit (kHz)	Result
Low	903	519	> 500	Compliance
Middle	915	519	> 500	Compliance
High	927	519	> 500	Compliance

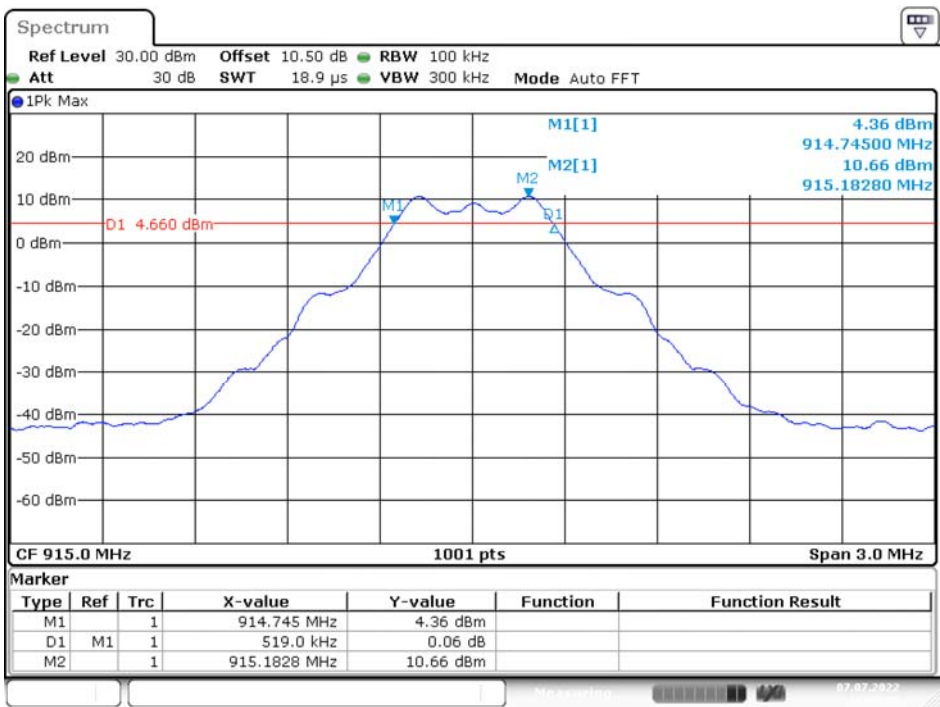
Please refer to the following plots

Low Channel



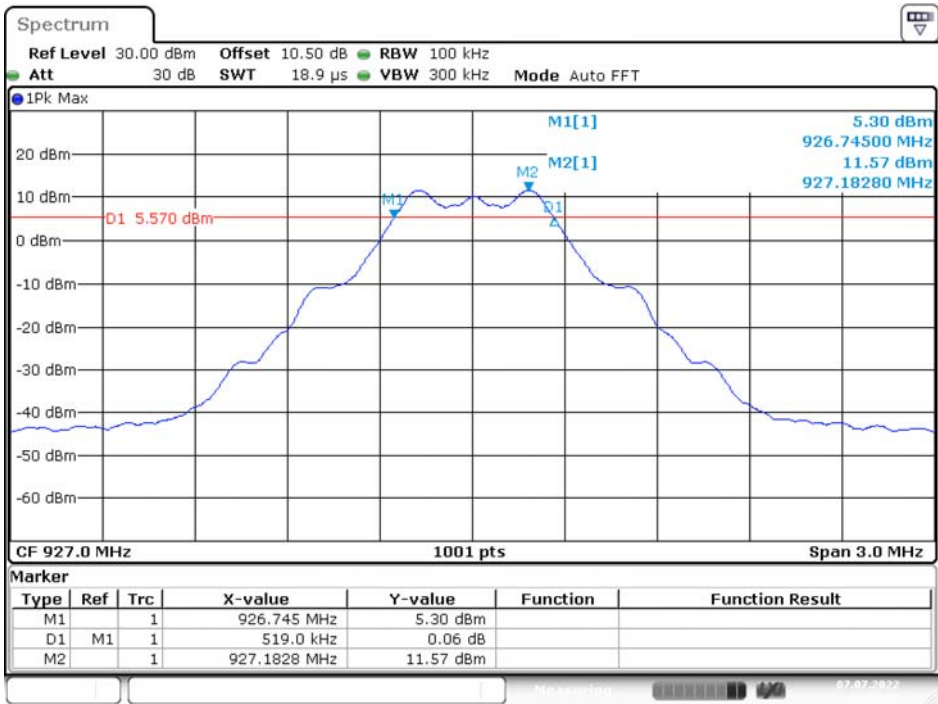
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Middle Channel



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High Channel



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9 FCC §15.247(b)(3) – Maximum Output Power

9.1 Applicable Standard

According to FCC §15.247(b) (3).

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

9.2 Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to measuring equipment.

9.3 Test Results

Conducted Peak Output Power

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	Power (W)	Limit (W)	Result
Low	903	9.61	0.009	1	PASS
Middle	915	10.72	0.012	1	PASS
High	927	11.57	0.014	1	PASS

10 FCC§15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

10.1 Applicable Standard

According to FCC §15.247(d).

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

10.2 Test Procedure

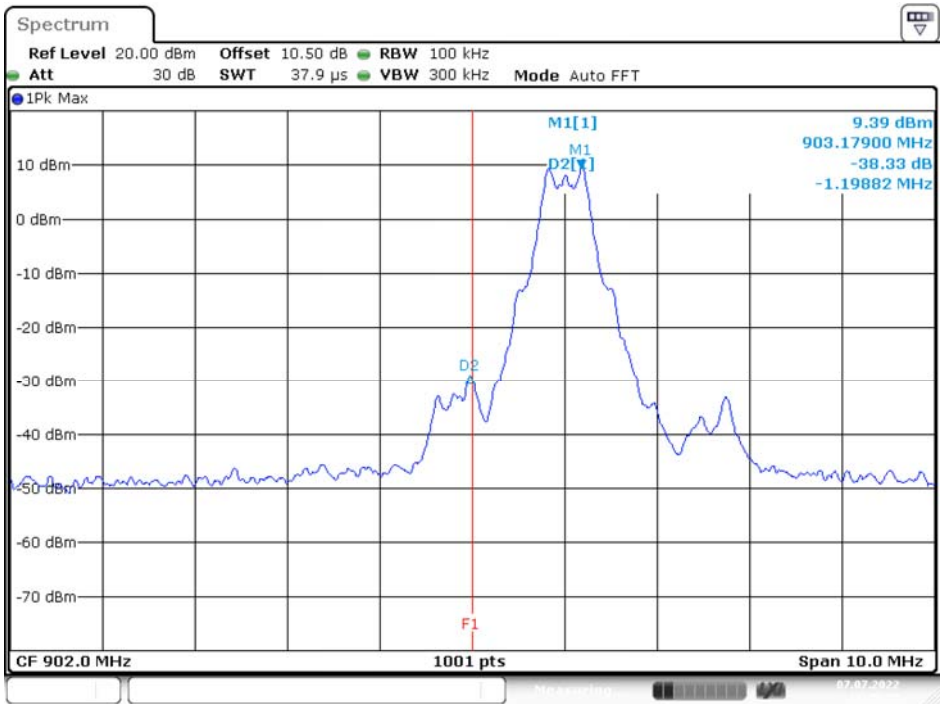
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

10.3 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
Low	903	38.33	≥ 20	PASS
High	927	55.28	≥ 20	PASS

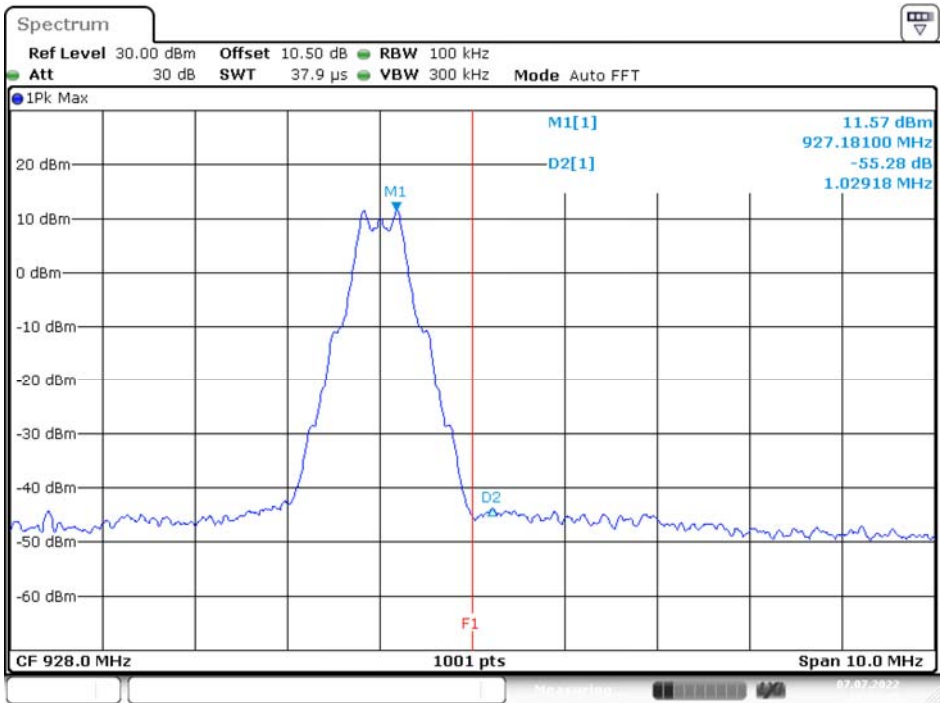
Please refer to the following plots

Band Edge, Left Side



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Band Edge, Right Side



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11 FCC §15.247(e) – Power Spectral Density

11.1 Applicable Standard

According to FCC §15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

11.2 Test Procedure

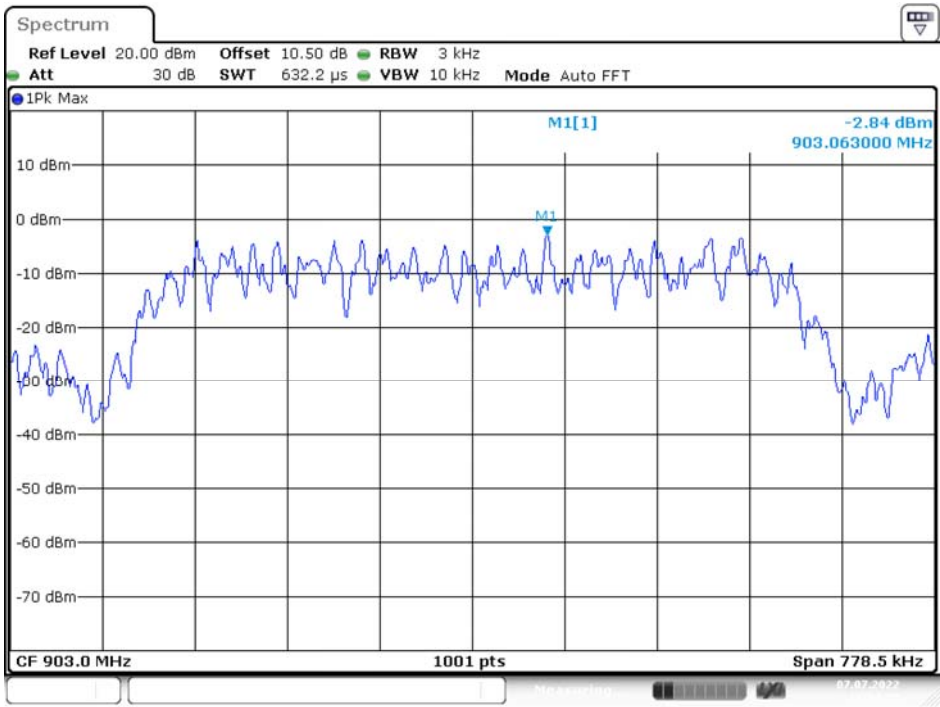
- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW $\geq [3 \times \text{RBW}]$.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat

11.3 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
Low	903	-2.84	8	Compliance
Middle	915	-1.63	8	Compliance
High	927	-0.73	8	Compliance

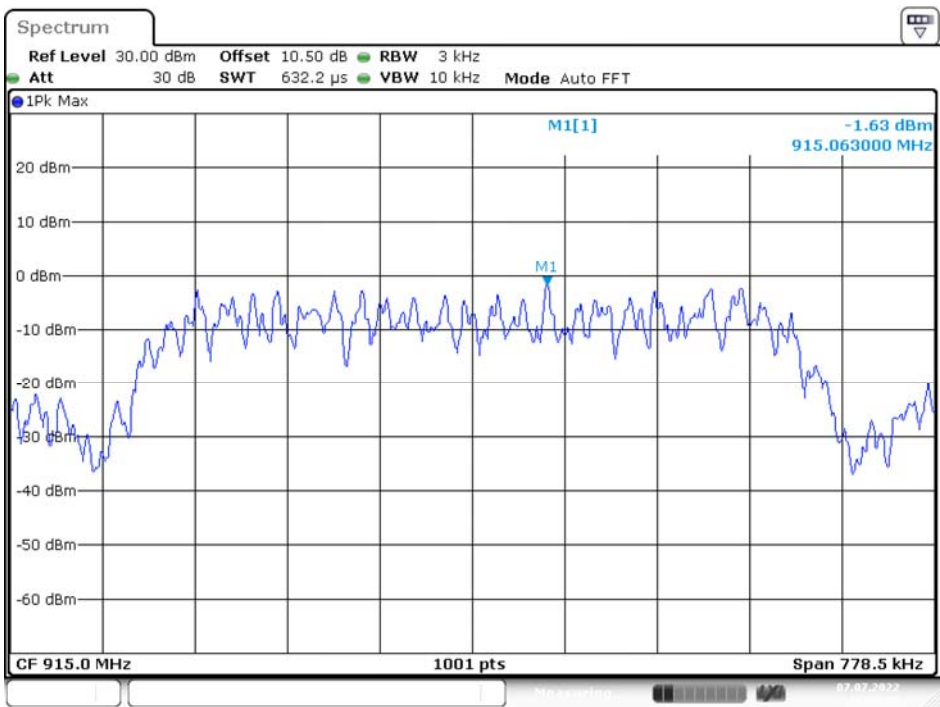
Please refer to the following plots

Low Channel



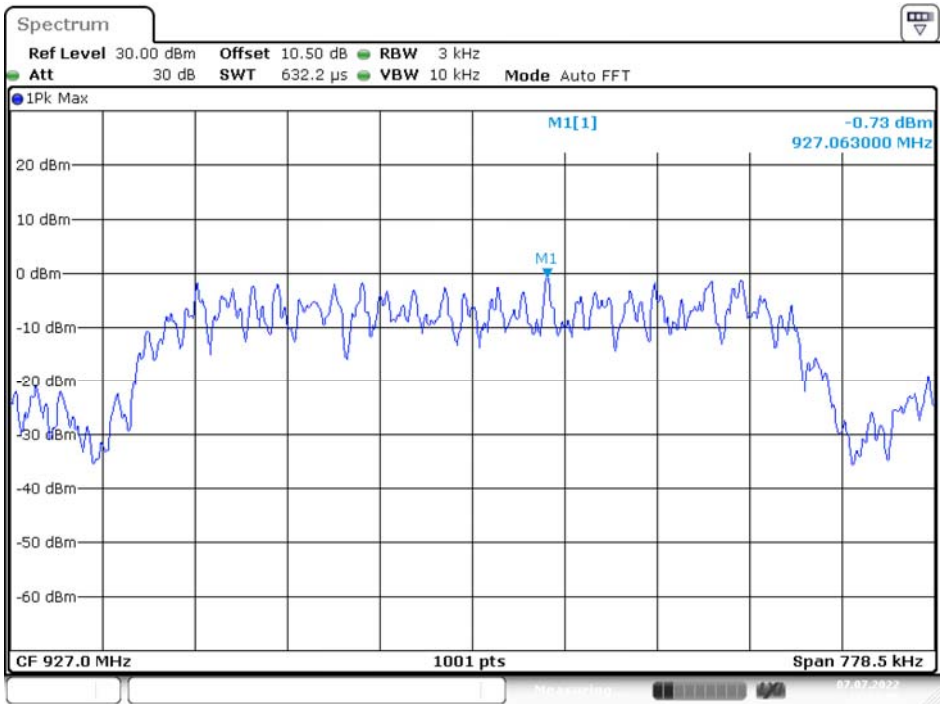
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Middle Channel



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High Channel



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***** END OF REPORT *****