TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15.247

TEST REPORT

For

LANSITEC Information Technology Co., Ltd.

Room 501, No. 21 Huashen Avenue, Nanjing, China.

FCC ID: 2APPL-LSTR100

Report Type:	**Product Type:**
Original Report	LoRa & BLE Device

Test Engineer:	Sam Ye
Report Number:	RSHA190924002-00C
Report Date:	2019-11-21
Reviewed By:	Oscar Ye EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	LANSITEC Information Technology Co., Ltd.
Tested Model	C256U-PQ
Series Model	100-18360, 100-18361, 100-18363, 100-18364, 100-18473, 100-02046, 100-02048, 100-02049, 100-02476, 100-02490, 100-02478, 100-02533, 100-02535, 100-02538, 100-00174, 100-00160, 100-00165, 100-02386, 100-02387, 100-02388
Model Difference	Model names
Product Type	LoRa & BLE Device
Power Supply	DC 3.7V
Operating Frequency	LoRa(500kHz): 903-914.2MHz,LoRa(125kHz): 902.3-914.9MHz; BLE: 2402~2480MHz
Channel Number	LoRa 125kHz: 64, 500kHz: 8; BLE:40
Channel Separation	LoRa 125kHz: 200kHz, 500kHz: 1.6 MHz;BLE:2MHz
Modulation Type	LoRa: FSK; BLE:GFSK
Antenna Type	BLE:PCB antenna; LoRa: Spring antenna
Maximum Antenna Gain	LoRa: 0dBi; BLE:1dBi

**All measurement and test data in this report was gathered from production sample serial number: 20190924002. (Assigned by the BACL. The EUT supplied by the applicant was received on 2019-09-24).*

Objective

This report is prepared on behalf of *LANSITEC Information Technology Co., Ltd.* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions' rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

Part 15.247 DTS and Part 15.247 DSS submissions with FCC ID: 2APPL-LSTR100.

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 and FCC KDB 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19 dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel List for LoRa mode:

The frequencies is F(MHz)=903.0+1.6*(n-64) (64<=n<=71). The lowest, middle, highest channel numbers of the EUT used and tested in this report are below.

Channel	Frequency (MHz)
64	903.0
68	909.4
71	914.2

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

RF test tool: X COM U2.0.exe.

Power Level: 17

Support Equipment List and Details

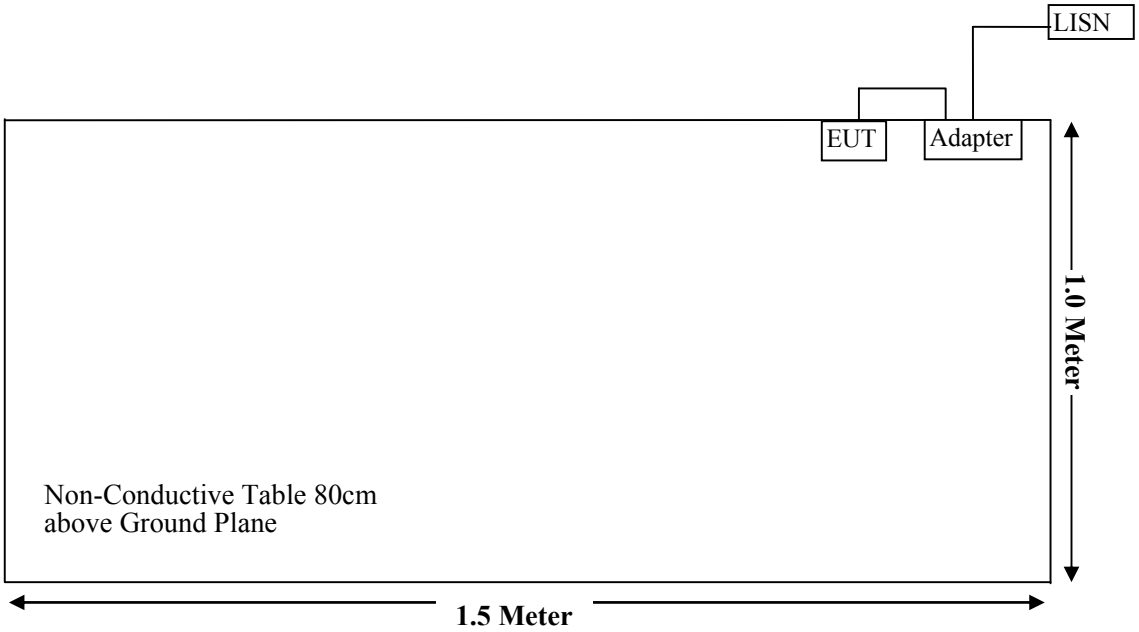
Manufacturer	Description	Model	Serial Number
Shanghai sucheng Electronic Co.,Ltd	Adapter	SC24W-1202000U	/

External I/O Cable

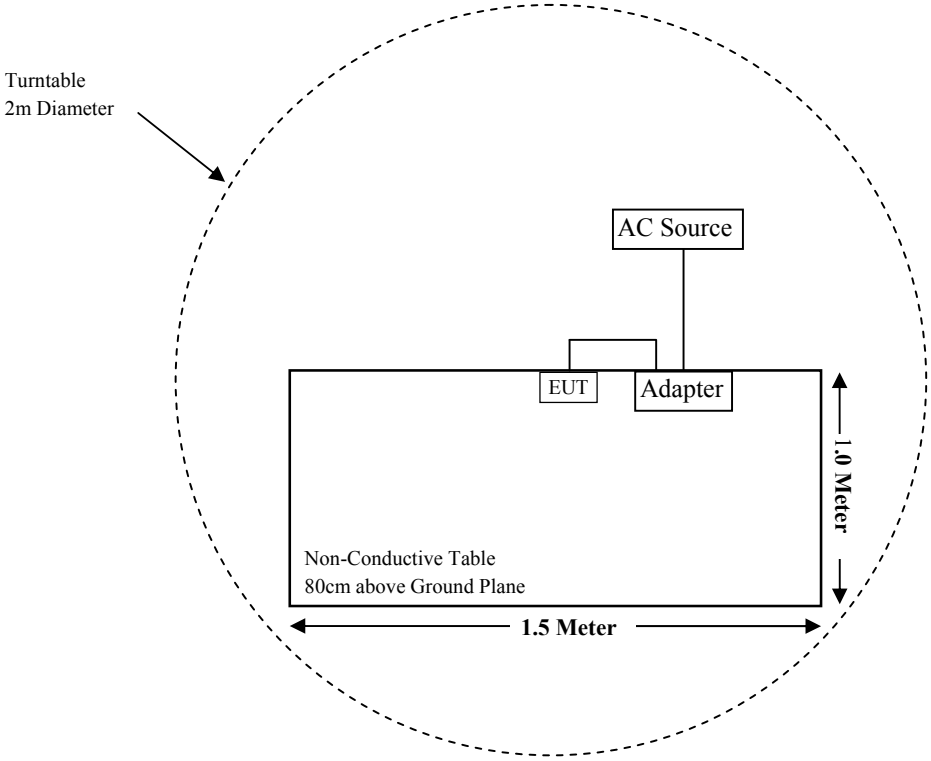
Cable Description	Length (m)	From Port	To
Power Cable	1.0	EUT	Adapter

Block Diagram of Test Setup

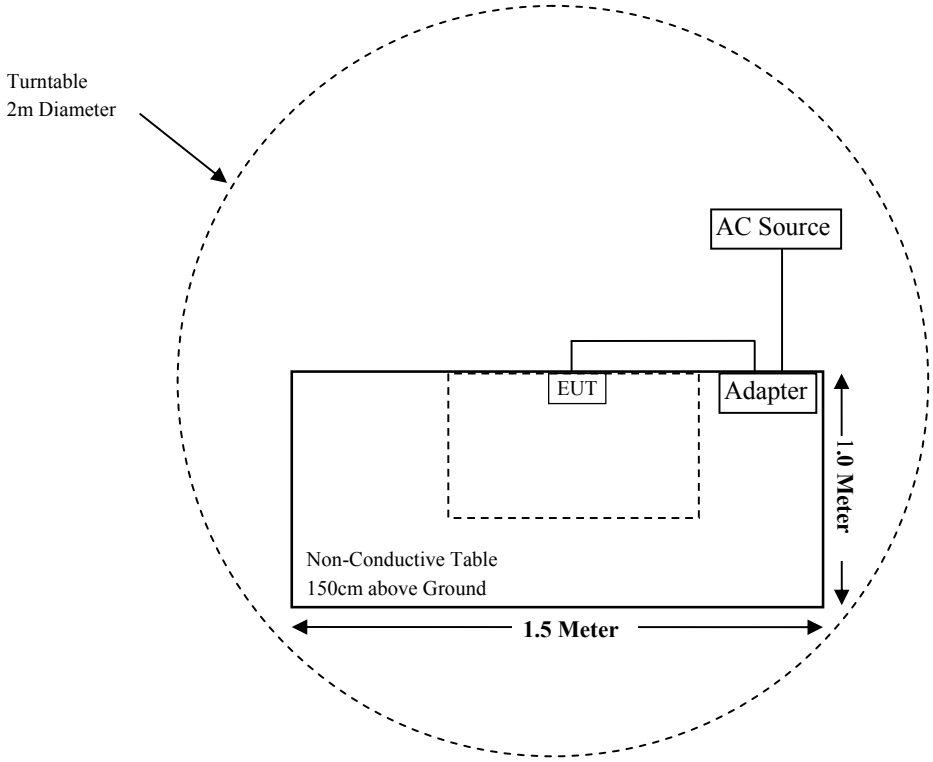
For Conducted Emissions:



For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §1.1310& §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test receiver	ESR	1316.3003K03-102454-Qd	2019-06-25	2020-06-24
Sunol Sciences	Bilog antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sonoma Instrunent	Pre-amplifier	310N	171205	2019-08-14	2020-08-13
Audix	Test Software	e3	V9	-	-
MICRO-COAX	Coaxial Cable	Cable-8	008	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2019-08-15	2020-08-14
Radiated Emission Test（Chamber 2#）					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2019-05-30	2020-05-29
ETS-LINDGREN	Horn Antenna	3115	6229	2017-07-15	2020-07-14
A.H.Systems，inc	Preamplifier	2641-1	491	2019-02-20	2020-02-19
Narda	Attenuator	10dB	010	2019-08-15	2020-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2019-08-15	2020-08-14
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2018-11-30	2019-11-29
Narda	Attenuator	10dB	010	2019-08-15	2020-08-14
Lansitec	RF Cable	Lansitec C01	C01	Each Time	N/A
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3003K03-101746-zn	2019-07-11	2020-07-10
Audix	Test Software	e3	V9	--	--
Rohde & Schwarz	LISN	ENV216	3560655016	2018-11-30	2019-11-29
Narda	Attenuator/6dB	10690812-2	26850-6	2019-01-10	2020-01-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2019-08-15	2020-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310& §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247(i) and subpart §1.1310, 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.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	/		f/1500	30
1500-100,000	/		1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)	MPE ratio
		(dBi)	(numeric)	(dBm)	(mW)				
LoRa (125kHz)	902.3-914.9	0	1.00	17.50	56.23	20	0.0112	0.60	**0.0187**
LoRa (500kHz)	903-914.2	0	1.00	17.50	56.23	20	0.0112	0.60	0.0187
BLE	2402-2480	1.00	1.26	-2.00	0.63	20	0.0002	1.00	0.0002

Note: BLE& LoRa can transmit simultaneously.

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0187+0.0002=\mathbf{0.0189 < 1.0}$$

Conclusion: The device meets FCC MPE at 20 cm distance.

FCC §15.203 - ANTENNA REQUIREMENT

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. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
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.

Antenna Connector Construction

The EUT has a spring antenna for Lora, which the antenna gain is 0dBi; fulfill the requirement of this section. Please refer to the EUT photos.

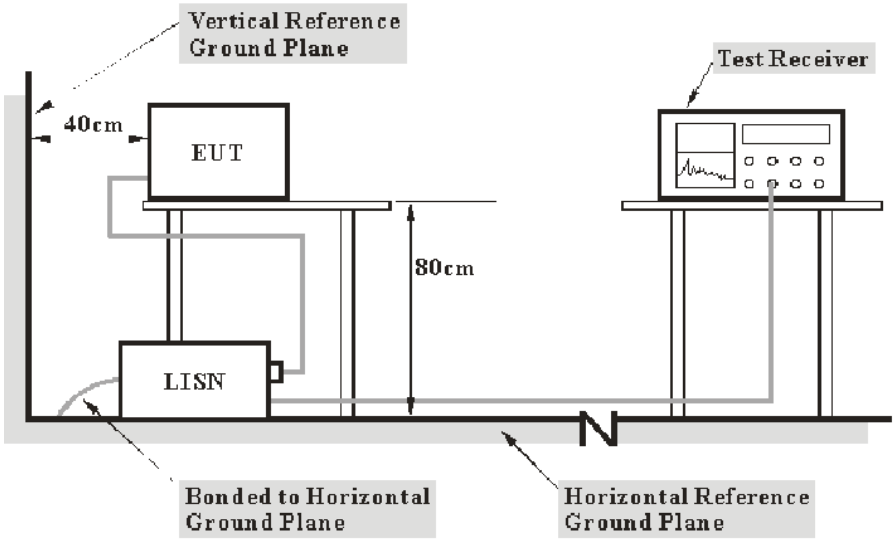
Result: Pass.

FCC §15.207 (a) - AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz - 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Over Limit Calculation

The Factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of 7 dB means the emission is 7 dB above the limit. The equation for over limit calculation is as follows:

Over Limit (dB) = Read level (dBμV) + Factor (dB) - Limit (dBμV)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

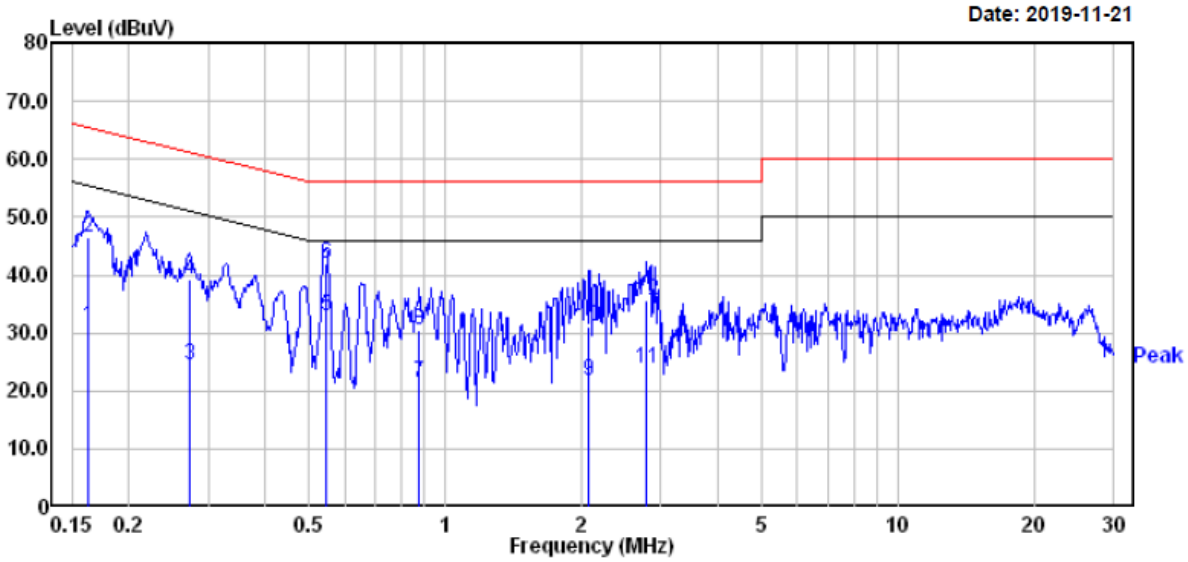
Environmental Conditions

Temperature:	22.3℃
Relative Humidity:	49 %
ATM Pressure:	101.2 kPa

The testing was performed by Sam Ye on 2019-11-21.

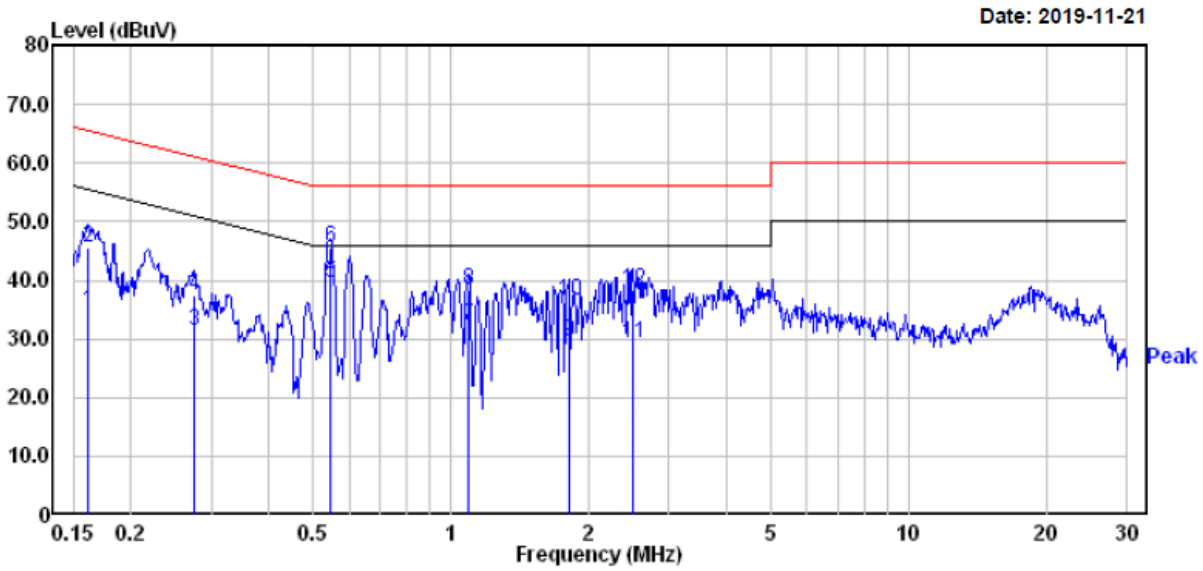
EUT operation mode: Transmitting in middle channel. (Worst case)

AC 120V/60 Hz, Line



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.162	11.40	19.83	31.23	55.34	-24.11	Average
2	0.162	26.60	19.83	46.43	65.34	-18.91	QP
3	0.273	4.50	19.82	24.32	51.03	-26.71	Average
4	0.273	19.40	19.82	39.22	61.03	-21.81	QP
5	0.546	13.10	19.75	32.85	46.00	-13.15	Average
6	0.546	22.20	19.75	41.95	56.00	-14.05	QP
7	0.876	1.59	19.73	21.32	46.00	-24.68	Average
8	0.876	10.89	19.73	30.62	56.00	-25.38	QP
9	2.077	1.90	19.77	21.67	46.00	-24.33	Average
10	2.077	11.30	19.77	31.07	56.00	-24.93	QP
11	2.794	4.50	19.47	23.97	46.00	-22.03	Average
12	2.794	16.20	19.47	35.67	56.00	-20.33	QP

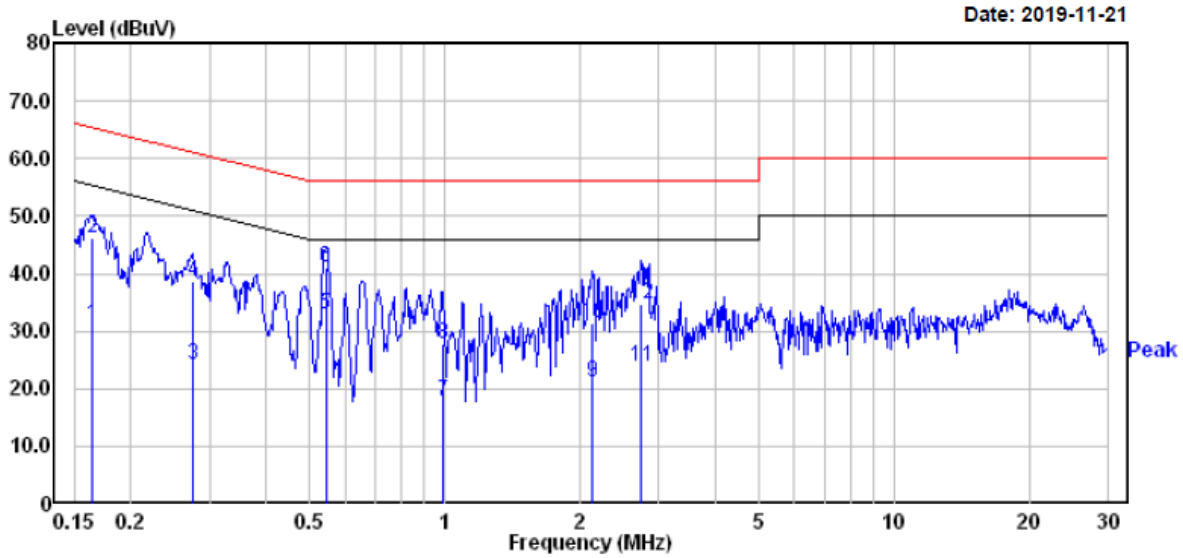
AC 120V/60 Hz, Neutral



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.162	14.90	19.83	34.73	55.38	-20.65	Average
2	0.162	25.80	19.83	45.63	65.38	-19.75	QP
3	0.274	11.50	19.82	31.32	50.98	-19.66	Average
4	0.274	17.60	19.82	37.42	60.98	-23.56	QP
5	0.546	19.79	19.75	39.54	46.00	-6.46	Average
6	0.546	25.90	19.75	45.65	56.00	-10.35	QP
7	1.094	12.50	19.82	32.32	46.00	-13.68	Average
8	1.094	18.40	19.82	38.22	56.00	-17.78	QP
9	1.810	9.80	19.84	29.64	46.00	-16.36	Average
10	1.810	16.70	19.84	36.54	56.00	-19.46	QP
11	2.500	9.69	19.48	29.17	46.00	-16.83	Average
12	2.500	18.99	19.48	38.47	56.00	-17.53	QP

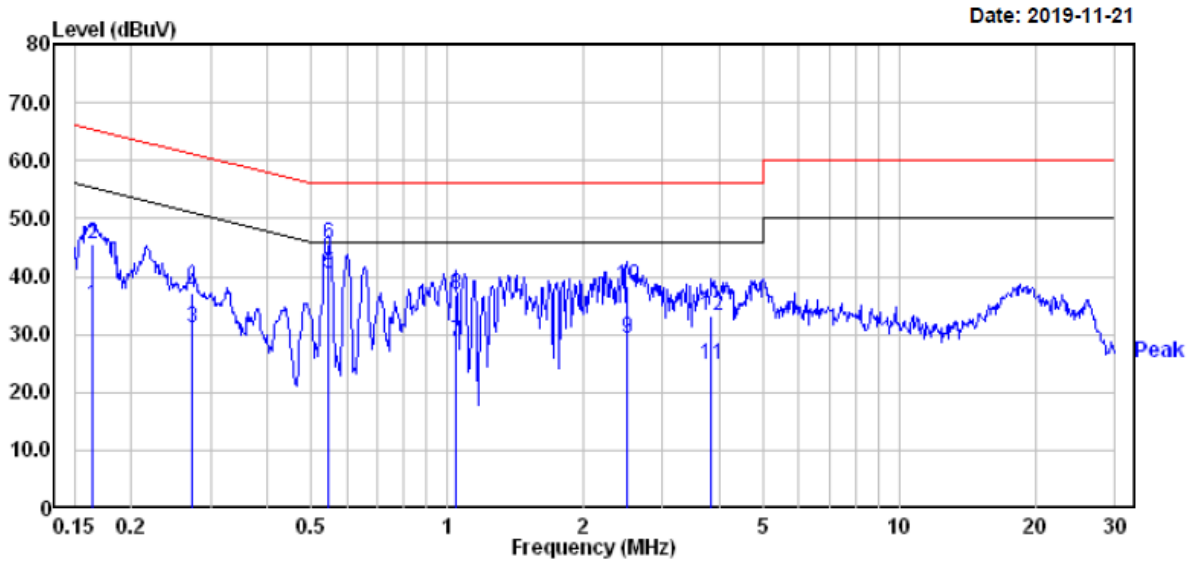
The worst case low Channel of BLE and low channel of Lora (125kHz)mode transmitting simultaneously was recorded

AC 120V/60 Hz, Line



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.164	11.20	19.83	31.03	55.25	-24.22	Average
2	0.164	26.40	19.83	46.23	65.25	-19.02	QP
3	0.274	4.40	19.82	24.22	50.98	-26.76	Average
4	0.274	18.90	19.82	38.72	60.98	-22.26	QP
5	0.544	13.10	19.75	32.85	46.00	-13.15	Average
6	0.544	21.40	19.75	41.15	56.00	-14.85	QP
7	0.989	-1.90	19.81	17.91	46.00	-28.09	Average
8	0.989	8.10	19.81	27.91	56.00	-28.09	QP
9	2.133	1.40	19.73	21.13	46.00	-24.87	Average
10	2.133	11.60	19.73	31.33	56.00	-24.67	QP
11	2.736	4.40	19.47	23.87	46.00	-22.13	Average
12	2.736	15.30	19.47	34.77	56.00	-21.23	QP

AC 120V/60 Hz, Neutral



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.164	15.30	19.83	35.13	55.25	-20.12	Average
2	0.164	25.80	19.83	45.63	65.25	-19.62	QP
3	0.273	11.30	19.82	31.12	51.03	-19.91	Average
4	0.273	17.30	19.82	37.12	61.03	-23.91	QP
5	0.546	20.61	19.75	40.36	46.00	-5.64	Average
6	0.546	25.90	19.75	45.65	56.00	-10.35	QP
7	1.043	9.00	19.82	28.82	46.00	-17.18	Average
8	1.043	16.90	19.82	36.72	56.00	-19.28	QP
9	2.500	9.69	19.48	29.17	46.00	-16.83	Average
10	2.500	18.80	19.48	38.28	56.00	-17.72	QP
11	3.840	5.40	19.47	24.87	46.00	-21.13	Average
12	3.840	13.70	19.47	33.17	56.00	-22.83	QP

Note:

1) Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Over Limit (dB) = Read level (dBμV) + Factor (dB) - Limit (dBμV)

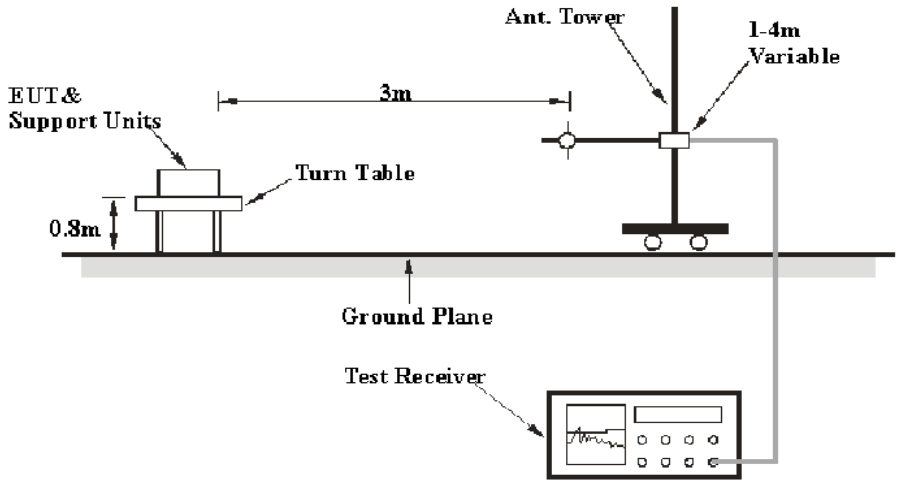
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

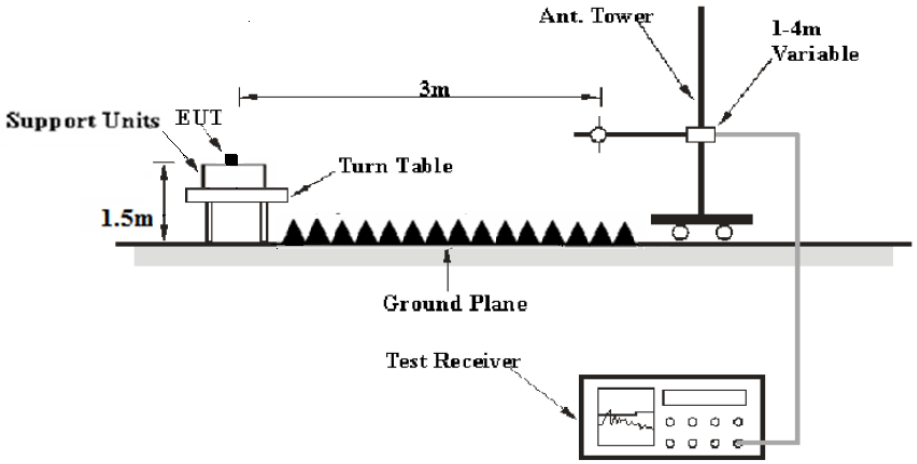
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



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

EMI Test Receiver Setup

The system was investigated from 30 MHz to10 GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz - 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	Ave

Test Procedure

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

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Factor & Over Limit Calculation (for below 1GHz)

The factor is calculated by adding Antenna Factor, Cable Loss and Amplifier Gain. The basic equation is as follows:

Factor (dB) =Antenna Factor (dB/m) + Cable Loss (dB) + Amplifier Gain (dB)

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over Limit of 7dB means the emission is 7 dB above the limit. The equation for over Limit calculation is as follows:

Over Limit (dB) = Read level (dBμV) + Factor (dB) - Limit (dBμV)

Corrected Amplitude & Margin Calculation (for above 1GHz)

The Corrected Amplitude 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:

Corrected Amplitude (dBμV /m) = Meter Reading (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

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

Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Test Data

Environmental Conditions

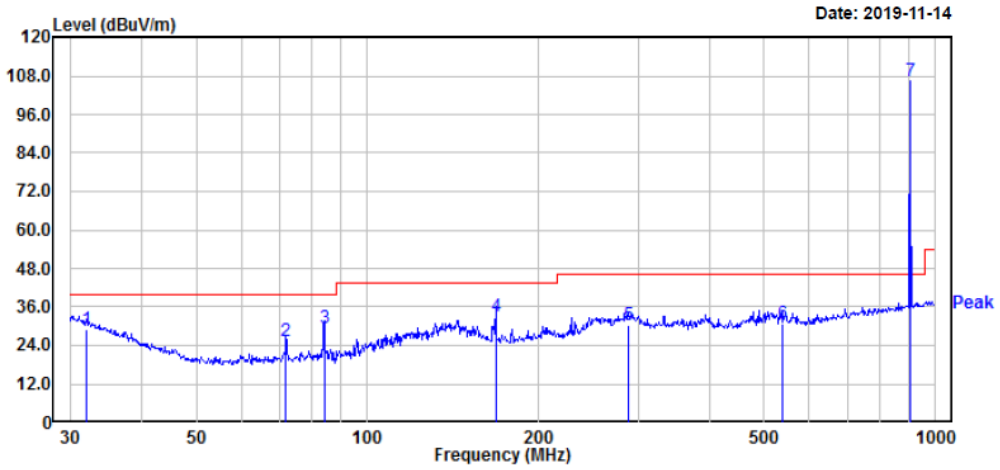
Temperature:	23.6~24.2℃
Relative Humidity:	48~51 %
ATM Pressure:	101.2~101.3 kPa

The testing was performed by Sam Ye from 2019-11-13 to 2019-11-21.

EUT operation mode: Transmitting

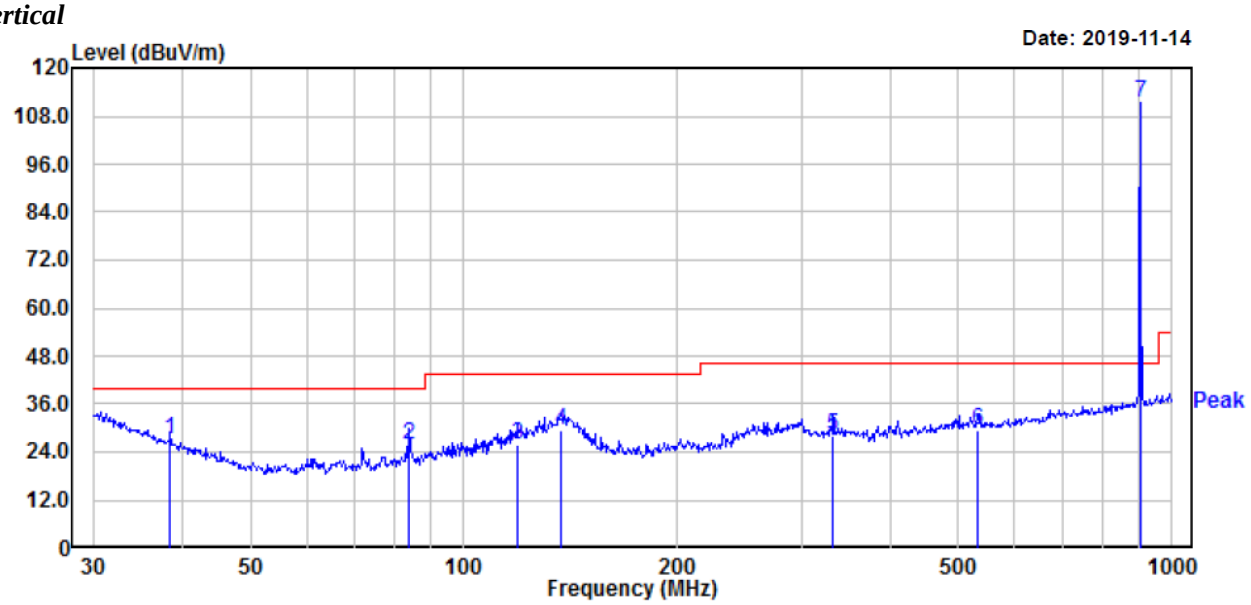
30MHz-1GHz
Horizontal

Frequency: 903.0MHz



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	APos	TPos	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	31.96	33.96	-4.76	29.20	40.00	-10.80	100	315	QP
2	71.83	42.11	-16.93	25.18	40.00	-14.82	200	352	QP
3	84.11	46.79	-17.20	29.59	40.00	-10.41	200	359	QP
4	168.41	45.59	-12.45	33.14	43.50	-10.36	100	150	QP
5	287.99	40.66	-10.45	30.21	46.00	-15.79	100	359	QP
6	537.59	35.89	-4.95	30.94	46.00	-15.06	200	68	QP
7	903.31	105.22	1.12	106.34	46.00	60.34	100	196	Basic Freq

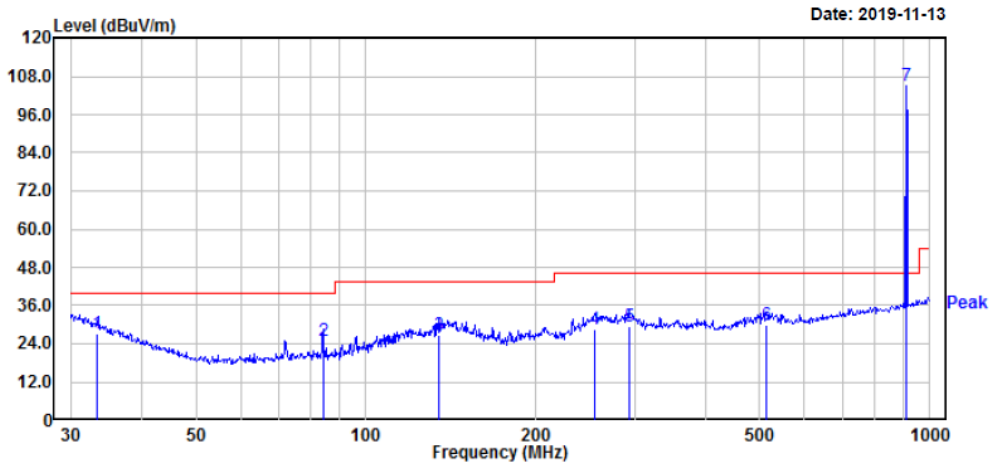
Vertical



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	APos	TPos	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	38.48	37.20	-10.18	27.02	40.00	-12.98	100	239	QP
2	83.82	43.14	-17.21	25.93	40.00	-14.07	200	261	QP
3	119.02	36.50	-10.85	25.65	43.50	-17.85	100	172	QP
4	137.42	40.92	-11.63	29.29	43.50	-14.21	100	347	QP
5	332.52	37.47	-9.56	27.91	46.00	-18.09	200	1	QP
6	531.96	34.33	-5.03	29.30	46.00	-16.70	100	245	QP
7	903.31	110.19	1.12	111.31	46.00	65.31	200	55	Basic Freq

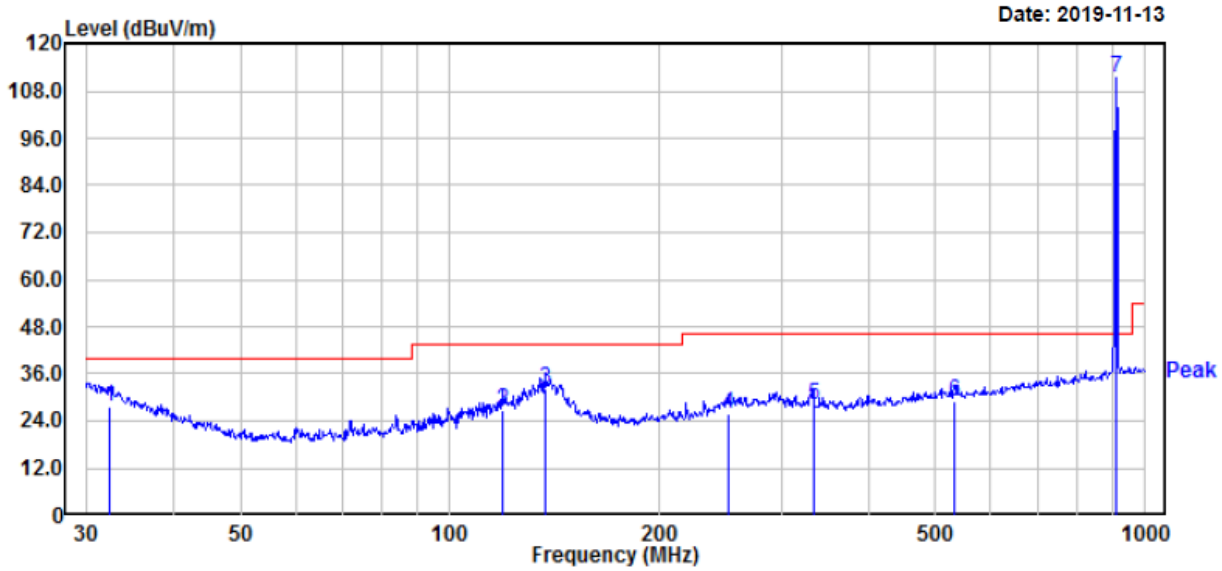
Horizontal

Frequency: 909.4MHz



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	APos	TPos	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	33.33	32.94	-5.89	27.05	40.00	-12.95	100	347	QP
2	84.11	41.93	-17.20	24.73	40.00	-15.27	200	358	QP
3	134.56	38.19	-11.47	26.72	43.50	-16.78	200	38	QP
4	254.73	40.36	-11.88	28.48	46.00	-17.52	100	143	QP
5	293.08	39.78	-10.37	29.41	46.00	-16.59	100	49	QP
6	513.63	35.26	-5.30	29.96	46.00	-16.04	200	56	QP
7	909.67	103.94	1.24	105.18	46.00	59.18	100	174	Basic Freq

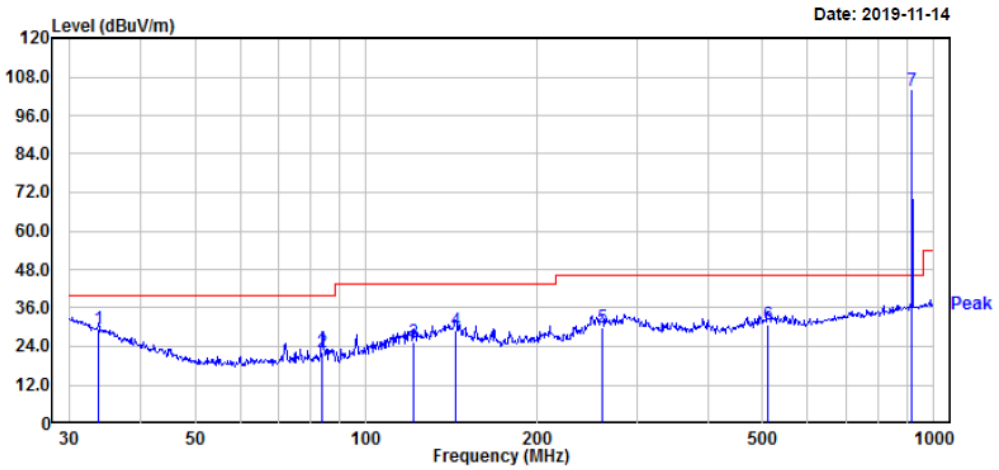
Vertical



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	APos	TPos	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	32.41	32.97	-5.14	27.83	40.00	-12.17	100	357	QP
2	119.02	37.53	-10.85	26.68	43.50	-16.82	100	334	QP
3	136.94	43.89	-11.60	32.29	43.50	-11.21	100	357	QP
4	251.18	37.82	-12.07	25.75	46.00	-20.25	200	0	QP
5	333.69	37.55	-9.53	28.02	46.00	-17.98	200	357	QP
6	531.96	34.19	-5.03	29.16	46.00	-16.84	100	284	QP
7	909.67	110.20	1.24	111.44	46.00	65.44	200	62	Basic Freq

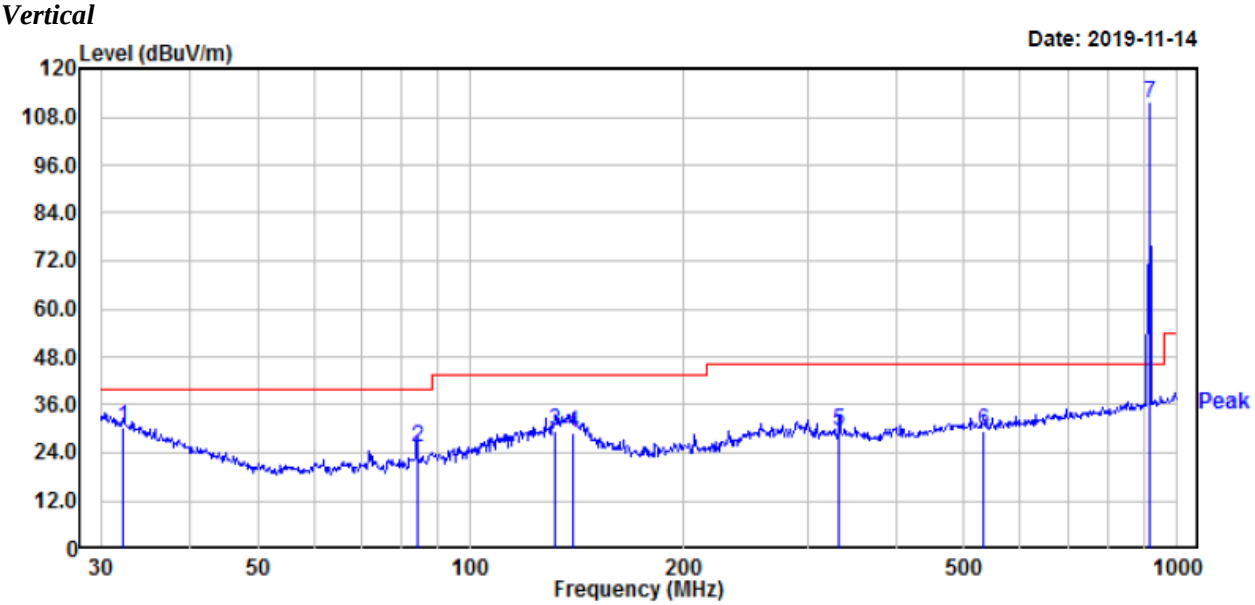
Horizontal

Frequency: 914.2MHz



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	APos	TPos	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	33.80	35.68	-6.28	29.40	40.00	-10.60	200	357	QP
2	83.82	39.60	-17.21	22.39	40.00	-17.61	200	56	QP
3	121.12	35.99	-10.71	25.28	43.50	-18.22	200	273	QP
4	143.83	40.91	-11.82	29.09	43.50	-14.41	200	357	QP
5	261.06	41.43	-11.55	29.88	46.00	-16.12	100	125	QP
6	510.04	36.24	-5.35	30.89	46.00	-15.11	200	147	QP
7	916.07	102.54	1.38	103.92	46.00	57.92	100	34	Basic Freq

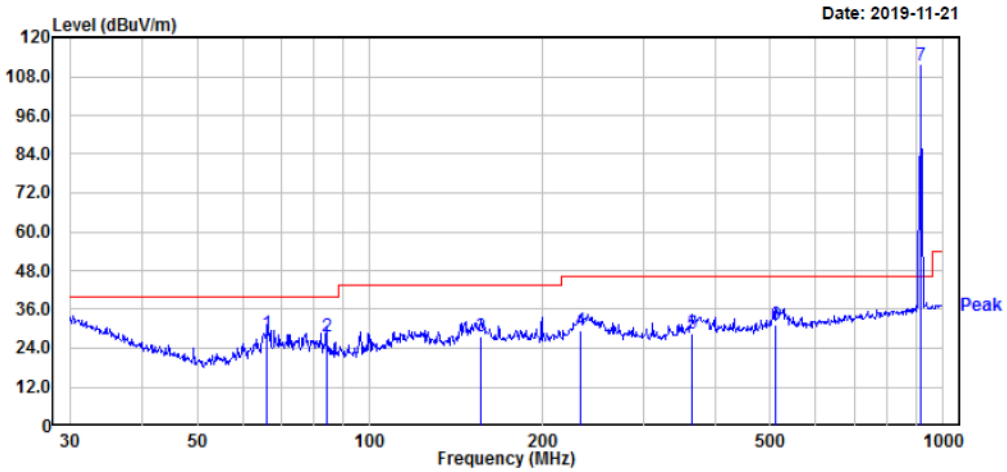
Vertical



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	APos	TPos	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	32.29	35.50	-5.04	30.46	40.00	-9.54	100	328	QP
2	84.11	42.34	-17.20	25.14	40.00	-14.86	200	270	QP
3	131.76	40.76	-11.33	29.43	43.50	-14.07	100	356	QP
4	139.85	40.51	-11.75	28.76	43.50	-14.74	100	356	QP
5	332.52	38.95	-9.56	29.39	46.00	-16.61	200	6	QP
6	531.96	34.31	-5.03	29.28	46.00	-16.72	100	133	QP
7	916.07	110.06	1.38	111.44	46.00	65.44	100	334	Basic Freq

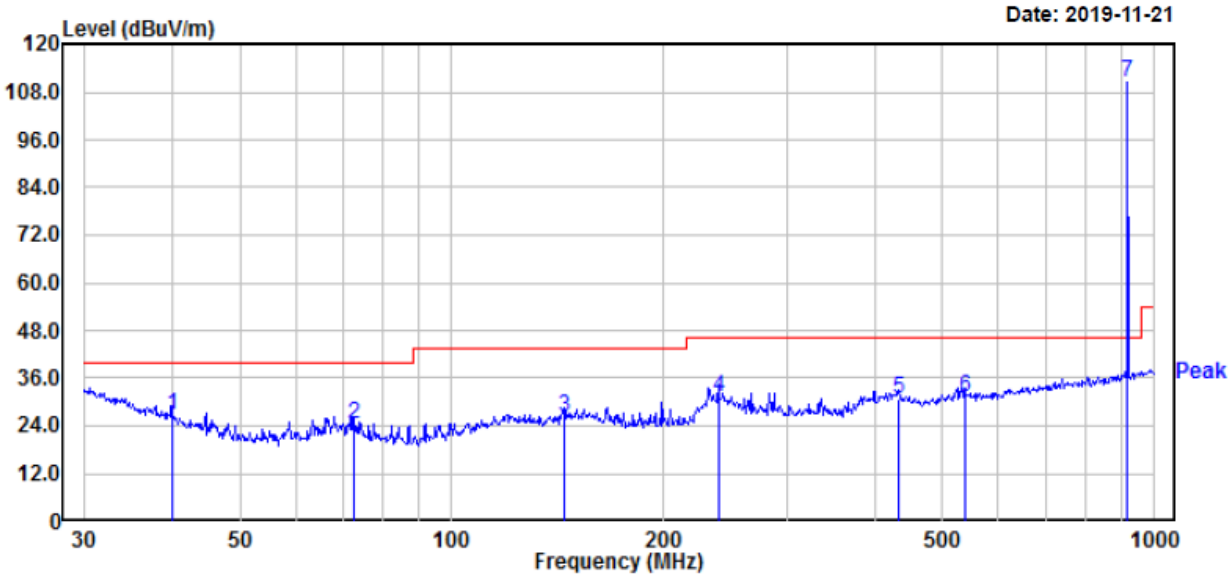
The worst case low Channel of BLE and low channel of Lora (125kHz) mode transmitting simultaneously was recorded

Horizontal



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	APos	TPos	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	66.27	45.49	-17.13	28.36	40.00	-11.64	200	165	QP
2	84.11	44.88	-17.20	27.68	40.00	-12.32	200	215	QP
3	155.91	39.74	-11.98	27.76	43.50	-15.74	200	77	QP
4	233.35	42.63	-13.01	29.62	46.00	-16.38	200	355	QP
5	365.54	37.01	-8.68	28.33	46.00	-17.67	100	355	QP
6	511.84	36.60	-5.32	31.28	46.00	-14.72	200	22	QP
7	916.07	110.13	1.38	111.51	46.00	65.51	100	0	Basic Freq

Vertical



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	APos	TPos	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	39.99	38.23	-11.44	26.79	40.00	-13.21	100	279	QP
2	72.85	41.21	-16.96	24.25	40.00	-15.75	100	290	QP
3	144.34	38.13	-11.82	26.31	43.50	-17.19	200	287	QP
4	239.99	44.02	-12.74	31.28	46.00	-14.72	200	1	QP
5	434.07	37.81	-6.93	30.88	46.00	-15.12	100	359	QP
6	537.59	36.41	-4.95	31.46	46.00	-14.54	100	135	QP
7	916.07	108.91	1.38	110.29	46.00	64.29	100	358	Basic Freq

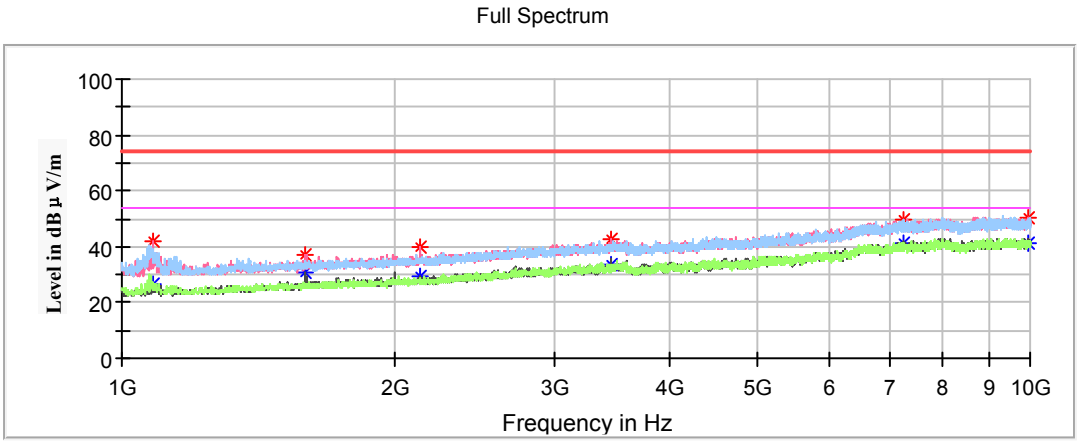
Note:
1) Factor (dB) =Antenna Factor (dB/m) + Cable Loss (dB) + Amplifier Gain (dB)
2) Over Limit (dB) = Read level (dBμV) + Factor (dB) - Limit (dBμV)

1GHz-10GHz

*Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded.*

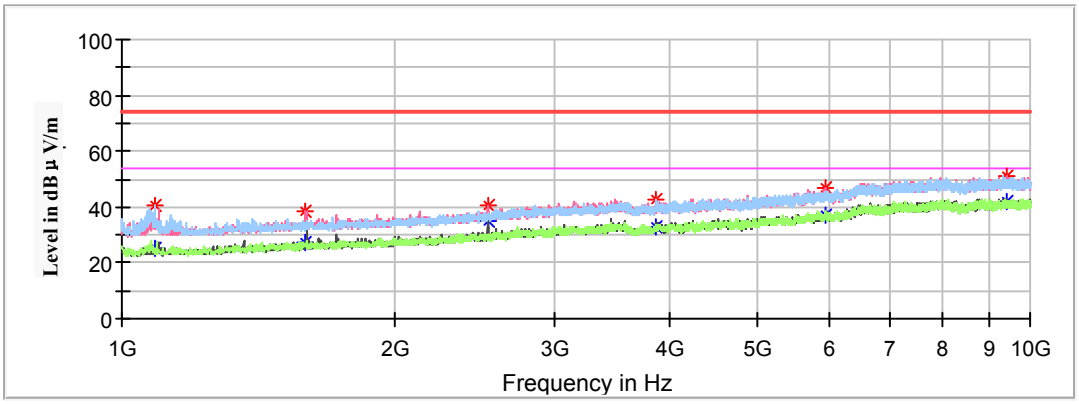
Note:
1. The test was performed with a 10dB Attenuator.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB) + Attenuator(dB)
   Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)
   Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV/m)

Low Channel: 903.0MHz



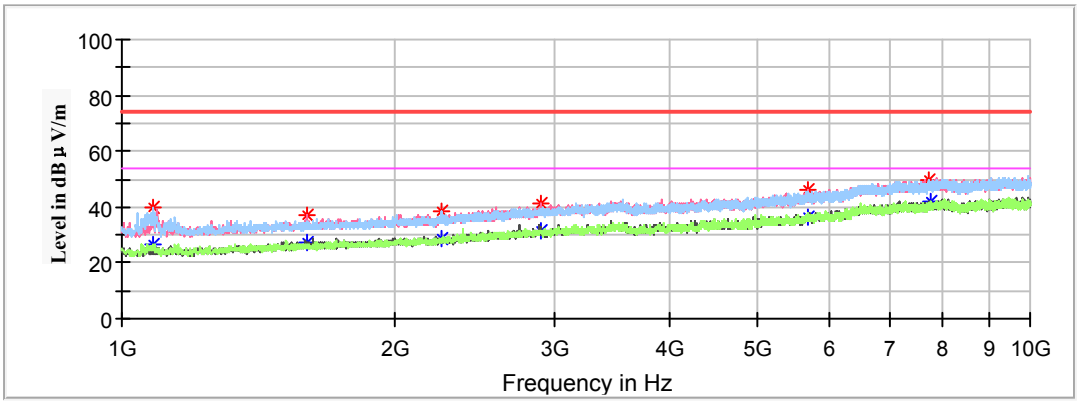
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Average (dBμV/m)	Height (cm)	Polar (H/V)				
1083.70	---	26.89	200	V	267	-12.2	54.00	27.11
1083.70	41.77	---	200	V	267	-12.2	74.00	32.23
1593.10	---	30.78	150	V	194	-9.6	54.00	23.22
1593.10	37.10	---	150	V	194	-9.6	74.00	36.90
2125.90	---	29.24	200	V	309	-7.9	54.00	24.76
2125.90	40.11	---	200	V	309	-7.9	74.00	33.89
3455.20	---	33.60	100	V	252	-3.6	54.00	20.40
3455.20	42.77	---	100	V	252	-3.6	74.00	31.23
7257.70	---	41.59	100	H	328	5.7	54.00	12.41
7257.70	49.48	---	100	H	328	5.7	74.00	24.52
9941.50	---	41.21	100	V	209	8.2	54.00	12.79
9941.50	50.41	---	100	V	209	8.2	74.00	23.59

Middle Channel: 909.4MHz



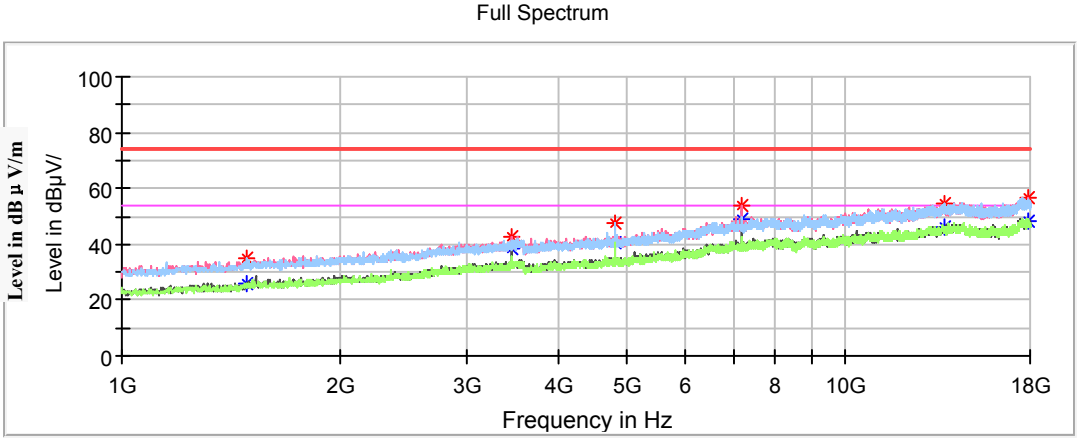
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polar (H/V)				
1087.30	---	25.51	150	H	223	-12.2	54.00	28.49
1087.30	40.39	---	150	H	223	-12.2	74.00	33.61
1594.00	---	27.12	200	V	341	-9.6	54.00	26.88
1594.00	38.57	---	200	V	341	-9.6	74.00	35.43
2526.40	---	34.94	100	V	313	-6.8	54.00	19.06
2526.40	40.73	---	100	V	313	-6.8	74.00	33.27
3866.50	---	32.72	150	H	283	-2.3	54.00	21.28
3866.50	42.87	---	150	H	283	-2.3	74.00	31.13
5940.10	---	36.84	100	V	74	2.2	54.00	17.16
5940.10	46.87	---	100	V	74	2.2	74.00	27.13
9409.60	---	41.90	150	V	22	7.7	54.00	12.10
9409.60	51.07	---	150	V	22	7.7	74.00	22.93

High Channel: 914.2MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polar (H/V)				
1084.60	---	26.59	150	H	208	-12.2	54.00	27.41
1084.60	39.95	---	150	H	208	-12.2	74.00	34.05
1598.50	---	27.58	100	V	285	-9.6	54.00	26.42
1598.50	37.03	---	100	V	285	-9.6	74.00	36.97
2251.00	---	28.90	200	H	243	-7.6	54.00	25.10
2251.00	38.61	---	200	H	243	-7.6	74.00	35.39
2895.40	---	31.28	150	V	238	-4.9	54.00	22.72
2895.40	41.44	---	150	V	238	-4.9	74.00	32.56
5703.40	---	36.28	200	V	341	1.8	54.00	17.72
5703.40	45.97	---	200	V	341	1.8	74.00	28.03
7752.70	---	42.07	100	V	19	6.6	54.00	11.93
7752.70	49.79	---	100	V	19	6.6	74.00	24.21

The worst case low Channel of BLE and low channel of Lora (125kHz) mode transmitting simultaneously was recorded.



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polar (H/V)				
1489.60	---	25.98	200	H	304	-10.0	54.00	28.02
1489.60	34.77	---	200	H	304	-10.0	74.00	39.23
3454.80	---	38.18	150	V	230	-3.6	54.00	15.82
3454.80	42.73	---	150	V	230	-3.6	74.00	31.27
4802.90	---	40.72	200	H	332	-0.6	54.00	13.28
4802.90	47.43	---	200	H	332	-0.6	74.00	26.57
7205.00	---	48.89	100	V	341	5.7	54.00	5.11
7205.00	54.16	---	100	V	341	5.7	74.00	19.84
13666.70	---	45.86	150	H	3	12.1	54.00	8.14
13666.70	54.83	---	150	H	3	12.1	74.00	19.17
17862.30	56.84	---	100	V	324	13.7	74.00	17.16
17862.30	---	47.91	100	V	324	13.7	54.00	6.09

Restricted Bands Emissions Test:

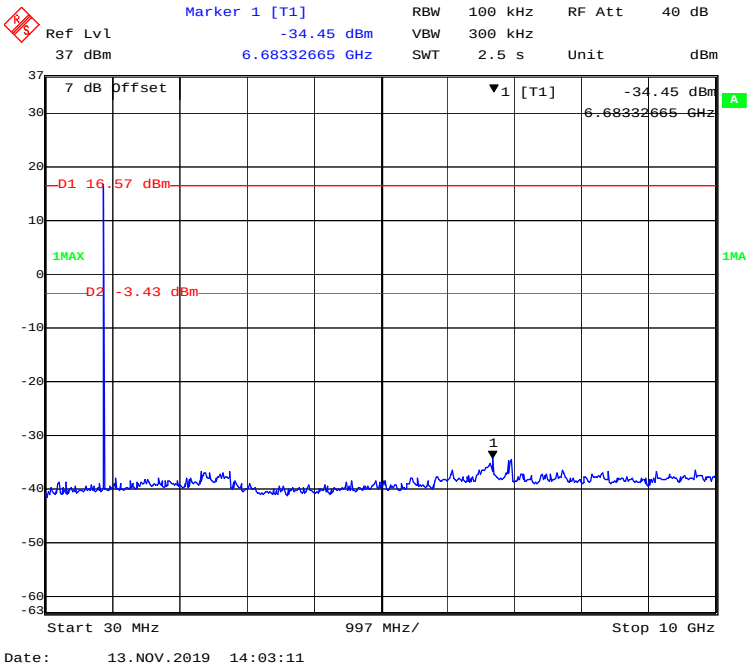
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded.)*

Note:
1. The test is performed with a 10dB Attenuator.
2. Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
   Corrected Amplitude = Corrected Factor + Reading
   Margin = Limit - Corrected. Amplitude

Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	QuasiPeak (dBµV/m)	Height (cm)	Polar (H/V)				
903.0MHz							
902.00	35.47	200	H	205	0.2	46	10.53
902.00	37.34	150	V	218	0.2	46	8.66
914.2MHz							
928.00	34.71	150	H	308	0.8	46	11.29
928.00	36.92	100	V	225	0.8	46	9.08

Conducted Spurious Emissions at Antenna Port:

Low Channel



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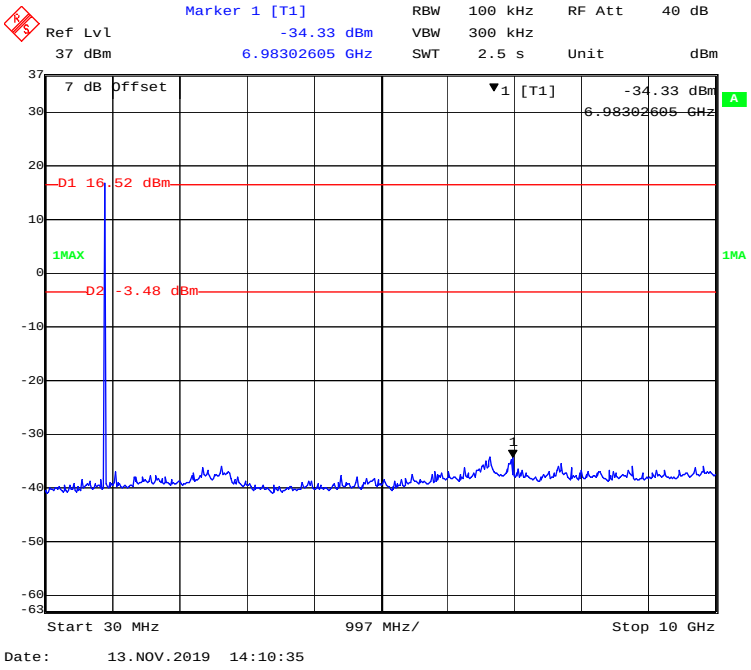
Middle Channel



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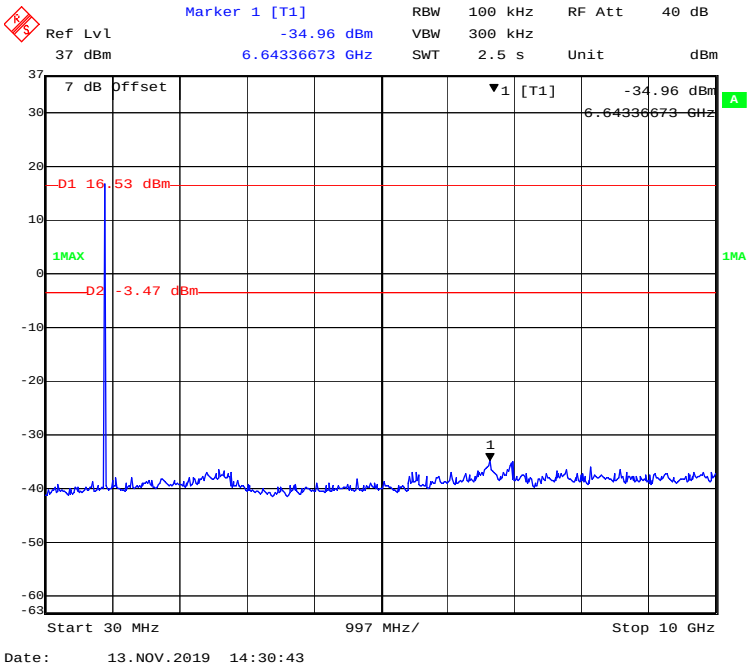
High Channel



FCC §15.247(a) (2) - 6 dB EMISSION BANDWIDTH

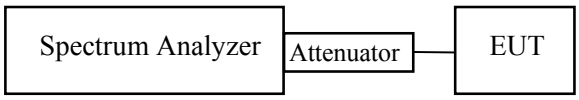
Applicable Standard

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.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.8.1

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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.



Test Data

Environmental Conditions

Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

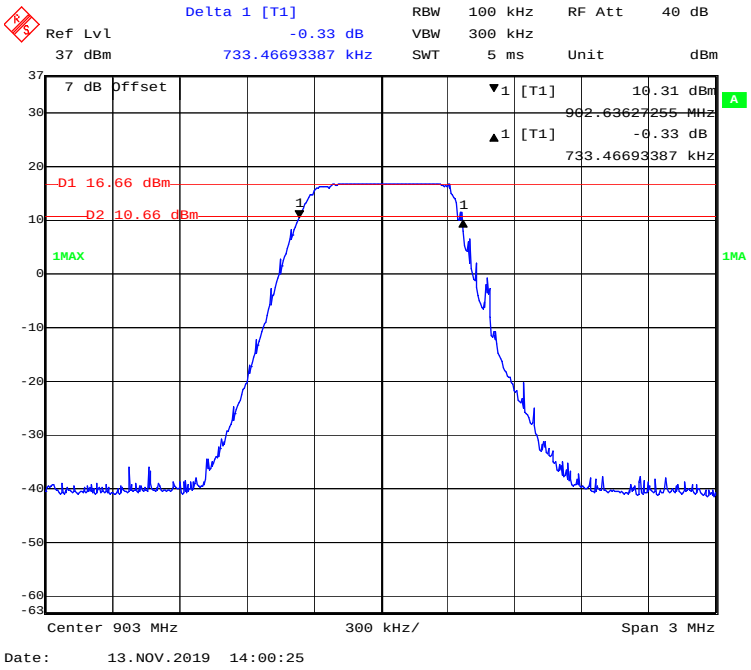
The testing was performed by Sam Ye on 2019-11-13.

Test Result: Pass.

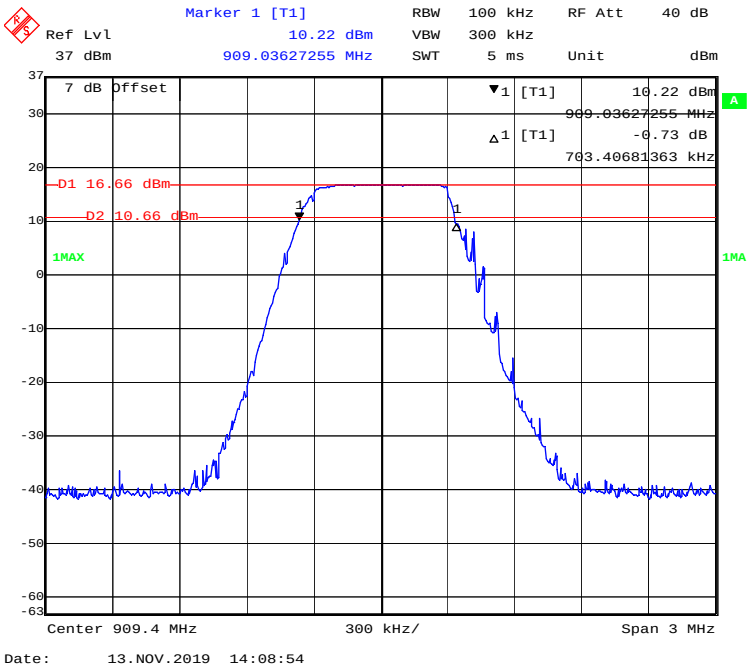
EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	Limit (MHz)
Low	903.00	0.733	≥0.5
Middle	909.40	0.703	≥0.5
High	914.20	0.764	≥0.5

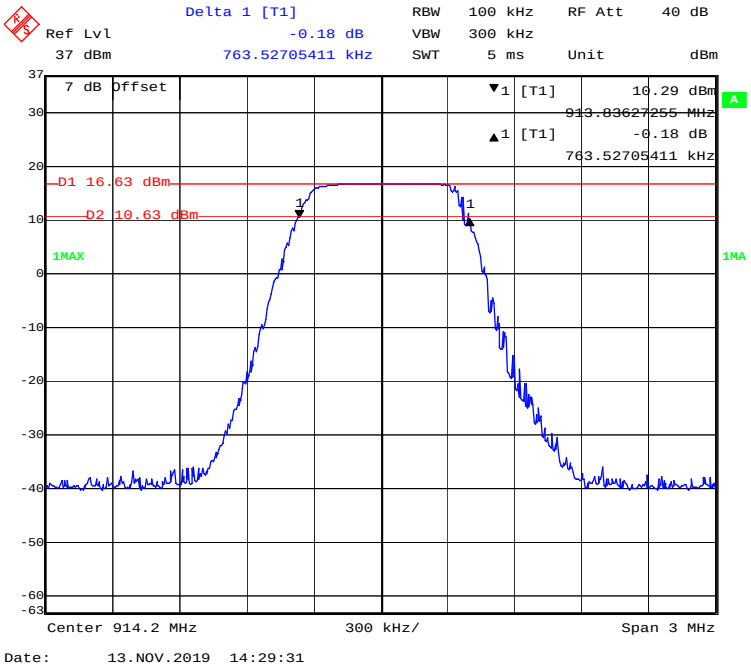
Low Channel



Middle Channel



High Channel



FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

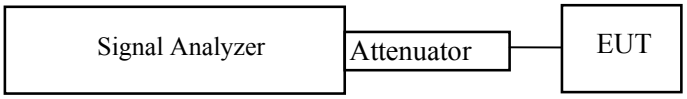
Applicable Standard

According to FCC §15.247(b) (3), for 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.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.9.1.1

1. Set the RBW ≥ DTS bandwidth.
2. Set VBW ≥ 3 x RBW.
3. Set span ≥ 3 x RBW
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.



Test Data

Environmental Conditions

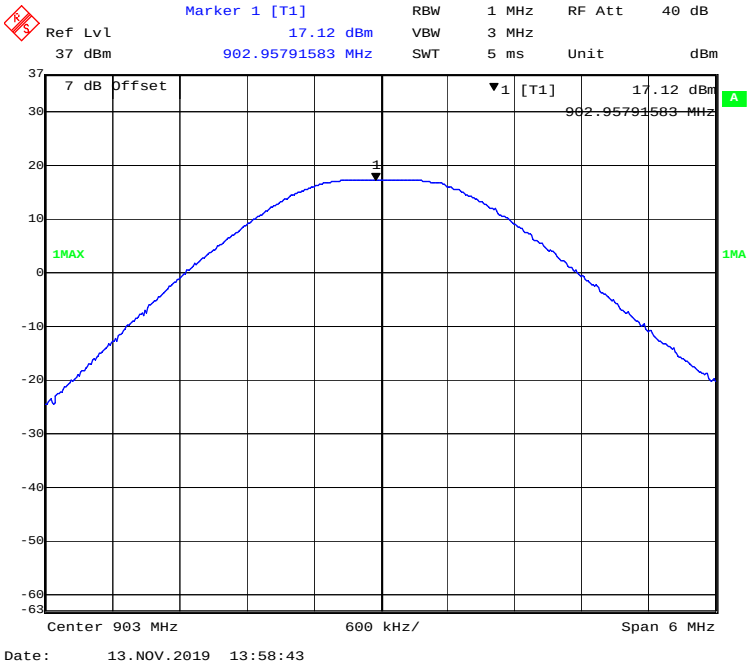
Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Sam Ye on 2019-11-13.

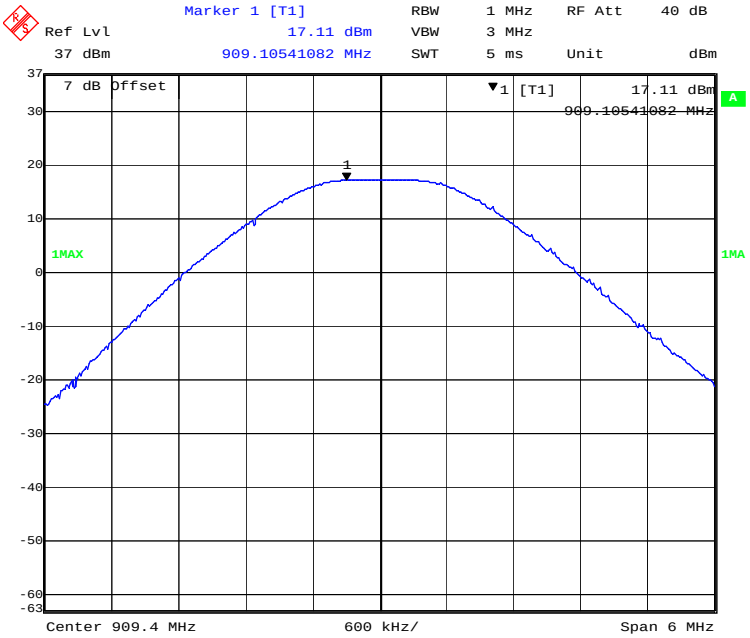
EUT operation mode: Transmitting

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
Low	903.00	17.12	30	Pass
Middle	909.40	17.11	30	Pass
High	914.20	17.06	30	Pass

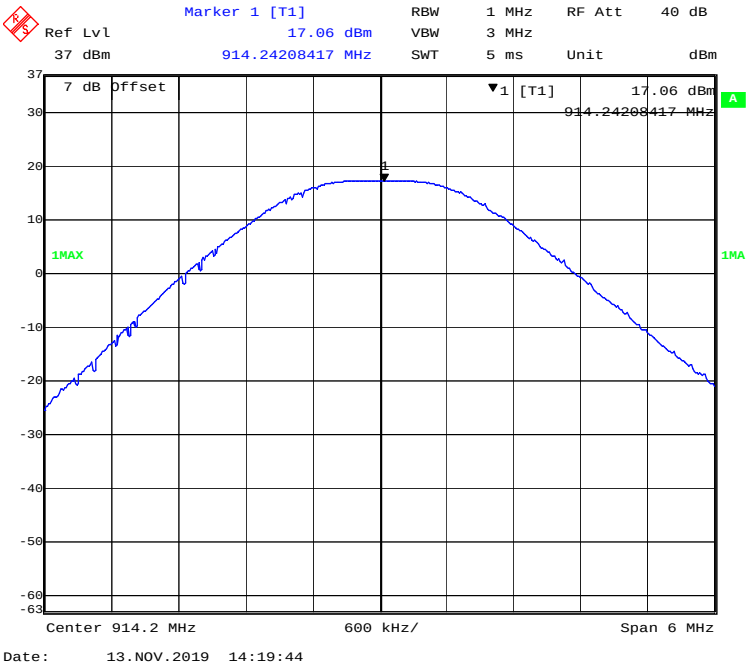
Low Channel



Middle Channel



High Channel



FCC §15.247(d) - BAND EDGE

Applicable Standard

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)).

Test Procedure

According to ANSI C63.10-2013 sub-clause 6.10.

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 middleest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the middleest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

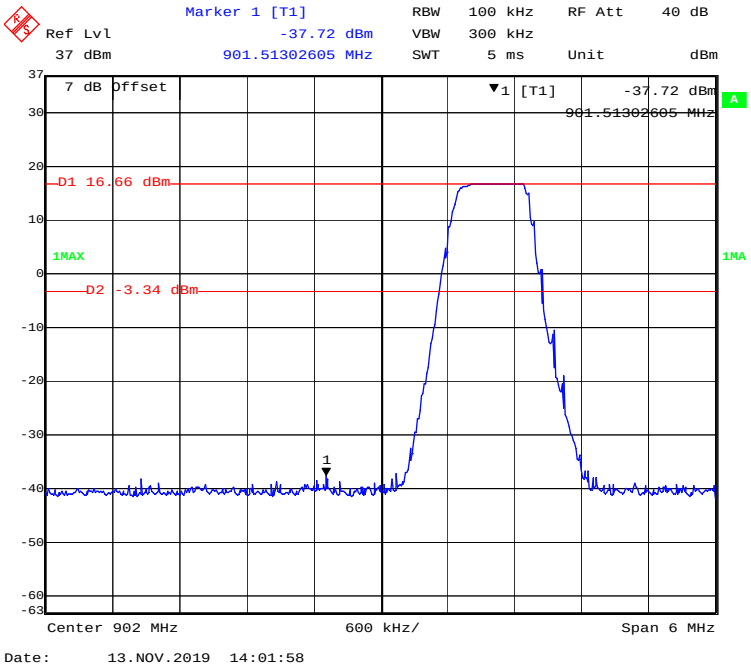
Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Sam Ye on 2019-11-13.

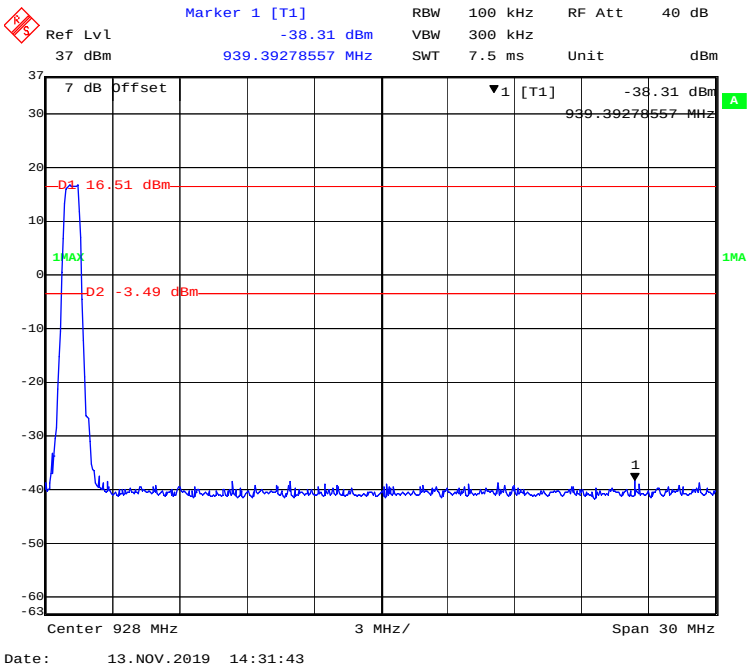
EUT operation mode: Transmitting

Test Result: Pass

Left Side



Right Side



FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

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.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.10.2

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

1. Set the RBW to: 3kHz≤ RBW≤100 kHz.
2. Set the VBW ≥ 3xRBW.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.
9. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Data

Environmental Conditions

Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

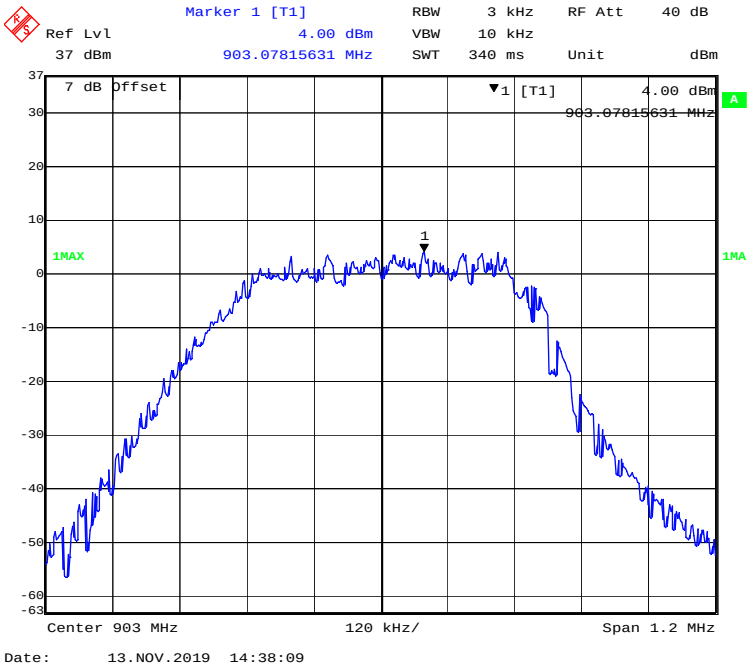
The testing was performed by Sam Ye on 2019-11-13.

EUT operation mode: Transmitting

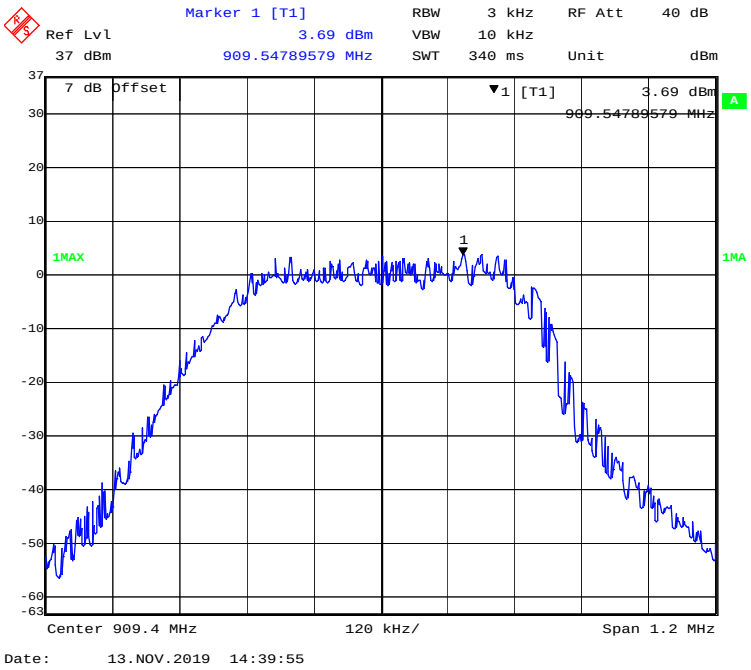
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Low	903.00	4.00	≤ 8
Middle	909.40	3.69	≤ 8
High	914.20	4.02	≤ 8

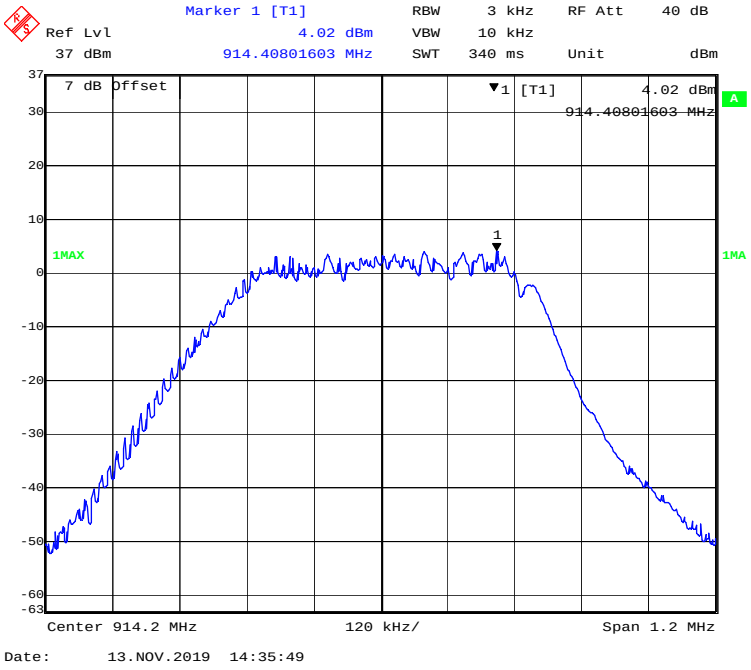
Low Channel



Middle Channel



High Channel



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