

# FCC REPORT

## (RFID)

**Applicant:** Chengdu Ebyte Electronic Technology Co., Ltd.  
**Address of Applicant:** Innovation Center D347, 4# XI-XIN road, High-tech district(west),  
Chengdu, Sichuan, China

### Equipment Under Test (EUT)

**Product Name:** Lora Module  
**Model No.:** E22-900T22S  
**Trade mark:** EBYTE

**FCC ID:** 2ALPH-E22900T22S

**Applicable standards:** FCC CFR Title 47 Part 15 Subpart C Section 15.247

**Date of sample receipt:** 07 Nov., 2018

**Date of Test:** 07 Nov., to 21 Nov., 2018

**Date of report issued:** 22 Nov., 2018

**Test Result:** PASS \*

\* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Bruce Zhang  
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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## 2 Version

Version No.	Date	Description
00	22 Nov., 2018	Original

**Tested by:** Zora Lee **Date:** 22 Nov., 2018  
**Test Engineer**

**Reviewed by:** Wimer Zhang **Date:** 22 Nov., 2018  
**Project Engineer**

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## 4 Test Summary

Test Items	Section in CFR 47	Result
Antenna requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(3)	Pass
6dB Emission Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Conducted and radiated Spurious Emission	15.205/15.209	Pass
<p><i>Remark:</i>  <i>Pass: Meet the requirement. N/A: Not Applicable for Non-adaptive equipment.</i></p>		

## 5 General Information

### 5.1 Client Information

Applicant:	Chengdu Ebyte Electronic Technology Co., Ltd.
Address:	Innovation Center D347, 4# XI-XIN road, High-tech district(west), Chengdu, Sichuan, China
Manufacturer/Factory:	Chengdu Ebyte Electronic Technology Co., Ltd.
Address:	Innovation Center D347, 4# XI-XIN road, High-tech district(west), Chengdu, Sichuan, China

### 5.2 General Description of E.U.T.

Product Name:	Lora Module
Model No.:	E22-900T22S
Operation Frequency:	903-927 MHz
Channel numbers:	25
Channel separation:	1 MHz
Modulation technology:	Lora
Antenna Type:	External Antenna
Antenna gain:	3.0 dBi
Power supply:	DC 5V
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

Operation Frequency each of channel					
Channel	Frequency	Channel	Frequency	Channel	Frequency
0	903MHz	10	913MHz	20	923MHz
1	904MHz	11	914MHz	21	924MHz
2	905MHz	12	915MHz	22	925MHz
3	906MHz	13	916MHz	23	926MHz
4	907MHz	14	917MHz	24	927MHz
5	908MHz	15	918MHz		
6	909MHz	16	919MHz		
7	910MHz	17	920MHz		
8	911MHz	18	921MHz		
9	912MHz	19	922MHz		
<p>Note:                      In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test. Channel No. 0, 12 &amp; 24 were selected as Lowest, Middle and Highest channel.</p>					

### 5.3 Test environment and test mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test mode:	
Transmitting mode	Keep the EUT in continuous transmitting with modulation
<p>The sample was placed 0.8m (below 1GHz)/1.5m (above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y &amp; Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. Duty cycle setting during the transmission is 100% with maximum power setting for all modulations.</p>	

### 5.4 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
DELL	PC	OPTIPLEX745	N/A	DoC
DELL	MONITOR	E178FPC	N/A	DoC
DELL	KEYBOARD	SK-8115	N/A	DoC
DELL	MOUSE	MOC5UO	N/A	DoC
EBYTE	Test suite	E15-UTL1	N/A	N/A

### 5.5 Measurement Uncertainty

Parameters	Expanded Uncertainty
Conducted Emission (9kHz ~ 30MHz)	±2.22 dB (k=2)
Radiated Emission (9kHz ~ 30MHz)	±2.76 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	±4.28 dB (k=2)
Radiated Emission (1GHz ~ 18GHz)	±5.72 dB (k=2)
Radiated Emission (18GHz ~ 40GHz)	±2.88 dB (k=2)

### 5.6 Laboratory Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> <li>● <b>FCC - Registration No.: 727551</b> Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been accredited as a testing laboratory by FCC (Federal Communications Commission). The Registration No. is 727551.</li> <li>● <b>IC - Registration No.: 10106A-1</b> The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.</li> <li>● <b>CNAS - Registration No.: CNAS L6048</b> Shenzhen Zhongjian Nanfang Testing Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6048.</li> <li>● <b>A2LA - Registration No.: 4346.01</b> This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <a href="https://portal.a2la.org/scopepdf/4346-01.pdf">https://portal.a2la.org/scopepdf/4346-01.pdf</a></li> </ul>
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### 5.7 Laboratory Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.  
 Address: No. B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road,  
 Bao'an District, Shenzhen, Guangdong, China  
 Tel: +86-755-23118282, Fax: +86-755-23116366  
 Email: info@ccis-cb.com, Website: http://www.ccis-cb.com

### 5.8 Test Instruments list

<b>Radiated Emission:</b>					
<b>Test Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Cal. Date (mm-dd-yy)</b>	<b>Cal. Due date (mm-dd-yy)</b>
3m SAC	SAEMC	9m*6m*6m	966	07-22-2017	07-21-2020
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-16-2018	03-15-2019
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-16-2018	03-15-2019
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-22-2017	06-21-2020
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170582	11-21-2017	11-20-2018
				11-21-2018	11-20-2019
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-07-2018	03-06-2019
Pre-amplifier	CD	PAP-1G18	11804	03-07-2018	03-06-2019
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-07-2018	03-06-2019
Spectrum analyzer	Rohde & Schwarz	FSP40	100363	11-21-2017	11-20-2018
				11-21-2018	11-20-2019
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-07-2018	03-06-2019
Simulated Station	Anritsu	MT8820C	6201026545	03-07-2018	03-06-2019
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2018	03-06-2019
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2018	03-06-2019
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-07-2018	03-06-2019

<b>Conducted Emission:</b>					
<b>Test Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Cal. Date (mm-dd-yy)</b>	<b>Cal. Due date (mm-dd-yy)</b>
EMI Test Receiver	Rohde & Schwarz	ESCI	101189	03-07-2018	03-06-2019
Pulse Limiter	SCHWARZBECK	OSRAM 2306	9731	03-07-2018	03-06-2019
LISN	CHASE	MN2050D	1447	03-19-2018	03-18-2019
LISN	Rohde & Schwarz	ESH3-Z5	8438621/010	07-21-2018	07-20-2019
Cable	HP	10503A	N/A	03-07-2018	03-06-2019
EMI Test Software	AUDIX	E3	Version: 6.110919b		

## 6 Test results and Measurement Data

### 6.1 Antenna requirement:

<b>Standard requirement:</b>	FCC Part 15 C Section 15.203 /247(c)
<p>15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.</p>	
<b>E.U.T Antenna:</b>	
<p>The BLE antenna is an External antenna which cannot replace by end-user, the best-case gain of the antenna is 3 dBi.</p>	

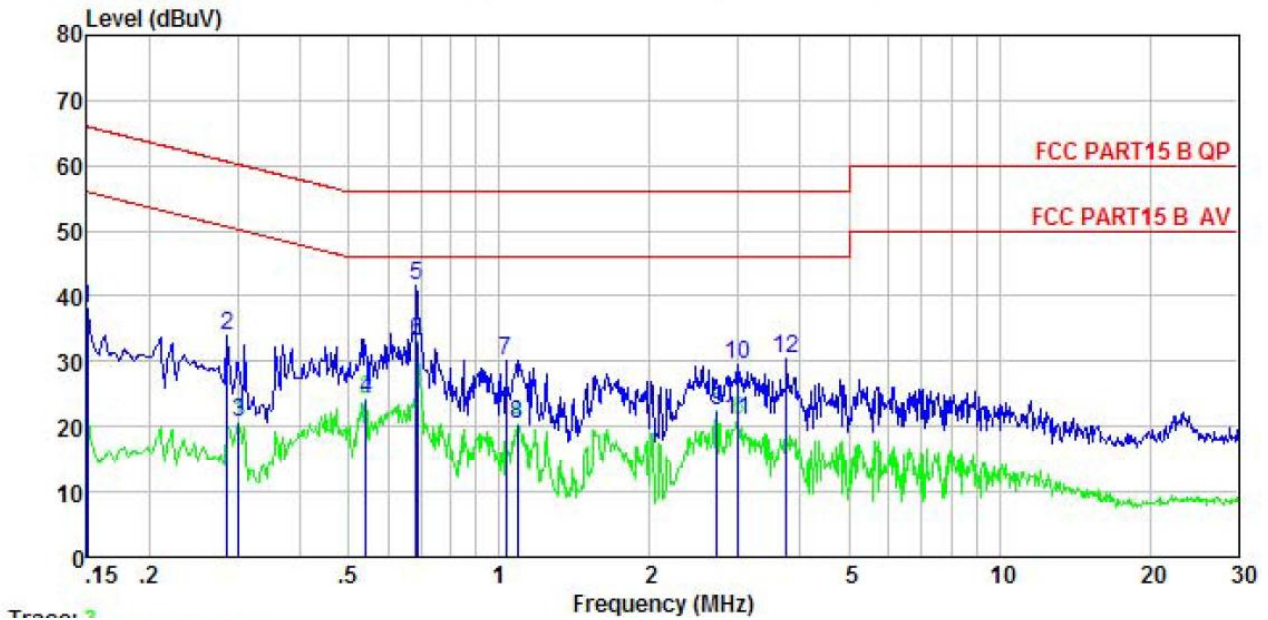


## 6.2 Conducted Emission

Test Requirement:	FCC Part 15 C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* Decreases with the logarithm of the frequency.			
Test procedure	<ol style="list-style-type: none"> <li>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.), which provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</li> <li>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.</li> </ol>		
Test setup:	<p>Remark:  E.U.T: Equipment Under Test  LISN: Line Impedance Stabilization Network  Test table height=0.8m</p>		
Test Instruments:	Refer to section 5.8 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

**Measurement Data:**

<b>Product name:</b>	Lora Module	<b>Product model:</b>	E22-900T22S
<b>Test by:</b>	Zora	<b>Test mode:</b>	Tx mode
<b>Test frequency:</b>	150 kHz ~ 30 MHz	<b>Phase:</b>	Line
<b>Test voltage:</b>	AC 120 V/60 Hz	<b>Environment:</b>	Temp: 22.5°C Huni: 55%

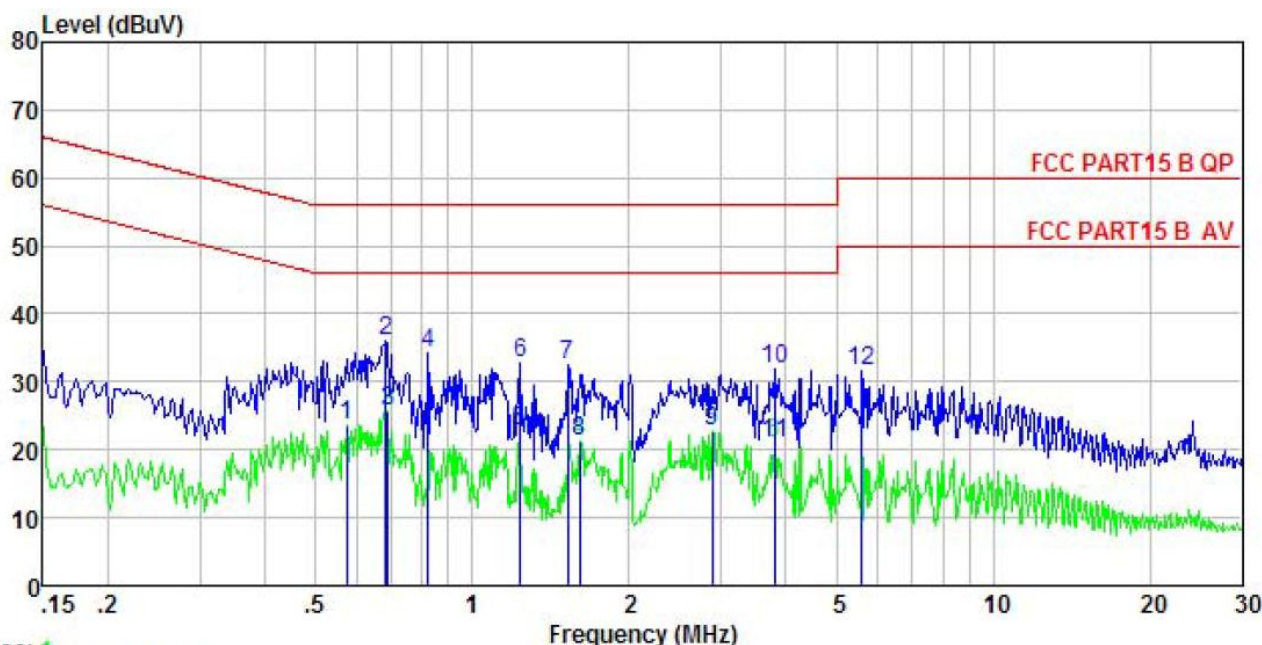


	Read	LISN	Cable	Level	Limit	Over	Remark
-----	-----	-----	-----	-----	-----	-----	-----
Freq	Level	Factor	Loss	Level	Line	Limit	Remark
-----	-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	27.23	0.18	10.78	38.19	66.00	-27.81 QP
2	0.286	23.15	0.13	10.74	34.02	60.63	-26.61 QP
3	0.302	9.84	0.13	10.74	20.71	50.19	-29.48 Average
4	0.541	13.32	0.12	10.76	24.20	46.00	-21.80 Average
5	0.683	30.76	0.13	10.77	41.66	56.00	-14.34 QP
6	0.686	22.20	0.13	10.77	33.10	46.00	-12.90 Average
7	1.032	19.22	0.13	10.87	30.22	56.00	-25.78 QP
8	1.088	9.27	0.13	10.88	20.28	46.00	-25.72 Average
9	2.721	11.26	0.16	10.93	22.35	46.00	-23.65 Average
10	3.009	18.36	0.16	10.92	29.44	56.00	-26.56 QP
11	3.009	9.88	0.16	10.92	20.96	46.00	-25.04 Average
12	3.759	19.30	0.18	10.90	30.38	56.00	-25.62 QP

**Notes:**

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

<b>Product name:</b>	Lora Module	<b>Product model:</b>	E22-900T22S
<b>Test by:</b>	Zora	<b>Test mode:</b>	Tx mode
<b>Test frequency:</b>	150 kHz ~ 30 MHz	<b>Phase:</b>	Neutral
<b>Test voltage:</b>	AC 120 V/60 Hz	<b>Environment:</b>	Temp: 22.5°C Huni: 55%

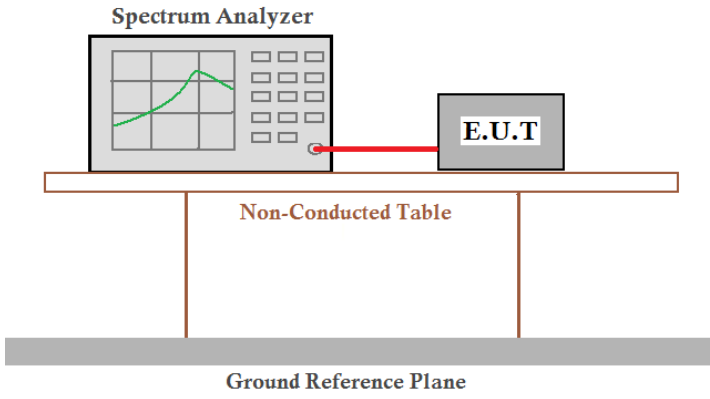


	Read Freq	Level	LISN Factor	Cable Loss	Level	Limit	Over	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.573	11.98	0.97	10.76	23.71	46.00	-22.29	Average
2	0.683	24.14	0.97	10.77	35.88	56.00	-20.12	QP
3	0.690	13.89	0.97	10.77	25.63	46.00	-20.37	Average
4	0.822	22.57	0.97	10.82	34.36	56.00	-21.64	QP
5	1.229	10.77	0.97	10.90	22.64	46.00	-23.36	Average
6	1.236	20.93	0.97	10.90	32.80	56.00	-23.20	QP
7	1.527	20.67	0.98	10.93	32.58	56.00	-23.42	QP
8	1.610	9.43	0.98	10.93	21.34	46.00	-24.66	Average
9	2.884	10.90	0.99	10.92	22.81	46.00	-23.19	Average
10	3.799	19.89	1.00	10.90	31.79	56.00	-24.21	QP
11	3.799	9.10	1.00	10.90	21.00	46.00	-25.00	Average
12	5.594	19.79	1.01	10.83	31.63	60.00	-28.37	QP

**Notes:**

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

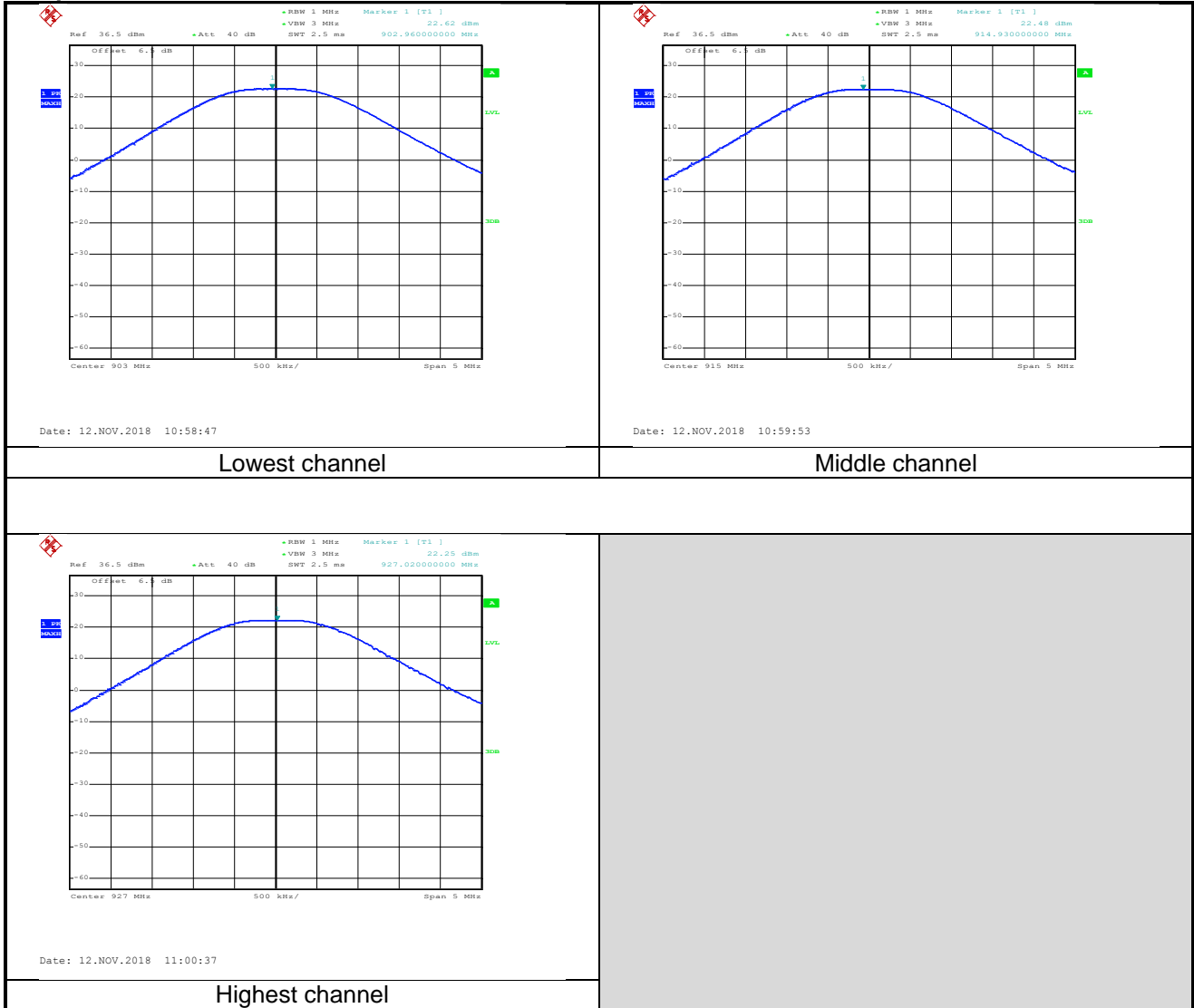
## 6.3 Conducted Output Power

Test Requirement:	FCC Part 15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	30dBm
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

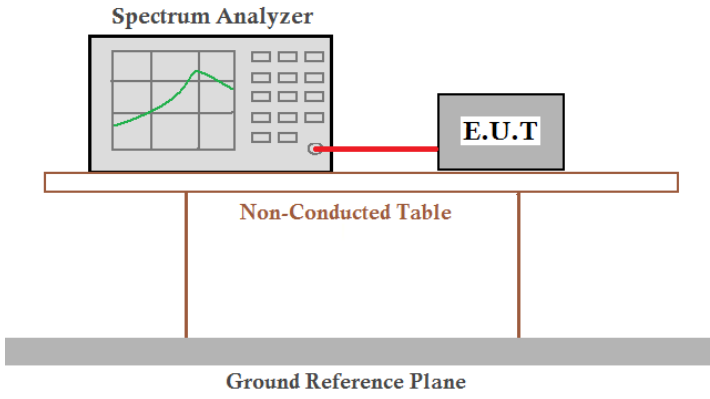
### Measurement Data:

Test CH	Maximum Conducted Output Power (dBm)	Limit(dBm)	Result
Lowest	22.62	30.00	Pass
Middle	22.48		
Highest	22.25		

Test plot as follows:



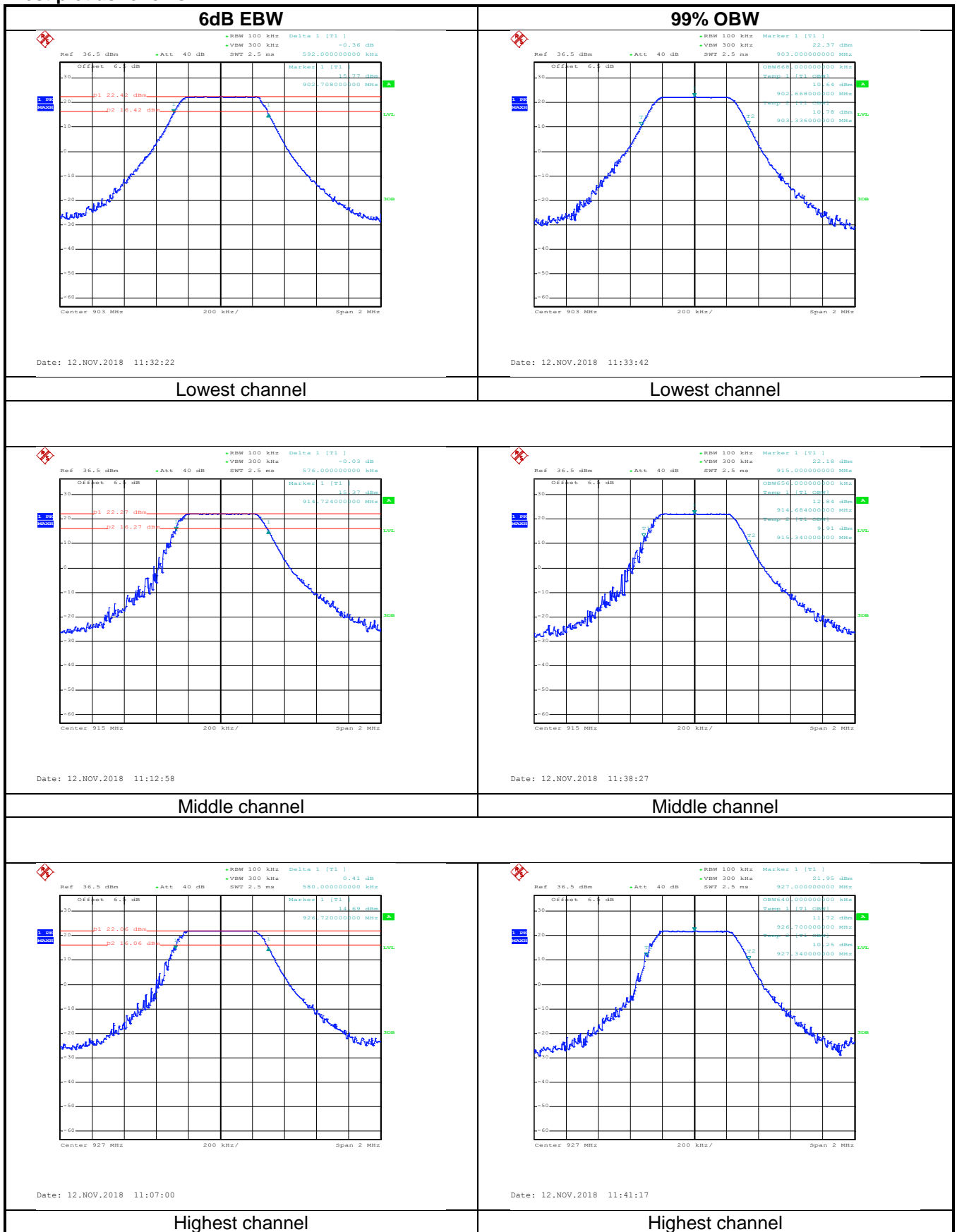
## 6.4 Occupy Bandwidth

Test Requirement:	FCC Part 15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	>500kHz
Test setup:	 <p>The diagram shows a Spectrum Analyzer on the left and an E.U.T. on the right, connected by a red cable. They are both on a table labeled 'Non-Conducted Table'. Below the table is a 'Ground Reference Plane'.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

### Measurement Data:

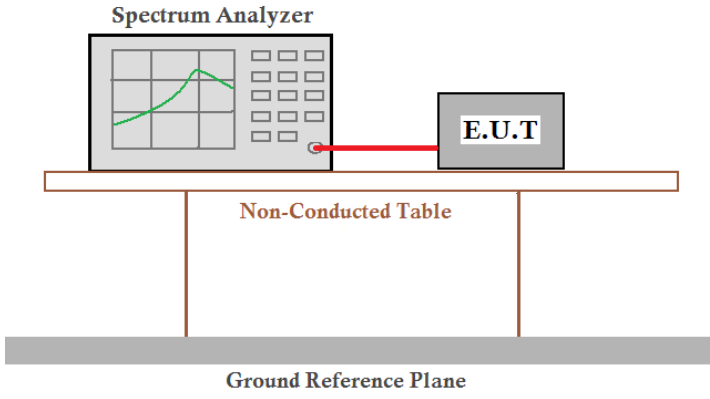
Test CH	6dB Emission Bandwidth (MHz)	Limit(kHz)	Result
Lowest	0.592	>500	Pass
Middle	0.576		
Highest	0.580		
Test CH	99% Occupy Bandwidth (MHz)	Limit(kHz)	Result
Lowest	0.668	N/A	N/A
Middle	0.656		
Highest	0.640		

Test plot as follows:





## 6.5 Power Spectral Density

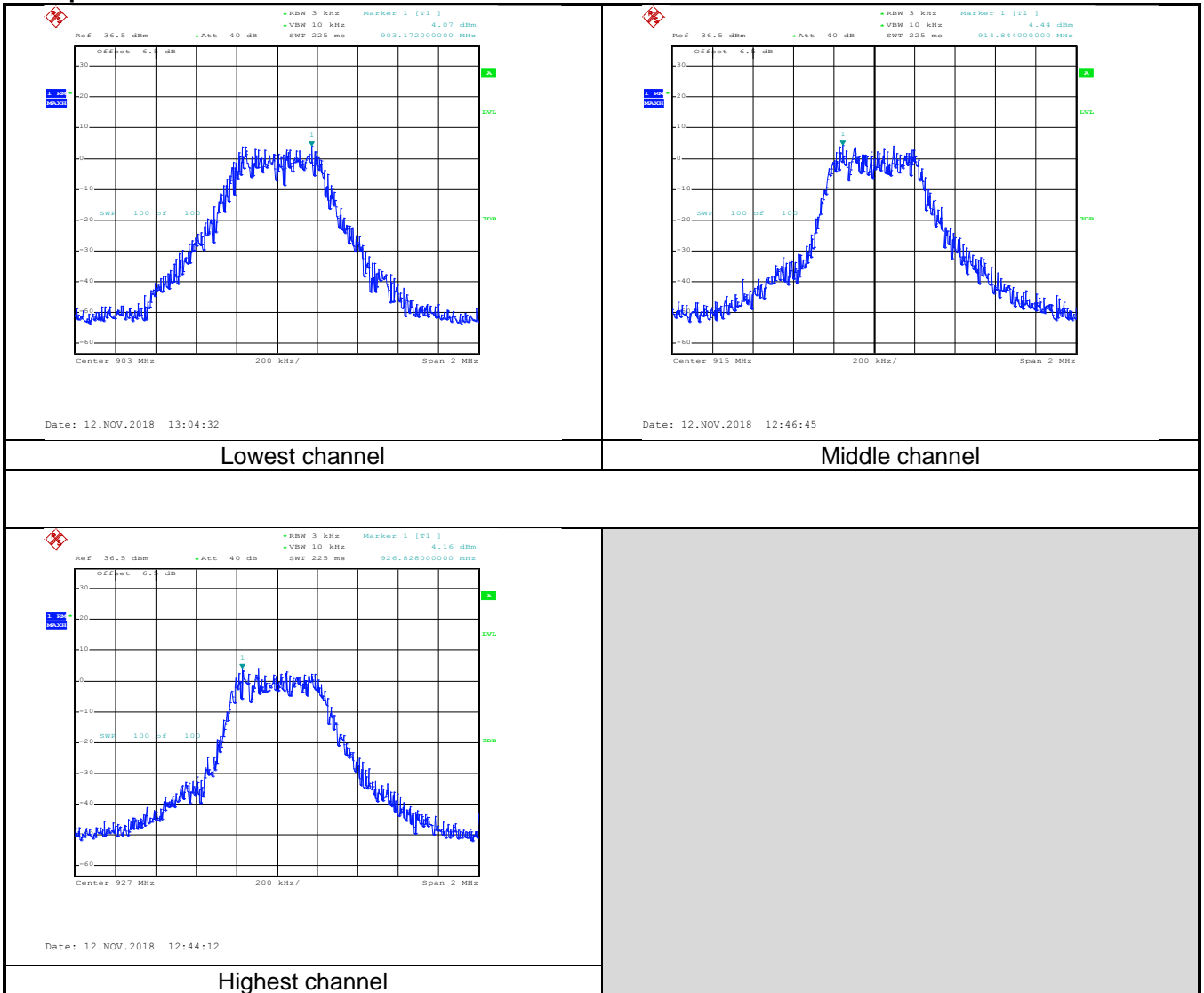
Test Requirement:	FCC Part 15 C Section 15.247 (e)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	8 dBm
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

### Measurement Data:

Test CH	Power Spectral Density (dBm)	Limit(dBm)	Result
Lowest	4.07	8.00	Pass
Middle	4.44		
Highest	4.16		

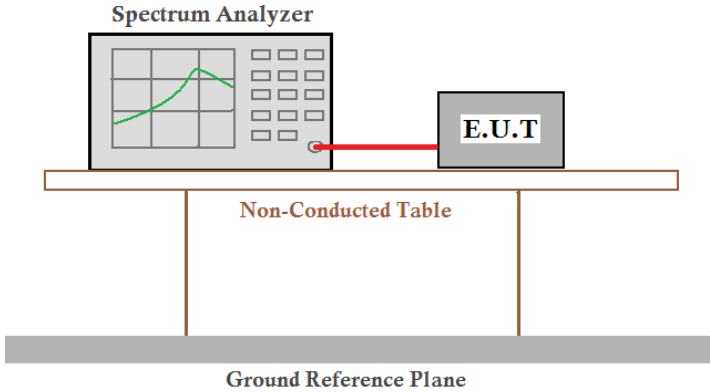


Test plots as follow:

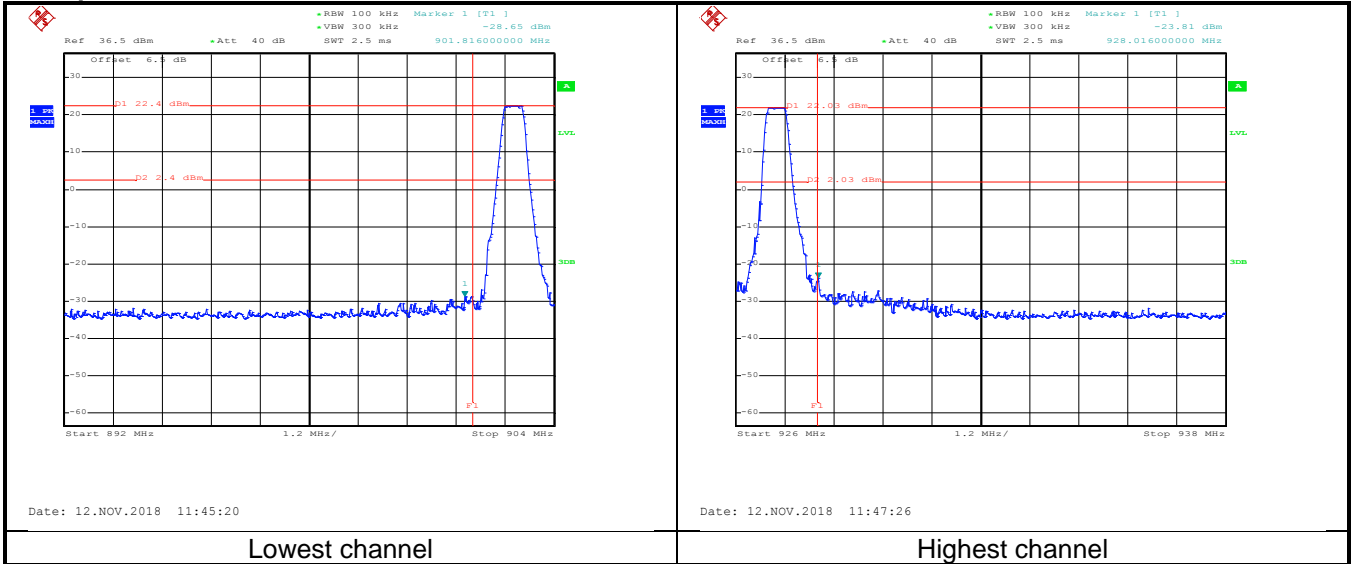


## 6.6 Band Edge

### 6.6.1 Conducted Emission Method

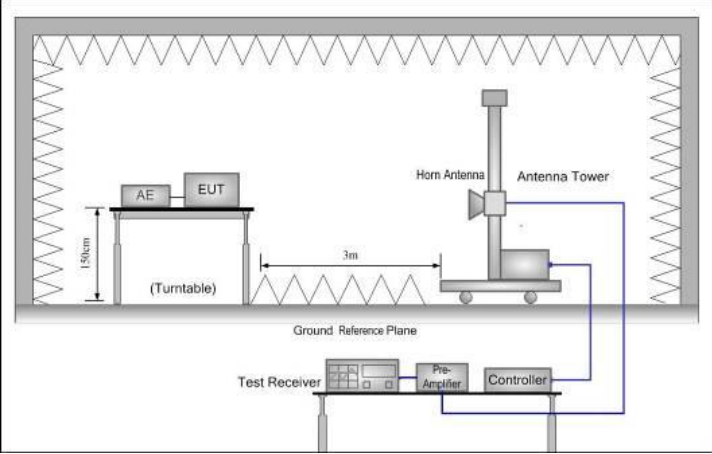
Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at 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.
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plots as follow:



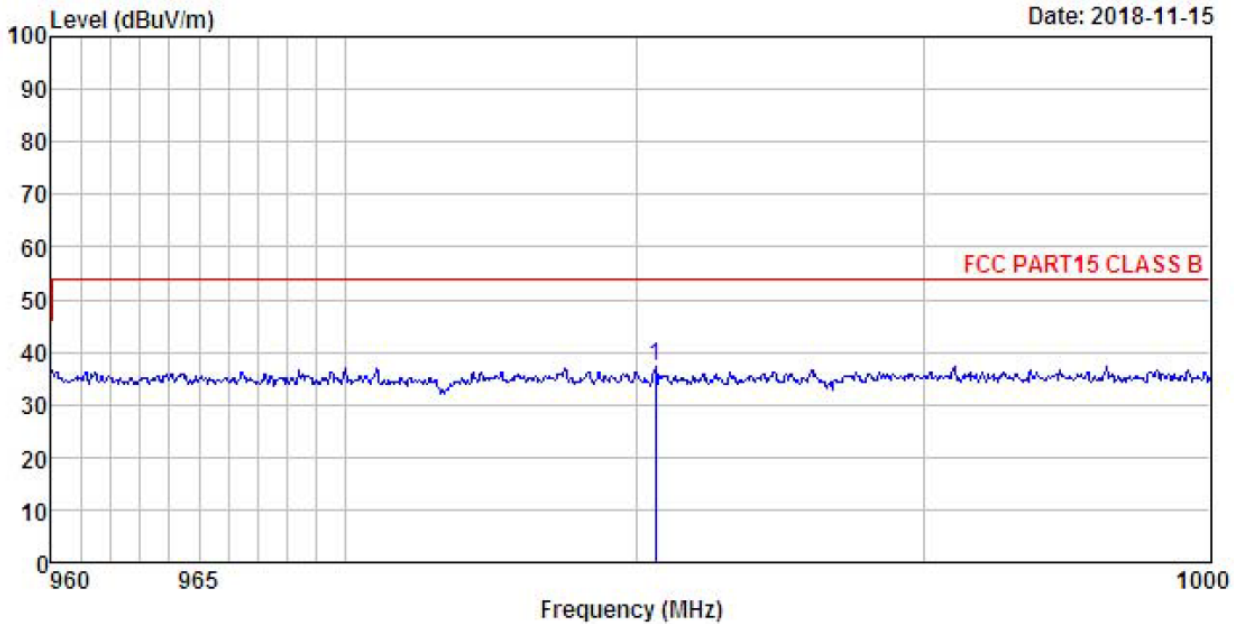
## 6.6.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10: 2013 and KDB 558074				
Test Frequency Range:	960MHz to 1.240GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	960MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
RMS		1MHz	3MHz	Average Value	
Limit:	Frequency	Limit (dBuV/m @3m)		Remark	
	960MHz-1GHz	54.00		Quasi-peak Value	
	Above 1GHz	54.00		Average Value	
74.00		Peak Value			
Test Procedure:	<ol style="list-style-type: none"> <li>1. The EUT was placed on the top of a rotating table 0.8m(below 1GHz) /1.5m(above 1GHz) above the groundat a 3 meter chamber.The table was rotated 360 degrees todetermine the position of the highest radiation.</li> <li>2. The EUT was set 3 meters away from the interference-receiving antenna, whichwas mounted on the top of a variable-height antenna tower.</li> <li>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li> <li>4. For each suspected emission, the EUT was arranged to its worst case and thenthe antenna was tuned to heights from 1 meter to 4 meters and the rotatablewas turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>5. The test-receiver system was set to Peak Detect Function and SpecifiedBandwidth with Maximum Hold Mode.</li> <li>6. If the emission level of the EUT in peak mode was 10dB lower than the limitspecified, then testing could be stopped and the peak values of the EUT wouldbe reported. Otherwise the emissions that did not have 10dB margin would bere-tested one by one using peak, quasi-peak or average method as specified andthen reported in a data sheet.</li> </ol>				
Test setup:	<p>Below 1GHz</p>				

	<p>Above 1GHz</p> 
<p>Test Instruments:</p>	<p>Refer to section 5.8 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.3 for details</p>
<p>Test results:</p>	<p>Passed</p>

**Below 1GHz:**

<b>Product Name:</b>	Lora Module	<b>Product Model:</b>	E22-900T22S
<b>Test By:</b>	Zora	<b>Test mode:</b>	Tx mode
<b>Test Channel:</b>	Highest channel	<b>Polarization:</b>	Vertical
<b>Test Voltage:</b>	AC 120V/60Hz	<b>Environment:</b>	Temp: 24°C Huni: 57%

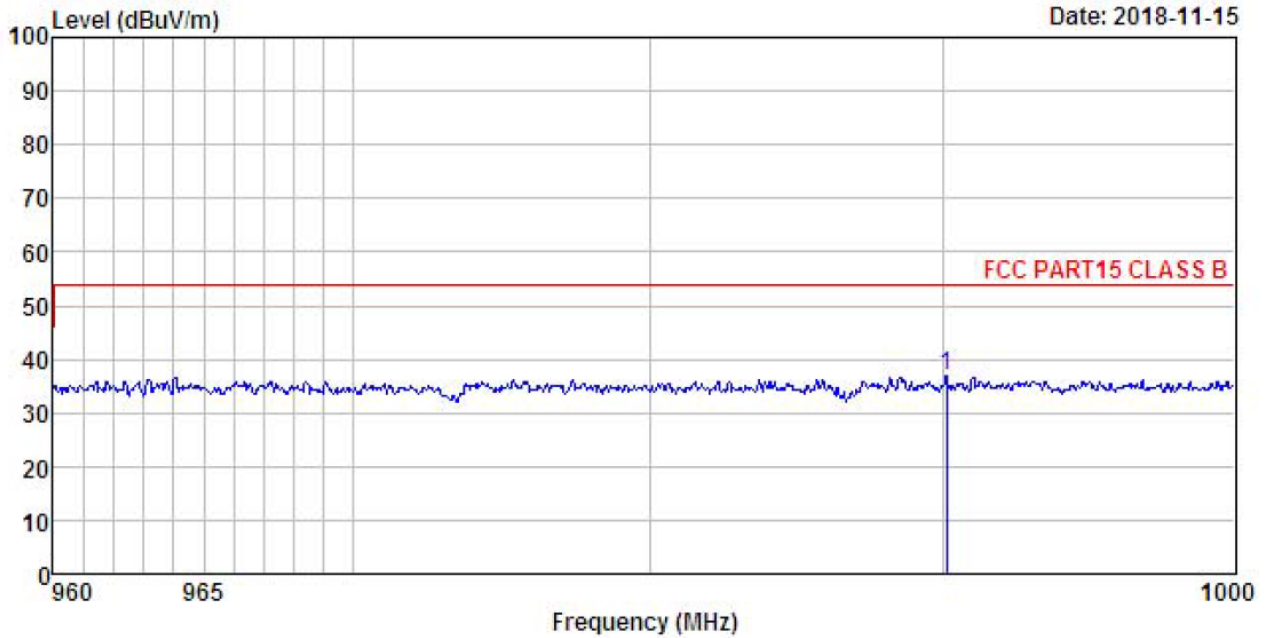


	ReadAntenna	Cable	Preamp	Limit	Over		
Freq	Level	Factor	Loss	Factor	Level	Line	Limit
-----	-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	980.636	10.12	22.65	4.37	0.00	37.14	54.00 -16.86

**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Pre-amplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

<b>Product Name:</b>	Lora Module	<b>Product Model:</b>	E22-900T22S
<b>Test By:</b>	Zora	<b>Test mode:</b>	Tx mode
<b>Test Channel:</b>	Highest channel	<b>Polarization:</b>	Horizontal
<b>Test Voltage:</b>	AC 120V/60Hz	<b>Environment:</b>	Temp: 24°C      Huni: 57%



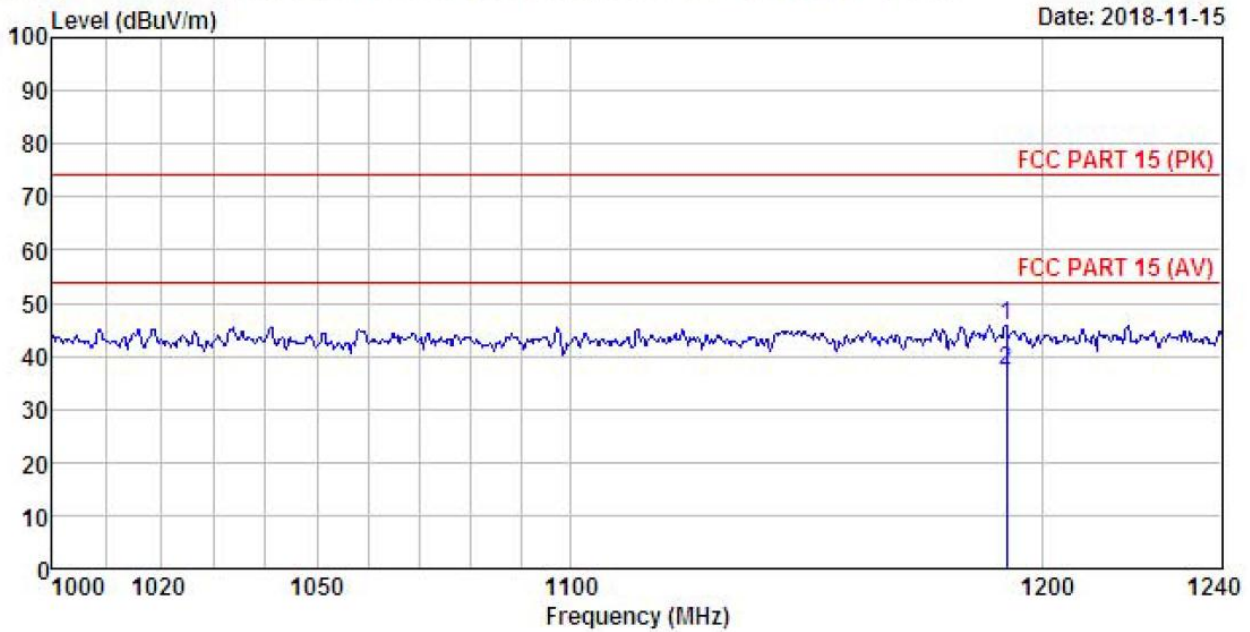
	Read	Antenna	Cable	Preamp	Limit	Over	
Freq	Level	Factor	Loss	Factor	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1    990.089	9.74	22.72	4.42	0.00	36.88	54.00	-17.12

**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

**Above 1GHz:**

<b>Product Name:</b>	Lora Module	<b>Product Model:</b>	E22-900T22S
<b>Test By:</b>	Zora	<b>Test mode:</b>	Tx mode
<b>Test Channel:</b>	Highest channel	<b>Polarization:</b>	Vertical
<b>Test Voltage:</b>	AC 120V/60Hz	<b>Environment:</b>	Temp: 24°C Humi: 57%



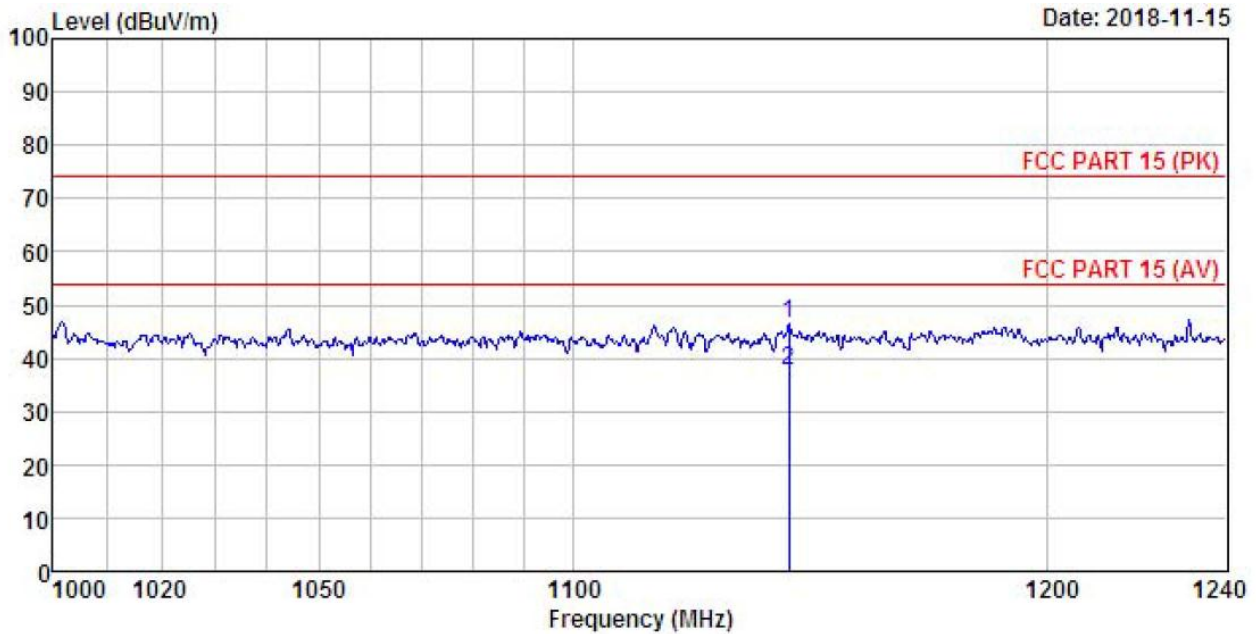
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1191.879	18.26	24.29	3.30	0.00	45.85	74.00	-28.15	Peak
2	1191.879	9.85	24.29	3.30	0.00	37.44	54.00	-16.56	Average

**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamp Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.



<b>Product Name:</b>	Lora Module	<b>Product Model:</b>	E22-900T22S
<b>Test By:</b>	Zora	<b>Test mode:</b>	Tx mode
<b>Test Channel:</b>	Highest channel	<b>Polarization:</b>	Horizontal
<b>Test Voltage:</b>	AC 120V/60Hz	<b>Environment:</b>	Temp: 24°C      Huni: 57%



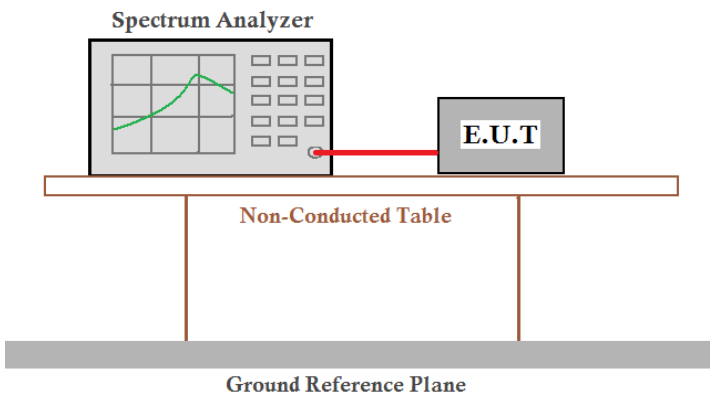
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1144.394	19.07	24.13	3.24	0.00	46.44	74.00	-27.56	Peak
2	1144.394	10.23	24.13	3.24	0.00	37.60	54.00	-16.40	Average

**Remark:**

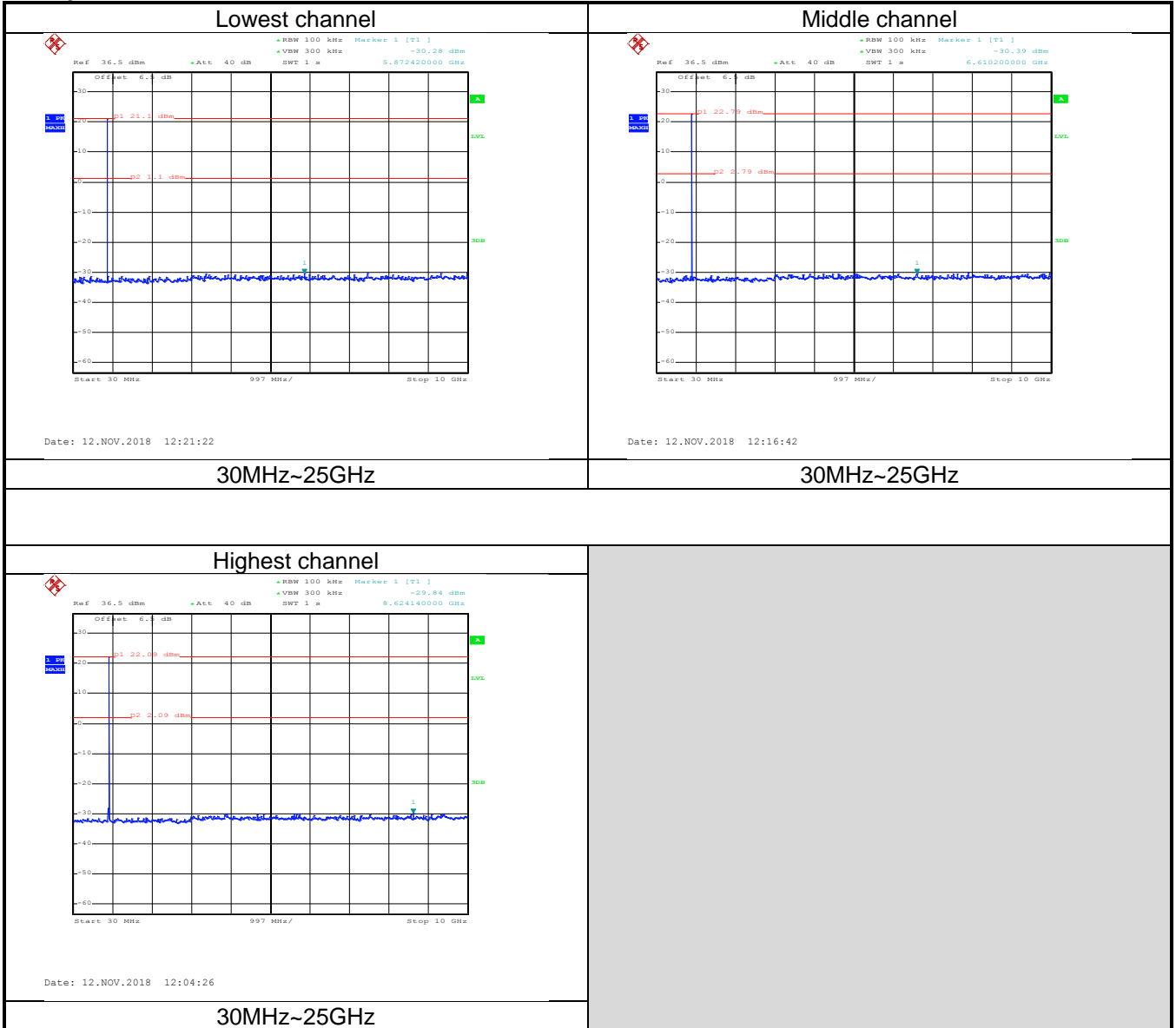
1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

## 6.7 Spurious Emission

### 6.7.1 Conducted Emission Method

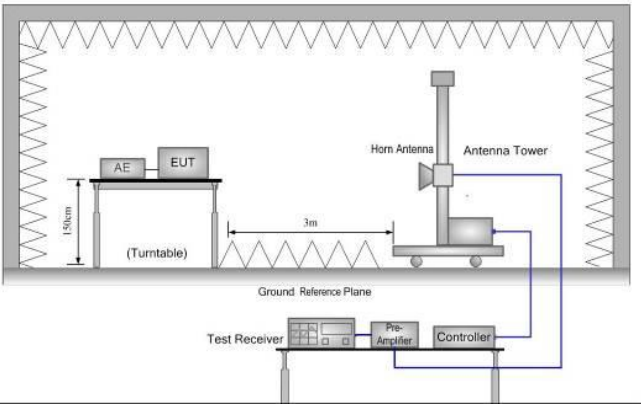
Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at 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.
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two legs and sits on a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plot as follows:



## 6.7.2 Radiated Emission Method

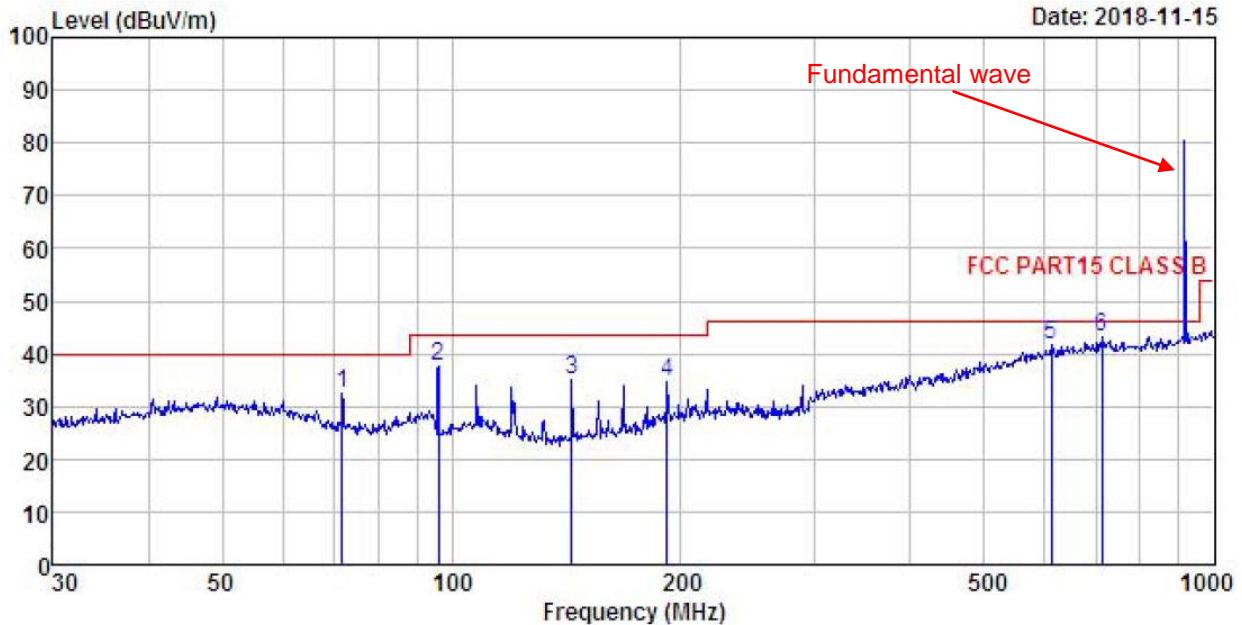
Test Requirement:	FCC Part 15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
RMS		1MHz	3MHz	Average Value	
Limit:	Frequency	Limit (dBuV/m @3m)			Remark
	30MHz-88MHz	40.0			Quasi-peak Value
	88MHz-216MHz	43.5			Quasi-peak Value
	216MHz-960MHz	46.0			Quasi-peak Value
	960MHz-1GHz	54.0			Quasi-peak Value
Above 1GHz	54.0			Average Value	
	74.0			Peak Value	
Test Procedure:	<ol style="list-style-type: none"> <li>The EUT was placed on the top of a rotating table 0.8m(below 1GHz)/1.5m(above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li> <li>For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</li> </ol>				
Test setup:	<p>Below 1GHz</p> <p>Above 1GHz</p>				

	
<p>Test Instruments:</p>	<p>Refer to section 5.8 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.3 for details</p>
<p>Test results:</p>	<p>Passed</p>
<p>Remark:</p>	<ol style="list-style-type: none"> <li>1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case.</li> <li>2. 9 kHz to 30MHz is too low, so only shows the data of above 30MHz in this report.</li> </ol>

**Measurement Data (worst case):**

**Below 1GHz:**

<b>Product Name:</b>	Lora Module	<b>Product Model:</b>	E22-900T22S
<b>Test By:</b>	Zora	<b>Test mode:</b>	Tx mode
<b>Test Frequency:</b>	30 MHz ~ 1 GHz	<b>Polarization:</b>	Vertical
<b>Test Voltage:</b>	AC 120V/60Hz	<b>Environment:</b>	Temp: 24°C Humi: 57%

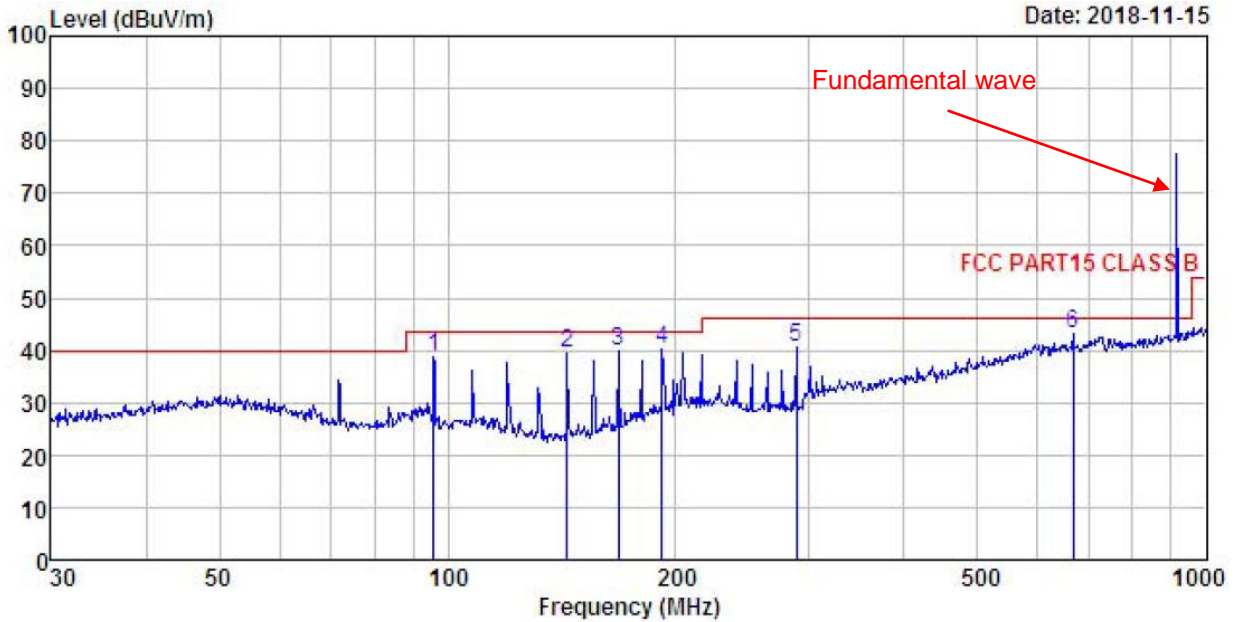


	Read	Antenna	Cable	Preamp	Level	Limit	Over	
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
-----	-----	-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	71.832	22.02	8.91	1.56	0.00	32.49	40.00	-7.51 QP
2	96.099	24.72	11.06	2.00	0.00	37.78	43.50	-5.72 QP
3	143.830	24.29	8.30	2.44	0.00	35.03	43.50	-8.47 QP
4	191.745	20.48	11.25	2.81	0.00	34.54	43.50	-8.96 QP
5	612.064	18.31	19.35	3.92	0.00	41.58	46.00	-4.42 QP
6	711.674	18.89	20.09	4.22	0.00	43.20	46.00	-2.80 QP

**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamp Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

<b>Product Name:</b>	Lora Module	<b>Product Model:</b>	E22-900T22S
<b>Test By:</b>	Zora	<b>Test mode:</b>	Tx mode
<b>Test Frequency:</b>	30 MHz ~ 1 GHz	<b>Polarization:</b>	Horizontal
<b>Test Voltage:</b>	AC 120V/60Hz	<b>Environment:</b>	Temp: 24°C Humi: 57%



	ReadAntenna	Cable	Preamp	Limit	Over			
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	95.762	25.83	11.00	2.01	0.00	38.84	43.50	-4.66 QP
2	143.830	28.57	8.30	2.44	0.00	39.31	43.50	-4.19 QP
3	167.824	27.72	9.34	2.64	0.00	39.70	43.50	-3.80 QP
4	191.745	26.23	11.25	2.81	0.00	40.29	43.50	-3.21 QP
5	287.990	24.01	13.53	2.91	0.00	40.45	46.00	-5.55 QP
6	668.142	19.27	19.80	3.97	0.00	43.04	46.00	-2.96 QP

**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.



**Above 1GHz:**

Test channel: Lowest channel								
Detector: Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1806.00	45.01	25.98	4.12	41.22	33.89	74.00	-40.11	Vertical
1806.00	44.77	25.98	4.12	41.22	33.65	74.00	-40.35	Horizontal
Detector: Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1806.00	39.62	25.98	4.12	41.22	28.50	54.00	-25.50	Vertical
1806.00	38.21	25.98	4.12	41.22	28.23	54.00	-25.77	Horizontal
Test channel: Middle channel								
Detector: Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1830.00	45.21	26.02	4.15	41.27	34.11	74.00	-39.89	Vertical
1830.00	44.78	26.02	4.15	41.27	33.68	74.00	-40.32	Horizontal
Detector: Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1830.00	39.68	26.02	4.15	41.27	28.58	54.00	-25.42	Vertical
1830.00	38.57	26.02	4.15	41.27	28.23	54.00	-25.77	Horizontal
Test channel: Highest channel								
Detector: Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1854.00	45.36	26.08	4.17	41.32	40.33	74.00	-33.67	Vertical
1854.00	44.80	26.08	4.17	41.32	43.09	74.00	-30.91	Horizontal
Detector: Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1854.00	39.56	26.08	4.17	41.32	37.44	54.00	-16.56	Vertical
1854.00	38.26	26.08	4.17	41.32	28.23	54.00	-25.77	Horizontal
<p>Remark:</p> <ol style="list-style-type: none"> <li>Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.</li> <li>The emission levels of other frequencies are very lower than the limit and not show in test report.</li> </ol>								