FCC REPORT

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:	Wireless transceiver module
Model No.:	E22-400T22S
Trade mark:	EBYTE
FCC ID:	2ALPH-E22400T22S
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.231(e)
Date of sample receipt:	22 Jan., 2019
Date of Test:	23 Jan., 2019 to 28 Mar., 2019
Date of report issued:	28 Mar., 2019
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.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

2 Version

Version No.	Date	Description
00	*28 Mar., 2019*	*Original*
01	*09 Apr., 2019*	*Update page 5 ,8 and 11*

Tested by: Mike.ou ***Date:*** *28 Mar., 2019*

Test Engineer

Reviewed by: Wimer Zhang ***Date:*** *28 Mar., 2019*

Project Engineer

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	Pass
Field strength of the fundamental signal	15.231 (e)	Pass
Spurious emissions	15.231 (e)/15.209	Pass
20dB Bandwidth	15.231 (c)	Pass
Duration Time	15.231(e)	Pass
Conducted Emission	15.207	N/A

Pass: The EUT comply with the essential requirements in the standard.

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:	Wireless transceiver module
Model No.:	E22-400T22S
Operation Frequency:	434MHz
Channel numbers:	1
Modulation type:	LORA
Antenna Type:	External antenna
Antenna gain:	3.0dBi
Power supply:	DC 5V

5.3 Test mode

Transmitting mode:	Keep the EUT in transmitting mode with modulation.

Pre-Test Mode:

CCIS has verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:

Axis	X	Y	Z
Field Strength(dBuV/m)	89.25	87.98	90.85

Final Test Mode:

According to ANSI C63.4 standards, the test results are both the “worst case” and “worst setup”:
Z axis (see the test setup photo)

5.4 Description of Support Units

Manufacturer	Description	Model	Serial Number	FCC ID/DoC
LENOVO	Laptop	SL510	2847A65	DoC
EBYTE	Test suite	E15-UTL1	N/A	N/A

5.5 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Registration No.: 727551**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been accredited as a testing laboratory by FCC (Federal Communications Commission). The Registration No. is 727551.

- **IC - Registration No.: 10106A-1**

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.

- **CNAS - Registration No.: CNAS L6048**

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.

- **A2LA - Registration No.: 4346.01**

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: https://portal.a2la.org/scopepdf/4346-01.pdf

5.6 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

5.7 Measurement Uncertainty

Parameters	Expanded Uncertainty
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)

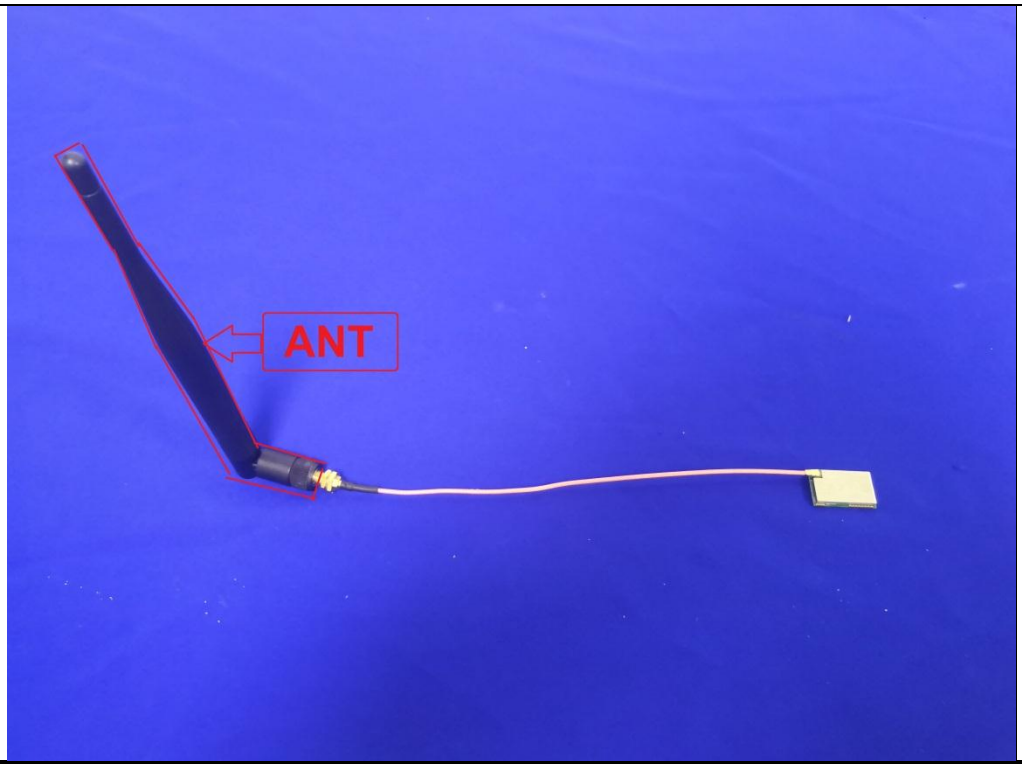
5.8 Test Instruments list

Radiated Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	SAEMC	9m*6m*6m	966	07-22-2017	07-21-2020
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-16-2018	03-15-2019
				03-06-2019	03-05-2020
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-16-2018	03-15-2019
				03-06-2019	03-05-2020
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-22-2017	06-21-2020
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170582	11-20-2018	11-19-2019
Loop Antenna	SCHWARZBECK	FMZB 1519 B	00044	04-28-2018	04-27-2019
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-07-2018	03-06-2019
				03-06-2019	03-05-2020
Pre-amplifier	CD	PAP-1G18	11804	03-07-2018	03-06-2019
				03-06-2019	03-05-2020
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-07-2018	03-06-2019
				03-06-2019	03-05-2020
Spectrum analyzer	Rohde & Schwarz	FSP40	100363	11-20-2018	11-19-2019
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-07-2018	03-06-2019
				03-06-2019	03-05-2020
Simulated Station	Anritsu	MT8820C	6201026545	03-07-2018	03-06-2019
				03-06-2019	03-05-2020
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2018	03-06-2019
				03-06-2019	03-05-2020
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2018	03-06-2019
				03-06-2019	03-05-2020
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-07-2018	03-06-2019
				03-06-2019	03-05-2020

6 Test results and Measurement Data

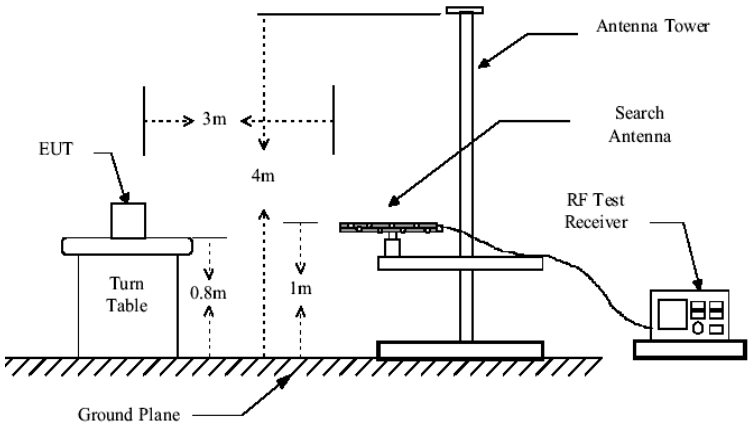
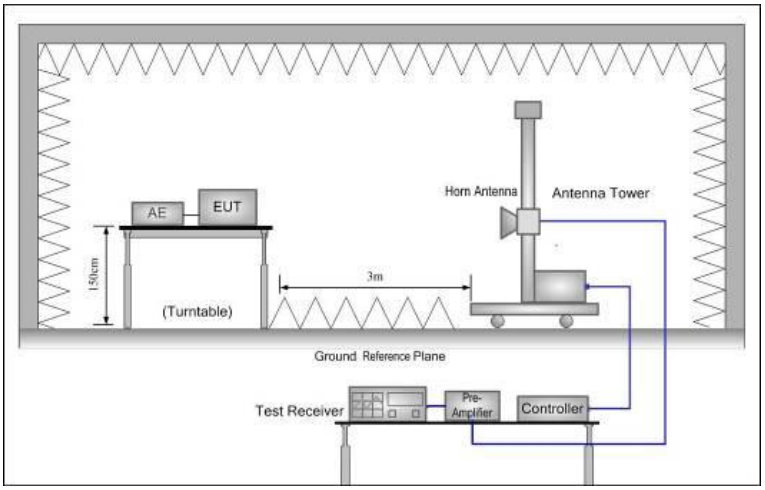
6.1 Antenna requirement:

Standard requirement:	FCC Part15 C Section 15.203
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.	
E.U.T Antenna:	
The antenna is External antenna which which cannot replace by end-user*. The best case gain of the antenna is 3.0dBi.*	



6.2 Radiated Emission

<table>
<tr><td>Test Requirement:</td><td colspan="5">FCC Part 15 C Section 15.231(e) and 15.209</td></tr>
<tr><td>Test Method:</td><td colspan="5">ANSI C63.4:2003</td></tr>
<tr><td>Test Frequency Range:</td><td colspan="5">30MHz to 5000MHz</td></tr>
<tr><td>Test site:</td><td colspan="5">Measurement Distance: 3m</td></tr>
<tr><td rowspan="4">Receiver setup:</td><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>100kHz</td><td>300kHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>RMS</td><td>1MHz</td><td>3MHz</td><td>Average Value</td></tr>
<tr><td rowspan="3">Limit:
(Field strength of the fundamental signal)</td><td colspan="2">Frequency</td><td colspan="2">Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td colspan="2" rowspan="2">434MHz</td><td colspan="2">72.87</td><td>Average Value</td></tr>
<tr><td colspan="2">92.87</td><td>Peak Value</td></tr>
<tr><td rowspan="7">Limit:
(Spurious Emissions)</td><td colspan="2">Frequency</td><td colspan="2">Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td colspan="2">30MHz-88MHz</td><td colspan="2">40.00</td><td>Quasi-peak Value</td></tr>
<tr><td colspan="2">88MHz-216MHz</td><td colspan="2">43.50</td><td>Quasi-peak Value</td></tr>
<tr><td colspan="2">216MHz-960MHz</td><td colspan="2">46.00</td><td>Quasi-peak Value</td></tr>
<tr><td colspan="2">960MHz-1GHz</td><td colspan="2">54.00</td><td>Quasi-peak Value</td></tr>
<tr><td colspan="2" rowspan="2">Above 1GHz</td><td colspan="2">54.00</td><td>Average Value</td></tr>
<tr><td colspan="2">74.00</td><td>Peak Value</td></tr>
<tr><td>Limit:
(outside of the specified frequency band)</td><td colspan="5">Or The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level whichever limit permits higher field strength.</td></tr>
<tr><td>Test Procedure:</td><td colspan="5">1. 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.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
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.
4. 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB 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 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</td></tr>
</table>

Test setup:	Below 1GHz  Above 1GHz 
Test Instruments:	Refer to section 5.8
Test mode:	Refer to section 5.3
Test results:	Passed

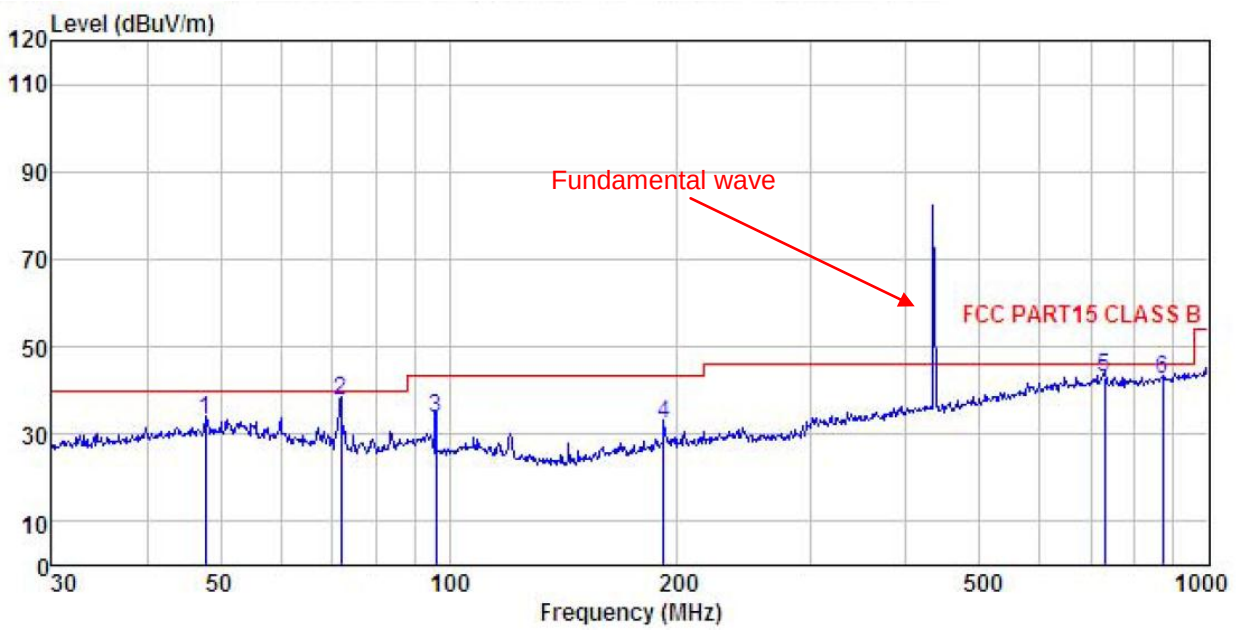
6.2.1 Field Strength Of The Fundamental Signal

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
434.0	67.90	15.92	3.16	0.00	86.98	92.87	-5.89	Vertical
	71.77	15.92	3.16	0.00	90.85	92.87	-2.02	Horizontal
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
434.0	51.50	15.92	3.16	0.00	70.58	72.87	-2.29	Vertical
	53.46	15.92	3.16	0.00	72.54	72.87	-0.33	Horizontal

6.2.2 Spurious Emissions

Below 1GHz:

Product Name:	Wireless transceiver module	**Product Model:**	E22-400T22S
Test By:	Mike	**Test mode:**	Tx mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical
Test Voltage:	DC 5V	**Environment:**	Temp: 24℃ Huni: 57%

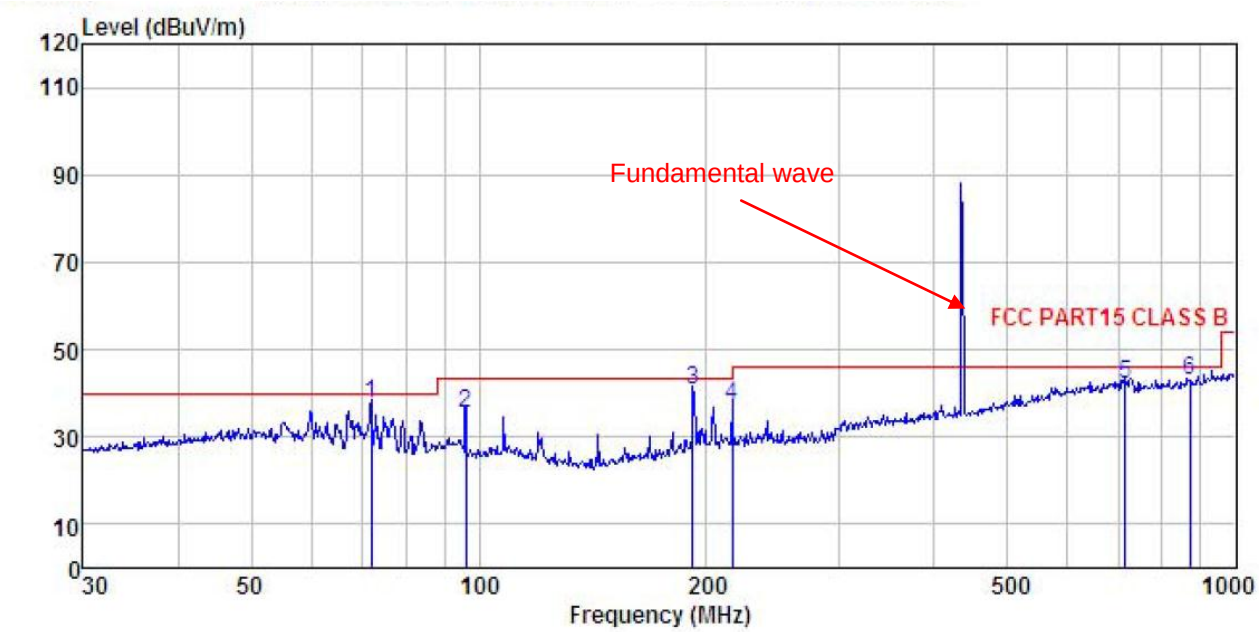


	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	47.826	17.98	13.93	1.27	0.00	33.18	40.00	-6.82	QP
2	72.084	27.21	8.88	1.56	0.00	37.65	40.00	-2.35	QP
3	96.099	20.79	11.06	2.00	0.00	33.85	43.50	-9.65	QP
4	191.745	18.33	11.25	2.81	0.00	32.39	43.50	-11.11	QP
5	729.358	18.26	20.51	4.29	0.00	43.06	46.00	-2.94	QP
6	869.130	16.93	21.69	4.01	0.00	42.63	46.00	-3.37	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.*

Product Name:	Wireless transceiver module	Product Model:	E22-400T22S
Test By:	Mike	Test mode:	Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	DC 5V	Environment:	Temp: 24℃ 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	72.084	27.19	8.88	1.56	0.00	37.63	40.00	-2.37	QP
2	96.099	22.30	11.06	2.00	0.00	35.36	43.50	-8.14	QP
3	191.745	26.76	11.25	2.81	0.00	40.82	43.50	-2.68	QP
4	216.024	22.40	12.12	2.85	0.00	37.37	46.00	-8.63	QP
5	714.173	17.87	20.15	4.23	0.00	42.25	46.00	-3.75	QP
6	869.130	17.05	21.69	4.01	0.00	42.75	46.00	-3.25	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

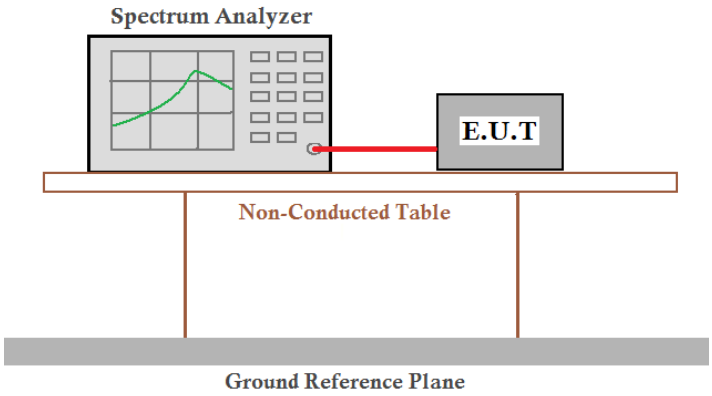
Peak value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1302.00	47.20	24.66	3.48	41.01	34.33	74.00	-39.67	Vertical
1736.00	51.43	25.81	4.03	41.15	40.12	74.00	-33.88	Vertical
2170.00	45.73	26.85	4.48	41.68	35.38	74.00	-38.62	Vertical
2604.00	76.41	27.84	4.96	41.87	67.34	74.00	-6.66	Vertical
3038.00	45.19	28.63	5.37	41.49	37.70	74.00	-36.30	Vertical
3472.00	46.21	28.89	5.73	41.43	39.40	74.00	-34.60	Vertical
3906.00	47.06	29.98	6.10	41.80	41.34	74.00	-32.66	Vertical
4340.00	46.34	30.84	6.62	41.92	41.88	74.00	-32.12	Vertical
1302.00	47.12	24.66	3.48	41.01	34.25	74.00	-39.75	Horizontal
1736.00	53.88	25.81	4.03	41.15	42.57	74.00	-31.43	Horizontal
2170.00	45.81	26.85	4.48	41.68	35.46	74.00	-38.54	Horizontal
2604.00	46.42	27.84	4.96	41.87	37.35	74.00	-36.65	Horizontal
3038.00	45.86	28.63	5.37	41.49	38.37	74.00	-35.63	Horizontal
3472.00	45.89	28.89	5.73	41.43	39.08	74.00	-34.92	Horizontal
3906.00	46.95	29.98	6.10	41.80	41.23	74.00	-32.77	Horizontal
4340.00	46.23	30.84	6.62	41.92	41.77	74.00	-32.23	Horizontal
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
1302.00	38.08	24.66	3.48	41.01	25.21	54.00	-28.79	Vertical
1736.00	42.52	25.81	4.03	41.15	31.21	54.00	-22.79	Vertical
2170.00	36.35	26.85	4.48	41.68	26.00	54.00	-28.00	Vertical
2604.00	37.96	27.84	4.96	41.87	28.89	54.00	-25.11	Vertical
3038.00	36.48	28.63	5.37	41.49	28.99	54.00	-25.01	Vertical
3472.00	36.26	28.89	5.73	41.43	29.45	54.00	-24.55	Vertical
3906.00	37.17	29.98	6.10	41.80	31.45	54.00	-22.55	Vertical
4340.00	37.45	30.84	6.62	41.92	32.99	54.00	-21.01	Vertical
1302.00	37.83	24.66	3.48	41.01	24.96	54.00	-29.04	Horizontal
1736.00	43.72	25.81	4.03	41.15	32.41	54.00	-21.59	Horizontal
2170.00	36.44	26.85	4.48	41.68	26.09	54.00	-27.91	Horizontal
2604.00	36.71	27.84	4.96	41.87	27.64	54.00	-26.36	Horizontal
3038.00	36.16	28.63	5.37	41.49	28.67	54.00	-25.33	Horizontal
3472.00	36.83	28.89	5.73	41.43	30.02	54.00	-23.98	Horizontal
3906.00	37.55	29.98	6.10	41.80	31.83	54.00	-22.17	Horizontal
4340.00	37.87	30.84	6.62	41.92	33.41	54.00	-20.59	Horizontal

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.

6.3 20dB Bandwidth

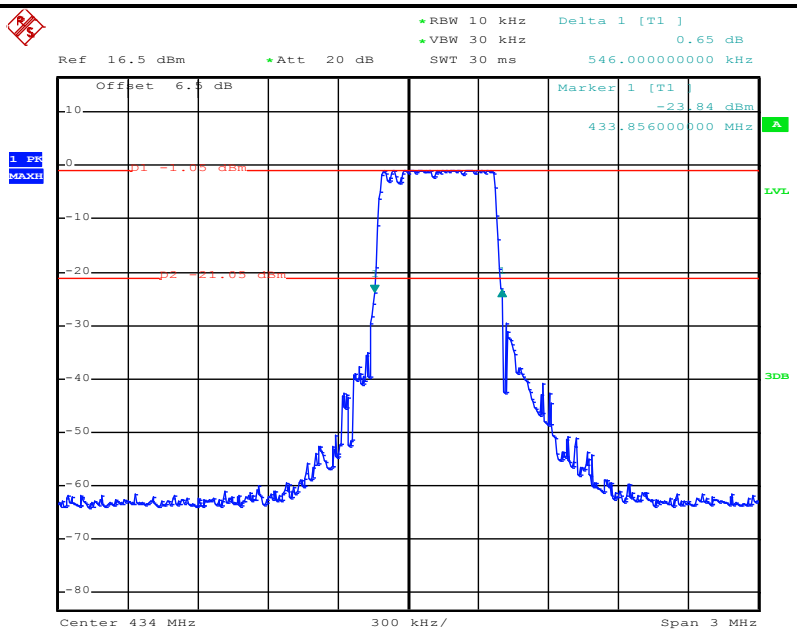
Test Requirement:	FCC Part15 C Section 15.231 (c)
Test Method:	ANSI C63.4:2014
Receiver setup:	RBW=10kHz, VBW=30kHz, detector: Peak
Limit:	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.
Test Procedure:	1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set the EUT to proper test channel. 3. Max hold the radiated emissions, mark the peak power frequency point and the -20dB upper and lower frequency points. 4. Read 20dB bandwidth.
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data

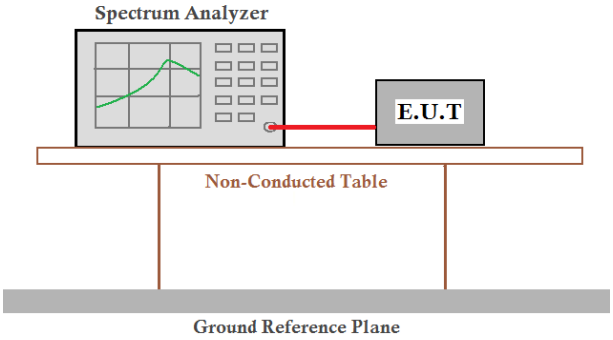
20dB bandwidth (MHz)	Limit (MHz)	Results
0.546	1.085	Passed

Note: Limit= Fundamental frequency×0.25%=434×0.25%=1.085MHz

Test plot as follows:



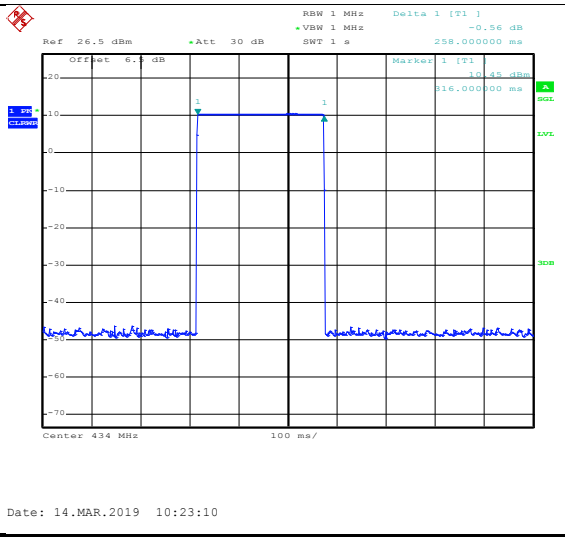
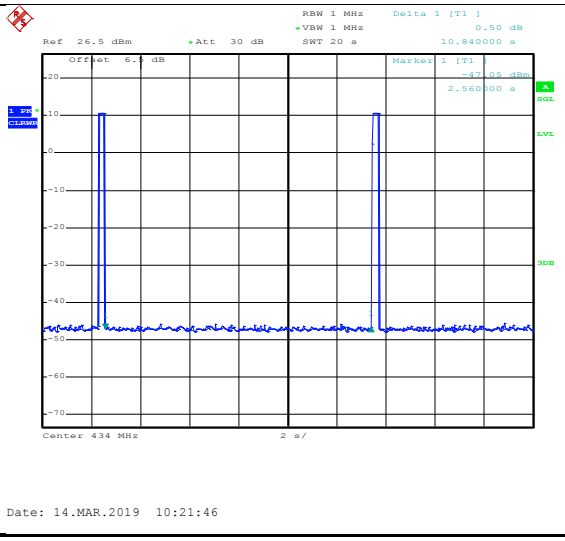
6.4 Duration Time

Test Requirement:	FCC Part15 C Section 15.231 (a)
Test Method:	ANSI C63.10: 2013
Receiver setup:	RBW=1 MHz, VBW=3 MHz, span=0Hz, detector: Peak
Limit:	the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.
Test mode:	Transmitting mode
Test Procedure:	1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set the EUT to proper test channel. 3. Single scan the transmission, and read the transmission time.
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data

Items	Test Data	Limit (second)	Result
Duration time	258ms	<1.0	Pass
Silent Time	10.84 s(see plot as below)	30* Duration time(No less than 10 s)	Pass

Test plot as follows:

Duration time slot-1:	Silent Time slot-2
	
Date: 14.MAR.2019 10:23:10	Date: 14.MAR.2019 10:21:46