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# TEST REPORT

## FCC PART 15 SUBPART C 15.247

Report Reference No. ....: **CTL2110275011-WF10**

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**Product Name** ....: Sapphire Tablet

**Model/Type reference** ....: S\_TAB

**List Model(s)**.....: N/A

**Trade Mark**.....: TravelWifi

**FCC ID**.....: **2ALSN-S-TAB**

**Applicant's name** ....: DHI Telecom Group

**Address of applicant** ....: 711 E. 20th St, Houston, Tx, 77008 United States

**Test Firm**.....: **Shenzhen CTL Testing Technology Co., Ltd.**

**Address of Test Firm** .....: Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

**Test specification**.....:

**Standard**.....: **47 CFR FCC Part 15 Subpart C 15.247**

**TRF Originator**.....: Shenzhen CTL Testing Technology Co., Ltd.

**Master TRF**.....: Dated 2011-01

**Date of receipt of test item** .....: Oct. 27, 2021

**Date of sampling** .....: Oct. 28, 2021

**Date of Test Date** .....: Oct. 28, 2021- Nov. 18, 2021

**Date of Issue** .....: Nov. 19, 2021

**Result**.....: **Pass**

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# TEST REPORT

<b>Test Report No. :</b>	<b>CTL2110275011-WF10</b>	Nov. 19, 2021
		Date of issue

Equipment under Test : Sapphire Tablet

Sample No. CTL2110275011-S003, CTL2110275011-S004

Model /Type : S\_TAB

Listed Models : N/A

**Applicant** : **DHI Telecom Group**

Address : 711 E. 20th St, Houston, Tx, 77008 United States

**Manufacturer** : **DHI Telecom Group**

Address : 711 E. 20th St, Houston, Tx, 77008 United States

<b>Test result</b>	<b>Pass *</b>
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\* In the configuration tested, the EUT complied with the standards specified page 5.

The test results presented in this report relate only to the object tested.

This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.

## \*\* Modified History \*\*

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## 1. SUMMARY

### 1.1. TEST STANDARDS

The tests were performed according to following standards:

**FCC Rules Part 15.247:** Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

**ANSI C63.10: 2013:** American National Standard for Testing Unlicensed Wireless Devices

**558074 D01 15.247 Meas Guidance v05r02:** Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spreda Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules

### 1.2. Test Description

FCC PART 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)(2)	6dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Conducted Output Power	PASS
FCC Part 15.247(e)	Power Spectral Density	PASS
FCC Part 15.205/ 15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge	PASS
FCC Part 15.203/15.247 (b)	Antenna Requirement	PASS

## 1.3. Test Facility

### 1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.

Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.10 and CISPR 32/EN 55032 requirements.

### 1.3.2 Laboratory accreditation

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

#### CNAS-Lab Code: L7497

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

#### A2LA-Lab Cert. No. 4343.01

Shenzhen CTL Testing Technology Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### IC Registration No.: 9618B CAB identifier: CN0041

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9618B on Jan. 22, 2019.

#### FCC-Registration No.: 399832 Designation No.: CN1216

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 399832, December 08, 2017.

## 1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance 0.15~30MHz	±3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 2. GENERAL INFORMATION

### 2.1. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

### 2.2. General Description of EUT

Product Name:	Sapphire Tablet
Model/Type reference:	S_TAB
Power supply:	DC 3.8V form battery
Hardware version:	LA2B22P2(YKL_Upad1.NA)
Software version:	L1965.4.01.02.NA00
<b>Bluetooth LE</b>	
Supported type:	Bluetooth low Energy
Modulation:	GFSK
Operation frequency:	2402MHz to 2480MHz
Channel number:	40
Channel separation:	2 MHz
Antenna type:	FPC Antenna
Antenna gain:	-3.93dBi

Note: For more details, please refer to the user's manual of the EUT.

### 2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software(QRCT3 Command) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing.

There are 40 channels provided to the EUT and Channel 00/19/39 were selected for BLE test.

#### Operation Frequency List :

Channel	Frequency (MHz)
<b>00</b>	<b>2402</b>
01	2404
02	2406
:	:
<b>19</b>	<b>2440</b>
:	:
37	2476
38	2478
<b>39</b>	<b>2480</b>

Note: The line display in grey were the channel selected for testing

### Power setting during the test:

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

#### Power Parameters:

Test Software Version		QRCT3 Command		
Frequency		2402MHz	2440MHz	2480MHz
BLE 1Mbps		Default	Default	Default

## 2.4. Special Accessories

Follow auxiliary equipment(s) test with EUT that provided by the manufacturer or laboratory is listed as follow:

Description	Manufacturer	Model	Technical Parameters	Certificate	Provided by
Adapter	MASS POWER	E010-1D050200VUU	Input: 100-240V~, 50/60Hz, 0.3A Output: 5.0V---2A	UL	laboratory
/	/	/	/	/	/

## 2.5. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ESH2-Z5	860014/010	2021/05/15	2022/05/14
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2021/04/08	2022/04/07
EMI Test Receiver	R&S	ESCI	1166.5950.03	2021/05/18	2022/05/17
Spectrum Analyzer	Agilent	E4407B	MY41440676	2021/05/14	2022/05/13
Spectrum Analyzer	Agilent	N9020A	US46220290	2021/05/14	2022/05/13
Spectrum Analyzer	Keysight	N9020A	MY53420874	2021/05/14	2022/05/13
Controller	EM Electronics	EM 1000	060859	2021/05/19	2022/05/18
Horn Antenna	Ocean Microwave	OBH100400	26999002	2020/11/28	2021/11/27
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2021/05/19	2022/05/18
Active Loop Antenna	Da Ze	ZN30900A	/	2021/05/19	2022/05/18
Amplifier	Agilent	8449B	3008A02306	2021/05/15	2022/05/14
Amplifier	Agilent	8447D	2944A10176	2021/05/15	2022/05/14
Temperature/Humidity Meter	Gangxing	CTH-608	02	2021/05/16	2022/05/15
Power Sensor	Agilent	U2021XA	MY55130004	2021/05/14	2022/05/13
Power Sensor	Agilent	U2021XA	MY55130006	2021/05/14	2022/05/13
Spectrum Analyzer	RS	FSP	1164.4391.38	2021/05/15	2022/05/14

The calibration interval was one year

## **2.6. Related Submittal(s) / Grant (s)**

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## **2.7. Modifications**

No modifications were implemented to meet testing criteria.

### 3. TEST CONDITIONS AND RESULTS

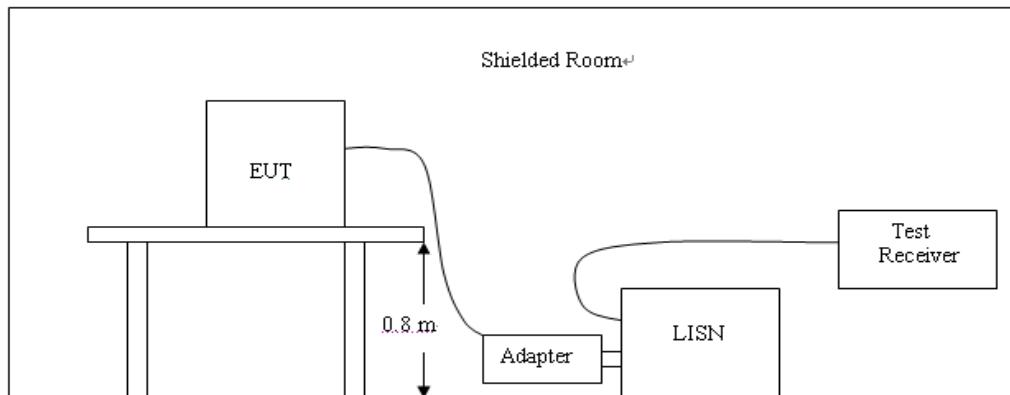
#### 3.1. Conducted Emissions Test

##### 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 CONFIGURATION



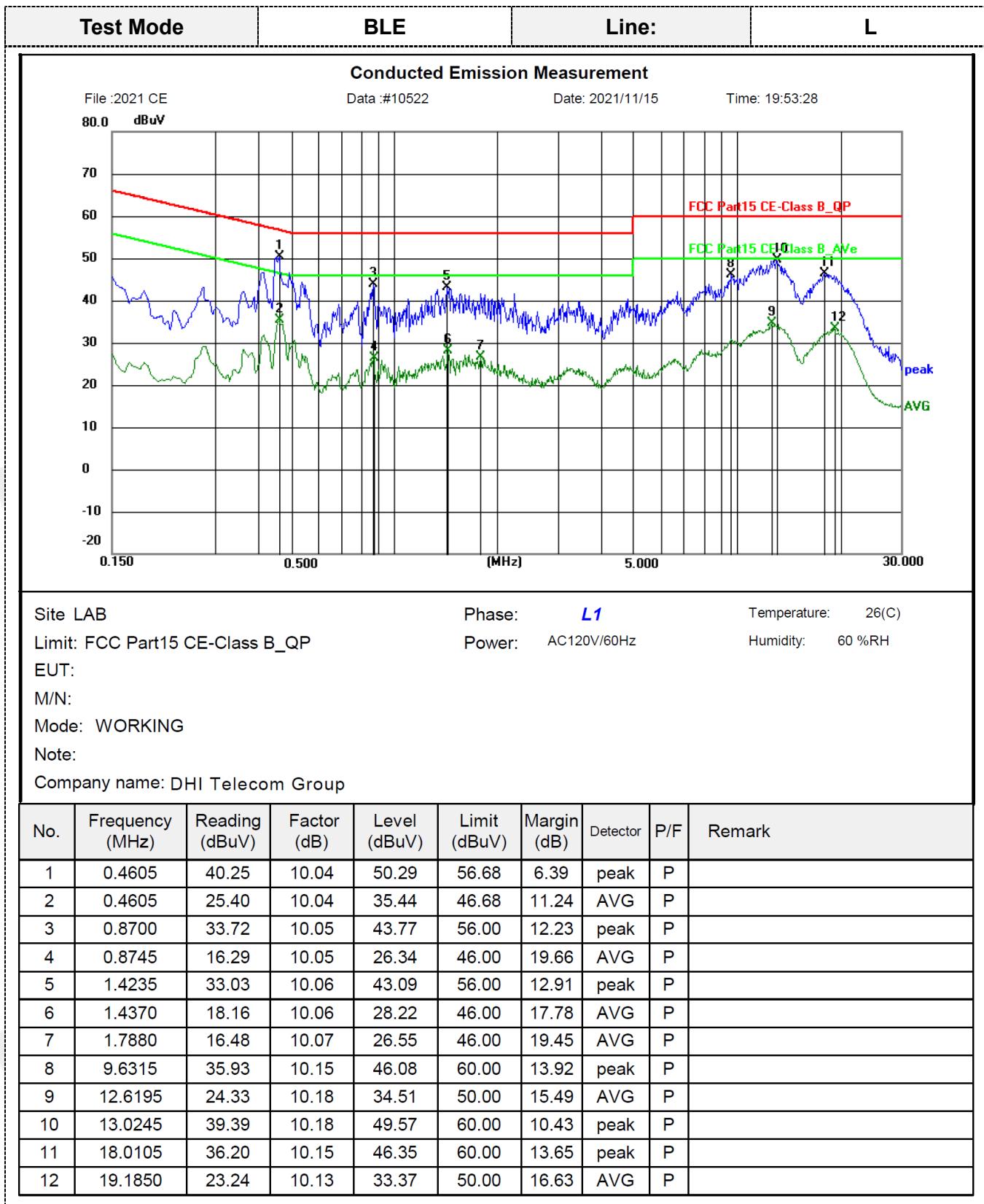
##### TEST PROCEDURE

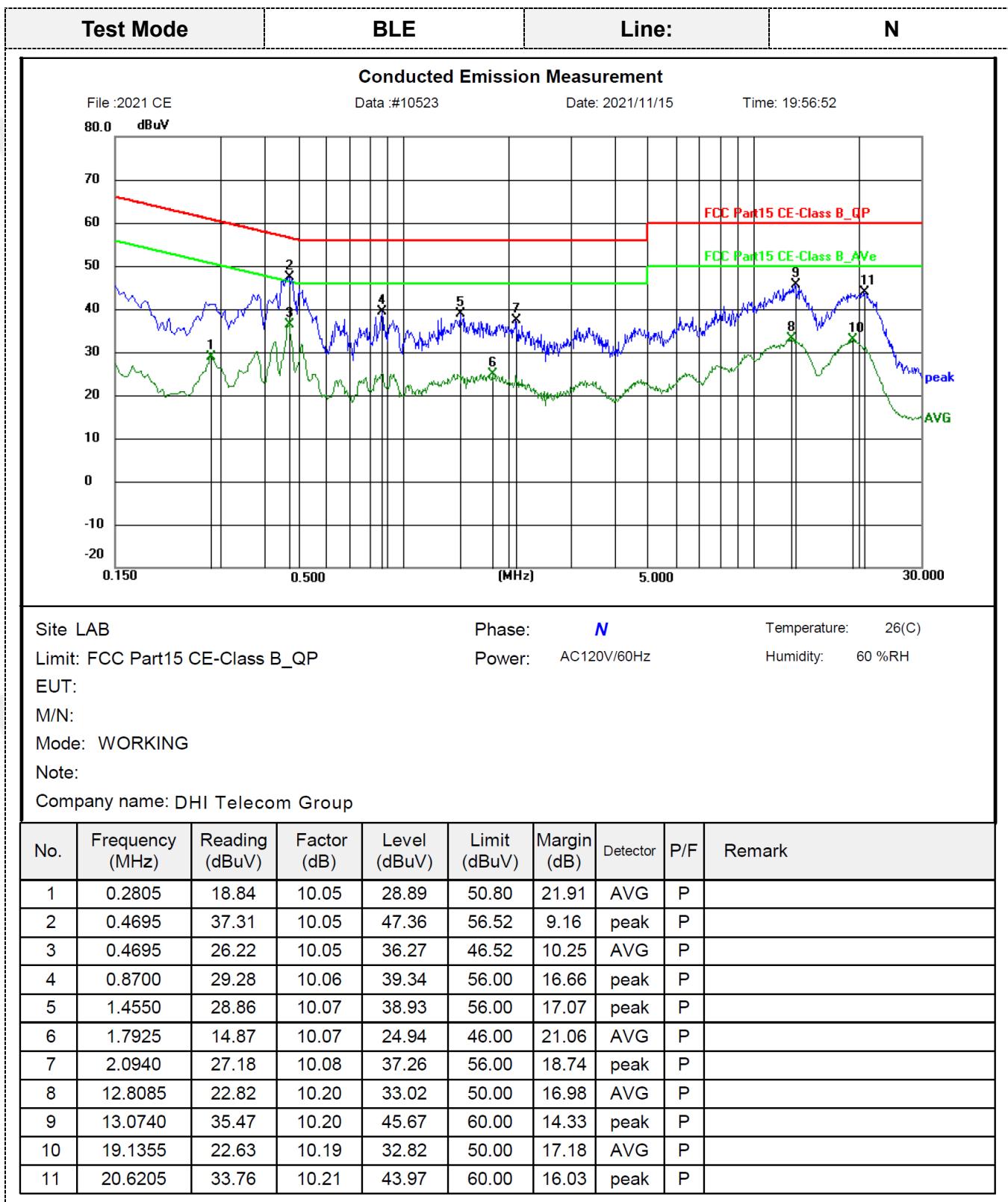
1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. The adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

**TEST RESULTS**

Remark:

- BLE mode was tested at Low, Middle, and High channel; only the worst result was reported as below:
- Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply(adapter)have been tested, only the worst result of 120 VAC, 60 Hz with BLE middle channel was reported as below:





Remark: Level(dBuV)=Reading(dBuV) + Factor(dB)

Margin=Limit(dBuV/m)- Level(dBuV/m)

### 3.2. Radiated Emissions and Band Edge

#### Limit

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

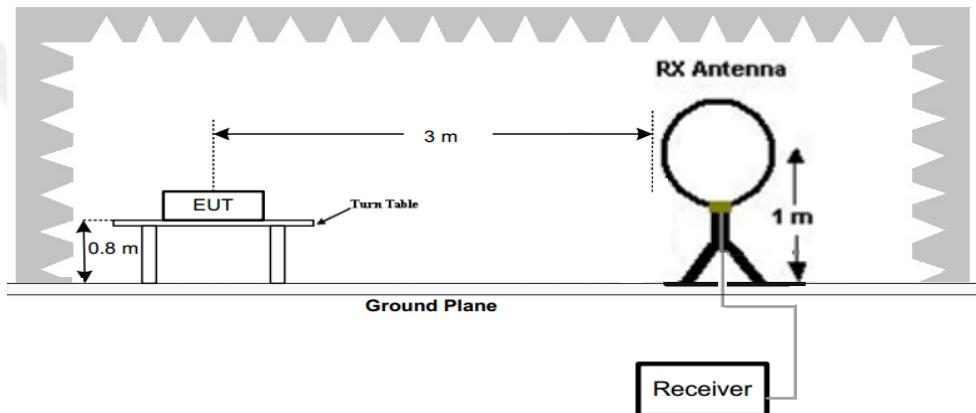
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

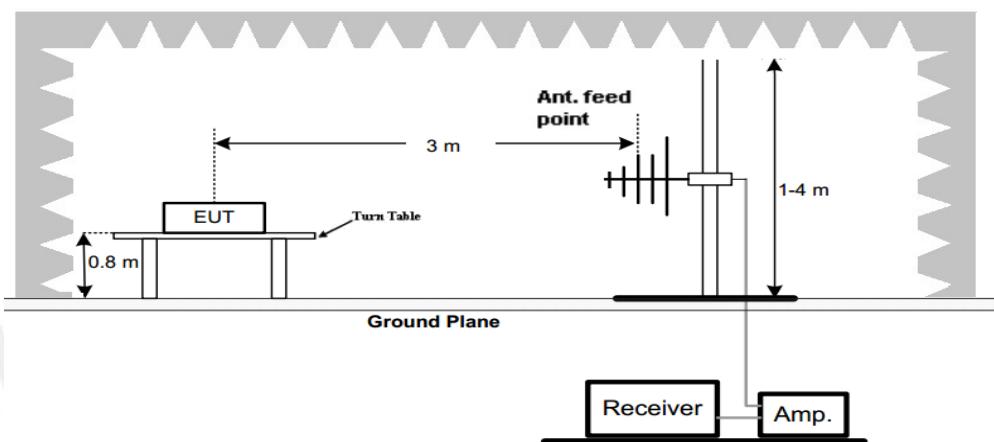
Frequency (MHz)	Distance (Meters)	Radiated (dB $\mu$ V/m)	Radiated ( $\mu$ V/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

#### TEST CONFIGURATION

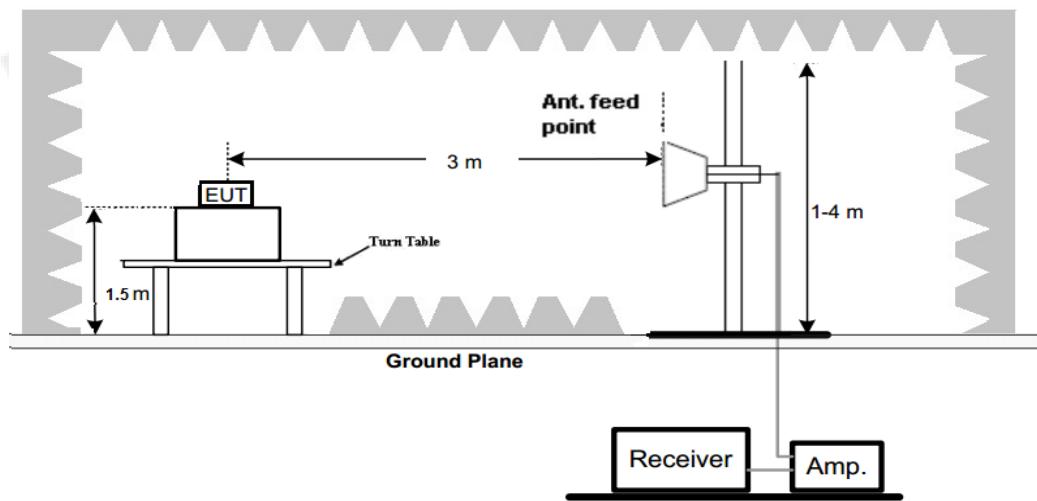
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



### Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0°C to 360°C to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Antenna	1

7. Setting test receiver/spectrum as following table states:

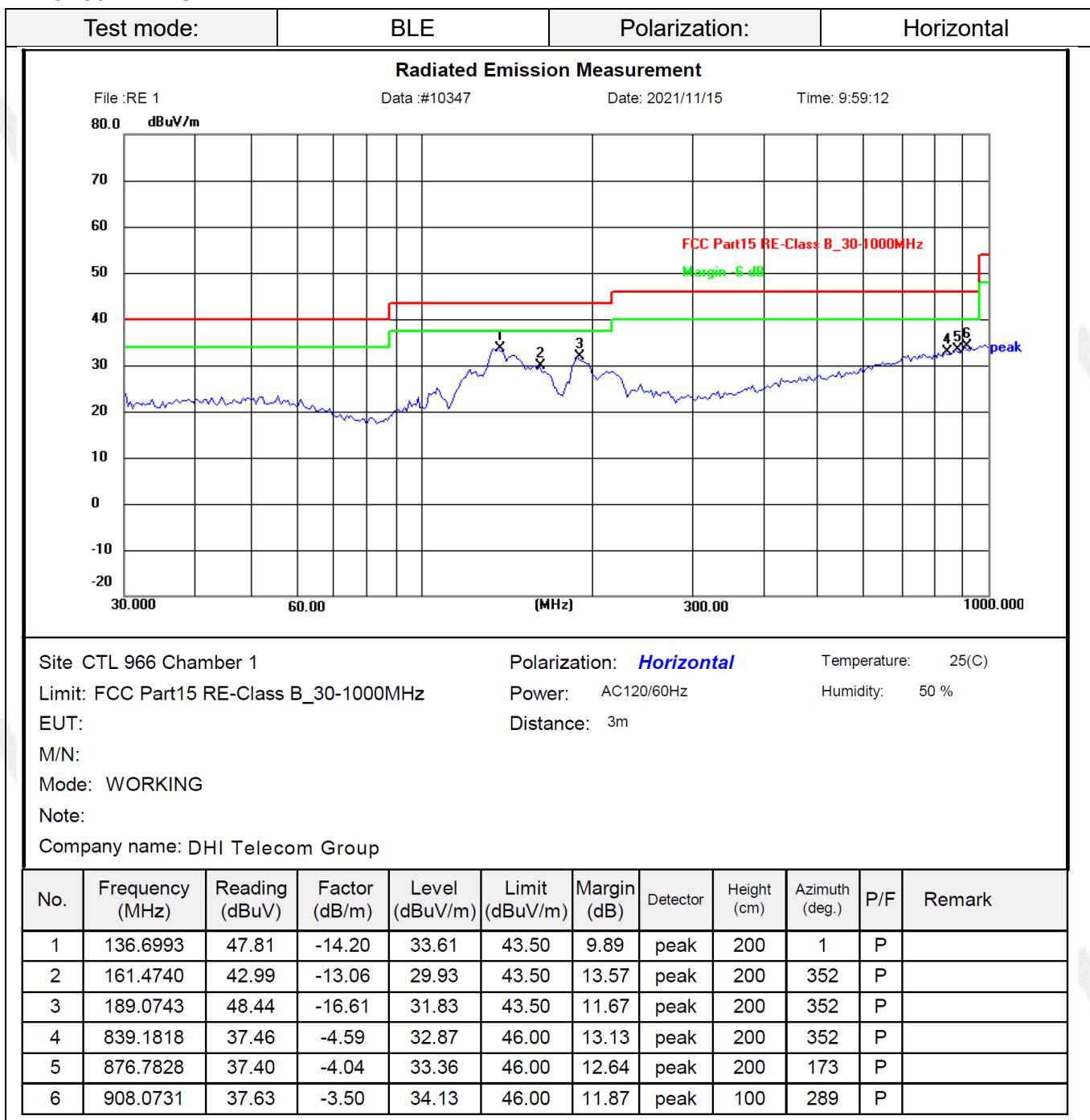
Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

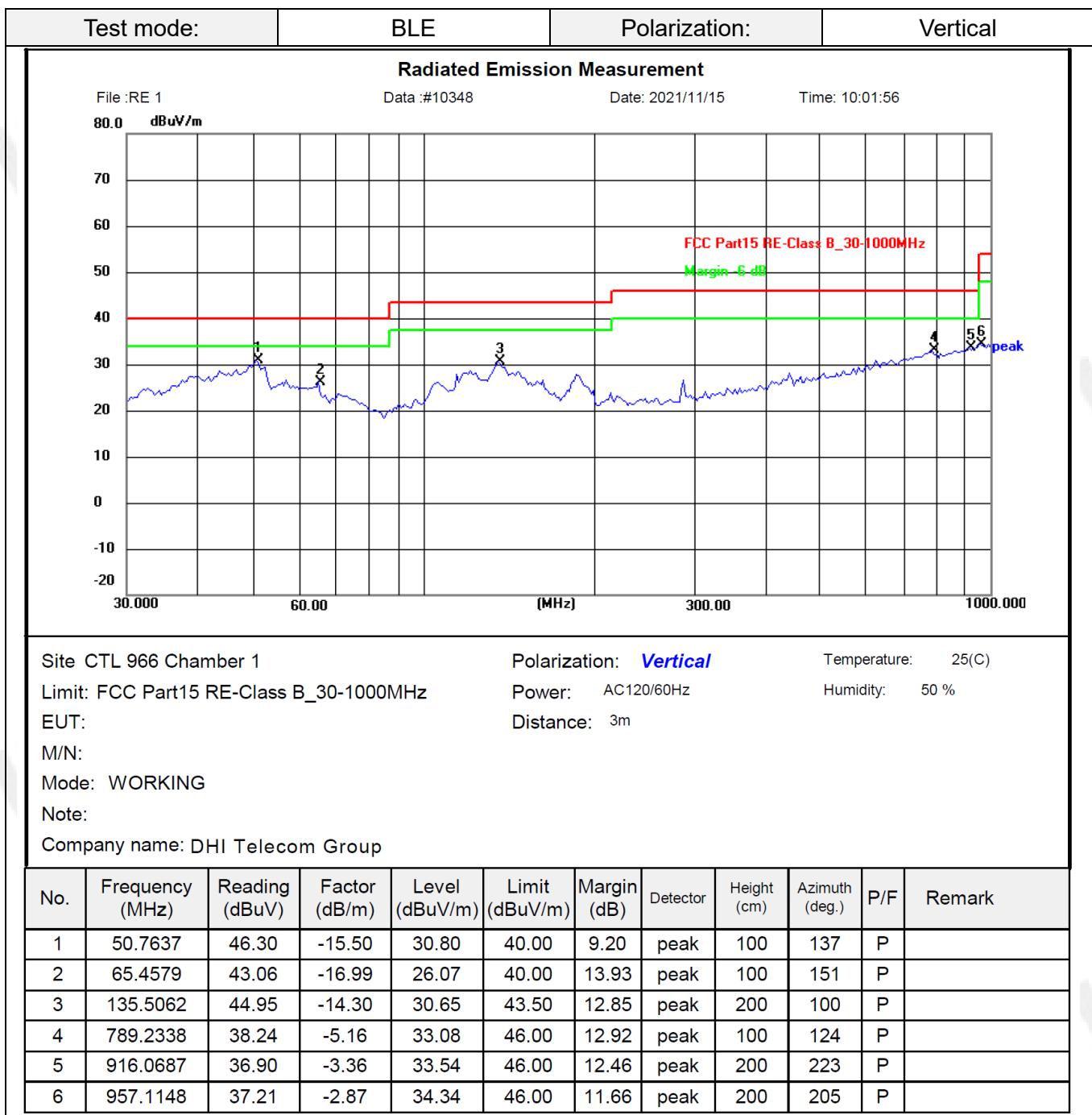
### TEST RESULTS

Remark:

1. For below 1GHz testing recorded worst at BLE middle channel.
2. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and the emission levels from 9kHz to 30MHz are attenuated 20dB below the limit and not recorded in report.

## For 30MHz-1GHz





Remark: Level(dBuV/m)=Reading(dBuV)+Factor(dB/m)

Margin=Limit(dBuV/m)-Level(dBuV/m)

For 1GHz to 25GHz

## GFSK (above 1GHz)

Frequency(MHz):		2402		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	50.26	PK	74	23.74	63.26	33.49	6.91	53.39
4804.00	--	AV	54	--	--	--	--	--
6570.37	48.25	PK	74	25.75	57.69	35.35	8.45	53.24
6570.37	--	AV	54	--	--	--	--	--
7206.00	47.96	PK	74	26.04	55.01	36.95	9.18	53.18
7206.00	--	AV	54	--	--	--	--	--

Frequency(MHz):		2402		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	50.46	PK	74	23.54	63.46	33.49	6.91	53.39
4804.00	--	AV	54	--	--	--	--	--
7050.99	47.95	PK	74	26.05	55.64	36.35	9.12	53.16
7050.99	--	AV	54	--	--	--	--	--
7206.00	47.70	PK	74	26.30	54.75	36.95	9.18	53.18
7206.00	--	AV	54	--	--	--	--	--

Frequency(MHz):		2440		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4880.00	49.91	PK	74	24.09	62.69	33.60	6.95	53.33
4880.00	--	AV	54	--	--	--	--	--
5272.56	48.37	PK	74	25.63	59.84	34.61	7.18	53.26
5272.56	--	AV	54	--	--	--	--	--
7320.00	47.72	PK	74	26.28	54.22	37.46	9.23	53.19
7320.00	--	AV	54	--	--	--	--	--

Frequency(MHz):		2440		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4880.00	50.50	PK	74	23.50	63.28	33.60	6.95	53.33
4880.00	--	AV	54	--	--	--	--	--
5614.40	48.12	PK	74	25.88	59.27	34.77	7.38	53.30
5614.40	--	AV	54	--	--	--	--	--
7320.00	47.64	PK	74	26.36	54.14	37.46	9.23	53.19
7320.00	--	AV	54	--	--	--	--	--

Frequency(MHz):		2480		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	50.11	PK	74	23.89	62.53	33.84	7.00	53.26
4960.00	--	AV	54	--	--	--	--	--
6544.23	48.30	PK	74	25.70	57.84	35.28	8.42	53.25
6544.23	--	AV	54	--	--	--	--	--
7440.00	48.13	PK	74	25.87	54.41	37.64	9.28	53.20
7440.00	--	AV	54	--	--	--	--	--

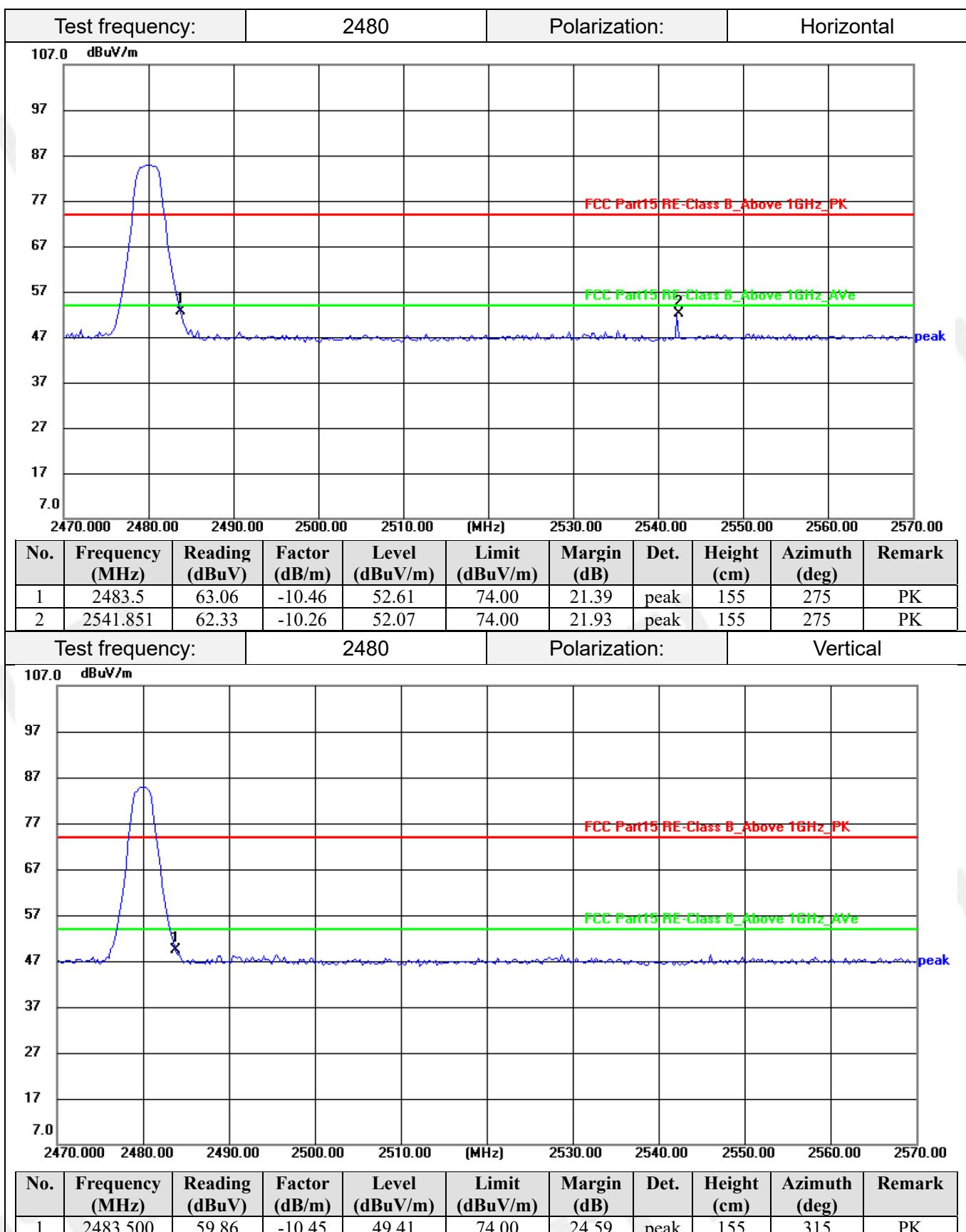
Frequency(MHz):		2480		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	50.45	PK	74	23.55	62.87	33.84	7.00	53.26
4960.00	--	AV	54	--	--	--	--	--
7334.34	47.72	PK	74	26.28	54.19	37.49	9.23	53.19
7334.34	--	AV	54	--	--	--	--	--
7440.00	47.92	PK	74	26.08	54.20	37.64	9.28	53.20
7440.00	--	AV	54	--	--	--	--	--

## REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
3. Margin value = Limit value - Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. Other emission levels are attenuated 20dB below the limit and not recorded in report.
6. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

**Results of Band Edges Test (Radiated)**

Test frequency:		2402		Polarization:		Horizontal				
107.0 dBuV/m										
97										
87										
77										
67										
57										
47										
37										
27										
17										
7.0										
2310.000 2320.000 2330.00 2340.00 2350.00 [MHz] 2370.00 2380.00 2390.00 2400.00 2410.00										
FCC Part15 RE-Class B_Above 1GHz PK										
FCC Part15 RE-Class B_Above 1GHz Ave										
peak										
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1	2390.000	57.14	-10.69	46.45	74.00	27.55	peak	155	155	PK
Test frequency:		2402		Polarization:		Vertical				
107.0 dBuV/m										
97										
87										
77										
67										
57										
47										
37										
27										
17										
7.0										
2310.000 2320.000 2330.00 2340.00 2350.00 [MHz] 2370.00 2380.00 2390.00 2400.00 2410.00										
FCC Part15 RE-Class B_Above 1GHz PK										
FCC Part15 RE-Class B_Above 1GHz Ave										
peak										
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1 *	2312.449	59.31	-10.79	48.52	74.00	24.48	peak	155	315	PK
2 *	2390.000	57.44	-10.69	46.75	74.00	27.25	peak	155	315	PK



## REMARKS:

1. Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)
2. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
3. Margin value = Limit value - Level value.
4. Other emission levels are attenuated 20dB below the limit and not recorded in report.
5. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

### 3.3. Maximum Conducted Output Power

#### Limit

The Maximum Peak Output Power Measurement is 30dBm.

#### Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power Meter.

#### Test Configuration



#### Test Results

Raw data reference to Annex for FCC BLE Appendix C.

### 3.4. Power Spectral Density

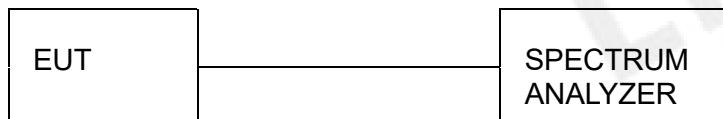
#### Limit

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.

#### Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW  $\geq$  3 kHz.
3. Set the VBW  $\geq 3 \times$  RBW.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be 8dBm.

#### Test Configuration



#### Test Results

Raw data reference to Annex for FCC BLE Appendix D.

### 3.5. 6dB Bandwidth

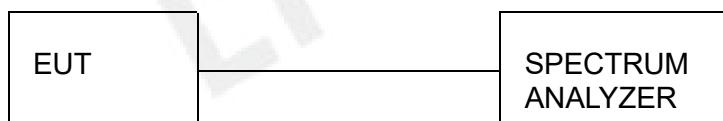
#### Limit

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

#### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

#### Test Configuration



#### Test Results

Raw data reference to Annex for FCC BLE Appendix A

### 3.6. Occupied Bandwidth

#### Limit

N/A

#### Test Procedure

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

RBW=1% to 5% of the OBW

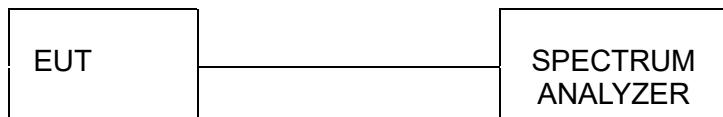
VBW=approximately 3 X RBW

Detector=Peak

Trace Mode: Max Hold

Use the 99% power bandwidth function of the instrument to measure the Occupied Bandwidth and recoded.

#### Test Configuration



#### Test Results

Raw data reference to Annex for FCC 2.4G WIFI Appendix B.

### 3.7. Out-of-band Emissions

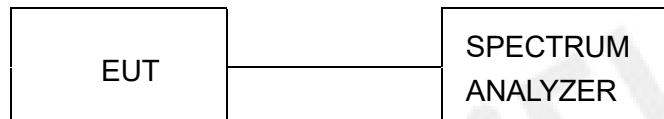
#### Limit

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.

#### Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

#### Test Configuration



#### Test Results

Raw data reference to Annex for FCC BLE Appendix E and Appendix F.

### 3.8. Antenna Requirement

#### Standard Applicable

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

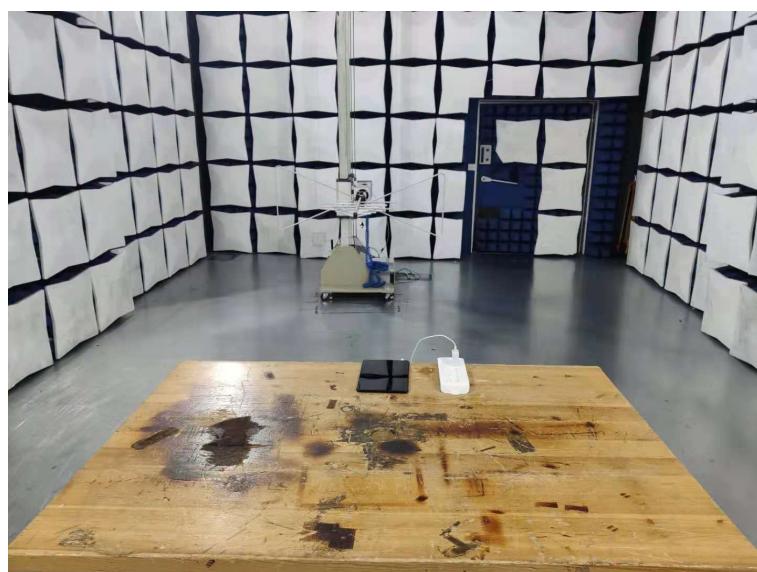
Refer to statement below for compliance

The manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

#### **Test Result:**

The device used an internal FPC antenna, the maximum gain is -3.93dBi for 2.4GHz WIFI.

#### 4. Test Setup Photos of the EUT



## 5. Photos of the EUT

Reference to the test report No. CTL2110275011-WF01

\*\*\*\*\* End of Report \*\*\*\*\*