

# **TEST REPORT**

Product Name : Embedded BLE Module

Model Number : EMB1016-P FCC ID : P53-EMB1016

Prepared for : Shanghai MXCHIP Information Technology Co., Ltd. Address : 9th Floor, No.5, Lane2145 JinshaJiang Road, Putuo

District, ShangHai, China (200333)

Prepared by : EMTEK (NINGBO) CO., LTD.

Address : 1F Building 4, 1177#, Lingyun Road, Ningbo National

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Report Number : ENB2203290173W00101R

Date(s) of Tests : March 29, 2022 to May 29, 2022

Date of Issue : June 16, 2022



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## 1 TEST RESULT CERTIFICATION

Applicant : Shanghai MXCHIP Information Technology Co., Ltd.

Address : 9th Floor, No.5, Lane2145 JinshaJiang Road, Putuo District, ShangHai, China

(200333)

Manufacturer : Shanghai MXCHIP Information Technology Co., Ltd.

Address : 9th Floor, No.5, Lane2145 JinshaJiang Road, Putuo District, ShangHai, China

(200333)

EUT : Embedded BLE Module

Model Name : EMB1016-P

Trademark : MXCHIP®

## Measurement Procedure Used:

APPLICABLE STANDARDS			
STANDARD	TEST RESULT		
FCC 47 CFR Part 2 , Subpart J FCC 47 CFR Part 15, Subpart C	PASS		

The above equipment was tested by EMTEK (NINGBO) CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2014) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.247

The test results of this report relate only to the tested sample identified in this report

Date of Test :	March 29, 2022 to May 29, 2022
	June Gao
Prepared by :	<u> </u>
	June Gao/Engineer
Reviewer :	V Zury
	Vinay/Supervisor &
	Tony Wei &
Approved & Authorized Signer :	***
	Tony Wei/Manager



## **2 EUT TECHNICAL DESCRIPTION**

Characteristics	Description
Product	Embedded BLE Module
Model Number	EMB1016-P
Sample Number	1#
Device Type	Bluetooth V5.1
Data Rate :	Up to 2 Mbps
Modulation:	GFSK
Operating Frequency Range:	2402-2480 MHz
Number of Channels:	40 Channels
Transmit Power Max:	7.25 dBm
Antenna Type:	PCB Antenna
Antenna Gain:	2.0 dBi
Power supply	DC 3.3V
Temperature Range:	-40℃ to +85℃
Date of Received:	March 29, 2022

Note: for more details, please refer to the User's manual of the EUT.



## 3 SUMMARY OF TEST RESULT

FCC Part Clause	Test Parameter	Verdict	Remark	
15.247(a)(2)	DTS (6dB) Bandwidth	PASS		
15.247(b)(3)	Maximum Peak Conducted Output Power	PASS		
15.247(e)	Maximum Power Spectral Density Level	PASS		
15.247(d)	Unwanted Emission Into Non-Restricted	PASS		
	Frequency Bands			
15.247(d)	Unwanted Emission Into Restricted Frequency	PASS		
15.209	Bands (conducted)			
15.247(d)	Radiated Spurious Emission	PASS		
15.209				
15.207	Conducted Emission Test	PASS		
15.247(b)	Antenna Application PASS			
	NOTE1: N/A (Not Applicable)			
NOTE2: According to FCC OET KDB 558074, the report use radiated				
	measurements in the restricted frequency bands. In addition, the radiated			
	test is also performed to ensure the emissions emanating from the device			
	cabinet also comply with the applicable limits.			

## RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: P53-EMB1016 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.



## 4 TEST METHODOLOGY

## 4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards: FCC 47 CFR Part 2, Subpart J FCC 47 CFR Part 15, Subpart C FCC KDB 558074 D01 15.247 Meas Guidance v05r02

## 4.2 MEASUREMENT EQUIPMENT USED

## 4.2.1 Conducted Emission Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LASTCAL.	CAL. INTERVAL
Test Receiver	Rohde & Schwarz	ESCI	101108	July 08, 2021	1 Year
L.I.S.N	Rohde & Schwarz	ENV216	101193	July 08, 2021	1 Year
L.I.S.N	Schwarzbeck	NSLK 8126	8126-462	July 08, 2021	1 Year
Pulse Limiter	MTS-systemtechnik	IMP-136	2611115-001-00 33	July 08, 2021	1 Year
RF Switching unit	Compliance Direction Systems Inc.	RSU-M2	38400	July 08, 2021	1 Year

## 4.2.2 Radiated Emission Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL. INTERVAL
Spectrum Analyzer	Rohde & Schwarz	ESCI	101107	July 08, 2021	1 Year
EMI Test Receiver	Rohde & Schwarz	ESCI	101107	July 08, 2021	1 Year
Pre-Amplifier	CD	PAP-0203	22015	July 08, 2021	1 Year
Bilog Antenna	Schwarzbeck	VULB9163	9163-467	July 12, 2021	2 Year
Cable	HUBER + SUHNER	CBL3-NN-0.5 M	101216-214050 0-2	July 08, 2021	1 Year
Cable	HUBER + SUHNER	CBL3-NN-3.0 M	101216-214300 0-2	July 08, 2021	1 Year
Cable	HUBER + SUHNER	CBL3-NN-9.0 M	101216-214900 0	July 08, 2021	1 Year
EXA Signal Analyzer	KEYSIGHT	N9010B	MY60242457	March 01, 2022	1 Year
Pre-Amplifier	Connphy Microwave Inc.	GLN-1G40G-4 165-K	0319104	Nov 22, 2021	1 Year
Horn Antenna	Schwarzbeck	BBHA 9120	9120D-707	April 13, 2021	2 Year
Cable	SMAMSMAM	A50-0.5M	N/A	July 08, 2021	1 Year
Cable	SMAMSMAM	A50-3M	N/A	July 08, 2021	1 Year
Cable	SMAMSMAM	A50-6M	N/A	July 08, 2021	1 Year
Band Reject Filter	O.M.Jones,Inc.dba	BRM50702-0	G049	July 08, 2021	1 Year

## 4.2.3 Radio Frequency Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL. INTERVAL
EXA Signal Analyzer	KEYSIGHT	N9010B	MY60242457	March 01, 2022	1 Year
Attenuator 10dB	Suzhou talent Microwave	TA10A2-S-18	N/A	July 08, 2021	1 Year



#### 4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (Bluetooth V5.1 DTS:1 Mbps and 2 Mbps) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list for Bluetooth V5.1 DTS:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	19	2440		
1	2404	20	2442	37	2476
2	2406	21	2444	38	2478
		.:		39	2480
Note: fc=2402MHz+k×2MHz k=1 to 39					

Test Frequency and channel for Bluetooth V5.1 DTS:

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	19	2440	39	2480

#### 4.4 TEST SOFTWARE

Item	Software	
Radiated Emission:	EMC (Ver. EMEC-3A1)	
Conducted Emission	EZ-EMC (Ver. CON-03A1)	



## 5 FACILITIES AND ACCREDITATIONS

#### 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

1F Building 4, 1177#, Lingyun Road, Ningbo National Hi-Tech Zone, Ningbo, Zhejiang, China. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 32.

## 5.2 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

EMC Lab. : Accredited by CNAS, 2019.04.02

The certificate is valid until 2023.1.20

The Laboratory has been assessed and proved to be in compliance with CNA

S-CL01:2018 (identical to ISO/IEC 17025:2017) The Certificate Registration Number is L6666.

Accredited by FCC

Designation Number: CN1302

Test Firm Registration Number: 436491

Accredited by A2LA

The certificate is valid until May 31, 2023

The Certificate Number is 4321.03.

Accredited by Industry Canada, November 14, 2016 The Certificate Registration Number is 46405-9469.

Name of Firm : EMTEK (NINGBO) CO., LTD.

Site Location : 1F Building 4, 1177#, Lingyun Road, Ningbo National Hi-Tech Zone, Ningbo,

Zhejiang, China.

## **6 TEST SYSTEM UNCERTAINTY**

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	±1x10^-5 MHz
Uncertainty for Output power test	±0.83 dB
Conducted Emissions Test	±2.0 dB
Radiated Emission Test	±2.0 dB
Occupied Bandwidth Test	±1.0 dB
Power density test	±1.85 dB
All emission, radiated	±3 dB
Antenna Port Emission	±3 dB
Temperature	±0.5℃
Humidity	±3%

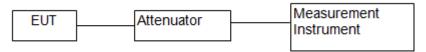
Measurement Uncertainty for a level of Confidence of 95%



#### 7 SETUP OF EQUIPMENT UNDER TEST

#### 7.1 RADIO FREQUENCY TEST SETUP 1

The Bluetooth V5.1 DTS component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



#### 7.2 RADIO FREQUENCY TEST SETUP 2

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.

#### Below 30MHz

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

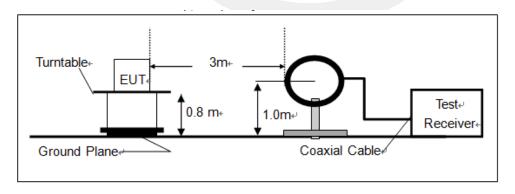
#### 30MHz-1GHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

#### Above 1GHz:

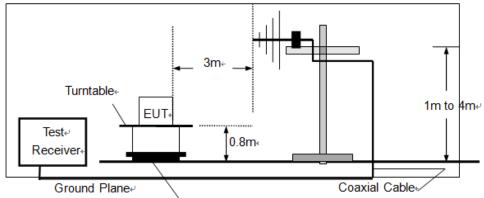
The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

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

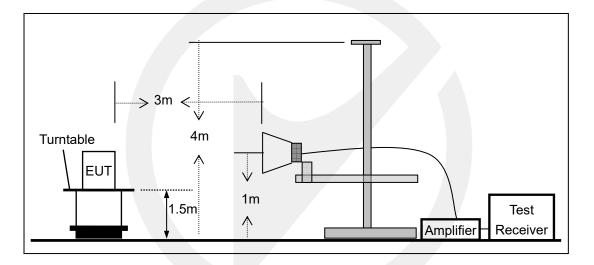




## (b) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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



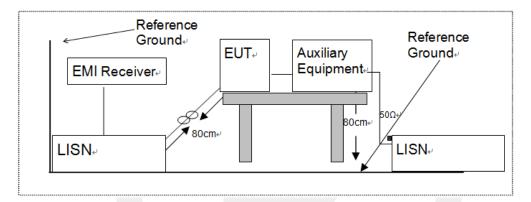


## 7.3 CONDUCTED EMISSION TEST SETUP

The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.

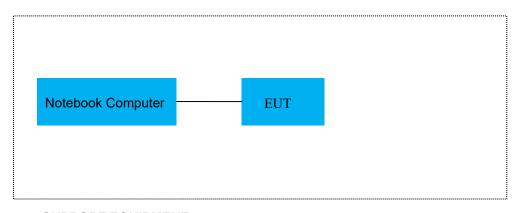
Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.1 m.

According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.





## 7.4 BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM



## 7.5 SUPPORT EQUIPMENT

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
1	1	1	1

Auxiliary Cable List and Details				
Cable Description Length (m) Shielded/Unshielded With / Without Ferrite				
1	1	1	1	

Auxiliary Equipment List and Details				
Description Manufacturer Model Serial Number				
Notebook Computer	Lenovo	E49L	WB06365006	

## Notes:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



## 8 TEST REQUIREMENTS

## 8.1 DTS 6DB BANDWIDTH

#### 8.1.1 Applicable Standard

According to FCC Part 15.247(a)(2) and KDB 558074 D01 15.247 Meas Guidance v05r02

## 8.1.2 Conformance Limit

The minimum -6 dB bandwidth shall be at least 500 kHz.

## 8.1.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

#### 8.1.4 Test Procedure

The EUT was operating in Bluetooth V5.1 DTS mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously

Set RBW = 100 kHz.

Set the video bandwidth (VBW) =300 kHz.

Set Span=2 times OBW

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

Allow the trace to stabilize.

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.

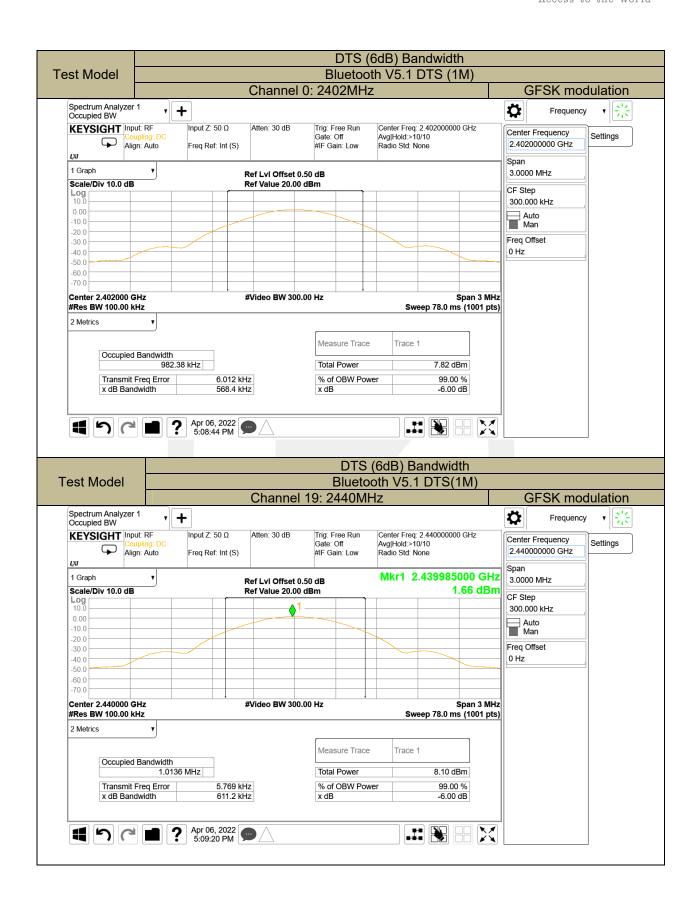
Measure and record the results in the test report.

#### **Test Results**

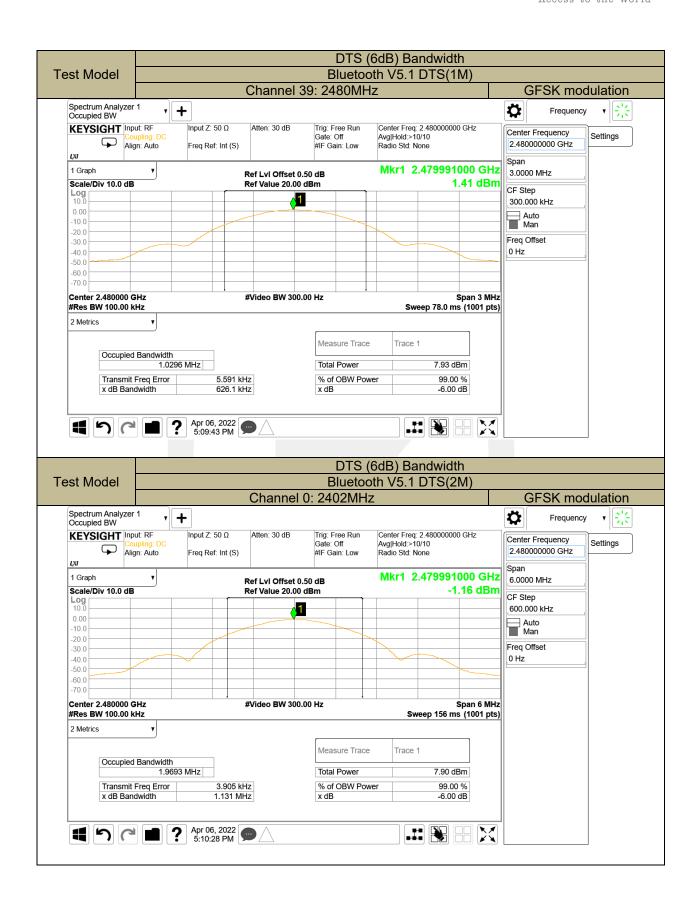
Temperature:	25.5° C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (kHz)	Limit (kHz)	Verdict
	0	2402	568.4	>500	PASS
BLE 1M	19	2440	611.2	>500	PASS
	39	2480	626.1	>500	PASS
	0	2402	1131.0	>500	PASS
BLE 2M	19	2440	1099.0	>500	PASS
	39	2480	959.4	>500	PASS















#### 8.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER

#### 8.2.1 Applicable Standard

According to FCC Part 15.247(b)(3) and KDB 558074 D01 15.247 Meas Guidance v05r02

#### 8.2.2 Conformance Limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 2400 - 2483.5 MHz bands shall not exceed: 1 Watt (30dBm).

#### 8.2.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

#### 8.2.4 Test Procedure

## ■ According to FCC Part15.247(b)(3)

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. For smart system, 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. 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.

Set the RBW ≥ DTS bandwidth(about 1MHz).

Set VBW = 3\*RBW(about 3MHz)

Set the span ≥ 3\*RBW

Set Sweep time = auto couple.

Set Detector = peak.

Set Trace mode = max hold.

Allow trace to fully stabilize. Use peak marker function to determine the peak amplitude level.

#### According to FCC Part 15.247(b)(4):

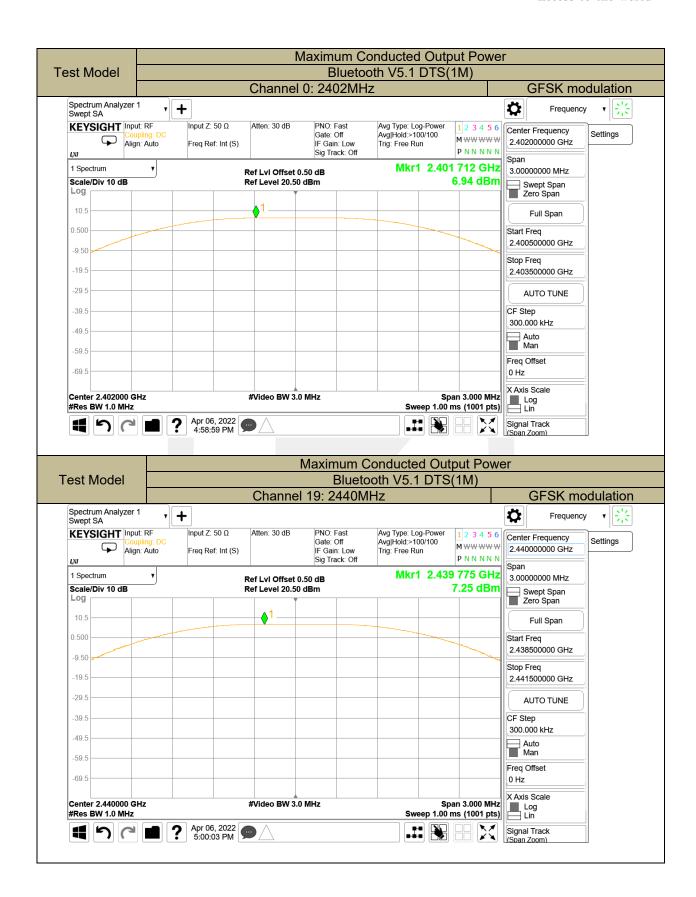
Conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## **Test Results**

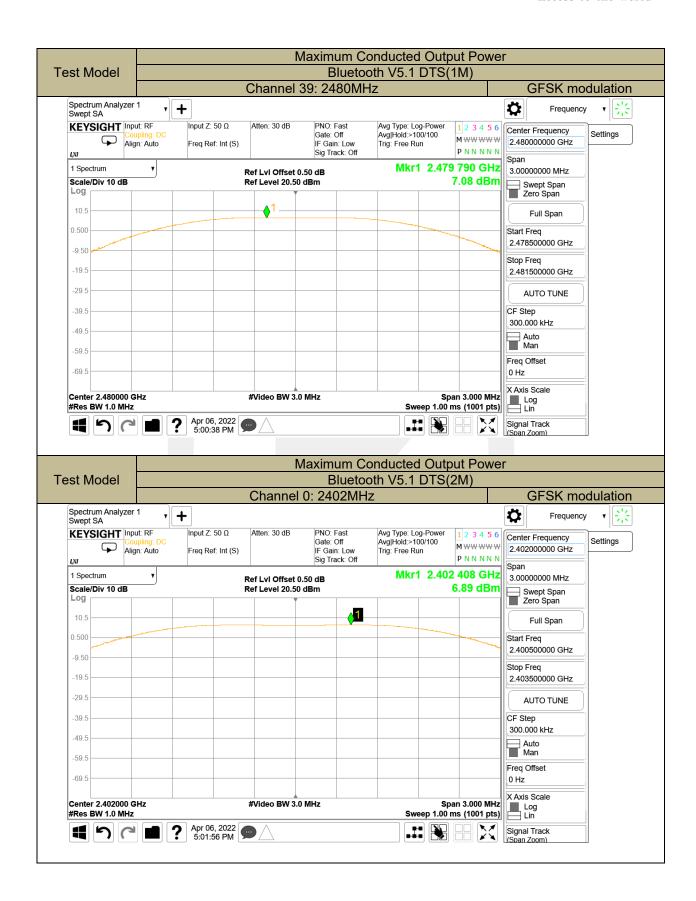
Temperature:	25.5° C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm)	Limit (dBm)	Verdict
	0	2402	6.94	30	PASS
BLE 1M	19	2440	7.25	30	PASS
	39	2480	7.08	30	PASS
	0	2402	6.89	30	PASS
BLE 2M	19	2440	7.25	30	PASS
	39	2480	7.08	30	PASS

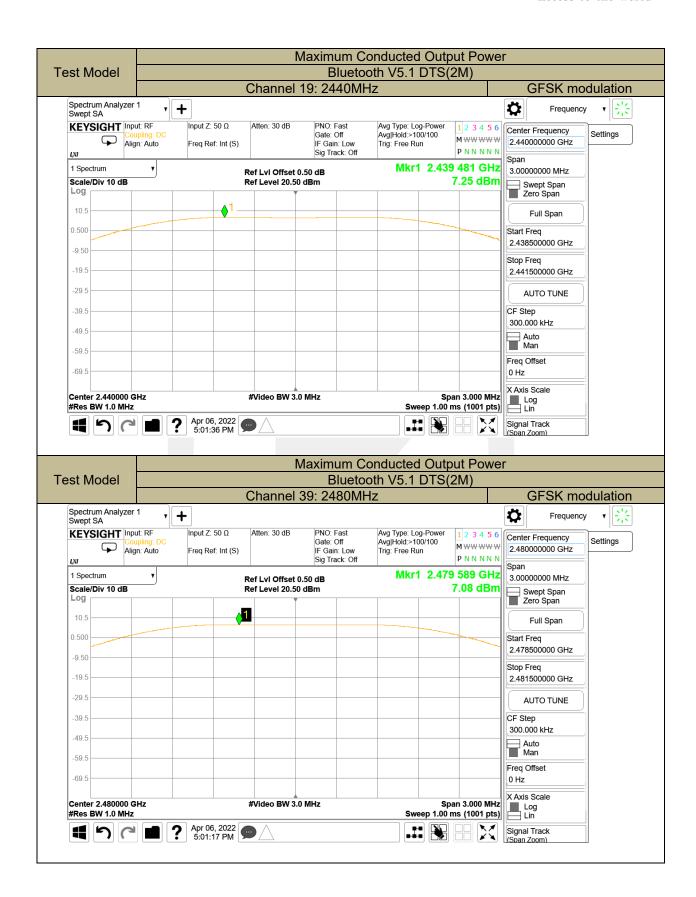














#### 8.3 MAXIMUM POWER SPECTRAL DENSITY

#### 8.3.1 Applicable Standard

According to FCC Part 15.247(e) and KDB 558074 D01 15.247 Meas Guidance v05r02

#### 8.3.2 Conformance Limit

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## 8.3.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

## 8.3.4 Test Procedure

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance

The transmitter output (antenna port) was connected to the spectrum analyzer

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz Set the VBW to: 10 kHz. Set Detector = peak.

Set Sweep time = auto couple. Set Trace mode = max hold. Allow trace to fully stabilize.

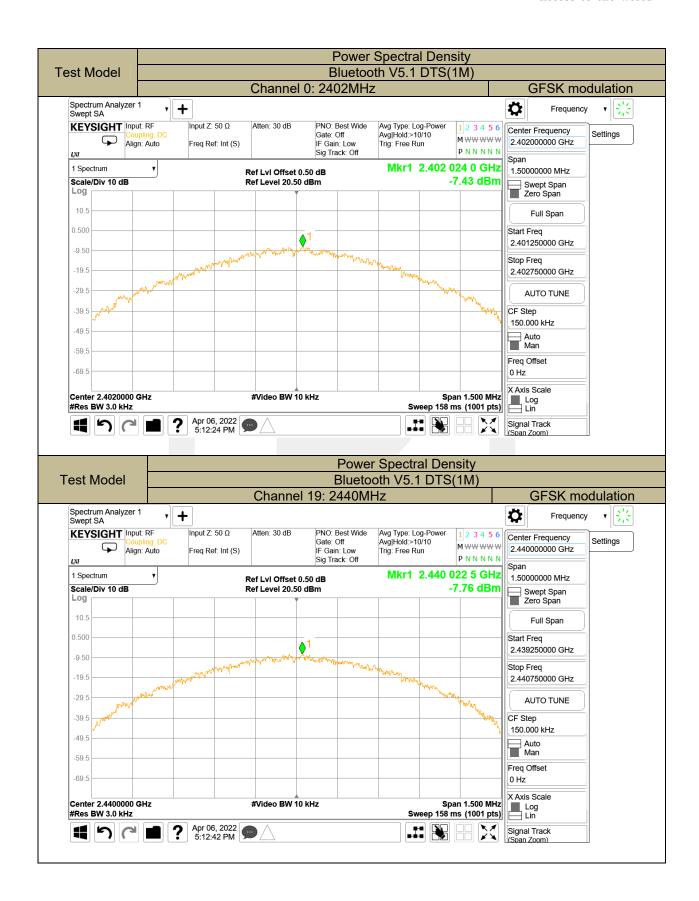
Use the peak marker function to determine the maximum amplitude level within the RBW.

#### 8.3.5 Test Results

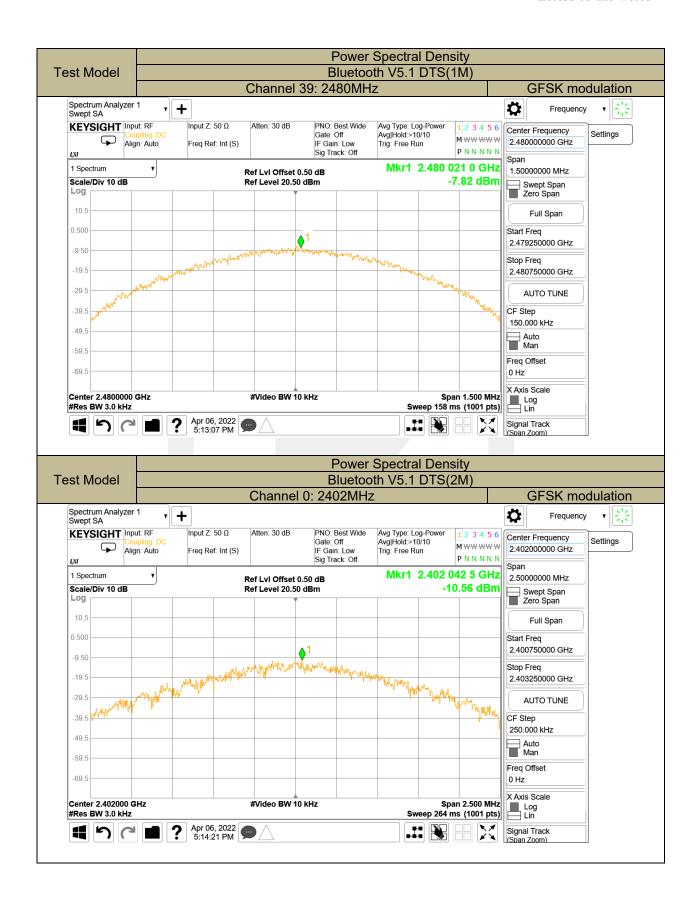
Temperature:	25.5° C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
	0	2402	-8.509	<8	PASS
BLE 1M	19	2440	-9.248	<8	PASS
	39	2480	-8.829	<8	PASS
	0	2402	-12.020	<8	PASS
BLE 2M	19	2440	-12.140	<8	PASS
	39	2480	-11.080	<8	PASS
Note: N/A					

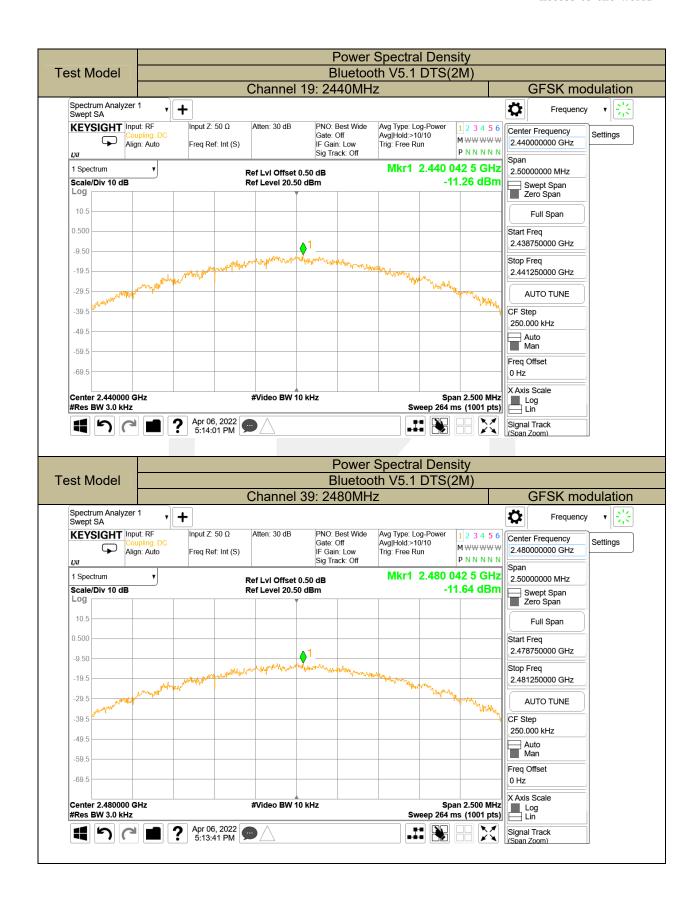














## 8.4 UNWANTED EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS

## 8.4.1 Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02

#### 8.4.2 Conformance Limit

According to FCC Part 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

#### 8.4.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

#### 8.4.4 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

#### ■ Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to = 1.5 times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW  $\geq$  3 x RBW.

Set Detector = peak.

Set Sweep time = auto couple.

Set Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

#### Emission level measurement

Set the center frequency and span to encompass frequency range to be measured.

Set the RBW = 100 kHz.

Set the VBW =300 kHz.

Set Detector = peak

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

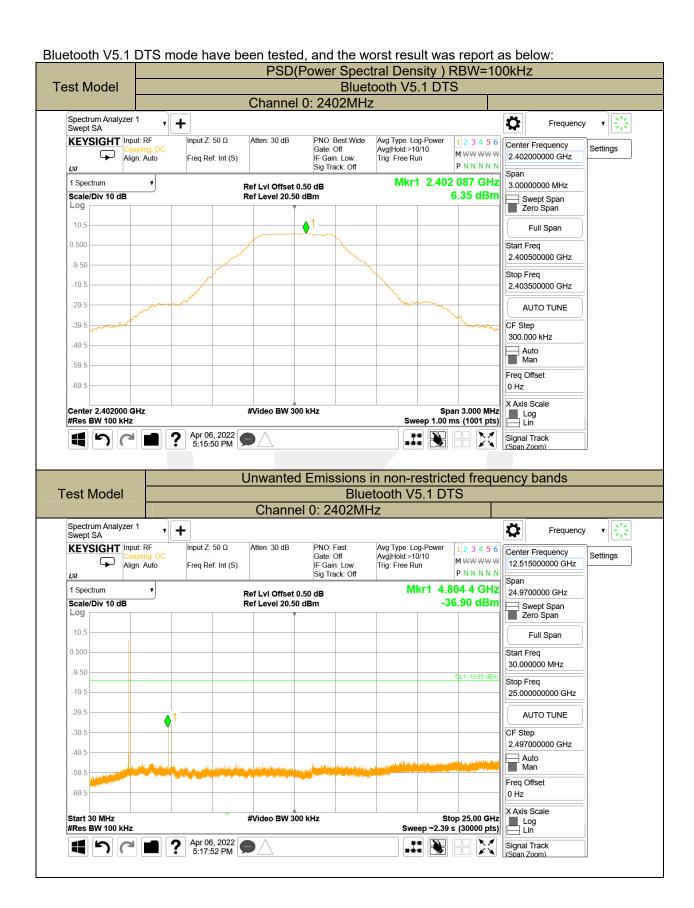
Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements. Report the three highest emissions relative to the limit.

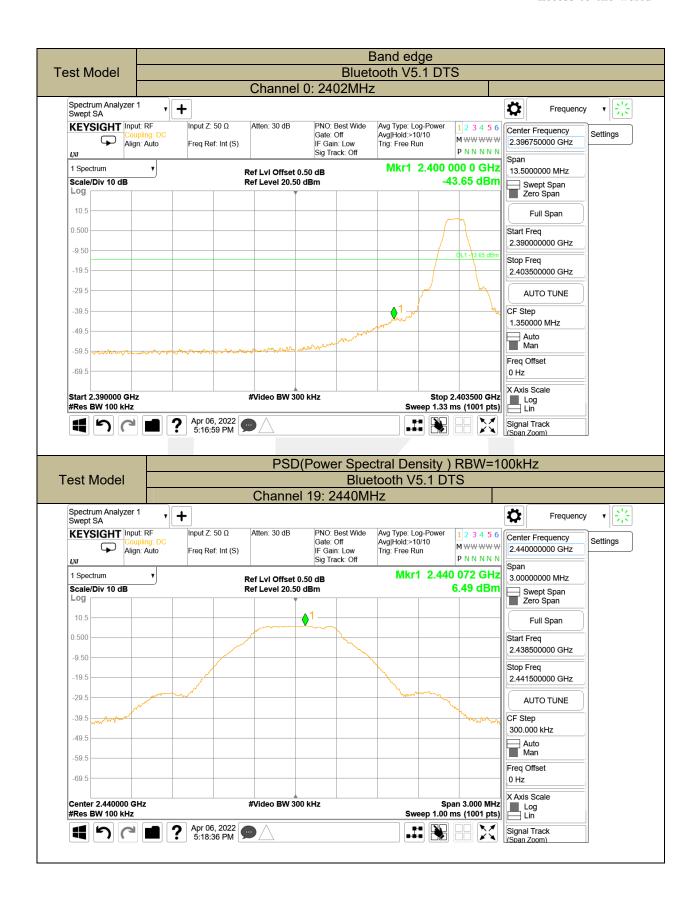
## 8.4.5 Test Results

Temperature:	25.5° C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

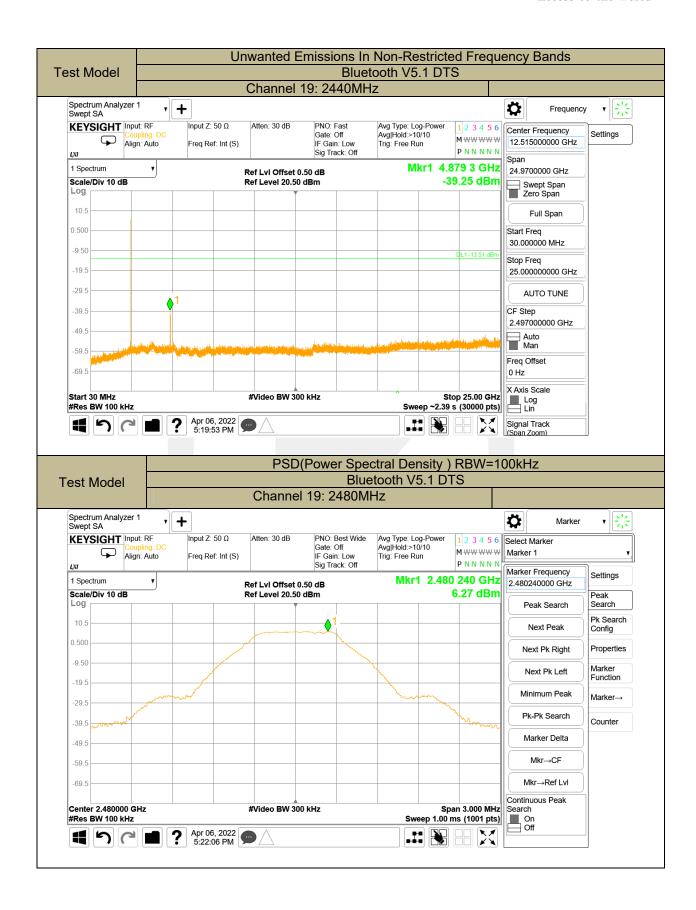




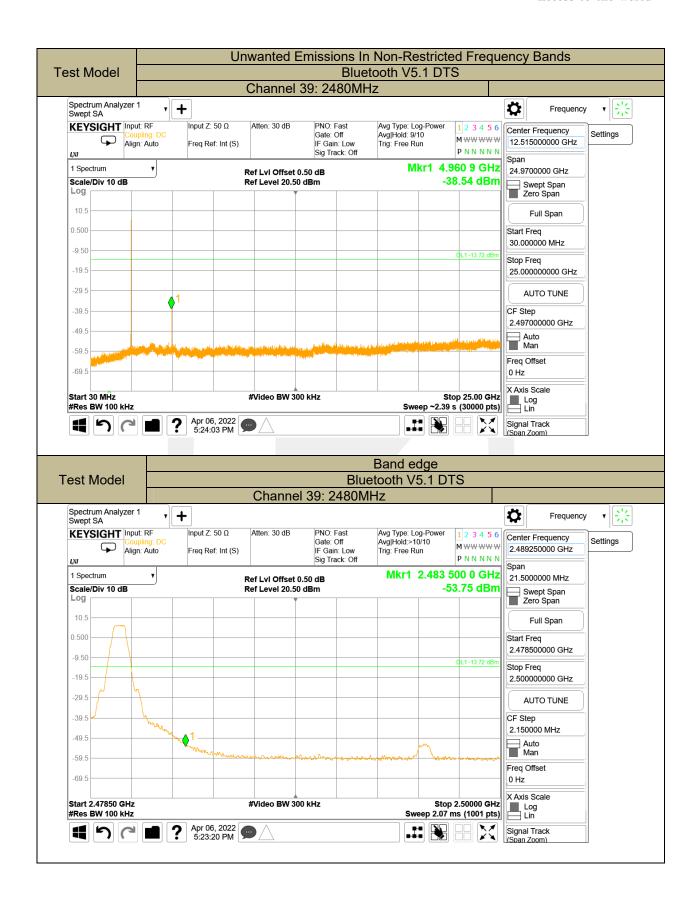














#### 8.5 RADIATED SPURIOUS EMISSION

#### 8.5.1 Applicable Standard

According to FCC Part 15.247(d) and 15.209 and KDB 558074 D01 15.247 Meas Guidance v05r02

#### 8.5.2 Conformance Limit

According to FCC Part 15.247(d): 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)).

According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

According to FCC Part15.209, the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted	Field Strength (µV/m)	Field Strength	Measurement
Frequency(MHz)		(dBµV/m)	Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	24000/F(KHz)	20 log (uV/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

## 8.5.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

#### 8.5.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \ge 1$  GHz(1GHz to 25GHz), 100 kHz for f < 1 GHz(30MHz to 1GHz)

 $VBW \geq RBW$ 



Sweep = auto
Detector function = peak
Trace = max hold

Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Repeat above procedures until all frequency measured was complete.

#### 8.5.5 Test Results

Temperature:	24° C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

Spurious Emission below 30MHz (9KHz to 30MHz)

Freq.	Ant.Pol.		ssion BuV/m)	Limit 3m	(dBuV/m)	Over(dB)		
(MHz)	H/V	PK	PK ` AV		AV	PK	AV	

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor =40log(Specific distance/ test distance)( dB);

Limit line=Specific limits(dBuV) + distance extrapolation factor



## ■ Spurious Emission Above 1GHz (1GHz to 25GHz) Bluetooth V5.1 DTS mode have been tested, and the worst result was report as below:

Test mode: BLE Frequency: Channel 0: 2402MHz

Freq.	Ant.Pol.	Emis Level(d	ssion BuV/m)	Limit 3m(	(dBuV/m)	Over(dB)		
(MHz)	H/V	PK `	ÁV	PK	AV	PK	AV	
4800.624	V	60.08	50.21	74.00	54.00	-13.92	-3.79	
7705.814	V	53.04	53.04 41.26		54.00	-20.96	-12.74	
11420.21	V	57.90	43.59	74.00	54.00	-16.10	-10.41	
4800.624	Н	62.46	51.36	74.00	54.00	-11.54	-2.64	
8037.456	Н	53.42	41.26	74.00	54.00	-20.58	-12.74	
11134.99	Н	58.98	46.59	74.00	54.00	-15.02	-7.41	

Test mode: BLE Frequency: Channel 19: 2440MHz

Freq.	Ant.Pol.		ssion BuV/m)	Limit 3m(	(dBuV/m)	Over(dB)		
(MHz)	H/V	PK .	AV	PK	AV	PK	AV	
4880.218	V	64.35	50.64	74.00	54.00	-9.65	-3.36	
6909.871	V	54.40	42.85	74.00	54.00	-19.60	-11.15	
9576.278	V	55.14	41.64	74.00	54.00	-18.86	-12.36	
4880.218	Н	63.79	50.27	74.00	54.00	-10.21	-3.73	
7181.818	Н	53.25	43.64	74.00	54.00	-20.75	-10.36	
9748.732	Н	54.50	42.97	74.00	54.00	-19.50	-11.03	

Test mode: BLE Frequency: Channel 39: 2480MHz

Freq.	Ant.Pol.		ssion BuV/m)	Limit 3m	(dBuV/m)	Over(dB)		
(MHz)	H/V	PK	AV	PK	AV	PK	AV	
1802.575	V	61.02	48.76	74.00	54.00	-12.98	-5.24	
4959.813	V	63.58 50.47		74.00	54.00	-10.42	-3.53	
11101.83	V	58.60	46.88	74.00	54.00	-15.40	-7.12	
4959.813	Н	64.40	50.23	74.00	54.00	-9.60	-3.77	
11035.50	Н	57.98	45.52	74.00	54.00	-16.02	-8.48	
14212.64	Н	62.52	47.65	74.00	54.00	-11.48	-6.35	

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).

- (2) Emission Level= Reading Level+Correct Factor +Cable Loss.
- (3) Correct Factor= Ant\_F + Cab\_L Preamp
- (4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.



## ■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2386.130	Н	60.56	74.00	48.79	54.00
2386.130	V	53.75	74.00	42.58	54.00

Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2483.550	Н	63.24	74.00	49.76	54.00
2483.533	V	55.87	74.00	43.71	54.00

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).

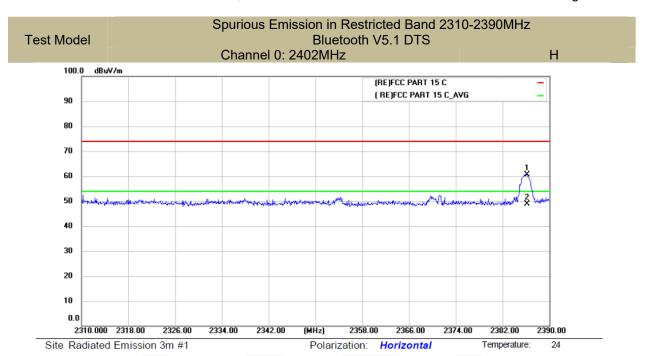
(2) Emission Level= Reading Level+Correct Factor +Cable Loss.

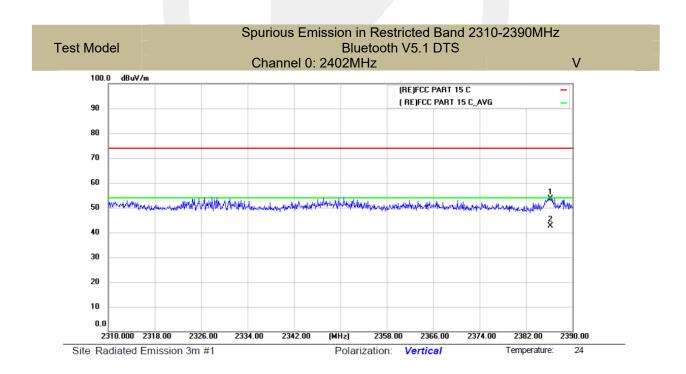
(3) Correct Factor= Ant\_F + Cab\_L - Preamp

(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

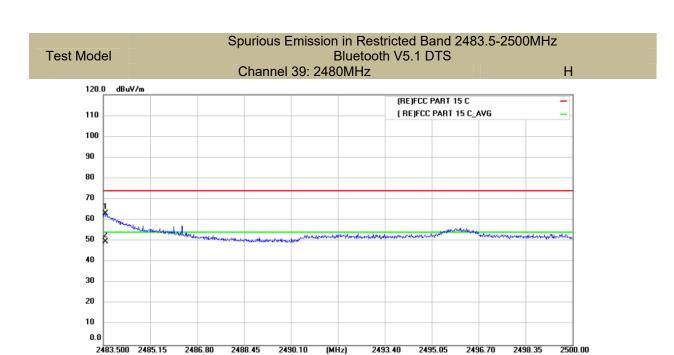


All the modulation modes were tested, the data of the worst mode are described in the following table







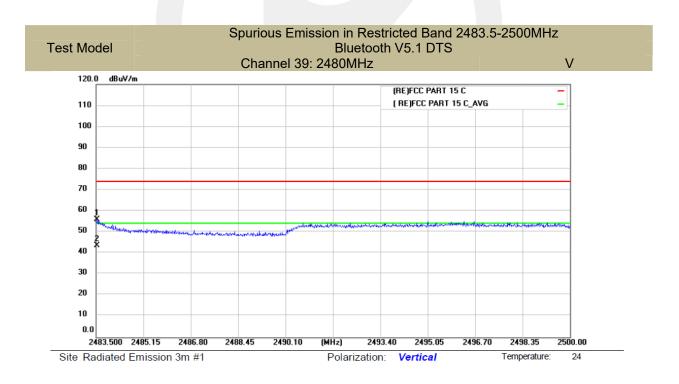


Polarization:

Horizontal

Temperature:

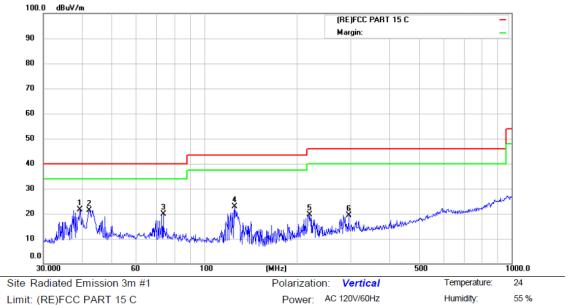
24



Site Radiated Emission 3m #1



## Spurious Emission below 1GHz (30MHz to 1GHz) All modes have been tested, and the worst result recorded was report as below:



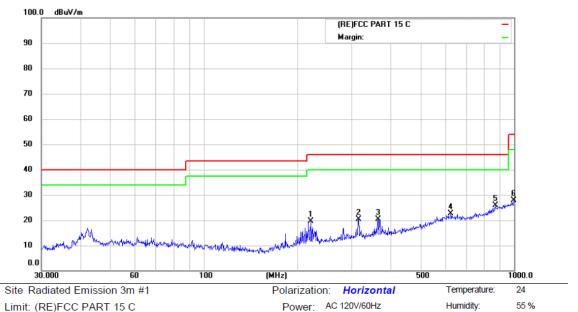
Limit: (RE)FCC PART 15 C

Mode:TX2402

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	39.4371	45.04	-23.34	21.70	40.00	-18.30	QP			
2		42.3022	44.87	-23.37	21.50	40.00	-18.50	QP			
3		73.6170	44.57	-24.67	19.90	40.00	-20.10	QP			
4	,	125.4457	47.30	-24.50	22.80	43.50	-20.70	QP			
5	2	220.6171	42.29	-22.59	19.70	46.00	-26.30	QP			
6	2	295.1468	39.72	-20.32	19.40	46.00	-26.60	QP			



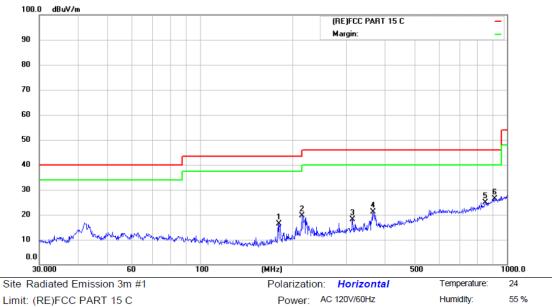


Mode:TX2402

Mode: TX24 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		221.3921	42.16	-22.56	19.60	46.00	-26.40	QP			
2		315.4806	40.44	-19.94	20.50	46.00	-25.50	QP			
3		364.2595	39.49	-19.19	20.30	46.00	-25.70	QP			
4		625.0780	35.42	-12.72	22.70	46.00	-23.30	QP			
5	*	869.1301	35.44	-9.64	25.80	46.00	-20.20	QP			
6		996.4995	35.43	-7.53	27.90	54.00	-26.10	QP			



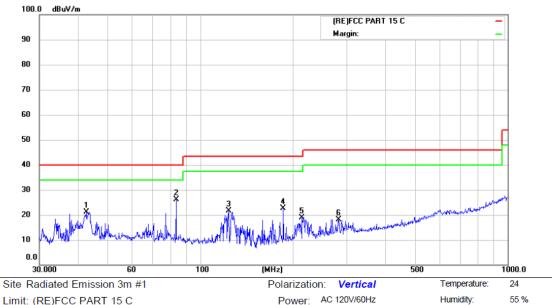


Limit: (RE)FCC PART 15 C

Mode:TX2440 Note:

No.	Mk.		Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		181.2834	40.66	-24.26	16.40	43.50	-27.10	QP			
2		215.2678	42.35	-22.75	19.60	43.50	-23.90	QP			
3		314.3764	38.05	-19.95	18.10	46.00	-27.90	QP			
4		366.8231	40.35	-19.15	21.20	46.00	-24.80	QP			
5		851.0353	34.94	-10.14	24.80	46.00	-21.20	QP			
6	*	912.8620	35.03	-8.63	26.40	46.00	-19.60	QP			



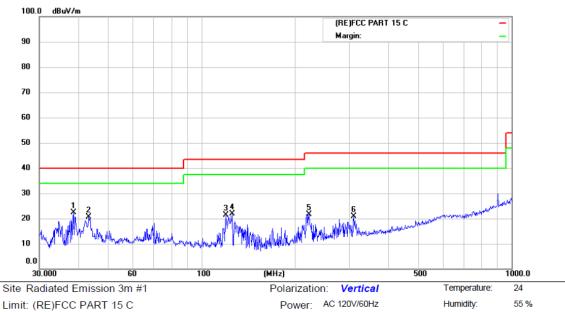


Limit: (RE)FCC PART 15 C

Mode:TX2440 Note:

No.	Mk.	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		42.6000	44.48	-23.38	21.10	40.00	-18.90	QP			
2	*	83.5221	51.23	-25.13	26.10	40.00	-13.90	QP			
3		124.1329	45.99	-24.39	21.60	43.50	-21.90	QP			
4		186.4408	46.57	-23.97	22.60	43.50	-20.90	QP			
5		214.5142	41.78	-22.78	19.00	43.50	-24.50	QP			
6		281.9945	38.82	-20.72	18.10	46.00	-27.90	QP			





Limit: (RE)FCC PART 15 C

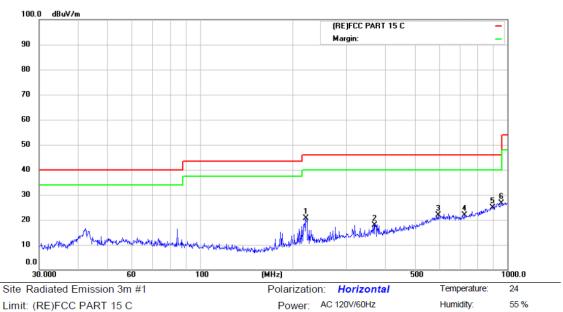
Mode:TX2480 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	38.6160	45.78	-23.48	22.30	40.00	-17.70	QP			
2		43.3534	44.02	-23.42	20.60	40.00	-19.40	QP			
3		119.8556	45.53	-24.03	21.50	43.50	-22.00	QP			
4		125.8863	46.34	-24.54	21.80	43.50	-21.70	QP			
5		222.1697	44.24	-22.54	21.70	46.00	-24.30	QP			
6	;	309.9977	40.92	-20.02	20.90	46.00	-25.10	QP			



Humidity:

55 %



Limit: (RE)FCC PART 15 C

Mode:TX2480 Note:

No.	Mk	c. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBu∨	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		221.3921	43.26	-22.56	20.70	46.00	-25.30	QP			
2		370.7023	37.09	-19.09	18.00	46.00	-28.00	QP			
3		595.1327	34.73	-12.83	21.90	46.00	-24.10	QP			
4		724.2610	34.46	-12.56	21.90	46.00	-24.10	QP			
5		893.8566	33.87	-8.97	24.90	46.00	-21.10	QP			
6	*	955.4381	34.77	-8.07	26.70	46.00	-19.30	QP			



#### 8.6 CONDUCTED EMISSIONS TEST

## 8.6.1 Applicable Standard

According to FCC Part 15.207(a)

## 8.6.2 Conformance Limit

## Conducted Emission Limit

Frequency(MHz)	Quasi-peak	Average		
0.15-0.5	66-56	56-46		
0.5-5.0	56	46		
5.0-30.0	60	50		

Note: 1. The lower limit shall apply at the transition frequencies

## 8.6.3 Test Configuration

Test according to clause 7.3 conducted emission test setup

#### 8.6.4 Test Procedure

The EUT was placed on a table which is 0.8 m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Repeat above procedures until all frequency measured were complete.

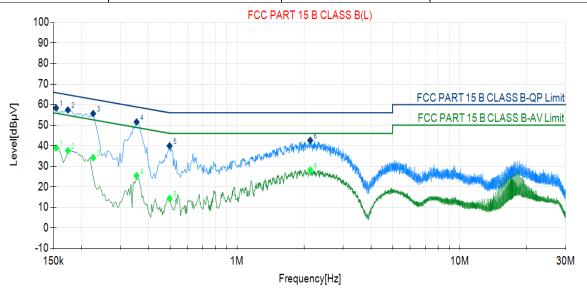
#### 8.6.5 Test Results

Pass.

<sup>2.</sup> The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.



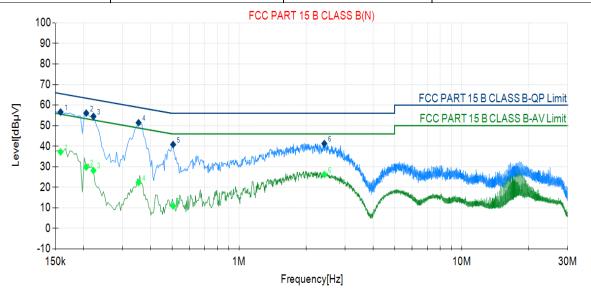
Project Information									
Mode:	TX	Voltage:	AC 120V/60Hz						
Environment:	Temp: 25°C; Humi:60%	Engineer:	Lucas Xu						



Fin	Final Data List										
NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.154	10.50	47.85	58.35	65.78	7.43	28.38	38.88	55.78	16.90	PASS
2	0.174	10.50	46.89	57.39	64.77	7.38	27.12	37.62	54.77	17.15	PASS
3	0.226	10.48	45.14	55.62	62.60	6.98	23.67	34.15	52.60	18.45	PASS
4	0.354	10.44	41.09	51.53	58.87	7.34	14.98	25.42	48.87	23.45	PASS
5	0.498	10.39	29.54	39.93	56.03	16.10	3.93	14.32	46.03	31.71	PASS
6	2.134	10.41	32.18	42.59	56.00	13.41	17.70	28.11	46.00	17.89	PASS



Project Information									
Mode:	TX	Voltage:	AC 120V/60Hz						
Environment:	Temp: 25°C; Humi:60%	Engineer:	Lucas Xu						



Fina	Final Data List										
NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	ΑV Value [dBμV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.158	10.49	46.15	56.64	65.57	8.93	26.71	37.20	55.57	18.37	PASS
2	0.206	10.46	45.64	56.10	63.37	7.27	19.34	29.80	53.37	23.57	PASS
3	0.222	10.45	44.07	54.52	62.74	8.22	17.72	28.17	52.74	24.57	PASS
4	0.354	10.41	41.01	51.42	58.87	7.45	11.90	22.31	48.87	26.56	PASS
5	0.506	10.42	30.41	40.83	56.00	15.17	0.52	10.94	46.00	35.06	PASS
6	2.418	10.60	30.66	41.26	56.00	14.74	15.59	26.19	46.00	19.81	PASS



#### 8.7 ANTENNA APPLICATION

## 8.7.1 Antenna Requirement

Standard 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 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 use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

FCC CRF Part 15.203

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.247 (b), if 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 6dBi.

8.7.2	Result
PASS.	
The EU Note:	T has 1 antenna: a PCB Antenna gain is 2.0 dBi;  Antenna use a permanently attached antenna which is not replaceable.  Not using a standard antenna jack or electrical connector for antenna replacement  The antenna has to be professionally installed (please provide method of installation)  which in accordance to section 15.203, please refer to the internal photos.

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



## 声明 Statement

- 1. 本报告无授权批准人签字及"检验报告专用章"无效;
  - This report will be void without authorized signature or special seal for testing report.
- 2. 未经许可本报告不得部分复制;

This report shall not be copied partly without authorization.

- 3. 本报告的检测结果仅对送测样品有效,委托方对样品的代表性和资料的真实性负责;
  - The test results or observations are applicable only to tested sample. Client shall be responsible for representativeness of the sample and authenticity of the material.
- 4. 本检测报告中检测项目标注有特殊符号则该项目不在资质认定范围内,仅作为客户委托、科研、教学或内部质量控制等目的使用;
  - The observations or tests with special mark fall outside the scope of accreditation, and are only used for purpose of commission, research, training, internal quality control etc.
- 5. 本检测报告以实测值进行符合性判定,未考虑不确定度所带来的风险,本实验室不承担相关责任, 特别约定、标准或规范中有明确规定的除外;
  - The test results or observations are provided in accordance with measured value, without taking risks caused by uncertainty into account. Without explicit stipulation in special agreements, standards or regulations, EMTEK shall not assume any responsibility.
- 6. 对本检测报告若有异议,请于收到报告之日起 20 日内提出;
  - Objections shall be raised within 20 days from the date receiving the report.