TEST REPORT

Product Name	:	TFT DASHBOARD
Model Number	:	351000-P15A
FCC ID	:	2BEZV-351000-P15A

Prepared for	:	Taizhou Zhongneng Motorcycle Co., Ltd.
Address	:	Building 8, 99 haixiu Road, Eastern New District, Taizhou Bay New District, Taizhou City, Zhejiang Province, P.R. China
Prepared by	:	EMTEK (NINGBO) CO., LTD.
Address	:	No. 8, Building 8, Lane 216, Qingyi Road, Ningbo Hi-Tech Zone, Ningbo, Zhejiang, China Tel: +86-574-27907998 Fax: +86-574-27721538

Report Number	:	ENB2312200251W00303R
Date(s) of Tests	:	December 20, 2023 to March 28, 2024
Date of Issue	:	April 10, 2024

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1 TEST RESULT CERTIFICATION

Applicant	:	Taizhou Zhongneng Motorcycle Co., Ltd.
Address	:	Building 8, 99 haixiu Road, Eastern New District, Taizhou Bay New District, Taizhou City, Zhejiang Province, P.R. China
Manufacturer	:	Ningbo Boxin Electric Appliance Co., Ltd
Address	:	89 Zhenxing West Road, Economic Development Zone, Yuyao City, Zhejiang Province
EUT	:	TFT DASHBOARD
Model Name	:	351000-P15A
Trademark	:	博尔旭 ® BOERXU

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 (2013) 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 : December 20, 2023 to March 28, 2024

Prepared by : June Gao /Engineer

Reviewer : Vinay /Supervisor

Approve & Authorized Signer : Tony wei/Manager

2 EUT TECHNICAL DESCRIPTION

Characteristics	Description
Product	TFT DASHBOARD
Model Number	351000-P15A
Sample Number	ENB2312200251W003-1-1
Device Type	Bluetooth V5.0
Data Rate :	Up to 1 Mbps
Modulation:	GFSK
Operating Frequency Range:	2402-2480 MHz
Number of Channels:	40 Channels
Transmit Power Max:	7.89 dBm
Antenna Type:	IPEX Antenna
Antenna Gain:	3.43 dBi
Power supply	DC 12V
Temperature Range:	-30℃~+80℃
Date of Received:	December 20, 2023

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 Frequency Bands	PASS	
15.247(d) 15.209	Unwanted Emission Into Restricted Frequency Bands (conducted)	PASS	
15.247(d) 15.209	Radiated Spurious Emission	PASS	
15.207	Conducted Emission Test	N/A	
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: 2BEZV-351000-P15A 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 Radiated Emission Test Equipment

Equ. No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
ENE-185	EMI Test Receiver	R&S	ESR7	102480	May 18, 2023	1 Year
ENE-190	Antenna multiple	Schwarzbeck	VULB 9163	01499	May 27, 2022	2 Year
ENE-191	Horn antenna	Schwarzbeck	BBHA 9120 D	02588	May 21, 2022	2 Year
ENE-195	Pre-Amplifier	JS Denki	PA09K03-40	JSPA21019	May 27, 2023	1 Year
ENE-204	Low frequency notch filterRf switching	JS Denki	JSDSW-F	JSDSW2211D02	May 27, 2023	1 Year
ENE-279	RF cable	Rosenberger	L17-C001-7000	/	June 01, 2023	1 Year
ENE-280	RF cable	Rosenberger	L17-C001-3500	/	June 01, 2023	1 Year
ENE-281	RF cable	Rosenberger	L08-C446-1500	/	June 01, 2023	1 Year
ENE-282-1	RF cable	Rosenberger	/	/	June 01, 2023	1 Year
ENE-282-2	RF cable	Rosenberger	/	/	June 01, 2023	1 Year
ENE-171	EXA Signal Analyzer	KEYSIGHT	N9010B	MY60242467	Feb. 28, 2023	1 Year
ENE-171	EXA Signal Analyzer	KEYSIGHT	N9010B	MY60242467	Feb. 27, 2024	1 Year
ENE-191	Horn antenna	Schwarzbeck	BBHA 9120 D	02588	May 21, 2022	2 Year
ENE-198	Pre-amplifier	JS Denki	PA0118-50	JSPA21022	April 28, 2023	1 Year
ENE-193	Horn antenna	Schwarzbeck	BBHA 9170	01190	May 21, 2022	2 Year
ENE-199	Pre-amplifier	JS Denki	PA1840-55	JSPA21023	April 28, 2023	1 Year
ENE-281-1	RF cable	Rosenberger	LA2-C125-3500	/	May 31, 2023	1 Year
ENE-281-2	RF cable	Rosenberger	LA2-C125-1500	/	May 31, 2023	1 Year
ENE-281-3	RF cable	Rosenberger	LU7-C1511-1200	/	May 31, 2023	1 Year

ENE-285-1	RF cable	Rosenberger	LA2-C199-6500	/	May 31, 2023	1 Year
ENE-290-1	RF cable	Schwarzbeck	LA1-C006-4000	/	May 31, 2023	1 Year
ENE-206	High frequency notch filterRf switching	JS Denki	JSDSW-F	202083582	April 28, 2023	1 Year

Note: ENE-171 was calibrated on February 27, 2024, and was not tested on that date.

4.2.2 Radio Frequency Test Equipment

Equ. No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
ENE-256	EXA Signal Anaalyzer	Keysight	N9010B	MY62060219	July 05, 2023	1 Year
ENE-172	RF Control Unit	Tonscend	JS0806-2(V.6E)	21L8060521	March 01, 2023	1 Year
ENE-172	RF Control Unit	Tonscend	JS0806-2(V.6E)	21L8060521	Feb 27, 2024	1 Year
ENE-092	DC Power Supply	KEFUNA	KDP3603	2004D3062946	July 07, 2023	1 Year

Note: The ENE-172 was calibrated on February 27, 2024, and was not tested on that date.

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 V5.0 DTS :1 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 V5.0 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 V5.0 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:	UI_mptool (V2.0)

5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

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

No. 8, Building 8, Lane 216, Qingyi Road, Ningbo Hi-Tech Zone, Ningbo, Zhejiang, ChinaJ
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**
The Certificate Registration Number is L6666.
The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2018 (identical to ISO/IEC 17025:2017)

Designation by FCC
Designation Number: CN1354
Test Firm Registration Number: 427606

Accredited by A2LA
The Certificate Number is 4321.03.
The certificate isvalid until May 31, 2025

Designation by Industry Canada
The Conformity Assessment Body Identifier is CN0114

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

Site Location : No. 8, Building 8, Lane 216, Qingyi Road, Hi-Tech Zone, Ningbo, Zhejiang, China

6 TEST SYSTEM UNCERTAINTY

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

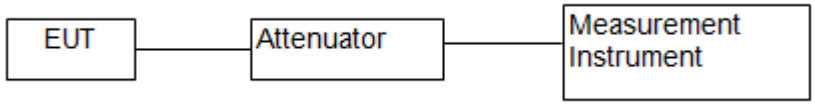
Parameter	Uncertainty
Radio Frequency	±1x10^-5 MHz
Uncertainty for Output power test	±0.83 dB
Conducted Emissions Test	±2.0 dB
Radiated Emission Test	±2.0 dB
Occupied Bandwidth Test	±1.0 dB
Power density test	±1.85 dB
All emission, radiated	±3 dB
Antenna Port Emission	±3 dB
Temperature	±0.5℃
Humidity	±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 V5.0 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.

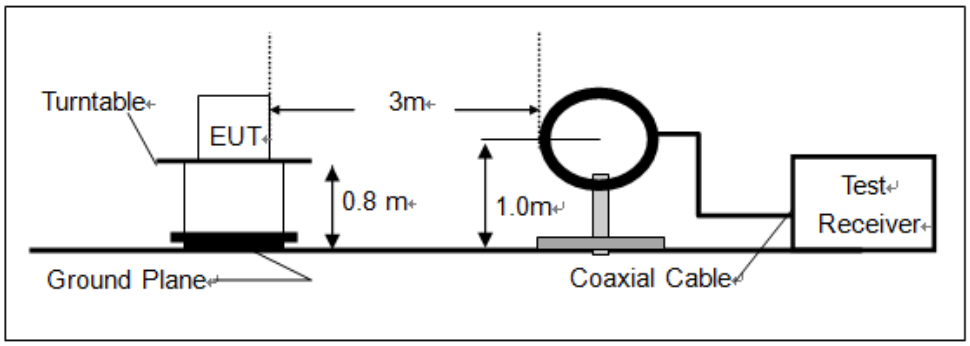
30MHz-1GHz：

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).

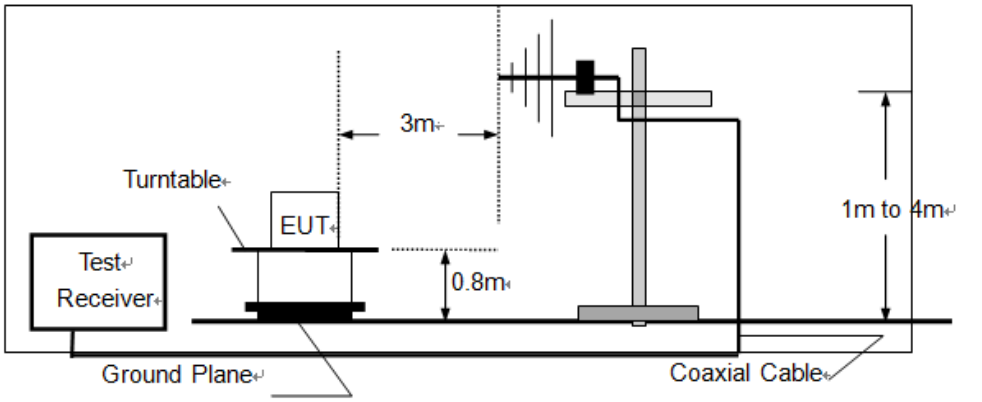
Above 1GHz：

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).

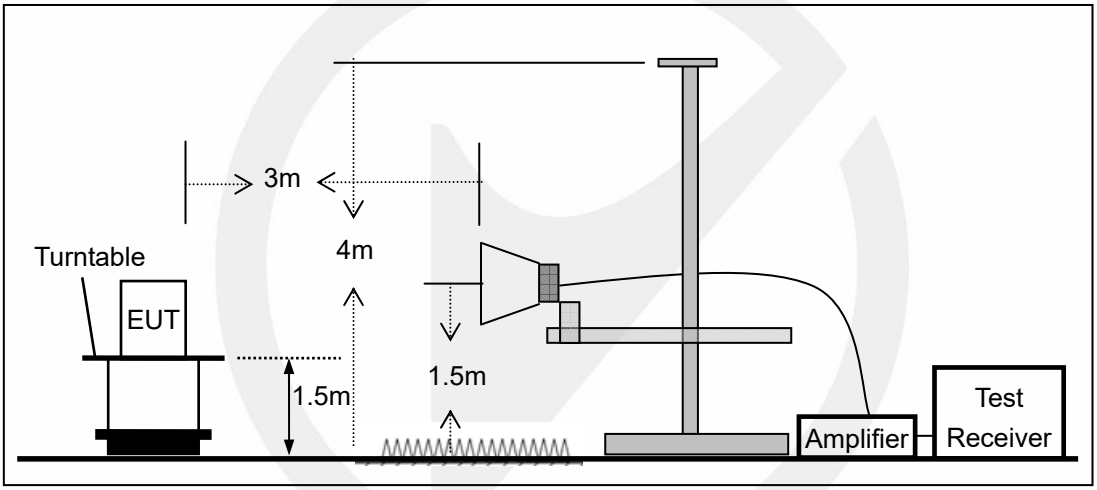
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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

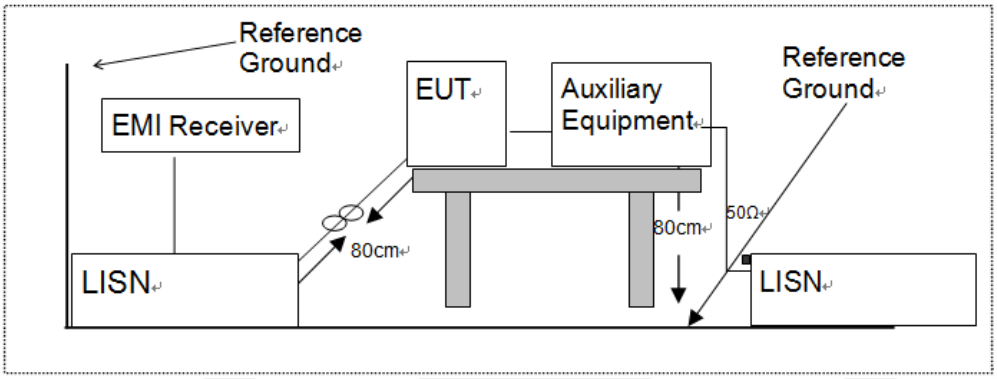


7.3 CONDUCTED EMISSION TEST SETUP

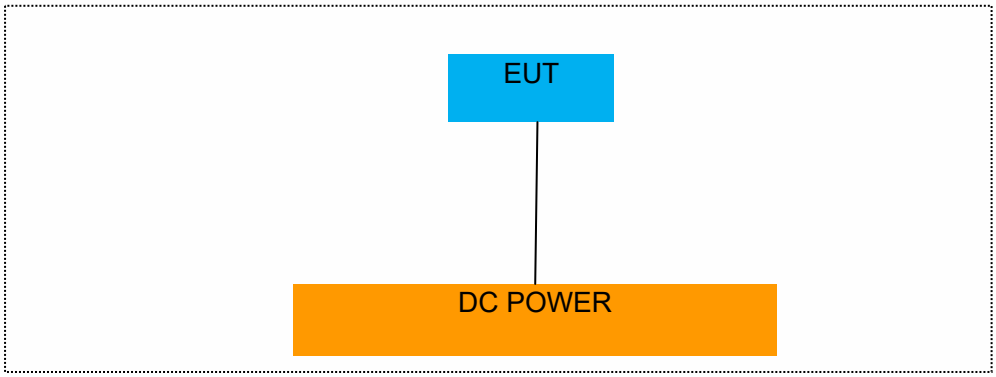
The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All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

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

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

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

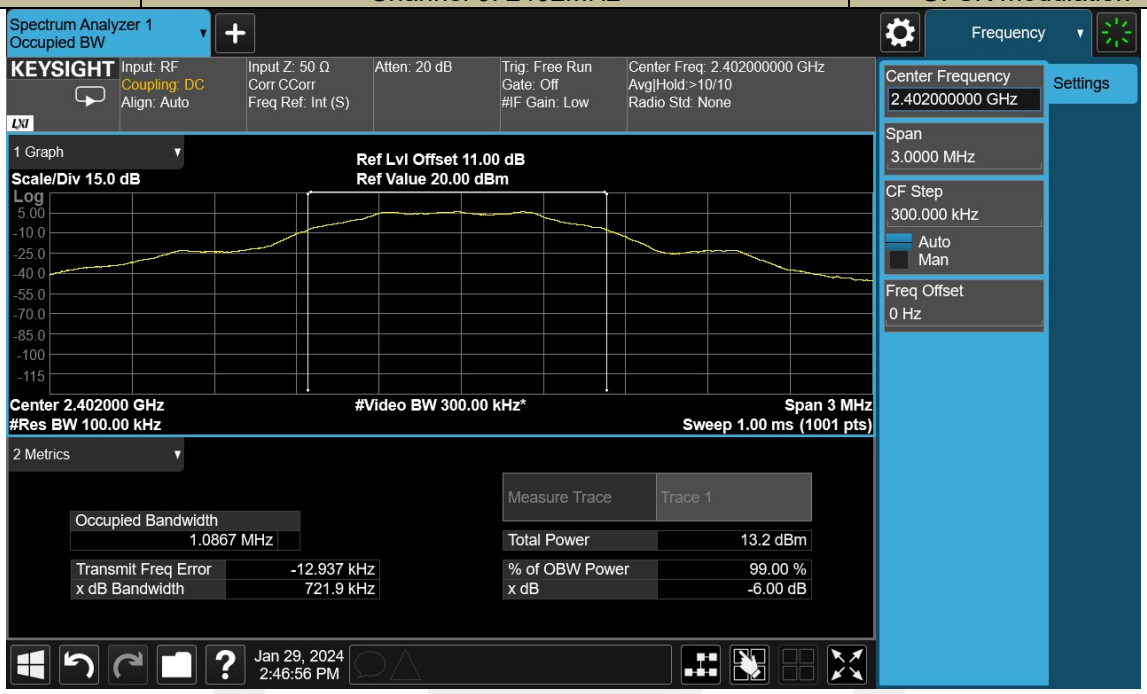
The EUT was operating in Bluetooth V5.0 DTS mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
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

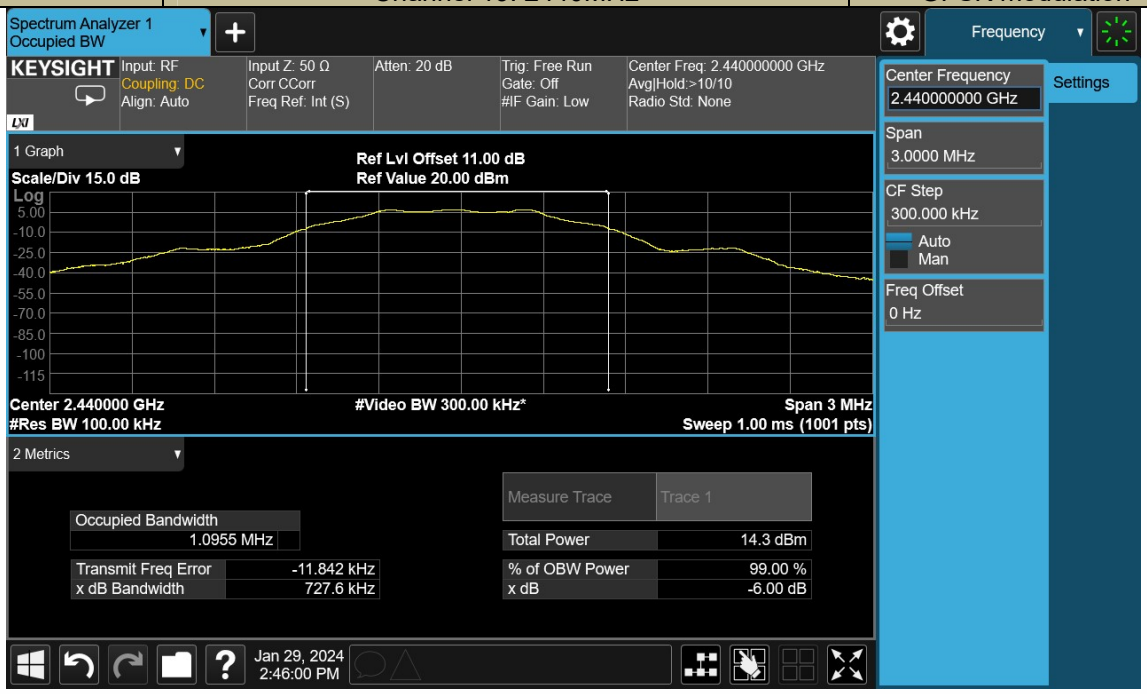
Temperature:	16° C
Relative Humidity:	45%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (kHz)	Limit (kHz)	Verdict
BLE 1M	0	2402	721.9	>500	PASS
	19	2440	727.6	>500	PASS
	39	2480	723.4	>500	PASS

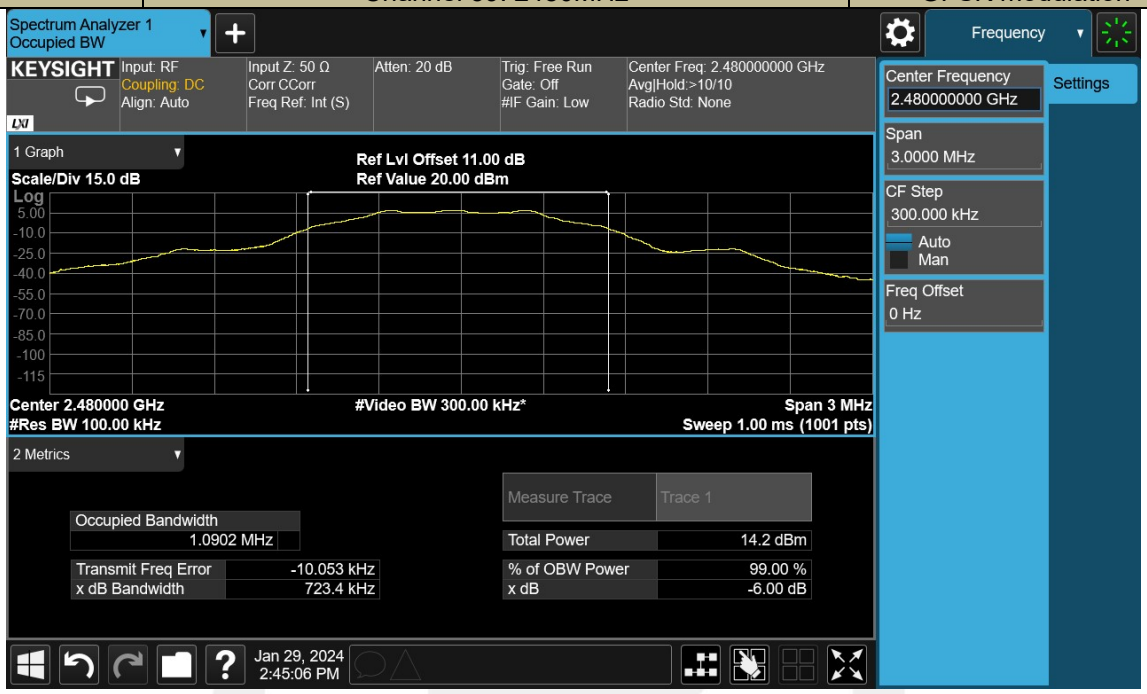
Test Model	DTS (6dB) Bandwidth	
	Bluetooth V5.0 DTS-1M	
	Channel 0: 2402MHz	GFSK modulation



Test Model	DTS (6dB) Bandwidth	
	Bluetooth V5.0 DTS-1M	
	Channel 19: 2440MHz	GFSK modulation



Test Model	DTS (6dB) Bandwidth	
	Bluetooth V5.0 DTS-1M	
	Channel 39: 2480MHz	GFSK modulation



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:	16° C
Relative Humidity:	45%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm)	Limit (dBm)	Verdict
BLE 1M	0	2402	6.68	30	PASS
	19	2440	7.65	30	PASS
	39	2480	7.89	30	PASS

Test Model	Maximum Conducted Output Power	
	Bluetooth V5.0 DTS-1M	
	Channel 0: 2402MHz	GFSK modulation

Test Model	Maximum Conducted Output Power	
	Bluetooth V5.0 DTS-1M	
	Channel 19: 2440MHz	GFSK modulation

Test Model	Maximum Conducted Output Power	
	Bluetooth V5.0 DTS-1M	
	Channel 39: 2480MHz	GFSK modulation

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

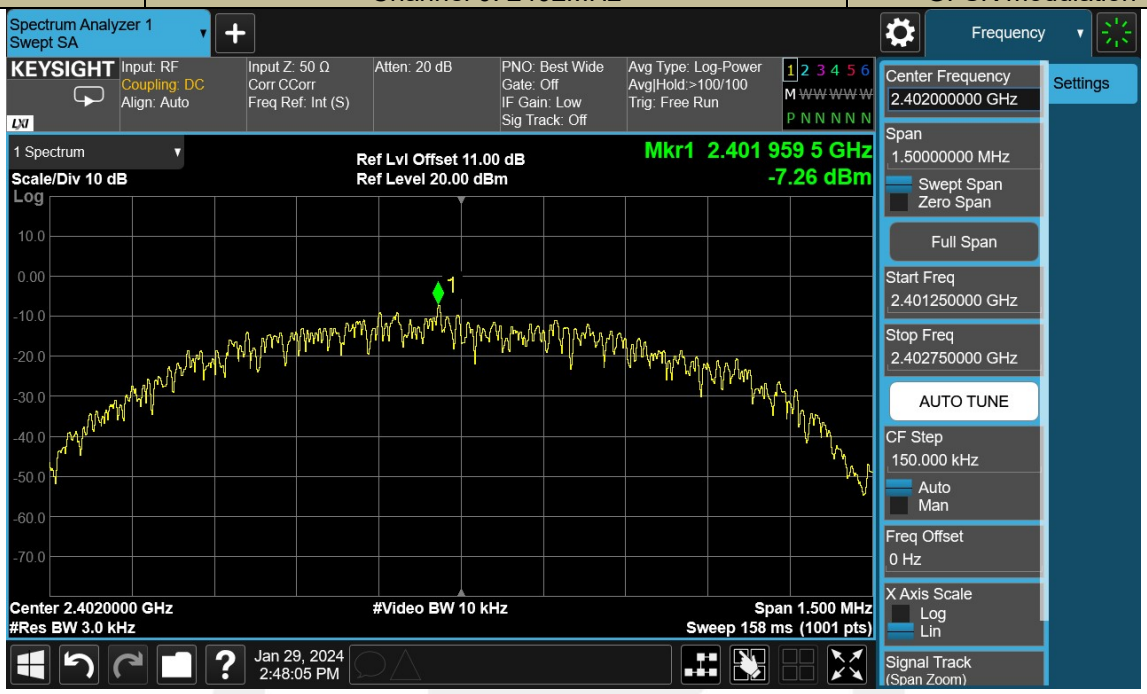
This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance
The transmitter output (antenna port) was connected to the spectrum analyzer
Set analyzer center frequency to DTS channel center frequency.
Set the span to 1.5 times the DTS bandwidth.
Set the RBW to: 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

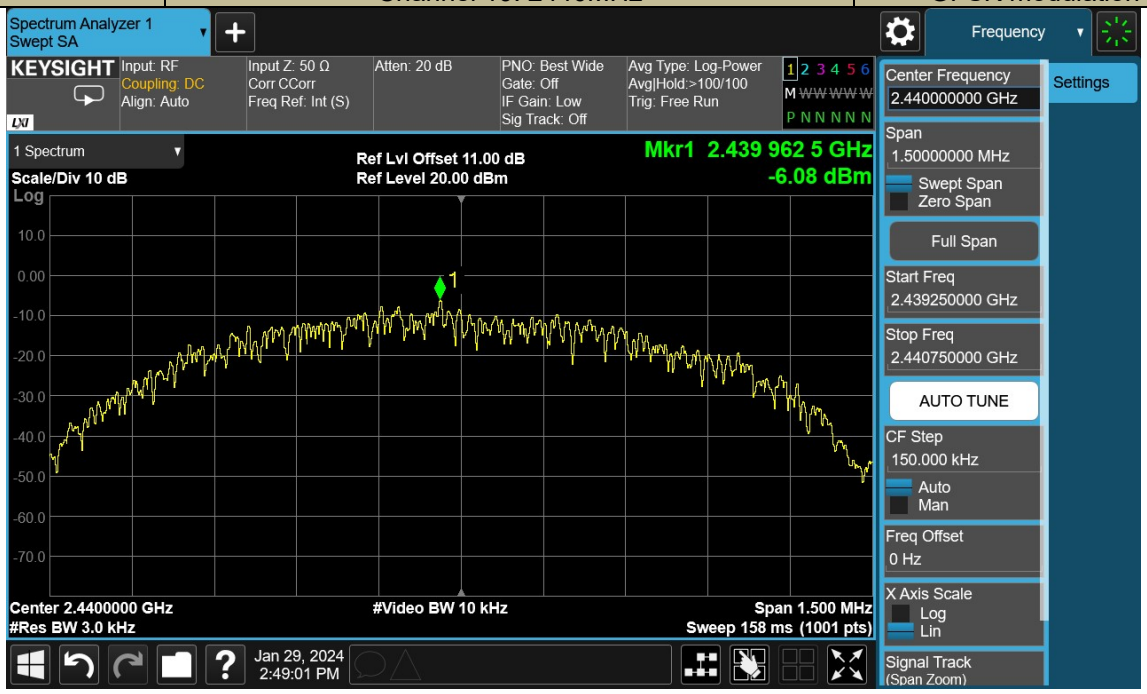
Temperature:	16° C
Relative Humidity:	45%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
BLE 1M	0	2402	-7.26	<8	PASS
	19	2440	-6.08	<8	PASS
	39	2480	-6.14	<8	PASS
Note: N/A					

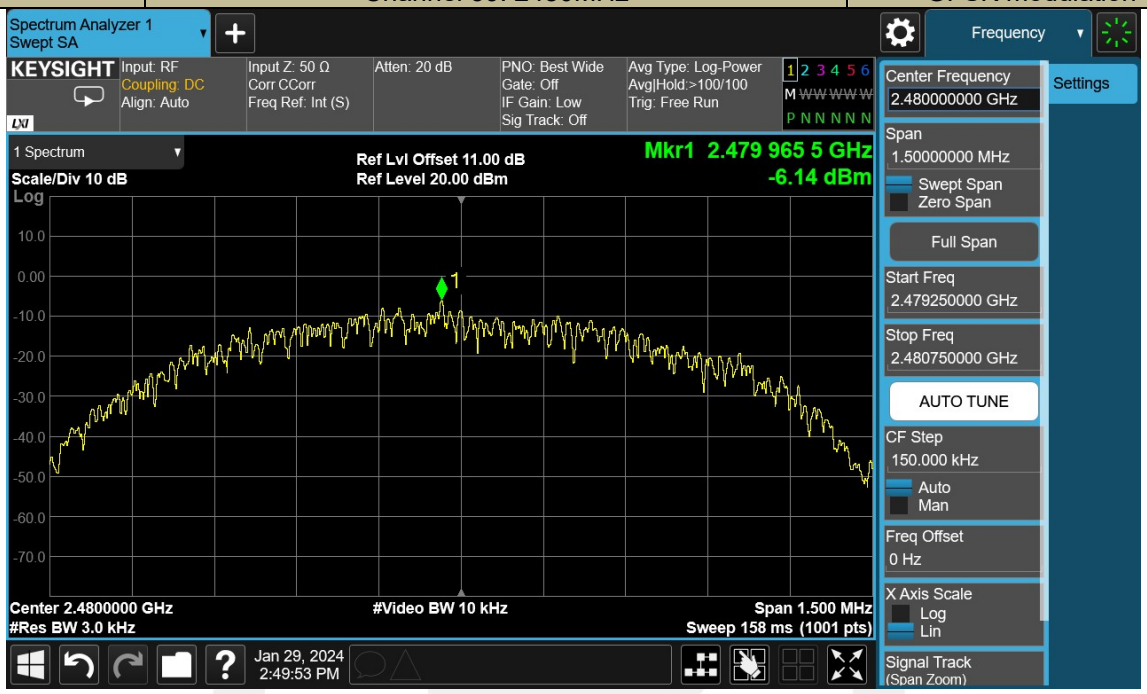
Test Model	Power Spectral Density	
	Bluetooth V5.0 DTS-1M	
	Channel 0: 2402MHz	GFSK modulation



Test Model	Power Spectral Density	
	Bluetooth V5.0 DTS-1M	
	Channel 19: 2440MHz	GFSK modulation



Test Model	Power Spectral Density	
	Bluetooth V5.0 DTS-1M	
	Channel 39: 2480MHz	GFSK modulation



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 ≥ 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**

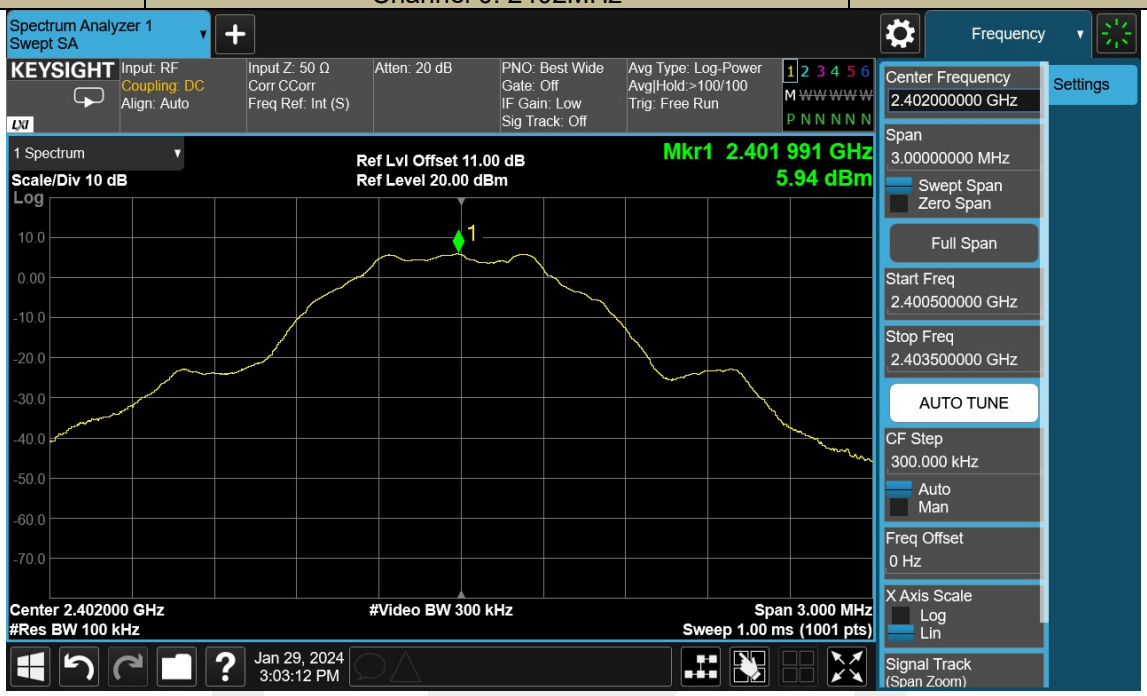
Set the center frequency and span to encompass frequency range to be measured.
Set the RBW = 100 kHz.
Set the VBW =300 kHz.
Set Detector = peak
Sweep time = auto couple.
Trace mode = max hold.
Allow trace to fully stabilize.
Use the peak marker function to determine the maximum amplitude level.
Ensure 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:	16° C
Relative Humidity:	45%
ATM Pressure:	1011 mbar

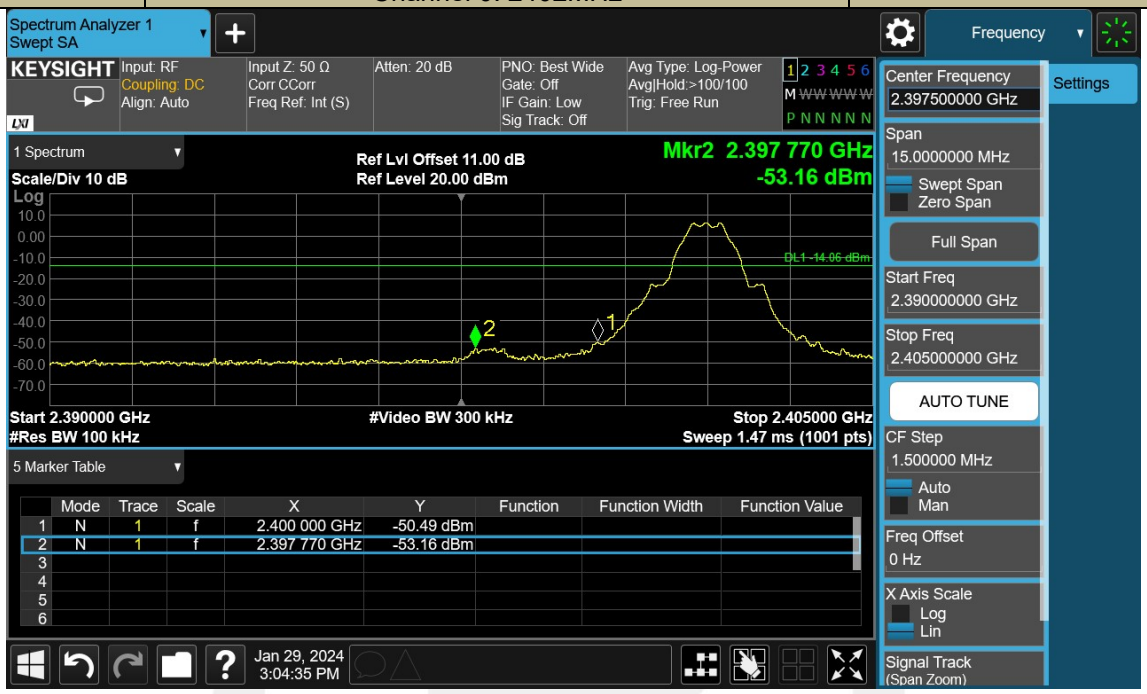
Bluetooth V5.0 DTS mode have been tested, and the worst result was report as below:

Test Model	PSD(Power Spectral Density) RBW=100kHz
	Bluetooth V5.0 DTS
	Channel 0: 2402MHz

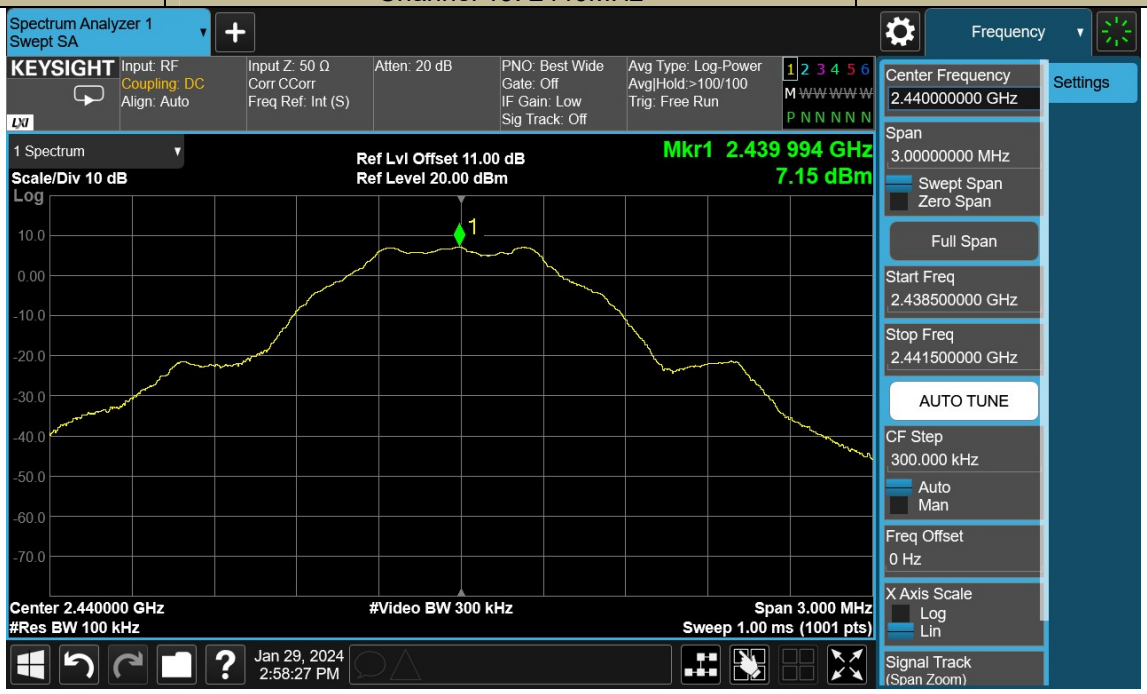


Test Model	Unwanted Emissions in non-restricted frequency bands
	Bluetooth V5.0 DTS
	Channel 0: 2402MHz

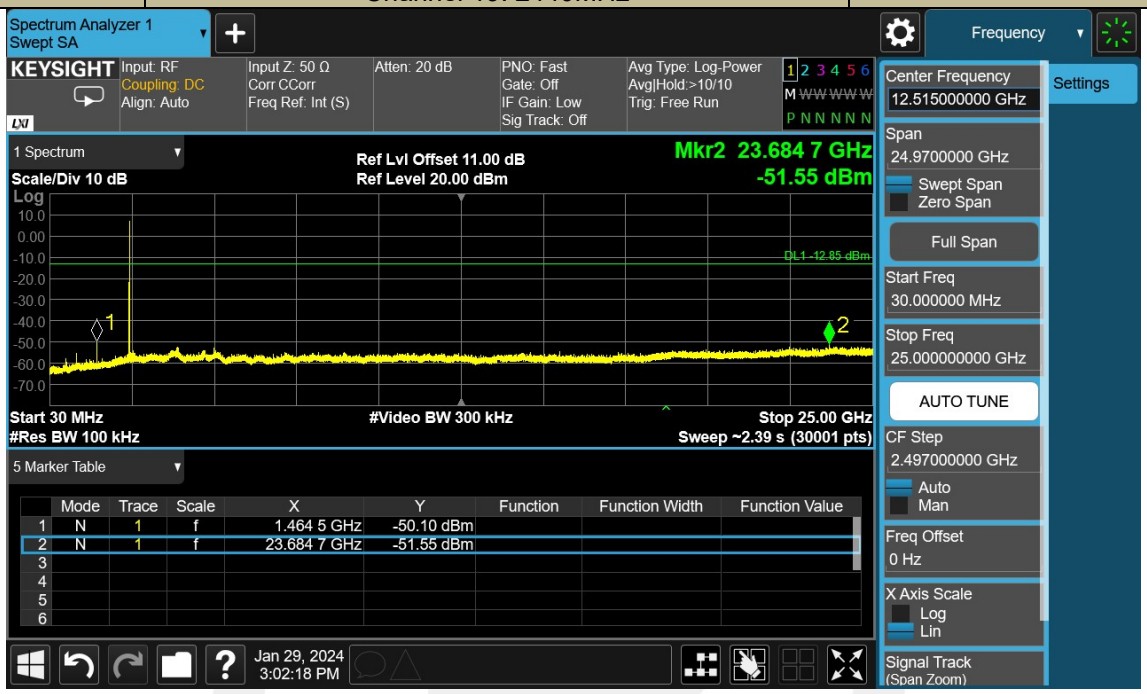
Test Model	Band edge
	Bluetooth V5.0 DTS
	Channel 0: 2402MHz



Test Model	PSD(Power Spectral Density) RBW=100kHz
	Bluetooth V5.0 DTS
	Channel 19: 2440MHz



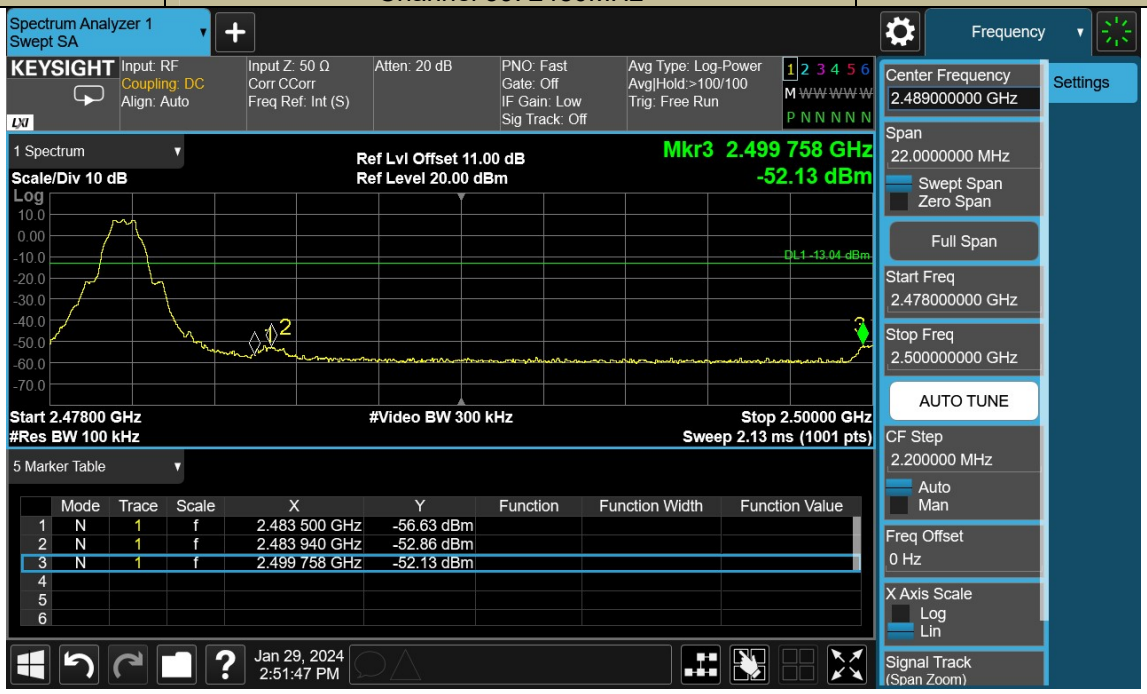
Test Model	Unwanted Emissions In Non-Restricted Frequency Bands
	Bluetooth V5.0 DTS
	Channel 19: 2440MHz



Test Model	PSD(Power Spectral Density) RBW=100kHz
	Bluetooth V5.0 DTS
	Channel 19: 2480MHz

Test Model	Unwanted Emissions In Non-Restricted Frequency Bands
	Bluetooth V5.0 DTS
	Channel 39: 2480MHz

Test Model	Band edge
	Bluetooth V5.0 DTS
	Channel 39: 2480MHz



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 Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement 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 ≥ 1 GHz(1GHz to 25GHz), 100 kHz for f < 1 GHz(30MHz to 1GHz)
VBW ≥ 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:	17° C
Relative Humidity:	40%
ATM Pressure:	1011 mbar

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

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	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 V5.0 DTS mode have been tested, and the worst result was report as below:

Test mode: BLE Frequency: Channel 0: 2402MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
7204.86	V	49.56	33.62	74.00	54.00	-24.44	-20.38
9608.78	V	50.24	35.97	74.00	54.00	-23.76	-18.03
17920.50	V	56.27	40.11	74.00	54.00	-17.73	-13.89
7206.86	H	51.52	36.25	74.00	54.00	-22.48	-17.75
9608.78	H	51.90	34.09	74.00	54.00	-22.10	-19.91
17980.00	H	56.78	40.68	74.00	54.00	-17.22	-13.32

Test mode: BLE Frequency: Channel 19: 2440MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
7318.85	V	49.85	33.26	74.00	54.00	-24.15	-20.74
9758.77	V	52.92	38.79	74.00	54.00	-21.08	-15.21
17924.00	V	56.64	41.26	74.00	54.00	-17.36	-12.74
7319.35	H	52.80	36.51	74.00	54.00	-21.20	-17.49
9760.77	H	54.46	38.74	74.00	54.00	-19.54	-15.26
17982.00	H	55.78	39.02	74.00	54.00	-18.22	-14.98

Test mode: BLE Frequency: Channel 39: 2480MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
7440.35	V	50.11	36.94	74.00	54.00	-23.89	-17.06
9918.76	V	50.61	34.16	74.00	54.00	-23.39	-19.84
17859.50	V	56.77	40.33	74.00	54.00	-17.23	-13.67
7440.35	H	53.37	37.68	74.00	54.00	-20.63	-16.32
9920.76	H	53.15	39.62	74.00	54.00	-20.85	-14.38
17988.50	H	56.64	41.03	74.00	54.00	-17.36	-12.97

Test mode: BLE+BT+WiFi2.4G Frequency: 2402MHz+2402MHz+2412MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
5146.00	V	42.29	29.64	74.00	54.00	-31.71	-24.36
7440.00	V	44.19	28.54	74.00	54.00	-29.81	-25.46
16470.50	V	53.93	38.59	74.00	54.00	-20.07	-15.41
4763.00	H	41.47	29.33	74.00	54.00	-32.53	-24.67
11061.00	H	51.55	34.28	74.00	54.00	-22.45	-19.72
14022.00	H	53.37	37.64	74.00	54.00	-20.63	-16.36

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

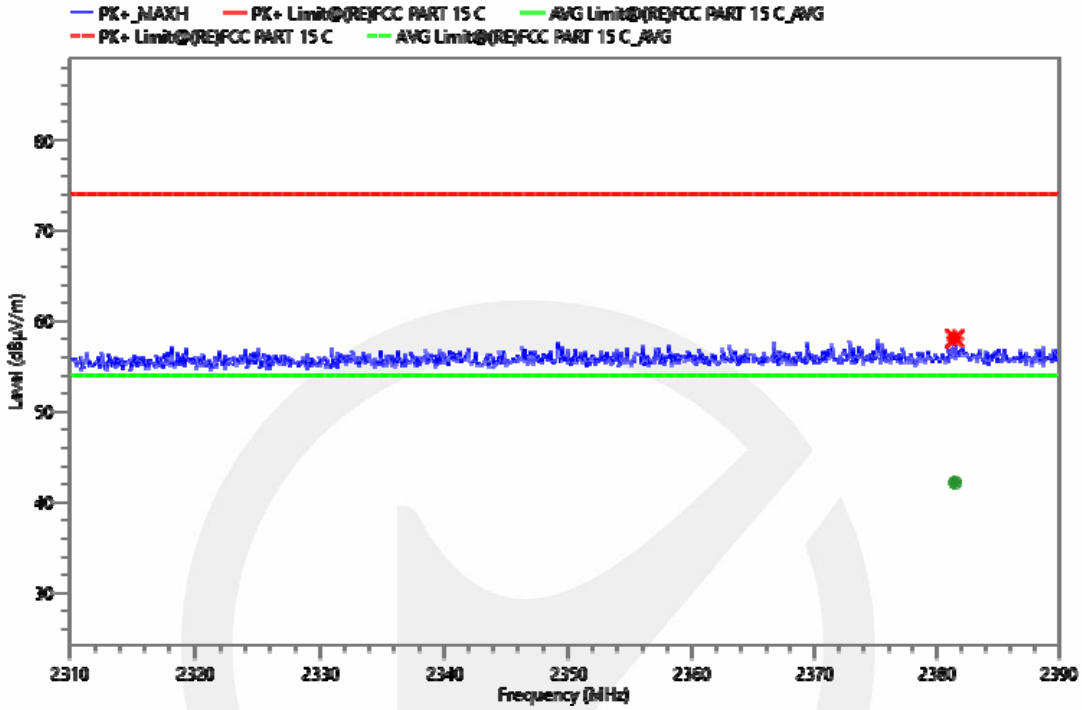
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2381.444	H	58.09	74.00	42.19	54.00
2351.339	V	57.93	74.00	41.34	54.00

Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2494.022	H	58.81	74.00	42.56	54.00
2491.804	V	58.54	74.00	42.13	54.00

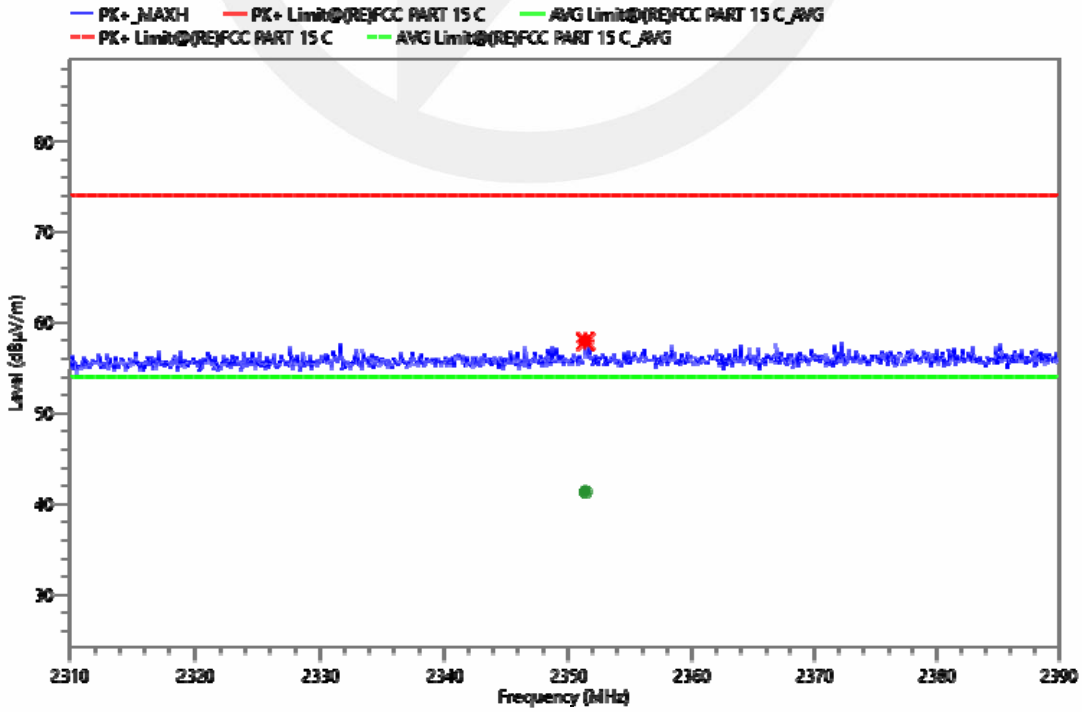
Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor +Cable Loss.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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

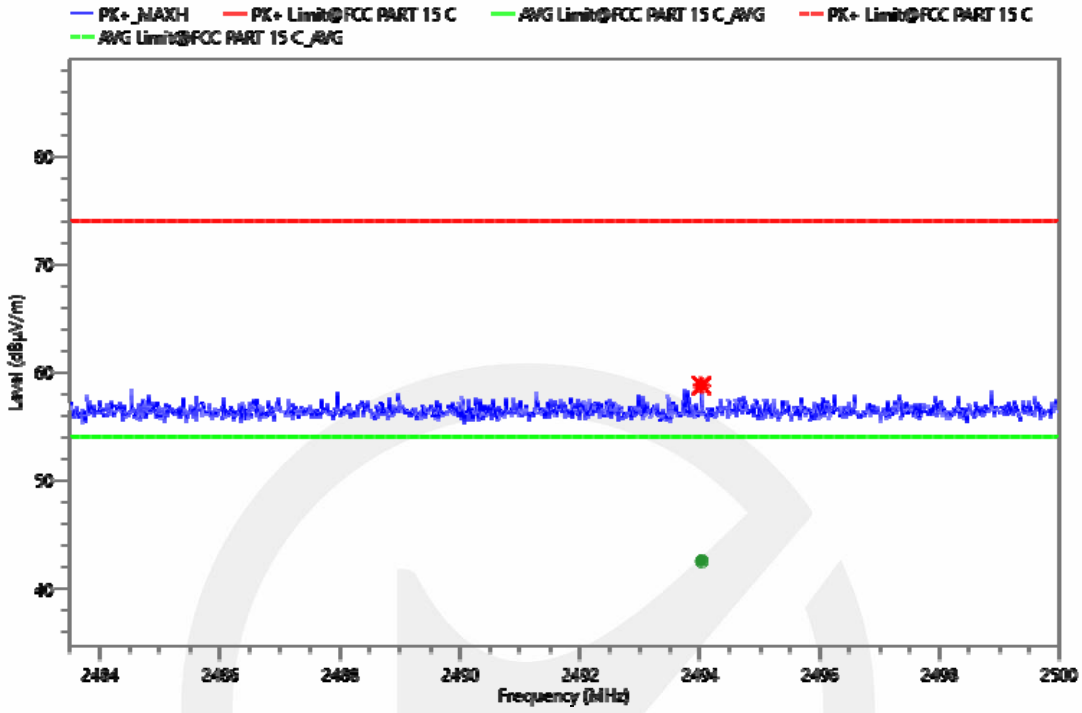
Test Model	Spurious Emission in Restricted Band 2310-2390MHz Bluetooth V5.0 DTS Channel 0: 2402MHz	H



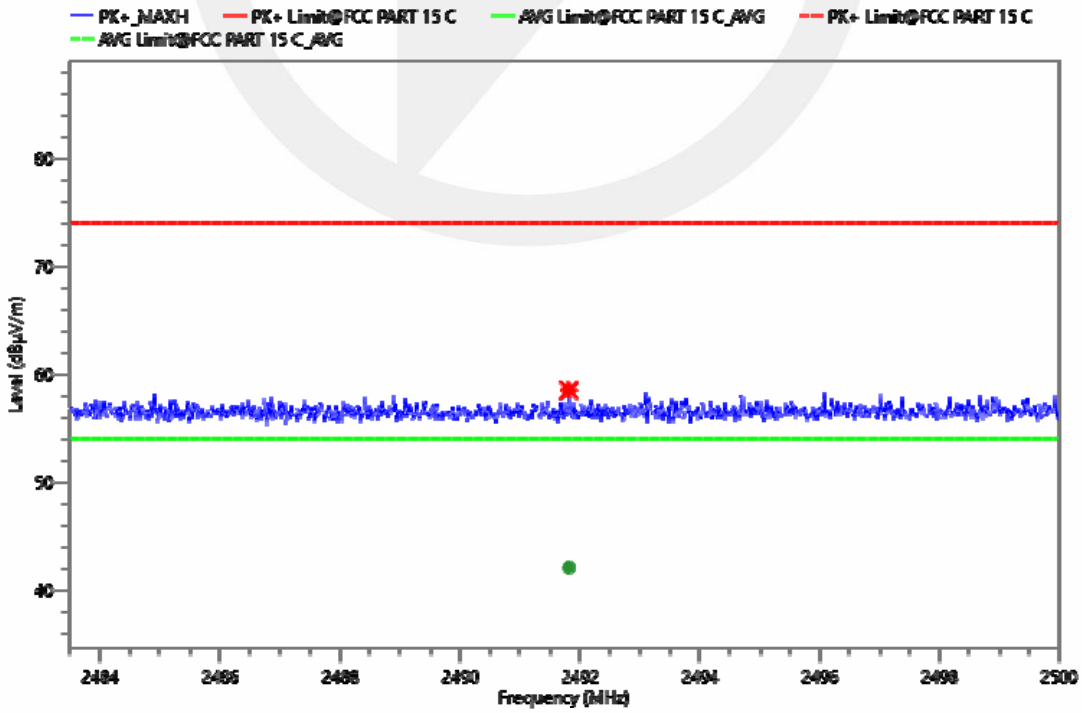
Test Model	Spurious Emission in Restricted Band 2310-2390MHz Bluetooth V5.0 DTS Channel 0: 2402MHz	V



Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz Bluetooth V5.0 DTS Channel 39: 2480MHz	H



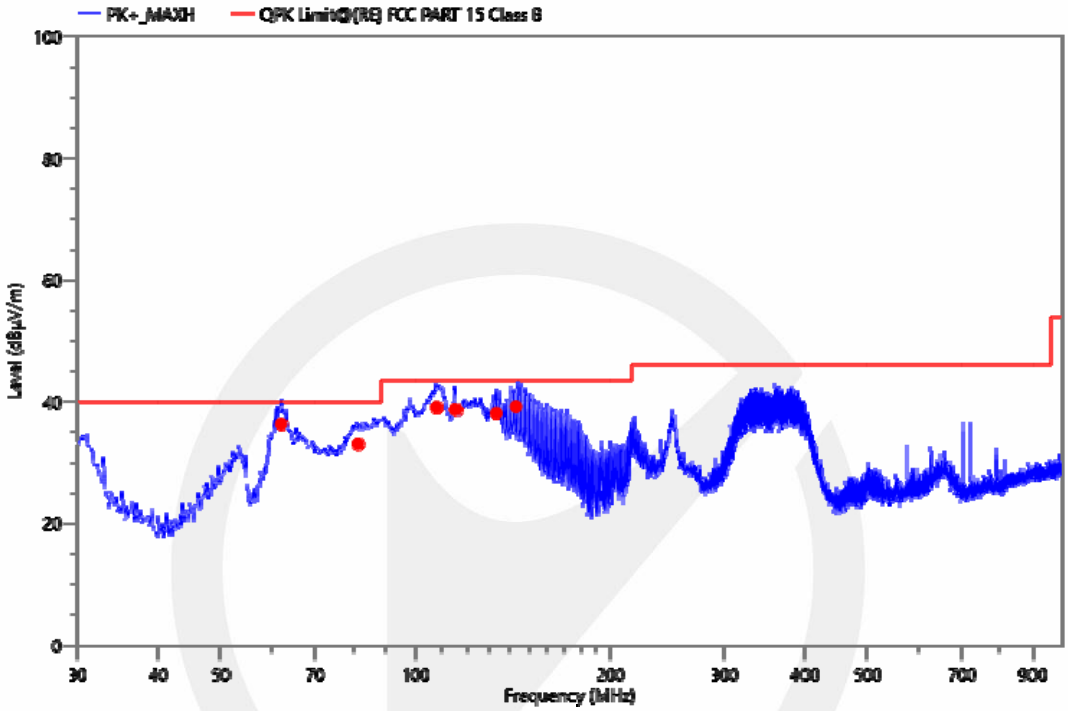
Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz Bluetooth V5.0 DTS Channel 39: 2480MHz	V



■ Spurious Emission below 1GHz (30MHz to 1GHz)

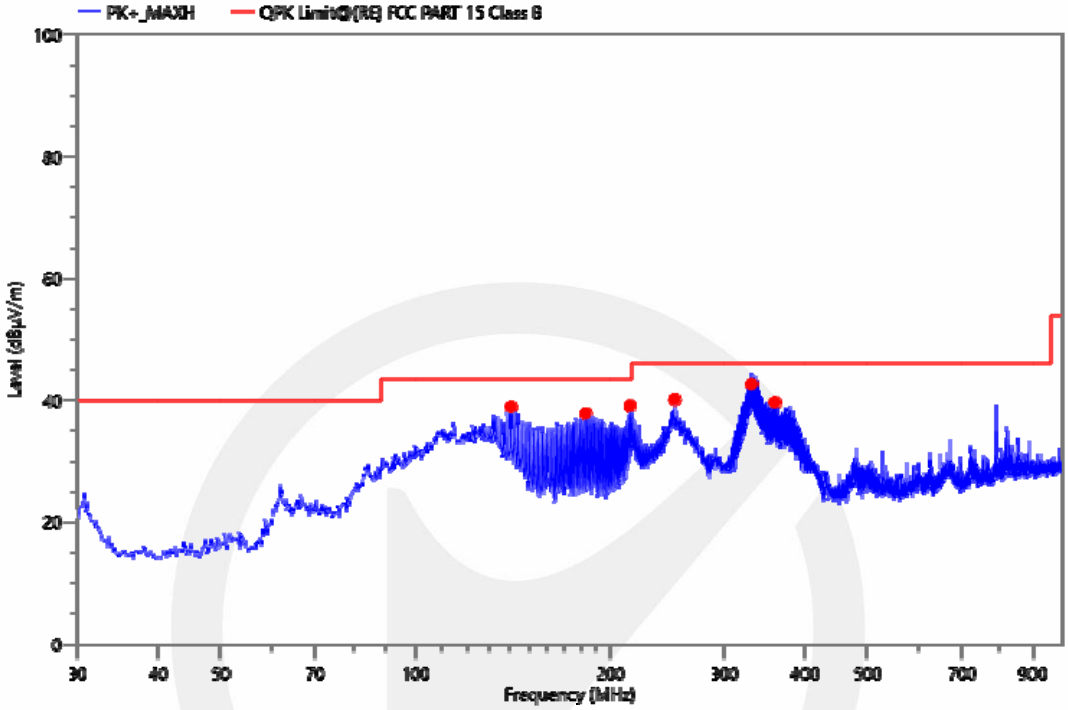
All modes have been tested, and the worst result recorded was report as below:

Project Information			
Mode:	TX 2402MHz	Voltage:	DC 12V
Environment:	Temp: 21℃; Humi:49%	Engineer:	Chris Fan



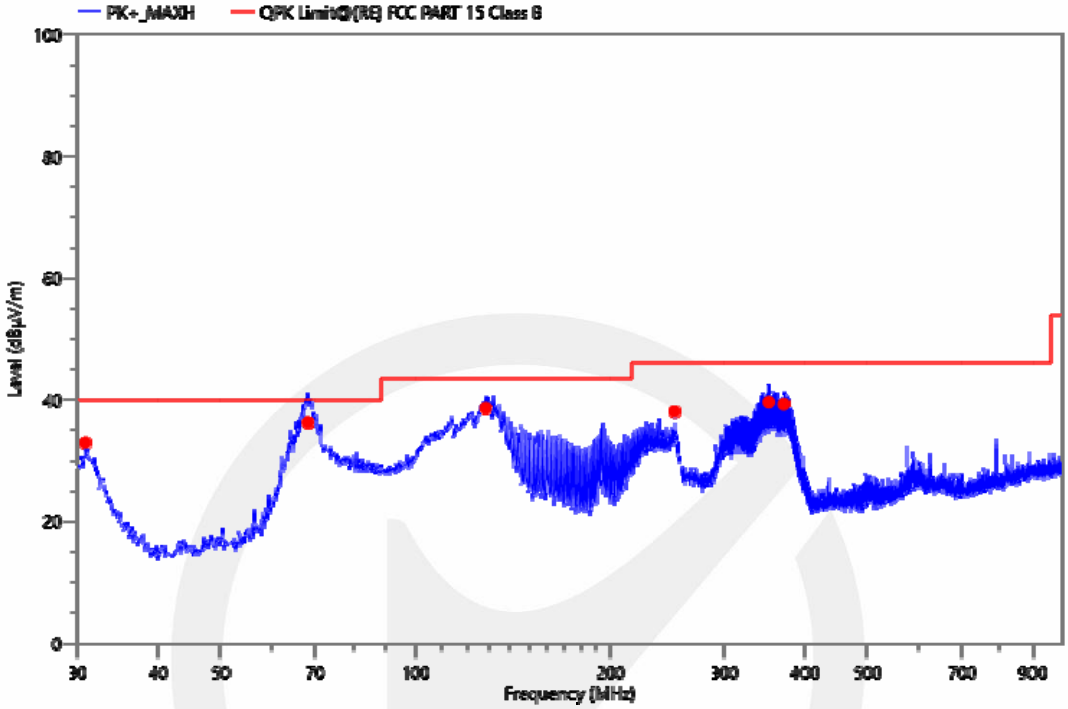
Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
61.977	62.09	-25.8	36.29	40.00	3.71	QPK	100	V	177.4	PASS
81.308	59.52	-26.47	33.05	40.00	6.95	QPK	100	V	133.4	PASS
107.883	64.18	-25.1	39.08	43.50	4.42	QPK	100	V	281.0	PASS
115.351	64.76	-26.06	38.70	43.50	4.80	QPK	100	V	228.0	PASS
133.295	65.42	-27.34	38.08	43.50	5.42	QPK	200	V	58.4	PASS
143.091	66.44	-27.29	39.15	43.50	4.35	QPK	100	V	338.8	PASS

Project Information			
Mode:	TX 2402MHz	Voltage:	DC 12V
Environment:	Temp: 21℃; Humi:49%	Engineer:	Chris Fan



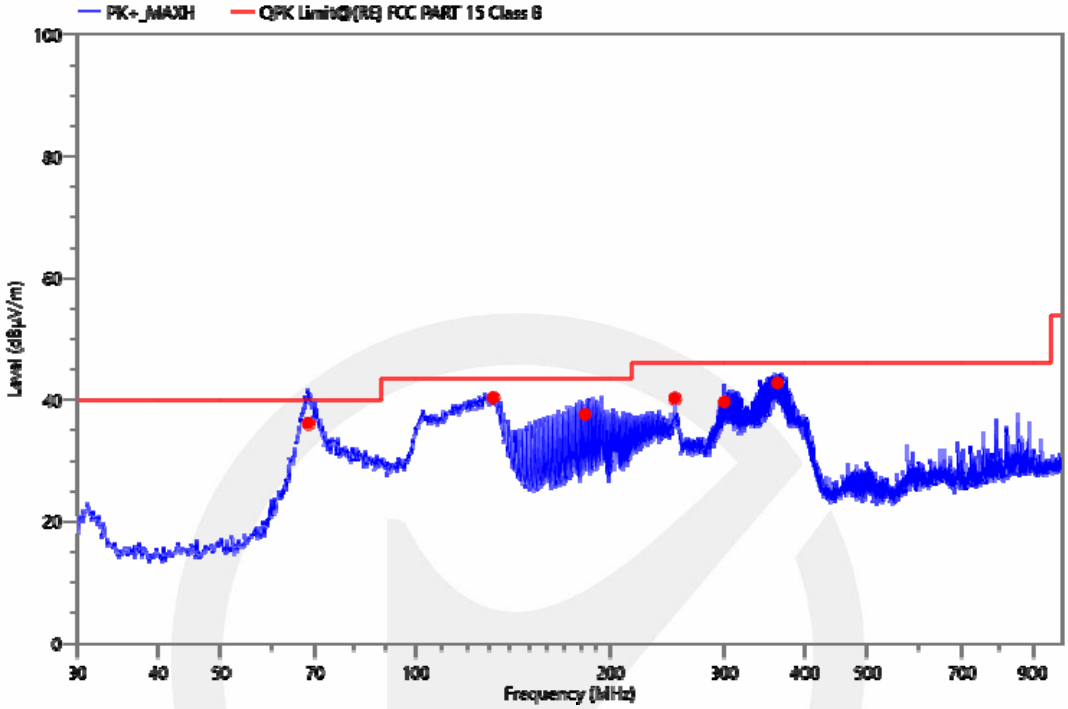
Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
140.375	66.33	-27.42	38.91	43.50	4.59	QPK	200	H	119.4	PASS
182.760	63.54	-25.71	37.83	43.50	5.67	QPK	200	H	16.4	PASS
214.476	62.91	-23.82	39.09	43.50	4.41	QPK	100	H	319.2	PASS
251.914	62.43	-22.26	40.17	46.00	5.83	QPK	100	H	187.7	PASS
330.767	63.29	-20.67	42.62	46.00	3.38	QPK	100	H	74.0	PASS
359.767	60.10	-20.47	39.63	46.00	6.37	QPK	100	H	106.1	PASS

Project Information			
Mode:	TX 2440MHz	Voltage:	DC 12V
Environment:	Temp: 21℃; Humi:49%	Engineer:	Chris Fan



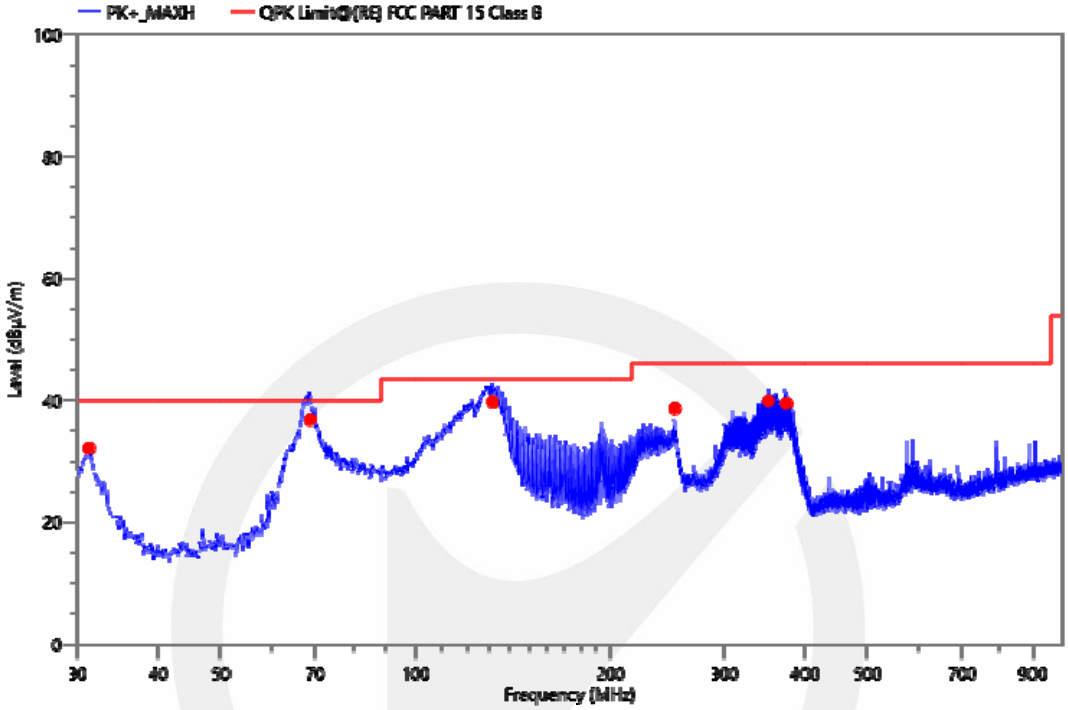
Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
30.873	58.27	-25.36	32.91	40.00	7.09	QPK	100	V	67.5	PASS
68.214	62.45	-26.22	36.23	40.00	3.77	QPK	100	V	230.6	PASS
128.251	65.76	-27.18	38.58	43.50	4.92	QPK	100	V	56.8	PASS
251.914	60.33	-22.26	38.07	46.00	7.93	QPK	100	V	0.9	PASS
352.396	60.16	-20.6	39.56	46.00	6.44	QPK	100	V	328.8	PASS
371.891	59.34	-20.11	39.23	46.00	6.77	QPK	100	V	182.4	PASS

Project Information			
Mode:	TX 2440MHz	Voltage:	DC 12V
Environment:	Temp: 21℃; Humi:49%	Engineer:	Chris Fan



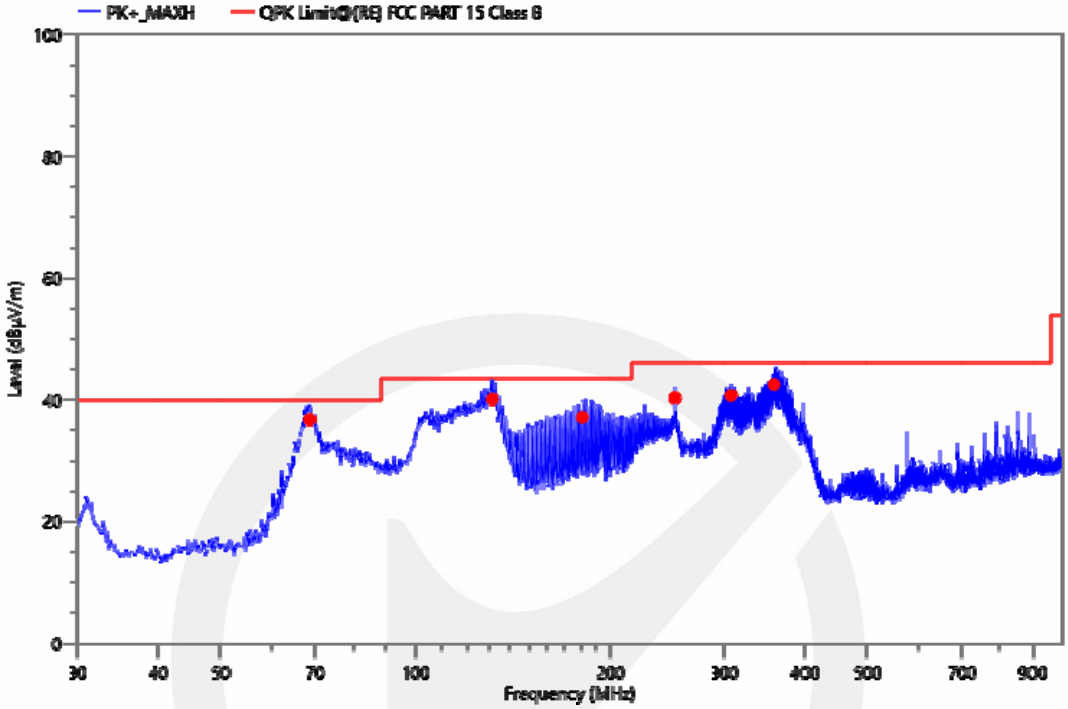
Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
68.286	62.36	-26.22	36.14	40.00	3.86	QPK	200.0	H	128.1	PASS
131.631	67.62	-27.31	40.31	43.50	3.19	QPK	200.0	H	70.3	PASS
182.566	63.26	-25.72	37.54	43.50	5.96	QPK	200	H	144.7	PASS
252.011	62.49	-22.26	40.23	46.00	5.77	QPK	100	H	237.9	PASS
300.021	61.63	-22.01	39.62	46.00	6.38	QPK	100	H	124.2	PASS
363.615	63.05	-20.35	42.70	46.00	3.30	QPK	100.0	H	360.0	PASS

Project Information			
Mode:	TX 2480MHz	Voltage:	DC 12V
Environment:	Temp: 21℃; Humi:49%	Engineer:	Chris Fan



Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
31.261	57.44	-25.26	32.18	40.00	7.82	QPK	200	V	67.2	PASS
68.728	63.08	-26.25	36.83	40.00	3.17	QPK	100	V	226.1	PASS
131.368	67.07	-27.31	39.76	43.50	3.74	QPK	100	V	52.9	PASS
252.011	60.97	-22.26	38.71	46.00	7.29	QPK	100	V	345.8	PASS
352.008	60.46	-20.6	39.86	46.00	6.14	QPK	100	V	324.4	PASS
374.995	59.53	-20.07	39.46	46.00	6.54	QPK	100	V	169.6	PASS

Project Information			
Mode:	TX 2480MHz	Voltage:	DC 12V
Environment:	Temp: 21℃; Humi:49%	Engineer:	Chris Fan



Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
68.667	62.96	-26.25	36.71	40.00	3.29	QPK	200	H	141.4	PASS
131.352	67.36	-27.31	40.05	43.50	3.45	QPK	200	H	90.8	PASS
180.820	62.88	-25.81	37.07	43.50	6.43	QPK	200	H	150.9	PASS
252.011	62.57	-22.26	40.31	46.00	5.69	QPK	100	H	229.3	PASS
307.392	62.25	-21.61	40.64	46.00	5.36	QPK	100	H	136.4	PASS
359.121	62.91	-20.48	42.43	46.00	3.57	QPK	100	H	360.0	PASS

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

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

N/A.
This product is powered by DC 12V.

8.7 ANTENNA APPLICATION

8.7.1 Antenna Requirement

Standard	Requirement
FCC CRF Part 15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the 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.

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 EUT has 1 antenna: an IPEX Antenna gain is 3.43 dBi;

Note: ☒ 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

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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.