

# TEST REPORT

Product Name : Power Line Communication Equipment  
Model Number : S2-PLC-CCO  
FCC ID : 2AWE8-S2-PLC-CCO

Prepared for : Ginlong Technologies Co., Ltd.  
Address : No.57 Jintong Road, Binhai, (seafront), Industrial Park,  
Xiangshan Ningbo, Xhejiang 315712 P.R. China

Prepared by : EMTEK (DONGGUAN) CO., LTD.  
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Date(s) of Tests : May 10, 2023 to May 18, 2023  
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# 1 TEST RESULT CERTIFICATION

Applicant : Ginlong Technologies Co., Ltd.  
 Address : No.57 Jintong Road, Binhai, (seafront), Industrial Park, Xiangshan Ningbo, Xhejiang 315712 P.R. China  
 Manufacturer : Ginlong Technologies Co., Ltd.  
 Address : No.57 Jintong Road, Binhai, (seafront), Industrial Park, Xiangshan Ningbo, Xhejiang 315712 P.R. China  
 EUT : Power Line Communication Equipment  
 Model Name : S2-PLC-CCO  
 Trademark : Solis

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 (DONGGUAN) 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 : May 10, 2023 to May 18, 2023

*Warren Deng*

Prepared by : Warren deng /Engineer

*Tim Dong*

Reviewer : Tim Dong /Supervisor

*Sam Lv*

Approved & Authorized Signer : Sam Lv /Manager



## 2 EUT TECHNICAL DESCRIPTION

Characteristics	Description
<b>Product</b>	Power Line Communication Equipment
<b>Model Number</b>	S2-PLC-CCO
<b>Sample Number</b>	1-1
<b>Device Type</b>	Bluetooth V4.2
<b>Data Rate :</b>	Up to 1 Mbps
<b>Modulation:</b>	GFSK
<b>Operating Frequency Range:</b>	2402-2480 MHz
<b>Number of Channels:</b>	40 Channels
<b>Transmit Power Max:</b>	-2.01 dBm
<b>Antenna Type:</b>	PCB Antenna
<b>Antenna Gain:</b>	3.42 dBi
<b>Power supply</b>	AC 120V/60Hz
<b>Adaptor</b>	M/N: HW-24-12AC14D Input: AC 100-240V, 50/60Hz, 0.8A Output: DC 12V, 2A
<b>Temperature Range:</b>	-40°C to +80°C
<b>Date of Received:</b>	May 10, 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	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: 2AWE8-S2-PLC-CCO 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	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Test Receiver	Rohde& Schwarz	ESCI	100137	2022/05/19	1Year
L.I.S.N.	Rohde& Schwarz	ENV216	101209	2022/05/19	1Year
RF Switching Unit	CDS	RSU-M2	38401	2022/05/19	1Year

#### 4.2.2 Radiated Emission Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EMI Test Receiver	Rohde & Schwarz	ESCI	101415	2022/05/19	1Year
Power Amplifier	HP	8447F	OPH64	2022/05/19	1Year
Bilog Antenna	Schwarzbeck	VULB9163	141	2022/05/22	1Year
Horn antenna	Schwarzbeck	BBHA9120D	1272	2022/05/22	1Year
Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	2022/05/19	1Year
Loop Antenna	Schwarzbeck	FMZB1513	1513-60	2022/05/22	2 Year
Signal Analyzer	R&S	FSV30	103039	2022/05/19	1Year
Bilog Antenna	Schwarzbeck	VULB9163	141	2022/05/22	1Year
Band reject Filter(50dB)	WI/DE	WRCGV-2400(2400-2485MHz)	2	2022/05/20	1 Year

#### 4.2.3 Radio Frequency Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Wireless Connectivity Tester	R&S	CMW270	102543	2022/06/21	1Year
Automatic Control Unit	Tonscend	JS0806-2	2118060480	2022/06/21	1Year
Signal Analyzer	KEYSIGHT	N9010B	MY60242456	2022/06/21	1Year
Analog Signal Generator	KEYSIGHT	N5173B	MY61252625	2022/06/21	1Year
UP/DOWN-Converter	R&S	CMW-Z800A	100274	2022/06/21	1Year
Vector Signal Generator	KEYSIGHT	N5182B	MY61252674	2022/06/21	1Year
Frequency Extender	KEYSIGHT	N5182BX07	MY59362541	2022/06/21	1Year
Temperature&Humidity test chamber	ESPEC	EL-02KA	12107166	2022/06/21	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 V4.2 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 V4.2 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:  $f_c = 2402\text{MHz} + k \times 2\text{MHz}$   $k = 1$  to 39

Test Frequency and channel for Bluetooth V4.2 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:	EspRFTestTool_v2.8_Manual (V2.8)
Conducted Emission	EspRFTestTool_v2.8_Manual (V2.8)

## 5 FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

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

-1&2F., Building 2, Zone A, Zhongda Marine Biotechnology Research and Development Base, No. 9, Xincheng Avenue, Songshanhu High-technology Industrial Development Zone, Dongguan, Guangdong, 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.

Designation 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 (DONGGUAN) CO., LTD.  
Site Location : -1&2F., Building 2, Zone A, Zhongda Marine Biotechnology Research and Development Base, No. 9, Xincheng Avenue, Songshanhu High-technology Industrial Development Zone, Dongguan, Guangdong, China



## 6 TEST SYSTEM UNCERTAINTY

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

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$ MHz
Uncertainty for Output power test	$\pm 0.83$ dB
Conducted Emissions Test	$\pm 2.0$ dB
Radiated Emission Test	$\pm 2.0$ dB
Occupied Bandwidth Test	$\pm 1.0$ dB
Power density test	$\pm 1.85$ dB
All emission, radiated	$\pm 3$ dB
Antenna Port Emission	$\pm 3$ dB
Temperature	$\pm 0.5^{\circ}\text{C}$
Humidity	$\pm 3\%$

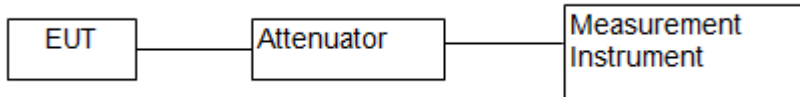
Measurement Uncertainty for a level of Confidence of 95%



## 7 SETUP OF EQUIPMENT UNDER TEST

### 7.1 RADIO FREQUENCY TEST SETUP 1

The Bluetooth V4.2 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.

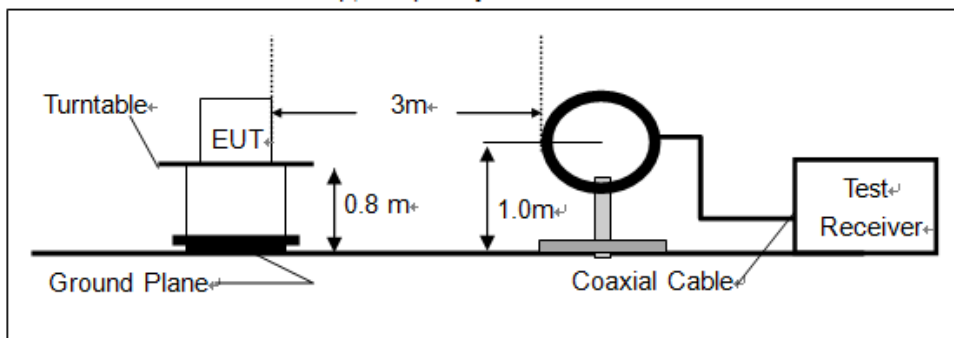
30MHz-1GHz:

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).

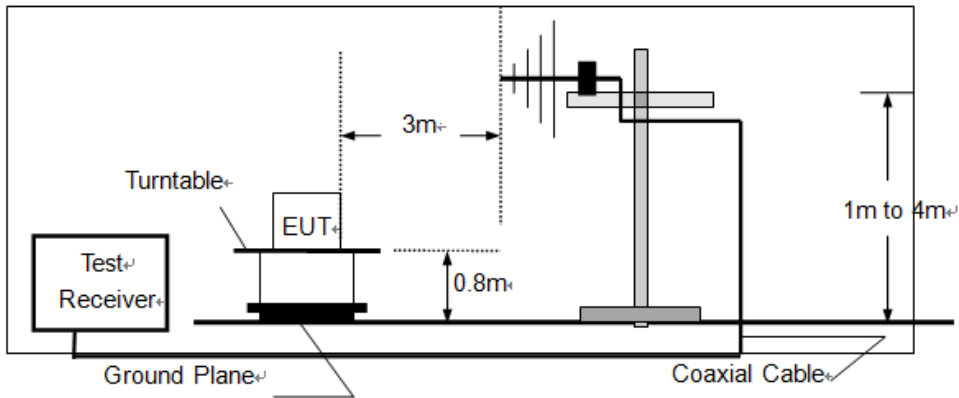
Above 1GHz:

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).

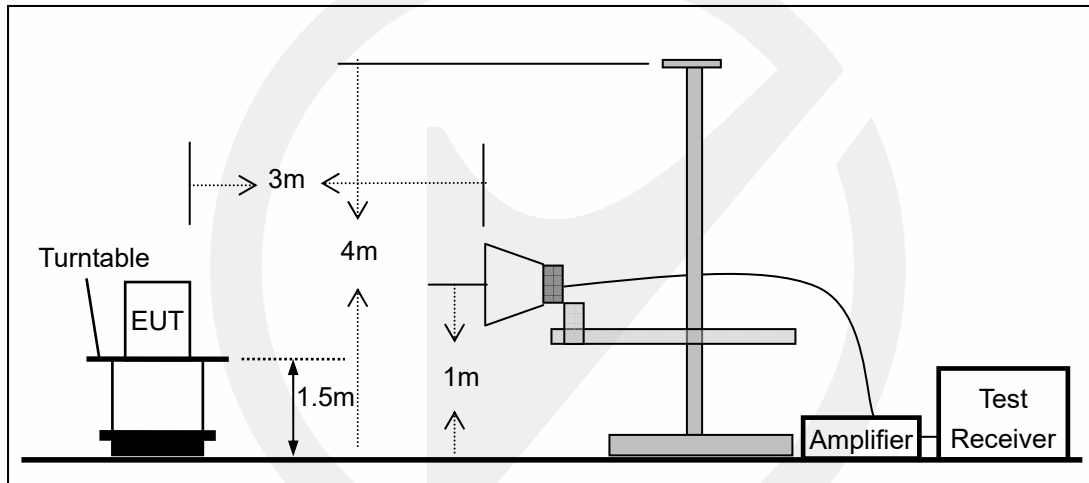
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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

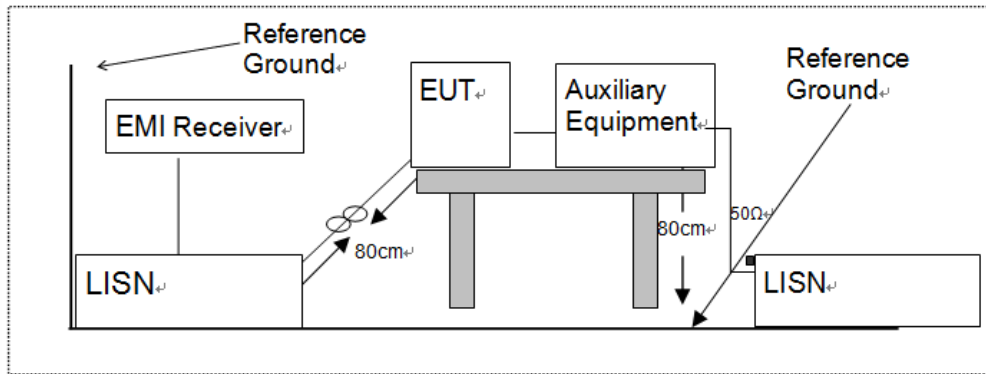


### 7.3 CONDUCTED EMISSION TEST SETUP

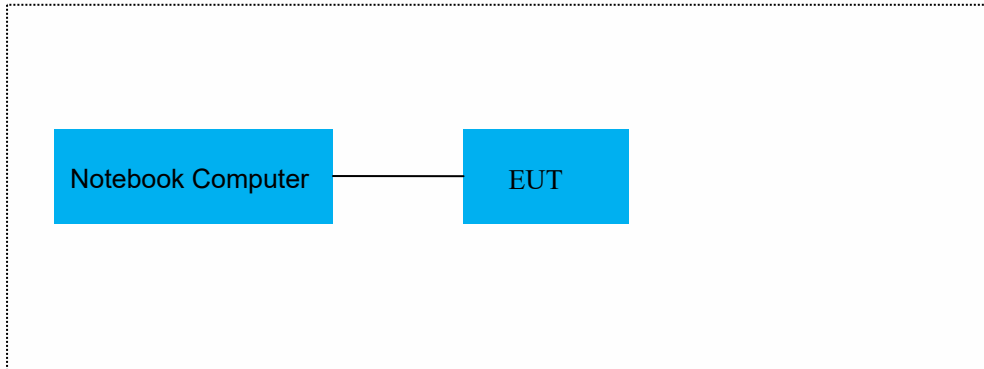
The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All 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 V4.2 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.

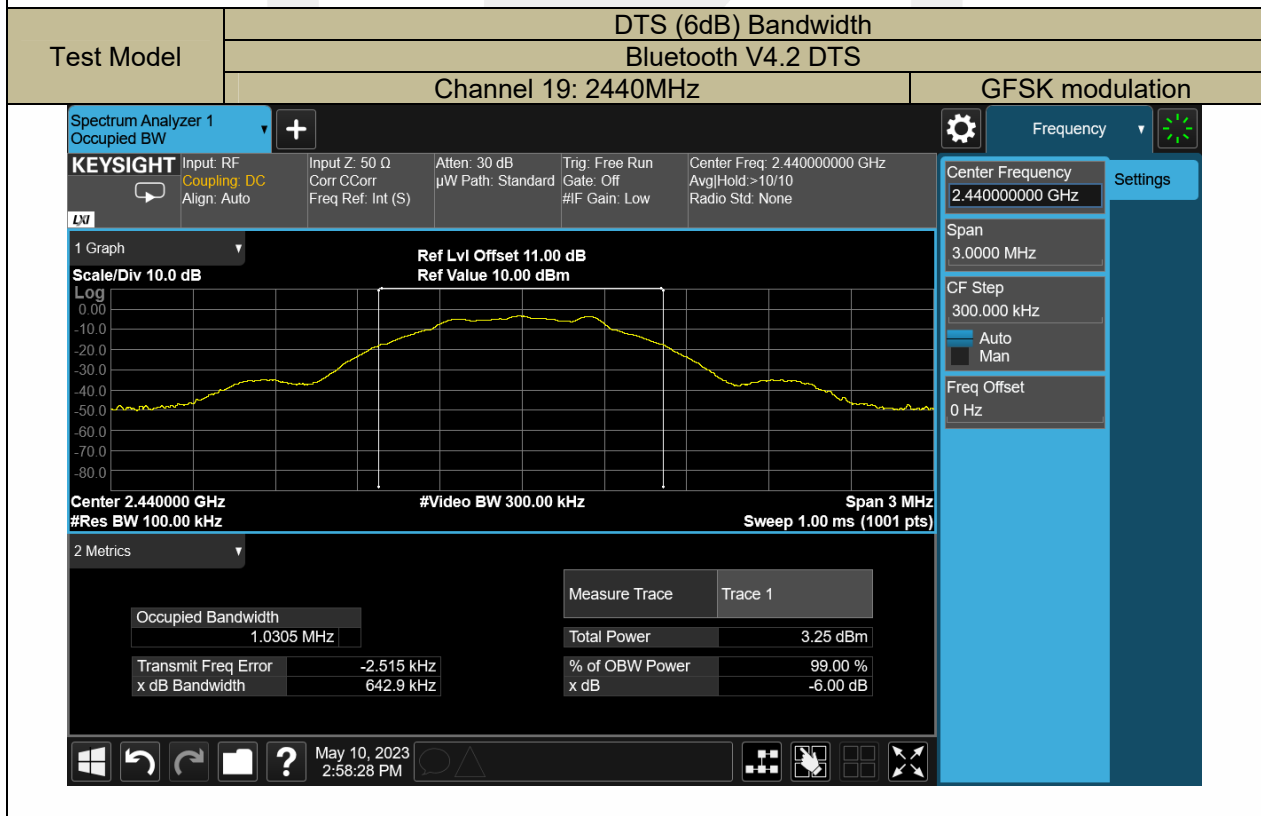
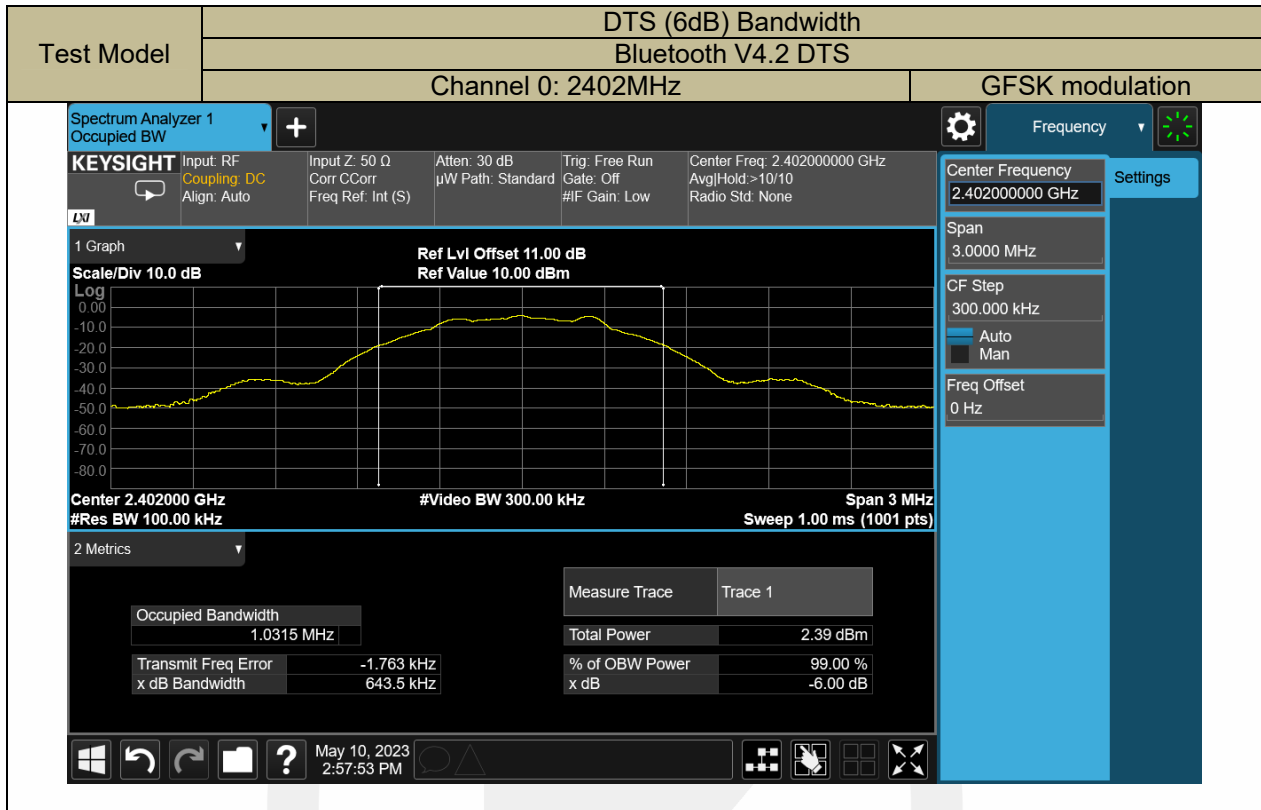
Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

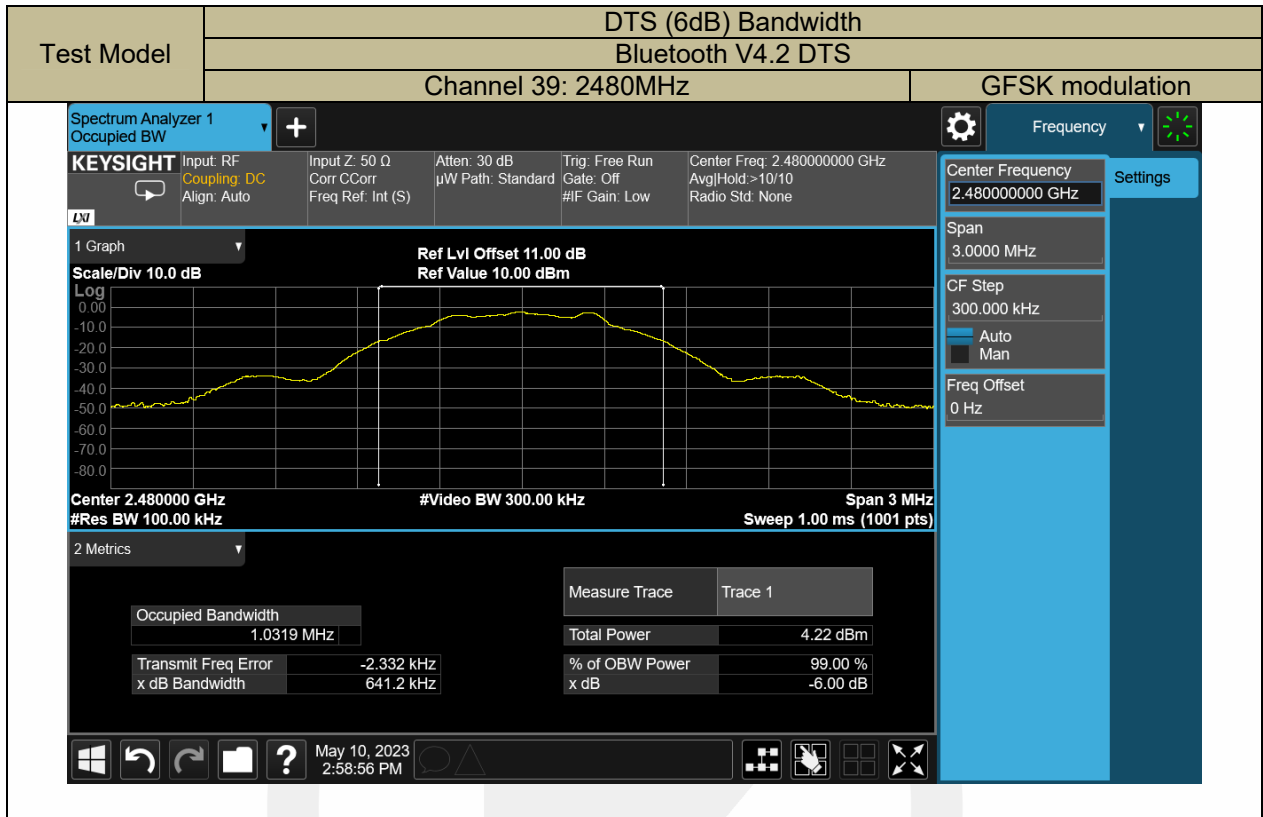
Measure and record the results in the test report.

#### Test Results

Temperature:	22° C
Relative Humidity:	60%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (kHz)	Limit (kHz)	Verdict
BLE 1M	0	2402	643.5	>500	PASS
	19	2440	642.9	>500	PASS
	39	2480	641.2	>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 Part 15.247(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 power 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  $\cong$  DTS bandwidth (about 1MHz).

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

Set the span  $\cong$  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.

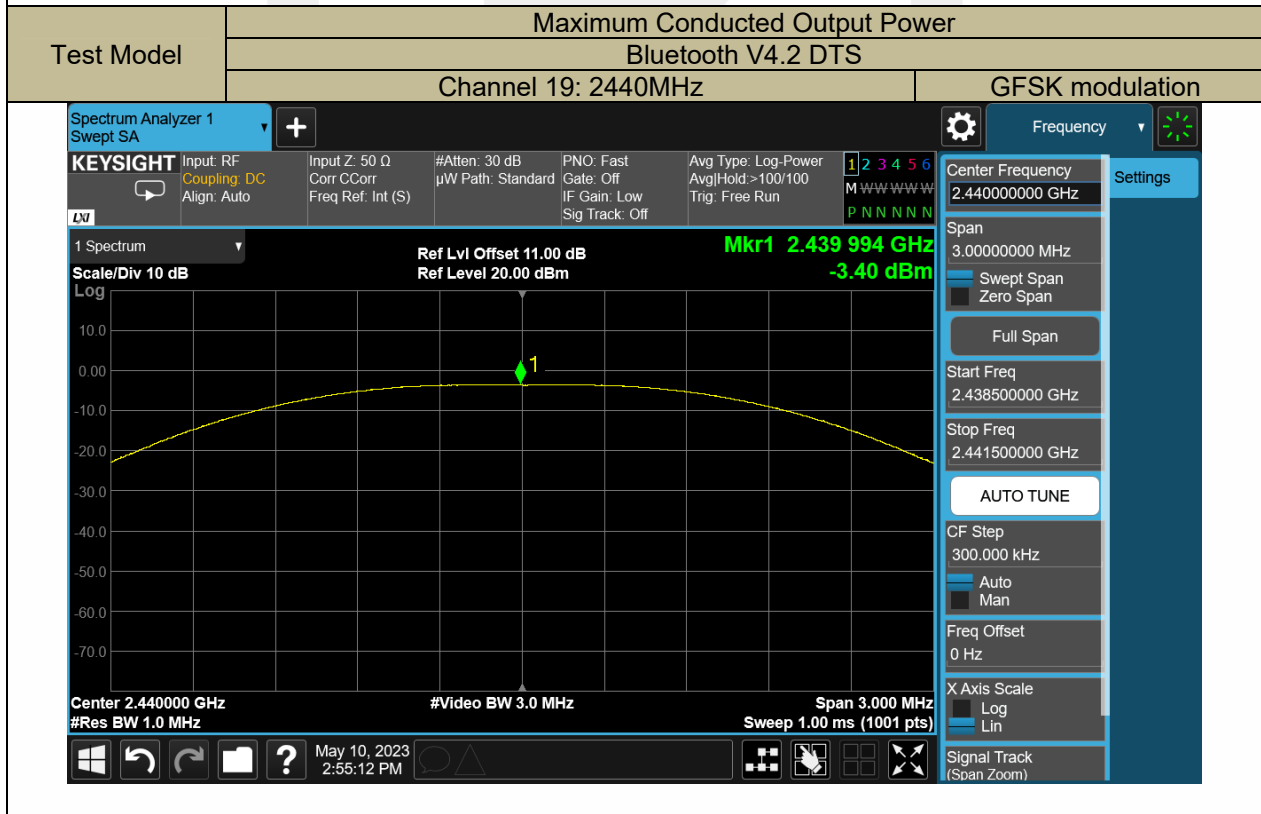
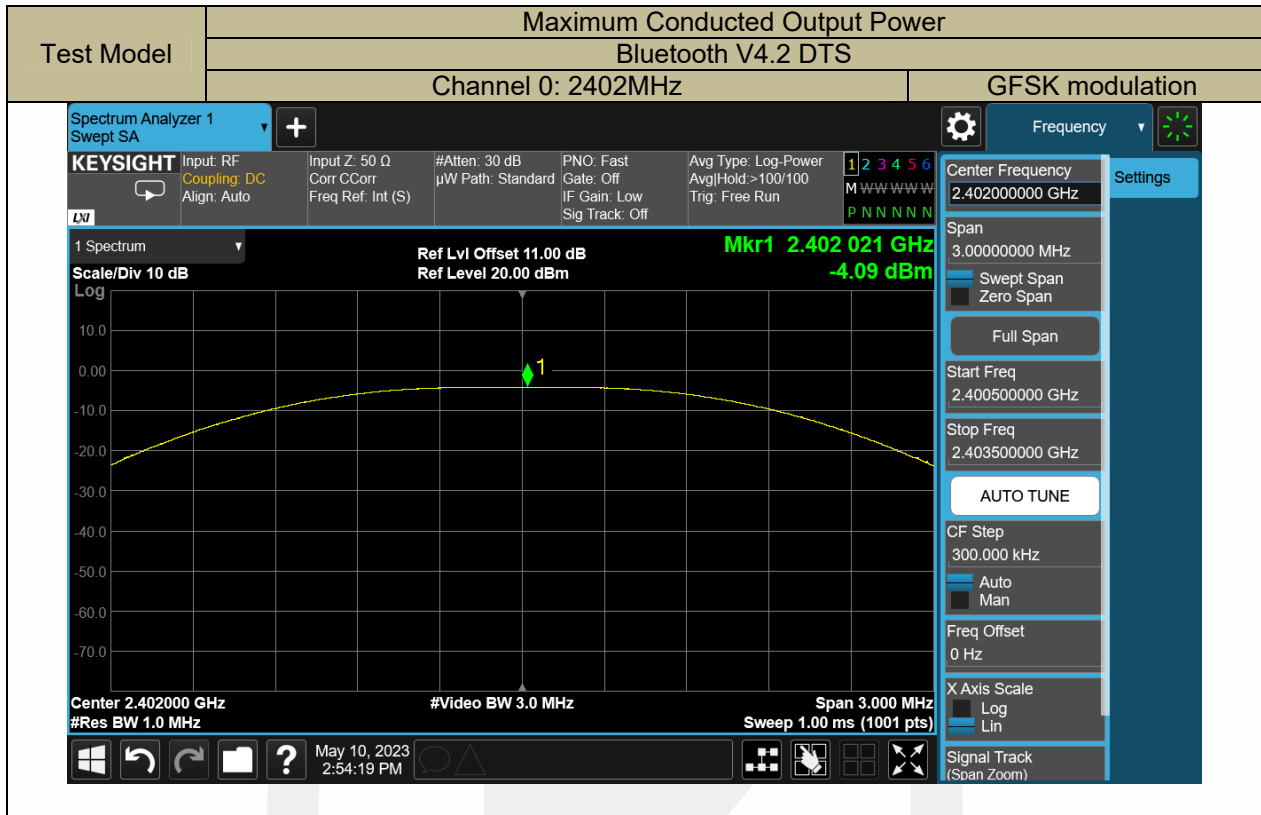
■ According to FCC Part 15.247(b)(4):

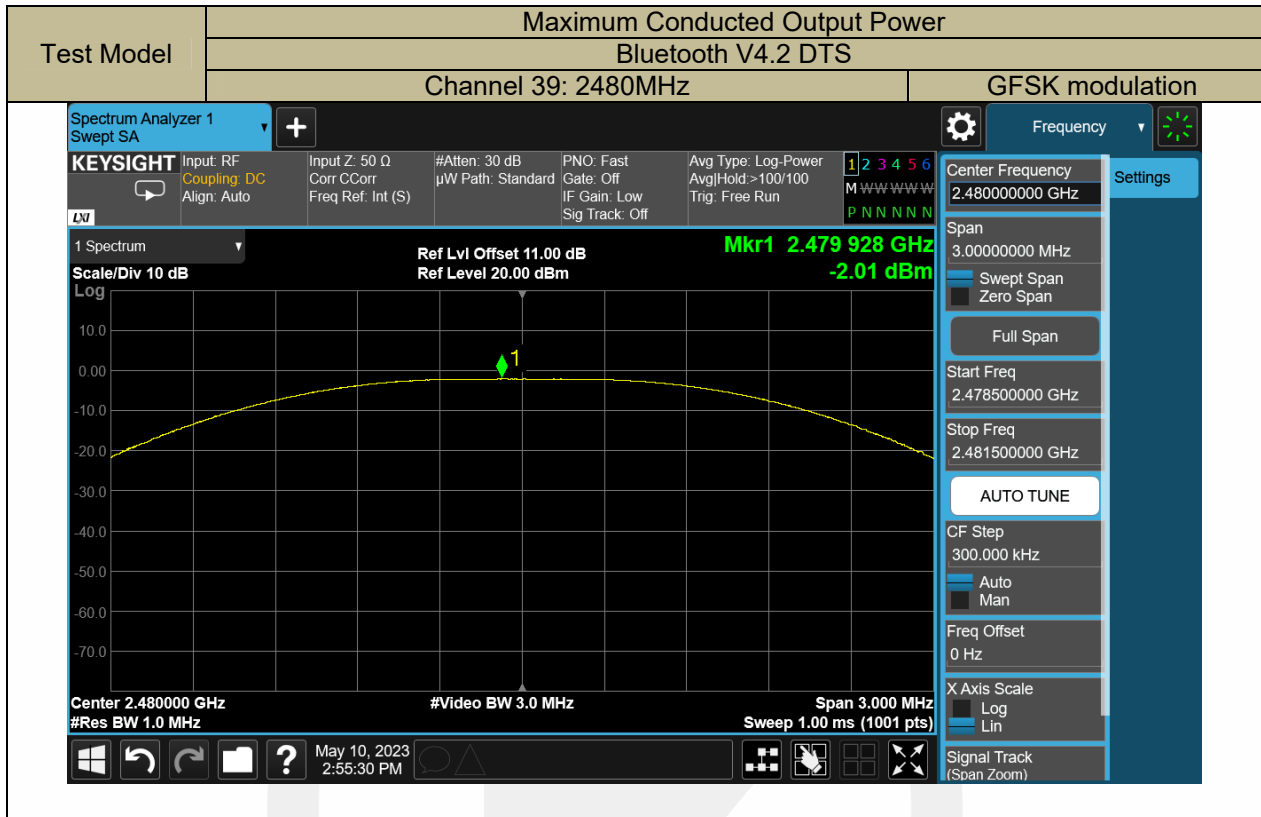
Conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced 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:	22° C
Relative Humidity:	60%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm)	Limit (dBm)	Verdict
BLE 1M	0	2402	-4.09	30	PASS
	19	2440	-3.40	30	PASS
	39	2480	-2.01	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.

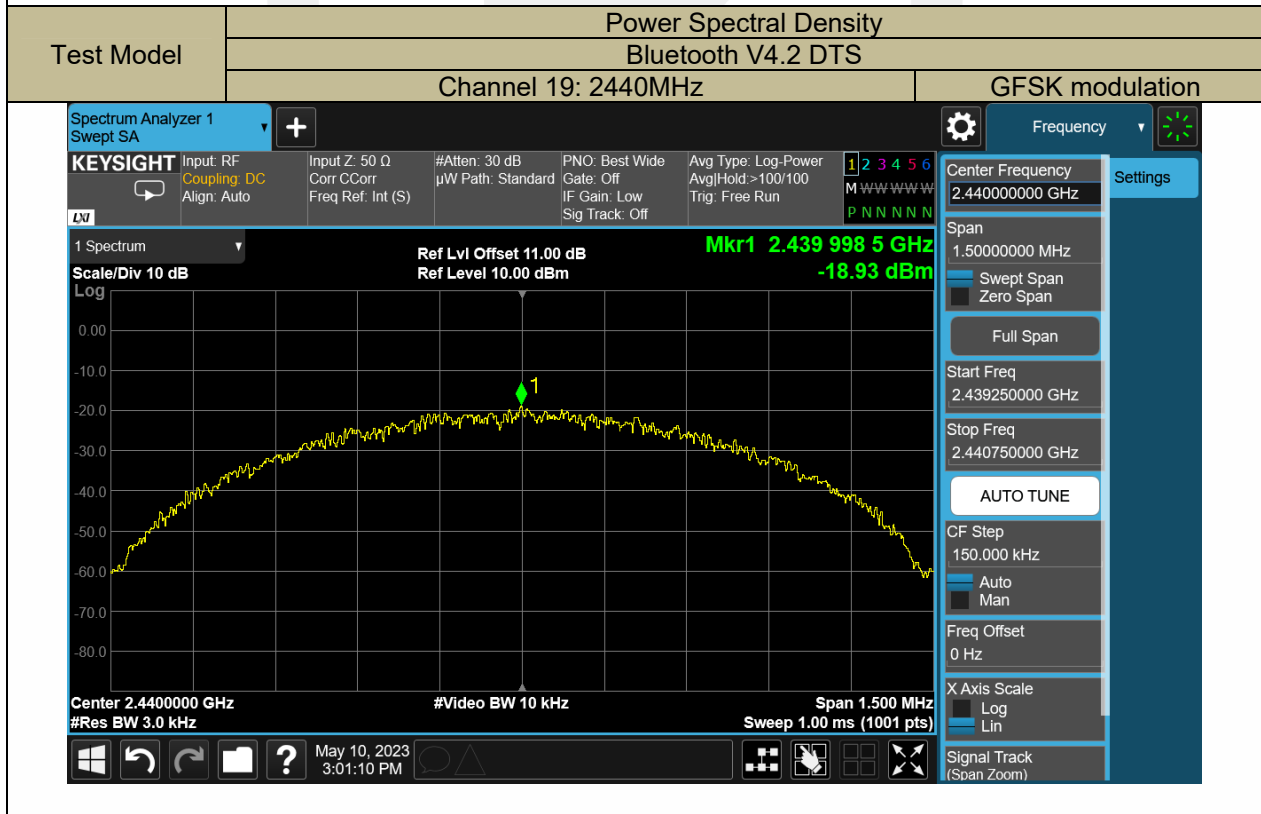
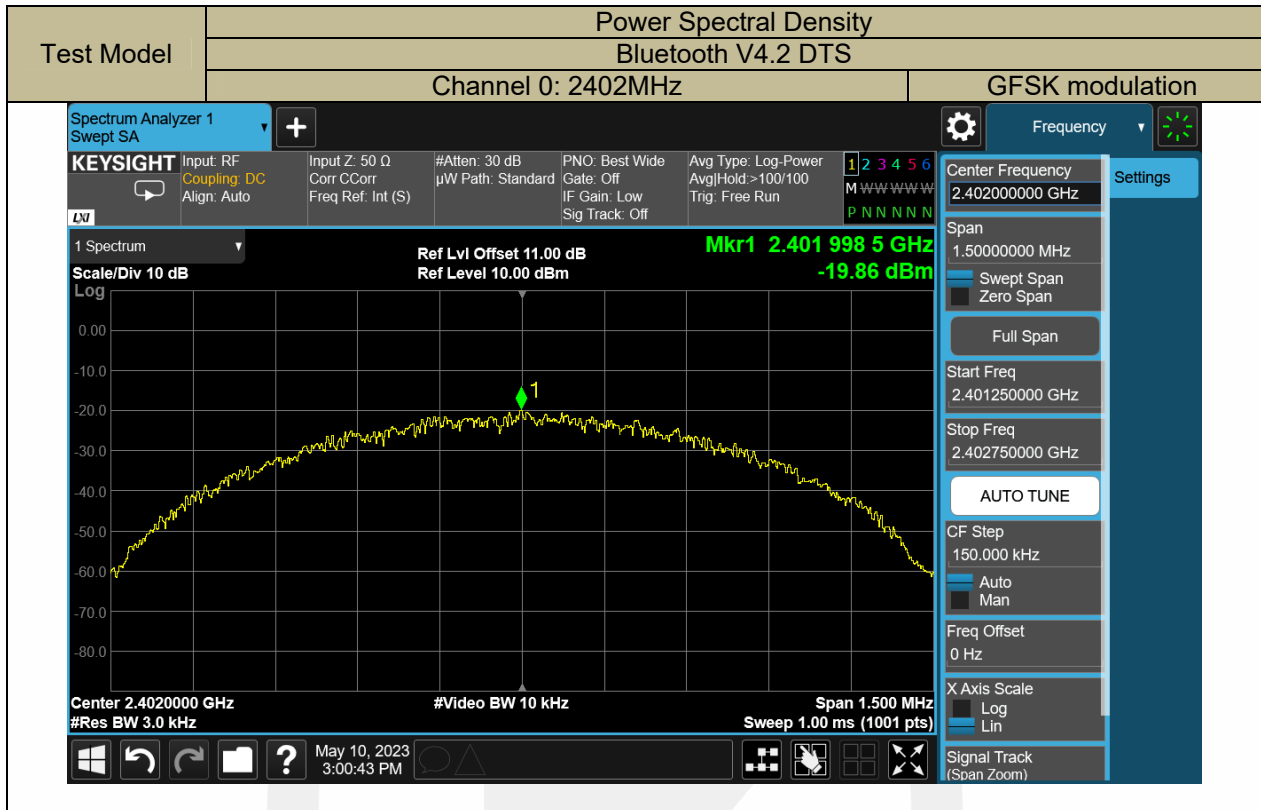
Allow trace to fully stabilize.

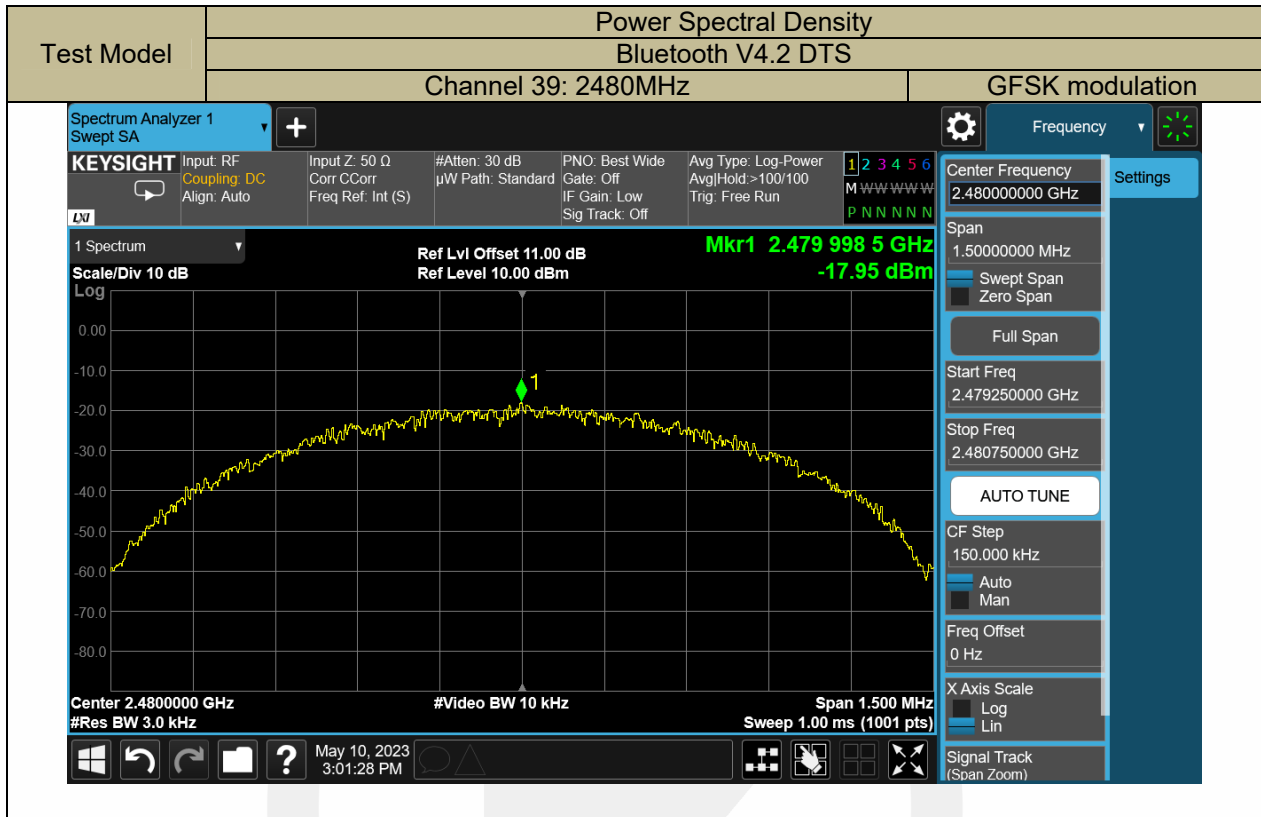
Use the peak marker function to determine the maximum amplitude level within the RBW.

#### 8.3.5 Test Results

Temperature:	22° C
Relative Humidity:	60%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
BLE 1M	0	2402	-19.86	<8	PASS
	19	2440	-18.93	<8	PASS
	39	2480	-17.95	<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  $\geq 3 \times$  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.

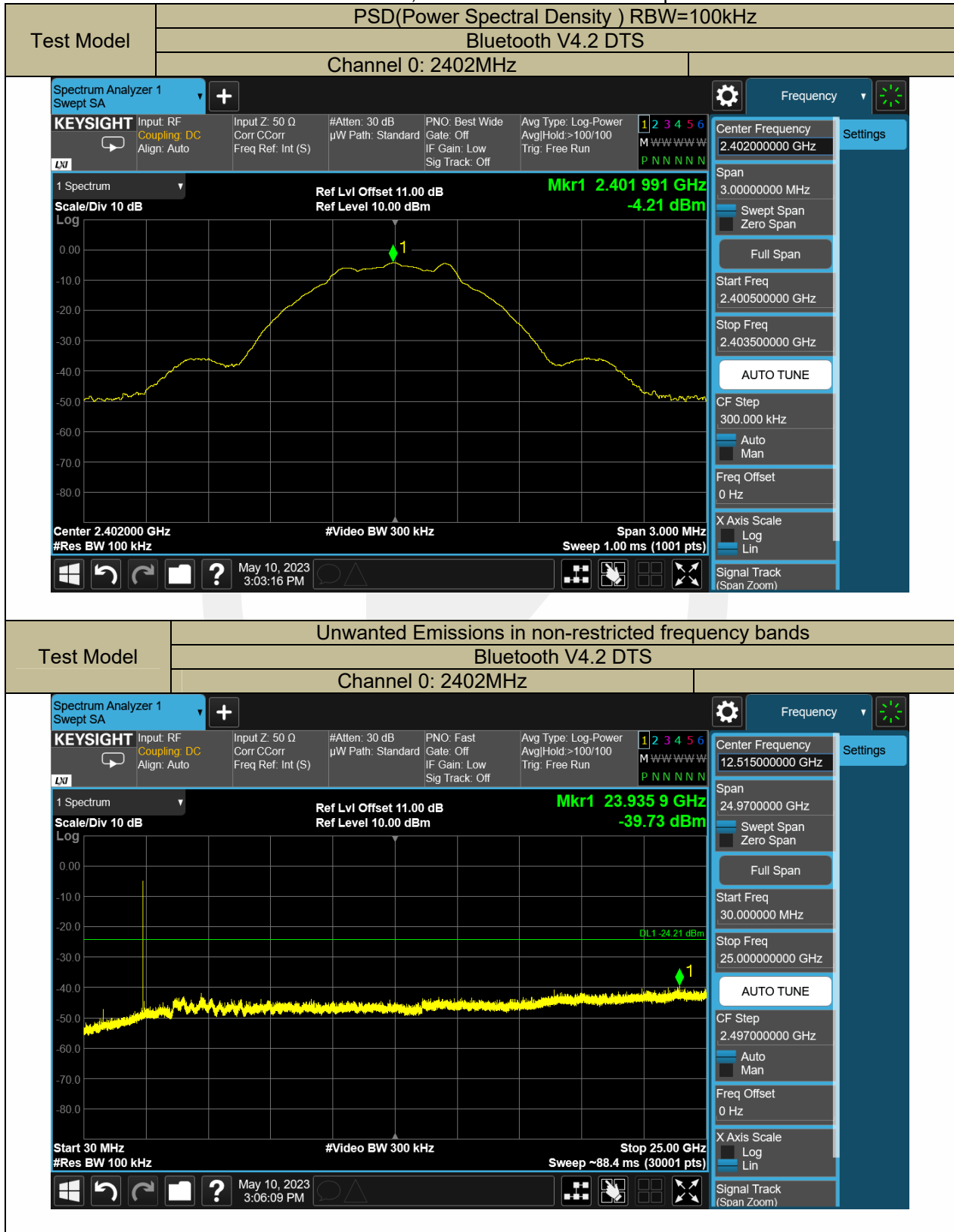
Use the peak marker function to determine the maximum amplitude level.

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.

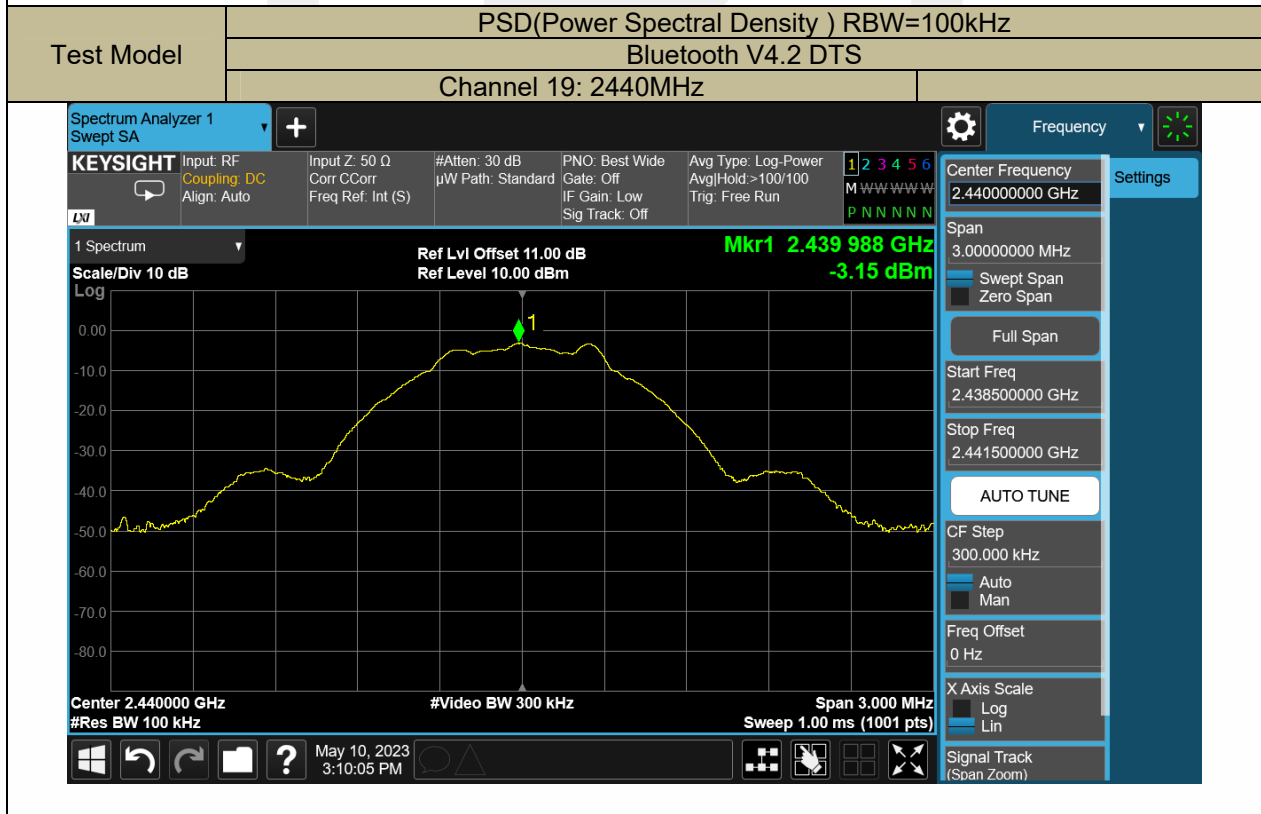
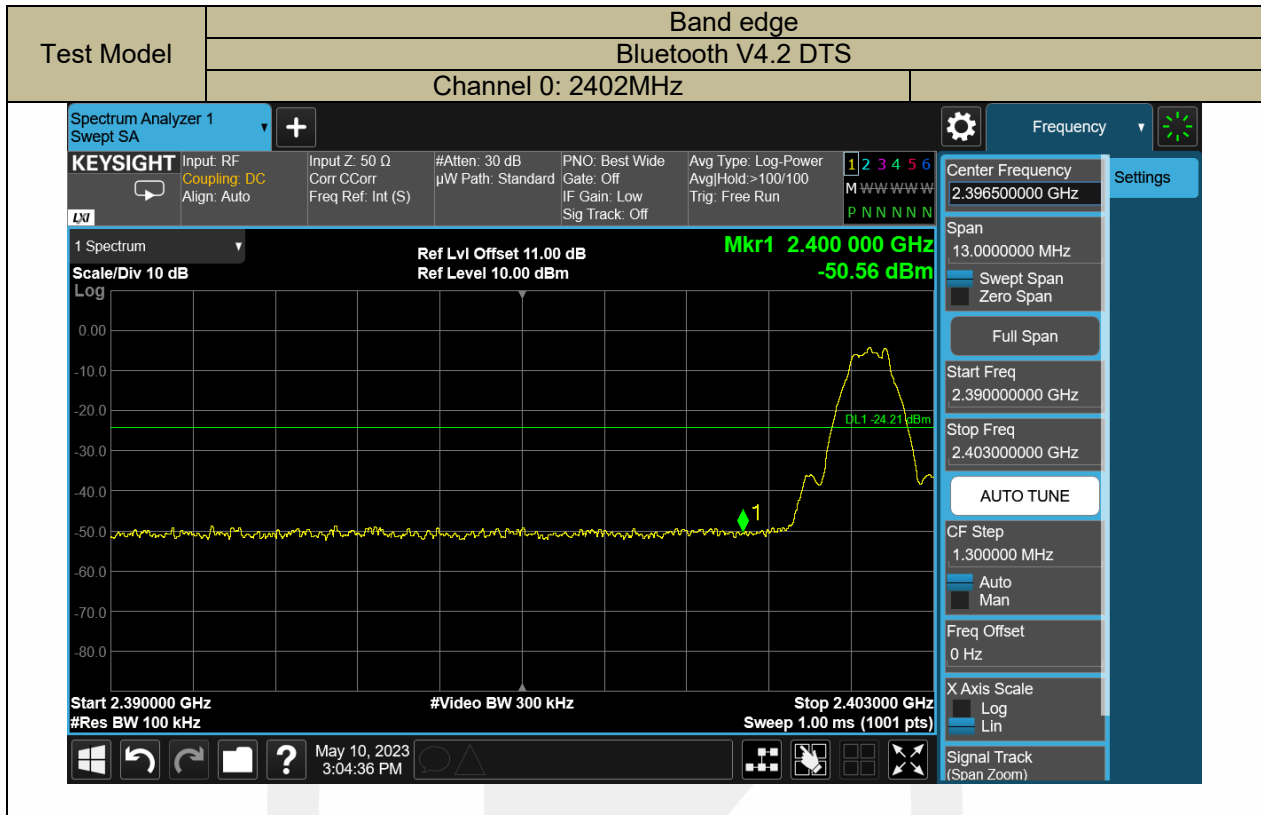
### 8.4.5 Test Results

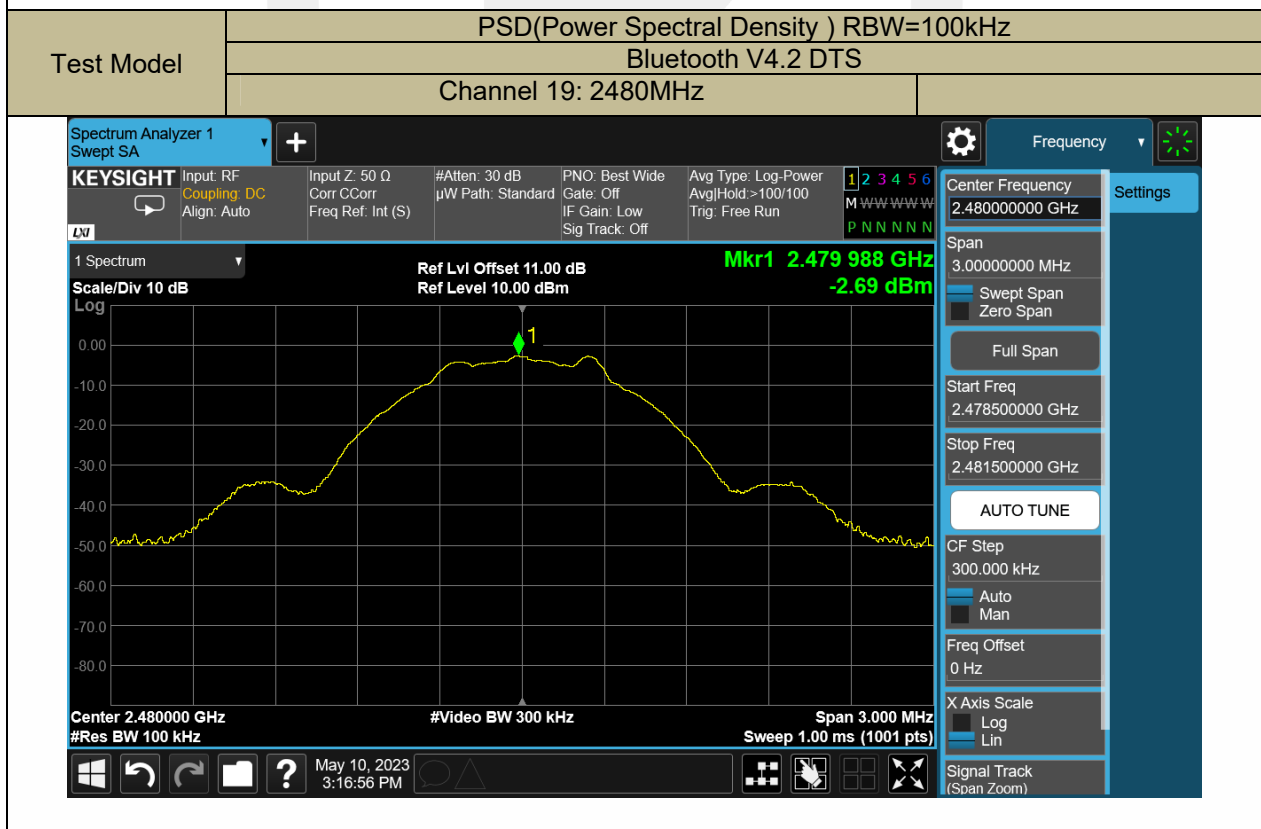
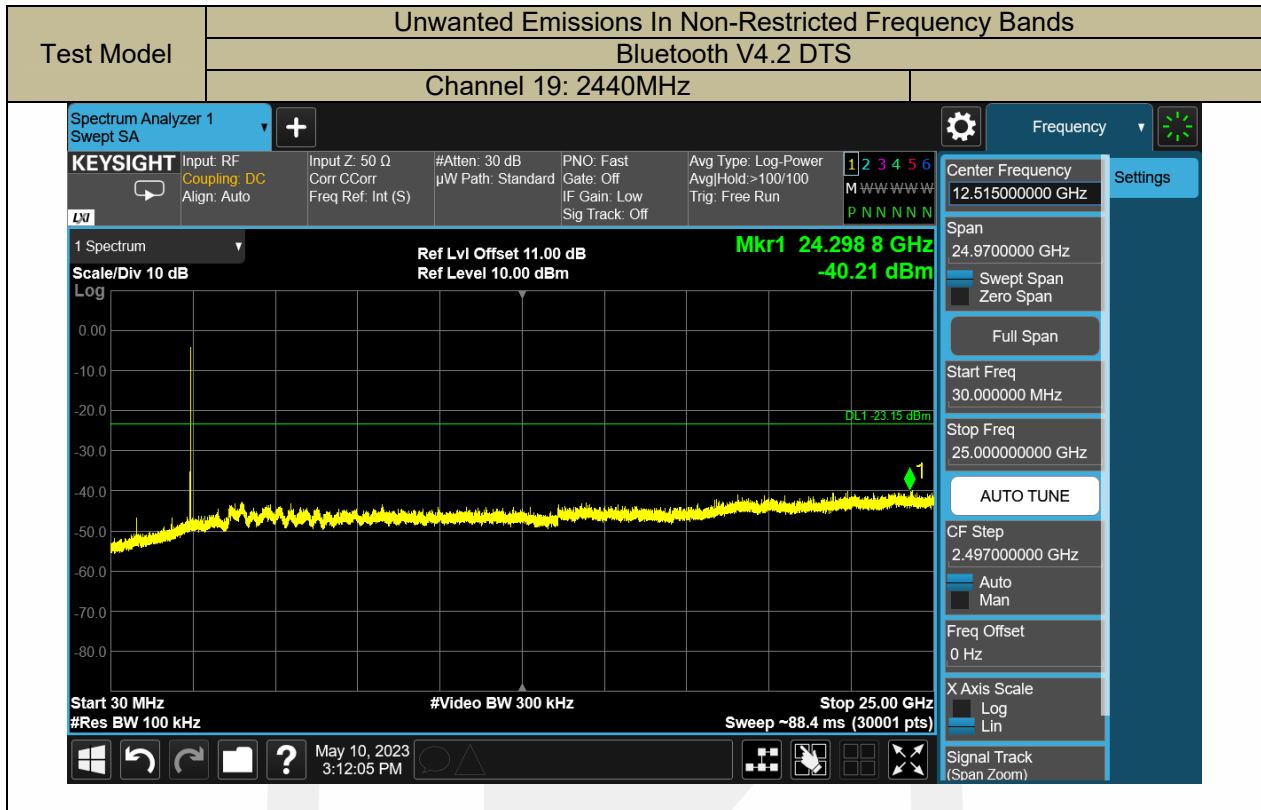
Temperature:	22° C
Relative Humidity:	60%
ATM Pressure:	1011 mbar

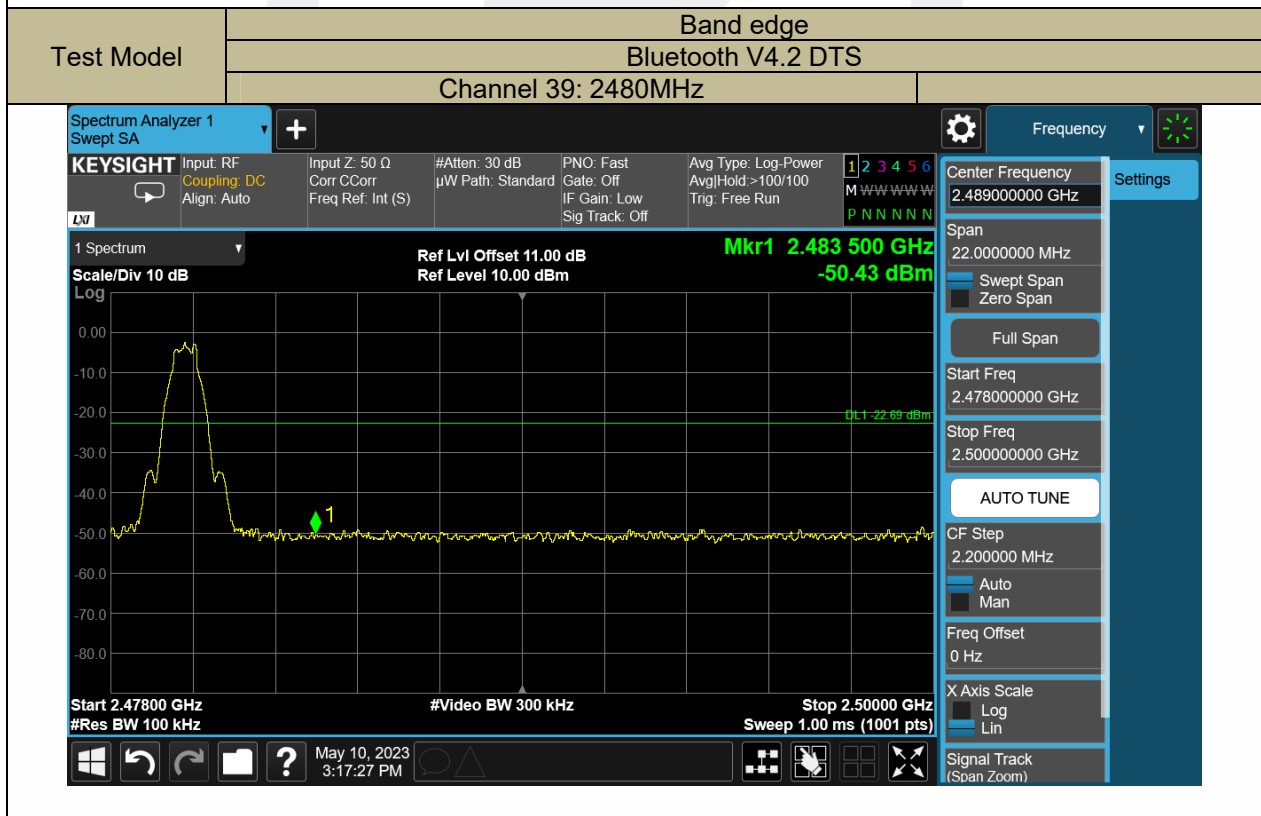
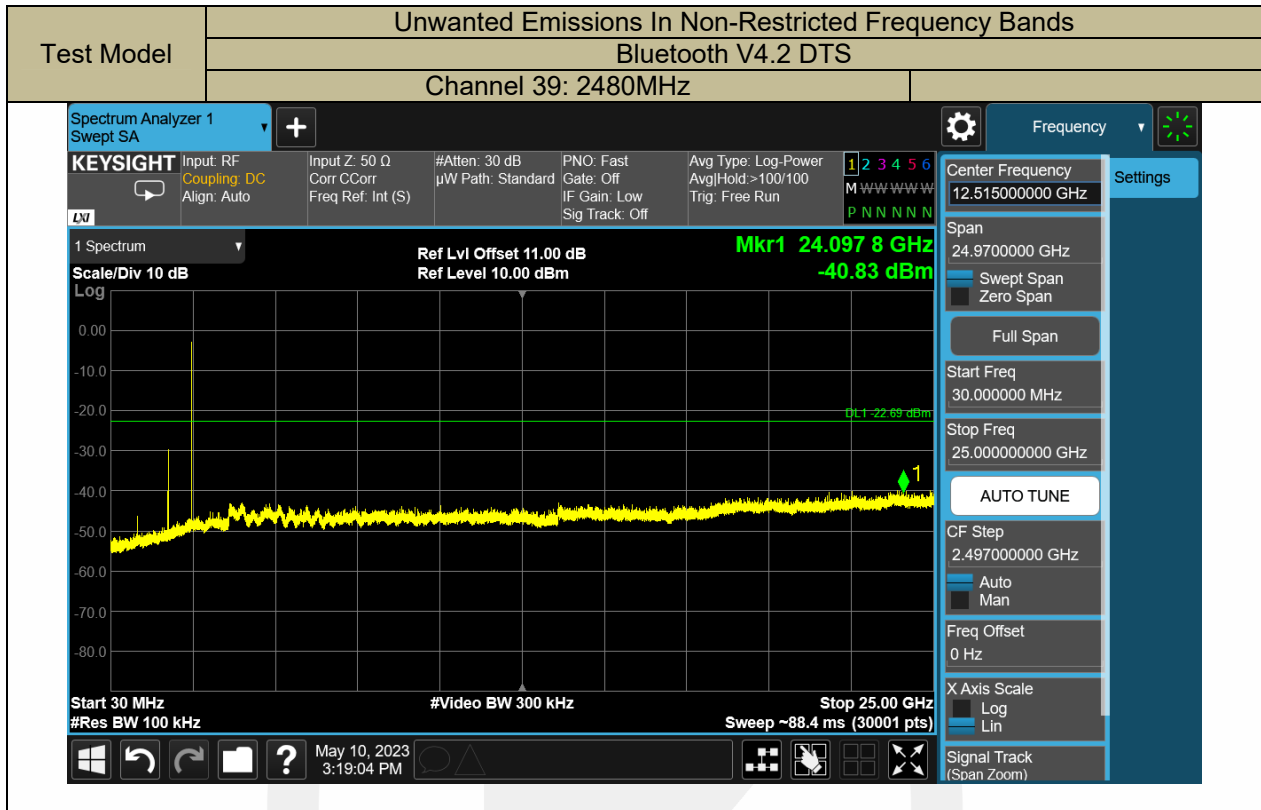
Bluetooth V4.2 DTS mode have been tested, and the worst result was report as below:











## 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 Part 15.205, 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 Part 15.209, 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  $f \geq 1$  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  $20\log(\text{dwell time}/100 \text{ ms})$ , 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:	22° C
Relative Humidity:	60%
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 =  $40\log(\text{Specific distance}/ \text{test distance})( \text{dB})$ ;

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

■ Spurious Emission Above 1GHz (1GHz to 25GHz)

Bluetooth V4.2 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
4804.00	V	42.29	28.77	74.00	54.00	-31.71	-25.23
7206.00	V	43.73	30.52	74.00	54.00	-30.27	-23.48
17972.00	V	57.23	45.85	74.00	54.00	-16.77	-8.15
4804.00	H	40.05	28.14	74.00	54.00	-33.95	-25.86
7206.00	H	42.68	29.66	74.00	54.00	-31.32	-24.34
17984.00	H	57.24	44.58	74.00	54.00	-16.76	-9.42

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
4880.00	V	38.54	22.49	74.00	54.00	-35.46	-31.51
7320.00	V	43.94	29.81	74.00	54.00	-30.06	-24.19
17969.50	V	57.20	45.08	74.00	54.00	-16.80	-8.92
4880.00	H	37.36	21.02	74.00	54.00	-36.64	-32.98
7320.00	H	43.20	30.57	74.00	54.00	-30.80	-23.43
17991.00	H	57.20	43.11	74.00	54.00	-16.80	-10.89

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
4960.00	V	45.15	29.35	74.00	54.00	-28.85	-24.65
7440.00	V	41.90	25.41	74.00	54.00	-32.10	-28.59
17997.00	V	56.62	40.07	74.00	54.00	-17.38	-13.93
4960.00	H	38.44	22.57	74.00	54.00	-35.56	-31.43
7440.00	H	42.51	29.66	74.00	54.00	-31.49	-24.34
17973.50	H	56.84	41.02	74.00	54.00	-17.16	-12.98

- 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

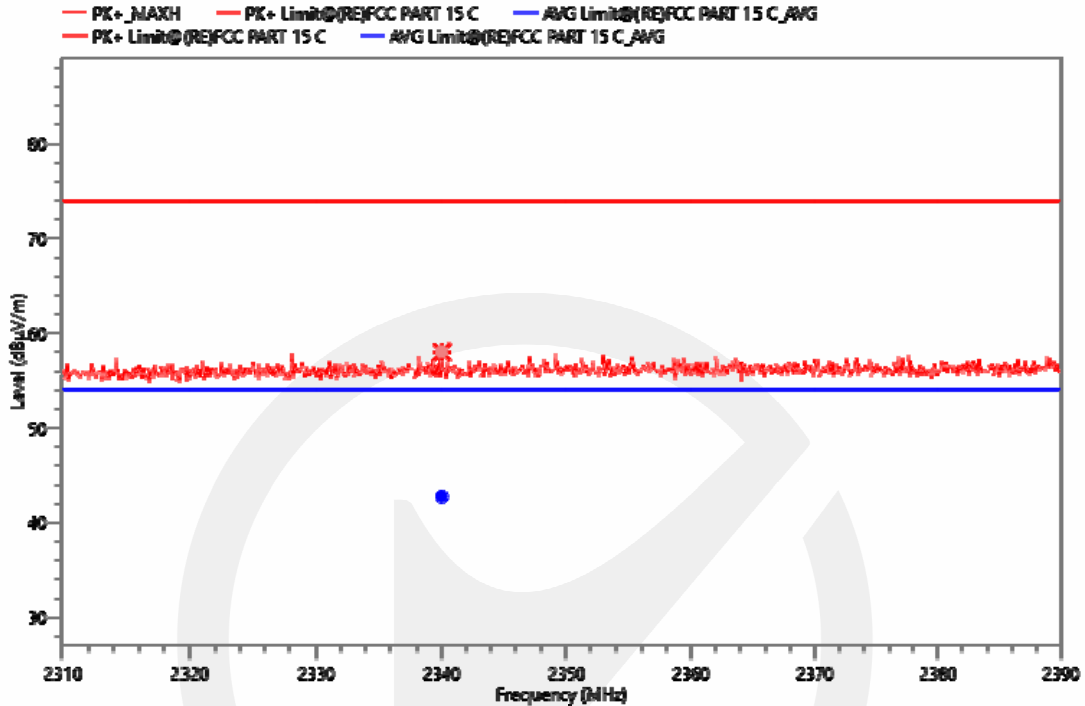
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2340.00	H	58.01	74.00	42.75	54.00
2380.52	V	58.60	74.00	42.51	54.00

Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2495.22	H	58.92	74.00	42.18	54.00
2487.53	V	58.79	74.00	44.24	54.00

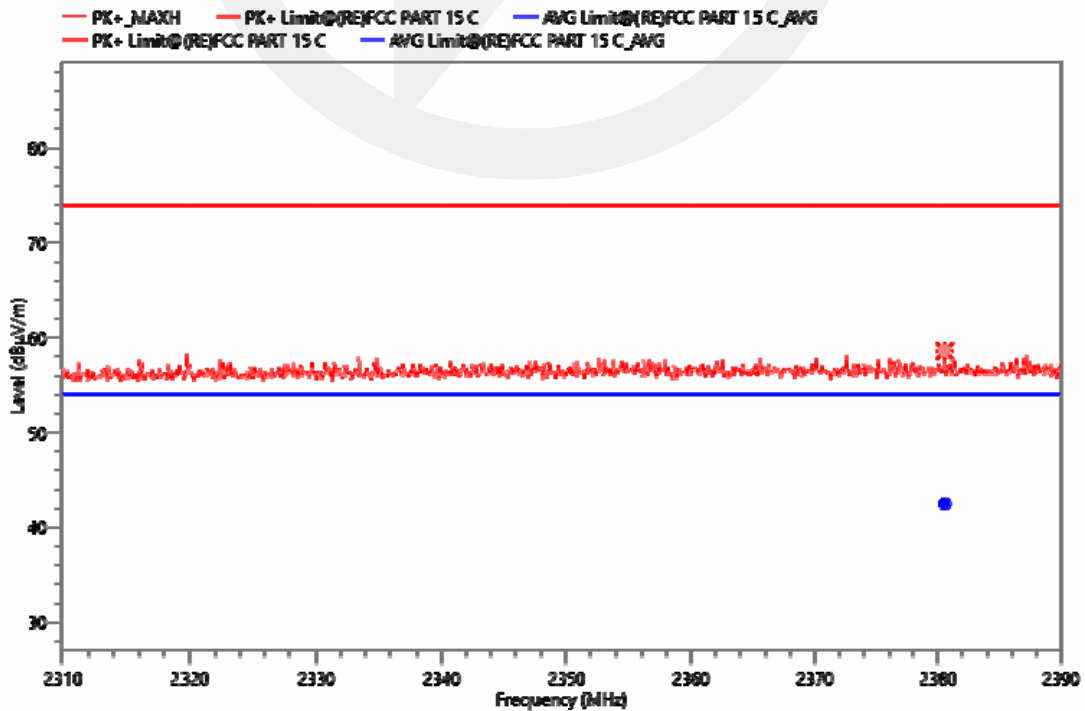
- Note:**
- (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
  - (2) Emission Level= Reading Level+Correct Factor +Cable Loss.
  - (3) Correct Factor= Ant\_F + Cab\_L - Preamp
  - (4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field 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 V4.2 DTS Channel 0: 2402MHz		H
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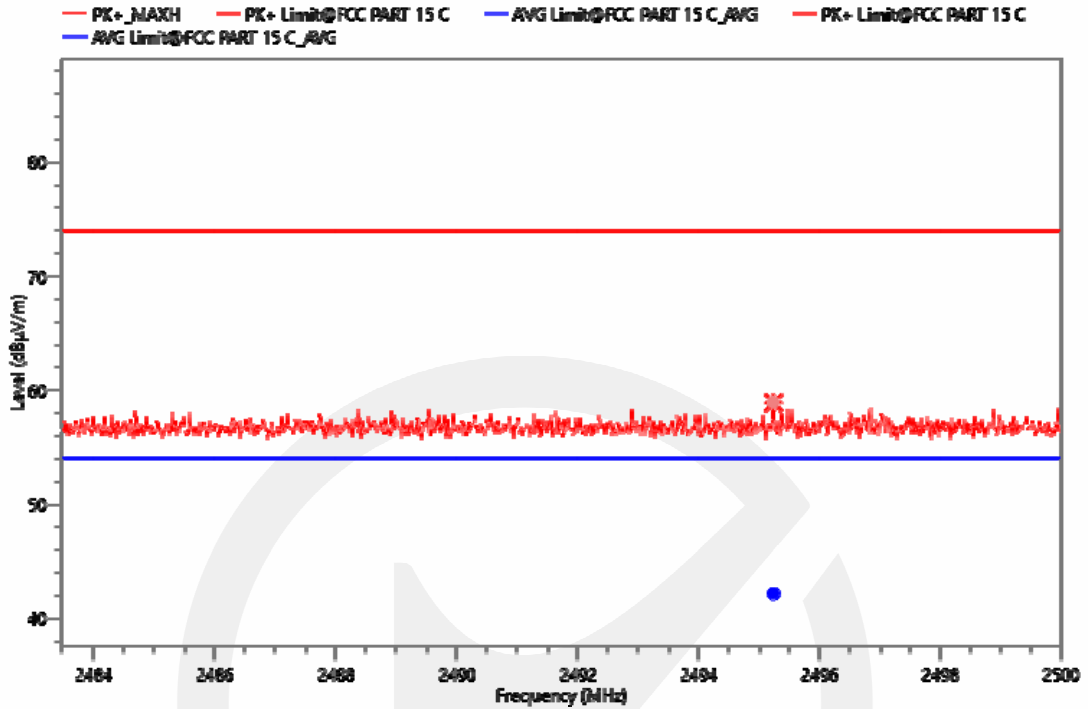


Test Model	Spurious Emission in Restricted Band 2310-2390MHz Bluetooth V4.2 DTS Channel 0: 2402MHz		V
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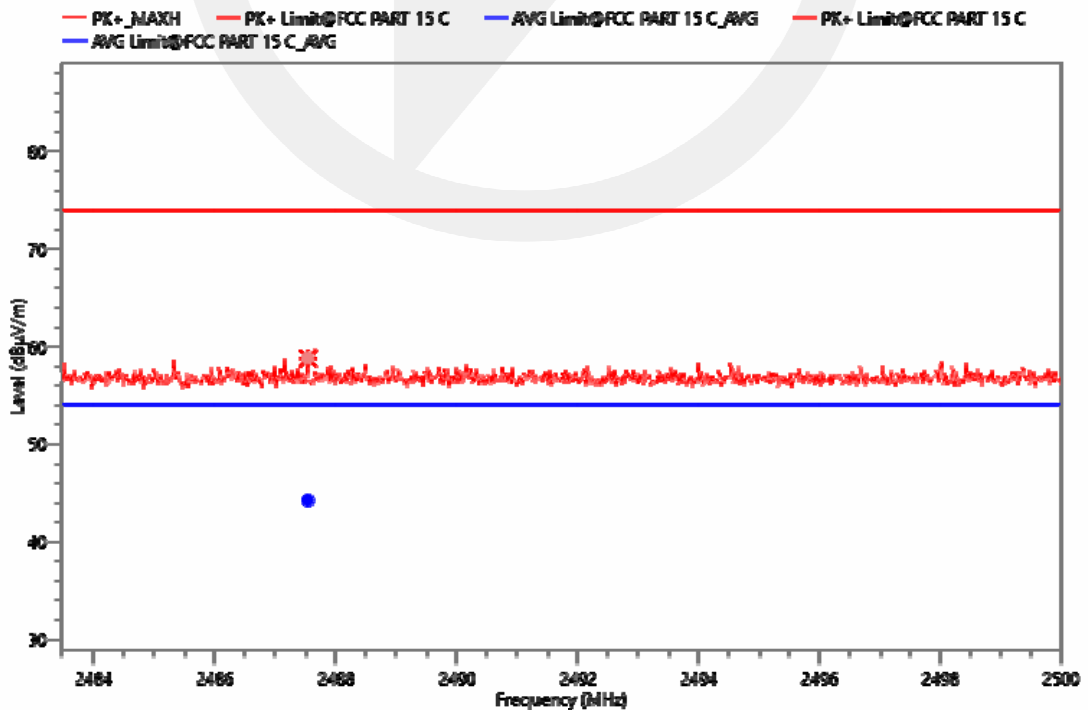




Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz Bluetooth V4.2 DTS	
	Channel 39: 2480MHz	H



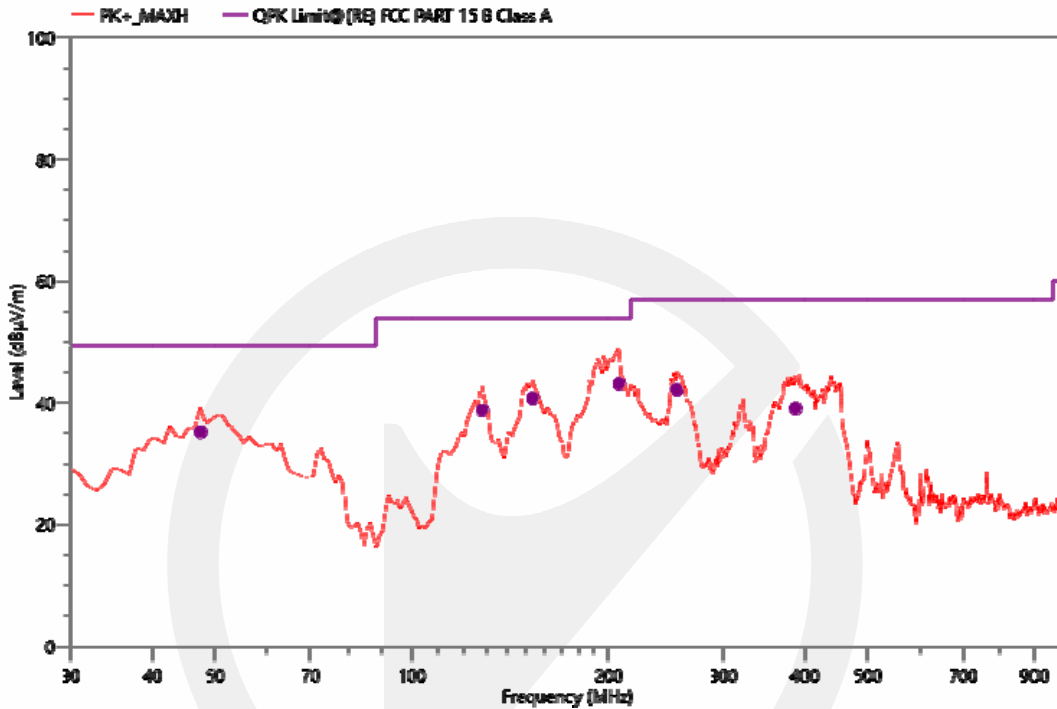
Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz Bluetooth V4.2 DTS	
	Channel 39: 2480MHz	V



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

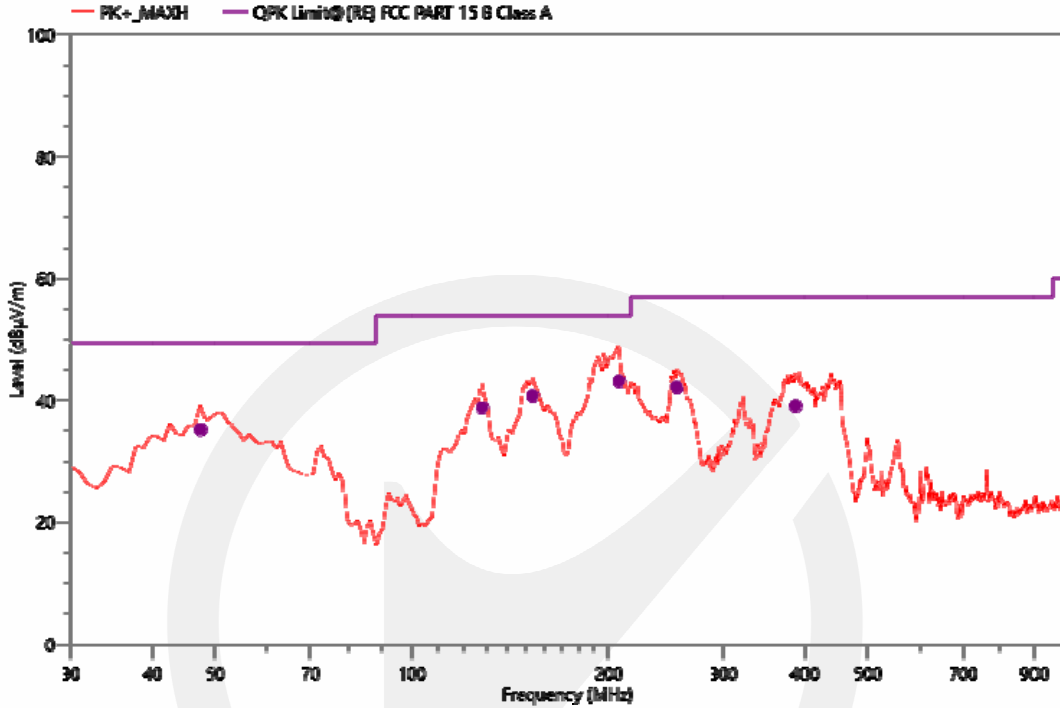
All modes have been tested, and the worst result recorded was report as below:

Project Information			
Mode:	TX 2402MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 21°C; Humi:70%	Engineer:	Arthur Chen



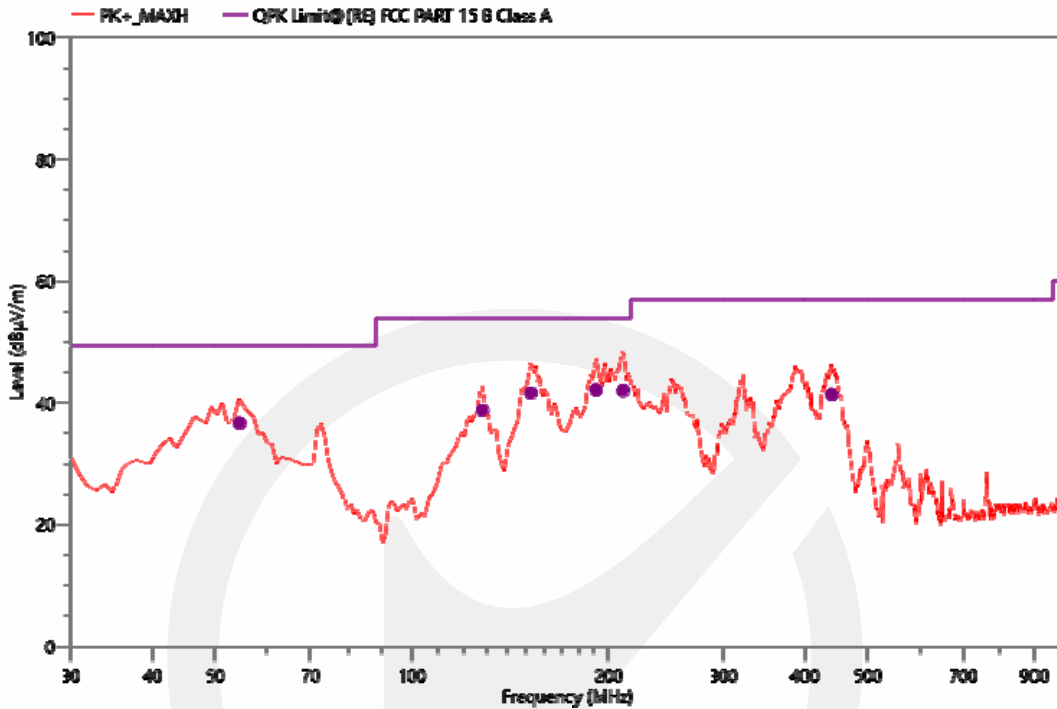
Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Verdict
47.460	62.92	35.21	49.50	14.29	QPK	100	V	288.0	-27.71	PASS
127.970	71.83	38.79	54.00	15.21	QPK	200	V	93.3	-33.04	PASS
153.190	74.42	40.76	54.00	13.24	QPK	100	V	173.7	-33.66	PASS
207.510	74.32	43.15	54.00	10.85	QPK	100	V	0	-31.17	PASS
255.040	71.65	42.18	56.90	14.72	QPK	100	V	301.7	-29.47	PASS
387.930	65.13	39.10	56.90	17.80	QPK	100	V	217.8	-26.03	PASS

Project Information			
Mode:	TX 2402MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 21°C; Humi:70%	Engineer:	Arthur Chen



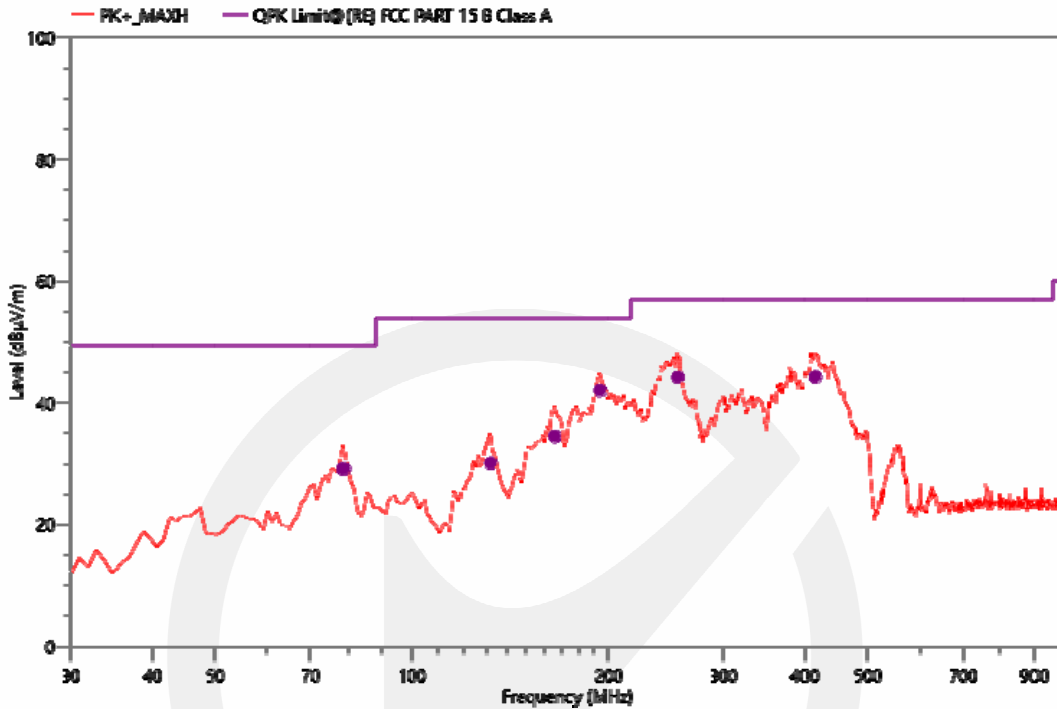
Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Verdict
77.530	60.36	26.88	49.50	22.62	QPK	200	H	359.1	-33.48	PASS
127.970	65.08	32.04	54.00	21.96	QPK	200	H	34.1	-33.04	PASS
194.900	71.31	39.83	54.00	14.17	QPK	100	H	198.5	-31.48	PASS
256.010	74.69	45.24	56.90	11.66	QPK	100	H	6.3	-29.45	PASS
418.000	66.29	41.24	56.90	15.66	QPK	100	H	203.3	-25.05	PASS
551.860	55.29	32.78	56.90	24.12	QPK	200	H	0.0	-22.51	PASS

Project Information			
Mode:	TX 2440MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 21°C; Humi:70%	Engineer:	Arthur Chen



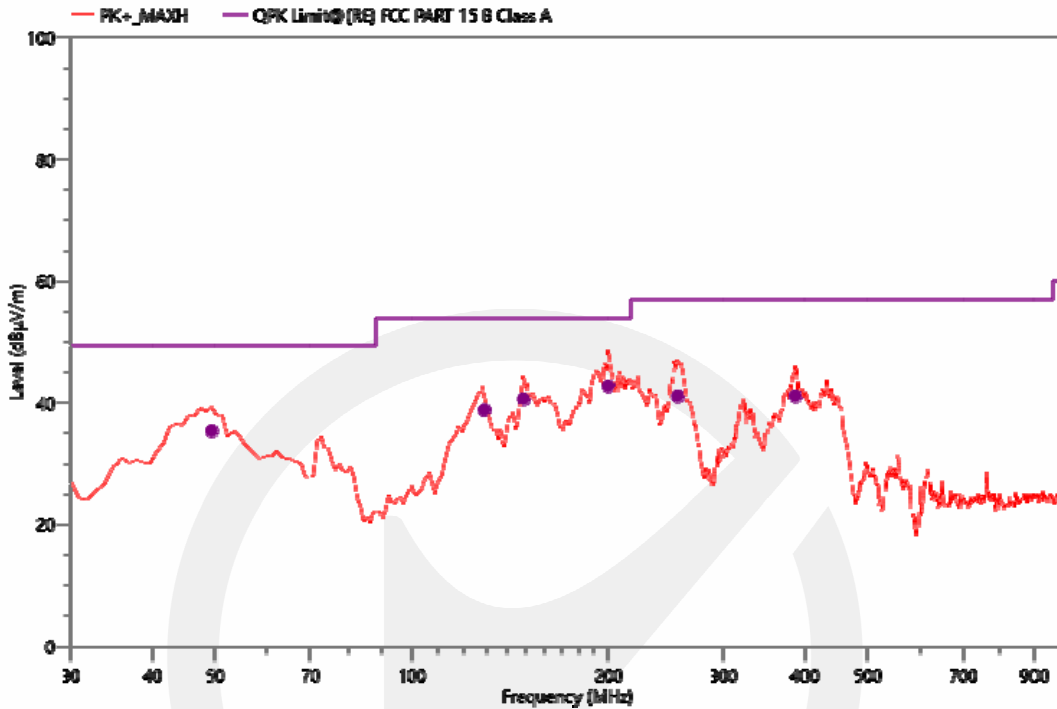
Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Verdict
54.250	65.05	36.70	49.50	12.80	QPK	100	V	286.8	-28.35	PASS
127.970	71.83	38.79	54.00	15.21	QPK	100	V	93.3	-33.04	PASS
152.220	75.33	41.63	54.00	12.37	QPK	100	V	186.2	-33.7	PASS
191.020	73.78	42.17	54.00	11.83	QPK	100	V	28.5	-31.61	PASS
210.420	73.14	42.03	54.00	11.97	QPK	100	V	0	-31.11	PASS
439.340	66.01	41.40	56.90	15.50	QPK	100	V	166.6	-24.61	PASS

Project Information			
Mode:	TX 2440MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 21°C; Humi:70%	Engineer:	Arthur Chen



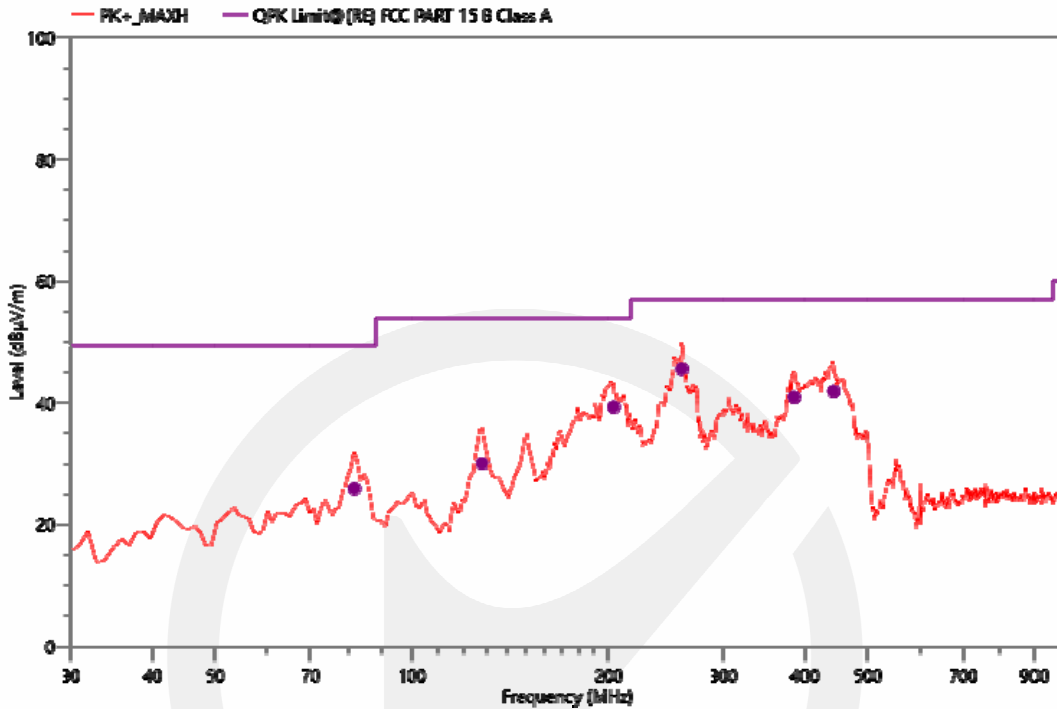
Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Verdict
78.500	62.85	29.19	49.50	20.31	QPK	200	H	0.0	-33.66	PASS
131.850	63.49	30.09	54.00	23.91	QPK	200	H	236.5	-33.4	PASS
165.800	67.71	34.50	54.00	19.50	QPK	200	H	6.7	-33.21	PASS
193.930	73.58	42.07	54.00	11.93	QPK	100	H	205.7	-31.51	PASS
256.010	73.69	44.24	56.90	12.66	QPK	100	H	6.3	-29.45	PASS
414.120	69.41	44.29	56.90	12.61	QPK	100	H	203.3	-25.12	PASS

Project Information			
Mode:	TX 2480MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 21°C; Humi:70%	Engineer:	Arthur Chen



Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Verdict
49.400	63.10	35.38	49.50	14.12	QPK	100	V	342.2	-27.72	PASS
128.940	72.04	38.84	54.00	15.16	QPK	100	V	93.3	-33.2	PASS
148.340	74.38	40.63	54.00	13.37	QPK	100	V	360.0	-33.75	PASS
199.750	74.04	42.72	54.00	11.28	QPK	100	V	5.2	-31.32	PASS
256.010	70.54	41.09	56.90	15.81	QPK	100	V	279.1	-29.45	PASS
387.930	67.13	41.10	56.90	15.80	QPK	100	V	217.8	-26.03	PASS

Project Information			
Mode:	TX 2480MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 21°C; Humi:70%	Engineer:	Arthur Chen



Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Verdict
81.410	59.56	25.91	49.50	23.59	QPK	200	H	355.5	-33.65	PASS
127.970	63.08	30.04	54.00	23.96	QPK	200	H	34.1	-33.04	PASS
203.630	70.56	39.32	54.00	14.68	QPK	100	H	295.0	-31.24	PASS
259.890	74.89	45.54	56.90	11.36	QPK	100	H	250.3	-29.35	PASS
385.990	67.03	40.94	56.90	15.96	QPK	200	H	323.4	-26.09	PASS
442.250	66.52	41.91	56.90	14.99	QPK	200	H	306.7	-24.61	PASS