MEASUREMENT REPORT
FCC PART 15.247 Bluetooth-LE

Report No.: S20240806134301E02
Issue Date: 09-23-2024

Applicant:	Xi'an NovaStar Tech Co., Ltd
Address:	Building 2, NovaStar Tech Park, No. 1699, Yunshui 3rd Road, Xi'an, Shaanxi, China
FCC ID:	2AG8JTU40P
Product:	LED Playback Control Processor
Model No.:	TU40 Pro
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01v05r02
Result:	Pass
Item Receipt Date:	Mar. 20, 2023
Test Date:	Mar. 26, 2023~ Sep. 18, 2024

Compiled By: Stone Zhang. (Stone Zhang) Senior Test Engineer

Approved By: Line chen (Line Chen) Engineer Manager

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2014. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of Fangguang Inspection & Testing Co., Ltd. Wuxi Branch

The test report must not be used by the client to claim product certifications, approval, or endorsement by NVLAP, NIST or any agency of U.S. Government.

Revision History

Report No.	Version	Description	Issue Date
S20240806134301E02	Rev. 01	/	09-23-2024

CONTENTS

Description Page

§2.1033 General Information 5

1. INTRODUCTION 6

1.1. Scope 6
1.2. Fangguang Test Location 6

2. PRODUCT INFORMATION 7

2.1. Equipment Description 7
2.2. Product Specification Subjective to this Report 7
2.3. Operation Frequency / Channel List 7
2.4. Device Capabilities 8
2.5. Description of Test Software 8
2.6. Test Mode 8
2.7. Test Configuration 8
2.8. EMI Suppression Device(s)/Modifications 8
2.9. EUT Photo 8
2.10. Labeling Requirements 9
2.11. Calculation with all conversion and correction factors used 9

3. DESCRIPTION OF TEST 10

3.1. Evaluation Procedure 10
3.2. AC Line Conducted Emissions 10
3.3. Radiated Emissions 11

4. ANTENNA REQUIREMENTS 12

5. TEST EQUIPMENT CALIBRATION DATE 13

6. MEASUREMENT UNCERTAINTY 14

7. TEST RESULT 15

7.1. Summary 15
7.2. 6dB Bandwidth Measurement 16
7.2.1. Test Limit 16
7.2.2. Test Procedure used 16
7.2.3. Test Setting 16
7.2.4. Test Setup 16
7.2.5. Test Result 17
7.3. Output Power Measurement 21

7.3.1. Test Limit 21
7.3.2. Test Procedure Used 21
7.3.3. Test Setting 21
7.3.4. Test Setup 22
7.3.5. Test Result of Output Power 22
7.4. Power Spectral Density Measurement 26
7.4.1. Test Limit 26
7.4.2. Test Procedure Used 26
7.4.3. Test Setting 26
7.4.4. Test Setup 27
7.4.5. Test Result 28
7.5. Conducted Band Edge and Out-of-Band Emissions 32
7.5.1. Test Limit 32
7.5.2. Test Procedure Used 32
7.5.3. Test Settitng 32
7.5.4. Test Setup 32
7.5.5. Test Result 33
7.6. Radiated Spurious Emission Measurement 46
7.6.1. Test Limit 46
7.6.2. Test Procedure Used 46
7.6.3. Test Setting 46
7.6.4. Test Setup 48
7.6.5. Test Result 50
7.7. Radiated Restricted Band Edge Measurement 64
7.7.1. Test Limit 64
7.7.2. Test Procedure Used 67
7.7.3. Test Setting 67
7.7.4. Test Setup 68
7.7.5. Test Result 69
7.8. AC Conducted Emissions Measurement 77
7.8.1. Test Limit 77
7.8.2. Test Setup 77
7.8.3. Test Result 78
8. CONCLUSION 80

§2.1033 General Information

Applicant:	Xi'an NovaStar Tech Co., Ltd
Applicant Address:	Building 2, NovaStar Tech Park, No. 1699, Yunshui 3rd Road, Xi'an, Shaanxi, China
Manufacturer:	Xi'an NovaStar Tech Co., Ltd
Manufacturer Address:	Building 2, NovaStar Tech Park, No. 1699, Yunshui 3rd Road, Xi'an, Shaanxi, China
Test Site:	Fangguang Inspection & Testing Co., Ltd.
LAB ID:	CN5037
Test Site Address:	G9 Building, China Sensor Network International Innovation Park No.200, Linghu AvenueWuxi, Jiangsu 214000 China
FCC Rule Part(s):	Part 15 Subpart C (15.247)
FCC ID:	2AG8JTU40P
Test Device Serial No.:	S/N.:/ ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	Digital Transmission System (DTS)

1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2. Fangguang Test Location

These measurement tests were performed at the Fangguang Inspection and testing Co.,LTD located at 200 Linghu Avenue, Xinwu District, Wuxi City. The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014.

2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	LED Playback Control Processor
Model Name:	TU40 Pro
Additional Model:	TU40 Proxxxxxx
Model Description:	TU40 Pro ,TU40 Proxxxxxx（Where 'X' can be any alphanumeric character or blank for marketing purpose, and do not affect product safety and EMC）
Trade Mark:	/
Input Voltage Range:	AC 100~240V 50/60Hz, 2-0.8A
Bluetooth Version:	5.0

2.2. Product Specification Subjective to this Report

Bluetooth Frequency	BLE: 2402~2480MHz
Number of Channels	BLE: 40
Channel Spacing	2 MHz
Type of modulation	GFSK
Data Rate	1Mbps&2Mbps
Antenna Type:	Dipole Antenna
Antenna Gain:	2.27 dBi

2.3. Operation Frequency / Channel List

BLE:

Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2404 MHz	02	2406 MHz
03	2408 MHz	04	2410 MHz	05	2412 MHz
06	2414 MHz	07	2416 MHz	08	2418 MHz
09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz
15	2432 MHz	16	2434 MHz	17	2436 MHz
18	2438 MHz	19	2440 MHz	20	2442 MHz
21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz
27	2456 MHz	28	2458 MHz	29	2460 MHz

30	2462 MHz	31	2464 MHz	32	2466 MHz
33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz
39	2480 MHz	--	--	--	--

EUT was tested with Channel 0, 19 and 39.

2.4. Device Capabilities

This device contains the following capabilities: Bluetooth (5.0)

Note: The maximum achievable duty cycle was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW =8MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles of BLE_1M are 60.32%, The duty cycles of BLE_2M are 31.75%.

2.5. Description of Test Software

The test utility software used during testing was “Windows cmd.exe”, and the test software power level setting is Default.

2.6. Test Mode

Test Mode	Mode 1: Transmit by BLE_1M
	Mode 2: Transmit by BLE_2M

2.7. Test Configuration

The EUT was tested per the guidance of KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.8. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.9. EUT Photo

The EUT external photo, internal photo and test setup photo, please refer to the plots in the S20240806134301-A1/A2/A3.

2.10. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

2.11. Calculation with all conversion and correction factors used

For AC Line Conducted Emissions Test:

Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

For Radiated Emissions Below 1GHz Test:

Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

For Radiated Emissions Above 1GHz Test:

Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure…….....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. The turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-25GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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."

- Use a unique coupling to the intentional radiator**.**

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	FWXGJC-2016-181	1 year	2025/07/22
Two-Line V-Network	R&S	ENV 216	FWXGJC-2016-182	1 year	2025/07/23
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-387	1 year	2025/02/25

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Loop Antenna	Schwarzbeck	FMZB 1519B	FWXGJC-2018-015	1 year	2025/07/23
Bi-Log Antenna	R&S	HL562E	FWXGJC-2016-267-06	1 year	2025/03/02
Broadband Horn Antenna	R&S	HF907	FWXGJC-2016-267-07	1 year	2025/07/26
Broadband Horn Antenna	Schwarzbeck	BBHA9170	FWXGJC-2018-016	1 year	2025/07/26
EMI Receiver	R&S	ESR26	FWXGJC-2016-267-01	1 year	2025/07/26
Pre-Amplifier	R&S	SCU-18D	FWXGJC-2016-267-05	1 year	2025/07/23
Pre-Amplifier	R&S	EMC184055 SE	FWXGJC-2018-018	1 year	2025/07/23
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-389	1 year	2025/02/25
Anechoic Chamber	Aimuke	EMCCT-3	FWXGJC-2016-270	3 year	2026/04/05

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Keysight	N9010B	FWXGJC-2018-010	1 year	2025/03/02
RF Control Unit	Toncend	JS0806-2	FWXGJC-2018-013	1 year	2025/05/19
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-386	1 year	2025/02/25

Test Software	Manufacturer	Version	Asset No.	Function
EMI Test Software	tonscend	V3.3.10	/	/
JS32	tonscend	V5.0.0	/	/

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.05dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 30MHz-1GHz: 3.06dB 1GHz-12.75GHz: 4.13dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 30MHz-1GHz: 1.00 dB 1GHz-26.5GHz: 1.30 dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.60dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.80dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.20MHz

7. TEST RESULT

7.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 7.2
15.247(b)(3)	Output Power	≤ 30dBm		Pass	Section 7.3
15.247(e)	Power Spectral Density	≤ 8dBm/3kHz		Pass	Section 7.4
15.247(d)	Band Edge	≥ 20dBc		Pass	Section 7.5
15.247(d)	Out-of-Band Emissions	≥ 20dBc		Pass	Section 7.6
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS GEN [8.9])	Radiated	Pass	Section 7.7
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits (RSS GEN [8.8])	Line Conducted	Pass	Section 7.8

Notes:

1) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
4) As the RF part is the same as the original project TU20 Pro, all conducted test data comes from the original report S20230316528501E05-G1.

7.2. 6dB Bandwidth Measurement

7.2.1. Test Limit

The minimum permissible 6dB bandwidth is 500 kHz.

7.2.2. Test Procedure used

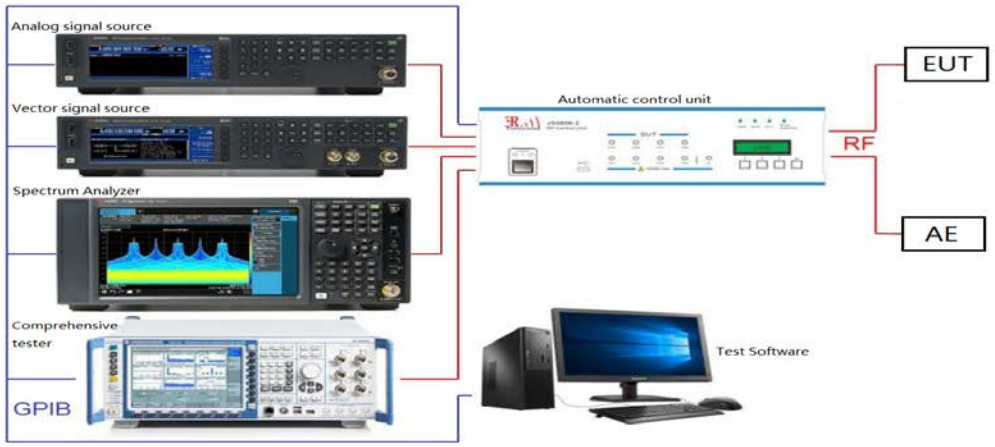
ANSI C63.10-2013 Section 11.8.2 Option 1

KDB 558074 D01 v05r02 – Section 8.2

7.2.3. Test Setting

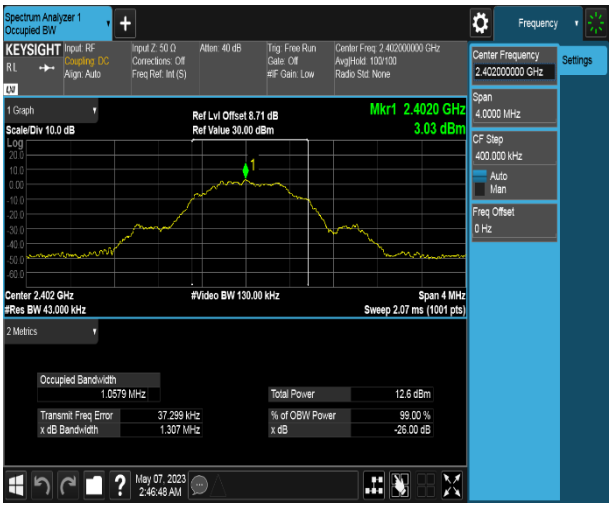
1. Set RBW = 100 kHz
2. VBW ≥ 3 × RBW
3. Detector = peak
4. Trace mode = max hold
5. Sweep = auto couple
6. Allow the trace was allowed to stabilize
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

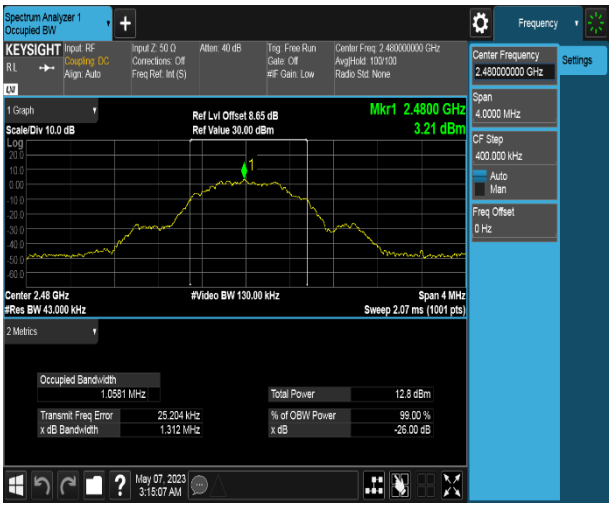
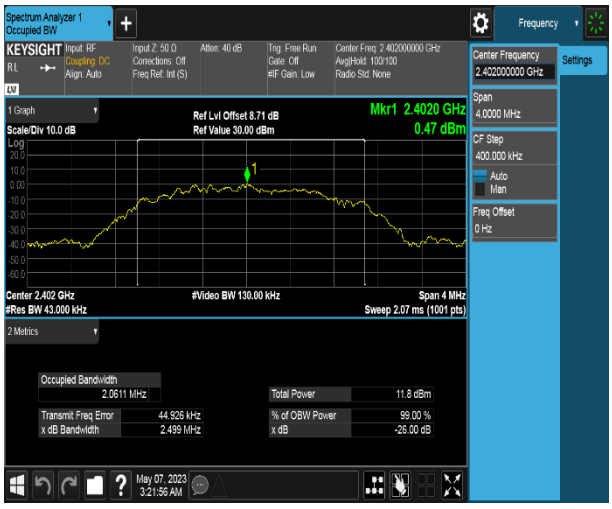
7.2.4. Test Setup

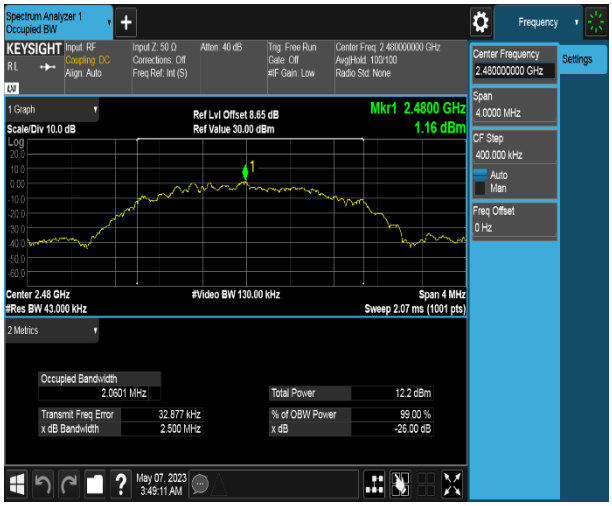


7.2.5. Test Result

Test Mode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	99% BW[MHz]	Verdict
BLE_1M	Ant1	2402	0.672	2401.684	2402.356	>=0.5	1.0579	PASS
		2440	0.692	2439.680	2440.372	>=0.5	1.0551	PASS
		2480	0.684	2479.668	2480.352	>=0.5	1.0581	PASS
BLE_2M	Ant1	2402	1.336	2401.364	2402.700	>=0.5	2.0611	PASS
		2440	1.288	2439.344	2440.632	>=0.5	2.0575	PASS
		2480	1.156	2479.448	2480.604	>=0.5	2.0601	PASS

BLE_1M_Ant1_2402
 
BLE_1M_Ant1_2440
 

BLE_1M_Ant1_2480
 
BLE_2M_Ant1_2402
 

BLE_2M_Ant1_2440
 
BLE_2M_Ant1_2480
 

7.3. Output Power Measurement

7.3.1. Test Limit

The maximum permissible conducted output power is 1 Watt (30dBm). And for antenna gain greater than 6dBi the limit shall reduce by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.3.2. Test Procedure Used

ANSI C63.10-2013 – Section 11.9.1.1

KDB 558074 D01 v05r02 – Section 8.3.1.2

7.3.3. Test Setting

1.Set the RBW ≥ DTS bandwidth.

2.Set the VBW ≥ [3 × RBW].

3.Set the span ≥[3 × RBW].

4.Detector = peak.

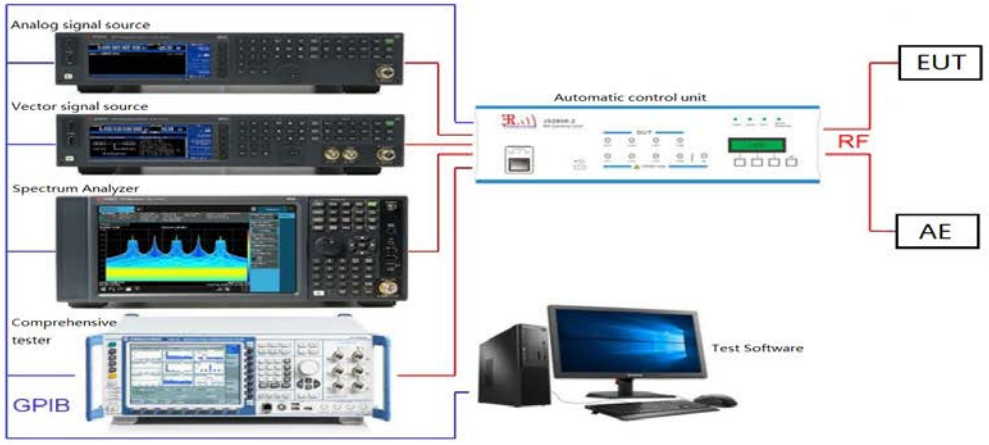
5.Sweep time = auto couple.

6.Trace mode = max hold.

7.Allow trace to fully stabilize.

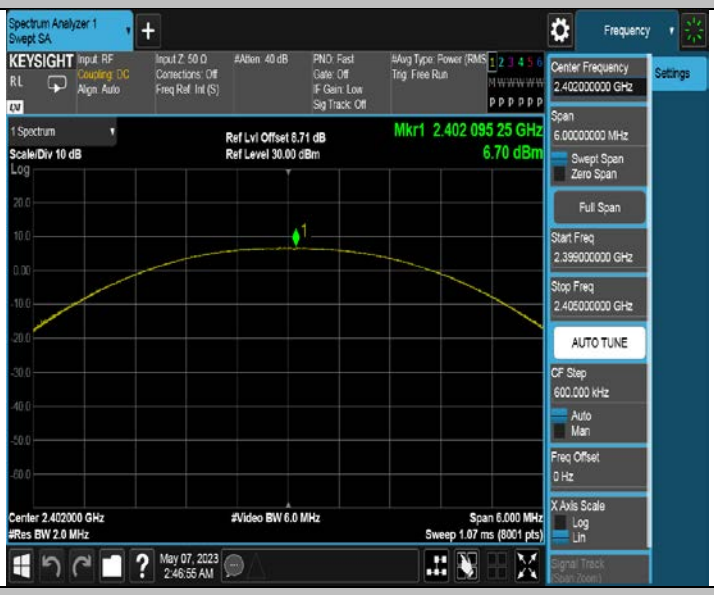
8. Use peak marker function to determine the peak amplitude level.

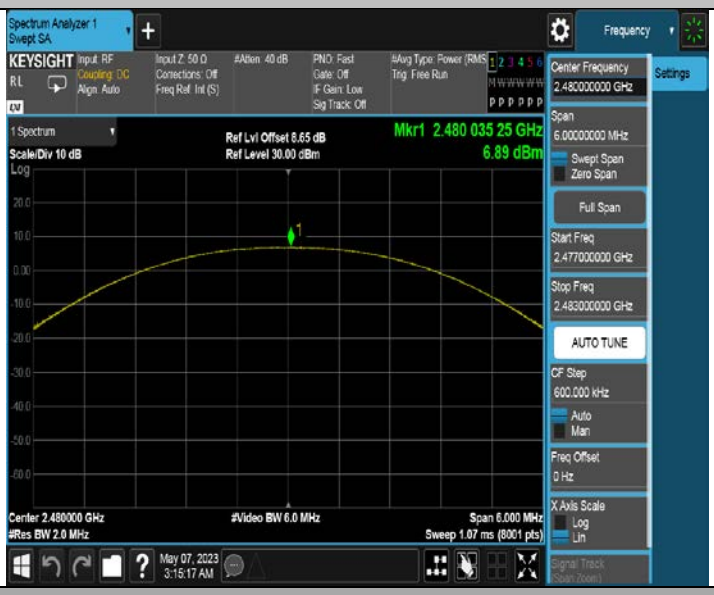
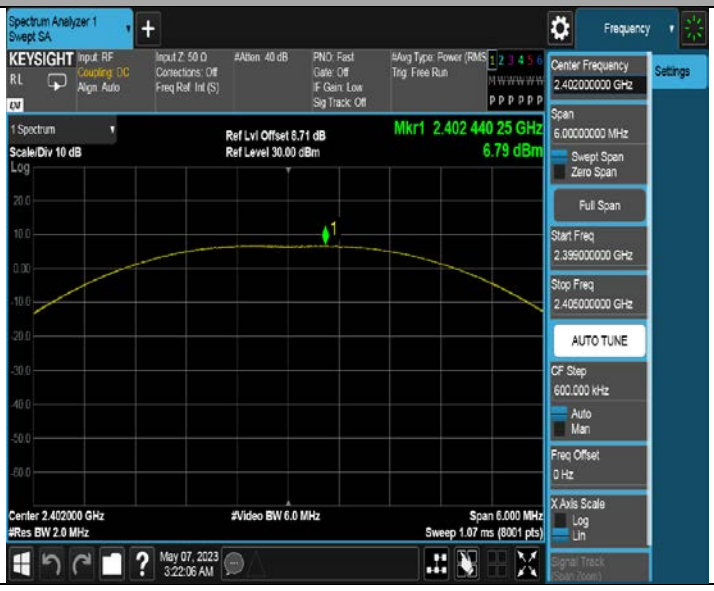
7.3.4. Test Setup



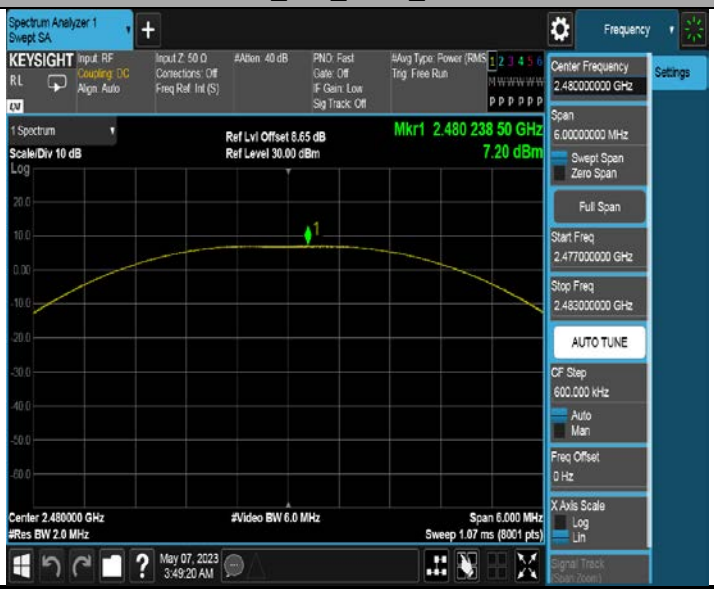
7.3.5. Test Result of Output Power

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	6.7	≤30	PASS
		2440	6.85	≤30	PASS
		2480	6.89	≤30	PASS
BLE_2M	Ant1	2402	6.79	≤30	PASS
		2440	6.75	≤30	PASS
		2480	7.2	≤30	PASS

BLE_1M_Ant1_2402

BLE_1M_Ant1_2440


BLE_1M_Ant1_2480

BLE_2M_Ant1_2402


BLE_2M_Ant1_2440

BLE_2M_Ant1_2480


7.4. Power Spectral Density Measurement

7.4.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band. And for antenna gain greater than 6dBi the limit shall reduce by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.4.2. Test Procedure Used

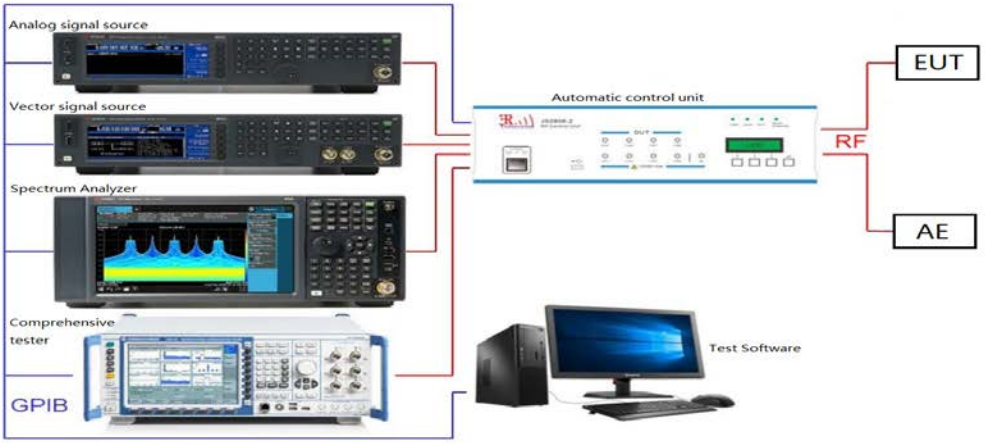
KDB 558074 D01 v05r02 - Section 8.4

ANSI C63.10 – Section 11.10.2

7.4.3. Test Setting

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ [3 × RBW].
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.

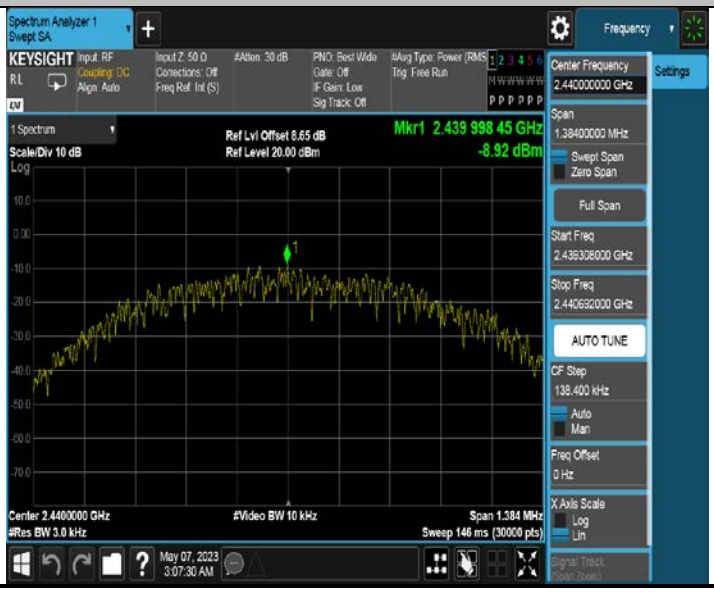
7.4.4. Test Setup

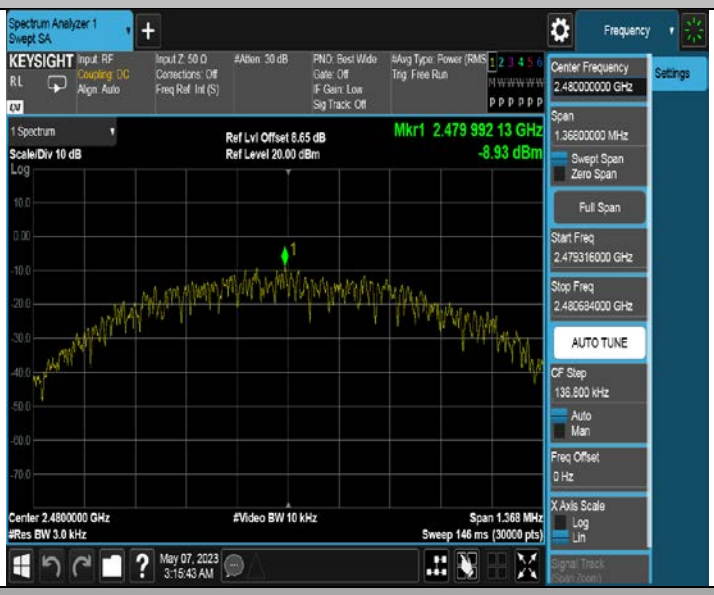
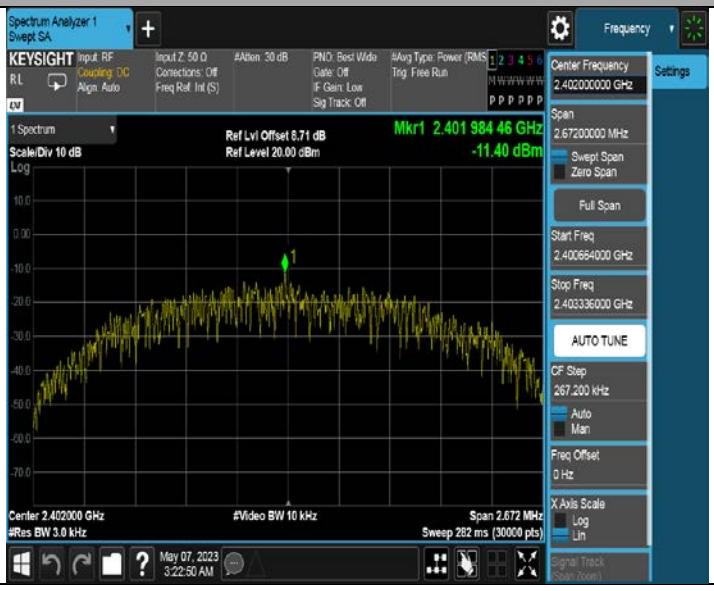


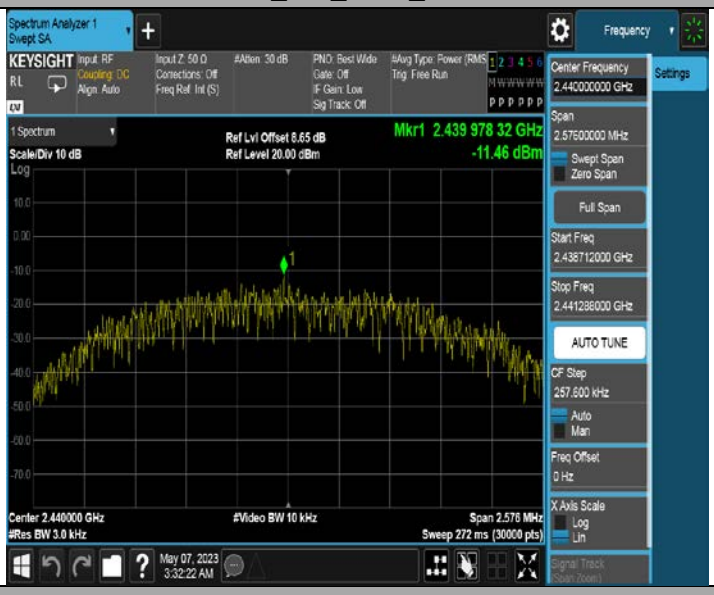
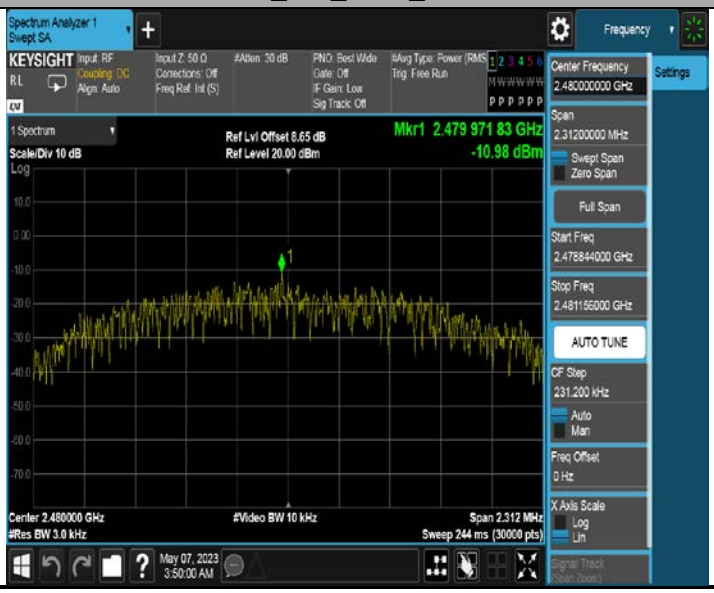
7.4.5. Test Result

Test Mode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-9.19	≤8.00	PASS
		2440	-8.92	≤8.00	PASS
		2480	-8.93	≤8.00	PASS
BLE_2M	Ant1	2402	-11.4	≤8.00	PASS
		2440	-11.46	≤8.00	PASS
		2480	-10.99	≤8.00	PASS

BLE_1M_Ant1_2402

BLE_1M_Ant1_2440


BLE_1M_Ant1_2480

BLE_2M_Ant1_2402


BLE_2M_Ant1_2440

BLE_2M_Ant1_2480


7.5. Conducted Band Edge and Out-of-Band Emissions

7.5.1. Test Limit

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth per the PSD procedure.

7.5.2. Test Procedure Used

KDB 558074 D01 v05r02 - Section 8.5 & Section 8.6

ANSI C63.10 – Section 11.11&11.12

7.5.3. Test Settitng

(a) Set the center frequency and span to encompass frequency range to be measured

(b) RBW = 100kHz

(c) VBW = 300kHz

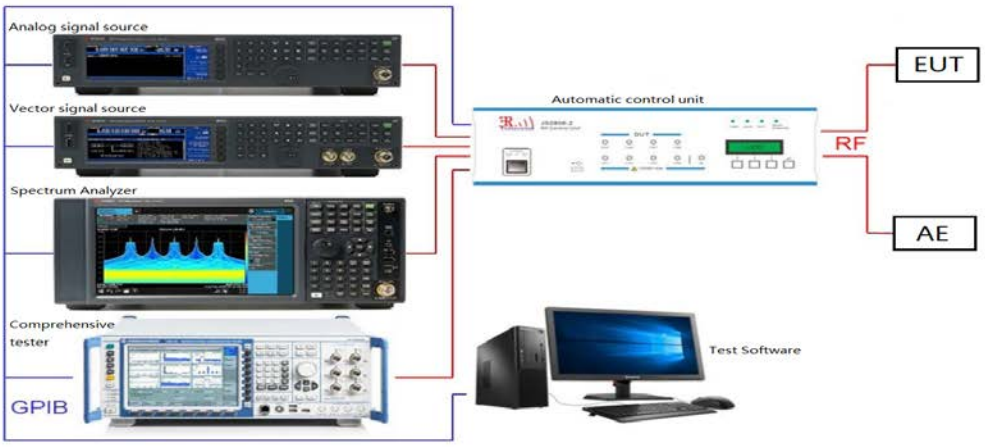
(d) Detector = Peak

(e) Trace mode = max hold

(f) Sweep time = auto couple

(g) The trace was allowed to stabilize

7.5.4. Test Setup



7.5.5. Test Result

Test Mode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	5.52	5.52	---	PASS
			30~1000	5.52	-61.35	≤-14.48	PASS
			1000~26500	5.52	-48.07	≤-14.48	PASS
		2440	Reference	5.74	5.74	---	PASS
			30~1000	5.74	-61.96	≤-14.26	PASS
			1000~26500	5.74	-48.78	≤-14.26	PASS
		2480	Reference	5.76	5.76	---	PASS
			30~1000	5.76	-62.09	≤-14.24	PASS
			1000~26500	5.76	-50.33	≤-14.24	PASS
BLE_2M	Ant1	2402	Reference	4.88	4.88	---	PASS
			30~1000	4.88	-60.73	≤-15.12	PASS
			1000~26500	4.88	-48.84	≤-15.12	PASS
		2440	Reference	4.80	4.80	---	PASS
			30~1000	4.80	-61.64	≤-15.2	PASS
			1000~26500	4.80	-49.34	≤-15.2	PASS
		2480	Reference	5.29	5.29	---	PASS
			30~1000	5.29	-61.7	≤-14.71	PASS
			1000~26500	5.29	-50.59	≤-14.71	PASS

BLE_1M_Ant1_Low_2402

BLE_1M_Ant1_High_2480


BLE_1M_Ant1_2402_0~Reference

BLE_1M_Ant1_2402_30~1000


BLE_1M_Ant1_2402_1000~26500

BLE_1M_Ant1_2440_0~Reference


BLE_1M_Ant1_2440_30~1000

BLE_1M_Ant1_2440_1000~26500


BLE_1M_Ant1_2480_0~Reference

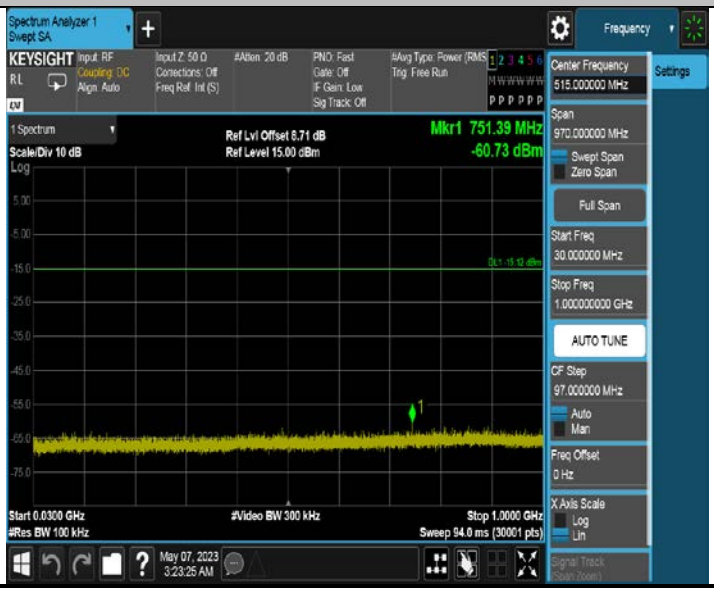
BLE_1M_Ant1_2480_30~1000


BLE_1M_Ant1_2480_1000~26500


BLE_2M_Ant1_Low_2402

BLE_2M_Ant1_High_2480


BLE_2M_Ant1_2402_0~Reference

BLE_2M_Ant1_2402_30~1000


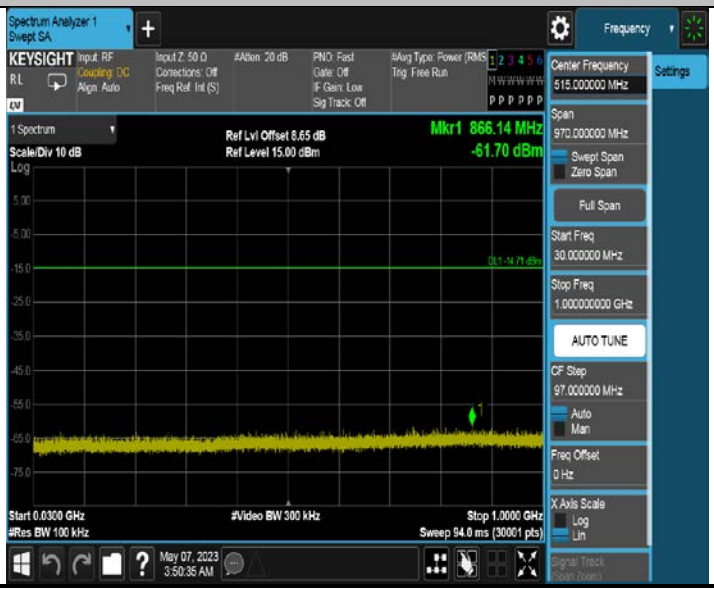
BLE_2M_Ant1_2402_1000~26500

BLE_2M_Ant1_2440_0~Reference


BLE_2M_Ant1_2440_30~1000

BLE_2M_Ant1_2440_1000~26500


BLE_2M_Ant1_2480_0~Reference

BLE_2M_Ant1_2480_30~1000


BLE_2M_Ant1_2480_1000~26500


7.6. Radiated Spurious Emission Measurement

7.6.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 – 0.490	2400/F (kHz)	300
0.490 – 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

7.6.2. Test Procedure Used

ANSI C63.10-2013 – Section 6.6.4.3

7.6.3. Test Setting

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in Table 1
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold

7. Trace was allowed to stabilize

Table 1 - RBW as a function of frequency

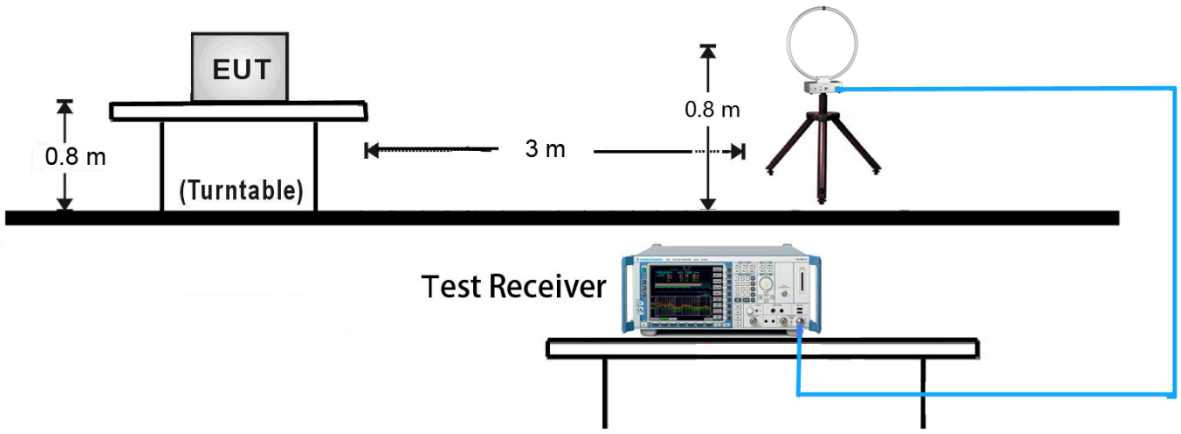
Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Average Field Strength Measurements

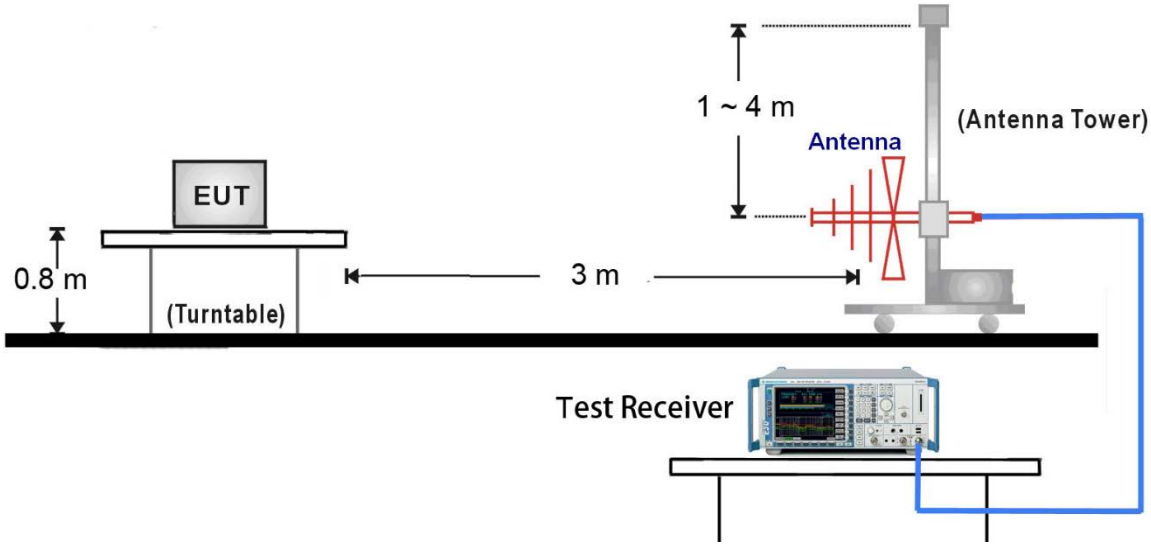
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = Power Average (RMS)
5. Number of sweep point = 2001 (Number of sweep points must be ≥ 2 x span / RBW)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces.

7.6.4. Test Setup

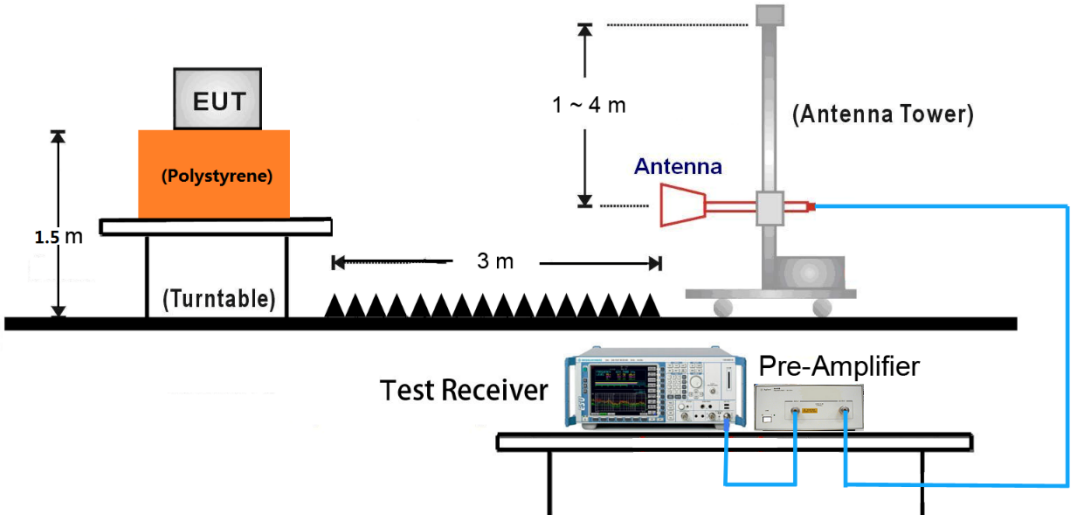
9kHz ~ 30MHz Test Setup:



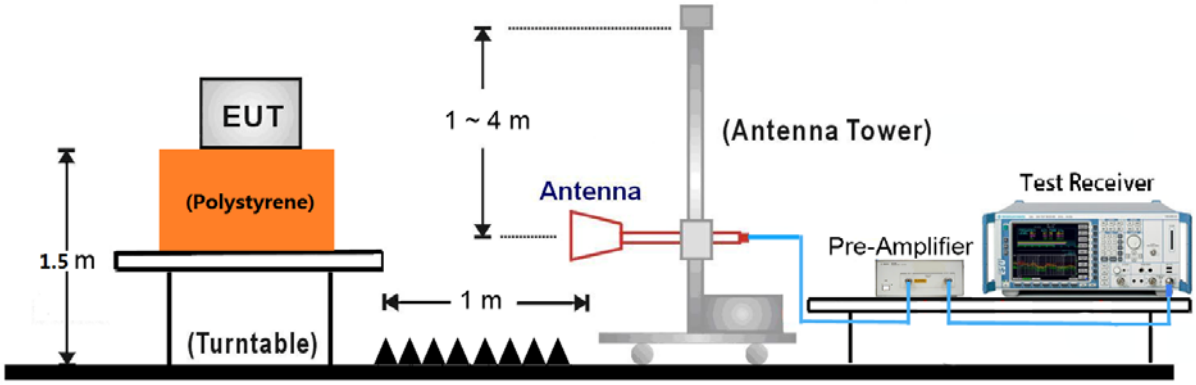
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



18GHz ~25GHz Test Setup:

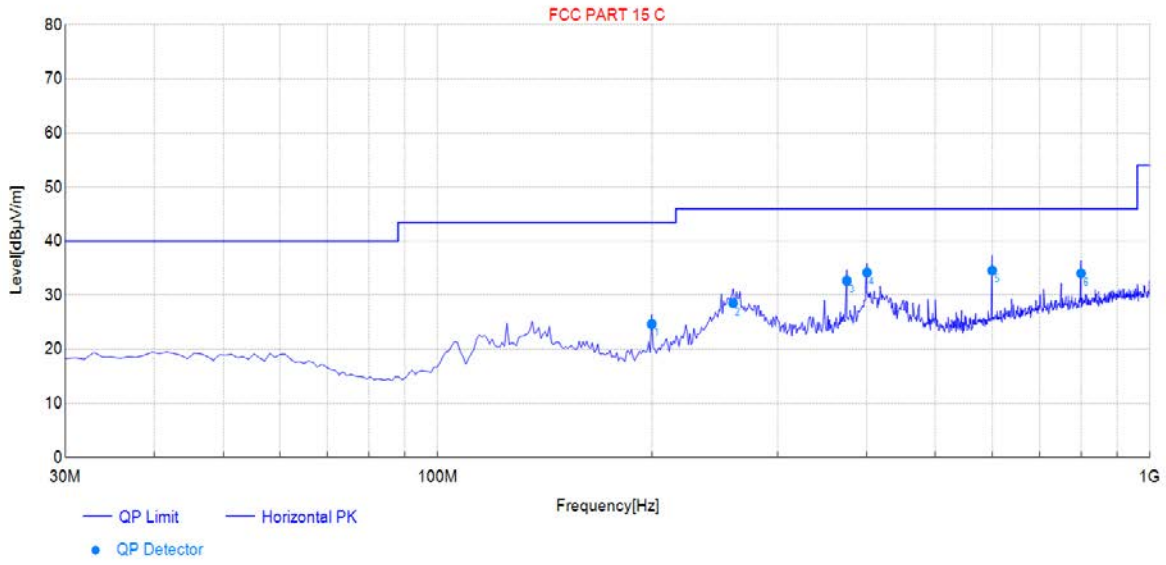


7.6.5. Test Result

The worst case of Radiated Emission below 1GHz:

30MHz – 1GHz Test Data

EUT:	LED Playback Control Processor	Polarity:	Horizontal
Model:	TU40 Pro	SN:	N/A
Mode:	Transmit at BLE Channel 00	Voltage:	AC 120V 60Hz
Environment:	Temp: 27.1℃; Humi:51%	Engineer:	Stone Zhang



Final Data List										
NO.	Frequency [MHz]	Factor [dB/m]	QP Reading [dBµV]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pol	Verdict
1	199.75	11.78	14.59	26.37	43.50	17.13	100	145	Horizontal	PASS
2	259.89	14.06	16.42	30.48	46.00	15.52	100	148	Horizontal	PASS
3	375.32	16.93	17.07	34.00	46.00	12.00	100	198	Horizontal	PASS
4	400.54	17.41	17.86	35.27	46.00	10.73	100	180	Horizontal	PASS
5	600.36	21.67	15.04	36.71	46.00	9.29	100	122	Horizontal	PASS
6	800.18	24.51	11.12	35.63	46.00	10.37	100	141	Horizontal	PASS

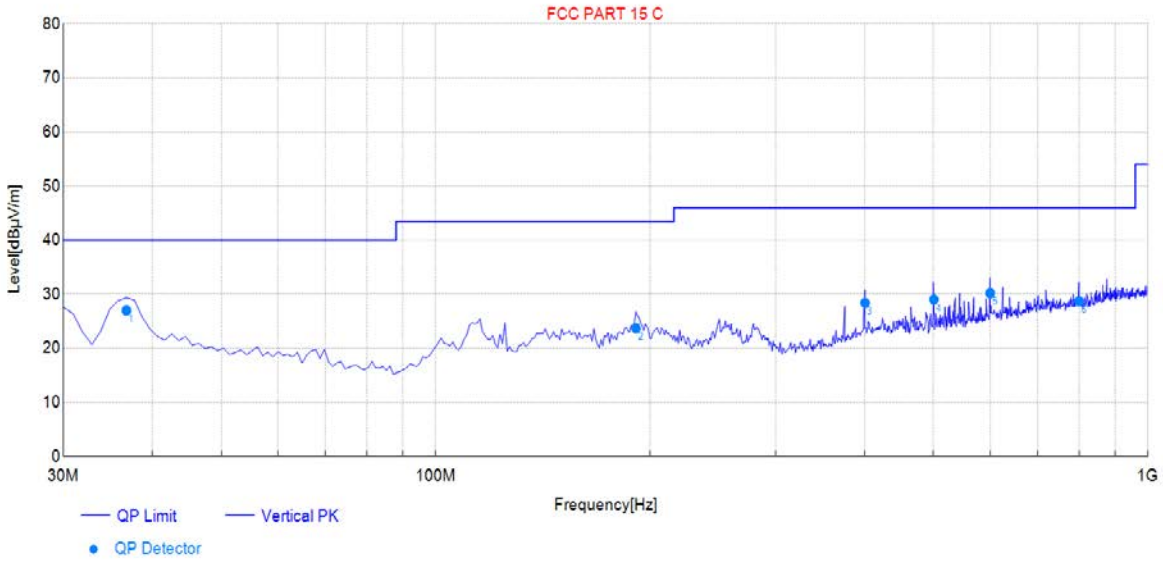
Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

(3) The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

EUT:	LED Playback Control Processor	Polarity:	Vertical
Model:	TU40 Pro	SN:	N/A
Mode:	Transmit at BLE Channel 00	Voltage:	AC 120V 60Hz
Environment:	Temp: 27.1℃; Humi:51%	Engineer:	Stone Zhang



Final Data List										
NO.	Frequency [MHz]	Factor [dB/m]	QP Reading [dBµV]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pol	Verdict
1	36.79	14.43	12.58	27.01	40.00	12.99	100	254	Vertical	PASS
2	191.02	12.61	13.32	25.93	43.50	17.57	100	260	Vertical	PASS
3	400.54	17.41	12.54	29.95	46.00	16.05	100	87	Vertical	PASS
4	500.45	19.51	11.92	31.43	46.00	14.57	100	91	Vertical	PASS
5	600.36	21.67	10.85	32.52	46.00	13.48	100	292	Vertical	PASS
6	800.18	24.51	7.27	31.78	46.00	14.22	100	106	Vertical	PASS

Note:

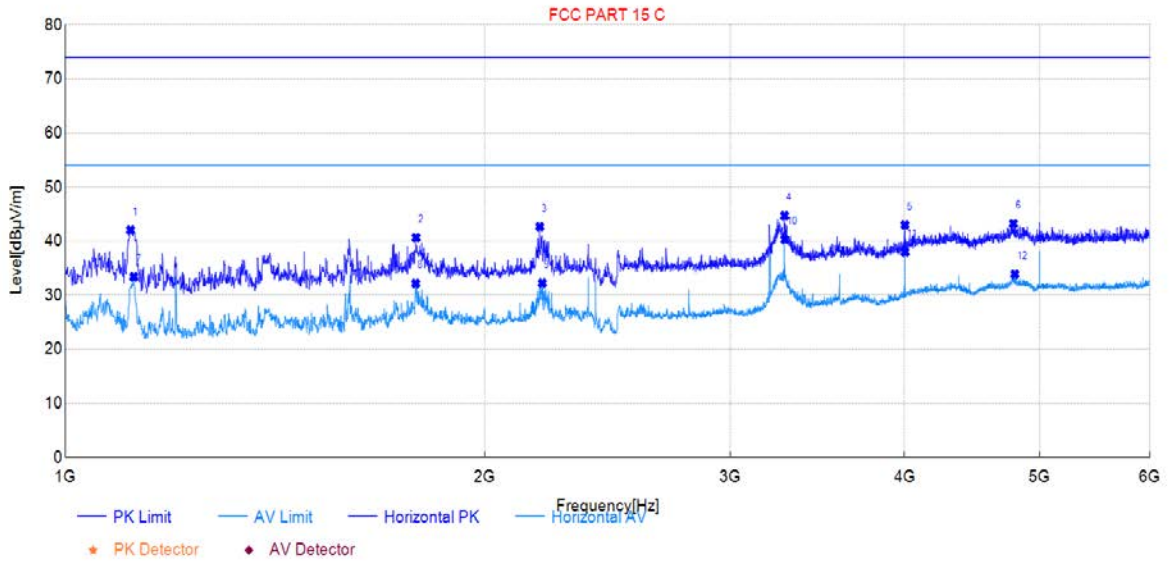
(1) Level=Reading + Factor

(2) Margin=Limit-Level

(3) The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

1GHz-6GHz

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	00	Test Engineer:	Stone Zhang



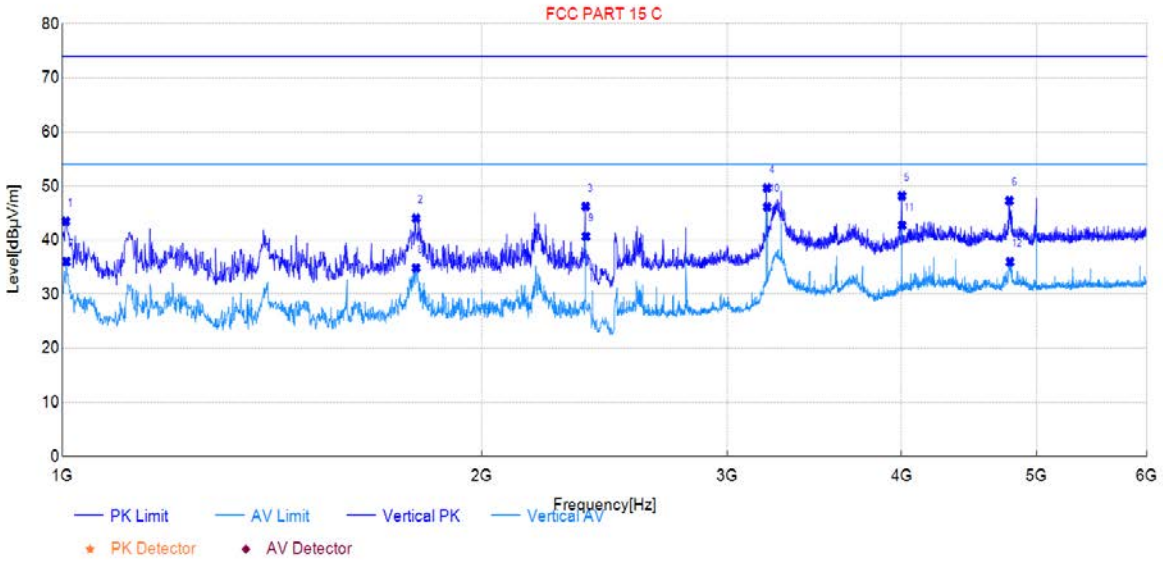
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	1114.00	65.86	42.07	-23.79	74.00	31.93	150	139	PK	Horizontal	PASS
2	1785.00	60.27	40.66	-19.61	74.00	33.34	150	356	PK	Horizontal	PASS
3	2190.00	59.92	42.67	-17.25	74.00	31.33	150	333	PK	Horizontal	PASS
4	3281.00	57.94	44.72	-13.22	74.00	29.28	150	54	PK	Horizontal	PASS
5	4003.00	51.58	43.01	-8.57	74.00	30.99	150	45	PK	Horizontal	PASS
6	4788.00	50.07	43.25	-6.82	74.00	30.75	150	76	PK	Horizontal	PASS
7	1120.00	57.17	33.41	-23.76	54.00	20.59	150	134	AV	Horizontal	PASS
8	1784.00	51.82	32.20	-19.62	54.00	21.80	150	356	AV	Horizontal	PASS
9	2199.00	49.46	32.25	-17.21	54.00	21.75	150	333	AV	Horizontal	PASS
10	3282.00	53.53	40.33	-13.20	54.00	13.67	150	72	AV	Horizontal	PASS
11	4004.00	46.57	38.01	-8.56	54.00	15.99	150	49	AV	Horizontal	PASS
12	4800.00	40.69	33.90	-6.79	54.00	20.10	150	328	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	00	Test Engineer:	Stone Zhang



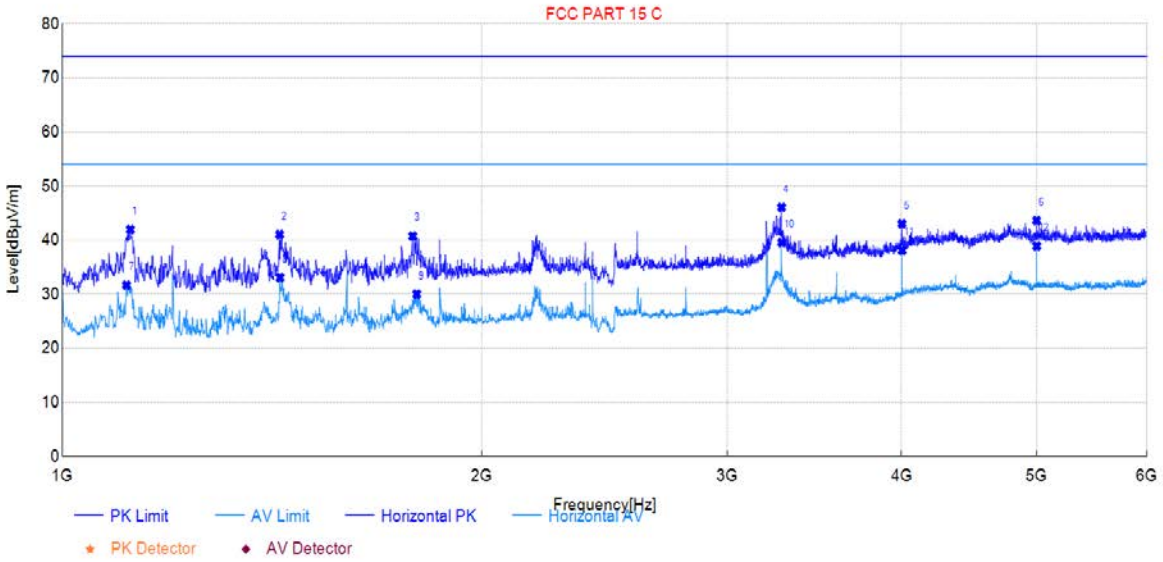
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	1006.00	66.66	43.52	-23.14	74.00	30.48	150	117	PK	Vertical	PASS
2	1794.00	63.04	44.07	-18.97	74.00	29.93	150	122	PK	Vertical	PASS
3	2374.00	62.81	46.24	-16.57	74.00	27.76	150	165	PK	Vertical	PASS
4	3203.00	62.83	49.69	-13.14	74.00	24.31	150	44	PK	Vertical	PASS
5	4003.00	56.47	48.20	-8.27	74.00	25.80	150	138	PK	Vertical	PASS
6	4780.00	54.66	47.30	-7.36	74.00	26.70	150	74	PK	Vertical	PASS
7	1007.00	59.18	36.05	-23.13	54.00	17.95	150	113	AV	Vertical	PASS
8	1794.00	53.84	34.87	-18.97	54.00	19.13	150	117	AV	Vertical	PASS
9	2375.00	57.27	40.71	-16.56	54.00	13.29	150	165	AV	Vertical	PASS
10	3204.00	59.29	46.15	-13.14	54.00	7.85	150	44	AV	Vertical	PASS
11	4004.00	50.98	42.72	-8.26	54.00	11.28	150	316	AV	Vertical	PASS
12	4785.00	43.36	36.00	-7.36	54.00	18.00	150	82	AV	Vertical	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	19	Test Engineer:	Stone Zhang



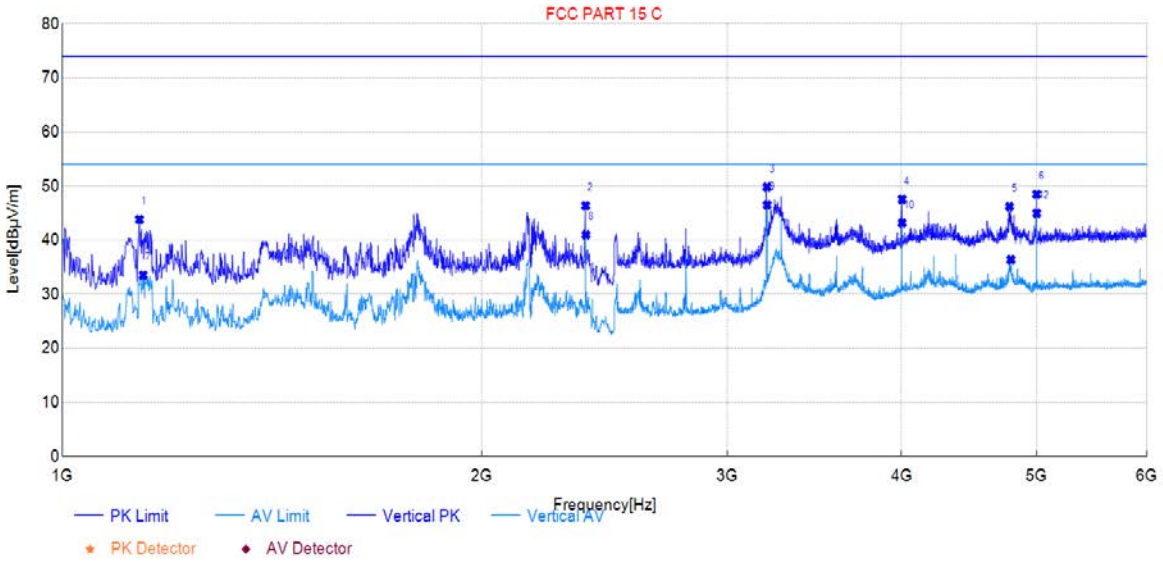
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	1119.00	65.73	41.97	-23.76	74.00	32.03	150	137	PK	Horizontal	PASS
2	1432.00	63.10	41.05	-22.05	74.00	32.95	150	80	PK	Horizontal	PASS
3	1784.00	60.41	40.79	-19.62	74.00	33.21	150	0	PK	Horizontal	PASS
4	3281.00	59.31	46.09	-13.22	74.00	27.91	150	67	PK	Horizontal	PASS
5	4003.00	51.61	43.04	-8.57	74.00	30.96	150	44	PK	Horizontal	PASS
6	5000.00	49.67	43.65	-6.02	74.00	30.35	150	102	PK	Horizontal	PASS
7	1112.00	55.49	31.70	-23.79	54.00	22.30	150	137	AV	Horizontal	PASS
8	1433.00	55.14	33.09	-22.05	54.00	20.91	150	80	AV	Horizontal	PASS
9	1796.00	49.53	30.02	-19.51	54.00	23.98	150	0	AV	Horizontal	PASS
10	3282.00	52.76	39.56	-13.20	54.00	14.44	150	67	AV	Horizontal	PASS
11	4004.00	46.70	38.14	-8.56	54.00	15.86	150	49	AV	Horizontal	PASS
12	5001.00	44.93	38.91	-6.02	54.00	15.09	150	67	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	19	Test Engineer:	Stone Zhang



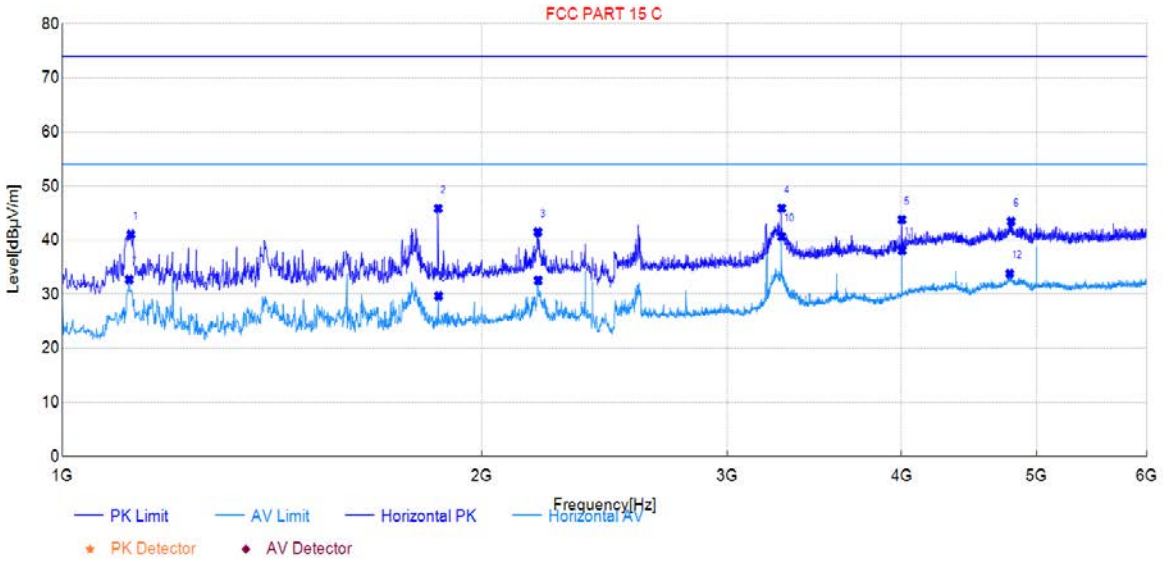
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	1136.00	66.55	43.86	-22.69	74.00	30.14	150	122	PK	Vertical	PASS
2	2374.00	62.95	46.38	-16.57	74.00	27.62	150	160	PK	Vertical	PASS
3	3203.00	62.98	49.84	-13.14	74.00	24.16	150	39	PK	Vertical	PASS
4	4004.00	55.82	47.56	-8.26	74.00	26.44	150	138	PK	Vertical	PASS
5	4781.00	53.58	46.23	-7.35	74.00	27.77	150	74	PK	Vertical	PASS
6	5000.00	55.20	48.48	-6.72	74.00	25.52	150	95	PK	Vertical	PASS
7	1143.00	56.18	33.52	-22.66	54.00	20.48	150	122	AV	Vertical	PASS
8	2375.00	57.56	41.00	-16.56	54.00	13.00	150	160	AV	Vertical	PASS
9	3204.00	59.68	46.54	-13.14	54.00	7.46	150	44	AV	Vertical	PASS
10	4004.00	51.45	43.19	-8.26	54.00	10.81	150	135	AV	Vertical	PASS
11	4792.00	43.75	36.41	-7.34	54.00	17.59	150	79	AV	Vertical	PASS
12	5001.00	51.71	44.99	-6.72	54.00	9.01	150	87	AV	Vertical	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	39	Test Engineer:	Stone Zhang



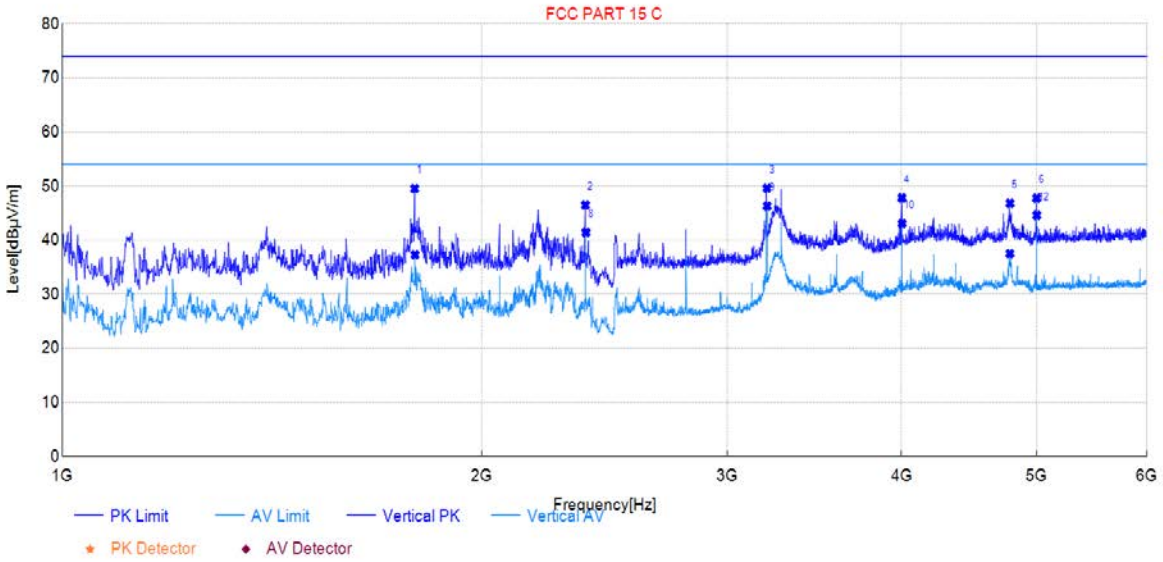
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	1120.00	64.82	41.06	-23.76	74.00	32.94	150	143	PK	Horizontal	PASS
2	1861.00	65.07	45.86	-19.21	74.00	28.14	150	75	PK	Horizontal	PASS
3	2194.00	58.73	41.50	-17.23	74.00	32.50	150	297	PK	Horizontal	PASS
4	3282.00	59.11	45.91	-13.20	74.00	28.09	150	70	PK	Horizontal	PASS
5	4003.00	52.39	43.82	-8.57	74.00	30.18	150	44	PK	Horizontal	PASS
6	4794.00	50.31	43.50	-6.81	74.00	30.50	150	27	PK	Horizontal	PASS
7	1117.00	56.51	32.74	-23.77	54.00	21.26	150	139	AV	Horizontal	PASS
8	1862.00	48.88	29.67	-19.21	54.00	24.33	150	75	AV	Horizontal	PASS
9	2195.00	49.80	32.57	-17.23	54.00	21.43	150	297	AV	Horizontal	PASS
10	3282.00	53.88	40.68	-13.20	54.00	13.32	150	70	AV	Horizontal	PASS
11	4004.00	46.67	38.11	-8.56	54.00	15.89	150	44	AV	Horizontal	PASS
12	4783.00	40.64	33.82	-6.82	54.00	20.18	150	1	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	39	Test Engineer:	Stone Zhang



Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	1790.00	68.58	49.58	-19.00	74.00	24.42	150	60	PK	Vertical	PASS
2	2373.00	63.10	46.53	-16.57	74.00	27.47	150	160	PK	Vertical	PASS
3	3203.00	62.80	49.66	-13.14	74.00	24.34	150	42	PK	Vertical	PASS
4	4003.00	56.10	47.83	-8.27	74.00	26.17	150	9	PK	Vertical	PASS
5	4785.00	54.17	46.81	-7.36	74.00	27.19	150	81	PK	Vertical	PASS
6	5000.00	54.50	47.78	-6.72	74.00	26.22	150	86	PK	Vertical	PASS
7	1791.00	56.31	37.32	-18.99	54.00	16.68	150	56	AV	Vertical	PASS
8	2375.00	57.99	41.43	-16.56	54.00	12.57	150	160	AV	Vertical	PASS
9	3204.00	59.45	46.31	-13.14	54.00	7.69	150	42	AV	Vertical	PASS
10	4004.00	51.35	43.09	-8.26	54.00	10.91	150	142	AV	Vertical	PASS
11	4784.00	44.87	37.51	-7.36	54.00	16.49	150	81	AV	Vertical	PASS
12	5001.00	51.34	44.62	-6.72	54.00	9.38	150	286	AV	Vertical	PASS

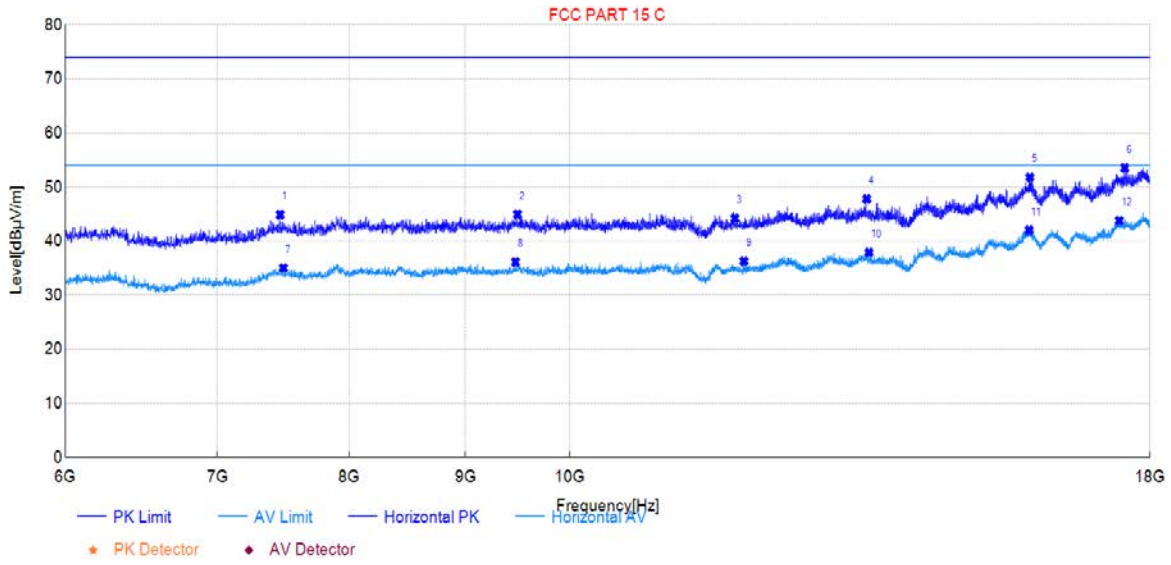
Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

6GHz-18GHz

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	00	Test Engineer:	Stone Zhang



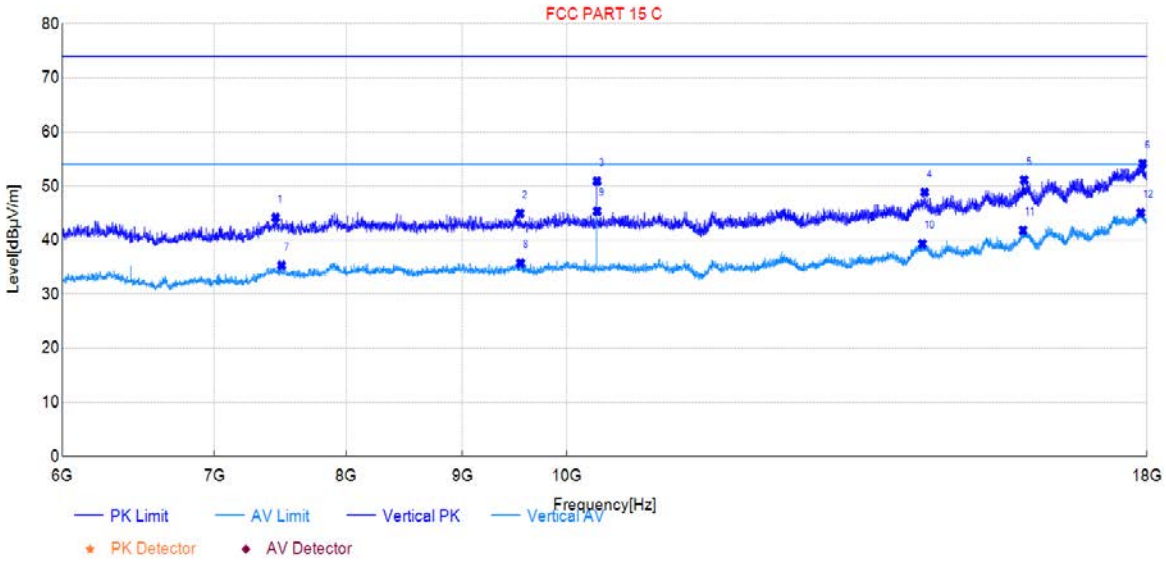
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	7459.50	47.80	44.90	-2.90	74.00	29.10	150	336	PK	Horizontal	PASS
2	9486.00	45.03	44.97	-0.06	74.00	29.03	150	90	PK	Horizontal	PASS
3	11821.50	42.98	44.23	1.25	74.00	29.77	150	295	PK	Horizontal	PASS
4	13510.50	44.51	47.82	3.31	74.00	26.18	150	281	PK	Horizontal	PASS
5	15939.00	42.05	51.83	9.78	74.00	22.17	150	195	PK	Horizontal	PASS
6	17545.50	40.09	53.56	13.47	74.00	20.44	150	8	PK	Horizontal	PASS
7	7483.50	38.03	35.06	-2.97	54.00	18.94	150	340	AV	Horizontal	PASS
8	9466.50	36.35	36.14	-0.21	54.00	17.86	150	3	AV	Horizontal	PASS
9	11931.00	35.10	36.31	1.21	54.00	17.69	150	100	AV	Horizontal	PASS
10	13542.00	34.69	37.92	3.23	54.00	16.08	150	3	AV	Horizontal	PASS
11	15927.00	32.28	42.06	9.78	54.00	11.94	150	160	AV	Horizontal	PASS
12	17448.00	30.96	43.82	12.86	54.00	10.18	150	32	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	00	Test Engineer:	Stone Zhang



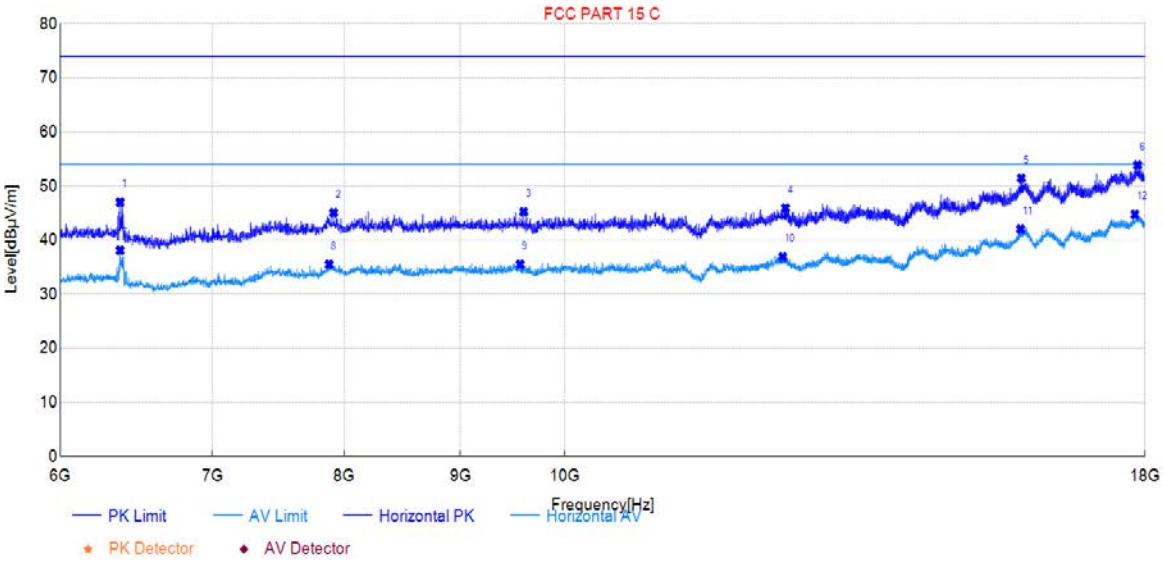
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	7447.50	47.05	44.18	-2.87	74.00	29.82	150	284	PK	Vertical	PASS
2	9540.00	44.99	44.97	-0.02	74.00	29.03	150	202	PK	Vertical	PASS
3	10312.50	50.49	50.93	0.44	74.00	23.07	150	85	PK	Vertical	PASS
4	14371.50	43.32	48.85	5.53	74.00	25.15	150	94	PK	Vertical	PASS
5	15894.00	41.97	51.16	9.19	74.00	22.84	150	279	PK	Vertical	PASS
6	17925.00	39.34	54.18	14.84	74.00	19.82	150	236	PK	Vertical	PASS
7	7492.50	38.35	35.35	-3.00	54.00	18.65	150	98	AV	Vertical	PASS
8	9544.50	35.80	35.78	-0.02	54.00	18.22	150	23	AV	Vertical	PASS
9	10314.00	44.90	45.35	0.45	54.00	8.65	150	85	AV	Vertical	PASS
10	14338.50	33.91	39.35	5.44	54.00	14.65	150	98	AV	Vertical	PASS
11	15876.00	32.99	41.83	8.84	54.00	12.17	150	231	AV	Vertical	PASS
12	17887.50	30.17	45.10	14.93	54.00	8.90	150	287	AV	Vertical	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	19	Test Engineer:	Stone Zhang



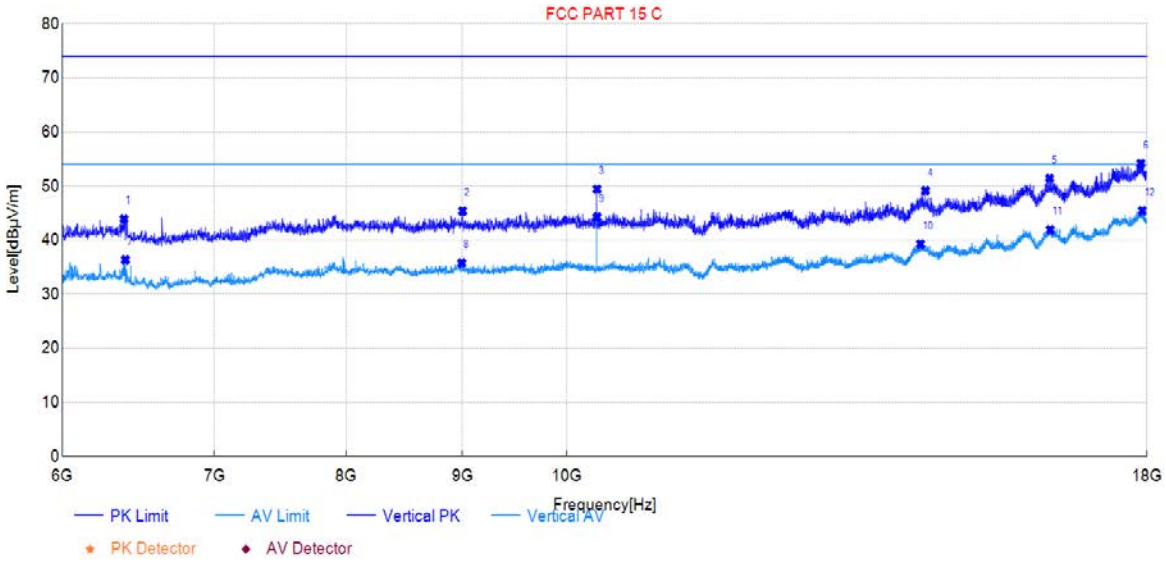
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	6375.00	51.89	47.02	-4.87	74.00	26.98	150	2	PK	Horizontal	PASS
2	7914.00	46.12	45.09	-1.03	74.00	28.91	150	288	PK	Horizontal	PASS
3	9594.00	45.46	45.26	-0.20	74.00	28.74	150	51	PK	Horizontal	PASS
4	12507.00	43.52	45.96	2.44	74.00	28.04	150	356	PK	Horizontal	PASS
5	15880.50	42.05	51.46	9.41	74.00	22.54	150	114	PK	Horizontal	PASS
6	17866.50	39.64	53.89	14.25	74.00	20.11	150	230	PK	Horizontal	PASS
7	6375.00	42.99	38.12	-4.87	54.00	15.88	150	2	AV	Horizontal	PASS
8	7878.00	36.97	35.54	-1.43	54.00	18.46	150	147	AV	Horizontal	PASS
9	9559.50	35.64	35.54	-0.10	54.00	18.46	150	284	AV	Horizontal	PASS
10	12472.50	34.53	36.94	2.41	54.00	17.06	150	7	AV	Horizontal	PASS
11	15870.00	32.87	42.07	9.20	54.00	11.93	150	244	AV	Horizontal	PASS
12	17817.00	30.79	44.78	13.99	54.00	9.22	150	137	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	19	Test Engineer:	Stone Zhang



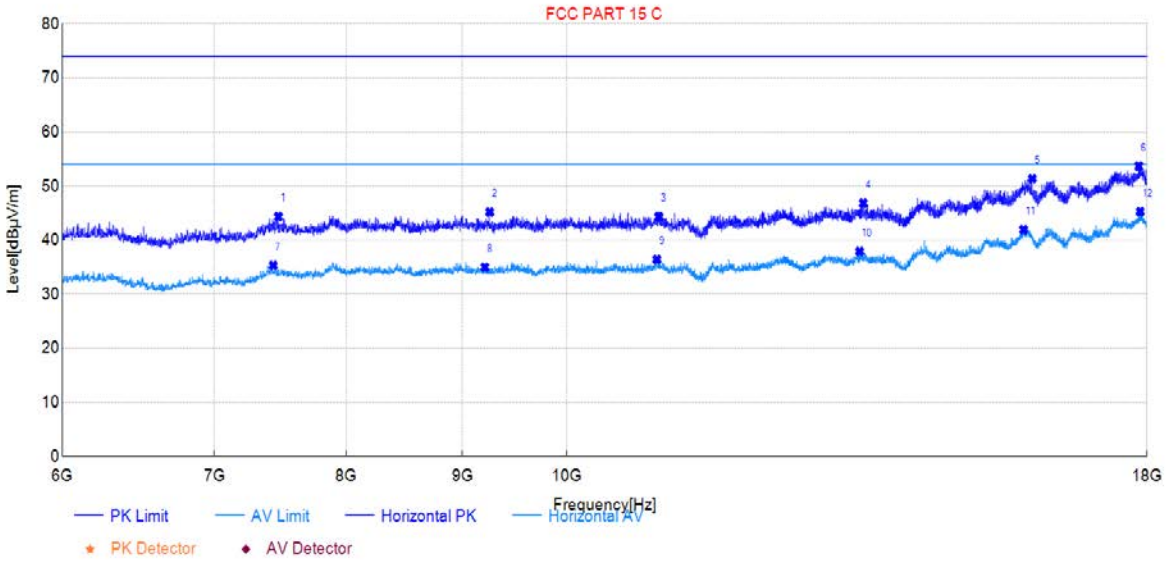
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	6387.00	48.75	43.96	-4.79	74.00	30.04	150	135	PK	Vertical	PASS
2	9000.00	46.17	45.39	-0.78	74.00	28.61	150	73	PK	Vertical	PASS
3	10312.50	49.01	49.45	0.44	74.00	24.55	150	48	PK	Vertical	PASS
4	14383.50	43.63	49.19	5.56	74.00	24.81	150	68	PK	Vertical	PASS
5	16309.50	42.09	51.43	9.34	74.00	22.57	150	360	PK	Vertical	PASS
6	17889.00	39.26	54.20	14.94	74.00	19.80	150	14	PK	Vertical	PASS
7	6396.00	41.25	36.38	-4.87	54.00	17.62	150	125	AV	Vertical	PASS
8	8992.50	36.59	35.78	-0.81	54.00	18.22	150	218	AV	Vertical	PASS
9	10314.00	43.83	44.28	0.45	54.00	9.72	150	87	AV	Vertical	PASS
10	14310.00	33.94	39.29	5.35	54.00	14.71	150	315	AV	Vertical	PASS
11	16320.00	32.55	41.92	9.37	54.00	12.08	150	263	AV	Vertical	PASS
12	17916.00	30.56	45.46	14.90	54.00	8.54	150	360	AV	Vertical	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	39	Test Engineer:	Stone Zhang



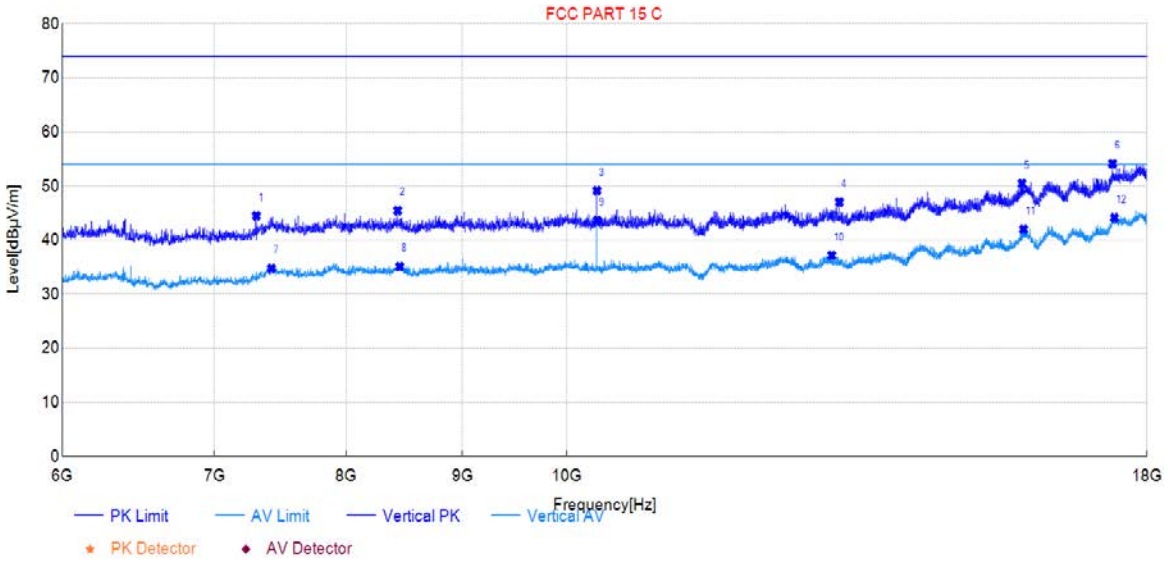
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	7468.50	47.30	44.37	-2.93	74.00	29.63	150	185	PK	Horizontal	PASS
2	9250.50	46.34	45.22	-1.12	74.00	28.78	150	47	PK	Horizontal	PASS
3	10977.00	43.14	44.37	1.23	74.00	29.63	150	67	PK	Horizontal	PASS
4	13504.50	43.51	46.84	3.33	74.00	27.16	150	0	PK	Horizontal	PASS
5	16026.00	42.02	51.38	9.36	74.00	22.62	150	12	PK	Horizontal	PASS
6	17850.00	39.55	53.71	14.16	74.00	20.29	150	57	PK	Horizontal	PASS
7	7429.50	38.16	35.35	-2.81	54.00	18.65	150	7	AV	Horizontal	PASS
8	9205.50	36.20	35.02	-1.18	54.00	18.98	150	247	AV	Horizontal	PASS
9	10957.50	35.29	36.45	1.16	54.00	17.55	150	337	AV	Horizontal	PASS
10	13455.00	34.80	37.93	3.13	54.00	16.07	150	232	AV	Horizontal	PASS
11	15883.50	32.49	41.96	9.47	54.00	12.04	150	289	AV	Horizontal	PASS
12	17877.00	30.99	45.29	14.30	54.00	8.71	150	162	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Test Mode:	BLE	Test Date:	2024-08-29
Test Channel:	39	Test Engineer:	Stone Zhang



Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	7303.50	47.95	44.51	-3.44	74.00	29.49	150	64	PK	Vertical	PASS
2	8427.00	46.64	45.49	-1.15	74.00	28.51	150	29	PK	Vertical	PASS
3	10312.50	48.75	49.19	0.44	74.00	24.81	150	103	PK	Vertical	PASS
4	13182.00	44.18	47.05	2.87	74.00	26.95	150	358	PK	Vertical	PASS
5	15861.00	41.93	50.50	8.57	74.00	23.50	150	103	PK	Vertical	PASS
6	17383.50	41.43	54.15	12.72	74.00	19.85	150	346	PK	Vertical	PASS
7	7416.00	37.58	34.80	-2.78	54.00	19.20	150	258	AV	Vertical	PASS
8	8445.00	36.43	35.17	-1.26	54.00	18.83	150	160	AV	Vertical	PASS
9	10314.00	43.22	43.67	0.45	54.00	10.33	150	83	AV	Vertical	PASS
10	13080.00	34.77	37.19	2.42	54.00	16.81	150	346	AV	Vertical	PASS
11	15885.00	33.02	42.03	9.01	54.00	11.97	150	131	AV	Vertical	PASS
12	17416.50	30.97	44.16	13.19	54.00	9.84	150	264	AV	Vertical	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

7.7. Radiated Restricted Band Edge Measurement

7.7.1. Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1] 0.495 - 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	8.25 - 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	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	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 - 156.525	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	--	--	--

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510MHz.

[2] Above 38.6

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

For RSS-Gen Section 8.10 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 8.10 of RSS-Gen, must also comply with the radiated emission limits specified in Section 8.9.

Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.009 - 0.110	240 - 285	9.0 - 9.2
2.1735 - 2.1905	322 - 335.4	9.3 - 9.5
3.020 - 3.026	399.9 - 410	10.6 - 12.7
4.125 - 4.128	608 - 614	13.25 - 13.4
4.17725 - 4.17775	960 - 1427	14.47 - 14.5
4.20725 - 4.20775	1435 - 1626.5	15.35 - 16.2
5.677 - 5.683	1645.5 - 1646.5	17.7 - 21.4
6.215 - 6.218	1660 - 1710	22.01 - 23.12
6.26775 - 6.26825	1718.8 -1722.2	23.6 - 24.0
6.31175 - 6.31225	2200 - 2300	31.2 - 31.8
8.291 - 8.294	2310 -2390	36.43 - 36.5
8.362 - 8.366	2655 - 2900	Above 38.6
8.37625 - 8.38675	3260 - 3267	--
8.41425 - 8.41475	3332 -3339	
12.29 - 12.293	334.5 - 3358	
12.51975 - 12.52025	3500 - 4400	
12.57675 - 12.57725	4500 - 5150	
13.36 -13.41	5350 - 5460	
16.42 - 16.423	7250 - 7750	
16.69475 - 16.69525	8025 - 8500	
16.80425 - 16.80475	--	
25.5 - 25.67		
37.5 - 38.25		
73 - 74.6		
74.8 - 75.2		
108 - 138		
156.52475 - 156.525225		
156.7 - 156.9		

All out of band emissions appearing in a restricted band as specified in Section 8.10 of the RSS-

Gen must not exceed the limits shown in Table per Section 8.9.

RSS-Gen Section 8.9		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

7.7.2. Test Procedure Used

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

7.7.3. Test Setting

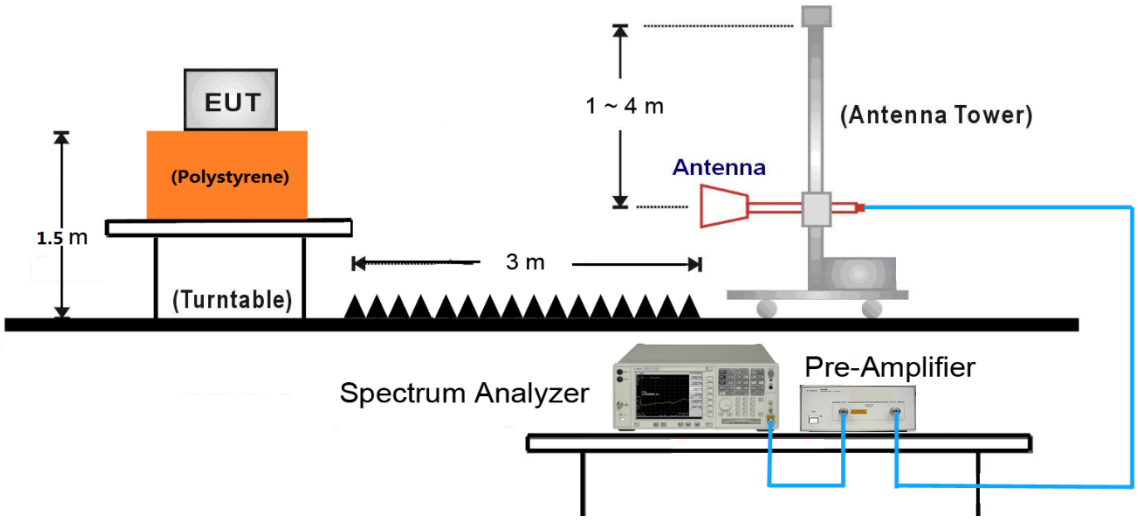
Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Field Strength Measurements

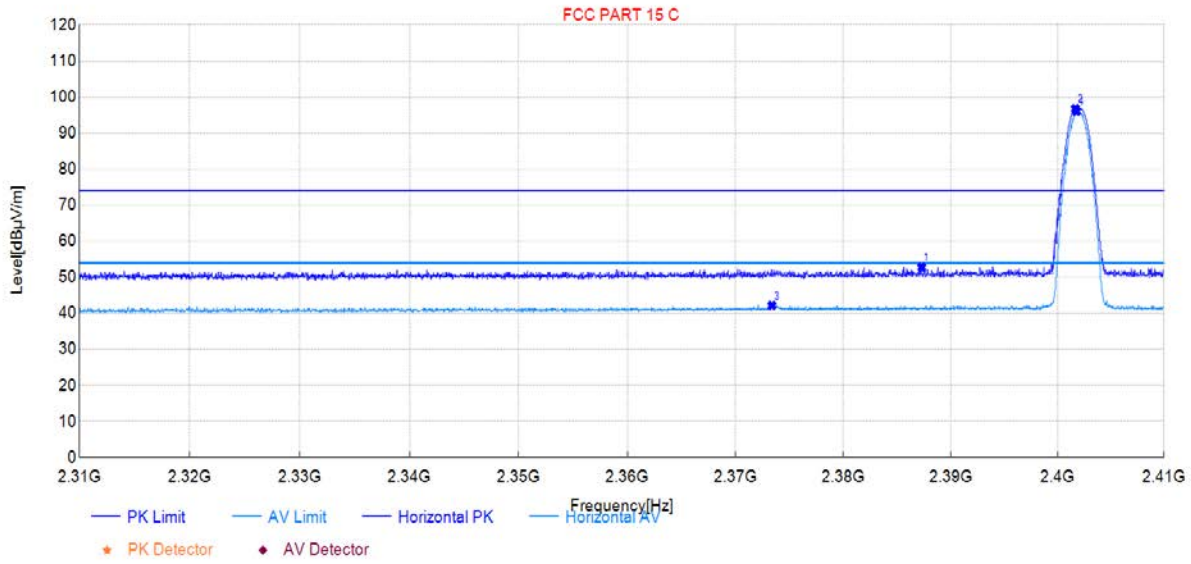
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = Power Average (RMS)
5. Number of sweep point = 2001 (Number of sweep points must be ≥ 2 x span / RBW)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces.

7.7.4. Test Setup



7.7.5. Test Result

Project Information			
EUT:	LED Playback Control Processor	Model:	TU40 Pro
Test Date:	2024-08-29	Voltage:	AC 120V 60Hz
Environment:	Temp: 27.1℃; Humi:51%	Engineer:	Stone Zhang
Remark:	Transmit by BLE_1M at Channel 2402MHz		

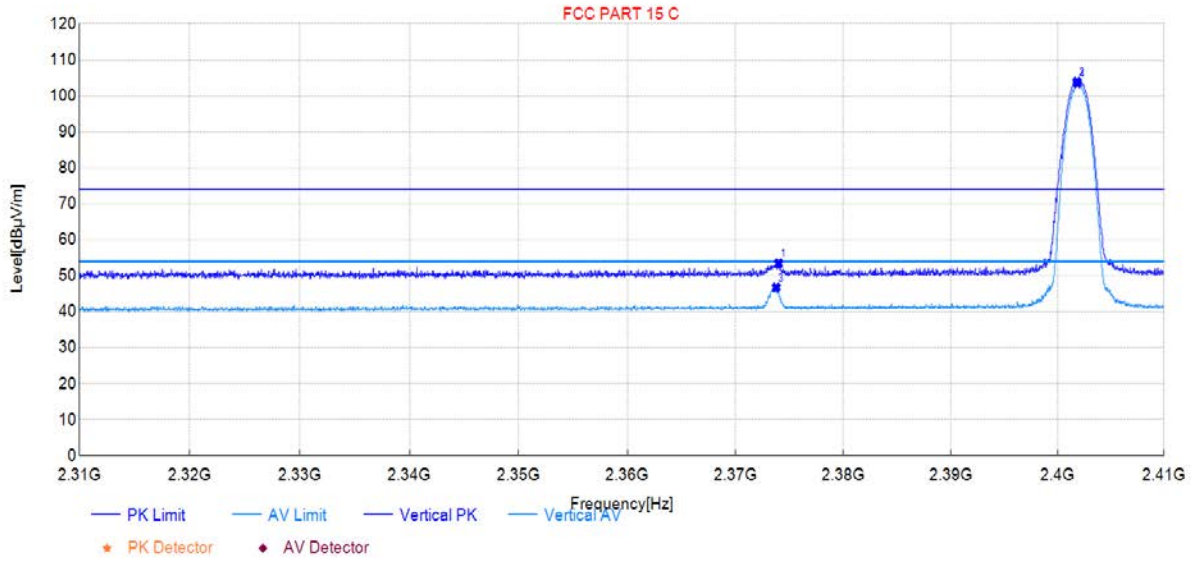


Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	2387.29	16.72	52.81	36.09	74.00	21.19	150	259	PK	Horizontal	PASS
2	2401.67	60.66	96.81	36.15	/	/	150	354	PK	Horizontal	PASS
3	2373.37	6.14	42.16	36.02	54.00	11.84	150	142	AV	Horizontal	PASS
4	2401.77	59.94	96.09	36.15	/	/	150	354	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level



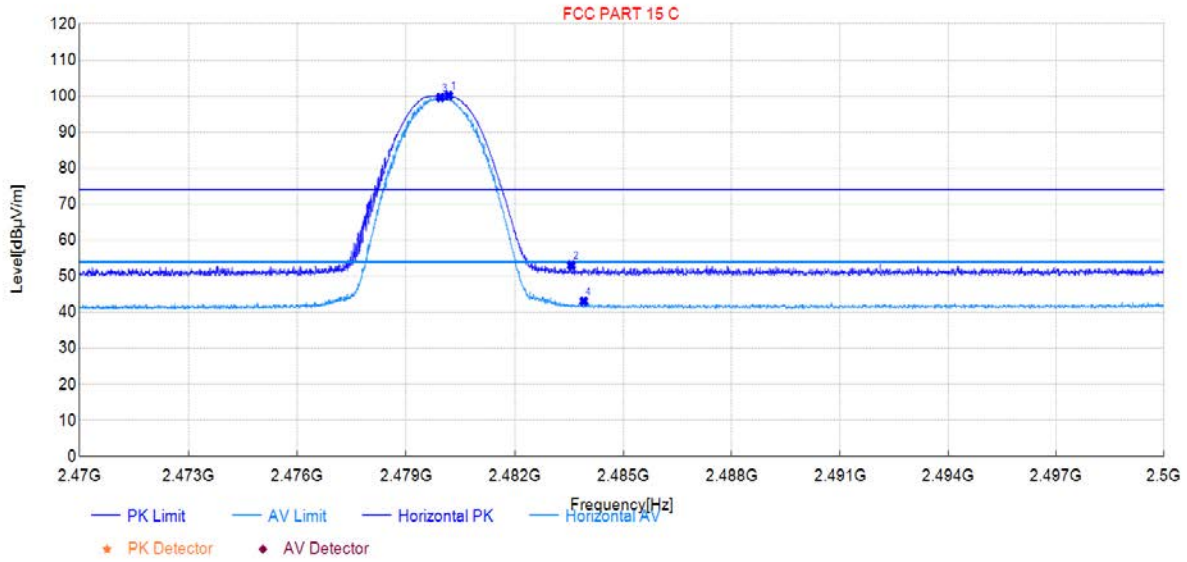
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	2373.99	17.58	53.47	35.89	74.00	20.53	150	81	PK	Vertical	PASS
2	2401.82	67.98	103.97	35.99	/	/	150	23	PK	Vertical	PASS
3	2373.77	10.88	46.77	35.89	54.00	7.23	150	163	AV	Vertical	PASS
4	2401.85	67.45	103.44	35.99	/	/	150	23	AV	Vertical	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Project Information			
EUT:	LED Playback Control Processor	Model:	TU40 Pro
Test Date:	2024-08-29	Voltage:	AC 120V 60Hz
Environment:	Temp: 27.1℃; Humi:51%	Engineer:	Stone Zhang
Remark:	Transmit by BLE_1M at Channel 2480MHz		

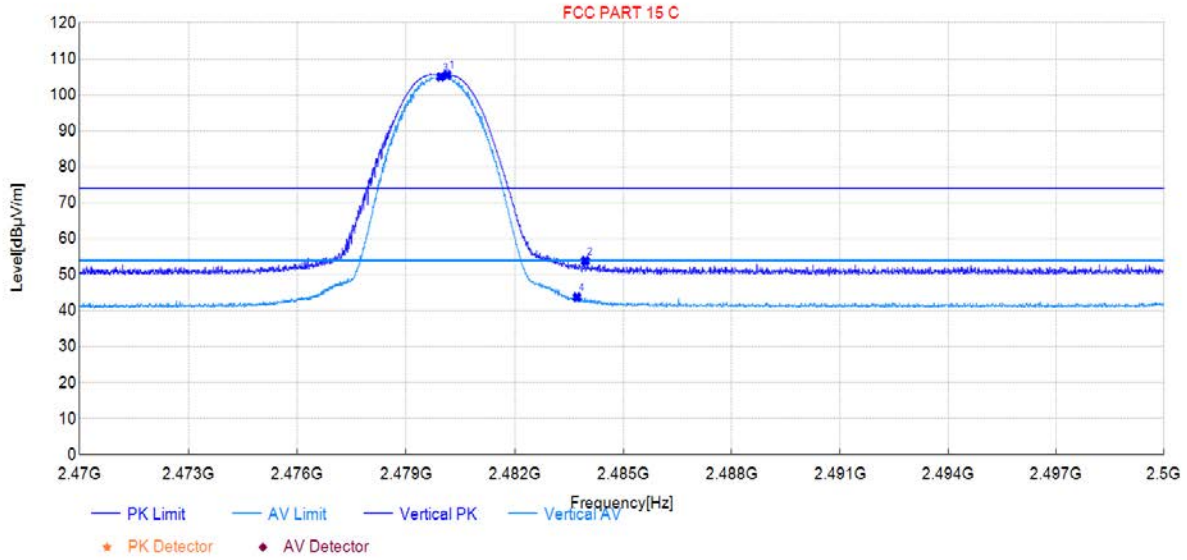


Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	2480.18	63.80	100.15	36.35	/	/	150	44	PK	Horizontal	PASS
2	2483.56	16.68	53.04	36.36	74.00	20.96	150	74	PK	Horizontal	PASS
3	2479.95	63.23	99.58	36.35	/	/	150	44	AV	Horizontal	PASS
4	2483.91	6.71	43.07	36.36	54.00	10.93	150	41	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level



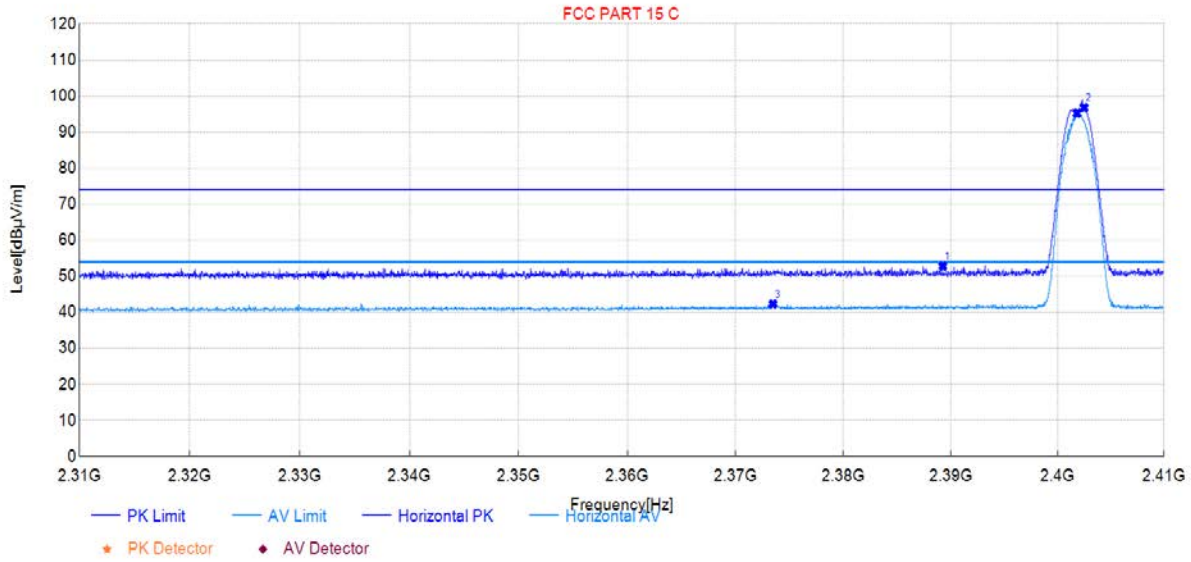
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	2480.14	69.49	105.57	36.08	/	/	150	167	PK	Vertical	PASS
2	2483.95	17.79	53.87	36.08	74.00	20.13	150	162	PK	Vertical	PASS
3	2479.95	68.94	105.02	36.08	/	/	150	170	AV	Vertical	PASS
4	2483.72	7.68	43.76	36.08	54.00	10.24	150	175	AV	Vertical	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Project Information			
EUT:	LED Playback Control Processor	Model:	TU40 Pro
Test Date:	2024-08-29	Voltage:	AC 120V 60Hz
Environment:	Temp: 27.1℃; Humi:51%	Engineer:	Stone Zhang
Remark:	Transmit by BLE_2M at Channel 2402MHz		

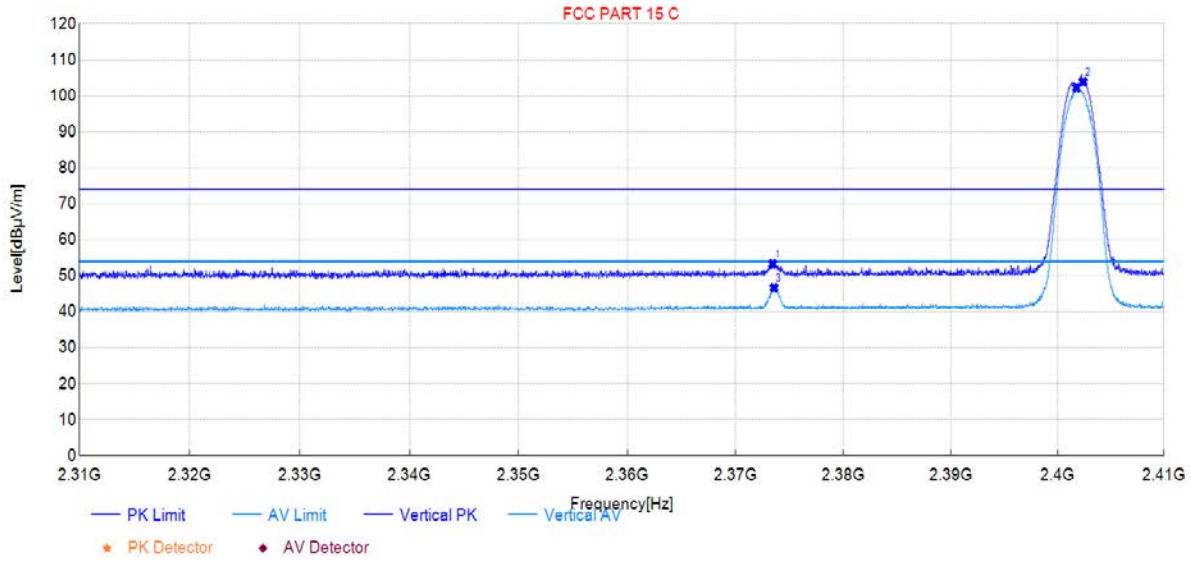


Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	2389.27	16.76	52.85	36.09	74.00	21.15	150	199	PK	Horizontal	PASS
2	2402.50	60.67	96.83	36.16	/	/	150	57	PK	Horizontal	PASS
3	2373.47	6.26	42.28	36.02	54.00	11.72	150	278	AV	Horizontal	PASS
4	2401.82	59.08	95.23	36.15	/	/	150	57	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level



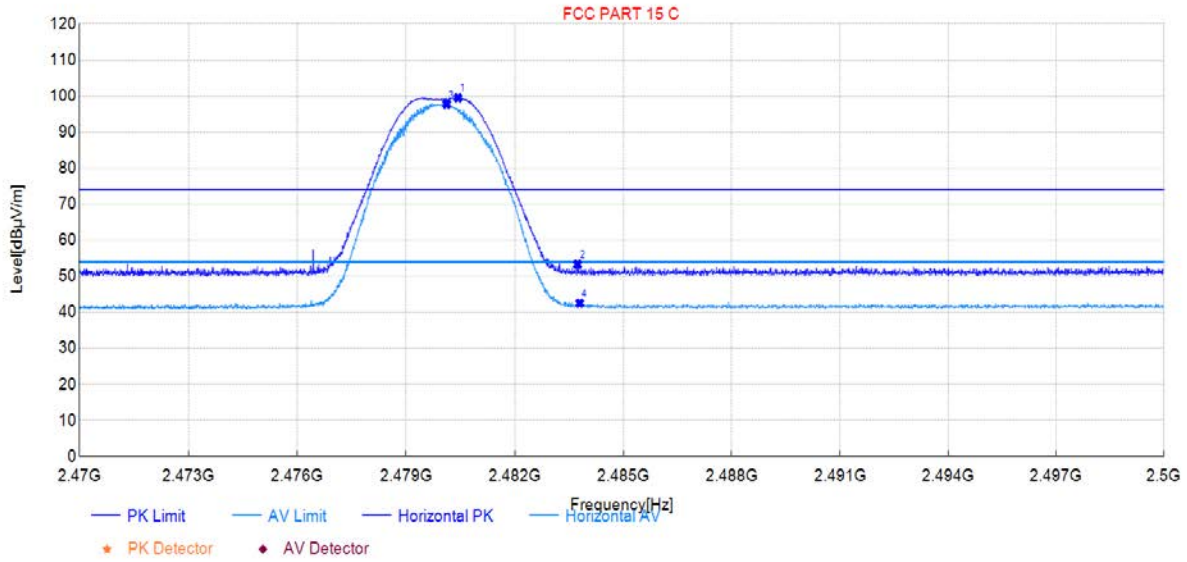
Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	2373.44	17.40	53.29	35.89	74.00	20.71	2373.44	17.40	PK	Vertical	PASS
2	2402.40	67.92	103.91	35.99	/	/	2402.40	67.92	PK	Vertical	PASS
3	2373.57	10.78	46.67	35.89	54.00	7.33	2373.57	10.78	AV	Vertical	PASS
4	2401.77	66.25	102.24	35.99	/	/	2401.77	66.25	AV	Vertical	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

Project Information			
EUT:	LED Playback Control Processor	Model:	TU40 Pro
Test Date:	2024-08-29	Voltage:	AC 120V 60Hz
Environment:	Temp: 27.1℃; Humi:51%	Engineer:	Stone Zhang
Remark:	Transmit by BLE_2M at Channel 2480MHz		

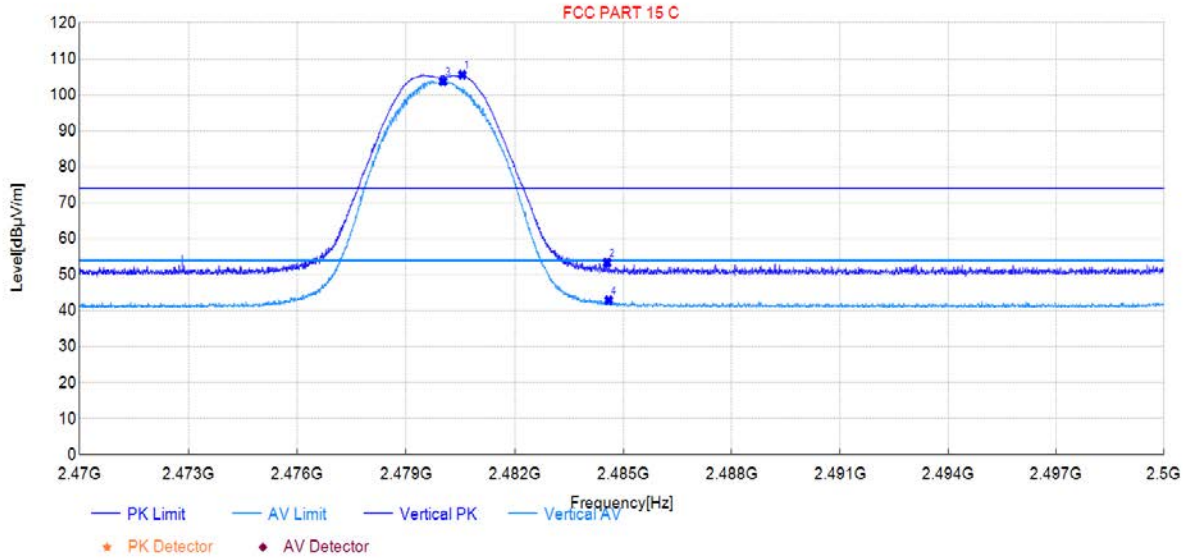


Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	2480.44	63.15	99.50	36.35	/	/	150	41	PK	Horizontal	PASS
2	2483.74	16.96	53.32	36.36	74.00	20.68	150	88	PK	Horizontal	PASS
3	2480.12	61.41	97.76	36.35	/	/	150	41	AV	Horizontal	PASS
4	2483.80	6.15	42.51	36.36	54.00	11.49	150	41	AV	Horizontal	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level



Suspected Data List											
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Det	Pol	Verdict
1	2480.56	69.51	105.59	36.08	/	/	150	170	PK	Vertical	PASS
2	2484.55	17.31	53.39	36.08	74.00	20.61	150	218	PK	Vertical	PASS
3	2480.02	67.61	103.69	36.08	/	/	150	170	AV	Vertical	PASS
4	2484.60	6.86	42.94	36.08	54.00	11.06	150	100	AV	Vertical	PASS

Note:

(1) Level=Reading + Factor

(2) Margin=Limit-Level

7.8. AC Conducted Emissions Measurement

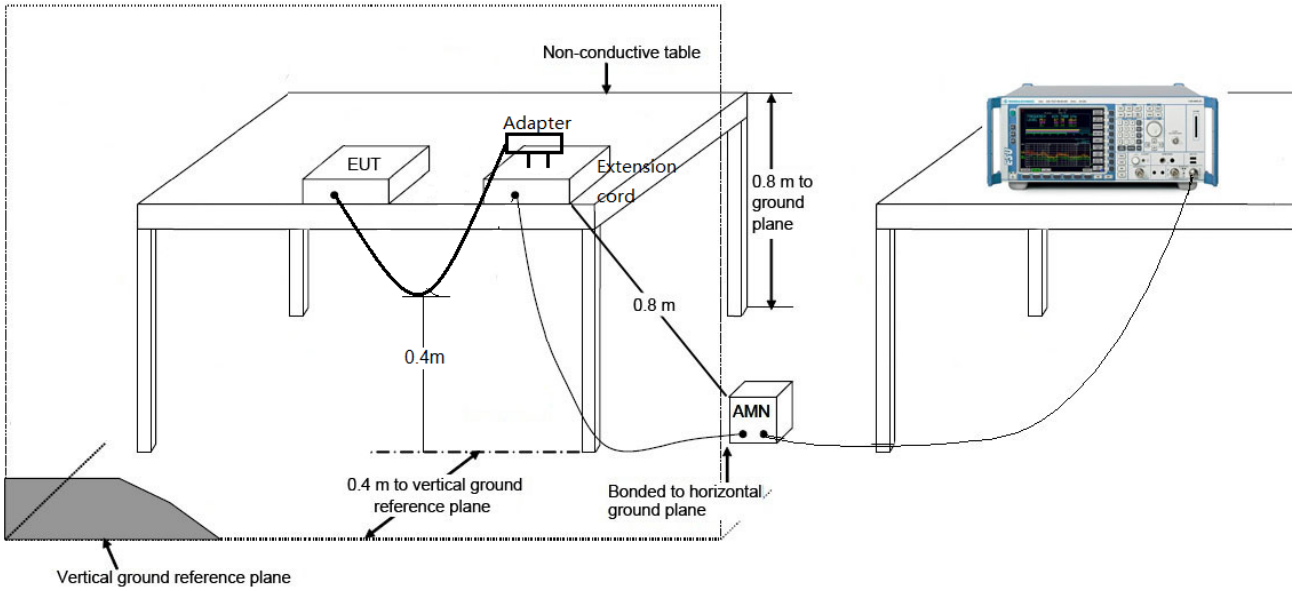
7.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 – 46
0.50 - 5.0	56	46
5.0 - 30	60	50

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

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

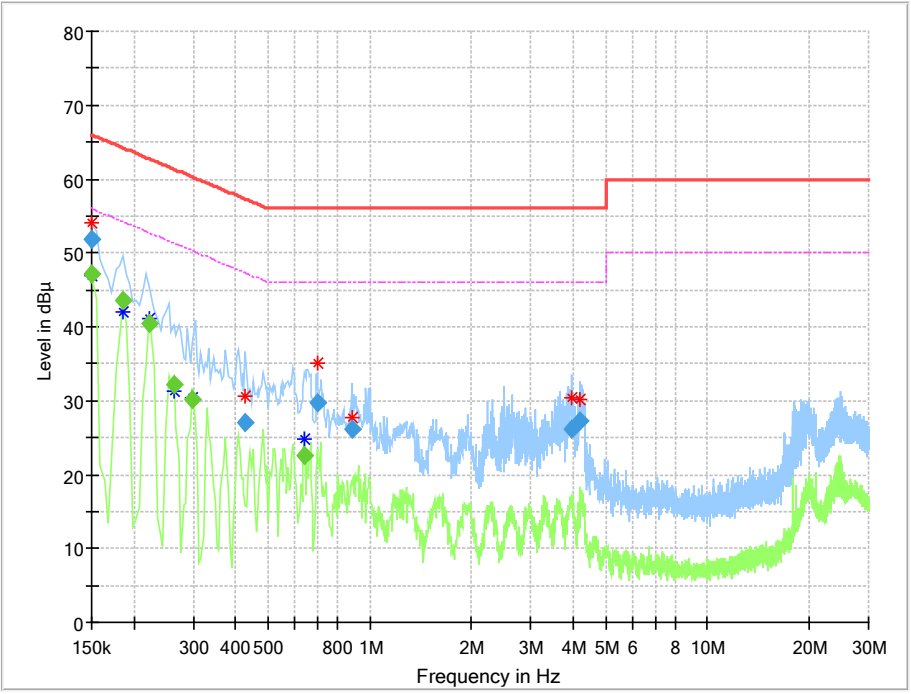
7.8.2. Test Setup



7.8.3. Test Result

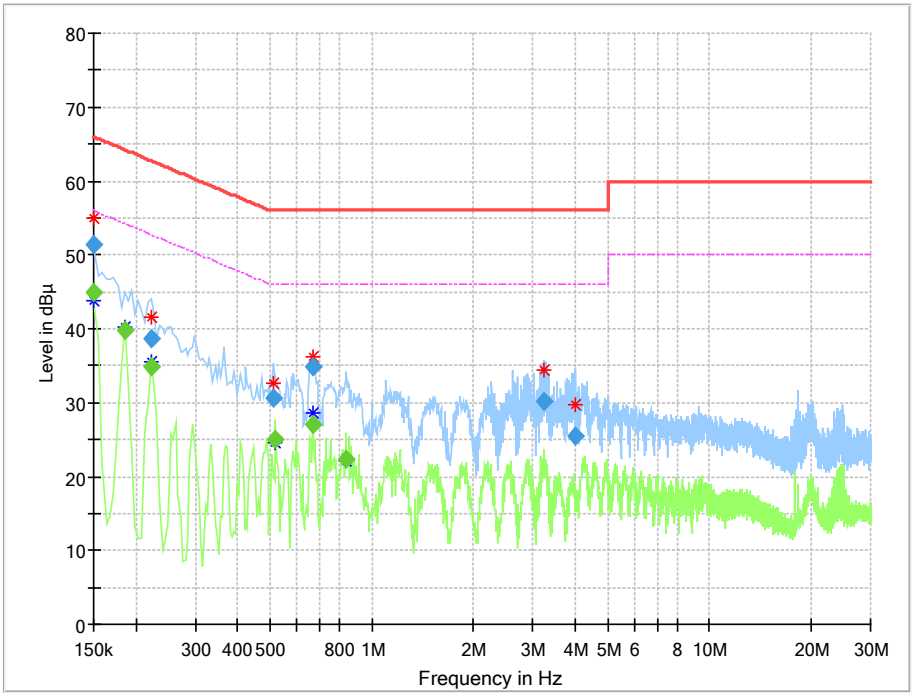
The worst case of Conducted Emissions:

EUT:	LED Playback Control Processor	Polarity:	LINE
Model:	TU40 Pro	Power Supply:	/
Mode:	/	Voltage:	120V/60Hz
Environment:	Temp: 24℃; Humi:52%	Engineer:	Stone Zhang
Remark:	Transmit at BLE_1M Channel 00		



Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	---	47.22	56.00	8.78	100.0	9.000	L1	ON	9.8
0.150000	51.95	---	66.00	14.05	100.0	9.000	L1	ON	9.8
0.186000	---	43.57	54.21	10.65	100.0	9.000	L1	ON	9.8
0.222000	---	40.40	52.74	12.34	100.0	9.000	L1	ON	9.8
0.262500	---	32.17	51.35	19.18	100.0	9.000	L1	ON	9.8
0.298500	---	30.06	50.28	20.22	100.0	9.000	L1	ON	9.8
0.429000	27.08	---	57.27	30.19	100.0	9.000	L1	ON	9.8
0.640500	---	22.56	46.00	23.44	100.0	9.000	L1	ON	9.8
0.699000	29.67	---	56.00	26.33	100.0	9.000	L1	ON	9.8
0.883500	26.09	---	56.00	29.91	100.0	9.000	L1	ON	9.8
3.966000	26.12	---	56.00	29.88	100.0	9.000	L1	ON	9.8
4.209000	27.36	---	56.00	28.64	100.0	9.000	L1	ON	9.8

EUT:	LED Playback Control Processor	Polarity:	NEUTRAL
Model:	TU40 Pro	Power Supply:	/
Mode:	/	Voltage:	120V/60Hz
Environment:	Temp: 24℃; Humi:52%	Engineer:	Stone Zhang
Remark:	Transmit at BLE_1M Channel 00		



Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	---	44.85	56.00	11.15	100.0	9.000	N	ON	9.8
0.150000	51.50	---	66.00	14.50	100.0	9.000	N	ON	9.8
0.186000	---	39.69	54.21	14.52	100.0	9.000	N	ON	9.8
0.222000	---	34.96	52.74	17.79	100.0	9.000	N	ON	9.8
0.222000	38.71	---	62.74	24.03	100.0	9.000	N	ON	9.8
0.510000	30.61	---	56.00	25.39	100.0	9.000	N	ON	9.8
0.519000	---	25.05	46.00	20.95	100.0	9.000	N	ON	9.8
0.667500	34.83	---	56.00	21.17	100.0	9.000	N	ON	9.8
0.667500	---	26.99	46.00	19.01	100.0	9.000	N	ON	9.8
0.838500	---	22.30	46.00	23.70	100.0	9.000	N	ON	9.8
3.219000	30.15	---	56.00	25.85	100.0	9.000	N	ON	9.8
4.015500	25.44	---	56.00	30.56	100.0	9.000	N	ON	9.8

8. CONCLUSION

The data collected relate only the item(s) tested and show that the **LED Playback Control Processor** is compliance with Part 15C of the FCC Rules.

The End