Nemko Korea Co., Ltd.

165-51, Yurim-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, 17042, Republic of Korea.
TEL :+82 31 330-1700 FAX:+82 31 322 2332

FCC EVALUATION REPORT FOR CERTIFICATION

Project No. : NK-23-R-231
Applicant : LG Electronics USA., Inc.
27, Digital-ro 27 ga-gil, Guro-gu SEOUL
08375, Korea, Republic of
Attn. : Byeong-Seob Lee

Dates of receipt : July 24, 2023
Dates of Issue : September 26, 2023
Test Site :
Nemko Korea Co., Ltd.

FCC ID:	**BEJ-F1DA2835P**
Applicant :	**LG Electronics USA., Inc.**
Brand Name	**LG**

Model:	**F1DA2835P**
Additional Model(s):	**-**
EUT Type:	**Bluetooth module**
Classification:	**Digital Transmission Systems (DTS)**
Date of Test:	**July 27, 2023 ~ September 05, 2023**
Applied Standard:	**FCC 47 CFR Part 15.247**

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested By : Hyeonseung Lee
Test Engineer

Reviewed By : Hoonpyo Lee
Technical Manager

Revision History

Rev.	Issue Date	Revisions	Revised By
00	September 26, 2023	Initial issue	Hyeonseung Lee

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Test facility

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2014), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) was used in determining radiated and conducted emissions emanating.

These measurement tests were conducted at **Nemko Korea Co., Ltd.**
The site address 165-51, Yurim-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, 17042, Rep. of Korea and 155, Osan-ro, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 16885 Rep. of Korea.

1.2 Accreditation and listing

Accreditation type		Accreditation number
FC	CAB Accreditation for DOC	Designation No. KR0026
KOLAS	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. KT155
Industry Canada	Canada IC Registered site	Site No. 29506 Site No. 2040E
VCCI	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
IECEE CB SCHEME	EMC CBTL	TL124
KC	KCC(RRL)Designated Lab.	Registration No. KR0026

2. EUT INFORMATION & TEST CONDITIONS

2.1 EUT Information

2.1.1 Specifications

EUT Type	Bluetooth module
Model Name	F1DA2835P
Frequency of Operation	2 402 MHz ~ 2 480 MHz
Peak Output Power (Conducted)	3.69 dBm
Number of Channels	40 CH
Modulations	GFSK
Antenna Gain (peak)	2.1 dBi
Antenna Setup	1TX / 1RX
EUT Rated Voltage	3.3 Vdc
EUT Test Voltage	3.3 Vdc
Remarks	-

2.1.2 Addiational model covered by this report

2.2 Operation During Test

The EUT is the transceiver which is Bluetooth v5.3 supporting BDR/EDR/LE mode.
The Laptop PC was used to control the EUT to transmit the wanted TX channel continuously (duty cycle < 98%) by the testing program (FCC) and testing command supported by manufacturer.
The operating voltage of EUT was 3.3 Vdc supplied from jig board connected to USB port on Laptop PC.

The EUT was tested at the lowest, middle and the highest channels with the maximum output power in accordance with the manufacturer's specifications. The worst data were recorded in the report.

2.2.1 Table of Test power setting

Frequency	Mode	Modulation	Power setting Level
2 402 MHz ~ 2 480 MHz	BLE 1Mbps	GFSK	10
	BLE 2Mbps		

2.2.2 Table of Test frequency

Frequency band	Modulation	Test Channel (CH)	Frequency (MHz)
2.4 GHz	GFSK	0	2 402
		19	2 440
		39	2 480

2.2.3 Average Output Power

Mode	Frequency	Average Output Power (dBm)	Average Output Power (mW)
Bluetooth LE 1Mbps	2 402	3.44	5.37
	2 440	3.52	5.47
	2 480	3.56	5.51
Bluetooth LE 2Mbps	2 402	2.98	4.74
	2 440	3.06	4.86
	2 480	3.09	4.90

2.2.4 Antenna Information

Frequency band	Modulation	Antenna TX mode	Support CDD	Support MIMO
2.4 GHz	GFSK	■ 1TX, □ 2TX	□ Yes, ■ No	□ Yes, ■ No

2.2.5 Additional Information Related to Testing

The cable and attenuator loss from 30 MHz to 26.5 GHz was reflected in spectrum analyzer with correction factor for all conducted testing.

2.2.6 Worst-case Configuration and Mode

Radiated emission below 1GHz was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

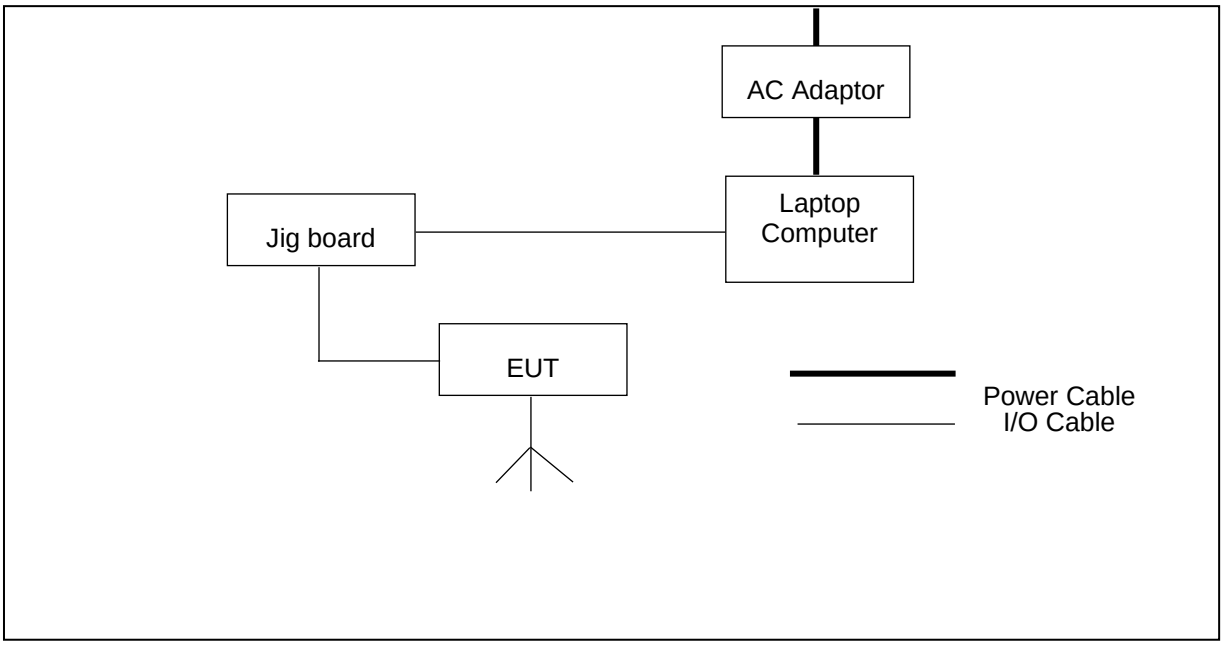
The emissions (Band-edge & spurious emissions) were investigated in three orthogonal orientations X, Y and Z.
Accordingly, the orientation was determined and tested as shown in the table below:

Test Items	X	Y	Z
Band-edge	O	-	-
Spurious emissions	O	-	-

2.3 Support Equipment

EUT	Anam Electronics Co., Ltd. Model : F1DA2835P	S/N: N/A
Laptop Computer	LG Model : 15Z90N-VP50ML	FCC DOC S/N : 003NZSJ038878
AC/DC Adapter	LG Model : WA-48B19FS	FCC DOC S/N : AKDS7648893016463

2.4 Setup Drawing



3. ANTENNA REQUIREMENTS

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15.

§15.203 of the FCC Rules part 15 Subpart C

: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The transmitter has permanently attached Dielectric Chip antenna (Internal antenna) on board.

Used Antenna	
Model name	2 402 MHz ~ 2 480 MHz
	Max. peak gain (dBi)
F1304R	2.1

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	Test Limit	Test Condition	Result	Remark
6dB Bandwidth	15.247(a)(2)	> 500 kHz	Conducted	Complies	-
Peak Output Power	15.247(b)(3)	< 1 Watt		Complies	-
Power Spectral Density	15.247(e)	< 8 dBm/3 kHz		Complies	-
Band Edge / Conducted Spurious Emission	15.247(d)	≥ 20 dBc		Complies	-
Radiated Spurious Emission	15.205, 15.209	< 74 dBμV/m (PK) < 54 dBμV/m (AV) Radiated limits detailed in 15.209	Radiated	Complies	-
AC Line Conducted Emission	15.207	FCC 15.207 Limits	Line Conducted	Complies	-

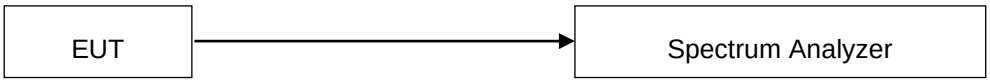
5. TEST METHODOLOGY

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 15.247 Meas Guidance v05r02.
4. ANSI C63.10-2013

6. DESCRIPTION OF TESTS

6.1 Duty Cycle

Test Setup

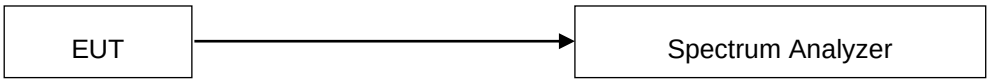


Test Procedure

EUTs Duty Cycle is measured at middle channel with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.
The spectrum analyzer setting is as follows.
RBW ≥ OBW ≤
RBW ≥ VBW
Span = zero span
Detector = Peak
The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100.

6.2 6 dB Bandwidth / Occupied Bandwidth

Test Setup



Test Measurement Method

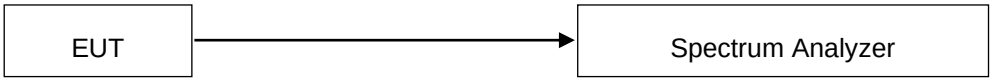
ANSI C63.10-2013, Section 11.8.2 Option 2
KDB 558074 D01 v05r02, Section 8.2

Test Procedure

EUTs 6 dB bandwidth is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.
The spectrum analyzer setting is as follows.
RBW = 100 kHz
VBW > 3 x RBW
Detector = Peak
Trace mode = max hold
Sweep = auto couple
Allow trace to fully stabilize.
The bandwidth measurement function on the spectrum analyzer is used to measure the 6 dB bandwidth.

6.3 Peak Output Power

Test Setup



Test Measurement Method

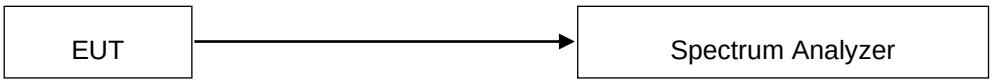
ANSI C63.10-2013, Section 11.9.1.1
KDB 558074 D01 v05r02, Section 8.3.1.1

Test Procedure

EUTs Maximum Peak Conducted Output Power is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.
The spectrum analyzer setting is as follows.
RBW ≥ DTS bandwidth
VBW ≥ 3 x RBW
Span ≥ 3 x RBW
Sweep time = auto couple
Detector = peak
Trace mode = max hold
Allow trace to fully stabilize.
Use peak marker function to determine the peak amplitude level.

6.4 Power Spectral Density

Test Setup



Test Measurement Method

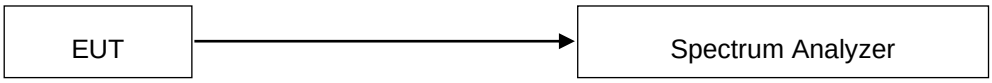
ANSI C63.10-2013, Section 11.10.2 Method PKPSD
KDB 558074 D01 v05r02, Section 8.4

Test Procedure

EUTs Power Spectral Density is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.
The spectrum analyzer setting is as follows.
Center frequency = DTS channel center frequency
Span = 1.5 times the DTS channel bandwidth
RBW ≥ 3 kHz
VBW ≥ 3 x RBW
Detector = peak
Sweep time = auto couple
Trace mode = max hold
Allow the trace to stabilize.
The peak search function on the spectrum analyzer is used to determine the maximum amplitude level within the RBW.

6.5 Band Edge / Conducted Spurious Emissions

Test Setup



Test Measurement Method

ANSI C63.10-2013, Section 11.11.3
KDB 558074 D01 v05r02, Section 8.5, Section 8.7.2

Test Procedure

EUTs Conducted spurious emissions are measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level. The spectrum analyzer setting is as follows.

1) Reference Level
Center frequency = DTS channel center frequency
Span ≥ 1.5 x DTS bandwidth
RBW = 100 kHz
VBW ≥ 3 x RBW
Detector = peak
Sweep time = auto couple
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.

2) Unwanted Emissions
Set the center frequency and span to encompass frequency range to be measured.
RBW = 100 kHz
VBW ≥ 3 x RBW
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.

6.6 Radiated Emissions

Test Measurement Method

ANSI C63.10-2013, Section 6.6.4.3, Section 11.11, Section 11.12
KDB 558074 D01 v05r02, Section 8.6, Section 8.7

Test Procedure

The measurement was performed at the test site that is specified in accordance with ANSI C63.10-2013.
The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna and 30 to 1000 MHz using Trilog broadband test antenna. Above 1 GHz, Horn antenna was used.
For emissions testing at below 1GHz, The test equipment was placed on turntable with 0.8 m above ground. For emission measurements above 1 GHz, The test equipment was placed on turntable with 1.5 m above ground. 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 EUT, cable, wire arrangement and mode of operation that has the highest amplitude relative to the limit was selected. Then, the turn table was rotated from 0˚ to 360˚ and an antenna mast was moved from 1 m to 4 m height to maximize the suspected highest amplitude signal. The final maximized level was recorded.

At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection. At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in ANSI 63.10-2013 section 11.12. Peak emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold. Average emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 10 kHz, Detector = Peak, Trace mode = max hold. Allow max hold to run for at least 50 times (1/duty cycle) traces.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88–216	150	3
216–960	200	3
Above 960	500	3

Radiated Emissions Limits per 47 CFR 15.209(a) & RSS-Gen (8.9)

6.7 AC Line Conducted Emissions

Test Measurement Method

ANSI C63.10-2013, Section 6.2

Test Procedure

The Line conducted emission test facility is located inside a 4 x 7 x 2.5 meter shielded enclosure.
It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6. A 1 m x 1.5 m wooden table 0.8 m height is placed 0.4 m away from the vertical wall and 1.5 m away from the side of wall of the shielded room. Rohde & Schwarz (ENV216) of the 50 ohm/50 µH Line Impedance Stabilization Network (LISN) are bonded to the shielded room. The EUT is powered from the Rohde & Schwarz LISN. Power to the LISNs are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1 / 2 ". If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs, All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1 meter length. Sufficient time for 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 spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 150 kHz to 30 MHz with 200 msec sweep time. The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCI). The detector functions were set to CISPR quasi-peak mode & average mode. The bandwidth of receiver was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; whichever determined the worst case emission.
Each EME reported was calibrated using the R&S signal generator.

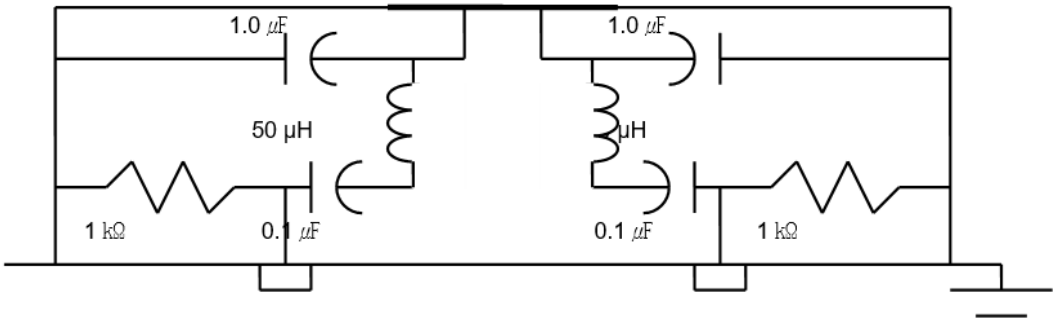


Fig. 2. LISN Schematic Diagram

7. TEST DATA

7.1 Duty Cycle

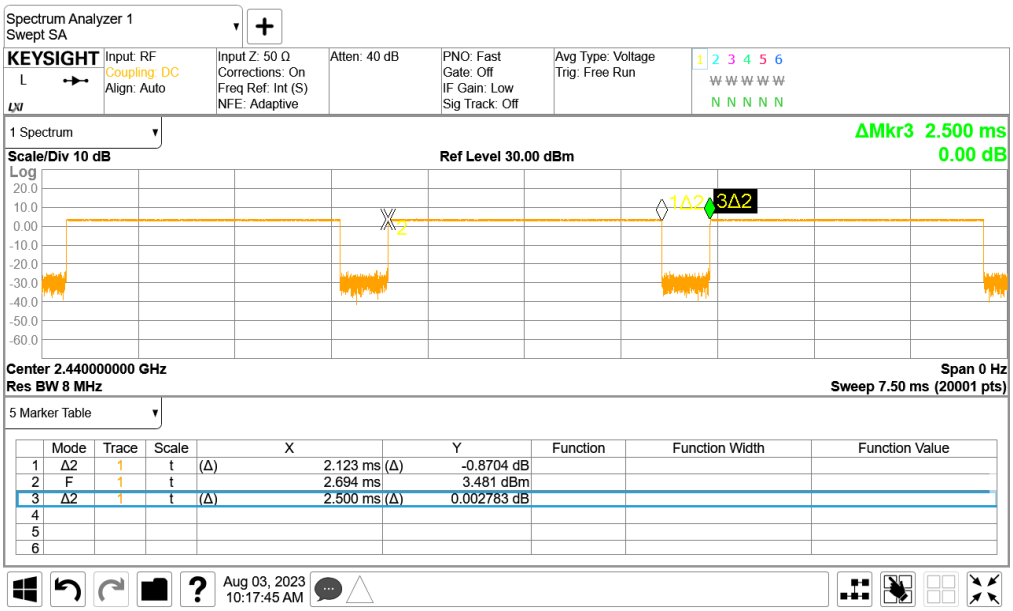
For reporting purposes only.

Result

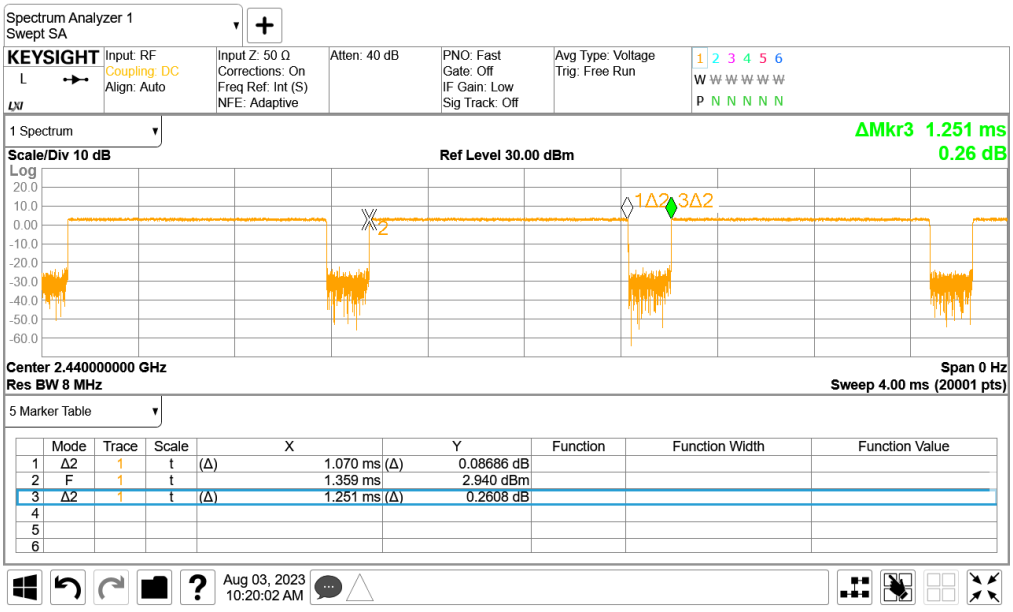
Mode	On time [msec]	Period [msec]	Duty cycle x [Linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum CBW [kHz]
BLE 1Mbps	2.120	2.500	0.848	84.80	0.72	0.47
BLE 2Mbps	1.070	1.251	0.855	85.53	0.68	0.93

PLOTS OF EMISSIONS

Duty Cycle, LE 1Mbps, Middle Channel (2 440 MHz)



Duty Cycle, LE 2Mbps, Middle Channel (2 440 MHz)



7.2 6 dB Bandwidth

FCC §15.247(a)(2)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

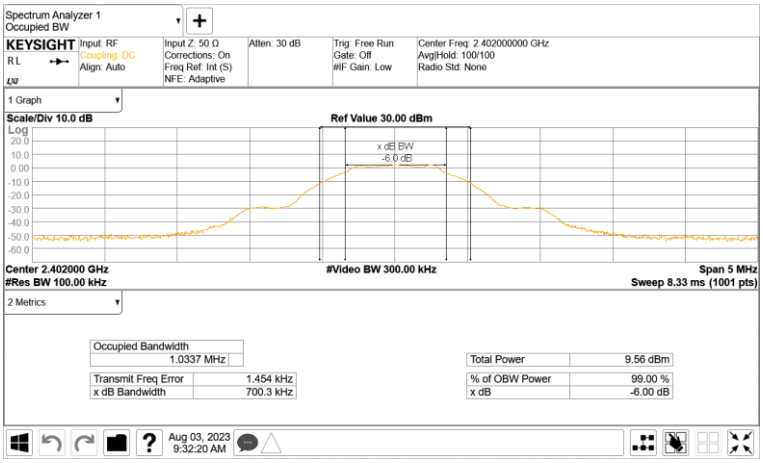
- 6 dB Bandwidth

Bluetooth Mode & Data Rate	Channel No.	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Bandwidth Limit (kHz)
LE 1Mbps	0	2 402	700	500
	19	2 440	697	500
	39	2 480	700	500

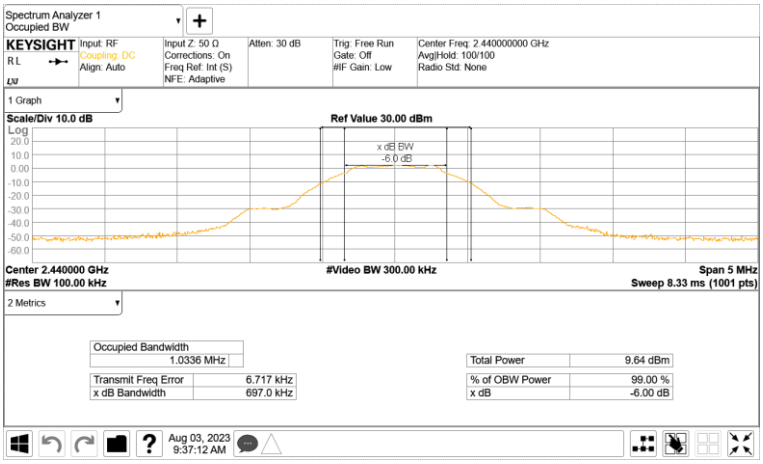
Bluetooth Mode & Data Rate	Channel No.	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Bandwidth Limit (kHz)
LE 2Mbps	0	2 402	1 172	500
	19	2 440	1 170	500
	39	2 480	1 171	500

PLOTS OF EMISSIONS

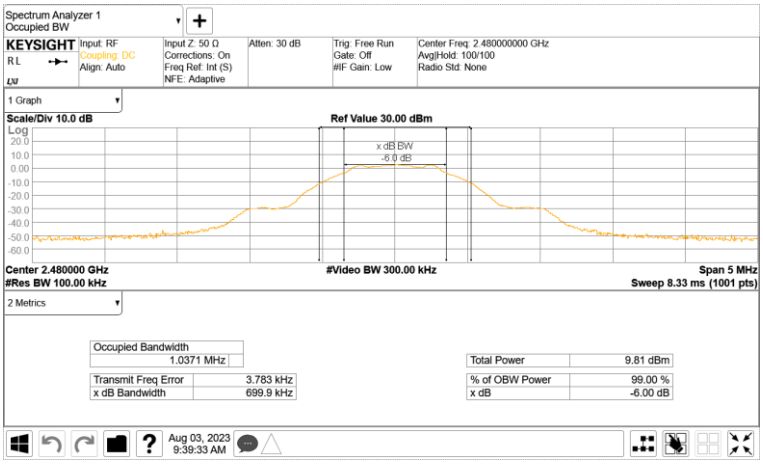
LE 1Mbps, 6 dB Bandwidth, Lowest Channel (2 402 MHz)



LE 1Mbps, 6 dB Bandwidth, Middle Channel (2 440 MHz)

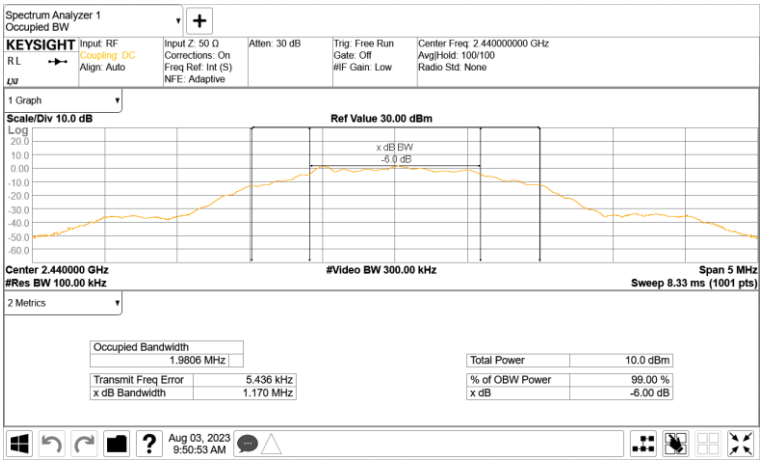


LE 1Mbps, 6 dB Bandwidth, Highest Channel (2 480 MHz)

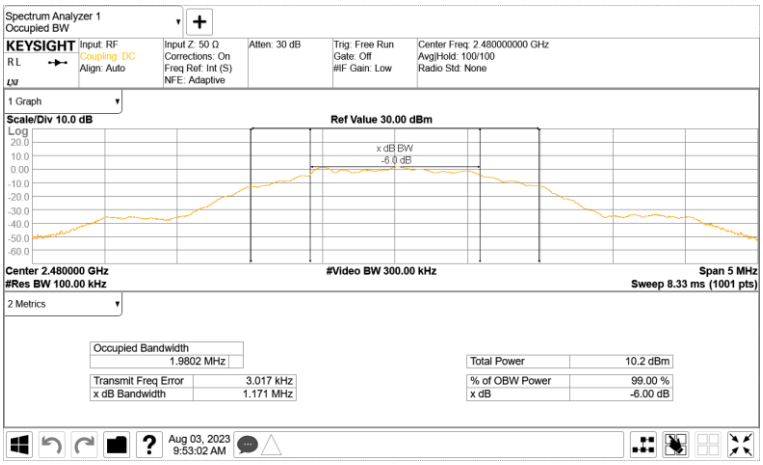


LE 2Mbps, 6 dB Bandwidth, Lowest Channel (2 402 MHz)

LE 2Mbps, 6 dB Bandwidth, Middle Channel (2 440 MHz)



LE 2Mbps, 6 dB Bandwidth, Highest Channel (2 480 MHz)



7.3 Peak Output Power

FCC §15.247(b)(3)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

Bluetooth Mode & Data Rate	Channel No.	Frequency (MHz)	Peak Output Power		Limit (dBm)
			(dBm)	(mW)	
LE 1Mbps	0	2 402	3.48	5.42	30.00
	19	2 440	3.53	5.48	30.00
	39	2 480	3.69	5.67	30.00

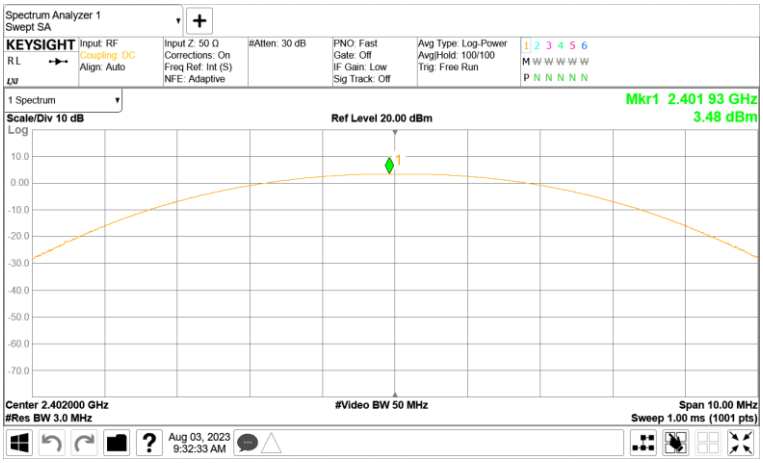
Bluetooth Mode & Data Rate	Channel No.	Frequency (MHz)	Peak Output Power		Limit (dBm)
			(dBm)	(mW)	
LE 2Mbps	0	2 402	3.41	5.33	30.00
	19	2 440	3.43	5.35	30.00
	39	2 480	3.58	5.54	30.00

Notes:

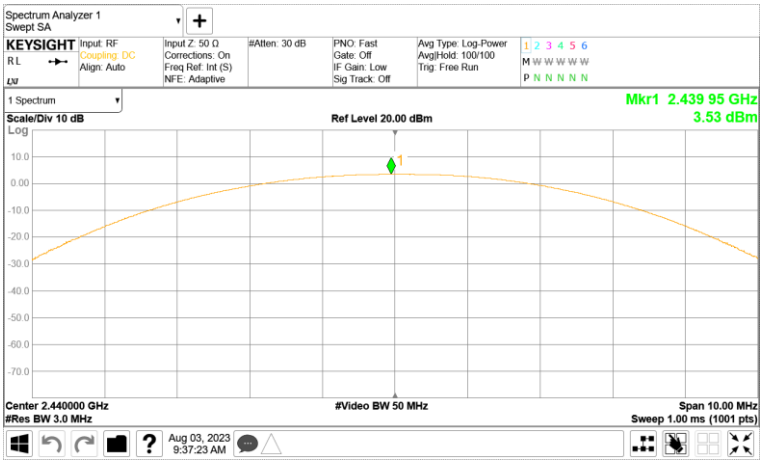
1. The following equation was used for spectrum offset:
   Spectrum offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

PLOTS OF EMISSIONS

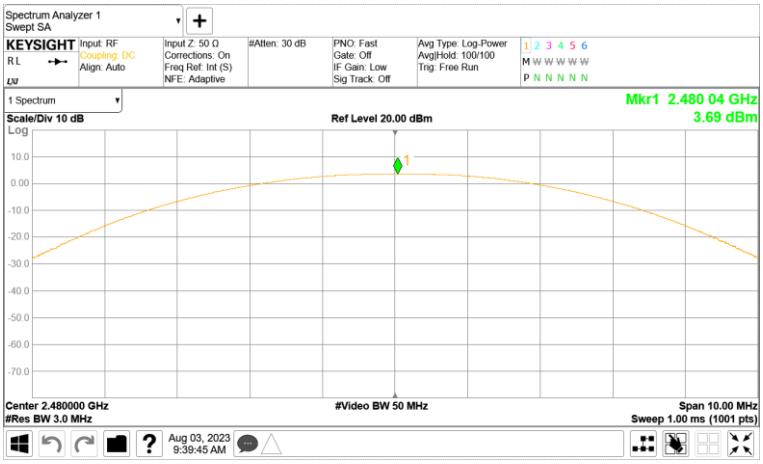
LE 1Mbps, Peak Output Power, Lowest Channel (2 402 MHz)



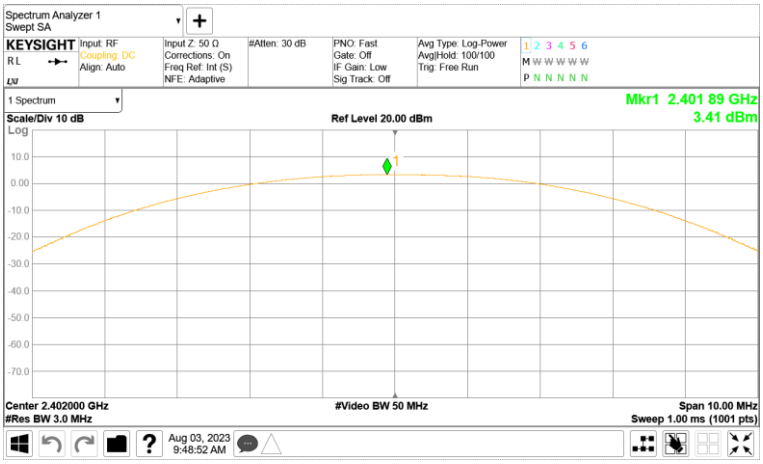
LE 1Mbps, Peak Output Power, Middle Channel (2 440 MHz)



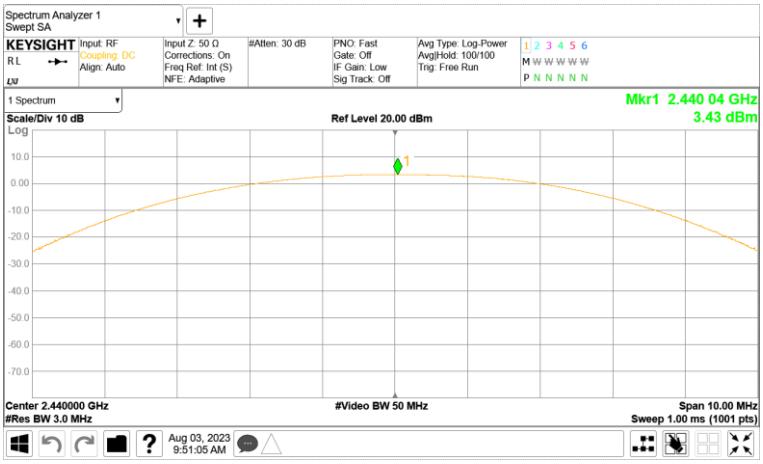
LE 1Mbps, Peak Output Power, Highest Channel (2 480 MHz)



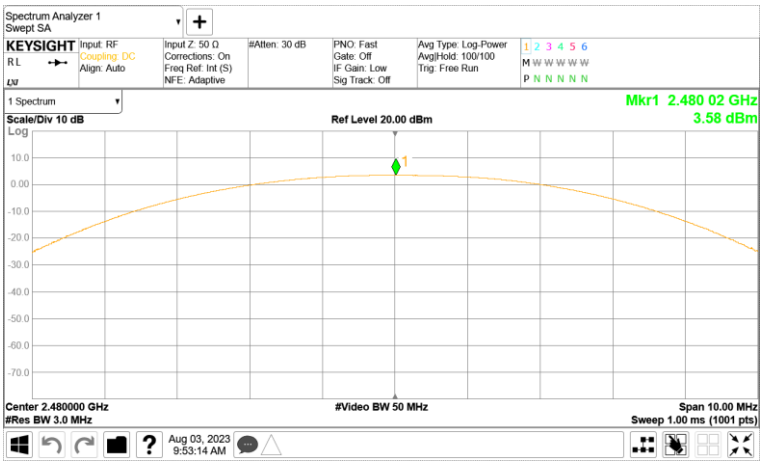
LE 2Mbps, Peak Output Power, Lowest Channel (2 402 MHz)



LE 2Mbps, Peak Output Power, Middle Channel (2 440 MHz)



LE 2Mbps, Peak Output Power, Highest Channel (2 480 MHz)



7.4 Power Spectral Density

FCC §15.247(e)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

Bluetooth Mode & Data Rate	Channel No.	Frequency (MHz)	Measured PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Margin (dB)
LE 1Mbps	0	2 402	-12.67	8.00	-20.67
	19	2 440	-12.55	8.00	-20.55
	39	2 480	-12.35	8.00	-20.35

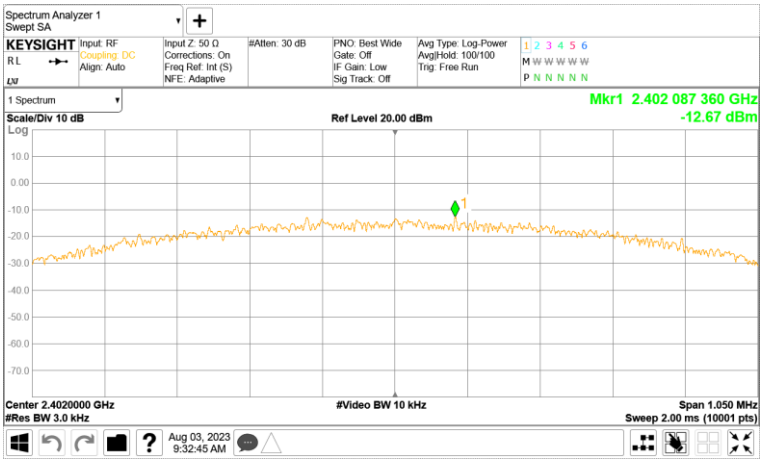
Bluetooth Mode & Data Rate	Channel No.	Frequency (MHz)	Measured PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Margin (dB)
LE 2Mbps	0	2 402	-15.98	8.00	-23.98
	19	2 440	-15.92	8.00	-23.92
	39	2 480	-15.86	8.00	-23.86

Notes:

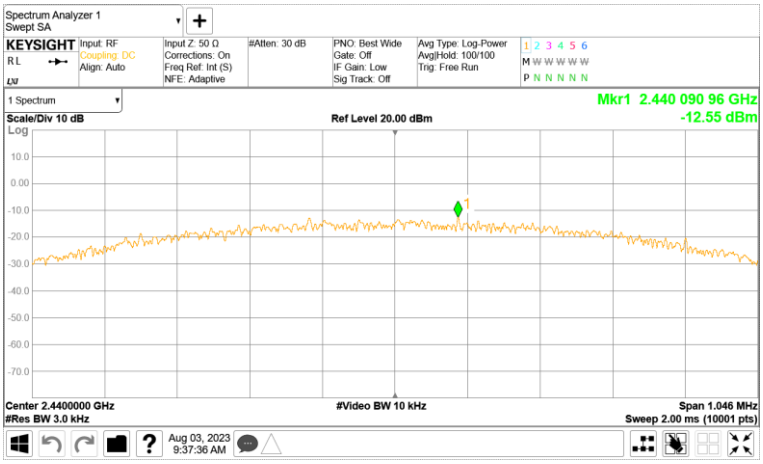
1. The following equation was used for spectrum offset:
   Spectrum offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

PLOTS OF EMISSIONS

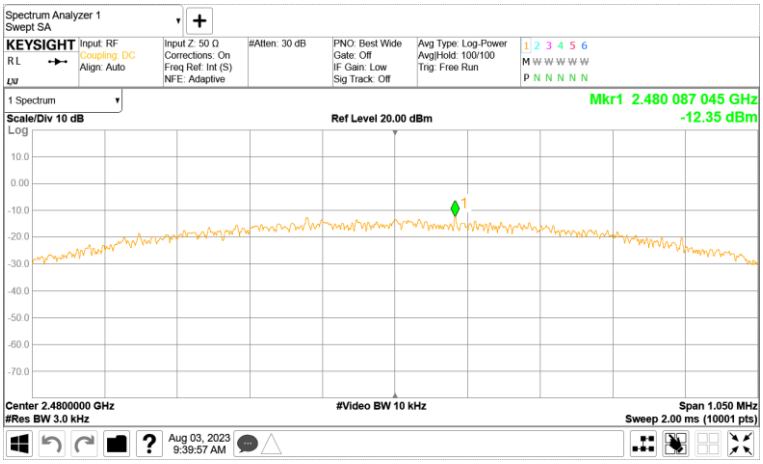
LE 1Mbps, Power Spectral Density, Lowest Channel (2 402 MHz)



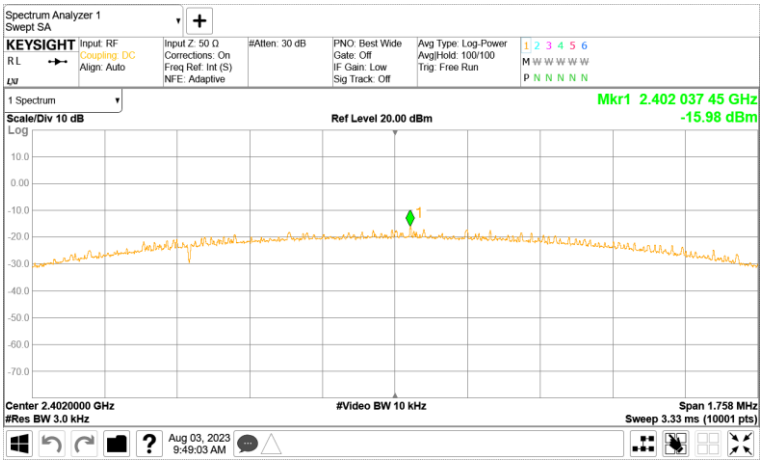
LE 1Mbps, Power Spectral Density, Middle Channel (2 440 MHz)



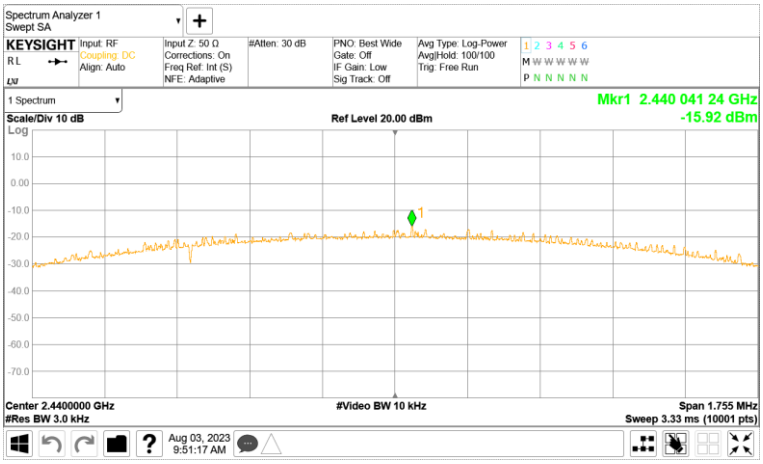
LE 1Mbps, Power Spectral Density, Highest Channel (2 480 MHz)



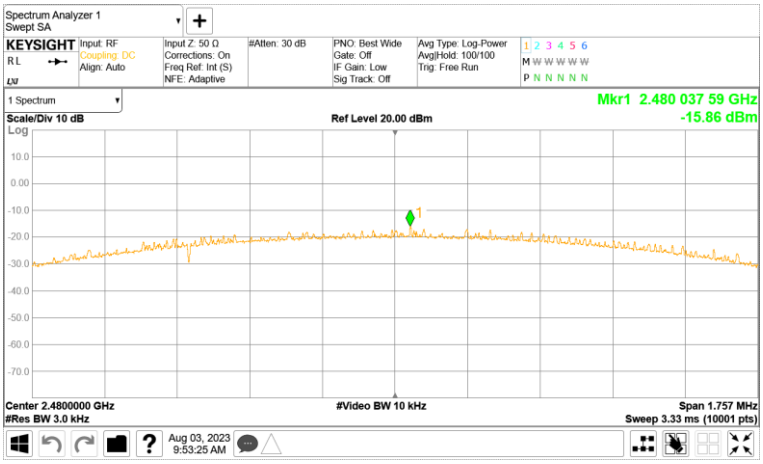
LE21Mbps, Power Spectral Density, Lowest Channel (2 402 MHz)



LE 2Mbps, Power Spectral Density, Middle Channel (2 440 MHz)



LE 2Mbps, Power Spectral Density, Highest Channel (2 480 MHz)



7.5 Band Edge / Conducted Spurious Emissions

FCC §15.247(d)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

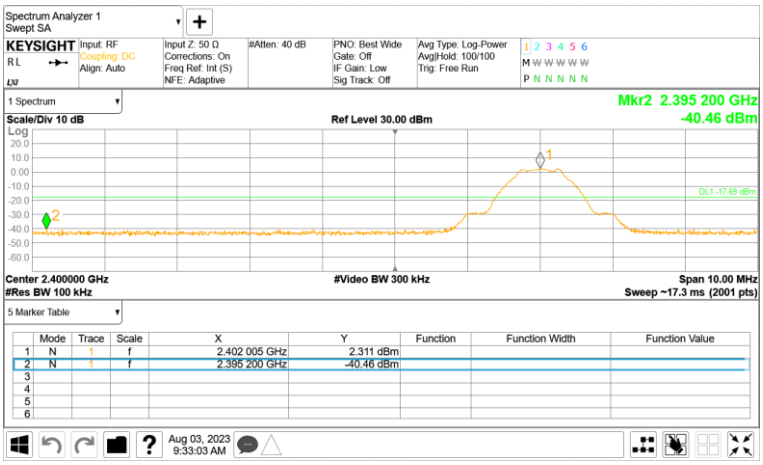
Bluetooth Mode & Data Rate	Channel No.	Frequency (MHz)	Conducted Spurious Emissions (dBc)	Limit (dBc)
LE 1Mbps	0	2 402	More than 20 dBc	20
	19	2 440	More than 20 dBc	20
	39	2 480	More than 20 dBc	20

Bluetooth Mode & Data Rate	Channel No.	Frequency (MHz)	Conducted Spurious Emissions (dBc)	Limit (dBc)
LE 2Mbps	0	2 402	More than 20 dBc	20
	19	2 440	More than 20 dBc	20
	39	2 480	More than 20 dBc	20

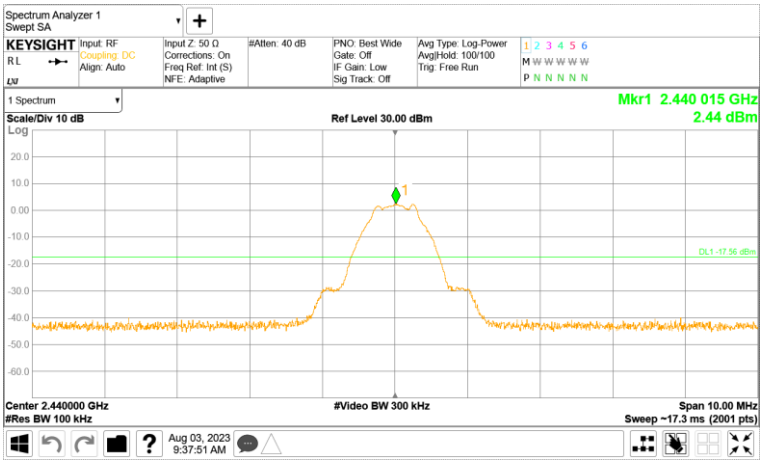
Notes:
The cable and attenuator loss from 30 MHz to 26.5 GHz was reflected in spectrum analyzer with correction factor for the spurious emissions test.

PLOTS OF EMISSIONS (Band Edge)

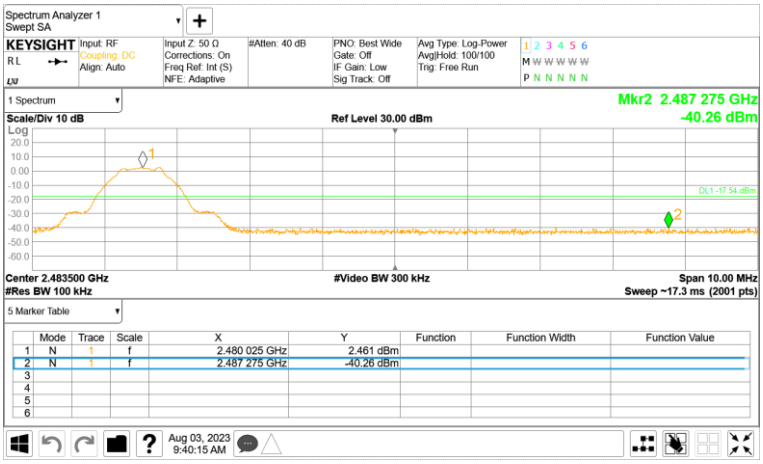
LE 1Mbps, Band Edge, Lowest Channel (2 402 MHz)



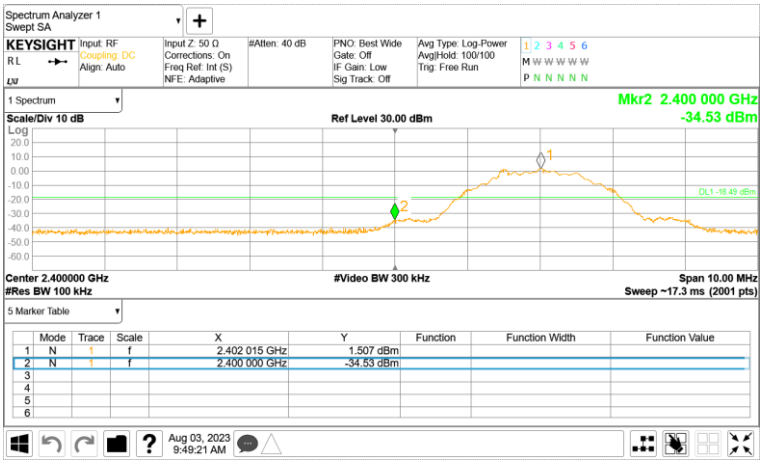
LE 1Mbps, Reference Level, Middle Channel (2 440 MHz)



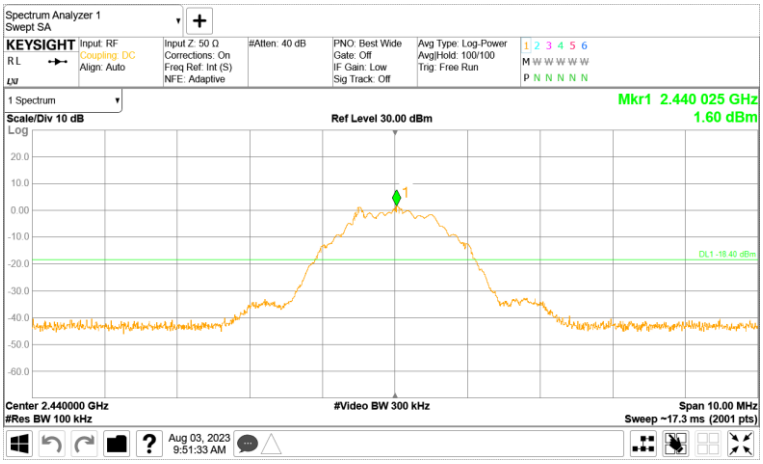
LE 1Mbps, Band Edge, Highest Channel (2 480 MHz)



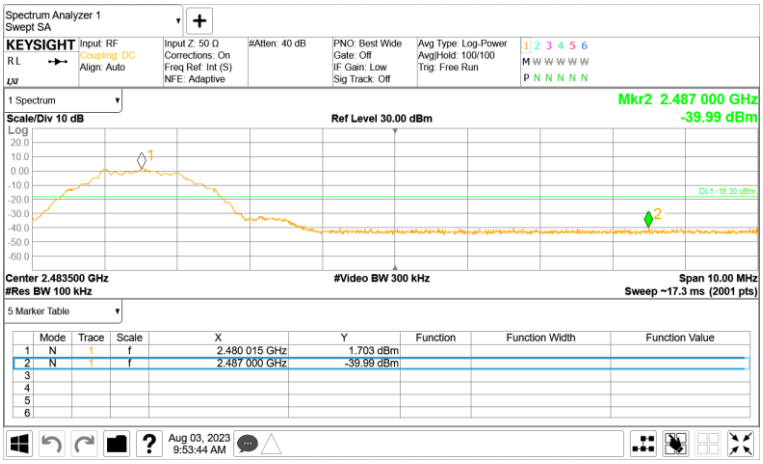
LE 2Mbps, Band Edge, Lowest Channel (2 402 MHz)



LE 2Mbps, Reference Level, Middle Channel (2 440 MHz)



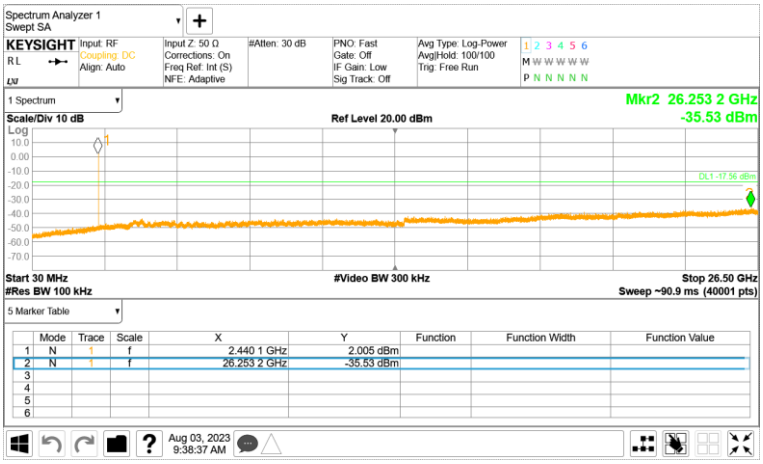
LE 2Mbps, Band Edge, Highest Channel (2 480 MHz)



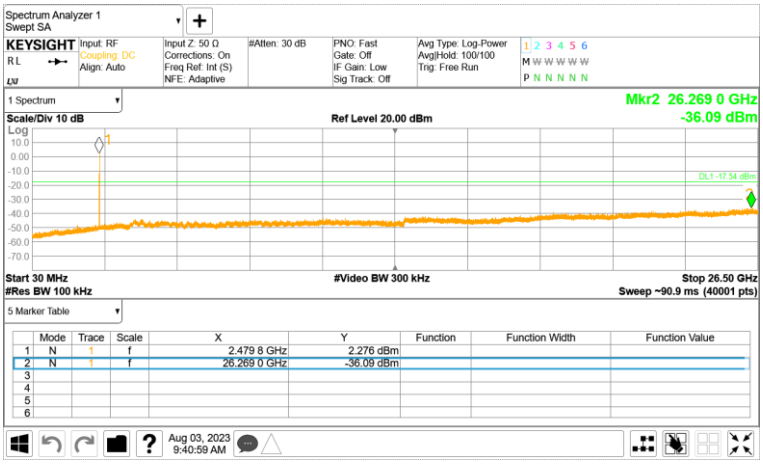
PLOTS OF EMISSIONS (Conducted Spurious Emissions)

LE 1Mbps, Conducted Spurious Emissions, Lowest Channel (2 402 MHz)

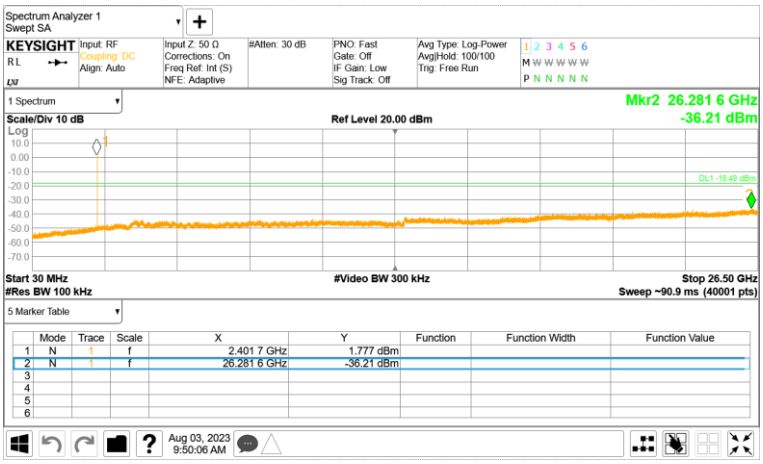
LE 1Mbps, Conducted Spurious Emissions, Middle Channel (2 440 MHz)



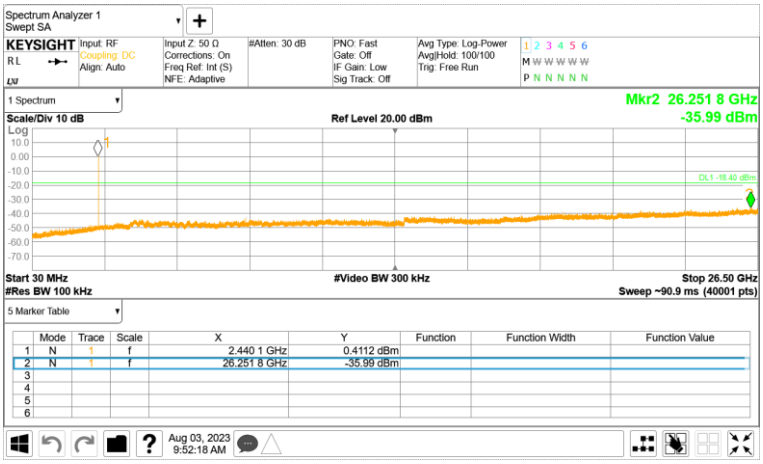
LE 1Mbps, Conducted Spurious Emissions, Highest Channel (2 480 MHz)



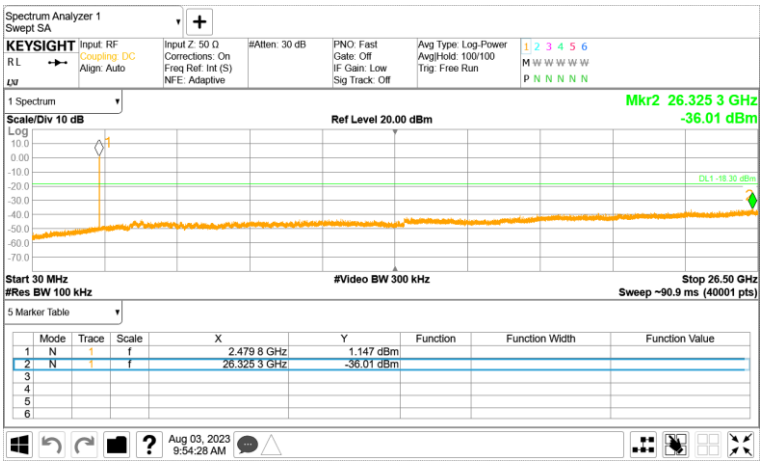
LE 2Mbps, Conducted Spurious Emissions, Lowest Channel (2 402 MHz)



LE 2Mbps, Conducted Spurious Emissions, Middle Channel (2 440 MHz)



LE 2Mbps, Conducted Spurious Emissions, Highest Channel (2 480 MHz)



7.6 Radiated Spurious Emissions

FCC §15.205, §15.209, §15.247(d)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

LE 1Mbps*_Lowest channel *(2 402 MHz)

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4 804.38	43.31	H	PK	1.7	45.01	74.00	28.99
7 675.63	40.64	V	PK	7.5	48.14	74.00	25.86

LE 1Mbps* _Middle channel *(2 440 MHz)

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4 880.00	43.21	V	PK	2.2	45.41	74.00	28.59
7 320.00	39.49	H	PK	6.2	45.69	74.00	28.31

LE 1Mbps*_Highest channel *(2 480 MHz)

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4 960.00	43.45	H	PK	2.4	45.85	74.00	28.15
7 440.00	38.92	H	PK	6.6	45.52	74.00	28.48

LE 2Mbps*_Lowest channel *(2 402 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4 804.38	43.40	V	PK	1.7	45.10	74.00	28.90
7 623.13	41.54	V	PK	7.1	48.64	74.00	25.36

LE 2Mbps*_Middle channel *(2 440 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4 880.00	42.02	H	PK	2.2	44.22	74.00	29.78
7 320.00	39.46	H	PK	6.2	45.66	74.00	28.34

LE 2Mbps*_Highest channel *(2 480 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4 960.00	42.70	H	PK	2.4	45.10	74.00	28.90
7 440.00	38.68	H	PK	6.6	45.28	74.00	28.72

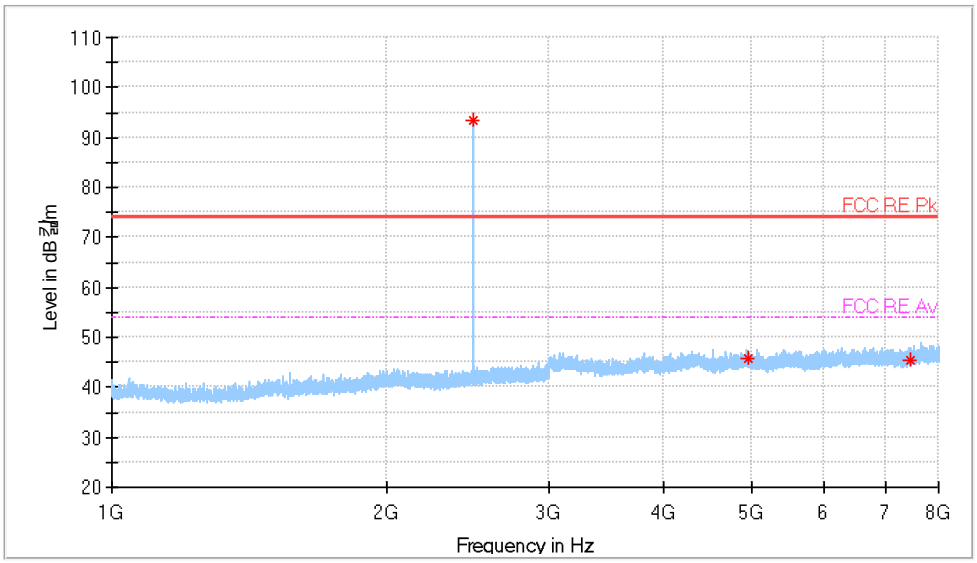
Notes:

1. *Pol. : H = Horizontal, V = Vertical, Mode : PK = Peak, AV = Average
2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Average measurement was not performed when peak-detected emission complies with the average limit.
4. Other spurious was under 20 dB below Fundamental.
5. Bluetooth 1Mbps, Highest channel (2 480 MHz) was the worst condition.
6. Bluetooth 2Mbps, Highest channel (2 480 MHz) was the worst condition.
7. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization.
8. Peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.
9. Average emissions were measured using RBW = 1 MHz, VBW = 10 kHz, Detector = Peak.
10. The spectrum was measured from 1 GHz to 10th harmonic and the worst-case emissions were reported.

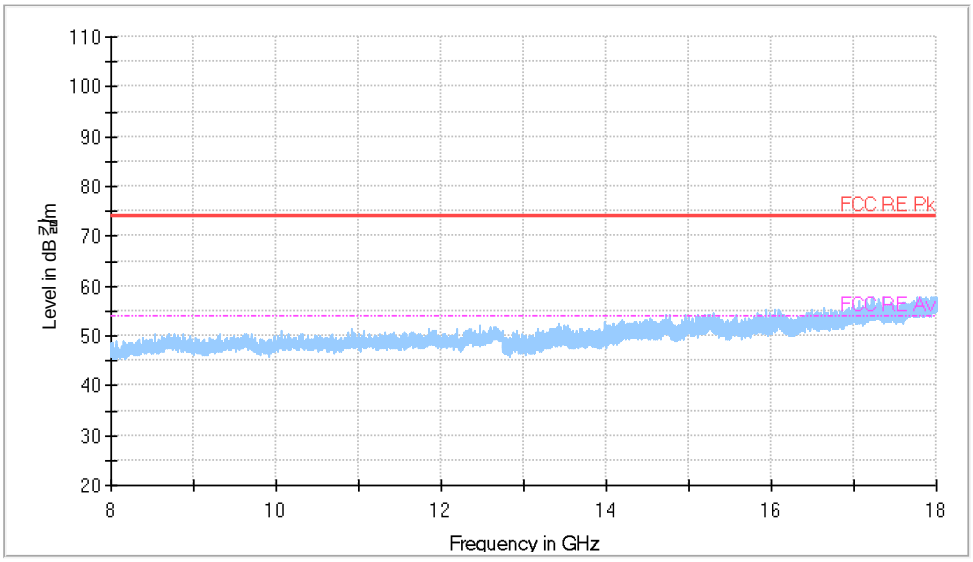
PLOTS OF EMISSIONS

Worst Case

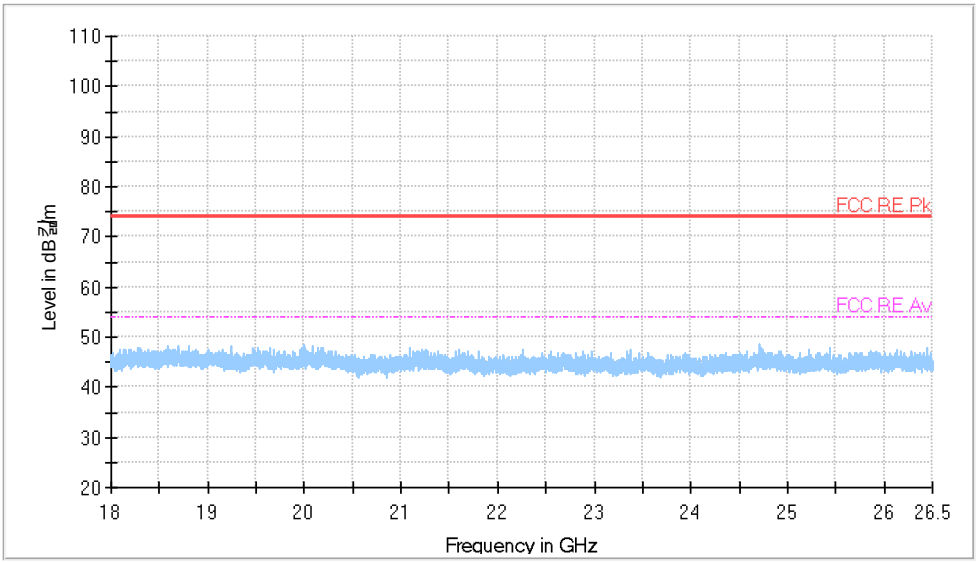
BLE 1Mbps, Highest Channel (2 480 MHz) : 1 GHz to 8 GHz_Peak



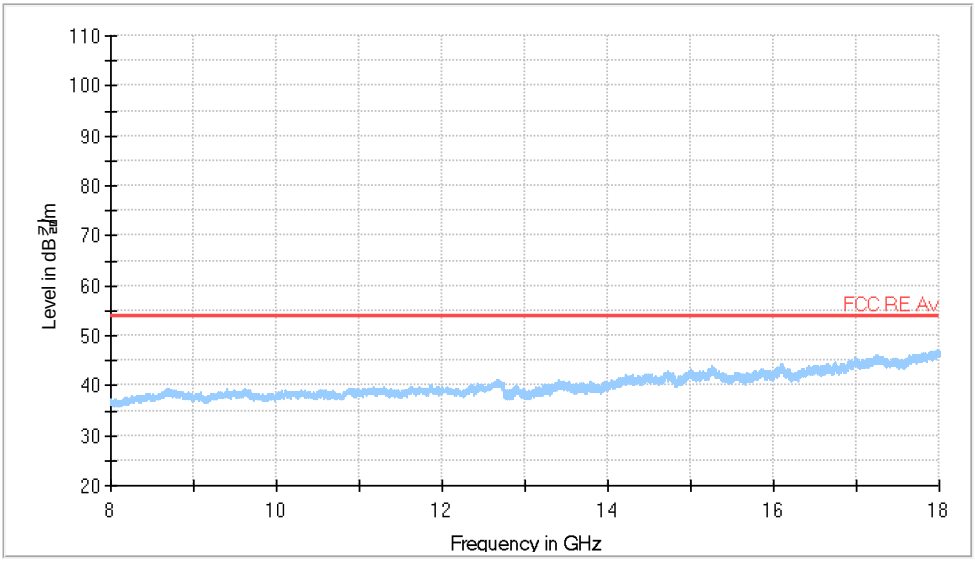
BLE 1Mbps Highest Channel (2 480 MHz) : 8 GHz to 18 GHz_Peak



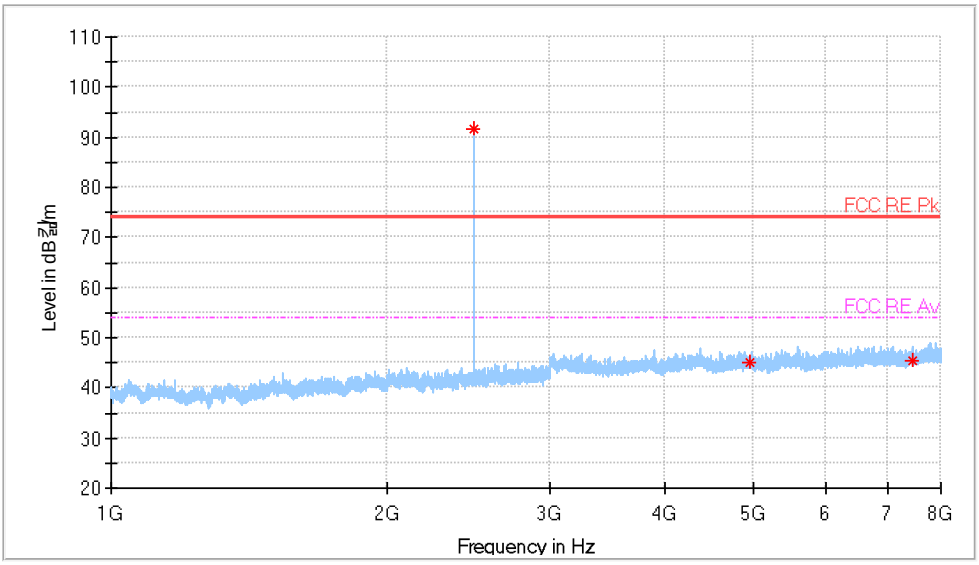
BLE 1Mbps Highest Channel (2 480 MHz) : 18 GHz to 26.5 GHz_Peak



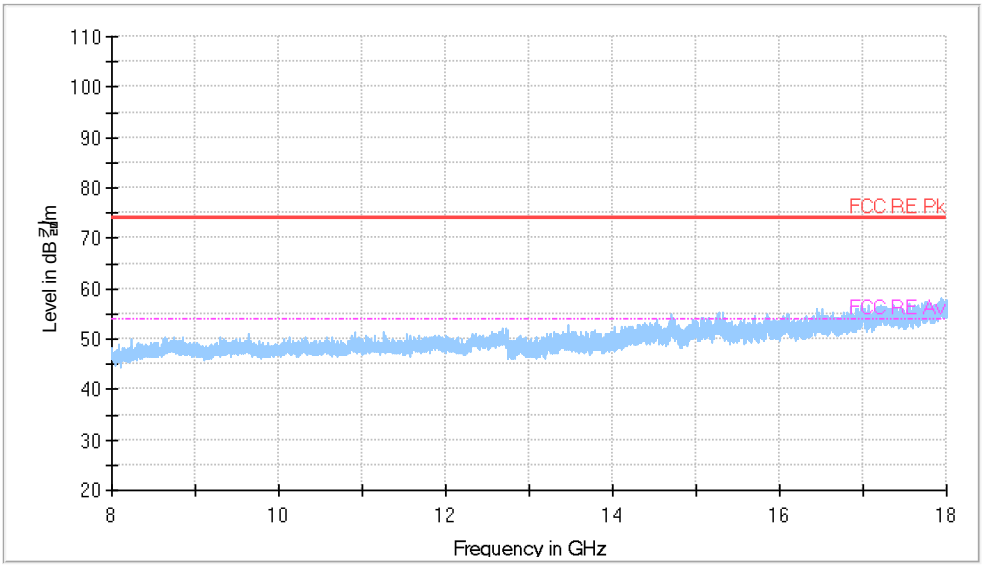
BLE 1Mbps, Highest Channel (2 480 MHz) : 8 GHz to 18 GHz_Average



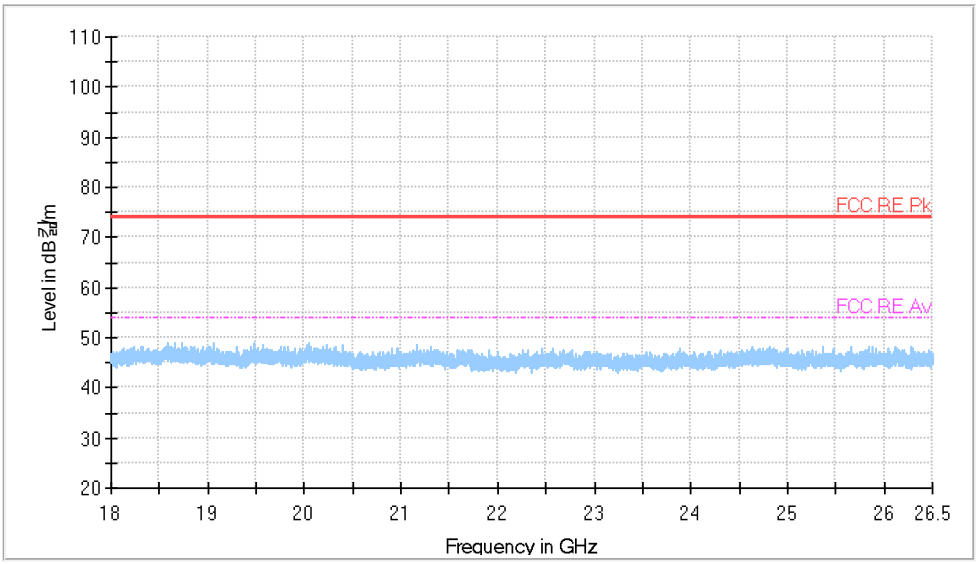
BLE 2Mbps, Highest Channel (2 480 MHz) : 1 GHz to 8 GHz_Peak



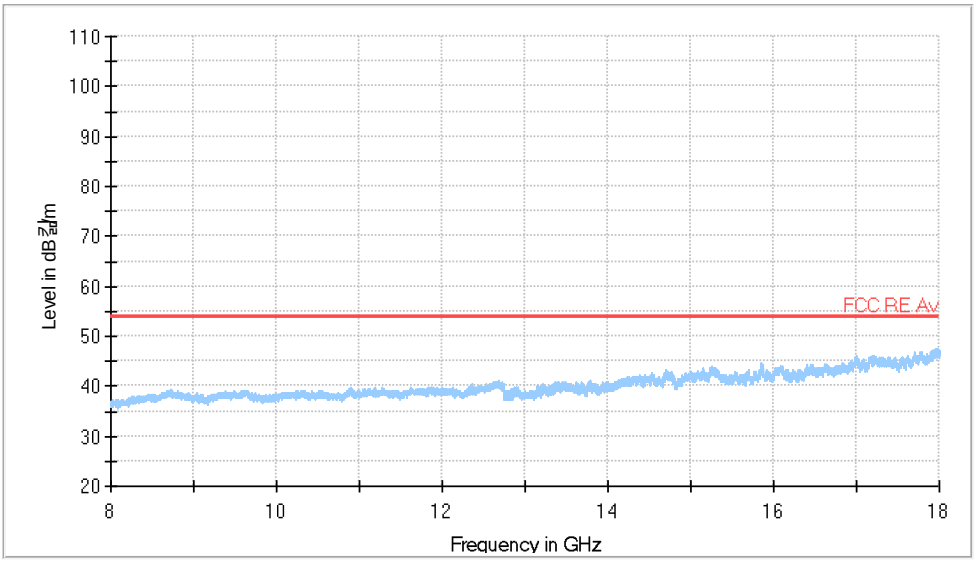
BLE 2Mbps Highest Channel (2 480 MHz) : 8 GHz to 18 GHz_Peak



BLE 2Mbps, Highest Channel (2 480 MHz) : 18 GHz to 26.5 GHz_Peak



BLE 2Mbps Highest Channel (2 480 MHz) : 8 GHz to 18 GHz_Average



7.7 Radiated Band Edge

FCC §15.205, §15.209

Test Mode : Set to Lowest channel and Highest channel

Result

BLE 1Mbps, Lowest Channel (2 402 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 318.21	52.18	H	PK	-8.0	44.18	74.00	29.82

BLE 1Mbps, Highest Channel (2 480 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 483.58	50.60	H	PK	-7.1	43.50	74.00	30.50

BLE 2Mbps, Lowest Channel (2 402 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 387.53	51.80	H	PK	-7.5	44.30	74.00	29.70

BLE 2Mbps, Highest Channel (2 480 MHz)

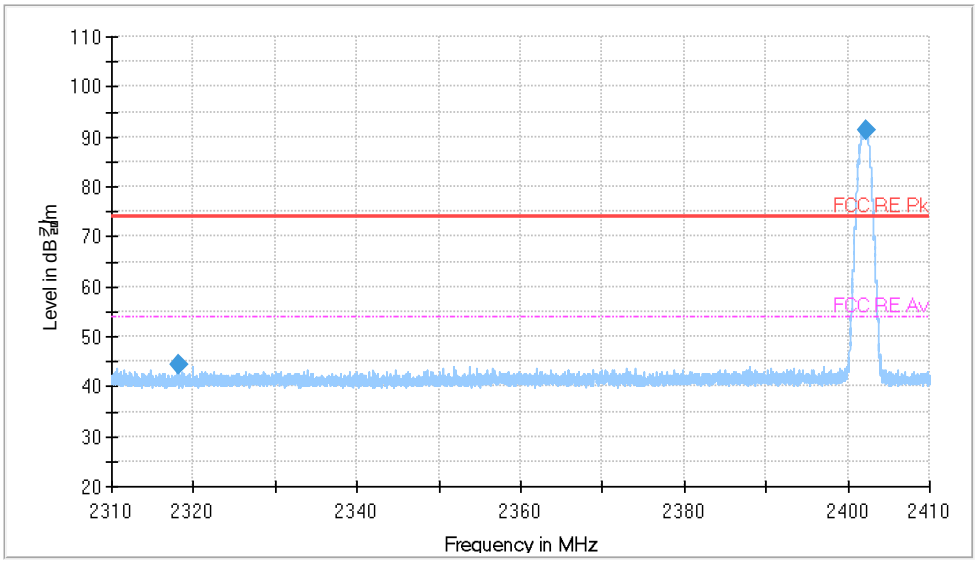
Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 492.47	50.28	V	PK	-7.1	43.18	74.00	30.82

Notes:

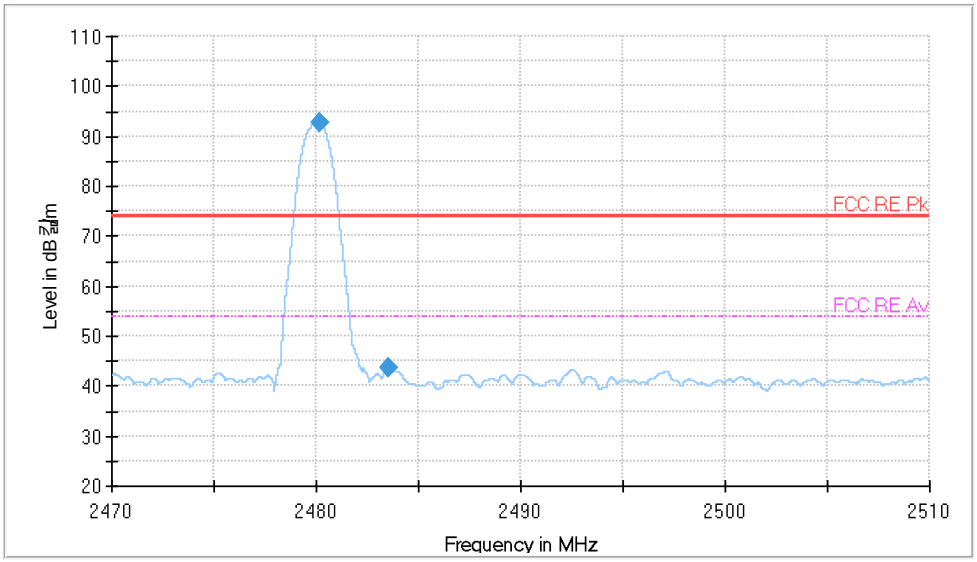
1. *Pol. : H = Horizontal, V = Vertical, Mode : PK = Peak, AV = Average
2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Average measurement was not performed when peak-detected emission complies with the average limit.
4. Other spurious was under 20 dB below Fundamental.
5. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization.
6. Peak emissions were measured using RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.

PLOTS OF EMISSIONS

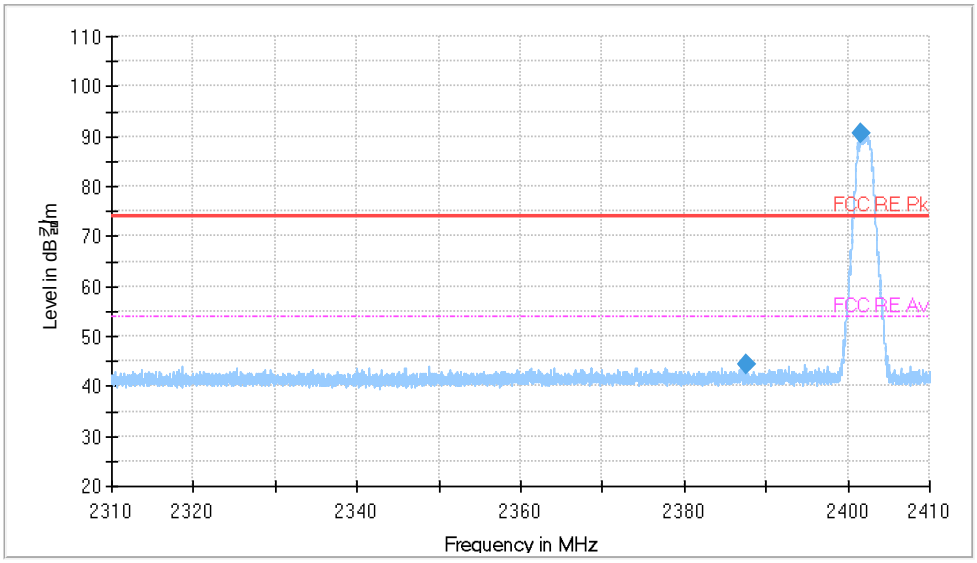
BLE 1Mbps, Lowest Channel (2 402 MHz)_Peak



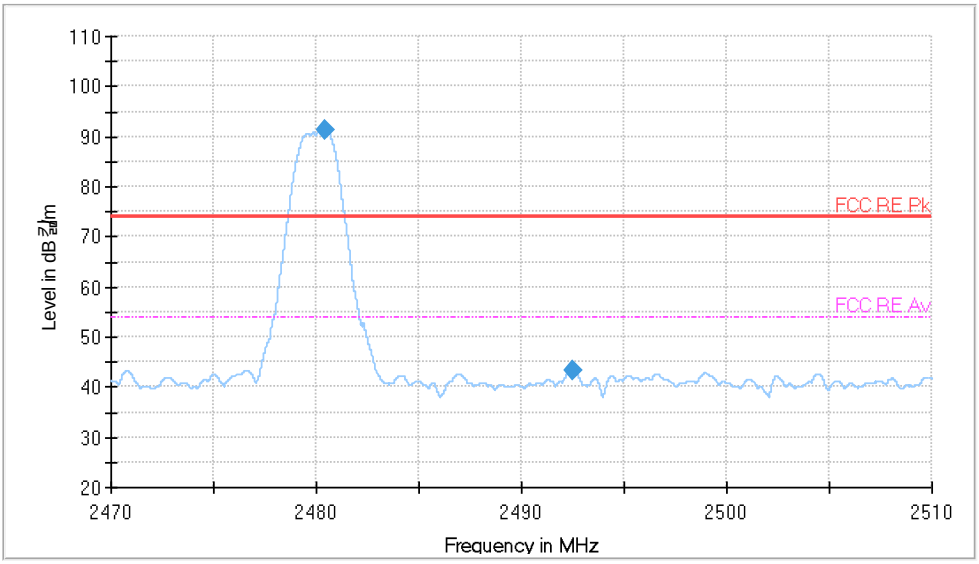
BLE 1Mbps, Highest Channel (2 480 MHz)_Peak



BLE 2Mbps, Lowest Channel (2 402 MHz)_Peak



BLE 2Mbps, Highest Channel (2 480 MHz)_Peak



7.8 Radiated Emissions_Below 1GHz

FCC §15.209

Result

BLE 1Mbps, Highest Channel (2 480 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	Mode*	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
35.07	56.18	V	QP	-23.2	32.98	40.00	7.02
73.22	56.69	H	QP	-27.9	28.79	40.00	11.21
97.58	45.32	H	QP	-24.2	21.12	43.50	22.38
190.00	47.95	H	QP	-24.1	23.85	43.50	19.65
233.11	42.81	H	QP	-23.4	19.41	46.00	26.59
875.68	43.68	H	QP	-9.8	33.88	46.00	12.12

Radiated Measurements at 3meters

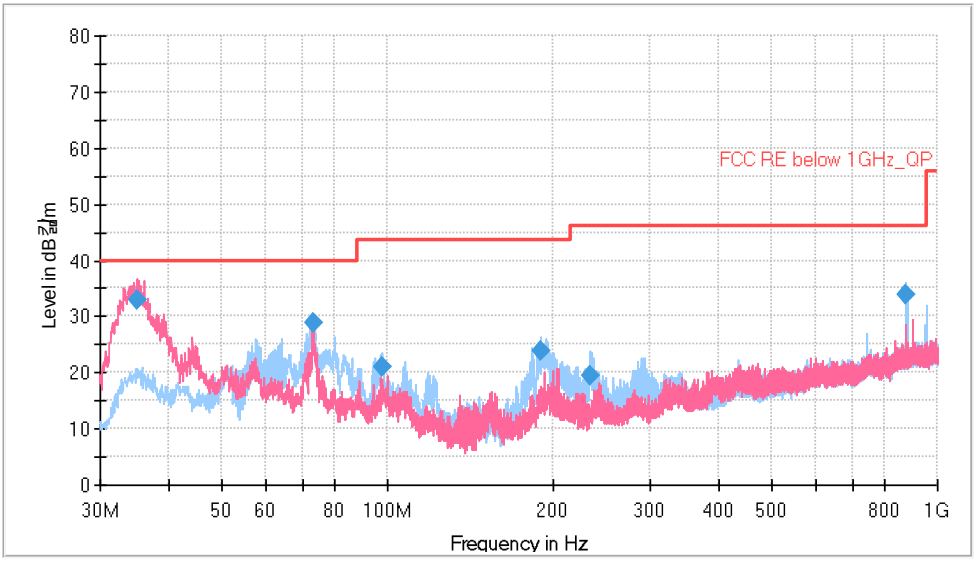
Notes:

1. The worst-case emission was reported.
2. *Pol. : H = Horizontal, V = Vertical, Mode : PK = Peak, QP = Qusi-Peak
3. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
4. Measurements using CISPR quasi-peak mode below 1 GHz.
5. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.
6. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
   Per FCC part 15.31(o), test results were not reported.
   Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open are test site.
   Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field based on KDB 414788.
7. The limit is on the FCC §15.209.

PLOTS OF EMISSIONS

Worst Case

Radiated emission below 1GHz, LE 1Mbps, Highest Channel (2 480 MHz)



7.9 AC Line Conducted

FCC §15.209

Result :

BLE 1Mbps, Highest Channel (2 480 MHz)

Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.154975	---	32.31	55.20	22.90	9.000	L1	ON	9.8
0.154975	48.15	---	65.20	17.05	9.000	L1	ON	9.8
0.159950	---	32.81	54.95	22.14	9.000	N	ON	9.8
0.159950	47.36	---	64.95	17.59	9.000	N	ON	9.8
0.187313	---	33.78	53.71	19.93	9.000	L1	ON	9.9
0.187313	44.37	---	63.71	19.34	9.000	L1	ON	9.9
0.204725	42.75	---	63.02	20.26	9.000	L1	ON	9.8
0.204725	---	31.56	53.02	21.46	9.000	L1	ON	9.8
0.341538	40.64	---	58.99	18.35	9.000	L1	ON	9.8
0.341538	---	33.91	48.99	15.08	9.000	L1	ON	9.8
0.411188	40.08	---	57.54	17.46	9.000	L1	ON	9.8
0.411188	---	33.74	47.54	13.80	9.000	L1	ON	9.8
0.413675	---	33.40	47.49	14.09	9.000	L1	ON	9.8
0.413675	39.66	---	57.49	17.83	9.000	L1	ON	9.8
3.321563	24.08	---	56.00	31.92	9.000	L1	ON	9.7
3.321563	---	15.56	46.00	30.44	9.000	L1	ON	9.7

Line Conducted Emissions Tabulated Data

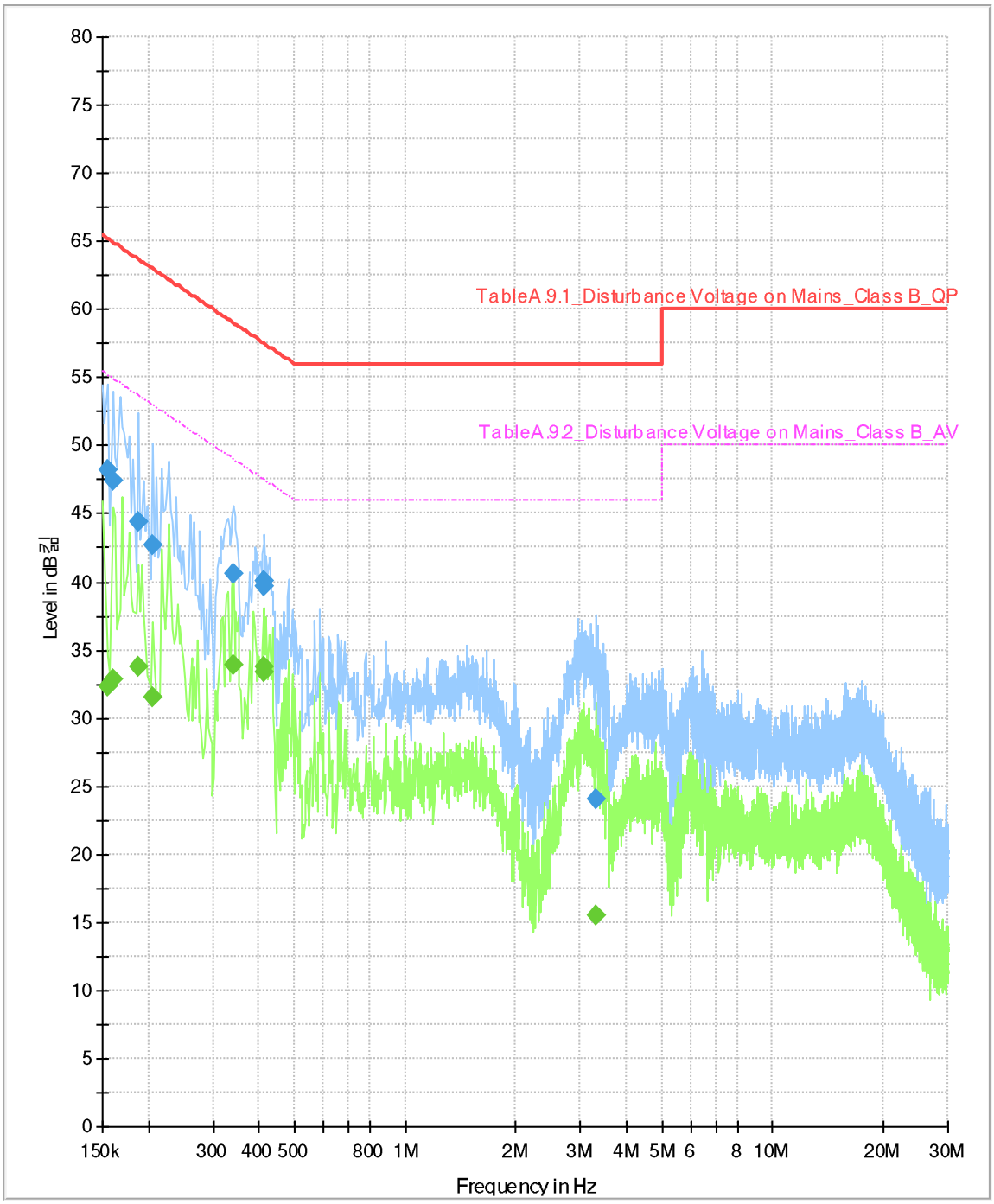
Notes:

1. Measurements using CISPR quasi-peak mode & average mode.
2. The worst channel was investigated and the worst -case emission are reported. See attached Plots.
3. Lowest channel (2 402MHz) is the worst case.
*4. *) Factor = LISN + Cable Loss*
*5. **) LINE : L = Line , N = Neutral*
6. The limit is on the FCC §15.207(a)

PLOTS OF EMISSIONS

Worst Case

AC Lice Conducted emission, LE 1Mbps, Highest Channel (2 480 MHz)



8. TEST EQUIPMENT

No.	Instrument	Manufacture	Model	Serial No.	Calibration Date	Calibration Due Date
1	DIGITAL MULTIMETER	EZ DIGITAL	DM-334	2111395	2022-10-13	2023-10-13
2	Humidity Temperature Recorder	Lutron	MHB-382SD	AK.26553	2022-10-17	2023-10-17
3	Signal Generator	R&S	SMB100A	175861	2023-04-13	2024-04-13
4	10 dB Attenuator	API technologies corp	40A2W-10	1917	2023-01-09	2024-01-09
5	Signal & Spectrum Analyzer	KEYSIGHT	N9030B	MY57144327	2023-03-31	2024-03-31
6	EMI TEST RECEIVER	R&S	ESW44	103091	2023-03-29	2024-03-29
7	TRILOG Broadband Test Antenna	Schwarzbeck	VULB 9163	01431	2022-11-16	2024-11-16
8	DOUBLE RIDGED HORN ANTENNA	R&S	HF907	100197	2023-01-13	2024-01-13
9	Horn Antenna	Q-par Angus	QMS-00225	17637	2023-09-07	2024-09-07
10	Signal Conditioning Unit	R&S	SCU 01	10029	2023-03-29	2024-03-29
11	Signal Conditioning Unit	R&S	SCU 18	10065	2023-03-29	2024-03-29
12	Signal Conditioning Unit	R&S	SCU-26D	1984522	2023-04-03	2024-04-03
13	OPEN SWITCH AND CONTROL UNIT	R&S	OSP120	101766	N/A	N/A
14	SWICH AND EXTENSION UNIT CAN-BUS	R&S	OSP150	100929	N/A	N/A
15	WiFi Filter Bank	R&S	U082	-	N/A	N/A
16	TWO-LINE V-NETWORK	R&S	ENV216	102829	2023-07-04	2024-07-04
17	EMI TEST RECEIVER	R&S	ESR3	102930	2023-07-03	2024-07-03

9. ACCURACY OF MEASUREMENT & DECISION RULE

9.1 Uncertainty Calculation

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.44 dB
Radiated Disturbance, 30 MHz to 1 GHz	5.68 dB
Radiated Disturbance, Above 1 GHz	5.06 dB

9.2 Decision rule

The choice of whether or not to include the measurement uncertainty of the measuring system used in the test in the conformance determination.:

☐ Application of internal procedures used in type testing where traceability of measurement uncertainty is established.
☒ Applying the decision that the standard used for type testing does not require it.

END REPORT