FCC Part 15.247

TEST REPORT

For

Cisco Systems, Inc.

125 West Tasman Drive, San Jose, CA 95134, USA

FCC ID: LDKEDOVE2617

Report Type: Original Report	**Product Type:** Cisco Catalyst 9120AX Series Wi-Fi 6 Access Points

Report Producer : Coco Lin

Report Number : RXZ220627002RF01

Report Date : 2022-07-08

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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ220627002	RXZ220627002RF01	2022-07-08	Original Report	Coco Lin

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Manufacturer	Cisco Systems, Inc.
	125 West Tasman Drive, San Jose, CA 95134, USA
Brand(Trade) Name	CISCO
Product (Equipment)	Cisco Catalyst 9120AX Series Wi-Fi 6 Access Points
Main Model Name	C9120AXE-B
Frequency Range	BLE Mode: 2402 ~ 2480 MHz
Channel Number	40
Transmit Power	4.67 dBm
Modulation Technique	BLE Mode: GFSK
Transmit Data Rate	BLE Mode: 1Mbps
Power Operation (Voltage Range)	55Vdc from PoE port
Received Date	2022/6/27
Date of Test	2022/6/30 ~ 2022/7/4

*All measurement and test data in this report was gathered from production sample serial number: RXZ220627002-01 (Assigned by BACL, New Taipei Laboratory).

1.2 Objective

This report is prepared on behalf of *Cisco Systems, Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
KDB 558074 D01 15.247 Meas Guidance v05r02

1.4 Statement

Decision Rule: No, (The test results do not include MU judgment)

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
The determination of the test results does not require consideration of the uncertainty of the measurement, unless the assessment is required by customer agreement, regulation or standard document specification.
Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is not responsible for the authenticity of the information provided by the applicant that affects the test results.

1.5 Measurement Uncertainty

Parameter		Uncertainty
AC Mains		±2.36 (dB)
RF output power, conducted		±0.93 (dB)
Power Spectral Density, conducted		±0.92 (dBm/kHz)
Occupied Bandwidth		±0.35 (MHz)
Unwanted Emissions, conducted		±1.69 (dB)
Emissions, radiated	30 MHz~1GHz	±5.22(dB)
	1 GHz~18 GHz	±6.12(dB)
	18 GHz~40 GHz	±4.99(dB)
Temperature		+/- 1.27 °C
Humidity		+/- 3 %

1.6 Environmental Conditions

Test Site	Test Date	Temperature (℃)	Relative Humidity (%)	ATM Pressure (hPa)	Test Engineer
AC Line Conducted Emissions	2022/6/30	26.5	50	1010	Aaron Pan
Radiation Spurious Emissions	2022/6/30 ~ 2022/7/4	22.5~24.1	54~58	1010	Andy Cheng
Conducted Spurious Emissions	2022/7/4	24.1	56	1010	Jim Chen
6 dB Emission Bandwidth	2022/7/4	24.1	56	1010	Jim Chen
Maximum Output Power	2022/7/4	24.1	56	1010	Jim Chen
100 kHz Bandwidth of Frequency Band Edge	2022/7/4	24.1	56	1010	Jim Chen
Power Spectral Density	2022/7/4	24.1	56	1010	Jim Chen

1.7 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) to collect test data is located on

☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3732) and the FCC designation No.TW3732 under the Mutual Recognition Agreement (MRA) in FCC Test.

2 System Test Configuration

2.1 Description of Test Configuration

For BLE mode, there are totally 40 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	--	--
2	2406	--	--
3	2408	37	2476
--	--	38	2478
19	2440	39	2480

For BLE Modes were tested with channel 0, 19 and 39.

The system was configured for testing in engineering mode, which was provided by manufacturer.

2.2 Equipment Modifications

No modification was made to the EUT.

2.3 EUT Exercise Software

The test software was used "Putty.exe v0.7"

Test Frequency		Low	Middle	High
Power Level Setting	BLE 1M	5	5	5

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number	S/N
POE Adapter	CISCO	SB-PWR-INJ2	C18426663000003170
NB	DELL	E6410	8N7PXN1

2.5 External Cable List and Details

Cable Description	Length (m)	From	To
RJ-45 Cable	1	EUT	POE Adapter
RJ-45 to USB Serial Cable	2	EUT	NB

2.6 Test Mode

Mode 1: BLE ONLY

Mode 2: WIFI 2.4GHz XOR + WIFI 5GHz Regular + WIFI 2.4GHz Aux + BLE

Mode 3: WIFI 2.4G XOR + WIFI 5GHz Regular + WIFI 5GHz Aux + BLE

Mode 4: WIFI 5G XOR + WIFI 5GHz Regular + WIFI 2.4GHz Aux + BLE

Mode 5: WIFI 5G XOR + WIFI 5GHz Regular + WIFI 5GHz Aux + BLE

Radiated spurious emissions for Transmitting simultaneously test: Mode 2-5.

Full System (Mode 1: BLE ONLY) for all test item.

Conducted output power for worst case :

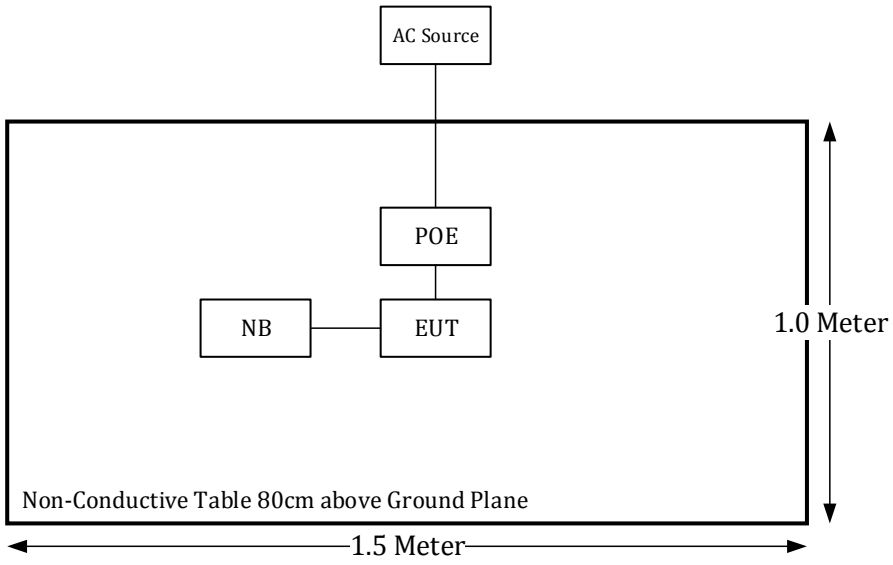
Worst case mode		Output power dBm
XOR WIFI-2.4GHz	AX20 Mode, 2437MHz	23.69
XOR WIFI-5GHz	AX40 Mode, 5230MHz	21.17
Regular WIFI-5GHz	AX20 Mode, 5220 MHz	22.90
AUX WIFI-2.4GHz	G Mode, 2437MHz	13.26
AUX WIFI-5GHz	A Mode, 5825MHz	13.75

2.7 Block Diagram of Test Setup

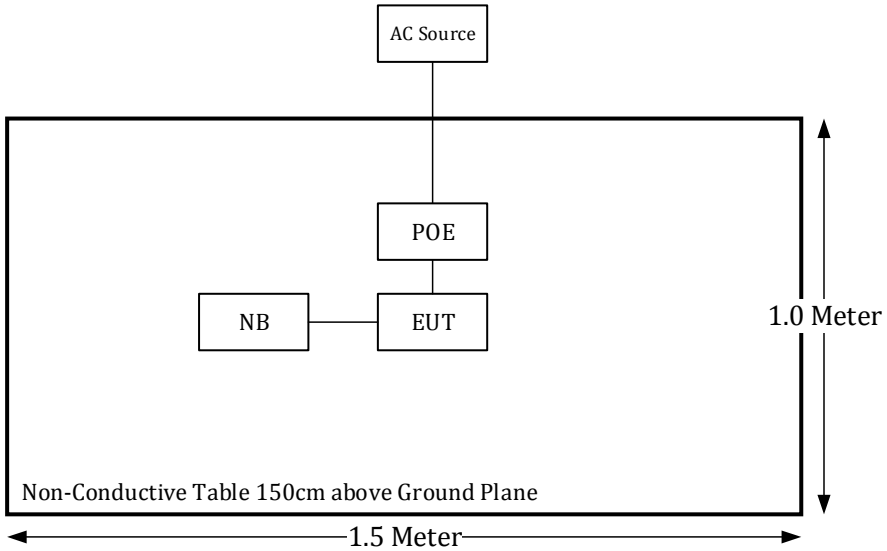
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

Radiation:

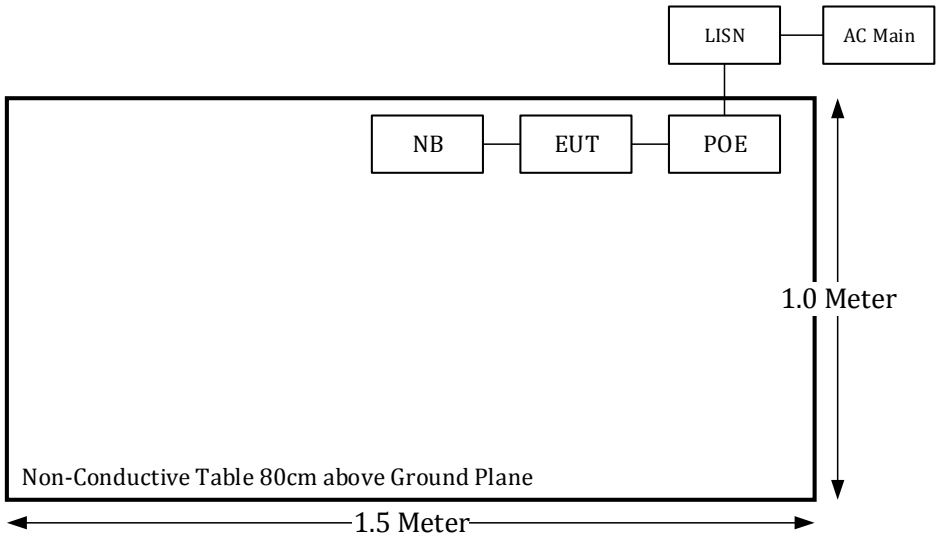
Below 1GHz:



Above 1GHz:



Conduction:



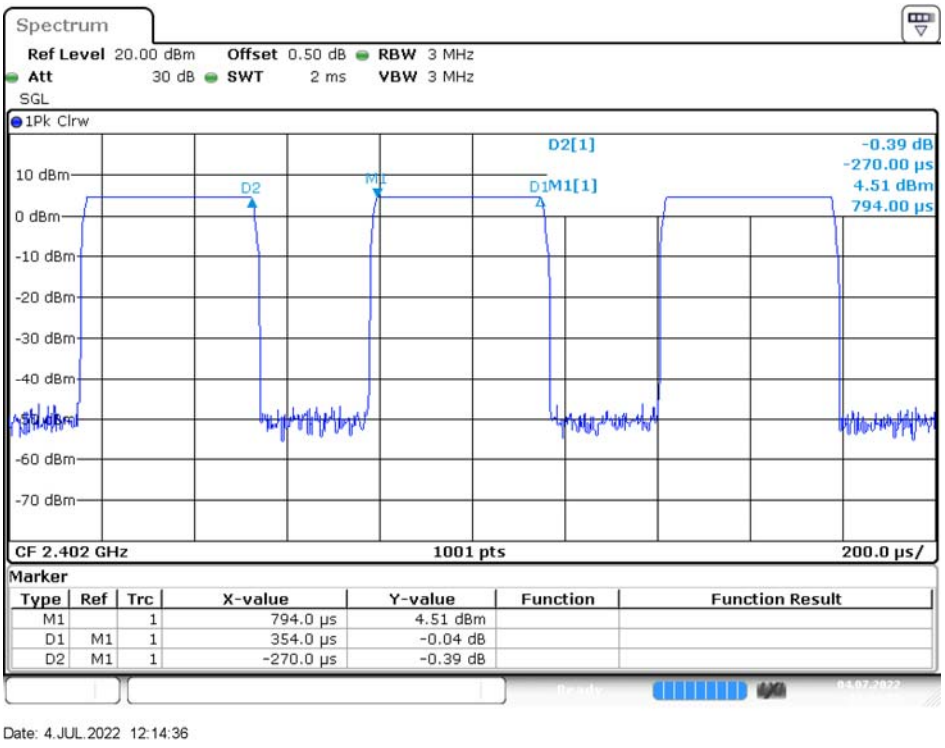
2.8 Duty Cycle

The duty cycle as below:

Radio Mode	T_{on} (ms)	$T_{on}+T_{off}$ (ms)	Duty Cycle (%)
BLE	0.354	0.624	57

Please refer to the following plots.

BLE Mode



3 Summary of Test Results

FCC Rules	Description of Test	Results
§15.247(i), §1.1307(b)(3)(i)	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

4 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conduction Room (CON-A)					
LISN	Rohde & Schwarz	ENV216	101612	2022/01/14	2023/01/13
LISN	Rohde & Schwarz	ENV216	101248	2022/6/22	2023/6/21
EMI Test Receiver	Rohde & Schwarz	ESW8	100947	2021/7/23	2022/7/22
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2021/7/29	2022/7/28
RF Cable	EMEC	EM-CB5D	1	2022/6/7	2023/6/6
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiation 3M Room (966-A)					
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2022/02/14	2023/02/13
Horn Antenna	EMCO	3115	9809-55583	2021/8/26	2022/8/25
Horn Antenna	ETS-Lindgren	3116	62638	2021/8/11	2022/8/10
Preamplifier	Sonoma	310N	130602	2022/6/8	2023/6/7
Preamplifier	A.H. system Inc.	PAM-0118P	466	2021/11/4	2022/11/3
Microware Preamplifier	EM Electronics Corporation	EM18G40G	60656	2021/12/27	2022/12/26
Spectrum Analyzer	Rohde & Schwarz	FSV40	101435	2021/12/27	2022/12/26
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2021/11/9	2022/11/8
Micro flex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2022/1/24	2023/1/23
Coaxial Cable	COMMATE	PEWC	8Dr	2021/12/24	2022/12/23
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2022/1/24	2023/1/23
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2021/12/24	2022/12/23
Cable	EMC	EMC105-SM-SM-10000	201003	2022/1/24	2023/1/23
Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2022/1/24	2023/1/23
Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-50CM	15120-1	2022/1/18	2023/1/17
Software	Audix	e3	18621a bacl	N.C.R	N.C.R

Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101435	2022/1/13	2023/1/12
Cable	UTIFLEX	UFA210A	9435	2021/10/5	2022/10/4
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2022/01/24	2023/01/23

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements.

5 FCC §15.247(i), §1.1307(b)(3)(i) - RF Exposure

5.1 Applicable Standard

According to subpart 15.247(i) and subpart §1.1307(b)(3)(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

For single RF sources (*i.e.,* any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold *Pth* (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). *Pth* is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\,cm}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\,cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\,cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

5.2 RF Exposure Evaluation Result

The EUT can be used in the following modes, selecting the worst mode for evaluation.

Mode 2: 2.4G XOR + 5G Regular + 2.4G Aux + BLE

Mode 3: 2.4G XOR + 5G Regular + 5G Aux + BLE

Mode 4: 5G XOR + 5G Regular + 2.4G Aux + BLE

Mode 5: 5G XOR + 5G Regular + 5G Aux + BLE

Worst case is Mode 3 :

Project info

Band	Freq (MHz)	Tune-up Power (dBm)	Ant Gain (dBi)	Distances (mm)	Duty (%)	Tune-up Power (mW)	ERP (dBm)	ERP (mW)
BLE	2480	5	6	300	100%	3.16	8.85	7.67
do0 2.4GHz XOR	2462	24	12	300	100%	251.19	33.85	2426.61
d01 5GHz Regualr	5850	23	11	300	100%	199.53	31.85	1531.09
do4 5G Aux	5850	14	6	300	100%	25.12	17.85	60.95

Option A

The available maximum time-averaged power is no more than 1 mW

Band	Freq (MHz)	Result Option A
BLE	2480	not exempt
do0 2.4GHz XOR	2462	not exempt
d01 5GHz Regualr	5850	not exempt
do4 5G Aux	5850	not exempt

Option B

The available maximum time-averaged power or effective radiated power (ERP), whichever is greater.

This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive).

Band	Freq (MHz)	Pth (mW)	X	ERP 20cm (mW)	Ratio	Result Option B
BLE	2480	3060.00	1.905	3060	0.00	exempt
do0 2.4GHz XOR	2462	3060.00	1.903	3060	0.79	exempt
d01 5GHz Regualr	5850	3060.00	2.091	3060	0.50	exempt
do4 5G Aux	5850	3060.00	2.091	3060	0.02	exempt

Simultaneous Analysis :

Band	Freq (MHz)	PSD Require	PSD (mW/cm^2)	PSD Limit (mW/cm^2)	Simultaneous TX	Ratio
BLE	2480	exempt	0.001	1.000	O	0.001
do0 2.4GHz XOR	2462	exempt	0.352	1.000	O	0.352
d01 5GHz Regualr	5850	exempt	0.222	1.000	O	0.222
do4 5G Aux	5850	exempt	0.009	1.000	O	0.009
Simultaneous Analysis (Limit 1)						0.584

Result: The EUT meets exemption requirement- RF exposure evaluation greater than **30cm** distance.

6 FCC §15.203 – Antenna Requirements

6.1 Applicable Standard

According to § 15.203,

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

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna does not exceed 6dBi.

6.2 Antenna Information

Manufacturer	Type	Antenna Gain
N/A	Dipole Antenna	2 dBi
N/A	Dipole Antenna	2 dBi
N/A	Dipole Antenna	2 dBi
N/A	Low Profile Dipole Antenna	3 dBi
N/A	Directionnel Antenna	6 dBi
N/A	Ceiling Mount Omni Antenna	2 dBi
N/A	Wall Mount Omni Antenna	4 dBi
N/A	Patch Antenna	6 dBi

Result: Compliance

7 FCC §15.207(a) – AC Line Conducted Emissions

7.1 Applicable Standard

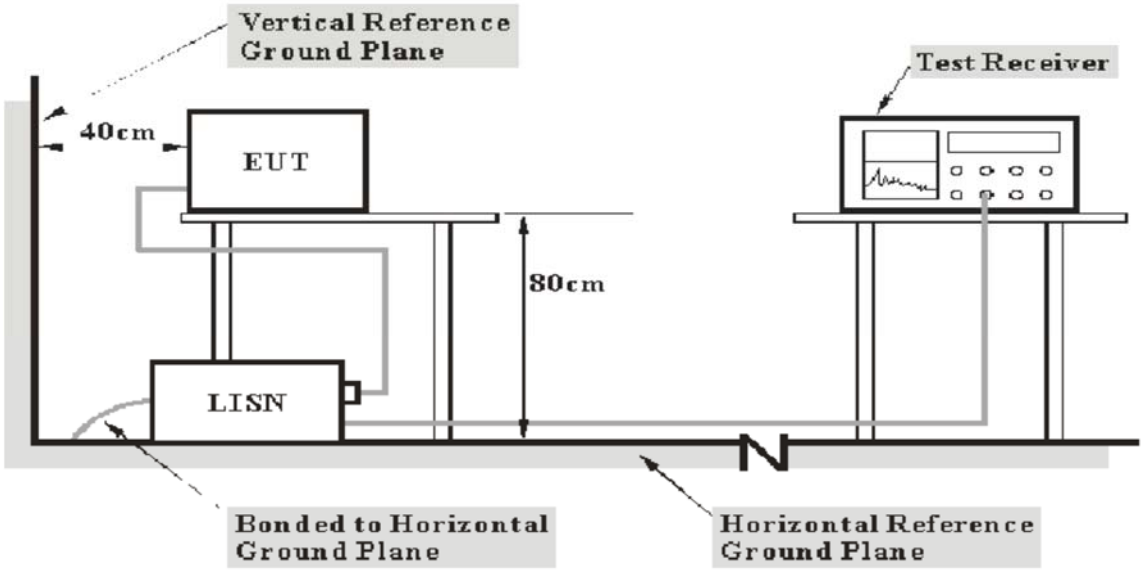
According to §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 1
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

7.2 EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

7.3 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150kHz to 30MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	IF B/W
150kHz – 30MHz	9kHz

7.4 Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

7.5 Corrected Factor & Margin Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

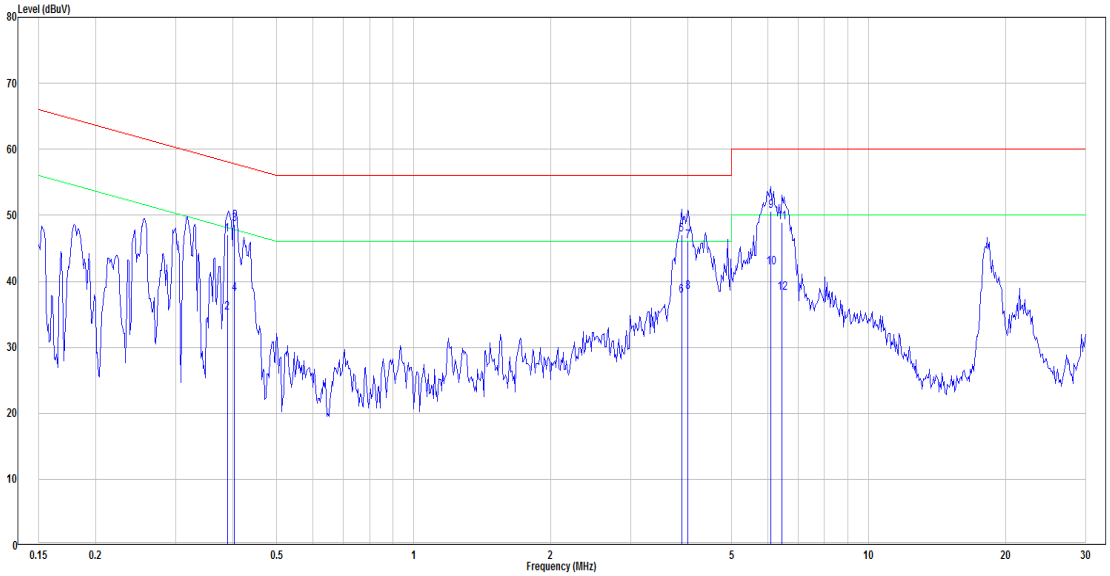
The “Over Limit” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of -7 dB means the emission is 7 dB below the limit. The equation for Over Limit calculation is as follows:

Over Limit = Level – Limit Line

7.6 Test Results

Test Mode: Transmitting

Main: AC120 V, 60 Hz, Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.389	27.49	19.51	47.00	58.08	-11.08	QP
2	0.389	15.67	19.51	35.18	48.08	-12.90	Average
3	0.404	29.14	19.51	48.65	57.77	-9.12	QP
4	0.404	18.55	19.51	38.06	47.77	-9.71	Average
5	3.881	27.44	19.63	47.07	56.00	-8.93	QP
6	3.881	18.11	19.63	37.74	46.00	-8.26	Average
7	4.006	26.40	19.63	46.03	56.00	-9.97	QP
8	4.006	18.78	19.63	38.41	46.00	-7.59	Average
9	6.089	31.00	19.68	50.68	60.00	-9.32	QP
10	6.089	22.45	19.68	42.13	50.00	-7.87	Average
11	6.454	29.27	19.68	48.95	60.00	-11.05	QP
12	6.454	18.51	19.68	38.19	50.00	-11.81	Average

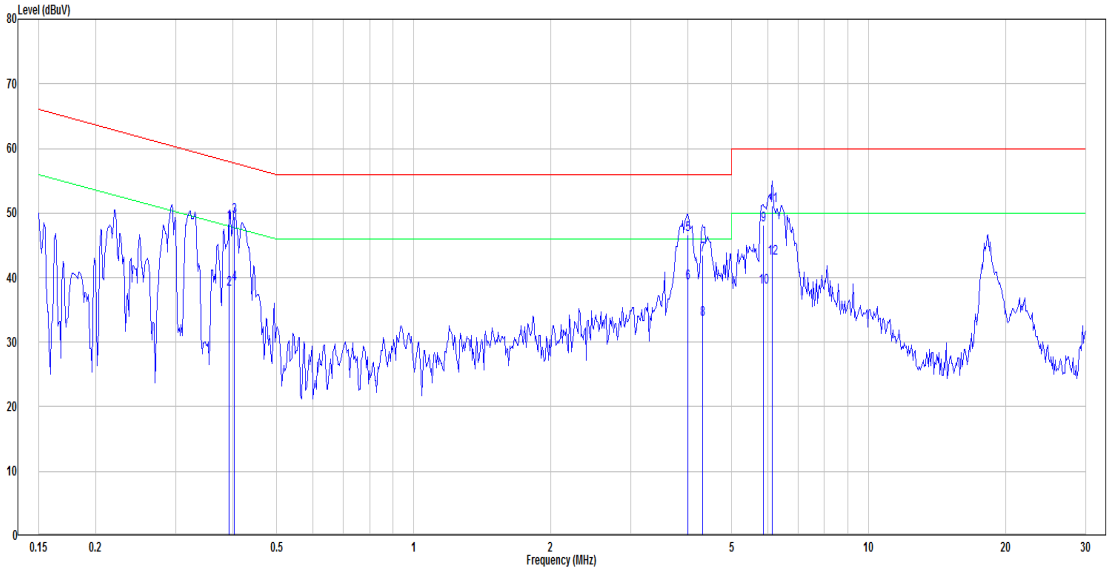
Note:

Level (Result) = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

Main: AC120 V, 60 Hz, Neutral



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.393	29.03	19.51	48.54	57.99	-9.45	QP
2	0.393	18.69	19.51	38.20	47.99	-9.79	Average
3	0.404	29.96	19.51	49.47	57.77	-8.30	QP
4	0.404	19.49	19.51	39.00	47.77	-8.77	Average
5	4.006	26.94	19.63	46.57	56.00	-9.43	QP
6	4.006	19.57	19.63	39.20	46.00	-6.80	Average
7	4.315	23.90	19.64	43.54	56.00	-12.46	QP
8	4.315	13.95	19.64	33.59	46.00	-12.41	Average
9	5.867	28.47	19.68	48.15	60.00	-11.85	QP
10	5.867	18.87	19.68	38.55	50.00	-11.45	Average
11	6.153	31.37	19.69	51.06	60.00	-8.94	QP
12	6.153	23.37	19.69	43.06	50.00	-6.94	Average

Note:

Level (Result) = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

8 FCC §15.209, §15.205 , §15.247(d) – Spurious Emissions

8.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	608 – 614	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	960 – 1240	5. 35 – 5. 46
2.1735 – 2.1905	16.80425 – 16.80475	1300 – 1427	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1435 – 1626.5	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1645.5 – 1646.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1660 – 1710	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1718.8 – 1722.2	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	2200 – 2300	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2310 – 2390	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2483.5 – 2500	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2690 – 2900	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	3260 – 3267	22.01 – 23.12
8.41425 – 8.41475	162.0125 –167.17	3.332 – 3.339	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3 3458 – 3 358	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3.600 – 4.400	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4		Above 38.6
13.36 – 13.41	399.9 – 410		

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

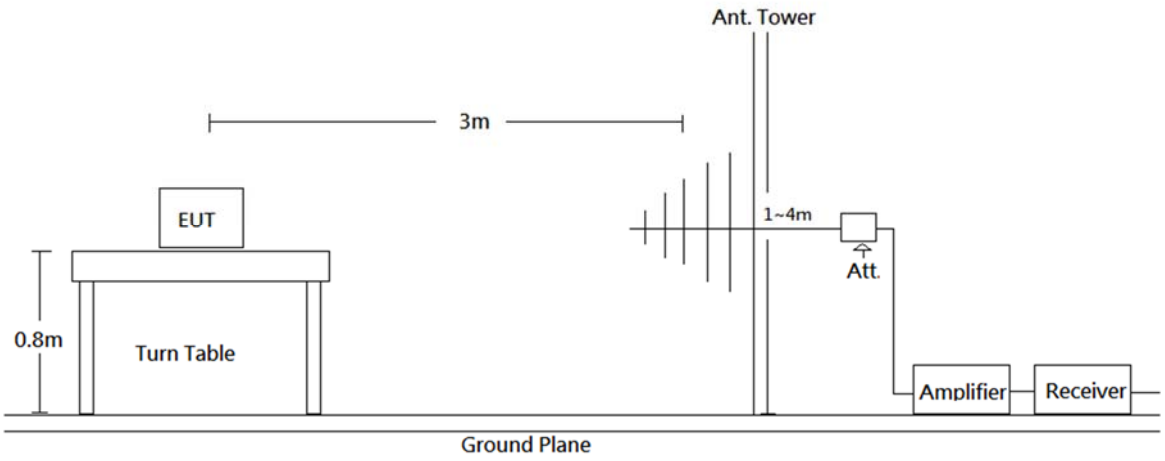
Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

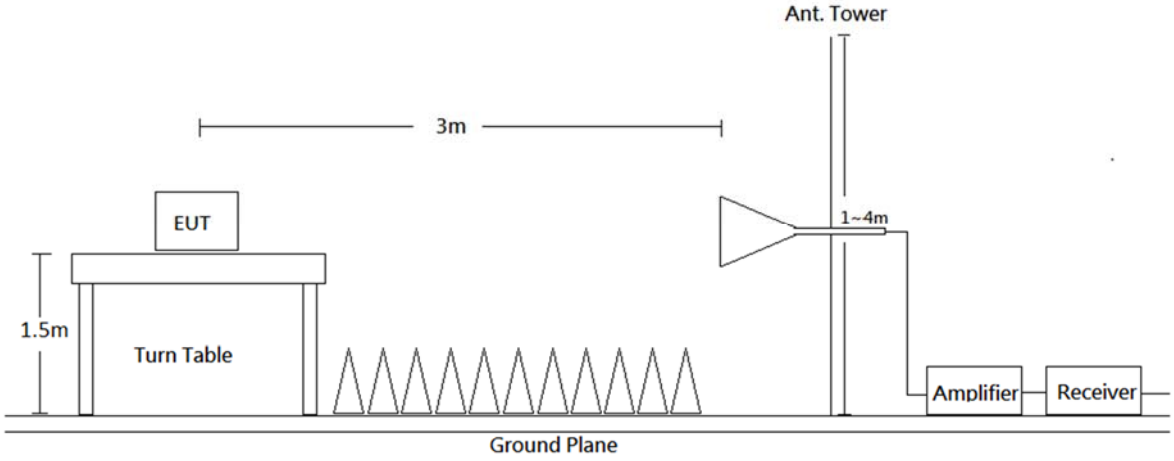
As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

8.2 EUT Setup

Below 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

8.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Duty cycle	Measurement method
30-1000 MHz	120 kHz	/	/	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	>98%	Ave
	1 MHz	1/T	<98%	Ave

Note: T is minimum transmission duration

8.4 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

8.5 Corrected Factor & Margin Calculation

The Correct Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

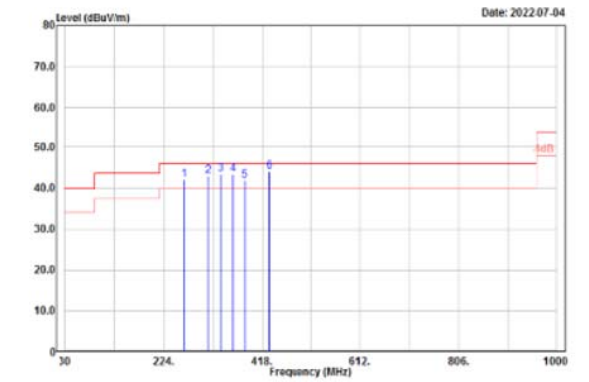
Margin = Result – Limit

8.6 Test Results

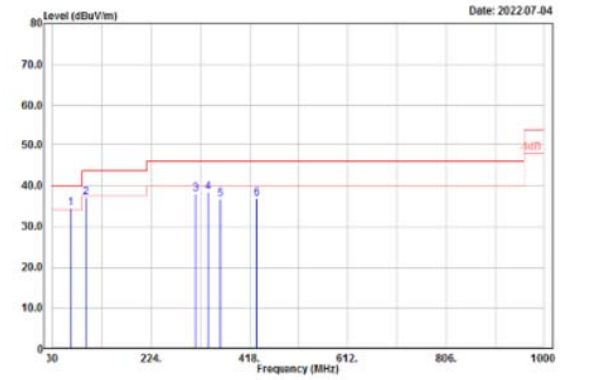
Test Mode: **BLE Mode** (Worst case is BLE mode high channel)

30MHz-1GHz:

BLE Mode / Horizontal	BLE Mode / Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
263.770	50.71	-8.72	41.99	46.00	-4.01	100	310	QP
311.300	50.10	-7.13	42.97	46.00	-3.03	100	238	QP
335.550	50.09	-6.69	43.40	46.00	-2.60	100	256	QP
359.800	49.22	-5.90	43.32	46.00	-2.68	100	262	QP
383.080	47.33	-5.57	41.76	46.00	-4.24	100	205	QP
431.580	47.87	-3.93	43.94	46.00	-2.06	100	211	QP



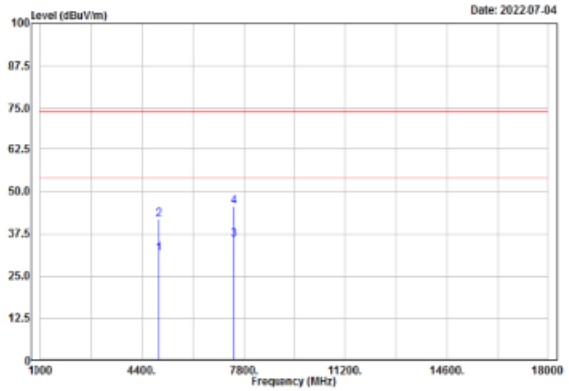
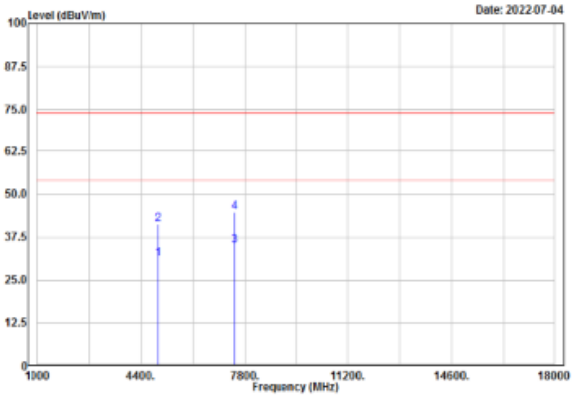
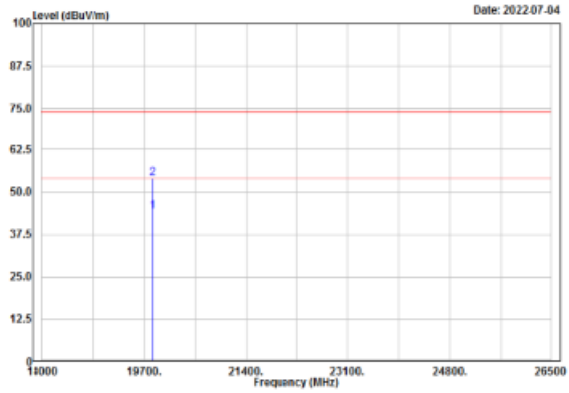
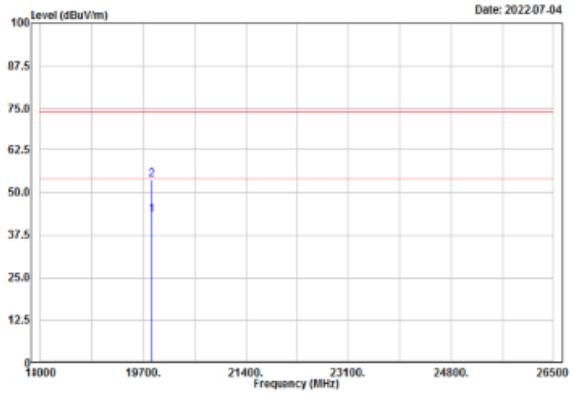
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
66.860	49.35	-14.77	34.58	40.00	-5.42	100	109	QP
95.960	50.43	-13.26	37.17	43.50	-6.33	100	300	QP
311.300	45.11	-7.13	37.98	46.00	-8.02	100	321	QP
335.550	45.02	-6.69	38.33	46.00	-7.67	100	270	QP
359.800	42.50	-5.90	36.60	46.00	-9.40	100	290	QP
431.580	40.84	-3.93	36.91	46.00	-9.09	100	245	QP

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

BLE Mode / Horizontal (1GHz-18GHz)	BLE Mode / Vertical (1GHz-18GHz)
	
BLE Mode / Horizontal (18GHz – 26.5GHz)	**BLE Mode / Vertical (18GHz – 26.5GHz)**
	

Above 1GHz

Horizontal

Low channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	33.90	-2.47	31.43	54.00	-22.57	174	278	Average
4804.000	43.92	-2.47	41.45	74.00	-32.55	174	278	Peak
7206.000	32.17	3.03	35.20	54.00	-18.80	200	3	Average
7206.000	42.27	3.03	45.30	74.00	-28.70	200	3	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4880.000	34.92	-2.24	32.68	54.00	-21.32	141	136	Average
4880.000	45.12	-2.24	42.88	74.00	-31.12	141	136	Peak
7320.000	32.40	3.34	35.74	54.00	-18.26	159	358	Average
7320.000	42.41	3.34	45.75	74.00	-28.25	159	358	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	33.75	-2.04	31.71	54.00	-22.29	178	52	Average
4960.000	43.65	-2.04	41.61	74.00	-32.39	178	52	Peak
7440.000	32.35	3.38	35.73	54.00	-18.27	144	6	Average
7440.000	42.26	3.38	45.64	74.00	-28.36	144	6	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Low channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	32.61	-2.47	30.14	54.00	-23.86	152	241	Average
4804.000	42.78	-2.47	40.31	74.00	-33.69	152	241	Peak
7206.000	31.81	3.03	34.84	54.00	-19.16	166	42	Average
7206.000	41.82	3.03	44.85	74.00	-29.15	166	42	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4880.000	34.73	-2.24	32.49	54.00	-21.51	198	303	Average
4880.000	44.85	-2.24	42.61	74.00	-31.39	198	303	Peak
7320.000	30.75	3.34	34.09	54.00	-19.91	161	125	Average
7320.000	40.69	3.34	44.03	74.00	-29.97	161	125	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	33.26	-2.04	31.22	54.00	-22.78	179	340	Average
4960.000	43.32	-2.04	41.28	74.00	-32.72	179	340	Peak
7440.000	31.52	3.38	34.90	54.00	-19.10	153	201	Average
7440.000	41.44	3.38	44.82	74.00	-29.18	153	201	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

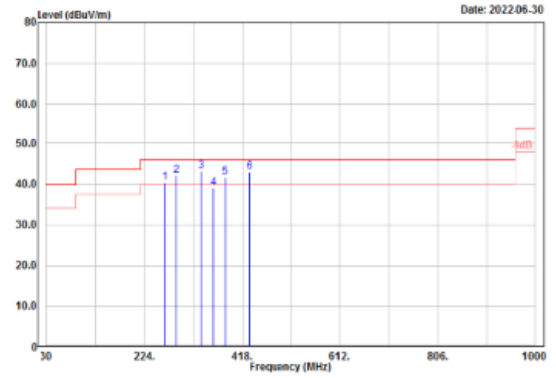
Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Transmitting simultaneously test:

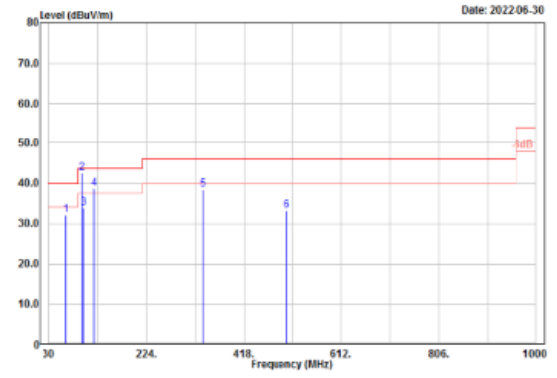
30MHz-1GHz:

Mode 2 / Horizontal



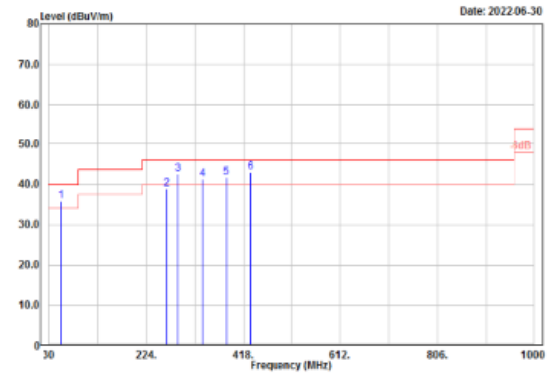
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
263.770	49.04	-8.72	40.32	46.00	-5.68	100	163	QP
287.050	49.89	-7.79	42.10	46.00	-3.90	100	227	QP
335.550	49.77	-6.69	43.08	46.00	-2.92	100	248	QP
359.800	44.95	-5.90	39.05	46.00	-6.95	100	187	QP
383.080	47.24	-5.57	41.67	46.00	-4.33	100	212	QP
431.580	46.92	-3.93	42.99	46.00	-3.01	100	215	QP

Mode 2 / Vertical



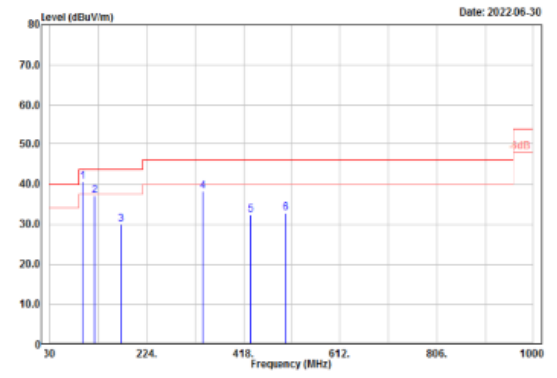
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
64.920	47.14	-14.95	32.19	40.00	-7.81	100	160	QP
95.960	55.70	-13.26	42.44	43.50	-1.06	100	209	QP
98.870	46.38	-12.48	33.90	43.50	-9.60	100	261	QP
119.240	47.14	-8.52	38.62	43.50	-4.88	100	154	QP
335.550	44.97	-6.69	38.28	46.00	-7.72	100	297	QP
503.360	35.53	-2.40	33.13	46.00	-12.87	100	74	QP

Mode 3 / Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
53.280	51.23	-15.47	35.76	40.00	-4.24	100	188	QP
263.770	47.61	-8.72	38.89	46.00	-7.11	100	50	QP
287.050	50.18	-7.79	42.39	46.00	-3.61	100	222	QP
335.550	47.82	-6.69	41.13	46.00	-4.87	100	249	QP
383.080	47.24	-5.57	41.67	46.00	-4.33	100	197	QP
431.580	46.79	-3.93	42.86	46.00	-3.14	100	216	QP

Mode 3 / Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
95.960	53.88	-13.26	40.62	43.50	-2.88	100	212	QP
119.240	45.66	-8.52	37.14	43.50	-6.36	100	46	QP
172.590	40.35	-10.36	29.99	43.50	-13.51	100	153	QP
335.550	44.85	-6.69	38.16	46.00	-7.84	100	302	QP
431.580	36.20	-3.93	32.27	46.00	-13.73	100	224	QP
503.360	35.13	-2.40	32.73	46.00	-13.27	100	55	QP

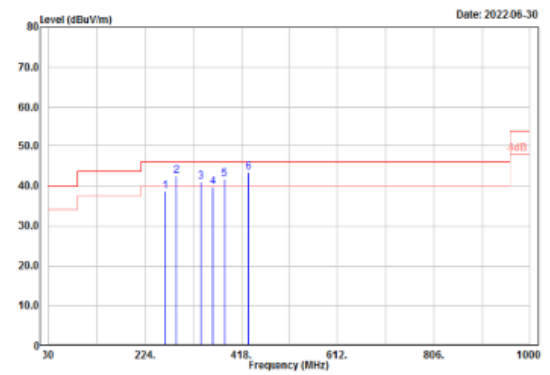
Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

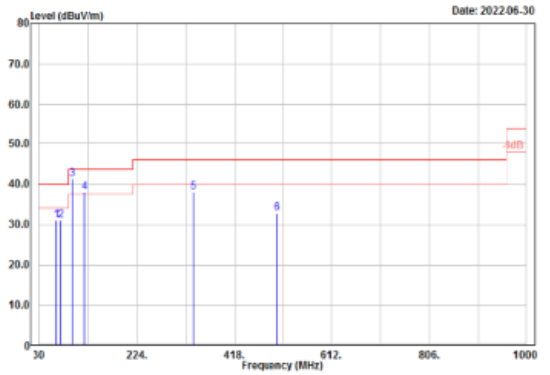
Spurious emissions more than 20 dB below the limit were not reported.

Mode 4 / Horizontal



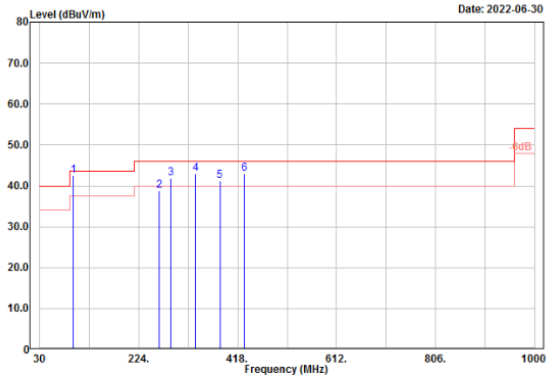
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
263.770	47.36	-8.72	38.64	46.00	-7.36	100	167	QP
287.050	50.35	-7.79	42.56	46.00	-3.44	100	225	QP
335.550	47.71	-6.69	41.02	46.00	-4.98	100	256	QP
359.800	45.49	-5.90	39.59	46.00	-6.41	100	200	QP
383.080	47.19	-5.57	41.62	46.00	-4.38	100	216	QP
431.580	47.28	-3.93	43.35	46.00	-2.65	100	212	QP

Mode 4 / Vertical



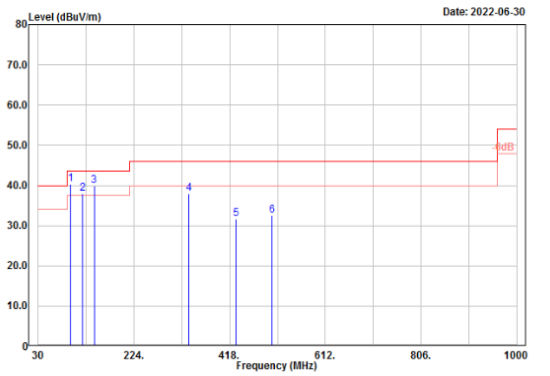
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
63.950	46.07	-14.98	31.09	40.00	-8.91	100	169	QP
73.650	45.59	-14.69	30.90	40.00	-9.10	100	309	QP
95.960	54.36	-13.26	41.10	43.50	-2.40	100	219	QP
119.240	46.53	-8.52	38.01	43.50	-5.49	100	121	QP
335.550	44.63	-6.69	37.94	46.00	-8.06	100	300	QP
503.360	35.19	-2.40	32.79	46.00	-13.21	100	84	QP

Mode 5 / Horizontal



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
95.960	55.65	-13.26	42.39	43.50	-1.11	100	248	QP
263.770	47.61	-8.72	38.89	46.00	-7.11	100	38	QP
287.050	49.72	-7.79	41.93	46.00	-4.07	100	227	QP
335.550	49.60	-6.69	42.91	46.00	-3.09	100	257	QP
383.080	46.82	-5.57	41.25	46.00	-4.75	100	208	QP
431.580	46.86	-3.93	42.93	46.00	-3.07	100	214	QP

Mode 5 / Vertical



Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
95.960	53.59	-13.26	40.33	43.50	-3.17	100	214	QP
119.240	46.43	-8.52	37.91	43.50	-5.59	100	36	QP
143.490	49.20	-9.30	39.90	43.50	-3.60	100	296	QP
335.550	44.64	-6.69	37.95	46.00	-8.05	100	302	QP
431.580	35.55	-3.93	31.62	46.00	-14.38	100	234	QP
503.360	34.93	-2.40	32.53	46.00	-13.47	100	69	QP

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Above 1GHz

Mode 2 :

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	33.22	-2.47	30.75	54.00	-23.25	156	27	Average
4804.000	43.11	-2.47	40.64	74.00	-33.36	156	27	Peak
4874.000	33.14	-2.25	30.89	54.00	-23.11	172	0	Average
4874.000	43.20	-2.25	40.95	74.00	-33.05	172	0	Peak
7206.000	30.94	3.03	33.97	54.00	-20.03	139	51	Average
7206.000	40.18	3.03	43.21	74.00	-30.79	139	51	Peak
7311.000	30.87	3.34	34.21	54.00	-19.79	203	45	Average
7311.000	40.94	3.34	44.28	74.00	-29.72	203	45	Peak
10440.000	30.25	7.97	38.22	54.00	-15.78	195	313	Average
10440.000	40.78	7.97	48.75	74.00	-25.25	195	313	Peak
15660.000	33.09	11.11	44.20	54.00	-9.80	144	267	Average
15660.000	42.40	11.11	53.51	74.00	-20.49	144	267	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	41.52	-0.57	40.95	54.00	-13.05	150	342	Average
19216.000	51.40	-0.57	50.83	74.00	-23.17	150	342	Peak
19496.000	42.72	0.25	42.97	54.00	-11.03	150	91	Average
19496.000	51.56	0.25	51.81	74.00	-22.19	150	91	Peak
20880.000	39.01	1.85	40.86	54.00	-13.14	150	339	Average
20880.000	49.11	1.85	50.96	74.00	-23.04	150	339	Peak
20920.000	29.05	1.81	30.86	54.00	-23.14	150	339	Average
20920.000	39.28	1.81	41.09	74.00	-32.91	150	339	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	33.41	-2.47	30.94	54.00	-23.06	152	129	Average
4804.000	43.21	-2.47	40.74	74.00	-33.26	152	129	Peak
4874.000	33.82	-2.25	31.57	54.00	-22.43	171	60	Average
4874.000	43.91	-2.25	41.66	74.00	-32.34	171	60	Peak
7206.000	31.64	3.03	34.67	54.00	-19.33	198	175	Average
7206.000	41.73	3.03	44.76	74.00	-29.24	198	175	Peak
7311.000	32.25	3.34	35.59	54.00	-18.41	177	314	Average
7311.000	42.18	3.34	45.52	74.00	-28.48	177	314	Peak
10440.000	30.93	7.97	38.90	54.00	-15.10	202	172	Average
10440.000	41.09	7.97	49.06	74.00	-24.94	202	172	Peak
15660.000	33.90	11.11	45.01	54.00	-8.99	144	73	Average
15660.000	43.83	11.11	54.94	74.00	-19.06	144	73	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	42.18	-0.57	41.61	54.00	-12.39	150	290	Average
19216.000	53.00	-0.57	52.43	74.00	-21.57	150	290	Peak
19496.000	42.01	0.25	42.26	54.00	-11.74	150	30	Average
19496.000	52.16	0.25	52.41	74.00	-21.59	150	30	Peak
20880.000	39.38	1.85	41.23	54.00	-12.77	150	107	Average
20880.000	47.94	1.85	49.79	74.00	-24.21	150	107	Peak
20920.000	29.42	1.81	31.23	54.00	-22.77	150	107	Average
20920.000	40.47	1.81	42.28	74.00	-31.72	150	107	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Mode 3 :

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	33.01	-2.47	30.54	54.00	-23.46	148	148	Average
4804.000	42.56	-2.47	40.09	74.00	-33.91	148	148	Peak
4874.000	32.63	-2.25	30.38	54.00	-23.62	161	163	Average
4874.000	42.87	-2.25	40.62	74.00	-33.38	161	163	Peak
7206.000	31.29	3.03	34.32	54.00	-19.68	200	158	Average
7206.000	41.23	3.03	44.26	74.00	-29.74	200	158	Peak
7311.000	31.02	3.34	34.36	54.00	-19.64	181	31	Average
7311.000	41.16	3.34	44.50	74.00	-29.50	181	31	Peak
10440.000	30.48	7.97	38.45	54.00	-15.55	149	139	Average
10440.000	40.37	7.97	48.34	74.00	-25.66	149	139	Peak
11650.000	29.45	8.77	38.22	54.00	-15.78	174	325	Average
11650.000	39.42	8.77	48.19	74.00	-25.81	174	325	Peak
15660.000	32.40	11.11	43.51	54.00	-10.49	195	325	Average
15660.000	41.61	11.11	52.72	74.00	-21.28	195	325	Peak
17475.000	30.46	13.25	43.71	54.00	-10.29	150	325	Average
17475.000	35.30	13.25	48.55	74.00	-25.45	150	325	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	41.78	-0.57	41.21	54.00	-12.79	150	0	Average
19216.000	51.90	-0.57	51.33	74.00	-22.67	150	0	Peak
19496.000	41.07	0.25	41.32	54.00	-12.68	150	74	Average
19496.000	51.10	0.25	51.35	74.00	-22.65	150	74	Peak
20880.000	37.83	1.85	39.68	54.00	-14.32	150	7	Average
20880.000	48.03	1.85	49.88	74.00	-24.12	150	7	Peak
23300.000	37.69	2.89	40.58	54.00	-13.42	150	7	Average
23300.000	47.14	2.89	50.03	74.00	-23.97	150	7	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	33.05	-2.47	30.58	54.00	-23.42	204	17	Average
4804.000	43.02	-2.47	40.55	74.00	-33.45	204	17	Peak
4874.000	33.14	-2.25	30.89	54.00	-23.11	172	37	Average
4874.000	43.52	-2.25	41.27	74.00	-32.73	172	37	Peak
7206.000	31.67	3.03	34.70	54.00	-19.30	139	346	Average
7206.000	41.67	3.03	44.70	74.00	-29.30	139	346	Peak
7311.000	31.43	3.34	34.77	54.00	-19.23	168	312	Average
7311.000	41.51	3.34	44.85	74.00	-29.15	168	312	Peak
10440.000	30.60	7.97	38.57	54.00	-15.43	200	225	Average
10440.000	40.68	7.97	48.65	74.00	-25.35	200	225	Peak
11650.000	29.57	8.77	38.34	54.00	-15.66	191	225	Average
11650.000	39.88	8.77	48.65	74.00	-25.35	191	225	Peak
15660.000	32.68	11.11	43.79	54.00	-10.21	188	281	Average
15660.000	43.25	11.11	54.36	74.00	-19.64	188	281	Peak
17475.000	30.77	13.25	44.02	54.00	-9.98	150	225	Average
17475.000	35.40	13.25	48.65	74.00	-25.35	150	225	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	42.52	-0.57	41.95	54.00	-12.05	150	278	Average
19216.000	52.74	-0.57	52.17	74.00	-21.83	150	278	Peak
19496.000	41.10	0.25	41.35	54.00	-12.65	150	294	Average
19496.000	51.15	0.25	51.40	74.00	-22.60	150	294	Peak
20880.000	38.74	1.85	40.59	54.00	-13.41	150	218	Average
20880.000	48.88	1.85	50.73	74.00	-23.27	150	218	Peak
23300.000	37.84	2.89	40.73	54.00	-13.27	150	218	Average
23300.000	47.59	2.89	50.48	74.00	-23.52	150	218	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Mode 4 :

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	31.78	-2.47	29.31	54.00	-24.69	161	2	Average
4804.000	42.03	-2.47	39.56	74.00	-34.44	161	2	Peak
4874.000	33.65	-2.25	31.40	54.00	-22.60	199	358	Average
4874.000	42.68	-2.25	40.43	74.00	-33.57	199	358	Peak
7206.000	31.02	3.03	34.05	54.00	-19.95	155	155	Average
7206.000	41.26	3.03	44.29	74.00	-29.71	155	155	Peak
7311.000	30.20	3.34	33.54	54.00	-20.46	171	309	Average
7311.000	40.39	3.34	43.73	74.00	-30.27	171	309	Peak
10440.000	30.01	7.97	37.98	54.00	-16.02	150	33	Average
10440.000	40.10	7.97	48.07	74.00	-25.93	150	33	Peak
10460.000	30.17	8.06	38.23	54.00	-15.77	205	353	Average
10460.000	40.03	8.06	48.09	74.00	-25.91	205	353	Peak
15660.000	33.64	11.11	44.75	54.00	-9.25	164	180	Average
15660.000	43.70	11.11	54.81	74.00	-19.19	164	180	Peak
15690.000	32.57	11.30	43.87	54.00	-10.13	200	183	Average
15690.000	42.57	11.30	53.87	74.00	-20.13	200	183	Peak
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	42.26	-0.57	41.69	54.00	-12.31	150	159	Average
19216.000	51.44	-0.57	50.87	74.00	-23.13	150	159	Peak
19496.000	42.55	0.25	42.80	54.00	-11.20	150	217	Average
19496.000	50.34	0.25	50.59	74.00	-23.41	150	217	Peak
20880.000	38.81	1.85	40.66	54.00	-13.34	150	156	Average
20880.000	48.01	1.85	49.86	74.00	-24.14	150	156	Peak
20920.000	39.24	1.81	41.05	54.00	-12.95	150	308	Average
20920.000	48.75	1.81	50.56	74.00	-23.44	150	308	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	32.09	-2.47	29.62	54.00	-24.38	142	240	Average
4804.000	42.68	-2.47	40.21	74.00	-33.79	142	240	Peak
4874.000	33.97	-2.25	31.72	54.00	-22.28	200	24	Average
4874.000	43.63	-2.25	41.38	74.00	-32.62	200	24	Peak
7206.000	31.74	3.03	34.77	54.00	-19.23	189	185	Average
7206.000	41.64	3.03	44.67	74.00	-29.33	189	185	Peak
7311.000	30.28	3.34	33.62	54.00	-20.38	154	30	Average
7311.000	40.78	3.34	44.12	74.00	-29.88	154	30	Peak
10440.000	30.21	7.97	38.18	54.00	-15.82	203	175	Average
10440.000	40.25	7.97	48.22	74.00	-25.78	203	175	Peak
10460.000	30.87	8.06	38.93	54.00	-15.07	193	1	Average
10460.000	40.61	8.06	48.67	74.00	-25.33	193	1	Peak
15660.000	33.81	11.11	44.92	54.00	-9.08	150	48	Average
15660.000	43.90	11.11	55.01	74.00	-18.99	150	48	Peak
15690.000	33.59	11.30	44.89	54.00	-9.11	143	1	Average
15690.000	43.28	11.30	54.58	74.00	-19.42	143	1	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	42.48	-0.57	41.91	54.00	-12.09	150	169	Average
19216.000	52.12	-0.57	51.55	74.00	-22.45	150	169	Peak
19496.000	43.01	0.25	43.26	54.00	-10.74	150	346	Average
19496.000	51.29	0.25	51.54	74.00	-22.46	150	346	Peak
20880.000	39.28	1.85	41.13	54.00	-12.87	150	15	Average
20880.000	49.06	1.85	50.91	74.00	-23.09	150	15	Peak
20920.000	39.59	1.81	41.40	54.00	-12.60	150	169	Average
20920.000	49.33	1.81	51.14	74.00	-22.86	150	169	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Mode 5 :

Horizontal

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	33.14	-2.47	30.67	54.00	-23.33	191	272	Average
4804.000	43.05	-2.47	40.58	74.00	-33.42	191	272	Peak
7206.000	30.62	3.03	33.65	54.00	-20.35	155	323	Average
7206.000	40.68	3.03	43.71	74.00	-30.29	155	323	Peak
10440.000	31.42	7.97	39.39	54.00	-14.61	144	113	Average
10440.000	40.60	7.97	48.57	74.00	-25.43	144	113	Peak
10460.000	31.37	8.06	39.43	54.00	-14.57	152	314	Average
10460.000	41.40	8.06	49.46	74.00	-24.54	152	314	Peak
11650.000	30.02	8.77	38.79	54.00	-15.21	166	353	Average
11650.000	39.87	8.77	48.64	74.00	-25.36	166	353	Peak
15660.000	32.40	11.11	43.51	54.00	-10.49	160	353	Average
15660.000	42.08	11.11	53.19	74.00	-20.81	160	353	Peak
15690.000	32.10	11.30	43.40	54.00	-10.60	185	296	Average
15690.000	42.69	11.30	53.99	74.00	-20.01	185	296	Peak
17475.000	30.46	13.25	43.71	54.00	-10.29	205	353	Average
17475.000	36.39	13.25	49.64	74.00	-24.36	205	353	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	41.17	-0.57	40.60	54.00	-13.40	150	301	Average
19216.000	50.32	-0.57	49.75	74.00	-24.25	150	301	Peak
20880.000	38.80	1.85	40.65	54.00	-13.35	150	128	Average
20880.000	48.22	1.85	50.07	74.00	-23.93	150	128	Peak
20920.000	39.16	1.81	40.97	54.00	-13.03	150	340	Average
20920.000	48.37	1.81	50.18	74.00	-23.82	150	340	Peak
23300.000	37.68	2.89	40.57	54.00	-13.43	150	128	Average
23300.000	46.78	2.89	49.67	74.00	-24.33	150	128	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	33.43	-2.47	30.96	54.00	-23.04	175	299	Average
4804.000	43.22	-2.47	40.75	74.00	-33.25	175	299	Peak
7206.000	31.30	3.03	34.33	54.00	-19.67	211	79	Average
7206.000	41.45	3.03	44.48	74.00	-29.52	211	79	Peak
10440.000	31.92	7.97	39.89	54.00	-14.11	151	260	Average
10440.000	41.36	7.97	49.33	74.00	-24.67	151	260	Peak
10460.000	31.48	8.06	39.54	54.00	-14.46	170	39	Average
10460.000	41.74	8.06	49.80	74.00	-24.20	170	39	Peak
11650.000	31.06	8.77	39.83	54.00	-14.17	144	39	Average
11650.000	41.03	8.77	49.80	74.00	-24.20	144	39	Peak
15660.000	32.58	11.11	43.69	54.00	-10.31	197	60	Average
15660.000	42.44	11.11	53.55	74.00	-20.45	197	60	Peak
15690.000	33.65	11.30	44.95	54.00	-9.05	148	85	Average
15690.000	43.10	11.30	54.40	74.00	-19.60	148	85	Peak
17475.000	33.19	13.25	46.44	54.00	-7.56	188	39	Average
17475.000	36.55	13.25	49.80	74.00	-24.20	188	39	Peak
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
19216.000	42.15	-0.57	41.58	54.00	-12.42	150	354	Average
19216.000	52.02	-0.57	51.45	74.00	-22.55	150	354	Peak
20880.000	39.70	1.85	41.55	54.00	-12.45	150	112	Average
20880.000	48.61	1.85	50.46	74.00	-23.54	150	112	Peak
20920.000	39.32	1.81	41.13	54.00	-12.87	150	171	Average
20920.000	48.88	1.81	50.69	74.00	-23.31	150	171	Peak
23300.000	38.66	2.89	41.55	54.00	-12.45	150	112	Average
23300.000	46.97	2.89	49.86	74.00	-24.14	150	112	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

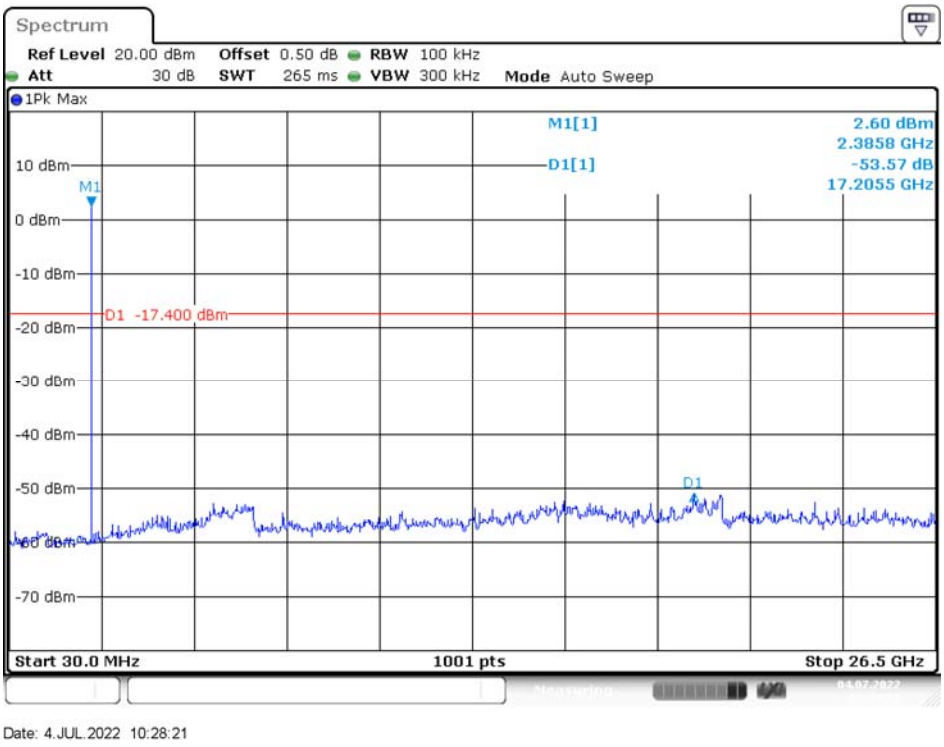
Spurious emissions more than 20 dB below the limit were not reported.

Conducted Spurious Emissions:

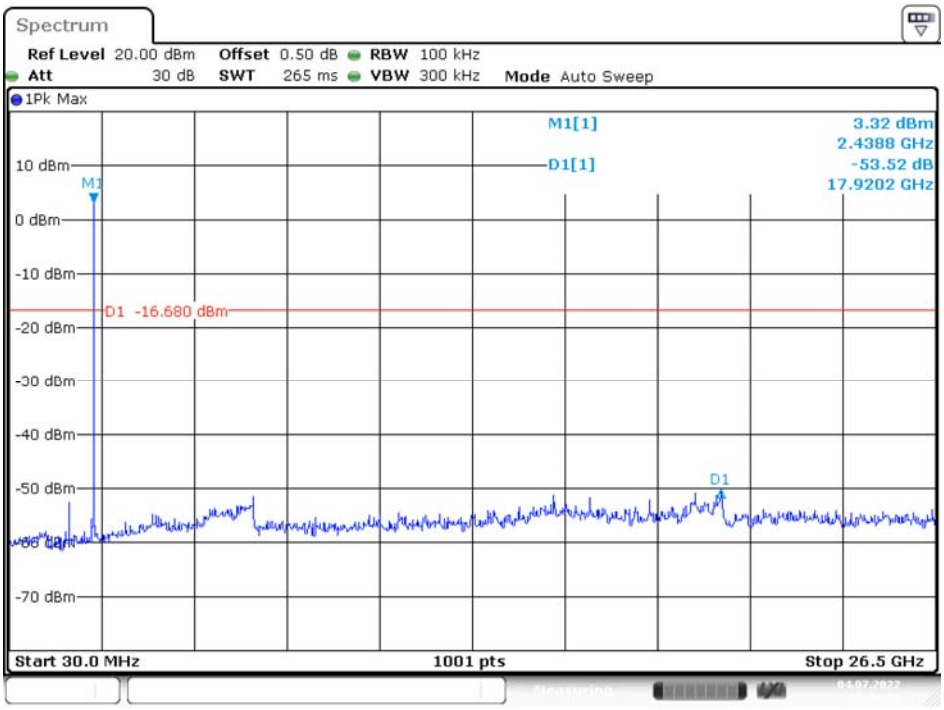
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
Low	2402	53.57	≥ 20	PASS
Middle	2440	53.52	≥ 20	PASS
High	2480	51.90	≥ 20	PASS

BLE Mode

Low Channel



Middle Channel



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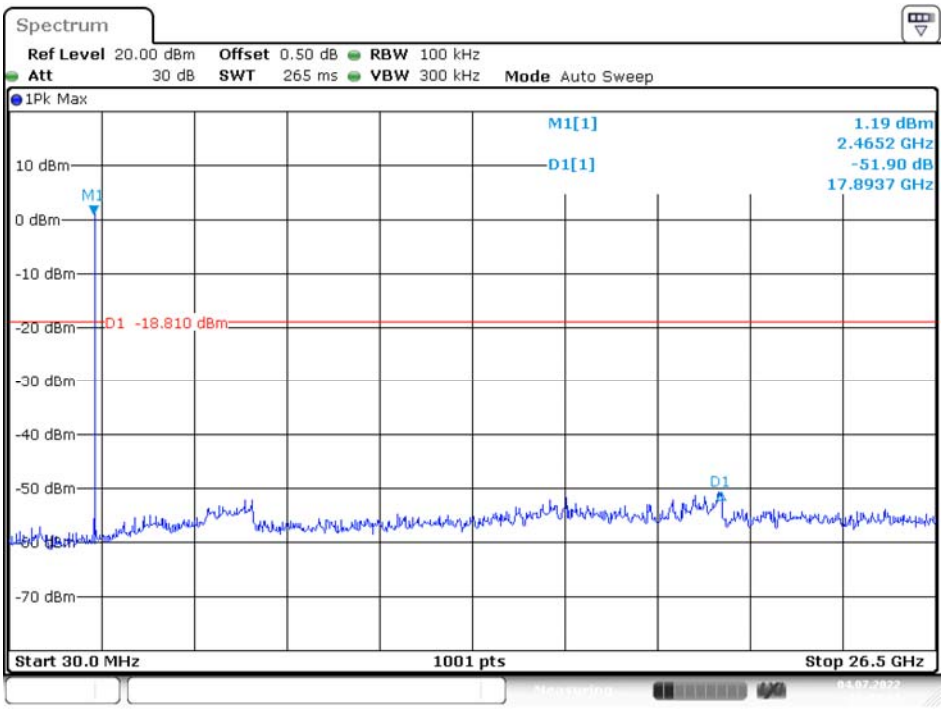
High Channel



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9 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

9.1 Applicable Standard

According to FCC §15.247(a)(2).

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

9.2 Test Procedure

The steps for the first option are as follows:

a) Set RBW = 100 kHz.

b) Set the VBW ≥ [3 × RBW].

c) Detector = peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) 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.

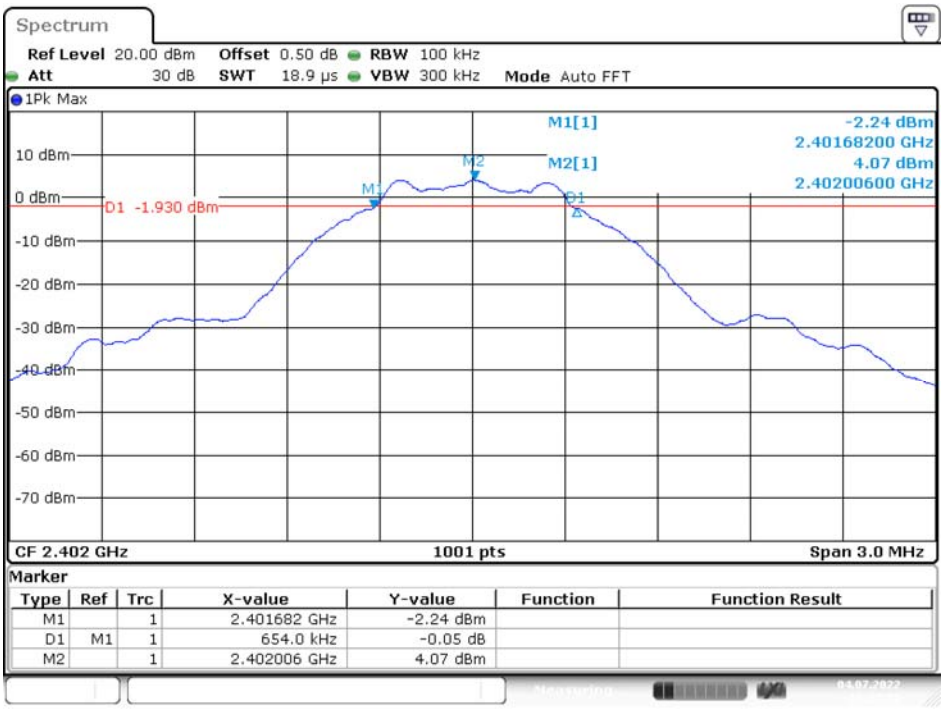
9.3 Test Results

Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	Limit (kHz)	Result
Low	2402	654	> 500	Compliance
Middle	2440	651	> 500	Compliance
High	2480	648	> 500	Compliance

Please refer to the following plots

BLE Mode

Low Channel



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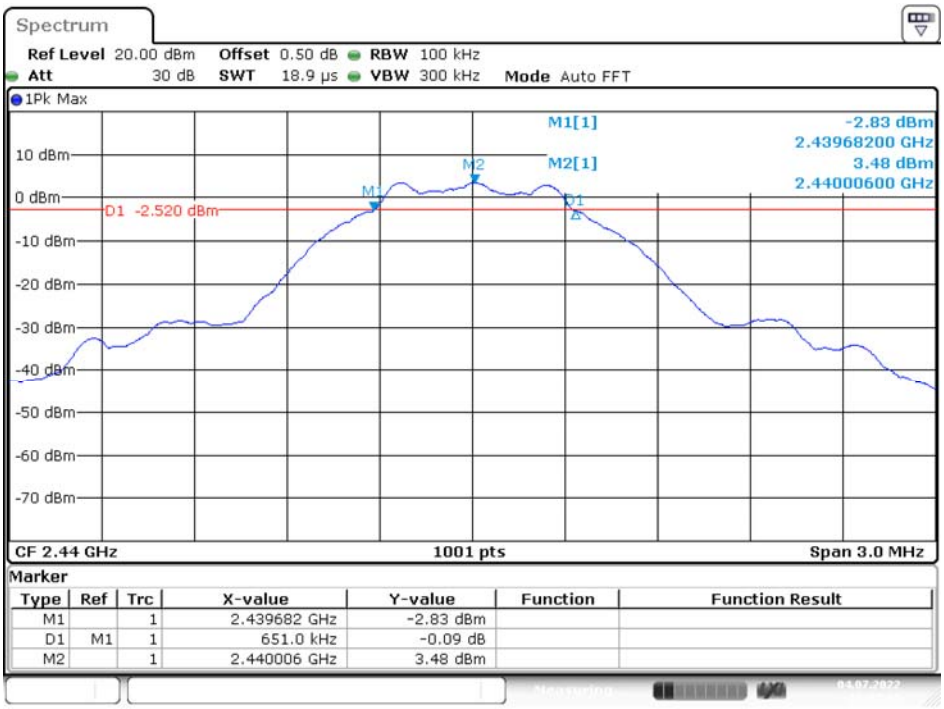
Middle Channel



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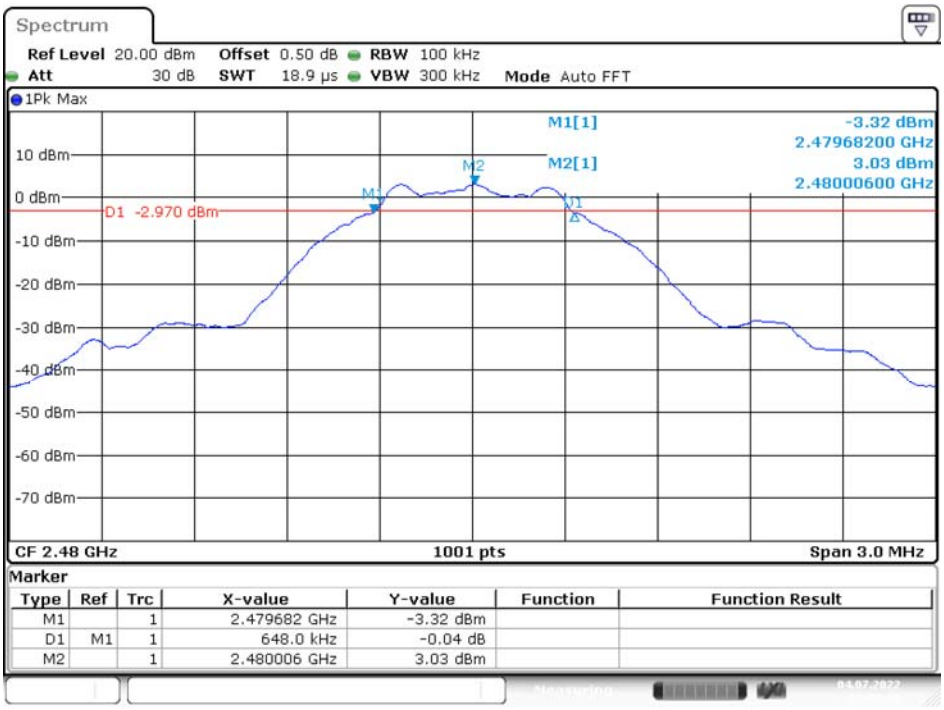
High Channel



10 FCC §15.247(b)(3) – Maximum Output Power

10.1 Applicable Standard

According to FCC §15.247(b) (3).

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

10.2 Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.

2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to measuring equipment.

10.3 Test Results

Conducted Peak Output Power

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	Power (W)	Limit (W)	Result
BLE Mode					
Low	2402	4.67	0.002	1	PASS
Middle	2440	3.65	0.002	1	PASS
High	2480	3.14	0.002	1	PASS

11 FCC§15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

11.1 Applicable Standard

According to FCC §15.247(d).

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

11.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

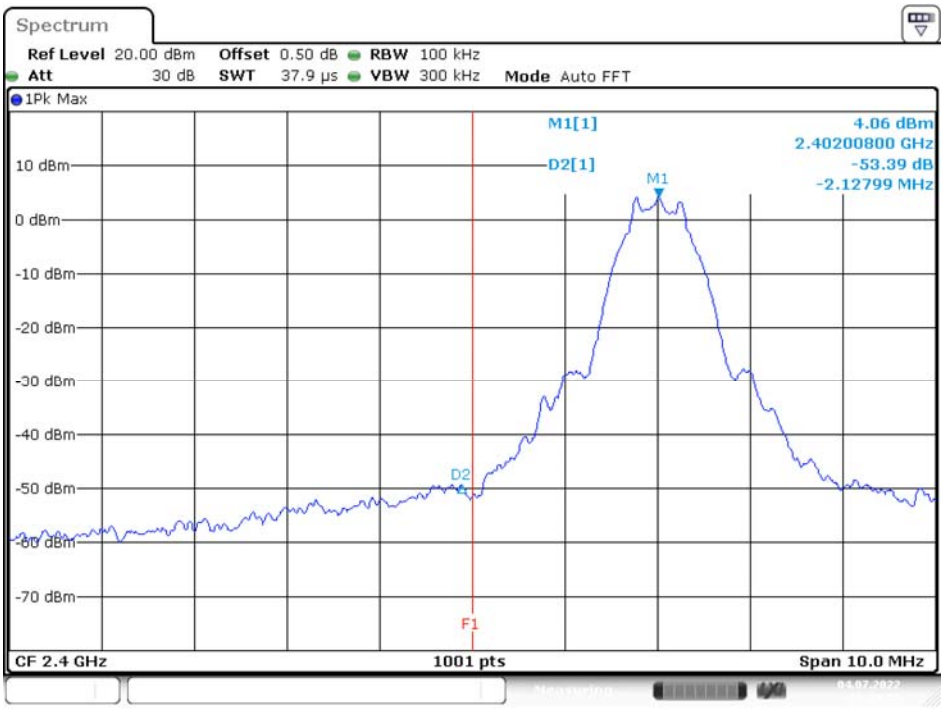
11.3 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
Low	2402	53.39	≥ 20	PASS
High	2480	58.02	≥ 20	PASS

Please refer to the following plots

BLE Mode

Band Edge, Left Side



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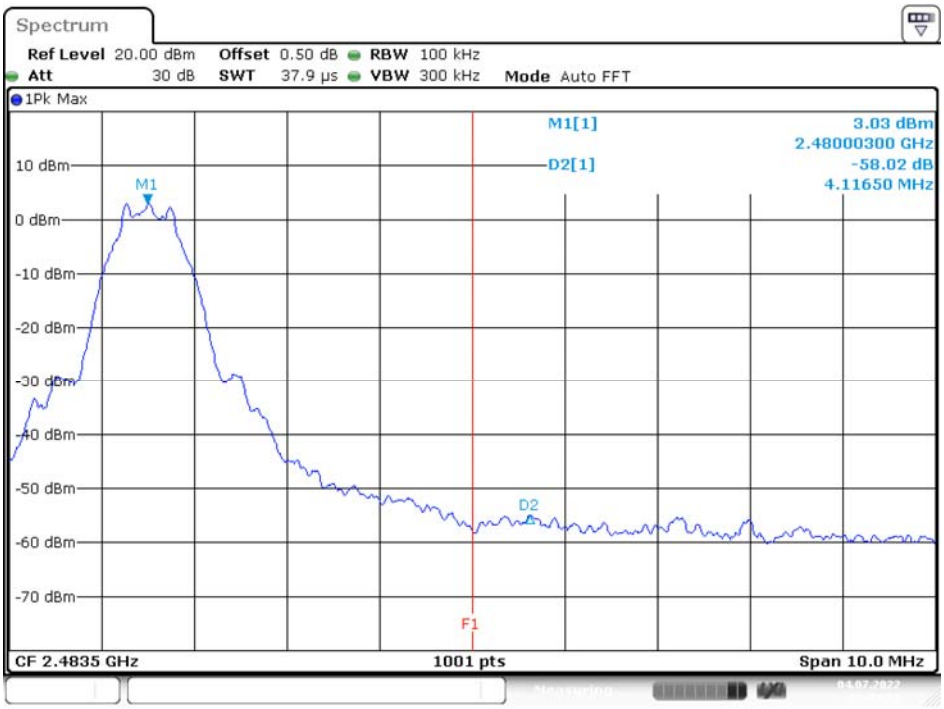
Band Edge, Right Side



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12 FCC §15.247(e) – Power Spectral Density

12.1 Applicable Standard

According to FCC §15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

12.2 Test Procedure

a) Set analyzer center frequency to DTS channel center frequency.

b) Set the span to 1.5 times the DTS bandwidth.

c) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.

d) Set the VBW ≥ [3 × RBW].

e) Detector = peak.

f) Sweep time = auto couple.

g) Trace mode = max hold.

h) Allow trace to fully stabilize.

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

j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat

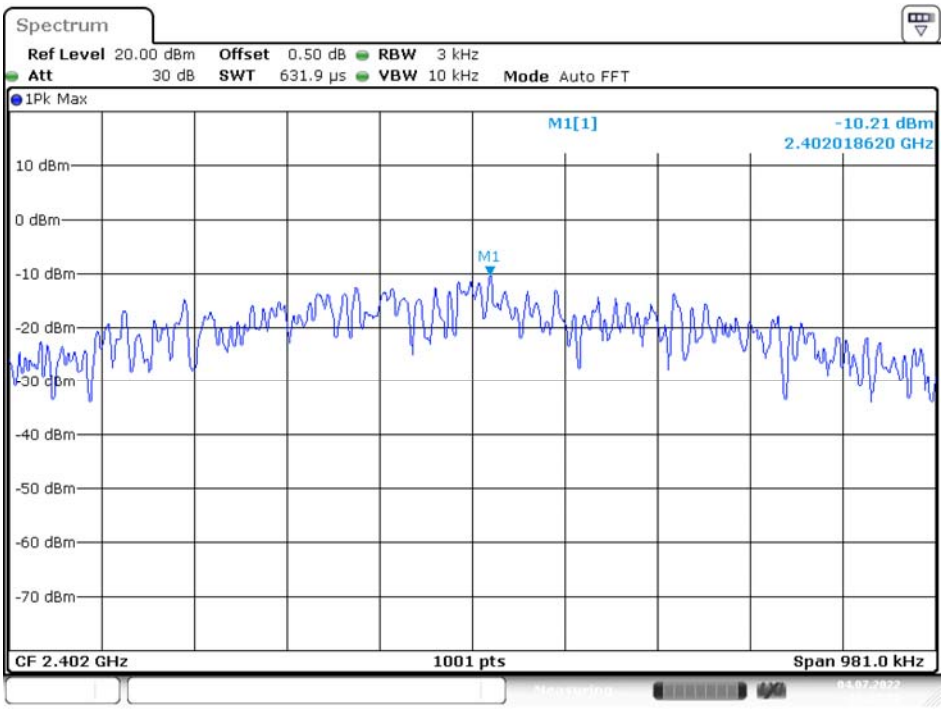
12.3 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
Low	2402	-10.21	8	Compliance
Middle	2440	-10.78	8	Compliance
High	2480	-11.22	8	Compliance

Please refer to the following plots

BLE Mode

Low Channel



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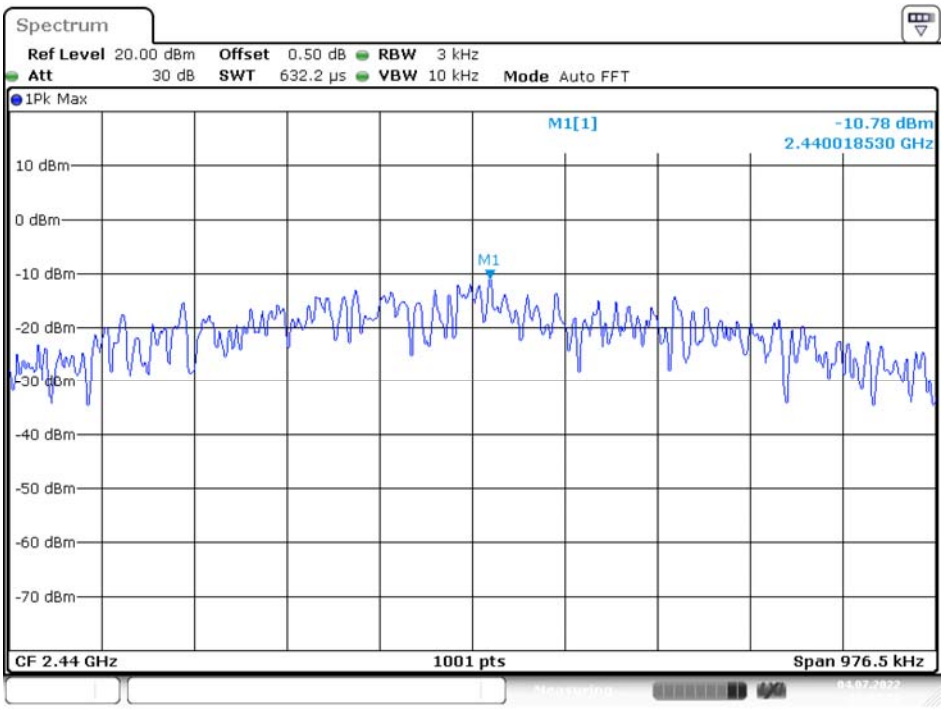
Middle Channel



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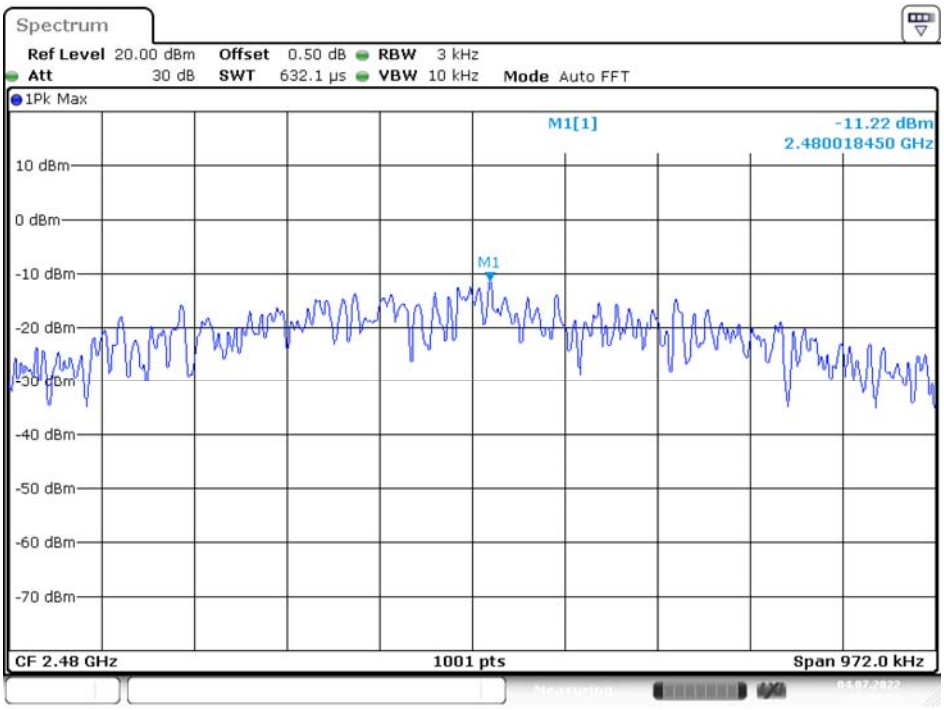
High Channel



******* END OF REPORT *******