FCC Part 15.247

TEST REPORT

For

Cisco Systems, Inc.

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

FCC ID: LDKDVONE2597

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

Report Producer : Eva Kao

Report Number : RXZ220627001RF01

Report Date : 2022-7-8

Reviewed By: Andy Shih

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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ220627001	RXZ220627001RF01	2022-7-8	Original Report	Eva Kao

TABLE OF CONTENTS

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	C9120AXI-B
Frequency Range	BLE Mode: 2402 ~ 2480 MHz
Channel Number	40
Transmit Power	3.84 dBm
Modulation Technique	BLE Mode: GFSK
Transmit Data Rate	BLE Mode: 1Mbps
Power Operation (Voltage Range)	55Vdc from PoE port
Received Date	2022/6/6
Date of Test	2022/6/28 ~ 2022/6/30

*All measurement and test data in this report was gathered from production sample serial number: RXZ220627001-01 (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 Related Submittal(s)/Grant(s)

N/A.

1.4 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

1.5 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.

1.6 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 %

1.7 Environmental Conditions

Test Site	Test Date	Temperature (℃)	Relative Humidity (%)	ATM Pressure (hPa)	Test Engineer
AC Line Conducted Emissions	2022/6/28	24.3	54	1010	Aaron Pan
Radiation Spurious Emissions	2022/6/28 ~ 2022/6/29	22.8 - 24.1	54 - 66	1010	Andy Cheng
Conducted Spurious Emissions	2022/6/28	24.3	54	1010	Boris Kao
6 dB Emission Bandwidth	2022/6/28	24.3	54	1010	Boris Kao
Maximum Output Power	2022/6/28	24.3	54	1010	Boris Kao
100 kHz Bandwidth of Frequency Band Edge	2022/6/28	24.3	54	1010	Boris Kao
Power Spectral Density	2022/6/28	24.3	54	1010	Boris Kao

1.8 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 :

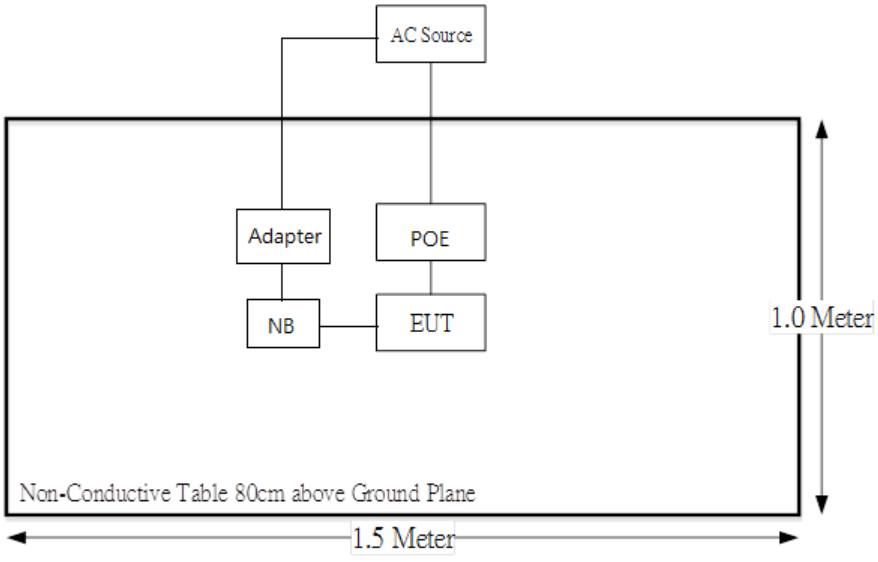
Worst case mode		Output power dBm
XOR WIFI-2.4GHz	B Mode, 2437MHz	23.89
XOR WIFI-5GHz	AX40 Mode, 5230MHz	23.68
Regular WIFI-5GHz	AX20 Mode, 5240 MHz	23.68
AUX WIFI-2.4GHz	G Mode, 2437MHz	20.11
AUX WIFI-5GHz	A Mode, 5220MHz	22.38

2.7 Block Diagram of Test Setup

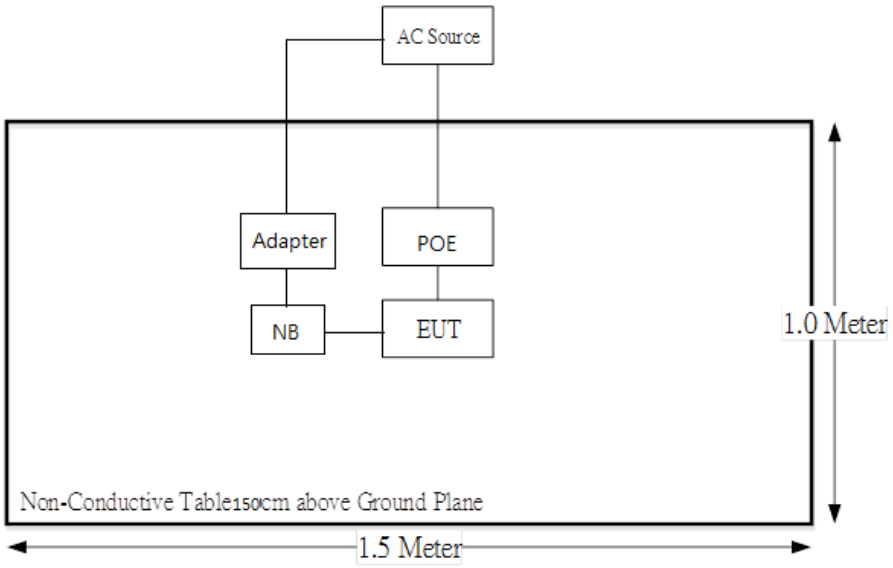
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

Radiation:

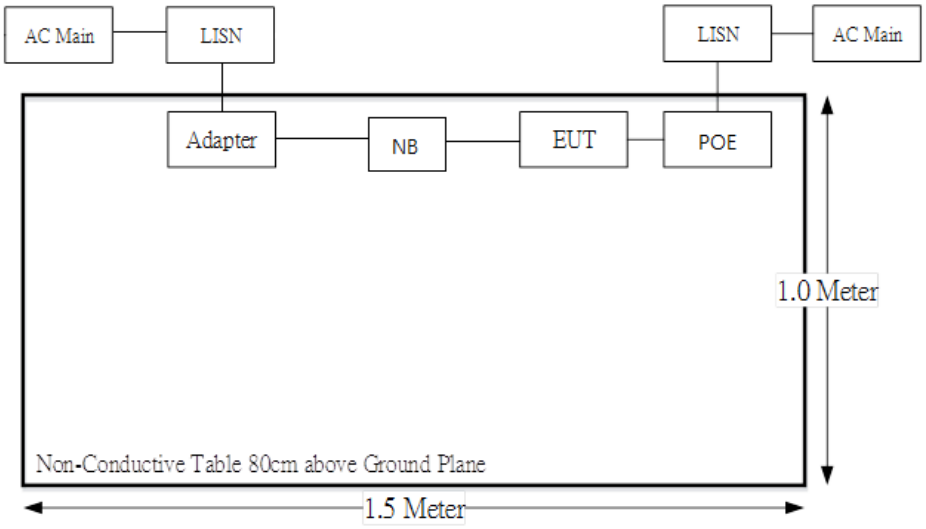
Below 1GHz:



Above 1GHz:



Conduction:



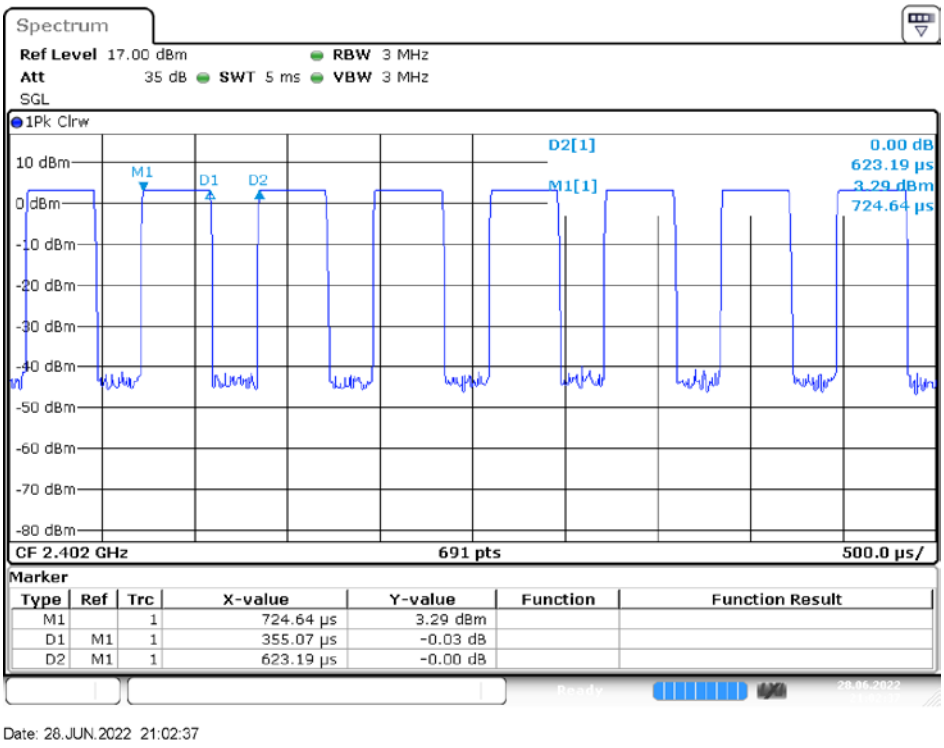
2.8 Duty Cycle

The duty cycle as below:

Radio Mode	T_{on} (ms)	$T_{on}+T_{off}$ (ms)	Duty Cycle (%)
BLE	0.355	0.623	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: 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

Worst case is Mode 5 :

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	4	3	300	100%	2.51	4.85	3.05
do0 5GHz XOR	5850	24.5	11	300	100%	281.84	33.35	2162.72
d01 5GHz Regualr	5850	24	11	300	100%	251.19	32.85	1927.52
do4 5G Aux	5850	23	5	300	100%	199.53	25.85	384.59

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 5GHz XOR	5850	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 5GHz XOR	5850	3060.00	2.091	3060	0.71	exempt
d01 5GHz Regualr	5850	3060.00	2.091	3060	0.63	exempt
do4 5G Aux	5850	3060.00	2.091	3060	0.13	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 5GHz XOR	5850	exempt	0.314	1.000	O	0.314
d01 5GHz Regualr	5850	exempt	0.280	1.000	O	0.280
do4 5G Aux	5850	exempt	0.056	1.000	O	0.056
Simultaneous Analysis (Limit 1)						0.651

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	single port, dual band omni	3 dBi

Result: Compliance

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

7.1 Applicable Standard

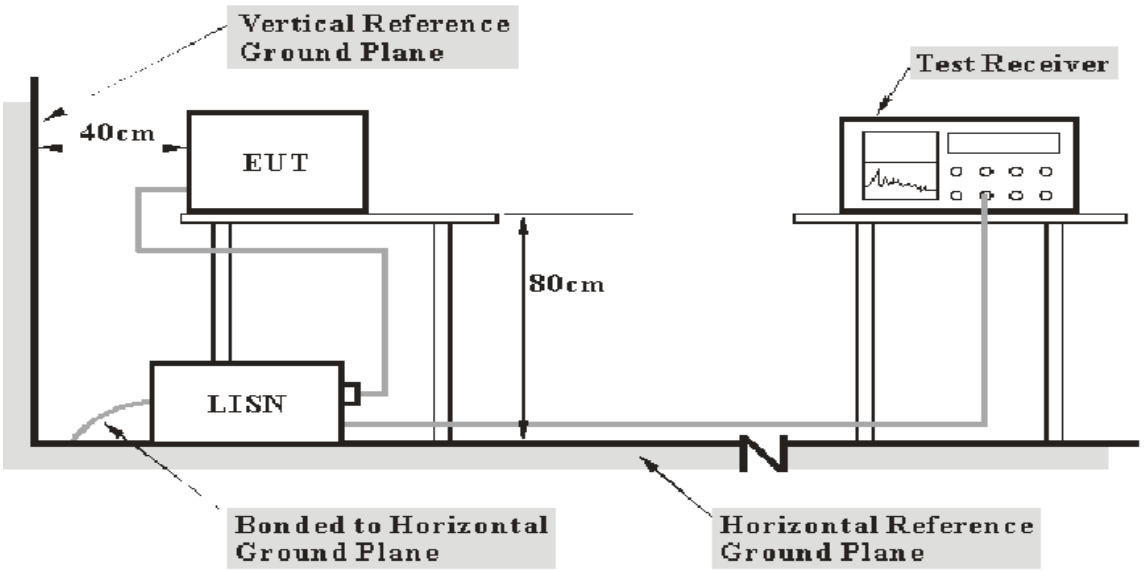
According to §15.207

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

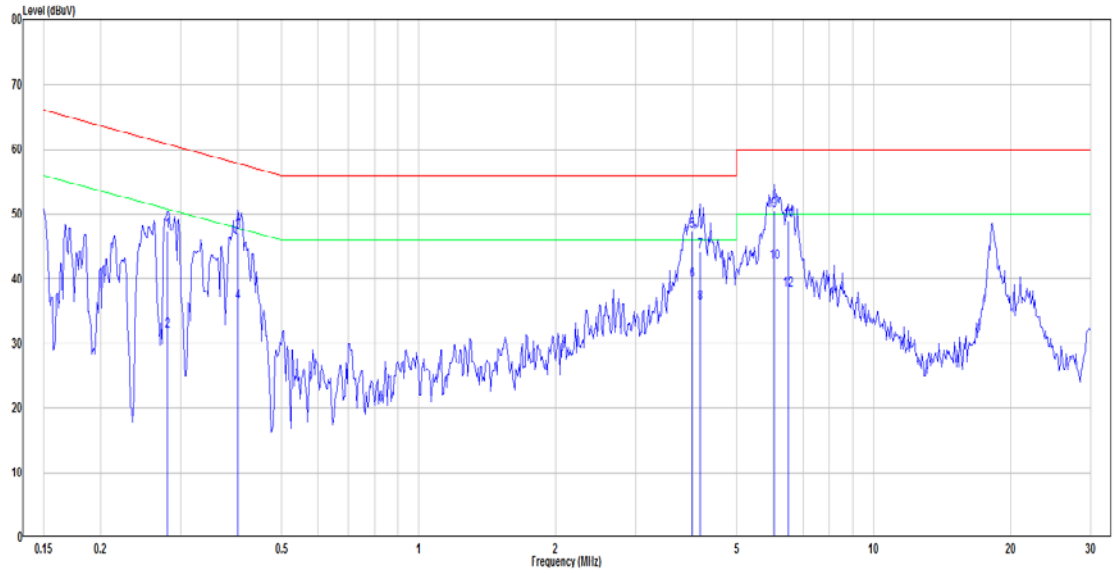
The “Over Limit” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of -7 dB means the emission is 7 dB below the limit. The equation for Over Limit calculation is as follows:

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	0.280	27.72	19.51	47.23	60.81	-13.58	QP
2	0.280	12.44	19.51	31.95	50.81	-18.86	Average
3	0.400	27.54	19.51	47.05	57.86	-10.81	QP
4	0.400	16.87	19.51	36.38	47.86	-11.48	Average
5	3.985	27.66	19.63	47.29	56.00	-8.71	QP
6	3.985	19.99	19.63	39.62	46.00	-6.38	Average
7	4.158	24.51	19.63	44.14	56.00	-11.86	QP
8	4.158	16.53	19.63	36.16	46.00	-9.84	Average
9	6.056	30.74	19.68	50.42	60.00	-9.58	QP
10	6.056	22.84	19.68	42.52	50.00	-7.48	Average
11	6.488	29.21	19.68	48.89	60.00	-11.11	QP
12	6.488	18.53	19.68	38.21	50.00	-11.79	Average

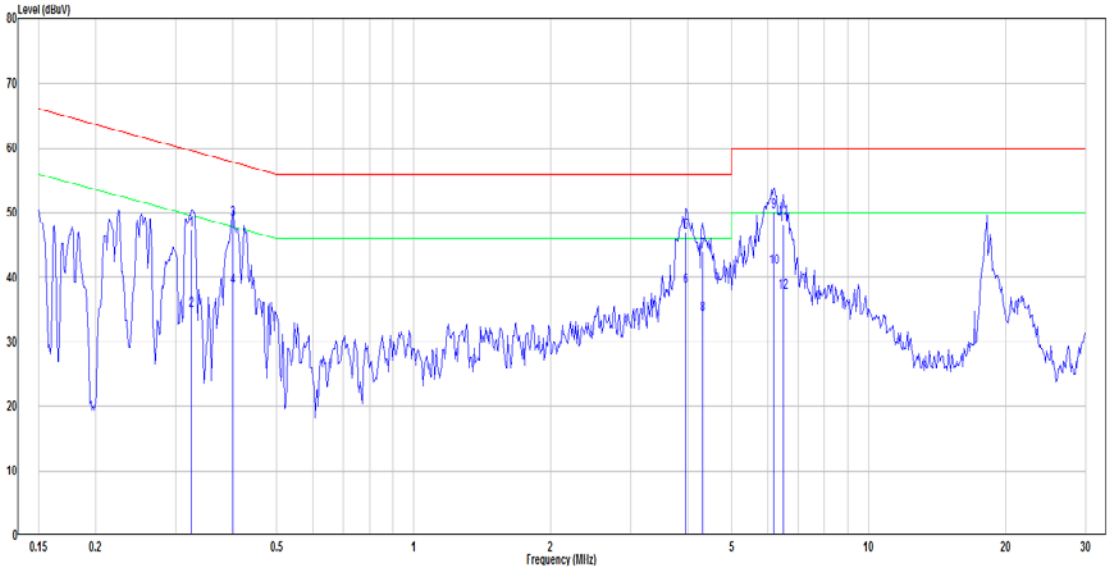
Note:

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	0.325	27.73	19.50	47.23	59.57	-12.34	QP
2	0.325	15.36	19.50	34.86	49.57	-14.71	Average
3	0.400	29.44	19.51	48.95	57.86	-8.91	QP
4	0.400	18.96	19.51	38.47	47.86	-9.39	Average
5	3.964	27.32	19.63	46.95	56.00	-9.05	QP
6	3.964	18.86	19.63	38.49	46.00	-7.51	Average
7	4.315	24.31	19.64	43.95	56.00	-12.05	QP
8	4.315	14.52	19.64	34.16	46.00	-11.84	Average
9	6.186	30.44	19.69	50.13	60.00	-9.87	QP
10	6.186	21.75	19.69	41.44	50.00	-8.56	Average
11	6.488	28.51	19.69	48.20	60.00	-11.80	QP
12	6.488	18.00	19.69	37.69	50.00	-12.31	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:

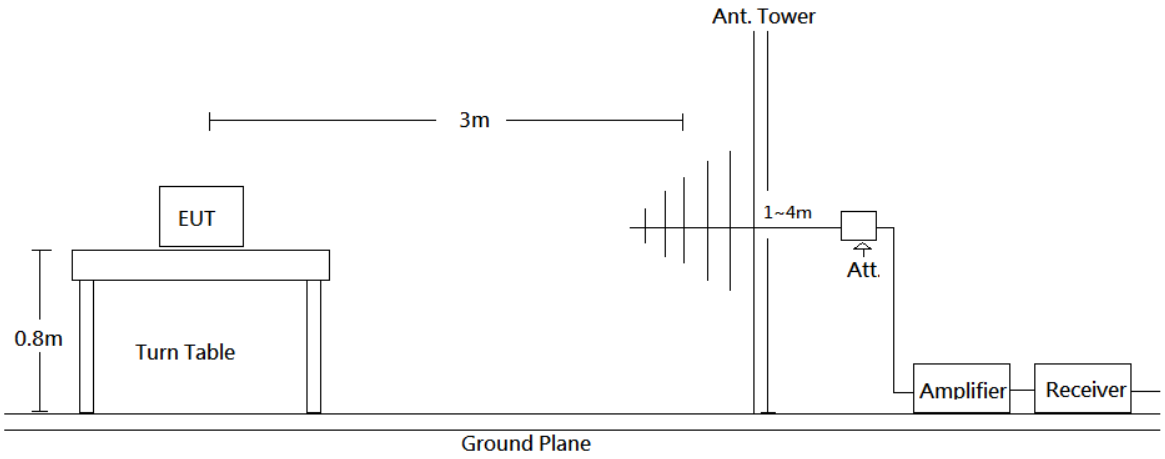
Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** 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.

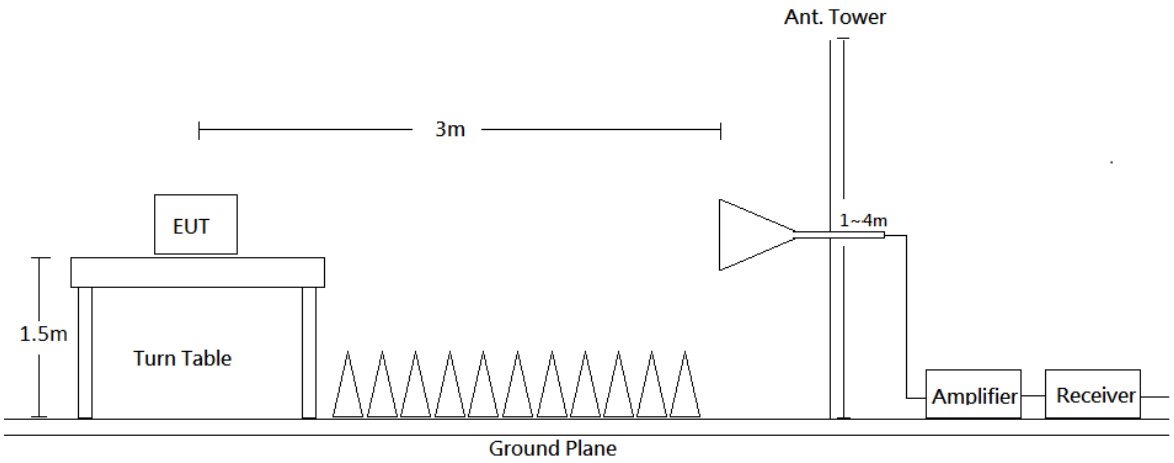
As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the 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:

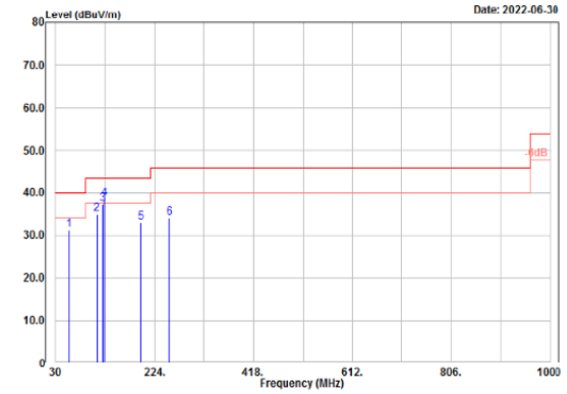
Margin = Result – Limit

8.6 Test Results

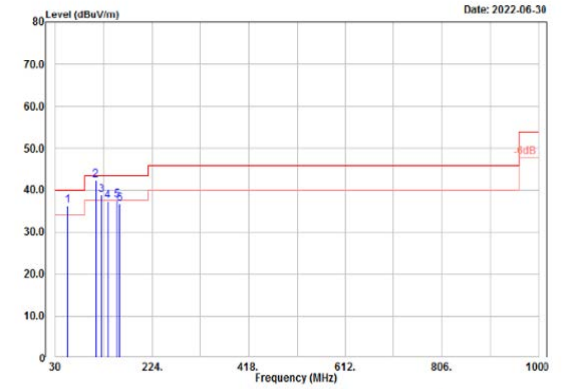
Test Mode: **BLE Mode** (Worst case is BLE mode high channel)

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)	(°)	
55.220	46.93	-15.67	31.26	40.00	-8.74	100	91	QP
110.510	44.74	-9.85	34.89	43.50	-8.61	100	314	QP
122.150	45.43	-8.21	37.22	43.50	-6.28	100	216	QP
126.030	46.63	-8.08	38.55	43.50	-4.95	100	219	QP
195.870	42.72	-9.76	32.96	43.50	-10.54	100	326	QP
251.160	43.99	-9.85	34.14	46.00	-11.86	100	5	QP



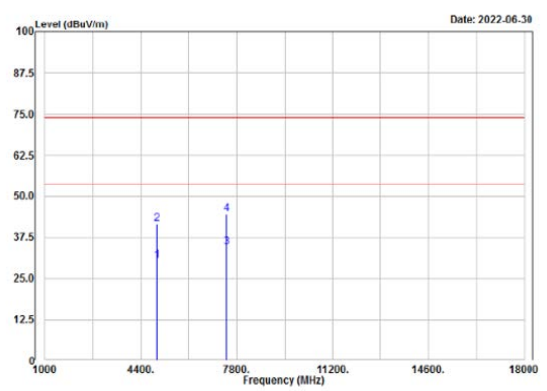
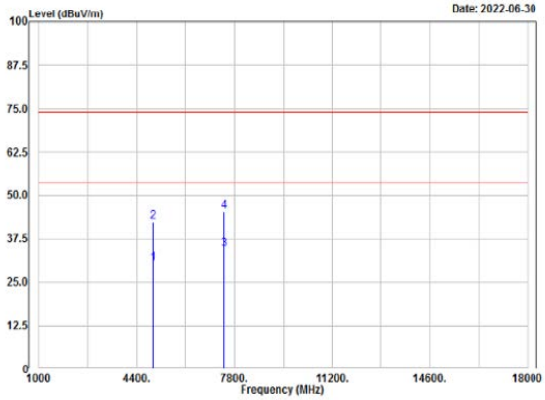
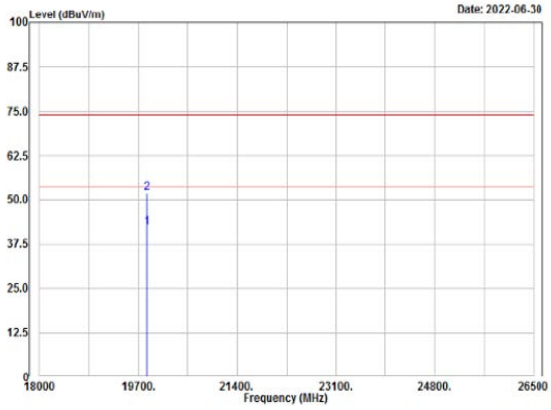
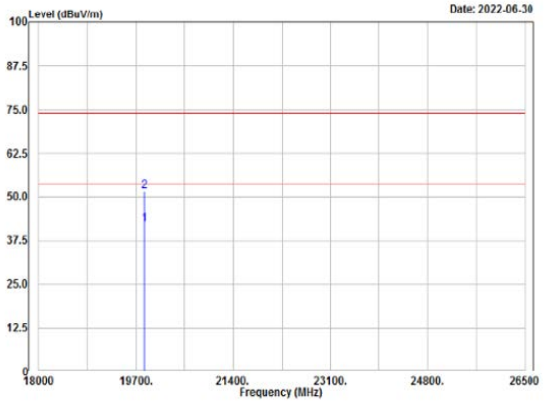
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
53.280	51.72	-15.47	36.25	40.00	-3.75	100	14	QP
110.510	52.31	-9.85	42.46	43.50	-1.04	100	3	QP
122.150	47.07	-8.21	38.86	43.50	-4.64	100	127	QP
134.760	45.85	-8.49	37.36	43.50	-6.14	100	114	QP
153.190	47.18	-9.57	37.61	43.50	-5.89	100	64	QP
159.010	46.12	-9.50	36.62	43.50	-6.88	100	24	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	32.94	-3.47	29.47	54.00	-24.53	151	329	Average
4804.000	43.80	-3.47	40.33	74.00	-33.67	151	329	Peak
7206.000	30.77	1.83	32.60	54.00	-21.40	146	0	Average
7206.000	41.95	1.83	43.78	74.00	-30.22	146	0	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4880.000	32.59	-2.24	30.35	54.00	-23.65	151	325	Average
4880.000	43.95	-2.24	41.71	74.00	-32.29	151	325	Peak
7320.000	30.42	3.34	33.76	54.00	-20.24	147	96	Average
7320.000	40.14	3.34	43.48	74.00	-30.52	147	96	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	32.46	-2.04	30.42	54.00	-23.58	153	2	Average
4960.000	43.48	-2.04	41.44	74.00	-32.56	153	2	Peak
7440.000	30.97	3.38	34.35	54.00	-19.65	149	321	Average
7440.000	41.06	3.38	44.44	74.00	-29.56	149	321	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	32.90	-2.47	30.43	54.00	-23.57	154	353	Average
4804.000	43.55	-2.47	41.08	74.00	-32.92	154	353	Peak
7206.000	30.62	3.03	33.65	54.00	-20.35	148	261	Average
7206.000	40.89	3.03	43.92	74.00	-30.08	148	261	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4880.000	32.46	-2.24	30.22	54.00	-23.78	152	239	Average
4880.000	43.03	-2.24	40.79	74.00	-33.21	152	239	Peak
7320.000	30.47	3.34	33.81	54.00	-20.19	149	174	Average
7320.000	41.11	3.34	44.45	74.00	-29.55	149	174	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	32.29	-2.04	30.25	54.00	-23.75	152	85	Average
4960.000	44.27	-2.04	42.23	74.00	-31.77	152	85	Peak
7440.000	31.04	3.38	34.42	54.00	-19.58	146	231	Average
7440.000	41.84	3.38	45.22	74.00	-28.78	146	231	Peak

Level (Result) = Reading + Factor.

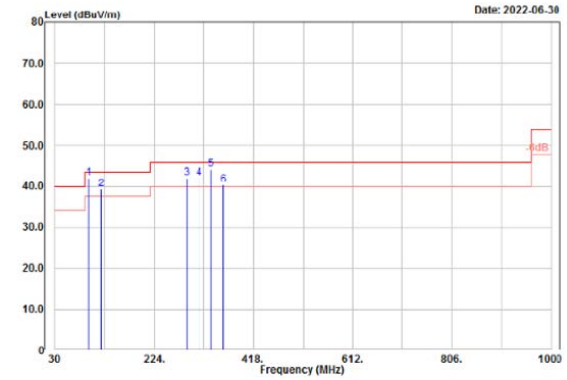
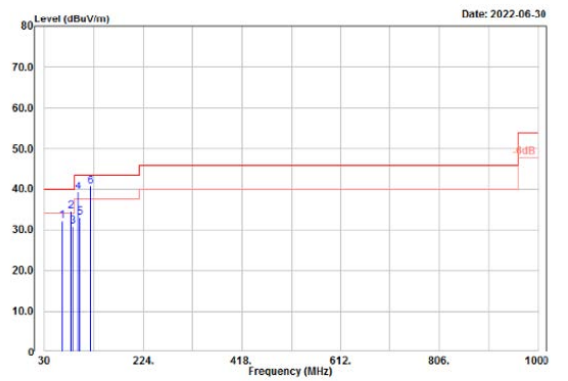
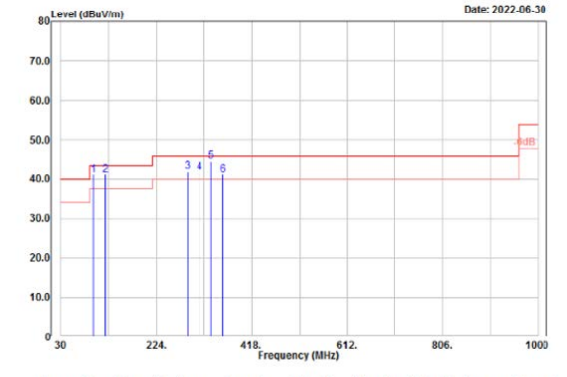
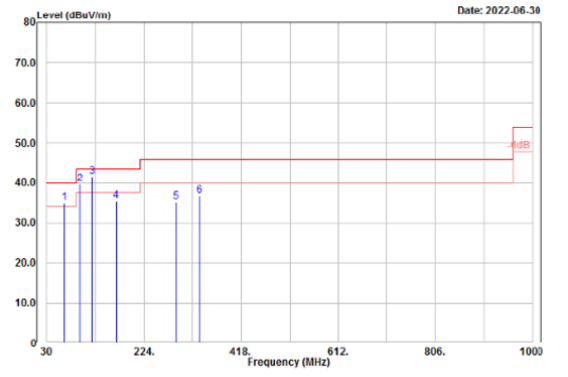
Margin = Level – Limit.

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	Mode 2 / Vertical
	
	

Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
95.960	55.30	-13.26	42.04	43.50	-1.46	100	43	QP
119.240	47.80	-8.52	39.28	43.50	-4.22	100	258	QP
287.050	49.88	-7.79	42.09	46.00	-3.91	100	211	QP
311.300	49.21	-7.13	42.08	46.00	-3.92	100	205	QP
335.550	51.00	-6.69	44.31	46.00	-1.69	100	91	QP
359.800	46.21	-5.90	40.31	46.00	-5.69	100	211	QP

Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
63.950	47.00	-14.98	32.02	40.00	-7.98	100	360	QP
81.410	49.75	-15.29	34.46	40.00	-5.54	100	38	QP
85.290	46.07	-15.34	30.73	40.00	-9.27	100	35	QP
95.960	52.51	-13.26	39.25	43.50	-4.25	100	212	QP
98.870	45.34	-12.48	32.86	43.50	-10.64	100	329	QP
119.240	49.30	-8.52	40.78	43.50	-2.72	100	1	QP

Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
95.960	54.43	-13.26	41.17	43.50	-2.33	100	40	QP
119.240	49.69	-8.52	41.17	43.50	-2.33	100	249	QP
287.050	49.95	-7.79	42.16	46.00	-3.84	100	212	QP
311.300	49.02	-7.13	41.89	46.00	-4.11	100	197	QP
335.550	51.32	-6.69	44.63	46.00	-1.37	100	100	QP
359.800	46.98	-5.90	41.08	46.00	-4.92	100	212	QP

Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
63.950	49.82	-14.98	34.84	40.00	-5.16	100	329	QP
95.960	52.93	-13.26	39.67	43.50	-3.83	100	233	QP
119.240	50.14	-8.52	41.62	43.50	-1.88	100	17	QP
167.740	45.27	-10.00	35.27	43.50	-8.23	100	0	QP
287.050	42.85	-7.79	35.06	46.00	-10.94	100	14	QP
335.550	43.42	-6.69	36.73	46.00	-9.27	100	170	QP

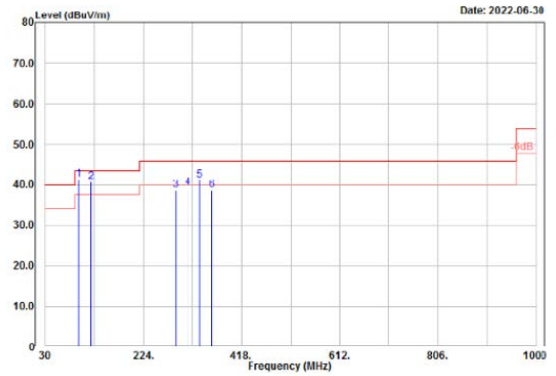
Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

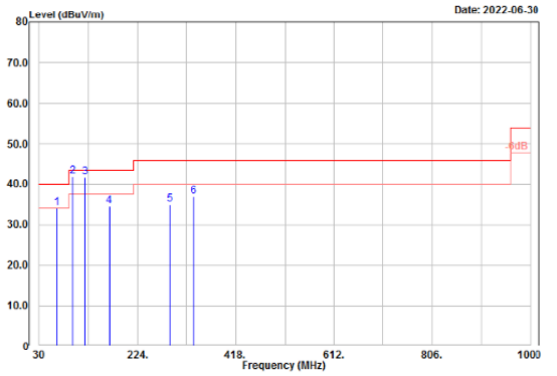
Spurious emissions more than 20 dB below the limit were not reported.

Mode 4 / Horizontal



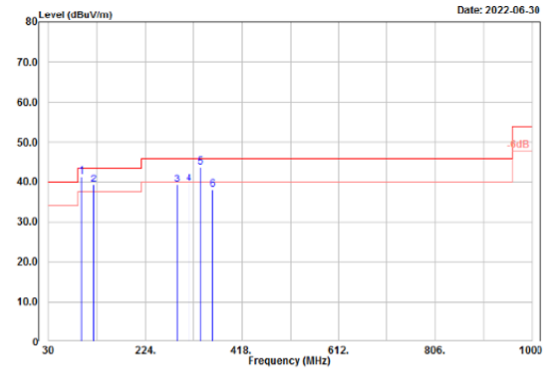
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
95.960	54.76	-13.26	41.50	43.50	-2.00	100	36	QP
119.240	49.36	-8.52	40.84	43.50	-2.66	100	254	QP
287.050	46.46	-7.79	38.67	46.00	-7.33	100	208	QP
311.300	46.32	-7.13	39.19	46.00	-5.81	100	201	QP
335.550	47.84	-6.69	41.15	46.00	-4.85	100	82	QP
359.800	44.53	-5.90	38.63	46.00	-7.37	100	217	QP

Mode 4 / Vertical



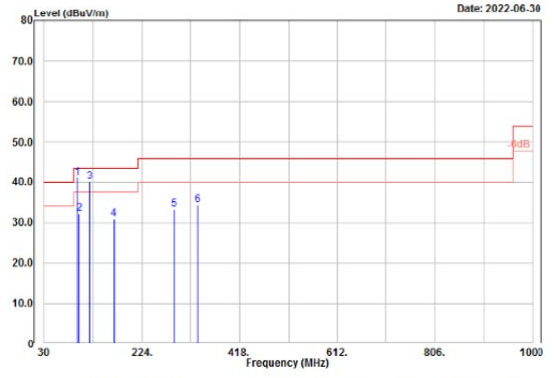
Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
63.950	49.09	-14.98	34.11	40.00	-5.89	100	280	QP
95.960	55.28	-13.26	42.02	43.50	-1.48	100	231	QP
119.240	50.27	-8.52	41.75	43.50	-1.75	100	1	QP
167.740	44.39	-10.00	34.39	43.50	-9.11	100	358	QP
287.050	42.79	-7.79	35.00	46.00	-11.00	100	18	QP
335.550	43.64	-6.69	36.95	46.00	-9.05	100	24	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	54.73	-13.26	41.47	43.50	-2.03	100	35	QP
119.240	47.82	-8.52	39.30	43.50	-4.20	100	273	QP
287.050	46.96	-7.79	39.17	46.00	-6.83	100	214	QP
311.300	46.56	-7.13	39.43	46.00	-5.57	100	193	QP
335.550	50.51	-6.69	43.82	46.00	-2.18	100	92	QP
359.800	43.86	-5.90	37.96	46.00	-8.04	100	212	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	54.39	-13.26	41.13	43.50	-2.37	100	225	QP
99.840	44.24	-12.18	32.06	43.50	-11.44	100	281	QP
119.240	48.54	-8.52	40.02	43.50	-3.48	100	360	QP
167.740	40.84	-10.00	30.84	43.50	-12.66	100	8	QP
287.050	41.01	-7.79	33.22	46.00	-12.78	100	18	QP
335.550	40.90	-6.69	34.21	46.00	-11.79	100	161	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	33.20	-2.47	30.73	54.00	-23.27	166	135	Average
4804.000	43.84	-2.47	41.37	74.00	-32.63	166	135	Peak
4874.000	33.10	-2.25	30.85	54.00	-23.15	193	244	Average
4874.000	43.22	-2.25	40.97	74.00	-33.03	193	244	Peak
7206.000	31.13	3.03	34.16	54.00	-19.84	204	184	Average
7206.000	41.18	3.03	44.21	74.00	-29.79	204	184	Peak
7311.000	30.49	3.34	33.83	54.00	-20.17	139	59	Average
7311.000	40.78	3.34	44.12	74.00	-29.88	139	59	Peak
10480.000	31.20	8.14	39.34	54.00	-14.66	178	315	Average
10480.000	40.15	8.14	48.29	74.00	-25.71	178	315	Peak
15720.000	32.34	11.40	43.74	54.00	-10.26	150	342	Average
15720.000	42.36	11.40	53.76	74.00	-20.24	150	342	Peak
19216.000	41.87	-0.57	41.30	54.00	-12.70	150	32	Average
19216.000	51.93	-0.57	51.36	74.00	-22.64	150	32	Peak
19496.000	41.19	0.25	41.44	54.00	-12.56	150	260	Average
19496.000	51.20	0.25	51.45	74.00	-22.55	150	260	Peak
20960.000	42.55	1.78	44.33	54.00	-9.67	150	342	Average
20960.000	48.62	1.78	50.40	74.00	-23.60	150	342	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	34.20	-2.47	31.73	54.00	-22.27	149	71	Average
4804.000	44.44	-2.47	41.97	74.00	-32.03	149	71	Peak
4874.000	34.90	-2.25	32.65	54.00	-21.35	167	338	Average
4874.000	44.90	-2.25	42.65	74.00	-31.35	167	338	Peak
7206.000	32.31	3.03	35.34	54.00	-18.66	171	56	Average
7206.000	42.24	3.03	45.27	74.00	-28.73	171	56	Peak
7311.000	30.69	3.34	34.03	54.00	-19.97	184	332	Average
7311.000	40.90	3.34	44.24	74.00	-29.76	184	332	Peak
10480.000	31.30	8.14	39.44	54.00	-14.56	153	195	Average
10480.000	40.34	8.14	48.48	74.00	-25.52	153	195	Peak
15720.000	33.41	11.40	44.81	54.00	-9.19	192	86	Average
15720.000	43.48	11.40	54.88	74.00	-19.12	192	86	Peak
19216.000	42.20	-0.57	41.63	54.00	-12.37	150	132	Average
19216.000	52.22	-0.57	51.65	74.00	-22.35	150	132	Peak
19496.000	41.60	0.25	41.85	54.00	-12.15	150	350	Average
19496.000	51.67	0.25	51.92	74.00	-22.08	150	350	Peak
20960.000	42.61	1.78	44.39	54.00	-9.61	150	289	Average
20960.000	49.63	1.78	51.41	74.00	-22.59	150	289	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	34.23	-2.47	31.76	54.00	-22.24	177	200	Average
4804.000	45.20	-2.47	42.73	74.00	-31.27	177	200	Peak
4874.000	34.72	-2.25	32.47	54.00	-21.53	204	132	Average
4874.000	44.82	-2.25	42.57	74.00	-31.43	204	132	Peak
7206.000	30.32	3.03	33.35	54.00	-20.65	161	245	Average
7206.000	40.41	3.03	43.44	74.00	-30.56	161	245	Peak
7311.000	30.19	3.34	33.53	54.00	-20.47	193	132	Average
7311.000	40.40	3.34	43.74	74.00	-30.26	193	132	Peak
10440.000	30.67	7.97	38.64	54.00	-15.36	150	41	Average
10440.000	40.99	7.97	48.96	74.00	-25.04	150	41	Peak
10480.000	30.16	8.14	38.30	54.00	-15.70	189	41	Average
10480.000	40.91	8.14	49.05	74.00	-24.95	189	41	Peak
15660.000	32.13	11.11	43.24	54.00	-10.76	200	41	Average
15660.000	39.20	11.11	50.31	74.00	-23.69	200	41	Peak
15720.000	32.43	11.40	43.83	54.00	-10.17	149	288	Average
15720.000	42.24	11.40	53.64	74.00	-20.36	149	288	Peak
19216.000	41.18	-0.57	40.61	54.00	-13.39	150	323	Average
19216.000	51.17	-0.57	50.60	74.00	-23.40	150	323	Peak
19496.000	41.70	0.25	41.95	54.00	-12.05	150	26	Average
19496.000	51.82	0.25	52.07	74.00	-21.93	150	26	Peak
20880.000	45.31	1.85	47.16	54.00	-6.84	150	323	Average
20880.000	49.35	1.85	51.20	74.00	-22.80	150	323	Peak
20960.000	45.39	1.78	47.17	54.00	-6.83	150	90	Average
20960.000	49.22	1.78	51.00	74.00	-23.00	150	90	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	35.30	-2.47	32.83	54.00	-21.17	204	173	Average
4804.000	45.36	-2.47	42.89	74.00	-31.11	204	173	Peak
4874.000	34.80	-2.25	32.55	54.00	-21.45	179	153	Average
4874.000	44.97	-2.25	42.72	74.00	-31.28	179	153	Peak
7206.000	31.12	3.03	34.15	54.00	-19.85	144	28	Average
7206.000	41.22	3.03	44.25	74.00	-29.75	144	28	Peak
7311.000	30.59	3.34	33.93	54.00	-20.07	193	356	Average
7311.000	40.58	3.34	43.92	74.00	-30.08	193	356	Peak
10440.000	30.89	7.97	38.86	54.00	-15.14	152	35	Average
10440.000	41.00	7.97	48.97	74.00	-25.03	152	35	Peak
10480.000	30.29	8.14	38.43	54.00	-15.57	169	211	Average
10480.000	40.94	8.14	49.08	74.00	-24.92	169	211	Peak
15660.000	33.03	11.11	44.14	54.00	-9.86	140	35	Average
15660.000	43.03	11.11	54.14	74.00	-19.86	140	35	Peak
15720.000	32.59	11.40	43.99	54.00	-10.01	186	35	Average
15720.000	42.74	11.40	54.14	74.00	-19.86	186	35	Peak
19216.000	41.31	-0.57	40.74	54.00	-13.26	150	257	Average
19216.000	51.32	-0.57	50.75	74.00	-23.25	150	257	Peak
19496.000	42.12	0.25	42.37	54.00	-11.63	150	281	Average
19496.000	52.11	0.25	52.36	74.00	-21.64	150	281	Peak
20880.000	46.22	1.85	48.07	54.00	-5.93	150	189	Average
20880.000	49.52	1.85	51.37	74.00	-22.63	150	189	Peak
20960.000	45.51	1.78	47.29	54.00	-6.71	150	189	Average
20960.000	49.59	1.78	51.37	74.00	-22.63	150	189	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	35.29	-2.47	32.82	54.00	-21.18	195	249	Average
4804.000	45.22	-2.47	42.75	74.00	-31.25	195	249	Peak
4874.000	34.62	-2.25	32.37	54.00	-21.63	163	255	Average
4874.000	44.70	-2.25	42.45	74.00	-31.55	163	255	Peak
7206.000	30.78	3.03	33.81	54.00	-20.19	151	360	Average
7206.000	40.89	3.03	43.92	74.00	-30.08	151	360	Peak
7311.000	30.42	3.34	33.76	54.00	-20.24	191	118	Average
7311.000	40.52	3.34	43.86	74.00	-30.14	191	118	Peak
10460.000	30.88	8.06	38.94	54.00	-15.06	201	56	Average
10460.000	40.92	8.06	48.98	74.00	-25.02	201	56	Peak
10480.000	30.23	8.14	38.37	54.00	-15.63	167	8	Average
10480.000	40.25	8.14	48.39	74.00	-25.61	167	8	Peak
15690.000	32.21	11.30	43.51	54.00	-10.49	174	75	Average
15690.000	41.21	11.30	52.51	74.00	-21.49	174	75	Peak
15720.000	32.78	11.40	44.18	54.00	-9.82	144	109	Average
15720.000	42.93	11.40	54.33	74.00	-19.67	144	109	Peak
19216.000	42.58	-0.57	42.01	54.00	-11.99	150	188	Average
19216.000	51.34	-0.57	50.77	74.00	-23.23	150	188	Peak
19496.000	43.23	0.25	43.48	54.00	-10.52	150	94	Average
19496.000	52.25	0.25	52.50	74.00	-21.50	150	94	Peak
20920.000	43.29	1.81	45.10	54.00	-8.90	150	354	Average
20920.000	49.14	1.81	50.95	74.00	-23.05	150	354	Peak
20960.000	43.92	1.78	45.70	54.00	-8.30	150	172	Average
20960.000	48.81	1.78	50.59	74.00	-23.41	150	172	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	35.30	-2.47	32.83	54.00	-21.17	155	170	Average
4804.000	45.30	-2.47	42.83	74.00	-31.17	155	170	Peak
4874.000	35.02	-2.25	32.77	54.00	-21.23	169	172	Average
4874.000	45.05	-2.25	42.80	74.00	-31.20	169	172	Peak
7206.000	31.24	3.03	34.27	54.00	-19.73	203	120	Average
7206.000	41.18	3.03	44.21	74.00	-29.79	203	120	Peak
7311.000	31.32	3.34	34.66	54.00	-19.34	139	336	Average
7311.000	41.52	3.34	44.86	74.00	-29.14	139	336	Peak
10460.000	31.13	8.06	39.19	54.00	-14.81	167	311	Average
10460.000	41.10	8.06	49.16	74.00	-24.84	167	311	Peak
10480.000	30.37	8.14	38.51	54.00	-15.49	204	133	Average
10480.000	40.43	8.14	48.57	74.00	-25.43	204	133	Peak
15690.000	32.74	11.30	44.04	54.00	-9.96	177	173	Average
15690.000	42.84	11.30	54.14	74.00	-19.86	177	173	Peak
15720.000	33.31	11.40	44.71	54.00	-9.29	148	282	Average
15720.000	43.40	11.40	54.80	74.00	-19.20	148	282	Peak
19216.000	42.71	-0.57	42.14	54.00	-11.86	150	98	Average
19216.000	51.77	-0.57	51.20	74.00	-22.80	150	98	Peak
19496.000	43.66	0.25	43.91	54.00	-10.09	150	95	Average
19496.000	52.17	0.25	52.42	74.00	-21.58	150	95	Peak
20920.000	44.09	1.81	45.90	54.00	-8.10	150	116	Average
20920.000	49.02	1.81	50.83	74.00	-23.17	150	116	Peak
20960.000	45.63	1.78	47.41	54.00	-6.59	150	119	Average
20960.000	49.77	1.78	51.55	74.00	-22.45	150	119	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	33.29	-2.47	30.82	54.00	-23.18	211	21	Average
4804.000	43.49	-2.47	41.02	74.00	-32.98	211	21	Peak
7206.000	31.57	3.03	34.60	54.00	-19.40	166	136	Average
7206.000	41.54	3.03	44.57	74.00	-29.43	166	136	Peak
10440.000	32.02	7.97	39.99	54.00	-14.01	178	21	Average
10440.000	33.05	7.97	41.02	74.00	-32.98	178	21	Peak
10460.000	31.06	8.06	39.12	54.00	-14.88	149	177	Average
10460.000	41.10	8.06	49.16	74.00	-24.84	149	177	Peak
10480.000	31.11	8.14	39.25	54.00	-14.75	150	109	Average
10480.000	41.16	8.14	49.30	74.00	-24.70	150	109	Peak
15660.000	28.11	11.11	39.22	54.00	-14.78	146	21	Average
15660.000	29.91	11.11	41.02	74.00	-32.98	146	21	Peak
15690.000	32.87	11.30	44.17	54.00	-9.83	171	45	Average
15690.000	42.91	11.30	54.21	74.00	-19.79	171	45	Peak
15720.000	33.51	11.40	44.91	54.00	-9.09	169	360	Average
15720.000	43.52	11.40	54.92	74.00	-19.08	169	360	Peak
19216.000	41.70	-0.57	41.13	54.00	-12.87	150	254	Average
19216.000	51.74	-0.57	51.17	74.00	-22.83	150	254	Peak
20880.000	42.62	1.85	44.47	54.00	-9.53	150	273	Average
20880.000	49.75	1.85	51.60	74.00	-22.40	150	273	Peak
20920.000	40.17	1.81	41.98	54.00	-12.02	150	273	Average
20920.000	49.35	1.81	51.16	74.00	-22.84	150	273	Peak
20960.000	40.01	1.78	41.79	54.00	-12.21	150	13	Average
20960.000	49.49	1.78	51.27	74.00	-22.73	150	13	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	35.85	-2.47	33.38	54.00	-20.62	154	188	Average
4804.000	45.95	-2.47	43.48	74.00	-30.52	154	188	Peak
7206.000	31.03	3.03	34.06	54.00	-19.94	167	62	Average
7206.000	41.07	3.03	44.10	74.00	-29.90	167	62	Peak
10440.000	31.32	7.97	39.29	54.00	-14.71	139	359	Average
10440.000	41.49	7.97	49.46	74.00	-24.54	139	359	Peak
10460.000	31.31	8.06	39.37	54.00	-14.63	189	359	Average
10460.000	41.40	8.06	49.46	74.00	-24.54	189	359	Peak
10480.000	31.26	8.14	39.40	54.00	-14.60	177	138	Average
10480.000	41.30	8.14	49.44	74.00	-24.56	177	138	Peak
15660.000	35.30	11.11	46.41	54.00	-7.59	165	359	Average
15660.000	38.35	11.11	49.46	74.00	-24.54	165	359	Peak
15690.000	33.19	11.30	44.49	54.00	-9.51	196	77	Average
15690.000	43.22	11.30	54.52	74.00	-19.48	196	77	Peak
15720.000	33.76	11.40	45.16	54.00	-8.84	210	325	Average
15720.000	43.95	11.40	55.35	74.00	-18.65	210	325	Peak
19216.000	42.42	-0.57	41.85	54.00	-12.15	150	61	Average
19216.000	52.44	-0.57	51.87	74.00	-22.13	150	61	Peak
20880.000	42.81	1.85	44.66	54.00	-9.34	150	0	Average
20880.000	49.97	1.85	51.82	74.00	-22.18	150	0	Peak
20920.000	43.71	1.81	45.52	54.00	-8.48	150	86	Average
20920.000	49.78	1.81	51.59	74.00	-22.41	150	86	Peak
20960.000	40.09	1.78	41.87	54.00	-12.13	150	0	Average
20960.000	50.04	1.78	51.82	74.00	-22.18	150	0	Peak

Level (Result) = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

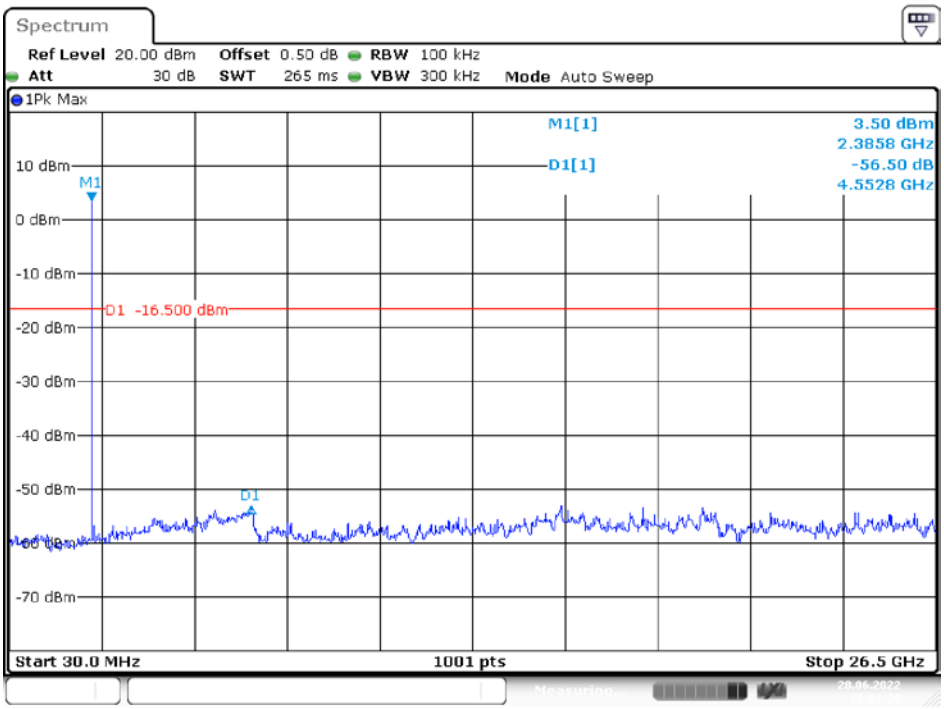
Spurious emissions more than 20 dB below the limit were not reported.

Conducted Spurious Emissions:

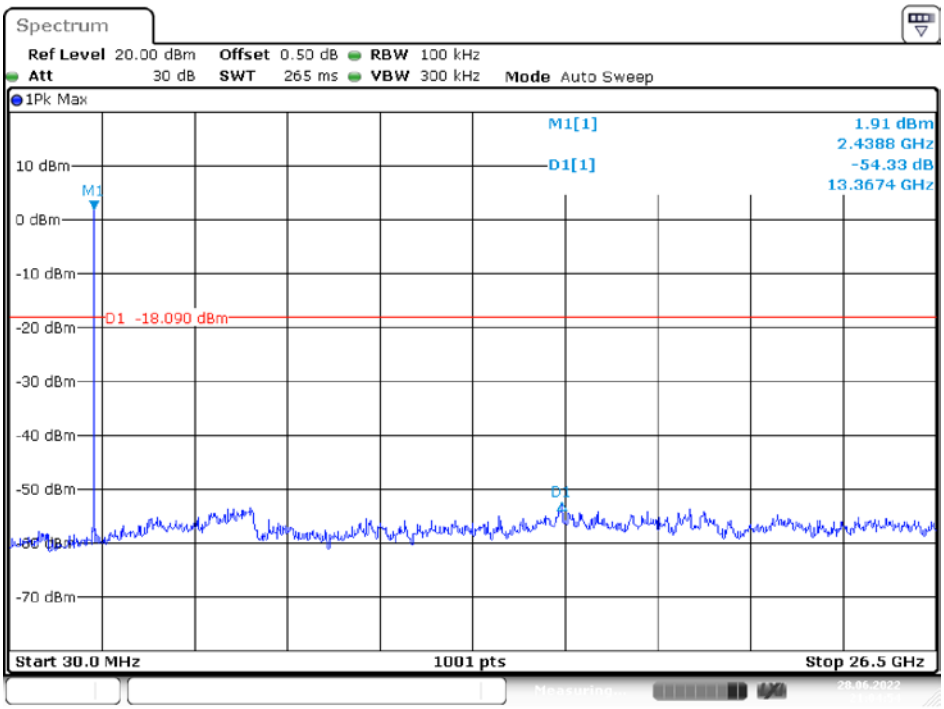
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
Low	2402	56.50	≥ 20	PASS
Middle	2440	54.33	≥ 20	PASS
High	2480	55.64	≥ 20	PASS

BLE Mode

Low Channel

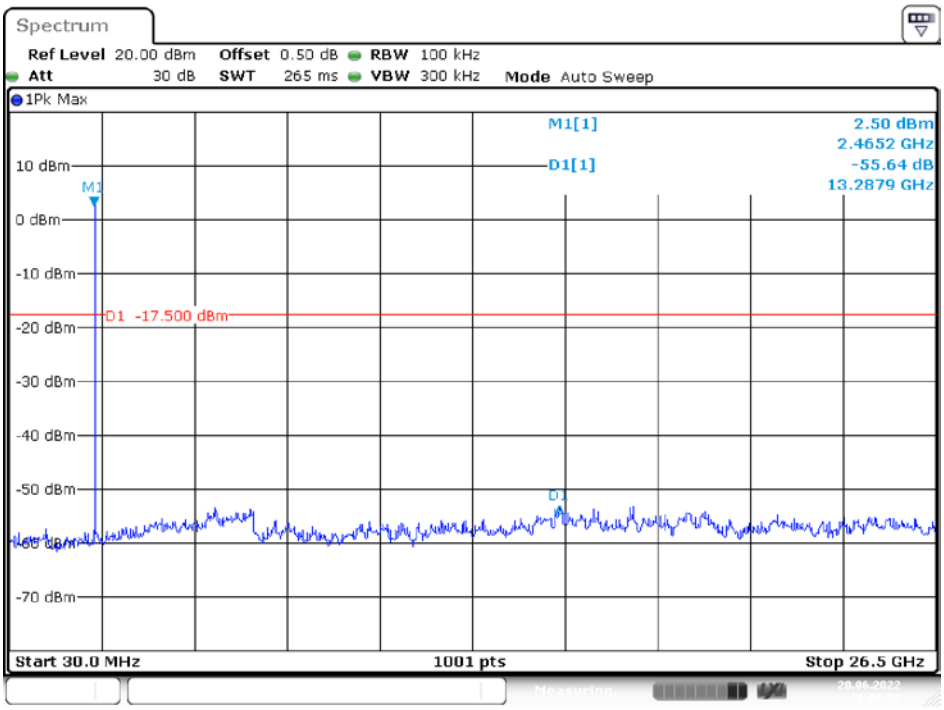


Middle Channel



Date: 28.JUN.2022 21:04:54

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.

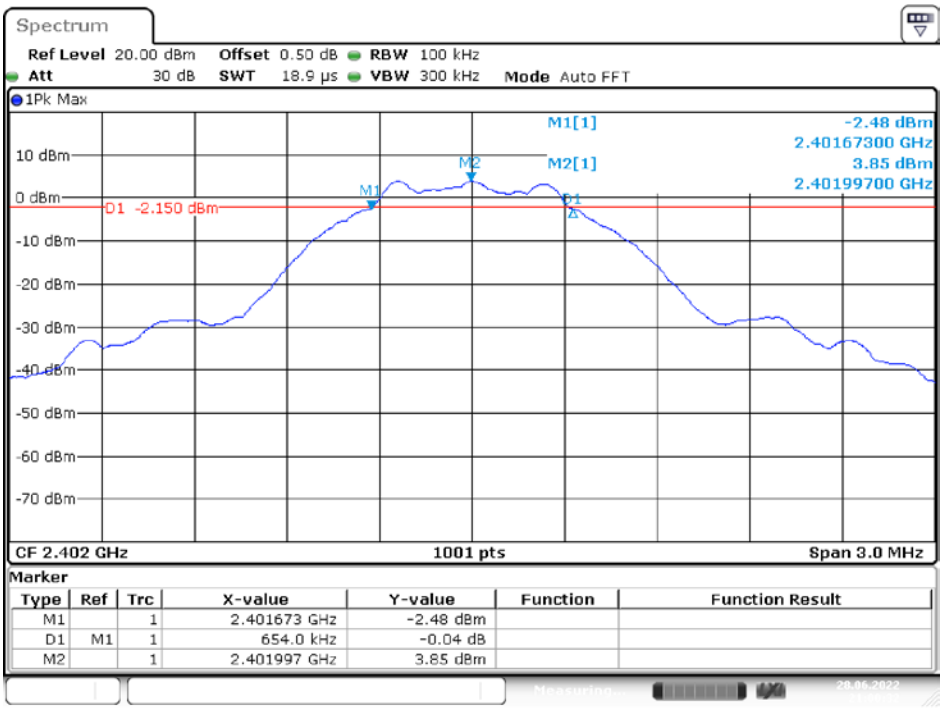
9.3 Test Results

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

Please refer to the following plots

BLE Mode

Low Channel



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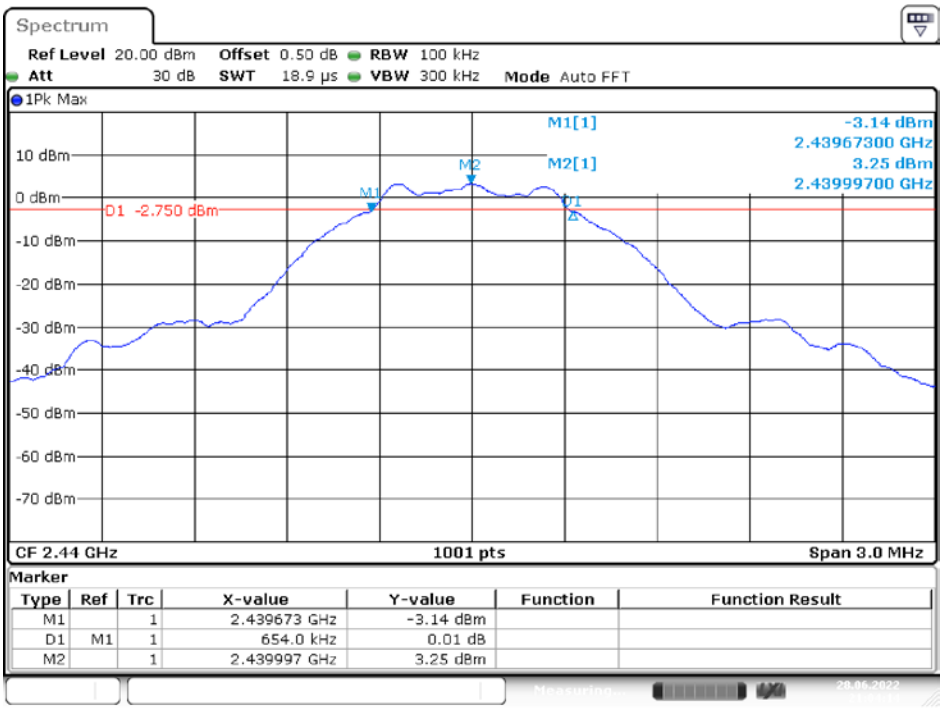
Middle Channel



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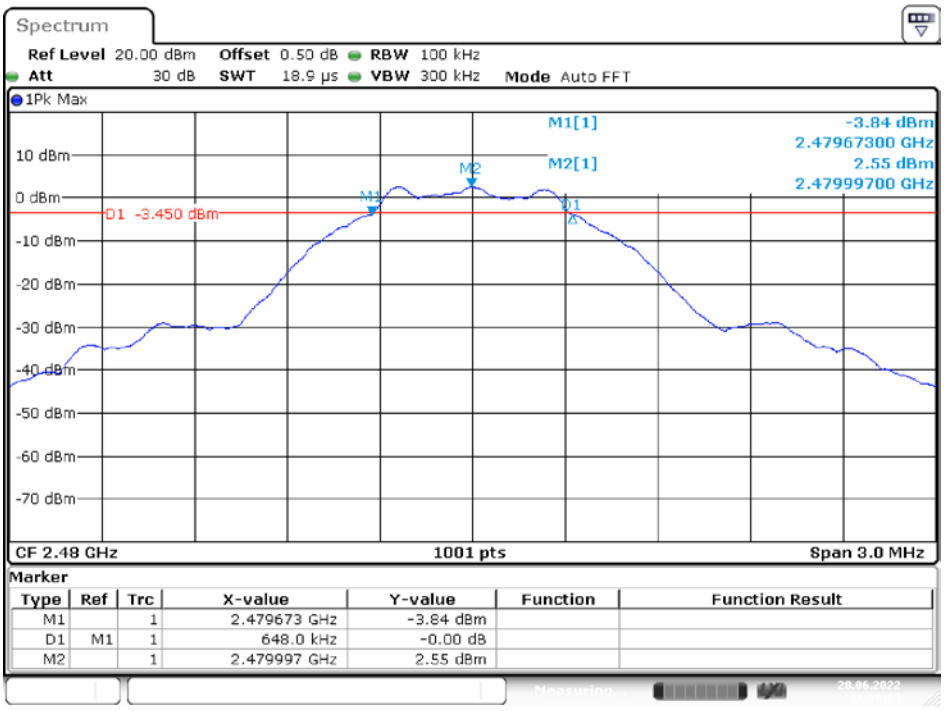
High Channel



Date: 28.JUN.2022 21:08:04

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	3.84	0.002	1	PASS
Middle	2440	3.48	0.002	1	PASS
High	2480	2.99	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.

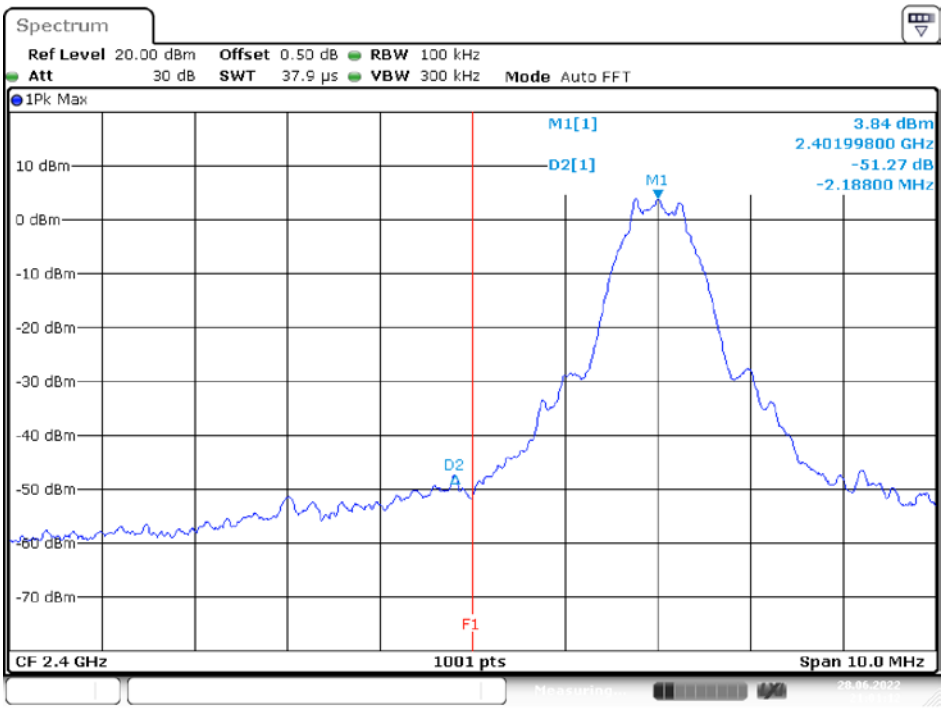
11.3 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
Low	2402	51.27	≥ 20	PASS
High	2480	57.61	≥ 20	PASS

Please refer to the following plots

BLE Mode

Band Edge, Left Side



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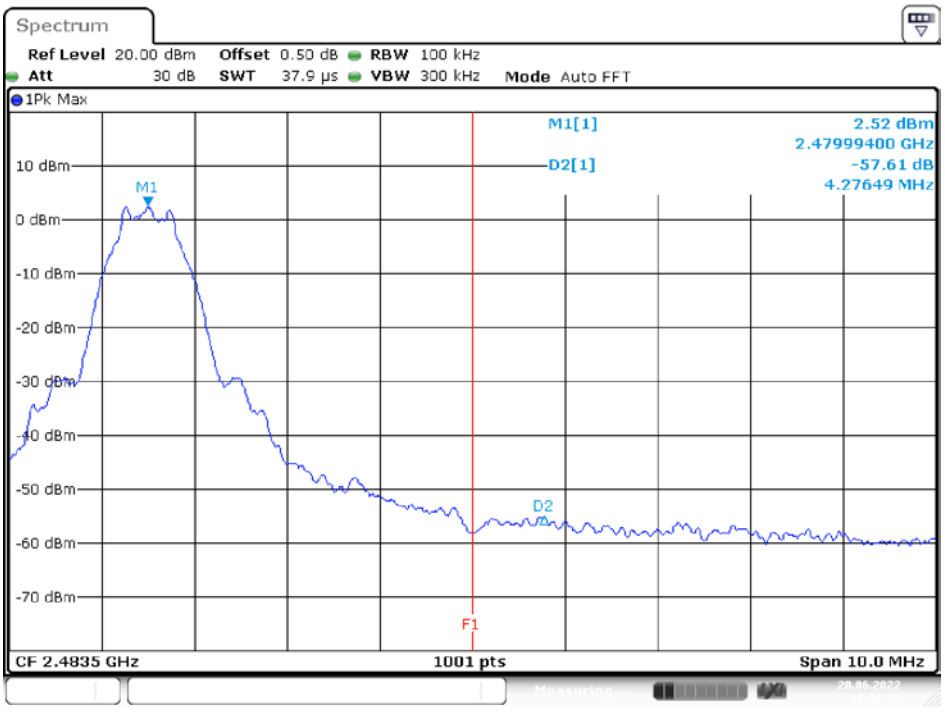
Band Edge, Right Side



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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

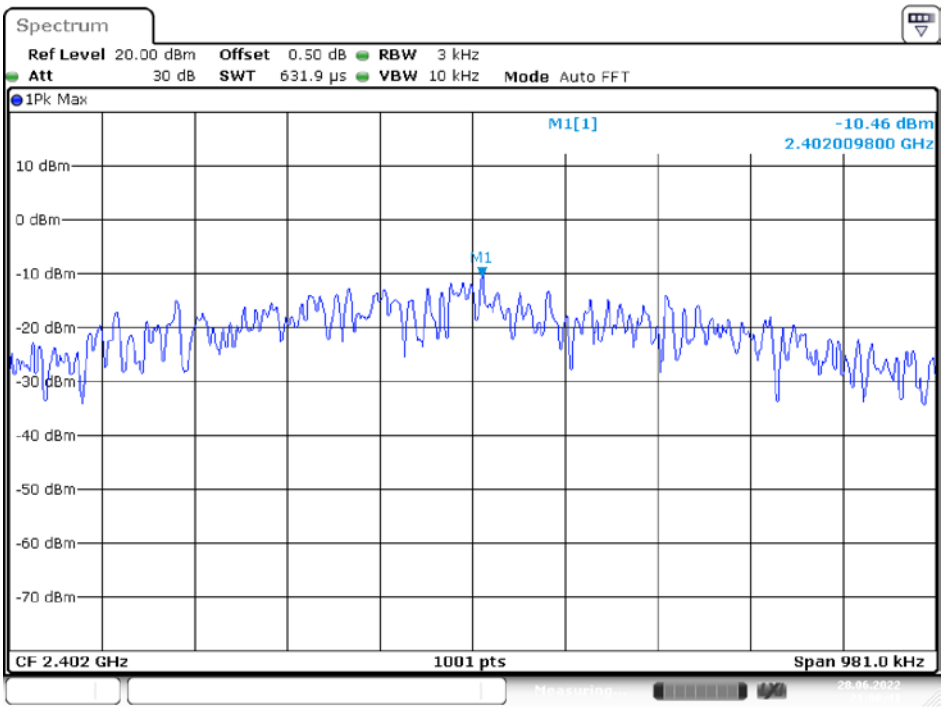
12.3 Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
Low	2402	-10.46	8	Compliance
Middle	2440	-11.05	8	Compliance
High	2480	-11.73	8	Compliance

Please refer to the following plots

BLE Mode

Low Channel



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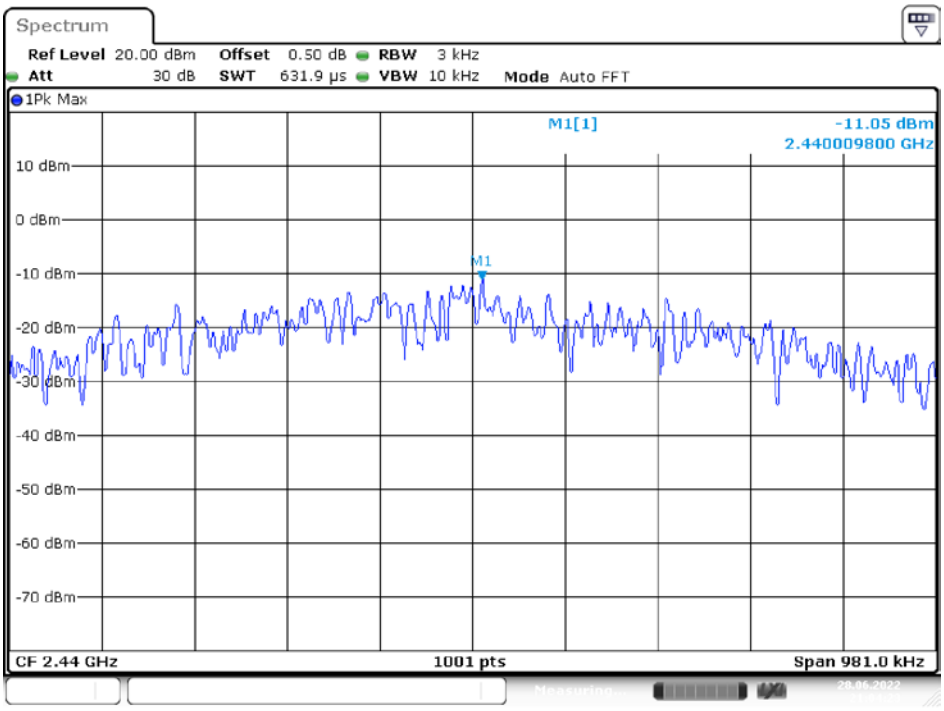
Middle Channel



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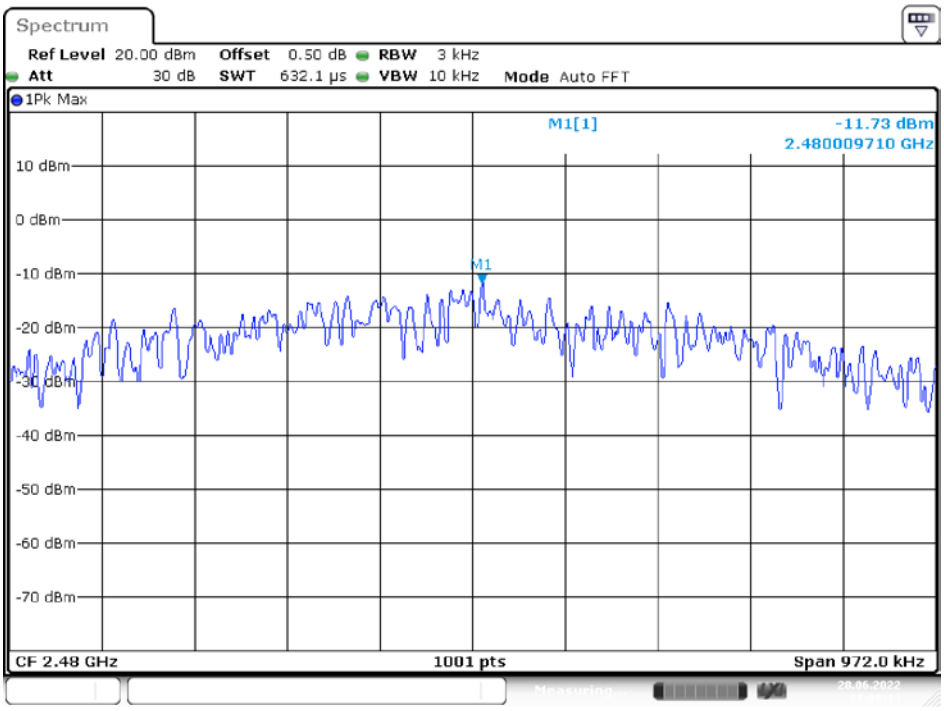
High Channel



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