FCC Radio Test Report

FCC ID: 2BDWL2417248

Report No.	:	eLab-FCCP-1-2303E004
Equipment	:	TELUS Doorbell Camera
Brand Name	:	TELUS
Test Model	:	DCF
Series Model	:	N/A
Applicant	:	TELUS Communications Inc.
Address	:	7th Floor,510 West Georgia Street,Vancouver, BC,V6B0M3 Canada
Radio Function	:	Bluetooth Low Energy (5.0)
FCC Rule Part(s)	:	FCC CFR Title 47, Part 15, Subpart C (15.247)
Measurement Procedure(s)	:	ANSI C63.10-2013
Date of Receipt	:	2023/12/21
Date of Test	:	2023/12/25 ~ 2024/1/8
Issued Date	:	2024/1/24

The above equipment has been tested and found in compliance with the requirement of the above standards by eLab Inc.

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Approved by : Sam Chuang

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Declaration

eLab represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

eLab's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **eLab** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **eLab** issued reports.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

eLab's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

eLab is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

CONTENTS

REVISION HISTORY

Report No.	Version	Description	Issued Date	Note
eLab-FCCP-1-2303E004	R00	Original Report.	2024/1/24	Valid

1 SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC CFR Title 47, Part 15, Subpart C				
Standard(s) Section	**Test Item**	**Test Result**	**Judgment**	**Remark**
15.207	AC Power Line Conducted Emissions	APPENDIX A	PASS	------
15.247(d) 15.205(a) 15.209(a)	Radiated Emissions	APPENDIX B APPENDIX C	PASS	------
15.247(a)(2)	Bandwidth	APPENDIX D	PASS	------
15.247(b)(3)	Maximum Output Power	APPENDIX E	PASS	------
15.247(d)	Power Spectral Density	APPENDIX F	PASS	------
15.247(e)	Antenna conducted Spurious Emission	APPENDIX G	PASS	------
15.203	Antenna Requirement	------	PASS	**Note(2)**

Note:

(1) “N/A” denotes test is not applicable to this device.

(2) The device what use a permanently attached antenna were considered sufficient to comply with the provisions of 15.203.

(3) The report format version is FR15CBT4.0_V1.0

1.1 TEST FACILITY

The test facilities used to collect the test data in this report:

No.64, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
The test sites and facilities are covered under FCC RN: 681248 and DN: TW4045.
☒ C01 ☒ CB01 ☒ TR01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y ± U**, where expanded uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k = 2**, providing a level of confidence of approximately **95 %**. The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2. The eLab measurement uncertainty is less than the CISPR 16-4-2 U_{cispr} requirement.

A. AC power line conducted emissions test:

Test Site	Method	Measurement Frequency Range	U (dB)
C01	CISPR	150 kHz ~ 30MHz	3.44

B. Radiated emissions test:

Test Site	Measurement Frequency Range	U,(dB)
CB01	0.03 GHz ~ 0.2 GHz	4.01
	0.2 GHz ~ 1 GHz	4.64
	1 GHz ~ 6 GHz	5.91
	6 GHz ~ 18 GHz	6.24
	18 GHz ~ 26 GHz	3.93
	26 GHz ~ 40 GHz	4.06

C. Conducted test:

Test Item	U,(dB)
Occupied Bandwidth	1.0502
Maximum Output Power	1.0406
Power Spectral Density	1.0502
Conducted Spurious emissions	1.1484
Conducted Band edges	1.0518

NOTE:
Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

Test Software	NB-03A1-01			
Modulation Mode	2402 MHz	2440 MHz	2480 MHz	Data Rate
BLE 5.0	DEF	DEF	DEF	1 Mbps
BLE 5.0	DEF	DEF	DEF	2 Mbps

1.4 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

Test Item	Environment Condition	Test Voltage	Tested by
AC Power Line Conducted Emissions	25°C, 45%	AC 120V	Hunter Chiang
Radiated Emissions	25°C, 60%	AC 120V	Hunter Chiang
Bandwidth	25°C, 64%	AC 120V	Hunter Chiang
Maximum Output Power	25°C, 64%	AC 120V	Hunter Chiang
Power Spectral Density	25°C, 64%	AC 120V	Hunter Chiang
Antenna conducted Spurious Emission	25°C, 64%	AC 120V	Hunter Chiang

2 GENERAL INFORMATION

2.1 DESCRIPTION OF EUT

Equipment	TELUS Doorbell Camera
Brand Name	TELUS
Test Model	DCF
Series Model	N/A
Model Difference(s)	N/A
Software Version	FW_0.06.011
Hardware Version	A
Power Source	AC Voltage supplied from AC/AC adapter. (support unit)
Power Rating	AC Voltage 10-24Vac, 10VA
Operation Frequency	2402 MHz ~ 2480 MHz
Modulation Type	GFSK
Bit Rate of Transmitter	1Mbps, 2Mbps
Max. Output Power	1Mbps: 2.61 dBm (0.0018 W) 2Mbps: 3.54 dBm (0.0023 W)

NOTE:
(1) The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

(2) Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

(3) Table for Filed Antenna:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	FIT	N/A	Dipole	N/A	2.55

Note:

1) Ant.1 refers to Main Antenna.
2) The above Antenna information are derived from the antenna data sheet provided by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

2.2 TEST MODES

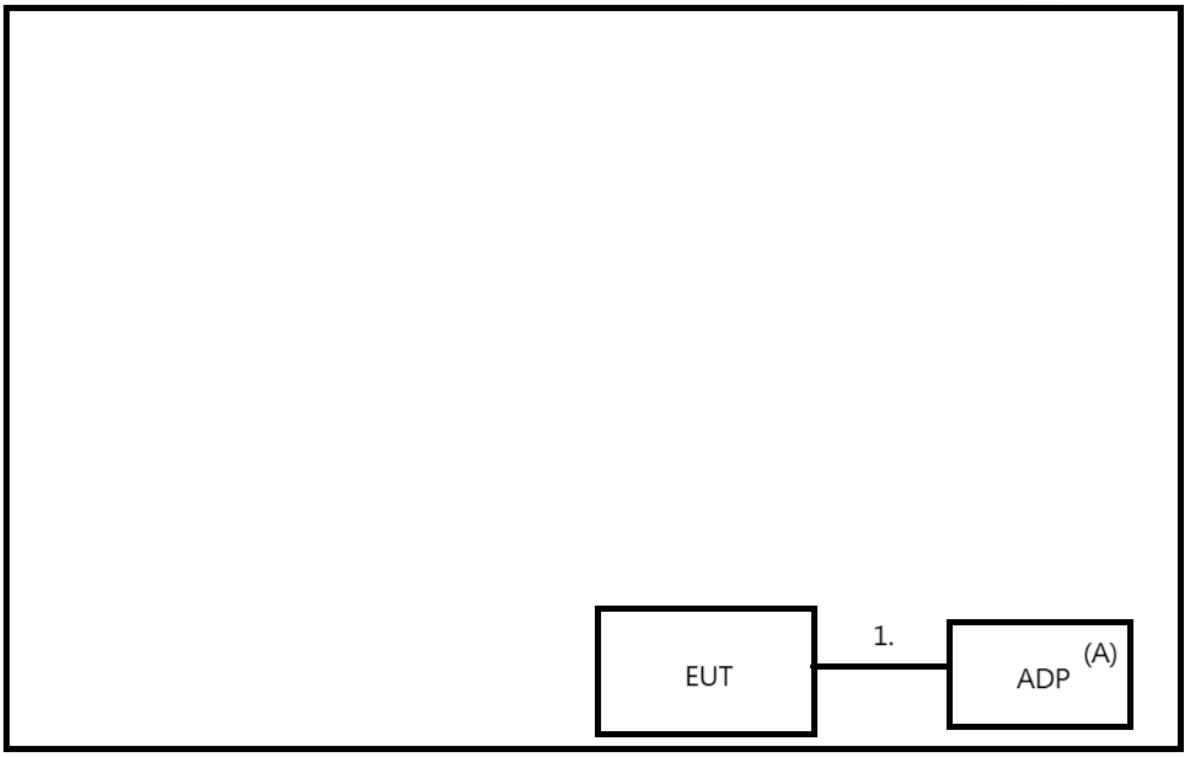
Test Items	Test mode	Channel	Note
AC power line conducted emissions	2 Mbps	39	-
Transmitter Radiated Emissions (below 1GHz)	2 Mbps	39	-
Transmitter Radiated Emissions (above 1GHz)	1/2 Mbps	00/39	Bandedge
	1/2 Mbps	00/19/39	Harmonic
Bandwidth	1/2 Mbps	00/19/39	-
Output Power	1/2 Mbps	00/19/39	-
Power Spectral Density	1/2 Mbps	00/19/39	-
Antenna conducted Spurious Emission	1/2 Mbps	00/19/39	-

NOTE:
(1) For radiated emission above 1 GHz test, the spurious points of 1GHz~26.5GHz have been pre-tested and in this report only recorded the worst case. The remaining spurious points are all below the limit value of 20dB.
(2) For AC power line conducted emissions and radiated emissions below 1 GHz test, the 2Mbps channel 39 is found to be the worst case and recorded.
(3) For radiated emission band edge test, both Vertical and Horizontal are evaluated, but only the worst case (Vertical) is recorded.

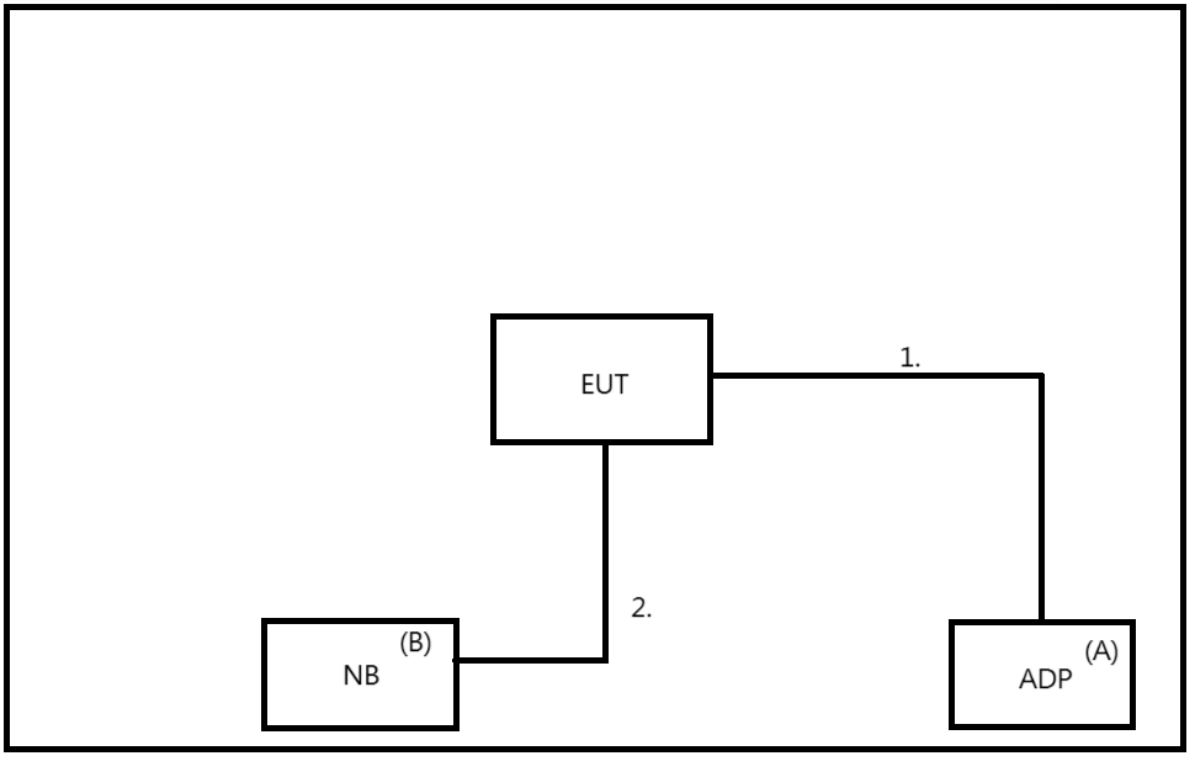
2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Equipment letters and Cable numbers refer to item numbers described in the tables of clause 2.4.

AC power line conducted emissions



Radiated Emissions



2.4 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Remarks
A	AC ADAPTOR	N/A	N/A	Supplied by test requester.
B	NB	lenovo	Lenovo G40-70m	Furnished by test lab.

Item	Cable Type	Ferrite Core	Length	Shielded	Remarks
1	Power Cable	N/A	N/A	1.5m	Supplied by test requester.
2	Type-C Cable	N/A	N/A	1m	Furnished by test lab.

3 AC POWER LINE CONDUCTED EMISSIONS TEST

3.1 LIMIT

Frequency (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56 *	56 - 46 *
0.50 - 5.0	56	46
5.0 - 30.0	60	50

NOTE:
(1) The tighter limit applies at the band edges.
(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
(3) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor (if use)
Margin Level = Measurement Value – Limit Value
Calculation example:

Reading Level		Correct Factor		Measurement Value
38.22	+	3.45	=	41.67

Measurement Value		Limit Value		Margin Level
41.67	-	60	=	-18.33

The following table is the setting of the receiver.

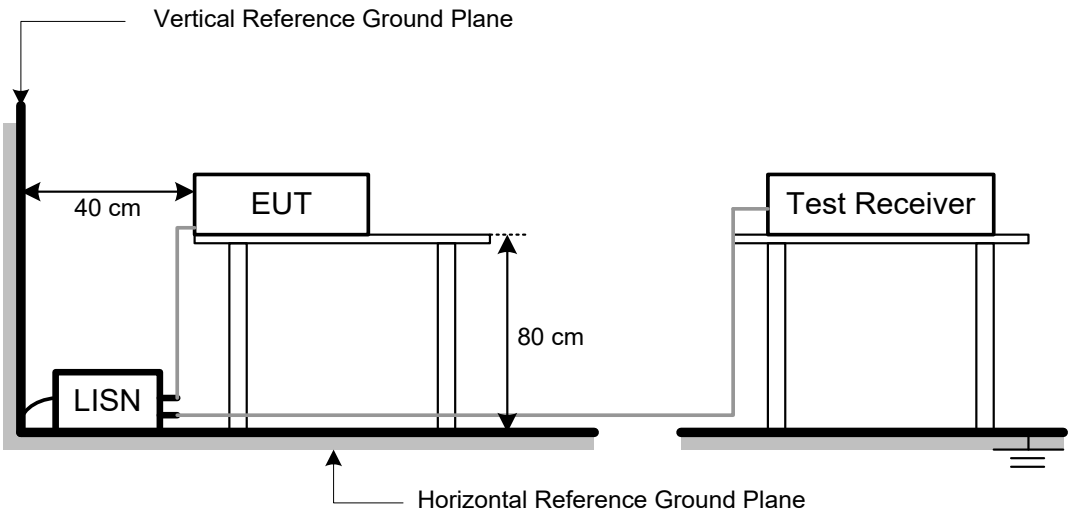
Receiver Parameter	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

3.2 TEST PROCEDURE

a. The EUT was placed 0.8 m above the horizontal ground plane with the EUT being connected to the power mains through a line impedance stabilization network (LISN).
All other support equipment were powered from an additional LISN(s).
The LISN provides 50 Ohm/50uH of impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle to keep the cable above 40 cm.
c. Excess I/O cables that are not connected to a peripheral shall be bundled in the center.
The end of the cable will be terminated, using the correct terminating impedance.
The overall length shall not exceed 1 m.
d. The LISN is spaced at least 80 cm from the nearest part of the EUT chassis.
e. For the actual test configuration, please refer to the related Item – EUT TEST PHOTO.

NOTE:
(1) In the results, each reading is marked as Peak, QP or AVG per the detector used.
BW=9 kHz (6 dB Bandwidth)
(2) All readings are Peak unless otherwise stated QP or AVG in column of Note. Both the QP and the AVG readings must be less than the limit for compliance.

3.3 TEST SETUP



3.4 TEST RESULT

Please refer to the **APPENDIX A**.

4 RADIATED EMISSIONS TEST

4.1 LIMIT

In case the emission falls within the restricted band specified on 15.205, then the 15.209 limit in the table below has to be followed.

LIMITS OF RADIATED EMISSIONS MEASUREMENT (9 kHz to 1000 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

LIMITS OF RADIATED EMISSIONS MEASUREMENT (Above 1000 MHz)

Frequency (MHz)	Radiated Emissions (dBuV/m)		Measurement Distance (meters)
	Peak	Average	
Above 1000	74	54	3

NOTE:
(1) The limit for radiated test was performed according to FCC CFR Title 47, Part 15, Subpart C.
(2) The tighter limit applies at the band edges.
(3) Emission level (dBuV/m)=20log Emission level (uV/m).
(4) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)
Margin Level = Measurement Value - Limit Value
Calculation example:

Reading Level		Correct Factor		Measurement Value
41.91	+	-8.36	=	33.55

Measurement Value		Limit Value		Margin Level
33.55	-	43.50	=	-9.95

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average

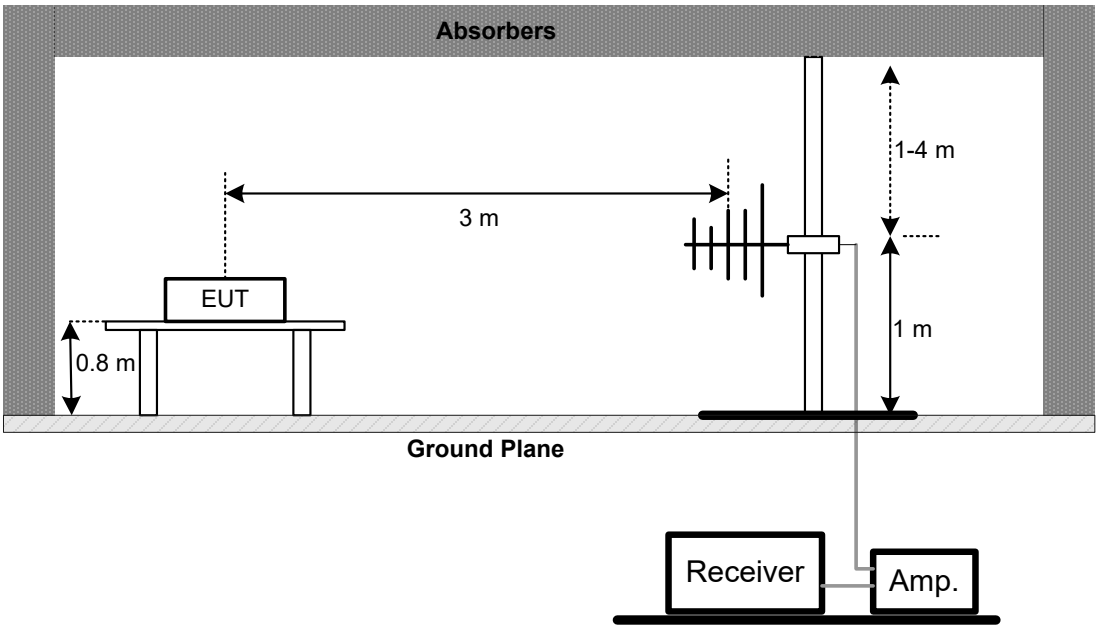
Spectrum Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9KHz~90KHz for PK/AVG detector
Start ~ Stop Frequency	90KHz~110KHz for QP detector
Start ~ Stop Frequency	110KHz~490KHz for PK/AVG detector
Start ~ Stop Frequency	490KHz~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

4.2 TEST PROCEDURE

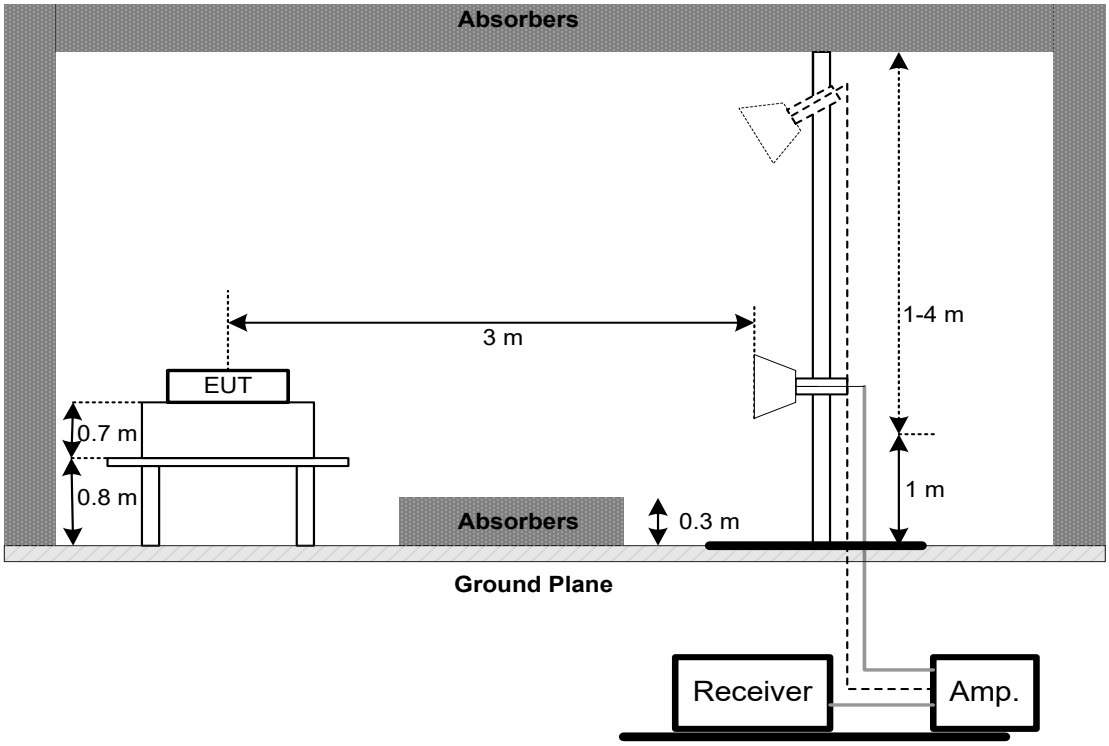
a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
c. The height of the equipment or of the substitution antenna shall be 0.8 m or 1.5 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn‘t perform. (below 1GHz)
h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn‘t perform. (above 1GHz)
i. For the actual test configuration, please refer to the related Item – EUT TEST PHOTO.

4.3 TEST SETUP

30 MHz to 1 GHz



Above 1 GHz



4.4 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.5 TEST RESULT – BELOW 30 MHZ

There were no emissions found below 30 MHz within 20 dB of the limit.

4.6 TEST RESULT – 30 MHZ TO 1 GHZ

Please refer to the APPENDIX B.

4.7 TEST RESULT – ABOVE 1 GHZ

Please refer to the APPENDIX C.

NOTE:

(1) No limit: This is fundamental signal, the judgment is not applicable.
For fundamental signal judgment was referred to Peak output test.

5 BANDWIDTH TEST

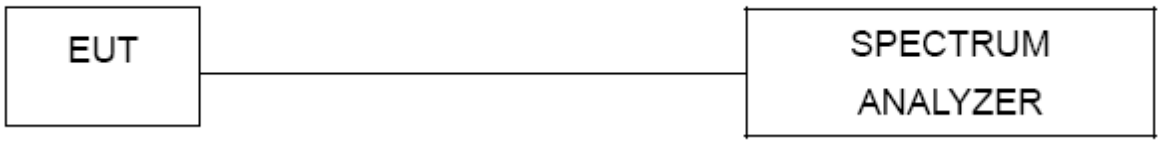
5.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

5.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = 2.5 ms.

5.3 TEST SETUP



5.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

5.5 TEST RESULTS

Please refer to the APPENDIX D.

6 OUTPUT POWER TEST

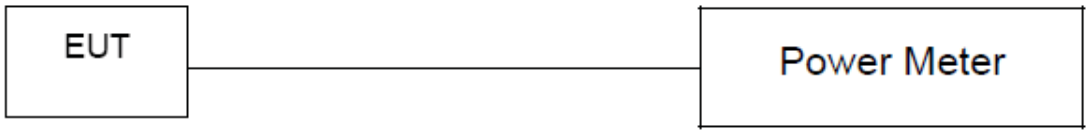
6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Maximum Output Power	1 watt or 30dBm	2400-2483.5	PASS

6.2 TEST PROCEDURE

a. The EUT was directly connected to the power meter and antenna output port as show in the block diagram below,
b. The maximum peak conducted output power was performed in accordance with FCC KDB 558074 D01 15.247 Meas Guidance.

6.3 TEST SETUP



6.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

6.5 TEST RESULTS

Please refer to the APPENDIX E.

7 POWER SPECTRAL DENSITY TEST

7.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e)	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

7.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting: RBW=3KHz, VBW=10 KHz, Sweep time = auto.

7.3 TEST SETUP

7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

7.5 TEST RESULTS

Please refer to the APPENDIX F.

8 ANTENNA CONDUCTED SPURIOUS EMISSION

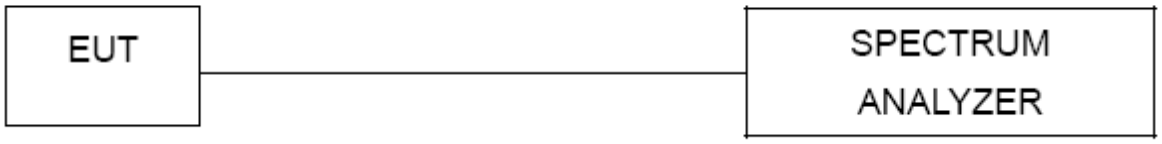
8.1 APPLIED PROCEDURES / LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits.

8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = 10 ms.

8.3 TEST SETUP



8.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

8.5 TEST RESULTS

Please refer to the APPENDIX G.

9 LIST OF MEASURING EQUIPMENTS

AC Power Line Conducted Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Reciver	MXE EMI Reciver	Agilent Technologies	N9038A	2023/6/26	2024/6/25
2	LISN	Two-Line V-Network	R&S	ENV216	2023/7/21	2024/7/20

Radiated Emissions_ Below 1G						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Reciver	MXE EMI Reciver	Agilent Technologies	N9038A	2023/6/26	2024/6/25
2	Antenna	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	2023/12/18	2024/12/17
3	Attenuator	6dB Attenuator	EMCI	EMCI-N-6-05	2023/12/18	2024/12/17

Radiated Emissions_ Above 1G						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum	EXA Signal Analyzer	Keysight	N9010A	2023/9/12	2024/9/11
2	Pre-Amplifier	1G-18G Pre-Amplifier	EMCI	EMC118A45SE	2023/7/18	2024/7/17
3	Antenna	Broad-Band Horn Antenna	RFSPIN	DRH18-E	2023/2/10	2024/2/9
4	Pre-Amplifier	18G-40G Pre-Amplifier	EMCI	EMC184045SE	2023/12/11	2024/12/10
5	Antenna	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	2023/6/29	2024/6/28

Bandwidth & Maximum Output Power & Power Spectral Density & Antenna conducted Spurious Emission						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP 30	100854	2023/6/26	2024/6/25

Remark: "N/A" denotes no model name, no serial no. or no calibration specified.
All calibration period of equipment list is one year.

10 EUT TEST PHOTO

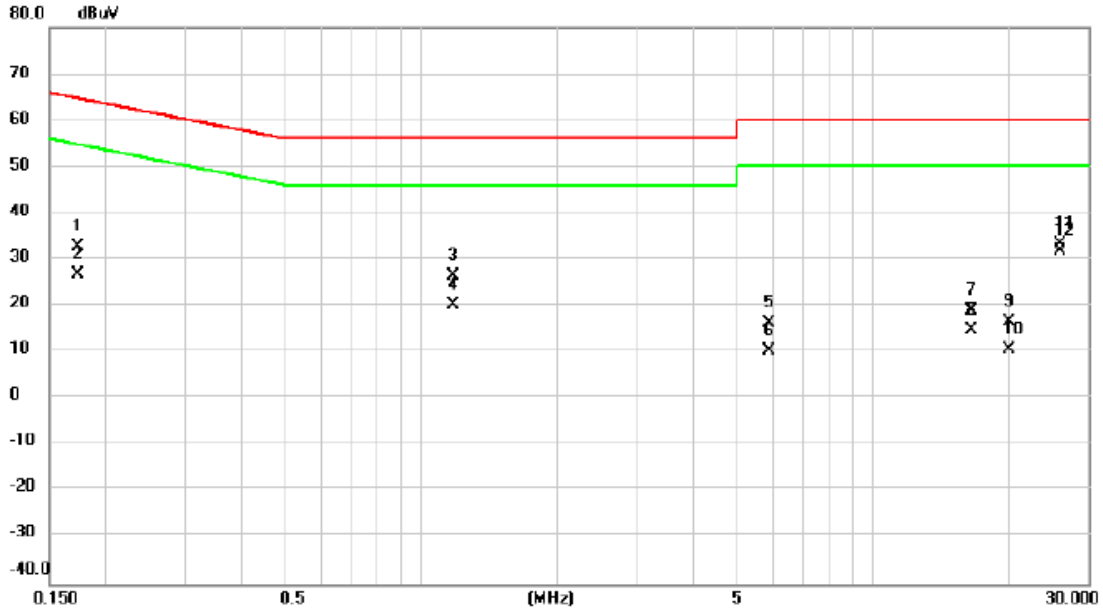
Please refer to APPENDIX-TEST PHOTOS.

11 EUT PHOTOS

Please refer to APPENDIX-EUT PHOTOS.

APPENDIX A AC POWER LINE CONDUCTED EMISSIONS

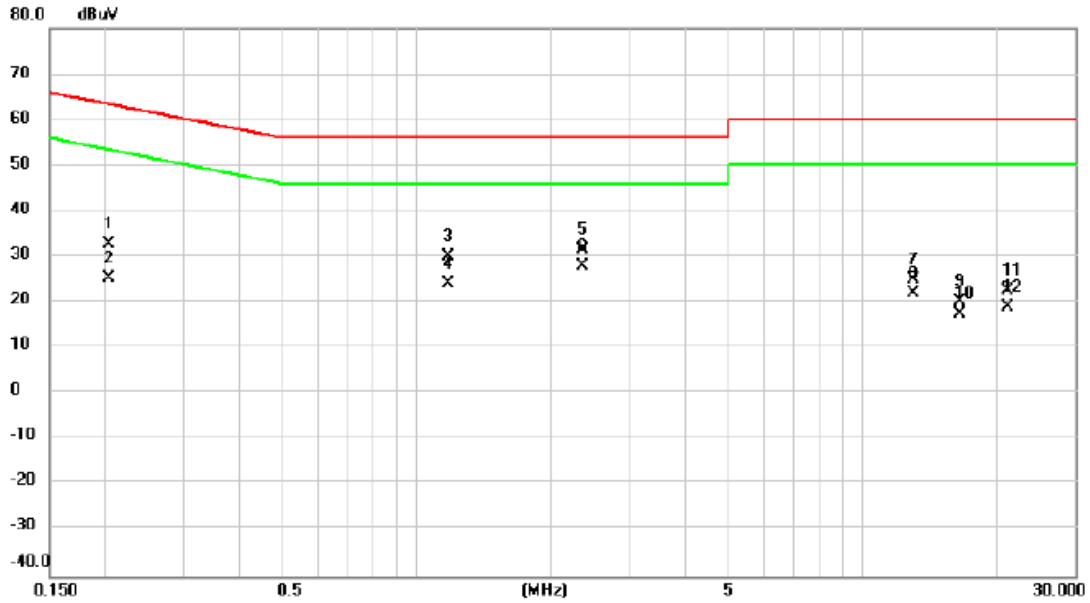
Test Mode	TX Mode Channel 39 _2Mbps	Tested Date	2024/1/5
Test Frequency	2480 MHz	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1734	23.04	9.67	32.71	64.80	-32.09	QP	
2		0.1734	17.20	9.67	26.87	54.80	-27.93	AVG	
3		1.1750	16.76	9.74	26.50	56.00	-29.50	QP	
4		1.1750	10.48	9.74	20.22	46.00	-25.78	AVG	
5		5.9000	6.31	9.93	16.24	60.00	-43.76	QP	
6		5.9000	0.38	9.93	10.31	50.00	-39.69	AVG	
7		16.4750	8.83	10.14	18.97	60.00	-41.03	QP	
8		16.4750	4.66	10.14	14.80	50.00	-35.20	AVG	
9		20.0000	6.22	10.19	16.41	60.00	-43.59	QP	
10		20.0000	0.35	10.19	10.54	50.00	-39.46	AVG	
11		25.9000	23.02	10.20	33.22	60.00	-26.78	QP	
12	*	25.9000	21.79	10.20	31.99	50.00	-18.01	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	TX Mode Channel 39 _2Mbps	Tested Date	2024/1/5
Test Frequency	2480 MHz	Phase	Neutral

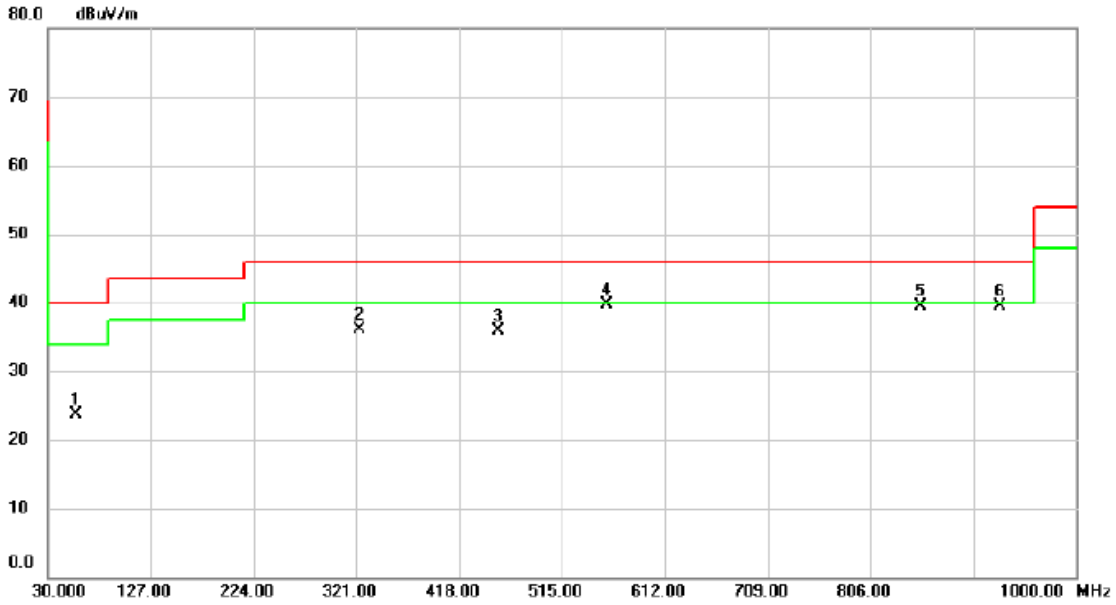


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2040	23.07	9.66	32.73	63.45	-30.72	QP	
2		0.2040	15.61	9.66	25.27	53.45	-28.18	AVG	
3		1.1750	20.45	9.74	30.19	56.00	-25.81	QP	
4		1.1750	14.44	9.74	24.18	46.00	-21.82	AVG	
5		2.3540	21.75	9.82	31.57	56.00	-24.43	QP	
6	*	2.3540	18.02	9.82	27.84	46.00	-18.16	AVG	
7		12.9500	14.67	10.16	24.83	60.00	-35.17	QP	
8		12.9500	11.91	10.16	22.07	50.00	-27.93	AVG	
9		16.4750	10.02	10.23	20.25	60.00	-39.75	QP	
10		16.4750	7.08	10.23	17.31	50.00	-32.69	AVG	
11		21.2000	12.16	10.33	22.49	60.00	-37.51	QP	
12		21.2000	8.53	10.33	18.86	50.00	-31.14	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX B RADIATED EMISSIONS - 30 MHZ TO 1 GHZ

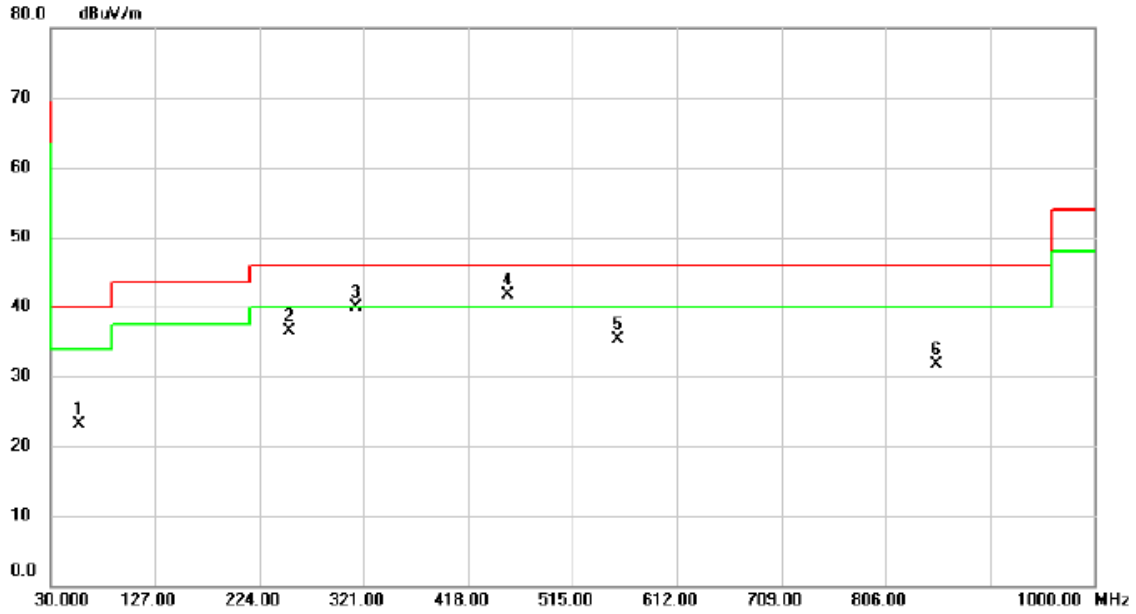
Test Mode	BLE 5.0 (2 Mbps)	Test Date	2024/1/5
Test Frequency	2480MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		56.1900	35.36	-11.65	23.71	40.00	-16.29	peak	100	272	
2		323.9100	45.80	-9.61	36.19	46.00	-9.81	peak	100	345	
3		454.8600	41.87	-5.93	35.94	46.00	-10.06	peak	200	113	
4	*	556.7100	43.68	-3.99	39.69	46.00	-6.31	peak	200	188	
5		853.5300	38.13	1.39	39.52	46.00	-6.48	peak	200	271	
6		928.2200	37.56	2.04	39.60	46.00	-6.40	peak	100	167	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2024/1/5
Test Frequency	2480MHz	Polarization	Horizontal

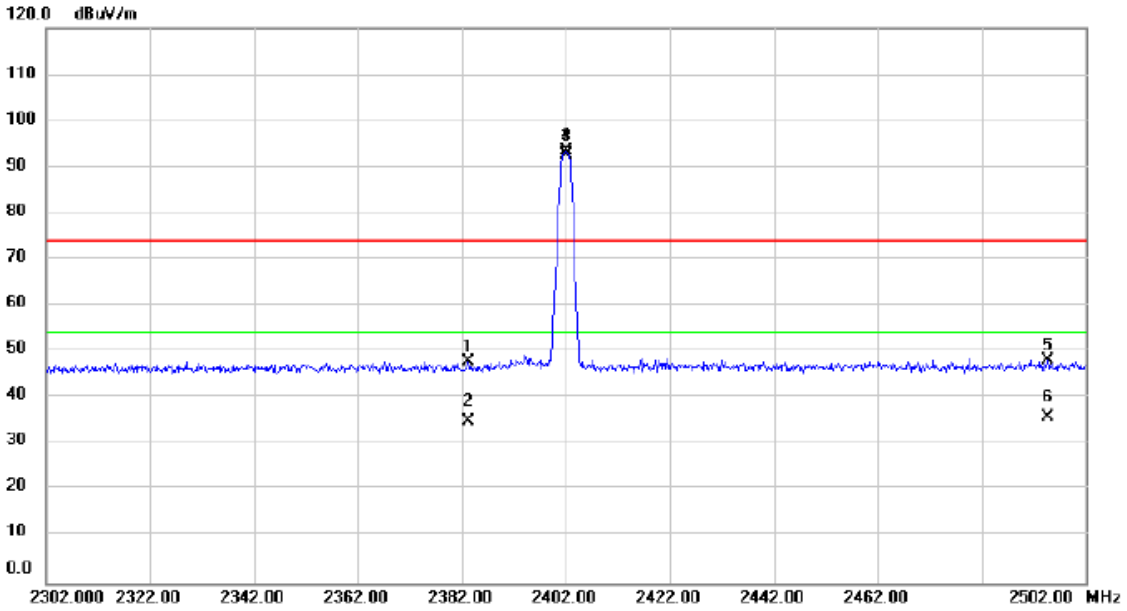


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		56.1900	34.66	-11.65	23.01	40.00	-16.99	peak	200	128	
2		252.1300	48.47	-11.94	36.53	46.00	-9.47	peak	200	325	
3		313.2400	49.84	-9.91	39.93	46.00	-6.07	peak	200	290	
4	*	454.8600	47.56	-5.93	41.63	46.00	-4.37	peak	100	150	
5		556.7100	39.34	-3.99	35.35	46.00	-10.65	peak	100	278	
6		853.5300	30.26	1.39	31.65	46.00	-14.35	peak	200	228	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX C RADIATED EMISSIONS - ABOVE 1 GHZ

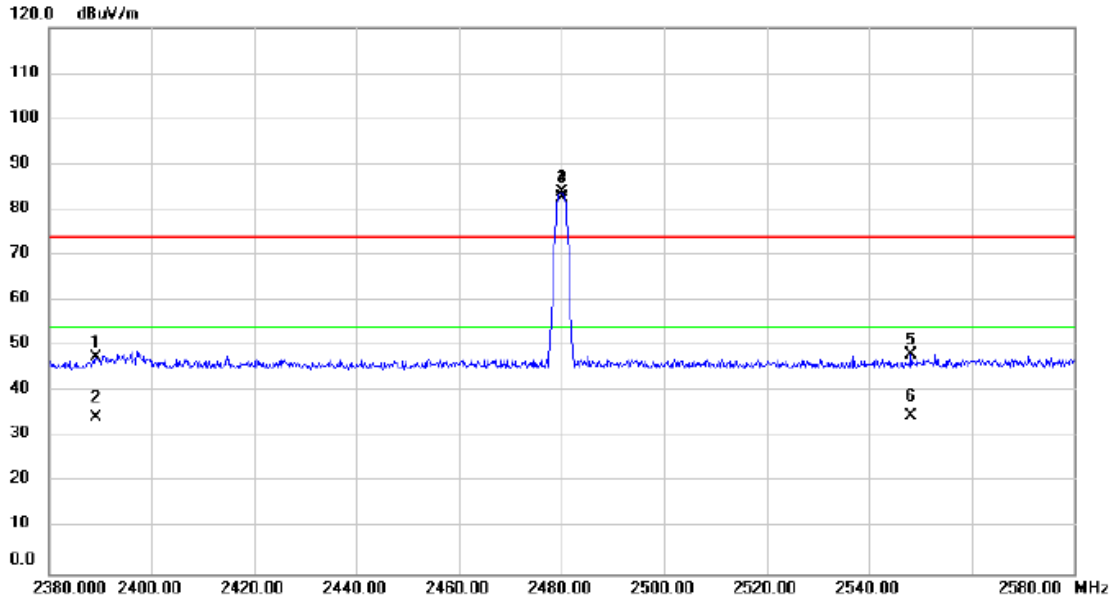
Test Mode	BLE 5.0 (1 Mbps)	Test Date	2023/12/28
Test Frequency	2402MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2383.200	45.12	2.73	47.85	74.00	-26.15	peak			
2		2383.200	32.19	2.73	34.92	54.00	-19.08	AVG			
3	X	2402.200	90.65	2.74	93.39	74.00	19.39	peak			No Limit
4	*	2402.200	89.69	2.74	92.43	54.00	38.43	AVG			No Limit
5		2494.600	45.36	2.81	48.17	74.00	-25.83	peak			
6		2494.600	32.89	2.81	35.70	54.00	-18.30	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

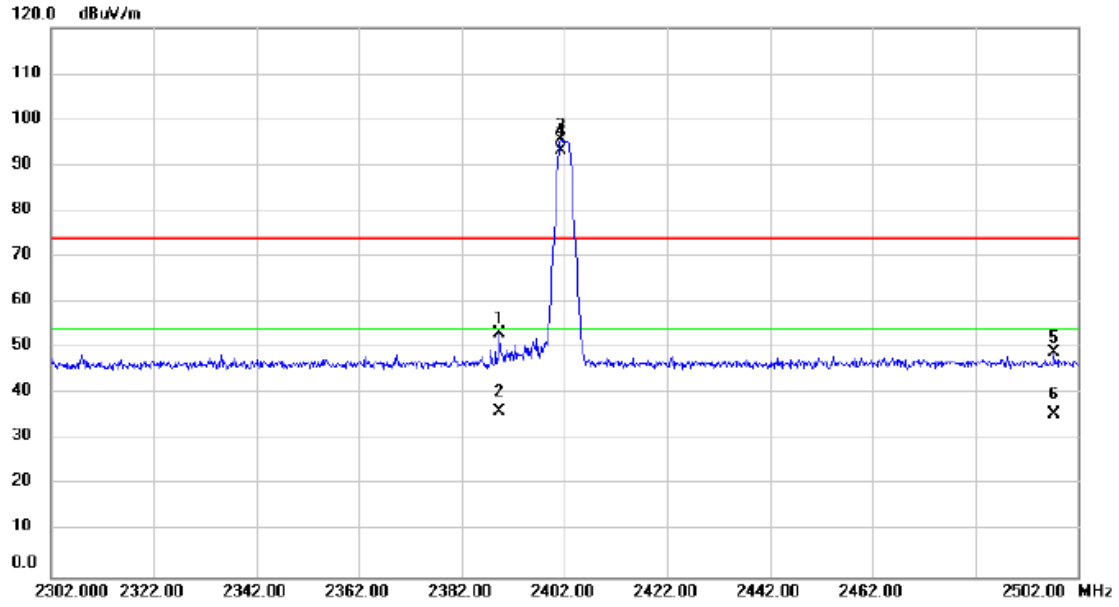
Test Mode	BLE 5.0 (1 Mbps)	Test Date	2023/12/28
Test Frequency	2480MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2389.200	44.72	2.73	47.45	74.00	-26.55	peak			
2		2389.200	31.73	2.73	34.46	54.00	-19.54	AVG			
3	X	2480.200	81.01	2.80	83.81	74.00	9.81	peak			No Limit
4	*	2480.200	79.80	2.80	82.60	54.00	28.60	AVG			No Limit
5		2548.200	45.10	3.00	48.10	74.00	-25.90	peak			
6		2548.200	31.58	3.00	34.58	54.00	-19.42	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

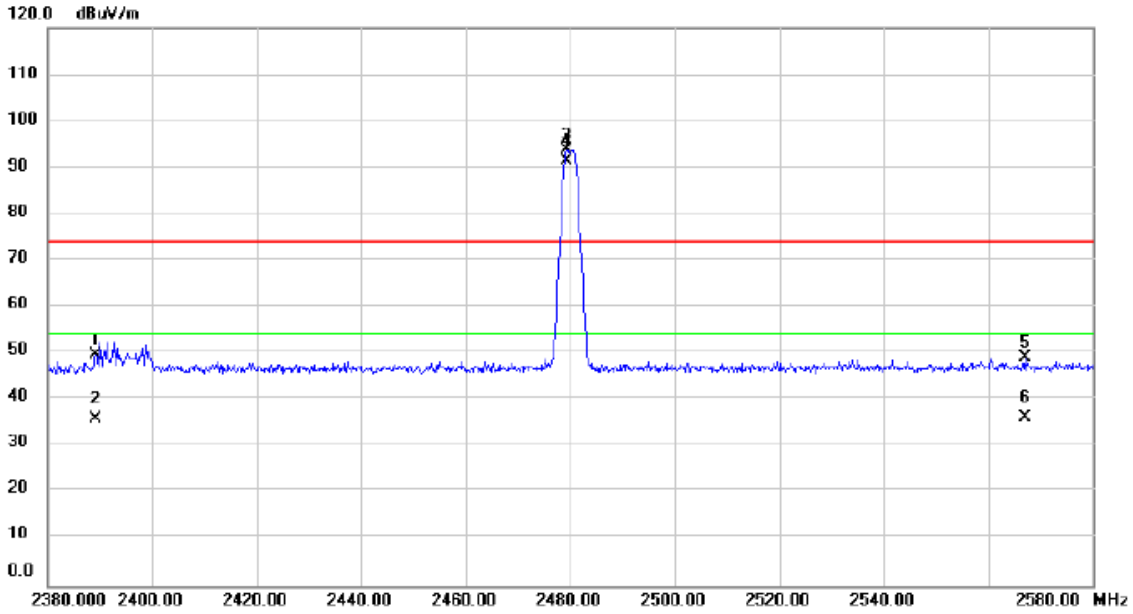
Test Mode	BLE 5.0 (2 Mbps)	Test Date	2023/12/28
Test Frequency	2402MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2389.400	50.53	2.73	53.26	74.00	-20.74	peak			
2		2389.400	33.44	2.73	36.17	54.00	-17.83	AVG			
3	X	2401.400	92.70	2.74	95.44	74.00	21.44	peak			No Limit
4	*	2401.400	90.32	2.74	93.06	54.00	39.06	AVG			No Limit
5		2497.400	46.14	2.81	48.95	74.00	-25.05	peak			
6		2497.400	32.63	2.81	35.44	54.00	-18.56	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

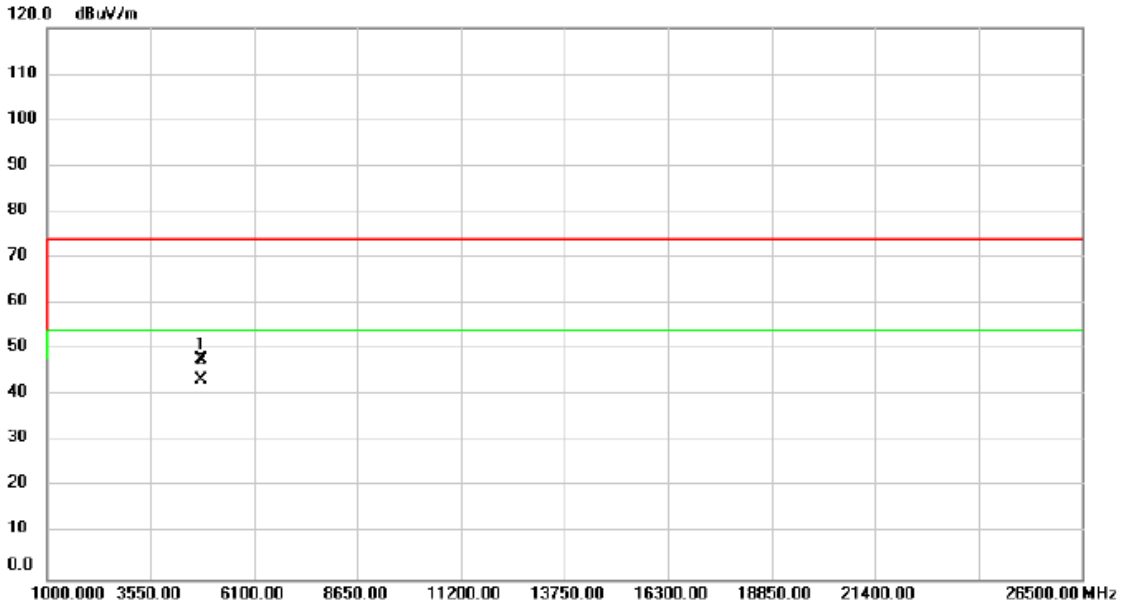
Test Mode	BLE 5.0 (2 Mbps)	Test Date	2023/12/28
Test Frequency	2480MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2389.200	46.93	2.73	49.66	74.00	-24.34	peak			
2		2389.200	33.09	2.73	35.82	54.00	-18.18	AVG			
3	X	2479.400	90.93	2.80	93.73	74.00	19.73	peak			No Limit
4	*	2479.400	88.45	2.80	91.25	54.00	37.25	AVG			No Limit
5		2567.000	45.84	3.07	48.91	74.00	-25.09	peak			
6		2567.000	33.08	3.07	36.15	54.00	-17.85	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

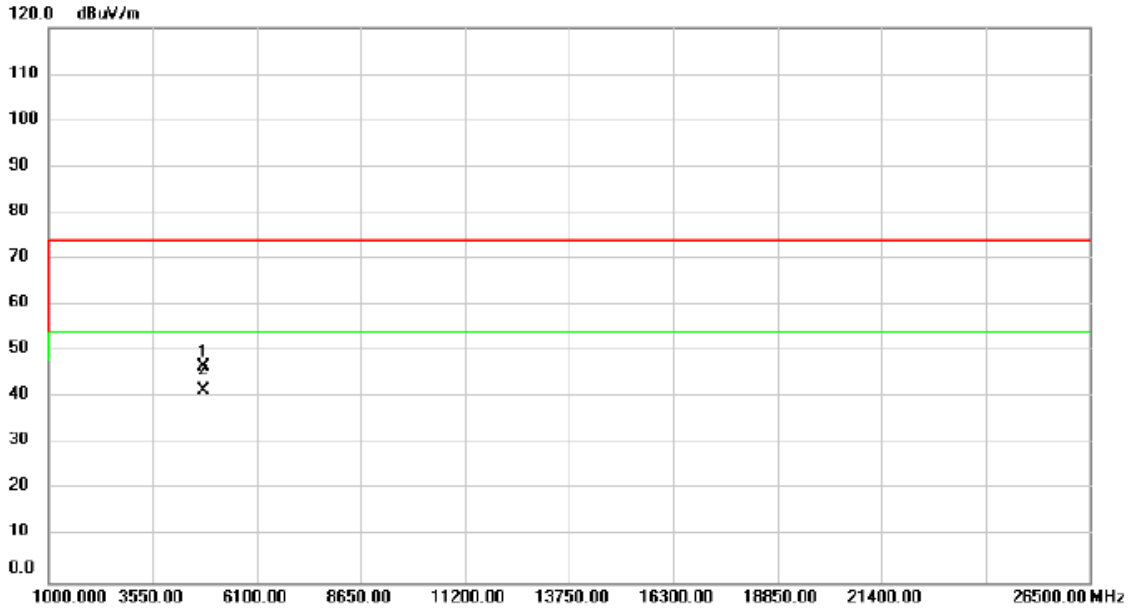
Test Mode	BLE 5.0 (1 Mbps)	Test Date	2023/12/28
Test Frequency	2402MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4799.500	48.93	-0.95	47.98	74.00	-26.02	peak			
2	*	4799.500	44.43	-0.95	43.48	54.00	-10.52	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

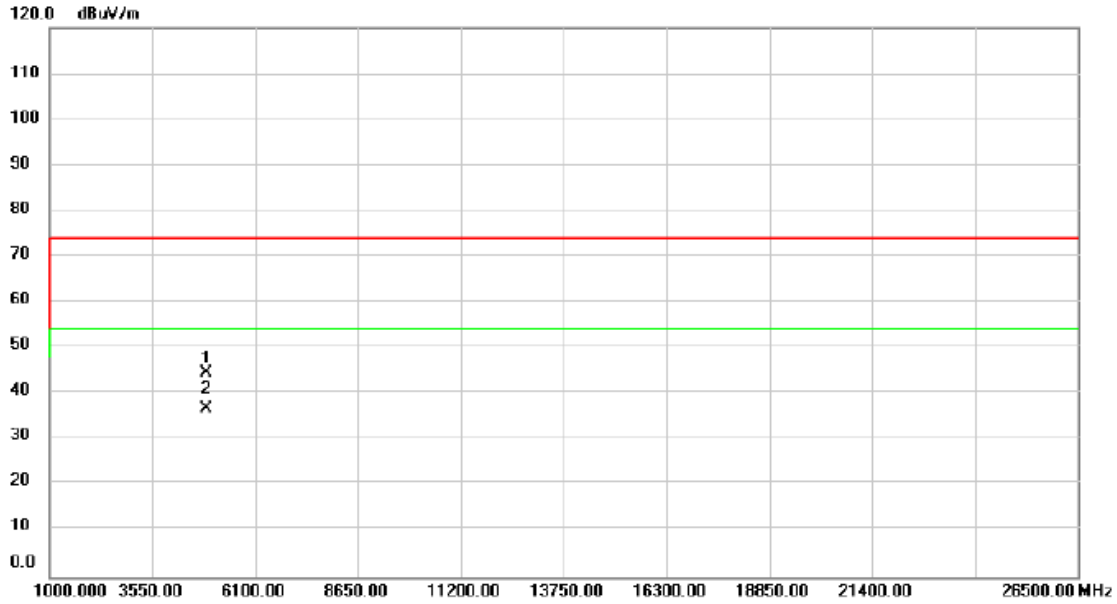
Test Mode	BLE 5.0 (1 Mbps)	Test Date	2023/12/28
Test Frequency	2402MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4799.500	47.59	-0.95	46.64	74.00	-27.36	peak			
2	*	4799.500	42.44	-0.95	41.49	54.00	-12.51	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

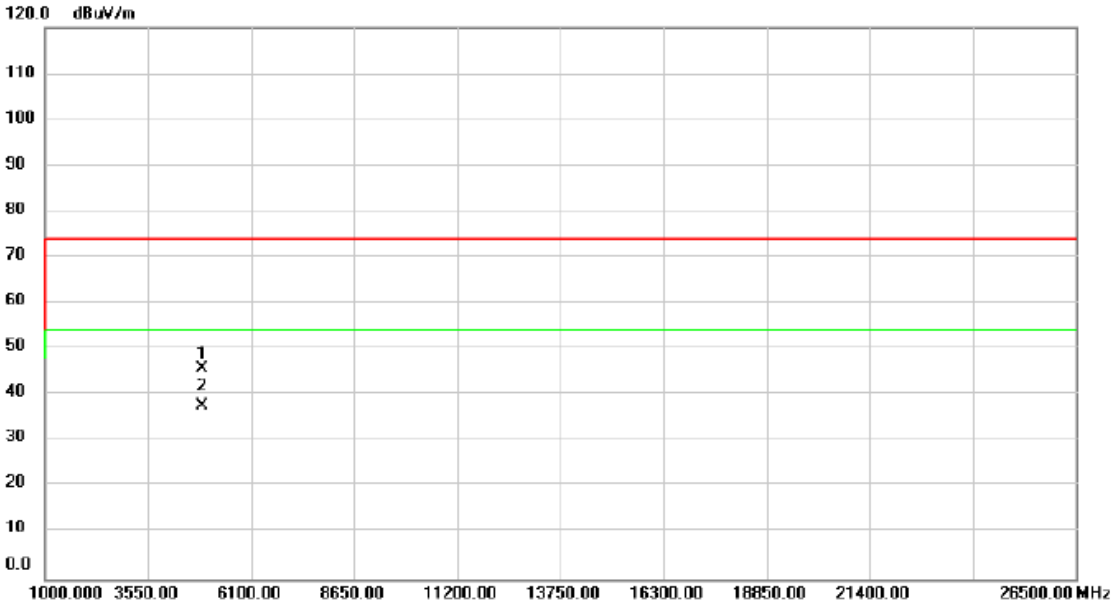
Test Mode	BLE 5.0 (1 Mbps)	Test Date	2023/12/28
Test Frequency	2440MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4876.000	45.18	-0.72	44.46	74.00	-29.54	peak			
2	*	4876.000	37.46	-0.72	36.74	54.00	-17.26	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

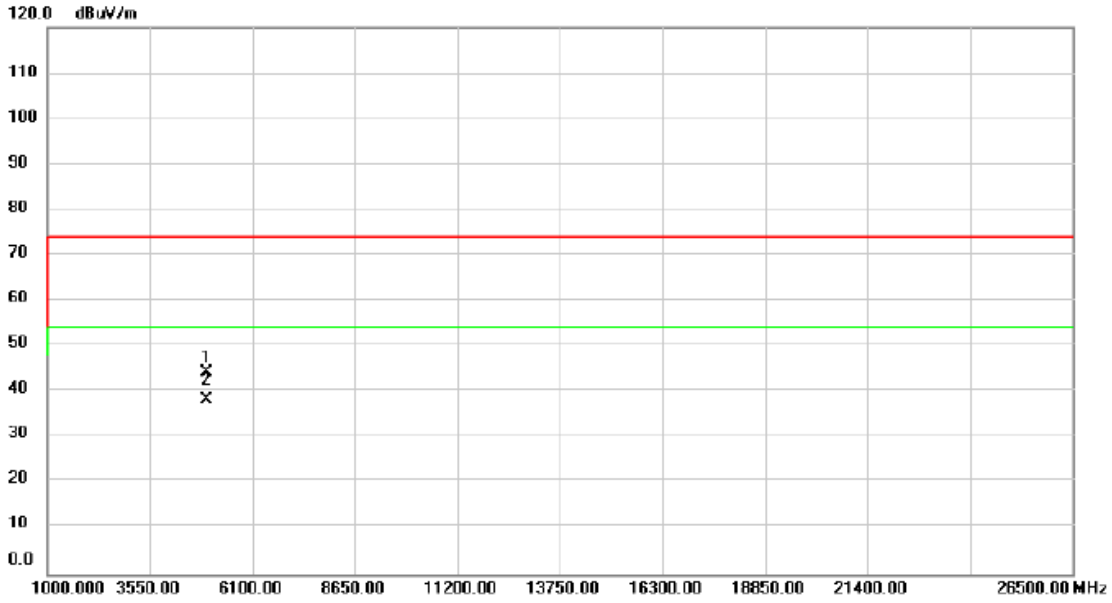
Test Mode	BLE 5.0 (1 Mbps)	Test Date	2023/12/28
Test Frequency	2440MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4876.000	46.61	-0.72	45.89	74.00	-28.11	peak			
2	*	4876.000	38.51	-0.72	37.79	54.00	-16.21	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

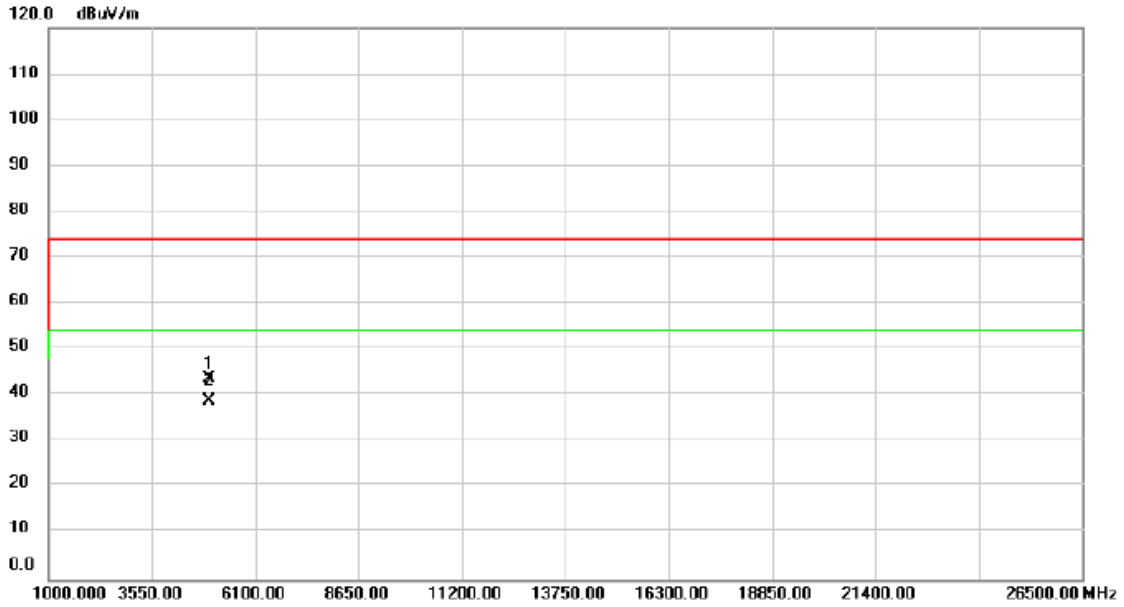
Test Mode	BLE 5.0 (1 Mbps)	Test Date	2023/12/28
Test Frequency	2480MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4952.500	44.75	-0.49	44.26	74.00	-29.74	peak			
2	*	4952.500	38.71	-0.49	38.22	54.00	-15.78	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

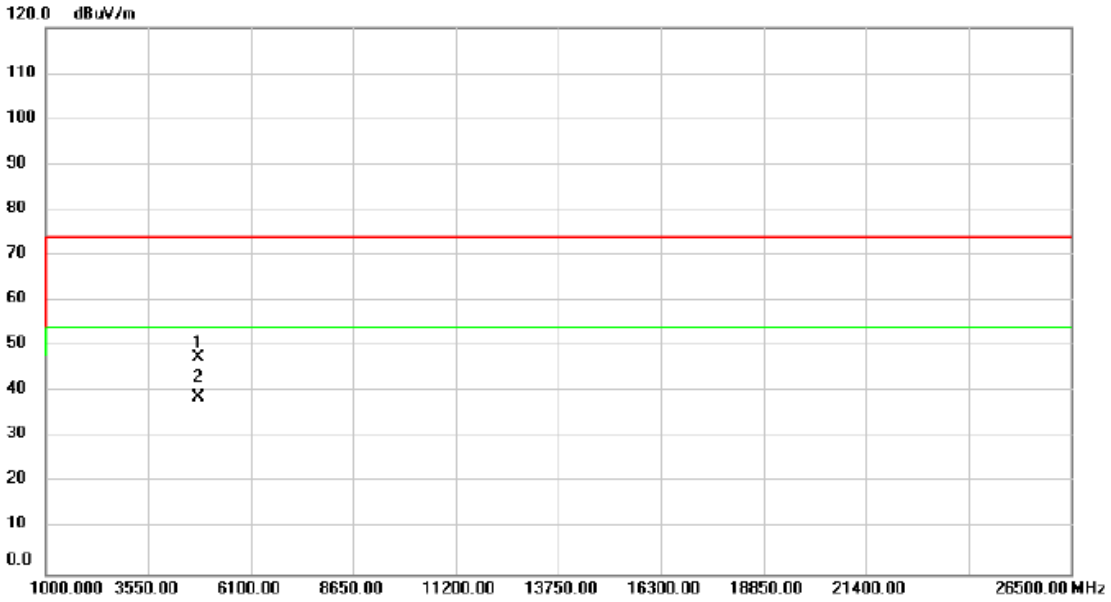
Test Mode	BLE 5.0 (1 Mbps)	Test Date	2023/12/28
Test Frequency	2480MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4952.500	44.08	-0.49	43.59	74.00	-30.41	peak			
2	*	4952.500	39.24	-0.49	38.75	54.00	-15.25	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

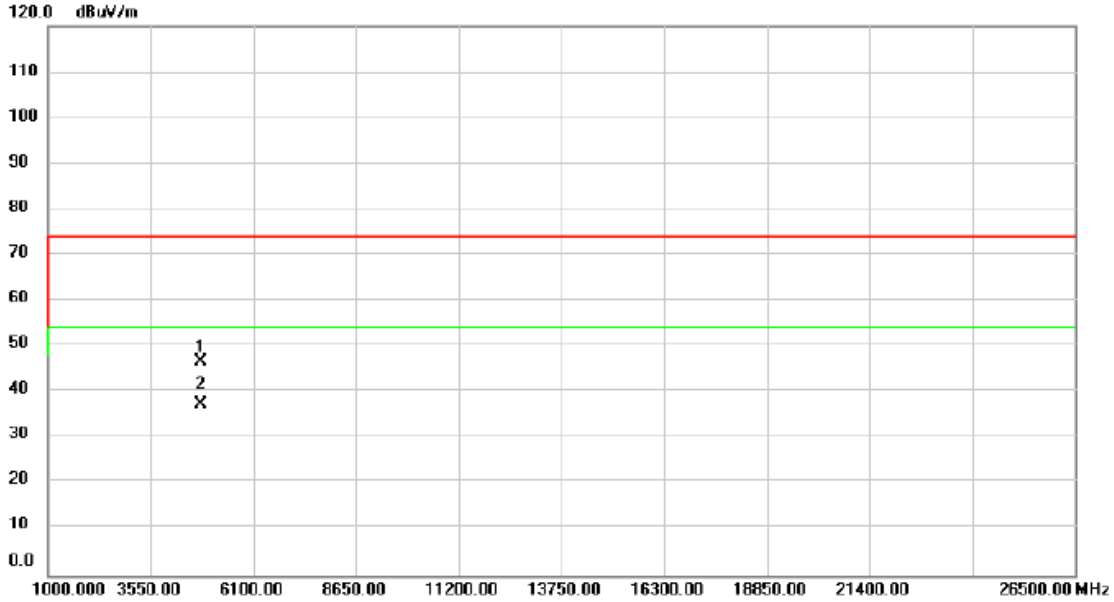
Test Mode	BLE 5.0 (2 Mbps)	Test Date	2023/12/28
Test Frequency	2402MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4799.500	48.64	-0.95	47.69	74.00	-26.31	peak			
2	*	4799.500	39.71	-0.95	38.76	54.00	-15.24	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

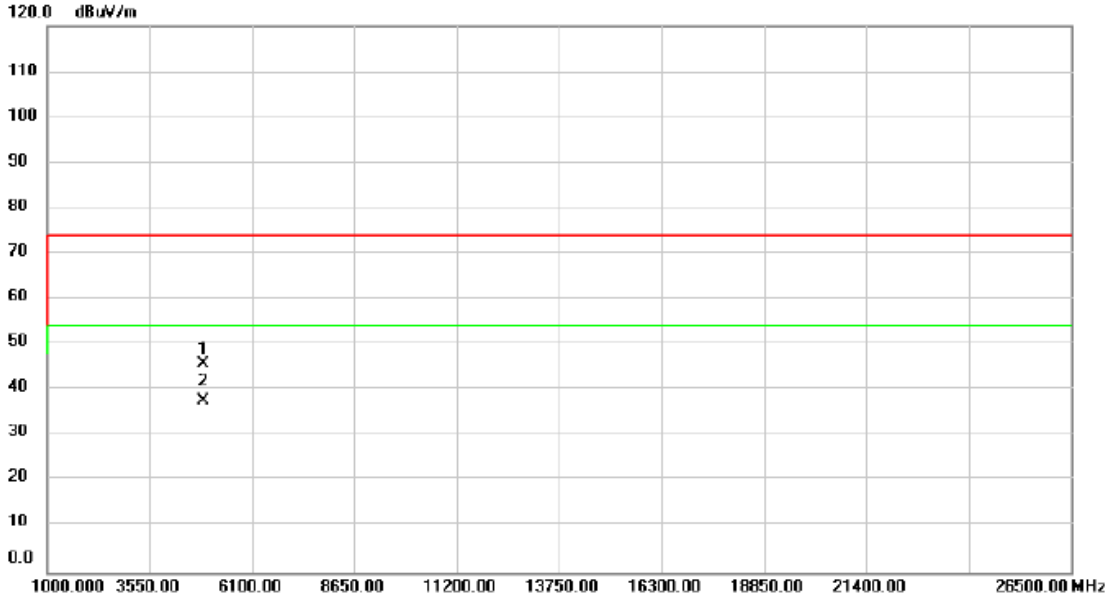
Test Mode	BLE 5.0 (2 Mbps)	Test Date	2023/12/28
Test Frequency	2402MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4799.500	47.61	-0.95	46.66	74.00	-27.34	peak			
2	*	4799.500	38.35	-0.95	37.40	54.00	-16.60	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

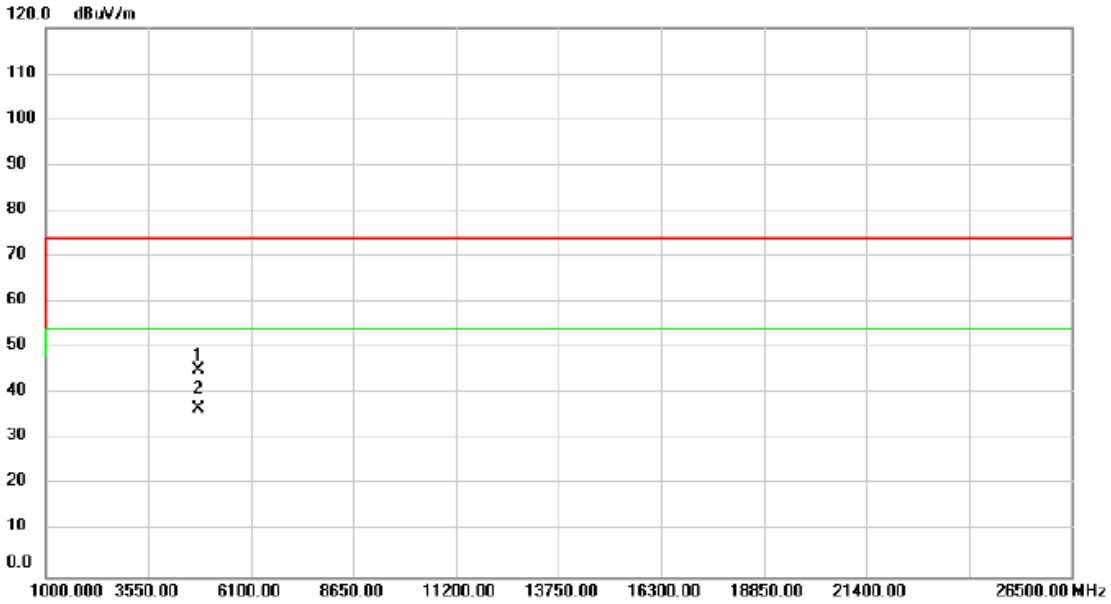
Test Mode	BLE 5.0 (2 Mbps)	Test Date	2023/12/28
Test Frequency	2440MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4876.000	46.62	-0.72	45.90	74.00	-28.10	peak			
2	*	4876.000	38.47	-0.72	37.75	54.00	-16.25	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

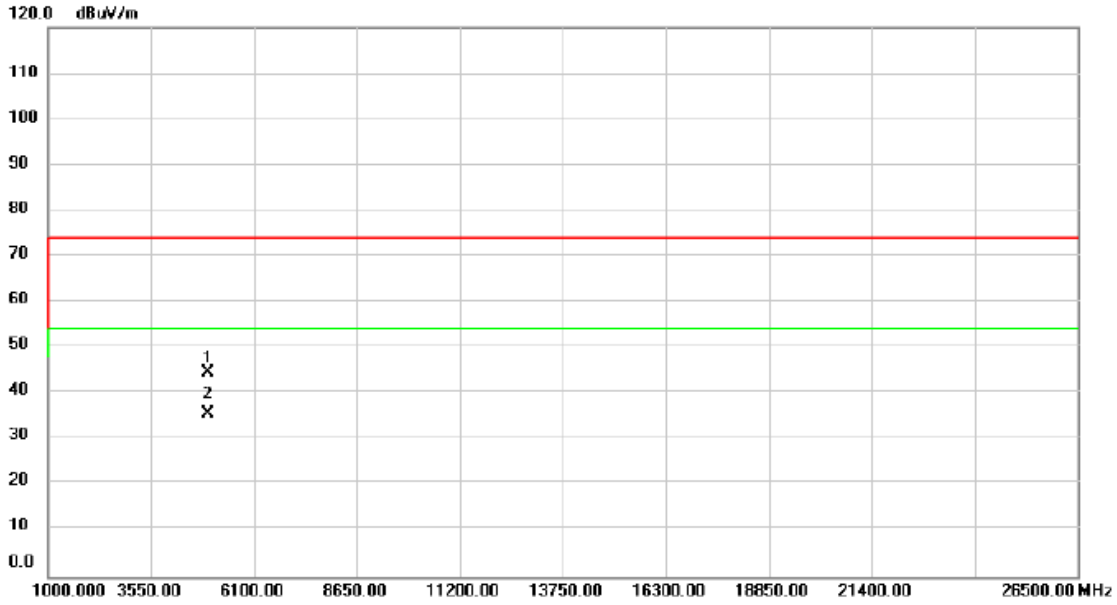
Test Mode	BLE 5.0 (2 Mbps)	Test Date	2023/12/28
Test Frequency	2440MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4799.500	46.20	-0.95	45.25	74.00	-28.75	peak			
2	*	4799.500	37.85	-0.95	36.90	54.00	-17.10	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

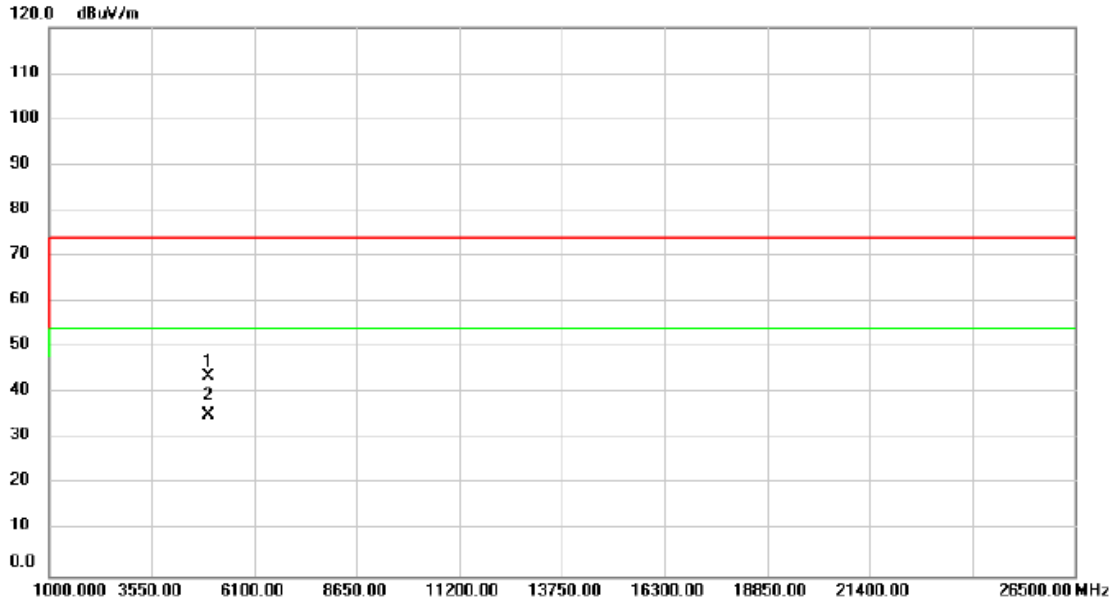
Test Mode	BLE 5.0 (2 Mbps)	Test Date	2023/12/28
Test Frequency	2480MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4960.000	45.01	-0.47	44.54	74.00	-29.46	peak			
2	*	4960.000	35.97	-0.47	35.50	54.00	-18.50	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2023/12/28
Test Frequency	2480MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4952.500	44.25	-0.49	43.76	74.00	-30.24	peak			
2	*	4952.500	35.77	-0.49	35.28	54.00	-18.72	AVG			

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

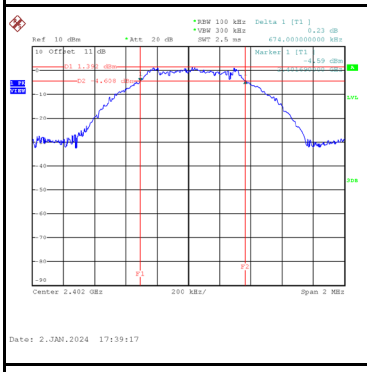
APPENDIX D BANDWIDTH

Test Mode:	1Mbps

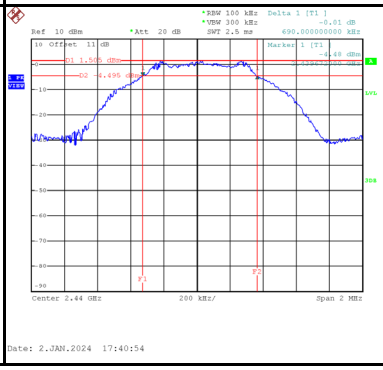
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.674	1.048	500	Pass
2440	0.690	1.056	500	Pass
2480	0.700	1.056	500	Pass

6dB Bandwidth

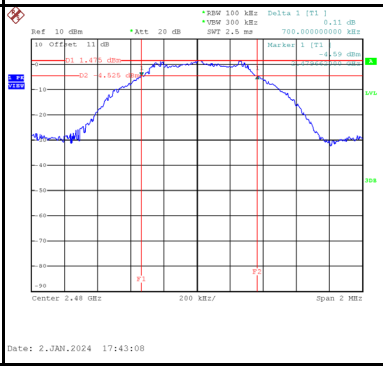
2402 MHz



2440 MHz

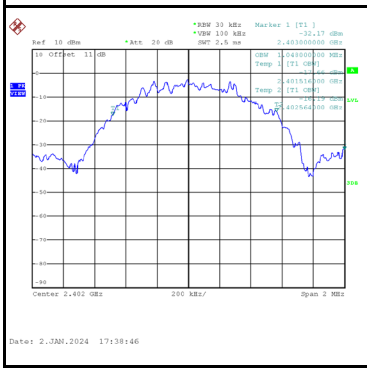


2480 MHz

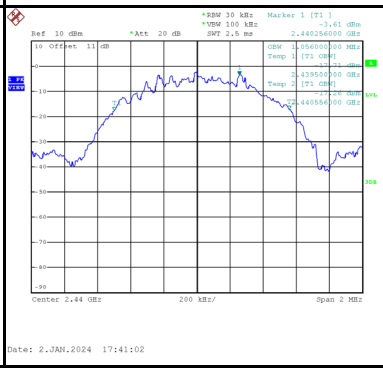


99% Occupied BW

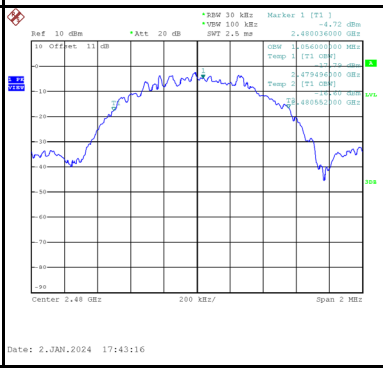
2402 MHz



2440 MHz



2480 MHz

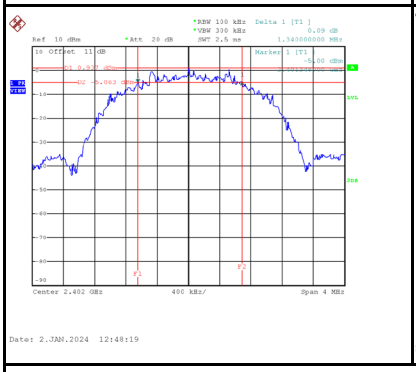


Test Mode:	2Mbps

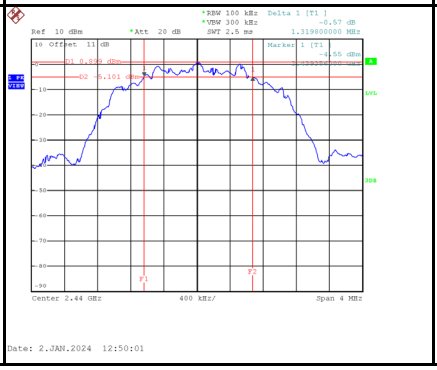
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	1.340	2.120	500	Pass
2440	1.320	2.120	500	Pass
2480	1.328	2.112	500	Pass

6dB Bandwidth

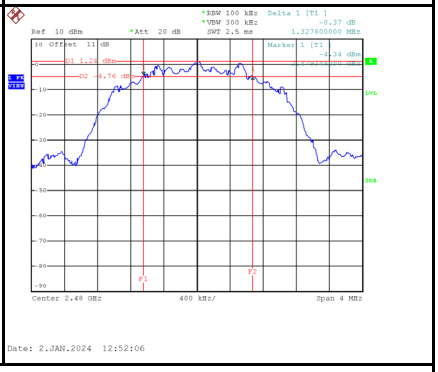
2402 MHz



2440 MHz

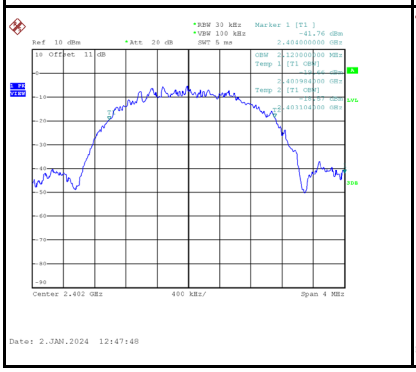


2480 MHz

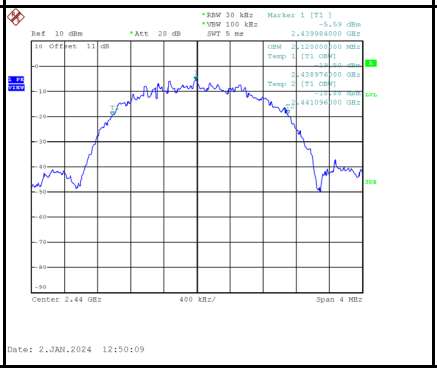


99% Occupied BW

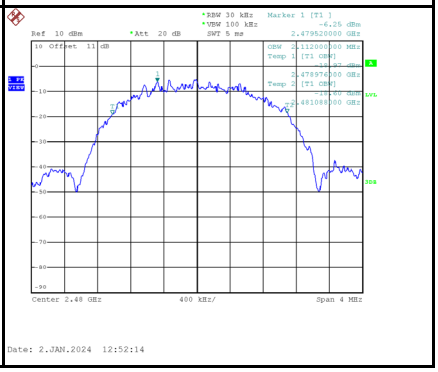
2402 MHz



2440 MHz



2480 MHz



APPENDIX E MAXIMUM OUTPUT POWER

Test Mode :	1Mbps	Tested Date	2023/12/26

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	2.41	0.0017	30.00	1.0000	Pass
2440	2.61	0.0018	30.00	1.0000	Pass
2480	2.54	0.0018	30.00	1.0000	Pass

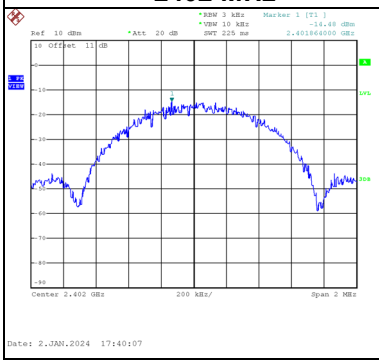
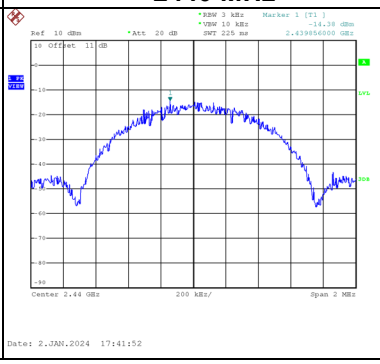
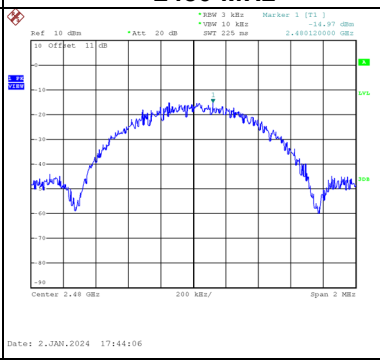
Test Mode :	2Mbps	Tested Date	2023/12/26

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	3.42	0.0022	30.00	1.0000	Pass
2440	3.07	0.0020	30.00	1.0000	Pass
2480	3.54	0.0023	30.00	1.0000	Pass

APPENDIX F POWER SPECTRAL DENSITY TEST

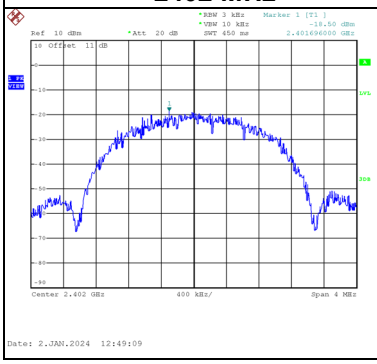
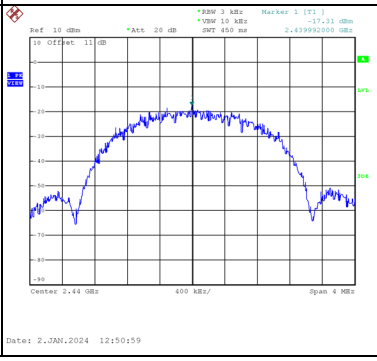
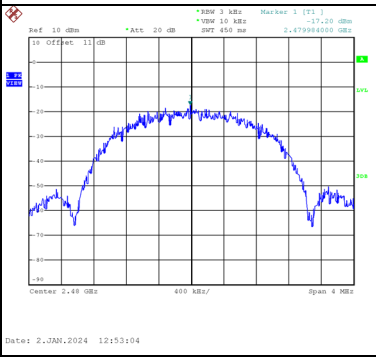
Test Mode :	1Mbps

Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-14.48	8	Pass
2440	-14.38	8	Pass
2480	-14.48	8	Pass

2402 MHz	2440 MHz	2480 MHz
		

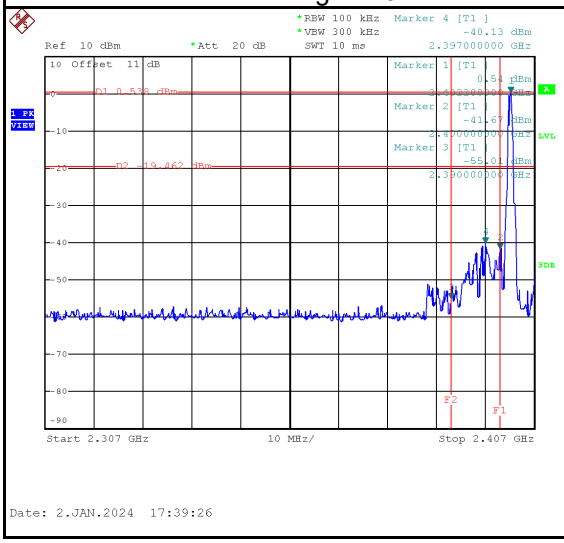
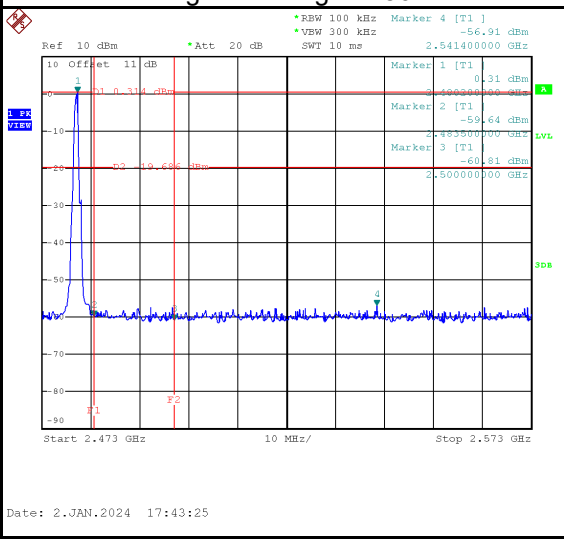
Test Mode :	2Mbps

Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-18.50	8	Pass
2440	-17.31	8	Pass
2480	-17.20	8	Pass

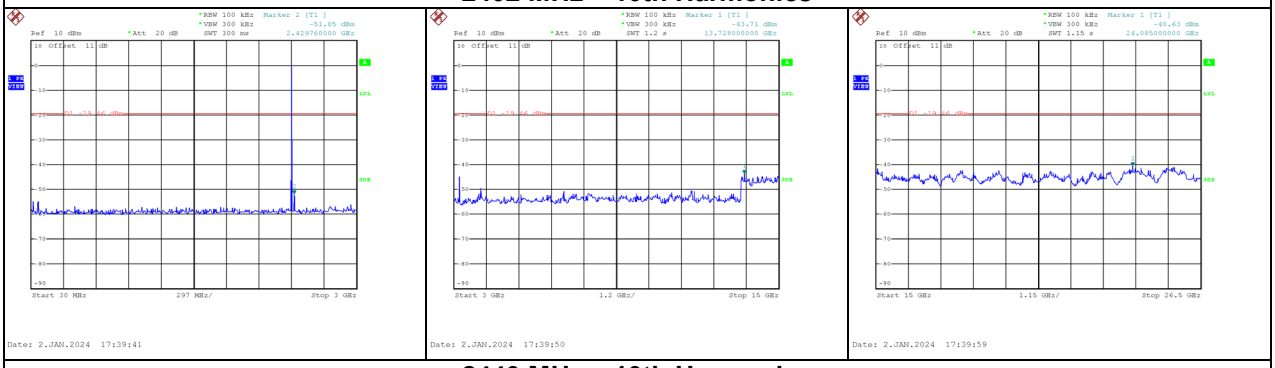
2402 MHz	2440 MHz	2480 MHz
		

APPENDIX G ANTENNA CONDUCTED SPURIOUS EMISSION

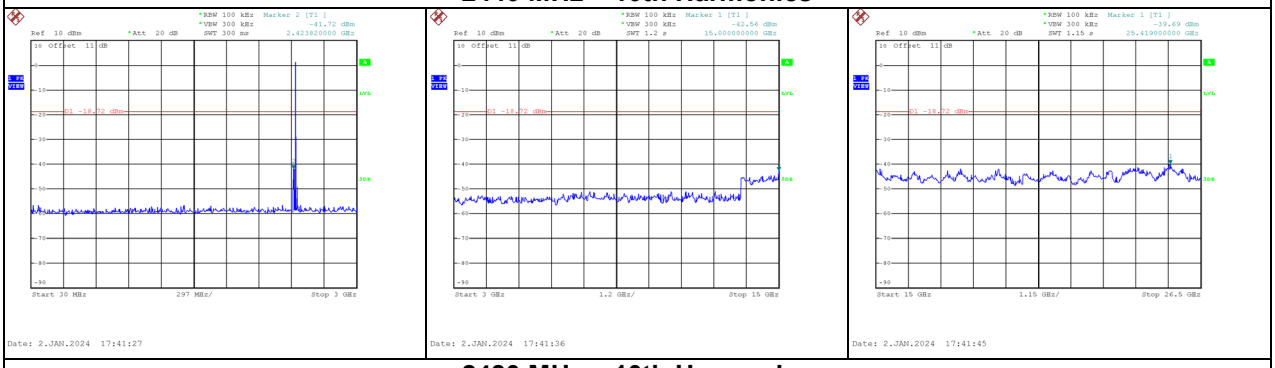
Test Mode :	1Mbps

Low Bandedge-2402 MHz	High Bandedge-2480 MHz
	

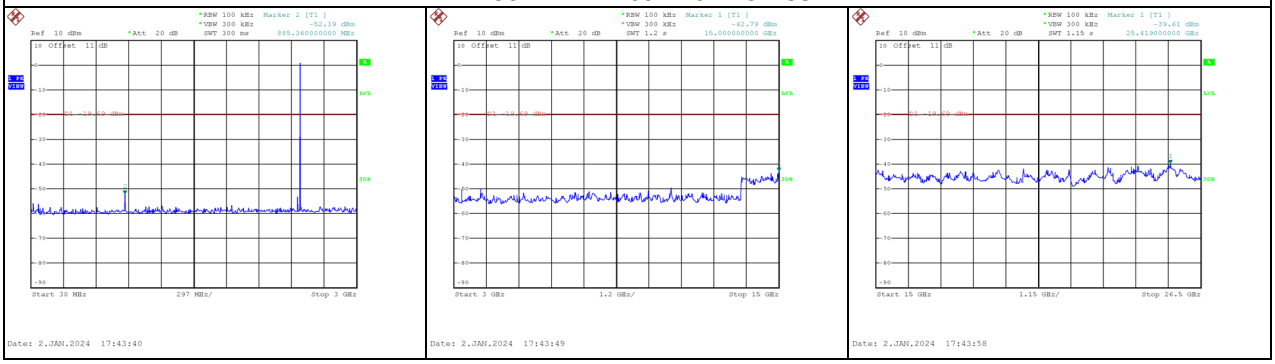
2402 MHz – 10th Harmonics



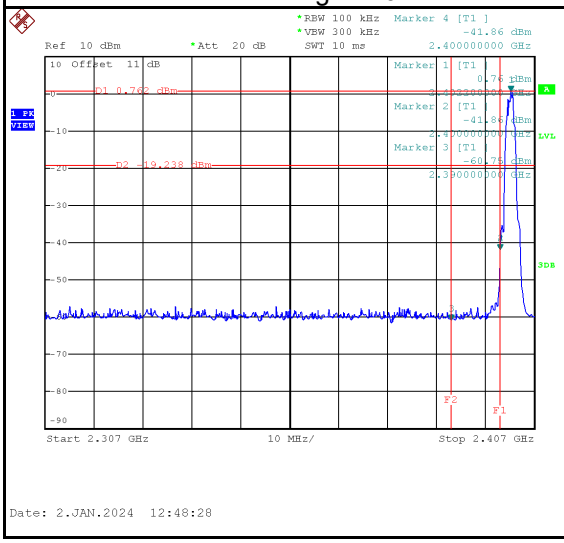
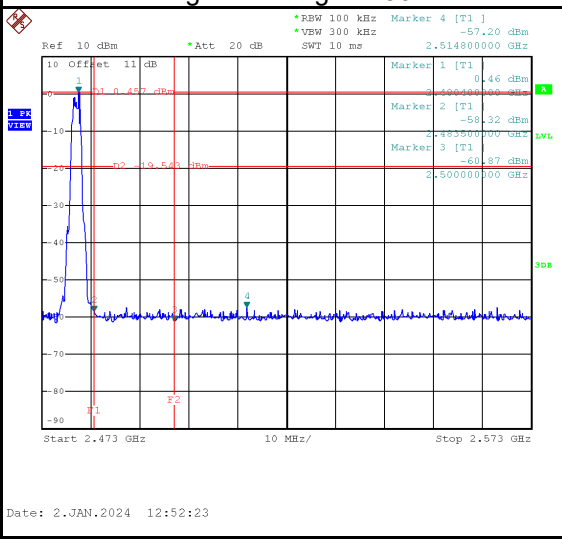
2440 MHz – 10th Harmonics



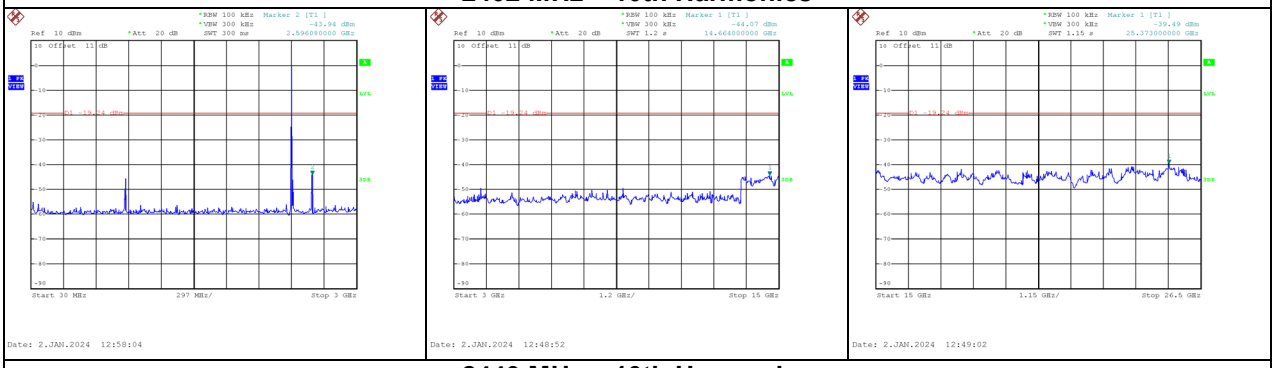
2480 MHz – 10th Harmonics



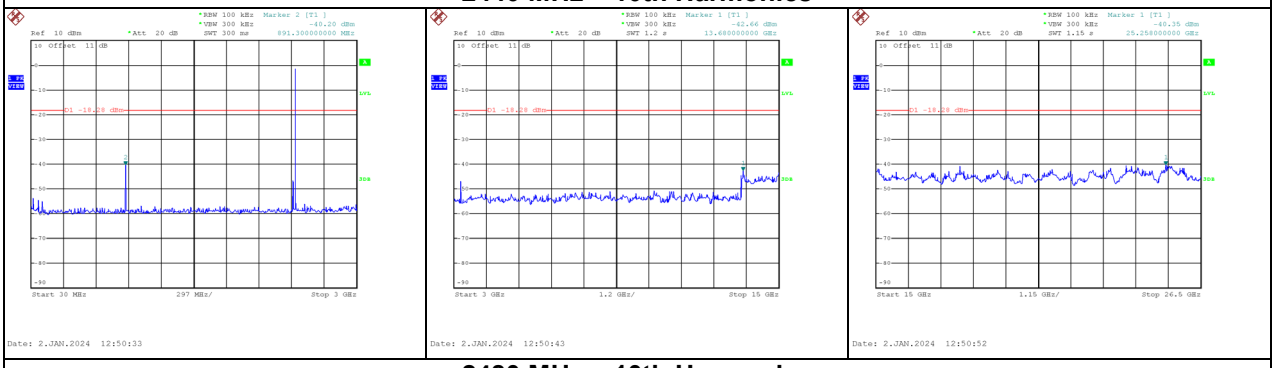
Test Mode :	2Mbps

Low Bandedge-2402 MHz	High Bandedge-2480 MHz
	

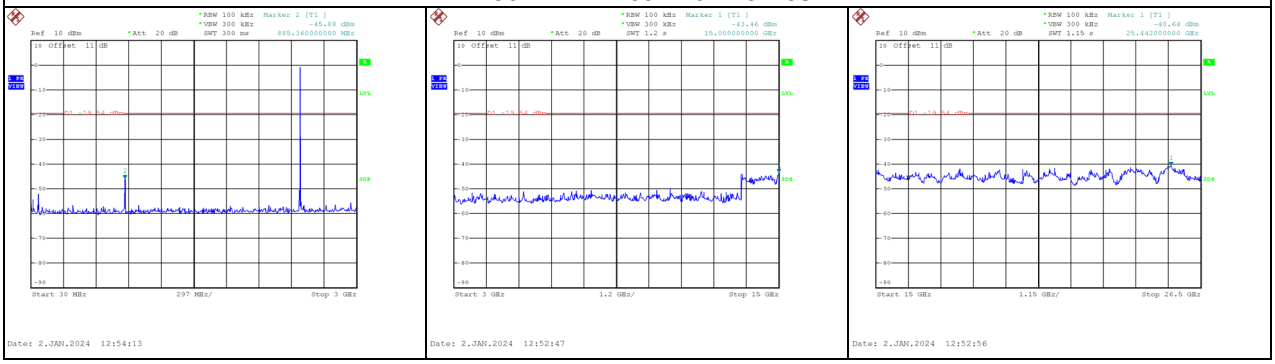
2402 MHz – 10th Harmonics



2440 MHz – 10th Harmonics



2480 MHz – 10th Harmonics



End of Test Report