

FCC Radio Test Report

FCC ID: 2APRZ-MAXWELL

Report No. : BTL-FCCP-2-2209T130
Equipment : Maxwell headset
Model Name : Maxwell
Brand Name : Audeze LLC
Applicant : Audeze LLC
Address : 3410 S Susan St, Santa Ana, CA 92704 USA

Radio Function : Bluetooth Low Energy

FCC Rule Part(s) : FCC CFR Title 47, Part 15, Subpart C (15.247)
Measurement Procedure(s) : ANSI C63.10-2013

Date of Receipt : 2022/10/4
Date of Test : 2022/10/4~ 2023/1/17
Issued Date : 2023/3/24

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

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Declaration

BTL 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).

BTL'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. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

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BTL'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.

BTL 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.

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REVISION HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-2-2209T130	R00	Original Report.	2022/11/30	Invalid
BTL-FCCP-2-2209T130	R01	Revised report to address TAF Audit's comments.	2023/3/24	Valid

1 SUMMARY OF TEST RESULTS

Test procedures according to the technical standards.

Standard(s) Section	Description	Test Result	Judgement	Remark
15.207	AC Power Line Conducted Emissions	APPENDIX A	Pass	-----
15.205 15.209 15.247(d)	Radiated Emissions	APPENDIX B APPENDIX C	Pass	-----
15.247(a)(2)	Bandwidth	APPENDIX D	Pass	-----
15.247(b)(3)	Output Power	APPENDIX E	Pass	-----
15.247(e)	Power Spectral Density	APPENDIX F	Pass	-----
15.247(d)	Antenna conducted Spurious Emission	APPENDIX G	Pass	-----
15.203	Antenna Requirement	-----	Pass	-----

NOTE:

- (1) "N/A" denotes test is not applicable in this Test Report.
- (2) The report format version is TP.1.1.1.

1.1 TEST FACILITY

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

Test Firm Location: No.18, Ln. 171, Sec. 2, Jiuzong Rd., Neihu Dist., Taipei City 114, Taiwan.
TAF Accreditation Number is 0659; FCC Designation Number is TW0659.

The satellite facilities under the test firm used to collect the test data in this report are:

No. 68-2, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

<input type="checkbox"/> CB12	<input type="checkbox"/> CB17	<input type="checkbox"/> SR01	<input type="checkbox"/> SR02	<input checked="" type="checkbox"/> SR05
<input type="checkbox"/> SR06	<input type="checkbox"/> SR09			

No. 72, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

<input checked="" type="checkbox"/> C06	<input checked="" type="checkbox"/> CB21	<input type="checkbox"/> CB22
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1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, 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 BTL measurement uncertainty is less than the CISPR 16-4-2 U_{cisp} requirement.

A. AC power line conducted emissions test:

Test Site	Method	Measurement Frequency Range	U (dB)
C06	CISPR	150 kHz ~ 30 MHz	3.44

B. Radiated emissions test:

Test Site	Measurement Frequency Range	U (dB)
CB21	0.03 GHz ~ 0.2 GHz	4.17
	0.2 GHz ~ 1 GHz	4.72
	1 GHz ~ 6 GHz	5.21
	6 GHz ~ 18 GHz	5.51
	18 GHz ~ 26 GHz	3.69
	26 GHz ~ 40 GHz	4.23

C. Conducted test :

Test Item	U (dB)
Occupied Bandwidth	0.5334
Output power	0.3669
Power Spectral Density	0.6591
Conducted Spurious emissions	0.5416
Conducted Band edges	0.5348

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 TEST ENVIRONMENT CONDITIONS

Test Item	Environment Condition	Test Voltage	Tested by
AC Power Line Conducted Emissions	21 °C, 58 %	AC 120V	Jay Tien
Radiated emissions below 1 GHz	23 °C, 59 %	DC 5V	Mark Wang
Radiated emissions above 1 GHz	23 °C, 59 %	DC 5V	Mark Wang
Bandwidth	22.9 °C, 51 %	DC 5V	Tim Lee
Output Power	22.9 °C, 51 %	DC 5V	Tim Lee
Power Spectral Density	22.9 °C, 51 %	DC 5V	Tim Lee
Antenna conducted Spurious Emission	22.9 °C, 51 %	DC 5V	Tim Lee

1.4 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

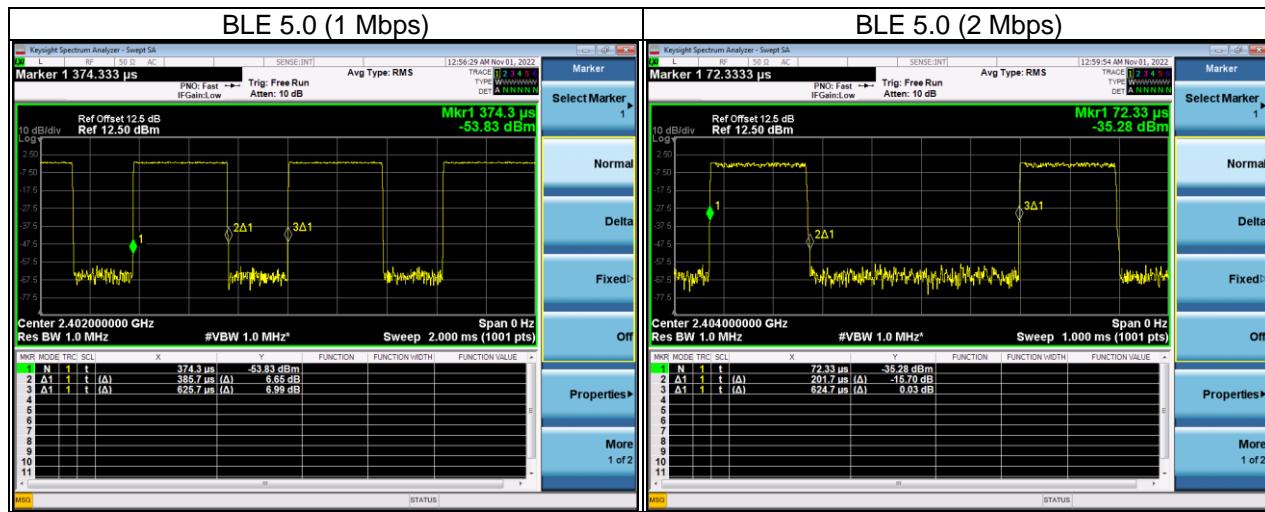
Test Software	AB1565/68 Lab Test Tool-3.2.2			
Modulation Mode	2402 MHz	2440 MHz	2480 MHz	Data Rate
BLE 5.0	52	52	52	1 Mbps
Modulation Mode	2404 MHz	2440 MHz	2478 MHz	Data Rate
BLE 5.0	52	52	52	2 Mbps

1.5 DUTY CYCLE

If duty cycle is $\geq 98\%$, duty factor is not required.

If duty cycle is $< 98\%$, duty factor shall be considered.

Remark	Delta 1			Delta 2	On Time/Period	10 log(1/Duty Cycle)
Mode	ON (ms)	Numbers (ON)	On Time (B) (ms)	Period (ON+OFF) (ms)	Duty Cycle (%)	Duty Factor (dB)
BLE 5.0 (1 Mbps)	0.386	1	0.386	0.626	61.64%	2.10
BLE 5.0 (2 Mbps)	0.202	1	0.202	0.625	32.29%	4.91



2 GENERAL INFORMATION

2.1 DESCRIPTION OF EUT

Equipment	Maxwell headset
Model Name	Maxwell
Brand Name	Audeze LLC
Model Difference	N/A
Power Source	Battery supplied.
Power Rating	5V—1.8A
Products Covered	2 * Maxwell Dongle: (1) Audeze LLC / Maxwell-X (2) Audeze LLC / Maxwell-P 1 * MIC 1 * USB Type C Cable 1 * 3.5mm Cable 1 * USB Type C to A Cable
Operation Band	2400 MHz ~ 2483.5 MHz
Operation Frequency	1 Mbps: 2402 MHz ~ 2480 MHz 2 Mbps: 2404 MHz ~ 2478 MHz
Modulation Technology	GFSK
Transfer Rate	1/2Mbps
Output Power Max.	1 Mbps: 4.80 dBm (0.0030 W) 2 Mbps: 4.35 dBm (0.0027 W)
Test Model	Maxwell
Sample Status	Engineering Sample
EUT Modification(s)	N/A

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:
BLE 5.0 (1 Mbps)

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

BLE (2 Mbps)

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

(3) Table for Filed Antenna

Ant.	Manufacturer	Model number	Type	Connector	Frequency (MHz)	Gain (dBi)
1	Ampacs Corporation	Maxwell_RX_Printed_ANT	PIFA	N/A	2400-2485	0.5

(4) 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	Normal/Idle	-	-
Transmitter Radiated Emissions (below 1GHz)	1 Mbps	39	-
Transmitter Radiated Emissions (above 1GHz)	1 Mbps	00/39	Bandedge
	2 Mbps	01/38	
	1 Mbps	00/19/39	Harmonic
	2 Mbps	01/19/38	
Bandwidth	1 Mbps	00/19/39	-
	2 Mbps	01/19/38	
Output Power	1 Mbps	00/19/39	-
	2 Mbps	01/19/38	
Power Spectral Density	1 Mbps	00/19/39	-
	2 Mbps	01/19/38	
Antenna conducted Spurious Emission	1 Mbps	00/19/39	-
	2 Mbps	01/19/38	

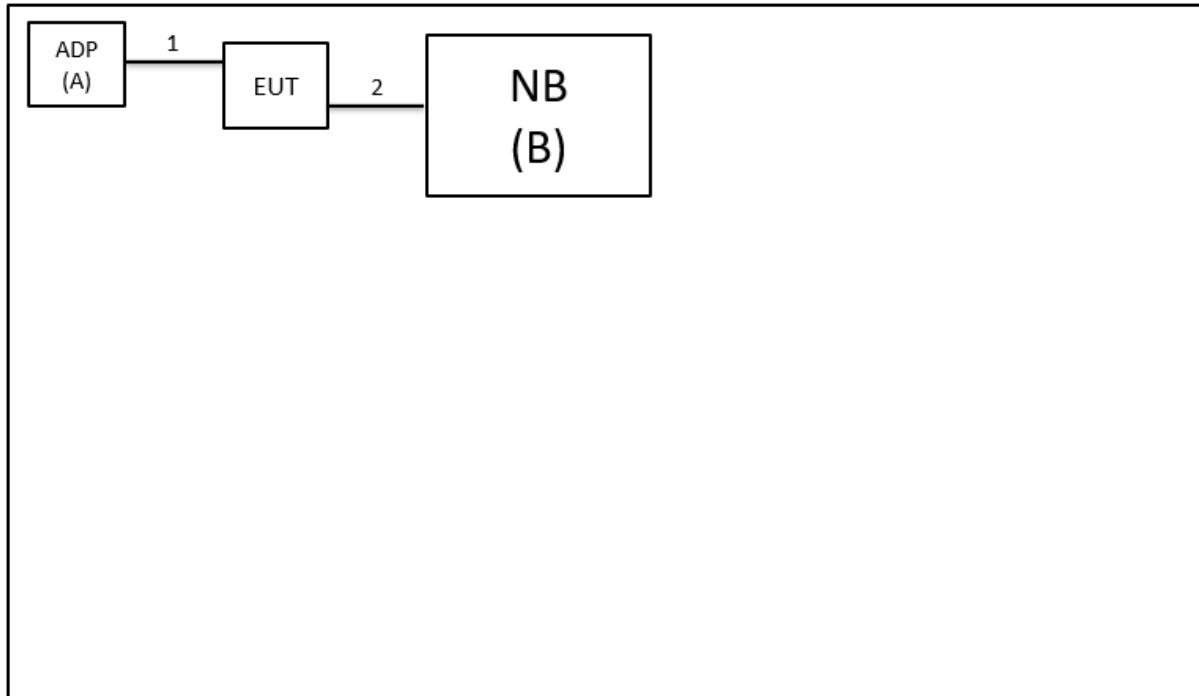
NOTE:

- (1) For radiated emission band edge test, both Vertical and Horizontal are evaluated, but only the worst case (Horizontal) is recorded.
- (2) All X, Y and Z axes are evaluated, but only the worst case (X axis) is recorded.

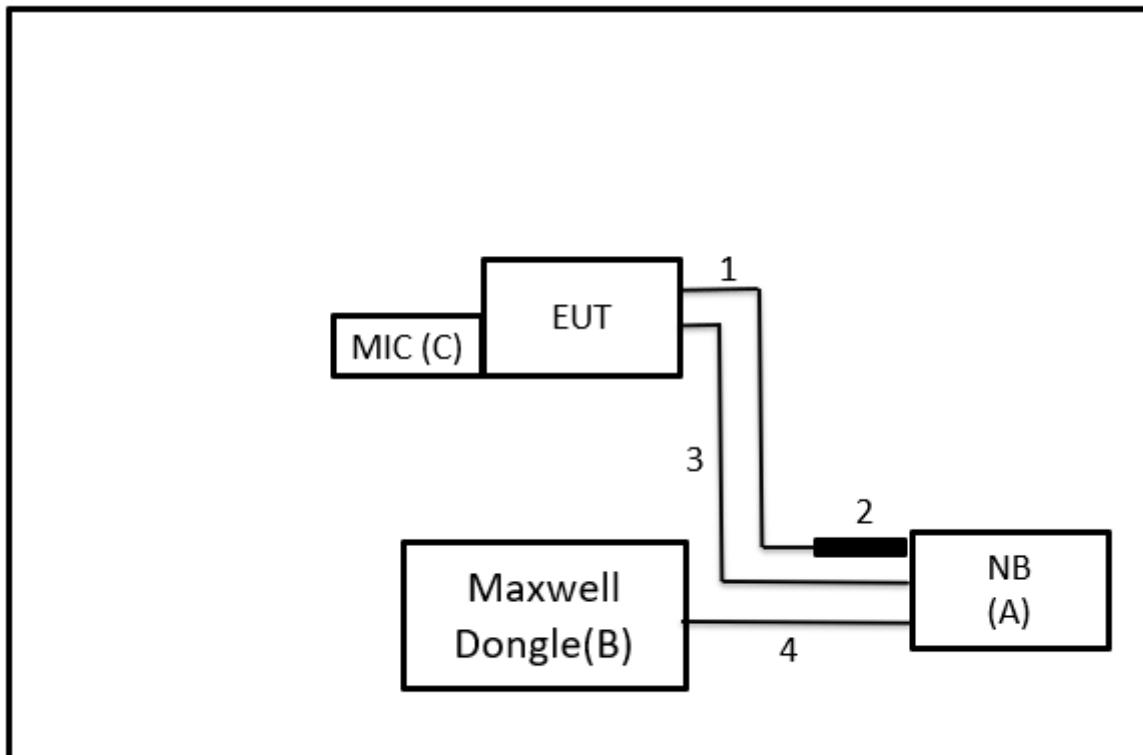
2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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

AC power line conducted emissions

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	ADP	SAMSUNG	EP-TA800	R37M9EDVX51SE3	Furnished by test lab.
B	NB	HP	TPN-I119	N/A	Furnished by test lab.

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
1	N/A	N/A	1.5M	USB C Cable	Supplied by test requester.
2	N/A	N/A	1.2M	AUX Cable	Supplied by test requester.

Radiated Emissions

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	NB	HP	TPN-I119	N/A	Furnished by test lab.
B	Maxwell Dongle	Audeze LLC	Maxwell-P	N/A	Supplied by test requester.
C	MIC	Primo	EM271Y	N/A	Supplied by test requester.

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
1	N/A	N/A	1.55m	USB Type C Cable	Supplied by test requester.
2	N/A	N/A	31.5cm	USB Type C to A Cable	Supplied by test requester.
3	N/A	N/A	1.27m	3.5mm Cable	Supplied by test requester.
4	N/A	N/A	31.5cm	USB Type C to A Cable	Supplied by test requester.

3 AC POWER LINE CONDUCTED EMISSIONS TEST

3.1 LIMIT

Frequency (MHz)	Limit (dB μ V)	
	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/50 μ H 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.

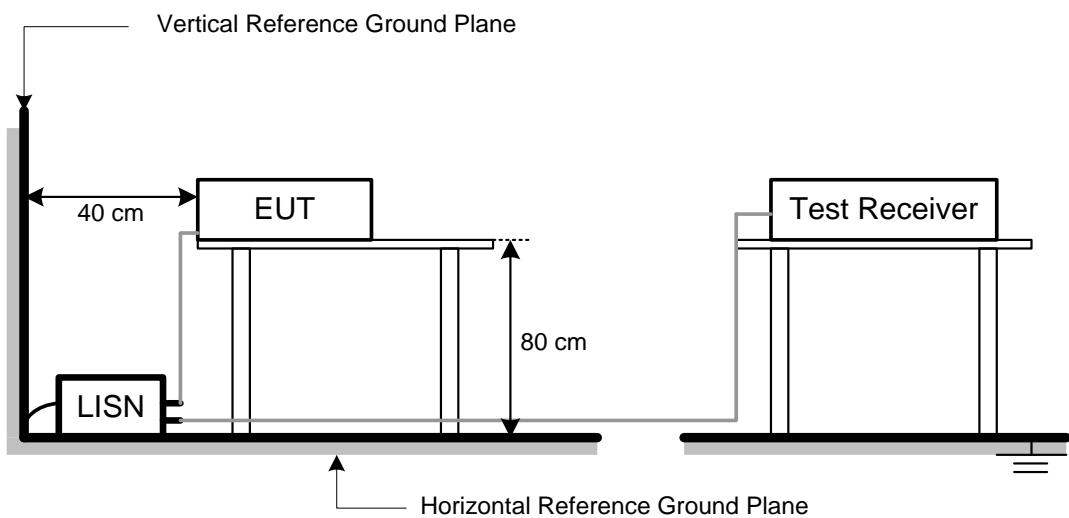
NOTE:

- (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 DEVIATION FROM TEST STANDARD

No deviation.

3.4 TEST SETUP



3.5 TEST RESULT

Please refer to the APPENDIX A.

4 RADIATED EMISSIONS TEST

4.1 LIMIT

In case the emission fall 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

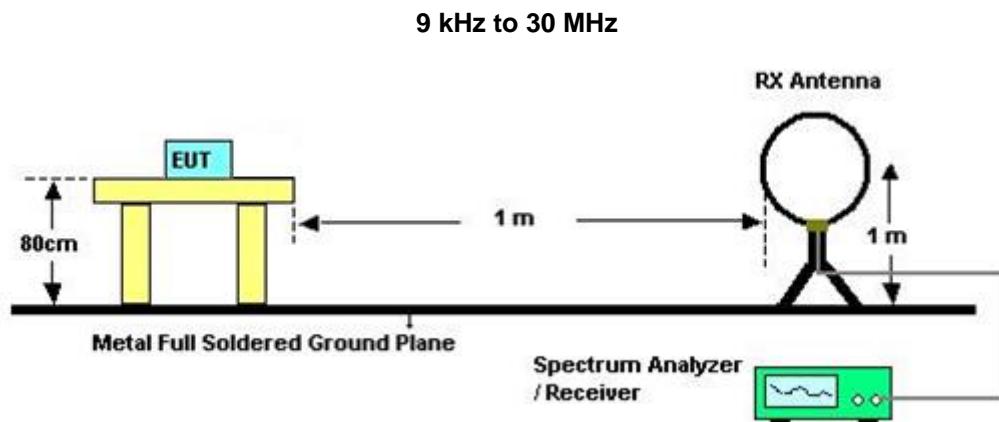
4.2 TEST PROCEDURE

- 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 DEVIATION FROM TEST STANDARD

No deviation.

4.4 TEST SETUP



4.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.6 TEST RESULT – BELOW 30 MHZ

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

4.7 TEST RESULT – 30 MHZ TO 1 GHZ

Please refer to the APPENDIX B.

4.8 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

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 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP



5.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

5.6 TEST RESULTS

Please refer to the APPENDIX D.

6 OUTPUT POWER TEST

6.1 APPLIED PROCEDURES / LIMIT

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 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

Please refer to the APPENDIX E.

7 POWER SPECTRAL DENSITY TEST

7.1 APPLIED PROCEDURES / LIMIT

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

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

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

7.6 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 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

8.6 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	TWO-LINE V-NETWORK	R&S	ENV216	101497	2022/5/13	2023/5/12
2	Test Cable	EMCI	EMCCFD300-BM-BMR-5000	170501	2022/8/3	2023/8/2
3	EMI Test Receiver	R&S	ESR3	102950	2022/4/12	2023/4/11
4	Measurement Software	EZ	EZ_EMC (Version NB-03A1-01)	N/A	N/A	N/A

Radiated Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Preamplifier	EMCI	EMC330N	980850	2022/9/19	2023/9/18
2	Preamplifier	EMCI	EMC118A45SE	980819	2022/3/8	2023/3/7
3	Preamplifier	EMCI	EMC184045SE	980882	2022/2/9	2023/2/8
4	Preamplifier	EMCI	EMC001340	980555	2022/4/6	2023/4/5
5	Test Cable	EMCI	EMC104-SM-SM-1000	220319	2022/3/15	2023/3/14
6	Test Cable	EMCI	EMC104-SM-SM-3000	220322	2022/3/15	2023/3/14
7	Test Cable	EMCI	EMC104-SM-SM-7000	220324	2022/3/15	2023/3/14
8	EXA Signal Analyzer	keysight	N9020B	MY57120120	2022/3/7	2023/3/6
9	Loop Ant	Electro-Metrics	EMCI-LPA600	274	2022/6/16	2023/6/15
10	Horn Antenna	RFSPIN	DRH18-E	211202A18EN	2022/5/18	2023/5/17
11	Horn Ant	Schwarzbeck	BBHA 9170D	1136	2022/5/18	2023/5/17
12	Log-bicon Antenna	Schwarzbeck	VULB9168	1369	2022/5/20	2023/5/19
13	6dB Attenuator	EMCI	EMCI-N-6-06	AT-N0625	2022/5/20	2023/5/19
14	Measurement Software	EZ	EZ_EMC (Version NB-03A1-01)	N/A	N/A	N/A

Bandwidth						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	Keysight	N9010A	MY54200240	2022/6/9	2023/6/8

Output Power						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Power Meter	Anritsu	ML2495A	1128008	2022/6/1	2023/5/31
2	Power Sensor	Anritsu	MA2411B	1126001	2022/6/1	2023/5/31

Power Spectral Density						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	Keysight	N9010A	MY54200240	2022/6/9	2023/6/8

Antenna conducted Spurious Emission

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	Keysight	N9010A	MY54200240	2022/6/9	2023/6/8

Remark: (1) "N/A" denotes no model name, no serial no. or no calibration specified.
(2) All calibration period of equipment list is one year.

10 EUT TEST PHOTO

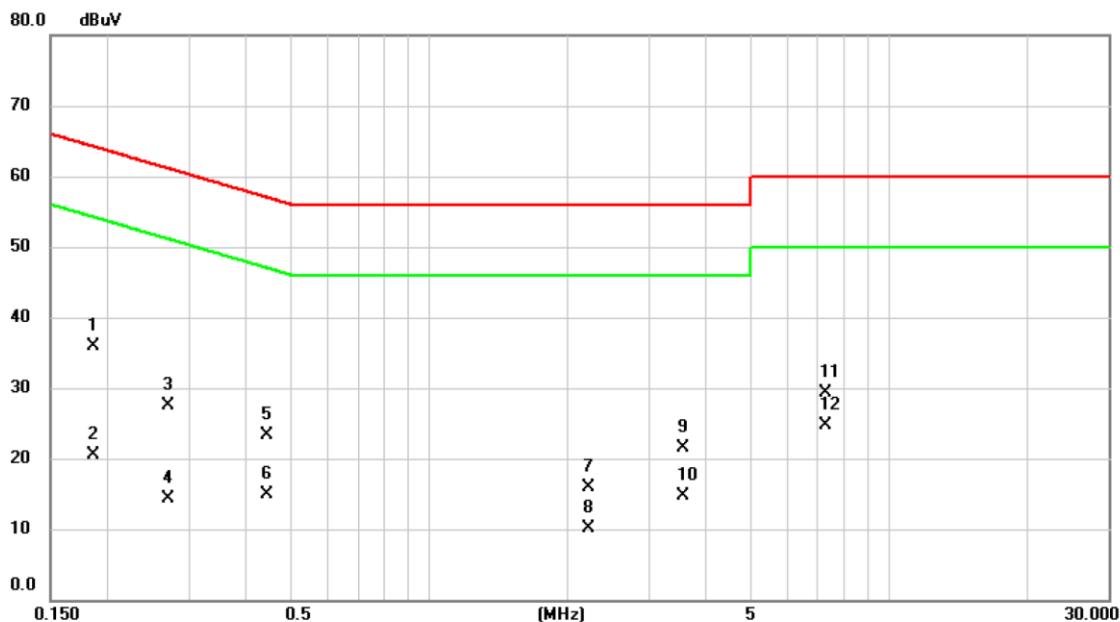
Please refer to document Appendix No.: TP-2209T130-FCCP-1 (APPENDIX-TEST PHOTOS).

11 EUT PHOTOS

Please refer to document Appendix No.: EP-2209T130-1 (APPENDIX-EUT PHOTOS).

APPENDIX A AC POWER LINE CONDUCTED EMISSIONS

Test Mode	Normal	Tested Date	2022/10/24
Test Frequency	-	Phase	Line

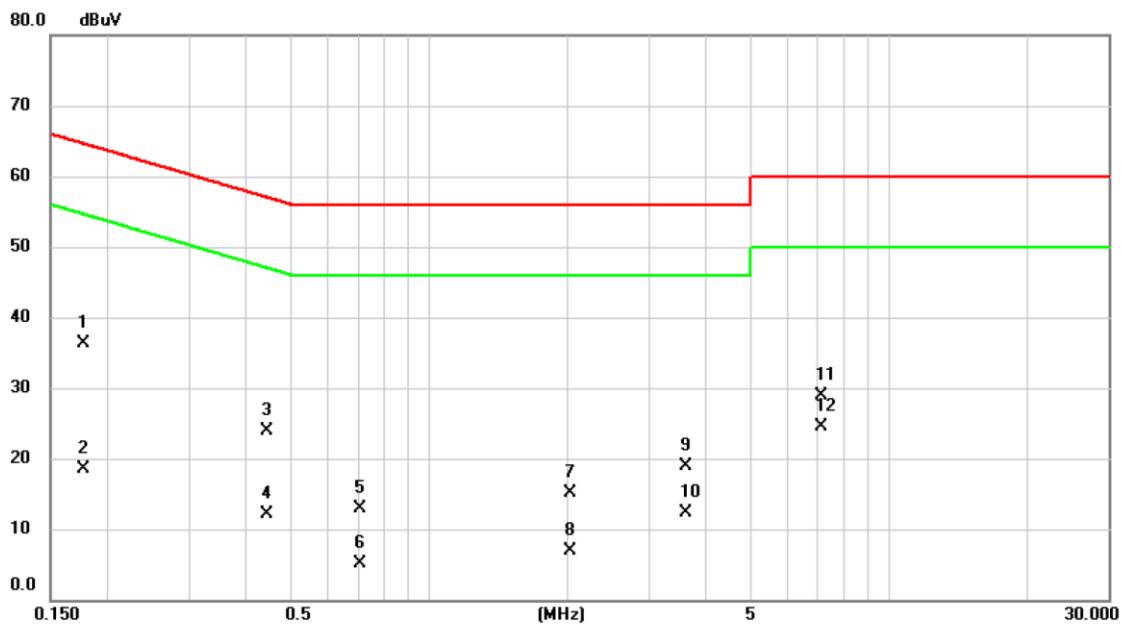


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Margin	
		MHz	dBuV	dB	dBuV	dB	Detector	Comment
1		0.1863	26.27	9.69	35.96	64.20	-28.24	QP
2		0.1863	10.78	9.69	20.47	54.20	-33.73	AVG
3		0.2714	17.76	9.69	27.45	61.07	-33.62	QP
4		0.2714	4.59	9.69	14.28	51.07	-36.79	AVG
5		0.4447	13.62	9.69	23.31	56.97	-33.66	QP
6		0.4447	5.30	9.69	14.99	46.97	-31.98	AVG
7		2.2244	6.24	9.75	15.99	56.00	-40.01	QP
8		2.2244	0.41	9.75	10.16	46.00	-35.84	AVG
9		3.5700	11.77	9.78	21.55	56.00	-34.45	QP
10		3.5700	4.93	9.78	14.71	46.00	-31.29	AVG
11		7.3027	19.37	9.85	29.22	60.00	-30.78	QP
12	*	7.3027	14.88	9.85	24.73	50.00	-25.27	AVG

REMARKS:

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

Test Mode	Normal	Tested Date	2022/10/24
Test Frequency	-	Phase	Neutral

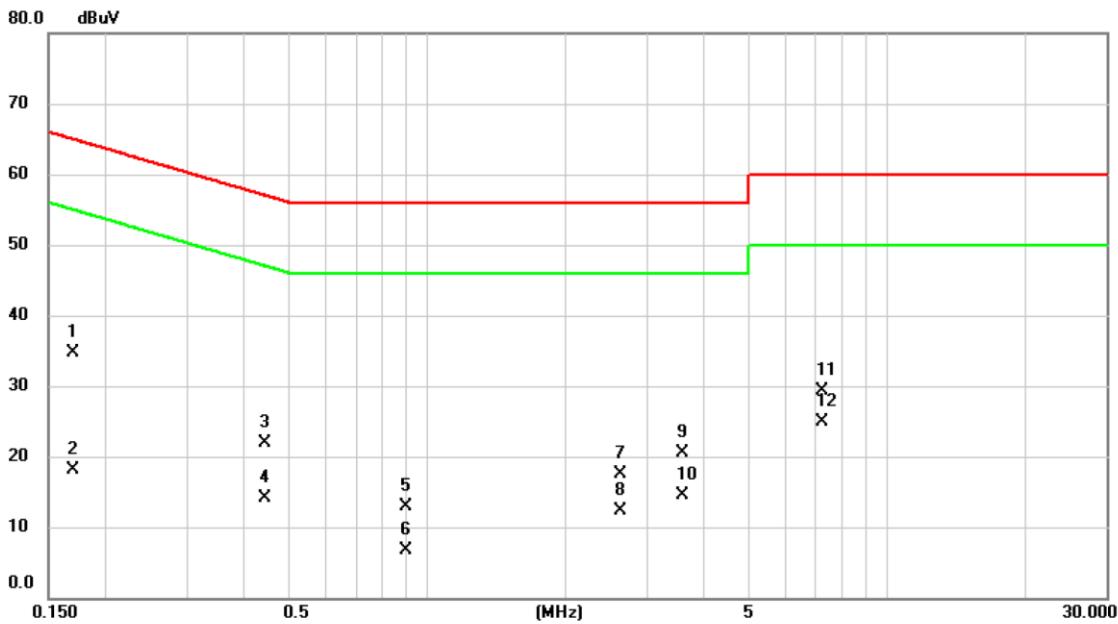


No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin	Detector	Comment
			Level	Factor	ment				
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1777	26.56	9.68	36.24	64.59	-28.35	QP	
2		0.1777	8.90	9.68	18.58	54.59	-36.01	AVG	
3		0.4425	14.14	9.69	23.83	57.01	-33.18	QP	
4		0.4425	2.37	9.69	12.06	47.01	-34.95	AVG	
5		0.7056	3.18	9.69	12.87	56.00	-43.13	QP	
6		0.7056	-4.61	9.69	5.08	46.00	-40.92	AVG	
7		2.0264	5.40	9.75	15.15	56.00	-40.85	QP	
8		2.0264	-2.91	9.75	6.84	46.00	-39.16	AVG	
9		3.6173	9.15	9.79	18.94	56.00	-37.06	QP	
10		3.6173	2.57	9.79	12.36	46.00	-33.64	AVG	
11		7.1048	19.14	9.86	29.00	60.00	-31.00	QP	
12 *		7.1048	14.58	9.86	24.44	50.00	-25.56	AVG	

REMARKS:

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

Test Mode	Idle	Tested Date	2022/10/24
Test Frequency	-	Phase	Line

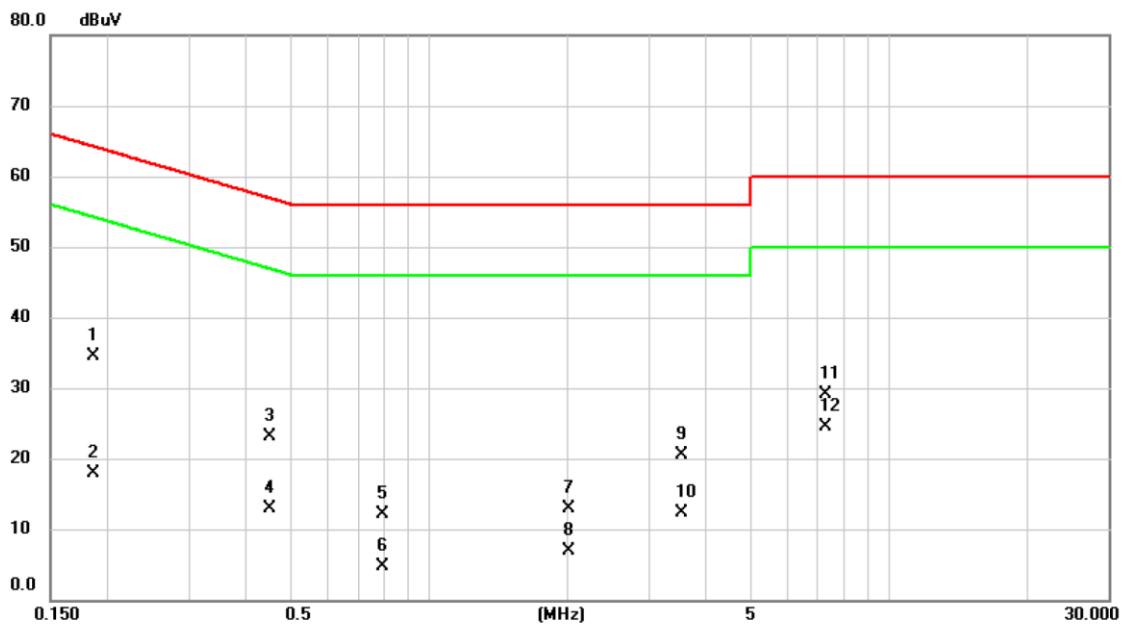


No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin	Detector	Comment
			Level	Factor	ment				
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1703	25.07	9.69	34.76	64.95	-30.19	QP	
2		0.1703	8.36	9.69	18.05	54.95	-36.90	AVG	
3		0.4447	12.21	9.69	21.90	56.97	-35.07	QP	
4		0.4447	4.45	9.69	14.14	46.97	-32.83	AVG	
5		0.9015	3.22	9.70	12.92	56.00	-43.08	QP	
6		0.9015	-2.92	9.70	6.78	46.00	-39.22	AVG	
7		2.6228	7.79	9.76	17.55	56.00	-38.45	QP	
8		2.6228	2.54	9.76	12.30	46.00	-33.70	AVG	
9		3.5858	10.77	9.78	20.55	56.00	-35.45	QP	
10		3.5858	4.80	9.78	14.58	46.00	-31.42	AVG	
11		7.2330	19.43	9.85	29.28	60.00	-30.72	QP	
12	*	7.2330	15.03	9.85	24.88	50.00	-25.12	AVG	

REMARKS:

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

Test Mode	Idle	Tested Date	2022/10/24
Test Frequency	-	Phase	Neutral



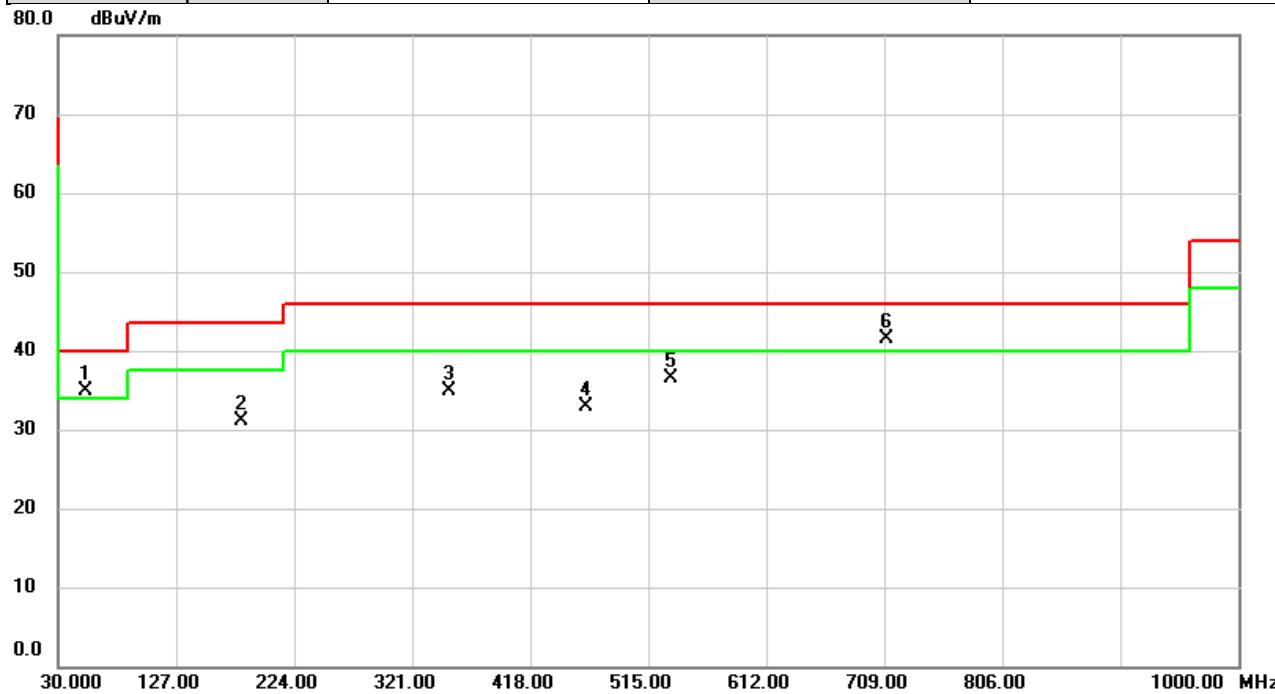
No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin	Detector	Comment
			Level	Factor	ment				
MHz		dBuV	dB	dBuV	dBuV	dB			
1	0.1863	24.82	9.68	34.50	64.20	-29.70	QP		
2	0.1863	8.18	9.68	17.86	54.20	-36.34	AVG		
3	0.4492	13.50	9.69	23.19	56.89	-33.70	QP		
4	0.4492	3.12	9.69	12.81	46.89	-34.08	AVG		
5	0.7934	2.40	9.69	12.09	56.00	-43.91	QP		
6	0.7934	-5.08	9.69	4.61	46.00	-41.39	AVG		
7	2.0107	3.25	9.75	13.00	56.00	-43.00	QP		
8	2.0107	-2.77	9.75	6.98	46.00	-39.02	AVG		
9	3.5407	10.78	9.78	20.56	56.00	-35.44	QP		
10	3.5407	2.45	9.78	12.23	46.00	-33.77	AVG		
11	7.2555	19.16	9.86	29.02	60.00	-30.98	QP		
12 *	7.2555	14.67	9.86	24.53	50.00	-25.47	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 (1 Mbps)	Test Date	2023/1/17
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	!	52.7303	46.28	-11.37	34.91	40.00	-5.09	peak	
2		180.9643	44.69	-13.51	31.18	43.50	-12.32	peak	
3		351.3933	45.28	-10.32	34.96	46.00	-11.04	peak	
4		463.4607	40.01	-7.16	32.85	46.00	-13.15	peak	
5		533.2037	42.48	-5.91	36.57	46.00	-9.43	peak	
6	*	711.4897	44.14	-2.57	41.57	46.00	-4.43	peak	

REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2023/1/17
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%



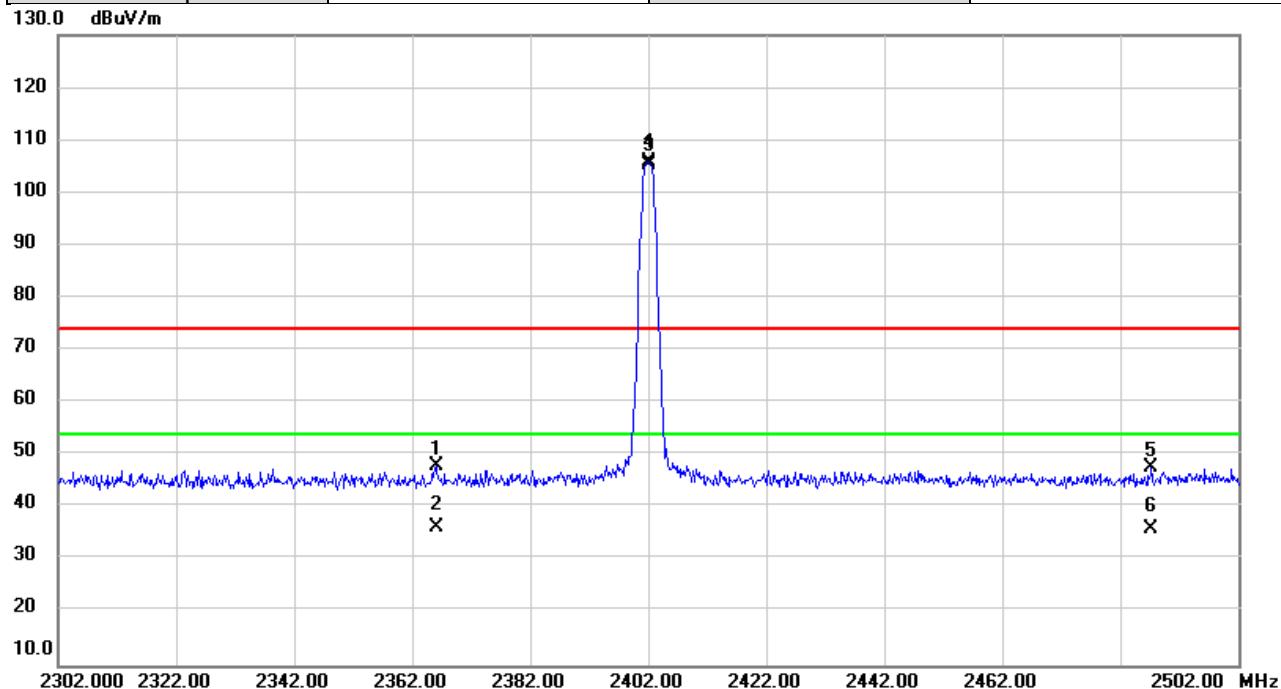
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector Comment
1	!	45.0673	46.36	-11.29	35.07	40.00	-4.93	peak
2		180.8350	48.90	-13.49	35.41	43.50	-8.09	peak
3		283.7843	43.55	-11.79	31.76	46.00	-14.24	peak
4		351.6197	48.11	-10.31	37.80	46.00	-8.20	peak
5		530.9727	39.72	-5.94	33.78	46.00	-12.22	peak
6	*	711.7483	47.41	-2.57	44.84	46.00	-1.16	peak

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	2022/10/25
Test Frequency	2402MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

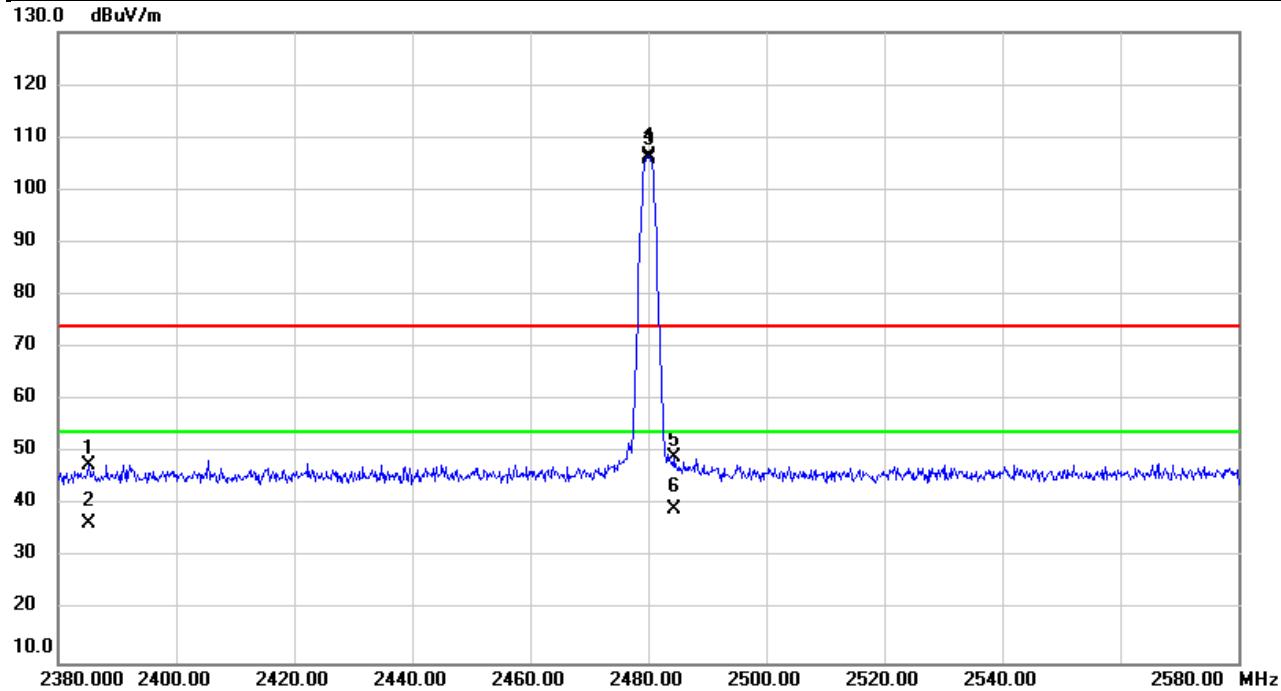


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector Comment
1		2366.007	53.75	-5.80	47.95	74.00	-26.05	peak
2		2366.007	42.17	-5.80	36.37	54.00	-17.63	AVG
3	X	2402.000	111.62	-5.75	105.87	74.00	31.87	peak NoLimit
4	*	2402.000	111.00	-5.75	105.25	54.00	51.25	AVG NoLimit
5		2487.333	53.29	-5.63	47.66	74.00	-26.34	peak
6		2487.333	41.71	-5.63	36.08	54.00	-17.92	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	2022/10/25
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

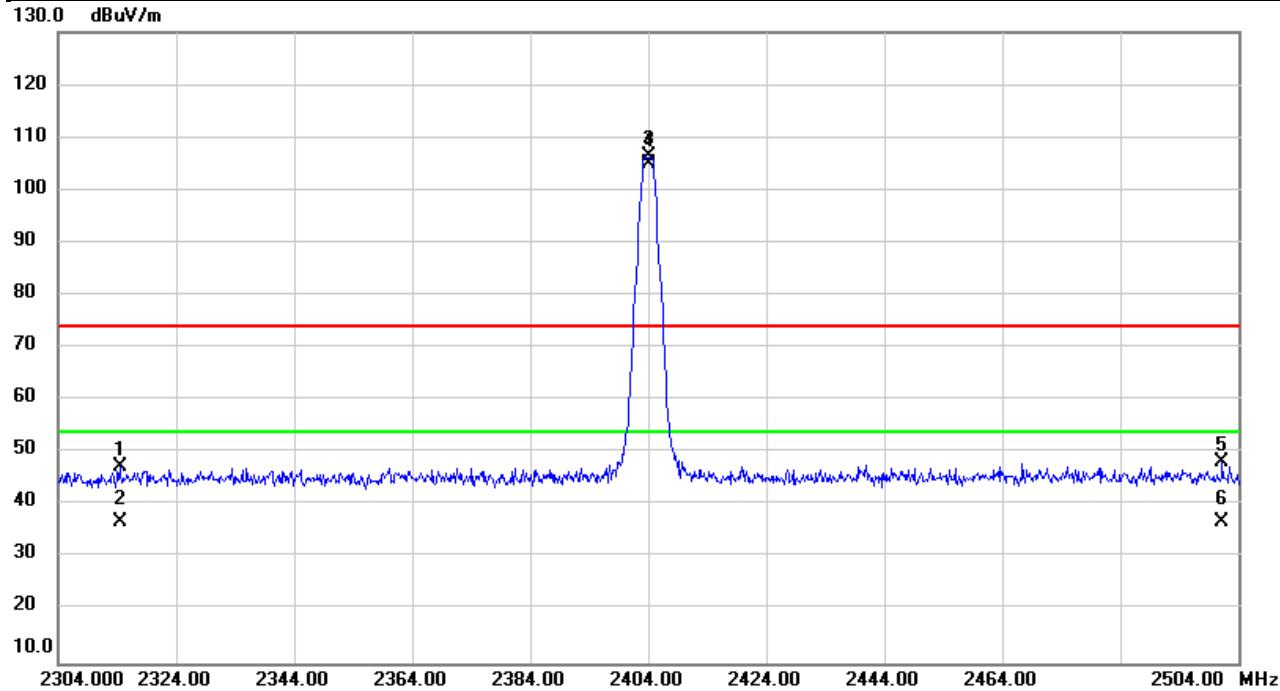


No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level						
MHz		dBuV	dB	dBuV/m	dBuV/m	dB			
1		2385.267	53.28	-5.77	47.51	74.00	-26.49	peak	
2		2385.267	42.46	-5.77	36.69	54.00	-17.31	AVG	
3	X	2480.000	111.99	-5.65	106.34	74.00	32.34	peak	NoLimit
4	*	2480.000	111.41	-5.65	105.76	54.00	51.76	AVG	NoLimit
5		2484.340	54.86	-5.65	49.21	74.00	-24.79	peak	
6		2484.340	44.91	-5.65	39.26	54.00	-14.74	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	2022/10/25
Test Frequency	2404MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

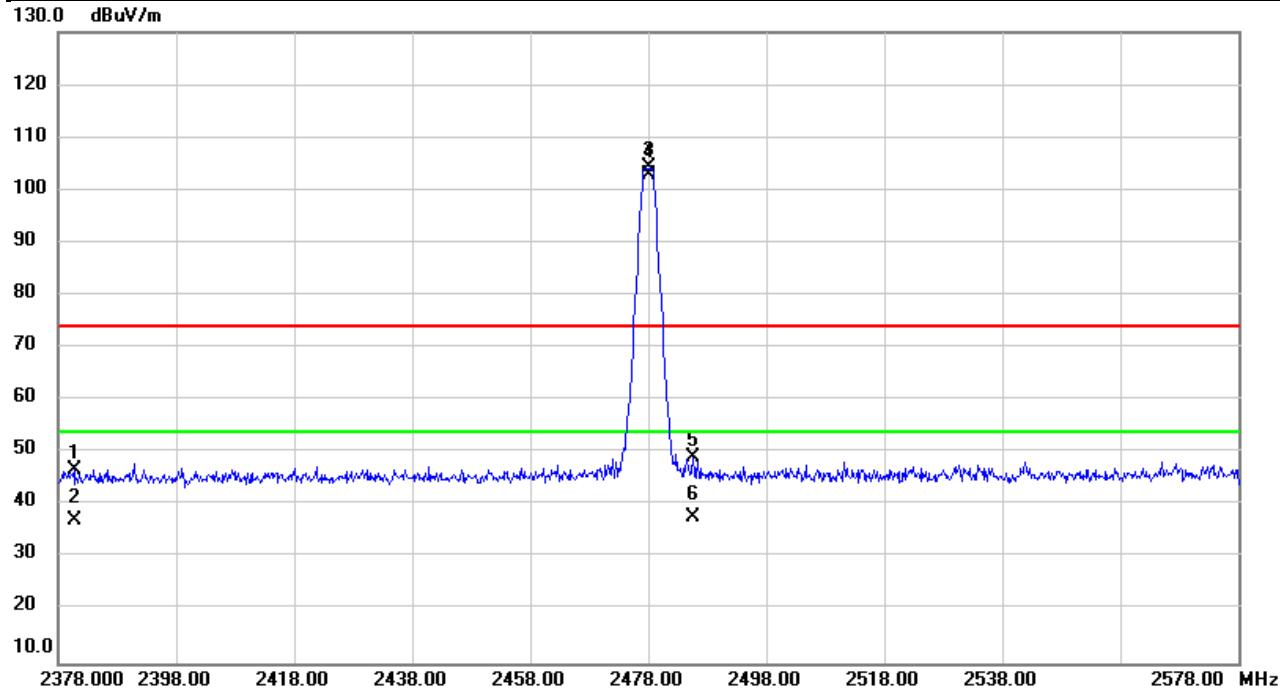


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector Comment
1		2314.447	53.10	-5.87	47.23	74.00	-26.77	peak
2		2314.447	42.74	-5.87	36.87	54.00	-17.13	AVG
3	X	2404.000	112.14	-5.75	106.39	74.00	32.39	peak NoLimit
4	*	2404.000	110.72	-5.75	104.97	54.00	50.97	AVG NoLimit
5		2501.267	53.79	-5.62	48.17	74.00	-25.83	peak
6		2501.267	42.45	-5.62	36.83	54.00	-17.17	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	2022/10/25
Test Frequency	2478MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

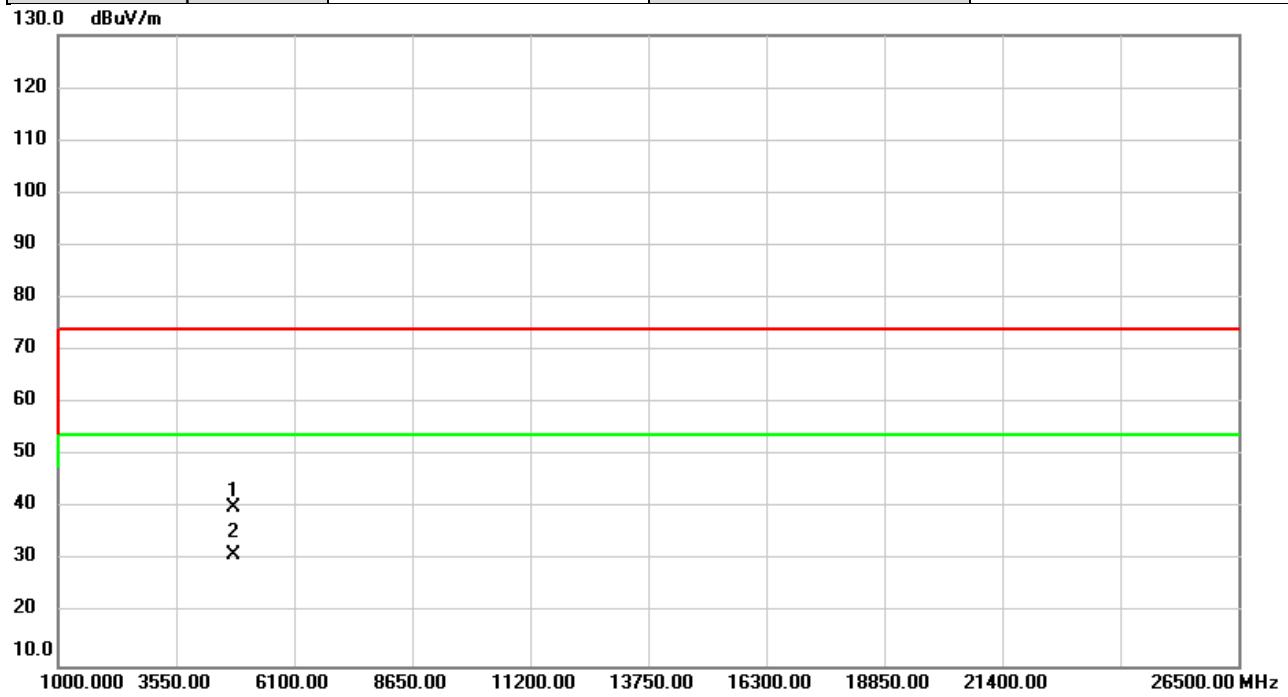


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector Comment
1		2380.740	52.67	-5.78	46.89	74.00	-27.11	peak
2		2380.740	42.99	-5.78	37.21	54.00	-16.79	AVG
3	X	2478.000	109.94	-5.65	104.29	74.00	30.29	peak NoLimit
4	*	2478.000	108.55	-5.65	102.90	54.00	48.90	AVG NoLimit
5		2485.593	54.93	-5.63	49.30	74.00	-24.70	peak
6		2485.593	43.46	-5.63	37.83	54.00	-16.17	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	2022/10/25
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	59%

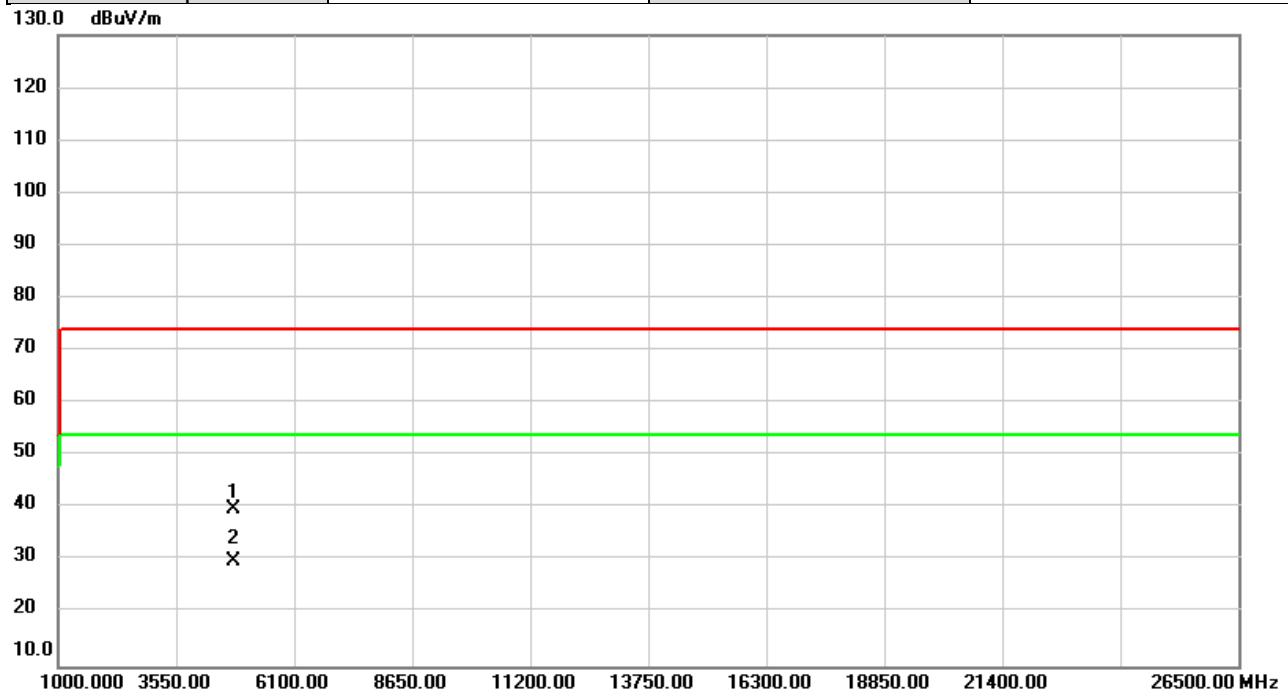


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4804.000	39.51	0.65	40.16	74.00	-33.84	peak
2	*	4804.000	30.65	0.65	31.30	54.00	-22.70	AVG

REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2022/10/25
Test Frequency	2402MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

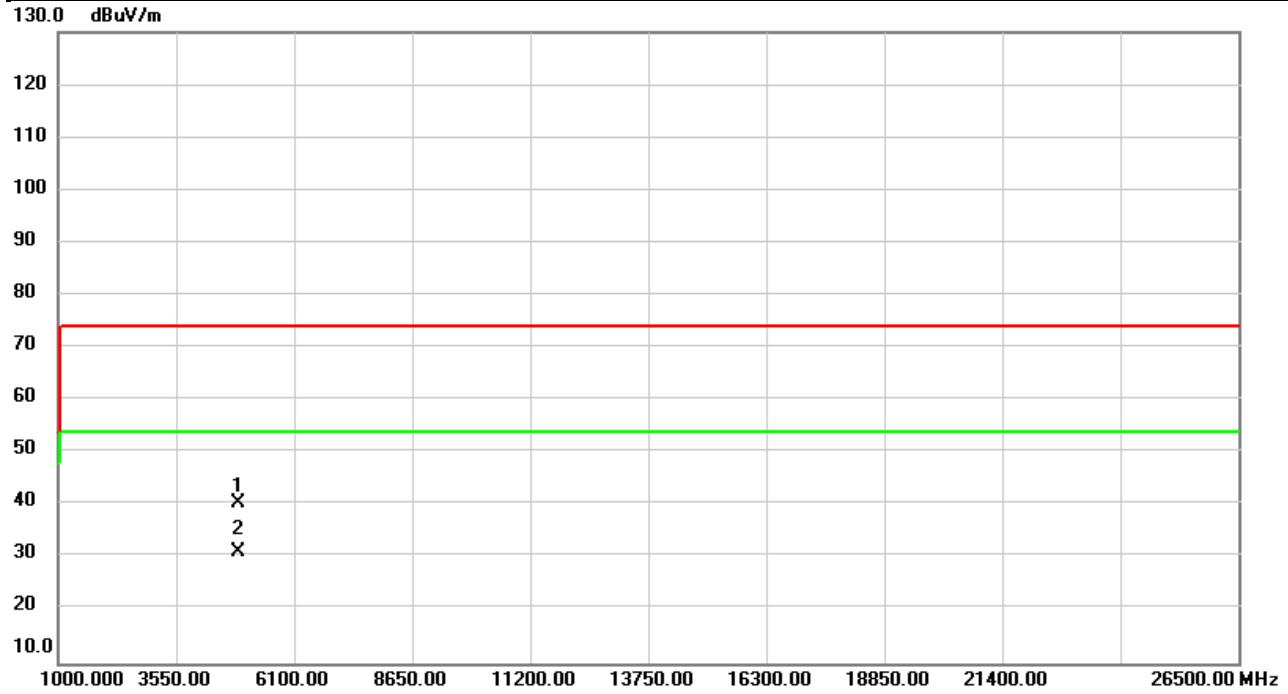


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4804.000	39.34	0.65	39.99	74.00	-34.01	peak
2	*	4804.000	29.23	0.65	29.88	54.00	-24.12	AVG

REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2022/10/25
Test Frequency	2440MHz	Polarization	Vertical
Temp	23°C	Hum.	59%

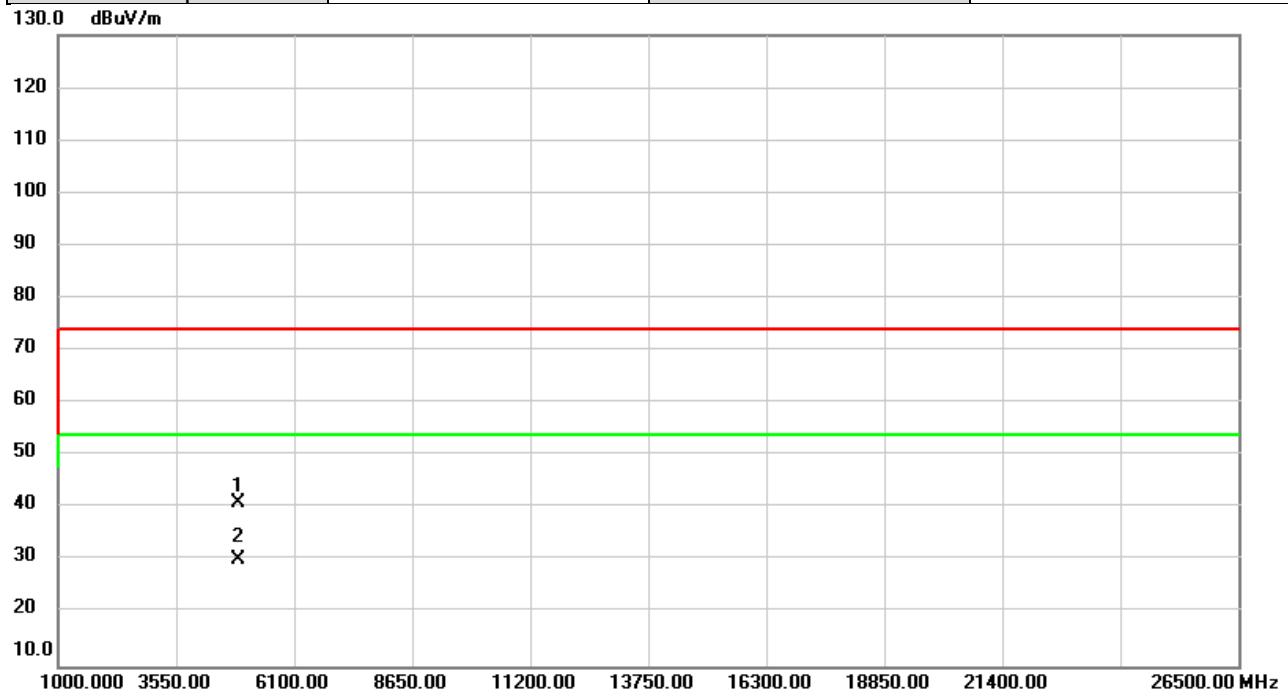


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4880.000	39.46	0.92	40.38	74.00	-33.62	peak
2	*	4880.000	30.10	0.92	31.02	54.00	-22.98	AVG

REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2022/10/25
Test Frequency	2440MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

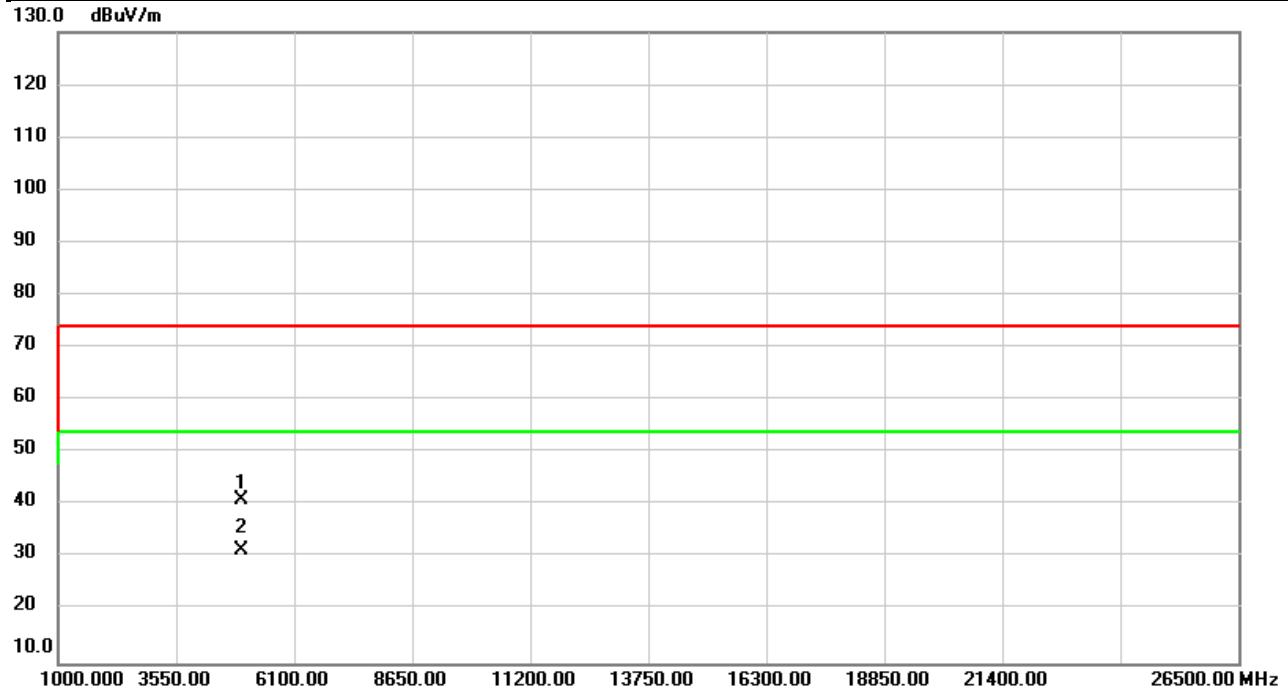


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	40.01	0.92	40.93	74.00	-33.07	peak	
2	*	4880.000	29.42	0.92	30.34	54.00	-23.66	AVG	

REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2022/10/25
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	59%

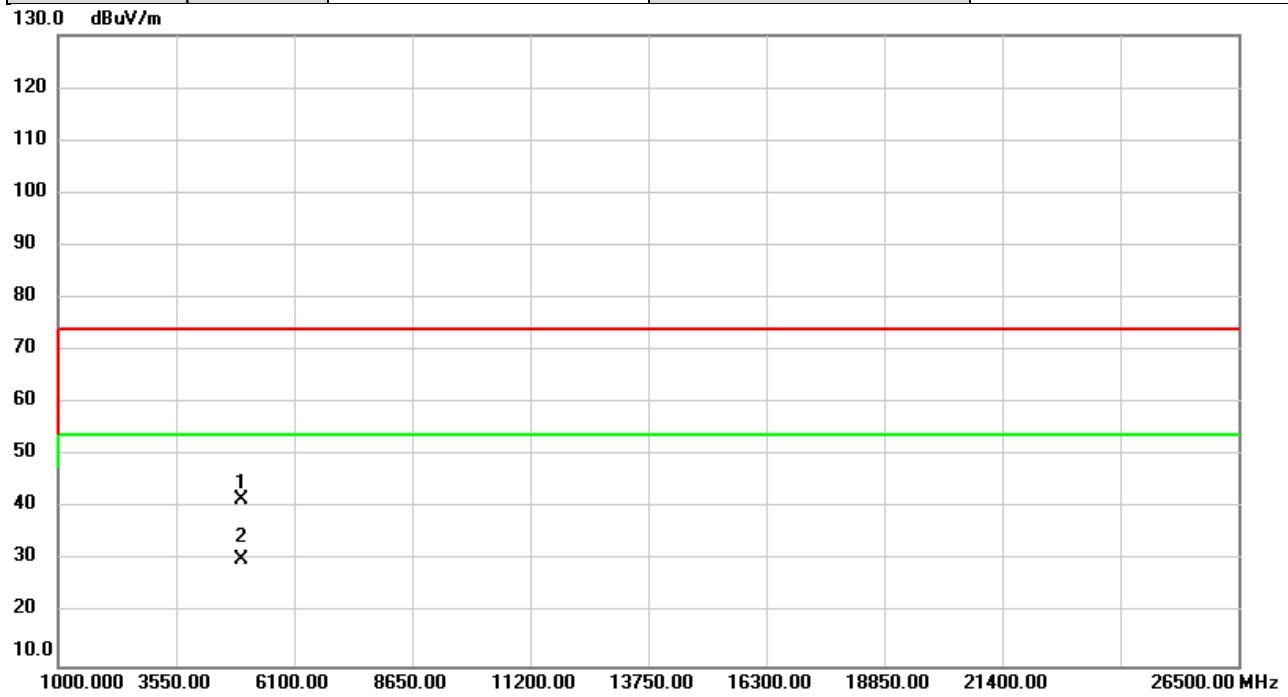


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4960.000	39.87	1.18	41.05	74.00	-32.95	peak
2	*	4960.000	30.26	1.18	31.44	54.00	-22.56	AVG

REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2022/10/25
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

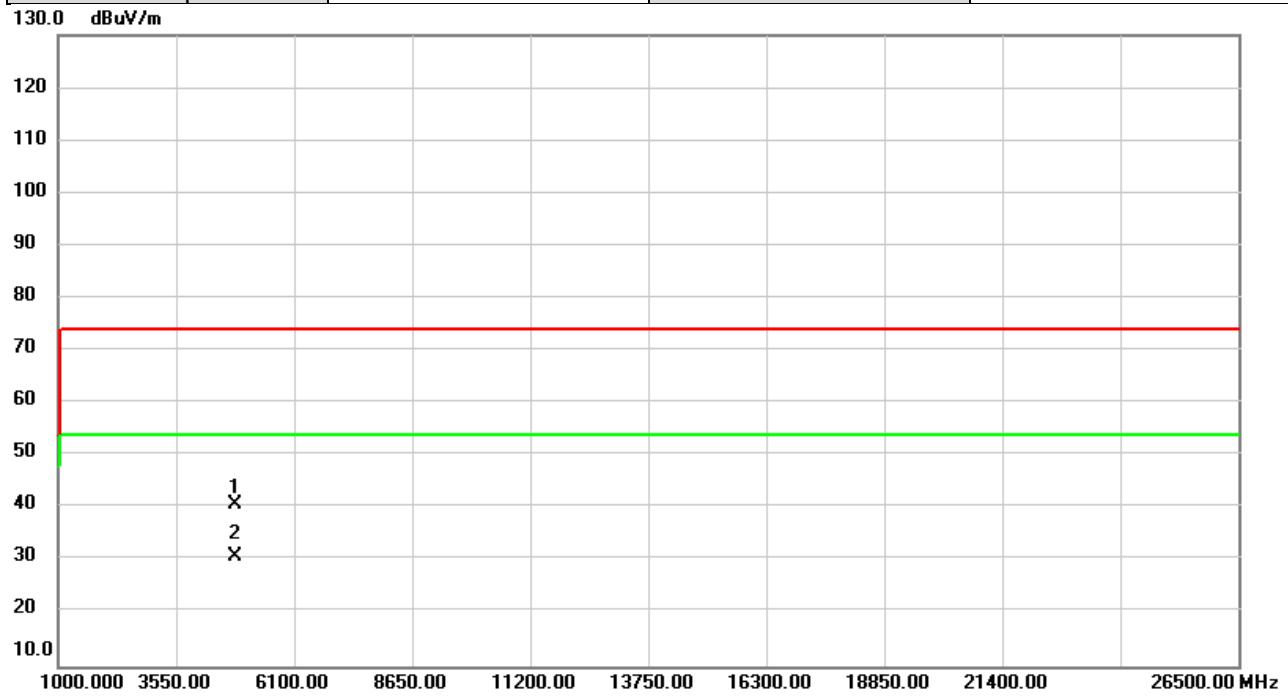


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4960.000	40.42	1.18	41.60	74.00	-32.40	peak
2	*	4960.000	29.01	1.18	30.19	54.00	-23.81	AVG

REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2022/10/25
Test Frequency	2404MHz	Polarization	Vertical
Temp	23°C	Hum.	59%

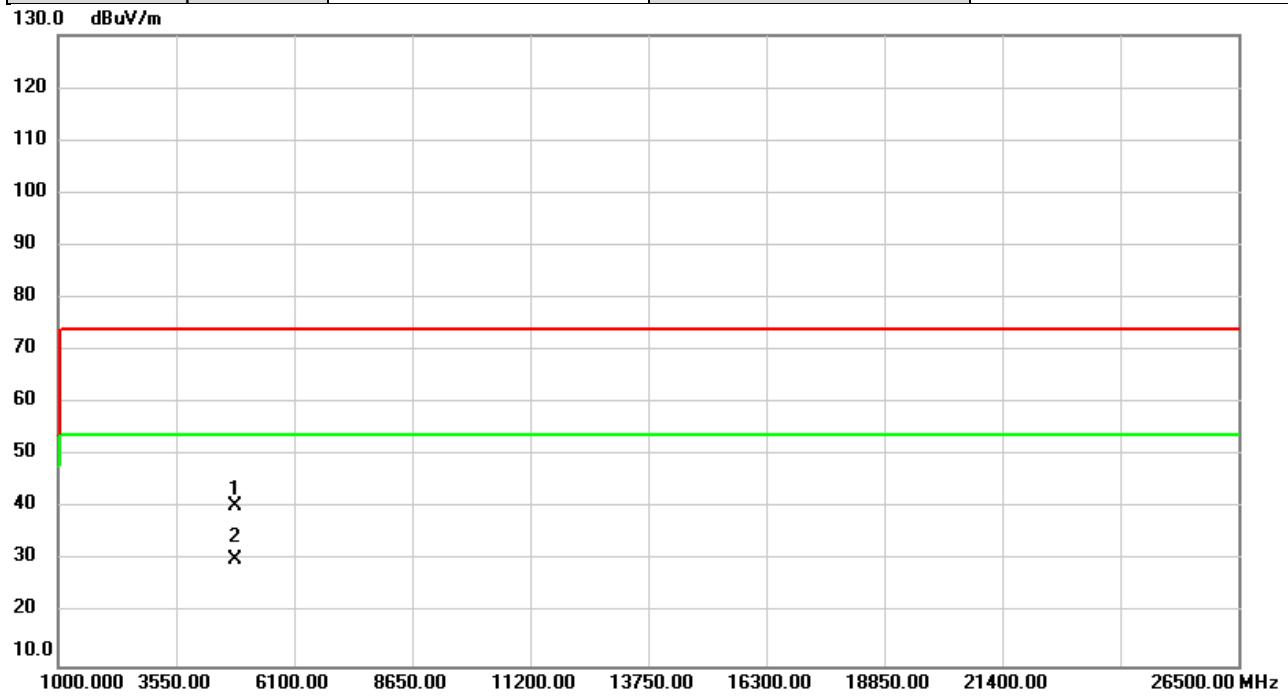


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4808.000	40.08	0.67	40.75	74.00	-33.25	peak
2	*	4808.000	30.30	0.67	30.97	54.00	-23.03	AVG

REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2022/10/25
Test Frequency	2404MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

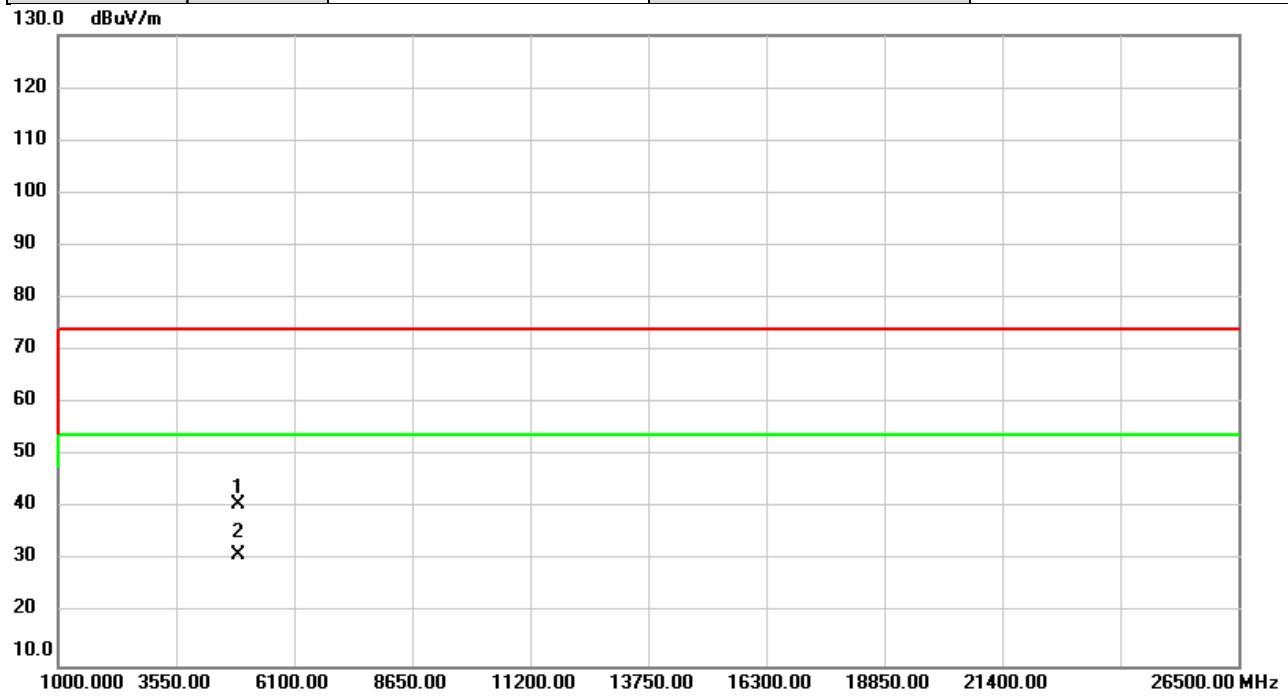


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4808.000	39.68	0.67	40.35	74.00	-33.65	peak
2	*	4808.000	29.67	0.67	30.34	54.00	-23.66	AVG

REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2022/10/25
Test Frequency	2440MHz	Polarization	Vertical
Temp	23°C	Hum.	59%

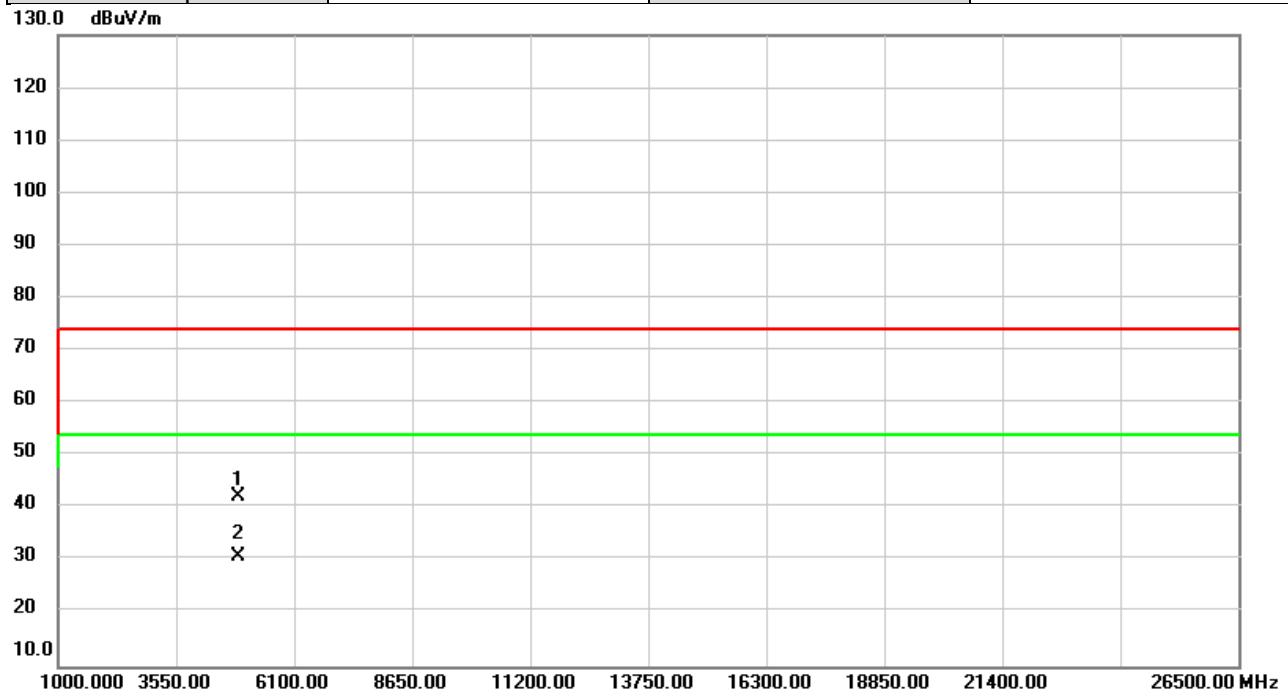


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4880.000	39.90	0.92	40.82	74.00	-33.18	peak
2	*	4880.000	30.33	0.92	31.25	54.00	-22.75	AVG

REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2022/10/25
Test Frequency	2440MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

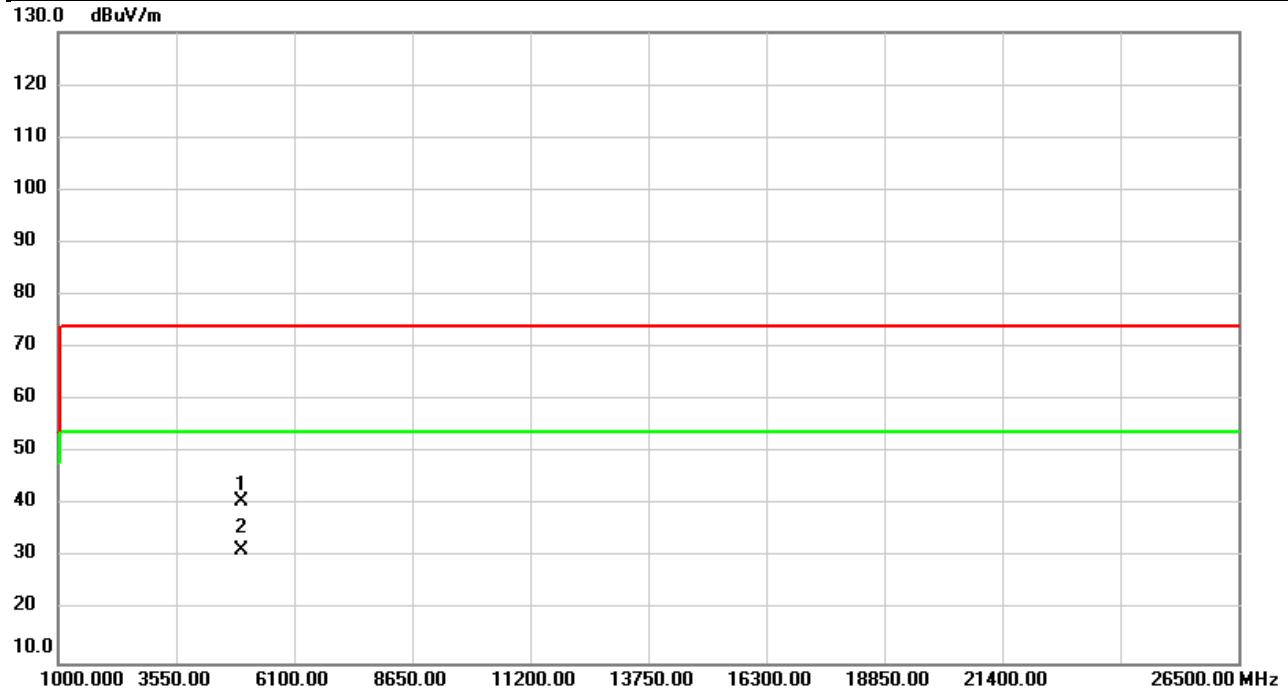


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4880.000	41.26	0.92	42.18	74.00	-31.82	peak
2	*	4880.000	29.92	0.92	30.84	54.00	-23.16	AVG

REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2022/10/25
Test Frequency	2478MHz	Polarization	Vertical
Temp	23°C	Hum.	59%

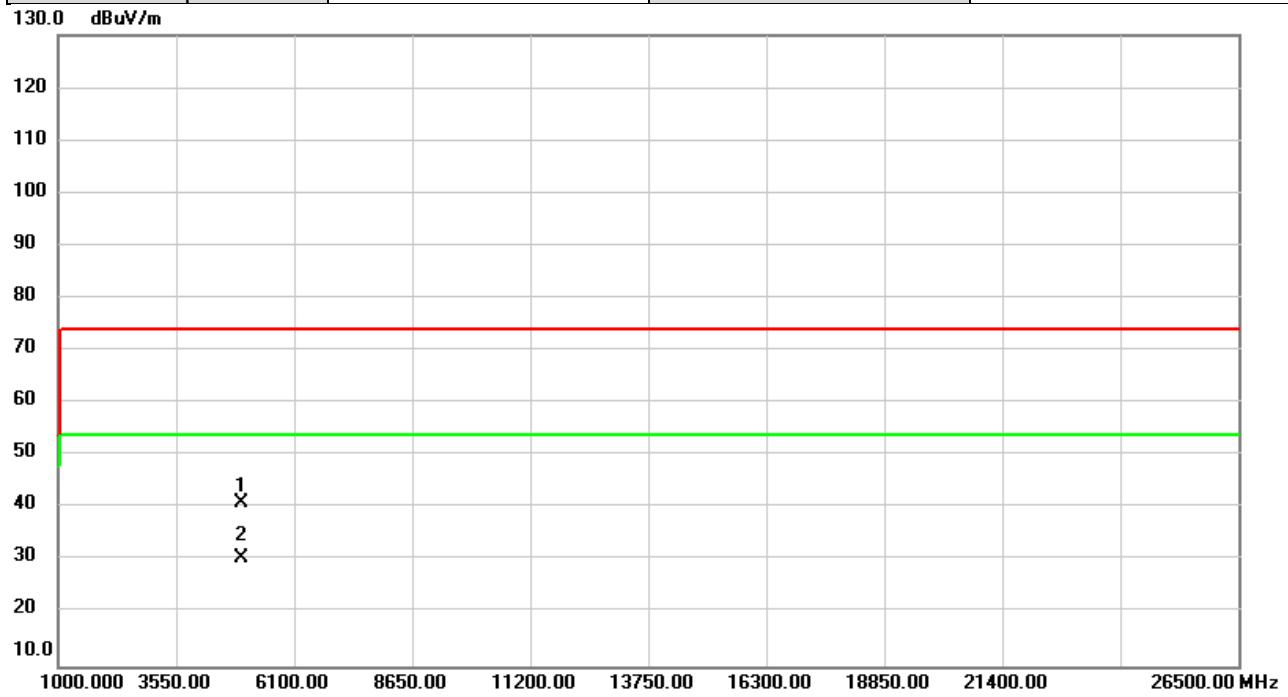


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4956.000	39.47	1.17	40.64	74.00	-33.36	peak
2	*	4956.000	30.25	1.17	31.42	54.00	-22.58	AVG

REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2022/10/25
Test Frequency	2478MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	Detector	Comment
1		4956.000	39.87	1.17	41.04	74.00	-32.96	peak
2	*	4956.000	29.41	1.17	30.58	54.00	-23.42	AVG

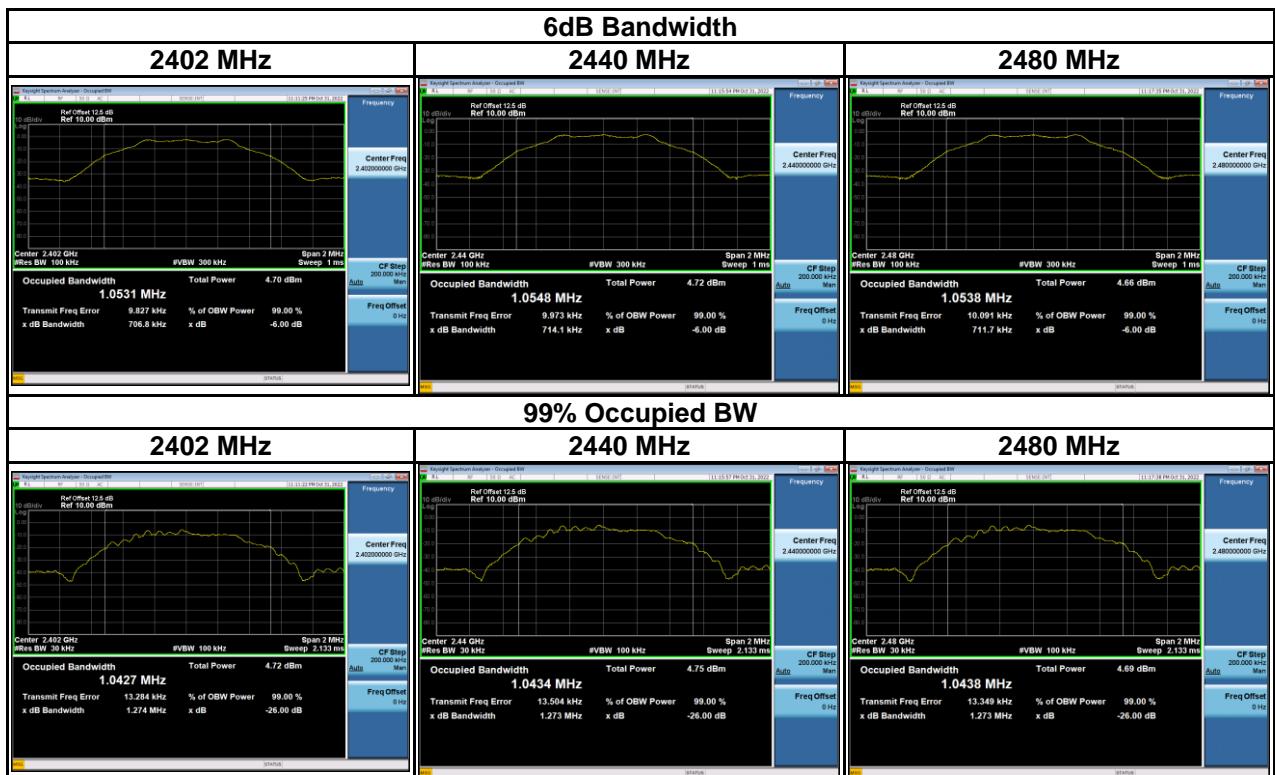
REMARKS:

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

APPENDIX D BANDWIDTH

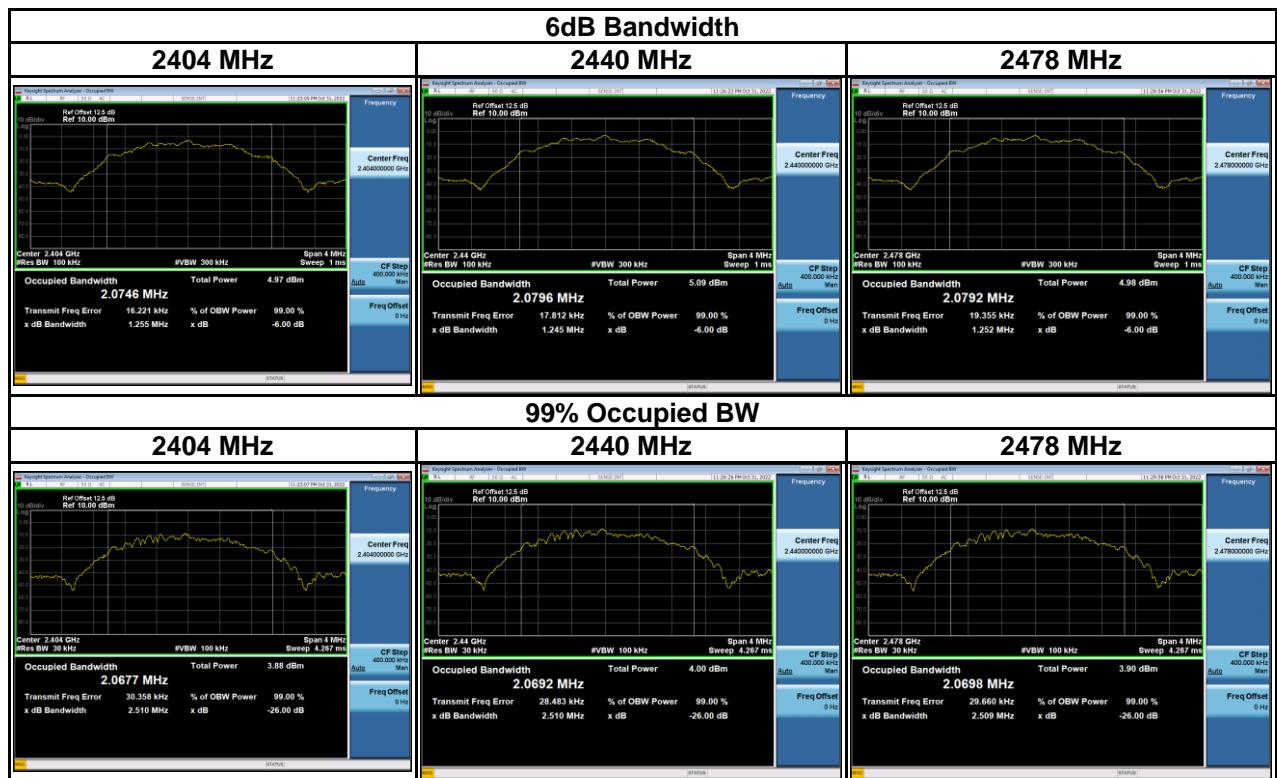
Test Mode:	BLE 5.0 (1 Mbps)
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Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.71	1.04	500	Pass
2440	0.71	1.04	500	Pass
2480	0.71	1.04	500	Pass



Test Mode	BLE 5.0 (2 Mbps)
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Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2404	1.26	2.07	500	Pass
2440	1.25	2.07	500	Pass
2478	1.25	2.07	500	Pass



APPENDIX E OUTPUT POWER

Test Mode	BLE 5.0 (1 Mbps)	Tested Date	2022/11/4
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Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	4.20	0.0026	30.00	1.0000	Pass
2440	4.80	0.0030	30.00	1.0000	Pass
2480	3.91	0.0025	30.00	1.0000	Pass

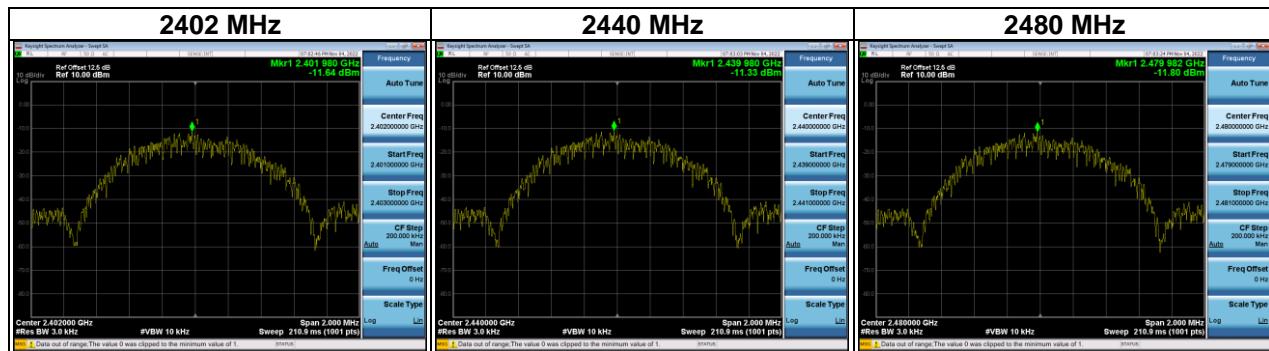
Test Mode	BLE 5.0 (2 Mbps)	Tested Date	2022/11/4
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Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2404	4.24	0.0027	30.00	1.0000	Pass
2440	4.35	0.0027	30.00	1.0000	Pass
2478	3.92	0.0025	30.00	1.0000	Pass

APPENDIX F POWER SPECTRAL DENSITY TEST

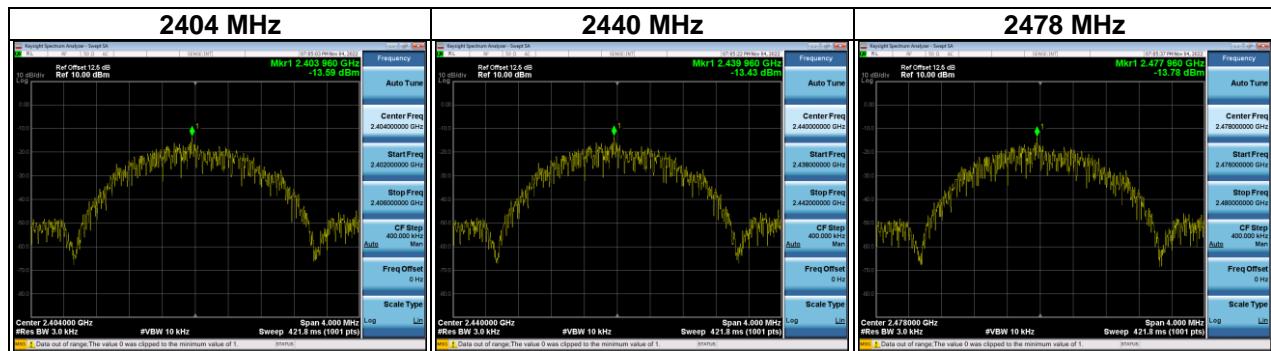
Test Mode	BLE5.0 (1 Mbps)
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Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-11.64	8	Pass
2440	-11.33	8	Pass
2480	-11.80	8	Pass



Test Mode	BLE 5.0 (2 Mbps)
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Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2404	-13.59	8	Pass
2440	-13.43	8	Pass
2478	-13.78	8	Pass



APPENDIX G ANTENNA CONDUCTED SPURIOUS EMISSION

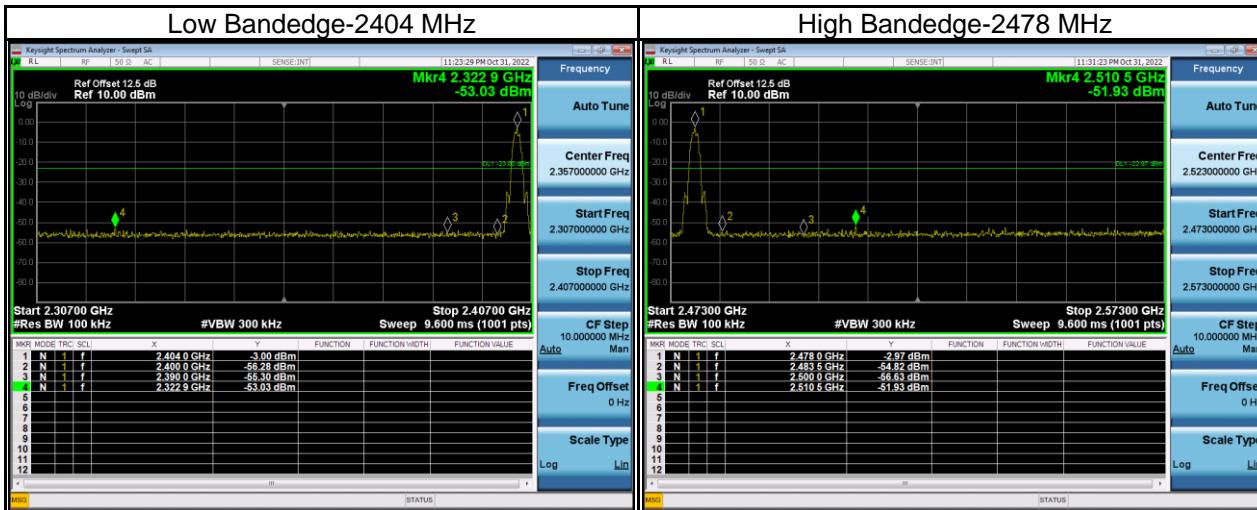
Test Mode

BLE 5.0 (1 Mbps)

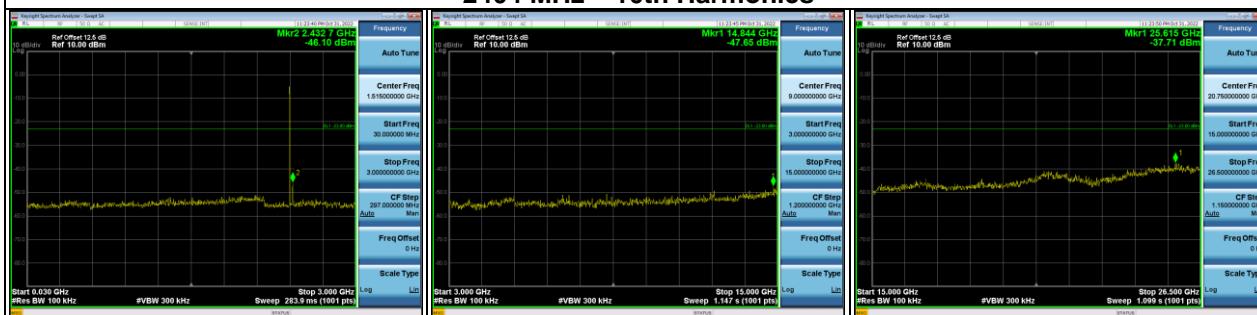


Test Mode

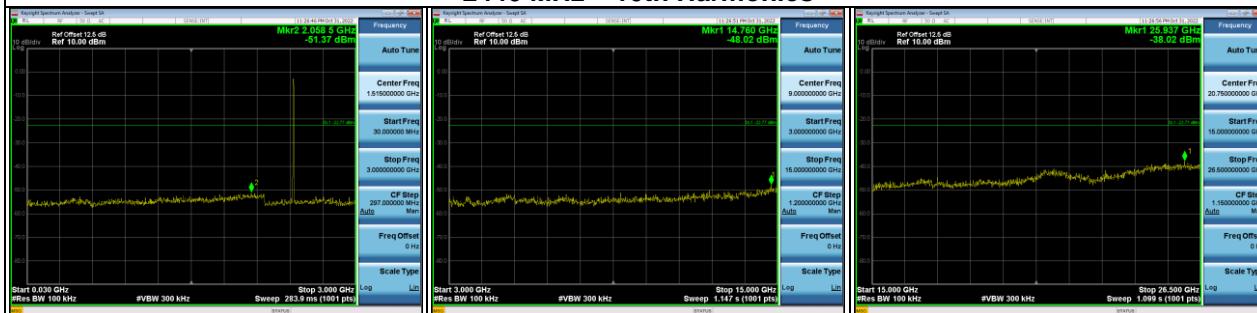
BLE 5.0 (2 Mbps)



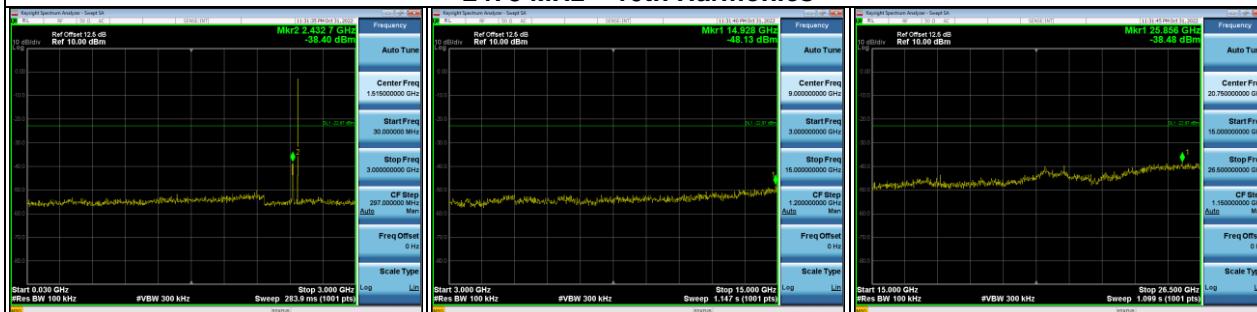
2404 MHz – 10th Harmonics



2440 MHz – 10th Harmonics



2478 MHz – 10th Harmonics



End of Test Report