FCC Radio Test Report

FCC ID: W59RT20

Report No.	:	BTL-FCCP-2-2204H010
Equipment	:	High Performance Gigabit Router
Model Name	:	RT-20
Brand Name	:	LUXUL
Applicant	:	Legrand AV Inc.
Address	:	6436 City West Pkwy, Eden Prairie, MN 55344 USA
Radio Function	:	Bluetooth Low Energy (4.2)
FCC Rule Part(s)	:	FCC CFR Title 47, Part 15, Subpart C (15.247)
Measurement Procedure(s)	:	ANSI C63.10-2013
Date of Receipt	:	2022/4/24
Date of Test	:	2022/4/24 ~ 2022/11/8
Issued Date	:	2022/12/13

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

Prepared by : Eric Lee, Engineer

Approved by : Jerry Chuang, Supervisor

Testing Laboratory 0659

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.

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.

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.

CONTENTS

REVISION HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-2-2204H010	R00	Original Report.	2022/11/29	Invalid
BTL-FCCP-2-2204H010	R01	Revised Typo.	2022/12/1	Invalid
BTL-FCCP-2-2204H010	R02	Revised report to address TCB's comments.	2022/12/7	Invalid
BTL-FCCP-2-2204H010	R03	Revised report to address TCB's comments.	2022/12/12	Invalid
BTL-FCCP-2-2204H010	R04	Revised report to address TCB's comments.	2022/12/13	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 locations stated below are under the TAF Accreditation Number 0659.
The satellite facilities under the test firm used to collect the test data in this report are:
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
(FCC DN: TW0659)
☒ C05 ☒ SR10 ☐ SR11
No. 72, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
(FCC DN: TW0659)
☐ C06 ☒ CB21 ☐ CB22

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 BTL 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)
C05	CISPR	150 kHz ~ 30MHz	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 Site	Test Item	U,(dB)
SR10	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	22 °C, 61 %	AC 120V	Jay Tien
Radiated emissions below 1 GHz	23 °C, 59 %	AC 120V	Mark Wang
Radiated emissions above 1 GHz	23 °C, 59 %	AC 120V	Mark Wang
Bandwidth	23.1°C, 49 %	AC 120V	Tim Lee
Output Power	23.1°C, 49 %	AC 120V	Tim Lee
Power Spectral Density	23.1°C, 49 %	AC 120V	Tim Lee
Antenna conducted Spurious Emission	23.1°C, 49 %	AC 120V	Tim Lee

1.4 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

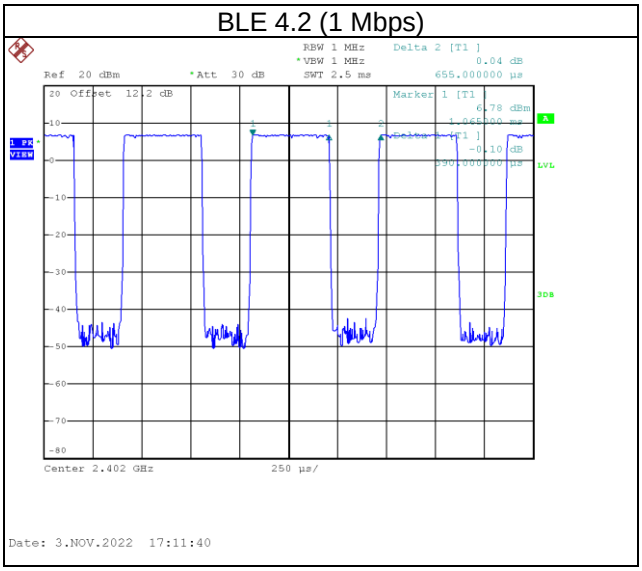
Test Software	TTProxy V11.00.26			
Modulation Mode	2402 MHz	2440 MHz	2480 MHz	Data Rate
BLE 4.2	08	08	08	1 Mbps

1.5 DUTY CYCLE

If duty cycle is ≥ 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 4.2 (1 Mbps)	0.390	1	0.390	0.655	59.54%	2.25

BLE 4.2 (1 Mbps)



2 GENERAL INFORMATION

2.1 DESCRIPTION OF EUT

Equipment	High Performance Gigabit Router
Model Name	RT-20
Brand Name	LUXUL
Model Difference	N/A
Power Source	AC Mains.
Power Rating	100-240 Vac, 50-60Hz, 0.7A
Products Covered	N/A
Operation Band	2400 MHz ~ 2483.5 MHz
Operation Frequency	2402 MHz ~ 2480 MHz
Modulation Technology	GFSK
Transfer Rate	1 Mbps
Output Power Max.	7.53 dBm (0.0057 W)
Test Model	RT-20
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:

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 Name	Model Name	Type	Connector	Frequency (MHz)	Gain (dBi)
-	PSA	RG-18	PCB	I-PEX	2400-2500	2.37

(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

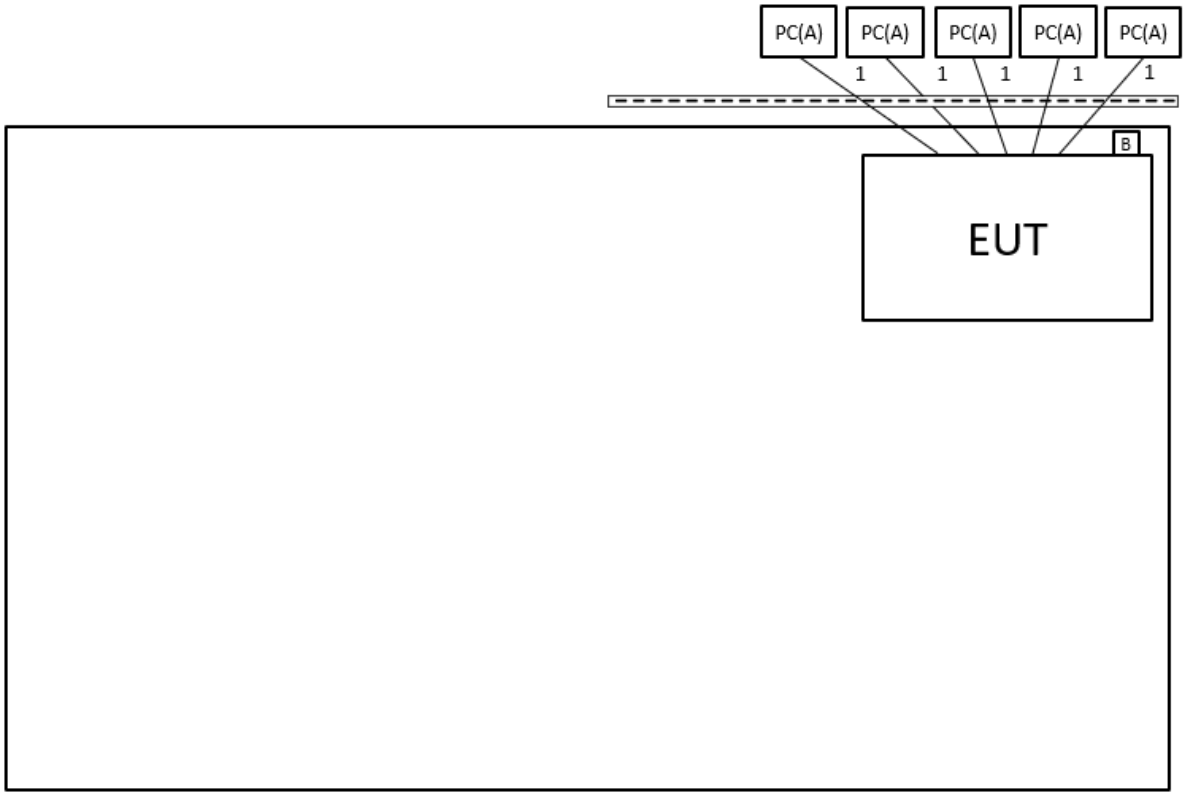
Test Items	Test mode	Channel	Note
AC power line conducted emissions	Normal/Idle	-	-
Transmitter Radiated Emissions (below 1GHz)	1 Mbps	39	-
Transmitter Radiated Emissions (above 1GHz)	1 Mbps	00/39	Bandedge
	1 Mbps	00/19/39	Harmonic
Bandwidth	1 Mbps	00/19/39	-
Output Power	1 Mbps	00/19/39	-
Power Spectral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

NOTE:
(1) For radiated emission band edge test, both Vertical and Horizontal are evaluated, but only the worst case (Vertical) is recorded.

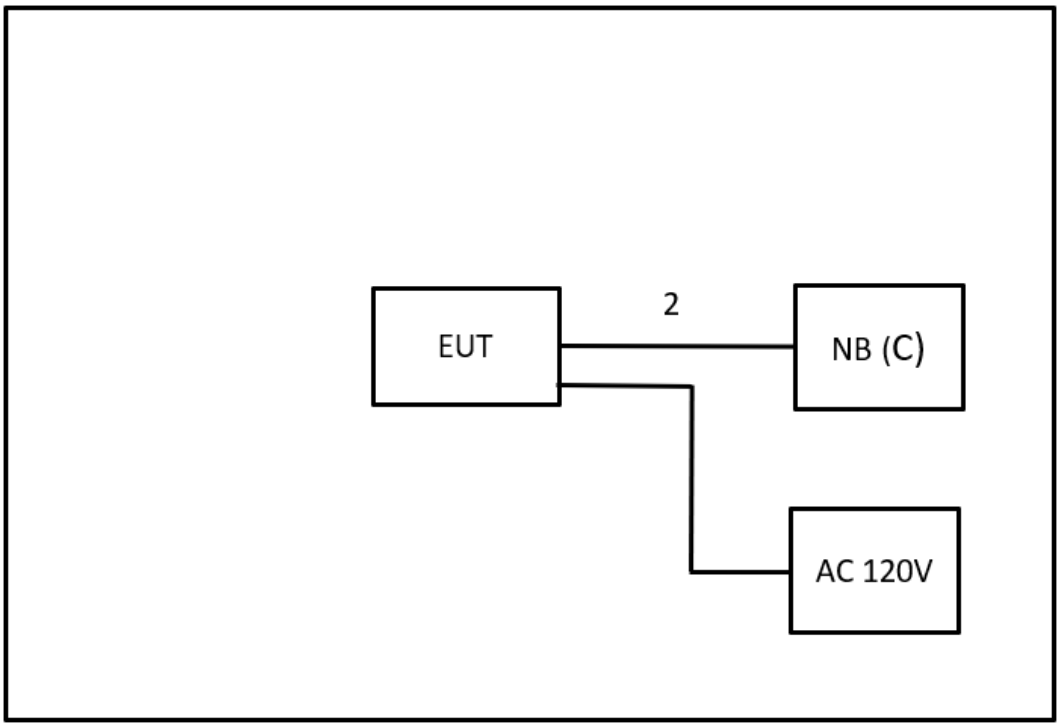
2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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.	Series No.	Remarks
A	PC	DELL	OptiPlex 7080	611WJA00	Furnished by test lab.
B	USB Dongle	Transcend	JetFlash 790	N/A	Furnished by test lab.
C	NB	acer	TMP446-M-50L4	N/A	Furnished by test lab.

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
1	NO	NO	2m	RJ-45 Cable	Furnished by test lab.
2	NO	NO	1m	RJ-45 Cable	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

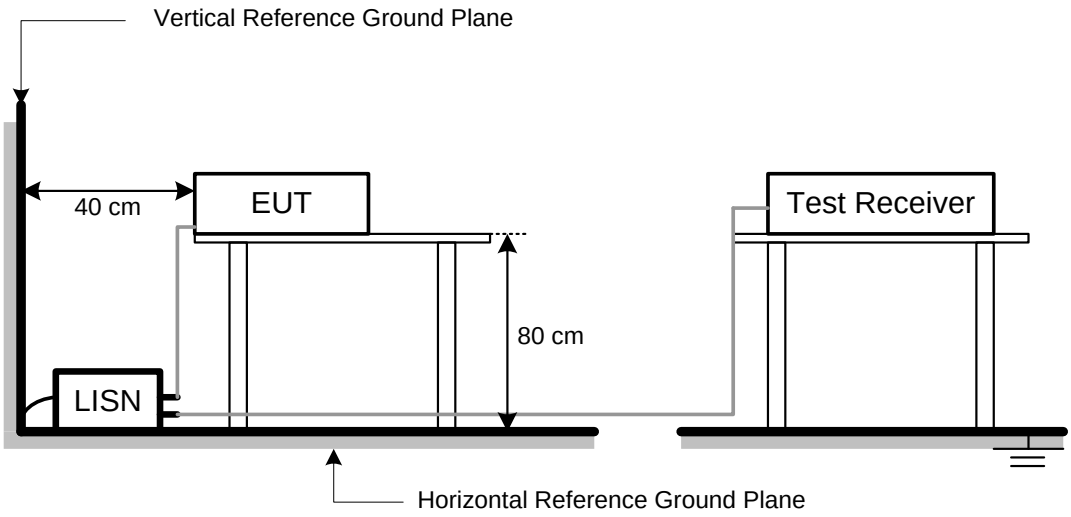
a. The EUT was placed 0.8 m above the horizontal ground plane with the EUT being connected to the power mains through a line impedance stabilization network (LISN).
All other support equipment were powered from an additional LISN(s).
The LISN provides 50 Ohm/50uH of impedance for the measuring instrument.
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 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

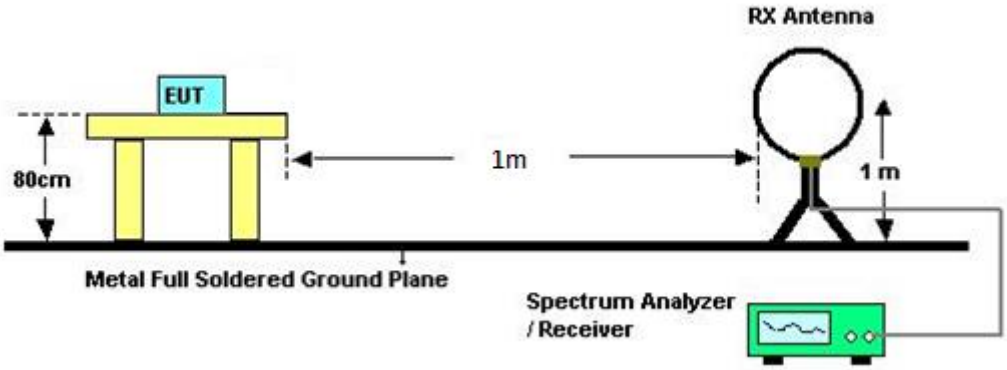
a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The measuring distance 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

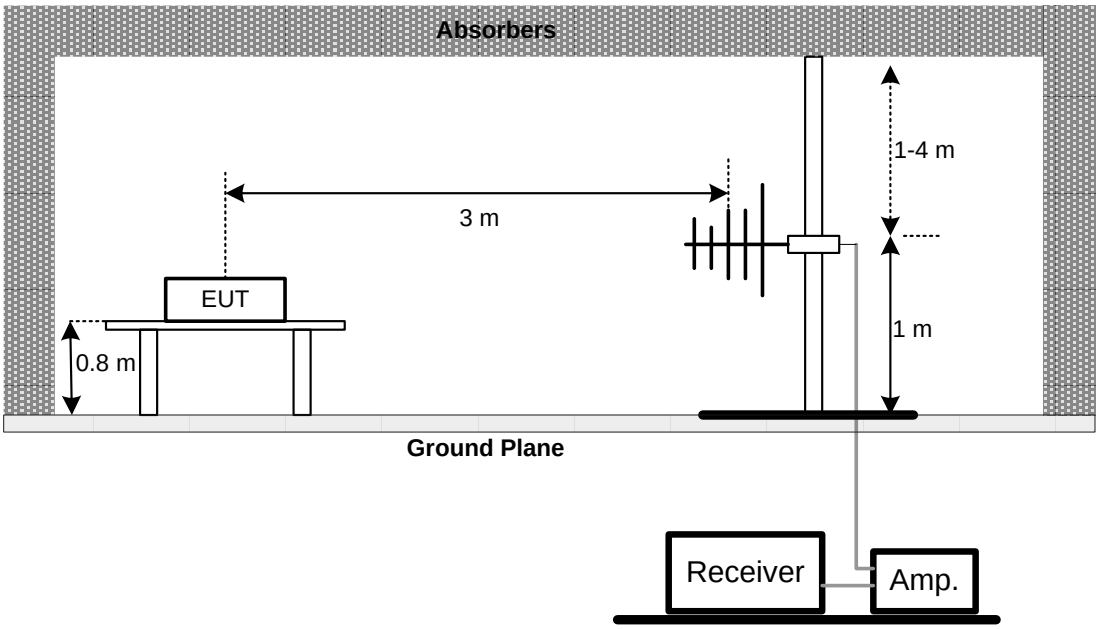
No deviation.

4.4 TEST SETUP

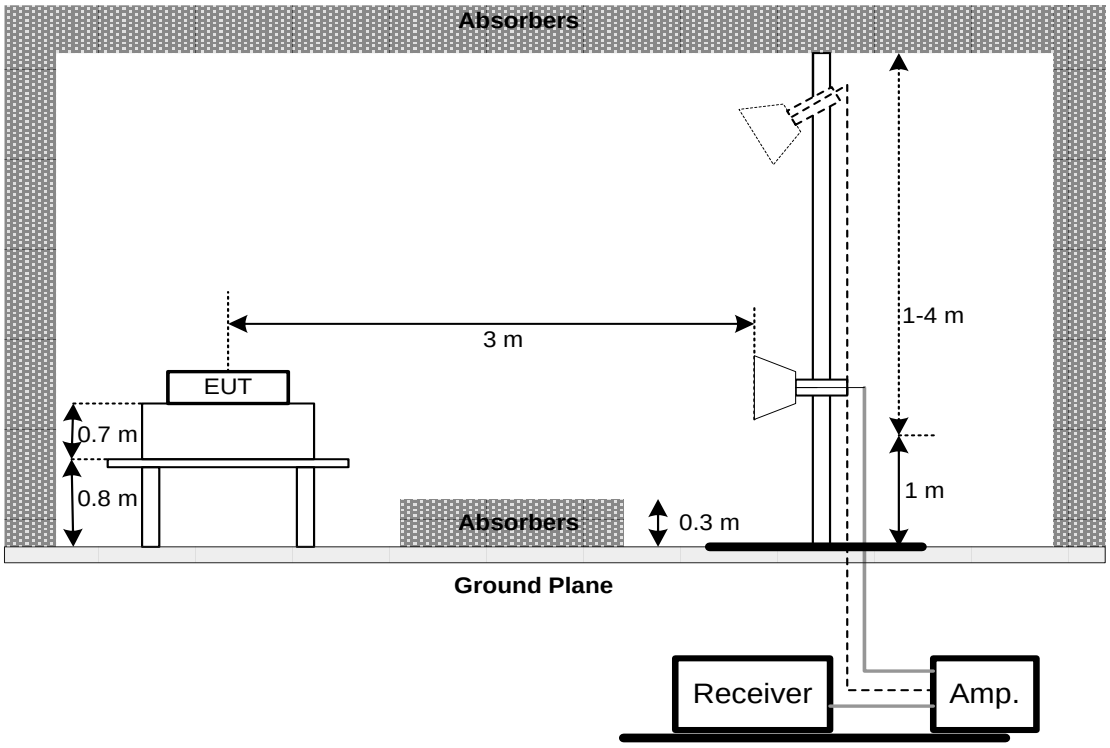
9 kHz to 30 MHz



30 MHz to 1 GHz



Above 1 GHz



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

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

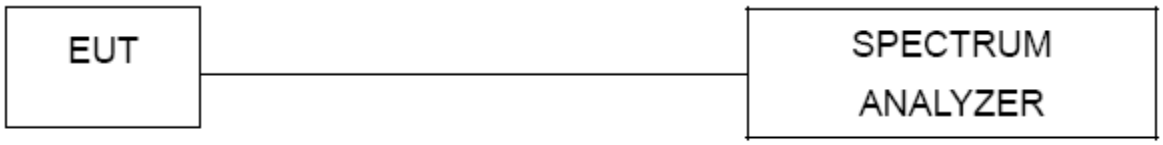
5.2 TEST PROCEDURE

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 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP



5.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

5.6 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 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP

6.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

6.6 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

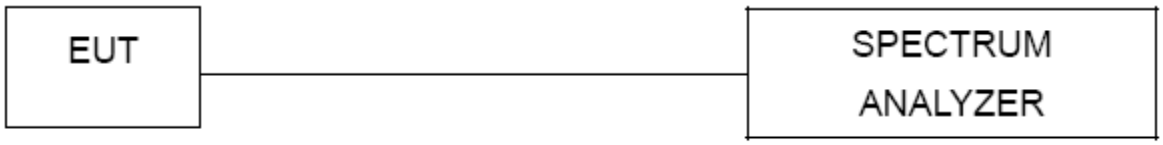
7.2 TEST PROCEDURE

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 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

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.

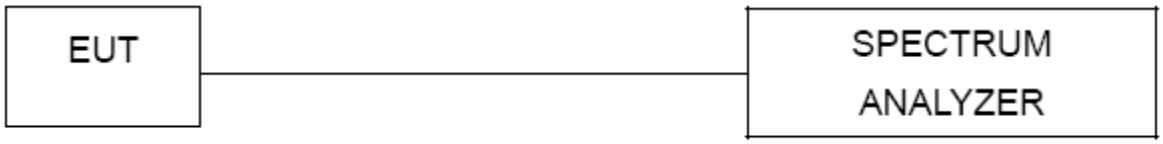
8.2 TEST PROCEDURE

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 was programmed to be in continuously transmitting mode.

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	101521	2022/9/28	2023/9/27
2	Test Cable	EMCI	EMCCFD300-BM-BMR-5000	220331	2022/3/31	2023/3/30
3	EMI Test Receiver	R&S	ESR 7	101433	2021/11/24	2022/11/23
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	R&S	FSP38	101139	2022/3/2	2023/3/1

Output Power						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Power Meter	Keysight	8990B	MY51000517	2022/3/18	2023/3/17
2	Power Sensor	Keysight	N1923A	MY58310005	2022/3/18	2023/3/17

Power Spectral Density						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP38	101139	2022/3/2	2023/3/1

Antenna conducted Spurious Emission						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP38	101139	2022/3/2	2023/3/1

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

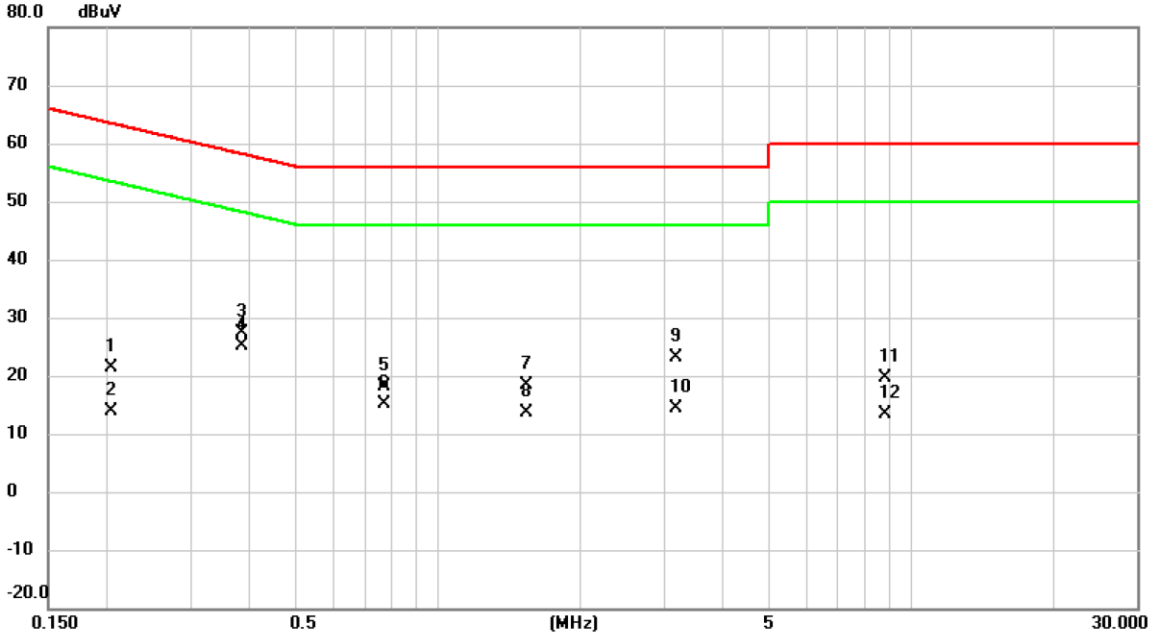
Please refer to document Appendix No.: TP-2204H010-FCCP-1 (APPENDIX-TEST PHOTOS).

11 EUT PHOTOS

Please refer to document Appendix No.: EP-2204H010-1 (APPENDIX-EUT PHOTOS).

APPENDIX A AC POWER LINE CONDUCTED EMISSIONS

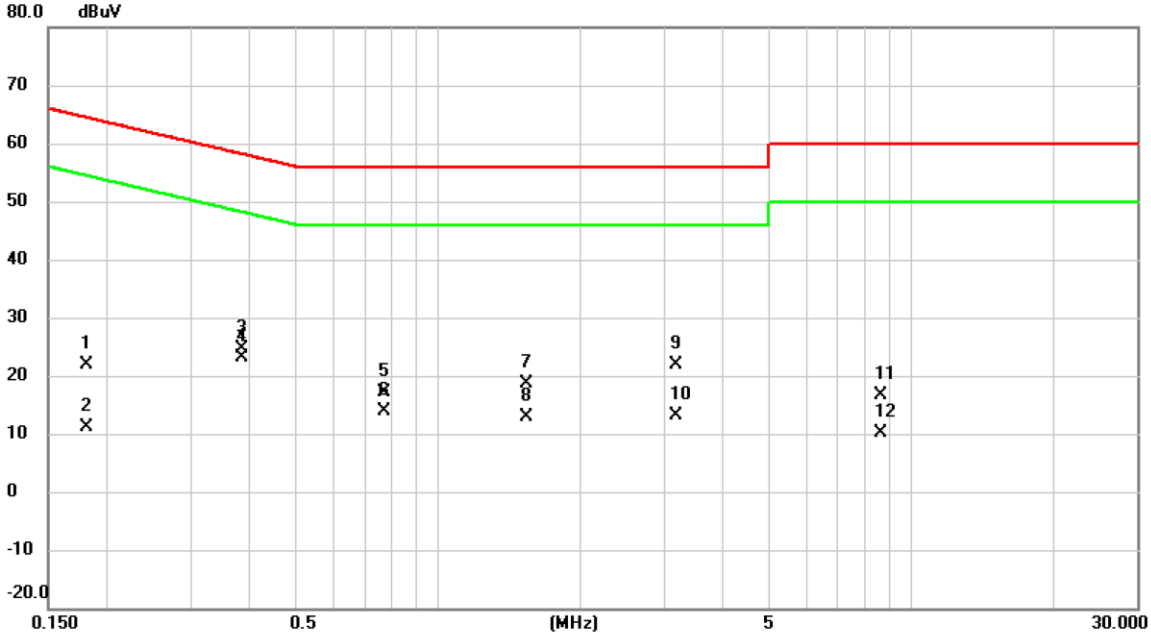
Test Mode	Normal	Tested Date	2022/11/4
Test Frequency	-	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2040	21.37	0.02	21.39	63.45	-42.06	QP	
2		0.2040	13.90	0.02	13.92	53.45	-39.53	AVG	
3		0.3840	27.29	0.02	27.31	58.19	-30.88	QP	
4	*	0.3840	25.02	0.02	25.04	48.19	-23.15	AVG	
5		0.7687	18.04	0.04	18.08	56.00	-37.92	QP	
6		0.7687	15.08	0.04	15.12	46.00	-30.88	AVG	
7		1.5382	18.37	0.06	18.43	56.00	-37.57	QP	
8		1.5382	13.53	0.06	13.59	46.00	-32.41	AVG	
9		3.1875	23.05	0.10	23.15	56.00	-32.85	QP	
10		3.1875	14.29	0.10	14.39	46.00	-31.61	AVG	
11		8.8080	19.35	0.17	19.52	60.00	-40.48	QP	
12		8.8080	13.17	0.17	13.34	50.00	-36.66	AVG	

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

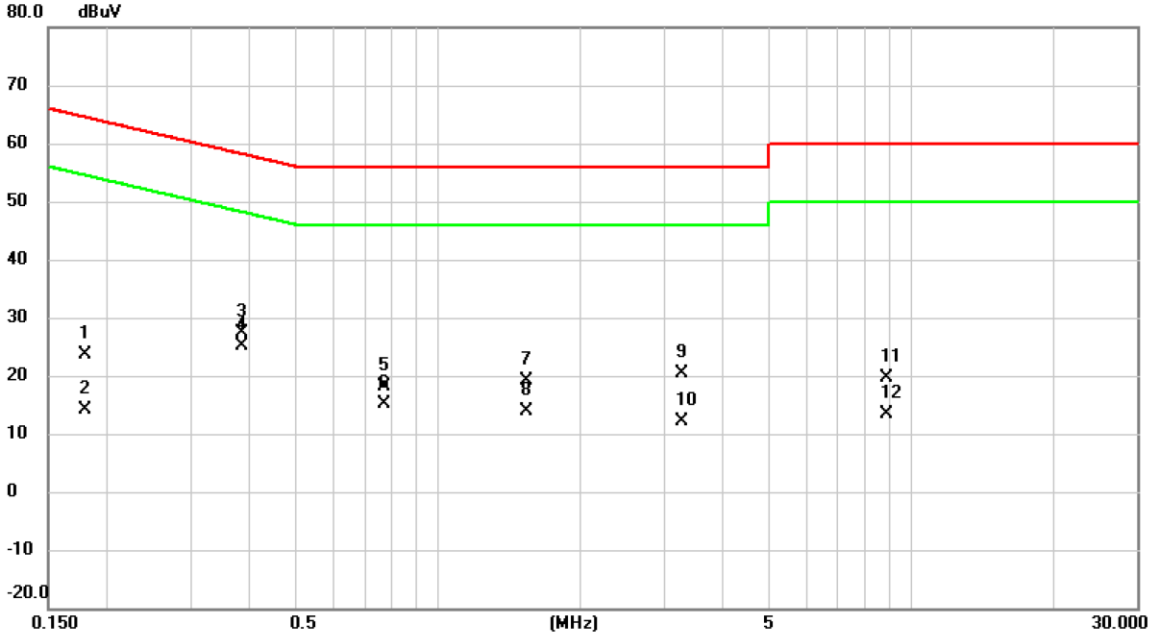
Test Mode	Normal	Tested Date	2022/11/4
Test Frequency	-	Phase	Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1815	21.86	0.02	21.88	64.42	-42.54	QP	
2		0.1815	11.05	0.02	11.07	54.42	-43.35	AVG	
3		0.3840	24.69	0.02	24.71	58.19	-33.48	QP	
4	*	0.3840	23.00	0.02	23.02	48.19	-25.17	AVG	
5		0.7687	16.99	0.04	17.03	56.00	-38.97	QP	
6		0.7687	13.92	0.04	13.96	46.00	-32.04	AVG	
7		1.5382	18.47	0.06	18.53	56.00	-37.47	QP	
8		1.5382	12.82	0.06	12.88	46.00	-33.12	AVG	
9		3.1898	21.89	0.10	21.99	56.00	-34.01	QP	
10		3.1898	12.92	0.10	13.02	46.00	-32.98	AVG	
11		8.6325	16.48	0.17	16.65	60.00	-43.35	QP	
12		8.6325	9.97	0.17	10.14	50.00	-39.86	AVG	

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

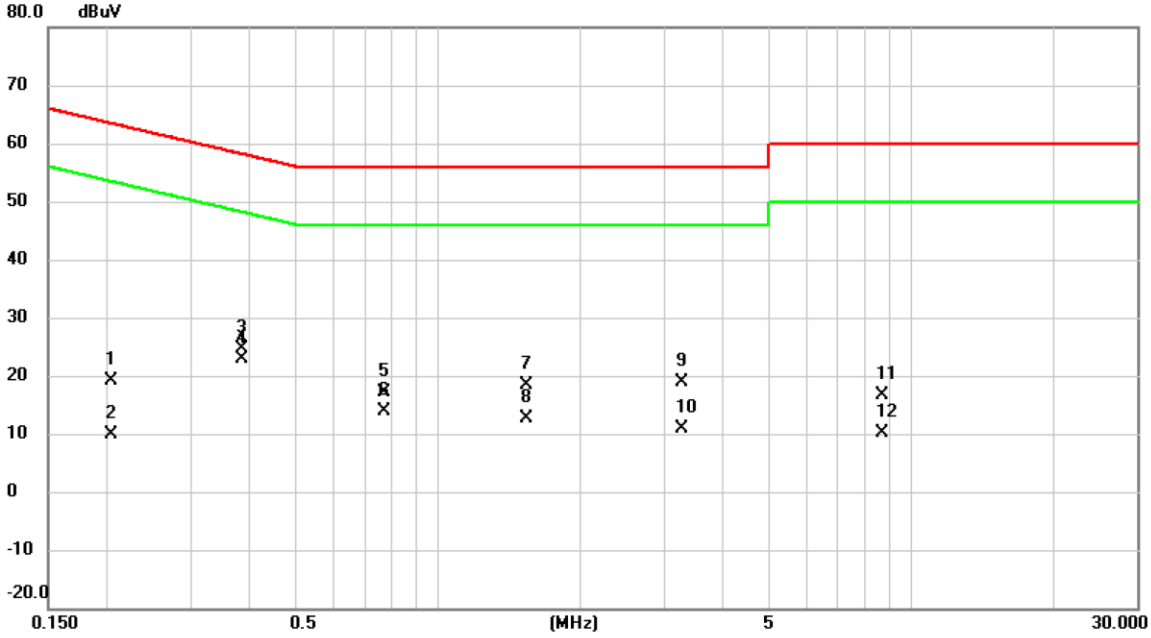
Test Mode	Idle	Tested Date	2022/11/4
Test Frequency	-	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1796	23.68	0.02	23.70	64.50	-40.80	QP	
2		0.1796	14.21	0.02	14.23	54.50	-40.27	AVG	
3		0.3840	27.32	0.02	27.34	58.19	-30.85	QP	
4	*	0.3840	25.20	0.02	25.22	48.19	-22.97	AVG	
5		0.7687	18.11	0.04	18.15	56.00	-37.85	QP	
6		0.7687	15.04	0.04	15.08	46.00	-30.92	AVG	
7		1.5382	18.97	0.06	19.03	56.00	-36.97	QP	
8		1.5382	13.74	0.06	13.80	46.00	-32.20	AVG	
9		3.2685	20.23	0.10	20.33	56.00	-35.67	QP	
10		3.2685	12.03	0.10	12.13	46.00	-33.87	AVG	
11		8.8688	19.38	0.17	19.55	60.00	-40.45	QP	
12		8.8688	13.16	0.17	13.33	50.00	-36.67	AVG	

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

Test Mode	Idle	Tested Date	2022/11/4
Test Frequency	-	Phase	Neutral

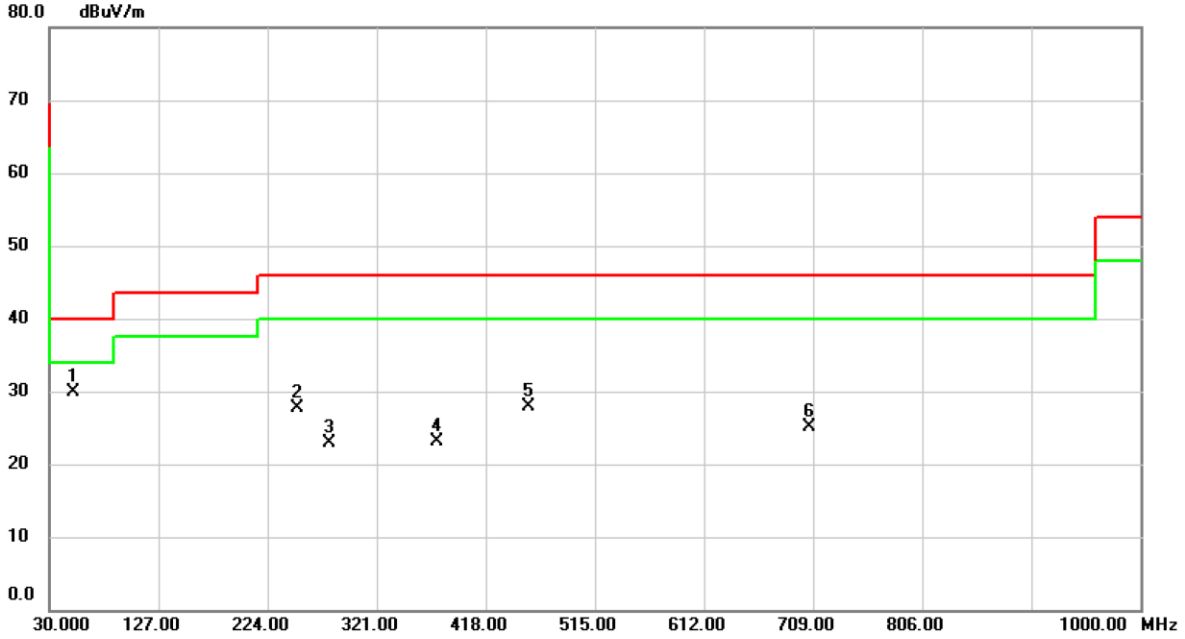


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2040	19.09	0.02	19.11	63.45	-44.34	QP	
2		0.2040	9.79	0.02	9.81	53.45	-43.64	AVG	
3		0.3840	24.72	0.02	24.74	58.19	-33.45	QP	
4	*	0.3840	22.87	0.02	22.89	48.19	-25.30	AVG	
5		0.7687	17.07	0.04	17.11	56.00	-38.89	QP	
6		0.7687	13.89	0.04	13.93	46.00	-32.07	AVG	
7		1.5382	18.21	0.06	18.27	56.00	-37.73	QP	
8		1.5382	12.66	0.06	12.72	46.00	-33.28	AVG	
9		3.2708	18.68	0.10	18.78	56.00	-37.22	QP	
10		3.2708	10.85	0.10	10.95	46.00	-35.05	AVG	
11		8.7000	16.51	0.17	16.68	60.00	-43.32	QP	
12		8.7000	9.86	0.17	10.03	50.00	-39.97	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

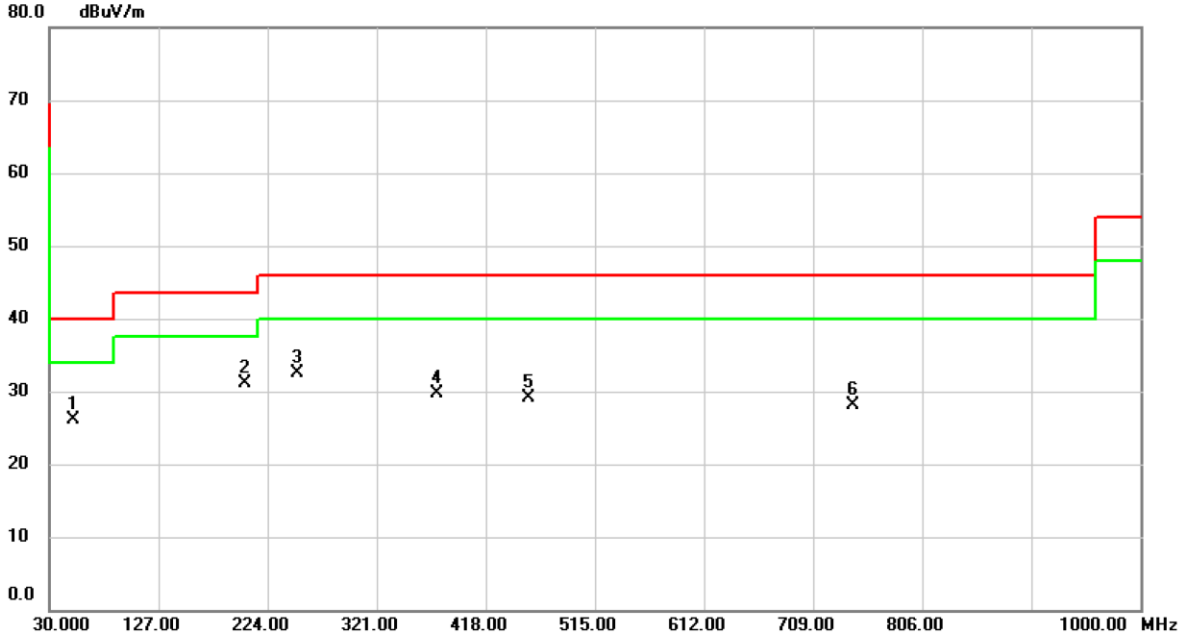
Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	51.4370	47.76	-17.94	29.82	40.00	-10.18	peak	
2		249.9960	47.78	-20.09	27.69	46.00	-18.31	peak	
3		279.0960	41.91	-19.00	22.91	46.00	-23.09	peak	
4		375.0290	39.55	-16.36	23.19	46.00	-22.81	peak	
5		456.5090	42.09	-14.18	27.91	46.00	-18.09	peak	
6		705.5403	34.19	-9.02	25.17	46.00	-20.83	peak	

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

Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

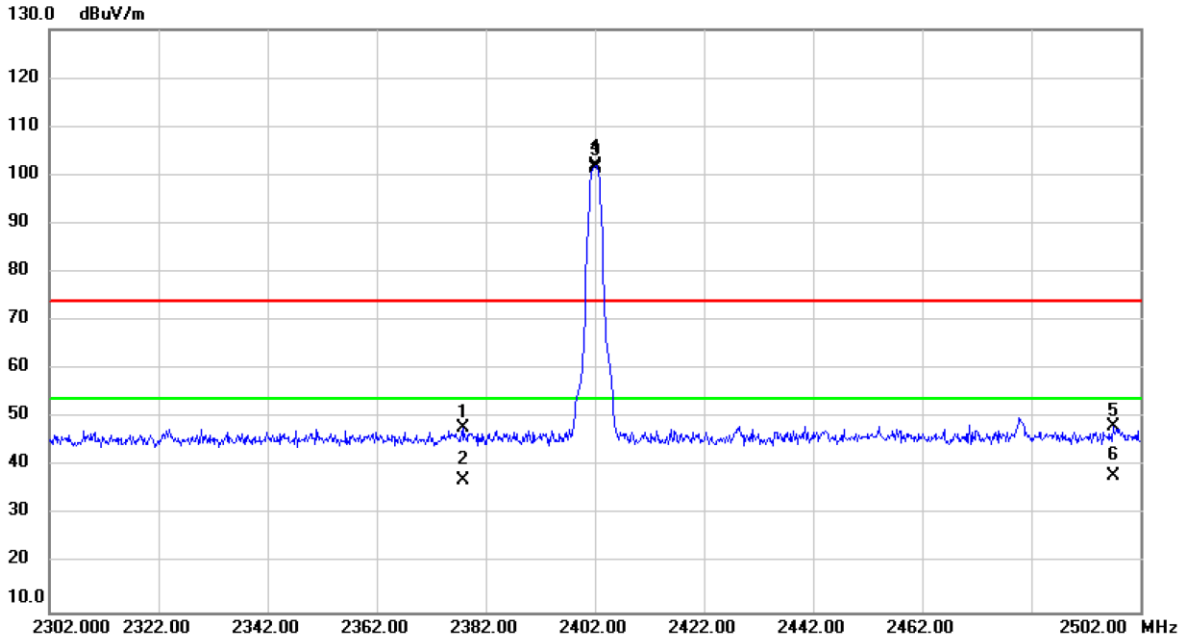


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		51.5987	44.15	-17.96	26.19	40.00	-13.81	peak	
2	*	203.7917	52.92	-21.79	31.13	43.50	-12.37	peak	
3		249.9960	52.65	-20.09	32.56	46.00	-13.44	peak	
4		374.9967	46.01	-16.38	29.63	46.00	-16.37	peak	
5		456.5090	43.26	-14.18	29.08	46.00	-16.92	peak	
6		744.6637	36.01	-7.99	28.02	46.00	-17.98	peak	

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

APPENDIX C RADIATED EMISSIONS - ABOVE 1 GHZ

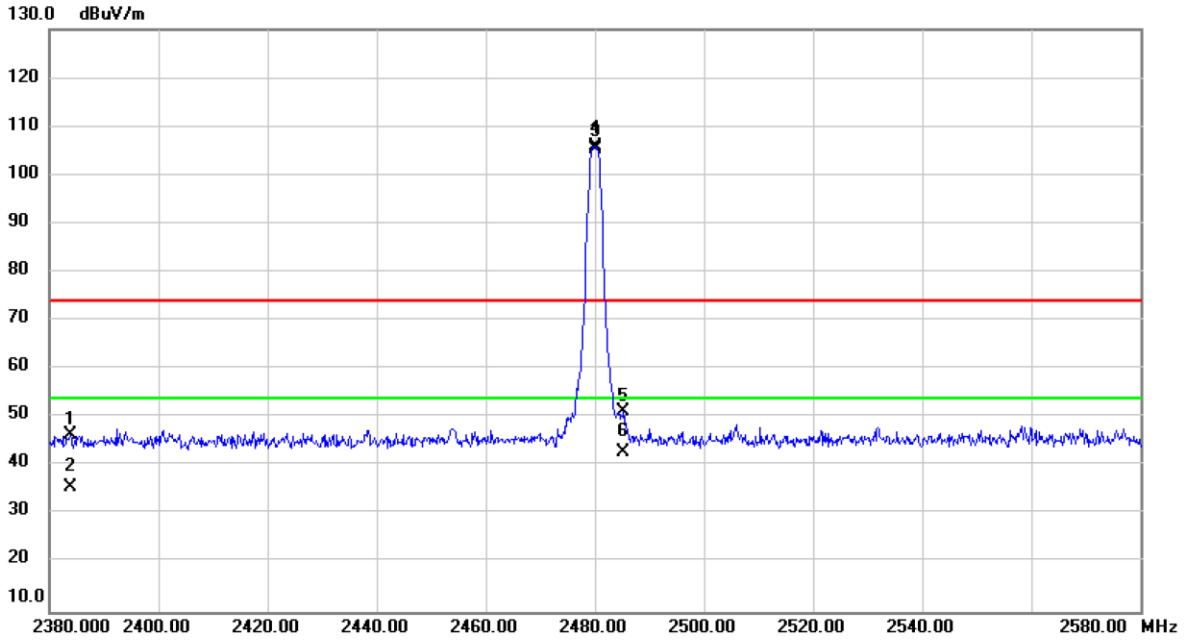
Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2377.747	53.76	-5.78	47.98	74.00	-26.02	peak	
2		2377.747	43.04	-5.78	37.26	54.00	-16.74	AVG	
3	X	2402.000	107.65	-5.75	101.90	74.00	27.90	peak	No Limit
4	*	2402.000	106.97	-5.75	101.22	54.00	47.22	AVG	No Limit
5		2496.987	53.76	-5.62	48.14	74.00	-25.86	peak	
6		2496.987	43.53	-5.62	37.91	54.00	-16.09	AVG	

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

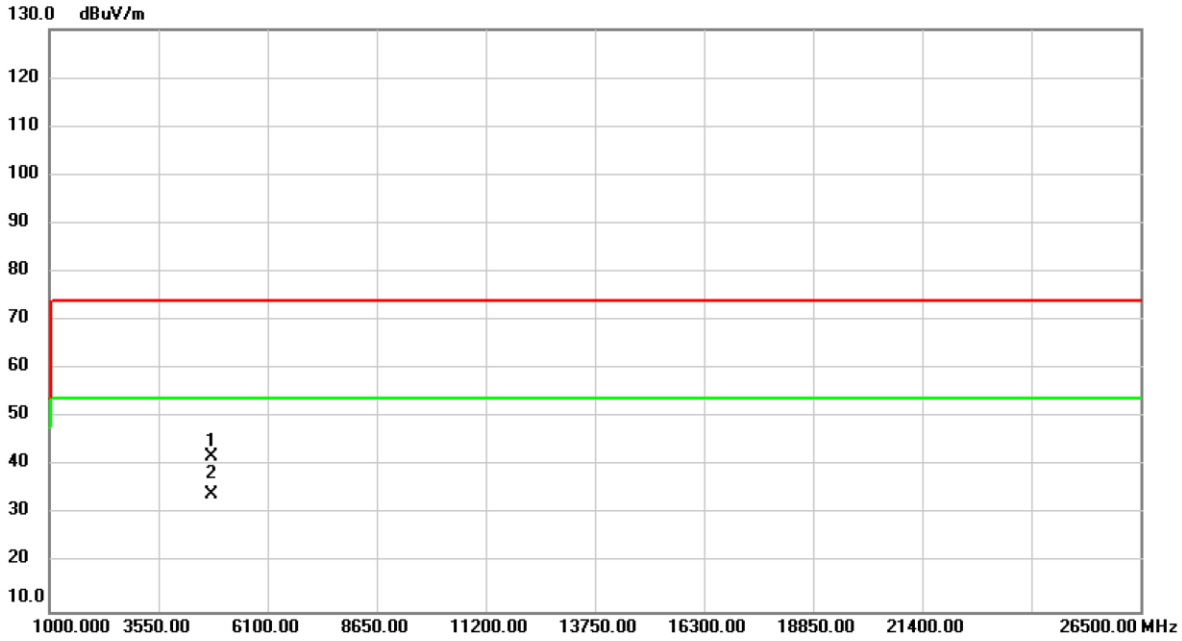
Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2383.913	52.25	-5.78	46.47	74.00	-27.53	peak	
2		2383.913	41.47	-5.78	35.69	54.00	-18.31	AVG	
3	X	2480.000	111.61	-5.65	105.96	74.00	31.96	peak	No Limit
4	*	2480.000	111.00	-5.65	105.35	54.00	51.35	AVG	No Limit
5		2485.213	56.85	-5.63	51.22	74.00	-22.78	peak	
6		2485.213	48.38	-5.63	42.75	54.00	-11.25	AVG	

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

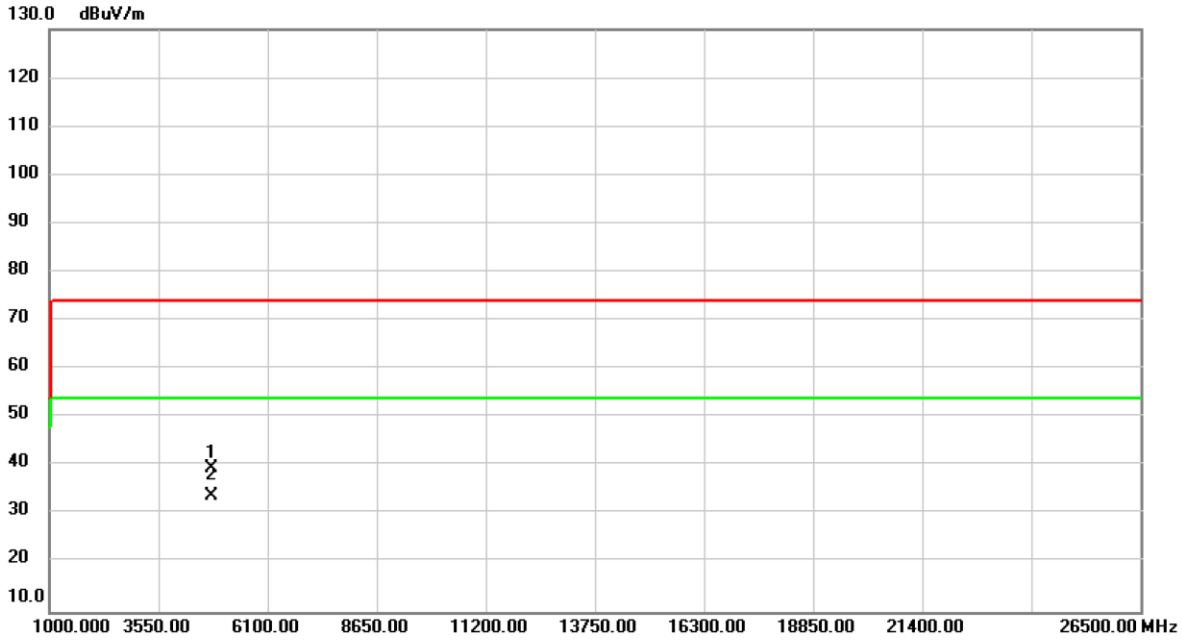
Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	41.42	0.65	42.07	74.00	-31.93	peak	
2	*	4804.000	33.55	0.65	34.20	54.00	-19.80	AVG	

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

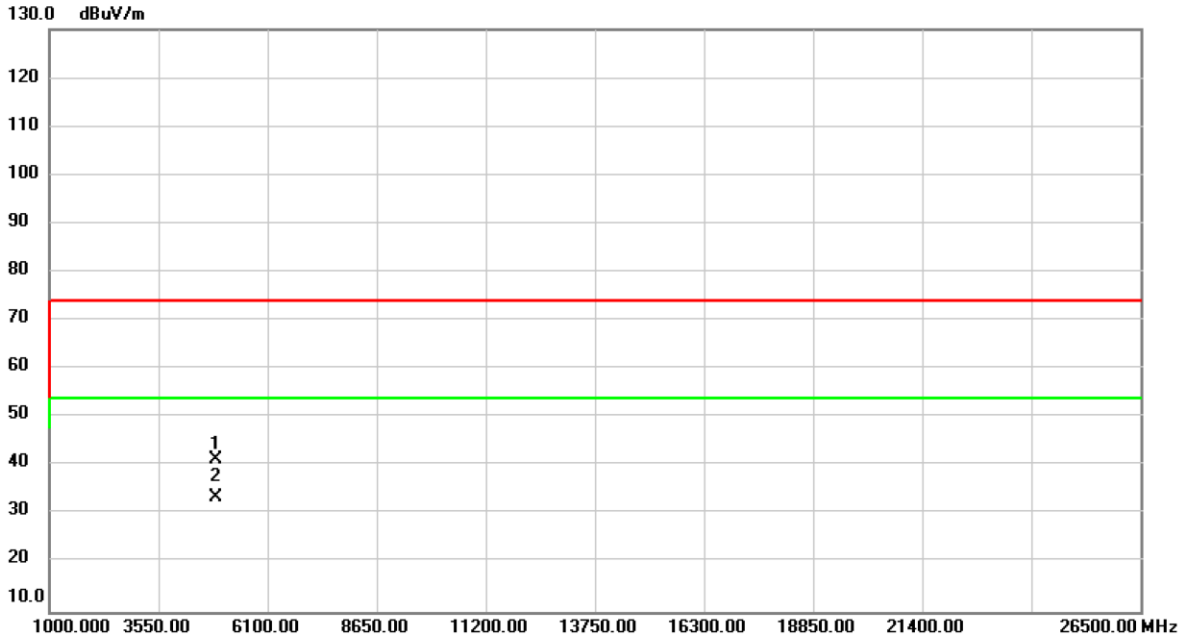
Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2402MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	38.90	0.65	39.55	74.00	-34.45	peak	
2	*	4804.000	33.21	0.65	33.86	54.00	-20.14	AVG	

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

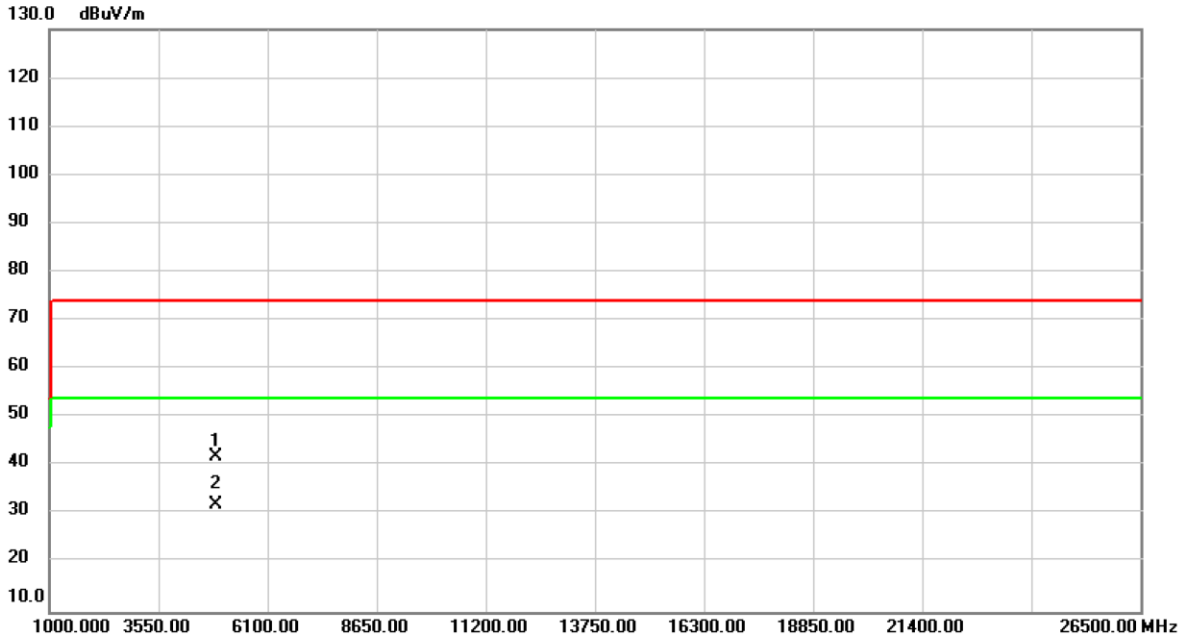
Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2440MHz	Polarization	Vertical
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	40.54	0.92	41.46	74.00	-32.54	peak	
2	*	4880.000	32.76	0.92	33.68	54.00	-20.32	AVG	

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

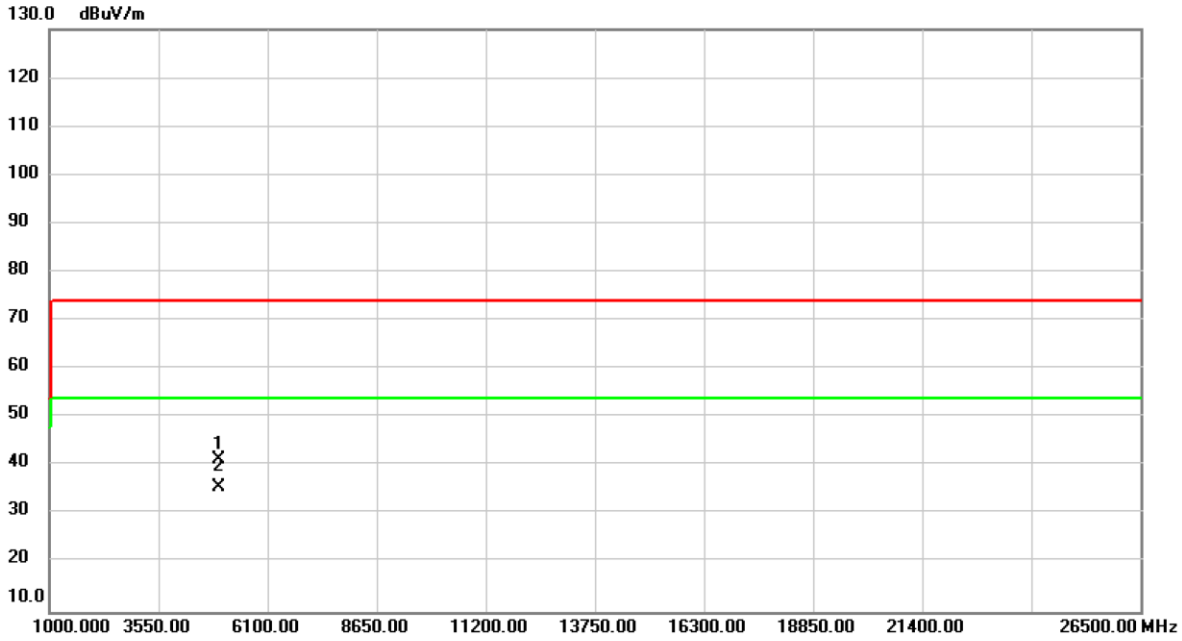
Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2440MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	41.01	0.92	41.93	74.00	-32.07	peak	
2	*	4880.000	31.25	0.92	32.17	54.00	-21.83	AVG	

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

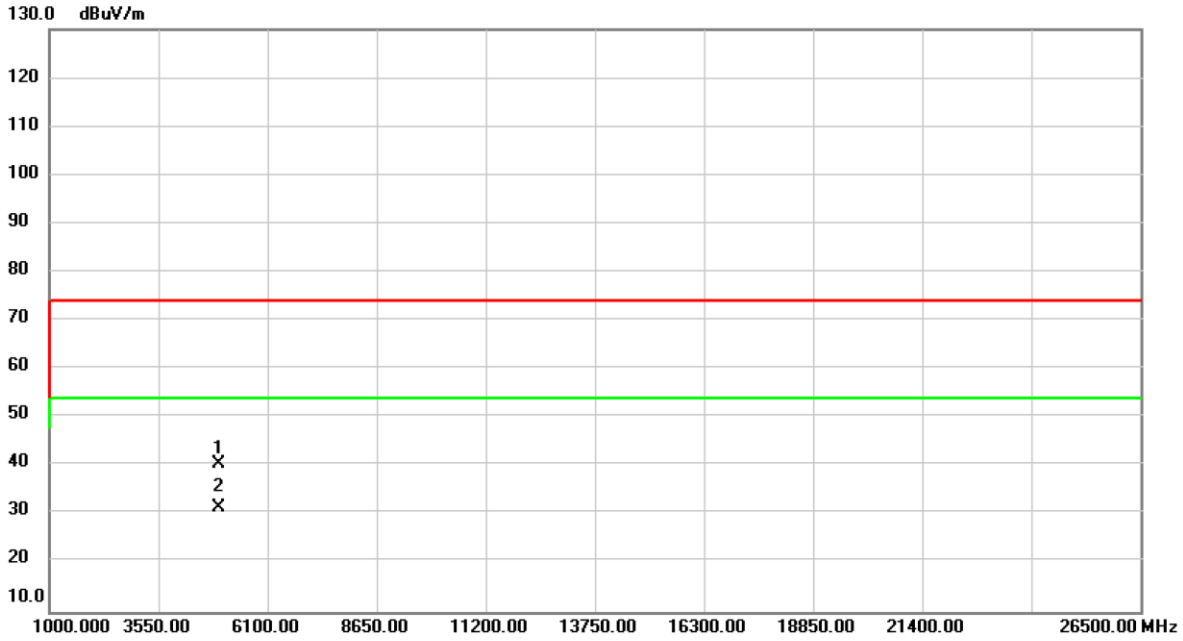
Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	40.29	1.18	41.47	74.00	-32.53	peak	
2	*	4960.000	34.62	1.18	35.80	54.00	-18.20	AVG	

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

Test Mode	BLE 4.2 (1 Mbps)	Test Date	2022/11/1
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	39.23	1.18	40.41	74.00	-33.59	peak	
2	*	4960.000	30.35	1.18	31.53	54.00	-22.47	AVG	

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

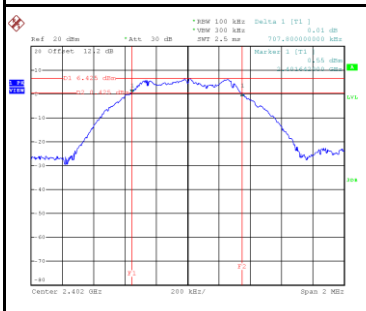
APPENDIX D BANDWIDTH

Test Mode:	1Mbps

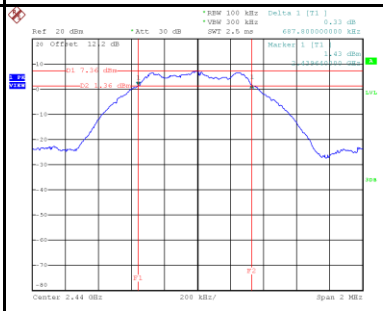
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.71	1.03	500	Pass
2440	0.69	1.03	500	Pass
2480	0.71	1.03	500	Pass

6dB Bandwidth

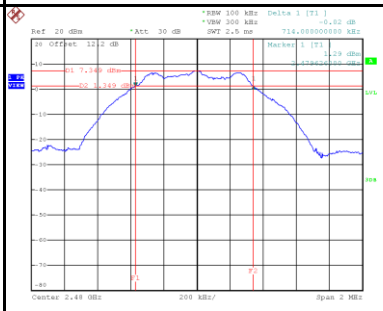
2402 MHz



2440 MHz

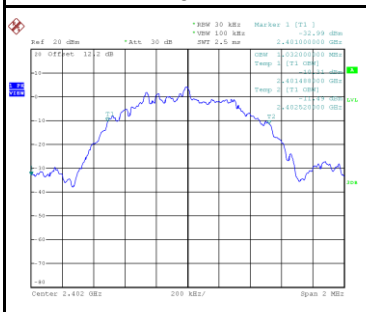


2480 MHz

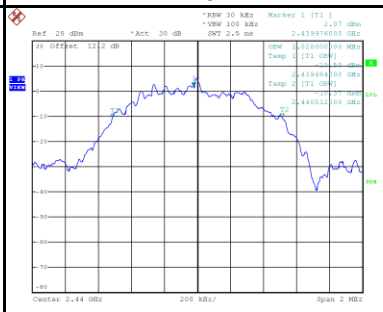


99% Occupied BW

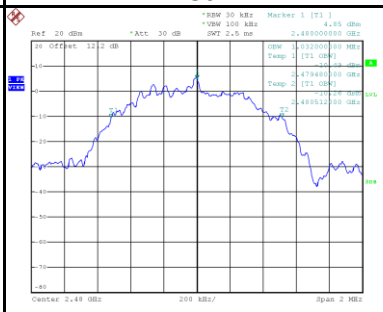
2402 MHz



2440 MHz



2480 MHz



APPENDIX E OUTPUT POWER

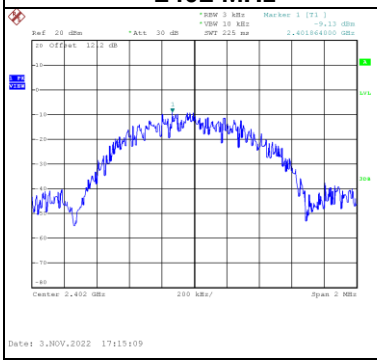
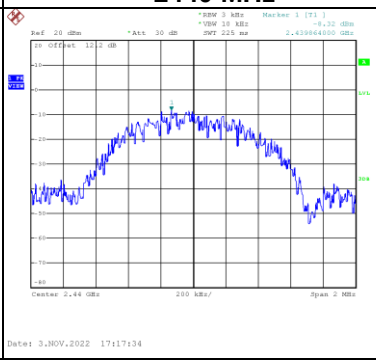
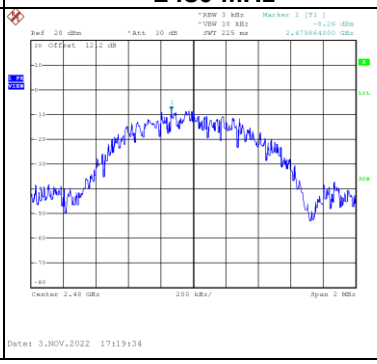
Test Mode :	1Mbps	Tested Date	2022/11/3

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	6.96	0.0050	30.00	1.0000	Pass
2440	7.53	0.0057	30.00	1.0000	Pass
2480	7.46	0.0056	30.00	1.0000	Pass

APPENDIX F POWER SPECTRAL DENSITY TEST

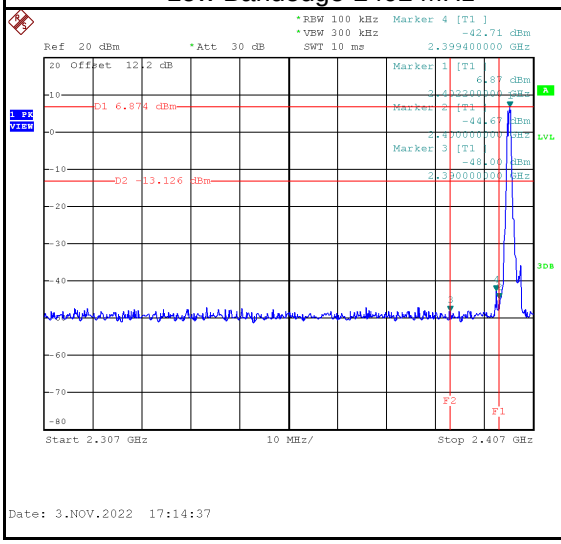
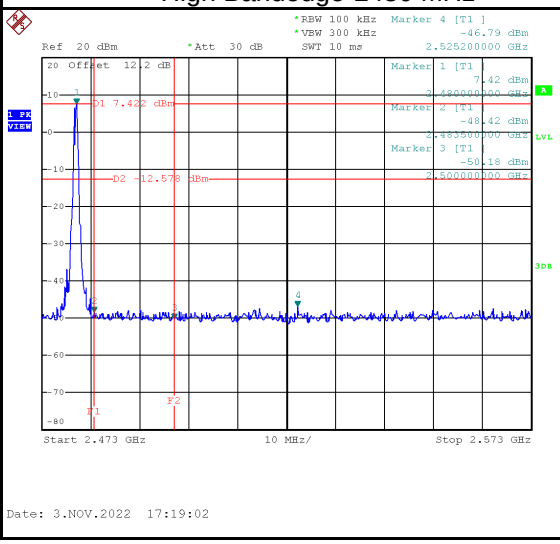
Test Mode :	1Mbps

Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-9.13	8	Pass
2440	-8.32	8	Pass
2480	-8.26	8	Pass

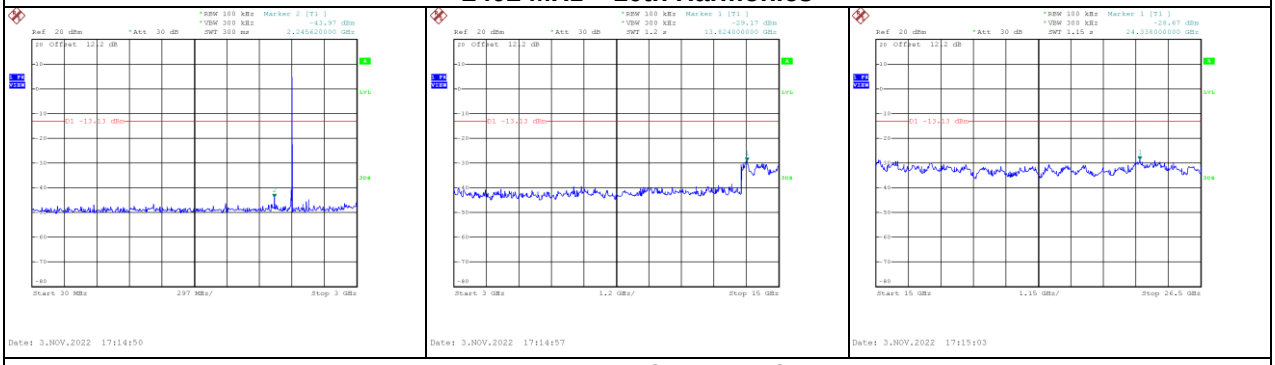
2402 MHz	2440 MHz	2480 MHz
		

APPENDIX G ANTENNA CONDUCTED SPURIOUS EMISSION

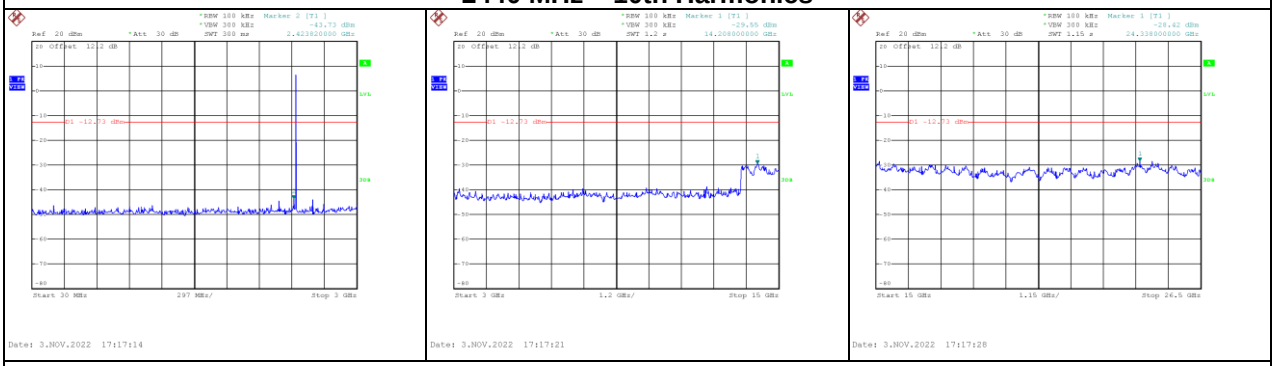
Test Mode :	1Mbps

Low Bandedge-2402 MHz	High Bandedge-2480 MHz
	

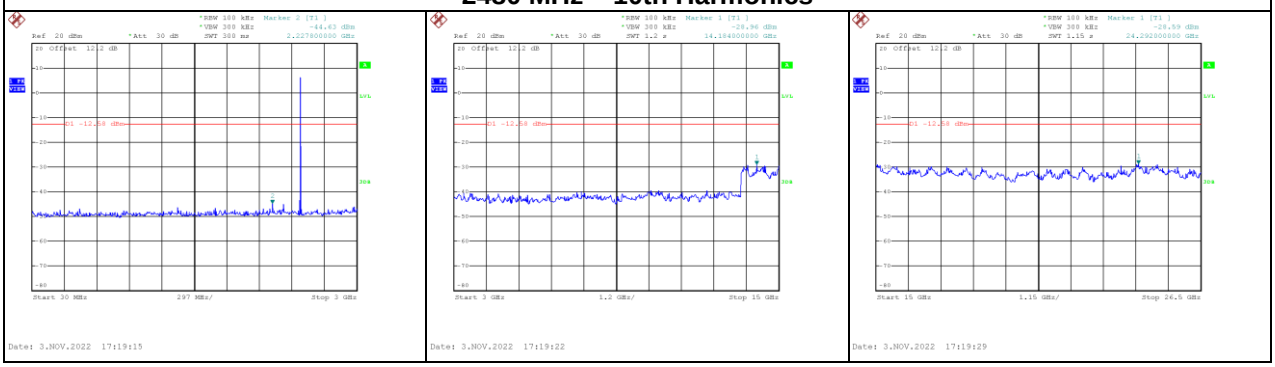
2402 MHz – 10th Harmonics



2440 MHz – 10th Harmonics



2480 MHz – 10th Harmonics



End of Test Report