FCC Radio Test Report

FCC ID: 2AVVT-CU413UCMPS1

Report No.	:	BTL-FCCP-7-2103T126B
Equipment	:	iTraMS CCU
Model Name	:	CU-41-3U-CM-PS1
Brand Name	:	Bosch
Applicant	:	Bosch Global Software Technologies Private Limited
Address	:	MS/PAC, Ban 601, Post Box No 3000 Hosur Road, Adugodi, Bengaluru, Karnataka-560030, India
Radio Function	:	Bluetooth Low Energy (4.0)
FCC Rule Part(s)	:	FCC CFR Title 47, Part15, Subpart C (15.247)
Measurement Procedure(s)	:	ANSI C63.10-2013
Date of Receipt	:	2022/7/27
Date of Test	:	2022/7/27 ~ 2023/1/17
Issued Date	:	2023/3/23

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

Prepared by : Eric Lee

Eric Lee, Engineer

Approved by : Jerry Chuang

Jerry Chuang, Supervisor

BTL Inc.

No.18, Ln. 171, Sec. 2, Jiuzong Rd., Neihu Dist., Taipei City 114, Taiwan

Tel: +886-2-2657-3299 Fax: +886-2-2657-3331 Web: www.newbtl.com Service mail: btl_qa@newbtl.com

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.

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REVISION HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-7-2103T126	R00	Original Report.	2021/9/17	Invalid
BTL-FCCP-7-2103T126	R01	Revised Typo.	2021/9/27	Valid
BTL-FCCP-7-2103T126B	R00	1. Added the fourth antenna. (MA173. A. LBI.001) 2. Modified applicant and address.	2022/11/22	Invalid
BTL-FCCP-7-2103T126B	R01	Revised report to address TAF Audit's comments.	2023/3/23	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	------	N/A	Note(3)
15.205 15.209 15.247(d)	Radiated Emissions	APPENDIX A APPENDIX B	Pass	------
15.247(a)(2)	Bandwidth	APPENDIX C	Pass	------
15.247(b)(3)	Output Power	APPENDIX D	Pass	------
15.247(e)	Power Spectral Density	APPENDIX E	Pass	------
15.247(d)	Antenna conducted Spurious Emission	APPENDIX F	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.
(3) This is a DC input device.

1.1 TEST FACILITY

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. 66, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
☒ CB15 ☐ CB16
No. 68-2, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
☐ CB12 ☒ SR05
Spot check test:
No. 72, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
☐ 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. Radiated emissions test :

Test Site	Measurement Frequency Range	U,(dB)
CB15 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

B. 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
Radiated emissions below 1 GHz	23 °C, 54 %	DC 32V	Jay Kao
Radiated emissions above 1 GHz	23 °C, 54 %	DC 32V	Jay Kao
Bandwidth	25.9 °C, 34 %	DC 32V	Vincent Lee
Output Power	25.9 °C, 34 %	DC 32V	Vincent Lee
Power Spectral Density	25.9 °C, 34 %	DC 32V	Vincent Lee
Antenna conducted Spurious Emission	25.9 °C, 34 %	DC 32V	Vincent Lee

Spot check test:

Test Item	Environment Condition	Test Voltage	Tested by
Radiated emissions below 1 GHz	Refer to data	DC 32V	Mark Wang
Radiated emissions above 1 GHz	Refer to data	DC 32V	Mark Wang

1.4 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

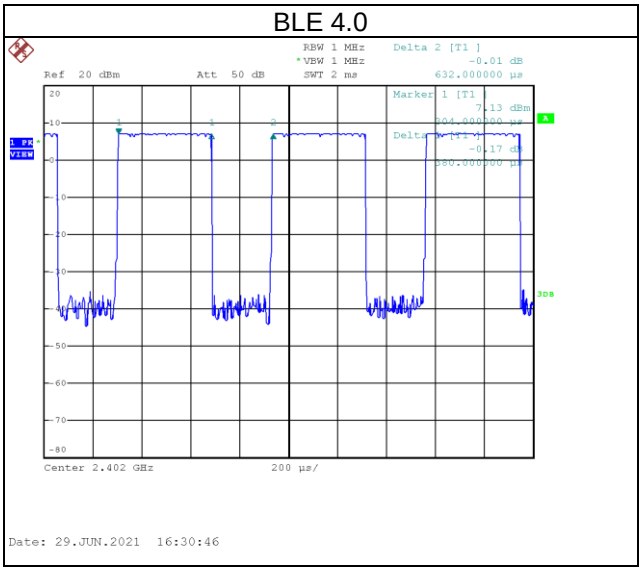
Test Software	Tera Term V4.80			
Modulation Mode	2402 MHz	2440 MHz	2480 MHz	Data Rate
BLE 4.0	8	8	8	1 Mbps

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 4.0	0.380	1	0.380	0.632	60.13%	2.21

BLE 4.0



2 GENERAL INFORMATION

2.1 DESCRIPTION OF EUT

Equipment	iTraMS CCU
Model Name	CU-41-3U-CM-PS1
Brand Name	Bosch
Model Difference	N/A
Power Source	DC Voltage supplied from DC Source.
Power Rating	DC 9-32V (12V or 24V)
Products Covered	N/A
Hardware Version/Test Model	AD00 A10 062
Software Version	1277401063
Operation Band	2400 MHz ~ 2483.5 MHz
Operation Frequency	2402 MHz ~ 2480 MHz
Modulation Technology	GFSK
Transfer Rate	1 Mbps
Output Power Max.	2.03 dBm (0.0016 W)
Test Model	CU-41-3U-CM-PS1
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:

Group I:

Antenna	Manufacture	Part No.	Type	Connector	Frequency (MHz)	Gain (dBi)
External antenna	TAOGLAS.	MA250.A.LBI.001	Dipole	SMA(M)ST	2400-2500	2.72

Group II:

Antenna	Manufacture	Part No.	Type	Connector	Frequency (MHz)	Gain (dBi)
Stubby antenna	TAOGLAS.	TG.08.0723	Dipole	SMA(M)ST	2400-2500	3.29

Group III:

Antenna	Manufacture	Part No.	Type	Connector	Frequency (MHz)	Gain (dBi)
Wi-Fi 2.4GHz antenna	taoglas antenna solutions	MA240.LBI.001	Dipole	SMA(M)	2400-2500	2.70

Group IV:

Antenna	Manufacture	Part No.	Type	Connector	Frequency (MHz)	Gain (dBi)
External antenna	TAOGLAS.	MA173. A. LBI.001	N/A	SMA(M)ST	2400-2500	1.31

NOTE: The EUT includes four groups of antennas, the Stubby antenna is the worst and recorded.

(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.

(5) In this report, the test results of below items refer to BTL-FCCP-7-2103T126 report due to the device is identical to the original device of the referencing report, except modified applicant and address and added the fourth antenna (MA173. A. LBI.001) with spot checks.

a. Radiated Emissions
b. Bandwidth
c. Output Power
d. Power Spectral Density
e. Antenna conducted Spurious Emission

Spot checks are applied to below items:

a. Radiated Emissions

2.2 TEST MODES

Test Items	Test mode	Channel	Note
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) All X, Y and Z axes are evaluated, but only the worst case (X axis) is recorded.

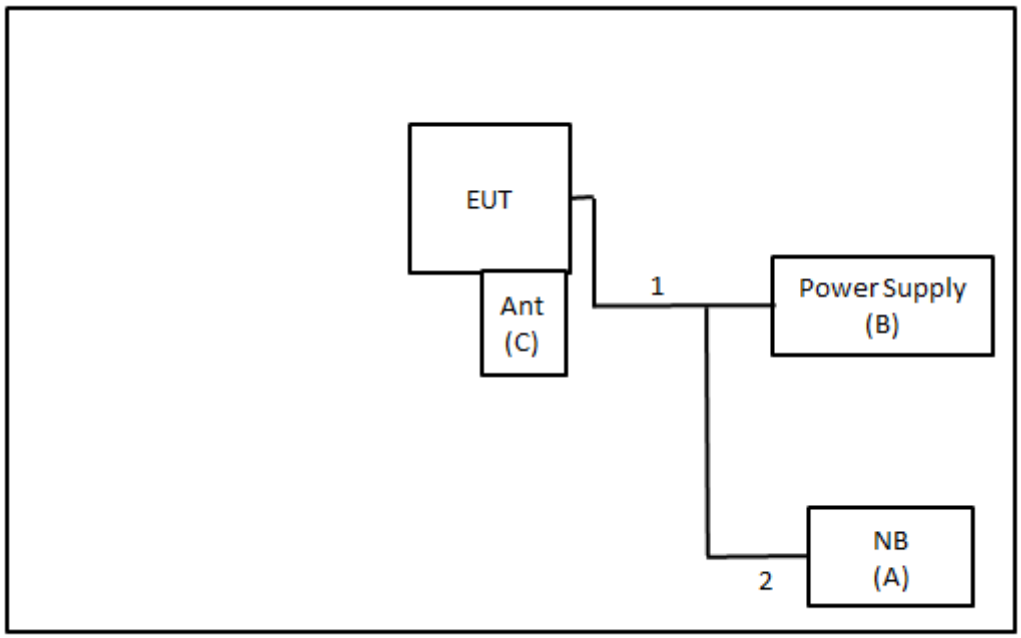
Spot check test:

Test Items	Test mode	Channel	Note
Transmitter Radiated Emissions (below 1GHz)	1 Mbps	39	-
Transmitter Radiated Emissions (above 1GHz)	1 Mbps	39	Bandedge
	1 Mbps	39	Harmonic

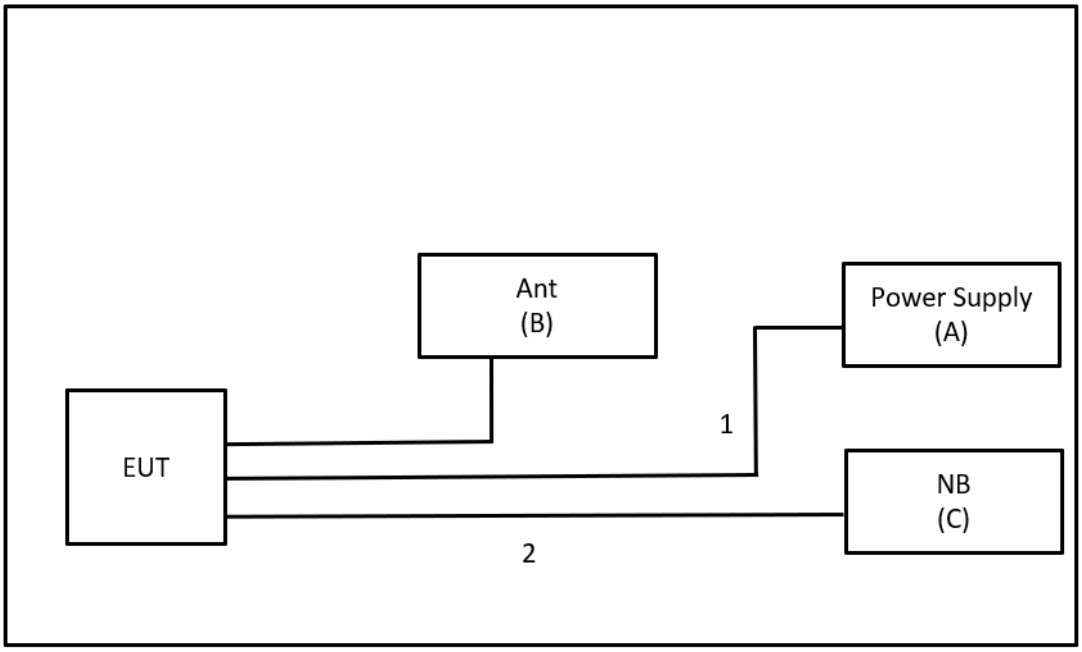
NOTE:
(1) For radiated emission band edge test, both Vertical and Horizontal are evaluated, but only the worst case (Vertical) is recorded.
(2) All X, Y and Z axes are evaluated, but only the worst case (Y axis) is recorded.

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.



Spot check test



2.4 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	NB	HP	TPN-I119	N/A	Furnished by test lab.
B	Power Supply	Twintex	TDS-60-15	N/A	Furnished by test lab.
C	Stubby antenna	Taoglas	TG.08.0723	N/A	Supplied by test requester

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
1	N/A	N/A	2m	Power Cord	Supplied by test requester
2	N/A	N/A	2.1m	RS 232 to USB	Supplied by test requester

Spot check test:

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	Power Supply	TWINTEX	Power Supply	N/A	Furnished by test lab.
B	Antenna	TAOGLAS.	MA173. A. LBI.001	N/A	Supplied by test requester
C	NB	Asus	X555LN-0021B4210U	N/A	Furnished by test lab.

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
1	N/A	N/A	2m	Power Cord	Supplied by test requester
2	N/A	N/A	2.1m	RS 232 to USB	Supplied by test requester

3 RADIATED EMISSIONS TEST

3.1 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 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

3.2 TEST PROCEDURE

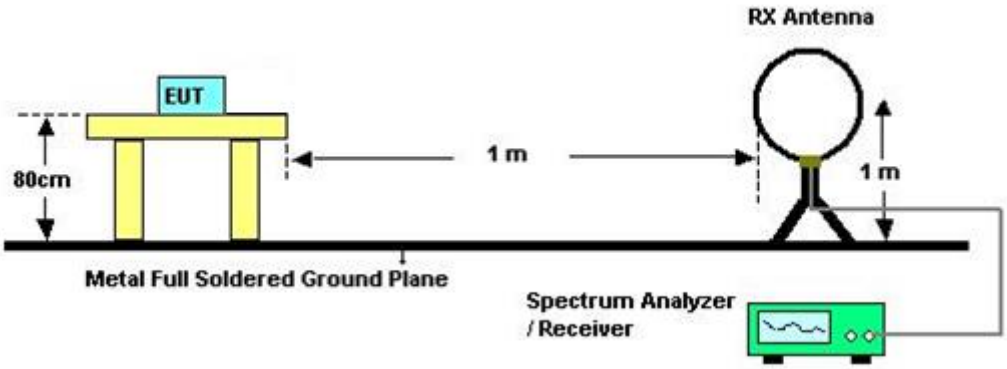
a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The measuring distance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

3.3 DEVIATION FROM TEST STANDARD

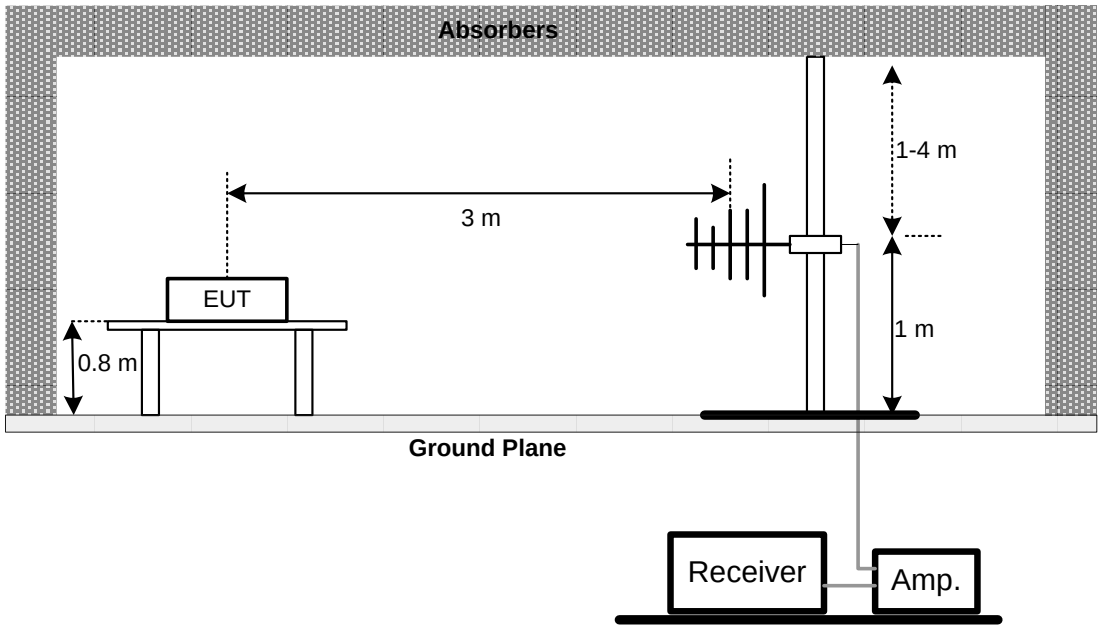
No deviation.

3.4 TEST SETUP

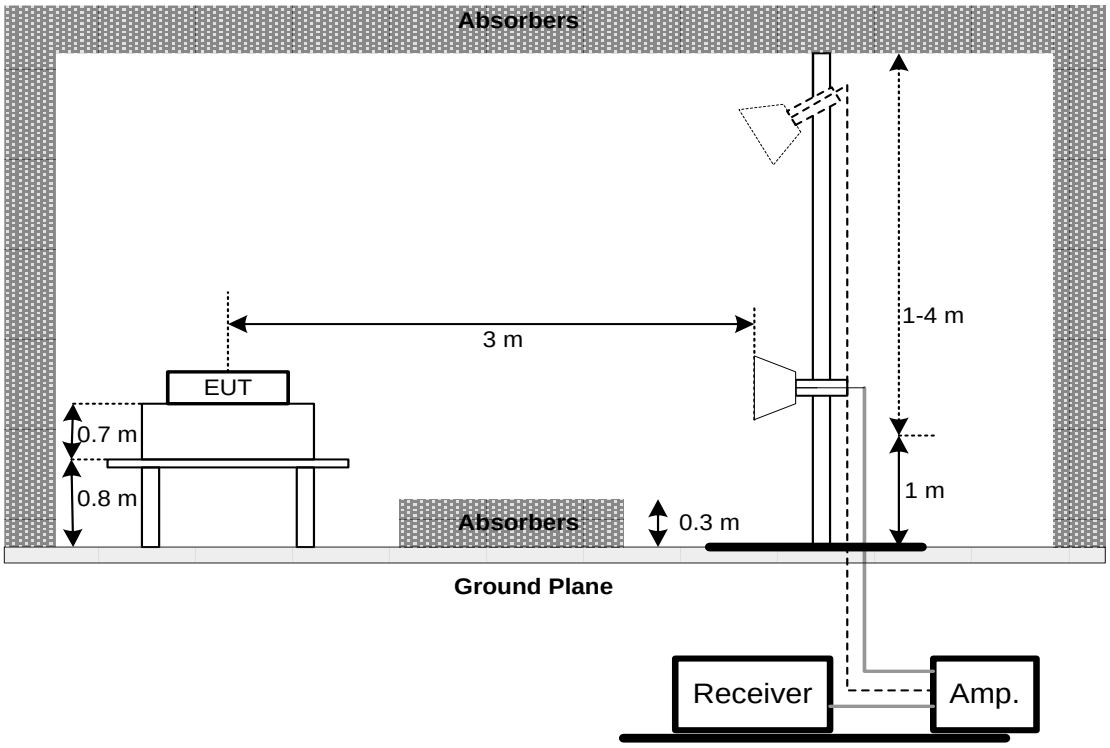
9 kHz to 30 MHz



30 MHz to 1 GHz



Above 1 GHz



3.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

3.6 TEST RESULT – BELOW 30 MHZ

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

3.7 TEST RESULT – 30 MHZ TO 1 GHZ

Please refer to the APPENDIX A.

3.8 TEST RESULT – ABOVE 1 GHZ

Please refer to the APPENDIX B.

NOTE:

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

4 BANDWIDTH TEST

4.1 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

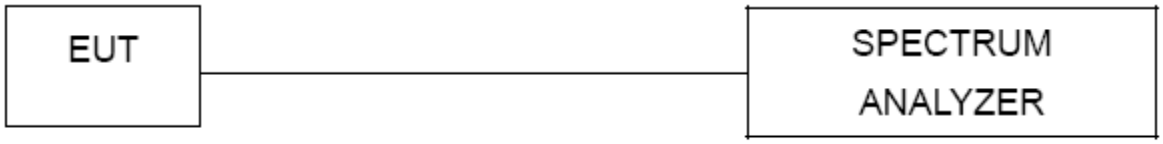
4.2 TEST PROCEDURE

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.

4.3 DEVIATION FROM STANDARD

No deviation.

4.4 TEST SETUP



4.5 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.

4.6 TEST RESULTS

Please refer to the APPENDIX C.

5 OUTPUT POWER TEST

5.1 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

5.2 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.

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 POWER SPECTRAL DENSITY TEST

6.1 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

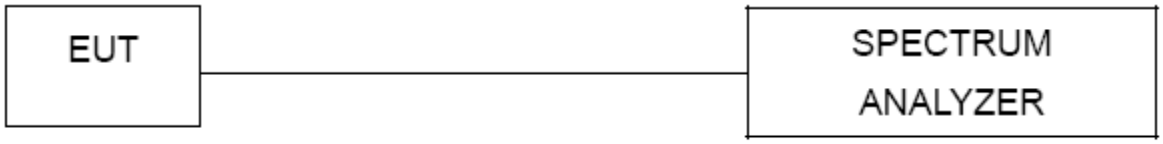
6.2 TEST PROCEDURE

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.

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 ANTENNA CONDUCTED SPURIOUS EMISSION

7.1 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.

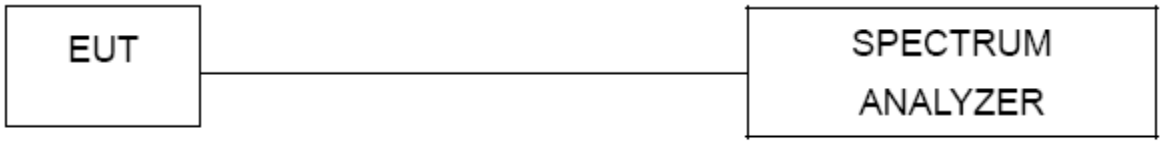
7.2 TEST PROCEDURE

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= 100KHz, VBW=300KHz, Sweep time = 10 ms.

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 LIST OF MEASURING EQUIPMENTS

Radiated Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Preamplifier	EMCI	EMC02325B	980217	2021/4/8	2022/4/7
2	Preamplifier	EMCI	EMC012645B	980267	2021/4/8	2022/4/7
3	Preamplifier	EMCI	EMC001340	980555	2021/4/8	2022/4/7
4	Test Cable	EMCI	EMC-SM-SM-1000	180809	2021/4/8	2022/4/7
5	Test Cable	EMCI	EMC104-SM-SM-3000	151205	2021/4/8	2022/4/7
6	Test Cable	EMCI	EMC-SM-SM-7000	180408	2021/4/8	2022/4/7
7	MXE EMI Receiver	Agilent	N9038A	MY554200087	2021/5/27	2022/5/26
8	Signal Analyzer	Agilent	N9010A	MY56480554	2020/8/25	2021/8/24
9	Loop Ant	Electro-Metrics	EMCI-LPA600	274	2021/6/1	2022/5/31
10	Horn Ant	SCHWARZBECK	BBHA 9120D	9120D-1342	2021/6/2	2022/6/1
11	Horn Ant	Schwarzbeck	BBHA 9170	BBHA 9170340	2021/7/9	2022/7/8
12	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	VULB 9168-352	2021/7/23	2022/7/22
13	5dB Attenuator	EMCI	EMCI-N-6-05	AT-N0625	2021/7/23	2022/7/22
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	FSP 40	100129	2021/6/8	2022/6/7

Output Power						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Power Meter	Anritsu	ML2495A	1128008	2021/5/26	2022/5/25
2	Power Sensor	Anritsu	MA2411B	1126001	2021/5/26	2022/5/25

Power Spectral Density						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP 40	100129	2021/6/8	2022/6/7

Antenna conducted Spurious Emission						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP 40	100129	2021/6/8	2022/6/7

Spot check test:

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

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

9 EUT TEST PHOTO

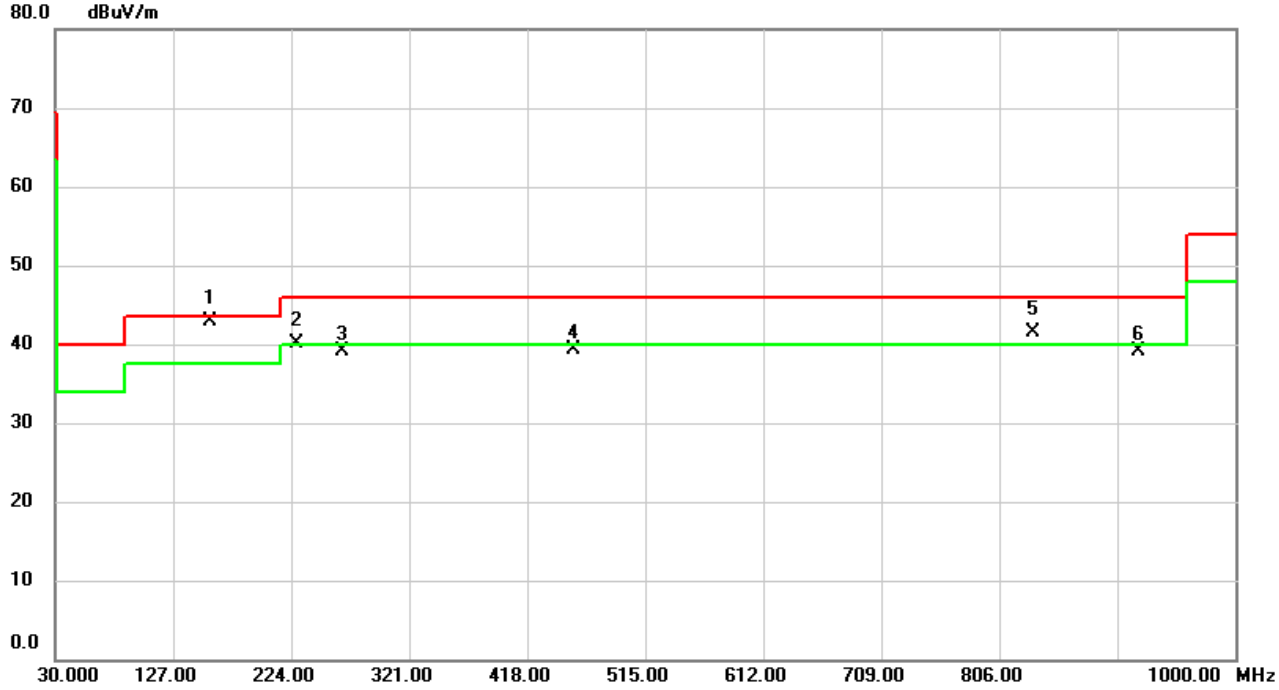
Please refer to document Appendix No.: TP-2103T126B-FCCP-3 (APPENDIX-TEST PHOTOS).

10 EUT PHOTOS

Please refer to document Appendix No.: EP-2103T126B-3 (APPENDIX-EUT PHOTOS).

APPENDIX A RADIATED EMISSIONS - 30 MHZ TO 1 GHZ

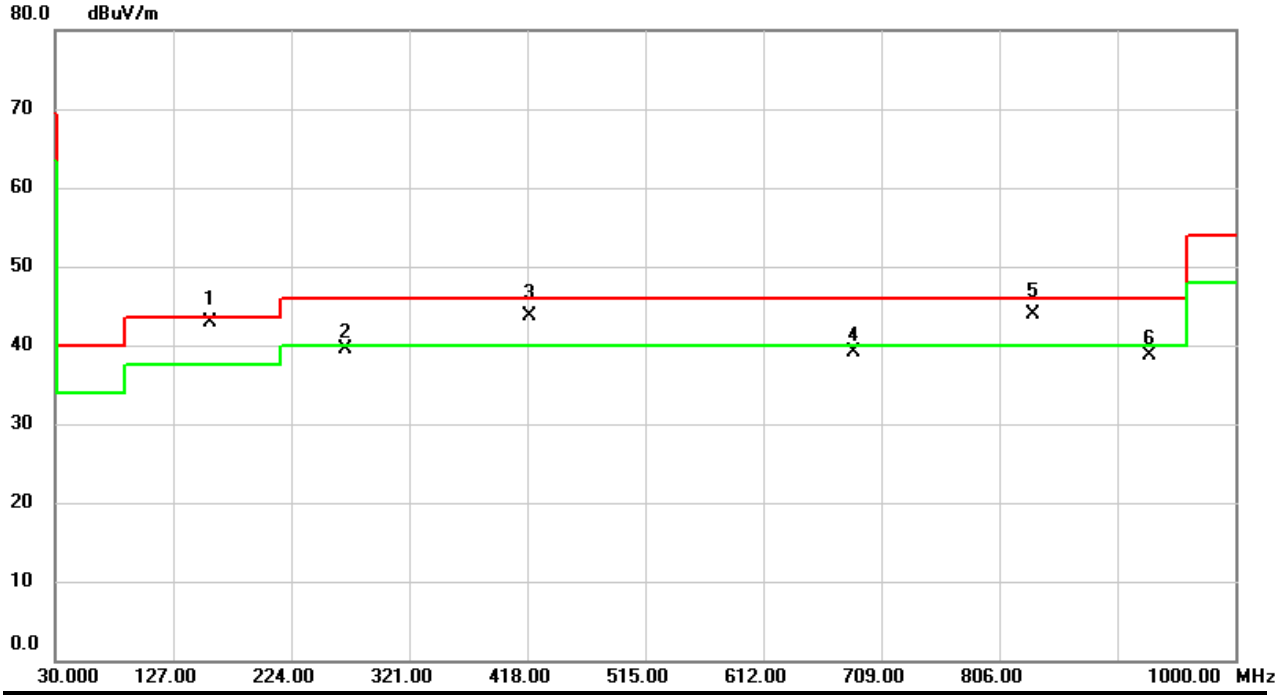
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	157.6520	51.25	-8.34	42.91	43.50	-0.59	QP	
2	!	228.7530	50.52	-10.37	40.15	46.00	-5.85	QP	
3		265.8070	47.69	-8.57	39.12	46.00	-6.88	peak	
4		455.6360	42.92	-3.59	39.33	46.00	-6.67	peak	
5	!	833.2893	38.52	3.04	41.56	46.00	-4.44	QP	
6		921.0420	34.53	4.49	39.02	46.00	-6.98	peak	

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

Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%

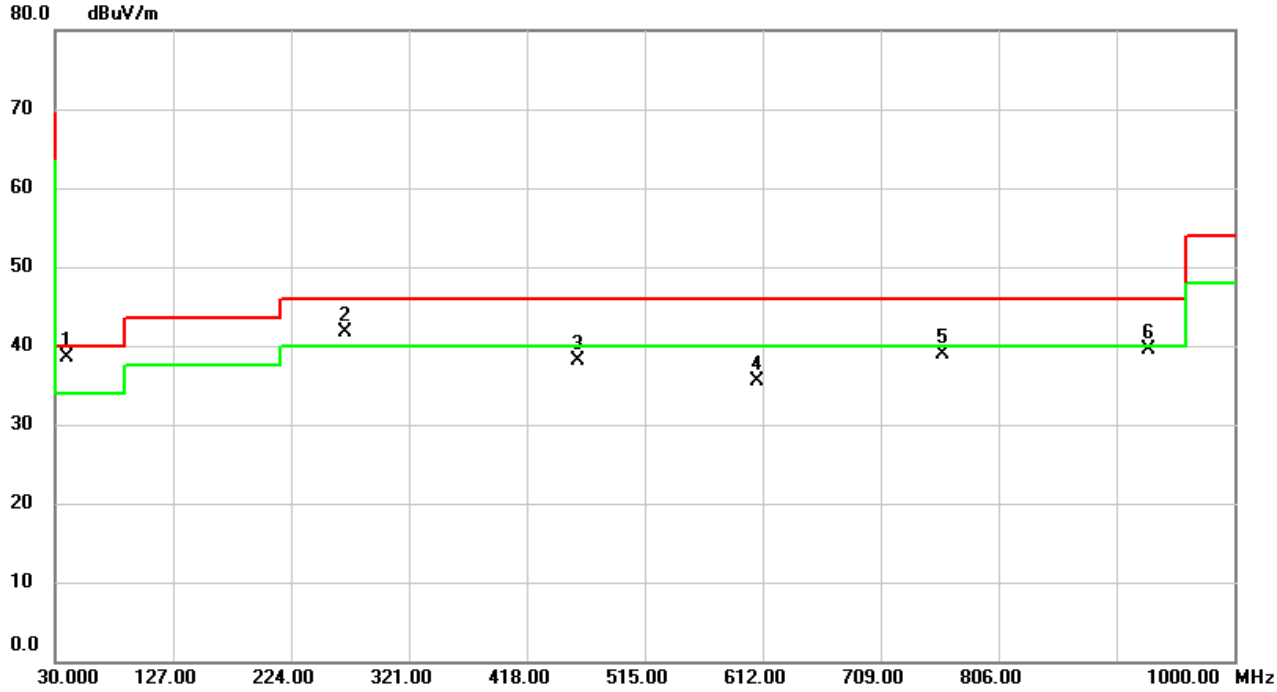


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	157.6843	51.31	-8.34	42.97	43.50	-0.53	QP	
2		268.5230	47.96	-8.40	39.56	46.00	-6.44	peak	
3	!	419.6166	48.10	-4.36	43.74	46.00	-2.26	QP	
4		685.9461	38.53	0.59	39.12	46.00	-6.88	peak	
5	!	833.2893	40.88	3.04	43.92	46.00	-2.08	QP	
6		929.9334	34.03	4.64	38.67	46.00	-7.33	peak	

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

Spot check test:

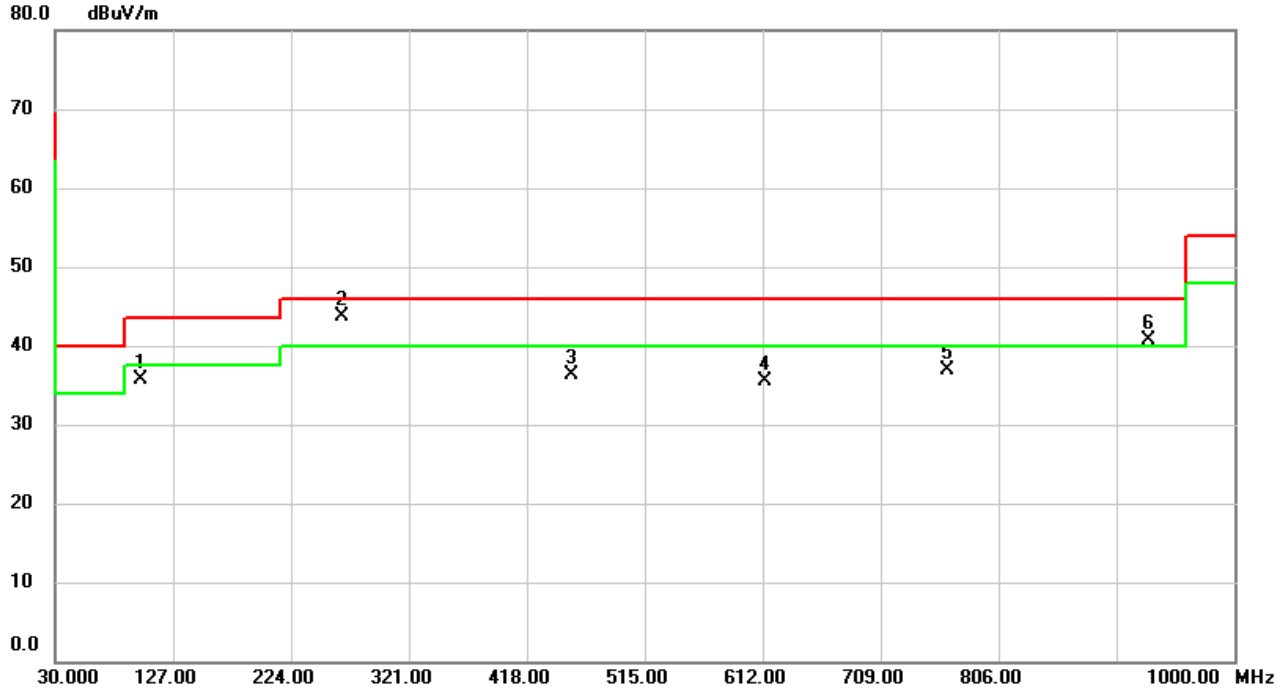
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2023/1/17
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	39.9262	50.43	-11.93	38.50	40.00	-1.50	peak	
2	!	268.6200	54.08	-12.31	41.77	46.00	-4.23	peak	
3		460.5183	45.39	-7.22	38.17	46.00	-7.83	peak	
4		606.9560	39.52	-4.08	35.44	46.00	-10.56	peak	
5		759.5692	40.32	-1.45	38.87	46.00	-7.13	peak	
6		929.9337	39.04	0.54	39.58	46.00	-6.42	peak	

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

Test Mode	BLE 4.0 (1 Mbps)	Test Date	2023/1/17
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	59%

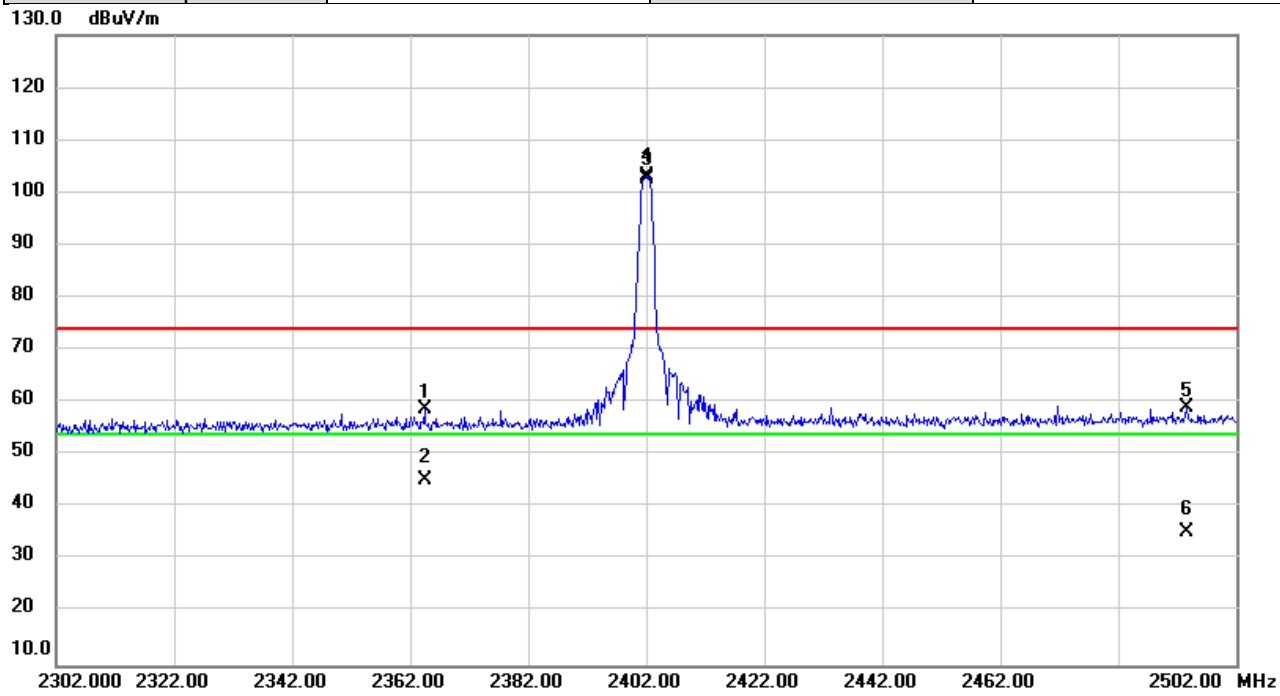


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		99.9370	51.98	-16.33	35.65	43.50	-7.85	peak	
2	*	265.5483	56.07	-12.46	43.61	46.00	-2.39	peak	
3		455.2480	43.60	-7.31	36.29	46.00	-9.71	peak	
4		613.7136	39.50	-4.00	35.50	46.00	-10.50	peak	
5		764.5810	38.23	-1.41	36.82	46.00	-9.18	peak	
6	!	929.9336	40.24	0.54	40.78	46.00	-5.22	peak	

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

APPENDIX B RADIATED EMISSIONS - ABOVE 1 GHZ

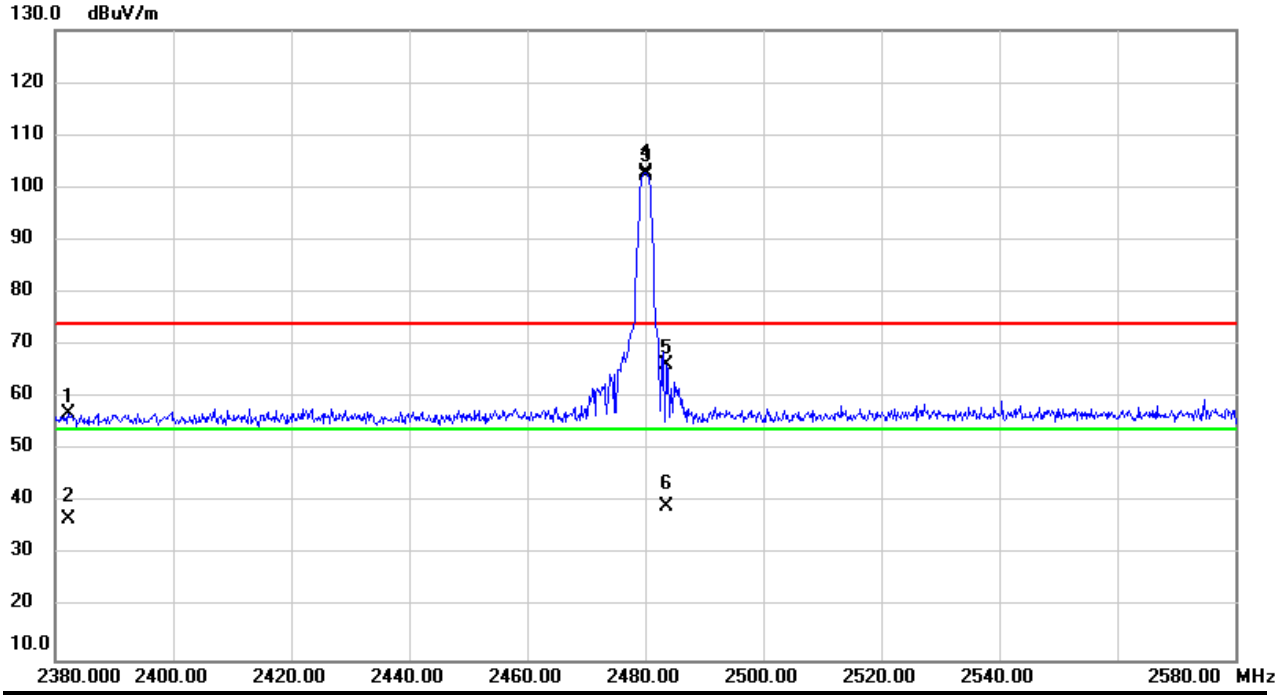
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2364.447	27.50	31.13	58.63	74.00	-15.37	peak	
2		2364.447	13.97	31.13	45.10	54.00	-8.90	AVG	
3	X	2402.000	72.01	31.26	103.27	74.00	29.27	peak	NoLimit
4	*	2402.000	71.37	31.26	102.63	54.00	48.63	AVG	NoLimit
5		2493.487	27.41	31.55	58.96	74.00	-15.04	peak	
6		2493.487	3.94	31.55	35.49	54.00	-18.51	AVG	

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

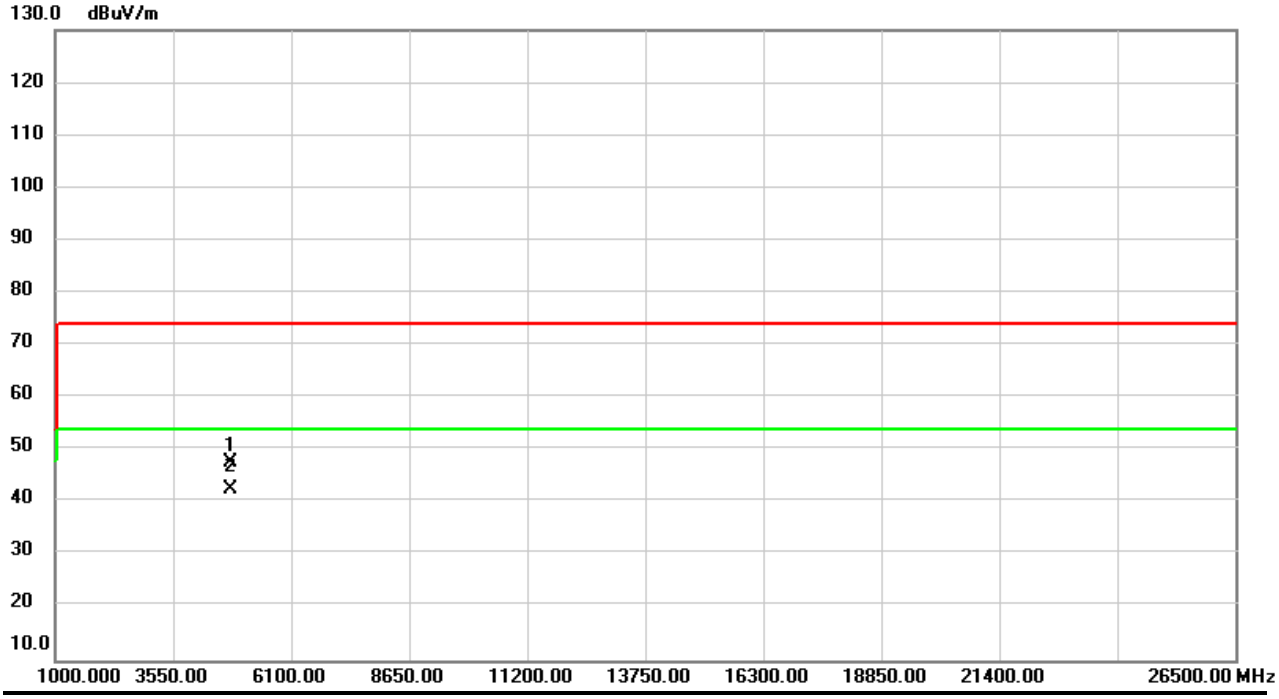
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2382.333	25.90	31.18	57.08	74.00	-16.92	peak	
2		2382.333	5.65	31.18	36.83	54.00	-17.17	AVG	
3	X	2480.000	71.38	31.51	102.89	74.00	28.89	peak	NoLimit
4	*	2480.000	70.76	31.51	102.27	54.00	48.27	AVG	NoLimit
5		2483.680	34.76	31.52	66.28	74.00	-7.72	peak	
6		2483.680	7.58	31.52	39.10	54.00	-14.90	AVG	

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

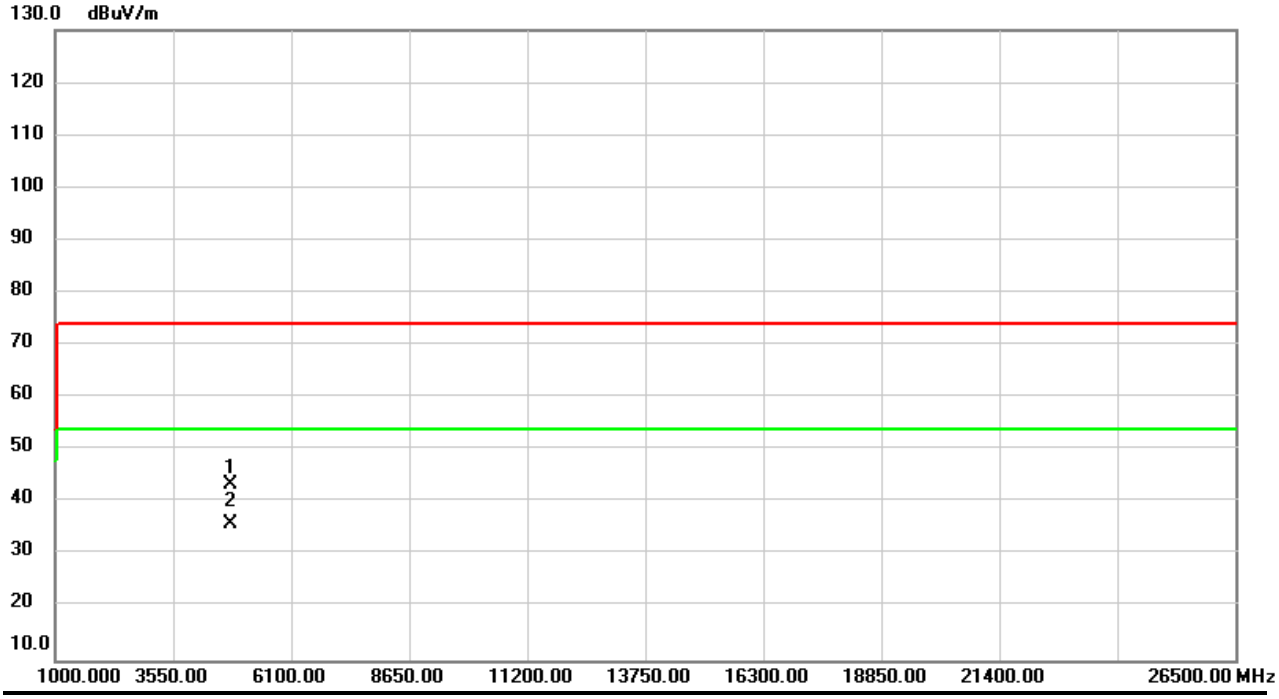
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	57.35	-9.84	47.51	74.00	-26.49	peak	
2	*	4804.000	52.42	-9.84	42.58	54.00	-11.42	AVG	

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

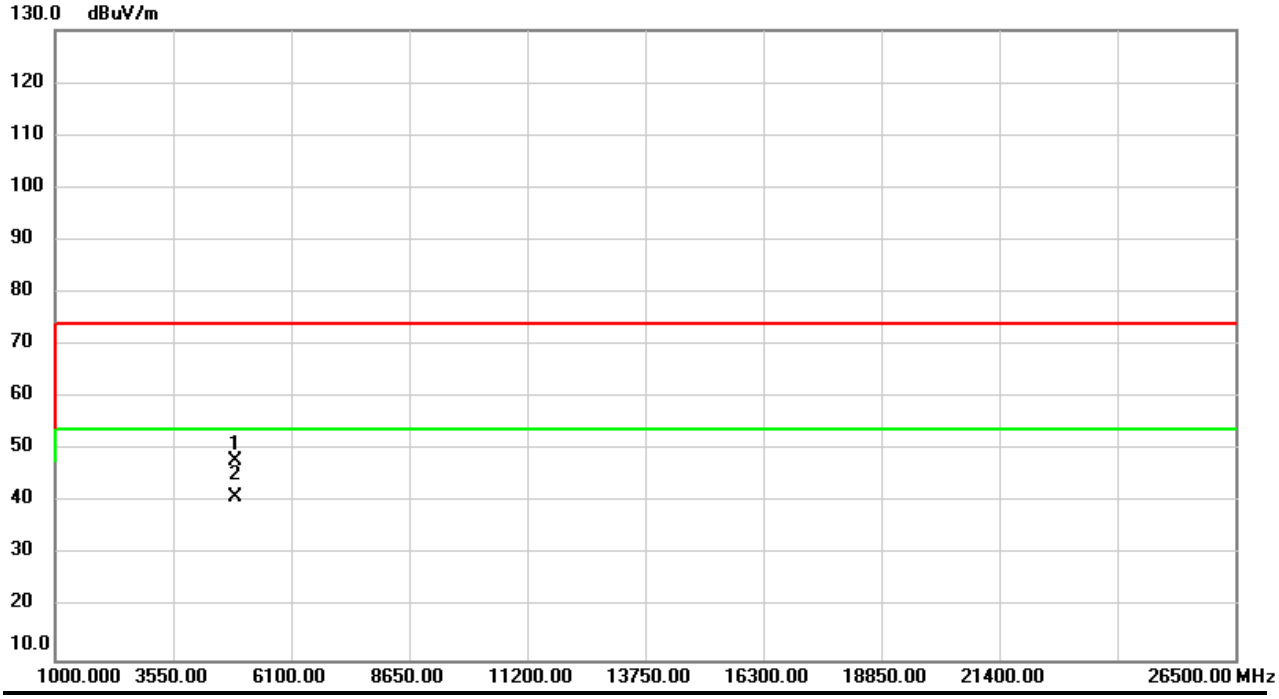
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	53.34	-9.84	43.50	74.00	-30.50	peak	
2	*	4804.000	45.65	-9.84	35.81	54.00	-18.19	AVG	

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

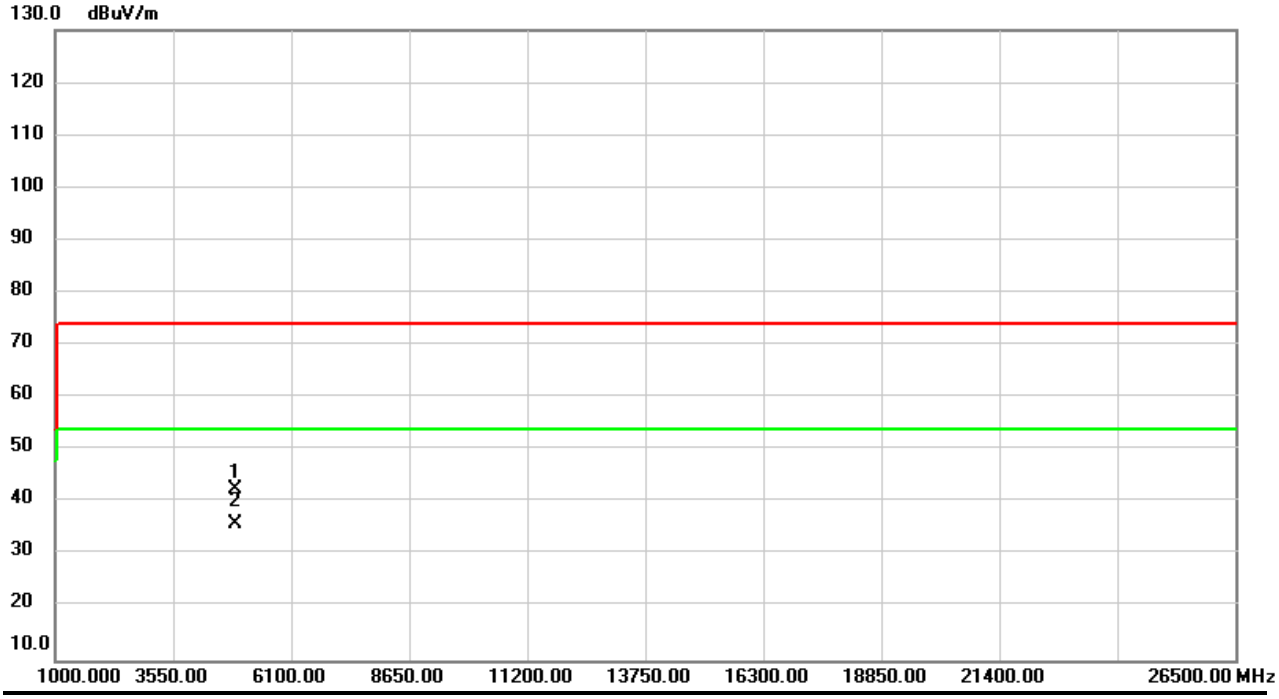
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2440MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	57.67	-9.77	47.90	74.00	-26.10	peak	
2	*	4880.000	50.95	-9.77	41.18	54.00	-12.82	AVG	

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

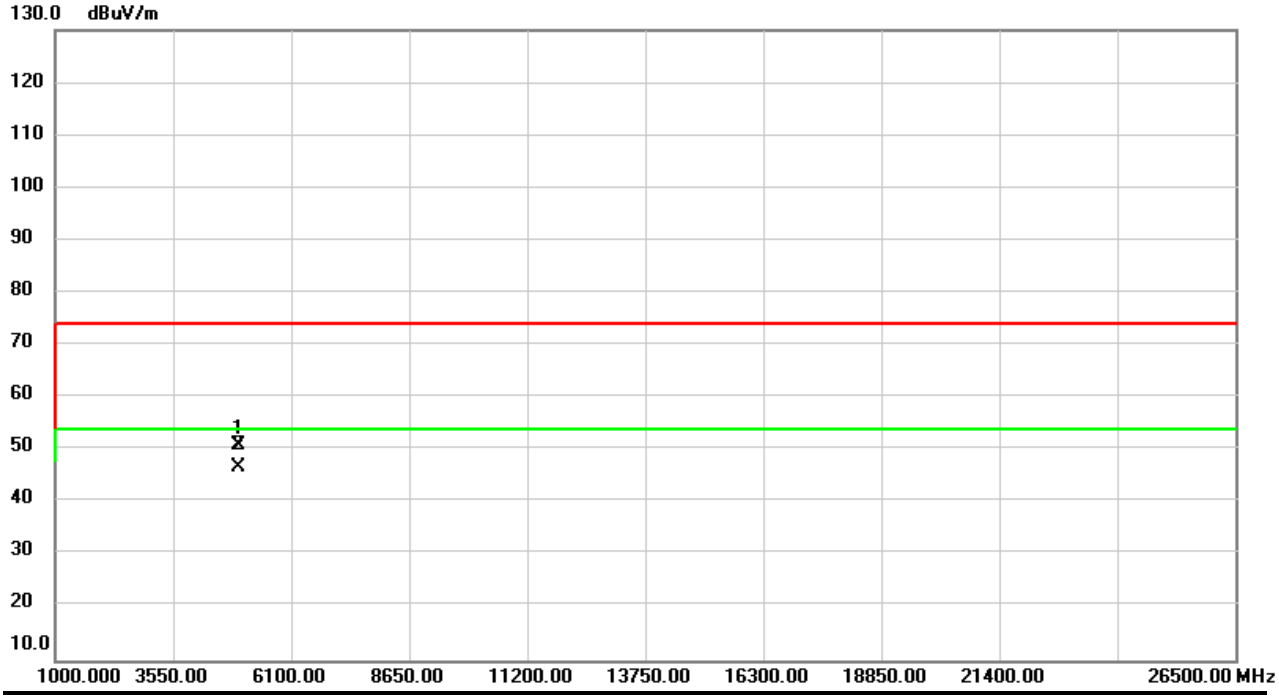
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2440MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	52.22	-9.77	42.45	74.00	-31.55	peak	
2	*	4880.000	45.77	-9.77	36.00	54.00	-18.00	AVG	

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

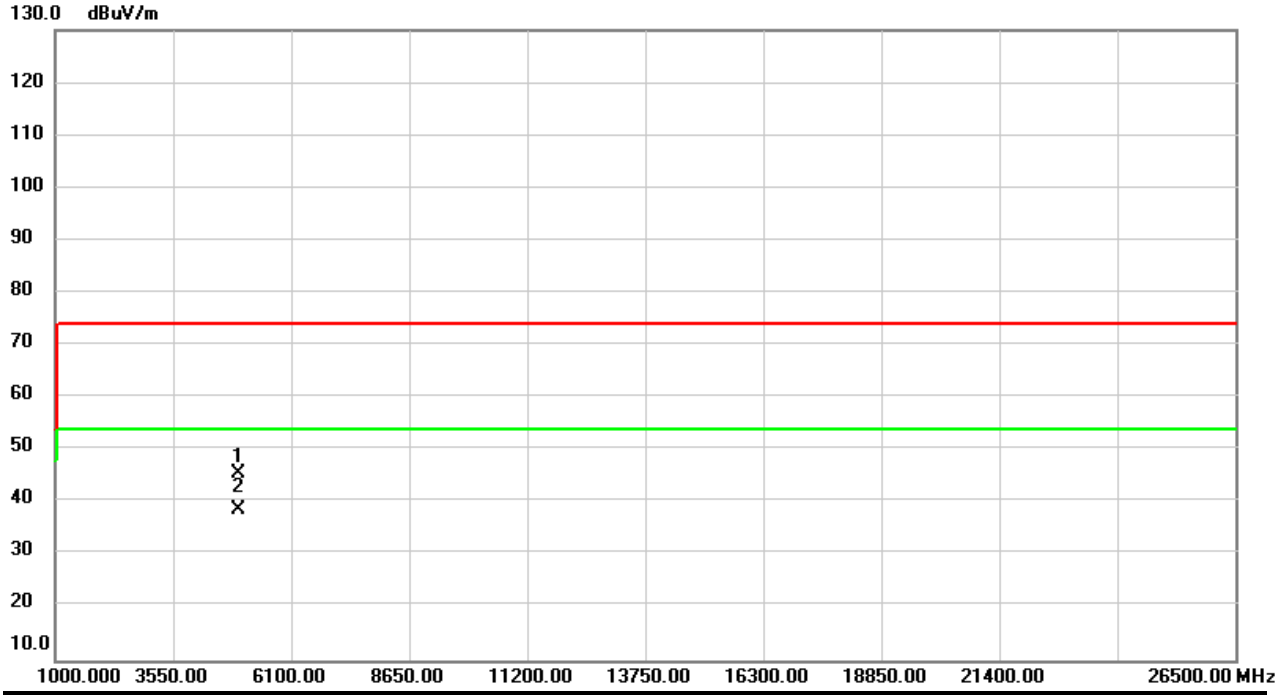
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	60.77	-9.68	51.09	74.00	-22.91	peak	
2	*	4960.000	56.35	-9.68	46.67	54.00	-7.33	AVG	

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

Test Mode	BLE 4.0 (1 Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%

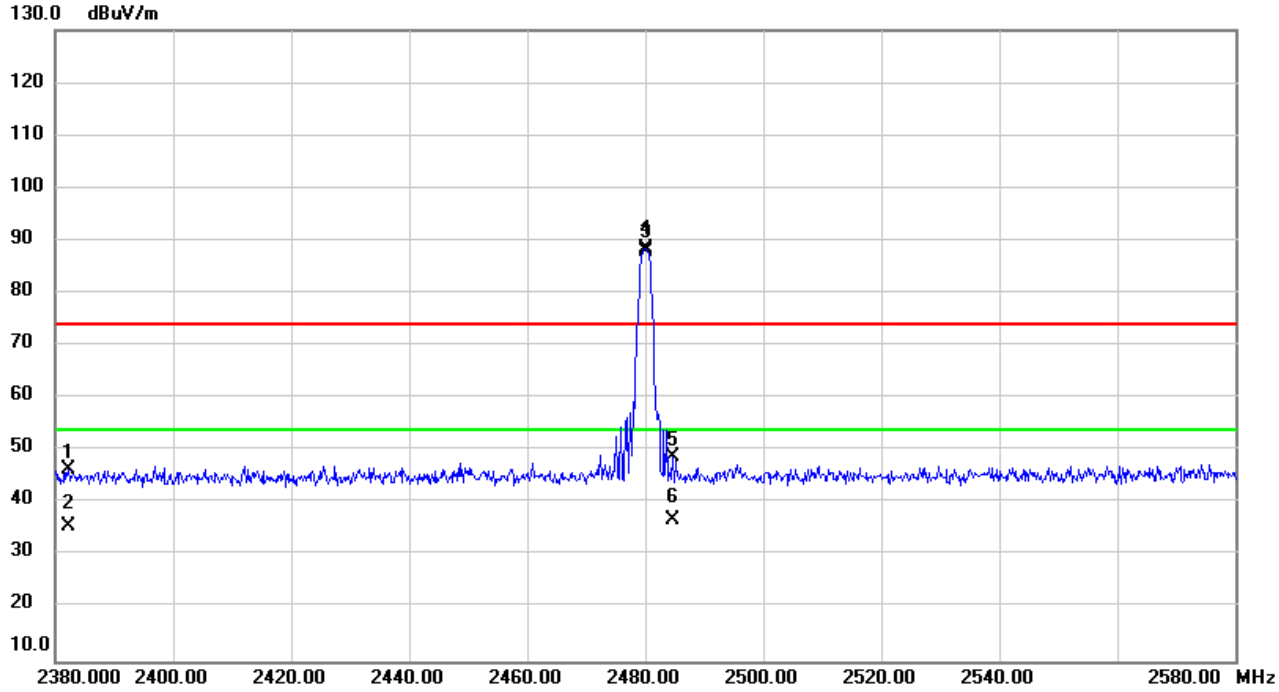


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	55.16	-9.68	45.48	74.00	-28.52	peak	
2	*	4960.000	48.43	-9.68	38.75	54.00	-15.25	AVG	

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

Spot check test:

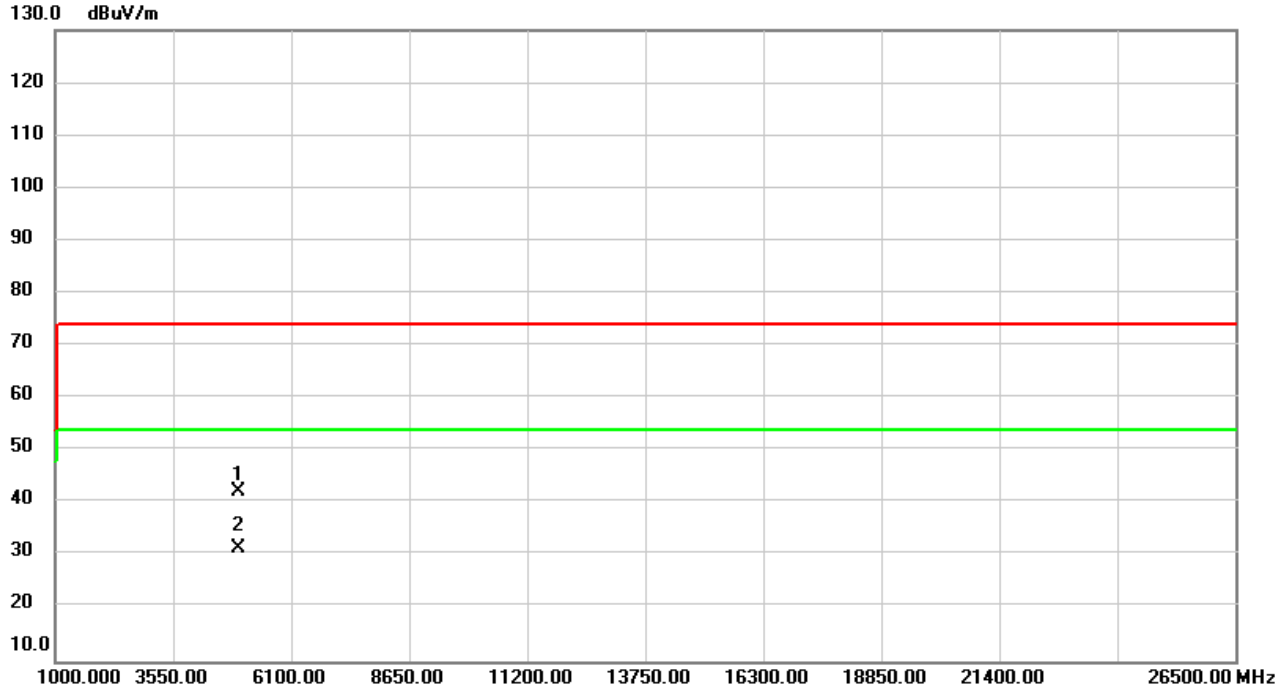
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2022/8/25
Test Frequency	2480MHz	Polarization	Vertical
Temp	24°C	Hum.	58%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2382.200	52.26	-5.78	46.48	74.00	-27.52	peak	
2		2382.200	41.58	-5.78	35.80	54.00	-18.20	AVG	
3	X	2480.000	94.11	-5.65	88.46	74.00	14.46	peak	NoLimit
4	*	2480.000	93.49	-5.65	87.84	54.00	33.84	AVG	NoLimit
5		2484.707	54.62	-5.64	48.98	74.00	-25.02	peak	
6		2484.707	42.34	-5.64	36.70	54.00	-17.30	AVG	

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

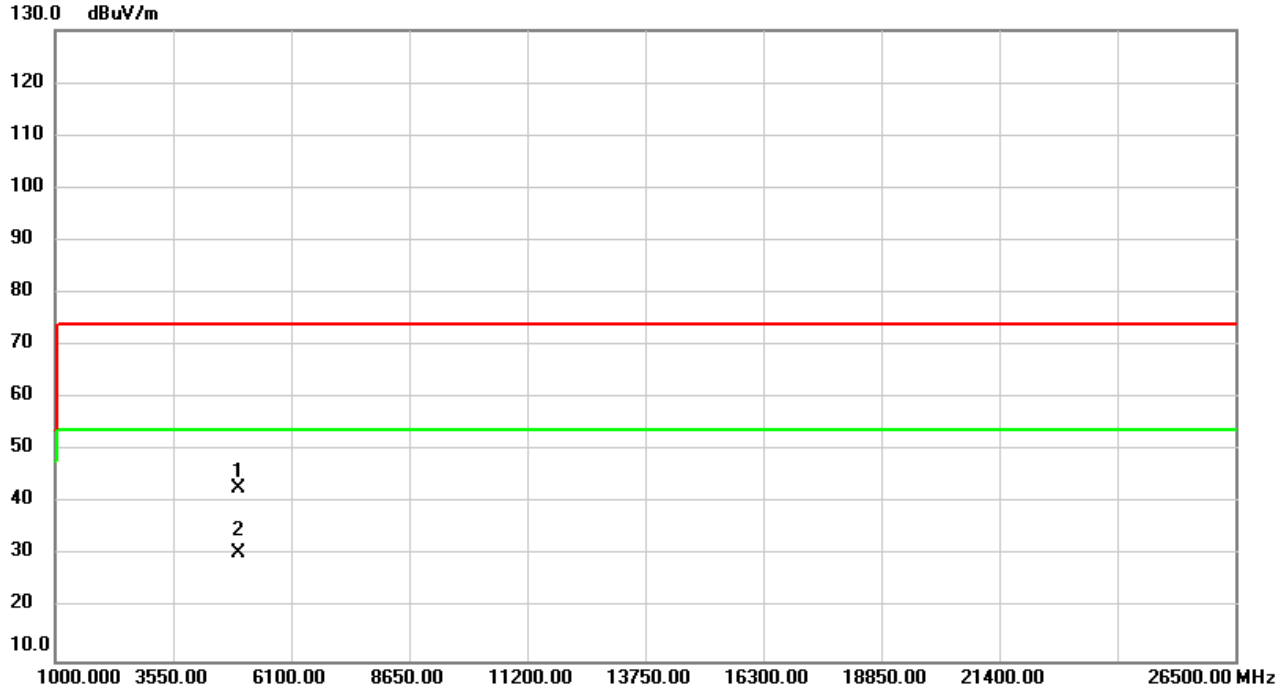
Test Mode	BLE 4.0 (1 Mbps)	Test Date	2022/8/25
Test Frequency	2480MHz	Polarization	Vertical
Temp	24°C	Hum.	58%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	40.98	1.18	42.16	74.00	-31.84	peak	
2	*	4960.000	30.15	1.18	31.33	54.00	-22.67	AVG	

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

Test Mode	BLE 4.0 (1 Mbps)	Test Date	2022/8/25
Test Frequency	2480MHz	Polarization	Horizontal
Temp	24°C	Hum.	58%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	41.52	1.18	42.70	74.00	-31.30	peak	
2	*	4960.000	29.51	1.18	30.69	54.00	-23.31	AVG	

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

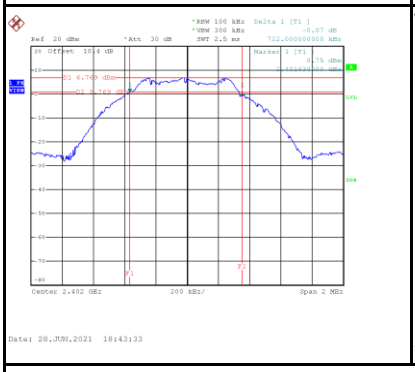
APPENDIX C BANDWIDTH

Test Mode:	1Mbps

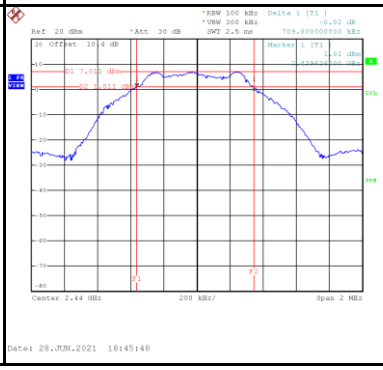
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.72	1.04	500	Pass
2440	0.71	1.03	500	Pass
2480	0.71	1.04	500	Pass

6dB Bandwidth

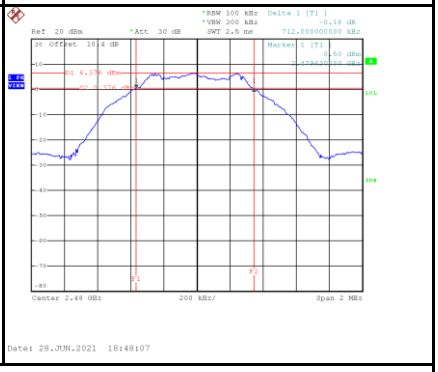
2402 MHz



2440 MHz

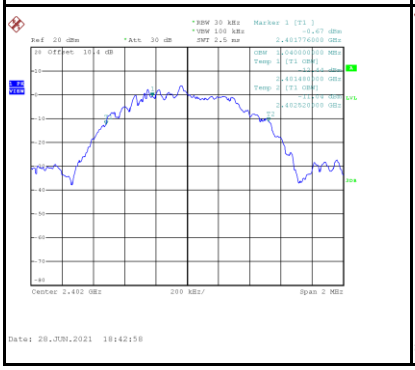


2480 MHz

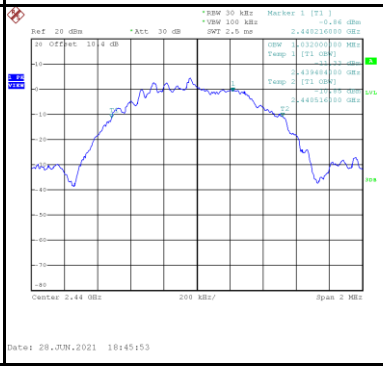


99% Occupied BW

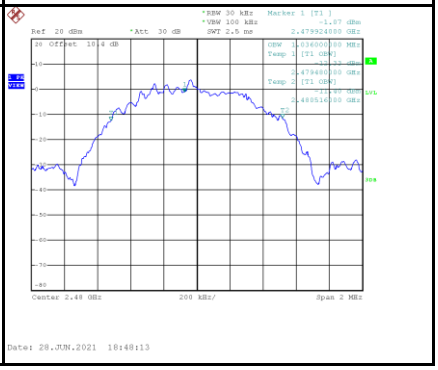
2402 MHz



2440 MHz



2480 MHz



APPENDIX D OUTPUT POWER

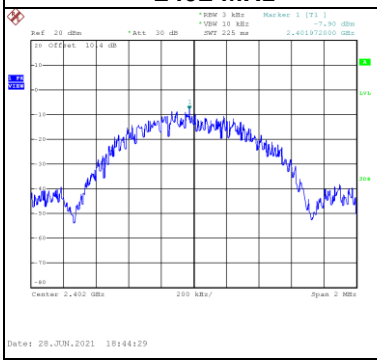
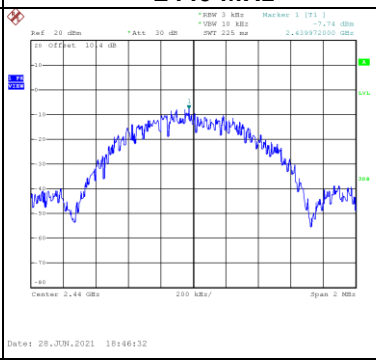
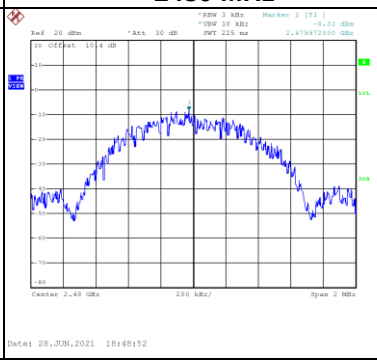
Test Mode :	1Mbps	Tested Date	2021/6/30

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	1.82	0.0015	30.00	1.0000	Pass
2440	2.03	0.0016	30.00	1.0000	Pass
2480	1.59	0.0014	30.00	1.0000	Pass

APPENDIX E POWER SPECTRAL DENSITY TEST

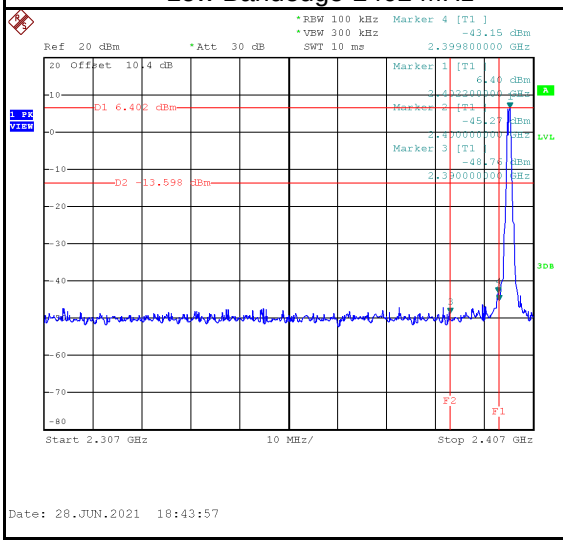
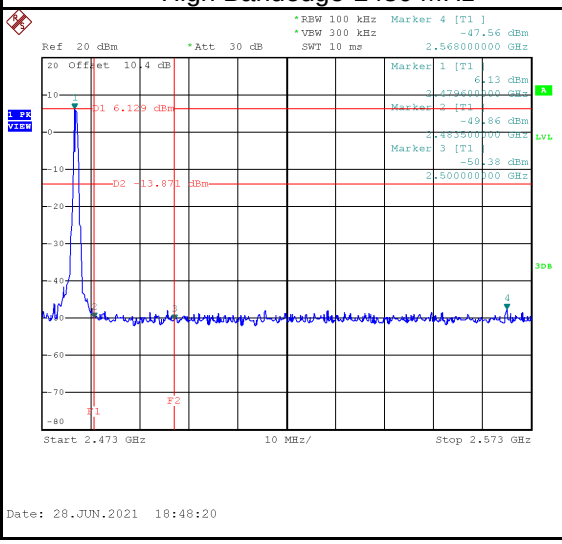
Test Mode :	1Mbps

Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-7.90	8	Pass
2440	-7.74	8	Pass
2480	-8.33	8	Pass

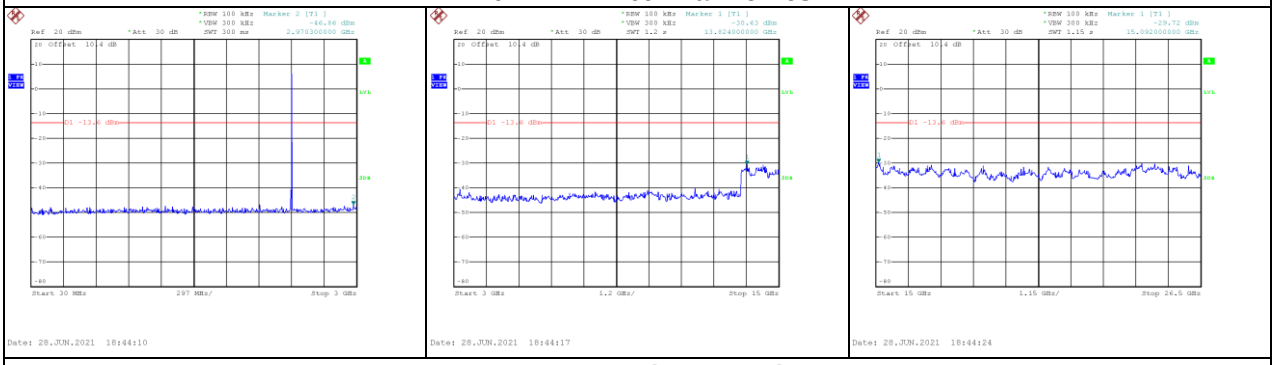
2402 MHz	2440 MHz	2480 MHz
		

APPENDIX F ANTENNA CONDUCTED SPURIOUS EMISSION

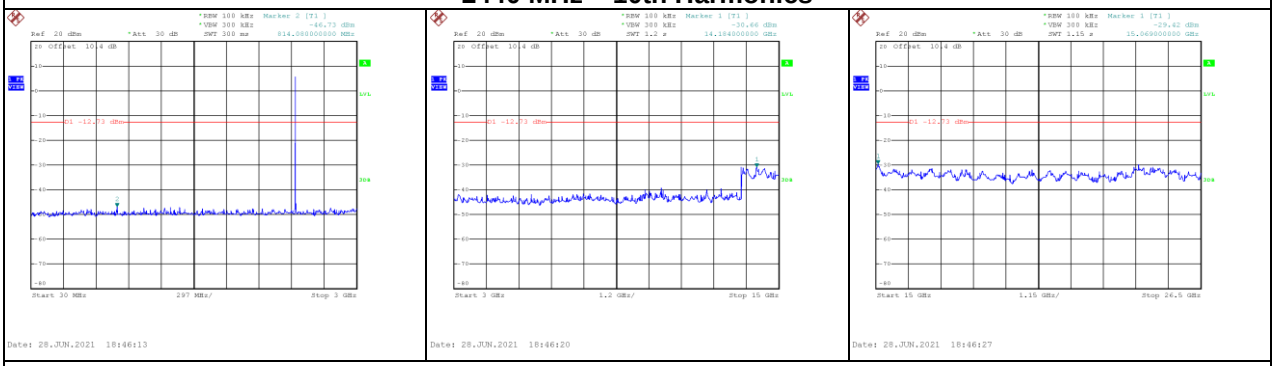
Test Mode :	1Mbps

Low Bandedge-2402 MHz	High Bandedge-2480 MHz
	

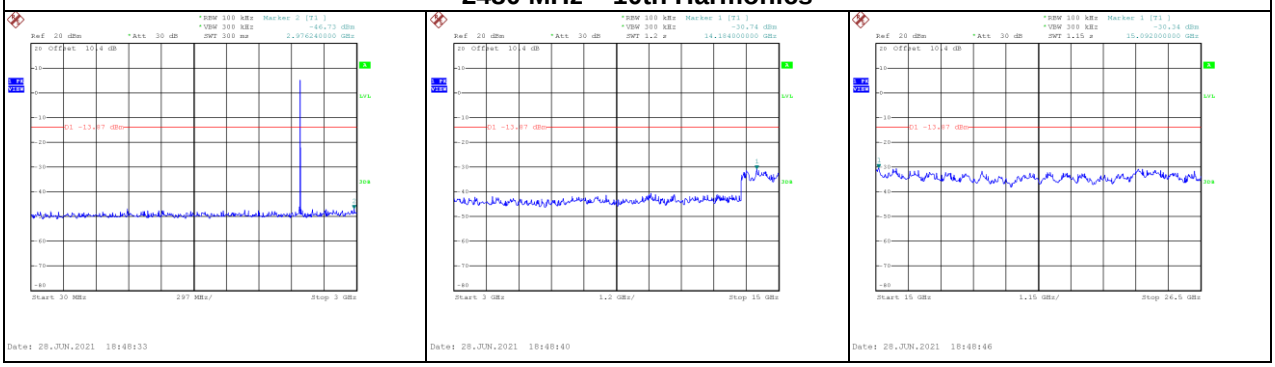
2402 MHz – 10th Harmonics



2440 MHz – 10th Harmonics



2480 MHz – 10th Harmonics



End of Test Report