

# FCC Radio Test Report

**FCC ID: 2A3E3-TAG360-SBM01**

**Report No.** : BTL-FCCP-1-2110T009  
**Equipment** : Smart Bike Module  
**Model Name** : SBM-TCI01  
**Brand Name** : SBM  
**Applicant** : TagBox Solutions Private Limited  
**Address** : 3504/A, 4th Floor, 14th Main Rd, HAL 2nd Stage, Indiranagar, Bengaluru, India 560038  
  
**Radio Function** : Bluetooth Low Energy 5.0  
  
**FCC Rule Part(s)** : FCC Part15, Subpart C (15.247)  
**Measurement Procedure(s)** : ANSI C63.10-2013  
  
**Date of Receipt** : 2021/10/5  
**Date of Test** : 2021/10/5~ 2021/11/10  
**Issued Date** : 2021/12/2

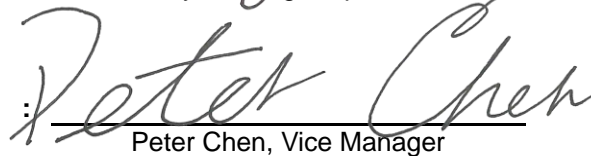
The above equipment has been tested and found in compliance with the requirement of the above standards by BTL Inc.

**Prepared by**

  
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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
BTL-FCCP-1-2110T009	R00	Original Report.	2021/11/25
BTL-FCCP-1-2110T009	R01	Modified Applicant Information.	2021/12/2

## 1 SUMMARY OF TEST RESULTS

Test procedures according to the technical standards.

FCC Part 15, Subpart C (15.247)				
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

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

No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

The test sites and facilities are covered under FCC RN: 674415 and DN: TW0659.

☐ C05      ☐ CB08      ☐ CB11      ☒ CB15      ☐ CB16  
☒ SR05

## 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  $U_{\text{CISPR}}$  requirement.

A. Radiated emissions test :

Test Site	Measurement Frequency Range	$U, (\text{dB})$
CB15	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	$U, (\text{dB})$
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	22 °C, 60 %	DC 12V	Eddie Lee
Radiated emissions above 1 GHz	22 °C, 60~62 %	DC 12V	Eddie Lee
Bandwidth	23.5 °C, 51 %	DC 12V	Tim Lian
Output Power	23.5 °C, 51 %	DC 12V	Tim Lian
Power Spectral Density	23.5 °C, 51 %	DC 12V	Tim Lian
Antenna conducted Spurious Emission	23.5 °C, 51 %	DC 12V	Tim Lian

#### 1.4 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

Test Software	nRF Connect 3.3.1 Version 1.1.2			
Modulation Mode	2402 MHz	2440 MHz	2480 MHz	Data Rate
BLE 5.0	3	-8	-4	1 Mbps
BLE 5.0	6	-4	-4	2 Mbps

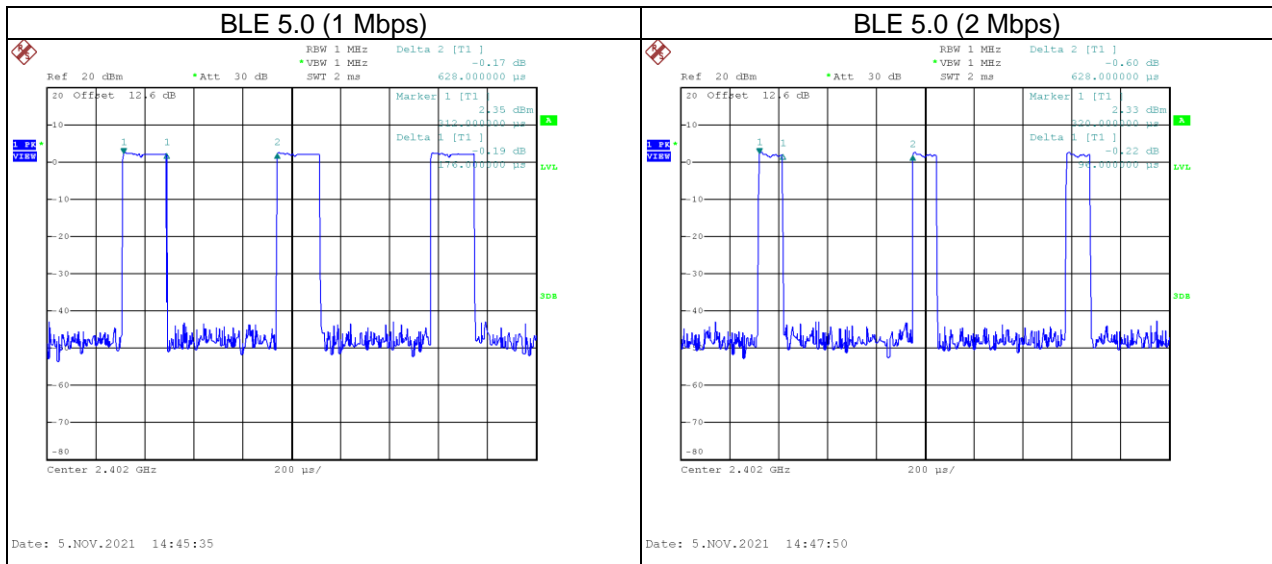
Mode	2402 MHz	2440 MHz	2480 MHz	Data Rate
Bandedge	8	-	8	1 Mbps
Harmonic	3	-8	-4	
Final Setting	3	-8	-4	
Bandedge	8	-	8	2 Mbps
Harmonic	6	-4	-4	
Final Setting	6	-4	-4	



## 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)	0.176	1	0.176	0.628	28.03%	5.52
BLE 5.0 (2 Mbps)	0.096	1	0.096	0.628	15.29%	8.16



## 2 GENERAL INFORMATION

### 2.1 DESCRIPTION OF EUT

Equipment	Smart Bike Module
Model Name	SBM-TCI01
Brand Name	SBM
Model Difference	N/A
Power Source	DC voltage supplied from DC power supply.
Power Rating	DC 12V
Products Covered	1 * key chain
Hardware Version	v2.1.8
Software Version	N/A
Operation Band	2400 MHz ~ 2483.5 MHz
Operation Frequency	2402 MHz ~ 2480 MHz
Modulation Technology	GFSK
Transfer Rate	1/2 Mbps
Output Power Max.	1 Mbps: -0.15 dBm (0.0010 W) 2 Mbps: 2.50 dBm (0.0018 W)
Test Model	SBM-TCI01
Sample Status	Engineering Sample
EUT Modification(s)	N/A

#### NOTE:

(1) For a more detailed features description, please refer to the manufacturer's specifications or the 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.	Manufacturer	Model Name	Type	Frequency Range (MHz)	Gain (dBi)
1	ignion <sup>™</sup>	NN01-102	Chip	2400 - 2500	1.7

## 2.2 TEST MODES

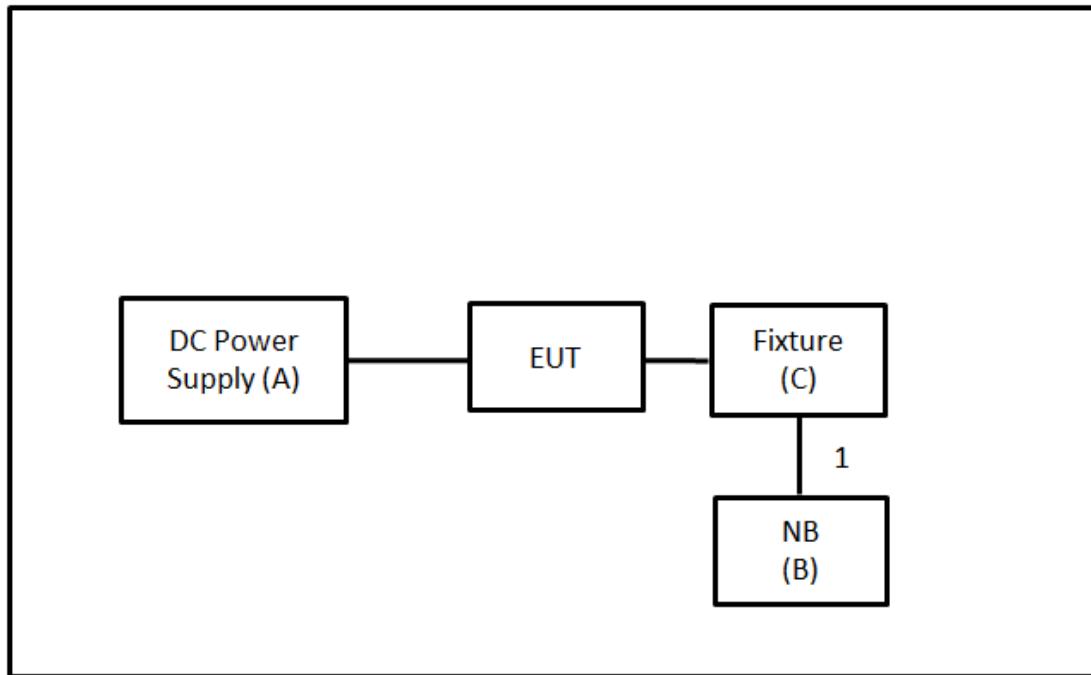
Test Items	Test mode	Channel	Note
Transmitter Radiated Emissions (below 1GHz)	1 Mbps	00	-
Transmitter Radiated Emissions (above 1GHz)	1 Mbps	00/39	Bandedge
	1 Mbps	00/19/39	Harmonic
Bandwidth	1 Mbps	00/19/39	-
Output Power	1 Mbps	00/19/39	-
Power Spectral Density	1 Mbps	00/19/39	-
Antenna conducted Spurious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



### 2.4 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	DC Power Supply	ABM	8303D	N/A	Furnished by test lab.
B	NB	HP	TPN-I119	N/A	Furnished by test lab.
C	Fixture	N/A	N/A	N/A	Supplied by test requester

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
1	N/A	N/A	1m	USB extension Cable	Furnished by test lab.

### 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

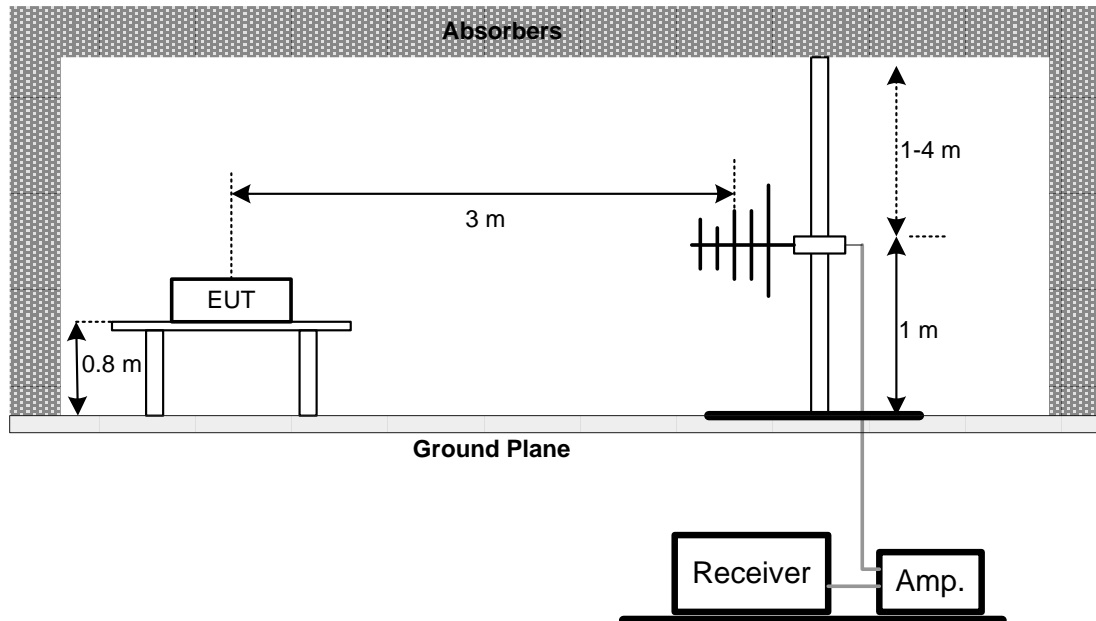
- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The measuring distance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

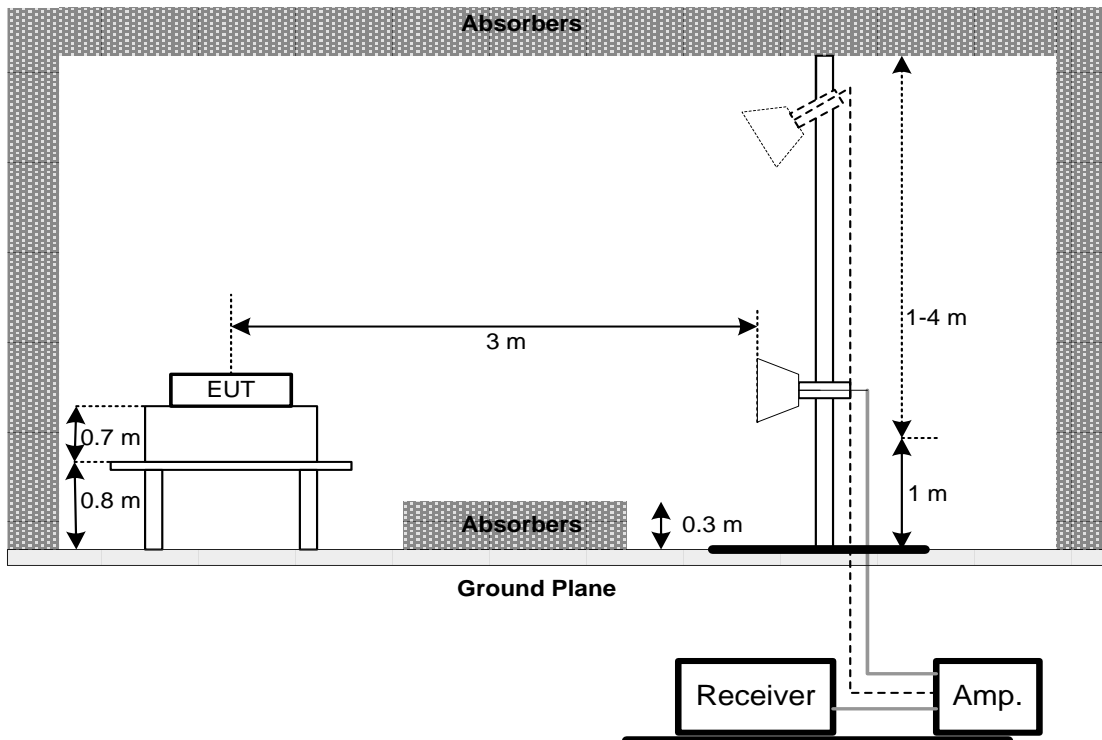
No deviation.

## 3.4 TEST SETUP

### 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	$\geq 500\text{KHz}$ (6dB bandwidth)	2400-2483.5	PASS

### 4.2 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= 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

- The EUT was directly connected to the power meter and antenna output port as show in the block diagram below,
- 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

- 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.

### 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.

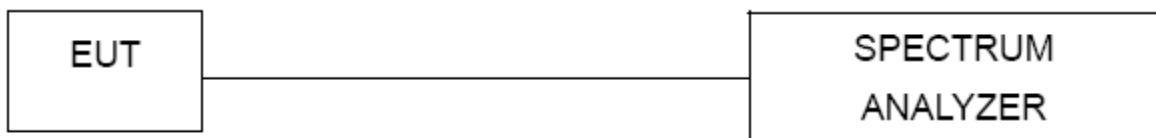
### 7.2 TEST PROCEDURE

- 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-100 0	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-700 0	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	2021/8/25	2022/8/24
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	2021/8/11	2022/8/10
13	5dB Attenuator	EMCI	EMCI-N-6-05	AT-N0625	2021/8/11	2022/8/10
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 30	100854	2021/4/16	2022/4/15

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 30	100854	2021/4/16	2022/4/15

Antenna conducted Spurious Emission						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP 30	100854	2021/4/16	2022/4/15

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**

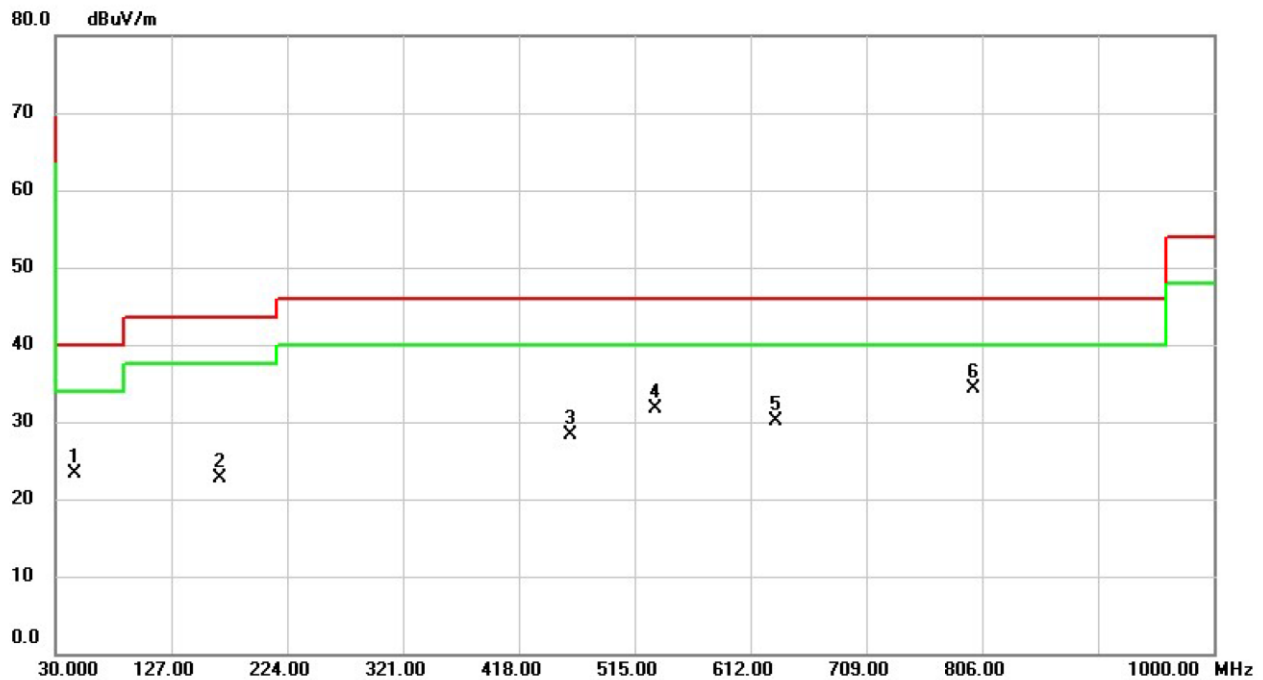
Please refer to document Appendix No.: TP-2110T009-FCCP-1 (APPENDIX-TEST PHOTOS).

**10 EUT PHOTOS**

Please refer to document Appendix No.: EP-2110T009-1 (APPENDIX-EUT PHOTOS).

## **APPENDIX A    RADIATED EMISSIONS - 30 MHZ TO 1 GHZ**

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2021/10/20
Test Frequency	2402MHz	Polarization	Vertical
Temp	22°C	Hum.	60%



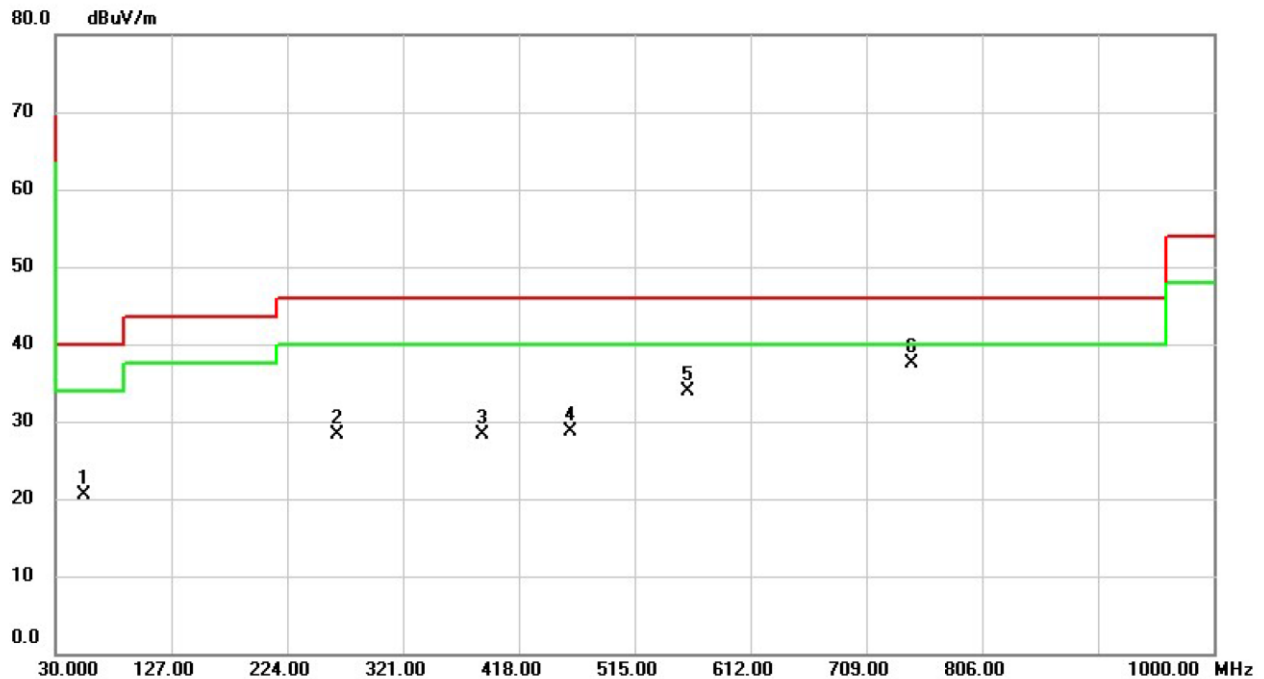
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1		45.6170	31.93	-8.72	23.21	40.00	-16.79	peak	
2		167.9986	32.10	-9.32	22.78	43.50	-20.72	peak	
3		461.1650	32.55	-4.22	28.33	46.00	-17.67	peak	
4		533.1065	34.65	-2.99	31.66	46.00	-14.34	peak	
5		633.7280	30.73	-0.54	30.19	46.00	-15.81	peak	
6	*	798.6603	32.33	1.93	34.26	46.00	-11.74	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	2021/10/20
Test Frequency	2402MHz	Polarization	Horizontal
Temp	22°C	Hum.	60%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		54.3470	29.42	-8.99	20.43	40.00	-19.57	peak	
2		265.7422	37.84	-9.48	28.36	46.00	-17.64	peak	
3		387.1540	34.65	-6.25	28.40	46.00	-17.60	peak	
4		461.5530	32.94	-4.21	28.73	46.00	-17.27	peak	
5		559.7493	36.32	-2.34	33.98	46.00	-12.02	peak	
6	*	746.7007	36.23	1.37	37.60	46.00	-8.40	peak	

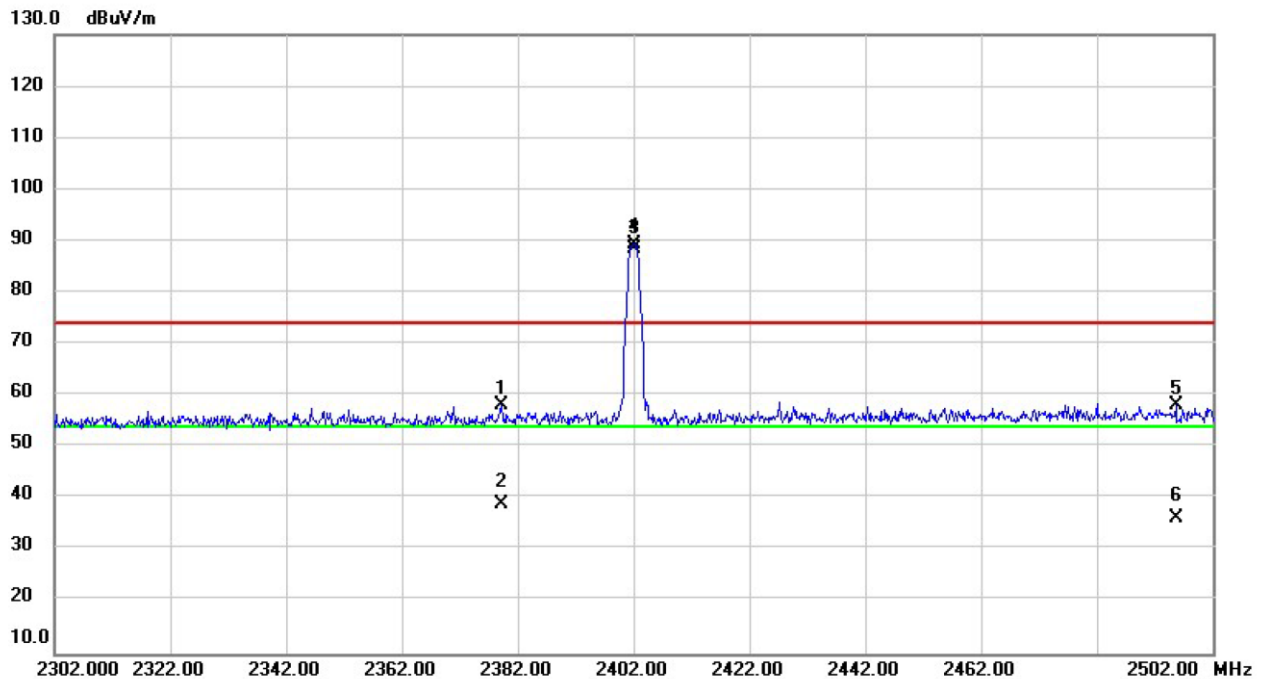
## REMARKS:

(1) Measurement Value = Reading Level + Correct Factor.

(2) Margin Level = Measurement Value - Limit Value.

**APPENDIX B    RADIATED EMISSIONS - ABOVE 1 GHZ**

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2021/10/19
Test Frequency	2402MHz	Polarization	Horizontal
Temp	22°C	Hum.	62%

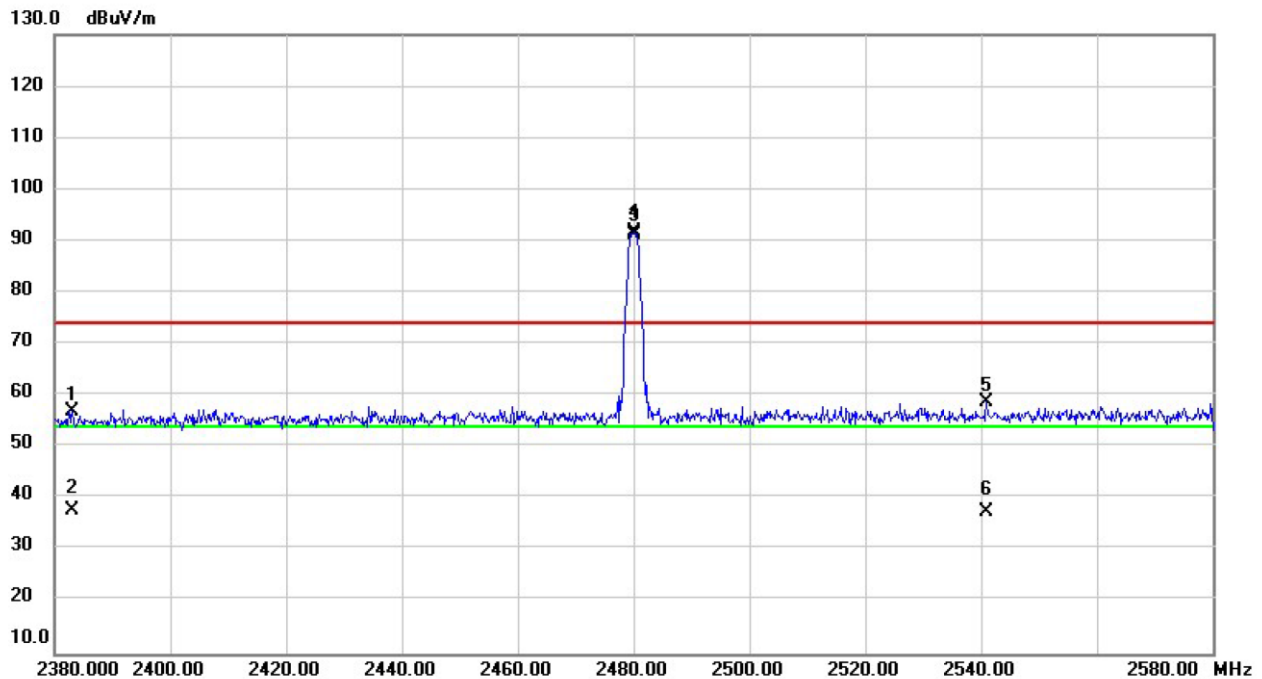


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2379.187	27.05	31.18	58.23	74.00	-15.77	peak	
2		2379.187	7.74	31.18	38.92	54.00	-15.08	AVG	
3	X	2402.000	57.98	31.26	89.24	74.00	15.24	peak	NoLimit
4	*	2402.000	57.20	31.26	88.46	54.00	34.46	AVG	NoLimit
5		2495.653	26.52	31.56	58.08	74.00	-15.92	peak	
6		2495.653	4.65	31.56	36.21	54.00	-17.79	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	2021/10/19
Test Frequency	2480MHz	Polarization	Horizontal
Temp	22°C	Hum.	62%



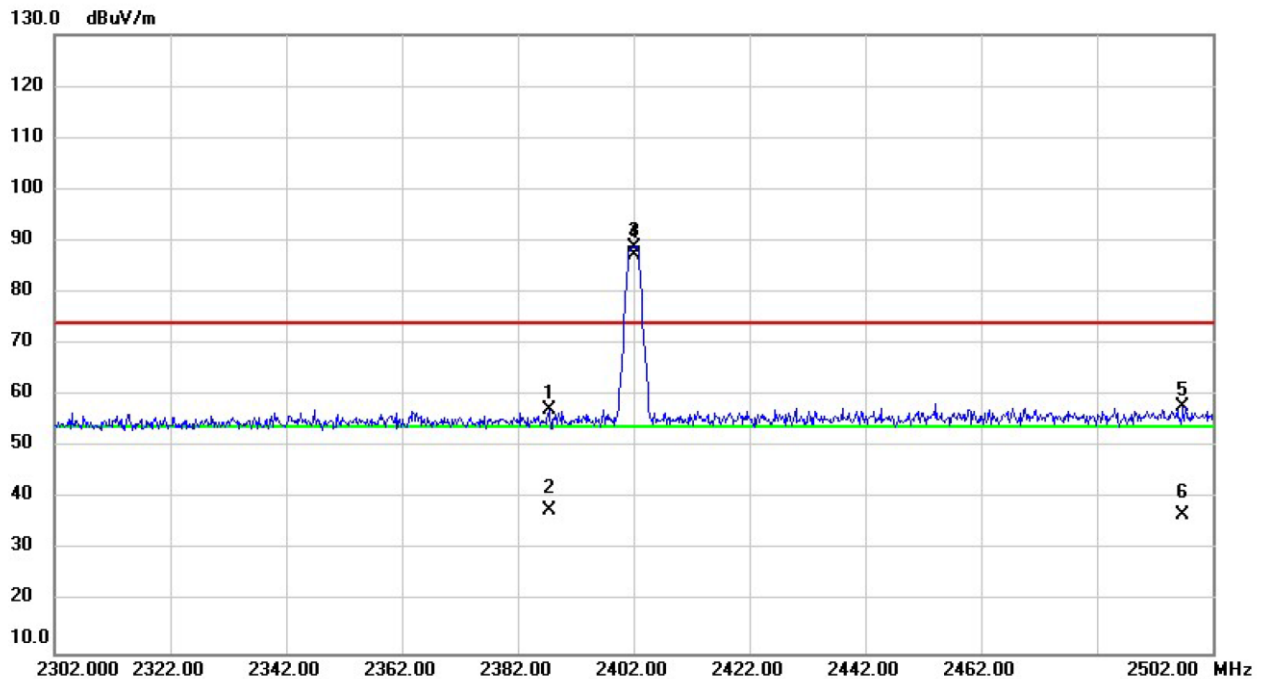
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2383.060	25.76	31.19	56.95	74.00	-17.05	peak	
2		2383.060	6.59	31.19	37.78	54.00	-16.22	AVG	
3	X	2480.000	60.11	31.51	91.62	74.00	17.62	peak	NoLimit
4	*	2480.000	59.67	31.51	91.18	54.00	37.18	AVG	NoLimit
5		2540.993	26.94	31.68	58.62	74.00	-15.38	peak	
6		2540.993	5.85	31.68	37.53	54.00	-16.47	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	2021/10/19
Test Frequency	2402MHz	Polarization	Horizontal
Temp	22°C	Hum.	62%



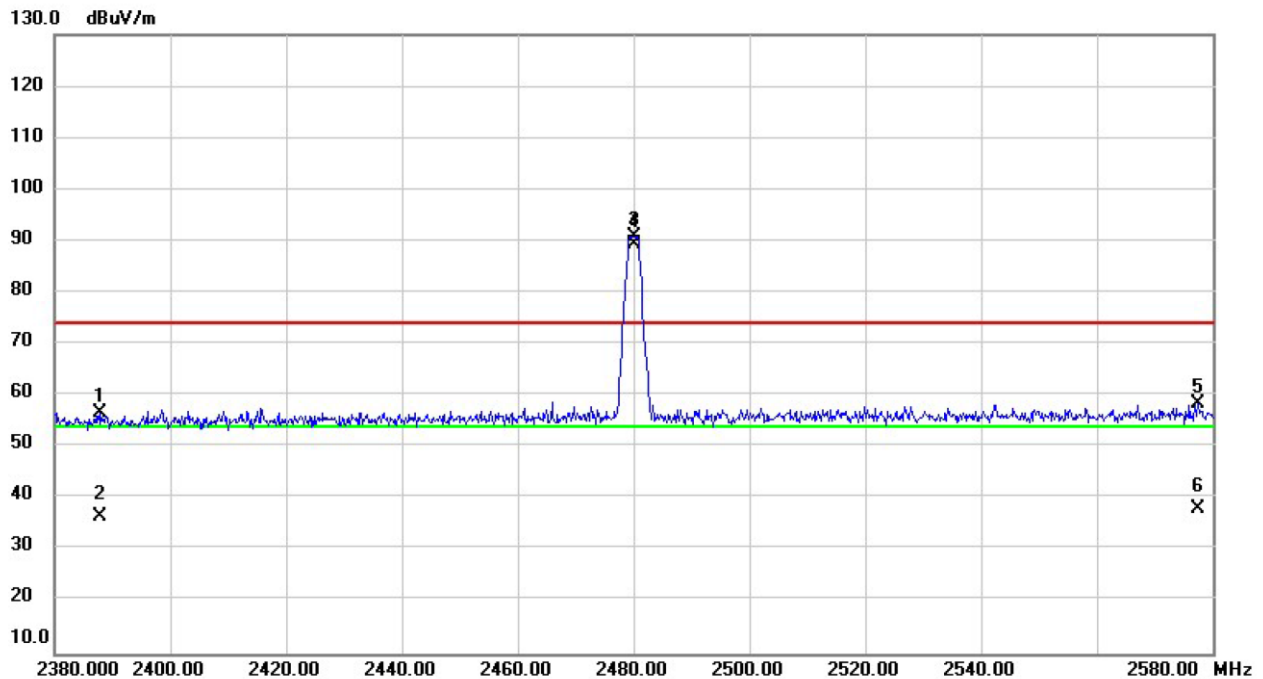
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2387.380	26.14	31.21	57.35	74.00	-16.65	peak	
2		2387.380	6.45	31.21	37.66	54.00	-16.34	AVG	
3	X	2402.000	57.61	31.26	88.87	74.00	14.87	peak	NoLimit
4	*	2402.000	55.90	31.26	87.16	54.00	33.16	AVG	NoLimit
5		2496.920	26.25	31.56	57.81	74.00	-16.19	peak	
6		2496.920	5.42	31.56	36.98	54.00	-17.02	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	2021/10/19
Test Frequency	2480MHz	Polarization	Horizontal
Temp	22°C	Hum.	62%



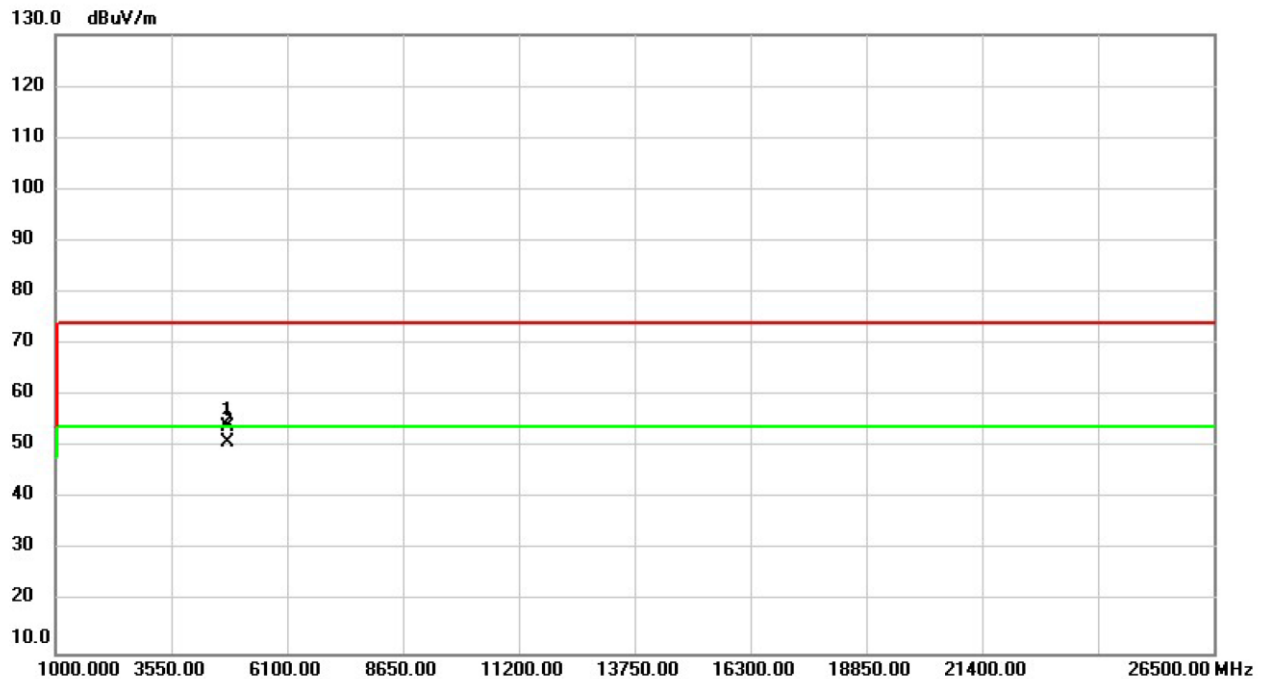
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2387.760	25.42	31.21	56.63	74.00	-17.37	peak	
2		2387.760	5.27	31.21	36.48	54.00	-17.52	AVG	
3	X	2480.000	59.46	31.51	90.97	74.00	16.97	peak	NoLimit
4	*	2480.000	57.99	31.51	89.50	54.00	35.50	AVG	NoLimit
5		2577.513	26.51	31.80	58.31	74.00	-15.69	peak	
6		2577.513	6.37	31.80	38.17	54.00	-15.83	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	2021/10/20
Test Frequency	2402MHz	Polarization	Vertical
Temp	22°C	Hum.	60%

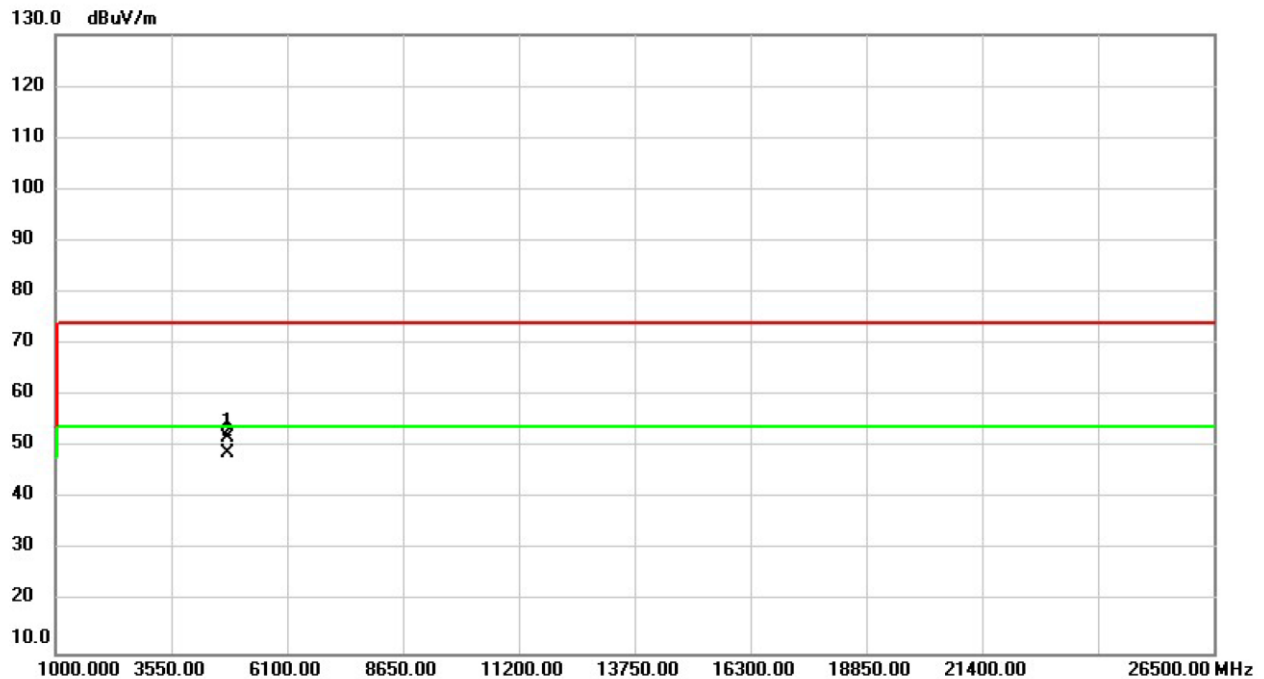


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	63.92	-9.84	54.08	74.00	-19.92	peak	
2	*	4804.000	60.86	-9.84	51.02	54.00	-2.98	AVG	

## REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2021/10/20
Test Frequency	2402MHz	Polarization	Horizontal
Temp	22°C	Hum.	60%



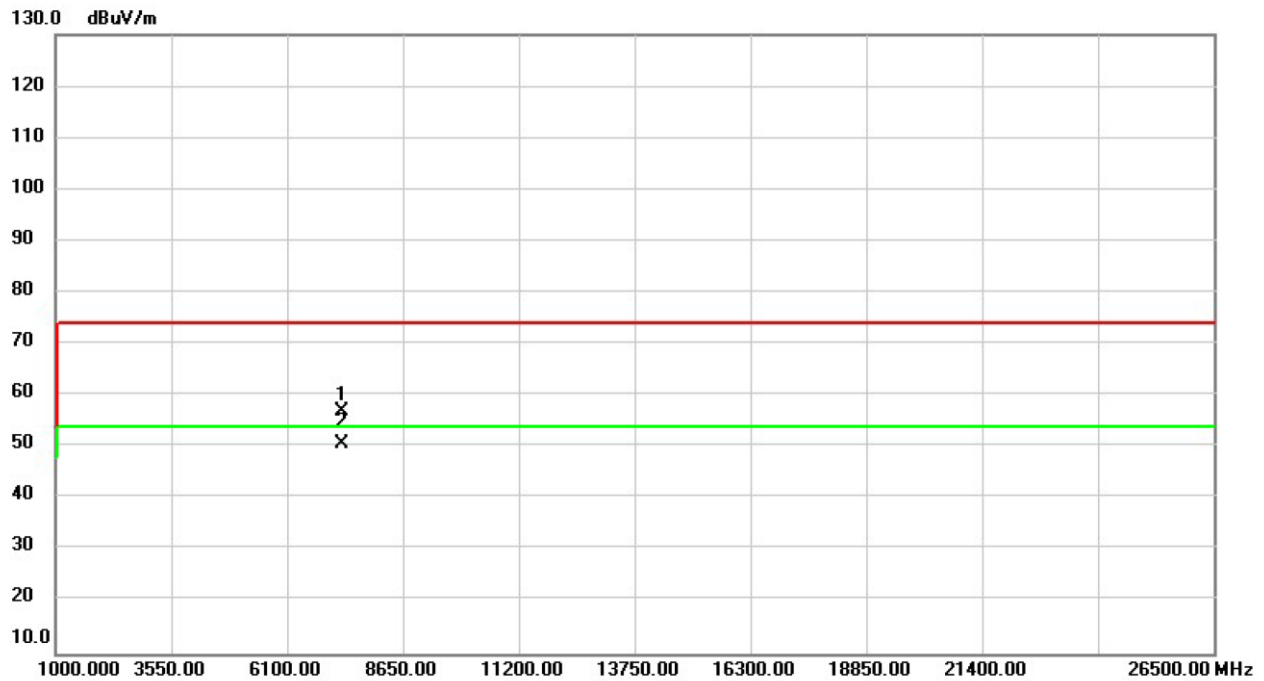
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	61.64	-9.84	51.80	74.00	-22.20	peak	
2	*	4804.000	58.59	-9.84	48.75	54.00	-5.25	AVG	

## REMARKS:

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



Test Mode	BLE 5.0 (1 Mbps)	Test Date	2021/10/20
Test Frequency	2440MHz	Polarization	Vertical
Temp	22°C	Hum.	60%

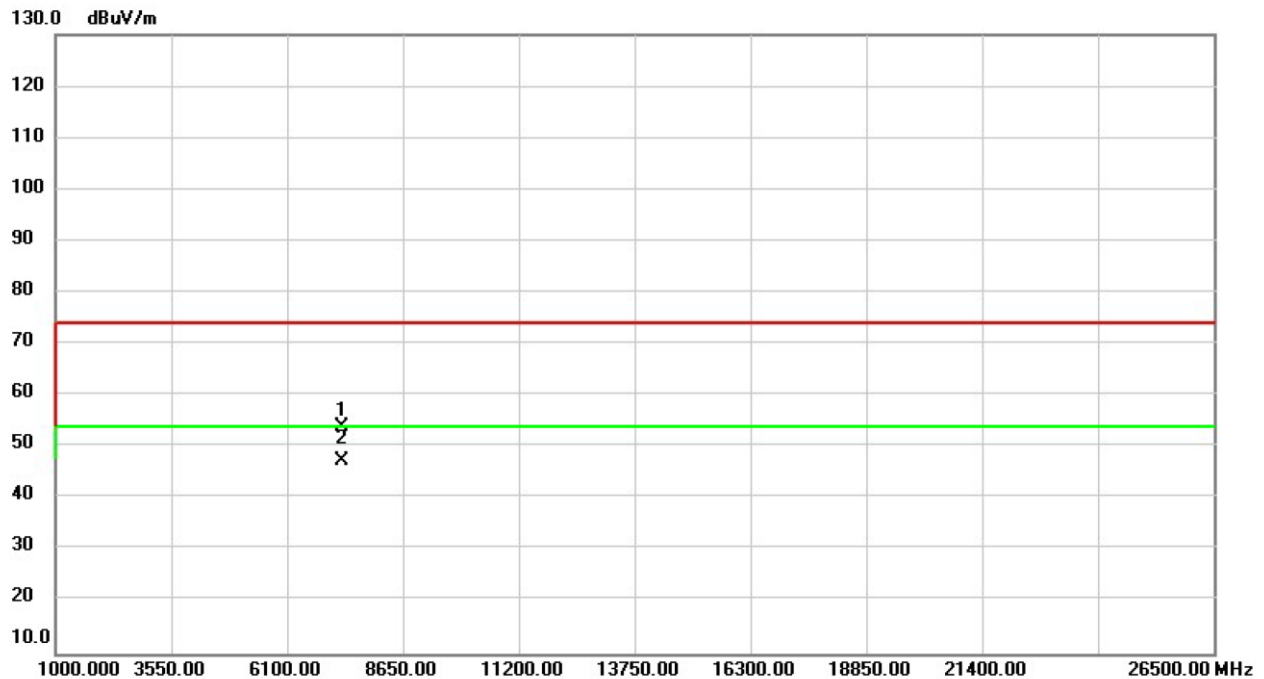


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7320.000	59.69	-2.76	56.93	74.00	-17.07	peak	
2	*	7320.000	53.47	-2.76	50.71	54.00	-3.29	AVG	

## REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2021/10/20
Test Frequency	2440MHz	Polarization	Horizontal
Temp	22°C	Hum.	60%

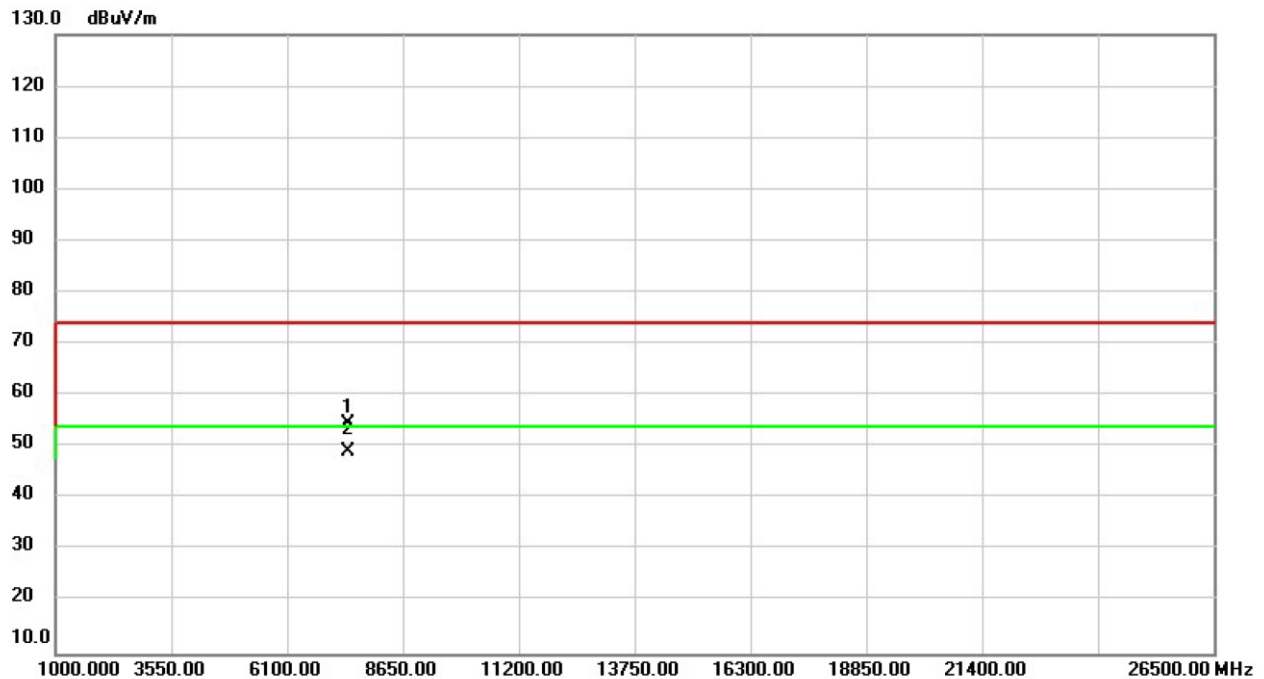


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7320.000	56.75	-2.76	53.99	74.00	-20.01	peak	
2	*	7320.000	50.03	-2.76	47.27	54.00	-6.73	AVG	

## REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2021/10/20
Test Frequency	2480MHz	Polarization	Vertical
Temp	22°C	Hum.	60%

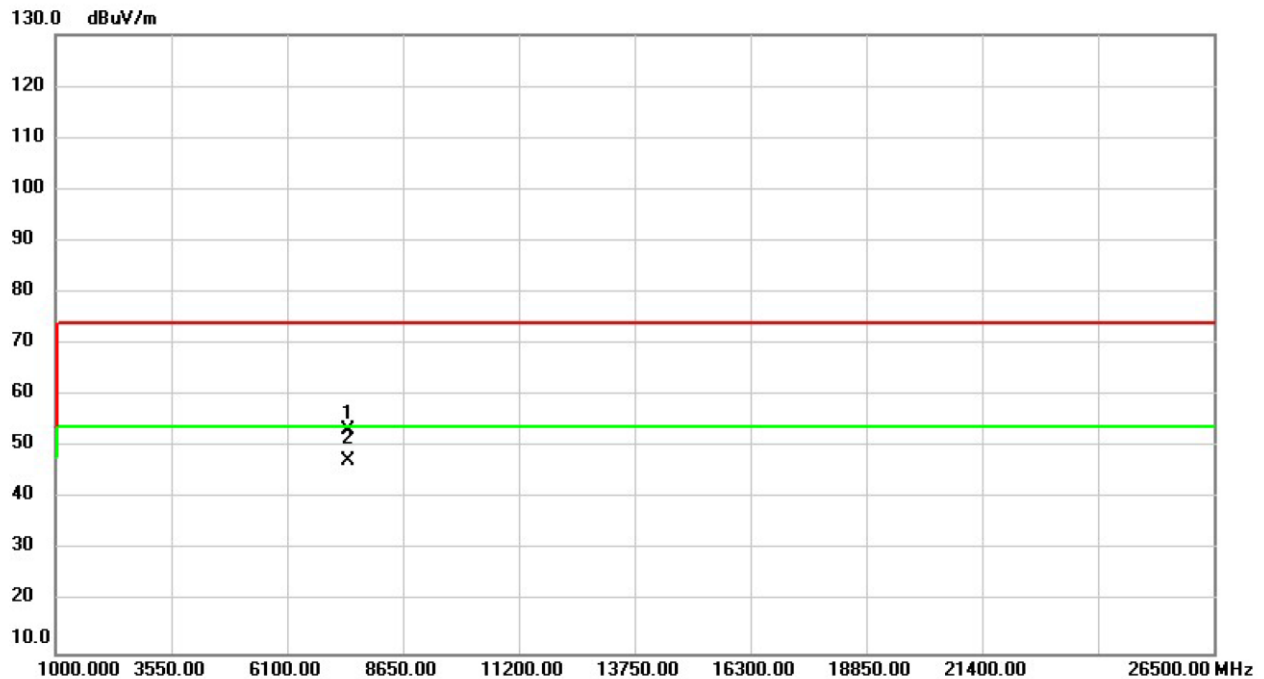


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7440.000	56.62	-2.19	54.43	74.00	-19.57	peak	
2	*	7440.000	51.25	-2.19	49.06	54.00	-4.94	AVG	

## REMARKS:

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

Test Mode	BLE 5.0 (1 Mbps)	Test Date	2021/10/20
Test Frequency	2480MHz	Polarization	Horizontal
Temp	22°C	Hum.	60%

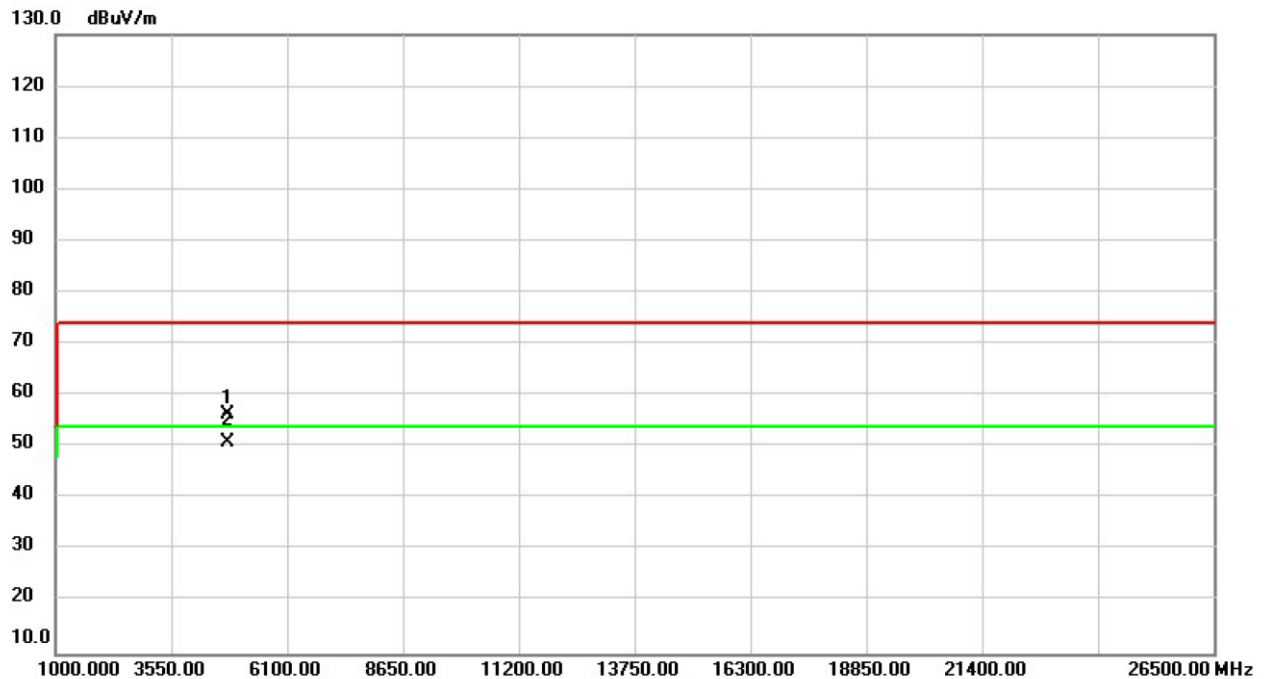


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7440.000	55.45	-2.19	53.26	74.00	-20.74	peak	
2	*	7440.000	49.39	-2.19	47.20	54.00	-6.80	AVG	

# REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2021/10/20
Test Frequency	2402MHz	Polarization	Vertical
Temp	22°C	Hum.	60%

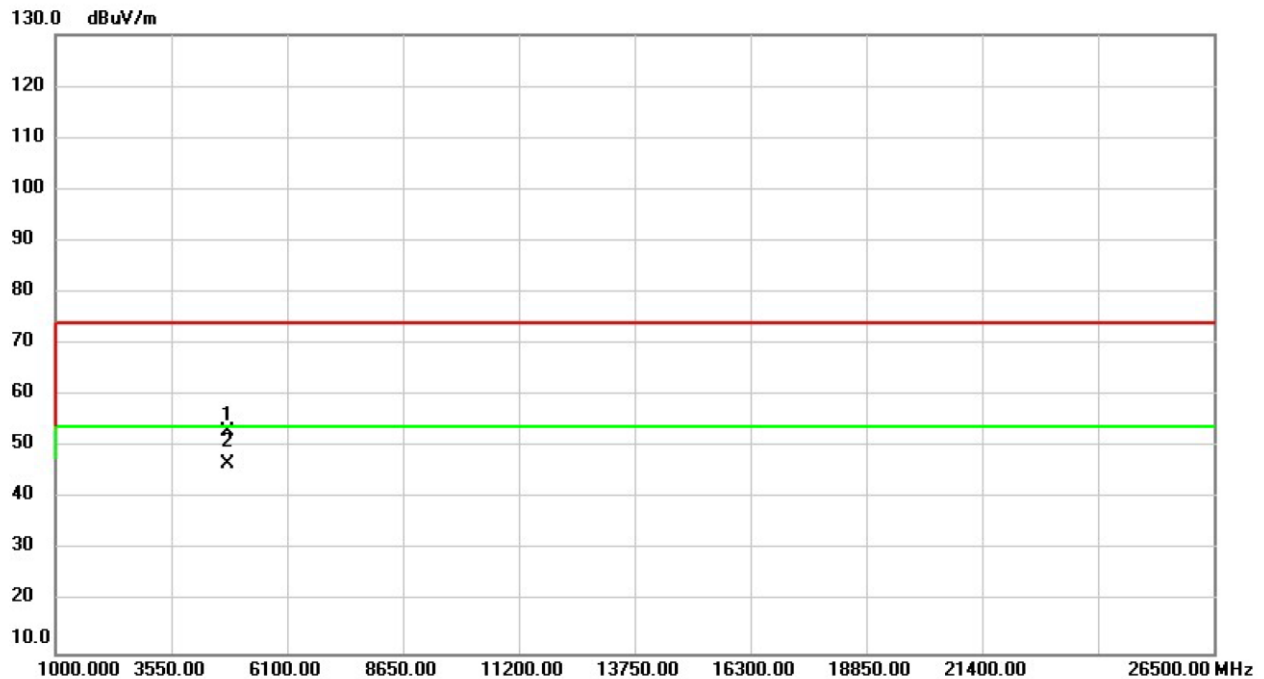


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	66.11	-9.84	56.27	74.00	-17.73	peak	
2	*	4804.000	60.86	-9.84	51.02	54.00	-2.98	AVG	

## REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2021/10/20
Test Frequency	2402MHz	Polarization	Horizontal
Temp	22°C	Hum.	60%

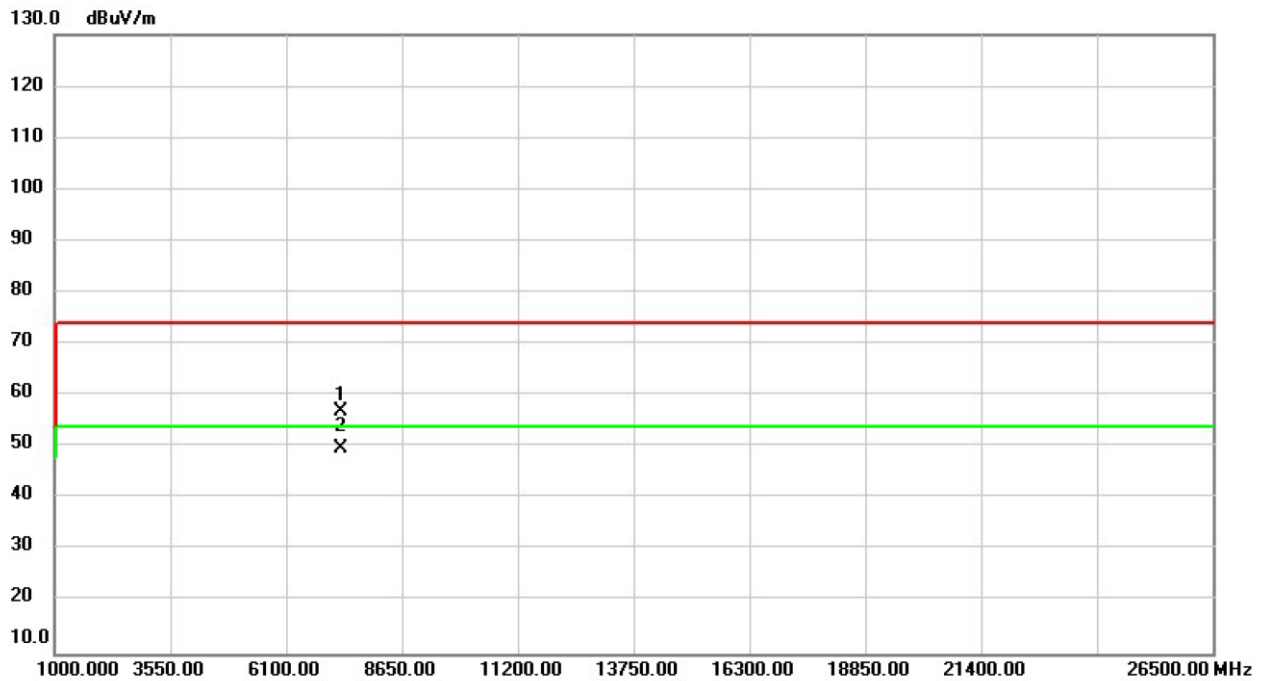


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	62.84	-9.84	53.00	74.00	-21.00	peak	
2	*	4804.000	56.73	-9.84	46.89	54.00	-7.11	AVG	

## REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2021/10/20
Test Frequency	2440MHz	Polarization	Vertical
Temp	22°C	Hum.	60%

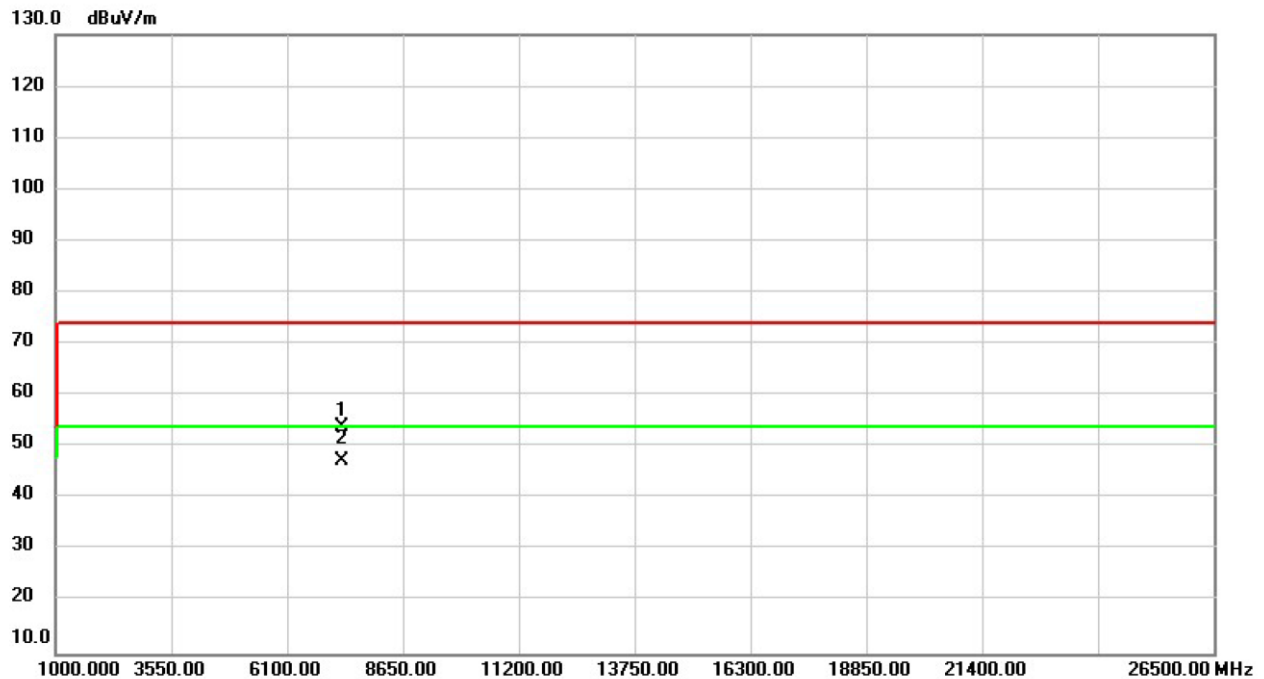


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7320.000	59.81	-2.76	57.05	74.00	-16.95	peak	
2	*	7320.000	52.65	-2.76	49.89	54.00	-4.11	AVG	

## REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2021/10/20
Test Frequency	2440MHz	Polarization	Horizontal
Temp	22°C	Hum.	60%



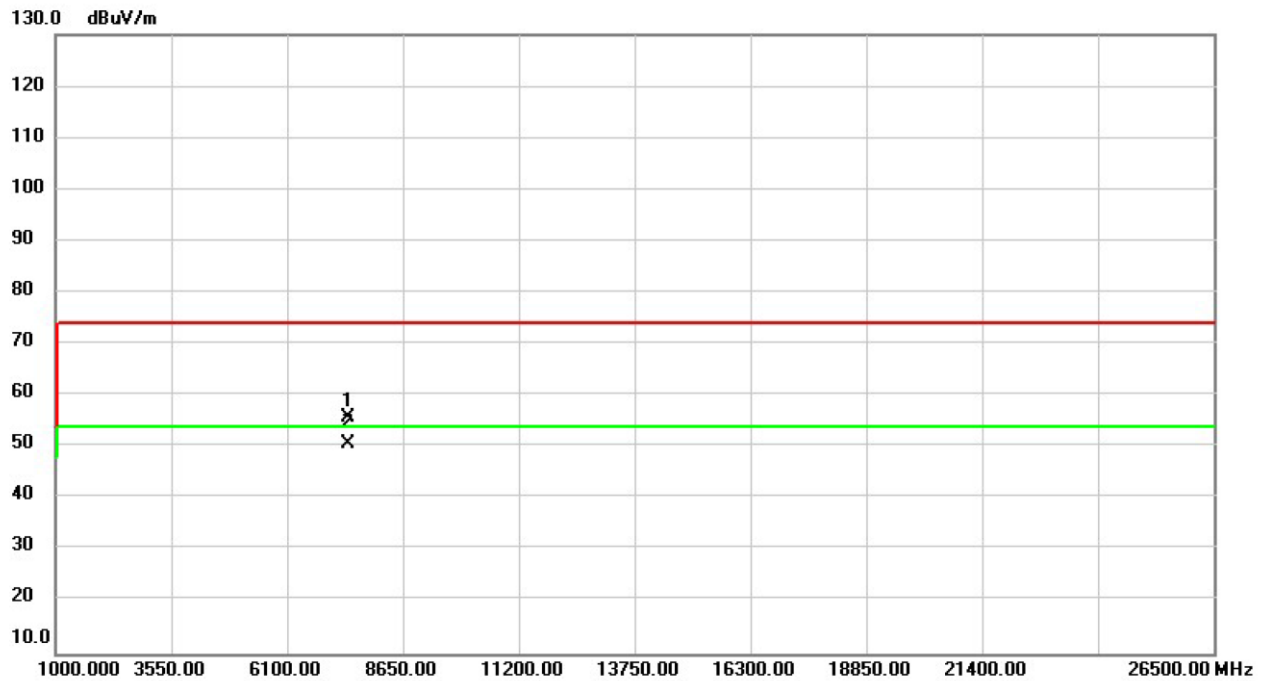
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7320.000	56.73	-2.76	53.97	74.00	-20.03	peak	
2	*	7320.000	50.08	-2.76	47.32	54.00	-6.68	AVG	

## REMARKS:

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



Test Mode	BLE 5.0 (2 Mbps)	Test Date	2021/10/20
Test Frequency	2480MHz	Polarization	Vertical
Temp	22°C	Hum.	60%

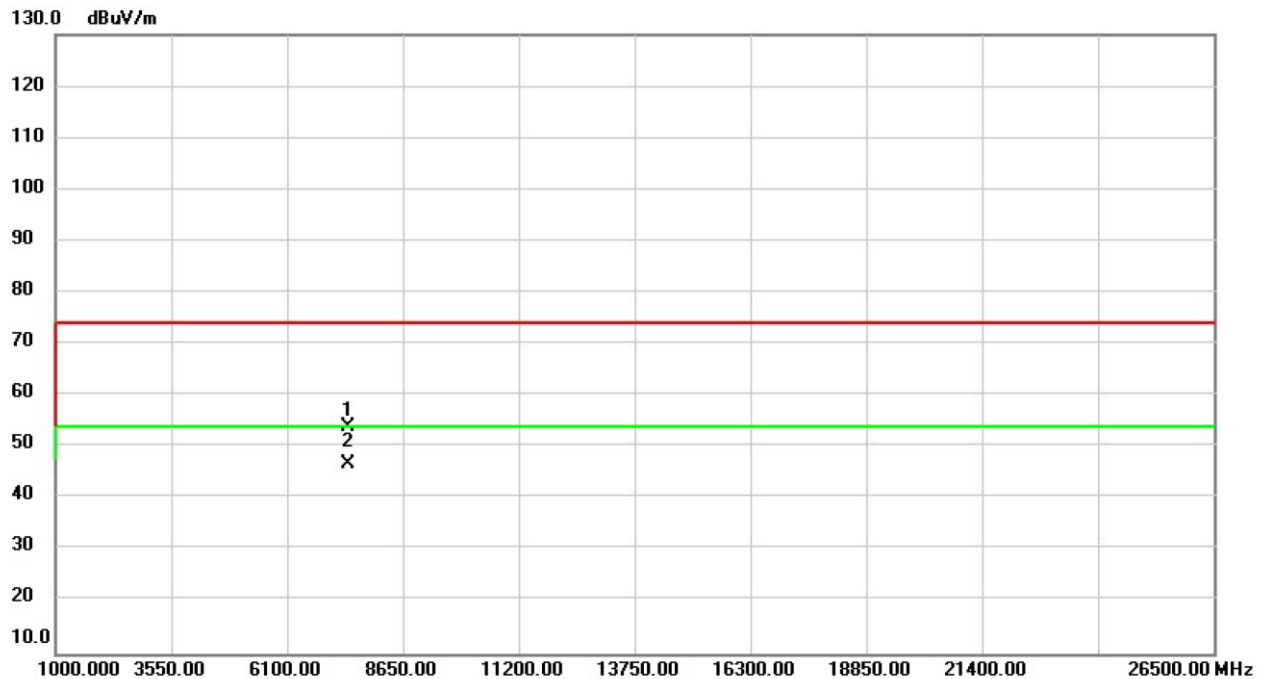


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7440.000	57.94	-2.19	55.75	74.00	-18.25	peak	
2	*	7440.000	52.79	-2.19	50.60	54.00	-3.40	AVG	

## REMARKS:

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

Test Mode	BLE 5.0 (2 Mbps)	Test Date	2021/10/20
Test Frequency	2480MHz	Polarization	Horizontal
Temp	22°C	Hum.	60%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		7440.000	56.06	-2.19	53.87	74.00	-20.13	peak	
2	*	7440.000	49.00	-2.19	46.81	54.00	-7.19	AVG	

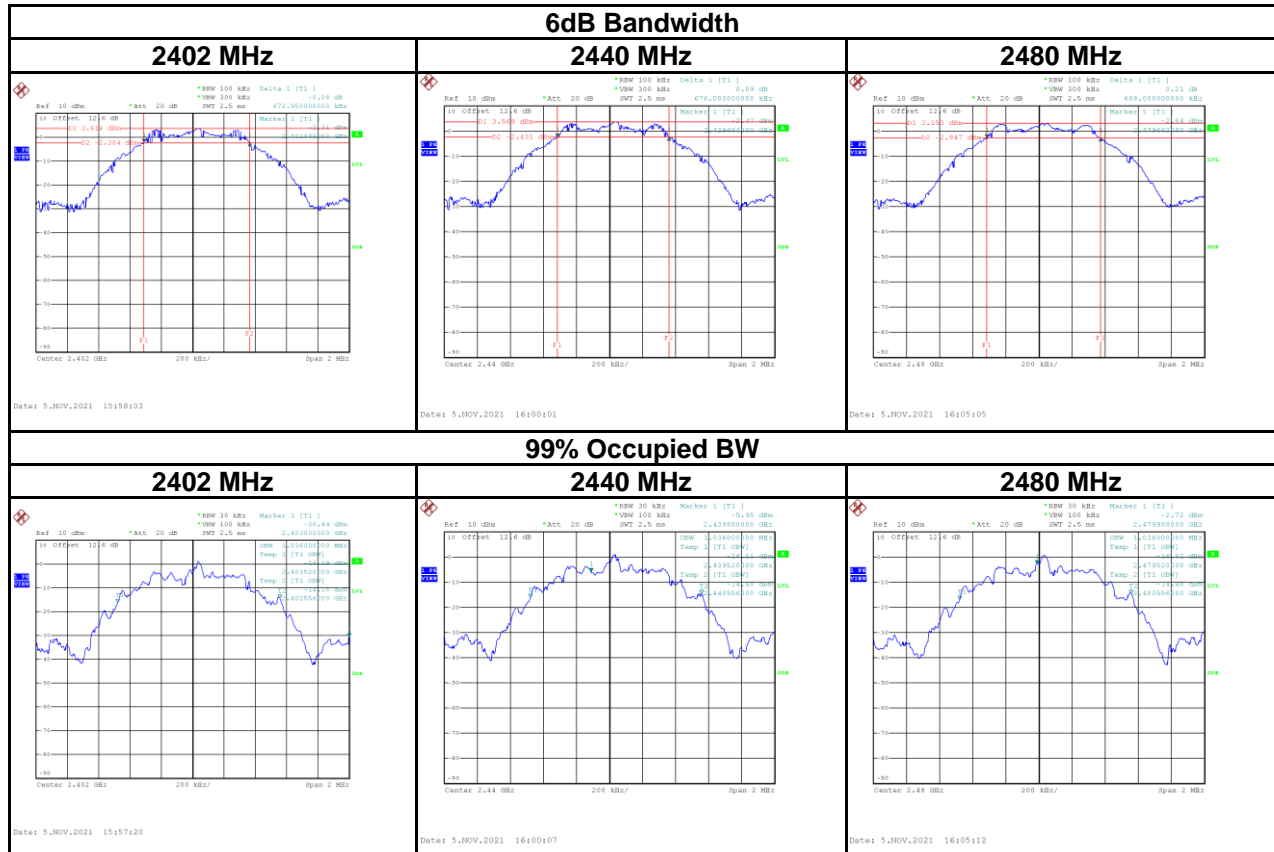
## REMARKS:

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

## **APPENDIX C    BANDWIDTH**

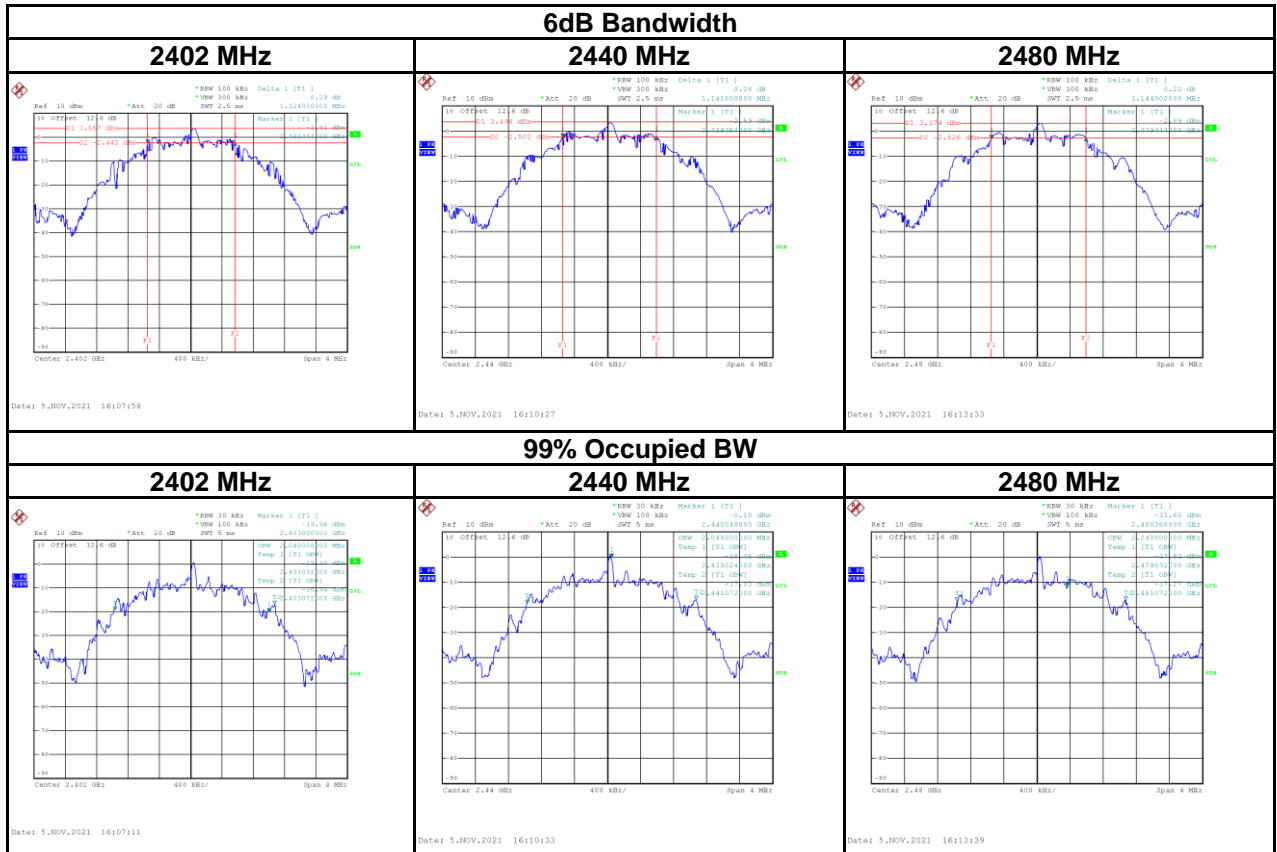
Test Mode:	1Mbps
------------	-------

Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.67	1.04	500	Pass
2440	0.68	1.04	500	Pass
2480	0.69	1.04	500	Pass



Test Mode:	2Mbps
------------	-------

Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	1.12	2.04	500	Pass
2440	1.14	2.05	500	Pass
2480	1.14	2.04	500	Pass



## **APPENDIX D    OUTPUT POWER**

Test Mode :	1Mbps	Tested Date	2021/11/5
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Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	-0.15	0.0010	30.00	1.0000	Pass
2440	-6.82	0.0002	30.00	1.0000	Pass
2480	-5.35	0.0003	30.00	1.0000	Pass

Test Mode :	2Mbps	Tested Date	2021/11/5
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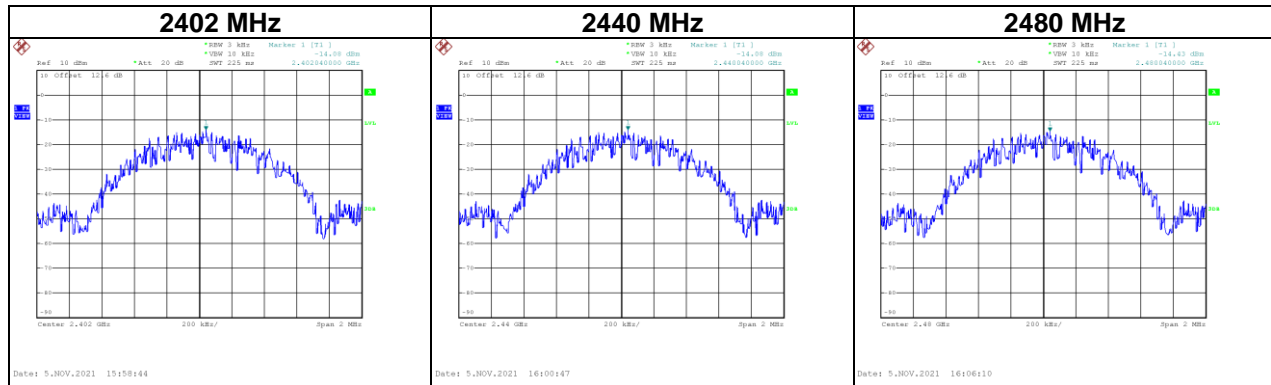
Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	2.50	0.0018	30.00	1.0000	Pass
2440	-4.91	0.0003	30.00	1.0000	Pass
2480	-5.30	0.0003	30.00	1.0000	Pass

**APPENDIX E POWER SPECTRAL DENSITY TEST**



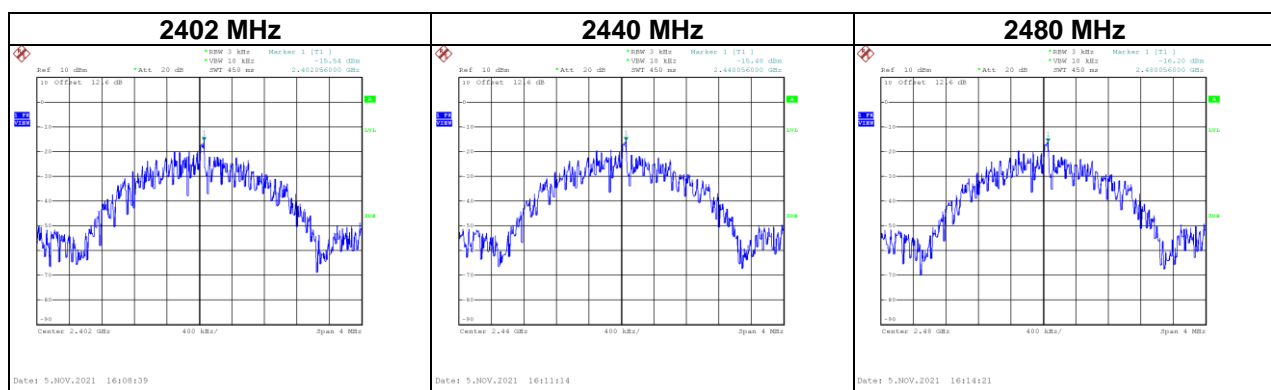
Test Mode :	1Mbps
-------------	-------

Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-14.08	8	Pass
2440	-14.08	8	Pass
2480	-14.43	8	Pass



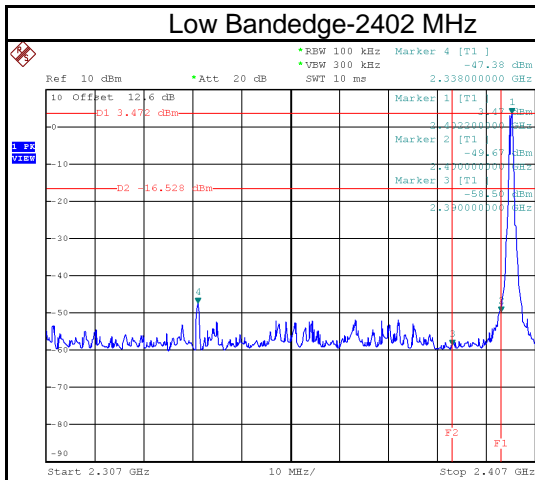
Test Mode :	2Mbps
-------------	-------

Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-15.54	8	Pass
2440	-15.48	8	Pass
2480	-16.20	8	Pass

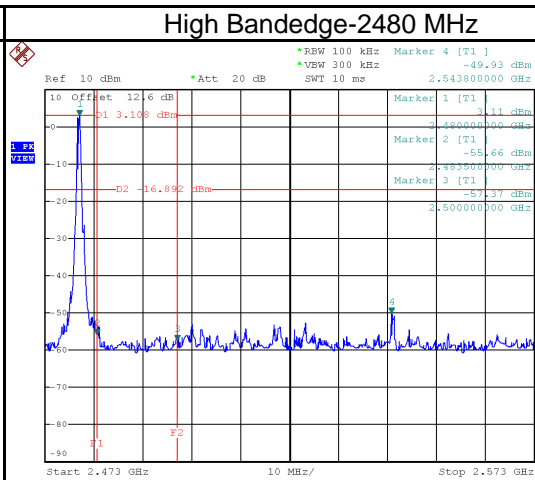


## **APPENDIX F    ANTENNA CONDUCTED SPURIOUS EMISSION**

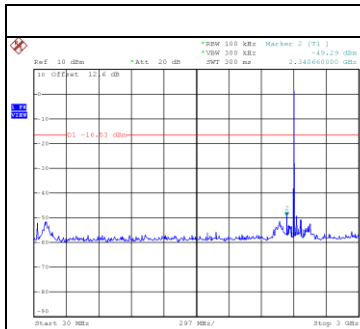
Test Mode : 1Mbps



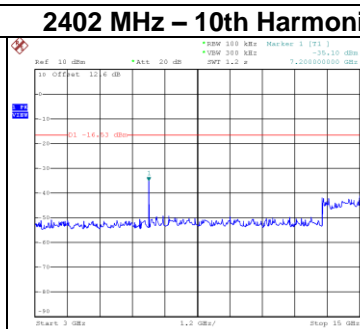
Date: 5.NOV.2021 15:58:11



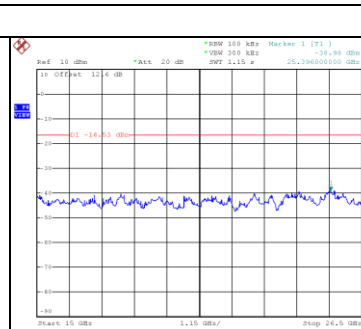
Date: 5.NOV.2021 16:05:36



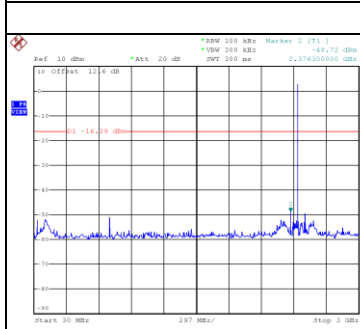
Date: 5.NOV.2021 15:58:24



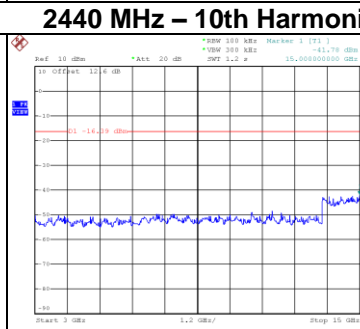
Date: 5.NOV.2021 15:58:31



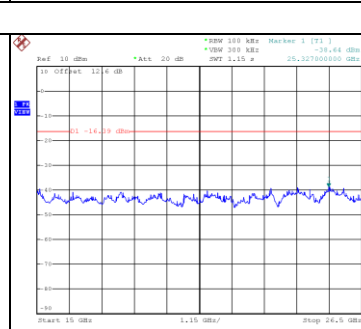
Date: 5.NOV.2021 15:58:39



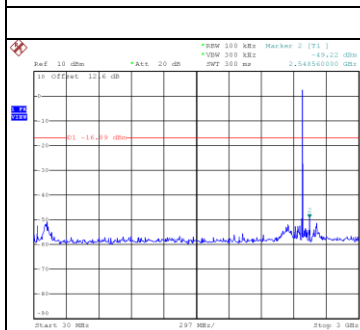
Date: 5.NOV.2021 16:00:27



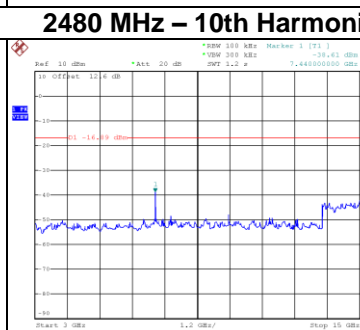
Date: 5.NOV.2021 16:00:34



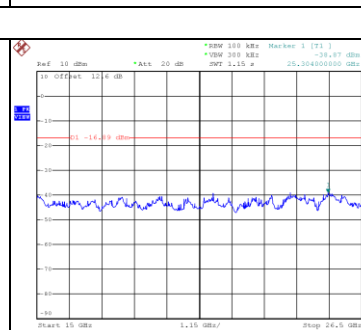
Date: 5.NOV.2021 16:00:41



Date: 5.NOV.2021 16:05:49



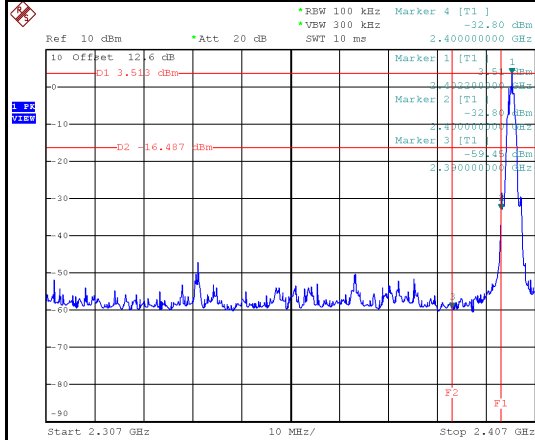
Date: 5.NOV.2021 16:05:57



Date: 5.NOV.2021 16:06:04

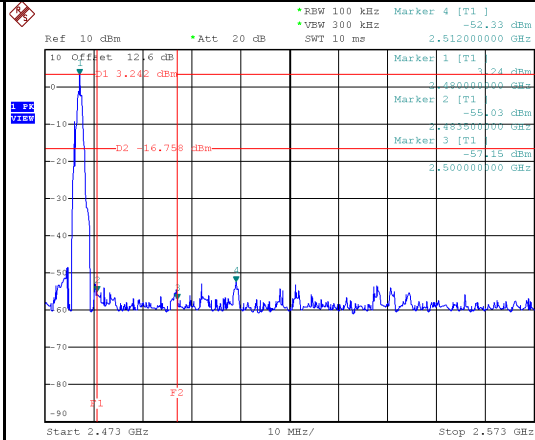
Test Mode : 2Mbps

## Low Bandedge-2402 MHz



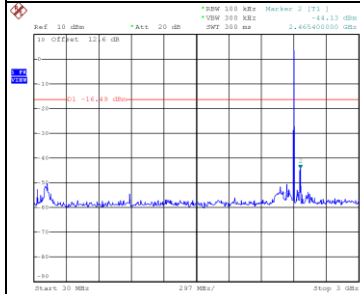
Date: 5.NOV.2021 16:08:05

## High Bandedge-2480 MHz

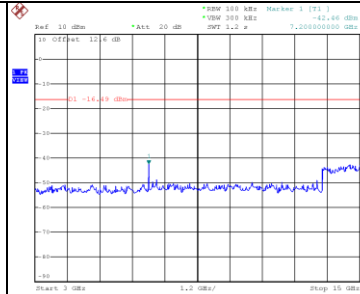


Date: 5.NOV.2021 16:13:47

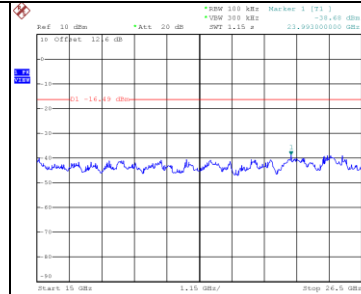
## 2402 MHz – 10th Harmonics



Date: 5.NOV.2021 16:08:18

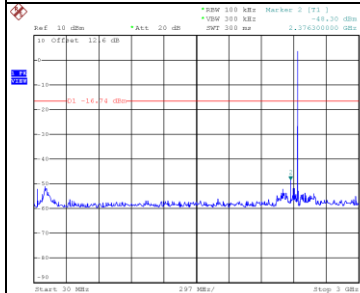


Date: 5.NOV.2021 16:08:26

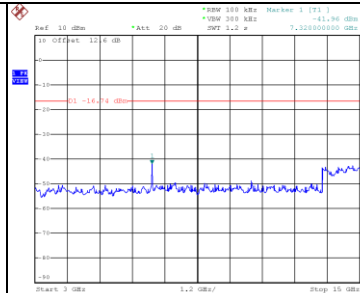


Date: 5.NOV.2021 16:08:33

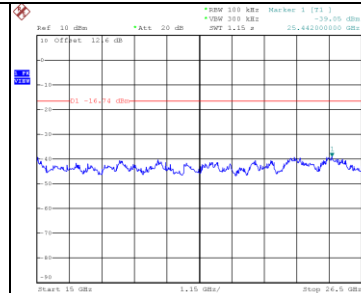
## 2440 MHz – 10th Harmonics



Date: 5.NOV.2021 16:10:53

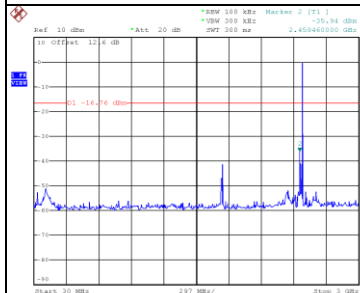


Date: 5.NOV.2021 16:11:01

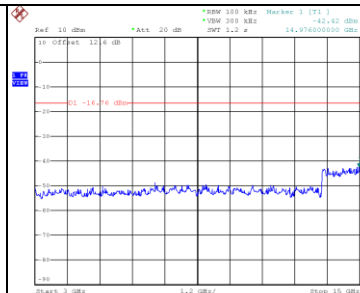


Date: 5.NOV.2021 16:11:08

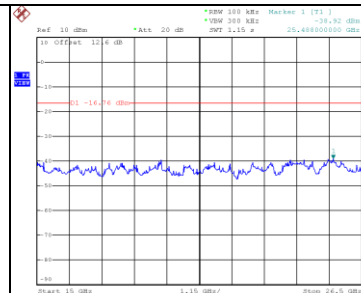
## 2480 MHz – 10th Harmonics



Date: 5.NOV.2021 16:14:01



Date: 5.NOV.2021 16:14:08



Date: 5.NOV.2021 16:14:15

End of Test Report