FCC Radio Test Report

FCC ID: 2AVVT-CU304080000

Report No.	:	BTL-FCCP-2-2103T126A
Equipment	:	iTraMS CCU
Model Name	:	CU-304-0800-00
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 EDR
FCC Rule Part(s)	:	FCC CFR Title 47, Part15, Subpart C (15.247)
Measurement Procedure(s)	:	ANSI C63.10-2013
Date of Receipt	:	2021/4/6
Date of Test	:	2021/4/6 ~ 2022/11/7
Issued Date	:	2022/12/26

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

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0659

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Declaration

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

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

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

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

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

Limitation

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

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

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REVISION HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-2-2103T126A	R00	Original Report.	2022/2/8	Invalid
BTL-FCCP-2-2103T126A	R01	Revised applicant address.	2022/2/18	Invalid
BTL-FCCP-2-2103T126A	R02	Added the fourth antenna. (MA173. A. LBI.001)	2022/11/10	Invalid
BTL-FCCP-2-2103T126A	R03	Revised applicant information.	2022/11/22	Invalid
BTL-FCCP-2-2103T126A	R04	Revised report to address TCB's comments.	2022/12/26	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)(1)(iii)	Number of Hopping Frequency	APPENDIX C	Pass	------
15.247 (a)(1)(iii)	Average Time of Occupancy	APPENDIX D	Pass	------
15.247 (a)(1)	Hopping Channel Separation	APPENDIX E	Pass	------
15.247 (a)(1)	Bandwidth	APPENDIX F	Pass	------
15.247 (b)(1)	Output Power	APPENDIX G	Pass	------
15.247(d)	Antenna conducted Spurious Emission	APPENDIX H	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.
(4) According to the declaration of manufacturer, FCC ID: 2AVVT-CU304080000 is a variant of FCC ID: 2AVVT-CU413UCMPS1.
The differences as following:

FCC ID	Differences
2AVVT-CU413UCMPS1	BT, BLE, WLAN 2.4 GHz, WWAN
2AVVT-CU304080000	BT, BLE, WLAN 2.4 GHz

The difference between two versions is that the WWAN radio components are removed, and the rests remain identical.
Thus, the test data of FCC ID: 2AVVT-CU413UCMPS1, report no. BTL-FCCP-6-2103T126, is leveraged in this test report to demonstrate the compliance of FCC ID: 2AVVT-CU304080000.
The test worst cases found in FCC ID: 2AVVT-CU413UCMPS1 are verified on FCC ID: 2AVVT-CU304080000 to ensure the compliance is kept.
This test report shows additional evidence (spot check results), as listed below, to demonstrate full compliance of the device:
a. Radiated Emissions
b. Output Power

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

For External Antenna: MA173. A. LBI.001
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	0.5338
Output power	0.3659
Conducted Spurious emissions	0.5416
Conducted Band edges	0.5348
Dwell time	0.6606
Channel separation	0.6606
Channel numbers	0.6606

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 %	AC 120V	Jay Kao
Radiated emissions above 1 GHz	23 °C, 54 %	AC 120V	Jay Kao
Number of Hopping Frequency	25.9 °C, 34 %	AC 120V	Vincent Lee
Average Time of Occupancy	25.9 °C, 34 %	AC 120V	Vincent Lee
Hopping Channel Separation	25.9 °C, 34 %	AC 120V	Vincent Lee
Bandwidth	25.9 °C, 34 %	AC 120V	Vincent Lee
Output Power	25.9 °C, 34 %	AC 120V	Vincent Lee
Antenna conducted Spurious Emission	25.9 °C, 34 %	AC 120V	Vincent Lee

Spot check test:

Test Item	Environment Condition	Test Voltage	Tested by
Radiated emissions below 1 GHz	Refer to data	DC 32V	Jay Kao
Radiated emissions above 1 GHz	Refer to data	DC 32V	Jay Kao
Output Power	25.9 °C, 34 %	DC 32V	Paul Shen

For External Antenna: MA173. A. LBI.001

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 TEST SOFTWARE SETTING

Test Software	Tera Term V4.80			
Modulation Mode	2402 MHz	2441 MHz	2480 MHz	Data Rate
GFSK	10.5	10.5	10.5	1 Mbps
π/4-DQPSK	8	8	8	2 Mbps
8DPSK	8	8	8	3 Mbps

Spot check test:

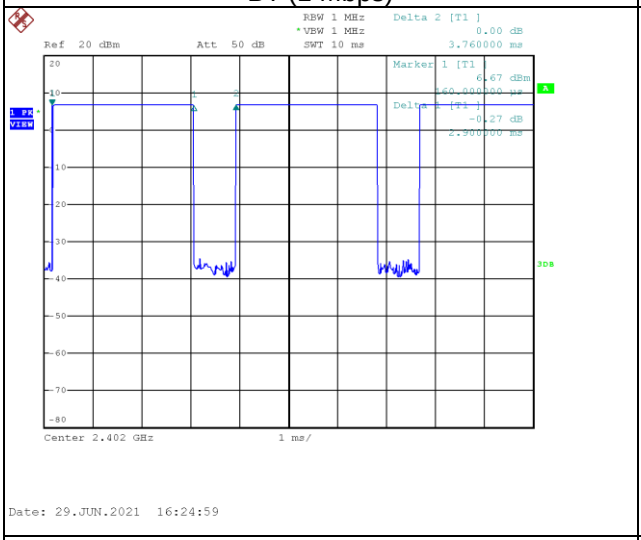
Test Software	Tera Term V.4.101			
Modulation Mode	2402 MHz	2441 MHz	2480 MHz	Data Rate
GFSK	8	8	8	1 Mbps
π/4-DQPSK	8	8	8	2 Mbps
8DPSK	8	8	8	3 Mbps

1.5 DUTY CYCLE

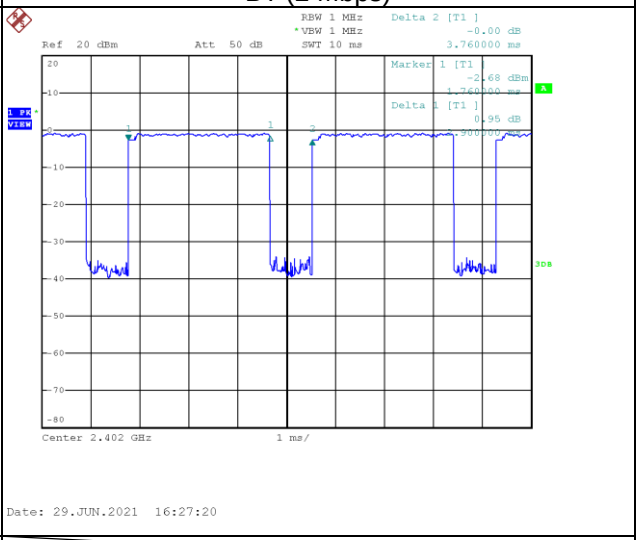
If duty cycle is ≥ 98 %, duty factor is not required.
If duty cycle is < 98 %, duty factor shall be considered.

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)
BT (1 Mbps)	2.900	1	2.900	3.760	77.13%	1.13
BT (2 Mbps)	2.900	1	2.900	3.760	77.13%	1.13
BT (3 Mbps)	2.900	1	2.900	3.760	77.13%	1.13

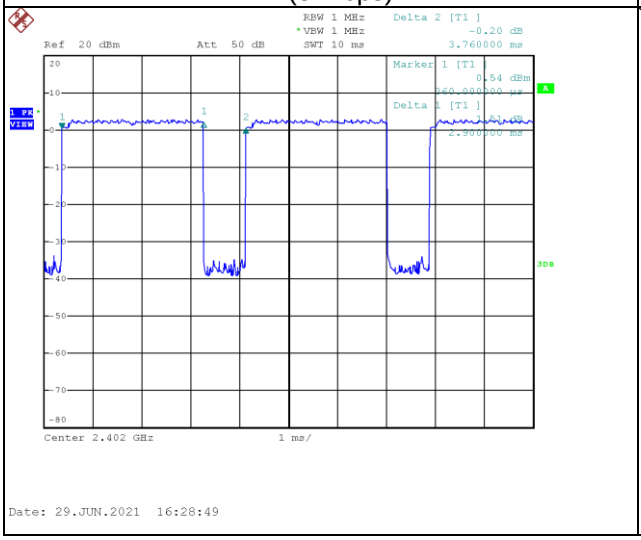
BT (1 Mbps)



BT (2 Mbps)



BT (3 Mbps)



2 GENERAL INFORMATION

2.1 DESCRIPTION OF EUT

Equipment	iTraMS CCU
Model Name	CU-304-0800-00
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 064
Software Version	1277401063
Operation Band	2400 MHz ~ 2483.5 MHz
Operation Frequency	2402 MHz ~ 2480 MHz
Modulation Type	GFSK, π/4-DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	1 Mbps, 2 Mbps, 3Mbps
Output Power Max.	1 Mbps: 6.82 dBm (0.0048 W) 2 Mbps: 3.03 dBm (0.0020 W) 3 Mbps: 3.28 dBm (0.0021 W)
Output Power Max. -Spot check test	1 Mbps: 3.28 dBm (0.0021 W) 2 Mbps: 3.22 dBm (0.0021 W) 3 Mbps: 3.41 dBm (0.0022 W)
Test Model	CU-304-0800-00
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)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

(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.

2.2 TEST MODES

Test Items	Test mode	Channel	Note
Transmitter Radiated Emissions (below 1GHz)	1 Mbps	00	-
Transmitter Radiated Emissions (above 1GHz)	1/3 Mbps	00/78	Bandedge
	1/3 Mbps	00/39/78	Harmonic
Number of Hopping Frequency	1/3 Mbps	00~78	-
Average Time of Occupancy	1/3 Mbps	00/39/78	-
Hopping Channel Separation	1/3 Mbps	00/39/78	-
Bandwidth	1/3 Mbps	00/39/78	-
Peak Output Power	1/2/3 Mbps	00/39/78	-
Antenna conducted Spurious Emission	1/3 Mbps	00/39/78	-

Spot check test:

Test Items	Test mode	Channel	Note
Transmitter Radiated Emissions (below 1GHz)	1 Mbps	00	-
Transmitter Radiated Emissions (above 1GHz)	1 Mbps	00	Bandedge
	1 Mbps	00	Harmonic
Peak Output Power	1/2/3 Mbps	00/39/78	-

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.

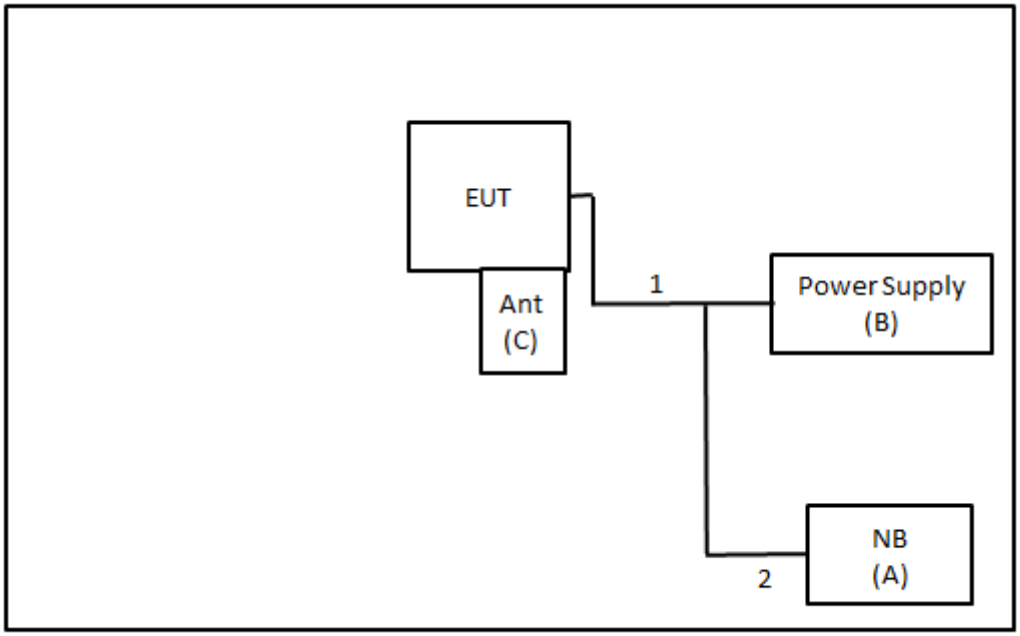
For External Antenna: MA173. A. LBI.001

Test Items	Test mode	Channel	Note
Transmitter Radiated Emissions (below 1GHz)	1 Mbps	00	-
Transmitter Radiated Emissions (above 1GHz)	1 Mbps	00	Bandedge
	1 Mbps	00	Harmonic

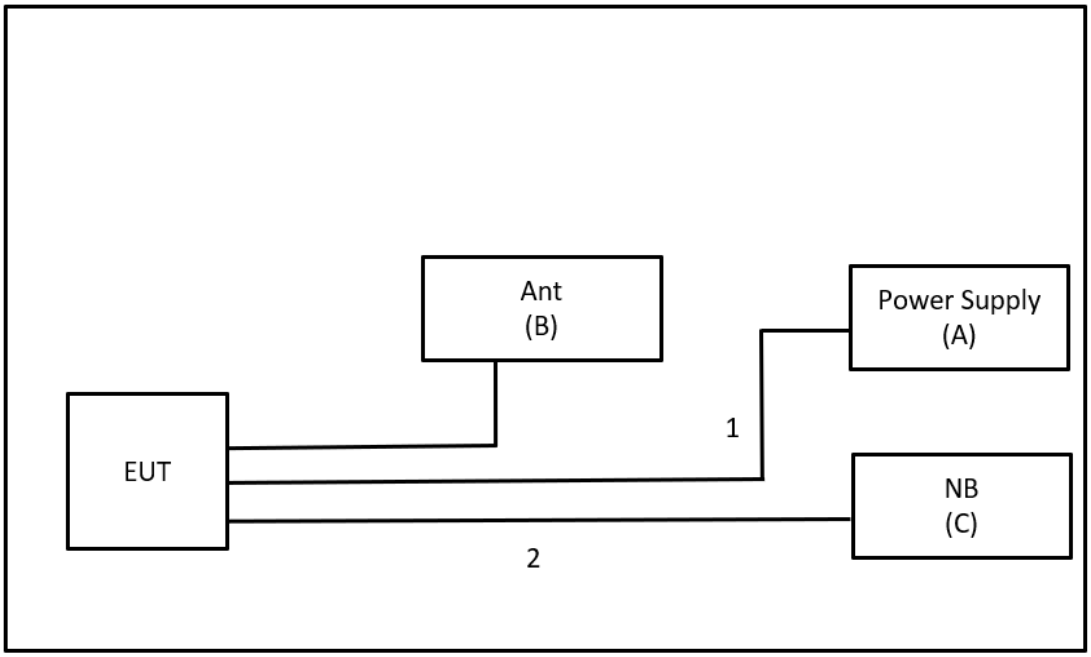
NOTE:
(1) For radiated emission band edge test, both Vertical and Horizontal are evaluated, but only the worst case (Vertical) is recorded.
(2) All X, Y and Z axes are evaluated, but only the worst case (Y axis) is recorded.

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.



For External Antenna: MA173. A. LBI.001



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

For External Antenna: MA173. A. LBI.001

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
35.45	+	-11.37	=	24.08

Measurement Value		Limit Value		Margin Level
24.08	-	40	=	-15.92

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

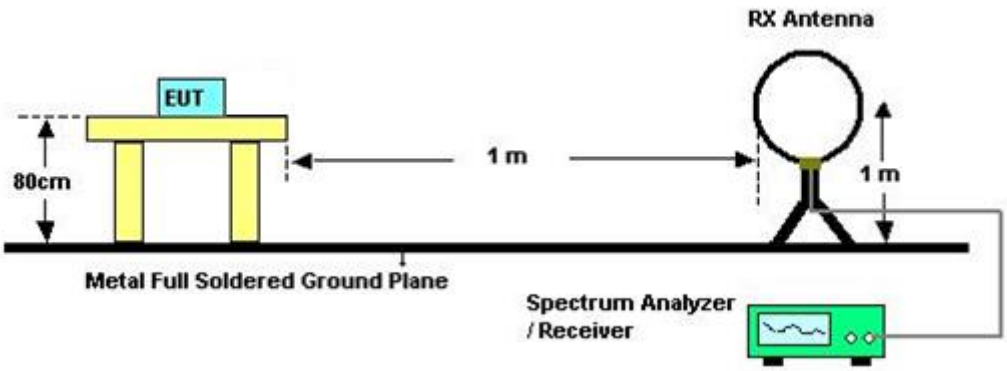
a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The measuring distance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

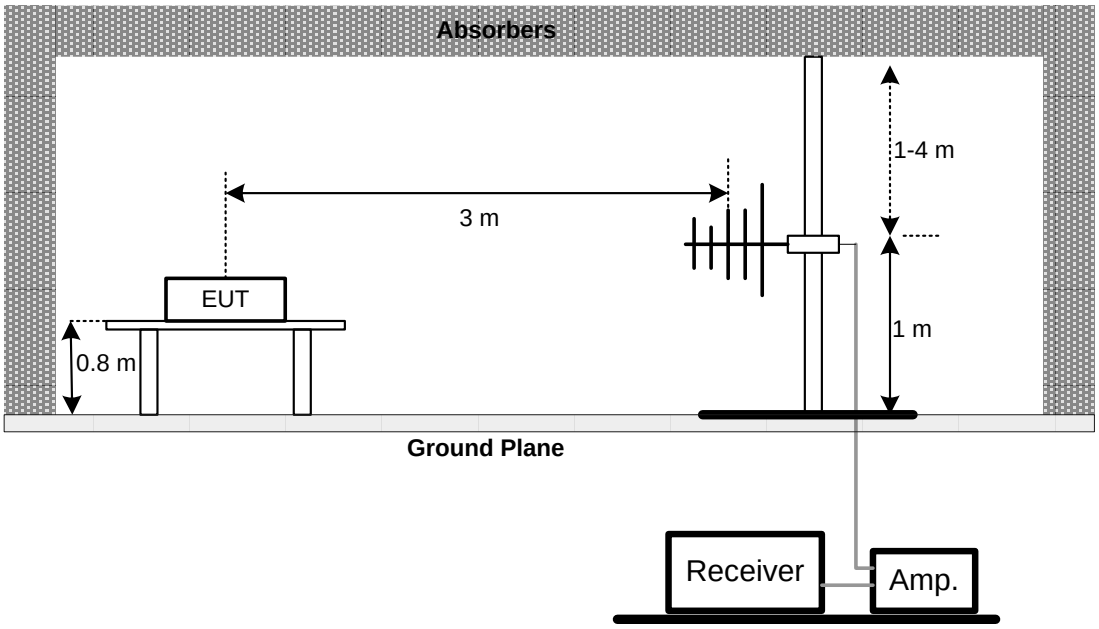
No deviation.

3.4 TEST SETUP

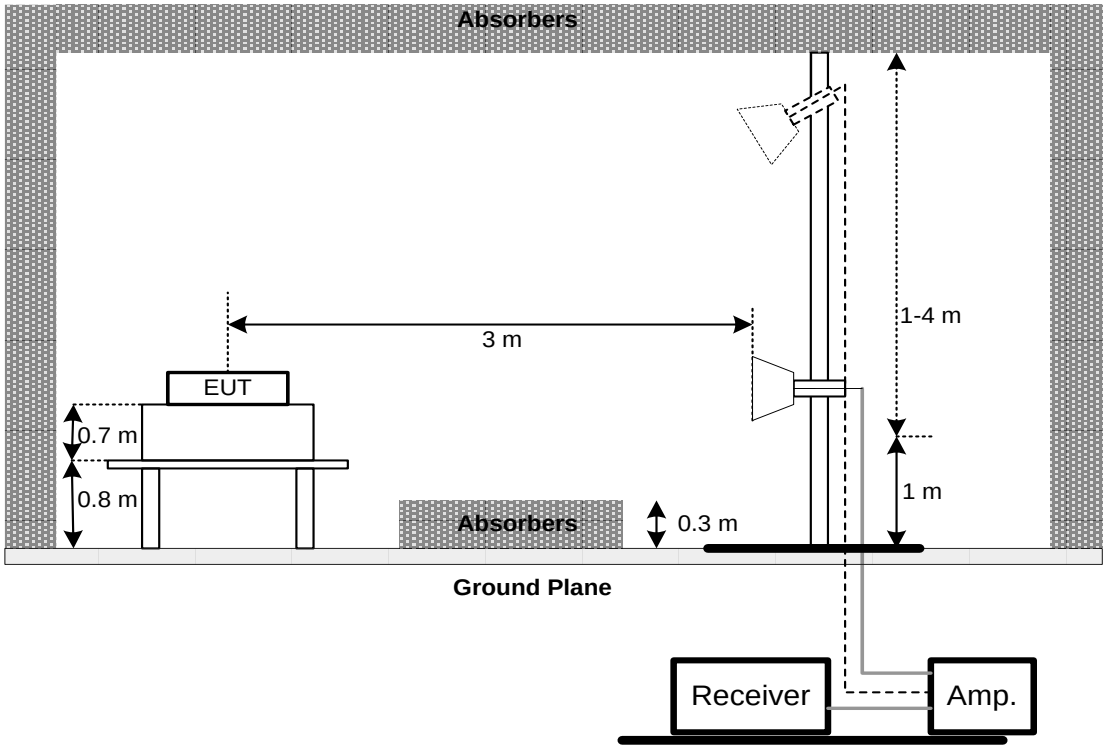
9 kHz to 30 MHz



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 NUMBER OF HOPPING CHANNEL

4.1 APPLIED PROCEDURES

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Frequency Range (MHz)	Result
15.247(a)(1)(iii)	Number of Hopping Channel	2400-2483.5	PASS

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating Frequency Range
RBW	100 KHz
VBW	100 KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

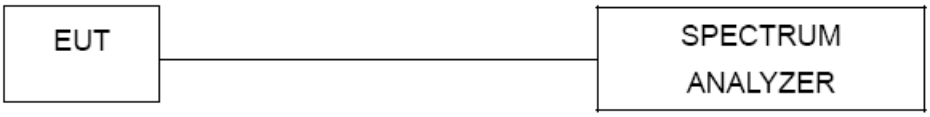
4.2 TEST PROCEDURE

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=100KHz, Sweep time = Auto.

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 AVERAGE TIME OF OCCUPANCY

5.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(1)(iii)	Average Time of Occupancy	0.4sec	2400-2483.5	PASS

5.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyzer
b. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
d. Sweep Time is more than once pulse time.
e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
f. Measure the maximum time duration of one single pulse.
g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
h. Measure the maximum time duration of one single pulse.
i. Measure the maximum time duration of one single pulse.
A Period Time = (channel number) * 0.4

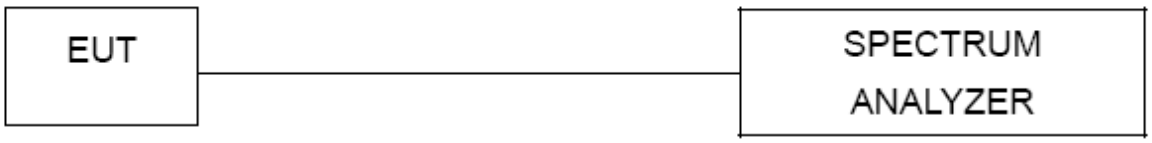
For Non-AFH Mode (79 Channel):
DH1 Time Solt: Reading * (1600/6)/79 * (0.4 * 79)
DH3 Time Solt: Reading * (1600/6)/79 * (0.4 * 79)
DH5 Time Solt: Reading * (1600/6)/79 * (0.4 * 79)

For AFH Mode (20 Channel):
DH1 Time Solt: Reading * (800/6)/20 * (0.4 * 20)
DH3 Time Solt: Reading * (800/6)/20 * (0.4 * 20)
DH5 Time Solt: Reading * (800/6)/20 * (0.4 * 20)

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 Hopping Channel Separation Measurement

6.1 APPLIED PROCEDURES / LIMIT

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 KHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RBW	30 KHz
VBW	100 KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

6.2 TEST PROCEDURE

a. The EUT must have its hopping function enabled

b. Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
Video (or Average) Bandwidth (VBW) ≥ RBW
Sweep = Auto
Detector function = Peak
Trace = Max Hold

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP

Spectrum Analayzer EUT

6.5 TEST RESULTS

Please refer to the APPENDIX E.

7 BANDWIDTH TEST

7.1 APPLIED PROCEDURES

FCC Part15 (15.247) , Subpart C		
Section	Test Item	Frequency Range (MHz)
15.247(a)(2)	Bandwidth	2400-2483.5

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RBW	30 KHz (20dB Bandwidth) / 30 KHz (Channel Separation)
VBW	100 KHz (20dB Bandwidth) / 100 KHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

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= 30KHz, VBW=100KHz, Sweep Time = Auto.

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP

7.5 EUT OPERATION CONDITIONS

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

7.6 TEST RESULTS

Please refer to the APPENDIX F.

8 OUTPUT POWER TEST

8.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(1)	Peak Output Power	0.125Watt or 21dBm	2400-2483.5	PASS

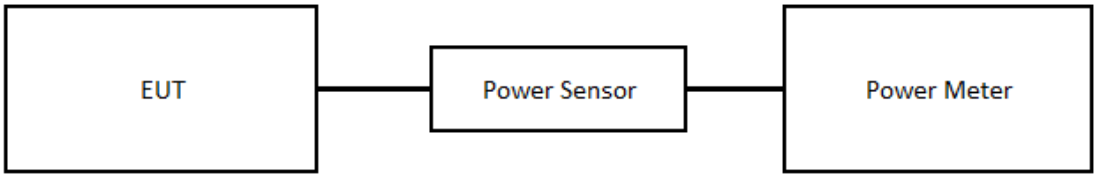
8.2 TEST PROCEDURE

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= 3MHz, VBW= 3MHz, Sweep time = Auto.

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

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

8.6 TEST RESULTS

Please refer to the APPENDIX G.

9 ANTENNA CONDUCTED SPURIOUS EMISSION

9.1 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.

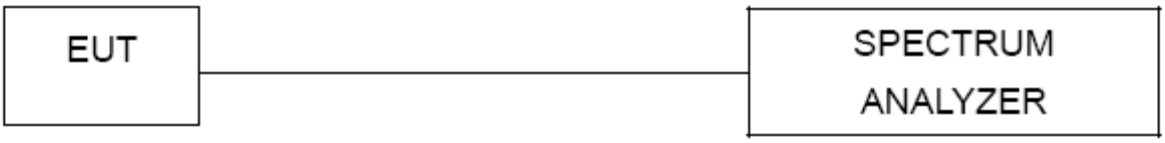
9.2 TEST PROCEDURE

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=100KHz, Sweep time = Auto.
c. Offset=antenna gain+cable loss

9.3 DEVIATION FROM STANDARD

No deviation.

9.4 TEST SETUP



9.5 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.

9.6 TEST RESULTS

Please refer to the APPENDIX H.

10 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

Number of Hopping Frequency						
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

Average Time of Occupancy						
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

Hopping Channel Separation						
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

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

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	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	2020/7/24	2021/7/23
13	5dB Attenuator	EMCI	EMCI-N-6-05	AT-N0625	2020/7/24	2021/7/23
14	Measurement Software	EZ	EZ_EMC (Version NB-03A1-01)	N/A	N/A	N/A

Output Power						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP38	101139	2021/3/5	2022/3/4
2	Power Meter	Anritsu	ML2487A	6K00004714	2020/9/3	2021/9/2

For External Antenna: MA173. A. LBI.001

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.

11 EUT TEST PHOTO

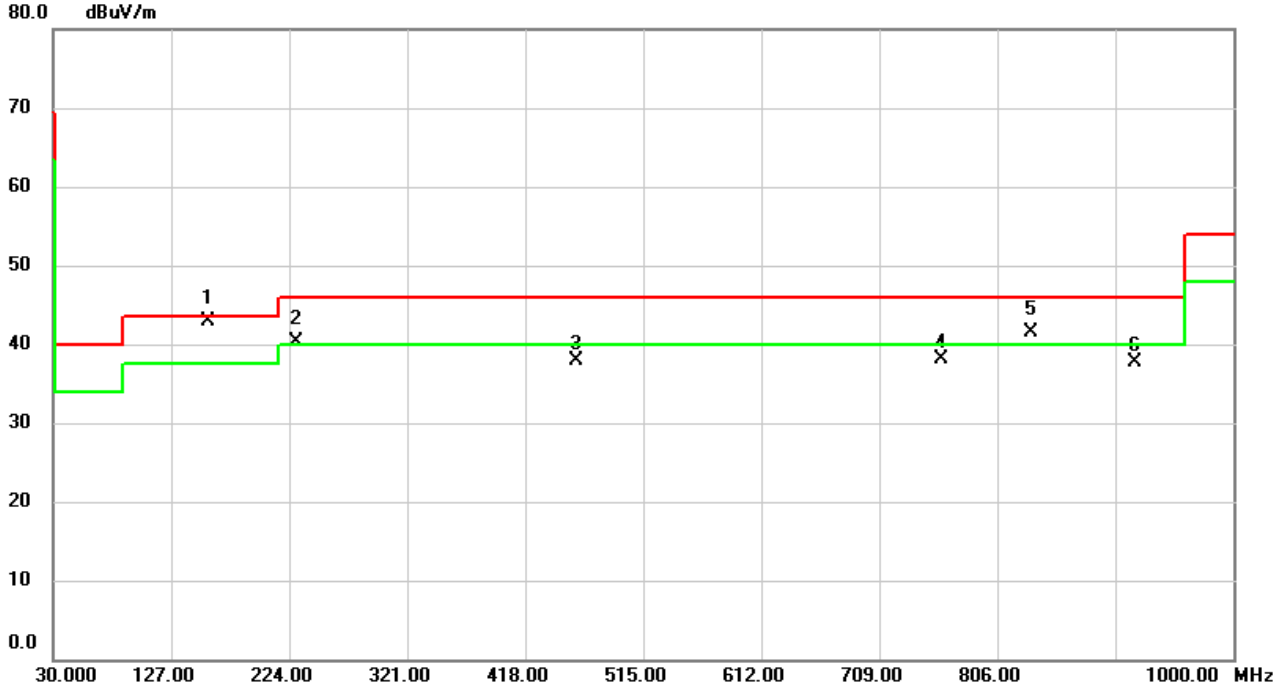
Please refer to document Appendix No.: TP-2103T126A-FCCP-1 (APPENDIX-TEST PHOTOS).

12 EUT PHOTOS

Please refer to document Appendix No.: EP-2103T126A-1 (APPENDIX-EUT PHOTOS).

APPENDIX A RADIATED EMISSIONS - 30 MHZ TO 1 GHZ

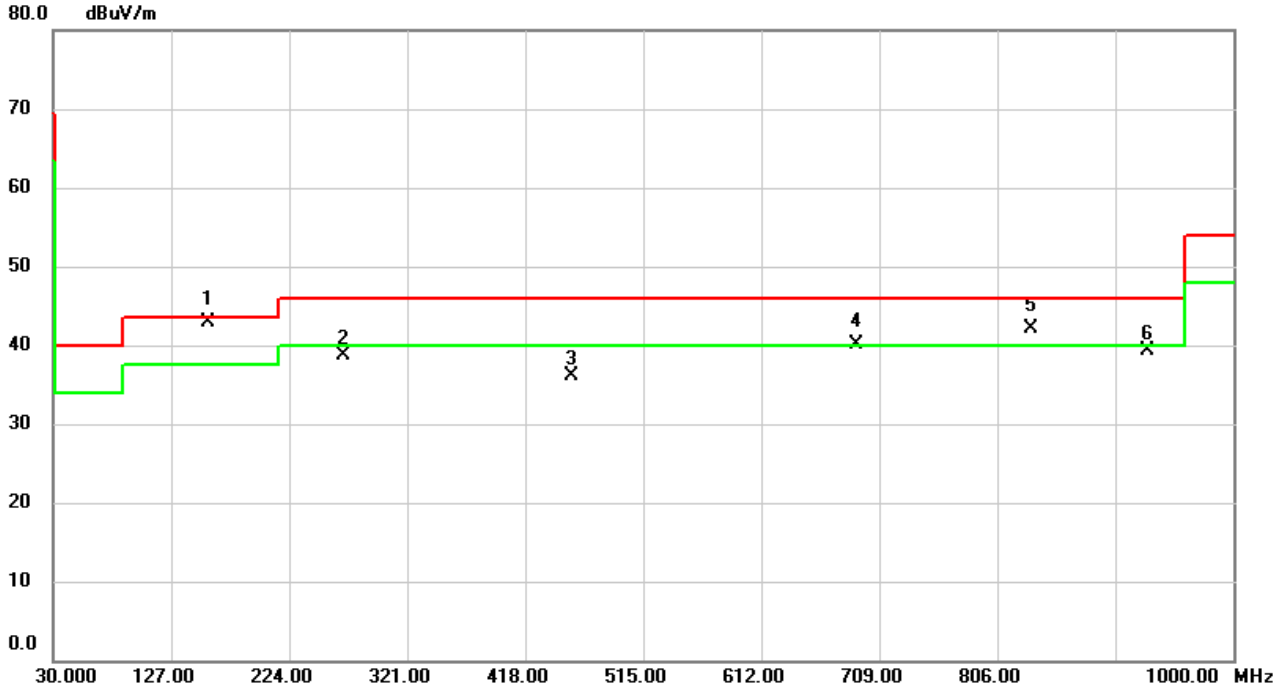
Test Mode	BT (1Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	157.6843	51.19	-8.34	42.85	43.50	-0.65	QP	
2	!	230.2726	50.65	-10.30	40.35	46.00	-5.65	QP	
3		460.5505	41.48	-3.51	37.97	46.00	-8.03	peak	
4		759.4400	36.06	1.98	38.04	46.00	-7.96	peak	
5	!	833.2893	38.45	3.04	41.49	46.00	-4.51	QP	
6		919.3283	33.24	4.46	37.70	46.00	-8.30	peak	

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

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

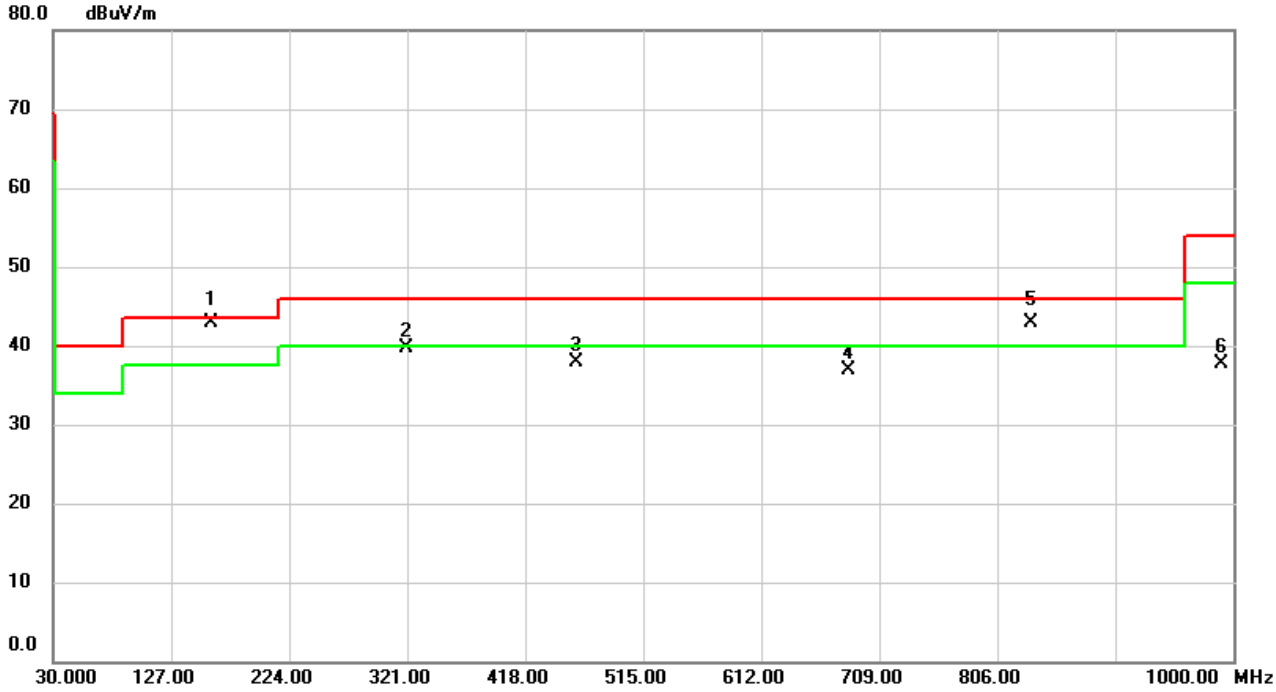


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	157.7165	51.23	-8.34	42.89	43.50	-0.61	QP	
2		268.5876	47.01	-8.39	38.62	46.00	-7.38	peak	
3		455.6682	39.69	-3.59	36.10	46.00	-9.90	peak	
4	!	690.8286	39.39	0.66	40.05	46.00	-5.95	QP	
5	!	833.2893	39.10	3.04	42.14	46.00	-3.86	QP	
6		929.9335	34.71	4.64	39.35	46.00	-6.65	peak	

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

Spot check test:

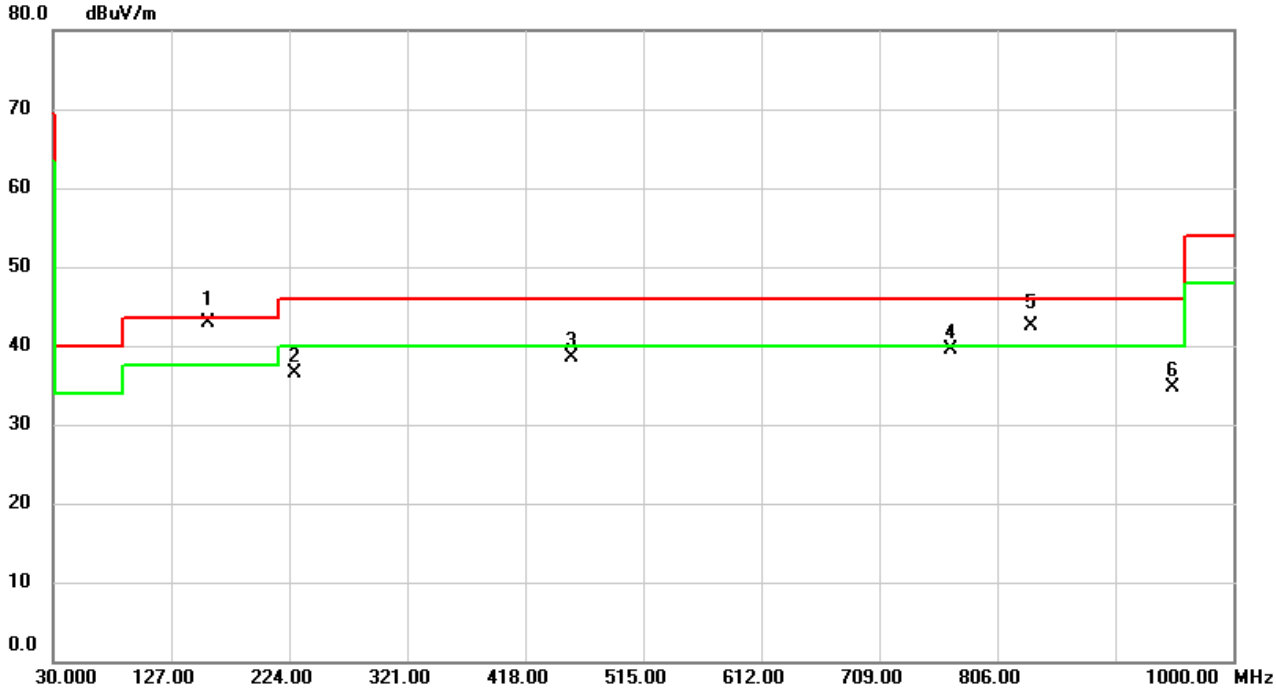
Test Mode	BT (1Mbps)	Test Date	2021/7/22
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	55%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	159.9473	51.25	-8.27	42.98	43.50	-0.52	QP	
2		319.9975	46.54	-6.88	39.66	46.00	-6.34	peak	
3		460.5504	41.48	-3.51	37.97	46.00	-8.03	peak	
4		683.2950	36.43	0.55	36.98	46.00	-9.02	peak	
5	!	833.2893	39.85	3.04	42.89	46.00	-3.11	QP	
6		990.7526	32.19	5.44	37.63	54.00	-16.37	peak	

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

Test Mode	BT (1Mbps)	Test Date	2021/7/22
Test Frequency	2402MHz	Polarization	Horizontal
Temp	23°C	Hum.	55%

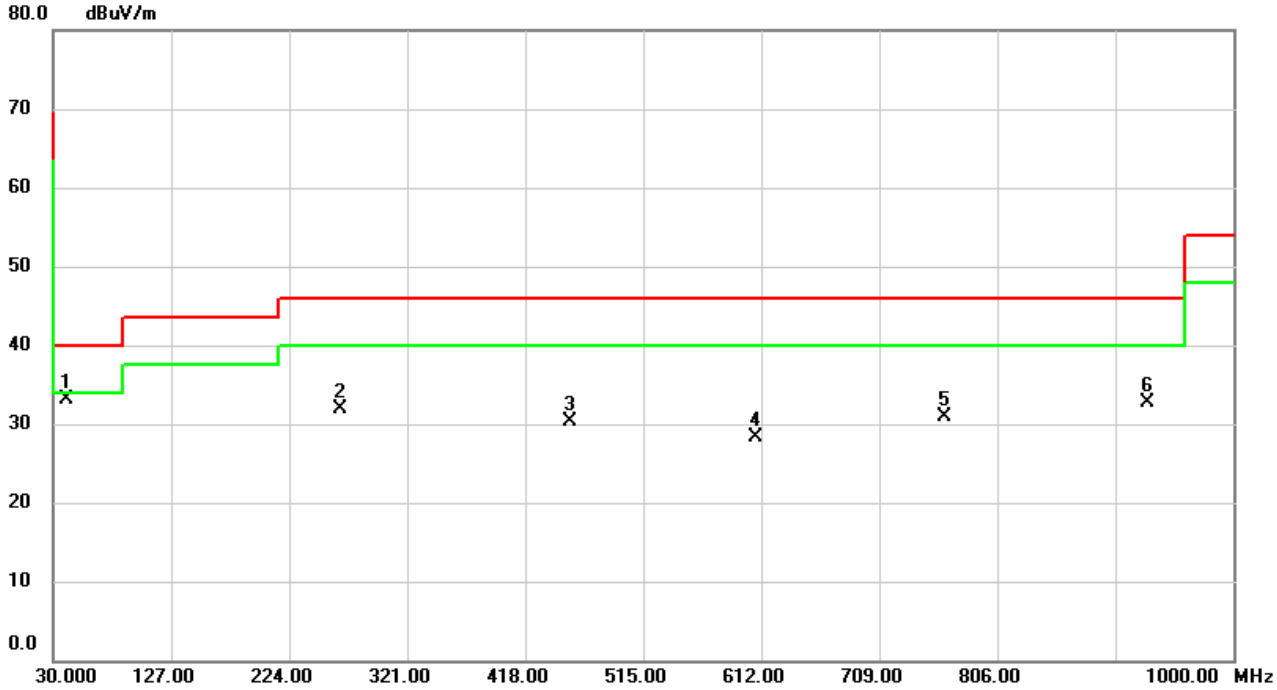


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	157.7162	51.27	-8.34	42.93	43.50	-0.57	QP	
2		228.6880	46.90	-10.38	36.52	46.00	-9.48	peak	
3		455.6682	42.19	-3.59	38.60	46.00	-7.40	peak	
4		767.5230	37.53	2.06	39.59	46.00	-6.41	peak	
5	!	833.2893	39.48	3.04	42.52	46.00	-3.48	QP	
6		950.3682	29.65	4.99	34.64	46.00	-11.36	peak	

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

For External Antenna: MA173. A. LBI.001

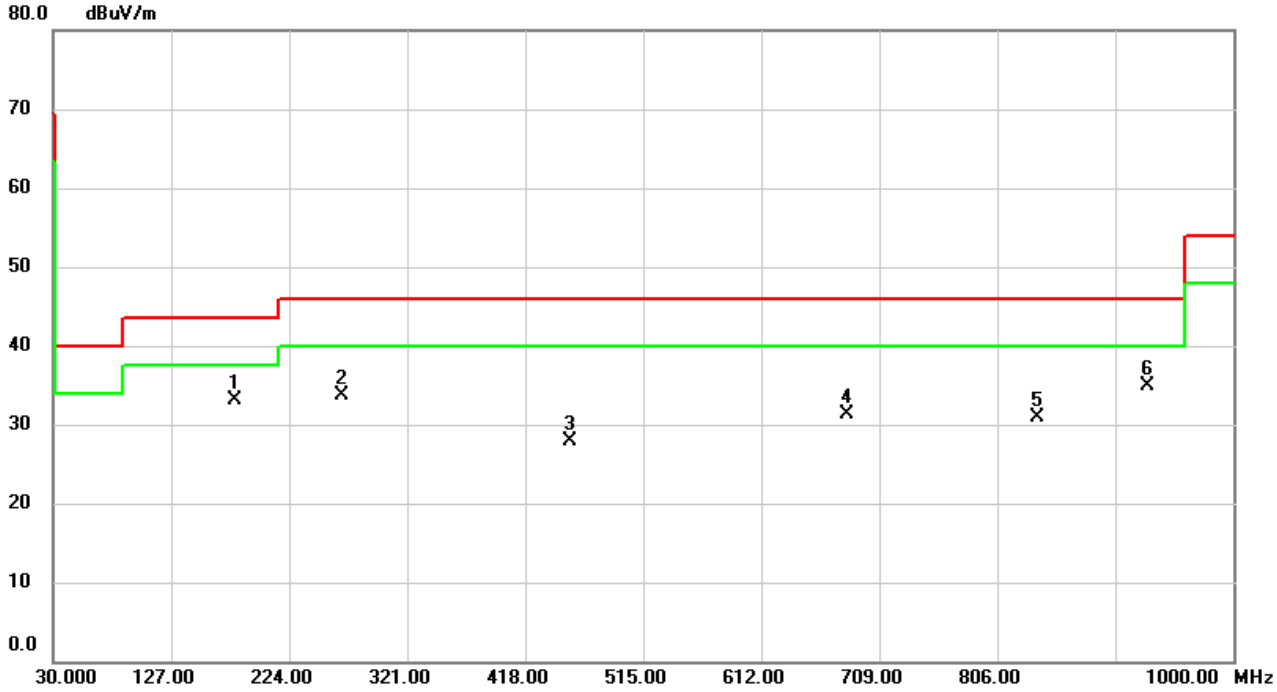
Test Mode	BT(1Mbps)	Test Date	2022/8/25
Test Frequency	2402MHz	Polarization	Vertical
Temp	28°C	Hum.	62%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	41.2843	50.74	-17.61	33.13	40.00	-6.87	peak	
2		265.6130	51.38	-19.52	31.86	46.00	-14.14	peak	
3		455.3450	44.49	-14.19	30.30	46.00	-15.70	peak	
4		606.9883	38.87	-10.50	28.37	46.00	-17.63	peak	
5		763.2877	38.50	-7.64	30.86	46.00	-15.14	peak	
6		929.9337	38.06	-5.33	32.73	46.00	-13.27	peak	

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

Test Mode	BT(1Mbps)	Test Date	2022/8/25
Test Frequency	2402MHz	Polarization	Horizontal
Temp	28°C	Hum.	62%

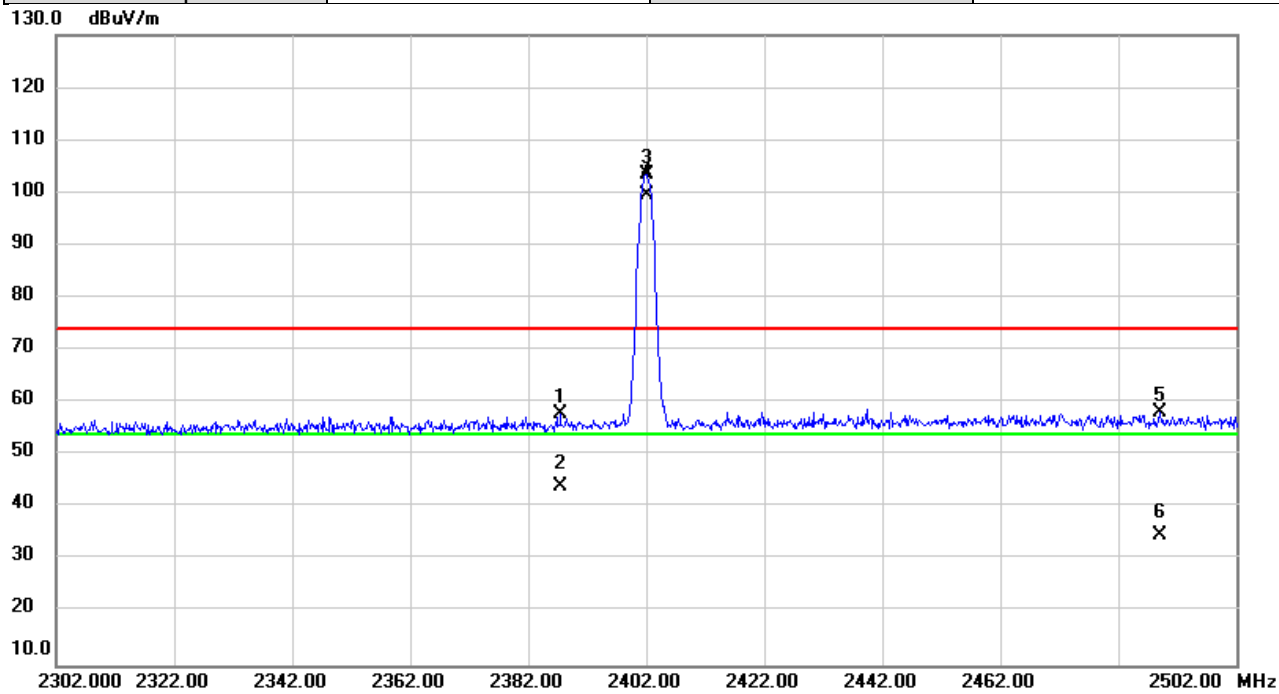


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	179.2830	52.87	-19.85	33.02	43.50	-10.48	peak	
2		267.3590	53.17	-19.43	33.74	46.00	-12.26	peak	
3		455.2803	42.19	-14.20	27.99	46.00	-18.01	peak	
4		682.8423	40.67	-9.38	31.29	46.00	-14.71	peak	
5		838.7860	37.52	-6.63	30.89	46.00	-15.11	peak	
6		929.9336	40.18	-5.33	34.85	46.00	-11.15	peak	

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

APPENDIX B RADIATED EMISSIONS - ABOVE 1 GHZ

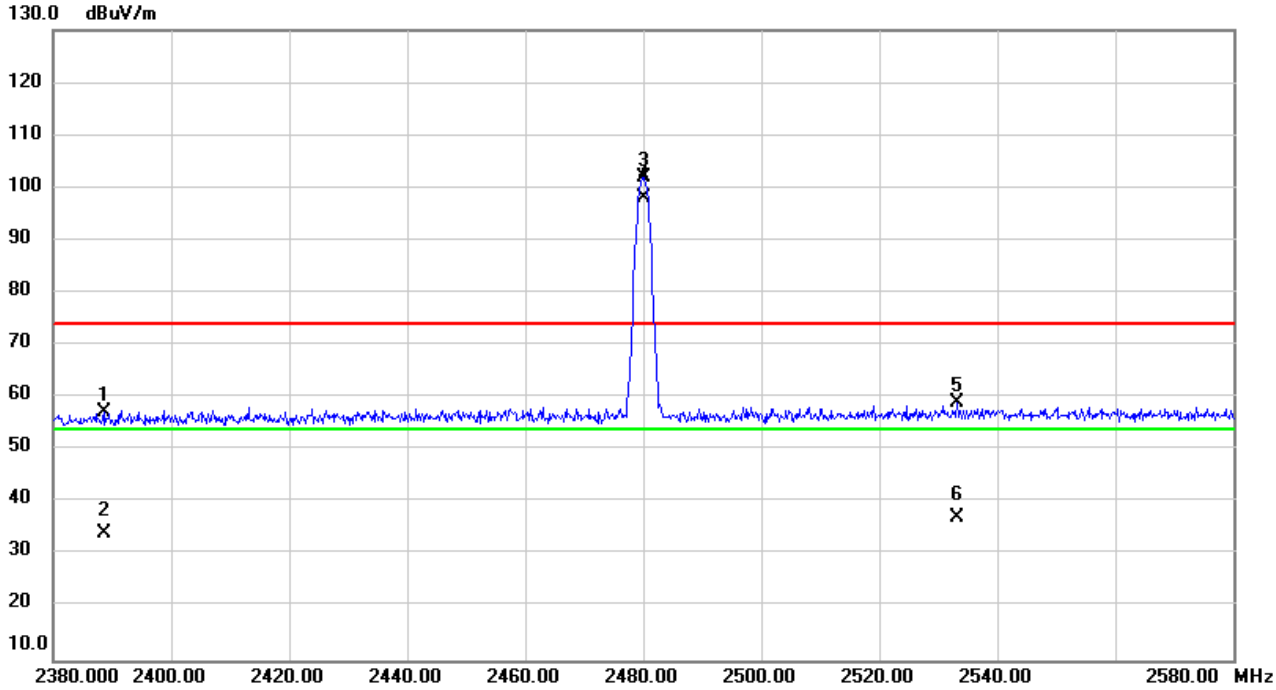
Test Mode	BT (1Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2387.520	26.50	31.21	57.71	74.00	-16.29	peak	
2		2387.520	12.94	31.21	44.15	54.00	-9.85	AVG	
3	X	2402.000	72.27	31.26	103.53	74.00	29.53	peak	NoLimit
4	*	2402.000	68.16	31.26	99.42	54.00	45.42	AVG	NoLimit
5		2489.173	26.52	31.53	58.05	74.00	-15.95	peak	
6		2489.173	3.19	31.53	34.72	54.00	-19.28	AVG	

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

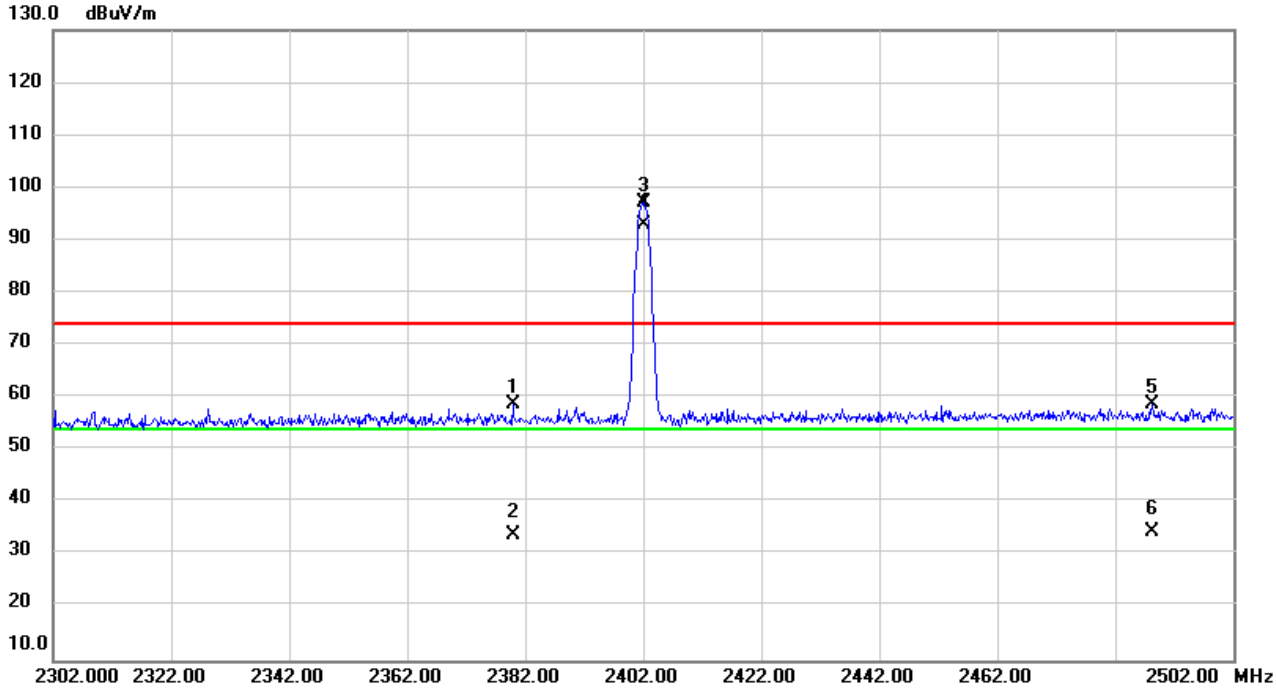
Test Mode	BT (1Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2388.547	25.91	31.21	57.12	74.00	-16.88	peak	
2		2388.547	2.95	31.21	34.16	54.00	-19.84	AVG	
3	X	2480.000	70.57	31.51	102.08	74.00	28.08	peak	NoLimit
4	*	2480.000	66.49	31.51	98.00	54.00	44.00	AVG	NoLimit
5		2533.327	27.34	31.67	59.01	74.00	-14.99	peak	
6		2533.327	5.61	31.67	37.28	54.00	-16.72	AVG	

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

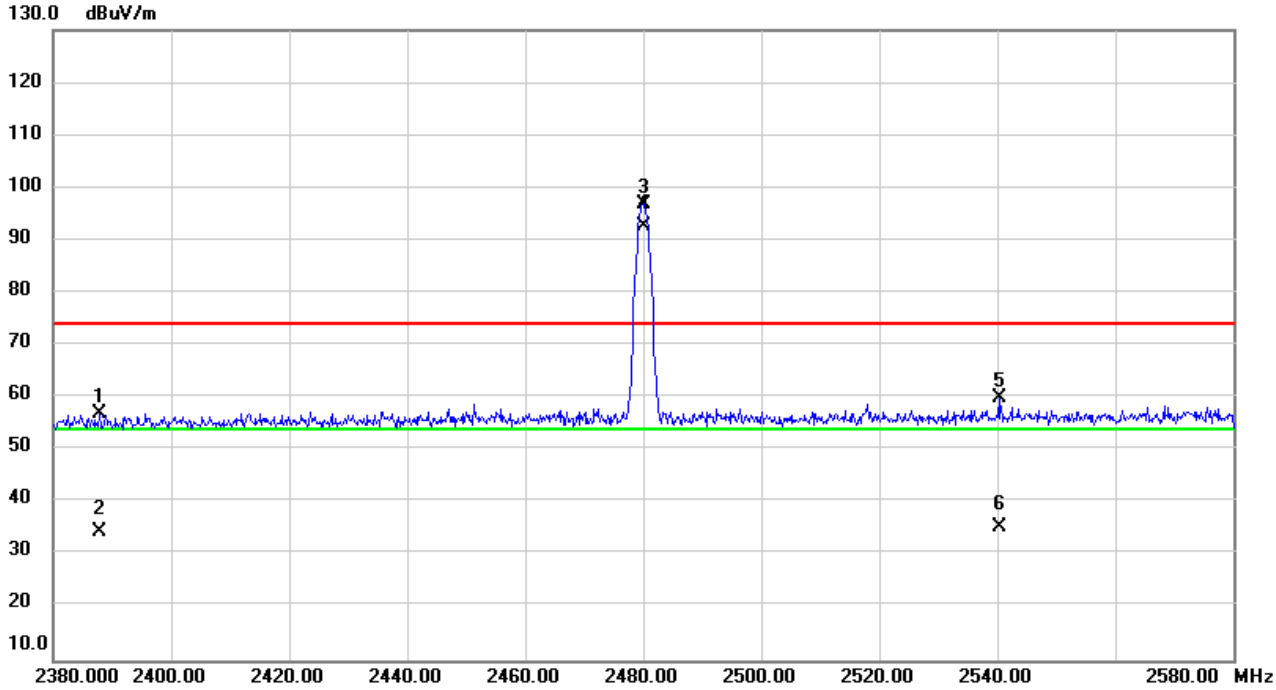
Test Mode	BT (3Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2379.973	27.44	31.18	58.62	74.00	-15.38	peak	
2		2379.973	2.76	31.18	33.94	54.00	-20.06	AVG	
3	X	2402.000	66.01	31.26	97.27	74.00	23.27	peak	NoLimit
4	*	2402.000	61.79	31.26	93.05	54.00	39.05	AVG	NoLimit
5		2488.380	27.19	31.53	58.72	74.00	-15.28	peak	
6		2488.380	2.99	31.53	34.52	54.00	-19.48	AVG	

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

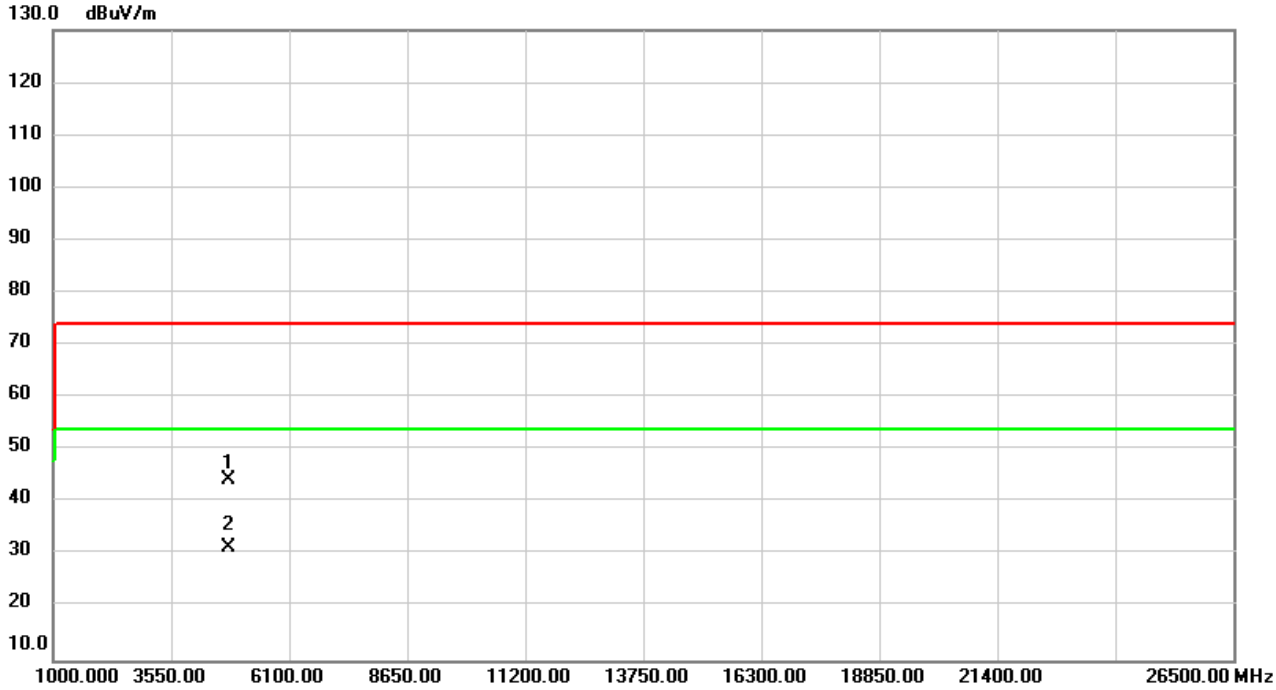
Test Mode	BT (3Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2387.800	25.61	31.21	56.82	74.00	-17.18	peak	
2		2387.800	3.11	31.21	34.32	54.00	-19.68	AVG	
3	X	2480.000	65.28	31.51	96.79	74.00	22.79	peak	NoLimit
4	*	2480.000	61.16	31.51	92.67	54.00	38.67	AVG	NoLimit
5		2540.300	28.41	31.68	60.09	74.00	-13.91	peak	
6		2540.300	3.69	31.68	35.37	54.00	-18.63	AVG	

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

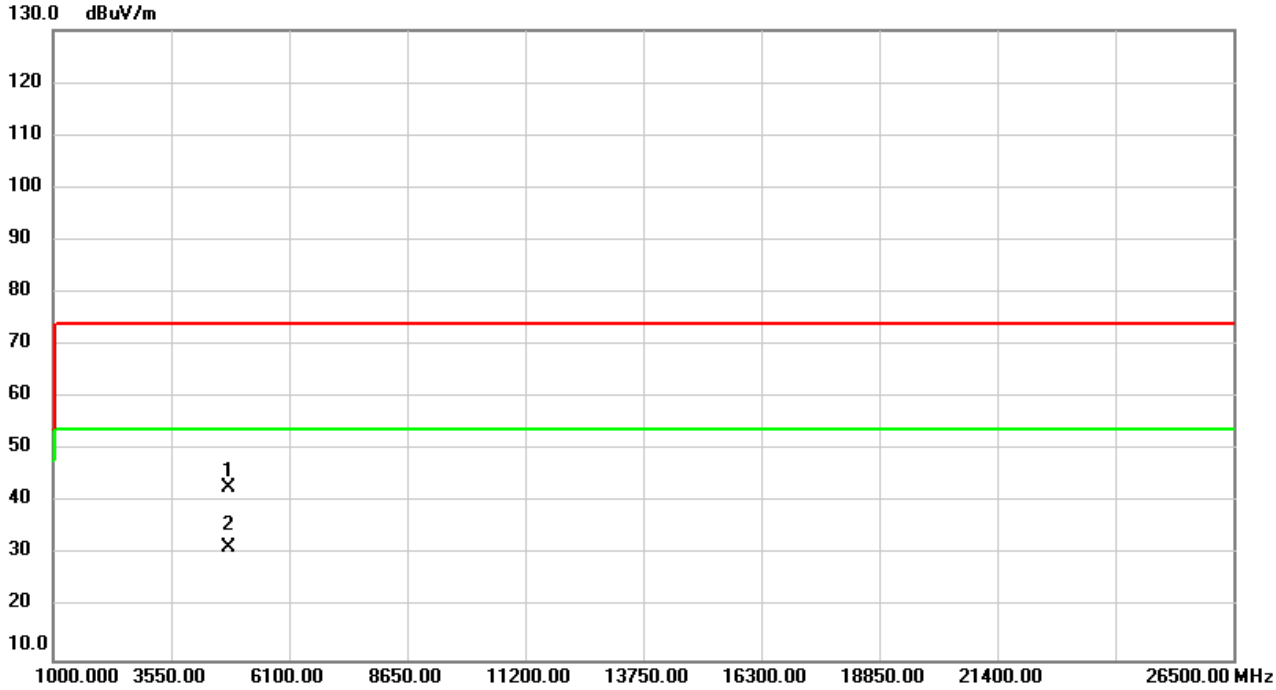
Test Mode	BT (1Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	54.18	-9.84	44.34	74.00	-29.66	peak	
2	*	4804.000	41.42	-9.84	31.58	54.00	-22.42	AVG	

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

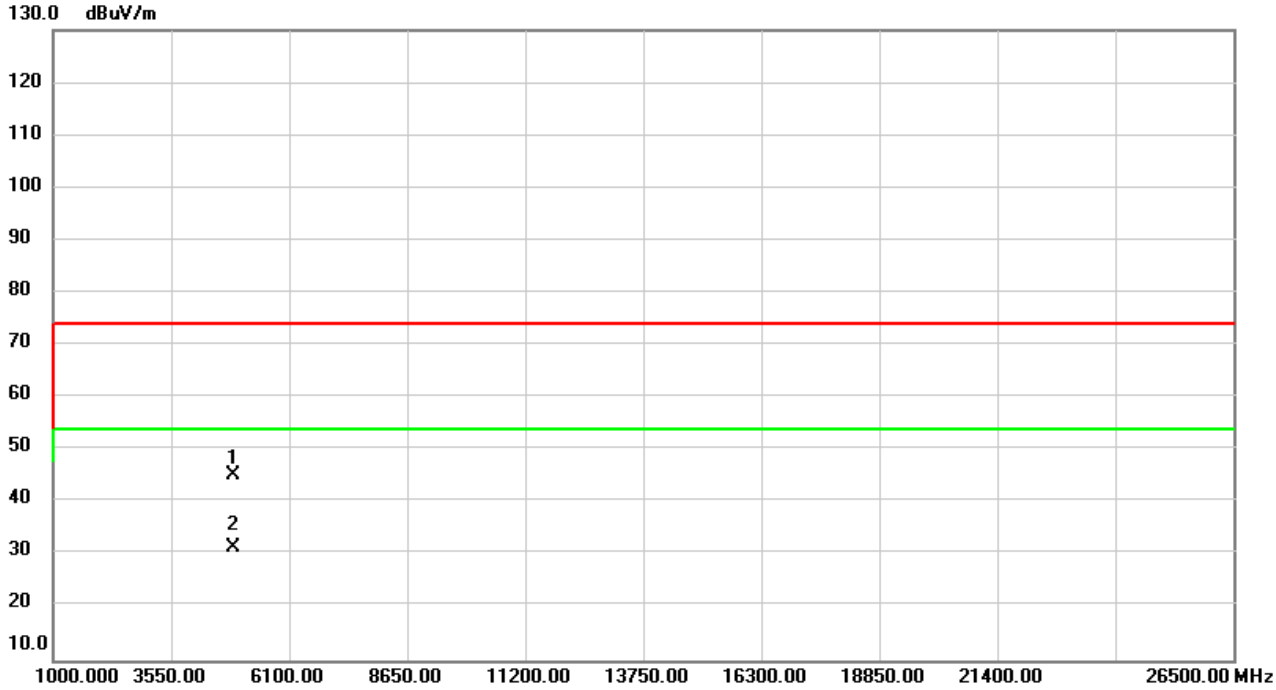
Test Mode	BT (1Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	52.72	-9.84	42.88	74.00	-31.12	peak	
2	*	4804.000	41.22	-9.84	31.38	54.00	-22.62	AVG	

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

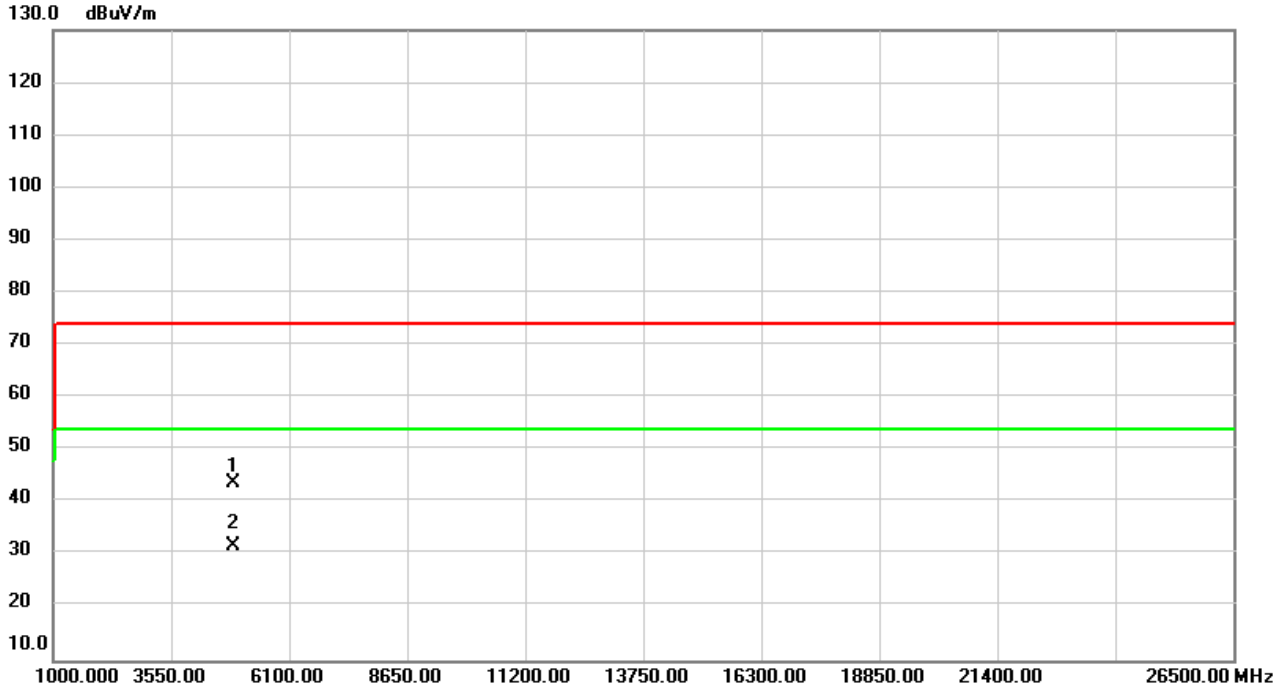
Test Mode	BT (1Mbps)	Test Date	2021/6/26
Test Frequency	2441MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4882.000	55.14	-9.77	45.37	74.00	-28.63	peak	
2	*	4882.000	41.31	-9.77	31.54	54.00	-22.46	AVG	

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

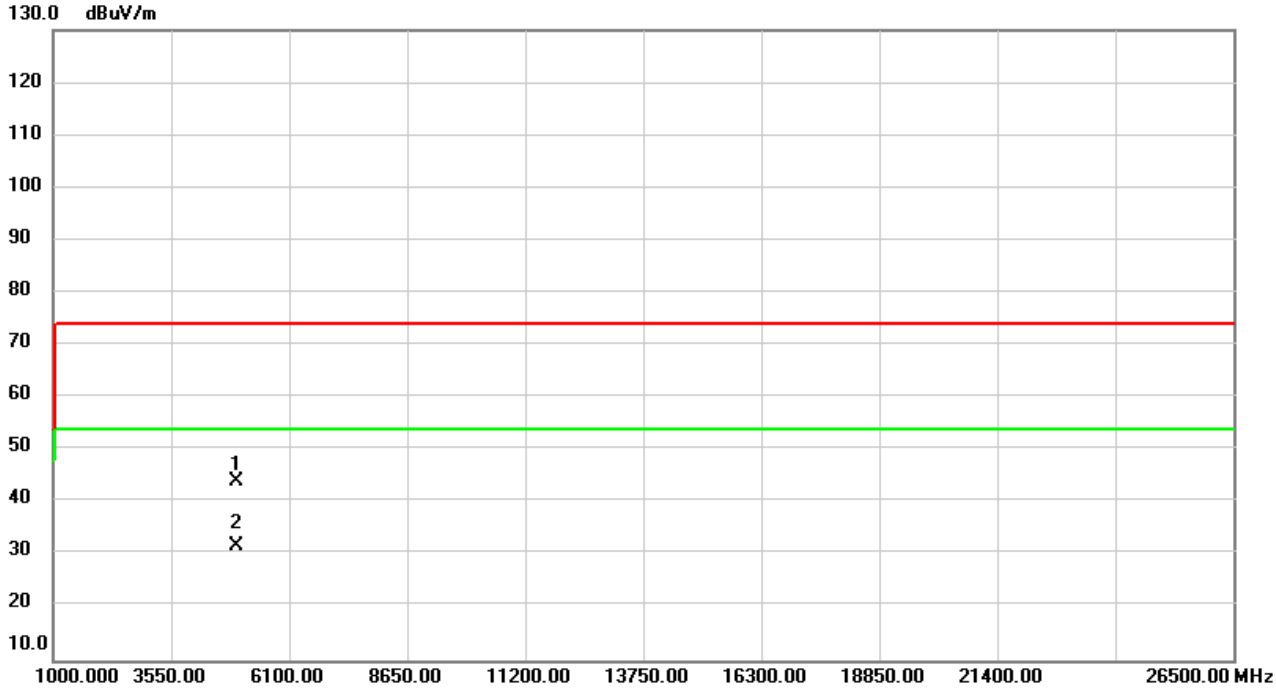
Test Mode	BT (1Mbps)	Test Date	2021/6/26
Test Frequency	2441MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4882.000	53.65	-9.77	43.88	74.00	-30.12	peak	
2	*	4882.000	41.41	-9.77	31.64	54.00	-22.36	AVG	

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

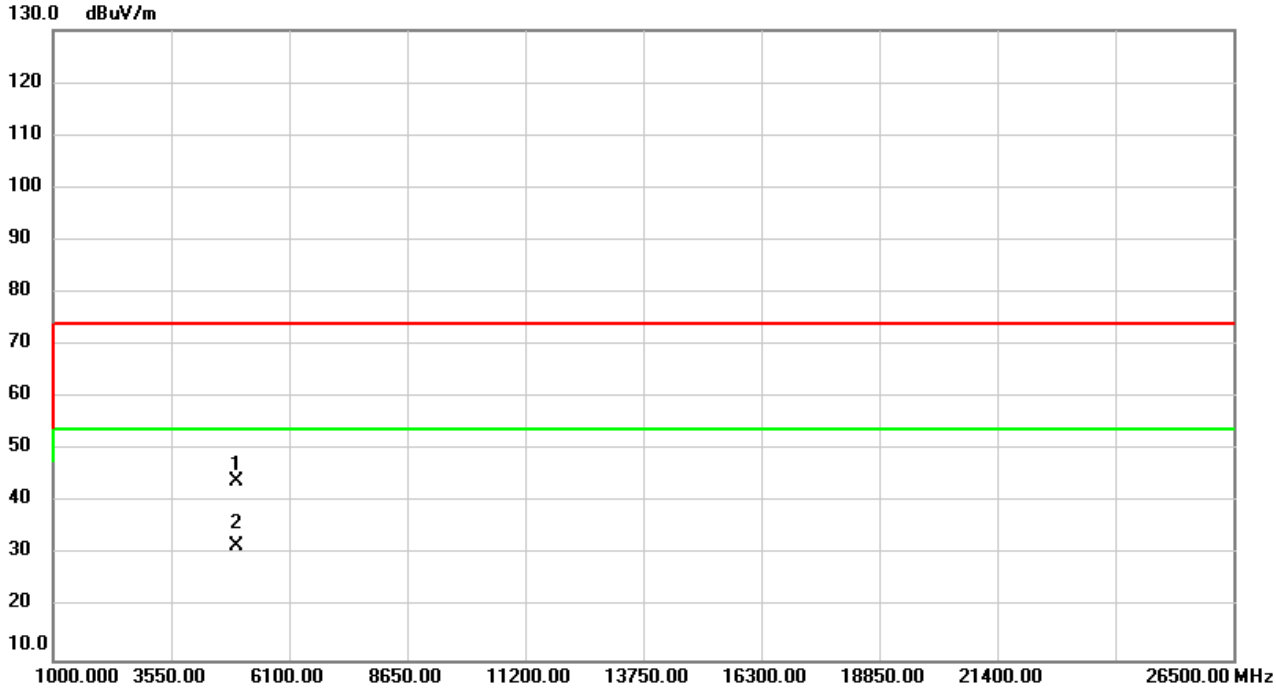
Test Mode	BT (1Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	53.84	-9.68	44.16	74.00	-29.84	peak	
2	*	4960.000	41.36	-9.68	31.68	54.00	-22.32	AVG	

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

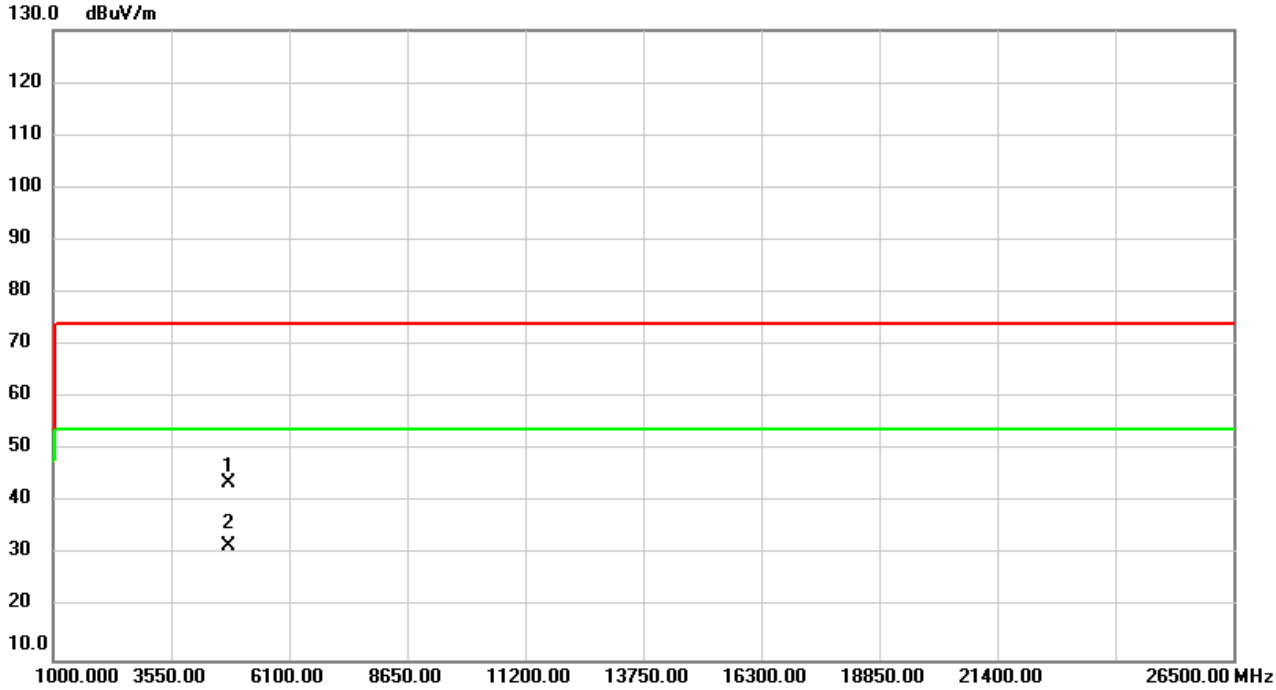
Test Mode	BT (1Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	53.62	-9.68	43.94	74.00	-30.06	peak	
2	*	4960.000	41.52	-9.68	31.84	54.00	-22.16	AVG	

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

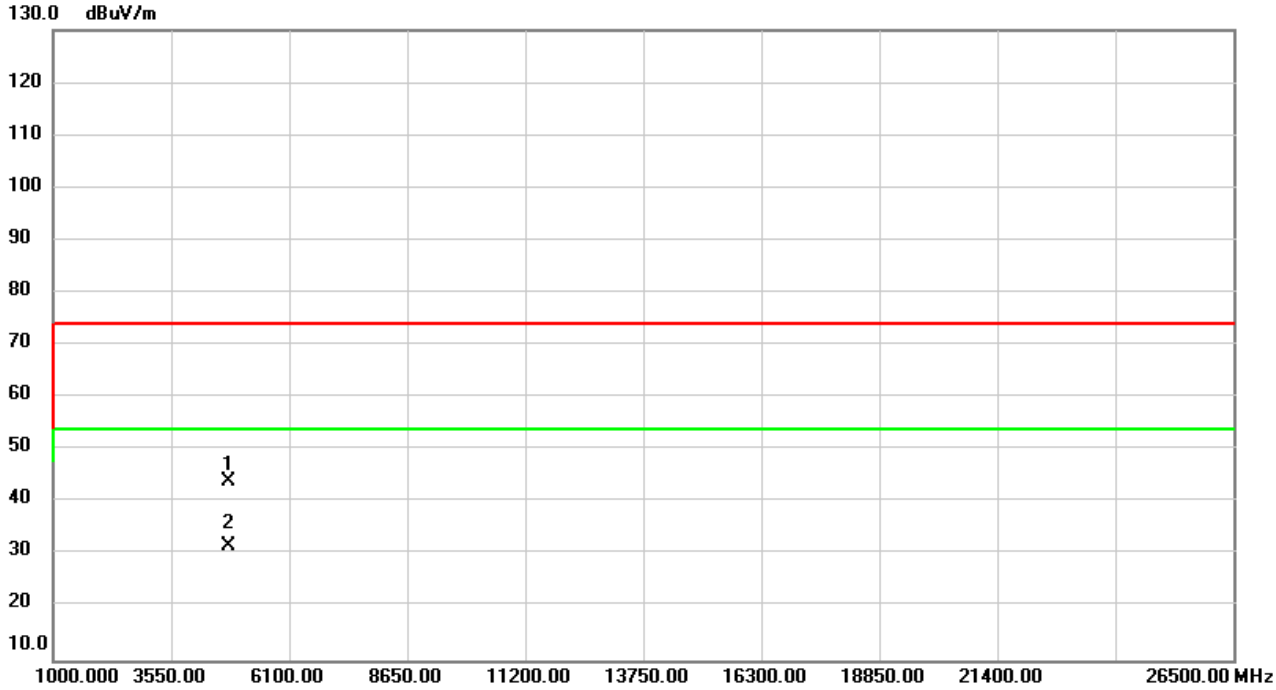
Test Mode	BT (3Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	53.70	-9.84	43.86	74.00	-30.14	peak	
2	*	4804.000	41.62	-9.84	31.78	54.00	-22.22	AVG	

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

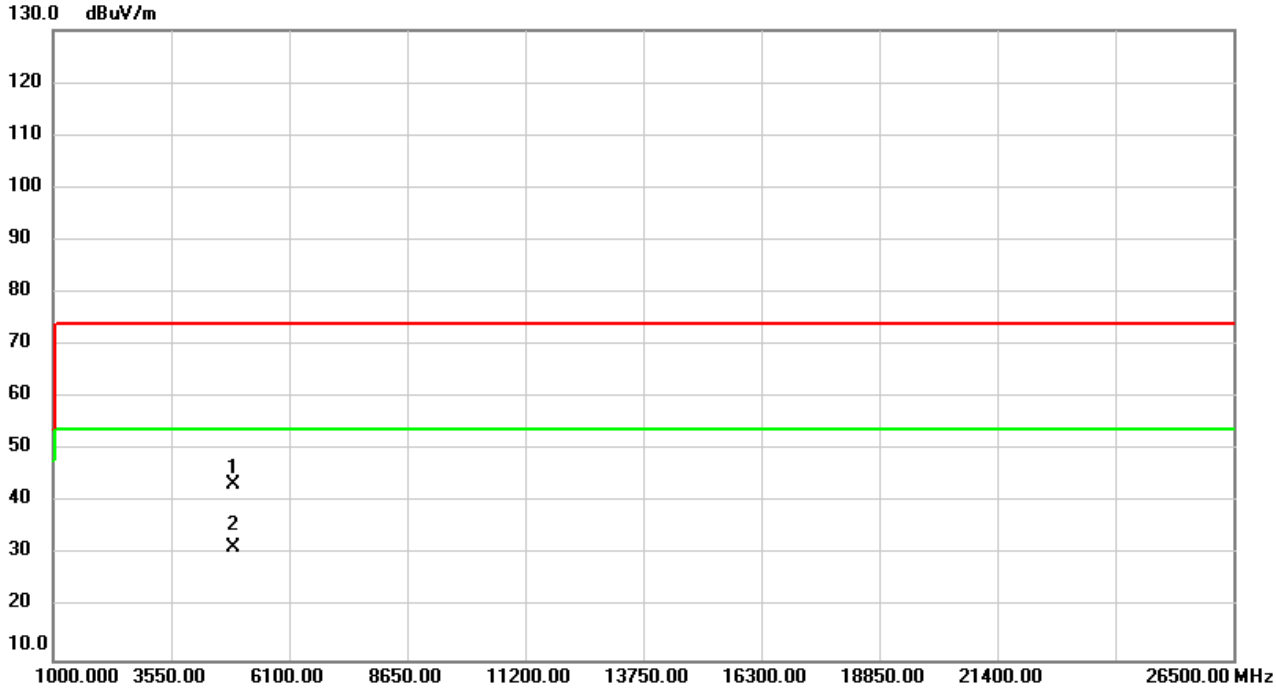
Test Mode	BT (3Mbps)	Test Date	2021/6/26
Test Frequency	2402MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	53.85	-9.84	44.01	74.00	-29.99	peak	
2	*	4804.000	41.52	-9.84	31.68	54.00	-22.32	AVG	

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

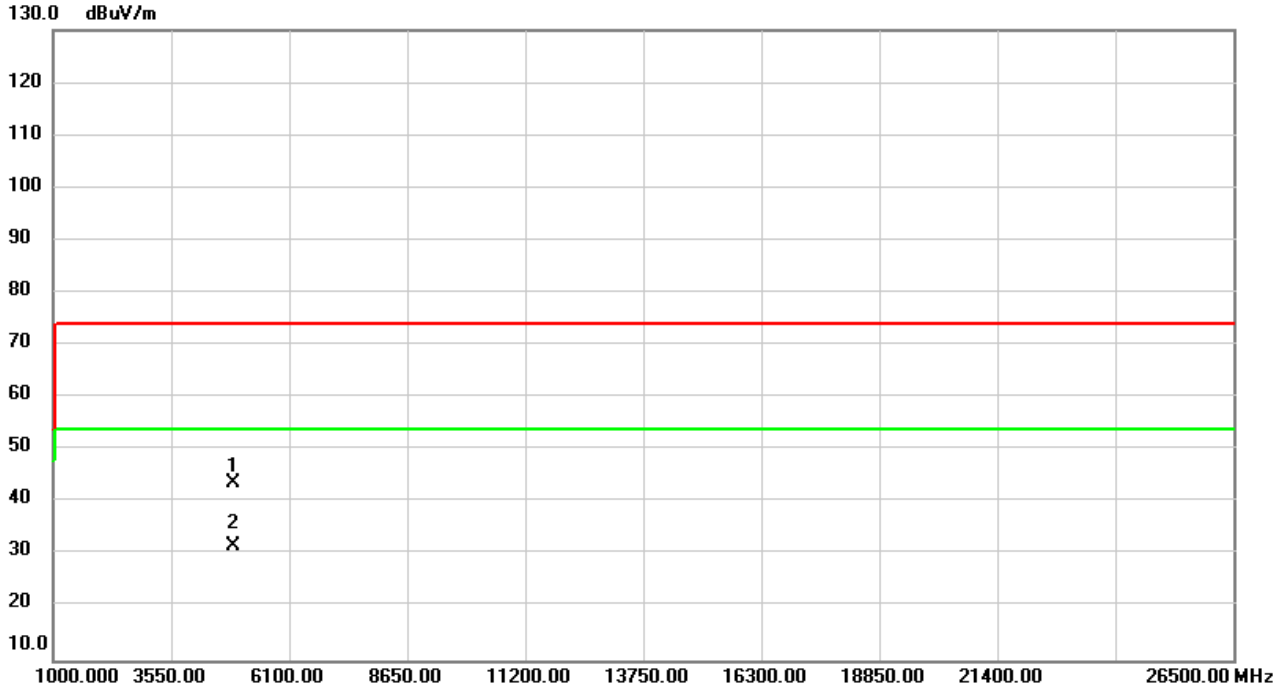
Test Mode	BT (3Mbps)	Test Date	2021/6/26
Test Frequency	2441MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4882.000	53.24	-9.77	43.47	74.00	-30.53	peak	
2	*	4882.000	41.28	-9.77	31.51	54.00	-22.49	AVG	

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

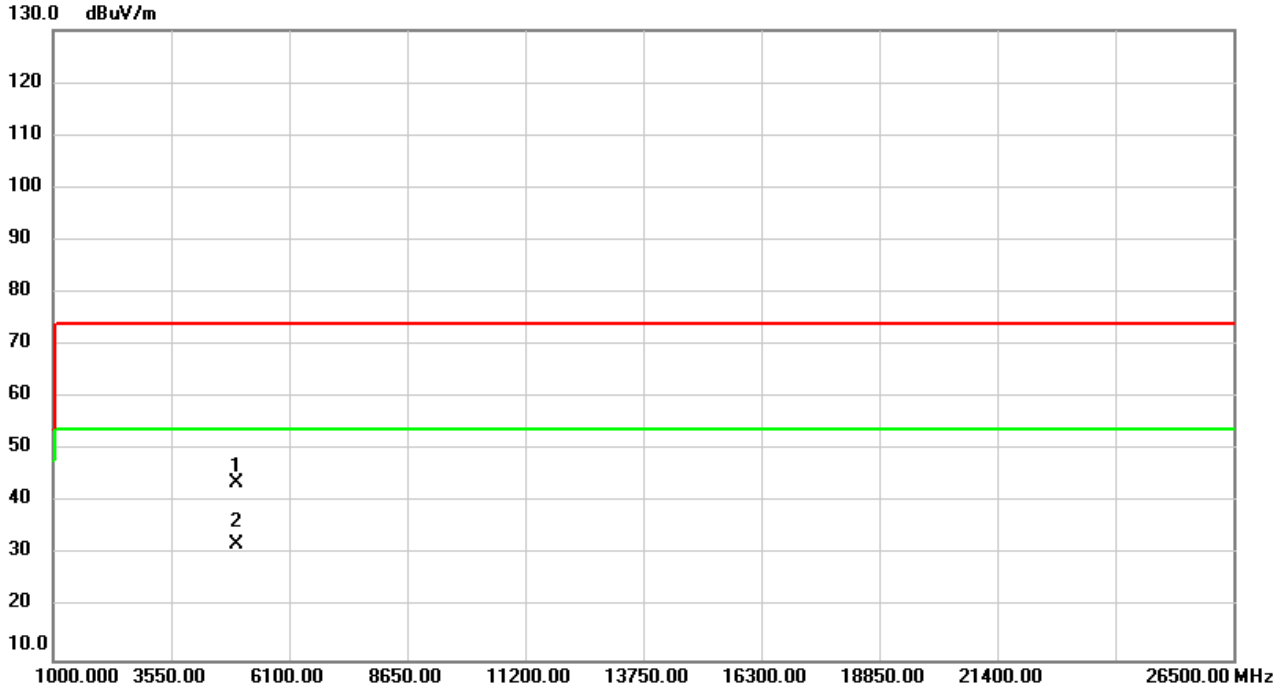
Test Mode	BT (3Mbps)	Test Date	2021/6/26
Test Frequency	2441MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4882.000	53.67	-9.77	43.90	74.00	-30.10	peak	
2	*	4882.000	41.37	-9.77	31.60	54.00	-22.40	AVG	

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

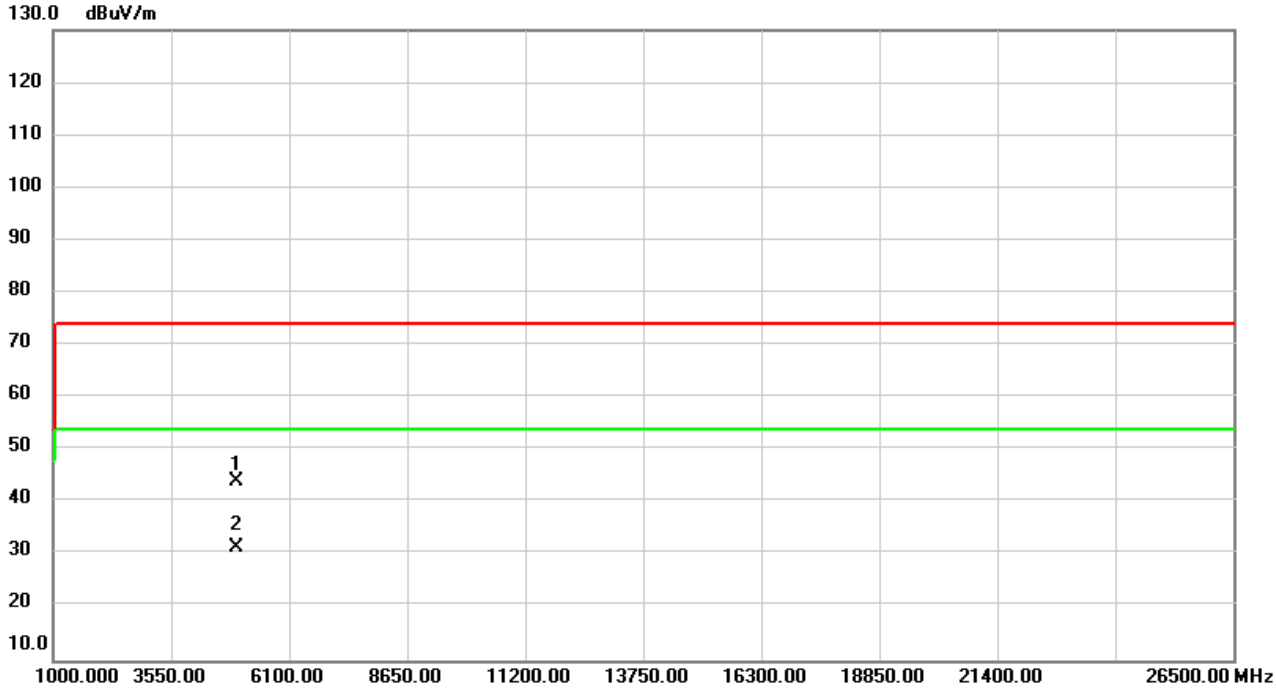
Test Mode	BT (3Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Vertical
Temp	23°C	Hum.	54%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	53.34	-9.68	43.66	74.00	-30.34	peak	
2	*	4960.000	41.59	-9.68	31.91	54.00	-22.09	AVG	

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

Test Mode	BT (3Mbps)	Test Date	2021/6/26
Test Frequency	2480MHz	Polarization	Horizontal
Temp	23°C	Hum.	54%

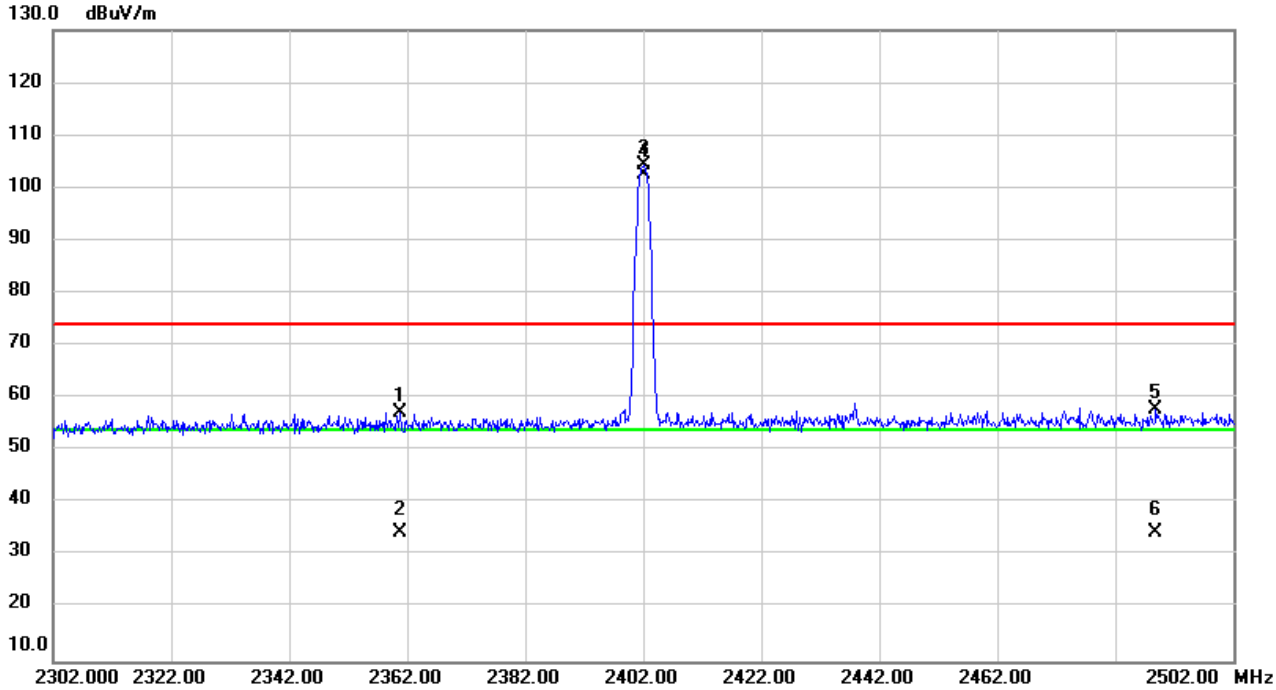


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	53.60	-9.68	43.92	74.00	-30.08	peak	
2	*	4960.000	41.23	-9.68	31.55	54.00	-22.45	AVG	

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

Spot check test:

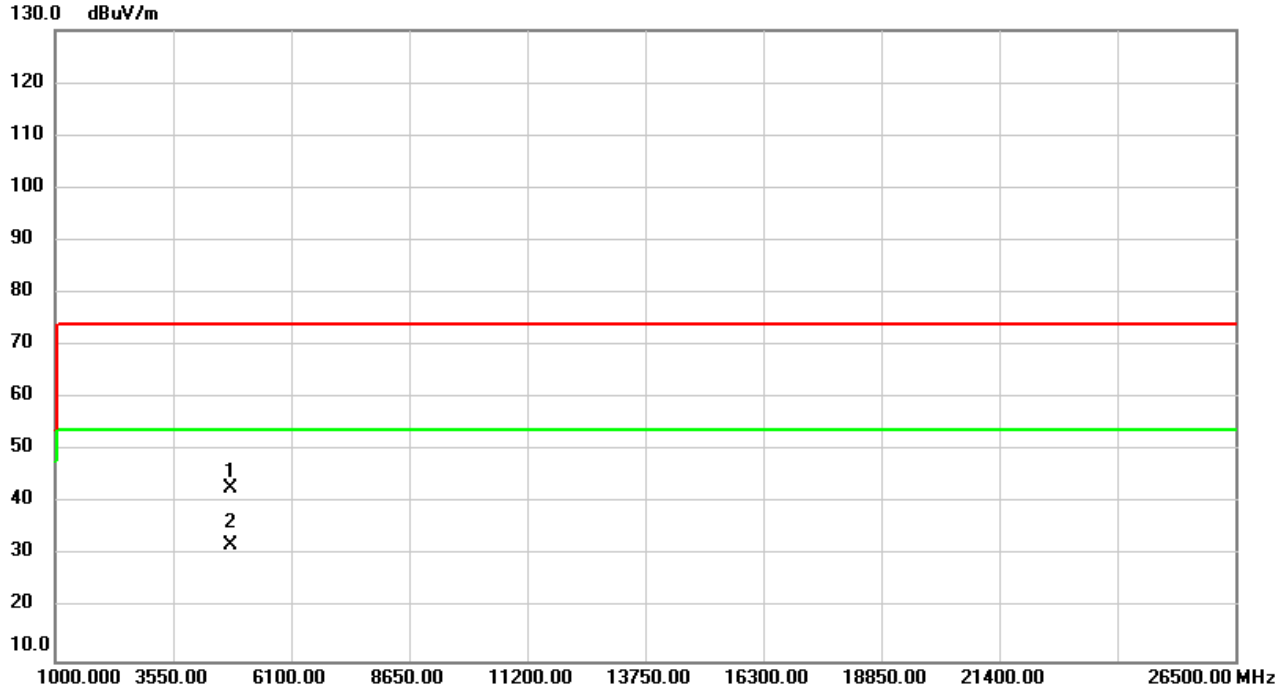
Test Mode	BT(1 Mbps)	Test Date	2021/7/22
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	55%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2360.847	26.22	31.12	57.34	74.00	-16.66	peak	
2		2360.847	3.39	31.12	34.51	54.00	-19.49	AVG	
3	X	2402.000	72.95	31.26	104.21	74.00	30.21	peak	NoLimit
4	*	2402.000	71.33	31.26	102.59	54.00	48.59	AVG	NoLimit
5		2488.913	26.37	31.53	57.90	74.00	-16.10	peak	
6		2488.913	2.90	31.53	34.43	54.00	-19.57	AVG	

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

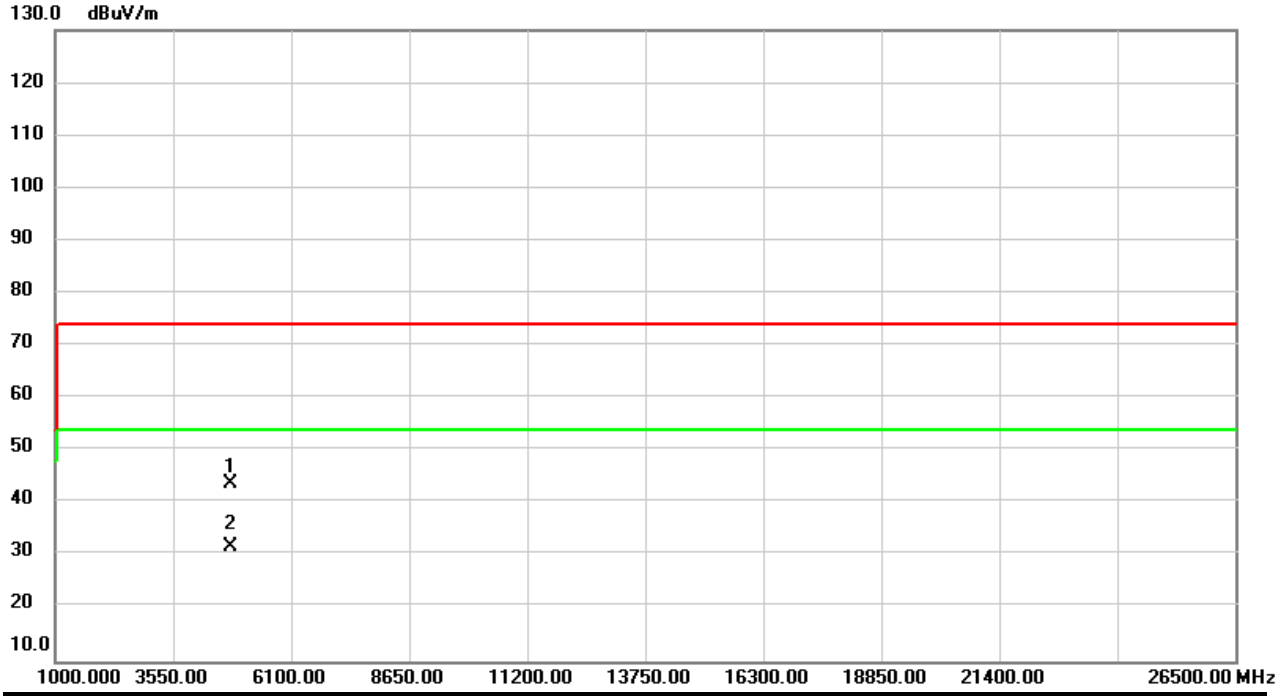
Test Mode	BT(1 Mbps)	Test Date	2021/7/22
Test Frequency	2402MHz	Polarization	Vertical
Temp	23°C	Hum.	55%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	52.64	-9.84	42.80	74.00	-31.20	peak	
2	*	4804.000	41.84	-9.84	32.00	54.00	-22.00	AVG	

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

Test Mode	BT(1 Mbps)	Test Date	2021/7/22
Test Frequency	2402MHz	Polarization	Horizontal
Temp	23°C	Hum.	55%

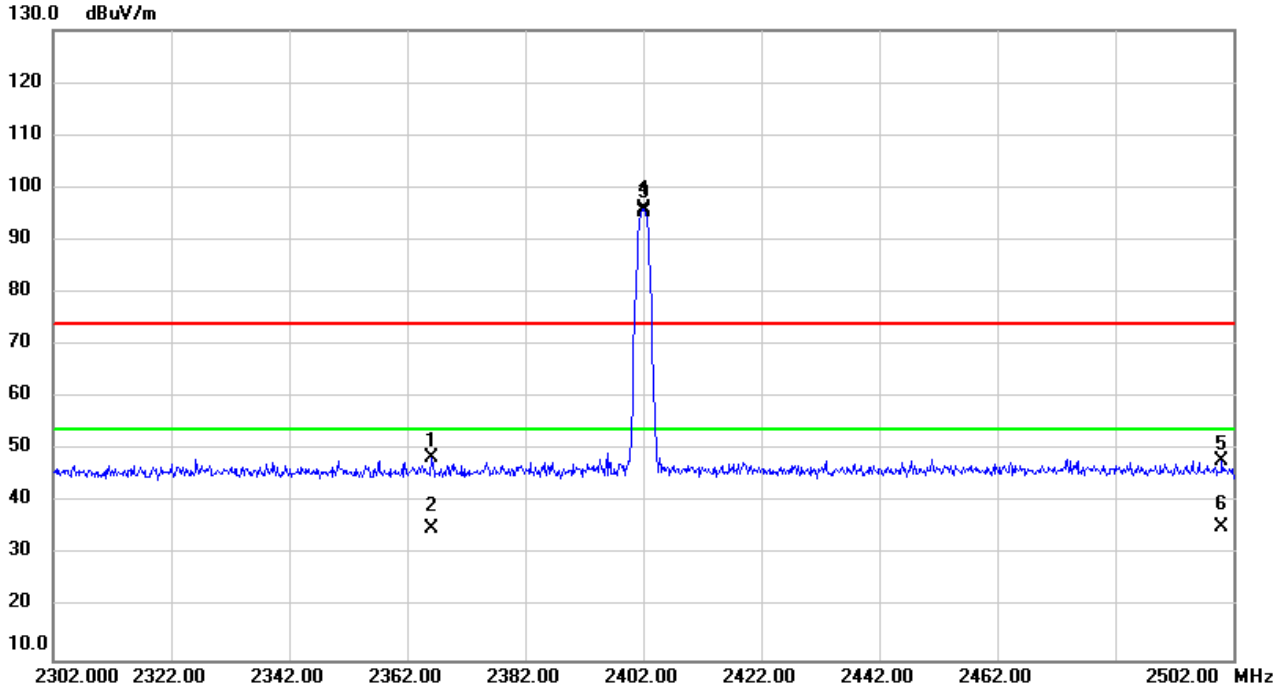


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	53.56	-9.84	43.72	74.00	-30.28	peak	
2	*	4804.000	41.64	-9.84	31.80	54.00	-22.20	AVG	

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

For External Antenna: MA173. A. LBI.001

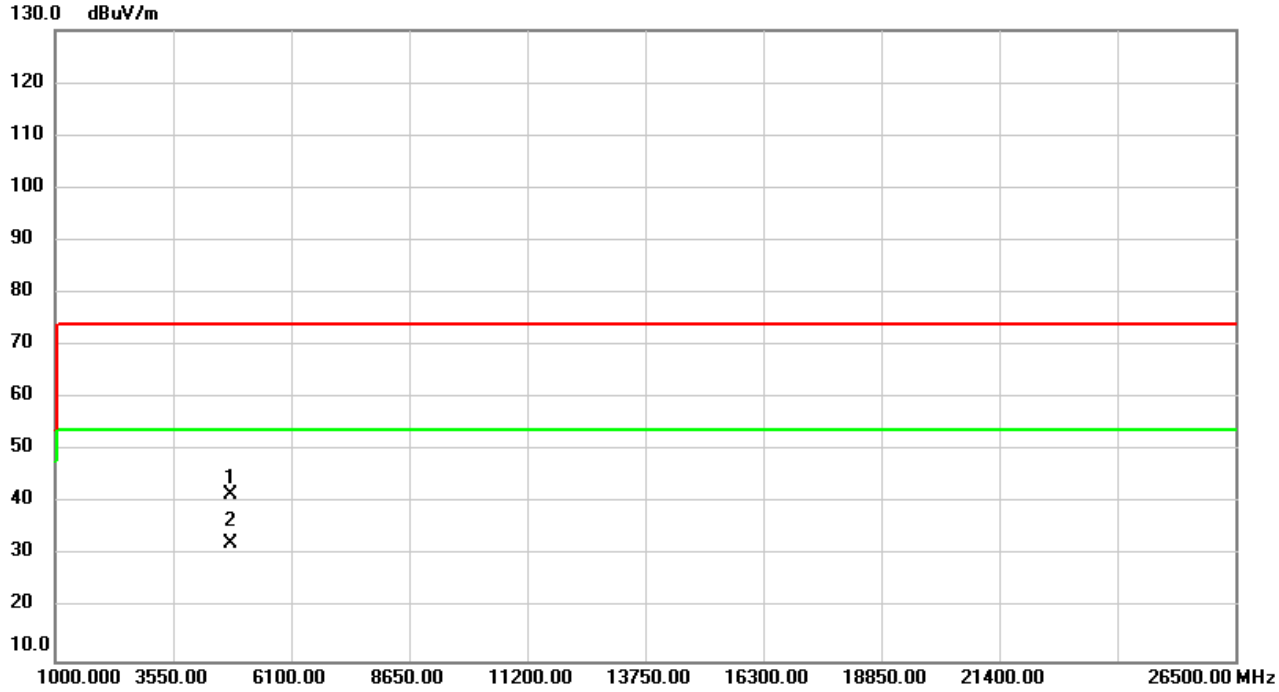
Test Mode	BT(1Mbps)	Test Date	2022/8/25
Test Frequency	2402MHz	Polarization	Vertical
Temp	28°C	Hum.	62%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2366.193	54.46	-5.80	48.66	74.00	-25.34	peak	
2		2366.193	40.88	-5.80	35.08	54.00	-18.92	AVG	
3	X	2402.000	101.71	-5.75	95.96	74.00	21.96	peak	NoLimit
4	*	2402.000	100.96	-5.75	95.21	54.00	41.21	AVG	NoLimit
5		2500.073	53.59	-5.62	47.97	74.00	-26.03	peak	
6		2500.073	40.84	-5.62	35.22	54.00	-18.78	AVG	

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

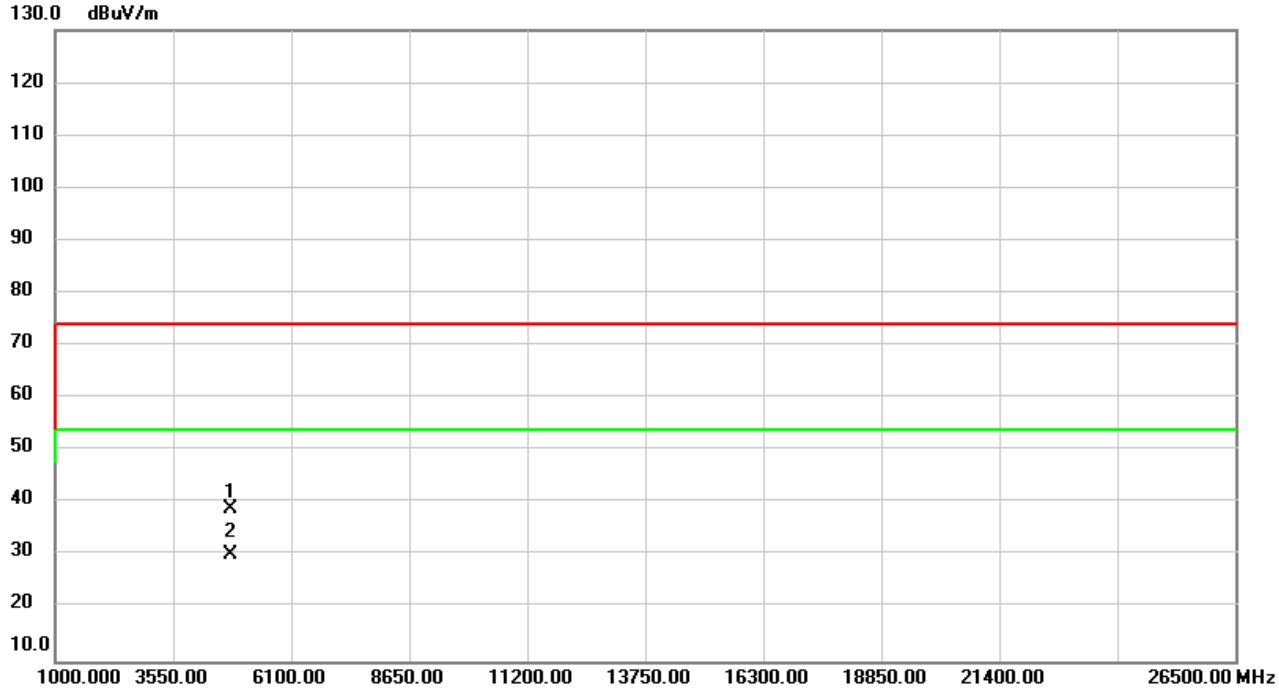
Test Mode	BT(1Mbps)	Test Date	2022/8/25
Test Frequency	2402MHz	Polarization	Vertical
Temp	28°C	Hum.	62%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	40.93	0.65	41.58	74.00	-32.42	peak	
2	*	4804.000	31.72	0.65	32.37	54.00	-21.63	AVG	

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

Test Mode	BT(1Mbps)	Test Date	2022/8/25
Test Frequency	2402MHz	Polarization	Horizontal
Temp	28°C	Hum.	62%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	38.44	0.65	39.09	74.00	-34.91	peak	
2	*	4804.000	29.56	0.65	30.21	54.00	-23.79	AVG	

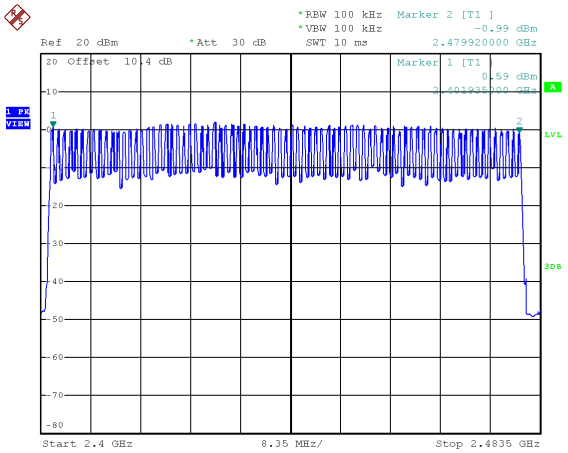
REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX C NUMBER OF HOPPING CHANNEL

Test Mode	1/3Mbps

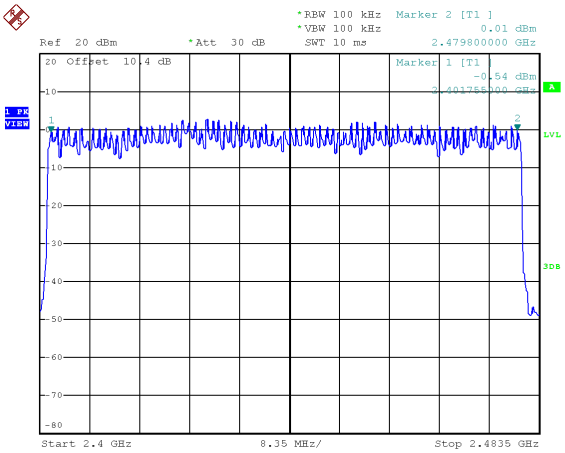
Test Mode	Number of Hopping Channel	≥ Limit	Test Result
1 Mbps	79	15	Pass
3 Mbps	79	15	Pass

1 Mbps



Date: 28.JUN.2021 19:04:21

3 Mbps



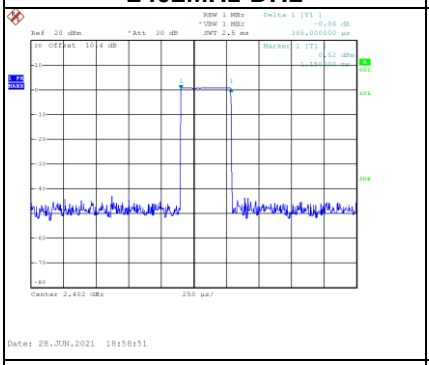
Date: 29.JUN.2021 12:36:00

APPENDIX D AVERAGE TIME OF OCCUPANCY

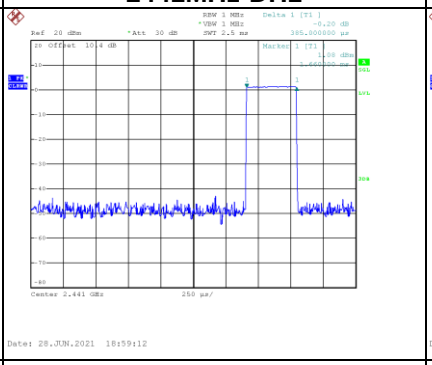
Test Mode :	1Mbps

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Result
DH5	2402	2.8800	0.3072	0.4000	Pass
DH3	2402	1.6600	0.2656	0.4000	Pass
DH1	2402	0.3850	0.1232	0.4000	Pass
DH5	2441	2.9200	0.3115	0.4000	Pass
DH3	2441	1.6600	0.2656	0.4000	Pass
DH1	2441	0.3850	0.1232	0.4000	Pass
DH5	2480	2.8800	0.3072	0.4000	Pass
DH3	2480	1.6600	0.2656	0.4000	Pass
DH1	2480	0.3850	0.1232	0.4000	Pass

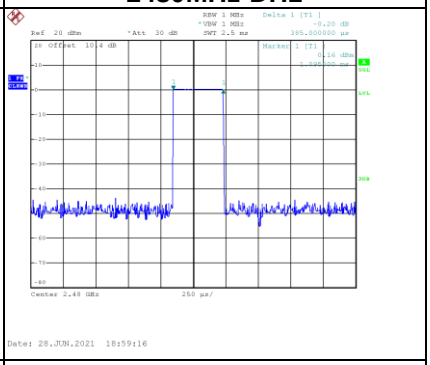
2402MHz-DH1



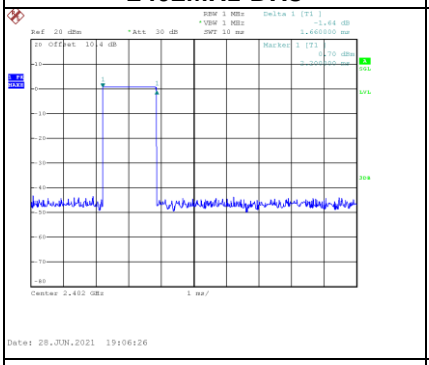
2441MHz-DH1



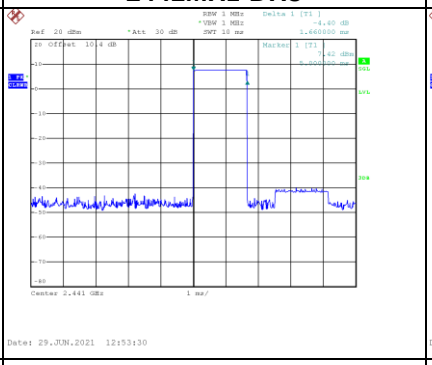
2480MHz-DH1



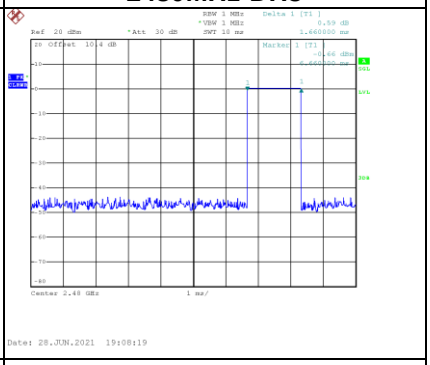
2402MHz-DH3



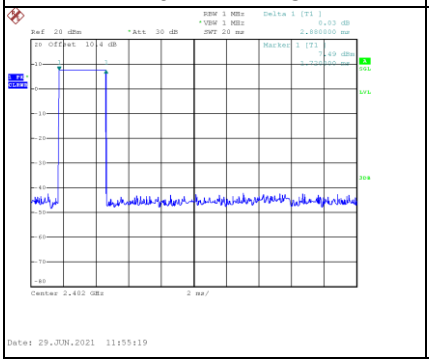
2441MHz-DH3



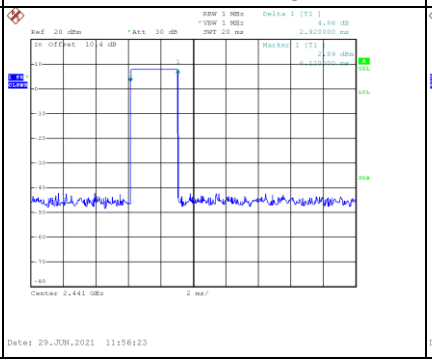
2480MHz-DH3



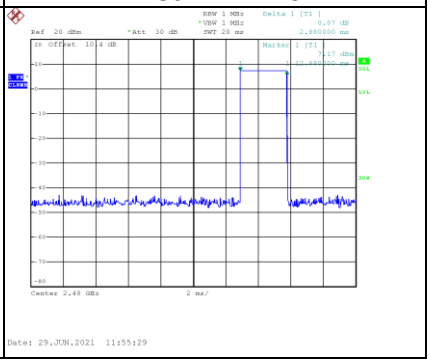
2402MHz-DH5



2441MHz-DH5



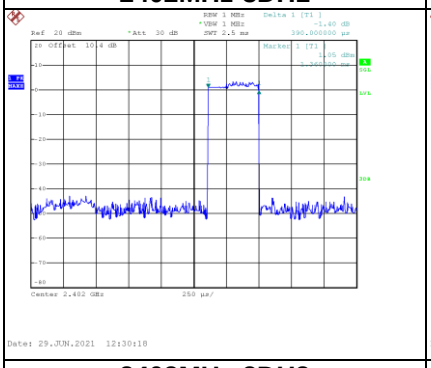
2480MHz-DH5



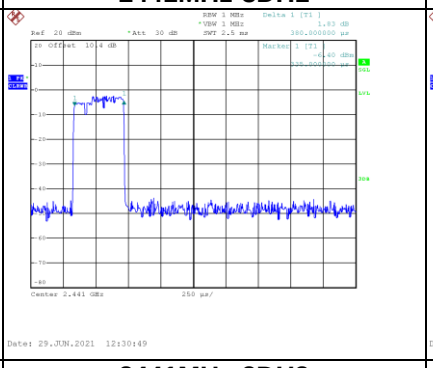
Test Mode :	3Mbps

Data Packet	Frequency (MHz)	Pulse Duration(ms)	Dwell Time(s)	Limits(s)	Test Result
3DH5	2402	2.8800	0.3072	0.4000	Pass
3DH3	2402	1.6400	0.2624	0.4000	Pass
3DH1	2402	0.3900	0.1248	0.4000	Pass
3DH5	2441	2.8800	0.3072	0.4000	Pass
3DH3	2441	1.6400	0.2624	0.4000	Pass
3DH1	2441	0.3800	0.1216	0.4000	Pass
3DH5	2480	2.9200	0.3115	0.4000	Pass
3DH3	2480	1.6400	0.2624	0.4000	Pass
3DH1	2480	0.3900	0.1248	0.4000	Pass

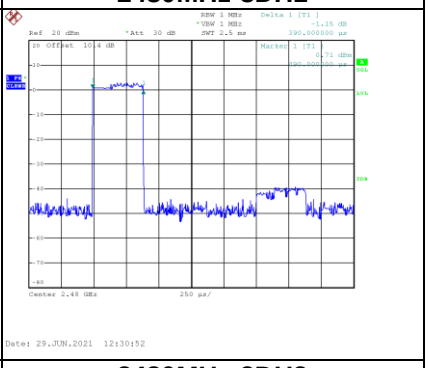
2402MHz-3DH1



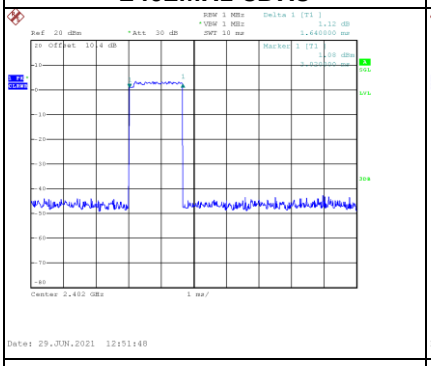
2441MHz-3DH1



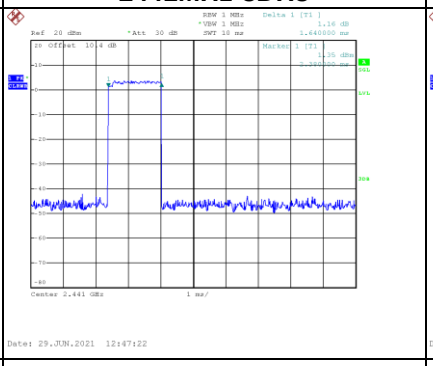
2480MHz-3DH1



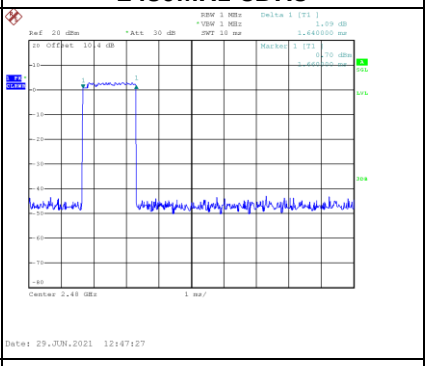
2402MHz-3DH3



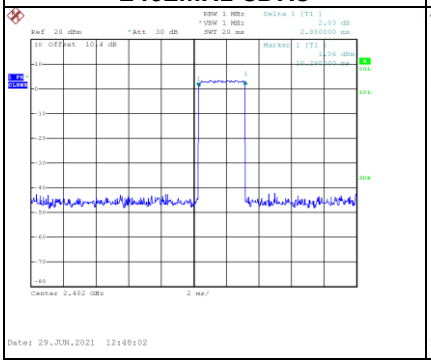
2441MHz-3DH3



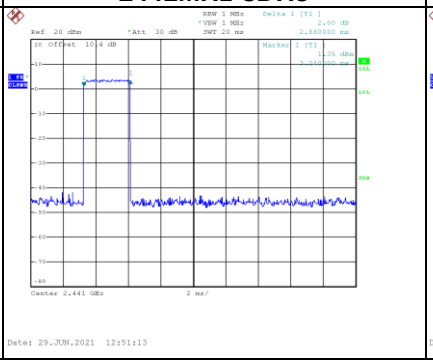
2480MHz-3DH3



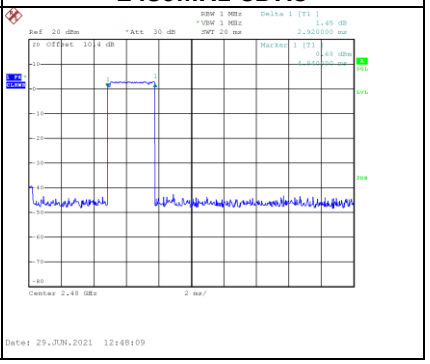
2402MHz-3DH5



2441MHz-3DH5



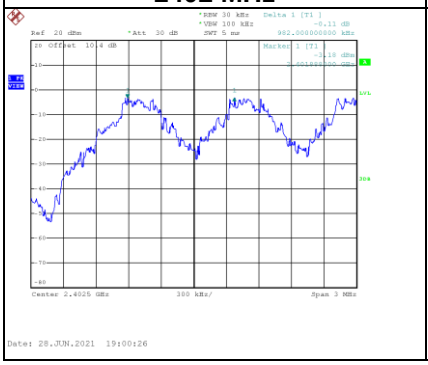
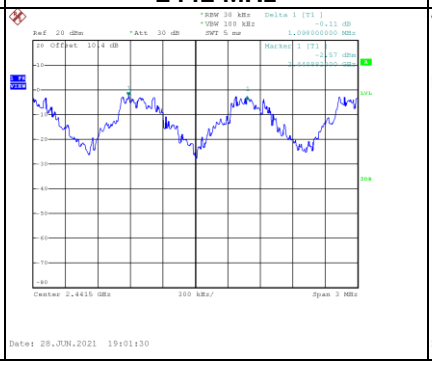
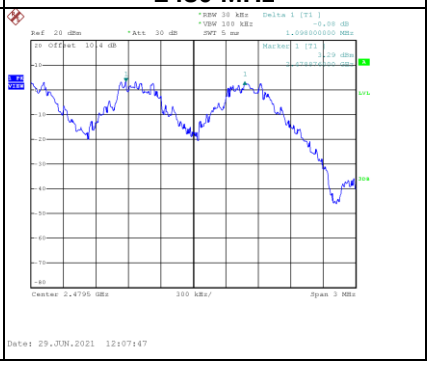
2480MHz-3DH5



APPENDIX E HOPPING CHANNEL SEPARATION MEASUREMENT

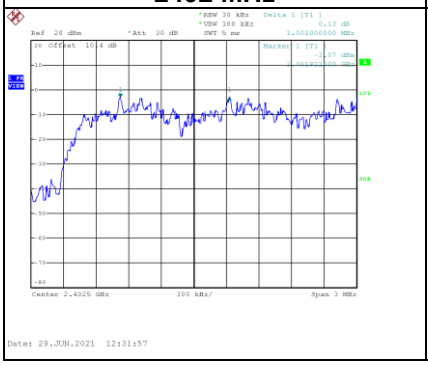
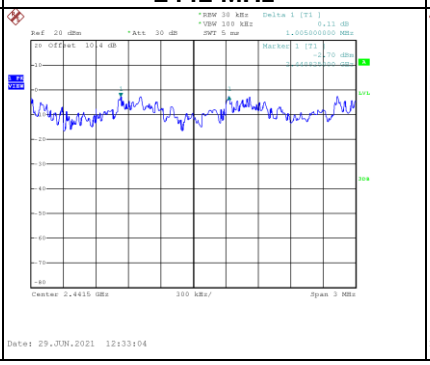
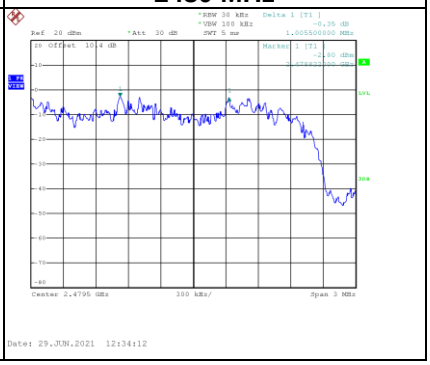
Test Mode :	Hopping on _1Mbps

Frequency (MHz)	Channel Separation (MHz)	2/3 of 20dB Bandwidth (MHz)	Test Result
2402	0.982	0.639	Pass
2441	1.098	0.640	Pass
2480	1.098	0.641	Pass

2402 MHz	2441 MHz	2480 MHz
		

Test Mode :	Hopping on _3Mbps

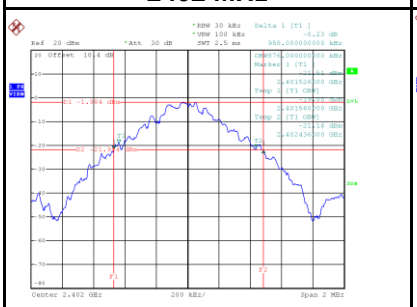
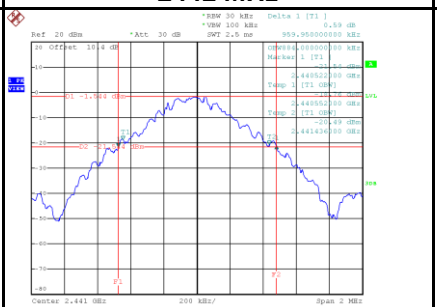
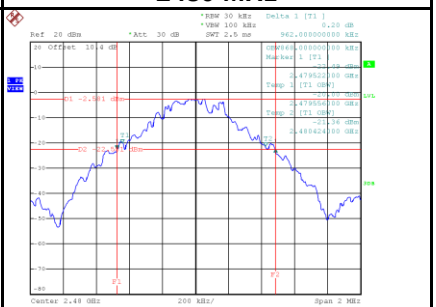
Frequency (MHz)	Channel Separation (MHz)	2/3 of 20dB Bandwidth (MHz)	Test Result
2402	1.002	0.869	Pass
2441	1.005	0.881	Pass
2480	1.006	0.879	Pass

2402 MHz	2441 MHz	2480 MHz
		

APPENDIX F BANDWIDTH

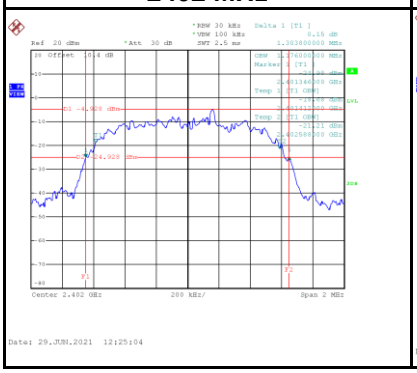
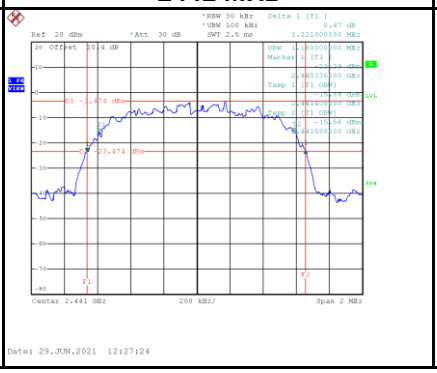
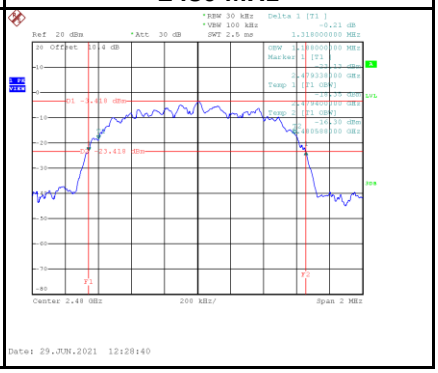
Test Mode :	1Mbps

Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied BW (MHz)	Test Result
2402	0.958	0.876	Pass
2441	0.960	0.884	Pass
2480	0.962	0.868	Pass

2402 MHz	2441 MHz	2480 MHz
		

Test Mode :	3Mbps

Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied BW (MHz)	Test Result
2402	1.304	1.176	Pass
2441	1.322	1.180	Pass
2480	1.318	1.188	Pass

2402 MHz	2441 MHz	2480 MHz
		

APPENDIX G 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	6.52	0.0045	21.00	0.1250	Pass
2441	6.82	0.0048	21.00	0.1250	Pass
2480	6.06	0.0040	21.00	0.1250	Pass

Test Mode :	2Mbps	Tested Date	2021/6/30

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	2.95	0.0020	21.00	0.1250	Pass
2441	3.03	0.0020	21.00	0.1250	Pass
2480	3.01	0.0020	21.00	0.1250	Pass

Test Mode :	3Mbps	Tested Date	2021/6/30

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	3.28	0.0021	21.00	0.1250	Pass
2441	3.25	0.0021	21.00	0.1250	Pass
2480	3.21	0.0021	21.00	0.1250	Pass

Spot check test:

Test Mode :	1Mbps	Tested Date	2021/7/23

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	3.12	0.0021	21.00	0.1250	Pass
2441	3.28	0.0021	21.00	0.1250	Pass
2480	3.17	0.0021	21.00	0.1250	Pass

Test Mode :	2Mbps	Tested Date	2021/7/23

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	3.16	0.0021	21.00	0.1250	Pass
2441	3.19	0.0021	21.00	0.1250	Pass
2480	3.22	0.0021	21.00	0.1250	Pass

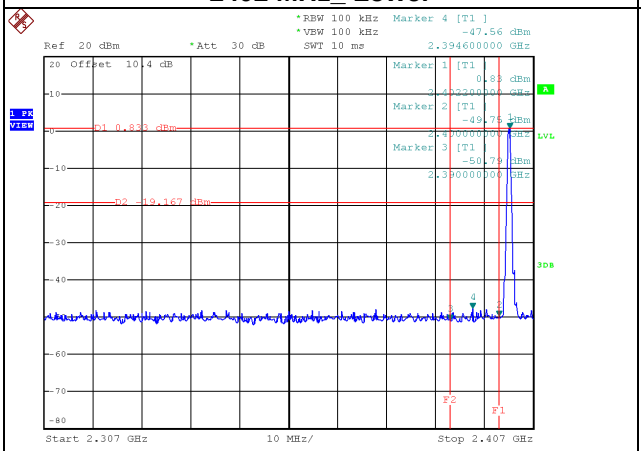
Test Mode :	3Mbps	Tested Date	2021/7/23

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	3.41	0.0022	21.00	0.1250	Pass
2441	3.29	0.0021	21.00	0.1250	Pass
2480	3.28	0.0021	21.00	0.1250	Pass

APPENDIX H ANTENNA CONDUCTED SPURIOUS EMISSION

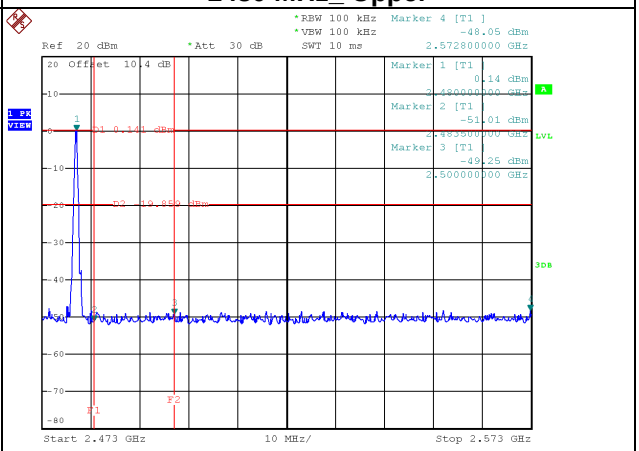
Test Mode	1Mbps

2402 MHz_ Lower



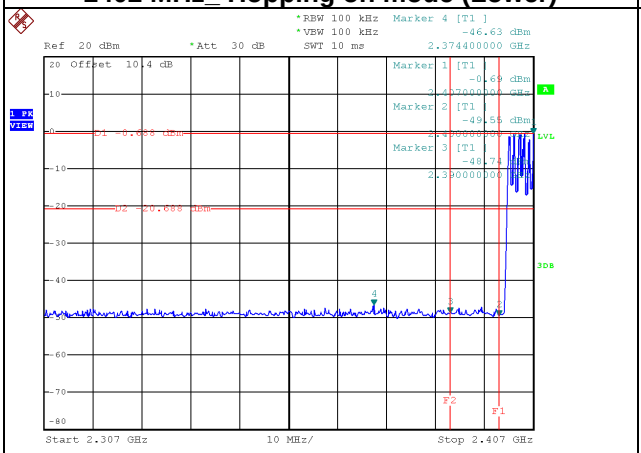
Date: 28.JUN.2021 18:52:20

2480 MHz_ Upper



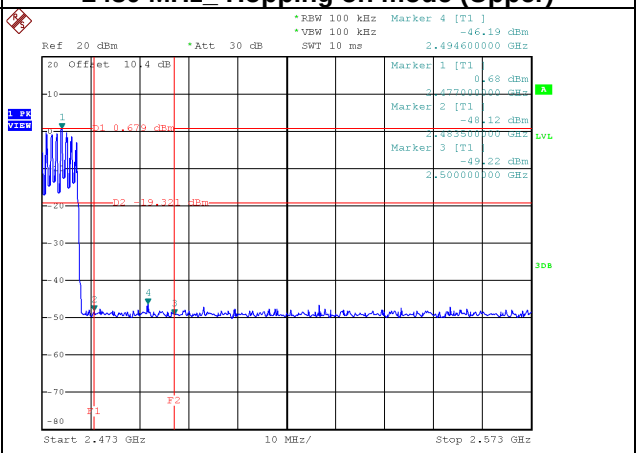
Date: 28.JUN.2021 18:55:46

2402 MHz_ Hopping on mode (Lower)



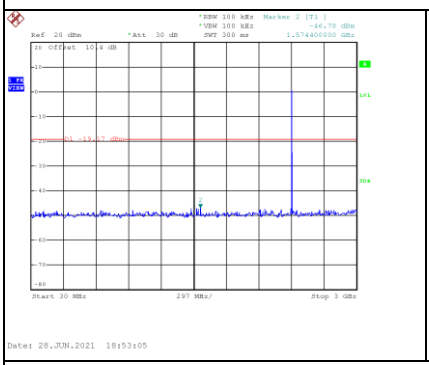
Date: 28.JUN.2021 19:04:55

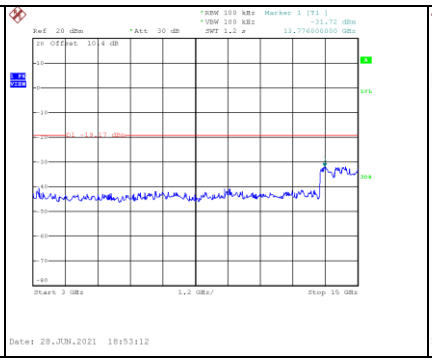
2480 MHz_ Hopping on mode (Upper)

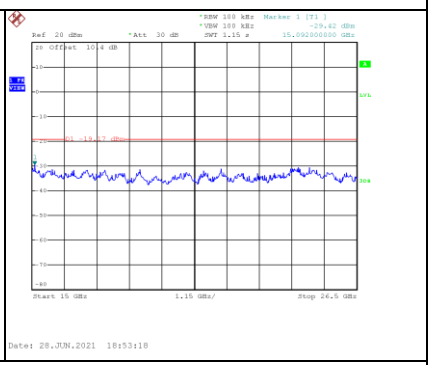


Date: 28.JUN.2021 19:05:29

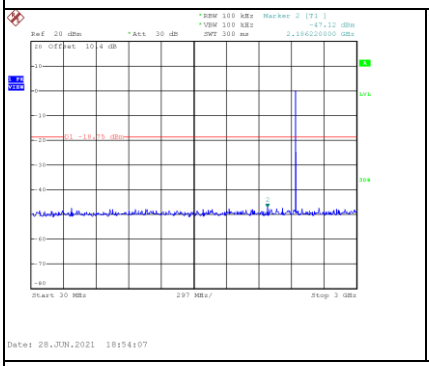
2402 MHz – 10th Harmonics

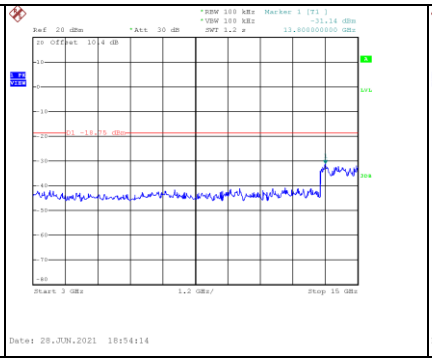


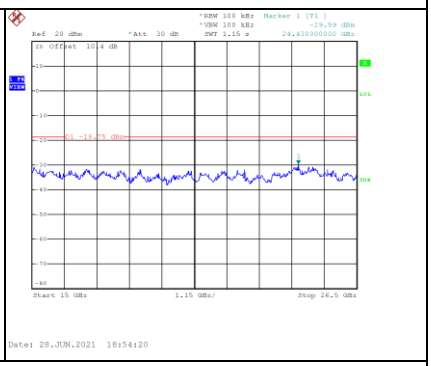




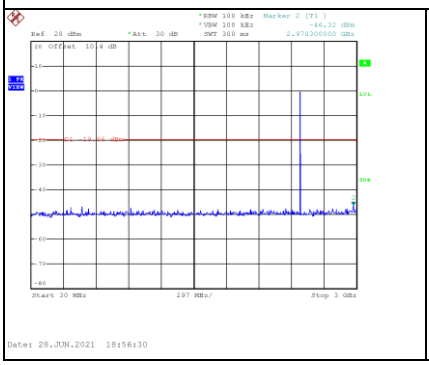
2441 MHz – 10th Harmonics

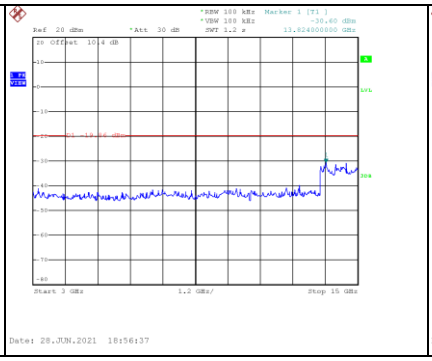


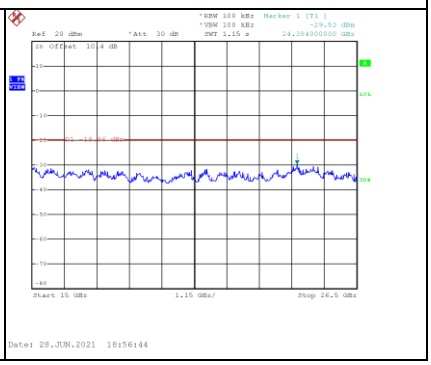




2480 MHz – 10th Harmonics

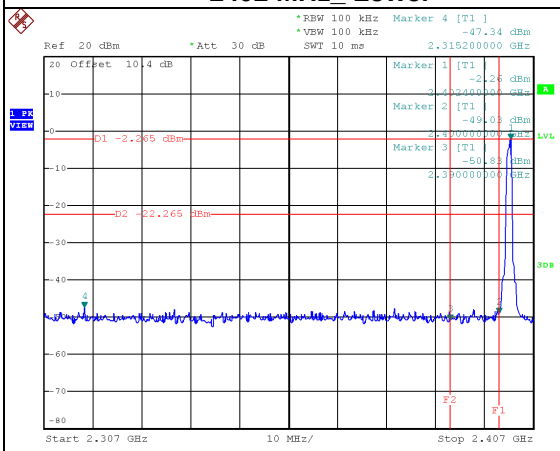






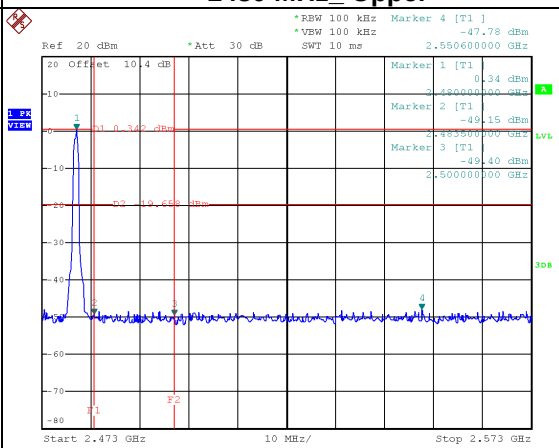
Test Mode	3Mbps

2402 MHz_ Lower



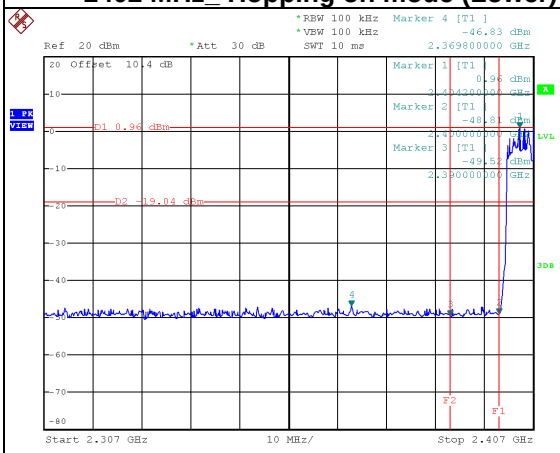
Date: 29.JUN.2021 12:24:38

2480 MHz_ Upper



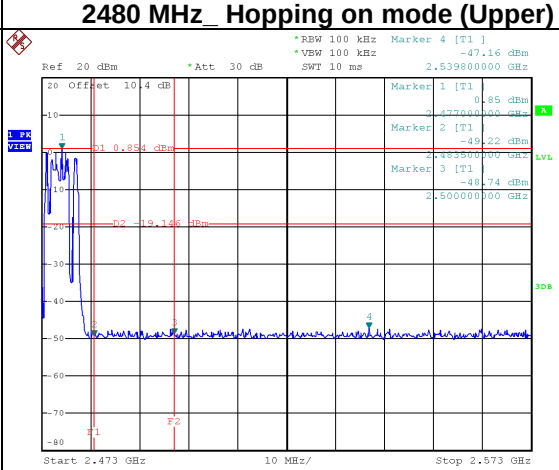
Date: 29.JUN.2021 12:28:13

2402 MHz_ Hopping on mode (Lower)



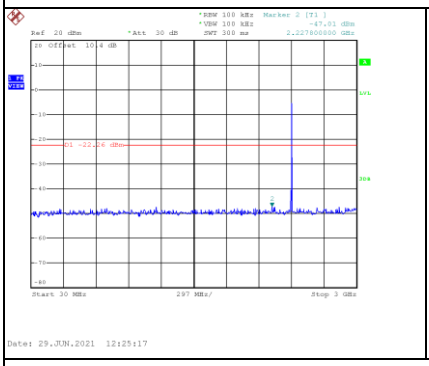
Date: 29.JUN.2021 12:36:34

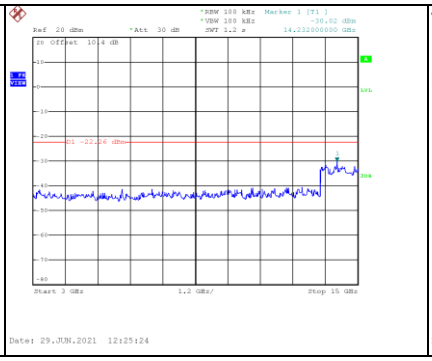
2480 MHz_ Hopping on mode (Upper)

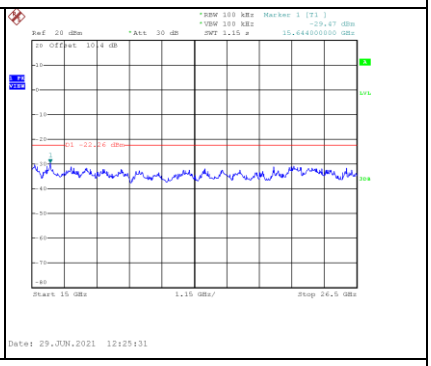


Date: 29.JUN.2021 12:37:25

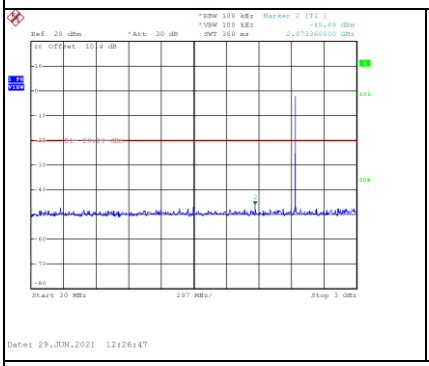
2402 MHz – 10 Harmonics

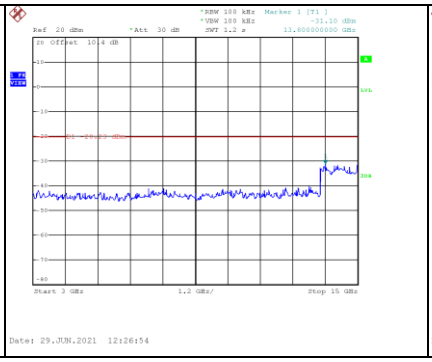


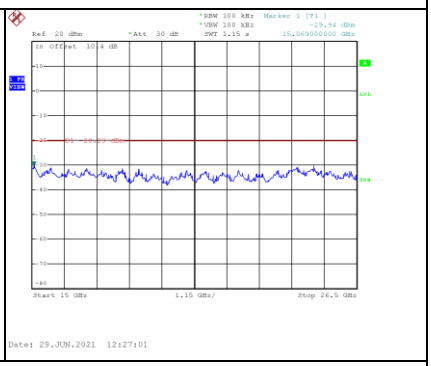




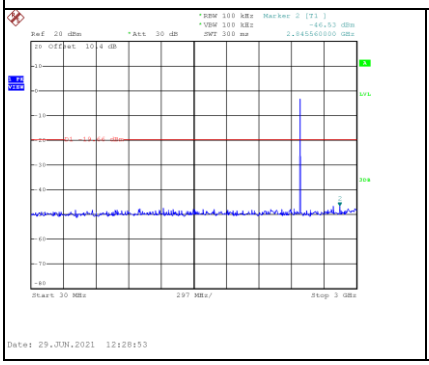
2441 MHz – 10 Harmonics

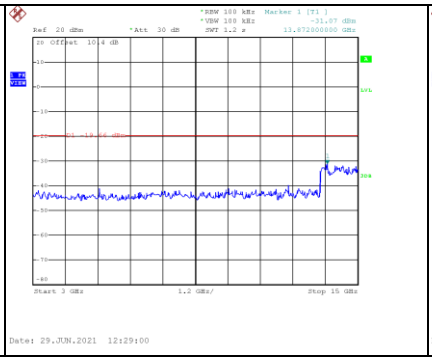


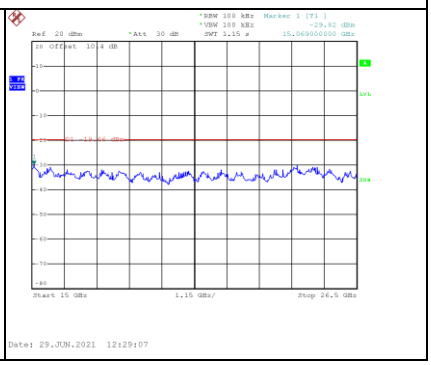




2480 MHz – 10 Harmonics







End of Test Report