FCC Radio Test Report

FCC ID: 2BH7FC520WSV2

Report No.	:	BTL-FCCP-1-2407G080B
Equipment	:	Outdoor Pan/Tilt Security Wi-Fi Camera
Model Name	:	Tapo C520WS
Brand Name	:	tp-link
Applicant	:	TP-Link Systems Inc.
Address	:	10 Mauchly, Irvine, CA 92618
Radio Function	:	Bluetooth Low Energy (5.0)
FCC Rule Part(s)	:	FCC CFR Title 47, Part 15, Subpart C (15.247)
Measurement Procedure(s)	:	ANSI C63.10-2013
Date of Receipt	:	2024/9/23
Date of Test	:	2024/10/01 ~ 2024/10/19
Issued Date	:	2024/12/2

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

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Declaration

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

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

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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-1-2407G080B	R00	Original Report.	2024/12/2	Valid

1 SUMMARY OF TEST RESULTS

Test procedures according to the technical standards.

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

1.1 TEST FACILITY

The test locations stated below are under the TAF Accreditation Number 0659.
The test location(s) used to collect the test data in this report are:
(FCC DN: TW0659)
No.64, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)
☒ CB20 ☒ TR01 ☒ C01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y ± U**, where expanded uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k = 2**, providing a level of confidence of approximately **95 %**. The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{cispr} requirement.

A. AC power line conducted emissions test:

Test Site	Method	Measurement Frequency Range	U (dB)
C01	CISPR	150 kHz ~ 30MHz	2.4498

B. Radiated emissions test:

Test Site	Measurement Frequency Range	U,(dB)
CB20	0.03 GHz ~ 0.2 GHz	4.17
	0.2 GHz ~ 1 GHz	4.72
	1 GHz ~ 6 GHz	5.20
	6 GHz ~ 18 GHz	5.50
	18 GHz ~ 26 GHz	3.69
	26 GHz ~ 40 GHz	4.23

C. Conducted test:

Test Item	U
Occupied Bandwidth	0.86 %
Output power	0.40 dB
Power Spectral Density	0.86 dB
Conducted Spurious emissions	1.83 dB
Conducted Band edges	1.83 dB

NOTE:
Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Environment Condition	Test Voltage	Tested by
AC Power Line Conducted Emissions	25°C, 45%	AC 120V	Barry Tsui
Radiated emissions 9KHz to 30MHz	25°C, 65%	AC 120V	Barry Tsui
Radiated emissions below 1 GHz	25°C, 65%	AC 120V	Barry Tsui
Radiated emissions above 1 GHz	25°C, 65%	AC 120V	Barry Tsui
Bandwidth	25°C, 88%	AC 120V	Cheng Tsai
Output Power	25°C, 88%	AC 120V	Cheng Tsai
Power Spectral Density	25°C, 88%	AC 120V	Cheng Tsai
Antenna conducted Spurious Emission	25°C, 88%	AC 120V	Cheng Tsai

2 GENERAL INFORMATION

2.1 DESCRIPTION OF EUT

Equipment	Outdoor Pan/Tilt Security Wi-Fi Camera
Model Name	Tapo C520WS
Brand Name	tp-link
Model Difference	N/A
Power Source	DC voltage from AC adapter. Model: T090085-2B1
Power Rating	I/P: 100-240V~ 50/60Hz 0.3A O/P: 9V⎓0.85A
HW Version	2.0
SW Version	2.0
Operation Band	2400 MHz ~ 2483.5 MHz
Operation Frequency	2402 MHz ~ 2480 MHz
Modulation Technology	GFSK
Transfer Rate	1 Mbps
Output Power Max.	1 Mbps: 6.37 dBm (0.0043 W)
Test Model	Tapo C520WS
Sample Status	Engineering Sample
EUT Modification(s)	N/A

NOTE:
(1) The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

(2) Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

(3) Table for Filed Antenna:

Ant.	Brand Name	Model Name	Type	Connector	Gain (dBi)
1	TP-Link Systems Inc.	Tapo C520WS	dipole	N/A	0.5
2	TP-Link Systems Inc.	Tapo C520WS	dipole	N/A	0.5

Note: Smart antenna system with two transmit/receive chains, but operating in a mode where only one transmit/receive chain is used.

(4) The above Antenna information are derived from the antenna data sheet provided by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

2.2 TEST MODES

Test Items	Test mode	Channel	Note
AC power line conducted emissions	Normal/Idle	-	-
Transmitter Radiated Emissions (below 1GHz)	1 Mbps	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	-

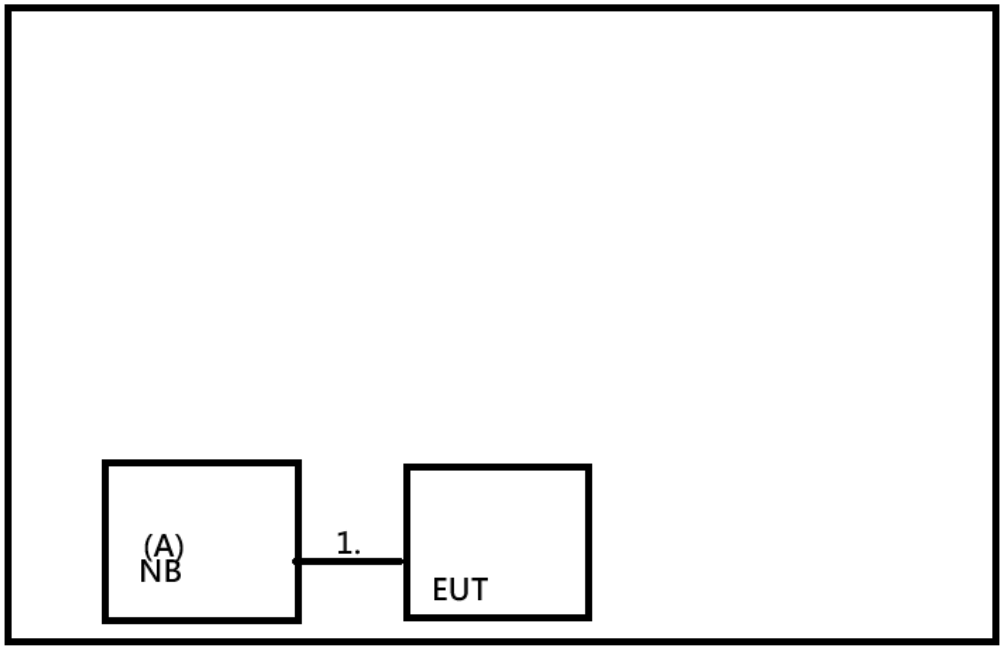
NOTE:
(1) For radiated emission band edge test, both Vertical and Horizontal are evaluated, but only the worst case (Horizontal) is recorded.
(2) For radiated emission above 1 GHz test, the spurious points of 1GHz~26.5GHz have been pre-tested and in this report only recorded the worst case. The remaining spurious points are all below the limit value of 20dB.
(3) For radiated emission below 1 GHz and above 18GHz test, the 1 Mbps channel 00 is found to be the worst case and recorded.

2.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

Test Software Version	AltobeamWLANFacility_V1.0.19		
Frequency (MHz)	2402	2440	2480
1Mbps	8	8	8

2.4 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.



2.5 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	NB	Lenovo	ThinkBook 14 G4 IAP	MP28KHAH	Furnished by test lab

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
1	YES	NO	0.3m	USB Cable	Supplied by test requester

3 AC POWER LINE CONDUCTED EMISSIONS TEST

3.1 LIMIT

Frequency (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56 *	56 - 46 *
0.50 - 5.0	56	46
5.0 - 30.0	60	50

NOTE:
(1) The tighter limit applies at the band edges.
(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
(3) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor (if use)
Margin Level = Measurement Value – Limit Value
Calculation example:

Reading Level		Correct Factor		Measurement Value
38.22	+	3.45	=	41.67

Measurement Value		Limit Value		Margin Level
41.67	-	60	=	-18.33

The following table is the setting of the receiver.

Receiver Parameter	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

3.2 TEST PROCEDURE

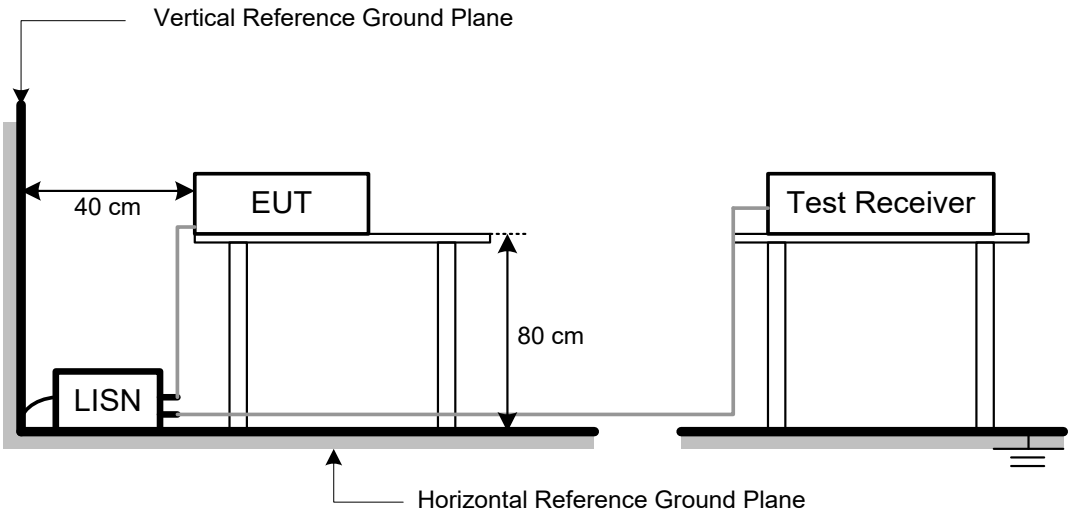
a. The EUT was placed 0.8 m above the horizontal ground plane with the EUT being connected to the power mains through a line impedance stabilization network (LISN).
All other support equipment were powered from an additional LISN(s).
The LISN provides 50 Ohm/50uH of impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle to keep the cable above 40 cm.
c. Excess I/O cables that are not connected to a peripheral shall be bundled in the center.
The end of the cable will be terminated, using the correct terminating impedance.
The overall length shall not exceed 1 m.
d. The LISN is spaced at least 80 cm from the nearest part of the EUT chassis.
e. For the actual test configuration, please refer to the related Item – EUT TEST PHOTO.

NOTE:
(1) In the results, each reading is marked as Peak, QP or AVG per the detector used.
BW=9 kHz (6 dB Bandwidth)
(2) All readings are Peak unless otherwise stated QP or AVG in column of Note. Both the QP and the AVG readings must be less than the limit for compliance.

3.3 DEVIATION FROM TEST STANDARD

No deviation.

3.4 TEST SETUP



3.5 TEST RESULT

Please refer to the **APPENDIX A**.

4 RADIATED EMISSIONS TEST

4.1 LIMIT

In case the emission fall within the restricted band specified on 15.205, then the 15.209 limit in the table below has to be followed.

LIMITS OF RADIATED EMISSIONS MEASUREMENT (9 kHz to 1000 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

LIMITS OF RADIATED EMISSIONS MEASUREMENT (Above 1000 MHz)

Frequency (MHz)	Radiated Emissions (dBuV/m)		Measurement Distance (meters)
	Peak	Average	
Above 1000	74	54	3

NOTE:
(1) The limit for radiated test was performed according to FCC CFR Title 47, Part 15, Subpart C.
(2) The tighter limit applies at the band edges.
(3) Emission level (dBuV/m)=20log Emission level (uV/m).
(4) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)
Margin Level = Measurement Value - Limit Value
Calculation example:

Reading Level		Correct Factor		Measurement Value
41.91	+	-8.36	=	33.55

Measurement Value		Limit Value		Margin Level
33.55	-	43.50	=	-9.95

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average

Spectrum Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9KHz~90KHz for PK/AVG detector
Start ~ Stop Frequency	90KHz~110KHz for QP detector
Start ~ Stop Frequency	110KHz~490KHz for PK/AVG detector
Start ~ Stop Frequency	490KHz~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

4.2 TEST PROCEDURE

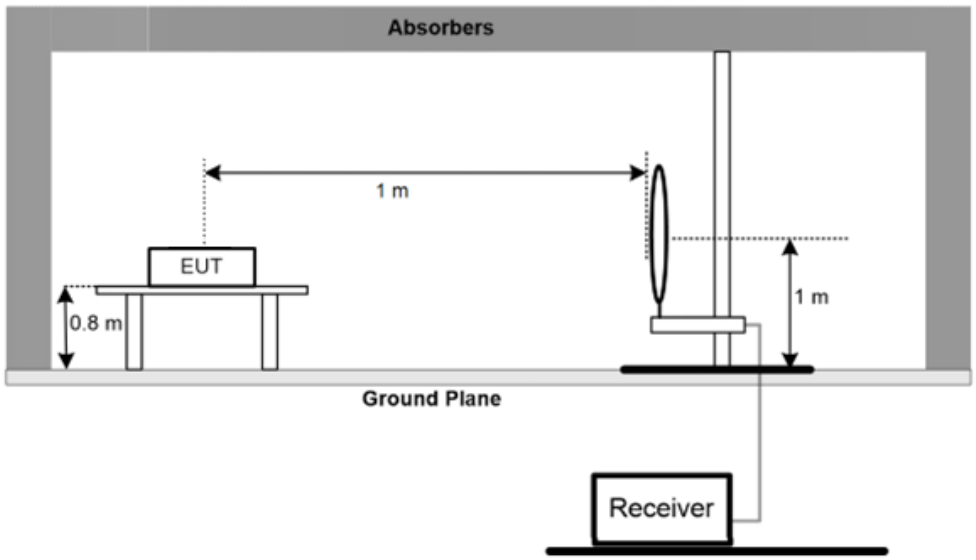
a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
c. The height of the equipment or of the substitution antenna shall be 0.8 m or 1.5 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn‘t perform. (below 1GHz)
h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn‘t perform. (above 1GHz)
i. For the actual test configuration, please refer to the related Item – EUT TEST PHOTO.

4.3 DEVIATION FROM TEST STANDARD

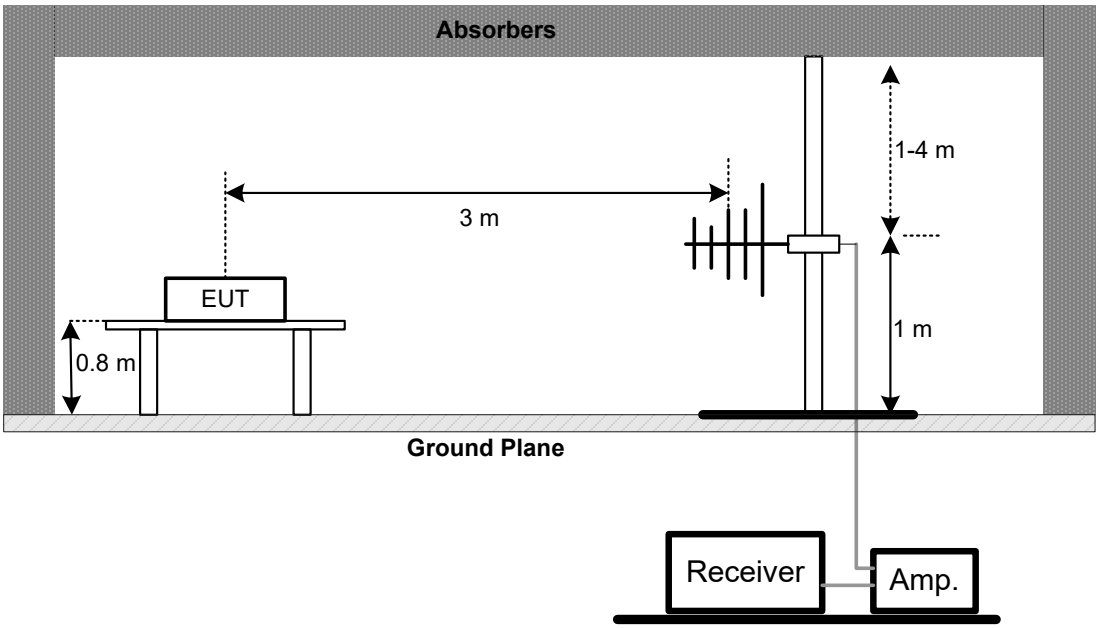
No deviation.

4.4 TEST SETUP

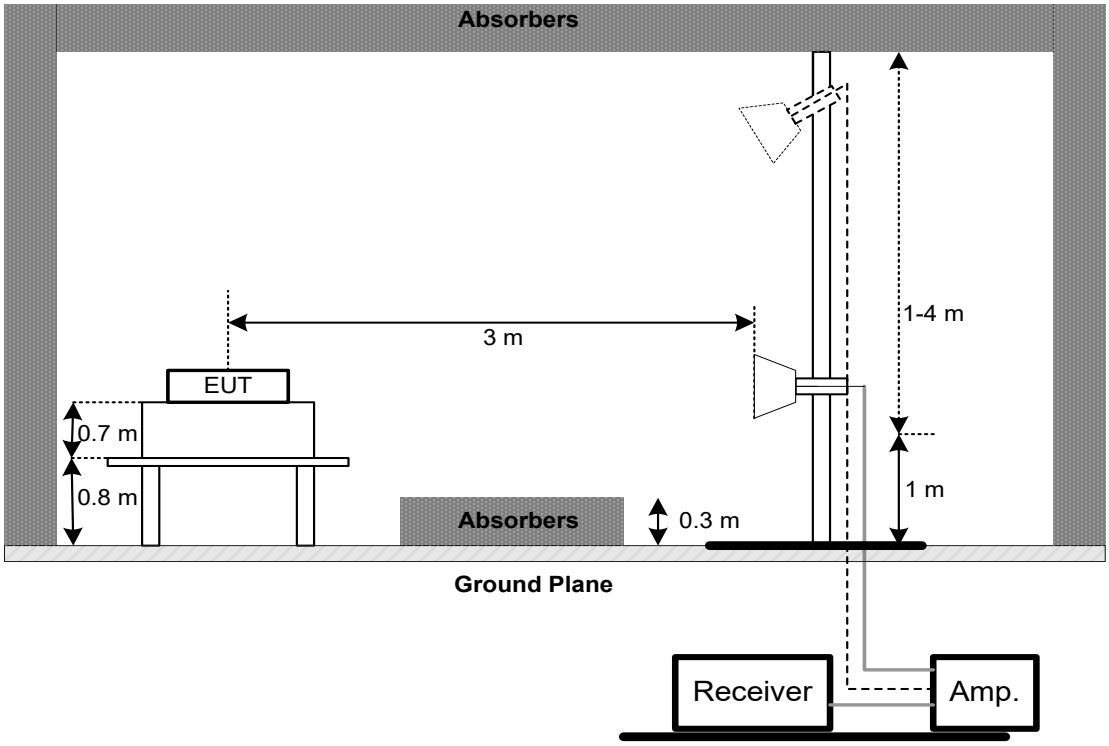
9 kHz to 30 MHz



30 MHz to 1 GHz



Above 1 GHz



4.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.6 TEST RESULT – BELOW 30 MHZ

Please refer to the APPENDIX B.

4.7 TEST RESULT – 30 MHZ TO 1 GHZ

Please refer to the APPENDIX C.

4.8 TEST RESULT – ABOVE 1 GHZ

Please refer to the APPENDIX D.

NOTE:

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

5 BANDWIDTH TEST

5.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

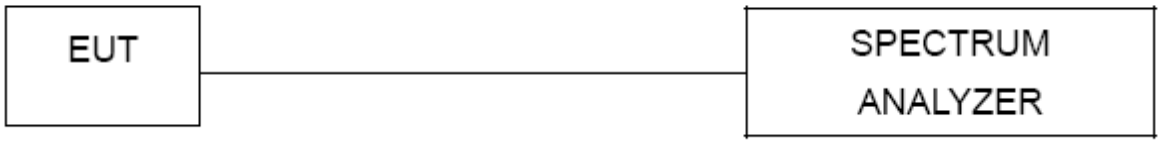
5.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = 2.5 ms.

5.3 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP



5.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

5.6 TEST RESULTS

Please refer to the APPENDIX E.

6 OUTPUT POWER TEST

6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Maximum Output Power	1 watt or 30dBm	2400-2483.5	PASS

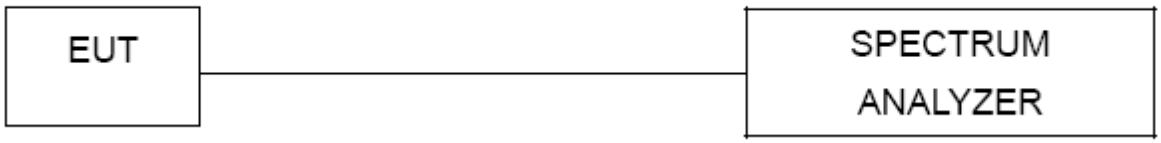
6.2 TEST PROCEDURE

a. The EUT was directly connected to the power meter and antenna output port as show in the block diagram below,
b. The maximum peak conducted output power was performed in accordance with FCC KDB 558074 D01 15.247 Meas Guidance.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

6.6 TEST RESULTS

Please refer to the APPENDIX F.

7 POWER SPECTRAL DENSITY TEST

7.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e)	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

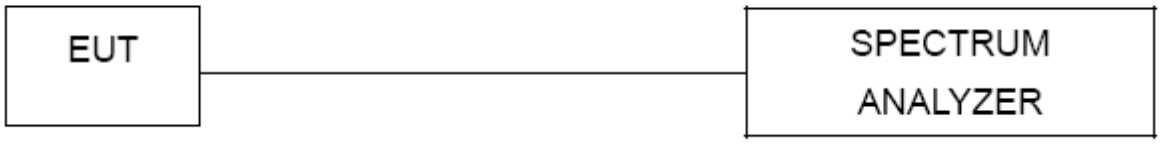
7.2 TEST PROCEDURE

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

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

7.6 TEST RESULTS

Please refer to the APPENDIX G.

8 ANTENNA CONDUCTED SPURIOUS EMISSION

8.1 APPLIED PROCEDURES / LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

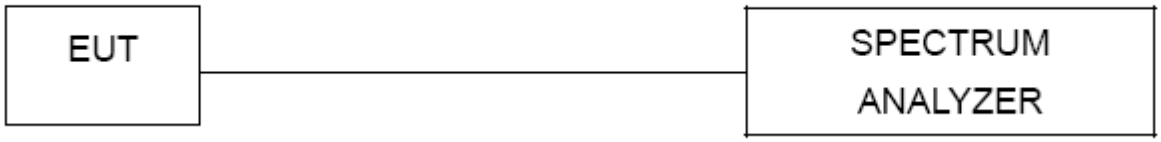
8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = 10 ms.

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

8.6 TEST RESULTS

Please refer to the APPENDIX H.

9 LIST OF MEASURING EQUIPMENTS

AC Power Line Conducted Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Two-Line V-Network	R&S	ENV216	101051	2024/6/26	2025/6/25
2	Test Cable	EMCI	EMCRG58-BM-BM-9000	210501	2023/12/11	2024/12/10
3	EMC Receiver	Keysight	N9038A	MY54130009	2024/6/27	2025/6/26
4	Measurement Software	Farad	EZ_EMC (Ver. NB-03A1-01)	N/A	N/A	N/A

Radiated Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Broad-Band Horn Antenna	RFSPIN	DRH18-E	210109A18E	2024/1/10	2025/1/9
2	Pre-Amplifier	EMCI	EMC051845SE	980779	2023/12/11	2024/12/10
3	Test Cable	EMCI	EMC105-SM-SM-1000	210119	2023/12/11	2024/12/10
4	Test Cable	EMCI	EMC105-SM-SM-3000	210118	2023/12/11	2024/12/10
5	Test Cable	EMCI	EMC105-SM-SM-7000	210117	2023/12/11	2024/12/10
6	EXA Spectrum Analyzer	keysight	N9010A	MY56480554/016	2024/9/13	2025/9/12
7	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	01207	2023/12/18	2024/12/17
8	EMC Receiver	Keysight	N9038A	MY54130009	2024/6/27	2025/6/26
9	Pre-Amplifier	EMCI	EMC001330-20201222	980807	2023/12/11	2024/12/10
10	Test Cable	EMCI	EMC-8D-NM-NM-5000	150106	2023/12/11	2024/12/10
11	Test Cable	EMCI	EMC-CFD-400-NM-NM-8000	200348	2023/12/11	2024/12/10
12	Test Cable	EMCI	EMC-CFD-400-NM-NM-3300	200343	2023/12/11	2024/12/10
13	Loop Ant.	Electro-Metrics	EMCI-LPA600	274	2024/7/5	2025/7/4
14	Pre-Amplifler	EMCI	EMC001340	980555	2023/12/1	2024/11/30
15	Measurement Software	Farad	EZ_EMC (Ver. NB-03A1-01)	N/A	N/A	N/A
16	Pre-Amplifier	EMCI	EMC184045SE	980512	2023/12/11	2024/12/10
17	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	340	2024/6/27	2025/6/26
18	Test Cable	EMCI	EMC102-KM-KM-1000	220328	2023/12/11	2024/12/10
19	Test Cable	EMCI	EMC101G-KM-KM-3000	220330	2023/12/11	2024/12/10

Bandwidth						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP 30	100854	2024/6/27	2025/6/26
2	10dbAttenuator	INMET	AHC-10dB	1	N/A	N/A
3	BTL-Conducred Test	N/A	1247788684	N/A	N/A	N/A

Output Power						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	USB Peak Power Sensor	Anritsu	MA24408A	12589	2023/10/25	2024/10/24
2	20dbAttenuator	INMET	AHC-20dB	1	N/A	N/A
3	Measurement Software	Anritsu	MA2440A Peak Power analyzer (Ver1.1.0.0)	N/A	N/A	N/A

Power Spectral Density						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP 30	100854	2024/6/27	2025/6/26
2	10dbAttenuator	INMET	AHC-10dB	1	N/A	N/A
3	BTL-Conducred Test	N/A	1247788684	N/A	N/A	N/A

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	2024/6/27	2025/6/26
2	10dbAttenuator	INMET	AHC-10dB	1	N/A	N/A
3	BTL-Conducred Test	N/A	1247788684	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.

10 EUT TEST PHOTO

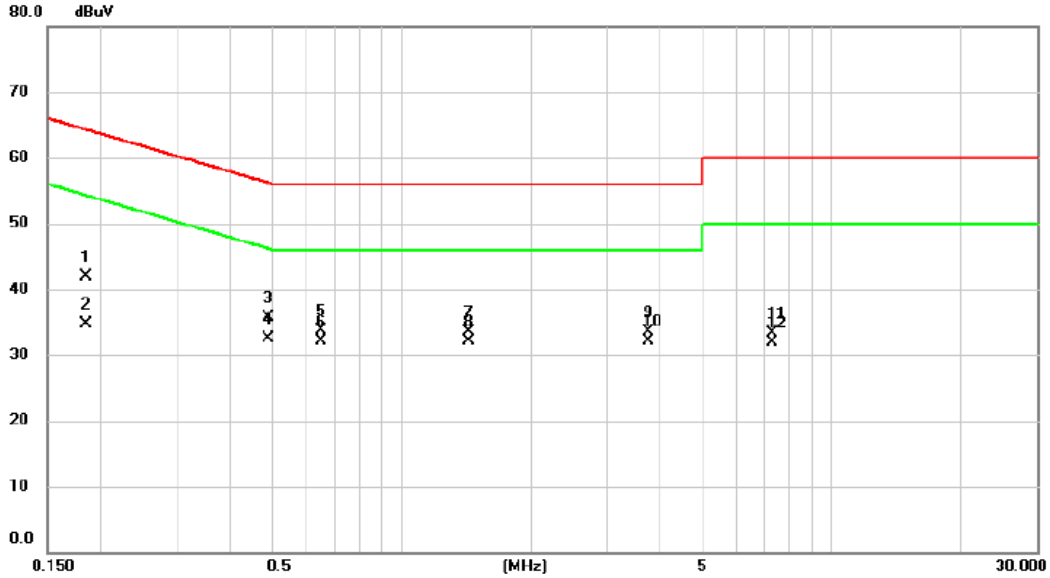
Please refer to document Appendix No.: TP-2407G080B-FCCP-1 (APPENDIX-TEST PHOTOS).

11 EUT PHOTOS

Please refer to document Appendix No.: EP-2407G080B-1 (APPENDIX-EUT PHOTOS).

APPENDIX A AC POWER LINE CONDUCTED EMISSIONS

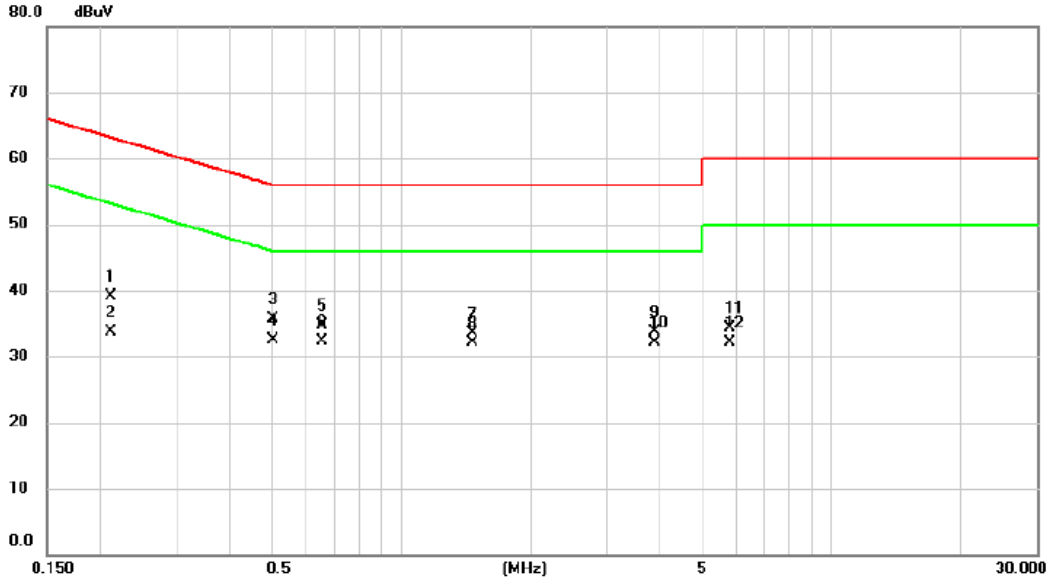
Test Mode	Normal	Tested Date	2024/10/4
Test Frequency	-	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1843	32.20	9.64	41.84	64.29	-22.45	QP	
2		0.1843	25.10	9.64	34.74	54.29	-19.55	AVG	
3		0.4906	26.06	9.66	35.72	56.16	-20.44	QP	
4	*	0.4906	22.75	9.66	32.41	46.16	-13.75	AVG	
5		0.6485	24.09	9.67	33.76	56.00	-22.24	QP	
6		0.6485	22.45	9.67	32.12	46.00	-13.88	AVG	
7		1.4360	23.84	9.73	33.57	56.00	-22.43	QP	
8		1.4360	22.35	9.73	32.08	46.00	-13.92	AVG	
9		3.7490	23.70	9.86	33.56	56.00	-22.44	QP	
10		3.7490	22.15	9.86	32.01	46.00	-13.99	AVG	
11		7.2750	23.41	9.96	33.37	60.00	-26.63	QP	
12		7.2750	21.94	9.96	31.90	50.00	-18.10	AVG	

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

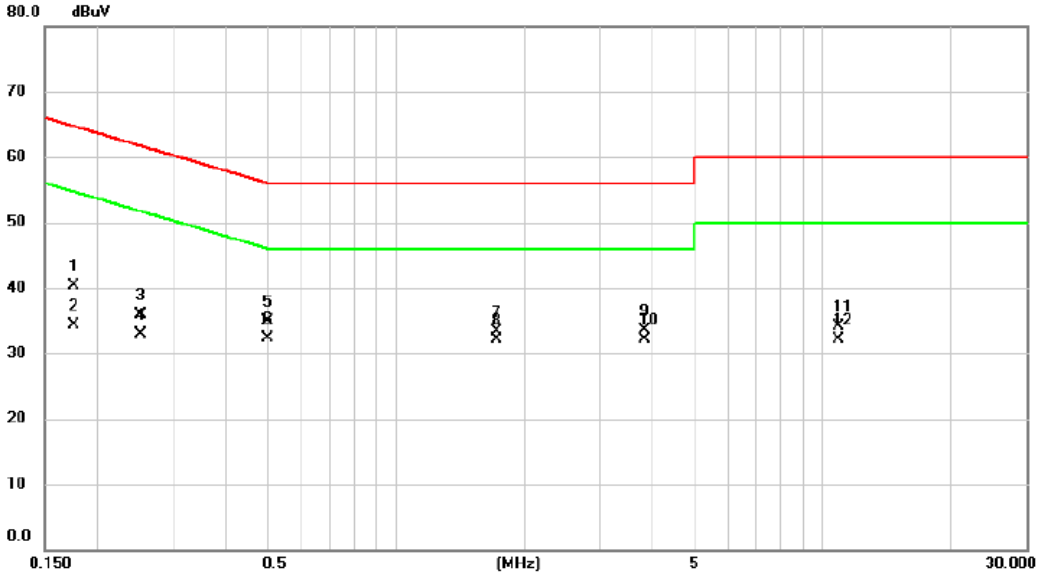
Test Mode	Normal	Tested Date	2024/10/4
Test Frequency	-	Phase	Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2116	29.38	9.63	39.01	63.14	-24.13	QP	
2		0.2116	24.14	9.63	33.77	53.14	-19.37	AVG	
3		0.5045	26.02	9.64	35.66	56.00	-20.34	QP	
4	*	0.5045	22.88	9.64	32.52	46.00	-13.48	AVG	
5		0.6530	24.99	9.65	34.64	56.00	-21.36	QP	
6		0.6530	22.56	9.65	32.21	46.00	-13.79	AVG	
7		1.4630	23.85	9.73	33.58	56.00	-22.42	QP	
8		1.4630	22.37	9.73	32.10	46.00	-13.90	AVG	
9		3.8885	23.81	9.85	33.66	56.00	-22.34	QP	
10		3.8885	22.18	9.85	32.03	46.00	-13.97	AVG	
11		5.8000	24.29	9.92	34.21	60.00	-25.79	QP	
12		5.8000	22.25	9.92	32.17	50.00	-17.83	AVG	

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

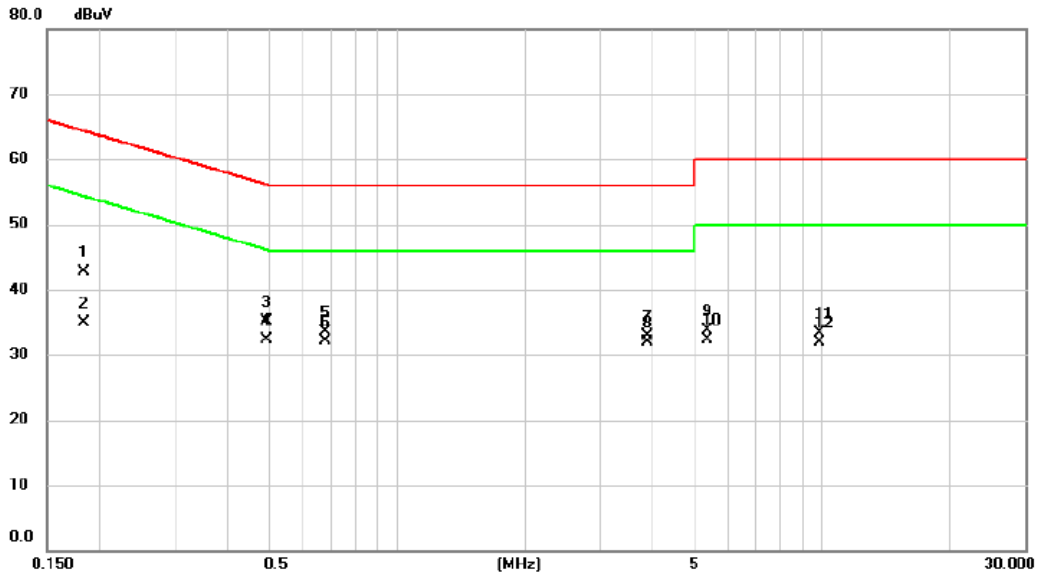
Test Mode	Idle	Tested Date	2024/10/4
Test Frequency	-	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1762	30.75	9.64	40.39	64.66	-24.27	QP	
2		0.1762	24.68	9.64	34.32	54.66	-20.34	AVG	
3		0.2518	26.30	9.64	35.94	61.70	-25.76	QP	
4		0.2518	23.19	9.64	32.83	51.70	-18.87	AVG	
5		0.5000	25.30	9.66	34.96	56.00	-21.04	QP	
6	*	0.5000	22.69	9.66	32.35	46.00	-13.65	AVG	
7		1.7240	23.57	9.77	33.34	56.00	-22.66	QP	
8		1.7240	22.35	9.77	32.12	46.00	-13.88	AVG	
9		3.8165	23.62	9.86	33.48	56.00	-22.52	QP	
10		3.8165	22.16	9.86	32.02	46.00	-13.98	AVG	
11		10.8500	24.02	10.05	34.07	60.00	-25.93	QP	
12		10.8500	22.03	10.05	32.08	50.00	-17.92	AVG	

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

Test Mode	Idle	Tested Date	2024/10/4
Test Frequency	-	Phase	Neutral

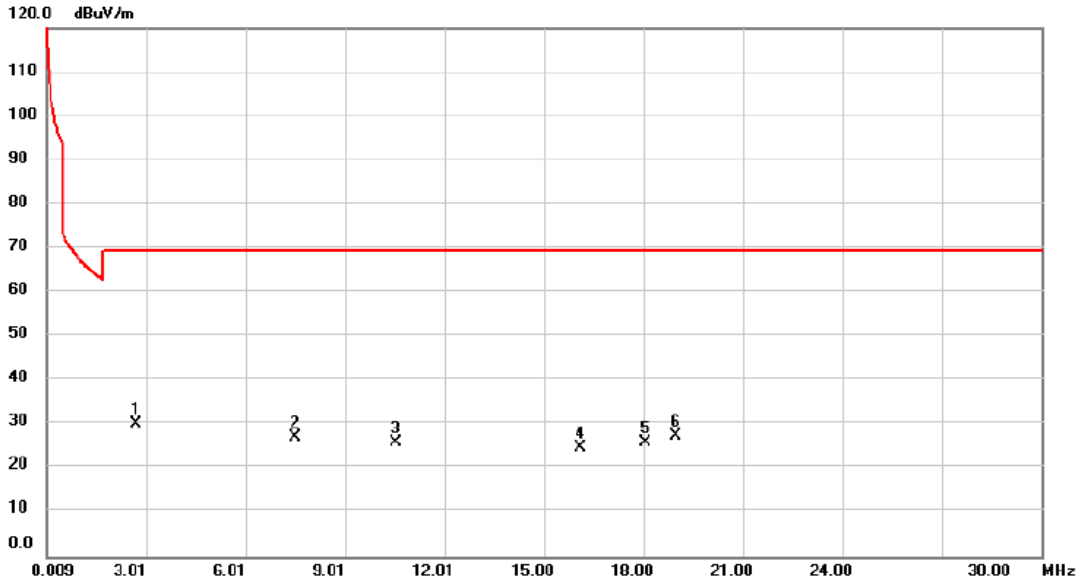


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1832	33.03	9.63	42.66	64.34	-21.68	QP	
2		0.1832	25.31	9.63	34.94	54.34	-19.40	AVG	
3		0.4927	25.39	9.64	35.03	56.12	-21.09	QP	
4	*	0.4927	22.72	9.64	32.36	46.12	-13.76	AVG	
5		0.6755	23.87	9.65	33.52	56.00	-22.48	QP	
6		0.6755	22.45	9.65	32.10	46.00	-13.90	AVG	
7		3.8840	23.00	9.85	32.85	56.00	-23.15	QP	
8		3.8840	22.15	9.85	32.00	46.00	-14.00	AVG	
9		5.3750	23.88	9.90	33.78	60.00	-26.22	QP	
10		5.3750	22.37	9.90	32.27	50.00	-17.73	AVG	
11		9.8750	23.19	10.03	33.22	60.00	-26.78	QP	
12		9.8750	21.96	10.03	31.99	50.00	-18.01	AVG	

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

APPENDIX B RADIATED EMISSIONS - 9 KHZ TO 30 MHZ

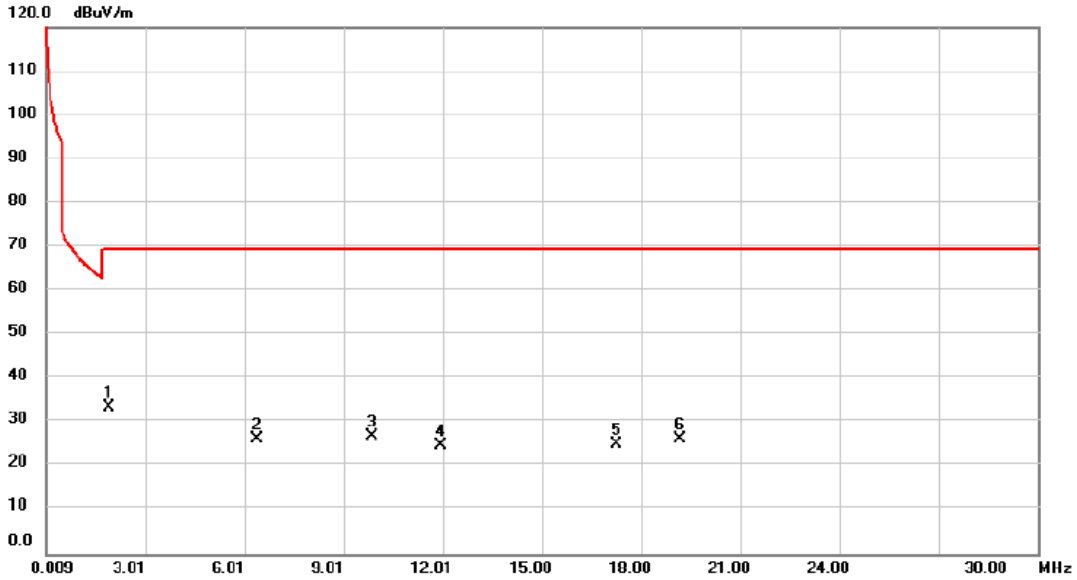
Test Mode	BLE (1Mbps)	Test Date	2024/10/7
Test Frequency	2402 MHz	Polarization	Vertical
Temp	25°C	Hum.	65%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	2.7082	34.90	-4.62	30.28	69.54	-39.26	peak	
2		7.5068	30.87	-3.78	27.09	69.54	-42.45	peak	
3		10.5358	30.11	-4.17	25.94	69.54	-43.60	peak	
4		16.0842	29.48	-4.74	24.74	69.54	-44.80	peak	
5		18.0636	30.37	-4.51	25.86	69.54	-43.68	peak	
6		18.9933	31.89	-4.42	27.47	69.54	-42.07	peak	

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

Test Mode	BLE (1Mbps)	Test Date	2024/10/7
Test Frequency	2402 MHz	Polarization	Vertical
Temp	25°C	Hum.	65%

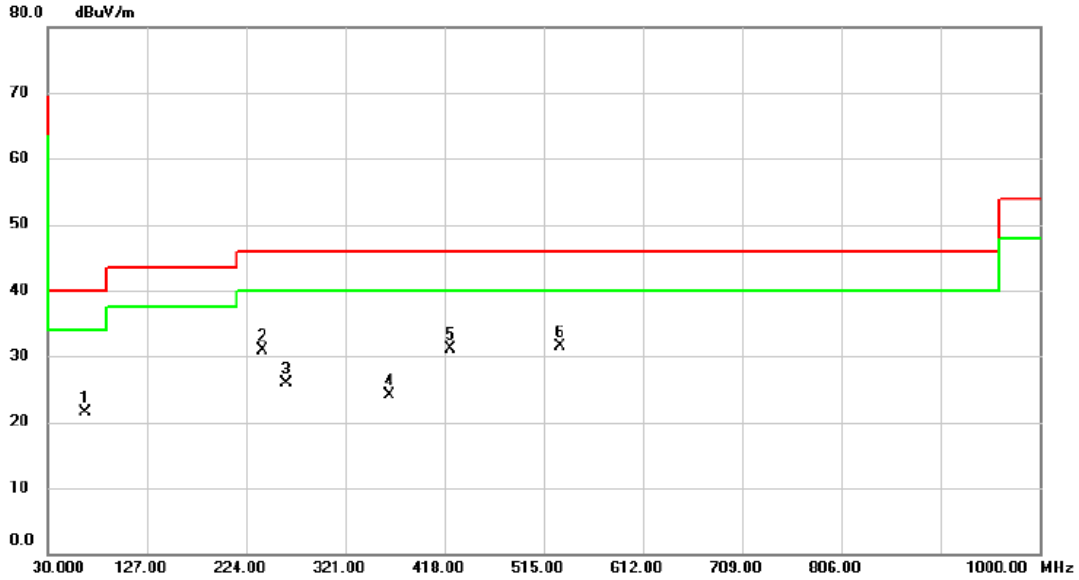


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	1.8984	36.92	-3.34	33.58	69.54	-35.96	peak	
2		6.3971	30.30	-3.99	26.31	69.54	-43.23	peak	
3		9.8760	30.92	-4.13	26.79	69.54	-42.75	peak	
4		11.9454	28.74	-4.12	24.62	69.54	-44.92	peak	
5		17.2538	29.72	-4.60	25.12	69.54	-44.42	peak	
6		19.2032	30.73	-4.43	26.30	69.54	-43.24	peak	

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

APPENDIX C RADIATED EMISSIONS - 30 MHZ TO 1 GHZ

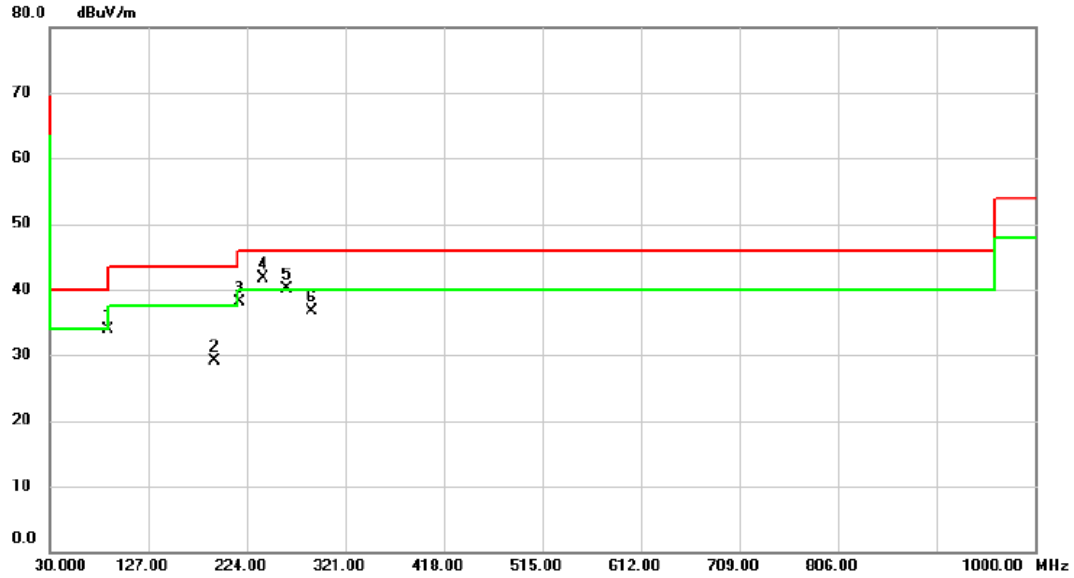
Test Mode	BLE (1Mbps)	Test Date	2024/10/7
Test Frequency	CH00: 2402 MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		66.8600	34.50	-13.06	21.44	40.00	-18.56	peak	
2		239.5200	43.17	-12.34	30.83	46.00	-15.17	peak	
3		263.7700	37.48	-11.54	25.94	46.00	-20.06	peak	
4		363.6800	32.69	-8.53	24.16	46.00	-21.84	peak	
5		423.8200	37.91	-6.77	31.14	46.00	-14.86	peak	
6	*	531.4900	36.17	-4.59	31.58	46.00	-14.42	peak	

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

Test Mode	BLE (1Mbps)	Test Date	2024/10/7
Test Frequency	CH00: 2402 MHz	Polarization	Horizontal

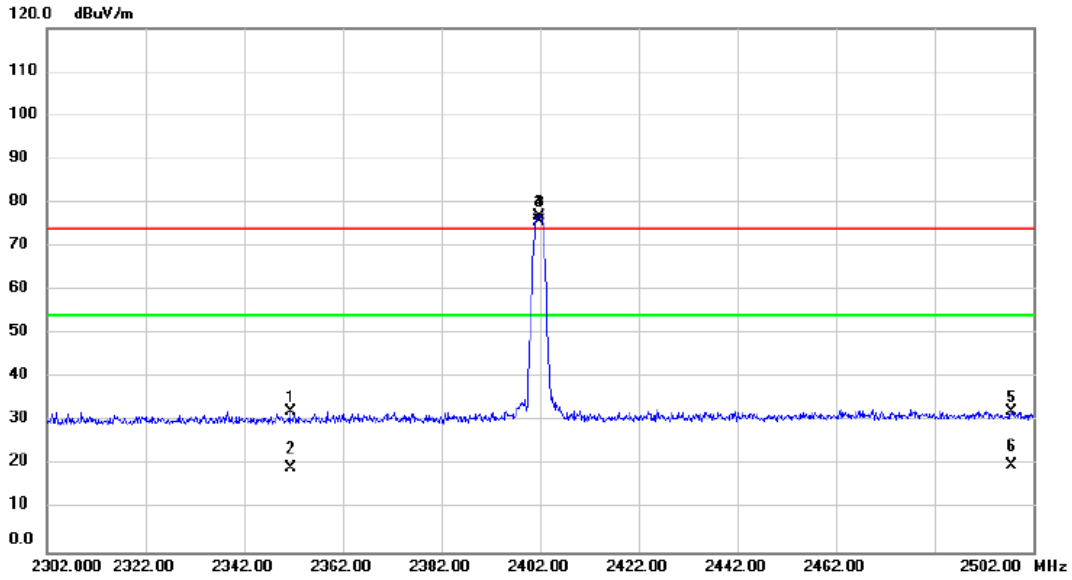


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		87.2300	50.90	-16.98	33.92	40.00	-6.08	peak	
2		191.9900	43.01	-13.85	29.16	43.50	-14.34	peak	
3		216.2400	52.19	-14.11	38.08	46.00	-7.92	peak	
4	*	239.5200	53.95	-12.34	41.61	46.00	-4.39	peak	
5		263.7700	51.67	-11.54	40.13	46.00	-5.87	peak	
6		288.0200	47.22	-10.43	36.79	46.00	-9.21	peak	

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

APPENDIX D RADIATED EMISSIONS - ABOVE 1 GHZ

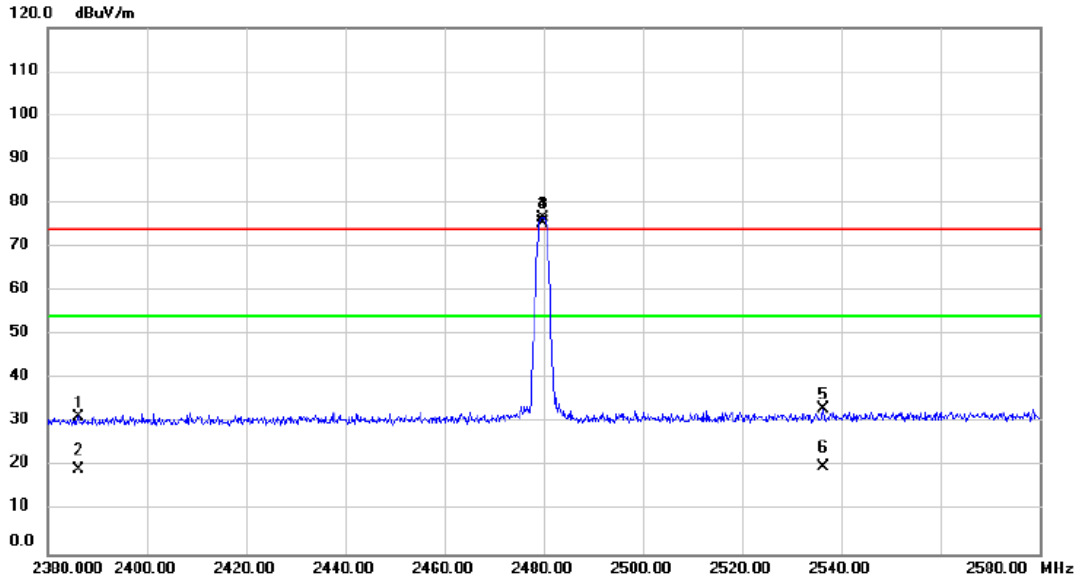
Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2402MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2351.400	38.57	-6.20	32.37	74.00	-41.63	peak	
2		2351.400	25.46	-6.20	19.26	54.00	-34.74	AVG	
3	X	2401.800	82.93	-6.09	76.84	74.00	2.84	peak	No Limit
4	*	2401.800	81.87	-6.09	75.78	54.00	21.78	AVG	No Limit
5		2497.600	38.22	-5.88	32.34	74.00	-41.66	peak	
6		2497.600	25.69	-5.88	19.81	54.00	-34.19	AVG	

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

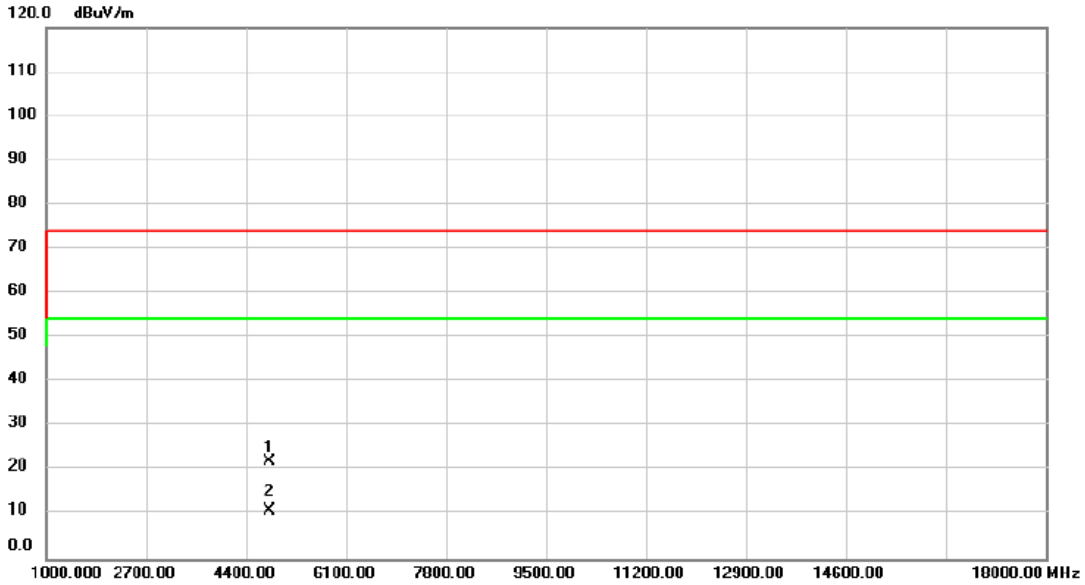
Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2480MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2386.200	37.63	-6.13	31.50	74.00	-42.50	peak	
2		2386.200	25.44	-6.13	19.31	54.00	-34.69	AVG	
3	X	2479.800	82.61	-5.92	76.69	74.00	2.69	peak	No Limit
4	*	2479.800	81.42	-5.92	75.50	54.00	21.50	AVG	No Limit
5		2536.400	38.81	-5.73	33.08	74.00	-40.92	peak	
6		2536.400	25.64	-5.73	19.91	54.00	-34.09	AVG	

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

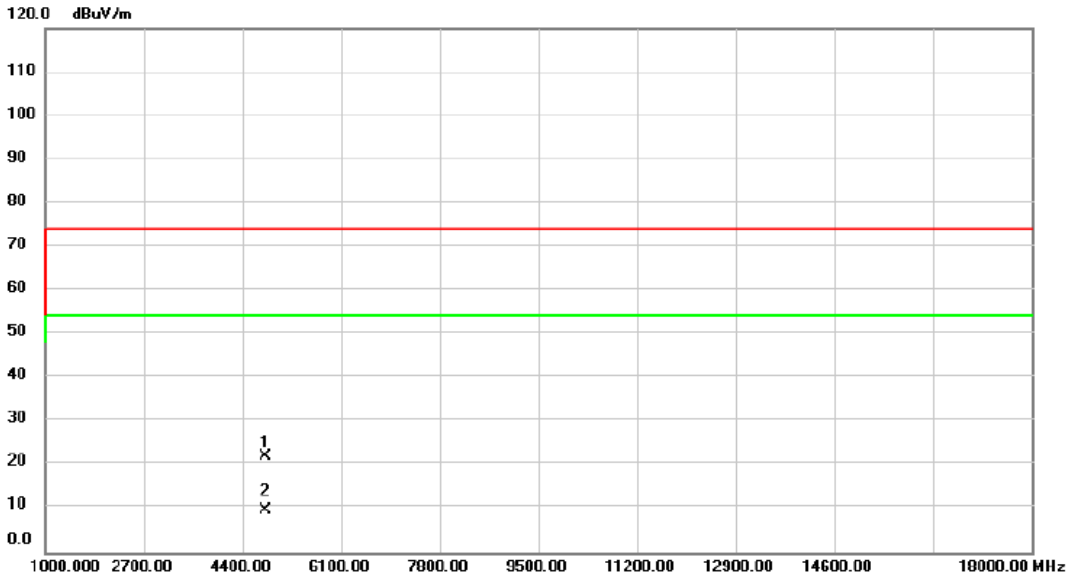
Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2402MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	30.73	-8.62	22.11	74.00	-51.89	peak	
2	*	4804.000	19.70	-8.62	11.08	54.00	-42.92	AVG	

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

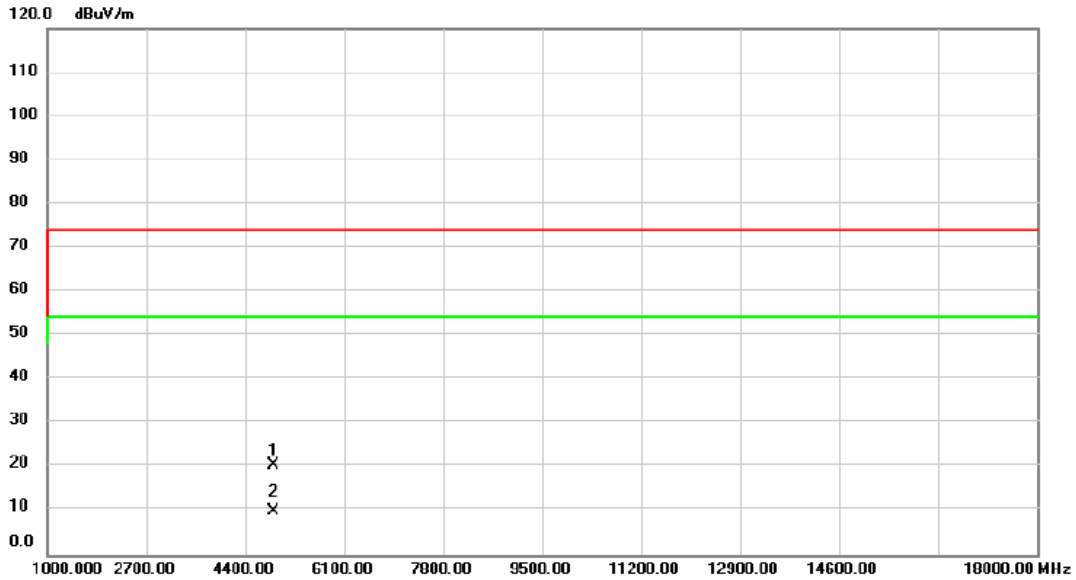
Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2402MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	30.71	-8.62	22.09	74.00	-51.91	peak	
2	*	4804.000	18.47	-8.62	9.85	54.00	-44.15	AVG	

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

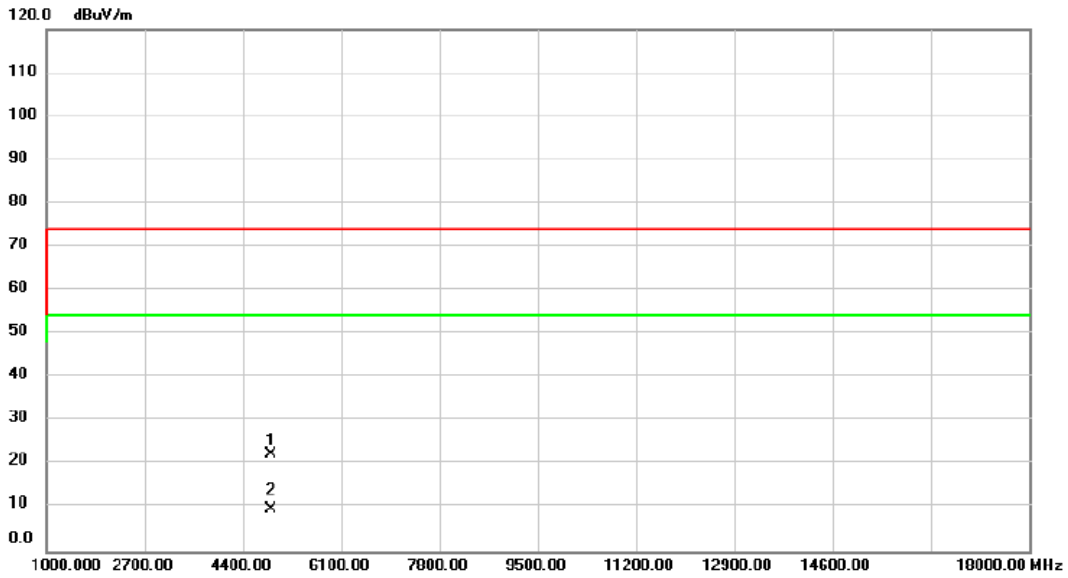
Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2440MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	28.96	-8.43	20.53	74.00	-53.47	peak	
2	*	4880.000	18.62	-8.43	10.19	54.00	-43.81	AVG	

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

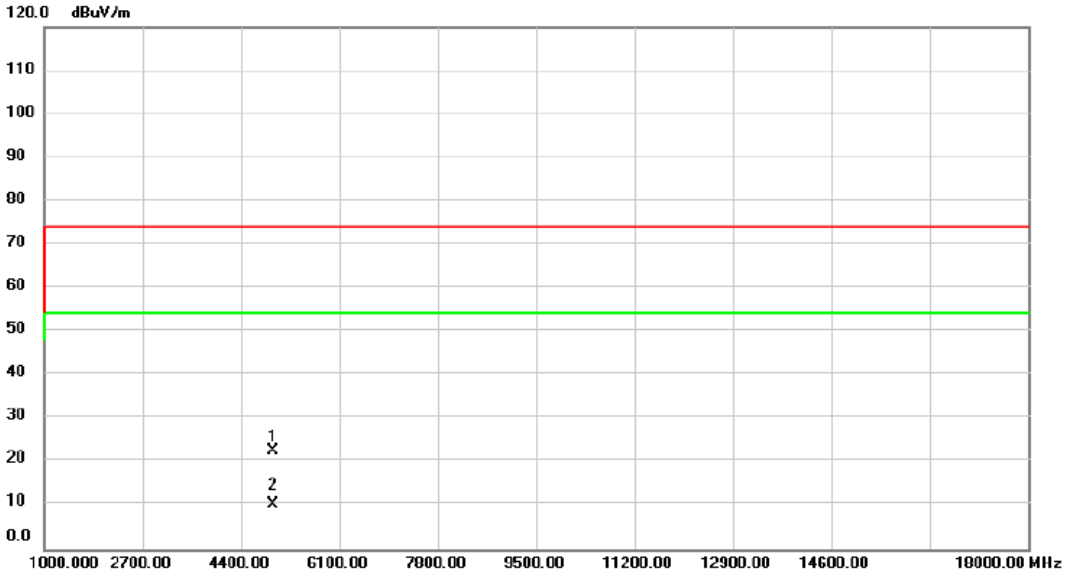
Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2440MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	30.67	-8.43	22.24	74.00	-51.76	peak	
2	*	4880.000	18.10	-8.43	9.67	54.00	-44.33	AVG	

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

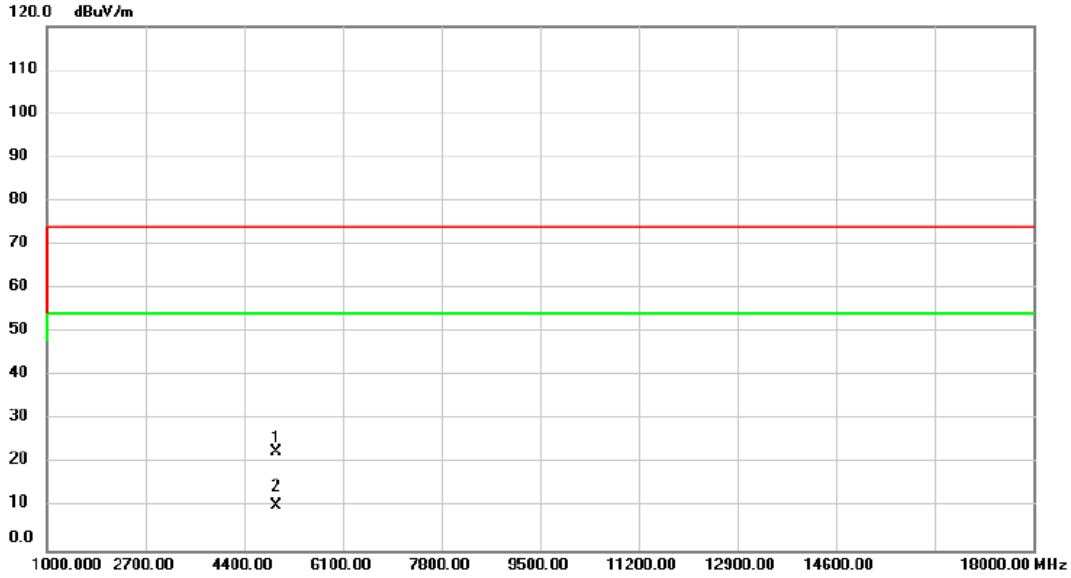
Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2480MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	30.76	-8.23	22.53	74.00	-51.47	peak	
2	*	4960.000	18.61	-8.23	10.38	54.00	-43.62	AVG	

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

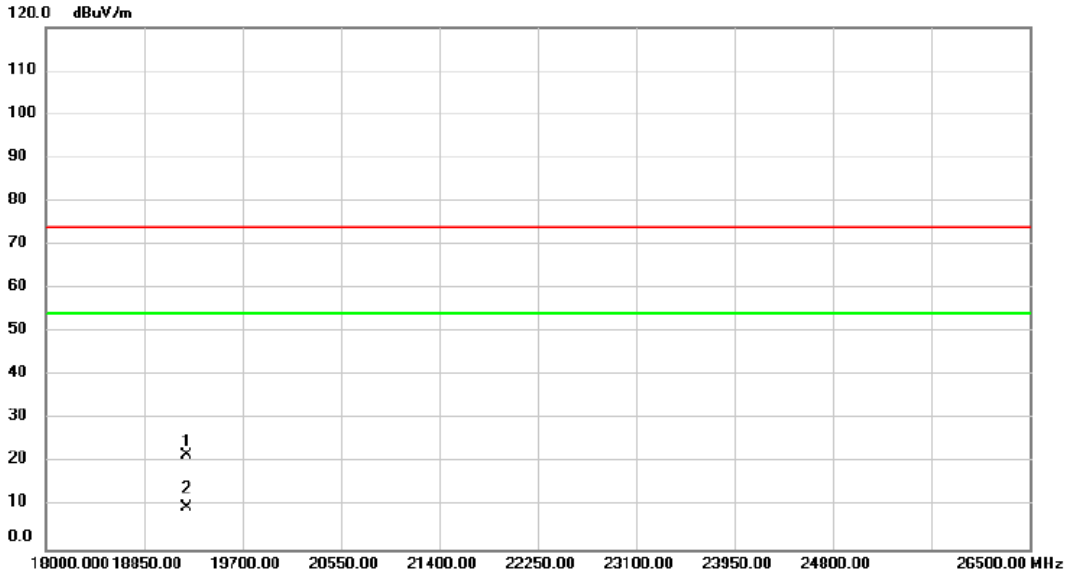
Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2480MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	30.81	-8.23	22.58	74.00	-51.42	peak	
2	*	4960.000	18.71	-8.23	10.48	54.00	-43.52	AVG	

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

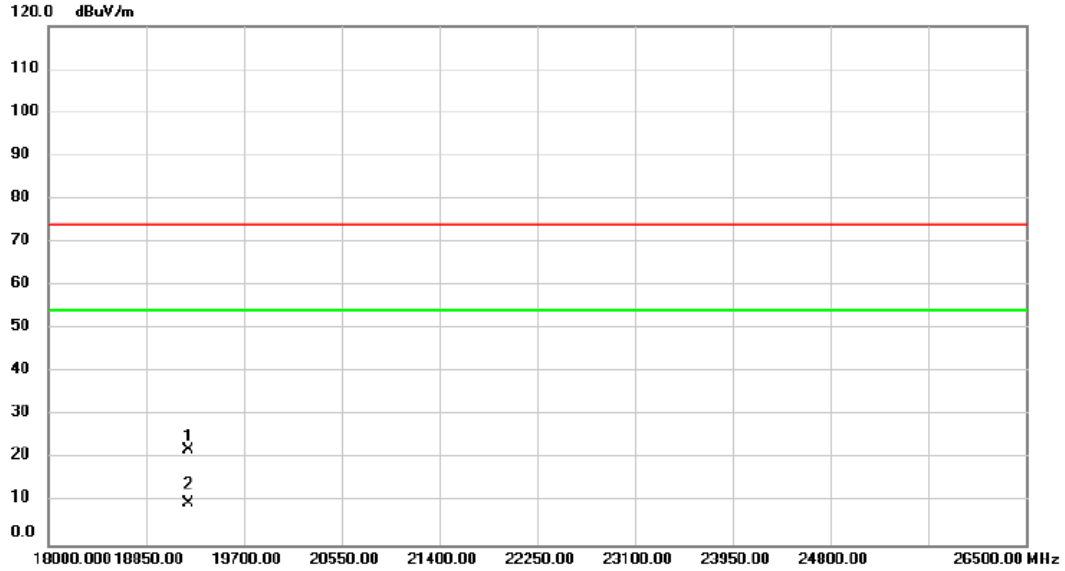
Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2402MHz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		19216.00	32.14	-10.51	21.63	74.00	-52.37	peak	
2	*	19216.00	20.12	-10.51	9.61	54.00	-44.39	AVG	

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

Test Mode	BLE (1 Mbps)	Test Date	2024/10/8
Test Frequency	2402MHz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		19216.00	32.60	-10.51	22.09	74.00	-51.91	peak	
2	*	19216.00	20.22	-10.51	9.71	54.00	-44.29	AVG	

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

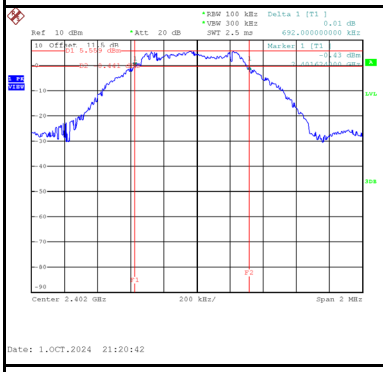
APPENDIX E BANDWIDTH

Test Mode:	1Mbps

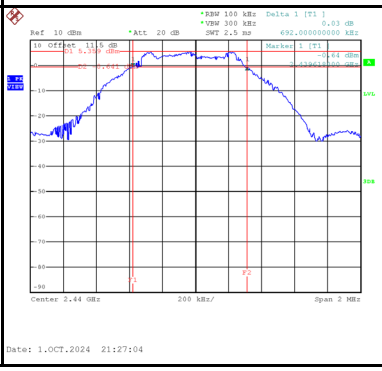
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.692	1.044	500	Pass
2440	0.692	1.044	500	Pass
2480	0.694	1.044	500	Pass

6dB Bandwidth

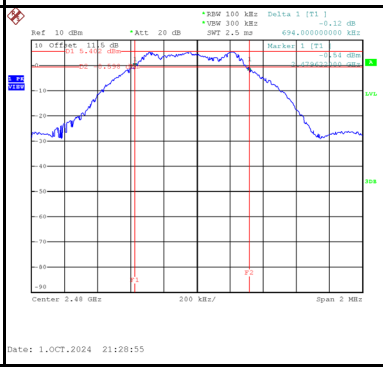
2402 MHz



2440 MHz

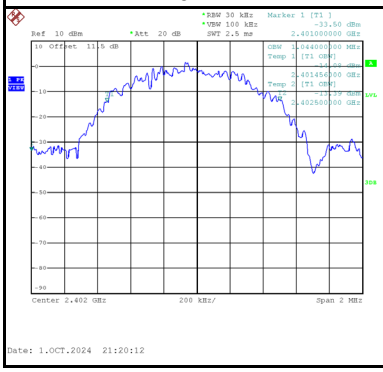


2480 MHz

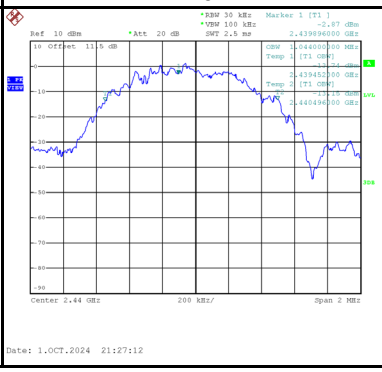


99% Occupied BW

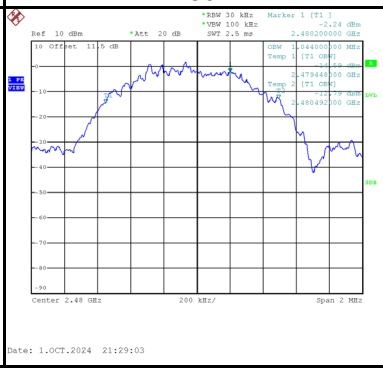
2402 MHz



2440 MHz



2480 MHz



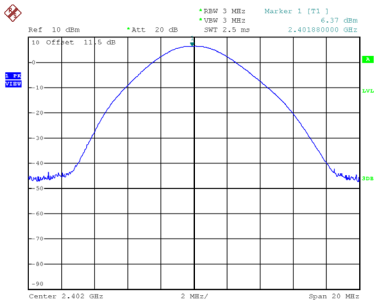
APPENDIX F OUTPUT POWER

Test Mode :	1Mbps	Tested Date	2024/10/1

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	6.37	0.0043	30.00	1.0000	Pass
2440	6.21	0.0042	30.00	1.0000	Pass
2480	6.22	0.0042	30.00	1.0000	Pass

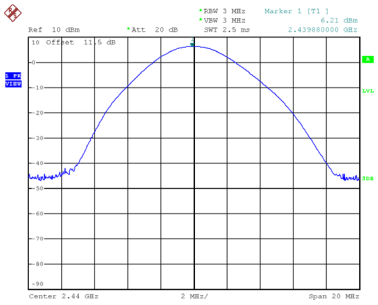
Note: Output power = Measure result + Cable loss

CH00



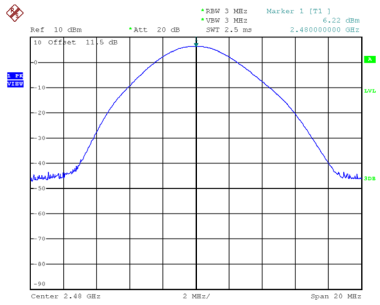
Date: 1.OCT.2024 21:21:39

CH19



Date: 1.OCT.2024 21:28:09

CH39

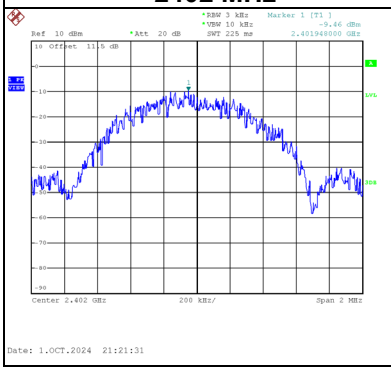
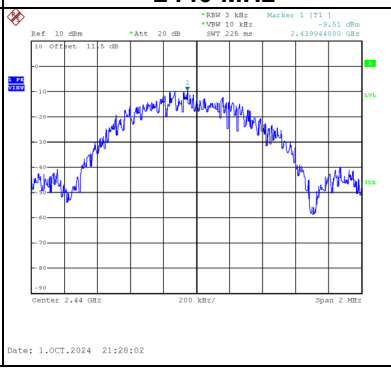
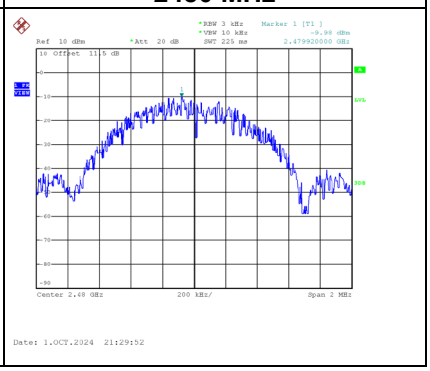


Date: 1.OCT.2024 21:30:00

APPENDIX G POWER SPECTRAL DENSITY TEST

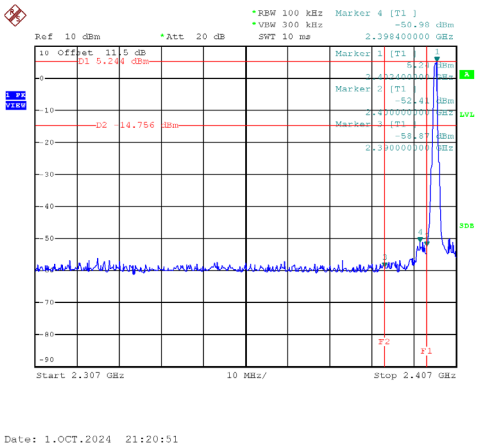
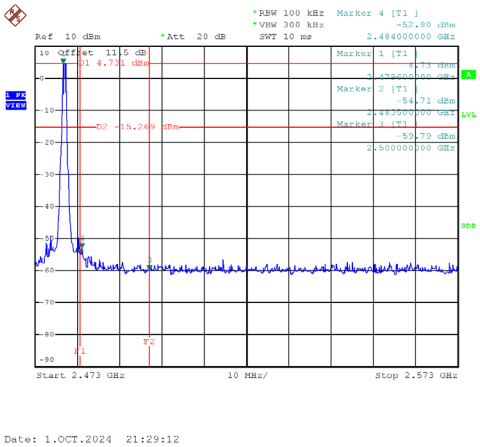
Test Mode :	1Mbps

Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-9.46	8	Pass
2440	-9.51	8	Pass
2480	-9.98	8	Pass

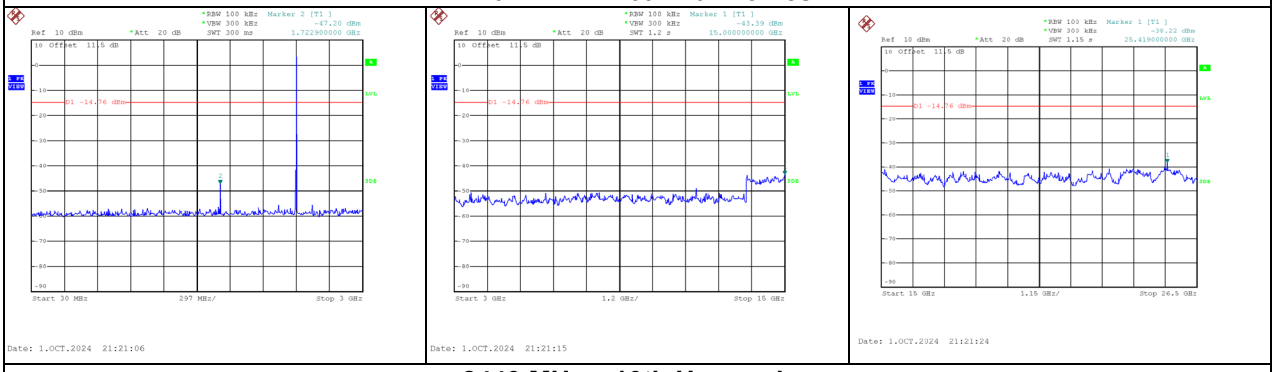
2402 MHz	2440 MHz	2480 MHz
		

APPENDIX H ANTENNA CONDUCTED SPURIOUS EMISSION

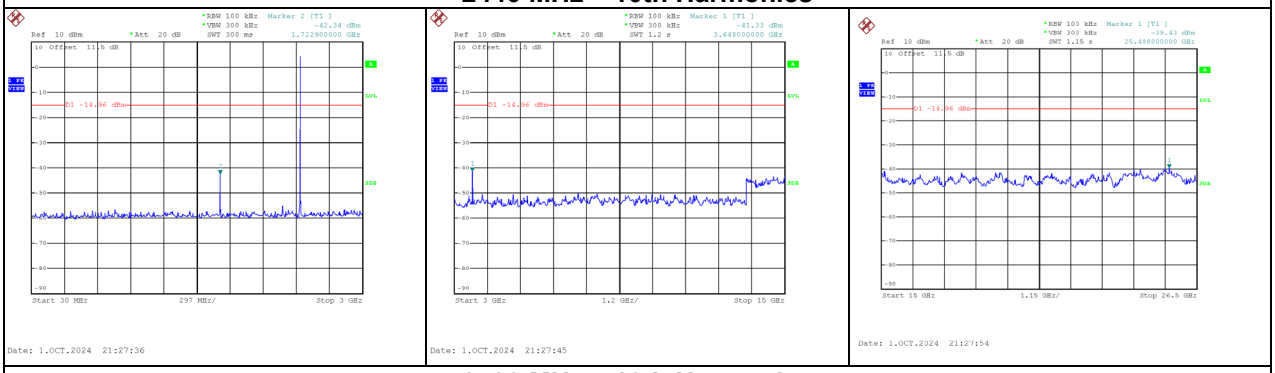
Test Mode :	1Mbps

Low Bandedge-2402 MHz	High Bandedge-2480 MHz
	

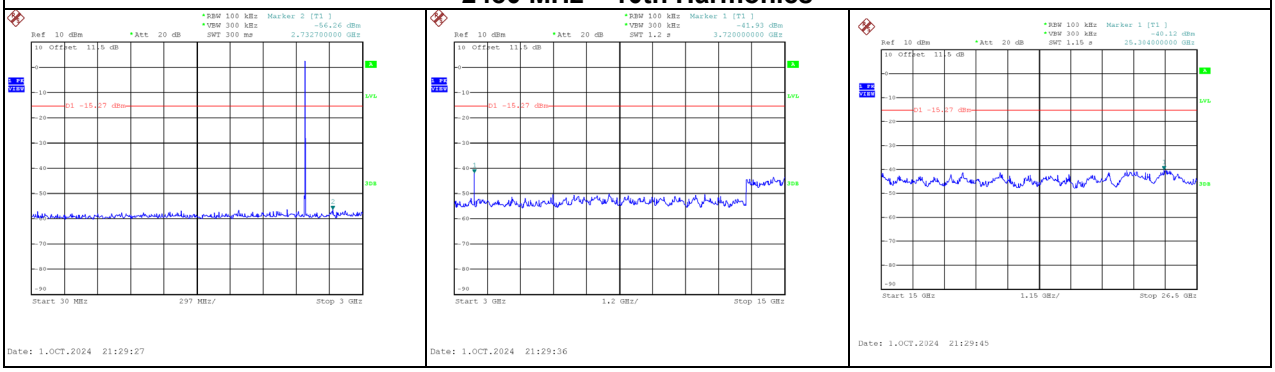
2402 MHz – 10th Harmonics



2440 MHz – 10th Harmonics



2480 MHz – 10th Harmonics



End of Test Report