



FCC Radio Test Report

FCC ID: 2ABVN-M18

This report concerns: Original Grant

Project No. : 2310E005
Equipment : Gaming mouse
Brand Name : msi
Test Model : M18
Series Model : M18 Pro, M18 S, M18 Premium, M18 X, M18 Plus
Applicant : Verico International Co., Ltd
Address : 12F-6., No.872, Zhongzheng Rd., Zhonghe Dist., New Taipei City 235, Taiwan (R.O.C.)
Manufacturer : Verico International Co., Ltd
Address : 12F-6., No.872, Zhongzheng Rd., Zhonghe Dist., New Taipei City 235, Taiwan (R.O.C.)
Factory : Dongguan You Hong Plastic Electronics Co.,Ltd.
Address : No.5, Xiabaotan Industrial 2nd Road, Shipai Town, Dongguan City, Guangdong Province, China
Date of Receipt : Nov. 23, 2023
Date of Test : Dec. 12, 2023 ~ Jan. 09, 2024
Issued Date : Jan. 12, 2024
Report Version : R00
Test Sample : Engineering Sample No.: DG20231123256
Standard(s) : FCC CFR Title 47, Part 15, Subpart C

The above equipment has been tested and found compliance with the requirement of the relative 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** 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: 2017 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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REPORT ISSUED HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-2-2310E005	R00	Original Report.	Jan. 12, 2024	Valid

1. APPLICABLE STANDARDS

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

ANSI C63.10-2013

The following reference test guidance is not within the scope of accreditation of NVLAP:

KDB 558074 D01 15.247 Meas Guidance v05r02

2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC CFR Title 47, Part 15, Subpart C				
Standard(s) Section	Test Item	Test Result	Judgment	Remark
15.207	AC Power Line Conducted Emissions	APPENDIX A	N/A	-----
15.247(d) 15.205(a) 15.209(a)	Radiated Emissions	APPENDIX B APPENDIX C APPENDIX D	PASS	-----
15.247(a)(2)	Bandwidth	APPENDIX E	PASS	-----
15.247(b)(3)	Maximum Output Power	APPENDIX F	PASS	-----
15.247(d)	Conducted Spurious Emission	APPENDIX G	PASS	-----
15.247(e)	Power Spectral Density	APPENDIX H	PASS	-----
15.203	Antenna Requirement	-----	PASS	Note(2)

Note:

(1) "N/A" denotes test is not applicable to this device.

(2) The device what use a permanently attached antenna were considered sufficient to comply with the provisions of 15.203.

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No. 3 Jinshagang 1st Rd. Shixia, Dalang Town, Dongguan City, Guangdong 523792.

BTL's Registration Number for FCC: 162128

BTL's Designation Number for FCC: CN5042

2.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

The BTL measurement uncertainty as below table:

A. AC power line conducted emissions Measurement:

Test Site	Method	Measurement Frequency Range	U,(dB)
DG-C02	CISPR	150kHz ~ 30MHz	2.88

B. Radiated emissions Measurement:

Test Site	Method	Measurement Frequency Range	U,(dB)
DG-CB01	CISPR	9kHz ~ 30MHz	2.36

Test Site	Method	Measurement Frequency Range	Ant. H / V	U,(dB)
DG-CB03 (3m)	CISPR	30MHz ~ 200MHz	V	4.40
		30MHz ~ 200MHz	H	3.62
		200MHz ~ 1,000MHz	V	4.58
		200MHz ~ 1,000MHz	H	3.98

Test Site	Method	Measurement Frequency Range	U,(dB)
DG-CB03 (3m)	CISPR	1GHz ~ 6GHz	4.08
		6GHz ~ 18GHz	4.62

Test Site	Method	Measurement Frequency Range	U,(dB)
DG-CB03 (1m)	CISPR	18 ~ 26.5 GHz	3.36
		26.5 ~ 40 GHz	3.58

C. Other Measurement:

Test Item	Uncertainty
Bandwidth	0.90 %
Maximum Output Power	1.3 dB
Conducted Spurious Emission	1.9 dB
Power Spectral Density	1.4 dB
Temperature	0.8 °C
Humidity	2.2 %

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

2.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By
AC Power Line Conducted Emissions	24°C	60%	AC 120V/60Hz	Hayden Chen
Radiated Emissions-9 kHz to 30 MHz	23°C	53%	DC 3.7V	Hayden Chen
Radiated Emissions-30 MHz to 1000 MHz	23°C	43%	DC 3.7V	Allen Tong
Radiated Emissions-Above 1000 MHz	23°C	42%	DC 3.7V	Allen Tong
Bandwidth	25°C	55%	DC 3.7V	Steve Zhou
Maximum Output Power	25°C	55%	DC 3.7V	Steve Zhou
Conducted Spurious Emission	25°C	55%	DC 3.7V	Steve Zhou
Power Spectral Density	25°C	55%	DC 3.7V	Steve Zhou

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	Gaming mouse
Brand Name	msi
Test Model	M18
Series Model	M18 Pro, M18 S, M18 Premium, M18 X, M18 Plus
Model Difference(s)	Only differ in model name and appearance color screen printing.
Hardware Version	VER1.0
Software Version	VER1.7
Power Source	1# Supplied from PC USB port. 2# Supplied from battery. Model: SDX902035
Power Rating	1# DC 5V 2# DC 3.7V, 600mAh
Operation Frequency	2405 MHz ~ 2470 MHz
Modulation Type	GFSK
Bit Rate of Transmitter	2Mbps
Max. Output Power	2Mbps: 0.33 dBm (0.0011 W)

Note:

- For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2405	02	2409	03	2413
04	2417	05	2422	06	2426
07	2430	08	2435	09	2440
10	2445	11	2450	12	2454
13	2458	14	2462	15	2466
16	2470				

3. Table for Filed Antenna:

Ant.	Manufacturer	Model Name	Antenna Type	Connector	Gain (dBi)
1	Shenzhen Jinxin Electronics Co., Ltd.	ANT_18.5*2.5	PCB	N/A	-0.71

Note: The antenna gain is provided by the manufacturer.

3.2 DESCRIPTION OF TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Pretest Mode	Description
Mode 1	TX Mode_2Mbps Channel 01/07/16
Mode 2	TX Mode_2Mbps Channel 16

Following mode(s) was (were) found to be the worst case(s) and selected for the final test.

AC power line conducted emissions test	
Final Test Mode	Description
Mode 2	TX Mode_2Mbps Channel 16

Radiated emissions test - Below 1GHz	
Final Test Mode	Description
Mode 2	TX Mode_2Mbps Channel 16

Radiated emissions test - Above 1GHz	
Final Test Mode	Description
Mode 1	TX Mode_2Mbps Channel 01/07/16

Conducted test	
Final Test Mode	Description
Mode 1	TX Mode_2Mbps Channel 01/07/16

Note:

- (1) 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.
- (2) For AC power line conducted emissions and radiated emissions below 1 GHz test, the 2Mbps Channel 16 is found to be the worst case and recorded.
- (3) For radiated emission above 1 GHz test, the polarization of Vertical and Horizontal are evaluated, the worst case is Horizontal and recorded.

3.3 PARAMETERS OF TEST SOFTWARE

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

Test Software Version	push-button		
Frequency (MHz)	2405	2430	2470
2Mbps	default	default	default

3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.5 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.
-	-	-	-	-

Item	Cable Type	Shielded Type	Ferrite Core	Length
-	-	-	-	-

4. AC POWER LINE CONDUCTED EMISSIONS

4.1 LIMIT

Frequency of Emission (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 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.

4.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling 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 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

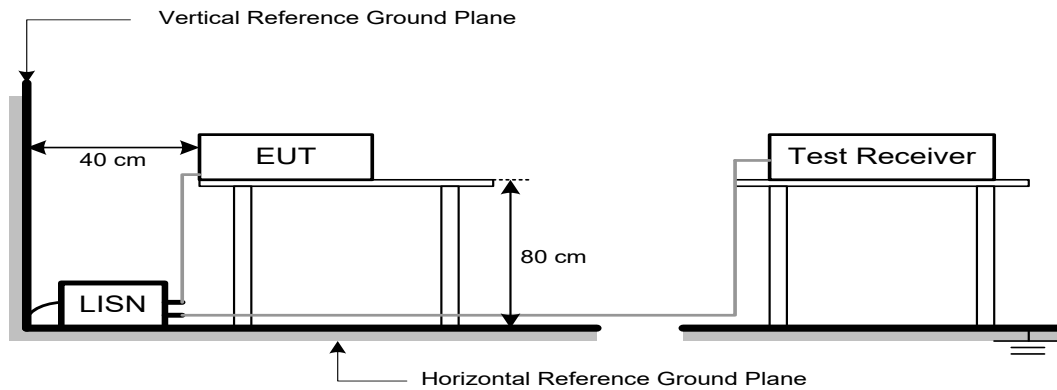
The following table is the setting of the receiver:

Receiver Parameters	Setting
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.3 DEVIATION FROM TEST STANDARD

No deviation.

4.4 TEST SETUP



4.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

4.6 TEST RESULTS

Please refer to the APPENDIX A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of 『Note』 . If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform. In this case, a " * " marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150 kHz to 30 MHz.

5. RADIATED EMISSIONS

5.1 LIMIT

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

LIMITS OF RADIATED EMISSION MEASUREMENT (9 kHz-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
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000 MHz)

Frequency (MHz)	(dBuV/m at 3 m)	
	Peak	Average
Above 1000	74	54

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).

5.2 TEST PROCEDURE

- 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 1 GHz)
- 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 1 GHz)
- The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; 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.
- 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).
- The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
- 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.
- 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 1 GHz)
- 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 1 GHz)
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

The following table is the setting of the receiver:

Spectrum Parameters	Setting
Start ~ Stop Frequency	9 kHz~150 kHz for RBW 200 Hz
Start ~ Stop Frequency	0.15 MHz~30 MHz for RBW 9 kHz
Start ~ Stop Frequency	30 MHz~1000 MHz for RBW 100 kHz

Spectrum Parameters	Setting
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1 MHz / 3 MHz for PK value 1 MHz / 1/T Hz for AVG value

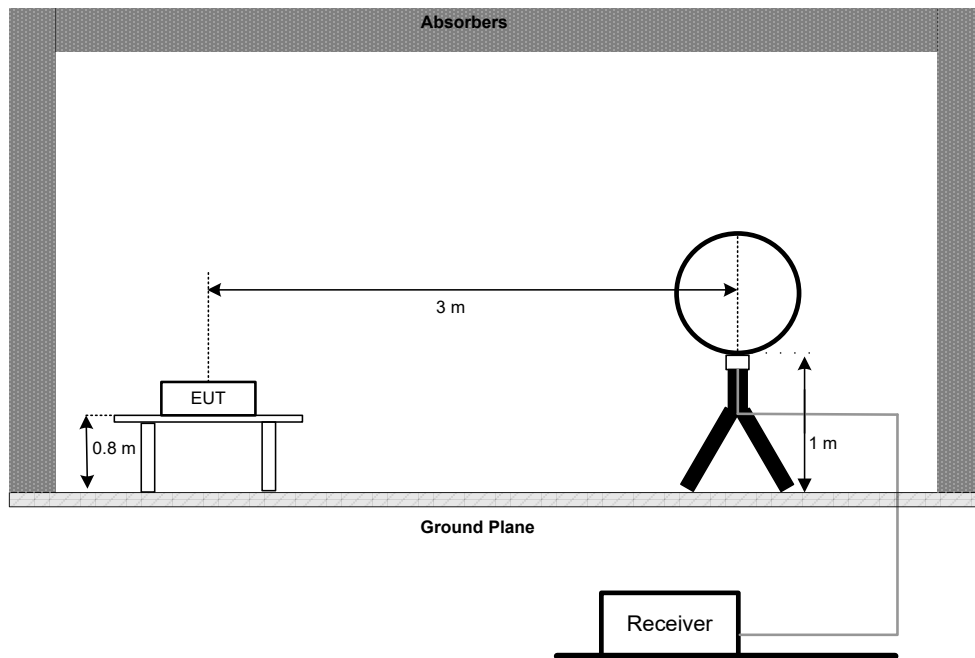
Spectrum Parameters	Setting
Start ~ Stop Frequency	9 kHz~90 kHz for PK/AVG detector
Start ~ Stop Frequency	90 kHz~110 kHz for QP detector
Start ~ Stop Frequency	110 kHz~490 kHz for PK/AVG detector
Start ~ Stop Frequency	490 kHz~30 MHz for QP detector
Start ~ Stop Frequency	30 MHz~1000 MHz for QP detector
Start ~ Stop Frequency	1 GHz~26.5 GHz for PK/AVG detector

5.3 DEVIATION FROM TEST STANDARD

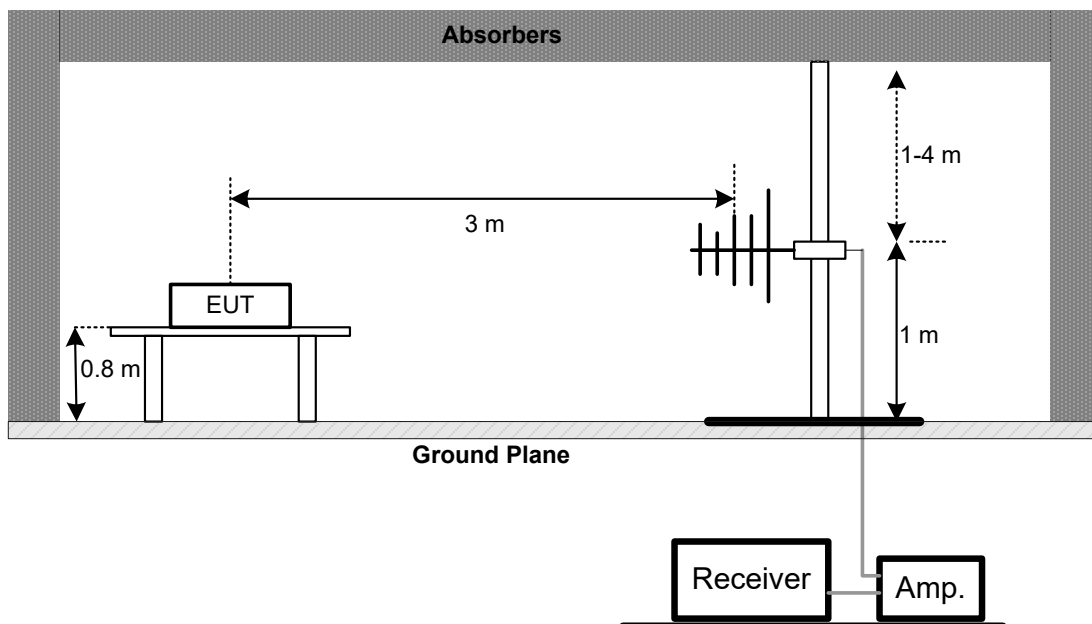
No deviation.

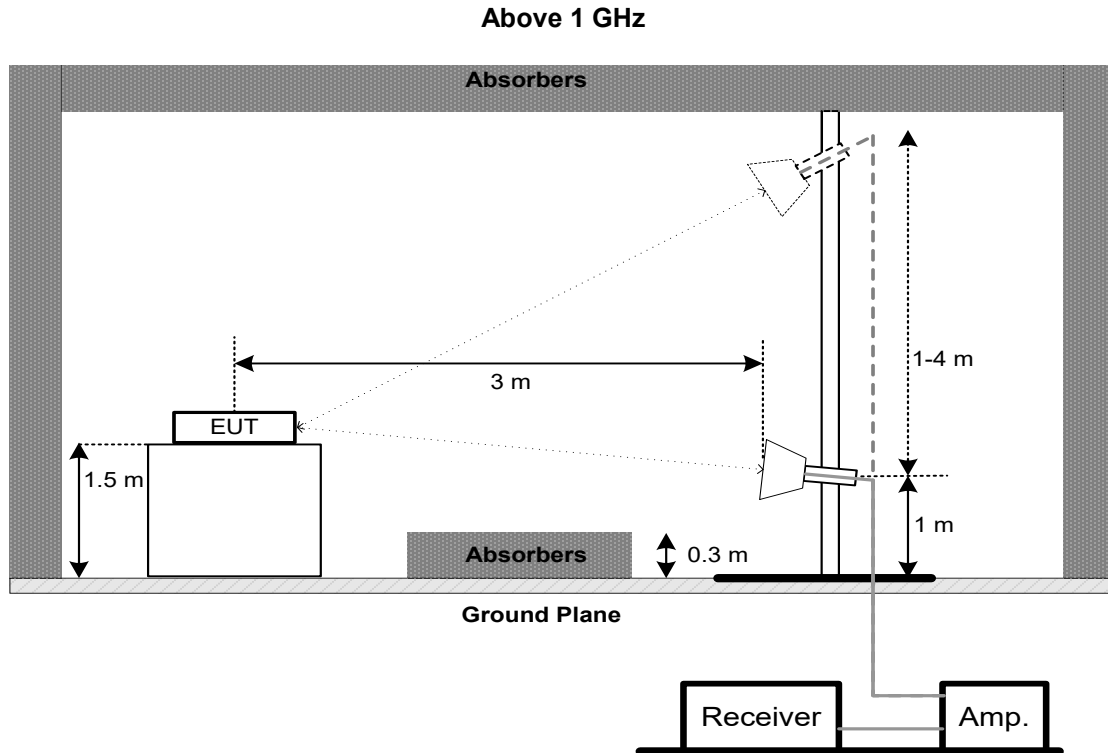
5.4 TEST SETUP

9 kHz to 30 MHz



30 MHz to 1 GHz





5.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

5.6 TEST RESULT - 9 kHz TO 30 MHz

Please refer to the APPENDIX B.

Remark:

- (1) Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB).
- (2) Limit line = specific limits (dBuV) + distance extrapolation factor.

5.7 TEST RESULT - 30 MHz TO 1000 MHz

Please refer to the APPENDIX C.

5.8 TEST RESULT - ABOVE 1000 MHz

Please refer to the APPENDIX D.

Remark:

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

6. BANDWIDTH

6.1 LIMIT

Section	Test Item	Limit
FCC 15.247(a)(2)	6 dB Bandwidth	≥ 500 kHz
	99% Emission Bandwidth	-

6.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- The following table is the setting of the spectrum analyzer:

For 6 dB Bandwidth:

Spectrum Parameters	Setting
Span Frequency	> Measurement Bandwidth
RBW	100 kHz
VBW	300 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

For 99% Emission Bandwidth:

Spectrum Parameters	Setting
Span Frequency	Between 1.5 times and 5.0 times the OBW
RBW	30 kHz
VBW	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

6.6 TEST RESULTS

Please refer to the APPENDIX E.

7. MAXIMUM OUTPUT POWER

7.1 LIMIT

Section	Test Item	Limit
FCC 15.247(b)(3)	Maximum Output Power	1.0000 watt or 30.00 dBm

7.2 TEST PROCEDURE

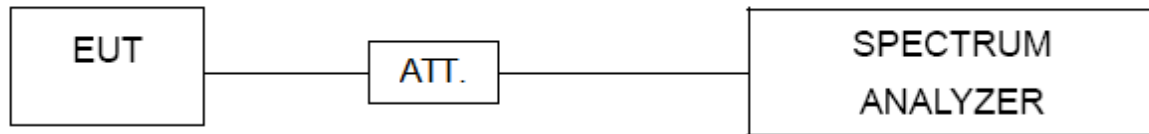
- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- The following table is the setting of the spectrum analyzer:

Spectrum Parameters	Setting
Span Frequency	$\geq 3 \times \text{RBW}$
RBW	3 MHz
VBW	3 MHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

7.6 TEST RESULTS

Please refer to the APPENDIX F.

8. CONDUCTED SPURIOUS EMISSION

8.1 LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 the transmitter demonstrates compliance with the peak Output Power limits. If the transmitter complies with the Output Power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.

8.2 TEST PROCEDURE

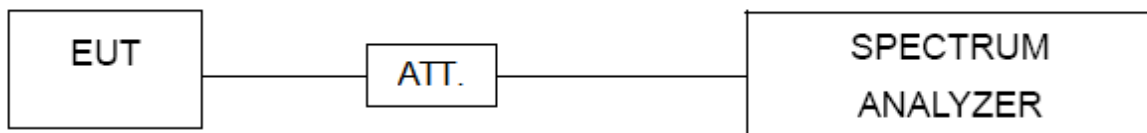
- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- The following table is the setting of the spectrum analyzer:

Spectrum Parameters	Setting
Start Frequency	30 MHz
Stop Frequency	26.5 GHz
RBW	100 kHz
VBW	300 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

8.6 TEST RESULTS

Please refer to the APPENDIX G.

9. POWER SPECTRAL DENSITY

9.1 LIMIT

Section	Test Item	Limit
FCC 15.247(e)	Power Spectral Density	8 dBm (in any 3 kHz)

9.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- The following table is the setting of the spectrum analyzer:

Spectrum Parameters	Setting
Span Frequency	2 MHz
RBW	3 kHz
VBW	10 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

9.3 DEVIATION FROM STANDARD

No deviation.

9.4 TEST SETUP



9.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

9.6 TEST RESULTS

Please refer to the APPENDIX H.

10. MEASUREMENT INSTRUMENTS LIST

AC Power Line Conducted Emissions					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EMI Test Receiver	R&S	ESR3	103027	Jun. 16, 2024
2	TWO-LINE V-NETWORK	R&S	ENV216	101447	Jan. 07, 2024
3	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
4	Cable	N/A	SFT205-NMNM-9M-001	9M	Nov. 27, 2024
5	643 Shield Room	ETS	6*4*3	N/A	N/A

Radiated Emissions - 9 kHz to 30 MHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Active Loop Antenna	Schwarzbeck	FMZB 1513-60B	1513-60 B-034	Apr. 01, 2024
2	MXE EMI Receiver	Keysight	N9038A	MY56400091	Dec. 22, 2024
3	Cable	N/A	RW2350-3.8A-NMB M-1.5M	N/A	Jun. 10, 2024
4	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
5	966 Chamber room	ETS	9*6*6	N/A	Jul. 11, 2024

Radiated Emissions - 30 MHz to 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	1461	Nov. 28, 2024
2	Attenuator	EMC INSTRUMENT	EMCI-N-6-06	AT-06010	Nov. 28, 2024
3	Preamplifier	EMC INSTRUMENT	EMC001330	980863	Nov. 17, 2024
4	Cable	RegaWay	LMR400-NMNM-12.5m	N/A	Jul. 04, 2024
5	Cable	RegaWay	LMR400-NMNM-3m	N/A	Jul. 04, 2024
6	Cable	RegaWay	LMR400-NMNM-0.5m	N/A	Jul. 04, 2024
7	Receiver	Agilent	N9038A	MY52130039	Jan. 07, 2024
8	Positioning Controller	MF	MF-7802	N/A	N/A
9	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
10	966 Chamber room	CM	9*6*6	N/A	May 17, 2024

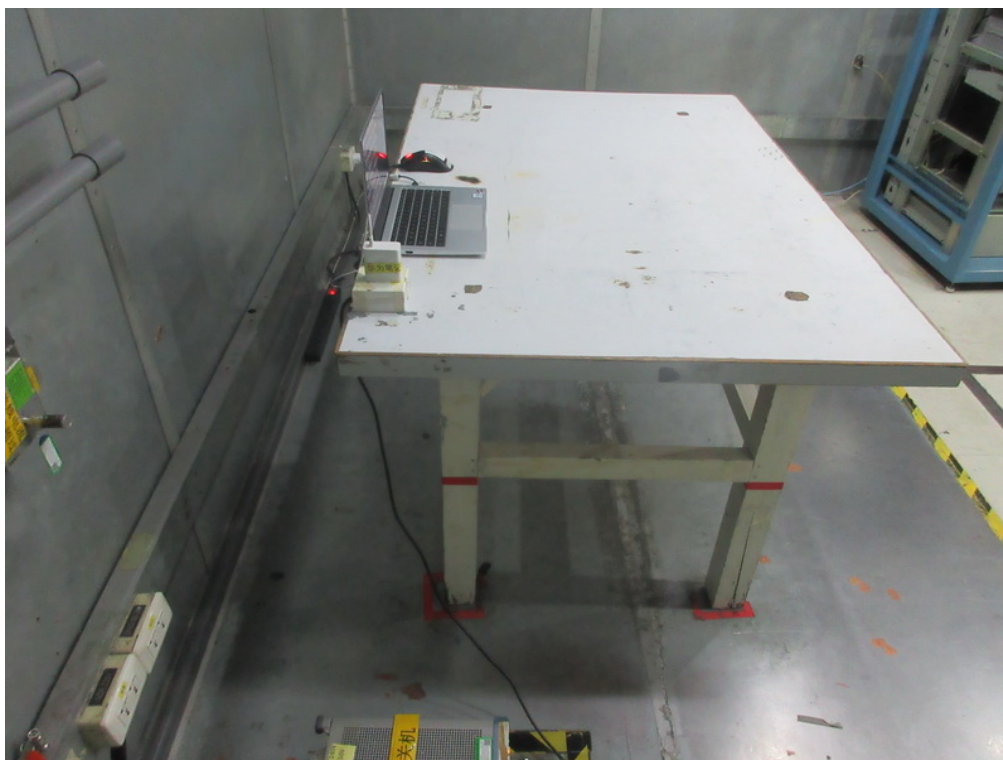
Radiated Emissions - Above 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Receiver	Agilent	N9038A	MY52130039	Jan. 07, 2024
2	Preamplifier	EMC INSTRUMENT	EMC118A45SE	980888	Nov. 17, 2024
3	EXA Spectrum Analyzer	Keysight	N9010A	MY55150209	Jun. 16, 2024
4	Double Ridged Guide Antenna	ETS	3115	75789	May 31, 2024
5	Cable	RegalWay	A81-SMAMSMAM-12.5M	N/A	Aug. 08, 2024
6	Cable	RegalWay	RWLP50-4.0A-NM RASM-2.5M	N/A	Aug. 08, 2024
7	Cable	RegalWay	RWLP50-4.0A-NM RASMRA-0.8M	N/A	Aug. 08, 2024
8	966 Chamber room	CM	9*6*6	N/A	May 17, 2024
9	Positioning Controller	MF	MF-7802	N/A	N/A
10	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
11	Attenuator	Talent Microwave	TA10A2-S-18	N/A	N/A
12	Filter	STI	STI15-9912	N/A	Jun. 16, 2024

Bandwidth & Maximum Output Power & Power Spectral Density & Conducted Spurious Emission					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Jun. 16, 2024
2	Attenuator	Talent Microwave	TA10A0-S-26.5	N/A	N/A
3	DC Block	N/A	N/A	N/A	N/A
4	Measurement Software	BTL	BTL Conducted Test	N/A	N/A

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

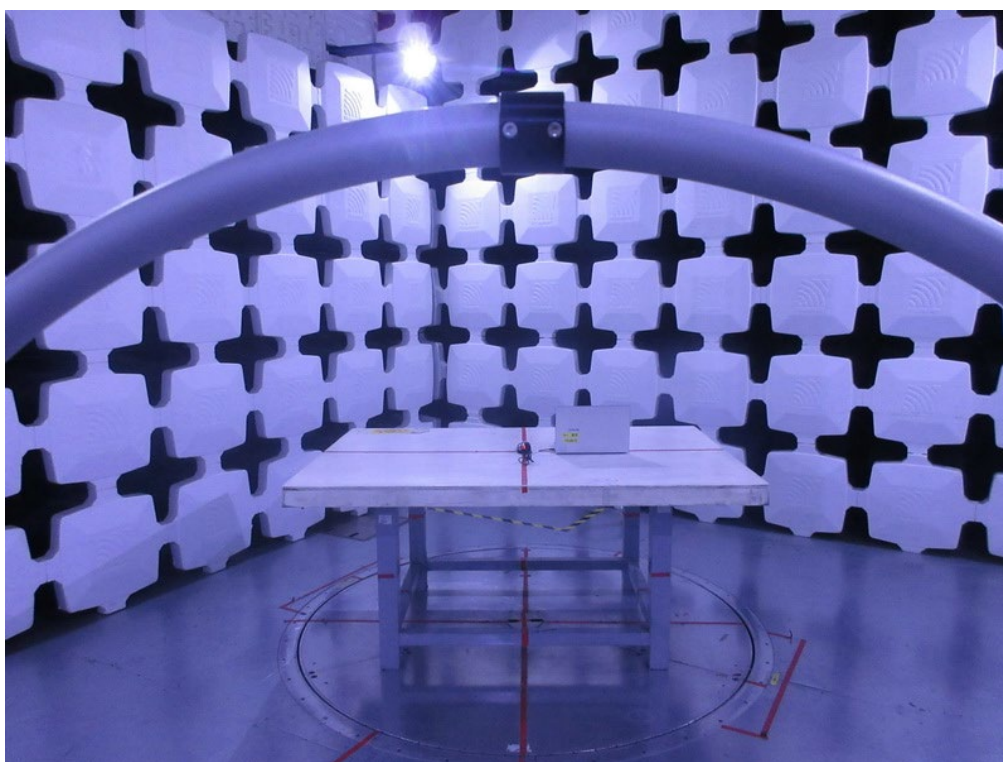
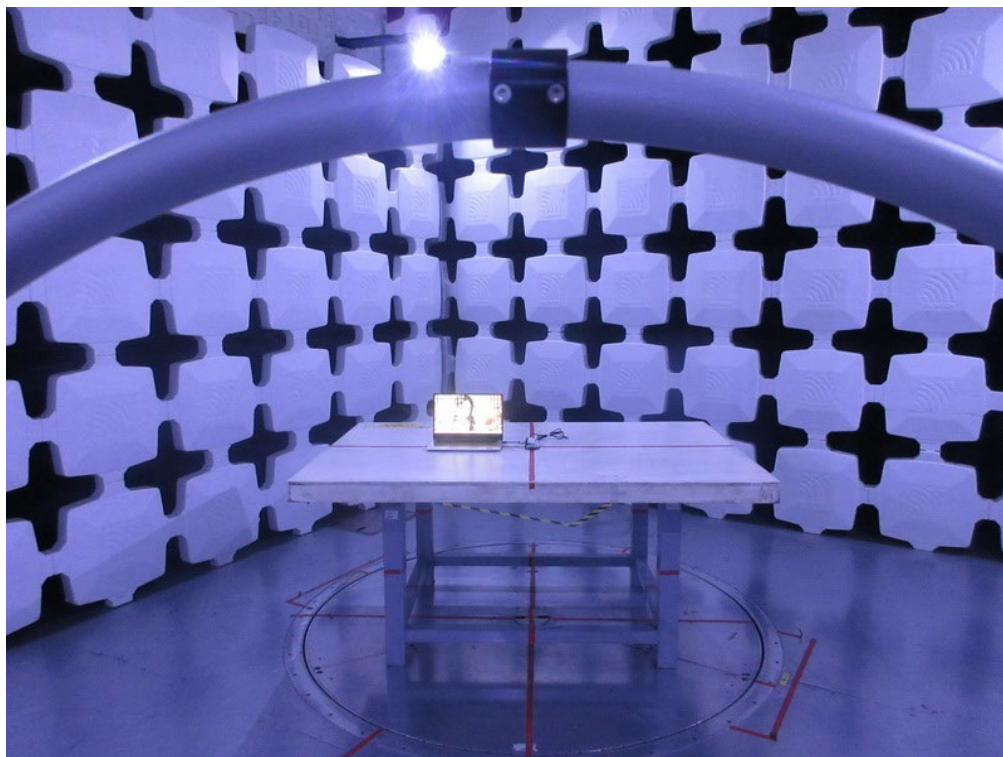
11. EUT TEST PHOTO

AC Power Line Conducted Emissions Test Photos



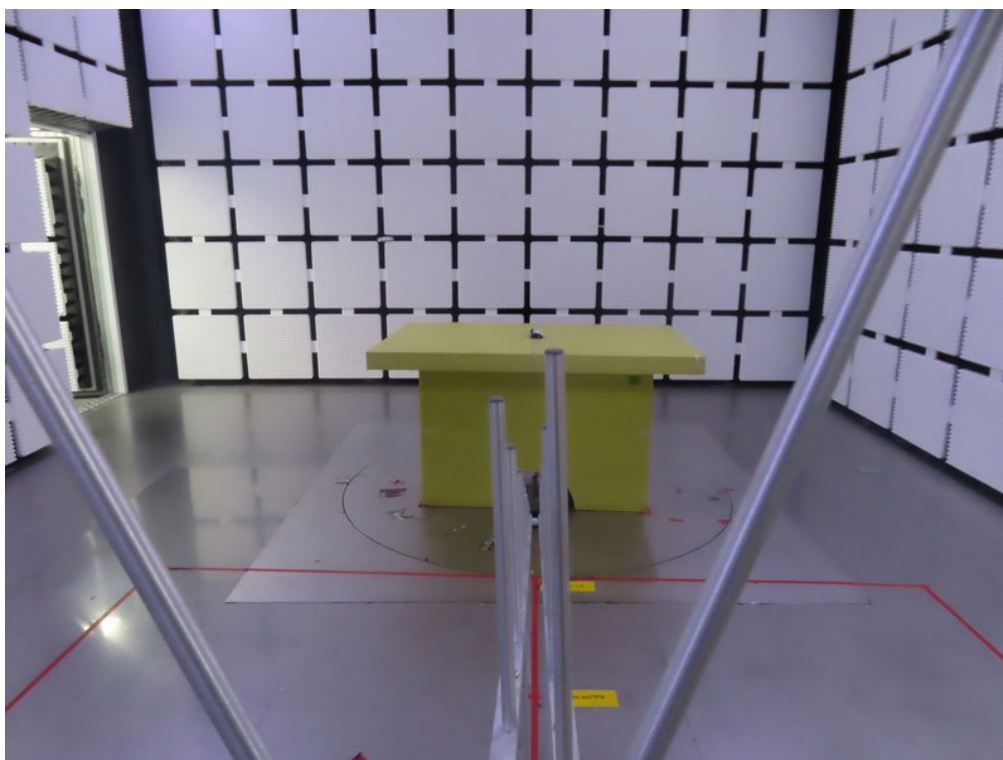
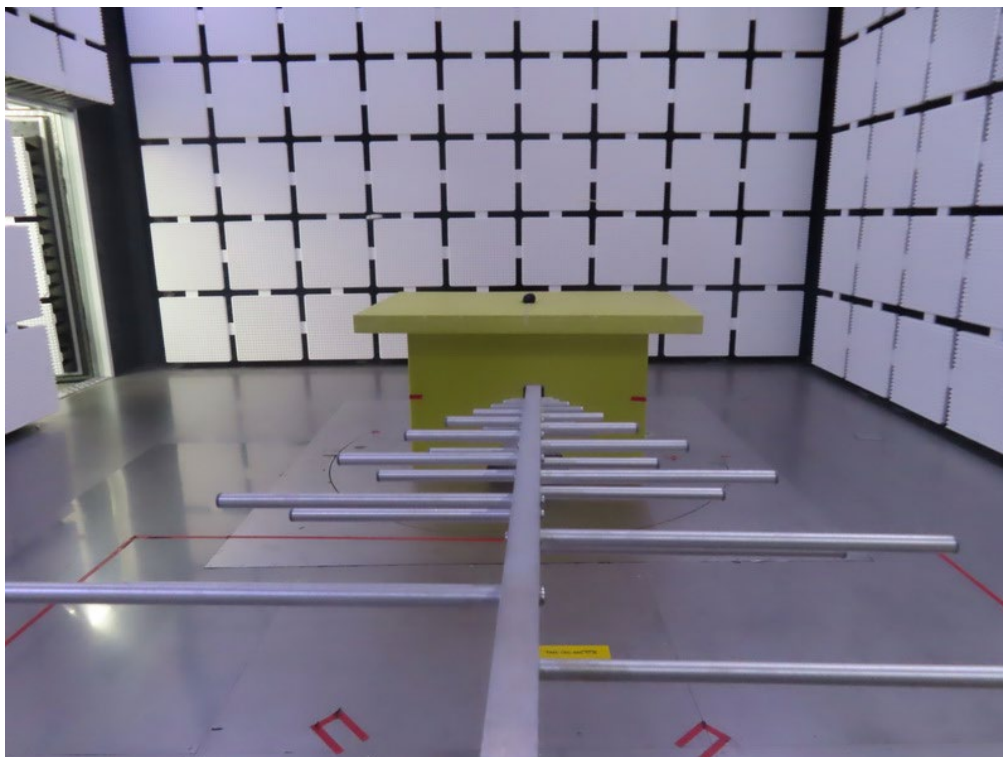
Radiated Emissions Test Photos

9 kHz to 30 MHz



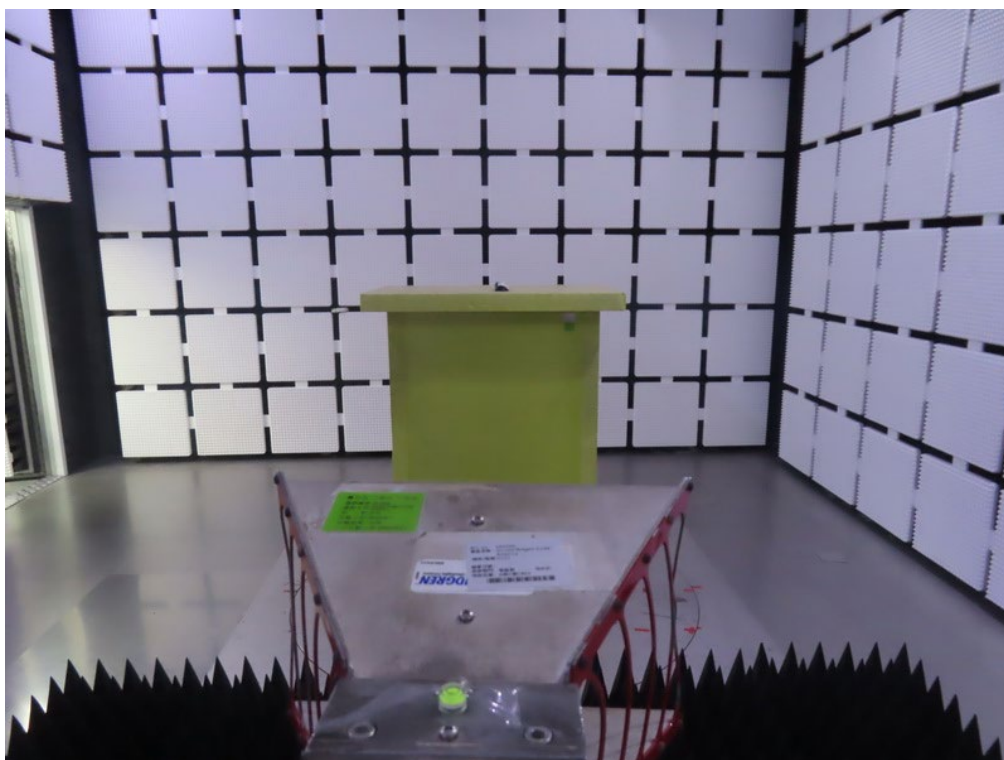
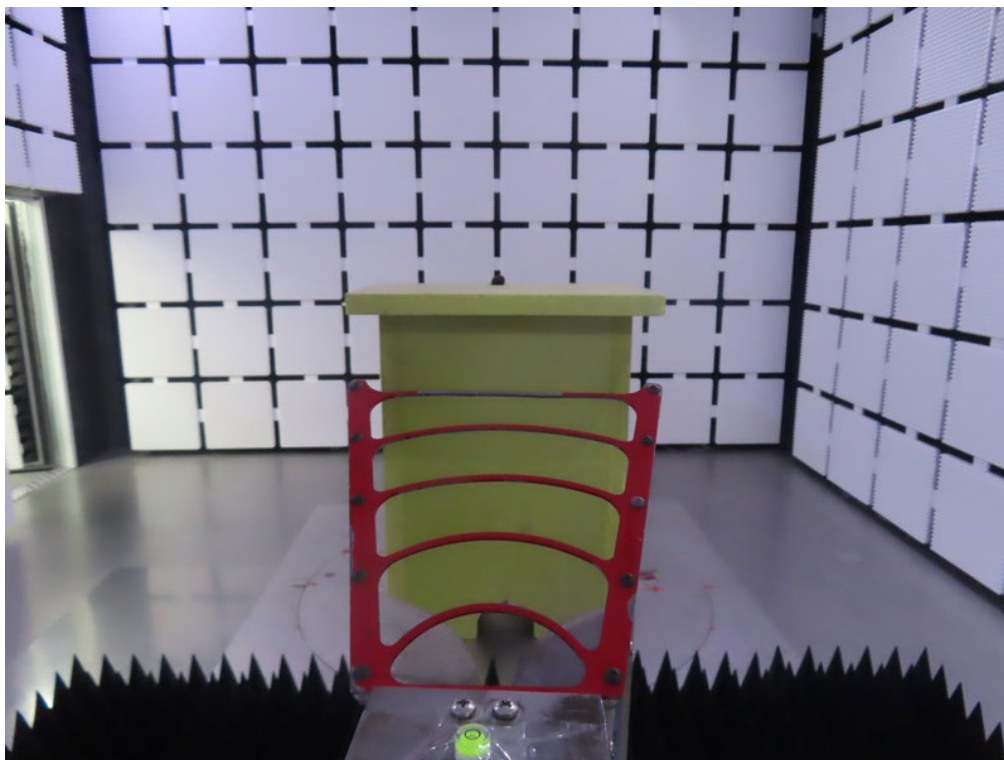
Radiated Emissions Test Photos

30 MHz to 1000 MHz



Radiated Emissions Test Photos

Above 1 GHz

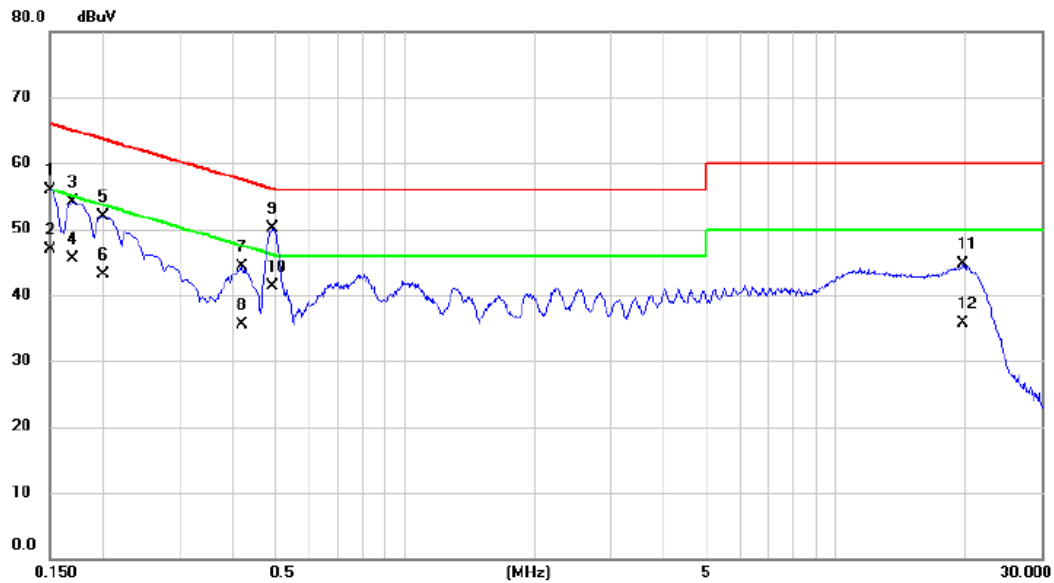


Conducted Test Photos



APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS

Test Mode	TX Mode_2Mbps Channel 16	Phase	Line
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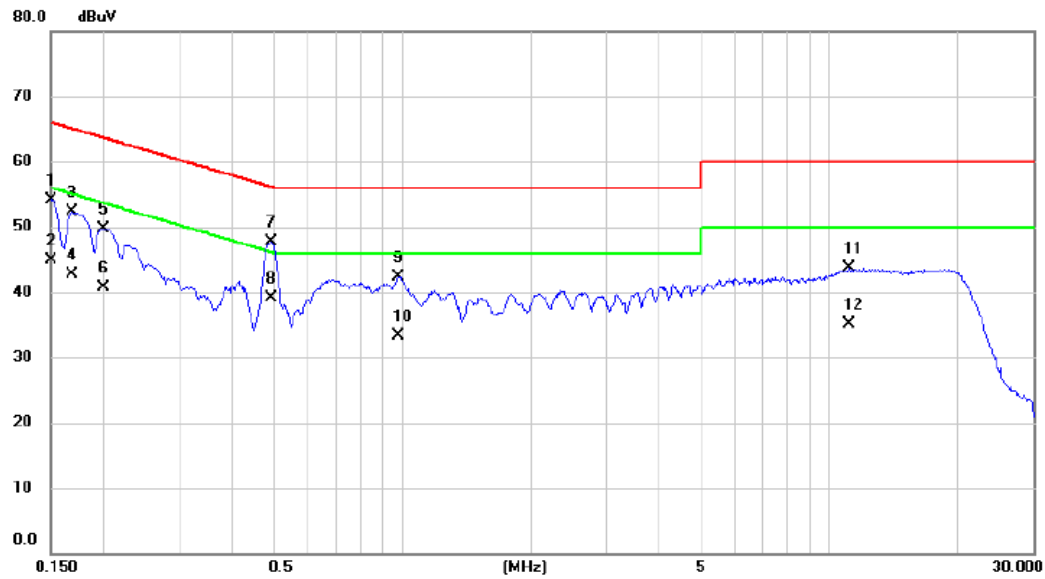
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1500	46.25	9.73	55.98	66.00	-10.02	QP	
2		0.1500	37.20	9.73	46.93	56.00	-9.07	AVG	
3		0.1703	44.30	9.74	54.04	64.95	-10.91	QP	
4		0.1703	35.80	9.74	45.54	54.95	-9.41	AVG	
5		0.1995	42.07	9.74	51.81	63.63	-11.82	QP	
6		0.1995	33.40	9.74	43.14	53.63	-10.49	AVG	
7		0.4200	34.57	9.77	44.34	57.45	-13.11	QP	
8		0.4200	25.70	9.77	35.47	47.45	-11.98	AVG	
9		0.4920	40.36	9.79	50.15	56.13	-5.98	QP	
10	*	0.4920	31.60	9.79	41.39	46.13	-4.74	AVG	
11		19.7294	34.25	10.45	44.70	60.00	-15.30	QP	
12		19.7294	25.30	10.45	35.75	50.00	-14.25	AVG	

REMARKS:

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

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

Test Mode	TX Mode_2Mbps Channel 16	Phase	Neutral
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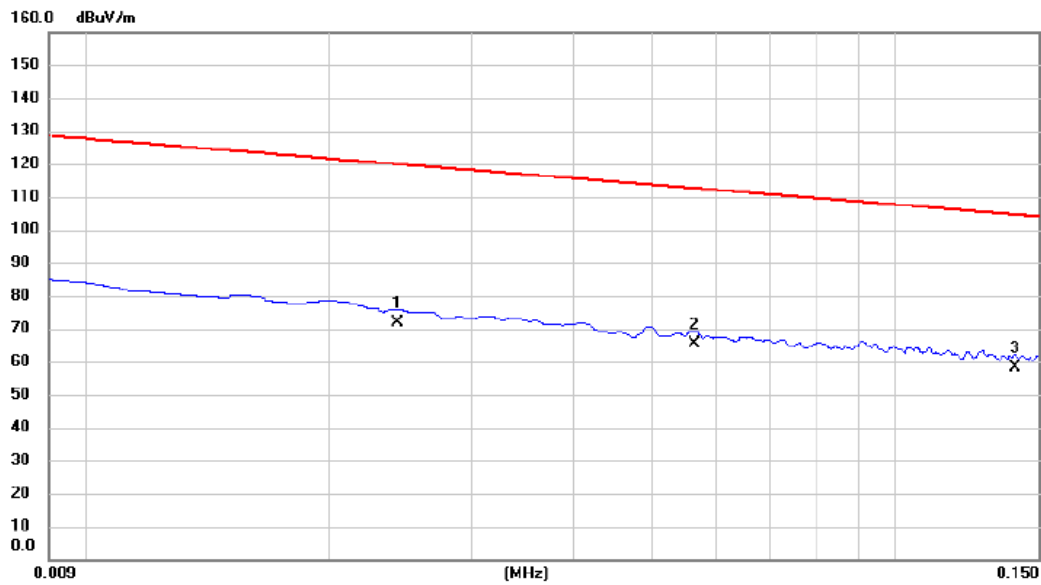
No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	0.1508	44.60	9.59	54.19	65.96	-11.77	QP	
2	0.1508	35.30	9.59	44.89	55.96	-11.07	AVG	
3	0.1685	42.62	9.59	52.21	65.03	-12.82	QP	
4	0.1685	33.20	9.59	42.79	55.03	-12.24	AVG	
5	0.1995	40.04	9.60	49.64	63.63	-13.99	QP	
6	0.1995	31.10	9.60	40.70	53.63	-12.93	AVG	
7	0.4920	38.14	9.65	47.79	56.13	-8.34	QP	
8 *	0.4920	29.40	9.65	39.05	46.13	-7.08	AVG	
9	0.9780	32.72	9.68	42.40	56.00	-13.60	QP	
10	0.9780	23.70	9.68	33.38	46.00	-12.62	AVG	
11	11.1075	33.38	10.40	43.78	60.00	-16.22	QP	
12	11.1075	24.80	10.40	35.20	50.00	-14.80	AVG	

REMARKS:

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

APPENDIX B - RADIATED EMISSION - 9 KHZ TO 30 MHZ

Test Mode	TX Mode_2Mbps Channel 16	Polarization	Ant 0°
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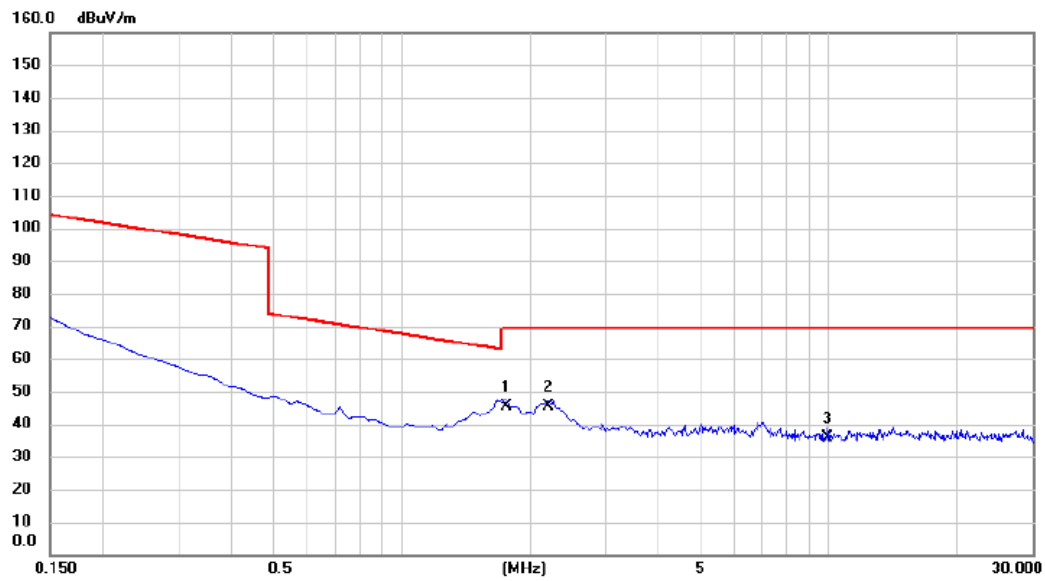


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		0.0243	51.68	20.11	71.79	119.89	-48.10	AVG	
2		0.0564	45.61	19.82	65.43	112.58	-47.15	AVG	
3	*	0.1405	38.45	19.83	58.28	104.65	-46.37	AVG	

REMARKS:

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

Test Mode	TX Mode_2Mbps Channel 16	Polarization	Ant 0°
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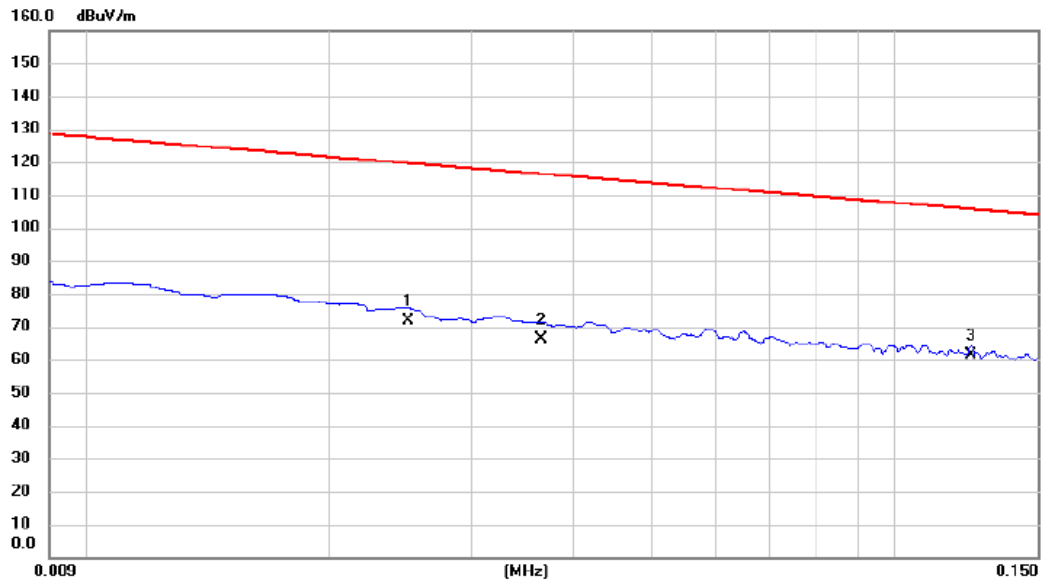


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	*	1.7620	25.69	19.81	45.50	69.54	-24.04	QP	
2		2.2096	25.61	19.81	45.42	69.54	-24.12	QP	
3		9.9260	15.65	20.21	35.86	69.54	-33.68	QP	

REMARKS:

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

Test Mode	TX Mode_2Mbps Channel 16	Polarization	Ant 90°
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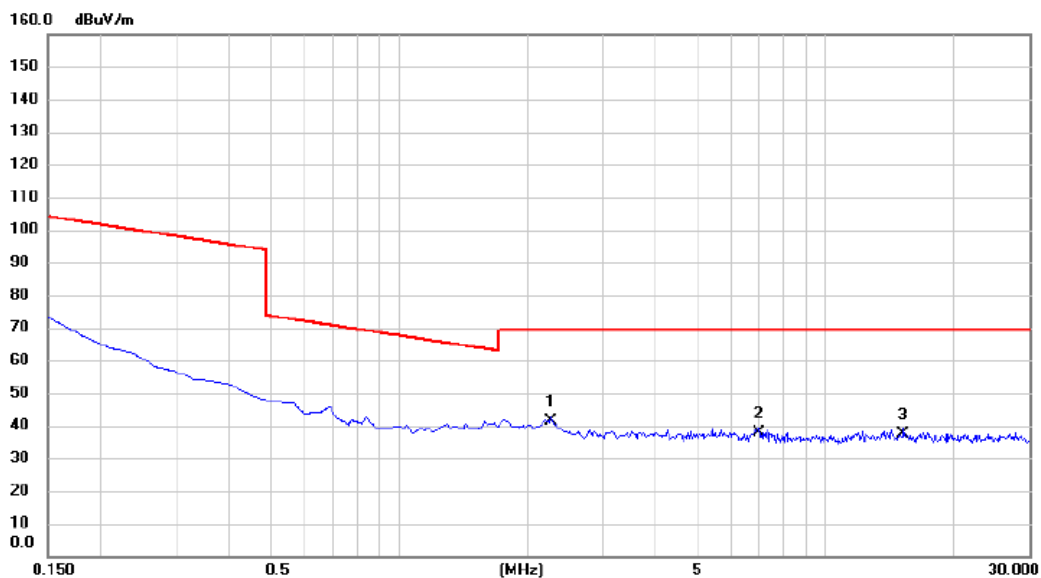


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.0250	51.64	20.07	71.71	119.65	-47.94	AVG	
2		0.0365	46.32	19.80	66.12	116.36	-50.24	AVG	
3	*	0.1242	41.63	19.83	61.46	105.73	-44.27	AVG	

REMARKS:

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

Test Mode	TX Mode_2Mbps Channel 16	Polarization	Ant 90°
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No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	*	2.2693	21.51	19.81	41.32	69.54	-28.22	QP	
2		6.9557	17.62	20.02	37.64	69.54	-31.90	QP	
3		15.1943	17.21	20.32	37.53	69.54	-32.01	QP	

REMARKS:

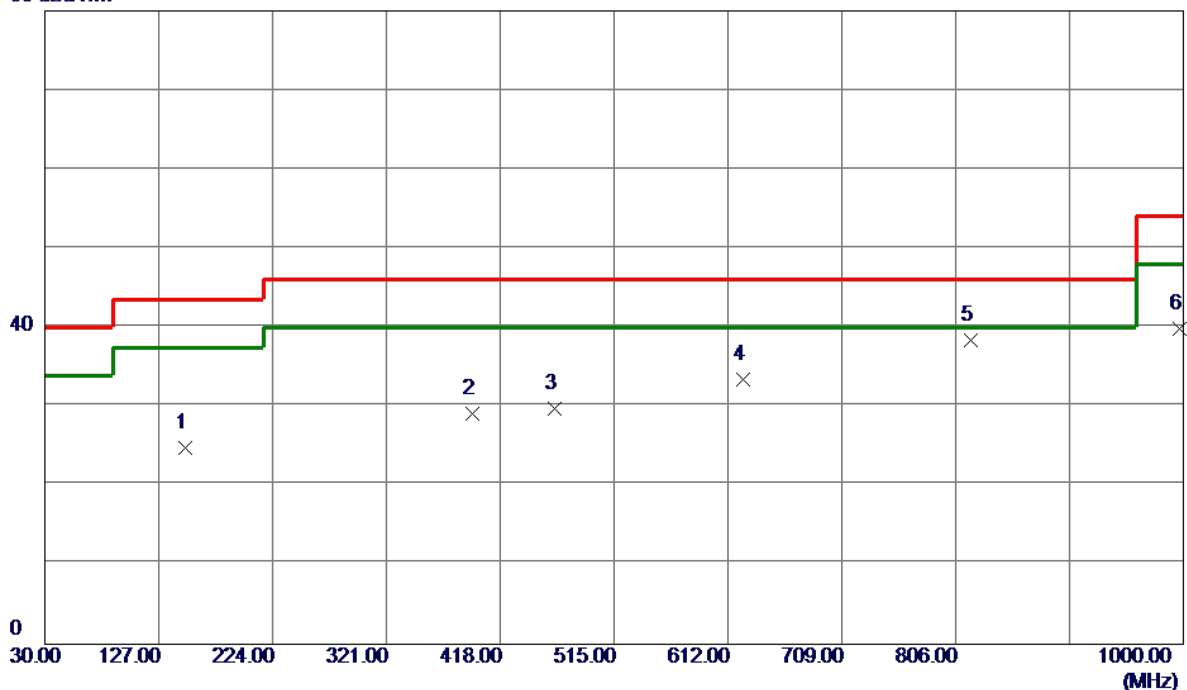
(1) Measurement Value = Reading Level + Correct Factor.

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

APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1000 MHZ

Test Mode	TX Mode_2Mbps Channel 16	Polarization	Vertical
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80 dBuV/m



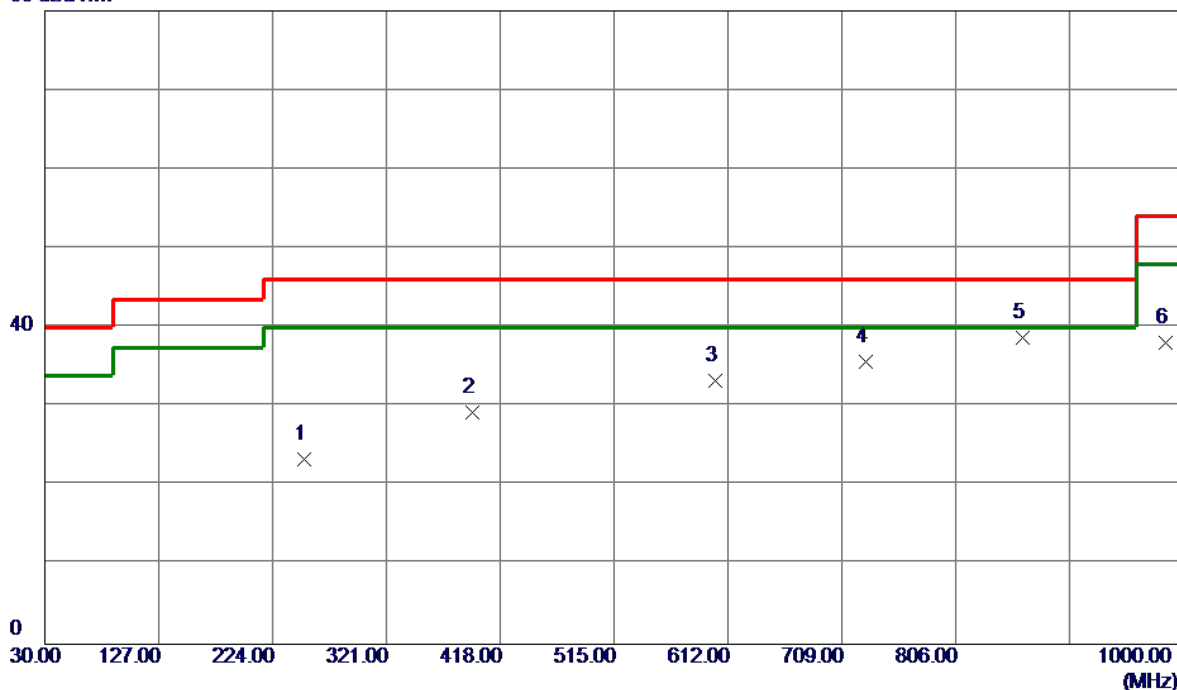
No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	149.3100	35.93	-11.19	24.74	43.50	-18.76	Peak	
2	394.2349	37.14	-8.09	29.05	46.00	-16.95	Peak	
3	464.5600	36.30	-6.55	29.75	46.00	-16.25	Peak	
4	624.6100	36.80	-3.35	33.45	46.00	-12.55	Peak	
5 *	819.0949	39.01	-0.67	38.34	46.00	-7.66	Peak	
6	996.6050	38.92	1.00	39.92	54.00	-14.08	Peak	

REMARKS:

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

Test Mode	TX Mode_2Mbps Channel 16	Polarization	Horizontal
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80 dBuV/m



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	251.1600	35.38	-12.08	23.30	46.00	-22.70	Peak	
2	394.7200	37.29	-8.07	29.22	46.00	-16.78	Peak	
3	601.3300	36.75	-3.45	33.30	46.00	-12.70	Peak	
4	729.8550	37.58	-1.91	35.67	46.00	-10.33	Peak	
5 *	862.7450	38.97	-0.18	38.79	46.00	-7.21	Peak	
6	984.4800	37.27	0.82	38.09	54.00	-15.91	Peak	

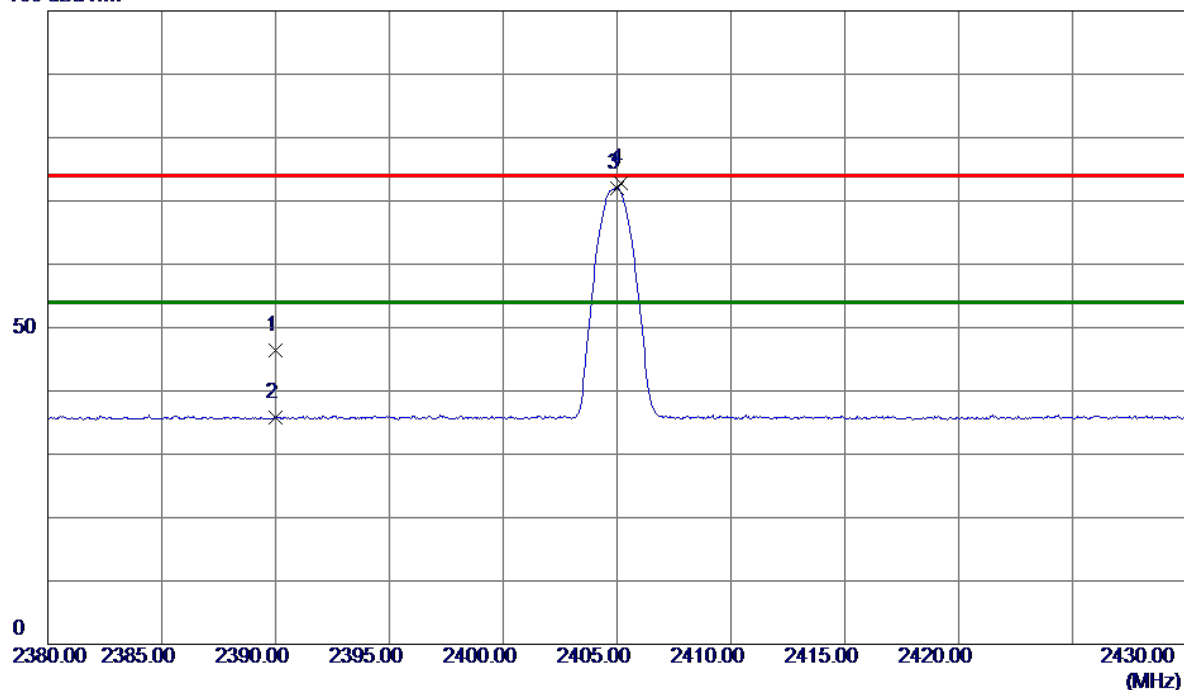
REMARKS:

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

APPENDIX D - RADIATED EMISSION - ABOVE 1000 MHZ

Test Mode	TX 2405 MHz _CH01_2Mbps	Polarization	Horizontal
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100 dBuV/m



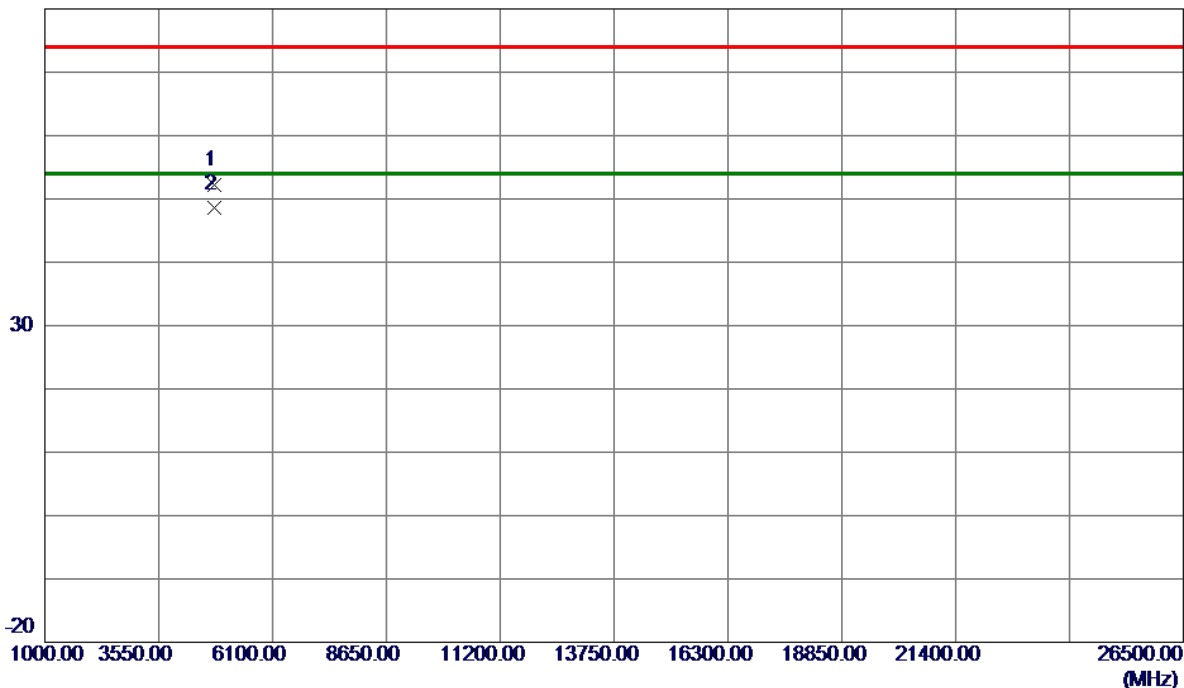
No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2390.0000	40.27	6.17	46.44	74.00	-27.56	Peak	
2	2390.0000	29.65	6.17	35.82	54.00	-18.18	AVG	
3 *	2405.0000	65.90	6.18	72.08	54.00	18.08	AVG	No Limit
4	2405.1500	66.68	6.18	72.86	74.00	-1.14	Peak	No Limit

REMARKS:

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

Test Mode	TX 2405 MHz _CH01_2Mbps	Polarization	Horizontal
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80 dBuV/m



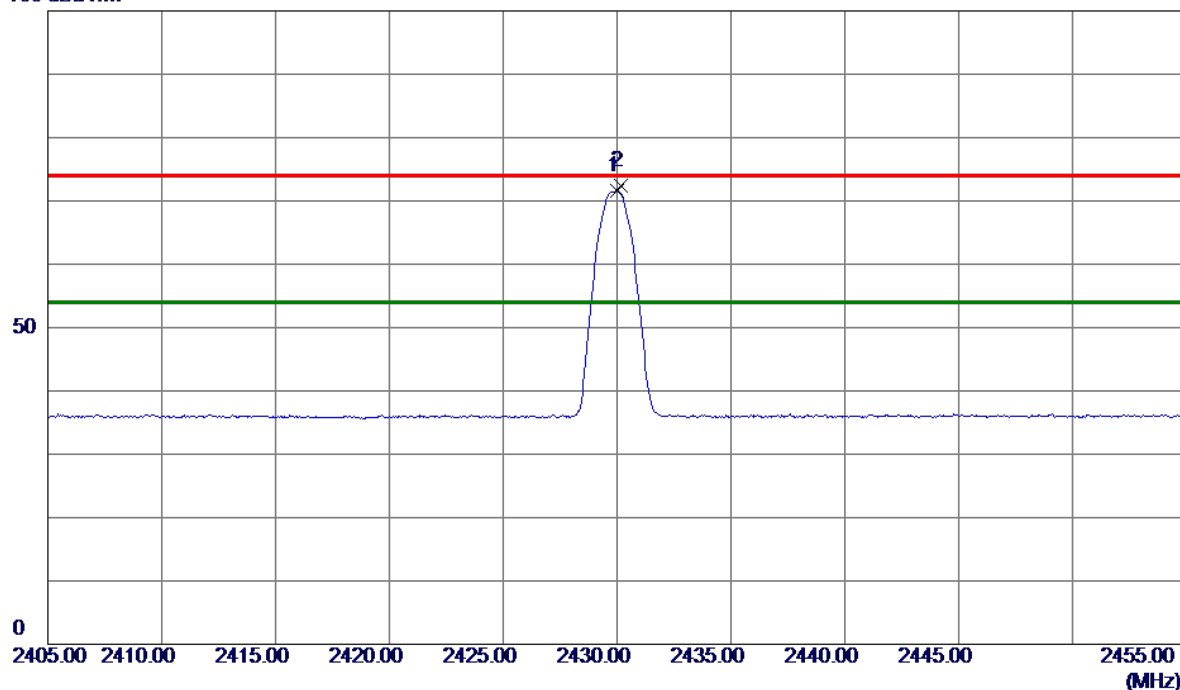
No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4809.2300	51.23	0.91	52.14	74.00	-21.86	Peak	
2 *	4809.5299	47.59	0.91	48.50	54.00	-5.50	AVG	

REMARKS:

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

Test Mode	TX 2430 MHz _CH07_2Mbps	Polarization	Horizontal
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100 dBuV/m



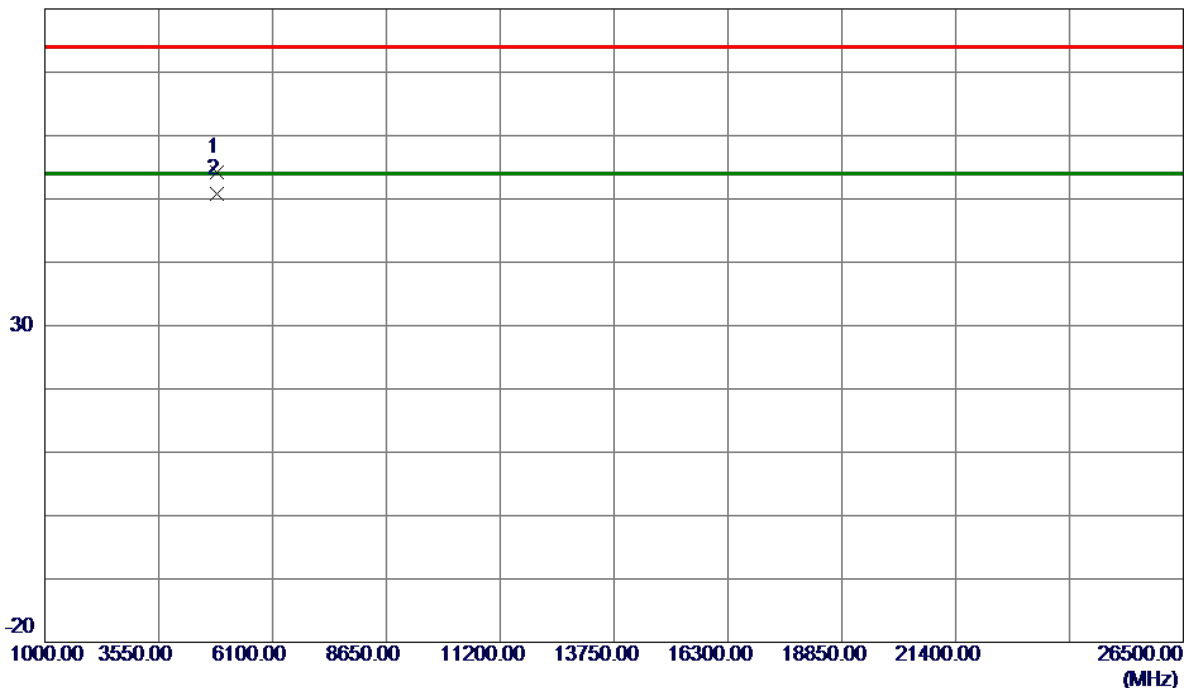
No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	2430.0000	65.46	6.19	71.65	54.00	17.65	AVG	No Limit
2	2430.1500	66.22	6.19	72.41	74.00	-1.59	Peak	No Limit

REMARKS:

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

Test Mode	TX 2430 MHz _CH07_2Mbps	Polarization	Horizontal
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80 dBuV/m



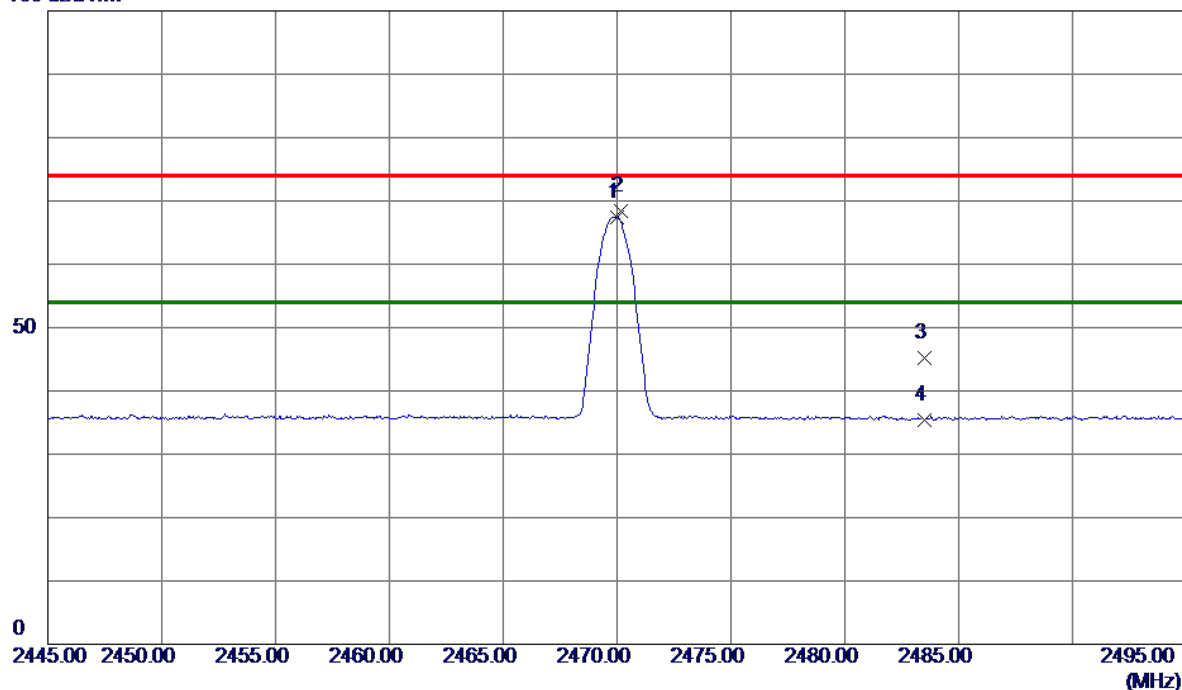
No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4859.2450	53.25	1.04	54.29	74.00	-19.71	Peak	
2 *	4859.4550	49.85	1.04	50.89	54.00	-3.11	AVG	

REMARKS:

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

Test Mode	TX 2470 MHz _CH16_2Mbps	Polarization	Horizontal
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100 dBuV/m

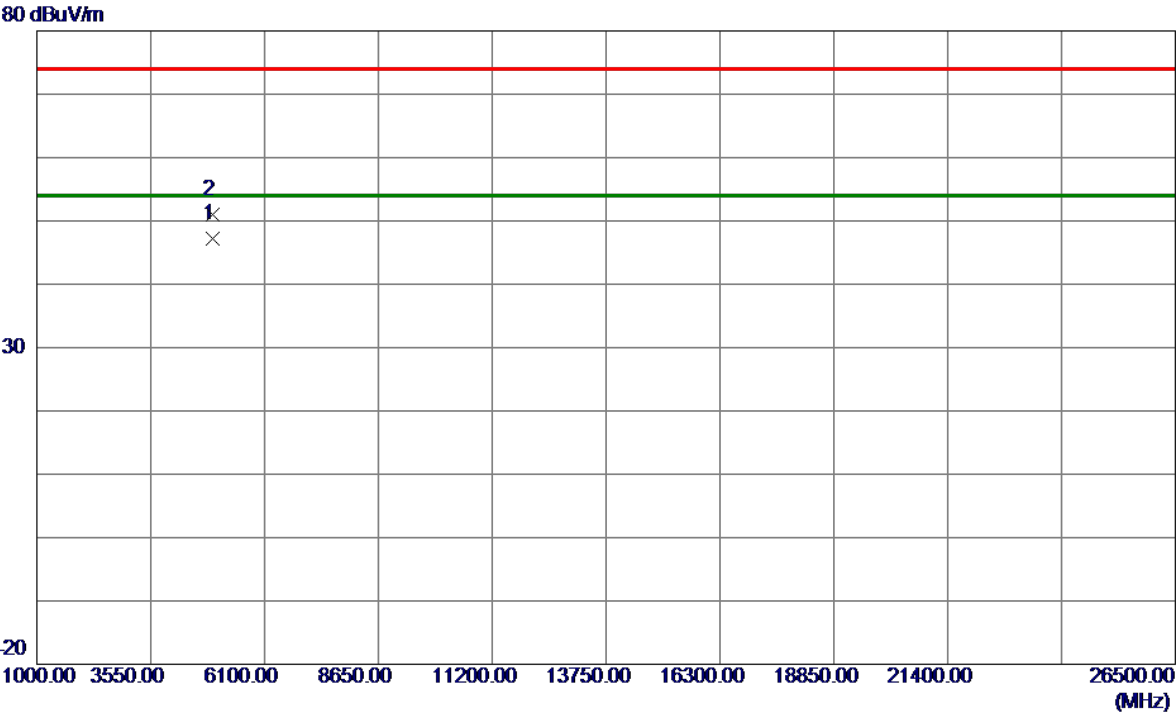


No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	2470.0000	61.27	6.22	67.49	54.00	13.49	AVG	No Limit
2	2470.1500	62.26	6.22	68.48	74.00	-5.52	Peak	No Limit
3	2483.5000	38.95	6.23	45.18	74.00	-28.82	Peak	
4	2483.5000	29.21	6.23	35.44	54.00	-18.56	AVG	

REMARKS:

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

Test Mode	TX 2470 MHz _CH16_2Mbps	Polarization	Horizontal
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No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	4939.3550	46.02	1.25	47.27	54.00	-6.73	AVG	
2	4940.2799	49.66	1.25	50.91	74.00	-23.09	Peak	

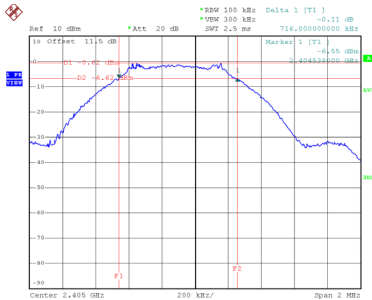
REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX E - BANDWIDTH

Test Mode	TX Mode _2Mbps
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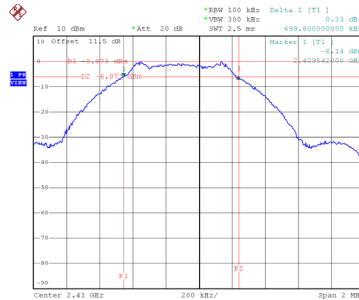
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	6 dB Bandwidth Min. Limit (MHz)	Test Result
01	2405	0.716	1.048	0.5	Pass
07	2430	0.700	1.020	0.5	Pass
16	2470	0.700	1.028	0.5	Pass

CH01



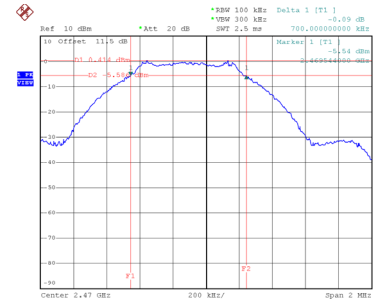
Date: 18.DEC.2023 20:45:52

CH07
6 dB Bandwidth



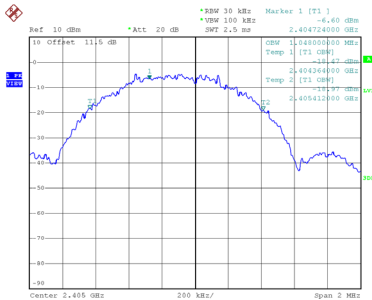
Date: 18.DEC.2023 20:47:43

CH16

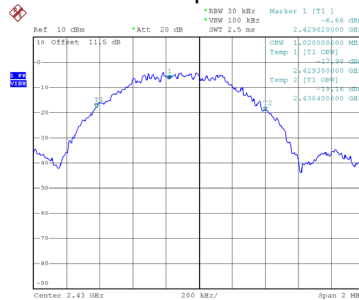


Date: 18.DEC.2023 20:57:11

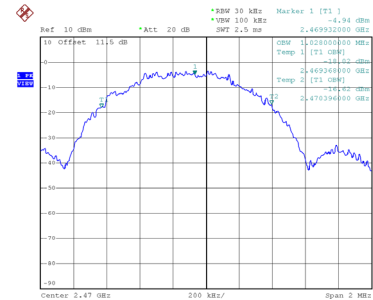
99 % Occupied Bandwidth



Date: 18.DEC.2023 20:44:56



Date: 18.DEC.2023 20:47:50

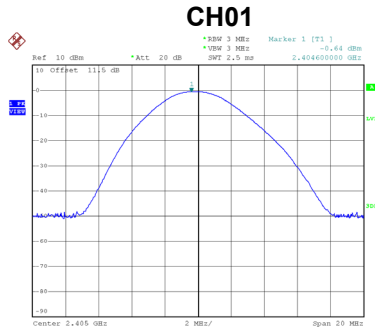


Date: 18.DEC.2023 20:57:18

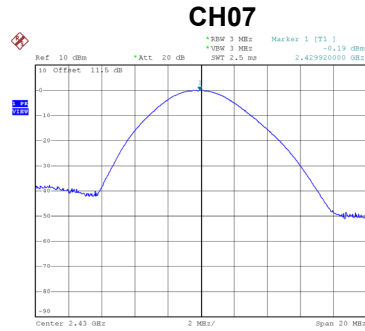
APPENDIX F - MAXIMUM OUTPUT POWER

Test Mode	TX Mode _2Mbps
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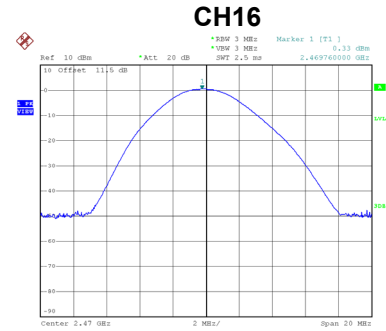
Frequency (MHz)	Output Power (dBm)	Output Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2405	-0.64	0.0009	30.00	1.0000	Pass
2430	-0.19	0.0010	30.00	1.0000	Pass
2470	0.33	0.0011	30.00	1.0000	Pass



Date: 18.DEC.2023 21:01:24



Date: 18.DEC.2023 21:02:14

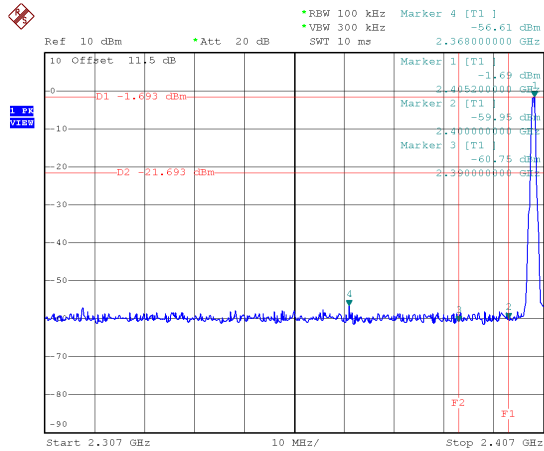


Date: 18.DEC.2023 21:03:08

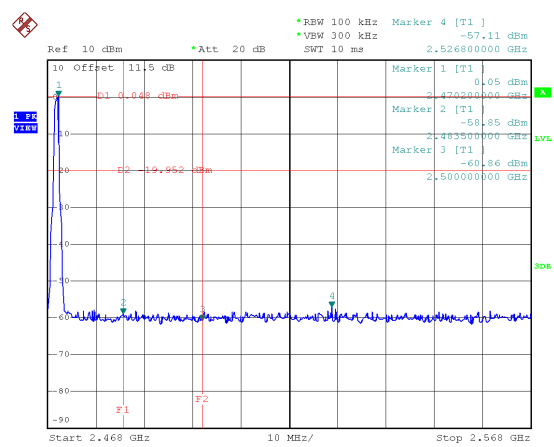
APPENDIX G - CONDUCTED SPURIOUS EMISSION

Test Mode	TX Mode_2Mbps
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Bandedge CH05 (Lower)



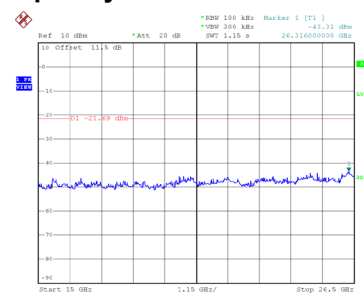
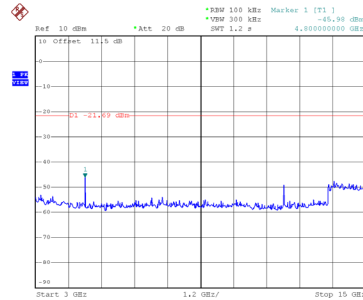
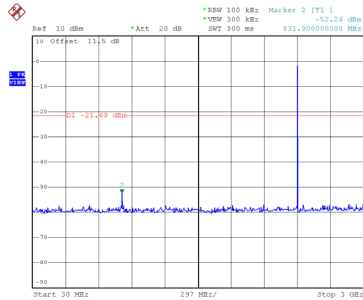
Bandedge CH16 (Upper)



Date: 18.DEC.2023 20:46:01

Date: 18.DEC.2023 20:57:27

CH05 – 10th Harmonic of the fundamental frequency

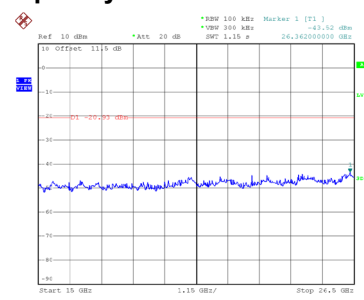
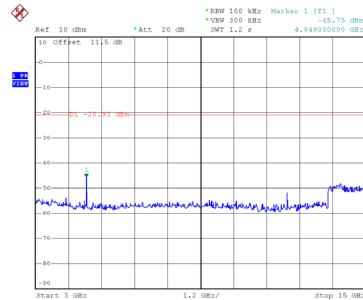
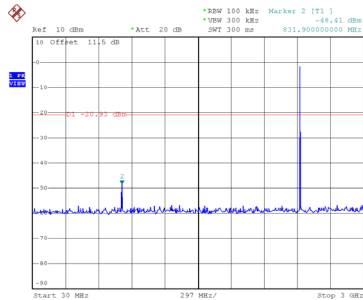


Date: 18.DEC.2023 20:46:16

Date: 18.DEC.2023 20:46:25

Date: 19.DEC.2023 20:46:34

CH07 – 10th Harmonic of the fundamental frequency

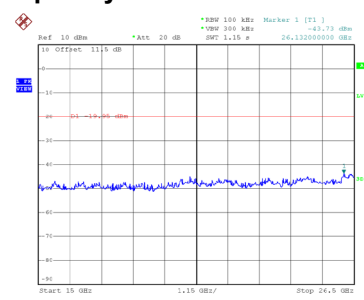
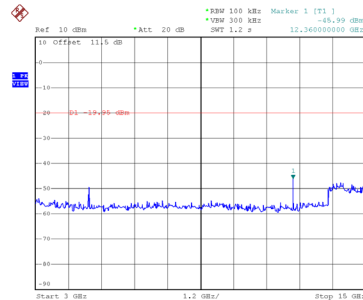
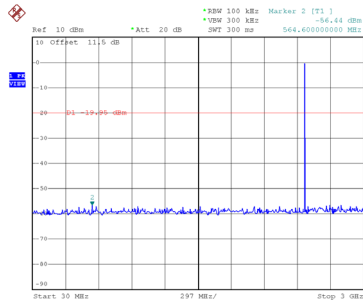


Date: 18.DEC.2023 20:48:13

Date: 18.DEC.2023 20:48:22

Date: 19.DEC.2023 20:48:32

CH16 – 10th Harmonic of the fundamental frequency



Date: 18.DEC.2023 20:57:42

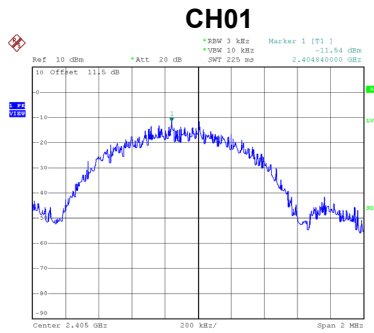
Date: 18.DEC.2023 20:57:51

Date: 19.DEC.2023 20:58:00

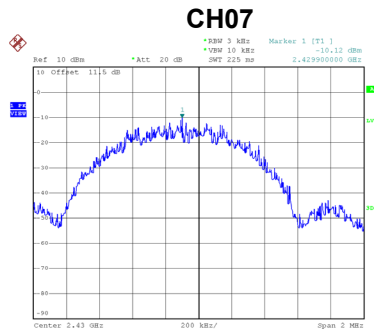
APPENDIX H - POWER SPECTRAL DENSITY

Test Mode	TX Mode _2Mbps
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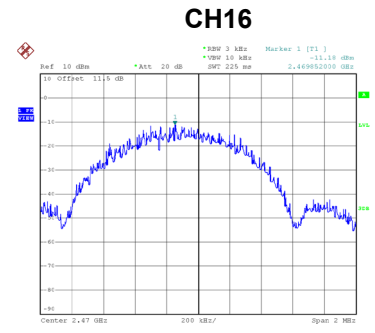
Channel	Frequency (MHz)	Power Spectral Density (dBm/3 kHz)	Max. Limit (dBm/3 kHz)	Test Result
01	2405	-11.54	8.00	Pass
07	2430	-10.12	8.00	Pass
16	2470	-11.18	8.00	Pass



Date: 18,DEC,2023 20:46:41



Date: 18,DEC,2023 20:48:38



Date: 18,DEC,2023 20:58:07

End of Test Report