Nien Made Enterprise Co., Ltd

TEST REPORT

Model:
BMCS-RF

REPORT NUMBER
240200104THC-001

ISSUE DATE
Apr. 16, 2024

PAGES
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DOCUMENT CONTROL NUMBER
GFT-OP-10h (28-Nov-2018)

Radio Spectrum
TEST REPORT

Applicant:	**Nien Made Enterprise Co., Ltd** **23F.-1, No. 98, Shizheng N. 7th Rd., Xitun Dist., Taichung City 407, Taiwan**
Product:	**Motorized cellular shade RF module**
Model No.:	**BMCS-RF**
FCC ID:	**Q3V-BMCS1**
Test Method/ Standard:	**47 CFR FCC Part 15.249 & ANSI C63.10 2013**
Test By:	**Intertek Testing Services Taiwan Ltd.,** **Hsinchu Laboratory** **No. 17, Ln. 246, Niupu S. Rd., Xiangshan Dist,** **Hsinchu City 300075, Taiwan**

Testing Laboratory
0597

Rich Nien
Engineer

Zero Chen
Reviewer

Revision History

Report No.	Issue Date	Revision Summary
240200104THC-001	Apr. 16, 2024	Original report

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Summary of Tests

Test	Reference	Results
Radiated Emission test	15.249(c), 15.209	Pass
Emission on the Band Edge	15.249(d)	Pass
Conducted Emission of AC Power	15.207	N/A
Antenna Requirement	15.203	Pass

Note: Please note that the test results with statement of conformity, the decision rules which are based on: Safety Testing: the specification, standard or IEC Guide 115.
Other Testing: the specification, standard and not taking into account the measurement uncertainty.

1. General Information

1.1 Identification of the EUT

Product:	Motorized cellular shade RF module
Model No.:	BMCS-RF
Operating Frequency:	2415, 2439, 2459MHz
Channel Number:	3 channels
Rated Power:	DC 7.4V from battery
Power Cord:	N/A
Sample receiving date:	2024/01/12
Sample condition:	Workable
Test Date(s):	2024/02/23 ~ 2024/02/26

1.2 Antenna description

Antenna Type: Chip Antenna
Connector Type: Fixed

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Paragraph 15.249 for non-spread spectrum devices.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

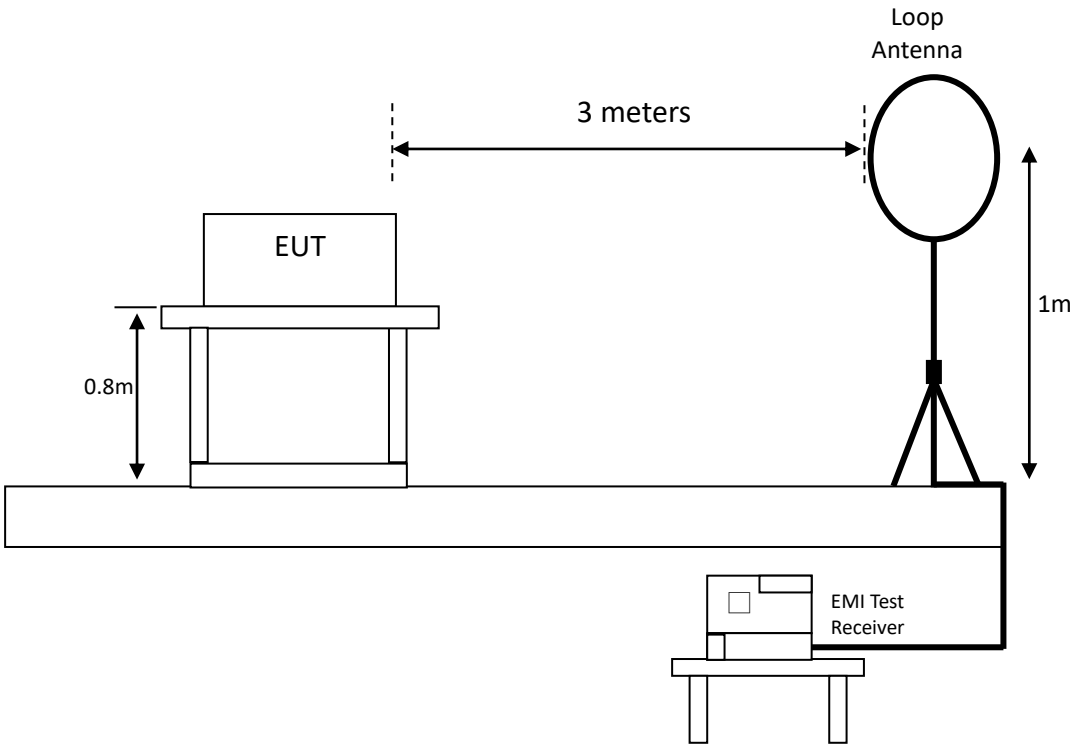
2.2 Operation mode

Connect the EUT to the power supply, control the EUT transmission frequency, and start the test.

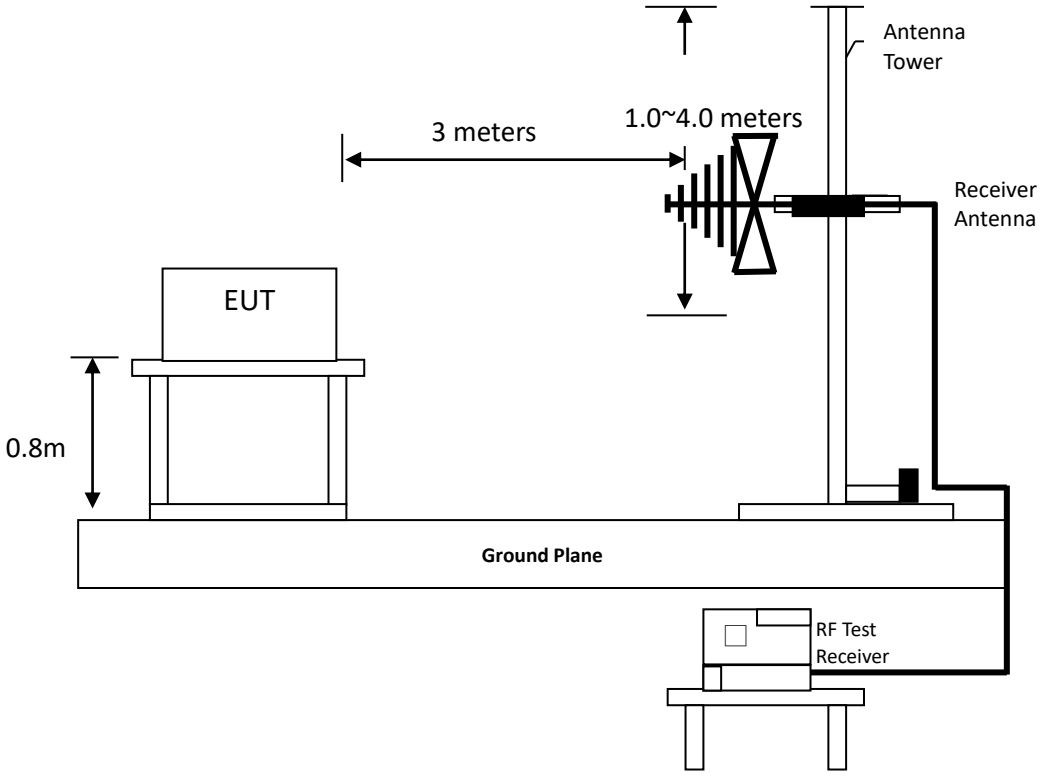
3. Radiated emission test FCC 15.249 (C)

3.1 Test setup & procedure

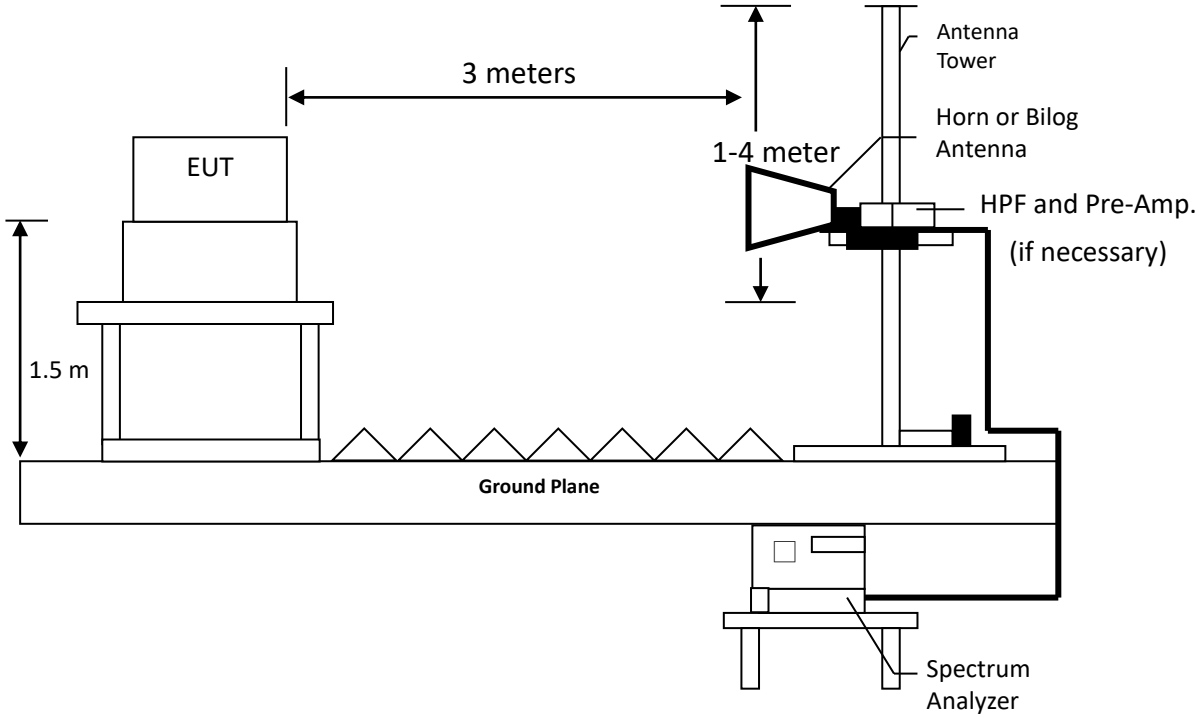
Radiated emission from 9kHz to 30MHz uses Loop Antenna:



Radiated emission below 1GHz using Bilog Antenna



Radiated emission above 1GHz using Horn Antenna



Radiated emissions were invested cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1 MHz RBW/ 3 MHz VBW) recorded also on the report.
The EUT for testing is arranged on a turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

3.2 Emission limit

3.2.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(mV/m@3m)	(dBuV/m@3m)	(uV/m@3m)	(dBuV/m@3m)
2400-2483.5	50	94	500	54

3.3.2 General radiated emission limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

Frequency MHz	15.209 Limits (dBµV/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

3.4 Radiated spurious emission test data

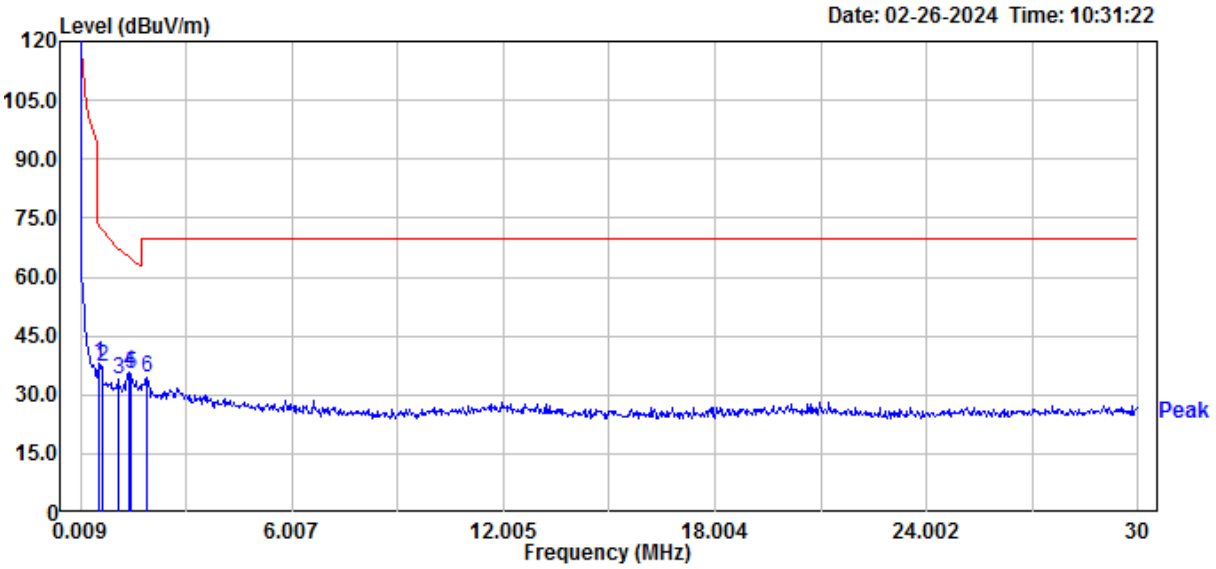
3.4.1 Measurement results: frequency range from 9 kHz to 30 MHz

Temperature:	19	℃
Relative Humidity:	63	%
Test Date:	2024/02/26	

The test was performed on EUT under continuously transmitting mode. The worst case occurred at 2459MHz Z-asix.

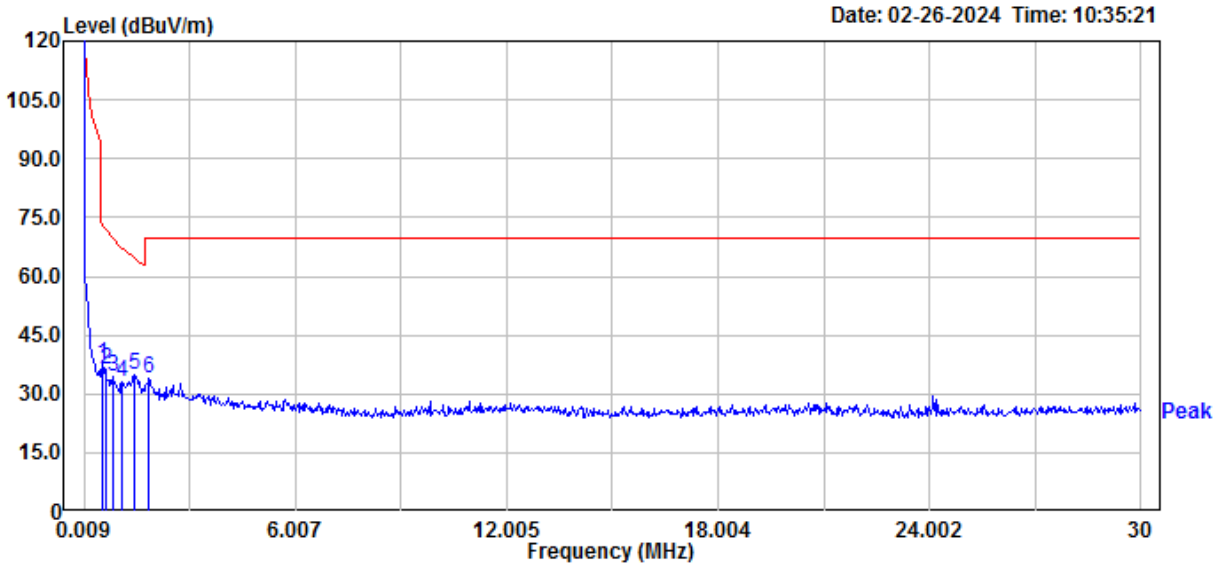
Antenna Polarization	Frequency (MHz)	Detector	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)
Perpendicular	0.519	PK	17.92	20.17	38.09	73.34	-35.25
Perpendicular	0.609	PK	18.03	18.97	37.00	71.93	-34.93
Perpendicular	1.059	PK	18.04	15.95	33.99	67.14	-33.15
Perpendicular	1.359	PK	18.02	17.58	35.60	64.96	-29.36
Perpendicular	1.449	PK	18.02	17.26	35.28	64.40	-29.12
Perpendicular	1.898	PK	17.97	16.36	34.33	69.54	-35.21

Remark: Corr. Factor = Antenna Factor + Cable Loss



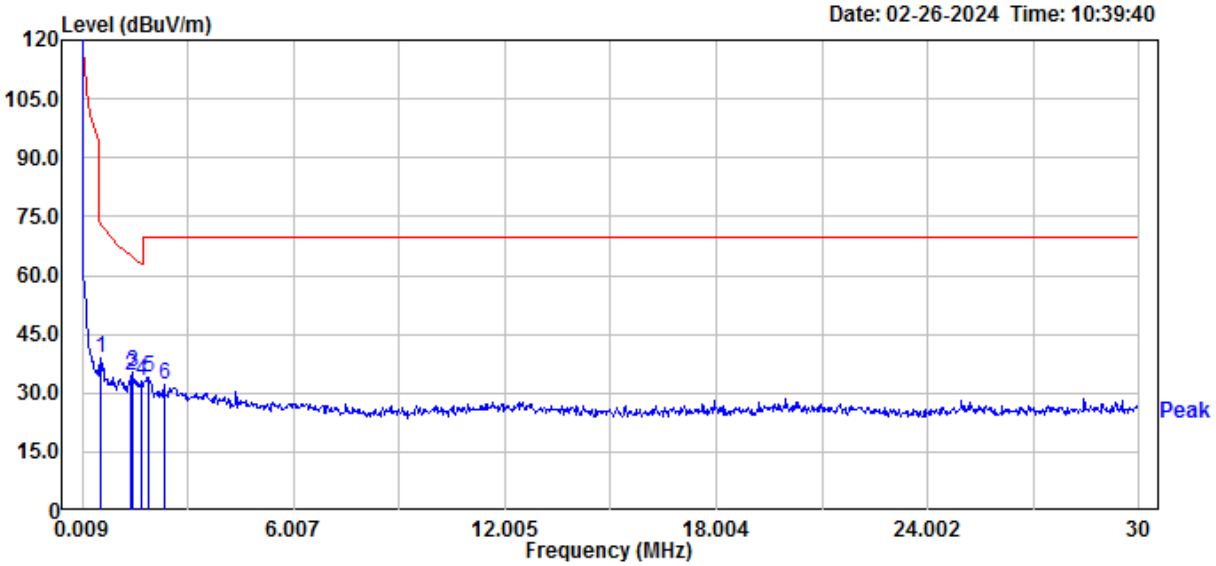
Antenna Polarization	Frequency (MHz)	Detector	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)
Parallel	0.519	PK	17.92	19.57	37.49	73.34	-35.85
Parallel	0.609	PK	18.03	18.05	36.08	71.93	-35.85
Parallel	0.819	PK	18.05	16.21	34.26	69.36	-35.10
Parallel	1.089	PK	18.04	15.09	33.13	66.90	-33.77
Parallel	1.419	PK	18.02	17.03	35.05	64.57	-29.52
Parallel	1.838	PK	17.98	15.81	33.79	69.54	-35.75

Remark: Corr. Factor = Antenna Factor + Cable Loss



Antenna Polarization	Frequency (MHz)	Detector	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)
Ground-parallel	0.519	PK	17.92	21.21	39.13	73.34	-34.21
Ground-parallel	1.359	PK	18.02	16.59	34.61	64.96	-30.35
Ground-parallel	1.419	PK	18.02	17.32	35.34	64.57	-29.23
Ground-parallel	1.659	PK	17.99	15.03	33.02	63.21	-30.19
Ground-parallel	1.868	PK	17.97	16.14	34.11	69.54	-35.43
Ground-parallel	2.318	PK	18.00	14.19	32.19	69.54	-37.35

Remark: Corr. Factor = Antenna Factor + Cable Loss



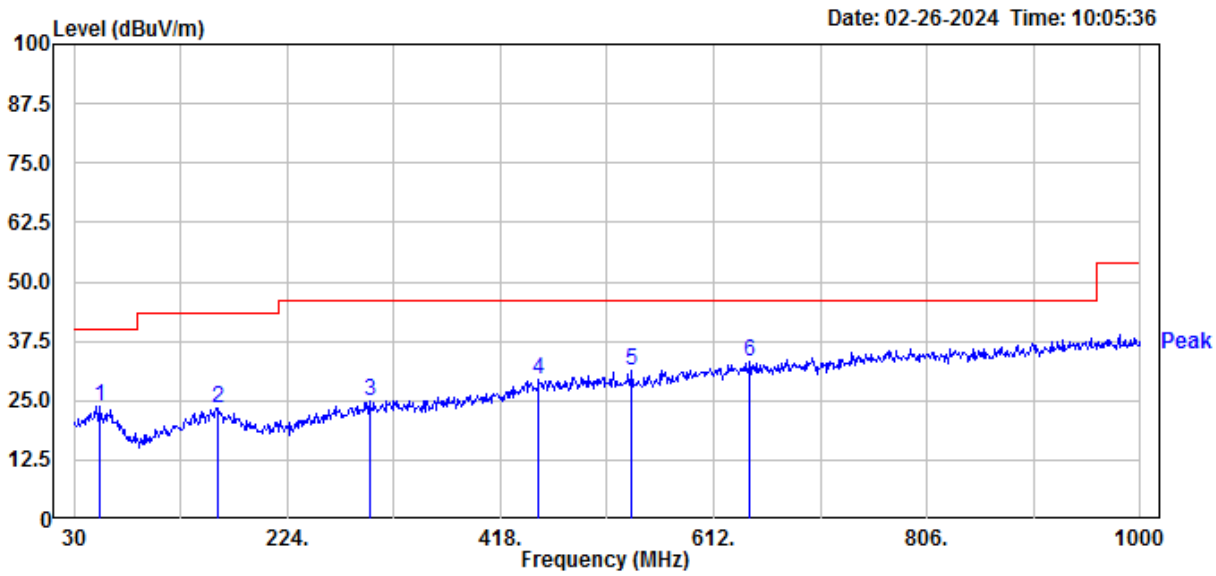
3.4.2 Measurement results: frequencies equal to or less than 1 GHz

Temperature:	19	℃
Relative Humidity:	63	%
Test Date:	2024/02/26	

The worst case occurred at 2459MHz.

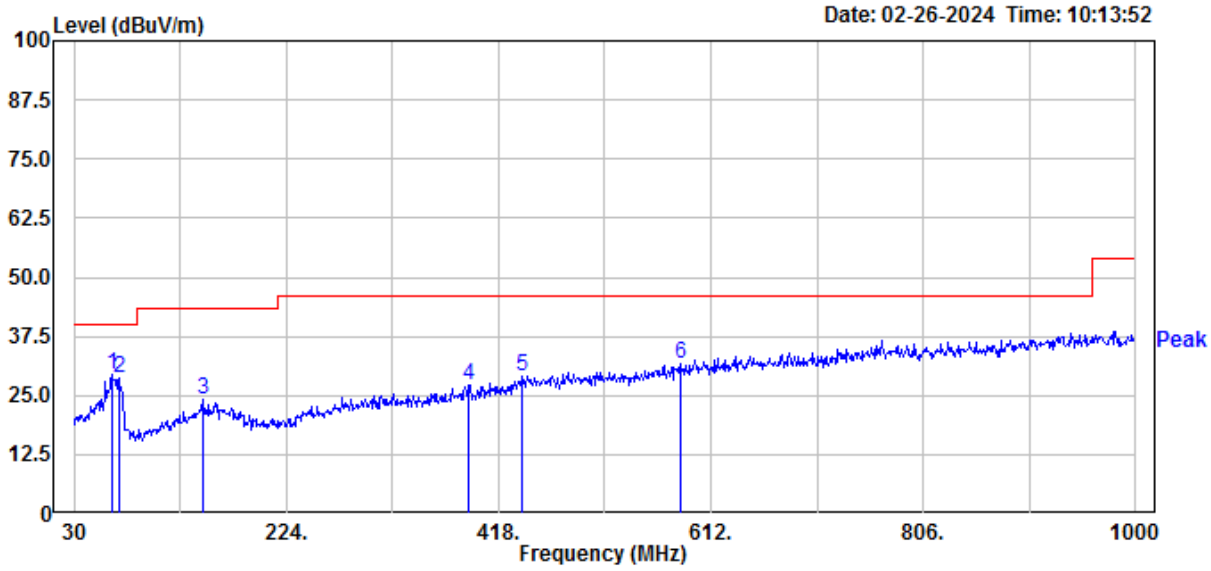
Antenna Polarization	Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)
Horizontal	52.31	PK	20.83	2.95	23.78	40.00	-16.22
Horizontal	160.95	PK	20.64	2.80	23.44	43.50	-20.06
Horizontal	298.69	PK	21.54	3.32	24.86	46.00	-21.14
Horizontal	452.92	PK	25.73	3.84	29.57	46.00	-16.43
Horizontal	537.31	PK	27.13	4.15	31.28	46.00	-14.72
Horizontal	644.98	PK	29.58	3.81	33.39	46.00	-12.61

Remark: Corr. Factor = Antenna Factor + Cable Loss



Antenna Polarization	Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)
Vertical	63.95	PK	19.57	9.80	29.37	40.00	-10.63
Vertical	70.74	PK	18.49	10.34	28.83	40.00	-11.17
Vertical	147.37	PK	20.43	3.81	24.24	43.50	-19.26
Vertical	390.84	PK	24.05	3.27	27.32	46.00	-18.68
Vertical	439.34	PK	25.58	3.60	29.18	46.00	-16.82
Vertical	583.87	PK	28.45	3.27	31.72	46.00	-14.28

Remark: Corr. Factor = Antenna Factor + Cable Loss



3.4.3 Measurement results: frequency above 1GHz

Temperature:	22	℃
Relative Humidity:	67	%
Test Date:	2024/2/23	

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)
Channel Low	4830	PK	H	-7.06	48.40	41.34	74.00	-32.66
	4830	PK	V	-7.06	50.31	43.25	74.00	-30.75
Channel Middle	4878	PK	H	-7.15	47.62	40.47	74.00	-33.53
	7317	PK	H	1.20	45.10	46.30	74.00	-27.70
	4878	PK	V	-7.15	51.35	44.20	74.00	-29.80
Channel High	4918	PK	H	-7.12	46.38	39.26	74.00	-34.74
	7377	PK	H	1.39	45.54	46.93	74.00	-27.07
	4918	PK	V	-7.12	49.57	42.45	74.00	-31.55

Remark: 1. Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain
2. The emissions were very low against the limit above 18 GHz.

4.4.4 Measurement results: Fundamental

Temperature:	22	℃
Relative Humidity:	67	%
Test Date:	2024/02/23	

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)
2415	PK	H	34.44	69.08	103.52	114.00	-10.48
	AV	H	---	---	79.17	94.00	-14.83
	PK	V	34.44	65.18	99.62	114.00	-14.38
	AV	V	---	---	75.27	94.00	-18.73
2439	PK	H	34.42	68.30	102.72	114.00	-11.28
	AV	H	---	---	78.37	94.00	-15.63
	PK	V	34.42	65.05	99.47	114.00	-14.53
	AV	V	---	---	75.12	94.00	-18.88
2459	PK	H	34.43	68.76	103.19	114.00	-10.81
	AV	H	---	---	78.84	94.00	-15.16
	PK	V	34.43	64.76	99.19	114.00	-14.81
	AV	V	---	---	74.84	94.00	-19.16

Remark:1. Correction Factor = Antenna Factor + Cable Loss-Pre Amp
2. AV Corrected Reading = PK Corrected Reading + Duty cycle correction factor(-24.35)

5. Radiated emission on the band edge FCC 15.249(d)

5.1 Operating environment

Temperature:	22	℃
Relative Humidity:	67	%
Test Date:	2024/2/23	

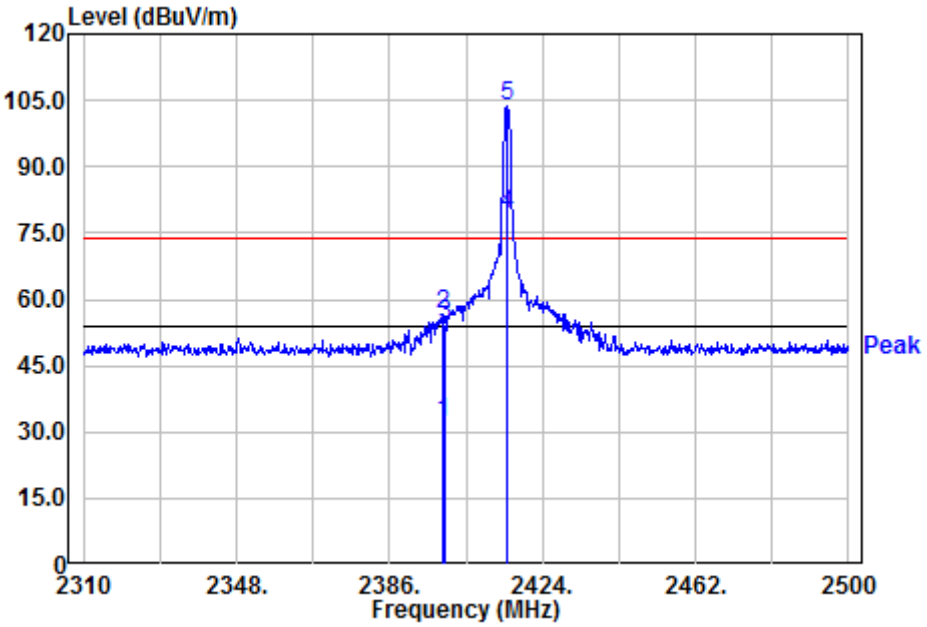
5.2 Radiated emission on the band edge test data

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

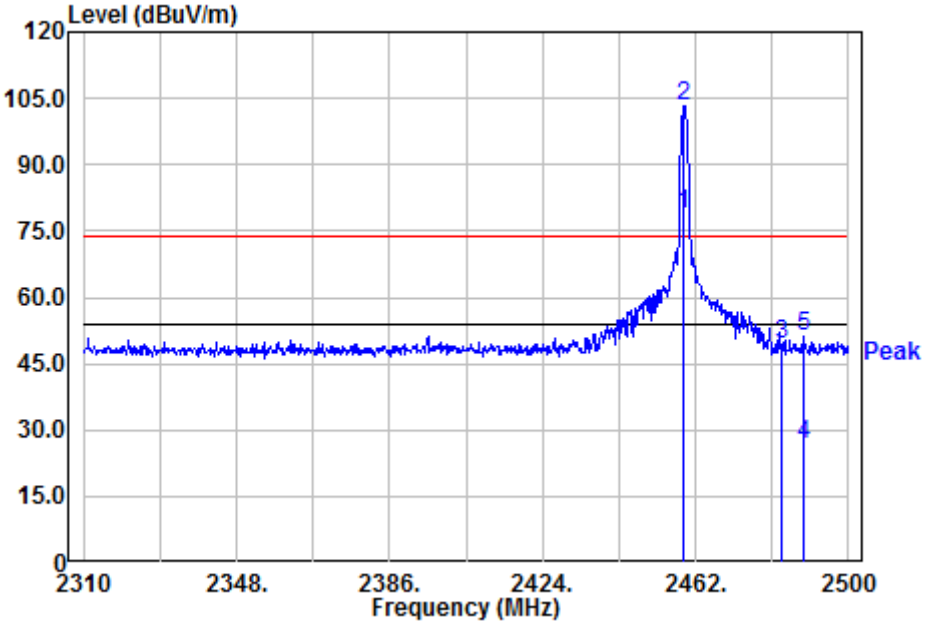
Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)	Restricted band (MHz)
Channel Low	2399.11	PK	H	34.45	21.99	56.44	74	-17.56	2310~2400
	2399.11	AV	H	-	-	32.09	54	-21.91	
Channel High	2488.98	PK	H	34.47	16.62	51.09	74	-22.91	2483.5~2500
	2488.98	AV	H	-	-	26.74	54	-27.26	

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain

Restricted Band Bandedge @ Low Ch TX PK



Restricted Band Bandedge @ High Ch TX PK



6. Conducted emission test FCC 15.207

Since the EUT is not connected to AC source, therefore, the test can be waived.

Appendix A: Test equipment list

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	KEYSIGHT	N9038B	MY63060107	2024/03/06	2025/03/05
Spectrum analyzer	KEYSIGHT	N9020B	MY63450146	2024/03/05	2025/03/04
Signal Analyzer	Agilent	N9030A	MY51380492	2023/07/17	2024/07/16
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-067	2024/01/16	2025/01/15
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-172	2024/01/02	2025/01/01
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-456	2023/12/27	2024/12/26
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170159	2023/09/01	2024/08/31
Pre-Amplifier	SGH	SGH118(45dB)	20220105-1	2024/01/23	2025/01/22
Pre-amplifier	SGH	SGH184	20201124-1	2023/10/31	2024/10/30
966-2(A) Cable	SUHNER	SUCOFLEX 104	295105/4	2024/03/02	2025/03/02
966-2(B) Cable	SUHNER	SUCOFLEX 104P	CB0005	2024/03/02	2025/03/02
RF Cable	SUHNER	SUCOFLEX 104P	9403 / 4P	2023/11/24	2024/11/23
Hight Pass Filter	Wainwright	WHKX3.0/18G-12SS	N/A	2023/05/24	2024/05/23
Power Meter	Anritsu	ML2495A	0844001	2024/01/08	2025/01/07
Power Sensor	Anritsu	MA2491A	031543	2024/01/08	2025/01/07
20dB Attenuator	PE	PE7001-20	N/A	2023/05/24	2024/05/23
966-2_3m Semi-Anechoic Chamber	966_2	CEM-966_2	N/A	2023/08/01	2024/07/31
Test software	Audix	e3	V9	NCR	NCR

Note: No Calibration Required (NCR).

Appendix B: Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of *k*=2.

Item	Uncertainty
Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m	2.73 dB
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	3.91 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	3.49 dB
Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	3.71 dB
Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	3.71 dB
Conducted Measurement	0.69 dB
AC Conducted Emission	1.31 dB