FCC/ISED - TEST REPORT

Report Number	:	**709502409690-00D**	Date of Issue: December 20, 2024

Model	:	CM-06-E-R, CM-06-E-V
Product Type	:	Tubular motor
Applicant	:	Coulisse B.V.
Address	:	Vonderweg 48 Enter, 7468 DC Netherlands
Manufacturer	:	Coulisse B.V.
Address	:	Vonderweg 48 Enter, 7468 DC Netherlands

Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	46

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1 Table of Contents

1 Table of Contents 2
2 Report Modification Record 3
3 Details about the Test Laboratory 3
4 Description of the Equipment under Test 4
5 Summary of Test Standards 6
6 Summary of Test Results 7
7 General Remarks 8
8 Test Setups 9
9 Systems test configuration 12
10 Technical Requirement 13
10.1 Conducted Emission 13
10.2 Conducted peak output power and e.i.r.p. 18
10.3 6dB bandwidth and 99% Occupied Bandwidth 20
10.4 Power spectral density 23
10.5 Spurious RF conducted emissions 25
10.6 Band edge 29
10.7 Spurious radiated emissions for transmitter 32
11 Test Equipment List 43
12 System Measurement Uncertainty 44
13 Photographs of Test Set-ups 45
14 Photographs of EUT 46

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2 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
709502409690-00D	First Issue	12/20/2024

3 Details about the Test Laboratory

Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
Telephone:	+86 21 6141 0123
Fax:	+86 21 6140 8600
FCC Registration No.:	820234
FCC Designation Number:	CN1183
ISED CAB identifier	CN0101
IC Registration No.:	31668

4 Description of the Equipment under Test

Product: Tubular Motor

PMN / HVIN / Model no.: CM-06-E-R, CM-06-E-V

FCC ID: ZY4CM06E1

IC: 28177-CM06E1

Options and accessories: NA

Rating: Input USB-C 5V

RF Transmission Frequency: 433.92MHz;
2402~2480 MHz (BLE5.0); 2405~2480 MHz (Thread)

No. of Operated Channel:

Operation Frequency each of channel for BLE							
Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

Operation Frequency each of channel for thread			
Channel	Frequency	Channel	Frequency
11	2405 MHz	19	2445 MHz
12	2410 MHz	20	2450 MHz
13	2415 MHz	21	2455 MHz
14	2420 MHz	22	2460 MHz
15	2425 MHz	23	2465 MHz
16	2430 MHz	24	2470 MHz
17	2435 MHz	25	2475 MHz
18	2440 MHz	26	2480 MHz

Modulation: 2.4GHz BLE: GFSK; 433.92MHz: FSK; Thread: O-QPSK

Hardware Version: E1

Software Version: E1

Antenna Type: 2.4GHz BLE/Thread: Line antenna; 433.92MHz: Line antenna

Antenna Gain:	2.4GHz BLE/Thread:2.2 dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Tubular motor which supports 433.92MHz transceiver,2.4GHz BLE and 2.4GHz thread. There are two models in all. Both of them have the same electrical construction, only difference is the model name. We chose model CM-06-E-R to perform all tests and listed the worst data in this report.
Test sample no.:	SHA-866063-2 (RF Radiated and Conducted)

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.

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5 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2023 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5 April 2018 + Amendment 1 March 2019 + Amendment 2 February 2021	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 3 August 2023	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10-2020.

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6 Summary of Test Results

Technical Requirements							
FCC Part 15 Subpart C & RSS-247 Issue 3/RSS-Gen Issue 5							
Test Condition			Pages	Test Site	Test Result		
					Pass	Fail	N/A
§15.207	RSS-GEN 8.8	Conducted emission AC power port	13-17	Site 1	☒	☐	☐
§15.247 (b) (3)	RSS-247 5.4(d)	Conducted peak output power & e.i.r.p	18-19	Site 1	☒	☐	☐
§15.247(a)(1)	RSS-247 5.1(a) & RSS-Gen 6.7	20dB bandwidth and 99% Occupied Bandwidth	---	---	☐	☐	☒
§15.247(a)(1)	RSS-247 5.1(b)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii)	RSS-247 5.1(d)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii)	RSS-247 5.1(d)	Dwell Time - Average Time of Occupancy	---	---	☐	☐	☒
§15.247(a)(2)	RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth and 99% Occupied Bandwidth	20-22	Site 1	☒	☐	☐
§15.247(e)	RSS-247 5.2(b)	Power spectral density	23-24	Site 1	☒	☐	☐
§15.247(e)	RSS-247 5.5	Spurious RF conducted emissions	25-28	Site 1	☒	☐	☐
§15.247(d)	RSS-247 5.5	Band edge	29-31	Site 1	☒	☐	☐
§15.247(d) & §15.209 & §15.205	RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	32-42	Site 1	☒	☐	☐
§15.203	RSS-Gen 6.8	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses line antenna, which gain is 2.2dBi for 2.4GHz BLE and thread.
In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

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7 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: ZY4CM06E1, IC: 28177-CM06E1 complies with Section 15.207,15.209,15.247 of the FCC Part 15, Subpart C rules and RSS-247, RSS-GEN.

This report in only for 2.4GHz Thread.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

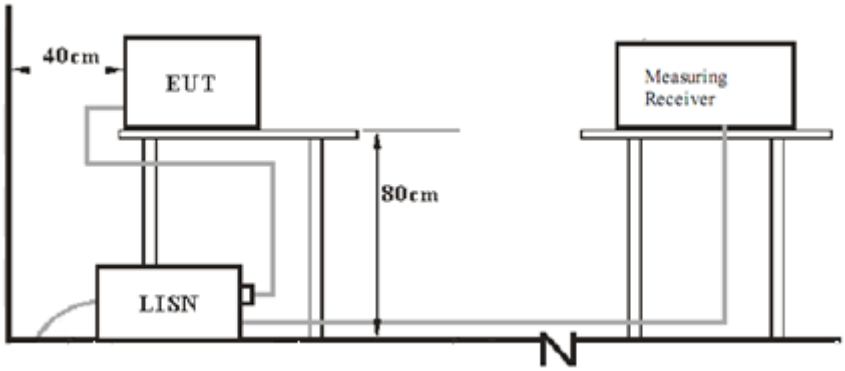
Sample Received Date:	November 12, 2024
Testing Start Date:	November 14, 2024
Testing End Date:	December 16, 2024

-TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:	Prepared by:	Tested by:
Hui TONG	Jiaxi XU	Tianji XU
Review Engineer	Project Engineer	Test Engineer

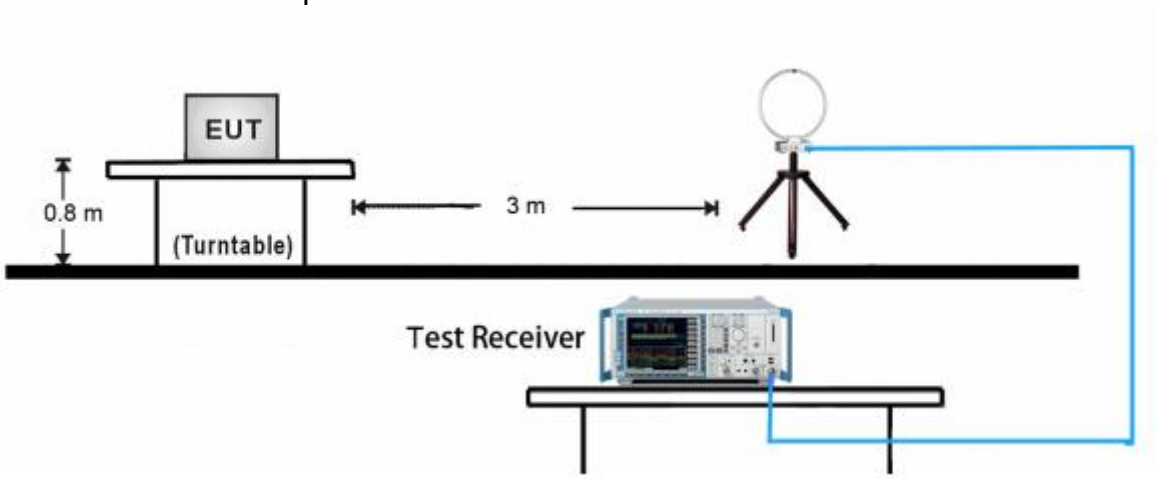
8 Test Setups

8.1 AC Power Line Conducted Emission test setups



8.2 Radiated test setups

9kHz ~ 30MHz Test Setup:



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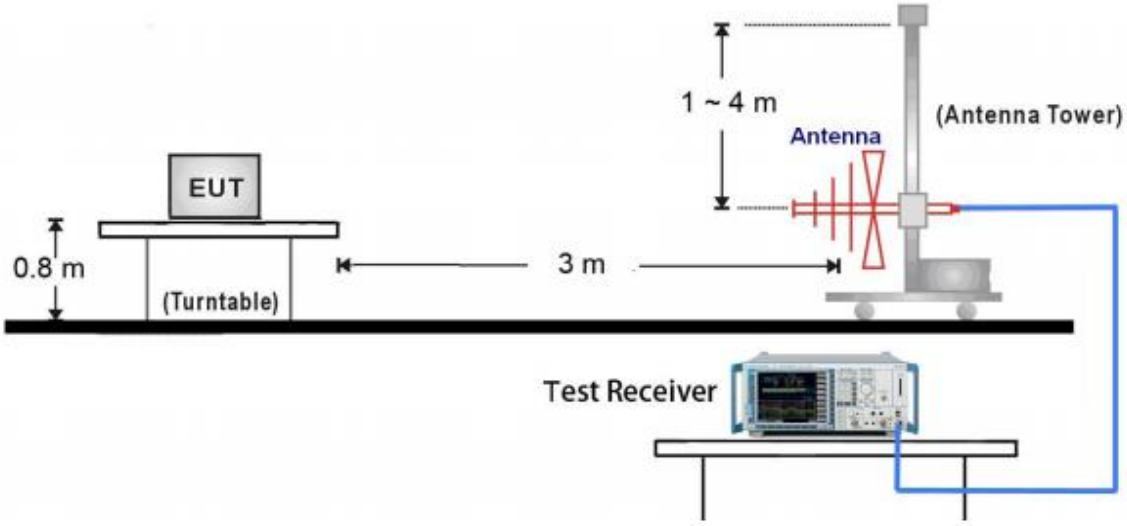
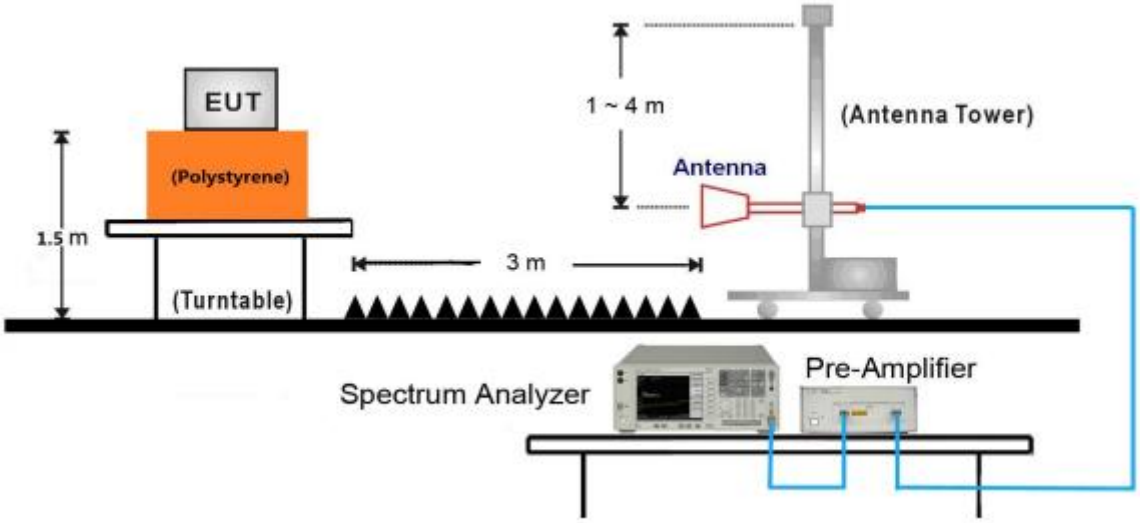
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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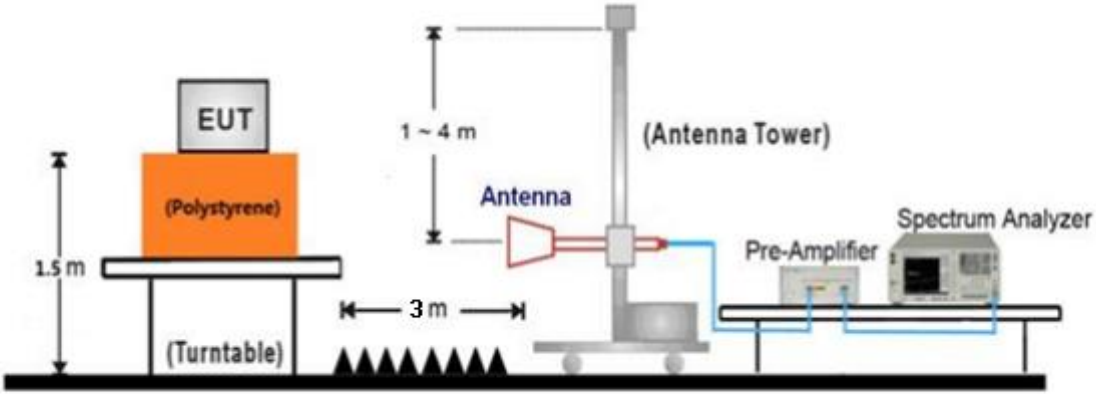
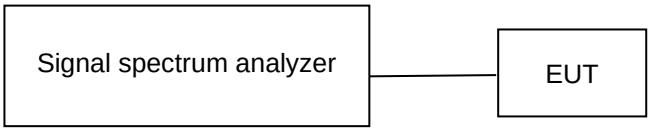
18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups



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9 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenovo	E470	PF-OU5TS7 17/09
AC/DC adapter	MLF	MLF-A260502000UU	--

Test software: secureCRT, which used to control the EUT in continues transmitting mode.

The system was configured to channel 11, 18, and 26 for the test.

Test Mode Applicability and Tested Channel Detail:

Mode	Tested Channel	Modulation	Power level setting
Thread	11	O-QPSK	0
	18	O-QPSK	0
	26	O-QPSK	0

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

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10 Technical Requirement

10.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

According to §15.207 & RSS-GEN 8.8, conducted emissions limit as below:

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

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Conducted Emission

150k-30MHz Conducted Emission Test

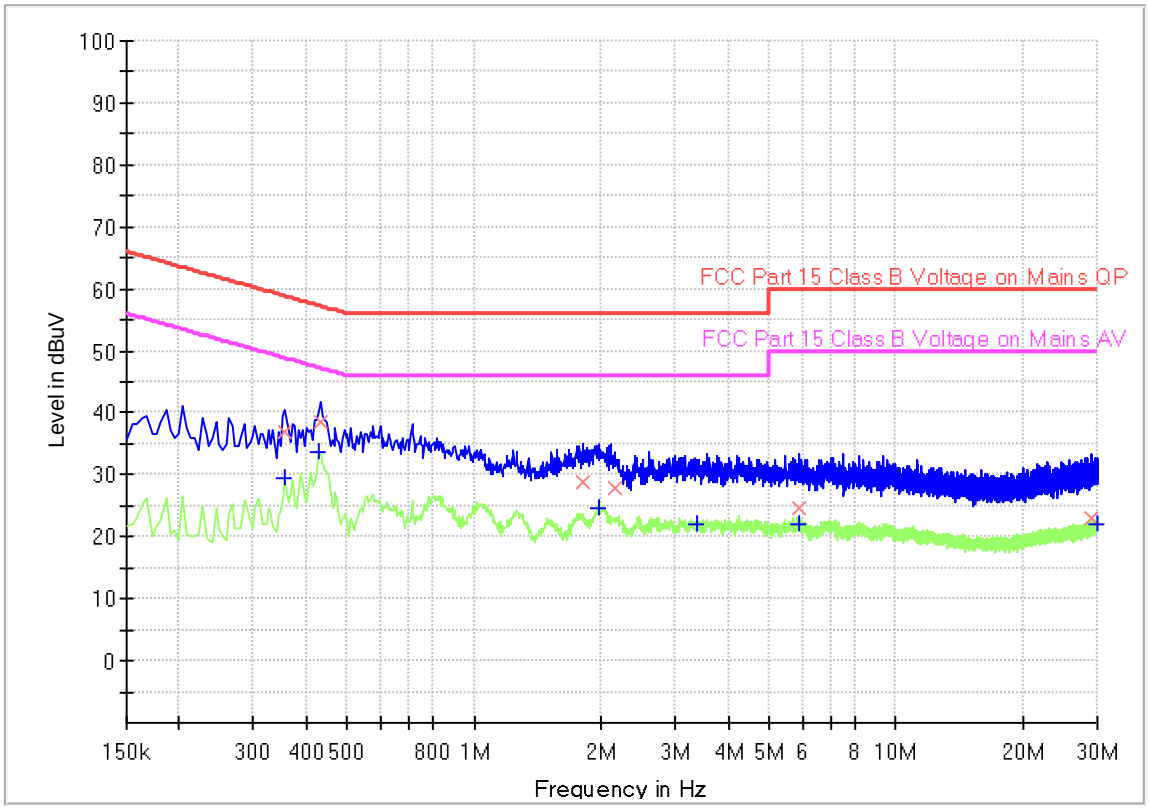
EUT Information

EUT Name:	Tubular motor
Model:	CM-06-E-R
Client:	Coulisse B.V
Op Cond:	Power on and charging mode, TX at 2405MHz
Operator:	Tianji Xu
Test Spec:	FCC part 15.207(a)
Comment:	Phase L
Sample No:	SHA-866063-2

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup:	Voltage with 2-Line-LISN
Receiver:	[ESR 3]
Level Unit:	dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB



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Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.357000	---	29.50	48.80	19.30	1000.0	9.000	L1	19.5
0.357000	36.96	---	58.80	21.84	1000.0	9.000	L1	19.5
0.429000	---	33.75	47.27	13.52	1000.0	9.000	L1	19.5
0.433500	38.44	---	57.19	18.75	1000.0	9.000	L1	19.5
1.815000	28.74	---	56.00	27.26	1000.0	9.000	L1	19.5
1.977000	---	24.61	46.00	21.39	1000.0	9.000	L1	19.5
2.148000	27.77	---	56.00	28.23	1000.0	9.000	L1	19.5
3.372000	---	22.09	46.00	23.91	1000.0	9.000	L1	19.5
5.869500	---	22.13	50.00	27.87	1000.0	9.000	L1	19.6
5.910000	24.77	---	60.00	35.23	1000.0	9.000	L1	19.6
28.968000	23.10	---	60.00	36.90	1000.0	9.000	L1	21.0
29.935500	---	21.95	50.00	28.05	1000.0	9.000	L1	21.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

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150k-30MHz Conducted Emission Test

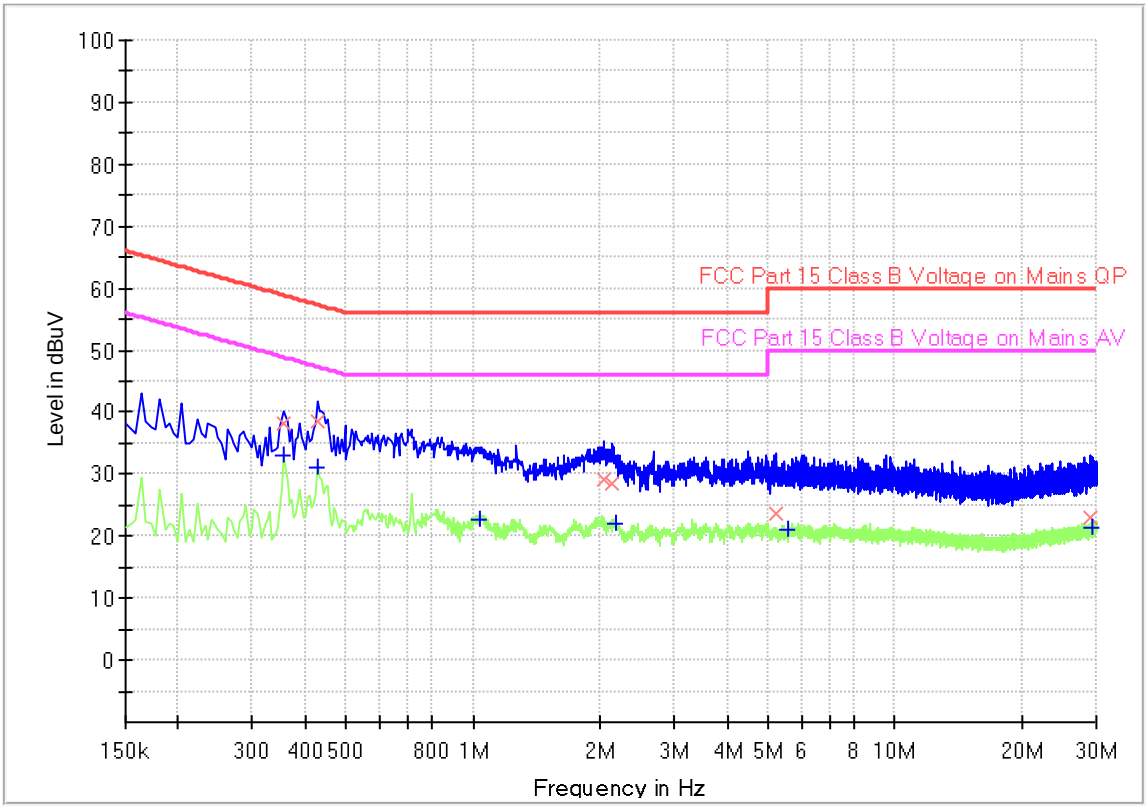
EUT Information

EUT Name:	Tubular motor
Model:	CM-06-E-R
Client:	Coulisse B.V
Op Cond:	Power on and charging mode, TX at 2405MHz
Operator:	Tianji Xu
Test Spec:	FCC part 15.207(a)
Comment:	Phase N
Sample No:	SHA-866063-2

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup:	Voltage with 2-Line-LISN
Receiver:	[ESR 3]
Level Unit:	dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB



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Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.357000	---	32.92	48.80	15.88	1000.0	9.000	N	19.4
0.357000	38.09	---	58.80	20.71	1000.0	9.000	N	19.4
0.429000	---	31.12	47.27	16.15	1000.0	9.000	N	19.5
0.429000	38.60	---	57.27	18.67	1000.0	9.000	N	19.5
1.041000	---	22.83	46.00	23.17	1000.0	9.000	N	19.5
2.040000	29.11	---	56.00	26.89	1000.0	9.000	N	19.5
2.143500	28.34	---	56.00	27.66	1000.0	9.000	N	19.5
2.170500	---	22.01	46.00	23.99	1000.0	9.000	N	19.5
5.226000	23.74	---	60.00	36.26	1000.0	9.000	N	19.6
5.595000	---	20.90	50.00	29.10	1000.0	9.000	N	19.6
29.130000	23.07	---	60.00	36.93	1000.0	9.000	N	20.8
29.332500	---	21.32	50.00	28.68	1000.0	9.000	N	20.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

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10.2 Conducted peak output power and e.i.r.p.

Test Method

1. Use the following spectrum analyzer settings:
   RBW > the 6 dB bandwidth of the emission being measured, VBW≥3RBW, Span≥3RBW
   Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

Limits

According to §15.247 (b) (3) & RSS-247 5.4(d) conducted peak output power limit as below:

	Frequency Range	**Limit**	**Limit**
	MHz	**W**	**dBm**
Conducted peak output power	2400-2483.5	≤1	≤30
e.i.r.p.	2400-2483.5	≤4	≤36

Test result as below table

Antenna gain=2.2dBi				
Frequency MHz	Conducted Peak Output Power(dBm) §15.247 (b) (3)	Result	e.i.r.p.(dBm) RSS-247 5.4(d)	Result
2405MHz	-0.89	Pass	1.31	Pass
2440MHz	-1.23	Pass	0.97	Pass
2480MHz	-1.41	Pass	0.79	Pass

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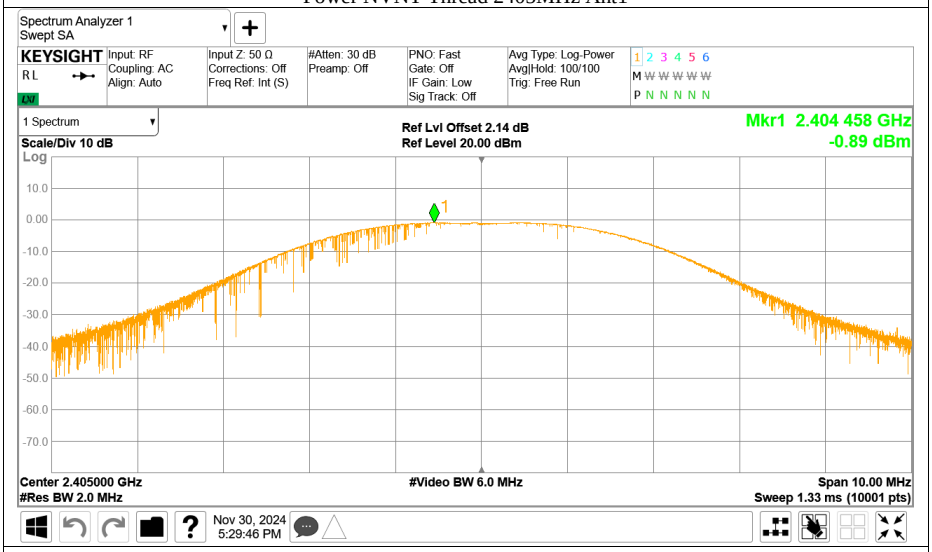
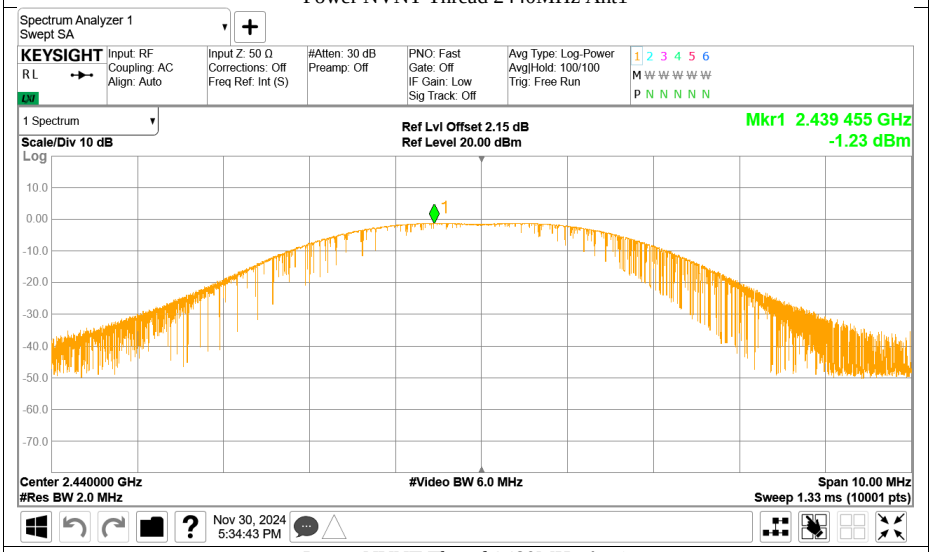
Test Graphs

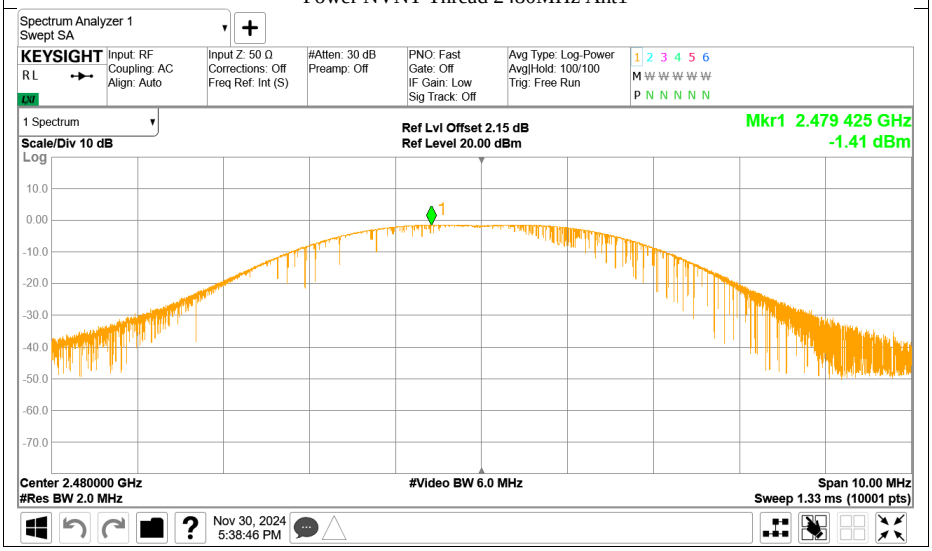
Power NVNT Thread 2405MHz Ant1



Power NVNT Thread 2440MHz Ant1



Power NVNT Thread 2480MHz Ant1



10.3 6dB bandwidth and 99% Occupied Bandwidth

Test Method

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   RBW=100KHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Use the automatic bandwidth measurement capability of an instrument, use the X dB bandwidth mode with X set to 6 dB.
5. Allow the trace to stabilize, record the 6 dB Bandwidth value.

Test Method for 99 % Bandwidth

1. Connect EUT test port to spectrum analyzer.
   Use the following spectrum analyzer settings:
   RBW=1% to 5% of the actual occupied, VBW≥3RBW, Sweep = auto,
   Detector function = peak, Trace = max hold
2. Use the occupied bandwidth measurement capability of test receiver.
3. Allow the trace to stabilize, record the occupied bandwidth value.

Limit

6dB bandwidth Limit [kHz]	99% bandwidth Limit [kHz]
≥500	--

Test result

Frequency MHz	6dB bandwidth (MHz)		Result	99% occupied bandwidth MHz
	result	limit	verdict	
2405	1.42	≥0.5	Pass	2.281
2440	1.479	≥0.5	Pass	2.263
2480	1.386	≥0.5	Pass	2.295

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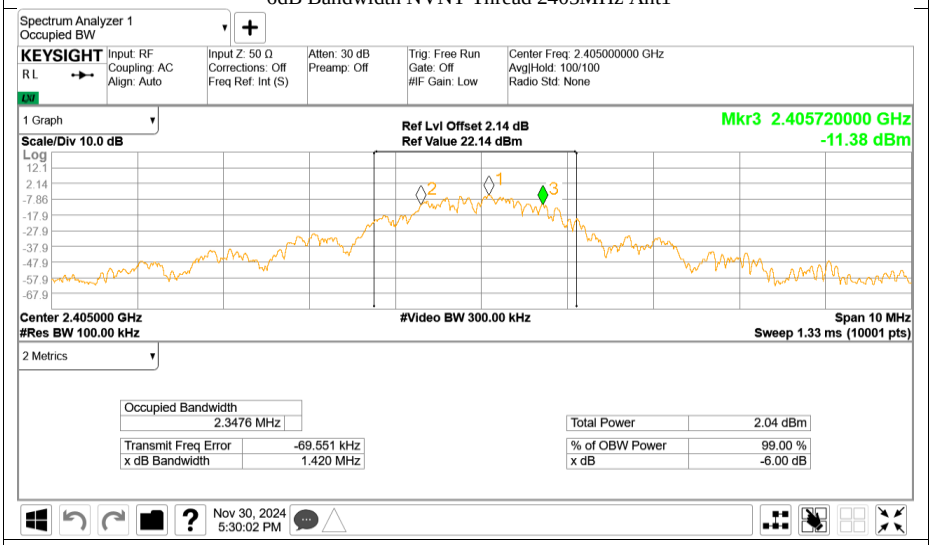
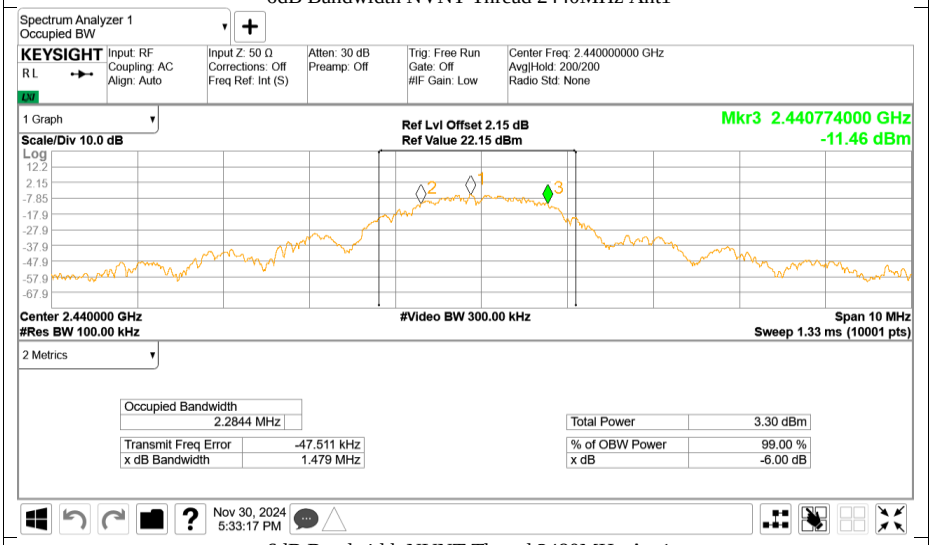
6dB Bandwidth

Test Graphs

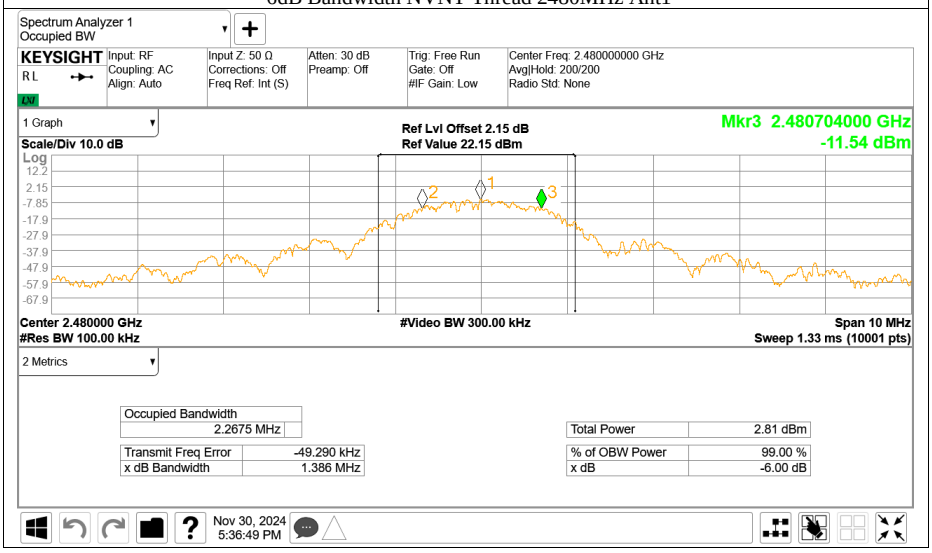
-6dB Bandwidth NVNT Thread 2405MHz Ant1



-6dB Bandwidth NVNT Thread 2440MHz Ant1



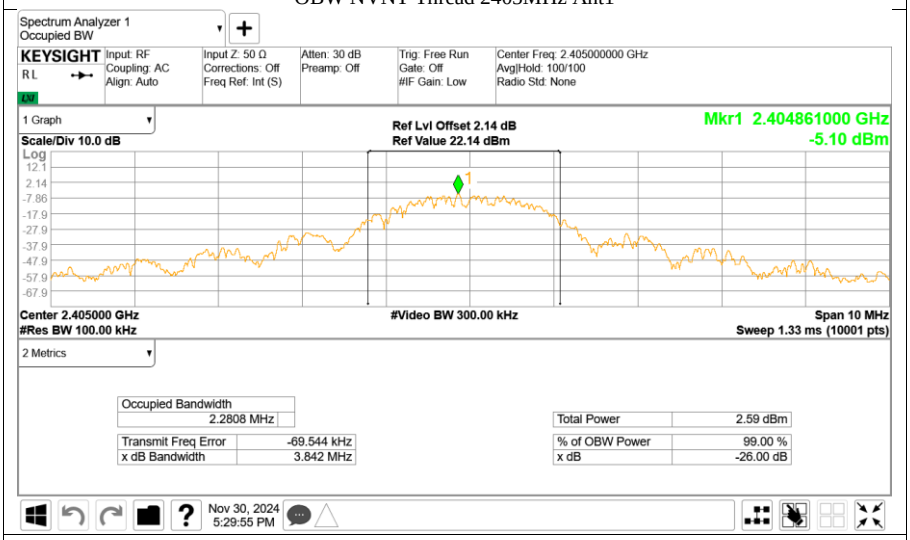
-6dB Bandwidth NVNT Thread 2480MHz Ant1



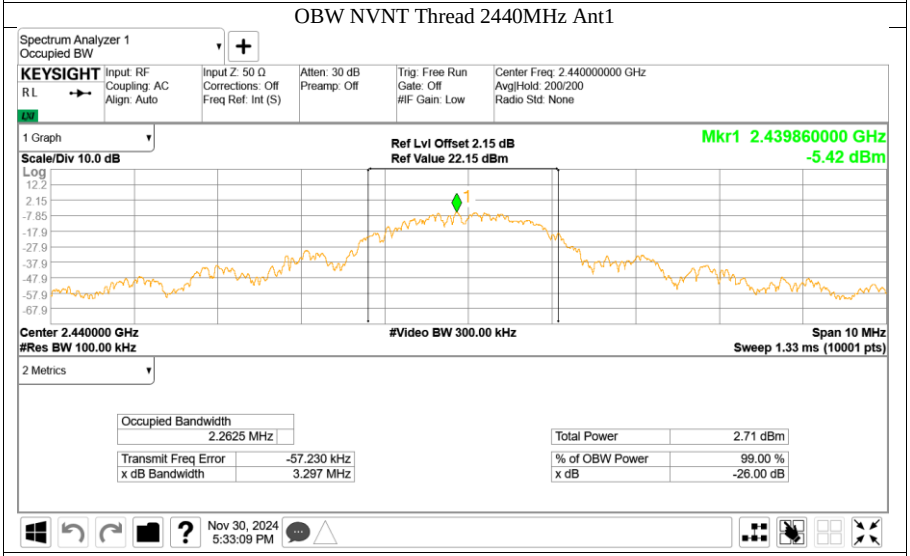
99% Occupied Bandwidth

Test Graphs

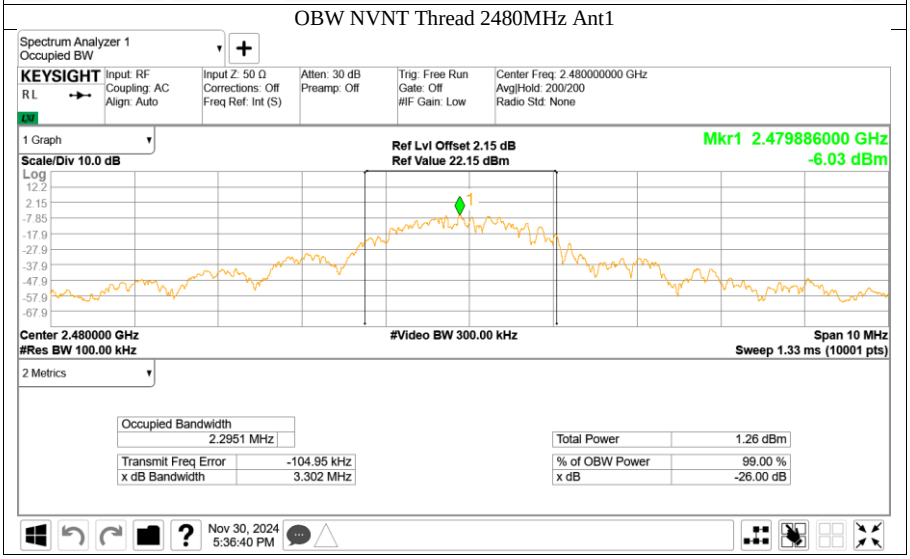
OBW NVNT Thread 2405MHz Ant1



OBW NVNT Thread 2440MHz Ant1



OBW NVNT Thread 2480MHz Ant1



10.4 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
4. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
5. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
6. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3kHz]
⩽8

Test result

Data transmission rate	Frequency	Power spectral density	Result
1Mbps	MHz	dBm/3kHz	
	Top channel 2405MHz	-15.96	Pass
	Middle channel 2440MHz	-15.53	Pass
	Bottom channel 2480MHz	-17.18	Pass

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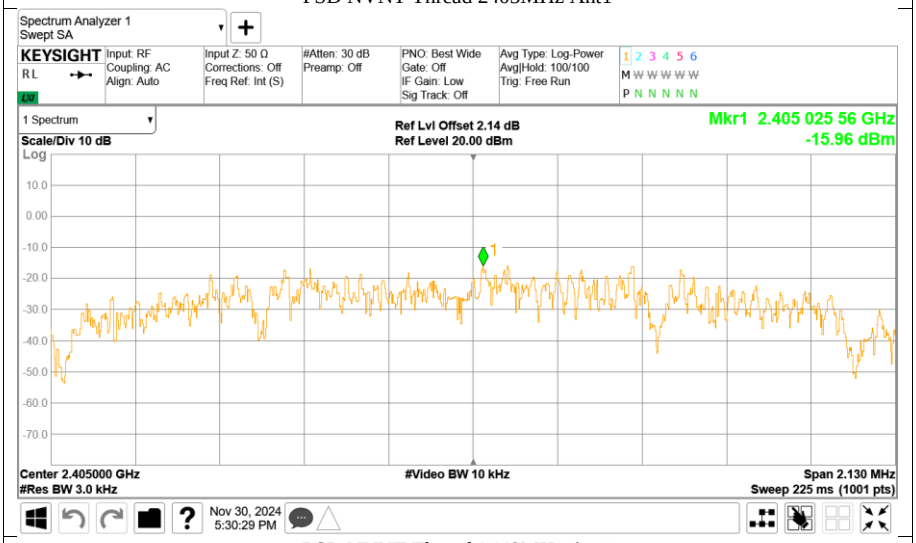
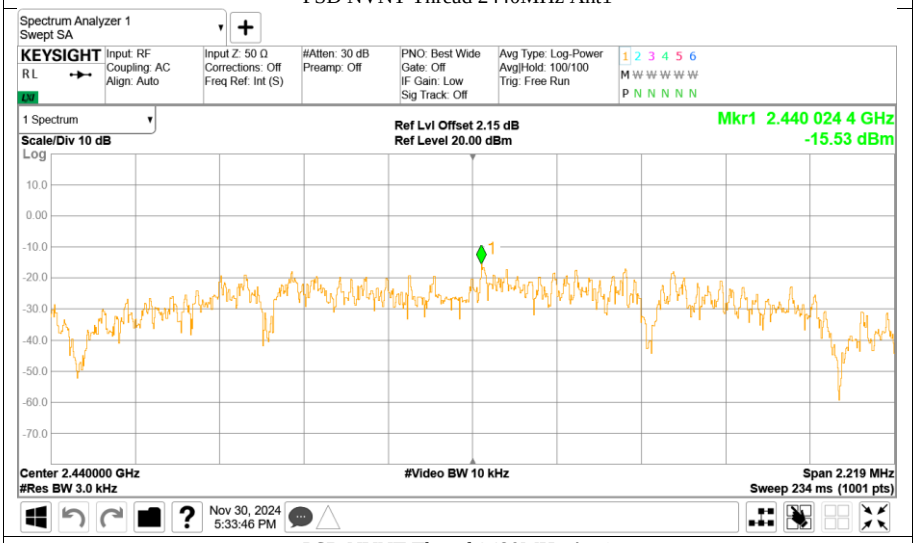
Power spectral density

Test Graphs

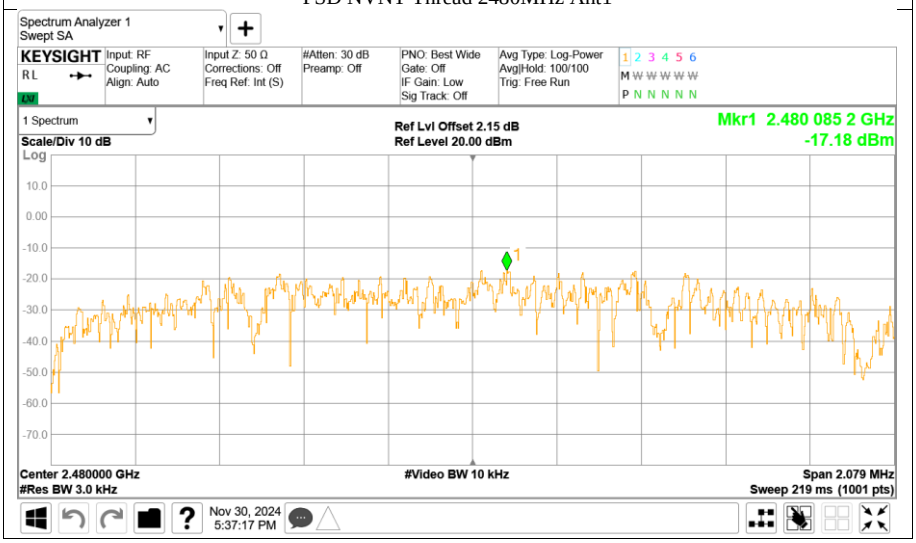
PSD NVNT Thread 2405MHz Ant1



PSD NVNT Thread 2440MHz Ant1



PSD NVNT Thread 2480MHz Ant1



10.5 Spurious RF conducted emissions

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

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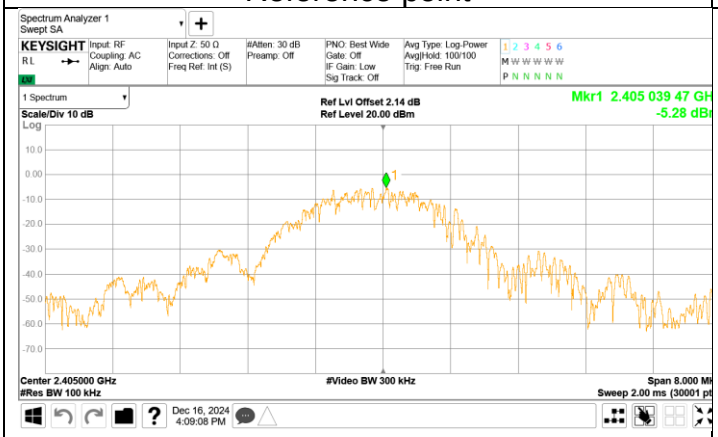
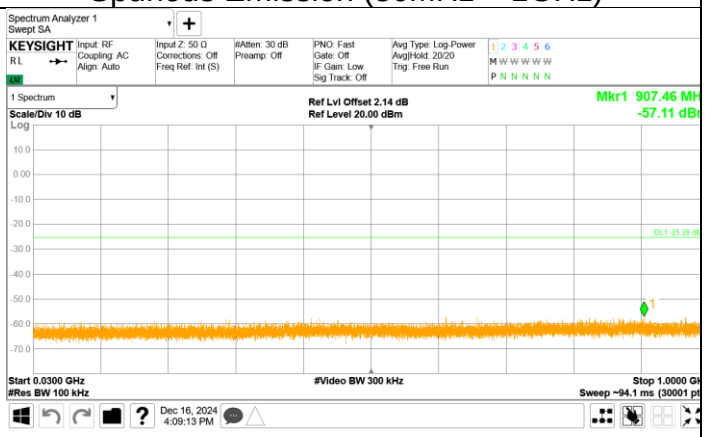
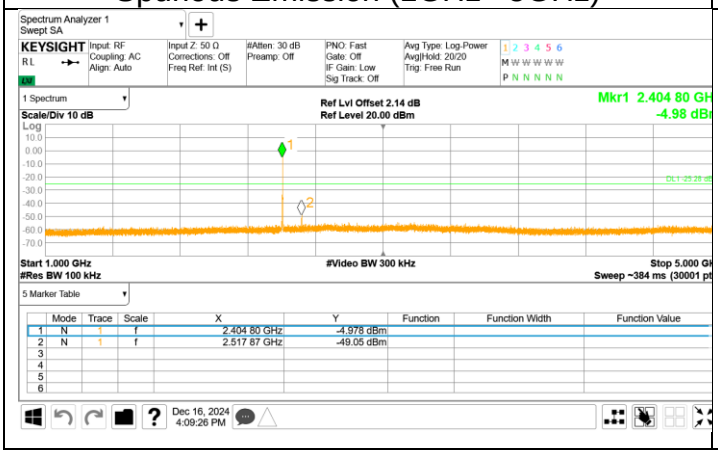
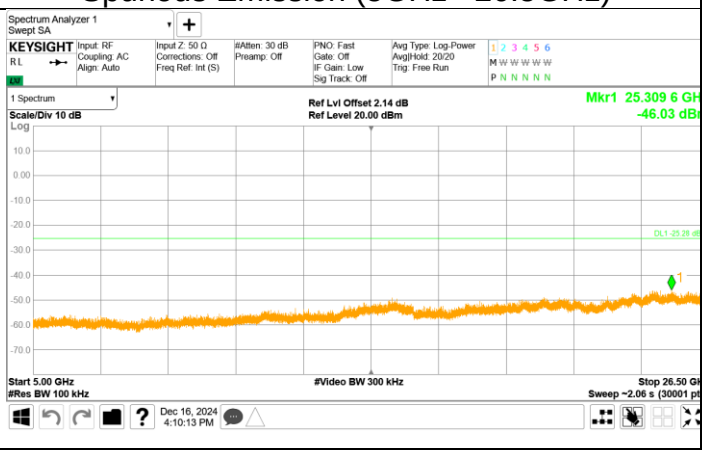
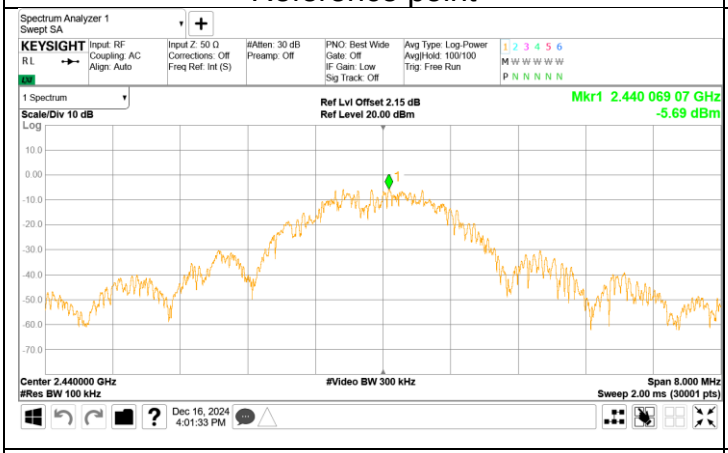
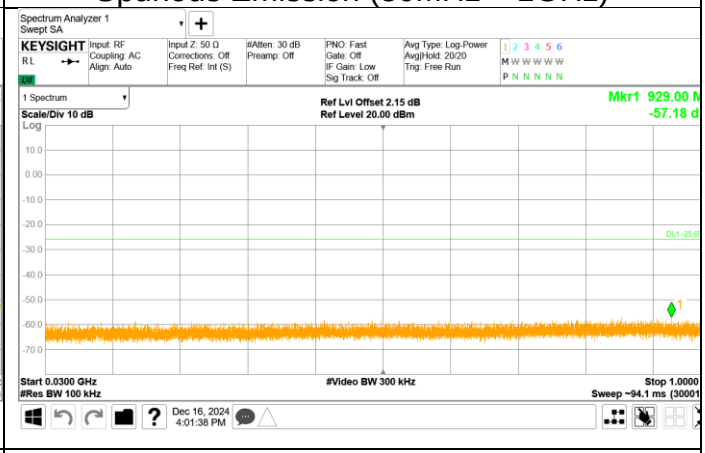
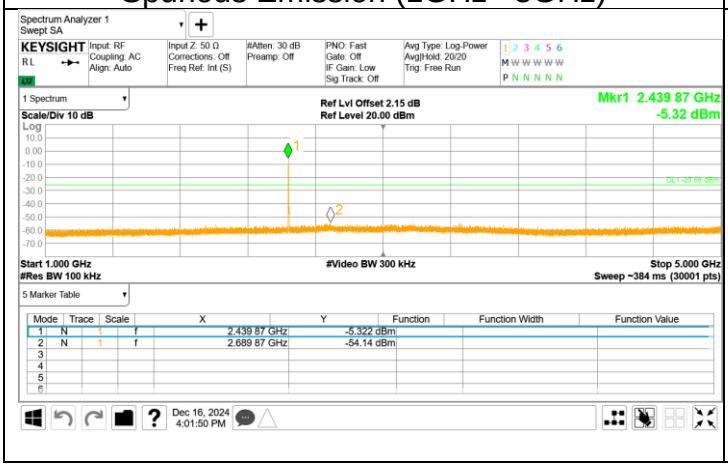
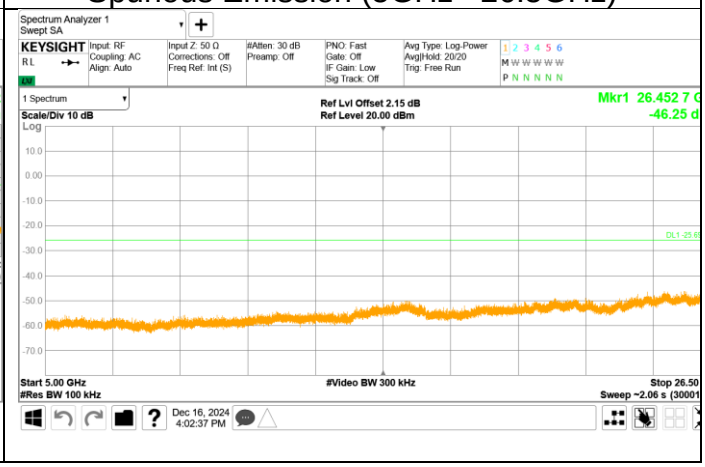
Spurious RF conducted emissions

Out-of-Band Emissions	
Channel 11 (2405MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

Out-of-Band Emissions	
Channel 18 (2440MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

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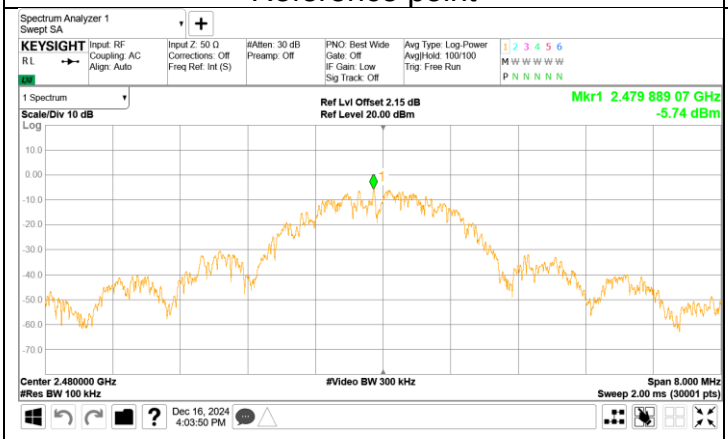
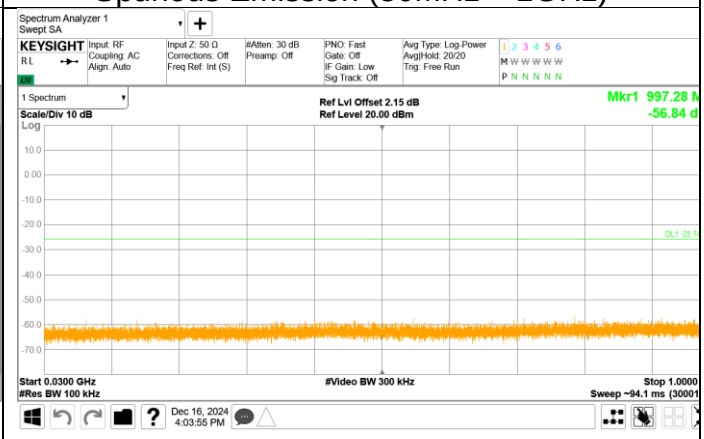
Out-of-Band Emissions

Channel 26 (2480MHz)

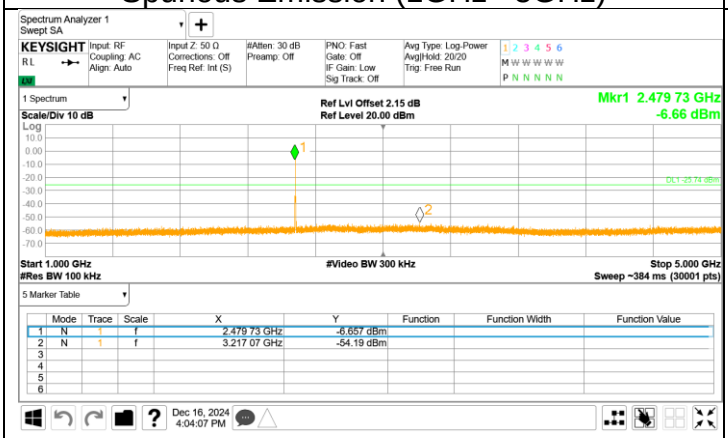
Reference point



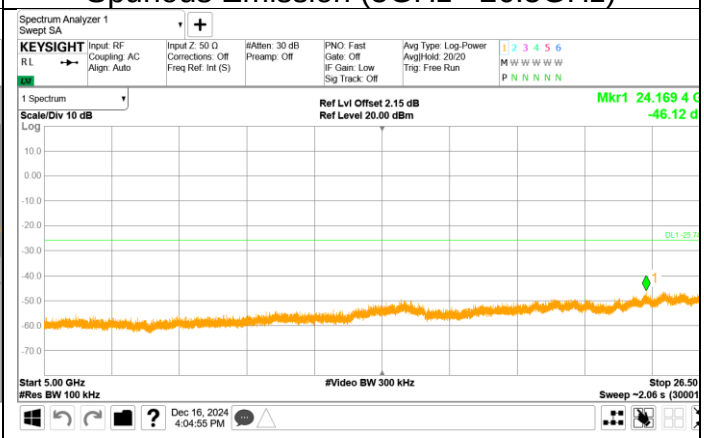
Spurious Emission (30MHz – 1GHz)



Spurious Emission (1GHz –5GHz)



Spurious Emission (5GHz –26.5GHz)



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10.6 Band edge

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize, use the peak and delta measurement to record the result.
5. The level displayed must comply with the limit specified in this Section.
6. Repeat above procedures until all frequencies measured were complete and submit all the plots.

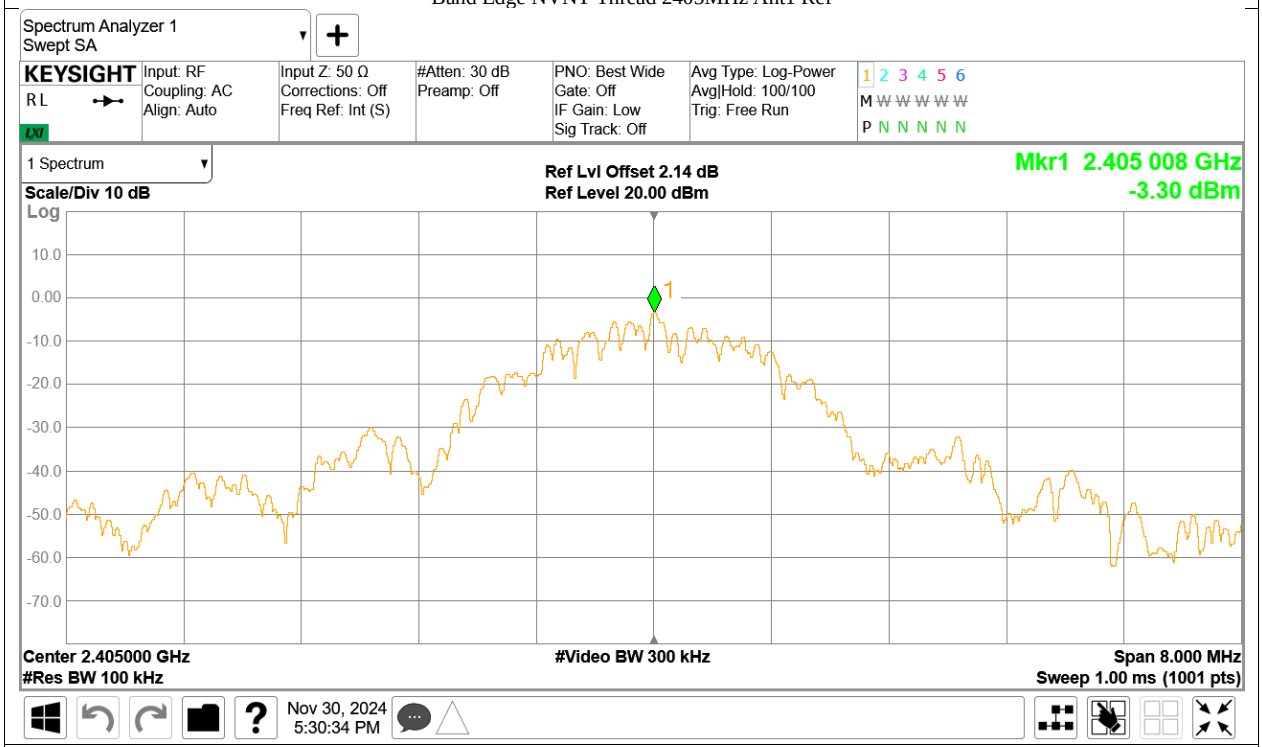
Limit

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under § 15.247(b)(3) and RSS-247 section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB.

Test result

Test Graphs

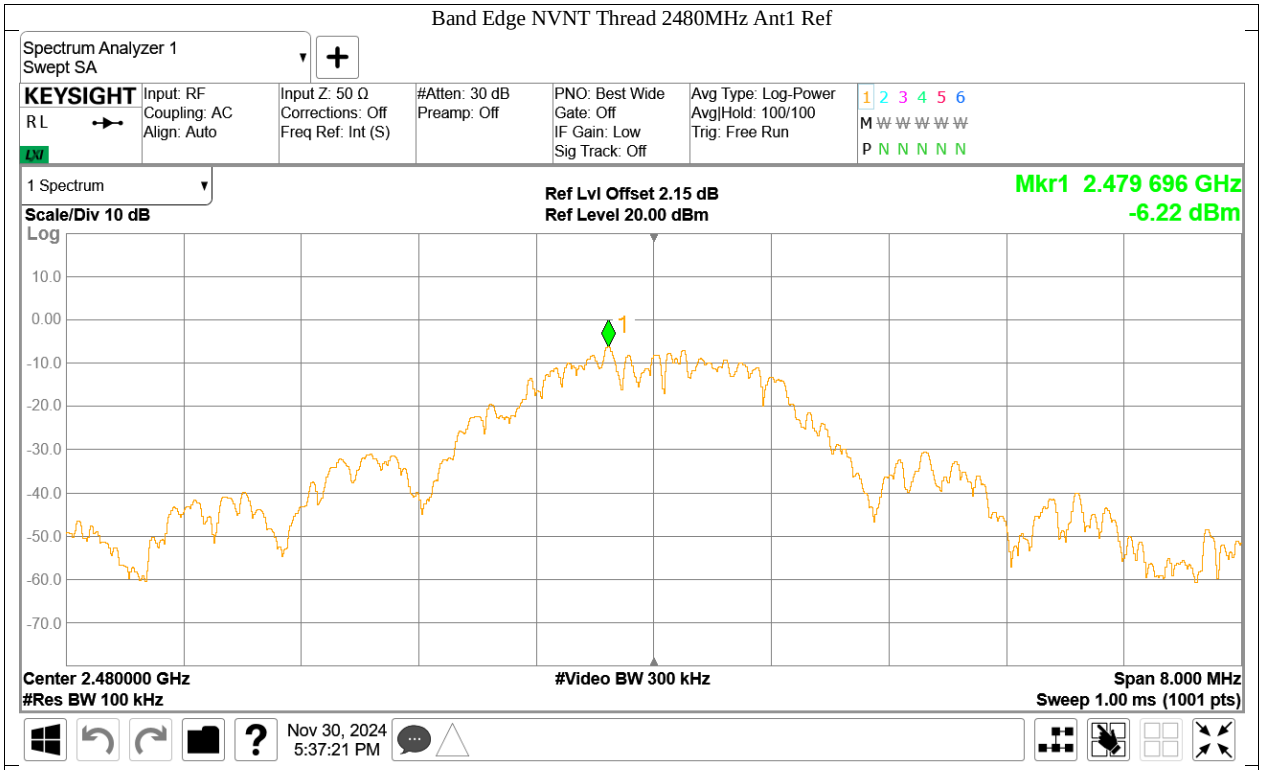
Band Edge NVNT Thread 2405MHz Ant1 Ref



Band Edge NVNT Thread 2405MHz Ant1 Emission

	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.405 0 GHz	-5.395 dBm			
2	N	1	f	2.400 0 GHz	-57.50 dBm			
3	N	1	f	2.390 0 GHz	-60.29 dBm			
4	N	1	f	2.375 2 GHz	-57.28 dBm			
5								
6								

Band Edge NVNT Thread 2480MHz Ant1 Ref



Band Edge NVNT Thread 2480MHz Ant1 Emission

	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.479 8 GHz	-5.999 dBm			
2	N	1	f	2.483 5 GHz	-54.79 dBm			
3	N	1	f	2.500 0 GHz	-58.56 dBm			
4	N	1	f	2.483 9 GHz	-48.72 dBm			
5								
6								

10.7 Spurious radiated emissions for transmitter

Test Method

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10

   1) Procedure for Unwanted Emissions Measurements Below 1000 MHz

   Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz to 120kHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

   2) For Peak unwanted emissions Above 1GHz:

   Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

   Procedures for average unwanted emissions measurements above 1GHz

   a) RBW = 1MHz.

   b) VBW \ [3 × RBW].

   c) Detector = AV (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.

   d) Averaging type = power (i.e., AV) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)

   e) Sweep time = auto.

   f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

   g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

   1) If power averaging (AV) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2)If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission (AV) at frequency above 1GHz.

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under § 15.247(b)(3) and RSS 247 section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in § 15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in§ 15.205(a) and RSS-Gen scetion8.9, must also comply with the radiated emission limits specified in § 15.209(a) and RSS-Gen section 8.10.

Frequency MHz	Field Strength uV/m	Measured Distance Meters
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30	30	30

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.
Data of measurement within frequency range 9kHz-30MHz and 18-25GHz is the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.

Test result

The worst case of Radiated Emission below 1GHz: Only the worst case listed as below.

30-1000MHz Radiated Emission

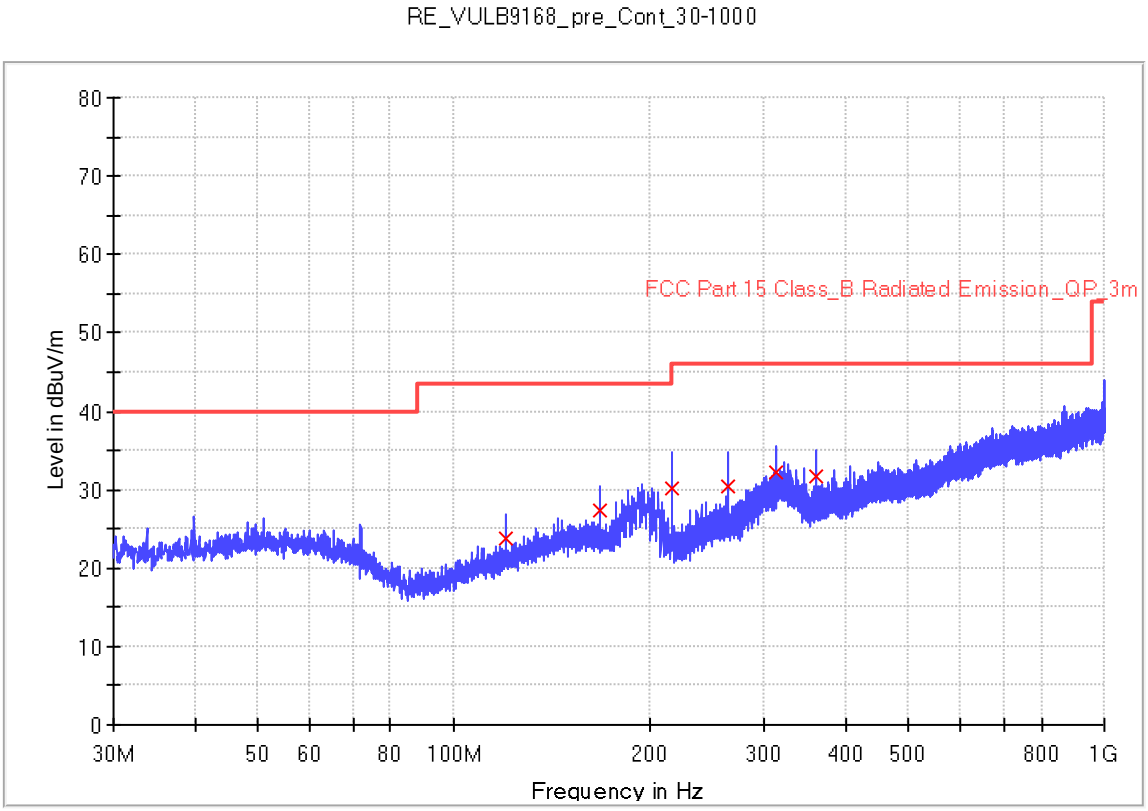
EUT Information

EUT Name:	Tubular motor
Model:	CM-06-E-R
Client:	Coulisse B.V
Op Cond:	Power on and TX at 2405MHz
Operator:	Tianji Xu
Test Spec:	FCC part 15.209(a)
Comment:	Horizontal
Sample No:	SHA-866063-2

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup:	RE_VULB9168
Receiver:	[ESR 3]
Level Unit:	dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.2 s	20 dB



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Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)
119.960000	23.8	1000.0	120.000	100.0	H	321.0	18.4	19.7
168.000000	27.4	1000.0	120.000	125.0	H	2.0	20.5	16.1
216.000000	30.1	1000.0	120.000	220.0	H	112.0	17.7	15.9
264.000000	30.5	1000.0	120.000	100.0	H	48.0	20.3	15.5
311.960000	32.2	1000.0	120.000	130.0	H	302.0	22.1	13.8
360.000000	31.6	1000.0	120.000	250.0	H	117.0	23.2	14.4

(continuation of the "Limit and Margin" table from column 16 ...)

Frequency (MHz)	Limit - QPK (dBuV/m)	Comment
119.960000	43.5	
168.000000	43.5	
216.000000	46.0	
264.000000	46.0	
311.960000	46.0	
360.000000	46.0	

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

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30-1000MHz Radiated Emission

EUT Information

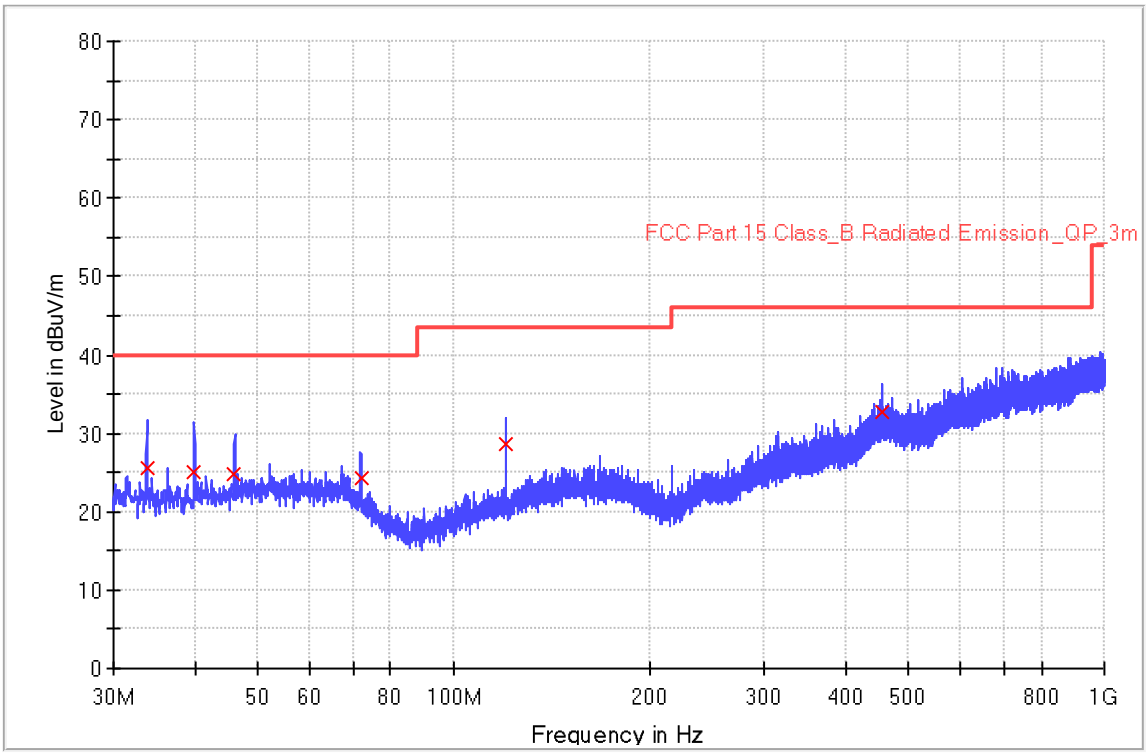
EUT Name:	Tubular motor
Model:	CM-06-E-R
Client:	Coulisse B.V
Op Cond:	Power on and TX at 2405MHz
Operator:	Tianji Xu
Test Spec:	FCC part 15.209(a)
Comment:	Vertical
Sample No:	SHA-866063-2

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup:	RE_VULB9168
Receiver:	[ESR 3]
Level Unit:	dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.2 s	20 dB

RE_VULB9168_pre_Cont_30-1000



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Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)
33.800000	25.6	1000.0	120.000	133.0	V	234.0	19.0	14.4
39.880000	25.1	1000.0	120.000	100.0	V	260.0	19.8	14.9
46.040000	24.7	1000.0	120.000	250.0	V	359.0	20.6	15.3
71.960000	24.3	1000.0	120.000	100.0	V	359.0	18.4	15.7
120.000000	28.6	1000.0	120.000	180.0	V	317.0	18.4	14.9
456.040000	32.8	1000.0	120.000	200.0	V	359.0	26.1	13.2

(continuation of the "Limit and Margin" table from column 16 ...)

Frequency (MHz)	Limit - QPK (dBuV/m)	Comment
33.800000	40.0	
39.880000	40.0	
46.040000	40.0	
71.960000	40.0	
120.000000	43.5	
456.040000	46.0	

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

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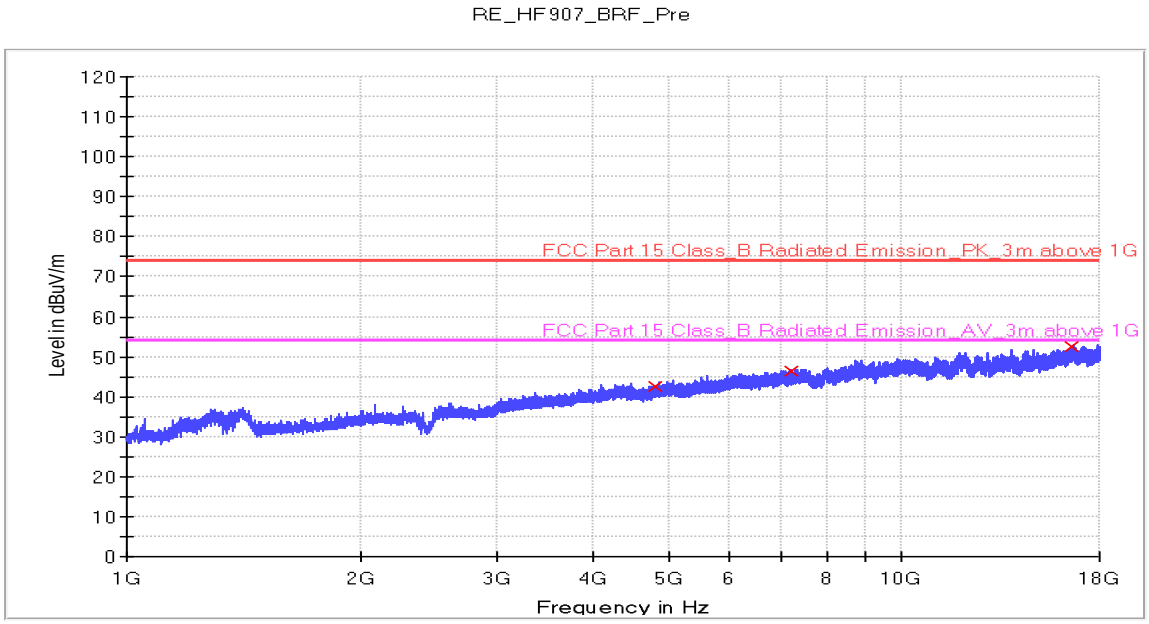
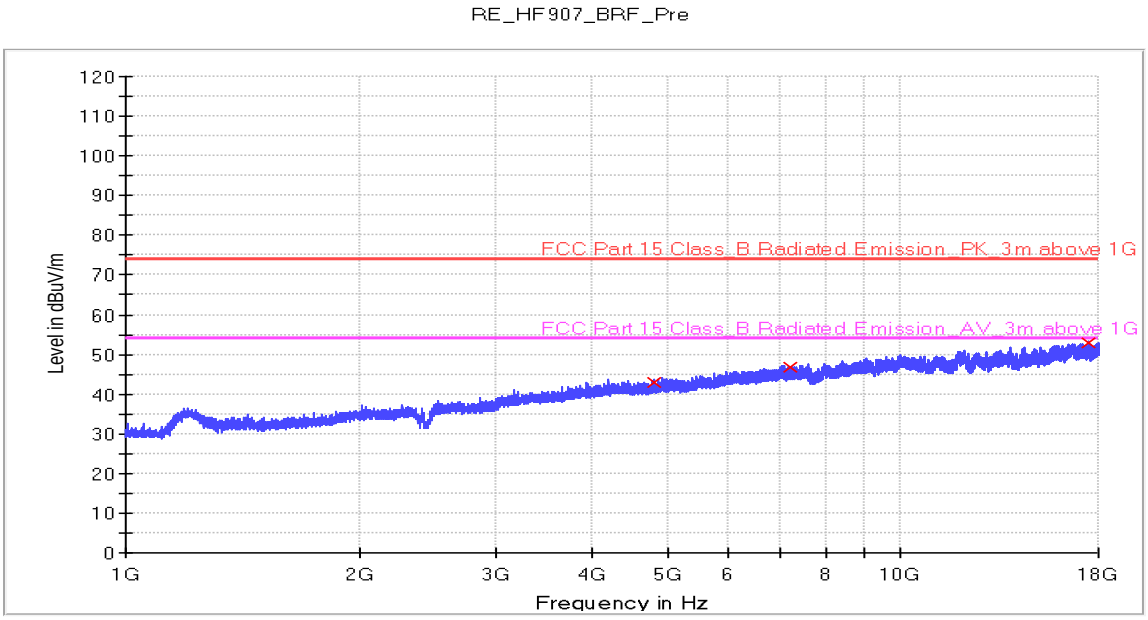
Radiated Emission 1-18 GHz

Frequency:2405MHz



Limit and Margin

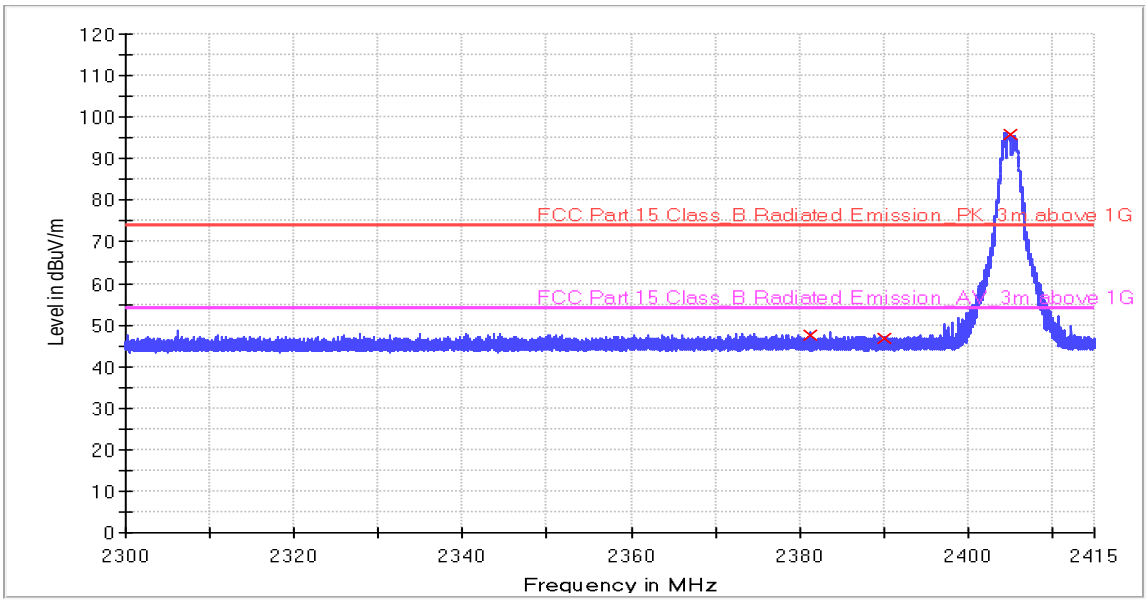
Frequency (MHz)	MaxPeak (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
4816.000000	42.7	1000.000	263.0	H	311.0	-2.7	31.3	74.0
7218.400000	46.2	1000.000	115.0	H	187.0	0.8	27.8	74.0
16610.800000	52.4	1000.000	196.0	H	24.0	7.0	21.6	74.0



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
4812.100000	43.1	1000.000	245.0	V	22.0	-2.7	30.9	74.0
7220.500000	46.7	1000.000	199.0	V	127.0	0.8	27.3	74.0
17427.400000	52.8	1000.000	251.0	V	178.0	7.4	21.2	74.0

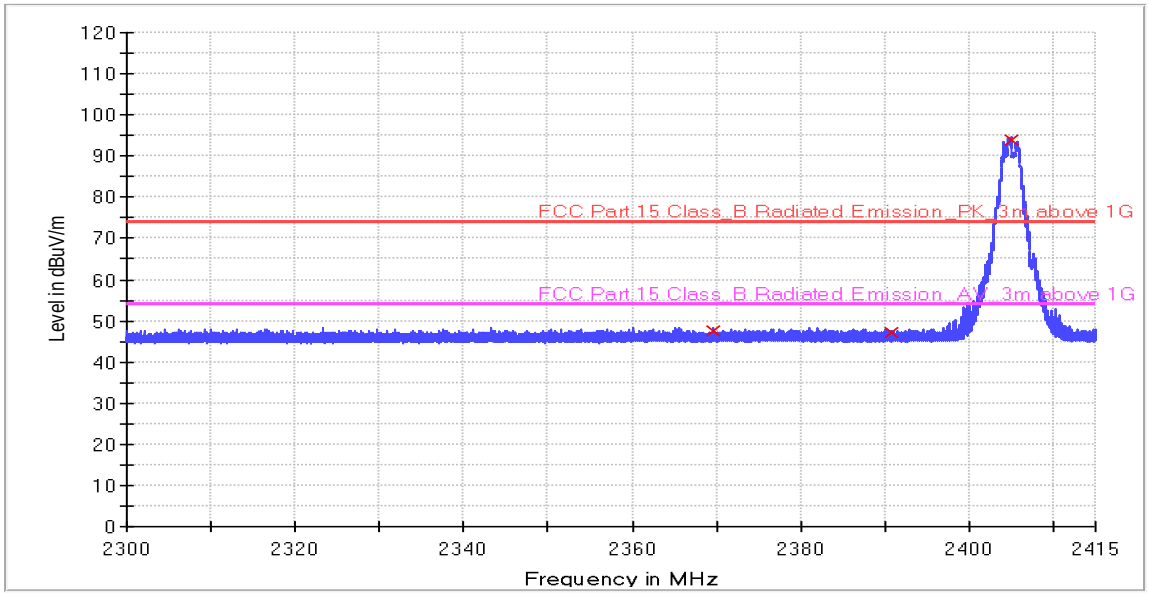
RE_HF907_BRF_Pre



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
2381.200000	47.5	1000.000	143.0	H	131.0	-10.8	26.5	74.0
2390.000000	46.8	1000.000	291.0	H	27.0	-10.8	27.2	74.0
2405.000000	95.7	1000.000	195.0	H	113.0	-10.8	---	---

RE_HF907_BRF_Pre



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
2369.500000	47.7	1000.000	163.0	V	94.0	-10.8	26.3	74.0
2390.800000	47.2	1000.000	109.0	V	216.0	-10.8	26.8	74.0
2405.000000	94.1	1000.000	208.0	V	22.0	-10.8	---	---

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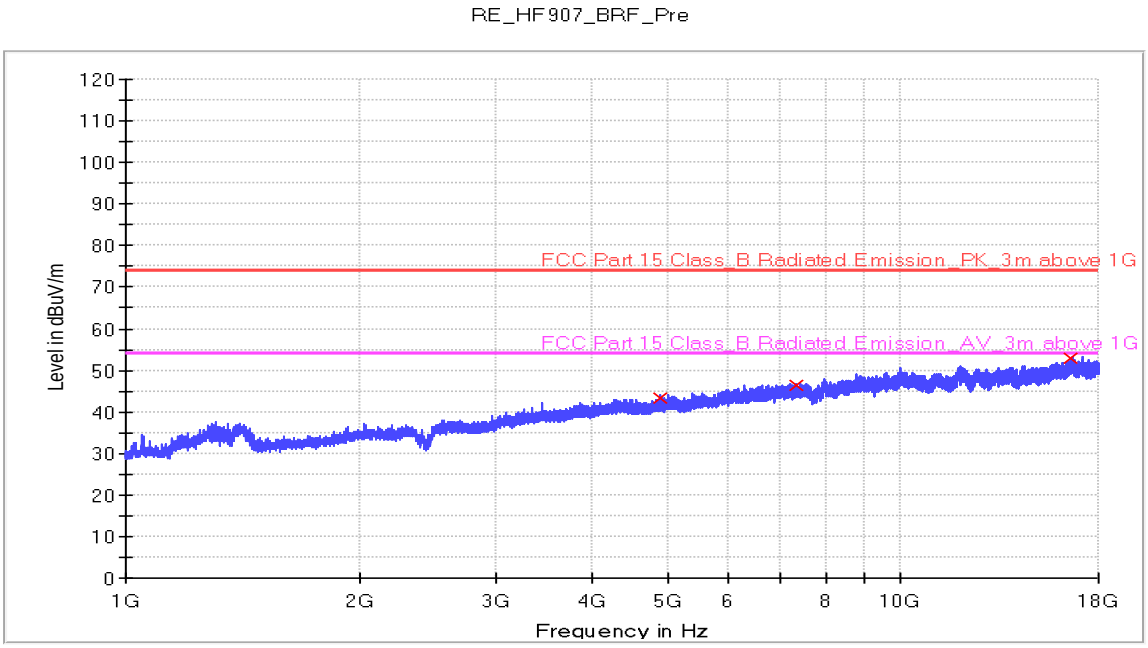
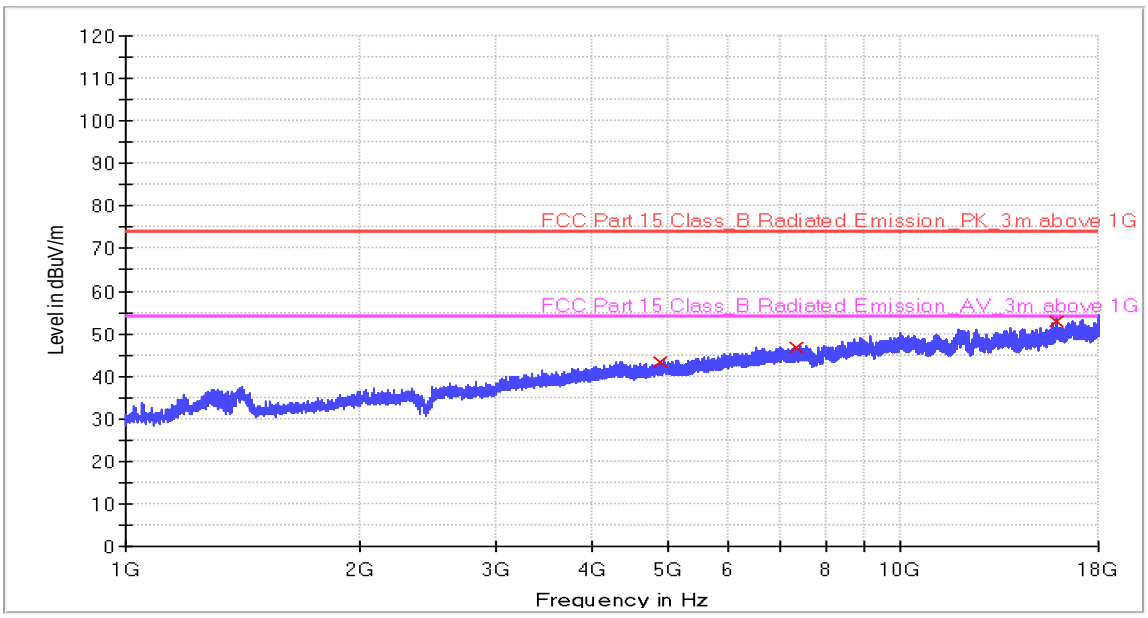
Frequency:2440MHz



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
4884.600000	43.2	1000.000	272.0	H	132.0	-2.4	30.8	74.0
7320.900000	46.5	1000.000	131.0	H	228.0	0.7	27.5	74.0
16606.600000	52.8	1000.000	243.0	H	33.0	7.0	21.2	74.0



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
4881.700000	43.2	1000.000	267.0	V	172.0	-2.4	30.8	74.0
7311.700000	46.8	1000.000	146.0	V	172.0	0.8	27.2	74.0
15899.500000	52.9	1000.000	136.0	V	172.0	5.9	21.1	74.0

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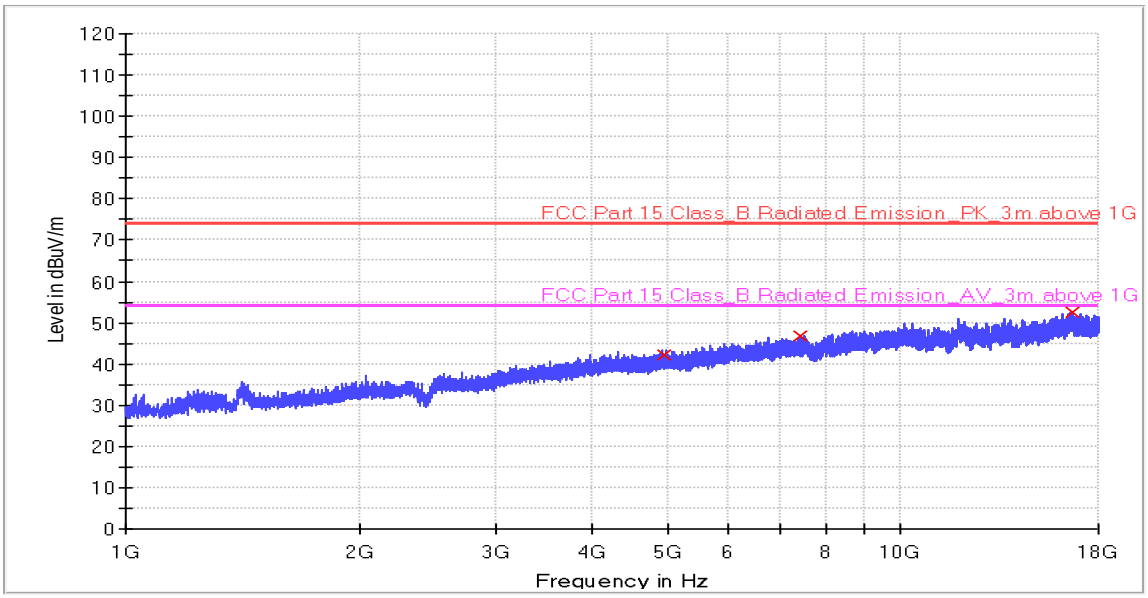
Frequency:2480MHz

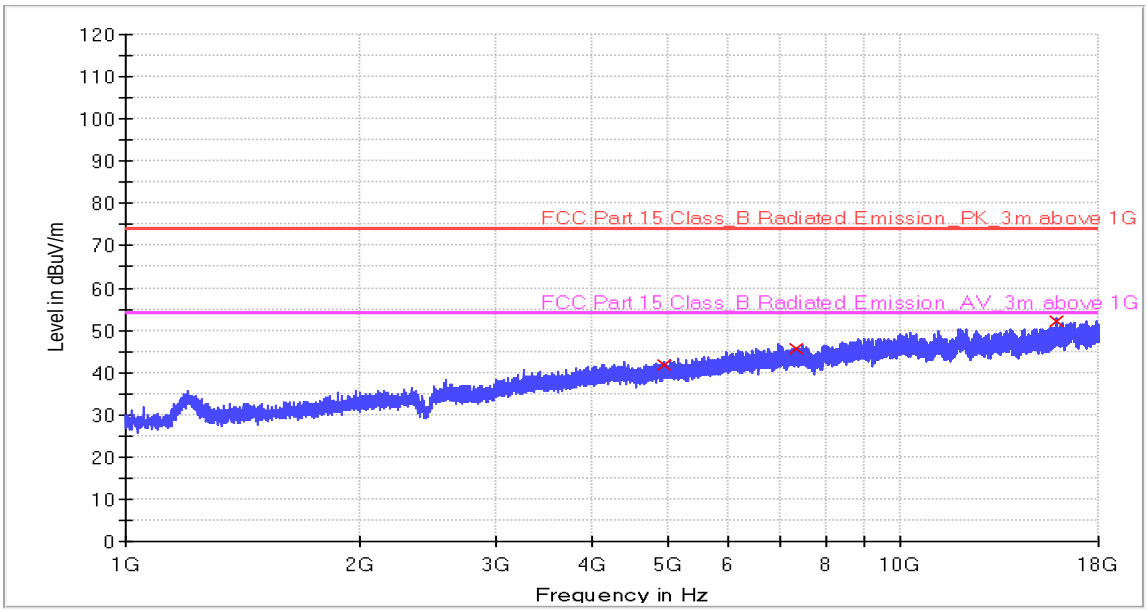
RE_HF907_BRF_Pre



Limit and Margin

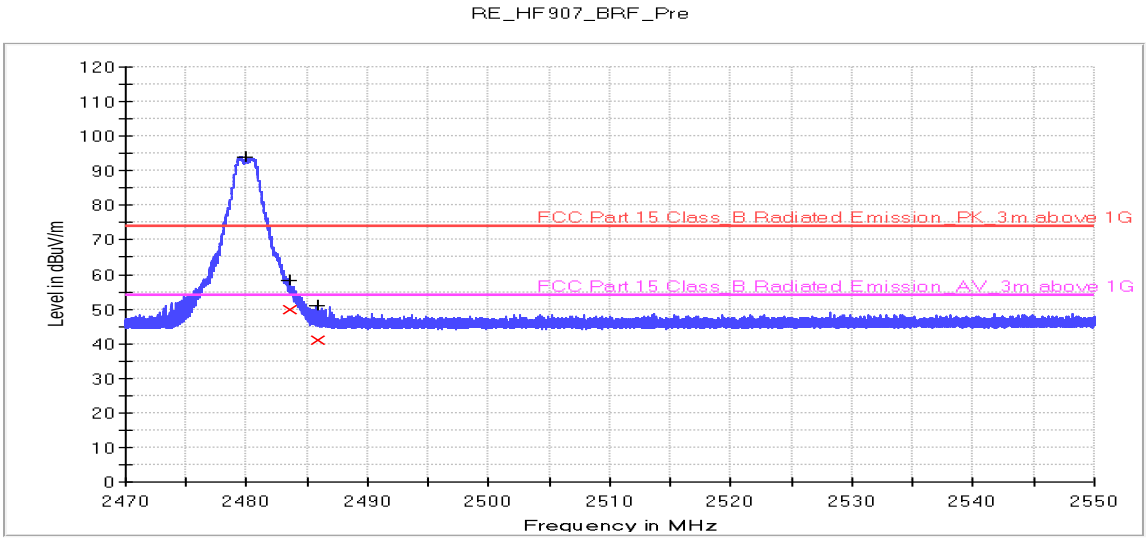
Frequency (MHz)	MaxPeak (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
4960.200000	42.3	1000.000	172.0	H	137.0	-2.3	31.7	74.0
7440.400000	46.7	1000.000	231.0	H	244.0	0.8	27.3	74.0
16676.200000	52.4	1000.000	216.0	H	30.0	7.2	21.6	74.0

RE_HF907_BRF_Pre



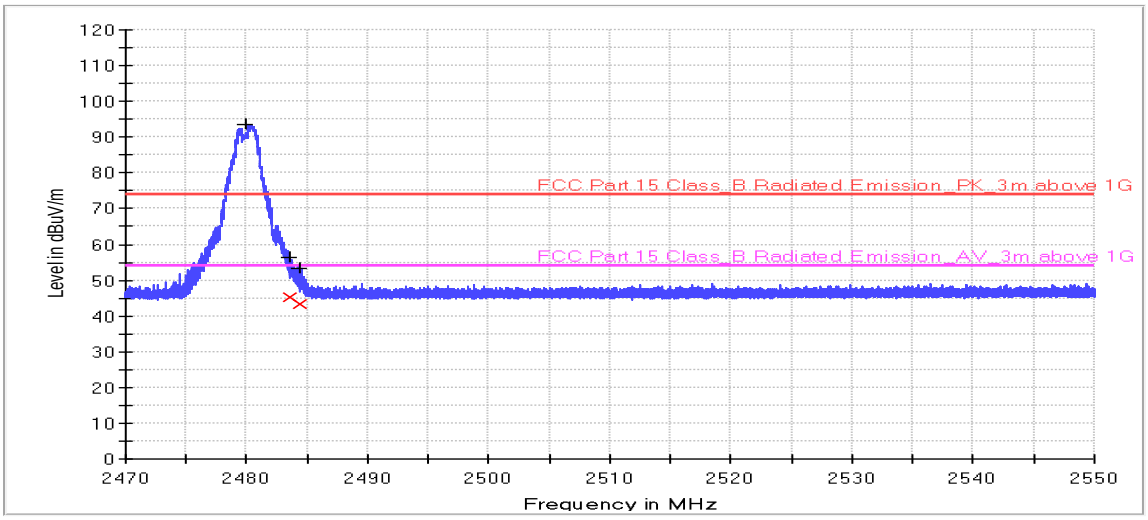
Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
4958.800000	41.8	1000.000	138.0	V	331.0	-2.3	32.2	74.0
7343.200000	45.8	1000.000	279.0	V	27.0	0.7	28.2	74.0
15922.900000	52.3	1000.000	235.0	V	137.0	5.9	21.7	74.0



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	AV (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBuV/	Margin - AV (dB)	Limit - AV (dBuV/
2480.000000	94.1	---	1000.000	187.0	H	178.0	-0.3	--	--	---	---
2483.500000	58.4	---	1000.000	155.0	H	18.0	-0.3	15.6	74	---	---
2483.500000	---	49.8	1000.000	126.0	H	221.0	-0.3	---	---	4.2	54.0
2485.800000	50.9	---	1000.000	173.0	H	175.0	-0.3	23.1	74	---	---
2485.800000	---	41.1	1000.000	231.0	H	230.0	-0.3	---	---	12.9	54.0



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	AV (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBuV/	Margin - AV (dB)	Limit - AV (dBuV/
2480.000000	93.4	---	1000.000	235.0	H	178.0	-0.3	--	--	---	---
2483.500000	56.4	---	1000.000	252.0	H	18.0	-0.3	17.6	74.0	---	---
2483.500000	---	45.3	1000.000	103.0	H	221.0	-0.3	---	---	8.7	54.0
2485.800000	53.4	---	1000.000	247.0	H	175.0	-0.3	20.6	74.0	---	---
2485.800000	---	43.2	1000.000	111.0	H	230.0	-0.3	---	---	10.8	54.0

Remark:

(1) Emission level= Original Receiver Reading + Correct Factor
(2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
(3) Margin = limit – Corrected Reading

11 Test Equipment List

List of Test Instruments
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Signal spectrum analyzer	Agilent	N9020B	MY59050168	2024-2-19	2025-2-18
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2024-8-1	2025-7-31
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2024-8-1	2025-7-31
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2024-8-30	2025-8-29
	Double-ridged waveguide horn antenna	Rohde & Schwarz	HF907	102868	2024-4-14	2025-4-13
	Pre-amplifier	Shenzhen HzEMC	HPA-081843	HYPA23026	2024-4-16	2025-4-15
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2024-6-26	2025-6-25
	Double Ridged Horn Antenna	ETS-Lindgren	3116C	00246076	2023-7-7	2026-7-6
	3m Semi-anechoic chamber	TDK	9X6X6	----	2024-5-8	2027-5-7
CE	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2024-8-1	2025-7-31
	LISN	Rohde & Schwarz	ENV216	101924	2024-8-1	2025-7-31

Measurement Software Information			
Test Item	Software	Manufacturer	Version
C	MTS 8310	MWRFtest	3.0.0.0
RE	EMC 32	Rohde & Schwarz	V10.50.40
CE	EMC 32	Rohde & Schwarz	V9.15.03

C - Conducted RF tests

- Conducted peak output power
- Power spectral density*

12 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, 3.16dB
Radiated Disturbance	9kHz to 30MHz, 3.52dB 30MHz to 1GHz, 5.03dB (Horizontal) 5.12dB (Vertical) 1GHz to 18GHz, 5.49dB 18GHz to 40GHz, 5.63dB
RF Conducted Measurement	Power related： 1.16dB Frequency related： 6.00×10^{-8}

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2023, clause 4.3.3.

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13 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

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14 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

----------End of Test Report----------

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