FCC - TEST REPORT

Report Number	:	**709502408754-00C**	Date of Issue:	October 22, 2024

Model	:	CM-08
Product Type	:	HONEYCOMB MOTOR
Applicant	:	Coulisse B.V.
Address	:	Vonderweg 48, 7468 DC Enter, THE NETHERLANDS
Production Facility	:	Ningbo Dooya Mechanical & Electronic Technology Co., Ltd.
Address	:	No.168 Shengguang Road, Luotuo, Zhenhai 315202 Ningbo, Zhejiang province, People's republic of China

Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	55

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1 Table of Contents

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
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2 Details about the Test Laboratory

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

3 Description of the Equipment under Test

Description of the Equipment Under Test

Product:	HONEYCOMB MOTOR
Model no.:	CM-08
FCC ID:	ZY4CM08B1
Options and accessories:	NA
Rating:	USB input: DC5V, 7W (12V for battery)
RF Transmission Frequency:	SRD transceiver: 433.92MHz; 2.4GHz BLE: 2402~2480 MHz
No. of Operated Channel:	SRD transceiver: 1; 2.4GHz BLE: 40
Modulation:	SRD transceiver: FSK; 2.4GHz BLE: GFSK
Channel list:	SRD transceiver: 433.92MHz; 2.4GHz BLE:

Bluetooth Low Energy							
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

Antenna Type:	SRD transceiver: Line Antenna; 2.4GHz BLE: Line Antenna
Antenna Gain:	SRD transceiver: -4dBi;

	2.4GHz BLE: 2.2dBi
Description of the EUT:	The Equipment Under Test (EUT) is a HONEYCOMB MOTOR with BLE function and SRD function (transceiver). We tested it and listed the worst data in this report.
Test sample no.:	SHA-831821-4 (Conducted sample), SHA-831821-5 (Radiated sample)

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, antenna gain or any information supplied.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2023 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

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

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5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207	Conducted emission AC power port	13-15	---	☒	☐	☐
§15.247 (b) (3)	Conducted peak output power	16-18	Site 1	☒	☐	☐
§15.247(a)(1)	20dB bandwidth and 99% Occupied Bandwidth	---	---	☐	☐	☒
§15.247(a)(1)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Dwell Time - Average Time of Occupancy	---	---	☐	☐	☒
§15.247(a)(2)	6dB bandwidth and 99% Occupied Bandwidth	19-23	---	☒	☐	☐
§15.247(e)	Power spectral density	24-26	---	☒	☐	☐
§15.247(d)	Spurious RF conducted emissions	27-33	---	☒	☐	☐
§15.247(d)	Band edge	34-38	---	☒	☐	☐
§15.247(d) & §15.209 & §15.205	Spurious radiated emissions for transmitter	39-51	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses a Line Antenna, which gain is -4dBi for SRD transceiver and 2.2dBi for 2.4GHz BLE. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: ZY4CM08B1 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

This report is only for the 2.4GHz BLE test report, for the 433.92MHz test report please refer to 709502408754-00B.

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.

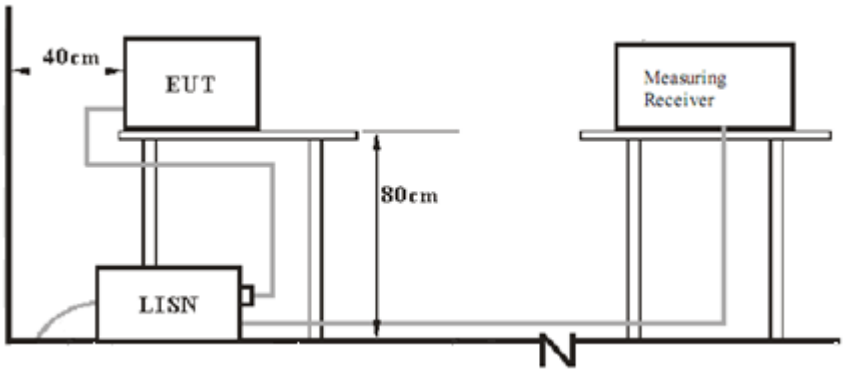
Sample Received Date:	July 15, 2024
Testing Start Date:	July 27, 2024
Testing End Date:	October 9, 2024

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

Reviewed by:	Prepared by:	Tested by:
Hui TONG	Wenqiang LU	Tianji XU
EMC Section Manager	EMC Project Engineer	EMC Test Engineer

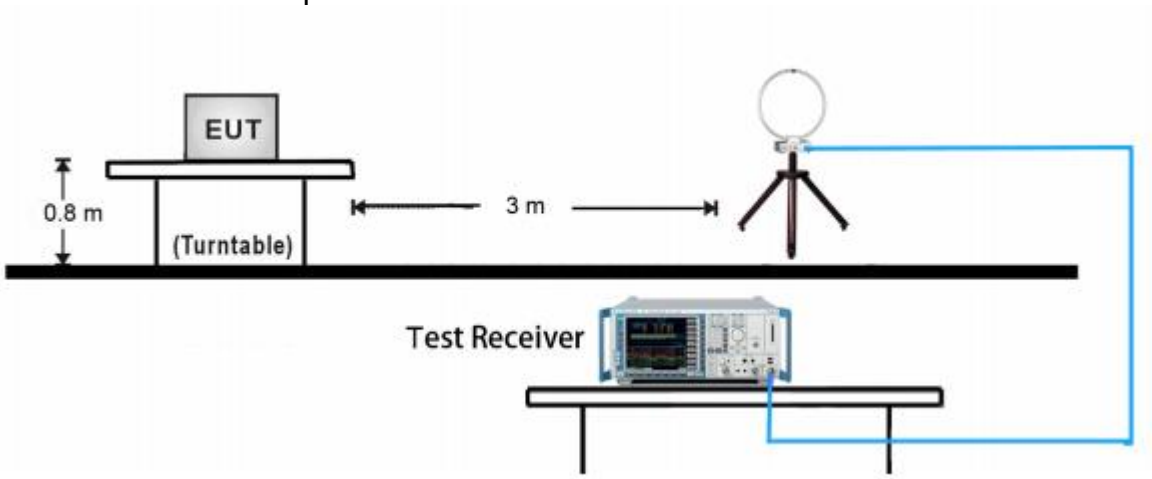
7 Test Setups

7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups

9kHz ~ 30MHz Test Setup:



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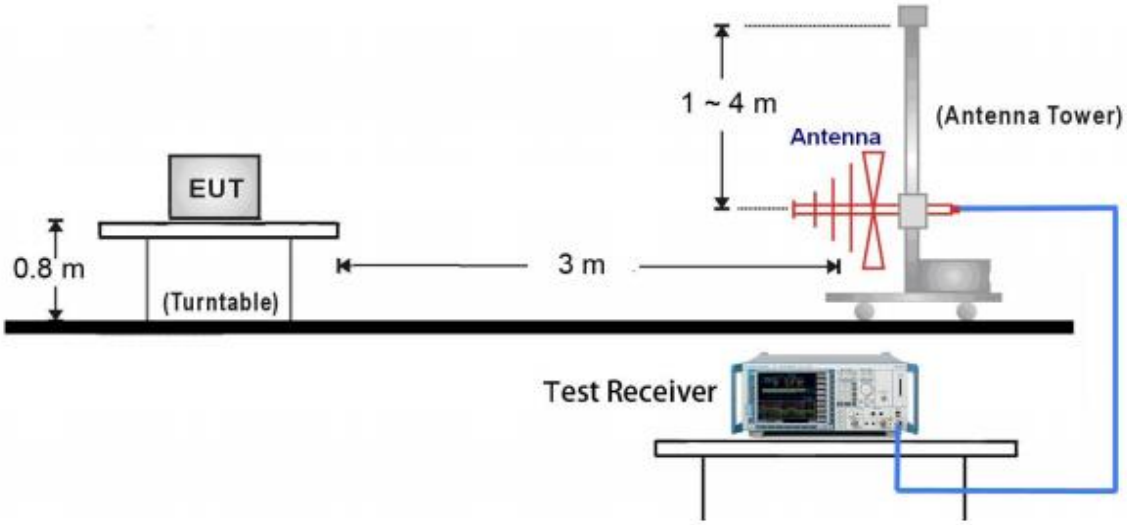
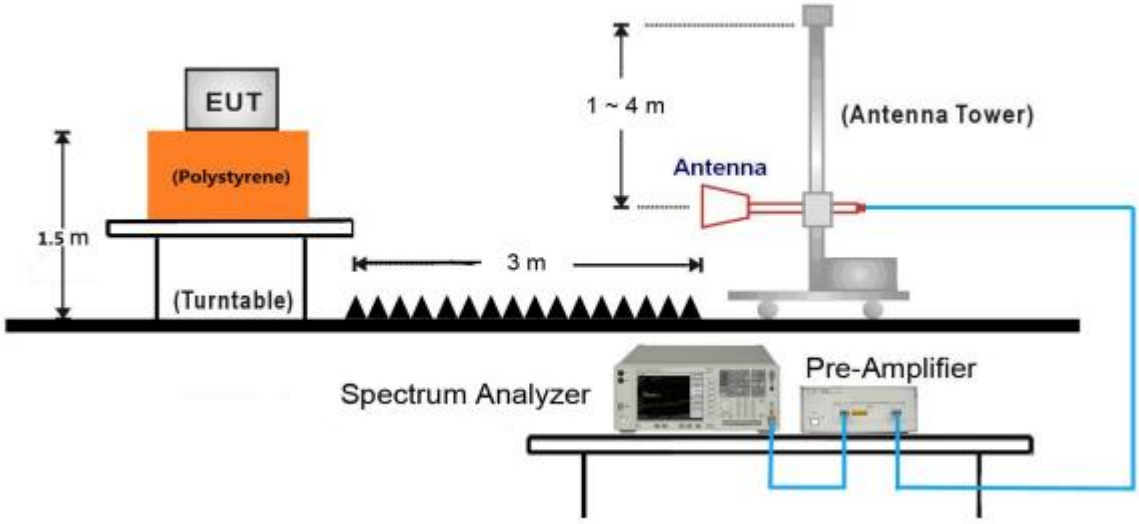
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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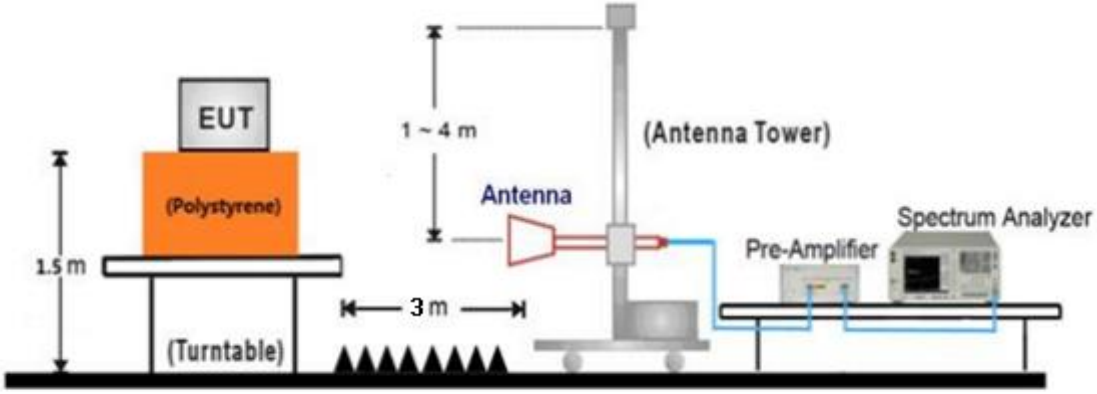
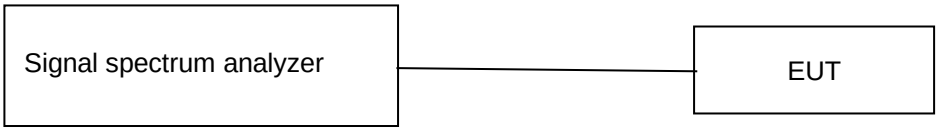
18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenove	X240	Notebook

Test software: BlueNRG GUI v4.0.0

The system was configured to channel 0, 19, and 39 for the test.

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.

Test Mode Applicability and Tested Channel Detail:

Mode	Tested Channel	Data Rate (Mbps)	Modulation	Index Value (Power level setting)
Bluetooth LE	0	1	GFSK	25
	19	1	GFSK	25
	39	1	GFSK	25

Mode	Tested Channel	Data Rate (Mbps)	Modulation	Index Value (Power level setting)
Bluetooth LE	0	2	GFSK	25
	19	2	GFSK	25
	39	2	GFSK	25

9 Technical Requirement

9.1 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. An EMI test receiver is used to test the emissions from both sides of AC line

Limit

According to §15.207, 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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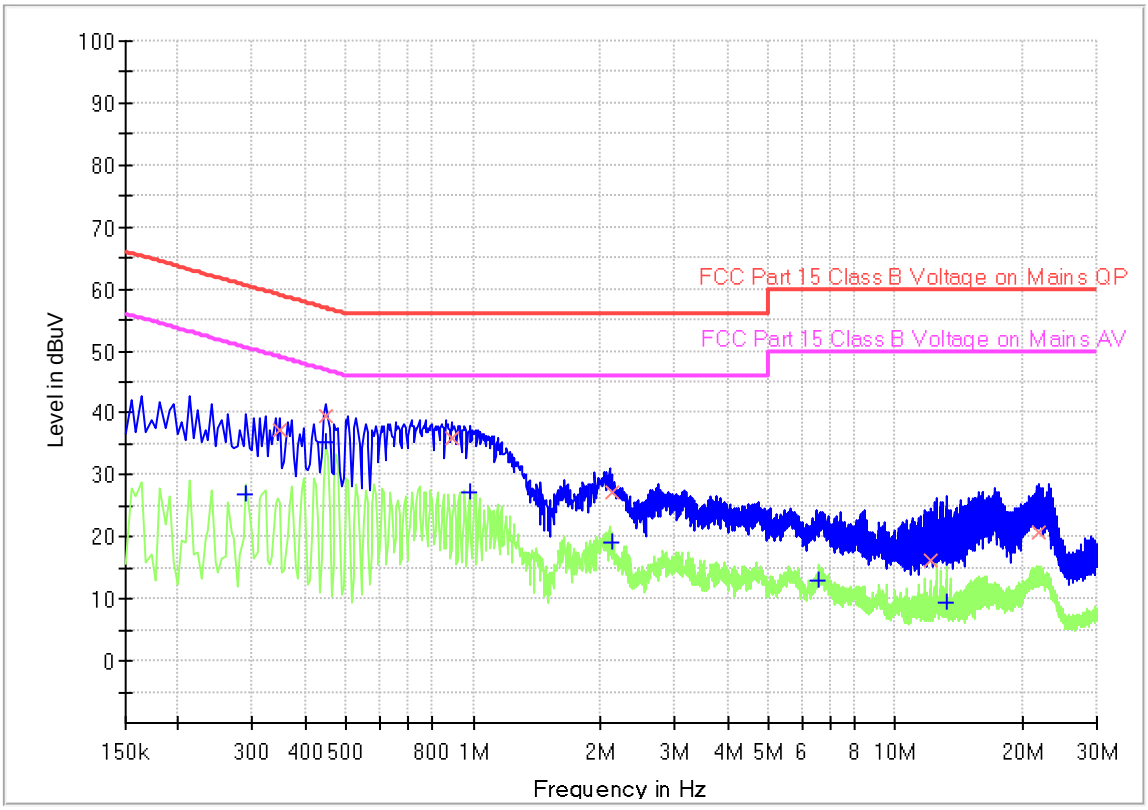
Product Type	:	HONEYCOMB MOTOR
M/N	:	CM-08
Operating Condition	:	Mode 1: Tx_2402MHz 2Mbps (worst case)
Test Specification	:	L-line
Comment	:	5VDC (powered by notebook whose input is 120V~, 60Hz)



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.289500	---	26.90	50.54	23.64	1000.0	9.000	L1	19.5
0.348000	37.30	---	59.01	21.71	1000.0	9.000	L1	19.5
0.447000	---	35.14	46.93	11.79	1000.0	9.000	L1	19.5
0.447000	39.48	---	56.93	17.45	1000.0	9.000	L1	19.5
0.888000	36.02	---	56.00	19.98	1000.0	9.000	L1	19.5
0.978000	---	27.16	46.00	18.84	1000.0	9.000	L1	19.5
2.125500	27.14	---	56.00	28.86	1000.0	9.000	L1	19.5
2.125500	---	19.07	46.00	26.93	1000.0	9.000	L1	19.5
6.603000	---	13.04	50.00	36.96	1000.0	9.000	L1	19.7
12.178500	16.31	---	60.00	43.69	1000.0	9.000	L1	19.9
13.200000	---	9.43	50.00	40.57	1000.0	9.000	L1	20.0
21.907500	20.65	---	60.00	39.35	1000.0	9.000	L1	20.7

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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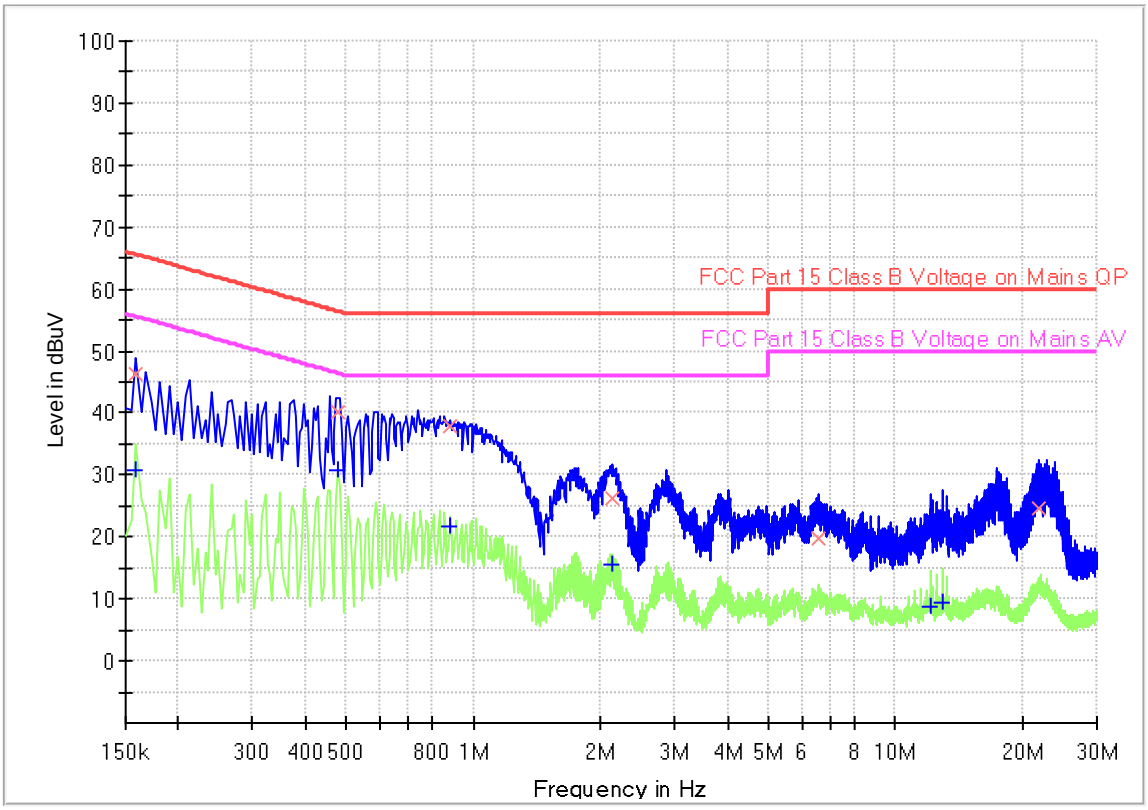
Product Type	:	HONEYCOMB MOTOR
M/N	:	CM-08
Operating Condition	:	Mode 1: Tx_2402MHz 2Mbps (worst case)
Test Specification	:	N-line
Comment	:	5VDC (powered by notebook whose input is 120V~, 60Hz)



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.159000	---	30.78	55.52	24.74	1000.0	9.000	N	19.4
0.159000	46.16	---	65.52	19.36	1000.0	9.000	N	19.4
0.478500	---	30.67	46.37	15.70	1000.0	9.000	N	19.5
0.478500	40.22	---	56.37	16.15	1000.0	9.000	N	19.5
0.883500	---	21.78	46.00	24.22	1000.0	9.000	N	19.5
0.883500	37.97	---	56.00	18.03	1000.0	9.000	N	19.5
2.139000	---	15.66	46.00	30.34	1000.0	9.000	N	19.5
2.143500	26.39	---	56.00	29.61	1000.0	9.000	N	19.5
6.562500	19.71	---	60.00	40.29	1000.0	9.000	N	19.6
12.169500	---	8.92	50.00	41.08	1000.0	9.000	N	19.8
12.903000	---	9.40	50.00	40.60	1000.0	9.000	N	19.8
21.853500	24.69	---	60.00	35.31	1000.0	9.000	N	20.4

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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9.2 Conducted peak output power

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), conducted peak output power limit as below:

	Frequency Range	Limit	Limit
	MHz	W	dBm
Conducted peak output power	2400-2483.5	≤1	≤30

Test result as below table

1Mbps

Frequency	Conducted Peak Output Power	Result
MHz	dBm	
Low channel 2402MHz	-1.25	Pass
Middle channel 2440MHz	-1.34	Pass
High channel 2480MHz	-1.48	Pass

2Mbps

Frequency	Conducted Peak Output Power	Result
MHz	dBm	
Low channel 2402MHz	-1.22	Pass
Middle channel 2440MHz	-1.37	Pass
High channel 2480MHz	-1.48	Pass

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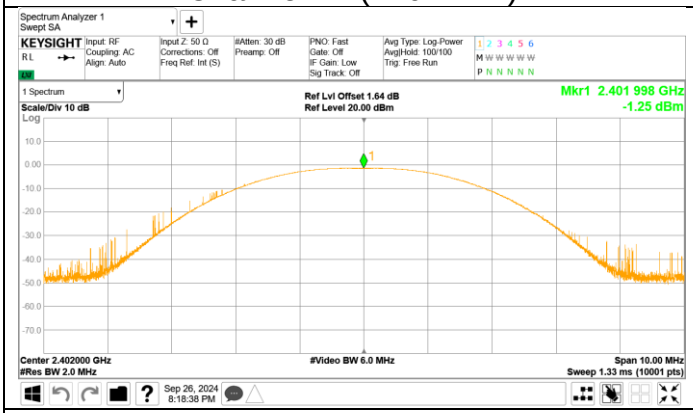
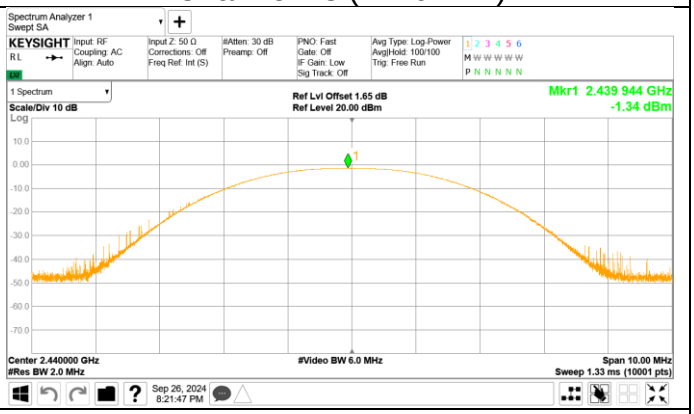
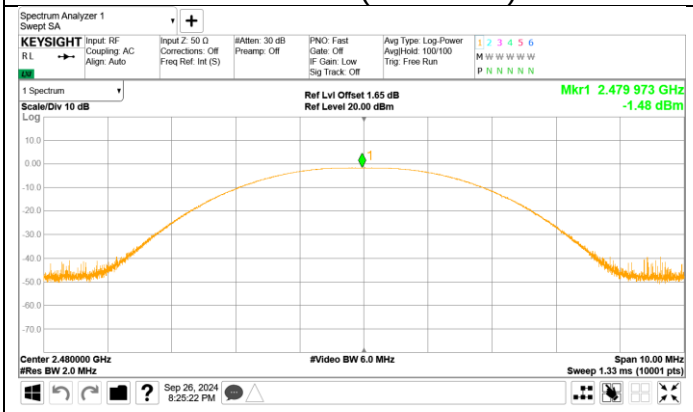
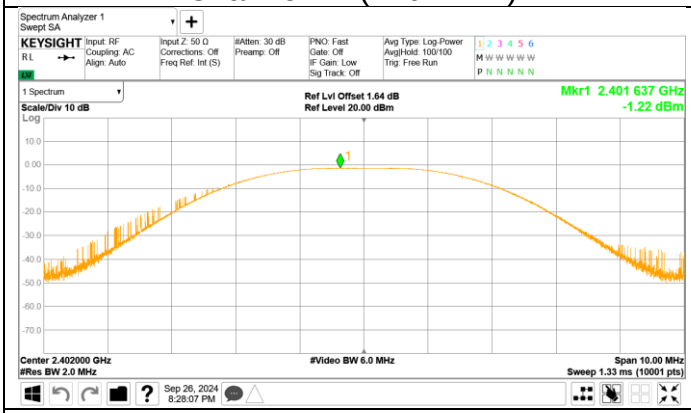
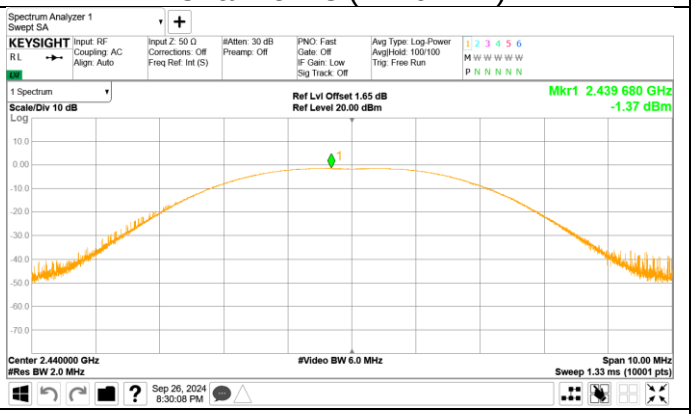
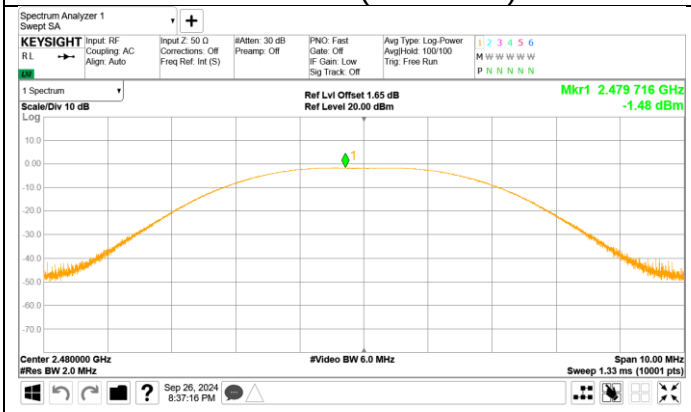
Peak output power 1Mbps	
Channel 11 (2402MHz)	Channel 18 (2440MHz)
	
Channel 26 (2480MHz)	
	

Peak output power 2Mbps	
Channel 11 (2402MHz)	Channel 18 (2440MHz)
	
Channel 26 (2480MHz)	
	

9.3 6dB bandwidth and 99% Occupied Bandwidth

Test Method for 6 dB Bandwidth

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

According to §15.247(a)(2), 6dB bandwidth limit as below:

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

Test result

1Mbps

Frequency MHz	6dB bandwidth kHz	**99% Bandwidth kHz**	Result
Top channel 2402MHz	666	1027	Pass
Middle channel 2440MHz	658	1031	Pass
Bottom channel 2480MHz	654	1027	Pass

2Mbps

Frequency MHz	6dB bandwidth kHz	**99% Bandwidth kHz**	Result
Top channel 2402MHz	1121	2037	Pass
Middle channel 2440MHz	1122	2029	Pass
Bottom channel 2480MHz	1125	2039	Pass

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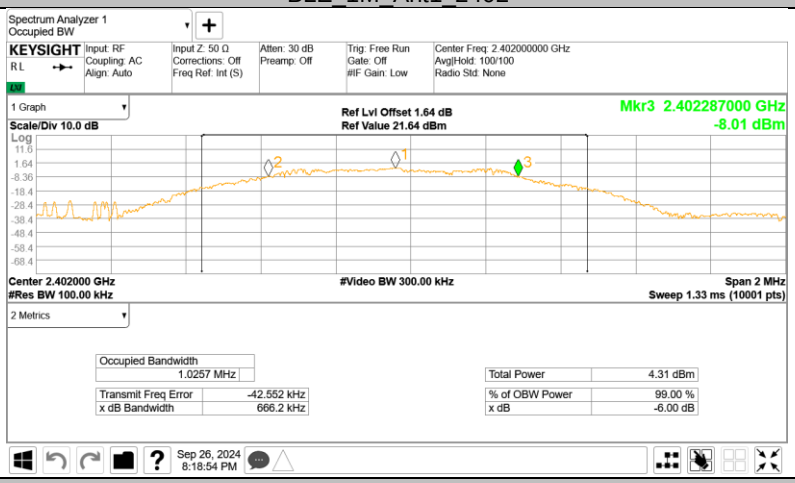
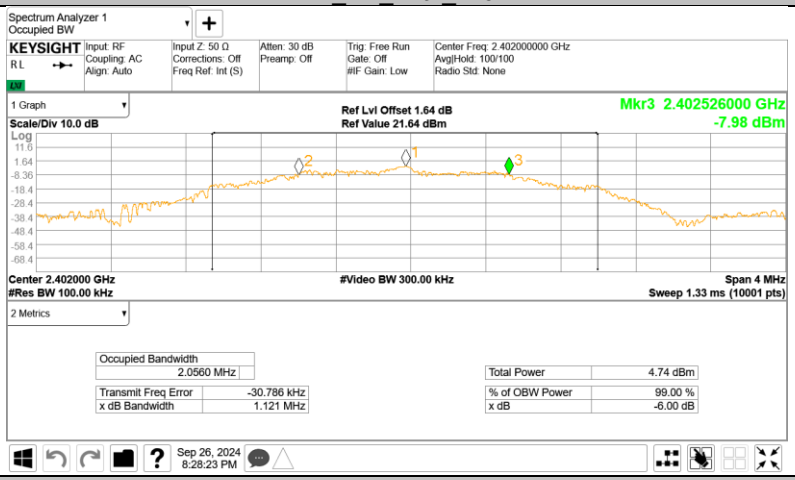
6dB Bandwidth

BLE_1M_Ant1_2402



BLE_1M_Ant1_2440

BLE_1M_Ant1_2480

BLE_2M_Ant1_2402

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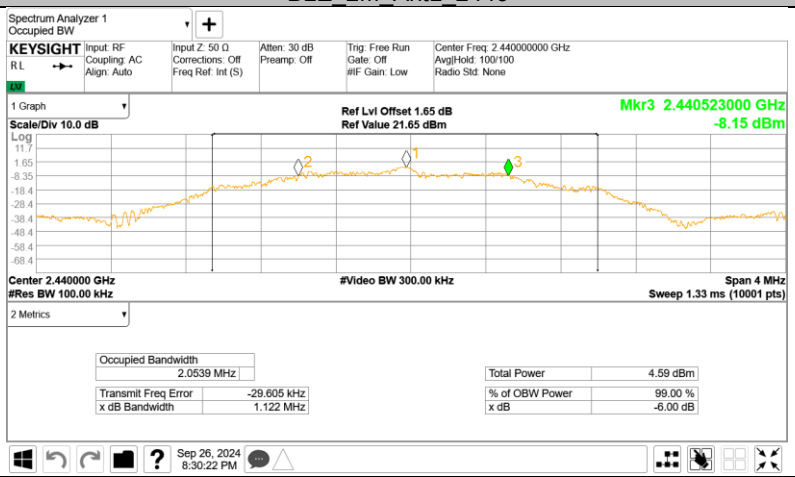
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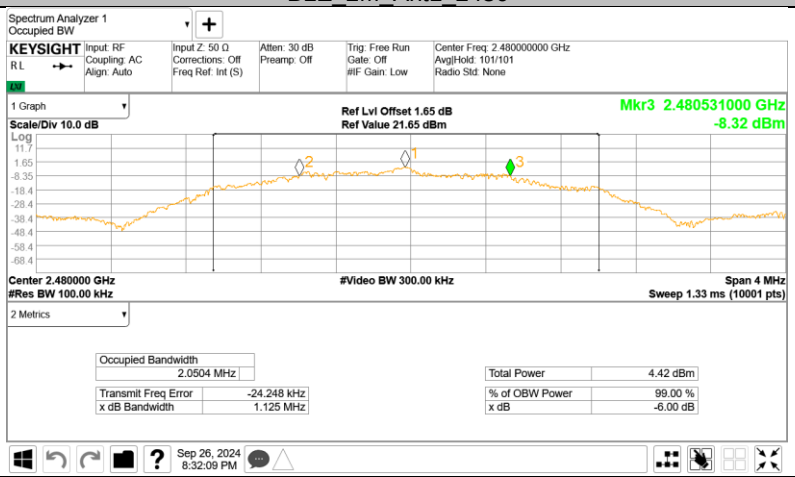
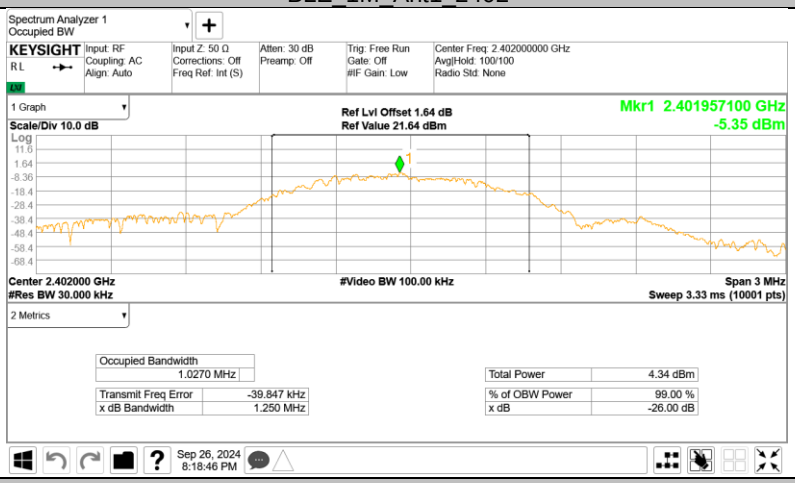


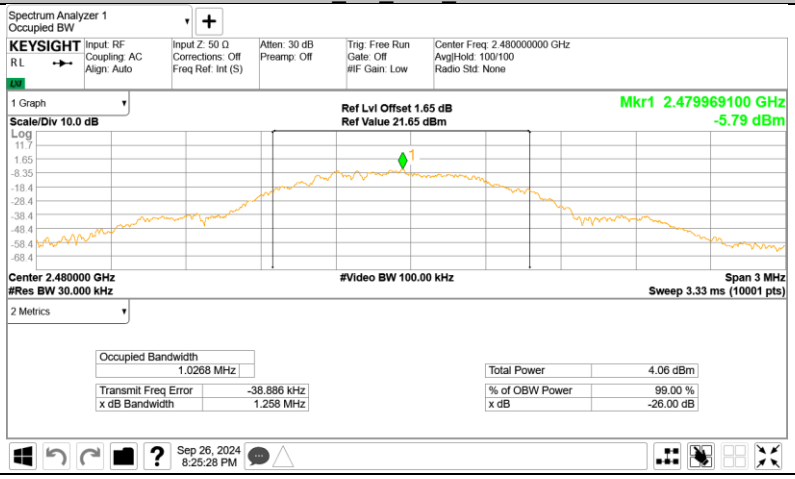
99% Occupied Bandwidth

BLE_1M_Ant1_2402



BLE_1M_Ant1_2440

BLE_1M_Ant1_2480



BLE_2M_Ant1_2402

BLE_2M_Ant1_2440

BLE_2M_Ant1_2480

9.4 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

1Mbps

Frequency	Power spectral density	Result
MHz	**dBm/3kHz**	
Top channel 2402MHz	-16.11	Pass
Middle channel 2440MHz	-15.84	Pass
Bottom channel 2480MHz	-16.02	Pass

2Mbps

Frequency	Power spectral density	Result
MHz	**dBm/3kHz**	
Top channel 2402MHz	-19.13	Pass
Middle channel 2440MHz	-19.4	Pass
Bottom channel 2480MHz	-19.35	Pass

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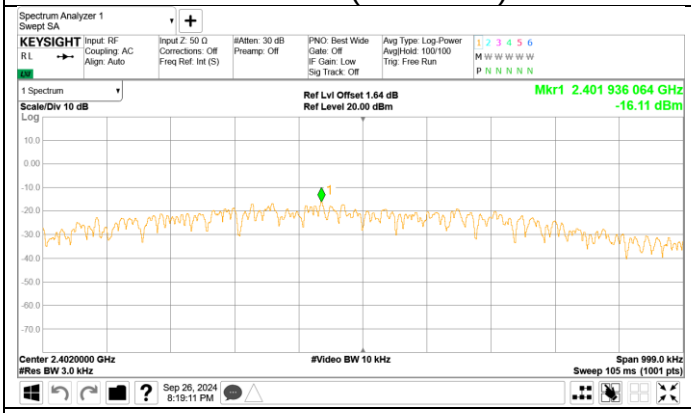
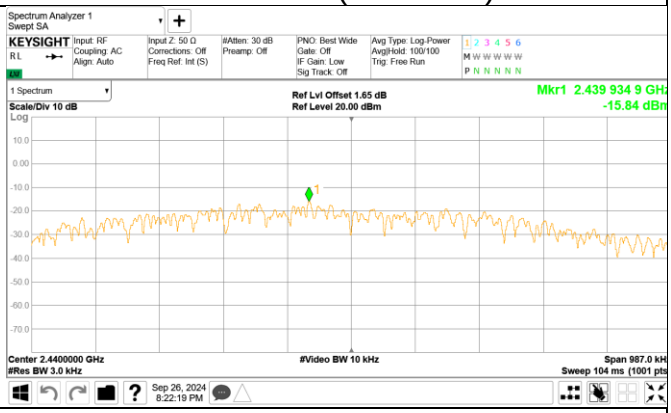
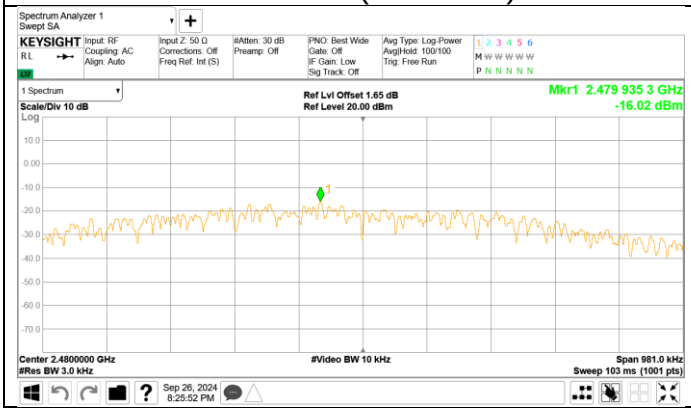
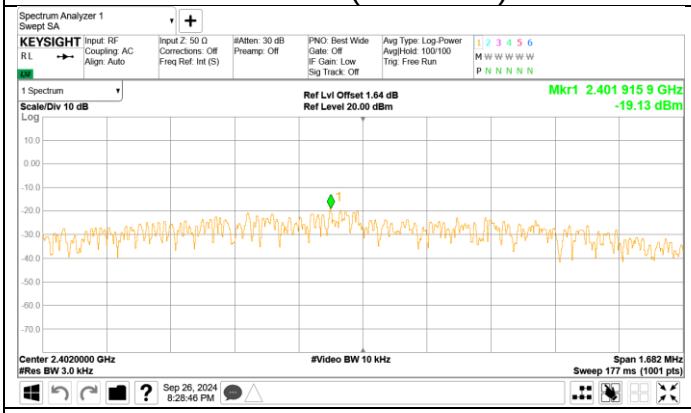
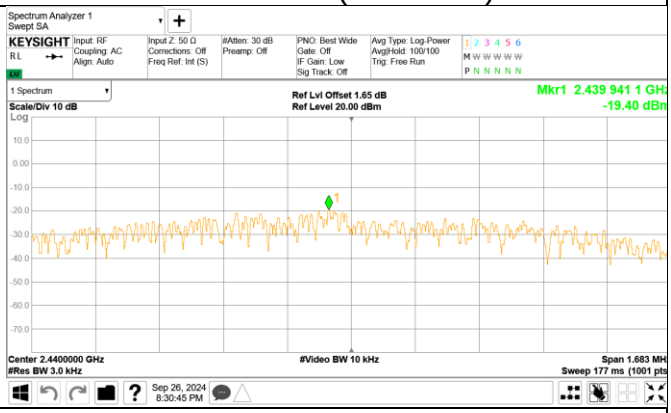
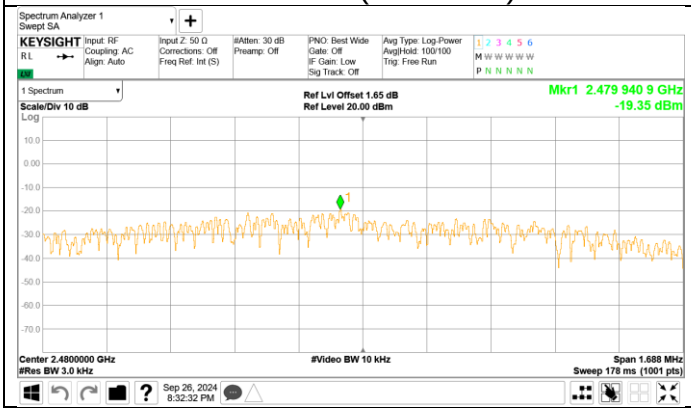
PK PSD (1Mbps)	
Channel 0 (2402MHz)	Channel 19 (2440MHz)
	
Channel 39 (2480MHz)	
	

PK PSD (2Mbps)	
Channel 0 (2402MHz)	Channel 19 (2440MHz)
	
Channel 39 (2480MHz)	
	

9.5 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

According to §15.247(d), spurious RF conducted emissions limit as below:

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

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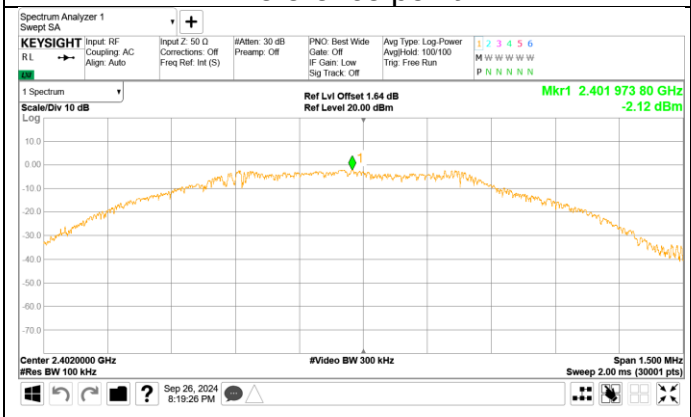
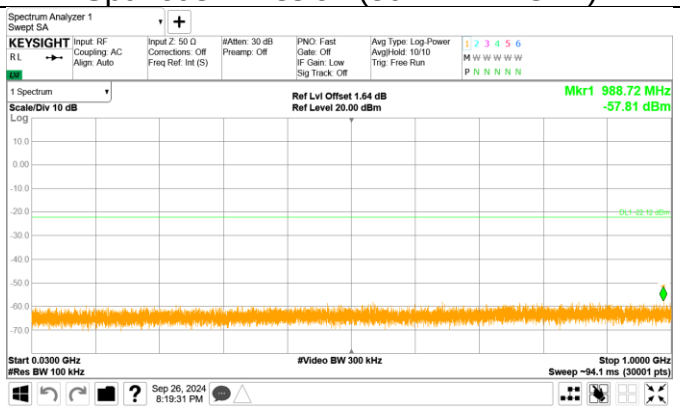
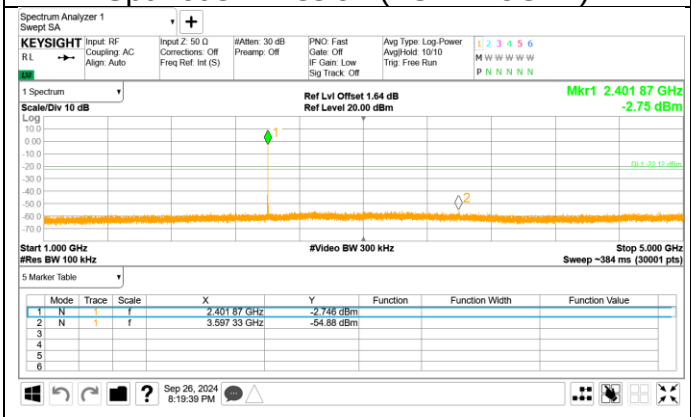
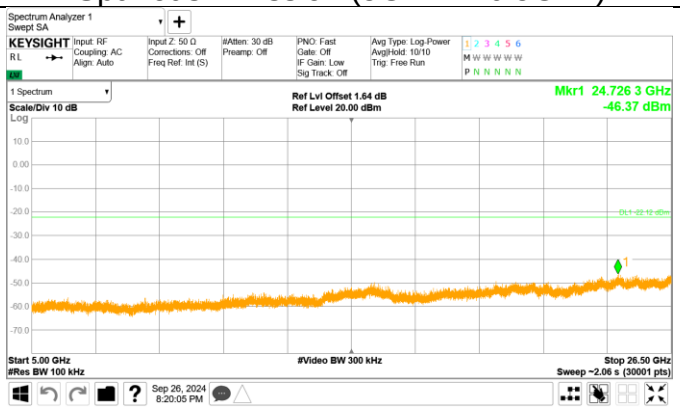
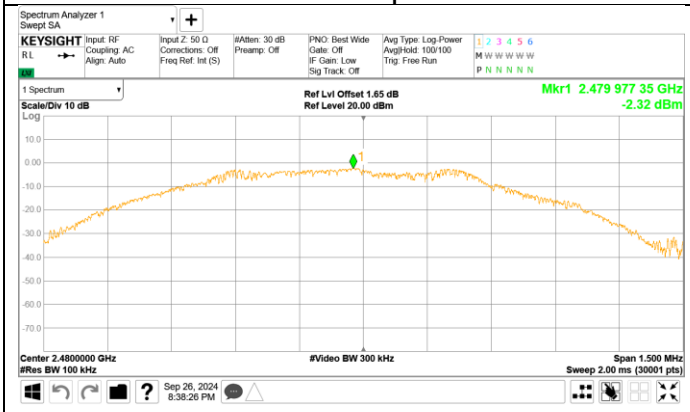
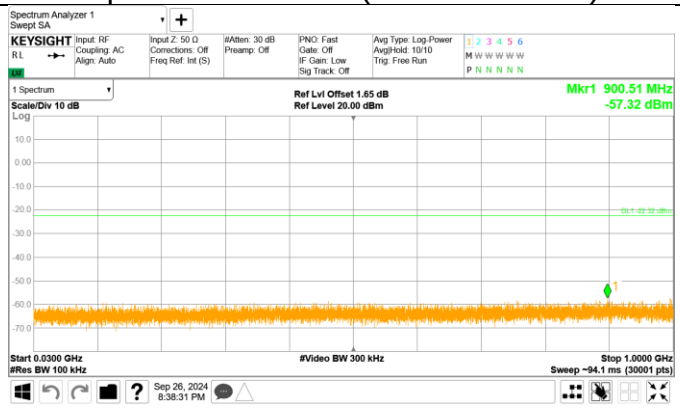
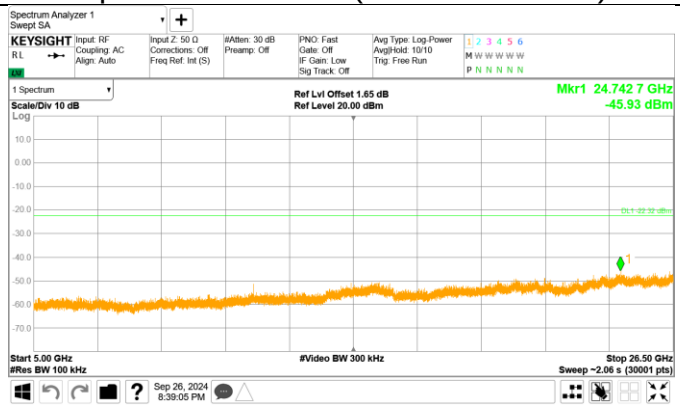
Spurious RF conducted emissions

Out-of-Band Emissions (1Mbps)	
Channel 0 (2402MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

Out-of-Band Emissions (1Mbps)	
Channel 19 (2440MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

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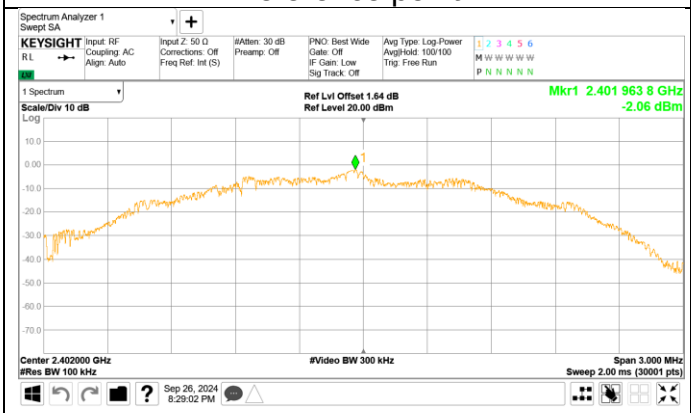
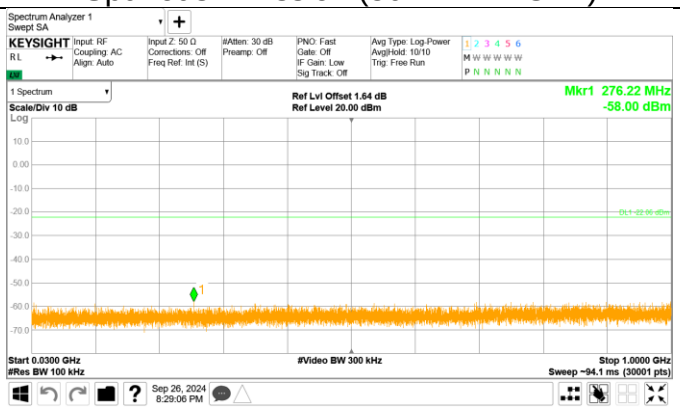
Out-of-Band Emissions (1Mbps)

Channel 39 (2480MHz)

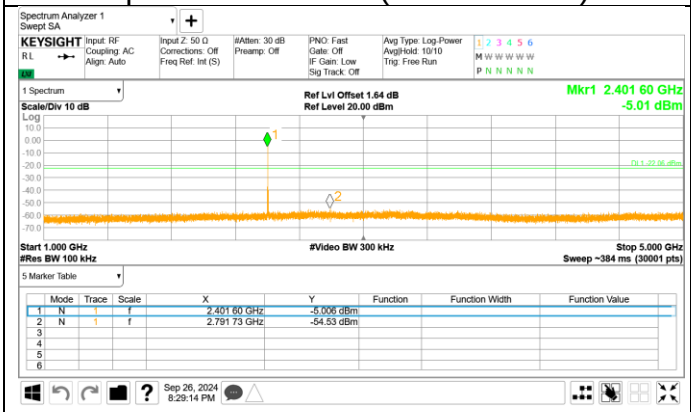
Reference point



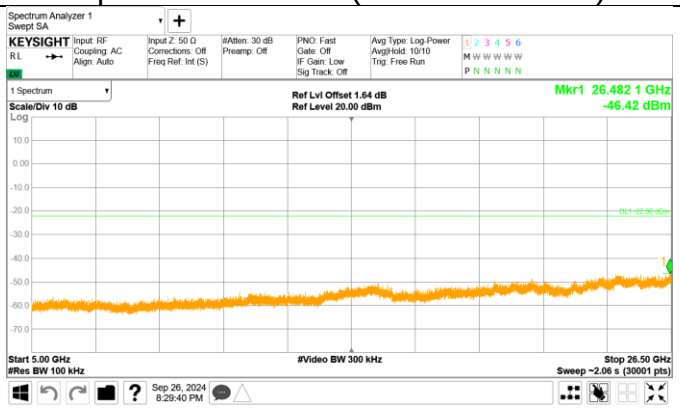
Spurious Emission (30MHz – 1GHz)

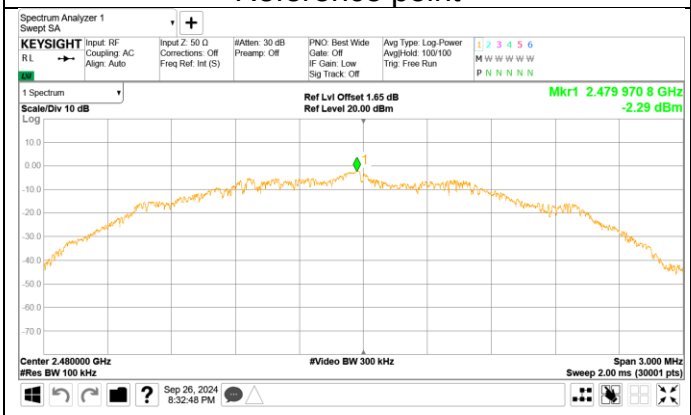
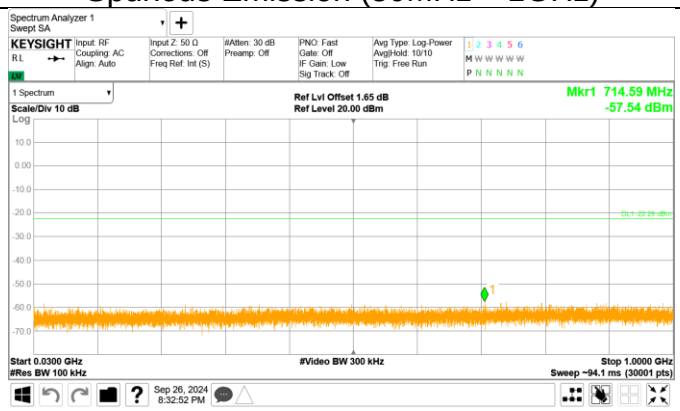
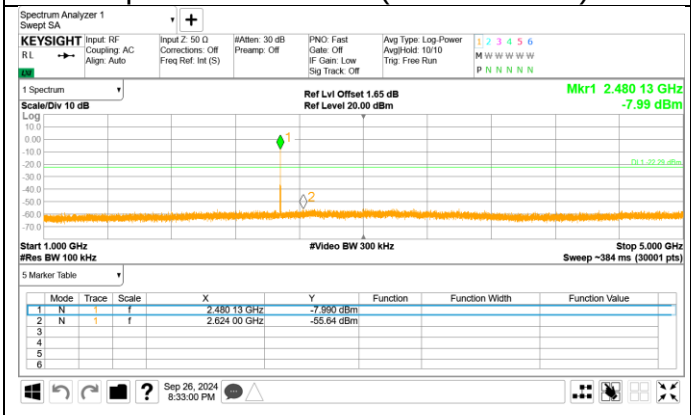
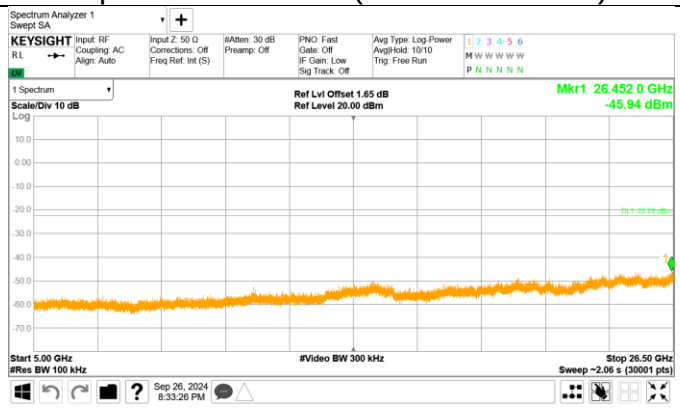


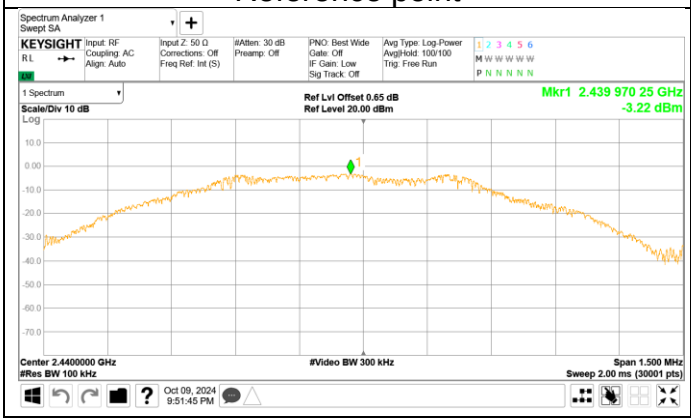
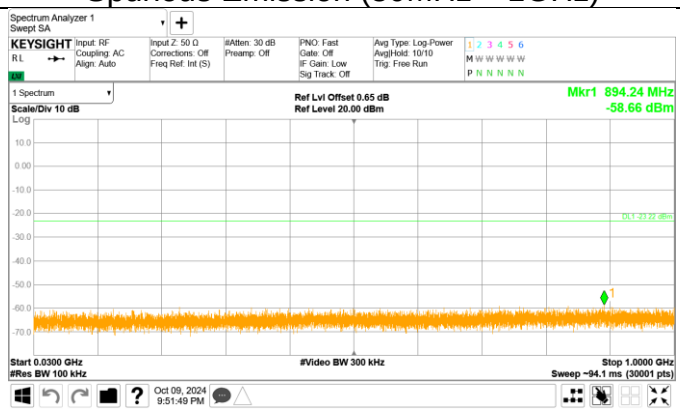
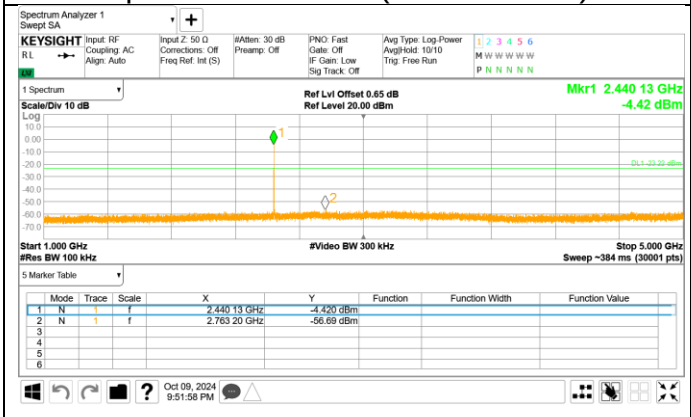
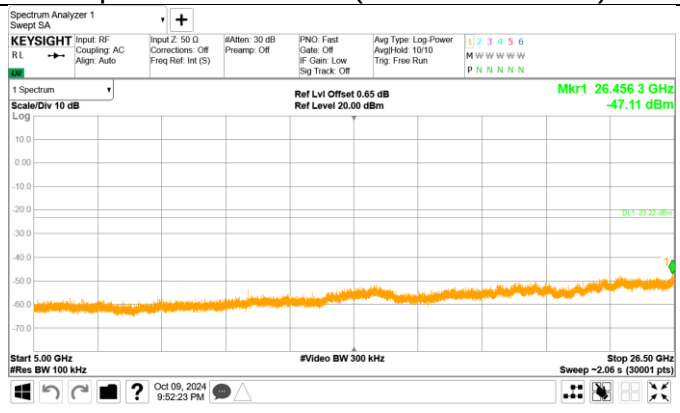
Spurious Emission (1GHz –5GHz)

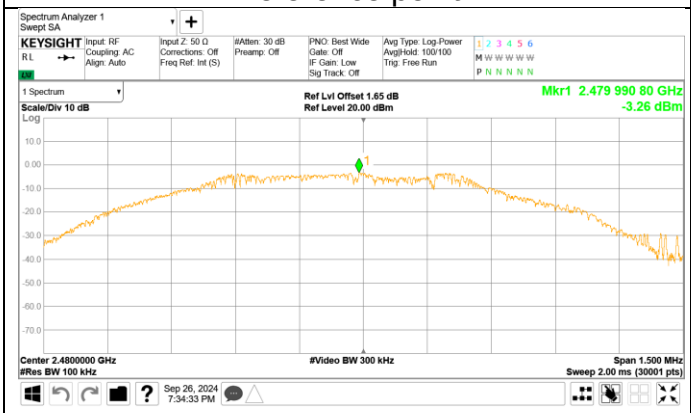
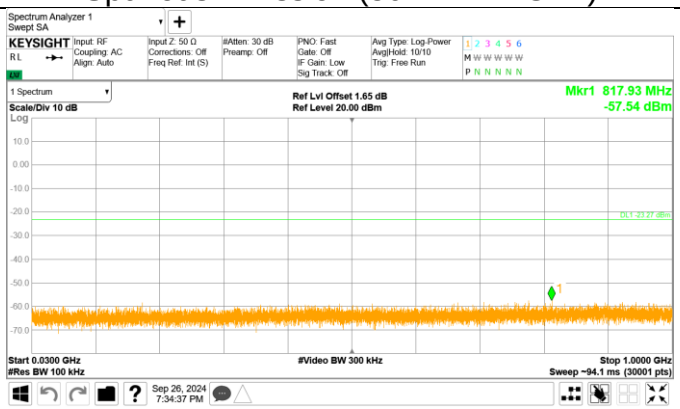
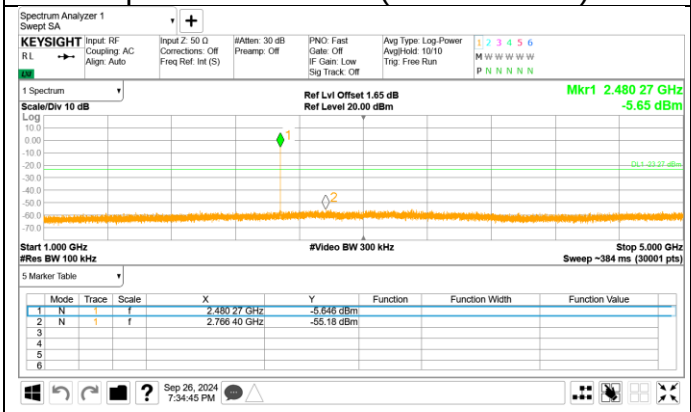
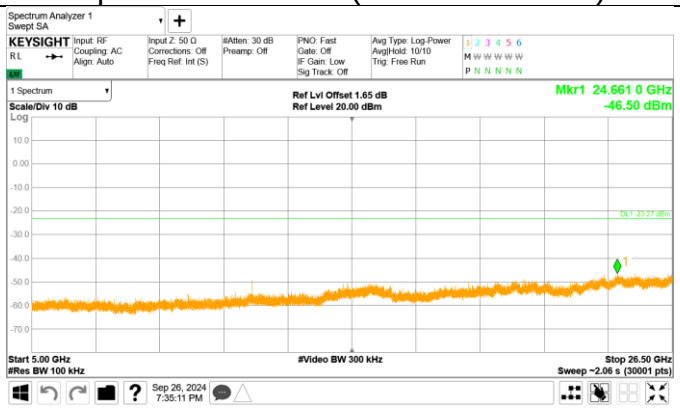


Spurious Emission (5GHz –26.5GHz)



Out-of-Band Emissions (2Mbps)	
Channel 0 (2402MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

Out-of-Band Emissions (2Mbps)	
Channel 19 (2440MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

Out-of-Band Emissions (2Mbps)	
Channel 39 (2480MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

9.6 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.

According to §15.247(d), band edge limit as below:

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

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