



FCC/ISED - TEST REPORT

Report Number	:	709502408755-00B	Date of Issue:	<u>November 18, 2024</u>
Model	:	<u>CM-08-E</u>		
Product Type	:	<u>HONEYCOMB MOTOR</u>		
Applicant	:	<u>Coulisse B.V.</u>		
Address	:	<u>Vonderweg 48, 7468 DC Enter,</u> <u>THE NETHERLANDS</u>		
Production Facility	:	<u>Ningbo Dooya Mechanical & Electronic Technology Co., Ltd.</u>		
Address	:	<u>No.168 Shengguang Road, Luotuo, Zhenhai 315202 Ningbo,</u> <u>Zhejiang province, People's republic of China</u>		

Test Result	:	☒ Positive ☐ Negative
Total pages including Appendices	:	55

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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
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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-E

Hardware Version Identification No. (HVIN) CM-08-EV2

Product Marketing Name (PMN) CM-08-E

FCC ID: ZY4CM08E1

IC: 28177-CM08E1

Options and accessories: NA

Rating: USB input: DC5V, 12W (12V for battery)

RF Transmission Frequency: SRD transceiver: 433.92MHz;
2.4GHz BLE: 2402~2480 MHz
2.4GHz Thread: 2405~2480MHz

No. of Operated Channel: SRD transceiver: 1;
2.4GHz BLE: 40
2.4GHz Thread: 16

Modulation: SRD transceiver: FSK;
2.4GHz BLE: GFSK
2.4GHz Thread: OQPSK

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

2.4GHz Thread:

Thread			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

Antenna Type: SRD transceiver: Line Antenna;
2.4GHz BLE: Line Antenna
2.4GHz Thread: Line Antenna

Antenna Gain: SRD transceiver: -4dBi;
2.4GHz BLE: 2.2dBi
2.4GHz Thread: 2.2dBi

Description of the EUT: The Equipment Under Test (EUT) is a HONEYCOMB MOTOR with BLE function and Thread function and SRD function (transceiver). We tested it and listed the worst data in this report.

Test sample no.: SHA-831821-9 (Conducted sample),
SHA-831821-10 (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.



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
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 Measurement Guidance v05r02 and ANSI C63.10-2013.



5 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	13-15	Site 1	☒	☐	☐
§15.247 (b) (3)	RSS-247 5.4(d)	Conducted peak output power	16-18	Site 1	☒	☐	☐
	RSS-247 5.4(d)	Equivalent Isotropic Radiated Power	16-18	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	19-23	---	☒	☐	☐
§15.247(e)	RSS-247 5.2(b)	Power spectral density	24-26	---	☒	☐	☐
§15.247(d)	RSS-247 5.5	Spurious RF conducted emissions	27-33	---	☒	☐	☐
§15.247(d)	RSS-247 5.5	Band edge	34-38	---	☒	☐	☐
§15.247(d) & §15.209 & §15.205	RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	39-51	Site 1	☒	☐	☐
§15.203	RSS-Gen 6.8	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 and Thread. 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: ZY4CM08E1, IC: 28177-CM08E1, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-247, RSS-GEN.

This report is only for the 2.4GHz BLE test report, for the Thread test report please refer to 709502408755-00C, for the 433.92MHz test report please refer to 709502408755-00A.

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: September 13, 2024

Testing End Date: November 16, 2024

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

Reviewed by:

Prepared by:

Tested by:



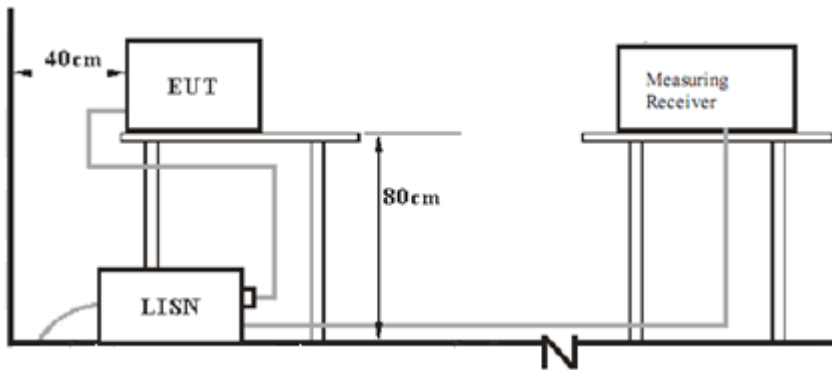
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EMC Test Engineer

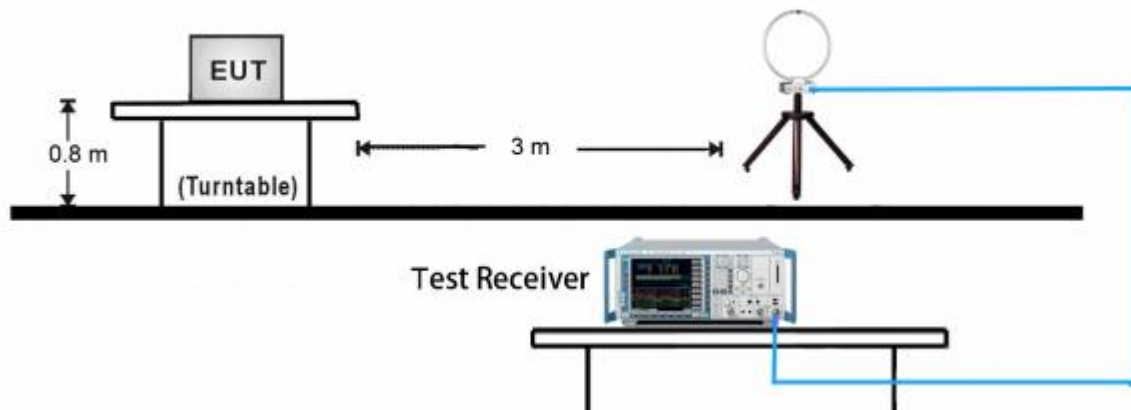
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

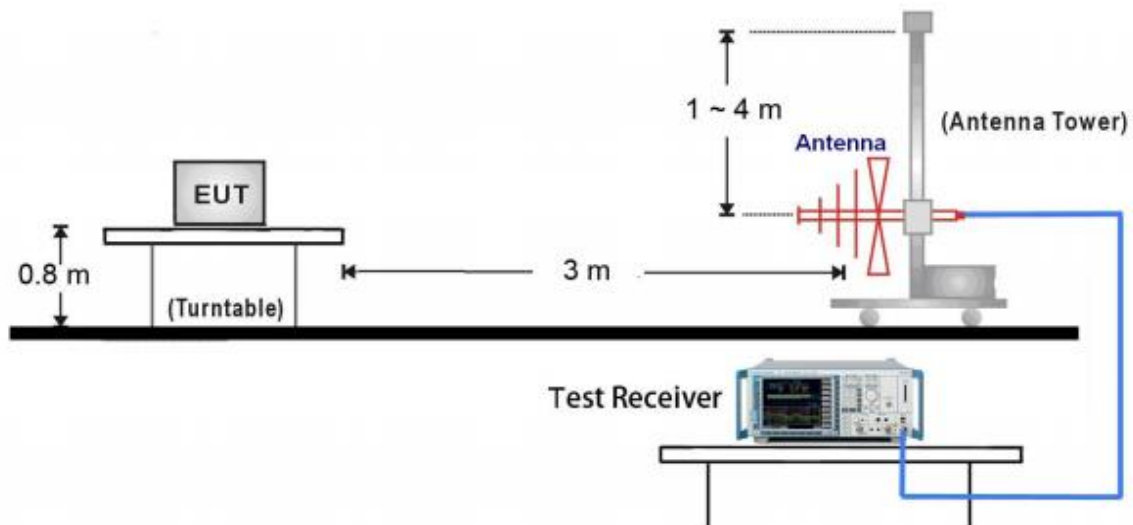


7.2 Radiated test setups

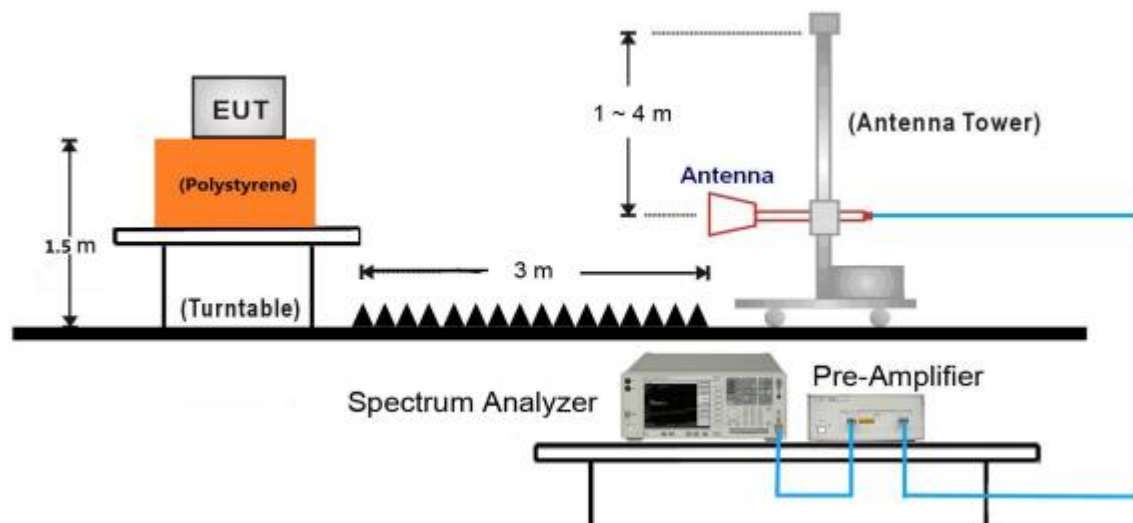
9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:

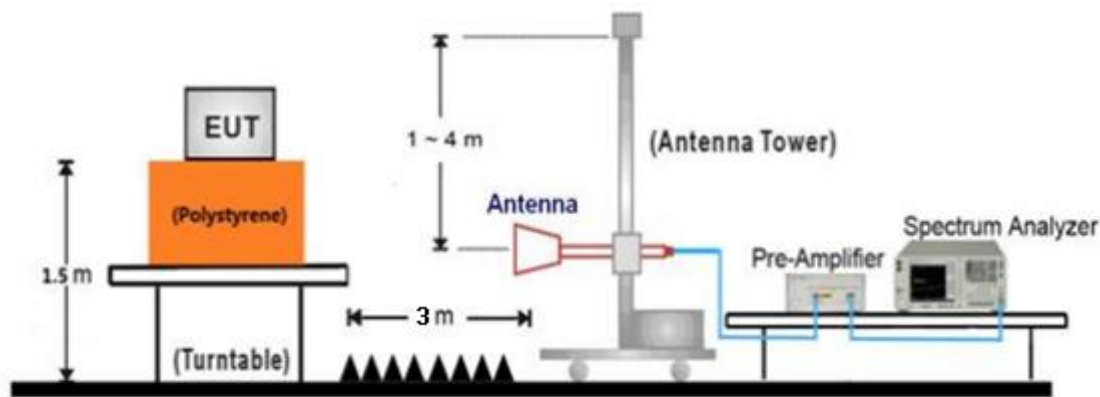


1GHz ~ 18GHz Test Setup:

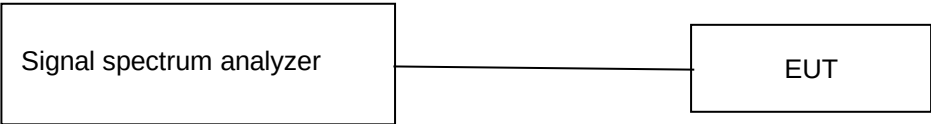




18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups





8 Systems test configuration

Auxiliary Equipment Used during Test:

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

Test software: nRF_DTM x64

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	8
	19	1	GFSK	8
	39	1	GFSK	8
	0	2	GFSK	8
	19	2	GFSK	8
	39	2	GFSK	8



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

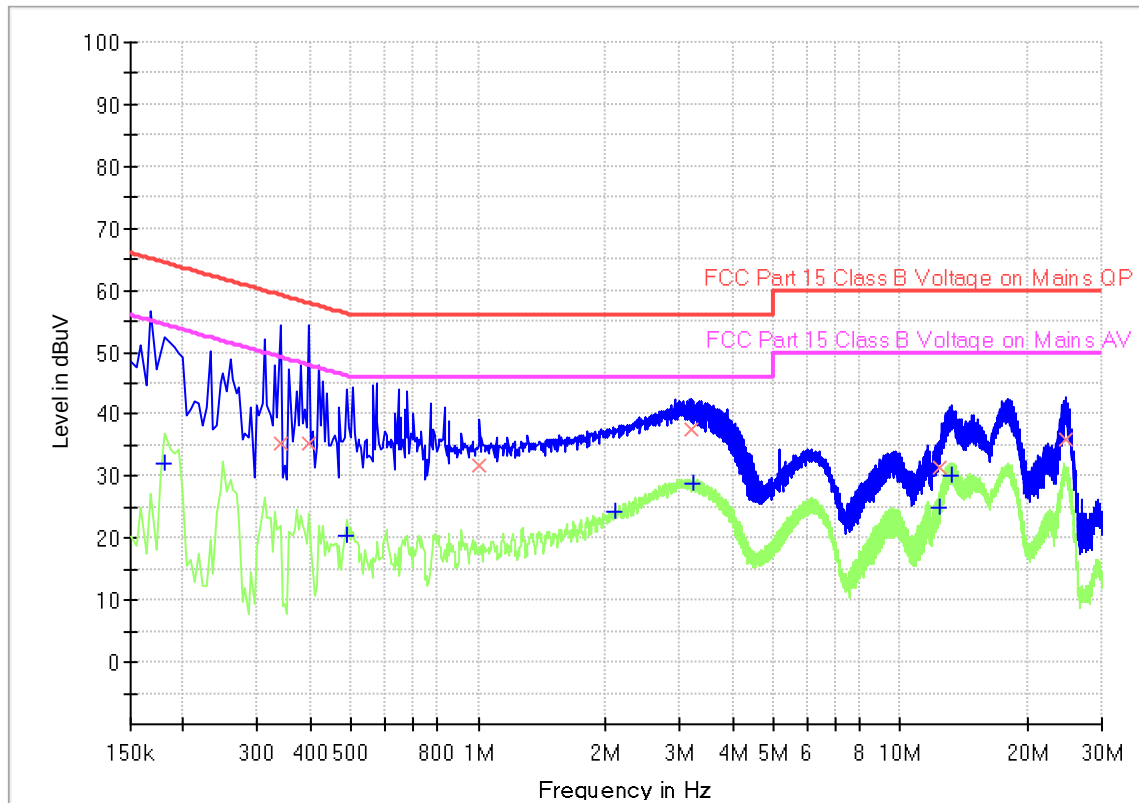
Limit

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

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

*Decreasing linearly with logarithm of the frequency

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



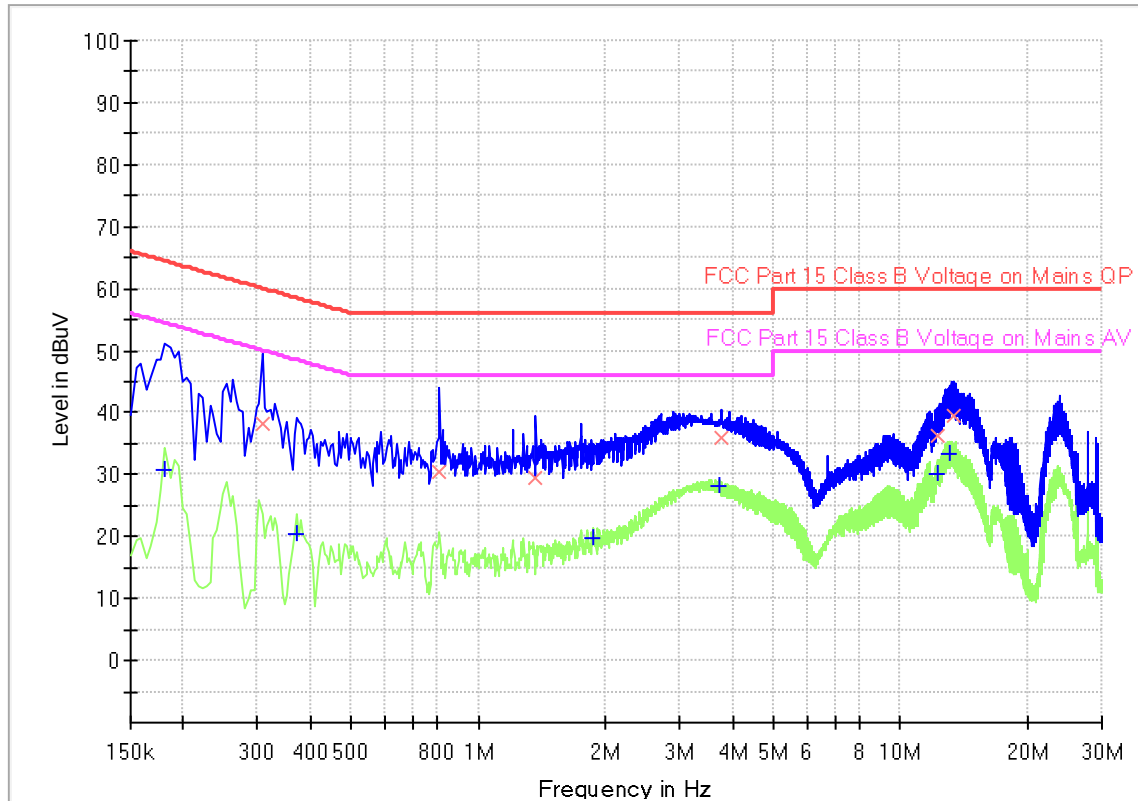
Final Result

Frequency (MHz)	Quasi Peak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.181500	---	32.05	54.42	22.37	1000.0	9.000	L1	19.4
0.339000	35.17	---	59.23	24.06	1000.0	9.000	L1	19.5
0.397500	35.43	---	57.91	22.48	1000.0	9.000	L1	19.5
0.487500	---	20.26	46.21	25.95	1000.0	9.000	L1	19.4
1.005000	31.61	---	56.00	24.39	1000.0	9.000	L1	19.5
2.098500	---	24.17	46.00	21.83	1000.0	9.000	L1	19.5
3.178500	37.60	---	56.00	18.40	1000.0	9.000	L1	19.5
3.237000	---	28.81	46.00	17.19	1000.0	9.000	L1	19.5
12.363000	---	25.04	50.00	24.96	1000.0	9.000	L1	19.9
12.403500	31.50	---	60.00	28.50	1000.0	9.000	L1	19.9
13.245000	---	30.22	50.00	19.78	1000.0	9.000	L1	20.0
24.616500	35.80	---	60.00	24.20	1000.0	9.000	L1	20.9

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

Product Type : HONEYCOMB MOTOR

M/N : CM-08-E
 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)
0.181500	---	30.79	54.42	23.63	1000.0	9.000	N	19.4
0.307500	38.15	---	60.04	21.89	1000.0	9.000	N	19.5
0.370500	---	20.34	48.49	28.15	1000.0	9.000	N	19.5
0.807000	30.42	---	56.00	25.58	1000.0	9.000	N	19.5
1.369500	29.62	---	56.00	26.38	1000.0	9.000	N	19.5
1.869000	---	19.74	46.00	26.26	1000.0	9.000	N	19.5
3.709500	---	28.15	46.00	17.85	1000.0	9.000	N	19.6
3.750000	35.91	---	56.00	20.09	1000.0	9.000	N	19.6
12.223500	---	30.24	50.00	19.76	1000.0	9.000	N	19.8
12.250500	36.35	---	60.00	23.65	1000.0	9.000	N	19.8
13.020000	---	33.45	50.00	16.55	1000.0	9.000	N	19.8
13.420500	39.59	---	60.00	20.41	1000.0	9.000	N	19.8

Note 1: Measure Level = Reading Level + Factor
 Factor = Cable Loss + LISN Factor + 10dB Attenuator



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 $\geq$ 3RBW, Span $\geq$ 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

1Mbps

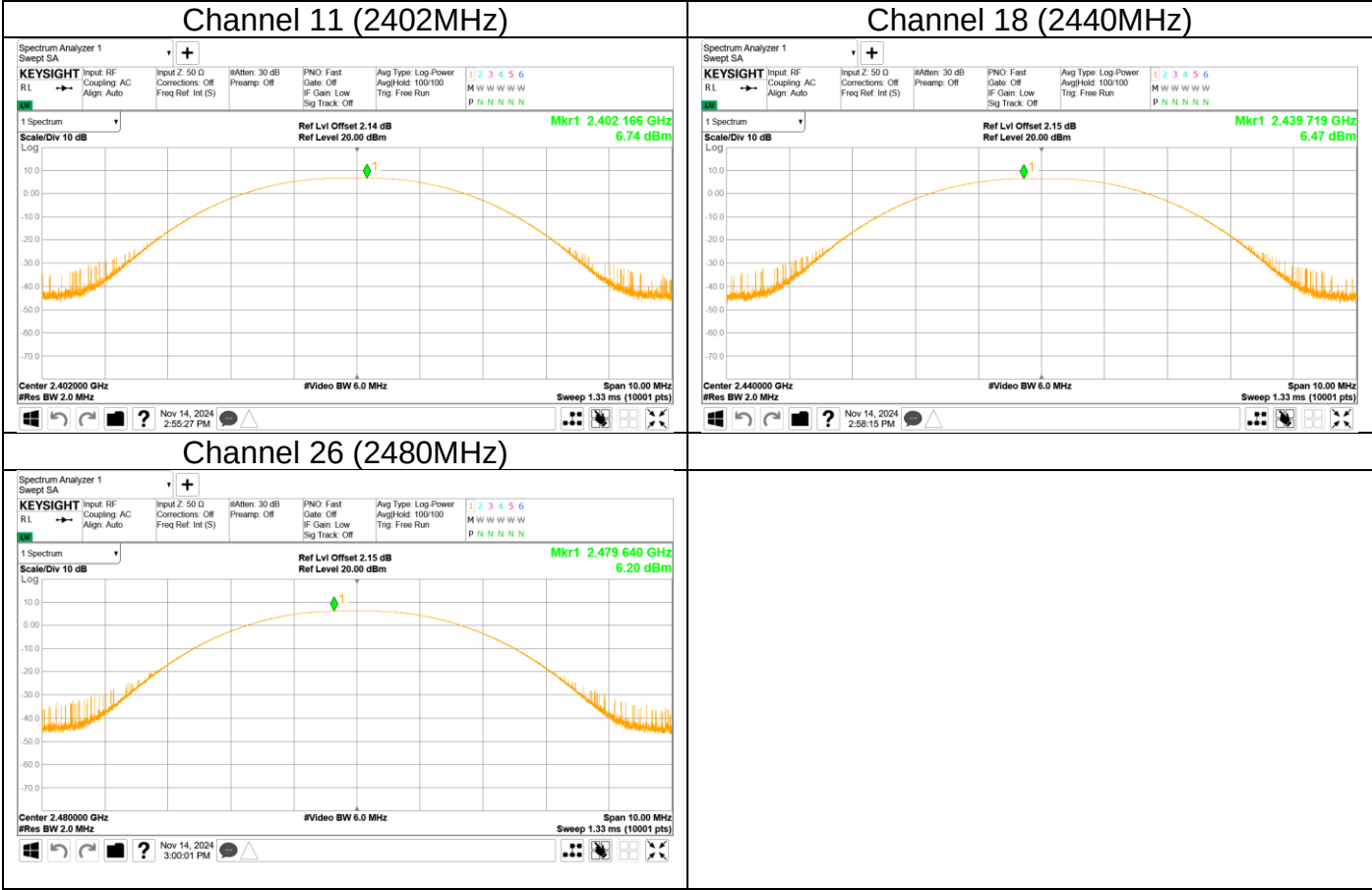
Frequency MHz	Conducted Peak Output Power dBm	E.I.R.P dBm	Result
Low channel 2402MHz	6.74	8.94	Pass
Middle channel 2440MHz	6.48	8.68	Pass
High channel 2480MHz	6.2	8.4	Pass

2Mbps

Frequency MHz	Conducted Peak Output Power dBm	E.I.R.P dBm	Result
Low channel 2402MHz	6.74	8.94	Pass
Middle channel 2440MHz	6.47	8.67	Pass
High channel 2480MHz	6.21	8.41	Pass

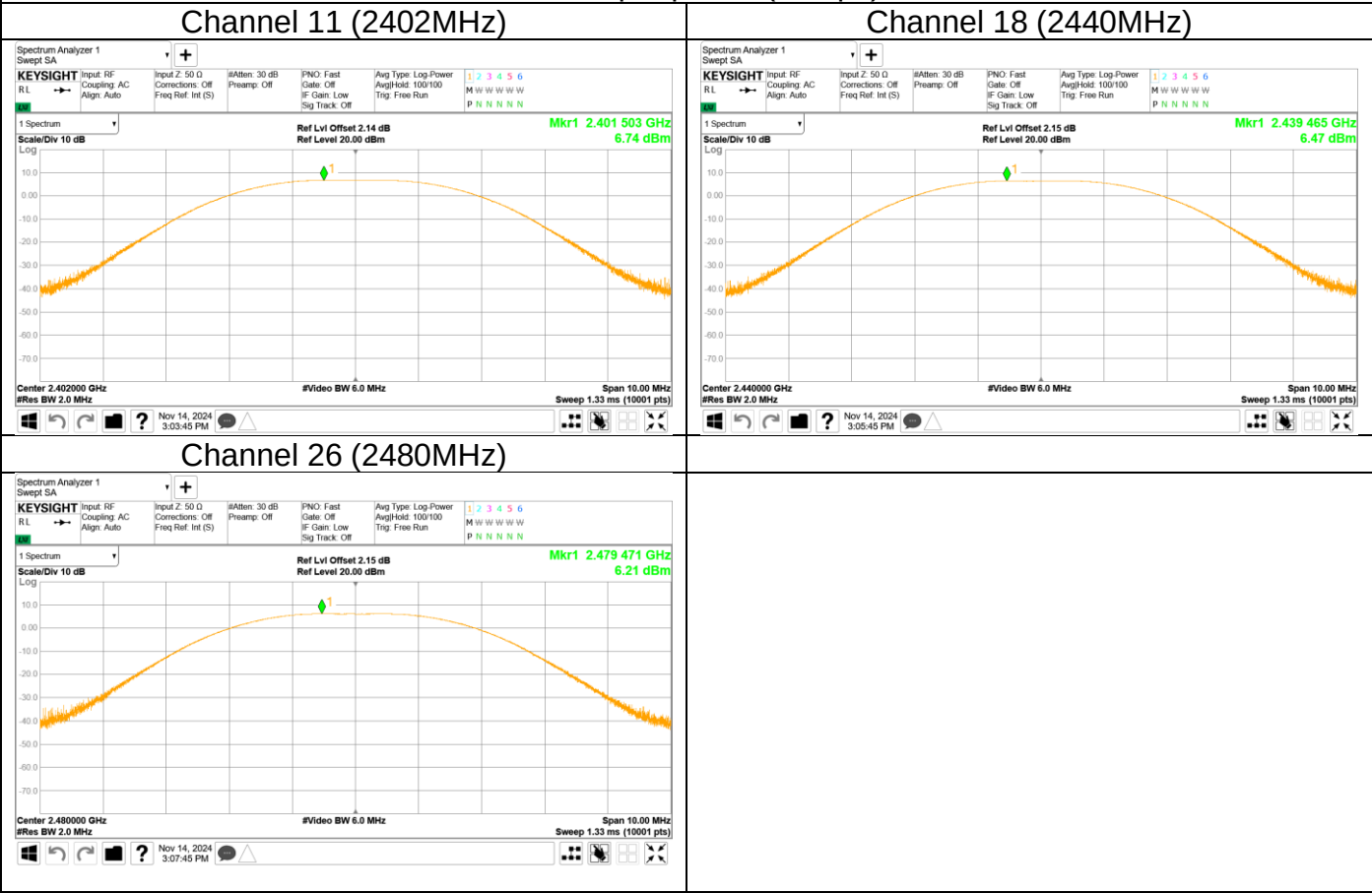


Peak output power (1Mbps)





Peak output power (2Mbps)





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

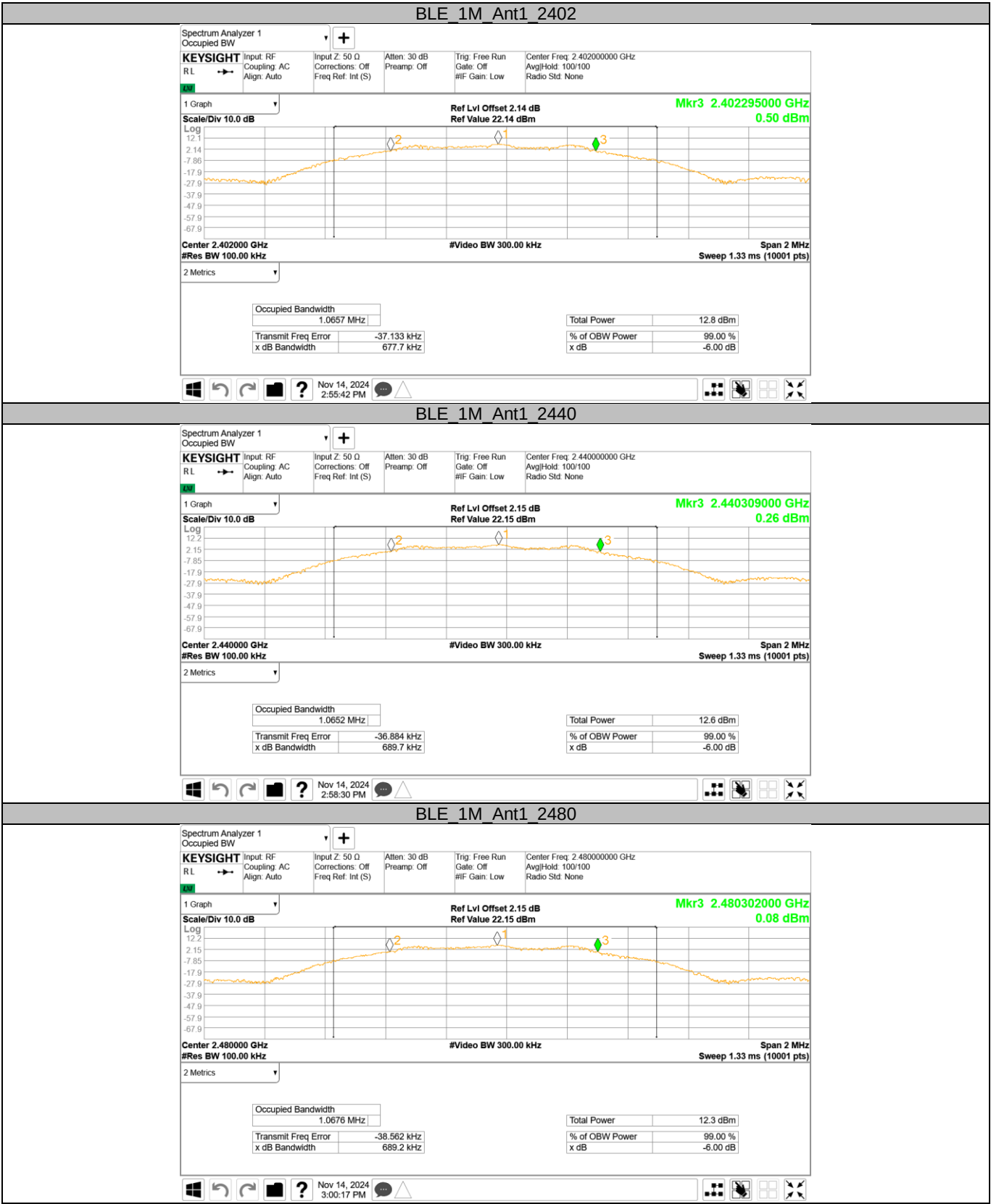
Frequency MHz	6dB bandwidth MHz	99% Bandwidth MHz	Result
Top channel 2402MHz	0.678	1.048	Pass
Middle channel 2440MHz	0.69	1.057	Pass
Bottom channel 2480MHz	0.689	1.046	Pass

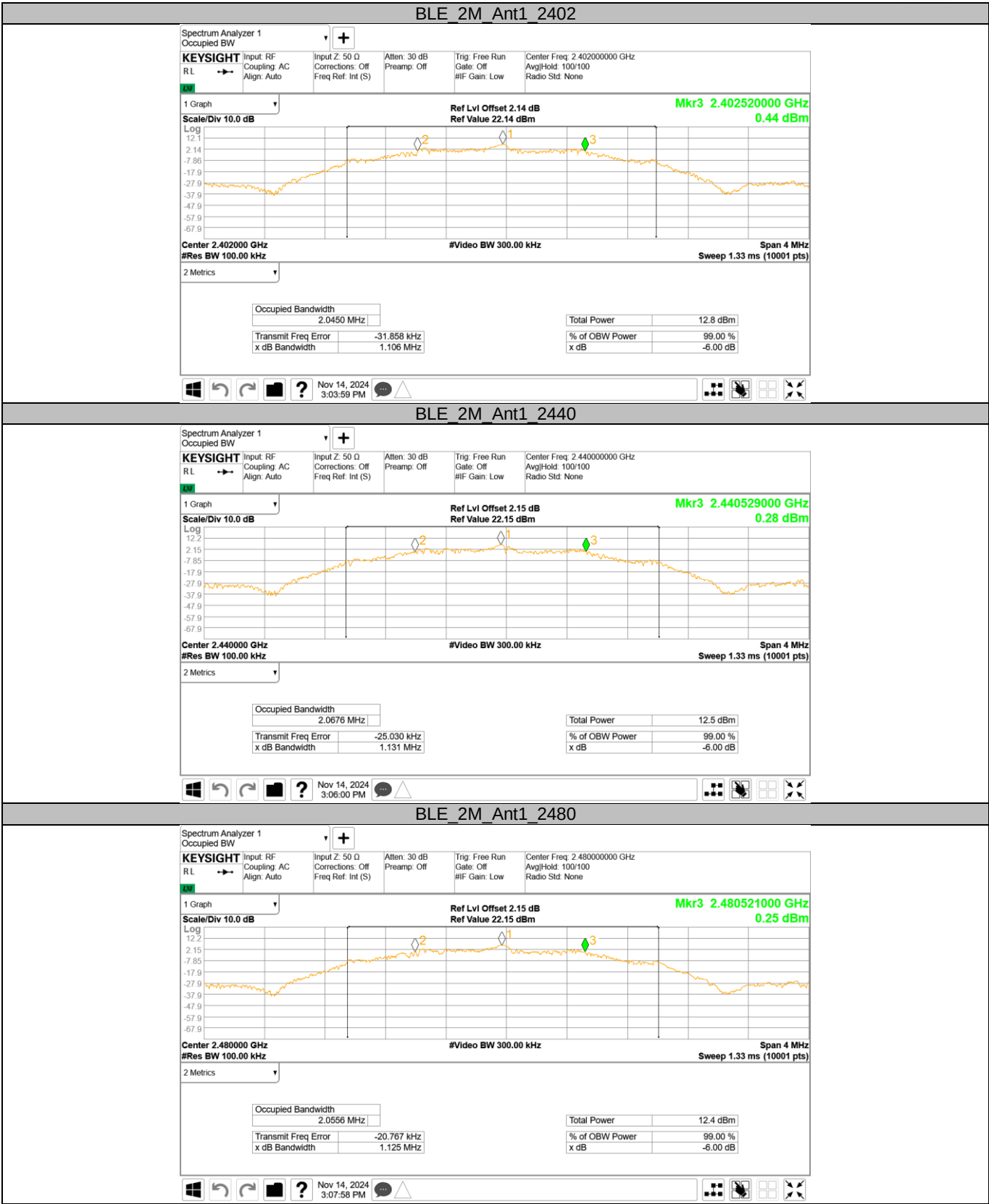
2Mbps

Frequency MHz	6dB bandwidth MHz	99% Bandwidth MHz	Result
Top channel 2402MHz	1.106	2.052	Pass
Middle channel 2440MHz	1.131	2.065	Pass
Bottom channel 2480MHz	1.125	2.072	Pass



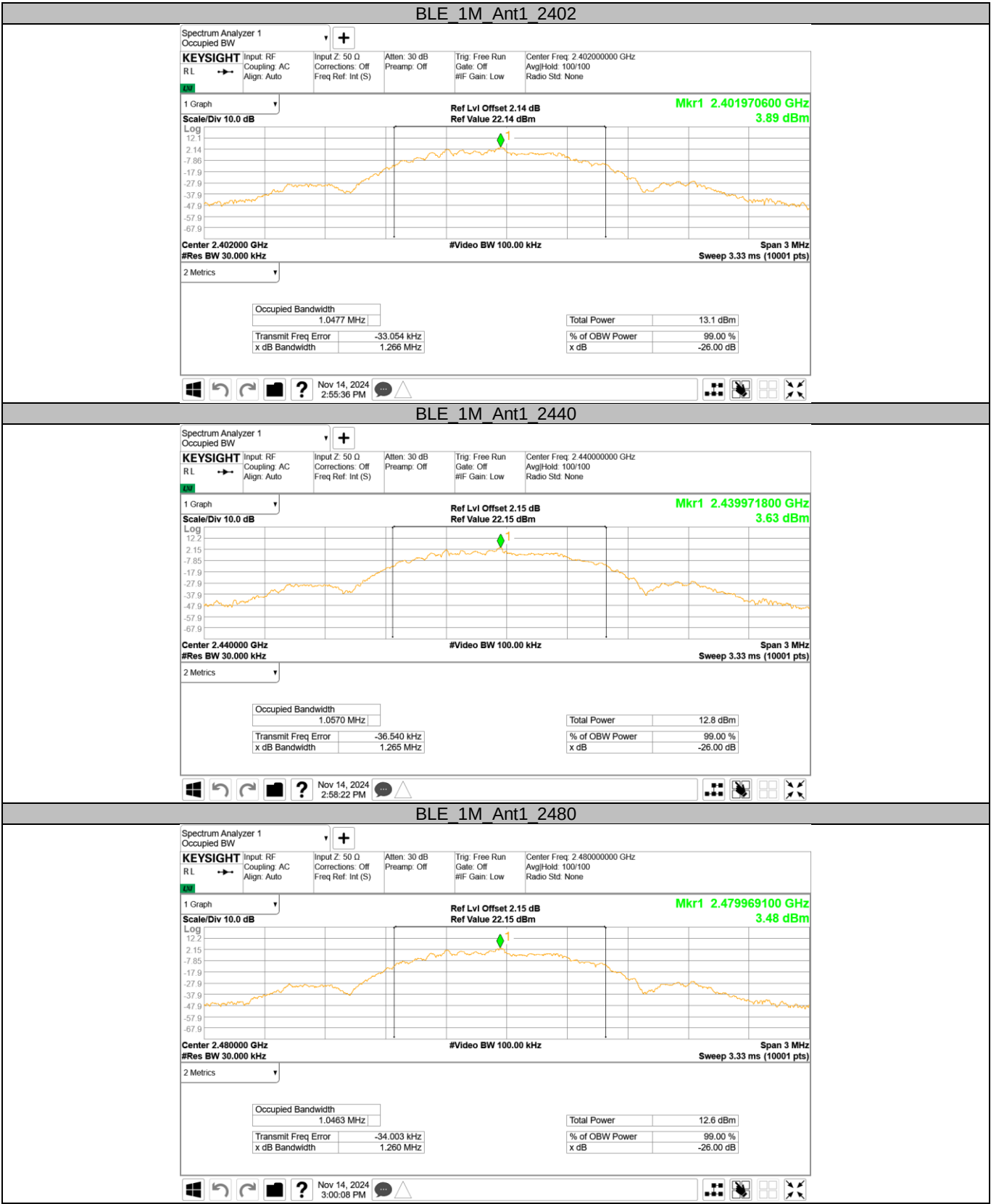
6dB Bandwidth

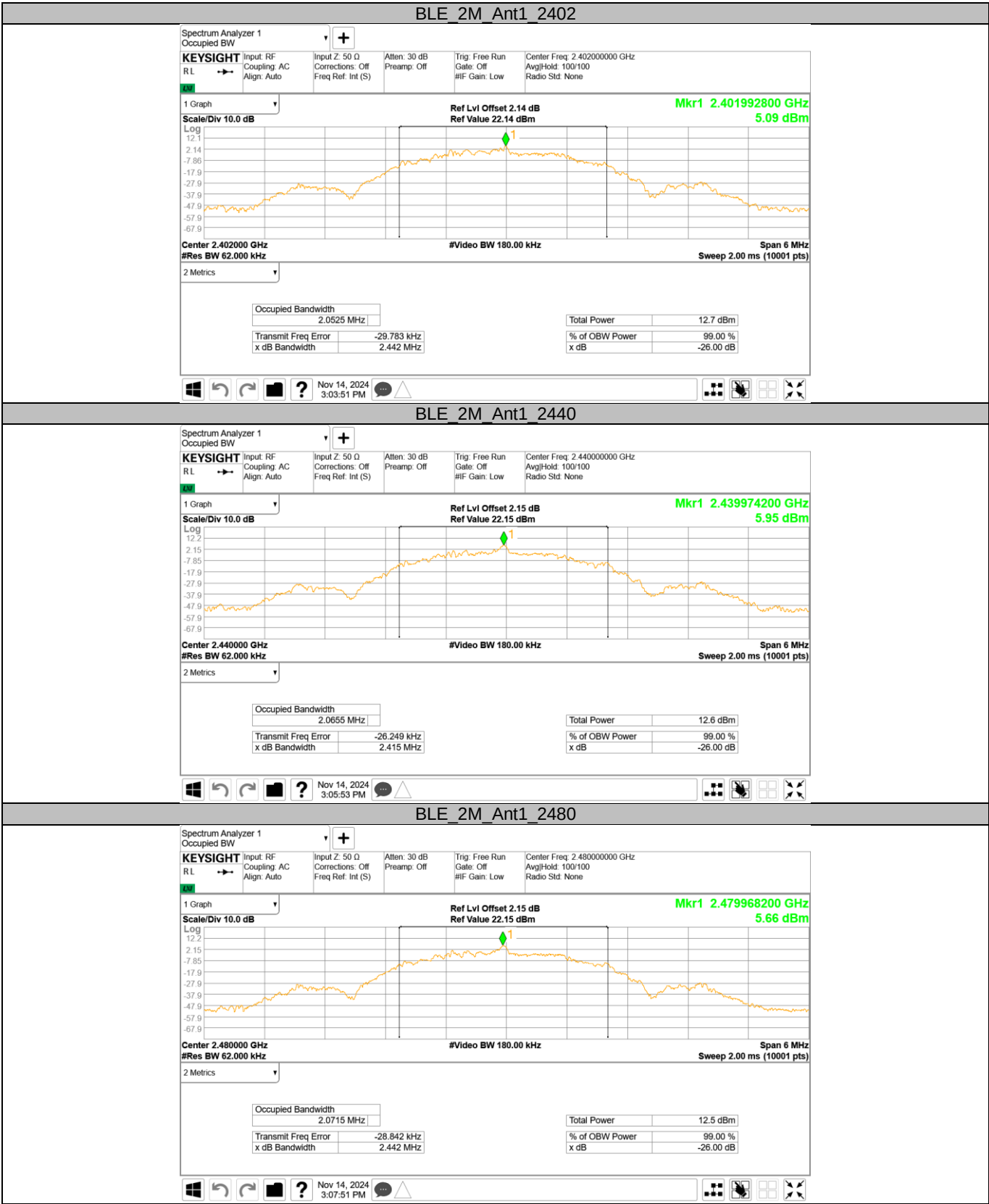






99% Occupied Bandwidth







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 $\geq$ 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

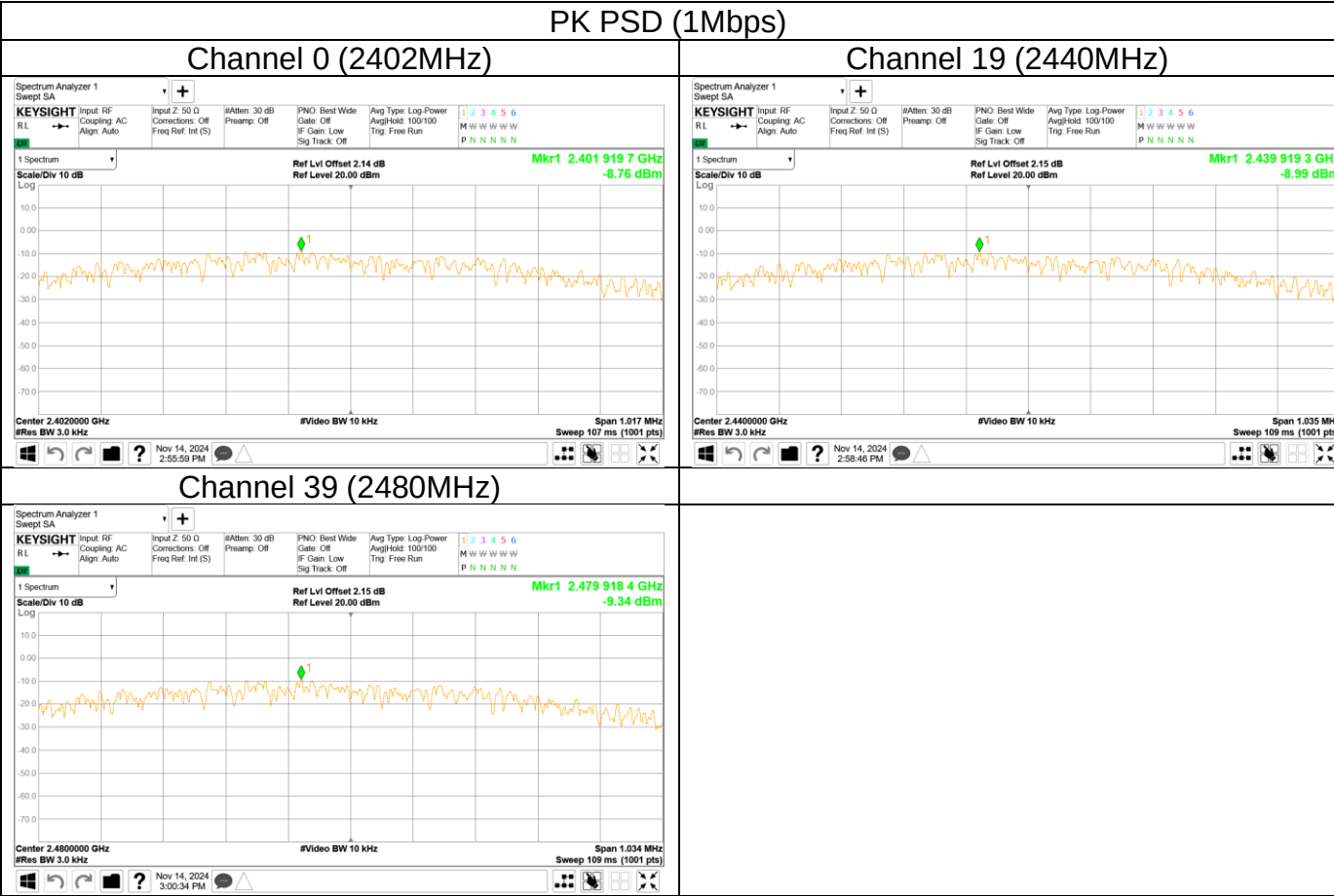
Test result

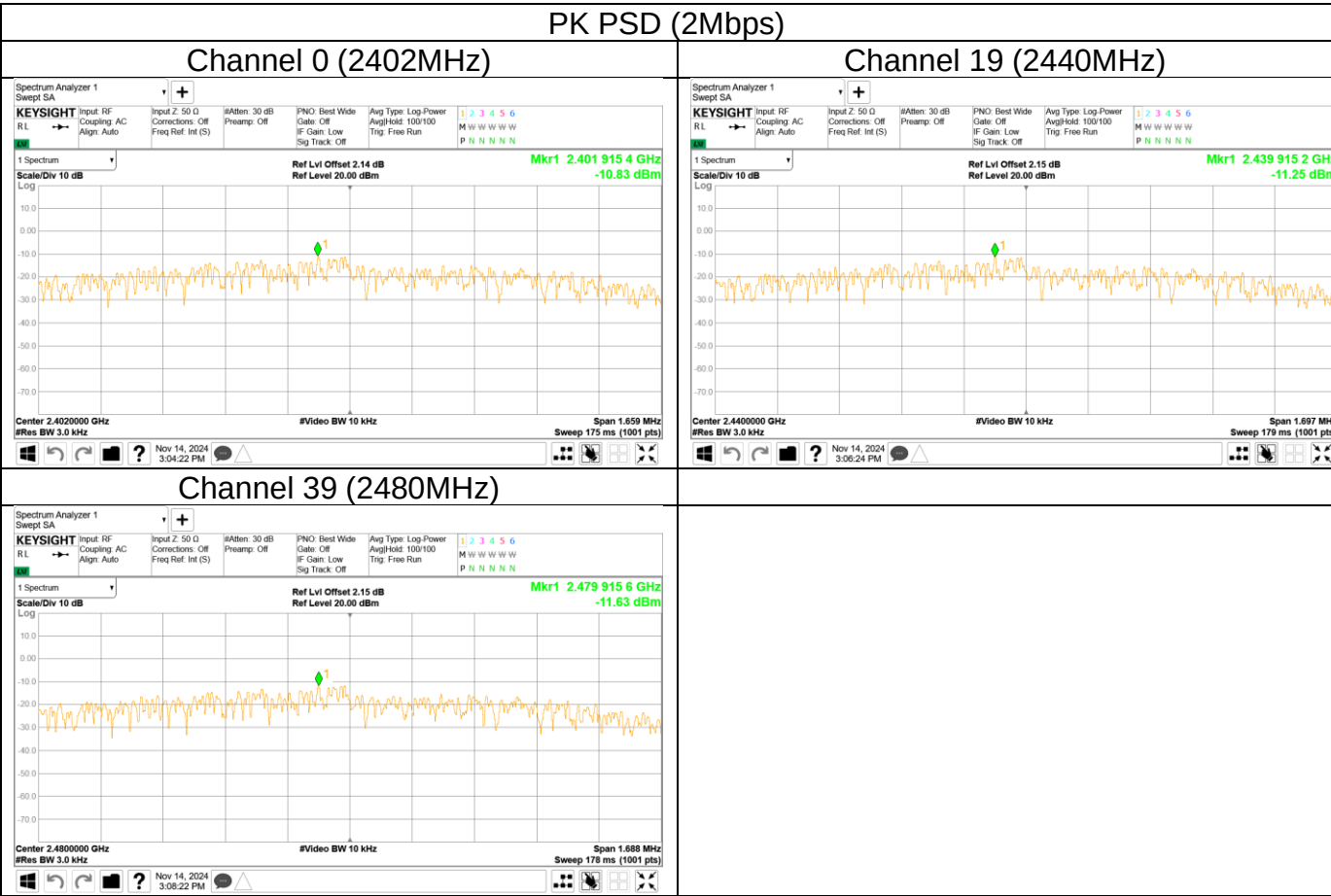
1Mbps

Frequency MHz	Power spectral density dBm/3kHz	Result
Top channel 2402MHz	-8.76	Pass
Middle channel 2440MHz	-8.99	Pass
Bottom channel 2480MHz	-9.34	Pass

2Mbps

Frequency MHz	Power spectral density dBm/3kHz	Result
Top channel 2402MHz	-10.83	Pass
Middle channel 2440MHz	-11.25	Pass
Bottom channel 2480MHz	-11.64	Pass







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 $\geq$ 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

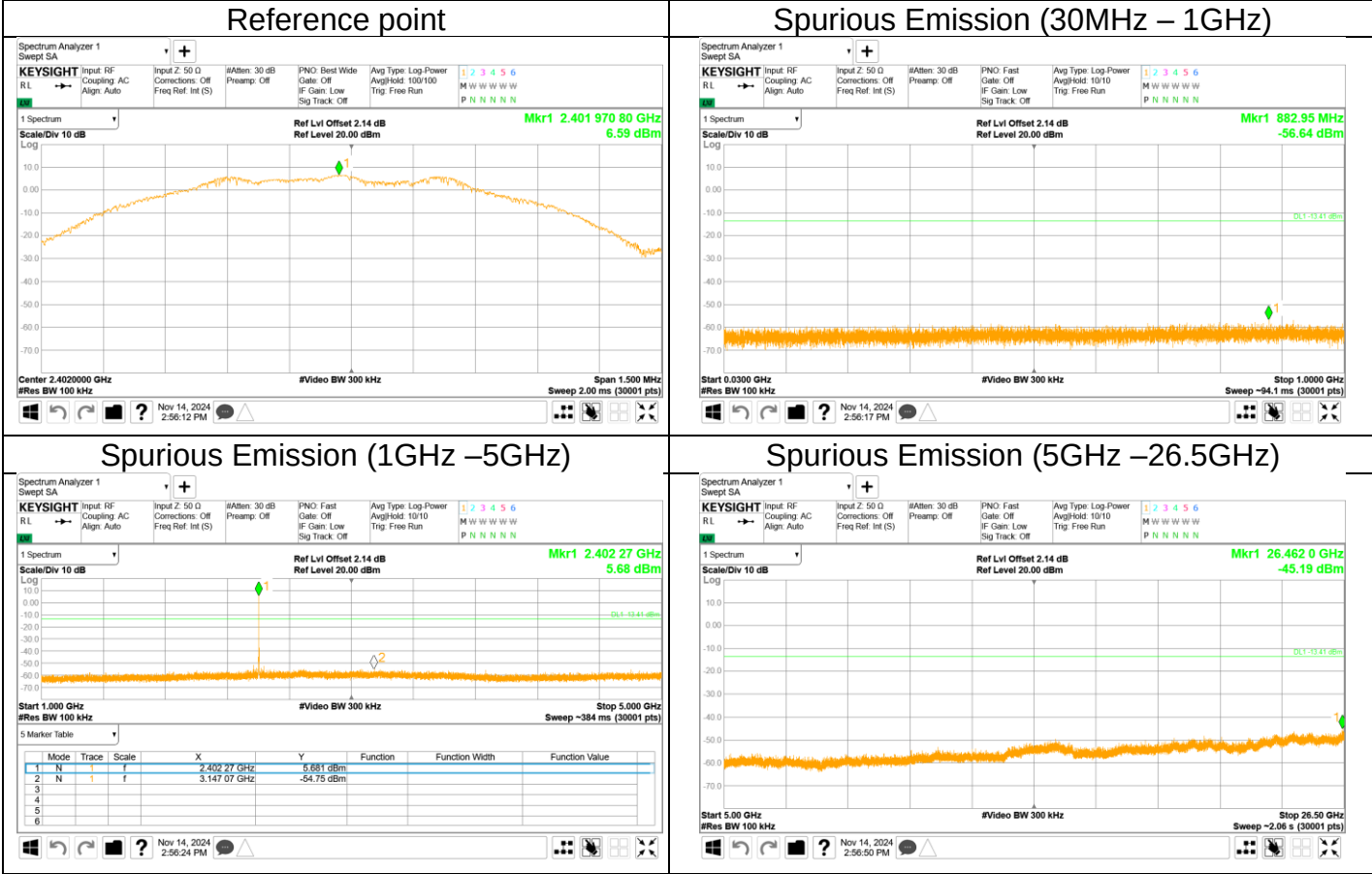
According to §15.247(d), spurious RF conducted emissions limit as below:

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



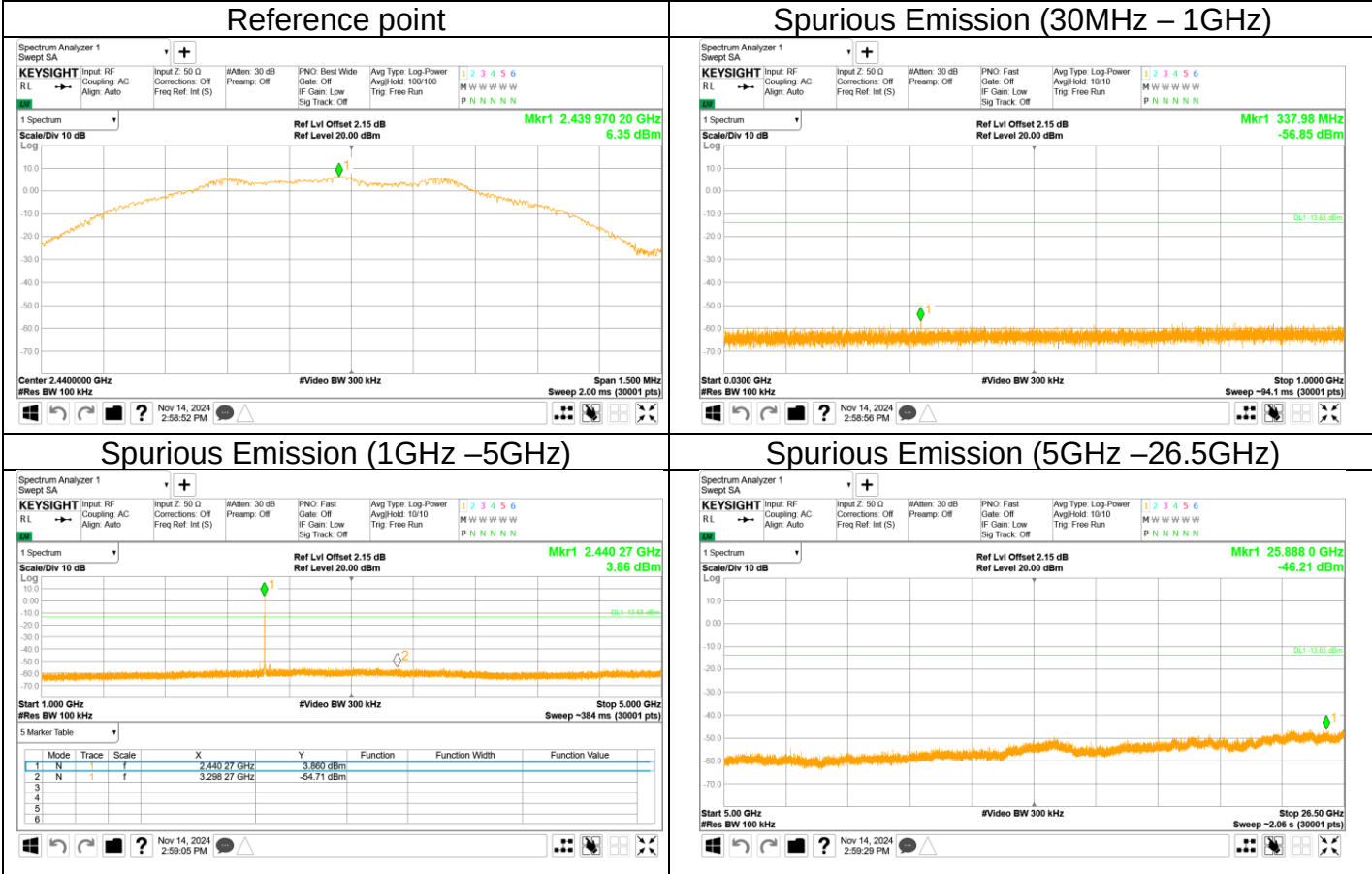
Spurious RF conducted emissions

Out-of-Band Emissions (1Mbps)
Channel 0 (2402MHz)



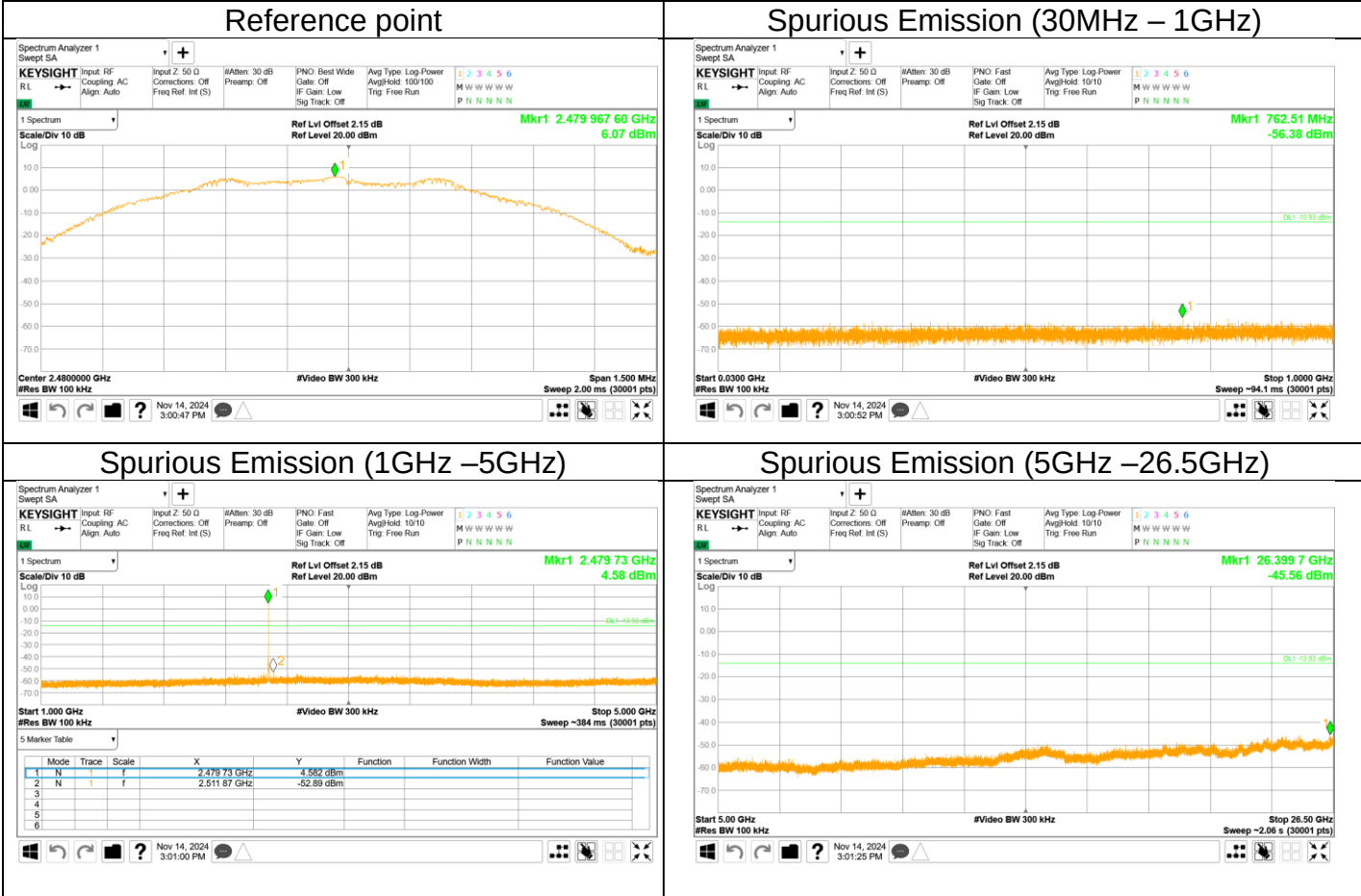


Out-of-Band Emissions (1Mbps)
Channel 19 (2440MHz)

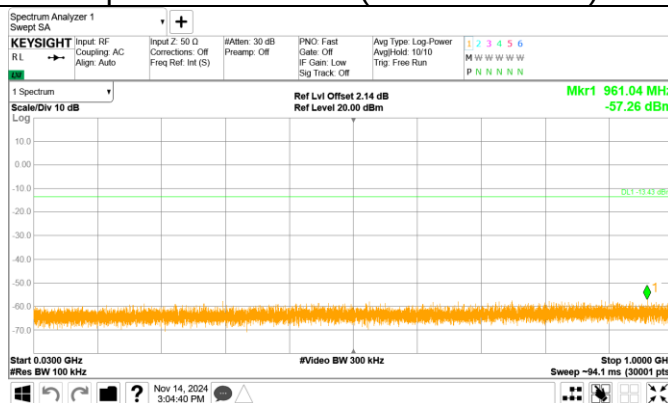




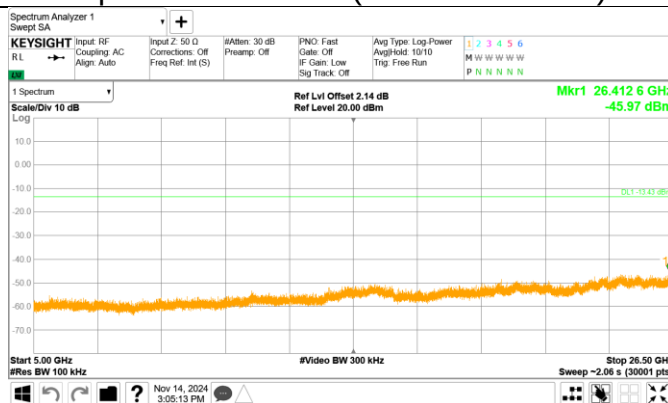
Out-of-Band Emissions (1Mbps)
Channel 39 (2480MHz)



Spurious Emission (30MHz – 1GHz)



Spurious Emission (5GHz –26.5GHz)





Out-of-Band Emissions (2Mbps)
Channel 19 (2440MHz)

