FCC/IC - TEST REPORT

Report Number	:	**709502400494-00A** Date of Issue: August 6, 2024
Model	:	F319, F325, F335, F350, F625, F635, F650, F950, F350D, F650D, F950D
Product Type	:	Thermal Monocular
Applicant	:	Zhejiang ULIRVISION Technology Co., Ltd.
Address	:	8F/9F/10F/17F, Block C, No. 581 Huoju Avenue, Puyan Street, Binjiang District, 310000 Hangzhou, Zhejiang, China
Production Facility	:	Zhejiang ULIRVISION Technology Co., Ltd.
Address	:	8F/9F/10F/17F, Block C, No. 581 Huoju Avenue, Puyan Street, Binjiang District, 310000 Hangzhou, Zhejiang, China
Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	64

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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

Product:	Thermal Monocular
Model no.:	F319, F325, F335, F350, F625, F635, F650, F950, F350D, F650D, F950D
Hardware Version Identification No. (HVIN)	F3190100, F3250100, F3350100, F3500100, F6250100, F6350100, F6500100, F9500100, F350D0100, F650D0100, F950D0100
Product Marketing Name (PMN)	F319, F325, F335, F350, F625, F635, F650, F950, F350D, F650D, F950D
FCC ID:	2BE6SHW0002
IC:	32259-HW0002
Options and accessories:	NA
Rating:	5VDC by adaptor: AC 100-240V/50/60Hz 3.6VDC Max by internal battery
RF Transmission Frequency:	For 802.11b/g/n-HT20: 2412~2462 MHz
No. of Operated Channel:	11 for 802.11b/802.11g/802.11n(H20)
Modulation:	Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing (OFDM) for 802.11g
Hardware Version:	0100
Software Version:	V_1.0.0.6
Data speed:	2.4G Wi-Fi: SISO:11b 1-11Mbps 11g 6-54Mbps 11n(H20) 6.5-72.2Mbps

Channel list:

802.11b/g/n(HT20)				
Ch	Fre(MHz)	Ch	Fre(MHz)	Ch
1	2412	7	2442	3
2	2417	8	2447	4
3	2422	9	2452	5
4	2427	10	2457	6
5	2432	11	2462	7
6	2437			

Antenna Type:	FPC
Antenna Gain:	1.95 dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Thermal Monocular Wi-Fi Module. The EUT support Wi-Fi operated at 2.4GHz.
Test sample no.:	SHA-818970-3 (Radiated sample)

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SHA-818970-2 (Conducted 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
RSS-Gen Issue 5 Amendment 2 February 2021	General Requirements for the Certification 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.

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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	14-16	Site 1	☒	☐	☐
§15.247 (b) (3)	RSS-247 5.4(d)	Conducted peak (average) output power	17-25	Site 1	☒	☐	☐
	RSS-247 5.4(d)	Equivalent Isotropic Radiated Power	17-18	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	26-32	Site 1	☒	☐	☐
§15.247(e)	RSS-247 5.2(b)	Power spectral density	33-36	Site 1	☒	☐	☐
§15.247(e)	RSS-247 5.5	Spurious RF conducted emissions	37-46	Site 1	☒	☐	☐
§15.247(d)	RSS-247 5.5	Band edge	47-53	Site 1	☒	☐	☐
§15.247(d) & §15.209 & §15.205	RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	54-60	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 FPC antenna, which gain is 1.95dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2BE6SHW0002, IC: 32259-HW0002 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-247, RSS-GEN.

According to client's declaration, all models are electrically identical with the PCB design, components and electromagnetic compatibility characteristics.
The differences of them are as follows: I.model name 2. IR resolution 3.Optional Lens .

	model	IR resolution	Optional Lens
difference	F319	384×288	19mm
	F325	384×288	25mm
	F335	384×288	35mm
	F350	384×288	50mm
	F625	640×512	25mm
	F635	640×512	35mm
	F650	640×512	50mm
	F950	1280×1024	50mm
	F350D	384×288	25-50mm zoom lens
	F650D	640×512	25-50mm zoom lens
	F950D	1280×1024	25-50mm zoom lens

So model F335 was chosen to perform all the tests. We tested it and listed the worst data in this report.

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: May 31, 2024

Testing Start Date: June 7, 2024

Testing End Date: June 28, 2024

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Reviewed by:	Prepared by:	Tested by:
Hui TONG	Wenqiang LU	Huali CHENG
Review Engineer	Project Engineer	Test Engineer

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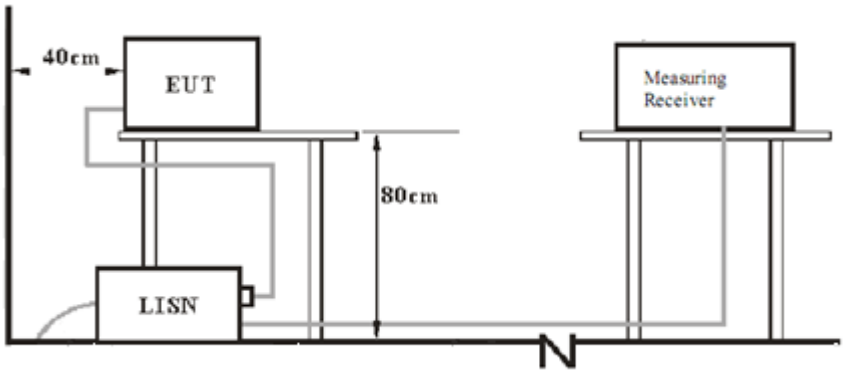
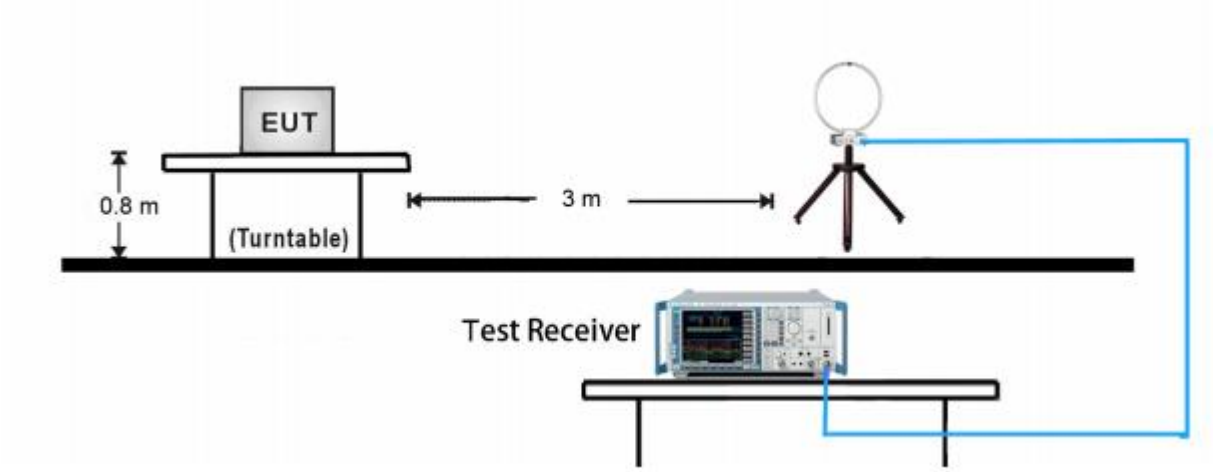
7 Test Setups

7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups

9kHz ~ 30MHz Test Setup:



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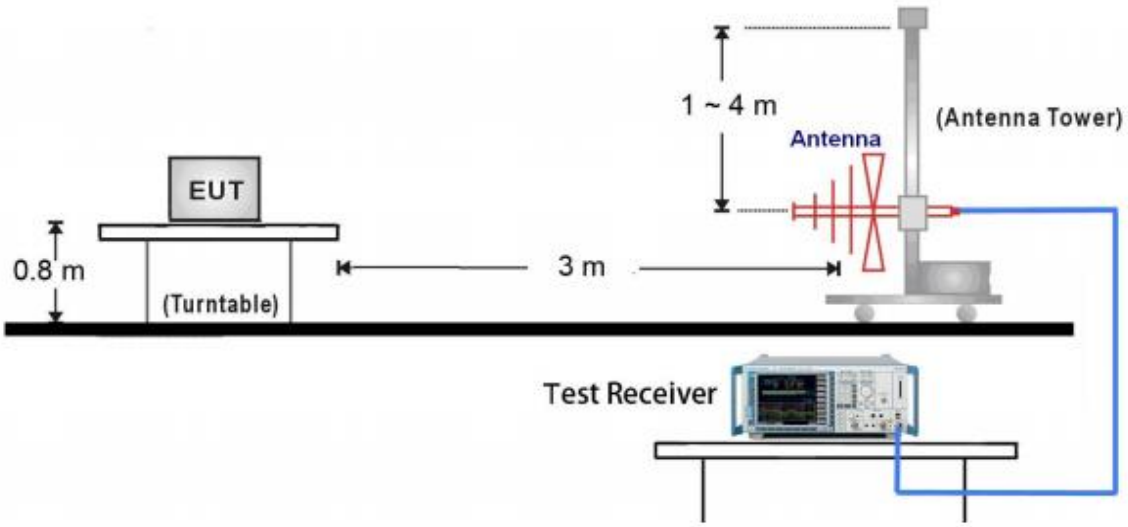
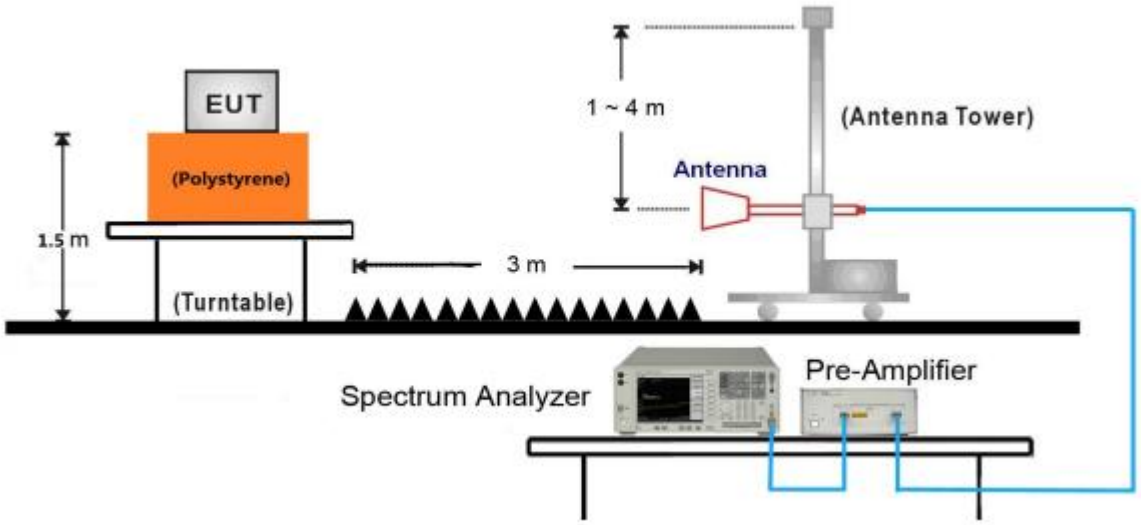
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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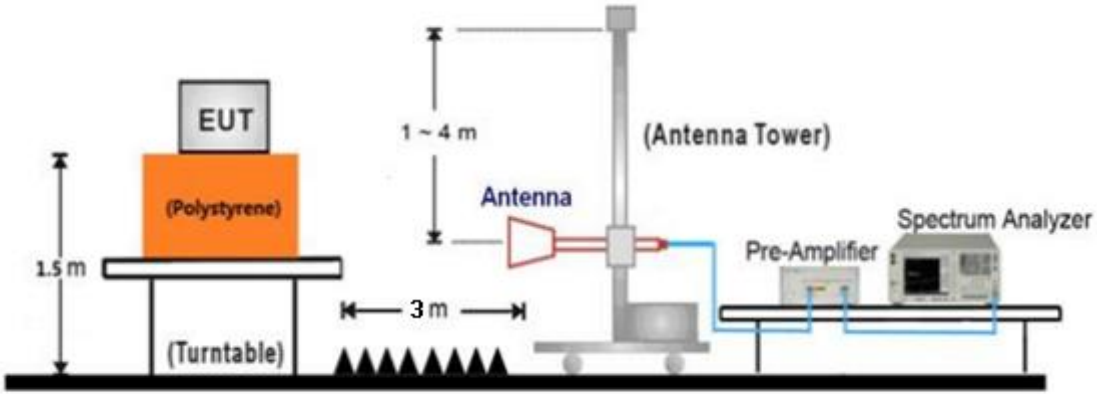
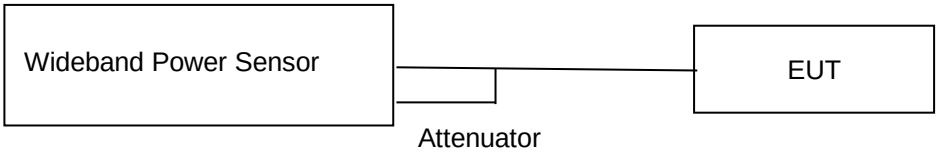
18GHz ~ 25GHz Test Setup:

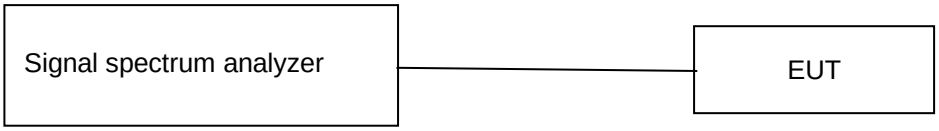


7.3 Conducted RF test setups

For Conducted peak output power



For other test items



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenove	E470	PF-OU5TS7 17/09

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

The system was configured to channel 1(2412MHz), 6(2437MHz), and 11(2462MHz) for the test.

Test Mode Applicability and Tested Channel Detail:

Mode	Tested Channel	Data Rate (Mbps)	Modulation	Index Value (Power level setting)
802.11b	1	1	CCK	default
	6	1	CCK	default
	11	1	CCK	default
802.11g	1	6	OFDM	default
	6	6	OFDM	default
	11	6	OFDM	default
802.11n HT20	1	MCS0	OFDM	default
	6	MCS0	OFDM	default
	11	MCS0	OFDM	default

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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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. 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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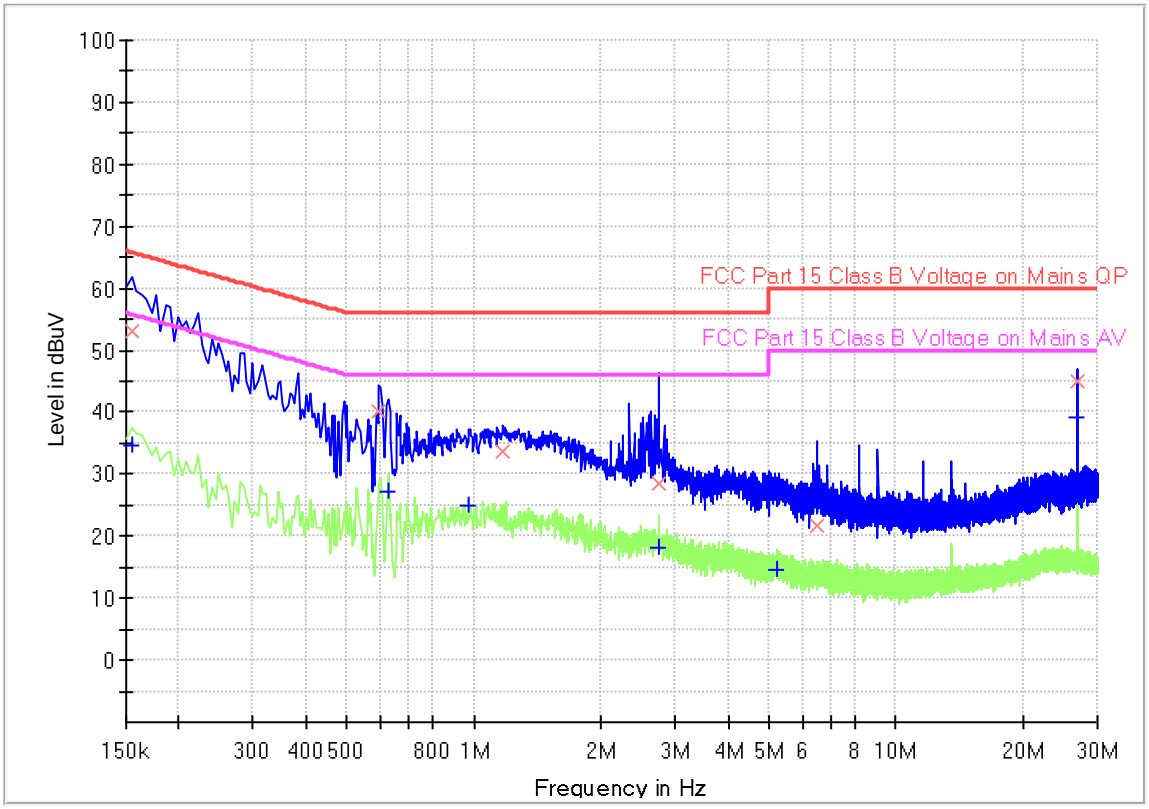
Product Type	:	Thermal Monocular
M/N	:	F335
Operating Condition	:	Mode 1: Tx_2437MHz for 802.11HT20 (worst case)
Test Specification	:	L-line
Comment	:	AC 120V/60Hz



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154500	---	34.54	55.75	21.21	1000.0	9.000	L1	19.4
0.154500	53.23	---	65.75	12.52	1000.0	9.000	L1	19.4
0.595500	40.26	---	56.00	15.74	1000.0	9.000	L1	19.4
0.627000	---	27.28	46.00	18.72	1000.0	9.000	L1	19.5
0.973500	---	24.97	46.00	21.03	1000.0	9.000	L1	19.5
1.176000	33.79	---	56.00	22.21	1000.0	9.000	L1	19.5
2.746500	28.43	---	56.00	27.57	1000.0	9.000	L1	19.5
2.746500	---	18.20	46.00	27.80	1000.0	9.000	L1	19.5
5.235000	---	14.47	50.00	35.53	1000.0	9.000	L1	19.6
6.504000	21.69	---	60.00	38.31	1000.0	9.000	L1	19.7
27.001500	---	39.30	50.00	10.70	1000.0	9.000	L1	21.1
27.001500	45.14	---	60.00	14.86	1000.0	9.000	L1	21.1

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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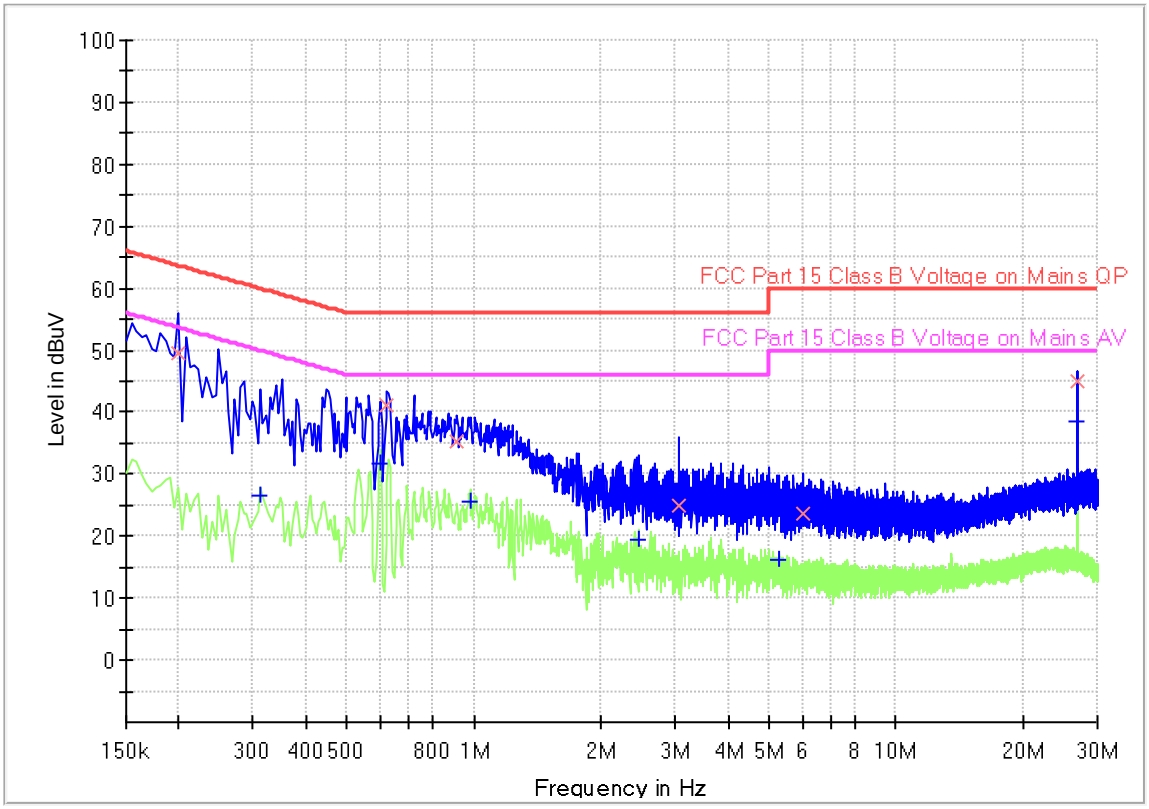
Product Type	:	Thermal Monocular
M/N	:	F335
Operating Condition	:	Mode 1: Tx_2437MHz for 802.11HT20 (worst case)
Test Specification	:	N-line
Comment	:	AC 120V/60Hz



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.199500	49.53	---	63.63	14.10	1000.0	9.000	N	19.4
0.312000	---	26.67	49.92	23.25	1000.0	9.000	N	19.5
0.600000	---	31.88	46.00	14.12	1000.0	9.000	N	19.4
0.622500	41.18	---	56.00	14.82	1000.0	9.000	N	19.4
0.910500	35.22	---	56.00	20.78	1000.0	9.000	N	19.5
0.982500	---	25.59	46.00	20.41	1000.0	9.000	N	19.5
2.463000	---	19.32	46.00	26.68	1000.0	9.000	N	19.5
3.061500	24.88	---	56.00	31.12	1000.0	9.000	N	19.5
5.307000	---	16.18	50.00	33.82	1000.0	9.000	N	19.6
5.995500	23.49	---	60.00	36.51	1000.0	9.000	N	19.6
27.001500	---	38.40	50.00	11.60	1000.0	9.000	N	20.6
27.001500	45.06	---	60.00	14.94	1000.0	9.000	N	20.6

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(average) output power and EIRP

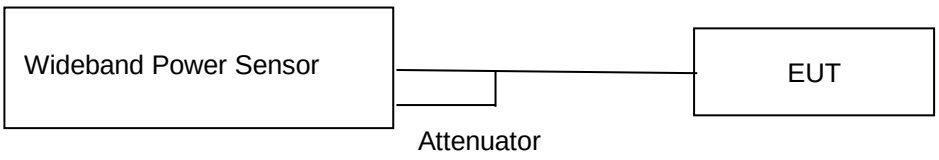
Test Method (1)

1. Measure the duty cycle D of the transmitter output signal.
2. Set span to at least 1.5 times the OBW.
3. Set RBW = 1% to 5% of the OBW, not to exceed 1 MHz.
4. Set VBW ≥ [3 × RBW].
5. Number of points in sweep ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)
6. Sweep time = auto.
7. Detector = RMS (i.e., power averaging), if available. Otherwise, use the sample detector mode.
8. Do not use sweep triggering. Allow the sweep to “free run.”
9. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the ON and OFF periods of the transmitter.
10. Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
11. Add [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the ON and OFF times of the transmission).

Test Method (2)

1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

4) Measure the peak power of the transmitter. This measurement is a peak over both the ON and OFF periods of the transmitter.



Wideband Power Sensor conducted test setup

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Limits

According to §15.247 (b) (3) & RSS-247 5.4(d), conducted peak (average) 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 (average power) as below table

802.11B

Frequency	Duty cycle Factor	Conducted Power	Total Power(average)	Result
MHz	dB	dBm	dBm	
Low channel 2412MHz	0	12.68	12.68	Pass
Middle channel 2437MHz	0	12.84	12.84	Pass
High channel 2462MHz	0	12.68	12.68	Pass

802.11G

Frequency	Duty cycle Factor	Conducted Power	Total Power(average)	Result
MHz	dB	dBm	dBm	
Low channel 2412MHz	0.31	13.26	13.57	Pass
Middle channel 2437MHz	0.31	13.31	13.62	Pass
High channel 2462MHz	0.31	12.98	13.29	Pass

802.11N20

Frequency	Duty cycle Factor	Conducted Power	Total Power(average)	Result
MHz	dB	dBm	dBm	
Low channel 2412MHz	0.33	13.61	13.94	Pass
Middle channel 2437MHz	0.33	13.62	13.95	Pass
High channel 2462MHz	0.33	13.67	14	Pass

Test result (conducted peak) as below table

802.11b: Antenna gain= 1.95dBi						
Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (3)			e.i.r.p. (dBm) RSS-247 5.4(d)		
	Result	limit	Verdict	Result	limit	Verdict
2412MHz	16.62	≤30	Pass	18.57	≤36	Pass
2437MHz	16.83	≤30	Pass	18.78	≤36	Pass
2462MHz	16.68	≤30	Pass	18.63	≤36	Pass

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802.11g: Antenna gain= 1.95dBi						
Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (3)			e.i.r.p. (dBm) RSS-247 5.4(d)		
	Result	limit	Verdict	Result	limit	Verdict
2412MHz	22.79	≤30	Pass	24.74	≤36	Pass
2437MHz	22.76	≤30	Pass	24.71	≤36	Pass
2462MHz	22.44	≤30	Pass	24.39	≤36	Pass

802.11n(HT20): Antenna gain= 1.95dBi						
Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (3)			e.i.r.p. (dBm) RSS-247 5.4(d)		
	Result	limit	Verdict	Result	limit	Verdict
2412MHz	23.08	≤30	Pass	25.03	≤36	Pass
2437MHz	**23.27**	≤30	Pass	**25.22**	≤36	Pass
2462MHz	23.04	≤30	Pass	24.99	≤36	Pass

Duty Cycle

Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)
NVNT	b	2412	Ant1	98.9	0
NVNT	b	2437	Ant1	98.87	0
NVNT	b	2462	Ant1	98.9	0
NVNT	g	2412	Ant1	93.19	0.31
NVNT	g	2437	Ant1	93.19	0.31
NVNT	g	2462	Ant1	93.19	0.31
NVNT	n20	2412	Ant1	92.78	0.33
NVNT	n20	2437	Ant1	92.77	0.33
NVNT	n20	2462	Ant1	92.77	0.33

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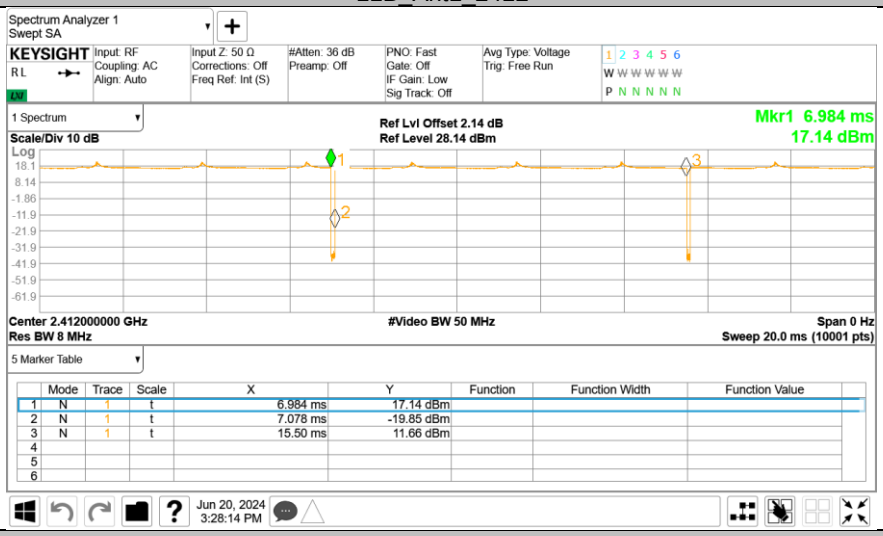
Duty Cycle

11B_Ant1_2412



11B_Ant1_2437

11B_Ant1_2462

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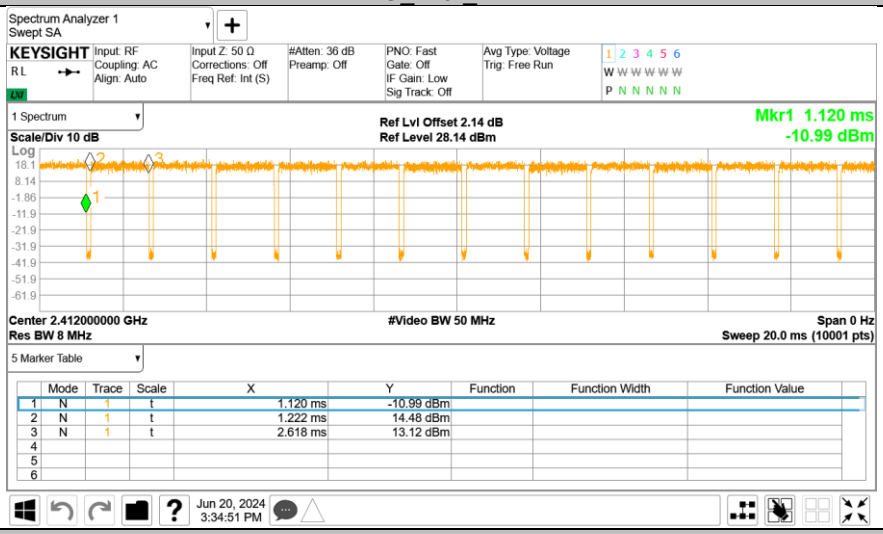
11G_Ant1_2412



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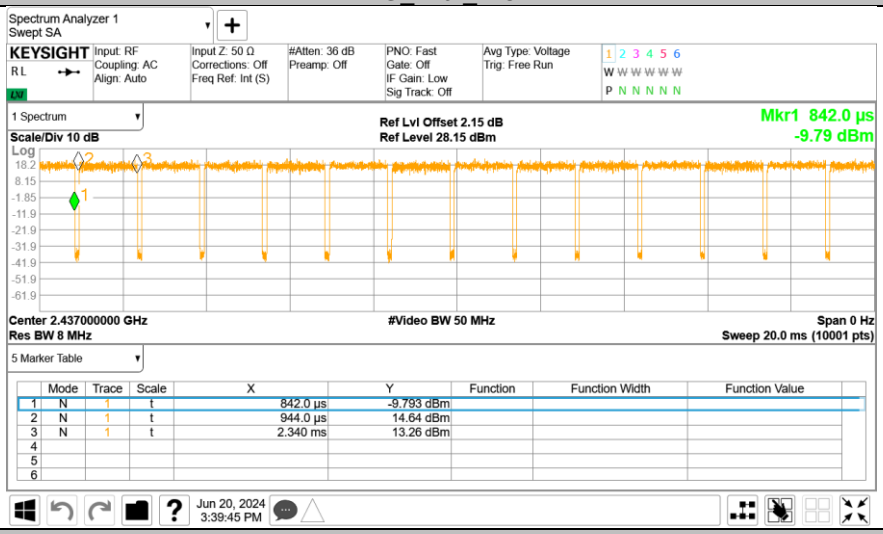

11G_Ant1_2462

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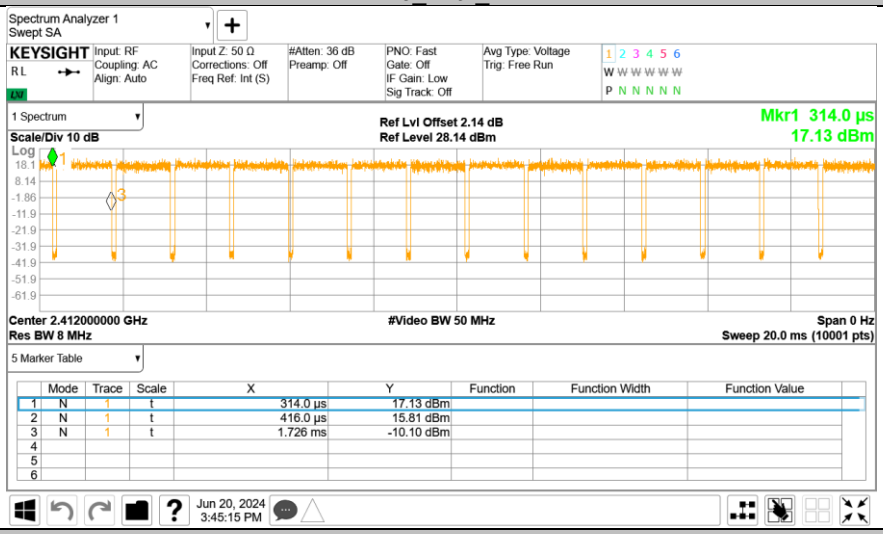

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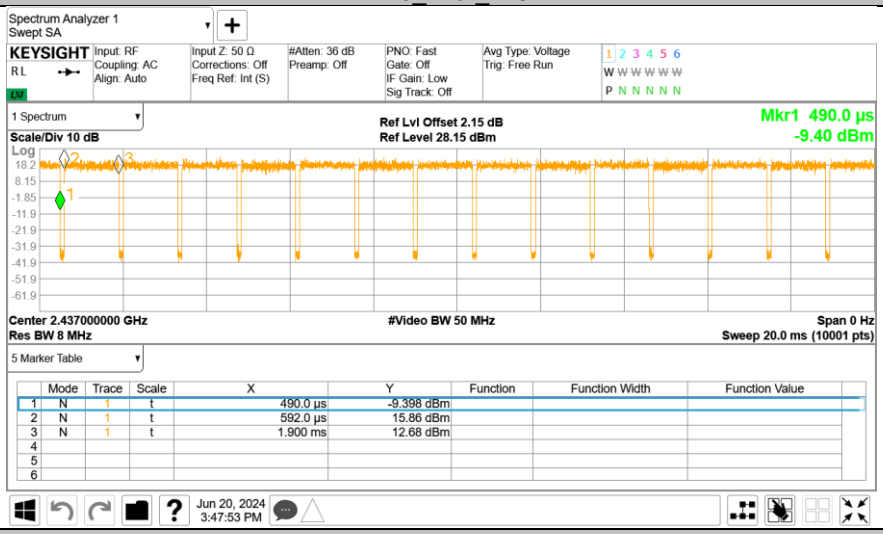

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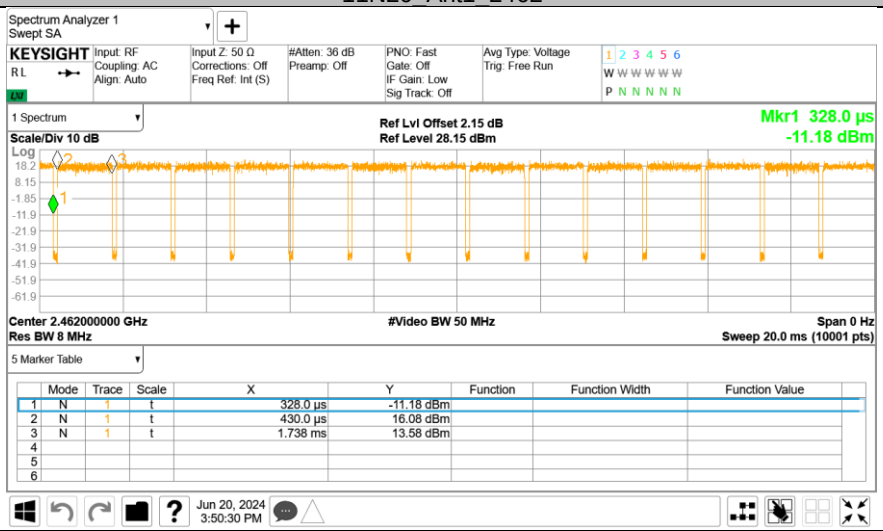

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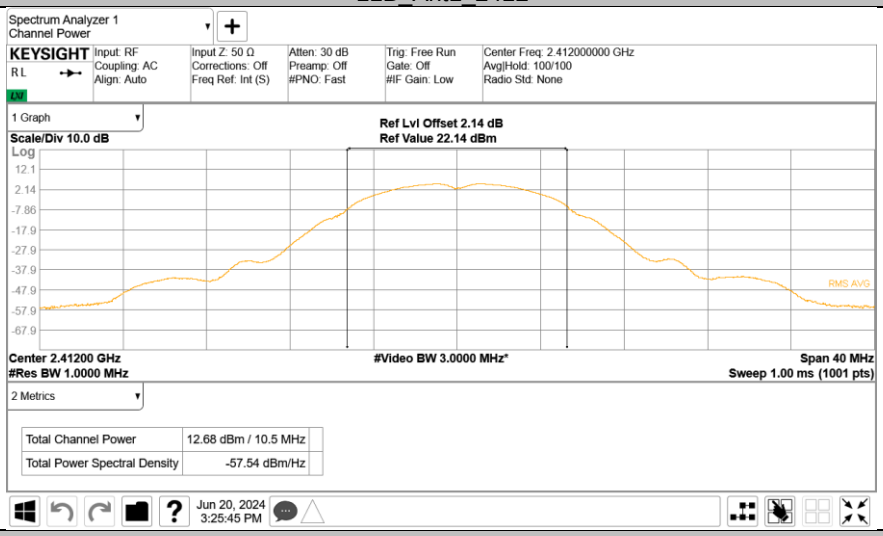
Conducted power

11B_Ant1_2412



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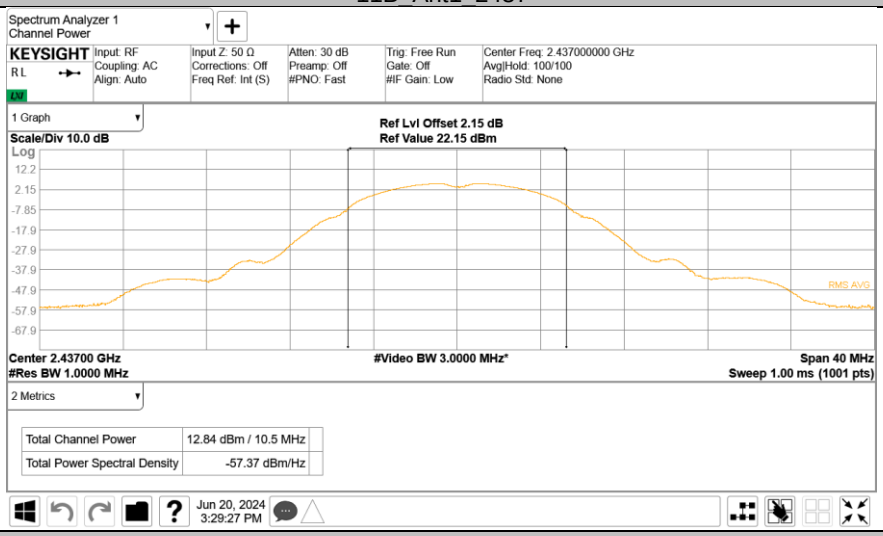

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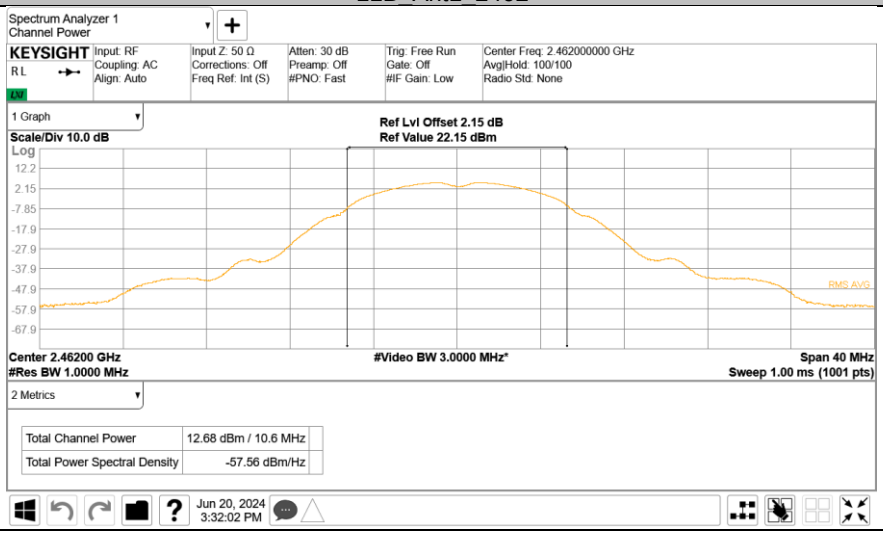

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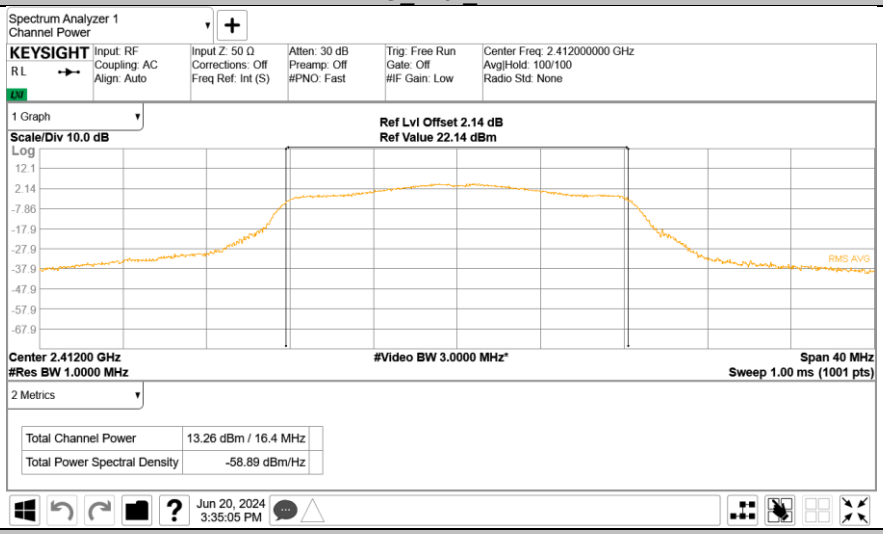

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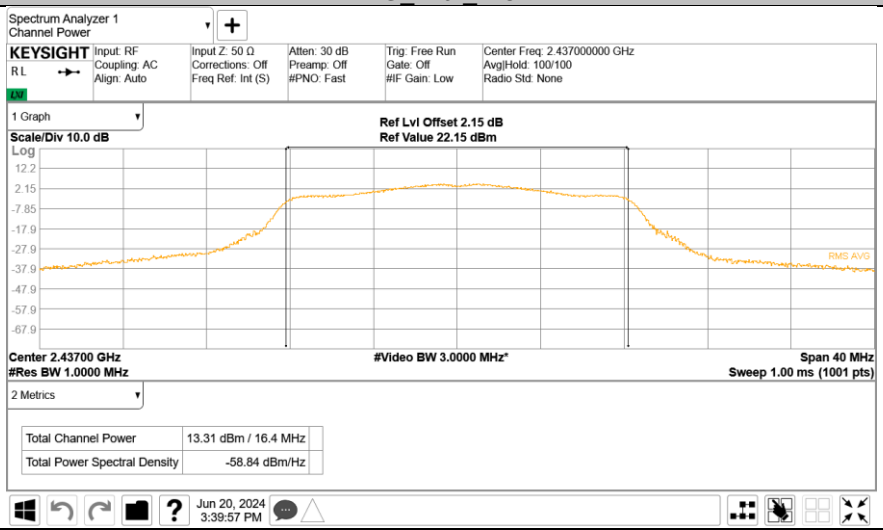

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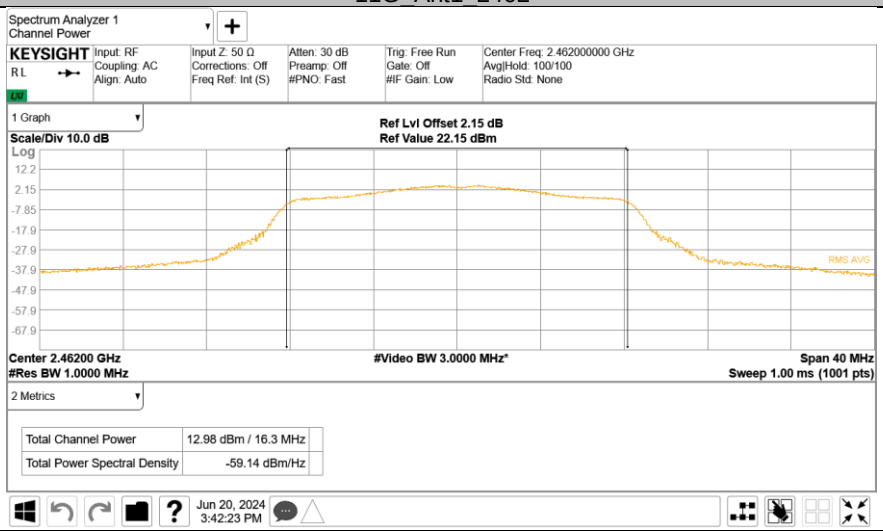

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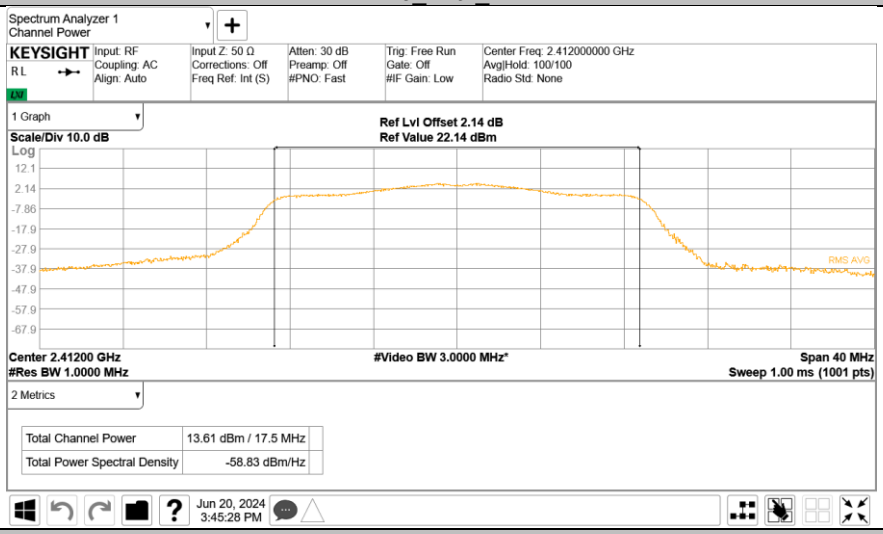
11N20_Ant1_2412



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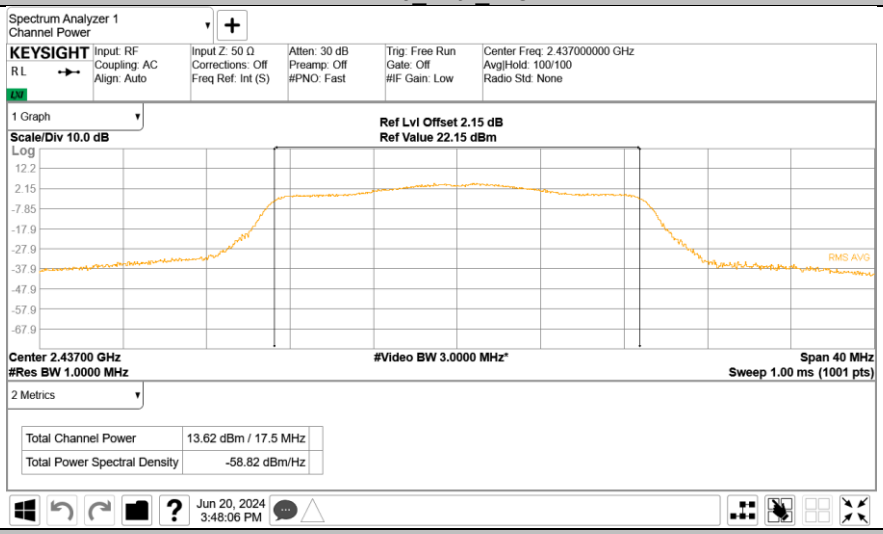

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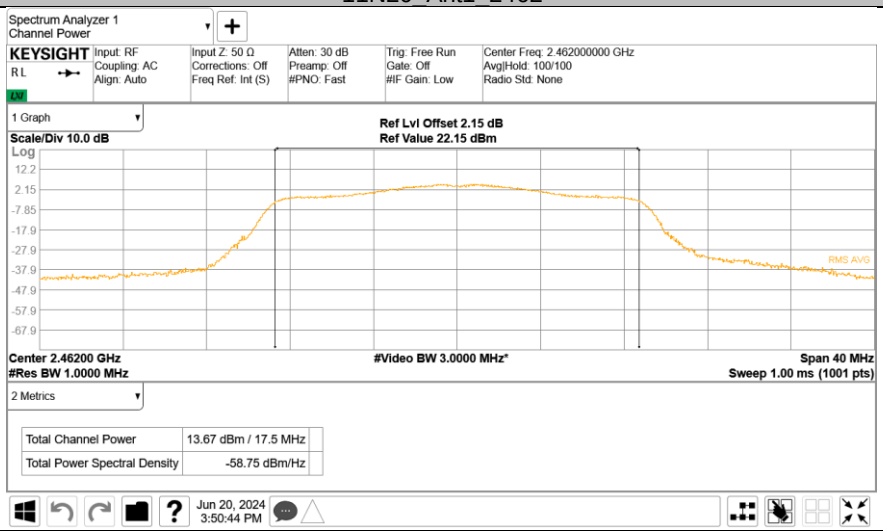

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9.3 6dB bandwidth and 99% Occupied Bandwidth

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

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

Test result

Test Mode	Frequency MHz	6dB bandwidth (MHz)		Result	99% occupied bandwidth MHz
		result	limit	verdict	
802.11b	2412	7.359	≥0.5	Pass	10.523
	2437	7.358	≥0.5	Pass	10.492
	2462	7.37	≥0.5	Pass	10.562
802.11g	2412	14.769	≥0.5	Pass	16.416
	2437	14.491	≥0.5	Pass	16.407
	2462	12.538	≥0.5	Pass	16.305
802.11n(HT20)	2412	15.469	≥0.5	Pass	17.532
	2437	13.341	≥0.5	Pass	17.537
	2462	12.477	≥0.5	Pass	17.462

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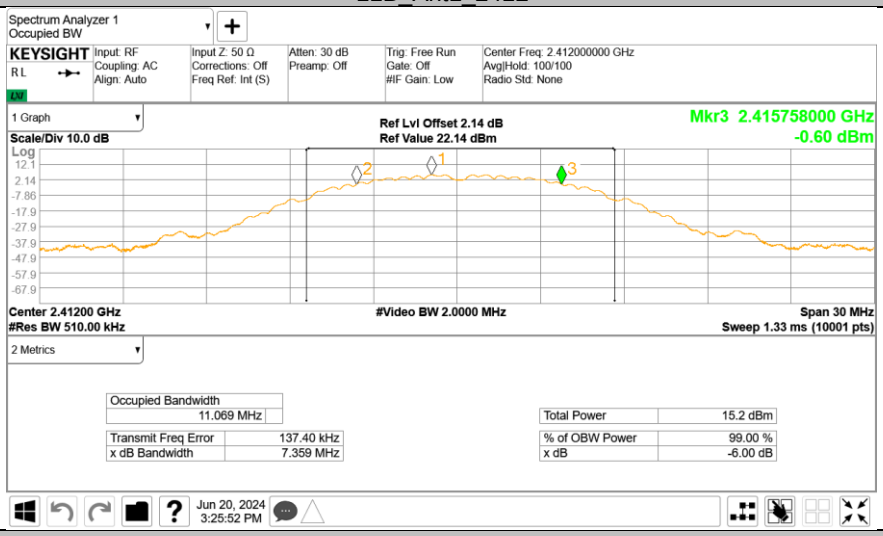
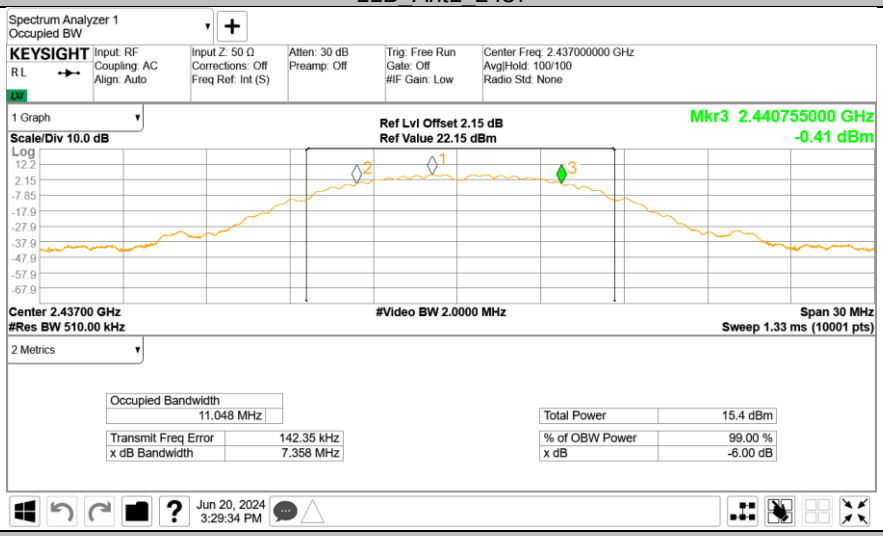
6 dB Bandwidth

11B_Ant1_2412



11B_Ant1_2437



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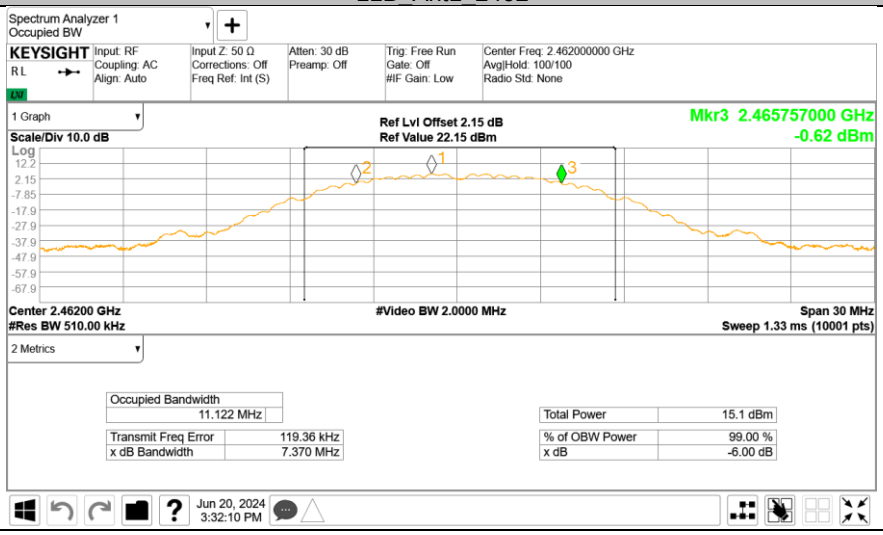
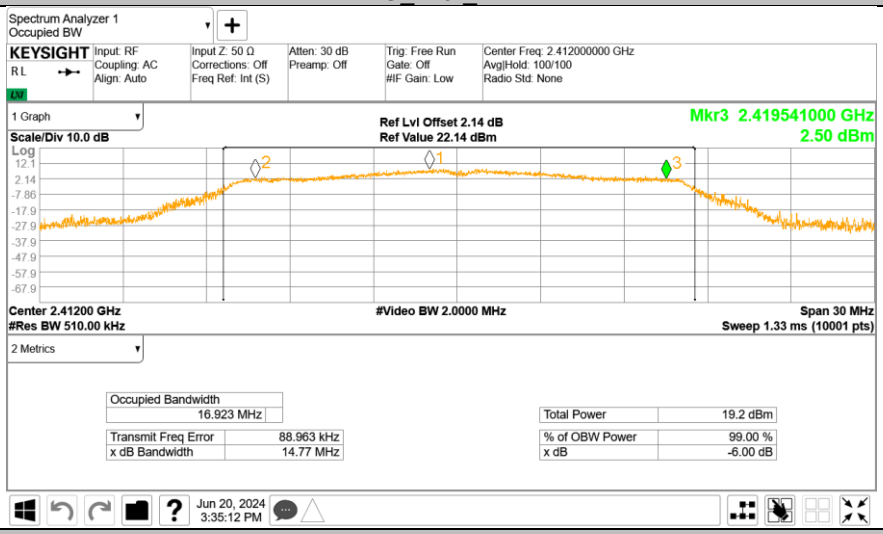


11G_Ant1_2412



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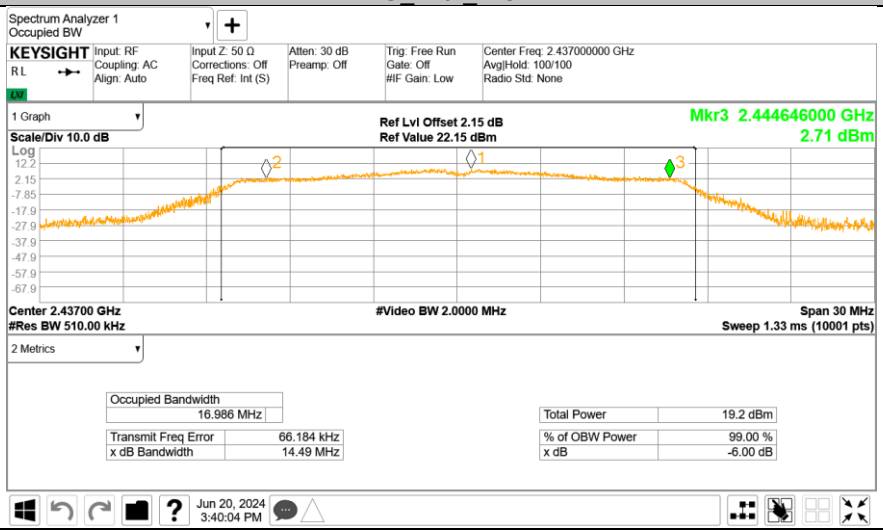
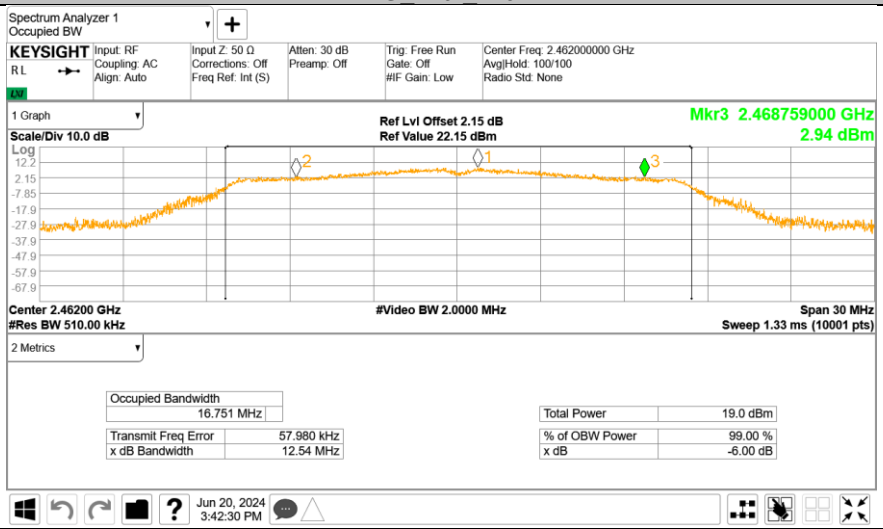


11G_Ant1_2462



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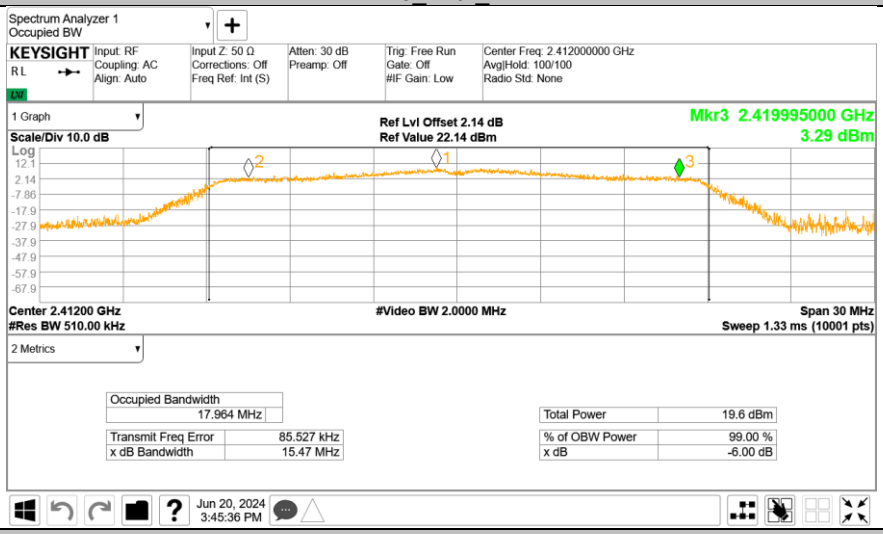
11N20_Ant1_2412



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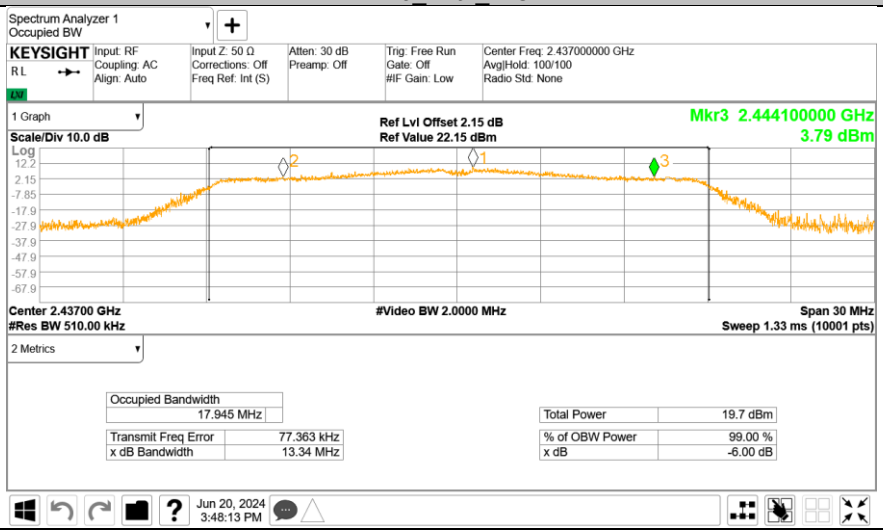

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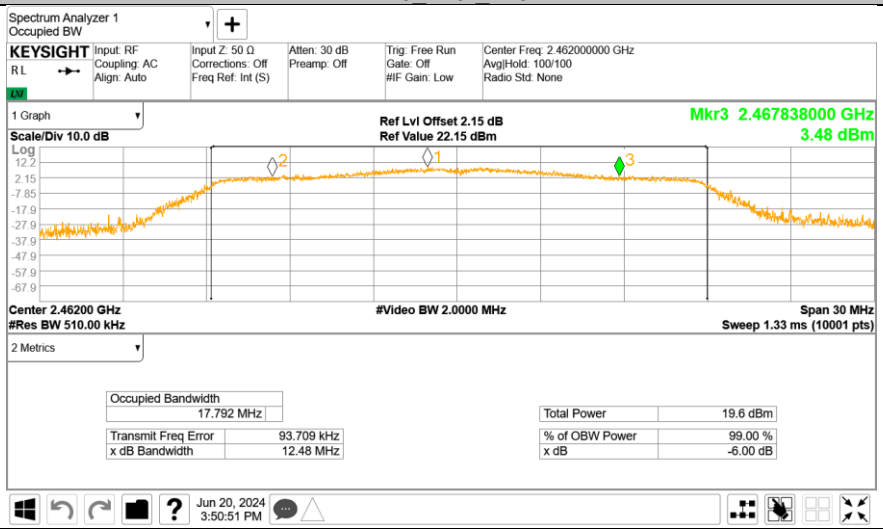

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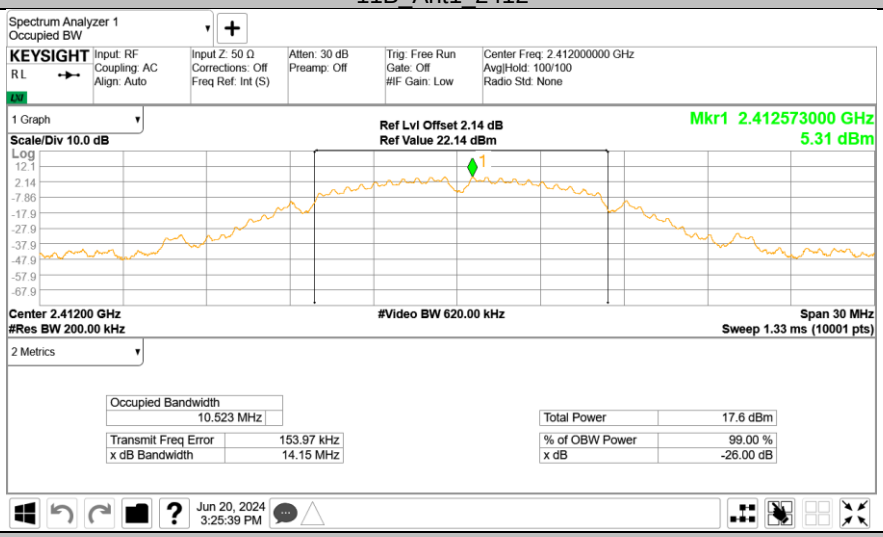
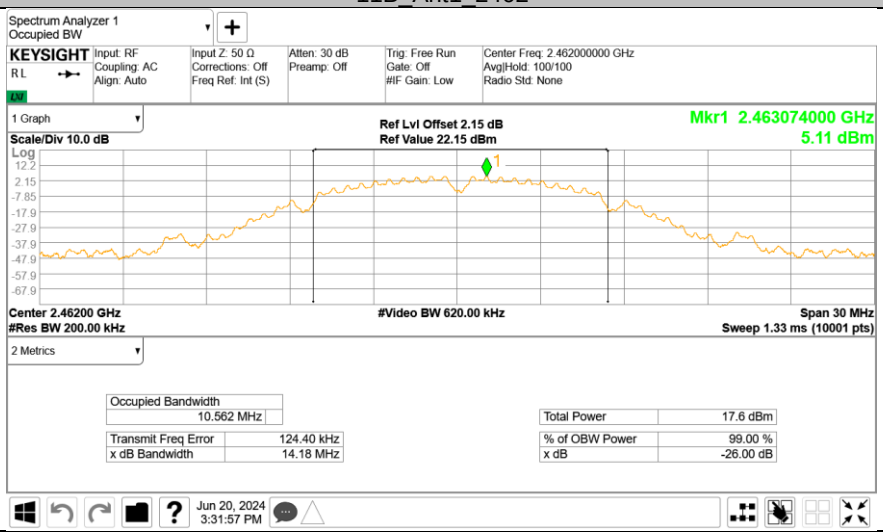
99% Occupied Bandwidth

11B_Ant1_2412



11B_Ant1_2437

11B_Ant1_2462



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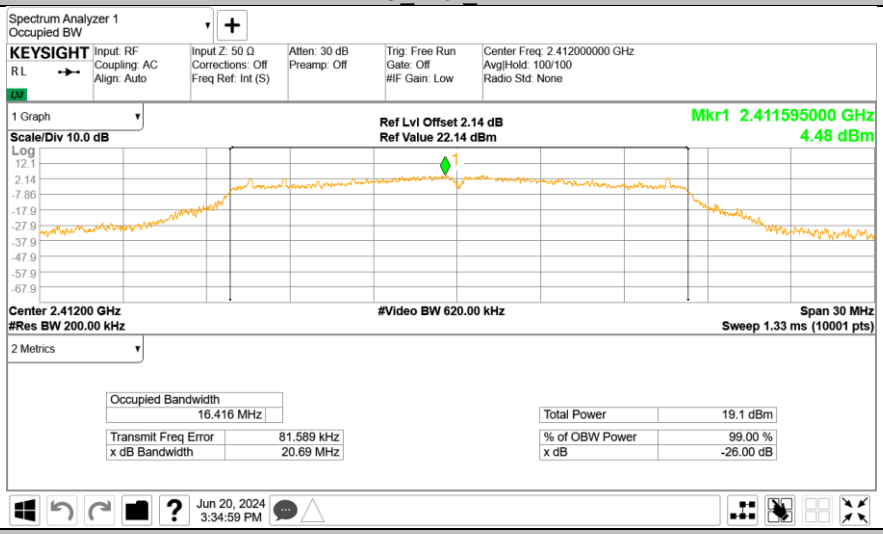
11G_Ant1_2412



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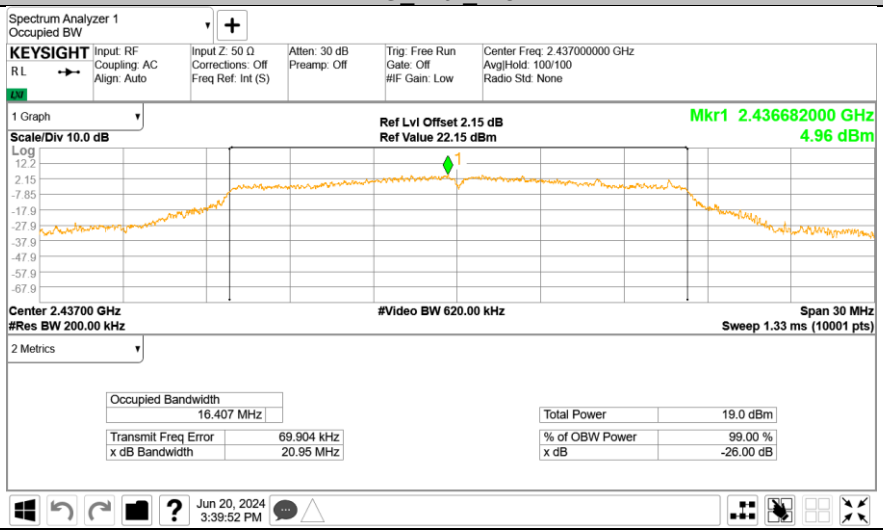

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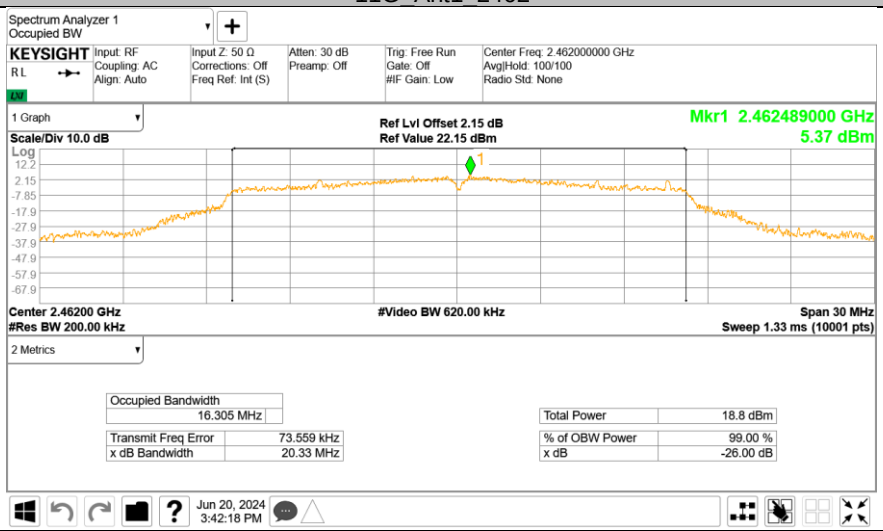

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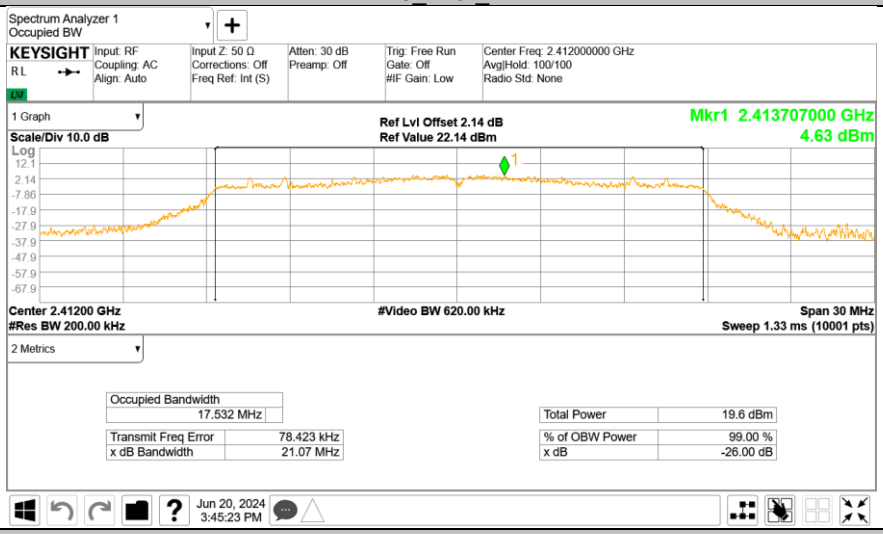

11N20_Ant1_2437


11N20_Ant1_2462


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

802.11 B

Frequency MHz	Power spectral density dBm/3kHz	Result
Low channel 2412MHz	-8.66	Pass
Middle channel 2437MHz	-8.75	Pass
High channel 2462MHz	-9.56	Pass

802.11 G

Frequency MHz	Power spectral density dBm/3kHz	Result
Low channel 2412MHz	-9.31	Pass
Middle channel 2437MHz	-9.2	Pass
High channel 2462MHz	-9.81	Pass

802.11 N20

Frequency MHz	Power spectral density dBm/3kHz	Result
Low channel 2412MHz	-8.5	Pass
Middle channel 2437MHz	-9.25	Pass
High channel 2462MHz	-8.79	Pass

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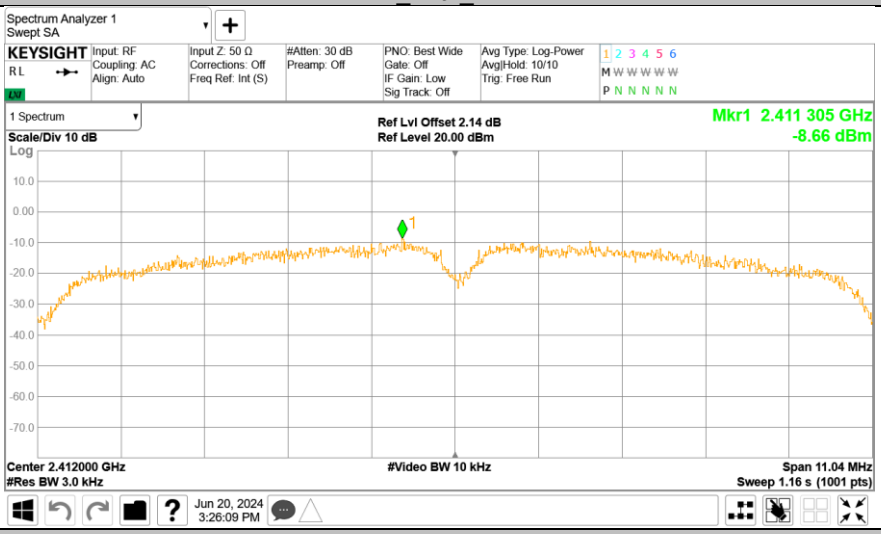
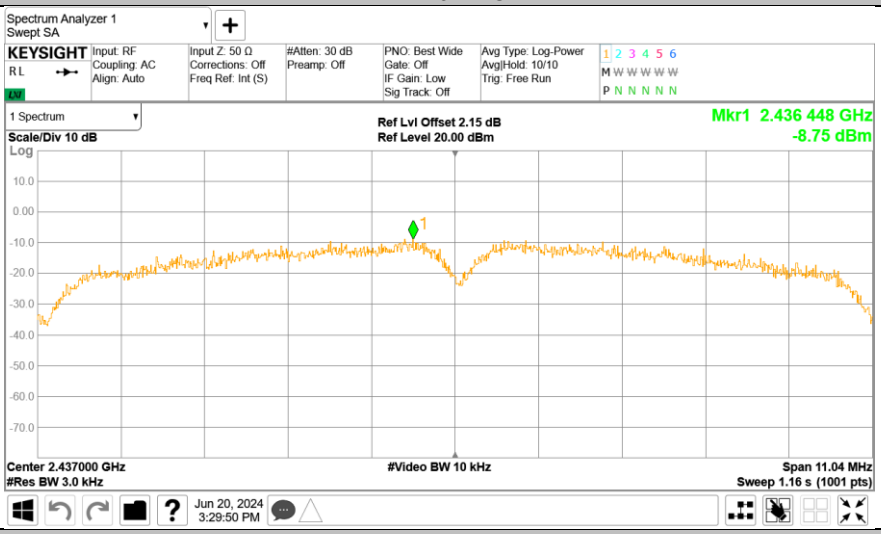
Power spectral density

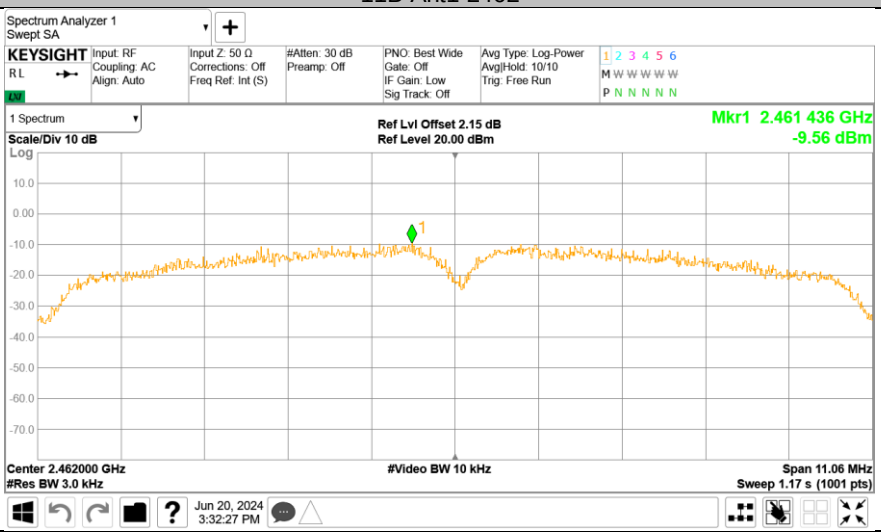
11B_Ant1_2412



11B Ant1 2437



11B Ant1 2462



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