

**FCC/IC - TEST REPORT**

Report Number : **709502400492-00A** Date of Issue: May 8, 2024

Model : E325, E335, E350, E625, E635, E650, E950, E350D, E650D, E950D

Product Type : Thermal Imaging Camera

Applicant : Zhejiang ULIRVISION Technology Co., Ltd.

Address : 17F Block C, Sunwave Building, 581 Huoju Avenue, Binjiang District, Hangzhou 310052, Zhejiang, China

Production Facility : Zhejiang ULIRVISION Technology Co., Ltd.

Address : 17F Block C, Sunwave Building, 581 Huoju Avenue, Binjiang District, Hangzhou 310052, 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
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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 Imaging Camera

Model no.: E325, E335, E350, E625, E635, E650, E950, E350D, E650D, E950D

Hardware Version Identification No. (HVIN) E3250001, E3350001, E3500001, E6250001, E6350001, E6500001, E9500001, E350D0001, E650D0001, E950D0001

Product Marketing Name (PMN) Thermal Imaging Camera

FCC ID: 2BE6SHW0001

IC: 32259-HW0001

Options and accessories: NA

Rating: 5VDC by adaptor: AC 100-240V/50/60Hz
3.7VDC 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: 0.0.0.1

Software Version: V_1.0.1.4

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 Imaging Camera Wi-Fi Module. The EUT support Wi-Fi operated at 2.4GHz.

Test sample no.: SHA-792424-3 (Radiated sample)



SHA-792424-2 (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.



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.



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.



6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2BE6SHW0001, IC: 32259-HW0001 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: 1.model name 2. IR resolution 3.Optional Lens .

difference	model	IR resolution	Optional Lens
	E325	384×288	25mm
	E335	384×288	35mm
	E350	384×288	50mm
	E625	640×512	25mm
	E635	640×512	35mm
	E650	640×512	50mm
	E950	1280×1024	50mm
	E350D	384×288	25-50mm zoom lens
	E650D	640×512	25-50mm zoom lens
	E950D	1280×1024	25-50mm zoom lens

So model E325 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: March 4, 2024

Testing Start Date: March 13, 2024

Testing End Date: June 18, 2024

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



Reviewed by:

Prepared by:

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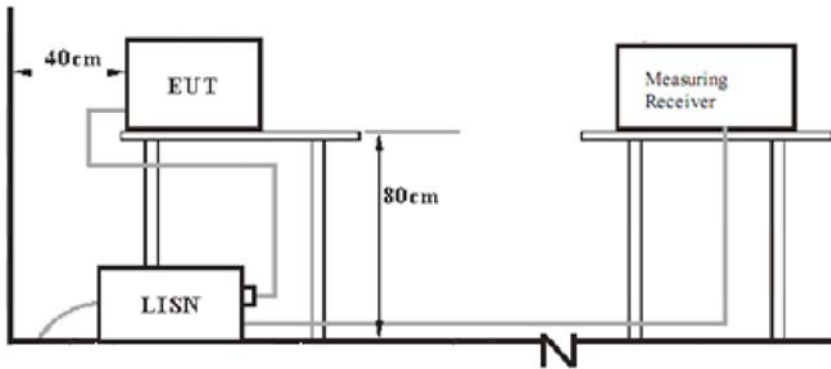
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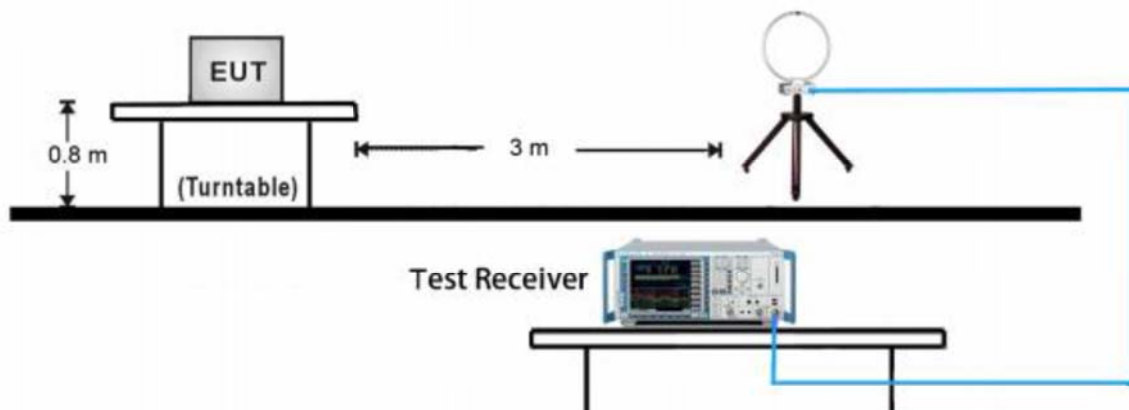
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

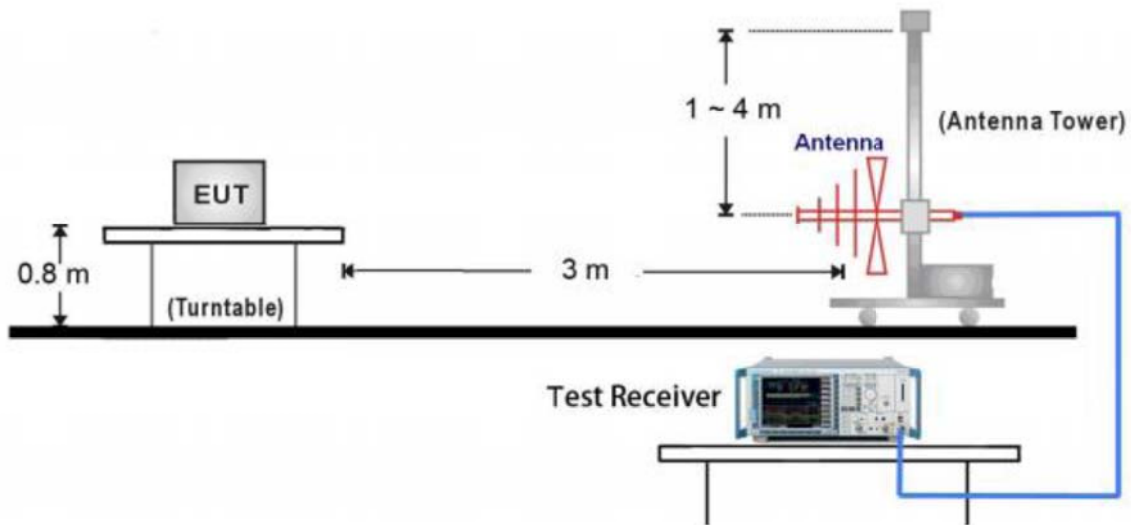


7.2 Radiated test setups

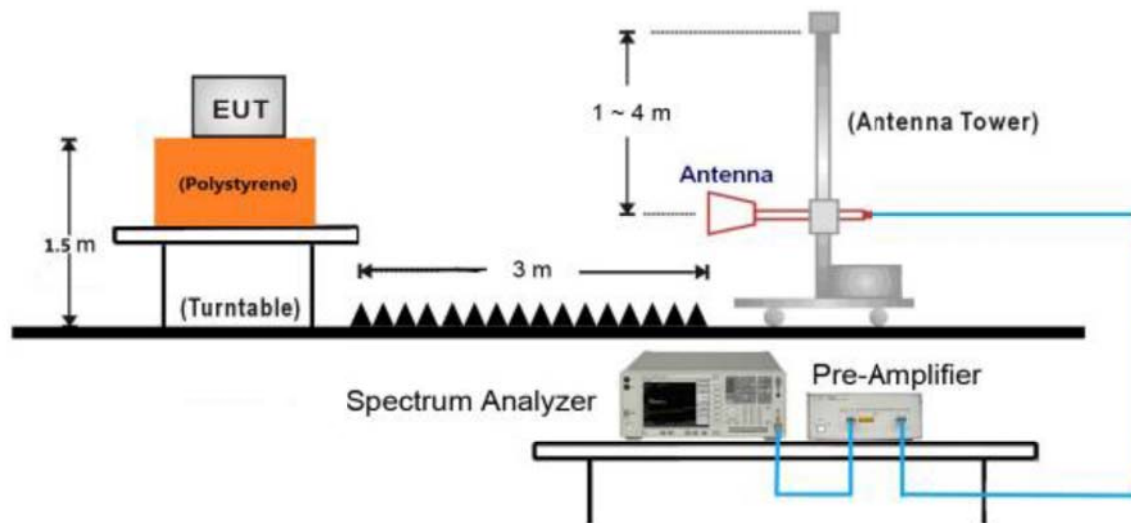
9kHz ~ 30MHz Test Setup:



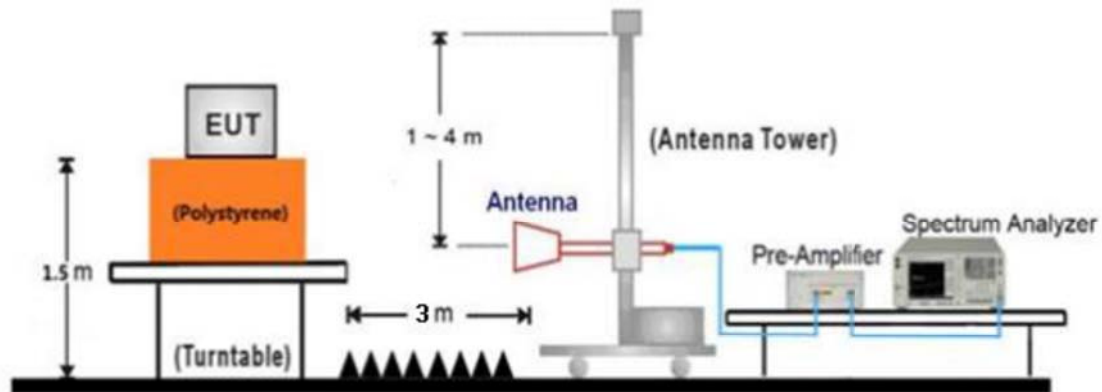
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:

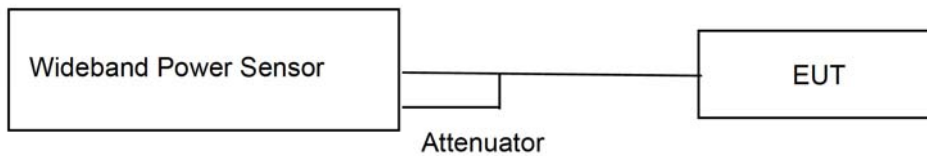


18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups

For Conducted peak output power



For other test items



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.

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

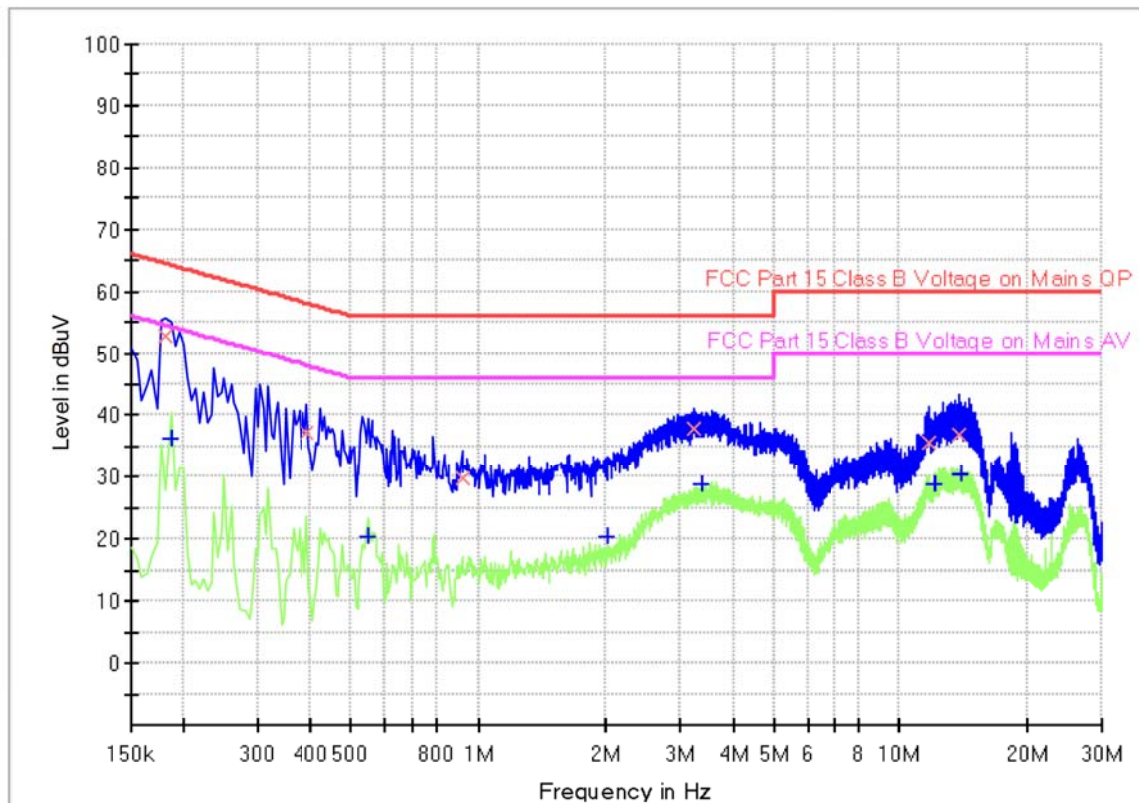
Limit

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

Frequency MHz	QP Limit 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 : Thermal Imaging Camera
 M/N : E325
 Operating Condition : Mode 1: Tx_2462MHz for 802.11HT20 (worst case)
 Test Specification : L-line
 Comment : AC 120V/60Hz



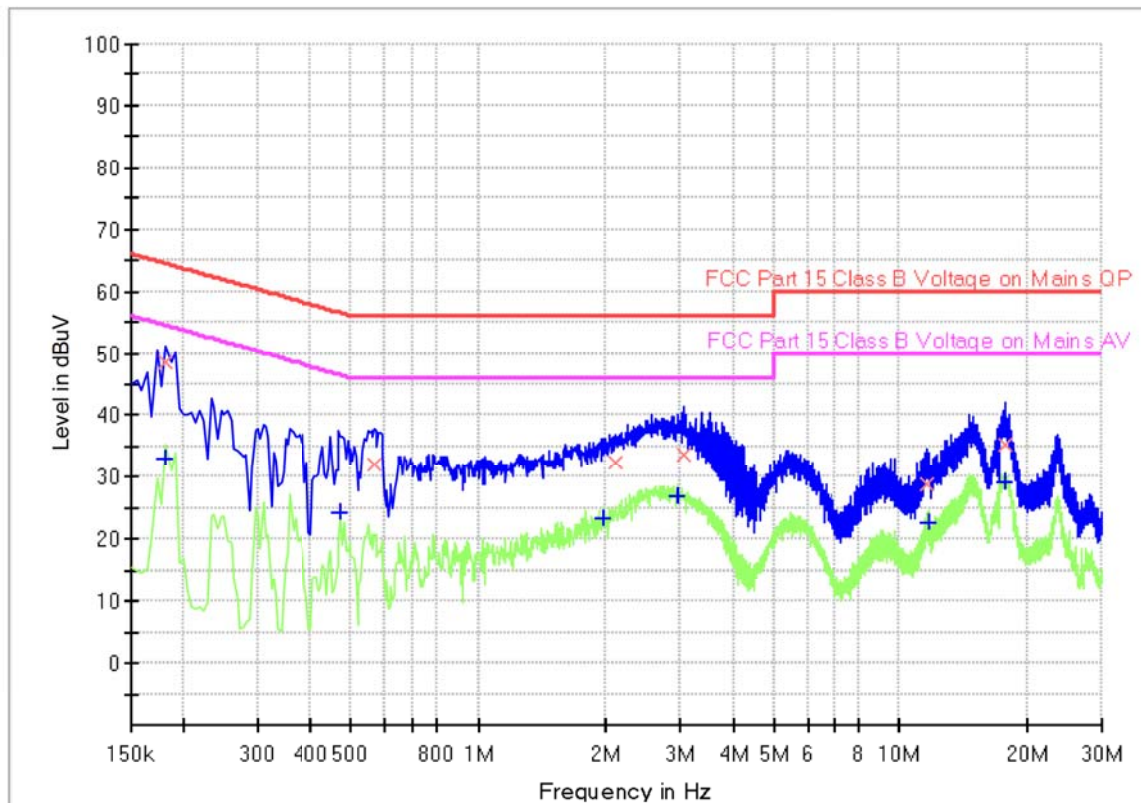
Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.181500	52.89	---	64.42	11.53	1000.0	9.000	L1	19.4
0.186000	---	36.15	54.21	18.06	1000.0	9.000	L1	19.4
0.393000	37.23	---	58.00	20.77	1000.0	9.000	L1	19.5
0.550500	---	20.57	46.00	25.43	1000.0	9.000	L1	19.4
0.915000	29.74	---	56.00	26.26	1000.0	9.000	L1	19.5
2.022000	---	20.27	46.00	25.73	1000.0	9.000	L1	19.5
3.246000	38.01	---	56.00	17.99	1000.0	9.000	L1	19.5
3.385500	---	28.96	46.00	17.04	1000.0	9.000	L1	19.5
11.701500	35.46	---	60.00	24.54	1000.0	9.000	L1	19.9
12.097500	---	28.93	50.00	21.07	1000.0	9.000	L1	19.9
13.785000	36.84	---	60.00	23.16	1000.0	9.000	L1	20.0
14.010000	---	30.36	50.00	19.64	1000.0	9.000	L1	20.0

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

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

Product Type : Thermal Imaging Camera
 M/N : E325
 Operating Condition : Mode 1: Tx_2462MHz 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)
0.181500	---	32.89	54.42	21.53	1000.0	9.000	N	19.4
0.181500	48.48	---	64.42	15.94	1000.0	9.000	N	19.4
0.474000	---	24.33	46.44	22.11	1000.0	9.000	N	19.5
0.568500	32.21	---	56.00	23.79	1000.0	9.000	N	19.5
1.981500	---	23.48	46.00	22.52	1000.0	9.000	N	19.5
2.103000	32.52	---	56.00	23.48	1000.0	9.000	N	19.5
2.958000	---	26.93	46.00	19.07	1000.0	9.000	N	19.5
3.048000	33.56	---	56.00	22.44	1000.0	9.000	N	19.5
11.548500	28.77	---	60.00	31.23	1000.0	9.000	N	19.8
11.665500	---	22.68	50.00	27.32	1000.0	9.000	N	19.8
17.803500	---	29.23	50.00	20.77	1000.0	9.000	N	20.0
17.826000	35.34	---	60.00	24.66	1000.0	9.000	N	20.0

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

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

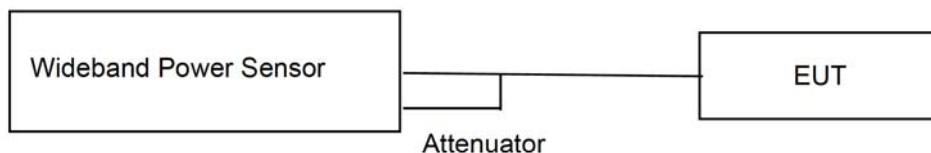
9.2 Conducted peak(average) output power and EIRP

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 $\geq [3 \times \text{RBW}]$.
5. Number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$. (This gives bin-to-bin spacing $\leq \text{RBW} / 2$, 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



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 MHz	Duty cycle Factor dB	Conducted Power dBm	Total Power(average) dBm	Result
Low channel 2412MHz	0	14.49	14.49	Pass
Middle channel 2437MHz	0	14.82	14.82	Pass
High channel 2462MHz	0	15.06	15.06	Pass

802.11G

Frequency MHz	Duty cycle Factor dB	Conducted Power dBm	Total Power(average) dBm	Result
Low channel 2412MHz	0	14.55	14.55	Pass
Middle channel 2437MHz	0	14.79	14.79	Pass
High channel 2462MHz	0	14.89	14.89	Pass

802.11N20

Frequency MHz	Duty cycle Factor dB	Conducted Power dBm	Total Power(average) dBm	Result
Low channel 2412MHz	0	14.55	14.55	Pass
Middle channel 2437MHz	0	14.66	14.66	Pass
High channel 2462MHz	0	15.21	15.21	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	17.12	≤30	Pass	19.07	≤36	Pass
2437MHz	18.05	≤30	Pass	20.00	≤36	Pass
2462MHz	18.63	≤30	Pass	20.58	≤36	Pass



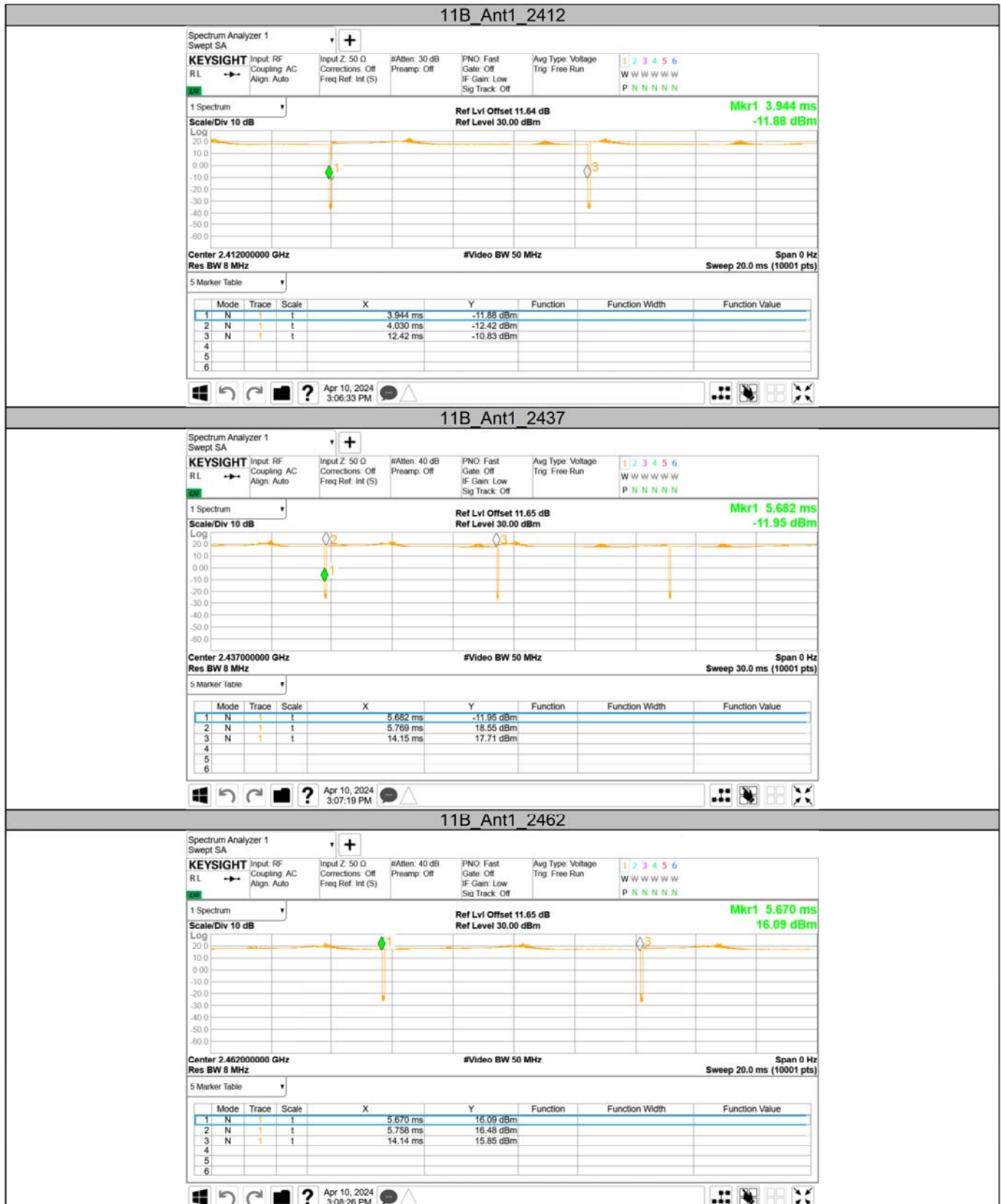
802.11g: Antenna gain= 1.95dBi						
Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (3)			e.i.r.p. (dBm) RSS-247 5.4(d)		
	Result	limit	Verdict	Result	limit	Verdict
2412MHz	21.50	≤30	Pass	23.45	≤36	Pass
2437MHz	22.69	≤30	Pass	24.64	≤36	Pass
2462MHz	23.20	≤30	Pass	25.15	≤36	Pass

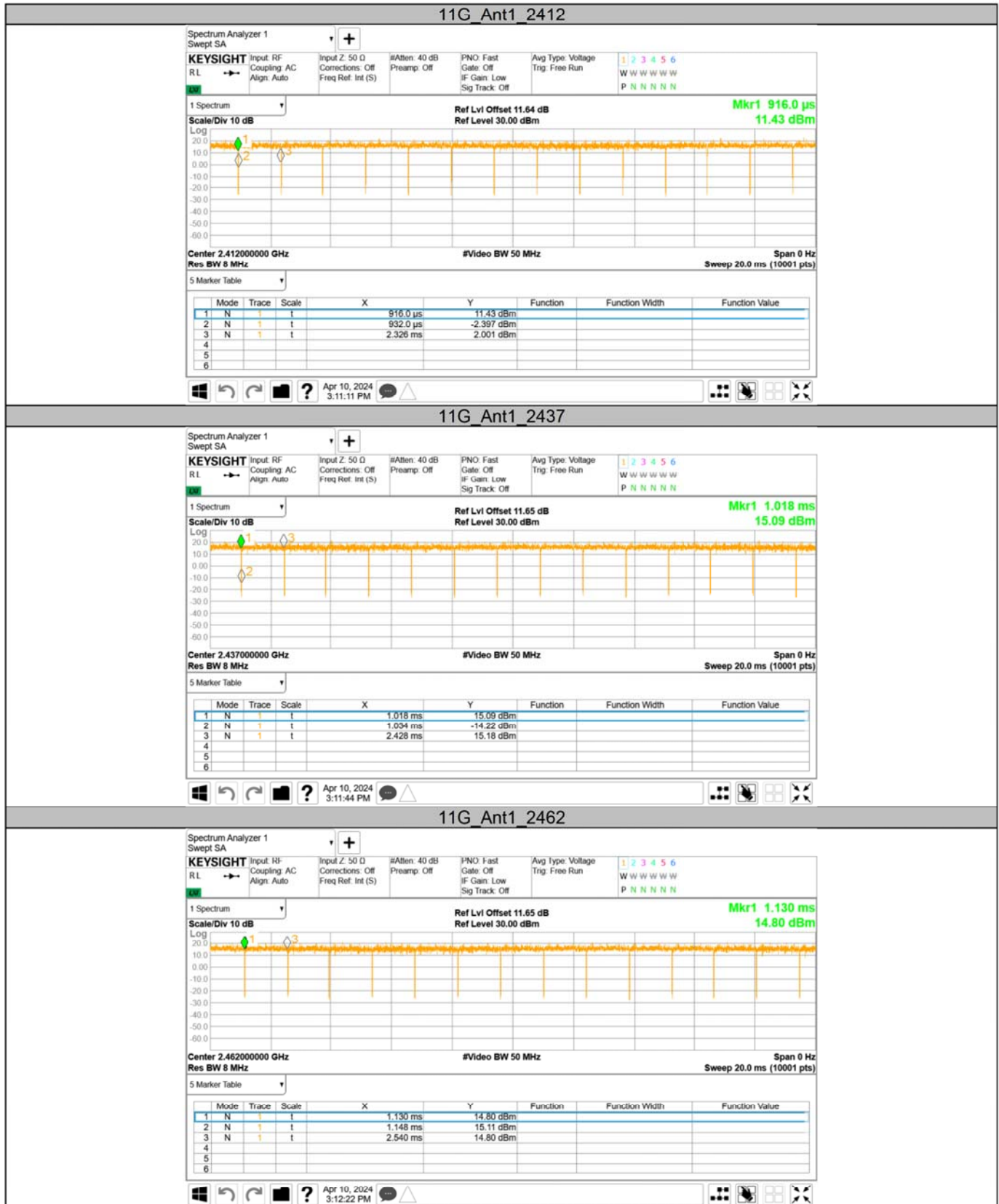
802.11n(HT20): Antenna gain= 1.95dBi						
Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (3)			e.i.r.p. (dBm) RSS-247 5.4(d)		
	Result	limit	Verdict	Result	limit	Verdict
2412MHz	21.59	≤30	Pass	23.54	≤36	Pass
2437MHz	22.71	≤30	Pass	24.66	≤36	Pass
2462MHz	23.42	≤30	Pass	25.37	≤36	Pass

Duty Cycle

Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)
NVNT	b	2412	Ant1	98.99	0
NVNT	b	2437	Ant1	98.97	0
NVNT	b	2462	Ant1	98.96	0
NVNT	g	2412	Ant1	98.87	0
NVNT	g	2437	Ant1	98.87	0
NVNT	g	2462	Ant1	98.72	0
NVNT	n20	2412	Ant1	98.79	0
NVNT	n20	2437	Ant1	98.94	0
NVNT	n20	2462	Ant1	98.79	0

Duty Cycle





11N20_Ant1_2412



11N20_Ant1_2437



11N20_Ant1_2462



Conducted power

11G_Ant1_2412



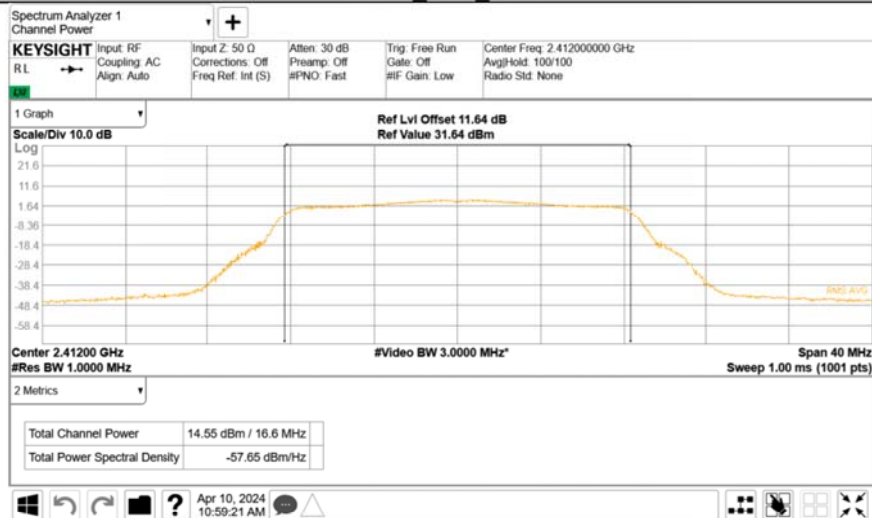
11G_Ant1_2437



11G_Ant1_2462



11N20_Ant1_2412



11N20_Ant1_2437



11N20_Ant1_2462



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 $\geq$ 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

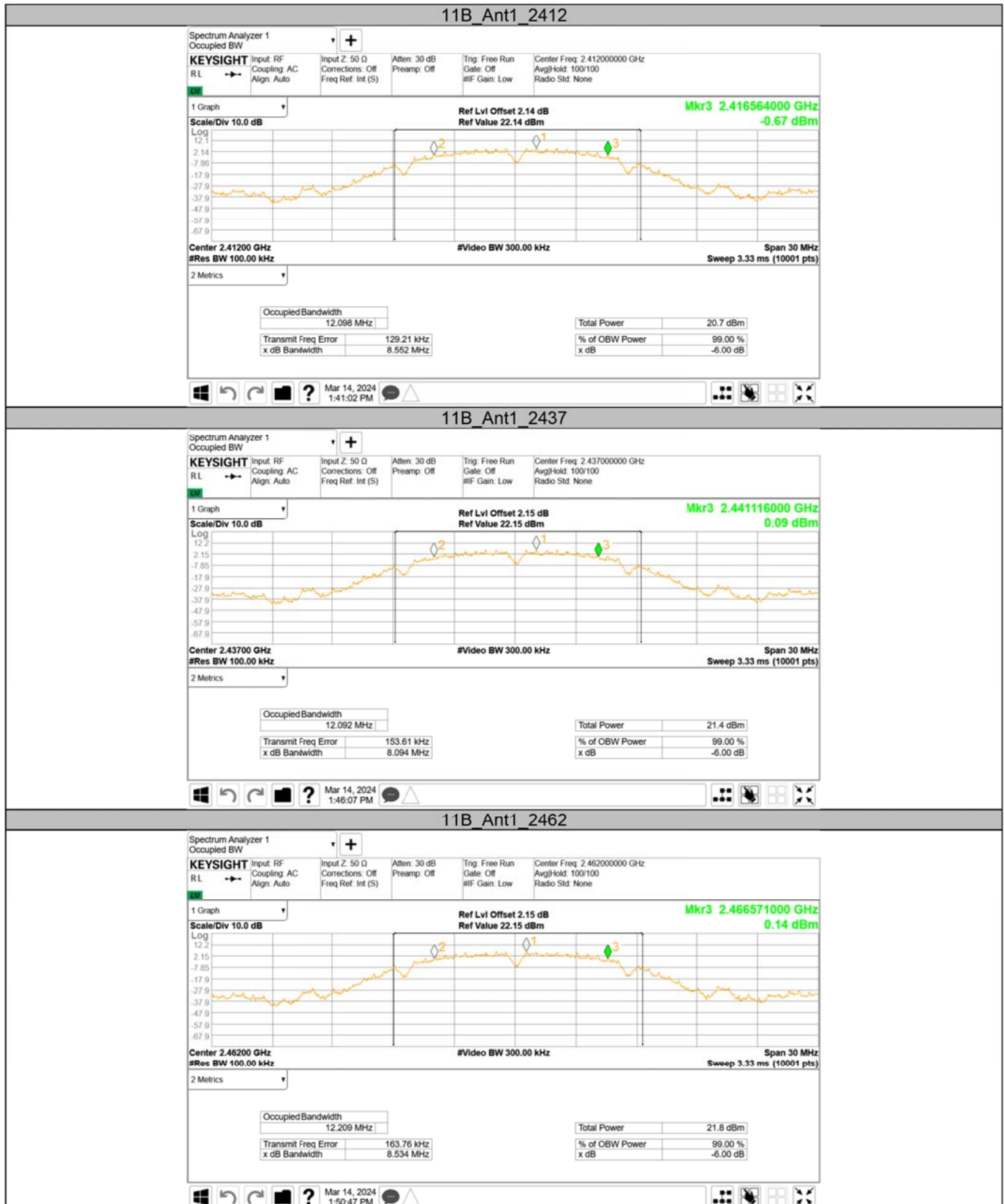
1. Connect EUT test port to spectrum analyzer.
Use the following spectrum analyzer settings:
RBW=1% to 5% of the actual occupied, VBW $\geq$ 3RBW, Sweep = auto,
Detector function = peak, Trace = max hold
2. Use the occupied bandwidth measurement capability of test receiver.
3. Allow the trace to stabilize,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

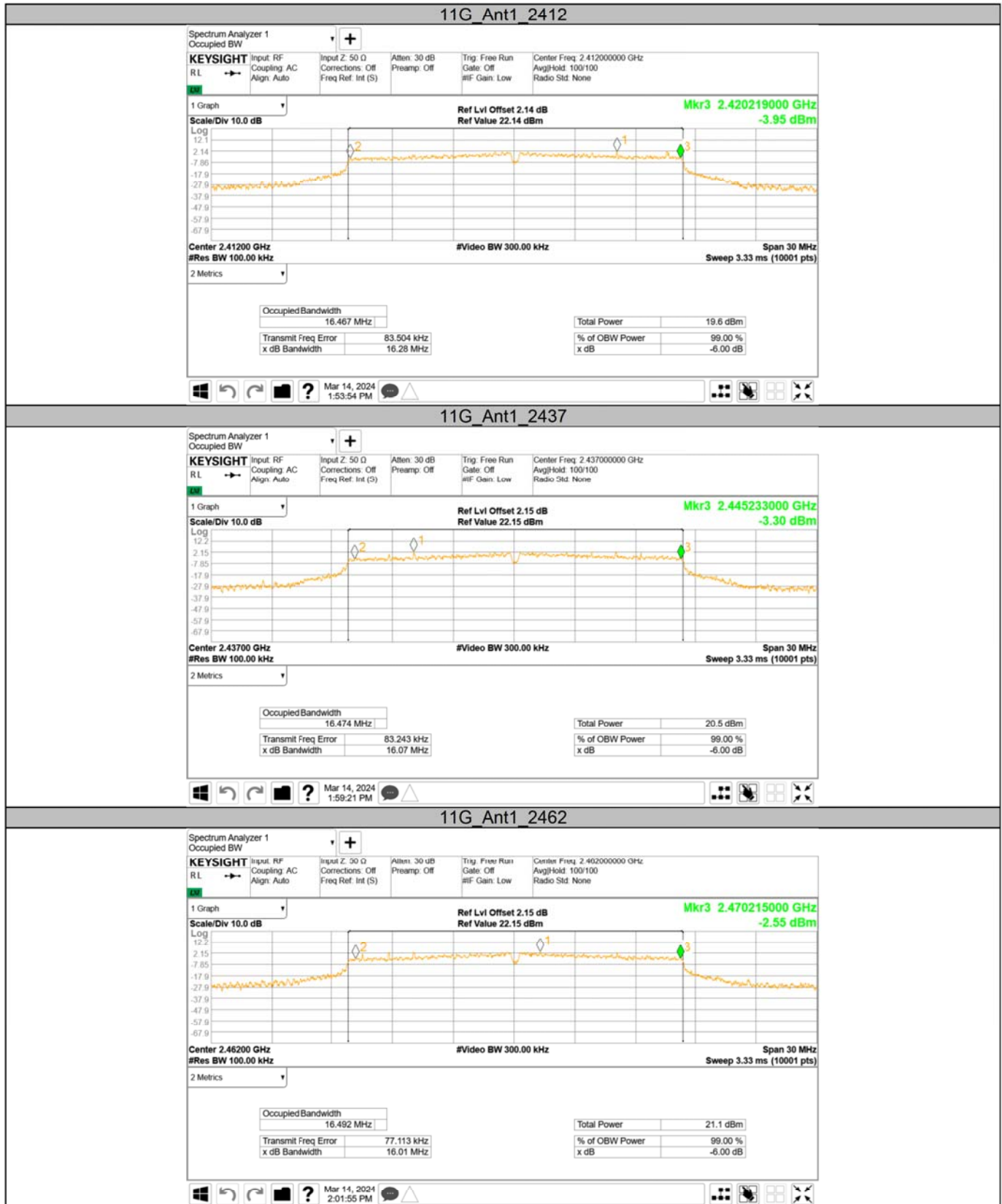
Limit

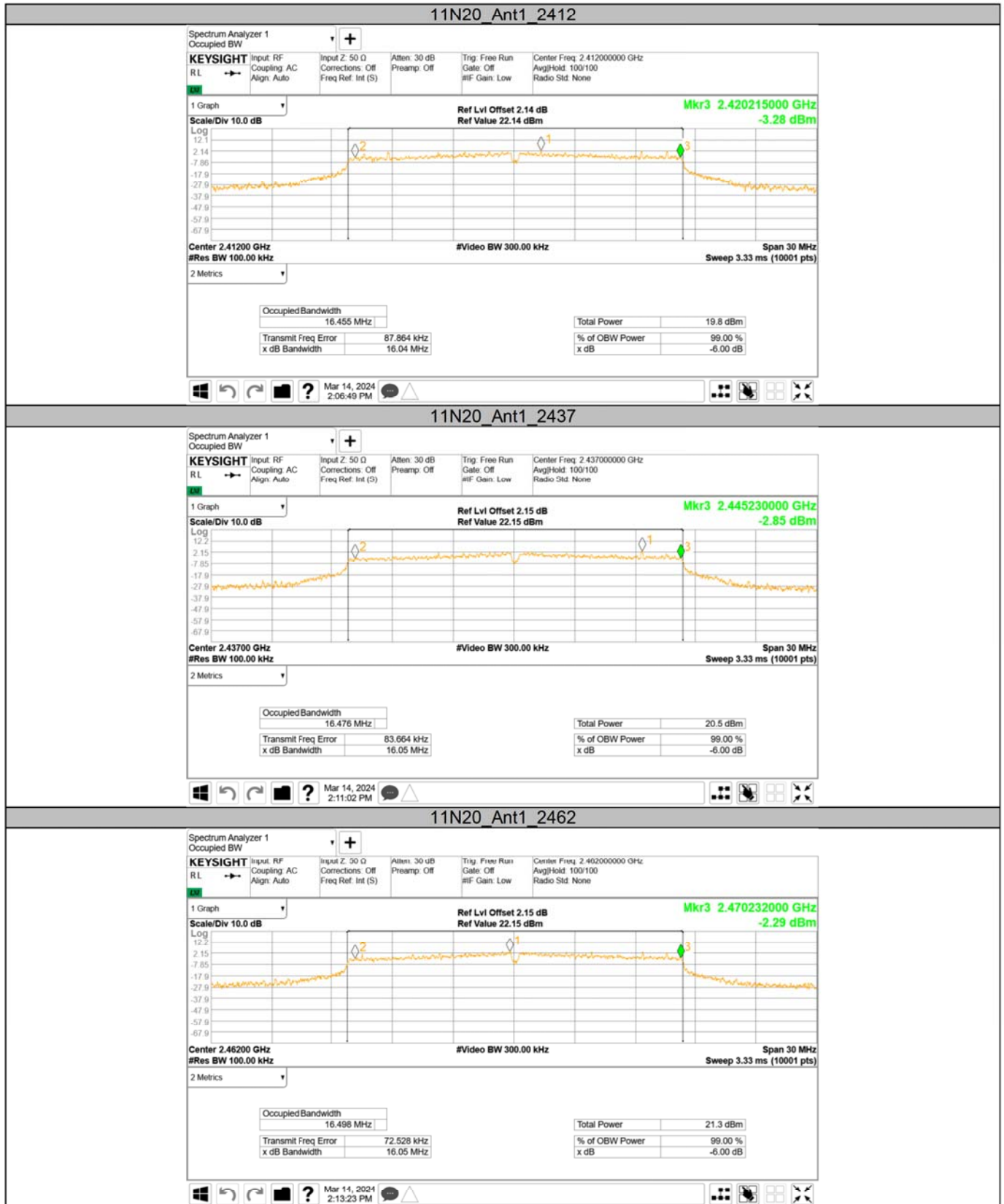
6dB bandwidth Limit [kHz]	99% bandwidth Limit [kHz]
≥ 500	--

Test result

Test Mode	Frequency MHz	6dB bandwidth (MHz)		Result	99% occupied bandwidth MHz
		result	limit	verdict	
802.11b	2412	8.552	≥ 0.5	Pass	12.105
	2437	8.094	≥ 0.5	Pass	12.108
	2462	8.534	≥ 0.5	Pass	12.179
802.11g	2412	16.284	≥ 0.5	Pass	16.6
	2437	16.074	≥ 0.5	Pass	16.624
	2462	16.007	≥ 0.5	Pass	16.673
802.11n(HT20)	2412	16.042	≥ 0.5	Pass	16.595
	2437	16.053	≥ 0.5	Pass	16.61
	2462	16.052	≥ 0.5	Pass	16.699

6 dB Bandwidth

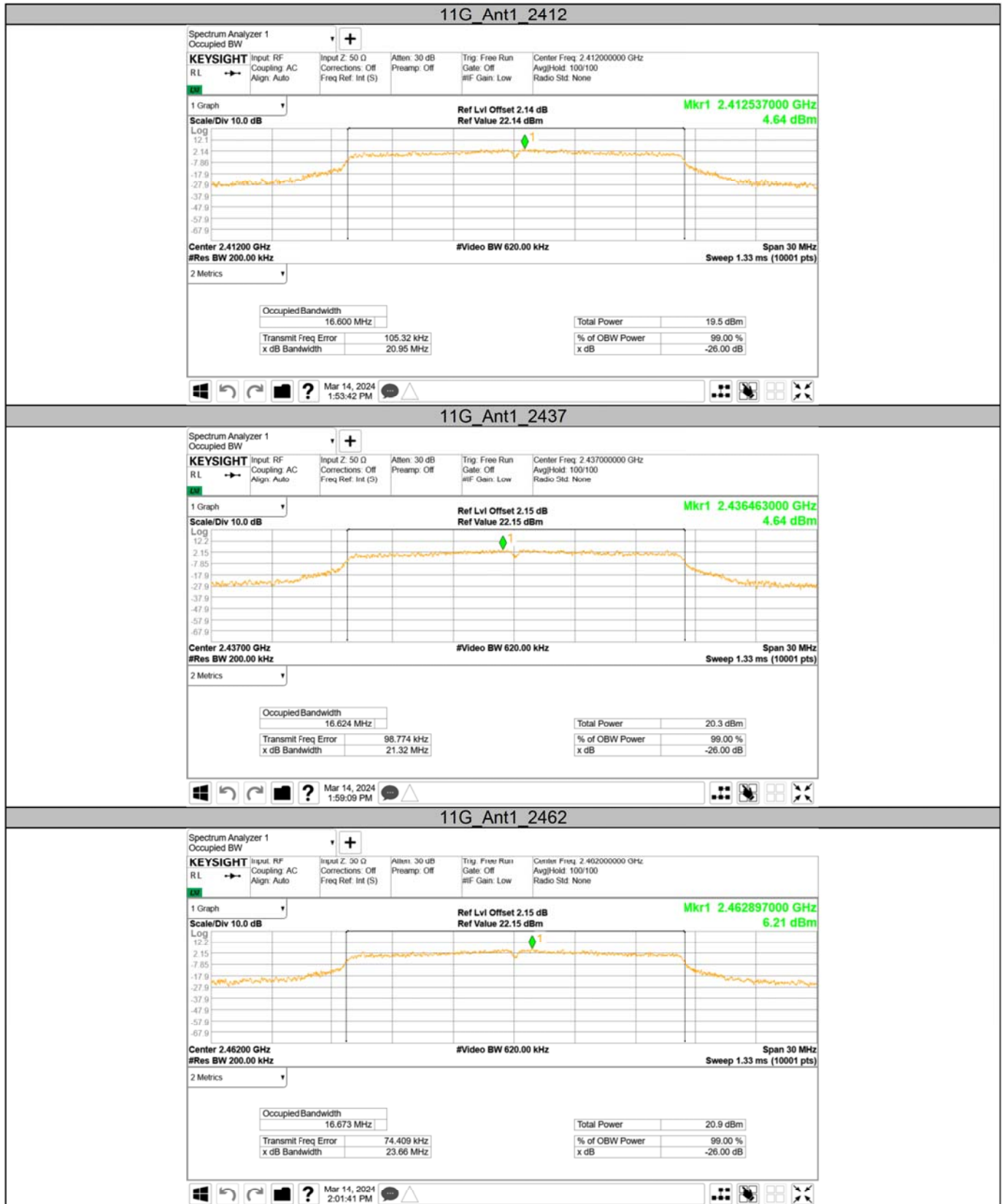






99% Occupied Bandwidth





11N20_Ant1_2412



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 $\geq$ 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
802.11 B

Frequency MHz	Power spectral density dBm/3kHz	Result
Low channel 2412MHz	-8.07	Pass
Middle channel 2437MHz	-7.69	Pass
High channel 2462MHz	-5.76	Pass

802.11 G

Frequency MHz	Power spectral density dBm/3kHz	Result
Low channel 2412MHz	-9.17	Pass
Middle channel 2437MHz	-8.39	Pass
High channel 2462MHz	-7.5	Pass

802.11 N20

Frequency MHz	Power spectral density dBm/3kHz	Result
Low channel 2412MHz	-9.21	Pass
Middle channel 2437MHz	-9.44	Pass
High channel 2462MHz	-7.78	Pass

Power spectral density

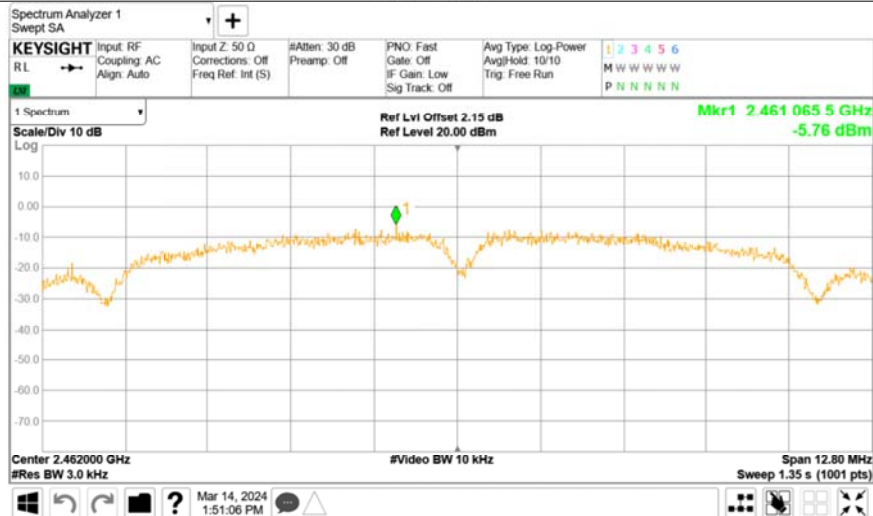
11B_Ant1_2412



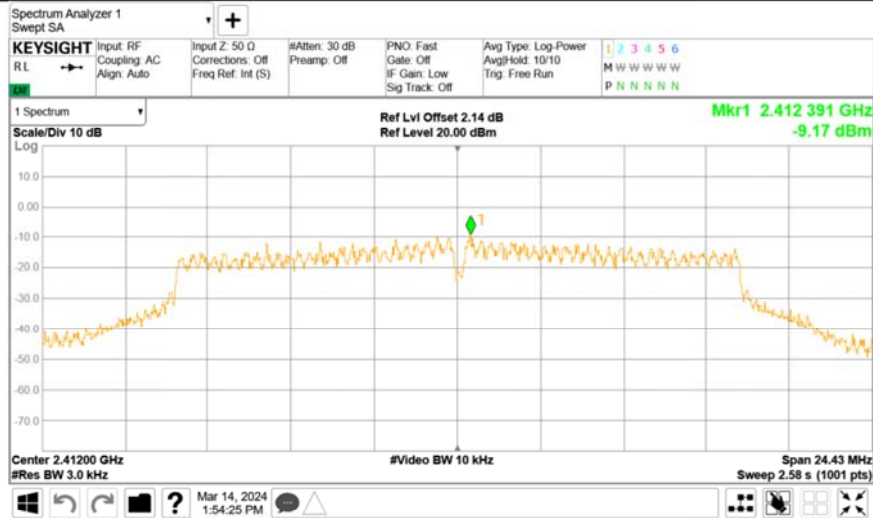
11B_Ant1_2437



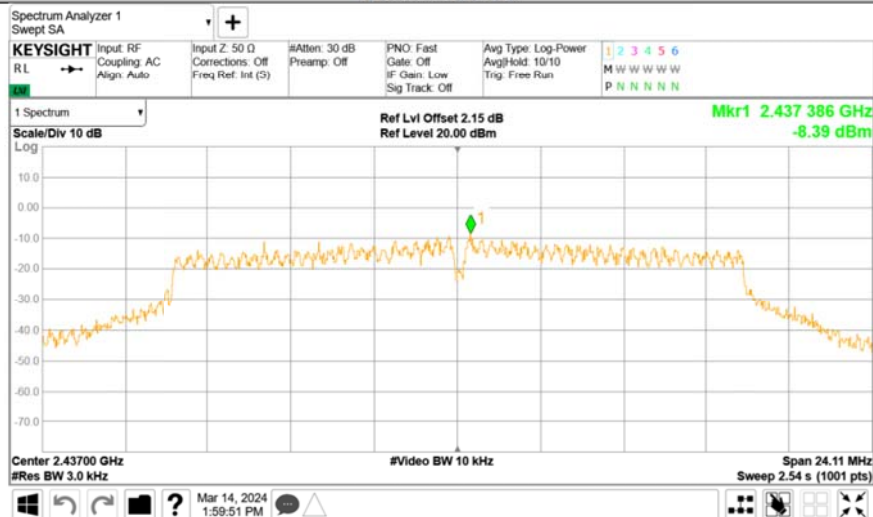
11B_Ant1_2462



11G Ant1 2412



11G Ant1 2437



11G Ant1 2462

