



Shenzhen Huaxin Information Technology Service Co., Ltd

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TEST REPORT

Report No.: HX260603R002

FCC ID.....: 2BDC6-SWITCHX3

IC.....: 33486-SWITCHX3

Applicant.....: Shelly Europe Ltd.

Address.....: 51 Cherni Vrah Blvd., bldg.3,fl.2-3,Sofia 1407,Bulgaria

Manufacturer.....: Shenzhen Ogemray Technology Co., Ltd

Address.....: 3/F-4/F, NO. 5 Bldg, Dongwu Industrial Park, Donghuan 1st Road, Longhua Town, Shenzhen, China

Product Name.....: Smart Module

Trade Mark.....: Shelly

Model/Type reference.....: Shelly X3A

Listed Model(s): /

Standard.....: FCC Rules Part 15.247
RSS-247 Issue 4

Date of receipt of test sample...: May. 20, 2026

Date of testing.....: May. 21, 2026 ~ Jun. 04, 2026

Date of issue.....: Jun. 04, 2026

Result.....: PASS

Compiled by:

(Printed name + signature)

Terry Su



Approved by:

(Printed name + signature)

Amy Zhai

Testing Laboratory Name.....: Shenzhen Huaxin Information Technology Service Co., Ltd

Address.....: 101, R & D Building, No.3 guansheng 4th Road, Luhua Community, Guanhu Street, Longhua District, Shenzhen, Guangdong, China

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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

[RSS-247 Issue 4](#): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

[ANSI C63.10-2020+Cor 1-2023+C63.10a-2024 + Errata to C63.10a-2024](#): American National Standard for Testing Unlicensed Wireless Devices.

[RSS-Gen Issue 5](#): General Requirements for Compliance of Radio Apparatus.

1.2. Report version

Revised No.	Date of issue	Description
01	Jun. 04, 2026	Original



1.3. Test Description

FCC Part 15 Subpart C (15.247) / RSS-247 Issue 4				
Test Item	Standard Section		Result	Test Engineer
	FCC	IC		
Antenna Requirement	15.203&15.247(b)(4)	RSS-Gen 6.8	Pass	Sain Liao
Conducted Emission	15.207	RSS-Gen 8.8	Pass	Ann Lu
Radiated Emissions Restricted Band and Radiated Spurious Emissions	15.205&15.209&15.247(d)	RSS-247 6.6 & RSS-Gen 8.10	Pass	Sain Liao
Conducted Band Edge and Spurious Emissions	15.247(d)	RSS-Gen 8.9 & RSS-Gen 8.10	Pass	Sain Liao
6dB Bandwidth	15.247(a)(2)	RSS-247 6.3.1 (a)	Pass	Sain Liao
Occupied Bandwidth	/	RSS-Gen 6.7	Pass	Sain Liao
Conducted Max Output Power	15.247(b)(3)	RSS-247 6.3.2	Pass	Sain Liao
Power Spectral Density	15.247(e)	RSS-247 6.3.1 (b)	Pass	Sain Liao
Transmitter Radiated Spurious	15.209&15.247(d)	RSS-247 6.6 & RSS-Gen 8.10	Pass	Sain Liao

Note: The measurement uncertainty is not included in the test result.



1.4. Test Facility

Shenzhen Huaxin Information Technology Service Co., Ltd

Add: 101, R & D Building, No.3 guansheng 4th Road, Luhua Community, Guanhu Street, Longhua District, Shenzhen, Guangdong, China

Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

A2LA-Lab Cert. No.: 6855.01

Shenzhen Huaxin Information Technology Service Co., Ltd EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

Industry Canada (Company Number: 31786, CAB Identifier: CN0147)

Shenzhen Huaxin Information Technology Service Co., Ltd EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 31786.

FCC (Registration No.: 932271, Designation Number CN1344)

Shenzhen Huaxin Information Technology Service Co., Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC)Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration NO.: 932271.

1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen Huaxin Information Technology Service Co., Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for Shenzhen Huaxin Information Technology Service Co., Ltd



Test Items	Measurement Uncertainty	Notes
DTS Bandwidth	$\pm 3.70\%$	(1)
Maximum Conducted Output Power	$\pm 0.60\text{dB}$	(1)
Maximum Power Spectral Density Level	$\pm 0.46\text{dB}$	(1)
Band-edge Compliance	$\pm 4.40\text{dB}$	(1)
Conducted Spurious Emissions	$\pm 1.40\text{dB}$	(1)
Conducted Emissions 9kHz~30MHz	$\pm 3.10\text{dB}$	(1)
Radiated Emissions 9kHz~30MHz	$\pm 3.62\text{dB}$	(1)
Radiated Emissions 30~1000MHz	$\pm 4.63\text{dB}$	(1)
Radiated Emissions 1~18GHz	$\pm 4.40\text{dB}$	(1)
Radiated Emissions 18~40GHz	$\pm 4.40\text{dB}$	(1)

Note (1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

1.6. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	21°C ~ 27°C
Relative Humidity:	40% ~ 60%
Air Pressure:	101kPa



2. GENERAL INFORMATION

2.1. Client Information

Applicant:	Shelly Europe Ltd.
Address:	51 Cherni Vrah Blvd., bldg.3,fl.2-3,Sofia 1407,Bulgaria
Manufacturer:	Shenzhen Ogemray Technology Co., Ltd
Address:	3/F-4/F, NO. 5 Bldg, Dongwu Industrial Park, Donghuan 1st Road, Longhua Town, Shenzhen, China

2.2. General Description of EUT

Product Name:	Smart Module
Trade Mark:	Shelly
Model/Type reference:	Shelly X3A
Listed Model(s):	/
Power supply:	3.3Vdc from PCB board
Hardware version:	/
Software version:	/
Samples No.:	YP260520-E001-1
WIFI Specification	
Modulation:	802.11b: DSSS(CCK, DQPSK, DBPSK) 802.11g/ n: OFDM(BPSK, QPSK, 16QAM, 64QAM)
Operation frequency:	802.11b/ g/ n(HT20): 2412MHz~2462MHz 802.11n(HT40): 2422MHz~2452MHz
Channel number:	802.11b/ g/ n(HT20): 11channels 802.11n(HT40): 7channels
Channel separation:	5MHz
Antenna type:	PCB Antenna
Antenna gain:	4.26dBi



2.3. Accessory Equipment information

Equipment Information			
Name	Model	S/N	Manufacturer
Notebook	ThinkPad E15 Gen4	/	Lenovo
/	/	/	/
Cable Information			
Name	Shielded Type	Ferrite Core	Length
/	/	/	/
Test Software Information			
Name	Versions	/	/
EspRFTTestTool	V5.2	/	/



2.4. Operation state

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing.

Operation Frequency List:

Channel	Frequency (MHz)
01	2412
02	2417
03	2422
04	2427
05	2432
06	2437
07	2442
08	2447
09	2452
10	2457
11	2462

Note: CH 01~CH 11 for 802.11b/g/n(HT20), CH 03~CH 09 for 802.11n(HT40).

Data Rated

Preliminary tests were performed in different data rate, and found which the below bit rate is worst case mode, so only show data which it is a worst case mode.

Mode	Data rate (worst mode)
802.11b	1Mbps
802.11g	6Mbps
802.11n(HT20)/ (HT40)	HT-MCS0

Test mode

For RF test items:
The engineering test program was provided and enabled to make EUT continuous transmit.
For AC power line conducted emissions:
The EUT was set to connect with the WLAN AP under large package sizes transmission.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data Recorded in the report.



2.5. Measurement Instruments List

RF Test System - SRD					
Item	Test Equipment	Manufacturer	Model No.	Versions/ Serial No.	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY51280803	Apr. 08, 2027
2	Wideband Radio Communication Tester	R&S	CMW500	157763	Apr. 08, 2027
3	MXG Vector Signal Generator	Agilent	N5182A	101795	Apr. 08, 2027
4	EXG Analog Signal Generator	Agilent	N5181A	MY47421151	Apr. 08, 2027
5	RF Sensor Unit	Techy	TR1029-2	20220428P009	Apr. 08, 2027
6	High and low temperature test chamber	Asprey	LX-225L	2020091401	Apr. 08, 2027
7	SRD Test Software	TACHOY	RTS	V1.0.0	/
8	2G/3G/4G Test Software	TST	TST-PASS	V2.0	/

Radiated emission					
Item	Test Equipment	Manufacturer	Model No.	Versions/ Serial No.	Calibrated until
1	EMI spectrum receiver	R&S	ESR7	102543	Apr. 09, 2027
2	9*6*6 anechoic chamber	Mao Rui	9*6*6	/	Apr. 09, 2028
3	Spectrum analyzer	R&S	FSV40-N	101795	Apr. 09, 2027
4	Preamplifier	Agilent	8449B	3008A00551	Apr. 08, 2027
5	Preamplifier	HP	8447D	1616A02061	Apr. 09, 2027
6	Preamplifier	SKET	LNPA1840G-50	SK2019040302	Apr. 09, 2027
7	Horn Antenna	SCHWARZBECK	BBHA9170	00369	Apr. 10, 2028
8	Horn Antenna	A. H. System, Inc	SAS-571	915	Apr. 10, 2028
9	Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	01318	Apr. 10, 2028
10	Loop Antenna	SCHWARZBECK	FMZB1519B	00128	Apr. 08, 2027
11	6dB Fixed Attenuator	SKET	AP_DC01G-2W-N-6 dB	SK2021012803	Apr. 08, 2027
12	RF Cable 0.009~1000MHz	Langjingkeji	N/J-NJ-RG58(1G) 9m	/	Apr. 09, 2027
13	RF Cable 1000~18000MHz	Langjingkeji	N/J-SMAAJ-406(18G) 9m	/	Apr. 09, 2027
14	RF Cable	Langjingkeji	2.92/M-2.92/M-0.5M	/	Apr. 12, 2027
15	RF Cable 18000~40000MHz	Langjingkeji	2.92/M-2.92/M-3M	/	Apr. 12, 2027
16	Test Software	SKET	EMC-I	V1.4.0.1	/
17	Test Software	FARA	EZ-EMC	FA-03A3	/



Conducted emission					
Item	Test Equipment	Manufacturer	Model No.	Versions/ Serial No.	Calibrated until
1	LISN	R&S	ENV216	101291	Apr. 09, 2027
2	LISN	R&S	ESH3-Z5	894981/024	Apr. 09, 2027
3	EMI Test Receiver	R&S	ESR7	102543	Apr. 09, 2027
5	RF Cable	Langjingkeji	N/J-NJ-RG58(1G) 10m	/	Apr. 09, 2027
6	Test Software	SKET	EMC-I	V1.4.0.1	/

Note: 1. The Cal. Interval was one year.

2. The cable loss has calculated in test result which connection between each test instruments.

3. TEST ITEM AND RESULTS

3.1. Conducted Emission

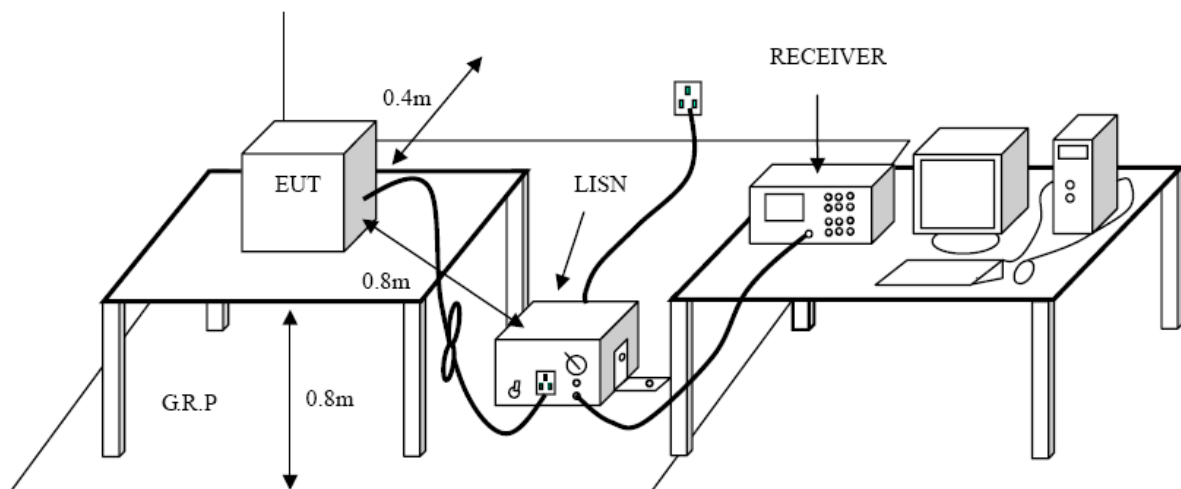
Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.207/ RSS-Gen 8.8:

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Configuration

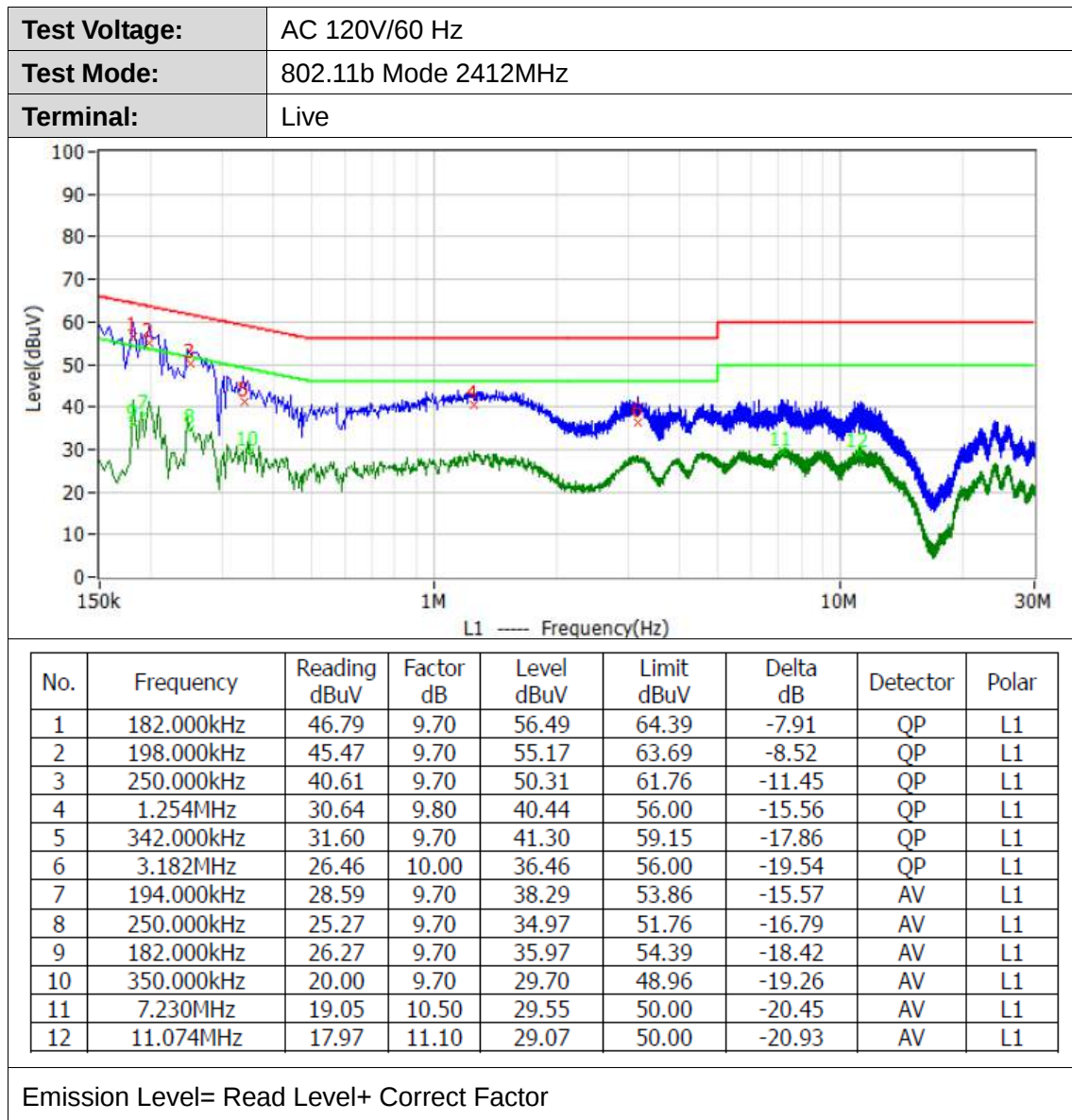


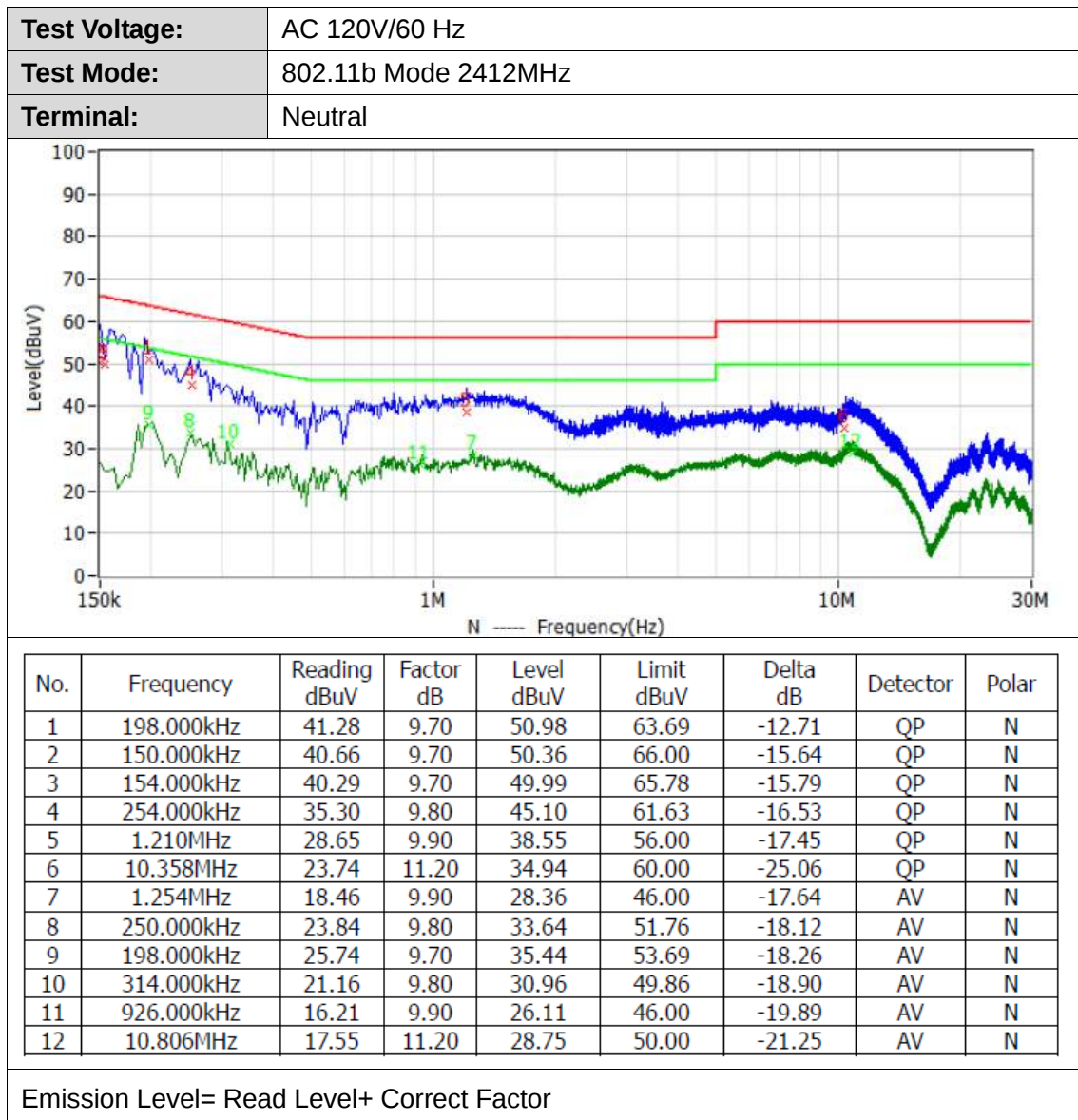
Test Procedure

1. The EUT was setup according to ANSI C63.10-2020+Cor 1-2023+C63.10a-2024 + Errata to C63.10a-2024 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
4. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
5. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
6. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
7. During the above scans, the emissions were maximized by cable manipulation.

**Test Mode:**

Please refer to the clause 2.4.

Test Results





3.2. Radiated Emission

Limit

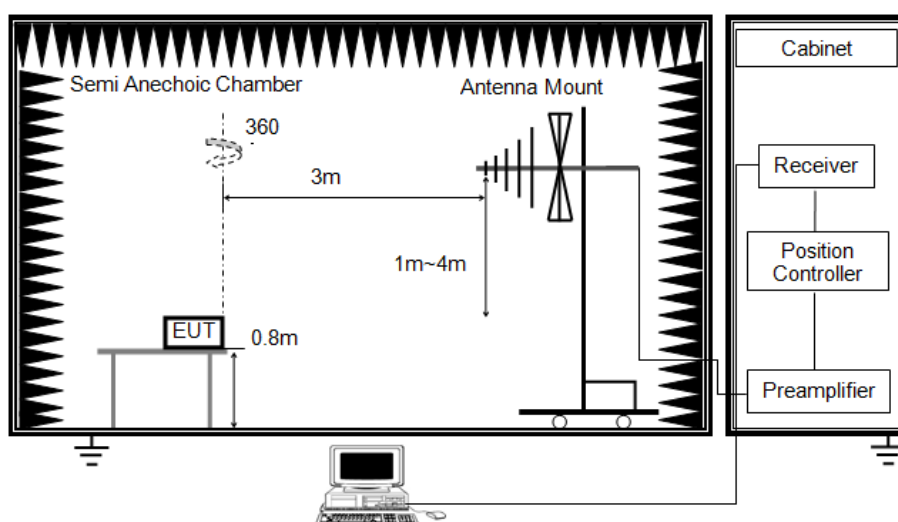
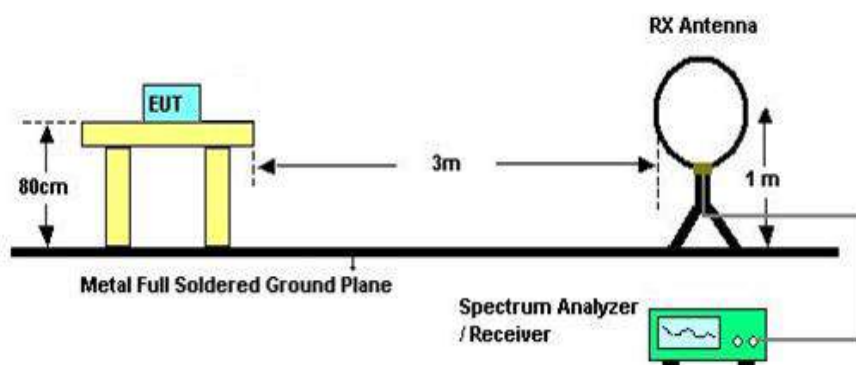
FCC CFR Title 47 Part 15 Subpart C Section 15.209/ RSS-Gen 8.9:

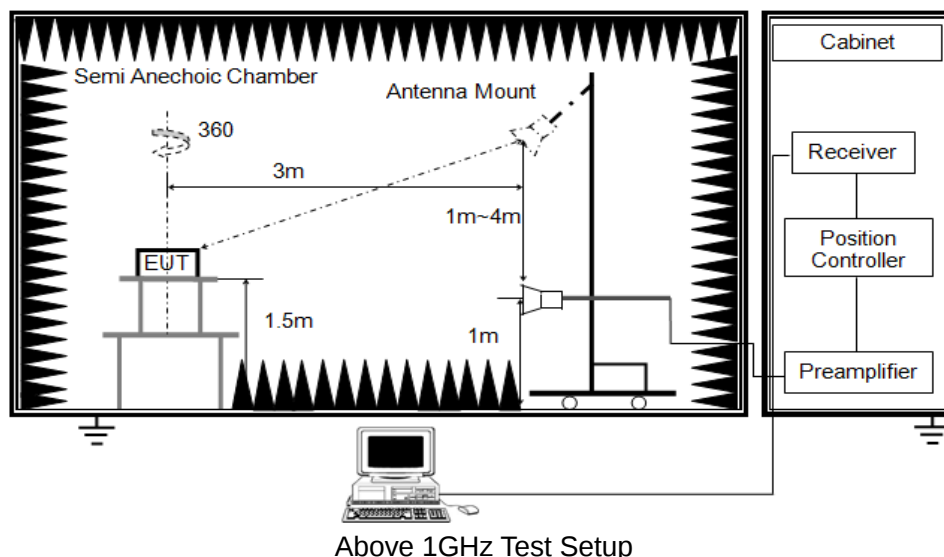
Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBuV/m)=20log Emission Level (uV/m).

Test Configuration





Test Procedure

1. The EUT was setup and tested according to ANSI C63.10-2020+Cor 1-2023+C63.10a-2024 + Errata to C63.10a-2024
 2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
 4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
 5. Set to the maximum power setting and enable the EUT transmit continuously.
 6. Use the following spectrum analyzer settings
 - (1) Span shall wide enough to fully capture the emission being measured
 - (2) Below 30 MHz:
9kHz – 150kHz, RBW=200Hz, VBW $\geq$ RBW, Sweep=auto, Detector function=peak, Trace=max hold;
150kHz – 30MHz, RBW=9kHz, VBW $\geq$ RBW, Sweep=auto, Detector function=peak, Trace=max hold; If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - (3) 30 MHz - 1 GHz:
RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - (4) From 1 GHz to 10th harmonic:
RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW $\geq$ 1/T Peak detector for Average value.
- Note 1: For the 1/T& Duty Cycle please refer to clause 3.8 Duty Cycle.

Test Mode

Please refer to the clause 2.4.

Test Result

Note: All modes have been tested, only show the worst case.

9 KHz~30 MHz

From 9 KHz to 30 MHz: Conclusion: PASS

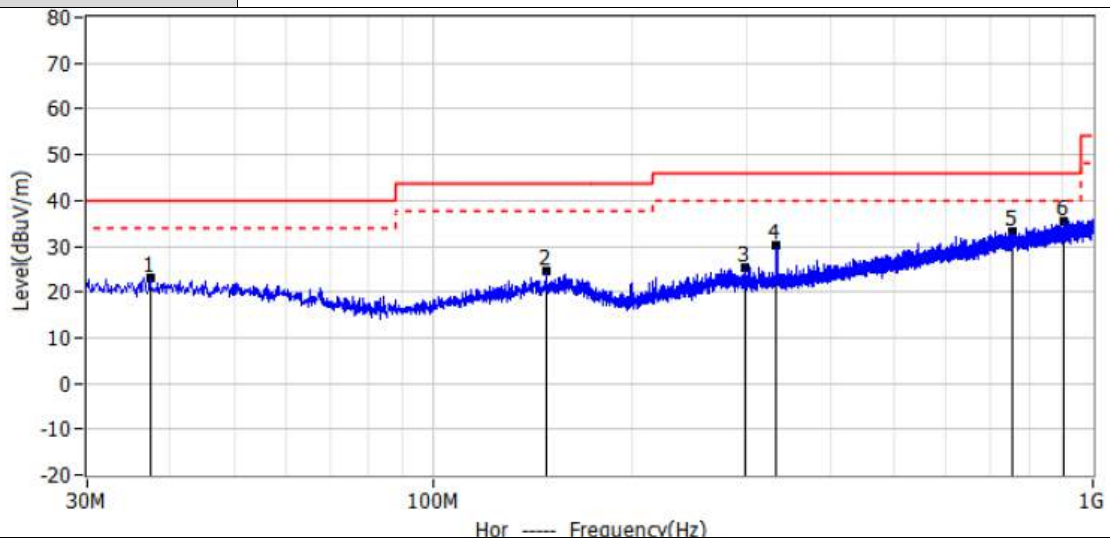


Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



30MHz-1GHz

Ant. Pol.	Horizontal
Test Mode:	802.11b Mode 2412MHz
Remark:	Only worse case is reported



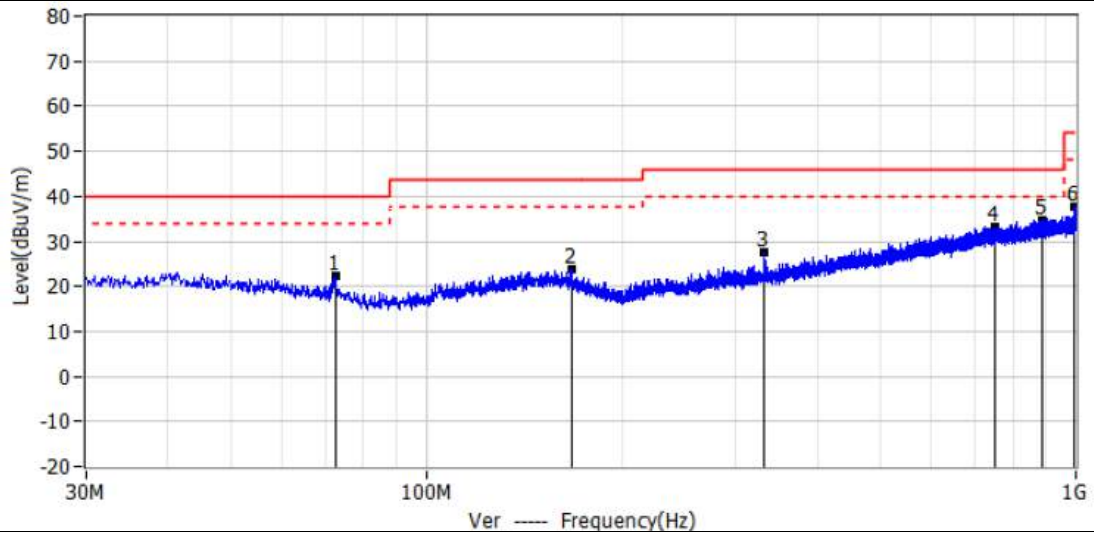
No.	Frequency	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Delta dB	Detector	Polar
1*	37.396MHz	9.4	13.6	23.0	40.0	-17.0	QP	Hor
2*	148.704MHz	10.3	14.1	24.4	43.5	-19.1	QP	Hor
3*	297.478MHz	11.7	13.8	25.5	46.0	-20.5	QP	Hor
4*	332.155MHz	15.3	14.9	30.2	46.0	-15.8	QP	Hor
5*	753.620MHz	10.7	22.5	33.2	46.0	-12.8	QP	Hor
6*	903.970MHz	11.2	24.1	35.3	46.0	-10.7	QP	Hor

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2. Margin value = Level -Limit value



Ant. Pol.	Vertical
Test Mode:	802.11b Mode 2412MHz
Remark:	Only worse case is reported



No.	Frequency	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Delta dB	Detector	Polar
1*	72.438MHz	12.0	10.5	22.5	40.0	-17.5	QP	Ver
2*	167.983MHz	10.2	13.6	23.8	43.5	-19.7	QP	Ver
3*	332.155MHz	12.6	14.9	27.5	46.0	-18.5	QP	Ver
4*	750.104MHz	10.8	22.4	33.2	46.0	-12.8	QP	Ver
5*	884.934MHz	11.0	23.8	34.8	46.0	-11.2	QP	Ver
6*	995.393MHz	12.9	24.8	37.7	54.0	-16.3	QP	Ver

Remarks:

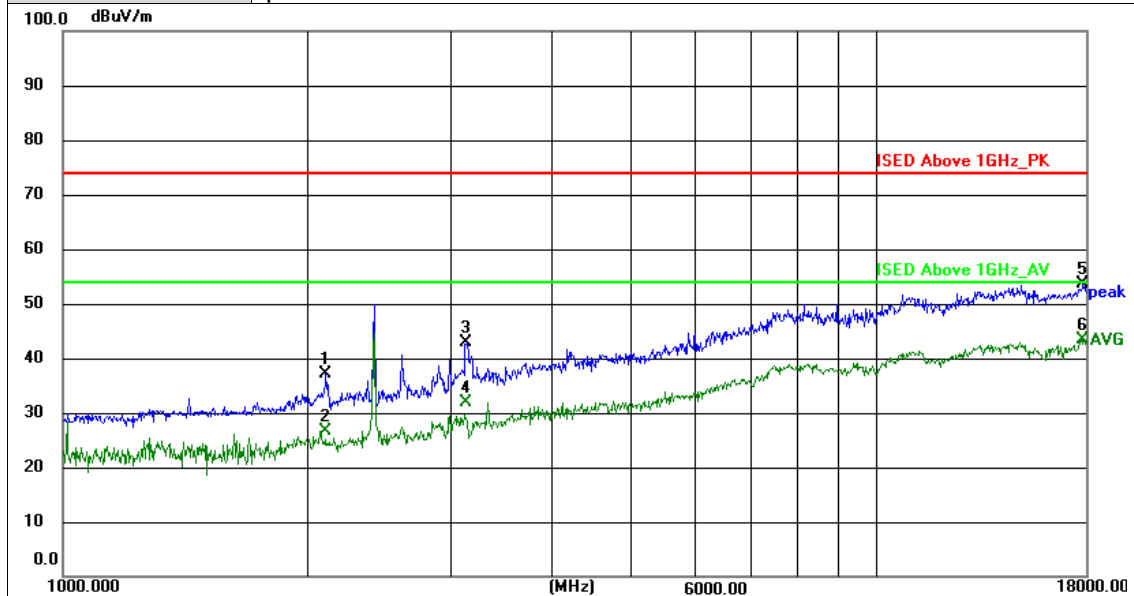
- Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- Margin value = Level -Limit value



1GHz-18GHz

All the modes were tested, and only the worst mode was presented. The worst mode was mode b.

Ant. Pol.	Horizontal
Test Mode:	802.11b Mode 2412MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.

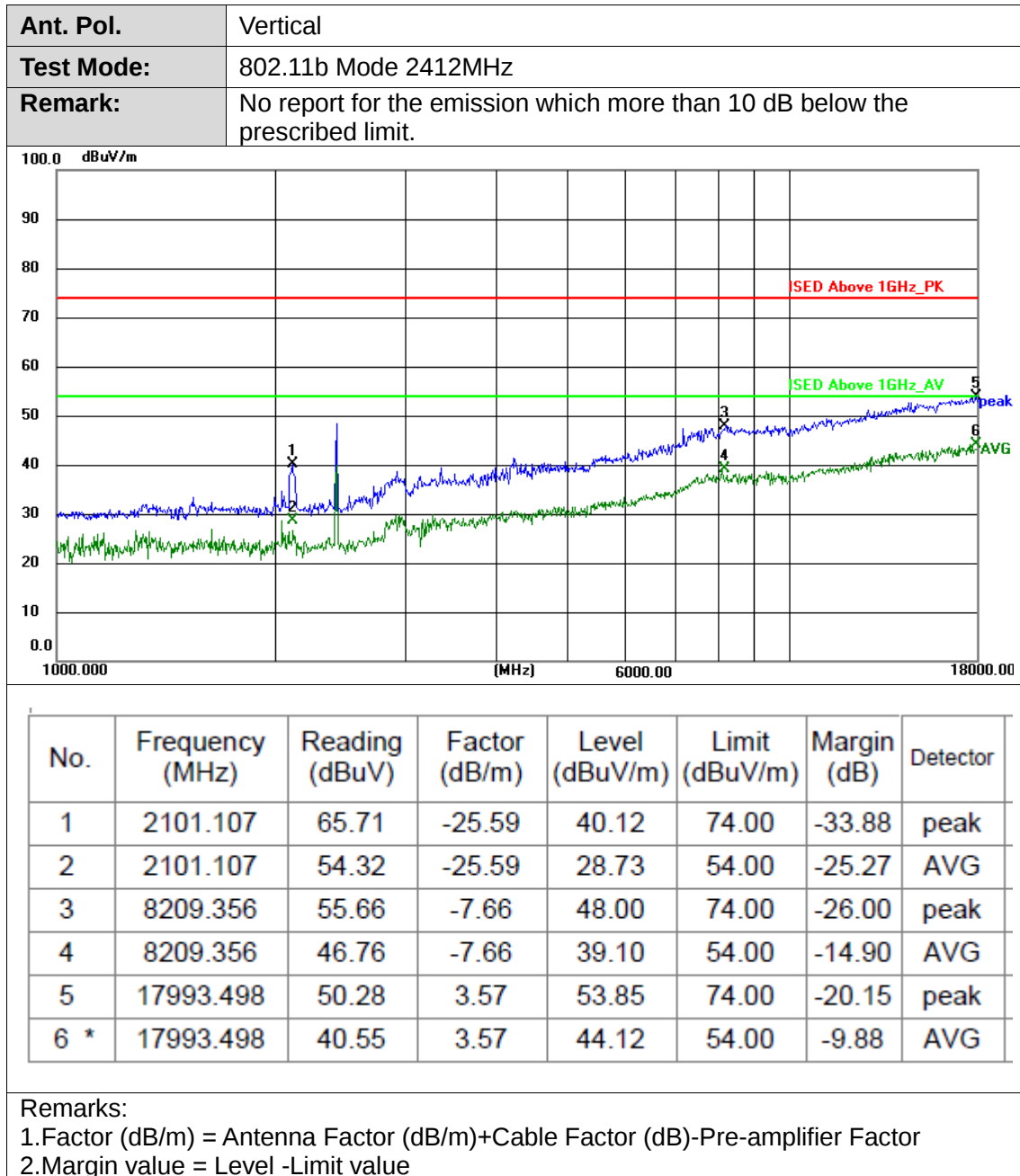


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2101.866	62.79	-25.58	37.21	74.00	-36.79	peak
2	2101.866	52.10	-25.58	26.52	54.00	-27.48	AVG
3	3141.144	65.28	-22.32	42.96	74.00	-31.04	peak
4	3141.144	54.31	-22.32	31.99	54.00	-22.01	AVG
5	17935.084	50.32	3.28	53.60	74.00	-20.40	peak
6 *	17935.084	40.18	3.28	43.46	54.00	-10.54	AVG

Remarks:

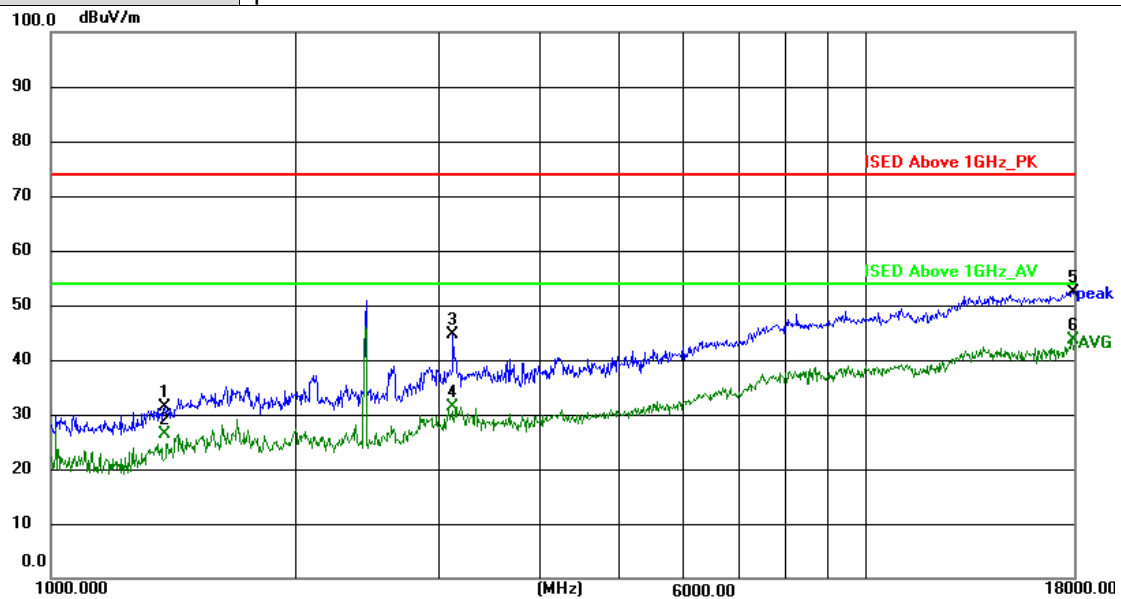
1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value





Ant. Pol.	Horizontal
Test Mode:	802.11b Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



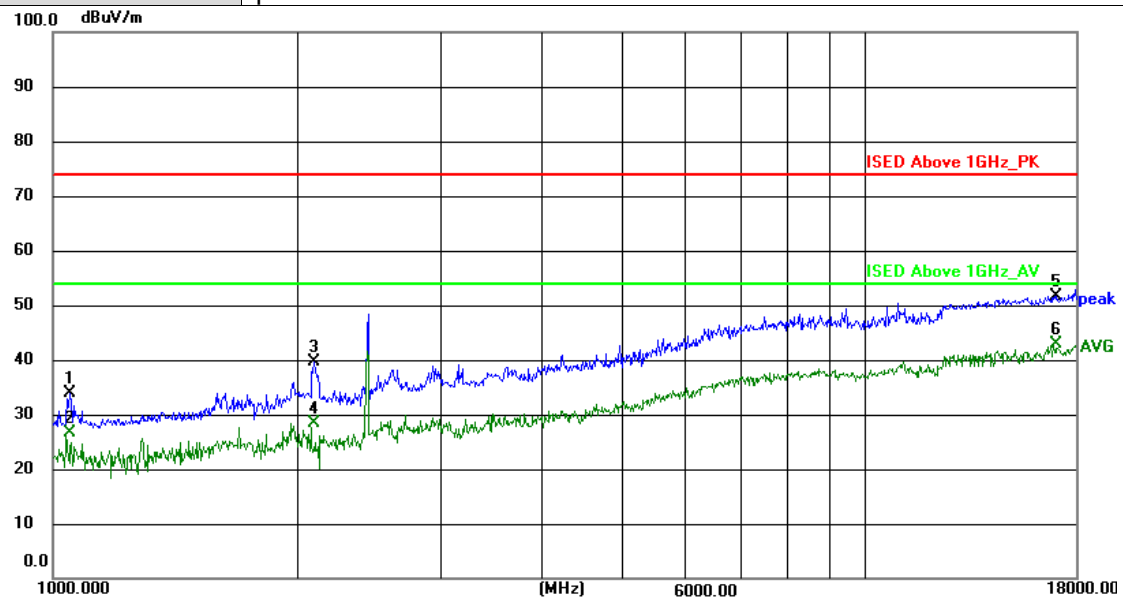
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1379.269	58.33	-26.96	31.37	74.00	-42.63	peak
2	1379.269	53.46	-26.96	26.50	54.00	-27.50	AVG
3	3119.655	67.04	-22.39	44.65	74.00	-29.35	peak
4	3119.655	53.85	-22.39	31.46	54.00	-22.54	AVG
5	17993.498	48.84	3.57	52.41	74.00	-21.59	peak
6 *	17993.498	40.06	3.57	43.63	54.00	-10.37	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	802.11b Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



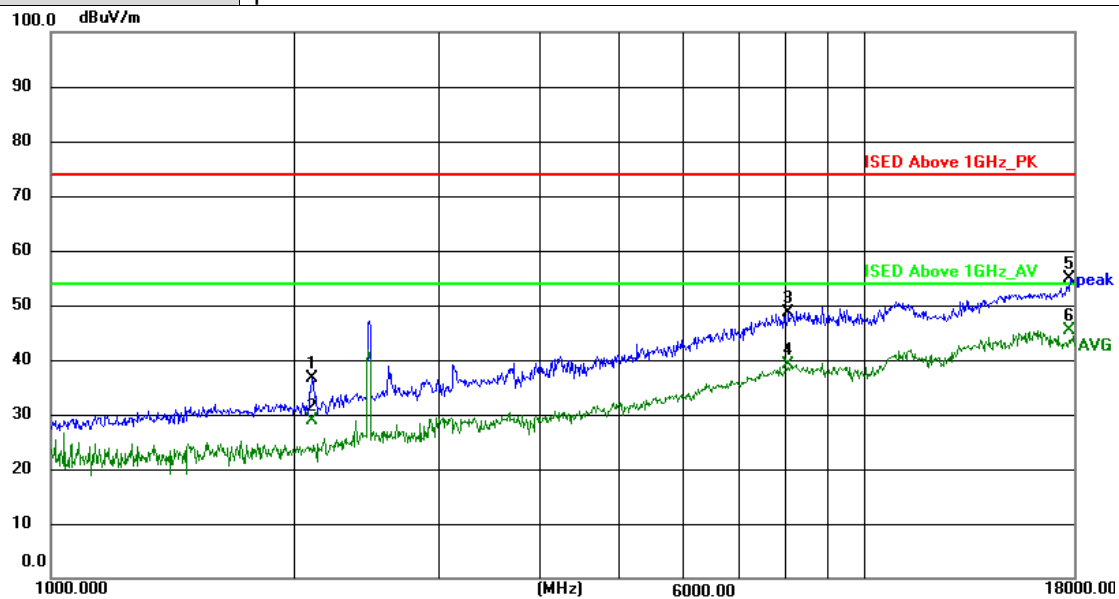
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1049.984	61.28	-27.52	33.76	74.00	-40.24	peak
2	1049.984	54.14	-27.52	26.62	54.00	-27.38	AVG
3	2094.286	65.13	-25.61	39.52	74.00	-34.48	peak
4	2094.286	54.04	-25.61	28.43	54.00	-25.57	AVG
5	17062.787	52.70	-1.09	51.61	74.00	-22.39	peak
6 *	17062.787	43.98	-1.09	42.89	54.00	-11.11	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
2. Margin value = Level - Limit value



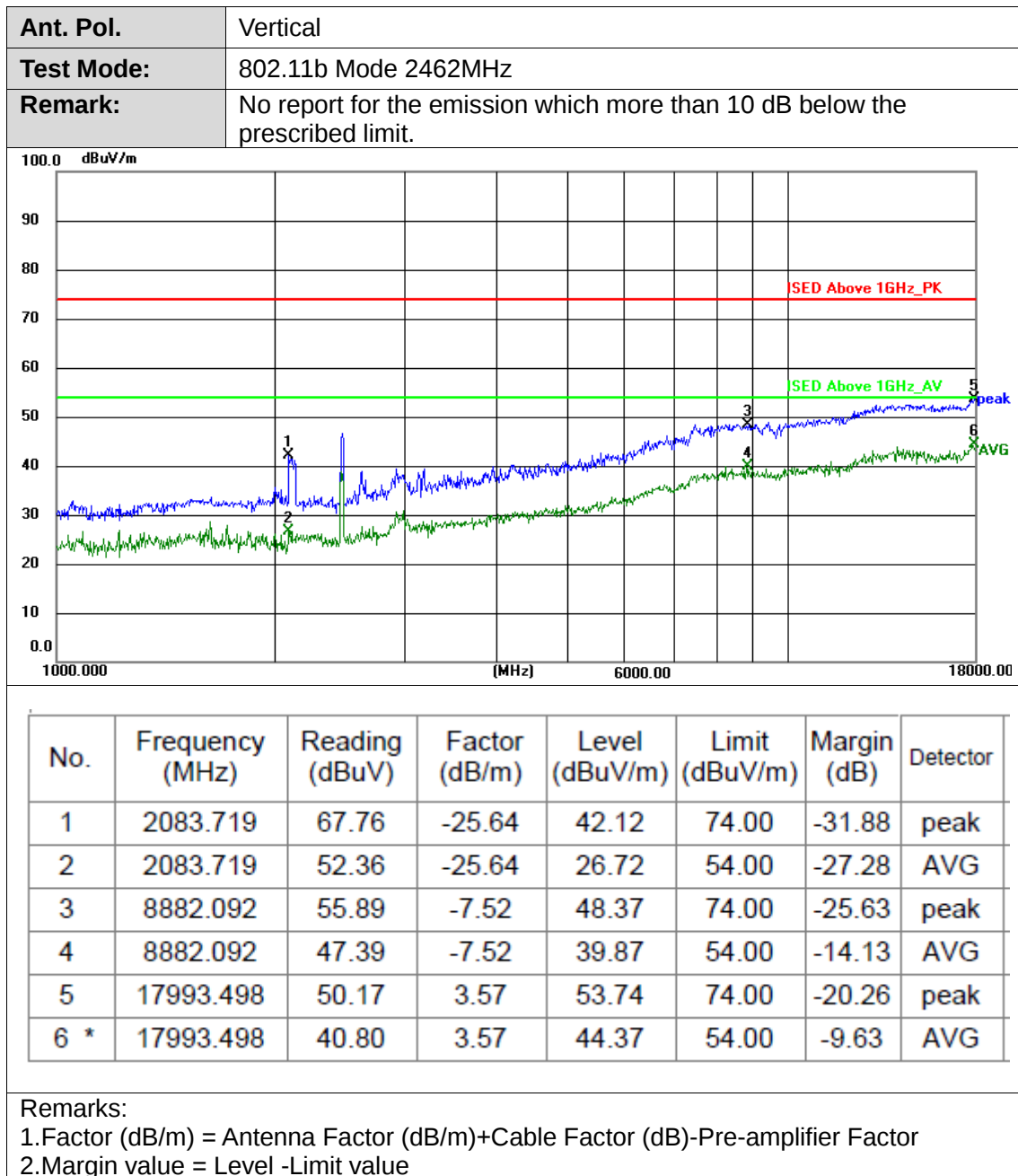
Ant. Pol.	Horizontal
Test Mode:	802.11b Mode 2462MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2095.800	62.24	-25.60	36.64	74.00	-37.36	peak
2	2095.800	54.54	-25.60	28.94	54.00	-25.06	AVG
3	8076.965	56.20	-7.68	48.52	74.00	-25.48	peak
4	8076.965	46.72	-7.68	39.04	54.00	-14.96	AVG
5	17889.782	51.81	3.05	54.86	74.00	-19.14	peak
6 *	17889.782	42.21	3.05	45.26	54.00	-8.74	AVG

Remarks:

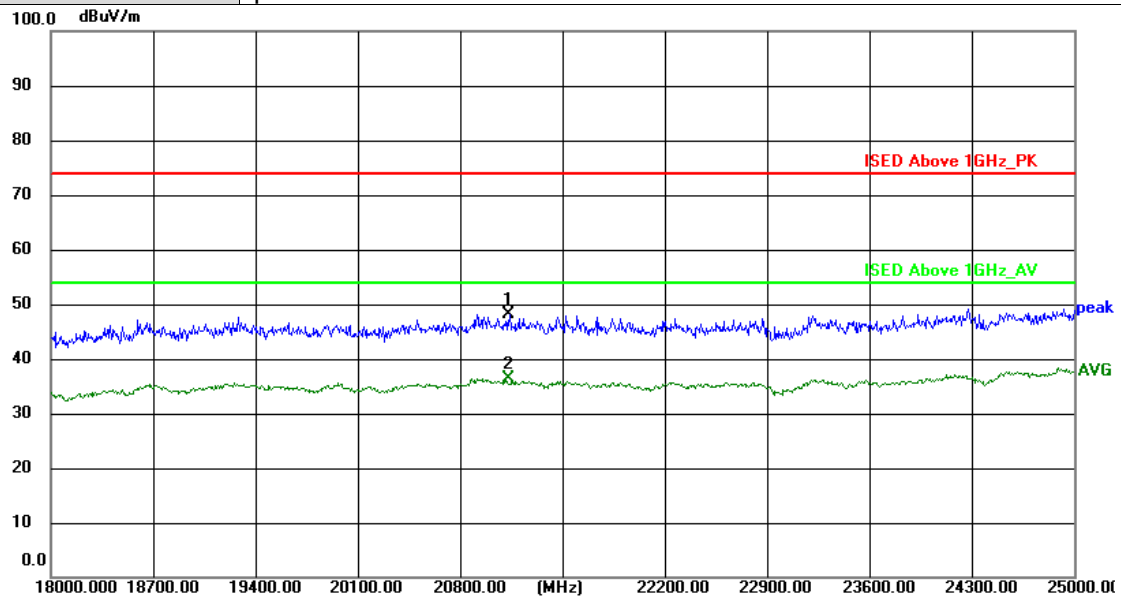
1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
2. Margin value = Level - Limit value





18GHz-25GHz

Ant. Pol.	Horizontal
Test Mode:	802.11b Mode 2412MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	21139.139	57.77	-9.73	48.04	74.00	-25.96	peak
2 *	21139.139	46.05	-9.73	36.32	54.00	-17.68	AVG

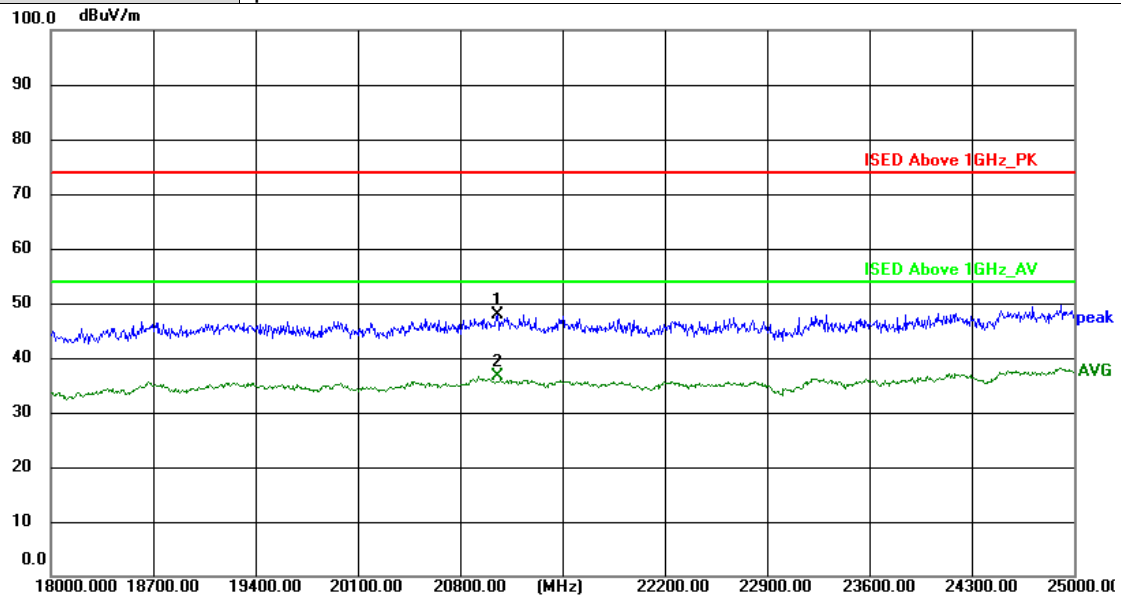
Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	802.11b Mode 2412MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



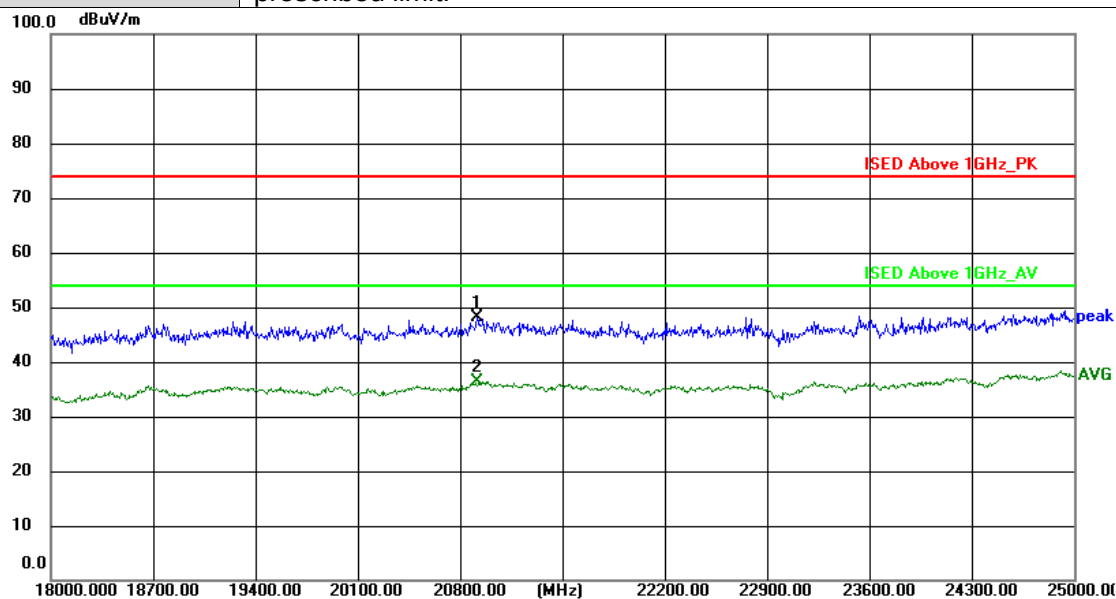
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	21055.055	57.55	-9.71	47.84	74.00	-26.16	peak
2 *	21055.055	46.28	-9.71	36.57	54.00	-17.43	AVG

Remarks:

- Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- Margin value = Level -Limit value



Ant. Pol.	Horizontal
Test Mode:	802.11b Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



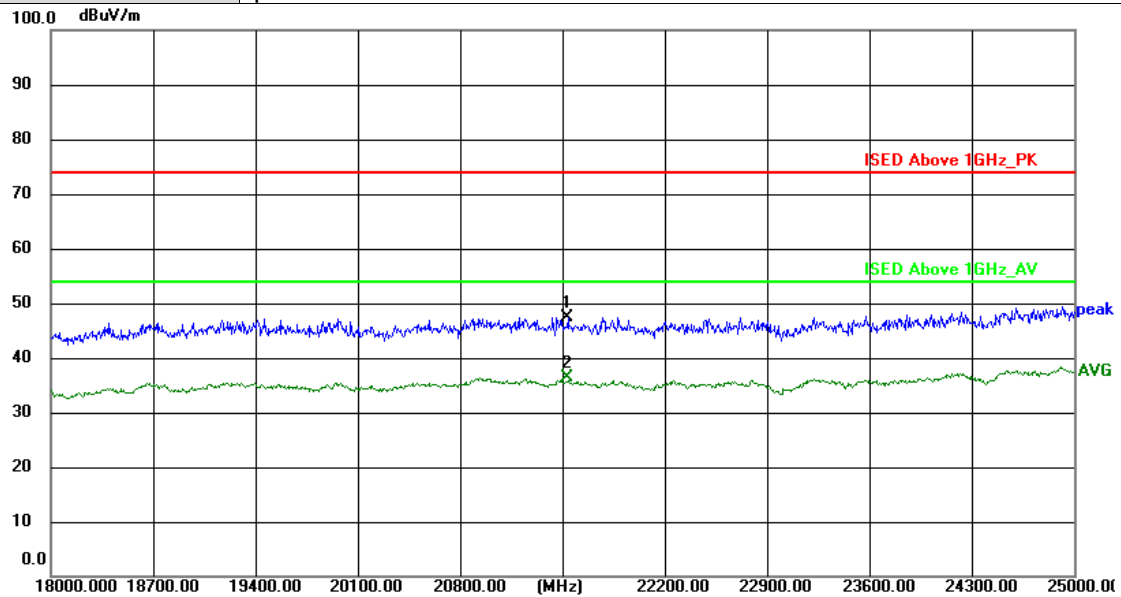
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	20914.915	58.09	-9.85	48.24	74.00	-25.76	peak
2 *	20914.915	46.30	-9.85	36.45	54.00	-17.55	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	802.11b Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



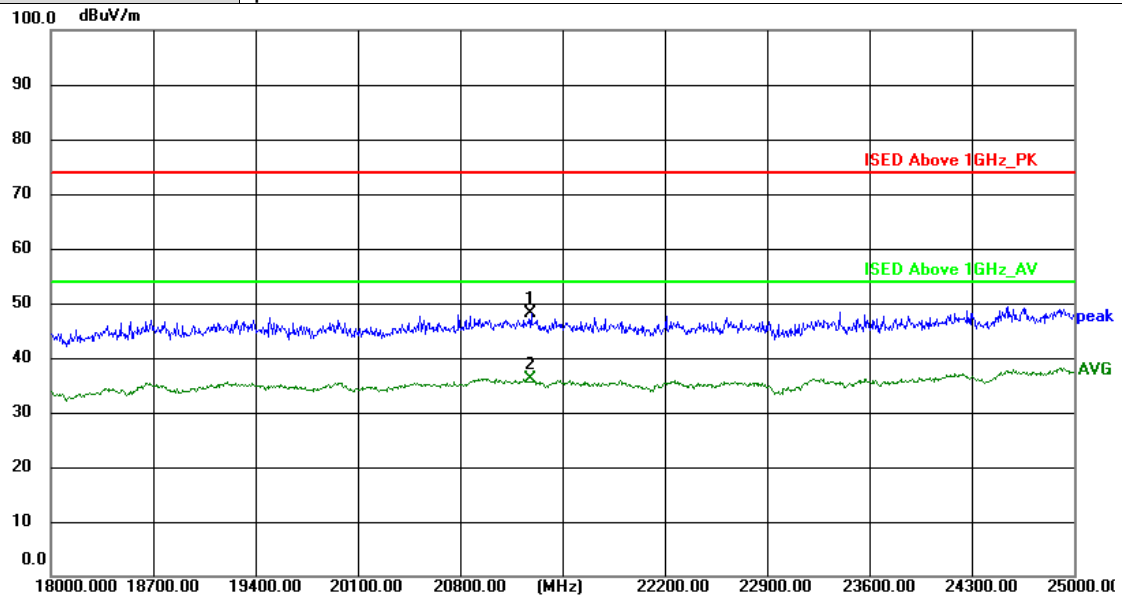
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	21538.538	57.34	-9.85	47.49	74.00	-26.51	peak
2 *	21538.538	46.29	-9.85	36.44	54.00	-17.56	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
2. Margin value = Level - Limit value



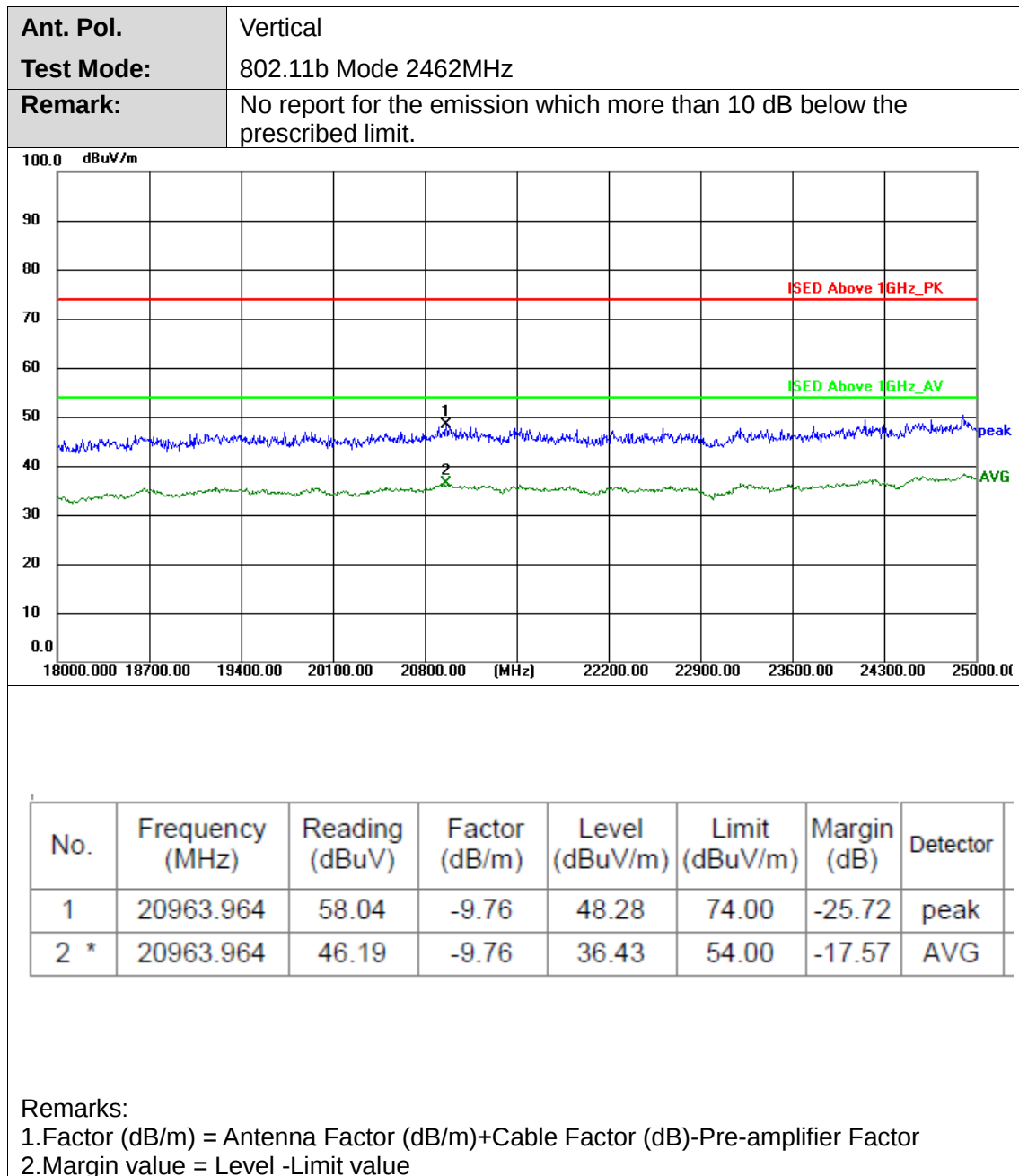
Ant. Pol.	Horizontal
Test Mode:	802.11b Mode 2462MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	21286.286	57.79	-9.77	48.02	74.00	-25.98	peak
2 *	21286.286	46.00	-9.77	36.23	54.00	-17.77	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
2. Margin value = Level - Limit value



Note: All the modes were tested, and only the worst mode was presented. The worst mode was mode b.

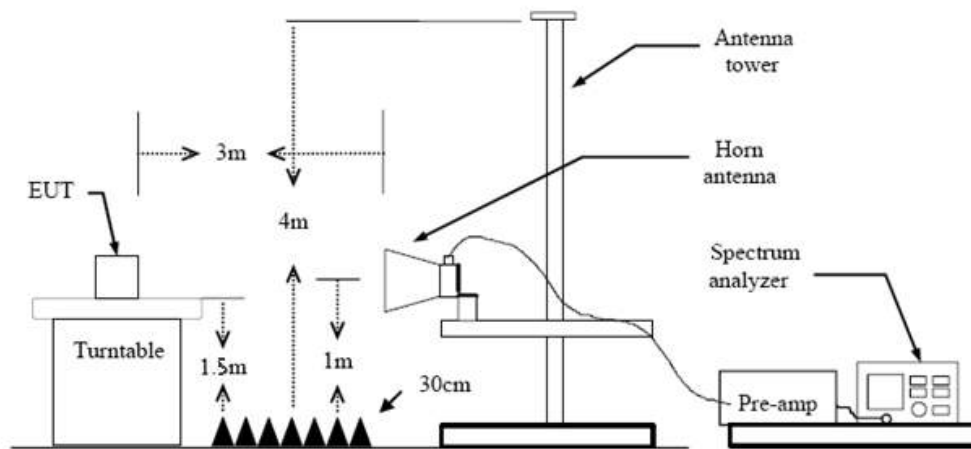
3.3. Radiated Emissions Restricted Band

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d)/ RSS-Gen 8.10:

Restricted Frequency Band (MHz)	(dBuV/m)(at 3m)	
	Peak	Average
2310 ~2390	74	54
2483.5 ~2500	74	54

Test Configuration



Test Procedure

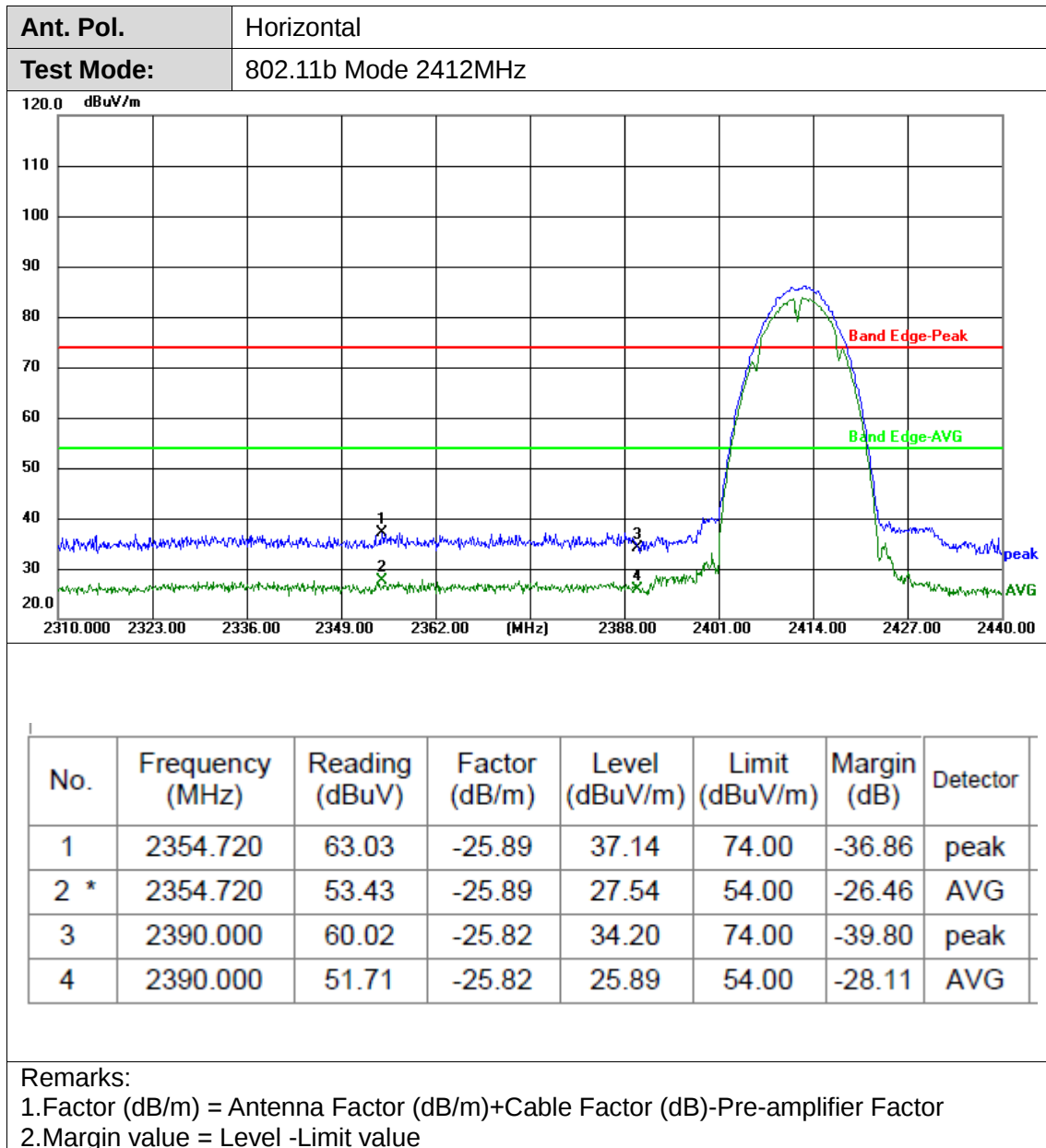
1. The EUT was setup and tested according to ANSI C63.10-2020+Cor 1-2023+C63.10a-2024 + Errata to C63.10a-2024 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2020+Cor 1-2023+C63.10a-2024 + Errata to C63.10a-2024 on radiated measurement.
5. The receiver set as follow:
RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW see note 1 with Peak Detector for Average Value.

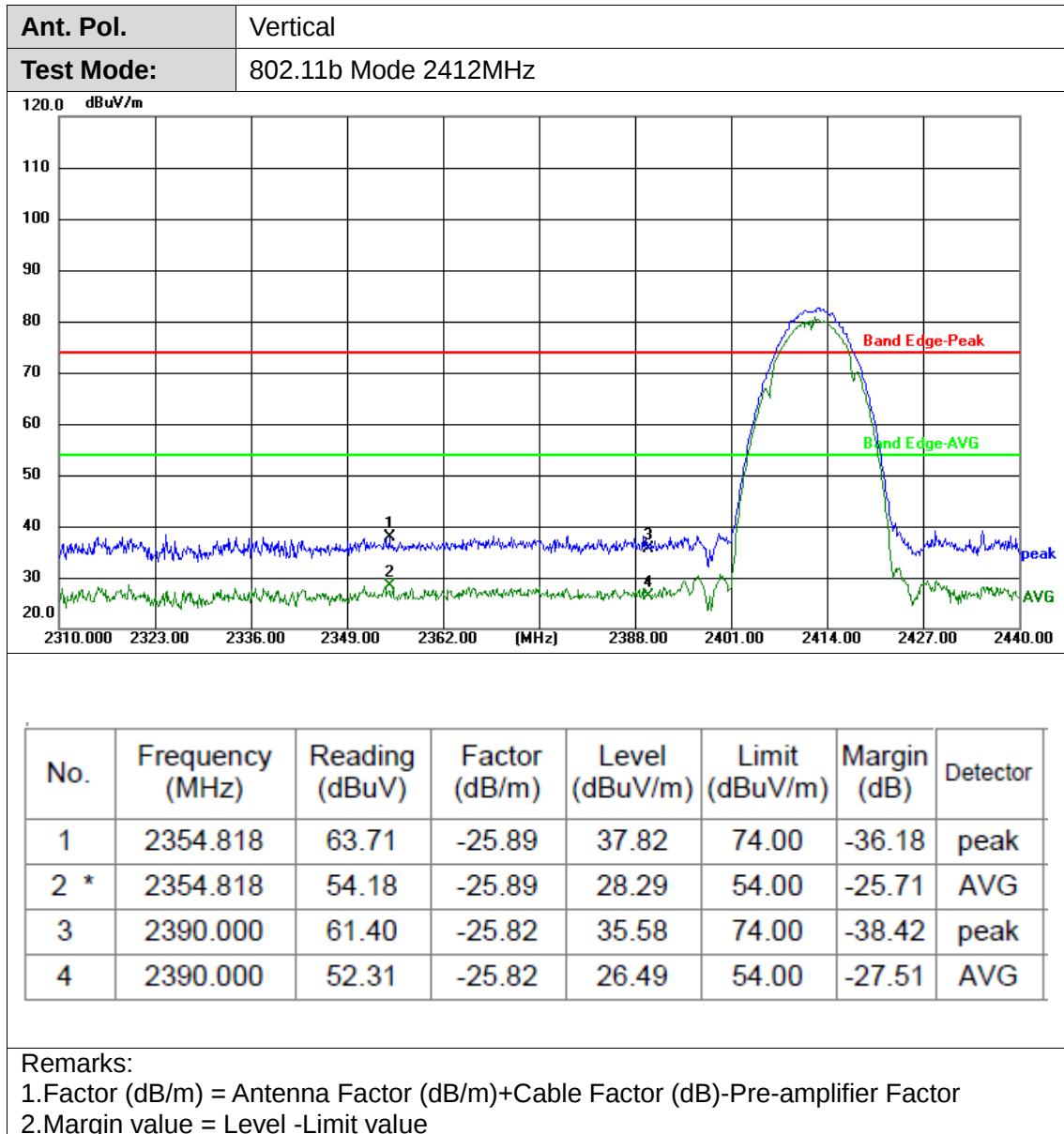
Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.8 Duty Cycle.

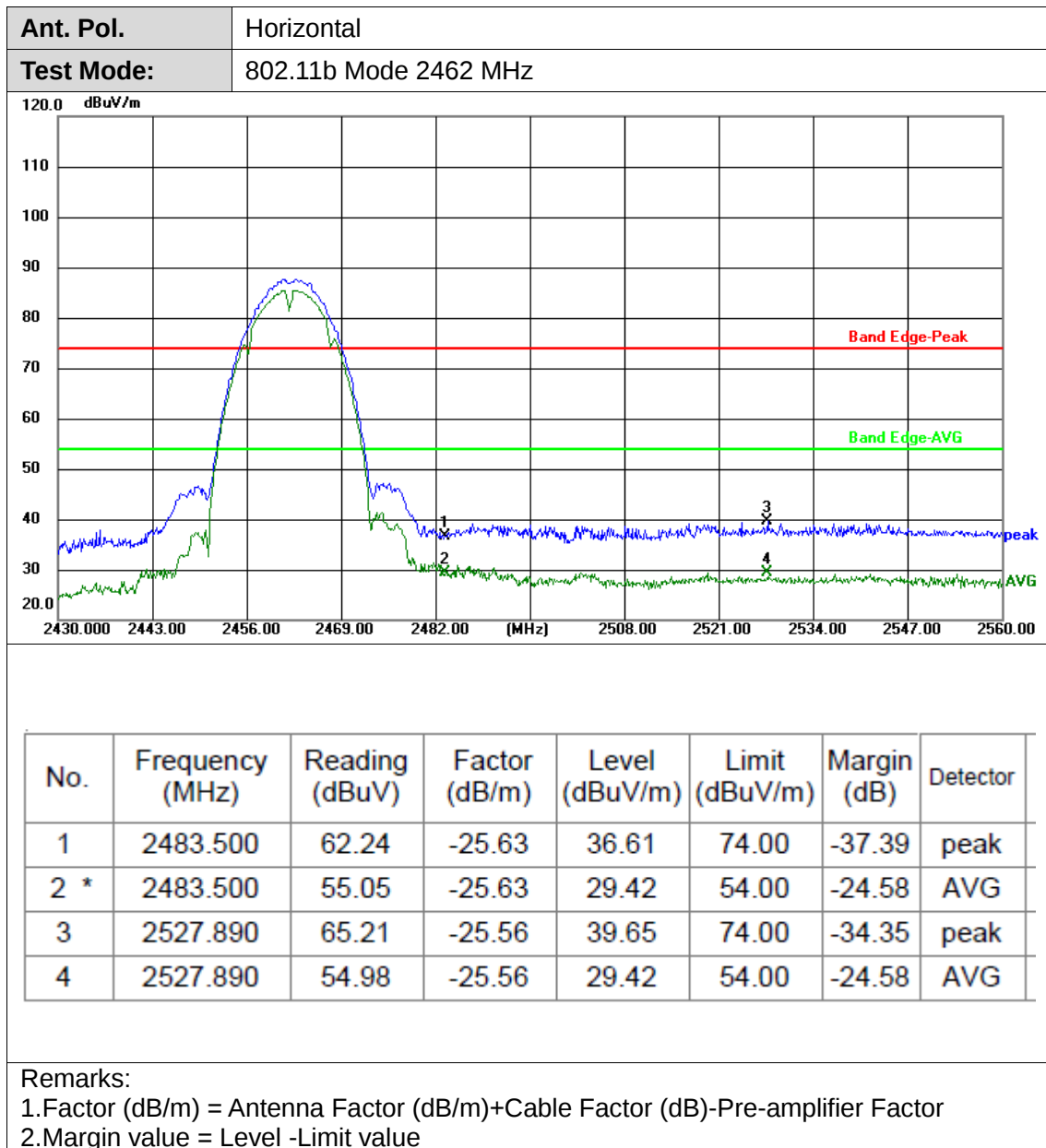
Test Mode

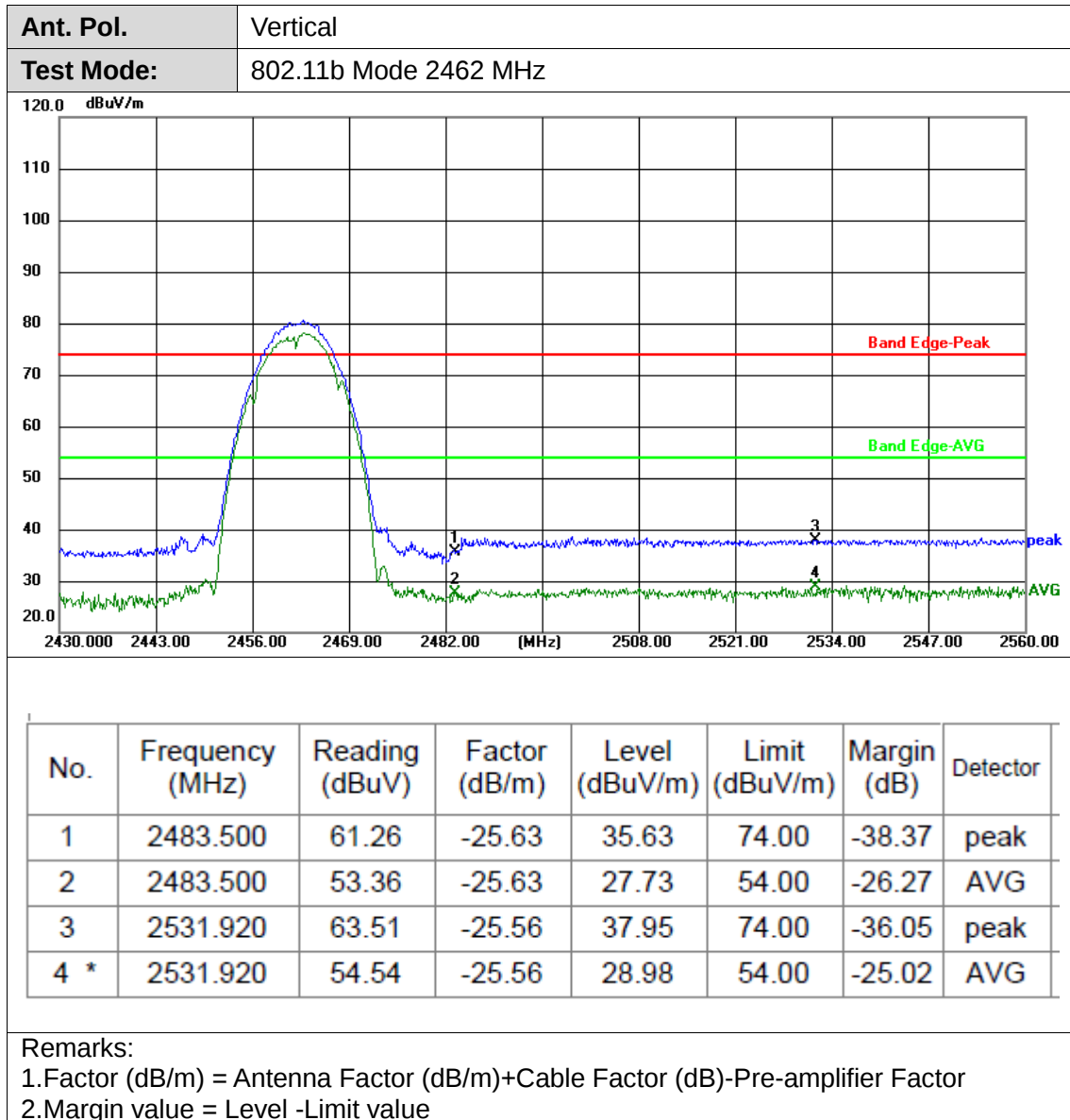
Please refer to the clause 2.4.

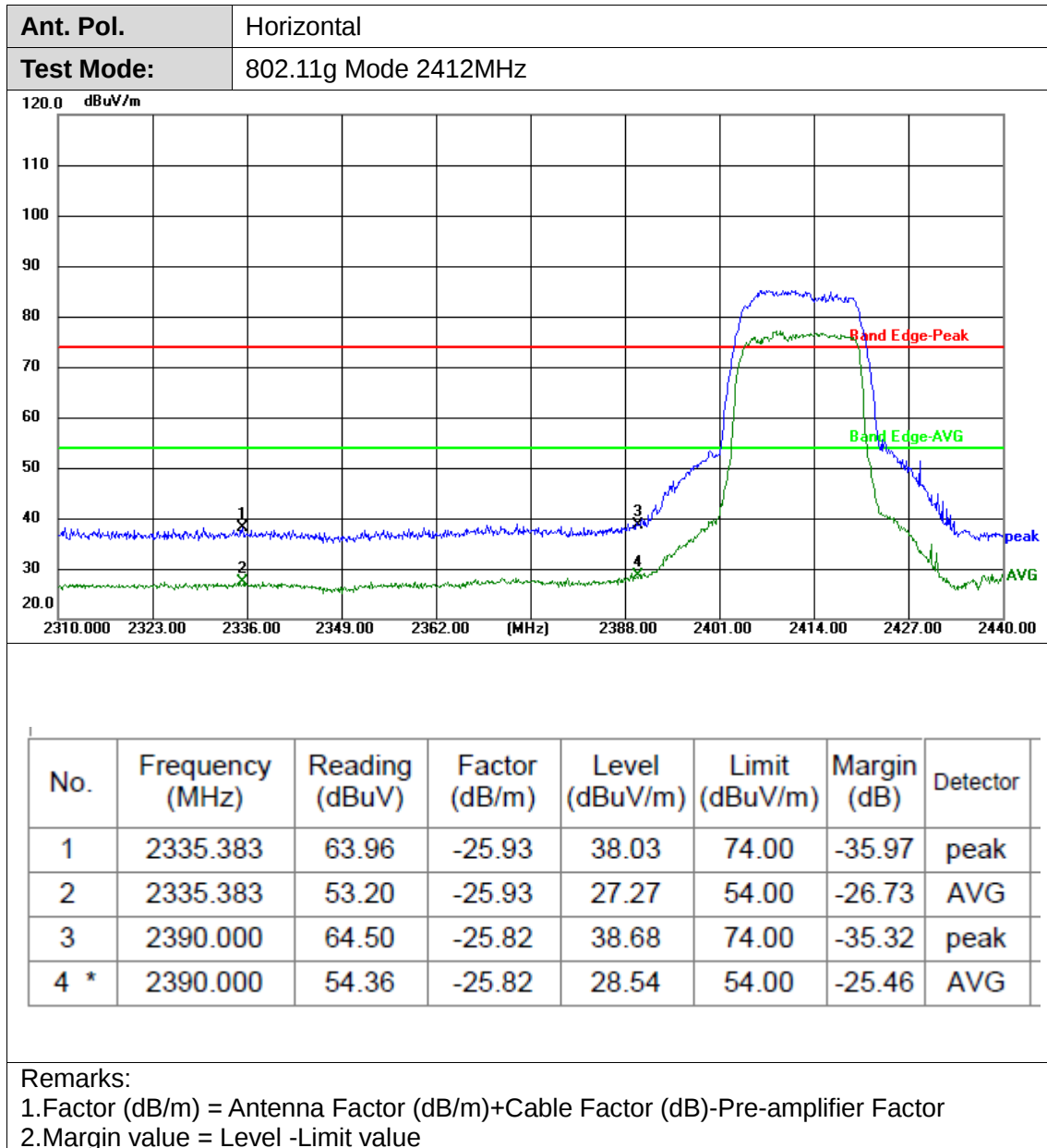
Test Results

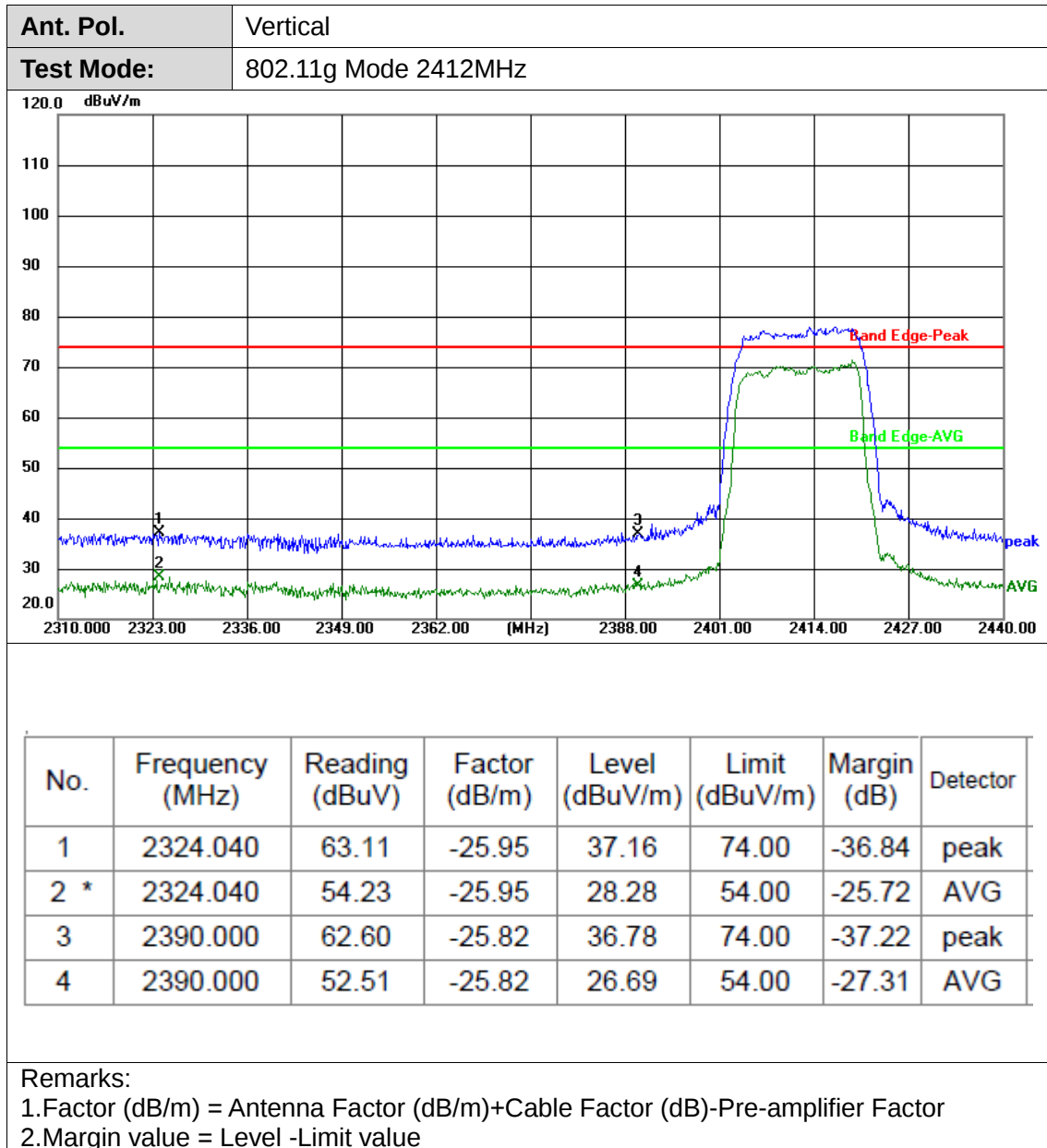


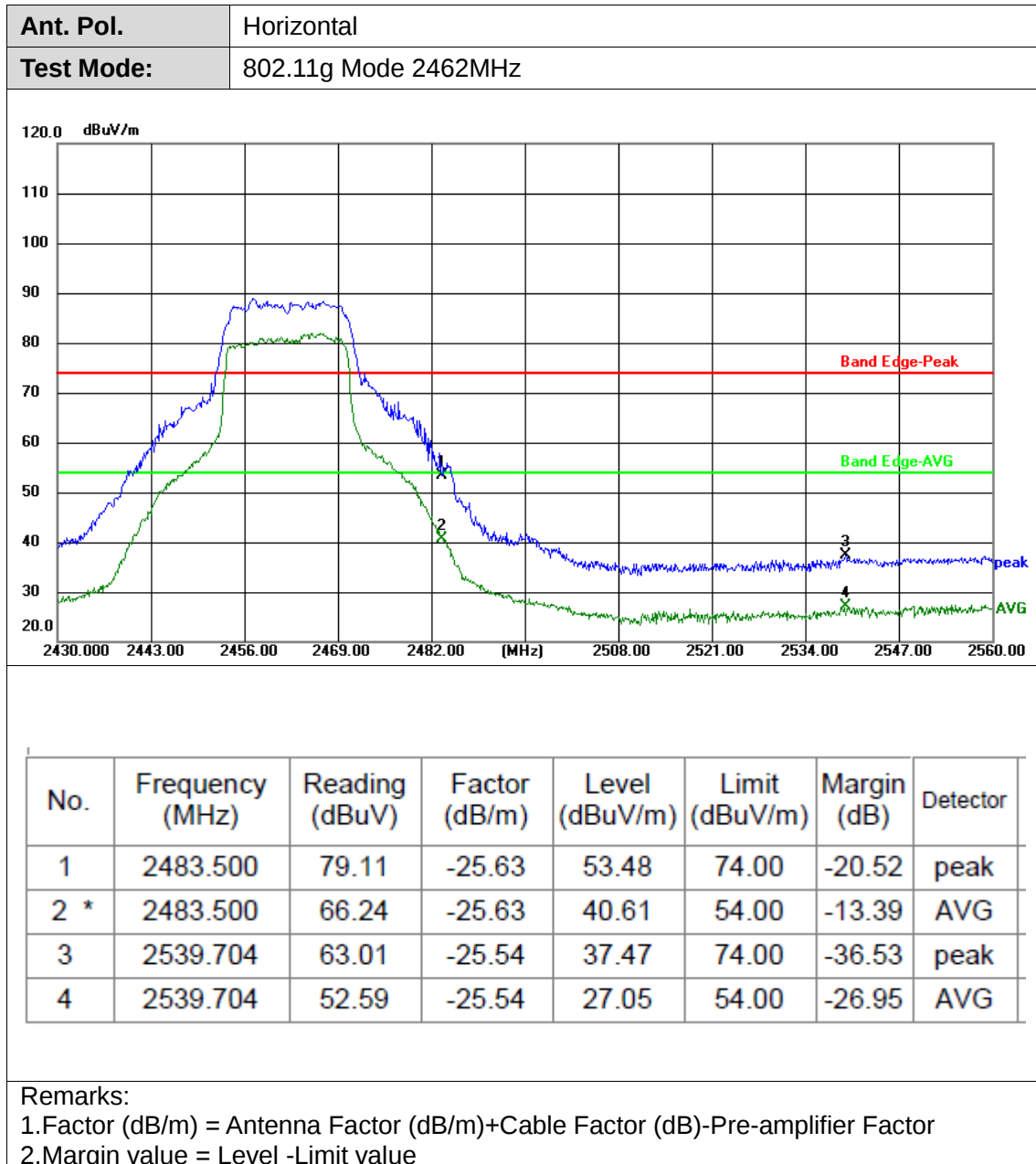


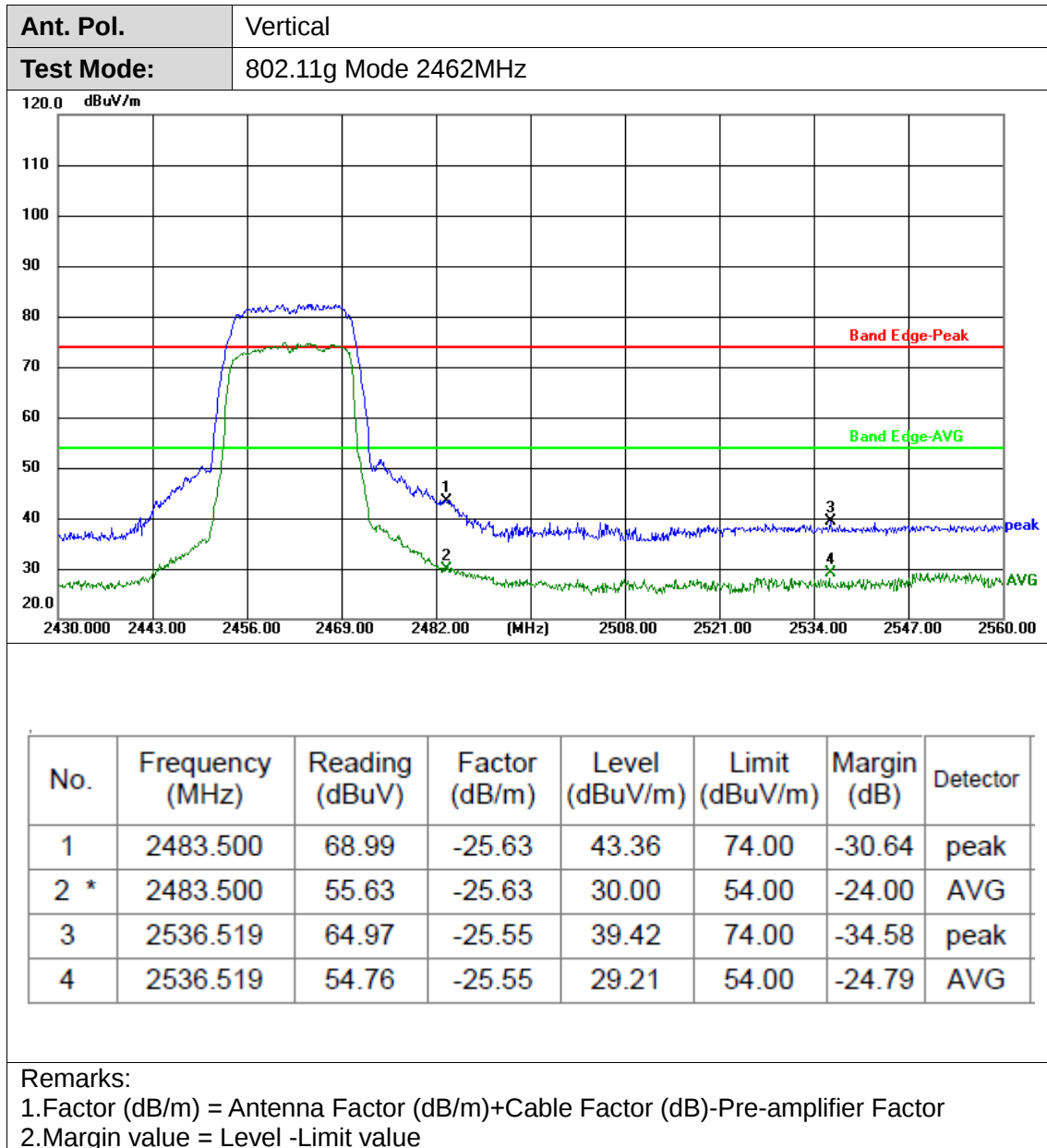


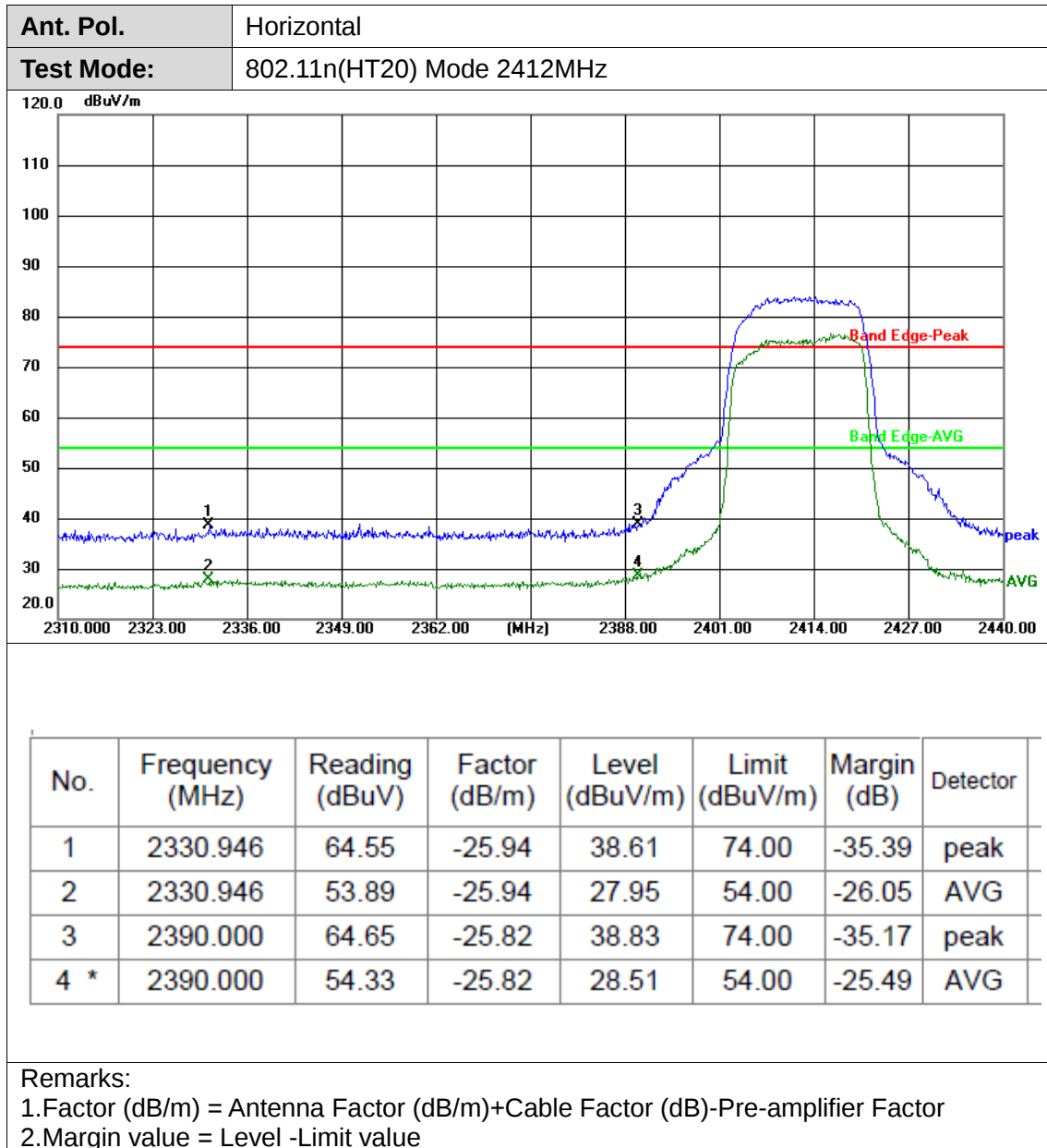


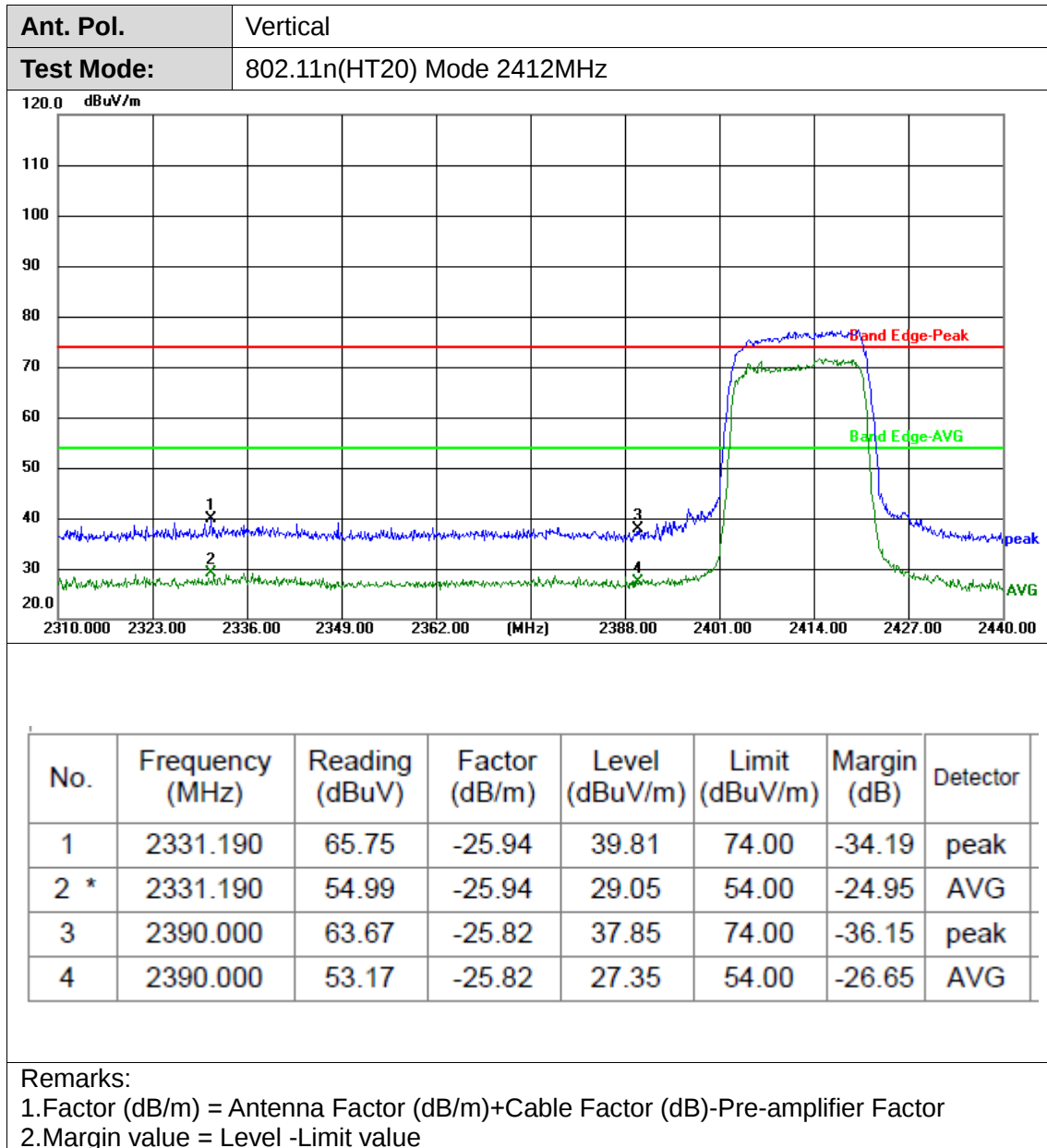


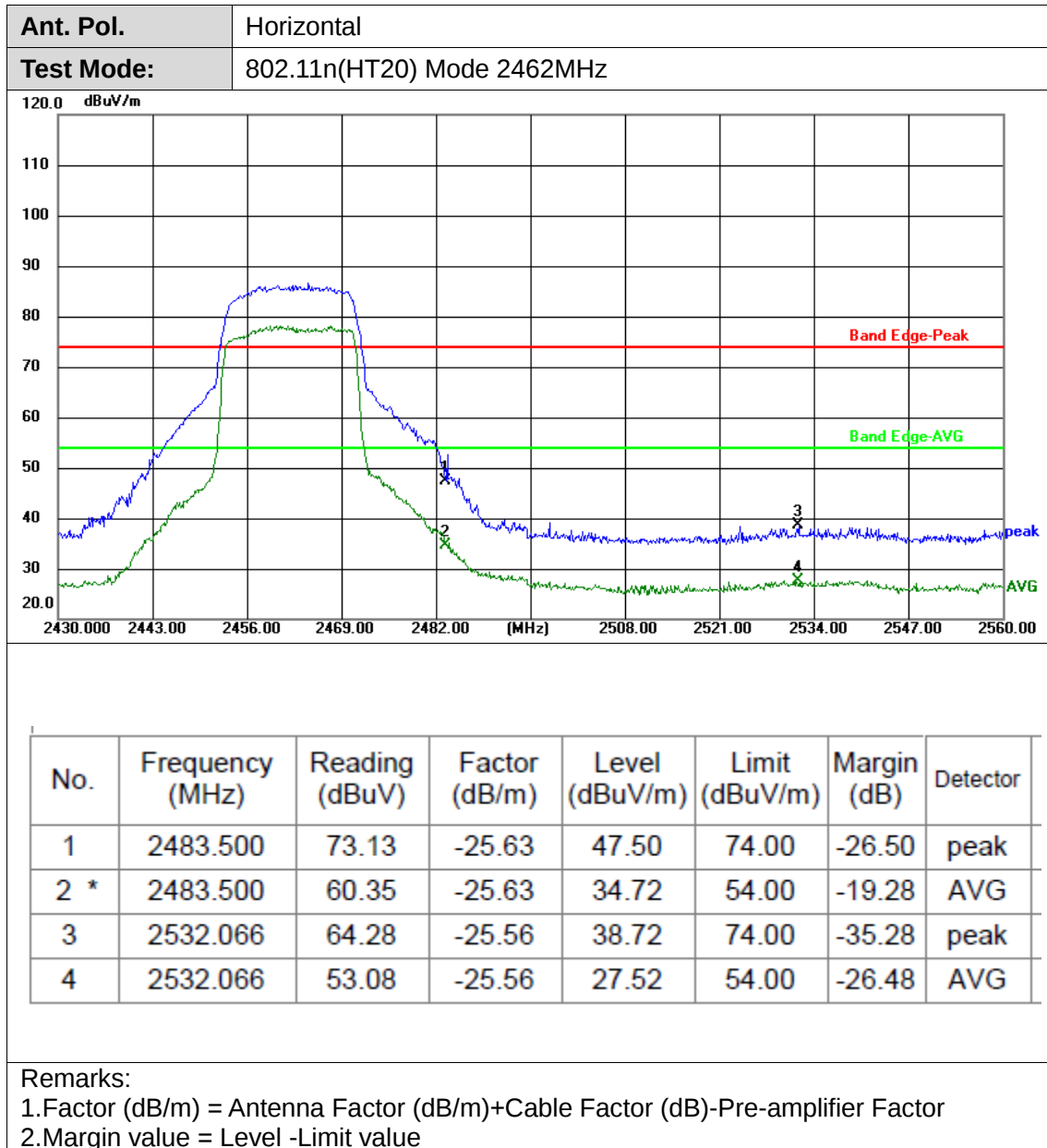


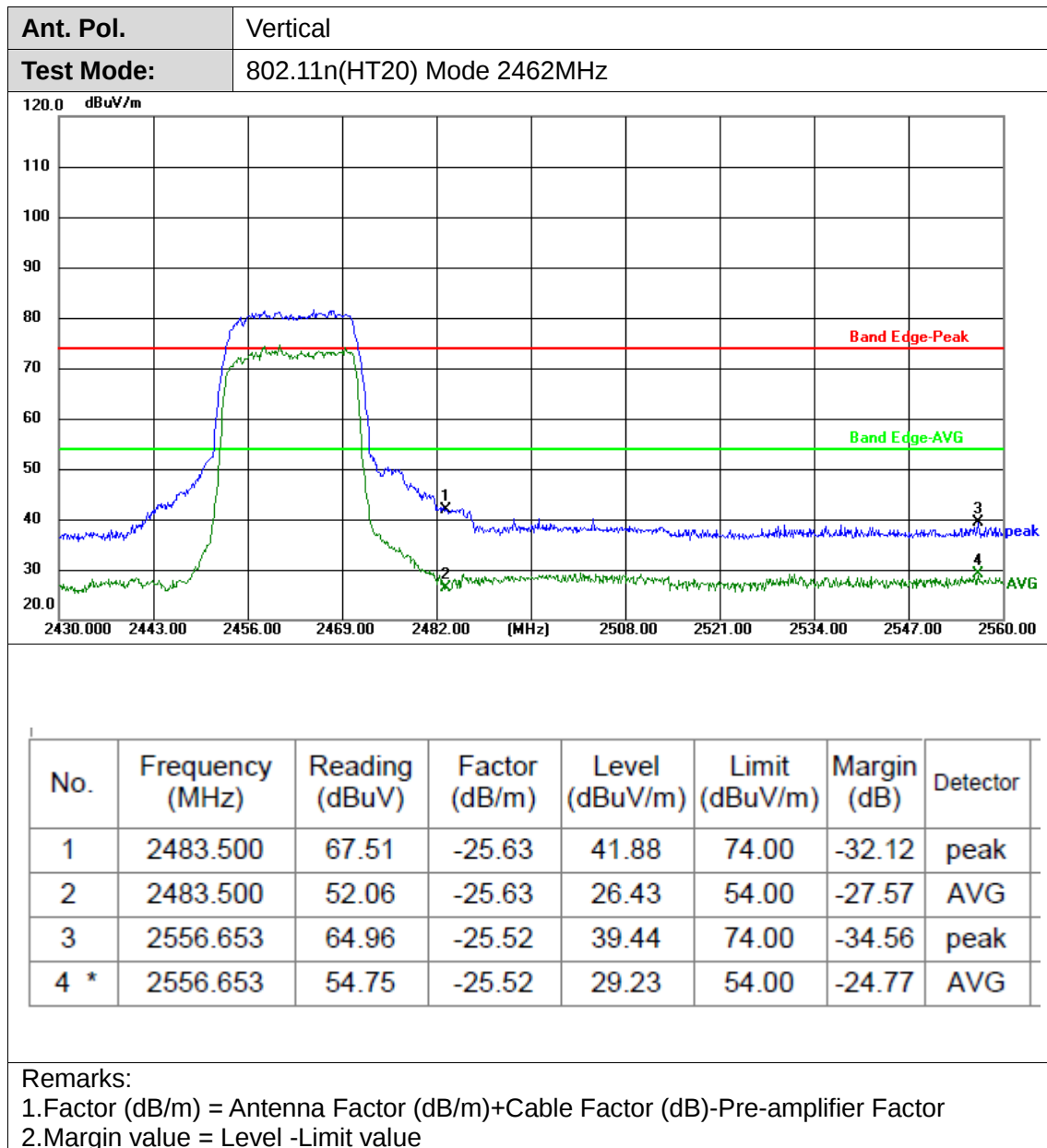


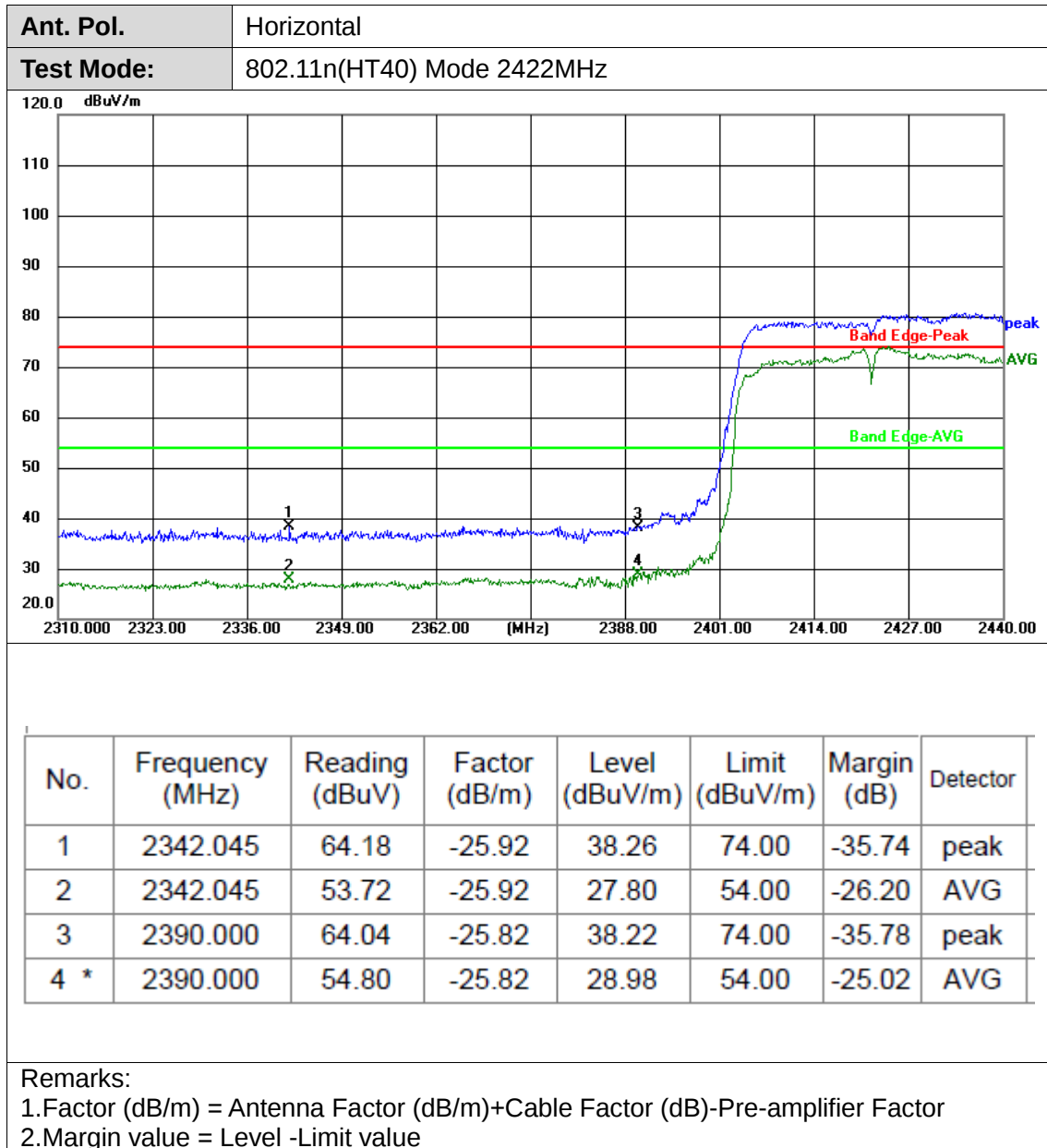


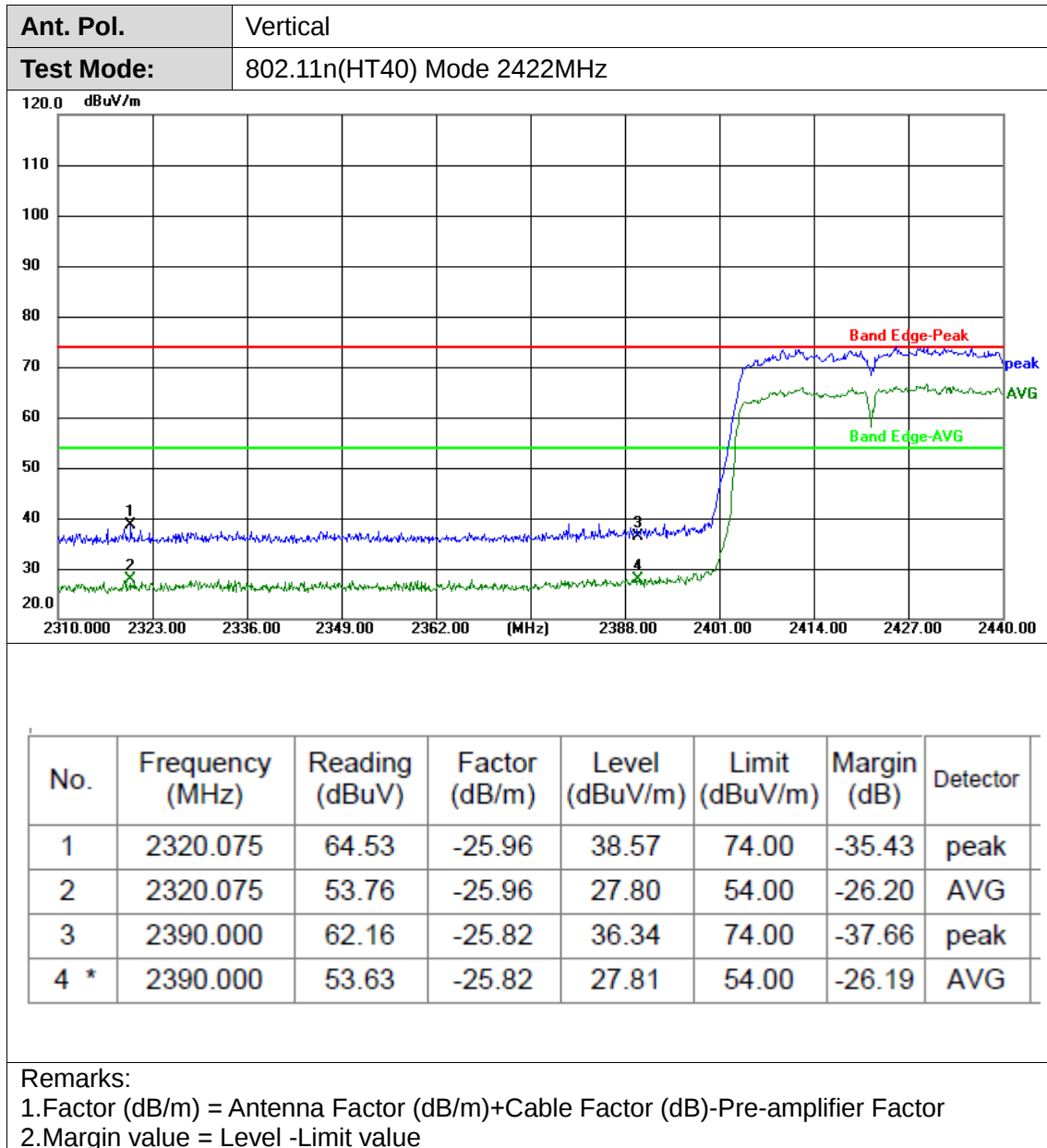


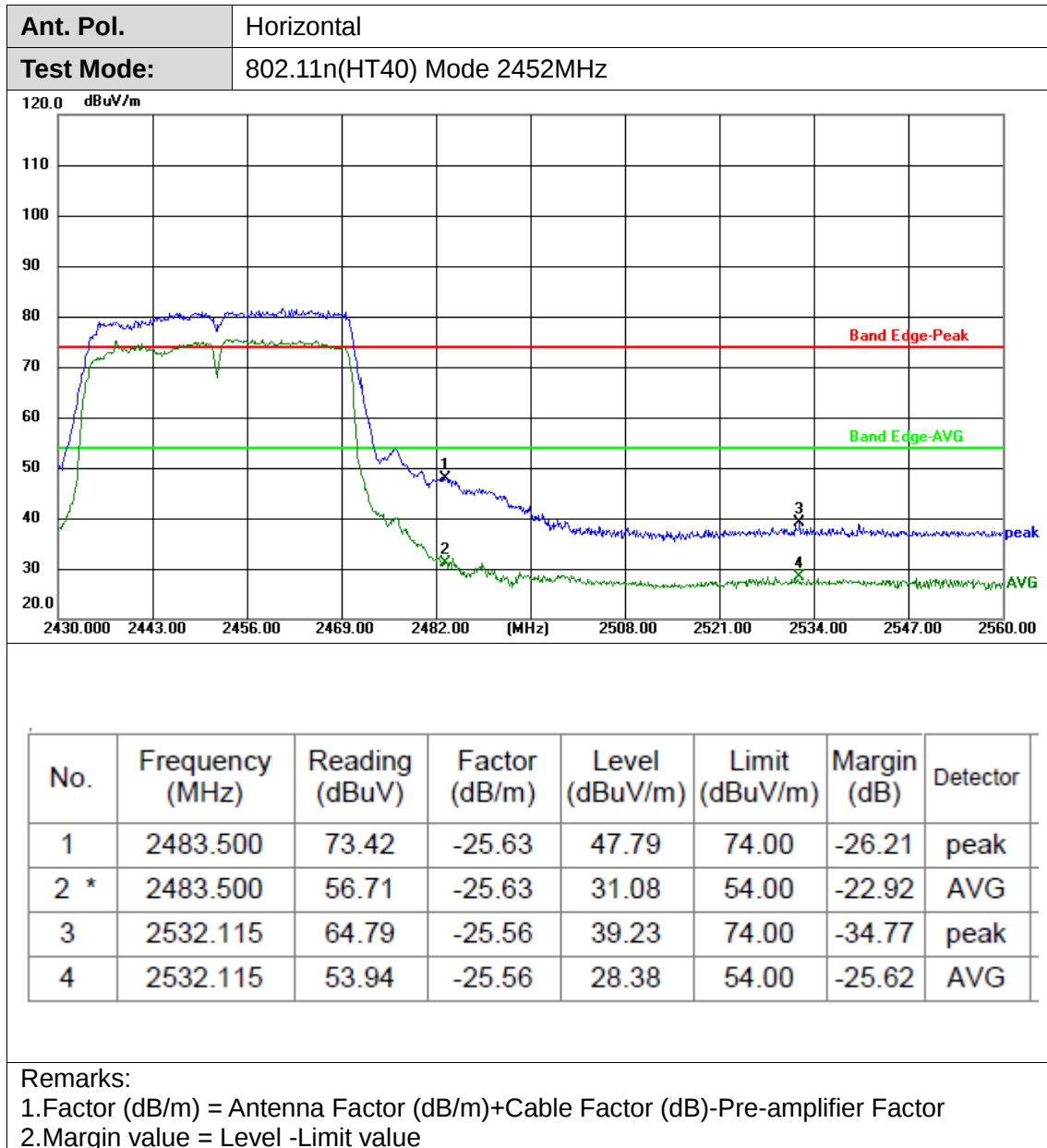


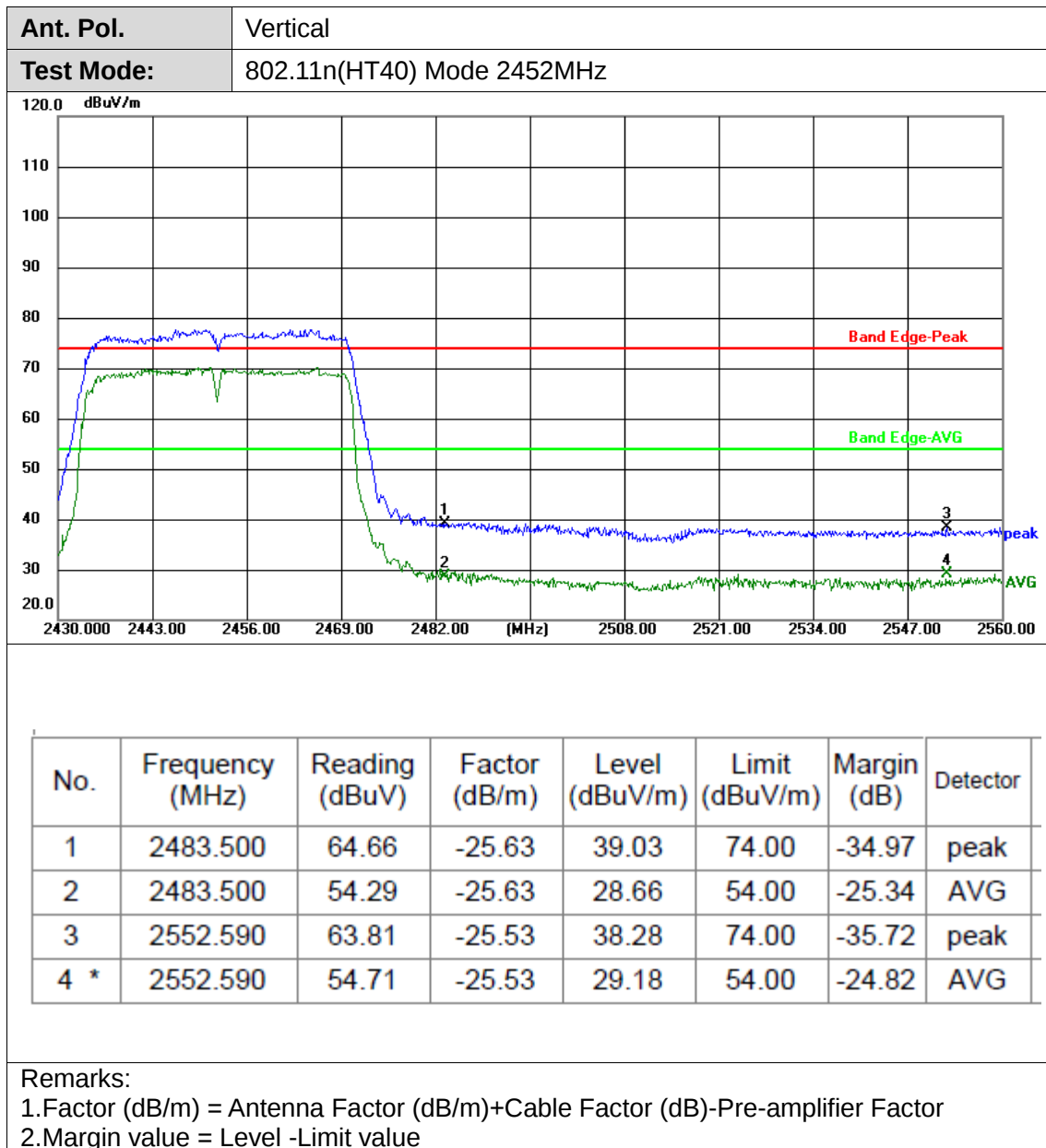












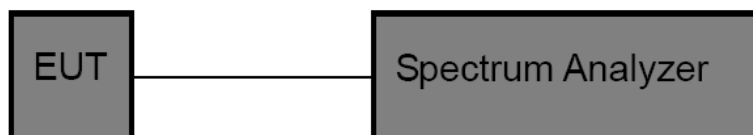


3.4. Band edge and Spurious Emissions (Conducted)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d)/ RSS-247 6.6: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 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.

Test Configuration



Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
RBW = 100 kHz, VBW $\geq$ RBW, scan up through 10th harmonic.
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

Test Mode

Please refer to the clause 2.4.

Test Results

**(1) Band edge Conducted Test**

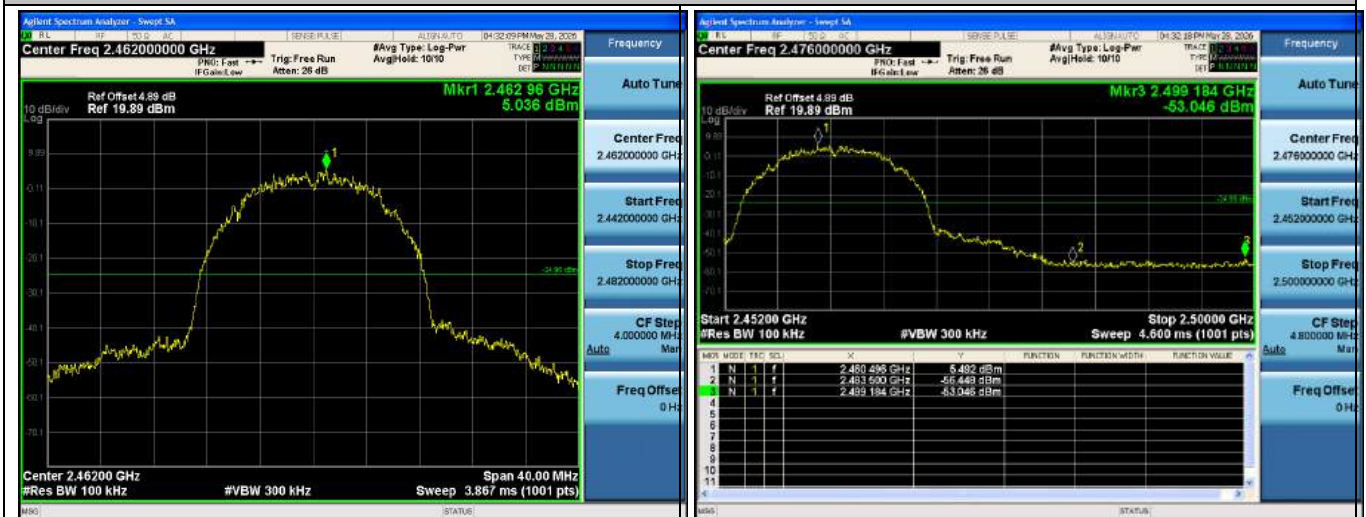
Test Mode	Test Frequency	Ref Level[dBm]	Result[dBm]	Limit[dBm]	Verdict
802.11b	2412	5.266	-44.821	-24.734	PASS
	2462	5.036	-53.046	-24.964	PASS
802.11g	2412	0.622	-31.275	-29.378	PASS
	2462	0.564	-40.631	-29.436	PASS
802.11n(HT20)	2412	0.579	-31.563	-29.421	PASS
	2462	0.578	-38.901	-29.422	PASS
802.11n(HT40)	2422	-3.189	-37.545	-33.189	PASS
	2452	-2.958	-37.535	-32.958	PASS



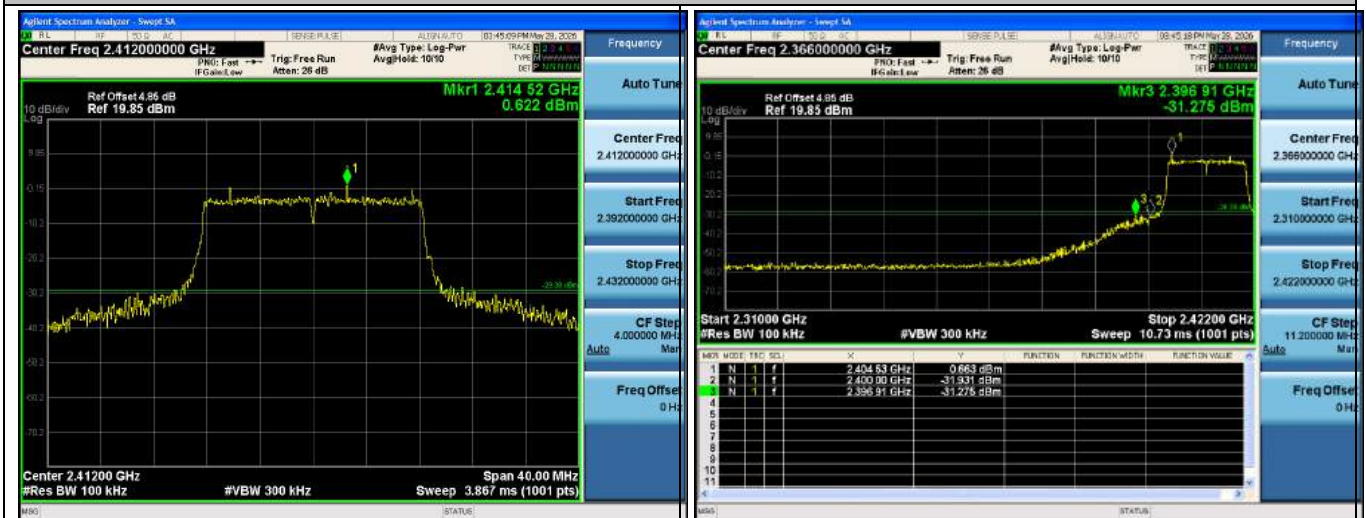
802.11b_2412



802.11b_2462



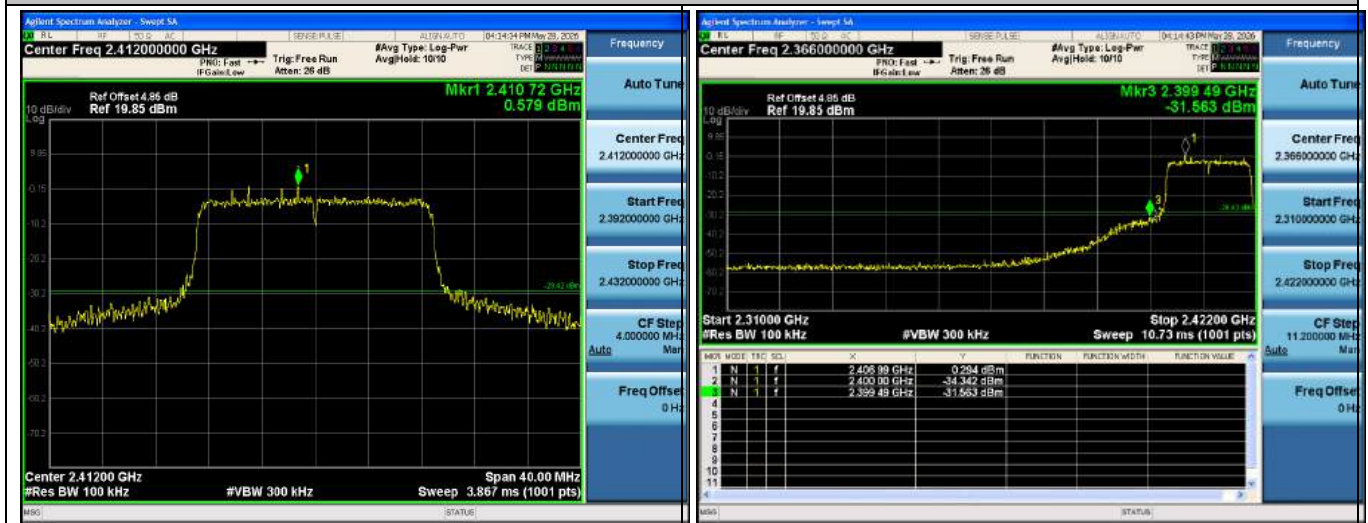
802.11g_2412



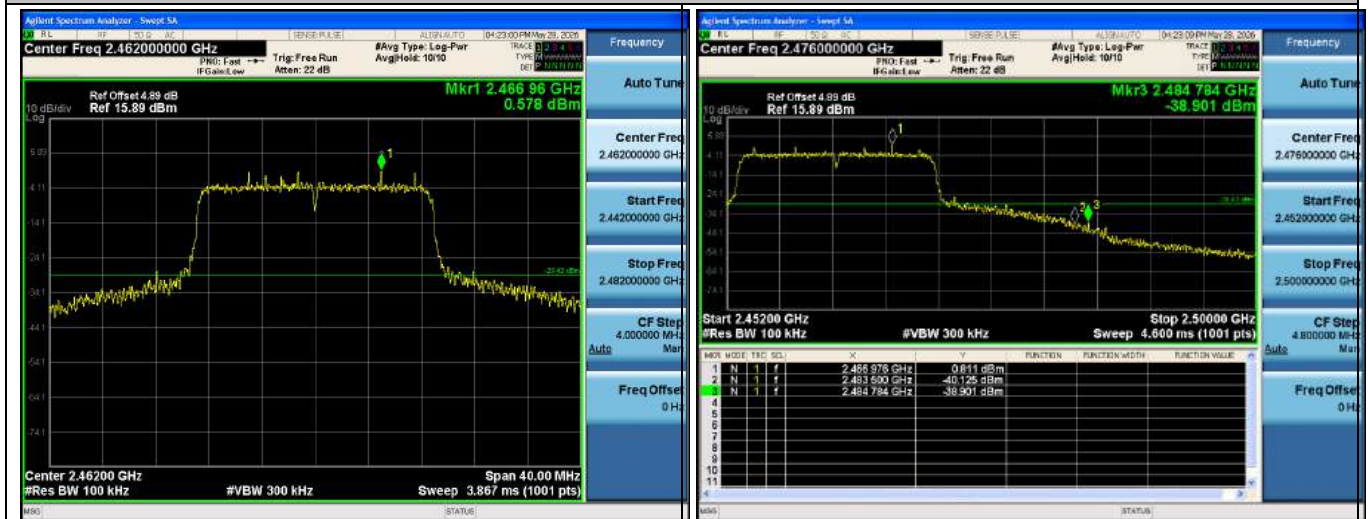
802.11g_2462



802.11n(HT20)_2412



802.11n(HT20)_2462



802.11n(HT40)_2422



**(2) Conducted Spurious Emissions Test**

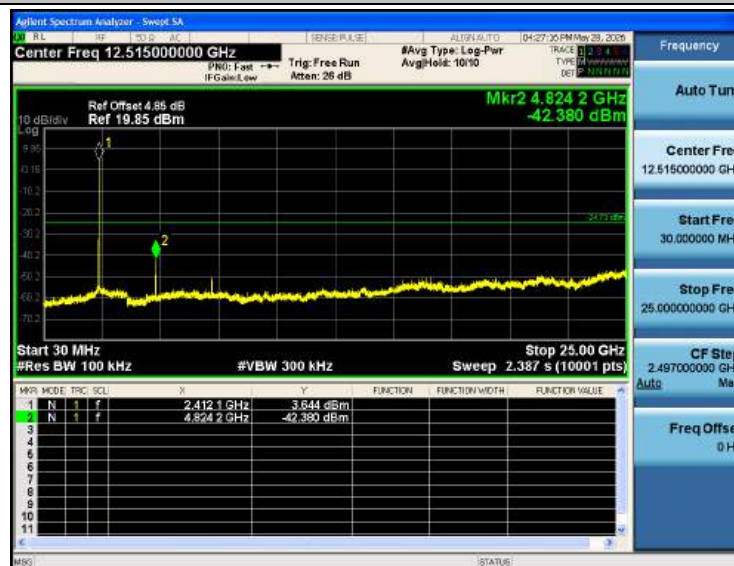
Test Mode	Frequency [MHz]	Ref Level [dBm]	Spurious level[dBm]	Limit[dBm]	Verdict
802.11b	2412	5.266	-42.380	-24.734	PASS
	2437	4.757	-44.248	-25.243	PASS
	2462	5.036	-46.785	-24.964	PASS
802.11g	2412	0.622	-46.735	-29.378	PASS
	2437	-0.076	-45.183	-30.076	PASS
	2462	0.564	-46.436	-29.436	PASS
802.11n(HT20)	2412	0.579	-46.327	-29.421	PASS
	2437	0.280	-47.043	-19.720	PASS
	2462	0.578	-50.314	-29.422	PASS
802.11n(HT40)	2422	-3.189	-51.029	-33.189	PASS
	2437	-3.462	-50.325	-33.462	PASS
	2452	-2.958	-51.802	-32.958	PASS



802.11b_2412_0~Reference



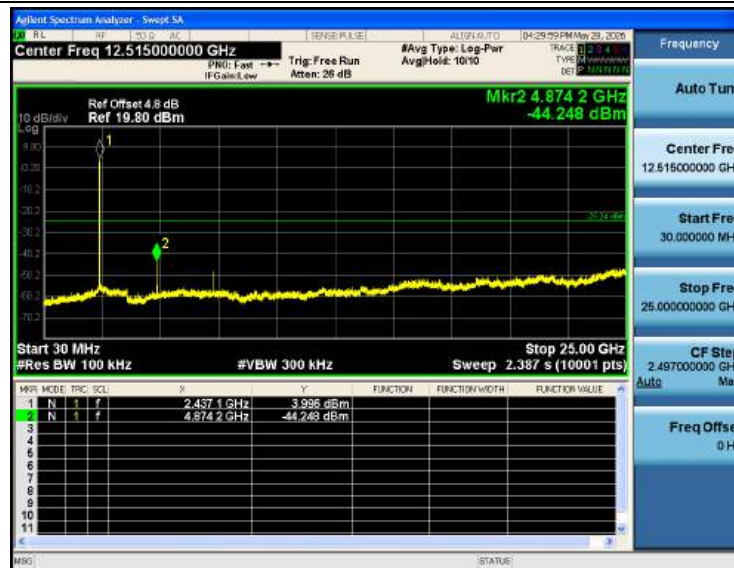
802.11b_2412_30~25000



802.11b_2437_0~Reference



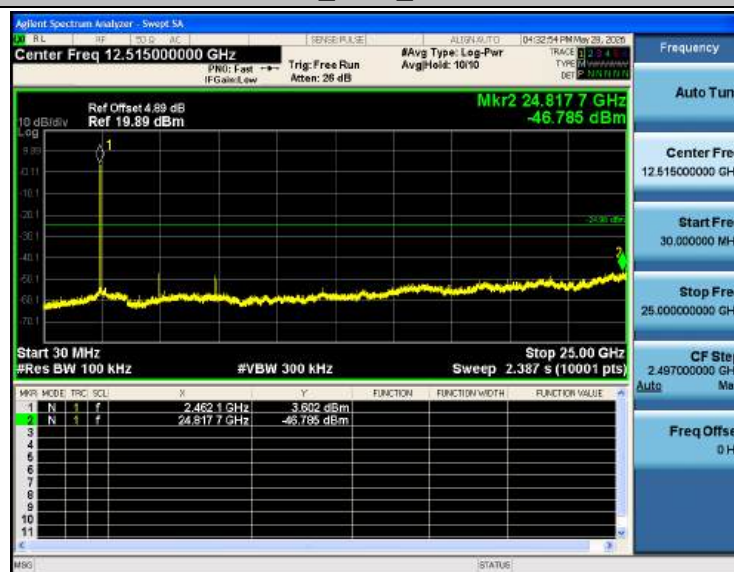
802.11b_2437_30~25000



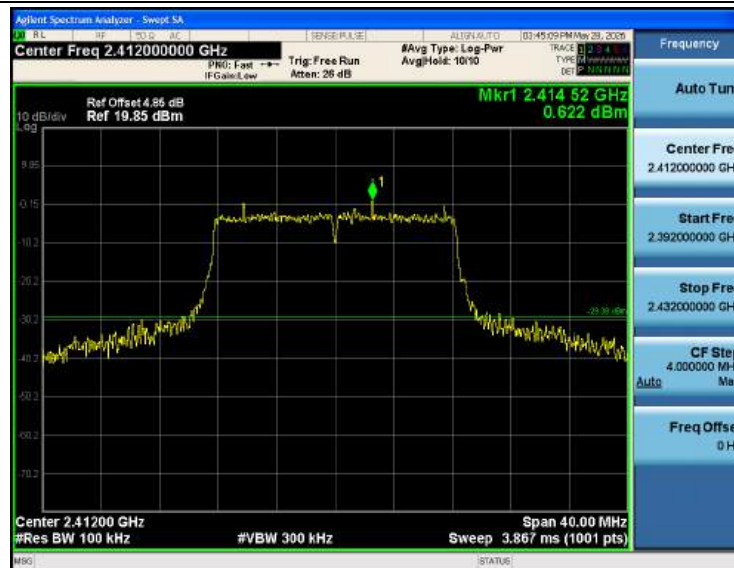
802.11b_2462_0-Reference



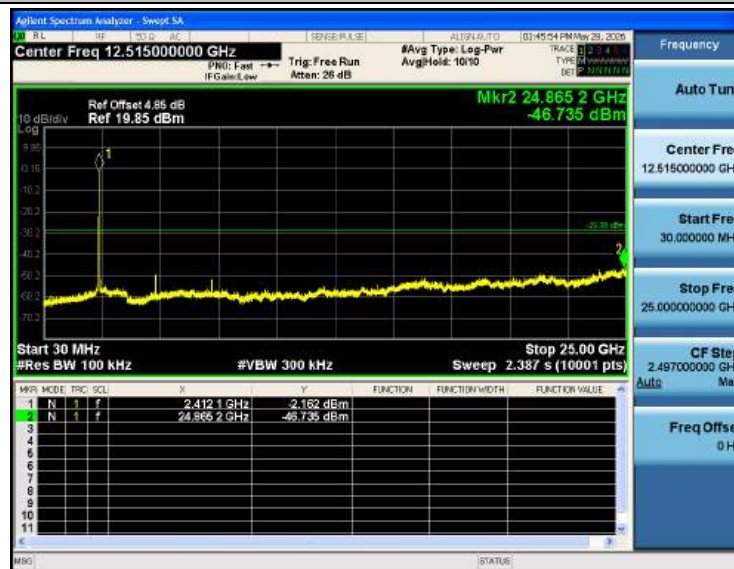
802.11b_2462_30~25000



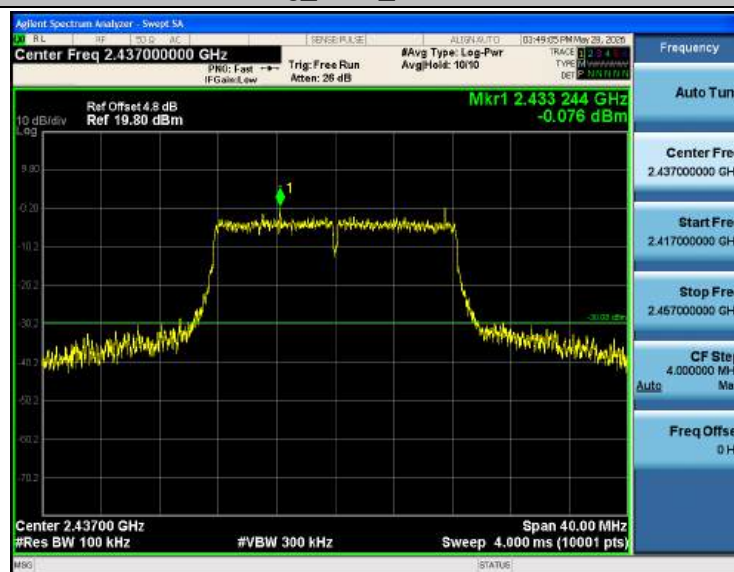
802.11g_2412_0-Reference



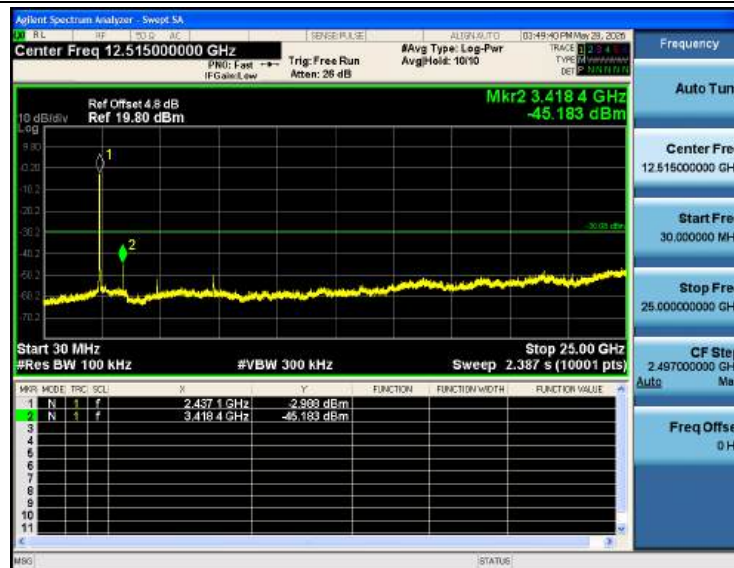
802.11g_2412_30~25000



802.11g_2437_0~Reference



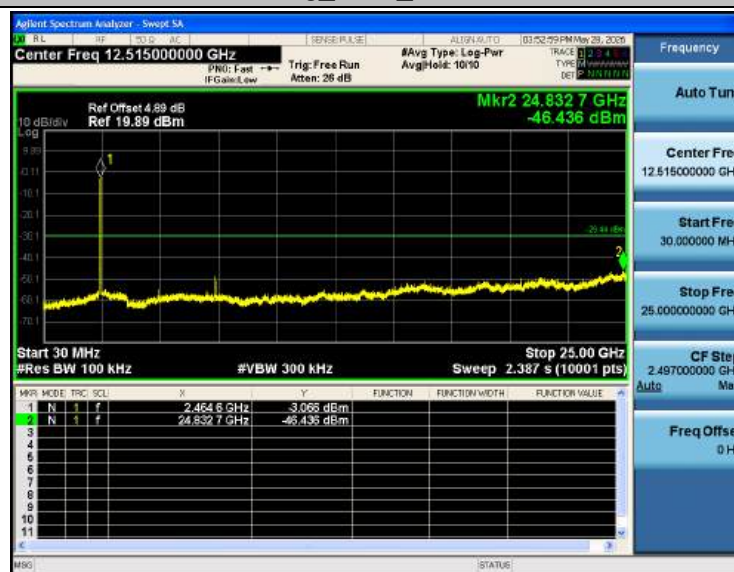
802.11g_2437_30~25000



802.11g_2462_0-Reference



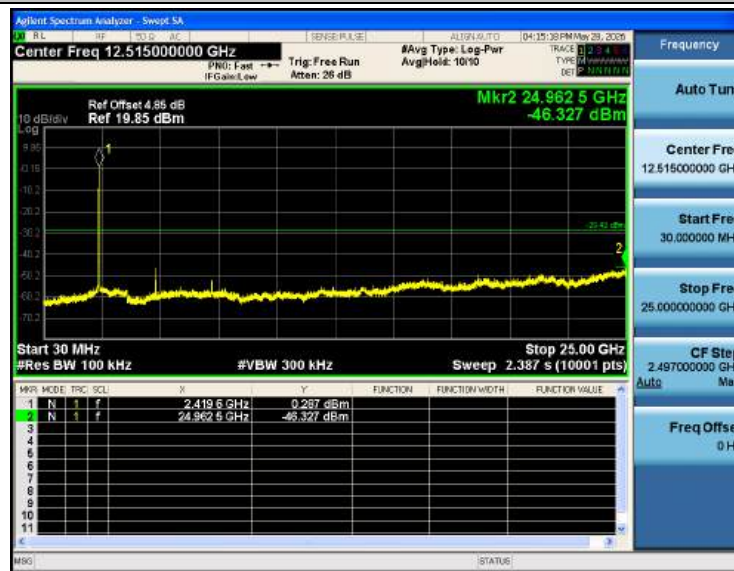
802.11g_2462_30~25000



802.11n(HT20)_2412_0-Reference



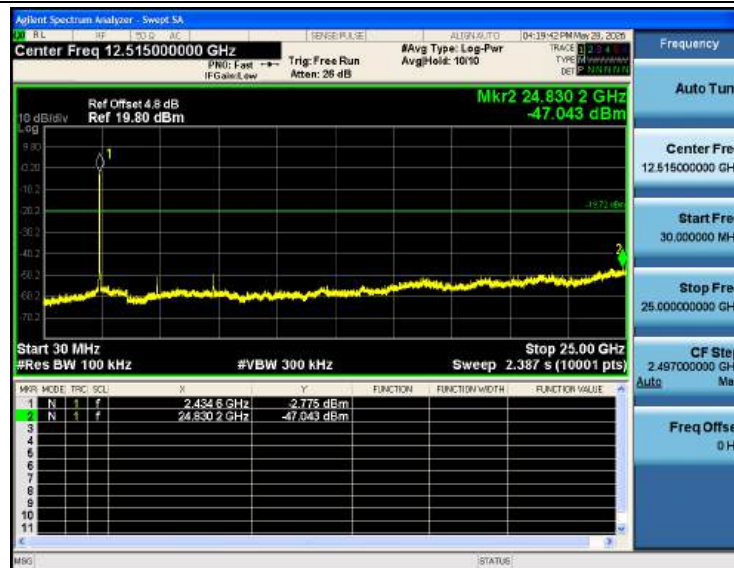
802.11n(HT20)_2412_30~25000



802.11n(HT20)_2437_0~Reference



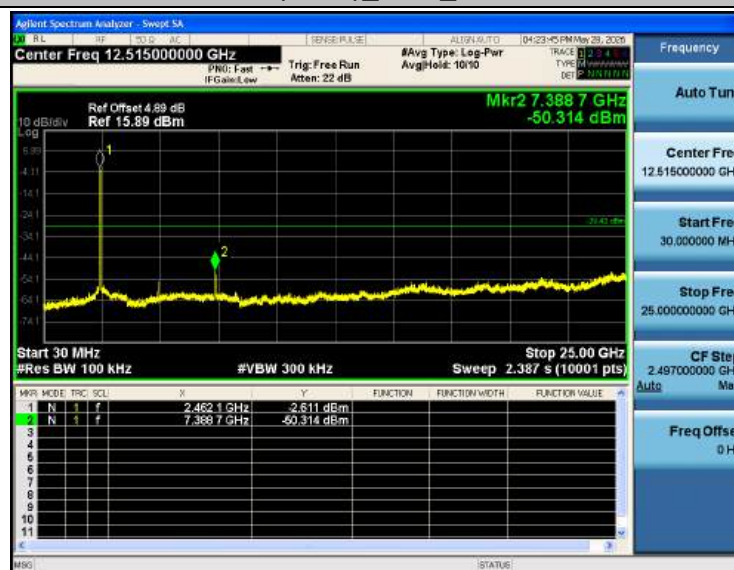
802.11n(HT20)_2437_30~25000



802.11n(HT20)_2462_0~Reference



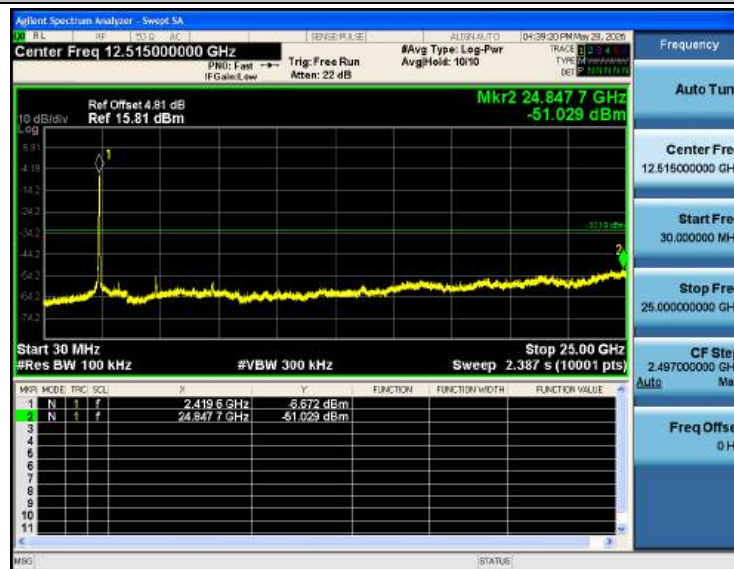
802.11n(HT20)_2462_30~25000



802.11n(HT40)_2422_0~Reference



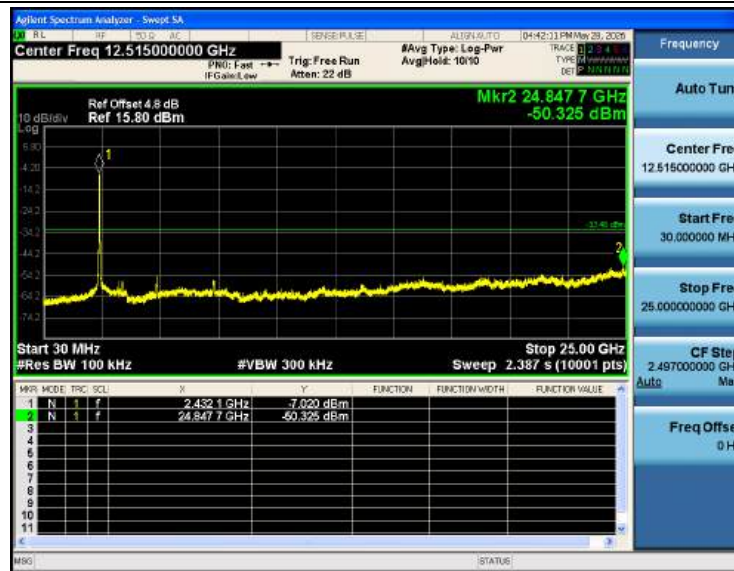
802.11n(HT40)_2422_30~25000



802.11n(HT40)_2437_0~Reference



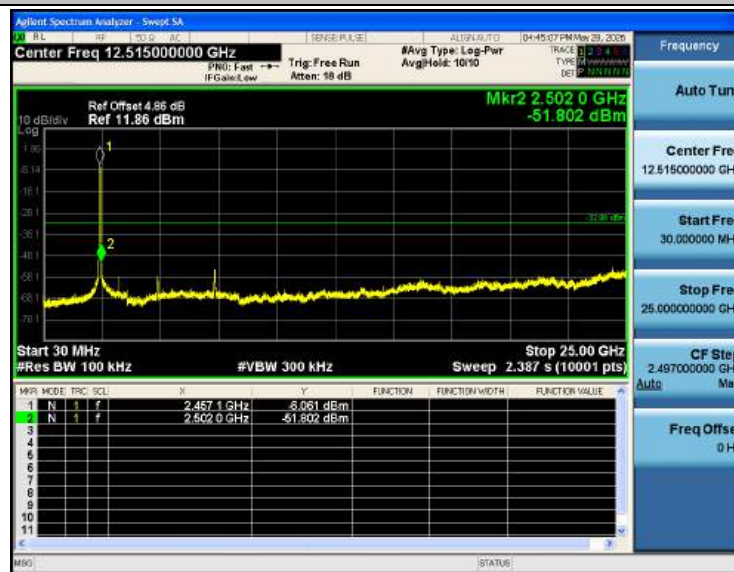
802.11n(HT40)_2437_30~25000



802.11n(HT40)_2452_0~Reference



802.11n(HT40)_2452_30~25000





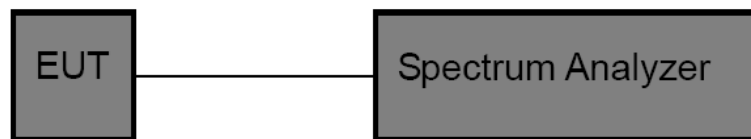
3.5. DTS Bandwidth

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(2)/ RSS-247 6.3.1 (a):

Test Item	Limit	Frequency Range(MHz)
DTS Bandwidth	≥ 500 KHz (6dB bandwidth)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. DTS Spectrum Setting:
 - (1) Set RBW = 100 kHz.
 - (2) Set the video bandwidth (VBW) ≥ 3 RBW.
 - (3) Detector = Peak.
 - (4) Trace mode = Max hold.
 - (5) Sweep = Auto couple.OCB Spectrum Setting:
 - (1) Set RBW = 1% ~ 5% occupied bandwidth.
 - (2) Set the video bandwidth (VBW) ≥ 3 RBW.
 - (3) Detector = Peak.
 - (4) Trace mode = Max hold.
 - (5) Sweep = Auto couple.

NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

Test Mode

Please refer to the clause 2.4.

**Test Results**

Test Mode	Frequency [MHz]	OBW [MHz]	DTS BW [MHz]	Limit [MHz]	Verdict
802.11b	2412	12.974	9.066	≥ 0.5	PASS
	2437	12.962	9.013	≥ 0.5	PASS
	2462	13.013	9.080	≥ 0.5	PASS
802.11g	2412	16.865	16.50	≥ 0.5	PASS
	2437	16.890	16.40	≥ 0.5	PASS
	2462	16.925	16.38	≥ 0.5	PASS
802.11n(HT20)	2412	17.544	16.82	≥ 0.5	PASS
	2437	17.575	16.98	≥ 0.5	PASS
	2462	17.601	17.03	≥ 0.5	PASS
802.11n(HT40)	2422	36.188	34.72	≥ 0.5	PASS
	2437	36.270	35.32	≥ 0.5	PASS
	2452	36.243	35.11	≥ 0.5	PASS



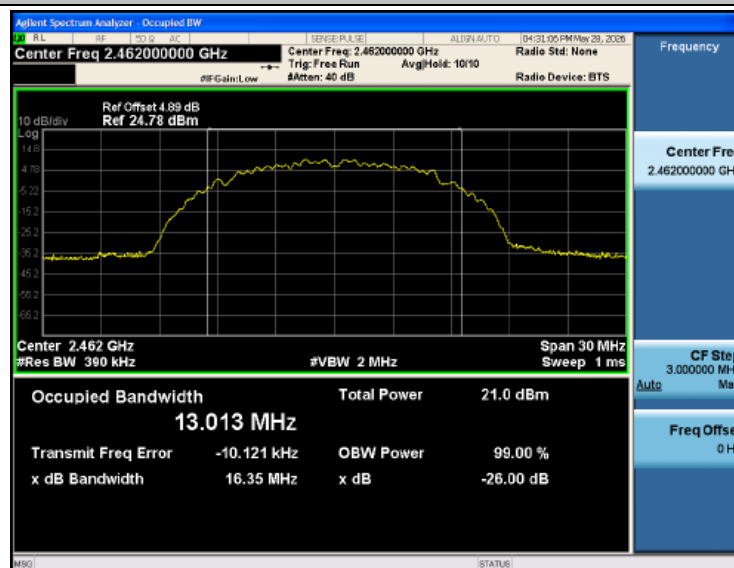
802.11b_OBW_2412



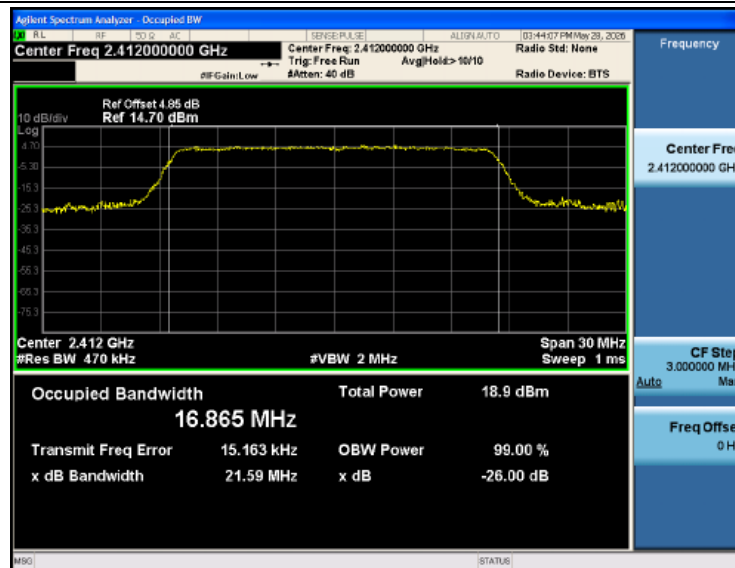
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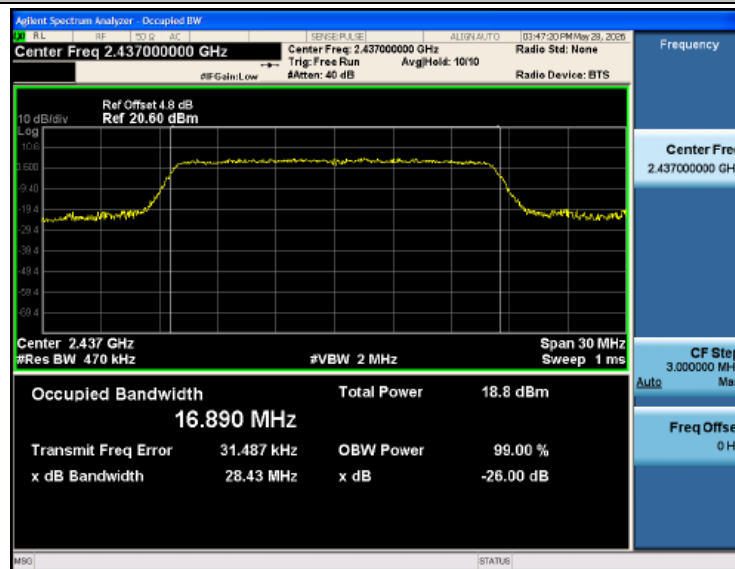
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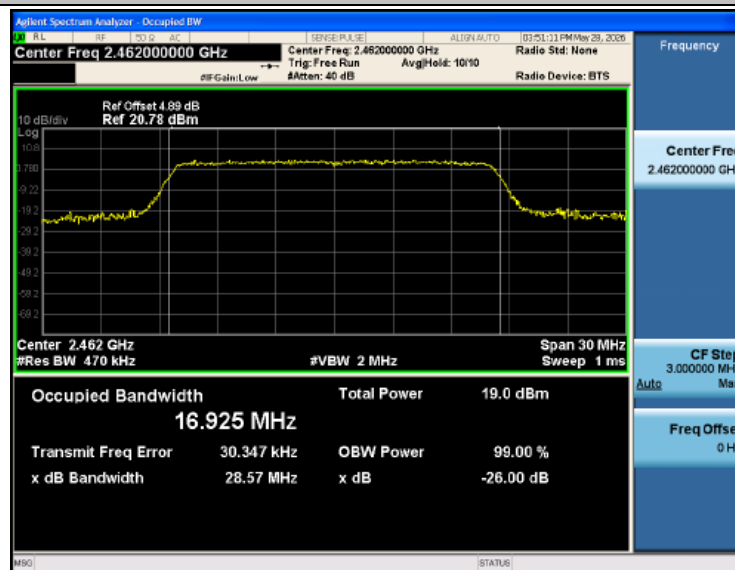
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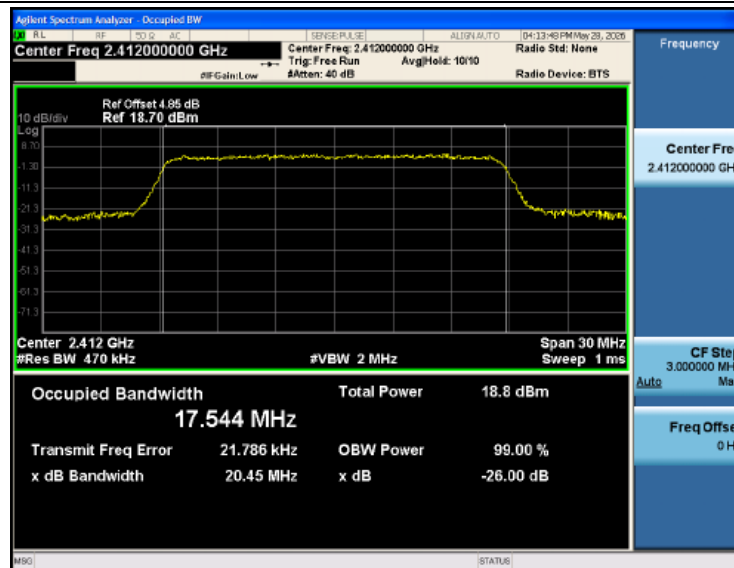
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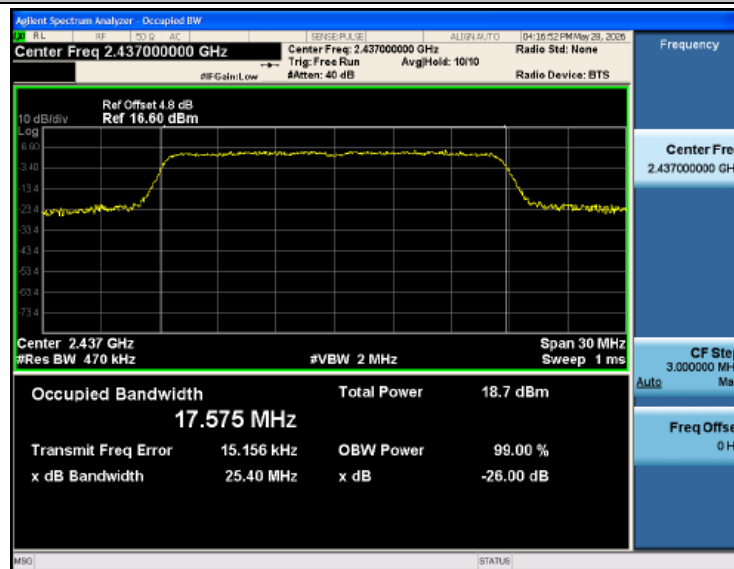
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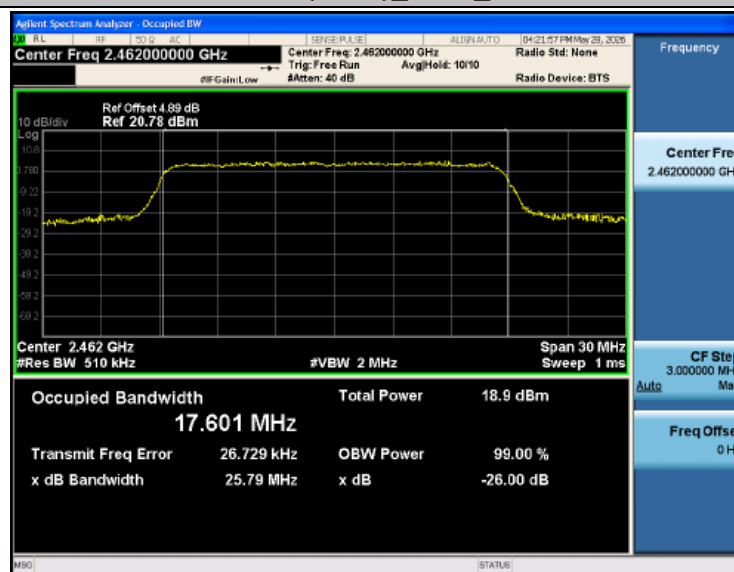
802.11n(HT20)_OBW_2412



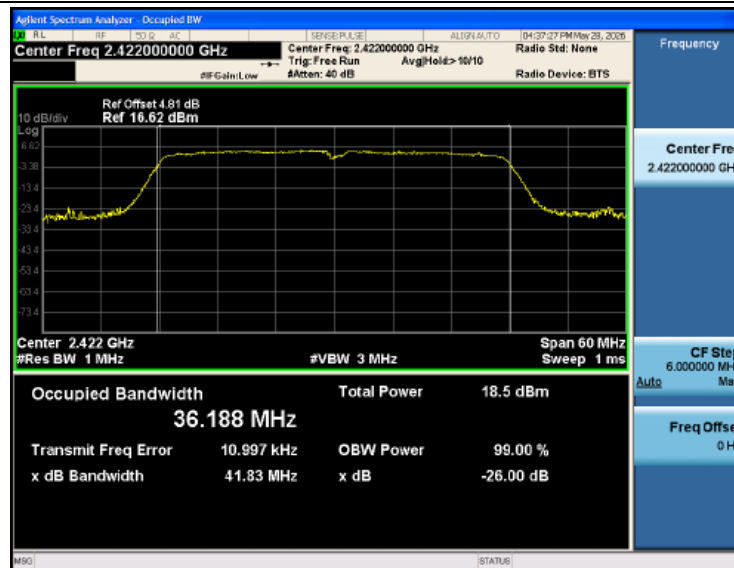
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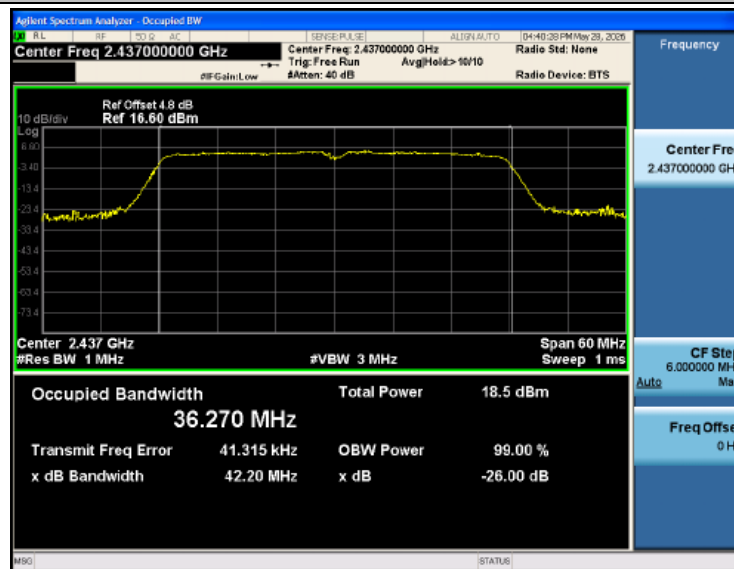
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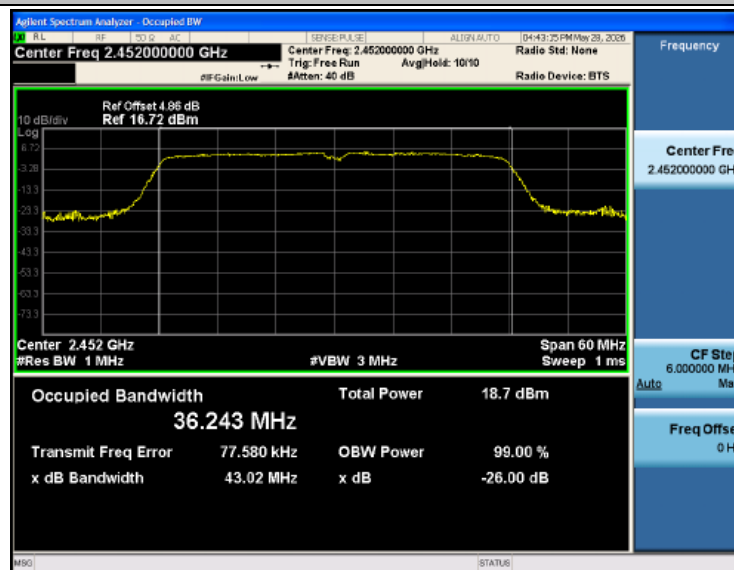
802.11n(HT40)_OBW_2422



802.11n(HT40)_OBW_2437

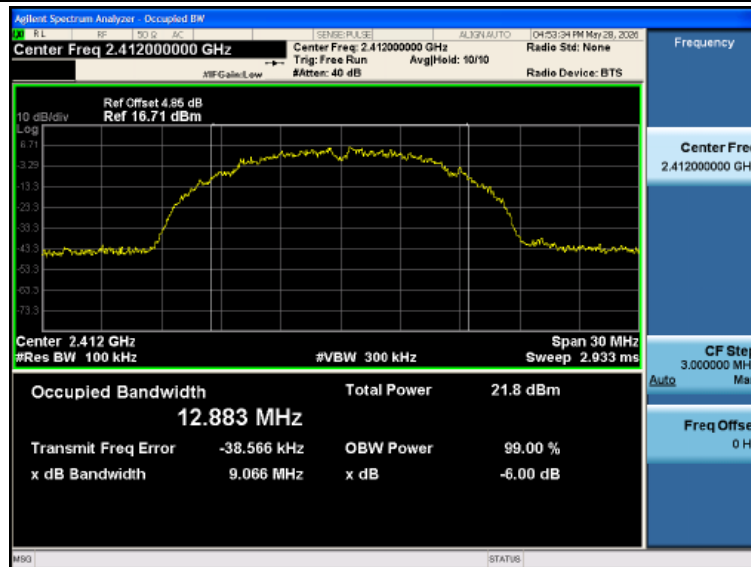


802.11n(HT40)_OBW_2452

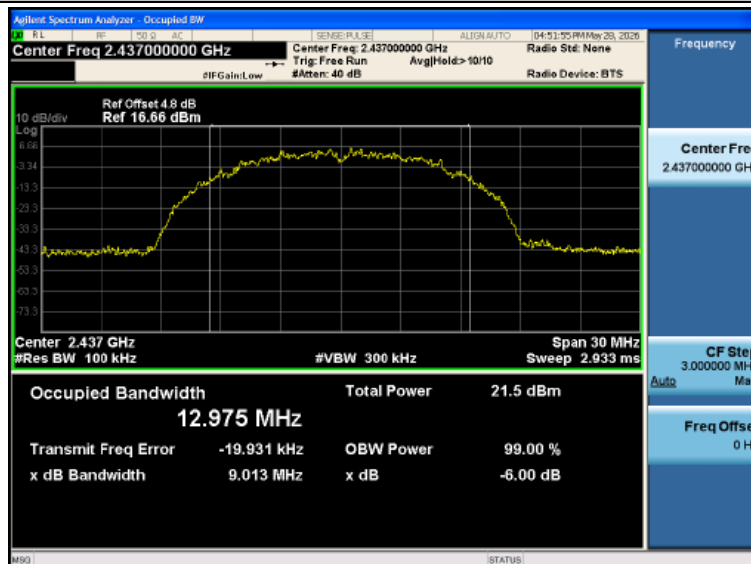




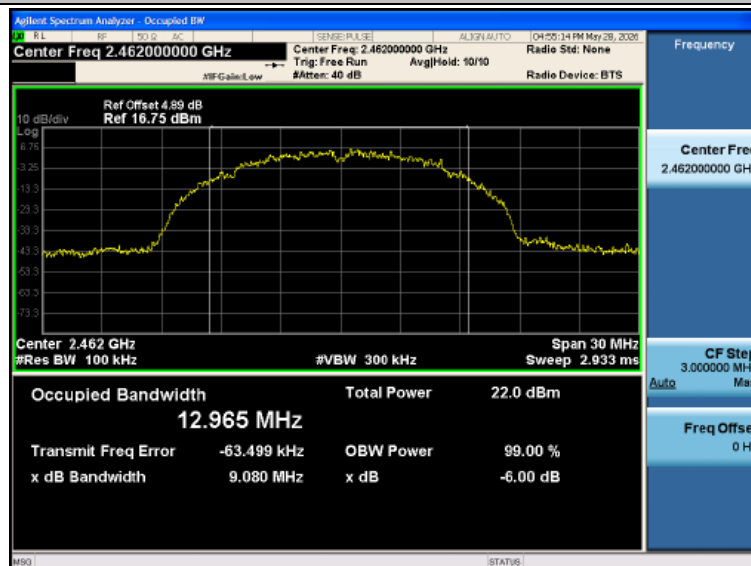
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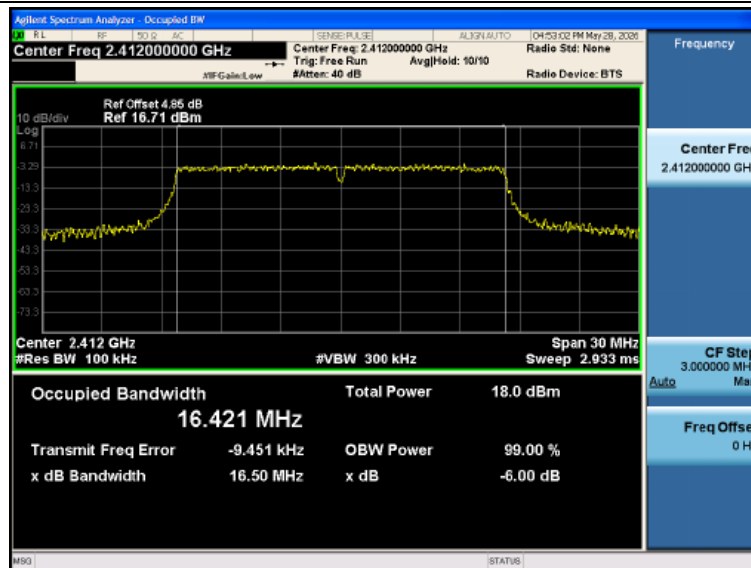
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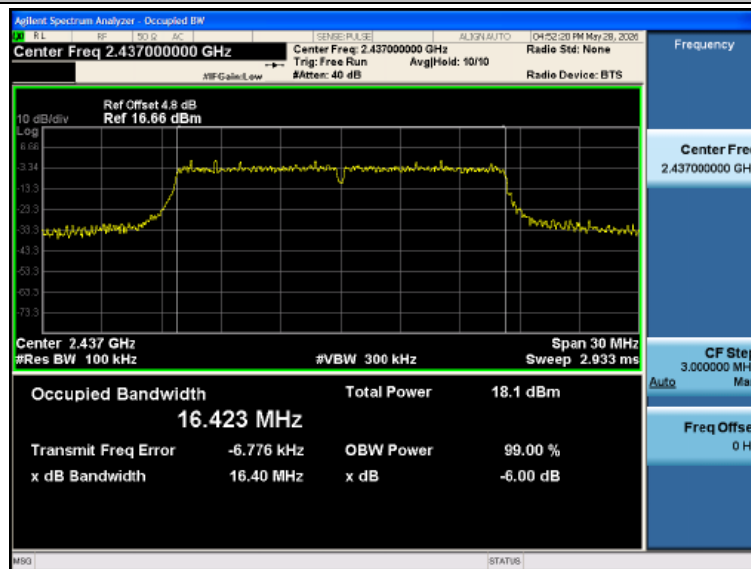
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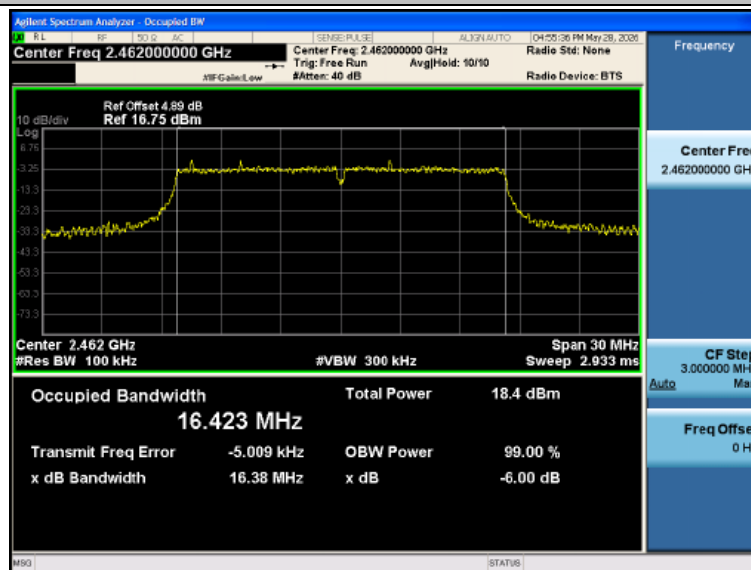
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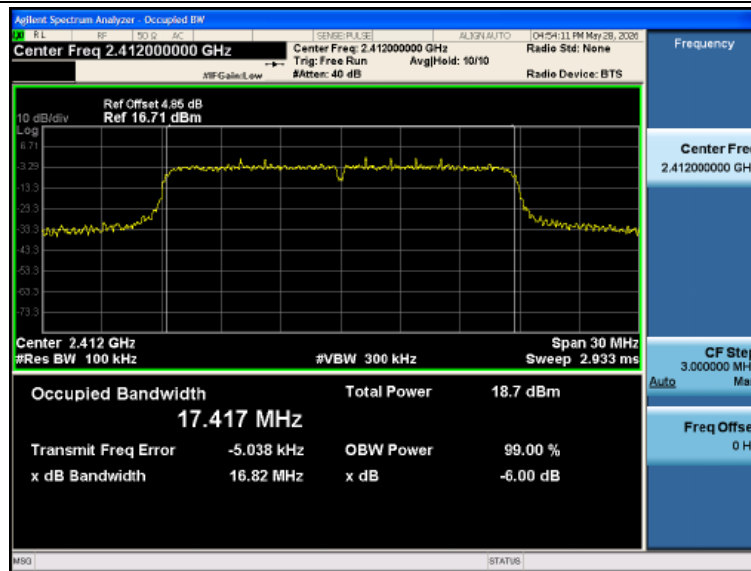
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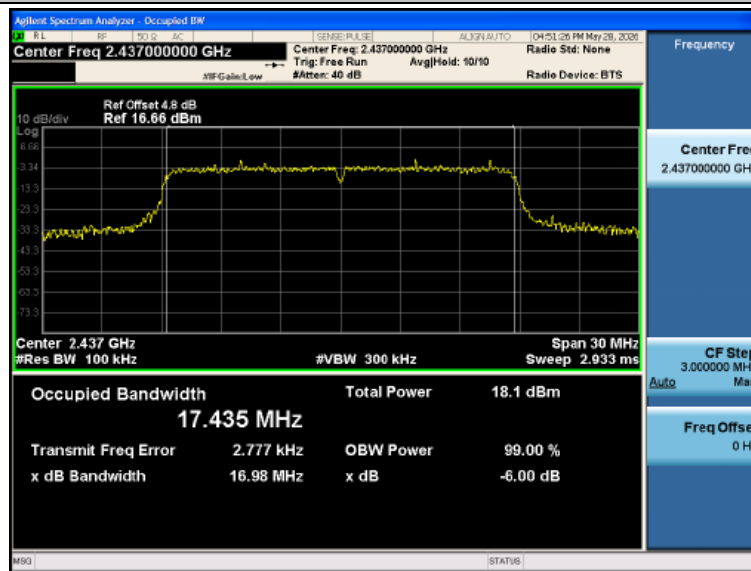
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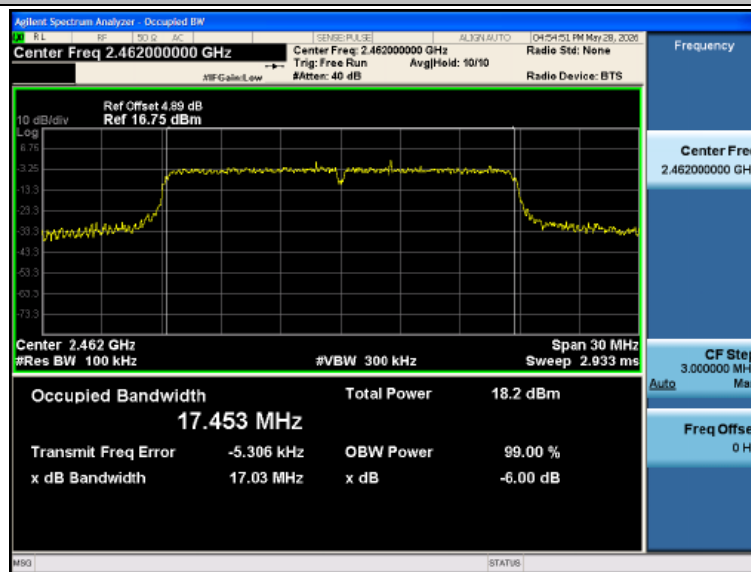
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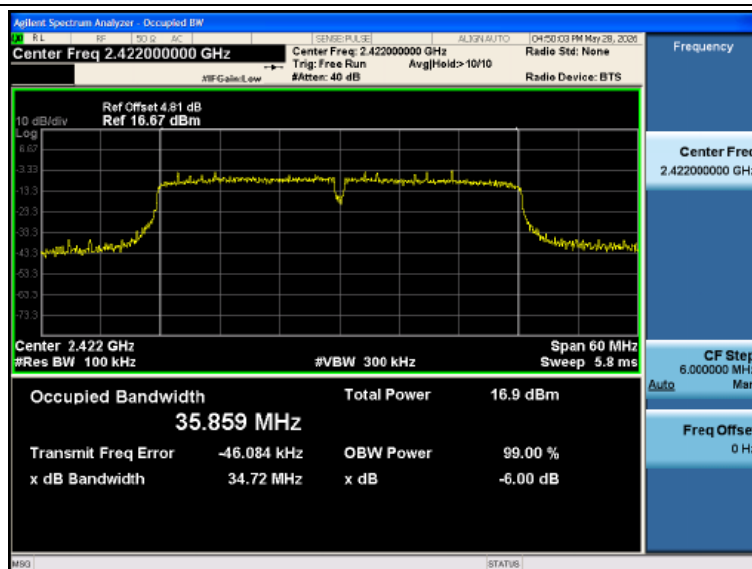
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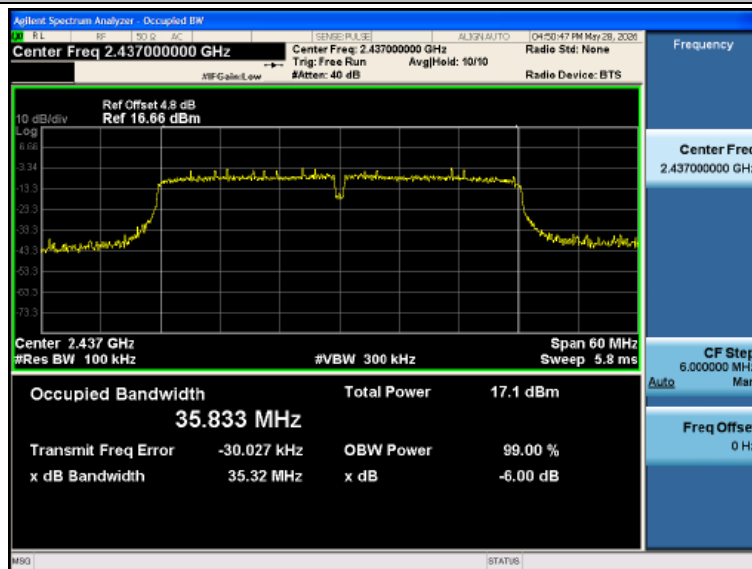
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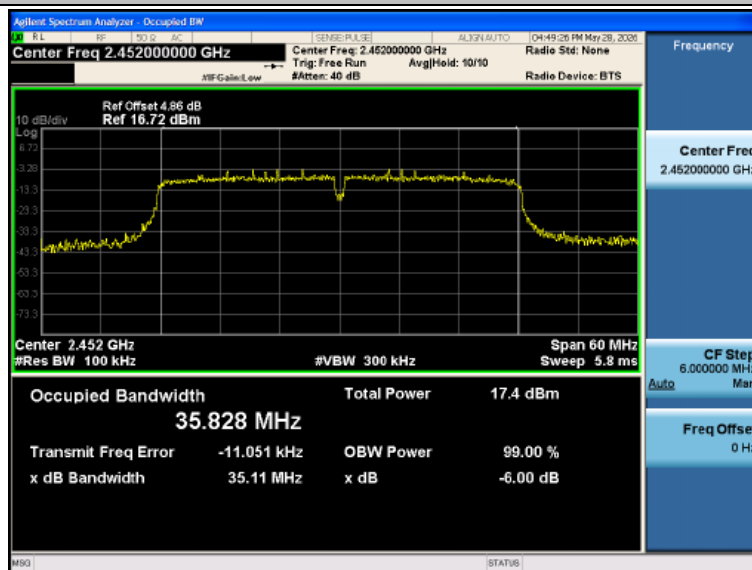
802.11n(HT40)_DTS_2422



802.11n(HT40)_DTS_2437



802.11n(HT40)_DTS_2452





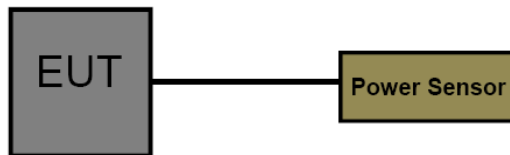
3.6. Maximum Conducted Output Power

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(3)/ RSS-247 6.3.2:

Section	Test Item	Limit	Frequency Range(MHz)
CFR 47 FCC 15.247(b)(3)	Maximum conducted output power	1 Watt or 30dBm	2400~2483.5
ISED RSS-247 6.3.2	Maximum conducted output power	1 Watt or 30dBm	2400~2483.5
ISED RSS-247 6.3.2	EIRP	4 Watt or 36dBm	2400~2483.5

Test Configuration



Test Procedure

1. The maximum conducted output power may be measured using a broadband RF power meter.
2. Power measurements were performed only when the EUT was transmitting at its AVG power control level using a broadband power meter with a pulse sensor.
3. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.
4. Record the measurement data.

Test Mode

Please refer to the clause 2.4.

Test Result



Test Mode	Frequency [MHz]	Result AVG [dBm]	E.I.R.P Result[dBm]	Limit[dBm]	E.I.R.P Limit[dBm]	Verdict
802.11b	2412	13.23	17.49	<=30	<=36	PASS
	2437	12.75	17.01	<=30	<=36	PASS
	2462	13.02	17.28	<=30	<=36	PASS
802.11g	2412	11.44	15.7	<=30	<=36	PASS
	2437	11.14	15.4	<=30	<=36	PASS
	2462	11.39	15.65	<=30	<=36	PASS
802.11n(HT20)	2412	11.16	15.42	<=30	<=36	PASS
	2437	11.06	15.32	<=30	<=36	PASS
	2462	11.35	15.61	<=30	<=36	PASS
802.11n(HT40)	2422	9.98	13.33	<=30	<=36	PASS
	2437	9.94	13.29	<=30	<=36	PASS
	2452	10.18	13.39	<=30	<=36	PASS

Note 1: Test results increased RF cable loss by 1dB and Duty Cycle Factor.

Note 2: Antenna gain:4.26dBi, E.I.R.P Result[dBm]= Result[dBm]+Antenna gain



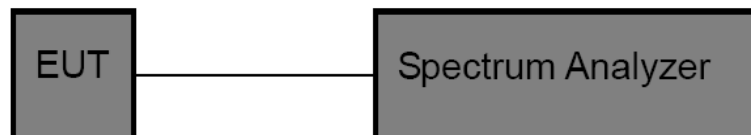
3.7. Power Spectral Density

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (e)/ RSS-247 6.3.1 (b):

Test Item	Limit	Frequency Range(MHz)
Power Spectral Density	8dBm(in any 3 kHz)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:
Set analyzer center frequency to DTS channel center frequency.
Set the span to 1.5 times the DTS bandwidth.
Set the RBW to: 3 kHz
Set the VBW to: 10 kHz
Detector: PK
Sweep time: Auto
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

Test Mode

Please refer to the clause 2.4.

**Test Result**

Test Mode	Frequency [MHz]	SA_PSD [dBm/30kHz]	Limit [dBm/3kHz]	Verdict
802.11b	2412	-10.99	<=8	PASS
	2437	-11.37	<=8	PASS
	2462	-10.92	<=8	PASS
802.11g	2412	-14.37	<=8	PASS
	2437	-14.85	<=8	PASS
	2462	-14.64	<=8	PASS
802.11n(HT20)	2412	-14.75	<=8	PASS
	2437	-4.42	<=8	PASS
	2462	-14.34	<=8	PASS
802.11n(HT40)	2422	-18.64	<=8	PASS
	2437	-18.50	<=8	PASS
	2452	-18.68	<=8	PASS



802.11b_2412



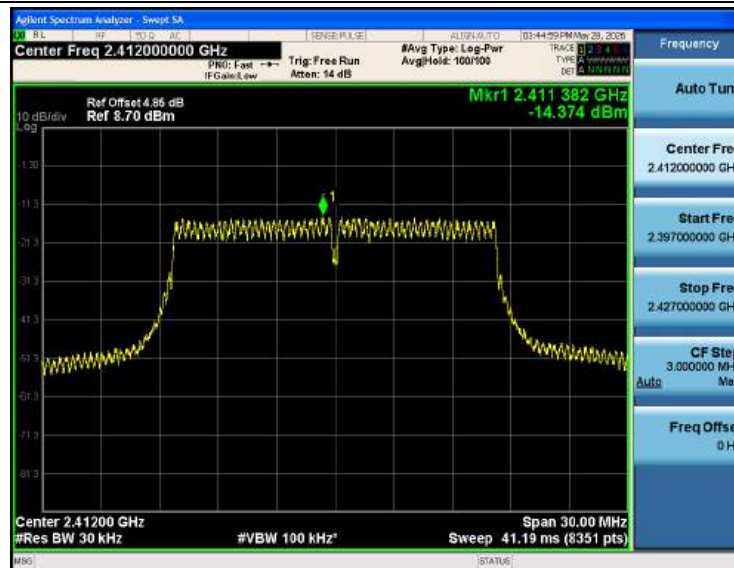
802.11b_2437



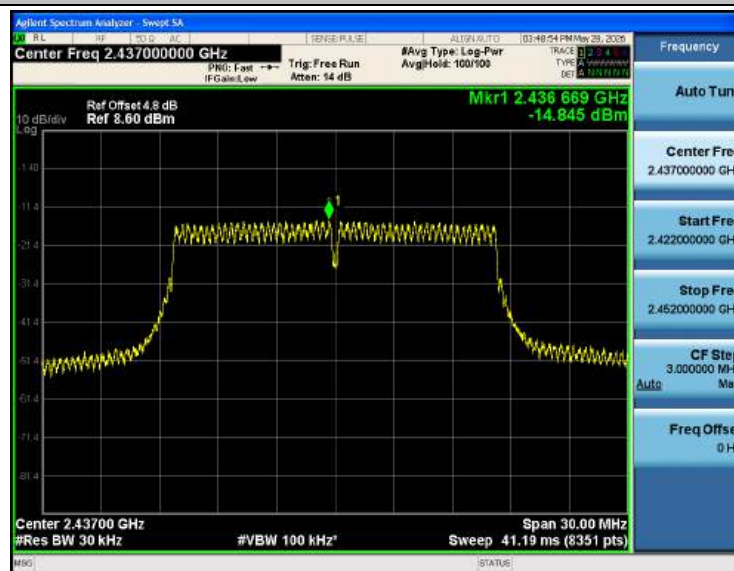
802.11b_2462



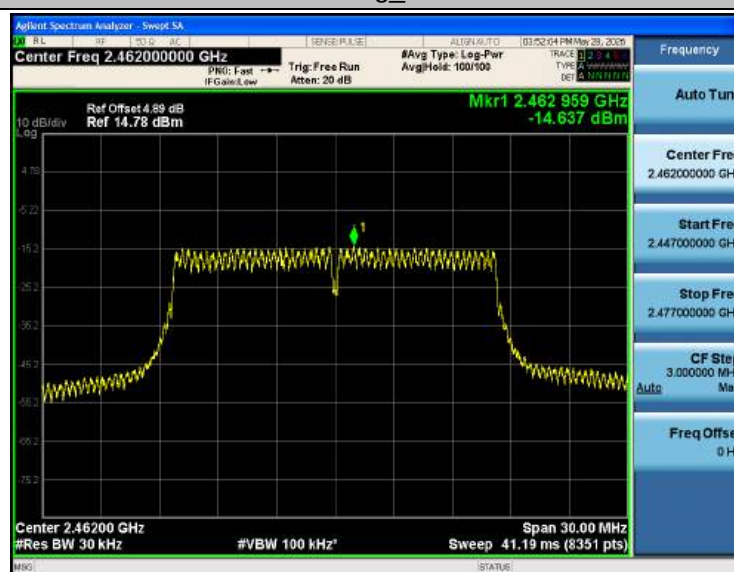
802.11g_2412



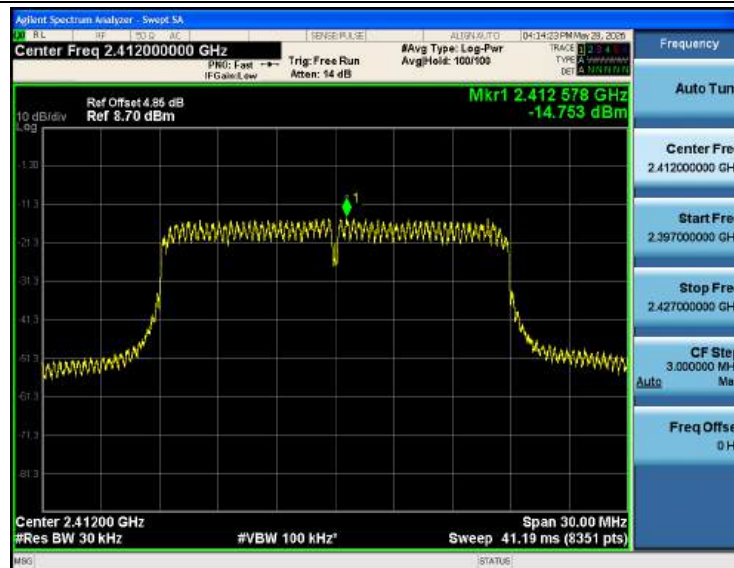
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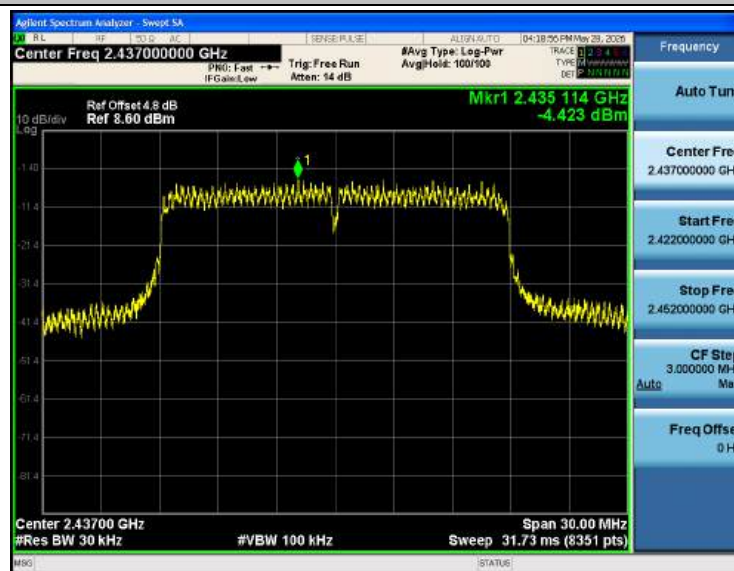
802.11g_2462



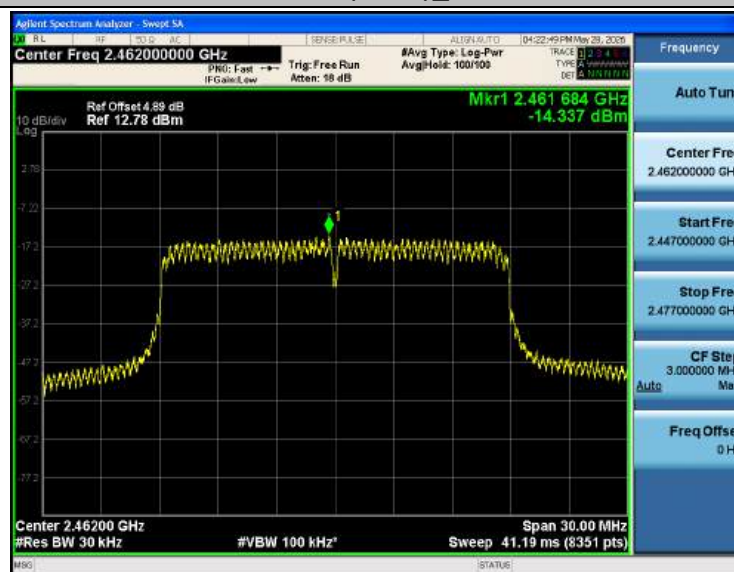
802.11n(HT20)_2412



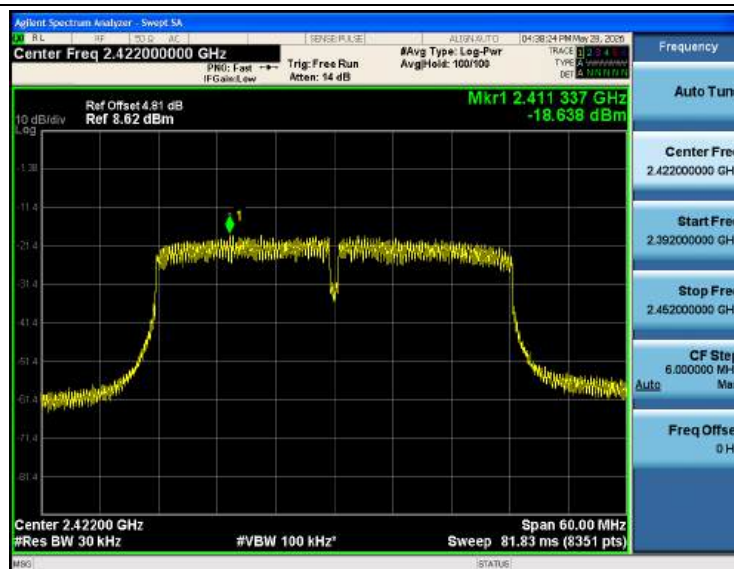
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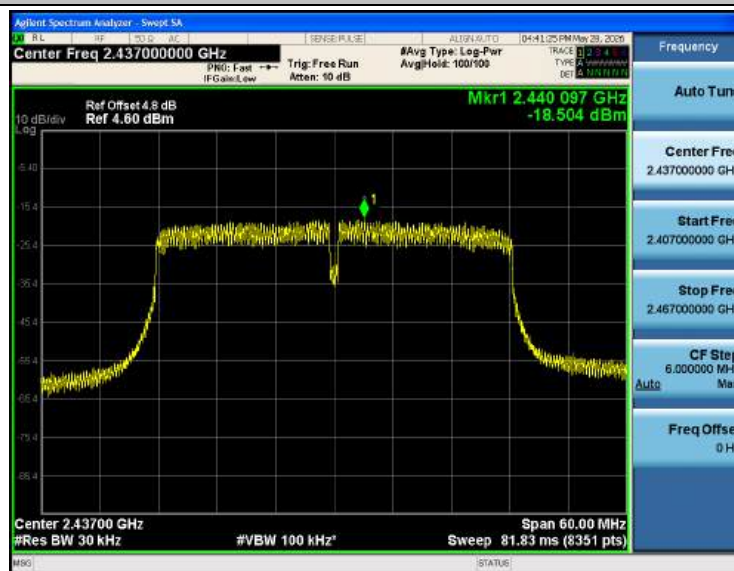
802.11n(HT20)_2462



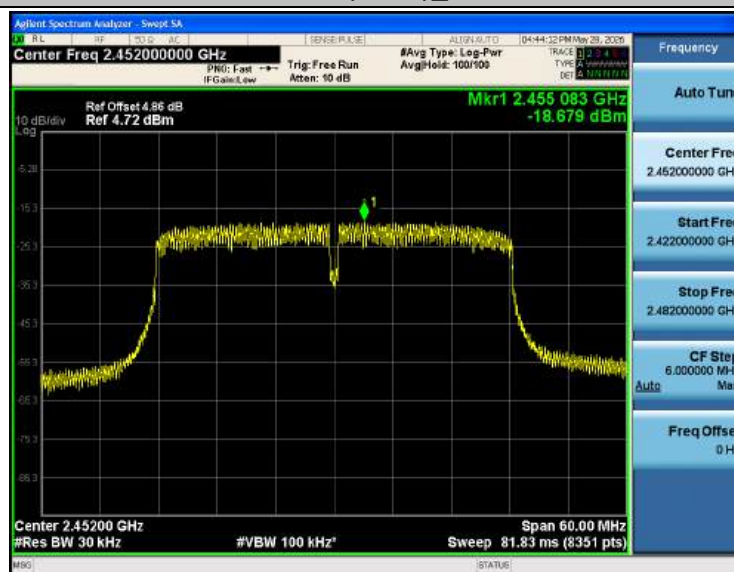
802.11n(HT40)_2422



802.11n(H40)_2437



802.11n(HT40)_2452



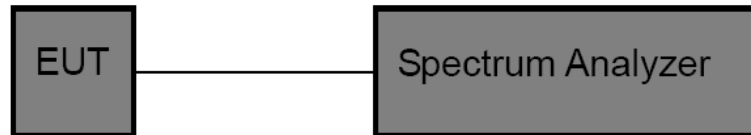


3.8. Duty Cycle

Limit

None, for report purposes only.

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:
Set analyzer center frequency to DTS channel center frequency.
Set the span to 0Hz
Set the RBW to 8MHz
Set the VBW to 8MHz
Detector: peak
Sweep time: auto
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

Test Mode

Please refer to the clause 2.4.

**Test Result**

Test Mode	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Duty Cycle Factor	1/T Minimum VBW (kHz)	Final setting For VBW (kHz)
802.11b	2412	100	100	100	0	/	1
	2437	100	100	100	0	/	1
	2462	100	100	100	0	/	1
802.11g	2412	100	100	100	0	/	1
	2437	100	100	100	0	/	1
	2462	10.98	11.02	99.64	0.09	1	1
802.11n(HT20)	2412	15.28	15.32	99.74	0.07	1	1
	2437	100	100	100	0	/	1
	2462	15.28	15.32	99.74	0.07	1	1
802.11n(HT40)	2422	7.44	7.48	99.47	0.13	1	1
	2437	7.44	7.48	99.47	0.13	1	1
	2452	9.94	9.98	99.60	0.10	1	1

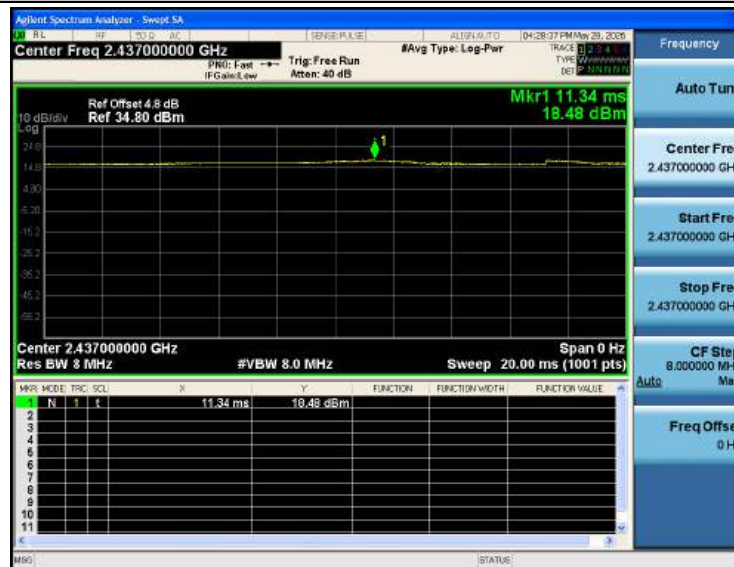
Note: Duty Cycle Factor = $10 \cdot \log_{10}(1/\text{Duty Cycle})$



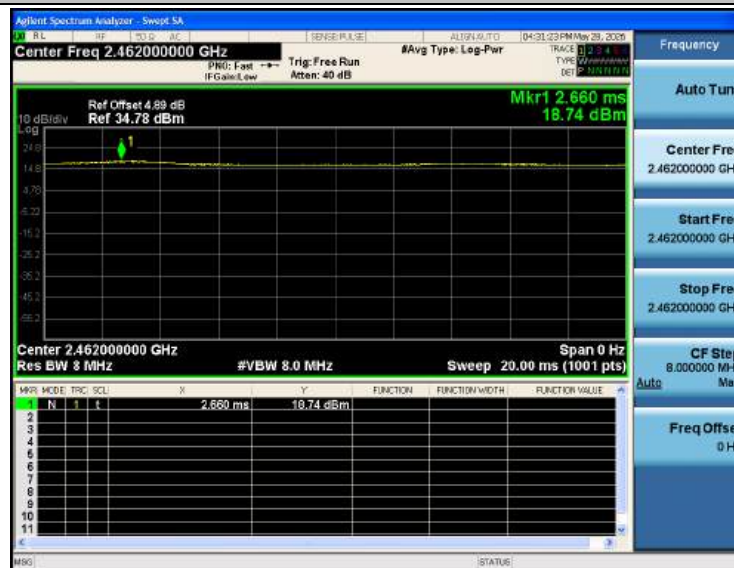
802.11b_2412



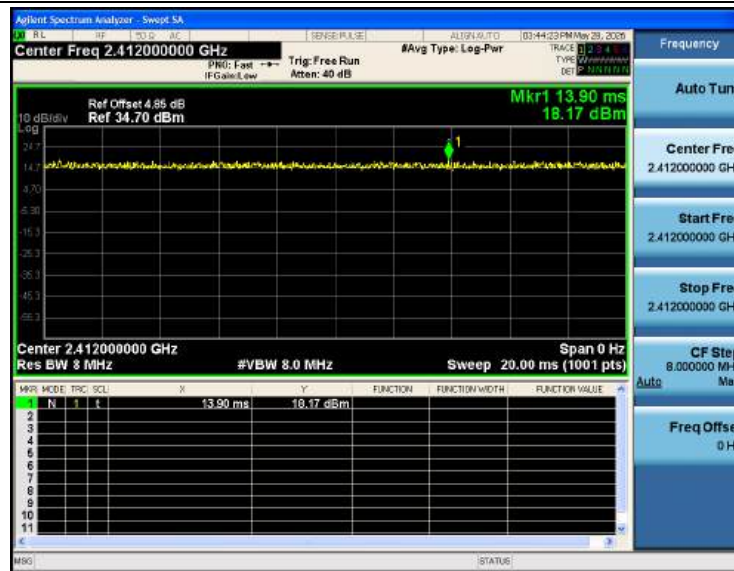
802.11b_2437



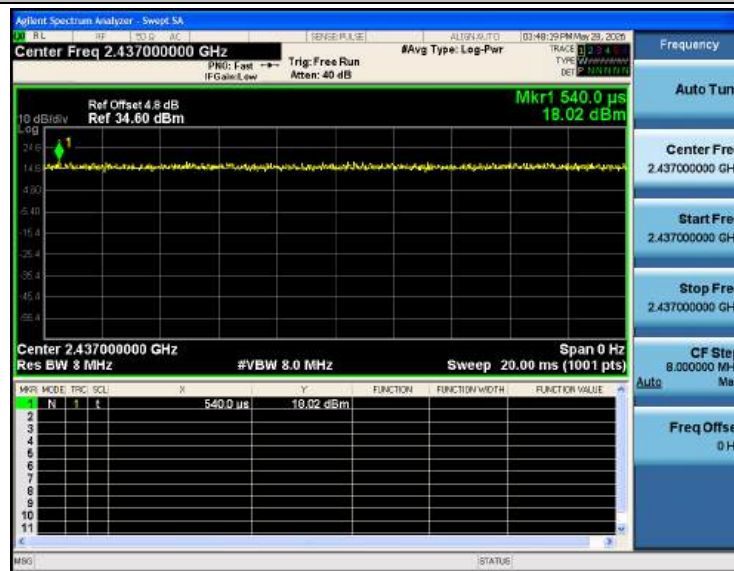
802.11b_2462



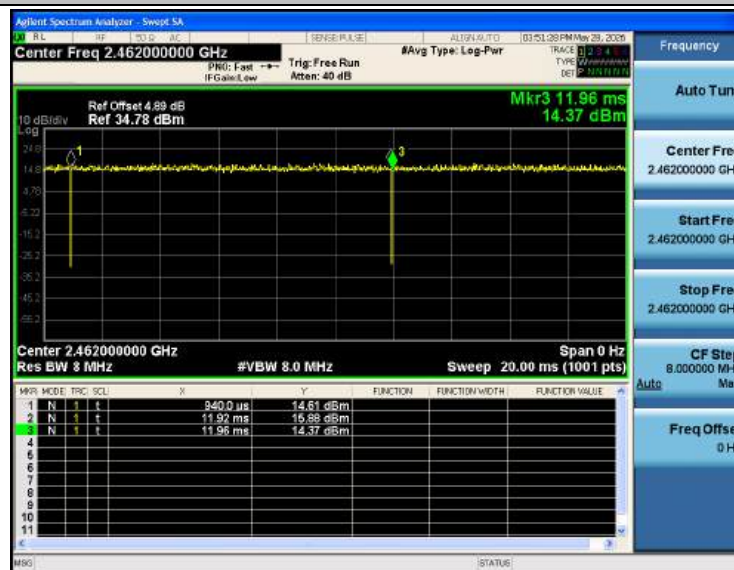
802.11g_2412



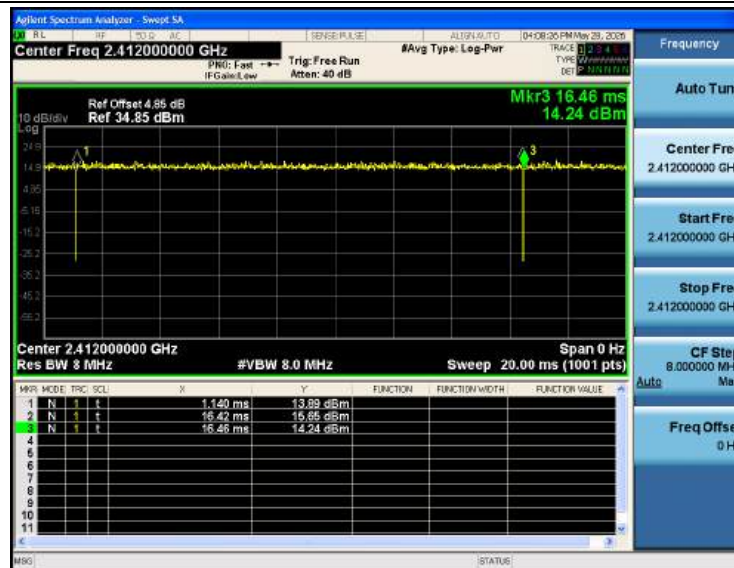
802.11g_2437



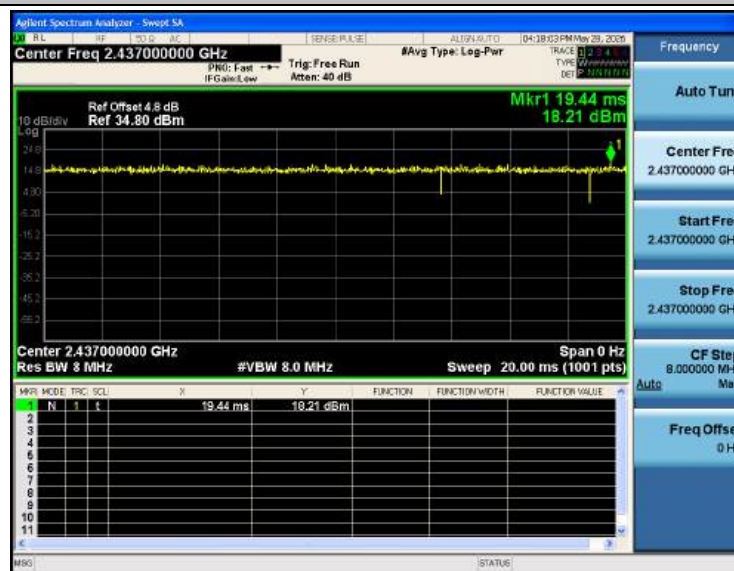
802.11g_2462



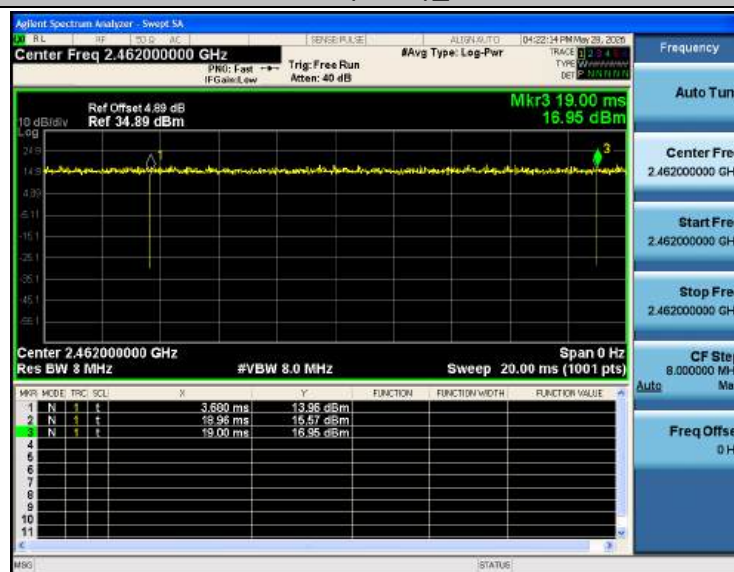
802.11n(HT20)_2412



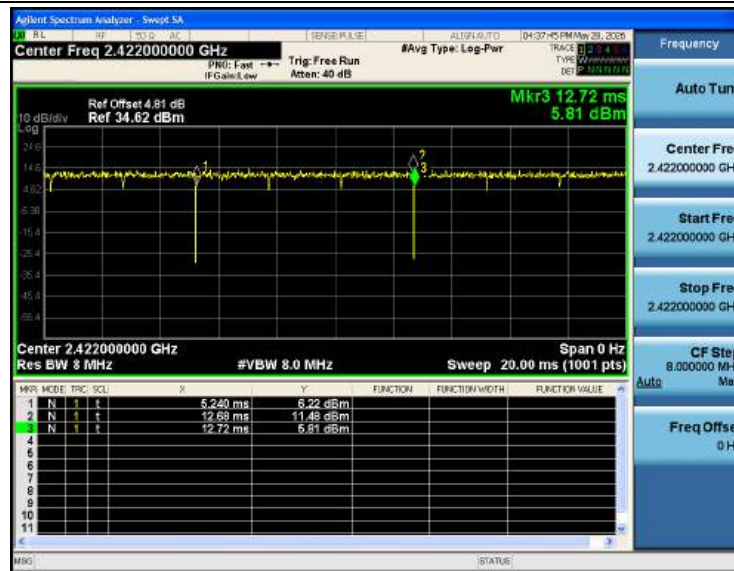
802.11n(HT20)_2437



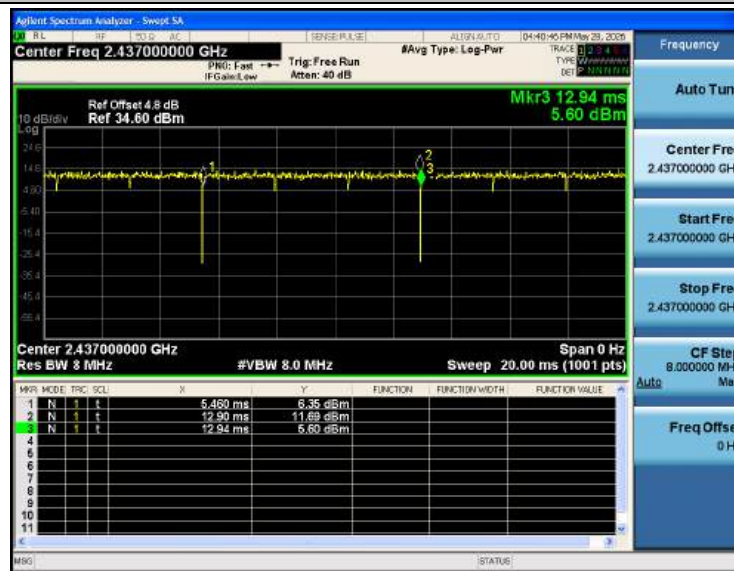
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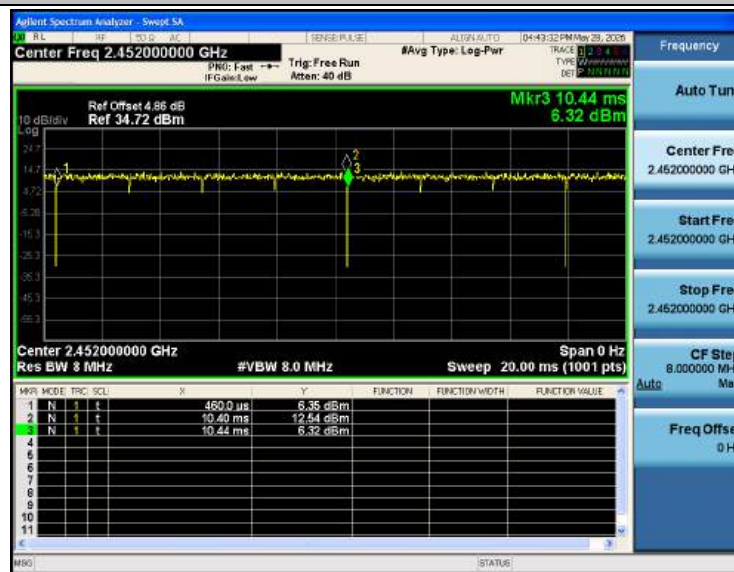
802.11n(HT40)_2422



802.11n(HT40)_2437



802.11n(HT40)_2452





3.9. Antenna requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

According to RSS-GEN Issue 5, section 6.8, The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer. The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

Test Result

The directional gain of the antenna less than 6dBi, please refer to the EUT internal photographs antenna photo.

*****THE END*****