FCC/ISED - TEST REPORT

Report Number	:	**68.950.23.0166.01**	Date of Issue:	**2023-04-07**
Model	:	**DTI 3/35 GEN 2, DTI 3/25 GEN 2, DTI 4/35, DTI 4/50**		
Product Type	:	Thermal Imaging monocular		
Applicant	:	Carl Zeiss AG		
Address	:	Carl-Zeiss-Straße 22, 73447 Oberkochen, GERMANY		
Manufacturer	:	Carl Zeiss AG		
Address	:	Carl-Zeiss-Straße 22, 73447 Oberkochen, GERMANY		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	**61**		

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1 Table of Contents

1 Table of Contents 2
2 Details about the Test Laboratory 3
3 Description of the Equipment Under Test 4
4 Summary of Test Standards 5
5 Summary of Test Results 6
6 General Remarks 7
7 Test Setups 8
8 Systems test configuration 9
9 Technical Requirement 10
9.1 Conducted Emission 10
9.2 Conducted peak output power 13
9.3 6dB bandwidth and 99% Occupied Bandwidth 15
9.4 Power spectral density 24
9.5 Spurious RF conducted emissions 28
9.6 Band edge testing 39
9.7 Spurious radiated emissions for transmitter 43
10 Test Equipment List 59
11 System Measurement Uncertainty 61

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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. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052 P.R. China
Telephone:	86 755 8828 6998
Fax:	86 755 8828 5299
FCC Registration No.:	514049
FCC Designation Number:	CN5009
IC Registration No.:	10320A
CAB identifier:	CN0077

3 Description of the Equipment Under Test

Product:	Thermal Imaging monocular
Product Marketing Name (PMN):	DTI 3/35 GEN 2, DTI 3/25 GEN 2, DTI 4/35, DTI 4/50
Model no.:	DTI 3/35 GEN 2, DTI 3/25 GEN 2, DTI 4/35, DTI 4/50
Hardware Version Identification No. (HVIN):	DTI 3/35 GEN 2, DTI 3/25 GEN 2, DTI 4/35, DTI 4/50
FCC ID:	2AMSP-DTI4
IC	22938-DTI4
Rating:	Charged by 5.0VDC, 2.0A adapter Or 3.6VDC by Rechargeable Lithium-ion battery
Options and accessories:	USB Cable
Rechargeable Li-ion Battery	Model: JQ033-14L Specification: 3.6V/3.4mAh(15.84Wh)
RF Transmission Frequency:	2412MHz-2462MHz
No. of Operated Channel:	11
Modulation:	DSSS, OFDM
Antenna Type:	Built-in omnidirectional yellow film antenna
Antenna Gain:	2.7dbi
Description of the EUT:	The Equipment Under Test (EUT) is a Thermal Imaging monocular which support Wi-Fi. The TX and RX range is 2412MHz – 2462MHz for 2.4GHz Wi-Fi

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2021 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5 April 2018 + A1 + A2	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 2 February 2017	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 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10 (2013).

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5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C/ RSS-247 Issue 2/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	10	Site 1	☒	☐	☐
§15.247 (b) (1) & RSS-247 5.4(d)	Conducted peak output power	13	Site 1	☒	☐	☐
RSS-247 5.4(d)	Equivalent Isotropic Radiated Power	13	Site 1	☒	☐	☐
§15.247(a)(1) & RSS-247 5.1(b)	20dB 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	---	---	☐	☐	☒
§15.247(a)(2) & RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth and 99% Occupied Bandwidth	15	Site 1	☒	☐	☐
§15.247(e) & RSS-247 5.2(b)	Power spectral density	22	Site 1	☒	☐	☐
§15.247(d) & RSS-247 5.5	Spurious RF conducted emissions	26	Site 1	☒	☐	☐
§15.247(d) & RSS-247 5.5	Band edge	37	Site 1	☒	☐	☐
§15.247(d) & §15.209 & RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	41	Site 1	☒	☐	☐
§15.203 & RSS-Gen 6.8	Antenna requirement	See note 2		☒	☐	☐

Note 1: N/A=Not Applicable.
Note 2: The EUT uses a Built-in omnidirectional yellow film antenna and manufacturer will stick it down with glue, which gain are 2.7dBi. In accordance to §15.203 & RSS-Gen 6.8, 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:2AMSP-DTI4, IC:22938-DTI4, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules and RSS-247, RSS-GEN.

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:	2023-02-10
Testing Start Date:	2023-02-10
Testing End Date:	2023-03-10

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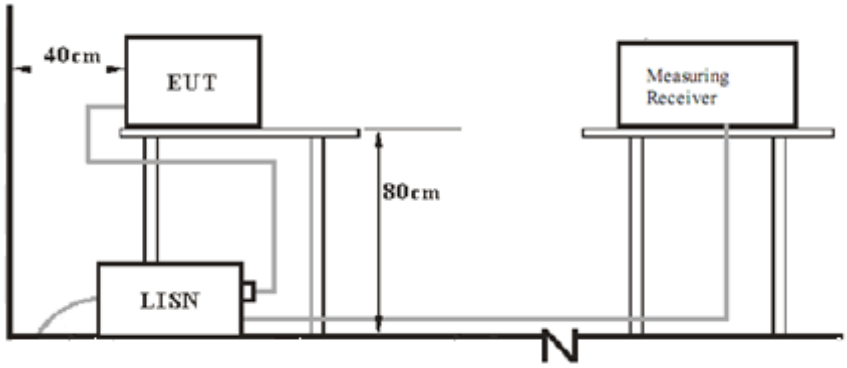
Reviewed by:	Prepared by:	Tested by:
John Zhi	Warlen Song	Carry Cai
Project Manager	Project Engineer	Test Engineer

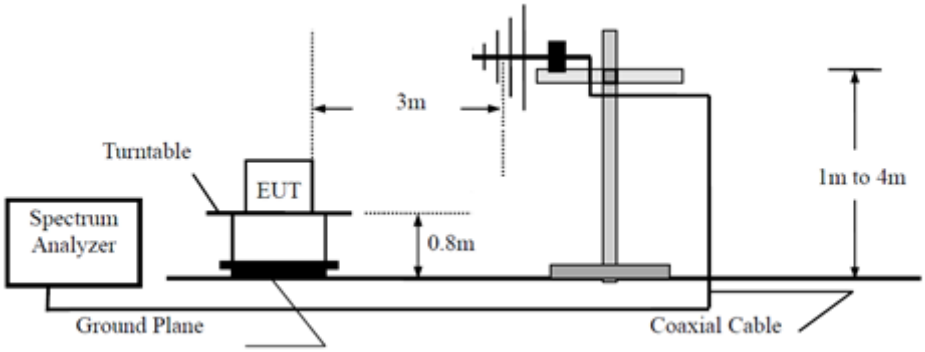
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

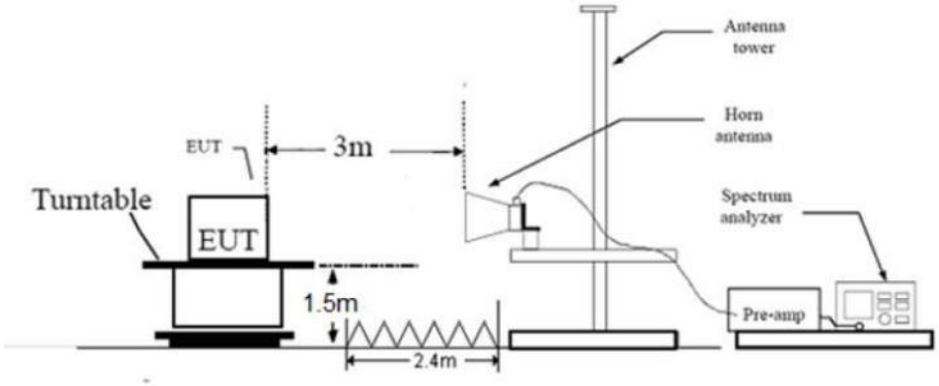


7.2 Radiated test setups

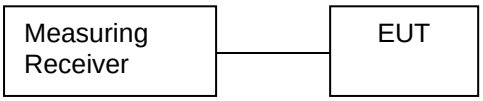
Below 1GHz



Above 1GHz



7.3 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
PC	Lenovo	X240	---
Adapter	Apple	A1357	---

Cables Used During Test:

Cable	Length	Shielded/unshielded	With / without ferrite
---	---	---	---

Test software information:

Test Software Version	---	
Mode	Setting TX Power	Packet Type
802.11b	17	DSSS
802.11g	17	OFDM
802.11n20	17	OFDM

The system was configured to non-hopping mode.

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.

Through pre-scan all kind of modulation and all kind of rates, find the 1Mbps of rate is the worst case of 802.11b; the 6Mbps of rate is the worst case of 802.11g; the 6.5Mbps of rate is the worst case of 802.11n20, only the worst case transmitter rate data mode in recorded in the report.

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

Limit

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

*Decreases with the logarithm of the frequency.

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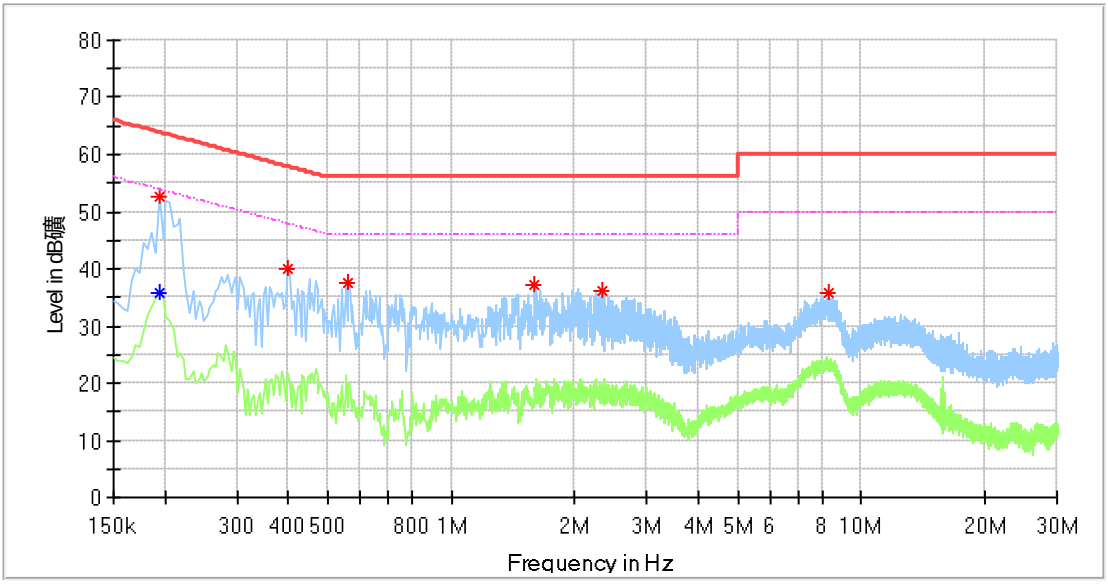
Conducted Emission

Product Type	:	Thermal Imaging monocular
M/N	:	DTI 3/35 GEN 2
Operating Condition	:	Charging + Transmit
Test Specification	:	Power Line, Live
Comment	:	AC 120V/60Hz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.194000	---	35.75	53.86	18.11	L1	10.34
0.194000	52.70	---	63.86	11.17	L1	10.34
0.398000	39.98	---	57.90	17.91	L1	10.35
0.562000	37.41	---	56.00	18.59	L1	10.36
1.598000	37.27	---	56.00	18.73	L1	10.39
2.330000	36.00	---	56.00	20.00	L1	10.42
8.342000	35.70	---	60.00	24.30	L1	10.73

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
---	---	---	---	---		---

Remark：
Level=Reading Level + Correction Factor
Correction Factor=Cable Loss + LISN Factor
(The Reading Level is recorded by software which is not shown in the sheet)

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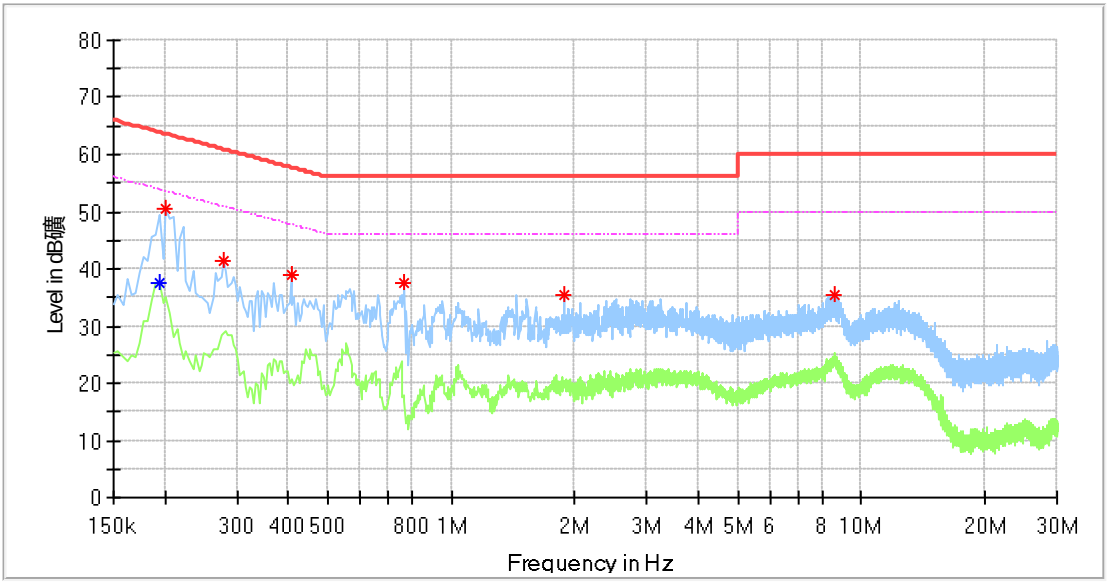
Conducted Emission

Product Type	:	Thermal Imaging monocular
M/N	:	DTI 3/35 GEN 2
Operating Condition	:	Charging + Transmit
Test Specification	:	Power Line, Neutral
Comment	:	AC 120V/60Hz (External adapter)



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.194000	---	37.64	53.86	16.22	N	10.38
0.202000	50.68	---	63.53	12.85	N	10.39
0.278000	41.41	---	60.88	19.46	N	10.42
0.406000	39.11	---	57.73	18.62	N	10.45
0.770000	37.37	---	56.00	18.63	N	10.49
1.890000	35.49	---	56.00	20.51	N	10.54
8.618000	35.33	---	60.00	24.67	N	10.91

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
---	---	---	---	---		---

Remark：
Level=Reading Level + Correction Factor
Correction Factor=Cable Loss + LISN Factor
(The Reading Level is recorded by software which is not shown in the sheet)

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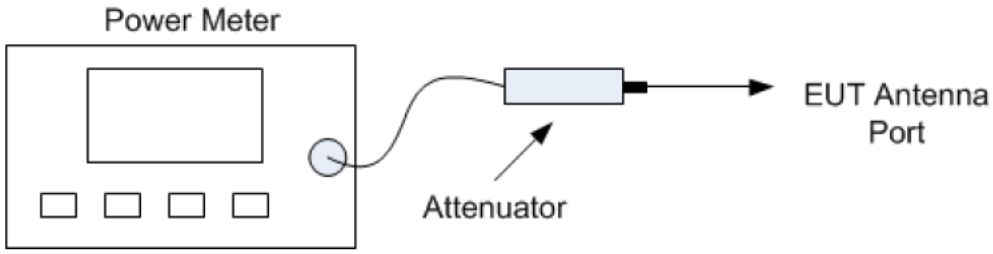
9.2 Conducted peak output power & EIRP

Test Method

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.



Power meter conducted test setup

Limits

According to §15.247 (b) (1) & RSS-247 5.4(d), conducted peak output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

According to & RSS-247 5.4(d), EIRP limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤4	≤36

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Test result as below table

802.11b_ modulation Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2412MHz	15.4	2.7	18.1	Pass
Middle channel 2437MHz	15.5	2.7	18.2	Pass
High channel 2462MHz	16.3	2.7	19.0	Pass

802.11g_ modulation Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm) Ant 0	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2412MHz	16.2	2.7	18.9	Pass
Middle channel 437MHz	15.9	2.7	18.6	Pass
High channel 2462MHz	16.6	2.7	19.3	Pass

802.11n20_modulation Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2412MHz	15.6	2.7	18.3	Pass
Middle channel 2437MHz	15.8	2.7	18.5	Pass
High channel 2462MHz	16.5	2.7	19.2	Pass

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9.3 6dB bandwidth and 99% Occupied Bandwidth

Test Method for 6 dB Bandwidth

1. Use the following spectrum analyzer settings:
RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Test Method for 99 % Bandwidth

1. 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 automatic bandwidth measurement capability of an instrument, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]
≥500

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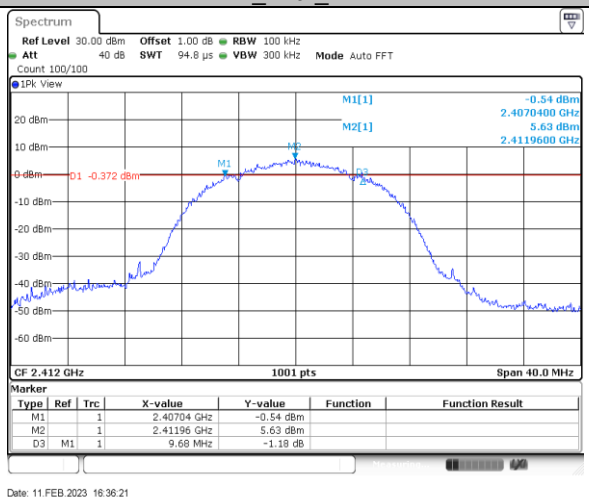
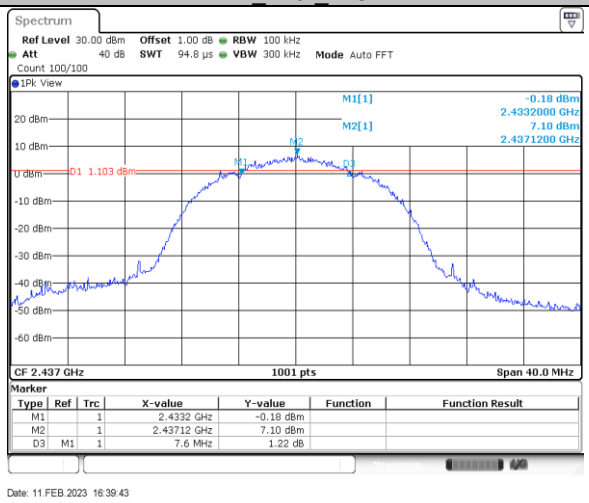
6dB Bandwidth

TestMode	Antenna	Channel [MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit [MHz]	Verdict
11B	Ant0	2412	9.680	2407.040	2416.720	0.5	PASS
	Ant0	2437	7.600	2433.200	2440.800	0.5	PASS
	Ant0	2462	7.520	2458.200	2465.720	0.5	PASS
11G	Ant0	2412	16.440	2403.760	2420.200	0.5	PASS
	Ant0	2437	16.440	2428.760	2445.200	0.5	PASS
	Ant0	2462	16.440	2453.760	2470.200	0.5	PASS
11N20	Ant0	2412	17.640	2403.160	2420.800	0.5	PASS
	Ant0	2437	16.400	2428.200	2444.600	0.5	PASS
	Ant0	2462	15.400	2454.200	2469.600	0.5	PASS

11B_Ant1_2412



11B_Ant1_2437



11B_Ant1_2462

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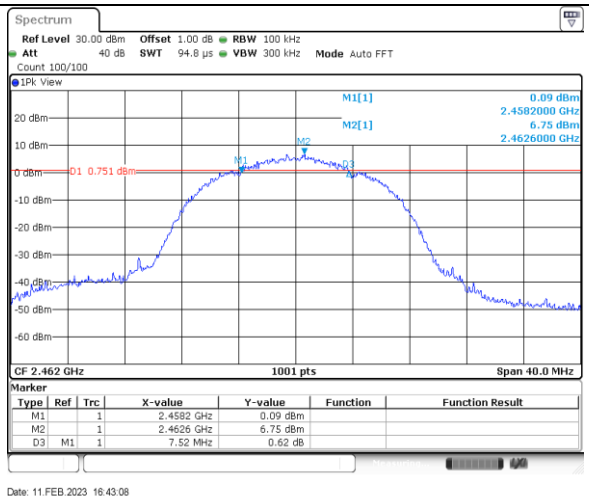

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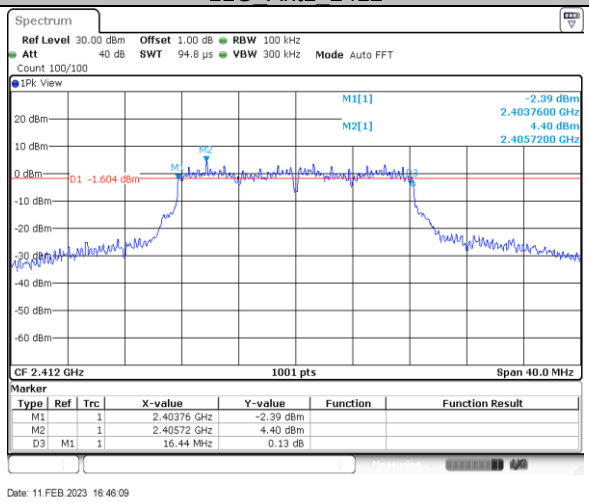

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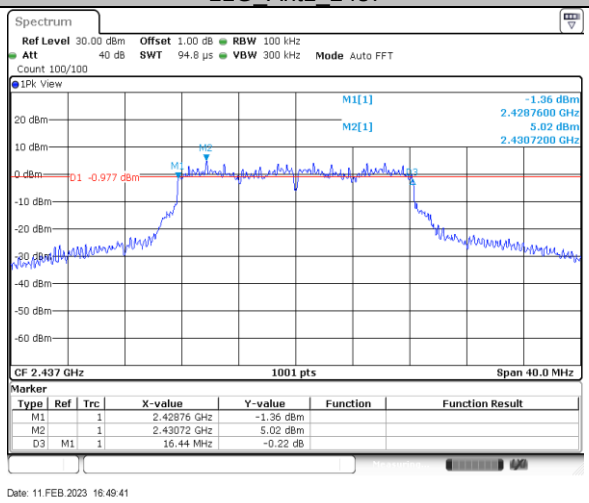

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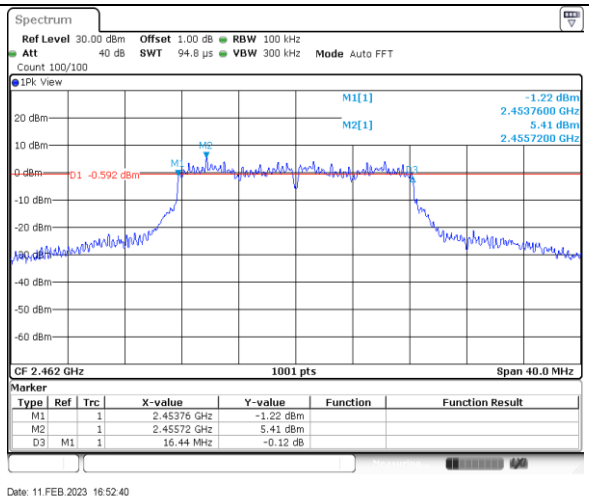

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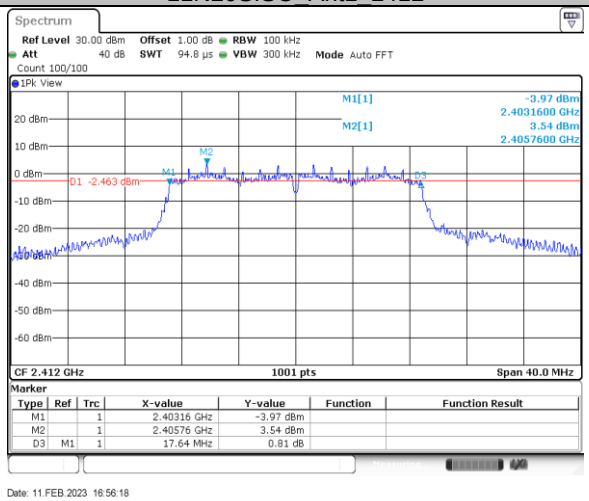

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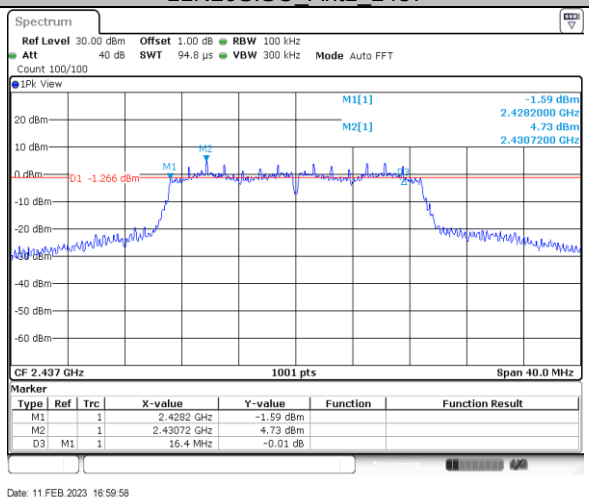

11N20SISO_Ant1_2462

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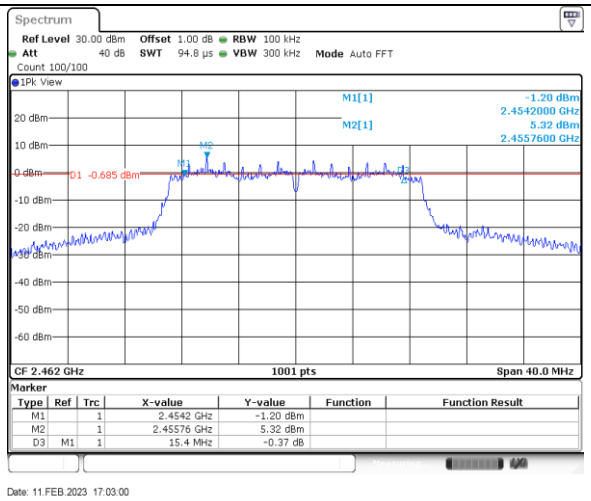

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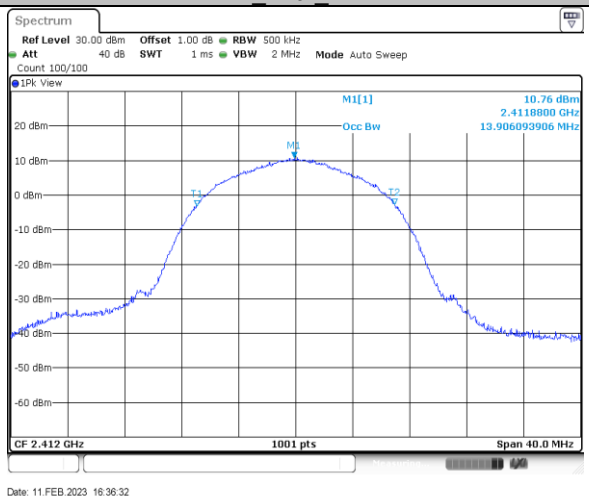
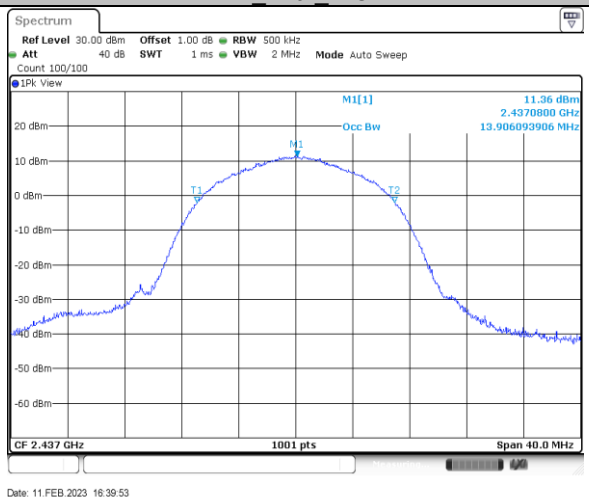
99% Bandwidth

TestMode	Antenna	Channel [MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant0	2412	13.906	2405.047	2418.953	---	PASS
		2437	13.906	2430.047	2443.953	---	PASS
		2462	13.906	2455.007	2468.913	---	PASS
11G	Ant0	2412	17.862	2403.129	2420.991	---	PASS
		2437	17.782	2428.129	2445.911	---	PASS
		2462	17.902	2453.089	2470.991	---	PASS
11N20SISO	Ant0	2412	19.580	2402.410	2421.990	---	PASS
		2437	19.500	2427.490	2446.990	---	PASS
		2462	19.341	2452.370	2471.710	---	PASS

11B_Ant1_2412



11B_Ant1_2437



11B_Ant1_2462

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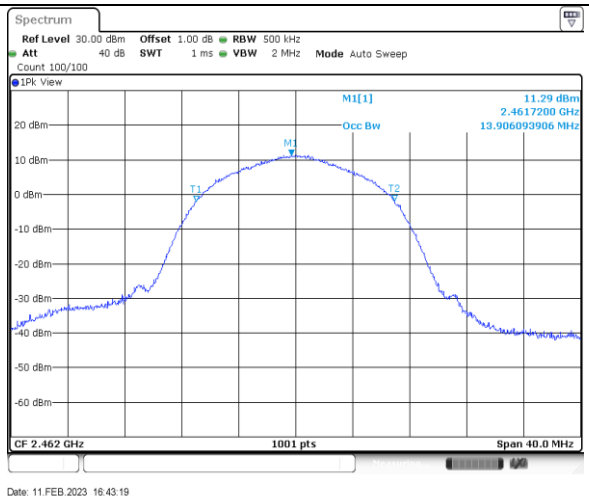
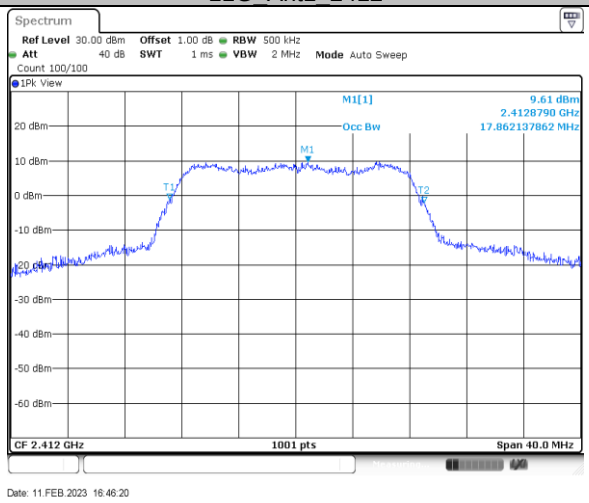
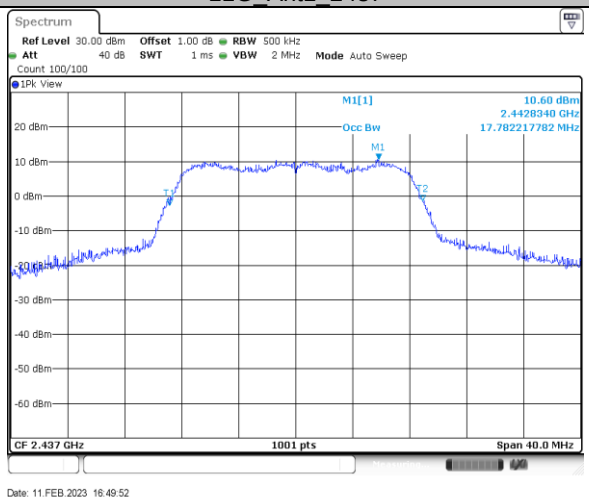


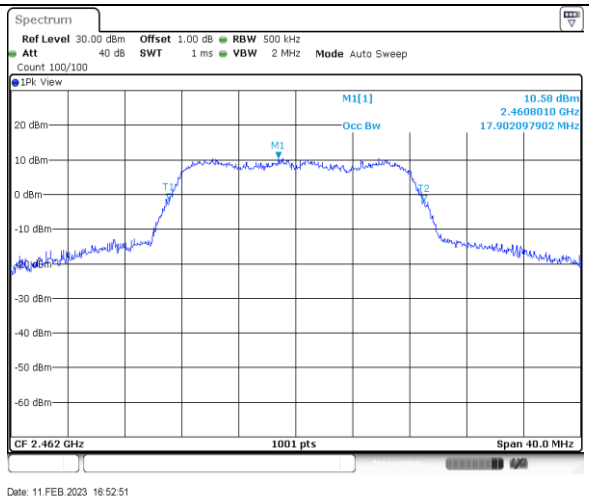
11G_Ant1_2412



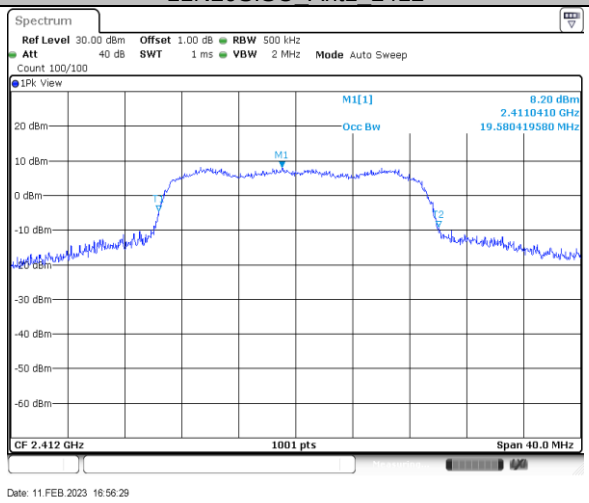
11G_Ant1_2437



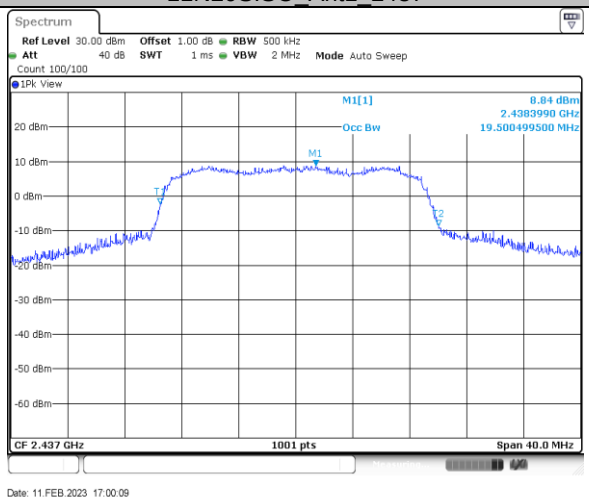
11G_Ant1_2462



11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462

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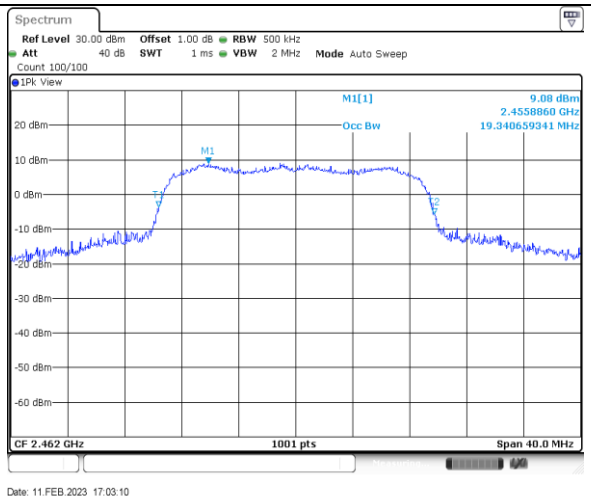

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9.4 Power spectral density

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 test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. 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.
3. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
4. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3KHz]
≤8

802.11b modulation Test Result

Frequency (MHz)	Power spectral density (dBm/3KHz)	Limit (dBm)	Result
	Ant 0		
Low channel 2412MHz	-7.94	8	Pass
Middle channel 2437MHz	-7.43	8	Pass
High channel 2462MHz	-8.09	8	Pass

802.11g modulation Test Result

Frequency (MHz)	Power spectral density (dBm/3KHz)	Limit (dBm)	Result
	Ant 0		
Low channel 2412MHz	-10.41	8	Pass
Middle channel 2437MHz	-9.38	8	Pass
High channel 2462MHz	-10.67	8	Pass

802.11n_HT20 modulation Test Result

Frequency (MHz)	Power spectral density (dBm/3KHz)	Limit (dBm)	Result
	Ant 0		
Low channel 2412MHz	-10.77	8	Pass
Middle channel 2437MHz	-10.17	8	Pass
High channel 2462MHz	-10.08	8	Pass

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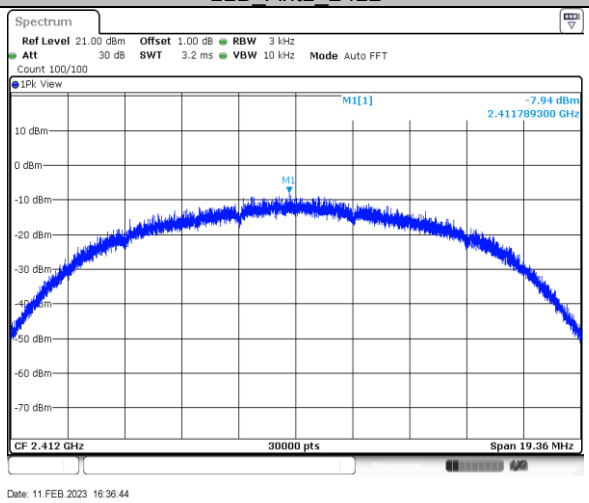
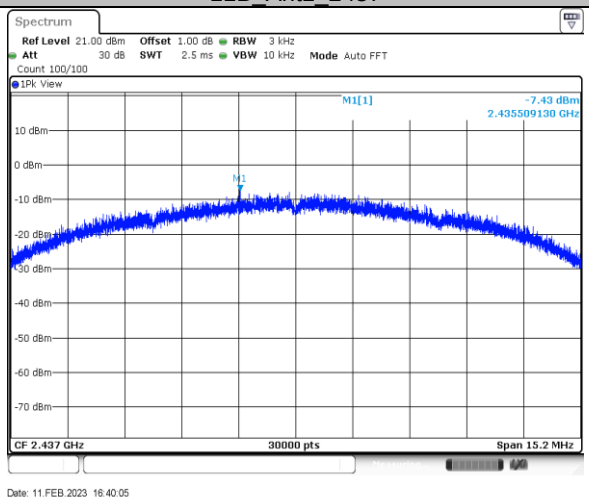
11B_Ant1_2412

11B_Ant1_2437

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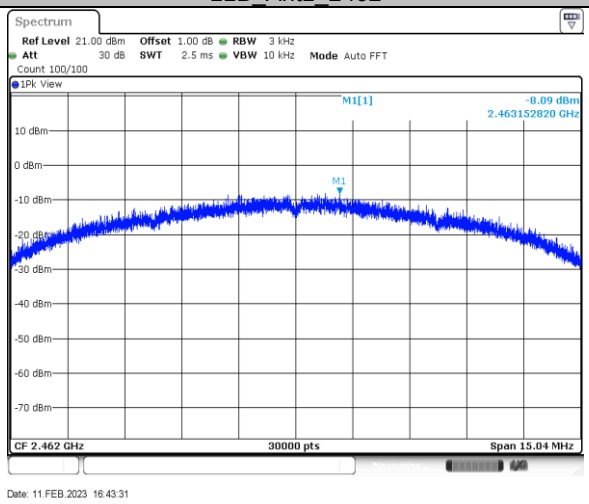
11G_Ant1_2412

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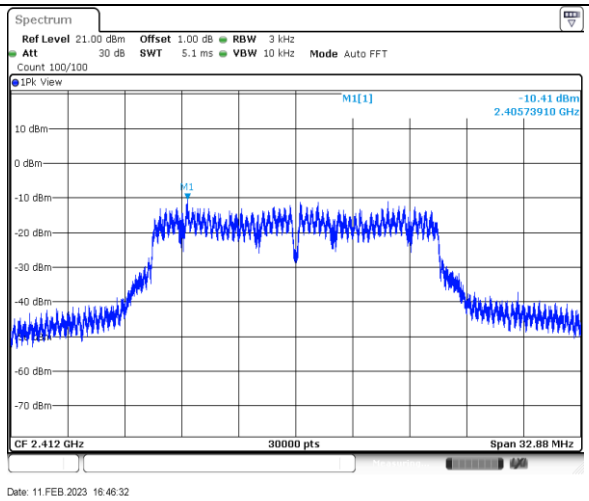

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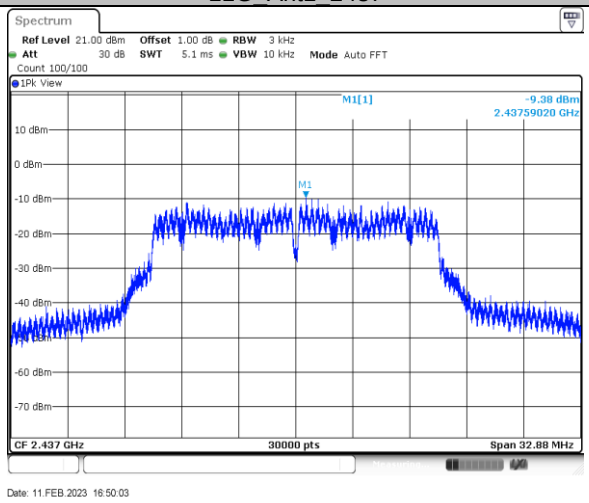

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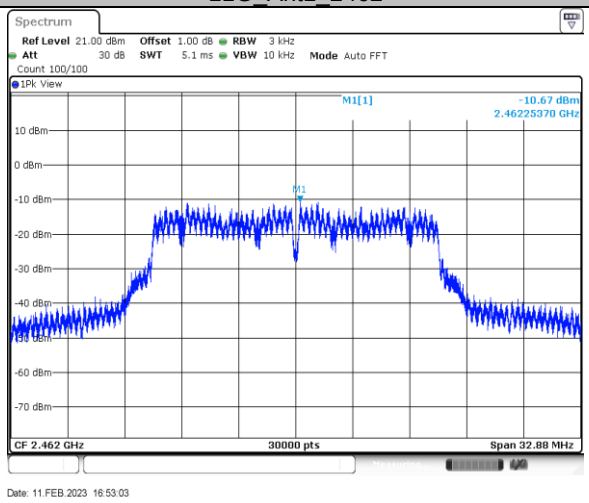
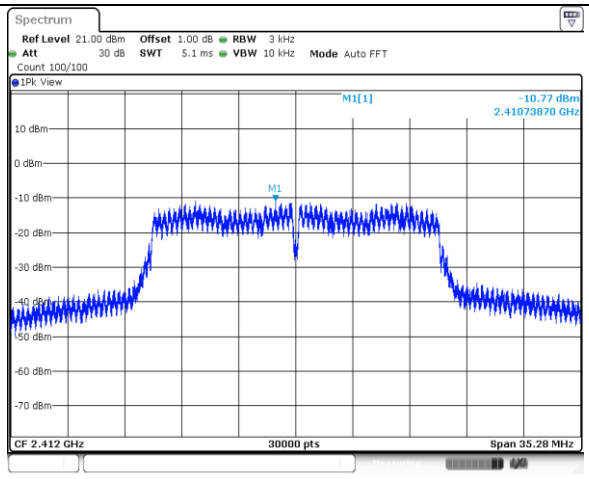
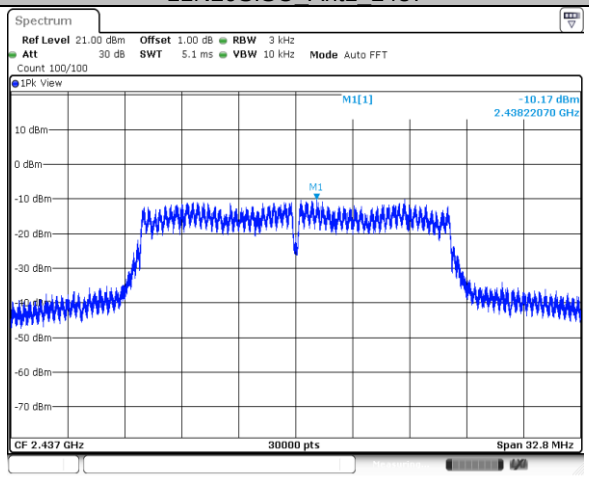


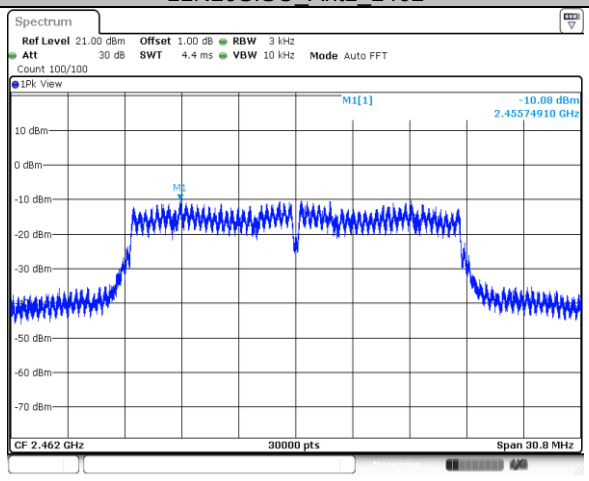
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462



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9.5 Spurious RF conducted emissions

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

Limit

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

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Spurious RF conducted emissions

TestMode	Antenna	Channel(dBm)	FreqRange(MHz)	Result(dBm)	Limit(dBm)	Verdict
11B	Ant0	2412	Reference	5.15	---	PASS
			30~1000	-67.58	<=-14.85	PASS
			1000~26500	-41.89	<=-14.85	PASS
	Ant0	2437	Reference	6.24	---	PASS
			30~1000	-67.88	<=-13.76	PASS
			1000~26500	-48.37	<=-13.76	PASS
	Ant0	2462	Reference	6.25	---	PASS
			30~1000	-68.23	<=-13.75	PASS
			1000~26500	-48.35	<=-13.75	PASS
11G	Ant0	2412	Reference	4.30	---	PASS
			30~1000	-68.23	<=-15.7	PASS
			1000~26500	-28.16	<=-15.7	PASS
	Ant0	2437	Reference	5.15	---	PASS
			30~1000	-68.44	<=-14.85	PASS
			1000~26500	-45.41	<=-14.85	PASS
	Ant0	2462	Reference	4.99	---	PASS
			30~1000	-67.92	<=-15.01	PASS
			1000~26500	-41.25	<=-15.01	PASS
11N20SISO	Ant0	2412	Reference	3.21	---	PASS
			30~1000	-67.27	<=-16.79	PASS
			1000~26500	-26.28	<=-16.79	PASS
	Ant0	2437	Reference	4.95	---	PASS
			30~1000	-68.33	<=-15.05	PASS
			1000~26500	-51.96	<=-15.05	PASS
	Ant0	2462	Reference	4.43	---	PASS
			30~1000	-68.79	<=-15.57	PASS
			1000~26500	-34	<=-15.57	PASS

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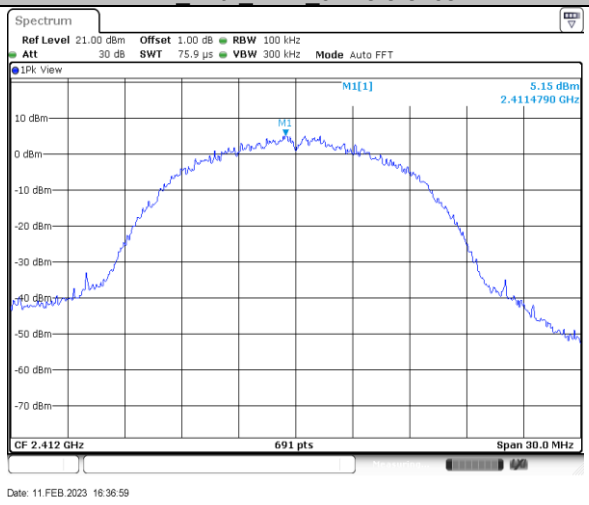
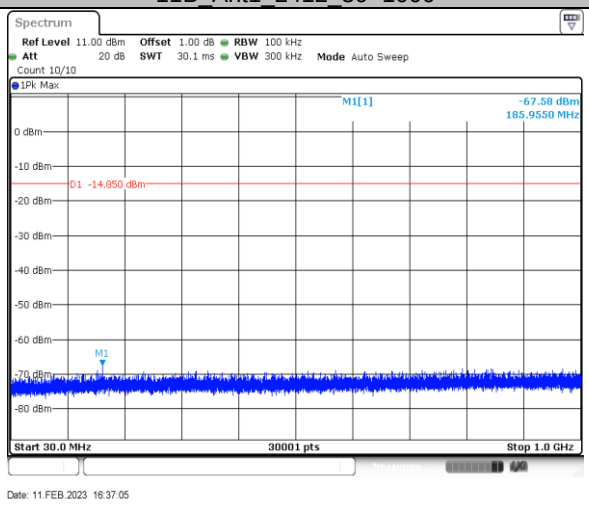
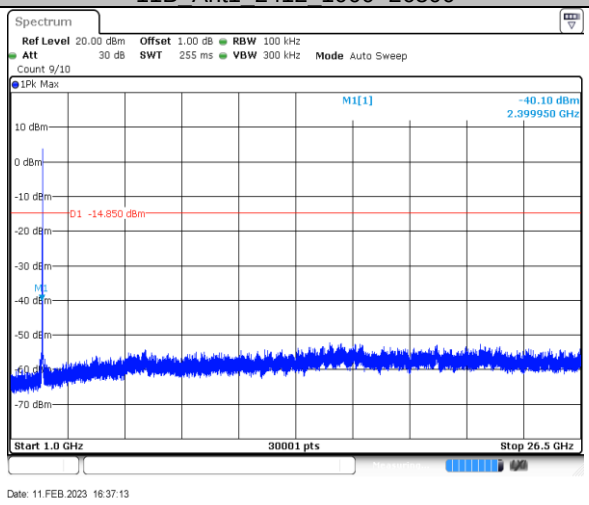
11B_Ant1_2412_0~Reference

11B_Ant1_2412_30~1000

11B_Ant1_2412_1000~26500

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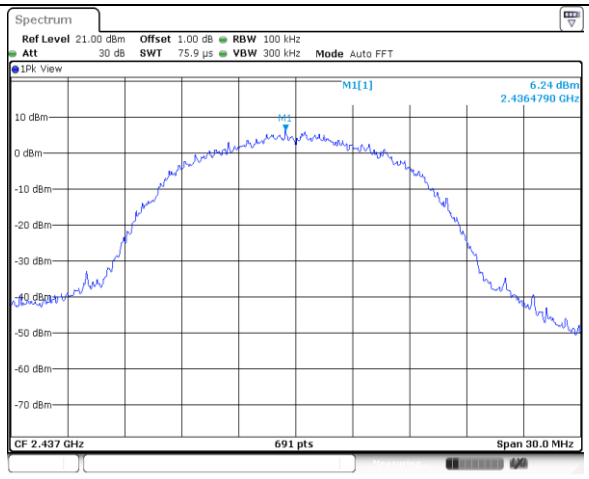
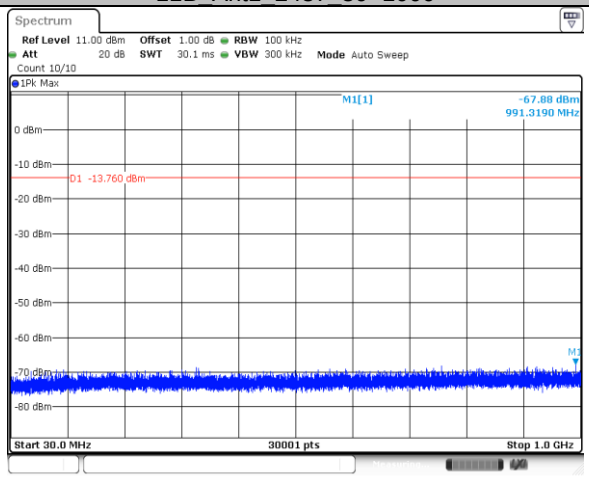
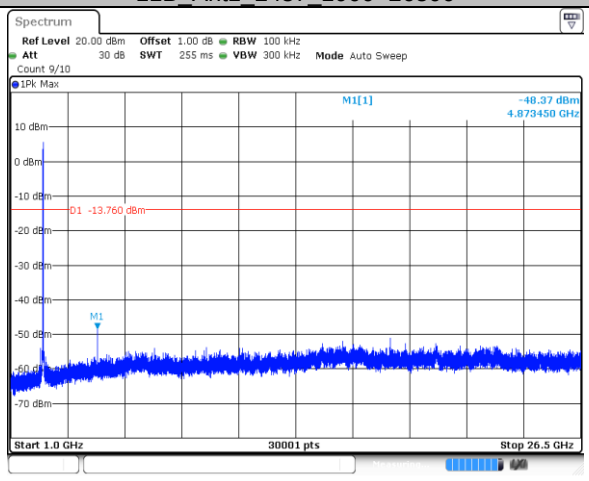


11B_Ant1_2437_30~1000



11B_Ant1_2437_1000~26500



11B_Ant1_2462_0~Reference

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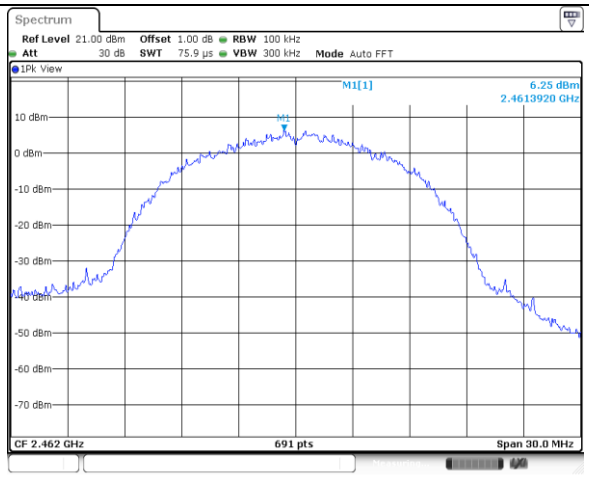
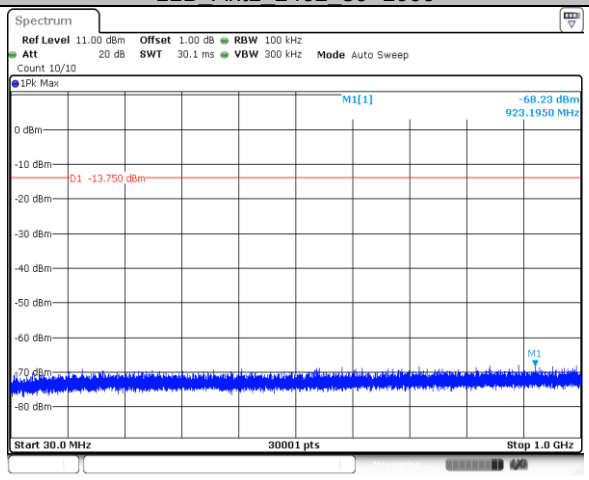
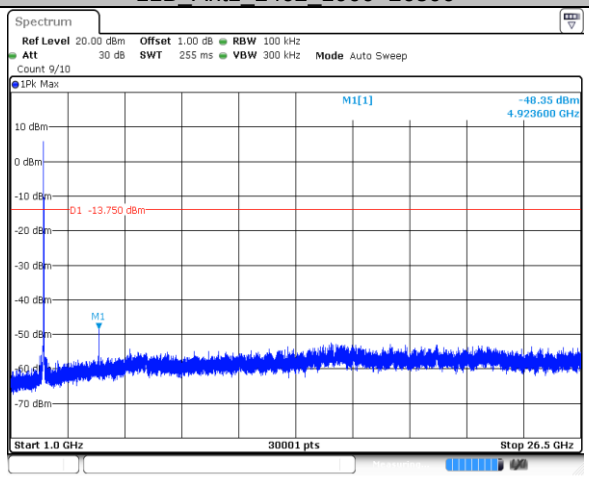


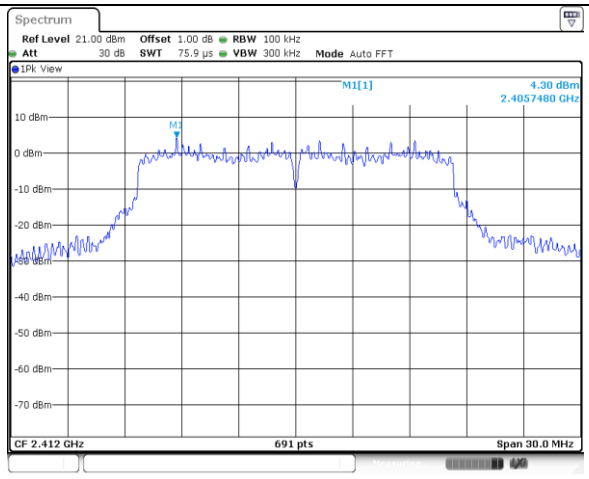
11B_Ant1_2462_30~1000



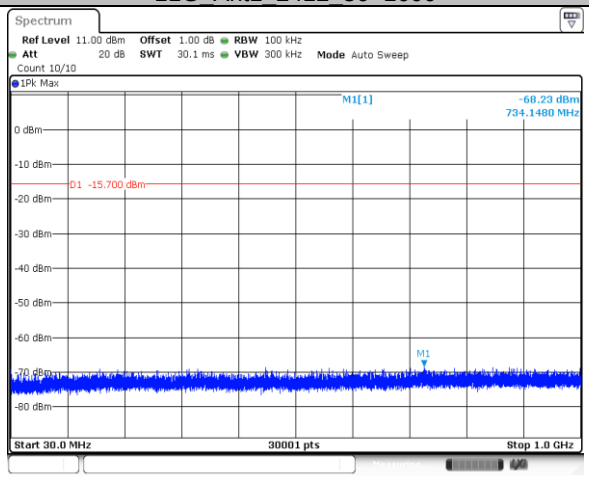
11B_Ant1_2462_1000~26500



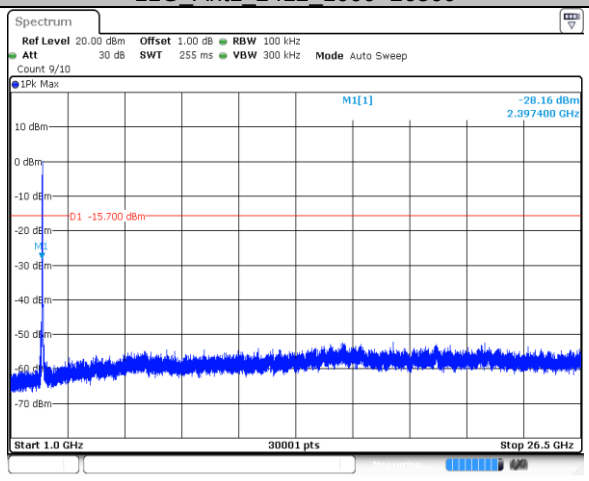
11G_Ant1_2412_0~Reference



11G_Ant1_2412_30~1000



11G_Ant1_2412_1000~26500



11G_Ant1_2437_0~Reference

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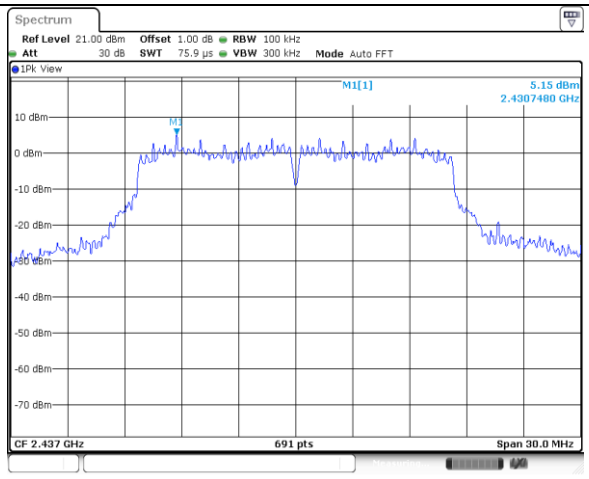
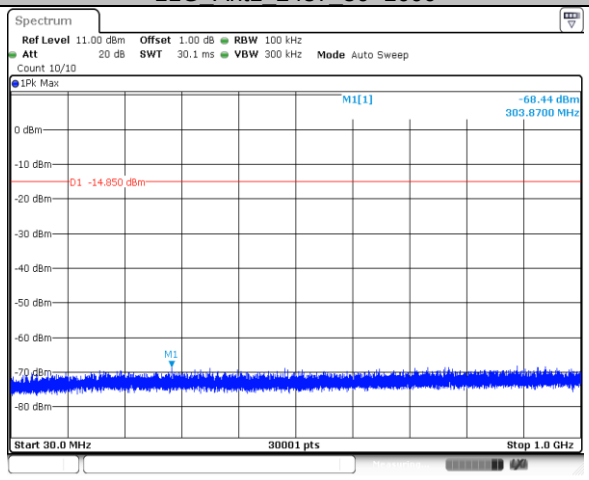
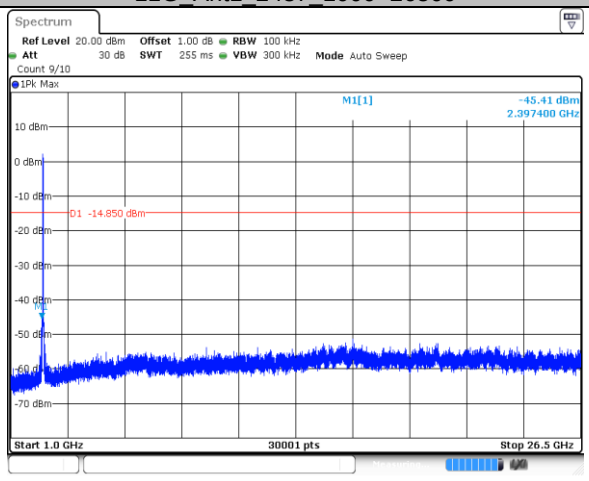


11G_Ant1_2437_30~1000



11G_Ant1_2437_1000~26500



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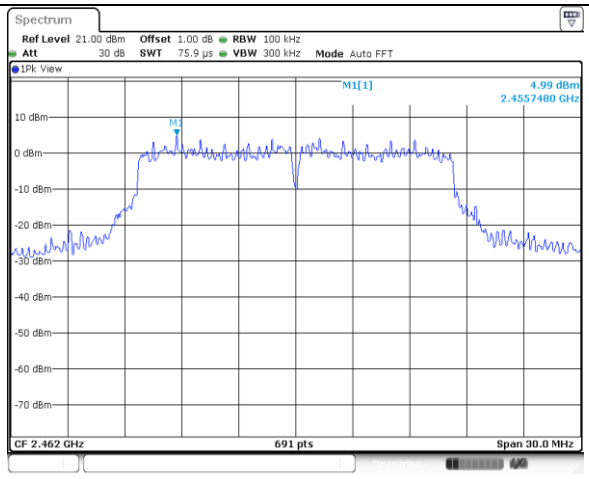
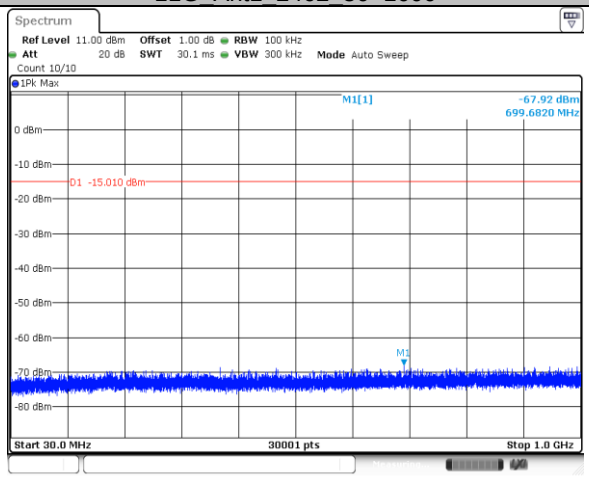


11G_Ant1_2462_30~1000



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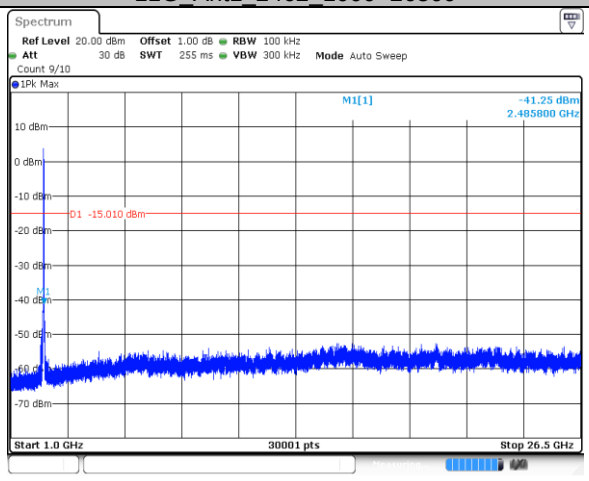

11N20SISO_Ant1_2412_0~Reference

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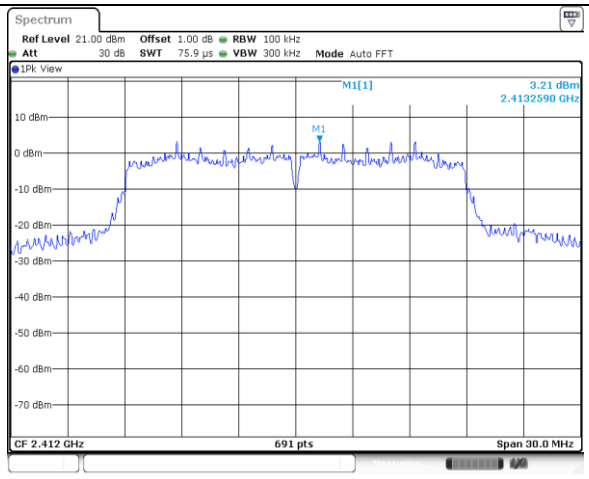
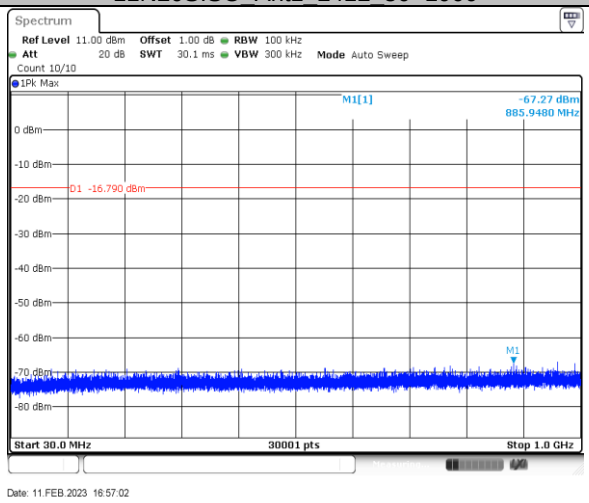
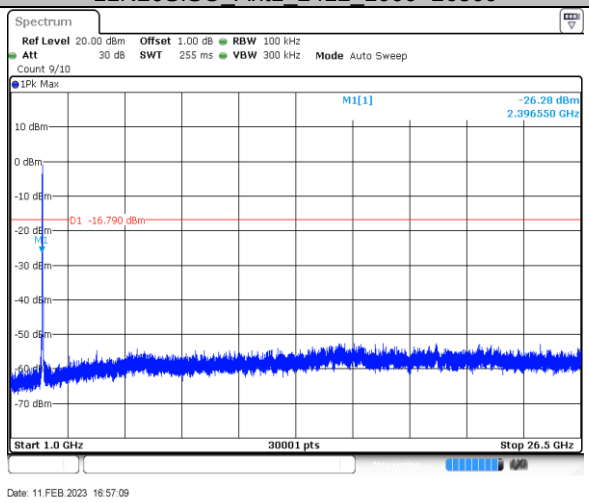


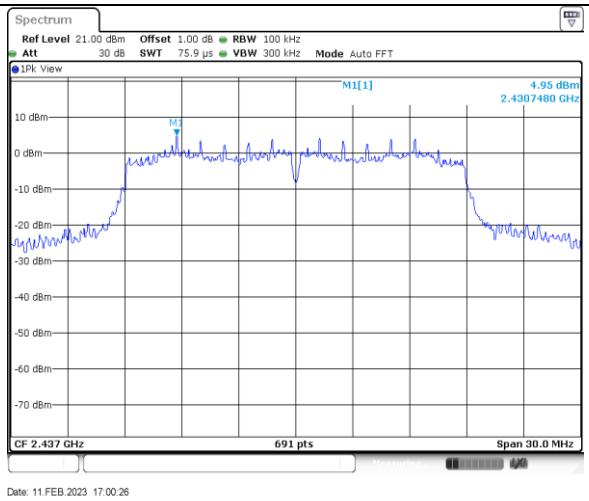
11N20SISO_Ant1_2412_30~1000



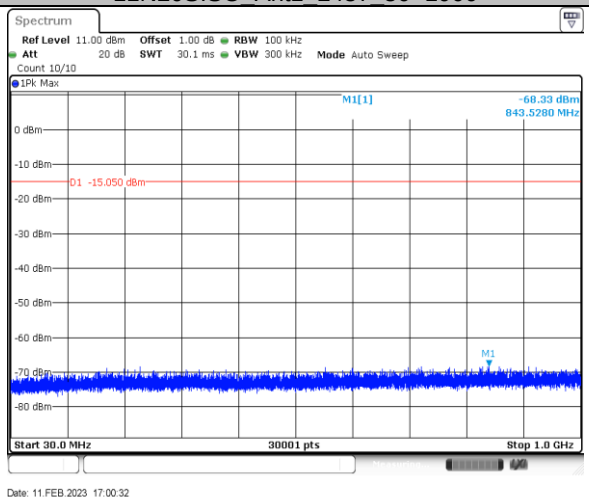
11N20SISO_Ant1_2412_1000~26500



11N20SISO_Ant1_2437_0~Reference



11N20SISO_Ant1_2437_30~1000



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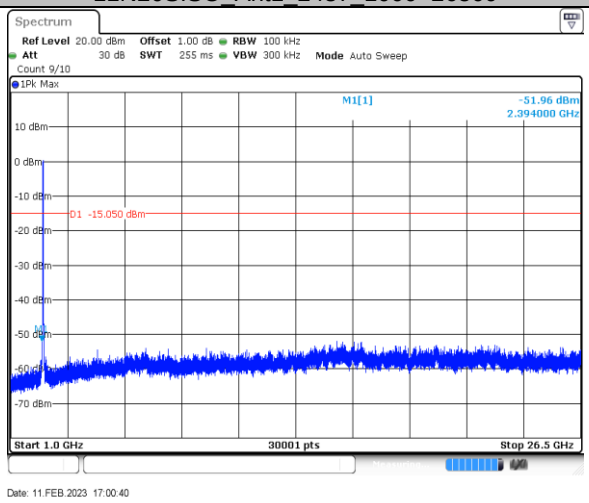

11N20SISO_Ant1_2462_0~Reference

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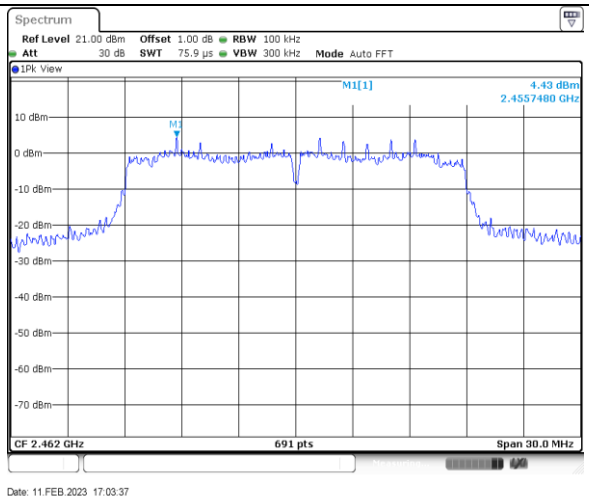
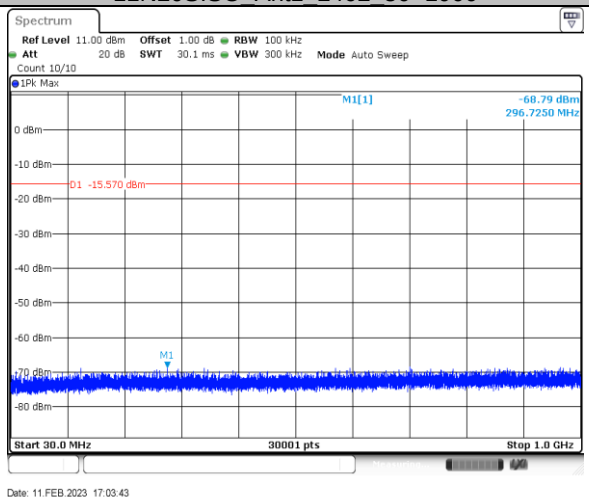
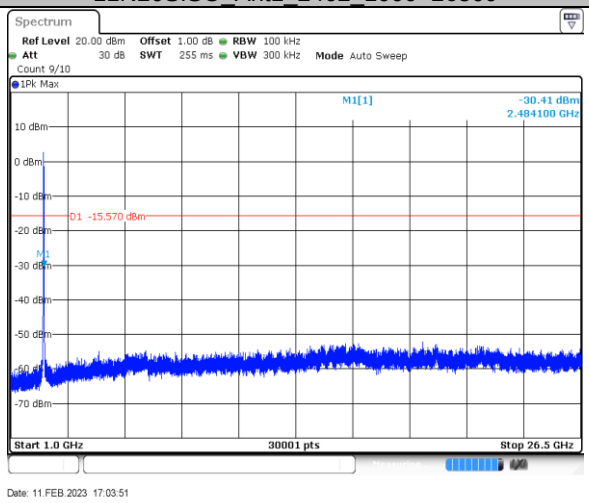


11N20SISO_Ant1_2462_30~1000



11N20SISO_Ant1_2462_1000~26500



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9.6 Band edge testing

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize, use the peak and delta measurement to record the result.
5. The level displayed must comply with the limit specified in this Section.
6. Repeat above procedures until all frequencies measured were complete and submit all the plots.

Limit:

According to §15.247(d) and RSS-247 5.5, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen 8.10, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

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

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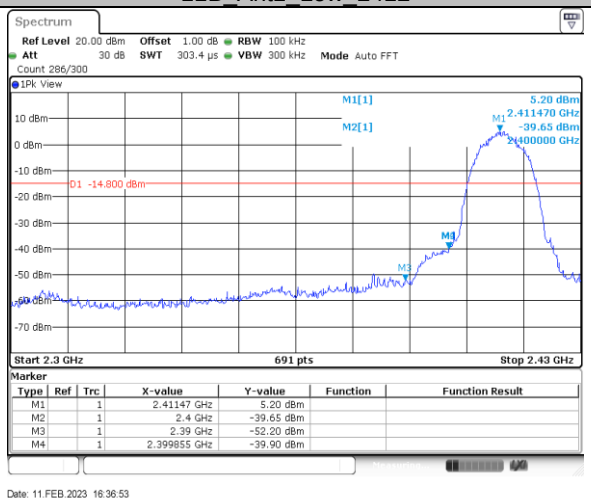
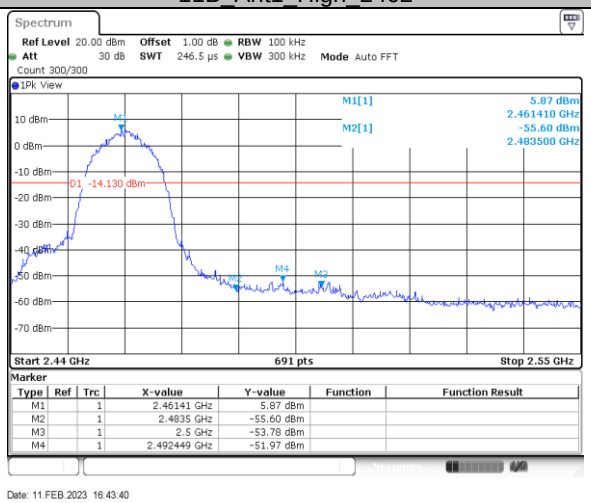
Band edge testing

TestMode	Antenna	ChName	Channel (MHz)	RefLevel (dBm)	Result (dBm)	Limit (dBm)	Verdict
11B	Ant0	Low	2412	5.20	-39.90	<=-14.80	PASS
	Ant0	High	2462	5.87	-51.97	<=-14.13	PASS
11G	Ant0	Low	2412	3.63	-23.61	<=-16.37	PASS
	Ant0	High	2462	5.24	-33.83	<=-14.76	PASS
11N20	Ant0	Low	2412	3.03	-23.59	<=-16.97	PASS
	Ant0	Low	2462	3.98	-29.27	<=-16.02	PASS

11B_Ant1_Low_2412



11B_Ant1_High_2462



11G_Ant1_Low_2412

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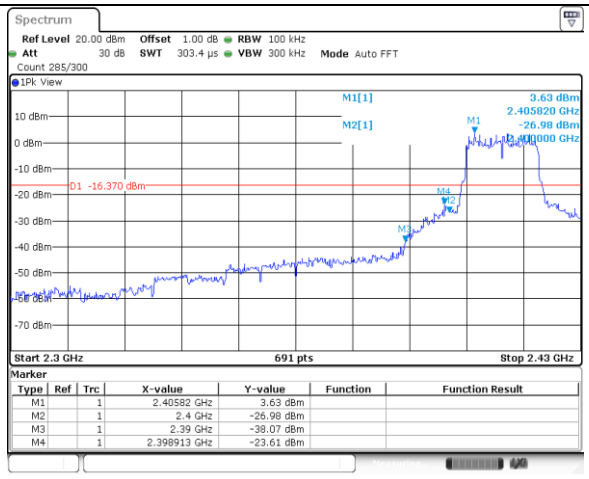
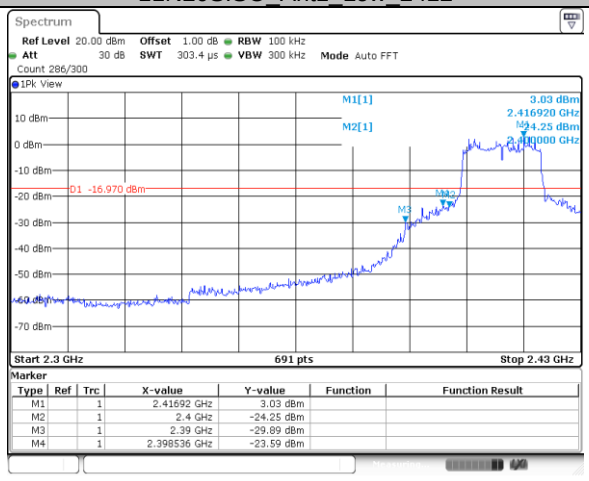
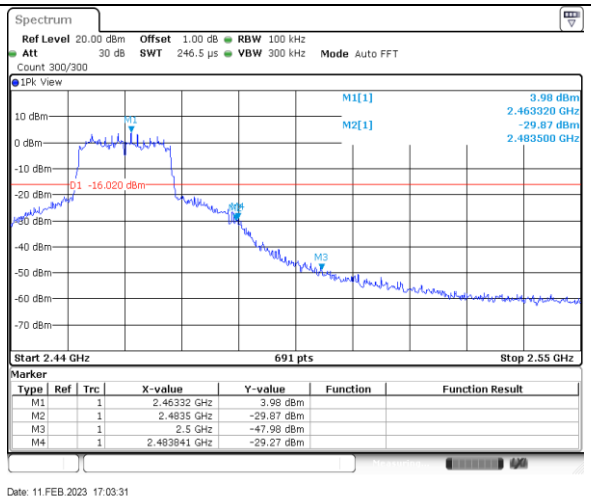


11G_Ant1_High_2462

11N20SISO_Ant1_Low_2412



11N20SISO_Ant1_High_2462



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9.7 Spurious radiated emissions for transmitter

Test Method

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following test receiver settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 KHz to 120KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1MHz.

b) VBW \ [3 × RBW].

c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.

d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction

factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

The radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section15.205 & RSS-GEN 8.10, must comply with the radiated emission limits specified in section 15.209 & RSS-Gen 6.13.

Frequency MHz	Field Strength µ V/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Note 1: Limit 3m(dBµV/m)=Limit 300m(dBµV/m)+40Log(300m/3m) (Below 30MHz)
Note 2: Limit 3m(dBµV/m)=Limit 30m(dBµV/m)+40Log(30m/3m) (Below 30MHz)

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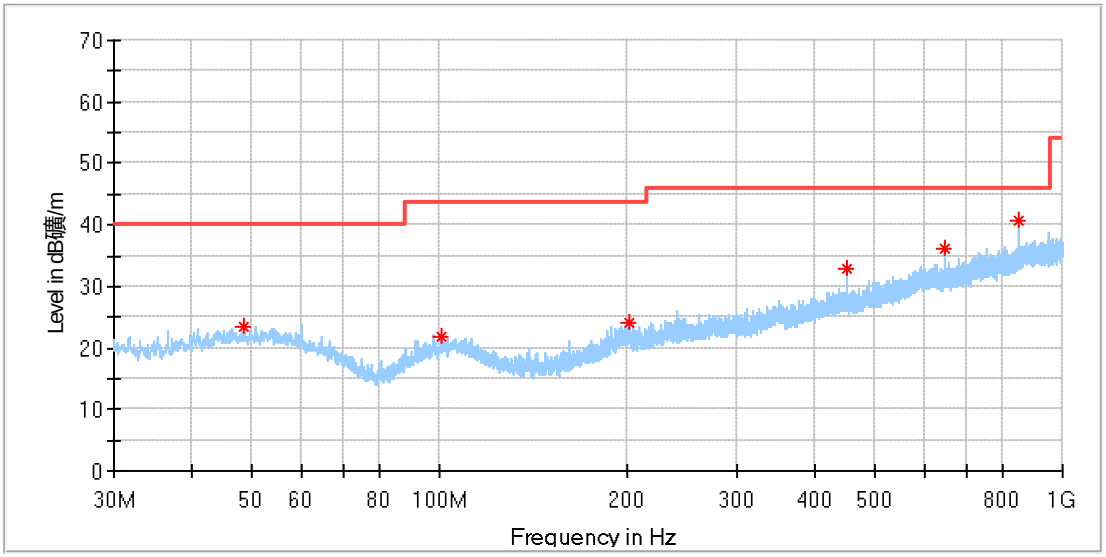
Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Transmitting spurious emission test result as below:

30MHz to 1000MHz:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
48.551250	23.33	40.00	16.67	200.0	H	0.0	20.56
100.506875	21.78	43.50	21.72	200.0	H	86.0	18.89
201.386875	24.15	43.50	19.35	200.0	H	0.0	18.97
449.949375	32.74	46.00	13.26	200.0	H	0.0	24.80
648.011250	36.28	46.00	9.72	200.0	H	184.0	28.47
850.013750	40.68	46.00	5.32	200.0	H	0.0	31.02

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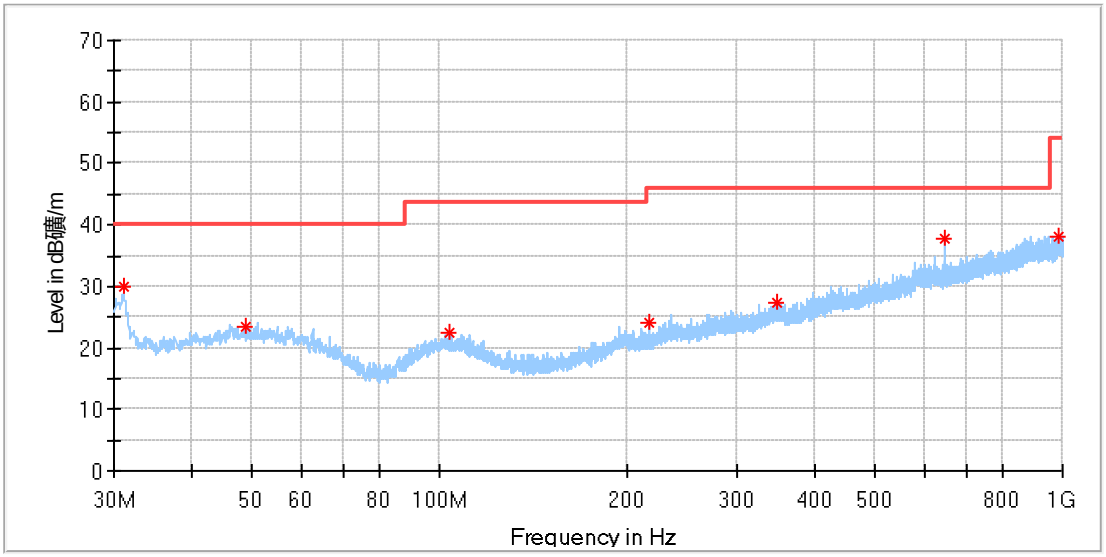

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
31.091250	29.92	40.00	10.08	100.0	V	127.0	17.79
48.915000	23.38	40.00	16.62	200.0	V	131.0	20.64
103.780625	22.42	43.50	21.08	100.0	V	283.0	19.04
216.664375	24.06	43.50	19.44	200.0	V	0.0	18.77
346.765625	27.27	46.00	18.73	100.0	V	168.0	23.23
647.950625	37.90	46.00	8.10	100.0	V	243.0	28.47
983.206875	38.25	54.00	15.75	100.0	V	0.0	32.36

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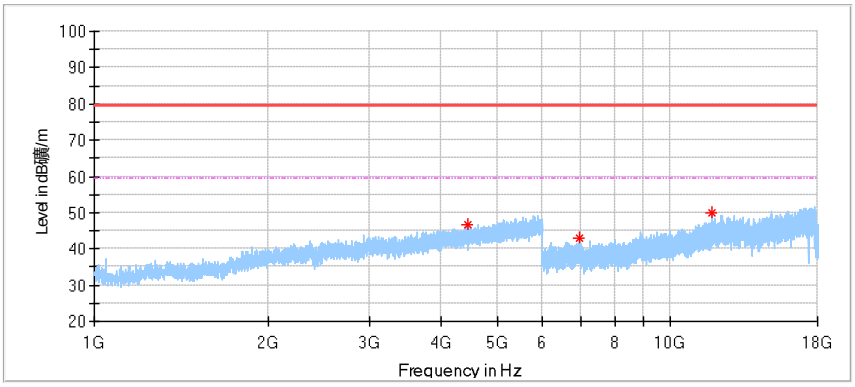
1GHz -18GHz:

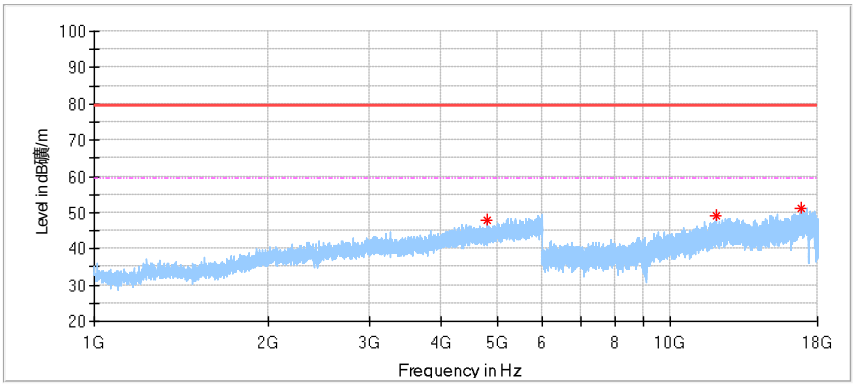
11B-Ant0_2412MHz

Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
4445.500000	46.86	79.50	32.64	H	69.0	3.07
6947.000000	43.06	79.50	36.44	H	354.0	9.65
11809.500000*	49.77	79.50	29.73	H	172.0	16.55

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
4810.000000*	47.70	79.50	31.80	V	301.0	3.75
11986.500000*	48.96	79.50	30.54	V	147.0	17.21
16829.000000	51.14	79.50	28.36	V	280.0	23.87

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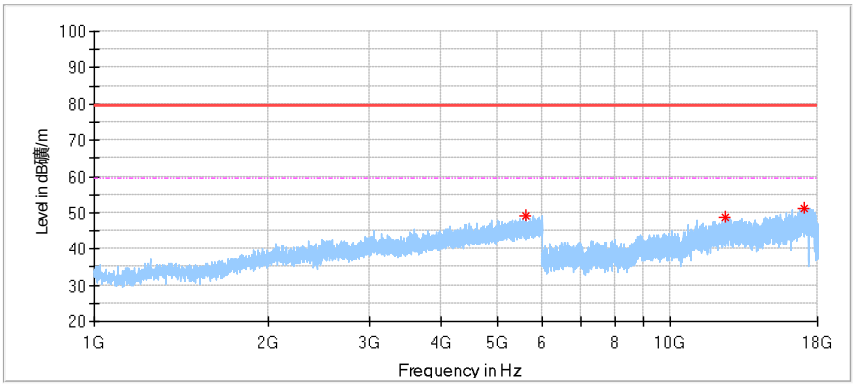
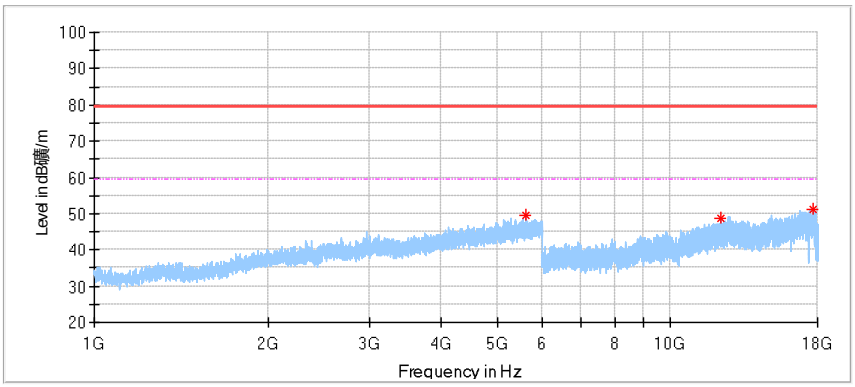
11B-Ant0_2437MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
5607.500000	49.02	79.50	30.48	H	0.0	5.65
12453.500000*	48.90	79.50	30.60	H	6.0	17.23
17111.500000	51.33	79.50	28.17	H	356.0	24.14

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
5600.000000	49.43	79.50	30.07	V	88.0	5.70
12234.500000*	48.80	79.50	30.70	V	136.0	17.31
17640.000000	51.24	79.50	28.26	V	274.0	23.87

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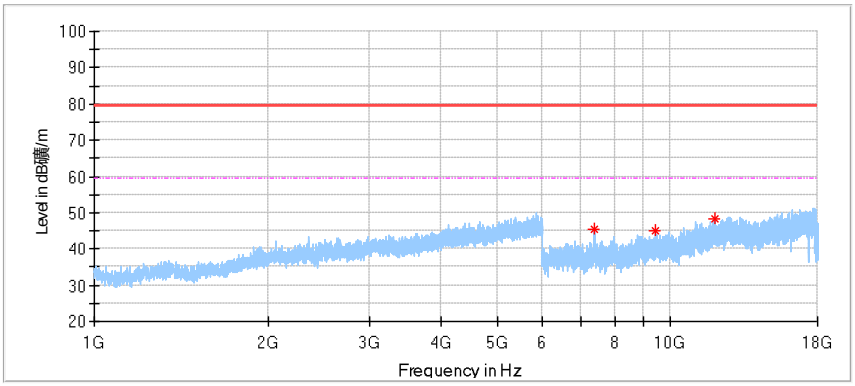
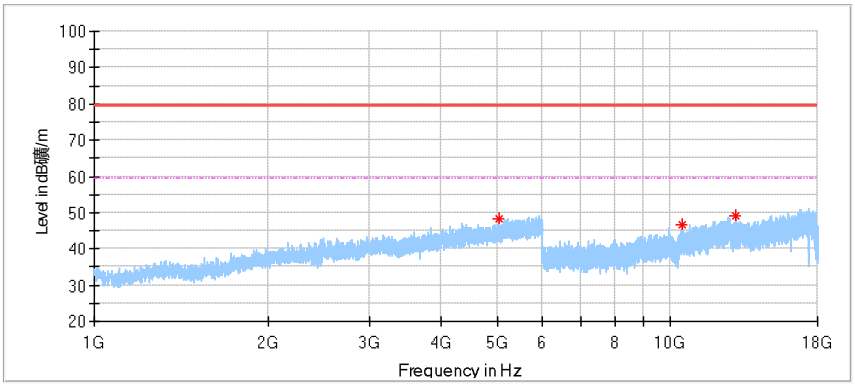
11B-Ant0_2462MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
7379.000000*	45.36	79.50	34.14	H	302.0	9.59
9405.000000*	45.23	79.50	34.27	H	26.0	13.47
11948.000000*	48.16	79.50	31.34	H	57.0	17.05

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
5035.500000*	48.41	79.50	31.09	V	4.0	4.49
10453.500000	46.59	79.50	32.91	V	331.0	14.05
13007.500000	49.09	79.50	30.41	V	356.0	17.81

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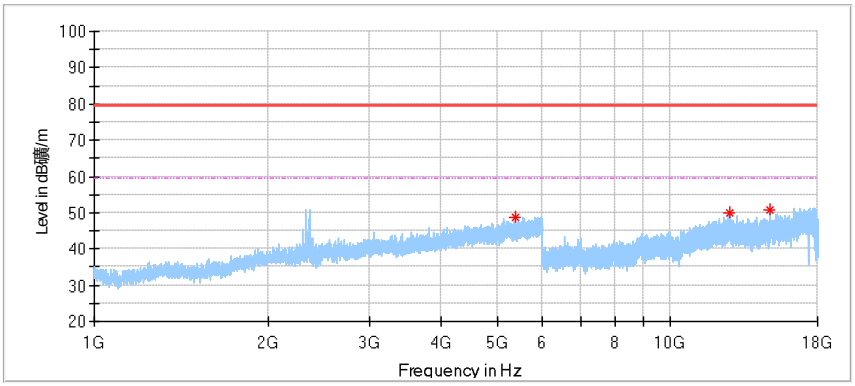
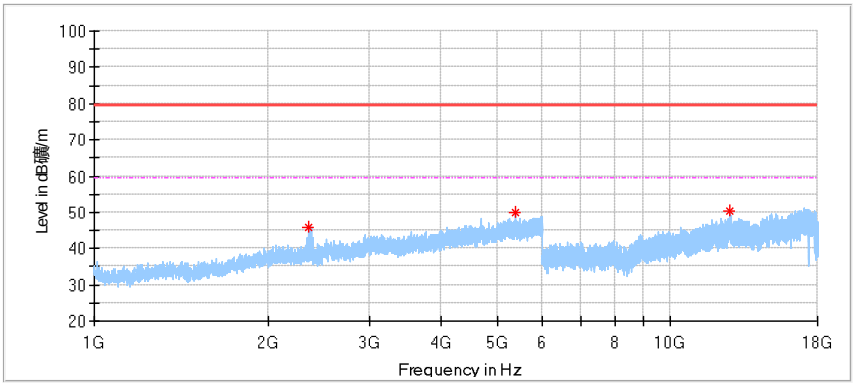
11G-Ant0_2412MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
5375.000000*	48.68	79.50	30.82	H	299.0	5.32
12674.000000*	49.82	79.50	29.68	H	356.0	18.29
14898.500000	50.72	79.50	28.78	H	162.0	18.73

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
2352.500000*	46.03	79.50	33.47	V	121.0	-3.32
5374.000000*	49.76	79.50	29.74	V	0.0	5.32
12651.500000*	50.21	79.50	29.29	V	269.0	18.59

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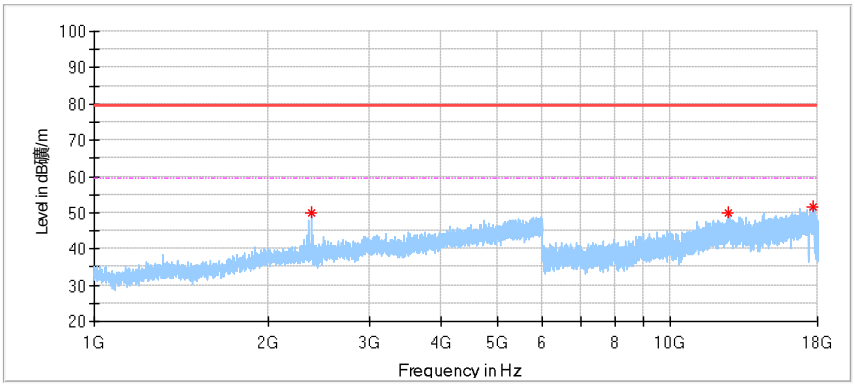
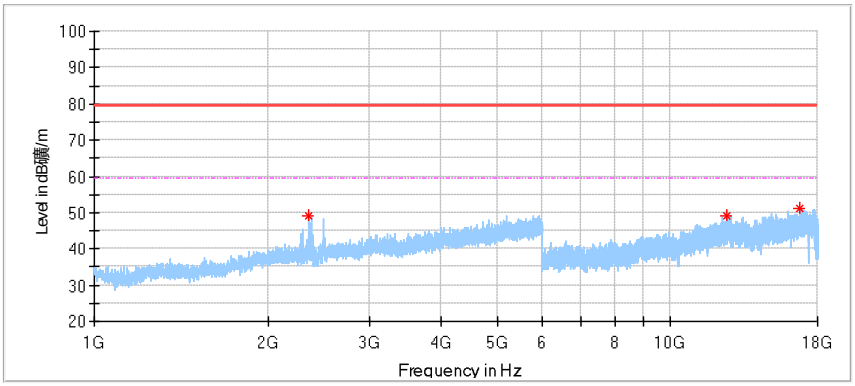
11G-Ant0_2437MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.000000*	49.88	79.50	29.62	H	148.0	-2.93
12625.500000*	49.95	79.50	29.55	H	0.0	18.46
17713.000000*	51.51	79.50	27.99	H	190.0	23.85

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
2350.500000*	48.98	79.50	30.52	V	9.0	-3.33
12540.000000*	49.28	79.50	30.22	V	57.0	17.58
16807.500000	51.38	79.50	28.12	V	162.0	23.83

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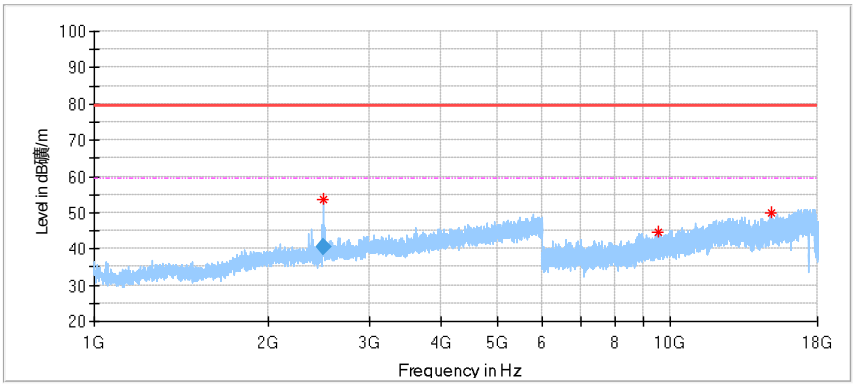
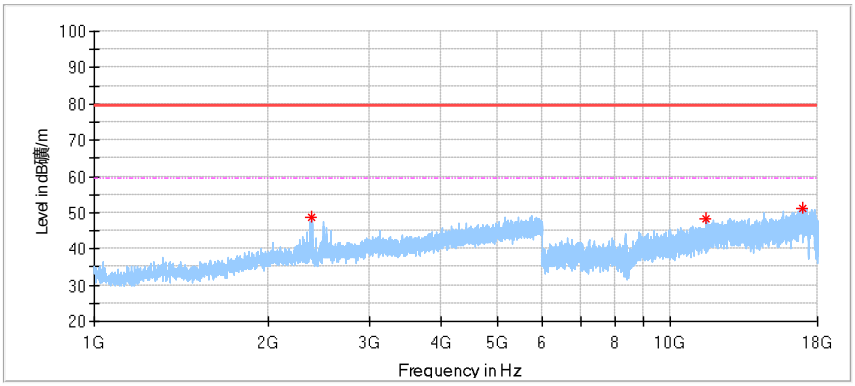
11G-Ant0_2462MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
2500.000000*	53.84	79.50	25.66	H	308.0	-2.19
9511.000000	44.62	79.50	34.88	H	80.0	13.70
14925.000000	50.03	79.50	29.47	H	356.0	18.78

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.500000*	48.75	79.50	30.75	V	15.0	-2.92
11500.000000*	48.10	79.50	31.40	V	241.0	15.59
16922.500000	51.02	79.50	28.48	V	131.0	24.08

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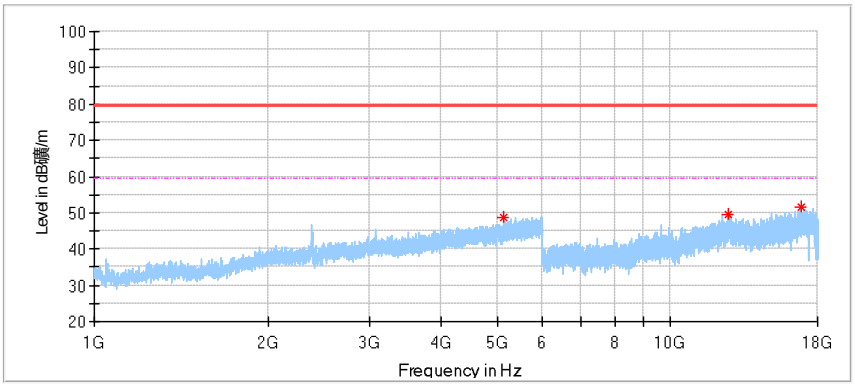
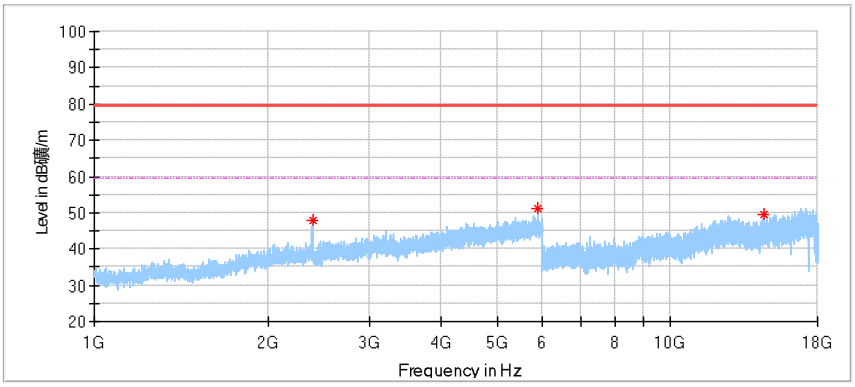
11N-HT20-Ant 0_2412MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
5146.500000	48.71	79.50	30.79	H	112.0	5.22
12592.500000*	49.74	79.50	29.76	H	213.0	18.12
16884.000000	51.41	79.50	28.09	H	269.0	23.99

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.000000*	47.84	79.50	31.66	V	0.0	-2.92
5885.500000	51.23	79.50	28.27	V	196.0	6.33
14495.000000*	49.67	79.50	29.83	V	161.0	17.76

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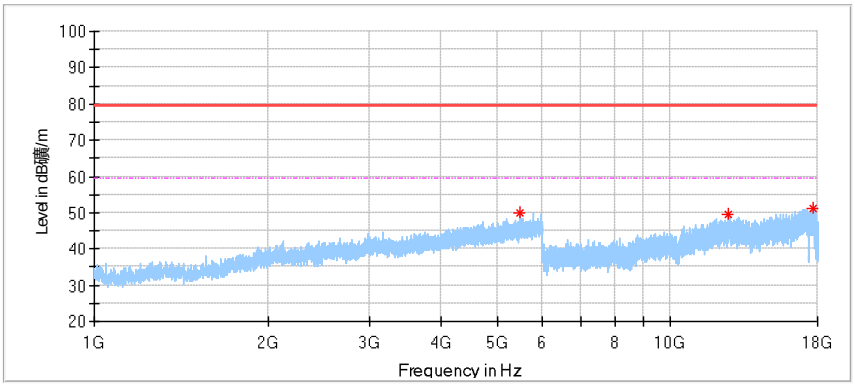
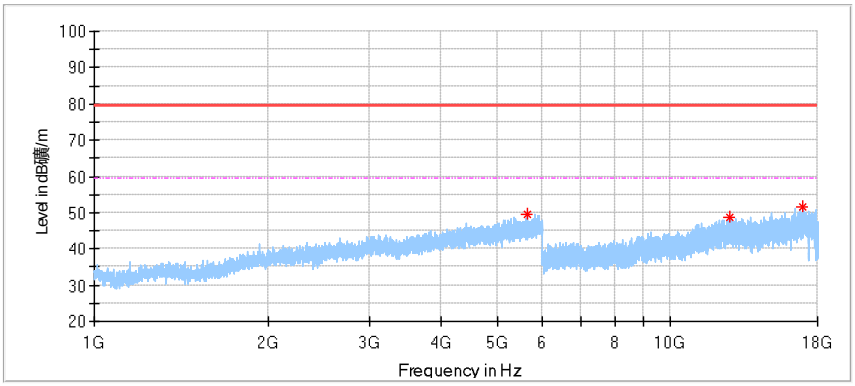
11N-HT20-Ant 0_2437MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
5492.500000	49.79	79.50	29.71	H	112.0	5.69
12598.000000*	49.54	79.50	29.96	H	30.0	18.18
17670.000000	51.30	79.50	28.20	H	244.0	23.86

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
5651.500000	49.40	79.50	30.10	V	148.0	5.36
12646.000000*	48.81	79.50	30.69	V	54.0	18.67
16946.000000	51.42	79.50	28.08	V	106.0	24.13

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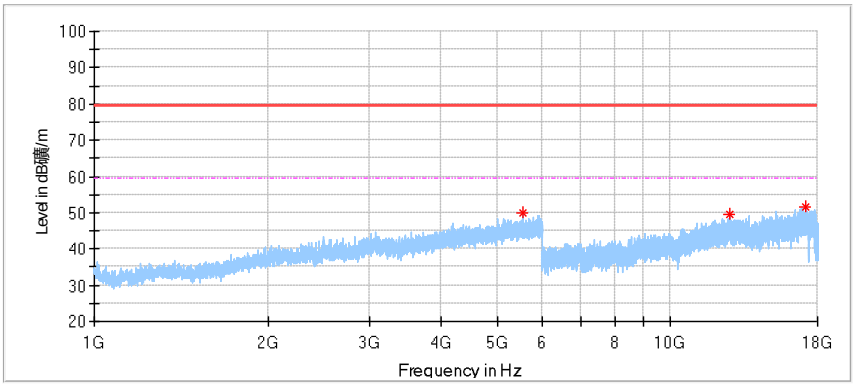
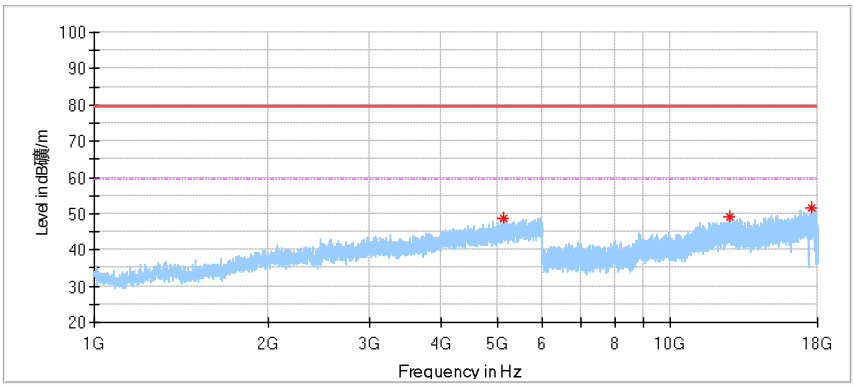
11N-HT20-Ant 0_2462MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
5539.000000	49.84	79.50	29.66	H	294.0	5.67
12666.500000*	49.64	79.50	29.86	H	106.0	18.39
17114.500000	51.39	79.50	28.11	H	106.0	24.15

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
5139.000000	48.65	79.50	30.85	V	149.0	5.17
12654.000000*	49.07	79.50	30.43	V	161.0	18.56
17538.000000	51.78	79.50	27.72	V	216.0	23.77

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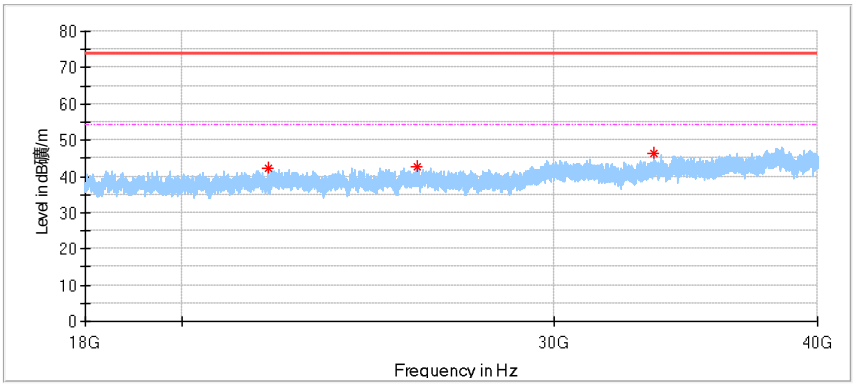
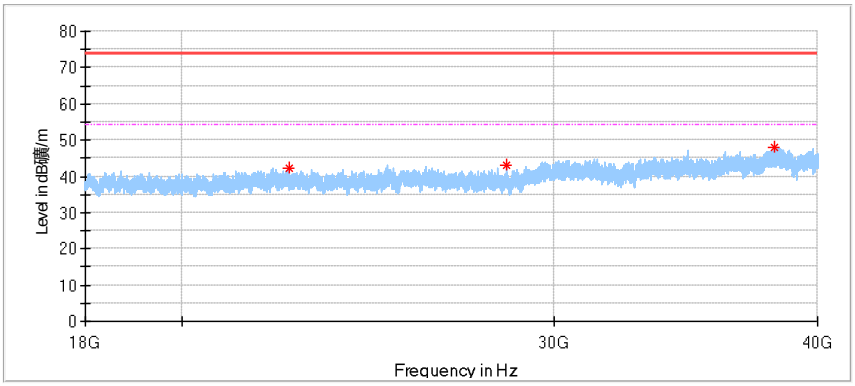
Above 18GHz:

11B_2412MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
21983.375000	42.34	74.00	31.66	H	192.0	-0.06
25854.000000	42.80	74.00	31.20	H	354.0	1.64
33459.125000	46.26	74.00	27.74	H	299.0	2.71

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
22470.812500*	42.22	74.00	31.78	V	356.0	0.43
28475.437500	42.97	74.00	31.03	V	155.0	0.97
38145.812500	47.88	74.00	26.12	V	345.0	5.72

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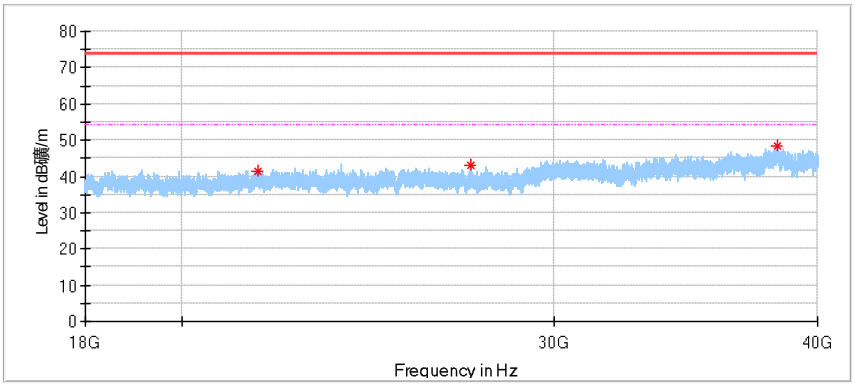
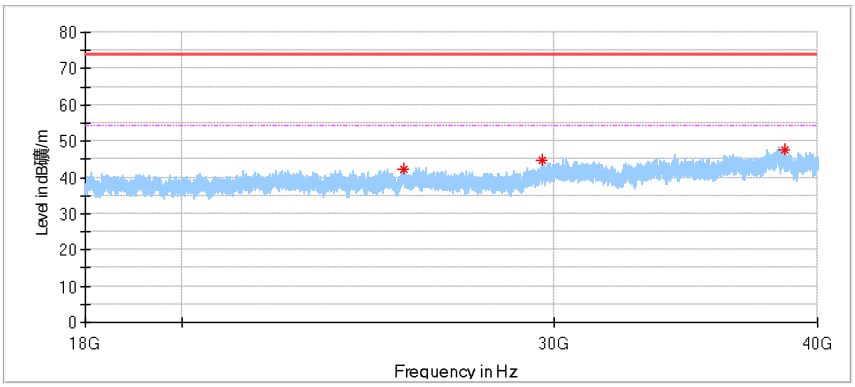
11B _2437MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
21736.562500	41.55	74.00	32.45	H	199.0	-0.20
27397.437500	43.08	74.00	30.92	H	61.0	1.76
38308.062500	48.29	74.00	25.71	H	280.0	6.46

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
25491.000000	42.26	74.00	31.74	V	141.0	1.48
29640.750000	44.69	74.00	29.31	V	0.0	1.92
38567.937500	47.50	74.00	26.50	V	202.0	6.29

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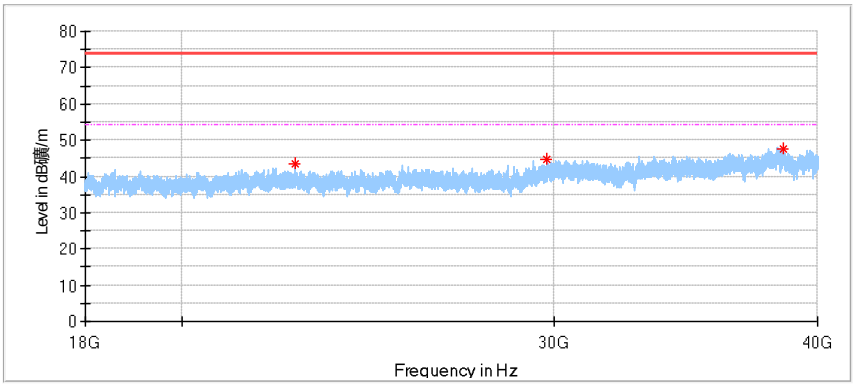
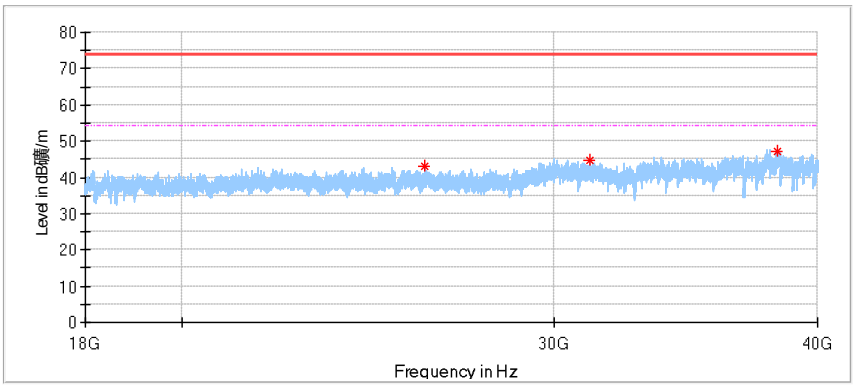
11B _2462MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
22639.250000*	43.40	74.00	30.60	H	358.0	0.33
29763.812500	44.53	74.00	29.47	H	4.0	1.97
38528.750000	47.52	74.00	26.48	H	248.0	6.45

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
26069.187500	43.25	74.00	30.75	V	261.0	1.55
31224.062500*	44.83	74.00	29.17	V	329.0	1.52
38270.250000	47.12	74.00	26.88	V	309.0	6.31

Remark:

(1) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205 & RSS-GEN 8.10.
(2) Data of measurement within frequency range 9kHz-30MHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.
(3) Corrected Amplitude = Read level + Corrector factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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10 Test Equipment List

Radiated Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2023-5-27
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9162	68-4-80-19-003	284	1	2023-7-12
Loop Antenna	Rohde & Schwarz	HFH2-Z2	68-4-80-14-006	100398	1	2023-8-17
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2023-6-19
Pre-amplifier	Rohde & Schwarz	SCU 08F2	68-4-29-19-004	08400018	1	2023-8-17
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2023-5-28
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2023-5-27
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2023-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.35.02	N/A	N/A

Radiated Emission 2# Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2023-5-28
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9162	68-4-80-19-003	284	1	2024-1-16
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	1	2023-5-9
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2023-5-28
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	1	2023-5-28
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2023-7-12
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2023-7-27
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	1	2023-5-27
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2023-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.35.02	N/A	N/A

Conducted Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	68-4-74-19-002	102590	1	2023-5-27
LISN	Rohde & Schwarz	ENV216	68-4-87-19-001	102472	1	2023-5-27
Attenuator	Shanghai Huaxiang	TS2-26-3	68-4-81-16-003	080928189	1	2023-5-27
Test software	Rohde & Schwarz	EMC32	68-4-90-19-005-A01	Version10.35.02	N/A	N/A
Shielding Room	TDK	CSR #2	68-4-90-19-005	----	3	2025-10-15

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Conducted RF Test System

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	1	2023-5-27
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	68-4-93-14-003	101226/100851	1	2023-5-27
Power Splitter	Weinschel	1580	68-4-85-14-001	SC319	1	2023-5-28
10dB Attenuator	Weinschel	4M-10	68-4-81-14-003	43152	1	2023-5-27
10dB Attenuator	R&S	DNF	68-4-81-14-004	DNF-001	1	2023-5-27
10dB Attenuator	R&S	DNF	68-4-81-14-005	DNF-002	1	2023-5-27
10dB Attenuator	R&S	DNF	68-4-81-14-006	DNF-003	1	2023-5-27
10dB Attenuator	R&S	DNF	68-4-81-14-007	DNF-004	1	2023-5-27
Test software	Tonscend	System for BT/WIFI	68-4-74-14-006-A13	Version 2.6.77.0518	N/A	N/A
Shielding Room	TDK	TS8997	68-4-90-19-003	----	3	2025-10-15

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11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz (for test using AMN ENV432 or ENV4200)	3.33dB
Uncertainty for Radiated Spurious Emission 30MHz-1000MHz	Horizontal: 4.59dB; Vertical: 4.75dB;
Uncertainty for Radiated Spurious Emission 1000MHz-18000MHz	Horizontal: 5.08dB; Vertical: 5.09dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 3.14dB; Vertical: 3.12dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.31dB Frequency test involved: 0.6×10-8 or 1%
Uncertainty Evaluation for Humidity	0.936%
Uncertainty Evaluation for Temperature	0.195 °C

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

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