TEST REPORT

APPLICANT	:	Testo SE & Co. KGaA
PRODUCT NAME	:	WLAN data logger
MODEL NAME	:	testo 160 T
BRAND NAME	:	testo
FCC ID	:	WAF-05722019
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2024-12-16
TEST DATE	:	2024-12-17 to 2025-01-15
ISSUE DATE	:	2025-02-20

Edited by: Zeng Xiaoying (Rapporteur)

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Change History		
Version	**Date**	**Reason for change**
1.0	2025-02-20	First edition

1. Summary of Test Result

No.	Section	Description	Test Date	Test Engineer	Result	Method Determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	N/A	Duty Cycle of Test Signal	Dec. 20, 2024	Li Xinpeng	PASS	No deviation
3	15.247(b)	Maximum Peak Conducted Output Power	Dec. 25, 2024	Li Xinpeng	PASS	No deviation
4	15.247(b)	Maximum Average Conducted Output Power	Dec. 25, 2024	Li Xinpeng	PASS	No deviation
5	15.247(a)	Bandwidth	Dec. 20, 2024	Li Xinpeng	PASS	No deviation
6	15.247(d)	Conducted Spurious Emission and Band Edge	Jan. 15, 2025	Li Xinpeng	PASS	No deviation
7	15.247(e)	Power Spectral Density	Jan. 15, 2025	Li Xinpeng	PASS	No deviation
8	15.207	Conducted Emission	Dec. 18, 2024	Fan Shengquan	PASS	No deviation
9	15.247(d)	Restricted Frequency Bands	Jan. 15, 2025	Li Hanbin	PASS	No deviation
10	15.209, 15.247(d)	Radiated Emission	Dec. 23&24, 2024	Li Hanbin	PASS	No deviation

Note 1: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013 and KDB 558074 D01 v05r02.

Note 2: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

Note 3: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

1.1. Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

• 47 CFR Part 15 Subpart C Radio Frequency Devices

1.2. Test Equipment List

1.2.1 Conducted Test Equipment

Equipment	Serial No.	Type	Manufacturer	Cal. Date	Due Date
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2024.02.19	2025.02.18
Power Sensor	MY54180008	U2021XA	Agilent	2024.09.11	2025.09.10
Attenuator	MTJ6004-20	VAT-10+	MTJ Cooperation	N/A	N/A
RF Cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
SMA Connector	CN01	RF03	HUBER-SUHNER	N/A	N/A

1.2.2 Conducted Emission Test Equipment

Equipment	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY56400093	N9038A	KEYSIGHT	2024.01.25	2025.01.24
LISN	8127449	NSLK 8127	Schwarzbeck	2024.02.02	2025.02.01
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2024.05.30	2025.05.29
RF Coaxial Cable (DC-100MHz)	BNC	MRE04	Qualwave	2024.07.02	2025.07.01

1.2.3 List of Software Used

Description	Manufacturer	Software Version
Test System	MaiWei	2.0.0.0
JS32-RE	Tonscend	5.0.0
TS+ -[JS32-CE]	Tonscend	2.5.0.0

1.2.4 Radiated Test Equipment

Equipment	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Signal Analyzer	MY56060145	N9020A	Agilent	2024.05.30	2025.05.29
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2024.06.22	2025.06.21
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2024.06.03	2025.06.02
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2024.06.22	2025.06.21
Test Antenna – Horn	BBHA9170 #773	BBHA9170	Schwarzbeck	2024.06.22	2025.06.21
Preamplifier (10MHz-6GHz)	46732	S10M100L3802	LUCIX CORP.	2024.05.30	2025.05.29
Preamplifier (2GHz-18GHz)	61171/61172	S020180L3203	LUCIX CORP.	2024.05.30	2025.05.29
Preamplifier (18GHz-40GHz)	DS77209	DCLNA0118-40C-S	Decentest	2024.05.30	2025.05.29
RF Coaxial Cable (DC-18GHz)	MRE001	PE330	Pasternack	2024.05.30	2025.05.29
RF Coaxial Cable (DC-18GHz)	MRE002	CLU18	Pasternack	2024.05.30	2025.05.29
RF Coaxial Cable (DC-18GHz)	MRE003	CLU18	Pasternack	2024.05.30	2025.05.29
RF Coaxial Cable (DC-40GHz)	22290045	QA360-40-KK-0.5	Qualwave	2024.07.03	2025.07.02
RF Coaxial Cable (DC-40GHz)	22290046	QA360-40-KKF-2	Qualwave	2024.07.03	2025.07.02
RF Coaxial Cable (DC-18GHz)	22120181	QA500-18-NN-5	Qualwave	2024.07.03	2025.07.02
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	N/A	N/A
Anechoic Chamber	N/A	9m*6m*6m	CRT	2022.05.10	2025.05.09

1.3. Measurement Uncertainty

Test Items	Uncertainty	Remark
Peak Output Power	±2.22dB	Confidence levels of 95%
Power Spectral Density	±2.22dB	Confidence levels of 95%
Bandwidth	±5%	Confidence levels of 95%
Conducted Spurious Emission	±2.77dB	Confidence levels of 95%
Restricted Frequency Bands	±5%	Confidence levels of 95%
Radiated Emission	±2.95dB	Confidence levels of 95%
Conducted Emission	±2.44dB	Confidence levels of 95%

1.4. Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
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FCC Designation Number:	CN1192
FCC Test Firm Registration Number:	226174

2. General Description

2.1. Information of Applicant and Manufacturer

Applicant:	Testo SE & Co. KGaA
Applicant Address:	Celsiusstr. 2, 79822 Titisee-Neustadt, Germany
Manufacturer:	Testo SE & Co. KGaA
Manufacturer Address:	Celsiusstr. 2, 79822 Titisee-Neustadt, Germany

2.2. Information of EUT

Product Name:	WLAN data logger	
Sample No.:	1#, 4#, 7#	
Hardware Version:	0216 1150	
Software Version:	V1.0.0	
Modulation Technology:	DSSS, OFDM	
Modulation Type:	Refer to section 2.4	
Wireless Technology:	802.11b, 802.11g, 802.11n (HT20)	
Operating Frequency Range:	2412MHz–2472MHz	
Antenna Type:	Dipole Antenna	
Antenna Gain:	2.49dBi	
Accessory Information:	AC Adapter	
	Brand Name:	N/A
	Model No.:	UES06WNCPU-050100SPA
	Serial No.:	N/A
	Rated Output:	5V⎓1A
	Rated Input:	100-240V~50/60Hz, 0.2A
	Manufacturer:	Dongguan Shilong Fuhua Electronic Co., Ltd

Note 1: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

2.3. Channel List of EUT

Nominal Channel Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**1**	**2412**	8	2447
	2	2417	9	2452
	3	2422	10	2457
	4	2427	11	2462
	5	2432	12	2467
	6	2437	**13**	**2472**
	7	**2442**		

Note 1: The black bold channels were selected for test.

2.4. Test Configuration of EUT

2.4.1. Modulation Type and Data Rate of EUT

Mode	Bandwidth (MHz)	Modulation Technology	Modulation Type	Data Rate
802.11b	20	DSSS	**DBPSK**	**1**/2/5.5/11Mbps
			DQPSK	
			CCK	
802.11g	20	OFDM	**BPSK**	**6**/9/12/18/24/36/48/54Mbps
			QPSK	
			16QAM	
			64QAM	
802.11n	20 (HT20)	OFDM	**BPSK**	**MCS0**~MCS7
			QPSK	
			16QAM	
			64QAM	

Note1: The worst-case mode (bold face) in all data rates has been determined during the pre-scan, only the test data of the worst-case were recorded in this report.

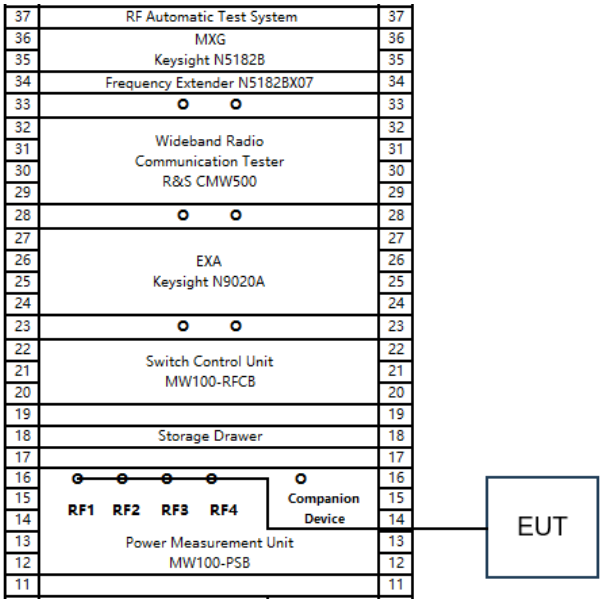
Note2: The RF signal transmission of EUT is controlled by the build-in engineering mode which is provided by the manufacturer. The recorded power setting value is the maximum that the engineering mode has configuration during testing.

2.5. Test Conditions

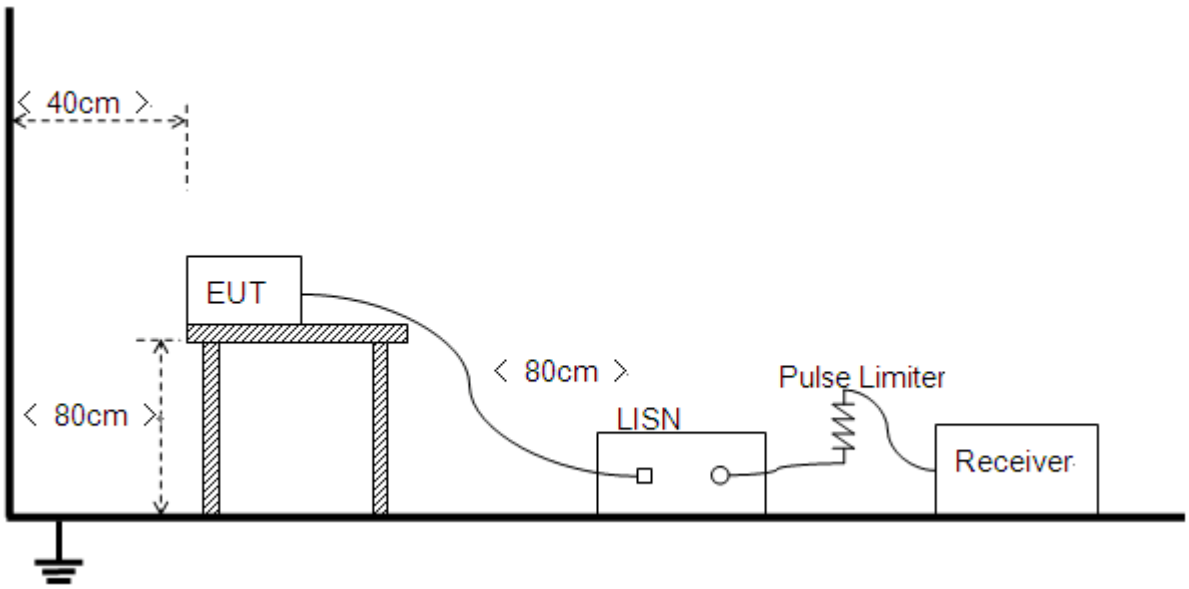
Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106

2.6. Test Setup Layout Diagram

2.6.1.Conducted Measurement

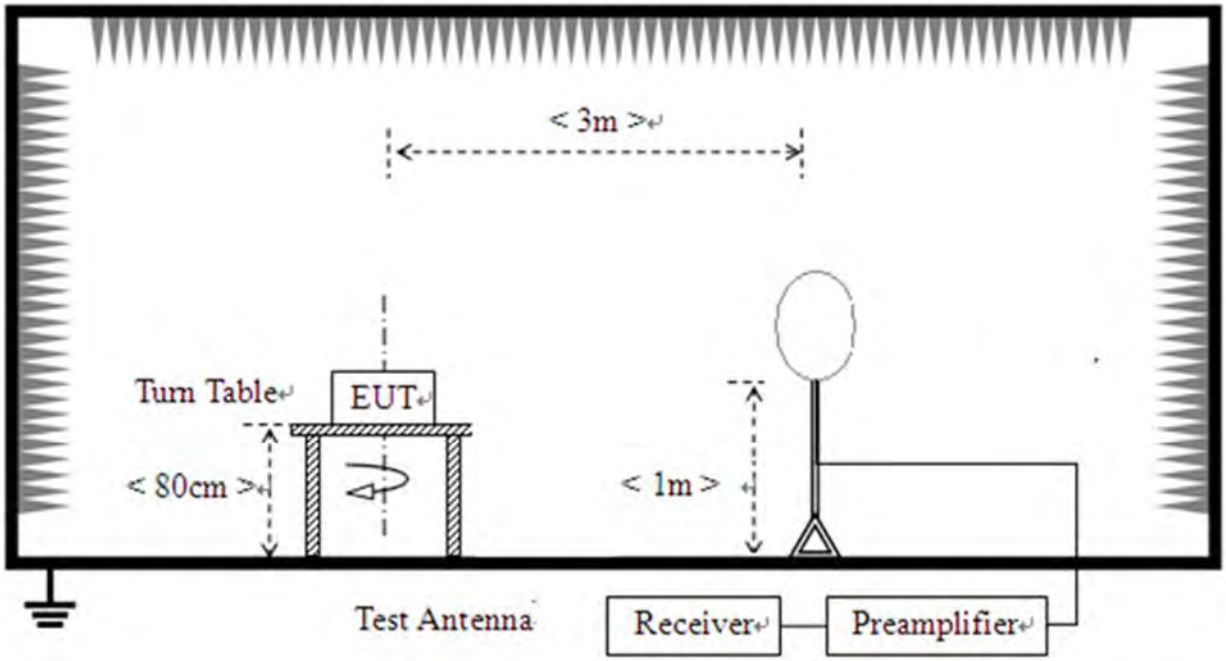


2.6.2.Conducted Emission Measurement

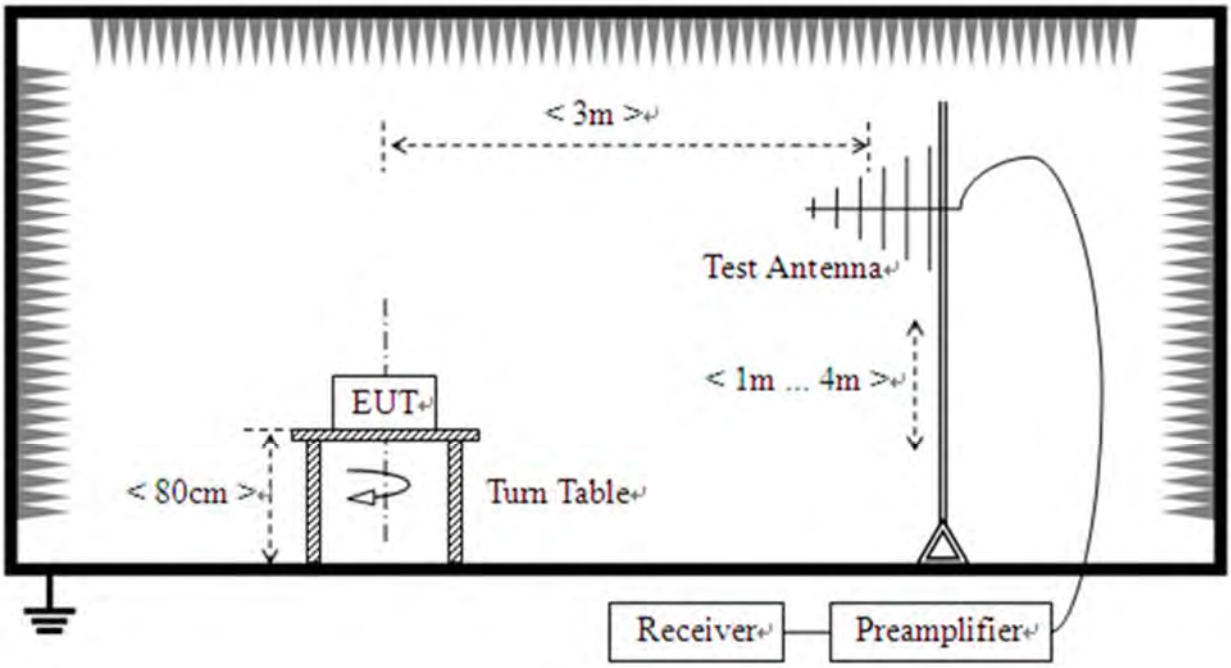


2.6.3.Radiation Measurement

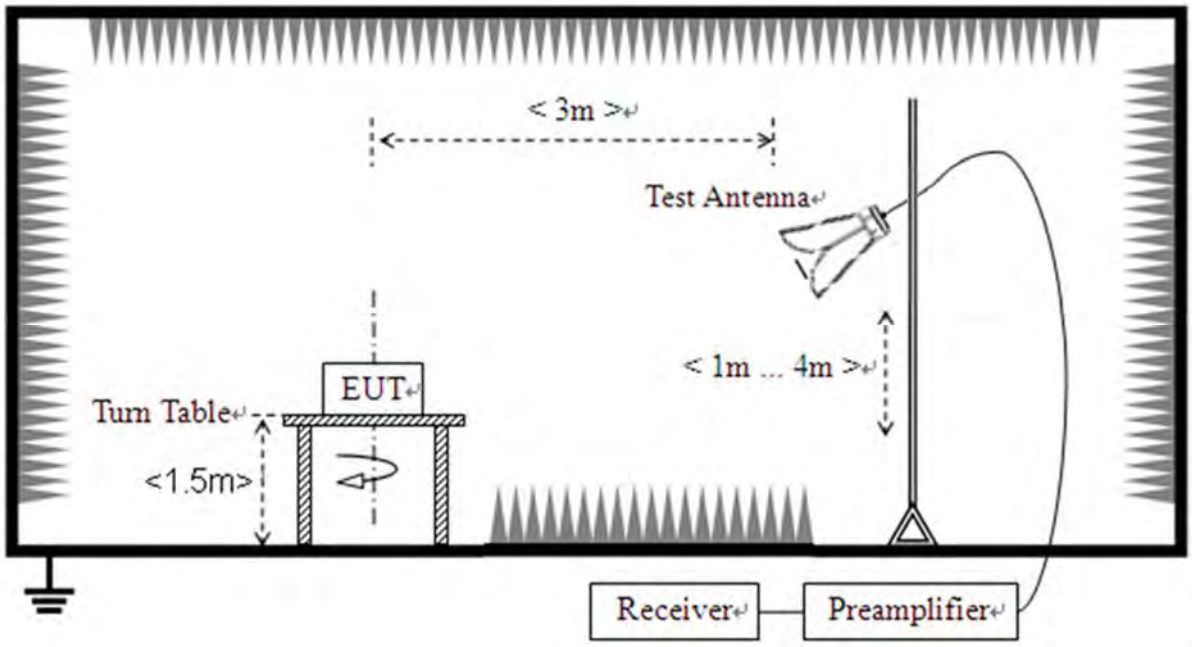
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



3. Test Results

3.1. Antenna Requirement

3.1.1.Requirement

According to FCC 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 an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.1.2.Test Result

Antenna location	Antenna Type	Coupling Method
☒Internal ☐External	☐FPC Antenna ☐Spring Antenna ☐Ceramic Antenna ☐Integrated Antenna ☒Dipole Antenna ☐PCB Antenna ☐PIFA Antenna ☐On-board Antenna	☒I-PEX Connector ☐SMA Connector ☐RP-SMA Connector ☐Metal Shrapnel ☐Layout

3.2. Duty Cycle of Test Signal

3.2.1.Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration(T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data are being acquired (i.e.,no transmitter OFF-time is to be considered).
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle (D). Within this sub clause, the duty cycle refers to the fraction of time over which the transmitter is ON and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ±2%; otherwise, the duty cycle is considered to be non constant.

3.2.2.Test Result

Refer to Annex A.1 in this report.

3.3. Maximum Peak and Average Conducted Output Power

3.3.1. Requirement

According to FCC section 15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: The maximum conducted output power of the intentional radiator shall not exceed 1 Watt.

3.3.2. Test Procedures

The EUT (Equipment under the test) which is coupled to the USB Wideband Power Sensor; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

3.3.3. Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.3.4. Test Result

Refer to Annex A.2 and A.3 in this report.

3.4.6 dB Bandwidth

3.4.1.Requirement

According to FCC section 15.247(a) (2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

3.4.1.Test Procedures

KDB 558074 Section 8.2 was used in order to prove compliance.

3.4.2.Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.4.3.Test Result

Refer to Annex A.4 in this report.

3.5. Conducted Spurious Emissions and Band Edge

3.5.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

3.5.2. Test Procedures

KDB 558074 Section 8.5 and 8.7 was used in order to prove compliance.

3.5.3. Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.5.4. Test Result

Refer to Annex A.5 and A.6 in this report.

3.6. Power Spectral Density

3.6.1.Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

3.6.2.Test Procedures

The measured power spectral density was calculated by the reading of the spectrum analyzer and calibration. Following is the test procedure for PSD test:
a) Set analyzer center frequency to channel center frequency
b) Set span to1.5 times DTS
c) Set RBW to 30kHz
d) Set VBW to 100kHz
e) Detector = peak
f) Sweep time = auto couple
g) Trace mode = max hold
h) Allow trace to fully stabilize
i) Use the peak marker function to determine the maximum amplitude level and recorded as PD
j) Use below formula to calculate the Conducted PSD value that at specified RBW:
Conducted PSD=PD-10lg(30k/3k)

3.6.3.Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.6.4.Test Result

Refer to Annex A.7 in this report.

3.7. Conducted Emission

3.7.1.Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

Note:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

3.7.2.Test Procedures

The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

3.7.3.Test Setup Layout

Refer to chapter 2.6.2 in this report.

3.7.4.Test Result

Refer to Annex A.8 in this report.

3.8. Restricted Frequency Bands

3.8.1.Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

3.8.2.Test Procedures

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.
For the Test Antenna:
Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1GHz
VBW = 3 MHz
Sweep = auto
Detector function = peak/average
Trace = max hold
Allow the trace to stabilize

3.8.3.Test Setup Layout

Refer to chapter 2.6.3 in this report.

3.8.4.Test Result

Refer to Annex A.9 in this report.

3.9. Radiated Emission

3.9.1.Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note1: For above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
Note2: For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table).

3.9.2.Test Procedures

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz.The antenna to EUT distance is 3meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 30MHz, the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9kHz-90 kHz, 110kHz-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

For measurements below 1GHz the resolution bandwidth is set to 100kHz for peak detection measurements or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1GHz the resolution bandwidth is set to 1MHz, the video band width is set to 3MHz for peak measurements and as applicable for average measurements.

The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions. For measurements above 1 GHz, keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.

3.9.3.Test Setup Layout

Refer to chapter 2.6.3 in this report.

3.9.4.Test Result

Refer to Annex A.10 in this report.

Annex A Test Data and Result

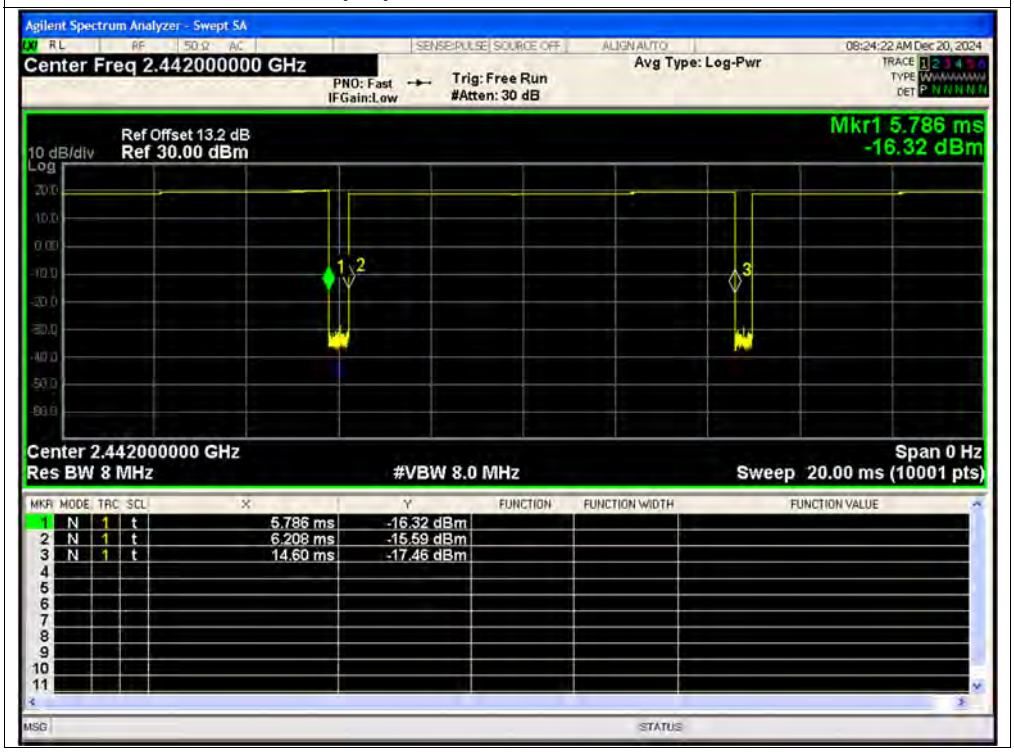
A.1. Duty Cycle of Test Signal

Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	b	2412	Ant1	94.63	0.24	0.12
NVNT	b	2442	Ant1	95.21	0.21	0.12
NVNT	b	2472	Ant1	95.8	0.19	0.12
NVNT	g	2412	Ant1	86.8	0.61	0.72
NVNT	g	2442	Ant1	88.23	0.54	0.72
NVNT	g	2472	Ant1	85.84	0.66	0.72
NVNT	n20	2412	Ant1	88.09	0.55	0.77
NVNT	n20	2442	Ant1	92.6	0.33	0.77
NVNT	n20	2472	Ant1	84.99	0.71	0.77

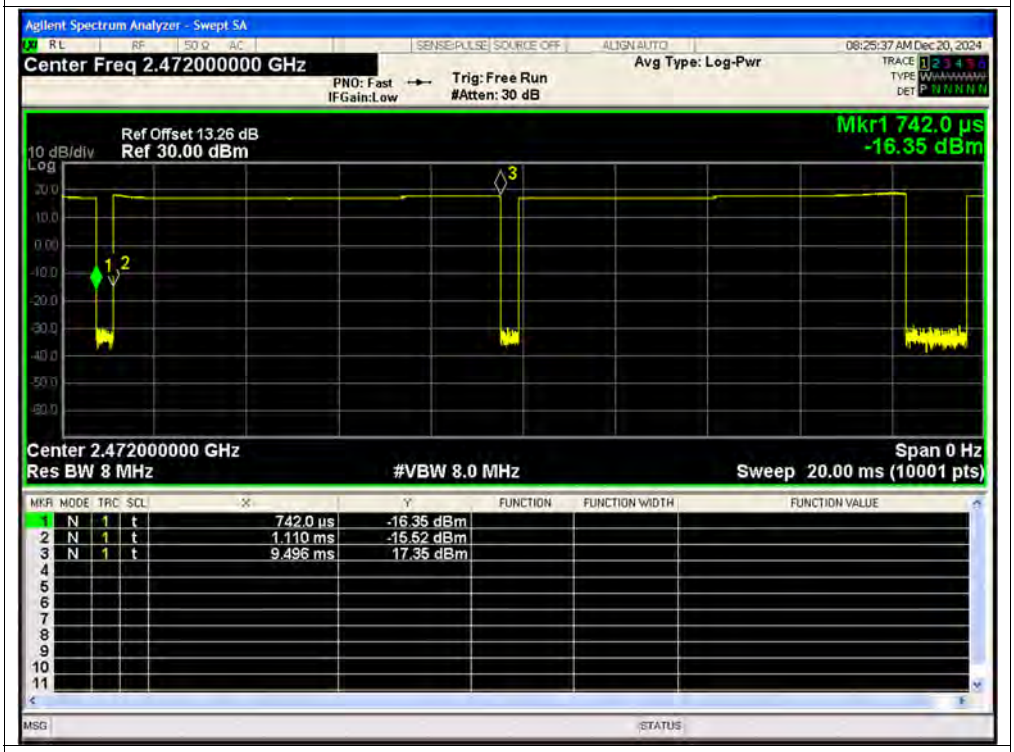
Test Graphs

Duty Cycle NVNT b 2412MHz Ant1

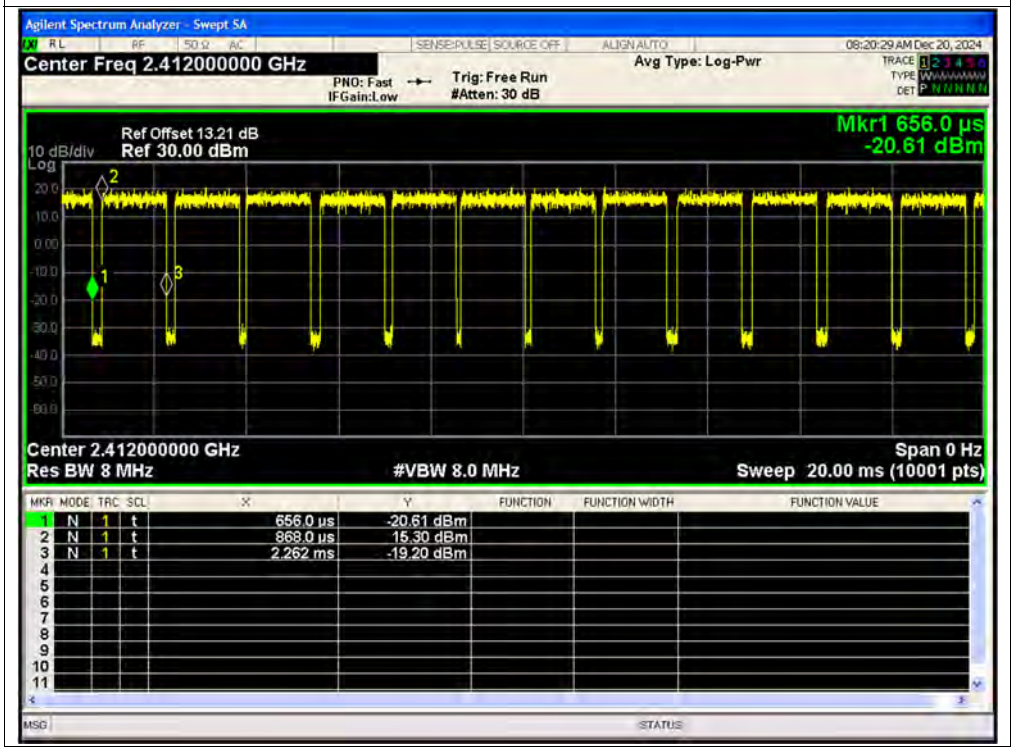
Duty Cycle NVNT b 2442MHz Ant1



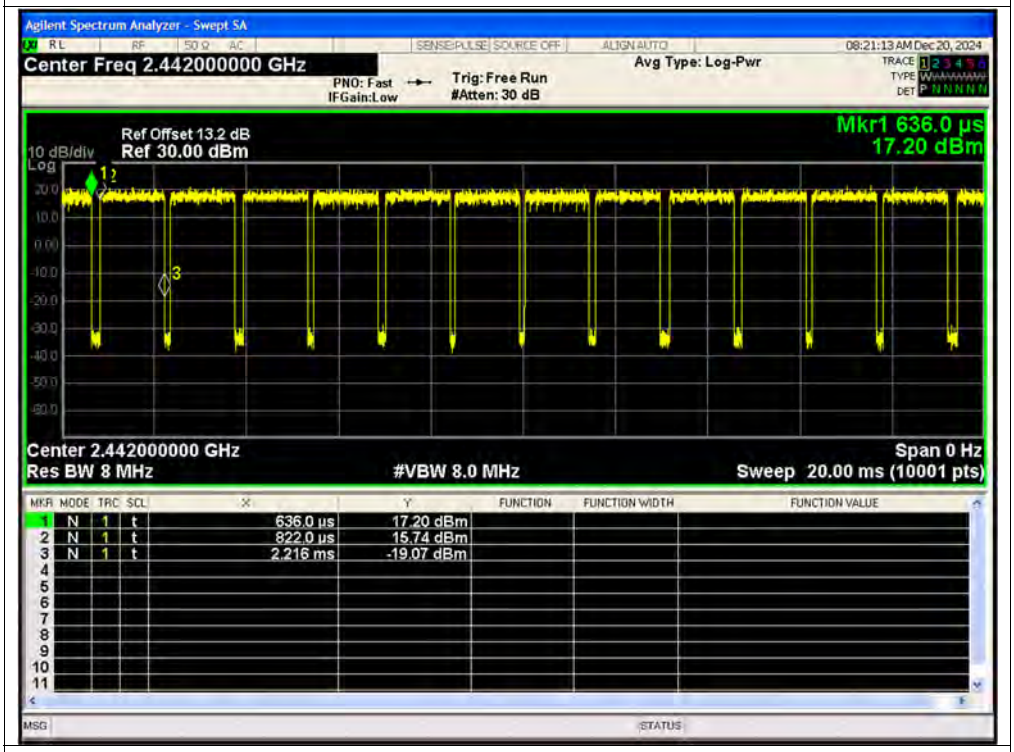
Duty Cycle NVNT b 2472MHz Ant1



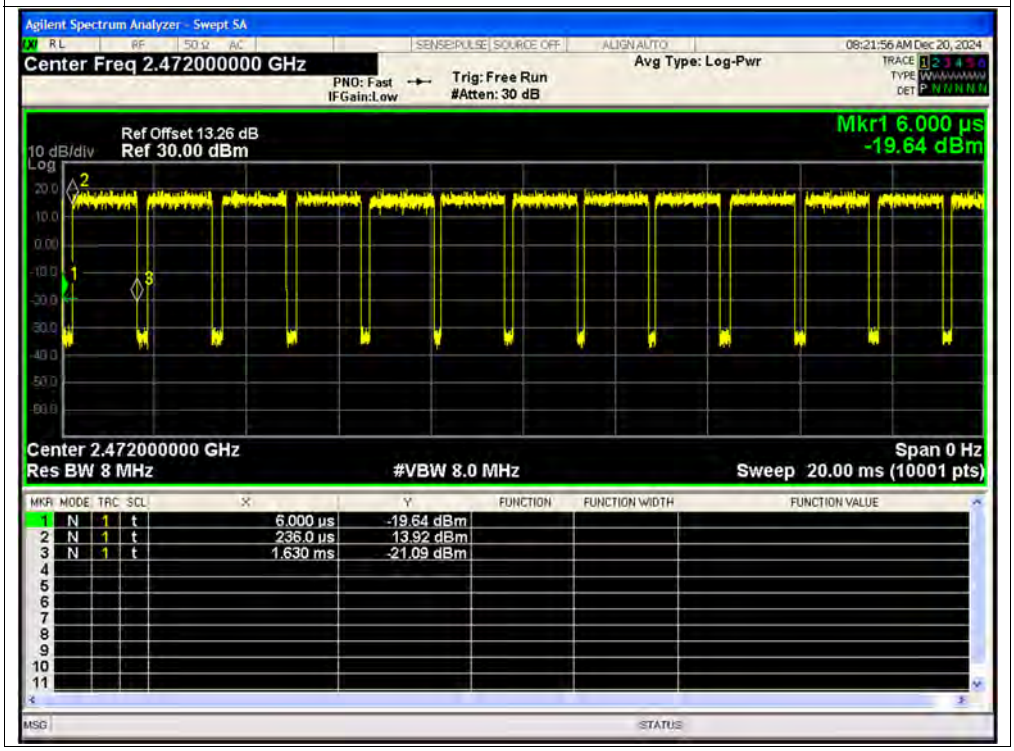
Duty Cycle NVNT g 2412MHz Ant1



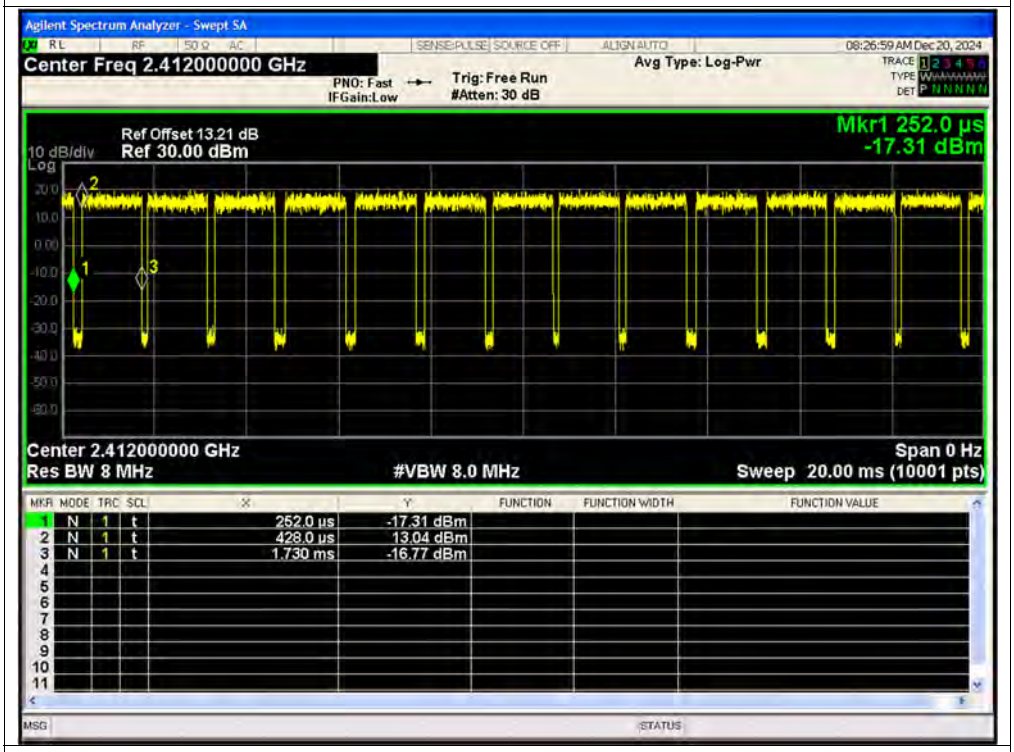
Duty Cycle NVNT g 2442MHz Ant1



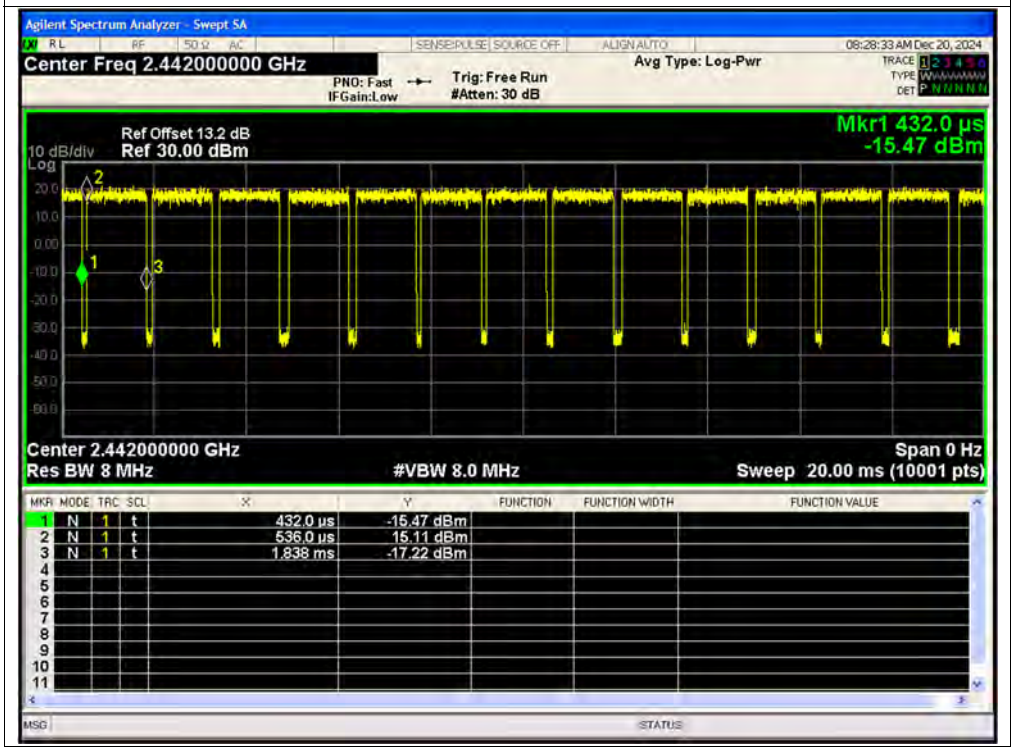
Duty Cycle NVNT g 2472MHz Ant1



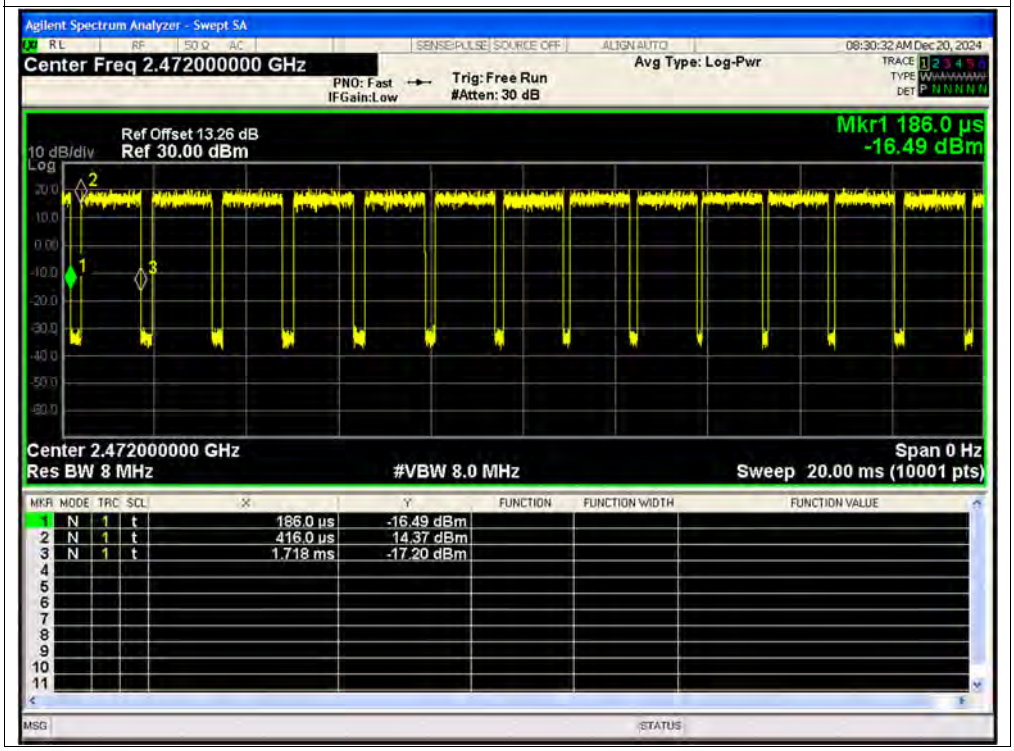
Duty Cycle NVNT n20 2412MHz Ant1



Duty Cycle NVNT n20 2442MHz Ant1



Duty Cycle NVNT n20 2472MHz Ant1

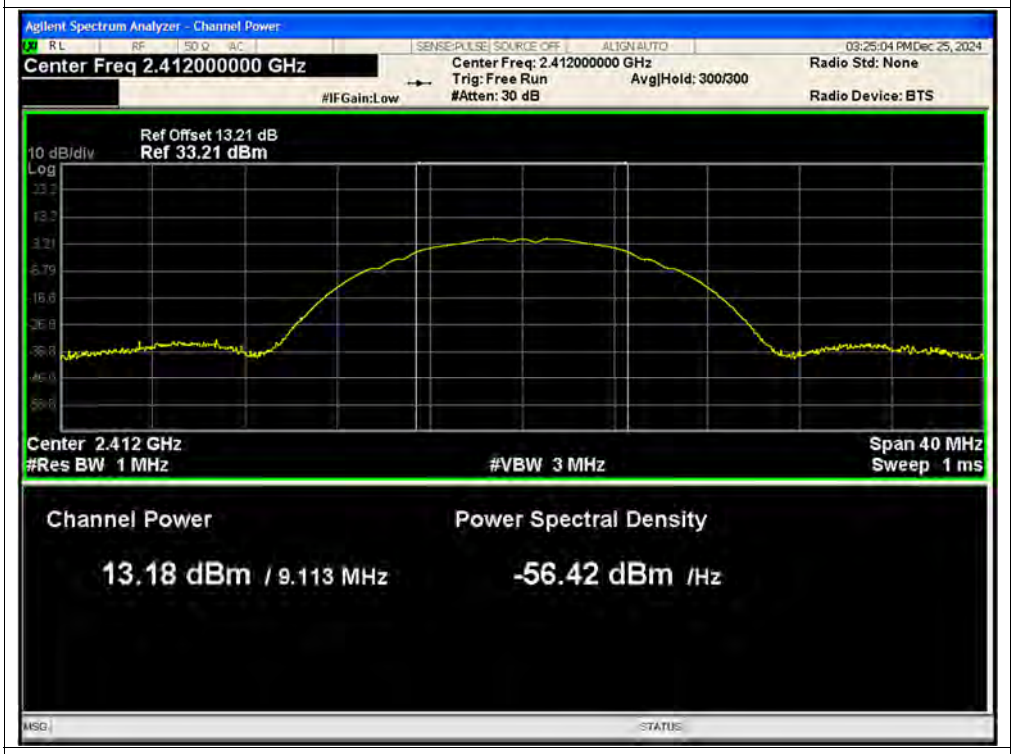


A.2. Maximum Peak Conducted Output Power

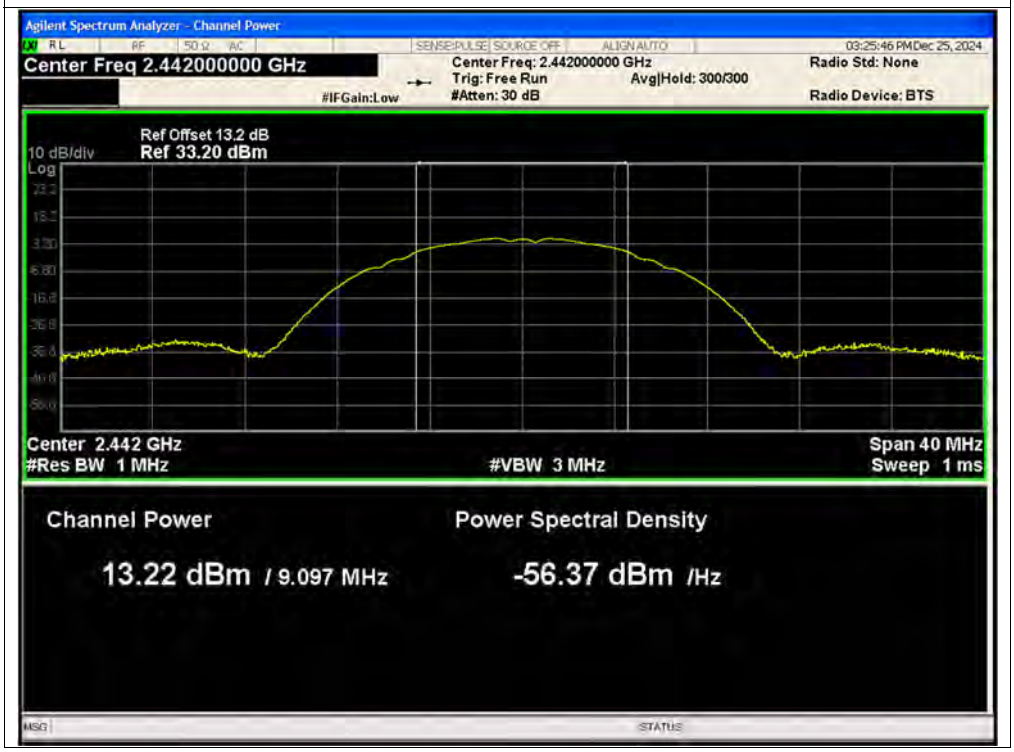
Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Conducted Power (dBm)	Total Conducted Power (W)	Limit Conducted (dBm)	Verdict
NVNT	b	2412	Ant1	13.18	0	13.18	0.0208	30	Pass
NVNT	b	2442	Ant1	13.22	0	13.22	0.02099	30	Pass
NVNT	b	2472	Ant1	12.81	0	12.81	0.0191	30	Pass
NVNT	g	2412	Ant1	15.38	0	15.38	0.03451	30	Pass
NVNT	g	2442	Ant1	17.65	0	17.65	0.05821	30	Pass
NVNT	g	2472	Ant1	15.22	0	15.22	0.03327	30	Pass
NVNT	n20	2412	Ant1	15.12	0	15.12	0.03251	30	Pass
NVNT	n20	2442	Ant1	16.76	0	16.76	0.04742	30	Pass
NVNT	n20	2472	Ant1	15.09	0	15.09	0.03228	30	Pass

Test Graphs

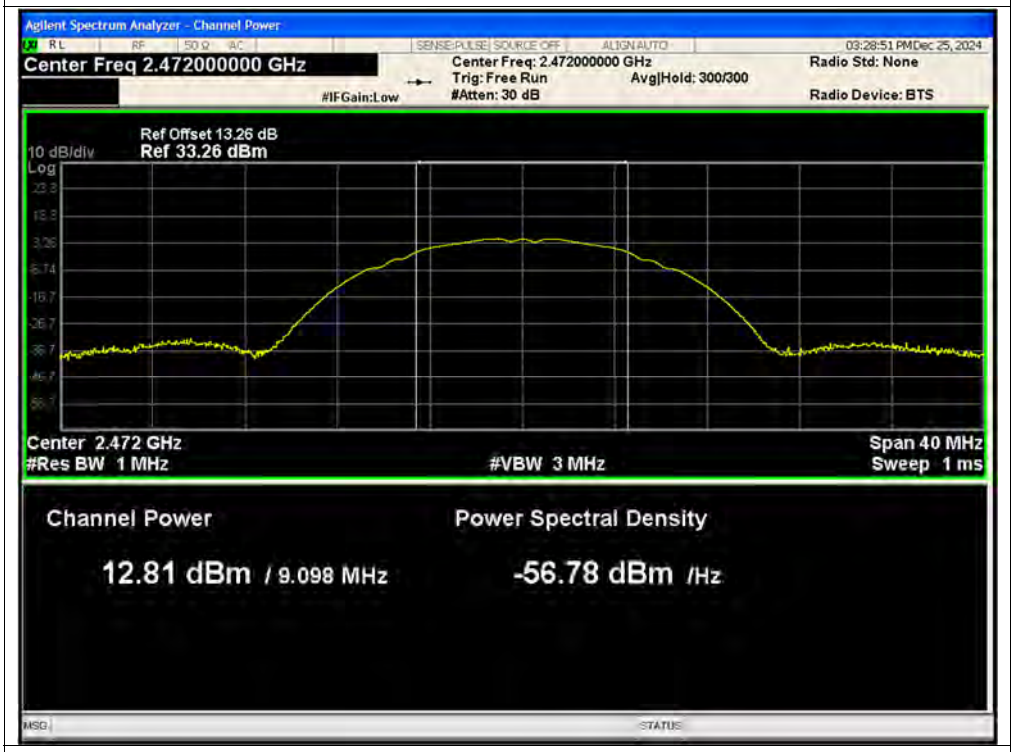
Peak Power NVNT b 2412MHz Ant1



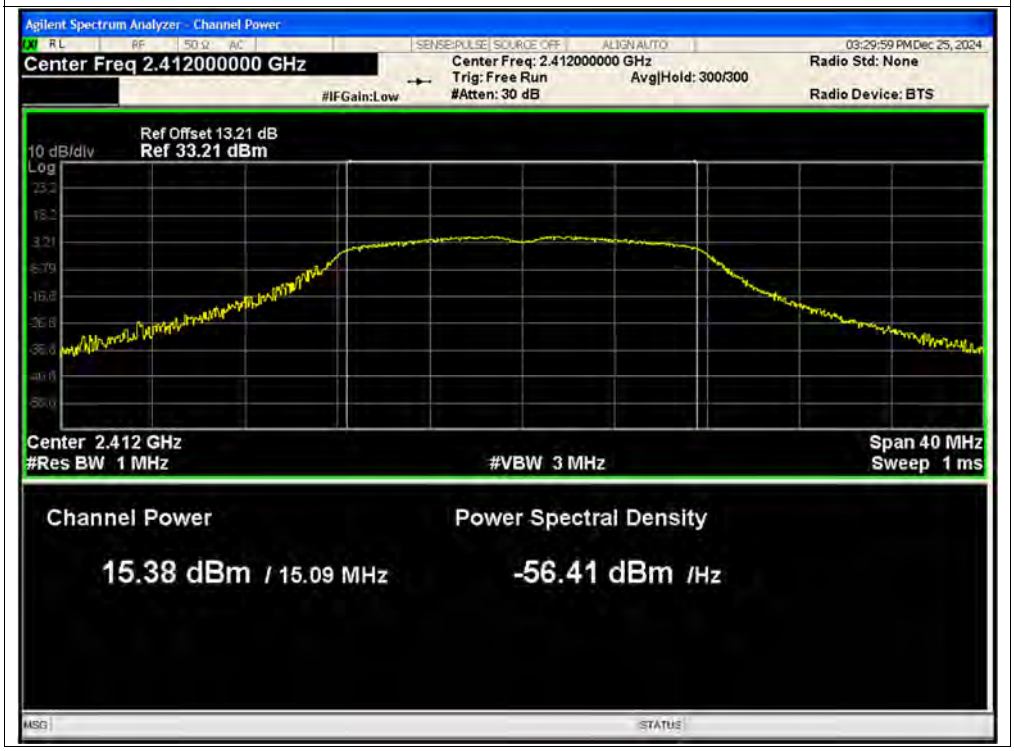
Peak Power NVNT b 2442MHz Ant1



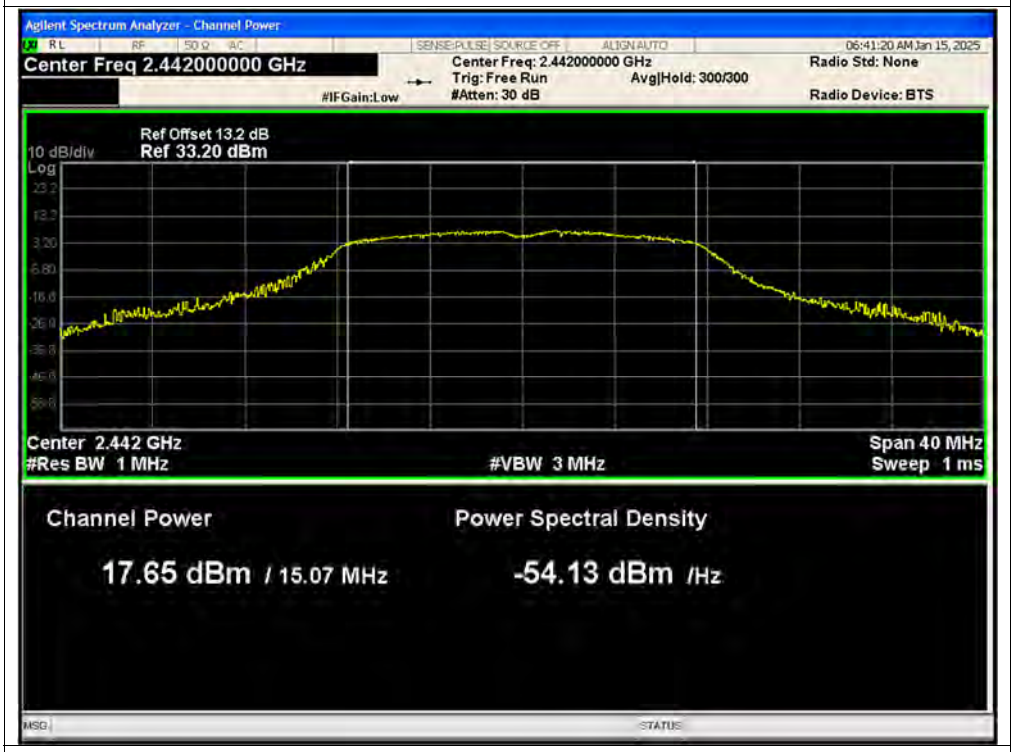
Peak Power NVNT b 2472MHz Ant1



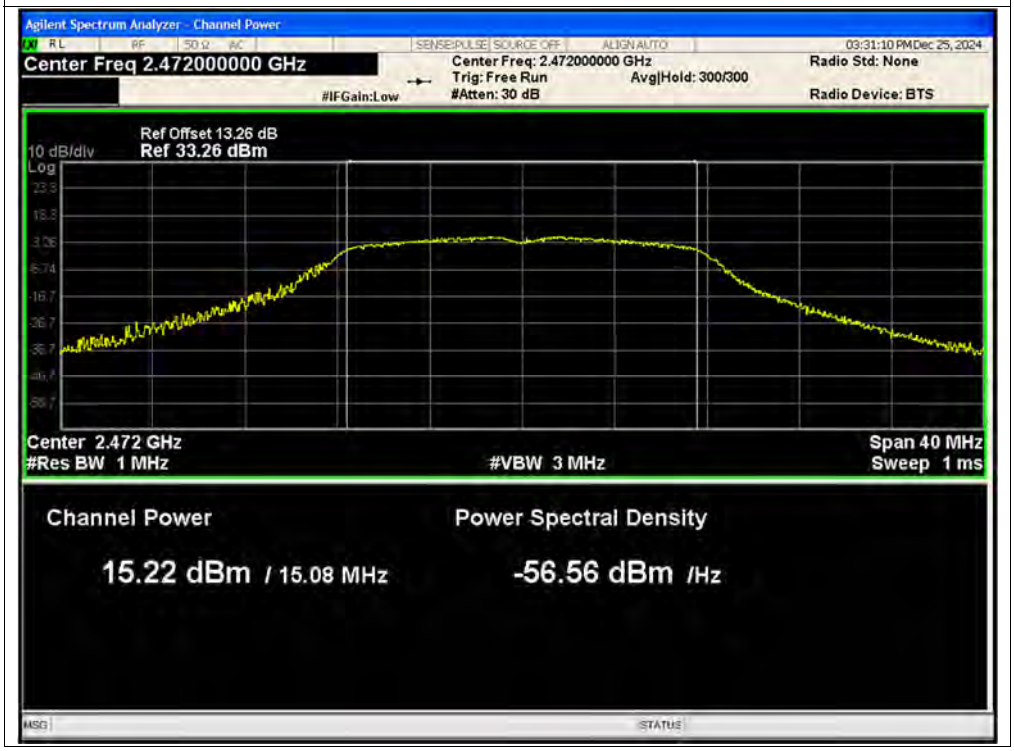
Peak Power NVNT g 2412MHz Ant1



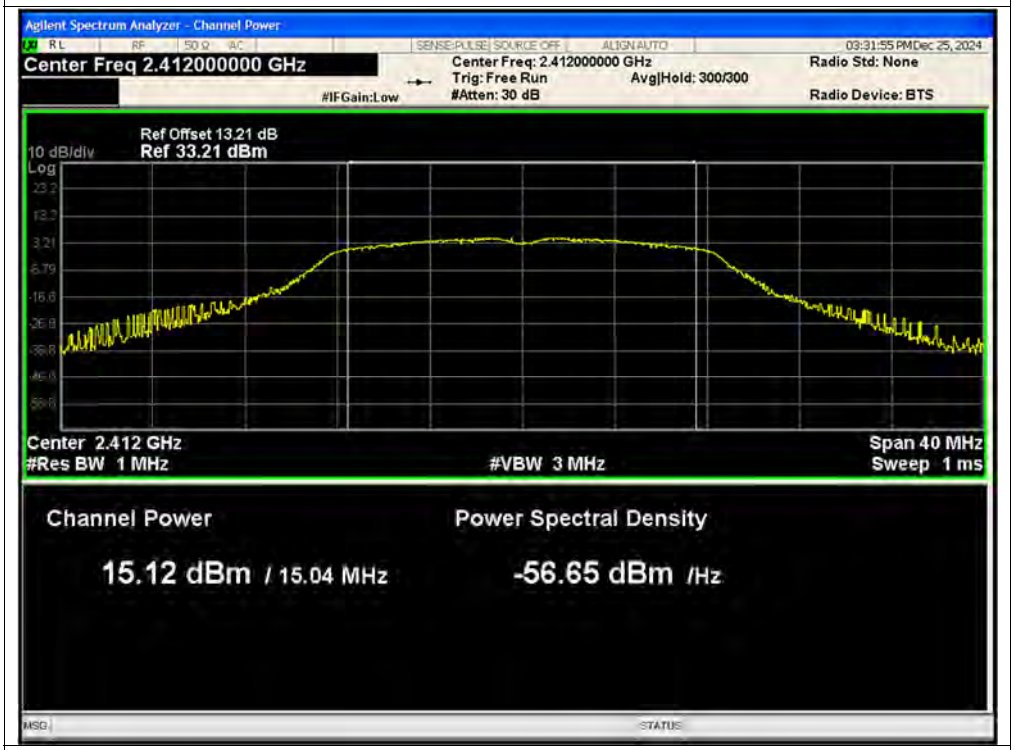
Peak Power NVNT g 2442MHz Ant1



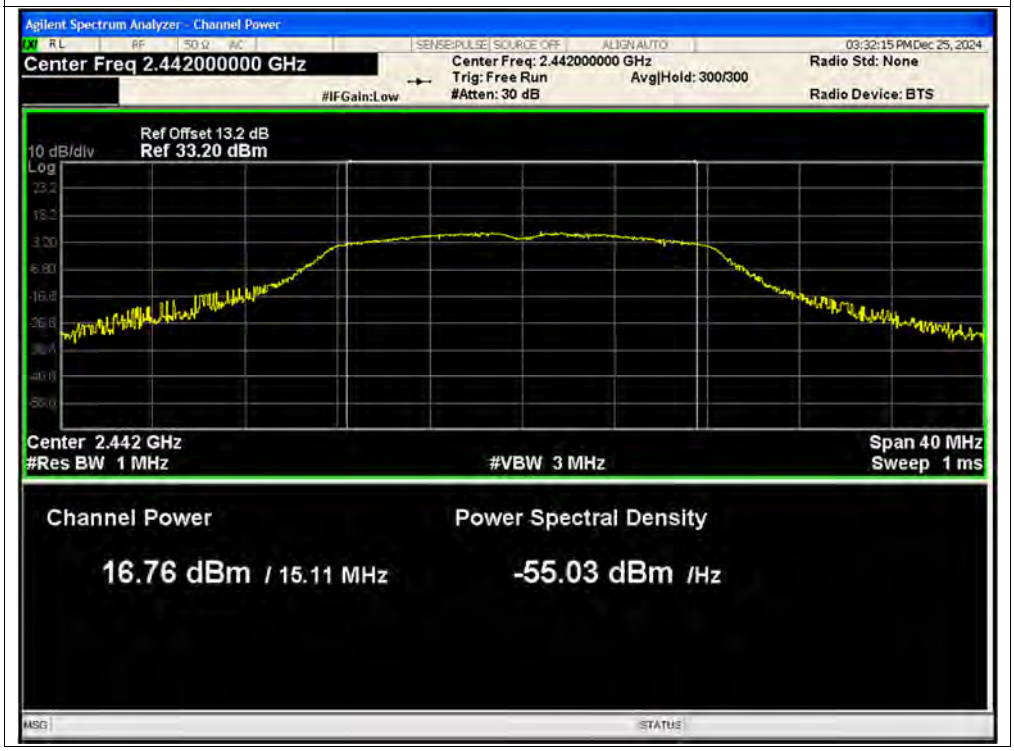
Peak Power NVNT g 2472MHz Ant1



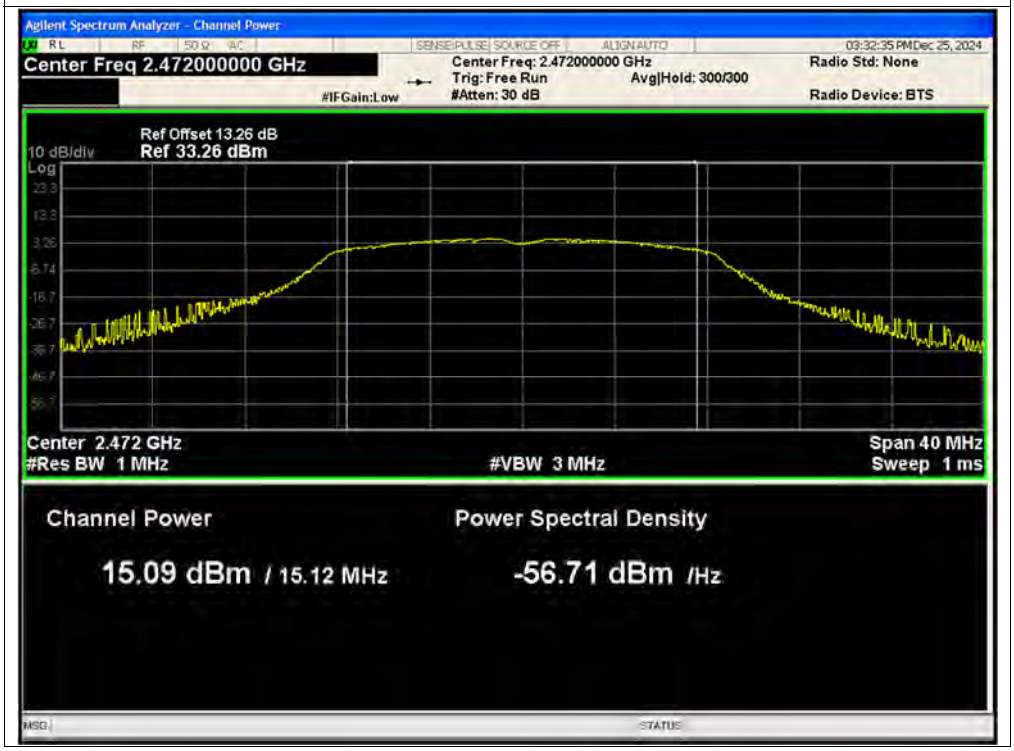
Peak Power NVNT n20 2412MHz Ant1



Peak Power NVNT n20 2442MHz Ant1



Peak Power NVNT n20 2472MHz Ant1

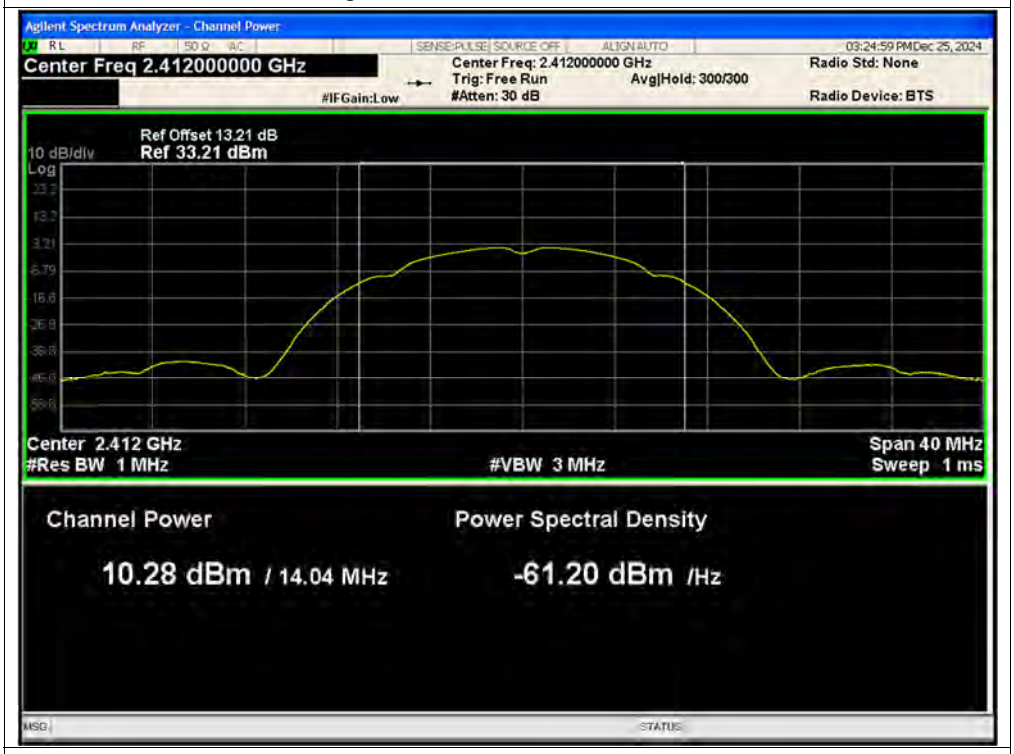


A.3. Maximum Average Conducted Output Power

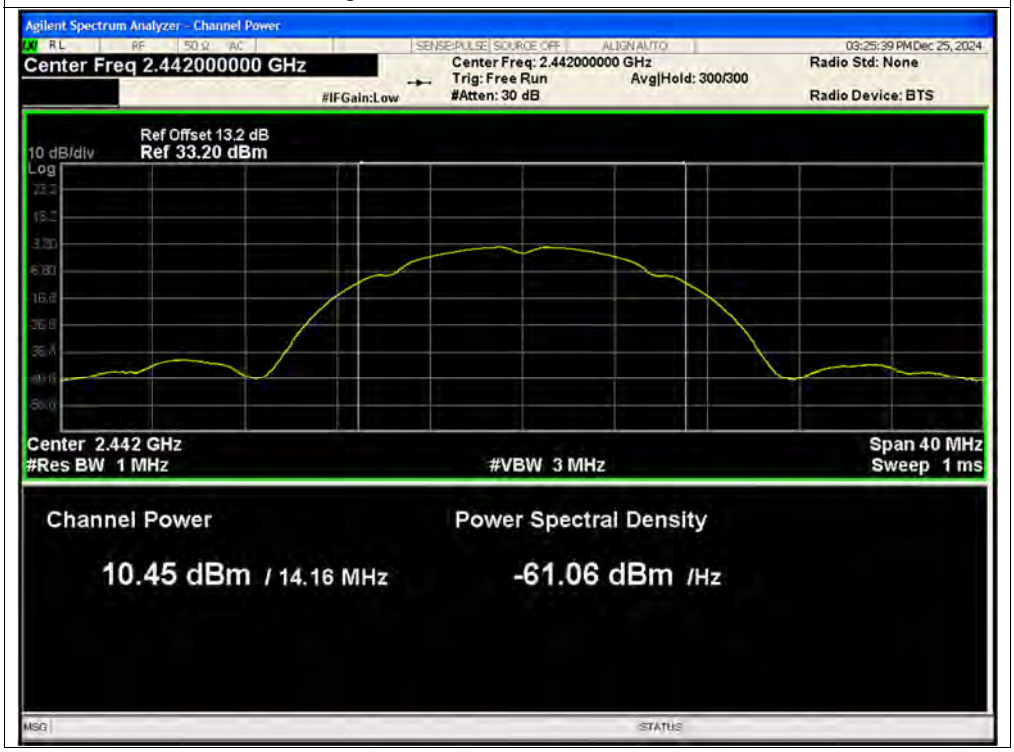
Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Conducted Power (dBm)	Total Conducted Power (W)	Limit Conducted (dBm)	Verdict
NVNT	b	2412	Ant1	10.28	0.24	10.52	0.01127	30	Pass
NVNT	b	2442	Ant1	10.45	0.21	10.66	0.01164	30	Pass
NVNT	b	2472	Ant1	10.09	0.19	10.28	0.01067	30	Pass
NVNT	g	2412	Ant1	7.19	0.61	7.8	0.00603	30	Pass
NVNT	g	2442	Ant1	8.88	0.54	9.42	0.00875	30	Pass
NVNT	g	2472	Ant1	7.08	0.66	7.74	0.00594	30	Pass
NVNT	n20	2412	Ant1	6.91	0.55	7.46	0.00557	30	Pass
NVNT	n20	2442	Ant1	8.72	0.33	9.05	0.00804	30	Pass
NVNT	n20	2472	Ant1	7.02	0.71	7.73	0.00593	30	Pass

Test Graphs

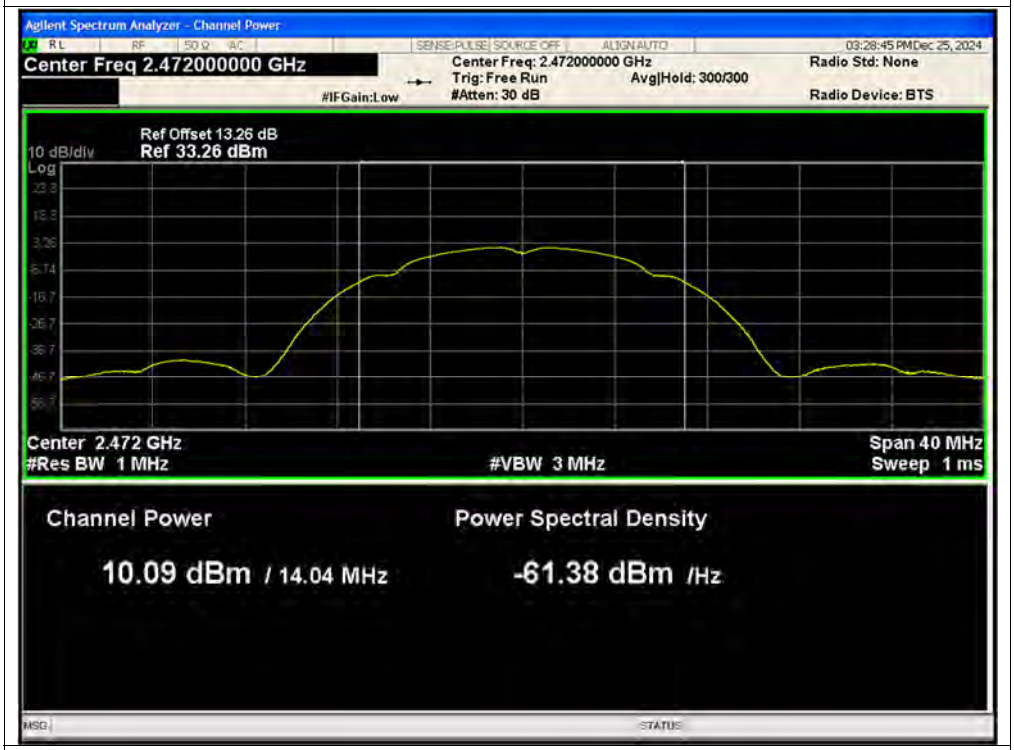
Average Power NVNT b 2412MHz Ant1



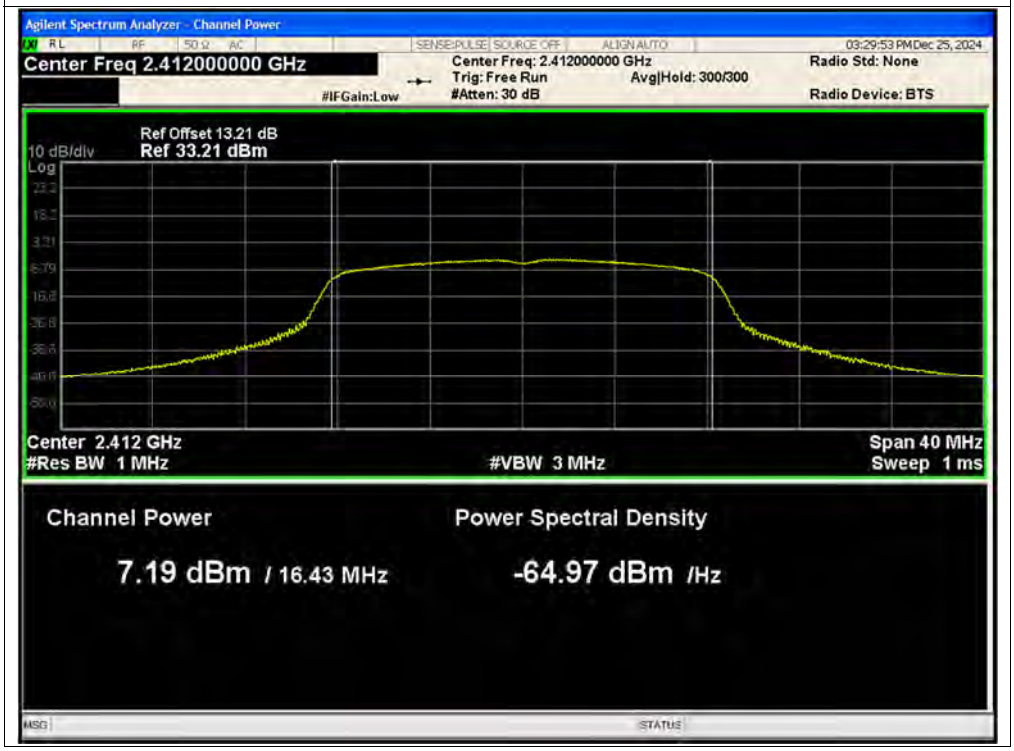
Average Power NVNT b 2442MHz Ant1



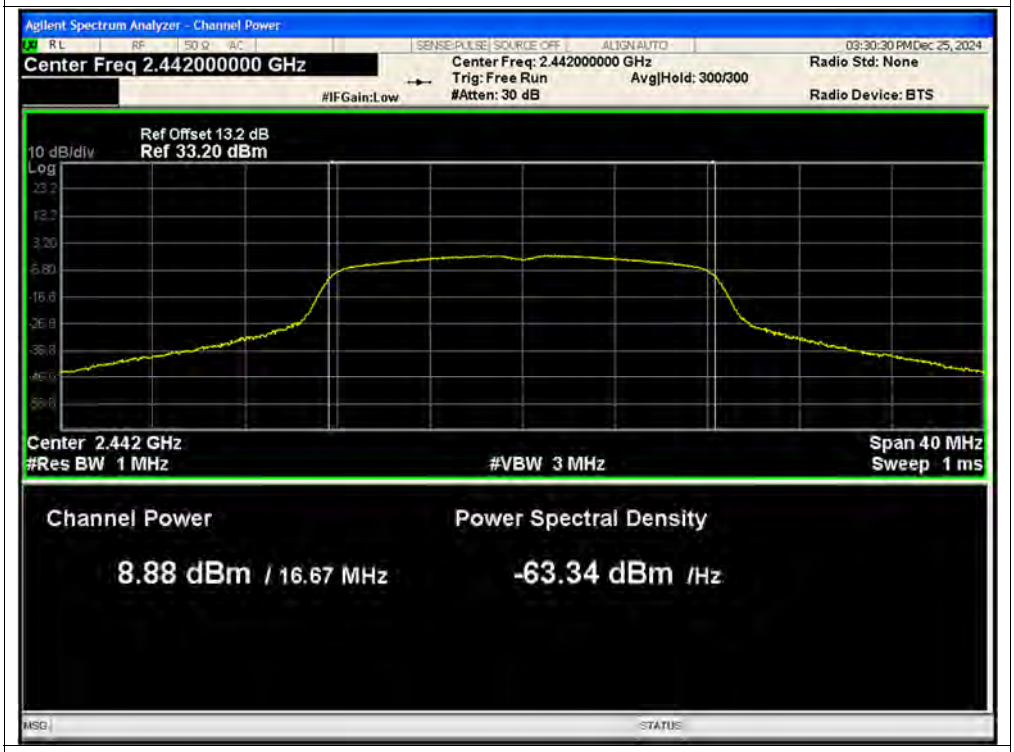
Average Power NVNT b 2472MHz Ant1



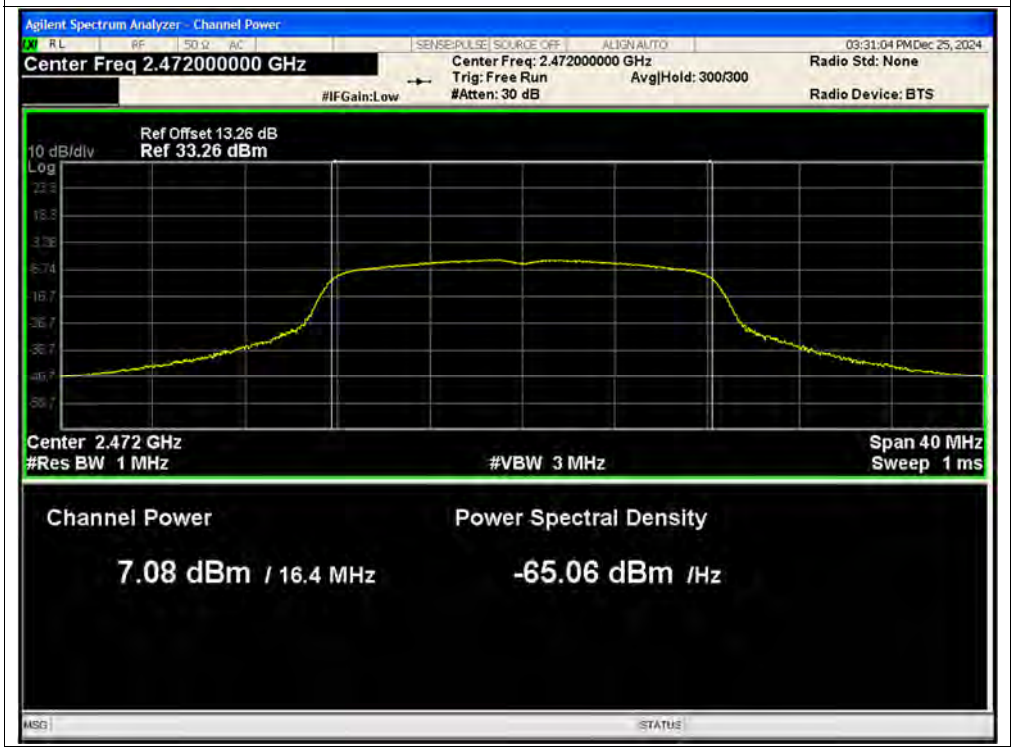
Average Power NVNT g 2412MHz Ant1



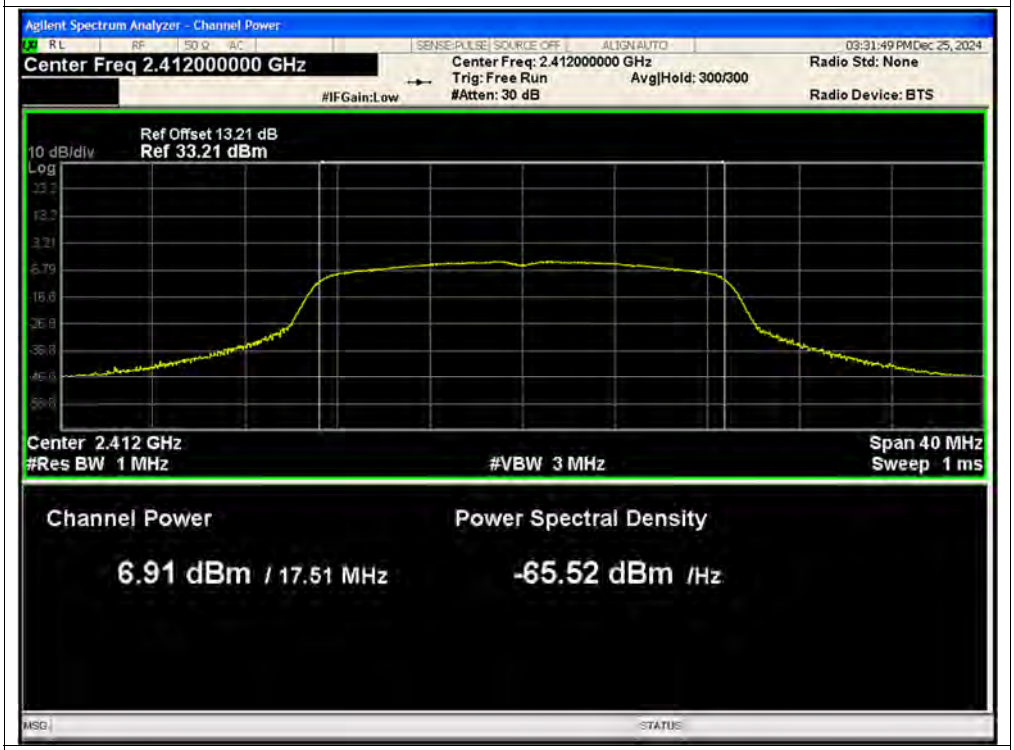
Average Power NVNT g 2442MHz Ant1



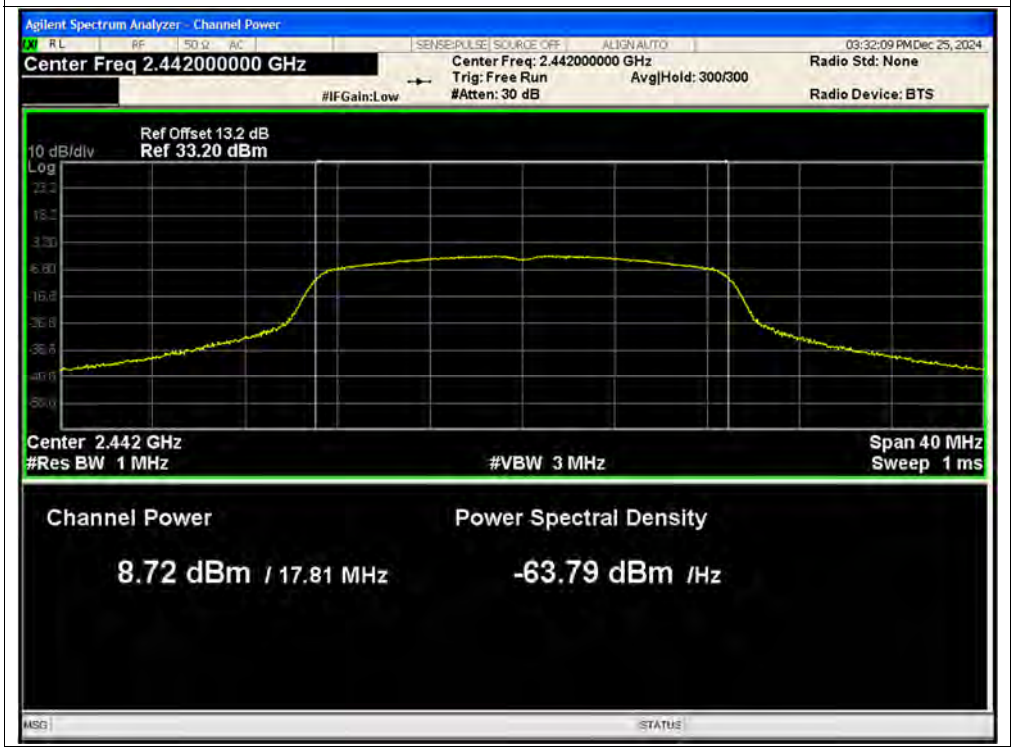
Average Power NVNT g 2472MHz Ant1



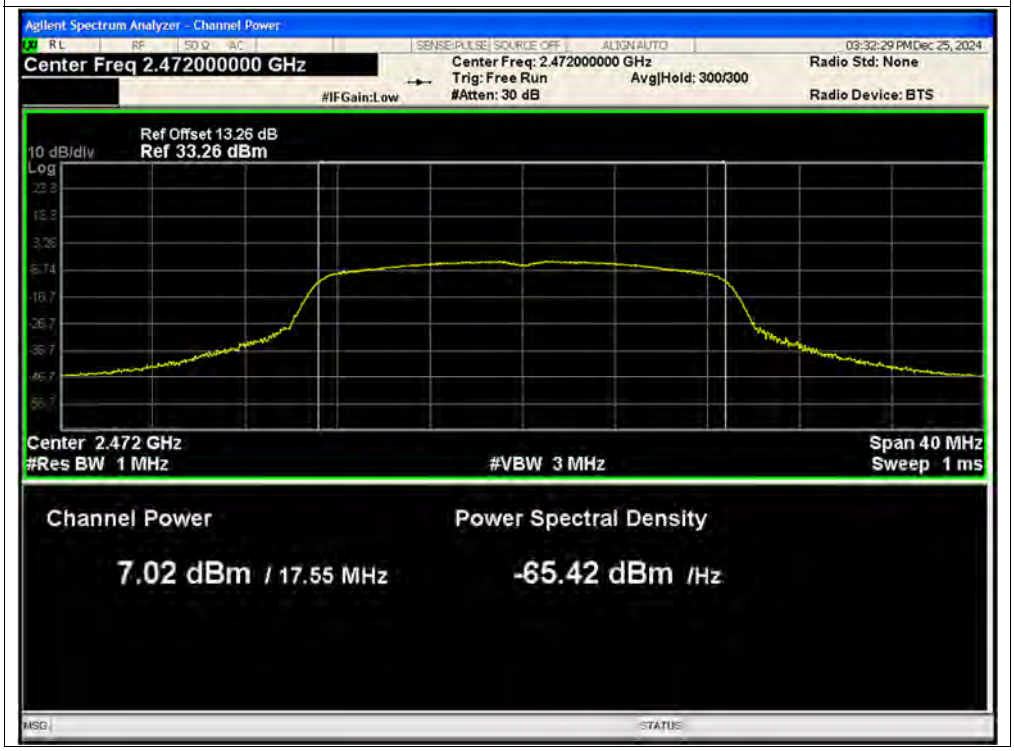
Average Power NVNT n20 2412MHz Ant1



Average Power NVNT n20 2442MHz Ant1



Average Power NVNT n20 2472MHz Ant1



A.4. 6 dB Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	b	2412	Ant1	9.113	0.5	Pass
NVNT	b	2442	Ant1	9.097	0.5	Pass
NVNT	b	2472	Ant1	9.098	0.5	Pass
NVNT	g	2412	Ant1	15.09	0.5	Pass
NVNT	g	2442	Ant1	15.07	0.5	Pass
NVNT	g	2472	Ant1	15.08	0.5	Pass
NVNT	n20	2412	Ant1	15.04	0.5	Pass
NVNT	n20	2442	Ant1	15.11	0.5	Pass
NVNT	n20	2472	Ant1	15.12	0.5	Pass

Test Graphs

-6dB Bandwidth NVNT b 2412MHz Ant1

-6dB Bandwidth NVNT b 2442MHz Ant1

-6dB Bandwidth NVNT b 2472MHz Ant1

-6dB Bandwidth NVNT g 2412MHz Ant1

-6dB Bandwidth NVNT g 2442MHz Ant1

-6dB Bandwidth NVNT g 2472MHz Ant1

-6dB Bandwidth NVNT n20 2412MHz Ant1

-6dB Bandwidth NVNT n20 2442MHz Ant1

-6dB Bandwidth NVNT n20 2472MHz Ant1

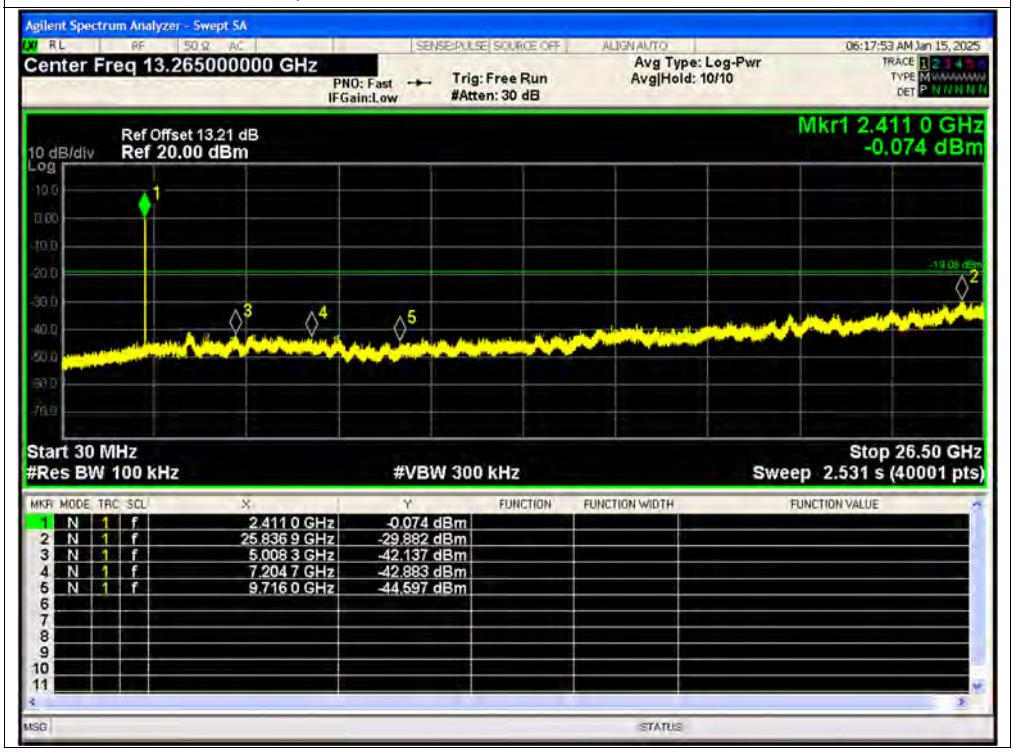
A.5. Conducted Spurious Emissions

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	b	2412	Ant1	-30.8	-20	Pass
NVNT	b	2442	Ant1	-29.7	-20	Pass
NVNT	b	2472	Ant1	-30.81	-20	Pass
NVNT	g	2412	Ant1	-27.33	-20	Pass
NVNT	g	2442	Ant1	-29.22	-20	Pass
NVNT	g	2472	Ant1	-26.86	-20	Pass
NVNT	n20	2412	Ant1	-27.8	-20	Pass
NVNT	n20	2442	Ant1	-28.15	-20	Pass
NVNT	n20	2472	Ant1	-27.45	-20	Pass

Test Graphs

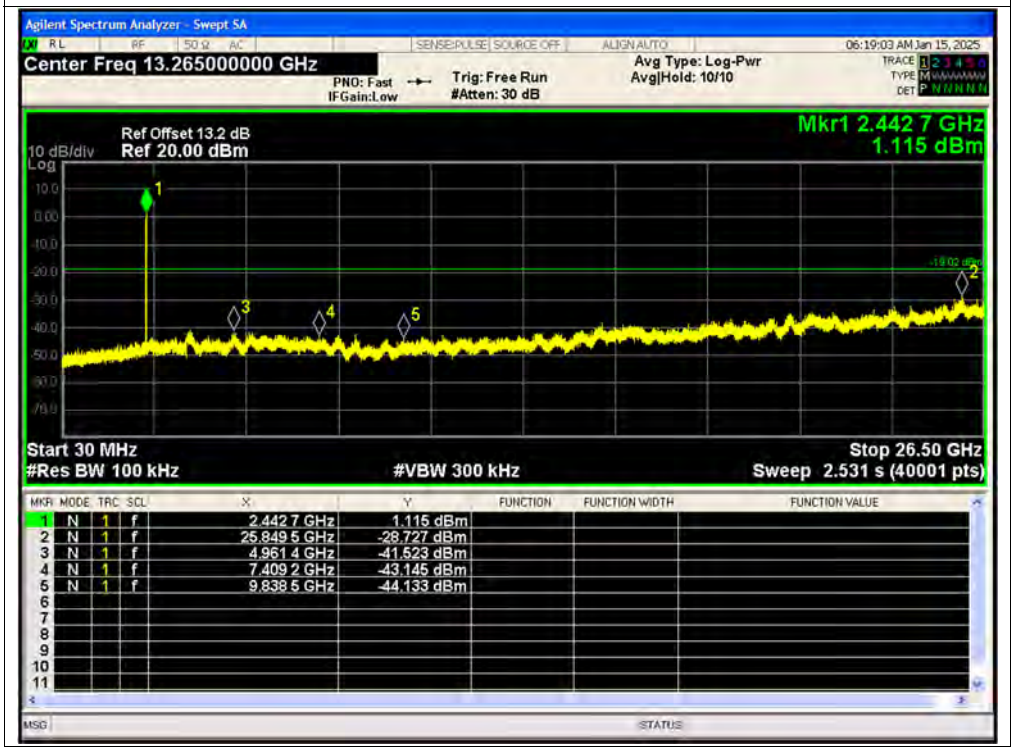
Tx. Spurious NVNT b 2412MHz Ant1 Ref

Tx. Spurious NVNT b 2412MHz Ant1 Emission



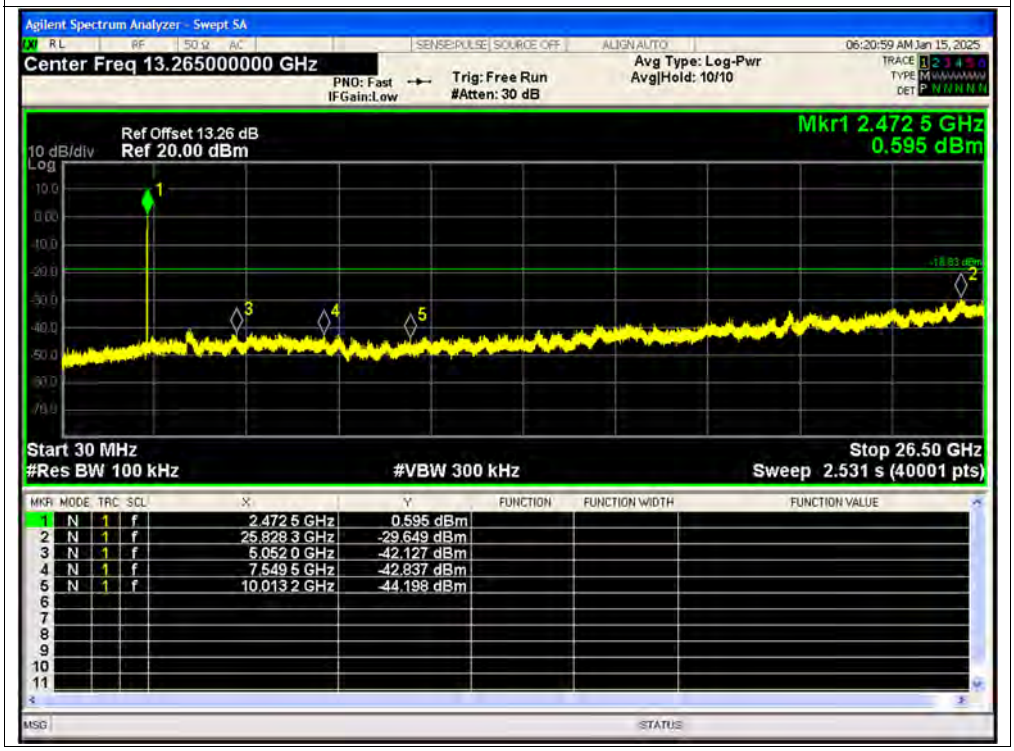
Tx. Spurious NVNT b 2442MHz Ant1 Ref

Tx. Spurious NVNT b 2442MHz Ant1 Emission



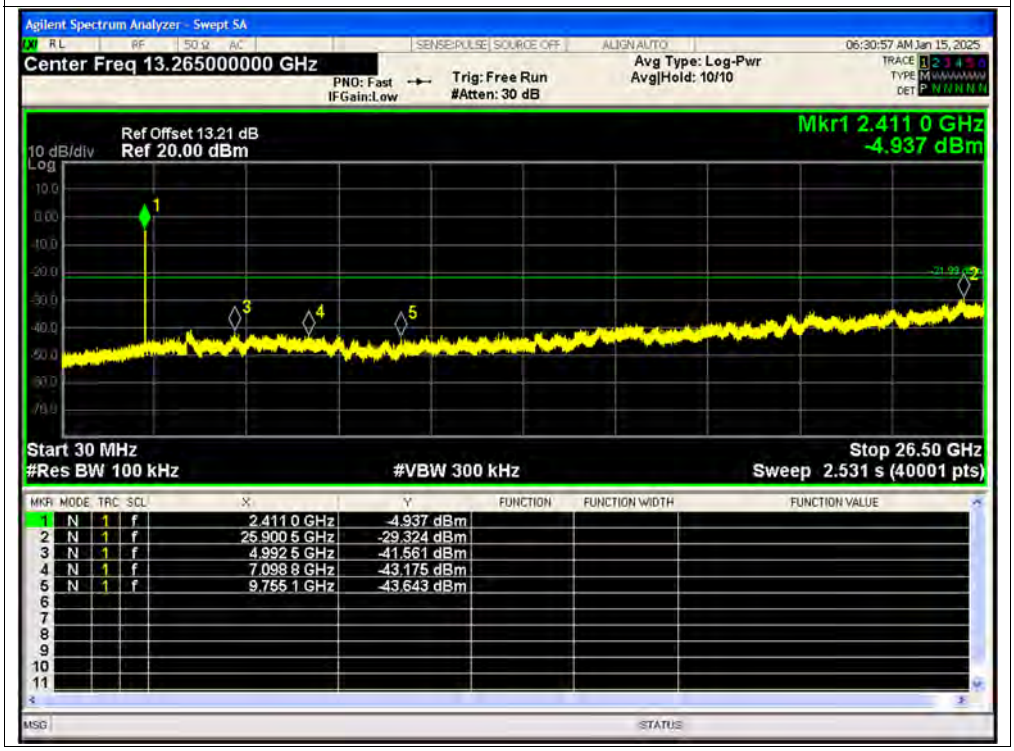
Tx. Spurious NVNT b 2472MHz Ant1 Ref

Tx. Spurious NVNT b 2472MHz Ant1 Emission



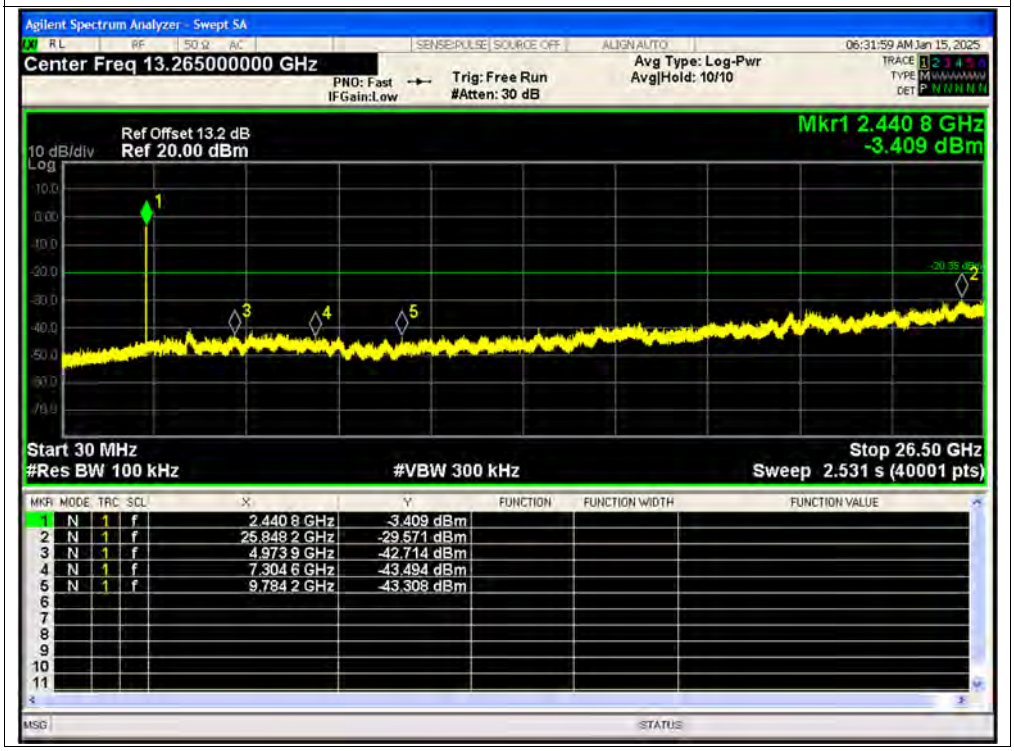
Tx. Spurious NVNT g 2412MHz Ant1 Ref

Tx. Spurious NVNT g 2412MHz Ant1 Emission



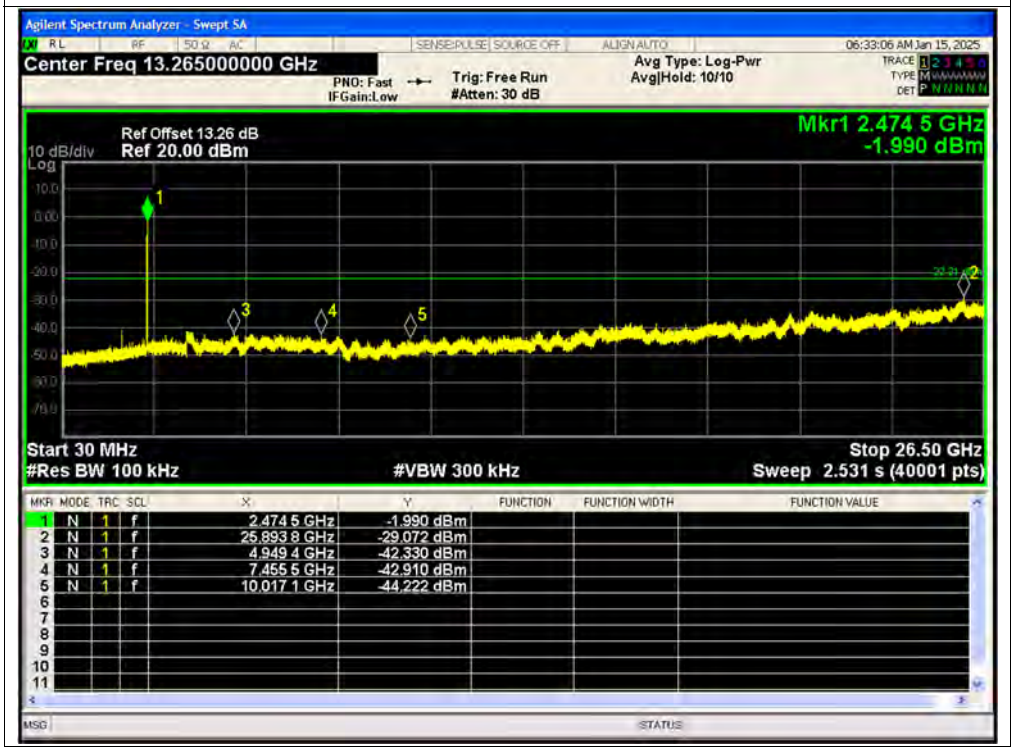
Tx. Spurious NVNT g 2442MHz Ant1 Ref

Tx. Spurious NVNT g 2442MHz Ant1 Emission



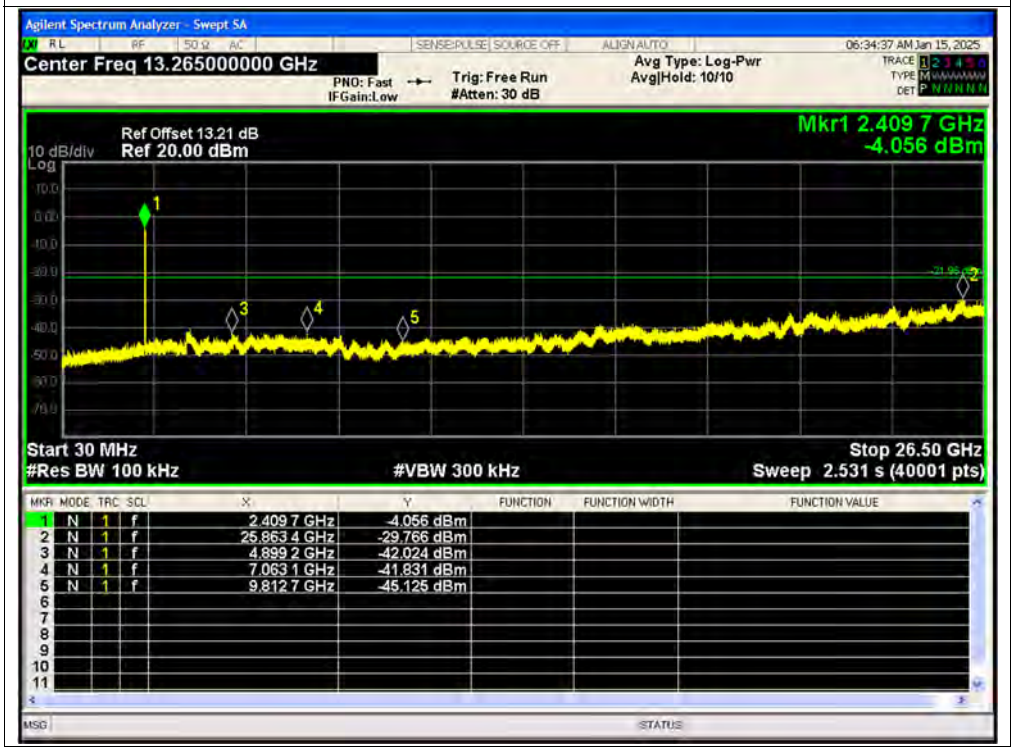
Tx. Spurious NVNT g 2472MHz Ant1 Ref

Tx. Spurious NVNT g 2472MHz Ant1 Emission



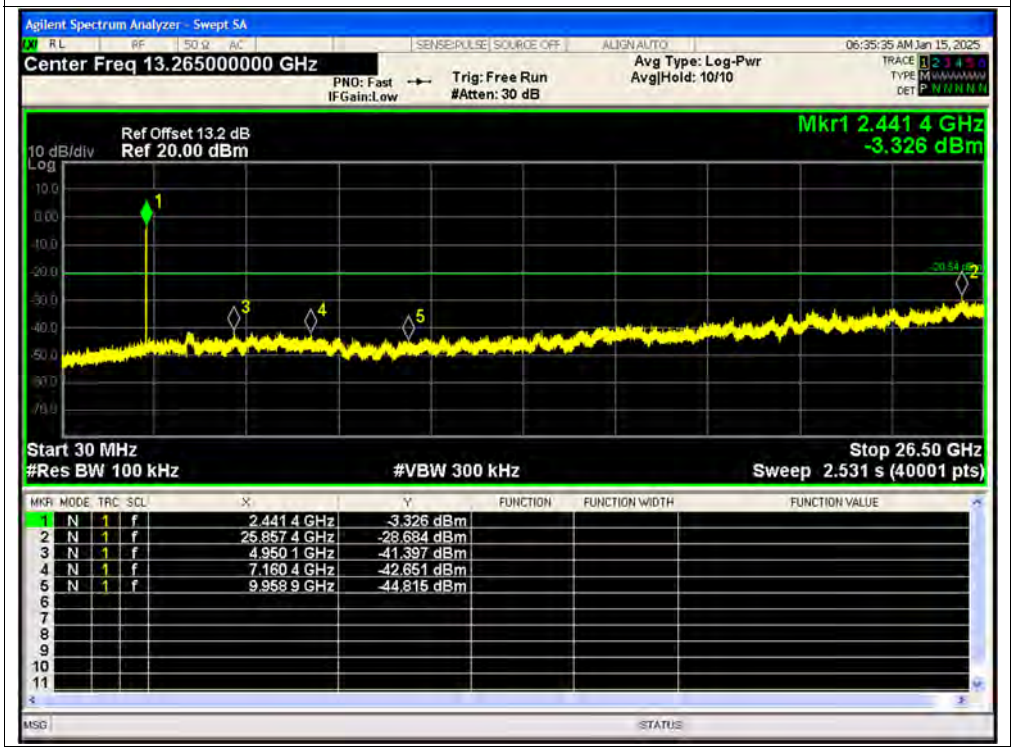
Tx. Spurious NVNT n20 2412MHz Ant1 Ref

Tx. Spurious NVNT n20 2412MHz Ant1 Emission



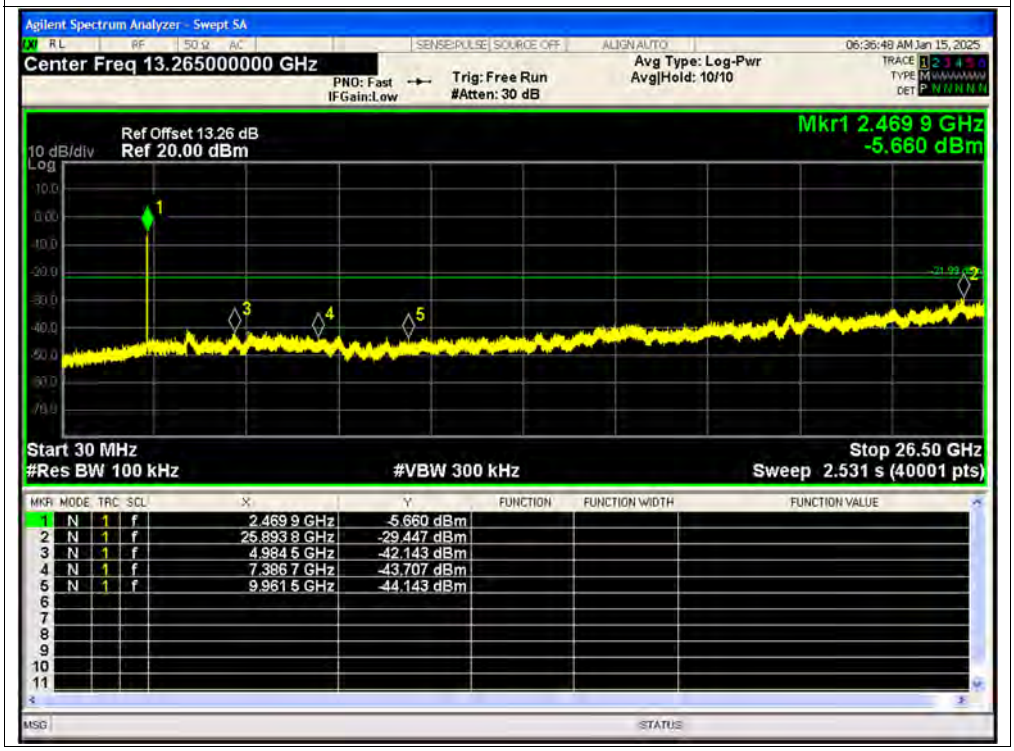
Tx. Spurious NVNT n20 2442MHz Ant1 Ref

Tx. Spurious NVNT n20 2442MHz Ant1 Emission



Tx. Spurious NVNT n20 2472MHz Ant1 Ref

Tx. Spurious NVNT n20 2472MHz Ant1 Emission



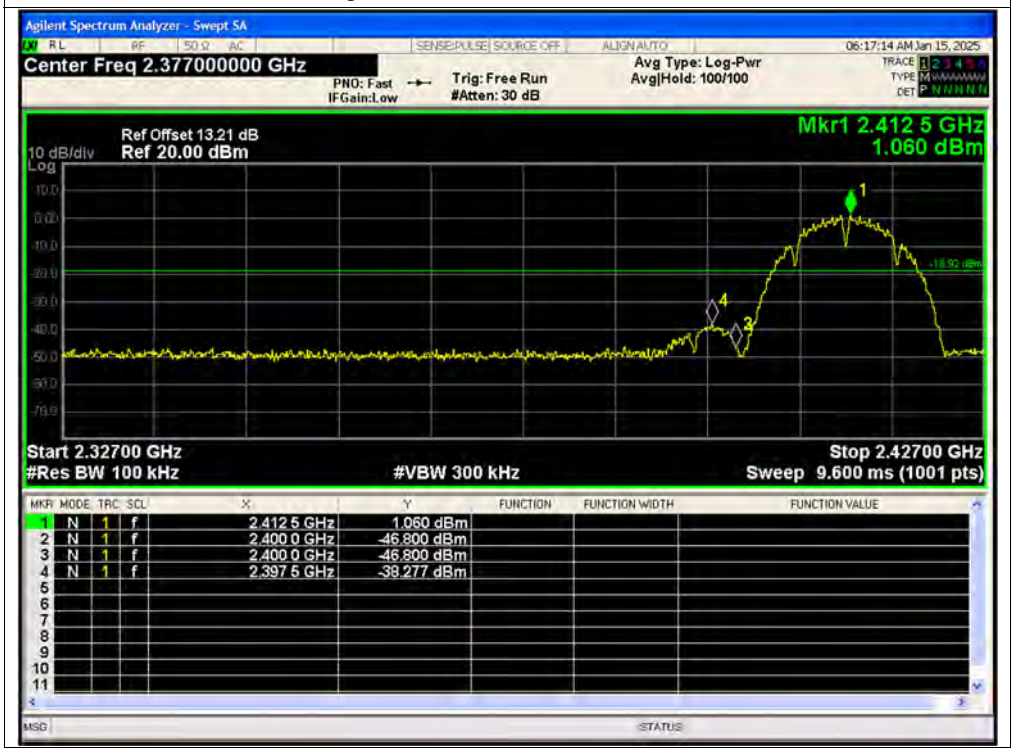
A.6. Band Edge

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	b	2412	Ant1	-39.35	-20	Pass
NVNT	b	2472	Ant1	-45.29	-20	Pass
NVNT	g	2412	Ant1	-29.63	-20	Pass
NVNT	g	2472	Ant1	-31	-20	Pass
NVNT	n20	2412	Ant1	-30.88	-20	Pass
NVNT	n20	2472	Ant1	-29.88	-20	Pass

Test Graphs

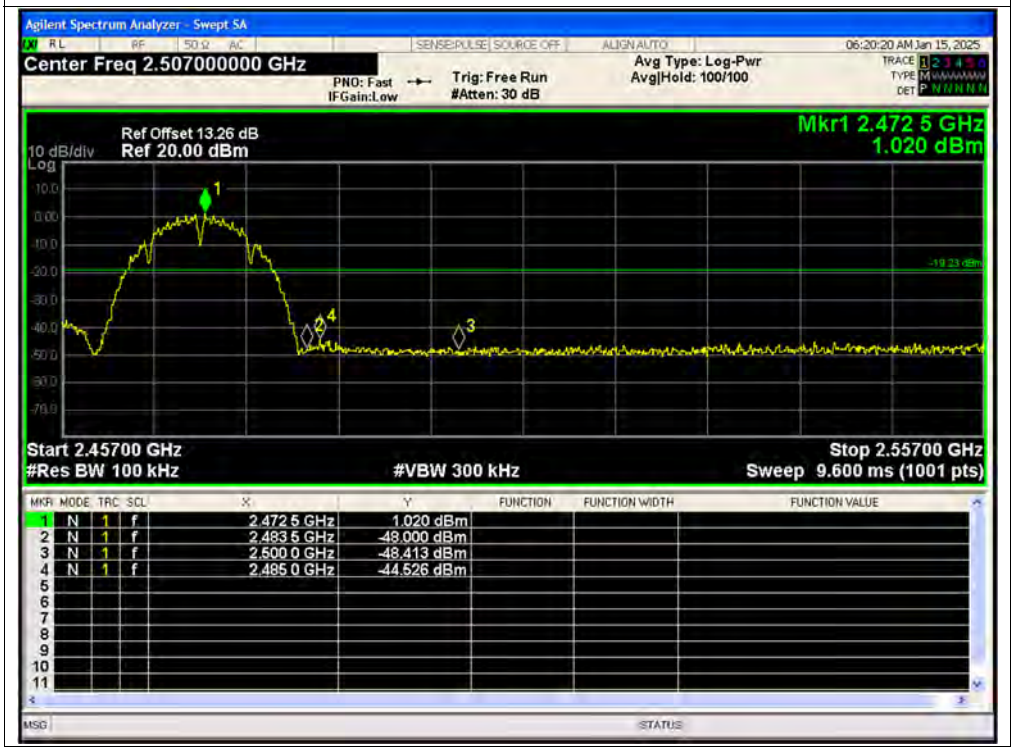
Band Edge NVNT b 2412MHz Ant1 Ref

Band Edge NVNT b 2412MHz Ant1 Emission



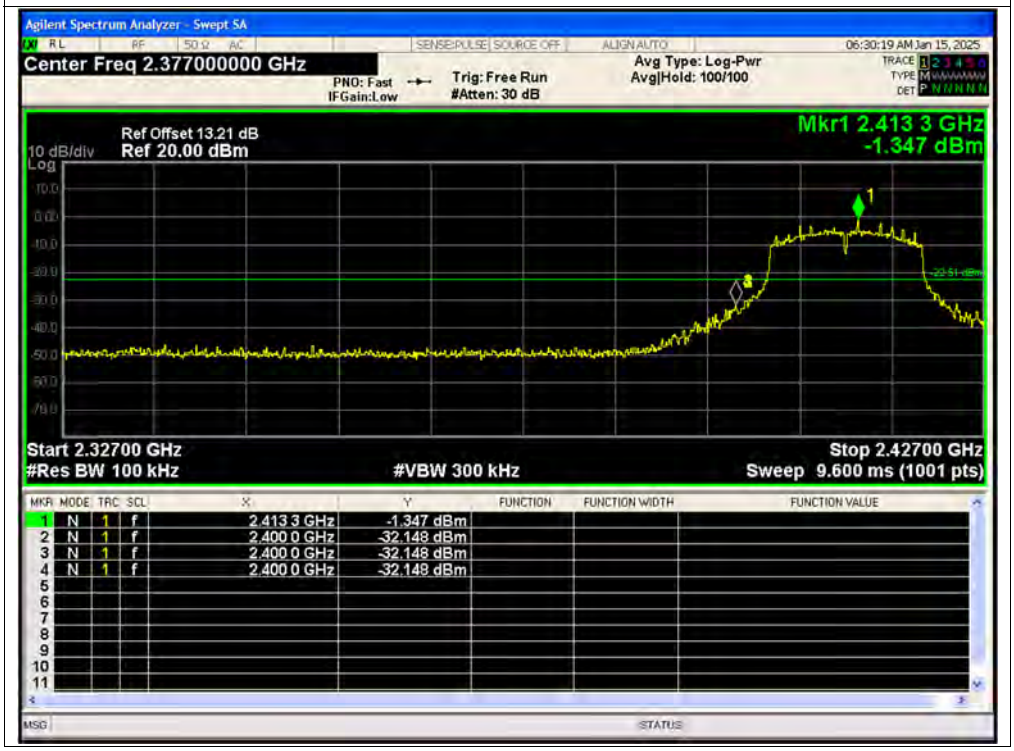
Band Edge NVNT b 2472MHz Ant1 Ref

Band Edge NVNT b 2472MHz Ant1 Emission



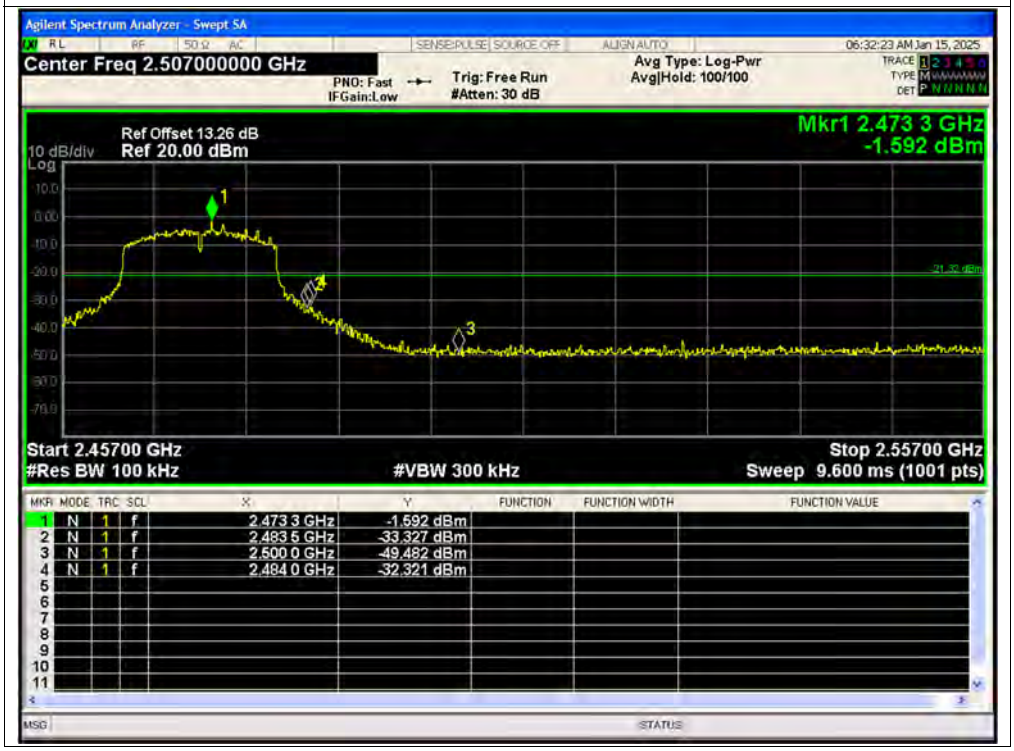
Band Edge NVNT g 2412MHz Ant1 Ref

Band Edge NVNT g 2412MHz Ant1 Emission



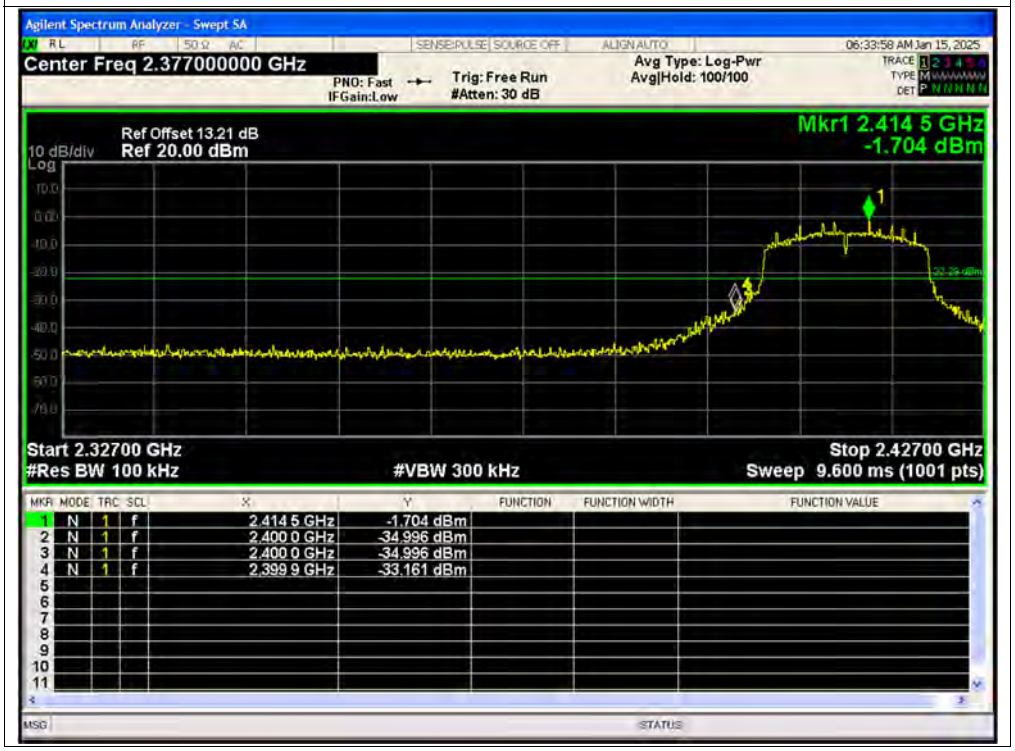
Band Edge NVNT g 2472MHz Ant1 Ref

Band Edge NVNT g 2472MHz Ant1 Emission



Band Edge NVNT n20 2412MHz Ant1 Ref

Band Edge NVNT n20 2412MHz Ant1 Emission



Band Edge NVNT n20 2472MHz Ant1 Ref

Band Edge NVNT n20 2472MHz Ant1 Emission

A.7. Power Spectral Density

Condition	Mode	Frequency (MHz)	Antenna	Conducted PSD (dBm/3kHz)	Duty Factor (dB)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
NVNT	b	2412	Ant1	-14.15	0	-14.15	8	Pass
NVNT	b	2442	Ant1	-14.17	0	-14.17	8	Pass
NVNT	b	2472	Ant1	-14.29	0	-14.29	8	Pass
NVNT	g	2412	Ant1	-17.25	0	-17.25	8	Pass
NVNT	g	2442	Ant1	-15.85	0	-15.85	8	Pass
NVNT	g	2472	Ant1	-17.21	0	-17.21	8	Pass
NVNT	n20	2412	Ant1	-16.87	0	-16.87	8	Pass
NVNT	n20	2442	Ant1	-14.48	0	-14.48	8	Pass
NVNT	n20	2472	Ant1	-16.35	0	-16.35	8	Pass

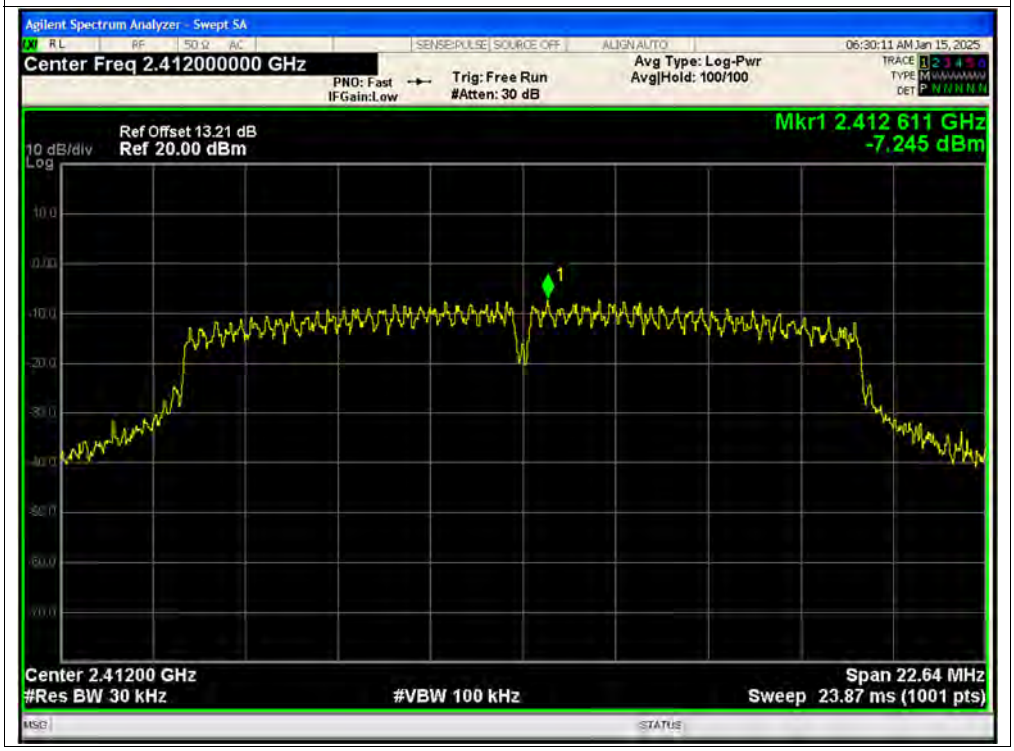
Test Graphs

PSD NVNT b 2412MHz Ant1

PSD NVNT b 2442MHz Ant1

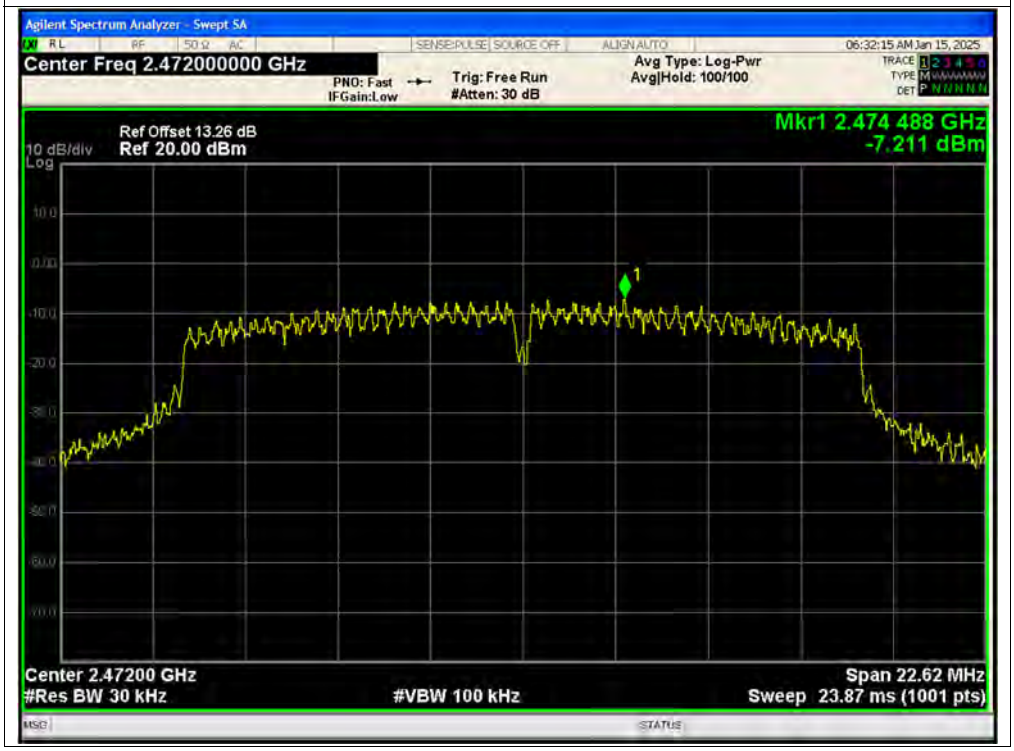
PSD NVNT b 2472MHz Ant1

PSD NVNT g 2412MHz Ant1

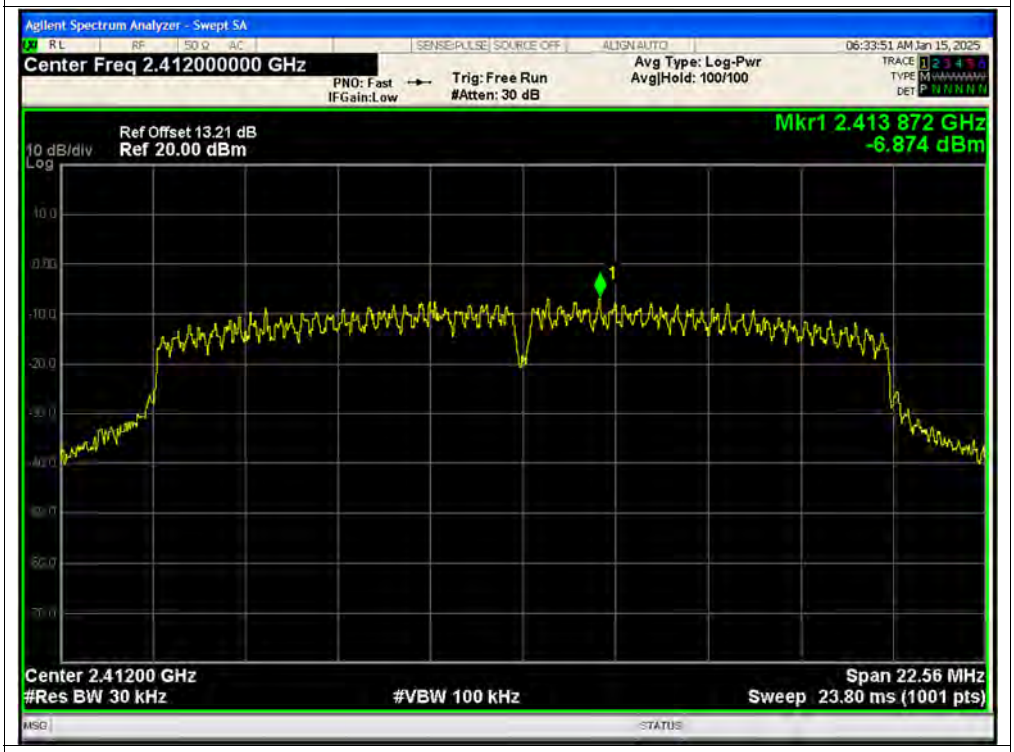


PSD NVNT g 2442MHz Ant1

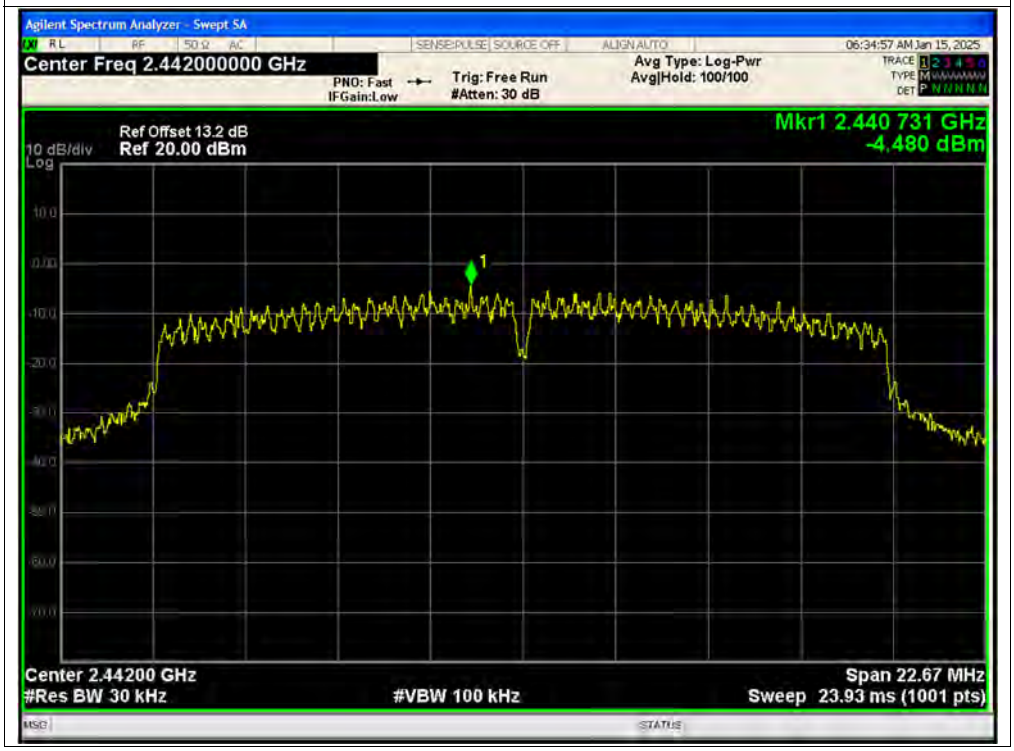
PSD NVNT g 2472MHz Ant1



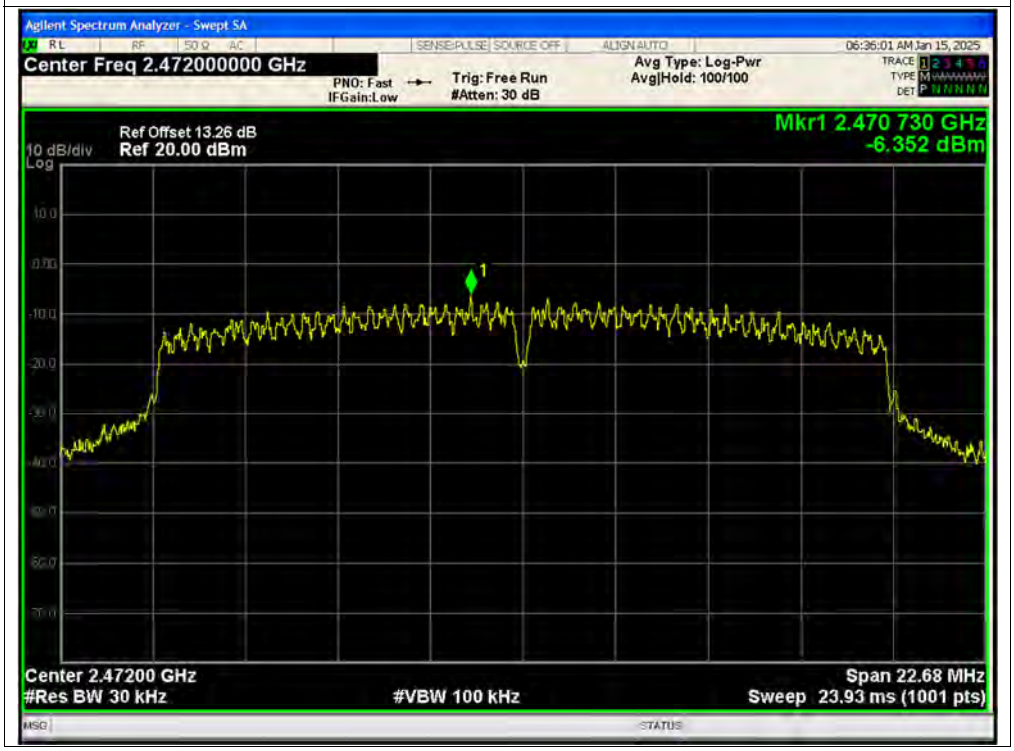
PSD NVNT n20 2412MHz Ant1



PSD NVNT n20 2442MHz Ant1



PSD NVNT n20 2472MHz Ant1



A.8. Conducted Emission

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Set RBW=9kHz, VBW=30kHz. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A. Test Setup:

Test Mode: EUT + Adapter + USB Cable + WIFI TX

Test voltage: AC 120V/60Hz

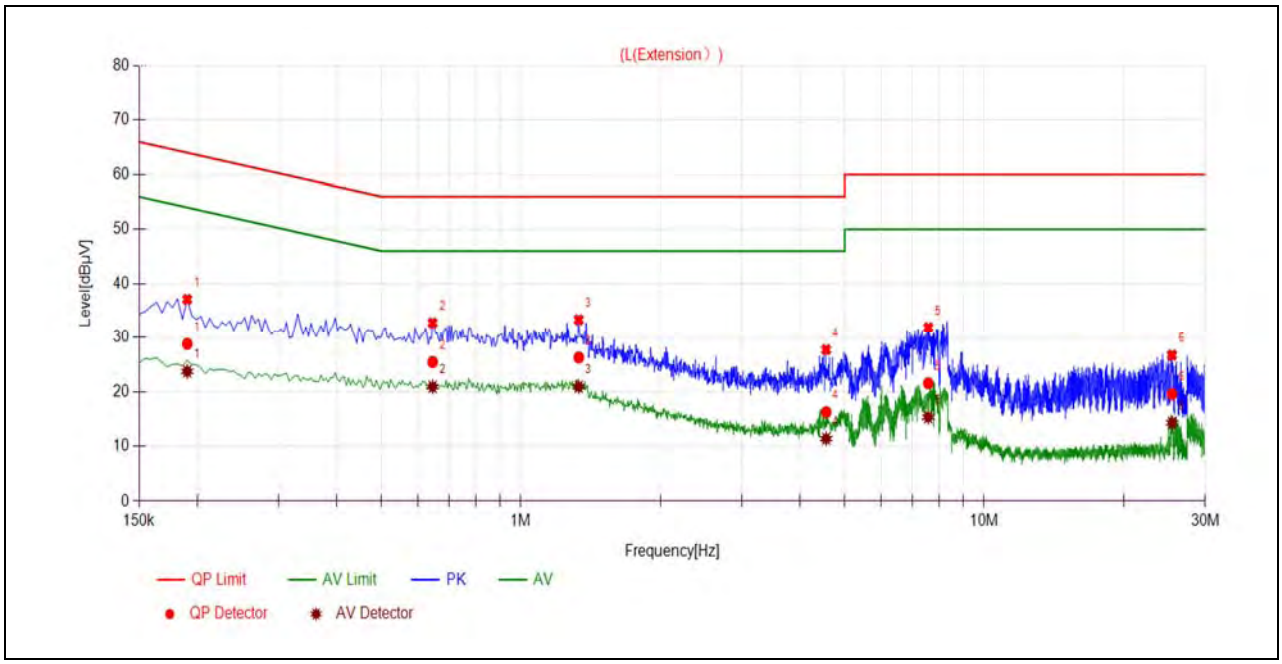
The measurement results are obtained as below:

E [dBμV] $=U_R + L_{Cable\ loss}$ [dB] + A_{Factor}

U_R: Receiver Reading

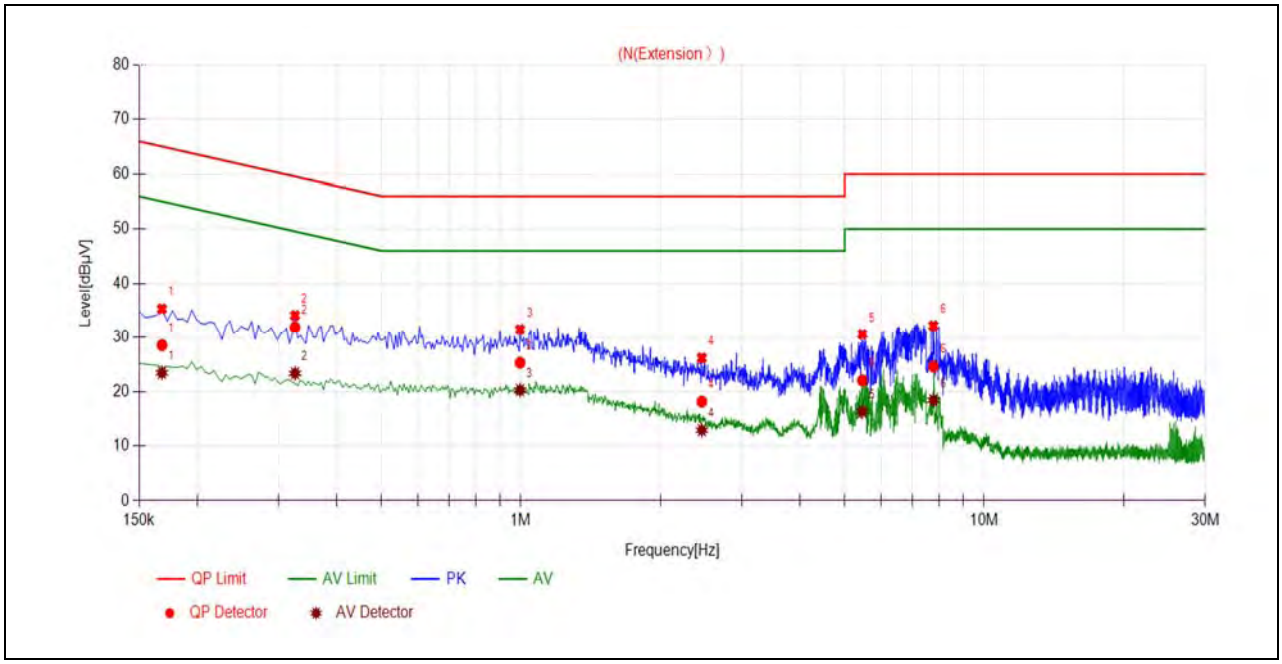
A_{Factor}: Voltage division factor of LISN

B. Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1905	28.80	23.71	64.02	54.02	Line	PASS
2	0.6450	25.44	20.88	56.00	46.00		PASS
3	1.3334	26.27	20.91	56.00	46.00		PASS
4	4.5601	16.22	11.35	56.00	46.00		PASS
5	7.5748	21.52	15.30	60.00	50.00		PASS
6	25.4380	19.55	14.26	60.00	50.00		PASS



(N Phase)

No.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1680	28.55	28.55	65.06	55.06	Neutral	PASS
2	0.3255	31.93	31.93	59.57	49.57		PASS
3	0.9959	25.30	25.30	56.00	46.00		PASS
4	2.4585	18.13	18.13	56.00	46.00		PASS
5	5.4600	22.03	22.03	60.00	50.00		PASS
6	7.7690	24.61	24.61	60.00	50.00		PASS

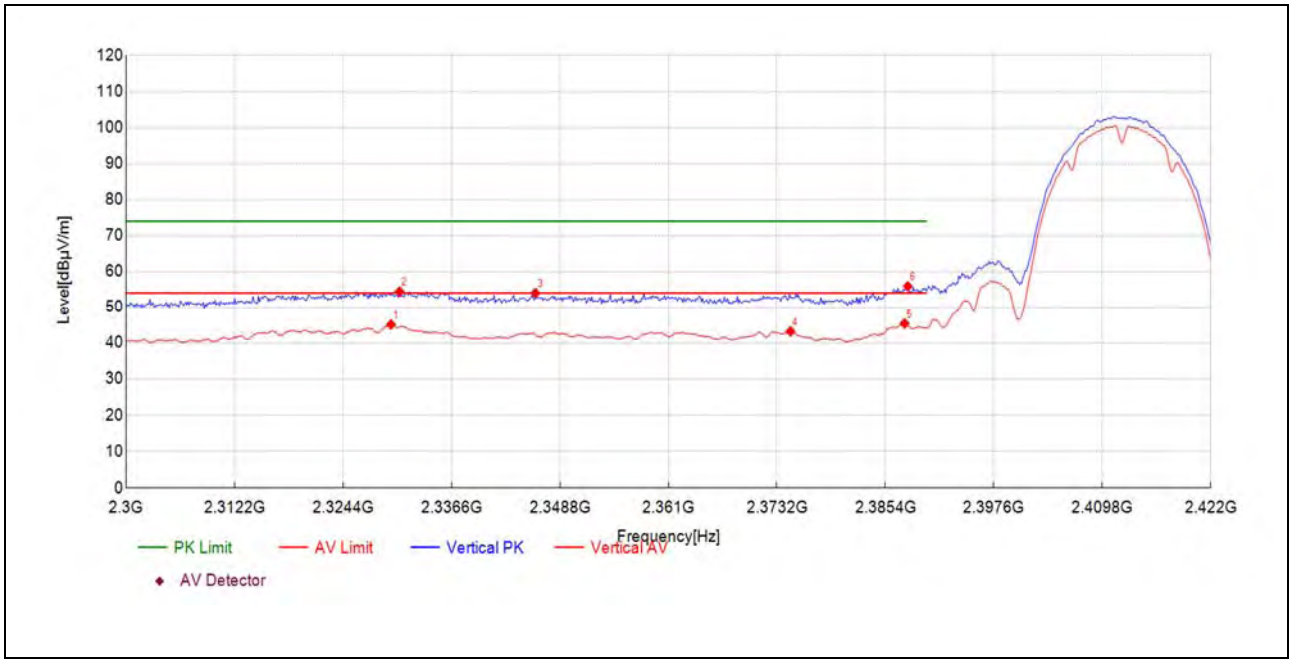
A.9. Restricted Frequency Bands

Note 1: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (Vertical) was recorded in this test report.

Note 2 All test modes and bandwidth were considered and evaluated respectively by performing full test, only the worst data were recorded for each bandwidth.

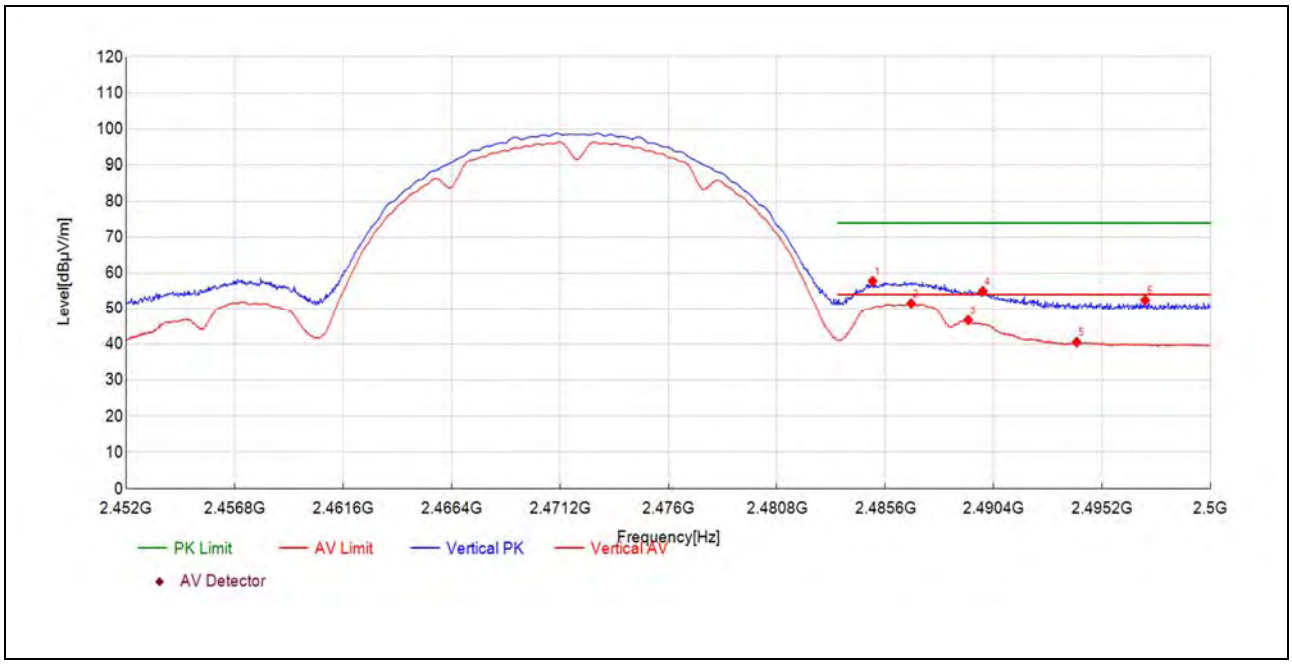
802.11b Mode

Plot for Channel 1



Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
2329.80	7.8	45.07	37.280	54.00	8.93	150	57	AV	PASS
2330.77	17.2	54.47	37.290	74.00	19.53	150	70	PK	PASS
2346.04	16.6	54.02	37.420	74.00	19.98	150	70	PK	PASS
2374.74	5.7	43.18	37.480	54.00	10.82	150	61	AV	PASS
2387.56	7.9	45.36	37.490	54.00	8.64	150	74	AV	PASS
2387.93	18.4	55.92	37.490	74.00	18.08	150	53	PK	PASS

Plot for Channel 13



Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
2485.04	19.5	57.75	38.270	74.00	16.25	150	34	PK	PASS
2486.75	13.3	51.53	38.270	54.00	2.47	150	34	AV	PASS
2489.27	8.5	46.72	38.260	54.00	7.28	150	39	AV	PASS
2489.91	16.7	55.00	38.260	74.00	19.00	150	39	PK	PASS
2494.07	2.3	40.55	38.260	54.00	13.45	150	39	AV	PASS
2497.09	14.2	52.49	38.250	74.00	21.51	150	108	PK	PASS

A.10. Radiated Emission

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak (or average) limit, it is unnecessary to perform an quasi-peak measurement (or average).

The measurement results are obtained as below:

E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]$-G_{preamp}$ [dB]

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

During the test, the total correction Factor A_T and A_{Factor} were built in test software.

Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Note 2 All test modes and bandwidth were considered and evaluated respectively by performing full test, only the worst data were recorded for each bandwidth.

Note 3 For the frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Note 4 For the frequency, which started from 18GHz to 10th harmonic of the highest frequency, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

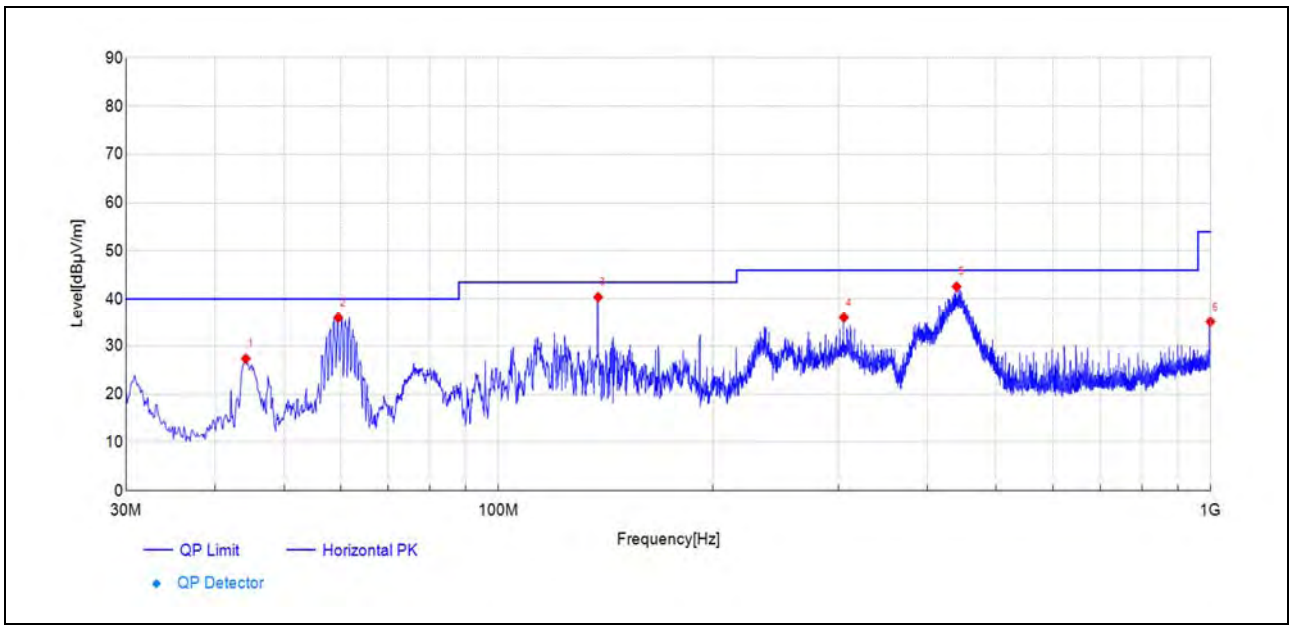
Field strength of fundamental:

Frequency [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Detector	Antenna Polarity
2411.07	56.9	94.62	37.680	PK	Horizontal

The field strength (the lowest) of fundamenta is more than 20dB higher than the unwanted emissions, in accordance with FCC part 15.215(b).

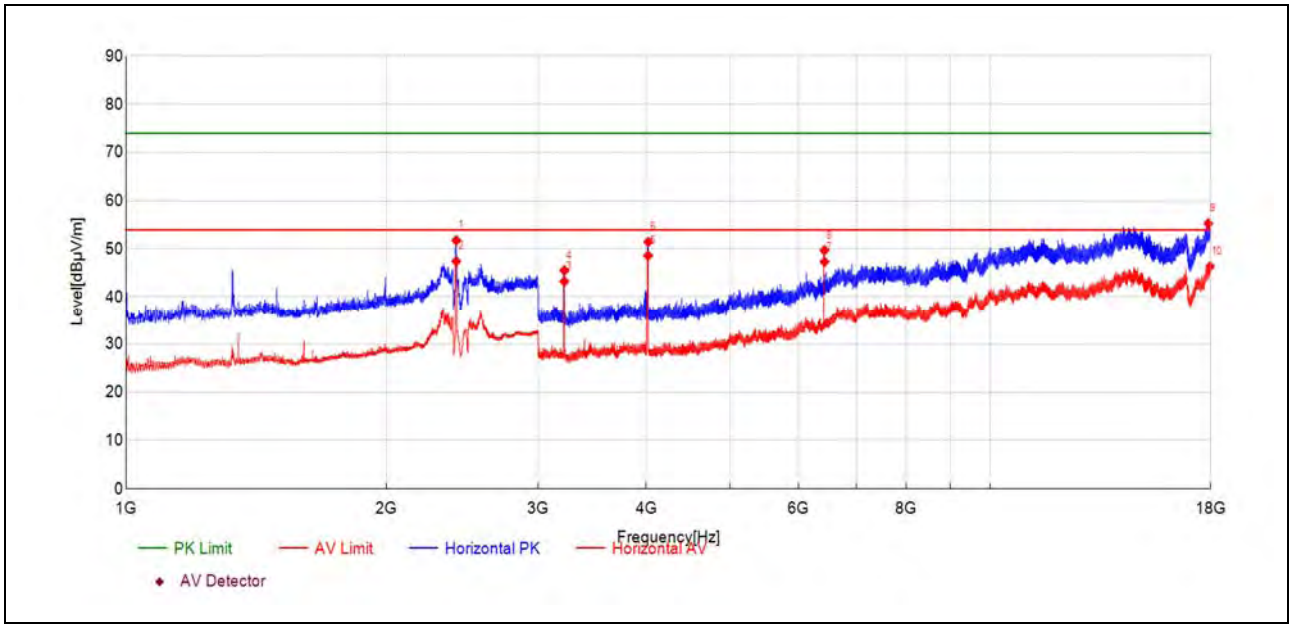
802.11b Mode

Plot for Channel 1



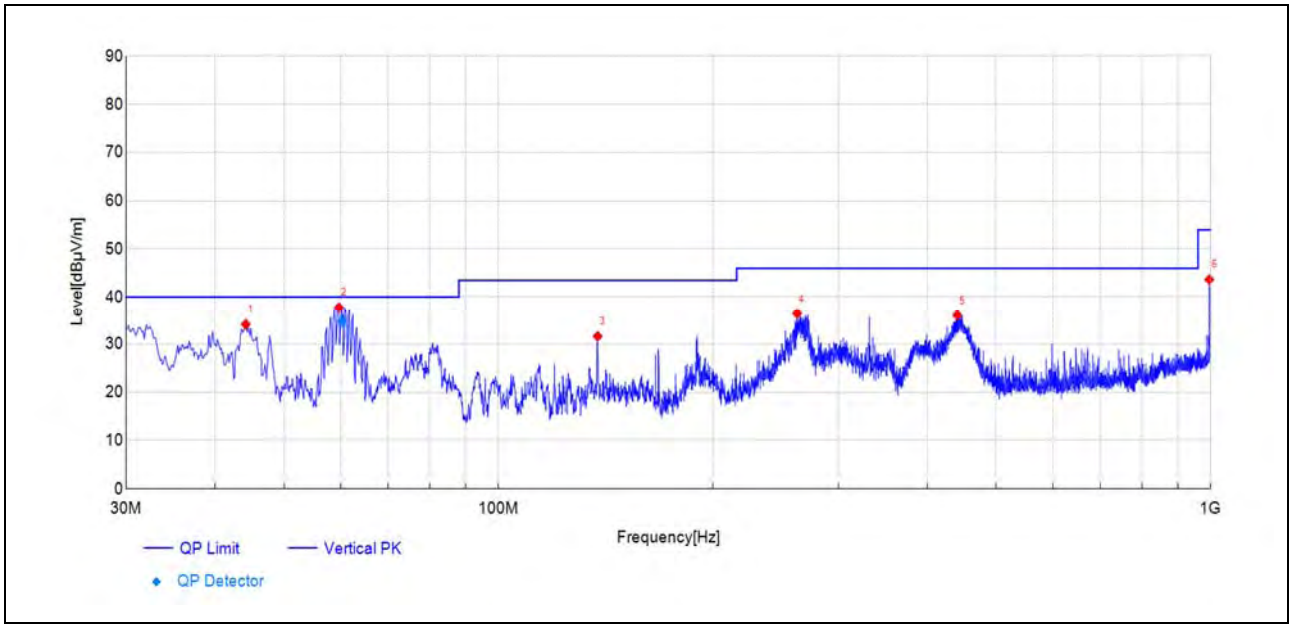
(Antenna Horizontal, 30MHz to 1GHz)

Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
44.19	55.2	27.37	-27.870	40.00	12.63	150	178	PK	PASS
59.59	64.5	35.96	-28.580	40.00	4.04	150	85	PK	PASS
138.03	72.6	40.40	-32.160	43.50	3.10	150	152	PK	PASS
305.48	61.1	35.98	-25.120	46.00	10.02	150	94	PK	PASS
439.83	64.8	42.58	-22.200	46.00	3.42	150	138	PK	PASS
999.15	45.8	35.10	-10.730	54.00	18.90	150	356	PK	PASS



(Antenna Horizontal, 1GHz to 18GHz)

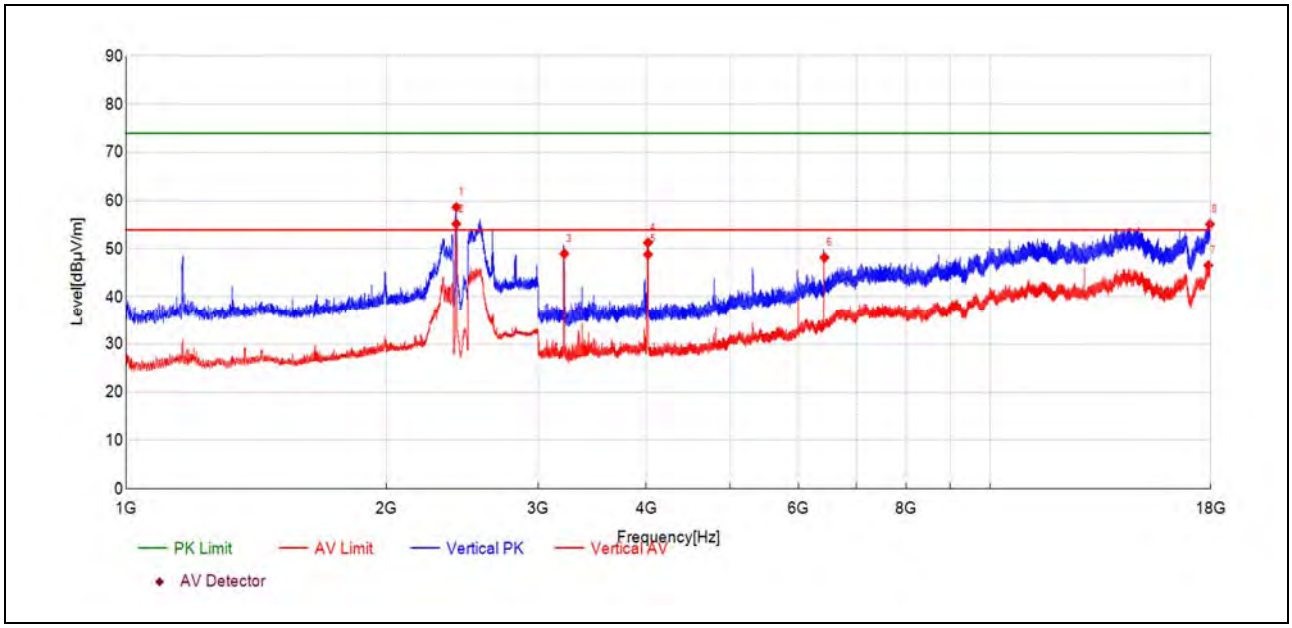
Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
2410.54	46.4	51.80	5.380	74.00	22.20	150	2	PK	N/A
2410.98	42.1	47.46	5.380	54.00	6.54	150	323	AV	N/A
3215.58	54.3	43.28	-11.000	54.00	10.72	150	57	AV	PASS
3216.01	56.6	45.55	-11.000	74.00	28.45	150	50	PK	PASS
4018.74	56.8	48.63	-8.190	54.00	5.37	150	239	AV	PASS
4020.89	59.7	51.50	-8.200	74.00	22.50	150	239	PK	PASS
6431.67	46.0	47.37	1.370	54.00	6.63	150	167	AV	PASS
6431.67	48.4	49.73	1.370	74.00	24.27	150	176	PK	PASS
17884.28	31.9	55.33	23.450	74.00	18.67	150	33	PK	PASS
17969.57	22.6	46.40	23.800	54.00	7.60	150	208	AV	PASS



(Antenna Vertical, 30MHz to 1GHz)

Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
44.19	62.0	34.15	-27.870	40.00	5.85	150	290	PK	PASS
59.71	66.3	37.77	-28.570	40.00	2.23	150	174	PK	PASS
137.79	63.8	31.64	-32.130	43.50	11.86	150	232	PK	PASS
262.68	64.1	36.44	-27.700	46.00	9.56	150	263	PK	PASS
440.67	58.2	36.09	-22.120	46.00	9.91	150	356	PK	PASS
995.64	54.2	43.67	-10.490	54.00	10.33	150	352	PK	PASS

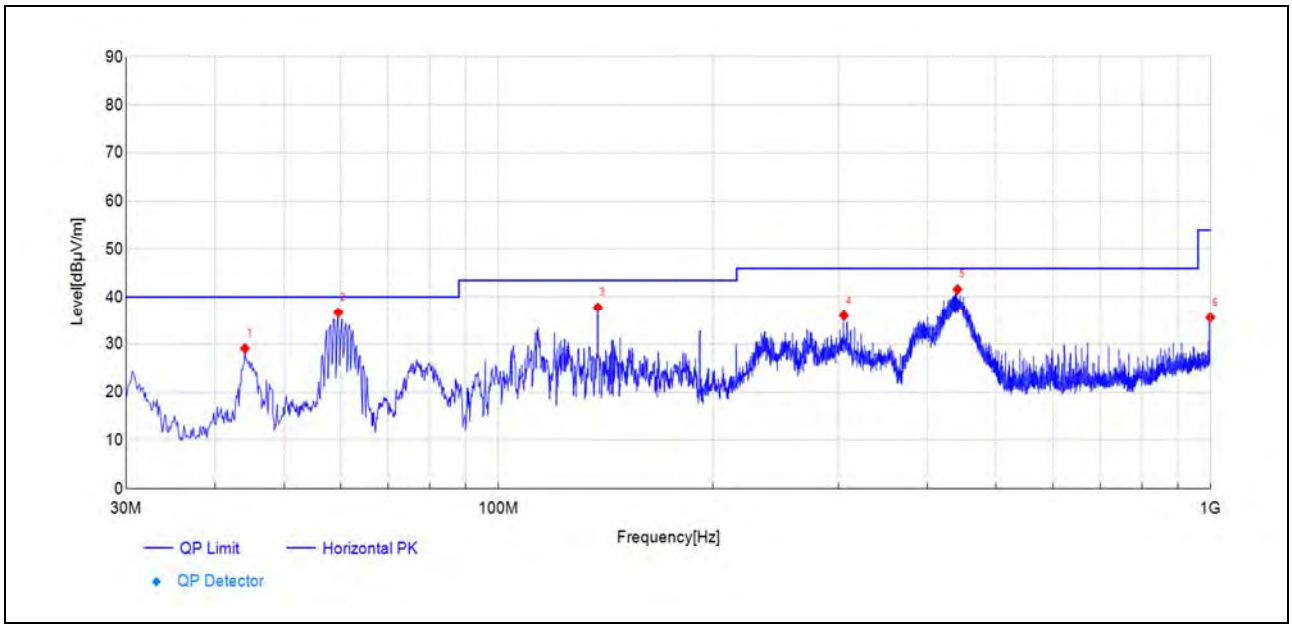
Fre. [MHz]	Factor [dB/m]	QP Reading [dBµV]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Verdict
60.35	-28.57	63.34	34.77	40.00	5.23	212	182	PASS



(Antenna Vertical, 1GHz to 18GHz)

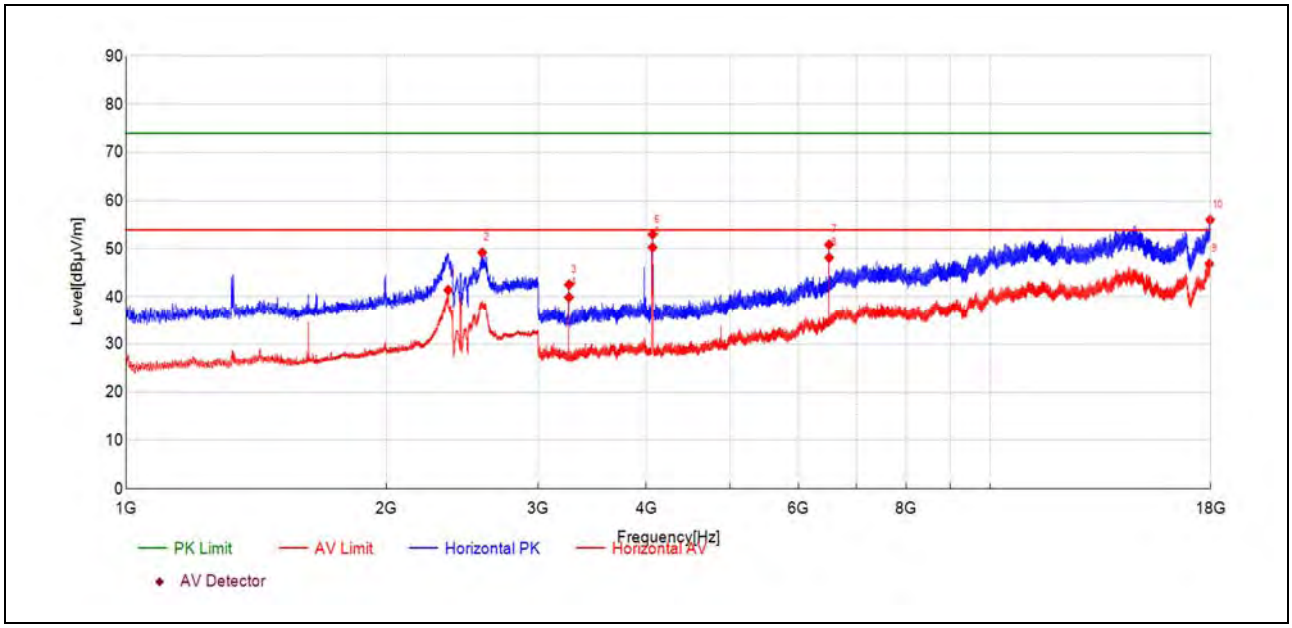
Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
2410.98	53.3	58.71	5.380	74.00	15.29	150	66	PK	N/A
2410.98	49.9	55.24	5.380	54.00	-1.24	150	56	AV	N/A
3215.58	60.0	49.02	-11.000	54.00	4.98	150	58	AV	PASS
4018.31	59.5	51.32	-8.190	74.00	22.68	150	327	PK	PASS
4018.74	57.1	48.89	-8.190	54.00	5.11	150	327	AV	PASS
6431.67	46.9	48.23	1.370	54.00	5.77	150	201	AV	PASS
17886.85	23.1	46.60	23.470	54.00	7.40	150	162	AV	PASS
17964.00	31.4	55.19	23.780	74.00	18.81	150	99	PK	PASS

Plot for Channel 7



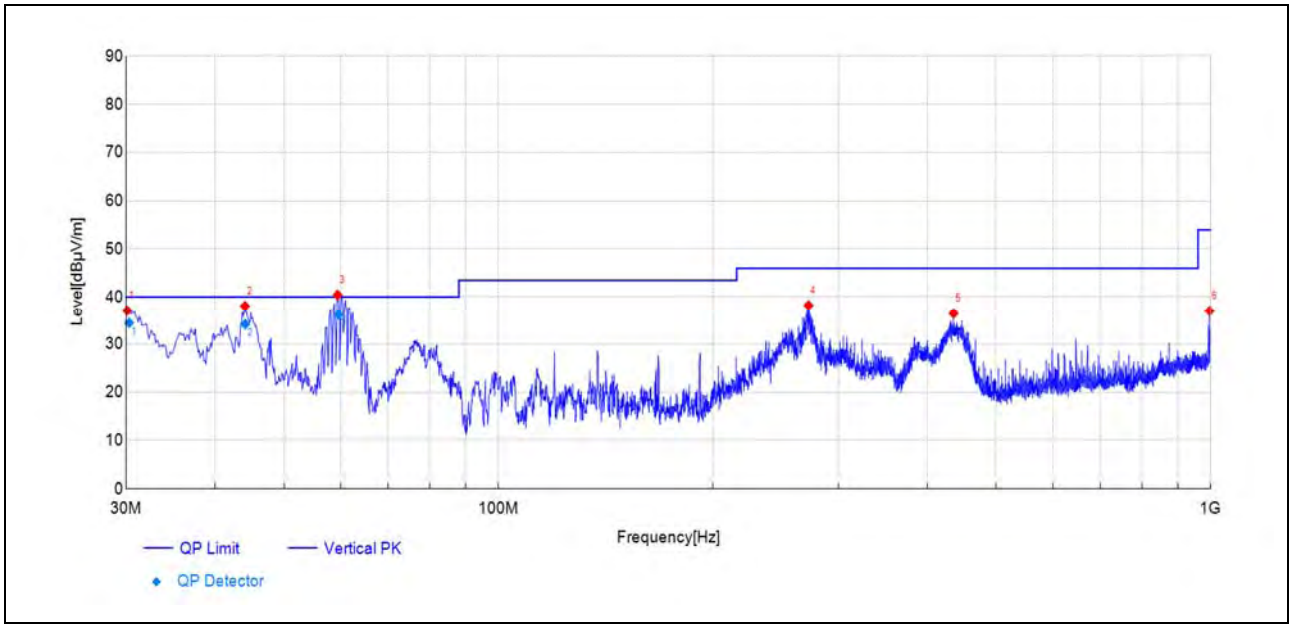
(Antenna Horizontal, 30MHz to 1GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
44.07	57.0	29.12	-27.830	40.00	10.88	150	163	PK	PASS
59.59	65.2	36.66	-28.580	40.00	3.34	150	87	PK	PASS
137.91	69.9	37.75	-32.140	43.50	5.75	150	140	PK	PASS
305.48	61.1	36.01	-25.120	46.00	9.99	150	284	PK	PASS
441.04	63.7	41.61	-22.090	46.00	4.39	150	127	PK	PASS
998.67	46.3	35.58	-10.700	54.00	18.42	150	145	PK	PASS



(Antenna Horizontal, 1GHz to 18GHz)

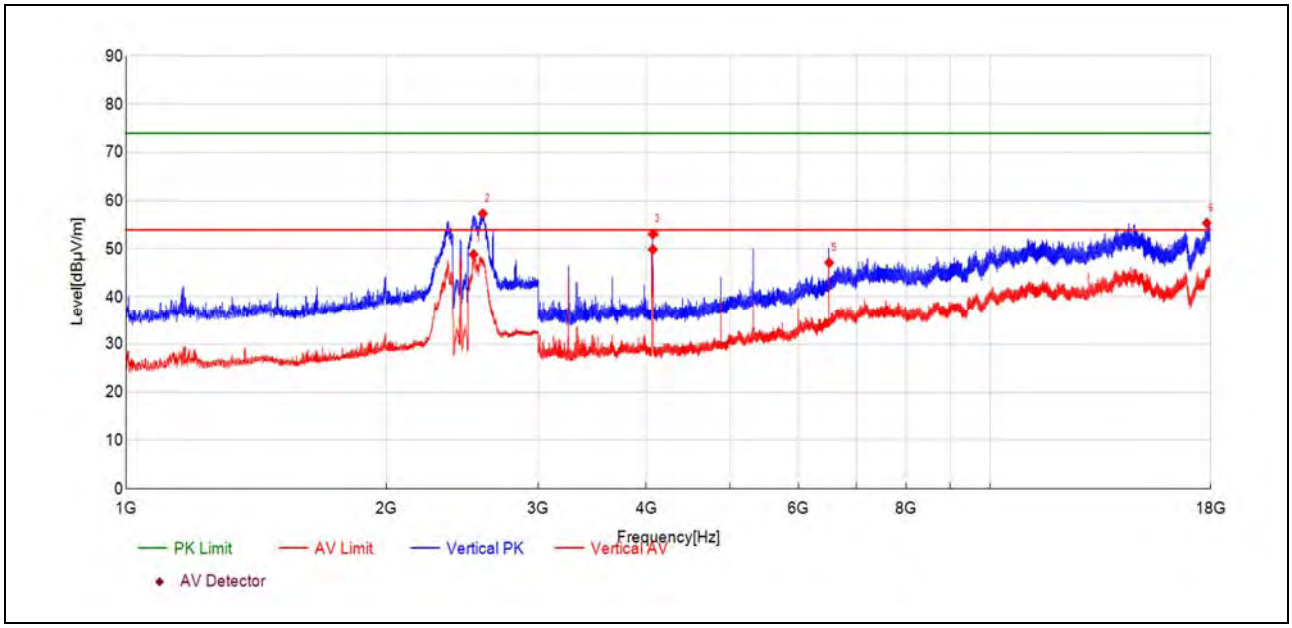
Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
2359.86	36.3	41.46	5.160	54.00	12.54	150	342	AV	PASS
2583.46	43.4	49.27	5.850	74.00	24.73	150	183	PK	PASS
3255.44	53.9	42.58	-11.300	74.00	31.42	150	158	PK	PASS
3255.86	51.2	39.94	-11.300	54.00	14.06	150	150	AV	PASS
4068.03	58.6	50.34	-8.280	54.00	3.66	150	238	AV	PASS
4068.46	61.3	53.06	-8.280	74.00	20.94	150	245	PK	PASS
6511.81	48.9	50.92	2.030	74.00	23.08	150	143	PK	PASS
6511.81	46.2	48.21	2.030	54.00	5.79	150	143	AV	PASS
17934.86	23.2	46.91	23.670	54.00	7.09	150	150	AV	PASS
17974.28	32.3	56.08	23.830	74.00	17.92	150	81	PK	PASS



(Antenna Vertical, 30MHz to 1GHz)

Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
30.12	67.9	37.12	-30.820	40.00	2.88	150	27	PK	PASS
44.07	65.9	38.08	-27.830	40.00	1.92	150	305	PK	PASS
59.46	69.0	40.45	-28.590	40.00	-0.45	150	140	PK	PASS
272.50	64.8	38.24	-26.550	46.00	7.76	150	283	PK	PASS
435.46	58.6	36.48	-22.130	46.00	9.52	150	49	PK	PASS
996.48	47.6	37.04	-10.550	54.00	16.96	150	360	PK	PASS

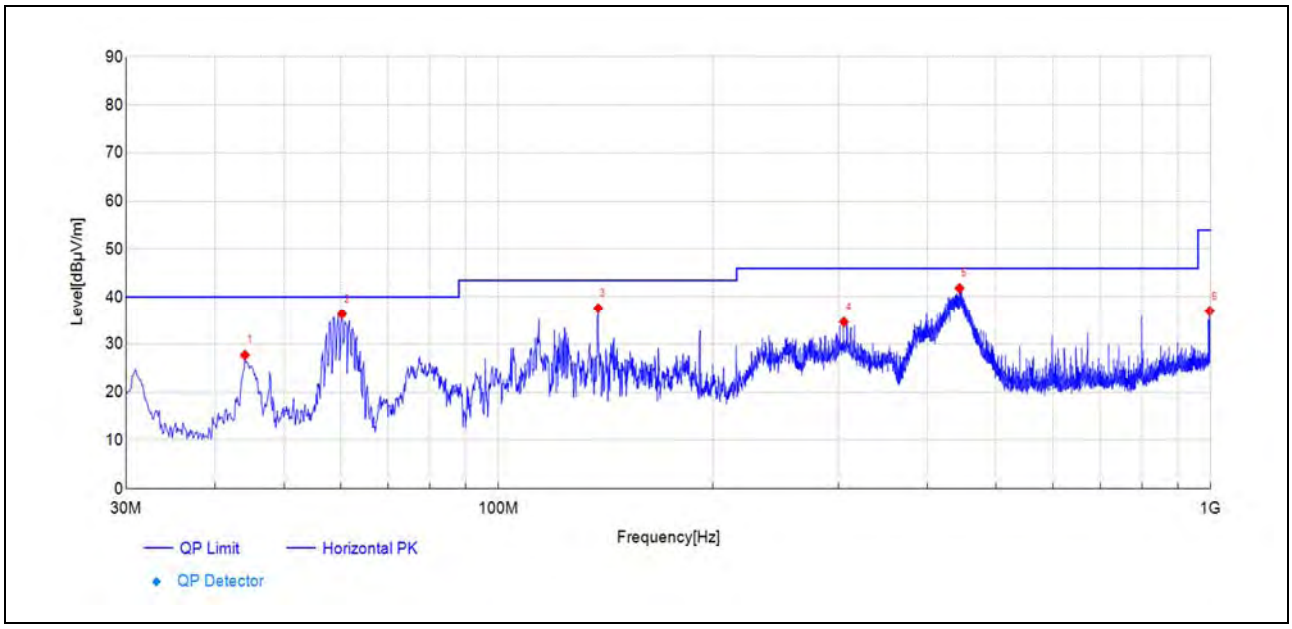
Fre. [MHz]	Factor [dB/m]	QP Reading [dBµV]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Verdict
30.30	-30.82	65.31	34.49	40.00	5.51	104	44	PASS
44.11	-27.83	62.04	34.21	40.00	5.79	100	303	PASS
59.65	-28.59	64.82	36.23	40.00	3.77	124	157	PASS



(Antenna Vertical, 1GHz to 18GHz)

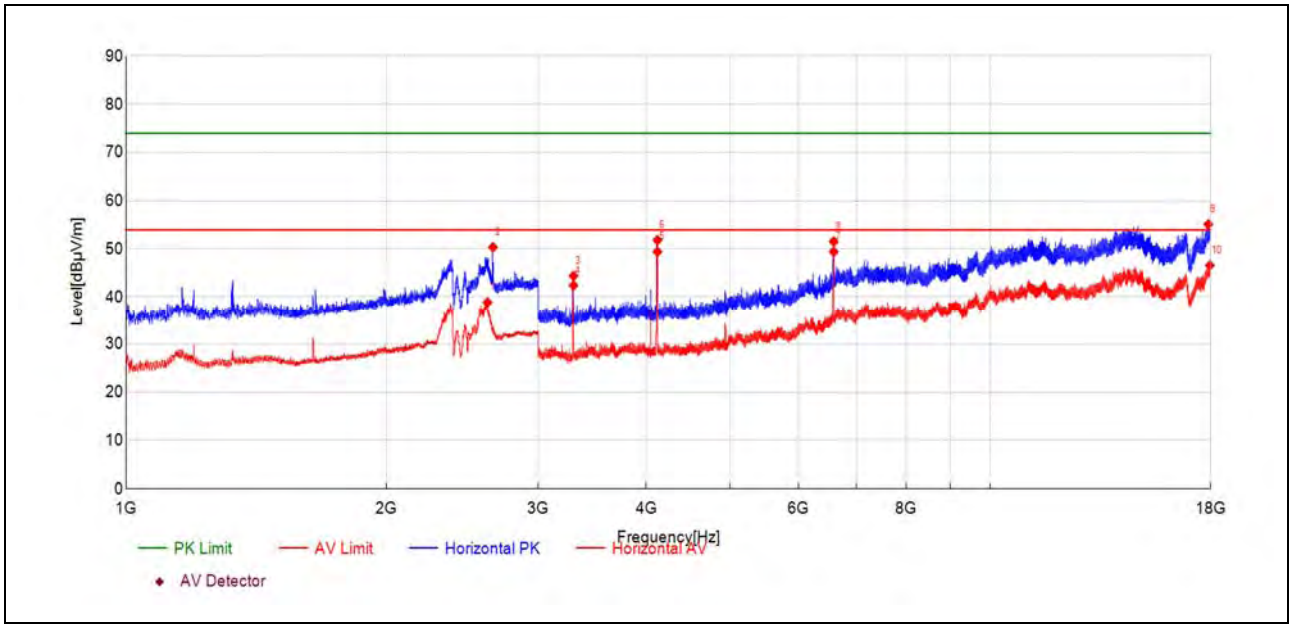
Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
2524.34	43.2	48.90	5.680	54.00	5.10	150	37	AV	PASS
2587.91	51.5	57.40	5.890	74.00	16.60	150	121	PK	PASS
4070.60	61.4	53.11	-8.280	74.00	20.89	150	1	PK	PASS
4070.60	58.2	49.91	-8.280	54.00	4.09	150	351	AV	PASS
6511.81	45.1	47.16	2.030	54.00	6.84	150	21	AV	PASS
17816.14	32.4	55.41	23.050	74.00	18.59	150	327	PK	PASS

Plot for Channel 13



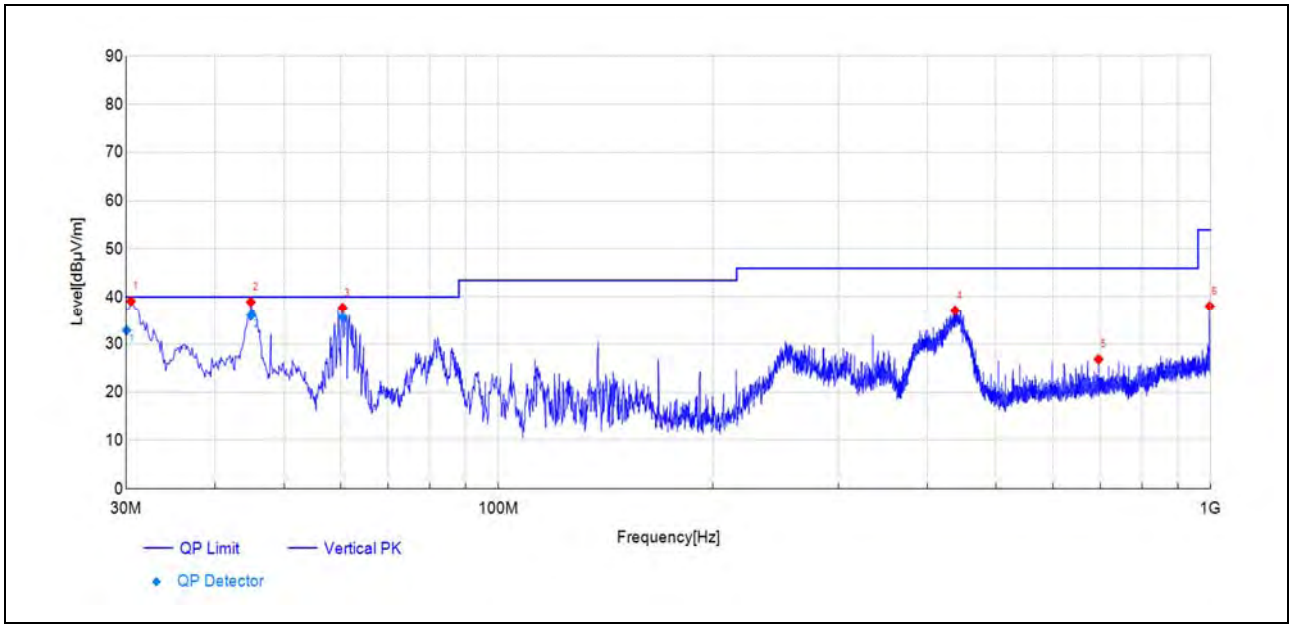
(Antenna Horizontal, 30MHz to 1GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
44.07	55.5	27.71	-27.830	40.00	12.29	150	183	PK	PASS
60.31	64.9	36.32	-28.620	40.00	3.68	150	67	PK	PASS
138.03	69.7	37.57	-32.160	43.50	5.93	150	156	PK	PASS
305.48	59.8	34.64	-25.120	46.00	11.36	150	80	PK	PASS
443.95	63.6	41.85	-21.780	46.00	4.15	150	125	PK	PASS
996.97	47.6	37.00	-10.590	54.00	17.00	150	94	PK	PASS



(Antenna Horizontal, 1GHz to 18GHz)

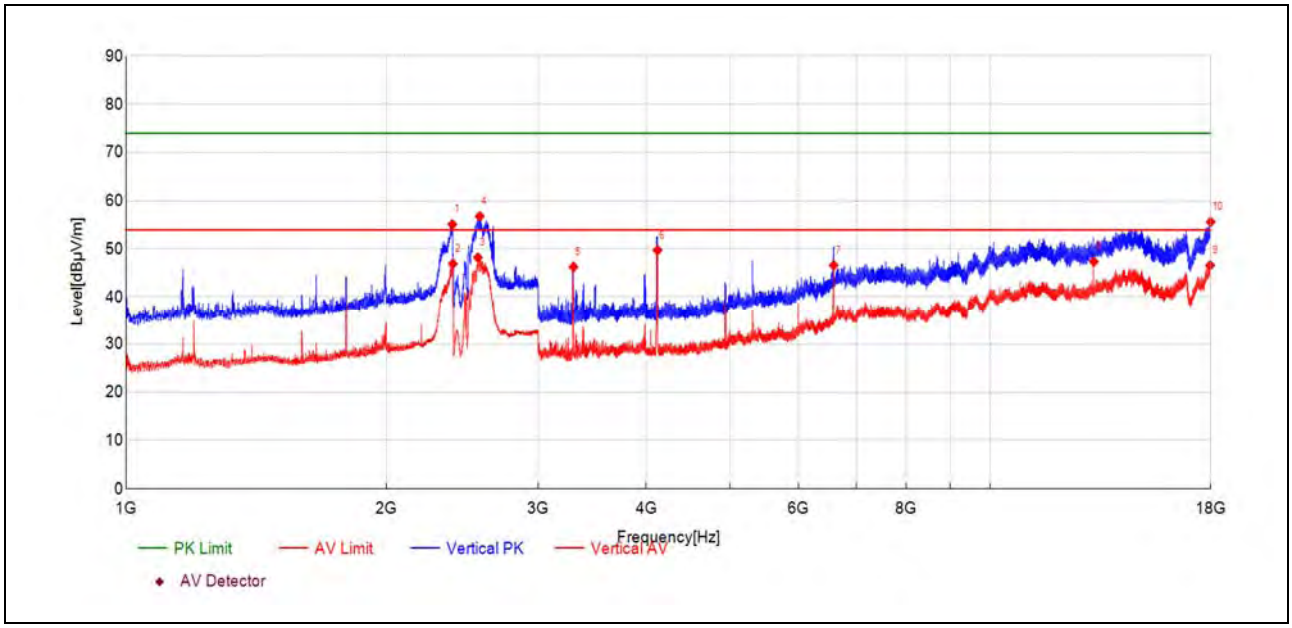
Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
2619.92	32.8	38.87	6.120	54.00	15.13	150	184	AV	PASS
2659.04	44.1	50.39	6.260	74.00	23.61	150	69	PK	PASS
3295.72	55.5	44.42	-11.110	74.00	29.58	150	151	PK	PASS
3295.72	53.5	42.43	-11.110	54.00	11.57	150	151	AV	PASS
4120.75	57.6	49.46	-8.160	54.00	4.54	150	238	AV	PASS
4120.75	60.0	51.84	-8.160	74.00	22.16	150	246	PK	PASS
6591.96	46.4	49.46	3.030	54.00	4.54	150	158	AV	PASS
6591.96	48.5	51.57	3.030	74.00	22.43	150	175	PK	PASS
17883.85	31.7	55.15	23.440	74.00	18.85	150	33	PK	PASS
17956.28	22.9	46.60	23.750	54.00	7.40	150	359	AV	PASS



(Antenna Vertical, 30MHz to 1GHz)

Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
30.49	69.9	39.12	-30.770	40.00	0.88	150	180	PK	PASS
44.91	67.0	38.94	-28.060	40.00	1.06	150	0	PK	PASS
60.43	66.4	37.70	-28.660	40.00	2.30	150	180	PK	PASS
437.52	59.3	37.11	-22.160	46.00	8.89	150	360	PK	PASS
696.03	42.4	26.84	-15.590	46.00	19.16	150	0	PK	PASS
997.09	48.7	38.07	-10.600	54.00	15.93	150	90	PK	PASS

Fre. [MHz]	Factor [dB/m]	QP Reading [dBµV]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Verdict
30.05	-30.77	63.67	32.90	40.00	7.10	162	212	PASS
44.99	-28.06	64.18	36.12	40.00	3.88	130	0	PASS
60.39	-28.66	64.33	35.67	40.00	4.33	141	174	PASS



(Antenna Vertical, 1GHz to 18GHz)

Fre. (MHz)	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
2386.09	49.9	55.13	5.200	74.00	18.87	150	62	PK	PASS
2389.64	41.8	46.96	5.200	54.00	7.04	150	57	AV	PASS
2554.57	42.7	48.24	5.550	54.00	5.76	150	34	AV	PASS
2566.57	51.2	56.85	5.670	74.00	17.15	150	109	PK	PASS
3295.72	57.4	46.29	-11.110	54.00	7.71	150	12	AV	PASS
4121.60	57.9	49.78	-8.150	54.00	4.22	150	5	AV	PASS
6591.96	43.6	46.63	3.030	54.00	7.37	150	202	AV	PASS
13184.01	31.8	47.40	15.600	54.00	6.60	150	75	AV	PASS
17972.14	22.8	46.63	23.820	54.00	7.37	150	357	AV	PASS
17999.14	31.8	55.67	23.920	74.00	18.33	150	12	PK	PASS

END OF REPORT