



REPORT No.: SZ25070176W01

TEST REPORT

APPLICANT : Zhejiang Lierda Internet of Things
Technology Co., Ltd.

PRODUCT NAME : Lierda Feng Series WB28 LoRa
Mesh Module

MODEL NAME : L-LRNWB28-84MN4

BRAND NAME : Lierda

FCC ID : 2AOFDL-LRNWB28

STANDARD(S) : 47 CFR Part 15 Subpart C

RECEIPT DATE : 2025-07-17

TEST DATE : 2025-08-06 to 2025-09-08

ISSUE DATE : 2025-11-20



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Change History		
Version	Date	Reason for change
1.0	2025-11-20	First edition



1. Summary of Test Result

No.	Section	Description	Test Date	Test Engineer	Result	Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	/
2	15.247(a) 15.247(h)	Hopping Mechanism	N/A	N/A	PASS	/
3	15.247(a)	Number of Hopping Frequency	Aug. 05, 2025	Lin Haoyang	PASS	/
4	ANSI C63.10	Duty Cycle	Aug. 06, 2025	Lin Haoyang	PASS	/
5	15.247(b)	Maximum Peak Conducted Output Power	Aug. 06, 2025	Lin Haoyang	PASS	/
6	15.247(b)	Maximum Average Conducted Output Power	Aug. 06, 2025	Lin Haoyang	PASS	/
7	15.247(a)	20dB Bandwidth	Aug. 06, 2025	Lin Haoyang	PASS	/
8	15.247(a)	Carrier Frequency Separation	Aug. 05, 2025	Lin Haoyang	PASS	/
9	15.247(a)	Time of Occupancy (Dwell time)	Sep. 08, 2025	Lin Haoyang	PASS	/
10	15.247(d)	Conducted Spurious Emission	Aug. 06, 2025	Lin Haoyang	PASS	/
11	15.207	Conducted Emission	N/A	N/A	N/A ^{Note1}	/
12	15.209, 15.247(d)	Radiated Emission	Aug. 19 to 28, 2025	Zhong Xiangyun	PASS	/

Note 1: Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

Note 2: The tests were performed according to the method of measurements prescribed in ANSI



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C63.10-2020, KDB 558074 D01 v05r02 and DA 00-075.

Note 3: Any additions, deviation, or exclusions from the method shall be noted in the "Remark".

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 Analyzer	MY53470836	N9010A	Agilent	2025.01.15	2026.01.14
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	101052	ESPI	R&S	2025.05.15	2026.05.14
LISN	103131	ENV 216	R&S	2025.03.20	2026.03.19
RF Coaxial Cable (DC-100MHz)	EMC-CE-00514	N/A	N/A	2025.05.06	2026.05.05

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	2025.05.13	2026.05.12
Test Antenna - Bi-Log	9163-274	VULB 9163	Schwarzbeck	2025.06.28	2026.06.27
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2025.05.16	2026.05.15
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2025.06.20	2026.06.19
Test Antenna – Horn	BBHA9170 #773	BBHA9170	Schwarzbeck	2025.06.20	2026.06.19
Preamplifier (10MHz-6GHz)	46732	S10M100L38 02	LUCIX CORP.	2025.05.13	2026.05.12
Preamplifier (2GHz-18GHz)	61171/61172	S020180L32 03	LUCIX CORP.	2025.05.13	2026.05.12
Preamplifier (18GHz-40GHz)	DS77209	DCLNA0118-40C-S	Decentest	2025.05.13	2026.05.12
RF Coaxial Cable (DC-18GHz)	MRE001	PE330	Pasternack	2025.05.13	2026.05.12
RF Coaxial Cable (DC-18GHz)	MRE002	CLU18	Pasternack	2025.05.13	2026.05.12
RF Coaxial Cable (DC-18GHz)	MRE003	CLU18	Pasternack	2025.05.13	2026.05.12
RF Coaxial Cable (DC-40GHz)	22290045	QA360-40-KK-0.5	Qualwave	2024.09.11	2025.09.10
RF Coaxial Cable (DC-40GHz)	22290046	QA360-40-KKF-2	Qualwave	2024.09.11	2025.09.10
RF Coaxial Cable (DC-18GHz)	22120181	QA500-18-NN-5	Qualwave	2024.09.11	2025.09.10
Anechoic Chamber	N/A	9m*6m*6m	CRT	2025.06.21	2028.06.20
Anechoic Chamber	N/A	9m*6m*6m	CRT	2022.11.30	2025.11.29



1.3. Measurement Uncertainty

Test Items	Uncertainty	Remark
Number of Hopping Frequency	±5%	Confidence levels of 95%
Peak Output Power	±2.22dB	Confidence levels of 95%
Bandwidth	±5%	Confidence levels of 95%
Carrier Frequency Separation	±5%	Confidence levels of 95%
Time of Occupancy (Dwell time)	±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
Telephone	+86 755 36698555
Facsimile	+86 755 36698525
FCC Designation Number	CN1192
FCC Test Firm Registration Number	226174

2. General Description

2.1. Information of Applicant and Manufacturer

Applicant:	Zhejiang Lierda Internet of Things Technology Co., Ltd.
Applicant Address:	Room 1402, Building 1, No.1326, Wenyi West Road, Cangqian street, Yuhang District, Hangzhou, Zhejiang Prov. China
Manufacturer:	Zhejiang Lierda Internet of Things Technology Co., Ltd.
Manufacturer Address:	Room 1402, Building 1, No.1326, Wenyi West Road, Cangqian street, Yuhang District, Hangzhou, Zhejiang Prov. China

2.2. Information of EUT

Product Name:	Lierda Feng Series WB28 LoRa Mesh Module
Sample No.:	1#, 2#
Hardware Version:	V01
Software Version:	V01
Equipment Type:	LoRa
Operating Frequency Range:	DSS: 902.4MHz–926.025MHz
Antenna Type:	Rod Antenna
Antenna Gain:	4.57dBi

Note 1: The EUT description presented in the report are provided by applicant and/or manufacturer, and the test laboratory is not responsible for the accuracy of the information. 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

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	902.400	16	908.400	32	914.400	48	920.400
1	902.775	17	908.775	33	914.775	49	920.775
2	903.150	18	909.150	34	915.150	50	921.150
3	903.525	19	909.525	35	915.525	51	921.525
4	903.900	20	909.900	36	915.900	52	921.900
5	904.275	21	910.275	37	916.275	53	922.275
6	904.650	22	910.650	38	916.650	54	922.650
7	905.025	23	911.025	39	917.025	55	923.025
8	905.400	24	911.400	40	917.400	56	923.400
9	905.775	25	911.775	41	917.775	57	923.775
10	906.150	26	912.150	42	918.150	58	924.150
11	906.525	27	912.525	43	918.525	59	924.525
12	906.900	28	912.900	44	918.900	60	924.900
13	907.275	29	913.275	45	919.275	61	925.275
14	907.650	30	913.650	46	919.650	62	925.650
15	908.025	31	914.025	47	920.025	63	926.025

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

2.4. Test Configuration of EUT

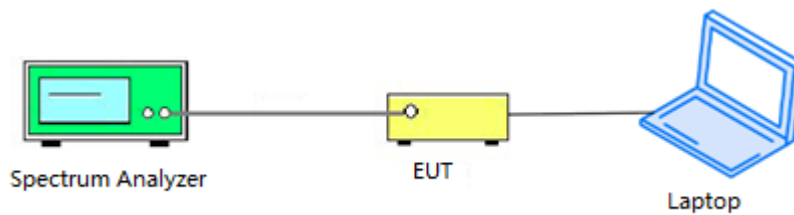
Test mode is used to control the EUT under the maximum power level during test.

2.5. Test Conditions

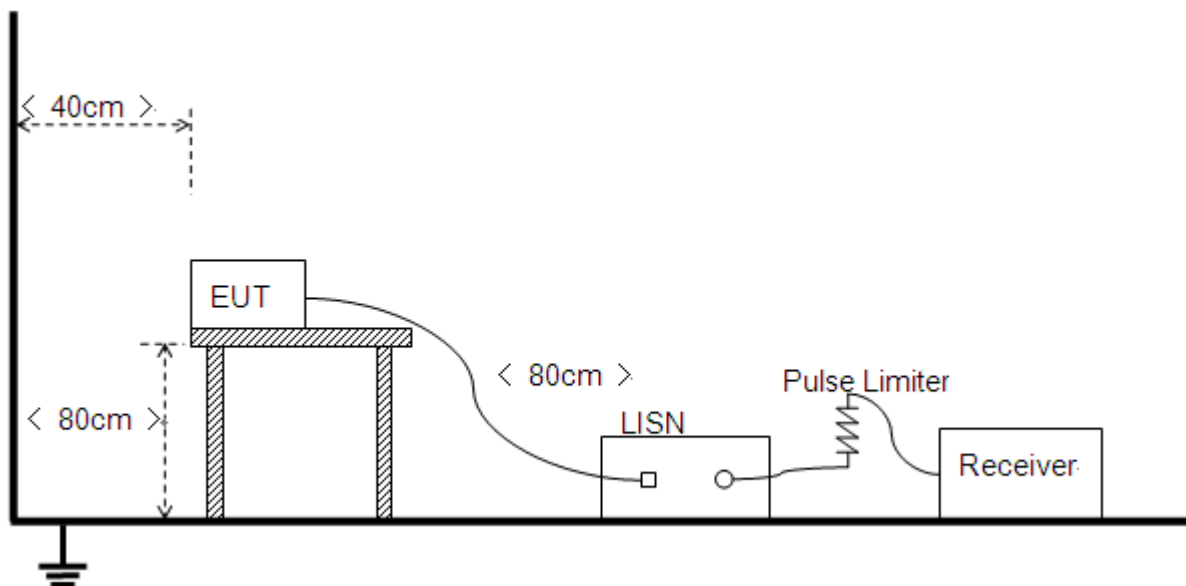
Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106

2.6. Test Setup Layout Diagram

2.6.1. Conducted Measurement

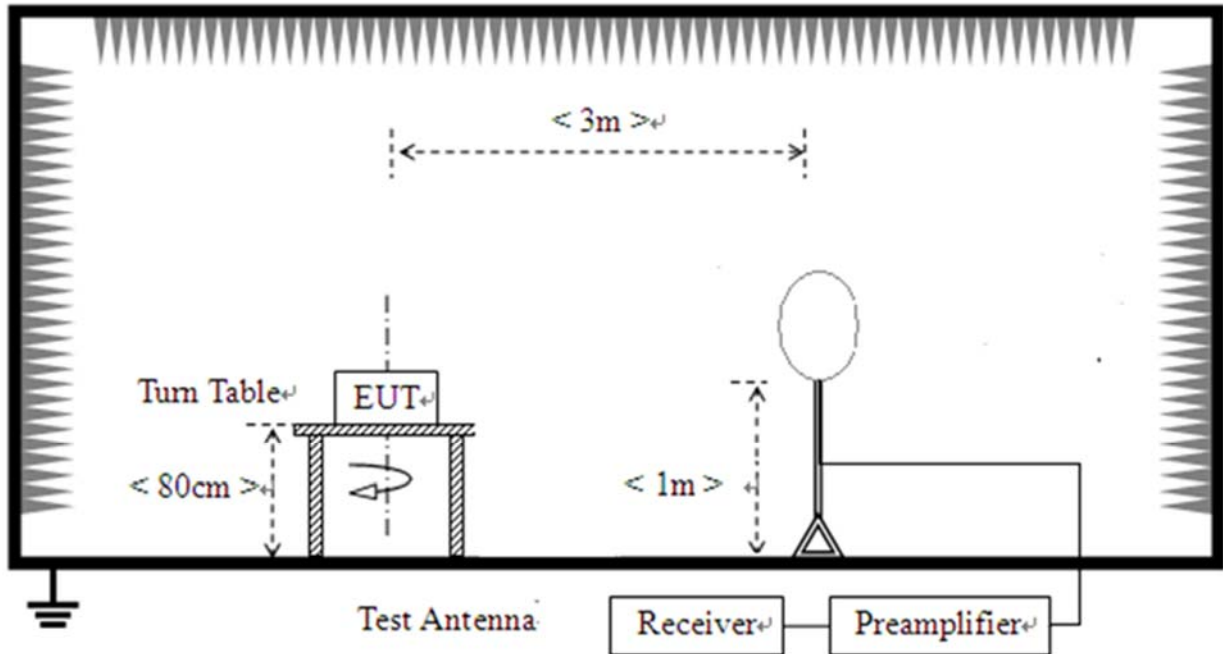


2.6.2. Conducted Emission Measurement

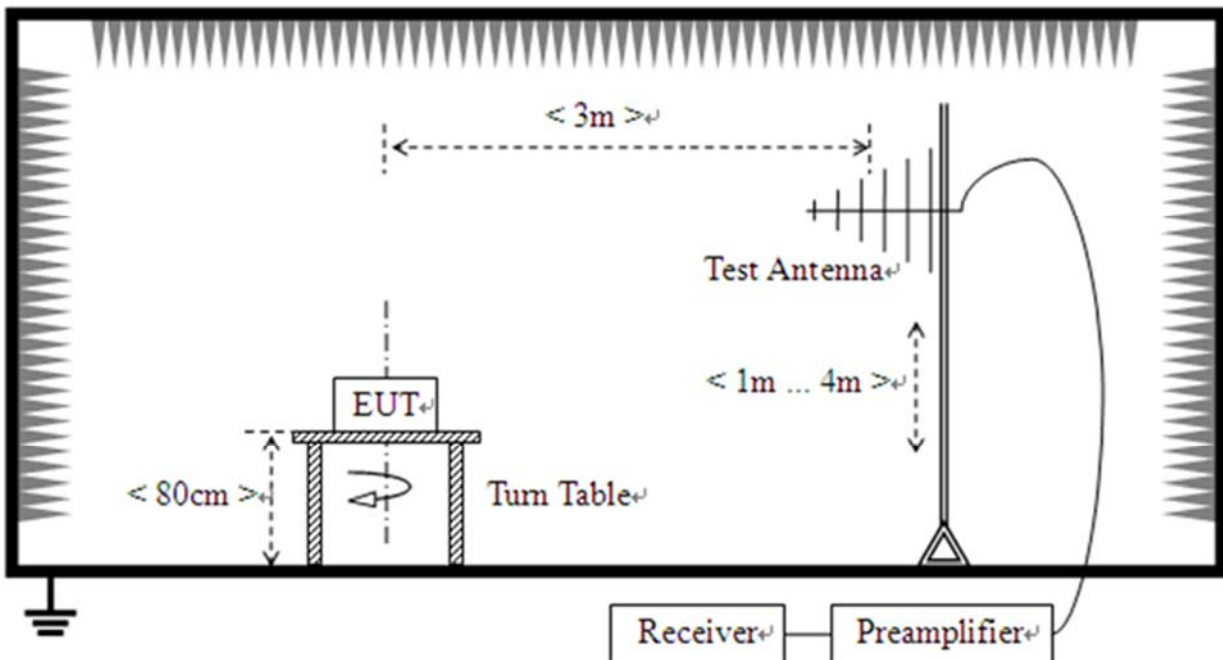


2.6.3.Radiation Measurement

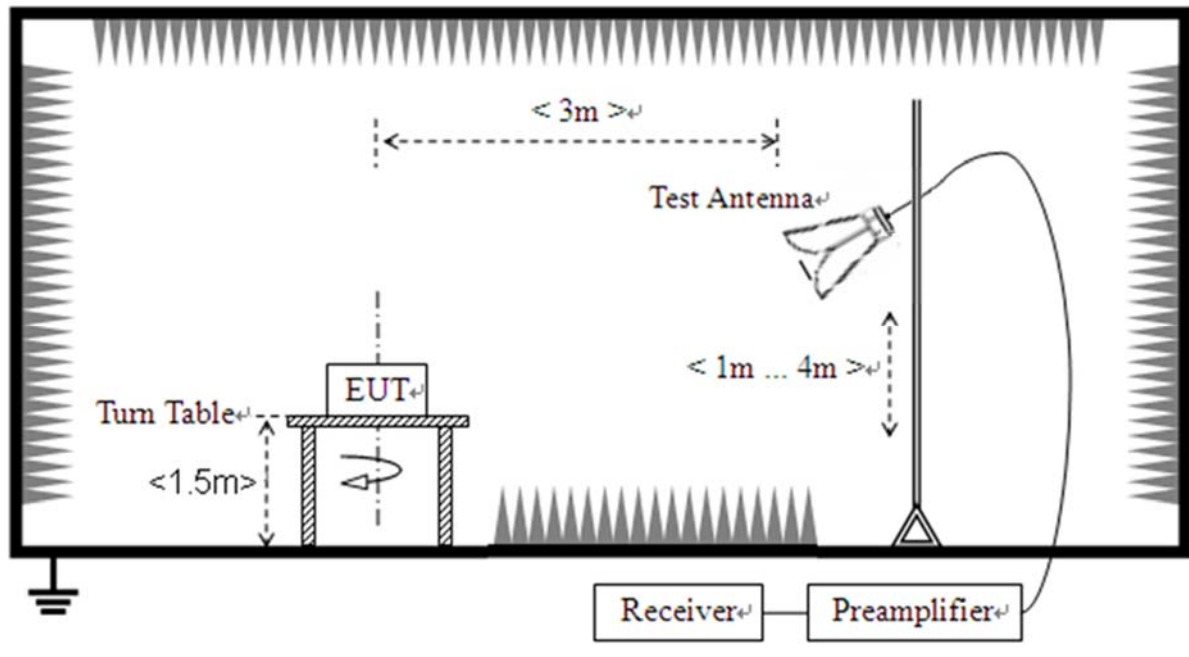
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to 1GHz



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

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

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

3.2. Hopping Mechanism

3.2.1. Requirement

According to FCC section 15.247(a)(1), a frequency hopping spread spectrum system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

According to FCC section 15.247(h), the incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

3.2.2. Test Result

The hopping mechanism of the EUT is based on the protocol that " **LoRaWAN** ".

3.3. Number of Hopping Frequency

3.3.1. Requirement

According to FCC section 15.247(a)(1)(i), frequency hopping systems operating in the 902MHz to 928MHz bands shall use at least 50 hopping frequencies if the 20dB bandwidth of the hopping channel is less than 250KHz; or at least 25 hopping frequencies if the 20dB bandwidth of the hopping channel is 250KHz or greater.

3.3.2. Test Procedures

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

VBW $\geq$ RBW

Sweep = auto

Detector function = peak



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Trace = max hold

Allow the trace to stabilize

3.3.3.Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.3.4.Test Result

Refer to Annex A.1 in this report.

3.4. Duty Cycle of Test Signal

3.4.1. 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 $\pm 2\%$; otherwise, the duty cycle is considered to be non constant.

3.4.2. Test Result

Refer to Annex A.2 in this report.



3.5. Maximum Peak Conducted Output Power

3.5.1. Requirement

According to FCC section 15.247(b)(2), for frequency hopping systems that operates in the 902MHz to 928MHz band employing at least 50 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt, and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.5.2. Test Procedures

KDB 558074 Section 8.3.1 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.3 in this report.



3.6. Maximum Average Conducted Output Power

3.6.1. Requirement

According to FCC section 15.247(b)(2), for frequency hopping systems that operates in the 902MHz to 928MHz band employing at least 50 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt, and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.6.2. Test Procedures

KDB 558074 Section 8.3.2 was used in order to prove compliance.

3.6.3. Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.6.4. Test Result

Refer to Annex A.4 in this report.



3.7.20 dB Bandwidth

3.7.1.Requirement

According to FCC section 15.247(a)(1), the 20 dB bandwidth is known as the 99% emission bandwidth, or 20 dB bandwidth ($10 \cdot \log 1\% = 20 \text{ dB}$) taking the total RF output power.

3.7.1.Test Procedures

Use the following spectrum analyzer settings:

Span = between 2 to 5 times the OBW, centered on the test channel

RBW= 1% to 5% of the OBW

VBW $\geq 3 \times$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

3.7.2.Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.7.3.Test Result

Refer to Annex A.5 in this report.



3.8. Carried Frequency Separation

3.8.1. Requirement

According to FCC section 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or of the 20dB bandwidth of the hopping channel, whichever is greater.

3.8.2. Test Procedures

The EUT must have its hopping function enabled. According to DA 00-705, use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) $\geq 1\%$ of the span

Video (or Average) Bandwidth (VBW) $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

3.8.3. Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.8.4. Test Result

Refer to Annex A.6 in this report.

3.9. Time of Occupancy (Dwell time)

3.9.1. Requirement

According to FCC §15.247(a) (1) (i), frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

3.9.2. Test Procedures

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in 10 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 20 second period is equal to (# of pulses in 20s) * pulse width.

3.9.3. Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.9.4. Test Result

Refer to Annex A.7 in this report.

3.10. Conducted Spurious Emissions and Band Edge

3.10.1.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.

3.10.2.Test Procedures

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 $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

3.10.3.Test Setup Layout

Refer to chapter 2.6.1 in this report.

3.10.4.Test Result

Refer to Annex A.8 and A.9 in this report.

3.11. Conducted Emission

3.11.1.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 50 μ H/50 Ω line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dB μ V)	
	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.

3.11.2.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.

3.11.3.Test Setup Layout

Refer to chapter 2.6.2 in this report.

3.11.4.Test Result

Refer to Annex A.10 in this report.

3.12. Radiated Emission

3.12.1.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 ($\mu\text{V/m}$)	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).



3.12.2.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.

3.12.3.Test Setup Layout

Refer to chapter 2.6.3 in this report.

3.12.4.Test Result

Refer to Annex A.11 in this report.



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Annex A Test Data and Result

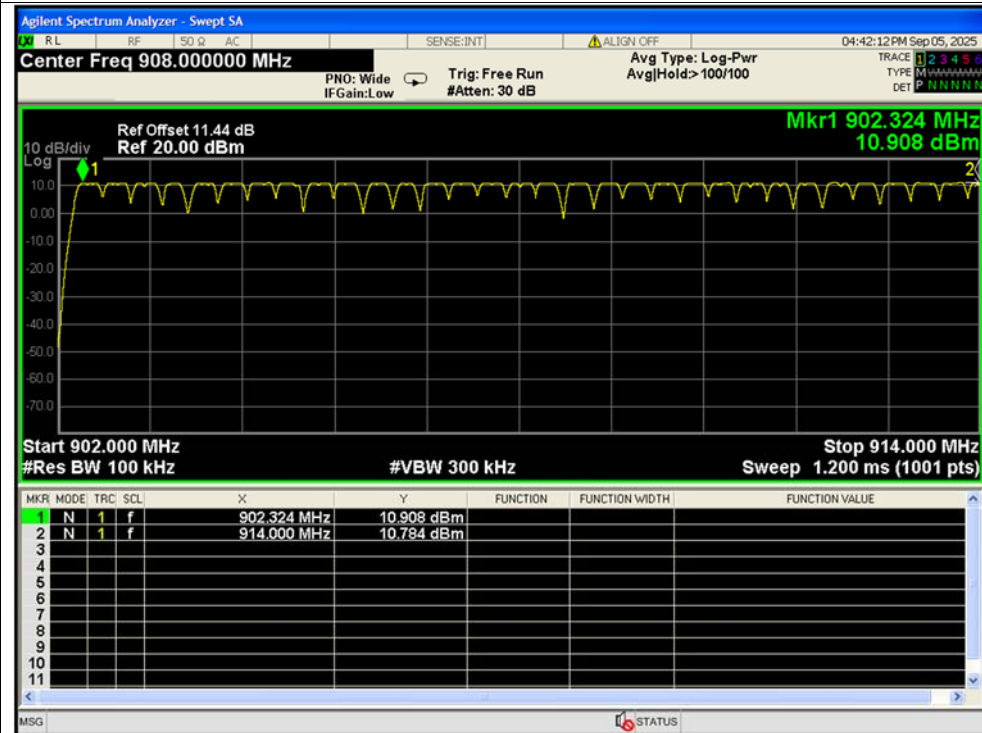
A.1. Number of Hopping Frequency

Condition	Mode	Antenna	Hopping Number	Limit	Verdict
NVNT	Lora-FHSS	Ant1	64	25	Pass

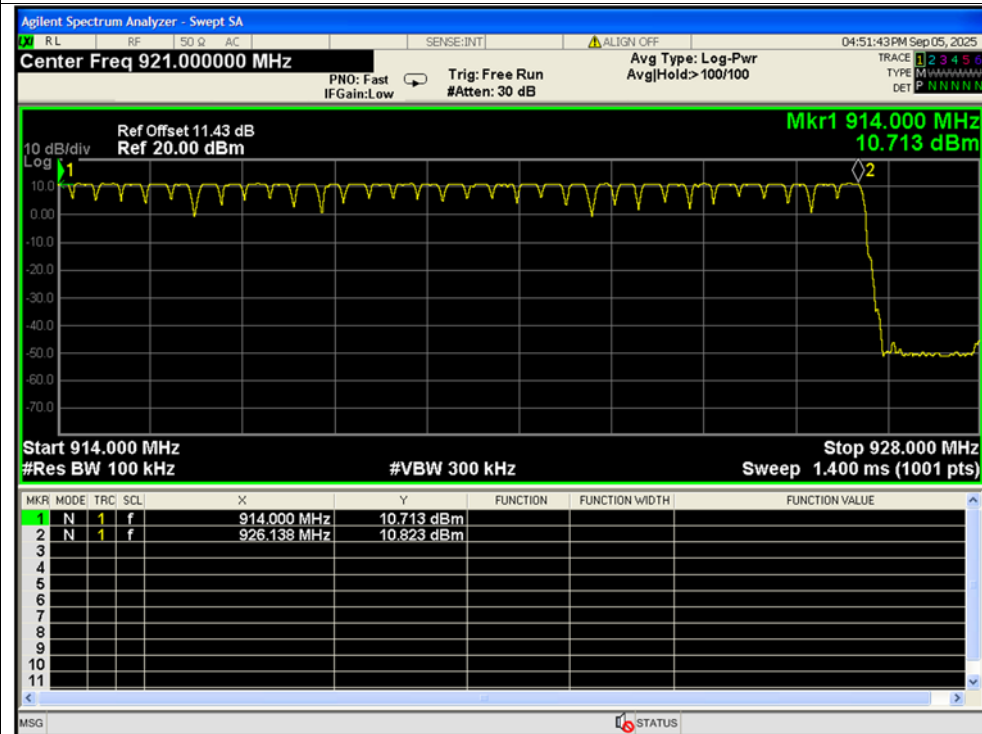


Test Graphs

Hopping No. NVNT LoRa-FHSS Lower Freq.Segment Ant1



Hopping No. NVNT LoRa-FHSS Higher Freq.Segment Ant1



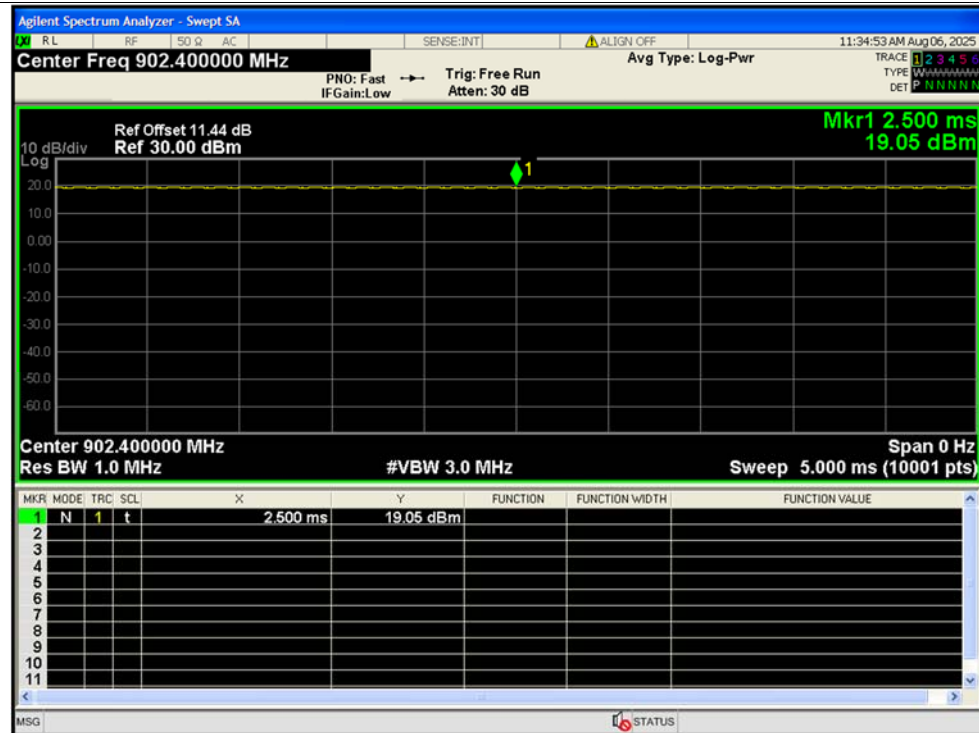
**A.2. Duty Cycle of Test Signal**

Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	Lora-FHSS	902.4	Ant1	100	0	0
NVNT	Lora-FHSS	914.4	Ant1	100	0	0
NVNT	Lora-FHSS	926.025	Ant1	100	0	0

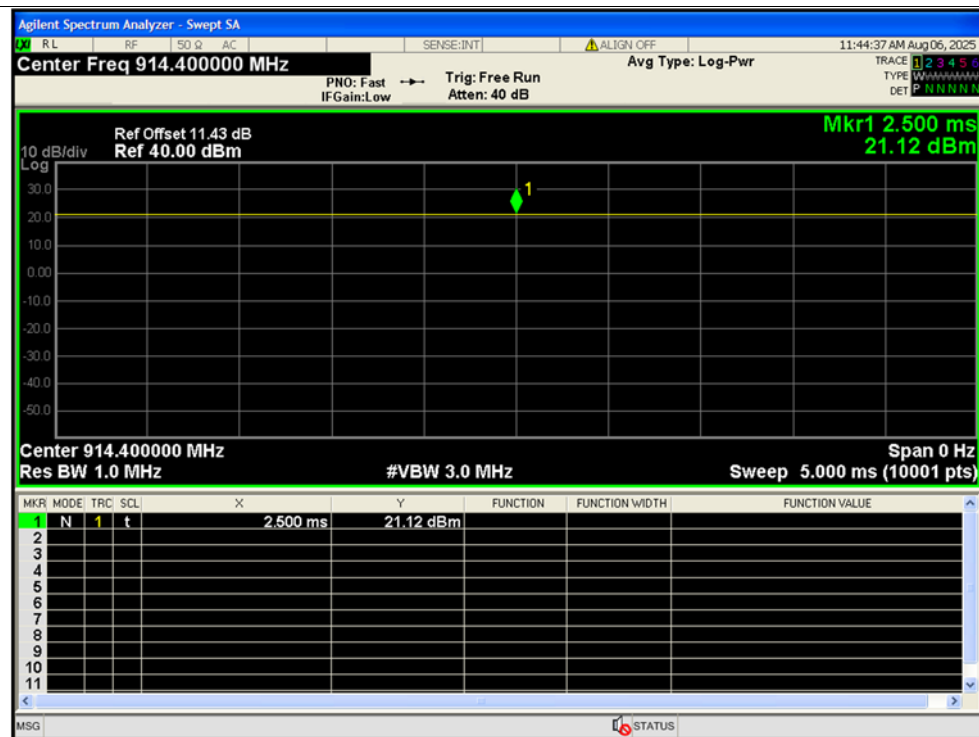


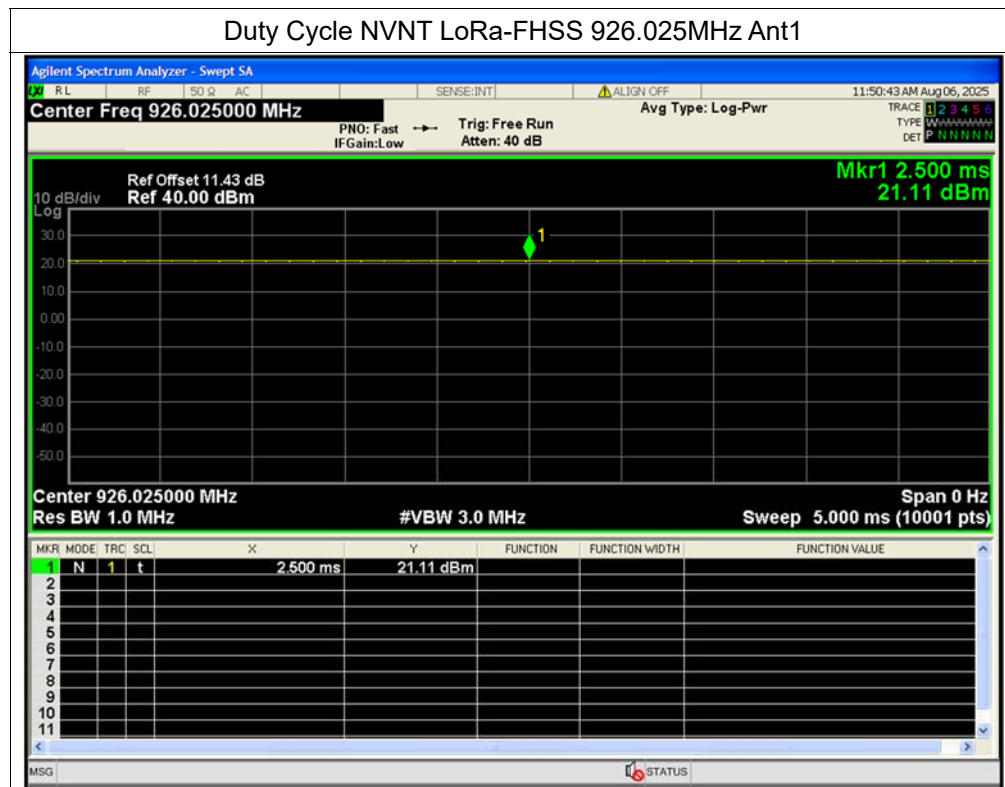
Test Graphs

Duty Cycle NVNT LoRa-FHSS 902.4MHz Ant1



Duty Cycle NVNT LoRa-FHSS 914.4MHz Ant1





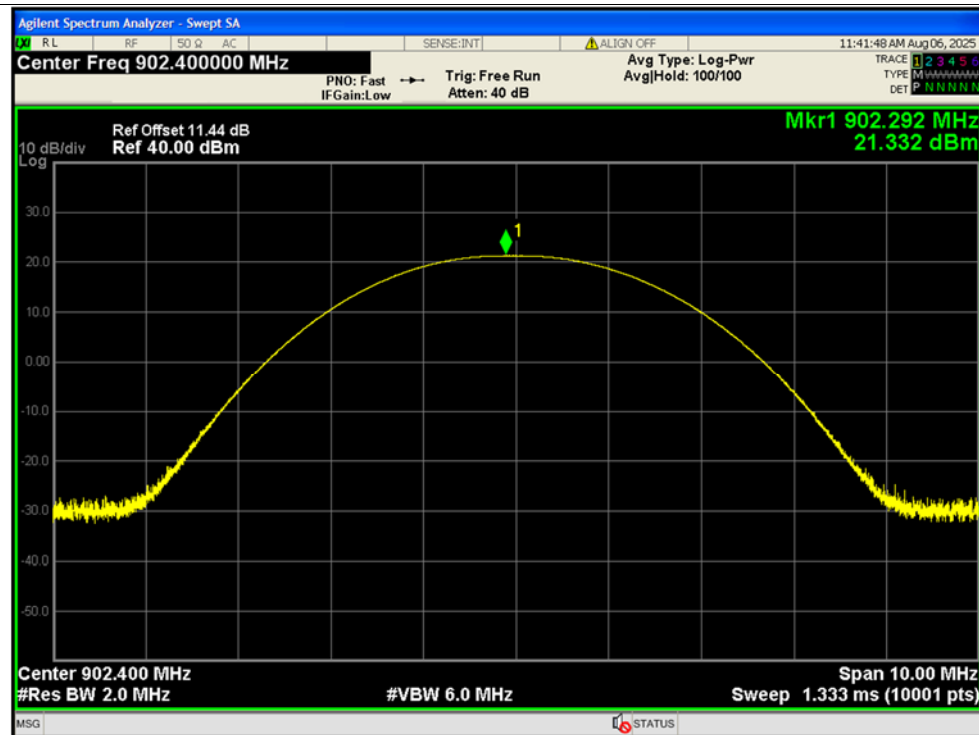
**A.3. Maximum Peak Conducted Output Power**

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Conducted Power (dBm)	Total Conducted Power (W)	Limit (dBm)	Verdict
NVNT	Lora-FHSS	902.4	Ant1	21.33	0	21.33	0.13583	30	Pass
NVNT	Lora-FHSS	914.4	Ant1	21.32	0	21.32	0.13552	30	Pass
NVNT	Lora-FHSS	926.025	Ant1	21.29	0	21.29	0.13459	30	Pass

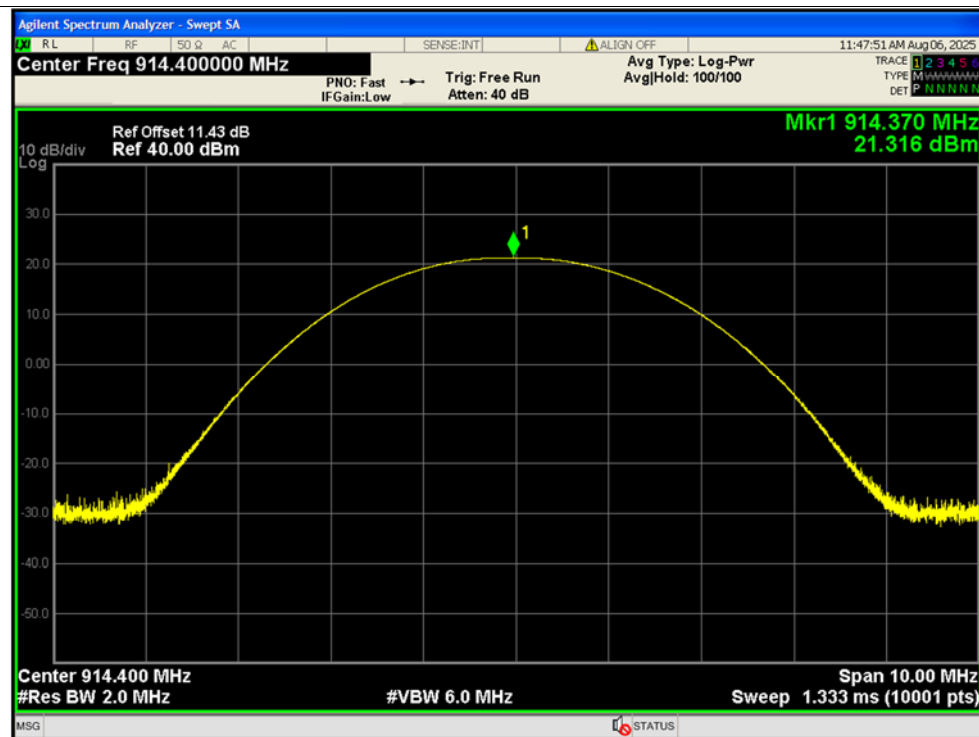


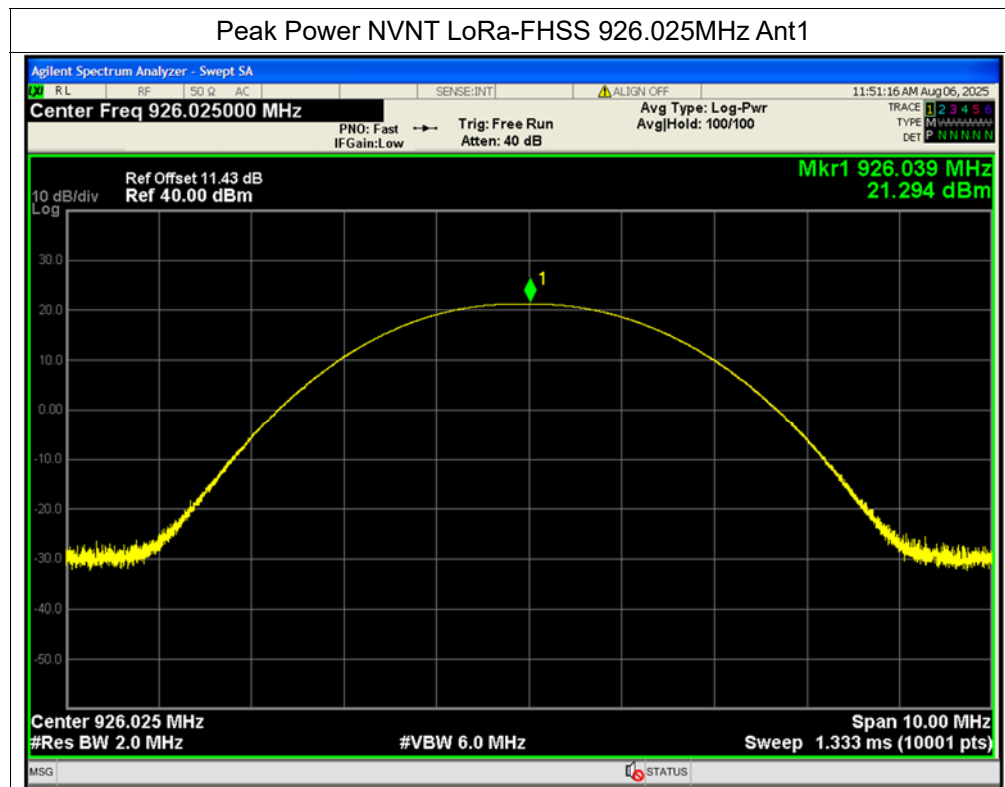
Test Graphs

Peak Power NVNT LoRa-FHSS 902.4MHz Ant1



Peak Power NVNT LoRa-FHSS 914.4MHz Ant1





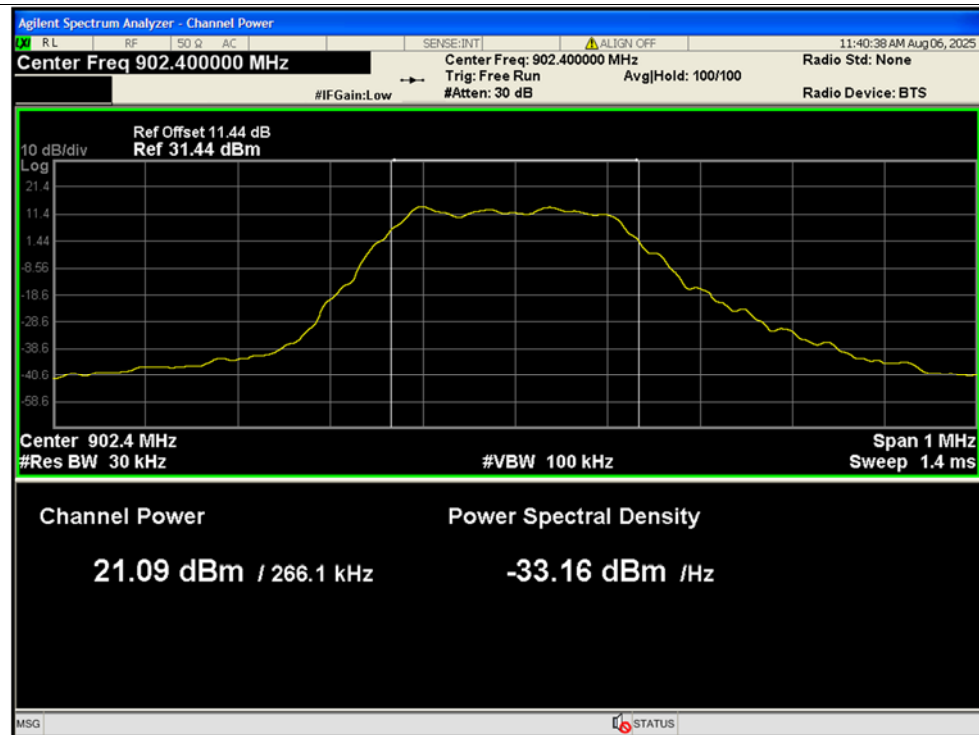
**A.4. Maximum Average Conducted Output Power**

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Conducted Power (dBm)	Total Conducted Power (W)	Limit (dBm)	Verdict
NVNT	Lora-FHSS	902.4	Ant1	21.09	0	21.09	0.12853	30	Pass
NVNT	Lora-FHSS	914.4	Ant1	21.15	0	21.15	0.13032	30	Pass
NVNT	Lora-FHSS	926.025	Ant1	21.15	0	21.15	0.13032	30	Pass

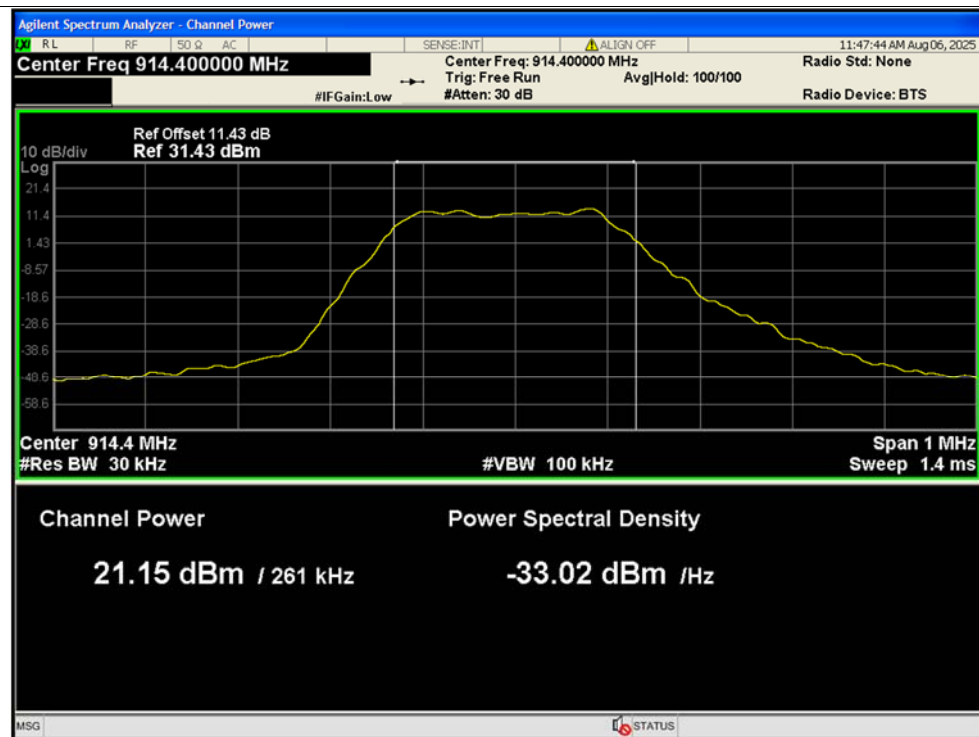


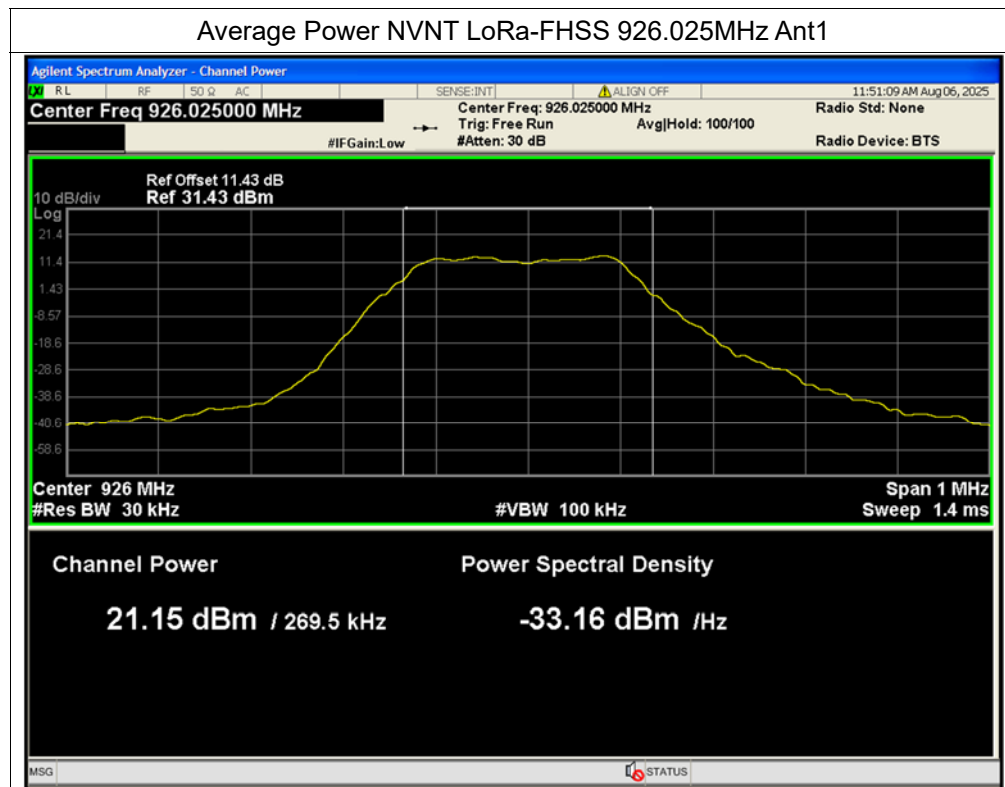
Test Graphs

Average Power NVNT LoRa-FHSS 902.4MHz Ant1



Average Power NVNT LoRa-FHSS 914.4MHz Ant1





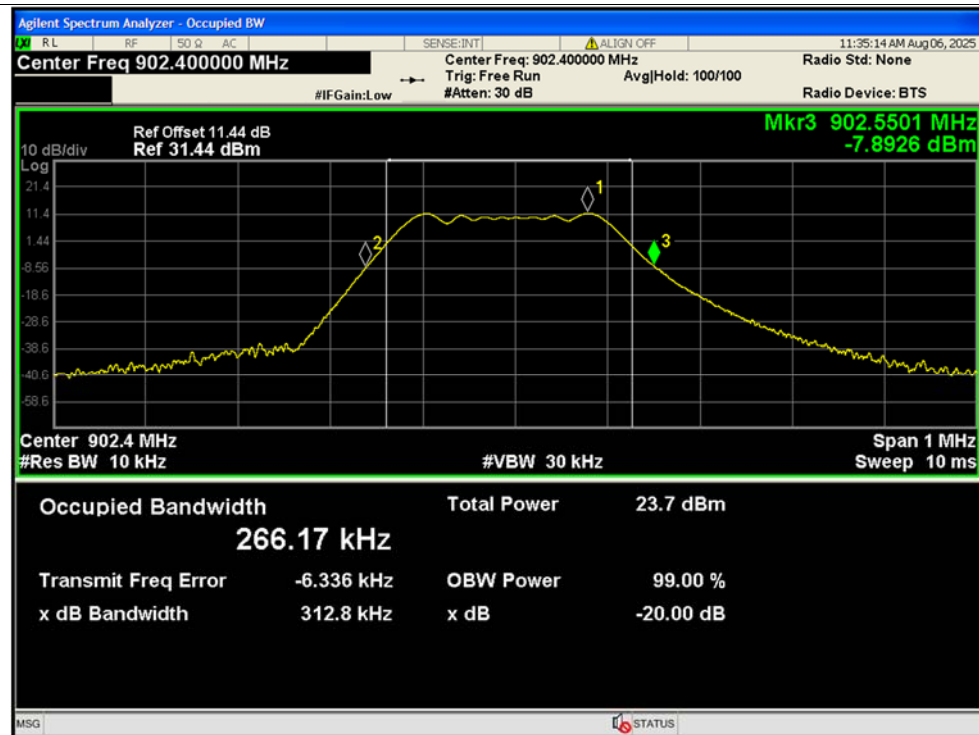
**A.5. 20 dB Bandwidth**

Condition	Mode	Frequency (MHz)	Antenna	-20 dB Bandwidth (MHz)
NVNT	Lora-FHSS	902.4	Ant1	0.3128
NVNT	Lora-FHSS	914.4	Ant1	0.3354
NVNT	Lora-FHSS	926.025	Ant1	0.3441

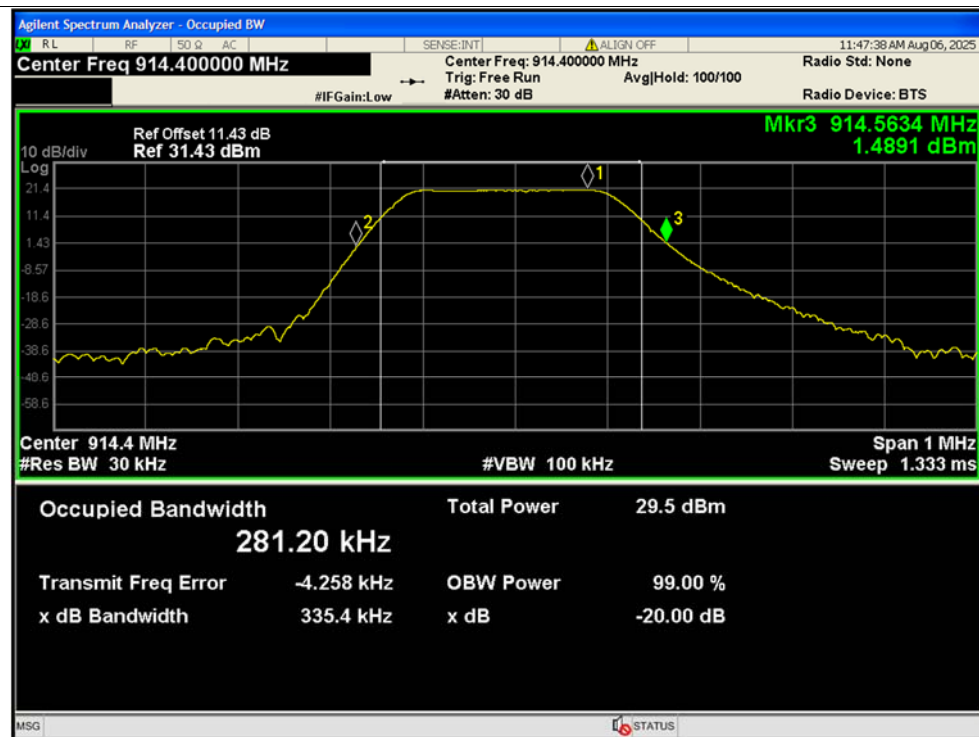


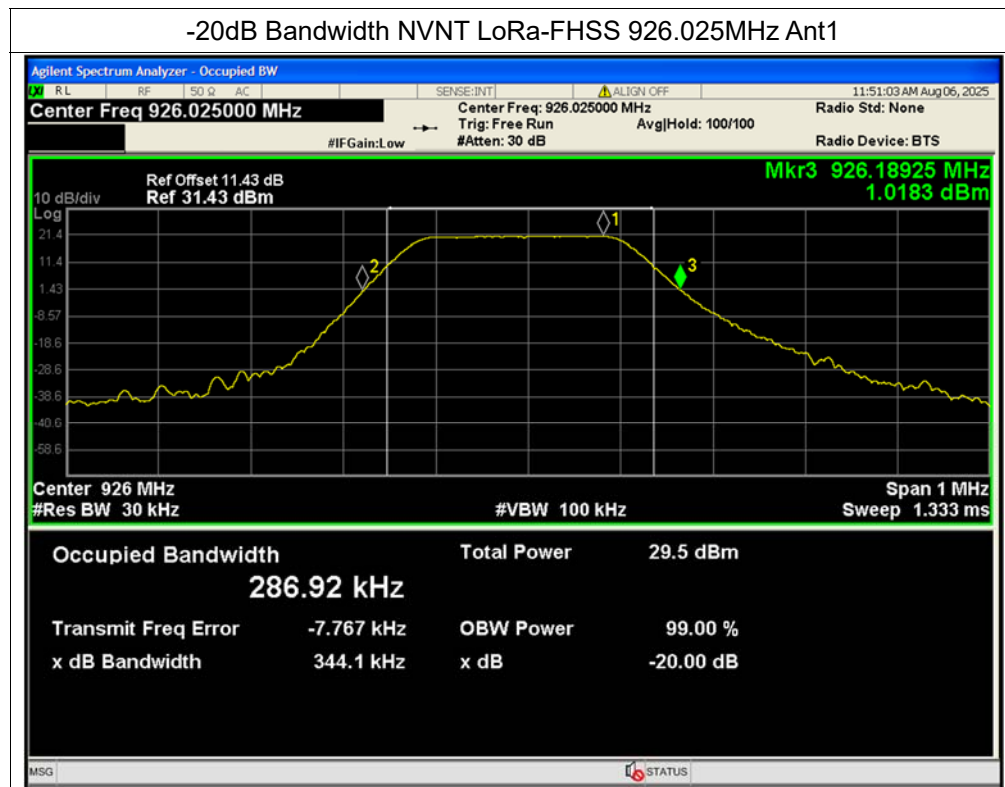
Test Graphs

-20dB Bandwidth NVNT LoRa-FHSS 902.4MHz Ant1



-20dB Bandwidth NVNT LoRa-FHSS 914.4MHz Ant1







REPORT No.: SZ25070176W01

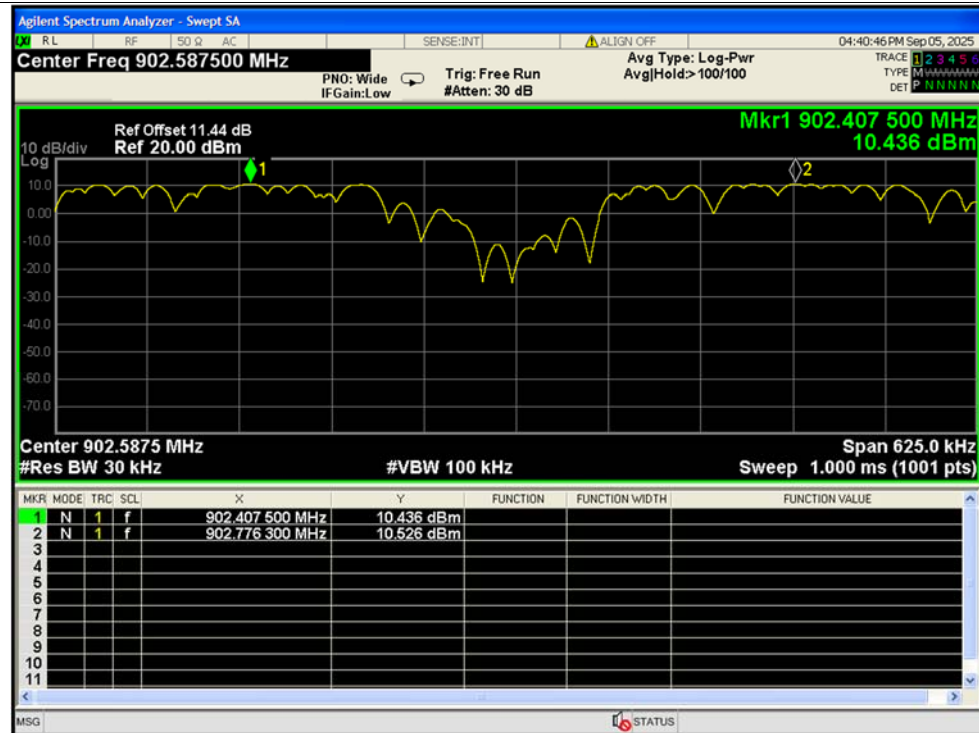
A.6. Carried Frequency Separation

Condition	Mode	Antenna	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	Lora-FHSS	Ant1	902.4075	902.7763	0.3688	0.3128	Pass
NVNT	Lora-FHSS	Ant1	914.3306	914.8369	0.5063	0.3354	Pass
NVNT	Lora-FHSS	Ant1	925.6075	926.1119	0.5044	0.3441	Pass

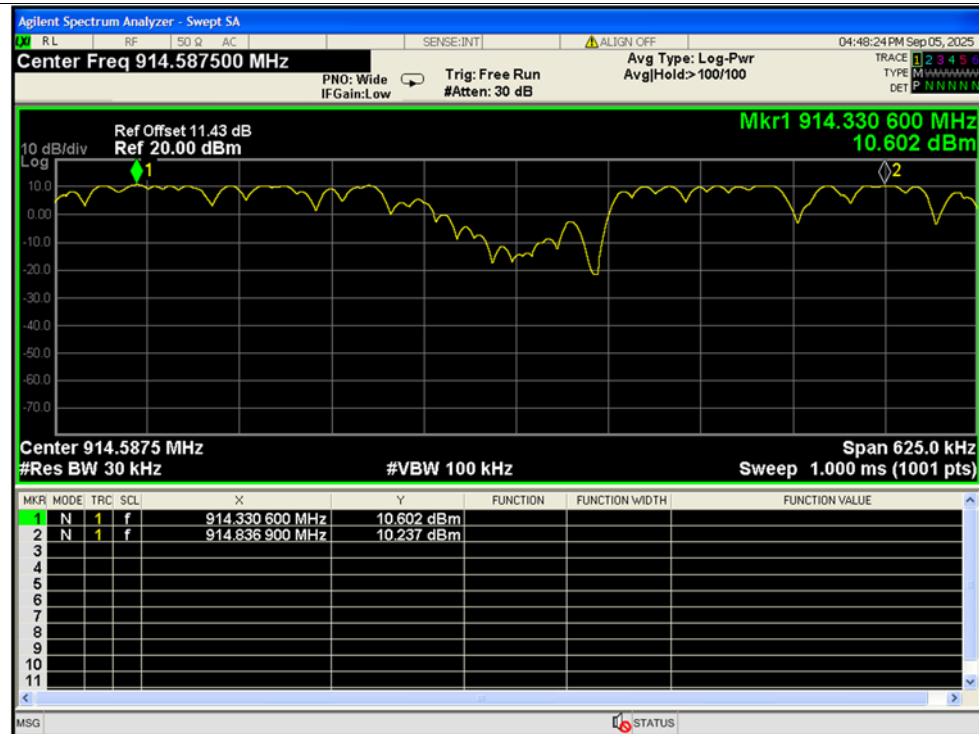


Test Graphs

CFS NVNT LoRa-FHSS 902.4MHz Ant1

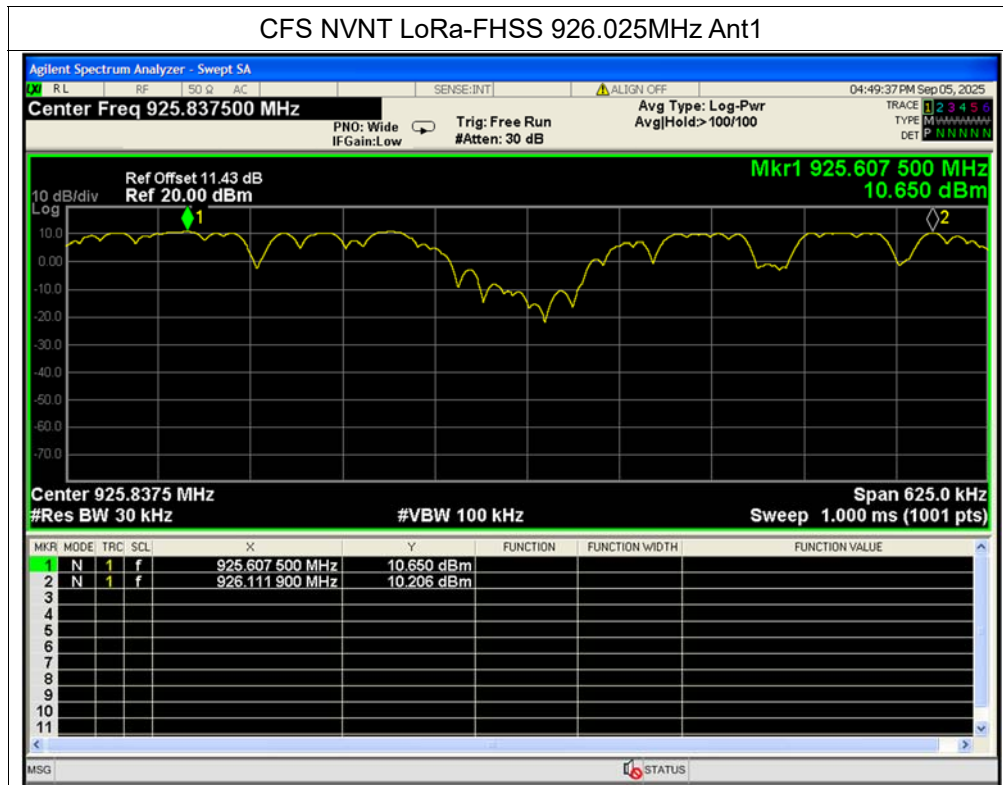


CFS NVNT LoRa-FHSS 914.4MHz Ant1





CFS NVNT LoRa-FHSS 926.025MHz Ant1



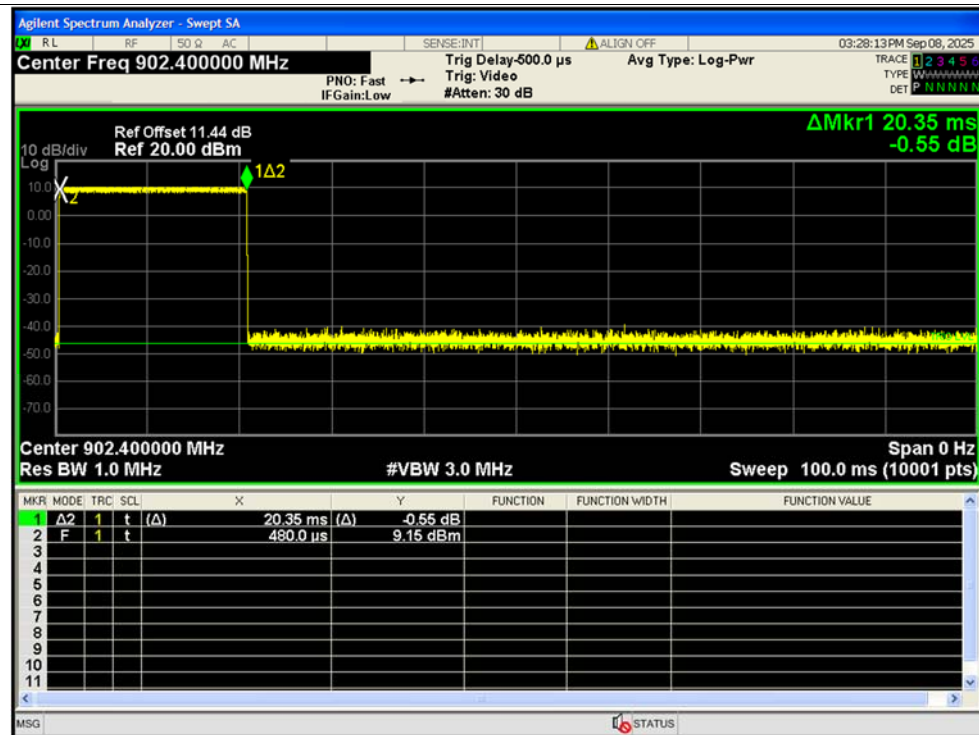
**A.7. Time of Occupancy (Dwell time)**

Condition	Mode	Frequency (MHz)	Antenna	Pulse Time (ms)	Total Dwell Time (ms)	Burst Count	Period Time (ms)	Limit (ms)	Verdict
NVNT	Lora-FHSS	902.4	Ant1	20.35	20.35	1	10000	400	Pass

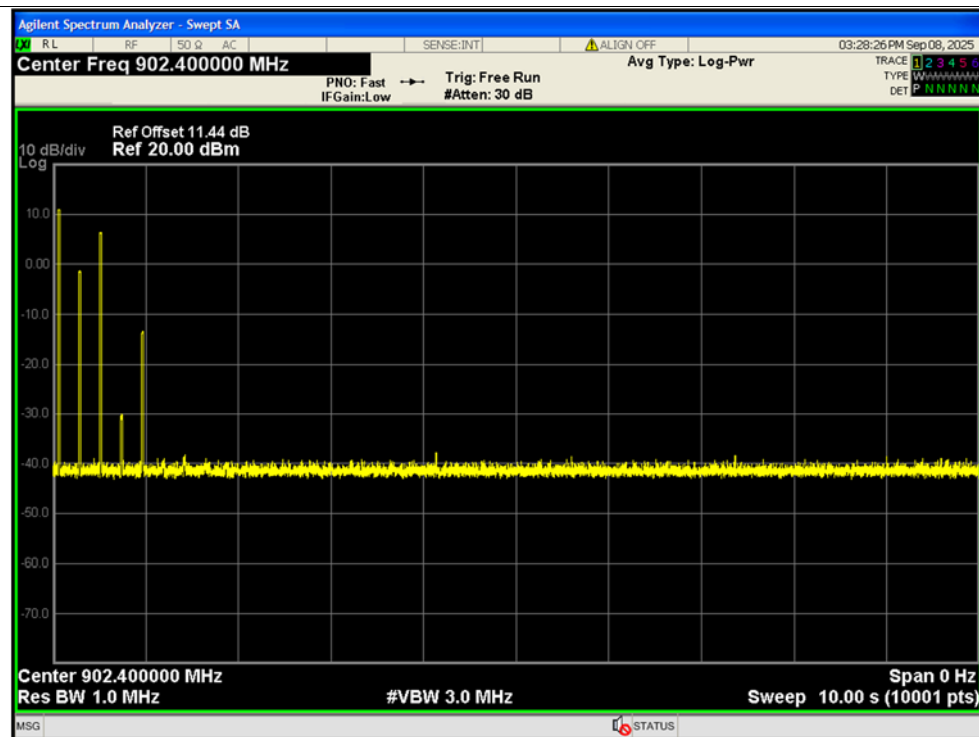


Test Graphs

Dwell NVNT LoRa-FHSS 902.4MHz Ant1 One Burst



Dwell NVNT LoRa-FHSS 902.4MHz Ant1 Accumulated



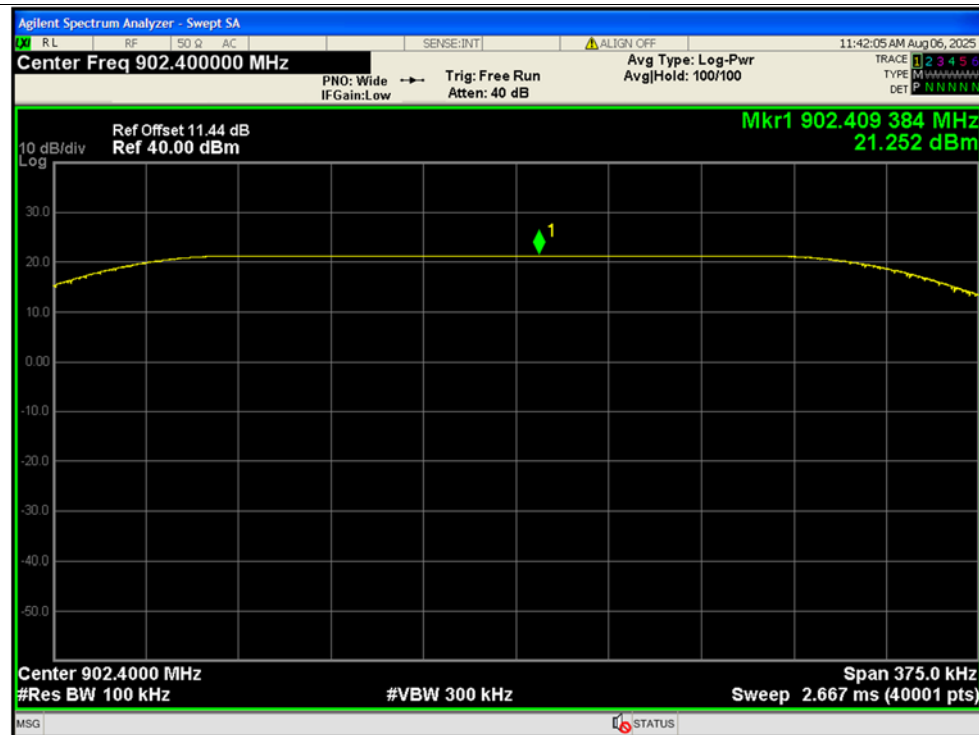
**A.8. Conducted Spurious Emissions**

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	Lora-FHSS	902.4	Ant1	-41.44	-20	Pass
NVNT	Lora-FHSS	914.4	Ant1	-42.1	-20	Pass
NVNT	Lora-FHSS	926.025	Ant1	-41.45	-20	Pass

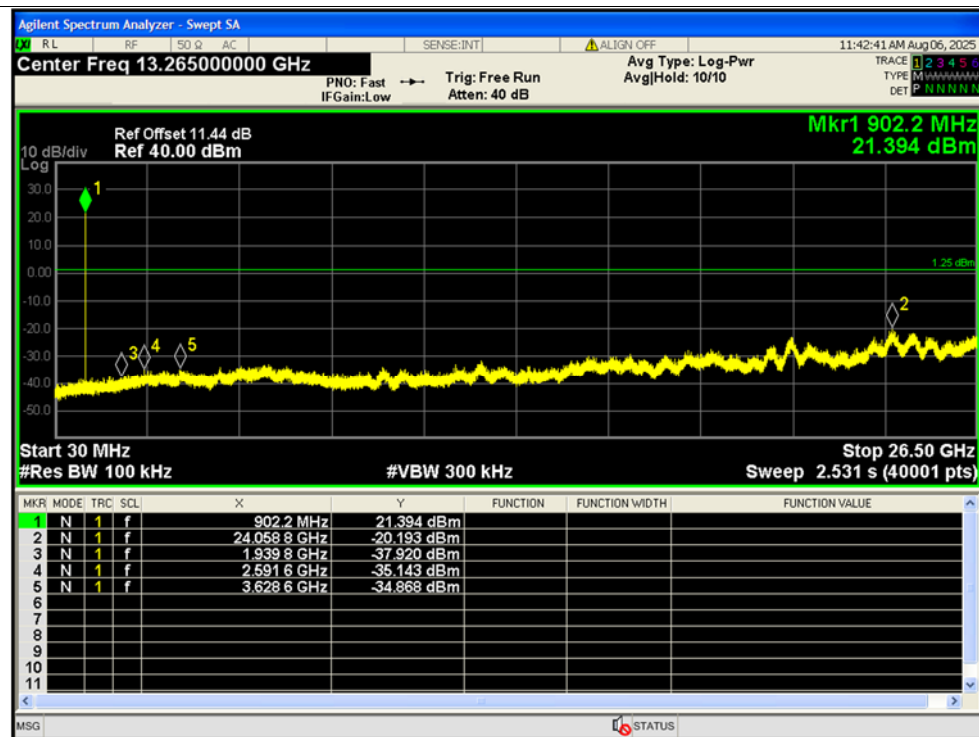


Test Graphs

Tx. Spurious NVNT LoRa-FHSS 902.4MHz Ant1 Ref

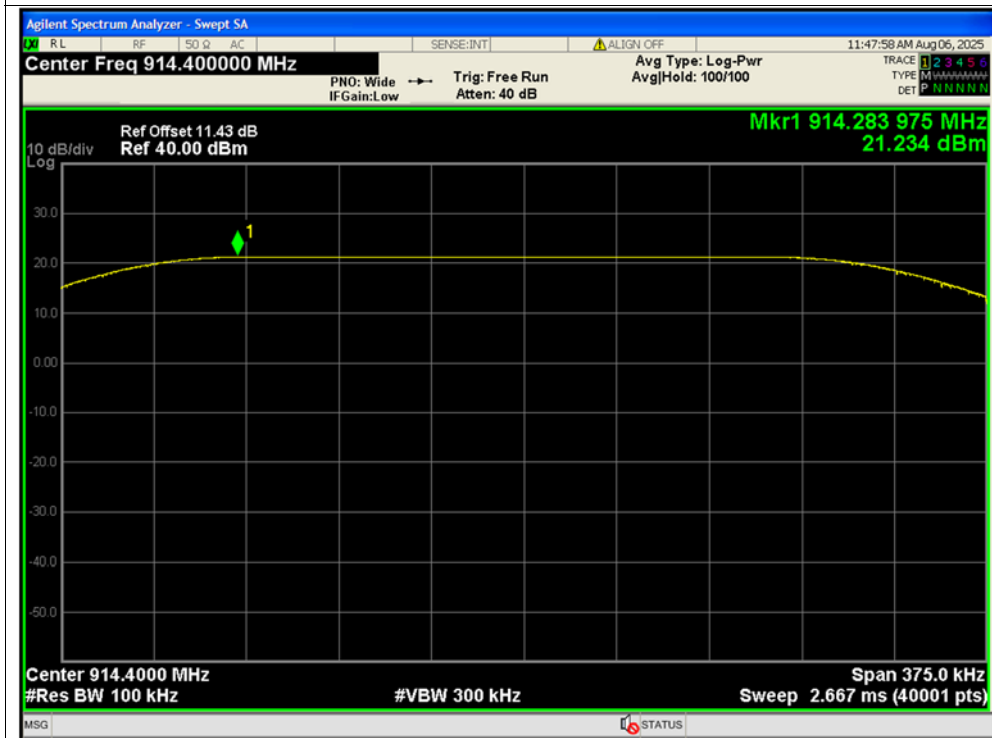


Tx. Spurious NVNT LoRa-FHSS 902.4MHz Ant1 Emission

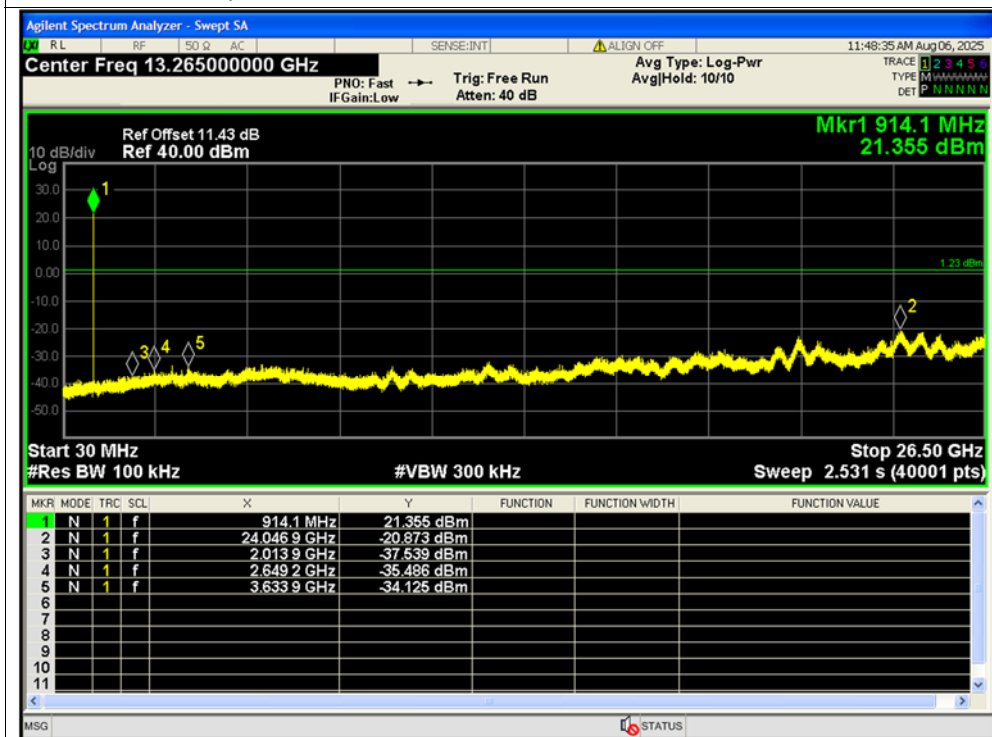




Tx. Spurious NVNT LoRa-FHSS 914.4MHz Ant1 Ref

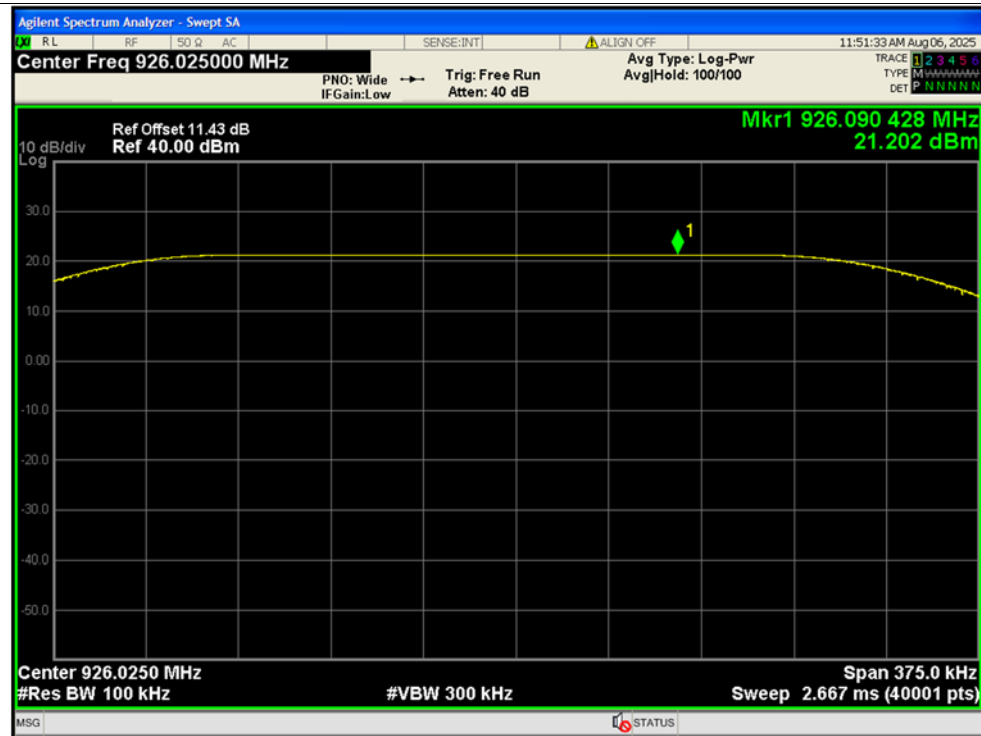


Tx. Spurious NVNT LoRa-FHSS 914.4MHz Ant1 Emission

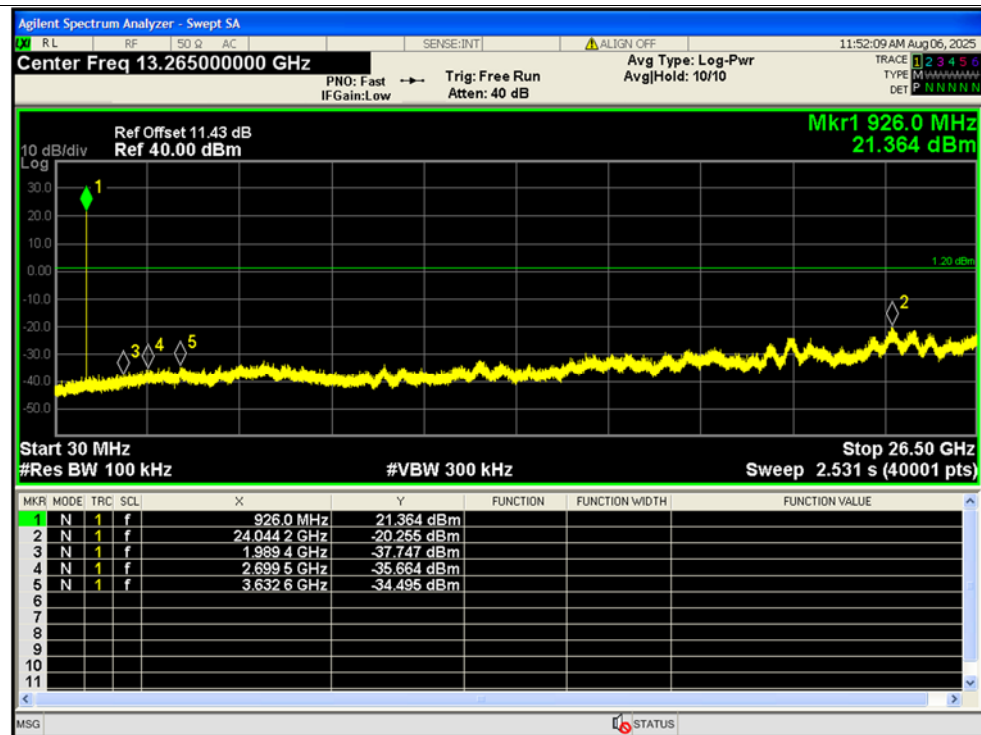




Tx. Spurious NVNT LoRa-FHSS 926.025MHz Ant1 Ref



Tx. Spurious NVNT LoRa-FHSS 926.025MHz Ant1 Emission



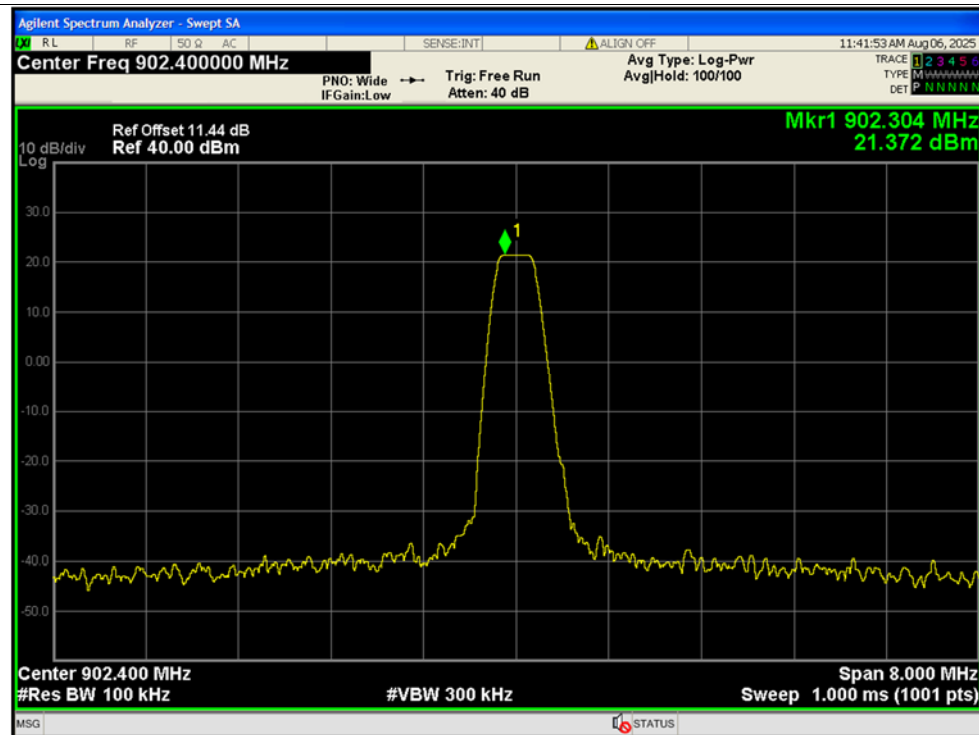
**A.9. Band Edge**

Condition	Mode	Frequency (MHz)	Antenna	Hopping Mode	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	Lora-FHSS	902.4	Ant1	No-Hopping	-46.85	-20	Pass
NVNT	Lora-FHSS	926.025	Ant1	No-Hopping	-49.29	-20	Pass
NVNT	Lora-FHSS	902.4	Ant1	Hopping	-59.15	-20	Pass
NVNT	Lora-FHSS	926.025	Ant1	Hopping	-55.97	-20	Pass

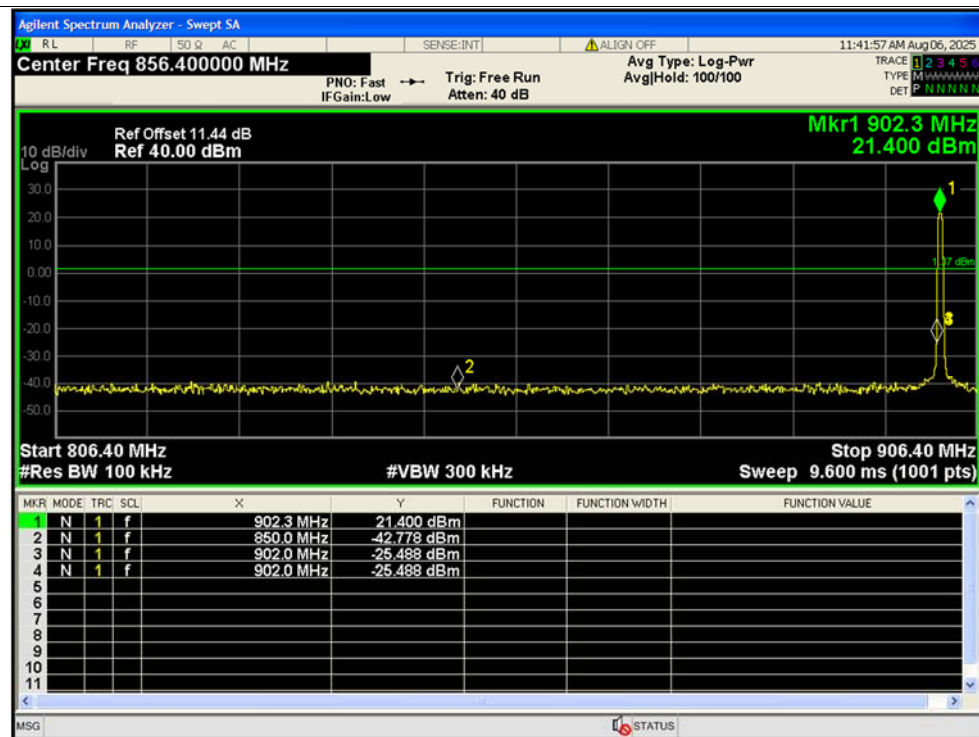


Test Graphs

Band Edge NVNT LoRa-FHSS 902.4MHz Ant1 No-Hopping Ref

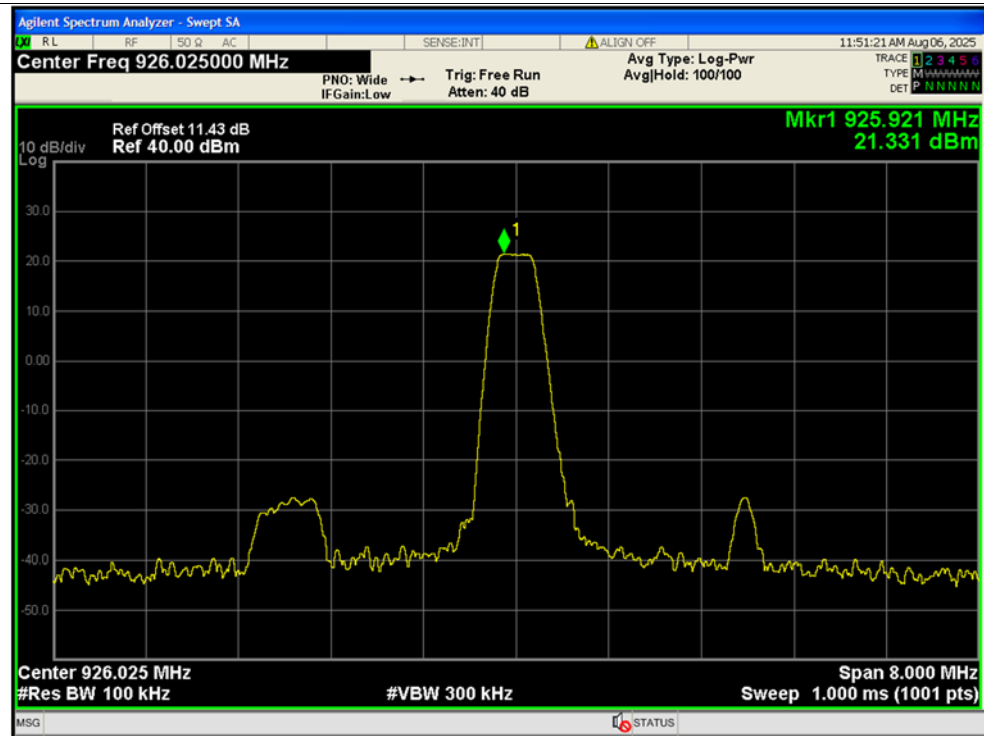


Band Edge NVNT LoRa-FHSS 902.4MHz Ant1 No-Hopping Emission

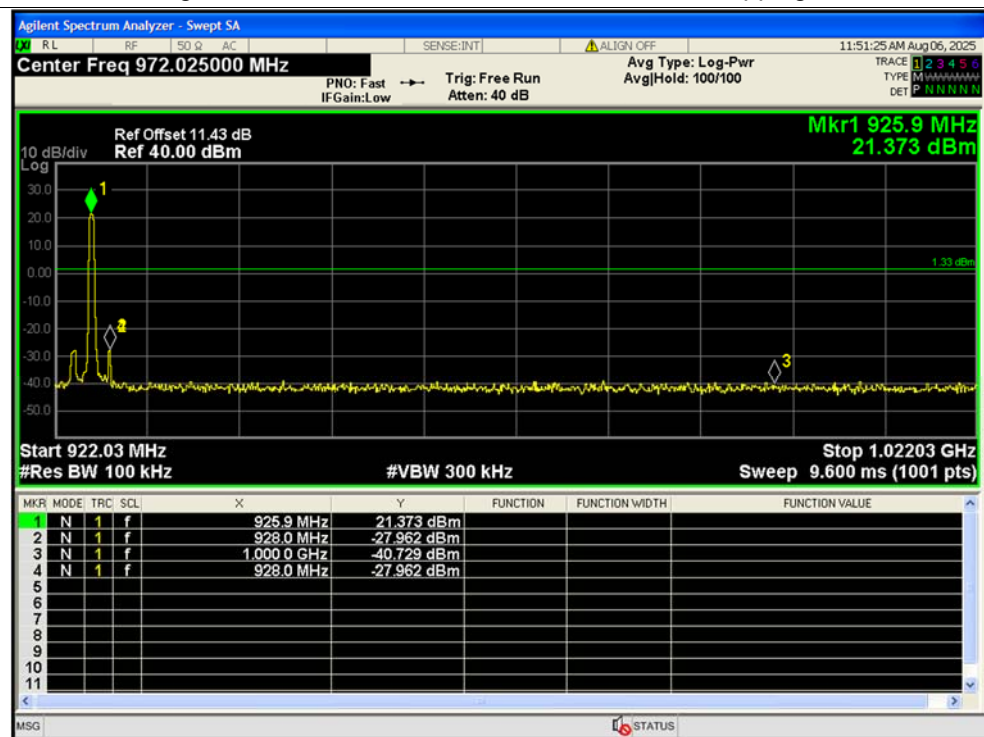




Band Edge NVNT LoRa-FHSS 926.025MHz Ant1 No-Hopping Ref



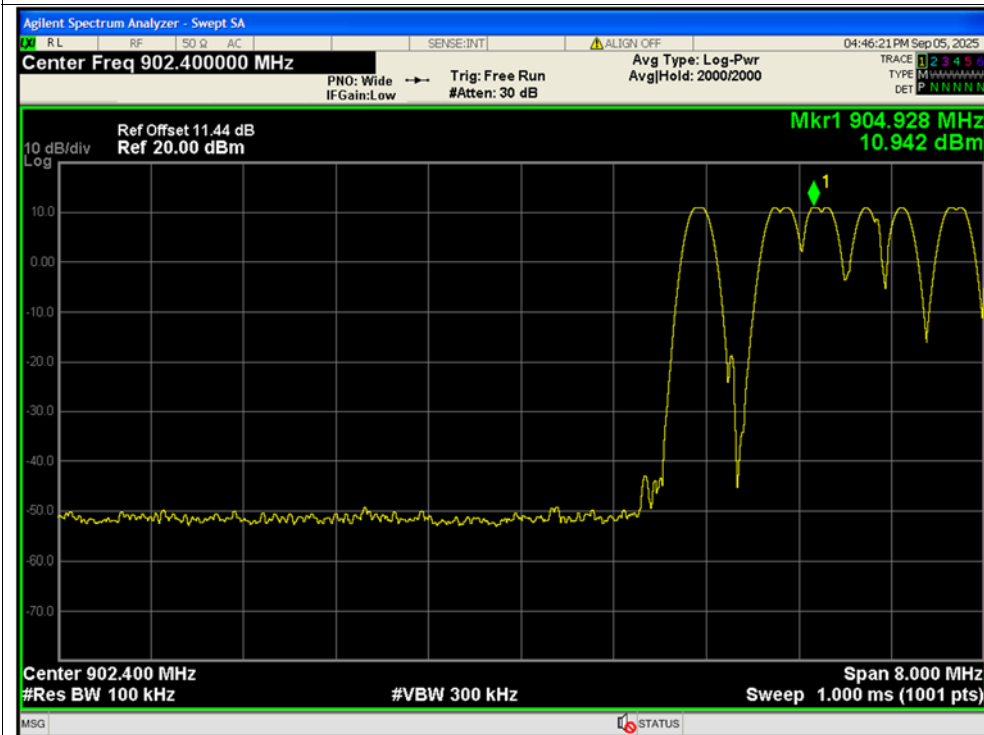
Band Edge NVNT LoRa-FHSS 926.025MHz Ant1 No-Hopping Emission



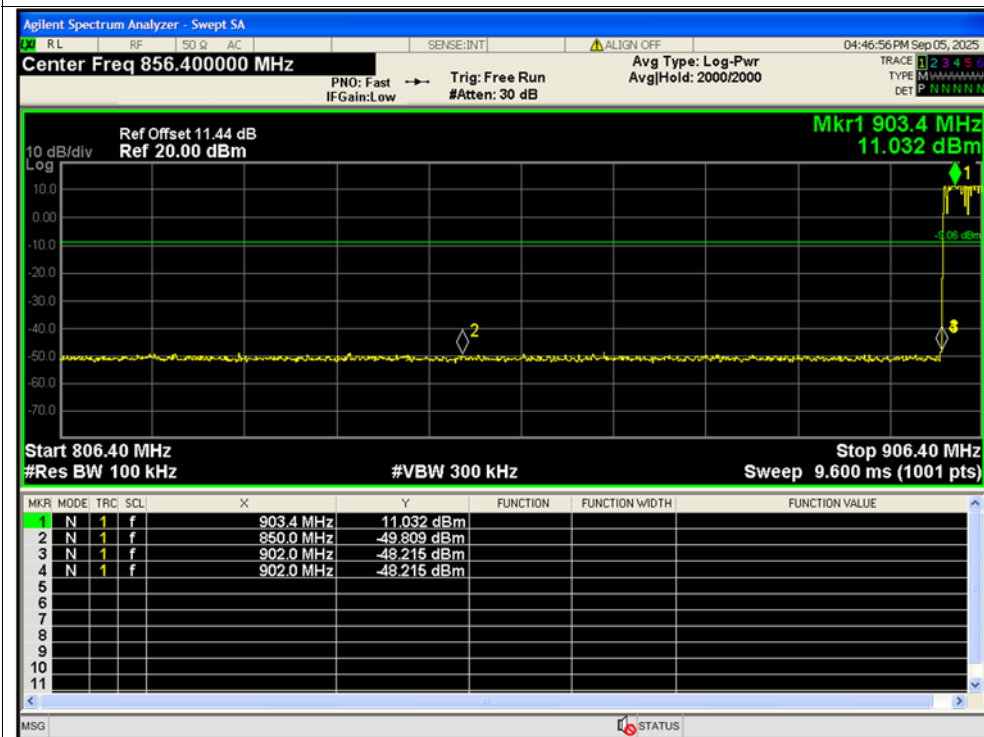


Test Graphs

Band Edge(Hopping) NVNT LoRa-FHSS 902.4MHz Ant1 Hopping Ref

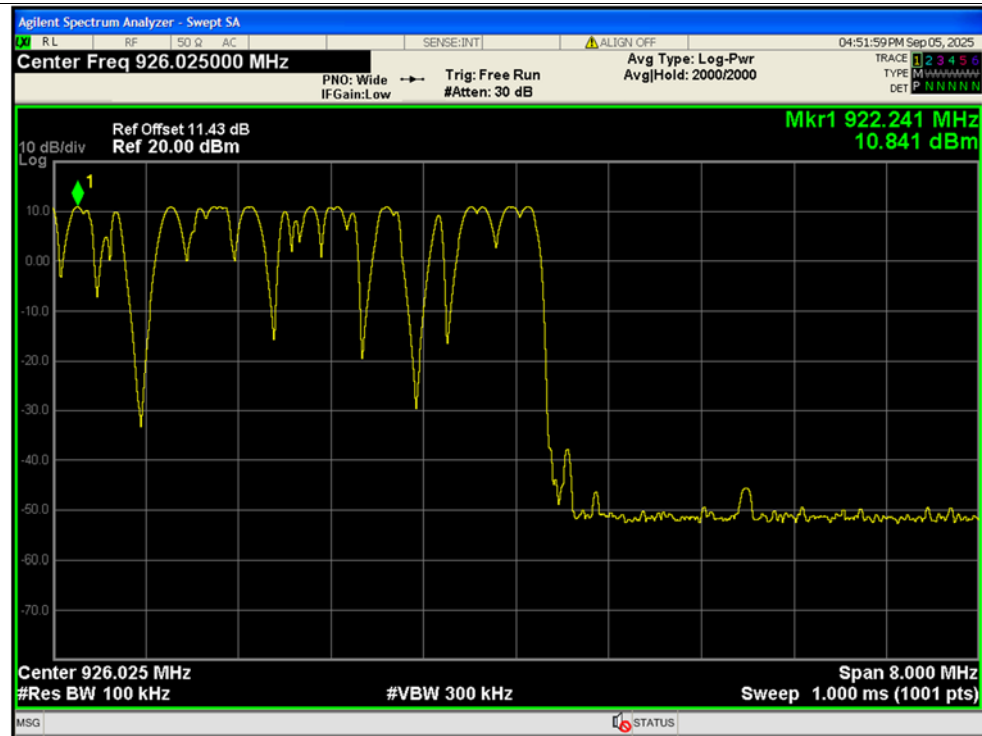


Band Edge(Hopping) NVNT LoRa-FHSS 902.4MHz Ant1 Hopping Emission

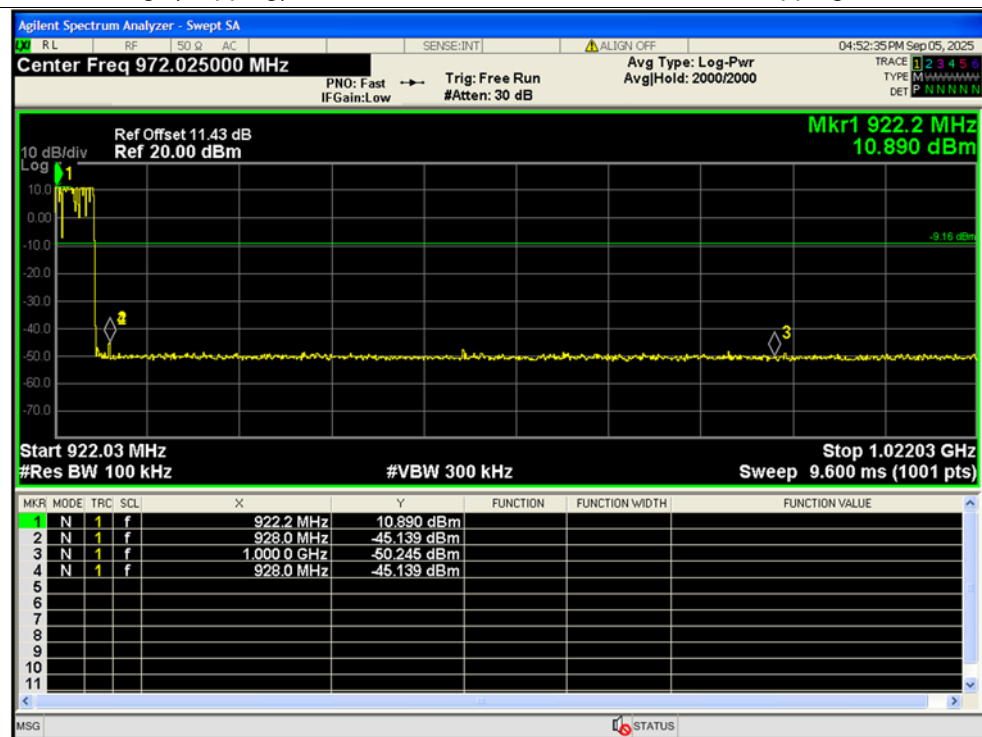




Band Edge(Hopping) NVNT LoRa-FHSS 926.025MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT LoRa-FHSS 926.025MHz Ant1 Hopping Emission





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A.10. Conducted Emission

This test case does not apply this kind of EUT.



A.11. 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:

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

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.

Note2: 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.

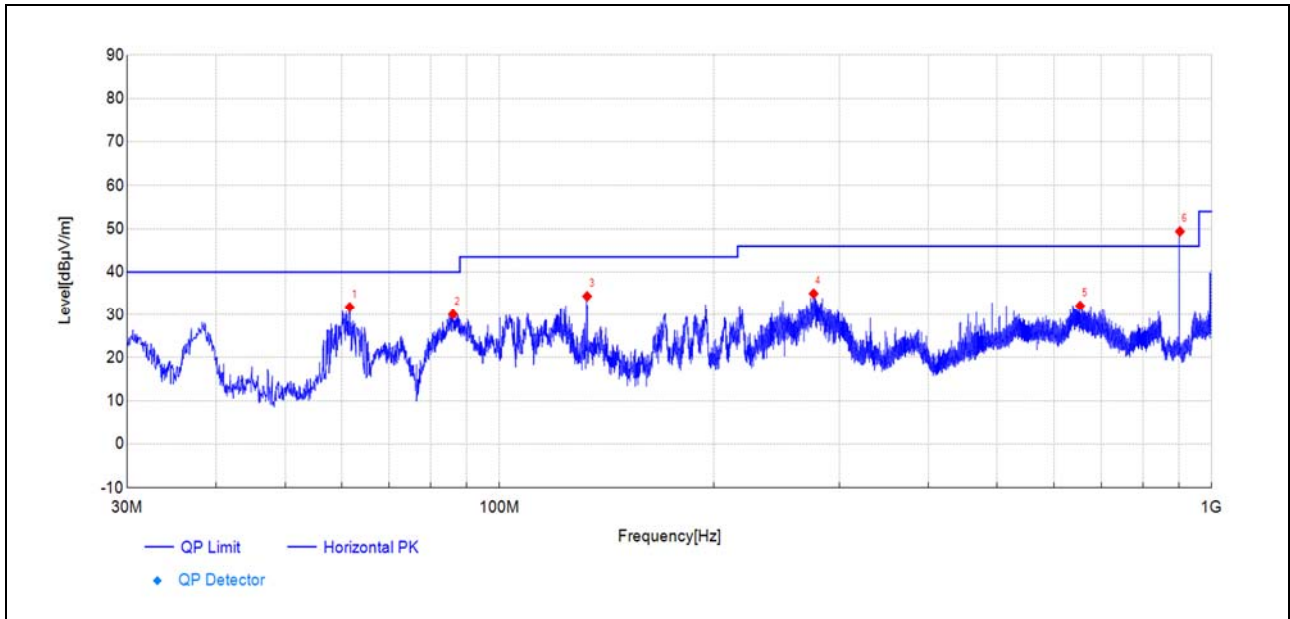
Note3: For the frequency, which started from 18GHz to 10th harmonic of the highest frequency, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Field strength of fundamental:

Frequency [MHz]	Reading [dB μ V]	Level [dB μ V/m]	Factor [dB/m]	Antenna Polarity
902.37	91.1	119.18	28.100	Vertical

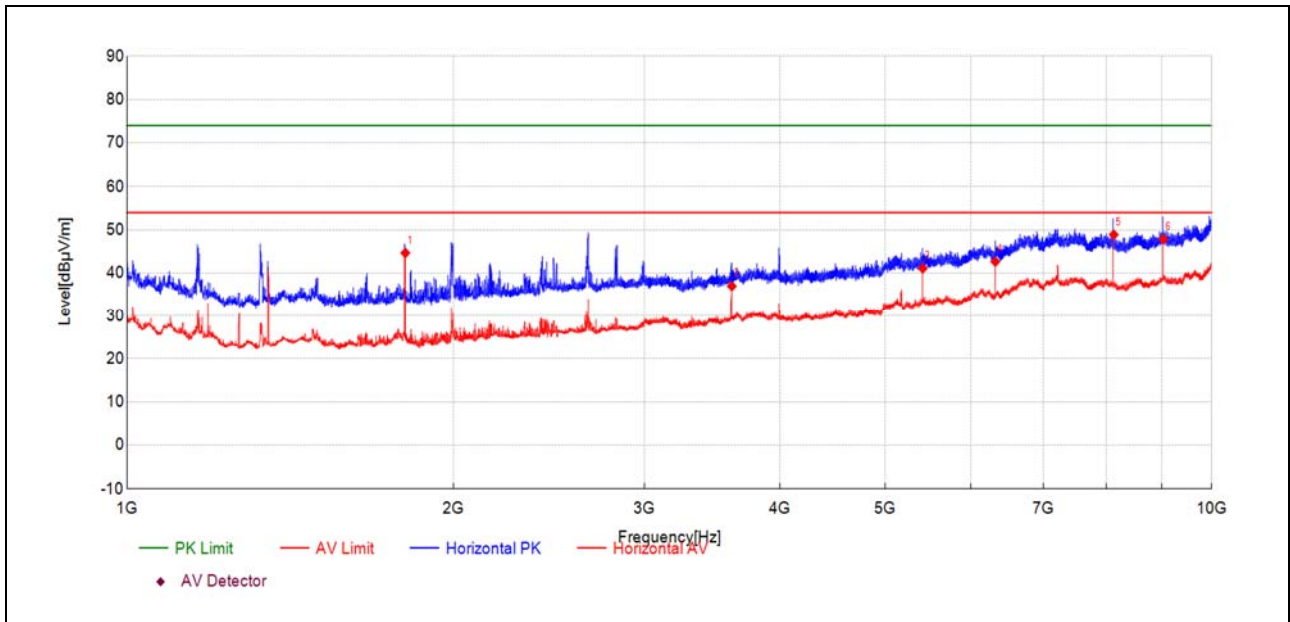
The field strength (the lowest) of fundamenta is more than 20dB higher than the unwanted emissions, in accordance with FCC part 15.215(b).

Plot for Channel 0



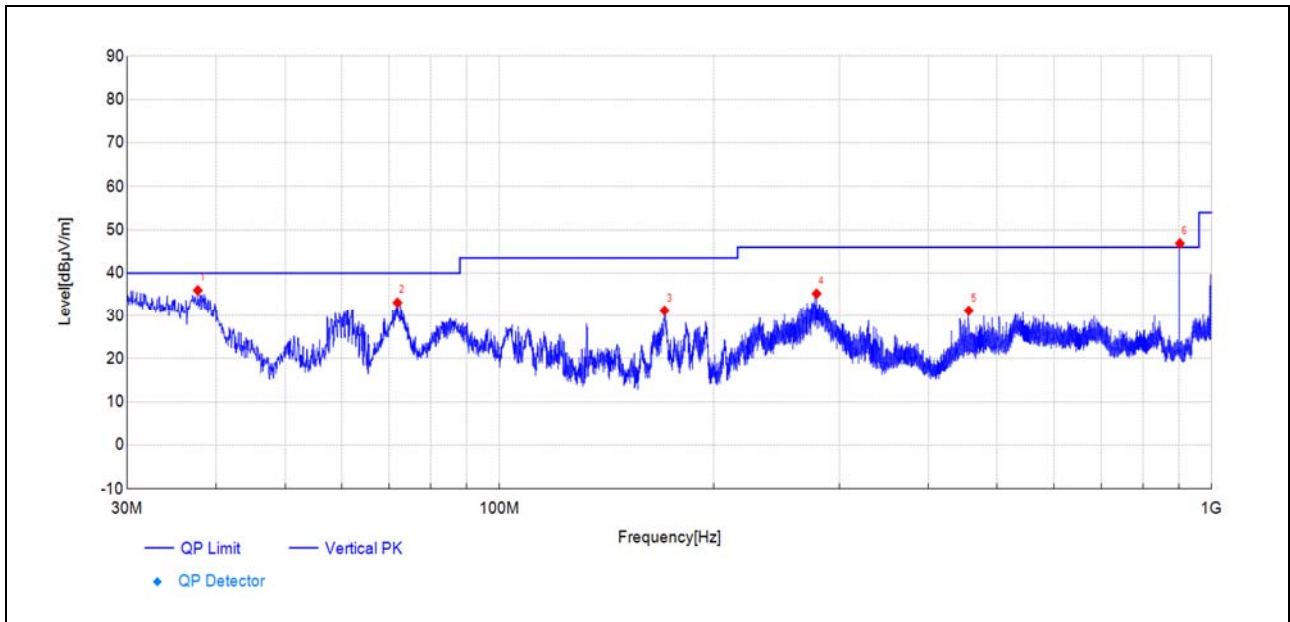
(Antenna Horizontal, 30MHz to 1GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
61.62	60.4	31.79	-28.560	40.00	8.21	150	58	PK	PASS
86.07	62.3	30.06	-32.260	40.00	9.94	150	91	PK	PASS
132.78	66.2	34.37	-31.840	43.50	9.13	150	64	PK	PASS
276.10	61.0	34.98	-26.020	46.00	11.02	150	302	PK	PASS
653.50	49.0	32.11	-16.910	46.00	13.89	150	261	PK	PASS
902.32	61.3	49.39	-11.880	-	-	150	200	PK	NA



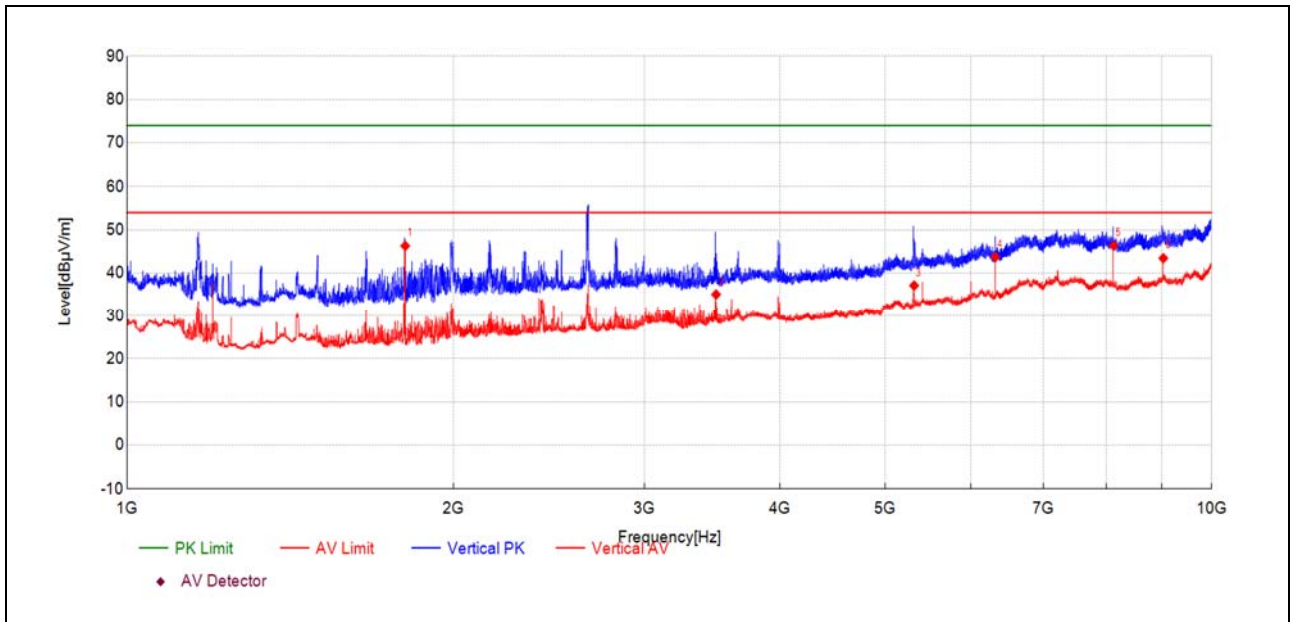
(Antenna Horizontal, 1GHz to 10GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
1805.36	63.2	44.66	-18.510	-	-	150	156	AV	NA
3610.44	46.0	36.97	-9.040	54.00	17.03	150	113	AV	PASS
5414.69	42.9	41.11	-1.750	54.00	12.89	150	168	AV	PASS
6317.29	41.9	42.66	0.810	54.00	11.34	150	89	AV	PASS
8122.47	43.7	48.90	5.180	54.00	5.10	150	57	AV	PASS
9025.54	41.0	47.83	6.820	54.00	6.17	150	57	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
37.71	65.4	35.99	-29.410	40.00	4.01	150	221	PK	PASS
71.91	64.4	33.12	-31.260	40.00	6.88	150	187	PK	PASS
170.51	62.2	31.21	-30.960	43.50	12.29	150	179	PK	PASS
278.77	61.4	35.23	-26.170	46.00	10.77	150	247	PK	PASS
456.00	52.6	31.21	-21.370	46.00	14.79	150	234	PK	PASS
902.27	58.8	46.87	-11.880	-	-	150	310	PK	NA

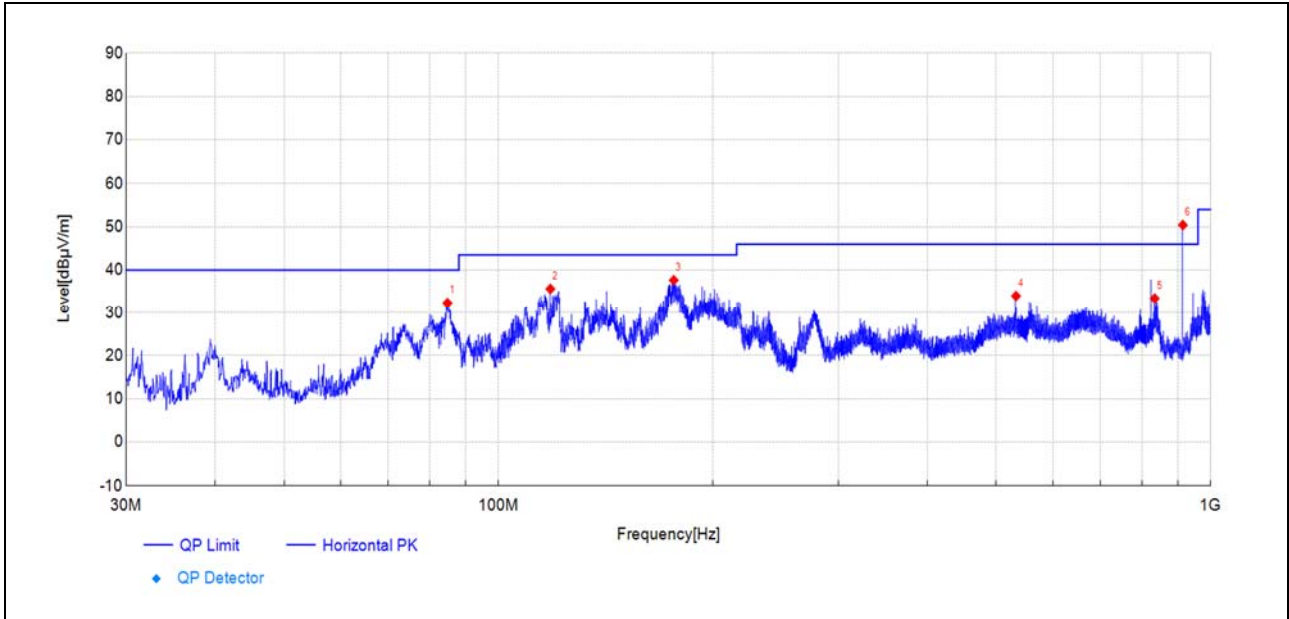


(Antenna Vertical, 1GHz to 10GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
1804.96	64.8	46.29	-18.510	54.00	7.71	150	116	AV	PASS
3491.90	44.8	35.05	-9.750	54.00	18.95	150	134	AV	PASS
5316.22	39.7	37.11	-2.580	54.00	16.89	150	49	AV	PASS
6317.75	42.9	43.72	0.820	54.00	10.28	150	57	AV	PASS
8121.07	41.2	46.35	5.180	54.00	7.65	150	151	AV	PASS
9023.67	36.7	43.45	6.790	54.00	10.55	150	57	AV	PASS

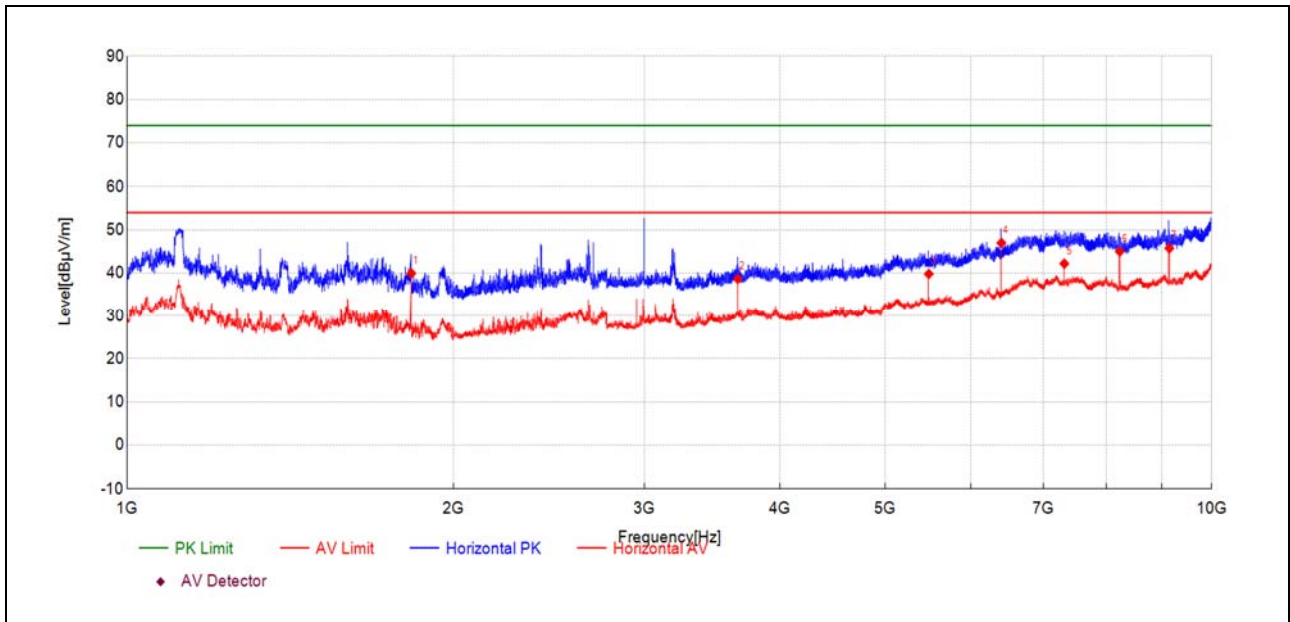


Plot for Channel 31



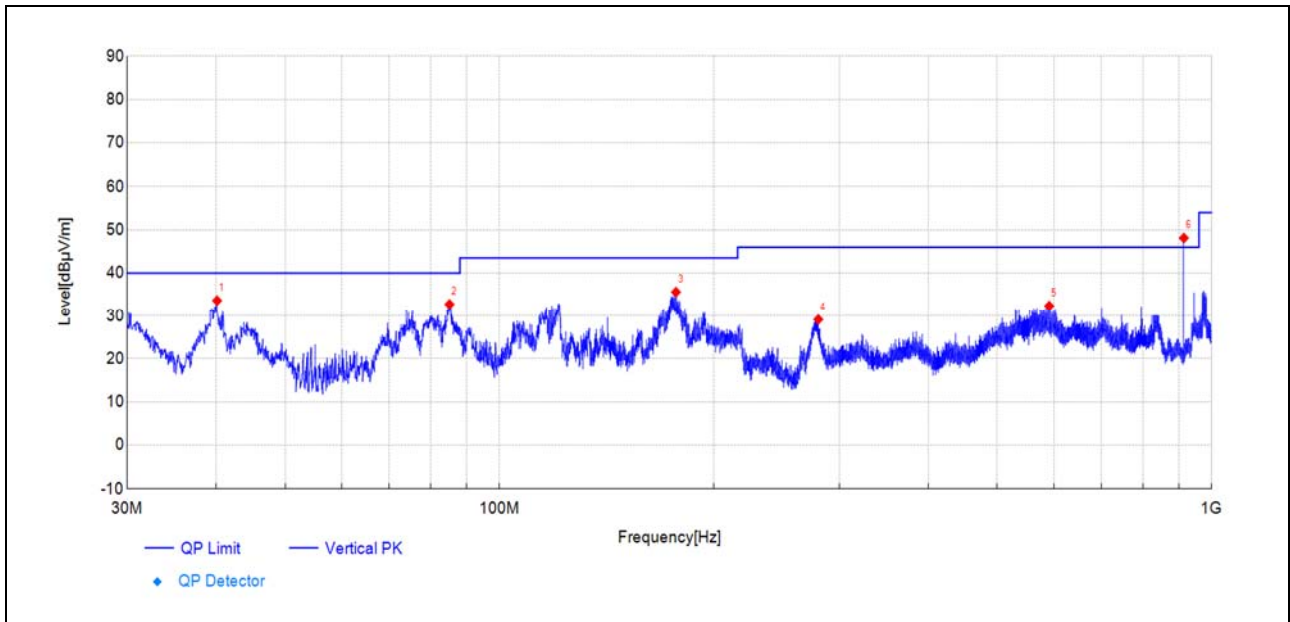
(Antenna Horizontal, 30MHz to 1GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
84.81	64.3	32.33	-31.950	40.00	7.67	150	77	PK	PASS
118.27	66.2	35.63	-30.610	43.50	7.87	150	85	PK	PASS
176.23	68.1	37.64	-30.490	43.50	5.86	150	77	PK	PASS
532.92	52.7	33.98	-18.720	46.00	12.02	150	51	PK	PASS
834.32	46.9	33.41	-13.500	46.00	12.59	150	160	PK	PASS
913.91	62.8	50.42	-12.400	-	-	150	224	PK	NA



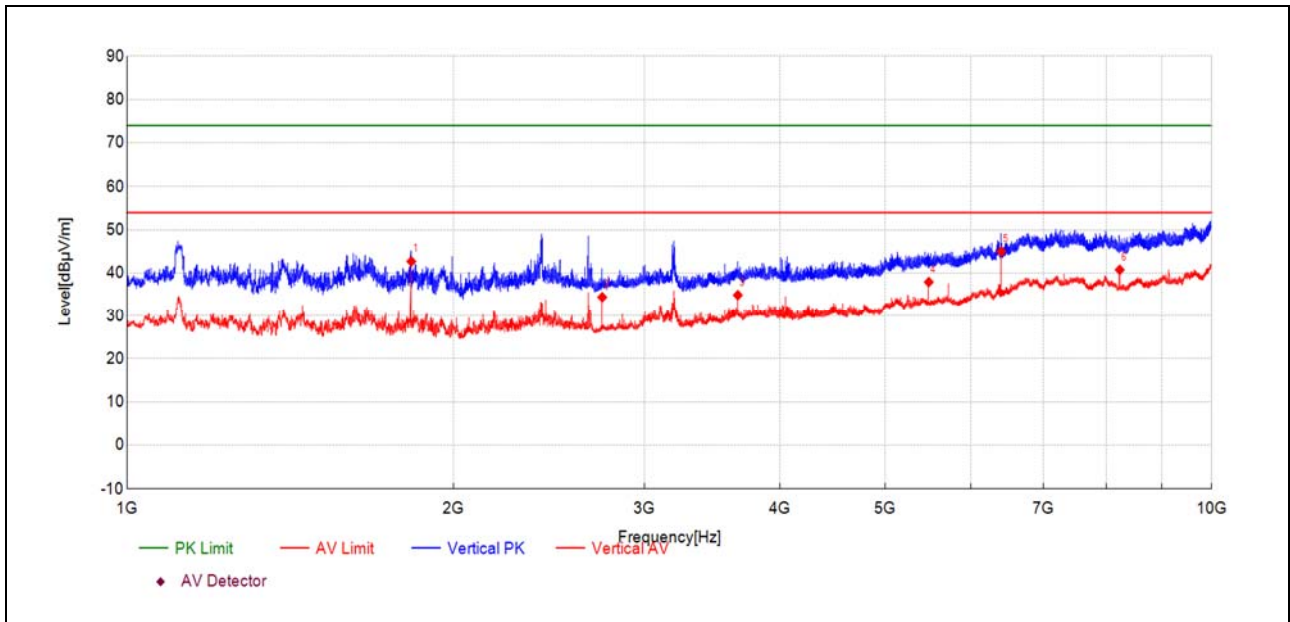
(Antenna Horizontal, 1GHz to 10GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
1828.57	58.4	39.96	-18.390	54.00	14.04	150	216	AV	PASS
3656.64	47.5	38.66	-8.860	54.00	15.34	150	106	AV	PASS
5484.70	41.8	39.81	-2.020	54.00	14.19	150	153	AV	PASS
6398.96	46.0	46.98	1.010	54.00	7.02	150	74	AV	PASS
7312.75	38.0	42.20	4.210	54.00	11.80	150	208	AV	PASS
8227.48	40.0	45.01	5.050	54.00	8.99	150	50	AV	PASS
9139.88	38.8	45.75	6.950	54.00	8.25	150	42	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
40.14	62.2	33.60	-28.610	40.00	6.40	150	181	PK	PASS
85.10	64.7	32.72	-32.020	40.00	7.28	150	174	PK	PASS
176.91	65.8	35.59	-30.200	43.50	7.91	150	22	PK	PASS
280.32	55.3	29.11	-26.230	46.00	16.89	150	118	PK	PASS
591.32	49.5	32.36	-17.110	46.00	13.64	150	98	PK	PASS
913.96	60.5	48.12	-12.400	-	-	150	242	PK	NA

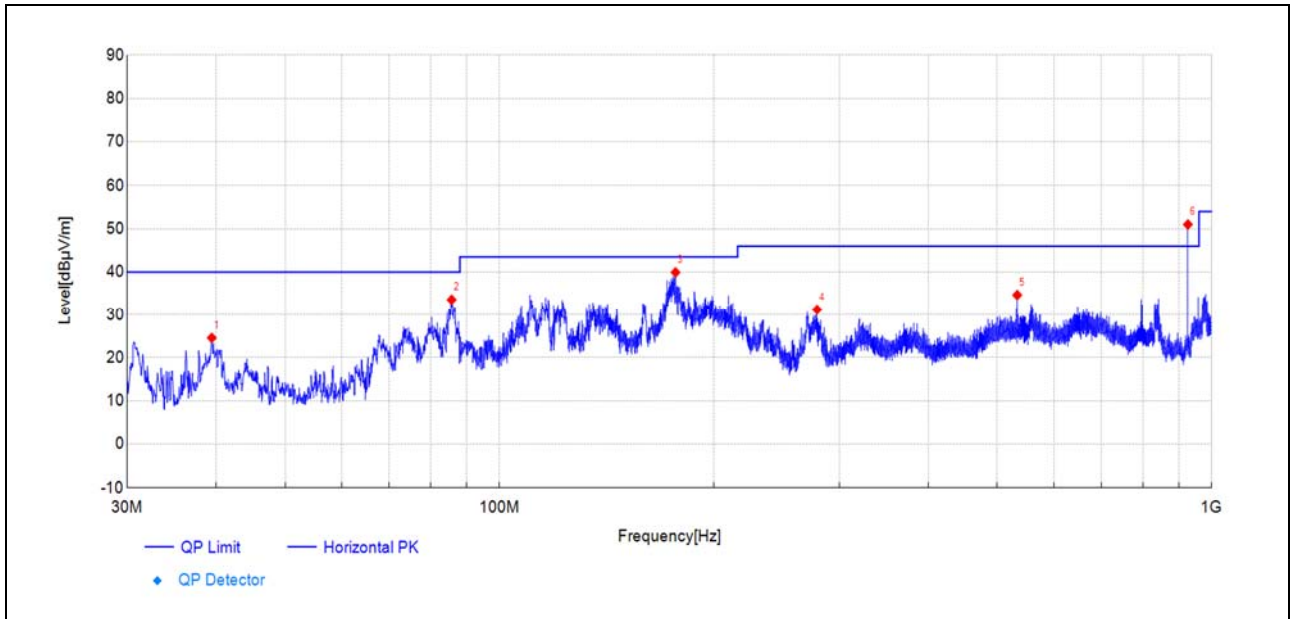


(Antenna Vertical, 1GHz to 10GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
1828.57	61.1	42.71	-18.390	54.00	11.29	150	114	AV	PASS
2742.35	47.2	34.40	-12.820	54.00	19.60	150	92	AV	PASS
3656.64	43.8	34.89	-8.860	54.00	19.11	150	150	AV	PASS
5484.70	40.0	37.93	-2.020	54.00	16.07	150	127	AV	PASS
6398.49	44.0	45.01	1.010	54.00	8.99	150	40	AV	PASS
8226.08	35.7	40.77	5.040	54.00	13.23	150	135	AV	PASS

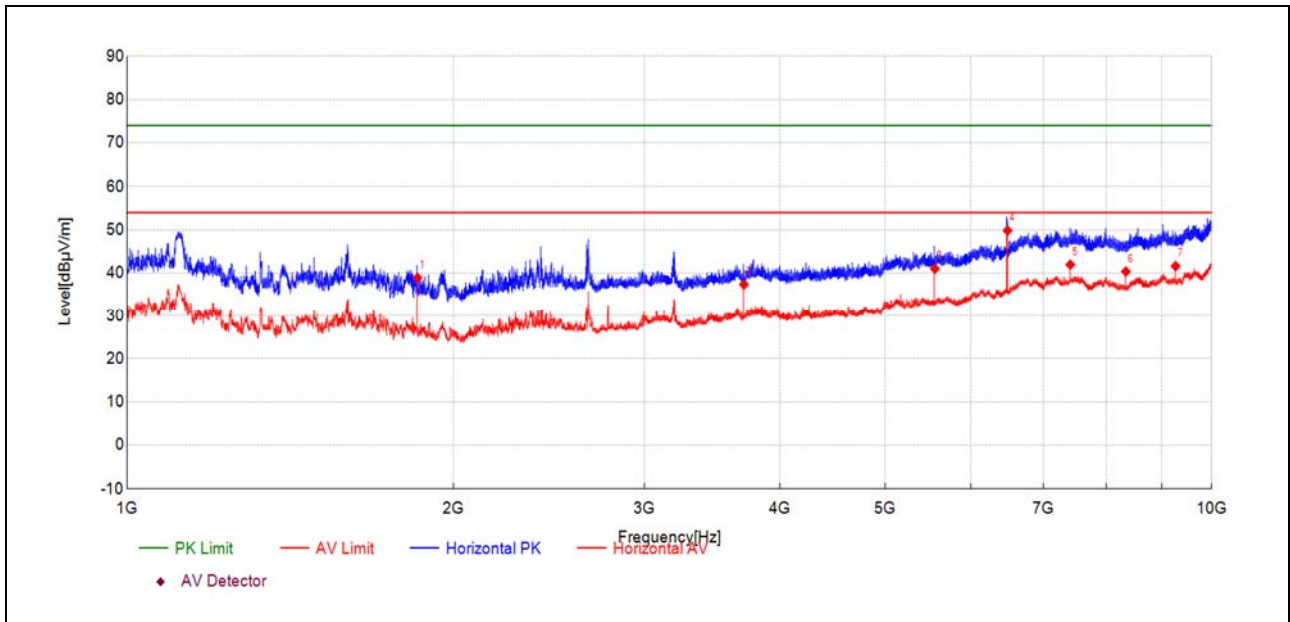


Plot for Channel 63



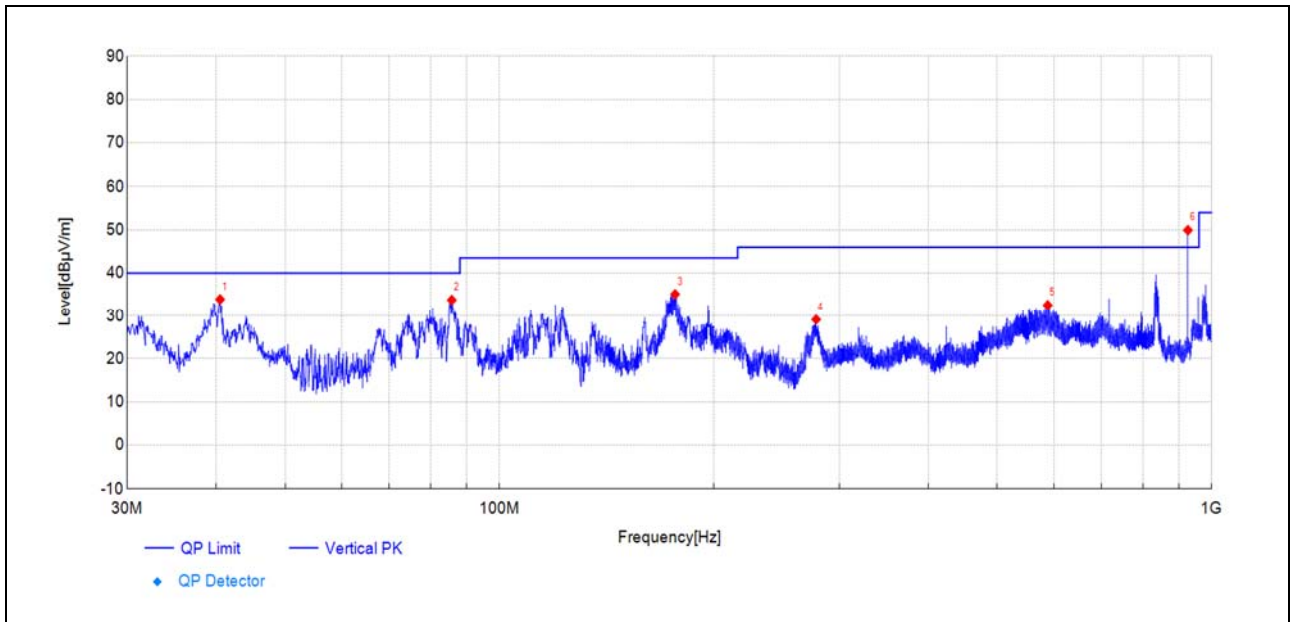
(Antenna Horizontal, 30MHz to 1GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
39.46	53.5	24.56	-28.950	40.00	15.44	150	9	PK	PASS
85.68	65.8	33.57	-32.180	40.00	6.43	150	98	PK	PASS
176.67	70.2	39.93	-30.300	43.50	3.57	150	85	PK	PASS
279.21	57.4	31.20	-26.190	46.00	14.80	150	356	PK	PASS
533.21	53.4	34.66	-18.720	46.00	11.34	150	64	PK	PASS
925.89	63.1	51.01	-12.120	-	-	150	214	PK	NA



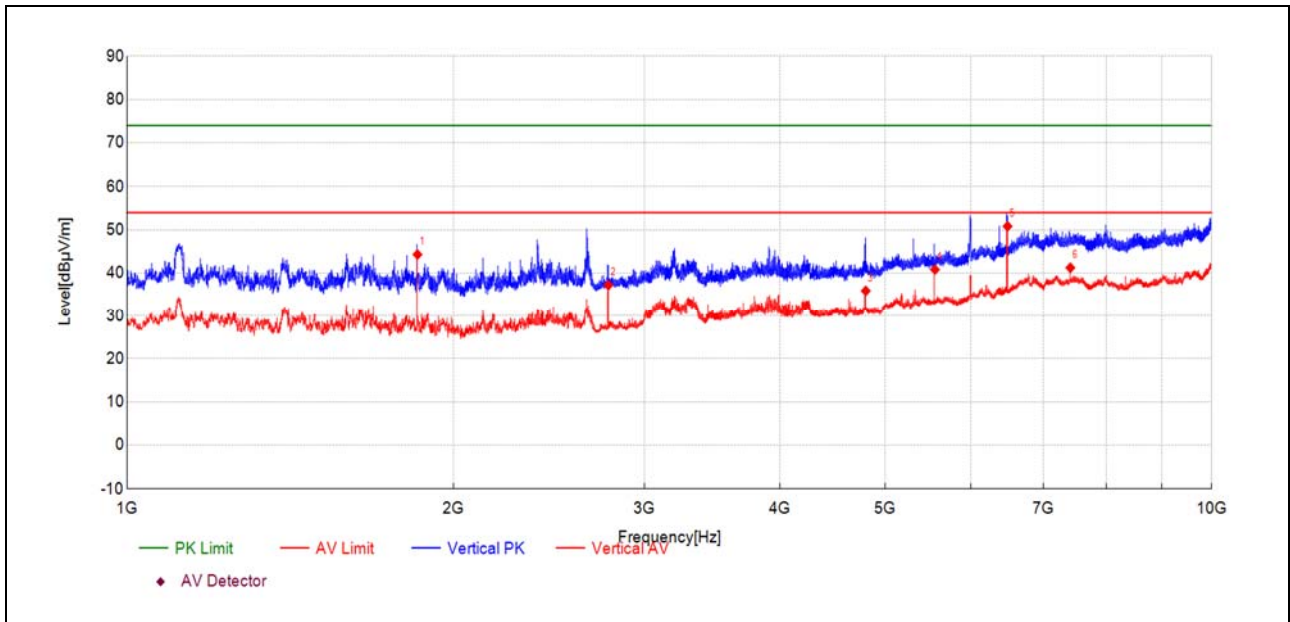
(Antenna Horizontal, 1GHz to 10GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
1852.57	57.2	38.91	-18.270	54.00	15.09	150	146	AV	PASS
3704.71	46.6	37.37	-9.210	54.00	16.63	150	138	AV	PASS
5556.57	43.2	41.02	-2.200	54.00	12.98	150	153	AV	PASS
6482.97	48.0	49.85	1.840	54.00	4.15	150	201	AV	PASS
7407.49	37.2	41.95	4.720	54.00	12.05	150	194	AV	PASS
8335.29	35.5	40.37	4.840	54.00	13.63	150	288	AV	PASS
9261.22	34.1	41.62	7.540	54.00	12.38	150	43	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
40.53	62.7	33.89	-28.770	40.00	6.11	150	174	PK	PASS
85.73	65.9	33.74	-32.200	40.00	6.26	150	181	PK	PASS
176.43	65.5	35.08	-30.410	43.50	8.42	150	31	PK	PASS
278.38	55.2	29.09	-26.140	46.00	16.91	150	256	PK	PASS
588.46	49.6	32.53	-17.070	46.00	13.47	150	78	PK	PASS
925.94	62.1	49.94	-12.110	-	-	150	235	PK	NA



(Antenna Vertical, 1GHz to 13GHz)

Fre. (MHz)	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Verdict
1852.57	62.6	44.31	-18.270	54.00	9.69	150	198	AV	PASS
2778.36	50.0	37.20	-12.750	54.00	16.80	150	106	AV	PASS
4797.72	41.1	35.88	-5.190	54.00	18.12	150	175	AV	PASS
5557.04	43.0	40.82	-2.190	54.00	13.18	150	110	AV	PASS
6482.97	49.0	50.84	1.840	54.00	3.16	150	79	AV	PASS
7407.96	36.5	41.25	4.720	54.00	12.75	150	103	AV	PASS

————— END OF REPORT —————