

RF TEST REPORT

Applicant	Copeland Comfort Control LP
FCC ID	2A4JN-VX4001
Product	VX4
Brand	Verdant
Model	VX4-TR-W; VX4-TR-B; VX4-NTR-W; VX4-NTR-B; VX4-WU-W; VX4-WU-B; VX4-NWU-W; VX4-NWU-B; VX4-TVF-W; VX4-TVF-B; VX4-RSR-W; VX4-RSR-B; VX4-NTVF-W; VX4-NTVF-B; VX4-NRSR-W; VX4-NRSR-B
Report No.	R2312A1367-R1
Issue Date	December 11, 2024

Eurofins TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2023)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Prepared by: Xu Ying

Approved by: Xu Kai

Eurofins TA Technology (Shanghai) Co., Ltd.

Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

TABLE OF CONTENT

1	Test Laboratory	4
1.1	Notes of the Test Report	4
1.2.	Test facility	4
1.3	Testing Location	4
2	General Description of Equipment under Test	5
2.1	Applicant and Manufacturer Information	5
2.2	General information	5
3	Applied Standards	7
4	Information about the FHSS characteristics	8
4.1	Frequency Hopping System Requirement	8
4.2	Test Configuration	9
5	Test Case Results	10
5.1	Power Output	10
5.2	Occupied Bandwidth (20dB)	12
5.3	Frequency Separation	14
5.4	Time of Occupancy (Dwell Time)	16
5.5	Band Edge Compliance	18
5.6	Number of hopping Frequency	21
5.7	Spurious RF Conducted Emissions	23
5.8	Unwanted Emission	25
5.9	Conducted Emission	45
6	Main Test Instruments	48
	ANNEX A: The EUT Appearance	49
	ANNEX B: Test Setup Photos	50

Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	Frequency Hopping System	15.247 (g), (h)	PASS
2	Output Power	15.247(b)(2)	PASS
3	Occupied Bandwidth (20dB)	15.247(a) (1) (i)	PASS
4	Frequency Separation	15.247(a) (1) (i)	PASS
5	Time of Occupancy (Dwell Time)	15.247(a) (1) (i)	PASS
6	Band Edge Compliance	15.247(d)	PASS
7	Number of Hopping Frequency	15.247(a) (1) (i)	PASS
8	Spurious RF Conducted Emissions	15.247(d)	PASS
9	Unwanted Emissions	15.247(d)	PASS
10	Conducted Emissions	15.207	PASS
Date of Testing: December 19, 2023 ~ December 25, 2023 and March 20, 2024 ~ March 31, 2024 Date of Sample Received: December 18, 2023			
Note: PASS: The EUT complies with the essential requirements in the standard. FAIL: The EUT does not comply with the essential requirements in the standard. All indications of Pass/Fail in this report are opinions expressed by Eurofins TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **Eurofins TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3 Testing Location

Company:	Eurofins TA Technology (Shanghai) Co., Ltd.
Address:	Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City:	Shanghai
Post code:	201201
Country:	P. R. China
Contact:	Xu Kai
Telephone:	+86-021-50791141/2/3
Fax:	+86-021-50791141/2/3-8000
Website:	https://www.eurofins.com/electrical-and-electronics
E-mail:	Kain.Xu@cpt.eurofinscn.com

2 General Description of Equipment under Test

2.1 Applicant and Manufacturer Information

Applicant	Copeland Comfort Control LP
Applicant address	8100 West Florissant Ave, St. Louis, United States of America
Manufacturer	Copeland Comfort Control LP
Manufacturer address	8100 West Florissant Ave, St. Louis, United States of America

2.2 General information

EUT Description			
Model	VX4-TR-W; VX4-TR-B; VX4-NTR-W; VX4-NTR-B; VX4-WU-W; VX4-WU-B; VX4-NWU-W; VX4-NWU-B; VX4-TVF-W; VX4-TVF-B; VX4-RSR-W; VX4-RSR-B; VX4-NTVF-W; VX4-NTVF-B; VX4-NRSR-W; VX4-NRSR-B		
Lab internal SN	Conducted	VX4-TR-B	R2312A1367/S01
	Radiated	VX4-TR-B	R2312A1367/S01
		VX4-NTR-B	R2312A1367/S02
		VX4-WU-B	R2312A1367/S03
		VX4-NWU-B	R2312A1367/S04
		VX4-TVF-B	R2312A1367/S05
Hardware Version	0059-5510 REV.003		
Software Version	fcc_test_01		
Power Supply	AC adapter		
Antenna Type	PCB Antenna		
Antenna Connector	A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)		
Antenna Gain	-3.19dBi		
Test Mode(s)	Model 900MHz		
Modulation Type	FSK2		
Total Channel Number	67		
Channel Space	380kHz		
Max. Output Power	9.23 dBm		
Operating Frequency Range(s)	902.46 ~ 927.54MHz		
Note: The EUT is sent from the applicant to Eurofins TA and the information of the EUT is declared by the applicant.			

Items	Model name & Shell color -White	Model name & Shell color -Black	Heat/Cool Relays (6pcs)	RS485/UART with Dry Contact Relay	UART (Protocol) with Dry Contact Relay	PIR Sensor	Notes	Test description
1	VX4-TR-W	VX4-TR-B	6	--	--	√	The only differences between models are color, icon and selling channels. Powered by 12VDC and 24VAC	VX4-TR-B for test all test items.
2	VX4-NTR-W	VX4-NTR-B	6	--	--	--	The only differences between models are color, icon and selling channels. Powered by 12VDC and 24VAC	VX4-NTR-B for test Radiated Emission.
3	VX4-WU-W	VX4-WU-B	0	--	--	√	The only differences between models are color, icon and selling channels. Powered by 12VDC, 24VAC or/and battery 3VDC (Two batteries are in series, 1.5VDC for each)	VX4-WU-B for test Radiated Emission.
4	VX4-NWU-W	VX4-NWU-B	0	--	--	--	The only differences between models are color, icon and selling channels. Powered by 12VDC, 24VAC or/and battery 3VDC (Two batteries are in series, 1.5VDC for each)	VX4-NWU-B for test Radiated Emission.
5	VX4-NRSR-W	VX4-NRSR-B	1	√	--	--	The only differences between models are color, icon and selling channels. Powered by 12VDC	/
6	VX4-RSR-W	VX4-RSR-B	1	√	--	√	The only differences between models are color, icon and selling channels. Powered by 12VDC	/
7	VX4-TVF-W	VX4-TVF-B	1	--	√	√	The only differences between models are color, icon and selling channels. Powered by 12VDC	VX4-TVF-B for test Radiated Emission.
8	VX4-NTVF-W	VX4-NTVF-B	1	--	√	--	The only differences between models are color, icon and selling channels. Powered by 12VDC	/
Note : All these model's PCB Layout, compnents, operating principle, and antenna are the same.								

3 Applied Standards

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

Test standards:

FCC CFR47 Part 15C (2023) Radio Frequency Devices

ANSI C63.10-2013

Reference standard:

KDB 558074 D01 15.247 Meas Guidance v05r02

4 Information about the FHSS characteristics

4.1 Frequency Hopping System Requirement

Standard requirement:

- (g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.
- (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.

4.2 Test Configuration

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

5 Test Case Results

5.1 Power Output

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the spectrum analyzer and 915MHz band test set via a power splitter with a known loss. The EUT is controlled by the 915MHz band test set to ensure max power transmission with proper modulation. The peak detector is used. RBW is set to 2 MHz; VBW is set to 6 MHz. These measurements have been tested at following channels: 0, 33 and 66.

Test Setup



Limits

Rule Part 15.247 (b) (2) specifies that " For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels."

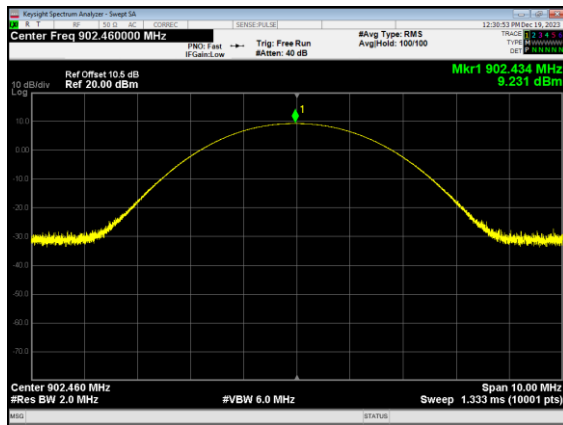
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=0.44$ dB.

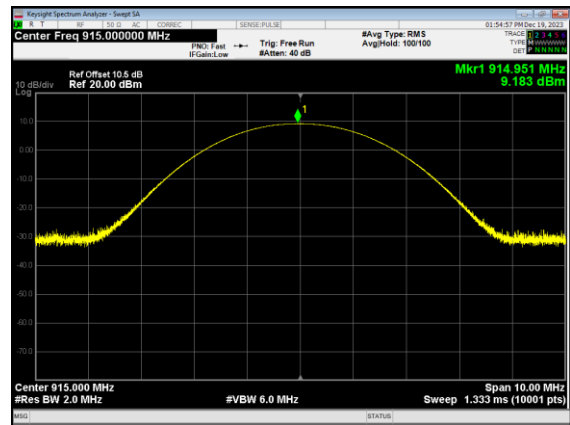
Test Results

Test Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Conclusion
Model 900MHz	0	902.46	9.23	30	PASS
	33	915	9.18	30	PASS
	66	927.54	9.16	30	PASS

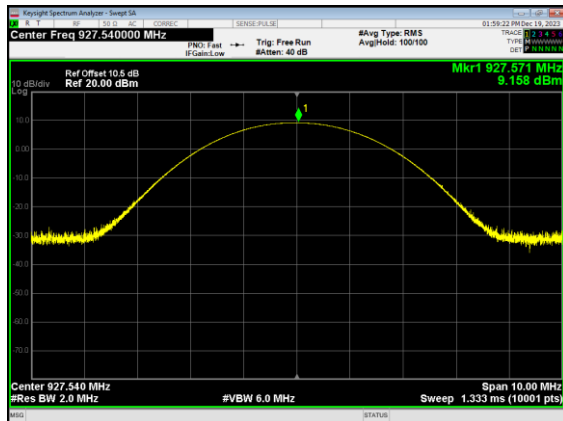
CH0, Carrier frequency (MHz): 902.46



Ch33, Carrier frequency (MHz): 915



Ch66, Carrier frequency (MHz): 927.54



5.2 Occupied Bandwidth (20dB)

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. The occupied bandwidth is measured using spectrum analyzer. RBW is set to 30kHz and VBW is set to 100kHz on spectrum analyzer. -20dB occupied bandwidths are recorded.

Test Setup



Limits

No specific occupied bandwidth requirements in part 15.247(a) (1) (i).

For 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.

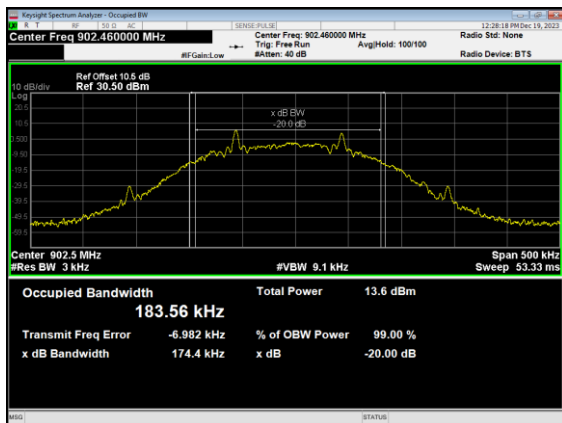
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=936$ Hz.

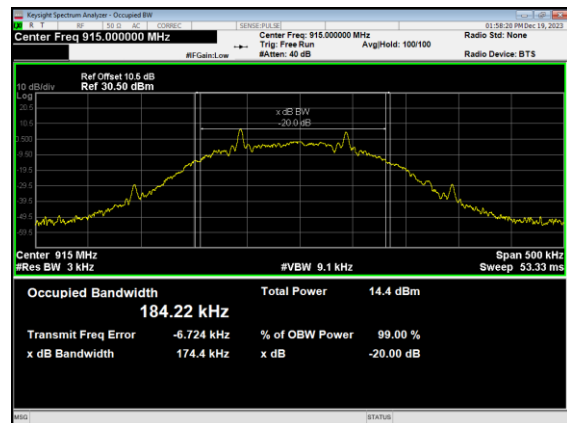
Test Results

Test Mode	Channel	Frequency (MHz)	99% bandwidth(MHz)	20dB Bandwidth(MHz)
Model 900MHz	0	902.46	0.184	0.174
	33	915	0.184	0.174
	66	927.54	0.184	0.174

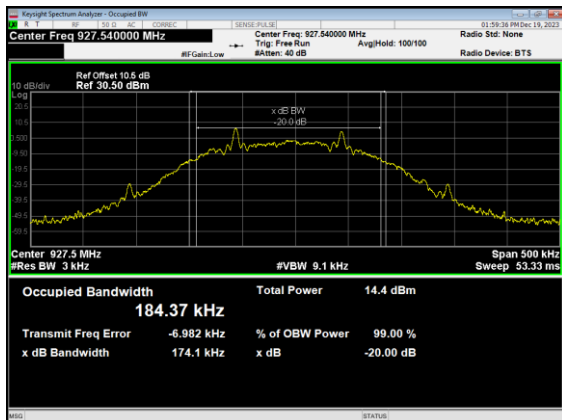
CH0, Carrier frequency (MHz): 902.46



CH33, Carrier frequency (MHz): 915



CH66, Carrier frequency (MHz): 927.54



5.3 Frequency Separation

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. RBW is set to 30 kHz and VBW is set to 100 kHz on spectrum analyzer. Set EUT on Hopping on mode.

Test setup



Limits

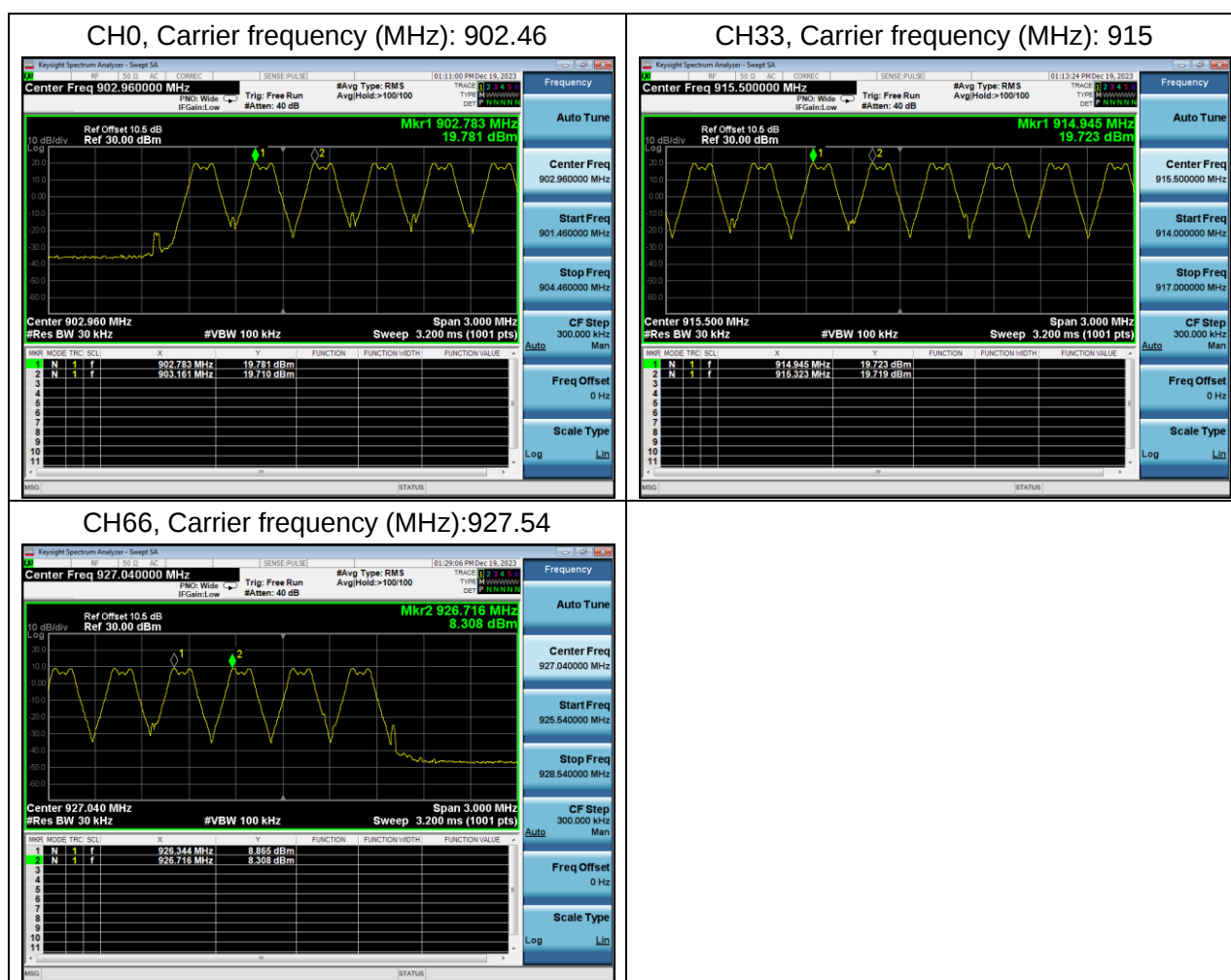
Rule Part 15.247(a)(1) (i) specifies that “For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater 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. ”

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=936$ Hz.

Test Results:

Test Mode	Carrier frequency (MHz)	Carrier frequency separation(MHz)	Limit (MHz)	Conclusion
Model 900MHz	902.46	0.378	0.174	PASS
	915	0.378	0.174	PASS
	927.54	0.372	0.174	PASS
Note: The limit is 20 dB Bandwidth.				



5.4 Time of Occupancy (Dwell Time)

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Methods of Measurement

The EUT was connected to the spectrum analyzer and Model 900MHz test set via a power splitter with a known loss. RBW100 KHz, VBW300 KHz. The dwell time is calculated by:

Dwell time = Average Transmit Time/ Channel (ms)*Number of Hops in 20s

Test Setup



Limits

Rule Part15.247(a) (1) (i) specifies that " For 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."

Dwell time	≤ 400ms
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$.

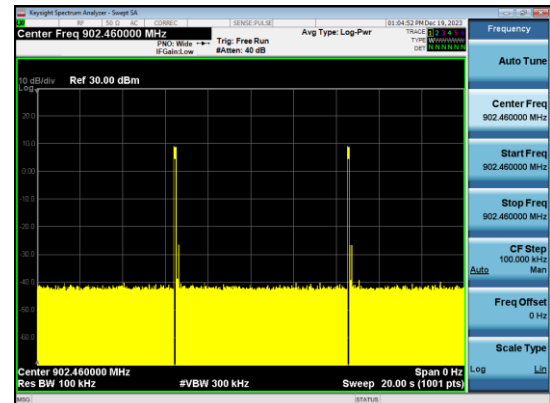
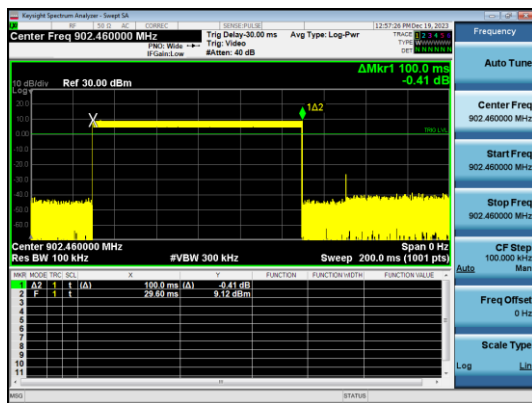
Requirements	Uncertainty
Dwell Time	$U=0.70\text{ms}$

Test Results:

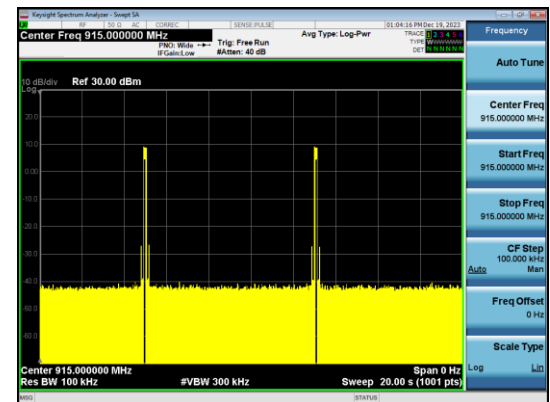
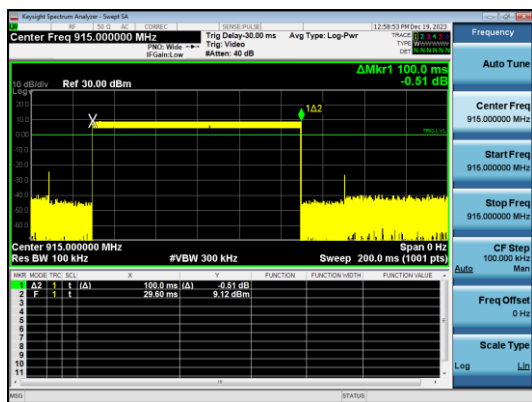
Test Mode	Channel	Average Transmit Time/ Channel (ms)	Number of Hops in 20s	Dwell time (ms)	Limit (ms)	Conclusion
Model 900MHz	0	100	2	200	400	PASS
	33	100	2	200	400	PASS
	66	99.6	2	199.2	400	PASS

Note: Dwell time = Average Transmit Time/ Channel (ms)*Number of Hops in 20s

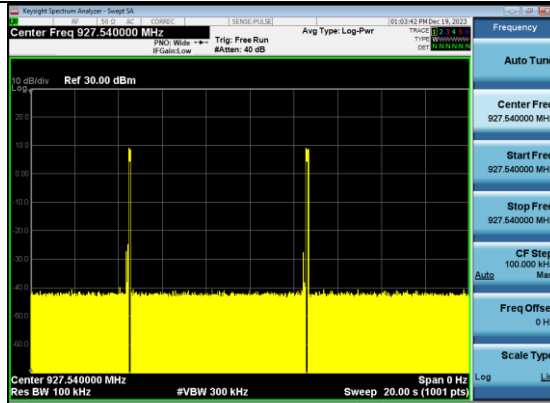
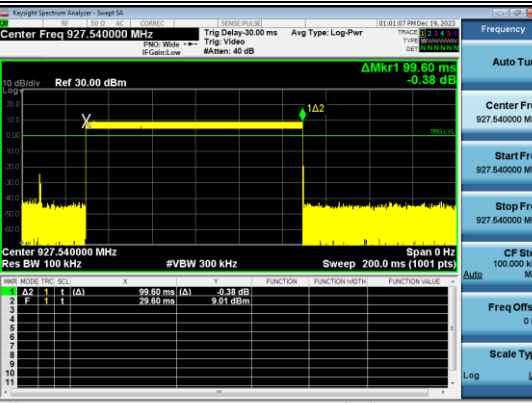
CH0, Carrier frequency (MHz): 902.46



CH33, Carrier frequency (MHz): 915



CH66, Carrier frequency (MHz): 927.54



5.5 Band Edge Compliance

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. The lowest and highest channels were measured. The peak detector is used. RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. EUT test for Hopping On mode and Hopping Off mode.

Test Setup



Limits

Rule Part 15.247(d) specifies that “In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.”

Measurement Uncertainty

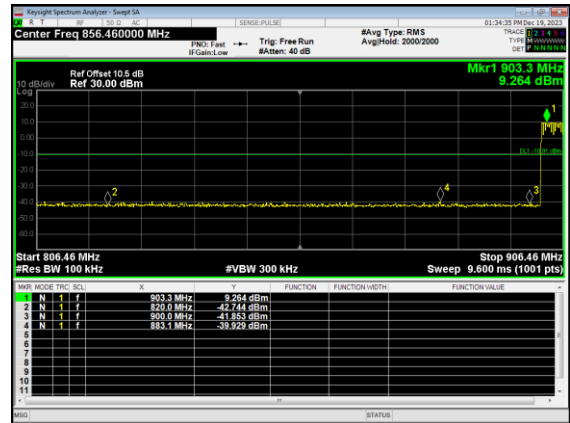
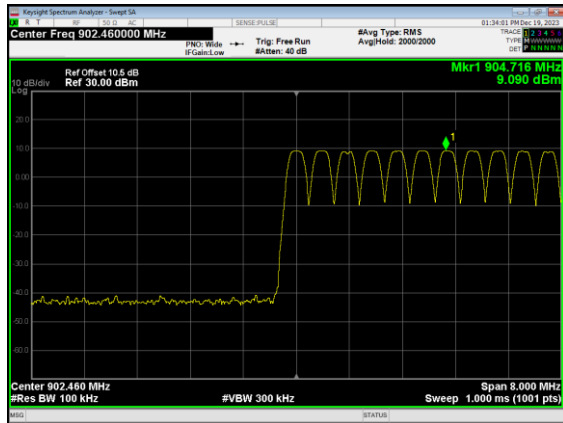
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
2GHz-3GHz	1.407 dB

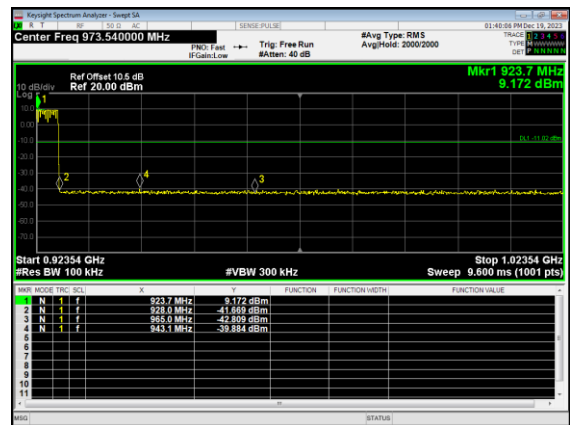
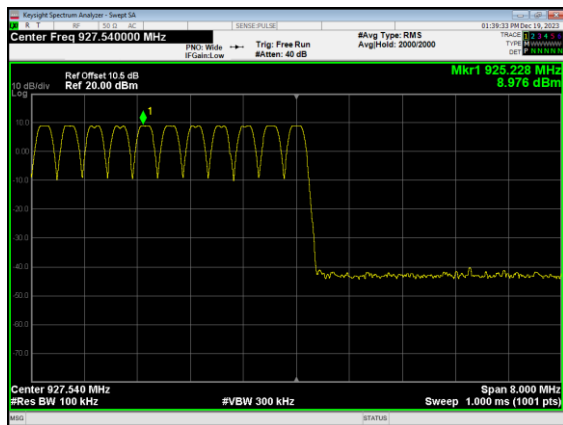
Test Results

Hopping On

CH0, Carrier frequency (MHz): 902.46

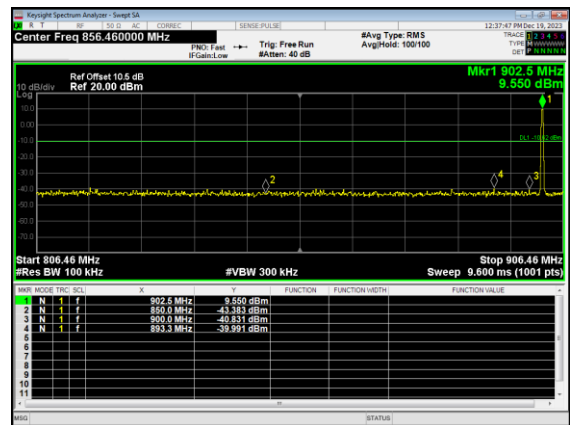
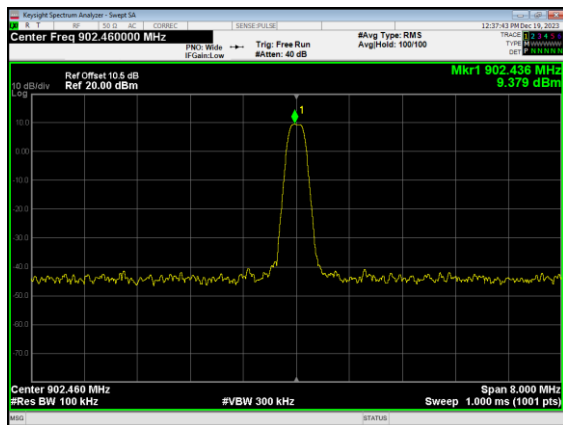


CH66, Carrier frequency (MHz): 927.54

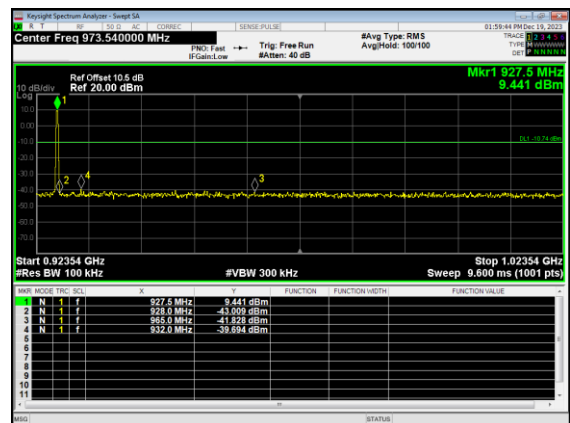
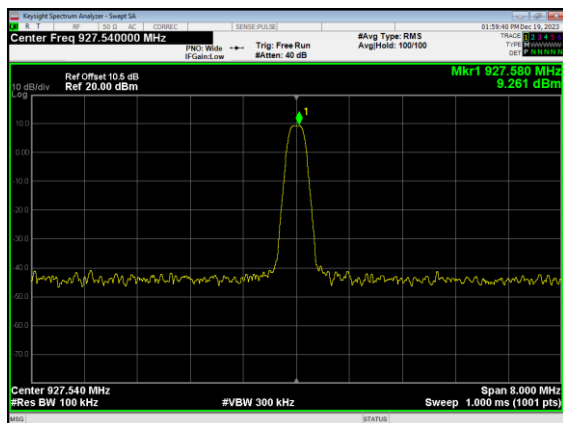


Hopping Off

CH0, Carrier frequency (MHz): 902.46



CH66, Carrier frequency (MHz): 927.54



5.6 Number of hopping Frequency

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. RBW is set to 100kHz and VBW is set to 300kHz on spectrum analyzer. Set EUT on Hopping on mode.

Test setup



Limits

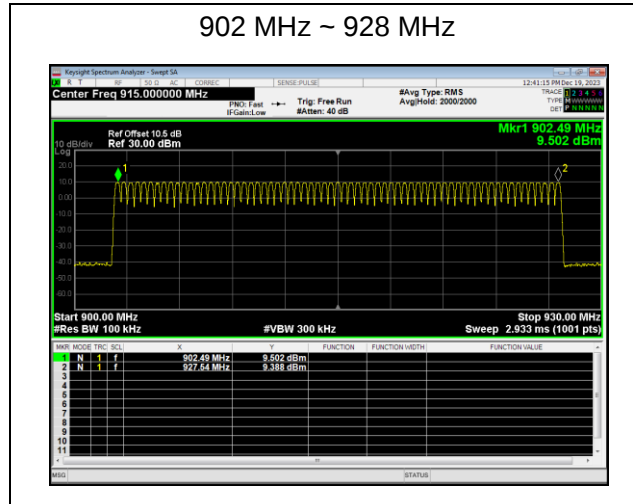
Rule Part 15.247(a) (1) (i)

For 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.

Frequency Band	20 dB Bandwidth of the hopping channel	Hopping Number
902~928	≤250kHz	≥50 channels
	≥250 kHz	≥25 channels

Test Results:

Test Mode	Range(MHz)	Number of hopping channels	Limits	conclusion
Model 900MHz	902-928	67	≥ 50 channels	PASS



5.7 Spurious RF Conducted Emissions

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW 100kHz and VBW 300 kHz, Sweep is set to AUTO.

The test is in transmitting mode.

Test setup



Limits

Rule Part 15.247(d) pacifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.”

Test Mode	Carrier frequency (MHz)	Reference value (dBm)	Limit
Model 900MHz	902.46	9.180	-10.82
	915	9.120	-10.88
	927.54	9.060	-10.94

Measurement Uncertainty

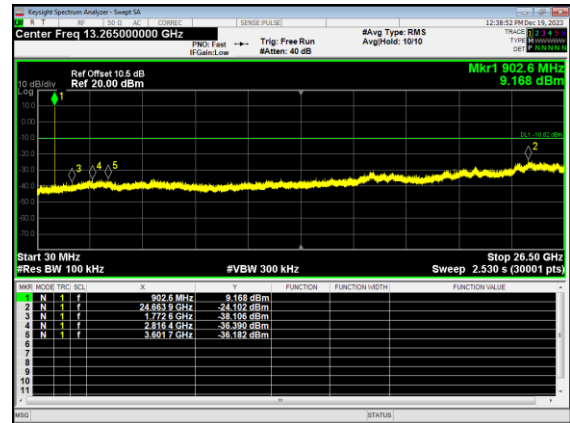
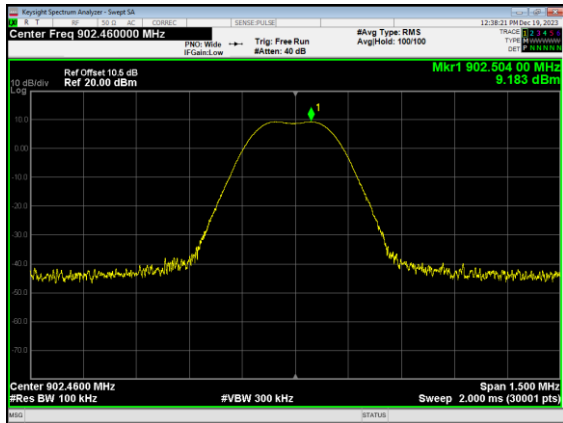
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-26GHz	1.407 dB

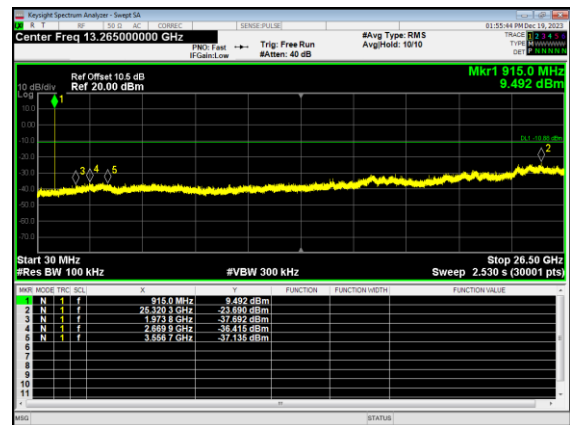
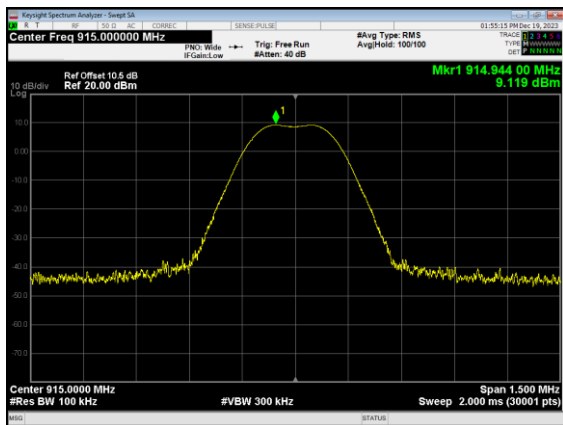
Test Results:

The signal beyond the limit is carrier.

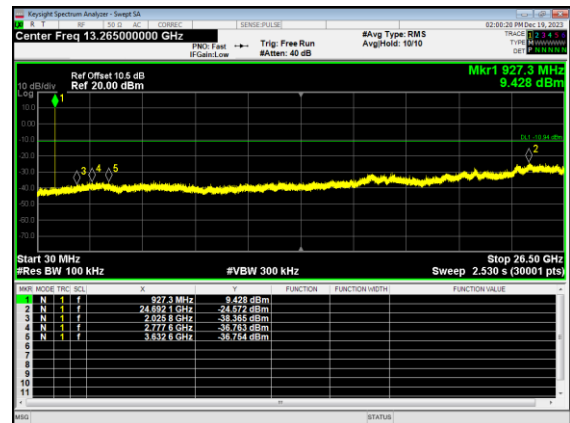
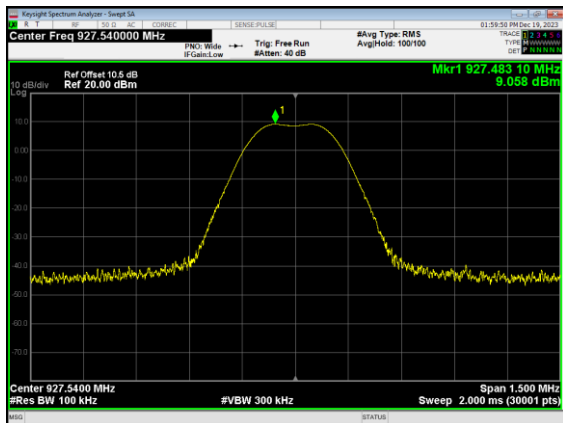
CH0, Carrier frequency (MHz): 902.46



CH33, Carrier frequency (MHz): 915



CH66, Carrier frequency (MHz): 927.54



5.8 Unwanted Emission

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The radiated emissions measurements were made in a typical installation configuration.

Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

During the test, below 30MHz, the center of the loop shall be 1 meters; above 30MHz, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.

Set the spectrum analyzer in the following:

9kHz~150 kHz

RBW=200Hz, VBW=1kHz/ Sweep=AUTO

150 kHz~30MHz

RBW=9KHz, VBW=30KHz,/ Sweep=AUTO

Below 1GHz

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz

(a) PEAK: RBW=1MHz VBW=3MHz/ Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO

detector; The measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

The dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit.

If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak- average correction factor, derived from the appropriate duty cycle calculation.

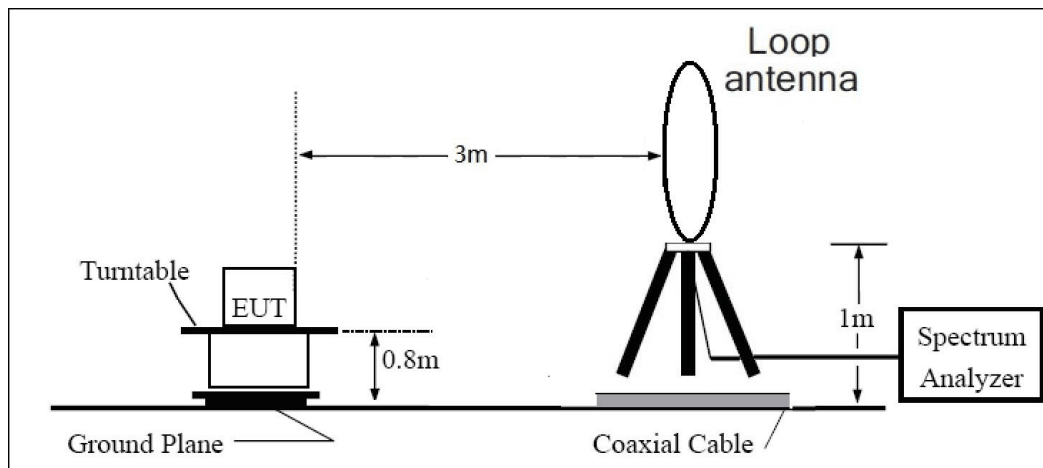
This setting method can refer to **KDB 558074 D01**.

This mode was measured in the following mode: EUT with cradle and EUT without cradle. The worst emission was found in EUT with cradle mode and the worst case was recorded.

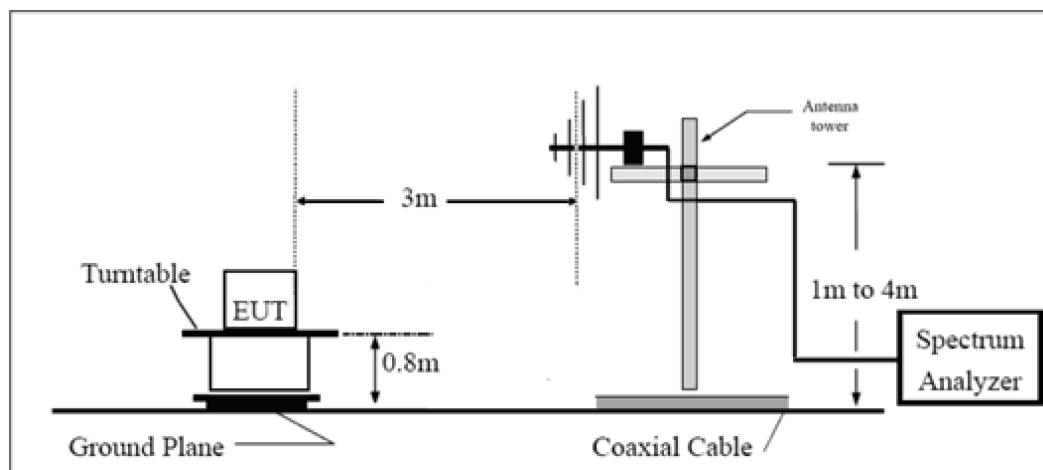
The test is in transmitting mode.

Test setup

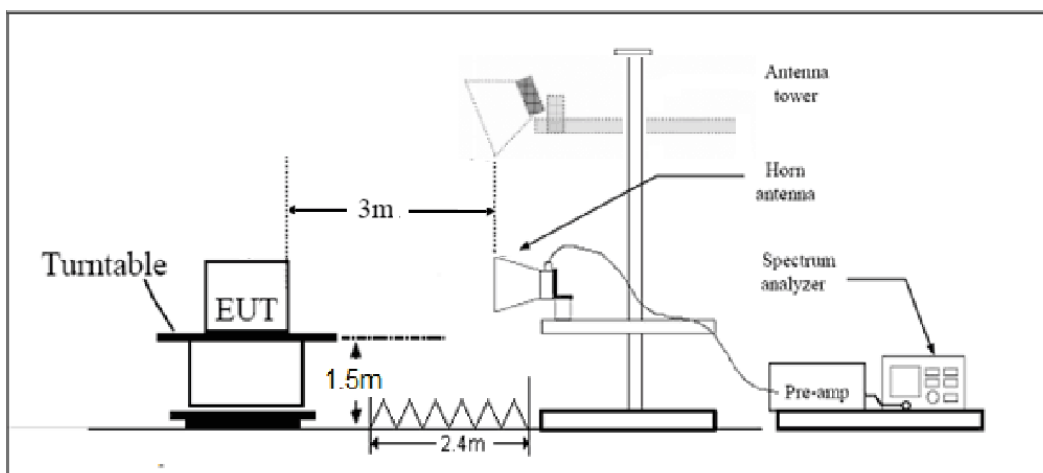
9kHz~ 30MHz



30MHz~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

Rule Part 15.247(d) specifies that “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) (see § 15.205(c)).”

Limit in restricted band

Frequency of emission (MHz)	Field strength($\mu\text{V/m}$)	Field strength($\text{dB}\mu\text{V/m}$)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54

§15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

Peak Limit=74dB $\mu\text{V/m}$

Average Limit=54dB $\mu\text{V/m}$

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.17 dB
200MHz-1GHz	4.84 dB
1-18GHz	4.35 dB

Test Results:

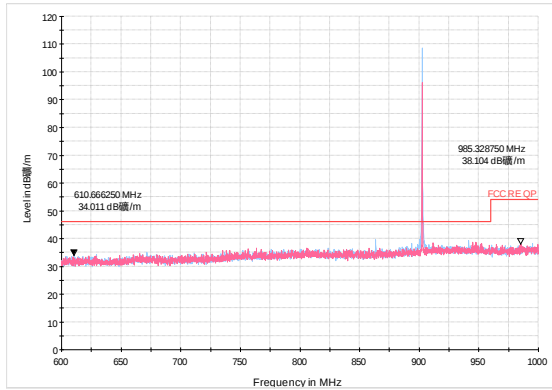
A symbol (dB μ V/m) in the test plot below means (dB μ V/m)

A symbol (dB V/) in the test plot below means (dB μ V/m)

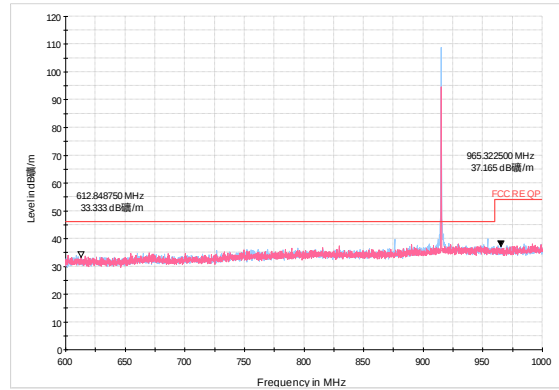
The signal beyond the limit is carrier.

VX4-TR-B

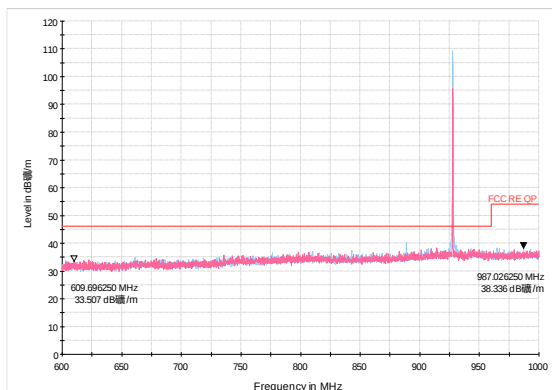
Channel 0: 902.46MHz



Channel 33: 915MHz

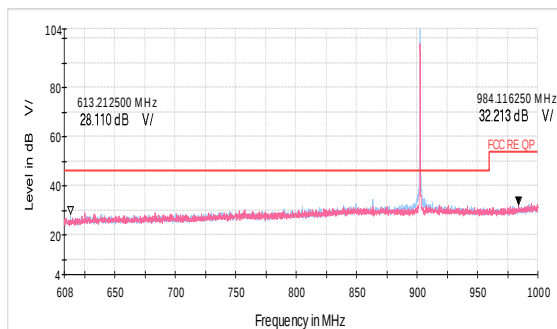


Channel 66: 927.54MHz



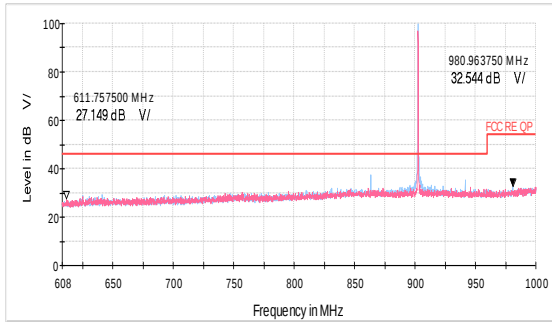
VX4-NTR-B

Channel 0: 902.46MHz



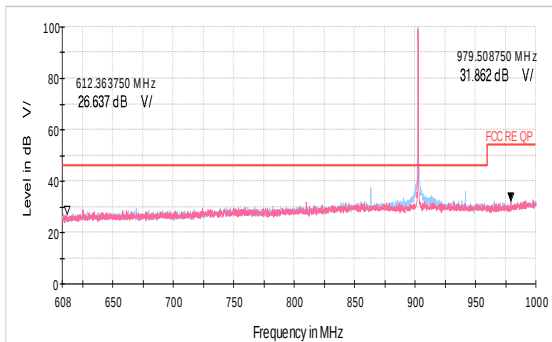
VX4-WU-B

Channel 0: 902.46MHz



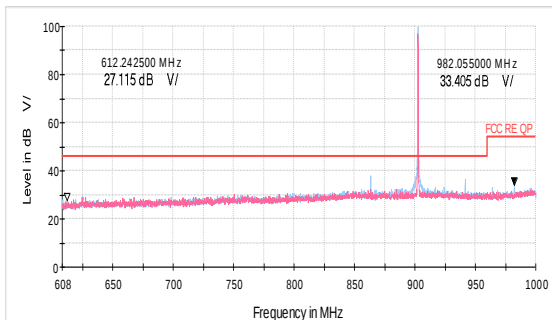
VX4-NWU-B

Channel 0: 902.46MHz



VX4-TVF-B

Channel 0: 902.46MHz



Result of RE

Test result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the Emissions in the frequency band 9kHz-30MHz are more than 20dB below the limit are not reported.

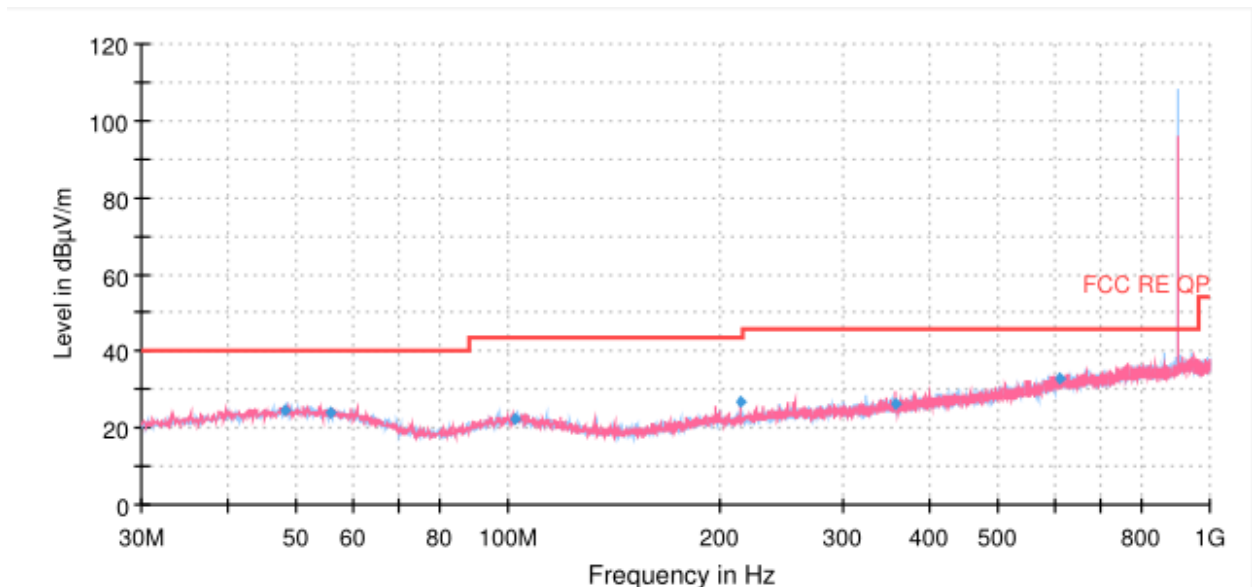
The following graphs display the maximum values of horizontal and vertical by software.

For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

Continuous TX mode:

VX4-TR-B

CH0: 902.46MHz



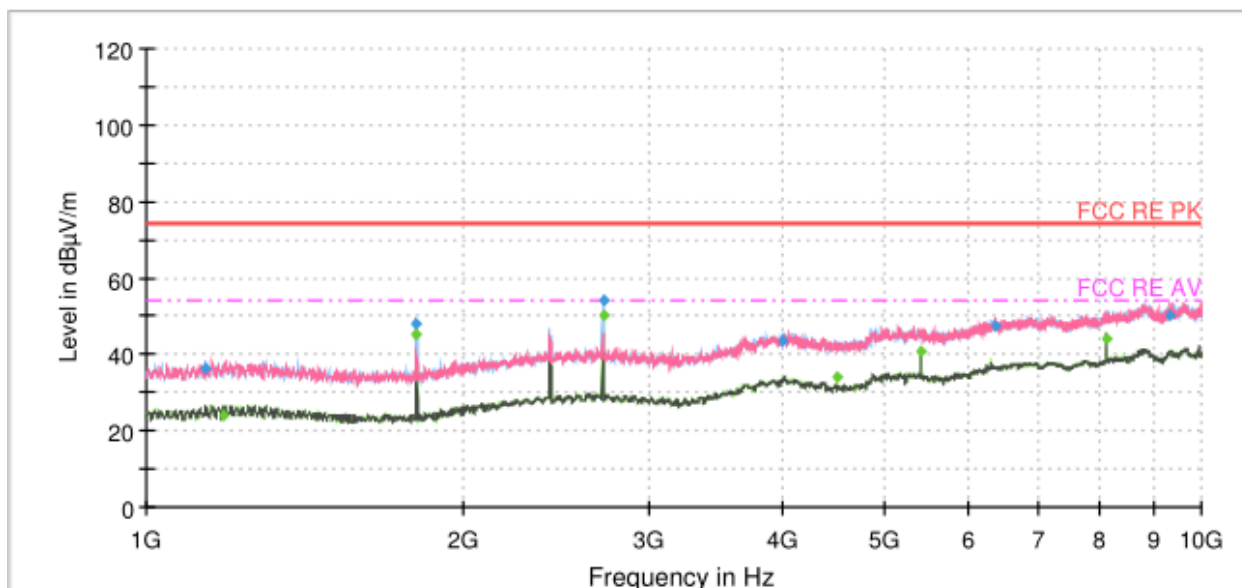
Note: The signal beyond the limit is carrier.

Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
48.19	24.30	40.00	15.70	177.0	H	330.00	20
55.67	23.82	40.00	16.18	107.0	V	314.00	20
102.51	22.21	43.50	21.29	195.0	H	38.00	19
214.50	27.01	43.50	16.49	214.0	V	268.00	18
357.25	26.08	46.00	19.92	116.0	V	250.00	23
610.99	32.91	46.00	13.09	206.0	H	142.00	28

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit – Quasi-Peak



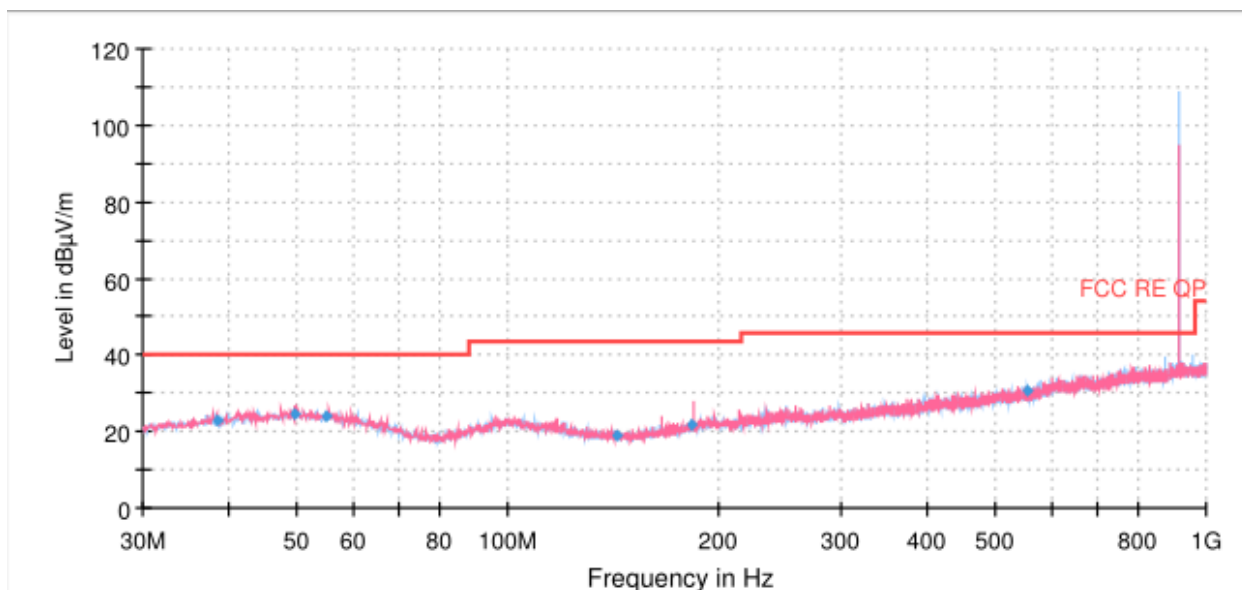
Radiates Emission from 1GHz to 10GHz

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1138.38	36.15	---	74.00	37.85	1000.00	210.0	H	0.00	-20
1185.63	---	23.95	54.00	30.05	1000.00	190.0	H	335.00	-20
1804.38	47.88	---	74.00	26.12	1000.00	102.0	H	13.00	-19
1804.38	---	45.41	54.00	8.59	1000.00	109.0	H	13.00	-19
2706.63	53.93	---	74.00	20.07	1000.00	106.0	H	308.00	-15
2706.63	---	50.46	54.00	3.54	1000.00	100.0	H	302.00	-15
4015.00	43.46	---	74.00	30.54	1000.00	100.0	H	14.00	-10
4512.25	---	33.79	54.00	20.21	1000.00	198.0	H	344.00	-9
5414.50	---	40.53	54.00	13.47	1000.00	100.0	V	213.00	-7
6379.75	47.36	---	74.00	26.64	1000.00	110.0	V	346.00	-4
8122.38	---	44.17	54.00	9.83	1000.00	100.0	V	208.00	-1
9345.25	50.45	---	74.00	23.55	1000.00	104.0	V	10.00	0

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

CH33: 915MHz



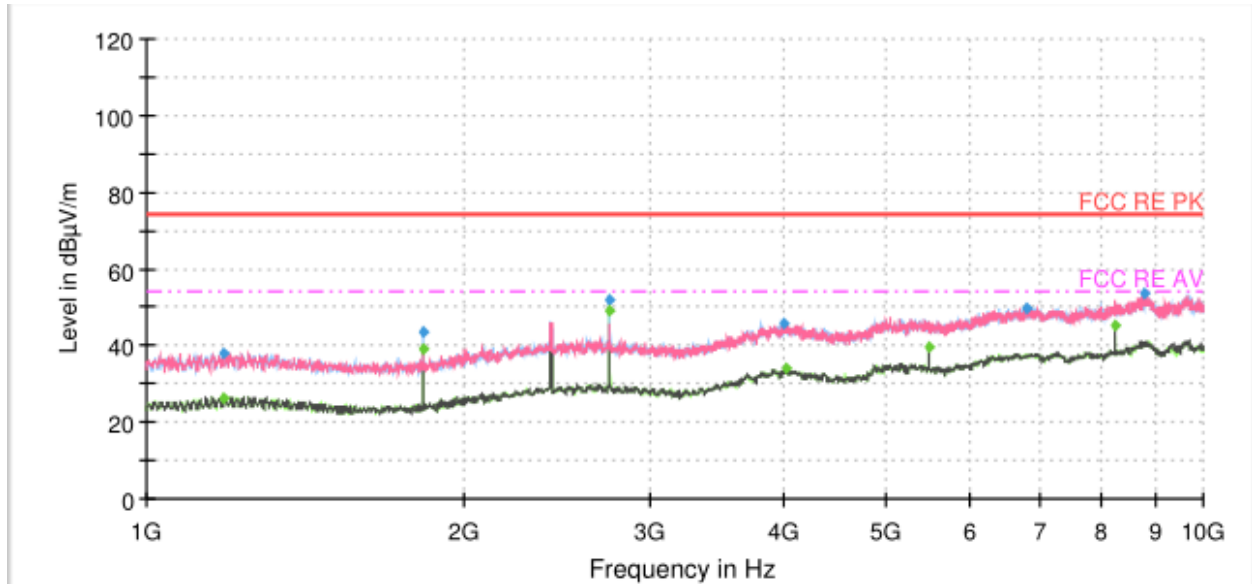
Note: The signal beyond the limit is carrier.

Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
38.36	22.84	40.00	17.16	104.0	V	273.00	19
49.48	24.34	40.00	15.66	187.0	V	6.00	20
55.10	23.94	40.00	16.06	175.0	V	300.00	20
143.25	18.92	43.50	24.58	113.0	V	133.00	15
182.89	21.68	43.50	21.82	119.0	V	308.00	17
553.60	30.48	46.00	15.52	100.0	V	147.00	26

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit – Quasi-Peak



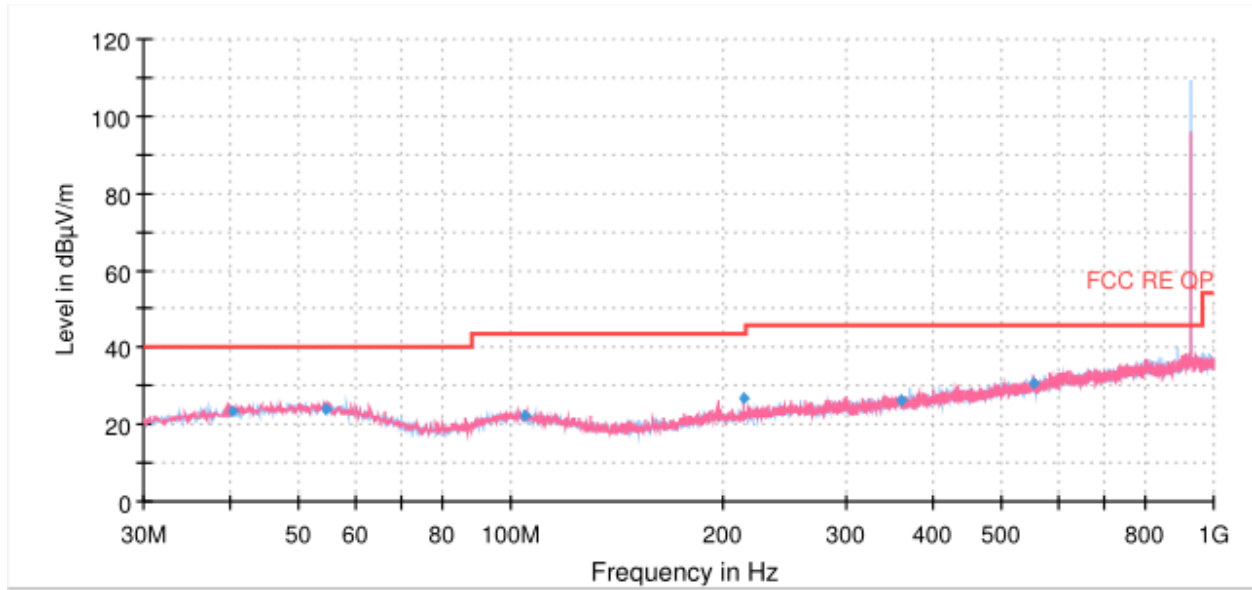
Radiates Emission from 1GHz to 10GHz

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1185.63	---	26.44	54.00	27.56	1000.00	100.0	H	0.00	-20
1185.63	38.01	---	74.00	35.99	1000.00	100.0	V	108.00	-20
1829.13	---	38.87	54.00	15.13	1000.00	100.0	H	8.00	-19
1829.13	43.70	---	74.00	30.30	1000.00	100.0	H	8.00	-19
2744.88	---	49.01	54.00	4.99	1000.00	100.0	H	292.00	-15
2744.88	51.94	---	74.00	22.06	1000.00	100.0	H	292.00	-15
4004.88	45.55	---	74.00	28.45	1000.00	200.0	H	81.00	-11
4021.75	---	34.00	54.00	20.00	1000.00	200.0	V	349.00	-11
5489.88	---	39.51	54.00	14.49	1000.00	100.0	V	202.00	-7
6785.88	49.89	---	74.00	24.11	1000.00	200.0	V	0.00	-3
8234.88	---	45.47	54.00	8.53	1000.00	100.0	V	256.00	-1
8812.00	53.65	---	74.00	20.35	1000.00	100.0	V	4.00	-1

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

CH0: 927.54MHz



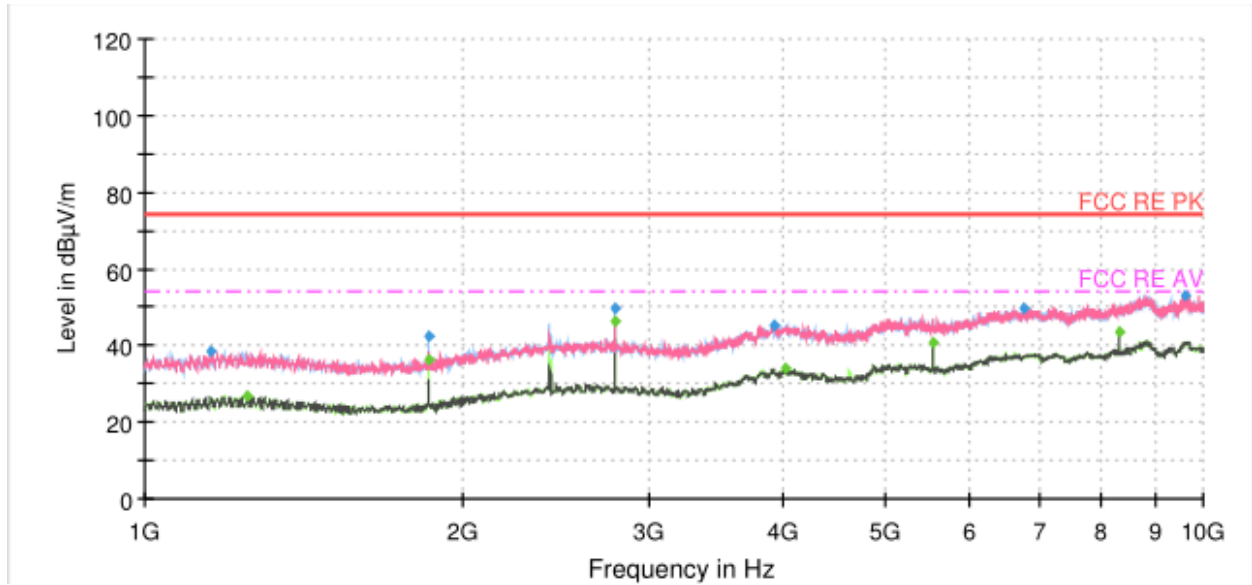
Note: The signal beyond the limit is carrier.

Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
40.14	23.16	40.00	16.84	102.0	V	172.00	19
54.62	24.01	40.00	15.99	109.0	V	254.00	20
104.21	22.05	43.50	21.45	118.0	V	7.00	19
214.50	26.76	43.50	16.74	221.0	V	354.00	18
360.16	26.03	46.00	19.97	121.0	H	70.00	23
554.28	30.51	46.00	15.49	103.0	V	198.00	26

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit – Quasi-Peak



Radiates Emission from 1GHz to 10GHz

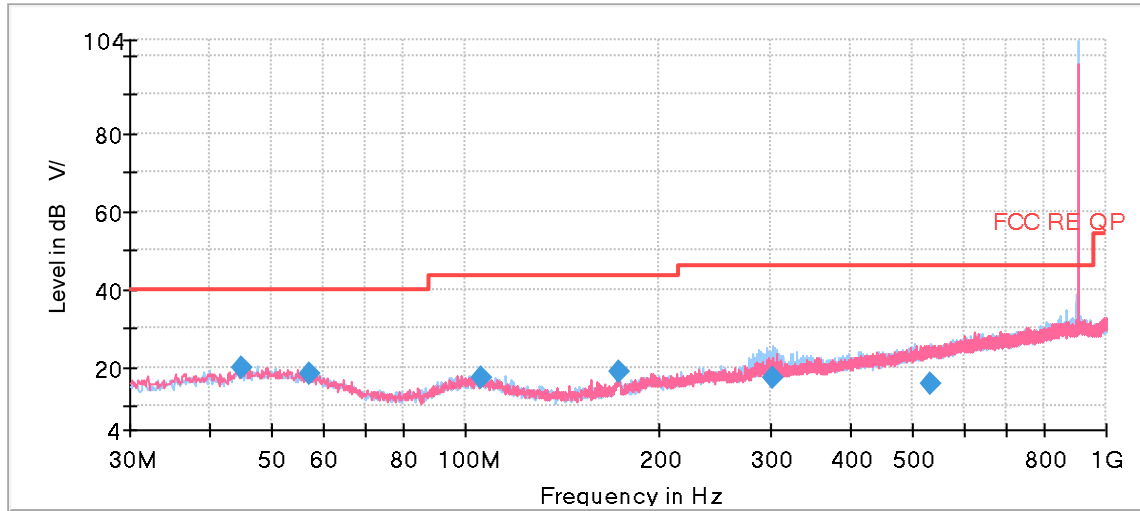
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1155.25	38.27	---	74.00	35.73	1000.00	100.0	H	8.00	-20
1249.75	---	26.65	54.00	27.35	1000.00	200.0	H	285.00	-19
1855.00	---	36.50	54.00	17.50	1000.00	200.0	H	122.00	-19
1855.00	42.19	---	74.00	31.81	1000.00	200.0	H	122.00	-19
2782.00	---	46.32	54.00	7.68	1000.00	100.0	H	278.00	-15
2782.00	49.49	---	74.00	24.51	1000.00	100.0	H	278.00	-15
3931.75	45.35	---	74.00	28.65	1000.00	100.0	H	356.00	-11
4020.63	---	34.02	54.00	19.98	1000.00	200.0	H	148.00	-11
5565.25	---	40.96	54.00	13.04	1000.00	200.0	H	216.00	-7
6776.88	49.72	---	74.00	24.28	1000.00	200.0	V	295.00	-3
8348.50	---	43.67	54.00	10.33	1000.00	100.0	V	212.00	-1
9622.00	53.00	---	74.00	21.00	1000.00	200.0	V	334.00	0

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

VX4-NTR-B

CH0: 902.46MHz



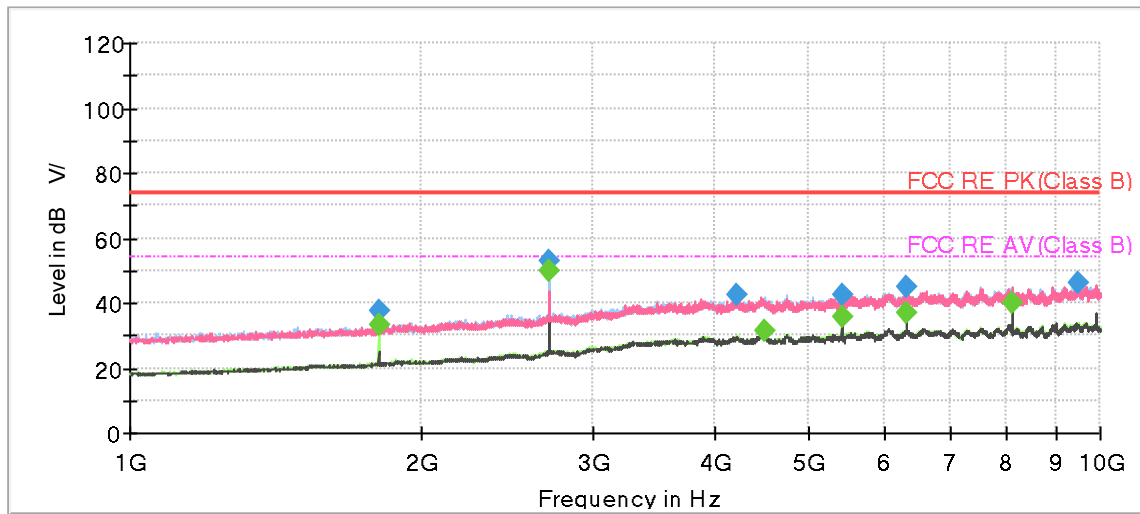
Note: The signal beyond the limit is carrier.

Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
44.748750	19.82	40.00	20.18	207.0	H	332.0	20.8
57.001250	18.50	40.00	21.50	109.0	V	158.0	20.2
105.696250	17.17	43.50	26.33	125.0	H	235.0	19.0
173.965000	18.68	43.50	24.82	225.0	V	225.0	20.0
302.243750	17.58	46.00	28.42	100.0	H	41.0	21.0
533.391250	15.62	46.00	30.38	175.0	H	189.0	25.9

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit – Quasi-Peak



Radiates Emission from 1GHz to 10GHz

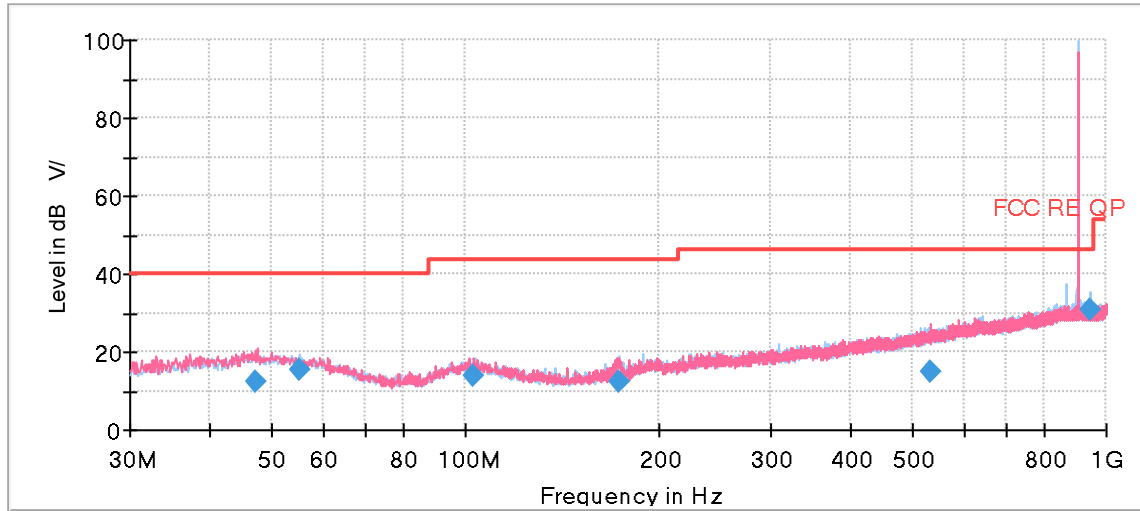
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1804.375000	---	33.31	54.00	20.69	500.0	200.0	H	147.0	-15.3
1804.375000	37.84	---	74.00	36.16	500.0	200.0	H	147.0	-15.3
2706.625000	---	49.70	54.00	4.30	500.0	200.0	H	104.0	-11.7
2706.625000	53.06	---	74.00	20.94	500.0	200.0	H	104.0	-11.7
4214.125000	42.36	---	74.00	31.64	500.0	100.0	H	346.0	-6.8
4512.250000	---	31.27	54.00	22.73	500.0	100.0	H	172.0	-5.7
5414.500000	42.70	---	74.00	31.30	500.0	100.0	H	84.0	-4.3
5414.500000	---	35.54	54.00	18.46	500.0	100.0	V	34.0	-4.3
6317.875000	45.05	---	74.00	28.95	500.0	200.0	H	147.0	-3.9
6317.875000	---	36.76	54.00	17.24	500.0	100.0	H	141.0	-3.9
8122.375000	---	39.75	54.00	14.25	500.0	100.0	V	15.0	-1.6
9490.375000	46.22	---	74.00	27.78	500.0	100.0	V	108.0	-0.3

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

VX4-WU-B

CH0: 902.46MHz



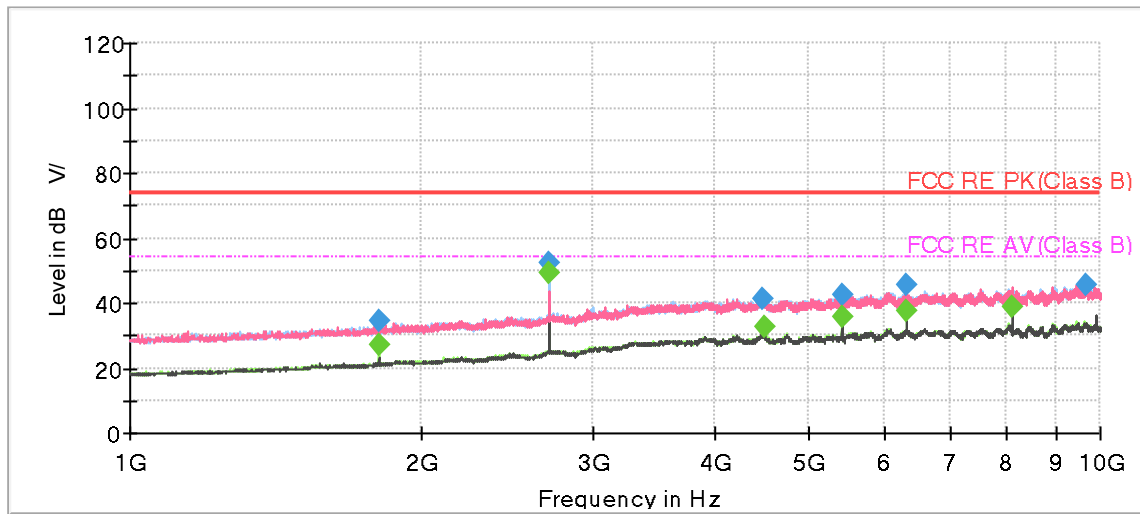
Note: The signal beyond the limit is carrier.

Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
47.138750	12.51	40.00	27.49	100.0	V	51.0	21.0
55.141250	15.23	40.00	24.77	184.0	H	46.0	20.6
103.236250	13.85	43.50	29.65	109.0	H	16.0	19.1
174.038750	12.44	43.50	31.06	184.0	H	251.0	19.9
531.817500	14.86	46.00	31.14	225.0	V	233.0	25.9
941.476250	30.74	46.00	15.26	100.0	H	134.0	30.6

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit – Quasi-Peak



Radiates Emission from 1GHz to 10GHz

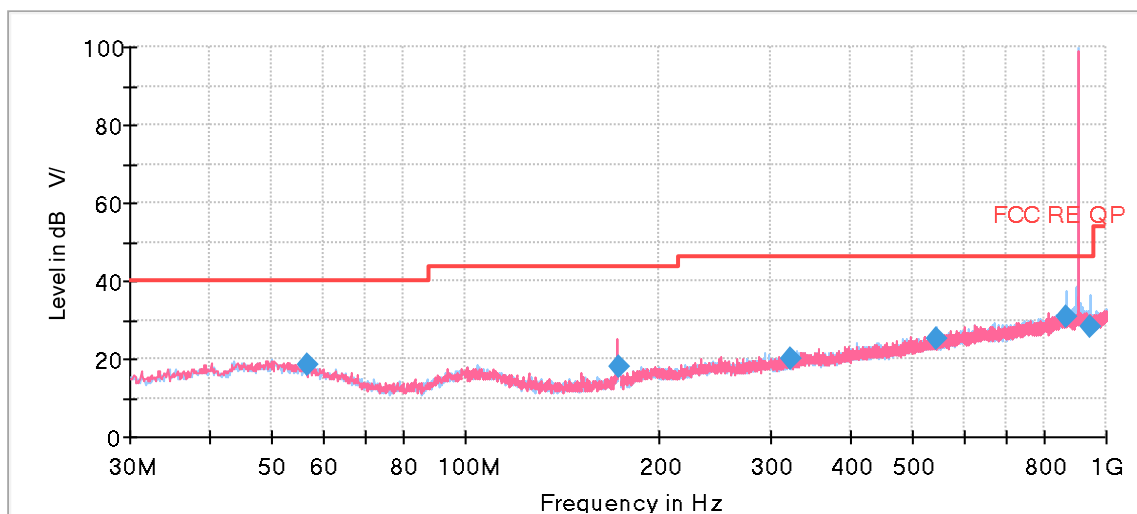
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1804.375000	---	27.31	54.00	26.69	500.0	200.0	H	164.0	-15.3
1804.375000	34.34	---	74.00	39.66	500.0	200.0	H	164.0	-15.3
2706.625000	---	48.98	54.00	5.02	500.0	200.0	H	94.0	-11.7
2706.625000	52.14	---	74.00	21.86	500.0	200.0	H	94.0	-11.7
4499.875000	41.51	---	74.00	32.49	500.0	200.0	H	18.0	-5.7
4512.250000	---	32.42	54.00	21.58	500.0	200.0	H	158.0	-5.7
5414.500000	42.57	---	74.00	31.43	500.0	200.0	H	24.0	-4.3
5414.500000	---	35.99	54.00	18.01	500.0	100.0	H	76.0	-4.3
6316.750000	45.50	---	74.00	28.50	500.0	100.0	H	126.0	-3.9
6317.875000	---	37.54	54.00	16.46	500.0	100.0	H	174.0	-3.9
8122.375000	---	38.84	54.00	15.16	500.0	100.0	V	8.0	-1.6
9687.250000	45.38	---	74.00	28.62	500.0	200.0	H	139.0	-0.8

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

VX4-NWU-B

CH0: 902.46MHz



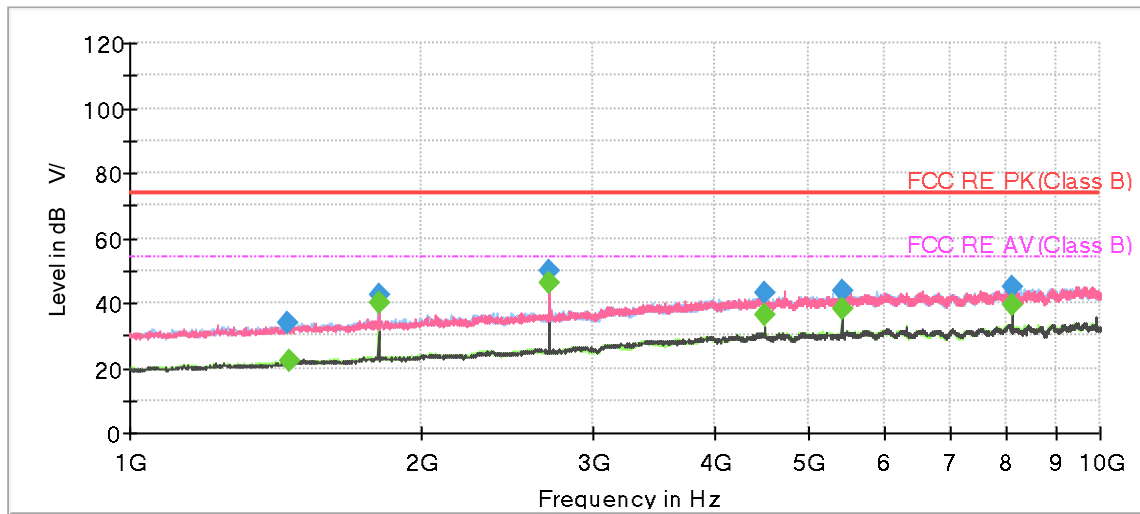
Note: The signal beyond the limit is carrier.

Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
56.710000	18.40	40.00	21.60	175.0	H	202.0	20.3
173.311250	17.89	43.50	25.61	125.0	V	324.0	19.3
321.562500	19.89	46.00	26.11	125.0	V	0.0	21.4
545.108750	24.94	46.00	21.06	225.0	H	274.0	25.9
863.472500	30.89	46.00	15.11	109.0	H	331.0	30.5
941.477500	28.46	46.00	17.54	100.0	H	38.0	30.6

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit – Quasi-Peak



Radiates Emission from 1GHz to 10GHz

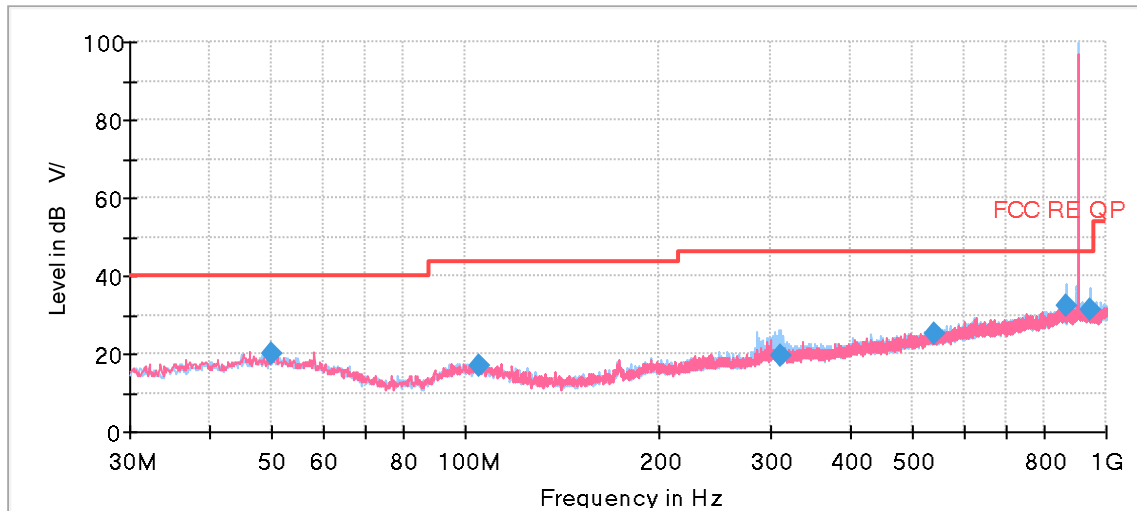
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1455.625000	33.71	---	74.00	40.29	500.0	200.0	V	204.0	-17.1
1461.250000	---	22.24	54.00	31.76	500.0	200.0	H	279.0	-17.0
1804.375000	---	39.86	54.00	14.14	500.0	100.0	H	44.0	-15.3
1804.375000	42.60	---	74.00	31.40	500.0	100.0	H	44.0	-15.3
2706.625000	---	46.30	54.00	7.70	500.0	100.0	H	300.0	-11.7
2707.750000	49.68	---	74.00	24.32	500.0	100.0	H	300.0	-11.7
4512.250000	42.81	---	74.00	31.19	500.0	100.0	H	344.0	-5.7
4512.250000	---	36.33	54.00	17.67	500.0	100.0	H	344.0	-5.7
5414.500000	43.67	---	74.00	30.33	500.0	100.0	H	216.0	-4.3
5414.500000	---	38.01	54.00	15.99	500.0	100.0	H	216.0	-4.3
8122.375000	---	39.14	54.00	14.86	500.0	100.0	V	212.0	-1.6
8122.375000	45.16	---	74.00	28.84	500.0	100.0	V	212.0	-1.6

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

VX4-TVF-B

CH0: 902.46MHz



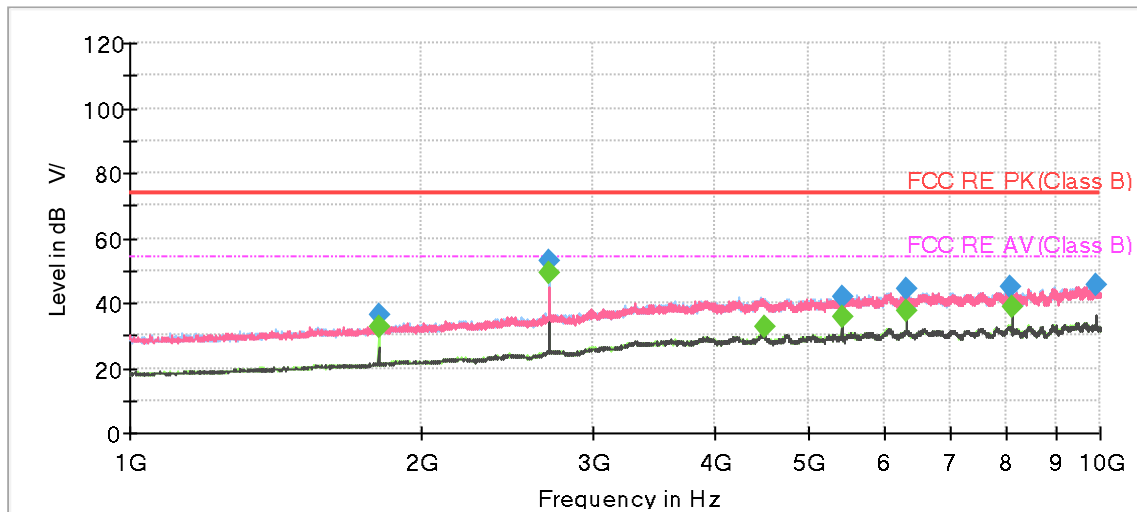
Note: The signal beyond the limit is carrier.

Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
49.891250	19.95	40.00	20.05	109.0	V	36.0	21.0
105.011250	17.13	43.50	26.37	175.0	H	196.0	19.0
309.842500	19.31	46.00	26.69	100.0	H	161.0	21.1
539.977500	25.12	46.00	20.88	125.0	H	307.0	25.9
863.472500	32.29	46.00	13.71	100.0	H	154.0	30.5
941.477500	31.27	46.00	14.73	100.0	H	132.0	30.6

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit – Quasi-Peak



Radiates Emission from 1GHz to 10GHz

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1804.375000	---	32.43	54.00	21.57	500.0	200.0	H	339.0	-15.3
1804.375000	36.55	---	74.00	37.45	500.0	200.0	H	339.0	-15.3
2706.625000	---	49.51	54.00	4.49	500.0	200.0	H	99.0	-11.7
2706.625000	52.75	---	74.00	21.25	500.0	200.0	H	99.0	-11.7
4512.250000	---	32.81	54.00	21.19	500.0	200.0	H	141.0	-5.7
5414.500000	42.00	---	74.00	32.00	500.0	100.0	H	77.0	-4.3
5414.500000	---	35.93	54.00	18.07	500.0	100.0	V	33.0	-4.3
6316.750000	---	37.23	54.00	16.77	500.0	100.0	H	180.0	-3.9
6317.875000	44.55	---	74.00	29.45	500.0	100.0	H	128.0	-3.9
8070.625000	44.75	---	74.00	29.25	500.0	200.0	V	354.0	-1.5
8122.375000	---	38.97	54.00	15.03	500.0	100.0	V	13.0	-1.6
9928.000000	45.30	---	74.00	28.70	500.0	100.0	V	108.0	-0.8

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

5.9 Conducted Emission

Ambient condition

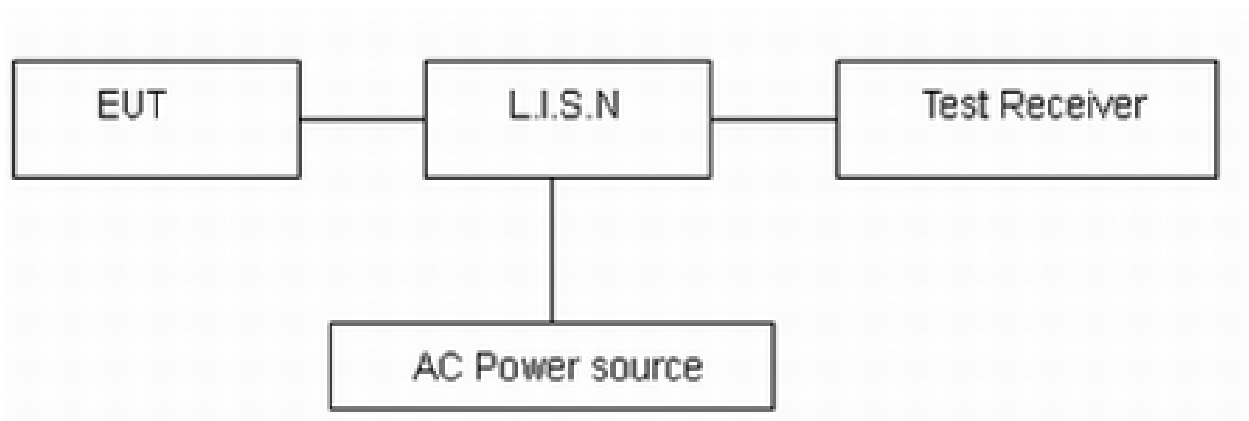
Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.10. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.

The test is in transmitting mode.

Test Setup



Note: AC Power source is used to 120V/60Hz.

Limits

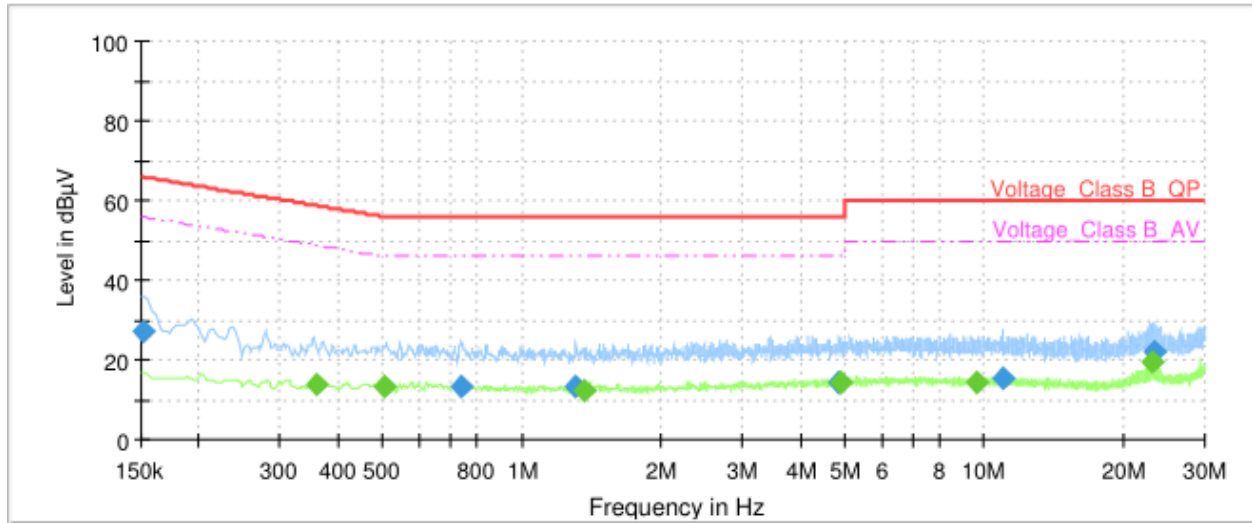
Frequency (MHz)	Conducted Limits(dB μ V)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50
*: Decreases with the logarithm of the frequency.		

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U=2.69$ dB.

Test Results:

Following plots, Blue trace uses the peak detection, Green trace uses the average detection.

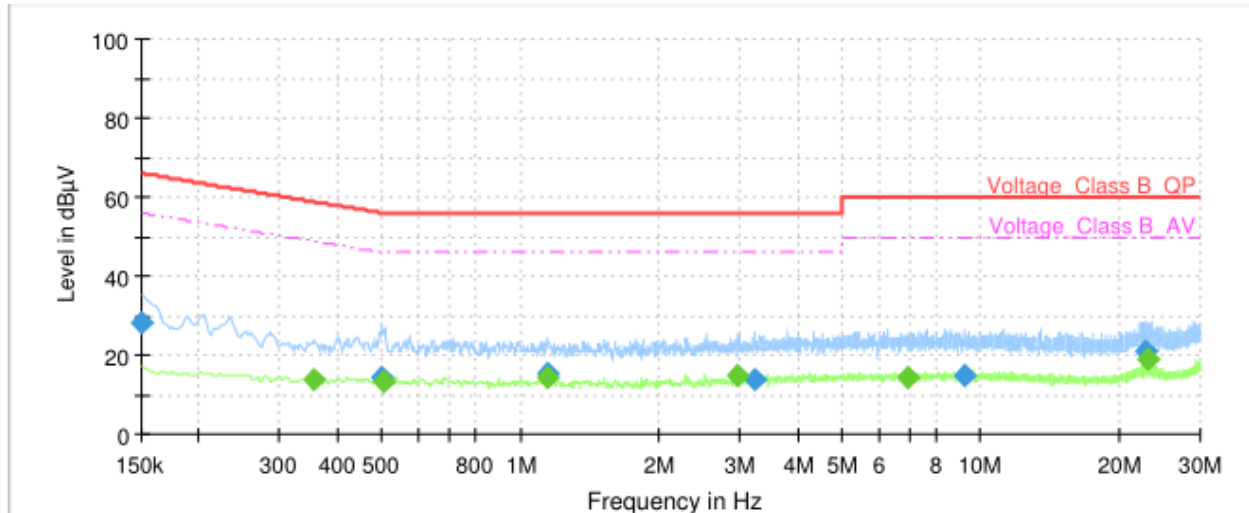


Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.15	27.27	---	65.88	38.61	1000.0	9.000	L1	ON	21.0
0.36	---	13.65	48.75	35.10	1000.0	9.000	L1	ON	21.0
0.51	---	13.40	46.00	32.60	1000.0	9.000	L1	ON	20.9
0.74	13.24	---	56.00	42.76	1000.0	9.000	L1	ON	20.5
1.31	13.21	---	56.00	42.79	1000.0	9.000	L1	ON	20.0
1.36	---	12.51	46.00	33.49	1000.0	9.000	L1	ON	20.0
4.83	14.47	---	56.00	41.53	1000.0	9.000	L1	ON	19.5
4.91	---	14.23	46.00	31.77	1000.0	9.000	L1	ON	19.5
9.64	---	14.50	50.00	35.50	1000.0	9.000	L1	ON	19.6
10.99	15.36	---	60.00	44.64	1000.0	9.000	L1	ON	19.5
23.00	---	19.73	50.00	30.27	1000.0	9.000	L1	ON	19.7
23.31	22.22	---	60.00	37.78	1000.0	9.000	L1	ON	19.7

Remark: Correct factor=cable loss + LISN factor

L line

Conducted Emission from 150 KHz to 30 MHz



Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.15	28.32	---	66.00	37.68	1000.0	9.000	N	ON	21.0
0.36	---	13.78	48.80	35.02	1000.0	9.000	N	ON	21.0
0.50	14.49	---	56.00	41.51	1000.0	9.000	N	ON	20.9
0.51	---	13.56	46.00	32.44	1000.0	9.000	N	ON	20.9
1.14	---	14.23	46.00	31.77	1000.0	9.000	N	ON	20.1
1.14	15.43	---	56.00	40.57	1000.0	9.000	N	ON	20.1
2.98	---	14.91	46.00	31.09	1000.0	9.000	N	ON	19.6
3.23	13.94	---	56.00	42.06	1000.0	9.000	N	ON	19.5
6.91	---	14.55	50.00	35.45	1000.0	9.000	N	ON	19.5
9.21	14.96	---	60.00	45.04	1000.0	9.000	N	ON	19.6
22.92	21.12	---	60.00	38.88	1000.0	9.000	N	ON	19.8
23.04	---	19.17	50.00	30.83	1000.0	9.000	N	ON	19.8

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 KHz to 30 MHz

6 Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Signal Analyzer	KEYSIGHT	N9020A	MY51330870	2023-05-12	2024-05-11
Radiates Emission					
EMI Test Receiver	R&S	ESCI3	100948	2023-05-12	2024-05-11
Signal Analyzer	R&S	FSV40	101298	2023-05-12	2024-05-11
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2023-04-16	2026-04-15
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9163	01111	2022-10-25	2025-10-24
Horn Antenna	SCHWARZBECK	BBHA 9120D	430	2021-07-26	2024-07-25
Amplifier	MWPA.CN	MWLA-010 200G40	YQ2103039B 01	2023-05-12	2024-05-11
Software	R&S	EMC32	9.26.01	/	/
Conducted Emission					
Artificial main network	R&S	ENV216	102191	2022-12-10	2024-12-09
EMI Test Receiver	R&S	ESR	101667	2023-05-12	2024-05-11
Software	R&S	EMC32	10.35.10	/	/

ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.

ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.

***** END OF REPORT *****