FCC/IC RF Test Report

For

Transmitter

Brand Name	:	**VOXX**
Model Number	:	**7147V, 7147VS**
FCC ID	:	**EZS7147V**
IC	:	**1513A-7147V**
Date of Receipt	:	**October 23, 2024**
Date of Report	:	**November 13, 2024**

Prepared for

Voxx Electronics Corporation (FCC)

2365 Pontiac Road, Auburn Hills, Michigan, 48326,United States

Voxx Electronics (IC)

2365 Pontiac Road Auburn Hills MI 48326 USA(excluding The states of Alaska)

Prepared by

Central Research Technology Co.

11, Lane 41, Fushuen St., Jungshan Chiu, Taipei 104, Taiwan

Testing Laboratory
0905

Verification of Compliance

Equipment under Test	: Transmitter
Model No.	: 7147V, 7147VS
FCC ID	: EZS7147V
IC	: 1513A-7147V
Applicant	: FCC: Voxx Electronics Corporation IC: Voxx Electronics
Address	: FCC: 2365 Pontiac Road, Auburn Hills, Michigan, 48326,United States IC: 2365 Pontiac Road Auburn Hills MI 48326 USA(excluding The states of Alaska)
Applicable Standards	: 47 CFR part 15, Subpart C ANSI C63.10:2020 RSS-210 Issue 11 RSS-Gen Issue 5+A2
Date of Testing	: October 25 ~ 29, 2024
Deviation	: The method, configuration and arrangement of the tests are following the requirement of customer and the applicable standards cited above.
Condition of Test Sample	: Mass Production

We, **Central Research Technology Co**., hereby certify that one sample of the designated product was tested in our facility during the period mentioned above. The test records, data evaluation and Equipment Under Test (EUT) configurations shown in the present report are true and accurate representation of the measurements of the sample's RF characteristics under the conditions herein specified.

The test results show that the EUT as described in the present report is in compliance with the requirements set forth in the standards mentioned above and apply to the tested sample identified in the present report only. The test report shall not be reproduced, except in its entirety, without the written approval of Central Research Technology Co.

PREPARED BY : _____ , DATE : November 13, 2024
(Cathy Chen/ Technical Manager)

APPROVED BY : _____ , DATE : November 13, 2024
(Sam Chien /Authorized Signatory)

Contents

Attachment 2 –External Photographs of EUT
Attachment 3 –Internal Photographs of EUT

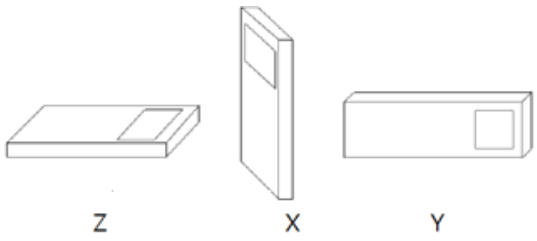
1 General Description

1.1 General Description of EUT

Equipment under Test	:	Transmitter
Model No.	:	7147V, 7147VS
HVIN	:	7147V, 7147VS
Series No.	:	1
Test Power in	:	3Vdc
Channel Numbers	:	1
Frequency Range	:	433.92 MHz
Modular Function	:	ASK

The difference between Model No.: 7147V and Model No. 7147VS is for icon screen different only. They are electronic identical. The Model Number 7147V was selected to perform all tests. It was taken as the representative condition for test and its data are recorded in the present document.

According to the preliminary test for X,Y and Z axis, it was found X axis is worse. It was taken as the representative condition for test and its data are recorded in the present document.



EUT Test step:

1. EUT turn on power.
2. EUT transmit signal.
3. According to pretest, all button RF modulation and signal are the same.Press “lock” button to transmit signal.

1.2 Applied standards

(1) Technical requirements

According to FCC 15.231(a) and RSS-210 A1.2, (a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition (5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

(2) Field strengths

According to FCC 15.231(b) and RSS-210 A.1.3 (a), the field strength of emissions from intentional radiators operated under this section shall not exceed the following: (1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in § 15.35 for averaging pulsed emissions and for limiting peak emissions apply.

Further, compliance with the provisions of § 15.205 shall be demonstrated using the measurement instrumentation specified in that section.(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength.

Fundamental frequency (MHz)	**Field strength of fundamental (microvolts/meter)**	**Field strength of spurious emissions (microvolts/meter)**
40.66-40.70	2,250	225
70-130	1,250	125
130-174	1,250 to 3,750*	125 to 375
174-260**	3,750	375
260-470**	3,750 to 12,500*	375 to 1,250*
Above 470	12,500	1,250

* Linear interpolation with frequency, f, in MHz:

* For 130-174 MHz: Field Strength (μV/m) = (56.81818 x f)-6136.3636

* For 260-470 MHz: Field Strength (μV/m) = (41.6667 x f)-7083.3333

** Frequency bands 225-328.6 MHz and 335.4-399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interference and degradation of their licence-exempt radio equipment in these frequency bands.

(3) Bandwidth of momentary signals

According to FCC 15.231(c) and RSS-210 A1.4, the bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier..

(4) Radiated emission measurements

According to FCC 15.209 and RSS-Gen 8.9, the general requirement of field strength of radiated emissions from intentional radiator at a distance of 3 meters shall not exceed the below table.

Frequency (MHz)	Measurement Distance (m)	Field Strength (uV/m)	Magnetic field strength (μA/m)
0.009-0.490	300	2400/F(kHz)	6.37/F(kHz)
0.490-1.705	30	24000/F(kHz)	63.7/F(kHz)
1.705-30.0	3	30	0.08
Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector. 2. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels using the free space impedance of 377 Ohms, The correction factor is 51.5 dB. For example, the measurement at frequency 9 kHz limit is 2400/9=48.5 dBuV/m, which is equivalent to 48.5 – 51.5 = -3 dBuA/m, which has the same limit to RSS-Gen.			

Frequency (MHz)	Measurement Distance (m)	Field Strength (uV/m)	Field Strength (dBuV/m)
30 – 88	3	100	40.0
88 – 216	3	150	43.5
216 – 960	3	200	46.0
above 960	3	500	54.0

(5) Antenna Requirement

According to FCC 15.203 and RSS-Gen 6.8, 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

(6) Restricted Band

FCC 15.205

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (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			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

RSS-Gen 8.10

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	12.57675 - 12.57725	322 - 335.4	4.5 - 5.15
0.495 - 0.505	13.36 - 13.41	399.9 - 410	5.35 - 5.46
2.1735 - 2.1905	16.42 - 16.423	608 - 614	7.25 - 7.75
3.020 - 3.026	16.69475 - 16.69525	960 - 1427	8.025 - 8.5
4.125 - 4.128	16.80425 - 16.80475	1435 - 1626.5	9.0 - 9.2
4.17725 - 4.17775	25.5 - 25.67	1645.5 - 1646.5	9.3 - 9.5
4.20725 - 4.20775	37.5 - 38.25	1660 - 1710	10.6 - 12.7
5.677 - 5.683	73 - 74.6	1718.8 - 1722.2	13.25 - 13.4
6.215 - 6.218	74.8 - 75.2	2200 - 2300	14.47 - 14.5
6.26775 - 6.26825	108 - 138	2310 - 2390	15.35 - 16.2
6.31175 - 6.31225	149.9 - 150.05	2483.5 - 2500	17.7 - 21.4
8.291 - 8.294	156.52475 - 156.52525	2655 - 2900	22.01 - 23.12
8.362 - 8.366	156.7 - 156.9	3260 - 3267	23.6 - 24.0
8.37625 - 8.38675	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
8.41425 - 8.41475	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.29 - 12.293	240 - 285	3500 - 4400	Above 38.6
12.51975 - 12.52025			

* Certain frequency bands listed in table and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

1.3 Test result

Test Item	FCC/RSS standard section	Report section	Test result
Technical requirements	FCC 15.231(a) RSS-210 A1.2	2	**PASS**
Field strength of the fundamental emissions	FCC 15.231(b) RSS-210 A1.3	3	**PASS**
Radiated emission measurements	FCC 15.209 RSS-Gen 8.10	4	**PASS**
Bandwidth of momentary signals	15.231(c) RSS-210 A1.4	5	**PASS**
AC conducted emission	FCC 15.207(a) RSS-Gen 8.8	N/A	**N/A** **(Battery)**
Antenna requirement	FCC 15.203 RSS-Gen	6	**PASS**

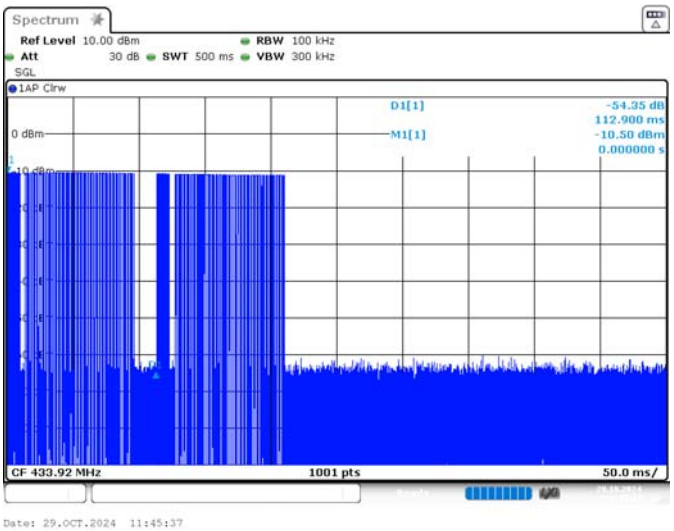
According to ANSI C63.10, determining compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

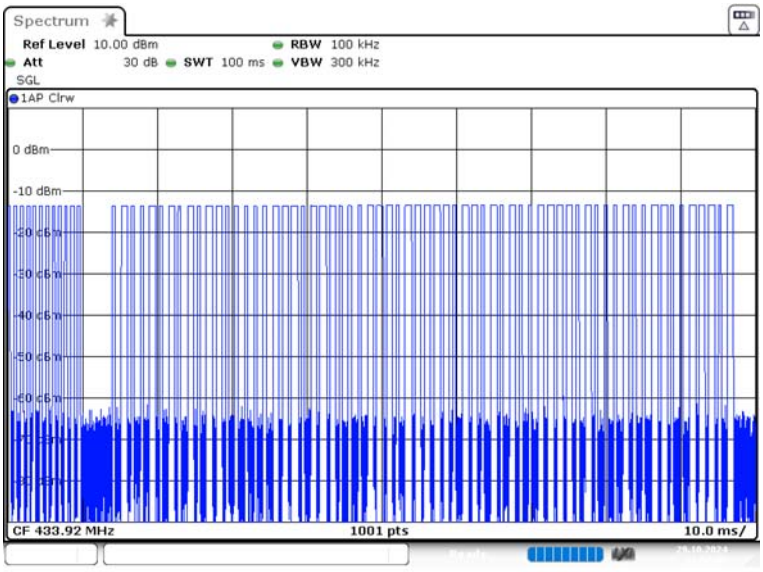
Calculation of average Factor

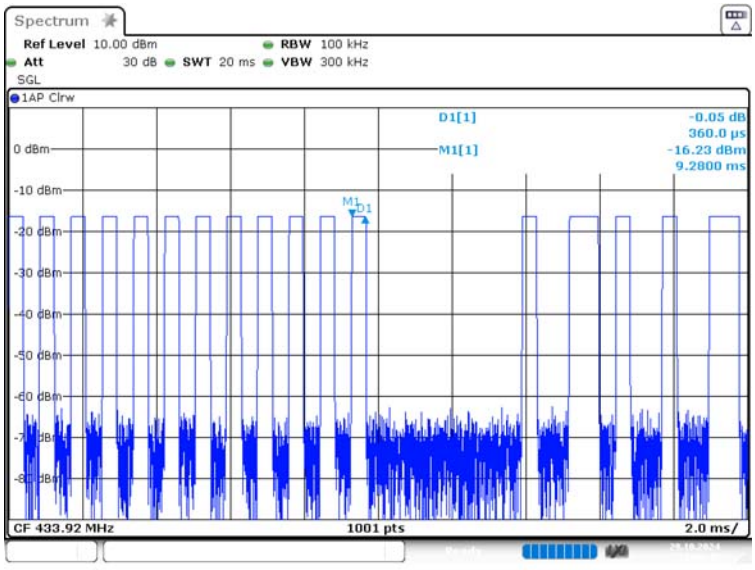
Test Mode : **Normal Mode** **Tester** : Cathy

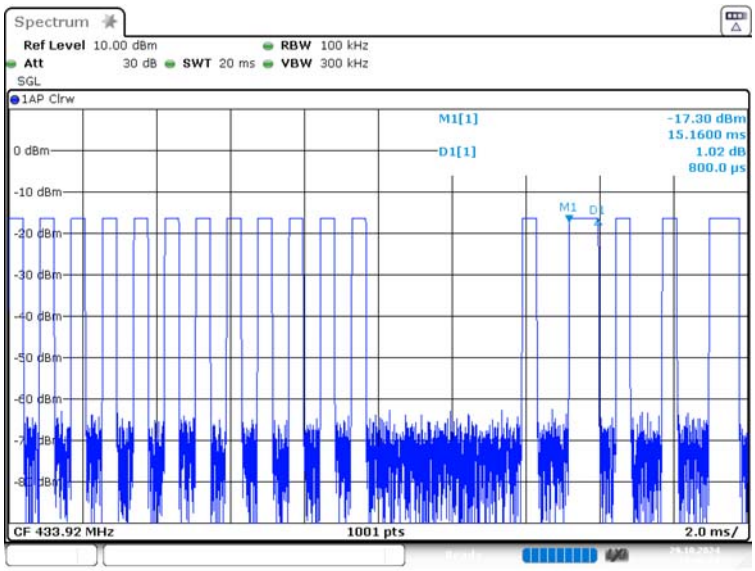
Ambient Temperature : 26℃ **Relative Humidity :** 67%

On time:360(us)*42+800(us)*36=43.92(ms)
Duty cycle= on time/ 100ms = 43.92/100= 0.44
Average factor = 20 log(duty cycle) = -7.13 dB




Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 30 dB SWT 100 ms VBW 300 kHz
SGL
1AP Clrw
0 dBm
-10 dBm
CF 433.92 MHz
1001 pts
10.0 ms/
Date: 29.OCT.2024 11:51:15


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 30 dB SWT 20 ms VBW 300 kHz
SGL
1AP Clrw
D1[1]
-0.05 dB
360.0 µs
M1[1]
-16.23 dBm
9.2800 ms
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 433.92 MHz
1001 pts
2.0 ms/
Date: 29.OCT.2024 11:48:47


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 30 dB SWT 20 ms VBW 300 kHz
SGL
1AP Clrw
M1[1]
-17.30 dBm
15.1600 ms
D1[1]
1.02 dB
800.0 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 433.92 MHz
1001 pts
2.0 ms/
Date: 29.OCT.2024 11:48:28

1.4 The Support Units

No.	Unit	Model No.	Trade Name	Power Code	Supported by lab.
N/A	-	-	-	-	-

Connecting Cables :

No.	Cable	Length	Shielded	Core	Shielded Backshell	Supported by lab.	Note
N/A	-	-	-	-	-	-	-

1.5 Layout of Setup

EUT

1.6 Test Instruments

Conducted Test

Test Site and Equipment	Manufacturer	Model No. /Serial No.	Last Calibration Date	Calibration Due Date
Spectrum Alayzer	R&S	FSV40/ 101609	2024/10/17	2025/10/16
Test room	N/A	TR13	NCR	NCR

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR:No Calibration Required.

Radiated Emission Test (Below 1GHz)

Test Site and Equipment	Manufacturer	Model No. /Serial No.	Last Calibration Date	Calibration Due Date
EMI Receiver	R&S	ESCS30/ 836858/020	2023/11/6	2024/11/5
Spectrum Alayzer	Agilent	E4407B/ MY45106795	2024/6/28	2025/6/27
Antenna	EMCO	6502/ 00020558	2024/9/9	2025/9/8
Antenna	SCHWARZBECK & Mini-Circuits	VULB 9168 & BW-N5W5+/ VULB 9168-668 & 003	2024/6/11	2025/6/10
Pre-amplifer	Mini-circuit	ZKL-1R5+/ 004	2024/6/3	2024/12/2
RF cable	JYEBAO	0214/ C0080-4 + C0080-1 + C0080-2+RSU(CRC-011/11)+C0080-3	2024/6/3	2025/6/2
Filter	Mini-Circuits	NHP-800/001	2024/9/23	2025/9/23
Test software	Audix	e3/ V6.20110303a2	NCR	NCR
Semi-anechoic chamber	ETS. LINDGREN	TR11/ 906-A	2024/5/27	2025/5/26

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR : No Calibration Required.
3. The calibration date of the semi-anechoic chamber listed above is the date of NSA measurement.

Radiated Emission Test (Above 1 GHz)

Test Site and Equipment	Manufacturer	Model No. /Serial No.	Last Calibration Date	Calibration Due Date
Antenna	EMCO	3117/ 0082847	2023/11/27	2024/11/26
Pre-amplifer	MITEQ	TTA1800-30-HG-N-M/ 1904295	2024/5/3	2025/5/2
RFcable	Suhner	Sucoflex 106P / C0091	2024/9/30	2025/9/29
RFcable	JMCA	MWX241/B/ C0103~C0104	2024/4/15	2025/4/14
MXA singal analyzer	KeySight	N9020A/ MY54420147	2024/7/9	2025/7/8
Test software	Audix	e3/ V9 20150907c	NCR	NCR
Semi-anechoic chamber	ETS. LINDGREN	TR1/ 17627-B	2023/12/9	2024/12/8

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR : No Calibration Required.
3. The calibration date of the chamber TR1 listed above is the date of site VSWR measurement.

1.7 Test Capability

Test Facility

The test facility used for evaluating the conformance of the EUT with each standard in the present report meets what required in CISPR16 series and ANSI C63.4:2014 amended as per ANSI 63.4a:2017.

Test Room	Type of Test Room	Descriptions
TR1	3m fully-anechoic chamber	For the radiated emission measurement (above 1GHz)
TR11	3m semi-anechoic chamber	For the radiated emission measurement (below 1GHz)
TR13	Test Site	For the RF conducted emission measurement.
TR5	Shielding Room	For the conducted emission measurement.
TR20	Shielding Room	

Test Laboratory Competence Information

Central Research Technology Co. has been accredited / filed / authorized by the agencies listed in the following table.

Certificate	Nation	Agency	Code	Mark
Accreditation Certificate	USA	NVLAP	200575-0	ISO/IEC 17025
	USA	FCC	TW1104, TW0019	ISO/IEC 17025
	R.O.C. (Taiwan)	TAF	0905	ISO/IEC 17025
	R.O.C. (Taiwan)	BSMI	SL2-IN-E-0033, SL2-IS-E-0033, SL2-R1/R2-E-0033, SL2-A1-E-0033, SL2-L1-E-0033	ISO/IEC 17025
	Canada	ISED	TW0905	ISO/IEC 17025
Site Filing Document	Japan	VCCI	R-11527,C-11609,T-11441, G-10010,C-20010, G-10614, T-20009	Test facility list & NSA Data
Authorization Certificate	Germany	TUV	UA 50235497	ISO/IEC 17025

The copy of each certificate can be downloaded from our web site: www.crc-lab.com

1.8 Measurement Uncertainty

The assessed measurement uncertainty with a suitable coverage factor K to ensure 95% confidence level for the normal distribution are shown as below, the values are less than U_{cispr} in table 1 of CISPR 16-4-2.

Test Item	Measurement Uncertainty	
Occupied Channel Bandwidth	0.6 %	
RF output power, conducted	0.1 dB	
Radiated Emission: (9kHz~30MHz)	Horizontal 3.12dB；Vertical 3.14dB	
Radiated Emission: (30MHz~1000MHz)	Horizontal 4.60dB；Vertical 6.12dB	
Radiated Emission: (1GHz~6GHz)	Horizontal 4.70dB；Vertical 4.56dB	
Line Conducted Emission	NSLK-8128-RC	2.92 dB
	ENV 4200	2.92 dB
	ESH2-Z5	2.94 dB

2 Technical requirements

Result: Pass

2.1 Applied standard

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released

2.2 Measurement Procedure

a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. Setting Spectrum Analzyer and measurement.

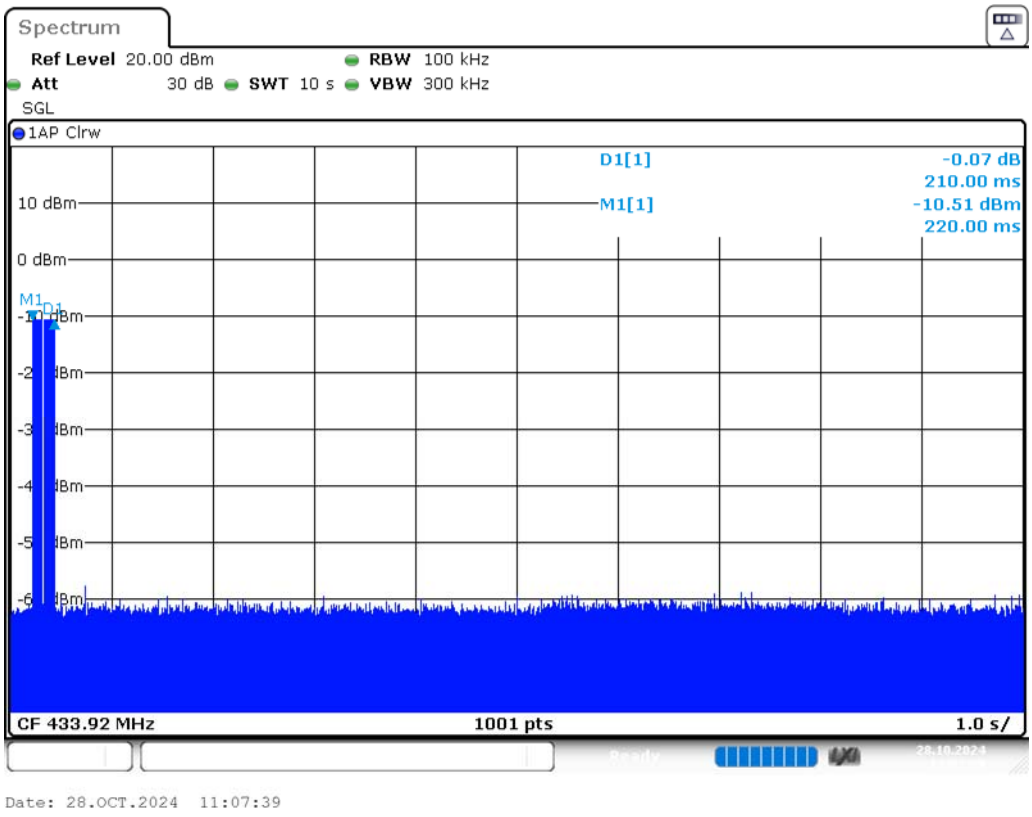
c. Measure the released time and compare with the required limit.

2.3 Test configuration

2.4 Test Data

Test Mode **: Normal Mode** **Tester** **:** Cathy
Ambient Temperature : 26℃ **Relative Humidity :** 67%
Atmospheric pressure : 1015 pa

After a transmitter being released, the transmitter cease transmission within 210 ms < 5 s.



3 Field strength of the fundamental emissions

Result: Pass

3.1 Applied standard

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	1,250 to 3,750*	125 to 375
174-260**	3,750	375
260-470**	3,750 to 12,500*	375 to 1,250*
Above 470	12,500	1,250

* Linear interpolation with frequency, f, in MHz:

* For 130-174 MHz: Field Strength (μV/m) = (56.81818 x f)-6136.3636

* For 260-470 MHz: Field Strength (μV/m) = (41.6667 x f)-7083.3333

** Frequency bands 225-328.6 MHz and 335.4-399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interference and degradation of their licence-exempt radio equipment in these frequency bands.

3.2 Measurement Procedure

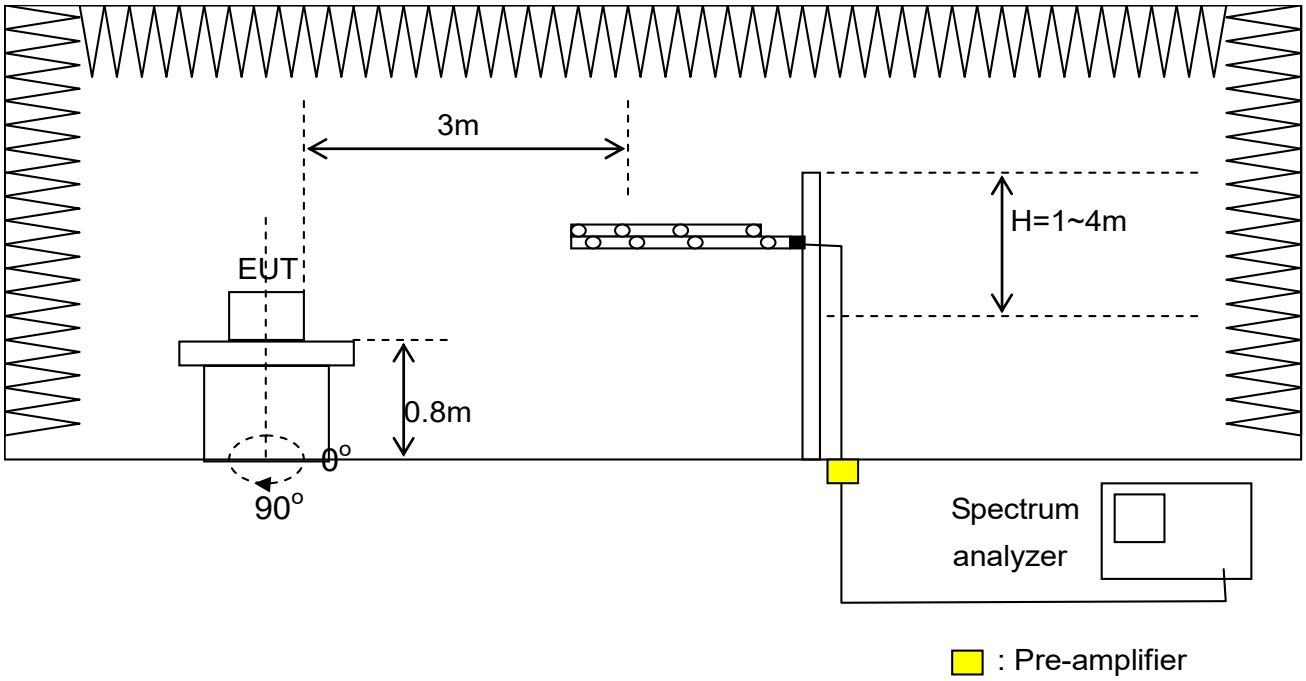
a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. Setting Spectrum Analzyer and measurement.

c. Spectrum Analyzer setting: RBW=120 kHz.

d. Measurement the Field strength of the fundamental emissions and compare with the required limit.

3.3 Test configuration

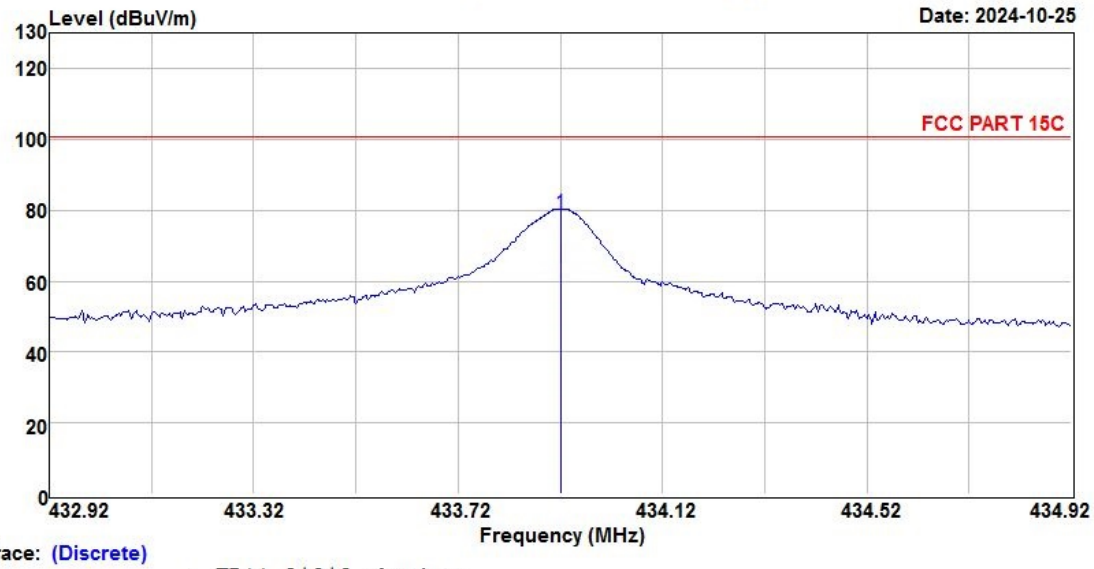


3.4 Test Data

Test Mode **: Continuous Transmitting**

Polarization **:** Horizontal **Tester** **:** Volvo

Ambient Temperature : 22℃ **Relative Humidity :** 53%



Trace: (Discrete)

Site : TR11 9*6*6 chamber
Condition : FCC PART 15C 3m VULB_9168-668 HORIZONTAL
Power :
Operator : Volvo T22 H53 P1013

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	433.922	80.26	96.59	-16.33	100.80	-20.54	122	148	HORIZONTAL	Peak

Peak Level (dBuV/m)	Average Factor (dB)	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
80.26	-7.13	73.13	80.8	7.67

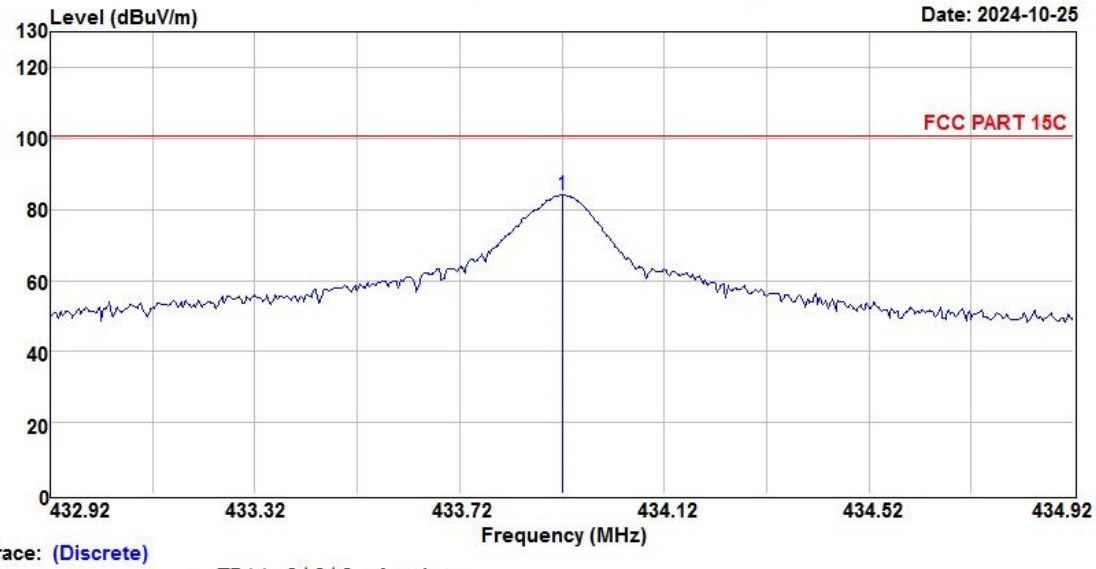
Note:

1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. Average factor calculation result refer to P11.
5. Average level =Peak Level + Average Factor

Test Mode : **Continuous Transmitting**

Polarization : Vertical **Tester** : Volvo

Ambient Temperature : 22℃ **Relative Humidity** : 53%



Trace: (Discrete)

Site : TR11 9*6*6 chamber
Condition : FCC PART 15C 3m VULB_9168-668 VERTICAL
Power :
Operator : Volvo T22 H53 P1013

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	433.922	83.94	100.27	-16.33	100.80	-16.86	135	267	VERTICAL	Peak

Peak Level (dBuV/m)	Average Factor (dB)	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
83.94	-7.13	76.81	80.8	3.99

Note:

1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. Average factor calculation result refer to P11.
5. Average level =Peak Level + Average Factor

4 Radiated Emission

Result: Pass

4.1 Applied standard

Radiated emissions shall comply with the field strength limits shown as below table.

Frequency (MHz)	Measurement Distance (m)	Field Strength (uV/m)	Magnetic field strength (μA/m)
0.009-0.490	300	2400/F(kHz)	6.37/F(kHz)
0.490-1.705	30	24000/F(kHz)	63.7/F(kHz)
1.705-30.0	3	30	0.08

Note

1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

2. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels using the free space impedance of 377 Ohms, The correction factor is 51.5 dB. For example, the measurement at frequency 9 kHz limit is 2400/9=48.5 dBuV/m, which is equivalent to 48.5 – 51.5 = -3 dBuA/m, which has the same limit to RSS-Gen.

Frequency (MHz)	Measurement Distance (m)	Field Strength (uV/m)	Field Strength (dBuV/m)
30 – 88	3	100	40.0
88 – 216	3	150	43.5
216 – 960	3	200	46.0
above 960	3	500	54.0

4.2 Measurement Procedure

a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. A software provided by client enabled the EUT to transmit and receive data at operating frequency.(if necessary)

c. If the EUT is tabletop equipment, it should be placed on a wooden table with a height of 0.8 meters above the reference ground plane in the semi-anechoic chamber. If the EUT is floor-standing equipment, it should be placed on a non-conducted support with a height of 12 millimeters above the reference ground plane in the semi-anechoic chamber.

d. The EUT is set 3m away from the interference receiving antenna.

e. Rapidly sweep the signal in the test frequency range by using the spectrum through the Maximum-peak detector.

f. Rotate the EUT from 0° to 360° and position the receiving antenna at heights from 1 to 4 meters above the reference ground plane continuously to determine at least six frequencies associated with higher emission levels and record them.

g. Then measure each frequency found from step f. by using the spectrum with rotating the EUT and positioning the receiving antenna height to determine the maximum level.

h. For measurement of frequency below 1000MHz, set the receiver detector to be Quasi-Peak per CISPR 16-1 to find out the maximum level occurred. Receiver Setting is 9 kHz – 150kHz: RBW=200 Hz, 150kHz – 30 MHz: RBW=9 kHz, 30 MHz- 1 GHz: RBW=120 kHz.

i. For measurement of frequency above 1000MHz, set the spectrum detector to be Peak or Average to find out the maximum level occurred, if any. Spectrum Alayzer Setting is Peak:RBW=1 MHz, VBW=3 MHz; Average: RBW=1 MHz, VBW=3 kHz.

j. Record frequency, azimuth angle of the turntable, height, and polarization of the receiving antenna and compare the maximum level with the required limit.

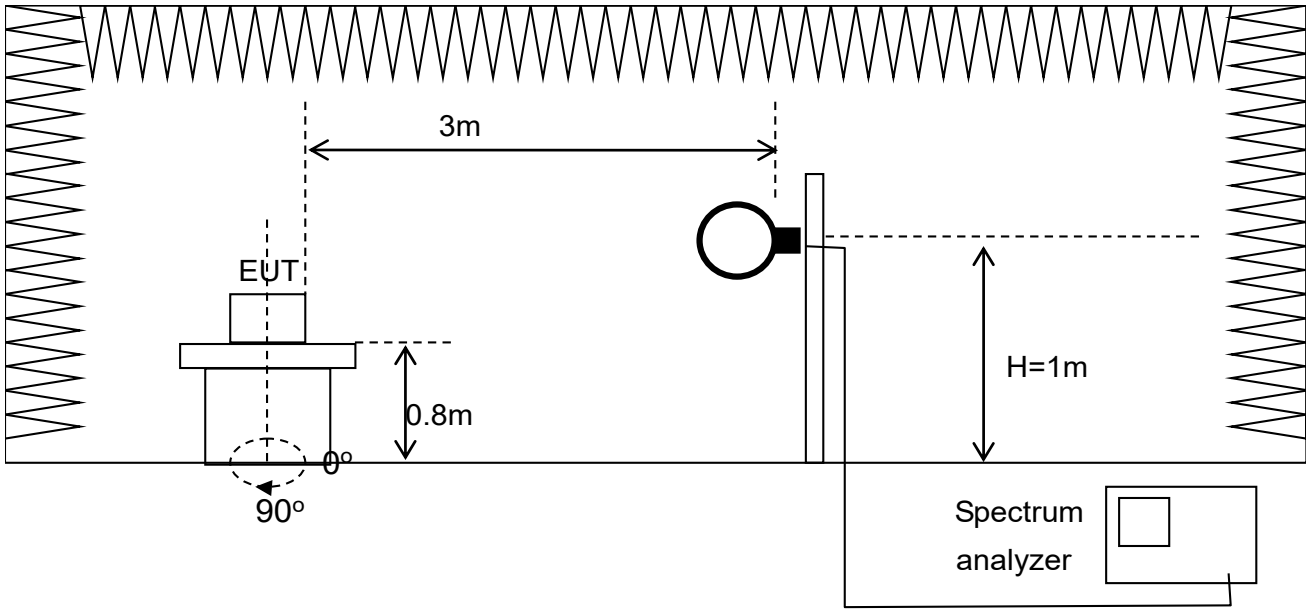
k. Change the receiving antenna to another polarization to measure radiated emission by following step e. to j. again.

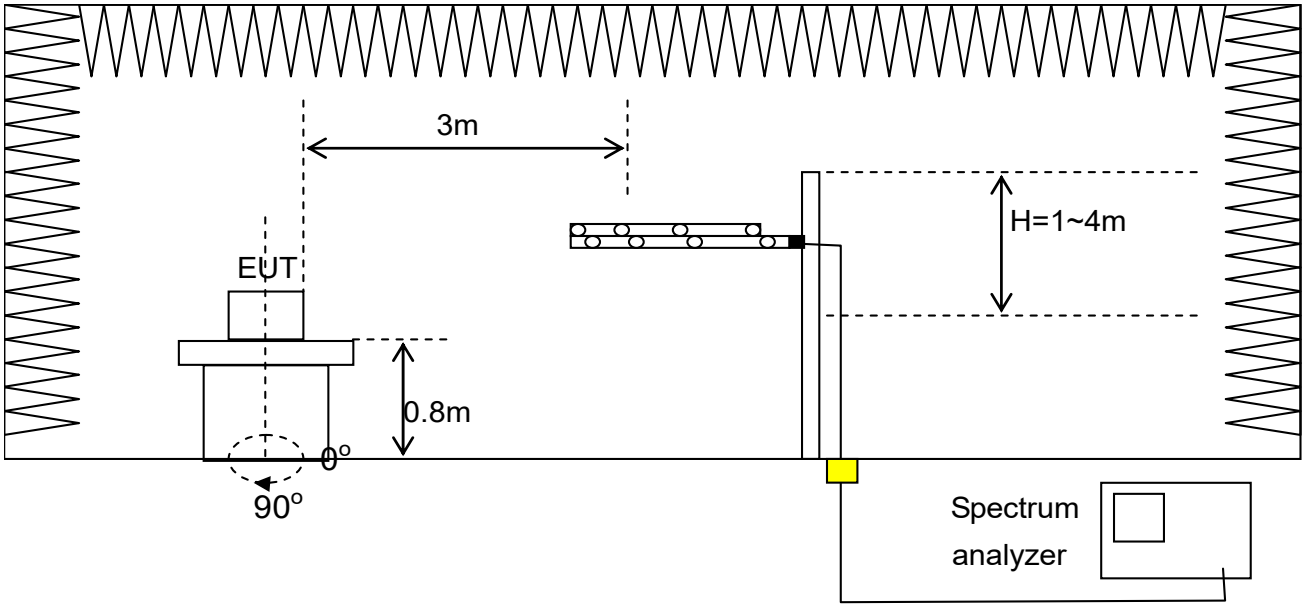
l. If the peak emission level below 1000MHz measured from step f. is 4dB lower than the limit specified, then the emission values presented will be the peak value only. Otherwise, accurate Q.P. value will be measured and presented.

m. If the peak emission level above 1000MHz measured from step f. is 20dB lower than the limit specified, then the emission values presented will be the peak value only. Otherwise, accurate A.V. value will be measured and presented.

4.3 Test configuration

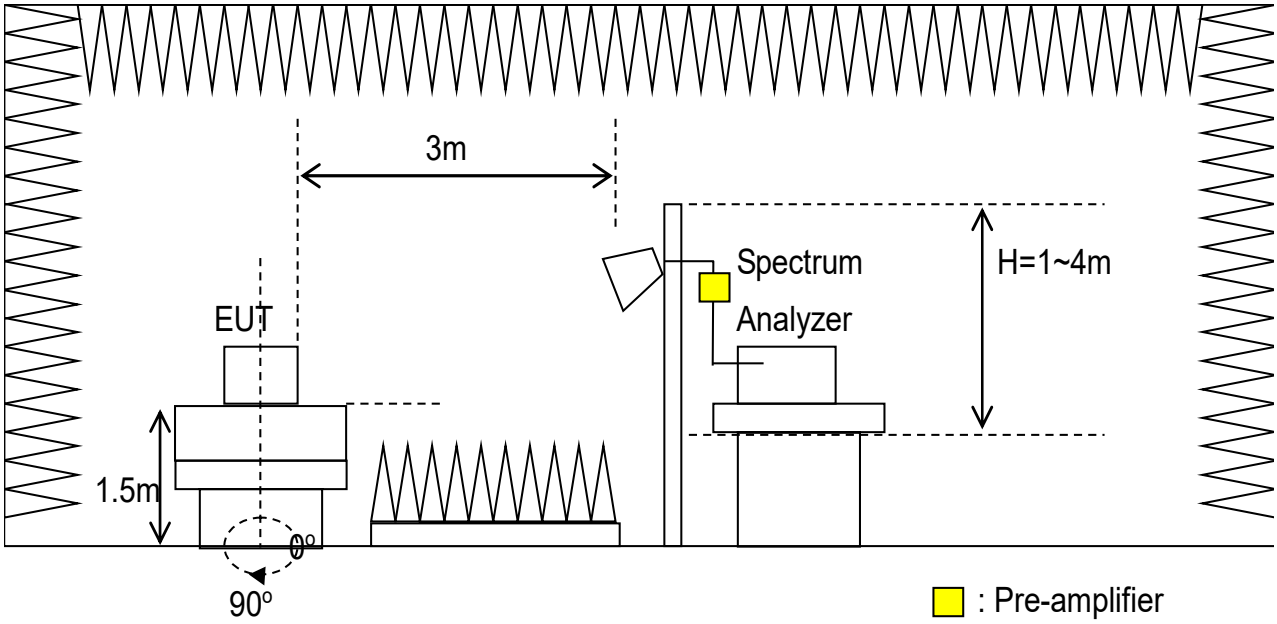
Below 1GHz





: Pre-amplifier

Above 1GHz



4.4 Test Data

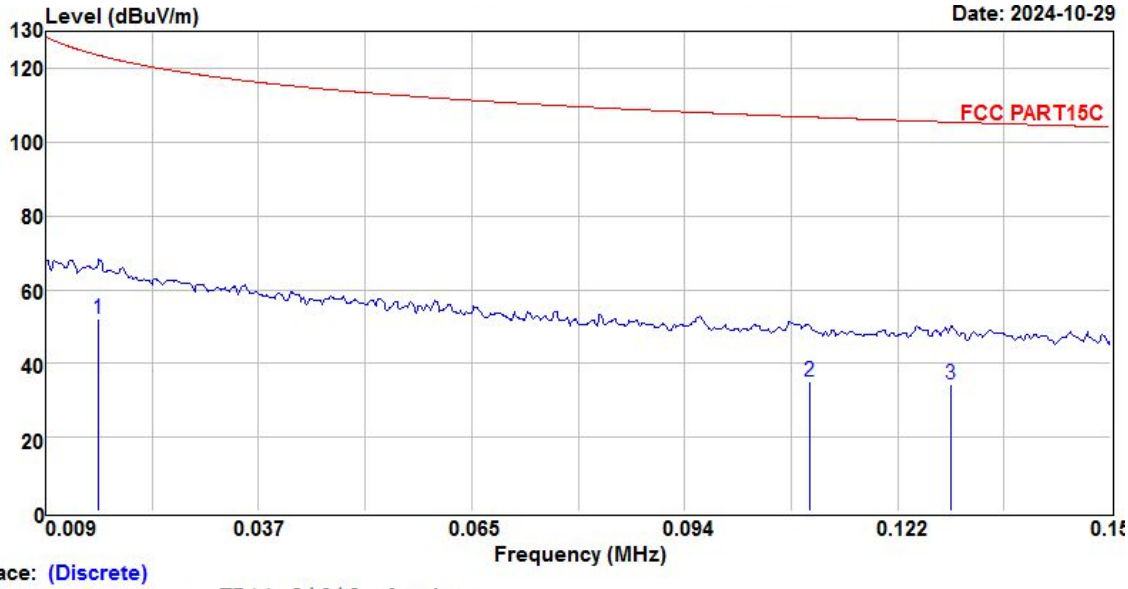
Radiated Emission Measurement below 1000MHz

Test Mode : **Continuous Transmitting**

Test Range : 9 kHz ~ 150 kHz

Polarization : Parallel **Tester** : Wilson

Ambient Temperature : 22℃ **Relative Humidity** : 53%



Trace: (Discrete)

Site : TR11 9*6*6 chamber
Condition : FCC PART15C 3m EMC06502LOOP
Power :
Operator : Wilson T22 H53 P1014

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	0.016	52.26	36.52	15.74	123.50	-71.24	100	163		Average
2	0.110	35.24	23.89	11.35	106.76	-71.52	100	249		Average
3	0.129	34.38	22.95	11.43	105.40	-71.02	100	294		Average

Note:

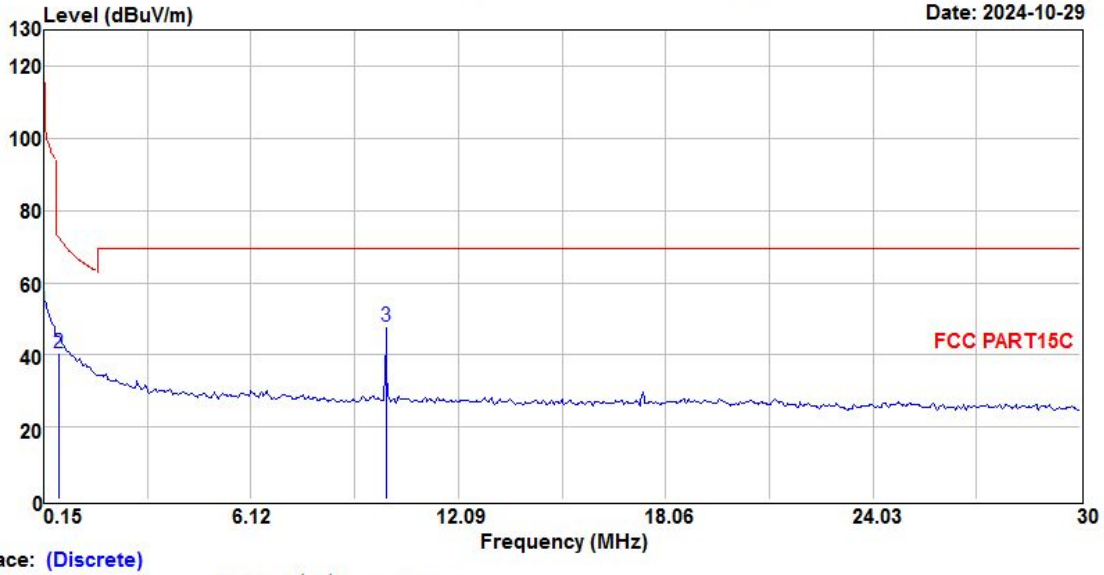
1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. QK. is abbreviation of Quasi-Peak
5. The receive antenna is setup at parallel, ground-parallel and perpendicular. The report just record the worst data of antenna orientation.

Test Mode **: Continuous Transmitting**

Test Range **:** 150 kHz ~30 MHz

Polarization **:** Parallel **Tester** **:** Wilson

Ambient Temperature : 22℃ **Relative Humidity** **:** 53%



Trace: (Discrete)

Site : TR11 9*6*6 chamber
Condition : FCC PART15C 3m EMC06502LOOP
Power :
Operator : Wilson T22 H53 P1014

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	0.150	52.08	40.57	11.51	104.08	-52.00	100	183		Average
2	0.598	40.40	28.97	11.43	72.08	-31.68	100	104		QP
3	10.001	47.77	35.90	11.87	69.50	-21.73	100	179		QP

Note:

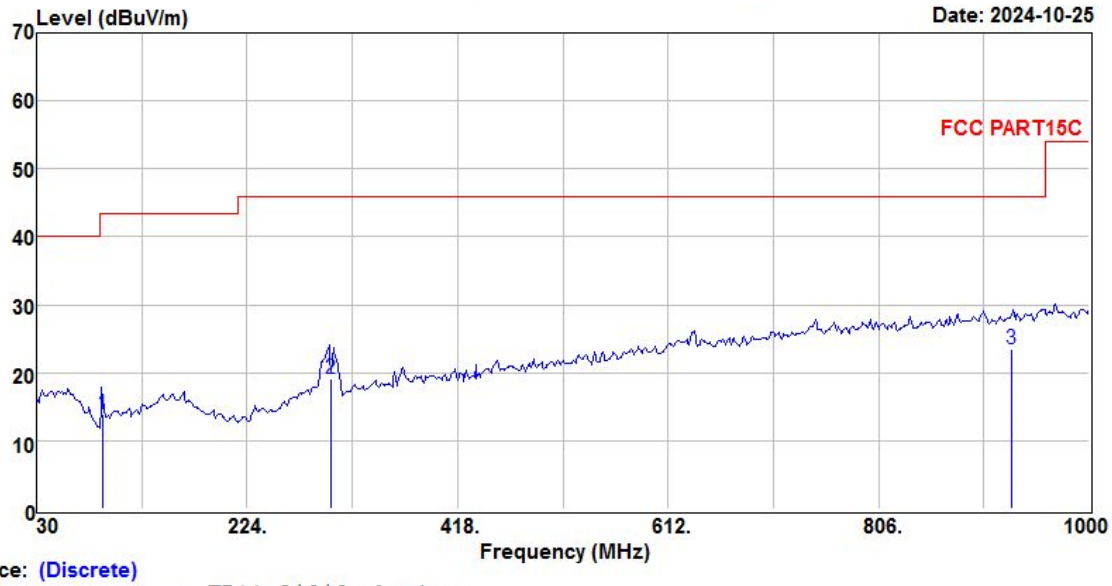
1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. QK. is abbreviation of Quasi-Peak
5. The receive antenna is setup at parallel, ground-parallel and perpendicular. The report just record the worst data of antenna orientation.

Test Mode : **Continuous Transmitting**

Test Range : 30 MHz ~1 GHz

Polarization : Horizontal **Tester** : Volvo

Ambient Temperature : 22℃ **Relative Humidity** : 53%



Trace: (Discrete)

Site : TR11 9*6*6 chamber
Condition : FCC PART15C 3m VULB_9168-668 HORIZONTAL
Power :
Operator : Volvo T22 H53 P1013

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	90.830	13.87	40.87	-27.00	43.50	-29.63	118	253	HORIZONTAL	QP
2	301.260	19.16	39.17	-20.01	46.00	-26.84	165	331	HORIZONTAL	QP
3	928.290	23.40	31.66	-8.26	46.00	-22.60	112	215	HORIZONTAL	QP

Note:

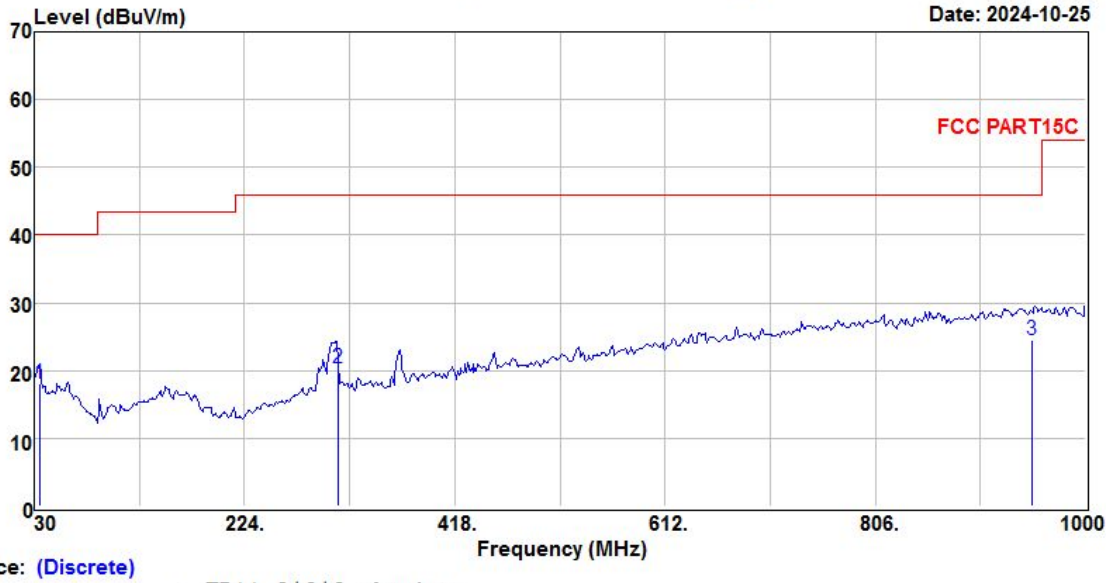
1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. QP = Quasi-Peak

Test Mode **: Continuous Transmitting**

Test Range **:** 30 MHz ~1GHz

Polarization **:** Vertical **Tester** **:** Volvo

Ambient Temperature : 22℃ **Relative Humidity** **:** 53%



Trace: (Discrete)

Site : TR11 9*6*6 chamber
Condition : FCC PART15C 3m VULB_9168-668 VERTICAL
Power :
Operator : Volvo T22 H53 P1013

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	34.832	18.08	40.47	-22.39	40.00	-21.92	100	108	VERTICAL	QP
2	310.090	20.38	40.08	-19.70	46.00	-25.62	100	226	VERTICAL	QP
3	950.040	24.58	32.70	-8.12	46.00	-21.42	100	52	VERTICAL	QP

Note:

1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. QP = Quasi-Peak

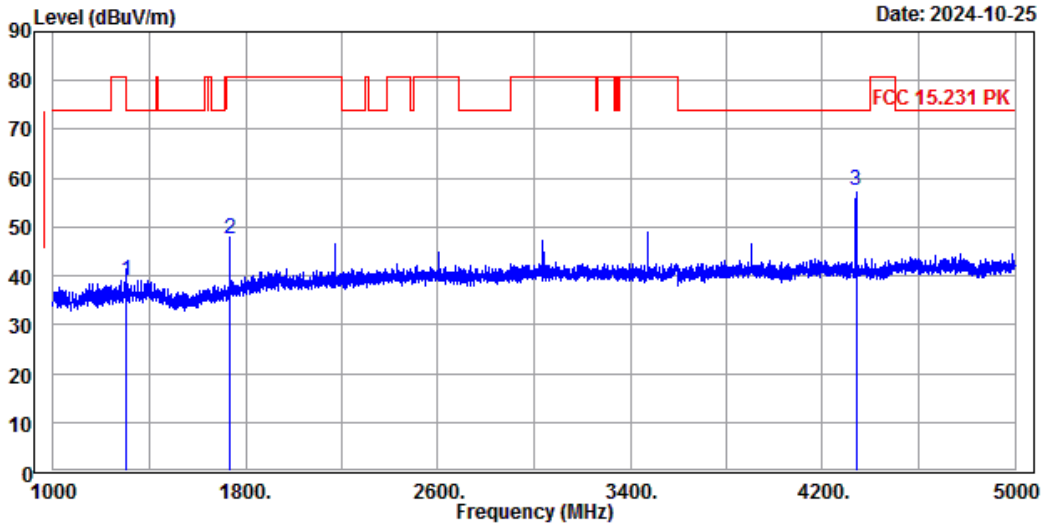
Radiated Emission Measurement above 1000MHz

Test Mode : **Continuous Transmitting**

Test Range : 1 GHz ~ 5 GHz

Polarization : Horizontal **Tester** : Carl

Ambient Temperature : 22℃ **Relative Humidity** : 54%



Condition : FCC 15.231 PK 3m EMCO_3117_82847 HORIZONTAL
POWER : DC3V
OPERATOR : carl,T:22,H:54,P:1007

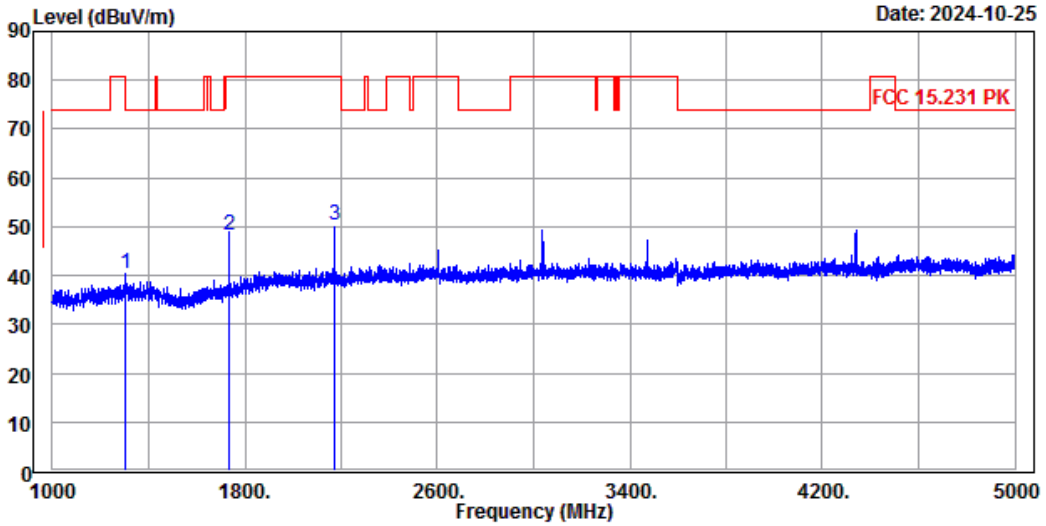
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	1301.320	39.00	58.07	-19.07	74.00	-35.00	178	246	HORIZONTAL	Peak
2	1735.250	47.51	66.16	-18.65	80.80	-33.29	189	258	HORIZONTAL	Peak
3	4339.270	57.42	71.95	-14.53	74.00	-16.58	227	154	HORIZONTAL	Peak

Frequency (MHz)	Peak Level (dBuV/m)	Average Factor (dB)	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4339.27	57.42	-7.13	50.29	54.0	3.71

Note:

1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. Average limit = Peak limit- 20.If the peak level meets average limit, average value doesn't need be recorded.
5. Average factor calculation result refer to P11.
6. Average level =Peak Level + Average Factor

Test Mode	**: Continuous Transmitting**		
Test Range	**:** 1 GHz ~ 5 GHz		
Polarization	**:** Vertical	**Tester**	**:** Carl
Ambient Temperature : 22℃		**Relative Humidity**	**:** 54%



Condition : FCC 15.231 PK 3m EMCO_3117_82847 VERTICAL
POWER : DC3V
OPERATOR : carl,T:22,H:54,P:1007

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	1302.520	40.31	59.40	-19.09	74.00	-33.69	169	101	VERTICAL	Peak
2	1735.840	48.13	66.77	-18.64	80.80	-32.67	194	351	VERTICAL	Peak
3	2170.270	50.21	66.50	-16.29	80.80	-30.59	160	43	VERTICAL	Peak

Note:

1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. Average limit = Peak limit- 20.If the peak level meets average limit, average value doesn't need be recorded.

5 Bandwidth of momentary signals

Result: Pass

5.1 Applied Standard

The occupied bandwidth of momentarily operated devices shall be less than or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the occupied bandwidth shall be less than or equal to 0.5% of the centre frequency.

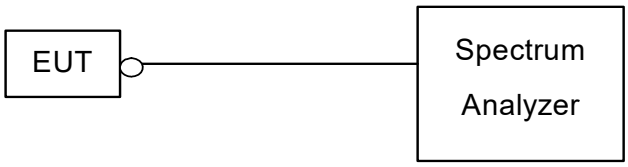
5.2 Measurement Procedure

a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual

b. Setting Spectrum Analzyer and measurement.

c. Record the 20 dB bandwidth for FCC , 99% bandwidth for RSS, and compare with the required limit.

5.3 Test Configuration



5.4 Test Data

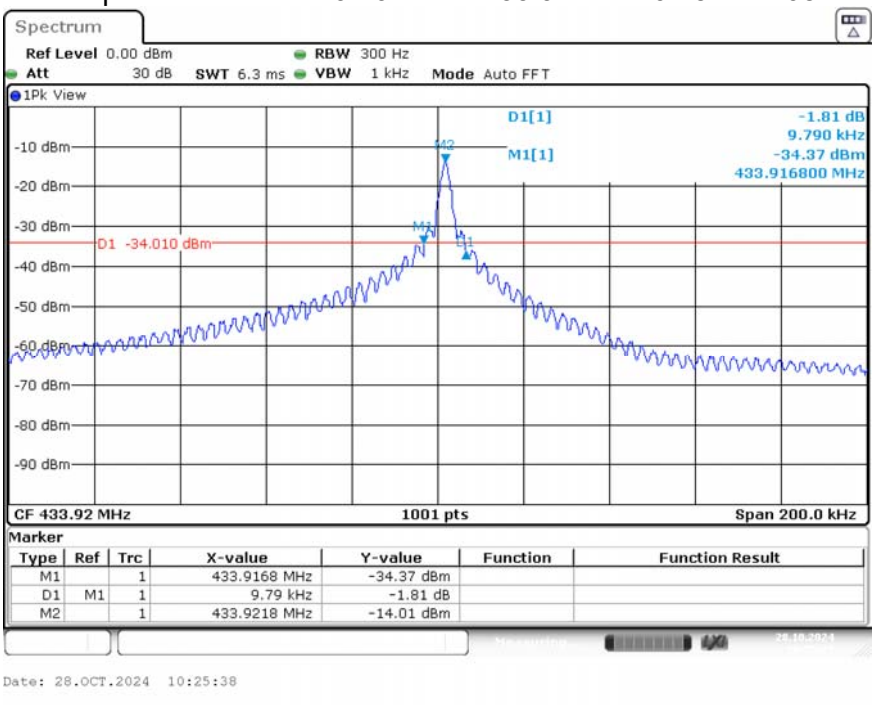
Test Model **: Continuous Transmitting**

Tester **:** Cathy

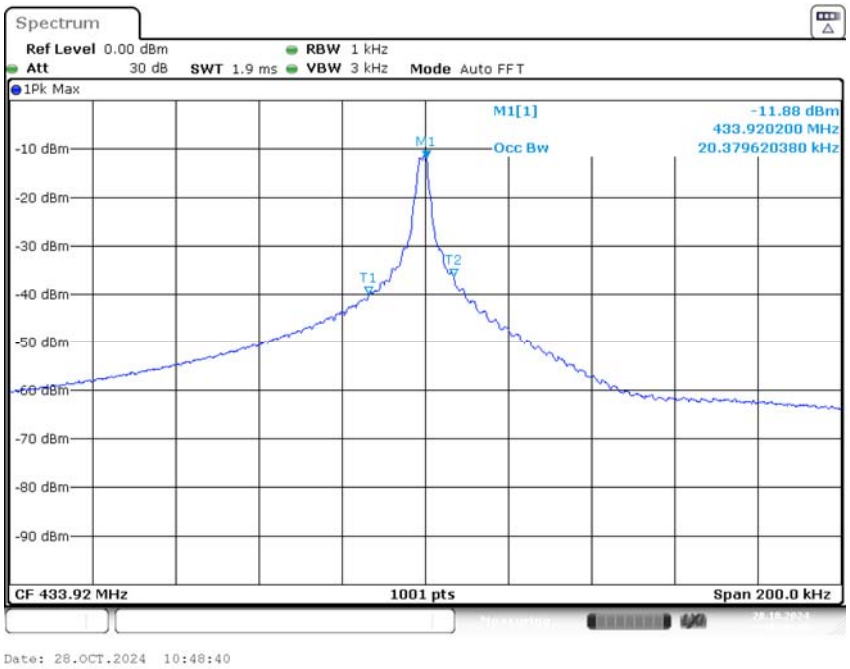
Ambient Temperature : 26℃ **Relative Humidity :** 67%

Atmospheric pressure : 1015 pa

20 dB occupied bandwidth = 9.79 kHz < 433.92MHz* 0.25%= 1.08 MHz



99% occupied bandwidth = 20.38kHz < 433.92 MHz* 0.25%= 1.08 MHz



6 Antenna Requirement

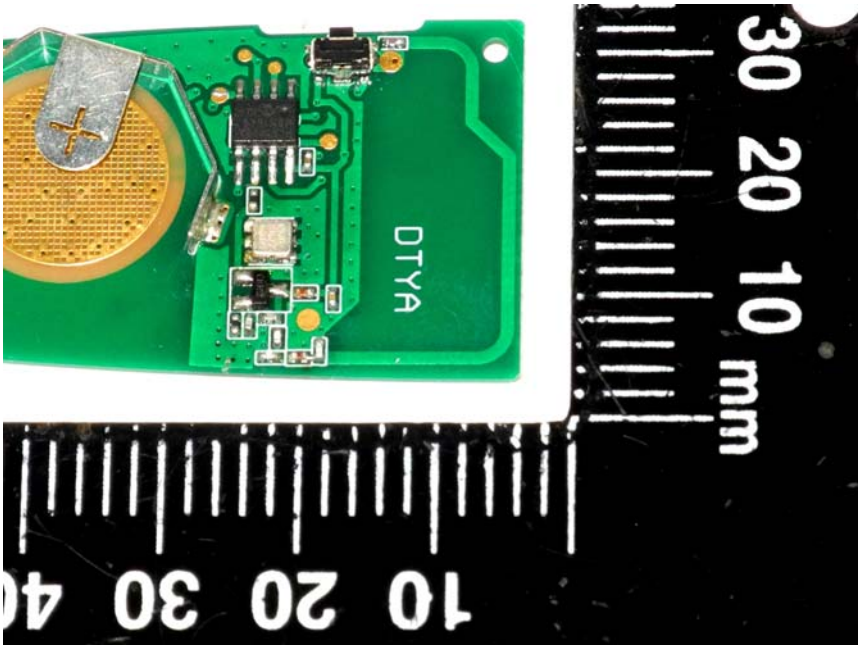
Result: Pass

6.1 Applied Standard

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

6.2 Atenna type

This is permanently attached antenna.



~ End of Report ~