

**CFR 47 FCC PART 15 SUBPART C  
ISED RSS-210 ISSUE 10**

**CERTIFICATION TEST REPORT**

*For*

**NACS DC**

**MODEL NUMBER: HVCON1MA200APL0000U1, HVCON1MA200ANL0000U1,  
HVCON1MA250APL0000U1, HVCON1MA250ANL0000U1,  
HVCON1MA380APL0000U1, HVCON1MA380ANL0000U1,  
HVCON2MA600APL0000U1, HVCON2MA600ANL0000U1,  
HVCON1MA80ANL0000U1, HVCON1MA80APL0000U1, HVCON1MA50ANL0000U1,  
HVCON1MA50APL0000U1, HVCON1MA40ANL0000U1, HVCON1MA40APL0000U1**

**FCC ID: 2BD3RNACSUHF434**

**IC: 31765-NACSUHF434**

**REPORT NUMBER: 47901071525-1-RF-1**

**ISSUE DATE: March 22, 2024**

*Prepared for*

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V0	3/22/2024	Initial Issue	

Summary of Test Results			
Clause	Test Items	FCC Rules	Test Results
1	Transmitter Timeout	CFR 47 FCC §15.231 (a) (1) ISED RSS-210 Annex A.1.1	Pass
2	20 dB Bandwidth and 99 % Occupied Bandwidth	CFR 47 FCC §15.231 (c) ISED RSS-210 Annex A.1.3	Pass
3	Radiated Emission	CFR 47 FCC §15.231 (b)(e) CFR 47 FCC §15.205 and §15.209 RSS-210 Annex A.1.2 RSS-GEN Clause 8.9 RSS-GEN Clause 8.10	Pass
4	AC Power Line Conducted Emission	ANSI C63.10-2013, Clause 6.2	Pass
5	Antenna Requirement	CFR 47 FCC §15.203 ISED RSS-Gen Clause 6.3	Pass
<p>Note 1: This test report is only published to and used by the applicant, and it is not for evidence purpose in China.</p> <p>Note 2: The measurement result for the sample received is &lt;Pass&gt; according to &lt; CFR 47 FCC PART 15 SUBPART C and &gt; when &lt;Accuracy Method&gt; decision rule is applied.</p> <p>N/A: In this whole report not applicable.</p>			

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## 1. ATTESTATION OF TEST RESULTS

### Applicant Information

Company Name: Amphenol PCD Shenzhen Co., Ltd  
101,201,301,601, Building C, Dagang Industrial Zone, Changzhen  
Address: Community, Yutang Sub-district, Guangming District, 518132  
Shenzhen, China

### Manufacturer Information

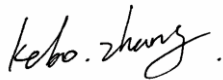
Company Name: Amphenol PCD Shenzhen Co., Ltd  
101,201,301,601, Building C, Dagang Industrial Zone, Changzhen  
Address: Community, Yutang Sub-district, Guangming District, 518132  
Shenzhen, China

### EUT Information

EUT Name: NACS DC  
Model: HVCON1MA200APL0000U1, HVCON1MA200ANL0000U1,  
HVCON1MA250APL0000U1, HVCON1MA250ANL0000U1,  
HVCON1MA380APL0000U1, HVCON1MA380ANL0000U1,  
HVCON2MA600APL0000U1, HVCON2MA600ANL0000U1,  
HVCON1MA80ANL0000U1, HVCON1MA80APL0000U1,  
HVCON1MA50ANL0000U1, HVCON1MA50APL0000U1,  
HVCON1MA40ANL0000U1, HVCON1MA40APL0000U1  
Sample Received Date: January 15, 2024  
Sample Status: Normal  
Sample ID: 6670812  
Date of Tested: January 15, 2024 ~ March 22, 2024

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
ISED RSS-210 Issue 10	PASS
ISED RSS-GEN Issue 5	PASS
CFR 47 FCC PART 15 SUBPART C	PASS

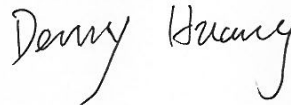
Prepared By:



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Kebo Zhang  
Senior Project Engineer

Checked By:



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Denny Huang  
Senior Project Engineer

Approved By:



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Stephen Guo  
Laboratory Manager

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with KDB 414788 D01 Radiated Test Site v01r01, FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-210 Issue 10 and RSS-GEN Issue 5.

## 3. FACILITIES AND ACCREDITATION

Accreditation Certificate	<p><b>A2LA (Certificate No.: 4102.01)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA.</p> <p><b>FCC (FCC Designation No.: CN1187)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules</p> <p><b>ISED (Company No.: 21320)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320.</p> <p><b>VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B, the VCCI registration No. is C-20012 and T-20011</p>
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Note 1: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

Note 2: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

Note 3: For below 30 MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz had been correlated to measurements performed on an OFS.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognize national standards.

### 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Conduction emission	3.62 dB
Radiation Emission test (include Fundamental emission) (9 kHz-30 MHz)	2.2 dB
Radiation Emission test (include Fundamental emission) (30 MHz-1 GHz)	4.00 dB
Radiation Emission test (1 GHz to 26GHz) (include Fundamental emission)	5.78 dB (1 GHz-18 GHz)
	5.23 dB (18 GHz-26 GHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	



## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

EUT Name	NACS DC	
Model	HVCON1MA200APL0000U1, HVCON1MA200ANL0000U1, HVCON1MA250APL0000U1, HVCON1MA250ANL0000U1, HVCON1MA380APL0000U1, HVCON1MA380ANL0000U1, HVCON2MA600APL0000U1, HVCON2MA600ANL0000U1, HVCON1MA80ANL0000U1, HVCON1MA80APL0000U1, HVCON1MA50ANL0000U1, HVCON1MA50APL0000U1, HVCON1MA40ANL0000U1, HVCON1MA40APL0000U1	
Model differences	For the detail, please refer to the model declaration letter.	
Remark	All the models have been considered, only the worst data for model HVCON1MA200APL0000U1 were recorded in the report.	
Product Description	Operation Frequency	433.92 MHz
Modulation	FSK	
Power Supply	3.3~12 Vdc	
Remark	All the power supply Voltage has been considered, only the worst case voltage 12Vdc test data record in this report.	

### 5.2. MAXIMUM FIELD STRENGTH

Frequency (MHz)	Maximum Peak Field Strength (dB $\mu$ V/m)
433.92	64.64

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
433.92	PCB	0

Note: The value of the antenna gain was declared by customer.

#### 5.4. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	55 ~ 70 %	
Atmospheric Pressure:	1025 Pa	
Temperature	TN	23 ~ 28 °C
Voltage:	VL	/
	VN	DC 12 V
	VH	/

Note: VL= Lower Extreme Test Voltage  
VN= Nominal Voltage  
VH= Upper Extreme Test Voltage  
TN= Normal Temperature

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	Load	/	/	/
2	AC/DC Adapter	TP	T120	Input: 100~240Vac, 50/60 Hz 0.6A Output: 12V, 1A

### I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
/	/	/	/	/	/

### ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
/	/	/	/	/

### SETUP DIAGRAM FOR TEST

The test sample can be into a transmission mode through the power on.

### Setup Diagram For Tests



## 5.6. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
EMI Test Receiver	R&S	ESR3	101961	Oct.13, 2023	Oct.12, 2024
Two-Line V-Network	R&S	ENV216	101983	Oct.13, 2023	Oct.12, 2024
Artificial Mains Networks	Schwarzbeck	NSLK 8126	8126465	Oct.13, 2023	Oct.12, 2024
Software					
Description		Manufacturer	Name	Version	
Test Software for Conducted Emissions		Farad	EZ-EMC	Ver. UL-3A1	

Radiated Emissions					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Oct.12, 2023	Oct.11, 2024
Hybrid Log Periodic Antenna	TDK	HLP-3003C	130959	Aug.02, 2021	Aug.01, 2024
Preamplifier	HP	8447D	2944A09099	Oct.12, 2023	Oct.11, 2024
EMI Measurement Receiver	R&S	ESR26	101377	Oct.12, 2023	Oct.11, 2024
Horn Antenna	TDK	HRN-0118	130940	July 20, 2021	July 19, 2024
Preamplifier	TDK	PA-02-0118	TRS-305-00067	Oct.12, 2023	Oct.11, 2024
Loop antenna	Schwarzbeck	1519B	00008	Dec.14, 2021	Dec.13, 2024
Preamplifier	TDK	PA-02-001-3000	TRS-302-00050	Oct.12, 2023	Oct.11, 2024
Software					
Description		Manufacturer	Name	Version	
Test Software for Radiated Emissions		Farad	EZ-EMC	Ver. UL-3A1	

Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	Spectrum Analyzer	Keysight	N9030A	MY55410512	Oct.12, 2023	Oct.11, 2024

## 6. ANTENNA PORT TEST RESULTS

### 6.1. ON TIME AND DUTY CYCLE

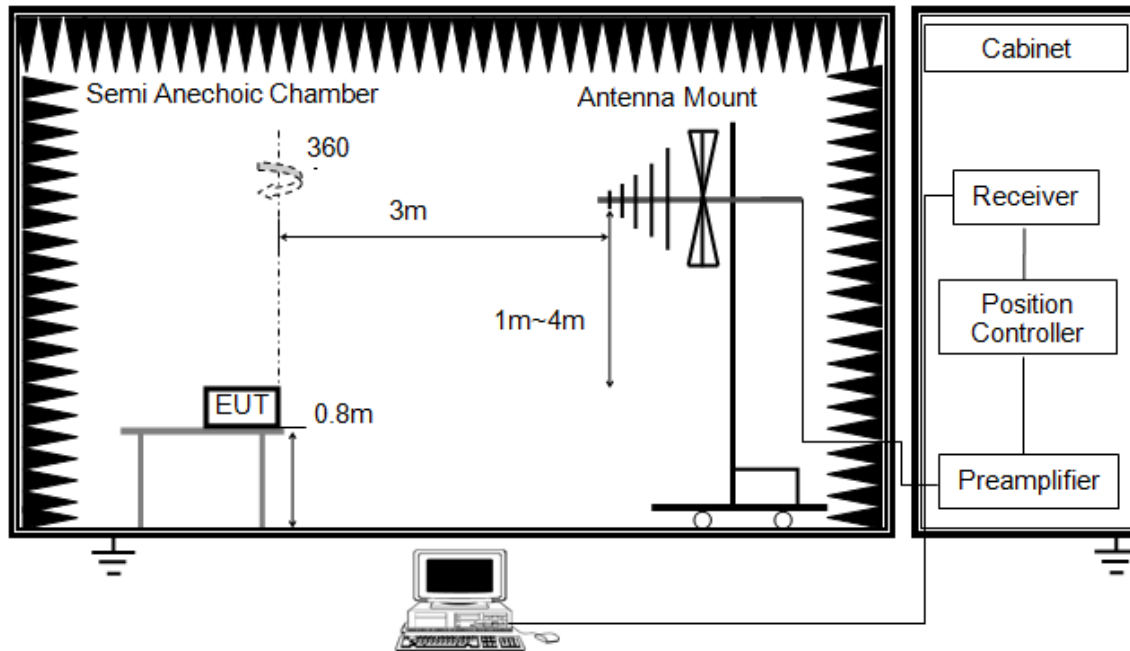
#### LIMITS

None; for reporting purposes only

#### PROCEDURE

FCC Reference:	CFR 47 §15.35(c)
Test Method Used:	ANSI C63.10 Section 7.5

#### TEST SETUP



- Set RBW of spectrum analyzer to 3 MHz and VBW to 3 MHz.
- Use a video trigger with the trigger level set to enable triggering only on full pulses.
- Sweep Time is at least a 100 ms.
- Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- Measure the maximum time duration of one single pulse.

#### TEST ENVIRONMENT

Temperature	25.4 °C	Relative Humidity	66 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 12 V

**RESULTS**

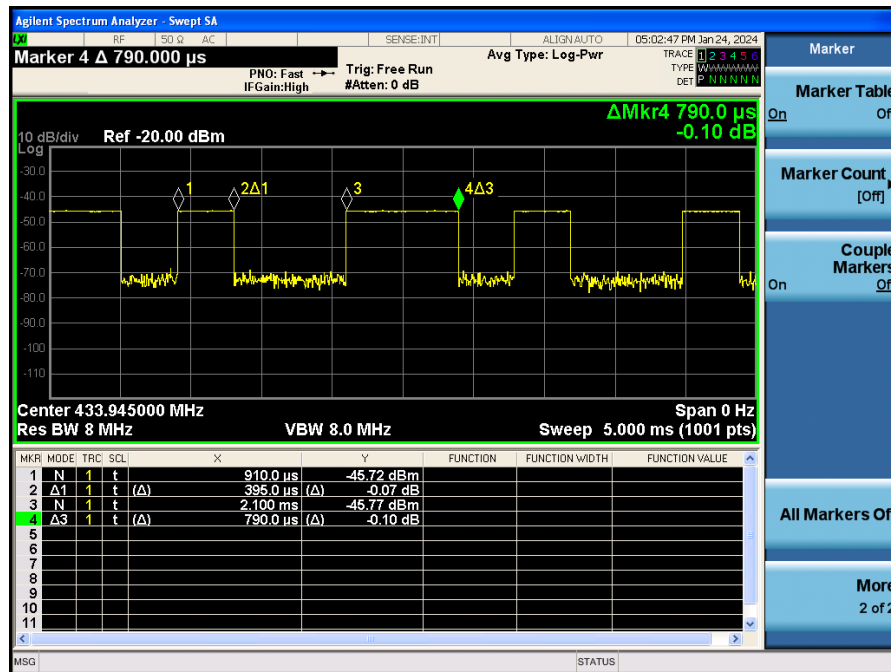
	On Time (ms)	Times	Total Ton times (ms)
Ton 1	0.395	46	18.17

	On Time (ms)	Times	Total Ton times (ms)
Ton 2	0.79	39	30.81

Total Ton times (ms)	Period (ms)	Duty Cycle (Linear)	Duty Cycle Correction Factor
48.98	100	0.4898	-6.2

Note: Duty Cycle Correction Factor=20log(x).  
Where: x is Duty Cycle

Ton



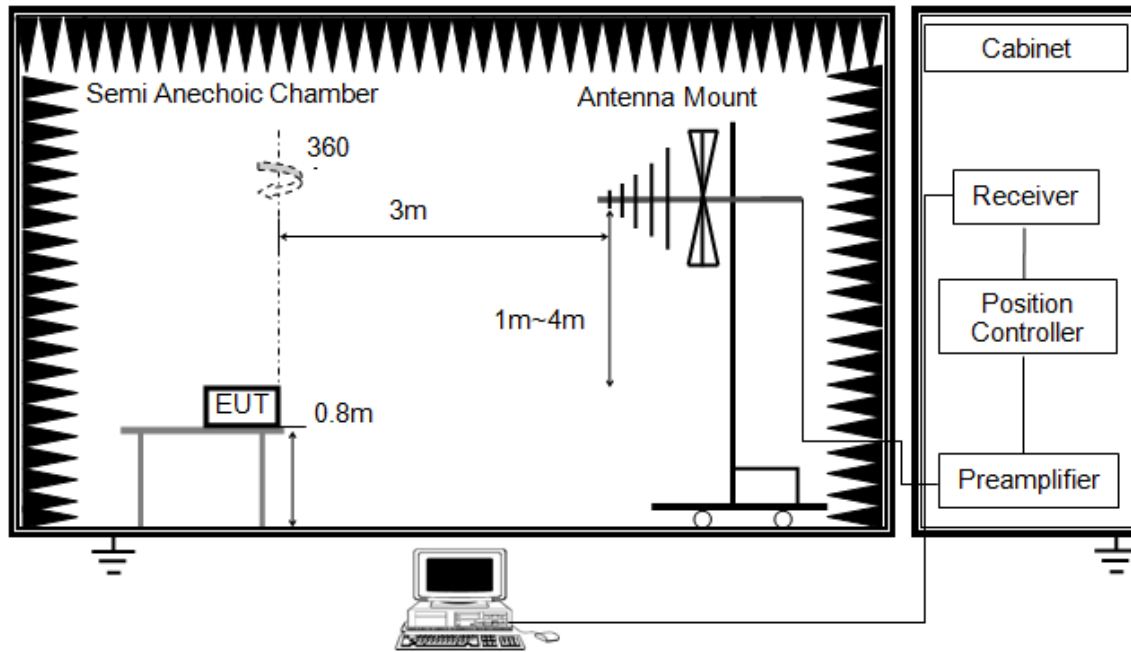


## 6.2. TRANSMITTER TIMEOUT

### TEST PROCEDURE

Rule Reference:	CFR 47 FCC §15.231(a) (1) ISED RSS-210 Annex A.1.1
Test Method Used:	The EUT transmitter was activated and monitored using a spectrum analyser for a period of 10 seconds.

### TEST SETUP





For CFR 47 Part 15.231(a):

- a. Set RBW of spectrum analyzer to 100 kHz and VBW to 300 kHz.
- b. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- c. Set Sweep Time to 10 s.
- d. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- e. Measure the maximum time duration of one single pulse.

### **LIMITS**

CFR 47 §15.231(a):

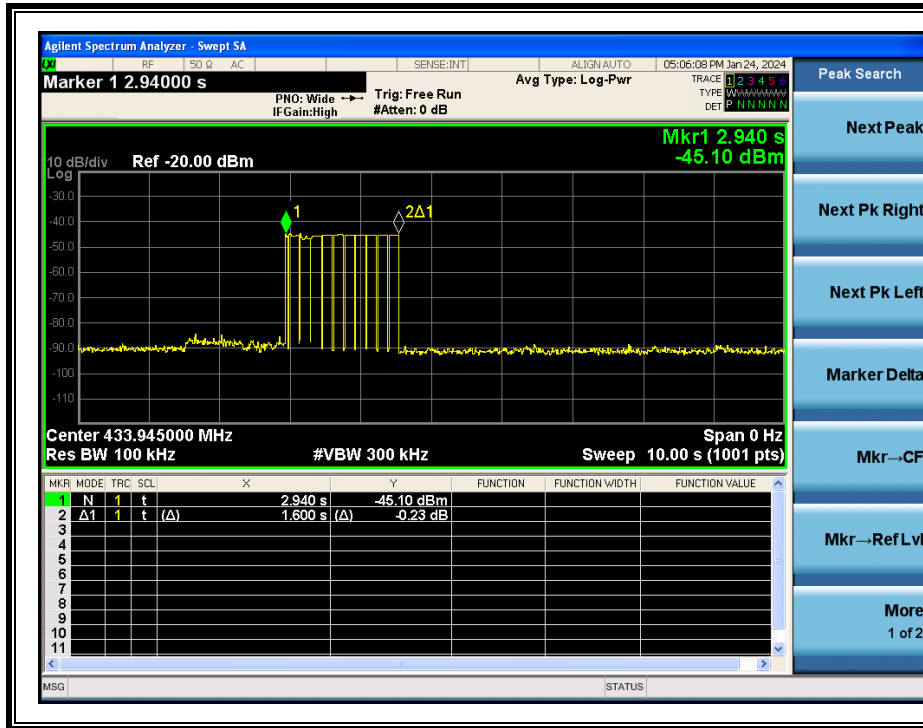
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

### **TEST ENVIRONMENT**

Temperature	25.4 °C	Relative Humidity	66 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 12 V

**RESULTS**

Manually transmitting mode		
Deactivation Time (seconds)	Limit (seconds)	Result
1.6	5.000	PASS



### 6.3. 20 dB BANDWIDTH AND 99 % OCCUPIED BANDWIDTH

#### LIMITS

CFR 47 FCC §15.231 (c) , ISED RSS-210 Annex A.1.3

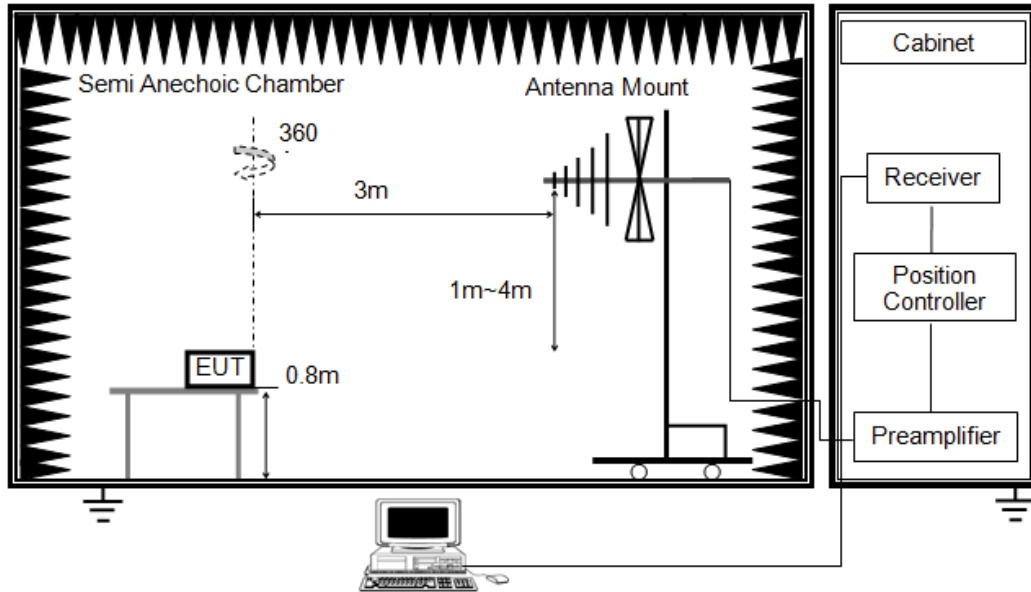
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

So, the limit calculated as:  $0.0025 * 433.92 \text{ MHz} = 1.0848 \text{ MHz}$

#### TEST PROCEDURE

FCC Reference:	CFR 47 Part 15.231(c)
Test Method Used:	ANSI C63.10 Section 6.9.2

## TEST SETUP



1. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
2. The EUT was placed on a turntable with 0.8 meter above ground.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower
4. Set the spectrum analyzer in the following setting as:  
 RBW is set to 1kHz and VBW is set 3kHz.

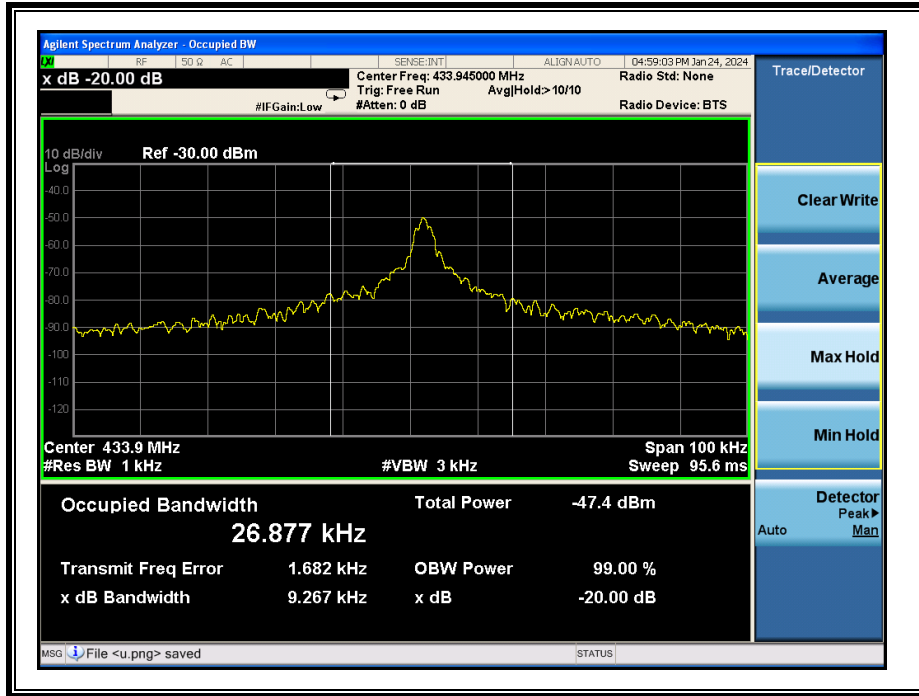
Note: Because the measured signal is CW or CW-like adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.

## TEST ENVIRONMENT

Temperature	25.4 °C	Relative Humidity	66 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 12 V

**RESULTS**

20 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)	Limit (MHz)	Result
9.267	26.877	1.0848	Pass



## 6.4. RADIATED TEST RESULTS

### LIMITS

CFR 47 FCC §15.231 (b)(e)

CFR 47 FCC §15.205 and §15.209

1. In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

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	<sup>1</sup> 1,250 to 3,750	<sup>1</sup> 125 to 375
174-260	3,750	375
260-470	<sup>1</sup> 3,750 to 12,500	<sup>1</sup> 375 to 1,250
Above 470	12,500	1,250

Note:

1. To obtain the average limit at the test frequency the values given in the table of FCC part 15.231(b) have to be linear interpolated and then converted to dBµV/m. The limit at 260 MHz is 3750 µV/m and at 470 MHz it is 12500 µV/m. Limit at 433.92 MHz is calculated as shown in ANSI C63.10 Section 7.6.2:

Limit [µV/m] = Lim<sub>lower</sub> + ΔF [(Lim<sub>upper</sub> – Lim<sub>lower</sub>) / (f<sub>upper</sub> – f<sub>lower</sub>)]  
where ΔF = f<sub>c</sub> – f<sub>lower</sub> = 433.92 – 260 = 173.92

Limit = 3750 + 173.92 \* [(12500 – 3750) / (470 -260)]  
= 3750 + 173.92 \* [8750 / 210]  
= 10996.7 µV/m

dBµV/m = 20 \* log (µV/m)  
= 20 \* log (10996.7)

Average Limit at 433.92 MHz = 80.8 dBµV/m

2. If the average limit is specified for the EUT, the peak limit is 20 dB above the average limit as specified in FCC 15.35 (b)

2. Please refer to CFR 47 FCC part 15.231(e)

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 <sup>1</sup>	50 to 150 <sup>1</sup>
174-260	1,500	150
260-470	1,500 to 5,000 <sup>1</sup>	150 to 500 <sup>1</sup>
Above 470	5,000	500

Note:

1. To obtain the average limit at the test frequency the values given in the table of FCC part 15.231(b) have to be linear interpolated and then converted to dBµV/m. The limit at 260 MHz is 3750 µV/m and at 470 MHz it is 12500 µV/m. Limit at 433.92 MHz is calculated as shown in ANSI C63.10 Section 7.6.2:

Limit [µV/m] = Lim<sub>lower</sub> + ΔF [(Lim<sub>upper</sub> – Lim<sub>lower</sub>) / (f<sub>upper</sub> – f<sub>lower</sub>)]  
where ΔF = f<sub>c</sub> – f<sub>lower</sub> = 433.92 – 260 = 173.92

Limit = 1500 + 173.92 \* [(5000 – 1500) / (470 -260)]  
= 1500 + 173.92 \* [3500 / 210]  
= 4398.7 µV/m

dBµV/m = 20 \* log (µV/m)  
= 20 \* log (4398.7)

Average Limit at 433.92 MHz = 72.87 dBµV/m

If the average limit is specified for the EUT, the peak limit is 20 dB above the average limit as specified in FCC 15.35 (b)

3. 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 (microvolts/meter)	Measurement distance (meters)
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

\*\*Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

4. Radiation Disturbance Test Limit for FCC (Class B) (9 kHz-1 GHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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
960~1000	500	3

Note: (1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).  
 Note: (2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). This paragraph (f) shall not apply to Access BPL devices operating below 30 MHz.

Restricted bands of operation

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
<sup>1</sup> 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	32.6-24.0
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	( <sup>2</sup> )
13.36-13.41			

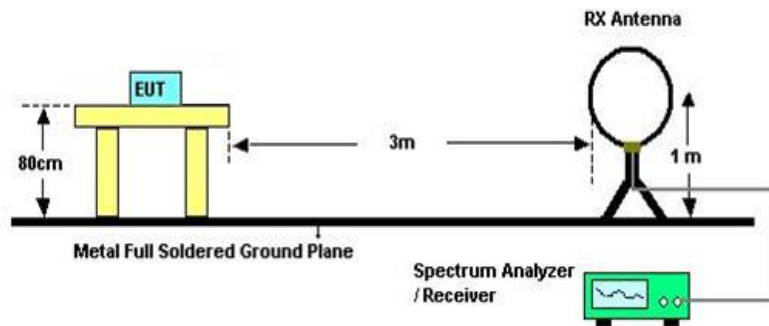
Note: <sup>1</sup>Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup>Above 38.6c



## TEST SETUP AND PROCEDURE

Below 30 MHz

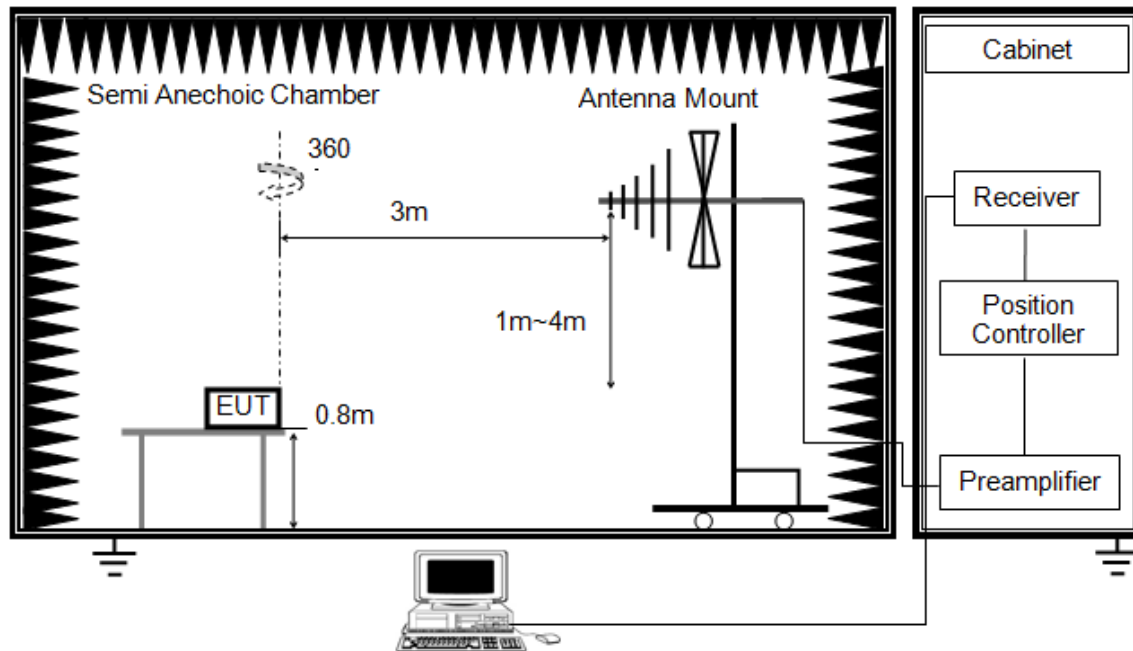


The setting of the spectrum analyser

RBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
VBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
Sweep	Auto
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.4.
2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80 cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a 1 m height antenna tower.
5. The radiated emission limits are based on 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.
6. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.
7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.
8. 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 (as reported in the table) using the free space impedance of  $377\Omega$ ; For example, the measurement frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to  $Y-51.5 = Z$  dBuA/m, which has the same

Below 1 GHz

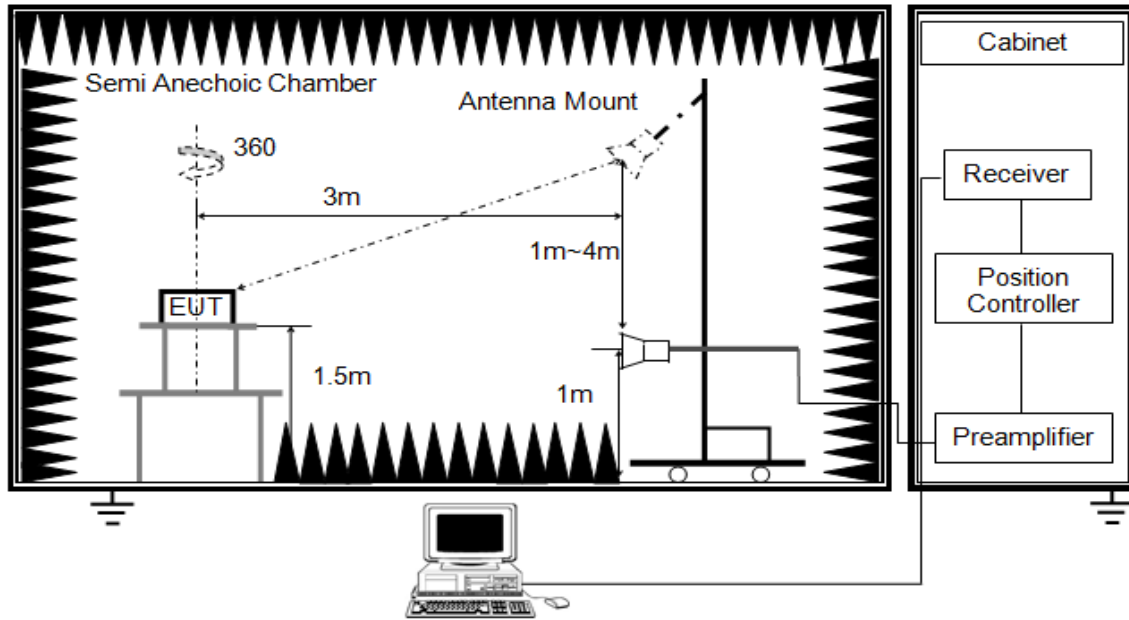


The setting of the spectrum analyser

RBW	120 kHz
VBW	300 kHz
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.5.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80 cm above ground.
4. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
5. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
6. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
7. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

Above 1 GHz

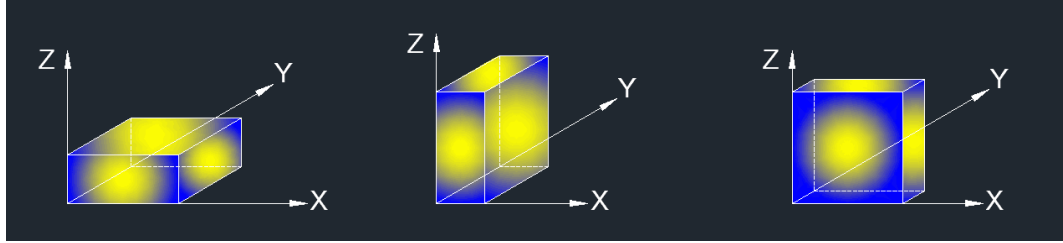


The setting of the spectrum analyser

RBW	1 MHz
VBW	PEAK: 3 MHz AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.6.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 1.5 m above ground.
4. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
5. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements. Where necessary, average emission are determined by applying the Duty Cycle Correction Factor to the peak measurements. For the Duty Cycle and Correction Factor please refer to clause 6.1. ON TIME AND DUTY CYCLE.

X axis, Y axis, Z axis positions:



Note: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

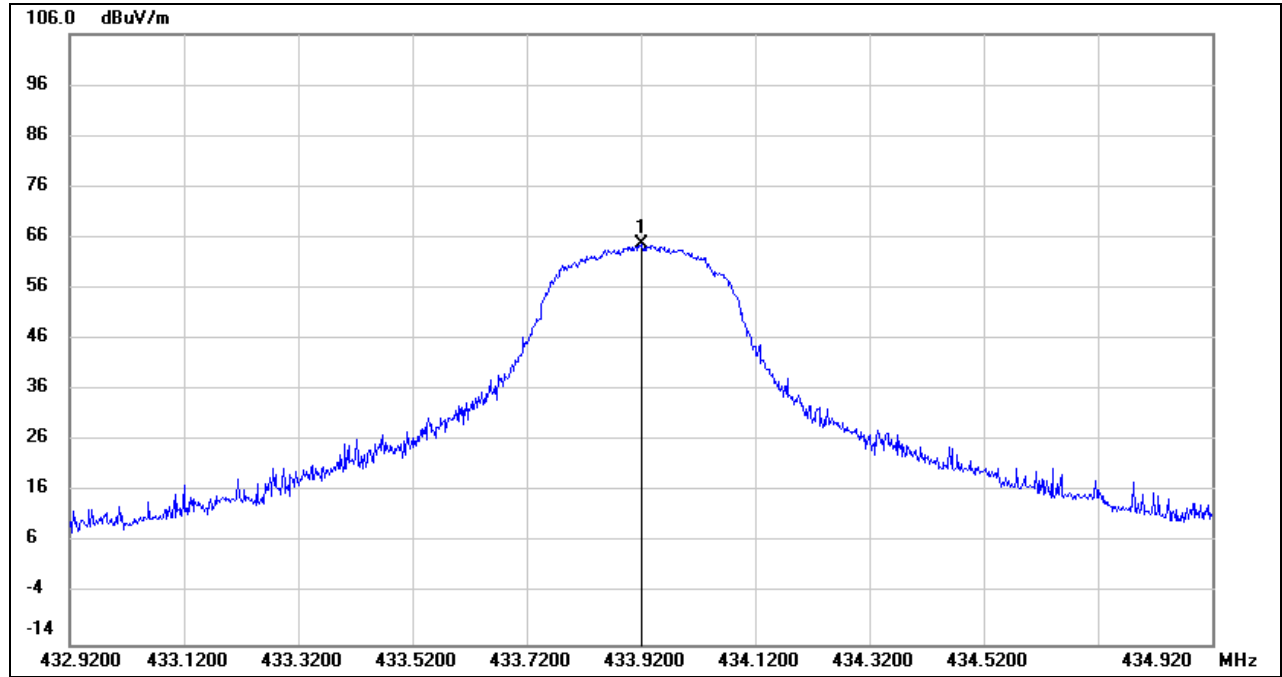
**TEST ENVIRONMENT**

Radiated Emissions - Below 1 GHz		Radiated Emissions - Above 1 GHz	
Temperature:	22.1 °C	Temperature:	24.3 °C
Humidity:	56 %	Humidity:	61 %
Atmosphere Pressure	101 kPa	Atmosphere Pressure	101 kPa
Test Voltage	DC 12 V	Test Voltage	DC 12 V

**RESULTS**

### 6.4.1. FIELD STRENGTH OF INTENTIONAL EMISSIONS

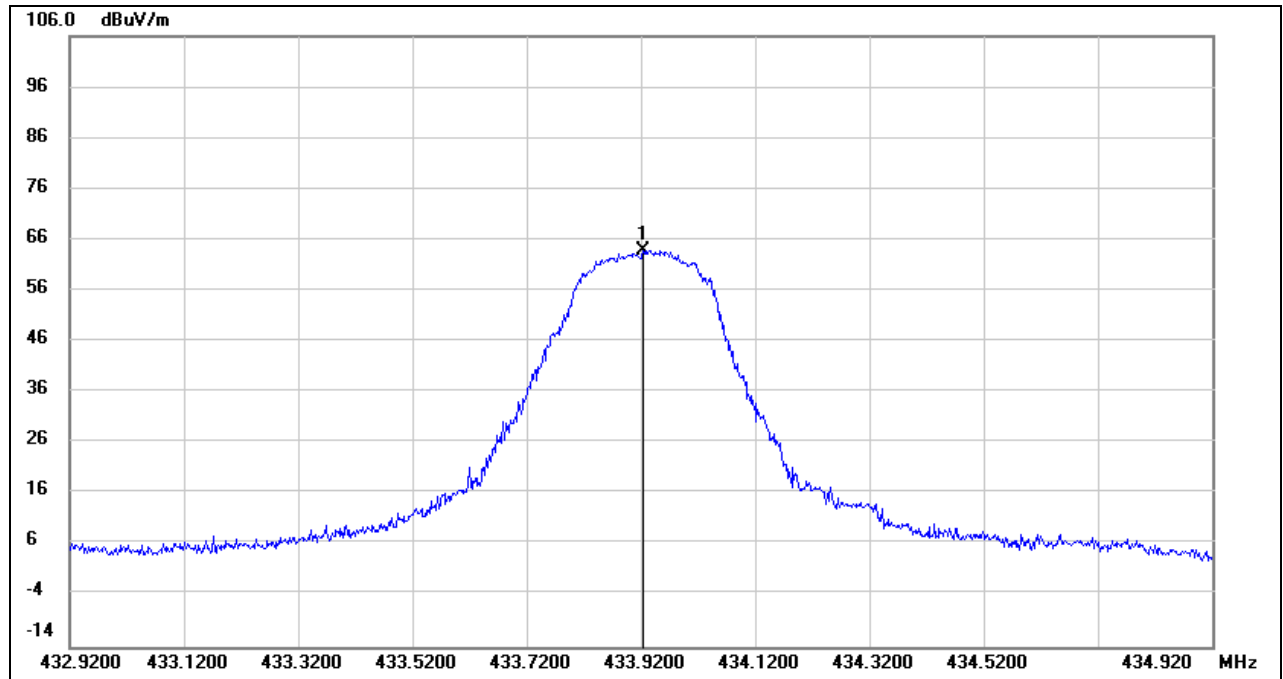
#### FIELD STRENGTH OF INTENTIONAL EMISSIONS (HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	433.9220	77.31	-12.67	64.64	100.8	-36.16	peak
		/	/	58.44	80.8	-22.36	avg

- Note: 1. Result Level = Read Level + Correct Factor.  
 2. Peak: Peak detector.  
 3. Average Result = Peak Result + Duty Correction Factor.

**FIELD STRENGTH OF INTENTIONAL EMISSIONS (VERTICAL)**

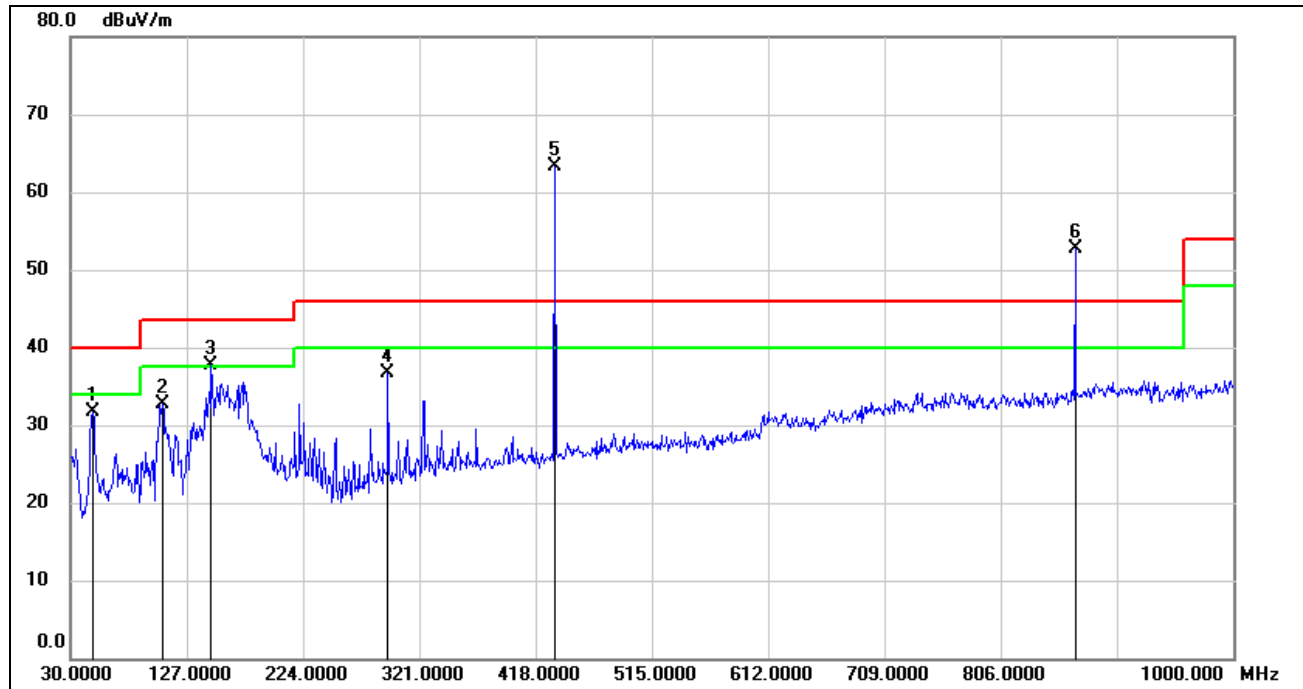


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	433.9239	76.54	-12.67	63.87	100.8	-36.93	peak
		/	/	57.67	80.8	-23.13	avg

- Note: 1. Result Level = Read Level + Correct Factor.  
 2. Peak: Peak detector.  
 3. Average Result = Peak Result + Duty Correction Factor.

### 6.4.2. SPURIOUS EMISSIONS BELOW 1 GHz AND ABOVE 30 MHz

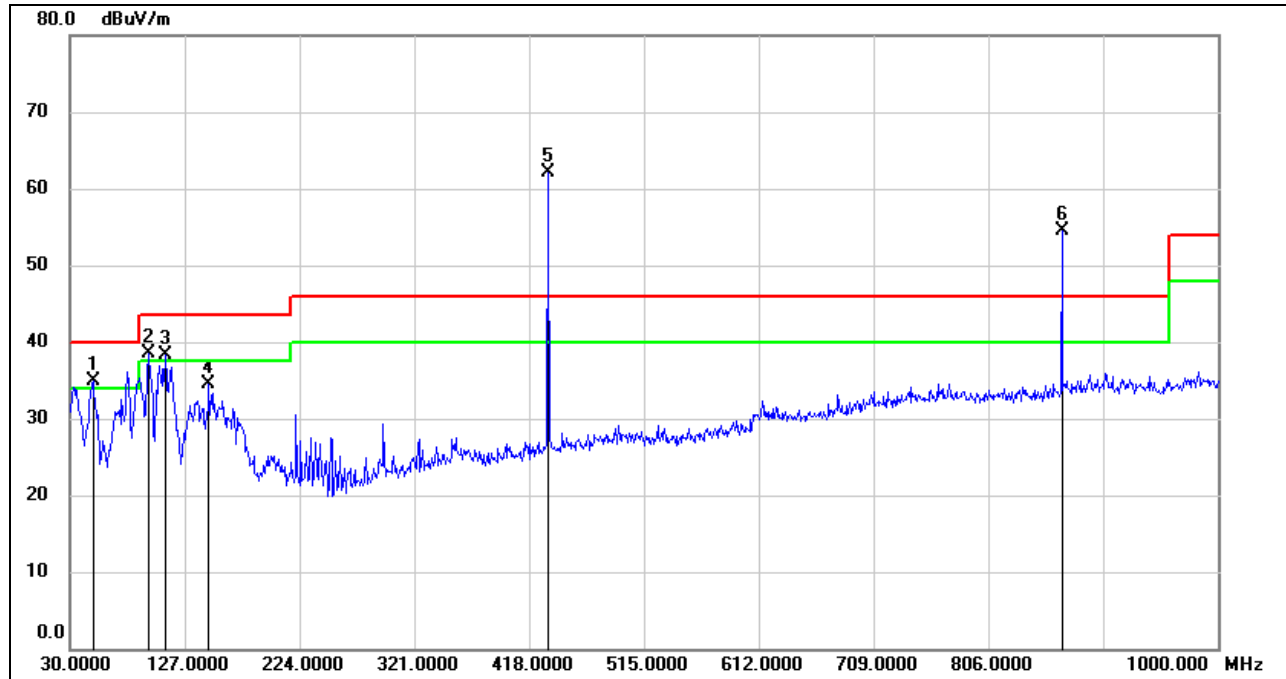
#### SPURIOUS EMISSIONS (HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	48.4300	51.63	-19.93	31.70	40.00	-8.30	QP
2	106.6300	52.91	-20.21	32.70	43.50	-10.80	QP
3	147.3700	55.79	-18.04	37.75	43.50	-5.75	QP
4	294.8100	51.94	-15.17	36.77	46.00	-9.23	QP
5	433.9200	74.98	-11.76	63.22	100.8	-37.58	Peak
		/	/	57.02	80.8	-23.78	Avg
6	868.0800	57.95	-5.30	52.65	80.8	-28.15	Peak
		/	/	46.45	60.8	-14.35	Avg

- Note: 1. Result Level = Read Level + Correct Factor.  
 2. Peak: Peak detector.  
 3. Average Result = Peak Result + Duty Correction Factor.  
 4. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.  
 5. Mark 5 is the fundamental frequency, Mark 6 is 2<sup>th</sup> harmonic.

### FIELD STRENGTH HARMONICS AND SPURIOUS EMISSIONS (VERTICAL)



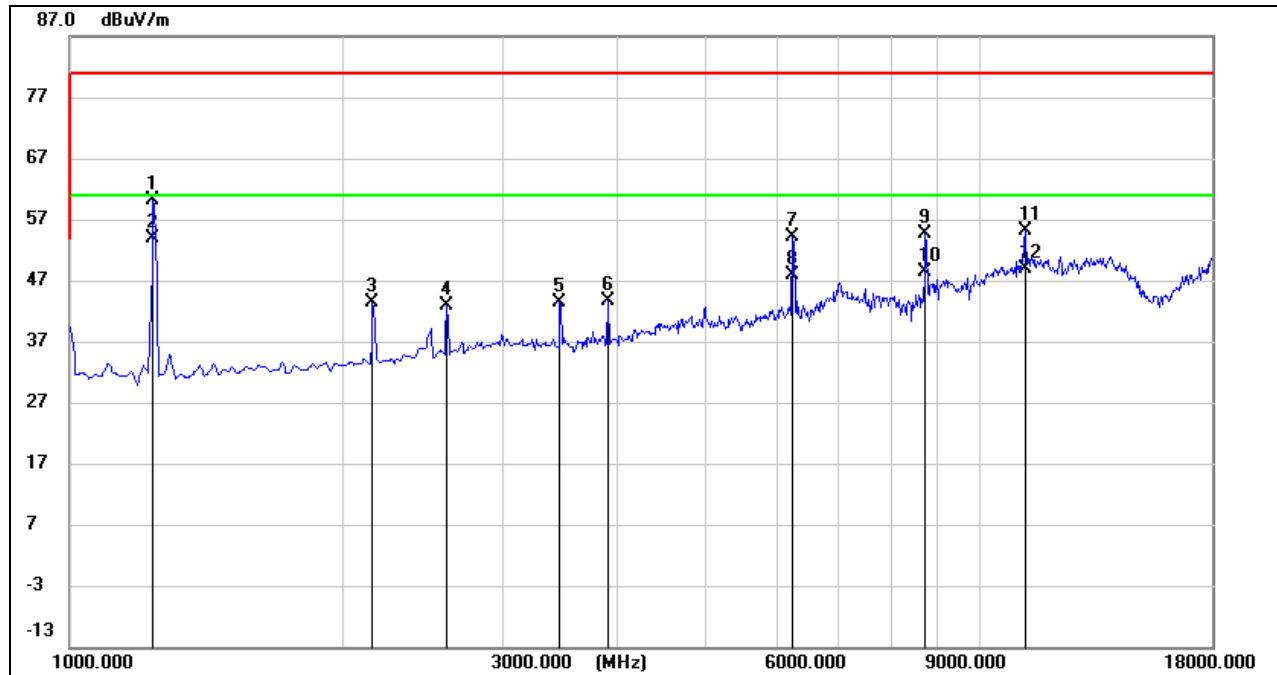
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	49.4000	54.92	-20.04	34.88	40.00	-5.12	QP
2	95.9600	59.71	-21.22	38.49	43.50	-5.01	QP
3	110.5100	58.27	-19.92	38.35	43.50	-5.15	QP
4	147.3700	52.59	-18.04	34.55	43.50	-8.95	QP
5	433.9200	73.96	-11.76	62.20	100.8	-38.6	Peak
		/	/	56.00	80.8	-24.8	Avg
6	868.0800	59.76	-5.30	54.46	80.8	-26.34	Peak
		/	/	48.26	60.8	-12.54	Avg

- Note:
1. Result Level = Read Level + Correct Factor.
  2. Peak: Peak detector.
  3. Average Result = Peak Result + Duty Correction Factor.
  4. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
  5. Mark 4 is the fundamental frequency, Mark 6 is 2<sup>th</sup> harmonic.



### 6.4.3. SPURIOUS EMISSIONS ABOVE 1 GHz

#### HARMONICS AND SPURIOUS EMISSIONS (HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1301.760	74.03	-13.92	60.11	80.80	-20.69	peak
2	1301.760	67.83	-13.92	53.91	60.80	-6.89	AVG
3	2169.600	53.70	-10.25	43.45	80.80	-37.35	peak
4	2603.520	50.80	-7.99	42.81	80.80	-37.99	peak
5	3471.360	49.26	-5.86	43.40	80.80	-37.40	peak
6	3905.280	48.43	-4.74	43.69	80.80	-37.11	peak
7	6074.880	51.41	2.66	54.07	80.80	-26.73	peak
8	6074.880	45.21	2.66	47.87	60.80	-12.93	AVG
9	8678.400	46.78	7.88	54.66	80.80	-26.14	peak
10	8678.400	40.58	7.88	48.46	60.80	-12.34	AVG
11	11281.920	40.47	14.63	55.10	80.80	-25.70	peak
12	11281.920	34.27	14.63	48.90	60.80	-11.90	AVG

Note: 1. Result Level = Read Level + Correct Factor.

2. Peak: Peak detector.

3. Average Result = Peak Result + Duty Correction Factor.

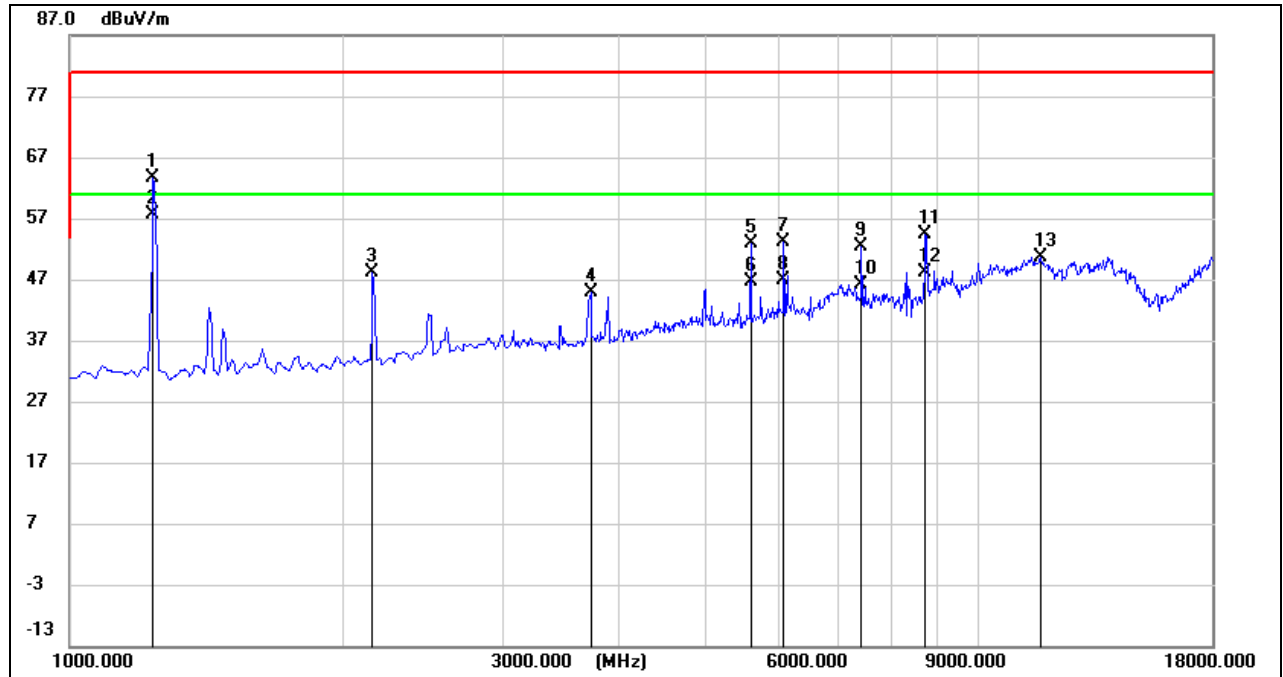
4. The average limit for harmonics out of the restrict bands are 60.8 dBuV/m, the average limit in the restrict bands is 54 dBuV/m.

5. If peak result complies with average limit, the average result is deemed to comply with average limit.

6. Mark 1~12 are harmonics in nonrestricted bands.

7. No burst found in Restricted bands.

**HARMONICS AND SPURIOUS EMISSIONS (VERTICAL)**



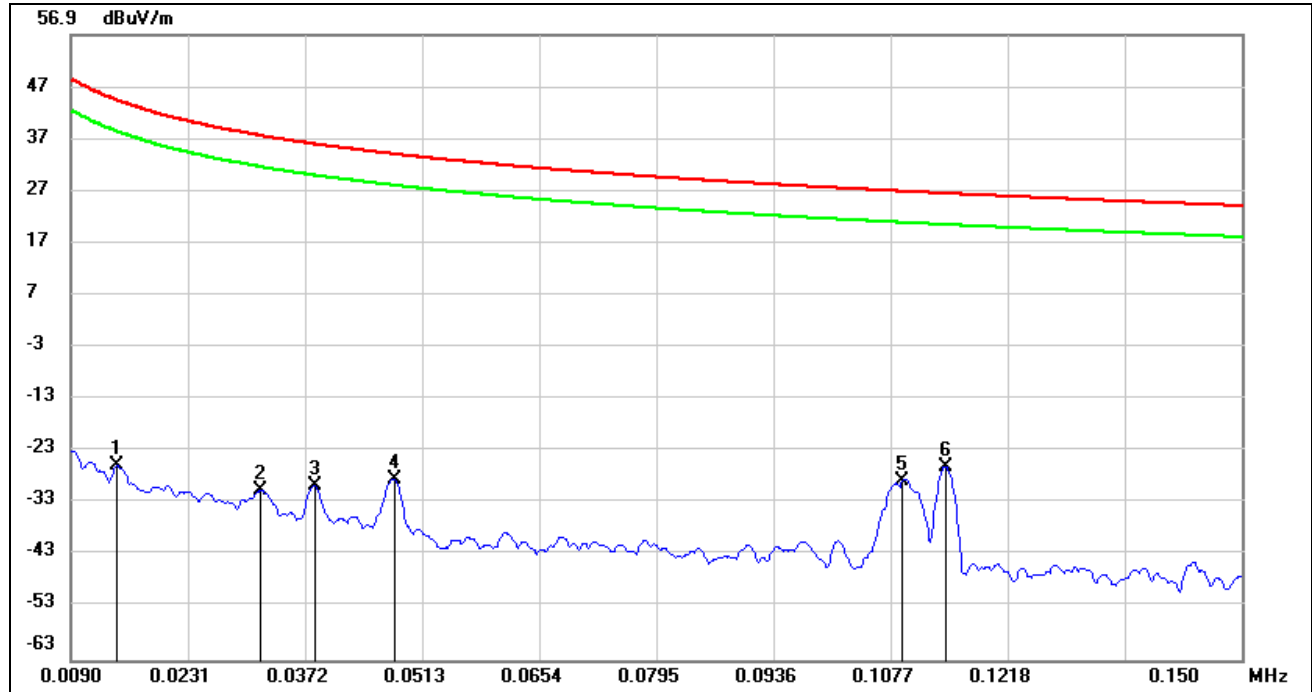
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1301.760	77.64	-13.92	63.72	80.80	-17.08	peak
2	1301.760	71.44	-13.92	57.52	60.80	-3.28	AVG
3	2169.600	58.49	-10.25	48.24	80.80	-32.56	peak
4	3905.280	49.99	-5.20	44.79	80.80	-36.01	peak
5	5640.960	52.05	0.73	52.78	80.80	-28.02	peak
6	5640.960	45.85	0.73	46.58	60.80	-14.22	AVG
7	6074.880	50.86	2.22	53.08	80.80	-27.72	peak
8	6074.880	44.66	2.22	46.88	60.80	-13.92	AVG
9	7376.640	46.61	5.77	52.38	80.80	-28.42	peak
10	7376.640	40.41	5.77	46.18	80.80	-34.62	peak
11	8678.400	46.66	7.76	54.42	80.80	-26.38	peak
12	8678.400	40.46	7.76	48.22	60.80	-12.58	AVG

- Note: 1. Result Level = Read Level + Correct Factor.  
 2. Peak: Peak detector.  
 3. Average Result = Peak Result + Duty Correction Factor.  
 4. The average limit for harmonics out of the restrict bands are 60.8 dBuV/m, the average limit in the restrict bands bands is 54 dBuV/m.  
 5. If peak result complies with average limit, the average result is deemed to comply with average limit.  
 6. Mark 1~12 are harmonics in nonrestricted bands.  
 7. No burst found in Restricted bands.

### 6.4.4. SPURIOUS EMISSIONS BELOW 30 MHz

#### SPURIOUS EMISSIONS (LOOP ANTENNA FACE ON TO THE EUT)

0.09 kHz ~ 150 kHz



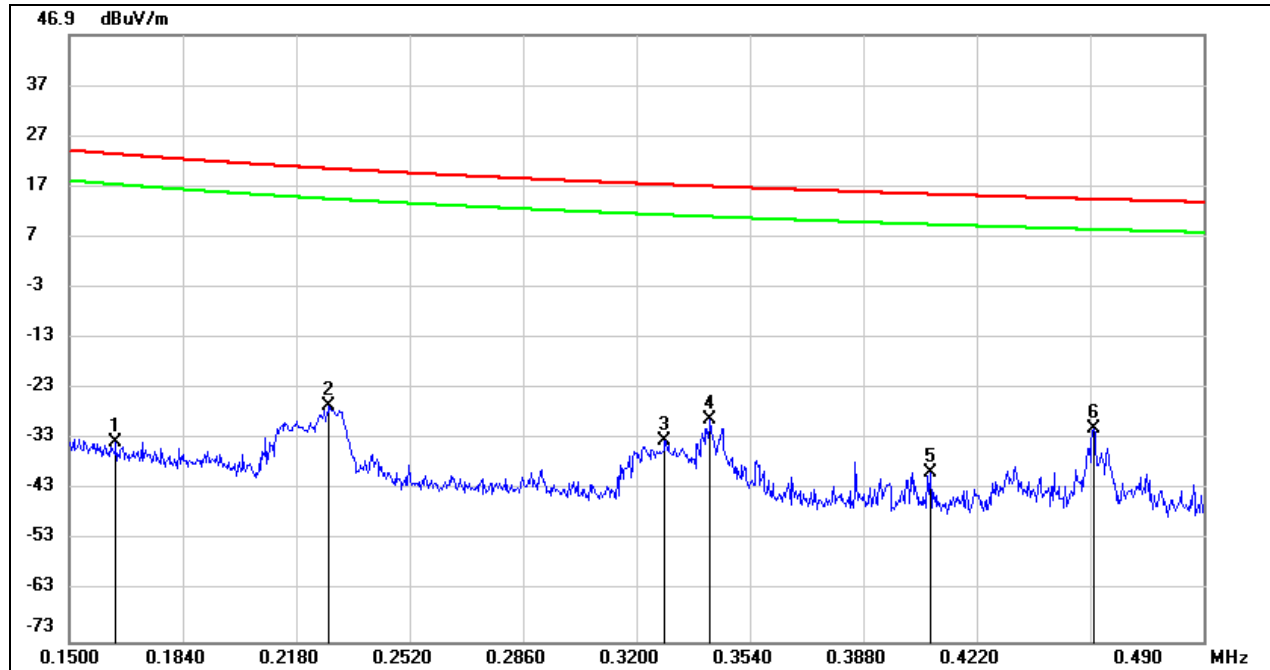
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	FCC Result (dBuV/m)	FCC Limit (dBuV/m)	ISED Result (dBuA/m)	ISED Limit (dBuA/m)	Margin (dB)	Remark
1	0.0145	61.98	-87.81	-25.83	44.37	-77.33	-7.13	-70.2	peak
2	0.0318	57.86	-88.27	-30.41	37.55	-81.91	-13.95	-67.96	peak
3	0.0383	58.69	-88.38	-29.69	35.94	-81.19	-15.56	-65.63	peak
4	0.0478	60.12	-88.56	-28.44	34.01	-79.94	-17.49	-62.45	peak
5	0.1091	59.85	-88.61	-28.76	26.85	-80.26	-24.65	-55.61	peak
6	0.1142	62.67	-88.67	-26	26.45	-77.5	-25.05	-52.45	peak

Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

**150 kHz ~ 490 kHz**



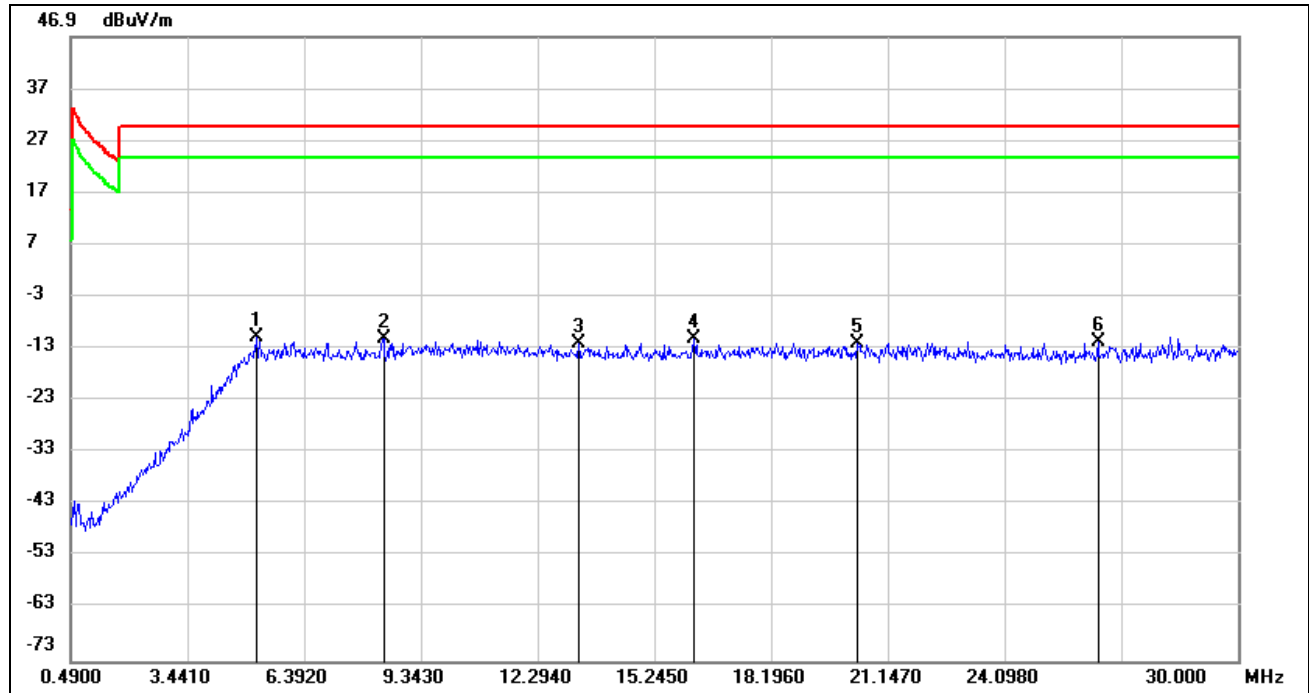
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	FCC Result (dBuV/m)	FCC Limit (dBuV/m)	ISED Result (dBuA/m)	ISED Limit (dBuA/m)	Margin (dB)	Remark
1	0.1638	55.54	-89.09	-33.55	23.32	-85.05	-28.18	-56.87	peak
2	0.2279	62.69	-89.02	-26.33	20.45	-77.83	-31.05	-46.78	peak
3	0.3285	55.77	-88.97	-33.2	17.27	-84.7	-34.23	-50.47	peak
4	0.3421	59.7	-88.96	-29.26	16.92	-80.76	-34.58	-46.18	peak
5	0.4081	49.39	-88.94	-39.55	15.39	-91.05	-36.11	-54.94	peak
6	0.457	57.87	-88.92	-31.05	14.4	-82.55	-37.1	-45.45	peak

Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

**490 kHz ~ 30 MHz**



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	FCC Result (dBuV/m)	FCC Limit (dBuV/m)	ISED Result (dBuA/m)	ISED Limit (dBuA/m)	Margin (dB)	Remark
1	5.1821	37.8	-48.56	-10.76	29.54	-62.26	-21.96	-40.3	peak
2	8.3987	36.64	-47.8	-11.16	29.54	-62.66	-21.96	-40.7	peak
3	13.3269	35.49	-47.44	-11.95	29.54	-63.45	-21.96	-41.49	peak
4	16.2483	36	-47.29	-11.29	29.54	-62.79	-21.96	-40.83	peak
5	20.3797	34.87	-46.79	-11.92	29.54	-63.42	-21.96	-41.46	peak
6	26.4588	34.68	-46.55	-11.87	29.54	-63.37	-21.96	-41.41	peak

- Note: 1. Measurement = Reading Level + Correct Factor.  
 2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.  
 3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

Note: All the modes had been tested, only the worst data was recorded in the report.

## 7. AC POWER LINE CONDUCTED EMISSION

### LIMITS

Please refer to CFR 47 FCC §15.207 (a) and ISED RSS-Gen Clause 8.8

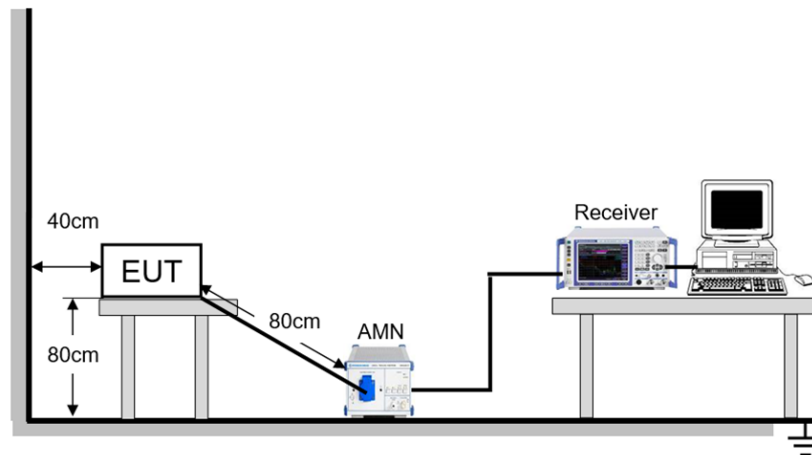
FREQUENCY (MHz)	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

### TEST PROCEDURE

The EUT is put on a table of non-conducting material that is 80 cm high. The vertical conducting wall of shielding is located 40 cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10-2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9 kHz.

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

### TEST SETUP

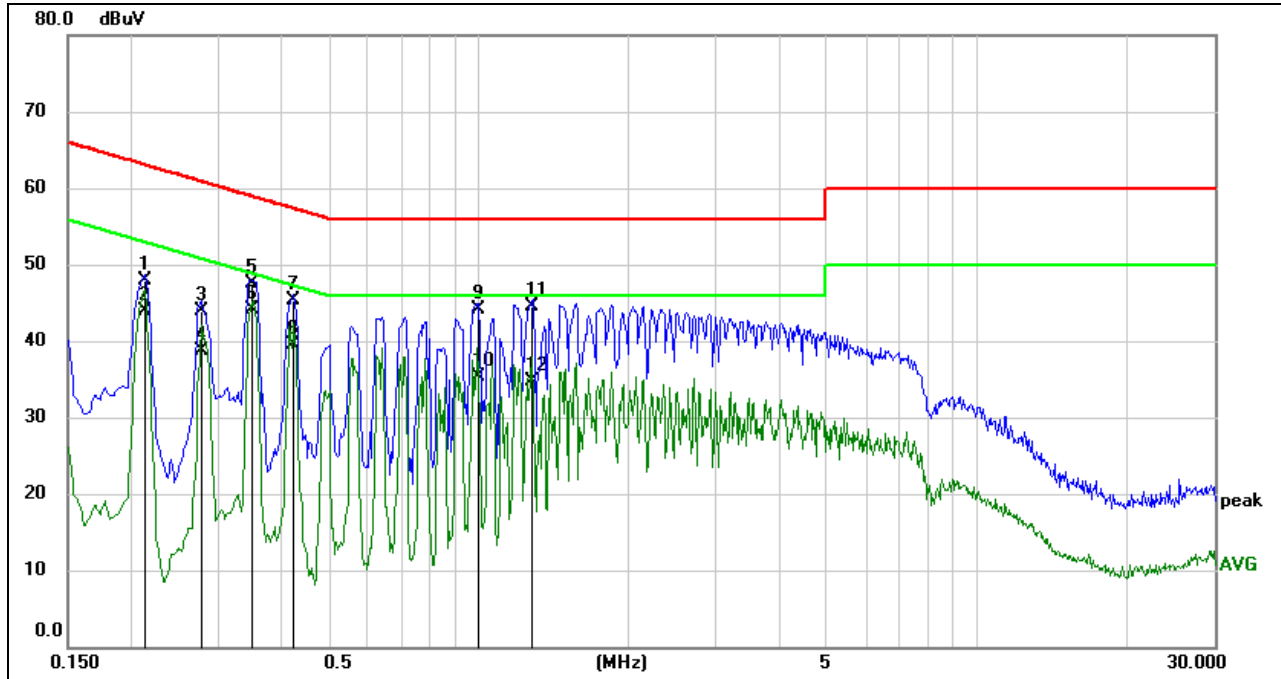


### TEST ENVIRONMENT

Temperature	22.5°C	Relative Humidity	57.8%
Atmosphere Pressure	101kPa	Test Voltage	AC 120 V, 60 Hz

**TEST RESULTS**

Test Mode:	433.92	Line:	L
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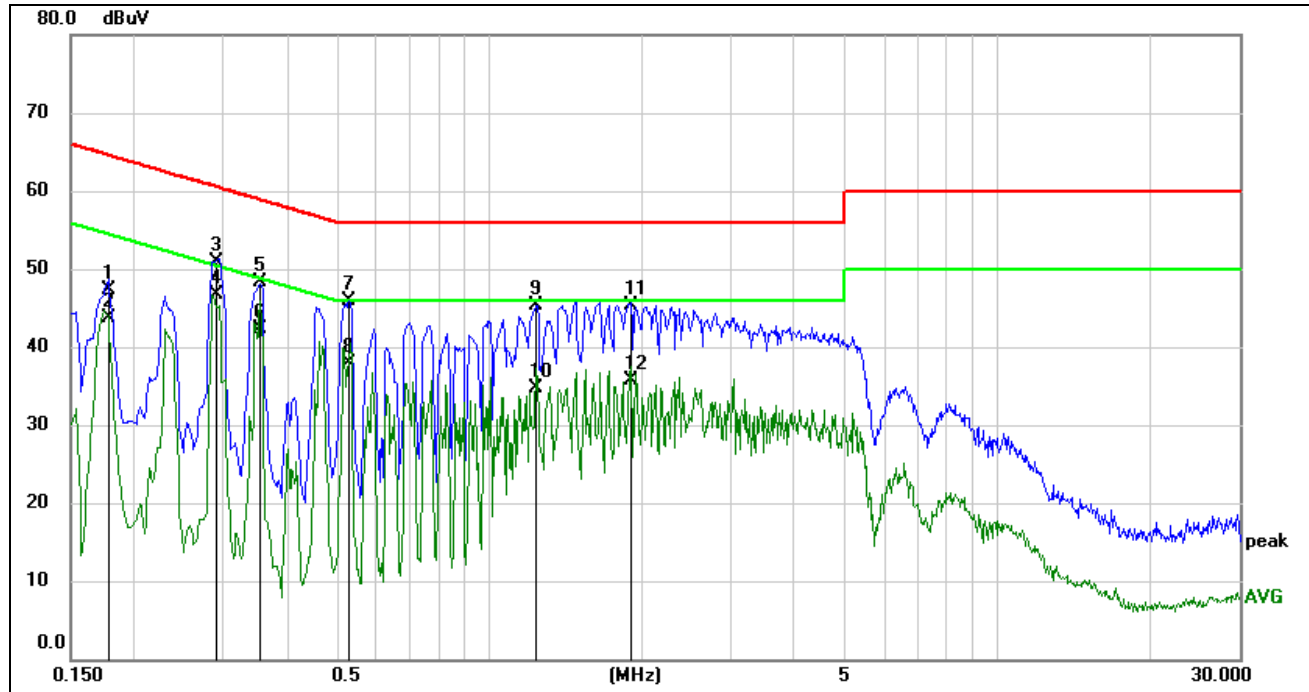


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.2147	38.31	9.59	47.90	63.02	-15.12	QP
2	0.2147	34.22	9.59	43.81	53.02	-9.21	AVG
3	0.2779	34.32	9.59	43.91	60.88	-16.97	QP
4	0.2779	29.11	9.59	38.70	50.88	-12.18	AVG
5	0.3524	37.94	9.59	47.53	58.91	-11.38	QP
6	0.3524	34.50	9.59	44.09	48.91	-4.82	AVG
7	0.4279	35.63	9.60	45.23	57.29	-12.06	QP
8	0.4279	29.97	9.60	39.57	47.29	-7.72	AVG
9	0.9986	34.44	9.61	44.05	56.00	-11.95	QP
10	0.9986	25.75	9.61	35.36	46.00	-10.64	AVG
11	1.2851	34.96	9.61	44.57	56.00	-11.43	QP
12	1.2851	25.14	9.61	34.75	46.00	-11.25	AVG

Note:

1. Result = Reading + Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz ~ 150 kHz), 9 kHz (150 kHz ~ 30 MHz).
4. Step size: 80 Hz (0.009 MHz ~ 0.15 MHz), 4 kHz (0.15 MHz ~ 30 MHz), Scan time: auto.

Test Mode:	433.92	Line	N
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1775	37.86	9.54	47.40	64.60	-17.20	QP
2	0.1775	34.21	9.54	43.75	54.60	-10.85	AVG
3	0.2900	41.35	9.56	50.91	60.52	-9.61	QP
4	0.2900	37.15	9.56	46.71	50.52	-3.81	AVG
5	0.3549	38.72	9.54	48.26	58.85	-10.59	QP
6	0.3549	32.73	9.54	42.27	48.85	-6.58	AVG
7	0.5267	36.45	9.50	45.95	56.00	-10.05	QP
8	0.5267	28.38	9.50	37.88	46.00	-8.12	AVG
9	1.2433	35.75	9.53	45.28	56.00	-10.72	QP
10	1.2433	25.09	9.53	34.62	46.00	-11.38	AVG
11	1.8955	35.76	9.61	45.37	56.00	-10.63	QP
12	1.8955	26.17	9.61	35.78	46.00	-10.22	AVG

Note:

1. Result = Reading + Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz ~ 150 kHz), 9 kHz (150 kHz ~ 30 MHz).
4. Step size: 80 Hz (0.009 MHz ~ 0.15 MHz), 4 kHz (0.15 MHz ~ 30 MHz), Scan time: auto.

Note: All the modes have been tested, only the worst data was recorded in the report.



## 8. ANTENNA REQUIREMENTS

### APPLICABLE REQUIREMENTS

Please refer 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. 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.

### RESULTS

Complies

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**END OF REPORT**