FCC Test Report

(PART 95 Subpart L)

Report No.:	RFBCKS-WTW-P25050539
FCC ID:	LXC-V2X-OBU-5931
Test Model:	OBU-5931
Received Date:	2024/7/15
Tested Date:	2025/6/4 ~ 2025/7/4
Issued Date:	2025/7/11
Applicant:	DENSO International America, Inc.
Address:	2251 Rutherford Road Suite 100, Carlsbad, California, 92008-8815 United States
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	(1) No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan (2) No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
FCC Registration / Designation Number:	(1) 788550 / TW0003 (2) 281270 / TW0032

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RFBCKS-WTW-P25050539	Original Release	2025/7/11

1 Certificate of Conformity

Product:	On-Board Unit
Brand:	MobiQ
Test Model:	OBU-5931
Sample Status:	Engineering sample
Applicant:	DENSO International America, Inc.
Tested Date:	2025/6/4 ~ 2025/6/30
Standards:	FCC Part 95, Subpart L FCC Part 2

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Pettie Chen , **Date:** 2025/7/11

Pettie Chen / Senior Specialist

Approved by : Jeremy Lin , **Date:** 2025/7/11

Jeremy Lin / Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 95 & Part 2			
Standard / Clause	Test Item	Result	Remarks
FCC 47 CFR Part 95.3204	OBU Transmit Power	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1049	Occupied bandwidth	Pass	Meet the requirement of limit.
FCC 47 CFR Part 95.3205	Out-of-Band Emissions (OOBE)	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1055	Frequency Stability	Pass	Meet the requirement of limit.
FCC 47 CFR Part 95.3205	Radiated Spurious	Pass	Meet the requirement of limit.

Notes: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3 dB
	30 MHz ~ 1 GHz	2.93 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.76 dB
	18 GHz ~ 40 GHz	1.77 dB
OBU Transmit Power	-	1.371 dB
Occupied bandwidth	-	72 Hz
Conducted emission	9kHz ~ 40GHz	2.79 dB
Frequency Stability	-	0.176 ppm

2.2 Test Instruments

For all test except Frequency Stability

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower KaiTuo	NA	NA	NA	NA
Antenna Tower Controller KaiTuo	KT-2000	NA	NA	NA
Turn Table Max-Full	MFT-151SS-0.5T	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208675	NA	NA
MXE EMI Receiver Agilent	N9038A	MY52260177	2024/9/19	2025/9/18
PXA Signal Analyzer Keysight	N9030B	MY57140488	2025/3/11	2026/3/10
Loop Antenna TESEQ	HLA 6121	45745	2024/8/21	2025/8/20
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-9000	201252(with PAD)	2025/1/14	2026/1/13
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-3000	201250	2025/1/14	2026/1/13
Preamplifier EMCI	EMC330N	980783	2025/1/14	2026/1/13
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-995	2024/10/9	2025/10/8
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-500	201245	2025/1/14	2026/1/13
Horn Antenna RFSPIN	DRH18-E	210104A18E	2024/11/10	2025/11/9
Preamplifier EMCI	EMC118A45SE	980810	2024/12/26	2025/12/25
RF Coaxial Cable EMCI	EMC104-SM-SM-9000	201230	2025/1/14	2026/1/13
RF Coaxial Cable EMCI	EMC104-SM-SM-3000	201242	2025/1/14	2026/1/13
RF Coaxial Cable EMCI	EMC104-SM-SM-1000	210101	2025/1/14	2026/1/13
Preamplifier EMCI	EMC184045SE	980787	2025/1/14	2026/1/13
Horn Antenna Schwarzbeck	BBHA 9170	9170-1048	2024/11/10	2025/11/9
RF Coaxial Cable EMCI	EMC101G-KM-KM-5000	201261	2025/1/14	2026/1/13
RF Coaxial Cable EMCI	EMC101G-KM-KM-3000	201258	2025/1/14	2026/1/13
RF Coaxial Cable EMCI	EMC101G-KM-KM-2000	201254	2025/1/14	2026/1/13

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in WM Chamber 7.

3. Test Date: 2025/6/4 ~ 2025/7/4

For Frequency Stability only

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
3-channel DC power supply JIN YIH Technology	ODP3033	ODP30332128138	NA	NA
Digital Multimeter Fluke	8050A	4660081	2025/06/06	2026/06/05
Spectrum Analyzer R&S	FSU43	101261	2025/4/16	2026/4/15
Software BV	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Temperature & Humidity Chamber Terchy	HRM-120RF	931022	2025/01/09	2026/01/08

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in Oven room.

3. Test Date: 2025/6/30

3 General Information

3.1 General Description of EUT

Product	On-Board Unit
Brand	MobiQ
Test Model	OBU-5931
Status of EUT	Engineering sample
Power Supply Rating	DC12V
Modulation Type	QPSK for OFDM
Channel Bandwidth	20MHz
Operating Frequency	5915MHz [20 MHz channel under 5905–5925 MHz]
Number of Channel	1
Max. EIRP Power	28.18dBm (0.658W)
Antenna Type	Ant. 0: V2X Antenna with 5.18dBi gain Ant. 1: V2X Antenna with 5.50dBi gain
Antenna Connector	Fakra
Accessory Device	NA
Data Cable Supplied	NA
Emission Designator	17M5D1D

Note:

1. This device is OBU without geo-fencing.
2. The WWAN module (Brand: WNC, Model: UMC-MT2731CBN, FCC ID: NKRUMC-MT2731CBN) is collocated in this EUT.
3. Detail antenna specification please refer to antenna datasheet an antenna gain measurement report.
4. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 Power Setting

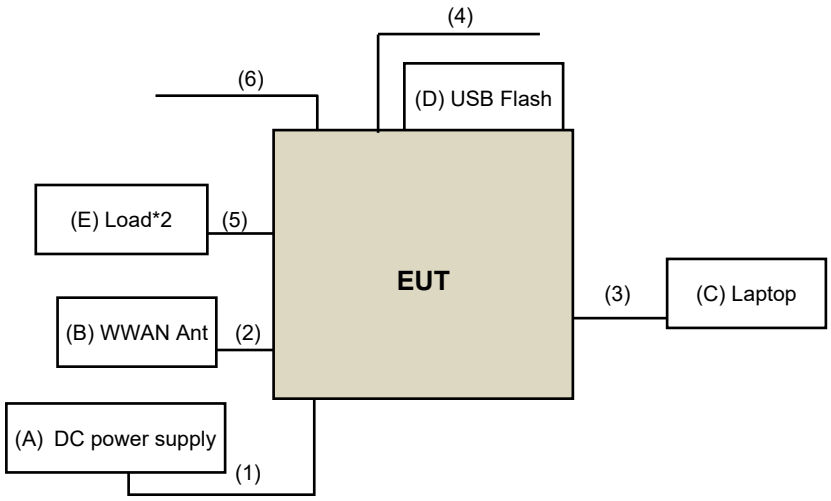
Channel	Power Setting
183	48

3.3 Description of Test Modes

1 channel is for the EUT:

Channel	Frequency (MHz)
183	5915

3.4 Configuration of System under Test



3.4.1 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	DC Power Supply	Topward	6603A	725906	NA	Provided by Lab
B	WWAN Ant	TE	ANT-LTE-WS-SMA	NA	NA	Supplied by applicant
C	Laptop	Lenovo	20J4 MD A003TW	PF-11H9AK	NA	Provided by Lab
D	USB Flash	SanDisk	SDDDC3	032G	NA	Provided by Lab
E	Load	Woken	00700A1AGA001F	NA	NA	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	DC power cable	1	10	No	0	Supplied by applicant
2	WWAN Ant cable	2	3	No	0	Supplied by applicant
3	Micro USB cable	1	1	Yes	0	Supplied by applicant
4	HDMI cable	1	1	Yes	0	Provided by Lab
5	RF cable	1	0.1	Yes	0	Provided by Lab
6	Audio cable	1	1.5	No	0	Provided by Lab

3.5 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports.
The worst case was found when positioned on X-plane. Following channel(s) was (were) selected for the final test as listed below:

EUT Configure Mode	Test Item	Available Channel	Tested Channel
-	OBU Transmit Power	183	183
-	Occupied bandwidth	183	183
-	Out-of-Band Emissions (OOBE)	183	183
-	Frequency Stability	183	183
-	Radiated Spurious	183	183

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
OBU Transmit Power	25deg. C, 70%RH	12Vdc	James Yang
Occupied bandwidth	25deg. C, 70%RH	12Vdc	James Yang
Out-of-Band Emissions (OOBE)	25deg. C, 70%RH	12Vdc	James Yang
Frequency Stability	25deg. C, 70%RH	12Vdc	James Yang
Radiated Spurious	23deg. C, 67%RH	12Vdc	Karl Lee

3.6 EUT Operating Conditions

Controlling software Tera Term version 4.106 has been activated to set the EUT under transmission condition continuously at specific channel frequency.

3.7 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC 47 CFR Part 2

FCC 47 CFR Part 95

KDB 511808 D01 C-V2X v02

ANSI C63.26-2015

Note: All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 C-V2X Transmit Power Measurement

4.1.1 Limits of C-V2X Transmit Power Measurement

OBU EIRP Limits

Channel (MHz)	Channel Bandwidth (MHz)	EIRP with Geofencing outside zone (dBm/BW)	EIRP with Geofencing operating within zone* or without Geofencing (dBm/BW)
5895-5905	10	33	23
5905-5915	10	33	33†
5915-5925	10	33	33†
5895-5915	20	33	23
5905-5925	20	33	33†
5895-5925	30	33	23

*Coordination zones of §90.387(b)[2]
† Reduced to 27dBm within ± 5 degrees of horizontal

4.1.2 Test Procedures

a) OBUs employing C-V2X technologies shall have a maximum EIRP that does not exceed the limits provided in §95.3204. The EIRP is measured as the maximum EIRP toward the horizon or horizontally, whichever is greater, based on the gain associated with the main or center of the transmission beam. The EIRP may be calculated from conducted power measurements using characterized antenna data or the antenna data sheet; however, the antenna data must have sufficient resolution to determine the antenna gain within ±5 degrees from the horizontal plane.

b) Radiated measurements shall be made if there is insufficient resolution in the antenna data to determine compliance. The resolution should be such that the antenna gain can be determined at ±5 degrees elevation. The general test setup is shown in Figure 2. The OBU transmit antenna shall be placed at a height of 1.5 meters and oriented such that the antenna's main lobe is facing parallel to the ground plane. The OBU shall be configured for testing to represent the actual installation.

c) The measurement antenna may be placed at any test distance if it is in the far field of the OBU transmit antenna and at least 3 meters away.*

* Electric field measurements are typically made in terms of dBμV/m and need to be converted to EIRP. This can be accomplished using the following equation: EIRP (dBm) = E0 + 20log10(d) – 104.8 where E0 is the electric field measured in dBμV/m and d is the measurement distance in meters.

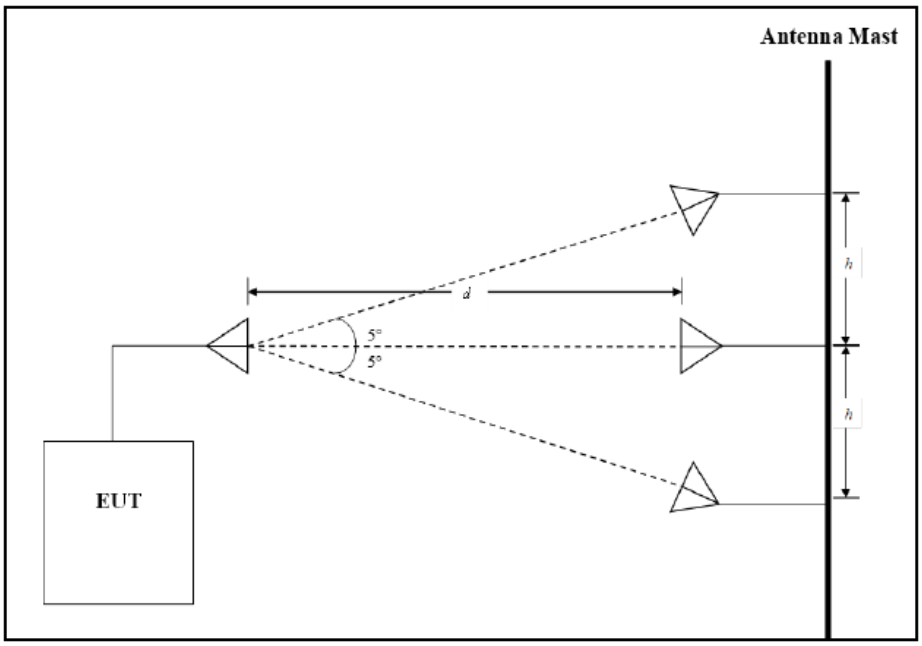
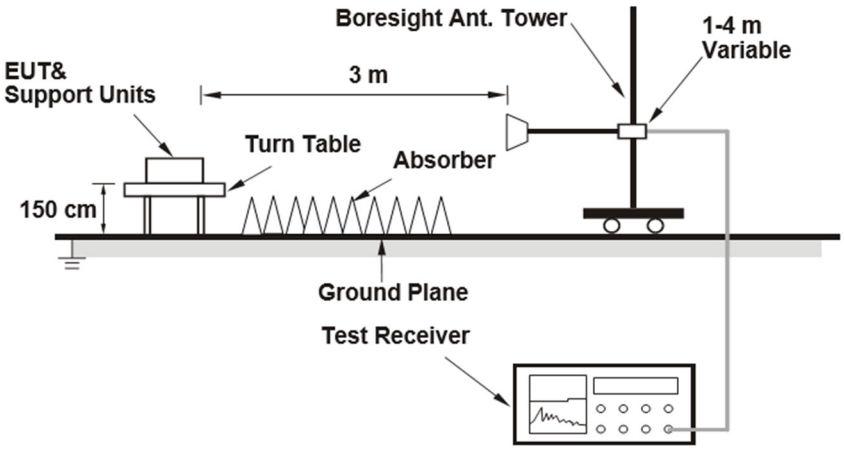


Figure 2. C-V2X OBU Radiated Test Setup Diagram

d) Several operating bands require the beam to be evaluated based on whether the device is transmitting in the coordination zone or operating without geofencing capabilities, as shown in Table 1. To determine compliance in these bands, after the maximum EIRP is measured, the receive measurement antenna shall be elevated to the appropriate height4 relative to the transmit antenna. Measurements or calculations for EIRP shall be performed at the upper and lower edges of the ±5-degree beam width. If the maximum EIRP is less than 27 dBm, then additional testing for ±5 degrees is not required.

e) OBUs with a maximum EIRP > 27 dBm shall describe the mechanism for reducing the main beam power to 27 dBm under §95.3204(a)(5) when the beam is within the ± 5 degrees elevation from the horizontal plane.

4.1.3 Test Setup



4.1.4 Test Results

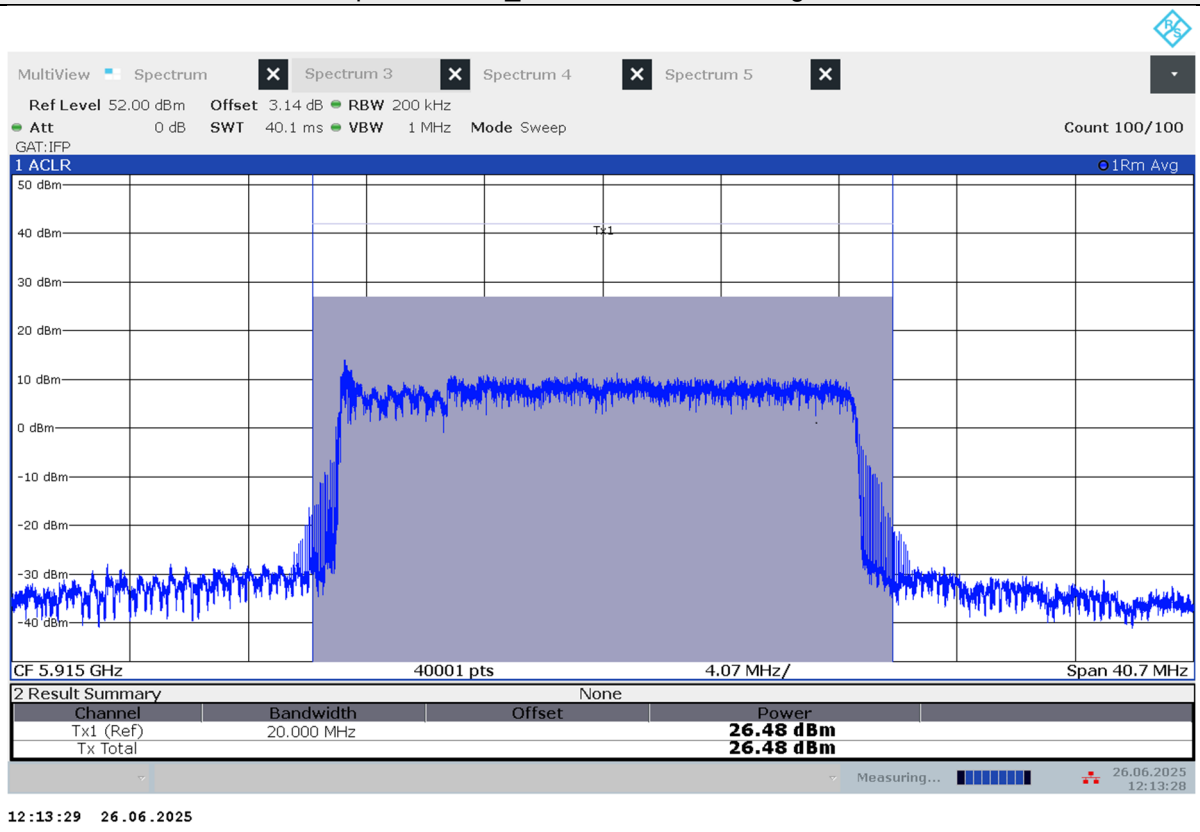
Channel	Channel Frequency (MHz)	Antenna Rotation Range	Raw Value (dBuV)	Cable Factor(dB)	Antenna Factor (dB/m)	Field Strength (dBμV/m)	Polarity
183	5915	±5	80.7	8.5	32.54	121.74	V
183	5915	±5	70.64	8.5	32.54	111.68	H

Note: Field Strength(dBμV/m) =Raw Value (dBuV)+ Antenna Factor(dB/m) + Cable Factor(dB)

Channel	Channel Frequency (MHz)	Antenna Rotation Range	Field Strength (dBμV/m)	Correction Factor(dB)	EIRP (dBm)	EIRP Limit [dBm]	Polarity
183	5915	±5	121.74	-95.26	26.48	≦27	V
183	5915	±5	111.68	-95.26	16.42	≦27	H

Note:
1. EIRP(dBm) = Field Strength(dBμV/m)+ Correction Factor(dB/m)
2. Correction Factor (dB) = 20log(D) – 104.8; where D is the measurement distance at 3 meters.

Spectrum Plot_ Antenna Rotation Range: ±5



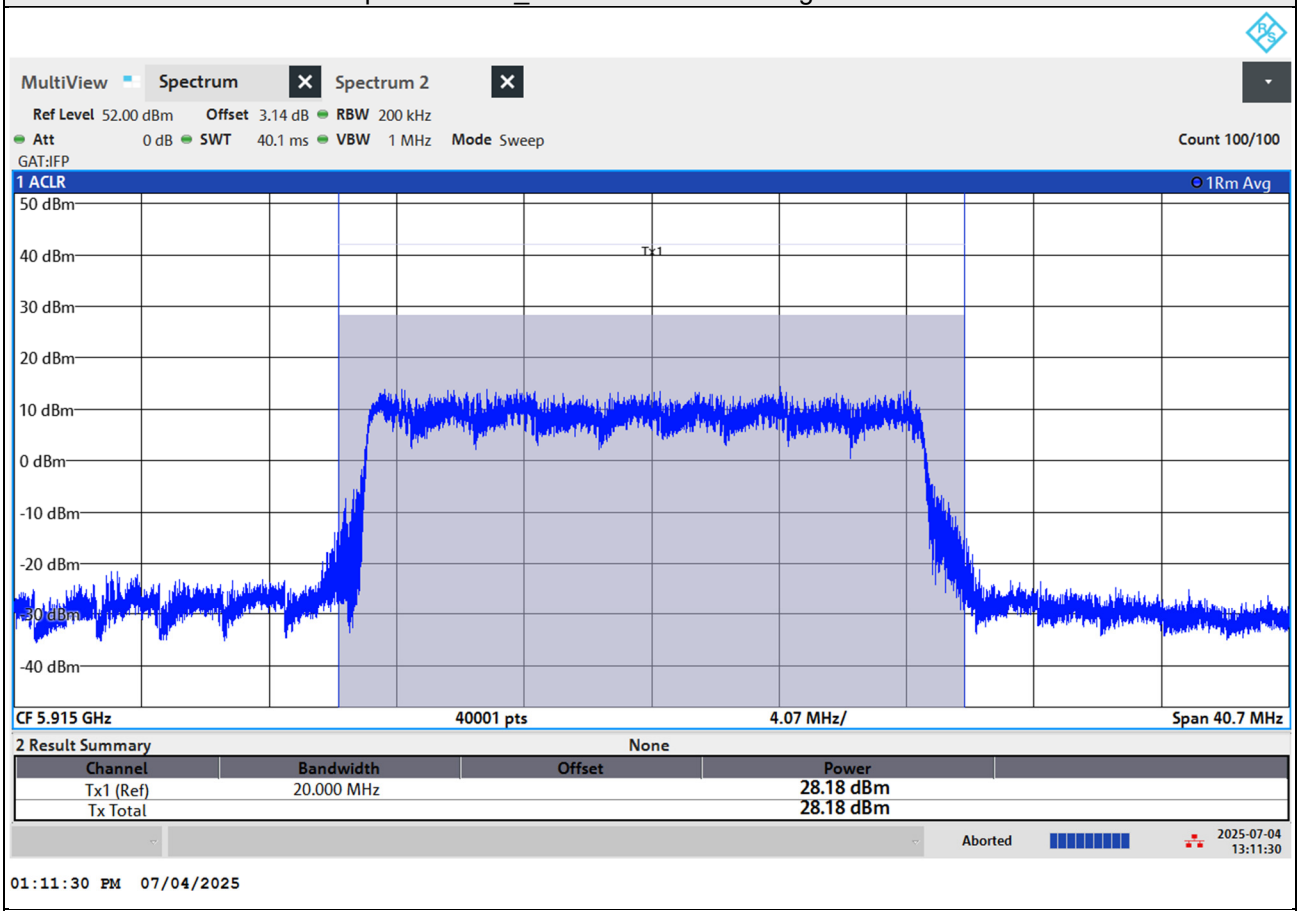
Channel	Channel Frequency (MHz)	Antenna Rotation Range	Raw Value (dBuV)	Cable Factor(dB)	Antenna Factor (dB/m)	Field Strength (dBμV/m)	Polarity
183	5915	Out of ±5	82.4	8.5	32.54	123.44	V
183	5915	Out of ±5	72.43	8.5	32.54	113.47	H

Note: Field Strength(dBμV/m) =Raw Value (dBuV)+ Antenna Factor(dB/m) + Cable Factor(dB)

Channel	Channel Frequency (MHz)	Antenna Rotation Range	Field Strength (dBμV/m)	Correction Factor(dB)	EIRP (dBm)	EIRP Limit [dBm]	Polarity
183	5915	Out of ±5	123.44	-95.26	28.18	≦33	V
183	5915	Out of ±5	113.47	-95.26	18.21	≦33	H

Note:
1. EIRP(dBm) = Field Strength(dBμV/m)+ Correction Factor(dB/m)
2. Correction Factor (dB) = 20log(D) – 104.8; where D is the measurement distance at 3 meters.

Spectrum Plot_ Antenna Rotation Range: Out of ±5



4.2 Occupied Bandwidth Measurement

4.2.1 Limits of Occupied Bandwidth Measurement

The OBW is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

4.2.2 Test Procedure

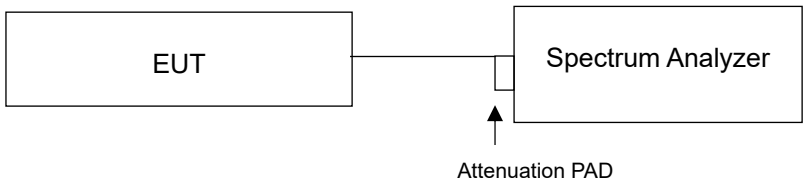
For the occupied bandwidth measurement method, please refer to section 5.4.4 of ANSI C63.26.
The following procedure shall be used for measuring (99%) power bandwidth:

a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).
b. The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
   NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.
d. Set the detection mode to peak, and the trace mode to max-hold.
e. If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.
f. The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

For the 26 dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

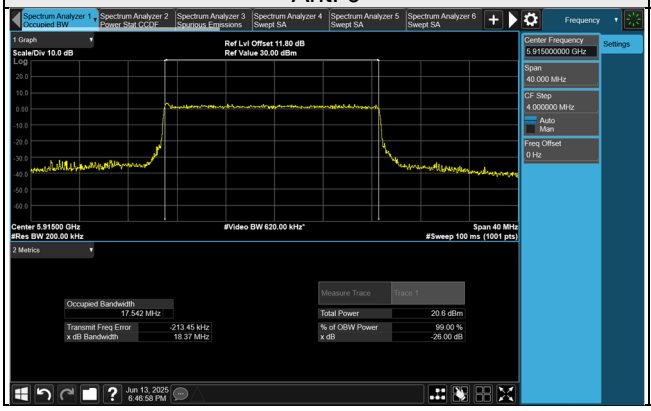
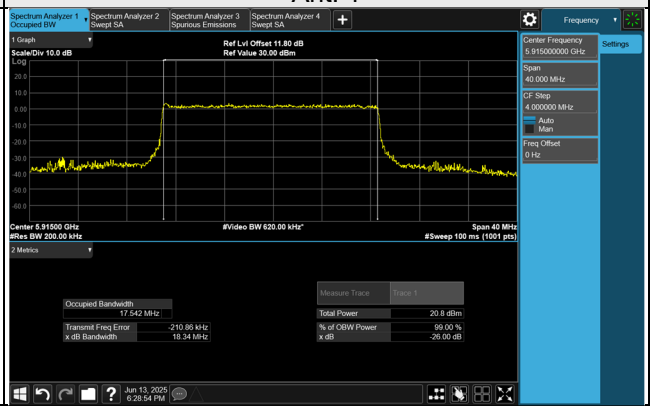
a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
b. The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
d. The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target "−X dB" requirement, i.e., if the requirement calls for measuring the −26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
e. Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
f. Determine the following reference values: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
g. Determine the "−X dB amplitude" as equal to (Reference Value − X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
h. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the "−X dB amplitude" determined in step f). If a marker is below this "−X dB amplitude" value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.
i. The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

4.2.3 Test Setup

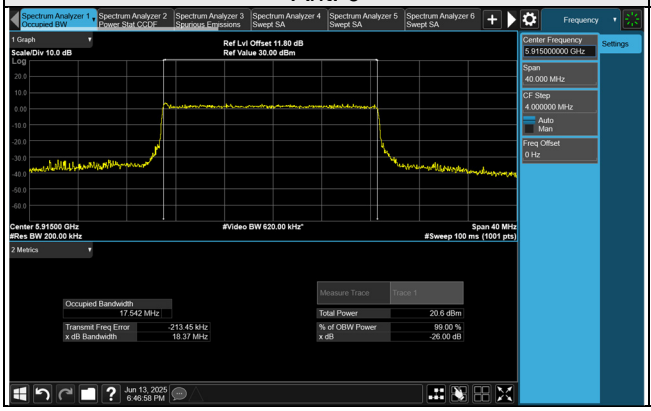
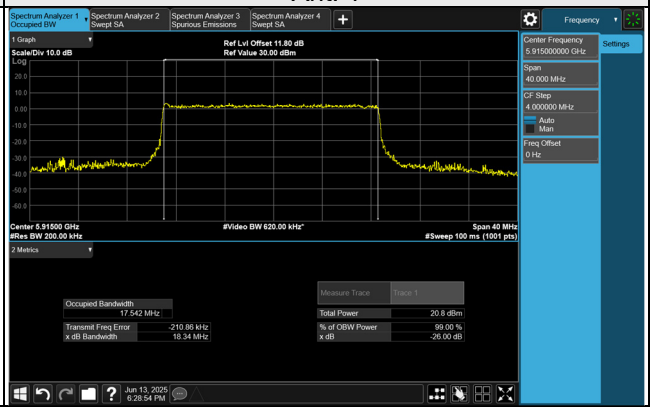


4.2.4 Test Result

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		Ant. 0	Ant. 1
183	5915	17.542	17.542

Spectrum Plot of Worst Value	
Ant. 0	Ant. 1
	

Channel	Frequency (MHz)	26dB Bandwidth (MHz)		Pass/Fail
		Ant. 0	Ant. 1	
183	5915	18.37	18.34	Pass

Spectrum Plot of Worst Value	
Ant. 0	Ant. 1
	

4.3 Out-of-Band Emissions (OOBE) Measurement

4.3.1 Limits of Out-of-Band Emissions (OOBE) Measurement

C-V2X OBUs must comply with the following out-of-band emissions limits. Conducted emissions limits measured at the antenna input shall not exceed:

(1) −16 dBm/100 kHz within ±1 megahertz of the band edges;
(2) −13 dBm/MHz within ±1 megahertz to ±5 megahertz of the band edges;
(3) −16 dBm/MHz within ±5 megahertz to ±30 megahertz of the band edges; and
(4) −28 dBm/MHz beyond 30 megahertz from the band edges.

4.3.2 Test Procedures

RSUs and OBUs must comply with the following guidelines:

a) Conducted limits measured at the antenna input must not exceed:
   1. -16 dBm/100 kHz within ± 1 megahertz of the band edges.
   2. -13 dBm/MHz within ± 1 megahertz to ± 5 megahertz of the band edges.
   3. -16 dBm/MHz within ± 5 megahertz to ± 30 megahertz of the band edges and
   4. -28 dBm/MHz beyond 30 megahertz from the band edges.

b) Compliance can be verified using an RMS average detector.
c) The general test methods of ANSI C63.26, section 5.7.3 and 5.7.4 shall be used.
d) There is no requirement as to how the plots are to be formatted or displayed, as long as all applicable data is presented.
e) For example, if the lab possesses a spectrum analyzer capable of performing segmented measurements with control of RBW, VBW, sweep time, number of points, detector type, etc., per segment, then all the segments from 1. – 4. in a) above, may appear on one single plot as shown in Figure 3.
f) When using the emission mask for plots or segments, ensure that the spectrum analyzer's automatic measurement feature is enabled to clearly display the "pass" or "fail" result on the plot as shown in Figure 3.

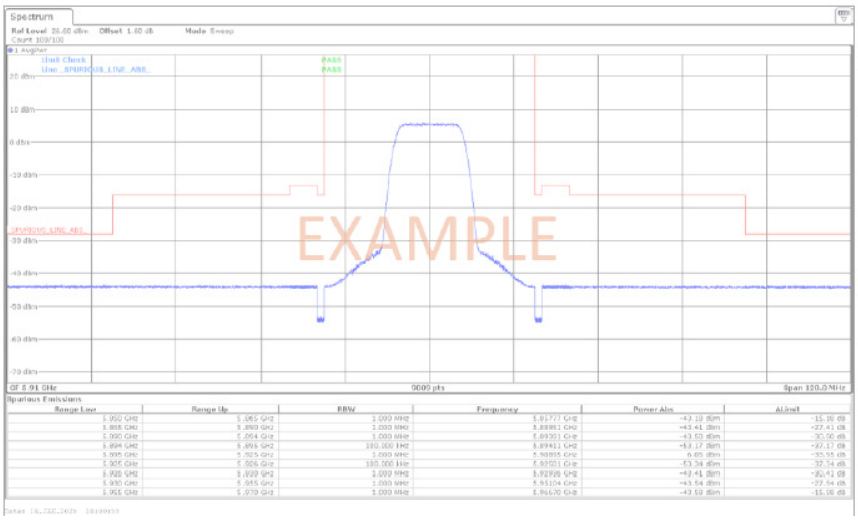
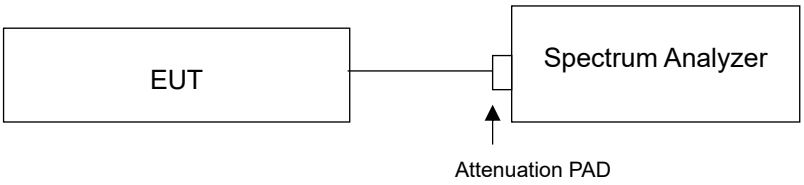


Figure 3. Example of C-V2X OOBE limits plot

g) If this method is used, then the report shall also include an example table from one channel displaying the RBW, VBW, sweep time, number of points, detector, etc. for each range in the emission mask.

h) If individual segments are measured, and the pertinent information, RBW, VBW, sweep time, number of points, etc. are displayed on the plot, then there is no need to add an additional sweep list table.
i) For devices with MIMO capabilities, follow the procedures specified in KDB Publication 662911 for summing emissions or adjusting emission levels measured on individual outputs by 10 log (N_{ANT}), where N_{ANT} is the number of outputs.
j) Testing shall be performed on all potential channel bandwidths and all potential power outputs which the RSU or OBU is capable of transmitting. If the RSU or OBU is capable of carrier aggregation (e.g., transmit a 10 MHz and 20 MHz channel simultaneously) then these combinations shall also be investigated. Care shall be taken to evaluate the impact of intermodulation while additional carriers are active and multiple configurations are possible (e.g., varying resource block configurations for 4G LTE).
k) Measurements shall be performed up to 40 GHz.
l) In addition to conducted measurements, the RSU or OBU shall also be tested for cabinet radiation with the antenna output terminated into a load.

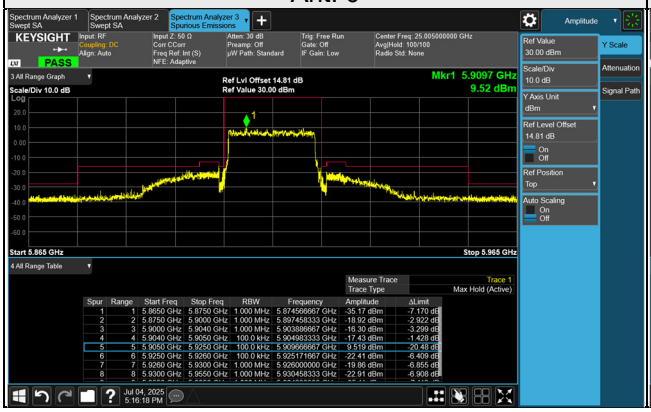
4.3.3 Test Setup



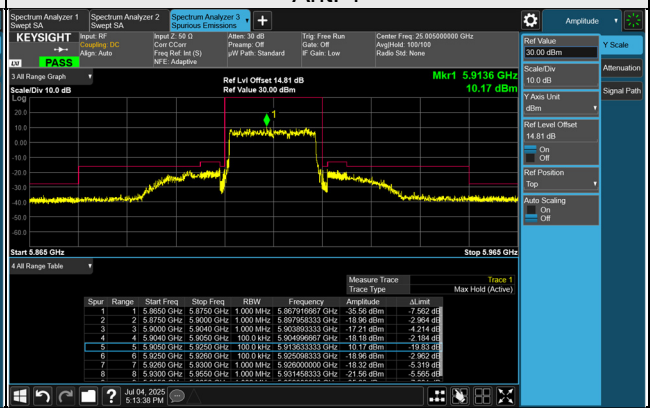
4.3.4 Test Results

CH183 5915MHz

Ant. 0

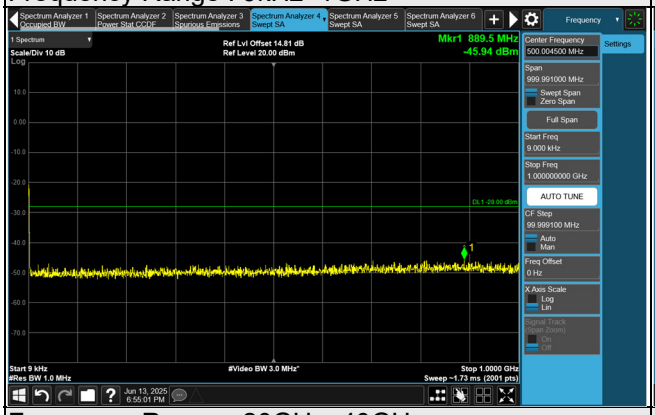
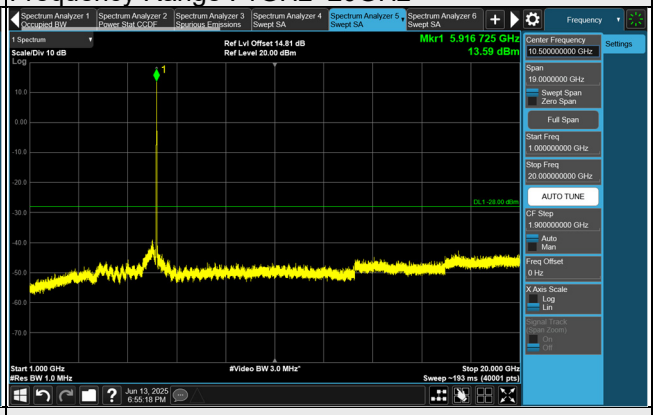
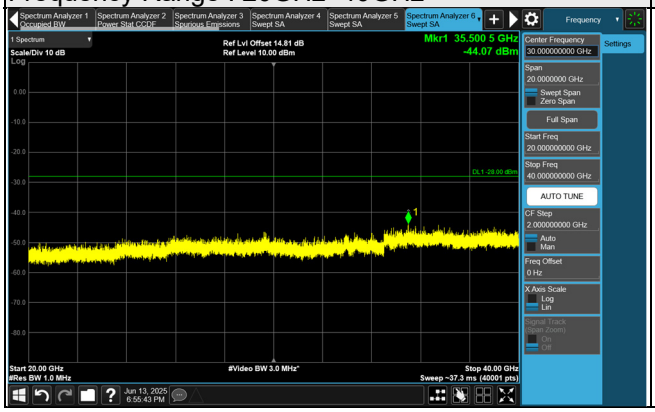


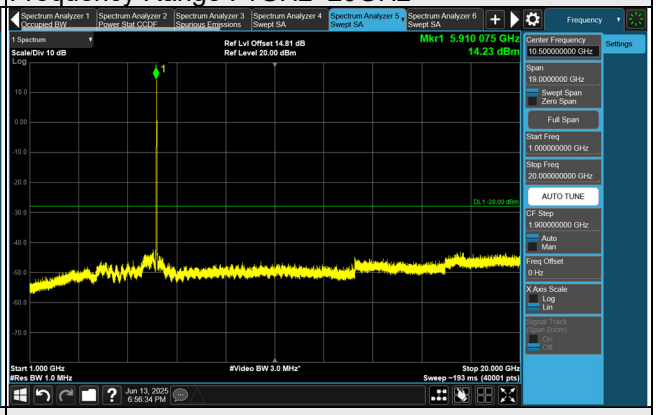
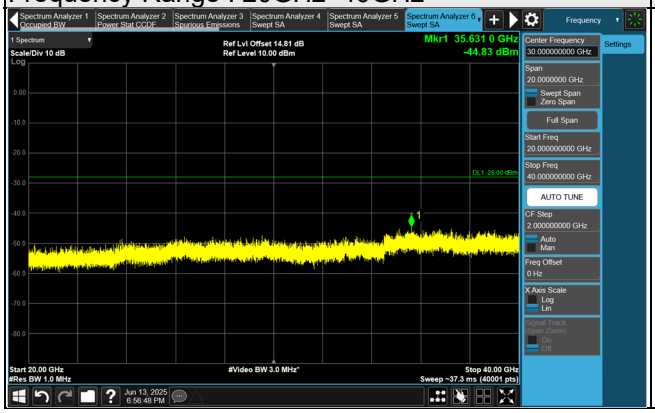
Ant. 1



Note. The ant.0/ant.1 ref level offset 14.81 = 10dB(Attenuator) + 1dB(Cable loss) + 0.8dB(connector loss) + 3.01dB(MIMO factor)

	Range 1	Range 2	Range 3	Range 4	Range 5	Range 6	Range 7	Range 8	Range 9
Range Start	5.865 GHz	5.875 GHz	5.900 GHz	5.904 GHz	5.905 GHz	5.925 GHz	5.926 GHz	5.930 GHz	5.955 GHz
Range Stop	5.875 GHz	5.900 GHz	5.904 GHz	5.905 GHz	5.925 GHz	5.926 GHz	5.930 GHz	5.955 GHz	5.965 GHz
RBW	1MHz	1MHz	1MHz	100kHz	100kHz	100kHz	1MHz	1MHz	1MHz
VBW	3MHz	3MHz	3MHz	300kHz	300kHz	300kHz	3MHz	3MHz	3MHz
Sweep Time Mode	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto
Sweep Time	1 ms	1 ms	1 ms	1 ms	1 ms	1 ms	1 ms	1 ms	1 ms
Sweep Point	601	601	601	601	601	601	601	601	601
Detector	RMS	RMS	RMS	RMS	RMS	RMS	RMS	RMS	RMS
Test Results	Pass	Pass	Pass	Pass	-	Pass	Pass	Pass	Pass

Ant. 0	
Channel 183	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~20GHz
	
Frequency Range : 20GHz~40GHz	
	

Ant. 1	
Channel 183	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~20GHz
	
Frequency Range : 20GHz~40GHz	
	

4.4 Frequency Stability Measurement

4.4.1 Limits of Frequency Stabiliity Measurement

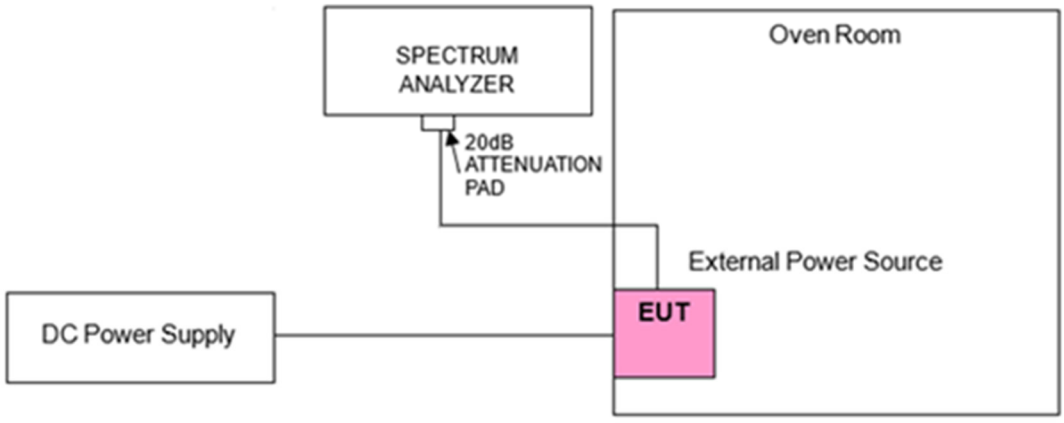
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

4.4.2 Test Procedure

a. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
b. EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ±0.5℃ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

Note: The frequency error was recorded frequency error from the spectrum analyzer.

4.4.3 Test Setup



4.4.4 Test Results

Frequency Error vs. Voltage

Voltage (Vdc)	CH183	
	Frequency (MHz)	Frequency Error (ppm)
12	5914.999997	-0.000507
9	5914.999999	-0.000169
16	5915.000002	0.000338

Note: The applicant defined the normal working voltage is 12Vdc.

Frequency Error vs. Temperature

Temp. (℃)	CH183	
	Frequency (MHz)	Frequency Error (ppm)
-30	5914.999995	-0.000845
-20	5915.000002	0.000338
-10	5915.000003	0.000507
0	5914.999996	-0.000676
10	5914.999999	-0.000169
20	5914.999998	-0.000338
30	5915.000003	0.000507
40	5914.999996	-0.000676
50	5915.000002	0.000338
60	5915.000003	0.000507
70	5914.999997	-0.000507

4.5 Radiated Spurious

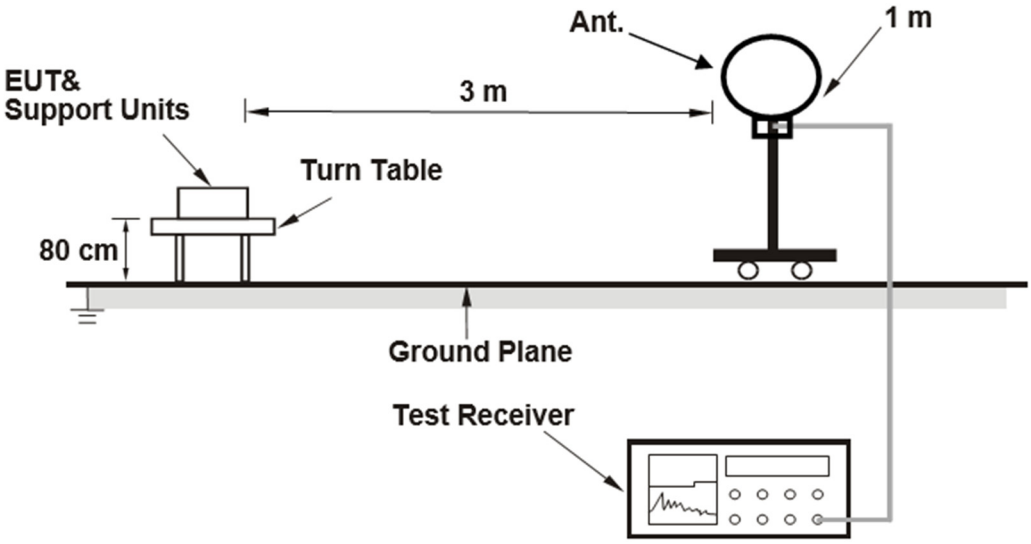
4.5.1 Limits of Radiated Spurious

Conducted emissions limits measured at the antenna input shall not exceed:

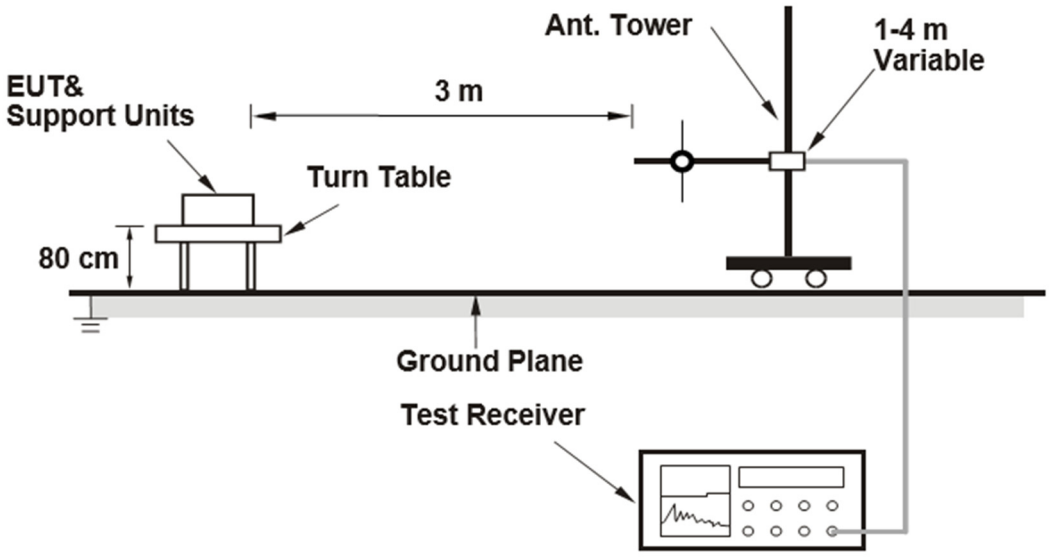
(1) −16 dBm/100 kHz within ±1 megahertz of the band edges;
(2) −13 dBm/MHz within ±1 megahertz to ±5 megahertz of the band edges;
(3) −16 dBm/MHz within ±5 megahertz to ±30 megahertz of the band edges; and
(4) −28 dBm/MHz beyond 30 megahertz from the band edges.

4.5.2 Test Setup

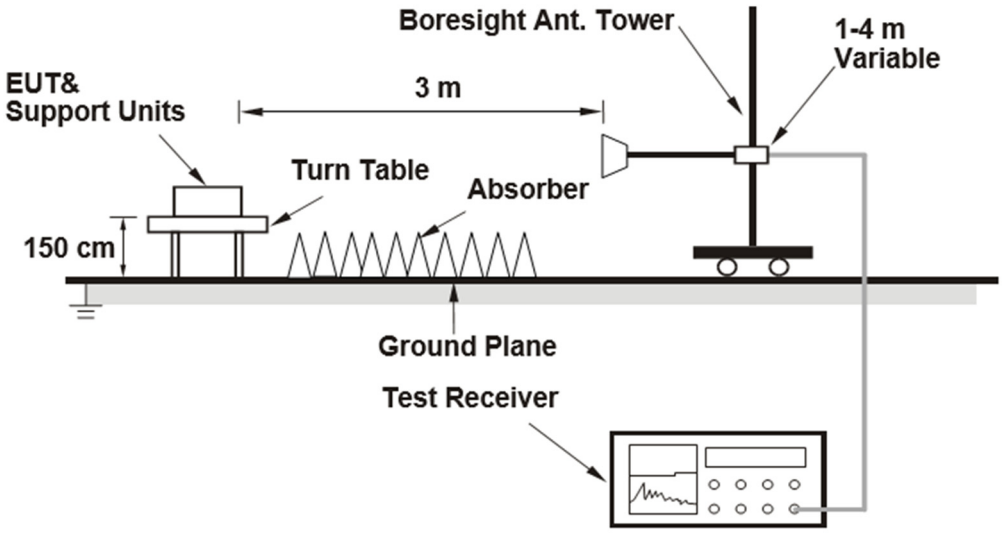
For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



For radiated emission above 1 GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.5.3 Test Procedure

For Radiated emission below 1GHz

a. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
b. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
c. Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
d. Following ANSI C63.26 section 5.5 and 5.2.7
e. EIRP (dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m.
f. ERP (dBm) = E (dBμV/m) + 20log(D) - 104.8 - 2.15; where D is the measurement distance (in the far field region) in m.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz. Set detector = average.
2. The amplitude of spurious emissions in the range 9 kHz to 30 MHz which are attenuated more than 20 dB below the permissible value need not be reported.

For Radiated emission above 1GHz

a. In the semi-anechoic chamber, EUT placed on the 1.5 m height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
b. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
c. Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
d. Following ANSI C63.26 section 5.5 and 5.2.7
e. EIRP (dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m.
f. ERP (dBm) = E (dBμV/m) + 20log(D) - 104.8 - 2.15; where D is the measurement distance (in the far field region) in m.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz. Set detector = average.

4.5.4 Test Results

Below 1GHz

Mode	TX channel 183	Frequency Range	Below 1000 MHz
Environmental Conditions	23 °C, 67 % RH	Input Power	12Vdc
Tested By	Karl Lee		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	81.41	-47.03	-28.00	-19.03	1.50 H	133	61.89	-108.92
2	156.10	-53.28	-28.00	-25.28	1.00 H	135	50.27	-103.55
3	183.26	-50.08	-28.00	-22.08	2.00 H	85	55.18	-105.26
4	272.50	-49.24	-28.00	-21.24	2.00 H	201	53.51	-102.75
5	399.57	-55.29	-28.00	-27.29	1.00 H	22	44.61	-99.90
6	533.43	-54.89	-28.00	-26.89	1.00 H	30	42.57	-97.46
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	46.49	-45.68	-28.00	-17.68	1.50 V	249	58.63	-104.31
2	**73.65**	**-45.06**	**-28.00**	**-17.06**	**1.50 V**	**249**	**62.02**	**-107.08**
3	242.43	-52.56	-28.00	-24.56	1.50 V	14	51.75	-104.31
4	383.08	-49.73	-28.00	-21.73	1.00 V	147	50.39	-100.12
5	499.48	-55.93	-28.00	-27.93	1.99 V	167	42.11	-98.04
6	616.85	-54.38	-28.00	-26.38	1.50 V	341	41.11	-95.49

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

Above 1GHz

Mode	TX channel 183	Frequency Range	1GHz ~ 40GHz
Environmental Conditions	23 °C, 67 % RH	Input Power	12Vdc
Tested By	Adair Peng		

Antenna Polarity & Test Distance : Horizontal at 1.5 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	11830.00	-47.10	-28.00	-19.10	1.33 H	152	32.91	-80.01
Antenna Polarity & Test Distance : Vertical at 1.5 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	11830.00	-46.65	-28.00	-18.65	1.84 V	115	33.36	-80.01

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: http://ee.bureauveritas.com.tw

The address and road map of all our labs can be found in our web site also.

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