



FCC PART 95L C-V2X WAIVER REPORT



Applicant:	Cohda Wireless Pty Ltd.
Address:	27 Greenhill Road Wayville SA 5034 Australia

Manufacturer or Supplier	Cohda Wireless Pty Ltd.
Address	27 Greenhill Road Wayville SA 5034 Australia
Product	On board (Transceiver) unit for Automotive.
Brand Name	Cohda Wireless
Model Name	MK6 OBU
Series Model	MK6 OBU
FCC ID	2AEGPMK6OBU
Date of tests	Sep.25, 2023 ~ Oct. 16, 2023

The tests have been carried out according to the requirements of the following standard:

☒ **KDB511808 D01 C-V2X Waiver v01,ANSI C63.26-2015**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Chao Wu Engineer / Mobile Department	Approved by Peibo Sun Manager / Mobile Department
 Date: Oct. 16, 2023	 Date: Oct. 16, 2023

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
PSU-QSU2307030110RF12	Original release	Oct. 16, 2023



1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 95			
No.	Test Description	Remark	Test result
1	Occupied bandwidth	Applicable	Compliance
2	C-V2X Transmit Power	Applicable	Compliance
3	Emissions Mask	Applicable	Compliance

*Test Lab Information Reference

Lab :

Huarui 7Layers High Technology (Suzhou) Co., Ltd.

Lab Address:

Tower N, Innovation Center, 88 Zhuyi Road, High-tech District, Suzhou City, Anhui Province

The FCC Site Registration No. is 434559; The Designation No. is CN1325.



1.1 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	UNCERTAINTY
Average EIRP	$\pm 4.70\text{dB}$
Occupied Channel Bandwidth	$\pm 43.58\text{KHz}$

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.



1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Pre-Amplifier	R&S	SCU18F1	100815	Aug.30,22	Aug.29,24
Pre-Amplifier	R&S	SCU08F1	101028	Sep.16,22	Sep.15,24
Signal Generator	R&S	SMB100A	182185	Feb.16,22	Fed.15,24
3m Fully-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EM C-01Chamber	Nov.24,22	Nov.23,25
3m Semi-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EM C-02Chamber	Nov.24,22	Nov.23,25
EMI TEST Receiver	R&S	ESW44	101973	Feb.25,22	Feb.24,24
Bilog Antenna	SCHWARZBECK	VULB 9163	1264	Feb.28,22	Feb.27,24
Horn Antenna	ETS-LINDGREN	3117	227836	Aug.22,22	Aug.21,24
Biconical Antenna	SCHWARZ	VUBA 9117	69250	Nov.14,22	Nov.13,24
Horn Antenna (18GHz-40GHz)	Steatite Q-par Antennas	QMS 00880	23486	Feb.23,22	Feb.22,24
Horn Antenna	Steatite Q-par Antennas	QMS 00208	23485	Aug.22,22	Aug.21,24
Loop Antenna	SCHWARZ	HFH2-Z2/Z2E	100976	Feb.23,22	Feb.22,24
WIDEBANDRADIO COMMUNICATION TESTER	R&S	CMW500	169399	Jun.27,22	Jun.26,24
Test Software	ELEKTRA	ELEKTRA4.32	N/A	N/A	N/A
Open Switch and Control Unit	R&S	OSP220	101964	N/A	N/A
DC Source	HYELEC	HY3010B	551016	Aug.31,22	Aug.30,24
Hygrothermograph	DELI	20210528	SZ014	Sep.06,22	Sep.05,24
PC	LENOVO	E14	HRSW0024	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-7.00M	N/A	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-4.00M	N/A	N/A	N/A
CABLE	R&S	W13.02	N/A	Apr.28,23	Oct.27,23
CABLE	R&S	W12.14	N/A	Apr.28,23	Oct.27,23
CABLE	R&S	J12J103539-00-1	SEP-03-20-069	Arp.28,23	Oct.27,23
CABLE	R&S	J12J103539-00-1	SEP-03-20-070	Arp.28,23	Oct.27,23
Temperature Chamber	votsch	VT4002	58566078100050	May.31,22	May.30,24

NOTE:

1. The calibration interval of the above test instruments is 6 months or 24 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in 3m Fully-anechoic Chamber.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 434559; The Designation No. is CN1325.



1.3 TEST ENVIRONMENT

Environment Parameter	96~98 kPa Selected Values During Tests	
Relative Humidity	40-60 % RH Ambient	
Value	Temperature(℃)	Voltage(V)
NTNV	25	12
LTLV	-20	10.2
LTHV	-20	13.8
HTLV	75	10.2
HTHV	75	13.8
Remark:		
NV: Normal Voltage LV: Low Extreme Test Voltage HV: High Extreme Test Voltage NT: Normal Temperature LT: Low Extreme Test Temperature HT: High Extreme Test Temperature		
The EUT was tested by adjustable DC power supply.		



2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT*	On board (Transceiver) unit for Automotive.	
BRAND NAME*	Cohda Wireless	
MODEL NAME*	MK6 OBU	
SERIES MODEL*	MK6 OBU	
NOMINAL VOLTAGE*	12V DC	
EXTREME TEMPERATURE*	-20°C and 75°C	
MODULATION TYPE*	C-V2X	BPSK,QPSK,16QAM,64QAM
OPERATING FREQUENCY*	C-V2X	5895 MHz – 5925 MHz
ANTENNA GAIN*	C-V2X	ANT 0: 5.0 dBi ANT 1: 5.0 dBi
ANTENNA TYPE*	C-V2X	Dipole Antenna
FCC ID*	2AEGPMK6OBU	
HW VERSION*	Rev 1.0	
SW VERSION*	19.Release.134186	
I/O PORTS*	Refer to user's manual	
CABLE SUPPLIED*	N/A	

NOTE:

1. *Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information , Test Lab is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.
2. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
3. The EUT incorporates a SISO function. Physically, the EUT provides two transmitters and two receivers. Both ICs share the 2 X C-V2X antenna ports through the use of RF switches and combiners but MK6 does not support MIMO on C-V2X.

MODULATION MODE	TX/RX FUNCTION
BPSK (1/2,3/4)	2TX /2RX
QPSK (1/2,3/4)	2TX /2RX
16QAM (1/2,3/4)	2TX /2RX
64QAM (2/3,3/4)	2TX /2RX

4. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.



List of Accessory:

ACCESSORIES	MANUFACTURER	ANTENNA TYPE	MODEL
2x Antenna for LTE/2G/3G/CDMA	Taoglas	Monopole Antenna	TG.66.0723
1x Antenna for WLAN/BT	Taoglas	Monopole Antenna	GW.05.0E23
1x Antenna for WLAN	Taoglas	Monopole Antenna	GW.05.0E23
2x Antenna for C-V2X	MobileMark	DOM Antenna	MGWG-303
2x Antenna for DSRC	MobileMark	DOM Antenna	MGWG-303
1x Antenna for GNSS	MobileMark	DOM Antenna	MGWG-303



2.2 DESCRIPTION OF TEST MODES

Under part 2 subpart J of the Commission rules to permit operation of cellular vehicle-to-everything (C-V2X) technology in the upper 30 megahertz (5895-5925 MHz) of the 5.9 GHz band (5850- 5925 MHz).

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
Occupied bandwidth	25deg. C, 60%RH	12Vdc (host equipment)	Chao Wu
C-2VX Transmit Power	25deg. C, 60%RH	12Vdc (host equipment)	Chao Wu
Emissions Mask	25deg. C, 60%RH	12Vdc (host equipment)	Chao Wu



2.3 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 standard:

ANSI C63.26-2015

KDB 511808 D01

All tests have been performed and recorded as per the above standard.



2.4 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photograph of the test configuration for reference.

For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).

2.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together without any other necessary accessories or support units.

For test

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	PC	Lenovo	ThinkPad E14	HRSW00024	N/A
2	DC Source	HYELEC	HY3010B	551016	N/A
3	Ethernet	N/A	N/A	N/A	N/A
4	CAN Connector	N/A	N/A	N/A	N/A

NO.	DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	DC Line: Unshielded, Detachable, 1.0m;
2	PC USB Line: Unshielded, Detachable, 1.0m;
3	CAN Box: Unshielded, Detachable, 1.8m;
4	Ethernet: Unshielded, Detachable, 0.8m;
5	Router:Unshielded, Detachable, 2.0m;



3. TEST TYPES AND RESULTS

3.1 OCCUPIED BANDWIDTH

3.1.1 LIMIT OF OCCUPIED BANDWIDTH

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.

3.1.2 TEST PROCEDURES

1.FOR 99 PERCENT OCCUPIED BANDWIDTH

2.The following procedure shall be used for measuring (99 %) power bandwidth:

3. Set center frequency to the nominal EUT channel center frequency.

4.Set span = 1.5 times to 5.0 times the OBW.

5. Set RBW = 1 % to 5 % of the OBW

6. Set VBW $\geq 3 \cdot$ RBW

7. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

8. Use the 99 % power bandwidth function of the instrument (if available).

9. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

10.FOR 26dB BANDWIDTH

11.Set RBW = approximately 1% of the emission bandwidth.

12.Set the VBW > RBW.

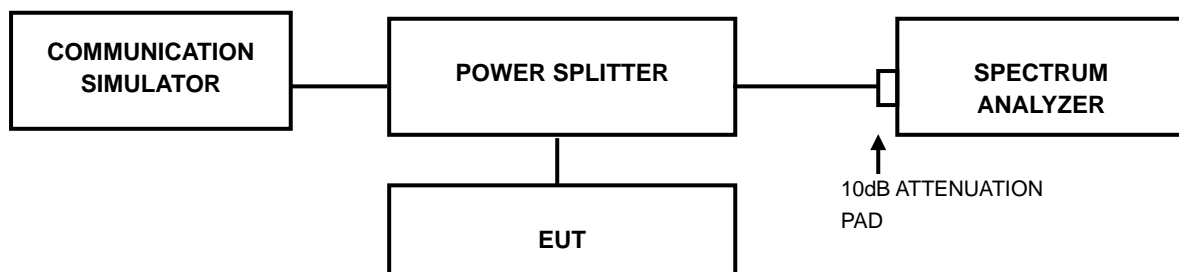
13.Detector = Peak.

14. Trace mode = max hold.

15.Measure the maximum width of the emission that is 26 dB down from the peak of the emission.

Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

3.1.3 TEST SETUP





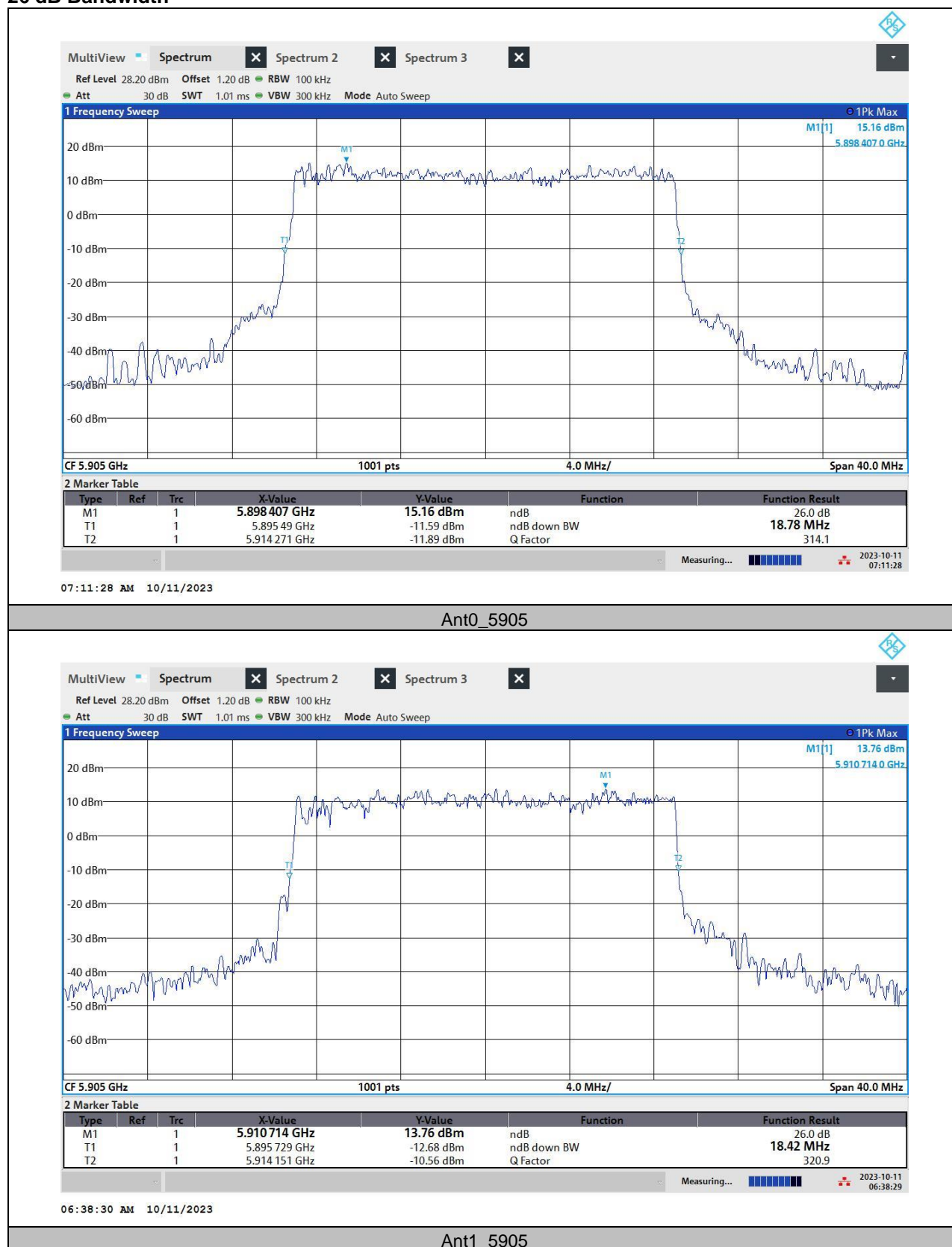
3.1.4 TEST RESULTS

TEST MODE	Channel	Antenna	Occupied Bandwidth (MHz)	26db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
C-V2X	5905	ANT0	17.80	18.78	5898.407	5914.271	---	PASS
		ANT1	17.92	18.42	5910.714	5914.151	---	PASS
	5910	ANT0	17.89	18.58	5906.723	5919.231	---	PASS
		ANT1	17.92	18.42	5913.117	5919.191	---	PASS
	5915	ANT0	17.86	18.46	5917.518	5924.111	---	PASS
		ANT1	17.85	18.46	5909.366	5924.231	---	PASS



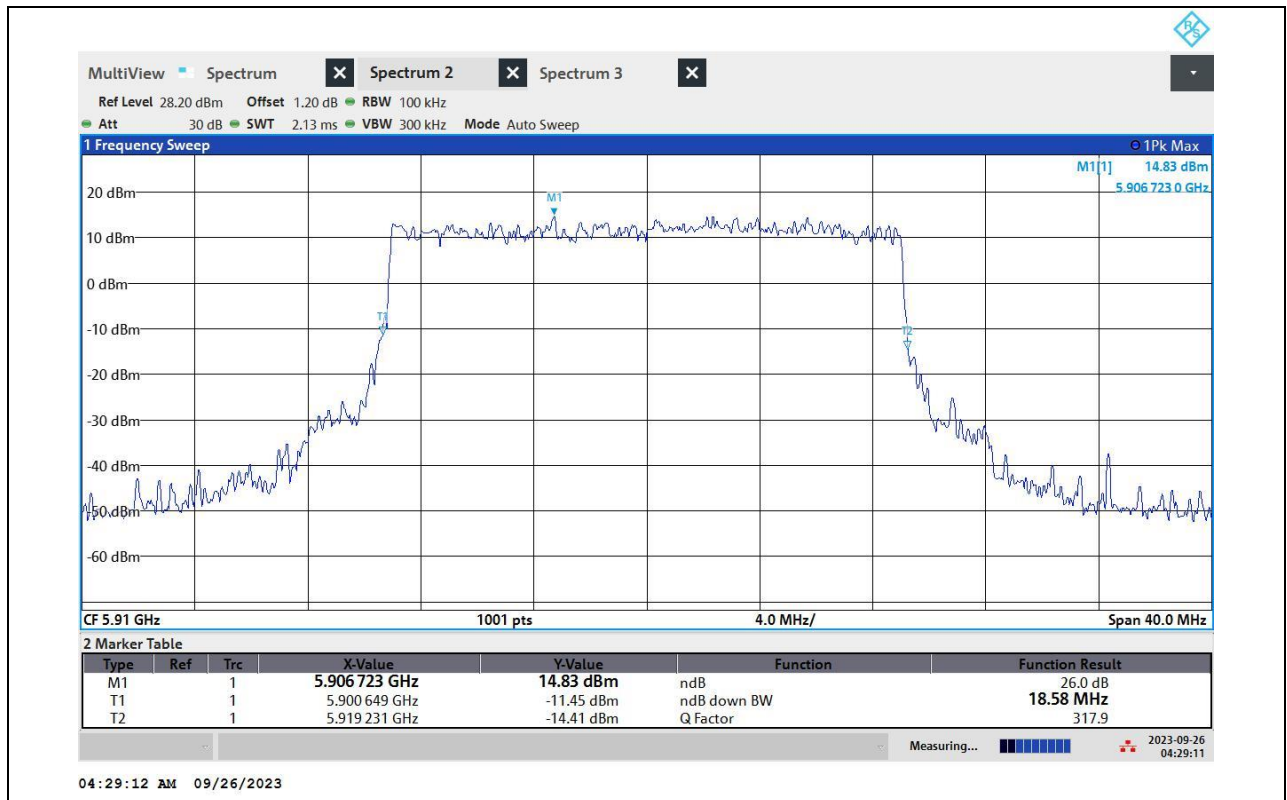
TEST GRAPHS

26 dB Bandwidth





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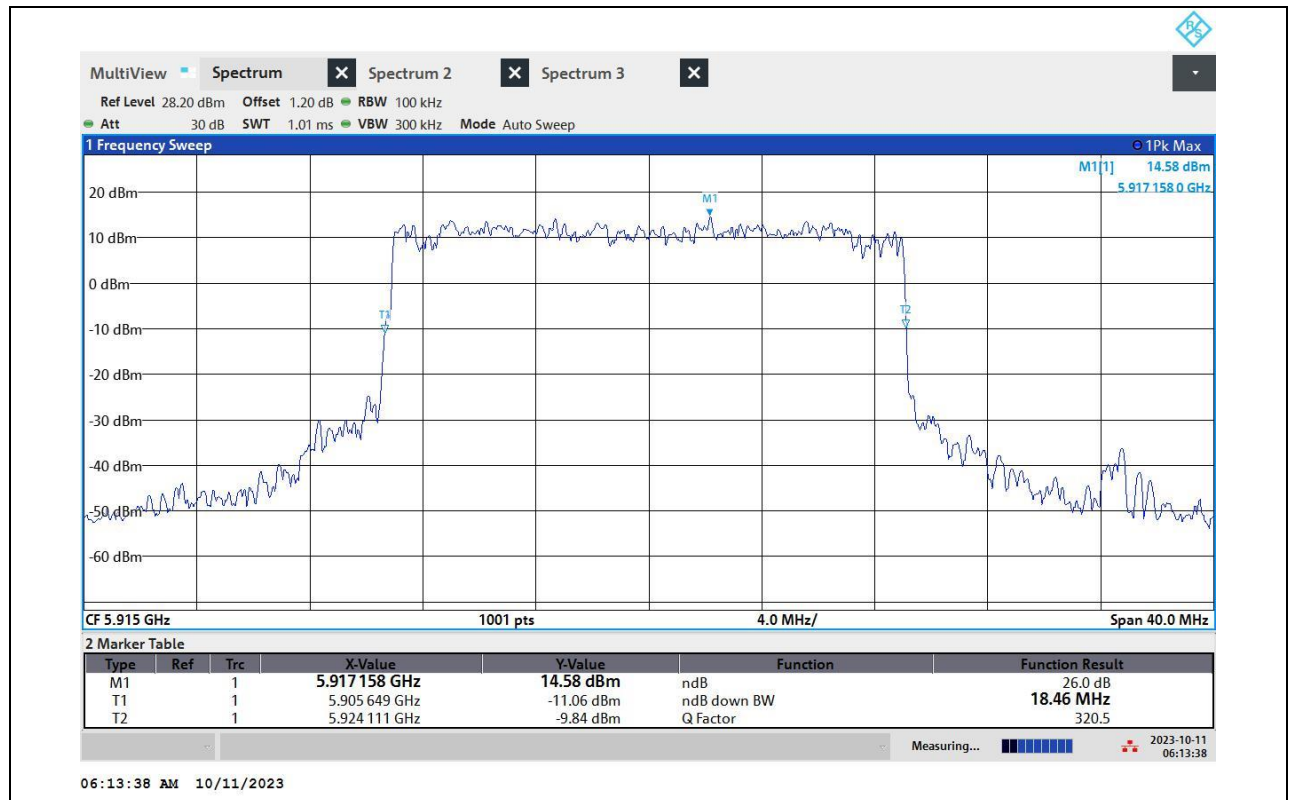
Ant0_5910



Ant1_5910



BUREAU VERITAS Test Report No.: PSU-QSU2307030110RF12



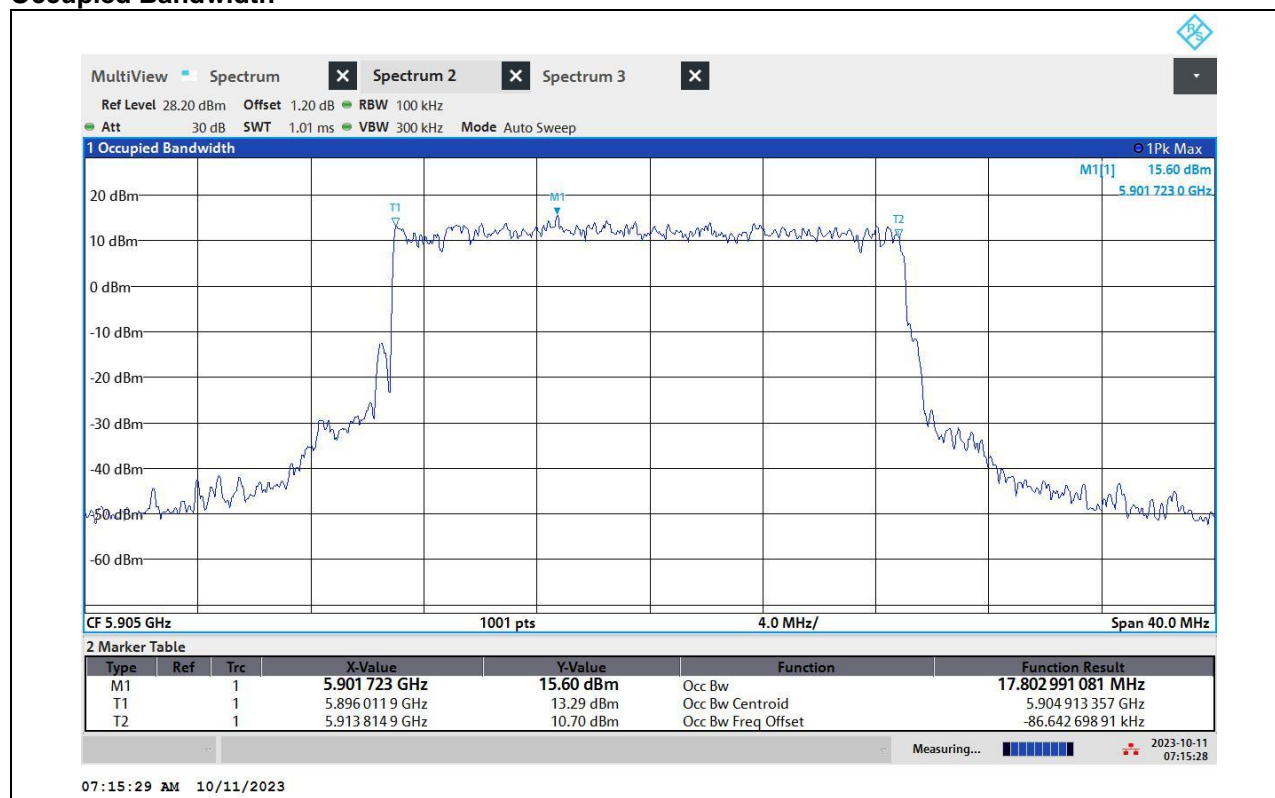
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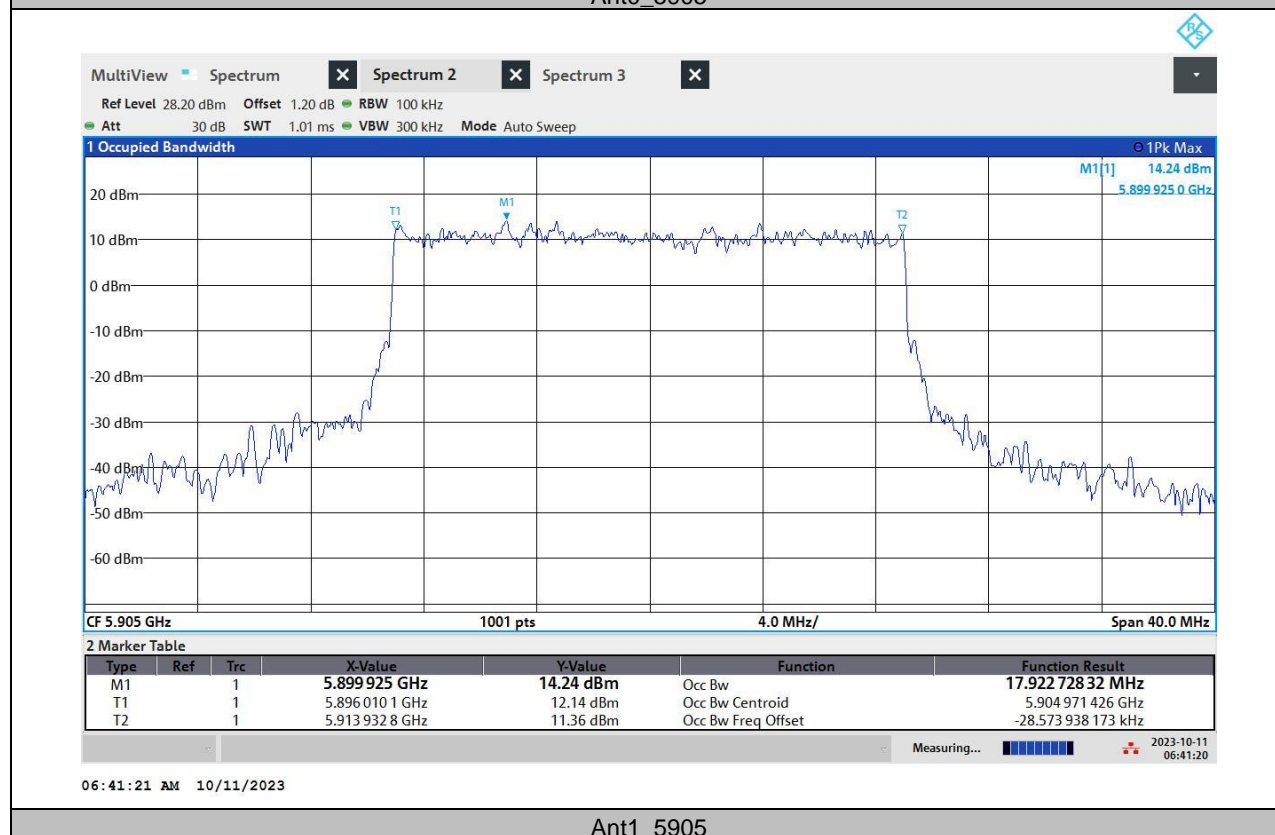
Ant1_5915



Occupied Bandwidth



Ant0_5905

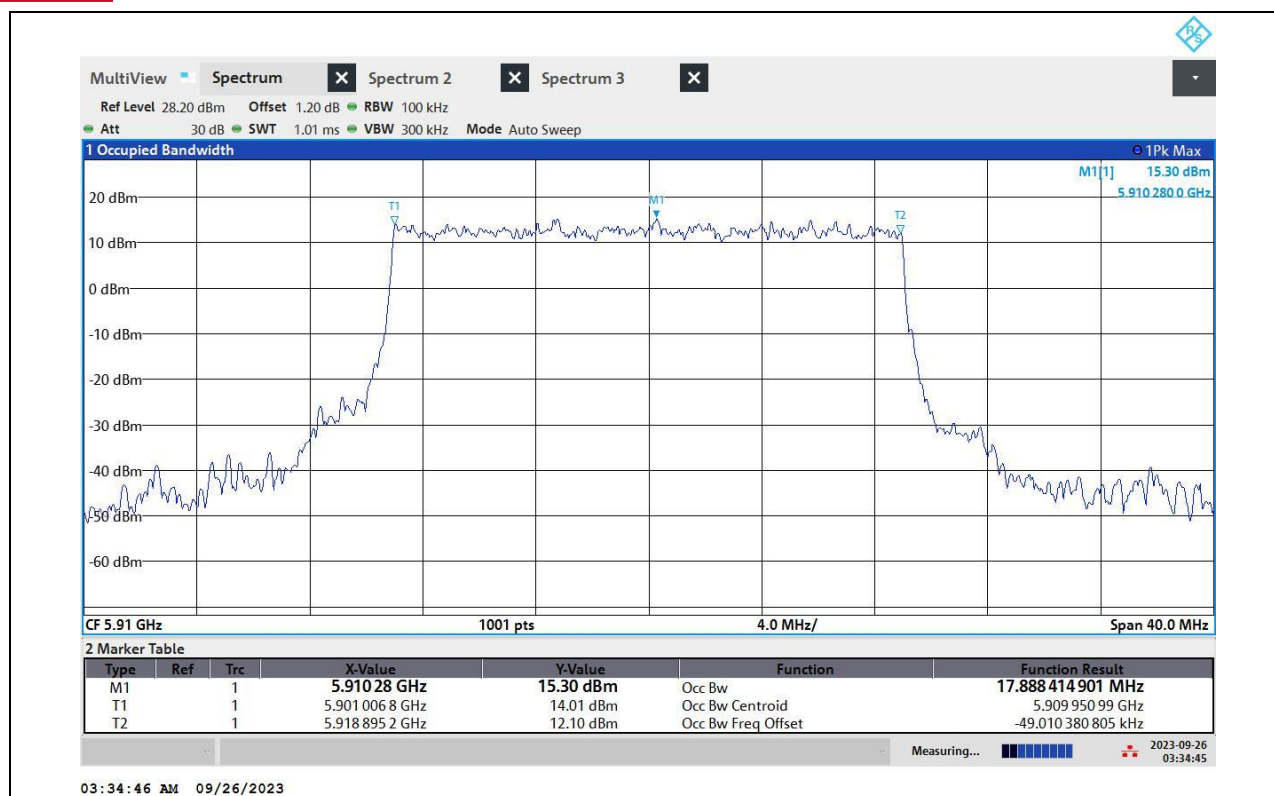


Ant1_5905

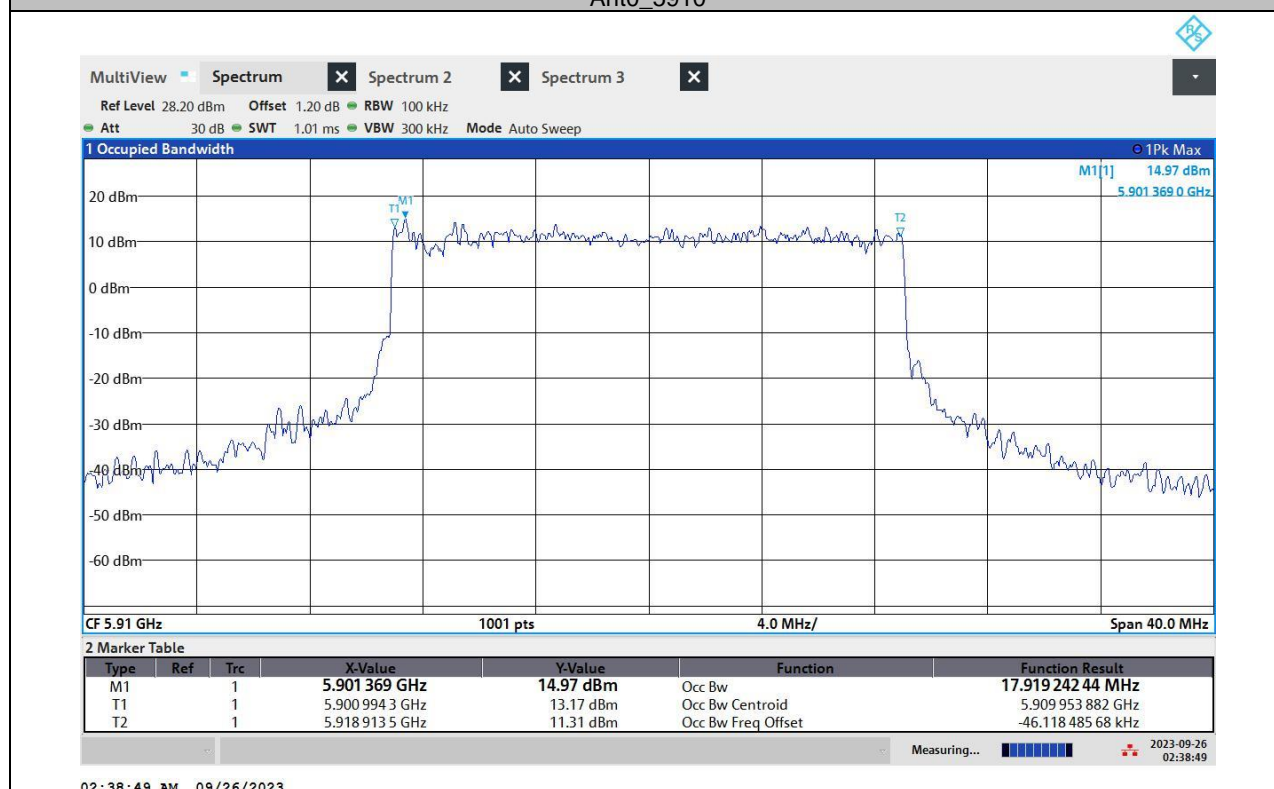


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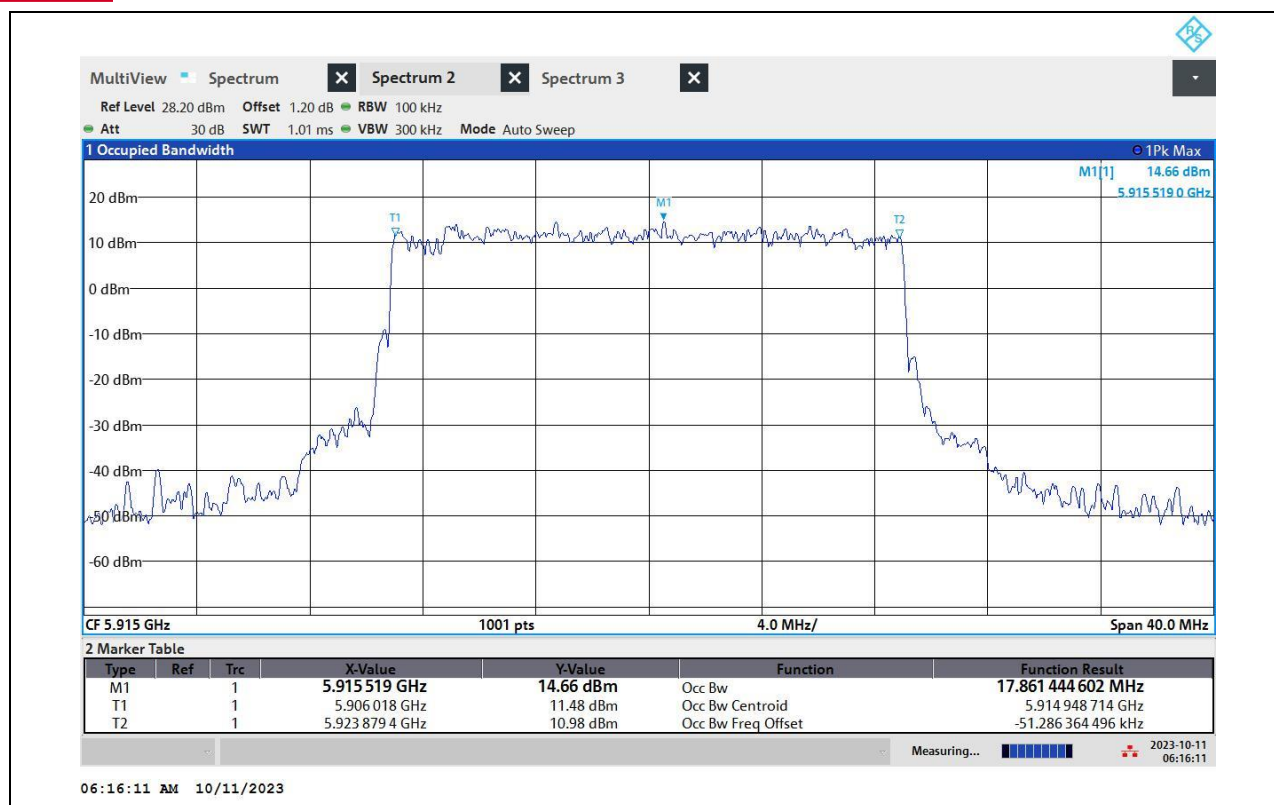
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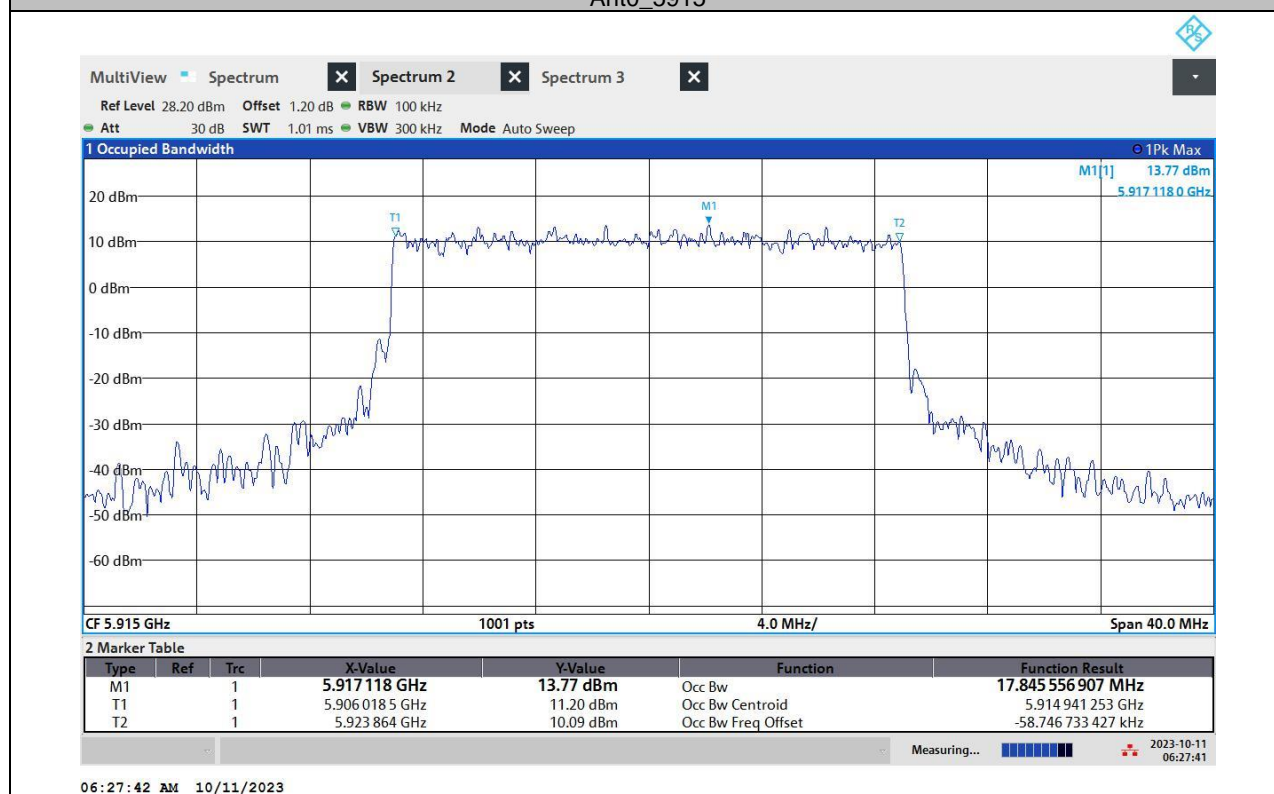
Ant1_5910



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Ant0_5915



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3.2 C-2VX TRANSMIT POWER

3.2.1 LIMITS

C-V2X OBU and RSU Operations

Frequency Range	Channel Bandwidth	OBU Limits	RSU EIRP Limit
5905-5925 MHz	20 MHz	33 dBm EIRP*; 27dBm EIRP within 5 degrees of horizontal	33 dBm EIRP

*EIRP (equivalent isotropically radiated power)

3.2.2 TEST PROCEDURES

According to requirements of 511808 D01 C-V2X Waiver v01, OBU Transmit Power Test Procedures :

- The on-board unit (OBU) EIRP shall not exceed the limits provided in the relevant waiver grant. The EIRP may be calculated from the conducted measurement using antenna test data or the antenna data sheet; however, the antenna data must have sufficient resolution to determine the EIRP in the waiver grant-provided elevation from the horizontal plane.
- Radiated emission measurements are necessary if there is not sufficient resolution in antenna data to determine compliance. The general test setup is shown in Figure 1. The OBU transmit antenna shall be placed at an elevation of 1.5 meters and oriented such that the main lobe of the antenna is facing parallel to the ground plane. The OBU shall also be configured for testing in a manner that is representative of the actual installation.
- The measurement antenna may be placed at any test distance provided that it is in the far field of the OBU transmit antenna and at least 3 meters away.

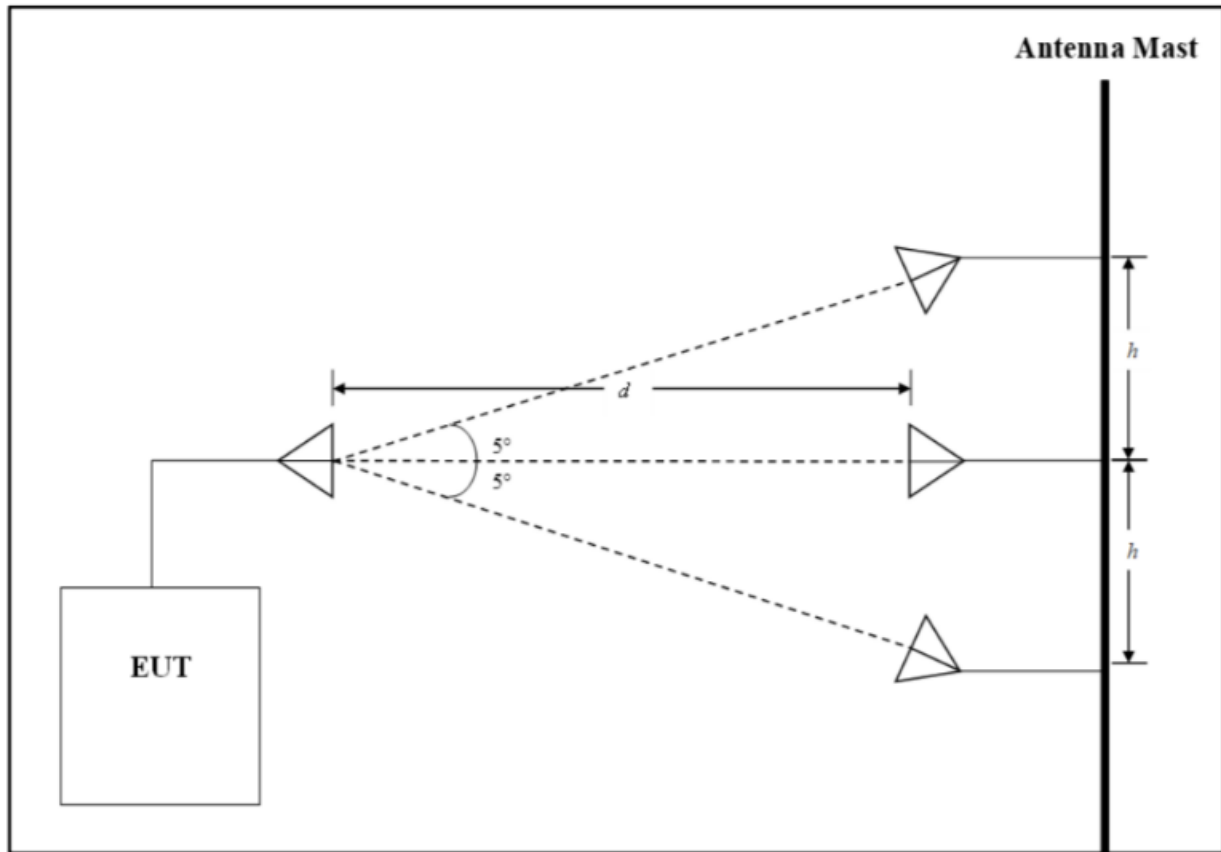


Figure 1. C-V2X OBU Radiated Test Setup Diagram

- d. An investigation shall be performed to ensure that the peak antenna gain is being measured. Once determined, the main lobe of the receive measurement antenna shall be configured such that it is boresight or coincident to the main lobe of the transmit antenna.
- e. After the peak EIRP is measured, the receive measurement antenna shall be elevated to the appropriate height as provided in the waiver grant relative to the transmit antenna.³ The measurement antenna shall also be rotated up or down such that the transmit antenna remains in the main lobe of the measurement antenna.



3.2.3 TEST SETUP

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

3.2.4 TEST RESULTS

Test Mode	Freq. [MHz]	Antena	EIRP (dBm)		EIRP Limit [dBm]	Verdict
			Peak Power [dBm]	Avg. Power [dBm]		
C-V2X	5905	ANT0	16.19	13.93	≤27.00	PASS
		ANT1	15.93	12.66	≤27.00	PASS
	5910	ANT0	16.21	13.58	≤27.00	PASS
		ANT1	15.07	12.39	≤27.00	PASS
	5915	ANT0	16.35	14.21	≤27.00	PASS
		ANT1	15.74	13.78	≤27.00	PASS



3.3 EMISSIONS MASK

3.3.1 LIMITS

C-V2X Out-of-Band Emissions (OOBE) Limits

Frequency Offset (MHz from Channel Edge)	OOBE EIRP Limits for C-V2X Transmissions (dBm/100 kHz)**
0.0	-16.0
1.0	-22.0
10.0	-30.0
20.0	-40.0

3.3.2 TEST PROCEDURE

According to requirements 511808 D01 C-V2X Waiver v01, An illustration of an emissions mask that may be applicable to RSUs and OBUs can be found in Figure 2.

a. Mask Test Procedure

1. Connect output of the antenna port to a spectrum analyzer or EMI receiver, with appropriate attenuation, as to not damage the instrumentation.
2. Set the reference level of the measuring equipment in accordance with procedure 4.1.5.2 of ANSI 63.10-2013.
3. Measure the 99% occupied bandwidth (OBW) using proper test procedures. This will be used to determine the channel edge.
4. Measure the power spectral density of the channel using the following procedure:
5. Set instrument center frequency to the frequency of channel being measured.
6. Set the span to at least 4 times the OBW.
7. Set resolution bandwidth (RBW) = 100 kHz.
8. Set video bandwidth (VBW) = 30 kHz
9. Number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$.
10. Sweep time = auto.
11. Detector = Peak
12. Trace mode = max hold.
13. Allow trace to fully stabilize.
14. In the case of devices which use multiple-input multiple-output (MIMO) technology, please follow the guidance in 662911 D01 Multiple Transmitter Output v02r01 E) 2) methods a) or c).
15. Use the instrumentation correction factors to account for cable loss and antenna gain since the final result is PSD EIRP. In the case of MIMO devices, please follow the guidance of 662911 D03 MIMO Antenna Gain Measurement v01 in determining aggregate antenna gain.

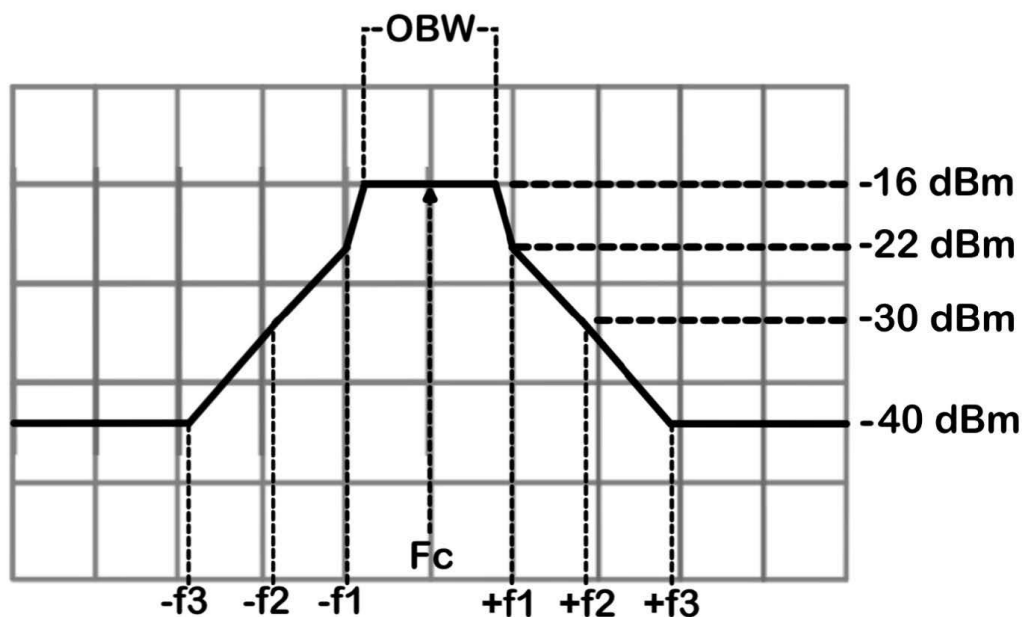


Figure 2

b. For the purposes of developing the emissions mask, the channel edge is defined as the offset from the frequency center (F_c) by $\pm OBW/2$. Keep in mind, the emissions mask is based upon an absolute EIRP value in dBm/100 kHz and not a relative change in amplitude (dBr). Therefore, it is not necessary to adjust the reference level so that the crest of the channel touches the top of the emissions mask. Using the measuring equipment limit line function, develop the emissions mask based on the emissions limits at the frequency offsets specified in the relevant waiver grant. For example, Figure 2 illustrates the emissions mask for the emissions levels at the frequency offsets described below:

1. The top of the mask is the 99% OBW with an emissions level of -16 dBm/100 kHz.
2. $+f_1$ and $-f_1$ is a frequency offset of 1 MHz from the channel edge with an emissions level of -22 dBm/100 kHz.
3. $+f_2$ and $-f_2$ is a frequency offset of 10 MHz from the channel edge with an emissions level of -30 dBm/100 kHz.
4. $+f_3$ and $-f_3$ is a frequency offset of 20 MHz from the channel edge with an emissions level of -40 dBm/100 kHz.



3.3.3 TEST SETUP

Step 1:

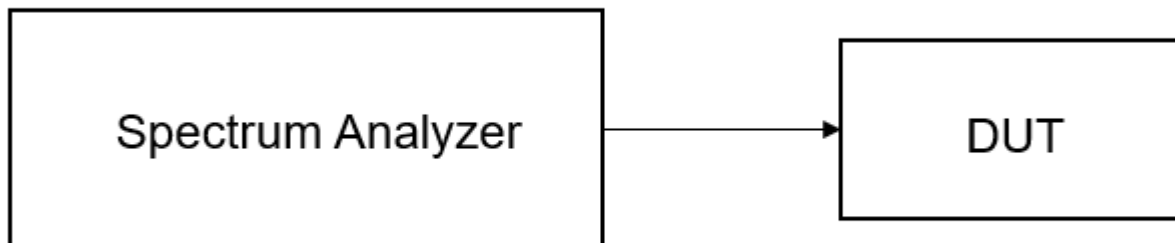
- Connect the DUT transmitter output to the test setup and activate normal operation at maximum output power.

Step 2:

- Measure the average power in the transmission bandwidth ($f_c \pm 4,5$ MHz) using a resolution bandwidth of 100 kHz. This shall be recorded as the "Power Spectral Density at the carrier centre frequency f_c " according to Table 6.

Step 3:

- Measure the power level in the range of $f_c \pm 15$ MHz with a resolution bandwidth of 100 kHz and record these values.
- The video signal of the spectrum analyser can be "gated" such that the spectrum measured is measured $4,0 \mu s$ before the beginning of the transmission to $4,0 \mu s$ after the end of the transmission.





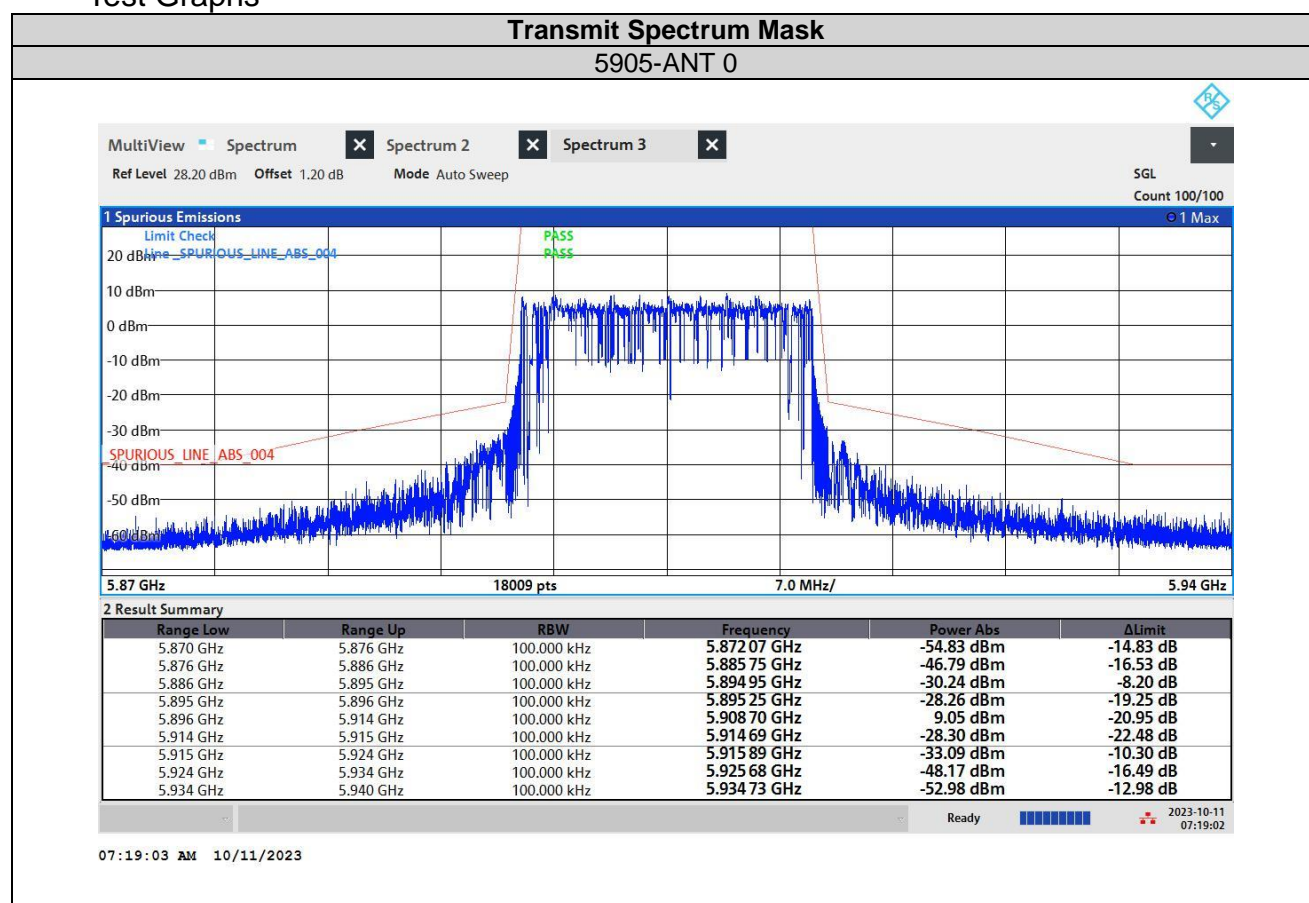
3.3.4 TEST RESULTS

Test Result

TEST MODE	Frequency [MHz]	Measurement Results [dBc]		Limits [dBc]	Results
		ANT0	ANT1		
C-V2X	5905	Note	Note	Note	PASS
	5910	Note	Note	Note	PASS
	5915	Note	Note	Note	PASS

NOTE: Refer to following test plots

Test Graphs

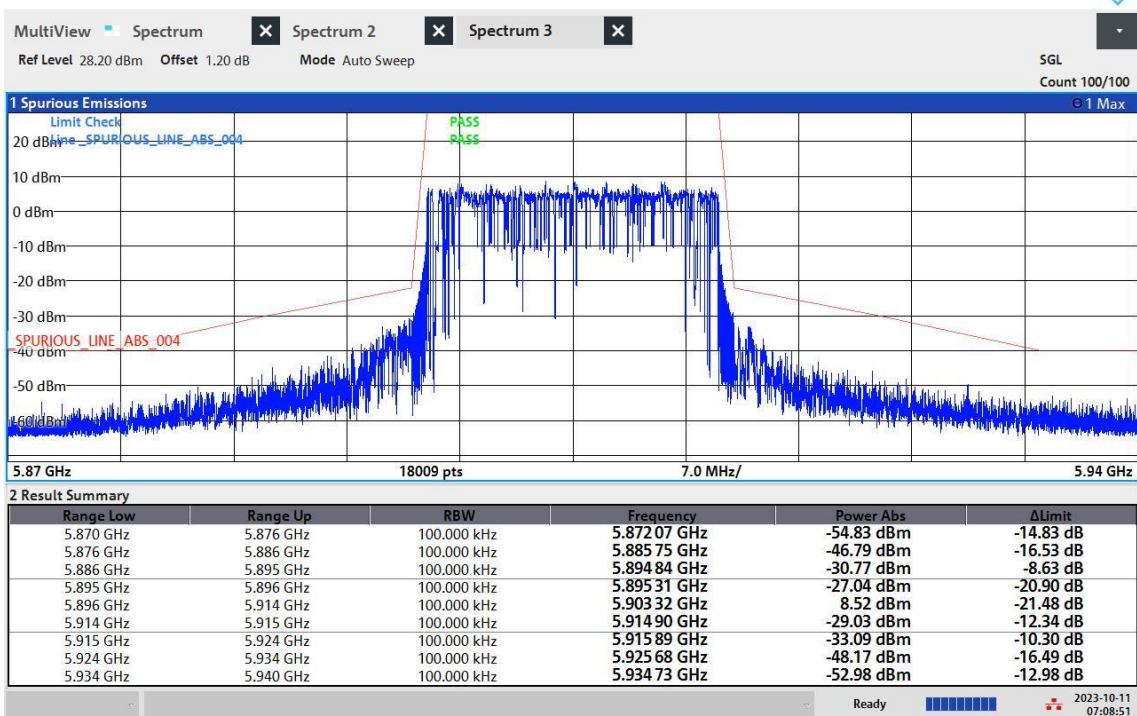




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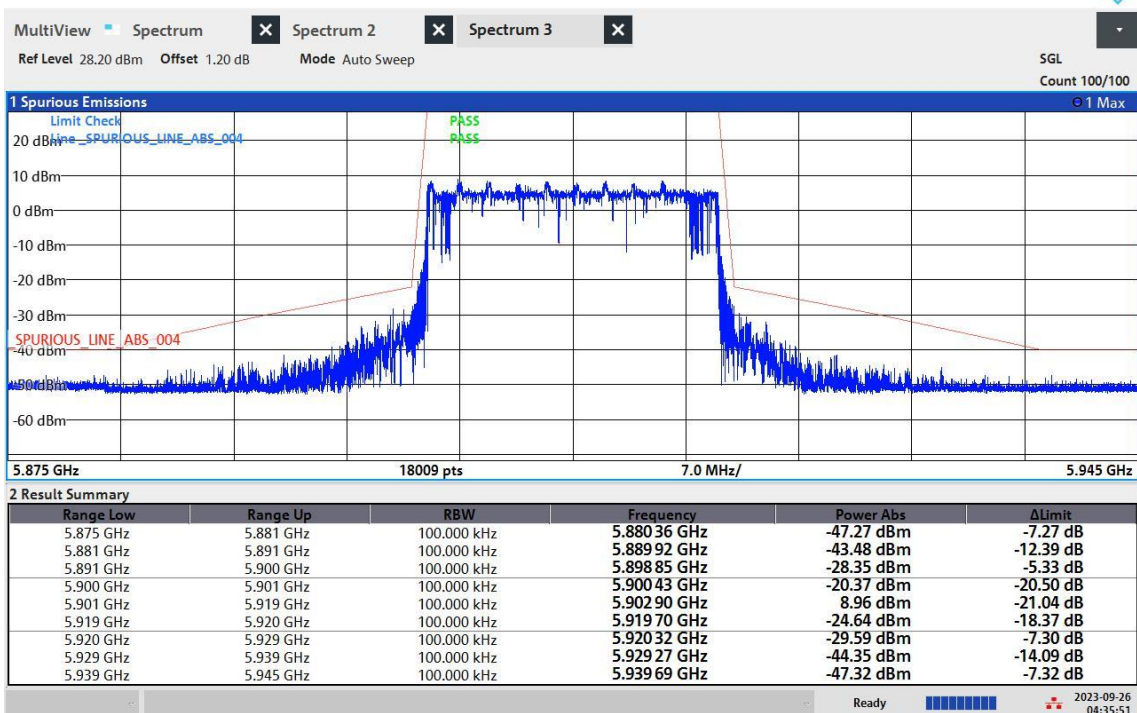
Test Report No.: PSU-QSU2307030110RF12

5905-ANT 1



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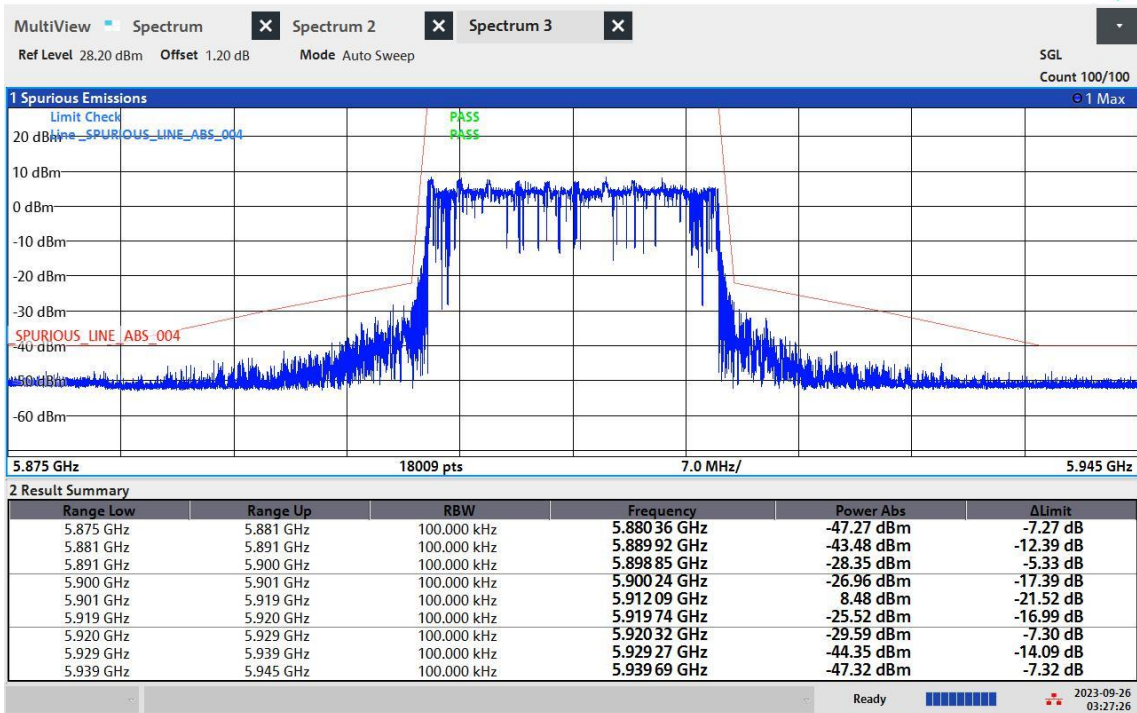
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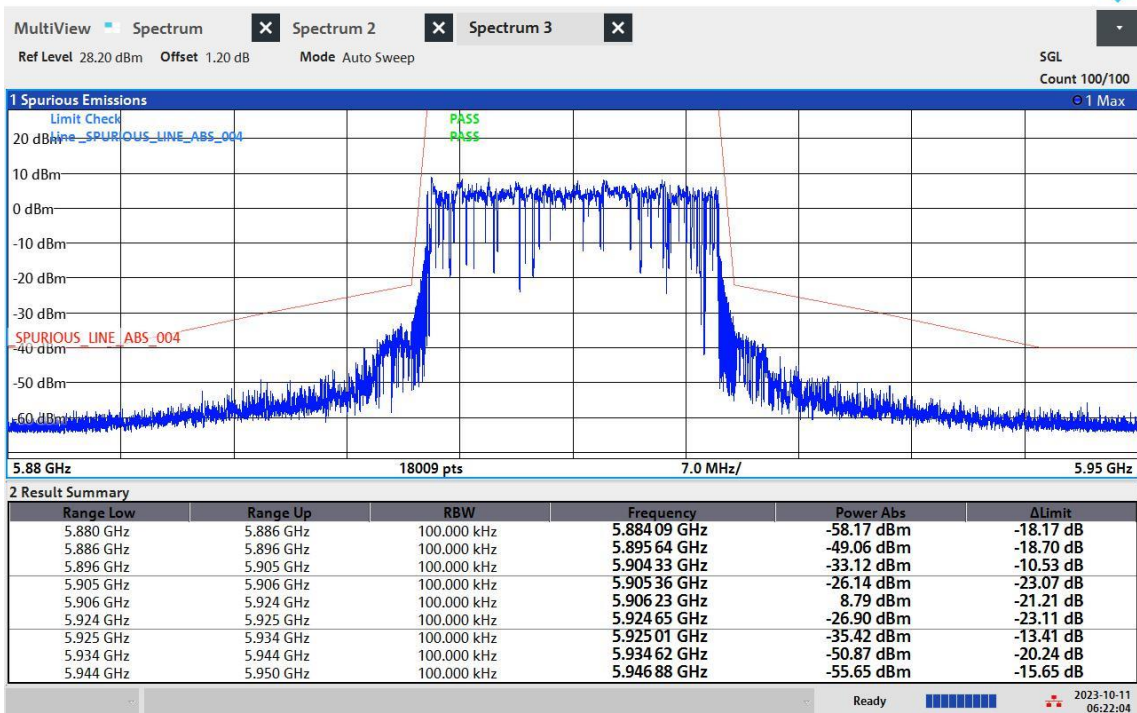


5910-ANT 1



03:27:27 AM 09/26/2023

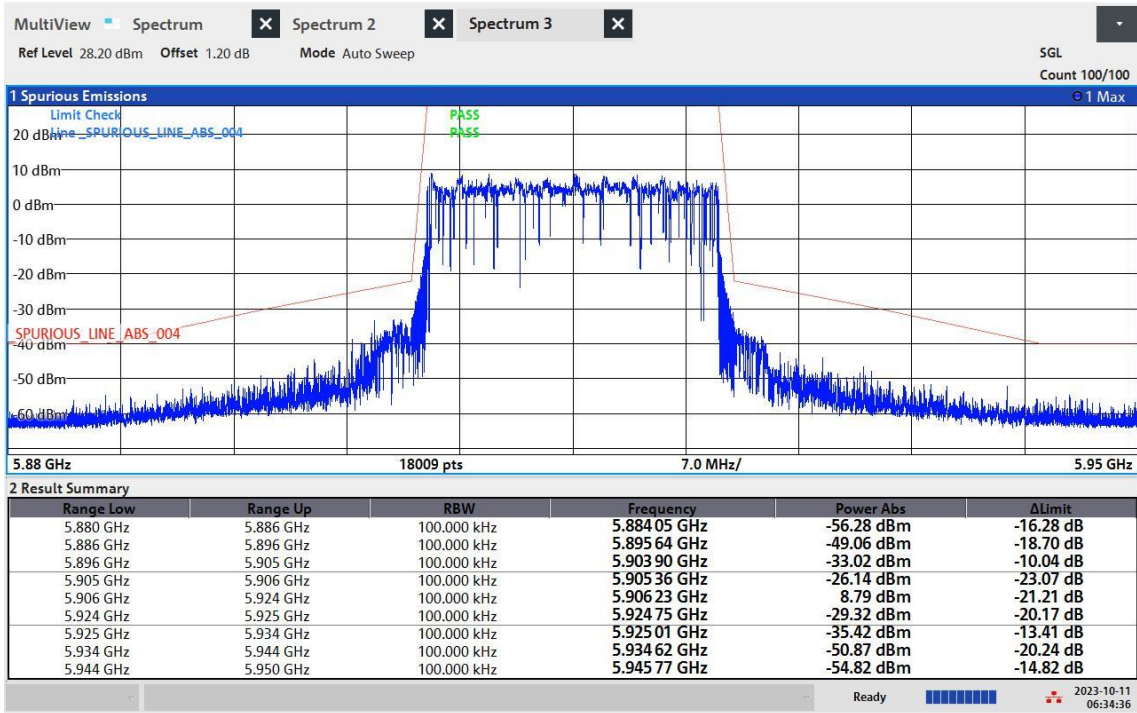
5915-ANT 0



06:22:05 AM 10/11/2023



5915-ANT 1



06:34:36 AM 10/11/2023



4. CONCLUSION

According to the requirements of KDB Publication 511808 D01, The Lab supplemented the C-V2X test. This OBU device applies for C-V2X waivers is FCC compliant.

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