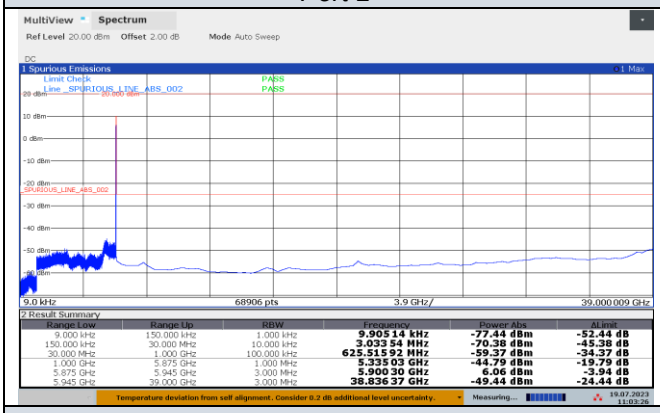
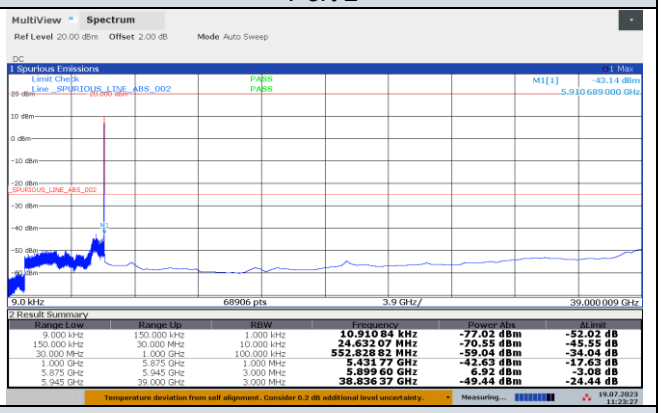
Plots of Transmit Transmitter Conducted Unwanted Emissions

Modulation: QPSK — *Port 1*

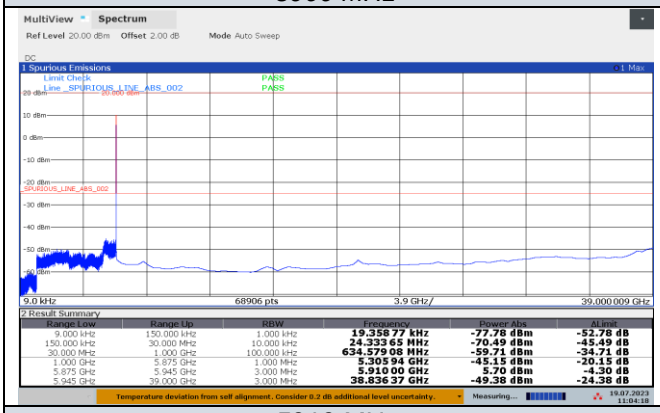


5900 MHz

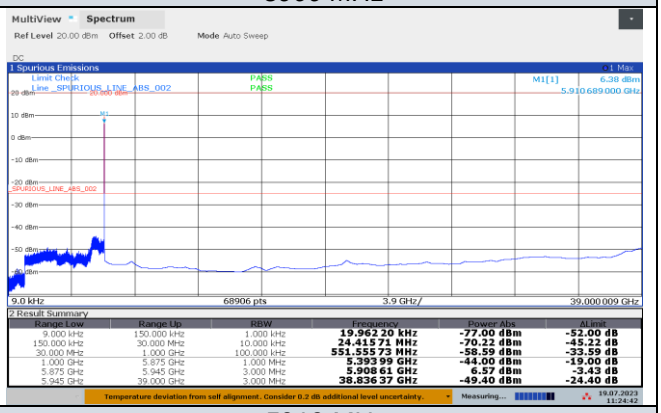
Modulation: QPSK — *Port 2*



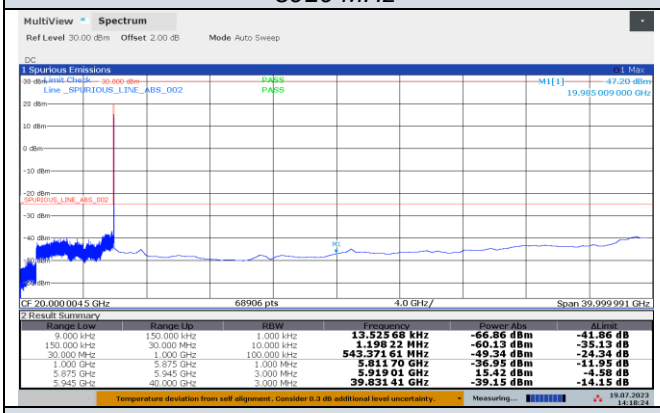
5900 MHz



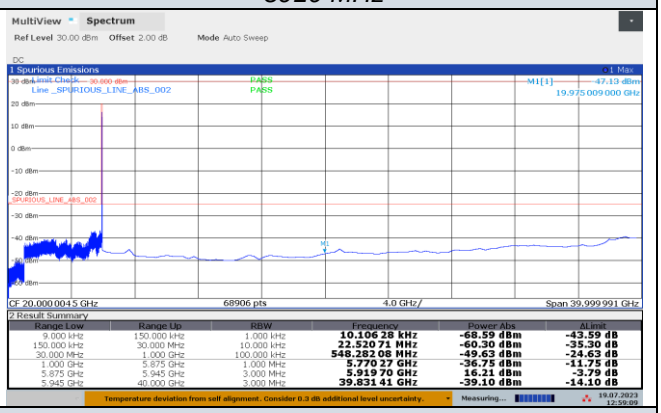
5910 MHz



5910 MHz



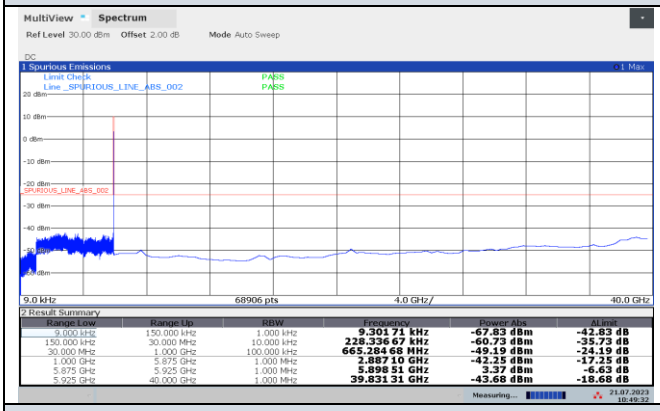
5920 MHz



5920 MHz

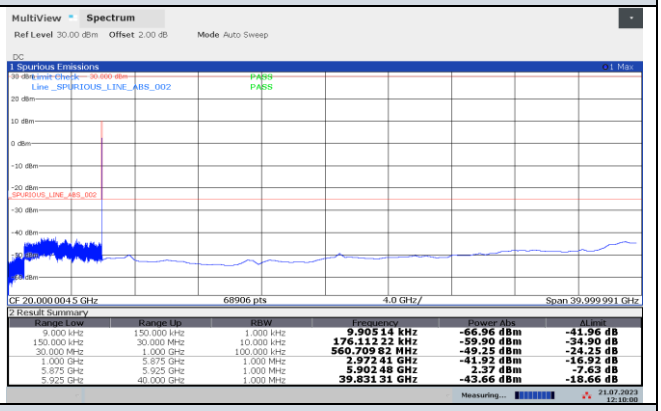
Plots of Transmit Transmitter Conducted Unwanted Emissions

Modulation: 16QAM — *Port 1*

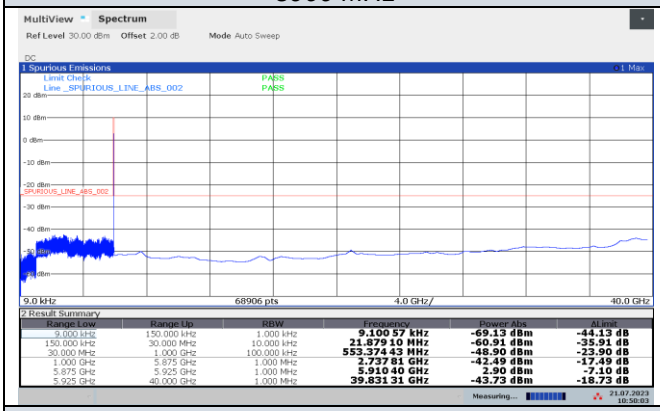


5900 MHz

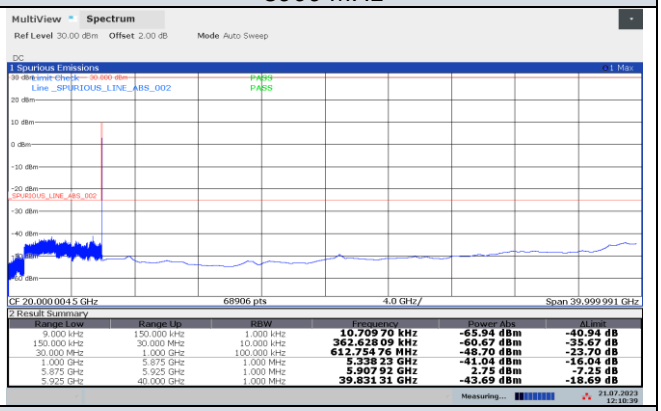
Modulation: 16QAM — *Port 2*



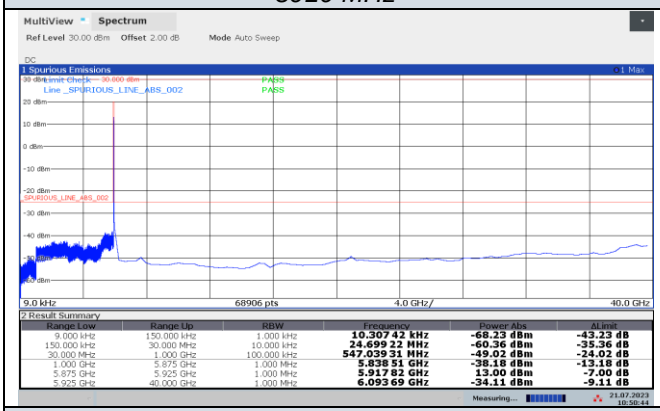
5900 MHz



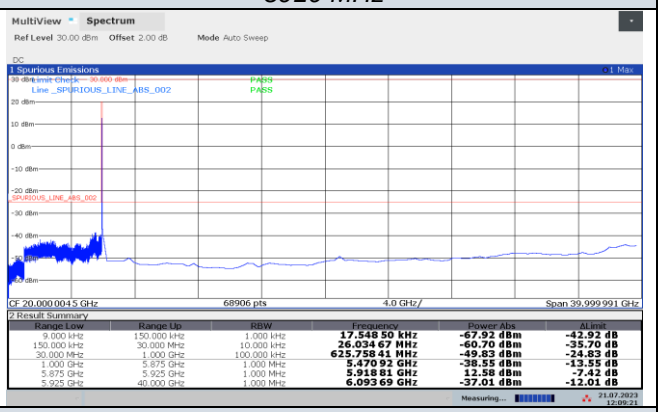
5910 MHz



5910 MHz



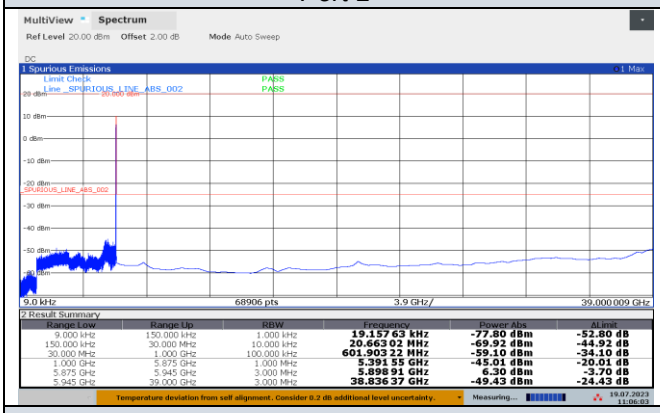
5920 MHz



5920 MHz

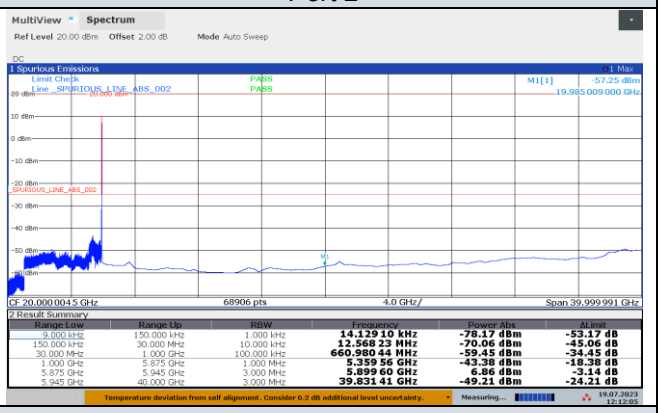
Plots of Transmit Transmitter Conducted Unwanted Emissions

Modulation: 64QAM — *Port 1*

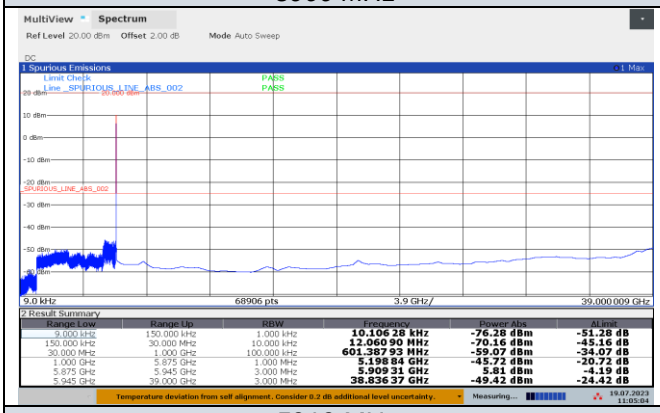


5900 MHz

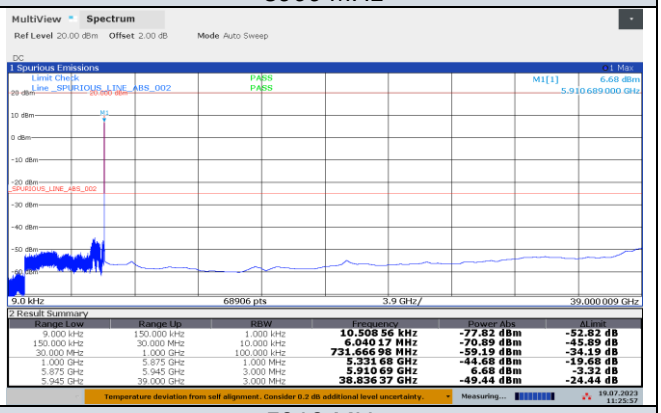
Modulation: 64QAM — *Port 2*



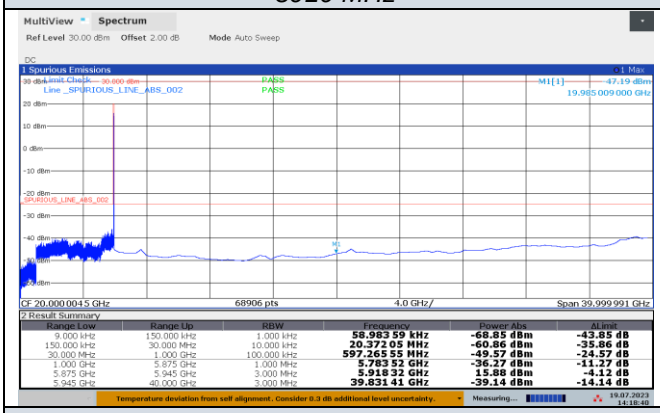
5900 MHz



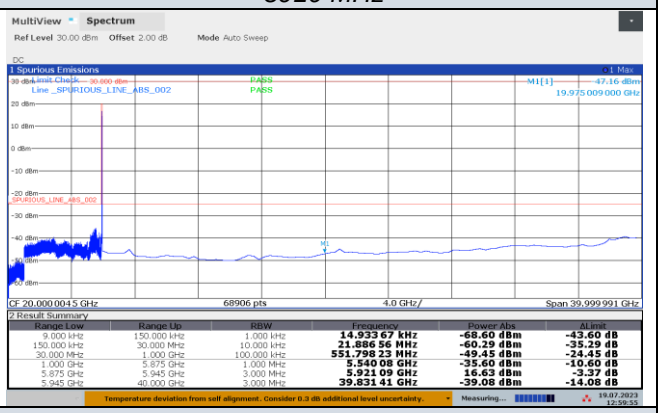
5910 MHz



5910 MHz



5920 MHz



5920 MHz

4.5. Frequency Stability [§2.1055 §90.213 & ASTM E2213-03 8.10.4]

4.5.1. LIMITS

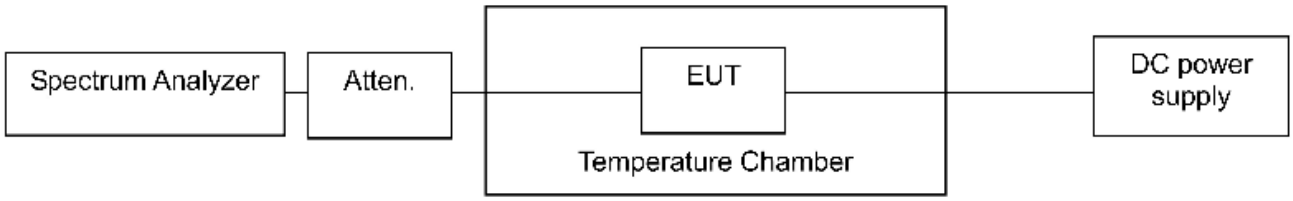
According to ASTM E2213-03 8.10.4 – Transmit Center Frequency Tolerance — The transmitted center frequency tolerance shall be ± 10 ppm maximum for RSUs and ± 10 ppm maximum for OBUs. The transmit center frequency and the symbol clock frequency shall be derived from the same reference oscillator.
According to § 2.1055 Measurement required: Frequency Stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:
  (1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
  (2) From −20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.
  (3) From 0° to + 50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(c) The frequency stability shall be measured with variation of primary supply voltage as follows:
  (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
  (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
  (3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

4.5.2. TEST CONFIGURATION



4.5.3. TEST PROCEDURE

EUT connect to Spectrum analyzer, test is performed in Thermal chamber.
These measurements shall also be performed at normal and extreme test conditions.

4.5.4. TEST RESULTS

Channel: 182				Frequency: 5910 MHz			
Temp (℃)	Power Supply	Frequency Drift [MHz]		Frequency Drift [ppm]		Limits [ppm]	Results
		Port 1	Port 2	Port 1	Port 2		
+50	POE 48.00V (V_{nom})	5909.982910	5909.983150	-2.89	-2.85	± 10	PASS
+40	POE 48.00V (V_{nom})	5909.986390	5909.987110	-2.30	-2.18	± 10	PASS
+30	POE 48.00V (V_{nom})	5909.988990	5909.988630	-1.86	-1.92	± 10	PASS
+20	POE 48.00V (V_{nom})	5910.005320	5910.005650	0.90	0.96	± 10	PASS
+10	POE 48.00V (V_{nom})	5910.012750	5910.012550	2.16	2.12	± 10	PASS
0	POE 48.00V (V_{nom})	5910.014290	5910.014180	2.42	2.40	± 10	PASS
-10	POE 48.00V (V_{nom})	5910.015730	5910.015590	2.66	2.64	± 10	PASS
-20	POE 48.00V (V_{nom})	5910.027980	5910.031680	4.73	5.36	± 10	PASS
+20	POE 55.20V (V_{nom})	5910.042110	5910.049300	7.13	8.34	± 10	PASS
+20	POE 40.80V (V_{nom})	5910.045350	5910.056380	7.67	9.54	± 10	PASS

4.6. Emission Types [§ASTM E2213-03]

4.6.1. STANDARD APPLICABLE

This clause specifies the PHY entity for an orthogonal frequency division multiplexing (OFDM) system and additions that have to be made to the base standard in order to accommodate the OFDM PHY. This DSRC radio frequency system is initially intended for the 5.850-5.925GHz licensed ITS Radio Services Band, as regulated in the United States by the Code of Federal Regulations, Title 47, Part 90. The OFDM system provides DSRC with data payload communication capabilities of 3, 4.5, 6, 9, 12, 18, 24, and 27Mbit/s. In addition, data payload capabilities of 6, 9, 12, 18, 24, 36, 48 and 54 Mbit/s can be supported in optional channel combinations.

4.6.2. VERDICT

The EUT carrier signal modulation type is OFDM and Emission type is D1D, meet ASTM E2213-03 on emission type requirement.

4.7. Modulation Standard [§ASTM E2213-03]

4.7.1. STANDARD APPLICABLE

This clause specifies the PHY entity for an orthogonal frequency division multiplexing (OFDM) system and additions that have to be made to the base standard in order to accommodate the OFDM PHY. This DSRC radio frequency system is initially intended for the 5.850-5.925GHz licensed ITS Radio Services Band, as regulated in the United States by the Code of Federal Regulations, Title 47, Part 90. The OFDM system provides DSRC with data payload communication capabilities of 3, 4.5, 6, 9, 12, 18, 24, and 27Mbit/s. In addition, data payload capabilities of 6, 9, 12, 18, 24, 36, 48 and 54 Mbit/s can be supported in optional channel combinations.

4.7.2. VERDICT

The EUT carrier signal modulation type is OFDM. The sub-carriers have the following data rates and modulations:

Data Rate, Mbits/s	Modulation	Coding Rate, R	Coded Bits per Subcarrier, N_{BPSC}	Coded Bits Per OFDM Symbol, N_{CBPS}	Data Bits Per OFDM Symbol, N_{DBPS}
3	BPSK	1/2	1	48	24
4.5	BPSK	3/4	1	48	36
6	QPSK	1/2	2	96	48
9	QPSK	3/4	2	96	72
12	16QAM	1/2	4	192	96
18	16QAM	3/4	4	192	144
24	64QAM	2/3	6	288	192
27	64QAM	3/4	6	288	216

Internal Photos

Pleae refer separate internal of the EUT.

Revision History

Revision	Issue Date	Revisions	Revised By
1.0	2023-07-25	Orignal Issue	Wenliang Li
1.1	2023-09-12	a. Revised product information as customer requied.	Wenliang Li

********** End of Report **********

DECLARATION

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.
If you have any questions on this report, please contact us within 15 days after issue this report.

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