

FCC Test Report

Equipment : IWCU (ITRI WAVE/DSRC Communication Unit)
Brand Name : IWCU
Model No. : IWCU-4.1-O-N-C
FCC ID : N3XIWCU41-GWP5121
Standard : 47 CFR FCC Part 95
Applicant : Industrial Technology Research Institute (ITRI)
Manufacturer : Rm. 126, Bldg. 51, 195, Sec. 4, Chung-Hsing Rd.,
Chutung, Hsinchu, 31040, Taiwan, R.O.C.

The product sample received on Apr. 02, 2012 and completely tested on Apr. 26, 2012. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI/TIA-603-D-2010 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:

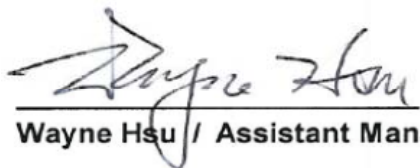

Wayne Hsu / Assistant Manager



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Summary of Test Result

Conformance Test Specifications					
Report Clause	Ref. Std. Clause	Description	Measured	Limit	Result
1.1.1	95.631	Emission Types	D1D (OFDM - BPSK,QPSK, 16QAM, 64QAM)	ASTM E2213-03	Complied
1.1.1	95.637	Modulation Standard	DSRC for IEEE 802.11p	ASTM E2213-03	Complied
3.1	95.633	Emission Bandwidth	Bandwidth [MHz] 5860-5920MHz(10M): 8.28	Information only	Complied
3.2	95.639	Maximum Transmitter Power	Power [dBm] Power Class C 5860-5920MHz: 17.34	ASTM E2213-03 8.9.1 Power [dBm] 5860-5920MHz: 28.8	Complied
3.2	95.639	Effective Isotropic Radiated Power (EIRP)	EIRP [dBm] Power Class C 5860-5920MHz: 22.34	ASTM E2213-03 8.9.1 EIRP [dBm] 5860-5920MHz: 33	Complied
3.3	95.635	Transmit Spectrum Mask	Device complies with spectral mask – refer to test data	ASTM E2213-03 8.9.2 Mask Class C	
3.4	2.1051	Transmitter Conducted Unwanted Emissions	9kHz-40GHz Band [dBm]: 5929.259MHz: -31.19 (Margin 6.19dB) [Ref. page 28]	ASTM E2213-03 8.9.2 9kHz-40GHz Bands: =< -25 dBm	Complied
3.5	2.1053	Transmitter Radiated Unwanted Emissions	30MHz-40GHz Band [dBuV/m at 3m]: 17760MHz: 69.34 (Margin 0.86dB) [Ref. page 37]	ASTM E2213-03 8.9.2 30MHz-40GHz Bands: =< -25 dBm e.i.r.p. [70.2 dBuV/m at 3m]	Complied
3.6	2.1055	Frequency Stability	8.57 ppm	ASTM E2213-03 8.9.4 ±10 [ppm]	

Revision History

[illegible]

1 General Description

1.1 Information

1.1.1 RF General Information

RF General Information					
Frequency Range (MHz)	IEEE Std. 802.11 Protocol	Ch. Frequency (MHz)	Channel Number	RF Output Power (dBm)	Designation of Emission
5850-5925	p (10MHz space)	5860-5920	172-184 [7]	17.34	8M28D1D
Note 1: IEEE Std. 802.11p-2010 modulation consists of BPSK, QPSK, 16QAM and 64QAM and multiple channel space [5MHz, 10MHz and 20MHz]. Then EUT support 10MHz channel space.					
Note 2: RF output power specifies that Maximum Conducted Output Power.					

Transmitter Chains & Receiver Chains Information					
IEEE Std. 802.11 Protocol	Number of Transmit Chains (N _{TX})	Number of Receive Chains (N _{RX})	Correlation Signals with Multiple N _{TX}	99% Emission Bandwidth (MHz)	Co-location
p (10MHz space)	1	1	N/A	8.28	N/A
Note 1: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (i.e., EUT has simultaneously co-transmitting that operating 2.4GHz and 5.9GHz.)					

1.1.2 Antenna Information

Antenna Category	
☐	Equipment placed on the market without antennas
☐	Integral antenna (antenna permanently attached)
☐	Temporary RF connector provided ; ☐ No temporary RF connector provided
☒	External antenna (dedicated antennas)
☒	Single power level with corresponding antenna(s). Power Level (PL): 1
☐	Multiple power level and corresponding antenna(s). Power Level (PL): 1~...
☒	Unique antenna connector. (e.g., MMCX, U.FL, IPX, and RP-SMA, RP-N type...)

Antenna General Information							
Antenna Port (Total 1 Port)				1 (TX/RX)			
Maximum RF Output Power Level (PL)				1, Total 1 Power Level (PL) setting			
Ant. No.	PL	Ant. Port [Ant No. X connect to Ant. Port Y]	Ant. Cat.	Ant. Type	Brand	Model	G _{ANT} (dBi)
1	1	1,2	External	Dipole	N/A	N/A	5.0

1.1.3 Type of EUT

Identify EUT	
EUT Serial Number	C194B29002A9C01
Presentation of Equipment	☒ Production ; ☐ Pre-Production ; ☐ Prototype
Type of EUT	
☐	Stand-alone
☒	Combined (EUT where the radio part is fully integrated within another device) Combined Equipment - Brand Name / Model No.: ...
☐	Plug-in radio (EUT intended for a variety of host systems) Host System - Brand Name / Model No.: ...
☐	Other:

1.1.4 Test Signal Duty Cycle

Test Signal Duty Cycle
☒ Continuous transmission - 100%
☐ Transmissions occur regularly in time - ...% - IEEE 802.11p (10MHz)
☐ Transmissions occur regularly in time - ...% - IEEE 802.11p (20MHz)

1.1.5 EUT Operational Condition

Supply Voltage	☒ AC mains	☐ DC	
Type of DC Source	☐ Internal DC supply	☒ External DC adapter	☐ Battery
Operational Voltage	☒ Vnom (110 V)	☒ Vmax (126.5 V)	☒ Vmin (93.5 V)
Operational Climatic	☒ Tnom (20°C)	☒ Tmax (50°C)	☒ Tmin (-20°C)

1.2 Accessories and Support Equipment

Support Equipment			
No.	Equipment	Brand Name	Model Name
1	(USB) Keyboard	IBM	SK-8815
2	(USB) Mouse	ASUS	M-UV69a
3	LCD Monitor	DELL	1703FPt
4	Personal computer	HP COMPAQ	dc7700

1.3 RF/EMI Suppression Device(s)/Modifications

RF/EMI suppression device(s) added and/or modifications made during testing.

- None

1.4 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 95
- ANSI/TIA-603-D-2010
- FCC KDB 971168 - Power Measurement License Digital Systems
- FCC KDB 662911 - Emissions Testing of Transmitters with Multiple Outputs
- FCC KDB 412172 - Guidelines for Determining the ERP and EIRP

1.5 Testing Location Information

Testing Location				
☒	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-318-0055		
☐	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C. TEL : 886-3-656-9065 FAX : 886-3-656-9085		
Test Condition		Test Site No.	Test Engineer	Test Environment
RF Conducted		TH01-HY	Ian Lee	23.1°C / 34%
Radiated Emission		03CH02-HY	Hsiao	22.6°C / 52%

1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Measurement Uncertainty			
Test Item		Uncertainty	Limit
Emission bandwidth		±1.42 %	N/A
RF output power, conducted		±0.63 dB	N/A
Unwanted emissions, conducted	30 – 1000 MHz	±0.51 dB	N/A
	1 – 18 GHz	±0.67 dB	N/A
	18 – 40 GHz	±0.83 dB	N/A
	40 – 200 GHz	N/A	N/A
All emissions, radiated	30 – 1000 MHz	±2.56 dB	N/A
	1 – 18 GHz	±3.59 dB	N/A
	18 – 40 GHz	±3.82 dB	N/A
	40 – 200 GHz	N/A	N/A
Temperature		±0.8 °C	N/A
Humidity		±3 %	N/A
DC and low frequency voltages		±3 %	N/A
Time		±1.42 %	N/A
Duty Cycle		±1.42 %	N/A

2 Test Configuration of EUT

2.1 The Worst Case Modulation Configuration

Worst Modulation Used for Conformance Testing						
Power Level		1				
IEEE 802.11 Protocol	Number of Transmit Chains (N _{TX})	Data Rate / MCS	Worst Data Rate / MCS	Worst Modulation Mode	RF Output Power (dBm)	EIRP Power (dBm)
p [10MHz]	1	3-27 Mbps	9Mbps	11P5.9G-10M	17.34	22.34
Note 1: IEEE Std. 802.11p-2010 modulation consists of BPSK, QPSK, 16QAM and 64QAM and multiple channel space [5MHz, 10MHz and 20MHz]. Then EUT support 10MHz channel space.						
Note 2: Modulation modes consist of 11P5.9-G-10M, 11P5.9G-20M: 11P5.9G: IEEE 802.11p (5.9GHz Band) 10M/20M: Channel Bandwidth 10MHz/20MHz						
Note 3: RF output power specifies that Maximum Conducted Output Power.						

2.2 Test Channel Frequencies Configuration

Test Channel Frequencies Configuration		
IEEE 802.11 Protocol	Worst Modulation Mode	Test Channel Frequencies (MHz) – FX (Frequencies Abbreviations)
p [10MHz]	11P5.9G-10M	5860-(F1), 5890-(F2), 5920-(F3), 5900-(F4), 5910-(F5)

2.3 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter					
Power Level		1			
Test Software Version		Art V 5.3			
Worst Modulation Mode	Number of Transmit Chains (N _{TX})	Frequency (MHz)	Power Setting	Data Rate	RF Output Power (dBm)
11P5.9G-10M	1	5860	19	9 Mbps	16.76
11P5.9G-10M	1	5890	19	9 Mbps	17.34
11P5.9G-10M	1	5920	18	9 Mbps	15.67
11P5.9G-10M	1	5900	19	9 Mbps	17.09
11P5.9G-10M	1	5910	19	9 Mbps	16.78

2.4 The Worst Case Measurement Configuration

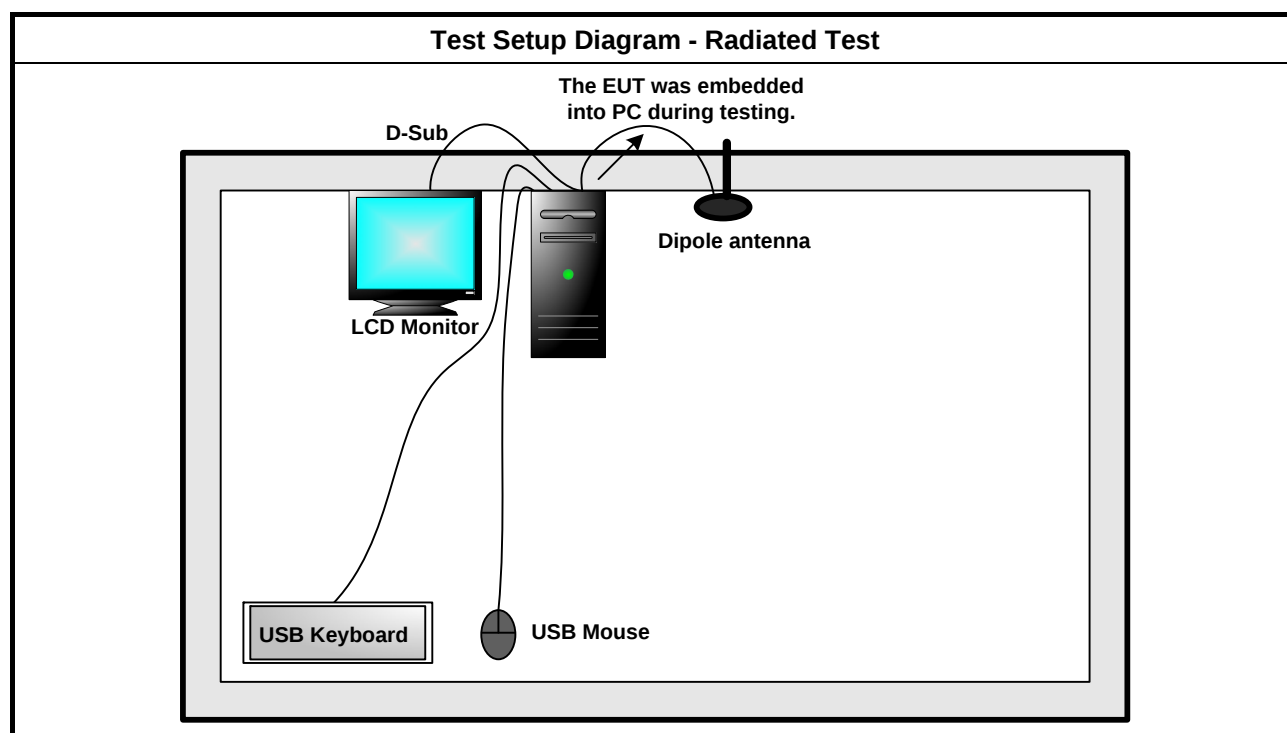
The Worst Case Mode for Following Conformance Tests				
Tests Item	AC power-line conducted emissions			
Condition	AC power-line conducted measurement for line and neutral			
Operating Mode	Operating Mode Description	Worst Modulation Mode	Test Freq.	Power Level
1	Normal Link	11P5.9G-10M	F2	1

The Worst Case Mode for Following Conformance Tests				
Tests Item	Emission Bandwidth Maximum Transmitter Power Effective Isotropic Radiated Power (EIRP) Transmit Spectrum Mask Transmitter Conducted Unwanted Emissions			
Test Condition	Conducted measurement at transmit chains			
Worst Modulation Mode	Number of Transmit Chains (N _{TX})	Worst Data Rate	Test Frequency	Power Level
11P5.9G-10M	1	9Mbps	F1, F2, F3	1

The Worst Case Mode for Following Conformance Tests				
Tests Item	Frequency Stability			
Test Condition	Conducted measurement at transmit chains			
Worst Modulation Mode	Number of Transmit Chains (N _{TX})	Worst Data Rate / MCS	Test Frequency	Power Level
11P5.9G-10M	1	9Mbps	F2	1

The Worst Case Mode for Following Conformance Tests						
Tests Item	Transmitter Radiated Unwanted Emissions					
Test Condition	Radiated measurement					
User Position	☒ EUT will be placed in fixed position.					
	☐ EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions. EUT shall be performed two or three orthogonal planes.					
Operating Mode < 1GHz	☒ 1. Continuous TX....					
	☐ 2. Other:...					
Worst Modulation Mode	Number of Transmit Chains (N _{TX})	Worst Data Rate / MCS	Test Frequency	Power Level	Ant No.	Worst Orthogonal Planes of EUT
11P5.9G-10M	1	9Mbps	F1, F2, F3	1	11P5.9G-10M	X Plane
Orthogonal Planes of EUT	X Axis		Y Axis		Z Axis	
						

2.5 Test Setup Diagram



3 Transmitter Test Result

3.1 Emission Bandwidth

3.1.1 Emission Bandwidth Limit

Emission Bandwidth Limit
N/A. Information only
Note 1: The 99% occupied bandwidth is the frequency bandwidth of the signal power at the 99% channel power of occupied bandwidth when resolution bandwidth should be approximately 1 % to 5 % of the occupied bandwidth (OBW). These measurements shall also be performed at normal test conditions.

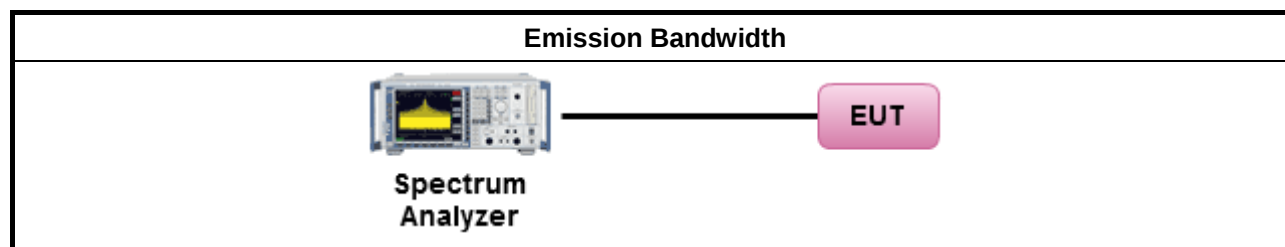
3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

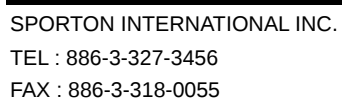
Test Method	
☒	For the emission bandwidth shall be measured using one of the options below:
☒	Refer as ANSI/TIA-603-D, clause 1.3.4.4 for test bandwidth.
☐	Refer as KDB 971168, clause 3 for signal bandwidth.
☐	Refer as IC RSS-Gen, clause 6.4.1 for occupied bandwidth.
☐	Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.
☒	For conducted measurement.
☐	For conducted measurements on devices with multiple transmit chains using options given below:
☐	Option 1: Multiple transmit chains measurements need to be performed on one of the active transmit chains (antenna outputs). All measurement had be performed on transmit chains 1.
☐	Option 2: Multiple transmit chains measurements need to be performed on each transmit chains individually (antenna outputs). All measurement had be performed on all transmit chains.
☐	Option 3: A power splitter/combiner shall be used to combine all the transmit chains (antenna outputs) into a single test point and record a single test point EBW.
☒	Temporary RF connector provided: Using temporary RF connector provided for connected measurement.
☐	No temporary RF connector provided: Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.
☐	For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level.

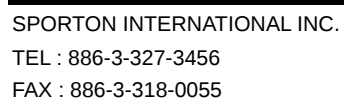
3.1.4 Test Setup

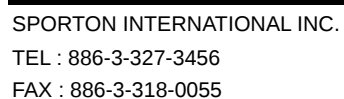


3.1.5 Test Result of Emission Bandwidth

Emission Bandwidth Result						
Power Level	1		Emission Bandwidth (MHz)			
Modulation Mode	N _{TX}	Freq. (MHz)	99% Bandwidth			
			Chain- Port 1	Chain- Port 2	Chain- Port 3	Chain- Port 4
11P5.9G-10M	1	5860	8.28	-	-	-
11P5.9G-10M	1	5890	8.20	-	-	-
11P5.9G-10M	1	5920	8.28	-	-	-
Limit			N/A			
Result			Complied			
Note 1: N _{TX} = Number of Transmit Chains						







3.2 Maximum Transmitter Power

3.2.1 Maximum Transmitter Power Limit

5850–5925 MHz Band				
Portable DSRCS-OBUs is 1.0 mW, other as following as:				
Frequency Range	Channel	BW: 5/10MHz	Cond. Power	EIRP Power
5855-5865	172	5860 MHz	28.8 dBm	33 dBm
5865-5875	174	5870 MHz	28.8 dBm	33 dBm
5875-5885	176	5880 MHz	28.8 dBm	33 dBm
5885-5895	178	5890 MHz	28.8 dBm	33 dBm
5895-5905	180	5900 MHz	20 dBm	23 dBm
5905-5915	182	5910 MHz	20 dBm	23 dBm
5915-5925	184	5920 MHz	28.8 dBm	33 dBm
Frequency Range	Channel	BW:20MHz	Cond. Power	EIRP Power
5855-5865	175	5875 MHz	20 dBm	23 dBm
5865-5875	181	5905 MHz	20 dBm	23 dBm
Note 1: Conducted power could overcome limits but EIRP power shall under limits				
Note 2: Refer as ASTM E2213-03 Clause 8.9.1, FCC Part 95.639 & FCC ET Docket No. 98-95.				

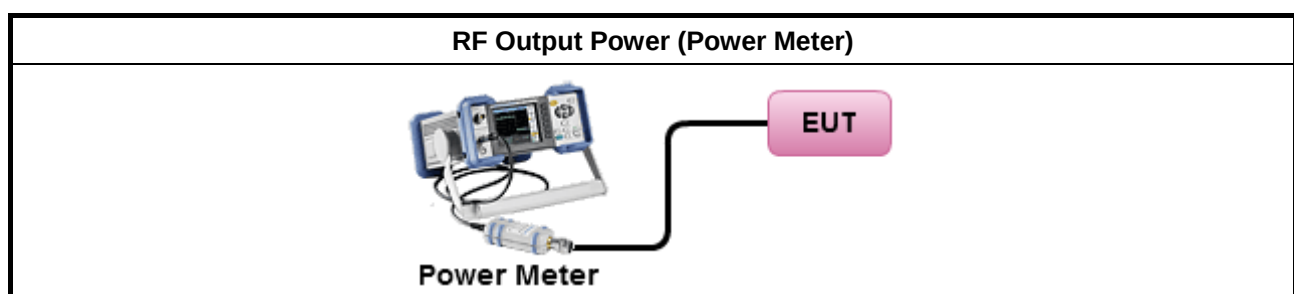
3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method	
☒	Maximum Transmitter Power
☒	Refer as ANSI/TIA-603-D, clause 3.2.1 for power meter measurement.
☐	Refer as KDB 971168, clause 4 average power over the fundamental signal bandwidth.
☐	Refer as KDB 789033, clause c)4, measurements may be performed using a wideband RF power meter with a thermocouple detector.
☒	Effective Isotropic Radiated Power (EIRP)
☒	Refer as KDB 412172, clause 1.3.2 following as power approach. $e.i.r.p. = P_T + G_T$.
☐	Refer as KDB 412172, clause 1.3.1 following as field strength approach. $e.i.r.p. = (E \times d)^2 / 30$.
☒	For conducted measurement.
☐	For conducted measurements on devices with multiple transmit chains: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
☒	Temporary RF connector provided: Using temporary RF connector provided for connected measurement.
☐	No temporary RF connector provided: Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path...
☐	For radiated measurement.
☐	Refer as KDB 412172, clause 2.2 following eirp can be used radiated test configuration.
☐	Refer as KDB 412172, clause 5 following eirp can be directly determined using the field strength.
☐	Refer as KDB 412172, clause 6 following eirp can be used signal/antenna substitution techniques.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Transmitter Power

Maximum Transmitter Power Result										
Power Level		1	RF Output Power (dBm)							
Directional Gain (dBi)		2.3								
Modulation Mode	N _{TX}	Freq. (MHz)	Chain-Port 1	Chain-Port 2	Chain-Port 3	Chain-Port 4	Sum Chain	Power Limit	EIRP Power	EIRP Limit
11P5.9G-10M	1	5860	16.76	-	-	-	16.76	28.8	21.76	33
11P5.9G-10M	1	5890	17.34	-	-	-	17.34	28.8	22.34	33
11P5.9G-10M	1	5920	15.67	-	-	-	15.67	28.8	20.67	33
11P5.9G-10M	1	5900	17.09	-	-	-	17.09	20	22.09	23
11P5.9G-10M	1	5910	16.78	-	-	-	16.78	20	21.78	23
Result			Complied							
Note 1: N _{TX} = Number of Transmit Chains										

3.3 Transmit Spectrum Mask

3.3.1 Transmit Spectrum Mask Limit

5850–5925 MHz Band					
Portable DSRCS-OBUs is 1.0 mW, other as following as:					
STA transmit power classification	Maximum STA transmit power (mW)		Maximum permitted EIRP (dBm)		
A	1		23		
B	10		23		
C	100		33		
D	760		33 for non-government / 44.8 for government		
STA transmit power classification	± 4.5 MHz offset ($\pm f1$)	± 5.0 MHz offset ($\pm f2$)	± 5.5 MHz offset ($\pm f3$)	± 10 MHz offset ($\pm f4$)	± 15 MHz offset ($\pm f5$)
Class A	0	-10	-20	-28	-40
Class B	0	-16	-20	-28	-40
Class C	0	-26	-32	-40	-50
Class D	0	-35	-45	-55	-65

Note 1: Refer as ASTM E2213-03 Clause 8.9.2.

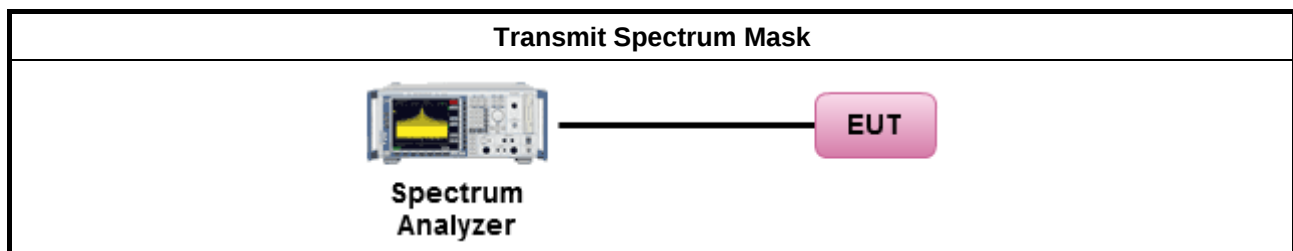
3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.3.3 Test Procedures

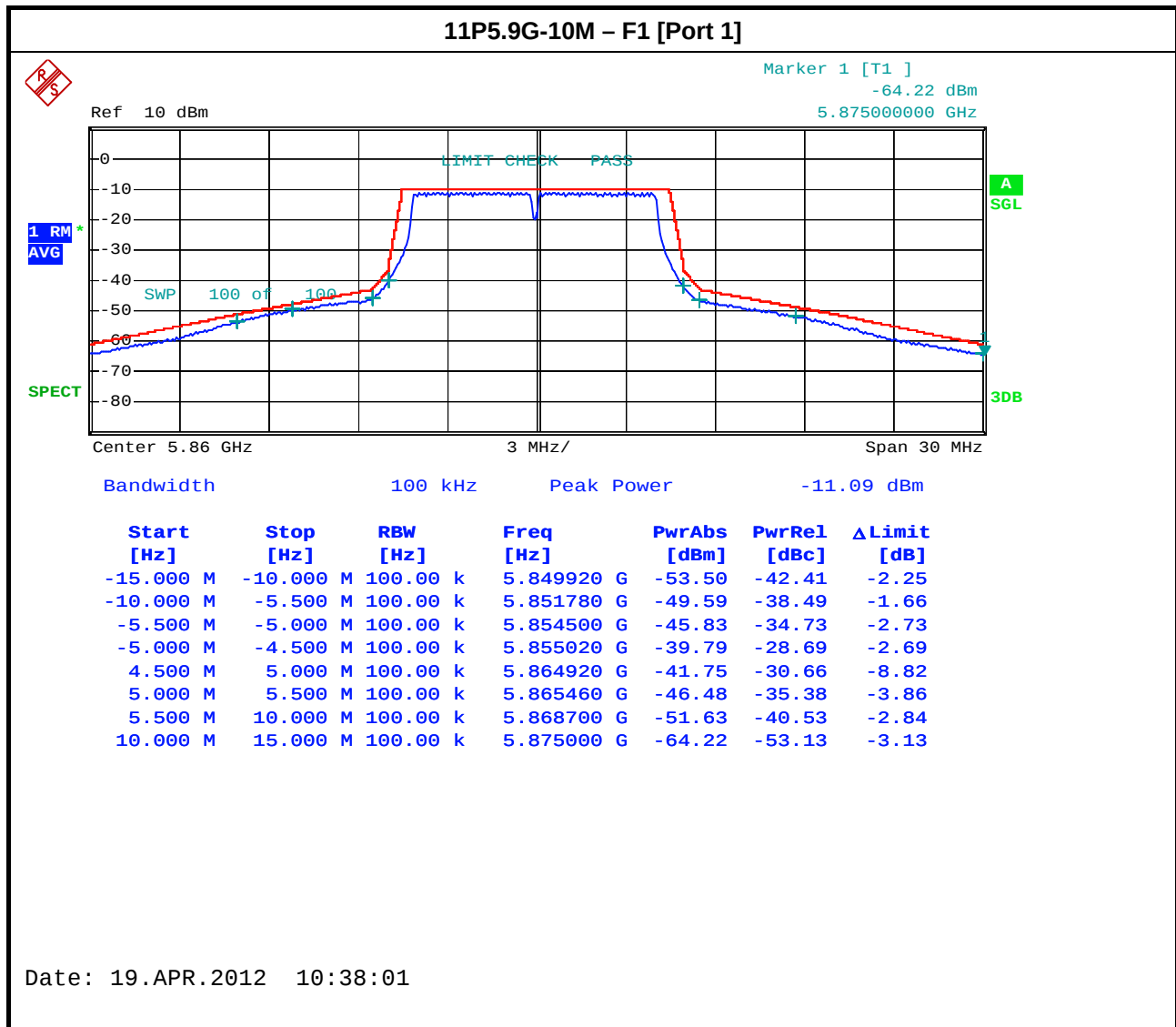
Test Method	
☒	The 0 dBm level is the maximum power spectral density measured in the channel. The measurements of transmit spectral density are made using 100 kHz resolution bandwidth and 30 kHz video bandwidth.
☒	For conducted measurement.
☒	For conducted measurements on devices with single transmit chain.
☐	For conducted measurements on devices with multiple transmit chains: Refer as FCC KDB 662911, when testing emissions against relative emission limits, tests may be performed on each output individually without summing or adding $10 \log(N)$ if the measurements are made relative to the in-band emissions on the individual outputs. All measurements need only to be performed on one of the active transmit chains (antenna outputs). All measurement had to be performed on transmit chains 1.
☒	Temporary RF connector provided: Using temporary RF connector provided for connected measurement.
☐	No temporary RF connector provided: Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.
☐	For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level.

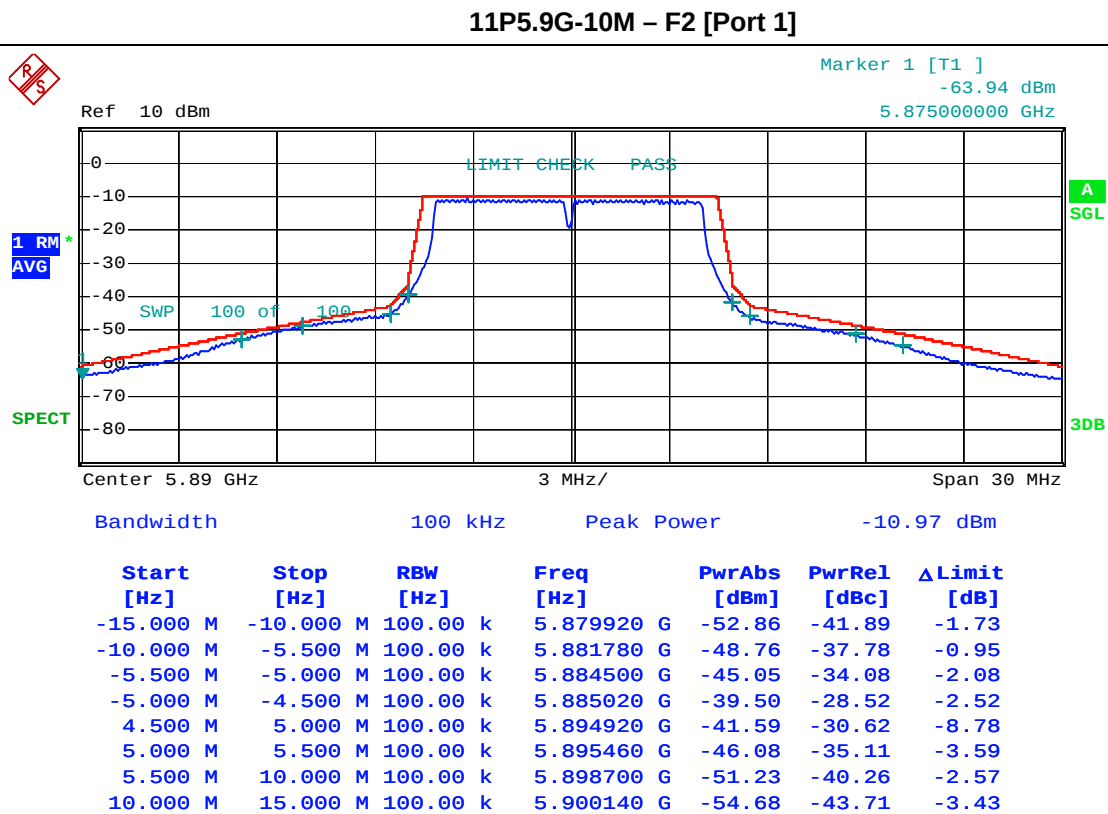
3.3.4 Test Setup



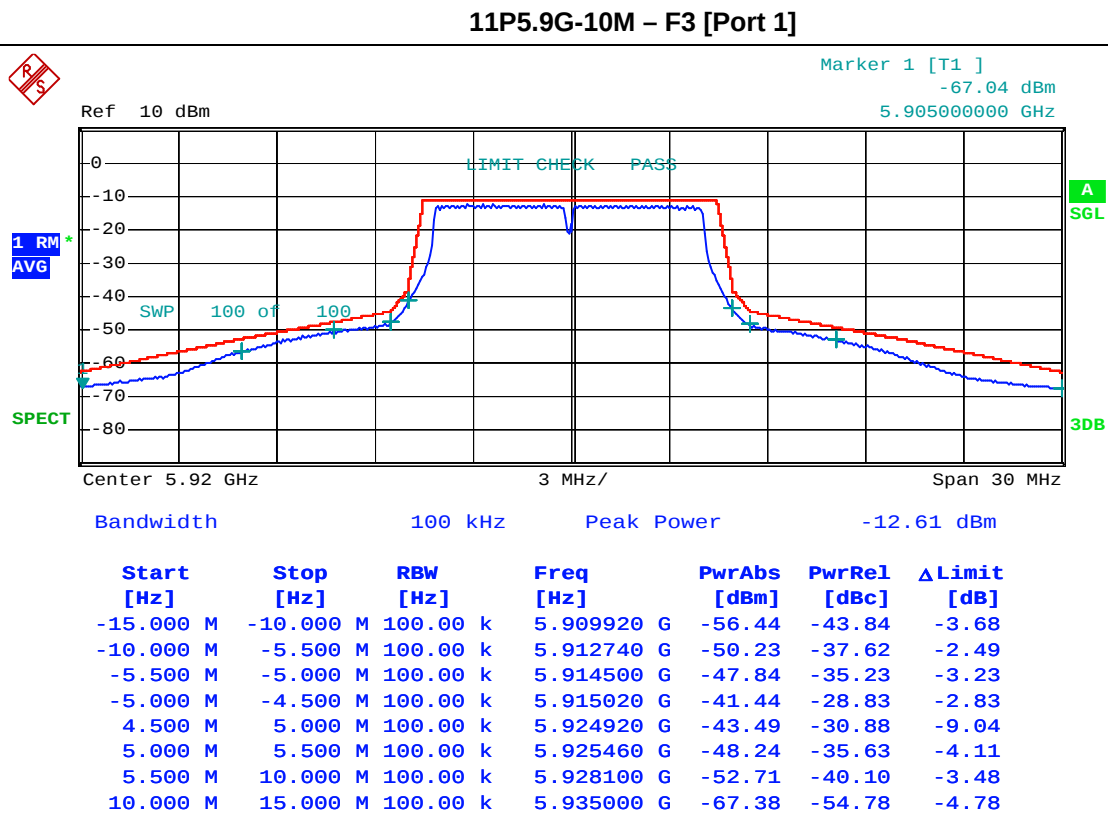
3.3.5 Test Result of Transmit Spectrum Mask

Transmit Spectrum Mask Result					
Power Level	1	Mask	C	Transmit Spectrum Mask	
Condition	NTX	Modulation Mode	Freq. (MHz)	Chain-Port 1	Result
TnomVnom	1	11P5.9G-10M	5860	Under Spectral Mask	Complied
TnomVnom	1	11P5.9G-10M	5890	Under Spectral Mask	Complied
TnomVnom	1	11P5.9G-10M	5920	Under Spectral Mask	Complied
TnomVnom	1	11P5.9G-10M	5900	Under Spectral Mask	Complied
TnomVnom	1	11P5.9G-10M	5910	Under Spectral Mask	Complied

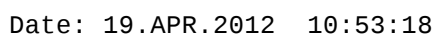


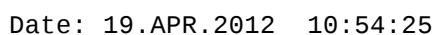


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3.4 Transmitter Conducted Unwanted Emissions

3.4.1 Transmitter Conducted Unwanted Emissions Limit

Transmitter Conducted Unwanted Emissions Limit
The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $[55 + 10 \log (P)]$ (-25dBm).
Note 1: Refer as ASTM E2213-03 Clause 8.9.2.

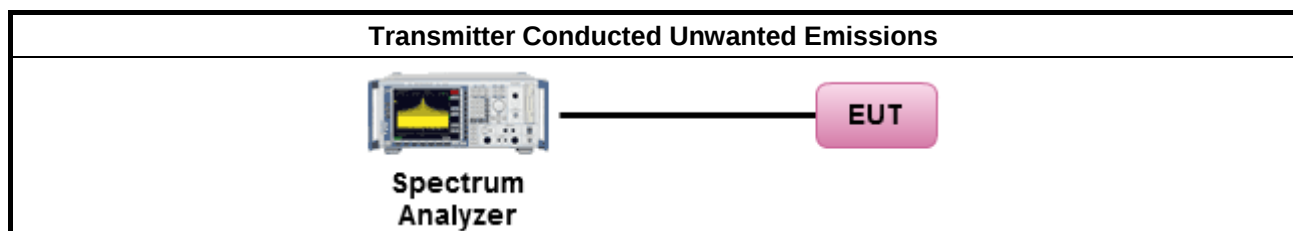
3.4.2 Measuring Instruments

Refer test equipment and calibration data list in test report clause 4.

3.4.3 Test Procedures

Test Method		
☒ Refer as ANSI/TIA-603-D-2010, clause 3.2.13 for conducted measurement.		
☐ In case a narrower measurement bandwidth was used, the following conversion formula has to be applied: (e.g. if reference bandwidth 1 MHz and measurement bandwidth 100 kHz, then measurement bandwidth conversion factor is 10 dB) $B = A + 10 \log (BW_{ref} / BW_{measured})$ • A is the value at the narrower measurement bandwidth; • B is the value referred to the reference bandwidth;		
☒ For conducted measurement.		
☒ For conducted measurements on devices with single transmit chain. ☐ For conducted measurements on devices with multiple transmit chains using options given below: <table border="1"> <tr> <td>☐ Option 1: measure and sum the spectra across the transmitter outputs.</td></tr> <tr> <td>☐ Option 2: N transmitter outputs, then spurious emissions limits on each individual output. Measure and add 10 log (N) dB.</td></tr> </table>	☐ Option 1: measure and sum the spectra across the transmitter outputs.	☐ Option 2: N transmitter outputs, then spurious emissions limits on each individual output. Measure and add 10 log (N) dB.
☐ Option 1: measure and sum the spectra across the transmitter outputs.		
☐ Option 2: N transmitter outputs, then spurious emissions limits on each individual output. Measure and add 10 log (N) dB.		
☒ Temporary RF connector provided: Using temporary RF connector provided for connected measurement.		
☐ No temporary RF connector provided: Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.		

3.4.4 Test Setup



3.4.5 Test Result of Transmitter Conducted Unwanted Emissions

Transmitter Conducted Unwanted Emissions Result							
Power Level	1	Ant. Gain (dBi)	5	Transmitter Conducted Unwanted Emissions			
Condition	NTX	Modulation Mode	Freq. (MHz)	Unwanted Freq. (MHz)	Chain-Port 1 (dBm)	Margin (dB)	Limit (dBm)
TnomVnom	1	11P5.9G-10M	5860	34211.51	-38.69	13.69	-25
TnomVnom	1	11P5.9G-10M	5890	37001.40	-38.99	13.99	-25
TnomVnom	1	11P5.9G-10M	5920	5929.26	-31.19	6.19	-25

11P5.9G-10M - F1 [Port 1]

Ref -10 dBm

Marker 1 [T1]
-60.09 dBm
5.946296875 GHz

Start 9 kHz 3.9999991 GHz/ Stop 40 GHz

Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
9.000 k	150.000 k	1.00 k	9.0000000 k	-76.68	-51.68
150.000 k	30.000 M	10.00 k	1.097738 M	-76.93	-51.93
30.000 M	1.000 G	100.00 k	421.273750 M	-73.89	-48.89
1.000 G	5.850 G	1.00 M	3.158250 G	-55.17	-30.17
5.925 G	40.000 G	1.00 M	34.211509 G	-38.69	-13.69

11P5.9G-10M - F2 [Port 1]

Ref -10 dBm

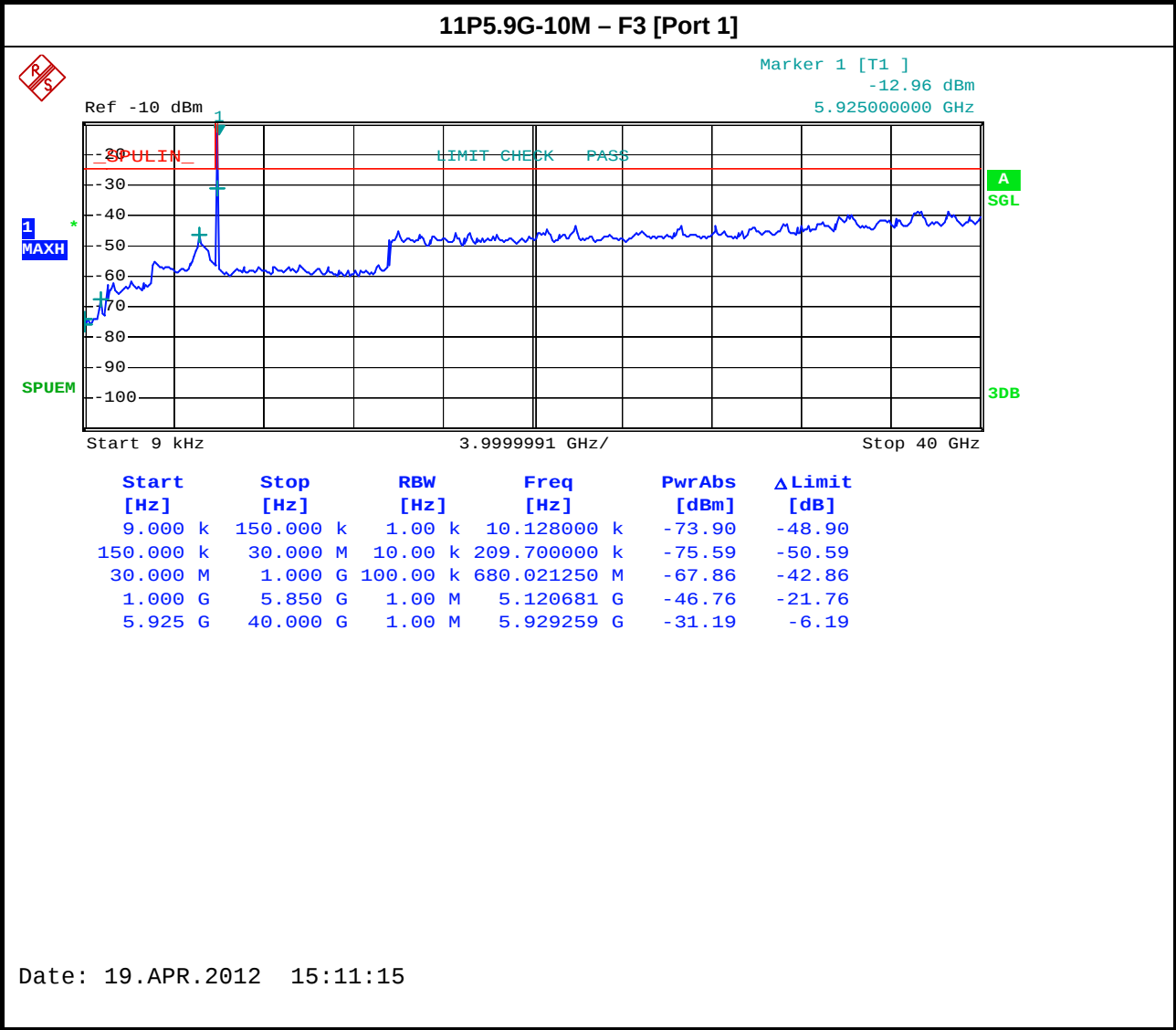
Marker 1 [T1]
-57.71 dBm
5.737843750 GHz

SPUEM

3dB

Start 9 kHz 3.9999991 GHz/ Stop 40 GHz

Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
9.000 k	150.000 k	1.00 k	10.974000 k	-73.69	-48.69
150.000 k	30.000 M	10.00 k	187.312500 k	-74.60	-49.60
30.000 M	1.000 G	100.00 k	996.968750 M	-73.50	-48.50
1.000 G	5.850 G	1.00 M	3.190381 G	-55.59	-30.59
5.925 G	40.000 G	1.00 M	37.001400 G	-38.99	-13.99



3.5 Transmitter Radiated Unwanted Emissions

3.5.1 Transmitter Radiated Unwanted Emissions Limit

Transmitter Radiated Unwanted Emissions Limit
The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $[55 + 10 \log (P)]$ (e.i.r.p. -25dBm [70.2 dBuV/m at 3m]).
Note 1: Refer as ASTM E2213-03 Clause 8.9.2.

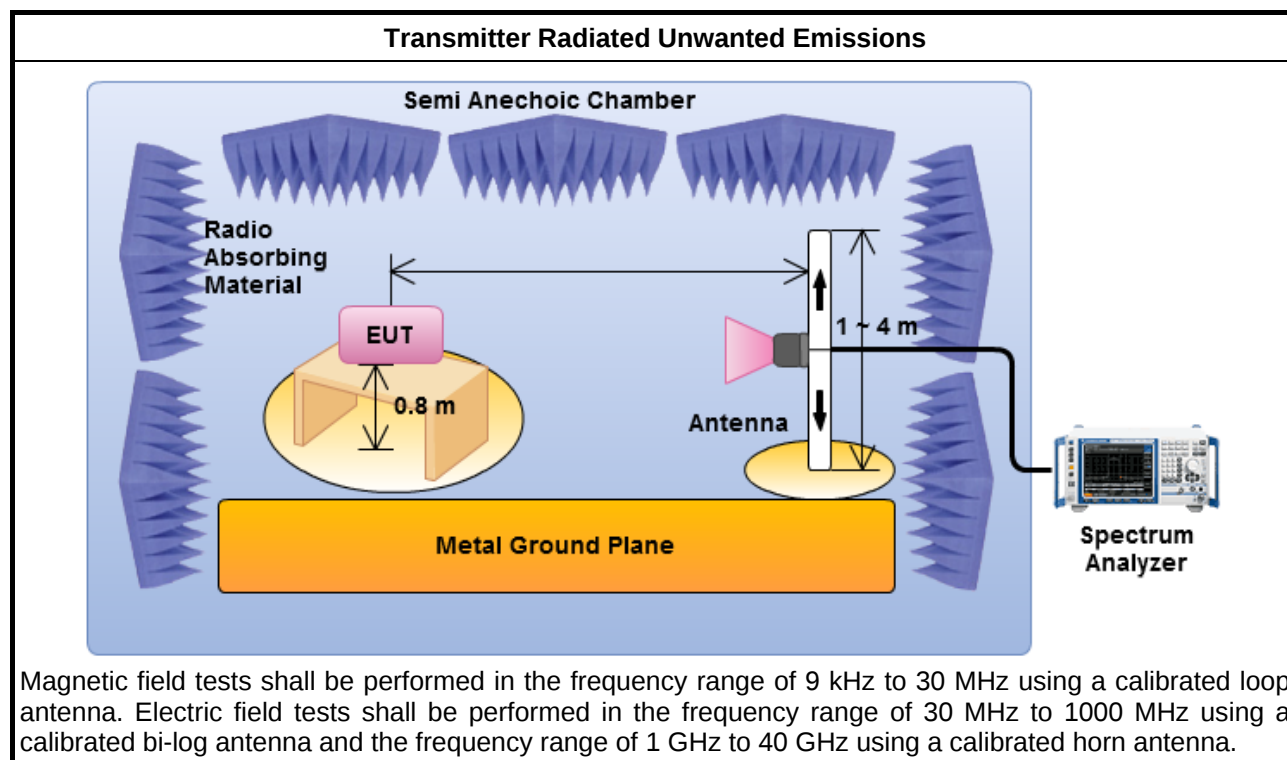
3.5.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.5.3 Test Procedures

Test Method
☒ Refer as ANSI/TIA-603-D-2010, clause 3.2.12 for radiated measurement.
☐ In case a narrower measurement bandwidth was used, the following conversion formula has to be applied: (e.g. if reference bandwidth 1 MHz and measurement bandwidth 100 kHz, then measurement bandwidth conversion factor is 10 dB) $B = A + 10 \log (BW_{ref} / BW_{measured})$ • A is the value at the narrower measurement bandwidth; • B is the value referred to the reference bandwidth;
☒ Effective Isotropic Radiated Power (EIRP)
☐ Refer as KDB 412172, clause 1.3.2 following as power approach. e.i.r.p.= $P_T + G_T$. ☒ Refer as KDB 412172, clause 1.3.1 following as field strength approach. e.i.r.p.= $(E \times d)^2 / 30$.
☐ For radiated measurement.
☐ Refer as KDB 412172, clause 2.2 following eirp can be used radiated test configuration. ☒ Refer as KDB 412172, clause 5 following eirp can be directly determined using the field strength. ☐ Refer as KDB 412172, clause 6 following eirp can be used signal/antenna substitution techniques.

3.5.4 Test Setup

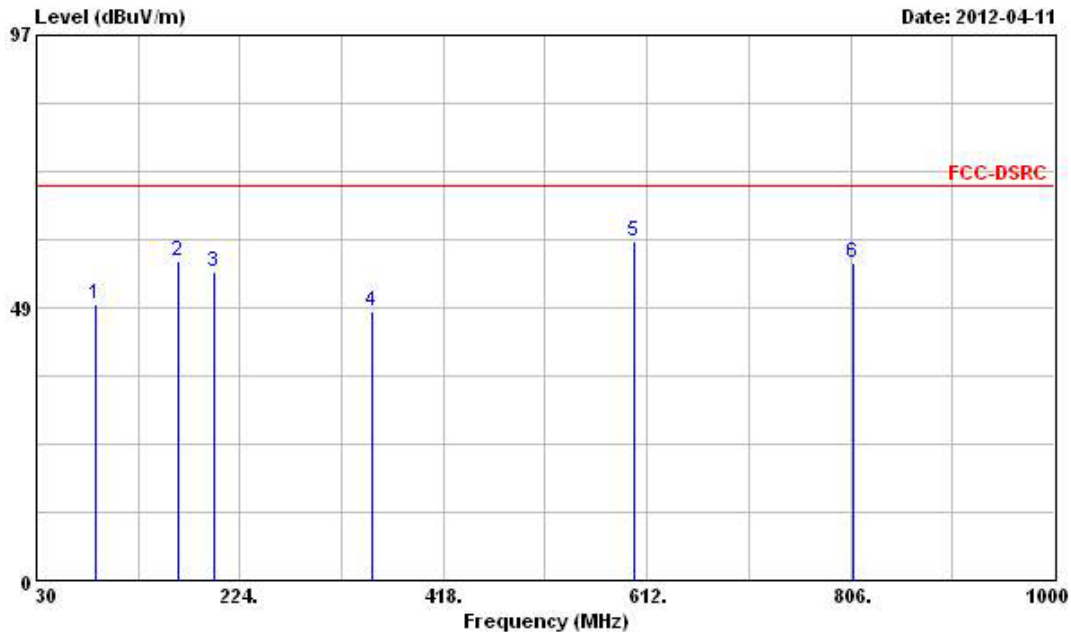


3.5.5 Test Result of Transmitter Radiated Unwanted Emissions (Below 1GHz)



Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation Mode	11P5.9G-10M	Power Level	1	Test Freq. (FX)	F1
Operating Mode	1	Ant. No.	1	Polarization	Horizontal
Operating Function	Continuous TX				



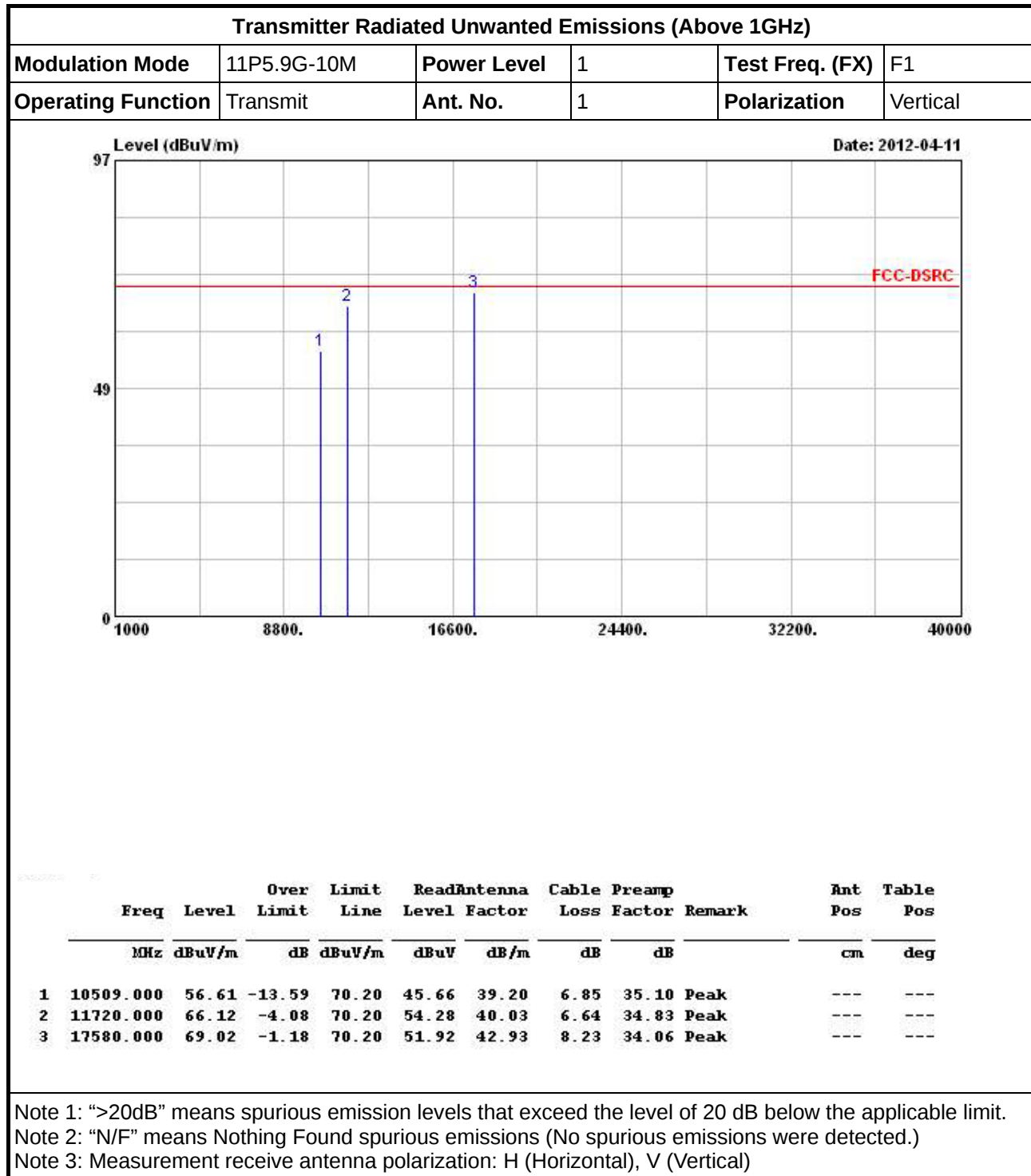
	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1 @	87.230	49.19	-21.01	70.20	66.55	8.92	1.57	27.85	Peak	---	---
2 @	164.830	56.93	-13.27	70.20	72.01	10.34	2.14	27.56	Peak	---	---
3 @	198.780	54.97	-15.23	70.20	68.69	11.28	2.42	27.42	Peak	---	---
4 @	350.100	47.84	-22.36	70.20	57.70	14.48	3.18	27.52	Peak	---	---
5 @	599.390	60.24	-9.96	70.20	64.31	20.15	4.24	28.46	Peak	---	---
6 @	808.910	56.58	-13.62	70.20	59.32	20.25	4.92	27.91	Peak	---	---

Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

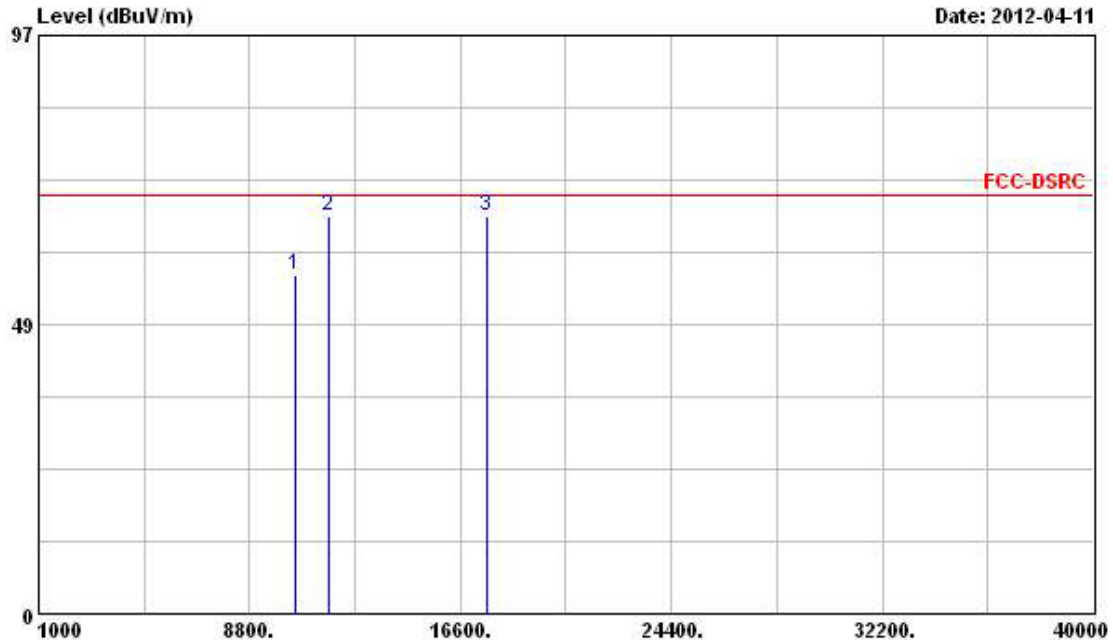
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

3.5.6 Test Result of Transmitter Radiated Unwanted Emissions (Above 1GHz)



Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11P5.9G-10M	Power Level	1	Test Freq. (FX)	F1
Operating Function	Transmit	Ant. No.	1	Polarization	Horizontal



Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1 @10509.000	56.88	-13.32	70.20	45.03	40.10	6.85	35.10	Peak	---	---
2 @11720.000	66.63	-3.57	70.20	54.13	40.69	6.64	34.83	Peak	---	---
3 @17580.000	66.66	-3.54	70.20	49.13	43.36	8.23	34.06	Peak	---	---

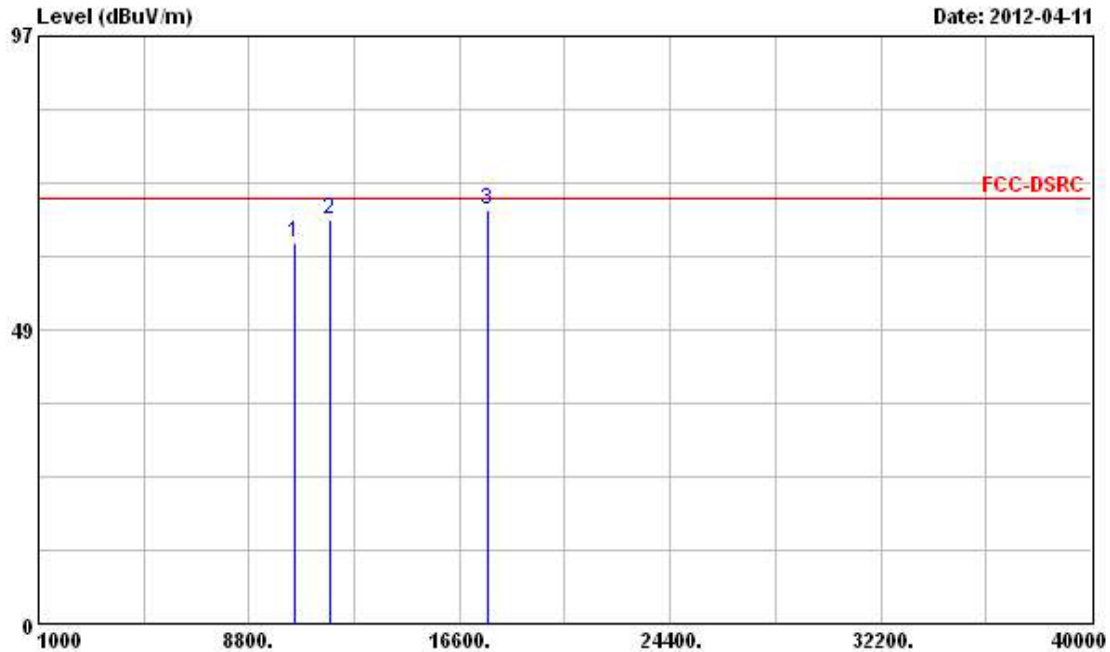
Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11P5.9G-10M	Power Level	1	Test Freq. (FX)	F2
Operating Function	Transmit	Ant. No.	1	Polarization	Vertical



Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1 @10509.000	62.83	-7.37	70.20	51.88	39.20	6.85	35.10	Peak	---	---
2 @11780.000	66.68	-3.52	70.20	54.85	40.07	6.64	34.88	Peak	---	---
3 @17670.000	68.44	-1.76	70.20	51.73	42.83	8.04	34.16	Peak	---	---

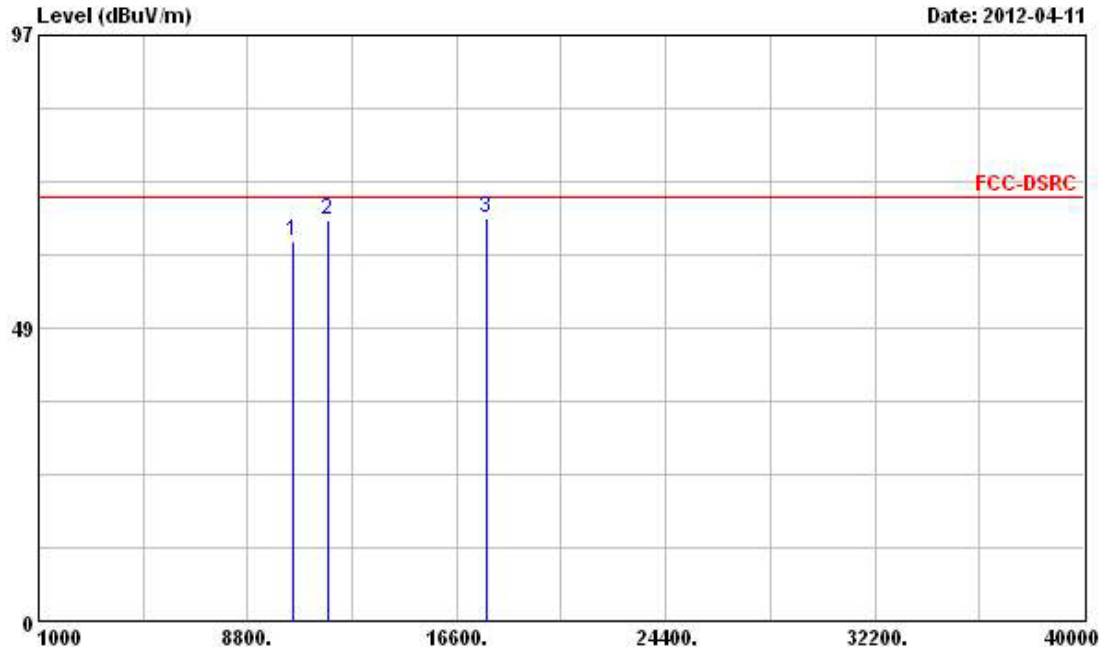
Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11P5.9G-10M	Power Level	1	Test Freq. (FX)	F2
Operating Function	Transmit	Ant. No.	1	Polarization	Horizontal



Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1 @10509.000	62.74	-7.46	70.20	50.89	40.10	6.85	35.10	Peak	---	---
2 @11780.000	66.47	-3.73	70.20	54.00	40.71	6.64	34.88	Peak	---	---
3 @17680.000	66.71	-3.49	70.20	49.62	43.30	7.95	34.16	Peak	---	---

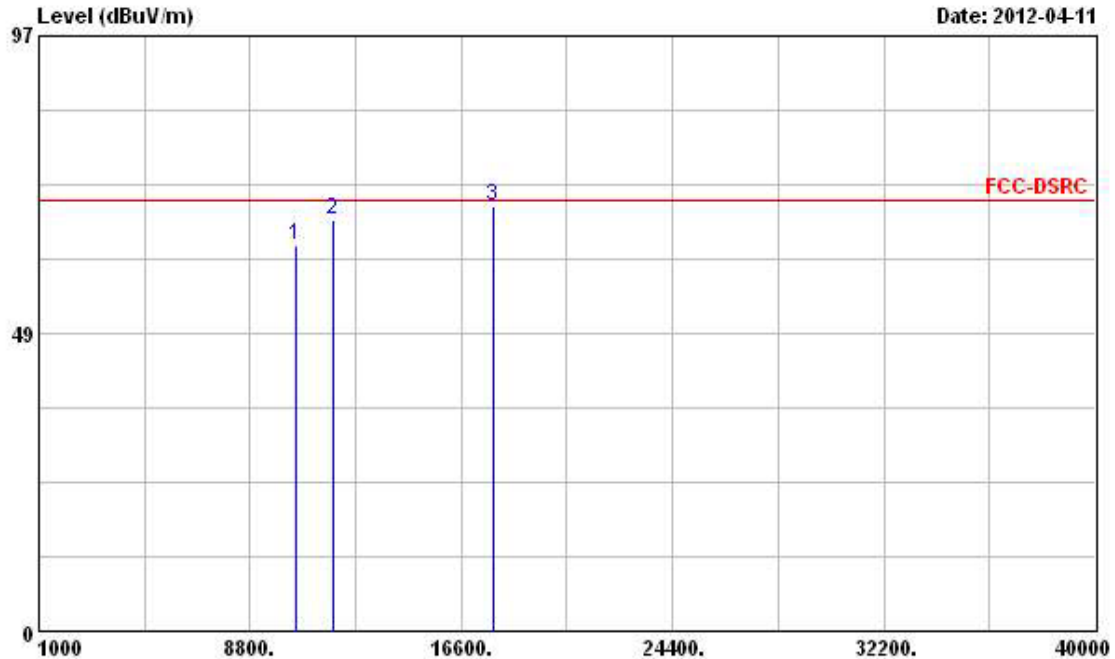
Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11P5.9G-10M	Power Level	1	Test Freq. (FX)	F3
Operating Function	Transmit	Ant. No.	1	Polarization	Vertical



Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1 @10509.000	63.00	-7.20	70.20	52.05	39.20	6.85	35.10	Peak	---	---
2 @11840.000	66.89	-3.31	70.20	55.04	40.11	6.64	34.90	Peak	---	---
3 @17760.000	69.34	-0.86	70.20	53.08	42.74	7.76	34.24	Peak	---	---

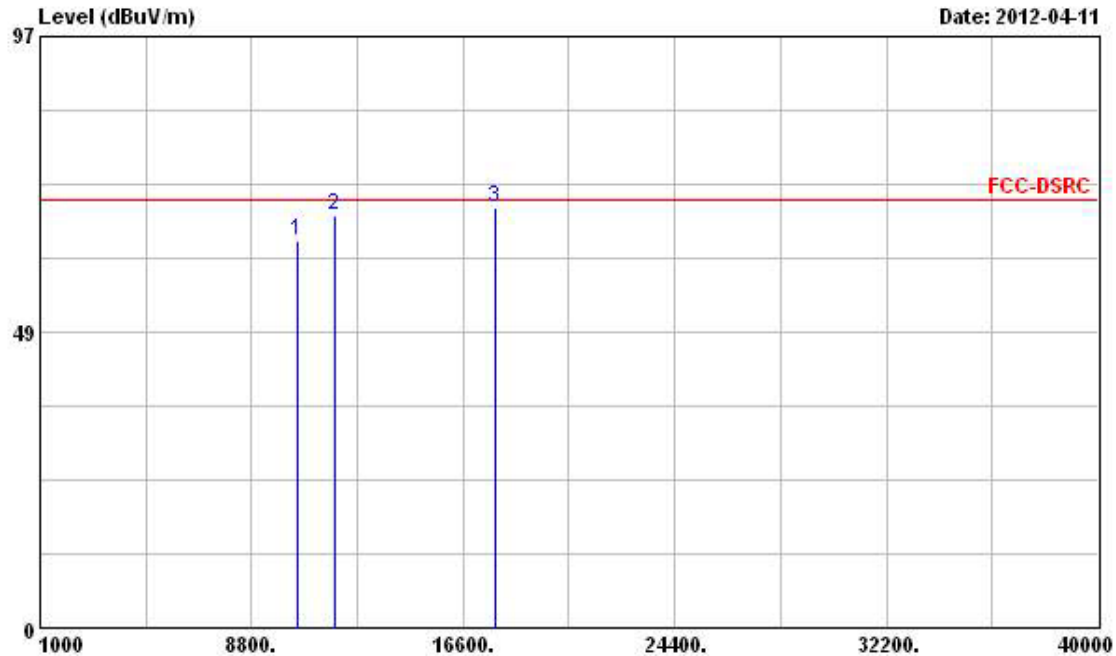
Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11P5.9G-10M	Power Level	1	Test Freq. (FX)	F3
Operating Function	Transmit	Ant. No.	1	Polarization	Horizontal



Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1 @10509.000	63.52	-6.68	70.20	51.67	40.10	6.85	35.10	Peak	---	---
2 @11840.000	67.55	-2.65	70.20	55.07	40.74	6.64	34.90	Peak	---	---
3 @17760.000	68.95	-1.25	70.20	52.19	43.24	7.76	34.24	Peak	---	---

Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

3.6 Frequency Stability

3.6.1 Frequency Stability Limit

Frequency Stability Limit	
ASTM E2213-03	
☒	The transmitter center frequency stability shall be ± 10 ppm maximum for DSRC 5.9GHz band.
☐	Type 1: 0 to 40°C for office environments.
☒	Type 2: -20 to 50°C for industrial environments.
☐	Type 3: -30 to 70°C for industrial environments.
☐	Type 4: -40 to 85°C for automotive environments.
Note 1: These measurements shall also be performed at normal and extreme test conditions.	

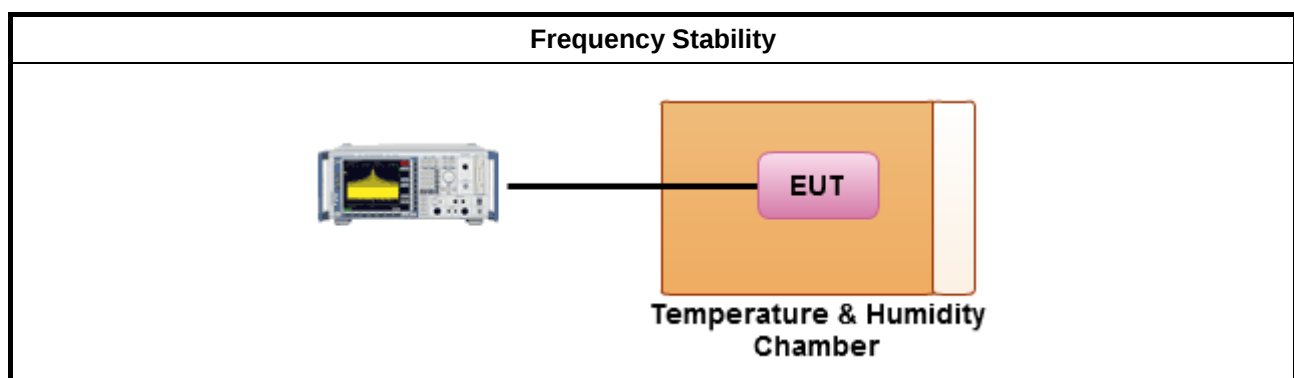
3.6.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

Test Method	
☒	Refer as ANSI/TIA-603-D-2010, clause 3.2.2 for frequency stability tests
☒	Frequency stability with respect to ambient temperature
☒	Frequency stability when varying supply voltage
☒	For conducted measurement.
☒	For conducted measurements on devices with multiple transmit chains: Measurements need only to be performed on one of the active transmit chains (antenna outputs)
☒	Temporary RF connector provided: Using temporary RF connector provided for connected measurement.
☐	No temporary RF connector provided: Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path
☐	For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level.

3.6.4 Test Setup



3.6.5 Test Result of Frequency Stability

Frequency Stability Result						
Power Level	1	Frequency Stability (ppm)				
Condition	Freq. (MHz)	0 min	2 min	5 min	10 min	Limit
T _{20°C} Vmax	5890	-7.84	-7.68	-7.84	-7.72	10.0
T _{20°C} Vmin	5890	-7.84	-7.73	-7.94	-7.81	10.0
T _{50°C} Vnom	5890	-7.10	-6.98	-7.15	-7.01	10.0
T _{40°C} Vnom	5890	-8.45	-8.40	-8.57	-8.44	10.0
T _{30°C} Vnom	5890	-8.47	-8.42	-8.52	-8.37	10.0
T _{20°C} Vnom	5890	-7.83	-7.82	-7.99	-7.83	10.0
T _{10°C} Vnom	5890	-6.99	-6.93	-7.00	-6.87	10.0
T _{0°C} Vnom	5890	-6.30	-6.27	-6.46	-6.28	10.0
T _{-10°C} Vnom	5890	-6.08	-6.07	-6.09	-5.93	10.0
T _{-20°C} Vnom	5890	-7.08	-6.93	-7.10	-6.99	10.0
Result		Complied				
Note 1: Measure at 85 % [Vmin] and 115 % [Vmax] of the nominal voltage [Vnom]. The nominal voltage refer test report clause 1.1.5 for EUT operational condition.						

4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum Analyzer	R&S	FSP 40	100305	9 KHz ~ 40 GHz	Feb. 21, 2012	Conducted (TH01-HY)
Power Sensor	Anritsu	MA2411B	1027452	300 MHz ~ 40 GHz	Jun. 16, 2011	Conducted (TH01-HY)
Power Meter	Anritsu	ML2495A	1124009	300 MHz ~ 40 GHz	Jun. 20, 2011	Conducted (TH01-HY)

Note: Calibration Interval of instruments listed above is one year.

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum Analyzer	R&S	FSP40	100593	9 kHz ~ 40 GHz	Aug. 08, 2011	Radiation (03CH02-HY)
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	30 MHz ~ 1 GHz 3m	May 11, 2011	Radiation (03CH02-HY)
Amplifier	Agilent	8447D	2944A11146	100 kHz ~ 1.3 GHz	Jul. 25, 2011	Radiation (03CH02-HY)
Amplifier	Agilent	8449B	3008A02373	1 GHz ~ 26.5 GHz	Jul. 25, 2011	Radiation (03CH02-HY)
Horn Antenna	ETS-LINDGREN	3117	00091920	1 GHz ~ 18 GHz	Nov. 15, 2011	Radiation (03CH02-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	30 MHz ~ 1 GHz	Nov. 11, 2011	Radiation (03CH02-HY)
RF Cable-high	SUHNER	SUCOFLEX106	03CH02-HY	1 GHz ~ 40 GHz	Mar. 06, 2012	Radiation (03CH02-HY)
Bilog Antenna	SCHAFFNER	CBL61128	2723	30 MHz ~ 2 GHz	Oct. 22, 2011	Radiation (03CH02-HY)
Turn Table	HD	DS 420	420/649/00	0 - 360 degree	N/A	Radiation (03CH02-HY)
Antenna Mast	HD	MA 240	240/559/00	1 m - 4 m	N/A	Radiation (03CH02-HY)

Note: Calibration Interval of instruments listed above is one year.

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Loop Antenna	R&S	HFH2-Z2	860004/001	9 kHz - 30 MHz	Jul. 29, 2010*	Radiation (03CH02-HY)

Note: Calibration Interval of instruments listed above is two year.

5 Certification of TAF Accreditation


財團法人全國認證基金會
Taiwan Accreditation Foundation

Certificate No. : L1190-111208

Certificate of Accreditation

This is to certify that

Sporton International Inc.
EMC & Wireless Communications Laboratory
No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien,
Taiwan, R.O.C.

is accredited in respect of laboratory

Accreditation Criteria	: ISO/IEC 17025:2005
Accreditation Number	: 1190
Originally Accredited	: December 15, 2003
Effective Period	: January 10, 2010 to January 09, 2013
Accredited Scope	: Testing Field, see described in the Appendix
Specific Accreditation Program	: Accreditation Program for Designated Testing Laboratory for Commodities Inspection Accreditation Program for Telecommunication Equipment Testing Laboratory Accreditation Program for BSMI Mutual Recognition Arrangement with Foreign Authorities


Jay-San Chen
President, Taiwan Accreditation Foundation
Date : December 08, 2011

P1, total 24 pages

The Appendix forms an integral part of this Certificate, which shall be invalid when use without the Appendix