



# FCC Test Report

**Equipment** : 5G Wireless Audio Transceiver Module ;  
5G Wireless Audio Receiver Module

**Brand Name** : Wistron

**Model No.** : WLL7010-D20(RoHS);WLL7011-D20(RoHS)

**FCC ID** : PU5AL5230S

**Standard** : 47 CFR FCC Part 15.247

**Operating Band** : 5725 MHz – 5850 MHz

**FCC Classification** : DTS

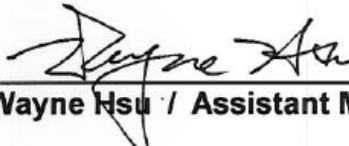
**Applicant** : Wistron Corporation  
21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist,  
New Taipei City 221, Taiwan R.O.C.

**Manufacturer** : Askey Computer Corp.  
10F, No. 119, Chienkang Rd., Chung-Ho, Taiwan, R.O.C.  
**ASKEY TECHNOLOGY (JIANG SU) LTD.**  
No. 1388, Jiao Tong Road, Wujiang Economic-Technological  
Development Area, Jiangsu Province, P.R. China

The product sample received on Aug. 29, 2013 and completely tested on Sep. 09, 2013. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2009 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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### APPENDIX A. TEST PHOTOS

### APPENDIX B. PHOTOGRAPHS OF EUT



## Summary of Test Result

Conformance Test Specifications					
Report Clause	Ref. Std. Clause	Description	Measured	Limit	Result
1.1.2	15.203	Antenna Requirement	Antenna connector mechanism complied	FCC 15.203	Complied
3.1	15.207	AC Power-line Conducted Emissions	[dBuV]: 0.1641380MHz 36.11 (Margin 19.14dB) - AV 51.46 (Margin 13.79dB) - QP	FCC 15.207	Complied
3.2	15.247(a)	Bandwidth	6dB Bandwidth [MHz] QPSK:9.79	$\geq$ 500kHz	Complied
3.3	15.247(b)	RF Output Power (Maximum Peak Conducted Output Power)	Power [dBm]:13.47	Power [dBm]:30	Complied
3.4	15.247(d)	Power Spectral Density	PSD [dBm/100kHz]:-21.71	PSD [dBm/3kHz]:8	Complied
3.5	15.247(c)	Transmitter Bandedge Emissions	Non-Restricted Bands: 5736.730MHz: 34.72dB	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied
3.6	15.247(c)	Transmitter Radiated Unwanted Emissions	Restricted Bands [dBuV/m at 3m]: 44.550MHz 33.81 (Margin 6.19dB) - PK	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied



## Revision History



## 1 General Description

### 1.1 Information

#### 1.1.1 RF General Information

RF General Information				
Frequency Range (MHz)	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N <sub>TX</sub> )	RF Output Power (dBm)
5725-5850	5736, 5762, 5814	3	1	13.47

Note 1: RF output power specifies that Maximum Peak Conducted Output Power.

#### 1.1.2 Antenna Information

Antenna Category	
<input checked="" type="checkbox"/>	Integral antenna (antenna permanently attached)
<input type="checkbox"/>	Temporary RF connector provided
<input checked="" type="checkbox"/>	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.

Antenna General Information			
No.	Ant. Cat.	Ant. Type	Gain (dBi)
1	Integral	PCB	3.20

#### 1.1.3 Type of EUT

Identify EUT	
EUT Serial Number	N/A
Presentation of Equipment	<input type="checkbox"/> Production ; <input type="checkbox"/> Pre-Production ; <input checked="" type="checkbox"/> Prototype
Type of EUT	
<input checked="" type="checkbox"/>	Stand-alone
<input type="checkbox"/>	Combined (EUT where the radio part is fully integrated within another device) Combined Equipment - Brand Name / Model No.:
<input type="checkbox"/>	Plug-in radio (EUT intended for a variety of host systems) Host System - Brand Name / Model No.:
<input type="checkbox"/>	Other:



#### 1.1.4 Test Signal Duty Cycle

Operated Mode for Worst Duty Cycle	
<input type="checkbox"/> Operated normally mode for worst duty cycle	
<input checked="" type="checkbox"/> Operated test mode for worst duty cycle	
<b>Test Signal Duty Cycle (x)</b>	<b>Power Duty Factor [dB] – (10 log 1/x)</b>
<input checked="" type="checkbox"/> 100.00%	0

#### 1.1.5 EUT Operational Condition

<b>Supply Voltage</b>	<input checked="" type="checkbox"/> AC mains	<input type="checkbox"/> DC	
<b>Type of DC Source</b>	<input type="checkbox"/> Internal DC supply	<input checked="" type="checkbox"/> Host	<input type="checkbox"/> Li-on Battery



## 1.2 Support Equipment

Support Equipment			
No.	Equipment	Brand Name	Model Name
1	AC Adapter	AMIGO	AMS9-0502000FU2
2	Test Fixture (Client Provide)	-	-
3	Test Fixture (Client Provide) (Remote Workstation)	-	-
4	5G Wireless Audio Transceiver Module ; 5G Wireless Audio Receiver Module (Remote Workstation)	Wistron	WLL7010-D20(RoHS); WLL7011-D20(RoHS)

## 1.3 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 15
- ANSI C63.10-2009
- FCC KDB 558074
- FCC KDB 662911
- FCC KDB 412172

## 1.4 Testing Location Information

Testing Location			
	HWA YA	ADD	TEL
<input checked="" type="checkbox"/>		No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.	
			886-3-327-3456      FAX :      886-3-327-0973
Test Condition		Test Site No.	Test Engineer
AC Conduction		CO04-HY	Zeus
RF Conducted		TH06-HY	Cain
Radiated Emission		03CH02-HY	Daniel
Test Environment			
24°C / 47%			
24.8°C / 61%			
23°C / 54%			



## 1.5 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	
AC power-line conducted emissions	±2.26 dB	N/A	
Emission bandwidth, 6dB bandwidth	±1.42 %	N/A	
RF output power, conducted	±0.63 dB	N/A	
Power density, conducted	±0.81 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			
Modulation Mode	Transmit Chains (N <sub>TX</sub> )	Data Rate / MCS	Worst Data Rate / MCS
QPSK	1	6-54 Mbps	22Mbps

### 2.2 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter (5725-5850MHz band)				
Test Software Version	N/A			
Modulation Mode	N <sub>TX</sub>	Test Frequency (MHz)		
		5736	5762	5814
QPSK	1	Default / 260	Default / 260	Default / 260



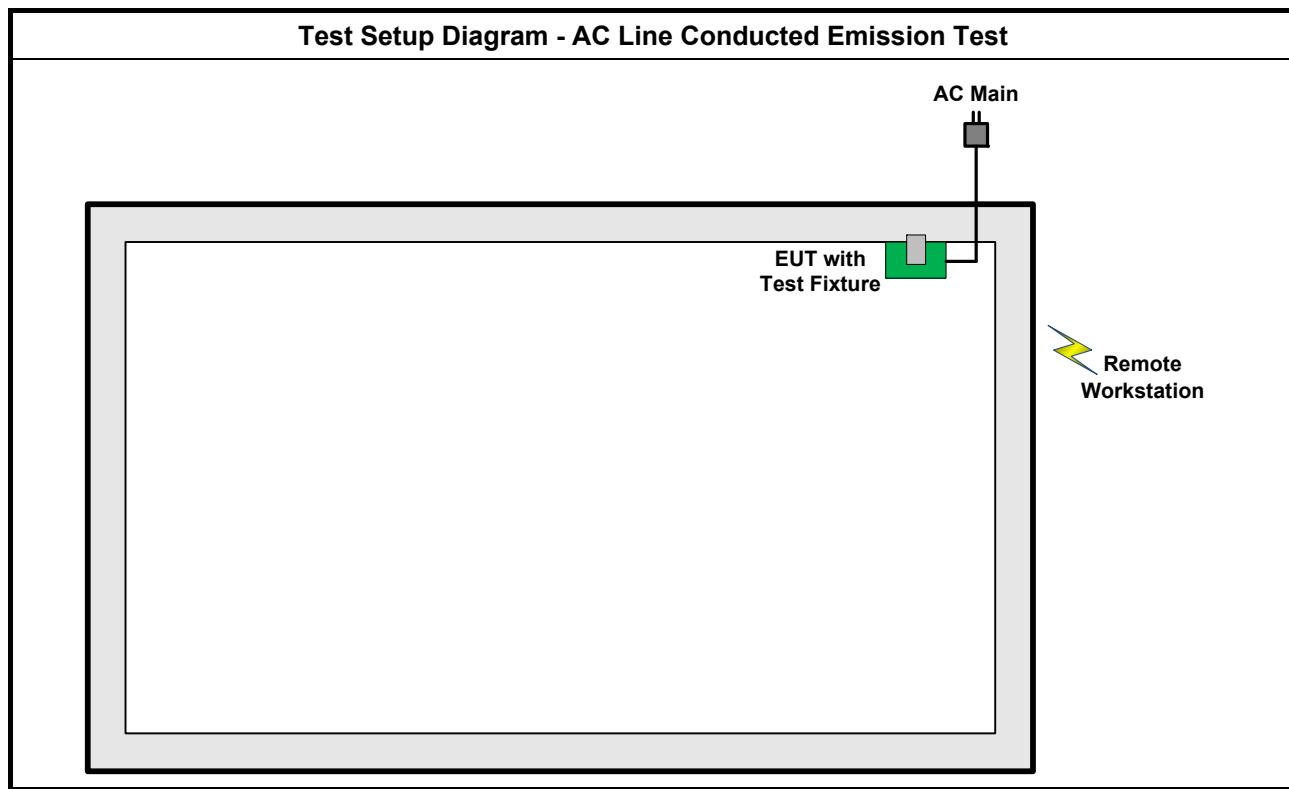
## 2.3 The Worst Case Measurement Configuration

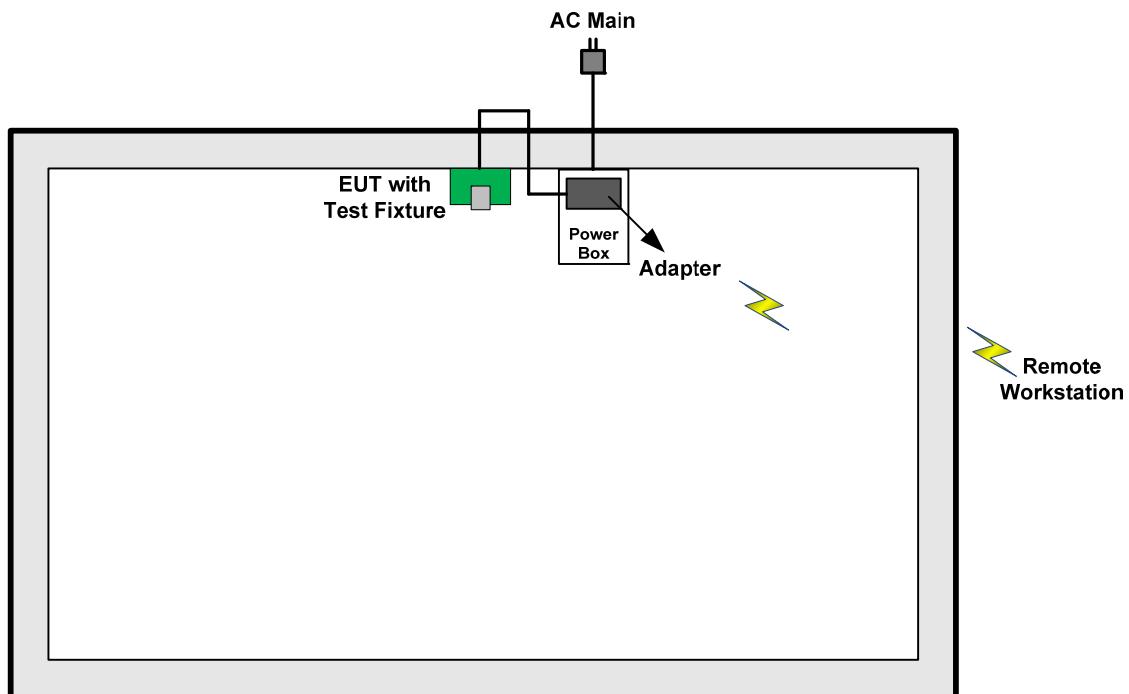
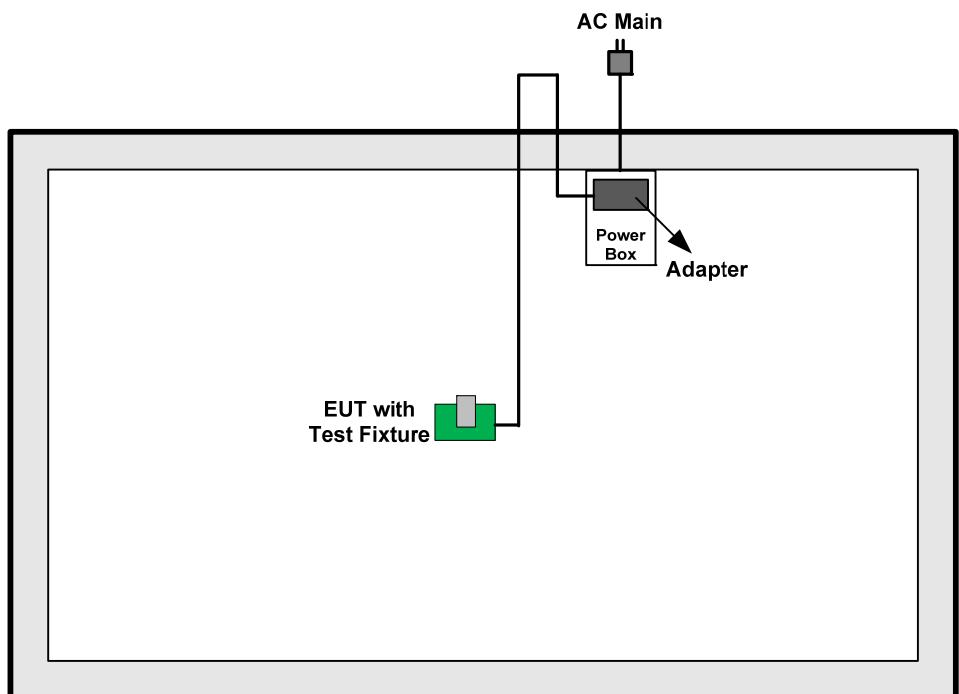
The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
Operating Mode	Operating Mode Description
1	AC Power & Radio link (WLAN)

The Worst Case Mode for Following Conformance Tests	
Tests Item	RF Output Power, Power Spectral Density, 6 dB Bandwidth
Test Condition	Conducted measurement at transmit chains
Modulation Mode	QPSK

The Worst Case Mode for Following Conformance Tests							
Tests Item	Transmitter Radiated Unwanted Emissions Transmitter Radiated Bandedge Emissions						
Test Condition	Radiated measurement						
User Position	<input type="checkbox"/> EUT will be placed in fixed position. <input checked="" type="checkbox"/> EUT will be placed in mobile position and operating multiple positions. EUT shall be performed three orthogonal planes. The worst planes is X. <input type="checkbox"/> 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	<input checked="" type="checkbox"/> 1. AC Power & Radio link (WLAN)						
Modulation Mode	QPSK						
Orthogonal Planes of EUT	<table border="1"><thead><tr><th>X Plane</th><th>Y Plane</th><th>Z Plane</th></tr></thead><tbody><tr><td></td><td></td><td></td></tr></tbody></table>	X Plane	Y Plane	Z Plane			
X Plane	Y Plane	Z Plane					

## 2.4 Test Setup Diagram



**Test Setup Diagram - Radiated Below 1GHz Test****Operating Mode 1** | **AC Power & Radio link (WLAN)****Test Setup Diagram - Radiated Above 1GHz Test****Operating Mode** | **AC Power & Continuous Transmit**

### 3 Transmitter Test Result

#### 3.1 AC Power-line Conducted Emissions

##### 3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: \* Decreases with the logarithm of the frequency.

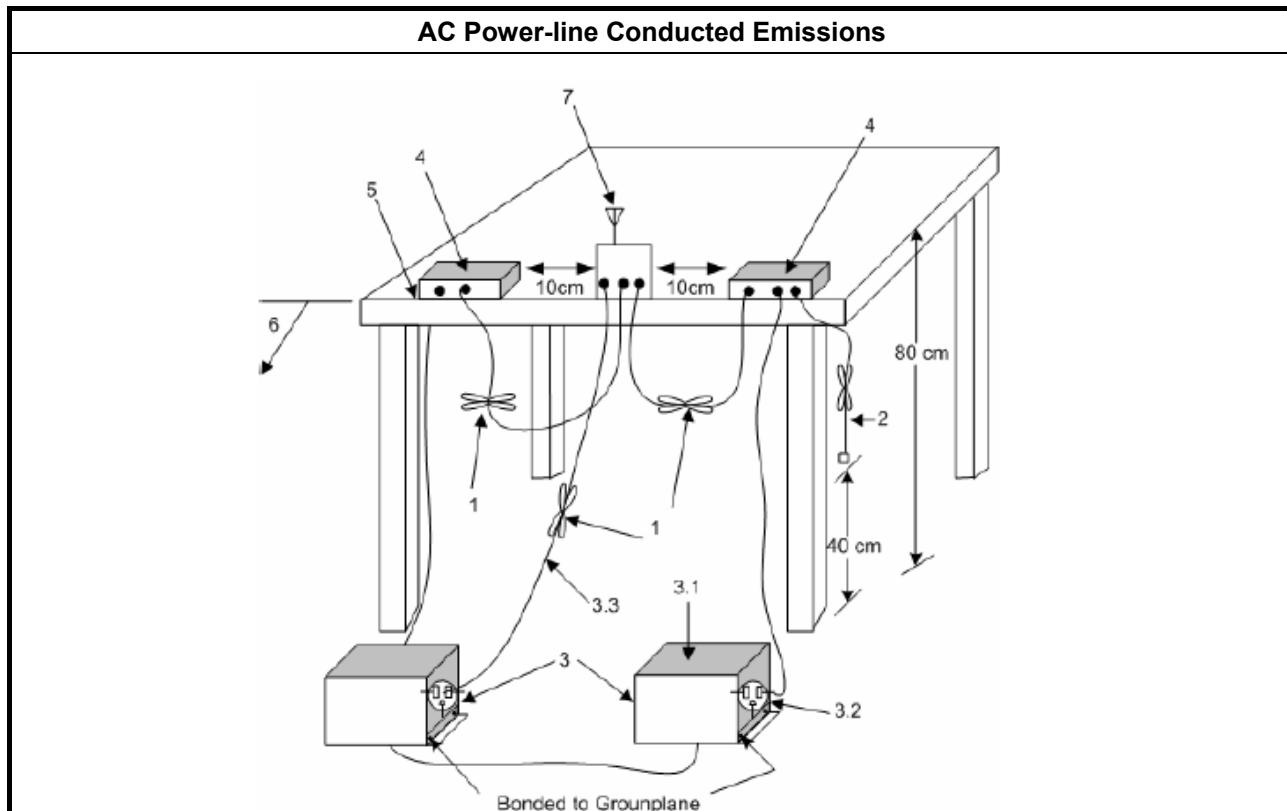
##### 3.1.2 Measuring Instruments

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

##### 3.1.3 Test Procedures

Test Method
<input checked="" type="checkbox"/> Refer as ANSI C63.10-2009, clause 6.2 for AC power-line conducted emissions.

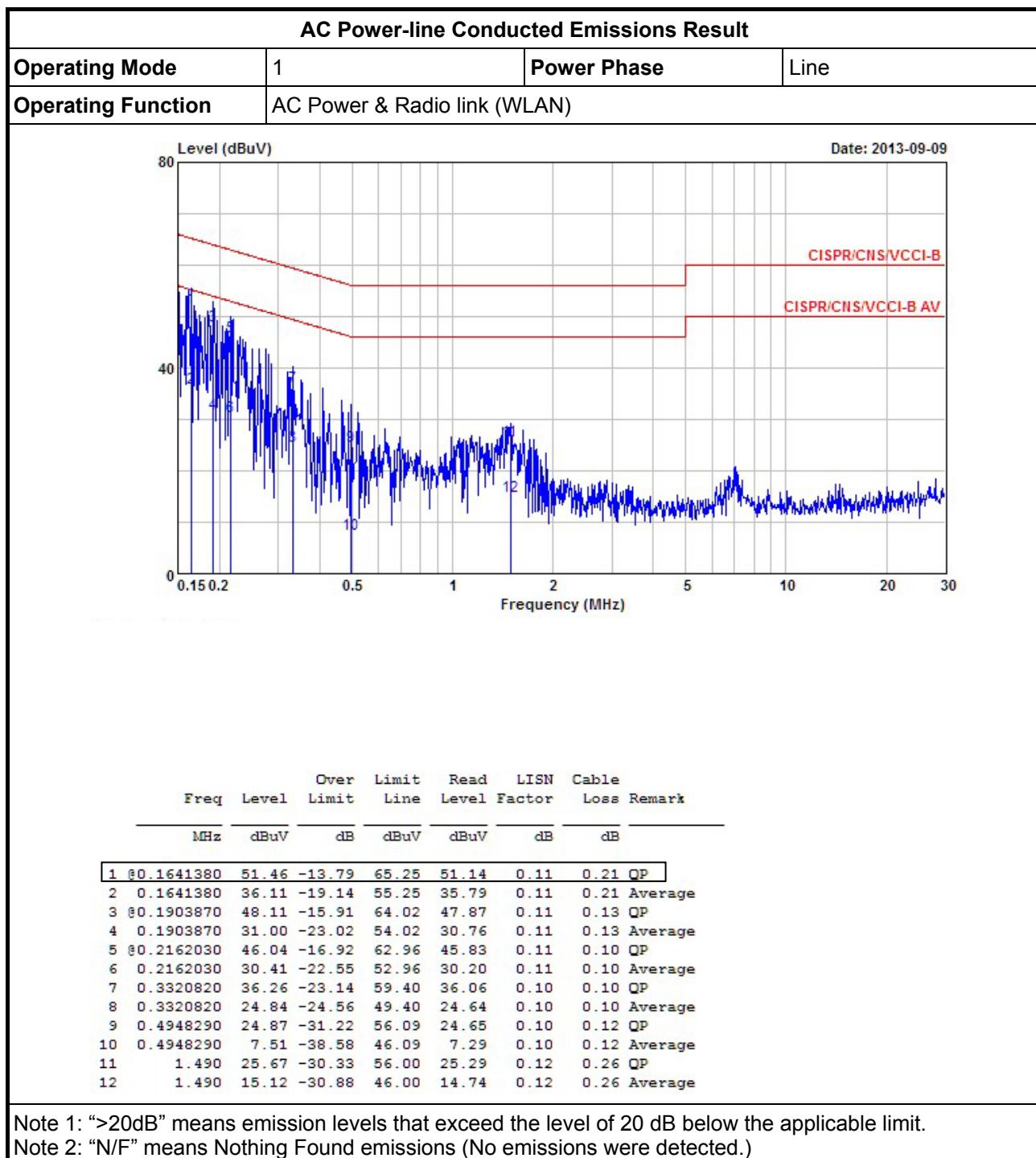
##### 3.1.4 Test Setup





## 3.1.5 Test Result of AC Power-line Conducted Emissions

AC Power-line Conducted Emissions Result																																																																																																																																							
Operating Mode	1	Power Phase	Neutral																																																																																																																																				
Operating Function	AC Power & Radio link (WLAN)																																																																																																																																						
<table><thead><tr><th>Freq</th><th>Level</th><th>Over Limit</th><th>Limit</th><th>Read Line</th><th>LISN</th><th>Cable</th><th></th></tr><tr><th>MHz</th><th>dBuV</th><th>dB</th><th>dBuV</th><th>dBuV</th><th>dB</th><th>dB</th><th></th></tr></thead><tbody><tr><td>1</td><td>46.66</td><td>-18.99</td><td>65.65</td><td>46.18</td><td>0.24</td><td>0.24</td><td>QP</td></tr><tr><td>2</td><td>30.36</td><td>-25.29</td><td>55.65</td><td>29.88</td><td>0.24</td><td>0.24</td><td>Average</td></tr><tr><td>3</td><td>46.11</td><td>-18.57</td><td>64.68</td><td>45.70</td><td>0.23</td><td>0.18</td><td>QP</td></tr><tr><td>4</td><td>27.92</td><td>-26.76</td><td>54.68</td><td>27.51</td><td>0.23</td><td>0.18</td><td>Average</td></tr><tr><td>5</td><td>45.17</td><td>-18.67</td><td>63.84</td><td>44.83</td><td>0.23</td><td>0.11</td><td>QP</td></tr><tr><td>6</td><td>28.19</td><td>-25.65</td><td>53.84</td><td>27.85</td><td>0.23</td><td>0.11</td><td>Average</td></tr><tr><td>7</td><td>40.96</td><td>-20.95</td><td>61.91</td><td>40.63</td><td>0.23</td><td>0.10</td><td>QP</td></tr><tr><td>8</td><td>27.46</td><td>-24.45</td><td>51.91</td><td>27.13</td><td>0.23</td><td>0.10</td><td>Average</td></tr><tr><td>9</td><td>35.79</td><td>-24.40</td><td>60.19</td><td>35.47</td><td>0.22</td><td>0.10</td><td>QP</td></tr><tr><td>10</td><td>26.35</td><td>-23.84</td><td>50.19</td><td>26.03</td><td>0.22</td><td>0.10</td><td>Average</td></tr><tr><td>11</td><td>29.93</td><td>-27.84</td><td>57.77</td><td>29.61</td><td>0.22</td><td>0.10</td><td>QP</td></tr><tr><td>12</td><td>18.78</td><td>-28.99</td><td>47.77</td><td>18.46</td><td>0.22</td><td>0.10</td><td>Average</td></tr><tr><td>13</td><td>21.47</td><td>-34.53</td><td>56.00</td><td>20.94</td><td>0.25</td><td>0.28</td><td>QP</td></tr><tr><td>14</td><td>17.16</td><td>-28.84</td><td>46.00</td><td>16.63</td><td>0.25</td><td>0.28</td><td>Average</td></tr></tbody></table>							Freq	Level	Over Limit	Limit	Read Line	LISN	Cable		MHz	dBuV	dB	dBuV	dBuV	dB	dB		1	46.66	-18.99	65.65	46.18	0.24	0.24	QP	2	30.36	-25.29	55.65	29.88	0.24	0.24	Average	3	46.11	-18.57	64.68	45.70	0.23	0.18	QP	4	27.92	-26.76	54.68	27.51	0.23	0.18	Average	5	45.17	-18.67	63.84	44.83	0.23	0.11	QP	6	28.19	-25.65	53.84	27.85	0.23	0.11	Average	7	40.96	-20.95	61.91	40.63	0.23	0.10	QP	8	27.46	-24.45	51.91	27.13	0.23	0.10	Average	9	35.79	-24.40	60.19	35.47	0.22	0.10	QP	10	26.35	-23.84	50.19	26.03	0.22	0.10	Average	11	29.93	-27.84	57.77	29.61	0.22	0.10	QP	12	18.78	-28.99	47.77	18.46	0.22	0.10	Average	13	21.47	-34.53	56.00	20.94	0.25	0.28	QP	14	17.16	-28.84	46.00	16.63	0.25	0.28	Average	
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Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.																																																																																																																																							
Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)																																																																																																																																							



## 3.2 6dB Bandwidth

### 3.2.1 6dB Bandwidth Limit

6dB Bandwidth Limit
<b>Systems using digital modulation techniques:</b>
<input checked="" type="checkbox"/> 6 dB bandwidth $\geq$ 500 kHz.

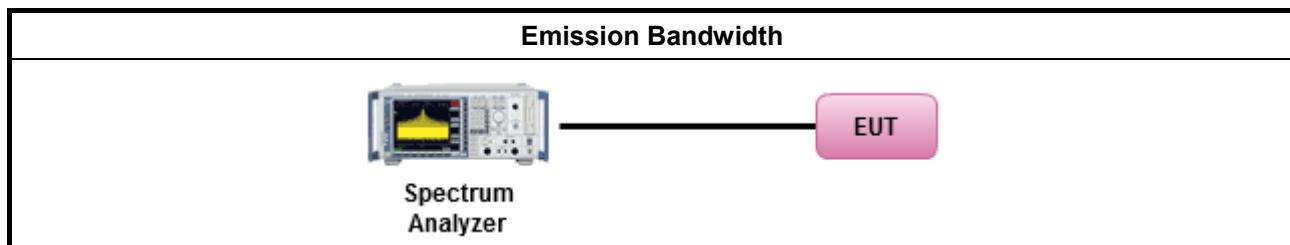
### 3.2.2 Measuring Instruments

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

### 3.2.3 Test Procedures

Test Method
<input checked="" type="checkbox"/> For the emission bandwidth shall be measured using one of the options below:
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.1 Option 1 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.2 Option 2 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.
<input checked="" type="checkbox"/> For conducted measurement.
<input type="checkbox"/> The EUT supports single transmit chain and measurements performed on this transmit chain.
<input type="checkbox"/> The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.
<input type="checkbox"/> The EUT supports multiple transmit chains using options given below:
<input type="checkbox"/> 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.
<input type="checkbox"/> 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.

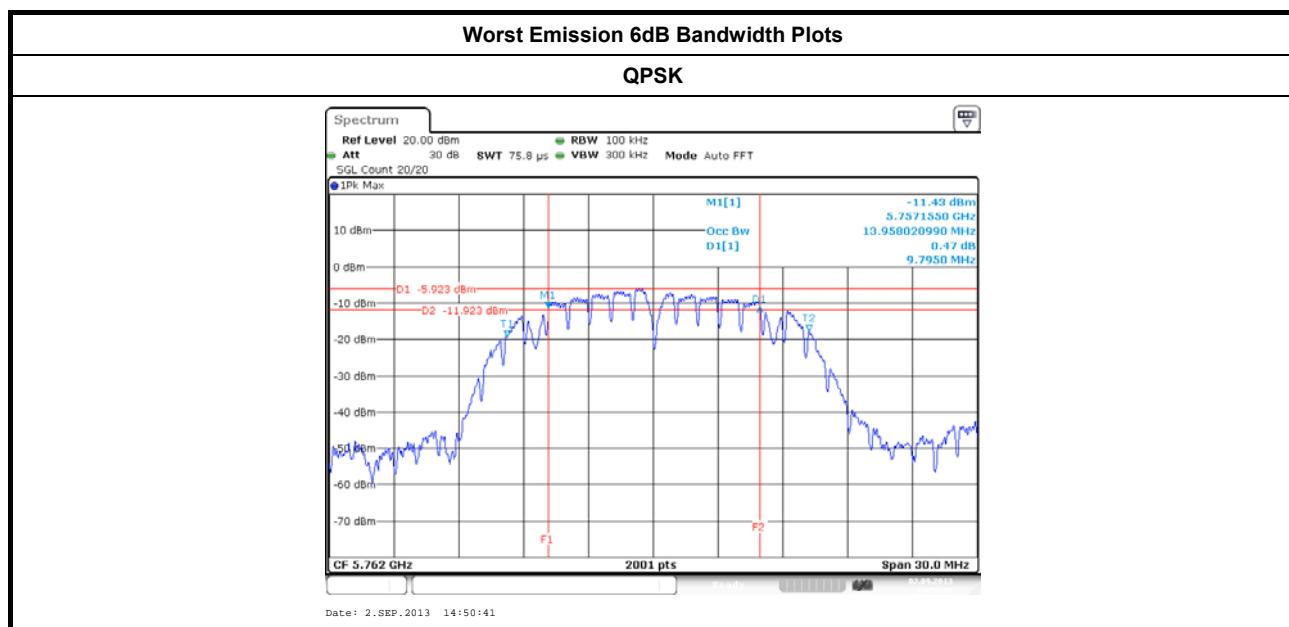
### 3.2.4 Test Setup



### 3.2.5 Test Result of Emission Bandwidth

Emission Bandwidth Result					
Condition			Emission Bandwidth (MHz)		
Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	99% Bandwidth		6dB Bandwidth
			Chain Port 1		Chain Port 1
QPSK	1	5736	13.94		9.81
QPSK	1	5762	13.95		9.79
QPSK	1	5814	13.97		9.81
Limit			N/A		≥500 kHz
Result			Complied		

Note 1: N<sub>TX</sub> = Number of Transmit Chains





### 3.3 RF Output Power

#### 3.3.1 RF Output Power Limit

RF Output Power Limit	
<b>Maximum Peak Conducted Output Power or Maximum Conducted Output Power Limit</b>	
<input checked="" type="checkbox"/> 5725-5850 MHz Band:	
<input checked="" type="checkbox"/> If $G_{TX} \leq 6$ dBi, then $P_{out} \leq 30$ dBm (1 W)	
<input checked="" type="checkbox"/> Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{out} = 30 - (G_{TX} - 6)$ dBm	
<input type="checkbox"/> Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{out} = 30$ dBm	
<b>e.i.r.p. Power Limit:</b>	
<input checked="" type="checkbox"/> 5725-5850 MHz Band	
<input checked="" type="checkbox"/> Point-to-multipoint systems (P2M): $P_{eirp} \leq 36$ dBm (4 W)	
<input type="checkbox"/> Point-to-point systems (P2P): N/A	
$P_{out}$ = maximum peak conducted output power or maximum conducted output power in dBm, $G_{TX}$ = the maximum transmitting antenna directional gain in dBi. $P_{eirp}$ = e.i.r.p. Power in dBm.	

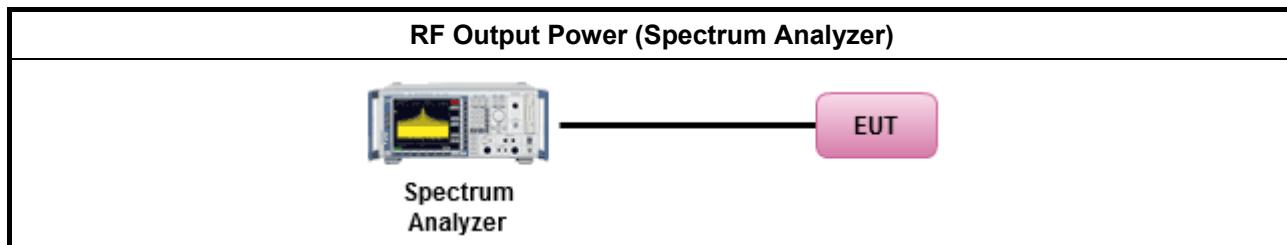
#### 3.3.2 Measuring Instruments

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

### 3.3.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/> Maximum Peak Conducted Output Power	<input type="checkbox"/> Refer as FCC KDB 558074, clause 9.1.1 Option 1 (RBW $\geq$ EBW method). <input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 9.1.2 Option 2 (integrated band power method). <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.1.3 Option 2 (peak power meter for VBW $\geq$ DTS BW)
<input checked="" type="checkbox"/> Maximum Conducted Output Power	[duty cycle $\geq$ 98% or external video / power trigger] <input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.2 Method AVGSA-1 (spectral trace averaging). <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.3 Method AVGSA-1 Alt. (slow sweep speed) duty cycle < 98% and average over on/off periods with duty factor <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging). <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.5 Method AVGSA-2 Alt. (slow sweep speed) RF power meter and average over on/off periods with duty factor or gated trigger <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.3 Method AVGPM (using an RF average power meter).
<input checked="" type="checkbox"/> For conducted measurement.	<input type="checkbox"/> The EUT supports single transmit chain and measurements performed on this transmit chain. <input type="checkbox"/> The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case. <input type="checkbox"/> The EUT supports multiple transmit chains using options given below: 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. <input type="checkbox"/> If multiple transmit chains, EIRP calculation could be following as methods: $P_{\text{total}} = P_1 + P_2 + \dots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $\text{EIRP}_{\text{total}} = P_{\text{total}} + \text{DG}$

### 3.3.4 Test Setup





### 3.3.5 Directional Gain for Power Measurement

Directional Gain (DG) Result				
Transmit Chains No.	1	-	-	-
Maximum $G_{ANT}$ (dBi)	3.20	-	-	-
Modulation Mode	$N_{TX}$	$N_{SS}$ (Min.)	Array Gain (dB)	Power DG (dBi) Note <sup>3</sup>
QPSK	1	1	-	3.20

Note 1: For all transmitter outputs with equal antenna gains, directional gain is to be computed as follows:  
Any transmit signals are correlated, Directional Gain =  $G_{ANT} + 10 \log(N_{TX})$   
All transmit signals are completely uncorrelated, Directional Gain =  $G_{ANT}$

Note 2: For all transmitter outputs with unequal antenna gains, directional gain is to be computed as follows:  
Any transmit signals are correlated, Directional Gain =  $10 \log[(10^{G1/20} + \dots + 10^{GN/20})^2 / N_{TX}]$   
All transmit signals are completely uncorrelated, Directional Gain =  $10 \log[(10^{G1/10} + \dots + 10^{GN/10}) / N_{TX}]$

Note 3: For Spatial Multiplexing, Directional Gain (DG) =  $G_{ANT} + 10 \log(N_{TX}/N_{SS})$ ,  
where  $N_{SS}$  = the number of independent spatial streams data.

Note 4: For CDD transmissions, directional gain is calculated as power measurements:  
Directional Gain (DG) =  $G_{ANT} + \text{Array Gain}$ , where Array Gain is as follows:  
Array Gain = 0 dB (i.e., no array gain) for  $N_{TX} \leq 4$ ;  
Array Gain = 0 dB (i.e., no array gain) for channel widths  $\geq 40$  MHz for any  $N_{TX}$ ;

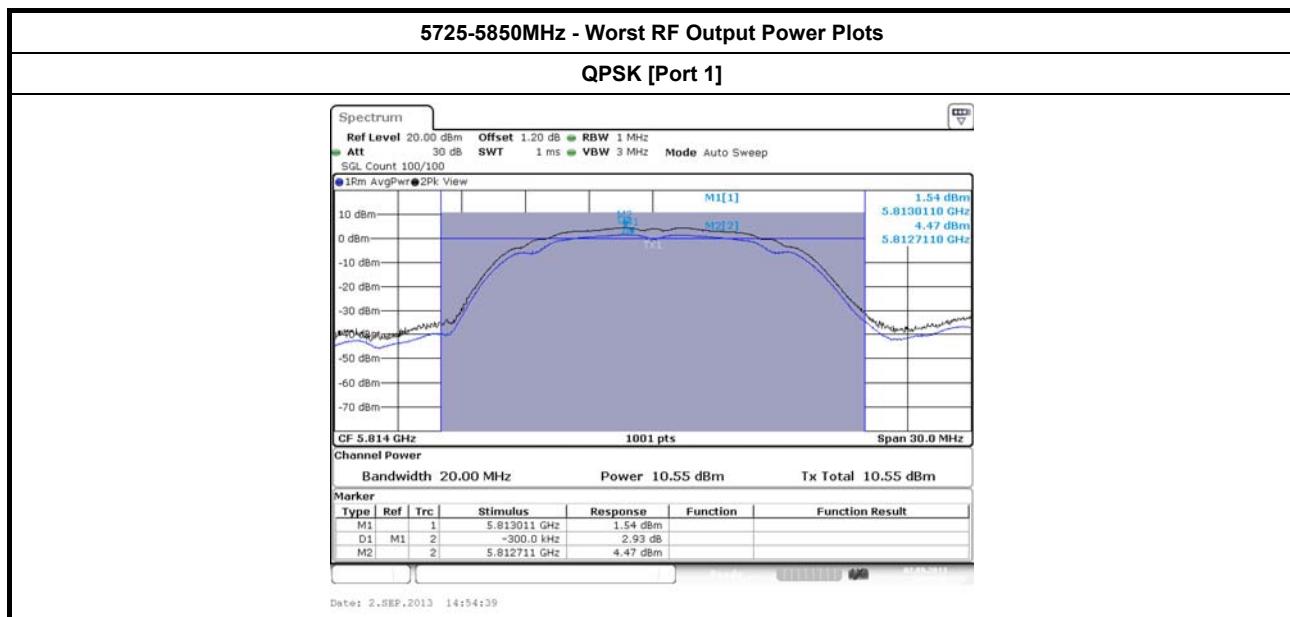


### 3.3.6 Test Result of Maximum Peak Conducted Output Power

Maximum Peak Conducted Output Power Result							
Condition			RF Output Power (dBm)				
Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	Chain Port 1	Power Limit	DG (dBi)	EIRP Power	EIRP Limit
QPSK	1	5736	13.31	30.00	3.20	16.51	36.00
QPSK	1	5762	12.53	30.00	3.20	15.73	36.00
QPSK	1	5814	13.47	30.00	3.20	16.67	36.00
Result			Complied				

### 3.3.7 Test Result of Maximum Conducted (Average) Output Power

Maximum Conducted Output Power Result							
Condition			RF Output Power (dBm)				
Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	Chain Port 1	Power Limit	DG (dBi)	EIRP Power	EIRP Limit
QPSK	1	5736	10.38	30.00	3.20	13.58	36.00
QPSK	1	5762	9.61	30.00	3.20	12.81	36.00
QPSK	1	5814	10.55	30.00	3.20	13.75	36.00
Result			Complied				





## 3.4 Power Spectral Density

### 3.4.1 Power Spectral Density Limit

Power Spectral Density Limit
<input checked="" type="checkbox"/> Power Spectral Density (PSD) $\leq 8 \text{ dBm/3kHz}$

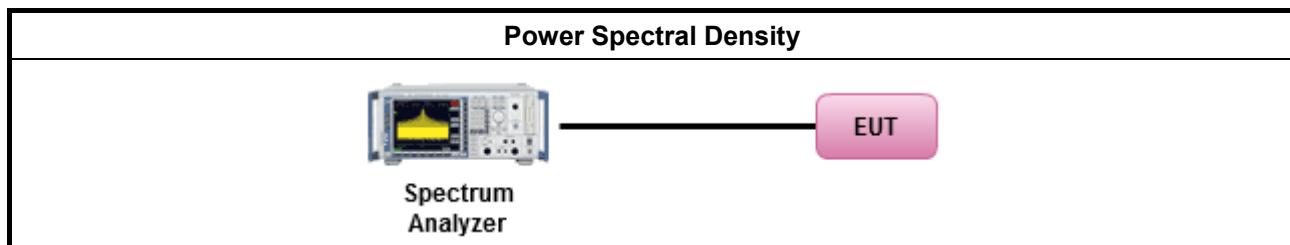
### 3.4.2 Measuring Instruments

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

### 3.4.3 Test Procedures

Test Method		
<input checked="" type="checkbox"/> Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).		
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 10.2 Method PKPSD (RBW=3-100kHz;detector=peak).. [duty cycle $\geq 98\%$ or external video / power trigger]		
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 10.3 Method AVGPSD-1 (spectral trace averaging).		
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.4 Method AVGPSD-1 Alt. (slow sweep speed) duty cycle $< 98\%$ and average over on/off periods with duty factor		
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.5 Method AVGPSD-2 (spectral trace averaging).		
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.6 Method AVGPSD-2 Alt. (slow sweep speed)		
<input checked="" type="checkbox"/> For conducted measurement. <input type="checkbox"/> The EUT supports single transmit chain and measurements performed on this transmit chain. <input type="checkbox"/> The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case. <input type="checkbox"/> The EUT supports multiple transmit chains using options given below: <table border="1"><tr><td><input type="checkbox"/> Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the <math>N_{TX}</math> output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.</td></tr><tr><td><input type="checkbox"/> Option 2: Measure and add <math>10 \log(N)</math> dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with <math>10 \log(N)</math>. Or each transmit chains shall be add <math>10 \log(N)</math> to compared with the limit.</td></tr></table>	<input type="checkbox"/> Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the $N_{TX}$ output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.	<input type="checkbox"/> Option 2: Measure and add $10 \log(N)$ dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with $10 \log(N)$ . Or each transmit chains shall be add $10 \log(N)$ to compared with the limit.
<input type="checkbox"/> Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the $N_{TX}$ output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.		
<input type="checkbox"/> Option 2: Measure and add $10 \log(N)$ dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with $10 \log(N)$ . Or each transmit chains shall be add $10 \log(N)$ to compared with the limit.		

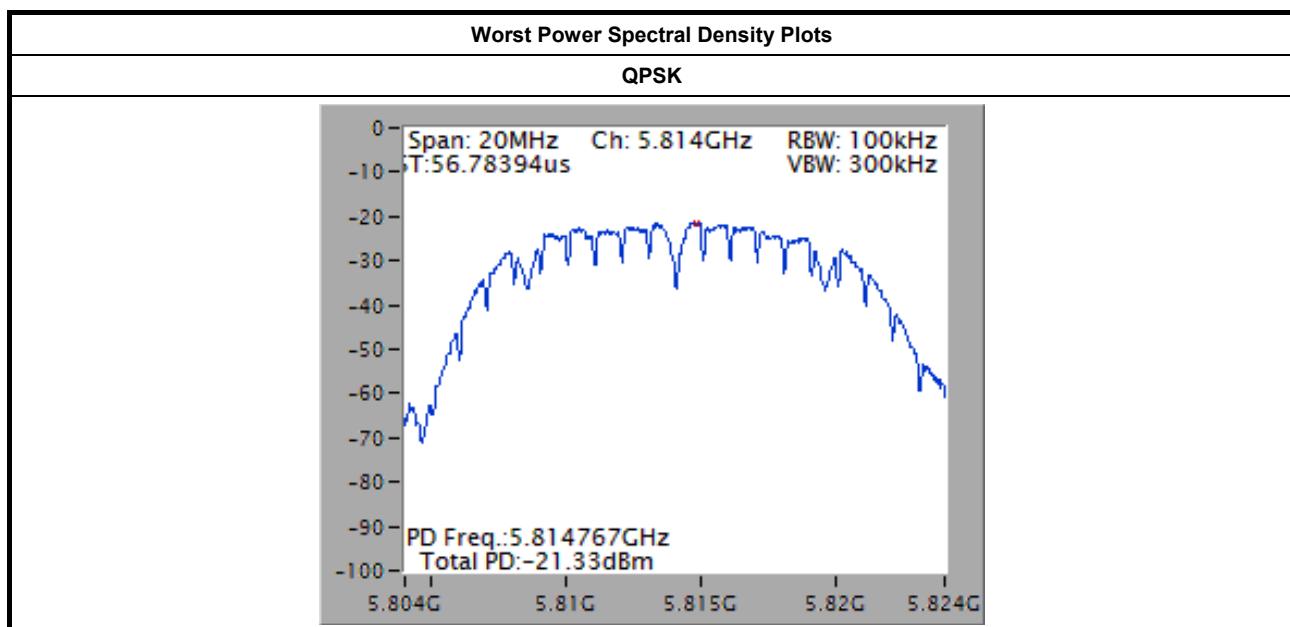
### 3.4.4 Test Setup



### 3.4.5 Test Result of Power Spectral Density

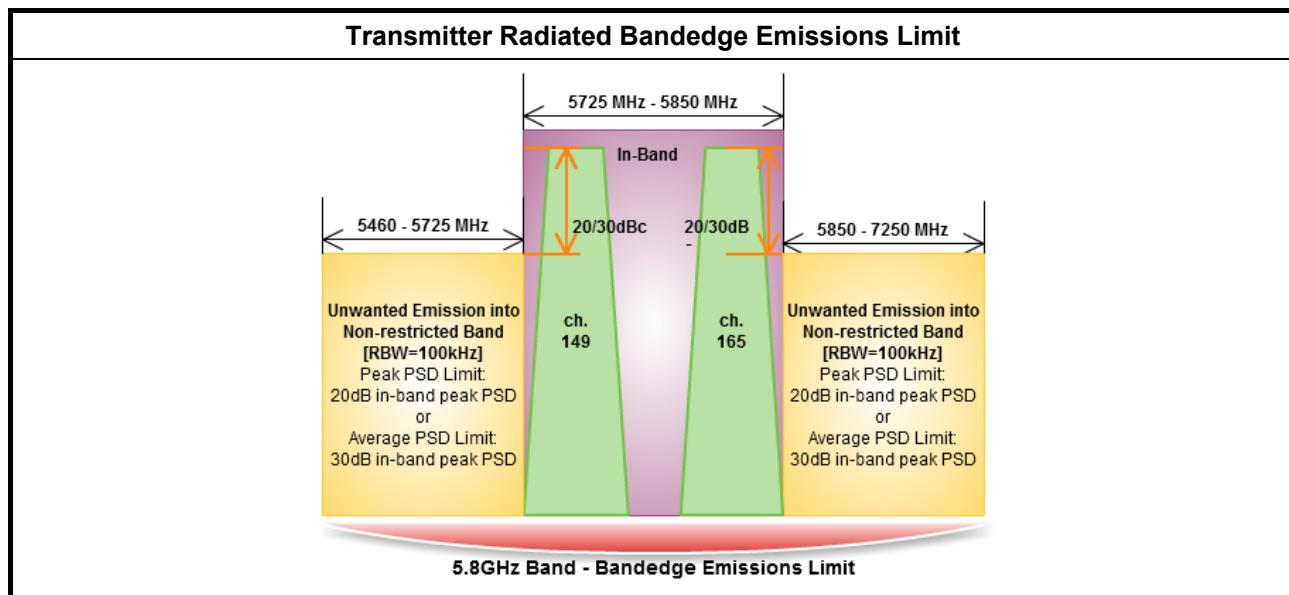
Condition			Power Spectral Density	
Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	Sum Chain (dBm/100kHz)	PSD Limit (dBm/3kHz)
QPSK	1	5736	-21.69	8
QPSK	1	5762	-21.71	8
QPSK	1	5814	-21.33	8
Result			Complied	

Note 1: PSD = sum each transmit chains by bin-to-bin PSD



## 3.5 Transmitter Bandedge Emissions

### 3.5.1 Transmitter Radiated Bandedge Emissions Limit



### 3.5.2 Measuring Instruments

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

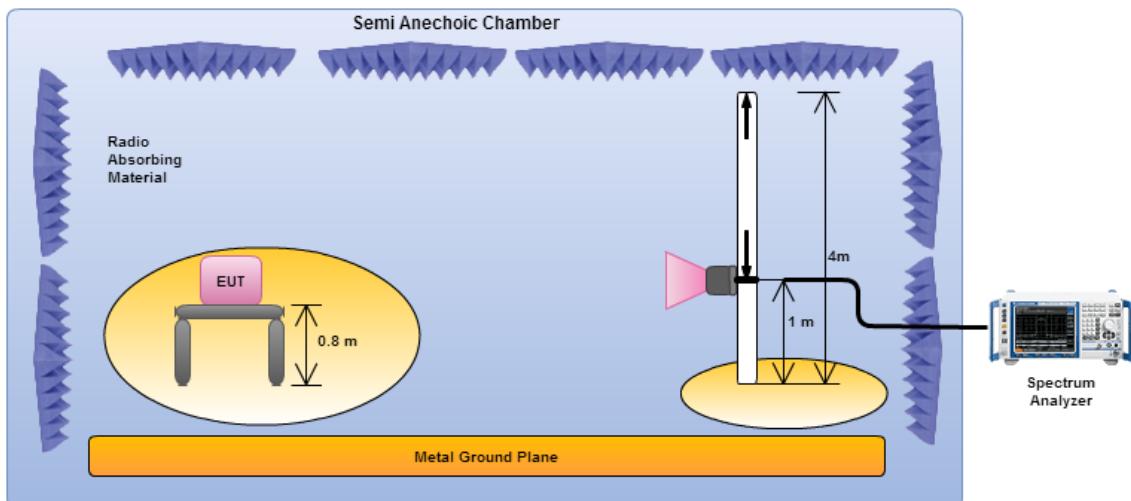


### 3.5.3 Test Procedures

Test Method								
<input checked="" type="checkbox"/> The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].								
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.2.2 bandedge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.								
<input checked="" type="checkbox"/> For the transmitter unwanted emissions shall be measured using following options below: <table border="1"><tr><td><input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands.</td></tr><tr><td><input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.</td></tr><tr><td><input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle <math>\geq 98\%</math>)</td></tr><tr><td><input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).</td></tr><tr><td><input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW <math>\geq 1/T</math>).</td></tr><tr><td><input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW <math>\geq 1/T</math>, where T is pulse time.</td></tr><tr><td><input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.</td></tr><tr><td><input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 11.3 and 12.2.4 measurement procedure peak limit.</td></tr></table>	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands.	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq 98\%$ )	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW $\geq 1/T$ ).	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW $\geq 1/T$ , where T is pulse time.	<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 11.3 and 12.2.4 measurement procedure peak limit.
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands.								
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.								
<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq 98\%$ )								
<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).								
<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW $\geq 1/T$ ).								
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW $\geq 1/T$ , where T is pulse time.								
<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.								
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 11.3 and 12.2.4 measurement procedure peak limit.								
<input checked="" type="checkbox"/> For the transmitter bandedge emissions shall be measured using following options below: <table border="1"><tr><td><input type="checkbox"/> Refer as FCC KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).</td></tr><tr><td><input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.2 for band-edge testing.</td></tr><tr><td><input type="checkbox"/> Refer as ANSI C63.10, clause 6.9.3 for marker-delta method for band-edge measurements.</td></tr></table>	<input type="checkbox"/> Refer as FCC KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.2 for band-edge testing.	<input type="checkbox"/> Refer as ANSI C63.10, clause 6.9.3 for marker-delta method for band-edge measurements.					
<input type="checkbox"/> Refer as FCC KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).								
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.2 for band-edge testing.								
<input type="checkbox"/> Refer as ANSI C63.10, clause 6.9.3 for marker-delta method for band-edge measurements.								
<input checked="" type="checkbox"/> For radiated measurement, refer as FCC KDB 558074, clause 12.2.7.								
<input checked="" type="checkbox"/> Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements). Measurements in the bandedge are typically made at a closer distance 1m, because the instrumentation noise floor is typically close to the radiated emission limit.								

### 3.5.4 Test Setup

#### Transmitter Radiated Bandedge Emissions



Electric field tests shall be performed in transmitter bandedge emissions using a calibrated horn antenna.

### 3.5.5 Transmitter Radiated Bandedge Emissions

#### 5725-5850MHz Transmitter Radiated Bandedge Emissions

Modulation	N <sub>TX</sub>	Test Freq. (MHz)	In-band PSD [i] (dB <sub>UV</sub> /100kHz)	Freq. (MHz)	Out-band PSD [o] (dB <sub>UV</sub> /100kHz)	[i] – [o] (dB)	Limit (dB)	Pol.
QPSK	1	5736	107.36	5736.730	72.64	34.72	20	H
QPSK	1	5814	107.34	5813.260	70.86	36.50	20	H

Note 1: Measurement worst emissions of receive antenna polarization



## 3.6 Transmitter Unwanted Emissions

### 3.6.1 Transmitter Radiated Unwanted Emissions Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Un-restricted Band Emissions Limit	
RF output power procedure	Limit (dB)
Peak output power procedure	20
Average output power procedure	30

Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

### 3.6.2 Measuring Instruments

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

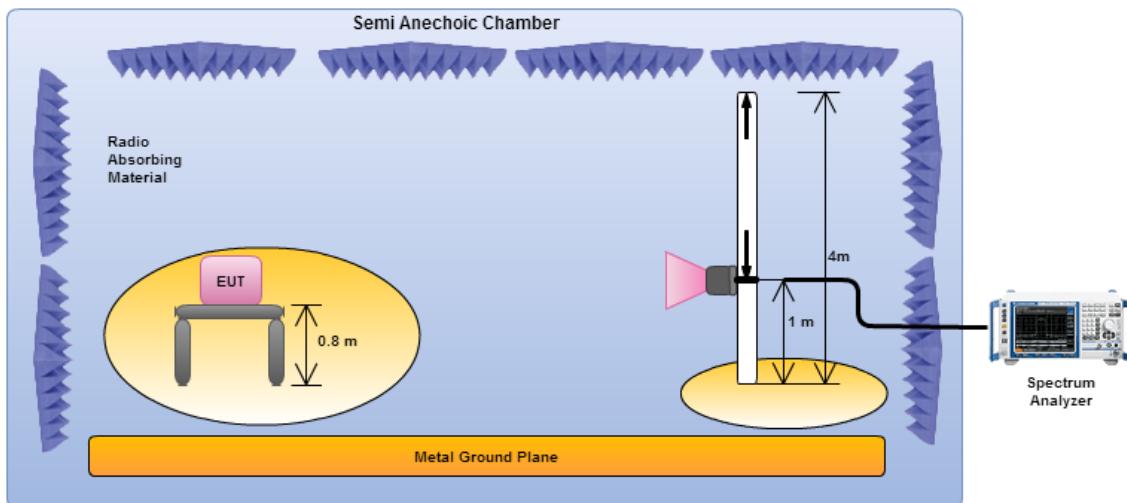


### 3.6.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).
<input checked="" type="checkbox"/>	Measurements in the frequency range 10 GHz - 18GHz are typically made at a closer distance 1m, because the instrumentation noise floor is typically close to the radiated emission limit.
<input checked="" type="checkbox"/>	Measurements in the frequency range above 18 GHz - 25GHz are typically made at a closer distance 0.5m, because the instrumentation noise floor is typically close to the radiated emission limit.
<input checked="" type="checkbox"/>	The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].
<input checked="" type="checkbox"/>	For the transmitter unwanted emissions shall be measured using following options below:
<input checked="" type="checkbox"/>	Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands.
<input checked="" type="checkbox"/>	Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq$ 98%)
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW $\geq$ 1/T).
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW $\geq$ 1/T, where T is pulse time.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 11.3 and 12.2.4 measurement procedure peak limit.
	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.3 measurement procedure Quasi-Peak limit.
<input checked="" type="checkbox"/>	For radiated measurement, refer as FCC KDB 558074, clause 12.2.7.
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz.
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.5 for radiated emissions from 30 MHz to 1000 MHz.
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.6 for radiated emissions from above 1 GHz.

### 3.6.4 Test Setup

#### Transmitter Radiated Unwanted Emissions



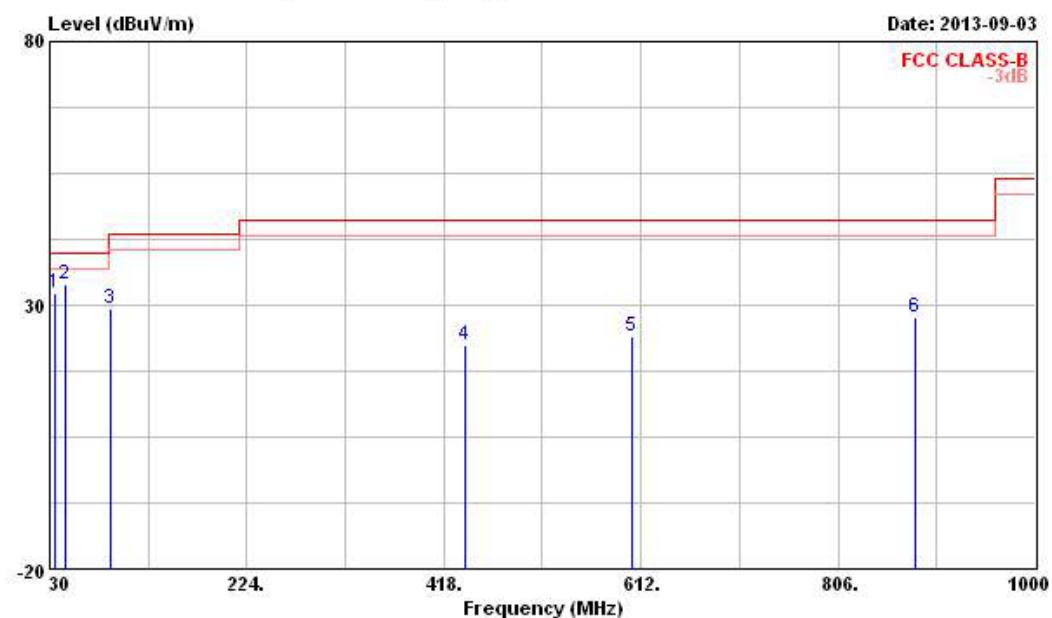
Magnetic field tests shall be performed in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna. Electric field tests shall be performed in the frequency range of 30 MHz to 1000 MHz using a calibrated bi-log antenna and the frequency range of 1 GHz to 40 GHz using a calibrated horn antenna.

### 3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.



### 3.6.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

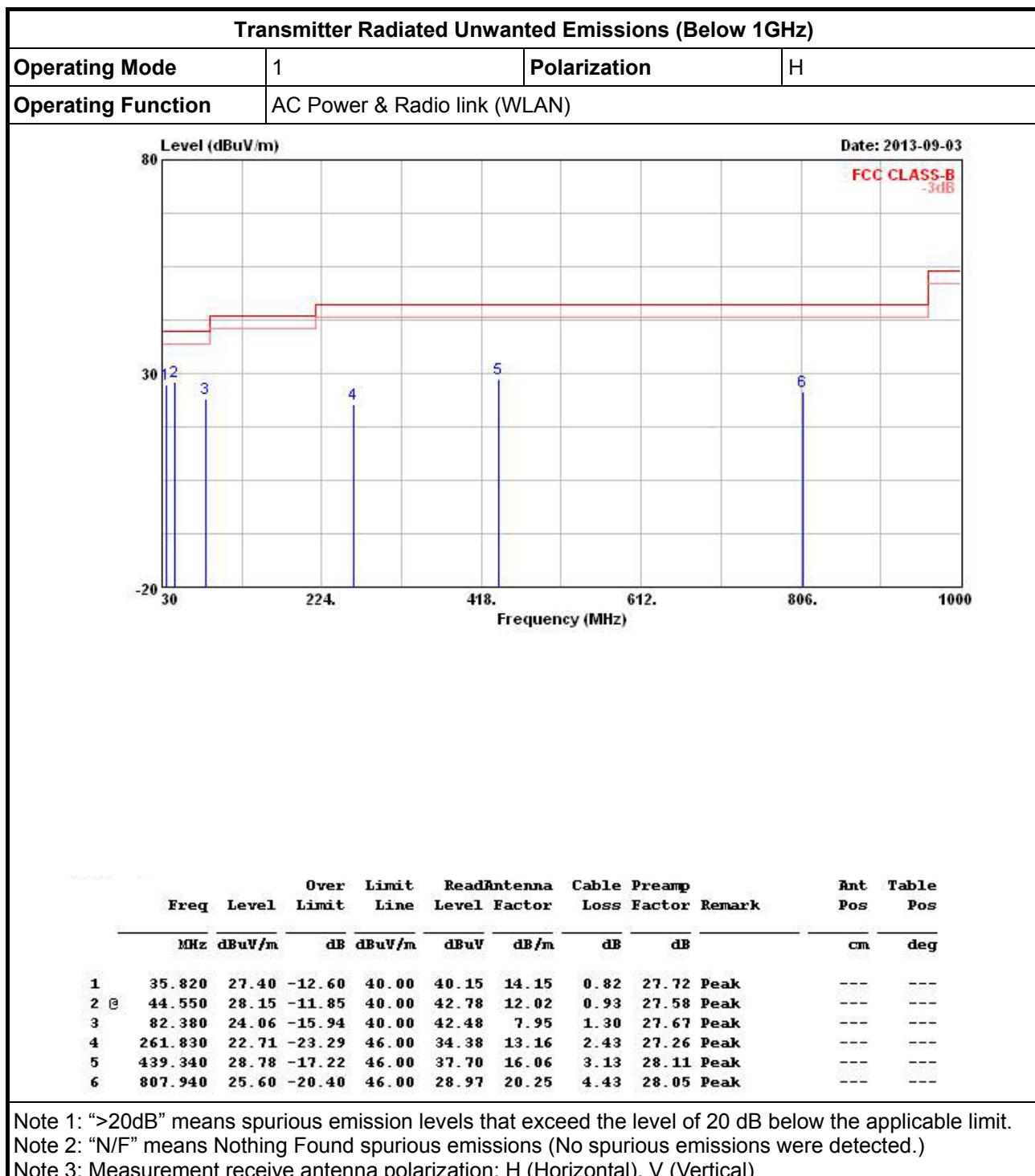


Freq	Level	Over Limit		ReadAntenna		Cable Preamp		Ant Pos	Table Pos	
		Line	Level	Factor	Loss	Factor	Remark			
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg
1	35.820	32.21	-7.79	40.00	44.96	14.15	0.82	27.72	Peak	---
2	44.550	33.81	-6.19	40.00	48.44	12.02	0.93	27.58	Peak	---
3	90.140	29.21	-14.29	43.50	46.08	9.50	1.34	27.71	Peak	---
4	439.340	22.41	-23.59	46.00	31.33	16.06	3.13	28.11	Peak	---
5	602.300	24.08	-21.92	46.00	28.73	20.15	3.69	28.49	Peak	---
6	881.660	27.59	-18.41	46.00	30.76	20.07	4.58	27.82	Peak	---

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

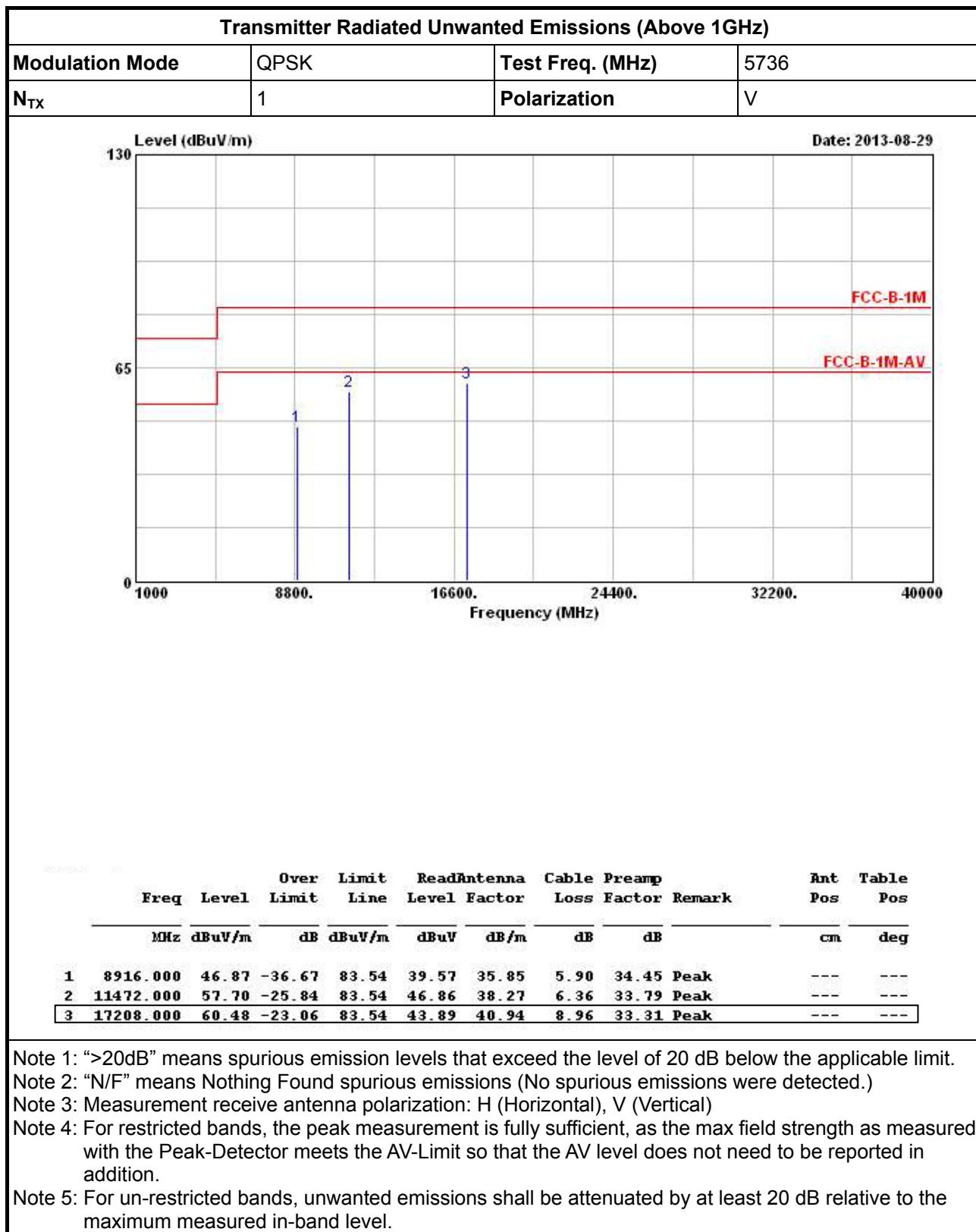
Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

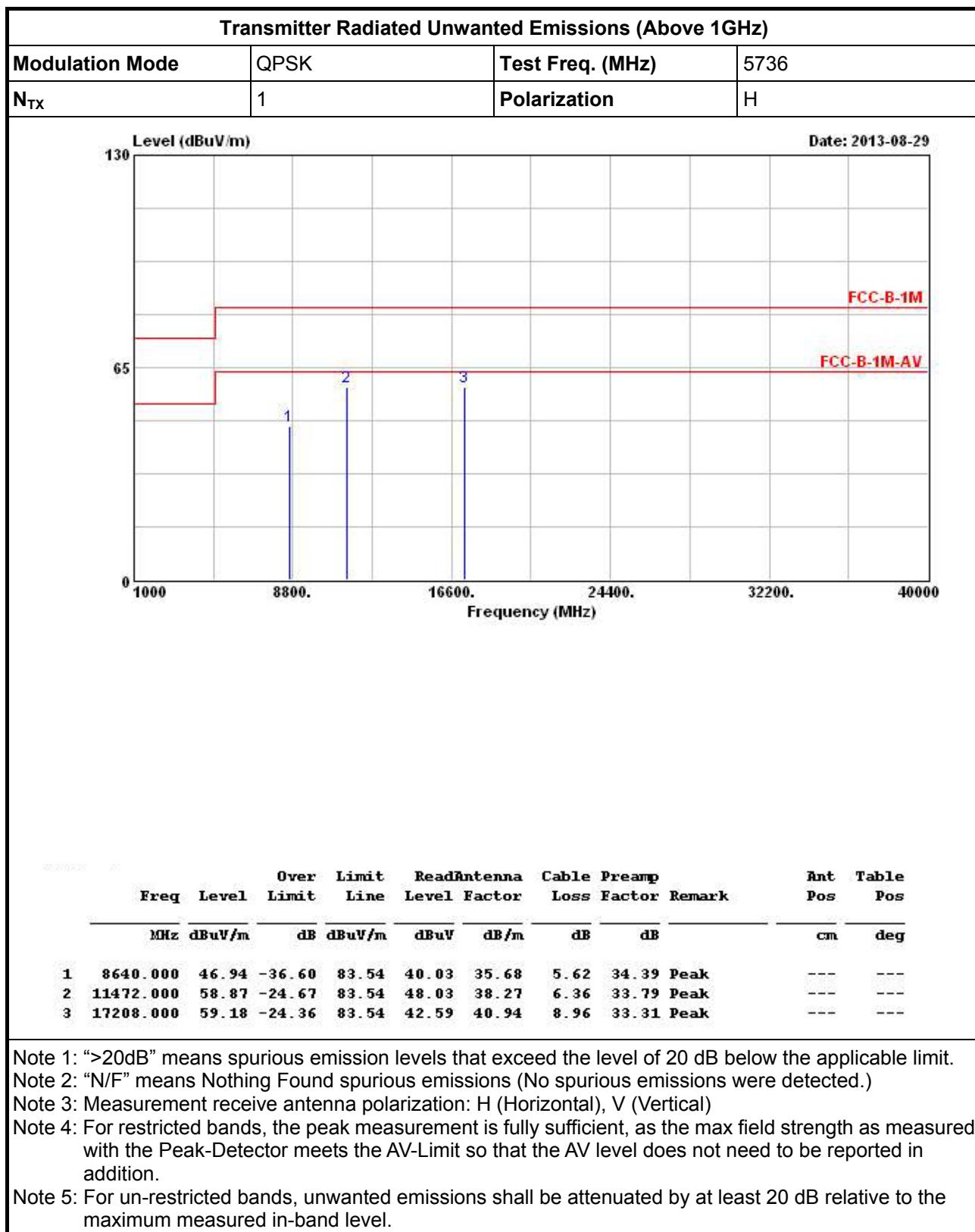
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

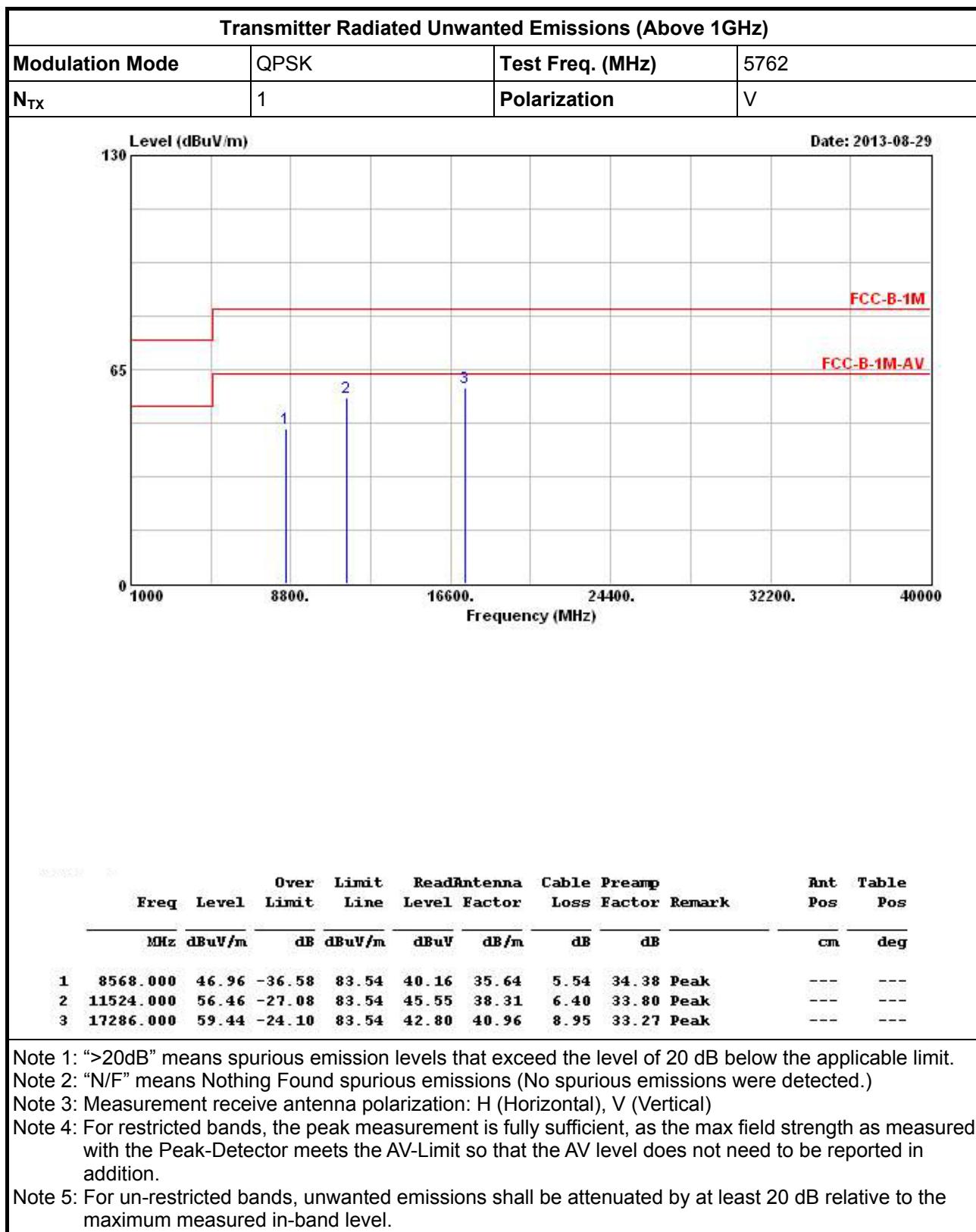


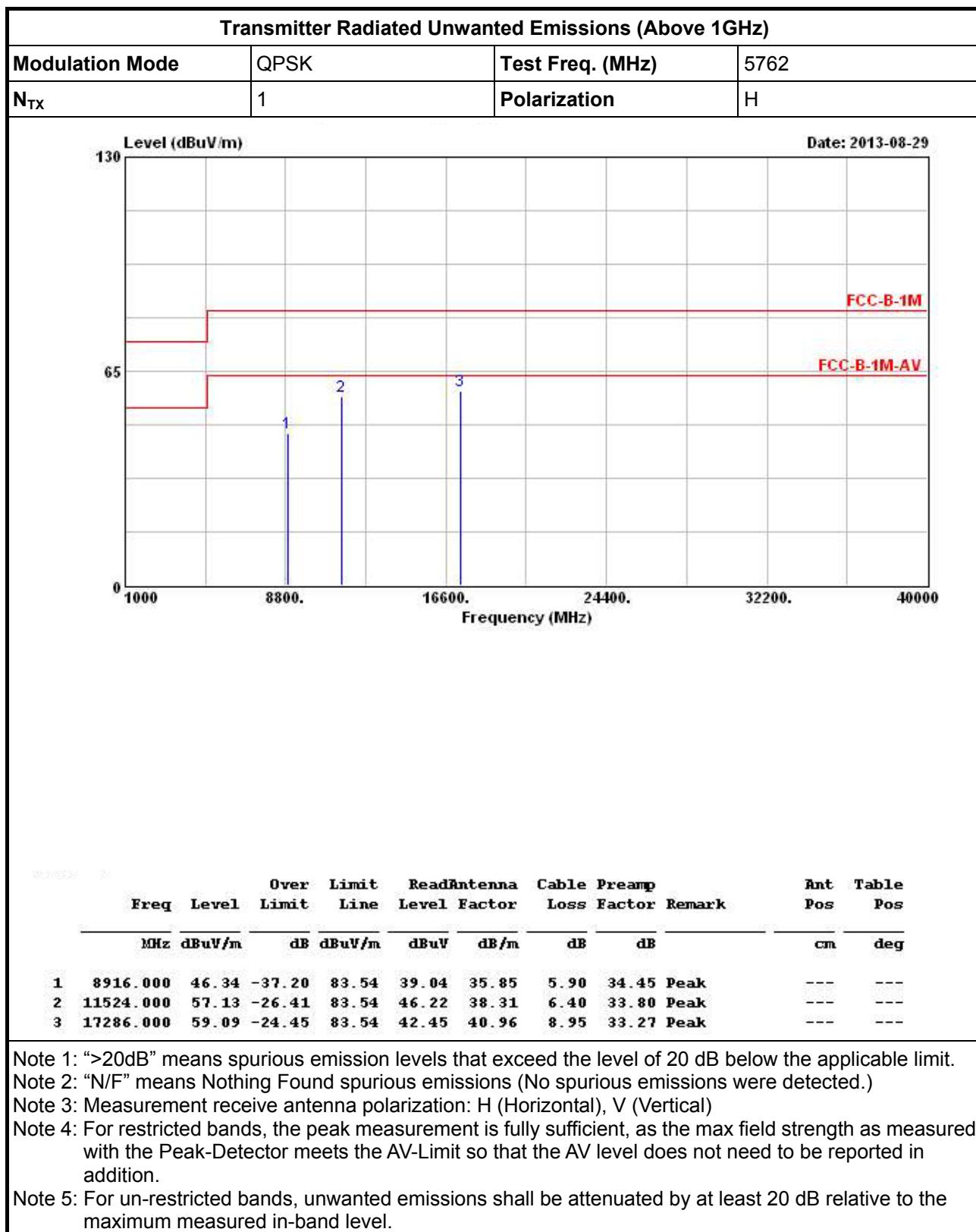


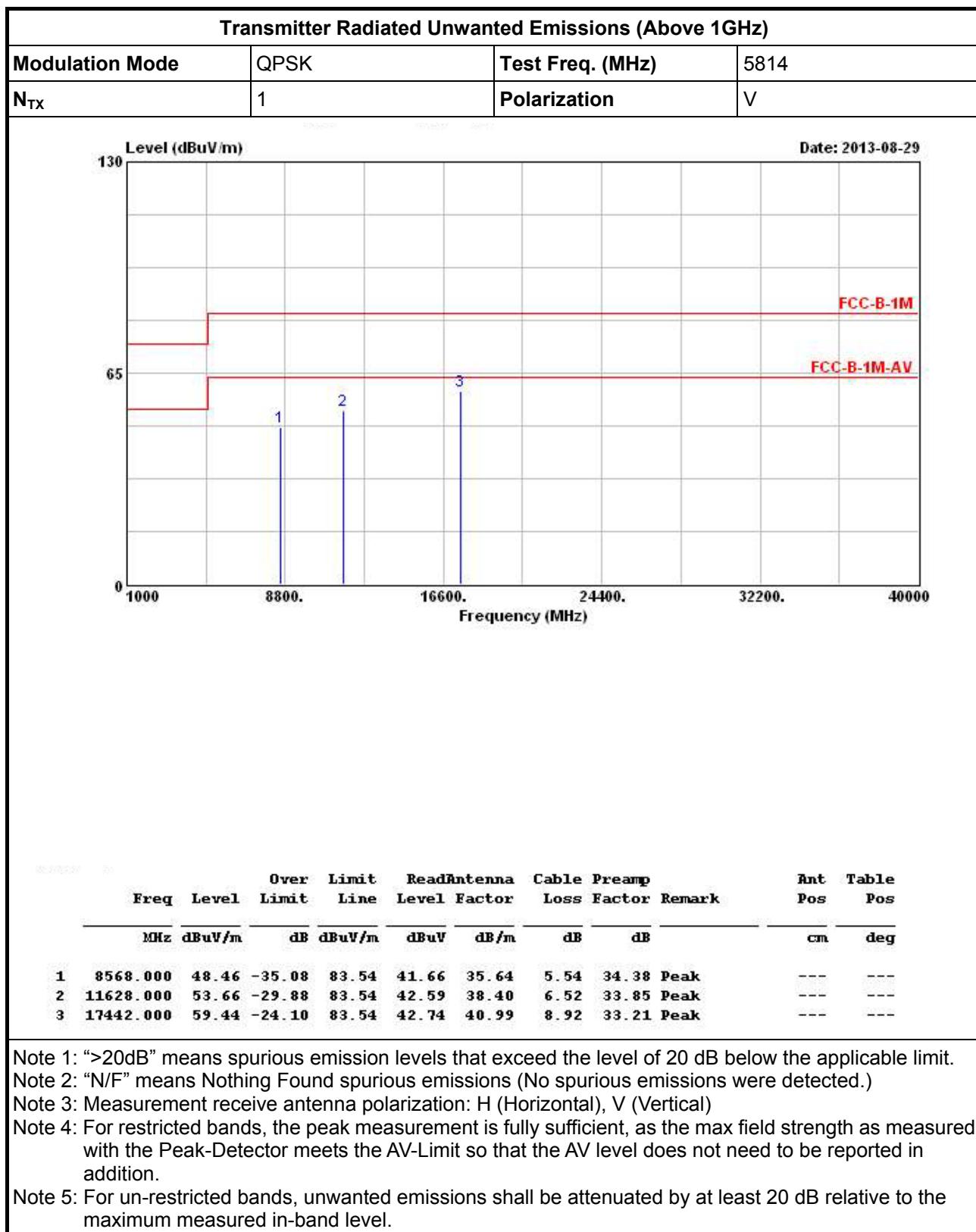
## 3.6.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)

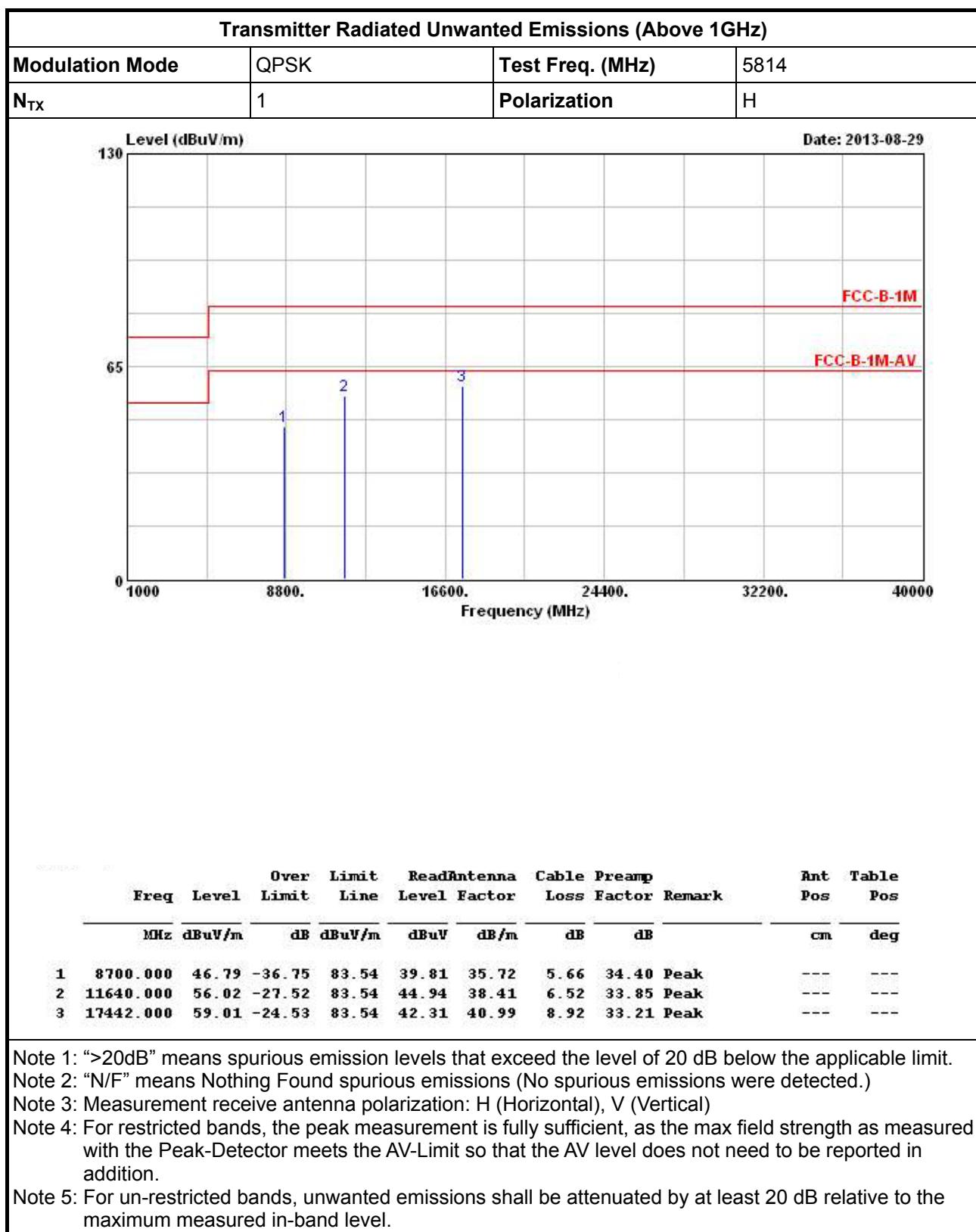














## 4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMC Receiver	R&S	ESCS 30	100174	9kHz ~ 2.75GHz	Mar. 26, 2013	Conduction (CO04-HY)
LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	8127-477	9kHz ~ 30MHz	Jan. 21, 2013	Conduction (CO04-HY)
LISN (Support Unit)	EMCO	3810/2NM	9703-1839	9kHz ~ 30MHz	Apr. 18, 2013	Conduction (CO04-HY)
RF Cable-CON	HUBER+SUHNER	RG213/U	7.61183201e+012	9kHz ~ 30MHz	Nov. 09, 2012	Conduction (CO04-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	FSP 40	100305	9KHz~40GHz	Mar. 20, 2013	Conducted (TH01-HY)
AC Power Source	G.W	APS-9102	EL920581	AC 0V ~ 300V	Jul. 16, 2013	Conducted (TH01-HY)
Temp. and Humidity Chamber	Giant Force	GTH-225-20-SP-SD	MAA1112-007	-20 ~ 100°C	Nov. 21, 2012	Conducted (TH01-HY)
RF Cable-2m	HUBER+SUHNER	SUCOFLEX_104	SN 345675/4	1GHz ~ 26.5GHz	Dec. 04, 2012	Conducted (TH01-HY)
RF Cable-0.2m	HUBER+SUHNER	SUCOFLEX_103	10712/4	1GHz ~ 33GHz	Dec. 04, 2012	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	9kHz ~ 40GHz	Sep. 14, 2012	Radiation (03CH02-HY)
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	30MHz ~ 1GHz 3m	May 11, 2013	Radiation (03CH02-HY)
Amplifier	Agilent	8447D	2944A11146	100kHz ~ 1.3GHz	Jul. 17, 2013	Radiation (03CH02-HY)
Amplifier	Agilent	8449B	3008A02364	1GHz ~ 26.5GHz	May. 06, 2013	Radiation (03CH02-HY)
Horn Antenna	ETS-LINDGREN	3117	00091920	1GHz ~ 18GHz	Nov. 16, 2012	Radiation (03CH02-HY)
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz ~ 40GHz	Jan. 08, 2013	Radiation (03CH02-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	Nov. 10, 2012	Radiation (03CH02-HY)
RF Cable-high	SUHNER	SUCOFLEX106	03CH02-HY	1GHz ~ 40GHz	Mar. 05, 2013	Radiation (03CH02-HY)
Bilog Antenna	SCHAFFNER	CBL61128	2723	30MHz ~ 2GHz	Oct. 22, 2012	Radiation (03CH02-HY)
Turn Table	Chaintek Instruments	3000	MF7802058	0~ 360 degree	N/A	Radiation (03CH02-HY)
Antenna Mast	MF	MF7802	MF780208205	1 ~ 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
Amplifier	MITEQ	AMF-6F-260400	9121372	26.5GHz ~ 40GHz	Apr. 19, 2013	Radiation (03CH02-HY)
Loop Antenna	TESEQ	HLA 6120	31244	9 kHz - 30 MHz	Dec. 02, 2012	Radiation (03CH02-HY)

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