



FCC Test Report

Equipment : Ultra-Slim Bluetooth Keyboard
Brand Name :  *Lightech*
Model No. : LT001xy (x=L or S, y=B or Blank ; the "L" of Leather Case, "S" of Shell, "B" of Backlight)
FCC ID : 2AEH2LT001LB
Standard : 47 CFR FCC Part 15.247
Operating Band : 2400 MHz – 2483.5 MHz
FCC Classification : DSS
Applicant : Lightech Co.,Ltd
Manufacturer : 5F.-8, No.80, Sec. 2, Guangfu Rd., Sanchong Dist., New Taipei City, Taiwan.

The product sample received on Apr. 08, 2015 and completely tested on Apr. 28, 2015. 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:


Vic Hsiao / Supervisor





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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]: 0.1548450MHz 53.61 (Margin 12.13dB) - QP 29.31 (Margin 26.43dB) - AV	FCC 15.207	Complied
3.2	15.247(a)	20dB Bandwidth	EDR: 1.0463MHz	N/A	Complied
3.2	15.247(a)	Carrier Frequency Separation (ChS)	EDR: 0.9986MHz	ChS \geq BW _{20dB} x2/3.	Complied
3.3	15.247(a)	Number of Hopping Frequencies (N)	Max: 79 Min: 15	N \geq 15	Complied
3.4	15.247(a)	Time of Occupancy (Dwell Time)	EDR: 0.318sec	0.4 s within 0.4 x N	Complied
3.5	15.247(b)	RF Output Power (Maximum Peak Conducted Output Power)	Power [dBm] BR: 3.40	Power [dBm] BR:21 EDR:21	Complied
3.6	15.247(c)	Transmitter Radiated Bandedge Emissions	Restricted Bands [dBuV/m at 3m]: 2354.06MHz 57.21 (Margin 16.79dB) - PK 43.98 (Margin 10.02dB) - AV	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied
3.7	15.247(c)	Transmitter Radiated Unwanted Emissions	Restricted Bands [dBuV/m at 3m]:95.960MHz 38.01 (Margin 5.49dB) - 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)	Bluetooth Mode	Ch. Frequency (MHz)	Channel Number	RF Output Power (dBm)
2400-2483.5	BR	2402-2480	0-78 [79]	3.40

Note 1: Bluetooth BR uses a GFSK (1Mbps).
Note 2: 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		
Ant. Cat.	Ant. Type	Gain (dBi)
Integral	PIFA	0.00



1.1.3 Type of EUT

Identify EUT	
EUT Serial Number	N/A
Presentation of Equipment	<input type="checkbox"/> Production ; <input checked="" type="checkbox"/> Pre-Production ; <input 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 checked="" type="checkbox"/> Operated test mode for worst duty cycle	
Test Signal Duty Cycle (x)	Power Duty Factor [dB] – (10 log 1/x)
<input checked="" type="checkbox"/> 79.26% - test mode single channel-DH5	1.01
Bluetooth ACL packets can be 1, 3, or 5 time slots. The DH1 packet can cover a single time slot. The DH3 packet can cover up to 3 time slots. The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle.	

1.1.5 EUT Operational Condition

Supply Voltage	<input type="checkbox"/> AC mains	<input checked="" type="checkbox"/> DC	
Type of DC Source	<input type="checkbox"/> External DC supply	<input checked="" type="checkbox"/> From Host System	<input checked="" type="checkbox"/> From Battery



1.2 Accessories and Support Equipment

Accessories Information				
Li-ion Battery	Brand Name	ZeniPower	Model Name	ICS273046
	Power Rating	3.7Vdc, 320mAh		

Reminder: Regarding to more detail and other information, please refer to user manual.

Support Equipment - AC Conduction and Radiated Emission				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E5530	DoC

Support Equipment - RF Conducted				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E5520	DoC

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 Public Notice DA 00-705



1.4 Testing Location Information

Testing Location			
<input checked="" type="checkbox"/>	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-327-0973	
Test Condition	Test Site No.	Test Engineer	Test Environment
AC Conduction	CO04-HY	Zeus	22°C / 44%
RF Conducted	TH06-HY	Leo	23.8°C / 64%
Radiated Emission	03CH03-HY	Terry	19°C / 60%

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=3)

Measurement Uncertainty		
Test Item	Uncertainty	
AC power-line conducted emissions	±2.3 dB	
Emission bandwidth, 6dB bandwidth	±1.4 %	
RF output power, conducted	±0.6 dB	
Power density, conducted	±0.8 dB	
Unwanted emissions, conducted	9 – 150 kHz	±0.4 dB
	0.15 – 30 MHz	±0.4 dB
	30 – 1000 MHz	±0.5 dB
	1 – 18 GHz	±0.7 dB
	18 – 40 GHz	±0.8 dB
	40 – 200 GHz	N/A
All emissions, radiated	9 – 150 kHz	±2.5 dB
	0.15 – 30 MHz	±2.3 dB
	30 – 1000 MHz	±2.6 dB
	1 – 18 GHz	±3.6 dB
	18 – 40 GHz	±3.8 dB
	40 – 200 GHz	N/A
Temperature	±0.8 °C	
Humidity	±3 %	
DC and low frequency voltages	±3 %	
Time	±1.4 %	
Duty Cycle	±1.4 %	



2 Test Configuration of EUT

2.1 The Worst Case Modulation Configuration

Worst Modulation Used for Conformance Testing					
Bluetooth Mode	Transmit Chains (N_{TX})	Data Rate	Modulation Mode	RF Output Power (dBm)	Worst Mode
BR	1	1 Mbps	BR-1Mbps	3.40	BR-1Mbps

Note 1: Bluetooth BR uses a combination of GFSK (1Mbps).
Note 2: Modulation modes consist below configuration:
 FHSS BR-1Mbps: GFSK (1Mbps)
Note 3: RF output power specifies that Maximum Peak Conducted Output Power.

2.2 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter			
Test Software Version	Broadcom BuleTool		
Modulation Mode	2402 MHz	2441 MHz	2480 MHz
BR,1Mbps	0	0	0



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	BR-1Mbps mode
2	USB Charger Mode

The operating mode 1 is the worst case and it was record in this test report.

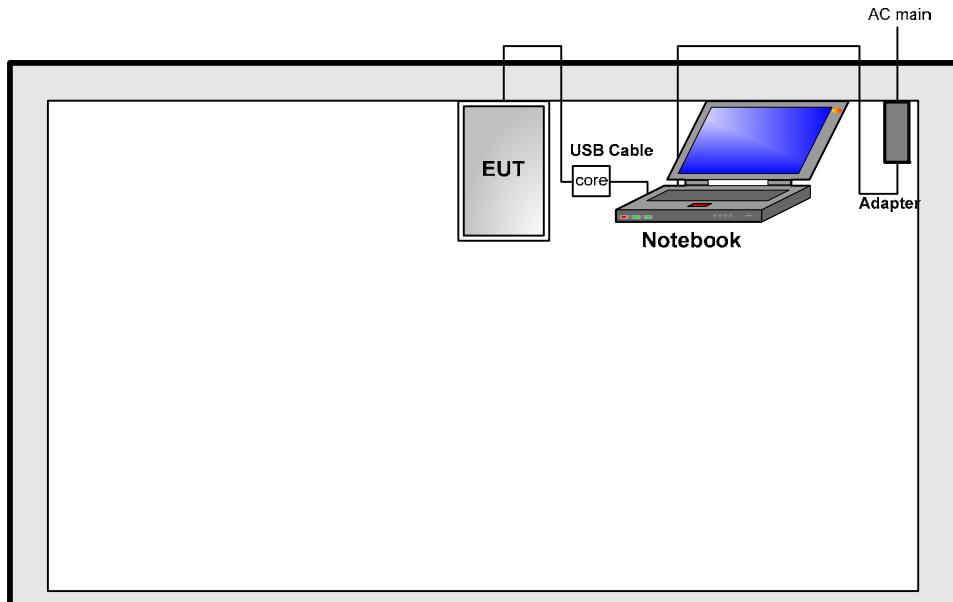
The Worst Case Mode for Following Conformance Tests	
Tests Item	RF Output Power, 20dB Bandwidth, Carrier Frequency Separation (ChS) Number of Hopping Frequencies (N), Time of Occupancy (Dwell Time)
Test Condition	Conducted measurement at transmit chains
Modulation Mode	BR-1Mbps

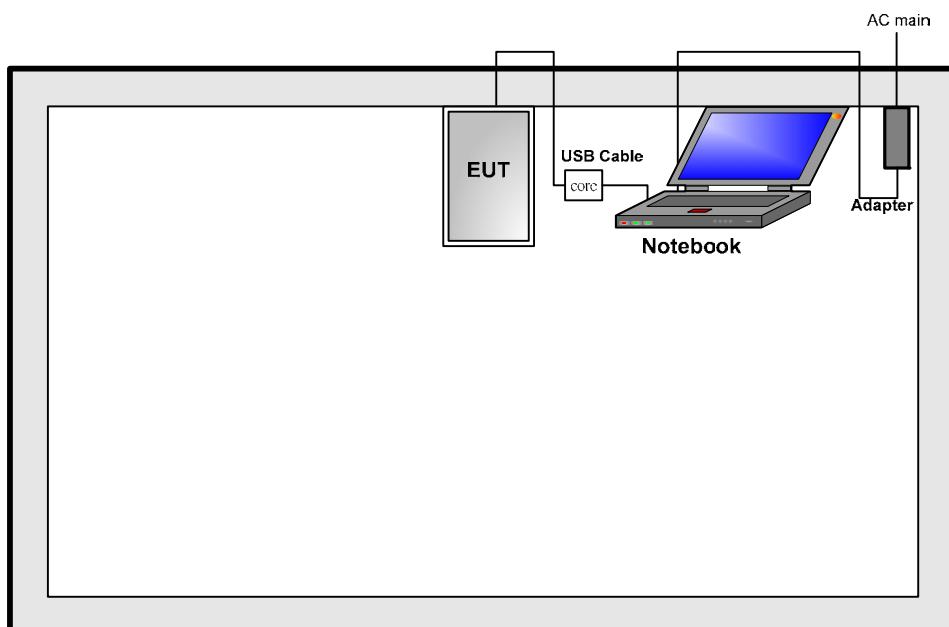
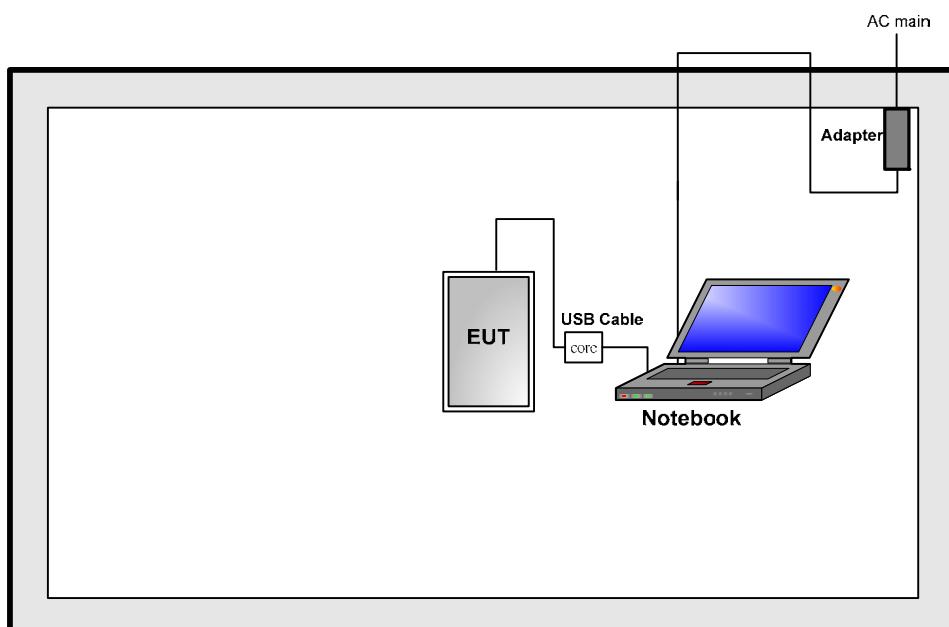
The Worst Case Mode for Following Conformance Tests									
Tests Item	Transmitter Radiated Bandedge Emissions Transmitter Radiated Unwanted Emissions								
Test Condition	Radiated measurement								
User Position	<input type="checkbox"/> EUT will be placed in fixed position. <input type="checkbox"/> EUT will be placed in mobile position and operating multiple positions. <input checked="" type="checkbox"/> EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions.								
Operating Mode	Operating Mode Description								
1	BR-1Mbps mode								
2	USB Charger Mode								
Modulation Mode	BR-1Mbps								
Orthogonal Planes of EUT	<table><thead><tr><th></th><th>X Plane</th><th>Y Plane</th><th>Z Plane</th></tr></thead><tbody><tr><td></td><td></td><td></td><td></td></tr></tbody></table>		X Plane	Y Plane	Z Plane				
	X Plane	Y Plane	Z Plane						
Worst Planes of EUT	V								

For operating mode 1 is the worst case and it was record in this test report.

2.4 Test Setup Diagram

Test Setup Diagram – AC Line Conducted Emission Test (Mode 1)



Test Setup Diagram - Radiated Test Below 1GHz (Mode 1)**Test Setup Diagram - Radiated Test Above 1GHz (Mode 1)**

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.

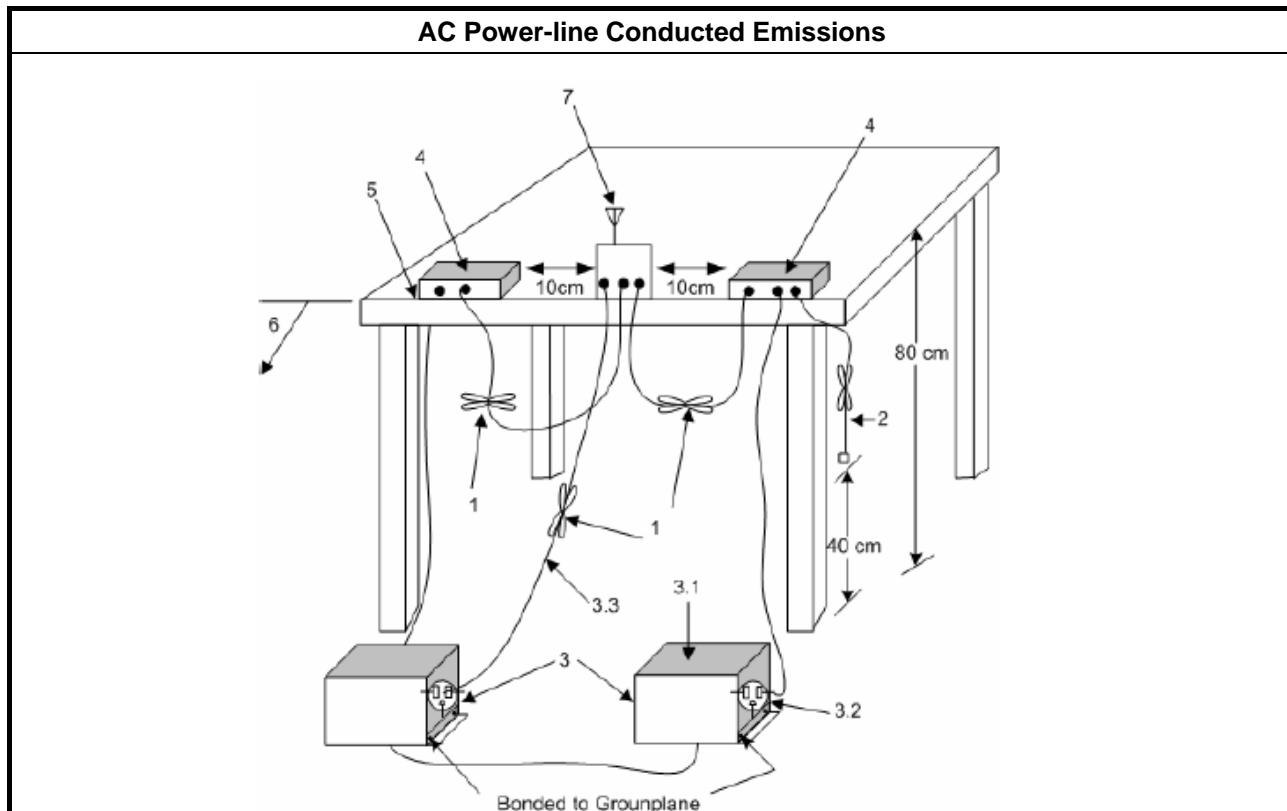
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

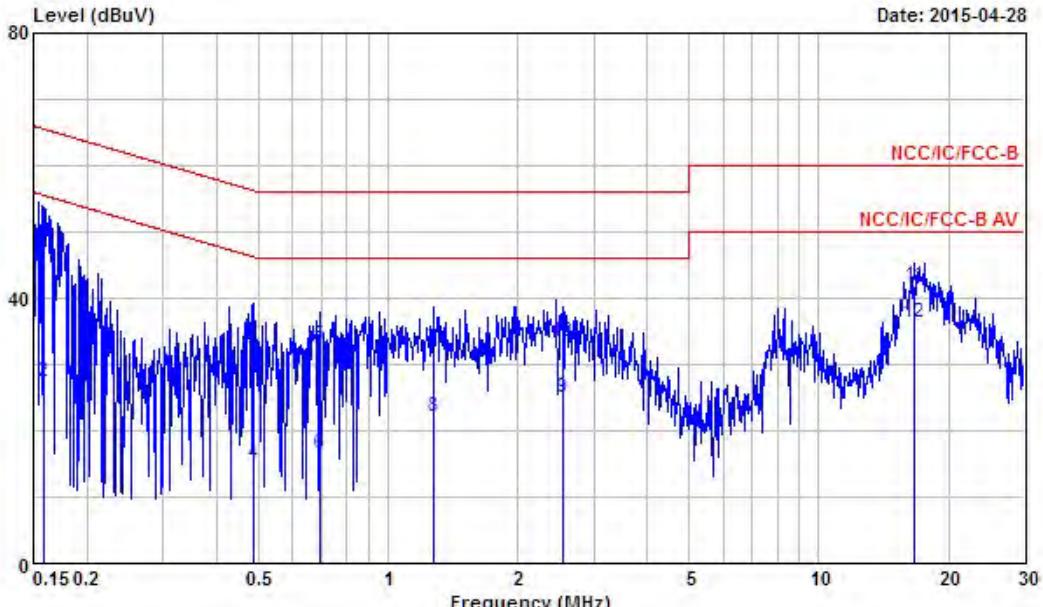
Test Method
<input checked="" type="checkbox"/> Refer as ANSI C63.10-2009, clause 6.2 for AC power-line conducted emissions.

3.1.4 Test Setup





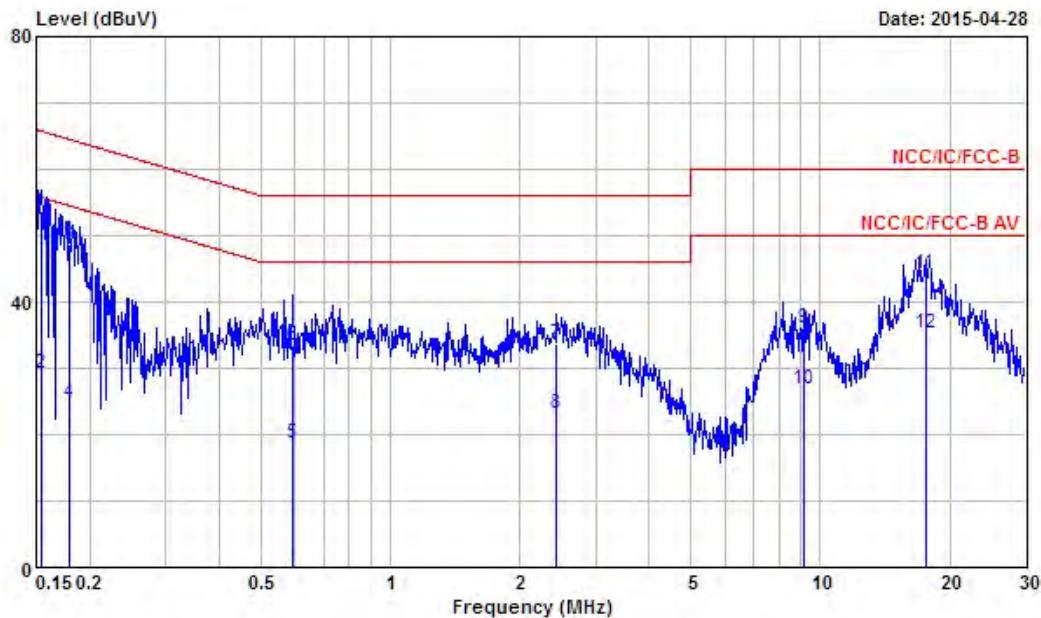
3.1.5 Test Result of AC Power-line Conducted Emissions

AC Power-line Conducted Emissions Result																																																																																																																							
Operating Mode	1	Power Phase	Neutral																																																																																																																				
Operating Function	BR-1Mbps mode																																																																																																																						
							Date: 2015-04-28																																																																																																																
<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 Factor</th><th>Remark</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>0.1590020</td><td>48.60</td><td>-16.92</td><td>65.52</td><td>48.16</td><td>0.07</td><td>0.37 QP</td></tr><tr><td>2</td><td>0.1590020</td><td>27.43</td><td>-28.09</td><td>55.52</td><td>26.99</td><td>0.07</td><td>0.37 Average</td></tr><tr><td>3</td><td>0.4863180</td><td>32.07</td><td>-24.16</td><td>56.23</td><td>31.36</td><td>0.07</td><td>0.64 QP</td></tr><tr><td>4</td><td>0.4863180</td><td>15.10</td><td>-31.13</td><td>46.23</td><td>14.39</td><td>0.07</td><td>0.64 Average</td></tr><tr><td>5</td><td>0.6935680</td><td>33.01</td><td>-22.99</td><td>56.00</td><td>32.21</td><td>0.08</td><td>0.72 QP</td></tr><tr><td>6</td><td>0.6935680</td><td>16.48</td><td>-29.52</td><td>46.00</td><td>15.68</td><td>0.08</td><td>0.72 Average</td></tr><tr><td>7</td><td>1.270</td><td>32.34</td><td>-23.66</td><td>56.00</td><td>31.45</td><td>0.09</td><td>0.80 QP</td></tr><tr><td>8</td><td>1.270</td><td>22.04</td><td>-23.96</td><td>46.00</td><td>21.15</td><td>0.09</td><td>0.80 Average</td></tr><tr><td>9</td><td>2.540</td><td>25.13</td><td>-20.87</td><td>46.00</td><td>24.25</td><td>0.11</td><td>0.77 Average</td></tr><tr><td>10</td><td>2.540</td><td>33.50</td><td>-22.50</td><td>56.00</td><td>32.62</td><td>0.11</td><td>0.77 QP</td></tr><tr><td>11</td><td>16.660</td><td>41.86</td><td>-18.14</td><td>60.00</td><td>40.73</td><td>0.36</td><td>0.77 QP</td></tr><tr><td>12</td><td>16.660</td><td>36.23</td><td>-13.77</td><td>50.00</td><td>35.10</td><td>0.36</td><td>0.77 Average</td></tr></tbody></table>								Freq	Level	Over Limit	Limit	Read Line	LISN	Cable Factor	Remark	MHz	dBuV	dB	dBuV	dBuV	dB	dB		1	0.1590020	48.60	-16.92	65.52	48.16	0.07	0.37 QP	2	0.1590020	27.43	-28.09	55.52	26.99	0.07	0.37 Average	3	0.4863180	32.07	-24.16	56.23	31.36	0.07	0.64 QP	4	0.4863180	15.10	-31.13	46.23	14.39	0.07	0.64 Average	5	0.6935680	33.01	-22.99	56.00	32.21	0.08	0.72 QP	6	0.6935680	16.48	-29.52	46.00	15.68	0.08	0.72 Average	7	1.270	32.34	-23.66	56.00	31.45	0.09	0.80 QP	8	1.270	22.04	-23.96	46.00	21.15	0.09	0.80 Average	9	2.540	25.13	-20.87	46.00	24.25	0.11	0.77 Average	10	2.540	33.50	-22.50	56.00	32.62	0.11	0.77 QP	11	16.660	41.86	-18.14	60.00	40.73	0.36	0.77 QP	12	16.660	36.23	-13.77	50.00	35.10	0.36	0.77 Average
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AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	BR-1Mbps mode		



Freq	Level	Over	Limit	Read	LISN	Cable
		Limit	Line	Level	Factor	Loss Remark
MHz	dBuV	dB	dBuV	dBuV	dB	dB
1 80.1548450	53.61	-12.13	65.74	53.21	0.05	0.35 QP
2 0.1548450	29.31	-26.43	55.74	28.91	0.05	0.35 Average
3 0.1786590	48.75	-15.80	64.55	48.26	0.06	0.43 QP
4 0.1786590	24.79	-29.76	54.55	24.30	0.06	0.43 Average
5 0.5947840	18.57	-27.43	46.00	17.81	0.07	0.69 Average
6 0.5947840	33.51	-22.49	56.00	32.75	0.07	0.69 QP
7 2.430	33.68	-22.32	56.00	32.80	0.11	0.77 QP
8 2.430	23.04	-22.96	46.00	22.16	0.11	0.77 Average
9 9.160	36.16	-23.84	60.00	35.15	0.22	0.79 QP
10 9.160	26.78	-23.22	50.00	25.77	0.22	0.79 Average
11 17.570	44.10	-15.90	60.00	43.01	0.34	0.75 QP
12 17.570	35.21	-14.79	50.00	34.12	0.34	0.75 Average

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 20dB Bandwidth and Carrier Frequency Separation

3.2.1 20dB Bandwidth and Carrier Frequency Separation Limit

20dB Bandwidth and Carrier Frequency Separation Limit for Frequency Hopping Systems	
<input checked="" type="checkbox"/> 2400-2483.5 MHz Band:	
<input type="checkbox"/> N ≥ 75 and ChS ≥ MAX (20 dB bandwidth, 25 kHz).	
<input checked="" type="checkbox"/> N ≥ 15 and ChS ≥ MAX (20 dB bandwidth x 2/3, 25 kHz).	

N: Number of Hopping Frequencies; ChS: Hopping Channel Separation

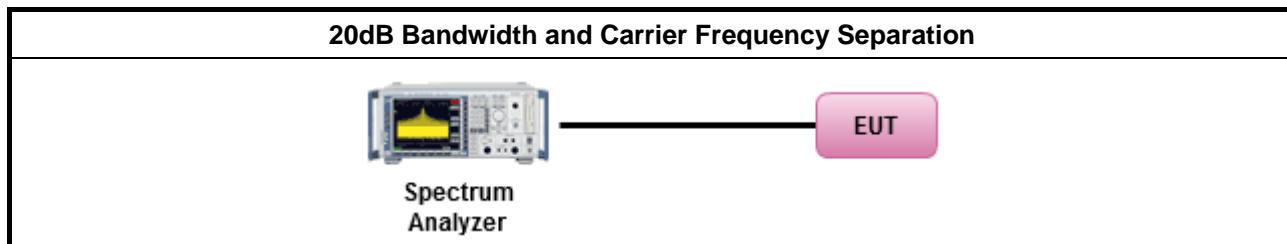
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

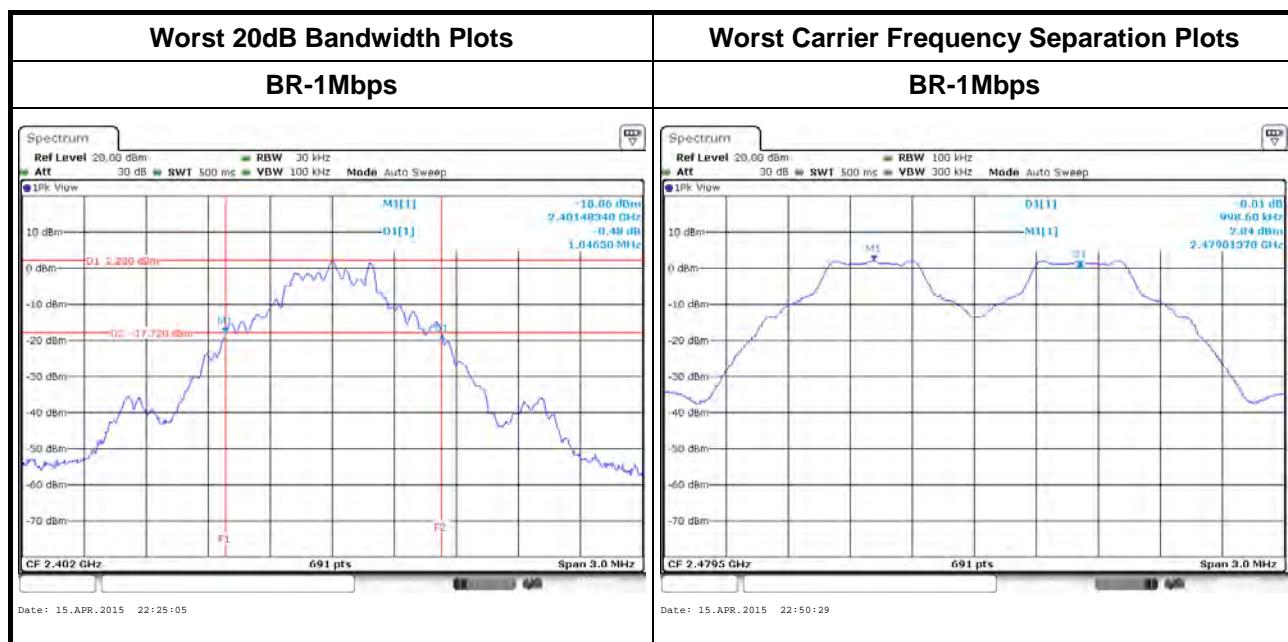
Test Method	
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.1 for 20 dB bandwidth measurement.	
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 7.7.2 for carrier frequency separation measurement.	
<input checked="" type="checkbox"/> For conducted measurement.	
<input checked="" 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.	

3.2.4 Test Setup



3.2.5 Test Result of 20dB Bandwidth and Carrier Frequency Separation

20dB Bandwidth and Carrier Frequency Separation Result					
Modulation Mode	Freq. (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Channel Separation (MHz)	Channel Separation Limits (MHz)
BR-1Mbps	2402	1.0463	0.9681	0.9986	0.698
BR-1Mbps	2441	1.0420	0.9594	0.9986	0.695
BR-1Mbps	2480	1.0333	0.9507	0.9986	0.689
Result			Complied		



3.3 Number of Hopping Frequencies

3.3.1 Number of Hopping Frequencies Limit

Number of Hopping Frequencies Limit for Frequency Hopping Systems	
<input checked="" type="checkbox"/> 2400-2483.5 MHz Band:	
<input type="checkbox"/> N ≥ 75 and ChS ≥ MAX (20 dB bandwidth, 25 kHz).	
<input checked="" type="checkbox"/> N ≥ 15 and ChS ≥ MAX (20 dB bandwidth x 2/3, 25 kHz).	

N: Number of Hopping Frequencies; ChS: Hopping Channel Separation

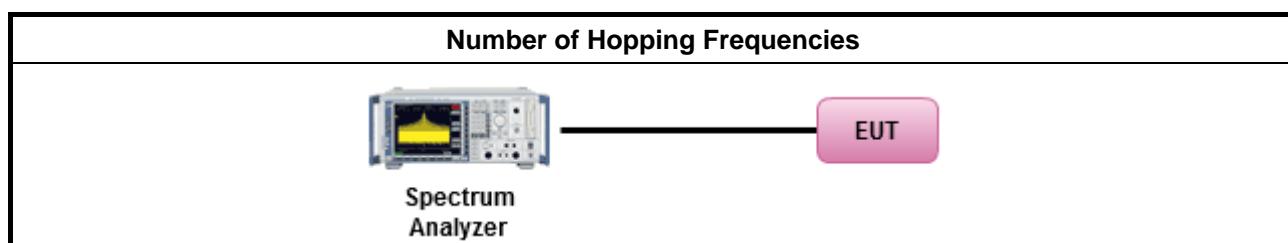
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

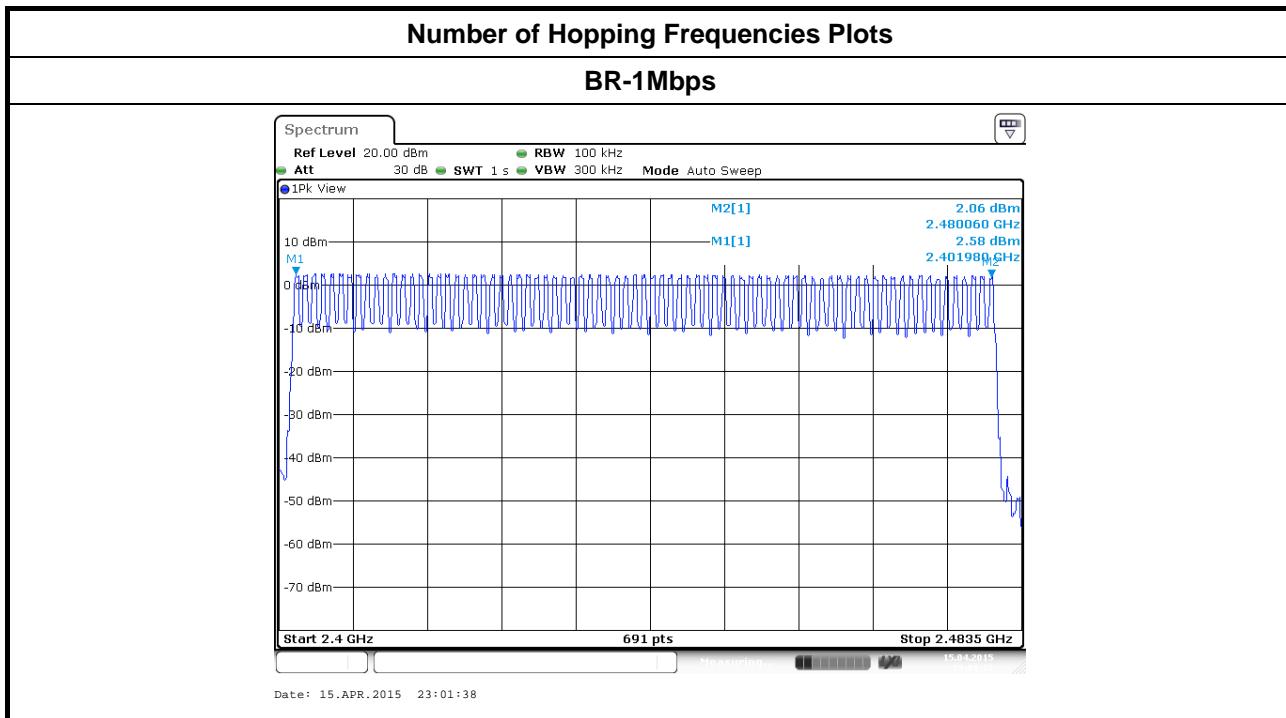
Test Method
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 7.7.3 for number of hopping frequencies measurement.
<input checked="" type="checkbox"/> For conducted measurement.
<input checked="" type="checkbox"/> The EUT supports single transmit chain and measurements performed on this transmit chain.
<input type="checkbox"/> The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.

3.3.4 Test Setup



3.3.5 Test Result of Number of Hopping Frequencies

Number of Hopping Frequencies Result			
Modulation Mode	Freq. (MHz)	Hopping Channel Number (N)	Hopping Channel Number Limits
BR-1Mbps	2402-2480	79	15
Result	Complied		



3.4 Time of Occupancy (Dwell Time)

3.4.1 Time of Occupancy (Dwell Time) Limit

Time of Occupancy (Dwell Time) Limit for Frequency Hopping Systems	
<input checked="" type="checkbox"/> 2400-2483.5 MHz Band: Dwell time \leq 0.4 second within $0.4 \times N$	
N: Number of Hopping Frequencies	

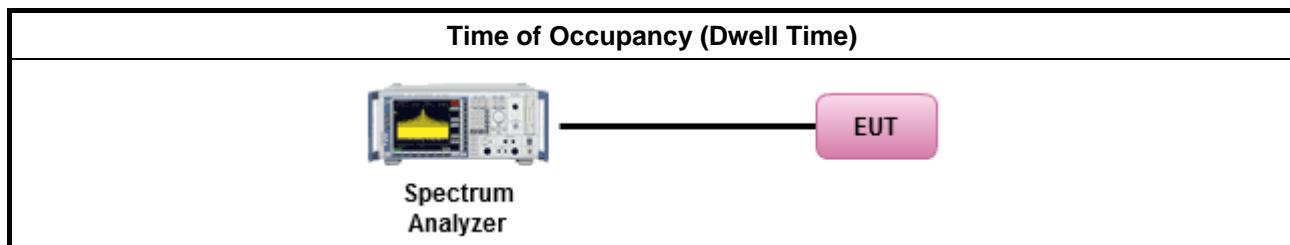
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 7.7.4 for dwell time measurement.	
<input checked="" type="checkbox"/> Bluetooth ACL packets can be 1, 3, or 5 time slots. Following as dwell time. Operate DH5 at maximum dwell time and maximum duty cycle.	
<input checked="" type="checkbox"/> The DH1 packet can cover a single time slot. A maximum length packet has duration of 1 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is $1/1600$ seconds, or 0.625ms. DH1 Packet permit maximum $1600 / 79 / 2 = 10.12$ hops per second in each channel (1 time slot RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times $10.12 \times 31.6 = 320$ within 31.6 seconds.	
<input checked="" type="checkbox"/> The DH3 packet can cover up to 3 time slots. A maximum length packet has duration of 3 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is $3/1600$ seconds, or 1.875ms. DH3 Packet permit maximum $1600 / 79 / 4 = 5.06$ hops per second in each channel (3 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times $5.06 \times 31.6 = 160$ within 31.6 seconds.	
<input checked="" type="checkbox"/> The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle. A maximum length packet has duration of 5 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is $5/1600$ seconds, or 3.125ms. DH5 Packet permit maximum $1600 / 79 / 6 = 3.37$ hops per second in each channel (5 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times $3.37 \times 31.6 = 106.6$ within 31.6 seconds	
<input checked="" type="checkbox"/> For conducted measurement.	
<input checked="" 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.	

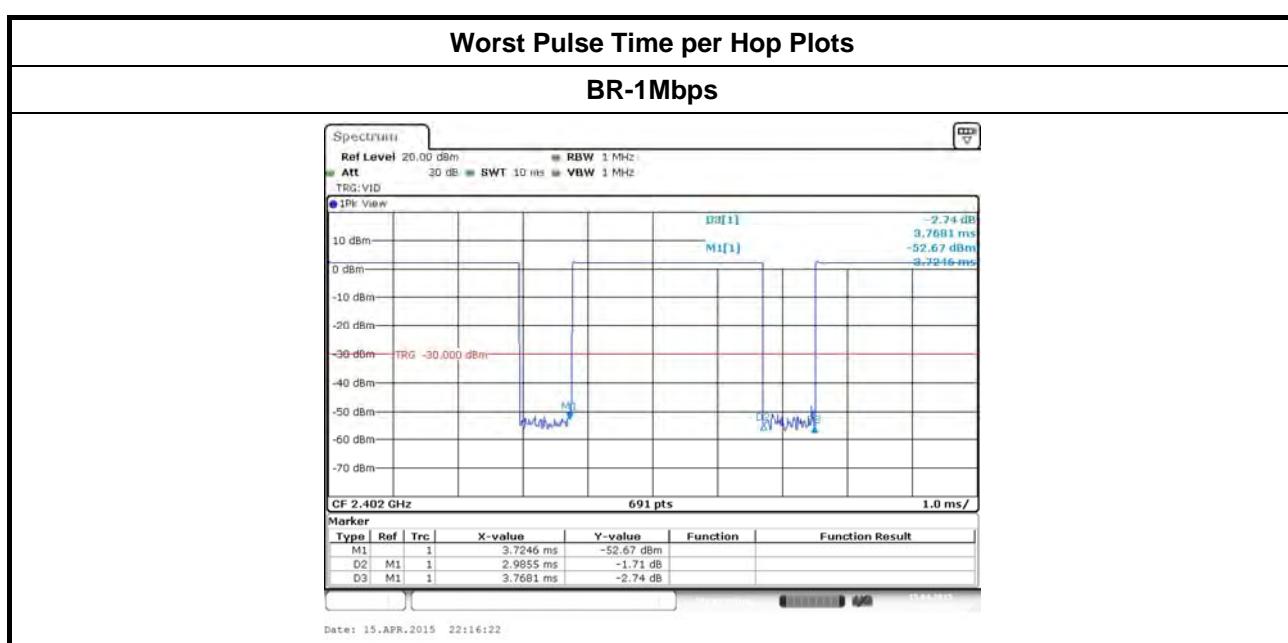
3.4.4 Test Setup



3.4.5 Test Result of Time of Occupancy (Dwell Time)

Time of Occupancy (Dwell Time) Result					
Modulation Mode	Freq. (MHz)	Pulse Time per Hop (ms)	Number of Pulse in [0.4 x N sec]	Dwell Time in [0.4 x N sec] (s)	Dwell Time Limits (s)
BR-1Mbps	2402	2.98	106.7	0.318	0.4
Result	Complied				

Bluetooth ACL packets can be 1, 3, or 5 time slots. The DH1 packet can cover a single time slot. The DH3 packet can cover up to 3 time slots. The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle. A maximum length packet has duration of 5 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is 5/1600 seconds, or 3.125ms.





3.5 RF Output Power

3.5.1 RF Output Power Limit

RF Output Power Limit for Frequency Hopping Systems	
Maximum Peak Conducted Output Power Limit	
<input checked="" type="checkbox"/> 2400-2483.5 MHz Band:	
<input type="checkbox"/> For Hopping Channel: $N \geq 75$	
	<input type="checkbox"/> If $G_{TX} \leq 6 \text{ dBi}$, then $P_{out} \leq 30 \text{ dBm}$ (1 W)
	<input type="checkbox"/> If $G_{TX} > 6 \text{ dBi}$, then $P_{out} = 30 - (G_{TX} - 6) \text{ dBm}$
<input checked="" type="checkbox"/> For Hopping Channel: $N \geq 15$	
	<input checked="" type="checkbox"/> If $G_{TX} \leq 6 \text{ dBi}$, then $P_{out} \leq 21 \text{ dBm}$ (0.125 W)
	<input type="checkbox"/> If $G_{TX} > 6 \text{ dBi}$, then $P_{out} = 21 - (G_{TX} - 6) \text{ dBm}$
e.i.r.p. Power Limit:	
<input checked="" type="checkbox"/> 2400-2483.5 MHz Band:	
	<input type="checkbox"/> For Hopping Channel: $N \geq 75 - P_{eirp} \leq 36 \text{ dBm}$ (4 W)
	<input checked="" type="checkbox"/> For Hopping Channel: $N \geq 15 - P_{eirp} \leq 27 \text{ dBm}$ (0.5 W)
G_{TX} = the maximum transmitting antenna directional gain in dBi.	
P_{eirp} = e.i.r.p. Power in dBm.	
N : Number of Hopping Frequencies	
ChS : Hopping Channel Separation	

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"/> Maximum Peak Conducted Output Power	
	<input type="checkbox"/> Refer as FCC DA 00-0705, spectrum analyzer for peak power.
	<input checked="" type="checkbox"/> Refer as FCC DA 00-0705, peak power meter for peak power.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 6.10.2.1 a) for peak power meter.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 6.10.2.1 a) for spectrum analyzer - (RBW \geq EBW).
<input checked="" type="checkbox"/> For conducted measurement.	
	<input checked="" 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.

3.5.4 Test Setup

RF Output Power (Peak Power Meter)





3.5.5 Test Result of Maximum Peak Conducted Output Power

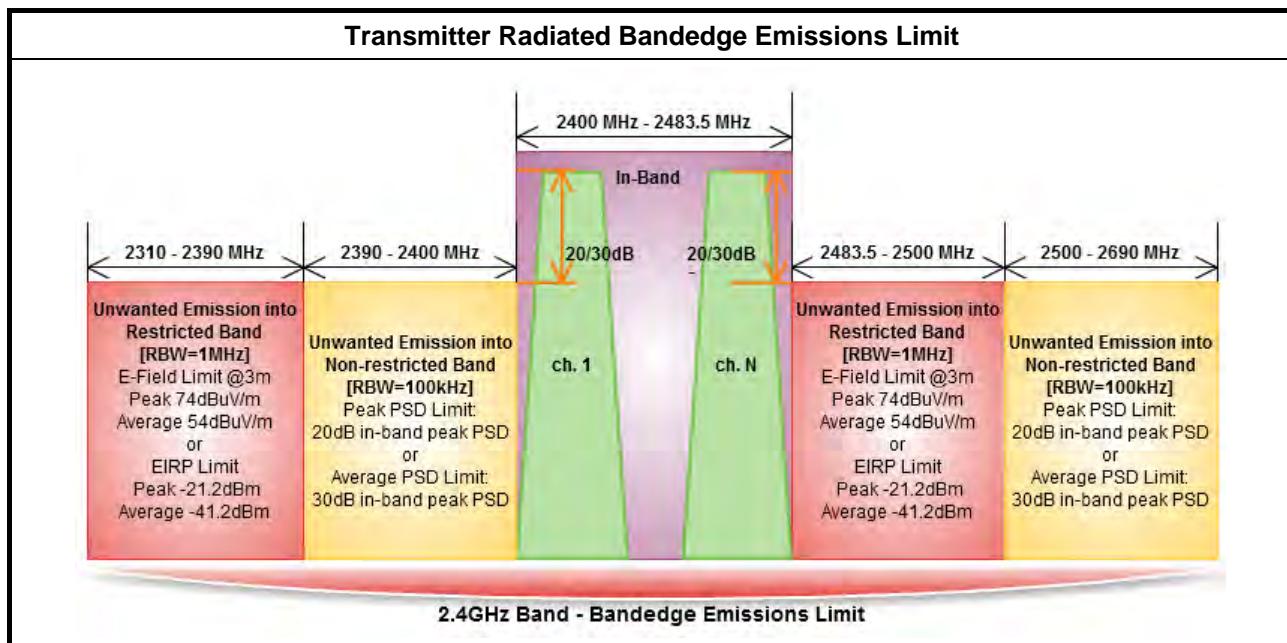
Maximum Peak Conducted Output Power Result						
Condition		RF Output Power (dBm)				
Modulation Mode	Freq. (MHz)	RF Output Power	Power Limit	Antenna Gain (dBi)	EIRP Power	EIRP Limit
BR-1Mbps	2402	3.4	21	0.00	3.4	27
BR-1Mbps	2441	3.26	21	0.00	3.26	27
BR-1Mbps	2480	2.87	21	0.00	2.87	27
Result		Complied				

3.5.6 Test Result of Maximum Average Conducted Output Power

Maximum Average Conducted Output Power Result						
Condition		RF Output Power (dBm)				
Modulation Mode	Freq. (MHz)	Average Power	Duty Factor (dB)	RF Output Power	Antenna Gain (dBi)	EIRP Power
BR-1Mbps	2402	2.04	1.01	3.05	0.00	3.05
BR-1Mbps	2441	1.87	1.01	2.88	0.00	2.88
BR-1Mbps	2480	1.51	1.01	2.52	0.00	2.52
Result		Complied				

3.6 Transmitter Radiated Bandedge Emissions

3.6.1 Transmitter Radiated Bandedge Emissions Limit



3.6.2 Measuring Instruments

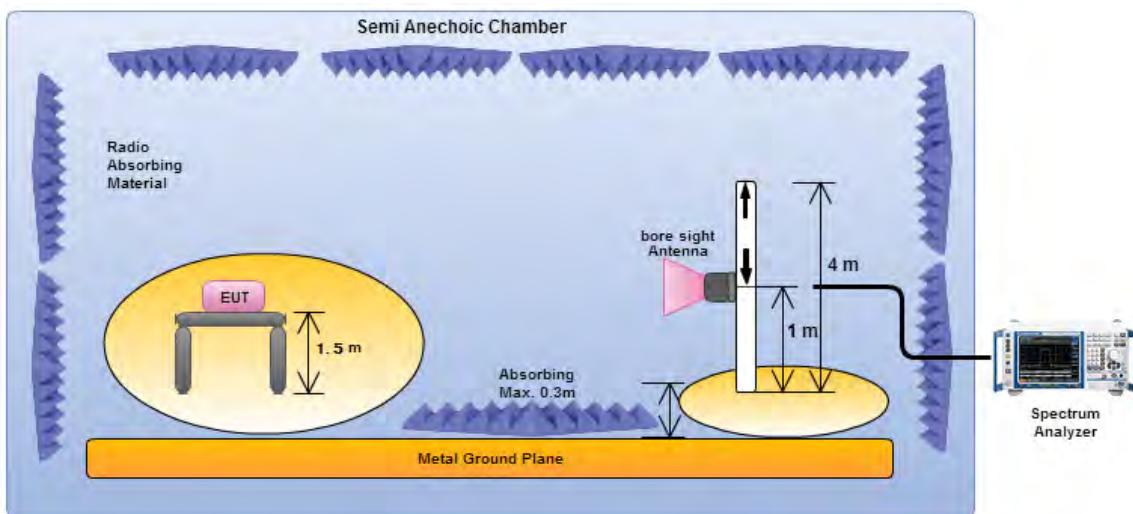
Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

Test Method – General Information	
<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:
<input checked="" type="checkbox"/> For unwanted emissions into non-restricted bands. 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.	
<input checked="" type="checkbox"/> For unwanted emissions into restricted bands.	
<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 ANSI C63.10, clause 4.2.3.2.2 measurement procedure peak limit.	
<input checked="" type="checkbox"/> For the transmitter bandedge emissions shall be measured using following options below:	
<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"/> Refer as ANSI C63.10, clause 7.7.9 for band-edge testing into non-restricted bands.	
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.6 for radiated emissions and test distance is 3m.	

3.6.4 Test Setup

Transmitter Radiated Bandedge Emissions



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

Note: FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 02, 2014.



3.6.5 Test Result of Transmitter Radiated Bandedge Emissions

Transmitter Radiated Bandedge Emissions (Non-restricted Band)							
Modulation	Test Freq. (MHz)	In-band PSD [i] (dBuV/100kHz)	Freq. (MHz)	Out-band PSD [o] (dBuV/100kHz)	[i] – [o] (dB)	Limit (dB)	Pol.
BR-1Mbps	2402	88.37	2399.96	59.76	28.61	20	H
BR -1Mbps	2480	84.96	2485.92	60.26	24.70	20	H

Note 1: Measurement worst emissions of receive antenna polarization

Transmitter Radiated Bandedge Emissions (Restricted Band)									
Modulation Mode	Freq. (MHz)	Measure Distance (m)	Freq. (MHz) PK	Level (dBuV/m) PK	Limit (dBuV/m) PK	Freq. (MHz) AV	Level (dBuV/m) AV	Limit (dBuV/m) AV	Pol.
BR-1Mbps	2402	3	2386.70	57.21	74	2354.06	43.98	54	H
BR -1Mbps	2480	3	2495.52	56.70	74	2499.52	43.64	54	H

Note 1: Measurement worst emissions of receive antenna polarization.

Note 2: Average emission setting: RBW=1MHz; VBW \geq 1/T, where T is "Pulse On Time", e.g., DH5 VBW \geq 1/3.125ms, VBW=1kHz



3.7 Transmitter Radiated Unwanted Emissions

3.7.1 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.

3.7.2 Measuring Instruments

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

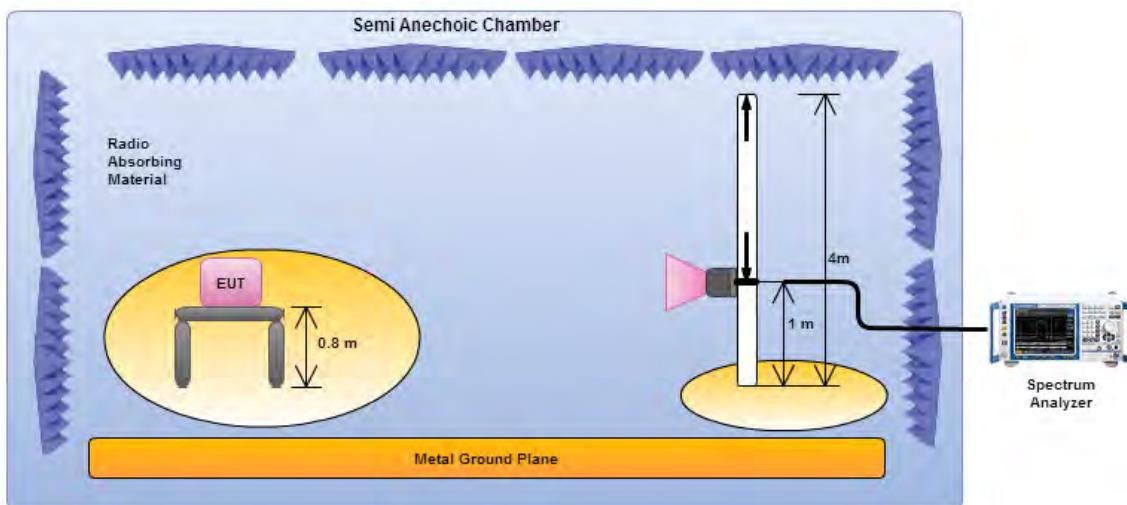


3.7.3 Test Procedures

Test Method – General Information	
<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"/>	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 DA 00-0705, for spurious radiated emissions. The dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{dwell time}/100 \text{ ms})$
<input type="checkbox"/>	For unwanted emissions into non-restricted bands. 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.
<input checked="" type="checkbox"/>	For unwanted emissions into restricted bands.
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). $\text{VBW} \geq 1/T$, 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 ANSI C63.10, clause 4.2.3.2.2 measurement procedure peak limit.
<input checked="" type="checkbox"/>	For radiated measurement.
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m.
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m.
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1 GHz and test distance is 3m.
<input checked="" type="checkbox"/>	The any unwanted emissions level shall not exceed the fundamental emission level.
<input checked="" type="checkbox"/>	All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

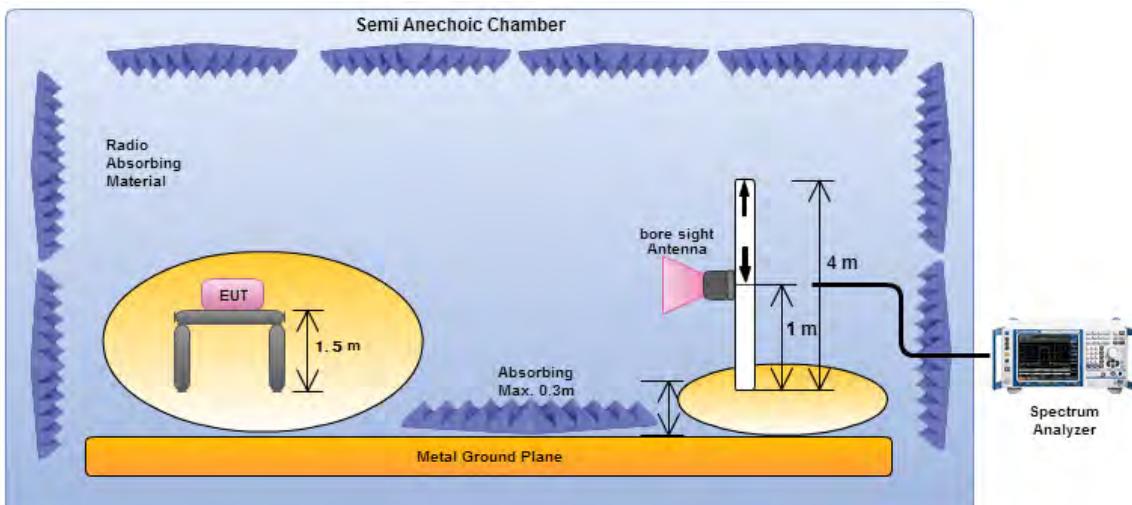
3.7.4 Test Setup

Transmitter Radiated Unwanted Emissions (below 1GHz)



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.

Transmitter Radiated Unwanted Emissions (Above 1GHz)



Electric field tests shall be performed in the frequency range of 1 GHz to 10th harmonic of highest fundamental frequency or 40 GHz using a calibrated horn antenna.

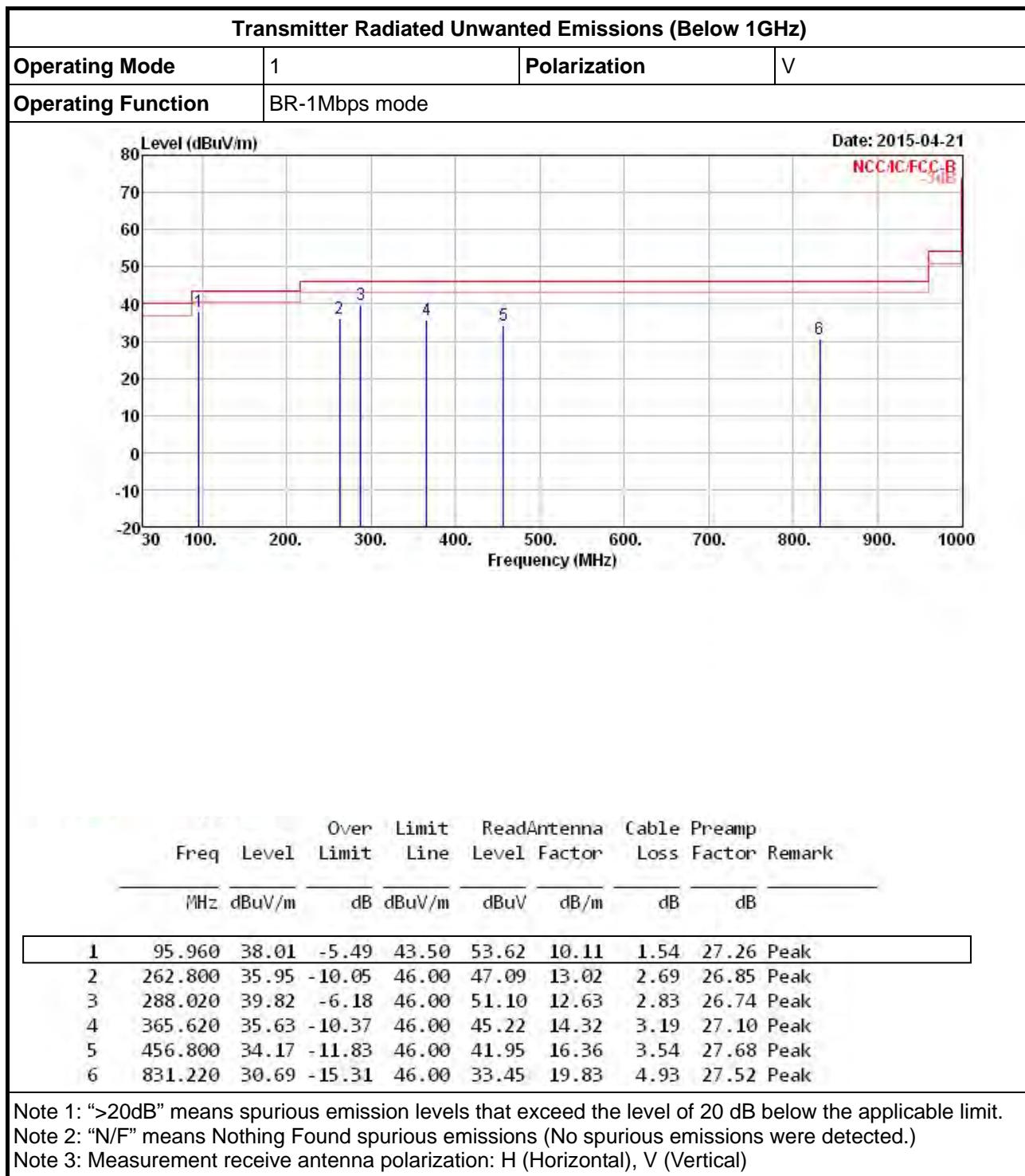
Note: FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 02, 2014.

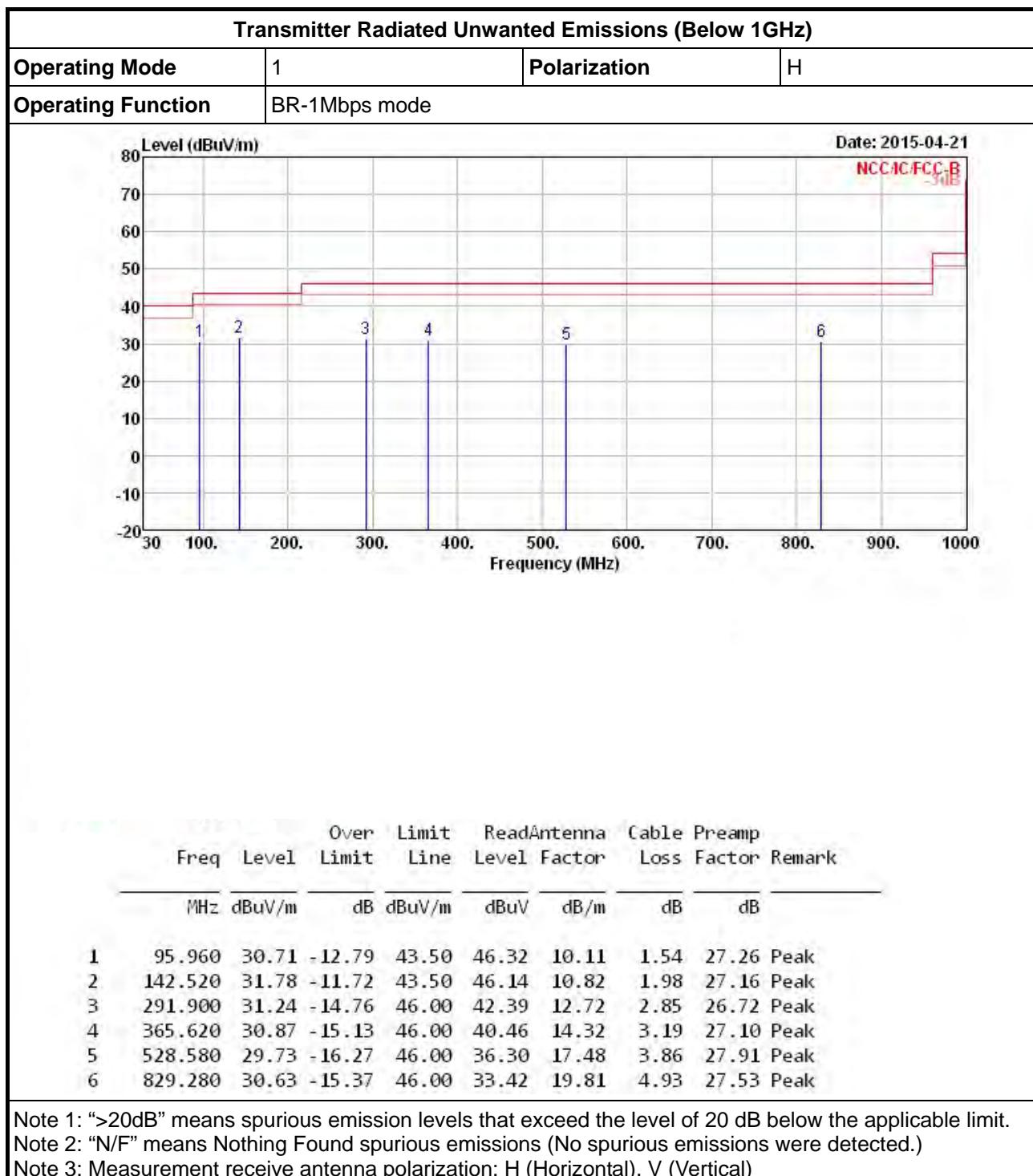
3.7.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

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



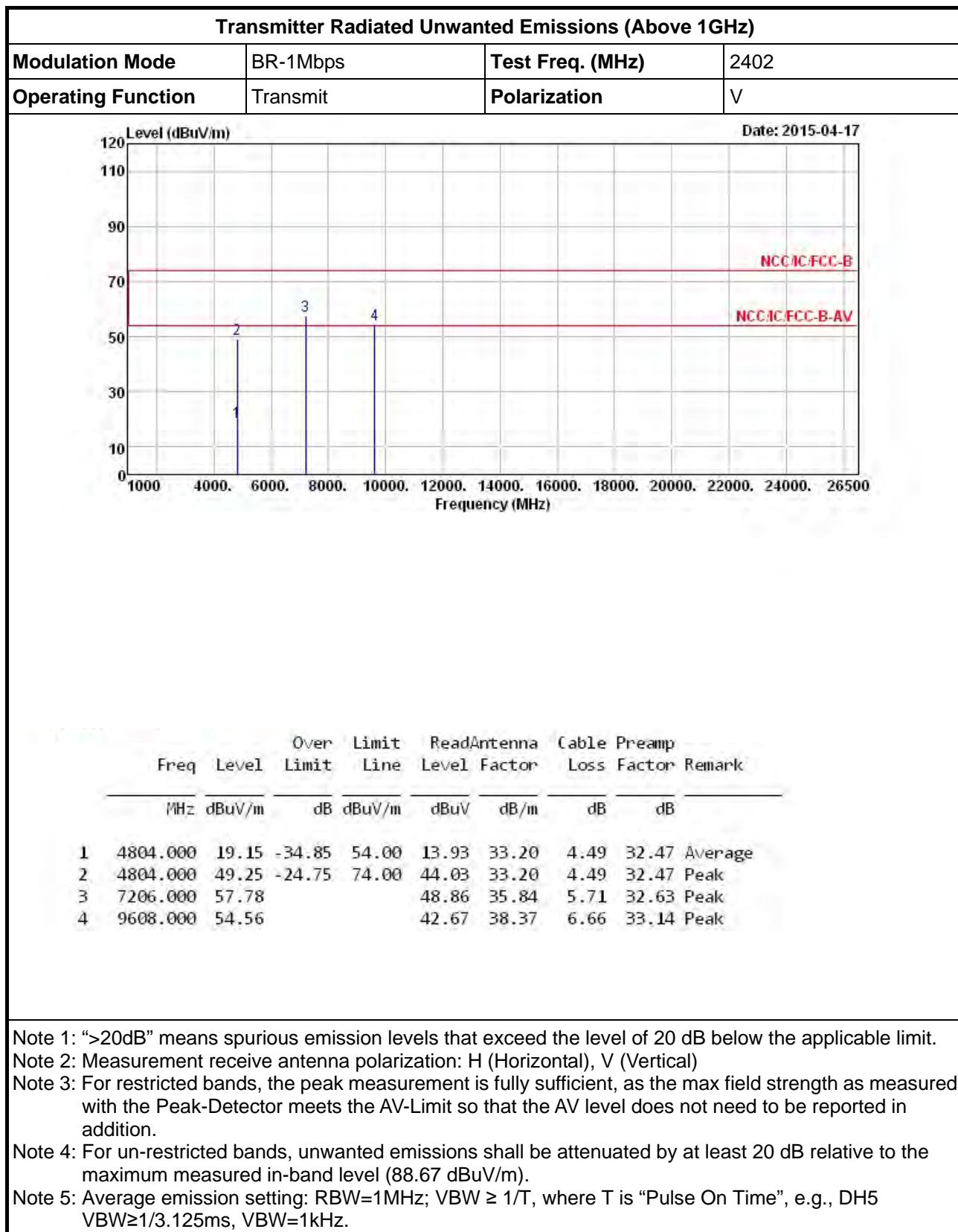
3.7.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

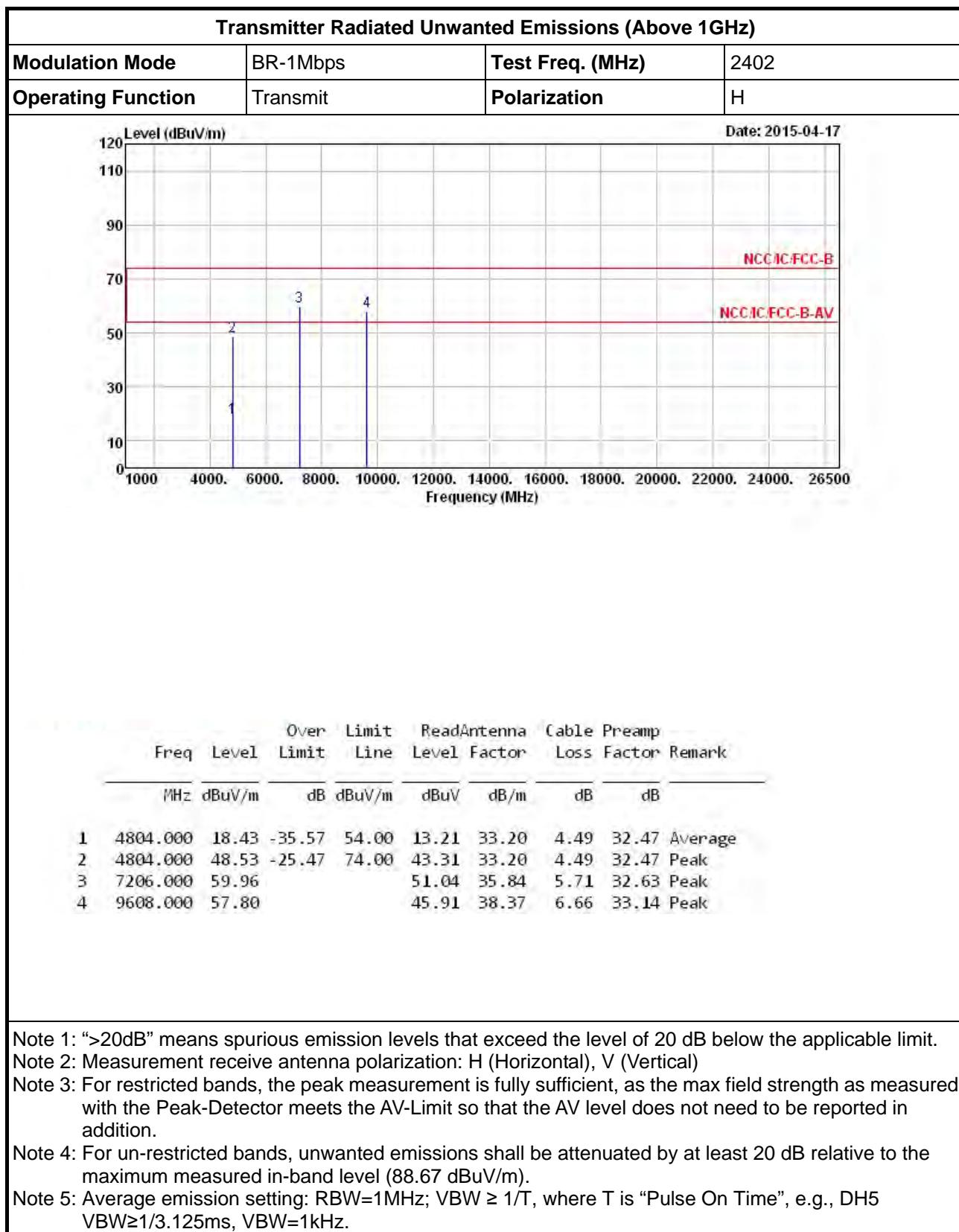


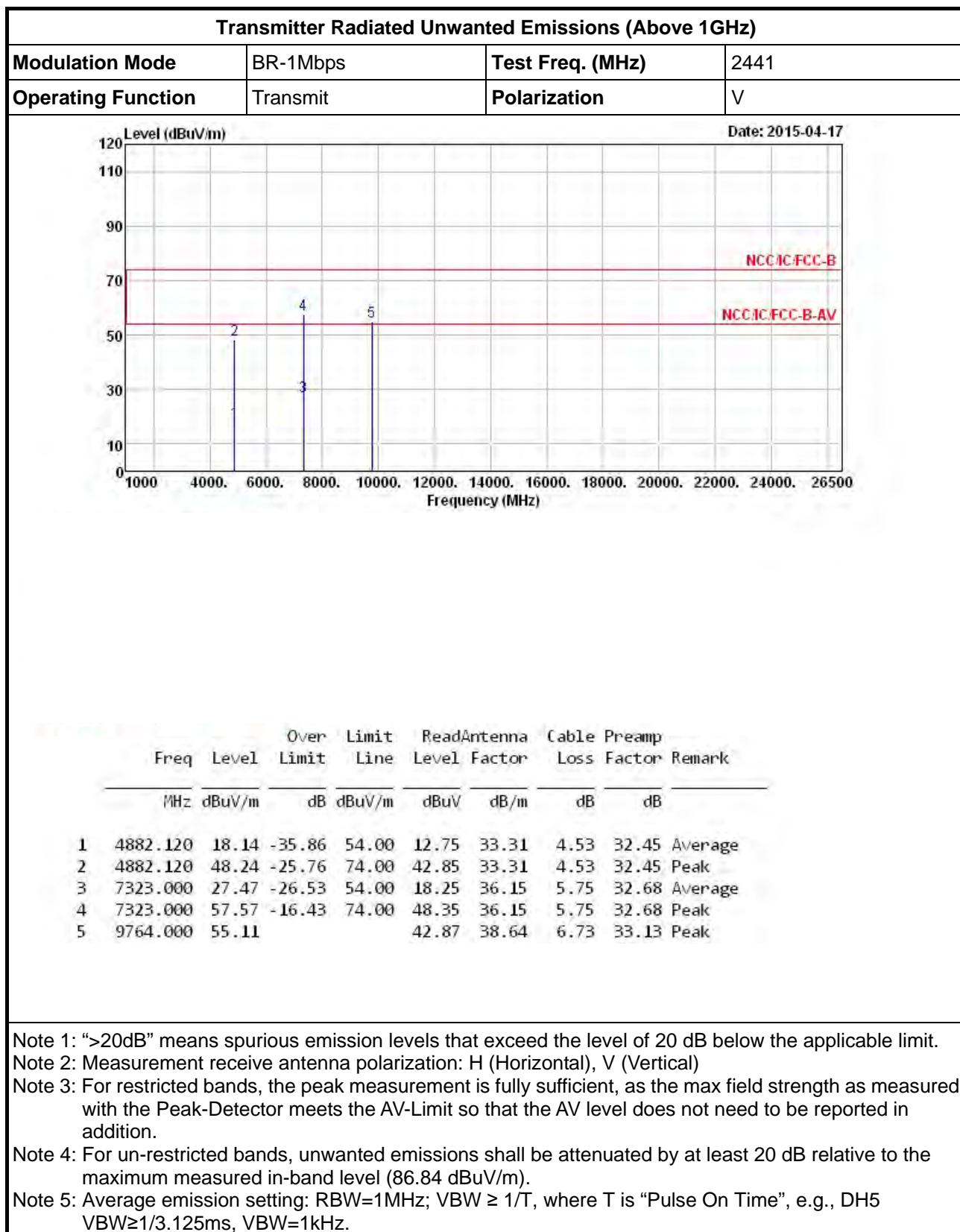


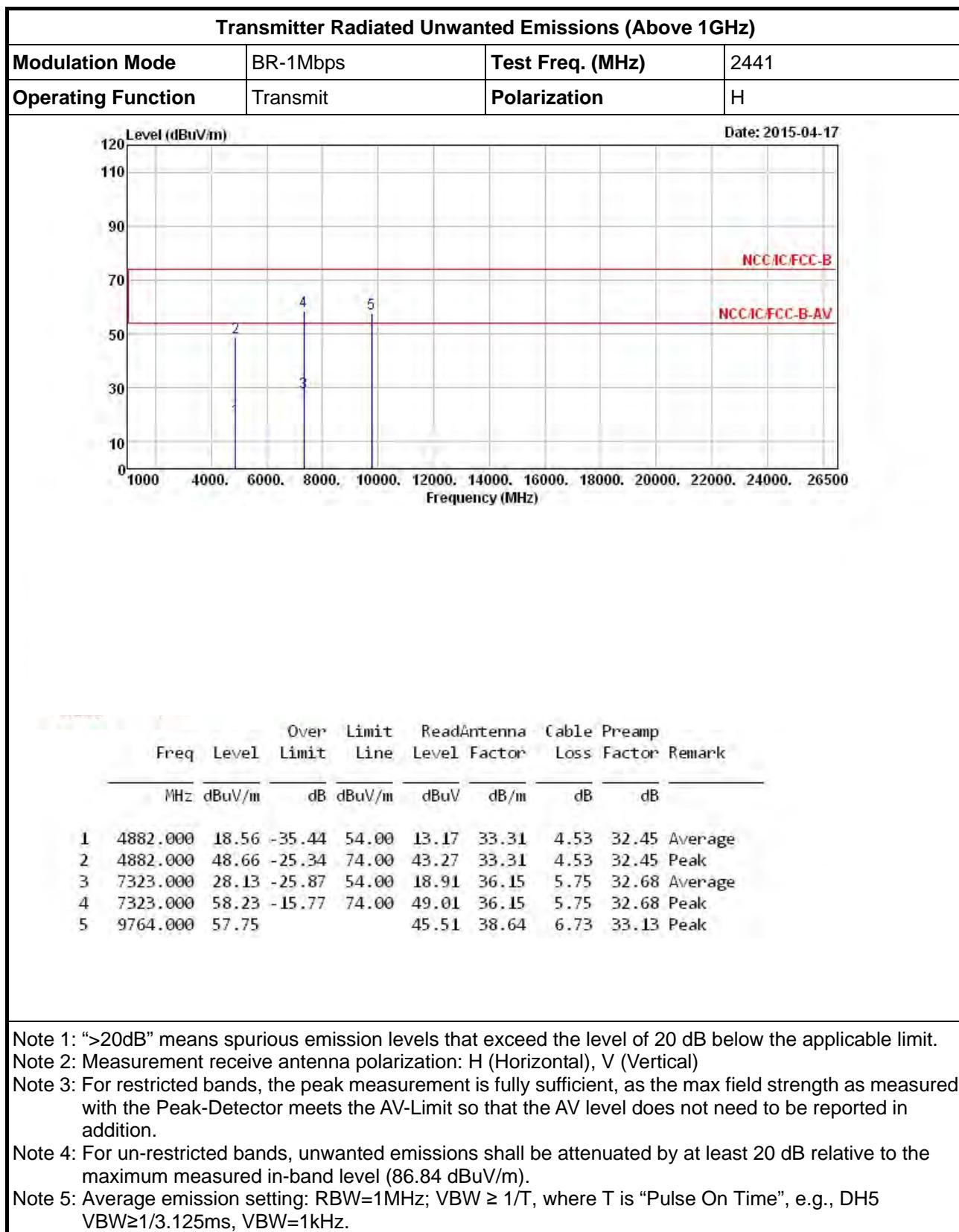


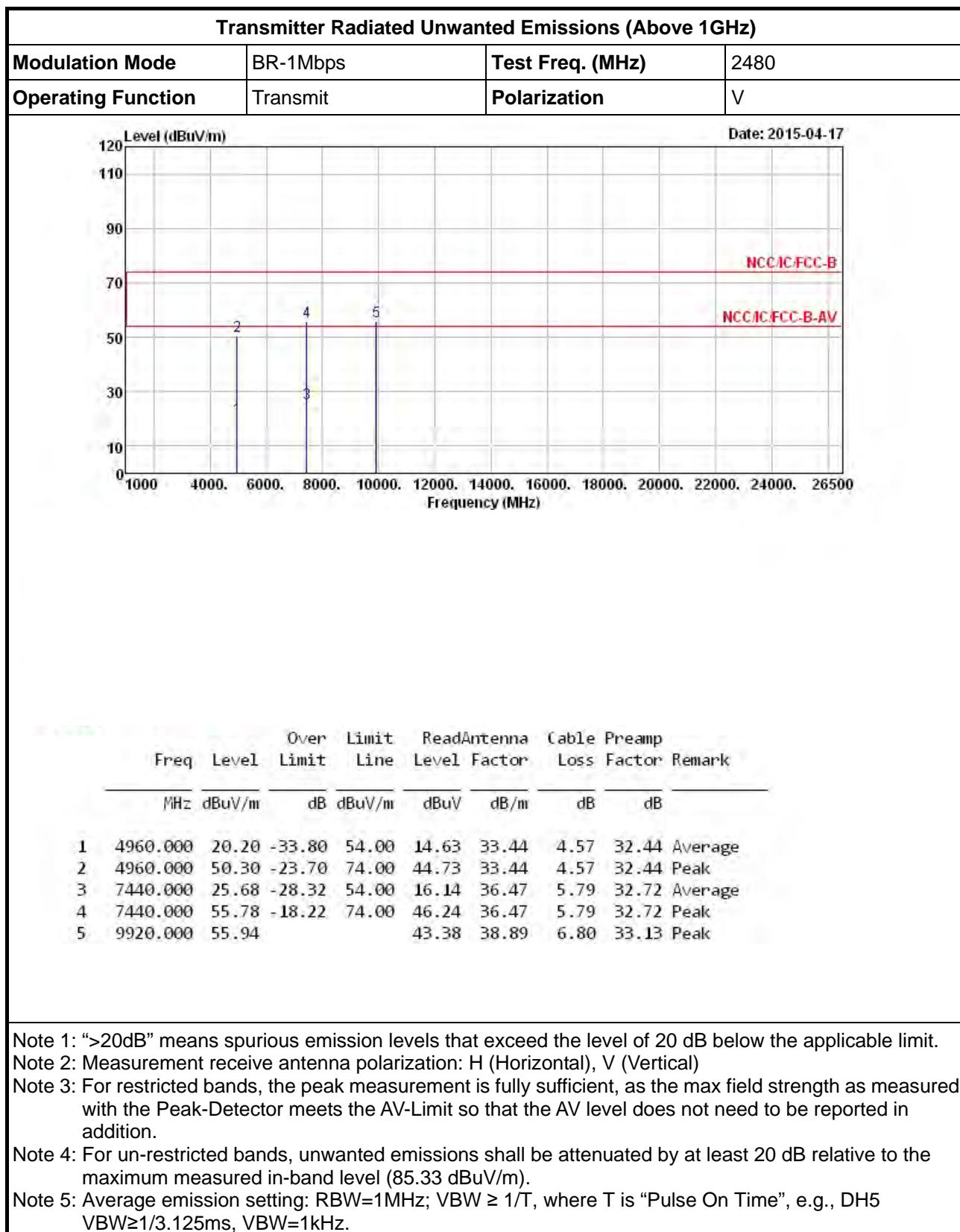
3.7.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)

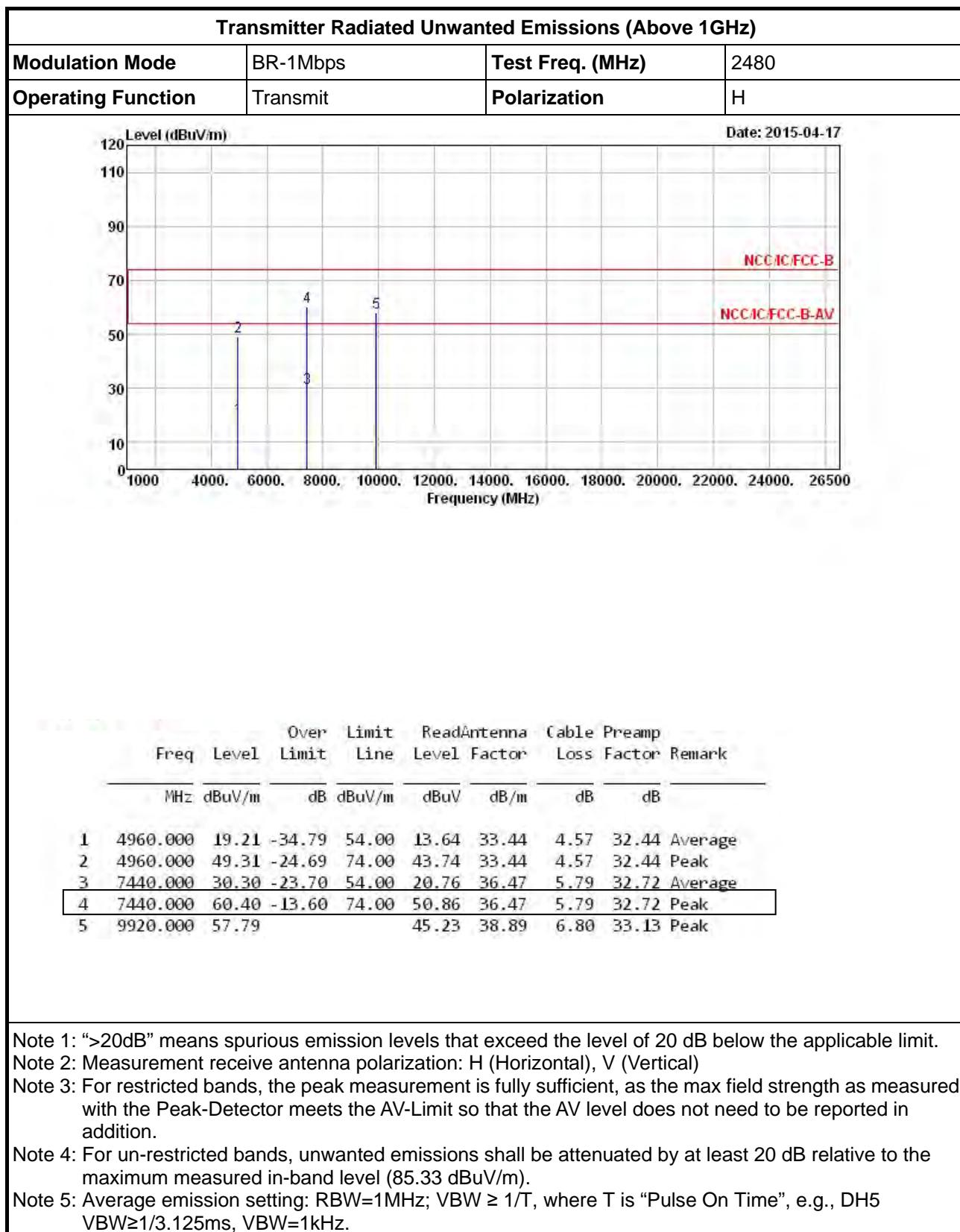














4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMC Receiver	R&S	ESCS 30	100174	9kHz ~ 2.75GHz	Apr. 15. 2015	AC Conduction
LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	8127-477	9kHz ~ 30MHz	Jan. 22, 2015	AC Conduction
RF Cable-CON	HUBER+SUHNER	RG213/U	07611832020001	9kHz ~ 30MHz	Oct. 31, 2014	AC Conduction
EMI Filter	LINDGREN	LRE-2030	2651	< 450 Hz	N/A	AC Conduction

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

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum Analyzer	R&S	FSV 40	101015	9KHz~40GHz	Jun. 01, 2014	RF Conducted
Signal Generator	R&S	SMR40	100116	10MHz ~ 40GHz	Jul. 31, 2014	RF Conducted
Power Sensor	Anritsu	MA2411B	1027452	300MHz ~ 40GHz	Jan. 29, 2015	RF Conducted
Power Meter	Anritsu	ML2495A	1124009	300MHz ~ 40GHz	Jan. 29, 2015	RF Conducted

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

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz ~ 1GHz 3m	Nov. 29, 2014	Radiation
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	May 05, 2014	Radiation
Amplifier	Agilent	8449B	3008A02120	1GHz ~ 26.5GHz	Sep. 01, 2014	Radiation
Spectrum	R&S	FSP40	100004	9kHz ~ 40GHz	Apr. 02, 2015	Radiation
Bilog Antenna	SCHAFFNER	CBL 6112D	22237	30MHz ~ 1GHz	Sep. 20, 2014	Radiation
Horn Antenna	ETS • LINDGREN	3115	6741	1GHz ~ 18GHz	Jul. 11, 2014	Radiation
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	18GHz ~ 40GHz	Jan. 27, 2015	Radiation
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	Nov. 15, 2014	Radiation
RF Cable-high	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz ~ 40GHz	Dec. 12, 2014	Radiation
Turn Table	EM Electronics	EM Electronics	060615	0 ~ 360 degree	N/A	Radiation
Antenna Mast	MF	MF-7802	MF780208179	1 ~ 4 m	N/A	Radiation

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

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Loop Antenna	TESEQ	HLA 6120	31244	9kHz ~ 30MHz	Feb. 02, 2015	Radiation

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