



FCC Test Report

Equipment : GSM/WCDMA Cellular Telephone with BT and WLAN
Brand Name : VERTU
Model No. : Constellation V
Type : RM-851V
FCC ID : P7QRM-851V
Standard : 47 CFR FCC Part 15.247
Operating Band : 2400 MHz – 2483.5 MHz
FCC Classification : DSS
Applicant : VERTU Corporation Limited
Manufacturer : Beacon Hill Road, Church Crookham,
Hampshire GU52 8DY, United Kingdom

The product sample received on Jul. 05, 2013 and completely tested on Jul. 11, 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]: 0.4563600 MHz 31.73 (Margin 15.03dB) - AV 38.40 (Margin 18.36dB) - QP	FCC 15.207	Complied
3.2	15.247(a)	20dB Bandwidth	EDR: 1.2960 MHz	N/A	Complied
3.2	15.247(a)	Carrier Frequency Separation (ChS)	EDR: 1.0000 MHz	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: 0.316 sec	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: 8.28 EDR: 9.64	Power [dBm] BR:21 EDR:21	Complied
3.6	15.247(c)	Transmitter Radiated Bandedge Emissions	Restricted Bands [dBuV/m at 3m]: 2483.50 MHz 60.35 (Margin 13.65 dB) - PK 51.43 (Margin 2.57 dB) - 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]: 47.46 MHz 33.00 (Margin 7.00 dB) - 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)	Co-location
2400-2483.5	BR / EDR	2402-2480	0-78 [79]	9.64	Yes

Note 1: Bluetooth BR uses a GFSK (1Mbps).
Note 2: Bluetooth EDR uses a combination of $\pi/4$ -DQPSK (2Mbps) and 8DPSK (3Mbps).
Note 3: RF output power specifies that Maximum Peak Conducted Output Power.
Note 4: 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 5GHz.)

1.1.2 Antenna Information

Antenna Category	
<input checked="" type="checkbox"/>	Integral antenna (antenna permanently attached)
<input checked="" type="checkbox"/>	Temporary RF connector provided
<input 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	PIFA	-2.40



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 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"/> 78.72% - test mode single channel-DH5	

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 checked="" type="checkbox"/> AC mains	<input checked="" type="checkbox"/> DC	<input type="checkbox"/> System
Type of DC Source	<input type="checkbox"/> Internal DC supply	<input checked="" type="checkbox"/> External DC adapter	<input checked="" type="checkbox"/> Battery



1.2 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	Serial No.
1	Notebook	DELL	E5500	DoC
2	Bluetooth™ Test Set with EDR (Remote)	R&S	CBT	--

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
- ♦ FCC KDB 412172

1.4 Testing Location Information

Testing Location				
<input checked="" type="checkbox"/>	HWA YA	ADD	: No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.	
		TEL	: 886-3-327-3456 FAX : 886-3-327-0973	
Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
AC Conduction	CO04-HY	Zeus	23°C / 52%	Jul. 11, 2013
RF Conducted	TH06-HY	Shiming	24.1°C / 61%	Jul. 07, 2013
Radiated Emission	03CH03-HY	Daniel	23°C / 55%	Jul. 10, 2013~ Jul. 11, 2013



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					
Bluetooth Mode	Transmit Chains (N_{TX})	Data Rate	Modulation Mode	RF Output Power (dBm)	Worst Mode
BR	1	1 Mbps	BR-1Mbps	8.28	EDR-3Mbps
EDR	1	2 Mbps	EDR-2Mbps	9.30	
EDR	1	3 Mbps	EDR-3Mbps	9.64	

Note 1: Bluetooth BR uses a combination of GFSK (1Mbps).
Note 2: Bluetooth EDR uses a combination of $\pi/4$ -DQPSK (2Mbps) and 8DPSK (3Mbps).
Note 3: Modulation modes consist below configuration:
 FHSS BR-1Mbps: GFSK (1Mbps), EDR-2Mbps: $\pi/4$ -DQPSK (2Mbps), EDR-3Mbps: 8DPSK(3Mbps)
Note 4: RF output power specifies that Maximum Peak Conducted Output Power.

2.2 Test Channel Frequencies Configuration

Test Channel Frequencies Configuration	
Bluetooth Mode	Test Channel Frequencies (MHz) – FX (Frequencies Abbreviations)
BR / EDR	2402-(F1), 2440-(F2), 2480-(F3)

2.3 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter			
Test Software Version	CBT	2402 MHz	2440 MHz
Modulation Mode	2402 MHz	2440 MHz	2480 MHz
BR,1Mbps	Default	Default	Default
EDR,2Mbps	Default	Default	Default
EDR,3Mbps	Default	Default	Default



2.4 The Worst Case Measurement Configuration

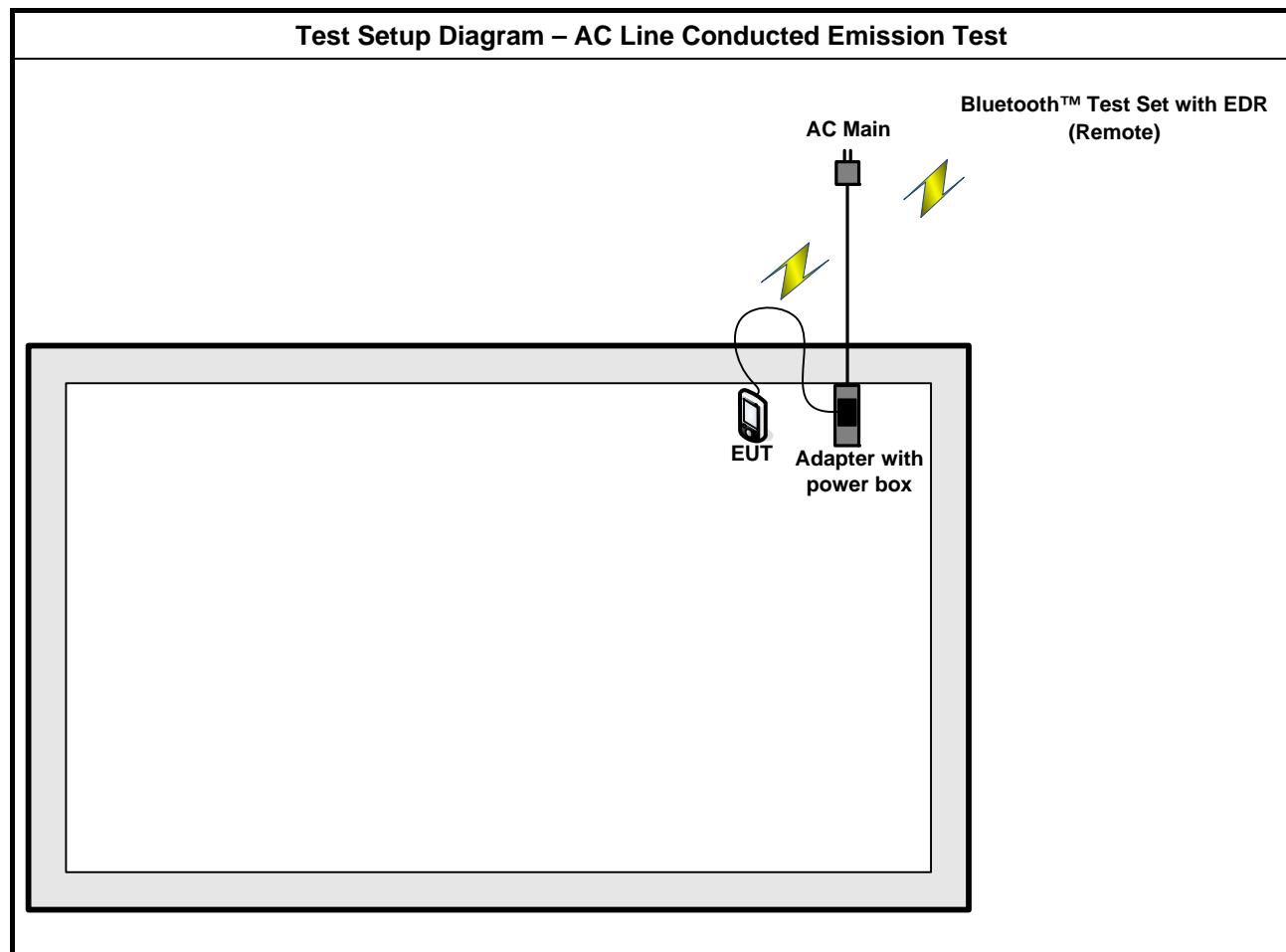
The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
Operating Mode	Operating Mode Description
1	Adapter Mode
2	USB Mode
3	Car Charger Mode
4	Portable Power Charger Mode

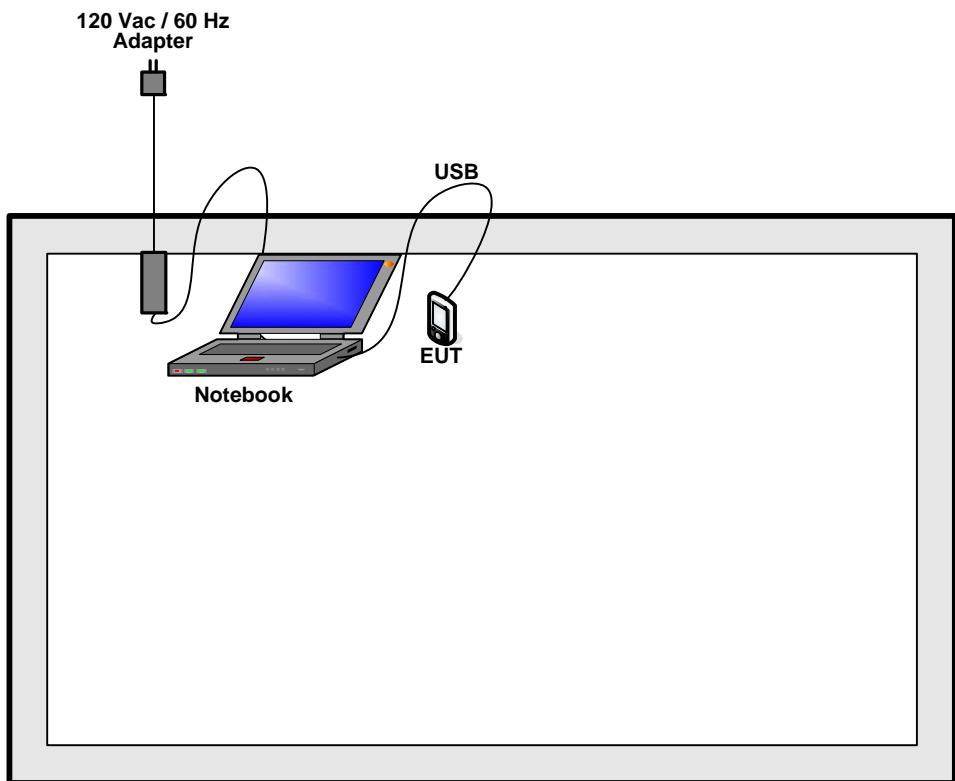
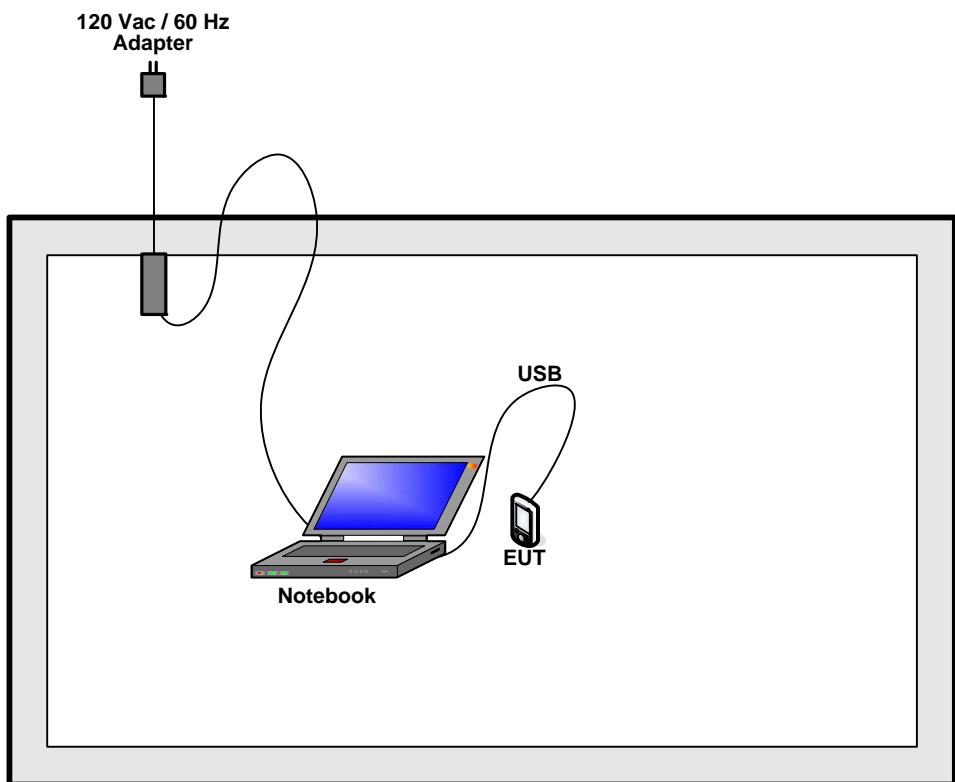
For operating mode 1 is the worst case and it was record in this test report.

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, EDR-3Mbps

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 type="checkbox"/> EUT will be placed in mobile position and operating multiple positions. EUT shall be performed two orthogonal planes. <input checked="" 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. The worst planes is X.						
Operating Mode Below 1GHz	<input checked="" type="checkbox"/> 1. Adapter Mode <input checked="" type="checkbox"/> 2. USB Mode <input checked="" type="checkbox"/> 3. Car Charger Mode <input checked="" type="checkbox"/> 4. Portable Power Charger Mode For operating mode 2 is the worst case and it was record in this test report.						
Operating Mode Above 1GHz	<input checked="" type="checkbox"/> 2. USB Mode						
Modulation Mode	BR-1Mbps, EDR-3Mbps						
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					

2.5 Test Setup Diagram



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

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.

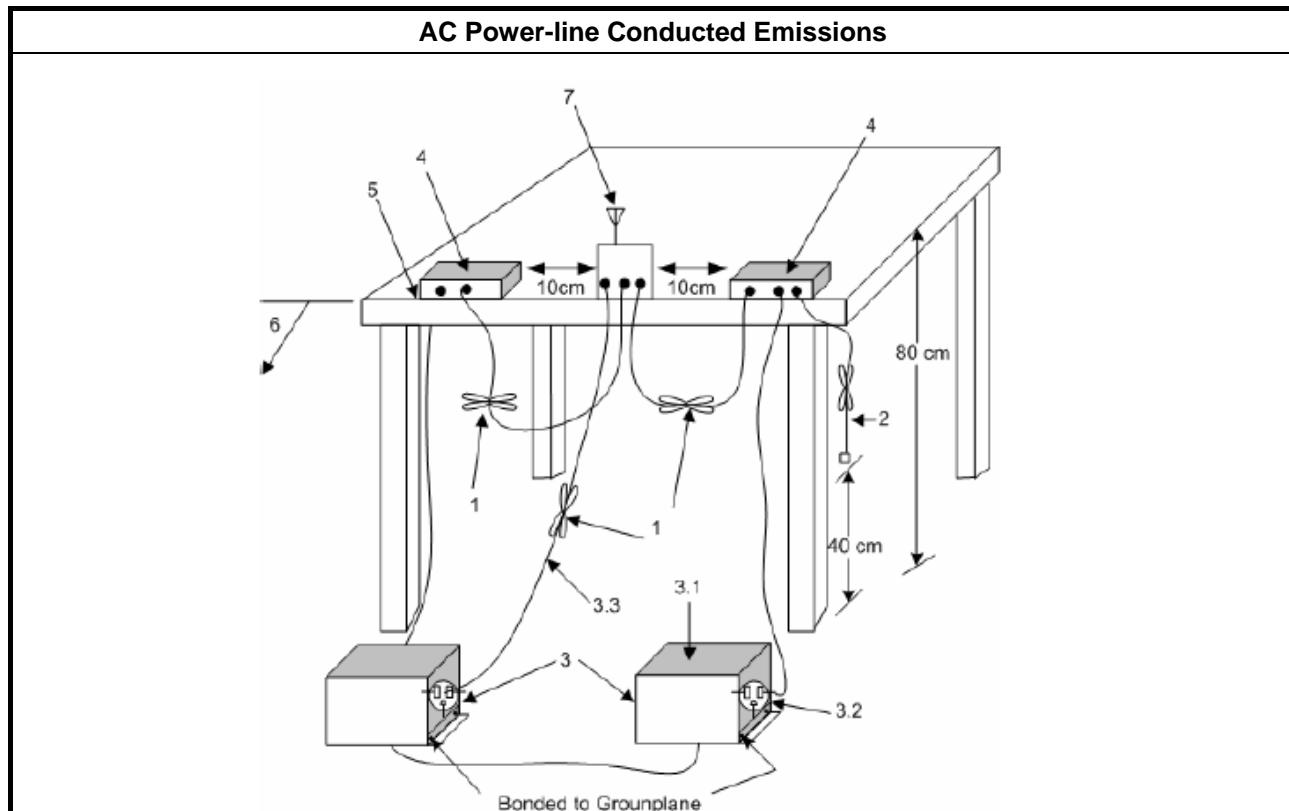
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

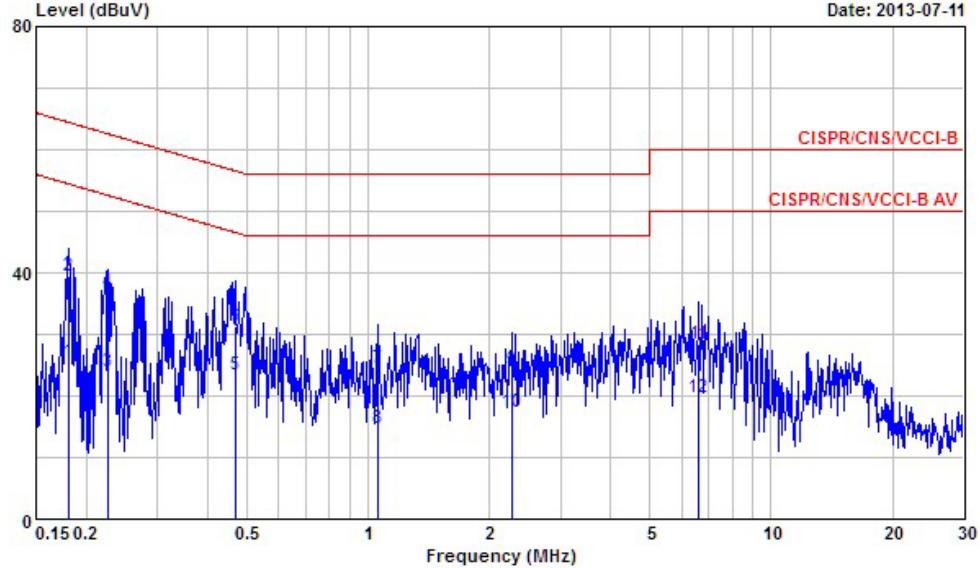
Test Method
<input checked="" type="checkbox"/> Refer as ANSI C63.10-2009, clause 6.2 for AC power-line conducted emissions.

3.1.4 Test Setup





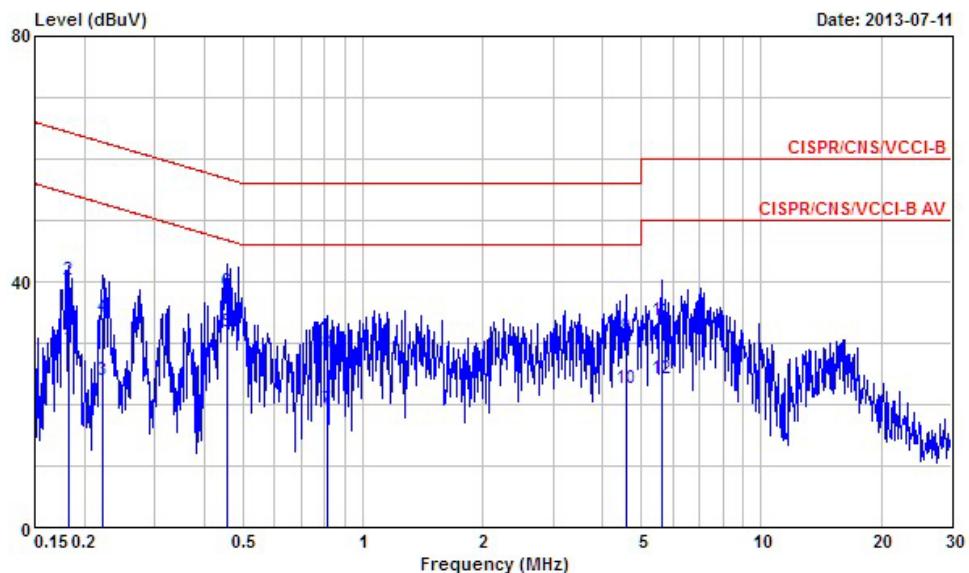
3.1.5 Test Result of AC Power-line Conducted Emissions

AC Power-line Conducted Emissions Result																																																																																																																							
Operating Mode	1	Power Phase	Neutral																																																																																																																				
Operating Function	Adapter Mode																																																																																																																						
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<table><thead><tr><th>Freq</th><th>Level</th><th>Over Limit</th><th>Line</th><th>Read Level</th><th>LISN Factor</th><th>Cable Loss</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>0.1815220</td><td>25.48</td><td>-28.94</td><td>54.42</td><td>25.09</td><td>0.23</td><td>0.16 Average</td></tr><tr><td>2</td><td>0.1815220</td><td>39.46</td><td>-24.96</td><td>64.42</td><td>39.07</td><td>0.23</td><td>0.16 QP</td></tr><tr><td>3</td><td>0.2267630</td><td>24.01</td><td>-28.56</td><td>52.57</td><td>23.68</td><td>0.23</td><td>0.10 Average</td></tr><tr><td>4</td><td>0.2267630</td><td>36.97</td><td>-25.60</td><td>62.57</td><td>36.64</td><td>0.23</td><td>0.10 QP</td></tr><tr><td>5</td><td>0.4686110</td><td>23.34</td><td>-23.20</td><td>46.54</td><td>23.00</td><td>0.22</td><td>0.12 Average</td></tr><tr><td>6</td><td>0.4686110</td><td>31.20</td><td>-25.34</td><td>56.54</td><td>30.86</td><td>0.22</td><td>0.12 QP</td></tr><tr><td>7</td><td>1.060</td><td>24.38</td><td>-31.62</td><td>56.00</td><td>23.94</td><td>0.23</td><td>0.21 QP</td></tr><tr><td>8</td><td>1.060</td><td>14.67</td><td>-31.33</td><td>46.00</td><td>14.23</td><td>0.23</td><td>0.21 Average</td></tr><tr><td>9</td><td>2.280</td><td>24.29</td><td>-31.71</td><td>56.00</td><td>23.75</td><td>0.26</td><td>0.28 QP</td></tr><tr><td>10</td><td>2.280</td><td>17.49</td><td>-28.51</td><td>46.00</td><td>16.95</td><td>0.26</td><td>0.28 Average</td></tr><tr><td>11</td><td>6.630</td><td>28.55</td><td>-31.45</td><td>60.00</td><td>28.04</td><td>0.36</td><td>0.15 QP</td></tr><tr><td>12</td><td>6.630</td><td>19.73</td><td>-30.27</td><td>50.00</td><td>19.22</td><td>0.36</td><td>0.15 Average</td></tr></tbody></table>								Freq	Level	Over Limit	Line	Read Level	LISN Factor	Cable Loss	Remark	MHz	dBuV	dB	dBuV	dBuV	dB	dB		1	0.1815220	25.48	-28.94	54.42	25.09	0.23	0.16 Average	2	0.1815220	39.46	-24.96	64.42	39.07	0.23	0.16 QP	3	0.2267630	24.01	-28.56	52.57	23.68	0.23	0.10 Average	4	0.2267630	36.97	-25.60	62.57	36.64	0.23	0.10 QP	5	0.4686110	23.34	-23.20	46.54	23.00	0.22	0.12 Average	6	0.4686110	31.20	-25.34	56.54	30.86	0.22	0.12 QP	7	1.060	24.38	-31.62	56.00	23.94	0.23	0.21 QP	8	1.060	14.67	-31.33	46.00	14.23	0.23	0.21 Average	9	2.280	24.29	-31.71	56.00	23.75	0.26	0.28 QP	10	2.280	17.49	-28.51	46.00	16.95	0.26	0.28 Average	11	6.630	28.55	-31.45	60.00	28.04	0.36	0.15 QP	12	6.630	19.73	-30.27	50.00	19.22	0.36	0.15 Average
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AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	Adapter Mode		



Freq	Level	Over	Limit	Read	LISN	Cable	
		Line	Level	Factor		Loss	Remark
MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.1824860	29.18	-25.19	54.37	28.92	0.11	0.15 Average
2	0.1824860	40.28	-24.09	64.37	40.02	0.11	0.15 QP
3	0.2220070	23.90	-28.84	52.74	23.69	0.11	0.10 Average
4	0.2220070	34.22	-28.52	62.74	34.01	0.11	0.10 QP
5	0.4563600	31.73	-15.03	46.76	31.52	0.10	0.11 Average
6	0.4563600	38.40	-18.36	56.76	38.19	0.10	0.11 QP
7	0.8173740	19.31	-26.69	46.00	19.02	0.11	0.18 Average
8	0.8173740	28.46	-27.54	56.00	28.17	0.11	0.18 QP
9	4.570	31.03	-24.97	56.00	30.68	0.16	0.19 QP
10	4.570	22.55	-23.45	46.00	22.20	0.16	0.19 Average
11	5.620	33.56	-26.44	60.00	33.22	0.18	0.16 QP
12	5.620	24.10	-25.90	50.00	23.76	0.18	0.16 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 ≥ 79 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

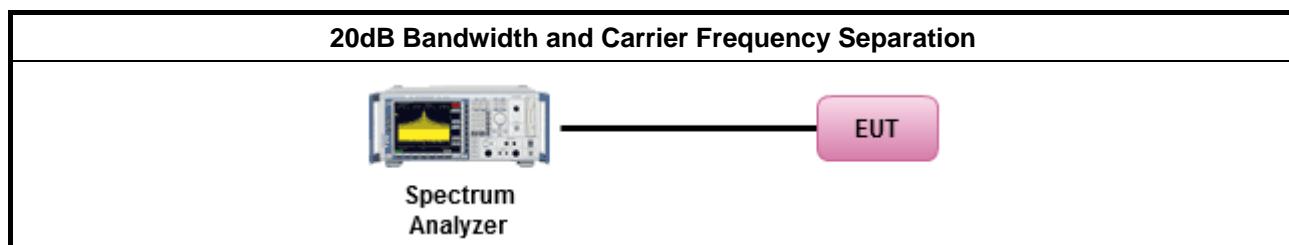
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

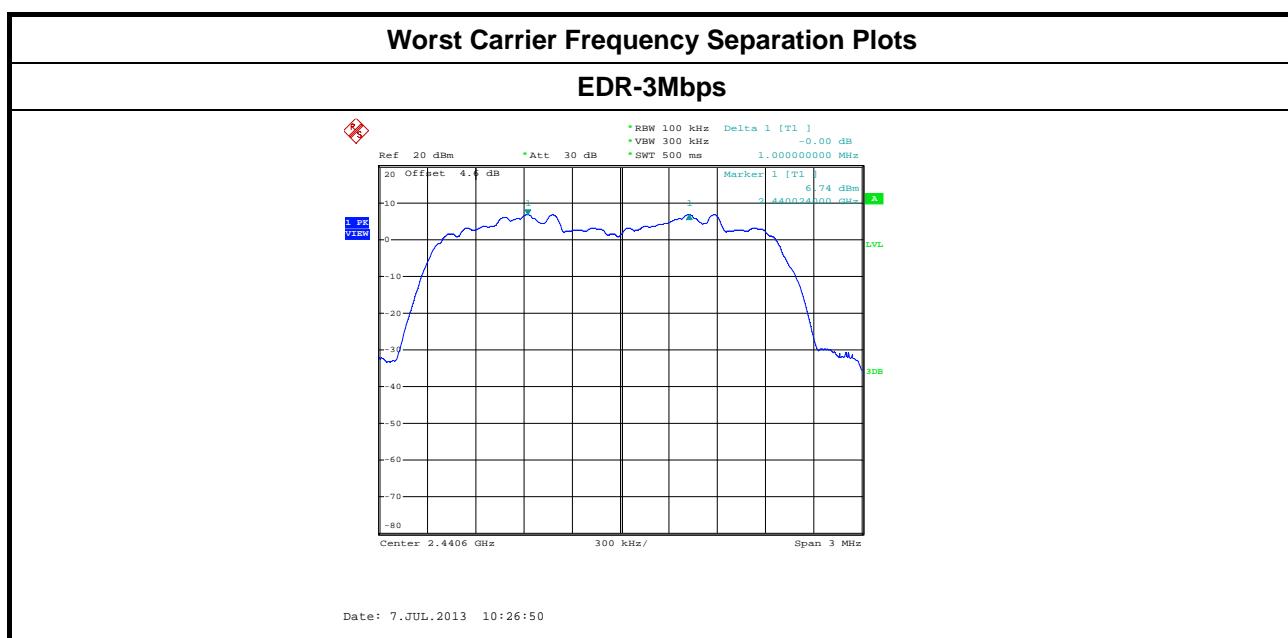
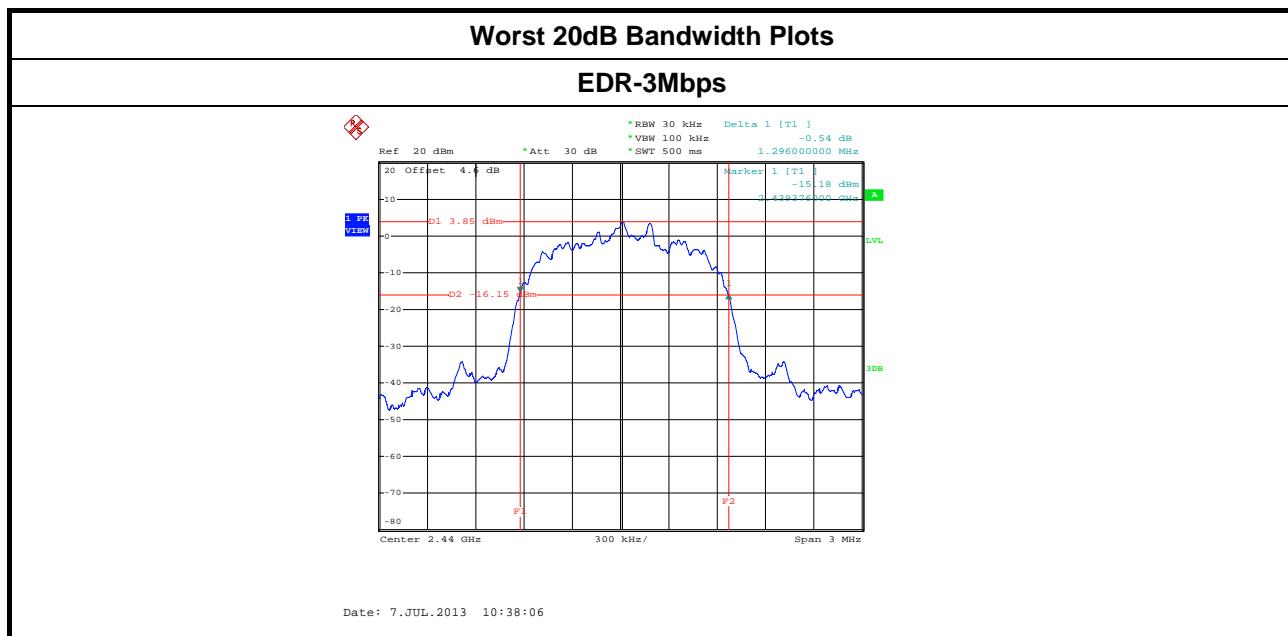
Test Method	
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.1 for 20 dB bandwidth measurement.	
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 7.7.2 for carrier frequency separation measurement.	
<input checked="" type="checkbox"/> For conducted measurement.	
<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)
EDR-3Mbps	2402	1.2960	1.1820	1.0000	0.8640
EDR-3Mbps	2440	1.2960	1.1820	1.0000	0.8640
EDR-3Mbps	2480	1.2960	1.1760	1.0000	0.8640
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 ≥ 79 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

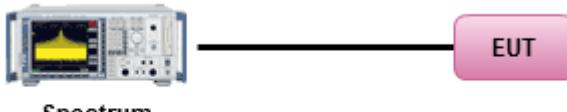
3.3.2 Measuring Instruments

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.

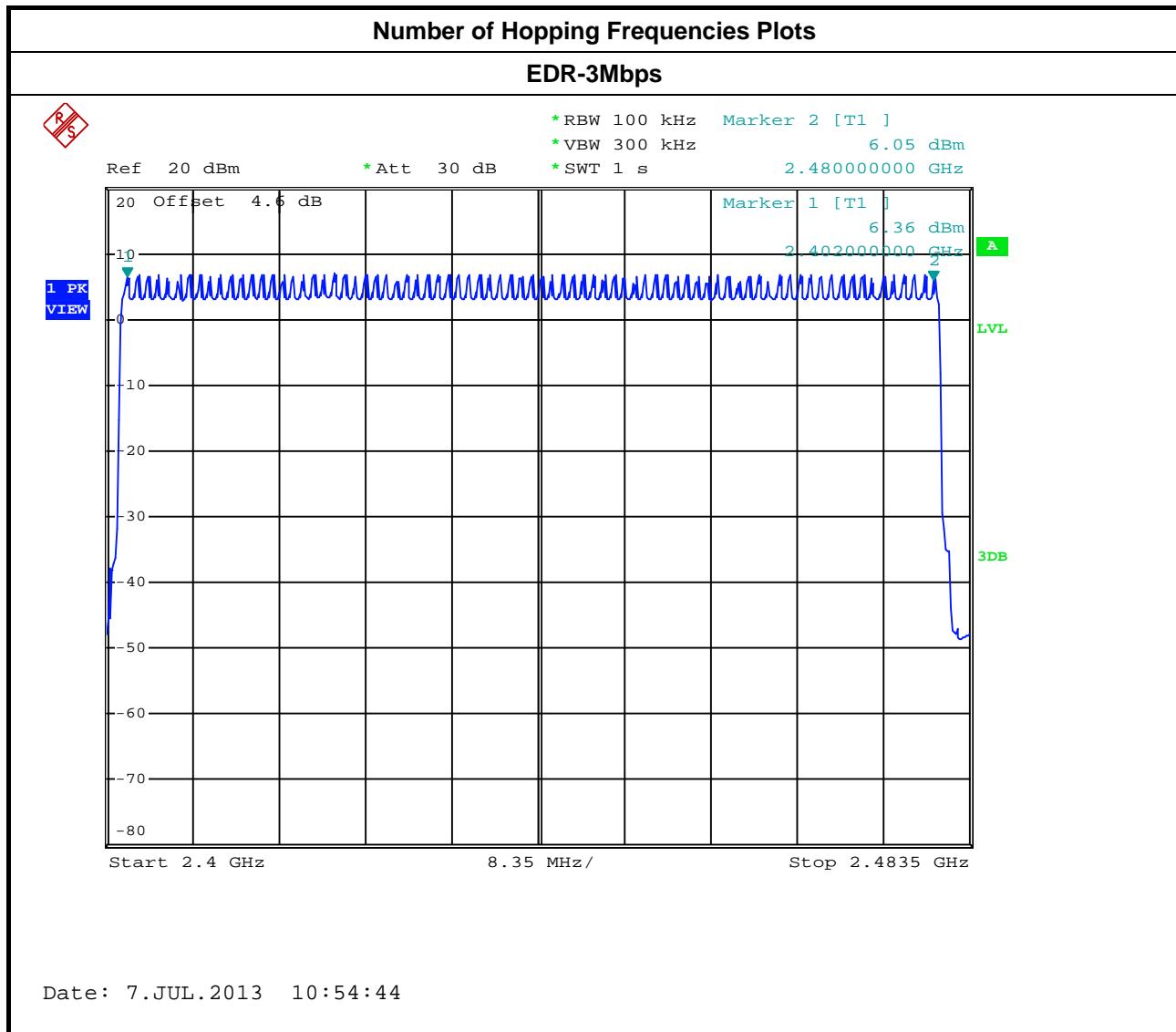
3.3.4 Test Setup

Number of Hopping Frequencies




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
EDR-3Mbps	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	

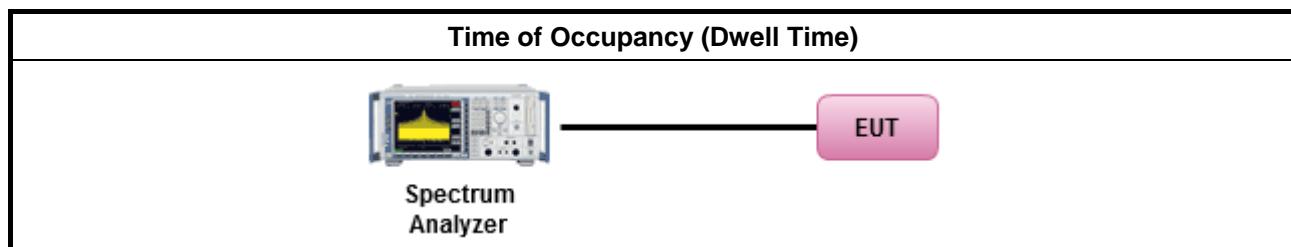
3.4.2 Measuring Instruments

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 RX, 1 time slot TX). 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 RX, 1 time slot TX). 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.	

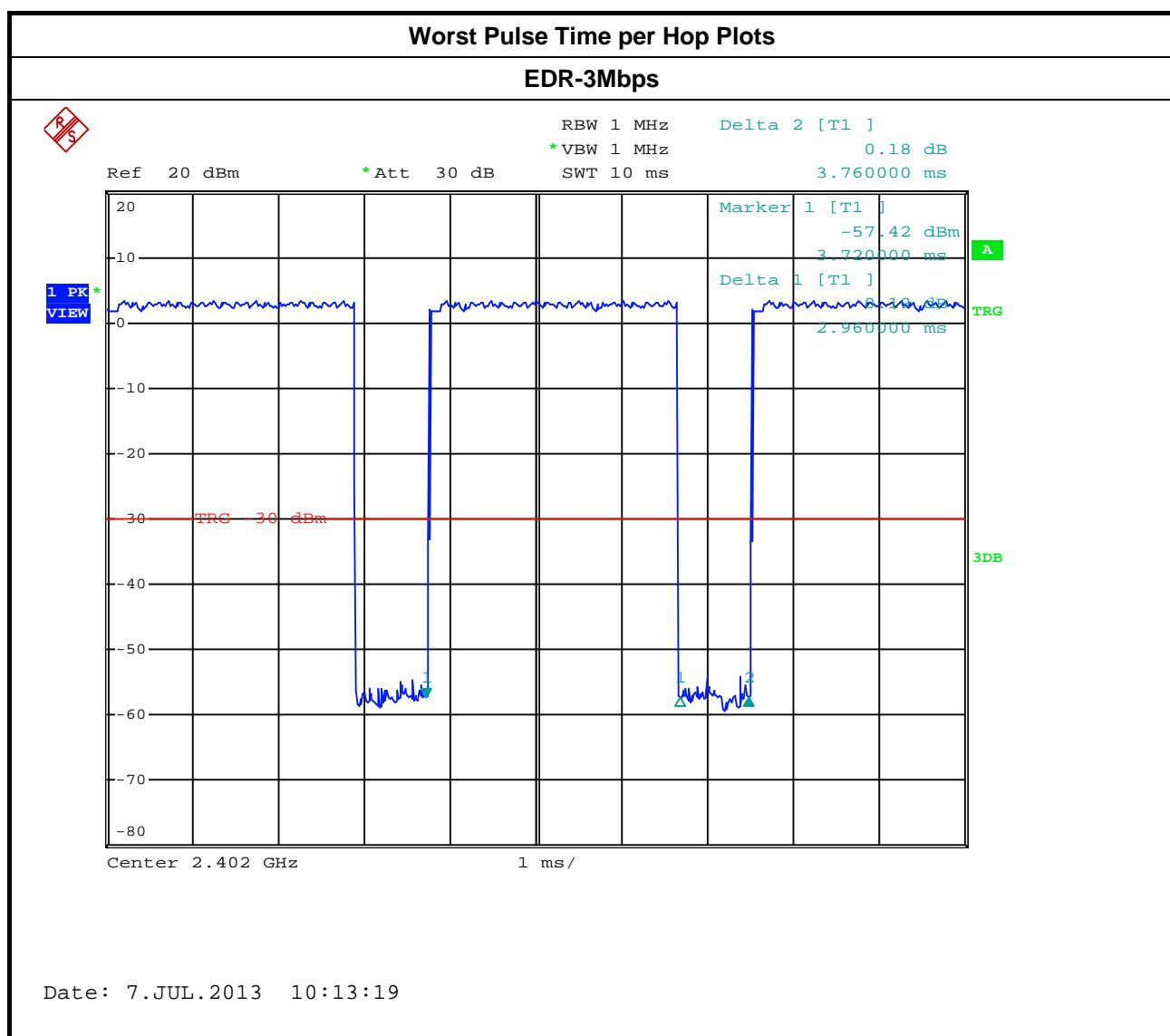
3.4.4 Test Setup



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)
EDR-3Mbps	2402	2.96	106.7	0.316	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: $N \geq 79$	
	<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: $N \geq 79 - P_{eirp} \leq 36 \text{ dBm}$ (4 W)
	<input checked="" type="checkbox"/> For Hopping Channel: $79 > N \geq 15 - P_{eirp} \leq 27 \text{ dBm}$ (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	

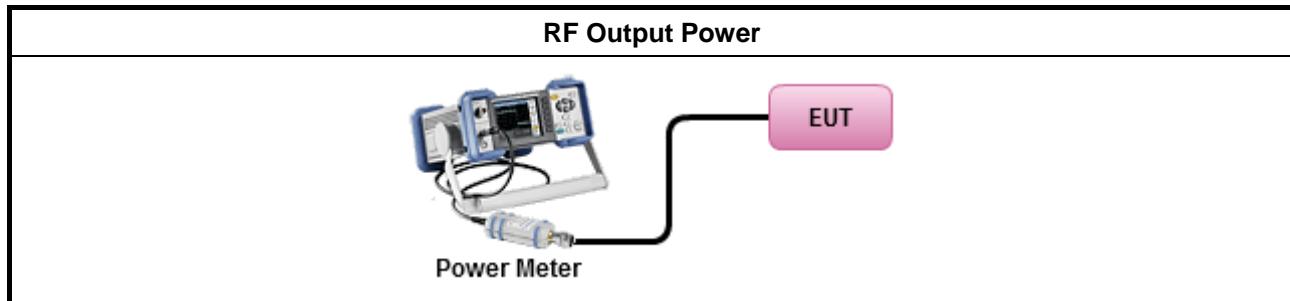
3.5.2 Measuring Instruments

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

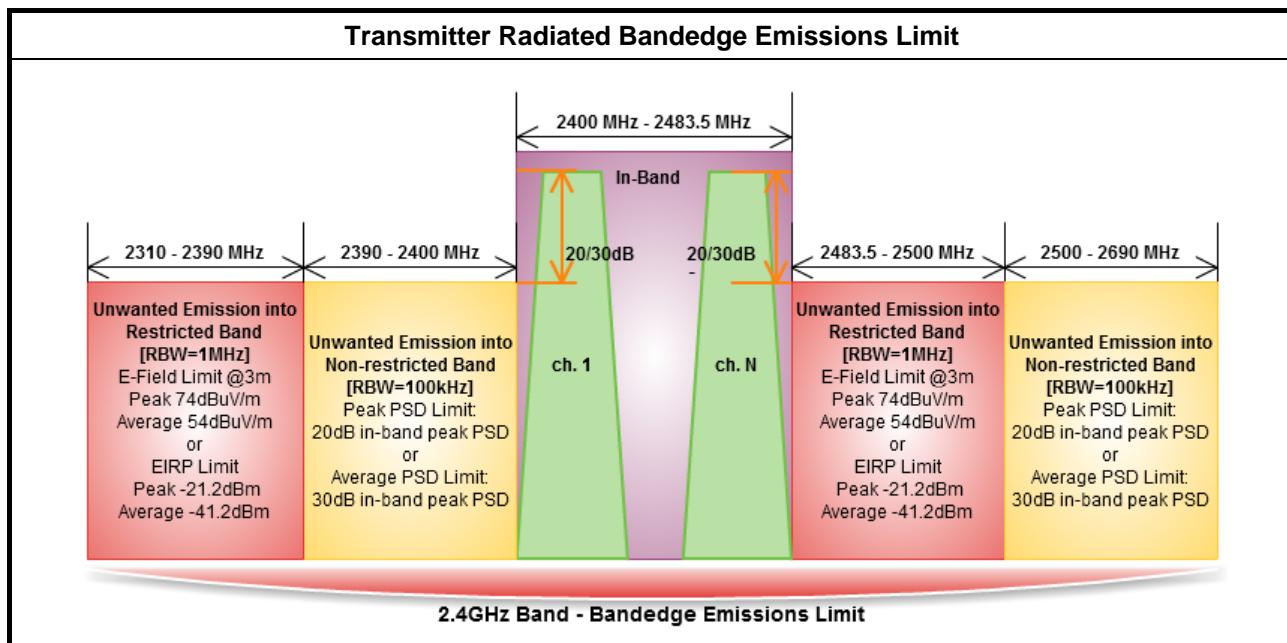


3.5.5 Test Result of Maximum Peak Conducted Output Power

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	8.15	21	-2.40	5.75	27
BR-1Mbps	2440	8.28	21	-2.40	5.88	27
BR-1Mbps	2480	8.14	21	-2.40	5.74	27
EDR-3Mbps	2402	9.53	21	-2.40	7.13	27
EDR-3Mbps	2440	9.64	21	-2.40	7.24	27
EDR-3Mbps	2480	9.47	21	-2.40	7.07	27
Result		Complied				

3.6 Transmitter Radiated Bandedge Emissions

3.6.1 Transmitter Radiated Bandedge Emissions Limit



3.6.2 Measuring Instruments

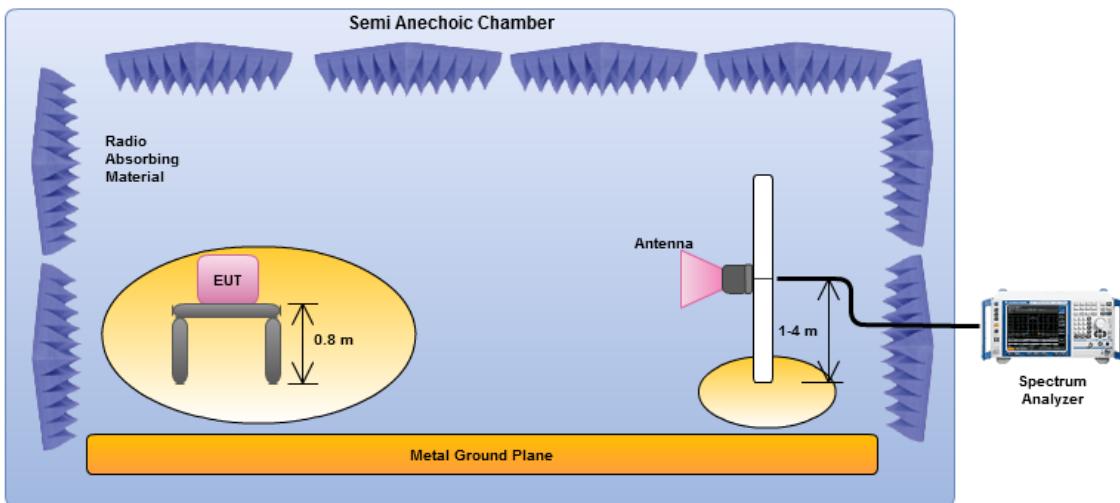
Refer a test equipment and calibration data table in this test report.

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.				
<table border="1" style="width: 100%;"> <tr> <td><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.</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 ANSI C63.10, clause 4.2.3.2.2 measurement procedure peak limit.</td></tr> </table>		<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"/> 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:				
<table border="1" style="width: 100%;"> <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> <tr> <td><input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 7.7.9 for band-edge testing into non-restricted bands.</td></tr> </table>		<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 6.9.2 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"/> For radiated measurement, refer as ANSI C63.10, clause 6.6 for radiated emissions from above 1 GHz.				

3.6.4 Test Setup

Transmitter Radiated Bandedge Emissions



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



3.6.5 Transmitter Radiated Bandedge Emissions

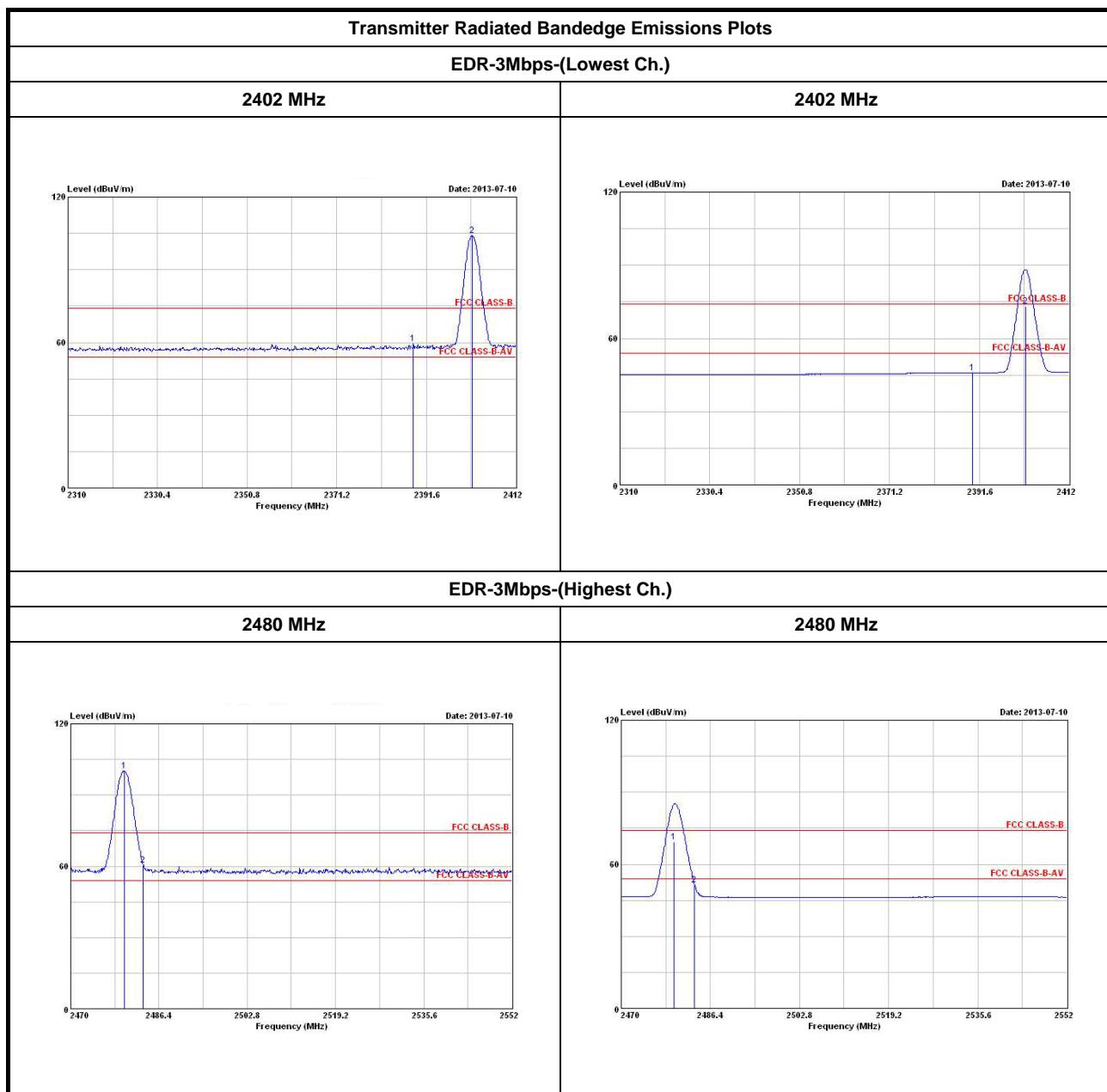
Transmitter Radiated Bandedge Emissions (Non-restricted Band)								
Modulation	N _{TX}	Test Freq. (MHz)	In-band PSD [i] (dBuV/100kHz)	Freq. (MHz)	Out-band PSD [o] (dBuV/100kHz)	[i] – [o] (dB)	Limit (dB)	Pol.
EDR-3Mbps	1	2402	101.74	2393.84	51.87	49.87	20	H
EDR-3Mbps	1	2480	97.85	2543.39	52.55	45.30	20	H

Note 1: Measurement worst emissions of receive antenna polarization

Transmitter Radiated Bandedge Emissions (Restricted Band)										
Modulation Mode	N _{TX}	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.
EDR-3Mbps	1	2402	3	2388.64	59.38	74	2390.00	45.93	54	H
EDR-3Mbps	1	2480	3	2483.50	60.35	74	2483.50	51.43	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.

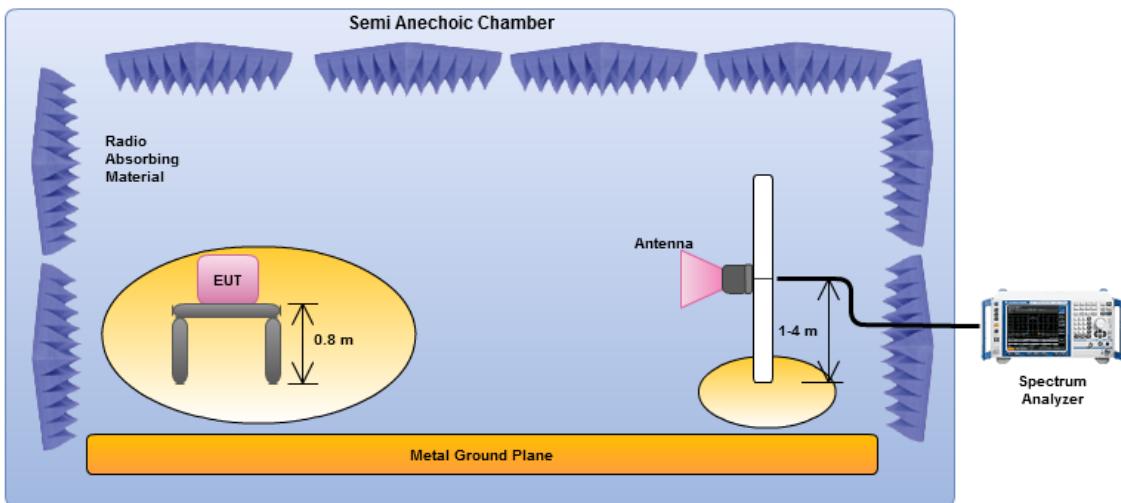


3.7.3 Test Procedures

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"/>	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 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 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). $\text{VBW} \geq 1/T$, 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 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.

3.7.4 Test Setup

Transmitter Radiated Unwanted Emissions



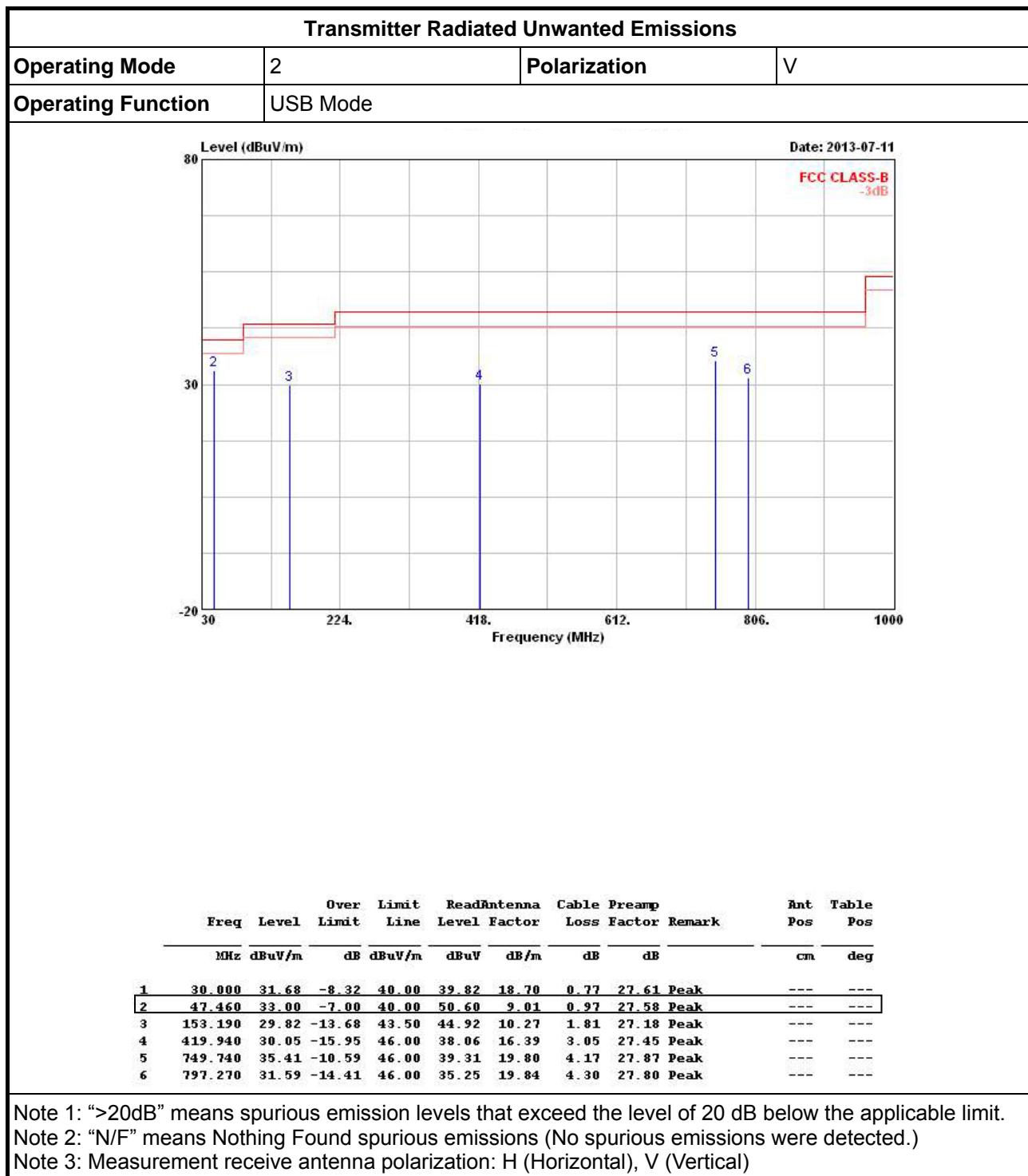
Magnetic field tests shall be performed in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna. Electric field tests shall be performed in the frequency range of 30 MHz to 1000 MHz using a calibrated bi-log antenna and the frequency range of 1 GHz to 40 GHz using a calibrated horn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

3.7.5 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.



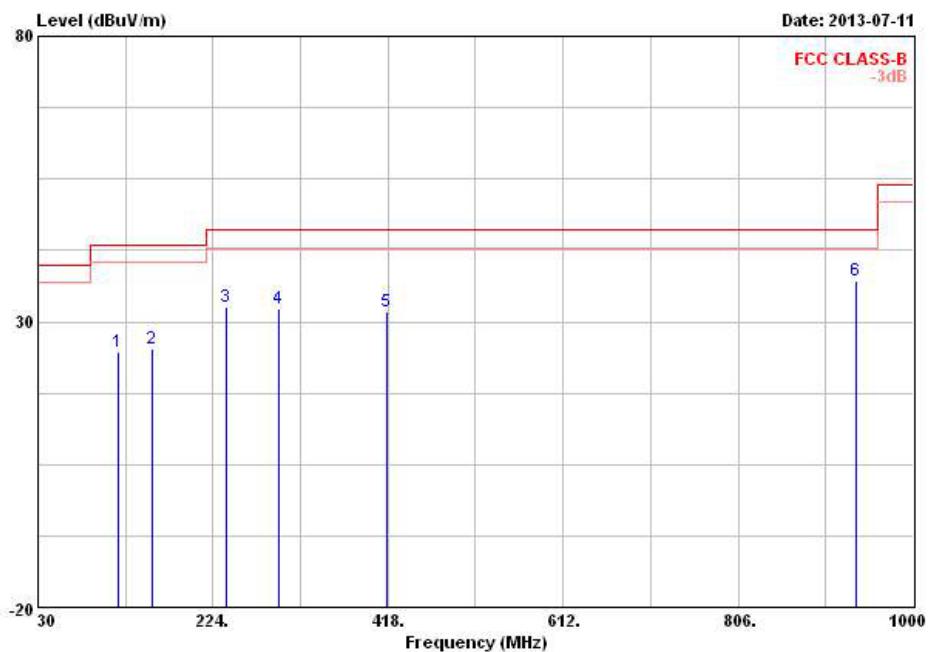
3.7.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)





Transmitter Radiated Unwanted Emissions

Operating Mode	2	Polarization	H
Operating Function	USB Mode		



Freq	Level	Over Limit		ReadAntenna		Cable Preamp			Ant Pos	Table Pos
		Limit	Line	Level	Factor	Loss	Factor	Remark		
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
118.270	24.66	-18.84	43.50	37.93	12.43	1.61	27.31	Peak	---	---
156.100	25.17	-18.33	43.50	40.43	10.09	1.82	27.17	Peak	---	---
238.550	32.71	-13.29	46.00	46.08	11.24	2.26	26.87	Peak	---	---
296.750	32.27	-13.73	46.00	43.26	13.11	2.56	26.66	Peak	---	---
417.030	31.80	-14.20	46.00	39.87	16.32	3.04	27.43	Peak	---	---
935.980	37.22	-8.78	46.00	39.19	20.25	4.73	27.45	Peak	---	---

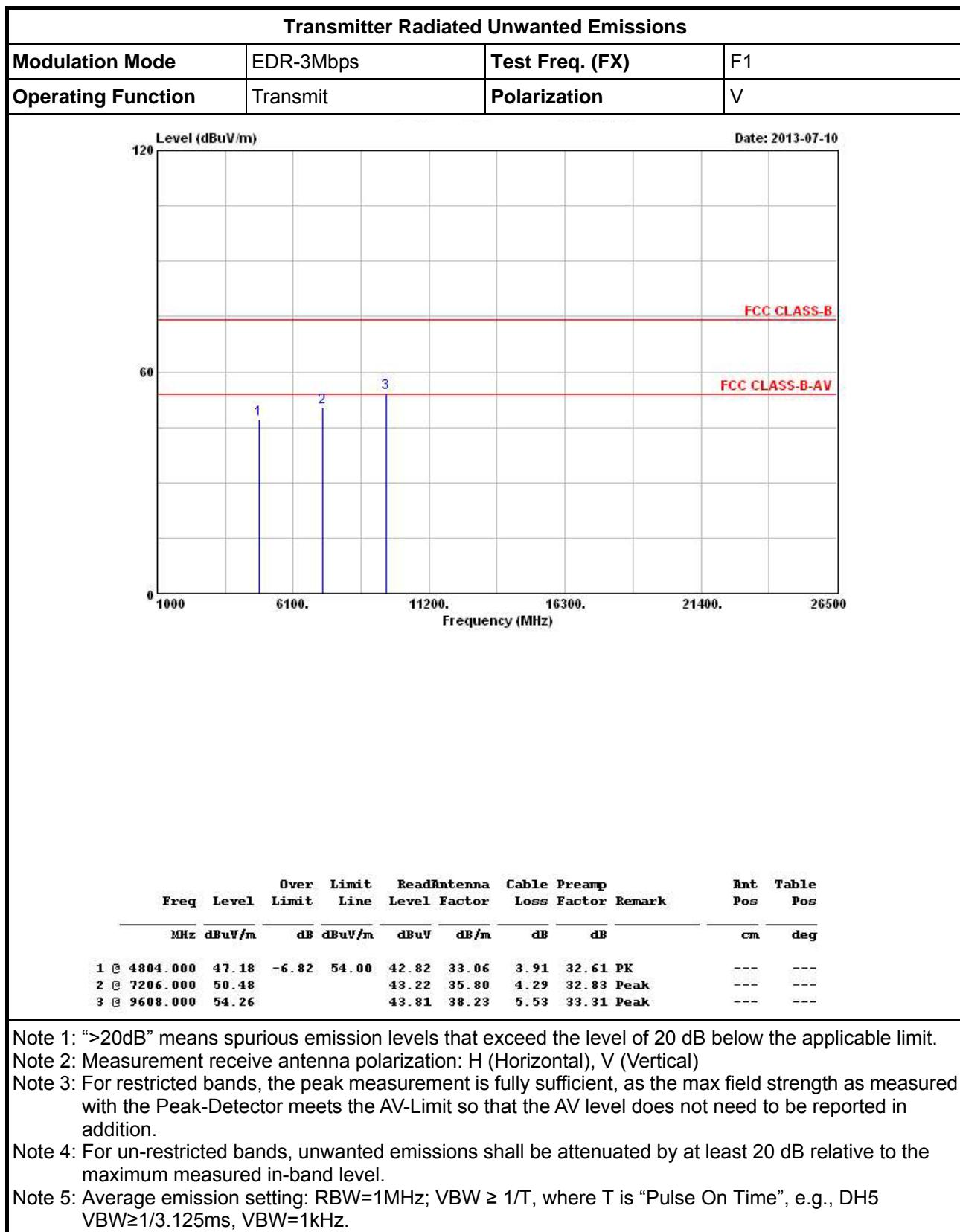
Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.

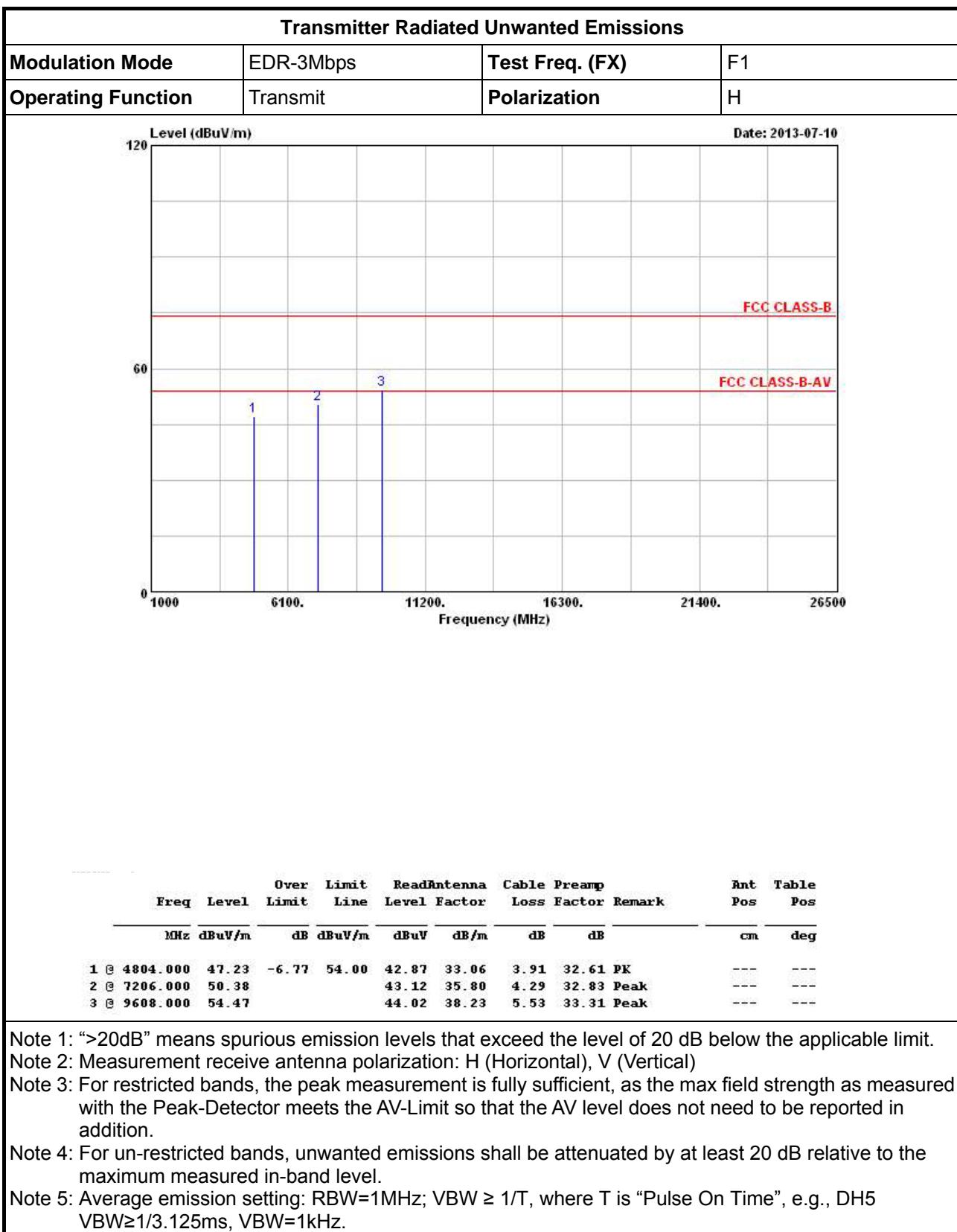
Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected)

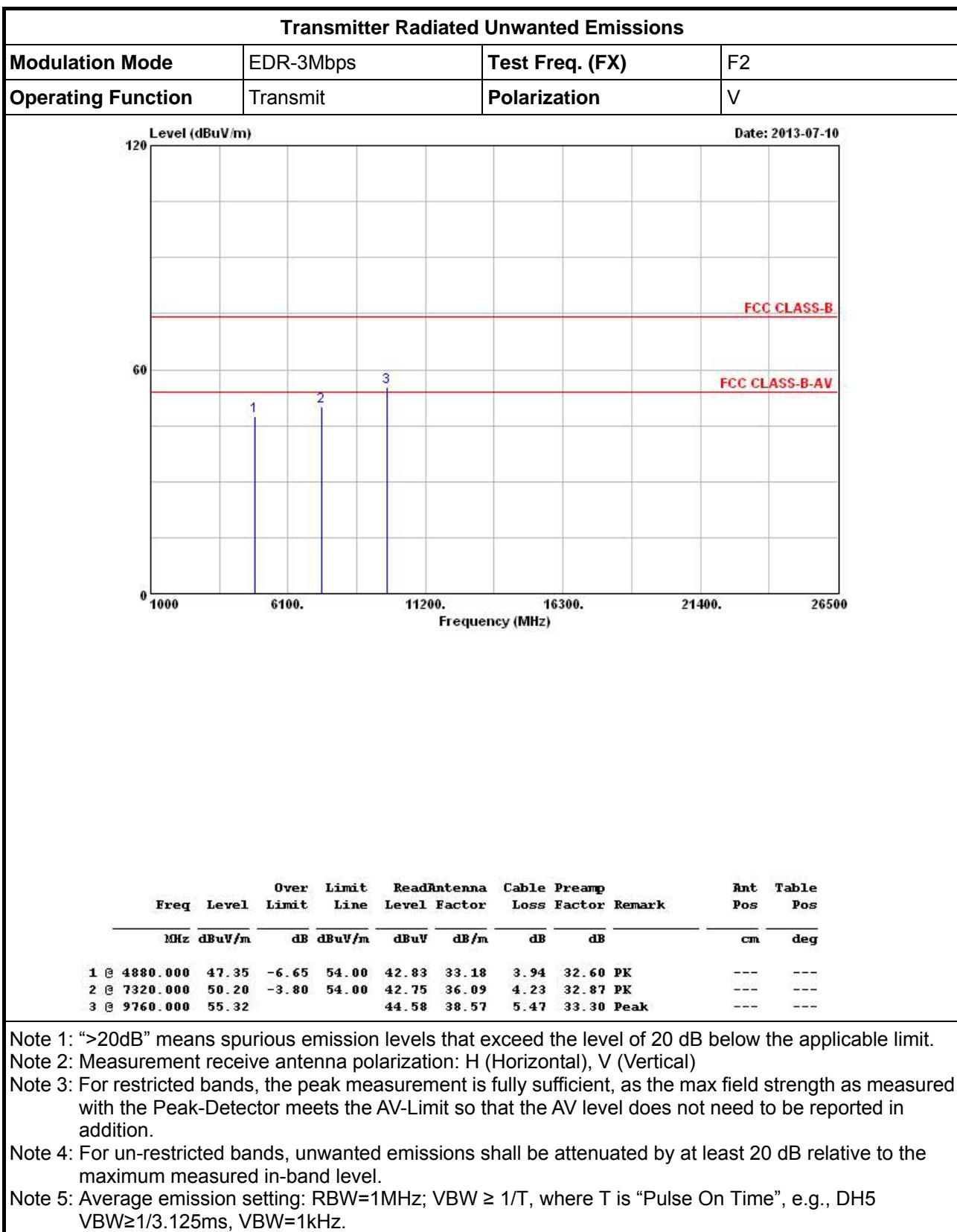
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)



3.7.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)



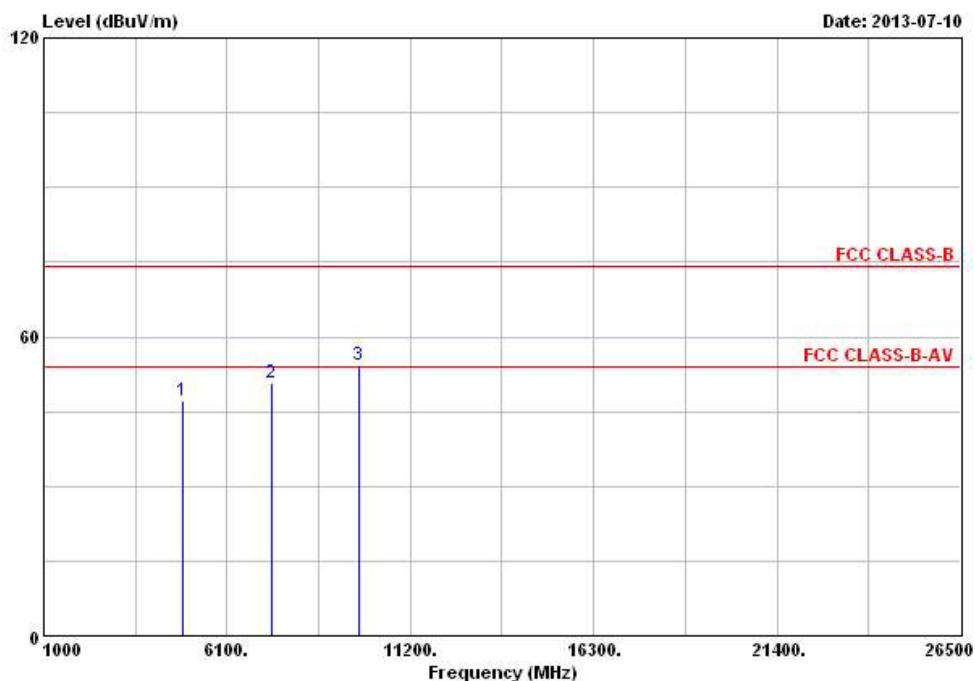






Transmitter Radiated Unwanted Emissions

Modulation Mode	EDR-3Mbps	Test Freq. (FX)	F2
Operating Function	Transmit	Polarization	H



Freq	Level	Over Limit		ReadAntenna		Cable Preamp		Ant Pos	Table Pos
		Limit	Line	Level	Factor	Loss	Factor		
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg
0.000	47.29	-6.71	54.00	42.77	33.18	3.94	32.60	PK	---
0.000	50.69	-3.31	54.00	43.24	36.09	4.23	32.87	PK	---
0.000	54.25			43.51	38.57	5.47	33.30	Peak	---

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

Note 2: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

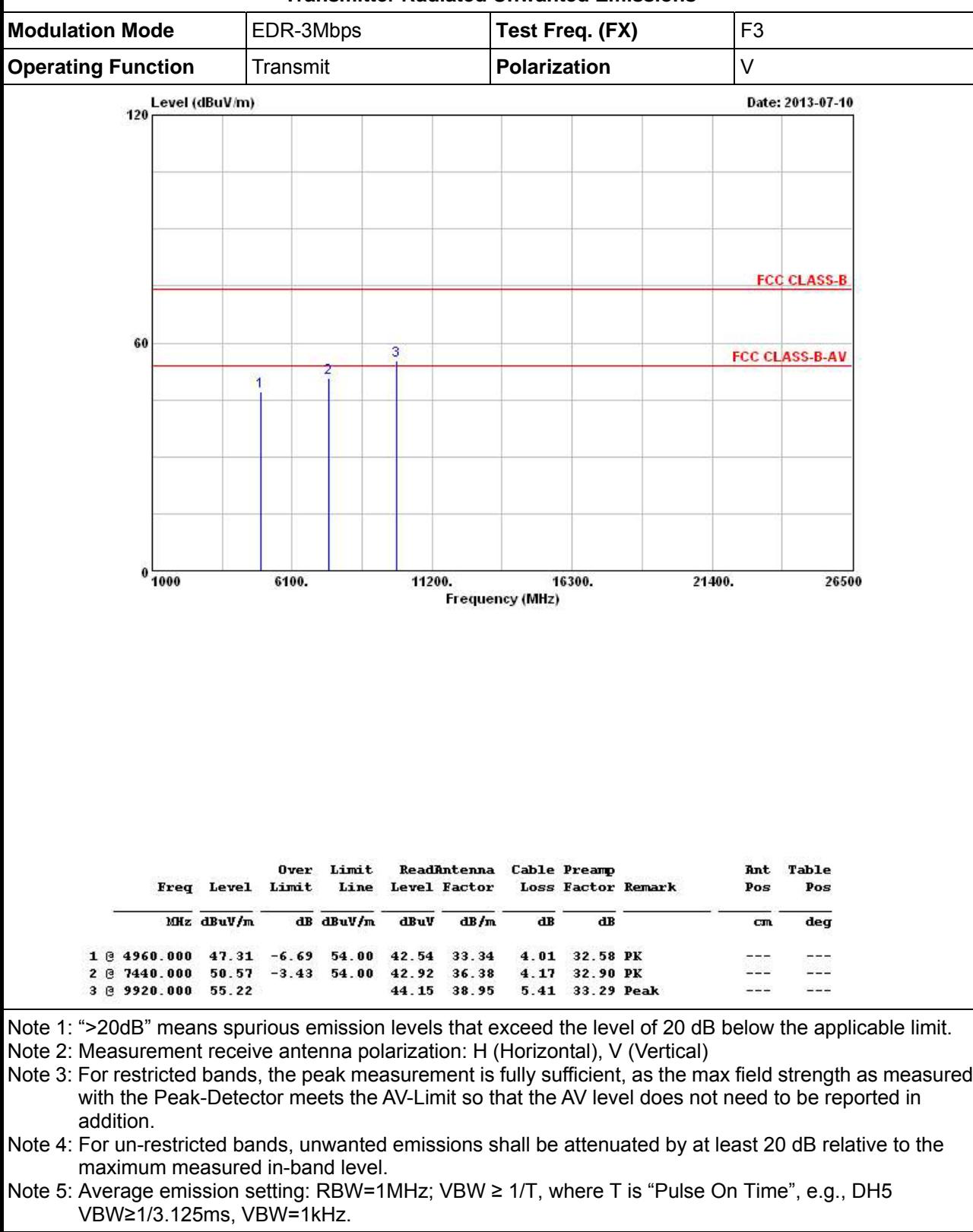
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

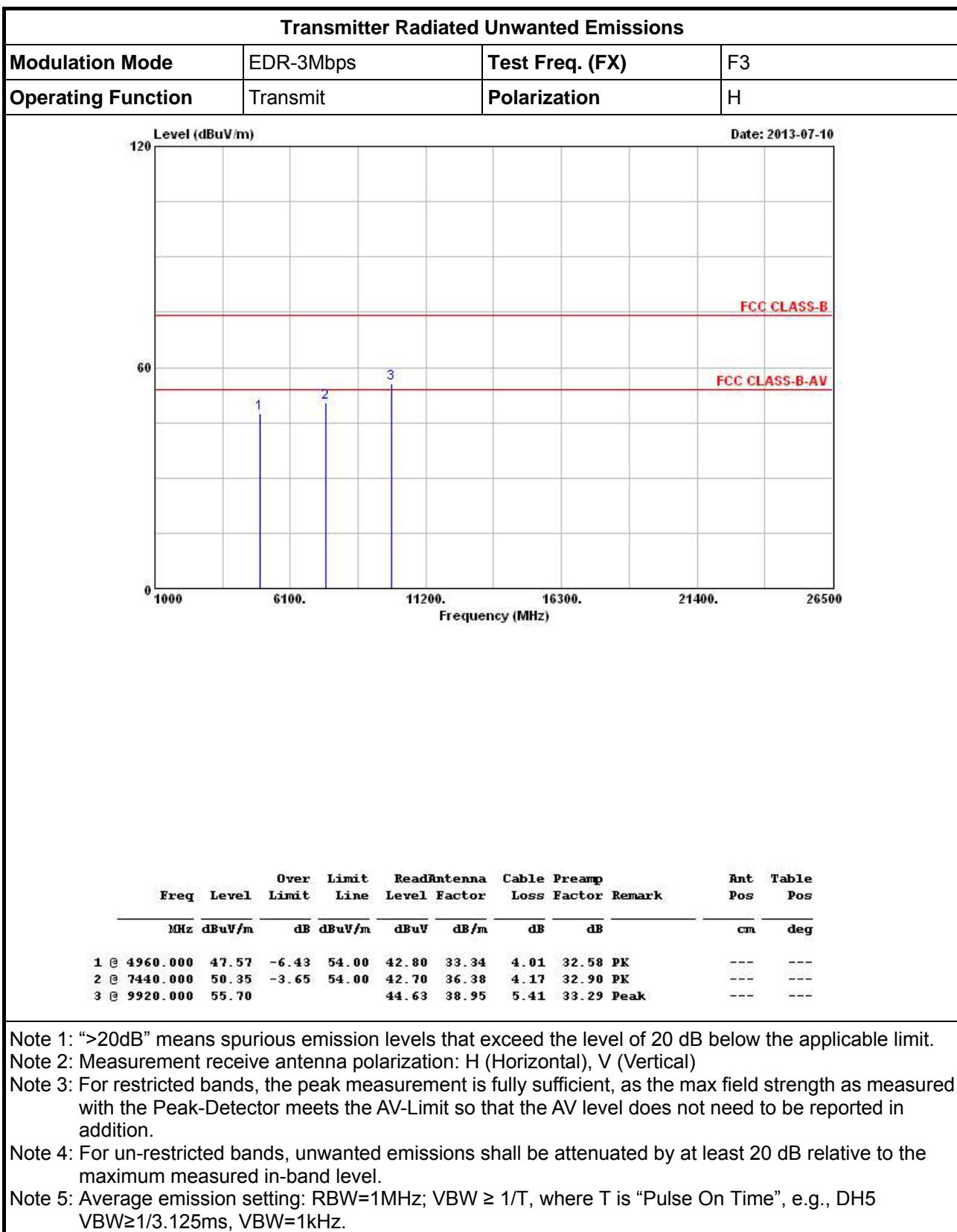
Note 4: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Note 5: Average emission setting: $\text{RBW}=1\text{MHz}$; $\text{VBW} \geq 1/T$, where T is “Pulse On Time”, e.g., DH5 $\text{VBW} \geq 1/3.125\text{ms}$, $\text{VBW}=1\text{kHz}$.



Transmitter Radiated Unwanted Emissions







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	FSV 40	101013	9KHz~40GHz	Jan. 29, 2013	Conducted (TH06-HY)
Temp. and Humidity Chamber	Giant Force	GTH-225-20-S	MAB0103-001	-20 ~ 100°C	Nov. 21, 2012	Conducted (TH06-HY)
Signal Generator	R&S	SMR40	100116	10MHz ~ 40GHz	Jun. 27, 2013	Conducted (TH06-HY)
Power Sensor	Anritsu	MA2411B	1027452	300MHz ~ 40GHz	Sep. 08, 2012	Conducted (TH06-HY)
Power Meter	Anritsu	ML2495A	1124009	300MHz ~ 40GHz	Sep. 08, 2012	Conducted (TH06-HY)
RF Cable-2m	HUBER+SUHNER	SUCOFLEX_104	SN 345673/4	1GHz ~ 26.5GHz	NA	Conducted (TH06-HY)
RF Cable-3m	HUBER+SUHNER	SUCOFLEX_104	SN 345668/4	1GHz ~ 26.5GHz	NA	Conducted (TH06-HY)

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	Dec. 01, 2012	Radiation (03CH03-HY)
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	May. 03, 2013	Radiation (03CH03-HY)
Amplifier	Agilent	8449B	3008A02120	1GHz ~ 26.5GHz	Aug. 16, 2012	Radiation (03CH03-HY)
Spectrum Analyzer	R&S	FSP30	100793	9kHz ~ 30GHz	Sep. 26, 2012	Radiation (03CH03-HY)
Receiver	R&S	ESU26	1302.6005.26	20Hz ~ 26.5GHz	Apr. 02, 2013	Radiation (03CH03-HY)
Bilog Antenna	SCHAFFNER	CBL 6112D	22237	30MHz ~ 1GHz	Sep. 22, 2012	Radiation (03CH03-HY)
Horn Antenna	EMCO	3115	6741	1GHz ~ 18GHz	May. 31, 2013	Radiation (03CH03-HY)
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz ~ 40GHz	Jan. 08, 2013	Radiation (03CH03-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz ~ 1GHz	Jan. 17, 2013	Radiation (03CH03-HY)
RF Cable-high	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz ~ 40GHz	Jan. 17, 2013	Radiation (03CH03-HY)
Turn Table	EM Electronics	EM Electronics	060615	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
Antenna Mast	MF	MF-7802	MF780208179	1 ~ 4 m	N/A	Radiation (03CH03-HY)

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

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Magnetic Loop Antenna	Teseq GmbH	HLA 6120	31244	0.01MHz ~ 30MHz	Dec. 02, 2012	Radiation (03CH03-HY)

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