



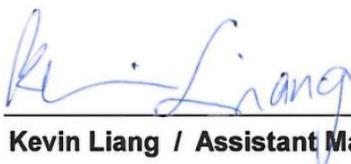
# FCC Test Report

**Equipment** : Wi-Fi enabled Video Doorbell  
**Brand Name** : RING  
**Model No.** : Video Doorbell Pro  
**FCC ID** : 2AEUPBHALP011  
**Standard** : 47 CFR FCC Part 15.247  
**Operating Band** : 2400 MHz – 2483.5 MHz  
**FCC Classification** : DSS  
**Applicant** : Bot Home Automation, Inc.  
1523 26th St, Santa Monica, CA 90404, USA  
**Manufacturer** : Chicony Electronics (Dong Guan ) Co.,Ltd.  
San Zhong Guan Li Qu, Qingxi Town, Dongguan  
City Guangdong 523651 China

The product sample received on Dec. 09, 2015 and completely tested on Jan. 08, 2016. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 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:

  
Kevin Liang / Assistant Manager



Testing Laboratory  
1190



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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
1.1.3	15.203	Antenna Requirement	Antenna connector mechanism complied	FCC 15.203	Complied
3.1	15.207	AC Power-line Conducted Emissions	[dBuV]: 2.284MHz 22.29 (Margin 33.71dB) - QP 21.69 (Margin 24.31dB) - AV	FCC 15.207	Complied
3.2	15.247(a)	20dB Bandwidth	EDR: 1.3155MHz	N/A	Complied
3.2	15.247(a)	Carrier Frequency Separation (ChS)	EDR: 1.0029MHz	ChS $\geq$ BW <sub>20dB</sub> 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: 0.315sec	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: 8.69 EDR: 7.41	Power [dBm] BR:21 EDR:21	Complied
3.6	15.247(d)	Transmitter Radiated Bandedge Emissions	Restricted Bands [dBuV/m at 3m]: 2383.52MHz 57.48 (Margin 16.52dB) - PK 45.51 (Margin 8.49dB) - AV	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied
3.7	15.247(d)	Transmitter Radiated Unwanted Emissions	Restricted Bands [dBuV/m at 3m]:458.74MHz 38.78 (Margin 7.22dB) - PK	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied



## Revision History



## 1 General Description

### 1.1 Information

#### 1.1.1 Product Details

The equipment is Ring Video Doorbell Wired. There are two sample of EUT. The only difference is the appearance. For more detailed features description, please refer to the specifications or user's manual.

#### 1.1.2 RF General Information

RF General Information				
Frequency Range (MHz)	Bluetooth Mode	Ch. Frequency (MHz)	Channel Number	RF Output Power (dBm)
2400-2483.5	BR / EDR	2402-2480	0-78 [79]	8.69

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.

#### 1.1.3 Antenna Information

Antenna Category	
<input checked="" type="checkbox"/>	Integral antenna (antenna permanently attached)
<input type="checkbox"/>	<input type="checkbox"/> Temporary RF connector provided
<input type="checkbox"/>	<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.
<input type="checkbox"/>	<input type="checkbox"/> External antenna (dedicated antennas)
<input type="checkbox"/>	<input type="checkbox"/> Single power level with corresponding antenna(s).
<input type="checkbox"/>	<input type="checkbox"/> Multiple power level and corresponding antenna(s).

Antenna General Information		
Ant. Cat.	Ant. Type	Gain (dBi)
Integral	PIFA	2.29



### 1.1.4 Type of EUT

Identify EUT	
EUT Serial Number	N/A
Presentation of Equipment	<input checked="" type="checkbox"/> Production ; <input 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:	

### 1.1.5 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"/> 78.38% - test mode single channel-DH5	1.06
<input checked="" type="checkbox"/> 78.76% - test mode single channel-DH5	1.04
<input checked="" type="checkbox"/> 78.76% - test mode single channel-DH5	1.04
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.	

### 1.1.6 EUT Operational Condition

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



## 1.2 Accessories and Support Equipment

Accessories Information				
Li-ion Battery	Brand Name	Fuji	Model Name	334038
	Power Rating	3.7 Vdc, 240 mAh		

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

Support Equipment - RF Conducted				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E5540	R33002 / DOC
2	Adapter for NB	DELL	HA65NM130	R35737 / DOC

Support Equipment - AC Conduction and Radiated Emission				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Transformer	TRIAD	VPL16-1600	DoC
2	Test Fixture	-	-	-

## 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 C63.10-2013
- FCC Public Notice DA 00-705

## 1.4 Testing Location Information

Testing Location				
<input checked="" type="checkbox"/>	HWA YA	ADD	: No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan City, Taiwan, R.O.C.	
Test Site Registration Number: 636805				
Test Condition	Test Site No.	Test Engineer	Test Environment	
AC Conduction	CO04-HY	Anthony	24°C / 57%	
RF Conducted	TH01-HY	Howard	22.5°C / 65%	
Radiated Emission	03CH09-HY	Terry	24.2°C / 57%	



## 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	
AC power-line conducted emissions	±2.3 dB	
Emission bandwidth, 6dB bandwidth	±0.6 %	
RF output power, conducted	±0.1 dB	
Power density, conducted	±0.6 dB	
Unwanted emissions, conducted	9 – 150 kHz	±0.4 dB
	0.15 – 30 MHz	±0.4 dB
	30 – 1000 MHz	±0.6 dB
	1 – 18 GHz	±0.5 dB
	18 – 40 GHz	±0.5 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	±5 %	
DC and low frequency voltages	±0.9%	
Time	±1.4 %	
Duty Cycle	±0.6 %	



## 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	8.69	BR-1Mbps
EDR	1	2 Mbps	EDR-2Mbps	7.20	
EDR	1	3 Mbps	EDR-3Mbps	7.41	

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 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter			
Test Software	PuTTY		
Modulation Mode	2402 MHz	2441 MHz	2480 MHz
BR,1Mbps	Default	Default	Default
EDR,2Mbps	Default	Default	Default
EDR,3Mbps	Default	Default	Default



## 2.3 The Worst Case Measurement Configuration

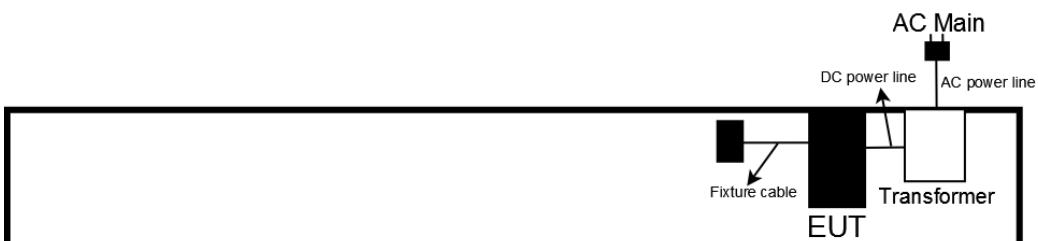
The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
Operating Mode	Operating Mode Description
1	Transmit Mode

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

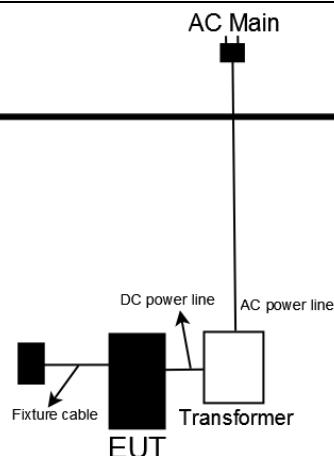
The Worst Case Mode for Following Conformance Tests			
Tests Item	Transmitter Radiated Bandedge Emissions Transmitter Radiated Unwanted Emissions		
Test Condition	Radiated measurement		
User Position	<input type="checkbox"/> EUT will be placed in fixed position. <input checked="" type="checkbox"/> EUT will be placed in mobile position and operating multiple positions. <input type="checkbox"/> EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions.		
Operating Mode	Operating Mode Description		
1	Transmit Mode		
Modulation Mode	Transmitter Radiated Bandedge Emissions: BR-1Mbps、EDR-2Mbps、EDR-3Mbps Transmitter Radiated Unwanted Emissions: For test mode BR-1Mbps, EDR-2Mbps and EDR-3Mbps of the transmitter were assess for pretest. The worst case was BR-1Mbps and recorded in this test report.		
Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane
Worst Planes of EUT	V		

## 2.4 Test Setup Diagram

**Test Setup Diagram – AC Line Conducted Emission Test**



**Test Setup Diagram - Radiated Test**



### 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.

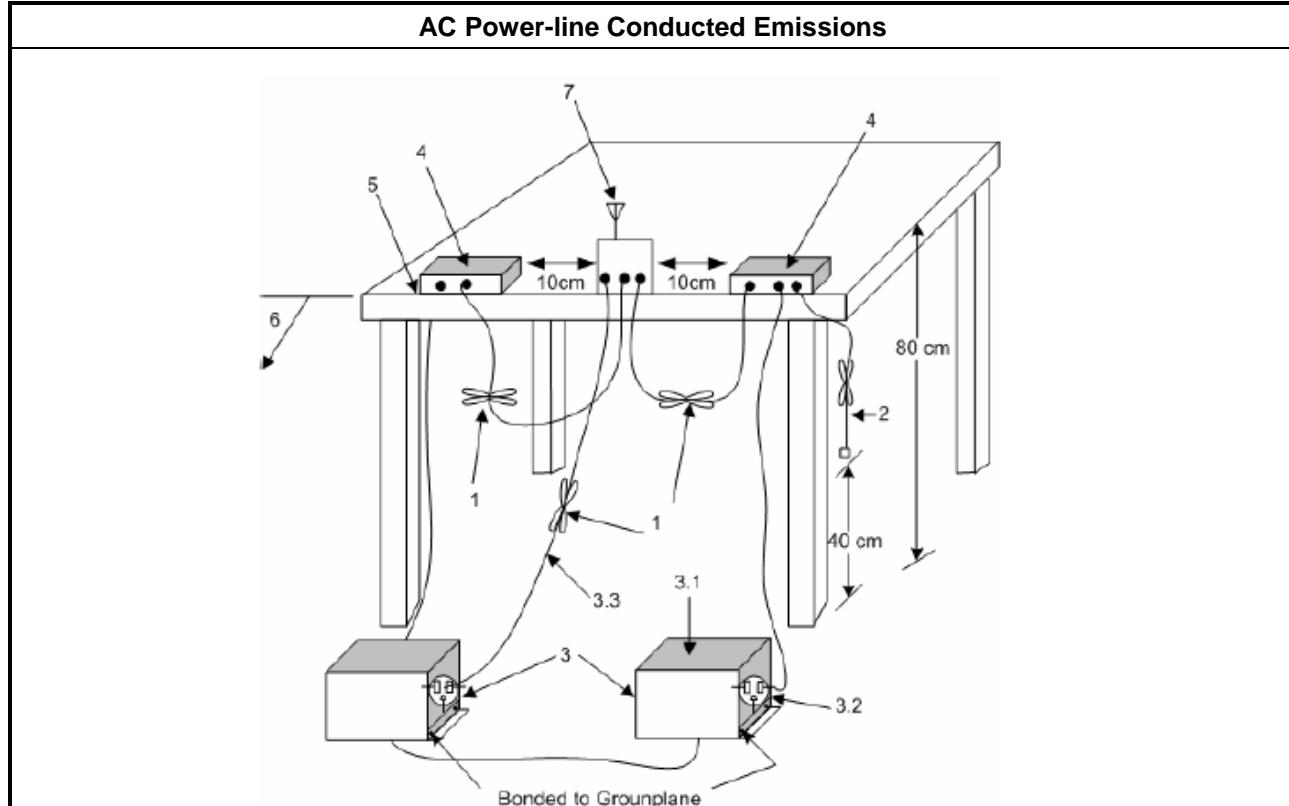
##### 3.1.2 Measuring Instruments

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

##### 3.1.3 Test Procedures

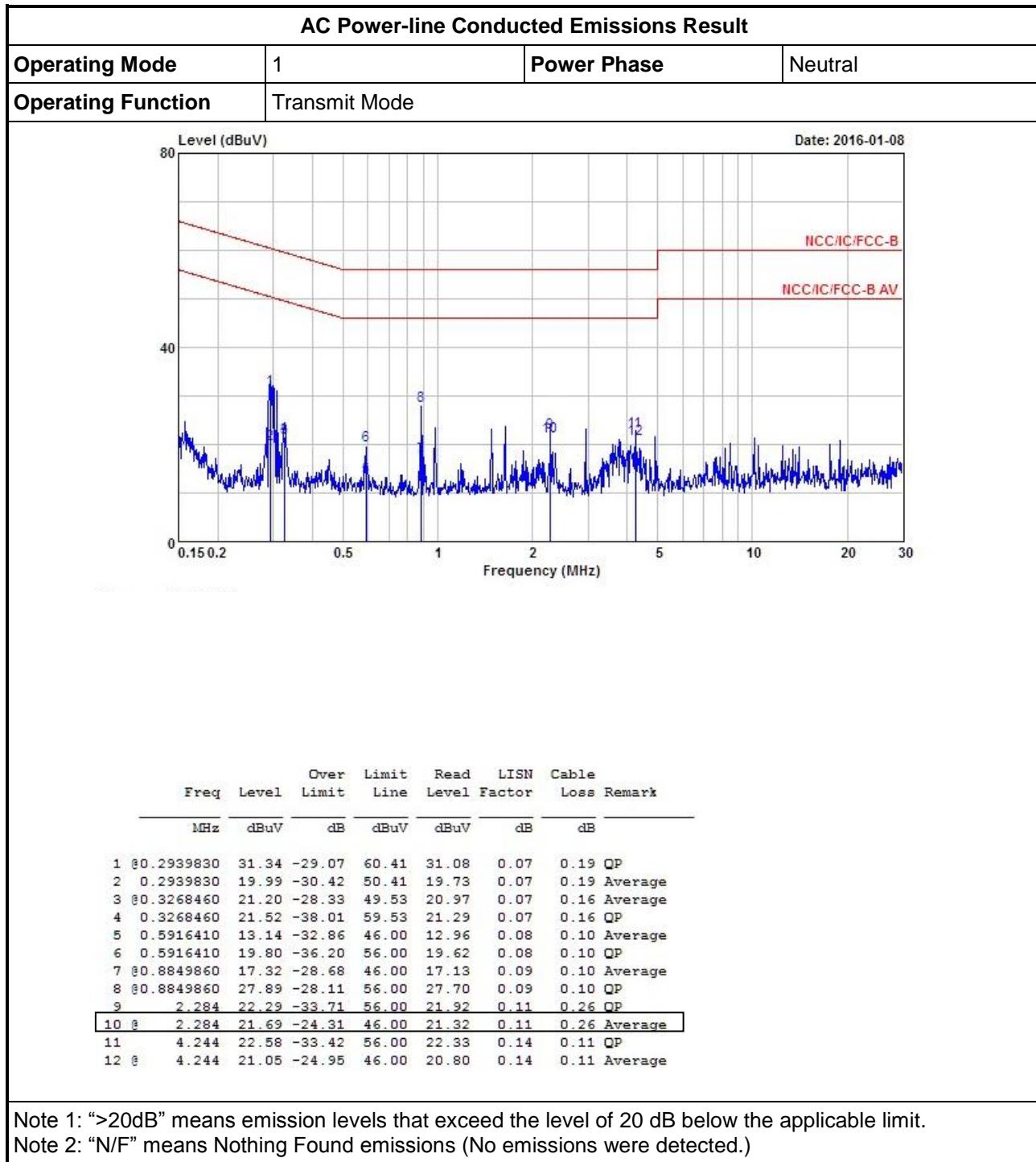
Test Method
<input checked="" type="checkbox"/> Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.

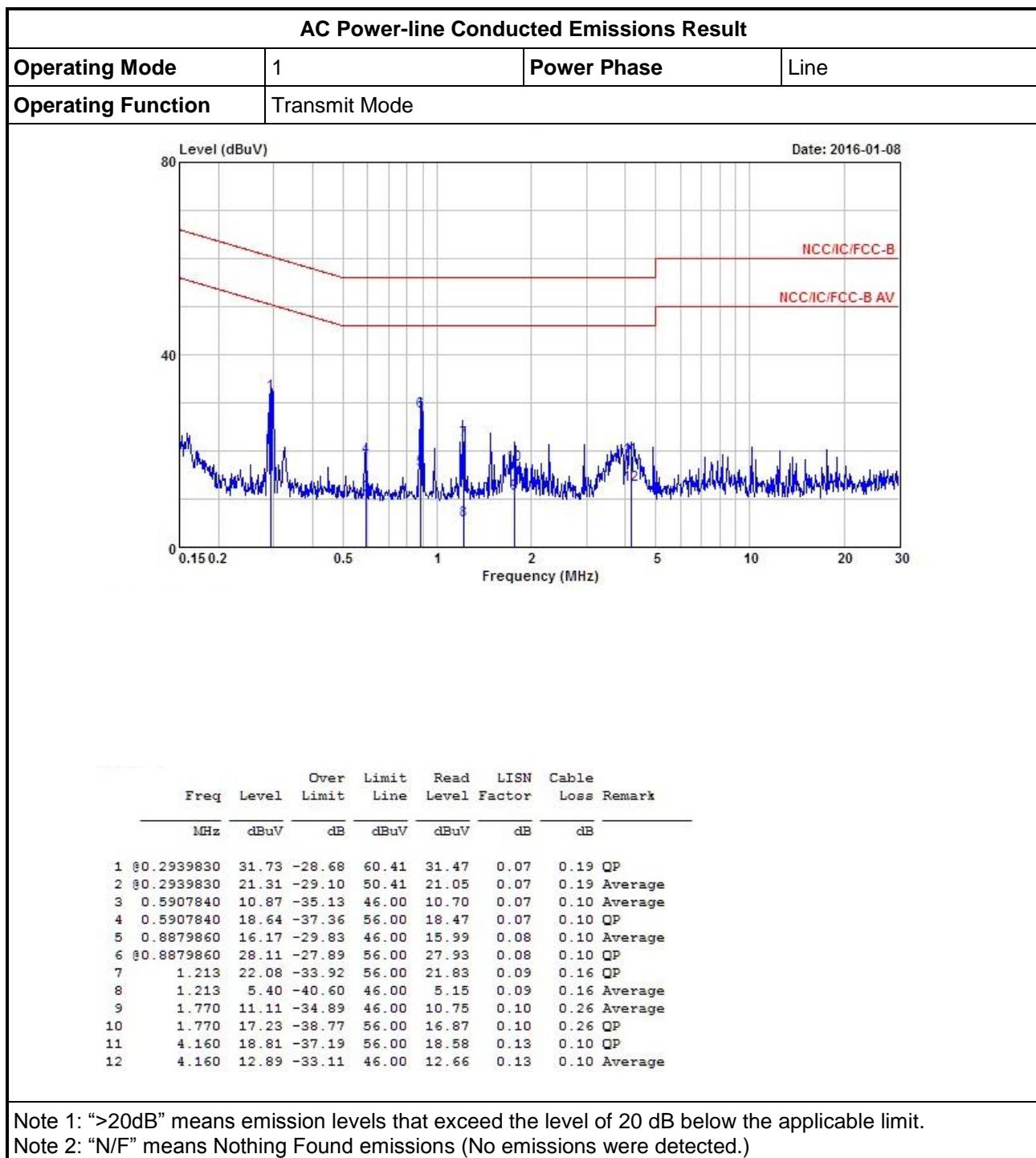
##### 3.1.4 Test Setup





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





## 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"/>	$N \geq 75$ and $ChS \geq MAX$ (20 dB bandwidth, 25 kHz).
<input checked="" type="checkbox"/>	$N \geq 15$ and $ChS \geq MAX$ (20 dB bandwidth $\times 2/3$ , 25 kHz).

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

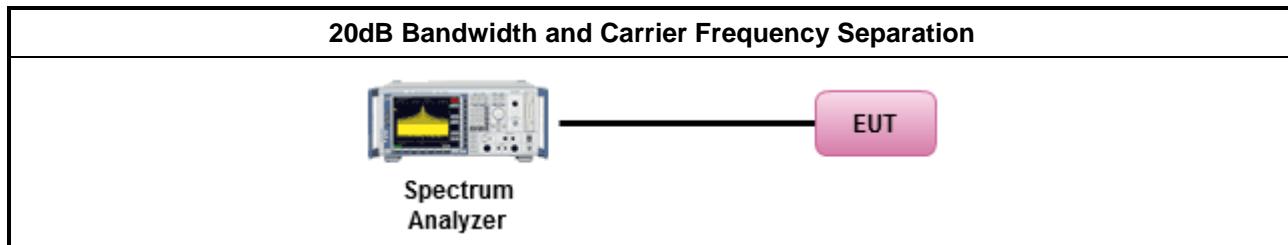
### 3.2.2 Measuring Instruments

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

### 3.2.3 Test Procedures

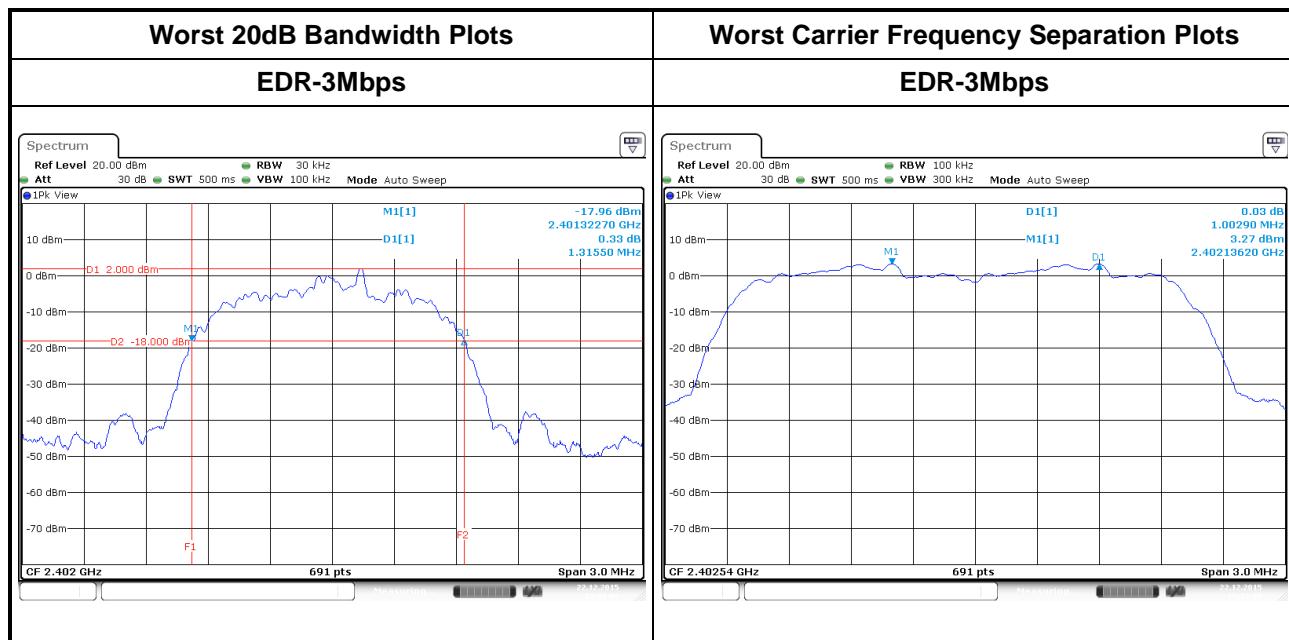
Test Method
<input checked="" type="checkbox"/> Refer as FCC Public Notice DA 00-705, clause 6.9.2 for 20 dB bandwidth measurement.
<input checked="" type="checkbox"/> Refer as FCC Public Notice DA 00-705, clause 7.8.2 for carrier frequency separation measurement.
<input checked="" type="checkbox"/> 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	0.9378	0.8813	0.9986	0.9378
BR-1Mbps	2441	0.9378	0.8813	0.9986	0.9378
BR-1Mbps	2480	0.9334	0.8813	0.9986	0.9334
EDR-3Mbps	2402	1.3155	1.2026	1.0029	1.3155
EDR-3Mbps	2441	1.3155	1.2026	0.9986	1.3155
EDR-3Mbps	2480	1.3155	1.2026	0.9986	1.3155
<b>Result</b>			<b>Complied</b>		



### 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

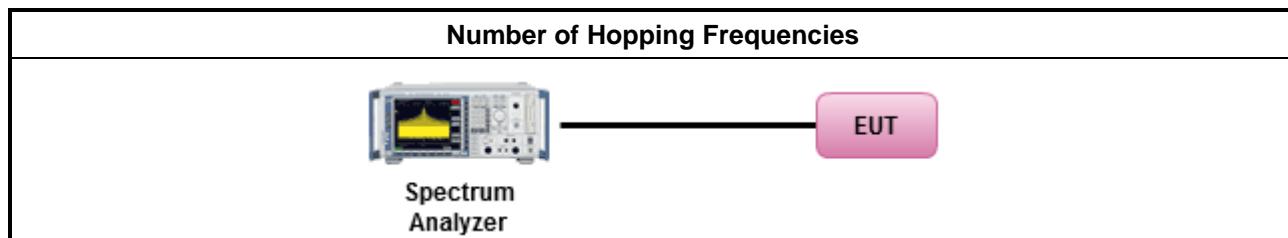
#### 3.3.2 Measuring Instruments

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 FCC Public Notice DA 00-705, clause 7.8.3 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.

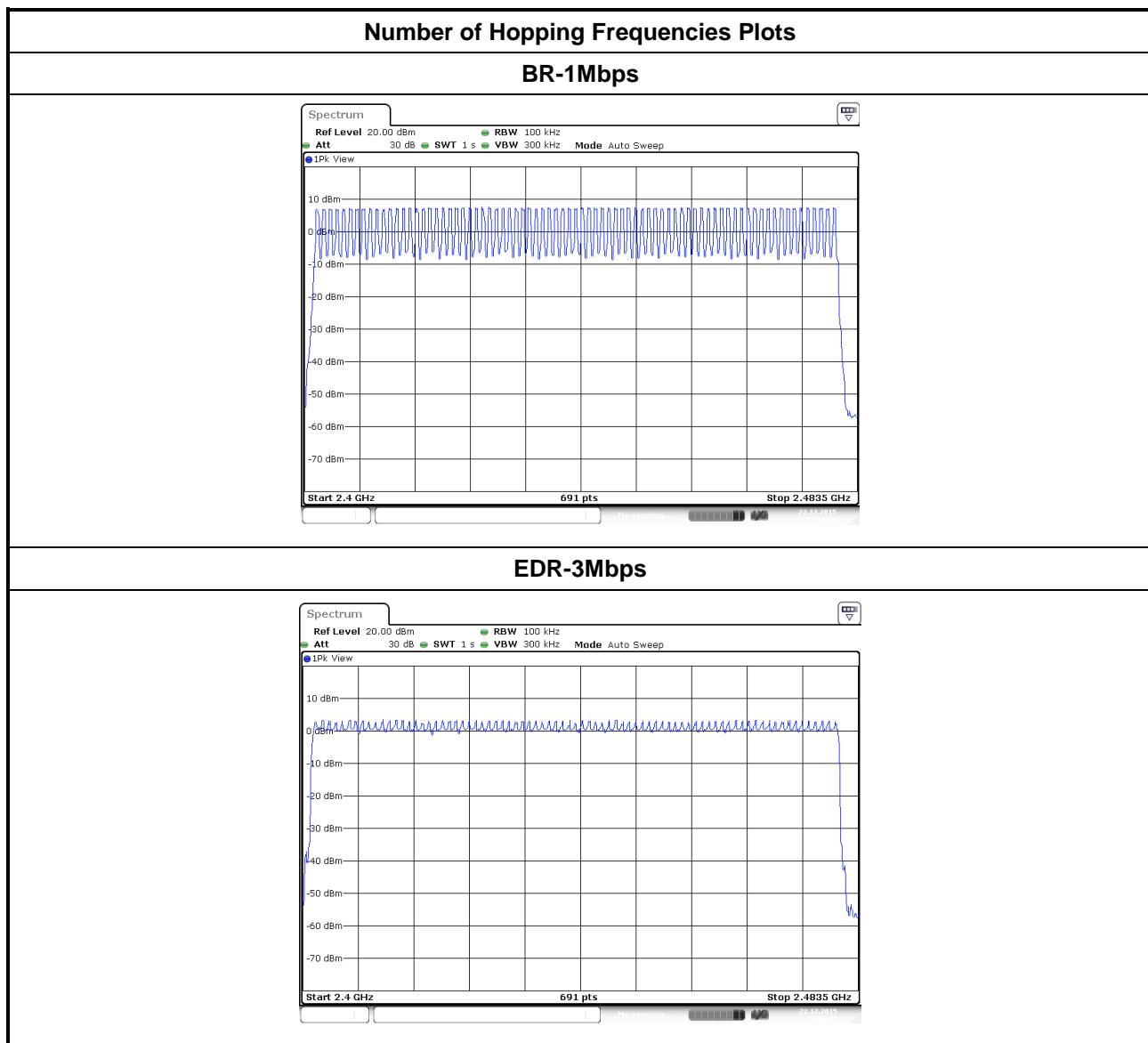
#### 3.3.4 Test Setup





### 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
EDR-3Mbps	2402-2480	79	15
<b>Result</b>	<b>Complied</b>		



### 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 $0.4 \times N$
<b>N:</b> Number of Hopping Frequencies

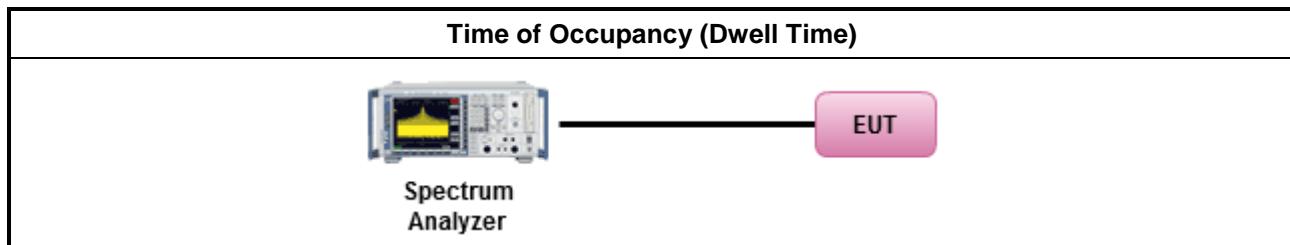
#### 3.4.2 Measuring Instruments

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 FCC Public Notice DA 00-705, clause 7.8.4 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

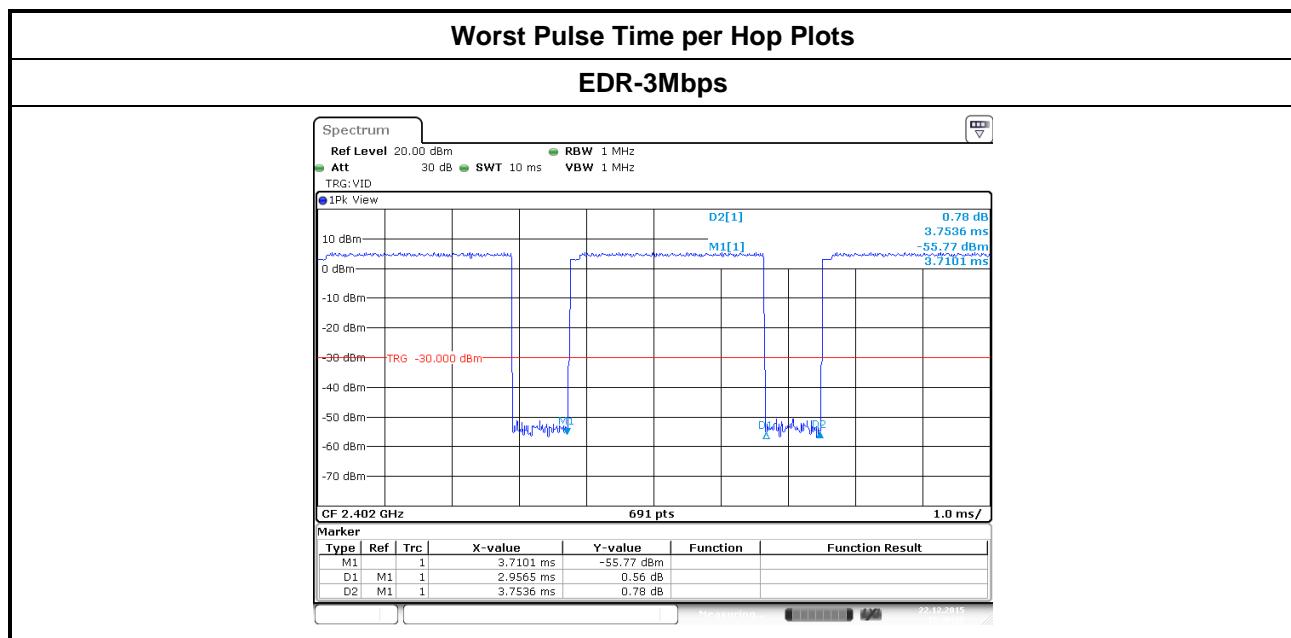




### 3.4.5 Test Result of Time of Occupancy (Dwell Time)

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	2.94	106.7	0.314	0.4
EDR-3Mbps	2402	2.96	106.7	0.315	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		
<b>Maximum Peak Conducted Output Power Limit</b>		
<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 $P_{Out} = 21 - (G_{TX} - 6) \text{ dBm}$		
<b>e.i.r.p. Power Limit:</b>		
<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

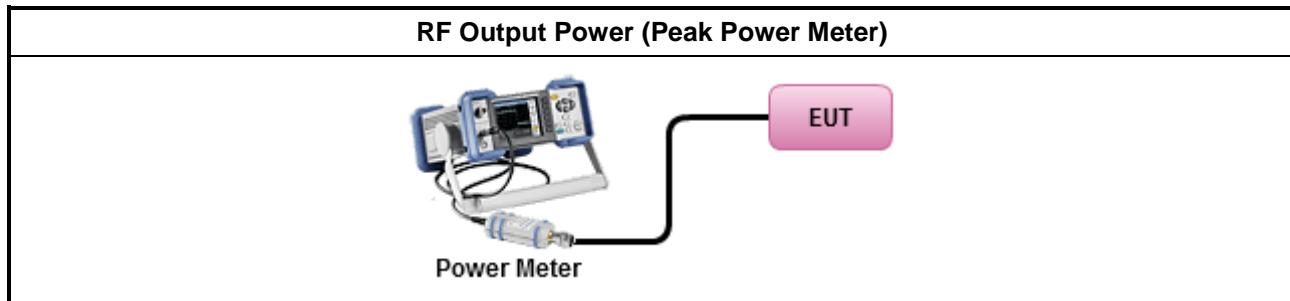
Refer a test equipment and calibration data table in this test report.

#### 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 11.9.1.3) for peak power meter.	
<input type="checkbox"/> Refer as ANSI C63.10, clause 11.9.1.1) 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

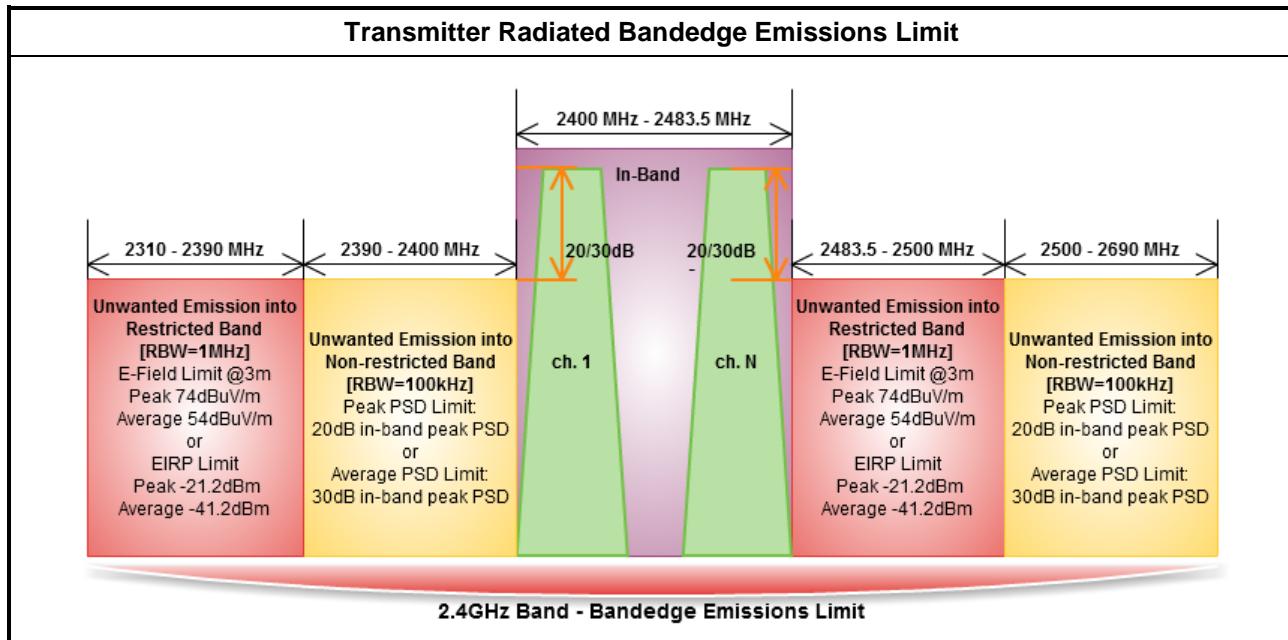
Maximum Peak Conducted Output Power Result						
Condition		RF Output Power (dBm)				
Modulation Mode	Freq. (MHz)	RF Output Power	Power Limit	Antenna Gain (dBi)	EIRP Power	EIRP Limit
BR-1Mbps	2402	8.32	21	2.29	10.61	27
BR-1Mbps	2441	8.69	21	2.29	10.98	27
BR-1Mbps	2480	8.62	21	2.29	10.91	27
EDR-3Mbps	2402	7.30	21	2.29	9.59	27
EDR-3Mbps	2441	7.41	21	2.29	9.7	27
EDR-3Mbps	2480	7.35	21	2.29	9.64	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	7.02	1.06	8.08	2.29	10.37
BR-1Mbps	2441	7.41	1.06	8.47	2.29	10.76
BR-1Mbps	2480	7.33	1.06	8.39	2.29	10.68
EDR-3Mbps	2402	3.63	1.04	4.67	2.29	6.96
EDR-3Mbps	2441	3.69	1.04	4.73	2.29	7.02
EDR-3Mbps	2480	3.61	1.04	4.65	2.29	6.94
Result		Complied				

## 3.6 Transmitter Radiated Bandedge Emissions

### 3.6.1 Transmitter Radiated Bandedge Emissions Limit



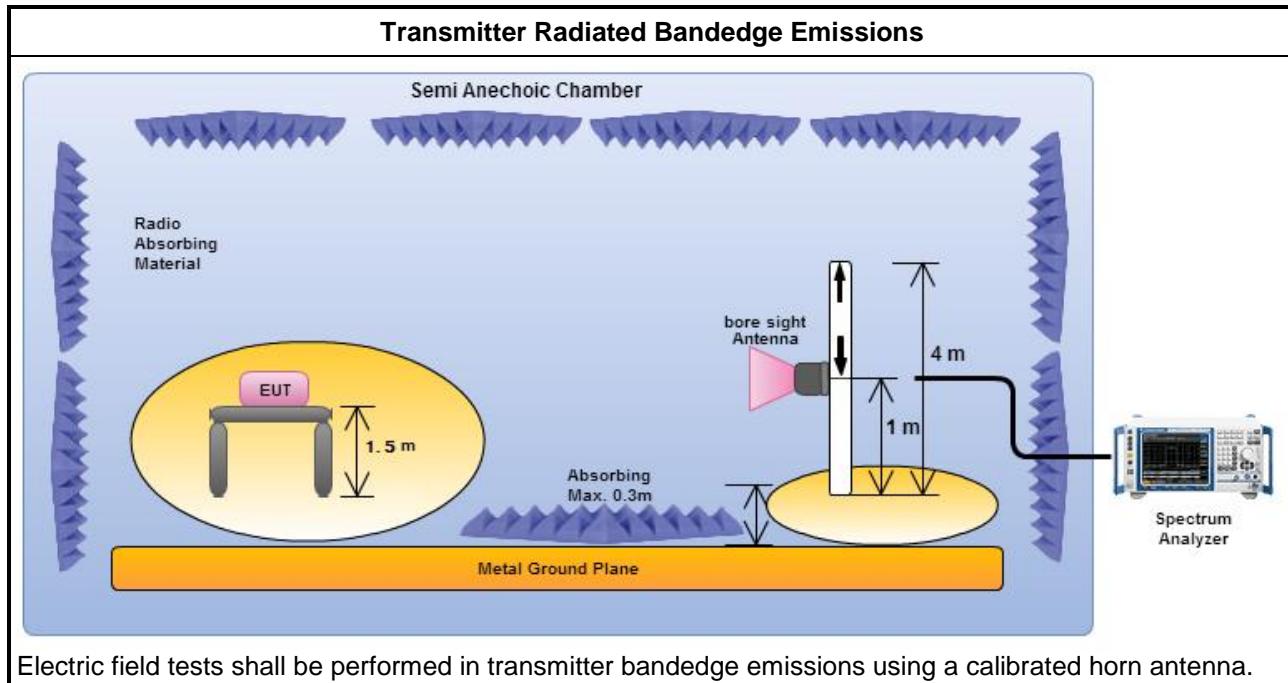
### 3.6.2 Measuring Instruments

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

### 3.6.3 Test Procedures

<b>Test Method – General Information</b>	
<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 6.10 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 4.1.4.2.3 (Reduced VBW). $VBW \geq 1/T$ , where T is pulse time.	
<input type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.	
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.2 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 6.10 for band-edge testing.	
<input type="checkbox"/> Refer as ANSI C63.10, clause 6.10.6.2 for marker-delta method for band-edge measurements.	
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 7.8.6 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



### 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	104.46	2399.96	46.67	57.79	20	H
BR -1Mbps	2480	106.23	2485.44	45.98	60.25	20	H
EDR-2Mbps	2402	101.53	2399.96	46.70	54.83	20	H
EDR-2Mbps	2480	101.64	2540.16	46.01	55.63	20	H
EDR-3Mbps	2402	101.36	2357.12	46.36	58	20	H
EDR-3Mbps	2480	101.34	2497.76	45.96	55.38	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	2379.97	56.54	74	2389.97	44.44	54	H
BR -1Mbps	2480	3	2484.00	57.48	74	2483.52	45.51	54	H
EDR-2Mbps	2402	3	2357.74	56.90	74	2389.15	44.43	54	H
EDR-2Mbps	2480	3	2485.44	57.39	74	2483.84	45.23	54	H
EDR-3Mbps	2402	3	2382.42	56.82	74	2389.56	44.40	54	H
EDR-3Mbps	2480	3	2493.92	57.60	74	2483.52	45.19	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 $\geq 1/3.125\text{ms}$ , 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.

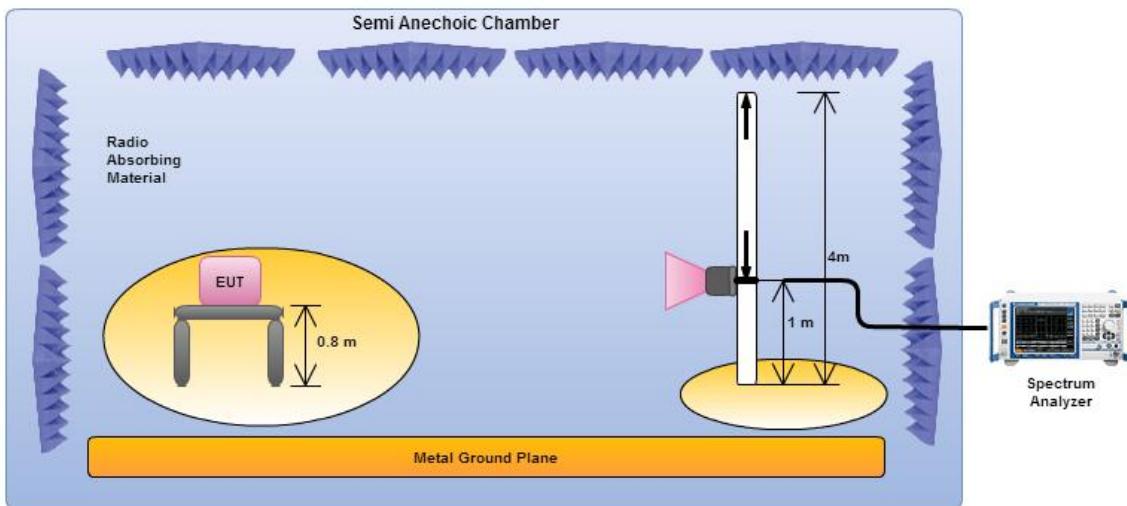


### 3.7.3 Test Procedures

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 4.1.4.2.3 (Reduced VBW). $\text{VBW} \geq 1/T$ , where T is pulse time.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.2 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.

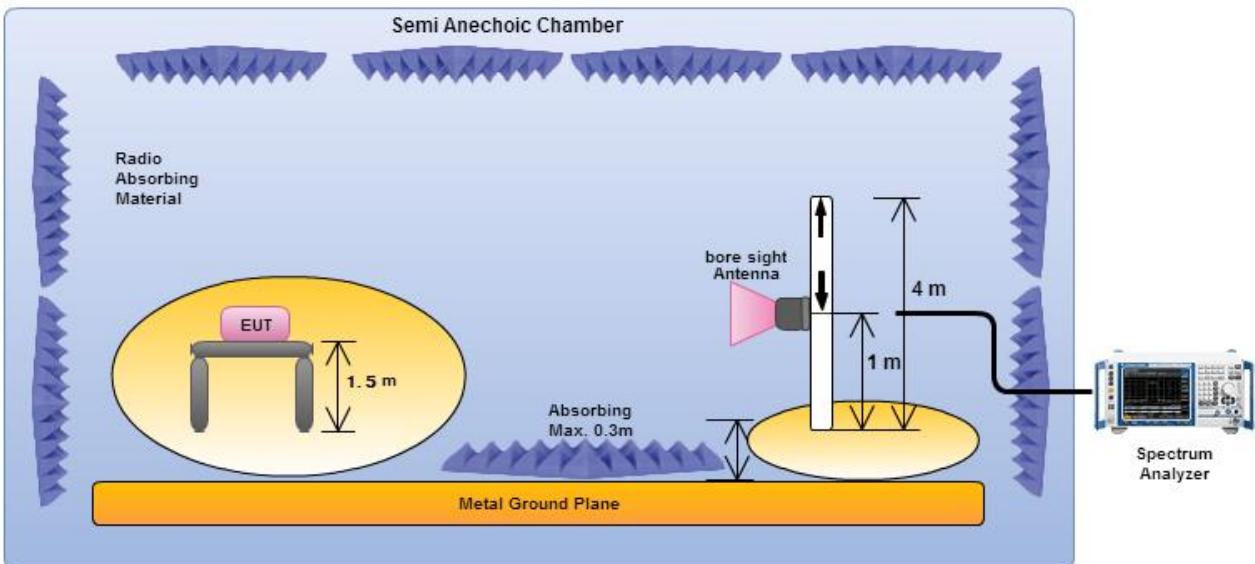
### 3.7.4 Test Setup

#### 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)



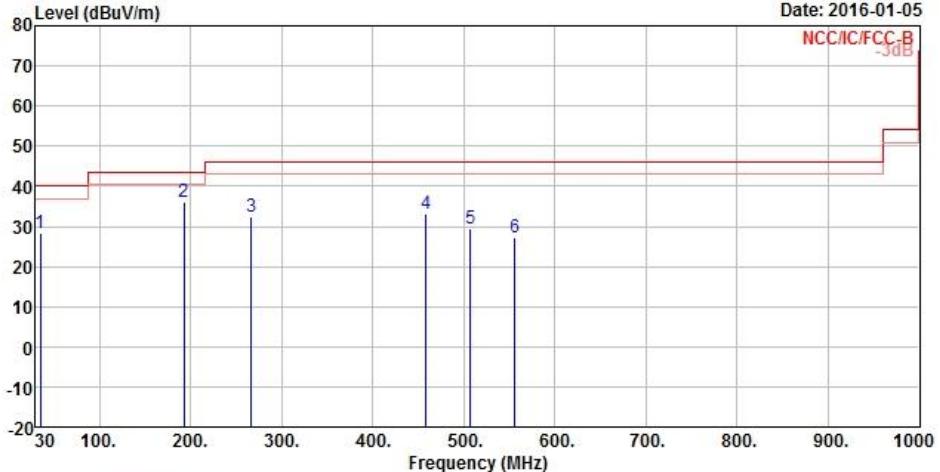
Electric field tests shall be performed in the frequency range of 1 GHz to 10th harmonic of highest fundamental frequency or 40 GHz using a calibrated horn antenna.

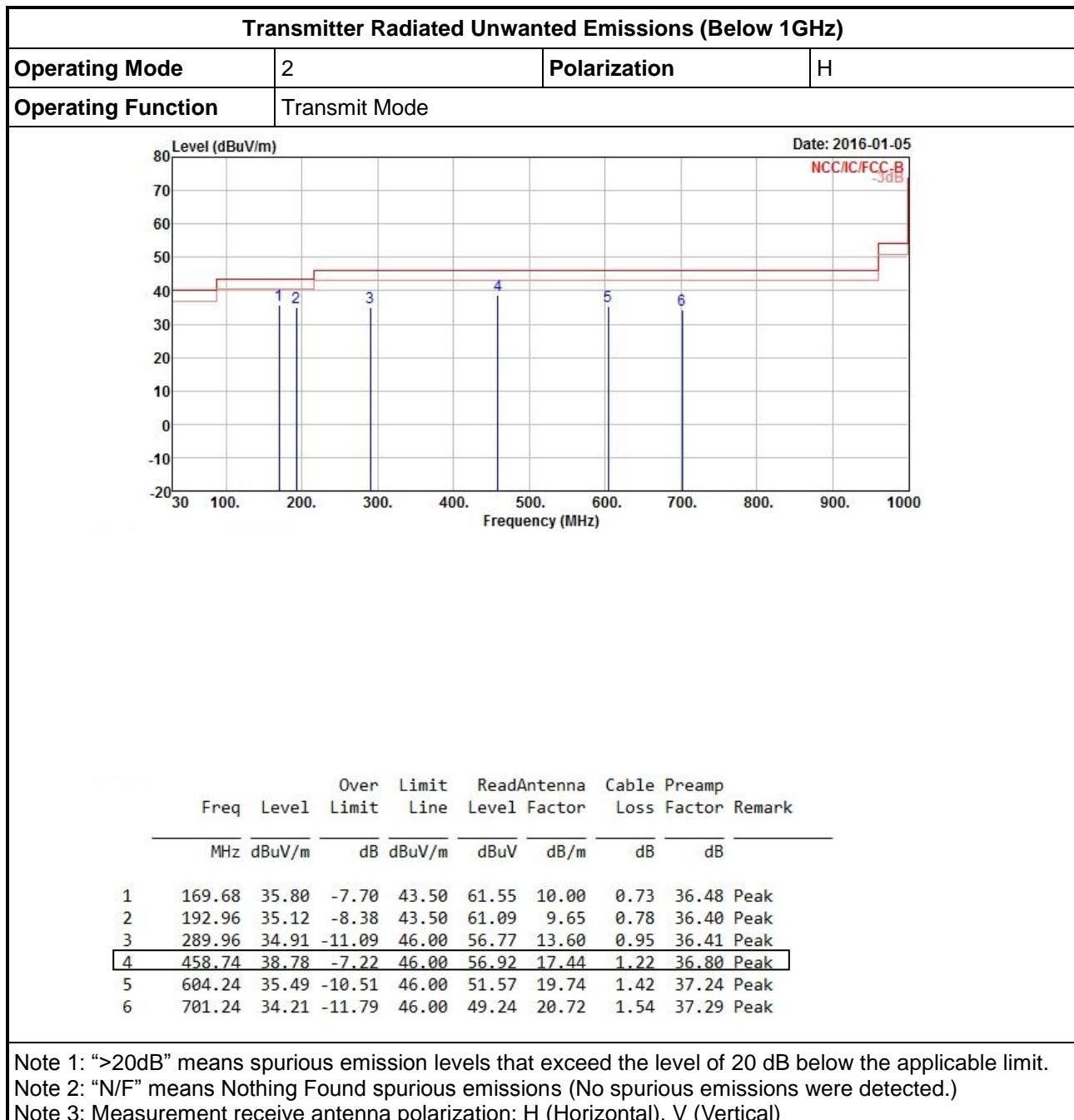
### 3.7.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

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)

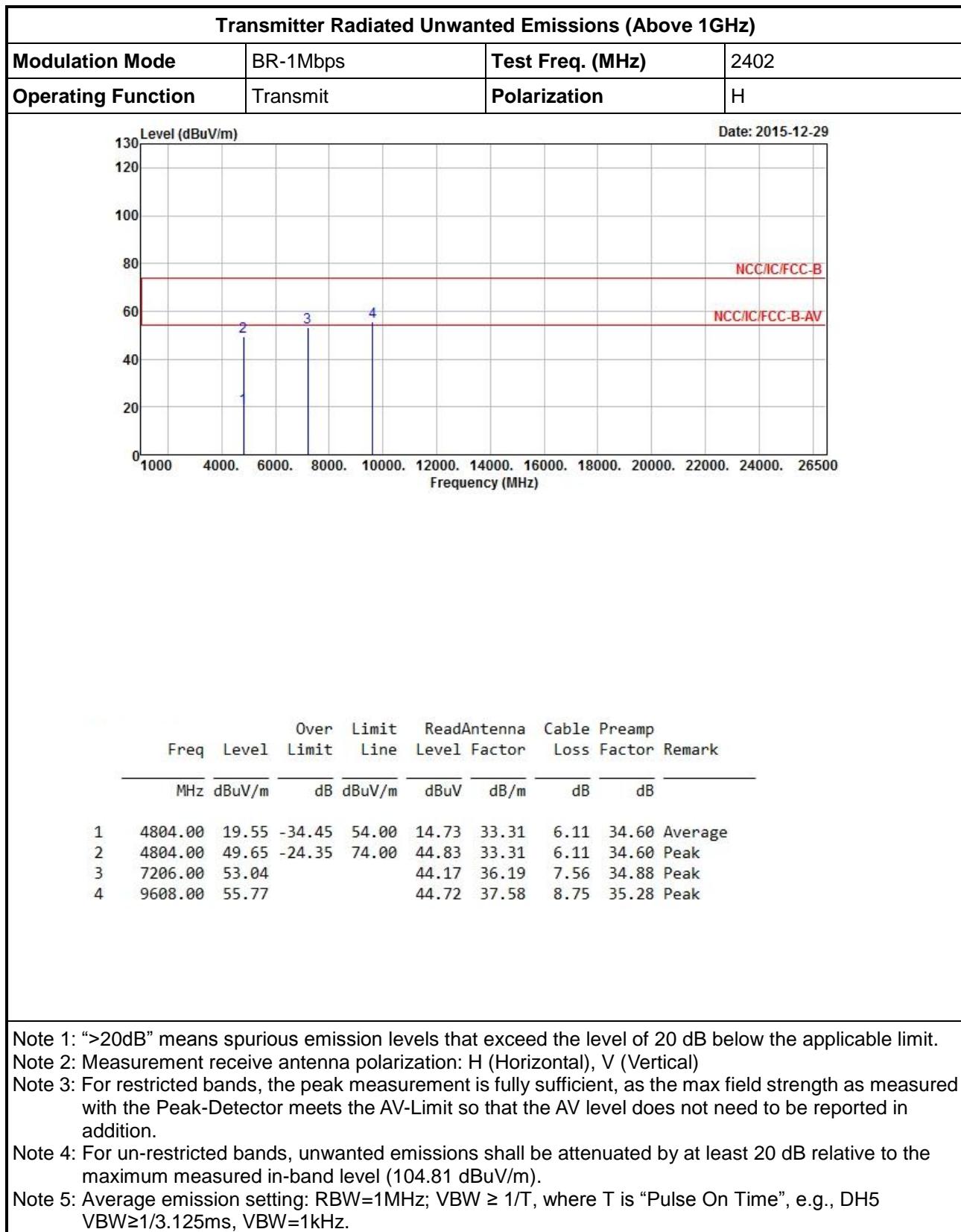
Transmitter Radiated Unwanted Emissions (Below 1GHz)											
Operating Mode	1			Polarization	V						
Operating Function	Transmit Mode										
Level (dBuV/m)									Date: 2016-01-05		
											
Over Limit											
Freq	Level	Over Limit	Line	Read	Antenna	Cable	Preamp	Remark			
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB				
1	34.85	28.29	-11.71	40.00	48.22	17.00	0.35	37.28 Peak			
2	192.96	35.92	-7.58	43.50	61.89	9.65	0.78	36.40 Peak			
3	266.68	32.58	-13.42	46.00	54.49	13.58	0.91	36.40 Peak			
4	458.74	33.05	-12.95	46.00	51.19	17.44	1.22	36.80 Peak			
5	507.24	29.52	-16.48	46.00	47.00	18.20	1.30	36.98 Peak			
6	555.74	27.37	-18.63	46.00	44.23	18.90	1.36	37.12 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)											

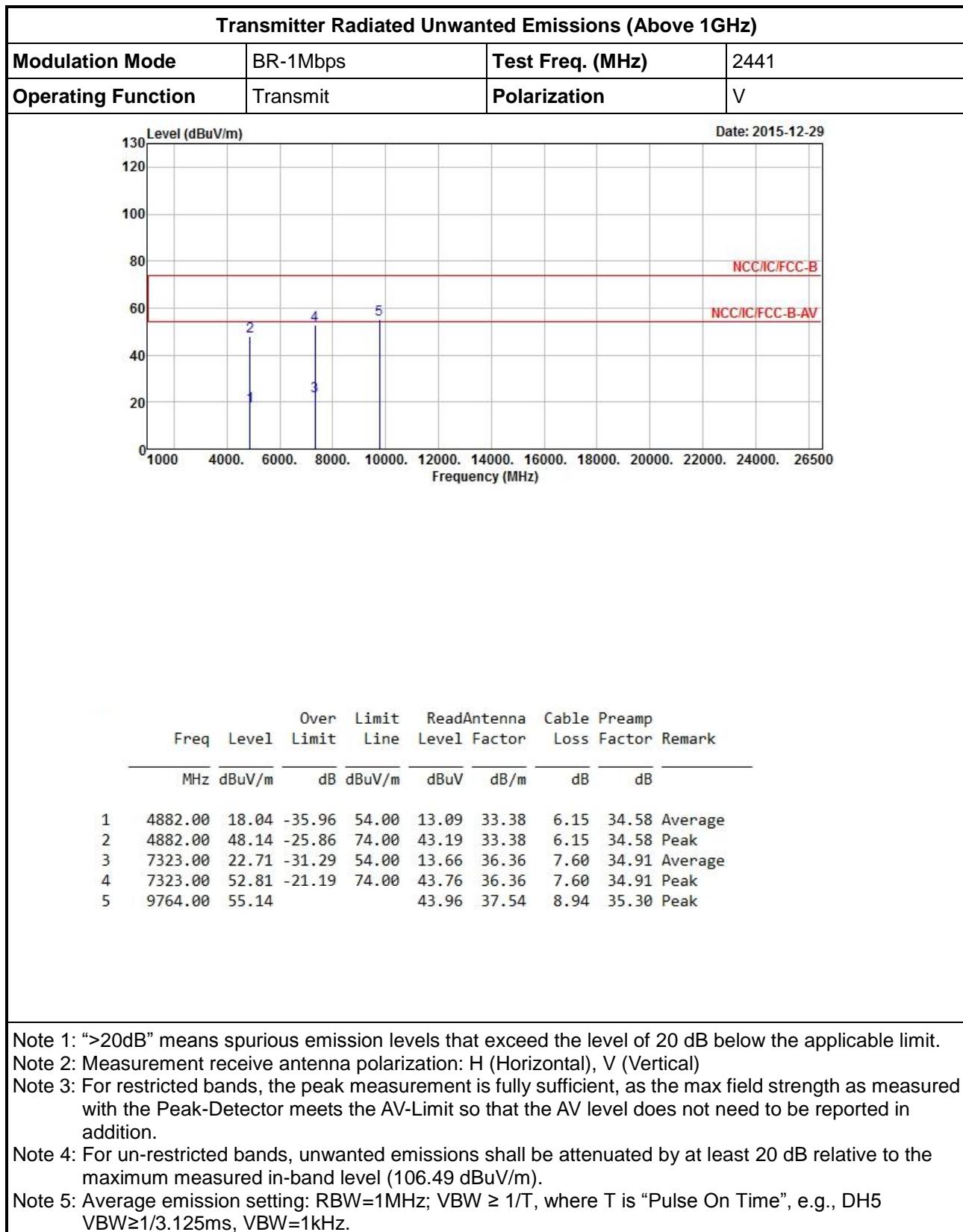


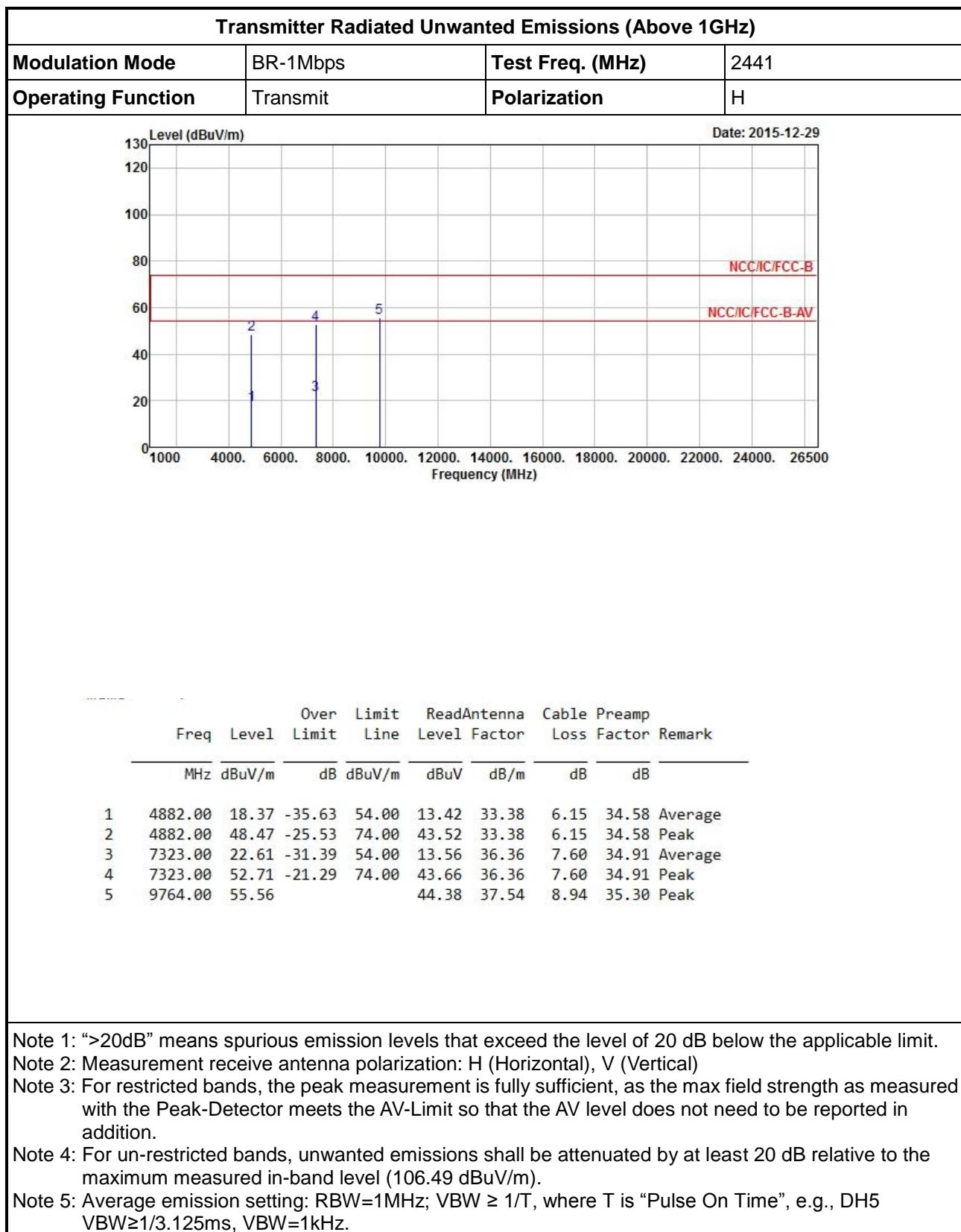


## 3.7.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Transmitter Radiated Unwanted Emissions (Above 1GHz)																																																																															
Modulation Mode		BR-1Mbps		Test Freq. (MHz)		2402																																																																									
Operating Function		Transmit		Polarization		V																																																																									
Level (dBuV/m)									Date: 2015-12-29																																																																						
<table><thead><tr><th></th><th>Freq</th><th>Over Limit</th><th>Limit</th><th>Read</th><th>Antenna</th><th>Cable</th><th>Preamp</th><th colspan="2"></th></tr><tr><th></th><th>Level</th><th>Limit</th><th>Line</th><th>Level</th><th>Factor</th><th>Loss</th><th>Factor</th><th colspan="2">Remark</th></tr><tr><th></th><th>MHz</th><th>dBuV/m</th><th>dB</th><th>dBuV/m</th><th>dBuV</th><th>dB/m</th><th>dB</th><th>dB</th><th></th></tr></thead><tbody><tr><td>1</td><td>4804.00</td><td>18.45</td><td>-35.55</td><td>54.00</td><td>13.63</td><td>33.31</td><td>6.11</td><td>34.60</td><td>Average</td></tr><tr><td>2</td><td>4804.00</td><td>48.55</td><td>-25.45</td><td>74.00</td><td>43.73</td><td>33.31</td><td>6.11</td><td>34.60</td><td>Peak</td></tr><tr><td>3</td><td>7206.00</td><td>51.84</td><td></td><td></td><td>42.97</td><td>36.19</td><td>7.56</td><td>34.88</td><td>Peak</td></tr><tr><td>4</td><td>9608.00</td><td>55.21</td><td></td><td></td><td>44.16</td><td>37.58</td><td>8.75</td><td>35.28</td><td>Peak</td></tr></tbody></table>											Freq	Over Limit	Limit	Read	Antenna	Cable	Preamp				Level	Limit	Line	Level	Factor	Loss	Factor	Remark			MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		1	4804.00	18.45	-35.55	54.00	13.63	33.31	6.11	34.60	Average	2	4804.00	48.55	-25.45	74.00	43.73	33.31	6.11	34.60	Peak	3	7206.00	51.84			42.97	36.19	7.56	34.88	Peak	4	9608.00	55.21			44.16	37.58	8.75	35.28	Peak
	Freq	Over Limit	Limit	Read	Antenna	Cable	Preamp																																																																								
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Note 4: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (104.81 dBuV/m).																																																																															
Note 5: 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.																																																																															









Transmitter Radiated Unwanted Emissions (Above 1GHz)																																																																															
Modulation Mode		BR-1Mbps		Test Freq. (MHz)		2480																																																																									
Operating Function		Transmit		Polarization		V																																																																									
Level (dBuV/m)									Date: 2015-12-29																																																																						
<table border="1"> <thead> <tr> <th>Freq</th> <th>Level</th> <th>Over Limit</th> <th>Limit</th> <th>Read</th> <th>Antenna</th> <th>Cable</th> <th>Preamplifier</th> <th colspan="2">Remark</th> </tr> <tr> <th>MHz</th> <th>dBuV/m</th> <th>dB</th> <th>dBuV/m</th> <th>dBuV</th> <th>dB/m</th> <th>dB</th> <th>dB</th> <th colspan="2"></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4960.00</td> <td>18.77</td> <td>-35.23</td> <td>54.00</td> <td>13.67</td> <td>33.47</td> <td>6.19</td> <td colspan="2">34.56 Average</td> </tr> <tr> <td>2</td> <td>4960.00</td> <td>48.87</td> <td>-25.13</td> <td>74.00</td> <td>43.77</td> <td>33.47</td> <td>6.19</td> <td colspan="2">34.56 Peak</td> </tr> <tr> <td>3</td> <td>7440.00</td> <td>22.96</td> <td>-31.04</td> <td>54.00</td> <td>13.74</td> <td>36.53</td> <td>7.64</td> <td colspan="2">34.95 Average</td> </tr> <tr> <td>4</td> <td>7440.00</td> <td>53.06</td> <td>-20.94</td> <td>74.00</td> <td>43.84</td> <td>36.53</td> <td>7.64</td> <td colspan="2">34.95 Peak</td> </tr> <tr> <td>5</td> <td>9920.00</td> <td>56.07</td> <td></td> <td></td> <td>44.74</td> <td>37.51</td> <td>9.13</td> <td colspan="2">35.31 Peak</td> </tr> </tbody> </table>										Freq	Level	Over Limit	Limit	Read	Antenna	Cable	Preamplifier	Remark		MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB			1	4960.00	18.77	-35.23	54.00	13.67	33.47	6.19	34.56 Average		2	4960.00	48.87	-25.13	74.00	43.77	33.47	6.19	34.56 Peak		3	7440.00	22.96	-31.04	54.00	13.74	36.53	7.64	34.95 Average		4	7440.00	53.06	-20.94	74.00	43.84	36.53	7.64	34.95 Peak		5	9920.00	56.07			44.74	37.51	9.13	35.31 Peak	
Freq	Level	Over Limit	Limit	Read	Antenna	Cable	Preamplifier	Remark																																																																							
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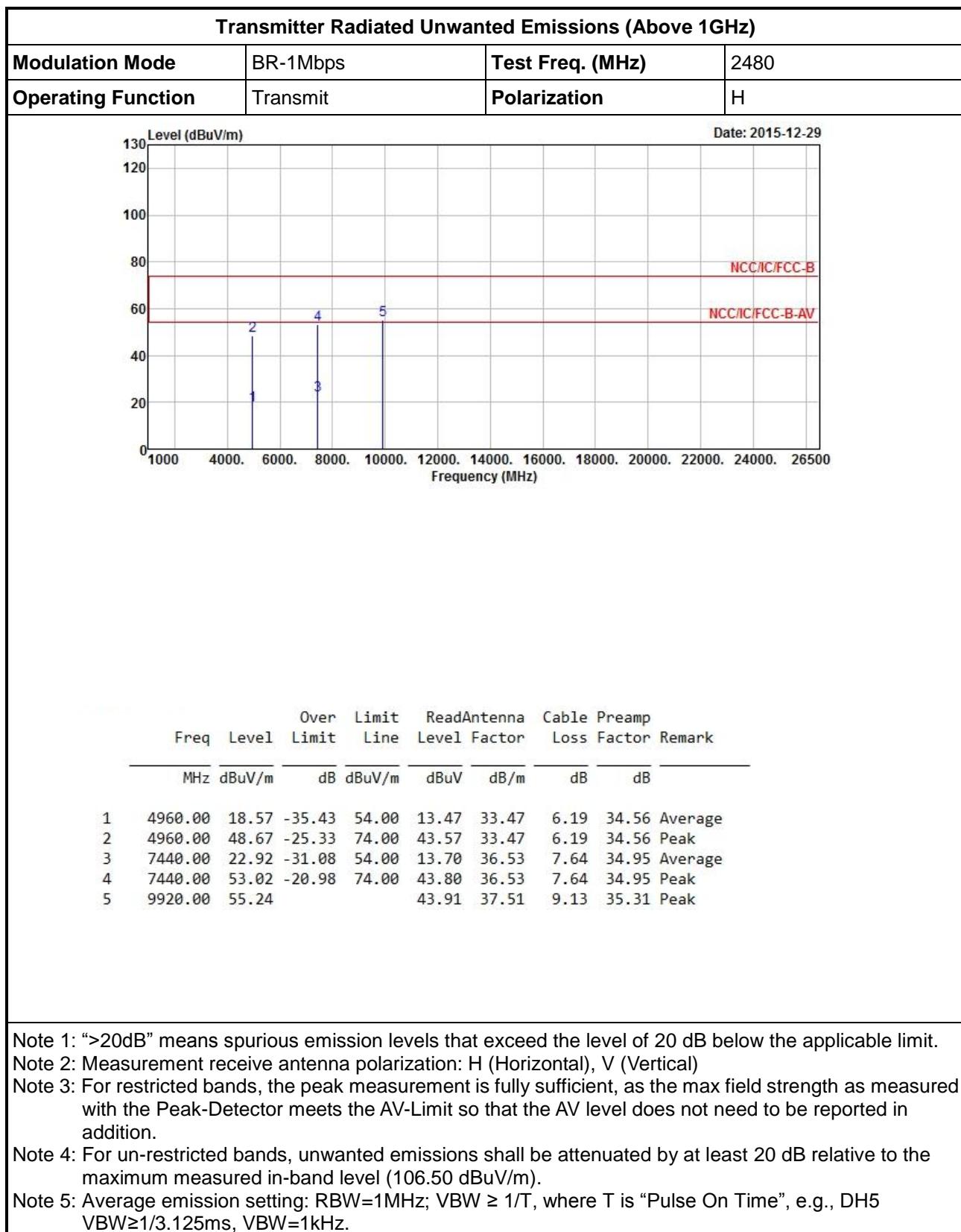
Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

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 (106.50 dBuV/m).

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





## 4 Test Equipment and Calibration Data

< AC Conduction >

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Last Cal.	Calibration Due Date
EMC Receiver	R&S	ESCS 30	100174	9kHz ~ 2.75GHz	Apr. 15, 2015	Apr. 14, 2016
LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	8127-477	9kHz ~ 30MHz	Jan. 22, 2015	Jan. 21, 2016
RF Cable-CON	HUBER+SUHNER	RG213/U	07611832020001	9kHz ~ 30MHz	Oct. 30, 2015	Oct. 29, 2016
EMI Filter	LINDGREN	LRE-2030	2651	< 450 Hz	N/A	N/A

< RF Conducted >

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Last Cal.	Calibration Due Date
Spectrum Analyzer	R&S	FSV 40	101500	9KHz~40GHz	May 06, 2015	May 05, 2016
Signal Generator	R&S	SMR40	100116	10MHz ~ 40GHz	Jul. 28, 2015	Jul. 27, 2016
Power Sensor	Anritsu	MA2411B	0917017	300MHz ~ 40GHz	Feb. 17, 2015	Feb. 16, 2016
Power Meter	Anritsu	ML2495A	0949003	300MHz ~ 40GHz	Feb. 17, 2015	Feb. 16, 2016

< Radiated Emission >

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Last Cal.	Calibration Due Date
3m Semi Anechoic Chamber	TDK	SAC-3M	03CH09-HY	30MHz ~ 1GHz 3m	Jul. 01, 2015	Jun. 30, 2016
3m Semi Anechoic Chamber	TDK	SAC-3M	03CH09-HY	1GHz ~ 18GHz 3m	Jul. 01, 2015	Jun. 30, 2016
Amplifier	EMC	EMC9135	980232	9kHz ~ 1.0GHz	Jan. 27, 2015	Jan. 26, 2016
Amplifier	Agilent	8449B	3008A02096	1GHz ~ 26.5GHz	Apr. 09, 2015	Apr. 08, 2016
Spectrum	KEYSIGHT	N9010A	MY54200885	10Hz ~ 44GHz	Jul. 15, 2015	Jul. 14, 2016
Bilog Antenna	TESEQ	CBL 6112D	35418	30MHz ~ 1GHz	Mar. 30, 2015	Mar. 29, 2016
Horn Antenna	AARONIA AG	POWERLOG 70180	05192	1GHz ~ 18GHz	Jan. 05, 2015	Jan. 04, 2016
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	18GHz ~ 40GHz	Jan. 27, 2015	Jan. 26, 2016
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	Jul. 23, 2015	Jul. 22, 2016
RF Cable-high	Jye Bao	RG142	03CH09-HY	1GHz ~ 40GHz	Jul. 23, 2015	Jul. 22, 2016

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Last Cal.	Calibration Due Date
Loop Antenna	ROHDE&SCHWARZ	HFH2-Z2	100330	9 kHz~30 MHz	Nov. 10, 2014	Nov. 09, 2016