



# FCC Test Report

**Equipment** : BOOMA Micro Bluetooth Speaker With Selfie Remote  
**Brand Name** : GOODZ2  
**Model No.** : FWS219  
**FCC ID** : 2AA5C-FWS219  
**Standard** : 47 CFR FCC Part 15.247  
**Operating Band** : 2400 MHz – 2483.5 MHz  
**FCC Classification** : DSS  
**Applicant** : CviLux Corporation  
9F., No.9, Lane 3, Sec 1, Chung-Cheng East Road,  
Tamshui, New Taipei City 25147, Taiwan

The product sample received on Mar. 24, 2015 and completely tested on Apr. 19, 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:

  
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James Fan / Assistant Manager





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## 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]: 0.327MHz 17.39 (Margin 32.14dB) - AV 27.08 (Margin 32.45dB) - QP	FCC 15.207	Complied
3.2	15.247(a)	20dB Bandwidth	1.1522 MHz	N/A	Complied
3.2	15.247(a)	Carrier Frequency Separation (ChS)	1.0029 MHz	ChS $\geq$ BW <sub>20dB</sub> x2/3.	Complied
3.3	15.247(a)	Number of Hopping Frequencies (N)	Max:79 Min:20	N $\geq$ 15	Complied
3.4	15.247(a)	Time of Occupancy (Dwell Time)	0.320 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] 6.02	Power [dBm] 27	Complied
3.6	15.247(d)	Emissions in non-restricted frequency bands	Out-of -band emissions are 20dB below the highest power	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied
3.7	15.247(d)	Transmitter Unwanted Emissions	Restricted Bands [dBuV/m at 3m]: 7323.00MHz 67.84 (Margin 6.16dB) - 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 / EDR V2.1	2402-2480	0-78 [79]	6.02
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.				

#### 1.1.2 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"/>	External antenna (dedicated antennas)
<input type="checkbox"/>	<input type="checkbox"/> RF connector provided
	<input type="checkbox"/> Unique antenna connector. (e.g., MMCX, U.FL, IPX, and RP-SMA, RP-N type...)
	<input type="checkbox"/> Standard antenna connector. (e.g., SMA, N, BNC, and TNC type...)

Antenna General Information				
No.	Ant. Cat.	Ant. Type	Connector	Gain (dBi)
1	Integral	Printed	No Connector	-1.69



### 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 type="checkbox"/> Operated normally hopping 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"/> 78.97% - test mode single channel - BR-1Mbps	1.03
<input checked="" type="checkbox"/> 79.58% - test mode single channel - EDR-2Mbps	0.99
<input checked="" type="checkbox"/> 79.09% - test mode single channel - EDR-3Mbps	1.02

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

Power Supply Type	From host: 5Vdc, 500mA From lithium battery: Brand: DONGGUAN YILINK ELECTRONICS TWCHNOLOGY CO.LTD Model: YL702025 Rating: 3.7Vdc, 300mAh
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## 1.2 Accessories and Support Equipment

Accessories				
No.	Equipment	Brand Name	Model Name	Spec.
1	Lithium battery	DONGGUAN YILINK ELECTRONICS TWCHNOLOGY CO.LTD	YL702025	Rating: 3.7Vdc, 300mAh.
2	Micro USB cable	---	---	0.28m shielded without core.

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	Latitude E6440	DoC
2	Adapter	Apple	A1385	---

## 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"/>	Sporton Lab	ADD : No. 52, Hwa Ya 1 <sup>st</sup> 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			
<input checked="" type="checkbox"/>	ICC Lab	ADD : No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsein 333, Taiwan (R.O.C.) TEL : 886-3-327-3456 FAX : 886-3-327-0973			
Test Condition					
RF Conducted	TH01-HY	Jack Li	22°C / 64%	Apr. 13, 2016	
AC Conduction	CO01-WS*	Howard Huang	20°C / 59%	Apr. 19, 2016	
Radiated Emission	03CH03-WS*	Warren Lee Felix Sung	21-22°C / 63-64%	Apr. 09 ~ Apr. 11, 2016	
Test site registered number [207696] with FCC. Test site registered number [10807C-1] with IC.					

Note: \* Sporton Lab subcontracts this test item to ICC lab (TAF:2732).

ICC lab is a TAF accreditation test firm and also is an approved provider of Sporton Lab.



## 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	±2.90 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
All emissions, radiated	30 – 1000 MHz	±3.66 dB
	Above 1GHz	±5.37 dB
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	4.12	EDR-3Mbps
EDR	1	2 Mbps	EDR-2Mbps	5.82	
EDR	1	3 Mbps	EDR-3Mbps	6.02	

### 2.2 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter			
Test Software Version / Instrument	rdahost		
Modulation Mode	2402 MHz	2441 MHz	2480 MHz
BR,1Mbps	89	89	89
EDR,2Mbps	89	89	89
EDR,3Mbps	89	89	89



## 2.3 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
<b>Tests Item</b>	AC power-line conducted emissions
<b>Condition</b>	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
1	USB charging + Radio link

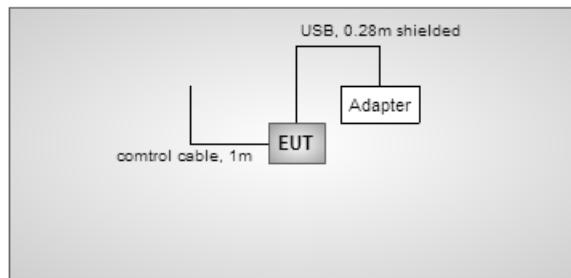
The Worst Case Mode for Following Conformance Tests	
<b>Tests Item</b>	RF Output Power, 20dB Bandwidth, Carrier Frequency Separation (ChS)
<b>Test Condition</b>	Conducted measurement at transmit chains
<b>Modulation Mode</b>	BR-1Mbps, EDR-2Mbps, EDR-3Mbps

The Worst Case Mode for Following Conformance Tests	
<b>Tests Item</b>	Number of Hopping Frequencies (N), Time of Occupancy (Dwell Time), Emissions in Non-Restricted Frequency Bands
<b>Test Condition</b>	Conducted measurement at transmit chains
<b>Modulation Mode</b>	EDR-3Mbps

The Worst Case Mode for Following Conformance Tests							
<b>Tests Item</b>	Transmitter Radiated Unwanted Emissions Transmitter Radiated Bandedge Emissions						
<b>Test Condition</b>	Radiated measurement						
<b>User Position</b>	<input type="checkbox"/> EUT will be placed in fixed position. <input checked="" type="checkbox"/> EUT will be placed in mobile position and operating multiple positions. EUT shall be performed three orthogonal planes. The worst planes is X. <input type="checkbox"/> EUT will be a battery-powered devices and operating multiple positions. EUT shall be performed two or three orthogonal planes. The worst planes is Y.						
<b>Operating Mode</b>	<input checked="" type="checkbox"/> 1. USB charging + Radio link						
<b>Modulation Mode</b>	BR-1Mbps, EDR-3Mbps						
<b>Orthogonal Planes of EUT</b>	<table border="1"><thead><tr><th>X Plane</th><th>Y Plane</th><th>Z Plane</th></tr></thead><tbody><tr><td></td><td></td><td></td></tr></tbody></table>	X Plane	Y Plane	Z Plane			
X Plane	Y Plane	Z Plane					

## 2.4 Test Setup Diagram

Test Setup Diagram - Radiated Test



Note: The support notebook is disconnected from EUT and removed from test table when EUT is set to transmit continuously.

### 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.

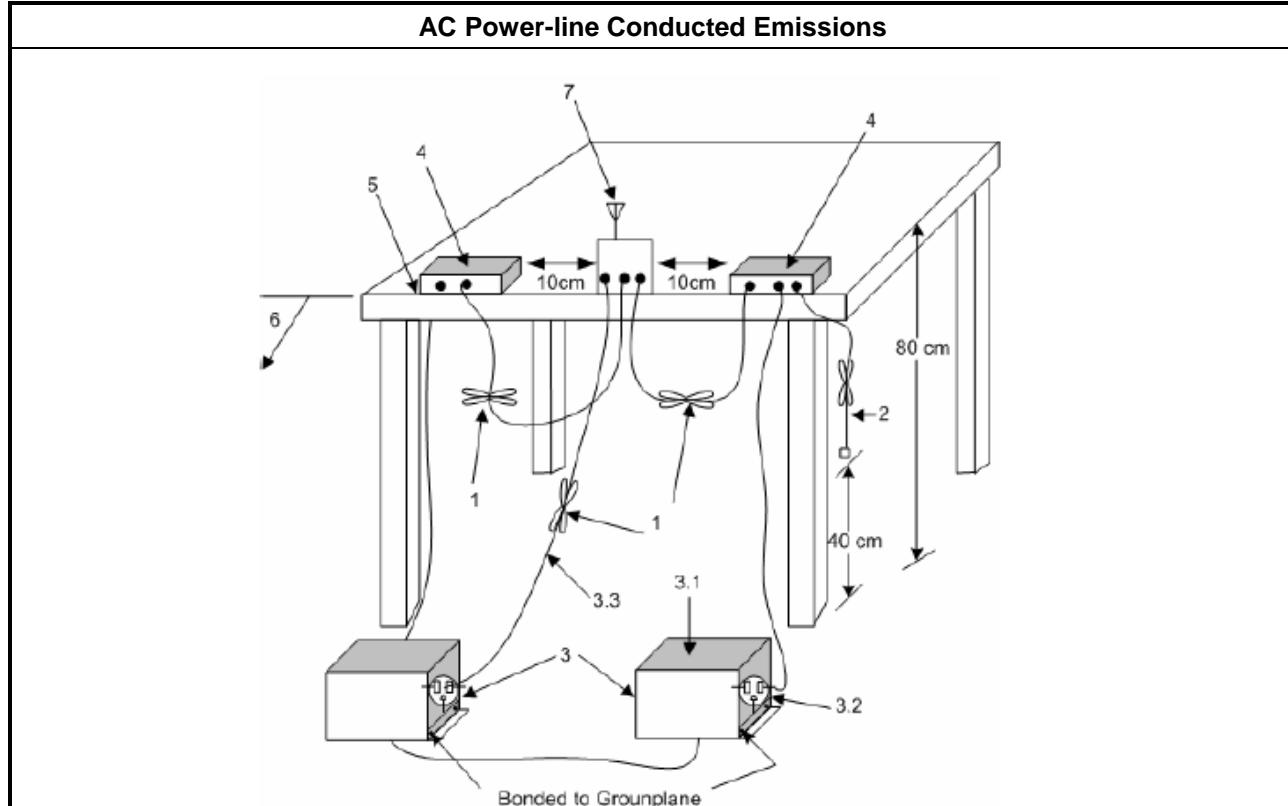
##### 3.1.2 Measuring Instruments

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

##### 3.1.3 Test Procedures

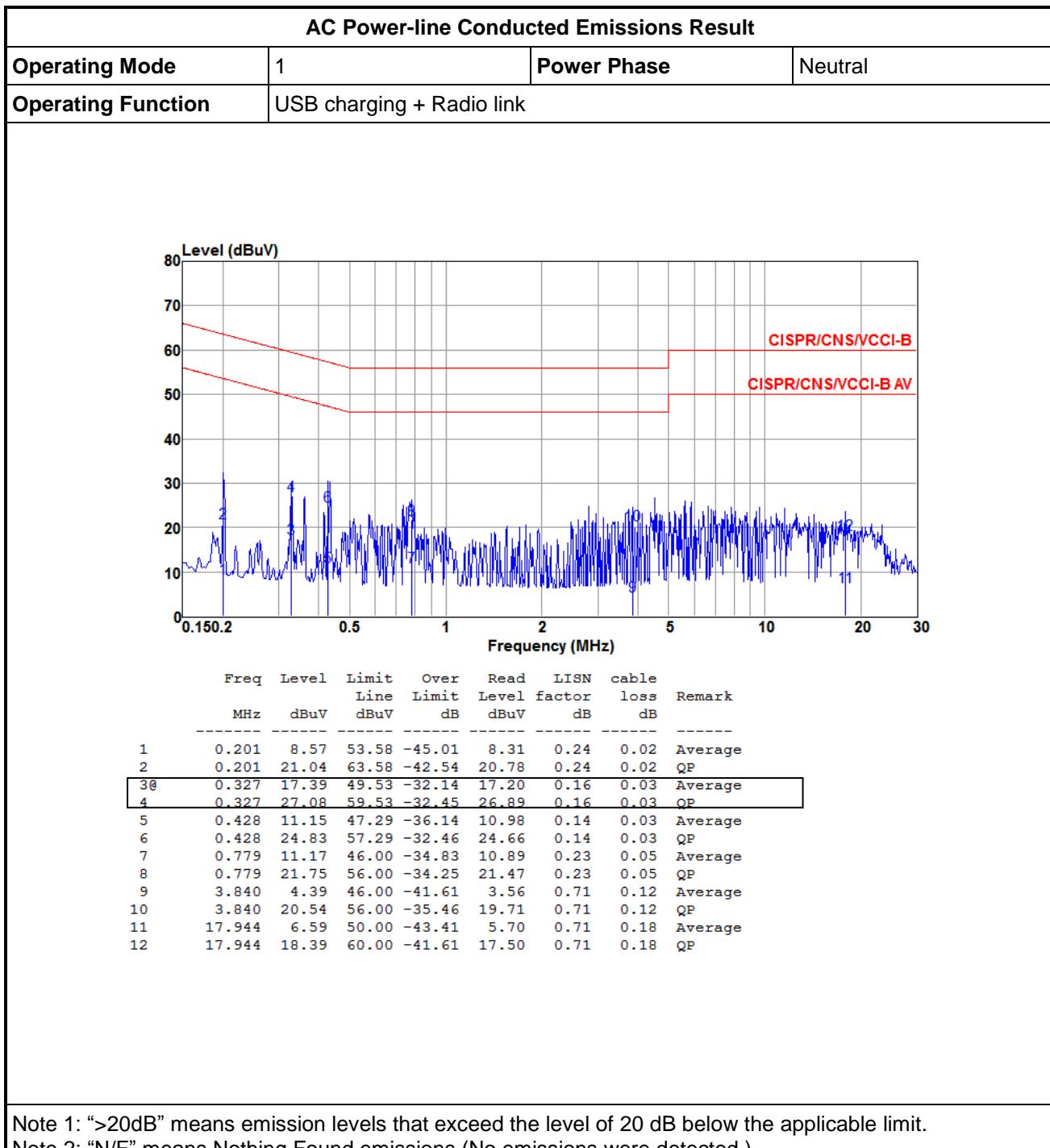
Test Method
<input checked="" type="checkbox"/> Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.

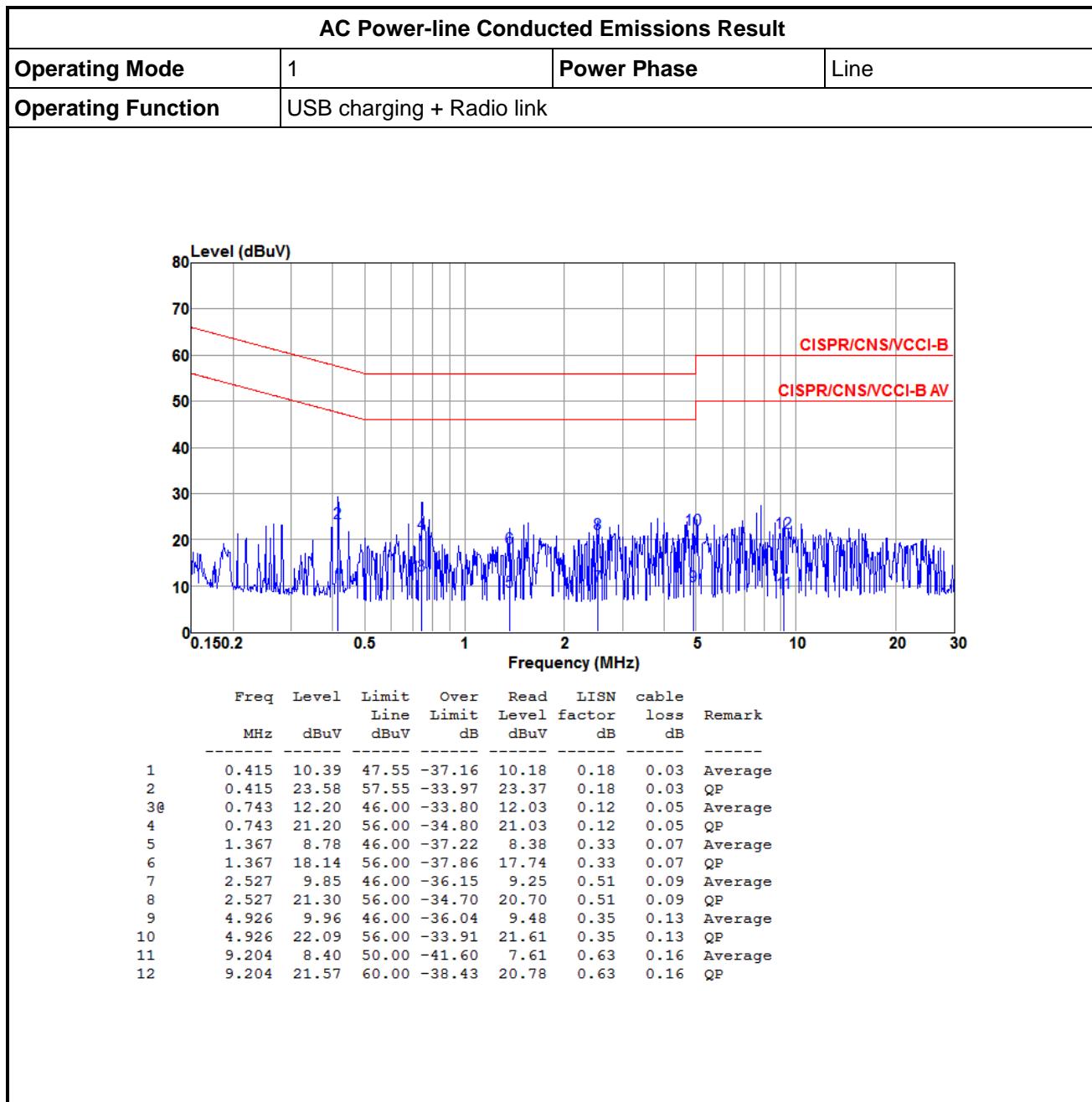
##### 3.1.4 Test Setup





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





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"/> $N \geq 75$ 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

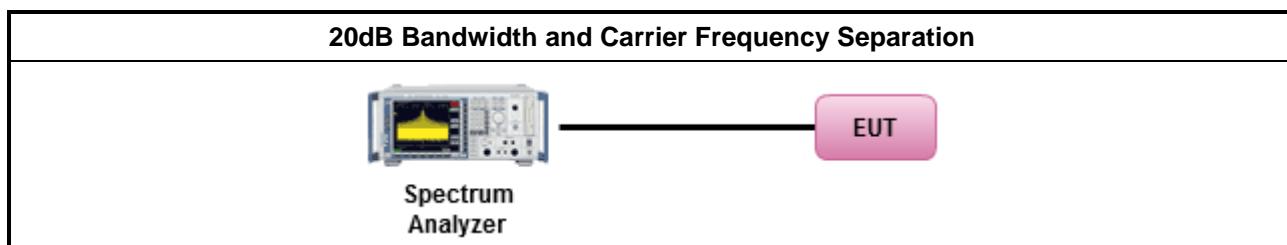
### 3.2.2 Measuring Instruments

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

### 3.2.3 Test Procedures

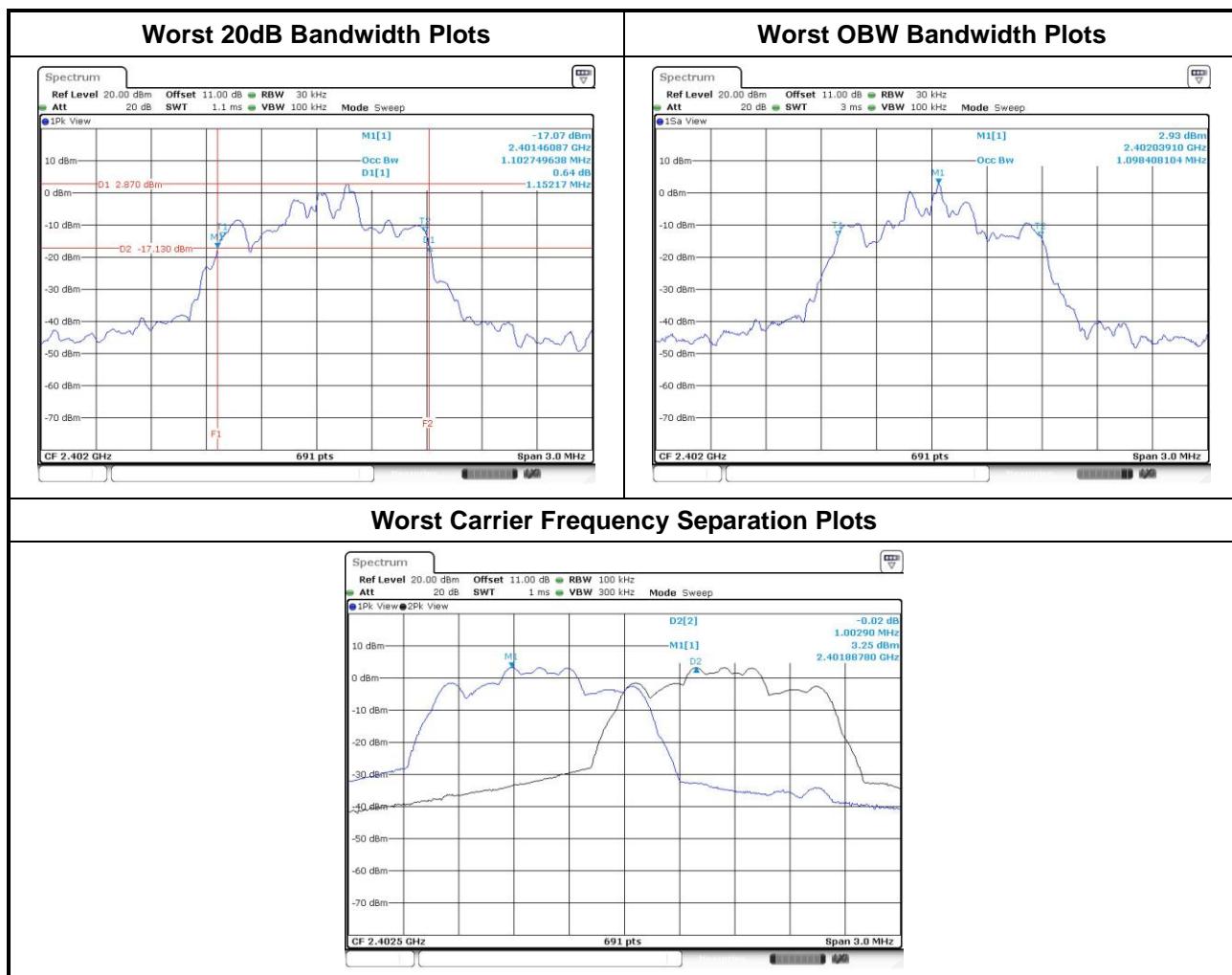
Test Method
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.1 for 20 dB bandwidth measurement.
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 7.8.2 for carrier frequency separation measurement.
<input checked="" type="checkbox"/> For conducted measurement.
<input 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	0.7565	0.8205	1.0029	0.504
BR-1Mbps	2441	0.7565	0.8205	1.0029	0.504
BR-1Mbps	2480	0.7565	0.8162	1.0029	0.504
EDR-2Mbps	2402	1.1522	1.0984	1.0029	0.768
EDR-2Mbps	2441	1.1522	1.0984	1.0029	0.768
EDR-2Mbps	2480	1.1522	1.0984	1.0029	0.768
EDR-3Mbps	2402	1.1435	1.0984	1.0029	0.762
EDR-3Mbps	2441	1.1435	1.0984	1.0029	0.762
EDR-3Mbps	2480	1.1435	1.0984	1.0029	0.762
<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"/> $N \geq 75$ 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

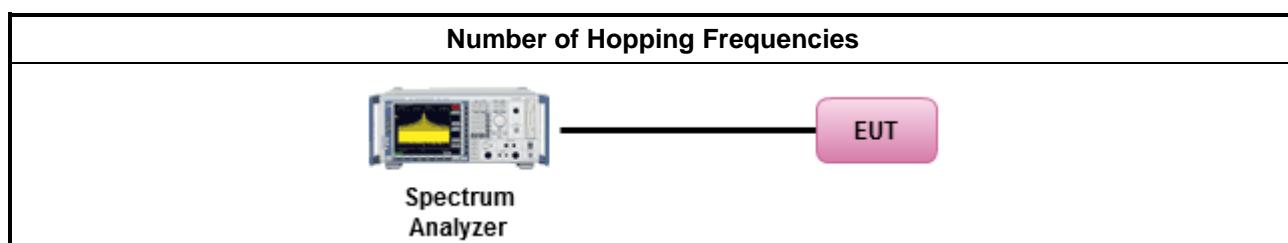
#### 3.3.2 Measuring Instruments

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 7.8.3 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.

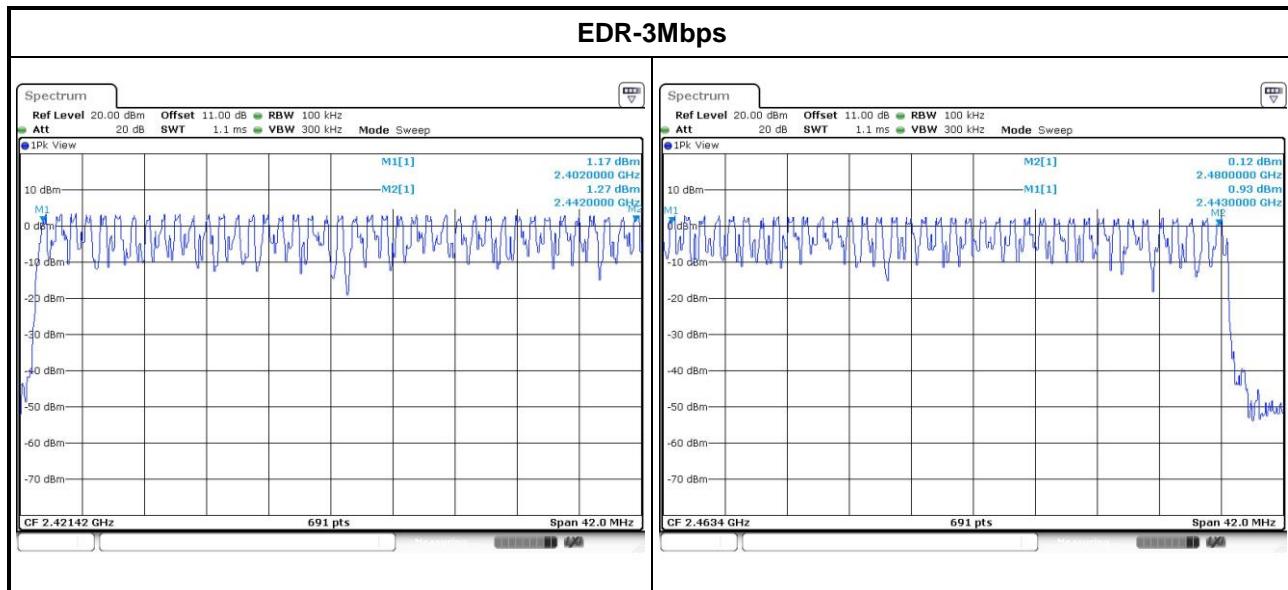
#### 3.3.4 Test Setup





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

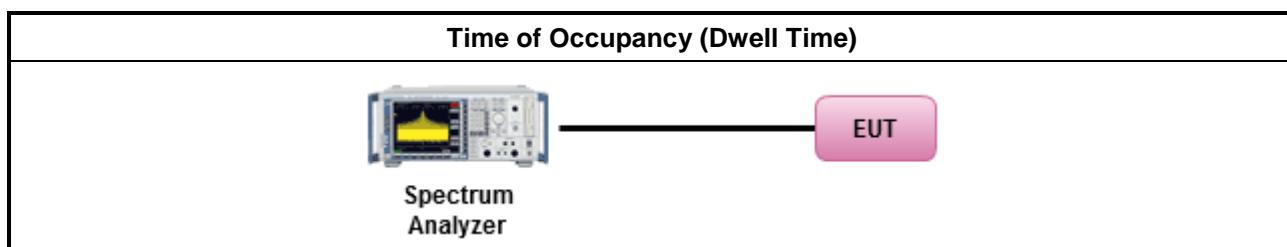
#### 3.4.2 Measuring Instruments

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 ANSI C63.10, 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.	

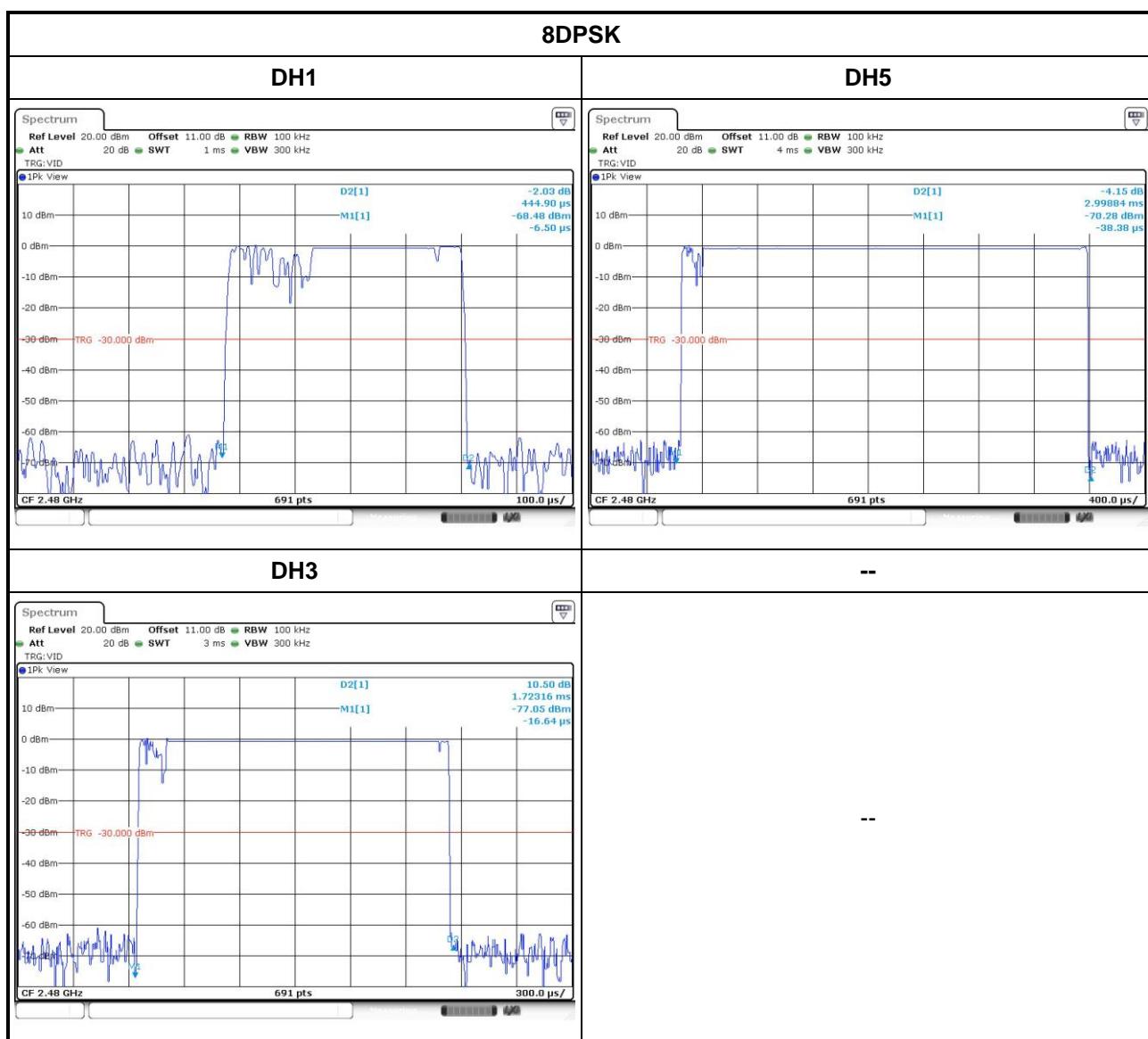
#### 3.4.4 Test Setup



### 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)
EDR-3Mbps	2480	3.00	106.7	0.320	0.4
<b>Result</b>		<b>Complied</b>			

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: $75 > N \geq 15 - P_{eirp} \leq 27 \text{ dBm}$ (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

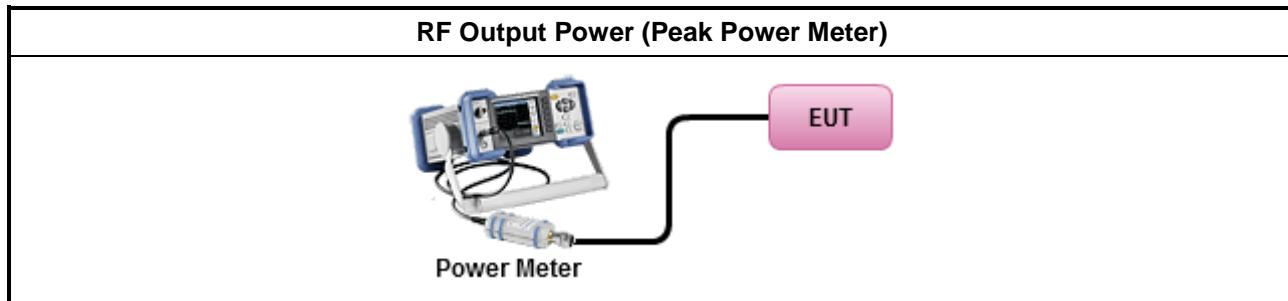
Refer a test equipment and calibration data table in this test report.

### 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 for peak power meter.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 6.10.2.1 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	4.12	21	-1.69	2.43	27
BR-1Mbps	2441	3.62	21	-1.69	1.93	27
BR-1Mbps	2480	2.97	21	-1.69	1.28	27
EDR-2Mbps	2402	5.82	21	-1.69	4.13	27
EDR-2Mbps	2441	5.52	21	-1.69	3.83	27
EDR-2Mbps	2480	4.93	21	-1.69	3.24	27
EDR-3Mbps	2402	<b>6.02</b>	21	-1.69	4.33	27
EDR-3Mbps	2441	5.44	21	-1.69	3.75	27
EDR-3Mbps	2480	4.83	21	-1.69	3.14	27
Result		Complied				

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	<b>2.69</b>	1.03	3.72	-1.69	2.03
BR-1Mbps	2441	2.19	1.03	3.22	-1.69	1.53
BR-1Mbps	2480	1.58	1.03	2.61	-1.69	0.92
EDR-2Mbps	2402	2.21	0.99	3.20	-1.69	1.51
EDR-2Mbps	2441	1.76	0.99	2.75	-1.69	1.06
EDR-2Mbps	2480	1.12	0.99	2.11	-1.69	0.42
EDR-3Mbps	2402	2.19	1.02	3.21	-1.69	1.52
EDR-3Mbps	2441	1.63	1.02	2.65	-1.69	0.96
EDR-3Mbps	2480	1.05	1.02	2.07	-1.69	0.38

Note: Average power is for reference only.

## 3.6 Emissions in Non-Restricted Frequency Bands

### 3.6.1 Emissions in Non-Restricted Frequency Bands Limit

Peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

### 3.6.2 Measuring Instruments

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

### 3.6.3 Test Procedures

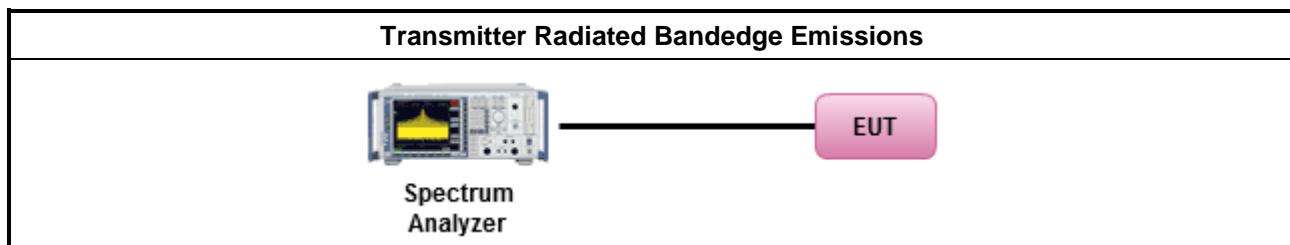
#### Reference level measurement

1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Use the peak marker function to determine the maximum PSD level

#### Emission level measurement

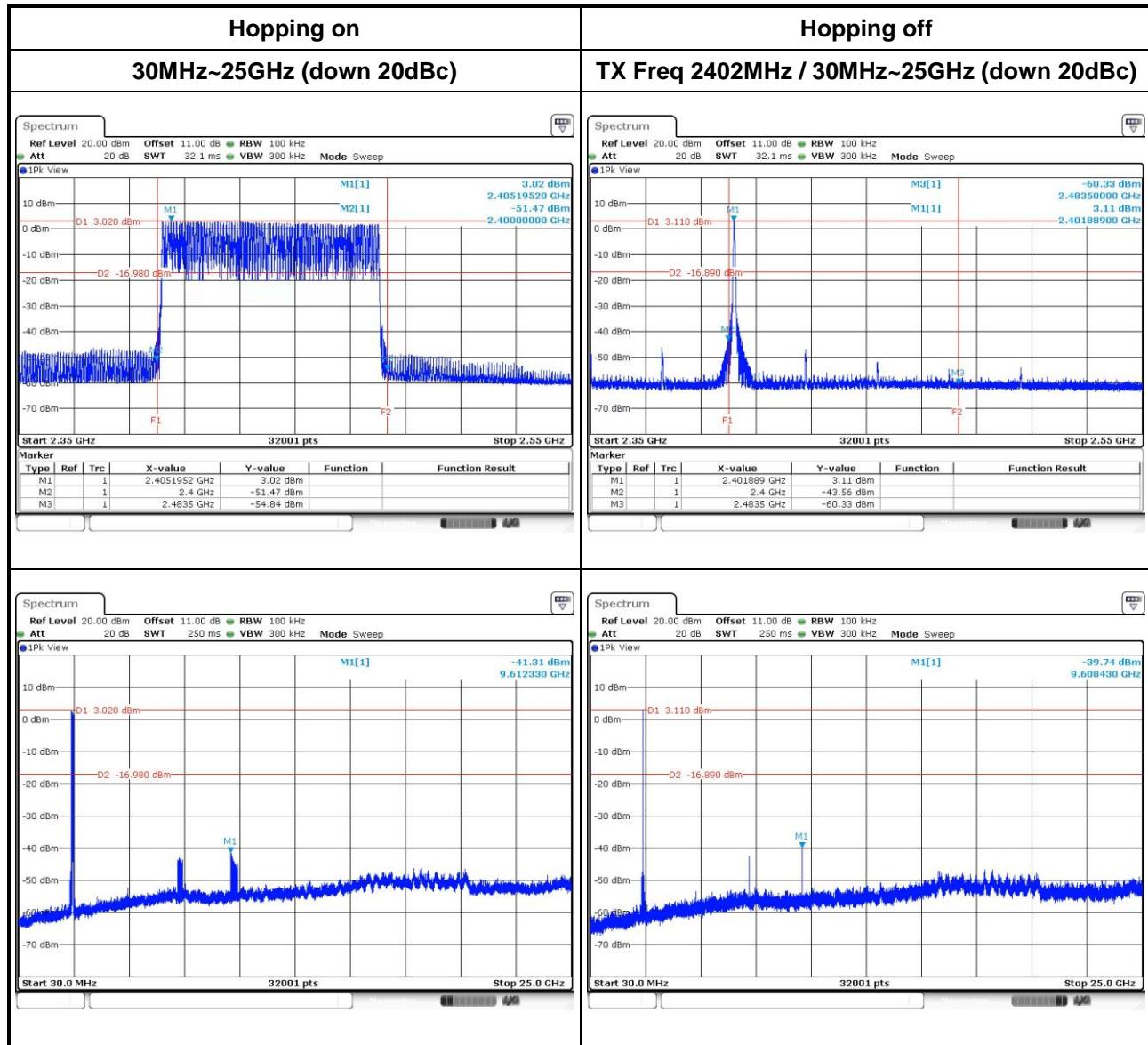
1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 25GHz
4. Use the peak marker function to determine the maximum amplitude level

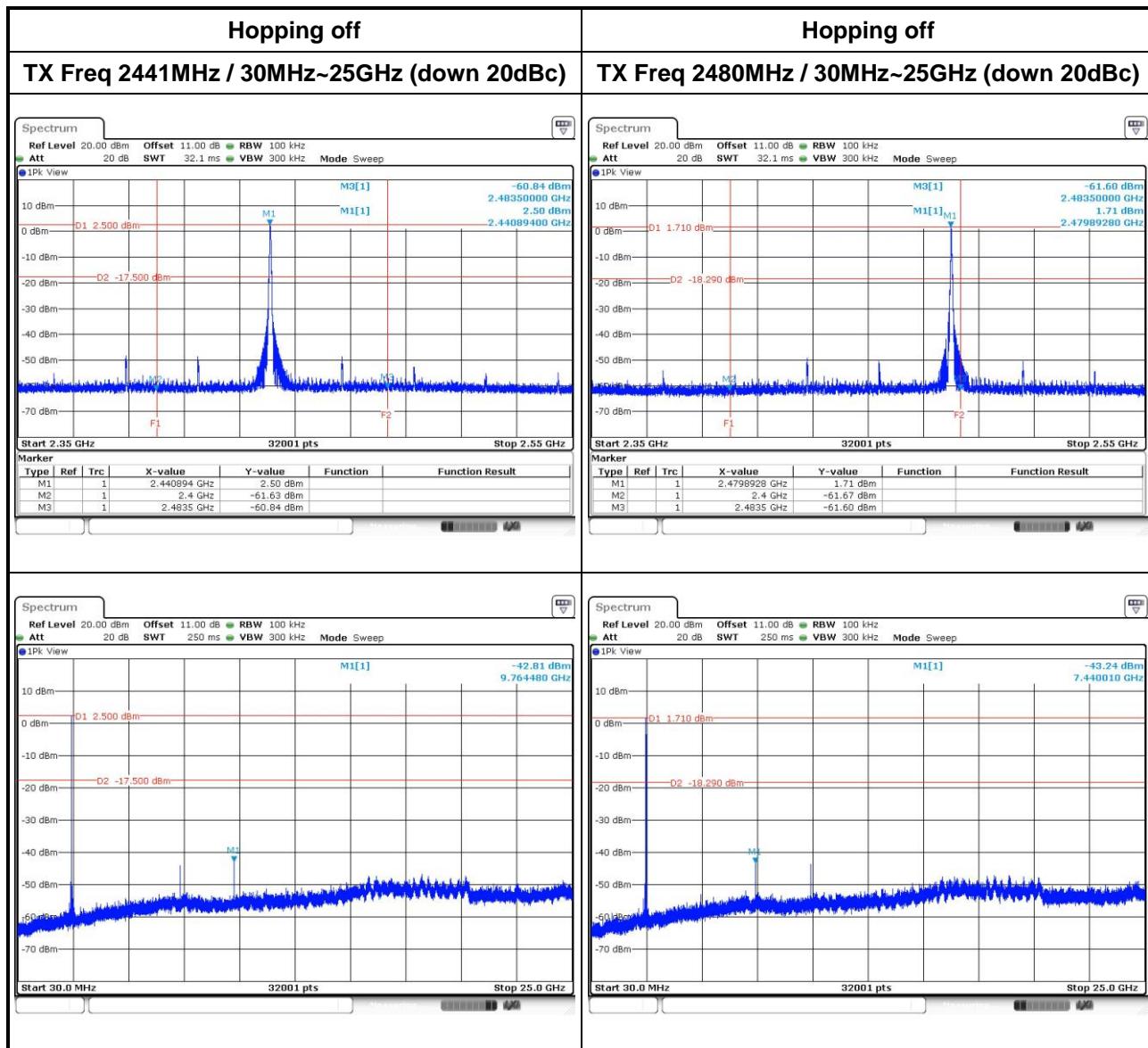
### 3.6.4 Test Setup



### 3.6.5 Test Result of Emissions in Non-Restricted Frequency Bands

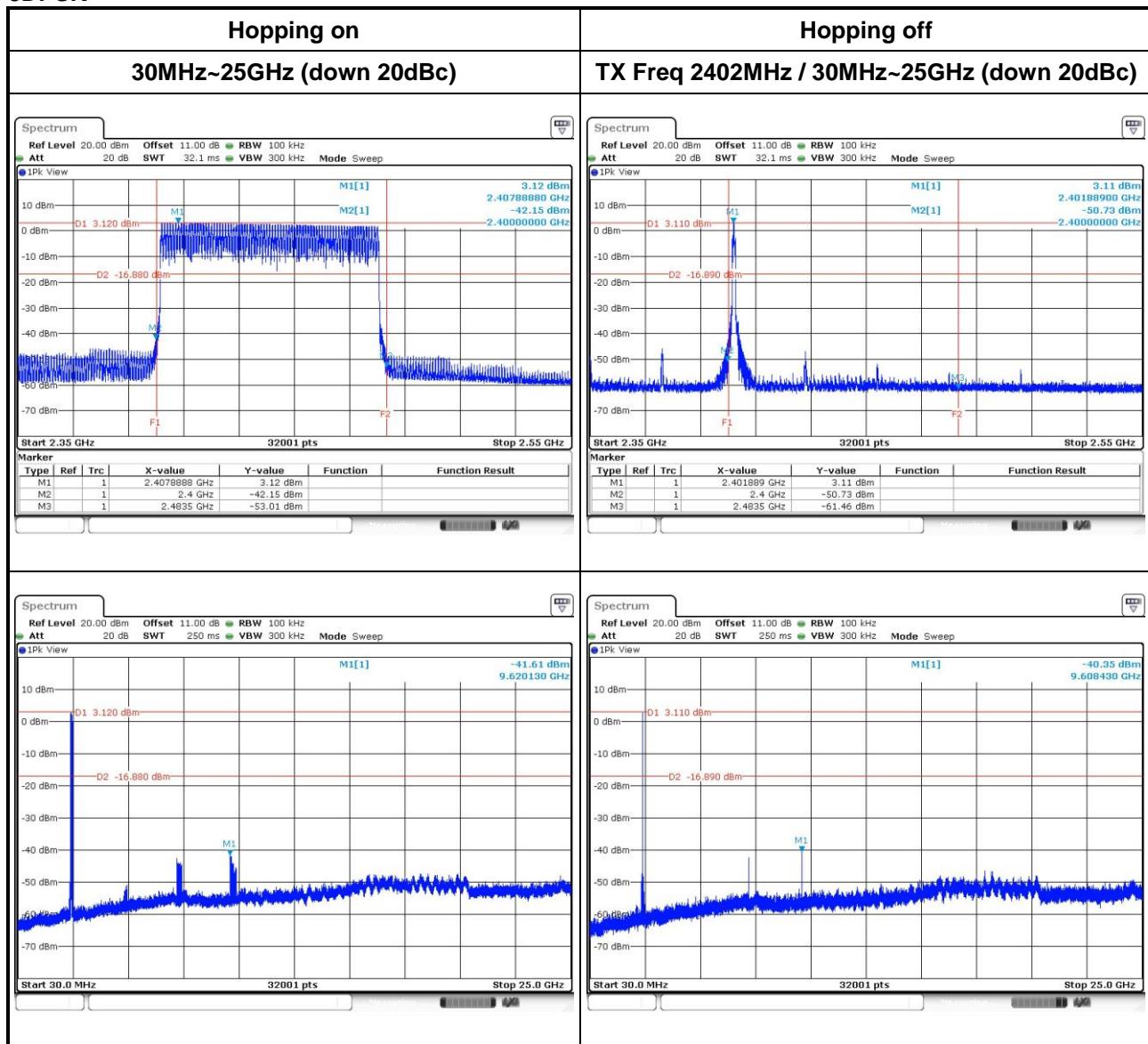
#### GFSK

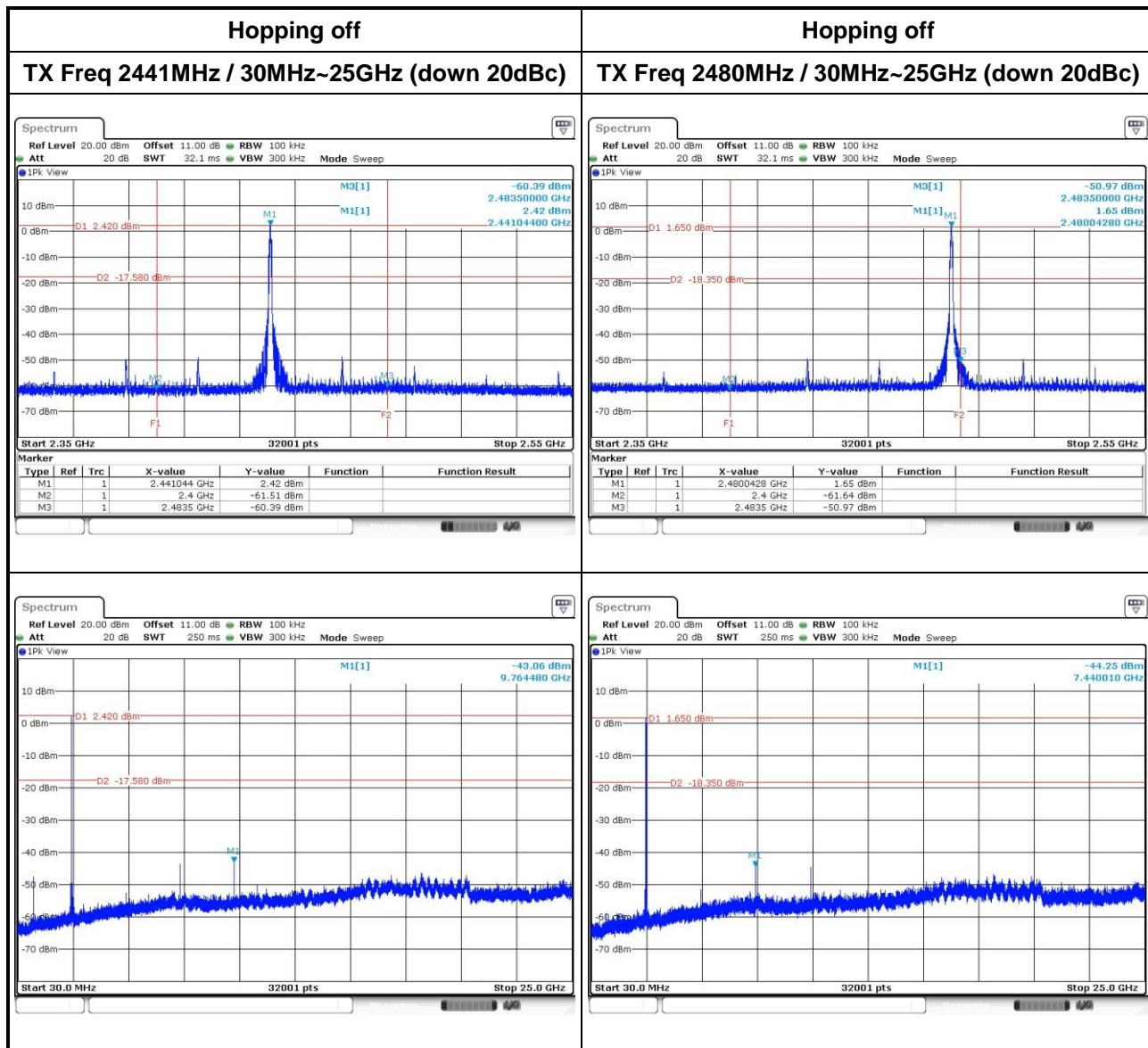






## 8DPSK







## 3.7 Transmitter 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.



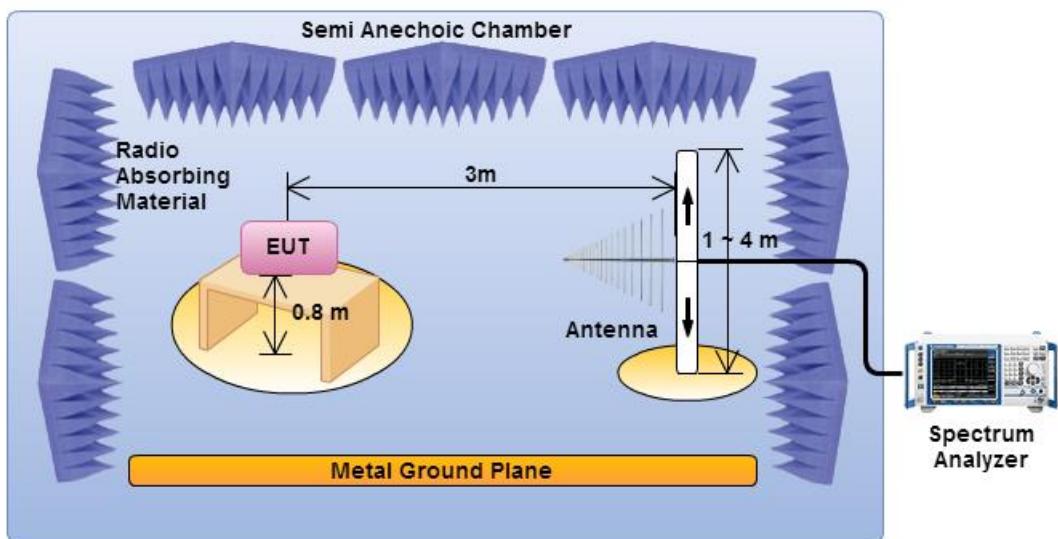
### 3.7.3 Test Procedures

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"/>	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 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 checked="" 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 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.

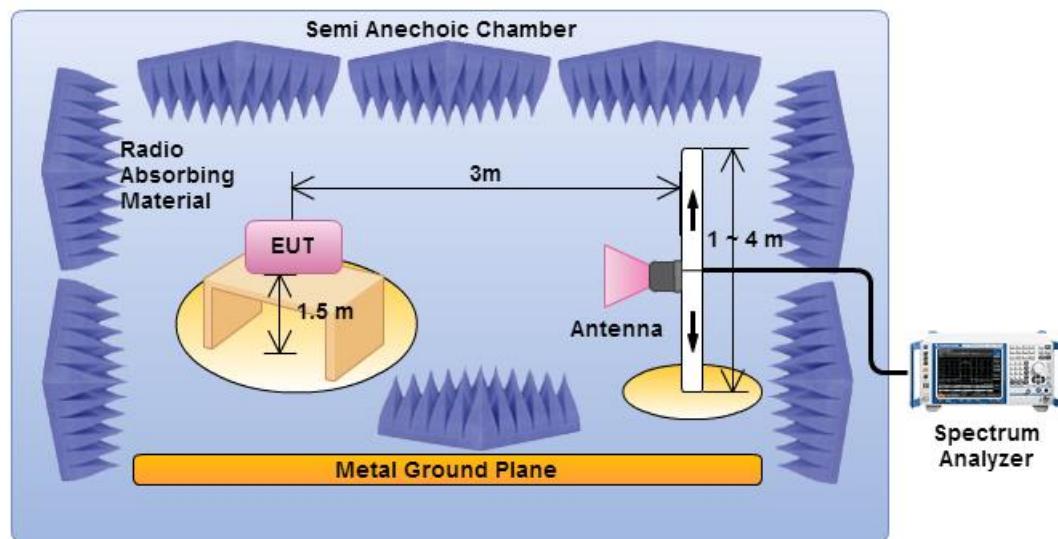
### 3.7.4 Test Setup

#### Transmitter Radiated Unwanted Emissions

Below 1GHz test:



Above 1GHz test:



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.

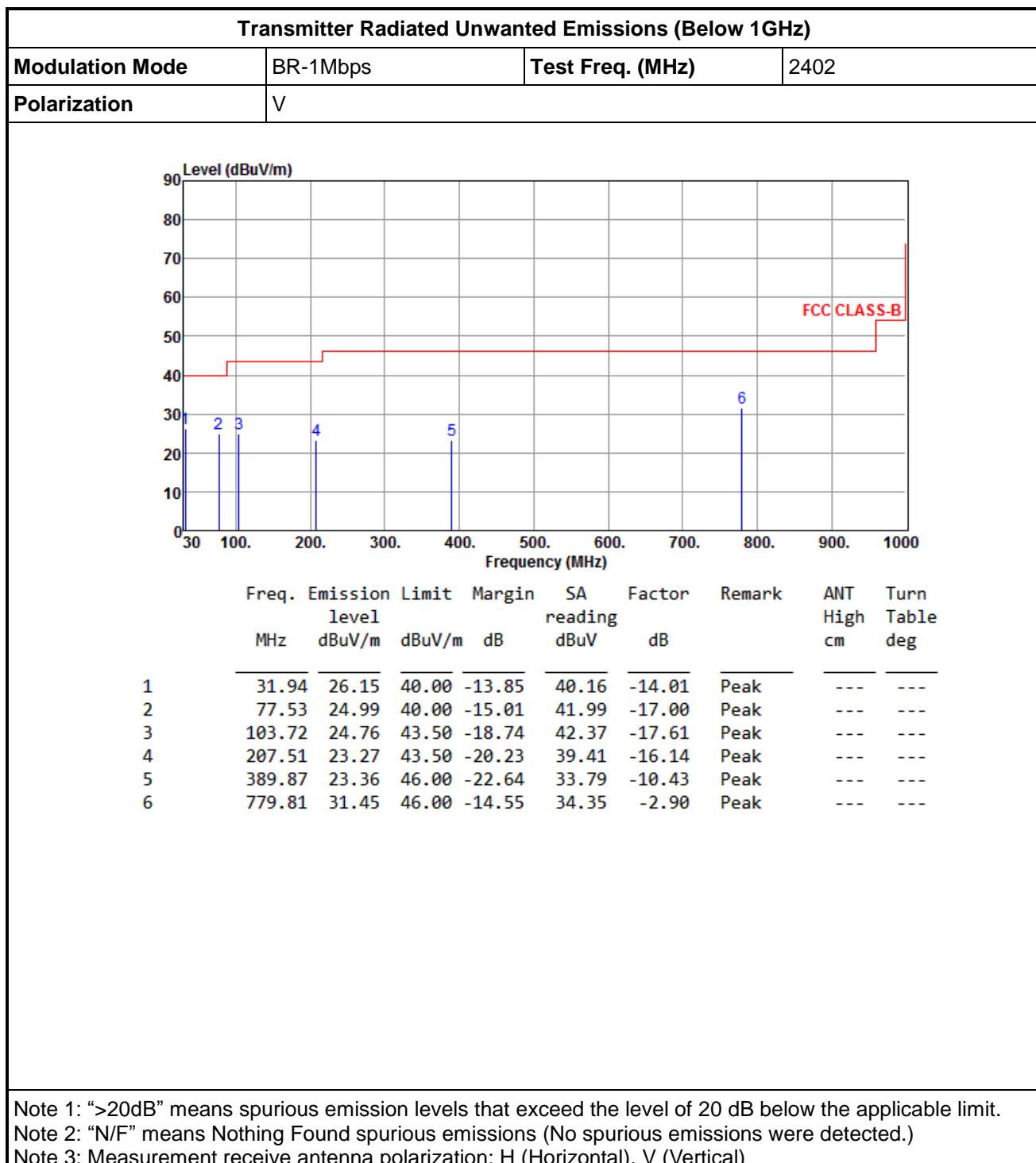
### 3.7.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

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



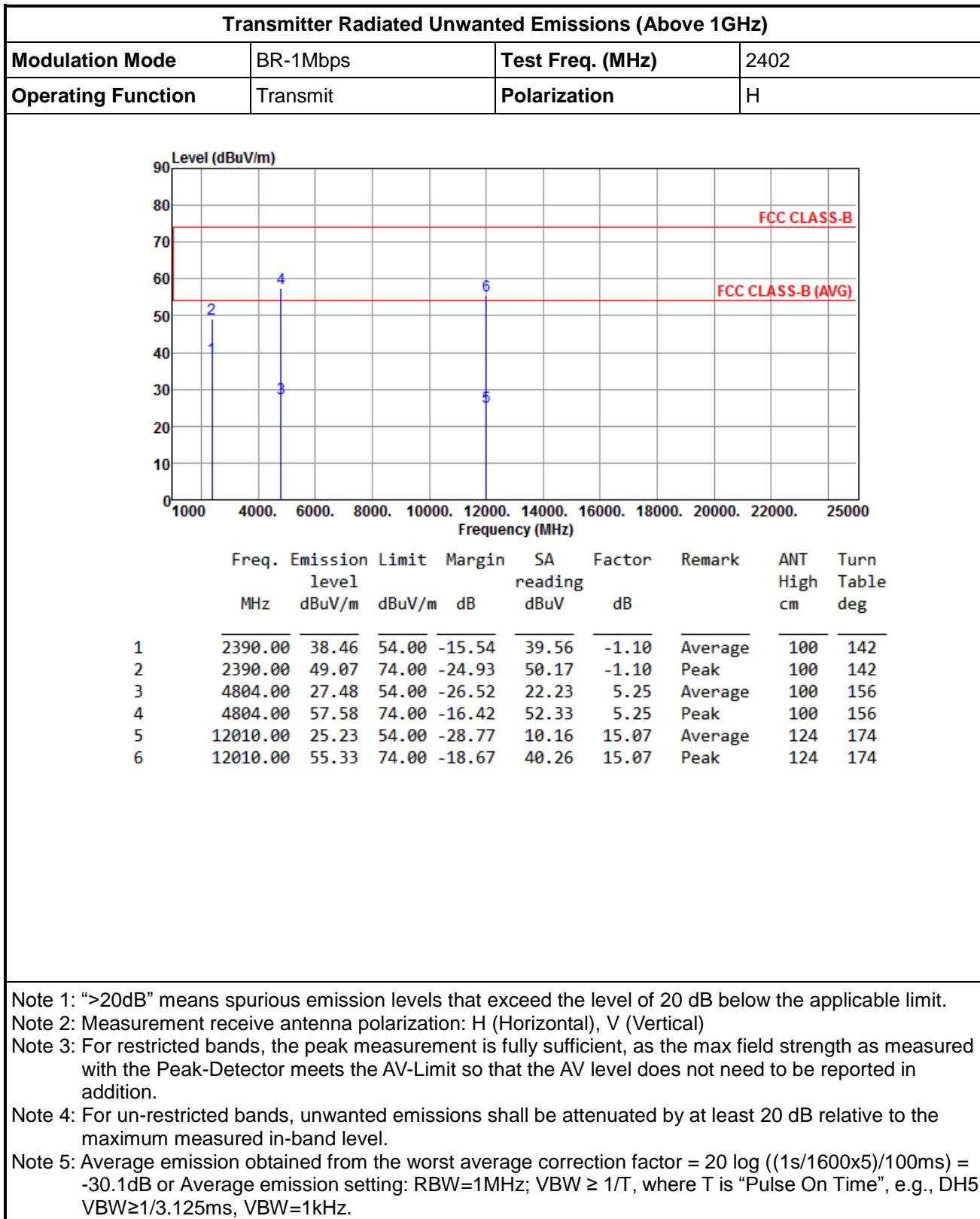
## 3.7.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Transmitter Radiated Unwanted Emissions (Below 1GHz)																																																																																																			
Modulation Mode	BR-1Mbps		Test Freq. (MHz)		2402																																																																																														
Polarization	H																																																																																																		
<table><thead><tr><th></th><th>Freq.</th><th>Emission</th><th>Limit</th><th>Margin</th><th>SA</th><th>Factor</th><th>Remark</th><th>ANT</th><th>Turn</th></tr><tr><th></th><th>level</th><th>level</th><th>reading</th><th>reading</th><th>dBuV</th><th>dB</th><th></th><th>High</th><th>Table</th></tr><tr><th></th><th>MHz</th><th>dBuV/m</th><th>dBuV/m</th><th>dB</th><th></th><th></th><th></th><th>cm</th><th>deg</th></tr></thead><tbody><tr><td>1</td><td>77.53</td><td>28.53</td><td>40.00</td><td>-11.47</td><td>45.53</td><td>-17.00</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>2</td><td>156.10</td><td>28.66</td><td>43.50</td><td>-14.84</td><td>42.01</td><td>-13.35</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>3</td><td>207.51</td><td>32.82</td><td>43.50</td><td>-10.68</td><td>48.96</td><td>-16.14</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>4</td><td>312.27</td><td>31.27</td><td>46.00</td><td>-14.73</td><td>43.77</td><td>-12.50</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>5</td><td>598.42</td><td>31.05</td><td>46.00</td><td>-14.95</td><td>36.77</td><td>-5.72</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>6</td><td>779.81</td><td>32.41</td><td>46.00</td><td>-13.59</td><td>35.31</td><td>-2.90</td><td>Peak</td><td>---</td><td>---</td></tr></tbody></table>											Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn		level	level	reading	reading	dBuV	dB		High	Table		MHz	dBuV/m	dBuV/m	dB				cm	deg	1	77.53	28.53	40.00	-11.47	45.53	-17.00	Peak	---	---	2	156.10	28.66	43.50	-14.84	42.01	-13.35	Peak	---	---	3	207.51	32.82	43.50	-10.68	48.96	-16.14	Peak	---	---	4	312.27	31.27	46.00	-14.73	43.77	-12.50	Peak	---	---	5	598.42	31.05	46.00	-14.95	36.77	-5.72	Peak	---	---	6	779.81	32.41	46.00	-13.59	35.31	-2.90	Peak	---	---
	Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn																																																																																										
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<p>Note 1: "&gt;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)</p>																																																																																																			





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





Transmitter Radiated Unwanted Emissions (Above 1GHz)									
Modulation Mode	BR-1Mbps		Test Freq. (MHz)		2402				
Operating Function	Transmit		Polarization		V				
Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table	
MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg	
1	2390.00	37.46	54.00	-16.54	38.56	-1.10	Average	116	216
2	2390.00	49.16	74.00	-24.84	50.26	-1.10	Peak	116	216
3	4804.00	25.27	54.00	-28.73	20.02	5.25	Average	100	202
4	4804.00	55.37	74.00	-18.63	50.12	5.25	Peak	100	202
5	12010.00	25.10	54.00	-28.90	10.03	15.07	Average	251	214
6	12010.00	55.20	74.00	-18.80	40.13	15.07	Peak	251	214

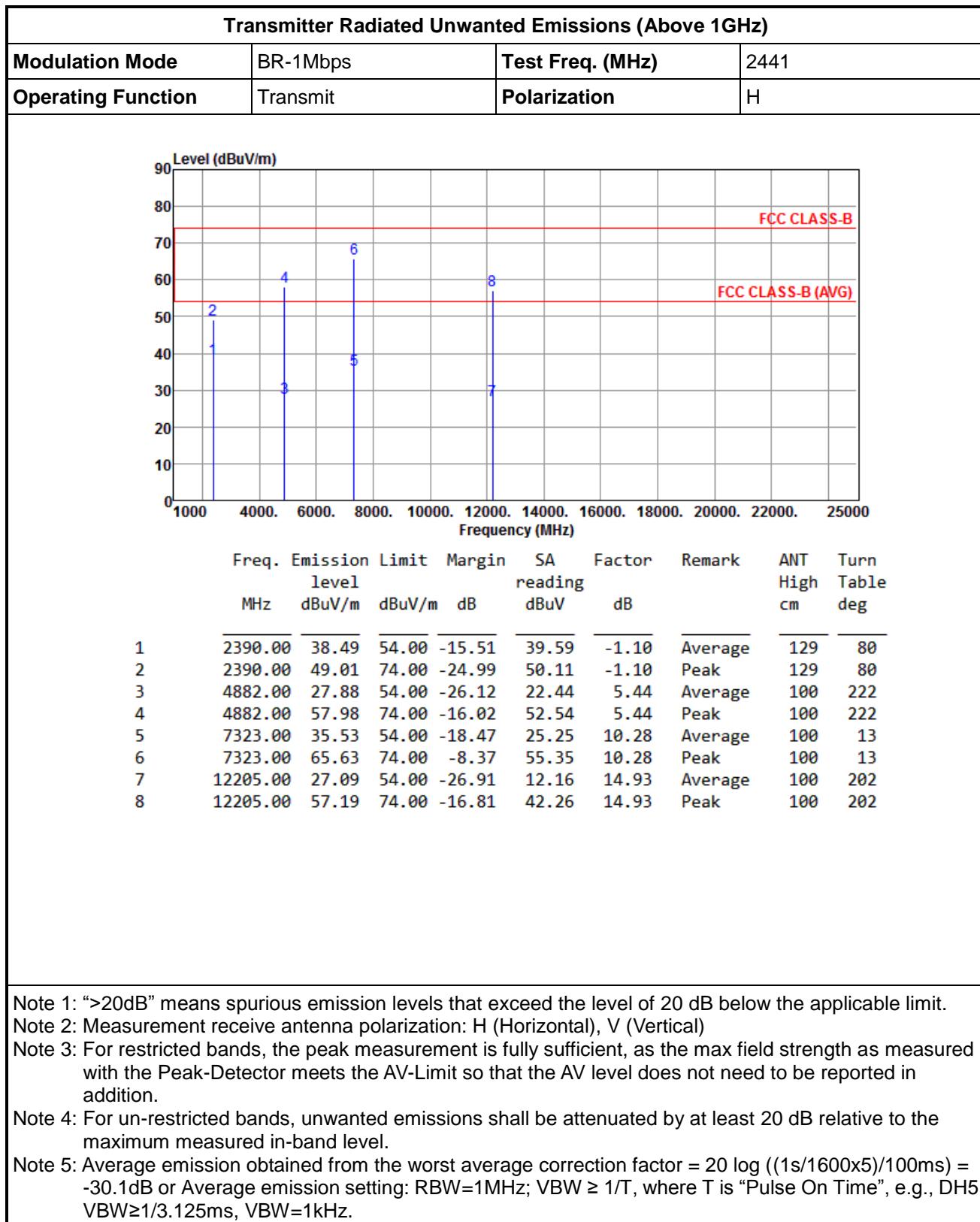
Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

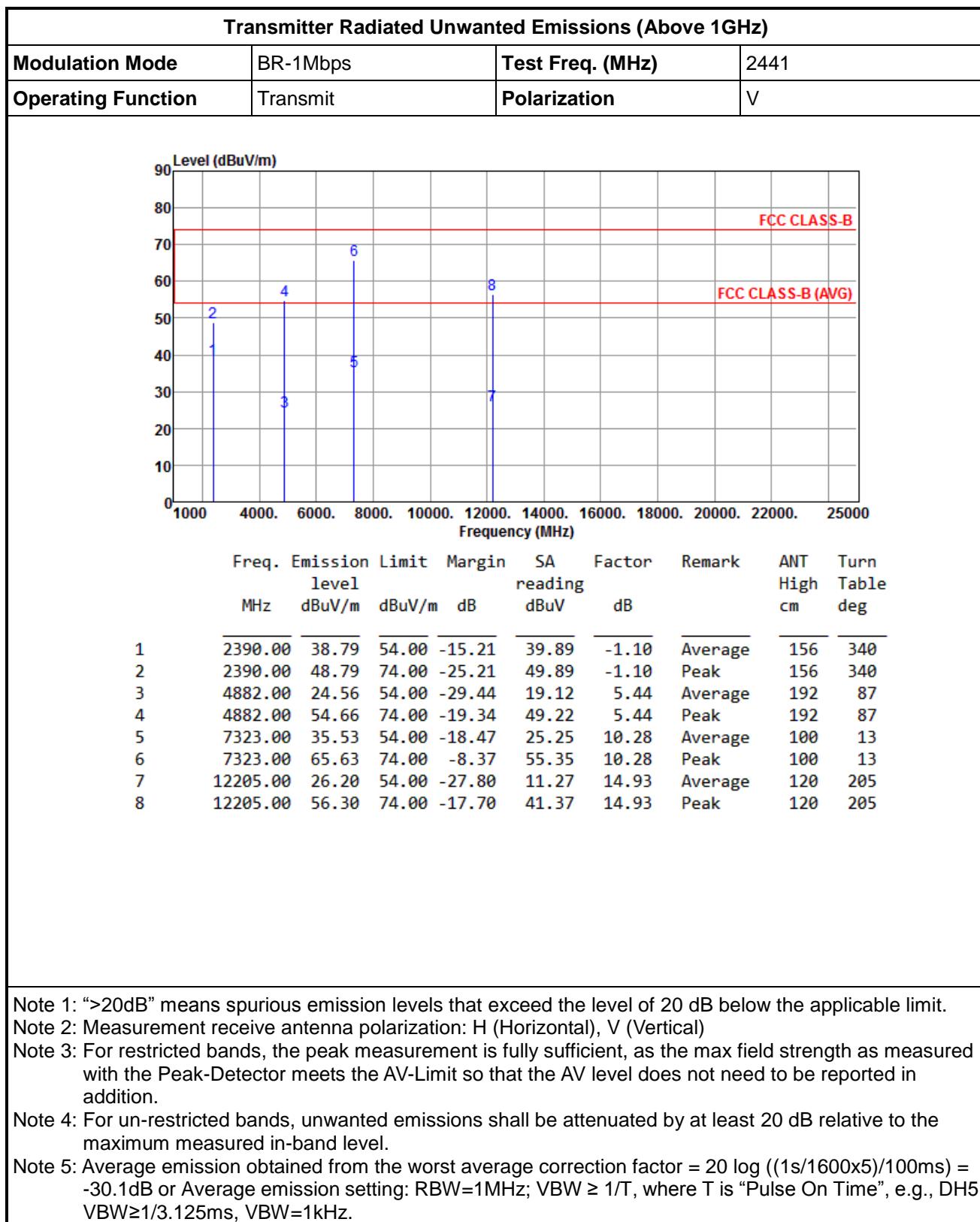
Note 2: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

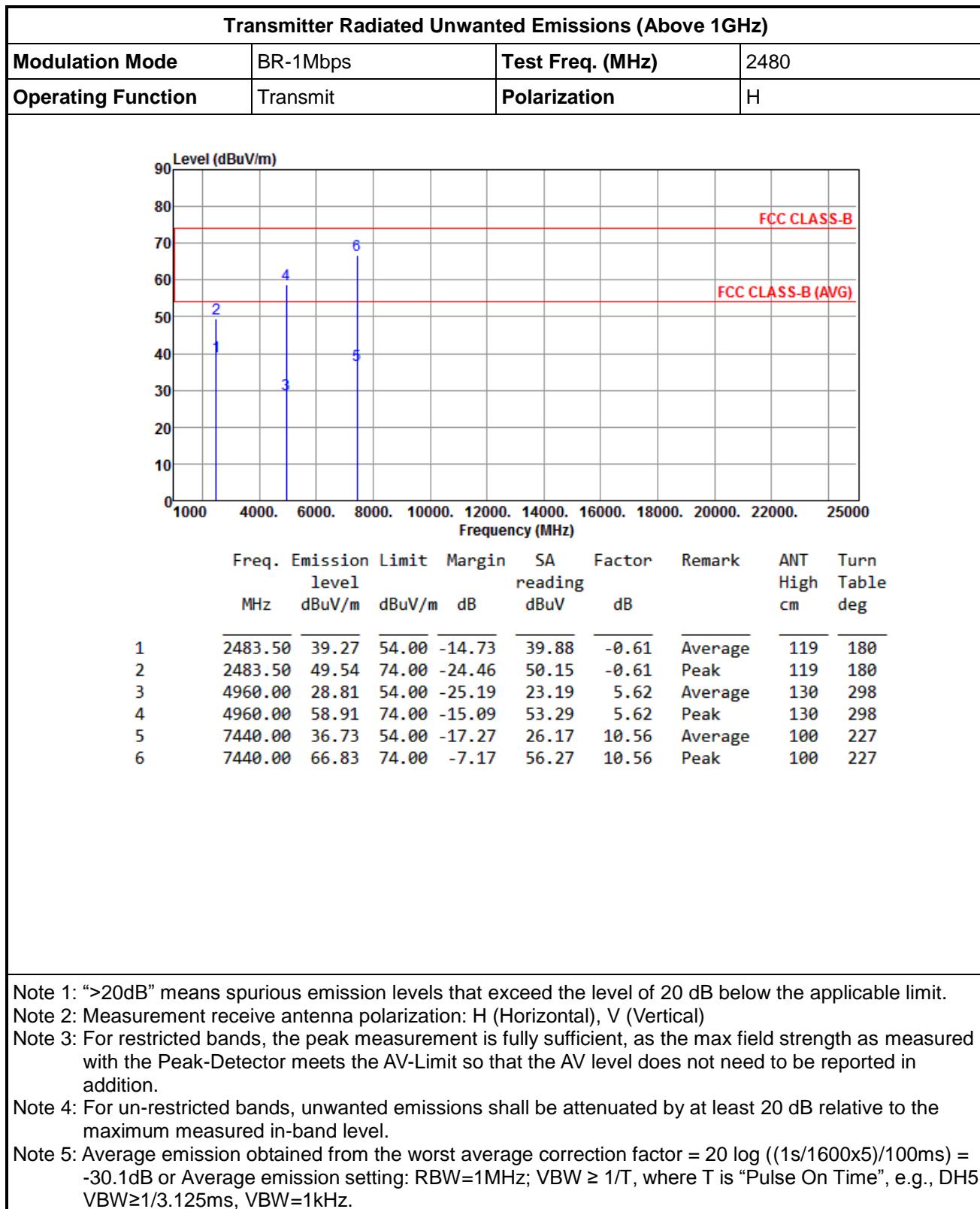
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

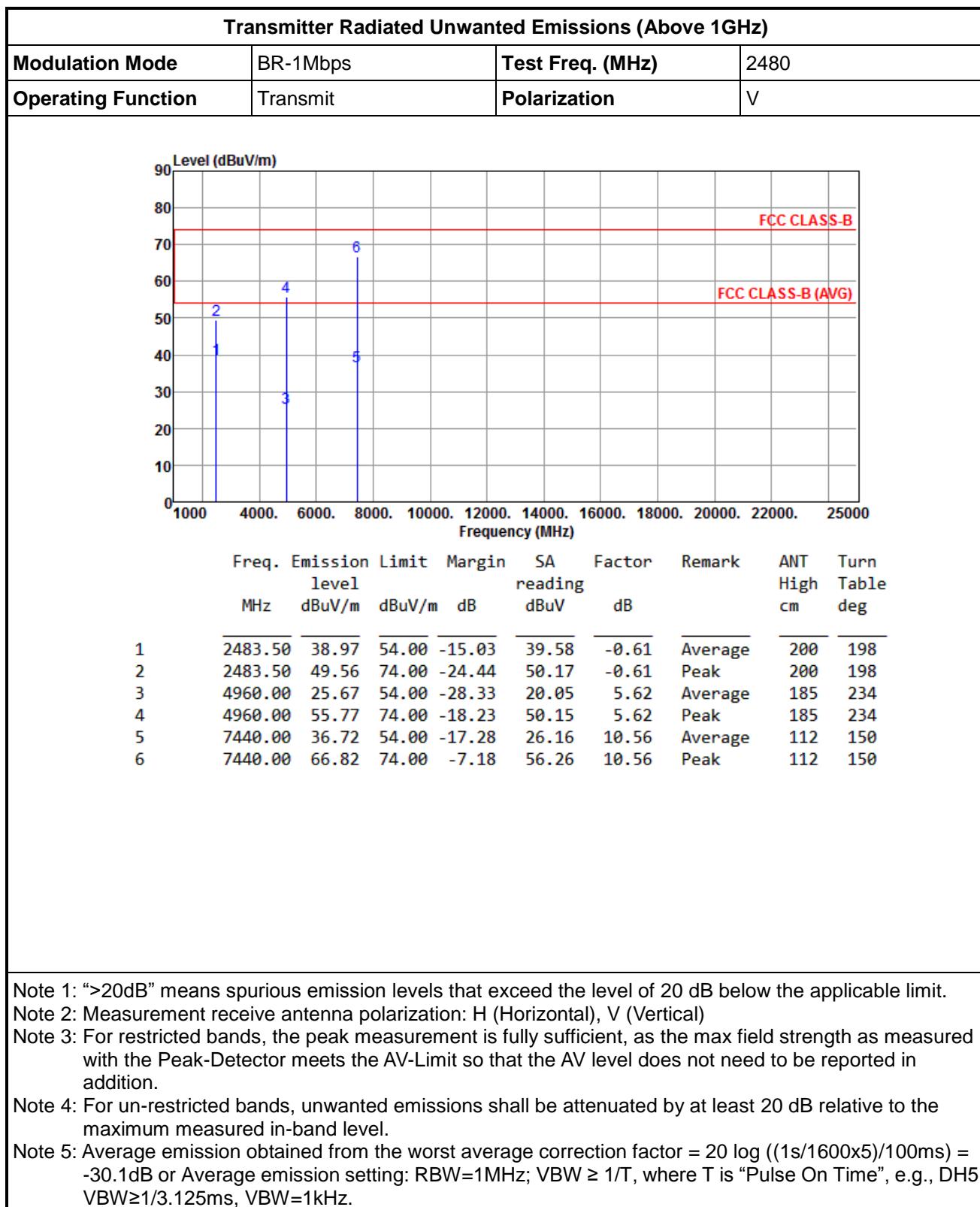
Note 4: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Note 5: Average emission obtained from the worst average correction factor =  $20 \log ((1s/1600x5)/100ms) = -30.1\text{dB}$  or 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.











## 3.7.8 Transmitter Radiated Unwanted Emissions (Above 1GHz) for 8DPSK

Transmitter Radiated Unwanted Emissions (Above 1GHz)																																																																																													
Modulation Mode	EDR-3Mbps		Test Freq. (MHz)		2402																																																																																								
Operating Function	Transmit		Polarization		H																																																																																								
<b>Graph of Transmitter Radiated Unwanted Emissions (Above 1GHz)</b>																																																																																													
<table border="1"> <thead> <tr> <th>Freq.</th> <th>Emission Limit</th> <th>Margin</th> <th>SA</th> <th>Factor</th> <th>Remark</th> <th>ANT</th> <th>Turn</th> </tr> <tr> <th>level</th> <th>level</th> <th>reading</th> <th>reading</th> <th>dB</th> <th></th> <th>High</th> <th>Table</th> </tr> <tr> <th>MHz</th> <th>dBuV/m</th> <th>dBuV/m</th> <th>dB</th> <th></th> <th></th> <th>cm</th> <th>deg</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2390.00</td> <td>38.74</td> <td>54.00</td> <td>-15.26</td> <td>39.84</td> <td>-1.10</td> <td>Average</td> <td>100</td> <td>156</td> </tr> <tr> <td>2</td> <td>2390.00</td> <td>49.03</td> <td>74.00</td> <td>-24.97</td> <td>50.13</td> <td>-1.10</td> <td>Peak</td> <td>100</td> <td>156</td> </tr> <tr> <td>3</td> <td>4804.00</td> <td>25.41</td> <td>54.00</td> <td>-28.59</td> <td>20.16</td> <td>5.25</td> <td>Average</td> <td>100</td> <td>180</td> </tr> <tr> <td>4</td> <td>4804.00</td> <td>55.51</td> <td>74.00</td> <td>-18.49</td> <td>50.26</td> <td>5.25</td> <td>Peak</td> <td>100</td> <td>180</td> </tr> <tr> <td>5</td> <td>12010.00</td> <td>23.26</td> <td>54.00</td> <td>-30.74</td> <td>8.19</td> <td>15.07</td> <td>Average</td> <td>126</td> <td>227</td> </tr> <tr> <td>6</td> <td>12010.00</td> <td>53.36</td> <td>74.00</td> <td>-20.64</td> <td>38.29</td> <td>15.07</td> <td>Peak</td> <td>126</td> <td>227</td> </tr> </tbody> </table>										Freq.	Emission Limit	Margin	SA	Factor	Remark	ANT	Turn	level	level	reading	reading	dB		High	Table	MHz	dBuV/m	dBuV/m	dB			cm	deg	1	2390.00	38.74	54.00	-15.26	39.84	-1.10	Average	100	156	2	2390.00	49.03	74.00	-24.97	50.13	-1.10	Peak	100	156	3	4804.00	25.41	54.00	-28.59	20.16	5.25	Average	100	180	4	4804.00	55.51	74.00	-18.49	50.26	5.25	Peak	100	180	5	12010.00	23.26	54.00	-30.74	8.19	15.07	Average	126	227	6	12010.00	53.36	74.00	-20.64	38.29	15.07	Peak	126	227
Freq.	Emission Limit	Margin	SA	Factor	Remark	ANT	Turn																																																																																						
level	level	reading	reading	dB		High	Table																																																																																						
MHz	dBuV/m	dBuV/m	dB			cm	deg																																																																																						
1	2390.00	38.74	54.00	-15.26	39.84	-1.10	Average	100	156																																																																																				
2	2390.00	49.03	74.00	-24.97	50.13	-1.10	Peak	100	156																																																																																				
3	4804.00	25.41	54.00	-28.59	20.16	5.25	Average	100	180																																																																																				
4	4804.00	55.51	74.00	-18.49	50.26	5.25	Peak	100	180																																																																																				
5	12010.00	23.26	54.00	-30.74	8.19	15.07	Average	126	227																																																																																				
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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. Note 5: Average emission obtained from the worst average correction factor = $20 \log ((1s/1600x5)/100ms) = -30.1\text{dB}$ or 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.																																																																																													



Transmitter Radiated Unwanted Emissions (Above 1GHz)									
Modulation Mode	EDR-3Mbps		Test Freq. (MHz)		2402				
Operating Function	Transmit		Polarization		V				
<p>Graph showing Transmitter Radiated Unwanted Emissions (Above 1GHz). The Y-axis is Level (dBuV/m) from 0 to 90. The X-axis is Frequency (MHz) from 1000 to 25000. Two horizontal lines are shown: FCC CLASS-B (72 dB) and FCC CLASS-B (AVG) (54 dB). Six measurement points are marked: 1 (2390.00 MHz, 38.94 dBuV/m), 2 (2390.00 MHz, 49.23 dBuV/m), 3 (4804.00 MHz, 23.60 dBuV/m), 4 (4804.00 MHz, 53.70 dBuV/m), 5 (12010.00 MHz, 23.94 dBuV/m), and 6 (12010.00 MHz, 54.04 dBuV/m).</p>									
Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table	
MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg	
1	2390.00	38.94	54.00	-15.06	40.04	-1.10	Average	125	223
2	2390.00	49.23	74.00	-24.77	50.33	-1.10	Peak	125	223
3	4804.00	23.60	54.00	-30.40	18.35	5.25	Average	100	230
4	4804.00	53.70	74.00	-20.30	48.45	5.25	Peak	100	230
5	12010.00	23.94	54.00	-30.06	8.87	15.07	Average	265	225
6	12010.00	54.04	74.00	-19.96	38.97	15.07	Peak	265	225

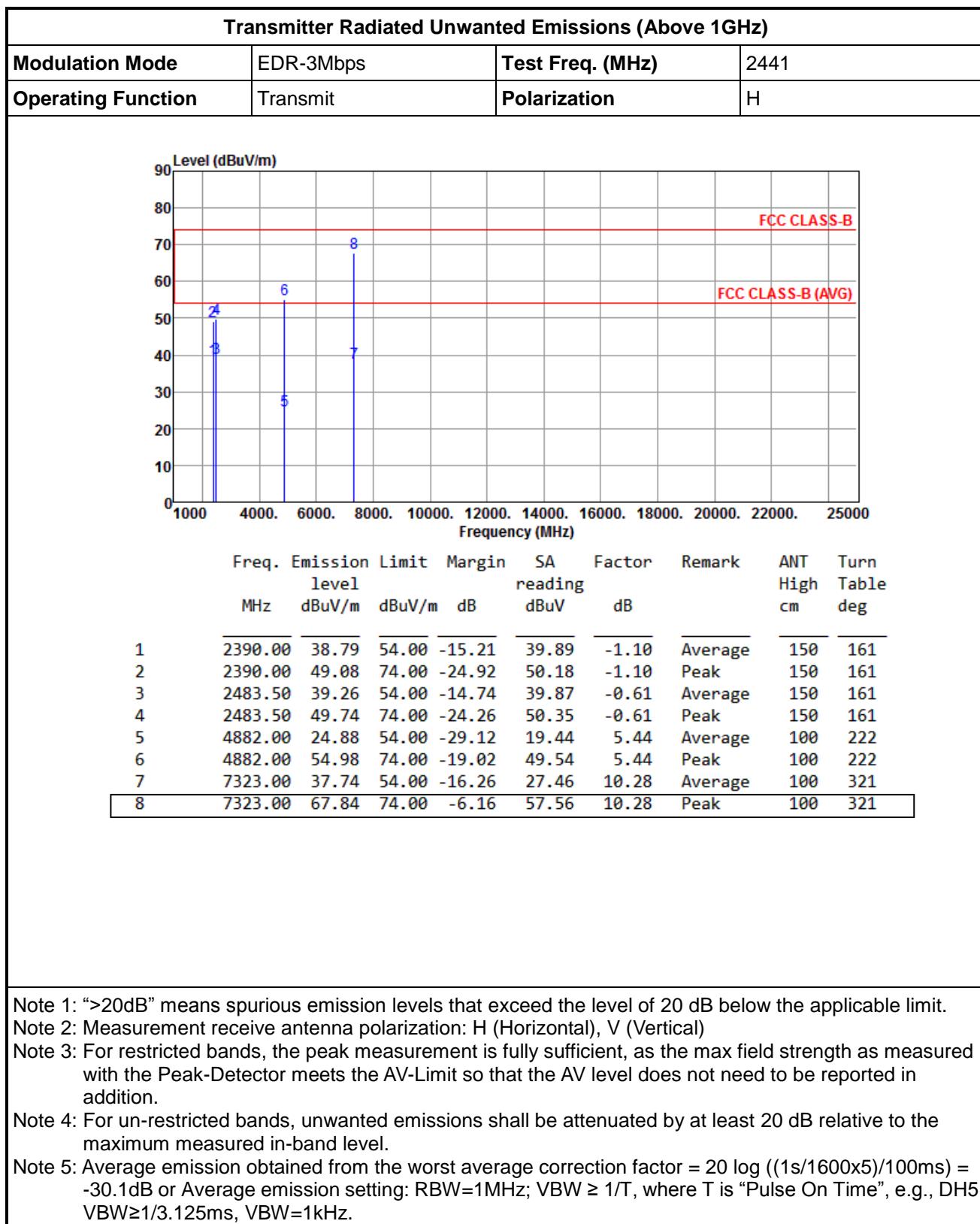
Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

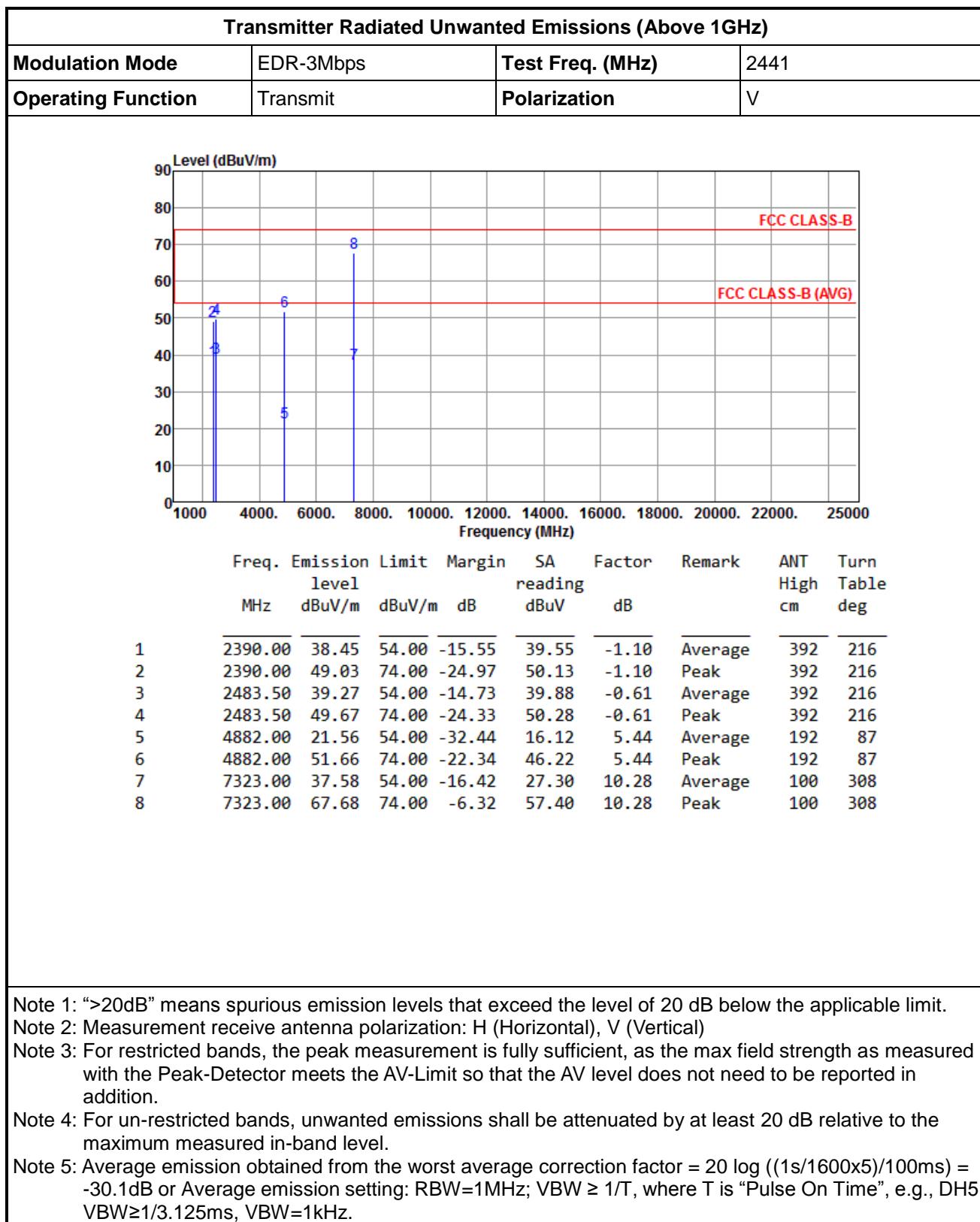
Note 2: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

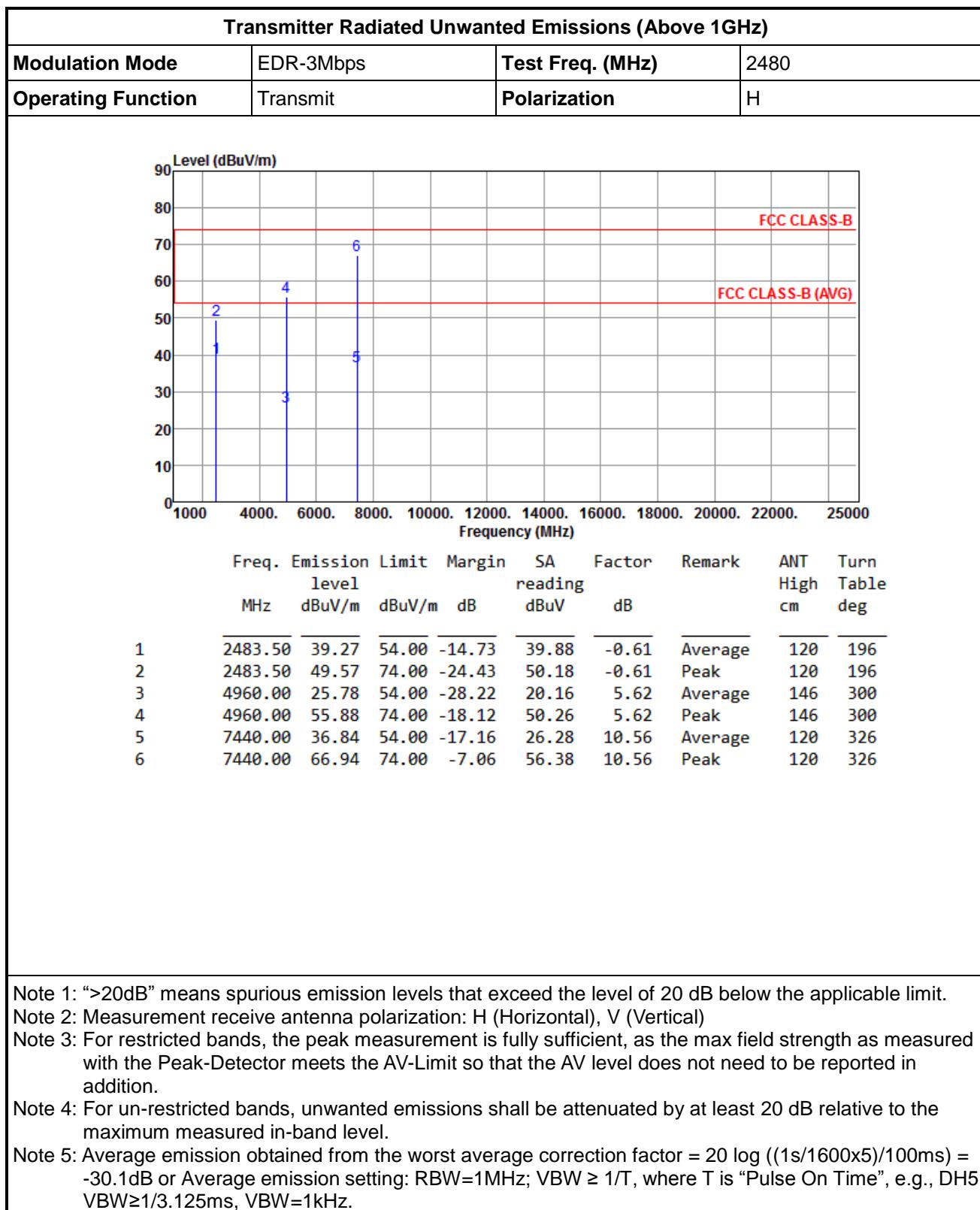
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

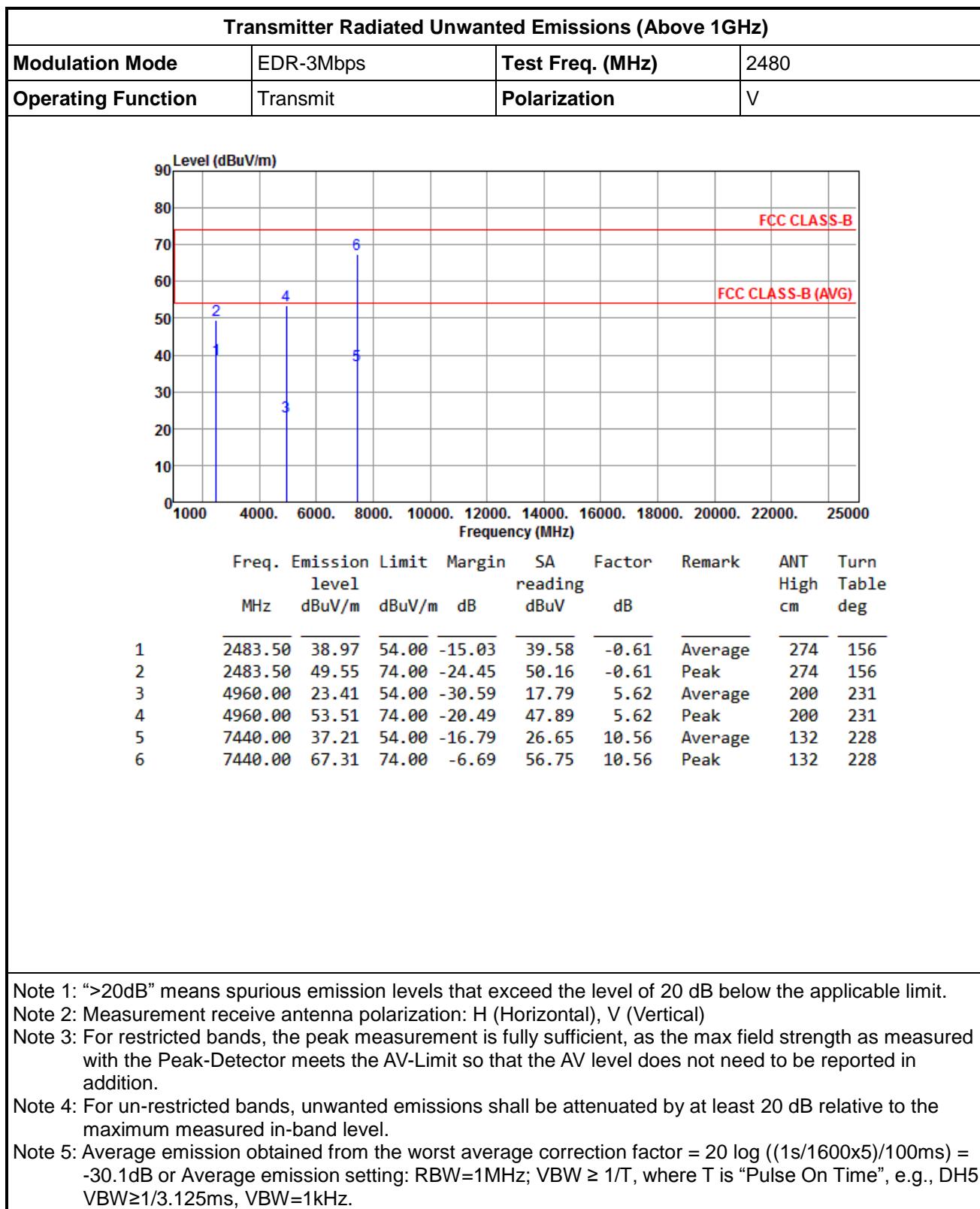
Note 4: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Note 5: Average emission obtained from the worst average correction factor =  $20 \log ((1s/1600x5)/100ms) = -30.1\text{dB}$  or 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

<b>Test Item</b>	RF Conducted				
<b>Test Site</b>	(TH01-HY)				
<b>Instrument</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Calibration Date</b>	<b>Calibration Until</b>
Spectrum Analyzer	R&S	FSV40	101500	May 06, 2015	May 05, 2016
Power Meter	Anritsu	ML2495A	0949003	Feb. 04, 2016	Feb. 03, 2017
Power Sensor	Anritsu	MA2411B	0917017	Feb. 04, 2016	Feb. 03, 2017
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA

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

<b>Test Item</b>	Radiated Emission				
<b>Test Site</b>	966 chamber 3 / (03CH03-WS)				
<b>Instrument</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Calibration Date</b>	<b>Calibration Until</b>
Spectrum Analyzer	Agilent	N9010A	MY53400091	Sep. 14, 2015	Sep. 13, 2016
Receiver	Agilent	N9038A	MY53290044	Oct. 14, 2015	Oct. 13, 2016
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-563	Dec. 29, 2015	Dec. 28, 2016
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Feb. 24, 2016	Feb. 23, 2017
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 04, 2015	Nov. 03, 2016
Loop Antenna	R&S	HFH2-Z2	11900	Nov. 16, 2015	Nov. 15, 2016
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 10, 2015	Dec. 09, 2016
Preamplifier	EMC	EMC02325	980187	Sep. 21, 2015	Sep. 20, 2016
Preamplifier	Agilent	83017A	MY53270014	Sep. 07, 2015	Sep. 06, 2016
Preamplifier	EMC	EMC184045B	980192	Sep. 01, 2015	Aug. 31, 2016
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Feb. 05, 2016	Feb. 04, 2017
RF cable-8M	HUBER+SUHNER	SUCOFLEX104	MY22600/4	Feb. 05, 2016	Feb. 04, 2017
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Feb. 05, 2016	Feb. 04, 2017
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Feb. 05, 2016	Feb. 04, 2017
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Feb. 05, 2016	Feb. 04, 2017
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Feb. 05, 2016	Feb. 04, 2017
Measurement Software	AUDIX	e3	6.120210g	NA	NA

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

<b>Test Item</b>	Conducted Emission				
<b>Test Site</b>	Conduction room 1 / (CO01-WS)				
<b>Instrument</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Calibration Date</b>	<b>Calibration Until</b>
EMC Receiver	R&S	ESCS 30	100169	Oct. 21, 2015	Oct. 20, 2016
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 13, 2015	Nov. 12, 2016
RF Cable-CON	EMC	EMCCFD300-BM-BM-6000	50821	Dec. 21, 2015	Dec. 20, 2016
Measurement Software	AUDIX	e3	6.120210k	NA	NA

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