FCC Test Report

Equipment	:	**Bluetooth Earphone**
Brand Name	:	**Bang & Olufsen**
Model No.	:	**Beoplay H5**
FCC ID	:	**TTUBEOPLAYH5**
Standard	:	**47 CFR FCC Part 15.247**
Operating Band	:	**2400 MHz – 2483.5 MHz**
FCC Classification	:	**DSS**
Applicant	:	**Bang & Olufsen A/S** Peter Bangs Vej 15, DK-7600 Struer, Denmark
Manufacturer		**DongGuan Data Target Electronic Ltd.** Vill.4, Shry Jye District, Shry Jye Town, Dong Guan City, Guang Dong, China

The product sample received on Apr. 19, 2016 and completely tested on May 11, 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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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]: 0.4661720MHz 41.63 (Margin 14.95dB) - QP 34.39 (Margin 12.19dB) - AV	FCC 15.207	Complied
3.2	15.247(a)	20dB Bandwidth	BR: 0.8813MHz	N/A	Complied
3.2	15.247(a)	Carrier Frequency Separation (ChS)	EDR: 0.9986MHz	ChS ≥ BW_{20dB} x2/3.	Complied
3.3	15.247(a)	Number of Hopping Frequencies (N)	Max: 79 Min: 15	N ≥ 15	Complied
3.4	15.247(a)	Time of Occupancy (Dwell Time)	EDR: 0.318sec	0.4 s within 0.4 x N	Complied
3.5	15.247(b)	RF Output Power (Maximum Peak Conducted Output Power)	Power [dBm] BR: 4.36 EDR: 7.06	Power [dBm] BR:21 EDR:21	Complied
3.6	15.247(d)	Transmitter Radiated Bandedge Emissions	[dBuV/m at 3m]: 2319.384MHz 64.13 (Margin 9.87dB) - PK 34.03 (Margin 19.97dB) - 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]:7323.00MHz 72.96 (Margin 1.04dB) – PK 42.86 (Margin 11.14dB) - AV	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied

Revision History

Report No.	Version	Description	Issued Date
FR640908AD	Rev. 01	Initial issue of report	May 23, 2016

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	2402-2480	0-78 [79]	7.06
Note 1: Bluetooth BR uses a GFSK (1Mbps). Note 2: Bluetooth EDR uses a combination of π/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	
☒	Integral antenna (antenna permanently attached)
	☐ Temporary RF connector provided
	☒ 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.
☐	External antenna (dedicated antennas)
	☐ Single power level with corresponding antenna(s).
	☐ Multiple power level and corresponding antenna(s).

Antenna General Information		
Ant. Cat.	**Ant. Type**	**Gain (dBi)**
Integral	Metal PIFA ANT	-0.68

1.1.3 Type of EUT

Identify EUT	
EUT Serial Number	N/A
Presentation of Equipment	☐ Production ; ☒ Pre-Production ; ☐ Prototype

Type of EUT	
☒	Stand-alone
☐	Combined (EUT where the radio part is fully integrated within another device) Combined Equipment - Brand Name / Model No.:
☐	Plug-in radio (EUT intended for a variety of host systems) Host System - Brand Name / Model No.:
☐	Other:

1.1.4 Test Signal Duty Cycle

Operated Mode for Worst Duty Cycle	
☒ Operated test mode for worst duty cycle	
Test Signal Duty Cycle (x)	**Power Duty Factor [dB] – (10 log 1/x)**
☒ 78.68% - test mode single channel-BR-1Mbps	1.04
☒ 79.31% - test mode single channel-EDR-2Mbps	1.01
☒ 79.54% - test mode single channel-EDR-3Mbps	0.99
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	☐ AC mains	☒ DC	
Type of DC Source	☐ External AC supply	☒ From Host System	☒ From Battery

1.2 Accessories and Support Equipment

Accessories				
Battery 1	Brand Name	VARTA	Model Name	CP1254 A2
	Power Rating	3.7 V_{dc}, 50mAh (Per pcs	Type	Li-ion, Button cell
USB Charger 1	Brand Name	Bang & Olufsen	Model Name	1035500
	Signal Line	1.27meter, non-shielded cable, with w/o ferrite core		

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

Support Equipment - RF Conducted			
No.	**Equipment**	**Brand Name**	**Model Name**
1	Notebook	DELL	E6400
2	AC Adapter for Notebook	DELL	HA65NM130

Support Equipment - Radiated Emission			
No.	**Equipment**	**Brand Name**	**Model Name**
1	Notebook	DELL	E5530
2	AC Adapter for Notebook	DELL	DA90E3-00

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							
☒	HWA YA	ADD	:	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.			
		TEL	:	886-3-327-3456	FAX	:	886-3-327-0973

Test Site Registration Number: FCC 553509			
Test Condition	**Test Site No.**	**Test Engineer**	**Test Environment**
AC Conduction	CO04-HY	Ryan	24℃ / 58%
RF Conducted	TH01-HY	Ryan	23.5°C / 63.5%
Radiated Emission	03CH03-HY	Jeff	22.3°C / 56%

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		±0.5%
RF output power, conducted		±0.1 dB
Power density, conducted		±0.5 dB
Unwanted emissions, conducted	±0.4 dB	±0.4 dB
	±0.4 dB	±0.4 dB
	±0.6 dB	±0.6 dB
	±0.5 dB	±0.5 dB
	±0.5 dB	±0.5 dB
	N/A	N/A
All emissions, radiated	±2.5 dB	±2.5 dB
	±2.3 dB	±2.3 dB
	±2.6 dB	±2.6 dB
	±3.6 dB	±3.6 dB
	±3.8 dB	±3.8 dB
	N/A	N/A
Temperature		±0.8 ℃
Humidity		±5 %
DC and low frequency voltages		±0.9%
Time		±1.4 %
Duty Cycle		±0.5 %

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	4.26	EDR-3Mbps
EDR	1	2 Mbps	EDR-2Mbps	6.55	
EDR	1	3 Mbps	EDR-3Mbps	**7.06**	

Note 1: Bluetooth BR uses a combination of GFSK (1Mbps).
Note 2: Bluetooth EDR uses a combination of π/4-DQPSK (2Mbps) and 8DPSK (3Mbps).
Note 3: Modulation modes consist below configuration:
FHSS BR-1Mbps: GFSK (1Mbps), EDR-2Mbps: π/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 Version	Blue Test3 2.6.2		
Modulation Mode	**2402 MHz**	**2441 MHz**	**2480 MHz**
BR,1Mbps	14	14	14
EDR,2Mbps	48	47	47
EDR,3Mbps	48	47	47

2.3 The Worst Case Measurement Configuration

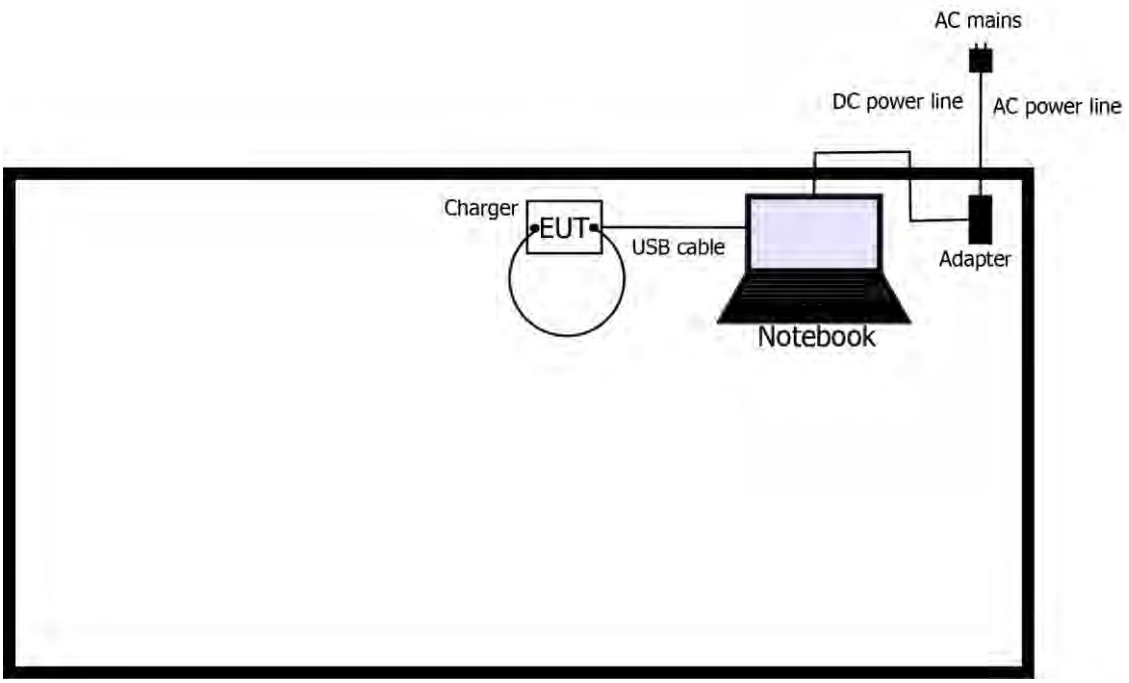
The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
Operating Mode	Operating Mode Description
1	EUT with Notebook via USB Cable & Transmitter

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

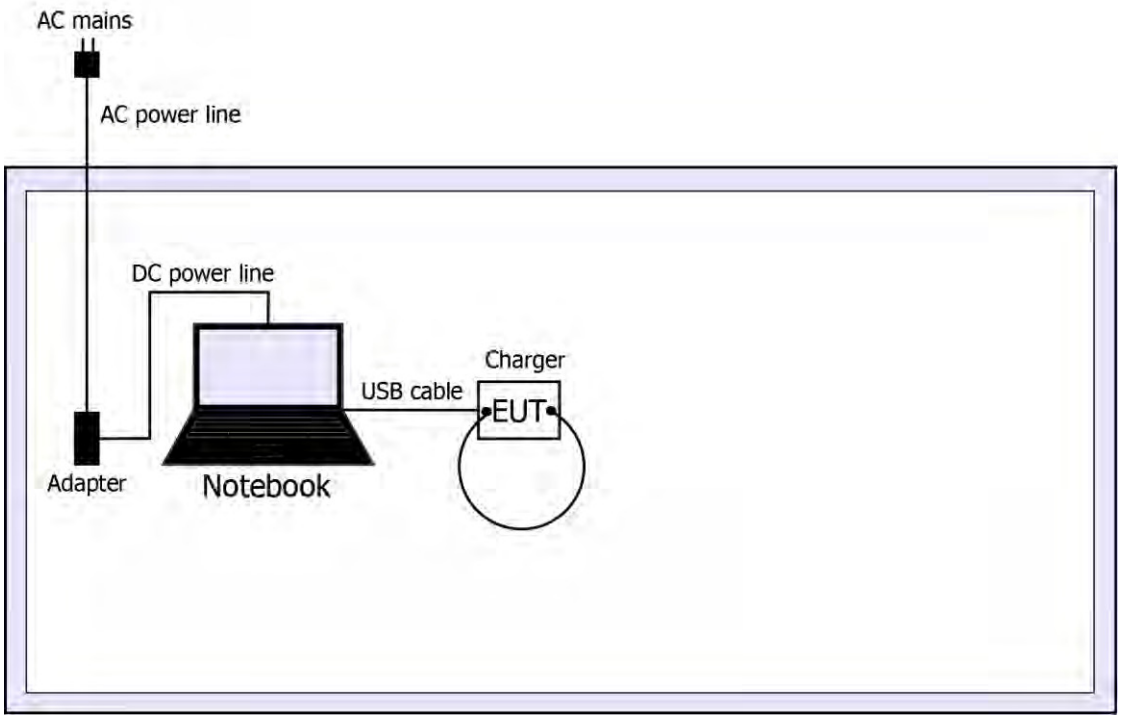
The Worst Case Mode for Following Conformance Tests			
Tests Item	Emission Bandwidth, Fundamental Emissions, Radiated Unwanted Emissions		
Test Condition	Radiated measurement		
User Position	☐ EUT will be placed in fixed position.		
	☒ EUT will be placed in mobile position and operating multiple positions. EUT shall be performed three orthogonal planes.		
	☐ EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions.		
Operating Mode	Operating Mode Description		
1	EUT with Battery & Transmitter		
2	EUT with Notebook via USB Cable & Transmitter		
The operating mode 2 is the worst case and it was record in this test report.			
Modulation Mode	BR-1Mbps, EDR-3Mbps		
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

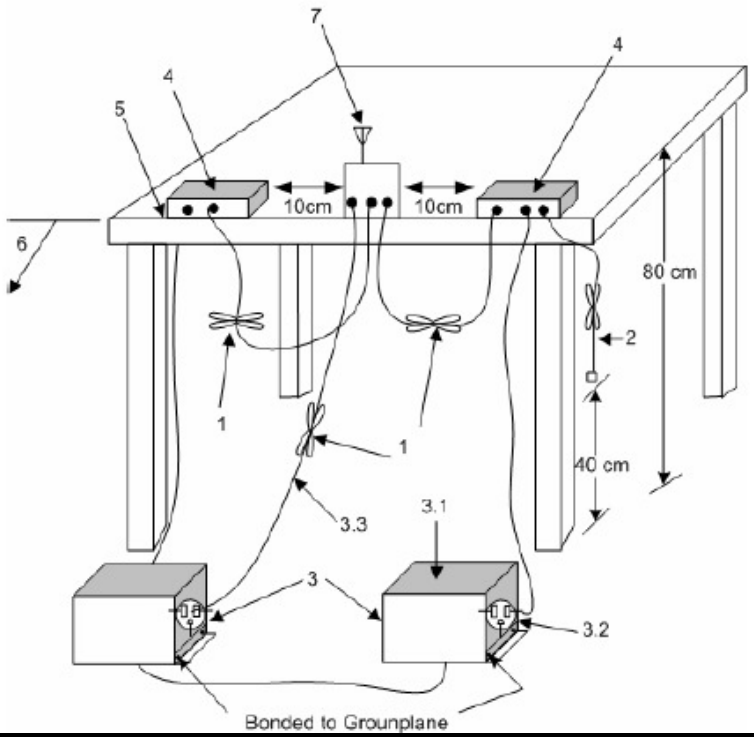
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method
☒ Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.

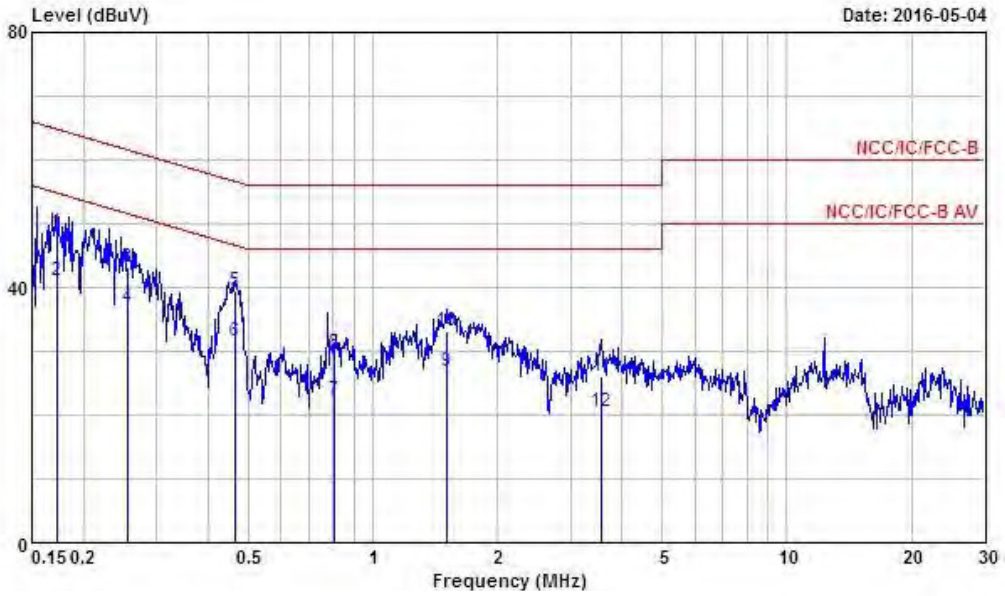
3.1.4 Test Setup

AC Power-line Conducted Emissions



3.1.5 Test Result of AC Power-line Conducted Emissions

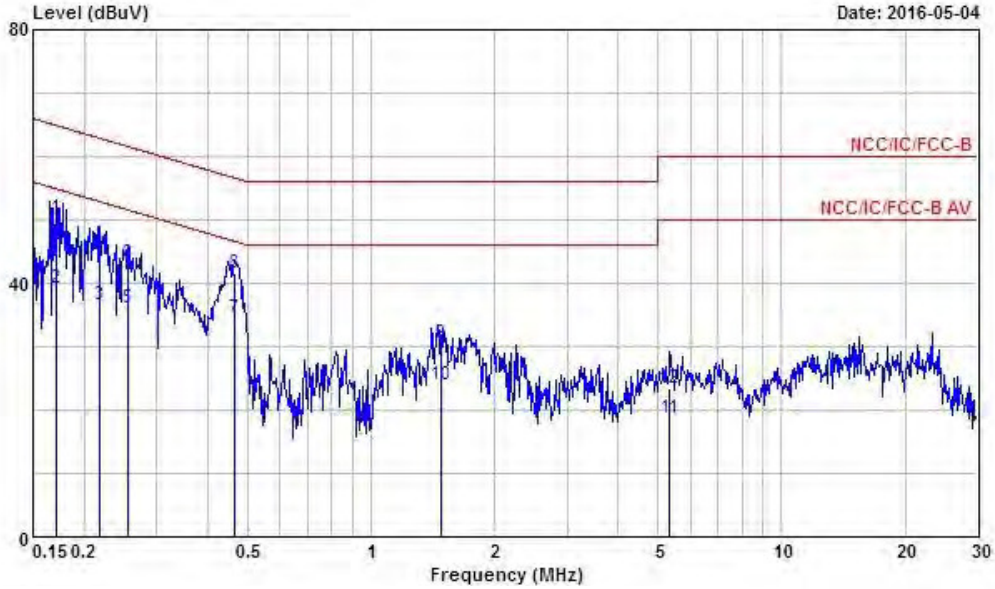
AC Power-line Conducted Emissions Result			
Operating Mode	1	**Power Phase**	Neutral
Operating Function	EUT with Notebook via USB Cable & Transmitter		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.1726540	48.80	-16.03	64.83	48.44	0.10	0.26	QP
2	0.1726540	41.08	-13.75	54.83	40.72	0.10	0.26	Average
3	0.2546720	43.24	-18.36	61.60	42.90	0.11	0.23	QP
4	0.2546720	36.97	-14.63	51.60	36.63	0.11	0.23	Average
5	0.4646720	39.37	-17.24	56.61	39.15	0.12	0.10	QP
6	0.4646720	31.45	-15.16	46.61	31.23	0.12	0.10	Average
7	0.8083120	22.49	-23.51	46.00	22.26	0.13	0.10	Average
8	0.8083120	29.72	-26.28	56.00	29.49	0.13	0.10	QP
9	1.509	26.76	-19.24	46.00	26.40	0.14	0.22	Average
10	1.509	33.23	-22.77	56.00	32.87	0.14	0.22	QP
11	3.570	26.16	-29.84	56.00	25.85	0.18	0.13	QP
12	3.570	20.66	-25.34	46.00	20.35	0.18	0.13	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.)

AC Power-line Conducted Emissions Result			
Operating Mode	1	**Power Phase**	Line
Operating Function	EUT with Notebook via USB Cable & Transmitter		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.1704450	50.17	-14.77	64.94	49.80	0.11	0.26	QP
2	0.1704450	39.32	-15.62	54.94	38.95	0.11	0.26	Average
3	0.2177070	36.69	-16.22	52.91	36.31	0.11	0.27	Average
4	0.2177070	45.08	-17.83	62.91	44.70	0.11	0.27	QP
5	0.2547970	36.16	-15.44	51.60	35.82	0.11	0.23	Average
6	0.2547970	43.05	-18.55	61.60	42.71	0.11	0.23	QP
7	0.4661720	34.39	-12.19	46.58	34.17	0.12	0.10	Average
8	0.4661720	41.63	-14.95	56.58	41.41	0.12	0.10	QP
9	1.476	30.52	-25.48	56.00	30.17	0.14	0.21	QP
10	1.476	23.84	-22.16	46.00	23.49	0.14	0.21	Average
11	5.330	18.78	-31.22	50.00	18.45	0.20	0.13	Average
12	5.330	23.49	-36.51	60.00	23.16	0.20	0.13	QP

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	
☒	2400-2483.5 MHz Band:
	☐ N ≥ 75 and ChS ≥ MAX (20 dB bandwidth, 25 kHz).
	☒ 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

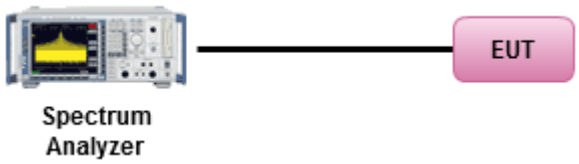
Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method	
☒	Refer as 15.247(a), clause 6.9.2 for 20 dB bandwidth measurement.
☒	Refer as 15.247(a), clause 7.8.2 for carrier frequency separation measurement.
☒	For conducted measurement.
	☒ The EUT supports single transmit chain and measurements performed on this transmit chain.
	☐ The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.

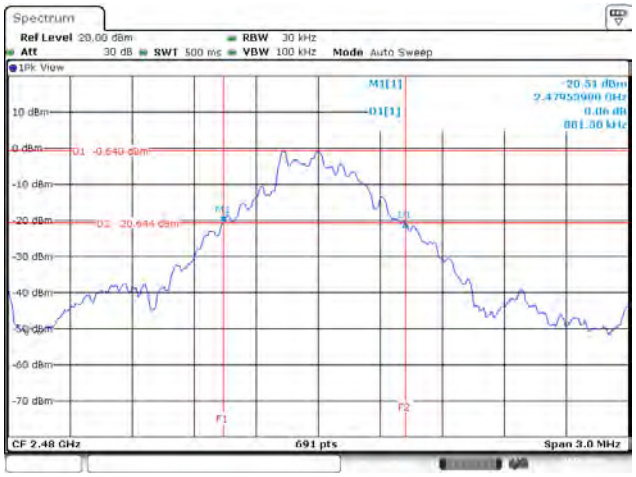
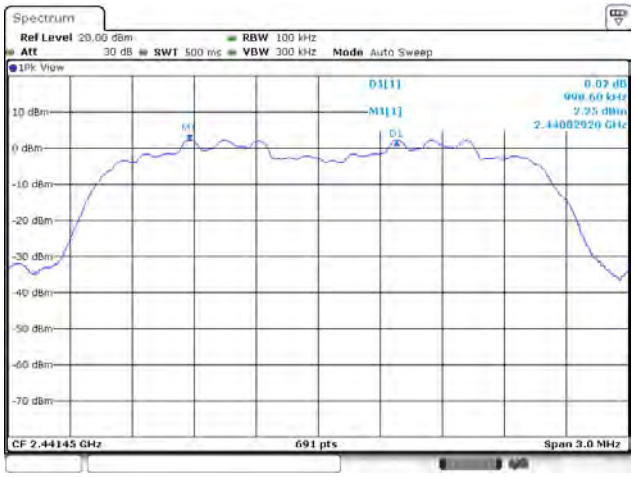
3.2.4 Test Setup

20dB Bandwidth and Carrier Frequency Separation



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	0.9421	0.8726	1.0029	0.628
BR-1Mbps	2441	0.8900	0.8422	0.9986	0.593
BR-1Mbps	2480	0.8813	0.8422	0.9942	0.588
EDR-3Mbps	2402	1.2547	1.1591	1.0029	0.836
EDR-3Mbps	2441	1.2547	1.1548	0.9986	0.836
EDR-3Mbps	2480	1.2547	1.1591	1.0029	0.836
Result		**Complied**			

Worst 20dB Bandwidth Plots	Worst Carrier Frequency Separation Plots
BR-1Mbps	**EDR-3Mbps**
	

3.3 Number of Hopping Frequencies

3.3.1 Number of Hopping Frequencies Limit

Number of Hopping Frequencies Limit for Frequency Hopping Systems	
☒	2400-2483.5 MHz Band:
	☐ N ≥ 75 and ChS ≥ MAX (20 dB bandwidth, 25 kHz).
	☒ N ≥ 15 and ChS ≥ MAX (20 dB bandwidth x 2/3, 25 kHz).
N: Number of Hopping Frequencies; **ChS**: Hopping Channel Separation	

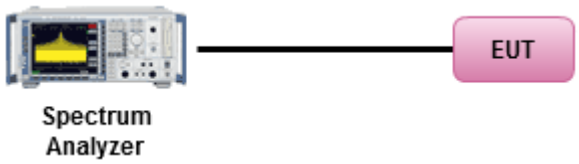
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
☒	Refer as ANSI C63.10, clause 7.8.3 for number of hopping frequencies measurement.
☒	For conducted measurement.
	☒ The EUT supports single transmit chain and measurements performed on this transmit chain.
	☐ The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.

3.3.4 Test Setup

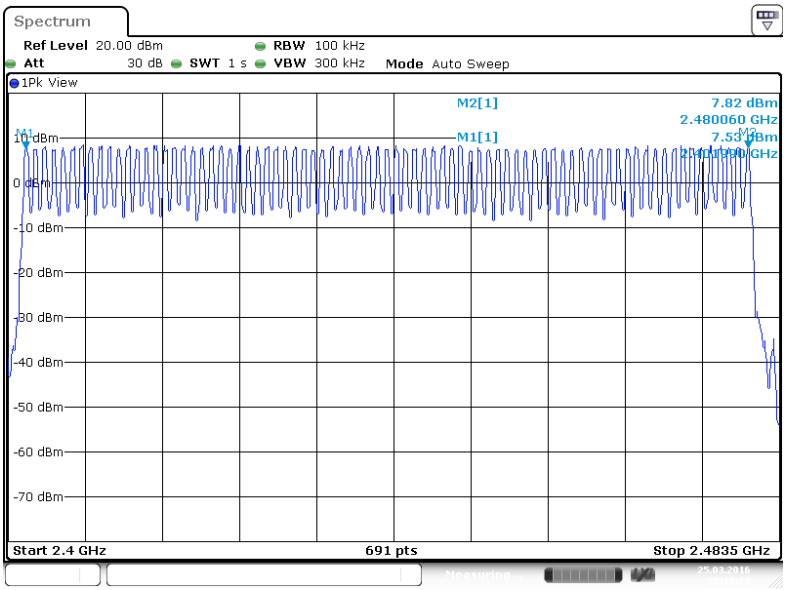
Number of Hopping Frequencies


3.3.5 Test Result of Number of Hopping Frequencies

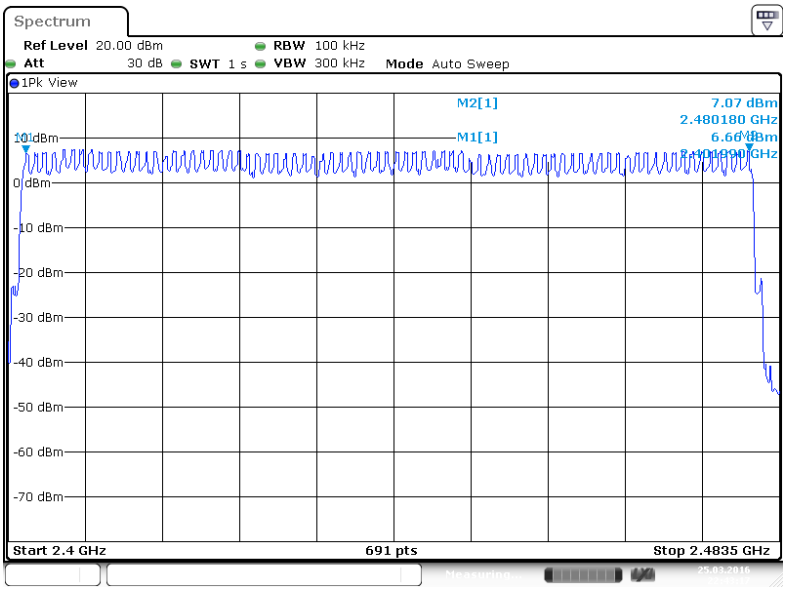
Number of Hopping Frequencies Result			
Modulation Mode	**Freq. (MHz)**	**Hopping Channel Number (N)**	**Hopping Channel Number Limits**
BR-1Mbps	2402-2480	79	15
EDR-3Mbps	2402-2480	79	15
Result	**Complied**		

Number of Hopping Frequencies Plots

BR-1Mbps



EDR-3Mbps



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
☒ 2400-2483.5 MHz Band: Dwell time ≤ 0.4 second within 0.4 x N
N: Number of Hopping Frequencies

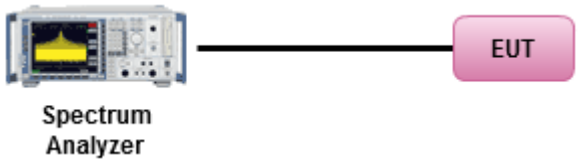
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method		
☒	Refer as 15.247(a), clause 7.8.4 for dwell time measurement.	
☒	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.	
	☒	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 x 31.6 = 320 within 31.6 seconds.
	☒	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 x 31.6 = 160 within 31.6 seconds.
	☒	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 x 31.6 = 106.6 within 31.6 seconds
☒	For conducted measurement.	
	☒	The EUT supports single transmit chain and measurements performed on this transmit chain.
	☐	The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.

3.4.4 Test Setup

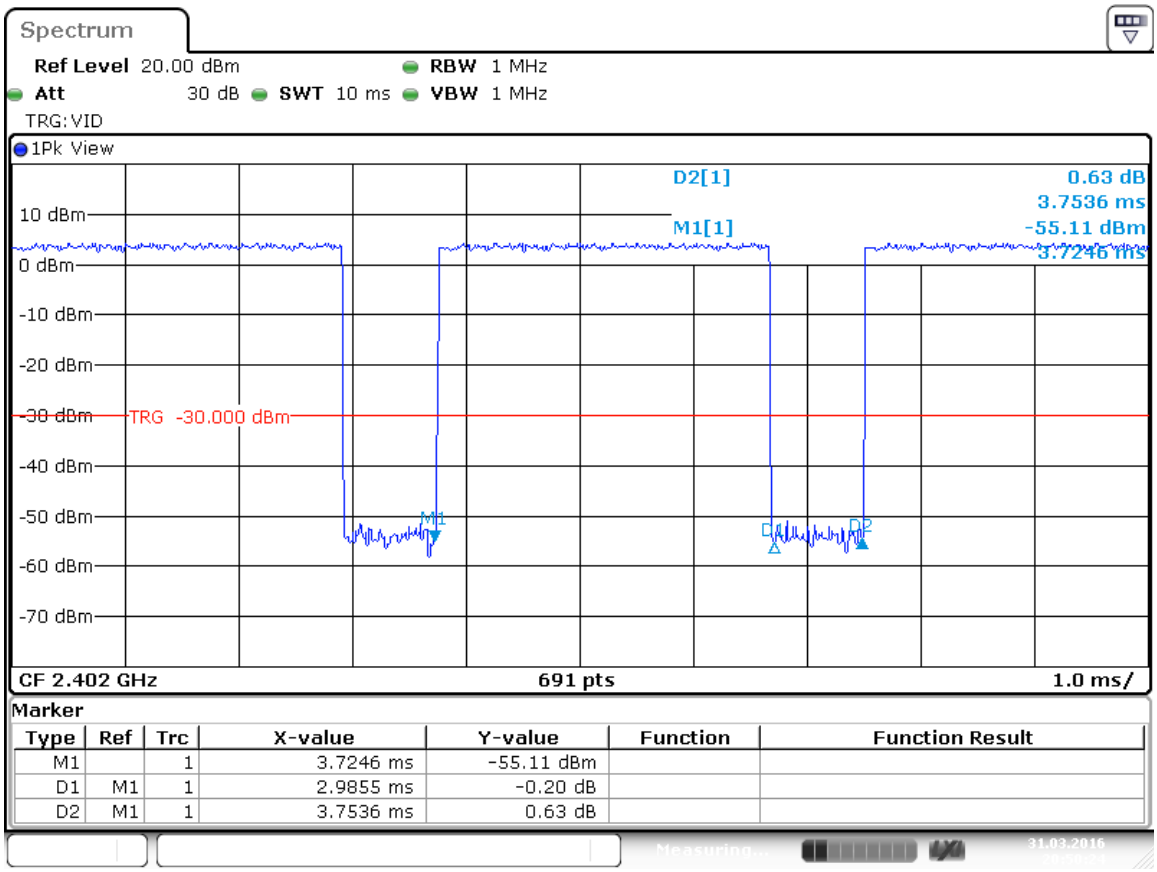
Time of Occupancy (Dwell Time)


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	2.99	106.7	0.318	0.4
Result		**Complied**			
Bluetooth ACL packets can be 1, 3, or 5 time slots. The DH1 packet can cover a single time slot. The DH3 packet can cover up to 3 time slots. The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle. A maximum length packet has duration of 5 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is 5/1600 seconds, or 3.125ms.					

Worst Pulse Time per Hop Plots

EDR-3Mbps



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			
☒	2400-2483.5 MHz Band:		
	☐	For Hopping Channel: N ≥ 75	
		☐	If G_{TX} ≤ 6 dBi, then P_{Out} ≤ 30 dBm (1 W)
		☐	If G_{TX} > 6 dBi, then P_{Out} = 30 – (G_{TX} – 6) dBm
	☒	For Hopping Channel: N ≥ 15	
		☒	If G_{TX} ≤ 6 dBi, then P_{Out} ≤ 21 dBm (0.125 W)
		☐	If G_{TX} > 6 dBi, then P_{Out} = 21 – (G_{TX} – 6) dBm
e.i.r.p. Power Limit:			
☒	2400-2483.5 MHz Band:		
	☐	For Hopping Channel: N ≥ 75 - P_{eirp} ≤ 36 dBm (4 W)	
	☒	For Hopping Channel: N ≥ 15 - P_{eirp} ≤ 27 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		
☒	Maximum Peak Conducted Output Power	
	☐	Refer as FCC DA 00-0705, spectrum analyzer for peak power.
	☒	Refer as FCC DA 00-0705, peak power meter for peak power.
	☐	Refer as ANSI C63.10, clause 11.9.1.3) for peak power meter.
	☐	Refer as ANSI C63.10, clause 11.9.1.1) for spectrum analyzer - (RBW ≥ EBW).
☒	For conducted measurement.	
	☒	The EUT supports single transmit chain and measurements performed on this transmit chain.
	☐	The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.

3.5.4 Test Setup

RF Output Power (Peak Power Meter)

3.5.5 Test Result of Maximum Peak Conducted Output Power

Maximum Peak Conducted Output Power Result						
Condition		RF Output Power (dBm)				
Modulation Mode	Freq. (MHz)	RF Output Power	Power Limit	Antenna Gain (dBi)	EIRP Power	EIRP Limit
BR-1Mbps	2402	4.26	21	-0.68	3.58	27
BR-1Mbps	2441	4.36	21	-0.68	3.68	27
BR-1Mbps	2480	4.26	21	-0.68	3.58	27
EDR-3Mbps	2402	6.69	21	-0.68	6.01	27
EDR-3Mbps	2441	6.91	21	-0.68	6.23	27
EDR-3Mbps	2480	7.06	21	-0.68	6.38	27
Result		Complied				

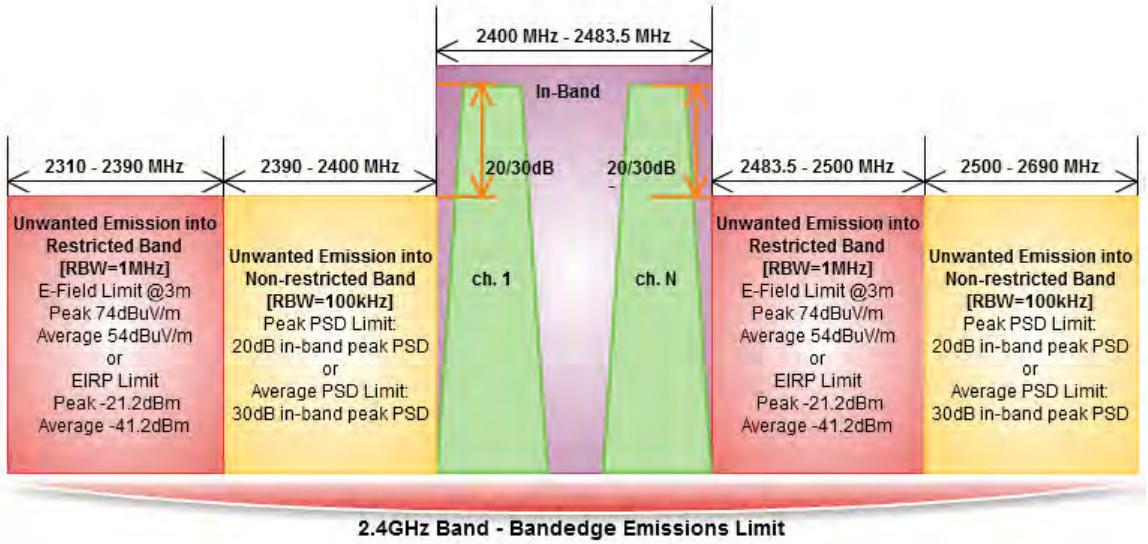
3.5.6 Test Result of Maximum Average Conducted Output Power

Maximum Average Conducted Output Power Result						
Condition		RF Output Power (dBm)				
Modulation Mode	Freq. (MHz)	Average Power	Duty Factor (dB)	RF Output Power	Antenna Gain (dBi)	EIRP Power
BR-1Mbps	2402	2.83	1.04	3.87	-0.68	3.19
BR-1Mbps	2441	2.94	1.04	3.98	-0.68	3.30
BR-1Mbps	2480	2.81	1.04	3.85	-0.68	3.17
EDR-3Mbps	2402	2.76	0.99	3.75	-0.68	3.07
EDR-3Mbps	2441	2.78	0.99	3.77	-0.68	3.09
EDR-3Mbps	2480	2.93	0.99	3.92	-0.68	3.24
Result		Complied				

3.6 Transmitter Radiated Bandedge Emissions

3.6.1 Transmitter Radiated Bandedge Emissions Limit

Transmitter Radiated Bandedge Emissions Limit



3.6.2 Measuring Instruments

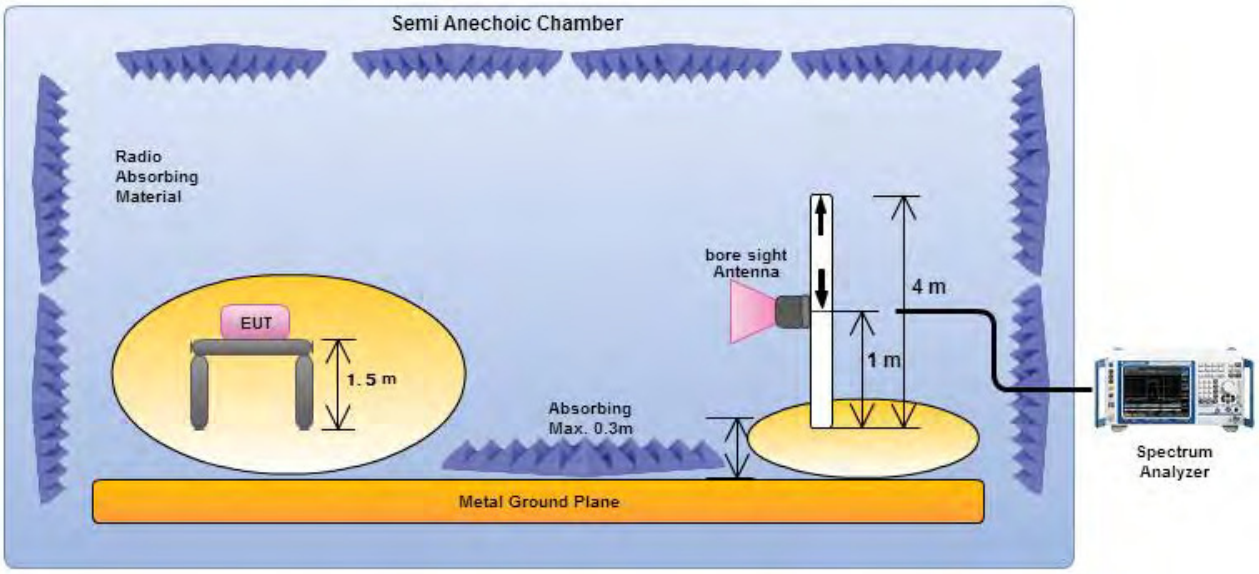
Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

Test Method – General Information			
☒	The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].		
☒	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.		
☒	For the transmitter unwanted emissions shall be measured using following options below:		
	☒	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.	
	☒	For unwanted emissions into restricted bands.	
		☒	Refer as ANSI C63.10, clause 4.1.4.2.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.
		☐	Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.
		☒	Refer as ANSI C63.10, clause 4.1.4.2.2 measurement procedure peak limit.
☒	For the transmitter bandedge emissions shall be measured using following options below:		
	☒	Refer as ANSI C63.10, clause 6.10 for band-edge testing.	
	☐	Refer as ANSI C63.10, clause 6.10.6.2 for marker-delta method for band-edge measurements.	
	☒	Refer as ANSI C63.10, clause 7.8.6 for band-edge testing into non-restricted bands.	
☒	Refer as ANSI C63.10, clause 6.6 for radiated emissions and test distance is 3m.		

3.6.4 Test Setup

Transmitter Radiated Bandedge Emissions



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

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	100.48	2399.964	58.94	41.54	20	V
BR -1Mbps	2480	104.45	2524.320	53.43	51.02	20	V
EDR-2Mbps	2402	101.58	2399.964	58.91	42.67	20	V
EDR-2Mbps	2480	100.48	2501.120	55.04	45.44	20	V
EDR-3Mbps	2402	101.58	2399.964	59.37	42.21	20	V
EDR-3Mbps	2480	100.57	2503.680	54.47	46.10	20	V

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	2336.928	63.43	74	2336.928	33.33	54	V
BR -1Mbps	2480	3	2498.880	63.49	74	2498.880	33.39	54	V
EDR-2Mbps	2402	3	2339.172	63.32	74	2339.172	33.22	54	V
EDR-2Mbps	2480	3	2486.400	63.37	74	2486.400	33.27	54	V
EDR-3Mbps	2402	3	2319.384	64.13	74	2319.384	34.03	54	V
EDR-3Mbps	2480	3	2497.760	63.43	74	2497.760	33.33	54	V

Note 1: Measurement worst emissions of receive antenna polarization.
Note 2: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is “Pulse On Time”, e.g., DH5 VBW≥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

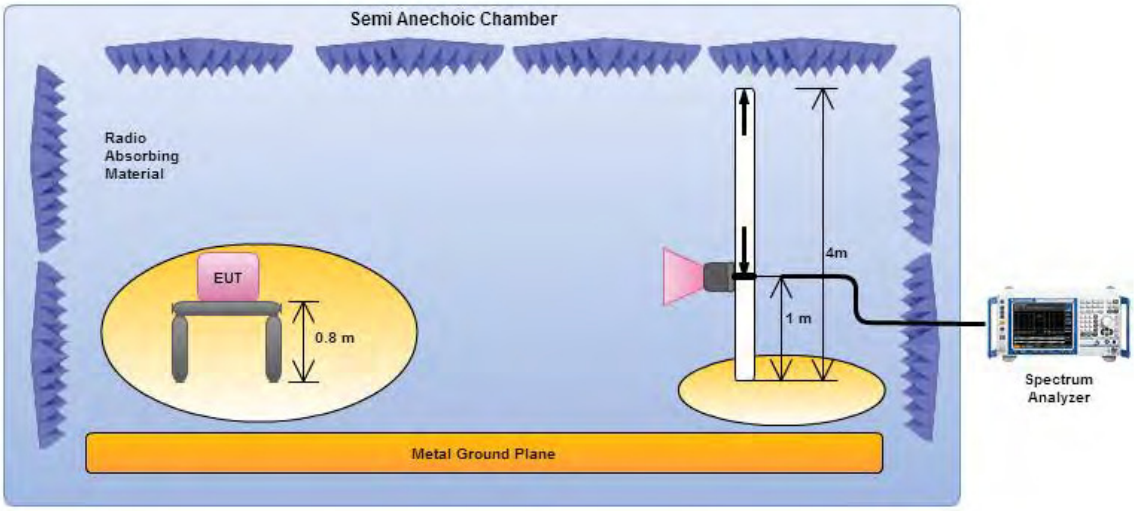
Refer a test equipment and calibration data table in this test report.

3.7.3 Test Procedures

Test Method – General Information			
☒	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).		
☒	The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].		
☒	For the transmitter unwanted emissions shall be measured using following options below:		
	☒	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 20log (dwell time/100 ms)	
	☐	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.	
	☒	For unwanted emissions into restricted bands.	
		☒	Refer as ANSI C63.10, clause 4.1.4.2.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.
		☐	Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.
		☒	Refer as ANSI C63.10, clause 4.1.4.2.2 measurement procedure peak limit.
☒	For radiated measurement.		
	☒	Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m.	
	☒	Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m.	
	☒	Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1 GHz and test distance is 3m.	
☒	The any unwanted emissions level shall not exceed the fundamental emission level.		
☒	All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.		

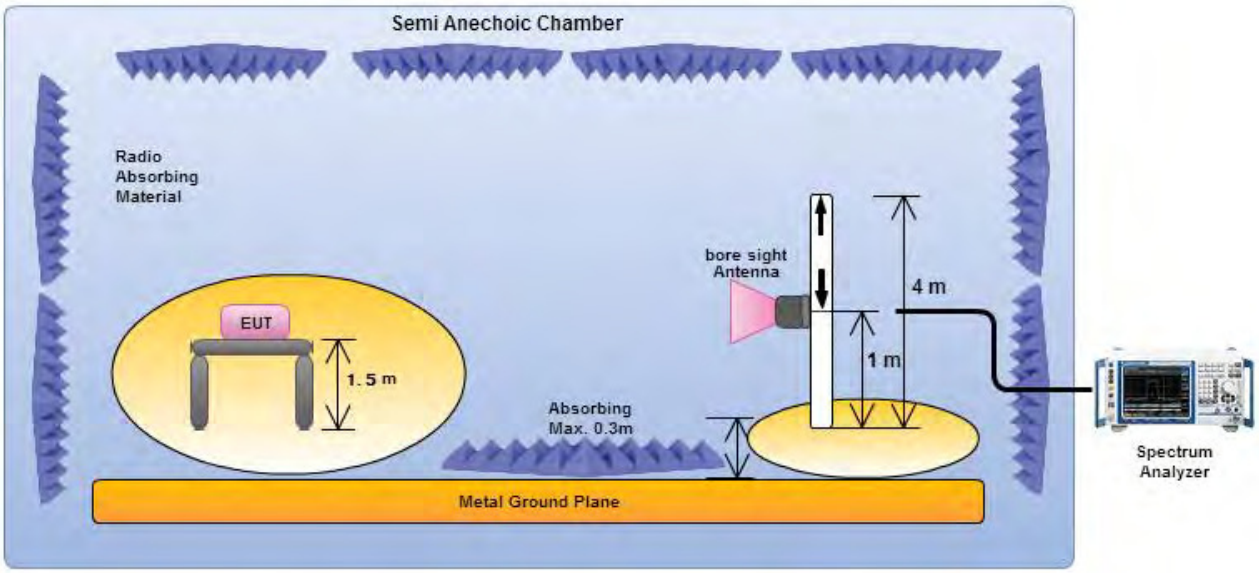
3.7.4 Test Setup

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)



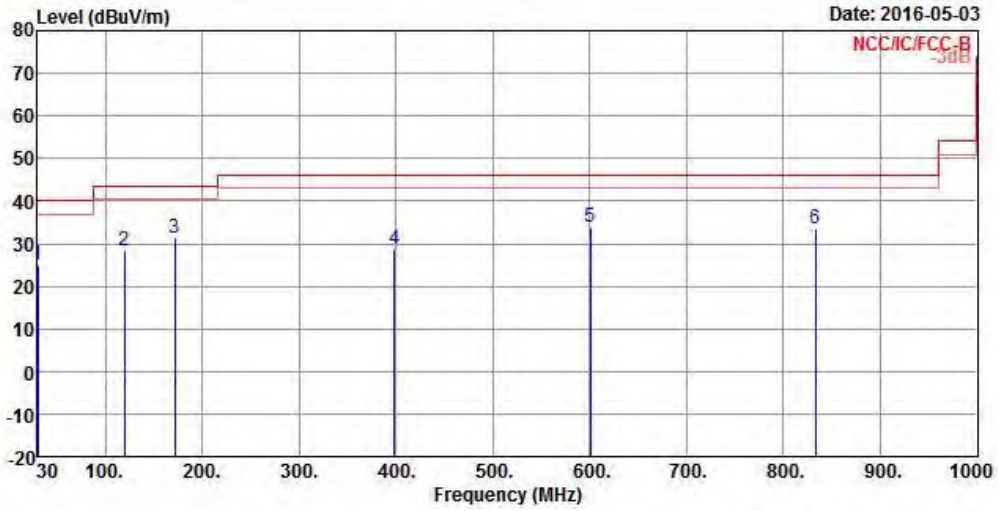
Electric field tests shall be performed in the frequency range of 1 GHz to 10th harmonic of highest fundamental frequency or 40 GHz using a calibrated horn antenna.

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)

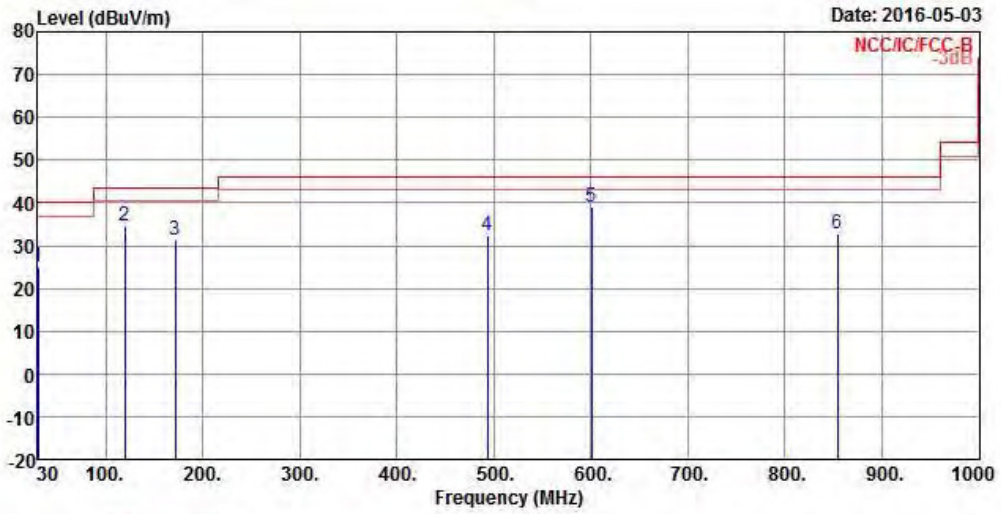
Transmitter Radiated Unwanted Emissions (Below 1GHz)			
Operating Mode	2	**Polarization**	V
Operating Function	EUT with Notebook via USB Cable & Transmitter		



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	30.000	25.16	-14.84	40.00	26.33	25.62	0.78	27.57	Peak
2	119.240	28.16	-15.34	43.50	34.93	18.81	1.69	27.27	Peak
3	171.620	31.21	-12.29	43.50	40.32	15.89	2.07	27.07	Peak
4	398.600	28.73	-17.27	46.00	30.48	22.33	3.24	27.32	Peak
5	600.360	33.81	-12.19	46.00	32.89	24.84	4.07	27.99	QP
6	833.160	33.46	-12.54	46.00	29.57	26.97	4.65	27.73	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)

Transmitter Radiated Unwanted Emissions (Below 1GHz)			
Operating Mode	2	**Polarization**	H
Operating Function	EUT with Notebook via USB Cable & Transmitter		

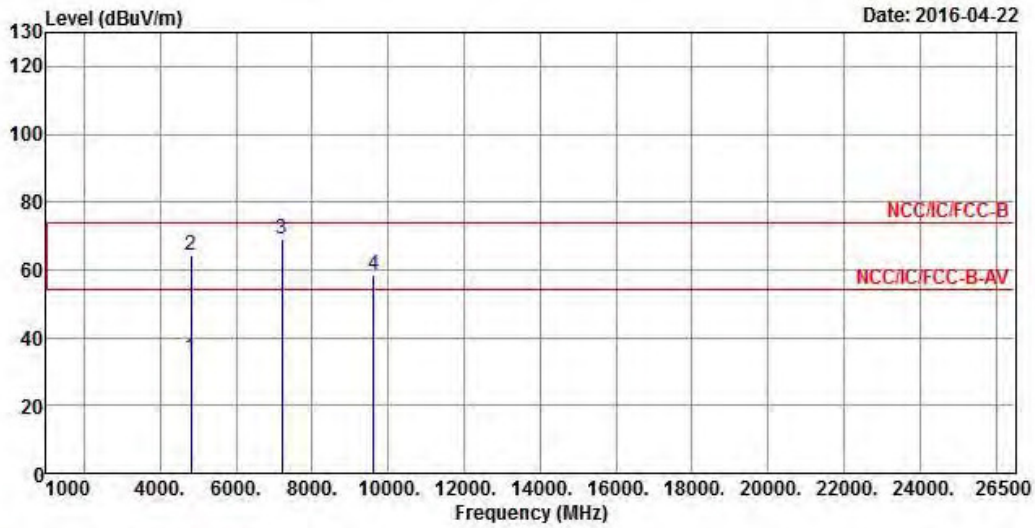


	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	30.000	24.86	-15.14	40.00	26.03	25.62	0.78	27.57	Peak
2	119.240	34.63	-8.87	43.50	41.40	18.81	1.69	27.27	Peak
3	171.620	31.37	-12.13	43.50	40.48	15.89	2.07	27.07	Peak
4	493.660	32.23	-13.77	46.00	32.81	23.70	3.54	27.82	Peak
5	600.360	38.90	-7.10	46.00	37.98	24.84	4.07	27.99	Peak
6	854.500	32.88	-13.12	46.00	28.67	27.19	4.71	27.69	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)

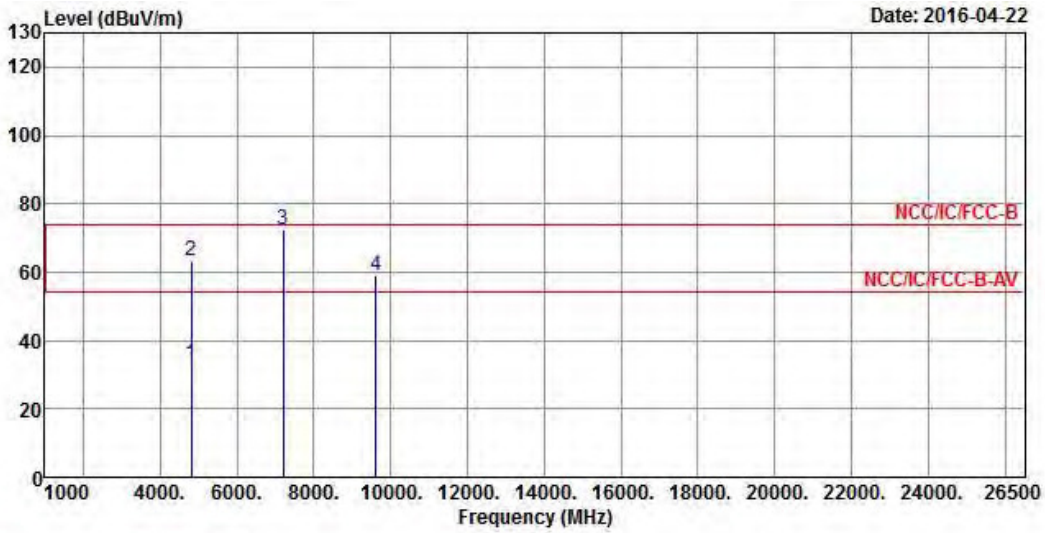
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	BR-1Mbps	**Test Freq. (MHz)**	2402
Operating Function	Transmit	**Polarization**	V



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4804.000	34.19	-19.81	54.00	28.36	33.02	5.36	32.55	Average
2	4804.000	64.29	-9.71	74.00	58.46	33.02	5.36	32.55	Peak
3	7206.000	69.32			59.31	35.74	7.04	32.77	Peak
4	9608.000	58.64			45.46	38.11	8.29	33.22	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 (100.69dBuV/m).
Note 5: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is “Pulse On Time”, e.g., DH5 VBW≥1/3.125ms, VBW=1kHz.

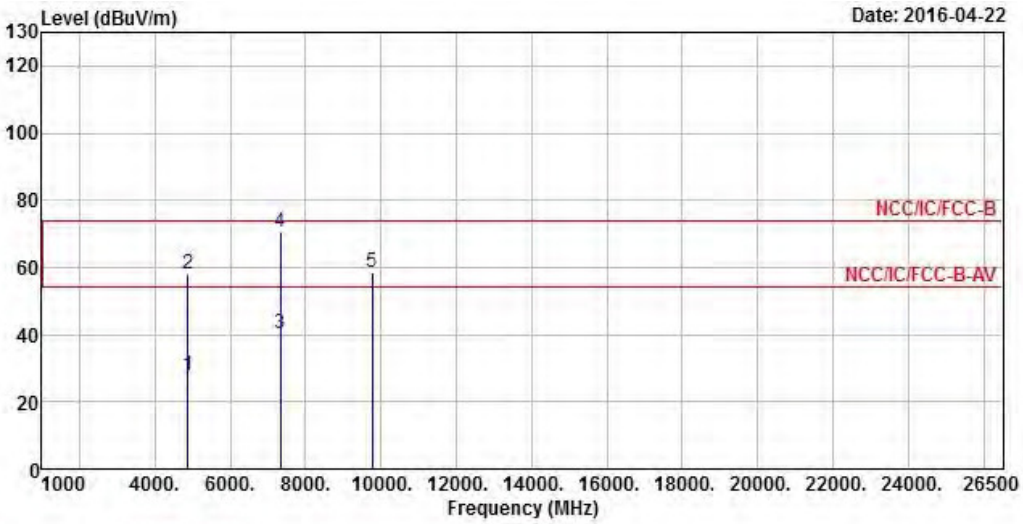
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	BR-1Mbps	**Test Freq. (MHz)**	2402
Operating Function	Transmit	**Polarization**	H



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4804.000	33.04	-20.96	54.00	27.21	33.02	5.36	32.55	Average
2	4804.000	63.14	-10.86	74.00	57.31	33.02	5.36	32.55	Peak
3	7206.000	72.25			62.24	35.74	7.04	32.77	Peak
4	9608.000	58.85			45.67	38.11	8.29	33.22	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 (100.69dBuV/m).
Note 5: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is “Pulse On Time”, e.g., DH5 VBW≥1/3.125ms, VBW=1kHz.

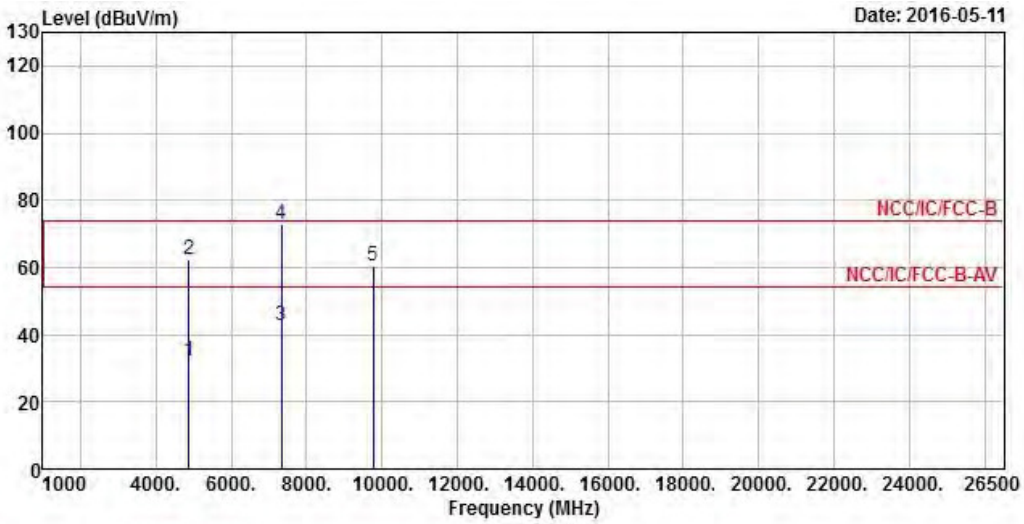
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	BR-1Mbps	**Test Freq. (MHz)**	2441
Operating Function	Transmit	**Polarization**	V



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4882.000	28.04	-25.96	54.00	21.90	33.16	5.51	32.53	Average
2	4882.000	58.14	-15.86	74.00	52.00	33.16	5.51	32.53	Peak
3	7323.000	40.31	-13.69	54.00	30.05	36.05	7.02	32.81	Average
4	7323.000	70.41	-3.59	74.00	60.15	36.05	7.02	32.81	Peak
5	9764.000	58.60			45.17	38.45	8.19	33.21	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 (102.32dBuV/m).
Note 5: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is “Pulse On Time”, e.g., DH5 VBW≥1/3.125ms, VBW=1kHz.

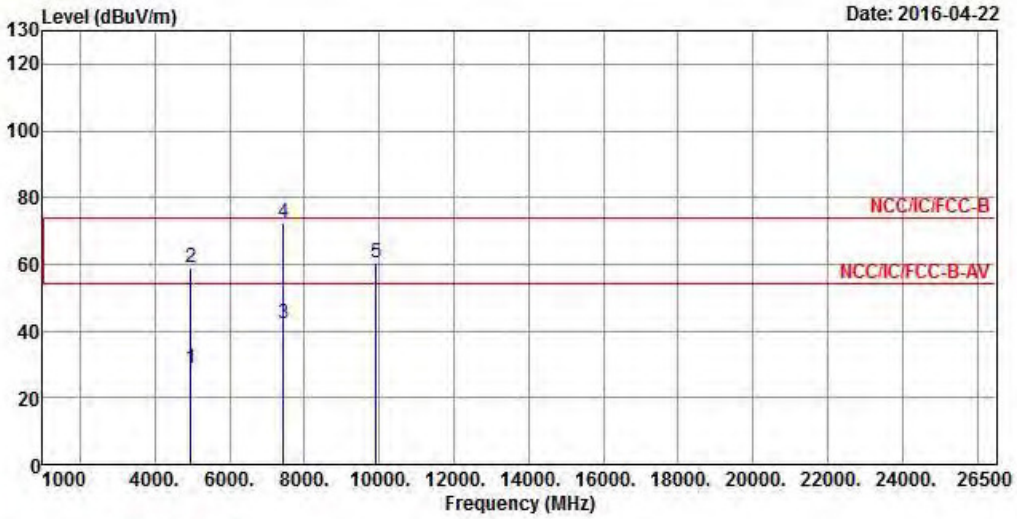
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	BR-1Mbps	**Test Freq. (MHz)**	2441
Operating Function	Transmit	**Polarization**	H



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4882.000	32.35	-21.65	54.00	26.21	33.16	5.51	32.53	Average
2	4882.000	62.45	-11.55	74.00	56.31	33.16	5.51	32.53	Peak
3	7323.000	42.86	-11.14	54.00	32.60	36.05	7.02	32.81	Average
4	7323.000	72.96	-1.04	74.00	62.70	36.05	7.02	32.81	Peak
5	9764.000	60.57			47.14	38.45	8.19	33.21	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 (102.32 dBuV/m).
Note 5: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is “Pulse On Time”, e.g., DH5 VBW≥1/3.125ms, VBW=1kHz.

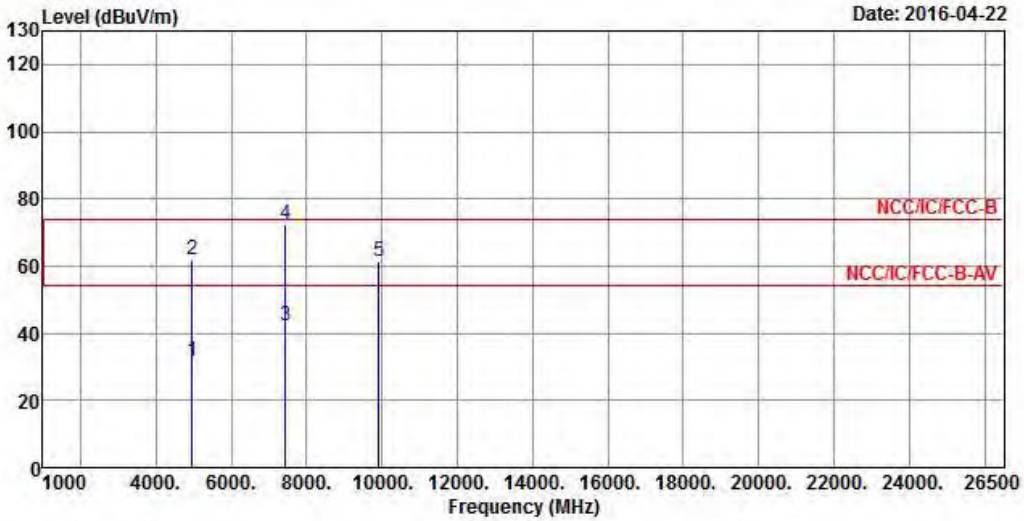
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	BR-1Mbps	**Test Freq. (MHz)**	2480
Operating Function	Transmit	**Polarization**	V



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4960.000	28.69	-25.31	54.00	22.22	33.33	5.66	32.52	Average
2	4960.000	58.79	-15.21	74.00	52.32	33.33	5.66	32.52	Peak
3	7440.000	42.20	-11.80	54.00	31.64	36.37	7.04	32.85	Average
4	7440.000	72.30	-1.70	74.00	61.74	36.37	7.04	32.85	Peak
5	9920.000	60.26			46.49	38.76	8.21	33.20	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 (104.63 dBuV/m).
Note 5: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is “Pulse On Time”, e.g., DH5 VBW≥1/3.125ms, VBW=1kHz.

Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	BR-1Mbps	**Test Freq. (MHz)**	2480
Operating Function	Transmit	**Polarization**	H



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4960.000	31.72	-22.28	54.00	25.25	33.33	5.66	32.52	Average
2	4960.000	61.82	-12.18	74.00	55.35	33.33	5.66	32.52	Peak
3	7440.000	42.23	-11.77	54.00	31.67	36.37	7.04	32.85	Average
4	7440.000	72.33	-1.67	74.00	61.77	36.37	7.04	32.85	Peak
5	9920.000	61.38			47.61	38.76	8.21	33.20	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 (104.63 dBuV/m).
Note 5: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is “Pulse On Time”, e.g., DH5 VBW≥1/3.125ms, 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	KETSIGHT	N9038A	MY54130031	20Hz ~ 8.4GHz	Apr. 14, 2016	Apr. 13, 2017
LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	8127-477	9kHz ~ 30MHz	Jan. 26, 2016	Jan. 25, 2017
RF Cable-CON	HUBER+SUHNER	RG213/U	07611832020001	9kHz ~ 30MHz	Oct. 30, 2015	Oct. 29, 2016
EMI Filter	LINDGREN	LRE-2030	2651	< 450 Hz	NCR	NCR

< 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. 04 ,2016	Feb. 03 ,2017
Power Meter	Anritsu	ML2495A	0949003	300MHz ~ 40GHz	Feb. 04, 2016	Feb. 03, 2017

< Radiated Emission >

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Last Cal.	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz ~ 1GHz 3m	Nov. 28, 2015	Nov. 27, 2016
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	1GHz ~ 18GHz 3m	Dec. 16, 2015	Dec. 15, 2016
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	May 11, 2015	May 10, 2016
Amplifier	Agilent	8449B	3008A02120	1GHz ~ 26.5GHz	Sep. 02, 2015	Sep. 01, 2016
Spectrum	R&S	FSV40	101513	9kHz ~ 40GHz	Feb. 16, 2016	Feb. 15, 2017
Bilog Antenna	SCHAFFNER	CBL 6112D	22237	30MHz ~ 1GHz	Sep. 18, 2015	Sep. 17, 2016
Horn Antenna	ETS・LINDGREN	3115	6741	1GHz ~ 18GHz	Jul. 15, 2015	Jul. 14, 2016
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	18GHz ~ 40GHz	Jan. 29, 2016	Jan. 28, 2017
Loop Antenna	R&S	HFH2-Z2	100330	9 kHz~30 MHz	Nov.16.2015	Nov.15.2017