

FCC Test Report

Equipment : ASUS Tablet
Brand Name : ASUS
Model No. : P023
FCC ID : MSQP023
Standard : 47 CFR FCC Part 15.247
Operating Band : 2400 MHz – 2483.5 MHz
Equipment Class : DSS
Applicant : ASUSTeK COMPUTER INC.
Manufacturer : 4F, No. 150, LI-TE RD., PEITOU, TAIPEI, TAIWAN

The product sample received on May 08, 2015 and completely tested on Jun. 02, 2015. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2009 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:


Vic Hsiao / Supervisor

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Summary of Test Result

Conformance Test Specifications					
Report Clause	Ref. Std. Clause	Description	Measured	Limit	Result
1.1.1	15.203	Antenna Requirement	Antenna connector mechanism complied	FCC 15.203	Complied
3.1	15.207	AC Power-line Conducted Emissions	[dBuV]: 2.840 MHz 44.01 (Margin 11.99 dB) - QP 35.21 (Margin 10.79 dB) - AV	FCC 15.207	Complied
3.2	15.247(a)	20dB Bandwidth	EDR: 1.3589 MHz	N/A	Complied
3.2	15.247(a)	Carrier Frequency Separation (ChS)	EDR: 0.9986 MHz	ChS $\geq$ BW _{20dB} x 2/3.	Complied
3.3	15.247(a)	Number of Hopping Frequencies (N)	Max: 79 Min: 15	N $\geq$ 15	Complied
3.4	15.247(a)	Time of Occupancy (Dwell Time)	EDR: 0.325 sec	0.4 s within 0.4 x N	Complied
3.5	15.247(b)	RF Output Power (that Maximum Peak Conducted Output Power)	Power [dBm] BR: 5.16 EDR: 5.79	Power [dBm] BR:21 EDR:21	Complied
3.6	15.247(c)	Transmitter Radiated Bandedge Emissions	Restricted Bands [dBuV/m at 3m]: 2483.53 MHz 58.34 (Margin 15.66 dB) - PK 45.98 (Margin 8.02 dB) - AV	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied
3.7	15.247(c)	Transmitter Radiated Unwanted Emissions	Restricted Bands [dBuV/m at 3m]: 598.42 MHz 40.30 (Margin 5.70 dB) - PK	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied



Report No. : FR550468-01AD

Revision History

[illegible]

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]	5.79
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	
☒	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.

Antenna General Information			
No.	Ant. Cat.	Ant. Type	Gain (dBi)
1	Integral	PIFA	2.75

1.1.3 SKU Information

SKU NO.	Sku 1	Sku 2
M/B	Z300C MAIN BOARD HDI	
CPU	INTEL PMB8016 E100 SoFIA 3GR 361 balls pin	
eMMC	KINGSTON / KE4CN3K6A // 8G	HYNIX / H26M52103FMR //16G
Memory	LPDDR3	LPDDR3
	ELPIDA / EDF8132A3MA-GD-F-R // 1G	SAMSUNG / K4E8E304EE-EGCE //1G
WIFI/BT/GPS	INTEL / PMB9102	
Front Camera	CAMERA MODULE 2M PIXELCHICONY/CIFE22120003870LH	CAMERA MODULE 0.3M PIXEL CHICONY / CIFE05220003870LH
Rear Camera	CAMERA MODULE 5M PIXELCHICONY/CJAE56020003870LH	CAMERA MODULE 2M PIXEL CHICONY / CIFE22220003870LH
LCD TOUCH SCREEN 10.1'	LCD TOUCH SCREEN 10.1'	
	CPT / CLAT101WR61	
Battery	Amperex Technology Limited / DC 3.8 Vdc, 4750 mAh/ 4890 mAh (MIN/TYP), 18.5 Wh	

Note: The EUT was pre-tested with SKU 1 and SKU 2, the worst case was SKU 2 and recorded in this report.

1.1.4 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:

**1.1.5 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)
☒ 48.78% - test mode single channel-DH5	3.12
Bluetooth ACL packets can be 1, 3, or 5 time slots. The DH1 packet can cover a single time slot. The DH3 packet can cover up to 3 time slots. The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle.	

1.1.6 EUT Operational Condition

Supply Voltage	☒ AC mains	☒ DC	
Type of DC Source	☒ From Host System	☒ External AC adapter	☒ Li-ion Battery

1.2 Accessories and Support Equipment

Accessories				
AC Adapter 1	Brand Name	ASUS	Model Name	PA-1070-07
	Vendor	LITEON		
	Power Rating	I/P:100-240Vac,0.25A, O/P: 5.2Vdc,1350mA		
AC Adapter 2	Brand Name	ASUS	Model Name	PSM06A-050Q
	Vendor	PHIHONG		
	Power Rating	I/P:100 -240Vac,0.25A, O/P: 5.2Vdc,1350mA		
AC Adapter 3	Brand Name	ASUS	Model Name	AD2005320
	Vendor	PI		
	Power Rating	I/P:100 -240Vac,0.25A, O/P: 5.2Vdc,1350mA		
Li-ion Battery	Brand Name	ASUS	Model Name	C11P1502
	Vendor	ATL	Power Rating	3.8Vdc, 4750mAh
USB Cable 1	Brand Name	ASUS	Model Name	L65U2009-CS-B
	Vendor	ASAP		
USB Cable 2	Brand Name	ASUS	Model Name	CUBB04M-AS0D0-EF
	Vendor	FOXCONN		
Docking	Brand Name	ASUS	Model Name	DA01
Z stylus / ASUS AC Touch pen	Brand Name	HanvonPenTech	Model Name	PAD-22 Z STYLUS

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

Support Equipment - RF Conducted			
No.	Equipment	Brand Name	Model Name
1	BT Station	RS	CBT

Support Equipment – AC Conduction and Radiated Emission			
No.	Equipment	Brand Name	Model Name
1	Notebook PC	DELL	E5530
2	BT Station (Remote)	RS	CBT

1.3 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ ANSI C63.10-2009
- ♦ 47 CFR FCC Part 15
- ♦ FCC DA 00-0705

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 Condition		Test Site No.	Test Engineer
AC Conduction		CO04-HY	Zeus
RF Conducted		TH01-HY	Rory
Radiated Emission		03CH03-HY	Allen
		Test Environment	
		23°C / 54%	
		22.7°C / 61.3%	
		25°C / 49%	

1.5 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Measurement Uncertainty		
Test Item		Uncertainty
AC power-line conducted emissions		±2.3 dB
Emission bandwidth, 6dB bandwidth		±0.6 %
RF output power, conducted		±0.1 dB
Power density, conducted		±0.6 dB
Unwanted emissions, conducted	9 – 150 kHz	±0.4 dB
	0.15 – 30 MHz	±0.4 dB
	30 – 1000 MHz	±0.6 dB
	1 – 18 GHz	±0.5 dB
	18 – 40 GHz	±0.5 dB
	40 – 200 GHz	N/A
All emissions, radiated	9 – 150 kHz	±2.5 dB
	0.15 – 30 MHz	±2.3 dB
	30 – 1000 MHz	±2.6 dB
	1 – 18 GHz	±3.6 dB
	18 – 40 GHz	±3.8 dB
	40 – 200 GHz	N/A
Temperature		±0.8 °C
Humidity		±5 %
DC and low frequency voltages		±0.9%
Time		±1.4 %
Duty Cycle		±0.6 %

2 Test Configuration of EUT

2.1 The Worst Case Modulation Configuration

Worst Modulation Used for Conformance Testing					
Bluetooth Mode	Transmit Chains (N _{TX})	Data Rate	Modulation Mode	RF Output Power (dBm)	Worst Mode
BR	1	1 Mbps	BR-1Mbps	5.16	EDR-3Mbps
EDR	1	2 Mbps	EDR-2Mbps	5.64	
EDR	1	3 Mbps	EDR-3Mbps	5.79	
Note 1: Bluetooth BR uses a combination of GFSK (1Mbps).					
Note 2: Bluetooth EDR uses a combination of $\pi/4$ -DQPSK (2Mbps) and 8DPSK (3Mbps).					
Note 3: Modulation modes consist below configuration:					
FHSS BR-1Mbps: GFSK (1Mbps), EDR-2Mbps: $\pi/4$ -DQPSK (2Mbps), EDR-3Mbps: 8DPSK(3Mbps)					
Note 4: RF output power specifies that Maximum Peak Conducted Output Power					

2.2 Test Channel Frequencies Configuration

Test Channel Frequencies Configuration	
Bluetooth Mode	Test Channel Frequencies (MHz) – FX (Frequencies Abbreviations)
BR / EDR	2402-(F1), 2441-(F2), 2480-(F3)

2.3 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter			
Test Software Version	CBT 32		
Modulation Mode	2402 MHz	2440 MHz	2480 MHz
BR,1Mbps	Default	Default	Default
EDR,2Mbps	Default	Default	Default
EDR,3Mbps	Default	Default	Default

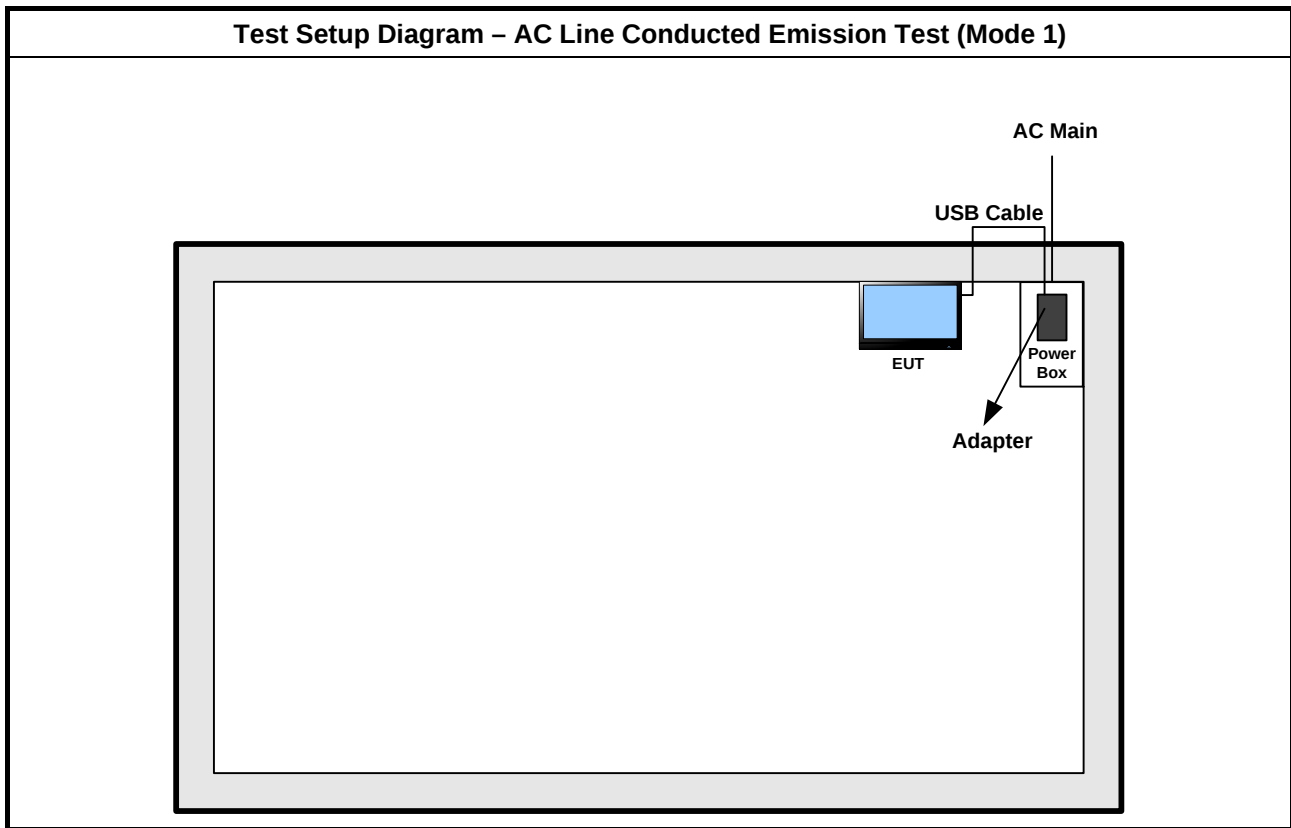
2.4 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
Operating Mode	Operating Mode Description
1	SKU #2 + AC Adapter 1 + USB Cable 1
2	SKU #2 + AC Adapter 2 + USB Cable 1
3	SKU #2 + AC Adapter 3 + USB Cable 1
4	SKU #2 + USB Cable 1
5	SKU #2 + USB Cable 2
6	SKU #1 + AC Adapter 1 + USB Cable 1
Operating mode 1 was the worst case and it is recorded in this test report.	

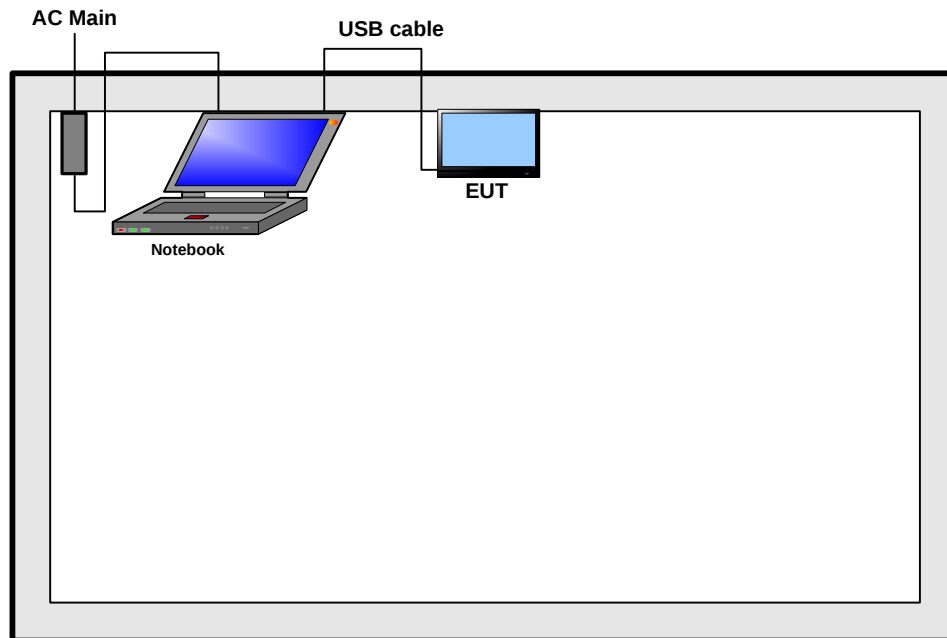
The Worst Case Mode for Following Conformance Tests	
Tests Item	RF Output Power, 20dB Bandwidth, Carrier Frequency Separation (ChS) Number of Hopping Frequencies (N), Time of Occupancy (Dwell Time)
Test Condition	Conducted measurement at transmit chains
Modulation Mode	BR-1Mbps, EDR-3Mbps

The Worst Case Mode for Following Conformance Tests			
Tests Item	Transmitter Radiated Bandedge Emissions Transmitter 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. EUT shall be performed three orthogonal planes.		
Operating Mode	Operating Mode Description		
Radiated Emissions Below 1GHz	1. SKU #2 + AC Adapter 1 + USB Cable 1		
	2. SKU #2 + AC Adapter 2 + USB Cable 1		
	3. SKU #2 + AC Adapter 3 + USB Cable 1		
	4. SKU #2 + USB Cable 1		
	5. SKU #2 + USB Cable 2		
	6. SKU #1 + AC Adapter 1 + USB Cable 1		
Operating mode 4 was the worst case and it is recorded in this test report.			
Radiated Emissions Above 1GHz	1. SKU #2 + AC Adapter 1 + USB Cable 1		
Modulation Mode	For test mode BR-1Mbps, EDR-2Mbps and EDR-3Mbps of the transmitter were assess for pretest. The worst case was recorded in this test report and shown below as the following: Transmitter Radiated Bandedge Emissions: BR-1Mbps / EDR-2Mbps / EDR-3Mbps . Transmitter Radiated Unwanted Emissions: BR-1Mbps		
Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane
			
Worst Planes of EUT	V		

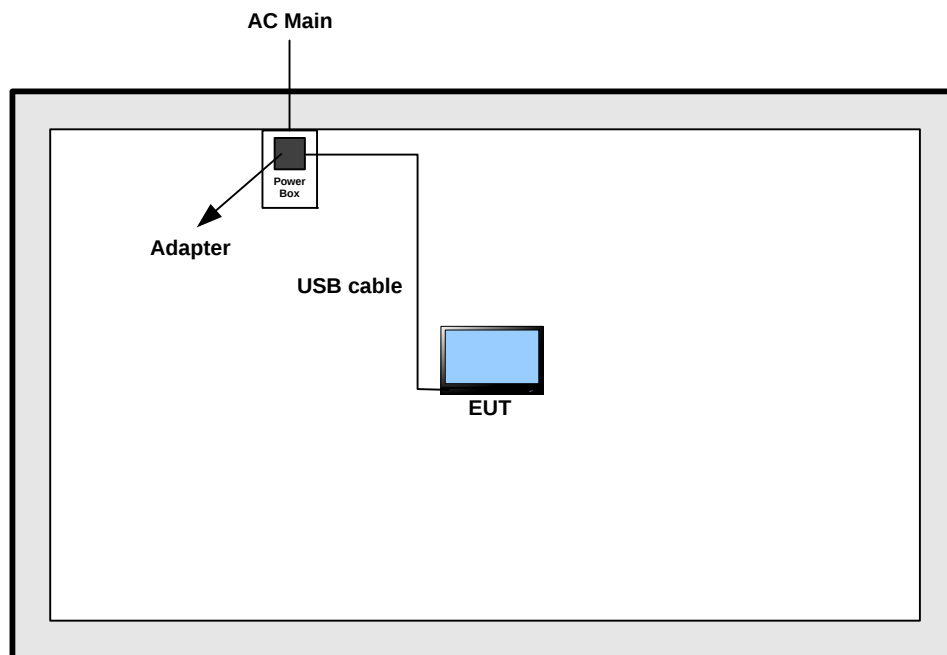
2.5 Test Setup Diagram



Test Setup Diagram - Radiated Test Below 1GHz (Mode 4)



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



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm of the frequency.

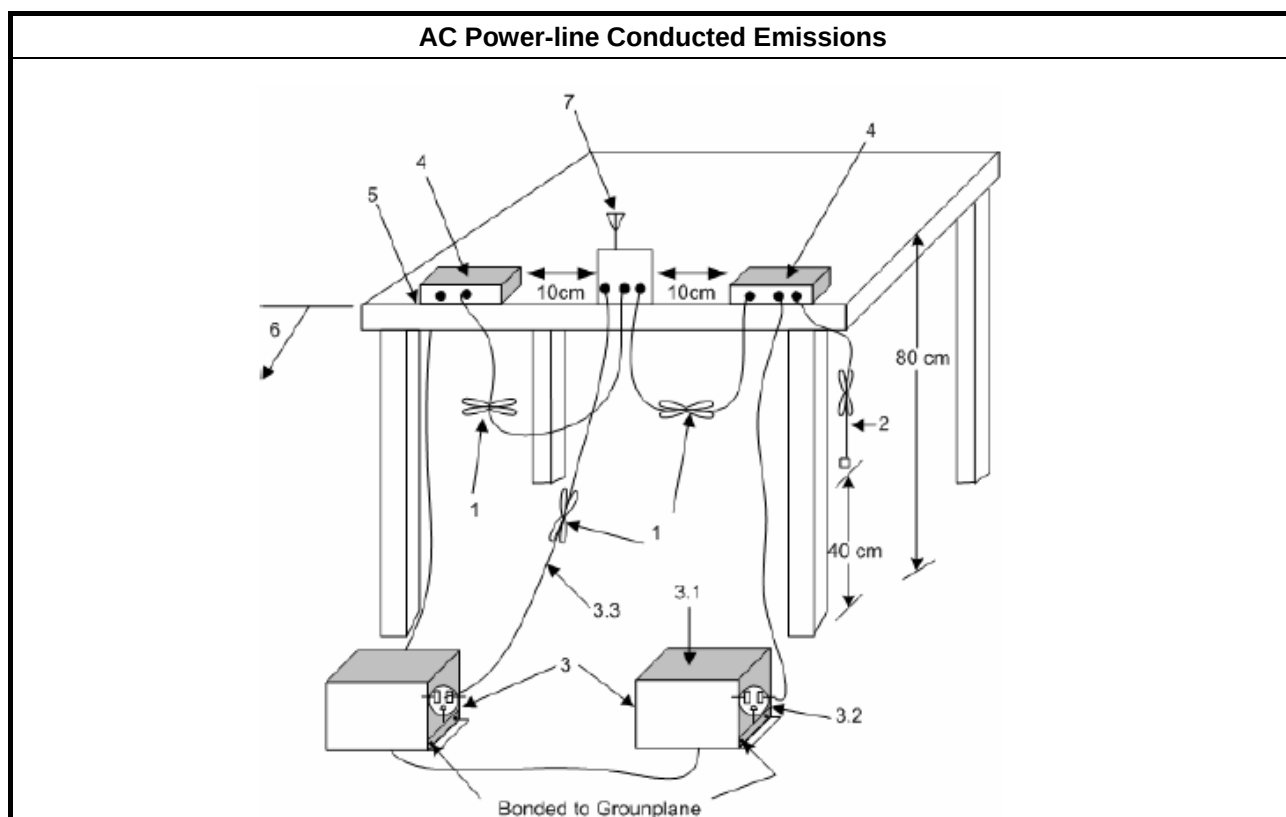
3.1.2 Measuring Instruments

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

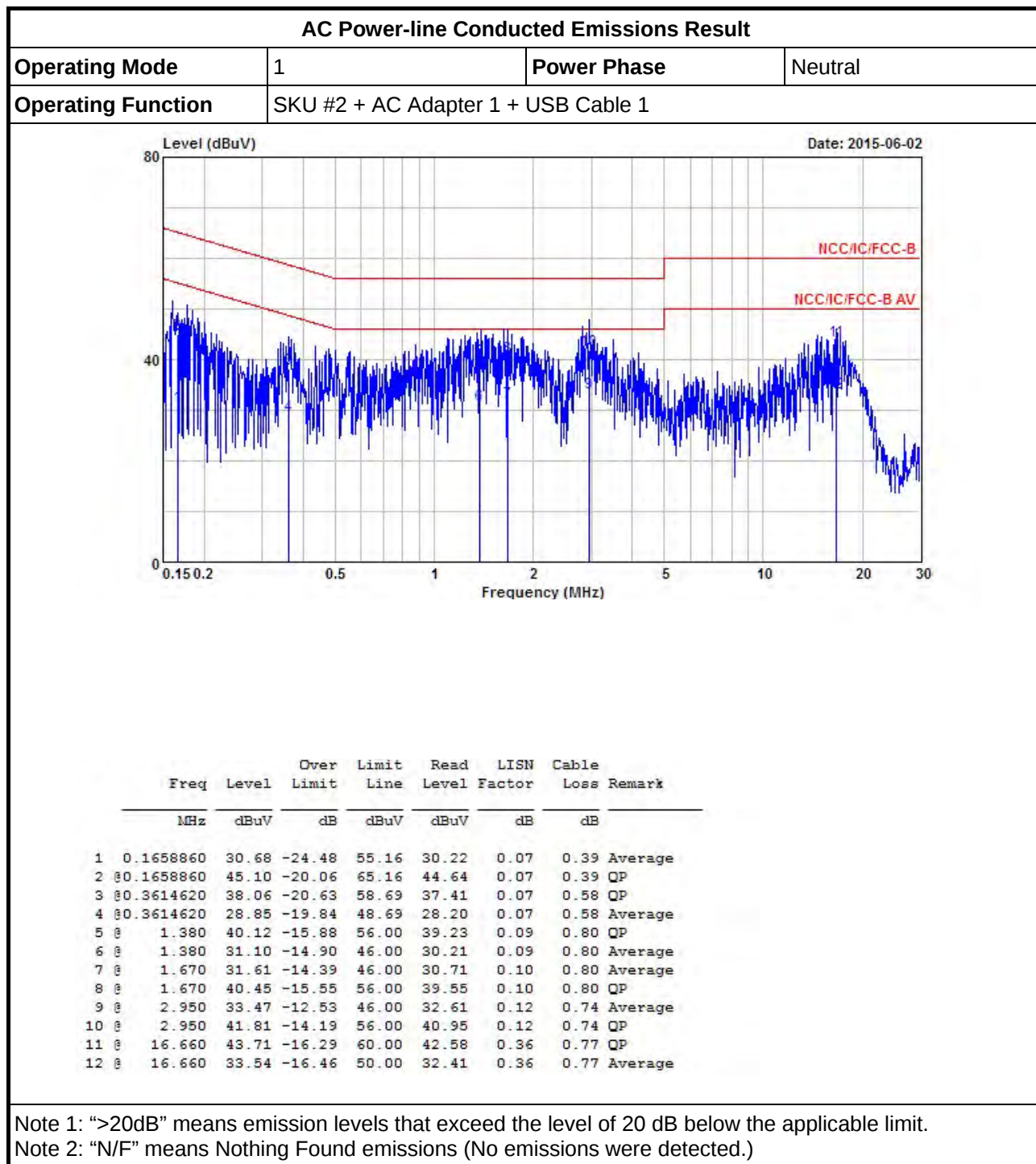
3.1.3 Test Procedures

Test Method
☒ Refer as ANSI C63.10-2009, clause 6.2 for AC power-line conducted emissions.

3.1.4 Test Setup

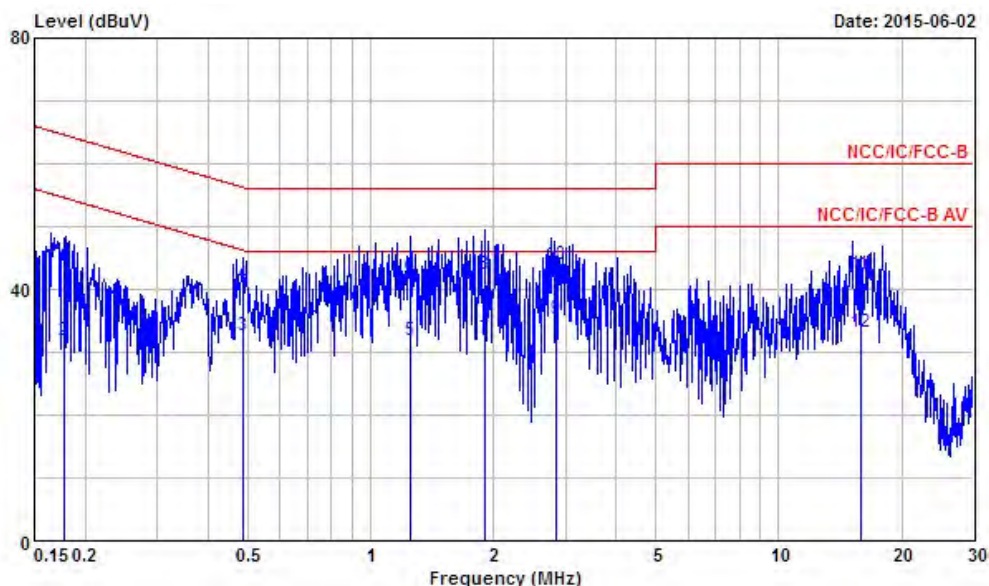


3.1.5 Test Result of AC Power-line Conducted Emissions



AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	SKU #2 + AC Adapter 1 + USB Cable 1		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.1767760	43.79	-20.85	64.64	43.30	0.06	0.43	QP
2	0.1767760	31.92	-22.72	54.64	31.43	0.06	0.43	Average
3	0.4863180	32.59	-13.64	46.23	31.88	0.07	0.64	Average
4	0.4863180	40.82	-15.41	56.23	40.11	0.07	0.64	QP
5	1.250	31.89	-14.11	46.00	31.00	0.09	0.80	Average
6	1.250	42.01	-13.99	56.00	41.12	0.09	0.80	QP
7	1.910	31.99	-14.01	46.00	31.09	0.10	0.80	Average
8	1.910	42.45	-13.55	56.00	41.55	0.10	0.80	QP
9	2.840	35.21	-10.79	46.00	34.35	0.11	0.75	Average
10	2.840	44.01	-11.99	56.00	43.15	0.11	0.75	QP
11	15.890	42.42	-17.58	60.00	41.32	0.32	0.78	QP
12	15.890	33.15	-16.85	50.00	32.05	0.32	0.78	Average

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

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

3.2 20dB Bandwidth and Carrier Frequency Separation

3.2.1 20dB Bandwidth and Carrier Frequency Separation Limit

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

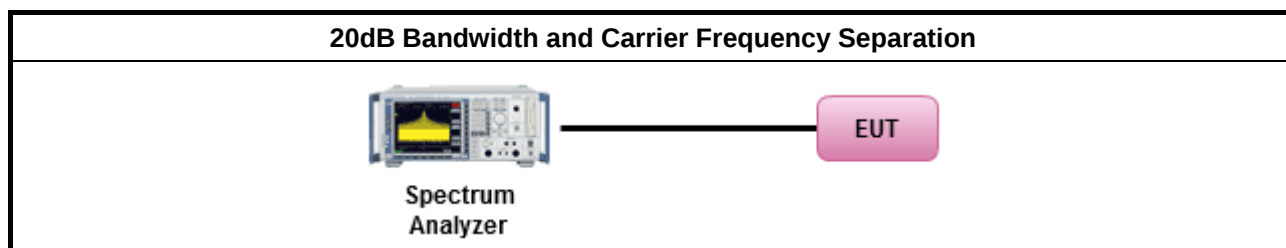
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method	
☒	Refer as ANSI C63.10, clause 6.9.1 for 20 dB bandwidth measurement.
☒	Refer as ANSI C63.10, clause 7.7.2 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

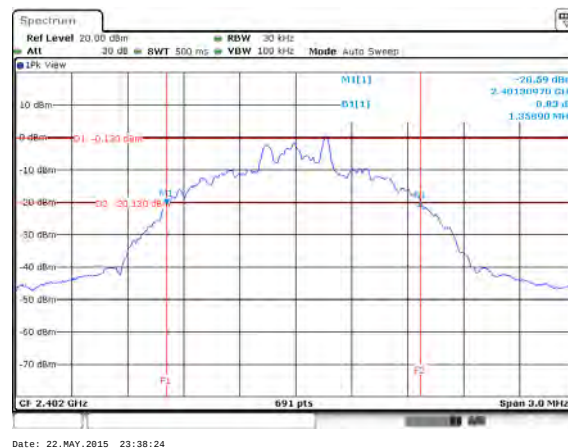


3.2.5 Test Result of 20dB Bandwidth and Carrier Frequency Separation

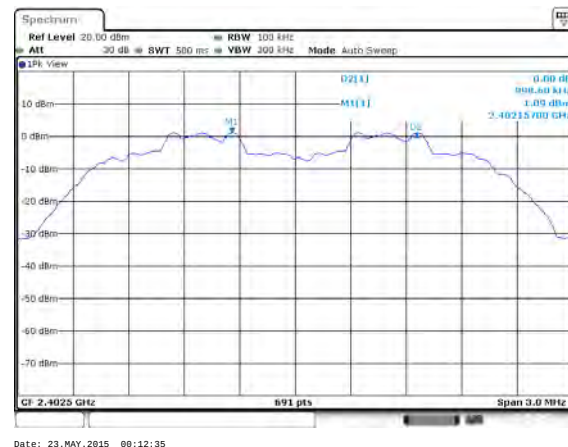
20dB Bandwidth and Carrier Frequency Separation Result					
Modulation Mode	Freq. (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Channel Separation (MHz)	Channel Separation Limits (MHz)
BR-1Mbps	2402	0.9378	0.8639	0.9986	0.625
BR-1Mbps	2441	0.9421	0.8639	0.9986	0.628
BR-1Mbps	2480	0.9421	0.8639	0.9986	0.628
EDR-3Mbps	2402	1.3589	1.2894	0.9986	0.906
EDR-3Mbps	2441	1.3415	1.2937	0.9986	0.894
EDR-3Mbps	2480	1.3459	1.2894	0.9986	0.897
Result		Complied			

EDR-3Mbps

Worst 20dB Bandwidth Plots



Worst Carrier Frequency Separation Plots



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:
☐	$N \geq 75$ and ChS $\geq$ MAX (20 dB bandwidth, 25 kHz).
☒	$N \geq 15$ and ChS $\geq$ MAX (20 dB bandwidth x 2/3, 25 kHz).
N: Number of Hopping Frequencies; ChS: Hopping Channel Separation	

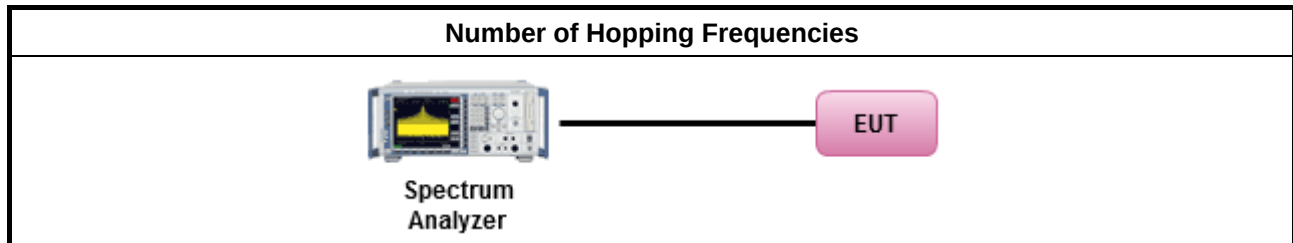
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

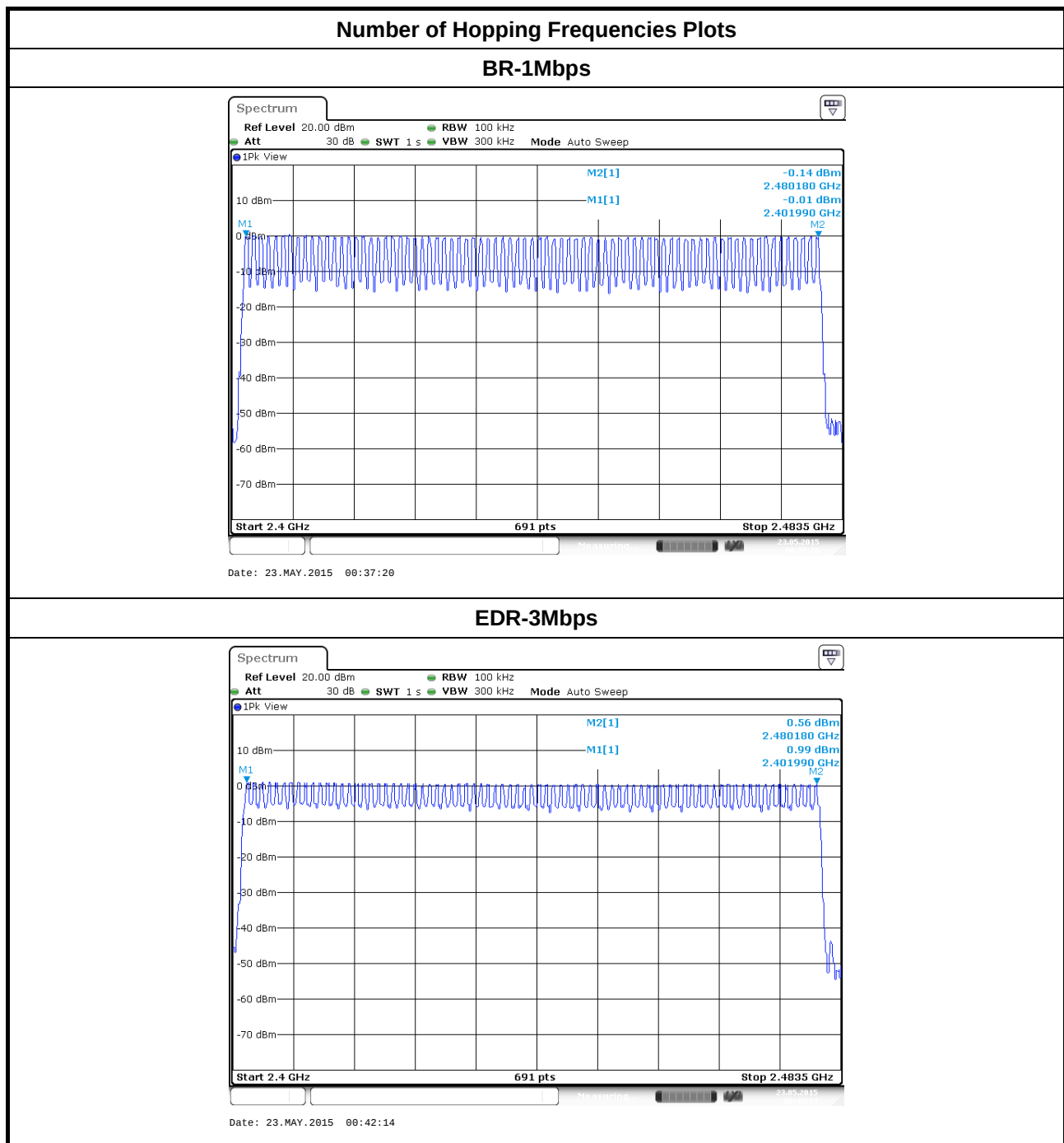
Test Method	
☒	Refer as ANSI C63.10, clause 7.7.3 for number of hopping frequencies measurement.
☒	For conducted measurement.
☒	The EUT supports single transmit chain and measurements performed on this transmit chain.
☐	The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.

3.3.4 Test Setup



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		



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 $0.4 \times N$
N: Number of Hopping Frequencies	

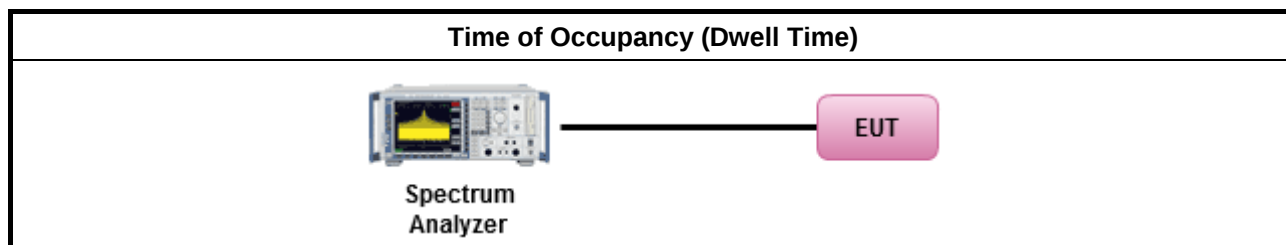
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method	
☒	Refer as ANSI C63.10, clause 7.7.4 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 $10.12 \times 31.6 = 320$ 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 $5.06 \times 31.6 = 160$ 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 $3.37 \times 31.6 = 106.6$ 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.

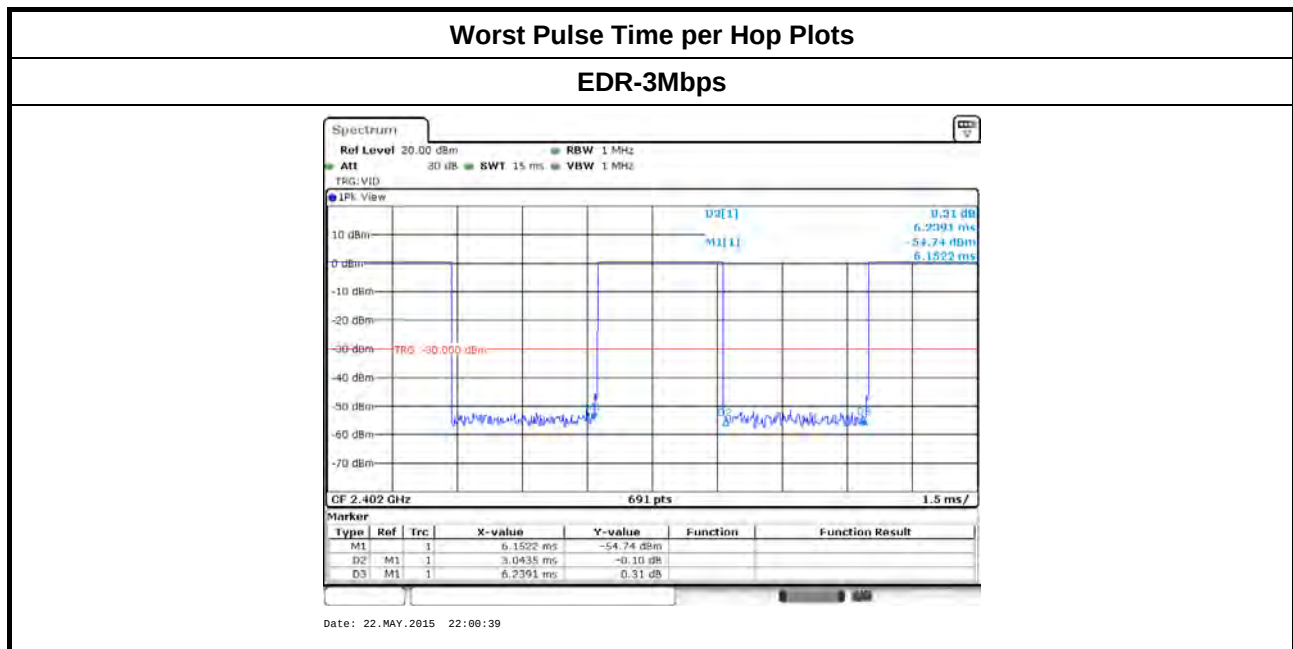
3.4.4 Test Setup



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	3.04	106.7	0.325	0.4
EDR-3Mbps	2402	3.04	106.7	0.325	0.4
Result		Complied			

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



3.5 RF Output Power

3.5.1 RF Output Power Limit

RF Output Power Limit for Frequency Hopping Systems	
Maximum Peak Conducted Output Power Limit	
☒ 2400-2483.5 MHz Band:	
	☐ For Hopping Channel: $N \geq 75$
	☐ If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)
	☐ If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ dBm
	☒ For Hopping Channel: $N \geq 15$
	☒ If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 21$ 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: $N \geq 75 - P_{eirp} \leq 36$ dBm (4 W)
	☒ For Hopping Channel: $N \geq 15 - P_{eirp} \leq 27$ 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	

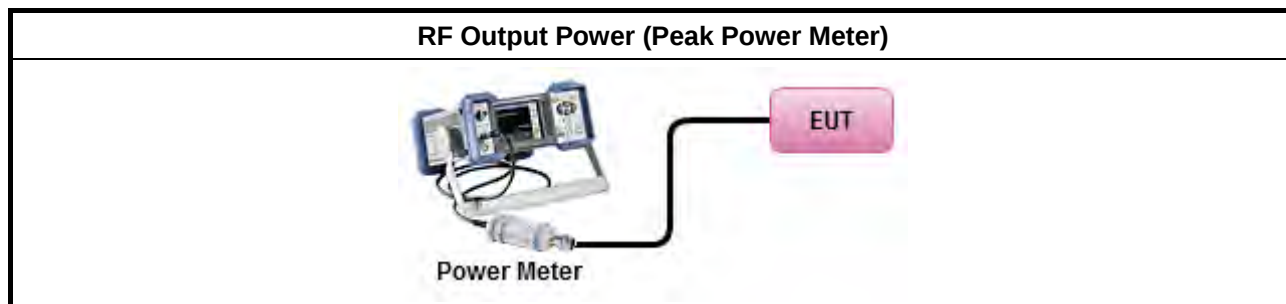
3.5.2 Measuring Instruments

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 6.10.2.1 a) for peak power meter.
	☐ Refer as ANSI C63.10, clause 6.10.2.1 a) for spectrum analyzer - (RBW $\geq$ 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



3.5.5 Test Result of Maximum Peak Conducted Output Power

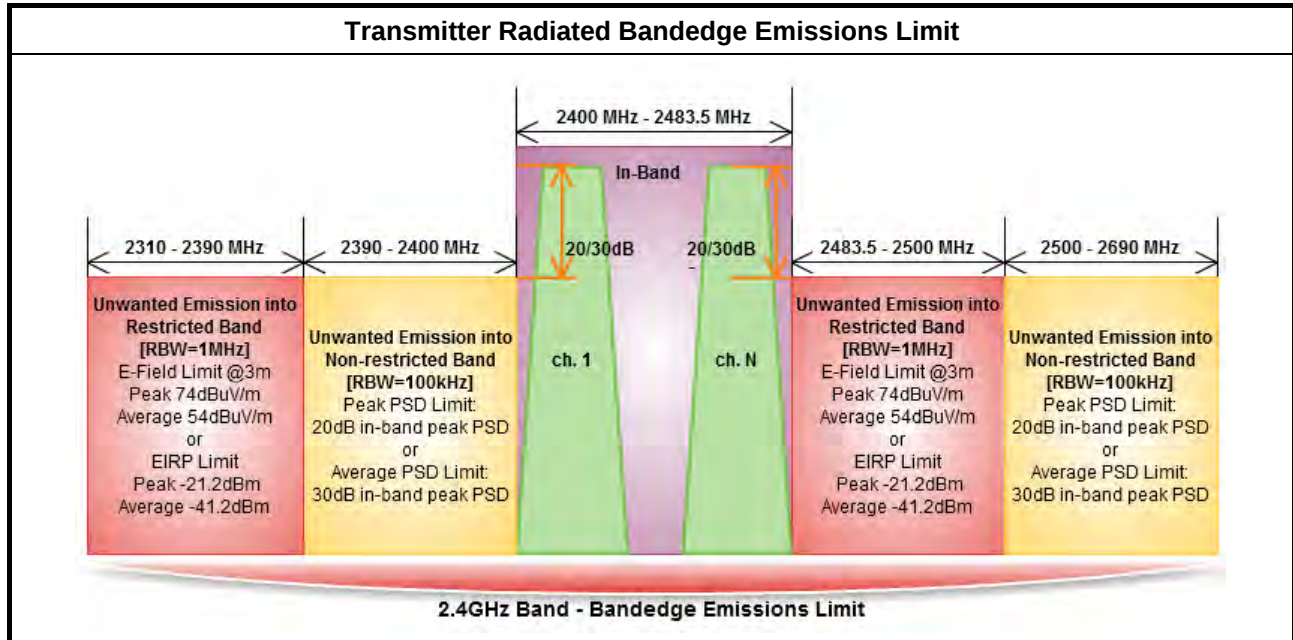
Maximum Peak Conducted Output Power Result						
Condition		RF Output Power (dBm)				
Modulation Mode	Freq. (MHz)	RF Output Power	Power Limit	Antenna Gain (dBi)	EIRP Power	EIRP Limit
BR-1Mbps	2402	5.16	21	2.75	7.91	27
BR-1Mbps	2441	4.32	21	2.75	7.07	27
BR-1Mbps	2480	4.58	21	2.75	7.33	27
EDR-3Mbps	2402	5.79	21	2.75	8.54	27
EDR-3Mbps	2441	5.07	21	2.75	7.82	27
EDR-3Mbps	2480	5.27	21	2.75	8.02	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	1.55	3.12	4.67	2.75	7.42
BR-1Mbps	2441	0.62	3.12	3.74	2.75	6.49
BR-1Mbps	2480	1.01	3.12	4.13	2.75	6.88
EDR-3Mbps	2402	-0.30	3.12	2.82	2.75	5.57
EDR-3Mbps	2441	-1.09	3.12	2.03	2.75	4.78
EDR-3Mbps	2480	-0.77	3.12	2.35	2.75	5.10
Result		Complied				

3.6 Transmitter Radiated Bandedge Emissions

3.6.1 Transmitter Radiated Bandedge Emissions Limit



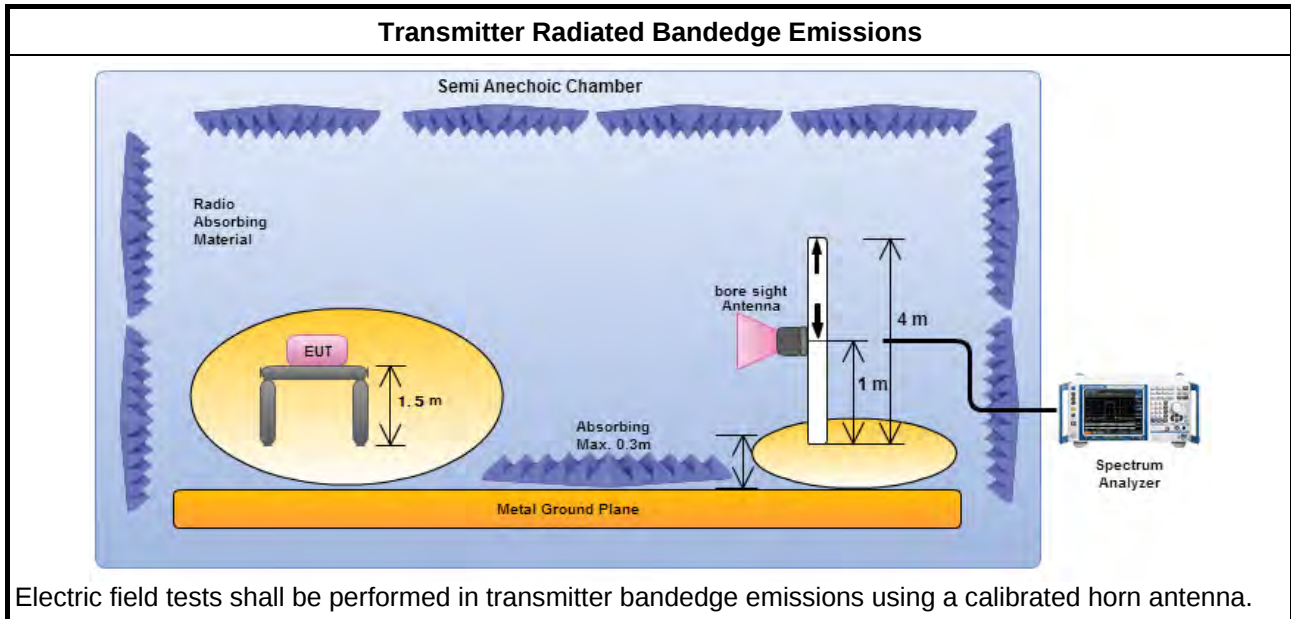
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

Test Method – General Information	
☒	The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].
☒	Refer as ANSI C63.10, clause 6.9.2.2 bandedge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.
☒	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 4.2.3.2.3 (Reduced VBW). VBW $\geq$ 1/T, where T is pulse time.
☐	Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
☒	Refer as ANSI C63.10, clause 4.2.3.2.2 measurement procedure peak limit.
☒	For the transmitter bandedge emissions shall be measured using following options below:
☒	Refer as ANSI C63.10, clause 6.9.2 for band-edge testing.
☐	Refer as ANSI C63.10, clause 6.9.3 for marker-delta method for band-edge measurements.
☒	Refer as ANSI C63.10, clause 7.7.9 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



3.6.5 Transmitter Radiated Bandedge Emissions

Transmitter Radiated Bandedge Emissions (Non-restricted Band)								
Modulation	N _{TX}	Test Freq. (MHz)	In-band PSD [i] (dBuV/100k Hz)	Freq. (MHz)	Out-band PSD [o] (dBuV/100k Hz)	[i] – [o] (dB)	Limit (dB)	Pol.
BR-1Mbps	1	2402	101.77	2393.84	59.89	41.88	20	H
BR-1Mbps	1	2480	100.73	2525.27	61.14	39.59	20	H
EDR-2Mbps	1	2402	102.61	2396.29	59.99	42.62	20	H
EDR-2Mbps	1	2480	101.54	2542.32	60.27	41.27	20	H
EDR-3Mbps	1	2402	102.54	2394.05	59.57	42.97	20	H
EDR-3Mbps	1	2480	101.54	2506.08	60.51	41.03	20	H
Note 1: Measurement worst emissions of receive antenna polarization.								

Transmitter Radiated Bandedge Emissions (Restricted Band)										
Modulation Mode	N _{TX}	Freq. (MHz)	Measure Distance (m)	Freq. (MHz) PK	Level (dBuV/ m) PK	Limit (dBuV/ m) PK	Freq. (MHz) AV	Level (dBuV/ m) AV	Limit (dBuV/ m) AV	Pol.
BR-1Mbps	1	2402	3	2350.19	56.87	74	2349.98	45.58	54	H
BR-1Mbps	1	2480	3	2486.40	58.34	74	2483.53	45.98	54	H
EDR-2Mbps	1	2402	3	2374.26	56.62	74	2349.98	44.41	54	H
EDR-2Mbps	1	2480	3	2486.40	58.37	74	2483.53	45.83	54	H
EDR-3Mbps	1	2402	3	2354.68	56.18	74	2349.98	44.13	54	H
EDR-3Mbps	1	2480	3	2486.40	58.87	74	2483.53	45.86	54	H
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

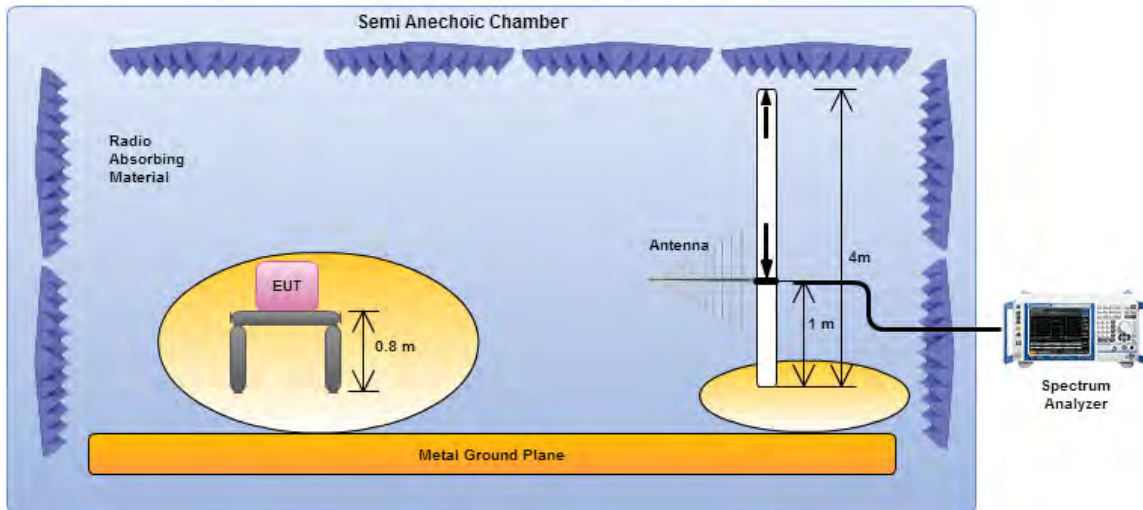
Refer a test equipment and calibration data table in this test report.

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 $\geq$ 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 $20\log(\text{dwell time}/100 \text{ ms})$
☒	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 4.2.3.2.3 (Reduced VBW). $\text{VBW} \geq 1/T$, where T is pulse time.
☐	Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
☒	Refer as ANSI C63.10, clause 4.2.3.2.2 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.

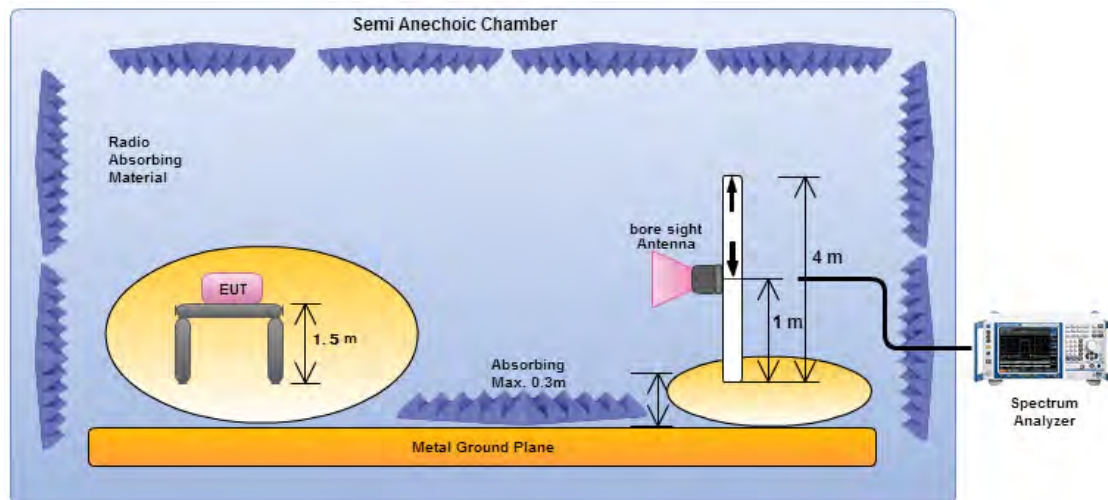
3.7.4 Test Setup

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

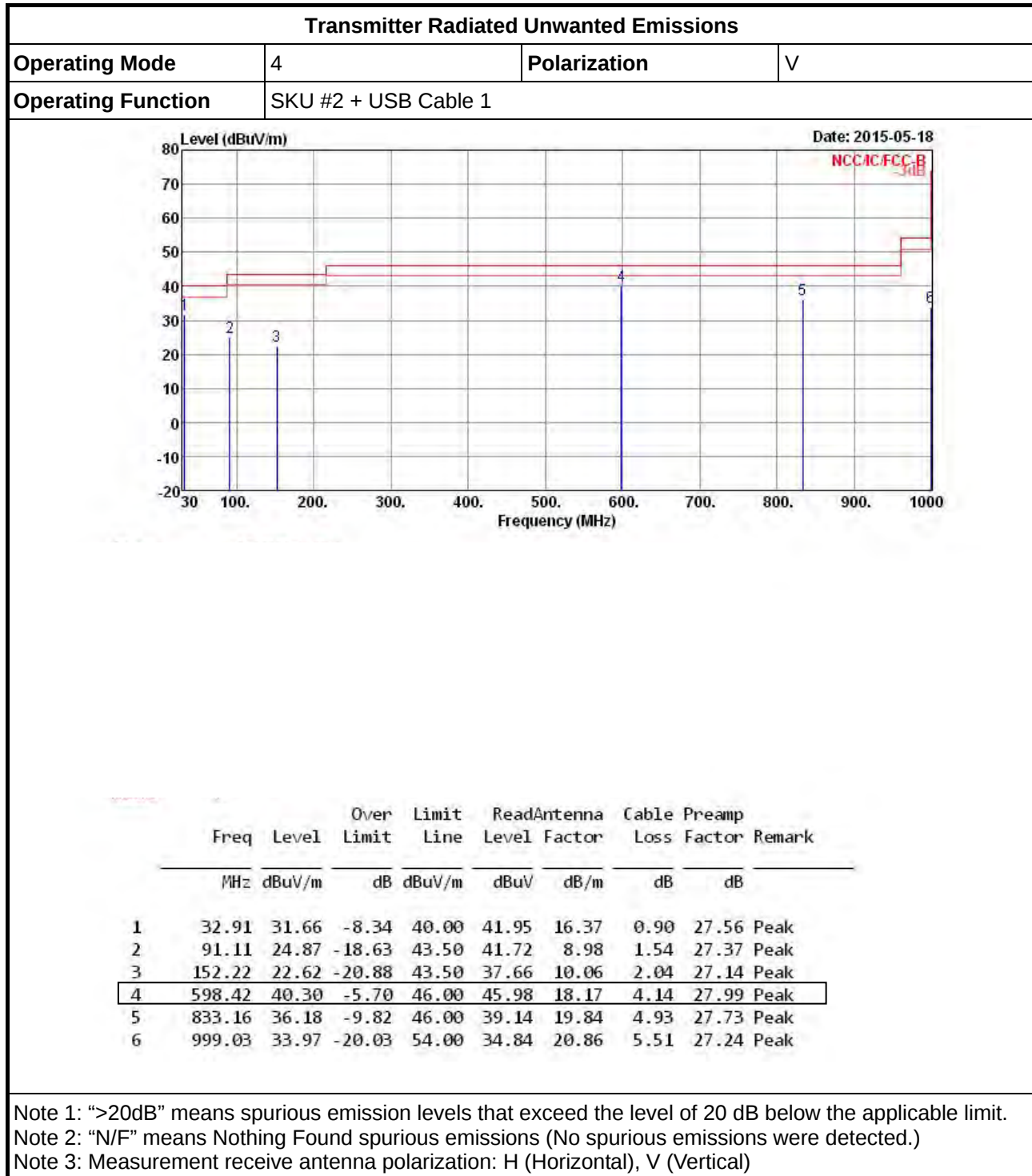


Electric field tests shall be performed in the frequency range of 1 GHz to 10th harmonic of highest fundamental frequency or 40 GHz using a calibrated horn antenna.

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

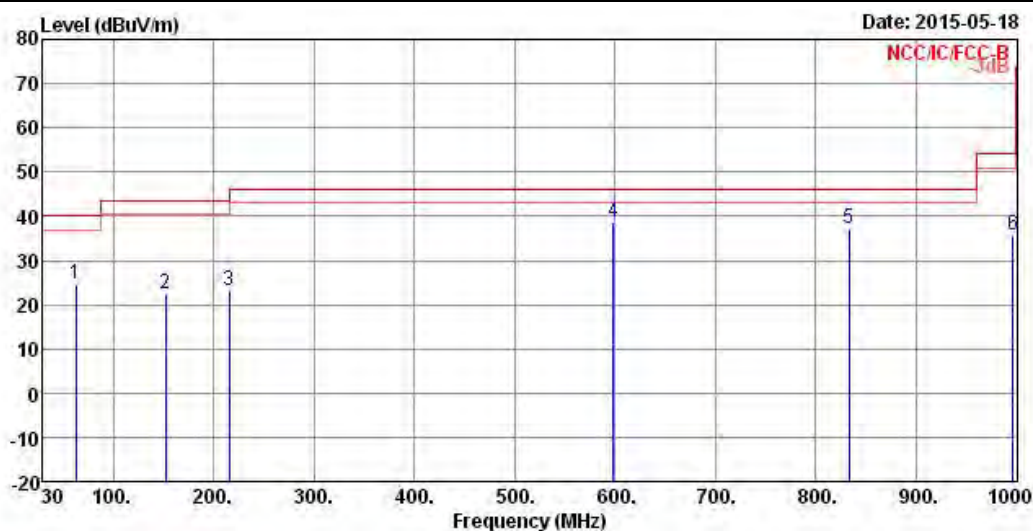
3.7.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

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

3.7.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)


Transmitter Radiated Unwanted Emissions

Operating Mode	4	Polarization	H
Operating Function	SKU #2 + USB Cable 1		

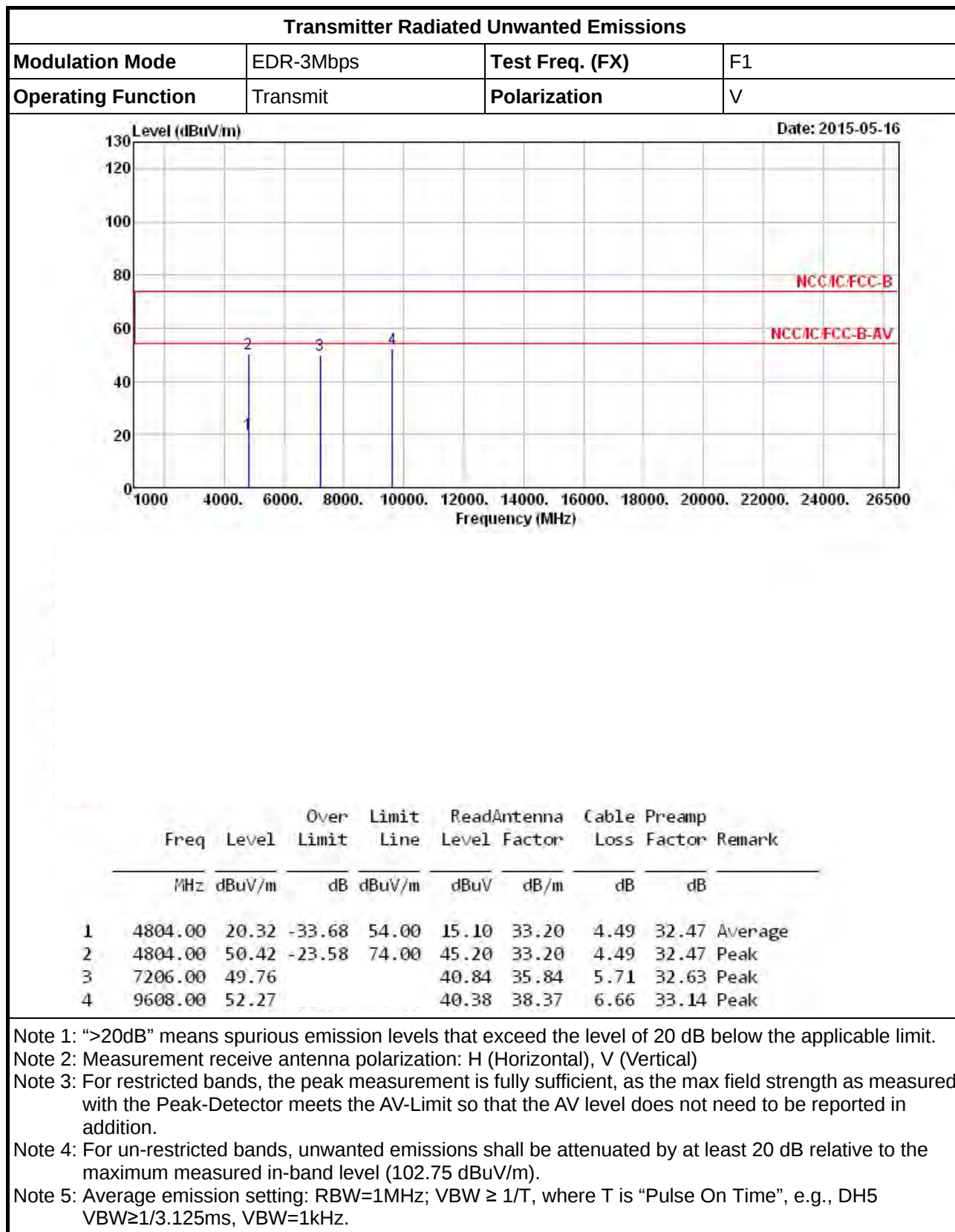


	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Cable Factor	Preamp Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	62.98	24.62	-15.38	40.00	44.71	6.10	1.28	27.47	Peak
2	152.22	22.31	-21.19	43.50	37.35	10.06	2.04	27.14	Peak
3	215.27	23.28	-20.22	43.50	38.90	8.88	2.41	26.91	Peak
4	598.42	38.70	-7.30	46.00	44.38	18.17	4.14	27.99	Peak
5	833.16	37.12	-8.88	46.00	40.08	19.84	4.93	27.73	Peak
6	996.12	35.85	-18.15	54.00	36.75	20.85	5.50	27.25	Peak

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

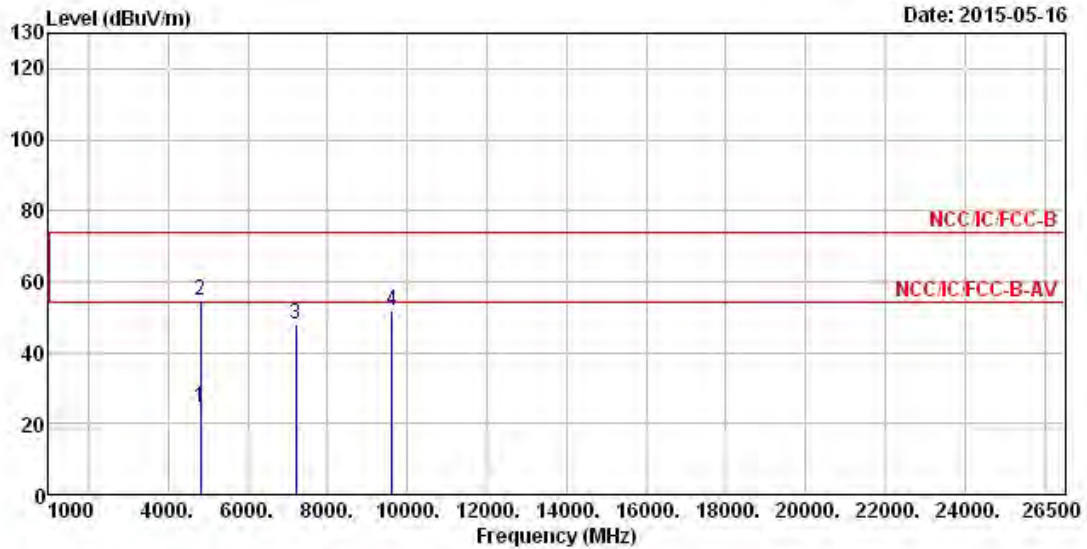
Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

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

3.7.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)


Transmitter Radiated Unwanted Emissions

Modulation Mode	EDR-3Mbps	Test Freq. (FX)	F1
Operating Function	Transmit	Polarization	H



	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Cable Factor	Preamp Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4804.00	24.54	-29.46	54.00	19.32	33.20	4.49	32.47	Average
2	4804.00	54.64	-19.36	74.00	49.42	33.20	4.49	32.47	Peak
3	7206.00	47.84			38.92	35.84	5.71	32.63	Peak
4	9608.00	51.91			40.02	38.37	6.66	33.14	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)

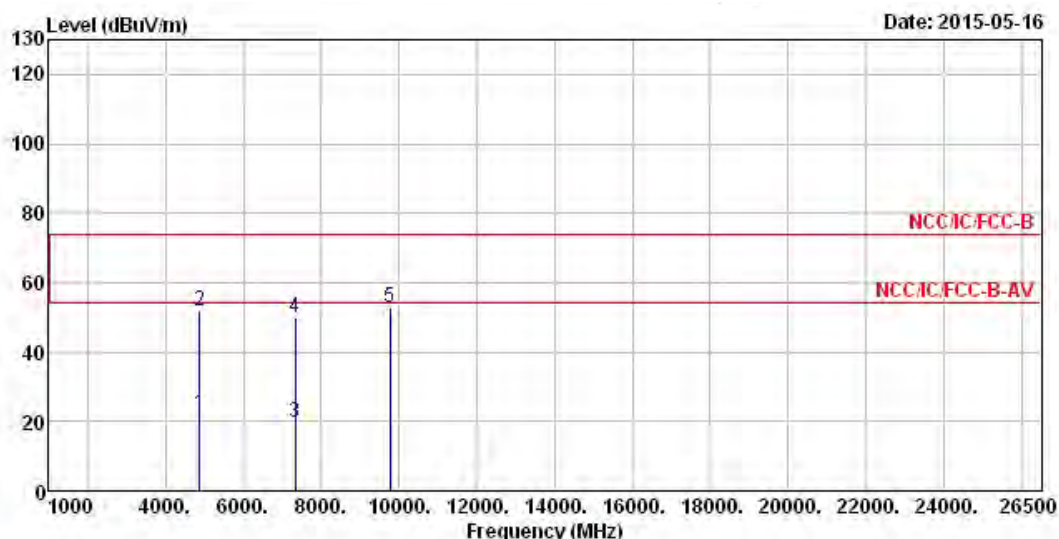
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Note 4: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (102.75 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

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



	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Cable Factor	Preamp Loss	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB
1	4882.00	21.84	-32.16	54.00	16.45	33.31	4.53	32.45 Average
2	4882.00	51.94	-22.06	74.00	46.55	33.31	4.53	32.45 Peak
3	7323.00	19.82	-34.18	54.00	10.60	36.15	5.75	32.68 Average
4	7323.00	49.92	-24.08	74.00	40.70	36.15	5.75	32.68 Peak
5	9764.00	52.84			40.60	38.64	6.73	33.13 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)

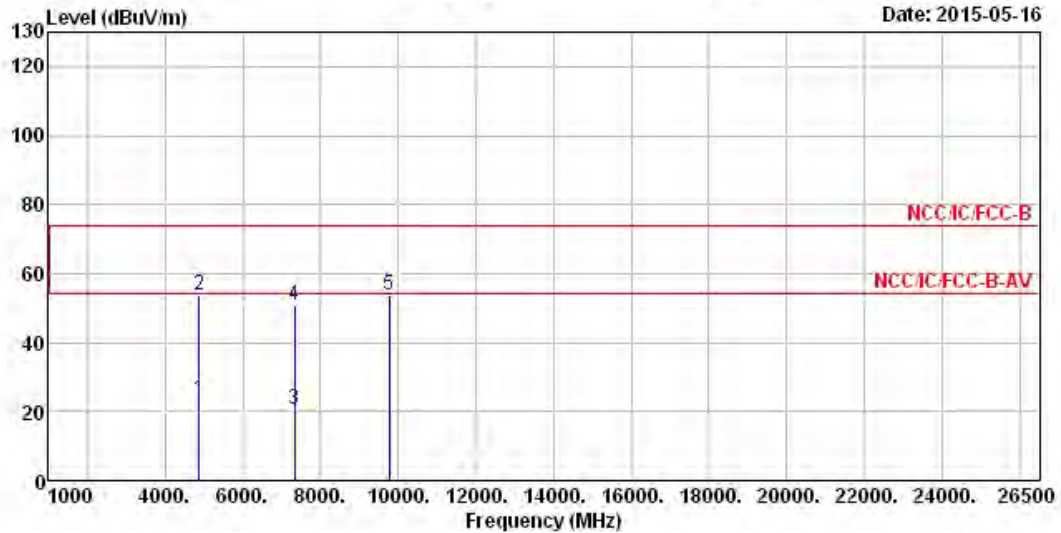
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Note 4: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (101.74 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

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



	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Cable Preamp Loss	Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB
1	4882.00	23.67	-30.33	54.00	18.28	33.31	4.53	32.45 Average
2	4882.00	53.77	-20.23	74.00	48.38	33.31	4.53	32.45 Peak
3	7323.00	20.65	-33.35	54.00	11.43	36.15	5.75	32.68 Average
4	7323.00	50.75	-23.25	74.00	41.53	36.15	5.75	32.68 Peak
5	9764.00	53.96			41.72	38.64	6.73	33.13 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)

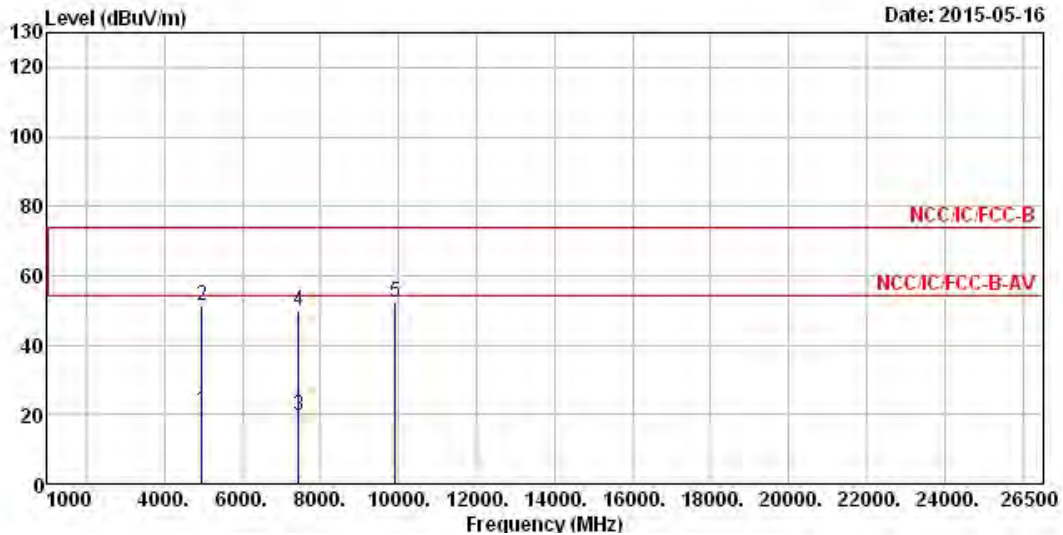
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Note 4: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (101.74 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

Modulation Mode	EDR-3Mbps	Test Freq. (FX)	F3
Operating Function	Transmit	Polarization	V



	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Cable Factor	Preamp Loss	Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4960.00	21.10	-32.90	54.00	15.53	33.44	4.57	32.44	Average
2	4960.00	51.20	-22.80	74.00	45.63	33.44	4.57	32.44	Peak
3	7440.00	19.86	-34.14	54.00	10.32	36.47	5.79	32.72	Average
4	7440.00	49.96	-24.04	74.00	40.42	36.47	5.79	32.72	Peak
5	9920.00	52.07			39.51	38.89	6.80	33.13	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)

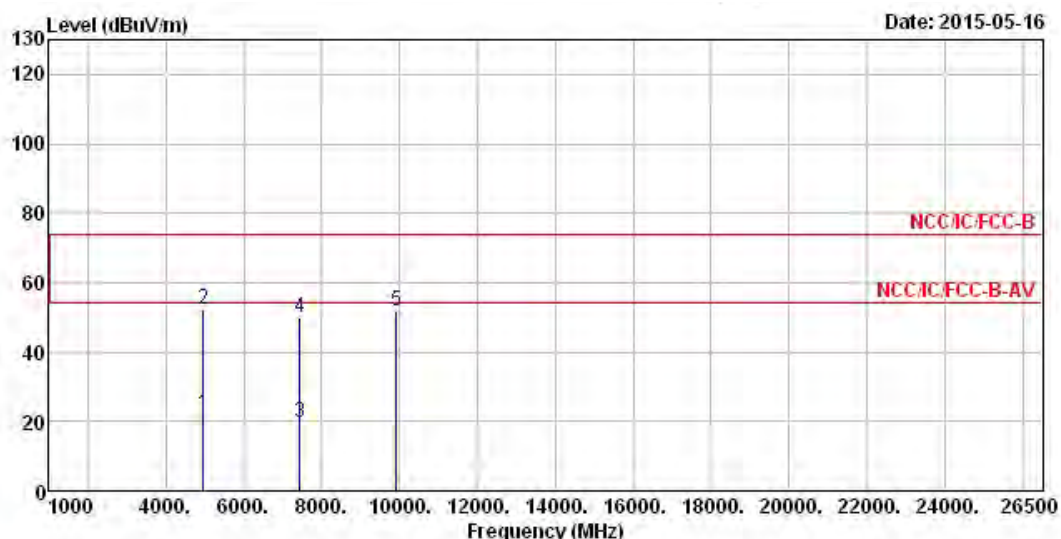
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Note 4: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (101.73 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

Modulation Mode	EDR-3Mbps	Test Freq. (FX)	F3
Operating Function	Transmit	Polarization	H



	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Cable Factor	Preamplifier Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4960.00	22.04	-31.96	54.00	16.47	33.44	4.57	32.44	Average
2	4960.00	52.14	-21.86	74.00	46.57	33.44	4.57	32.44	Peak
3	7440.00	19.57	-34.43	54.00	10.03	36.47	5.79	32.72	Average
4	7440.00	49.67	-24.33	74.00	40.13	36.47	5.79	32.72	Peak
5	9920.00	52.03	-	-	39.47	38.89	6.80	33.13	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 (101.73 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

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

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

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum Analyzer	R&S	FSV 40	101500	9KHz~40GHz	May 05, 2015	RF Conducted
Signal Generator	R&S	SMR40	100116	10MHz ~ 40GHz	Jul. 31, 2014	RF Conducted
DC Power Source	G.W.	GPC-6030D	C671845	DC 1V ~ 60V	Jul. 26, 2014	RF Conducted
Power Sensor	Anritsu	MA2411B	1027452	300MHz ~ 40GHz	Jan. 29, 2015	RF Conducted
Power Meter	Anritsu	ML2495A	1124009	300MHz ~ 40GHz	Jan. 29, 2015	RF Conducted
BT Station	R&S	CBT	100959	N/A	Aug. 26, 2014	RF Conducted

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



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

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

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

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