

FCC C1PC Test Report

Equipment : BL600 Series Bluetooth Low Energy Module
Brand Name : Laird Technologies
Model No. : BL600-ST
Additional Model No. : BL620-ST
FCC ID : PI4BL600T
Standard : 47 CFR FCC Part 15.247
Operating Band : 2400 MHz – 2483.5 MHz
FCC Classification : DTS
Applicant : EZURiO Ltd.
(– a business unit of Laird Technologies)
Saturn House, Mercury Park, Wooburn Green,
Bucks, HP10 0HH, UK
Manufacturer : Laird Technologies
11160 Thompson Ave., Lenexa, Kansas, 66219,
USA

The product sample received on Feb. 27, 2013 and completely tested on Mar. 13, 2013. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2009 and shown compliance with the applicable technical standards.

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

Reviewed by:

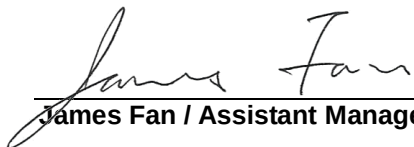

James Fan / Assistant Manager

Table of Contents

1	GENERAL DESCRIPTION	5
1.1	Information.....	5
1.2	Support Equipment.....	7
1.3	Testing Applied Standards	7
1.4	Testing Location Information	7
1.5	Measurement Uncertainty	8
2	TEST CONFIGURATION OF EUT.....	9
2.1	The Worst Case Modulation Configuration	9
2.2	Test Channel Frequencies Configuration.....	9
2.3	The Worst Case Power Setting Parameter	9
2.4	The Worst Case Measurement Configuration.....	10
2.5	Test Setup Diagram	12
3	TRANSMITTER TEST RESULT	13
3.1	AC Power-line Conducted Emissions	13
3.2	6dB Bandwidth	16
3.3	RF Output Power	18
3.4	Power Spectral Density	21
3.5	Transmitter Radiated Bandedge Emissions	23
3.6	Transmitter Radiated Unwanted Emissions	26
4	TEST EQUIPMENT AND CALIBRATION DATA	37
	APPENDIX A. TEST PHOTOS	A1-A5

Summary of Test Result

Conformance Test Specifications					
Report Clause	Ref. Std. Clause	Description	Measured	Limit	Result
1.1.3	15.203	Antenna Requirement	Antenna connector mechanism complied	FCC 15.203	Complied
3.1	15.207	AC Power-line Conducted Emissions	[dBuV]:0.1590MHz 34.38 (Margin 21.14dB) - AV 40.55 (Margin 24.97dB) - QP	FCC 15.207	Complied
3.2	15.247(a)	6dB Bandwidth	LE:539.13 kHz	≥500kHz	Complied
3.3	15.247(b)	RF Output Power (Maximum Peak Conducted Output Power)	Power [dBm] LE:2.55	Power [dBm] LE:30	Complied
3.4	15.247(d)	Power Spectral Density	PSD [dBm/3kHz] LE: -12.67	PSD [dBm/3kHz]: 8	Complied
3.5	15.247(c)	Transmitter Radiated Bandedge Emissions	Restricted Bands [dBuV/m at 3m]:2483.51MHz 66.74 (Margin 7.26dB) - PK 36.69 (Margin 17.31dB) - AV	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied
3.6	15.247(c)	Transmitter Radiated Unwanted Emissions	Restricted Bands [dBuV/m at 3m]:209.45MHz 36.99 (Margin 6.51dB) – PK	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied

Revision History

[illegible]

1 General Description

1.1 Information

This is a FCC Class I Permissive Change report.

This report is issued as a duplicate report to original Sporton report no. FR331334. The modification is the addition of multiple-listing model **BL620-ST** for marketing purpose.

1.1.1 RF General Information

RF General Information					
Frequency Range (MHz)	Bluetooth Version	Ch. Frequency (MHz)	Channel Number	RF Output Power (dBm)	Co-location
2400-2483.5	v4.0 LE	2402-2480	0-39 [40]	2.55	N/A
Note 1: Bluetooth LE (Low Energy) using GFSK modulation for DTS digital modulation. Note 2: RF output power specifies that Maximum Peak Conducted Output Power. Note 3: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (i.e., EUT has simultaneously co-transmitting that operating 2.4GHz and 5GHz.)					

1.1.2 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 specific host systems) Host System - Brand Name / Model No.: ...Laird / DVK-BL600-ST Refer to section 1.1.3 for antenna information
☐	Other:

1.1.3 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)
☒	RF connector provided
☒	Unique antenna connector. (e.g., MMCX, U.FL, IPX, and RP-SMA, RP-N type...)
☐	Standard antenna connector. (e.g., SMA, N, BNC, and TNC type...)

Antenna General Information						
No.	EUT Model	Ant. Cat.	Ant. Type	Ant. Brand/Model	Ant. Connector	Gain (dBi)
1	BL600-ST	External	Dipole	MAG. LAYERS SCIENTIFIC-TECHNICS CO., LTD EDA-8709-2G4R2-A40-CY	SMA Male Reverse	2.0

1.1.4 Test Signal Duty Cycle

Operated Mode for Worst Duty Cycle	
☐	Operated normally 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)
☒ 97.07% - test mode single channel - LE	0.13

1.1.5 EUT Operational Condition

Supply Voltage	☐ AC mains	☒ DC 3.3V or DC 1.8V	
Type of DC Source	☐ Internal DC supply	☒ Host	☐ Battery

1.2 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	Serial No.
1	Notebook	DELL	Latitude E5420	-

1.3 Testing Applied Standards

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

- ♦ 47 CFR FCC Part 15
- ♦ ANSI C63.10-2009
- ♦ FCC KDB 558074
- ♦ FCC KDB 412172

1.4 Testing Location Information

Testing Location				
☒	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C		
		TEL : 886-3-327-3456 FAX : 886-3-327-0973		
Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-HY	Ian Du	24°C / 63%	Mar. 08, 2013
AC Conduction	CO04-HY	Bill Hsiao	20°C / 53%	Mar. 14, 2013
Radiated Emission	03CH05-HY	Daniel Hsu	25°C / 65%	Feb. 27 ~ Mar. 08, 2013

1.5 Measurement Uncertainty

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

Measurement Uncertainty			
Test Item		Uncertainty	Limit
AC power-line conducted emissions		±2.26 dB	N/A
Emission bandwidth, 6dB bandwidth		±1.42 %	N/A
RF output power, conducted		±0.63 dB	N/A
Power density, conducted		±0.81 dB	N/A
Unwanted emissions, conducted	30 – 1000 MHz	±0.51 dB	N/A
	1 – 18 GHz	±0.67 dB	N/A
	18 – 40 GHz	±0.83 dB	N/A
	40 – 200 GHz	N/A	N/A
All emissions, radiated	30 – 1000 MHz	±2.56 dB	N/A
	1 – 18 GHz	±3.59 dB	N/A
	18 – 40 GHz	±3.82 dB	N/A
	40 – 200 GHz	N/A	N/A
Temperature		±0.8 °C	N/A
Humidity		±3 %	N/A
DC and low frequency voltages		±3 %	N/A
Time		±1.42 %	N/A
Duty Cycle		±1.42 %	N/A

2 Test Configuration of EUT

2.1 The Worst Case Modulation Configuration

Worst Modulation Used for Conformance Testing				
Bluetooth Version	Transmit Chains (N _{TX})	Data Rate	Modulation Mode	RF Output Power (dBm)
v4.0 LE	1	1 Mbps	LE-1Mbps	2.55
Note 1: Bluetooth LE (Low Energy) using GFSK modulation for DTS digital modulation. Note 2: Modulation modes consist below configuration: DSSS LE-1Mbps: GFSK (1Mbps) Note 3: 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)
LE	2402-(F1), 2440-(F2), 2480-(F3)

2.3 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter			
Test Software Version	UwTerminal v6.3		
Modulation Mode	2402 MHz	2440 MHz	2480 MHz
LE,1Mbps	0	0	0

2.4 The Worst Case Measurement Configuration

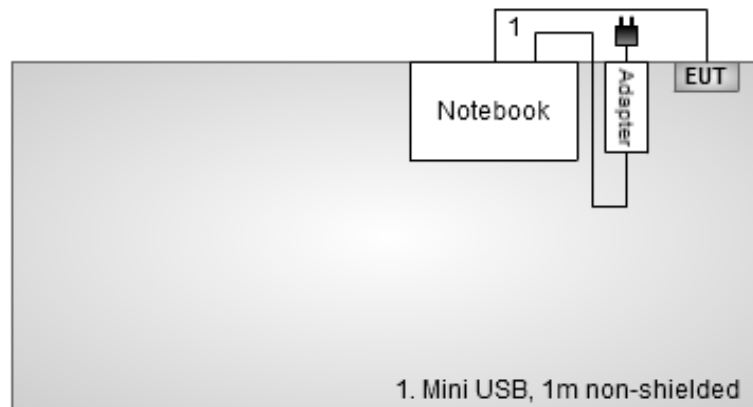
The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
Operating Mode	Operating Mode Description
1	USB Power & Radio link (BT)

The Worst Case Mode for Following Conformance Tests	
Tests Item	RF Output Power, Power Spectral Density, 6 dB Bandwidth
Test Condition	Conducted measurement at transmit chains
Modulation Mode	LE-1Mbps
Operating Mode	Operating Mode Description
1	USB Power & Radio link (BT)

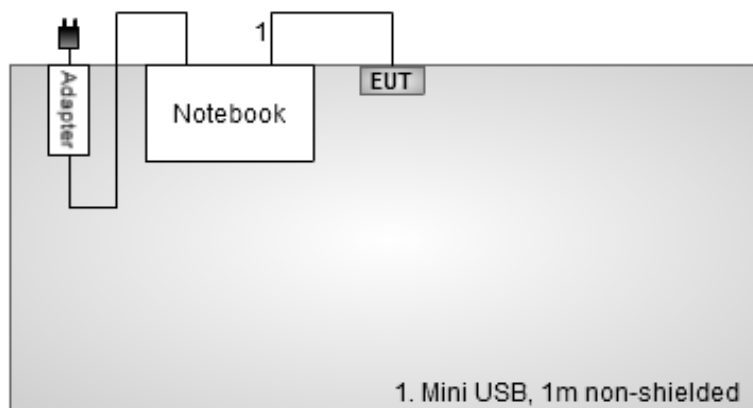
The Worst Case Mode for Following Conformance Tests			
Tests Item	Transmitter Radiated Unwanted Emissions Transmitter Radiated Bandedge Emissions		
Test Condition	Radiated measurement		
User Position	☐ EUT will be placed in fixed position. ☐ EUT will be placed in mobile position and operating multiple positions. EUT shall be performed two orthogonal planes. The worst planes is X. ☒ EUT will be operating multiple positions. EUT shall be performed two or three orthogonal planes. The worst plane is Z.		
Pretesting Mode < 1GHz	☒ 1. USB Power & Radio link (BT), DC 3.3V ☐ 2. USB Power & Radio link (BT), DC 1.8V		
Orthogonal Planes of EUT	X Plane 	Y Plane 	Z Plane 
Pretesting mode 1 is the worst case and it was record in this test report.			
Modulation Mode	LE-1Mbps		
Operating Mode	Operating Mode Description		
1	USB Power & Radio link (BT), DC 3.3V		

2.5 Test Setup Diagram

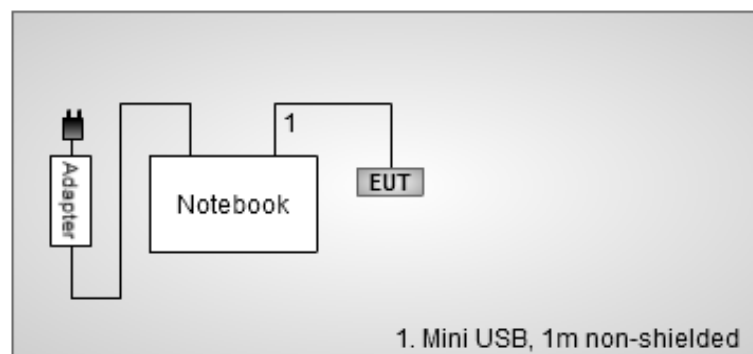
Test Setup Diagram – AC Line Conducted Emission Test



Test Setup Diagram - Radiated Below 1GHz Test



Test Setup Diagram - Radiated Above 1GHz 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.

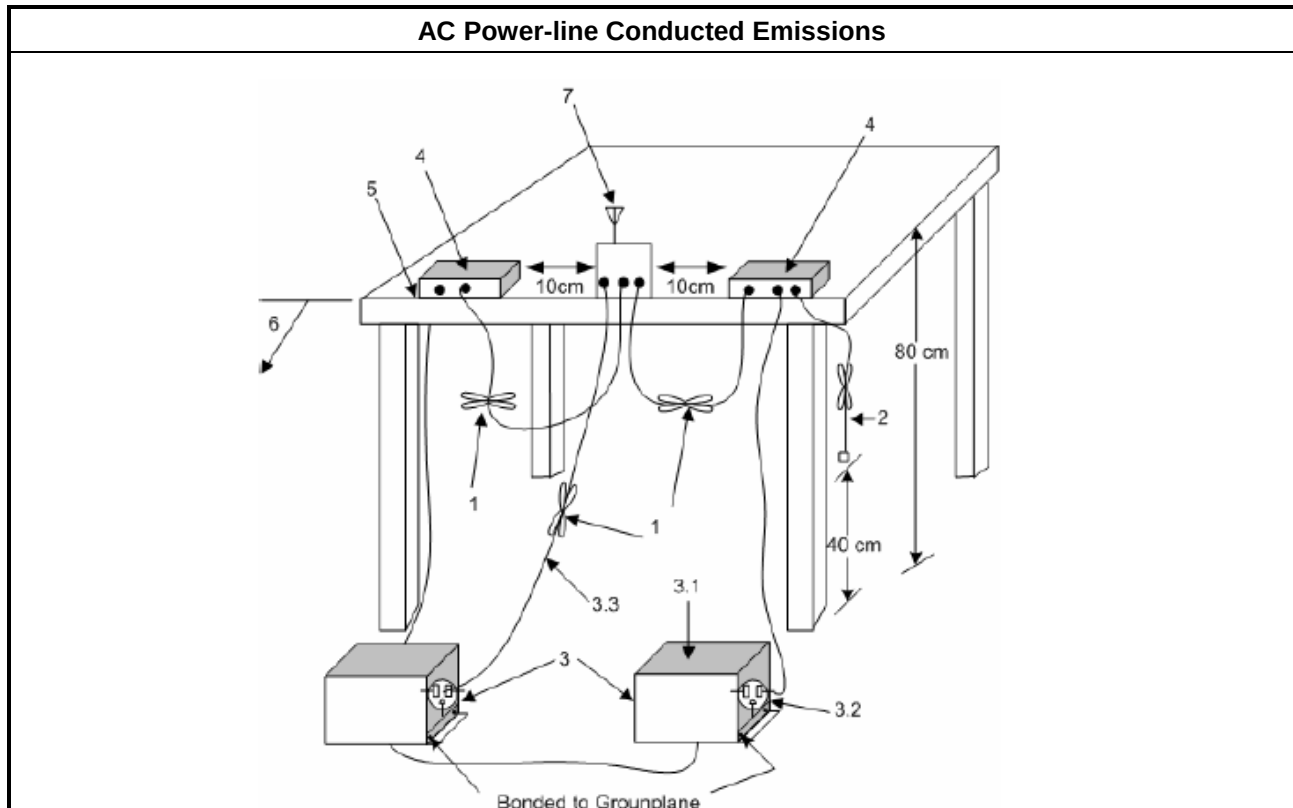
3.1.2 Measuring Instruments

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

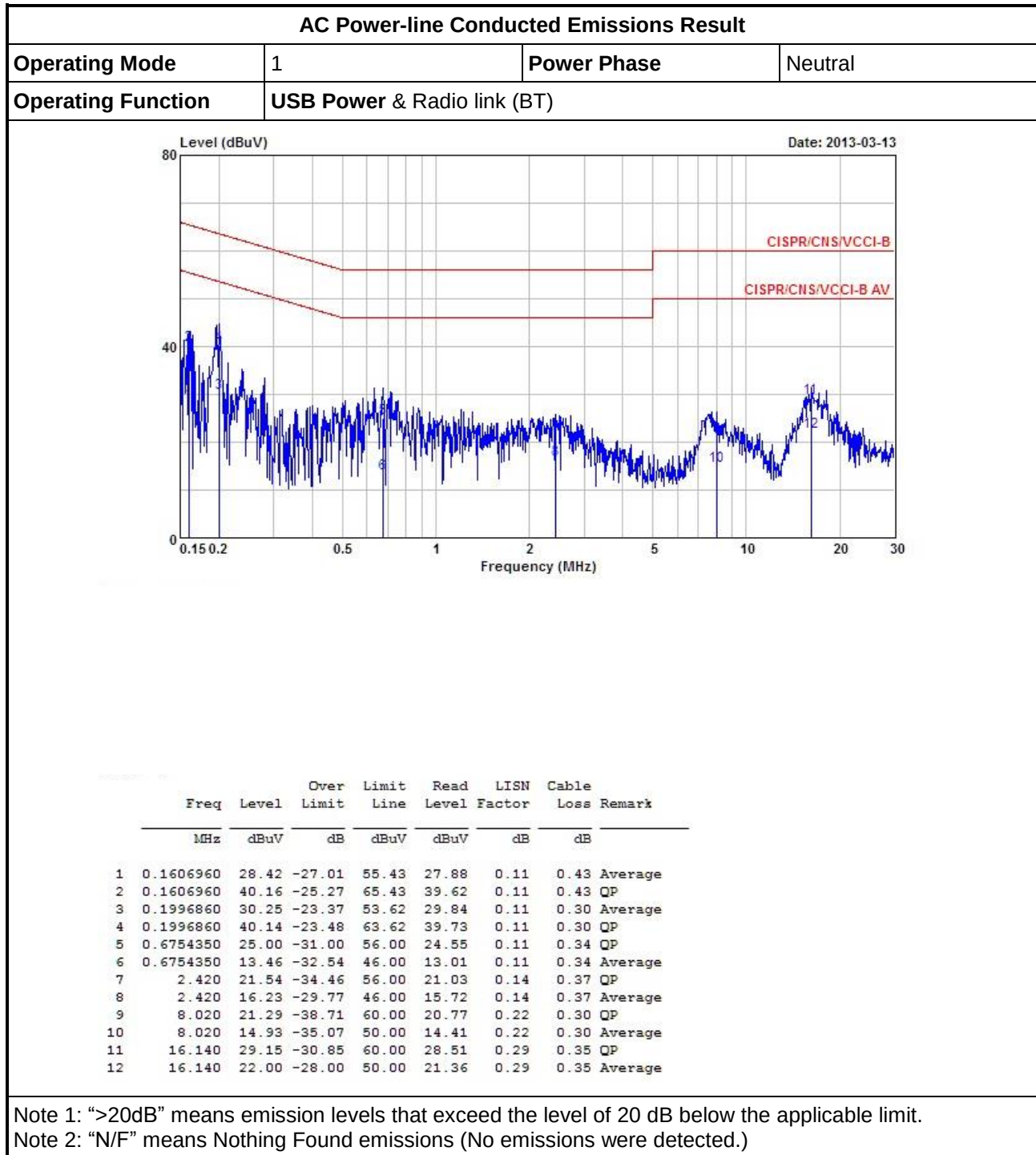
3.1.3 Test Procedures

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

3.1.4 Test Setup

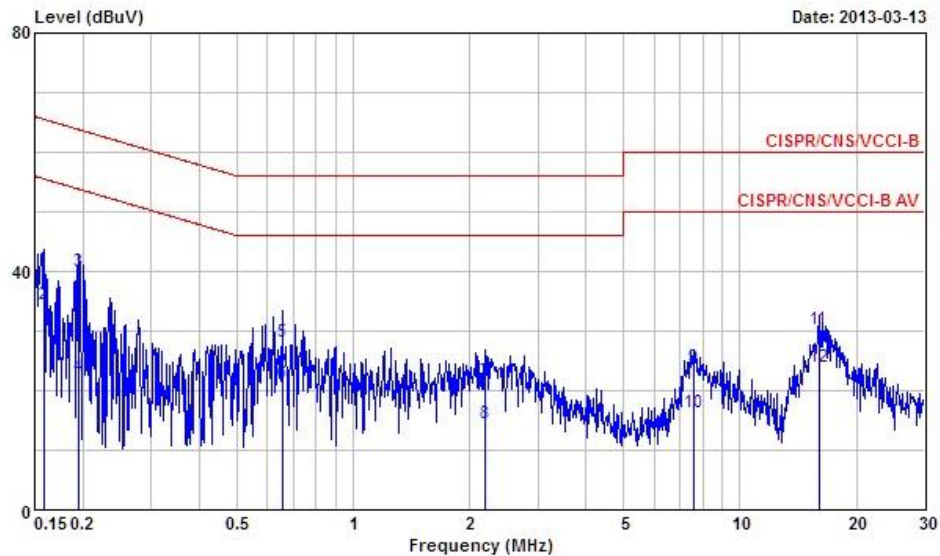


3.1.5 Test Result of AC Power-line Conducted Emissions



AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	USB Power & Radio link (BT)		



	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.1590020	40.55	-24.97	65.52	39.88	0.24	0.43	QP
2	0.1590020	34.38	-21.14	55.52	33.71	0.24	0.43	Average
3	0.1954980	40.09	-23.71	63.80	39.55	0.23	0.31	QP
4	0.1954980	22.44	-31.36	53.80	21.90	0.23	0.31	Average
5	0.6543010	28.04	-27.96	56.00	27.46	0.23	0.35	QP
6	0.6543010	21.20	-24.80	46.00	20.62	0.23	0.35	Average
7	2.200	21.61	-34.39	56.00	20.96	0.26	0.39	QP
8	2.200	14.39	-31.61	46.00	13.74	0.26	0.39	Average
9	7.610	23.91	-36.09	60.00	23.23	0.38	0.30	QP
10	7.610	16.38	-33.62	50.00	15.70	0.38	0.30	Average
11	15.970	30.17	-29.83	60.00	29.30	0.51	0.36	QP
12	15.970	23.85	-26.15	50.00	22.98	0.51	0.36	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 6dB Bandwidth

3.2.1 6dB Bandwidth Limit

6dB Bandwidth Limit	
Systems using digital modulation techniques:	
☒	6 dB bandwidth $\geq$ 500 kHz.

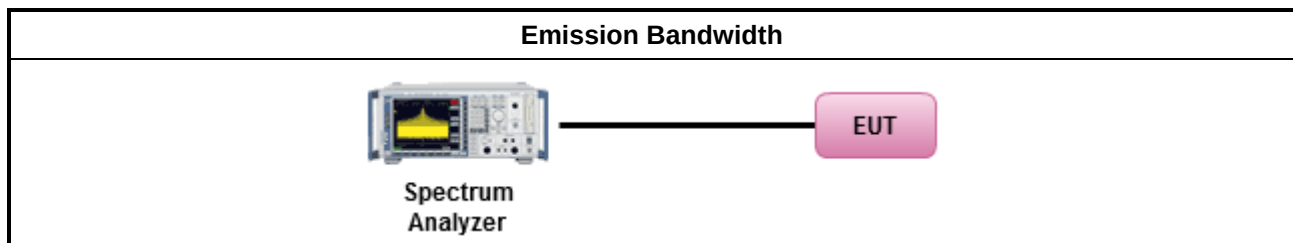
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

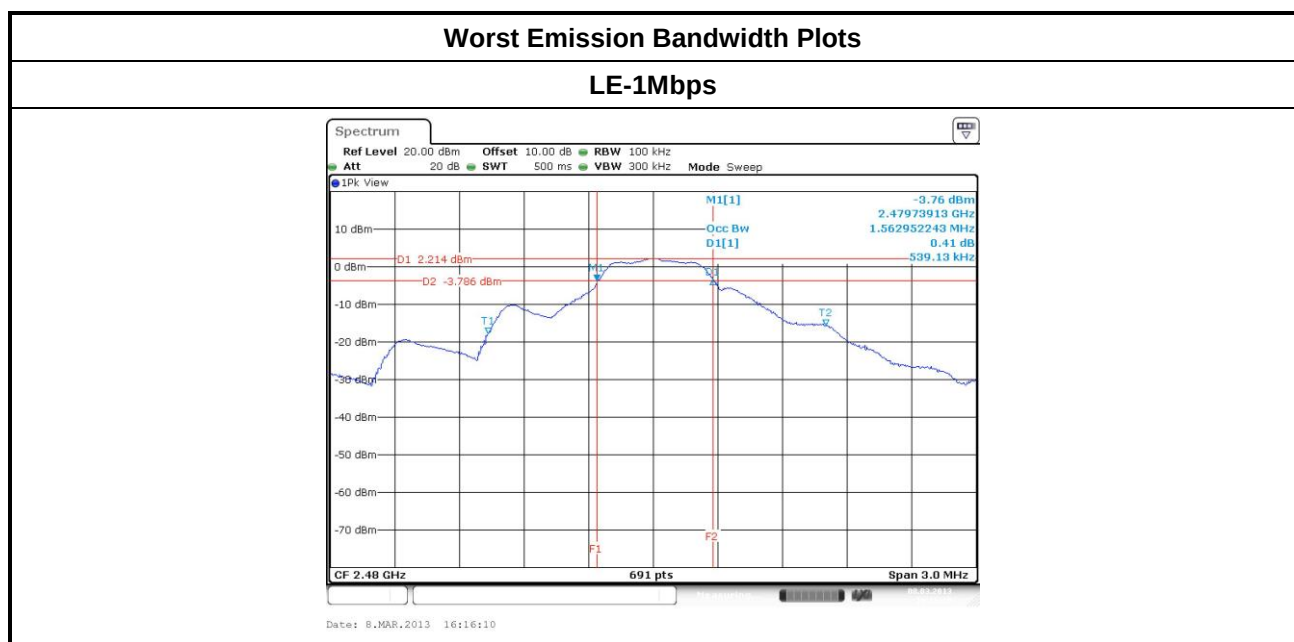
Test Method	
☒	For the emission bandwidth shall be measured using one of the options below:
☒	Refer as FCC KDB 558074, clause 7.1 Option 1 for 6 dB bandwidth measurement.
☐	Refer as FCC KDB 558074, clause 7.2 Option 2 for 6 dB bandwidth measurement.
☐	Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.
☒	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 Emission Bandwidth

Emission Bandwidth Result			
Modulation Mode	Freq. (MHz)	99% Bandwidth (kHz)	6dB Bandwidth (kHz)
LE-1Mbps	2402	985.53	530.43
LE-1Mbps	2440	1263.39	534.78
LE-1Mbps	2480	1562.95	539.13
Limit		N/A	≥500 kHz
Result		Complied	



3.3 RF Output Power

3.3.1 RF Output Power Limit

RF Output Power Limit for Digital Modulation Systems	
Maximum Peak Conducted Output Power or Maximum Conducted Output Power Limit	
☒	2400-2483.5 MHz Band:
☒	If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)
☐	Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ dBm
e.i.r.p. Power Limit:	
☒	2400-2483.5 MHz Band
☒	Point-to-multipoint systems (P2M): $P_{eirp} \leq 36$ dBm (4 W)
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi. P_{eirp} = e.i.r.p. Power in dBm.	

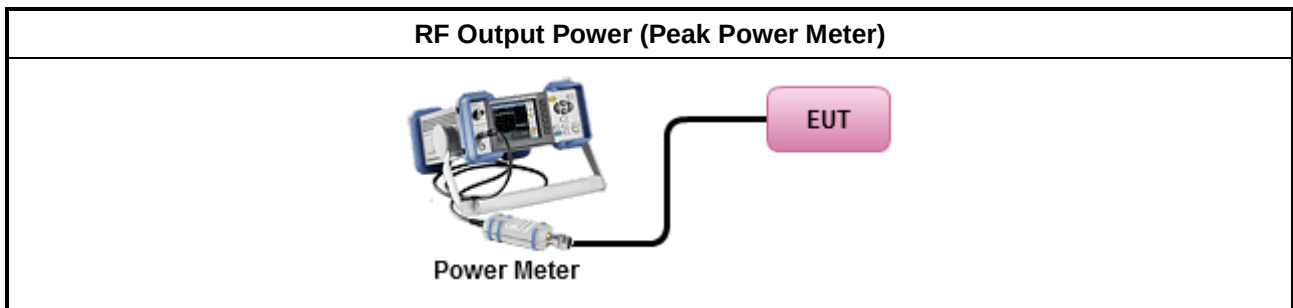
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
☒	Maximum Peak Conducted Output 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).
☒	Refer as FCC KDB 558074, clause 2 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 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
LE-1Mbps	2402	2.55	30	2.0	4.55	36
LE-1Mbps	2440	2.44	30	2.0	4.44	36
LE-1Mbps	2480	2.34	30	2.0	4.34	36
Result		Complied				

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

Power Spectral Density Limit	
☒	Power Spectral Density (PSD) ≤ 8 dBm/3kHz

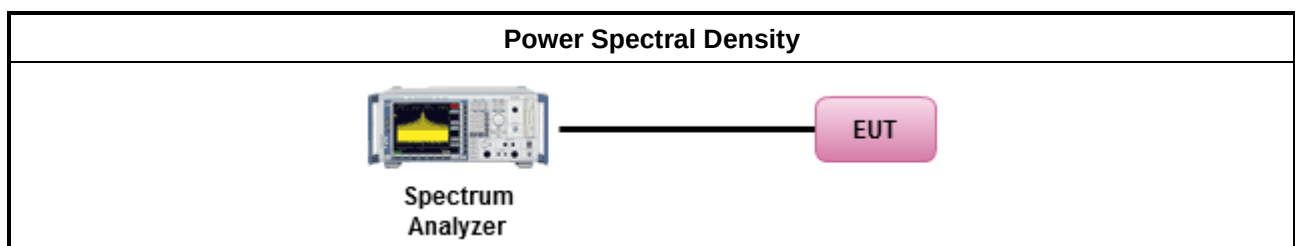
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

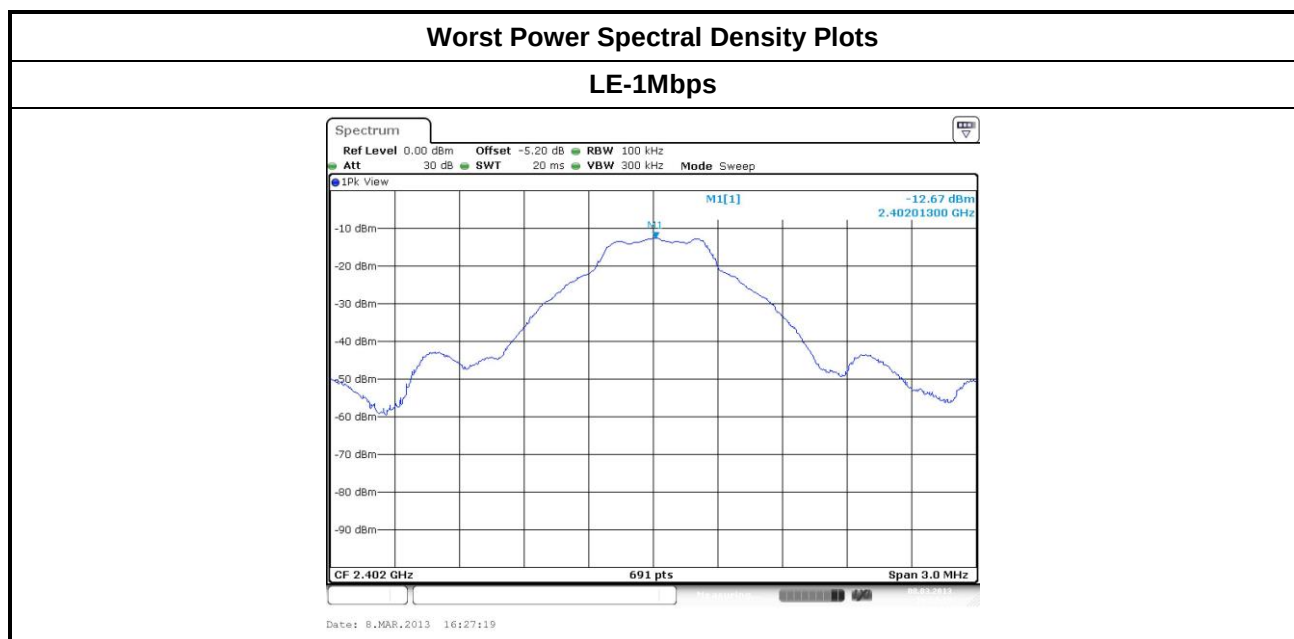
Test Method	
☒	Power spectral density procedures that the same method as used to determine the conducted output power shall be used to determine the power spectral density. In addition, the use of a peak PSD procedure will always result in a "worst-case" measured level for comparison to the limit. Therefore, whenever the DTS bandwidth exceeds 500 kHz, it is acceptable to utilize the peak PSD procedure to demonstrate compliance to the PSD limit, regardless of how the fundamental output power was measured. For the power spectral density shall be measured using below options:
☒	Refer as FCC KDB 558074, clause 9.1 Option 1 - (RBW $\geq$ 3kHz; sweep=auto, detector=peak).
☐	Refer as FCC KDB 558074, clause 9.2 Option 2 - (RBW $\geq$ 3kHz; sweep=auto, average=100).
☐	Refer as FCC KDB 558074, clause 9.3 Option 3 - (RBW $\geq$ 3kHz; slow sweep speed).
☐	Refer as FCC KDB 558074, clause 9.4 Alternative 1 (average PSD; Add 10log (1/duty cycle).
☐	RBW>3kHz, add the bandwidth correction factor (BWCF) adjusting in PSD per 3kHz.
☒	Refer as FCC KDB 558074, clause 2 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



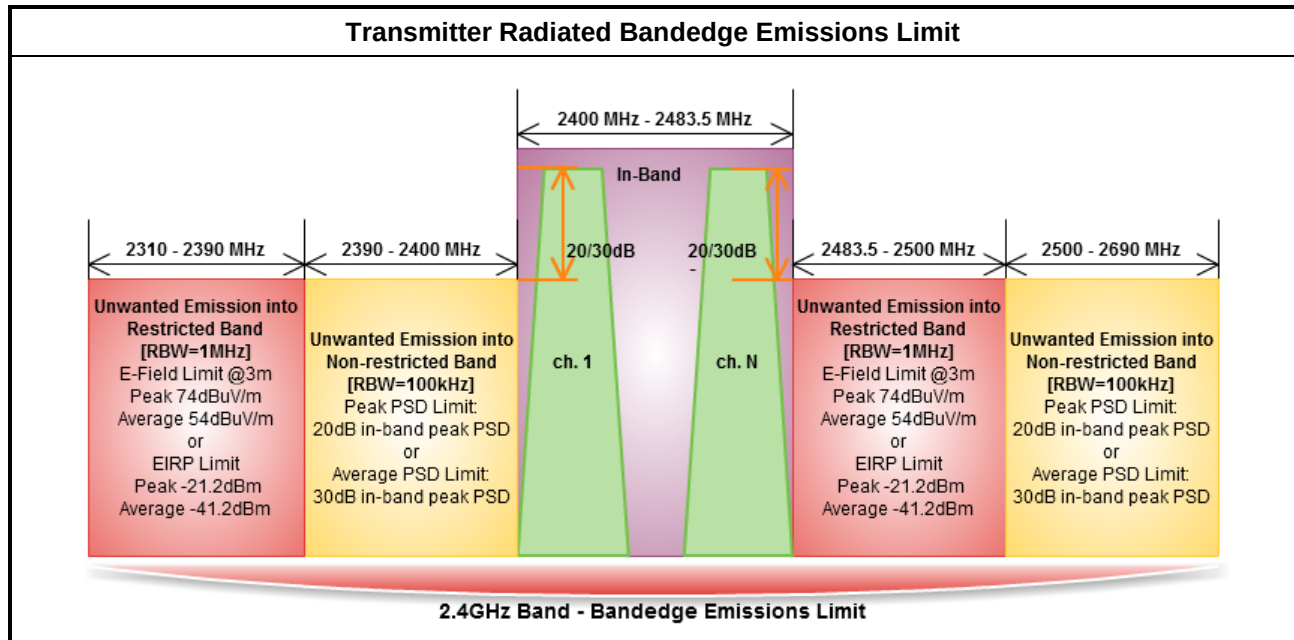
3.4.5 Test Result of Power Spectral Density

Power Spectral Density Result (dBm/3kHz)			
Modulation Mode	Freq. (MHz)	PSD	PSD Limit
LE-1Mbps	2402	-12.67	8
LE-1Mbps	2440	-12.75	8
LE-1Mbps	2480	-12.88	8
Result		Complied	
Note 1: PSD [dBm/3kHz] = PSD [dBm/100kHz] + BWFC [-15.2 dB]			



3.5 Transmitter Radiated Bandedge Emissions

3.5.1 Transmitter Radiated Bandedge Emissions Limit



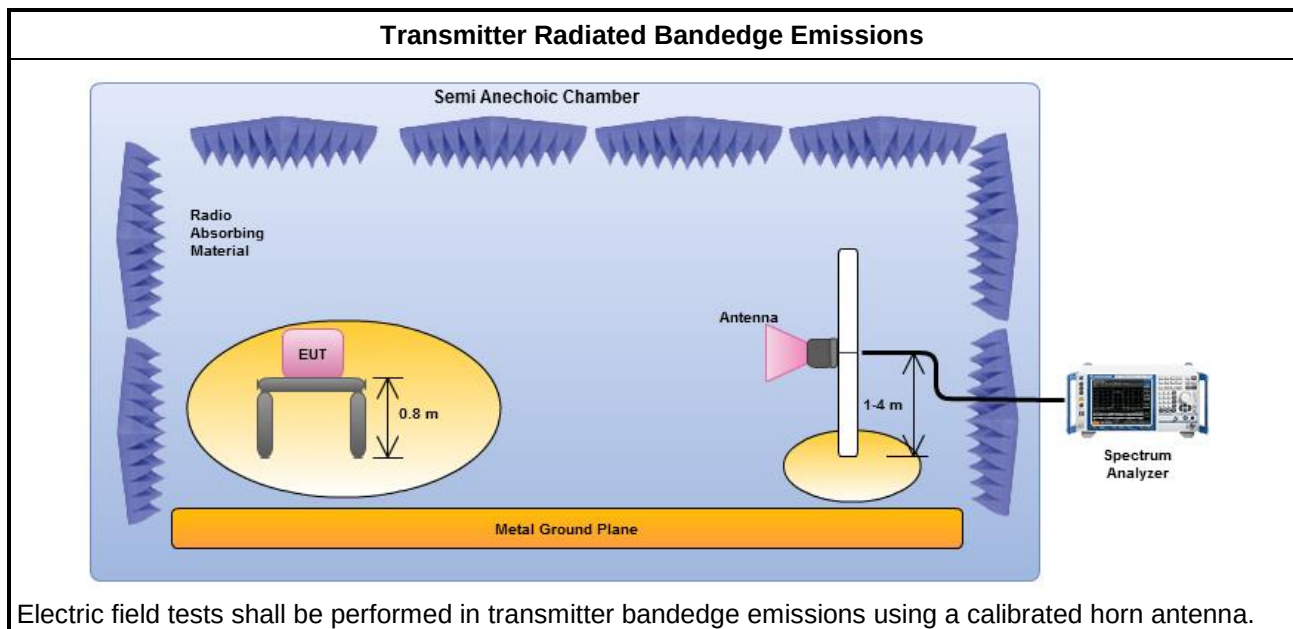
3.5.2 Measuring Instruments

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

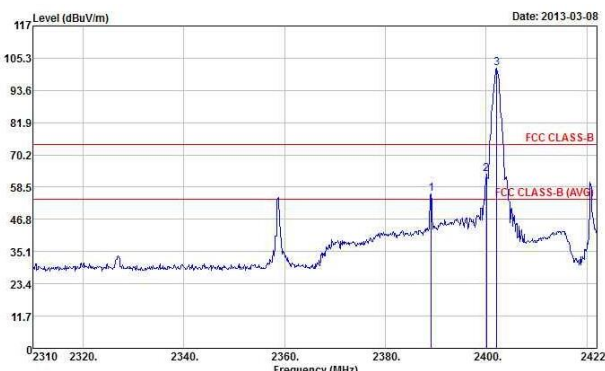
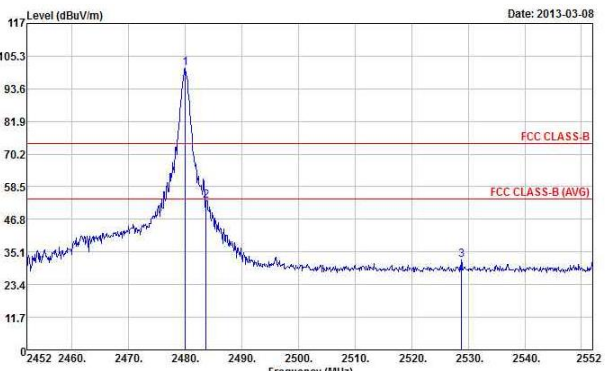
3.5.3 Test Procedures

Test Method – General Information	
☒	The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].
☒	Refer as ANSI C63.10, clause 6.9.2.2 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.
☒	For radiated measurement, refer as FCC KDB 558074, clause 10.2.1.
☒	For conducted measurement, refer as FCC KDB 558074, clause 10.2.2.

3.5.4 Test Setup



3.5.5 Test Result of Transmitter Radiated Bandedge Emissions

Transmitter Radiated Bandedge Emissions Result								
Modulation	LE-1Mbps		Non-restricted Band Emissions					
Non-restricted Band (MHz)	Test Ch. Freq. (MHz)	In-band PSD [i] (dBuV/100kHz)	NBE Freq. (MHz)	Out-band PSD [o] (dBuV/100kHz)	[i] – [o] (dB)	Limit (dB)	Level Type	Pol. note 1
2390-2400	2402	101.82	2400.00	63.18	38.64	20	PK	V
2500-2690	2480	101.10	2528.80	32.22	68.88	20	PK	V
Low Bandedge				Up Bandedge				
								

Note 1: Measurement worst emissions of receive antenna polarization: V (Vertical)

Transmitter Radiated Bandedge Emissions Result								
Modulation	LE-1Mbps		Restricted Band Emissions					
Restricted Band (MHz)	Test Ch. Freq. (MHz)	In-band PSD [i] (dBuV/1MHz)	RBE Freq. (MHz)	Measure Distance (m)	Out-Band Level (dBuV/m)	Limit (dBuV/m)	Level Type	Pol. note 1
2310-2390	2402	101.84	2389.07	3	62.79	74	PK	V
2310-2390	2402	100.62	2385.82	3	30.96	54	AV	V
2483.5-2500	2480	101.25	2483.5	3	66.74	74	PK	V
2483.5-2500	2480	99.95	2483.5	3	36.69	54	AV	V

Note 1: Measurement worst emissions of receive antenna polarization: V (Vertical).

Note 2: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is "Pulse On Time", e.g., LE VBW≥1/625us, VBW=3kHz.

3.6 Transmitter Radiated Unwanted Emissions

3.6.1 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.

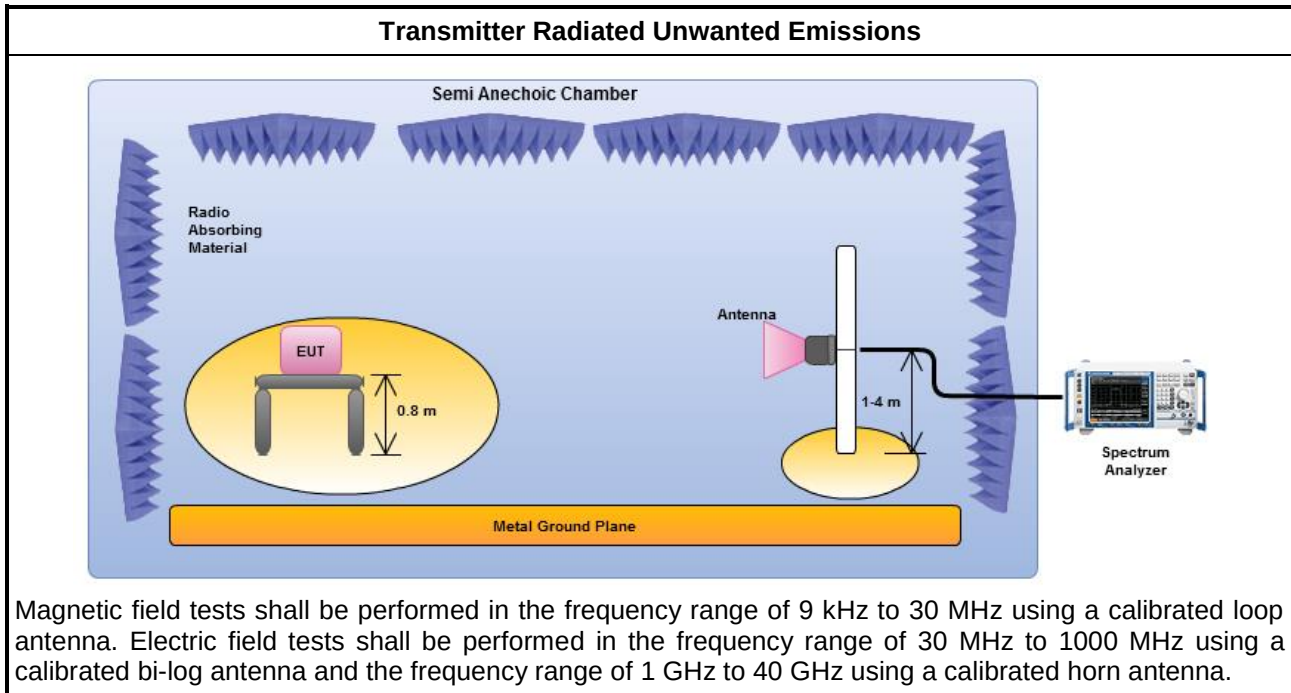
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

Test Method – General Information	
☒	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).
☐	Measurements in the frequency range 10 GHz - 18GHz are typically made at a closer distance 1m, because the instrumentation noise floor is typically close to the radiated emission limit.
☐	Measurements in the frequency range above 18 GHz - 25GHz are typically made at a closer distance 0.5m, because the instrumentation noise floor is typically close to the radiated emission limit.
☐	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:
☒	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 radiated measurement.
☒	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz.
☒	Refer as ANSI C63.10, clause 6.5 for radiated emissions from 30 MHz to 1000 MHz.
☒	Refer as ANSI C63.10, clause 6.6 for radiated emissions from above 1 GHz.

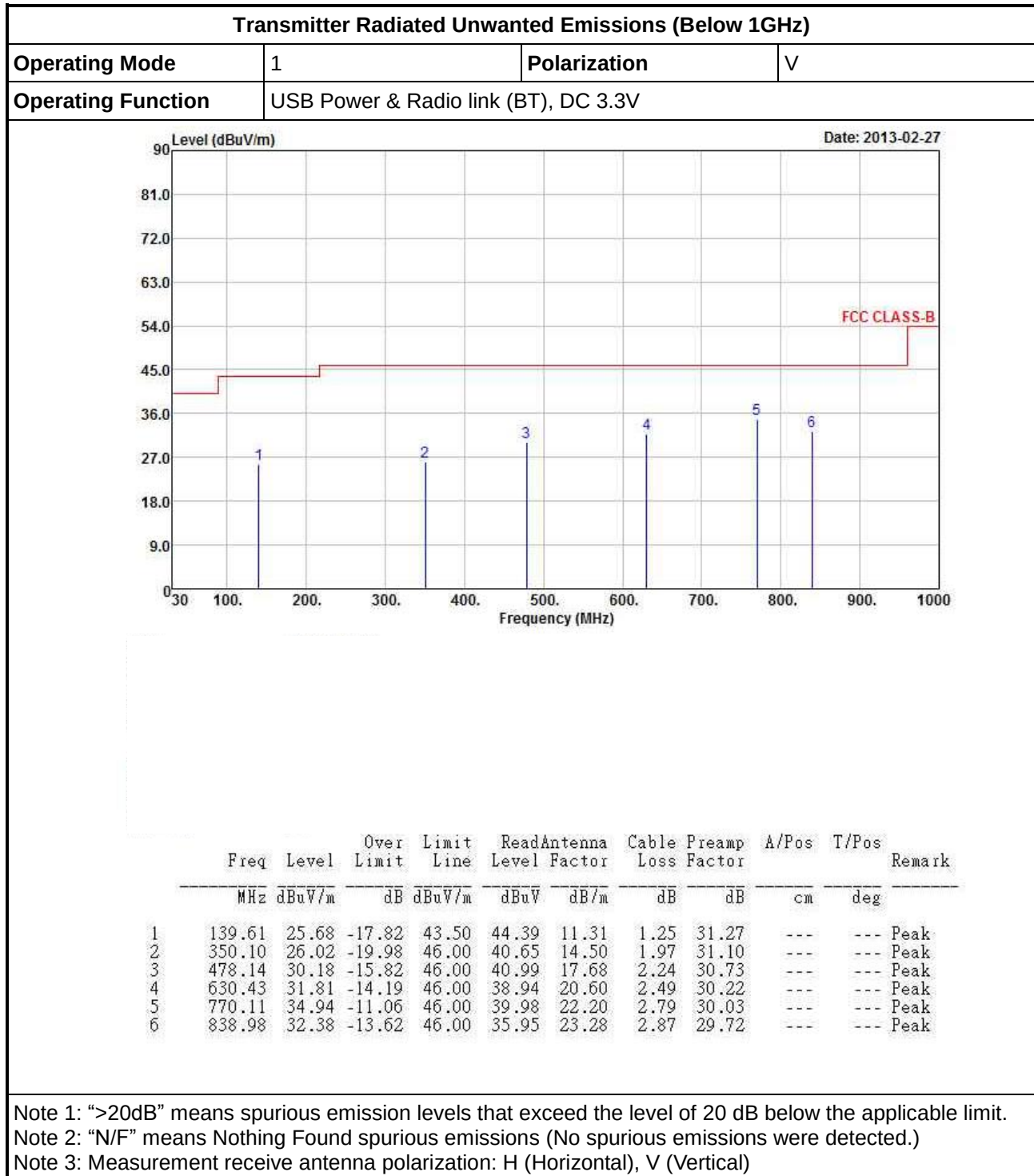
3.6.4 Test Setup



3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

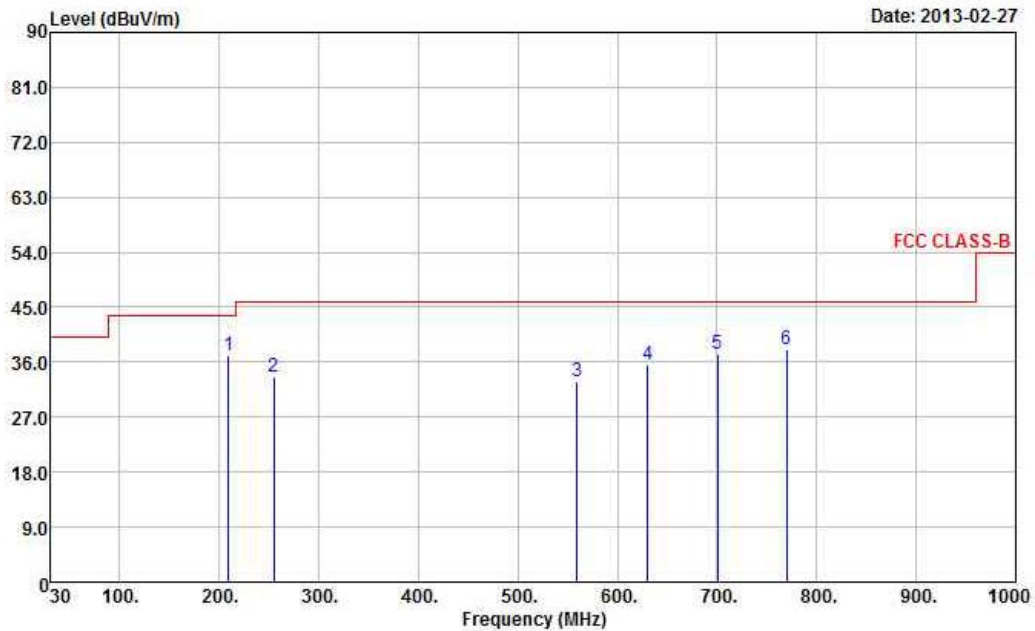
All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

3.6.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)



Transmitter Radiated Unwanted Emissions (Below 1GHz)

Operating Mode	1	Polarization	H
Operating Function	USB Power & Radio link (BT), DC 3.3V		



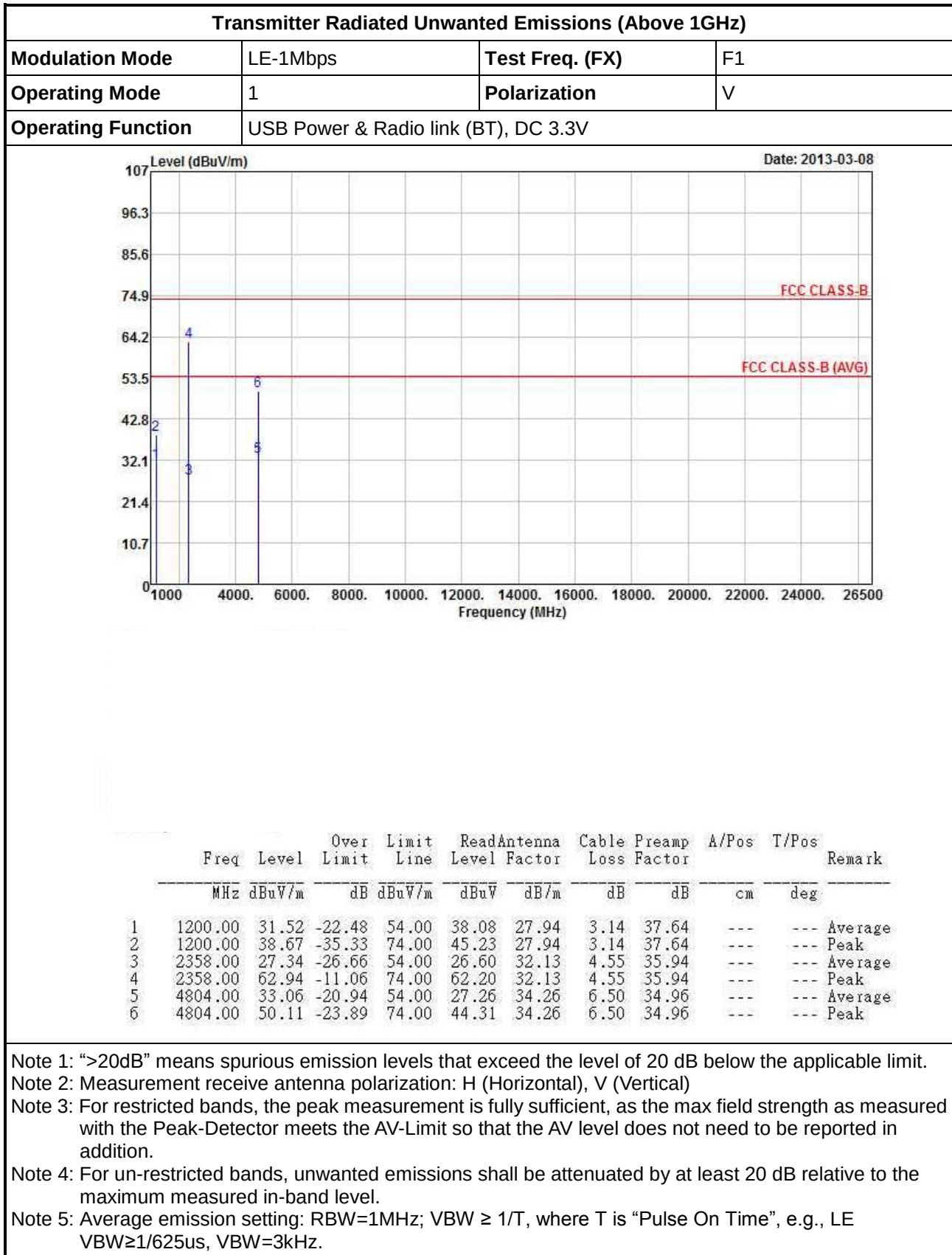
	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	A/Pos	T/Pos	Remark
	MHz	dBuV/m	Limit	Line	Level	Loss	Factor	cm	deg	
			dB	dBuV/m	dBuV	dB	dB			
1	209.45	36.99	-6.51	43.50	57.52	9.19	1.47	31.19	---	Peak
2	255.04	33.53	-12.47	46.00	49.45	13.26	1.77	30.95	---	Peak
3	559.62	32.79	-13.21	46.00	40.96	20.28	2.48	30.93	---	Peak
4	630.43	35.71	-10.29	46.00	42.84	20.60	2.49	30.22	---	Peak
5	700.27	37.43	-8.57	46.00	44.41	20.71	2.52	30.21	---	Peak
6	770.11	38.09	-7.91	46.00	43.13	22.20	2.79	30.03	---	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.)

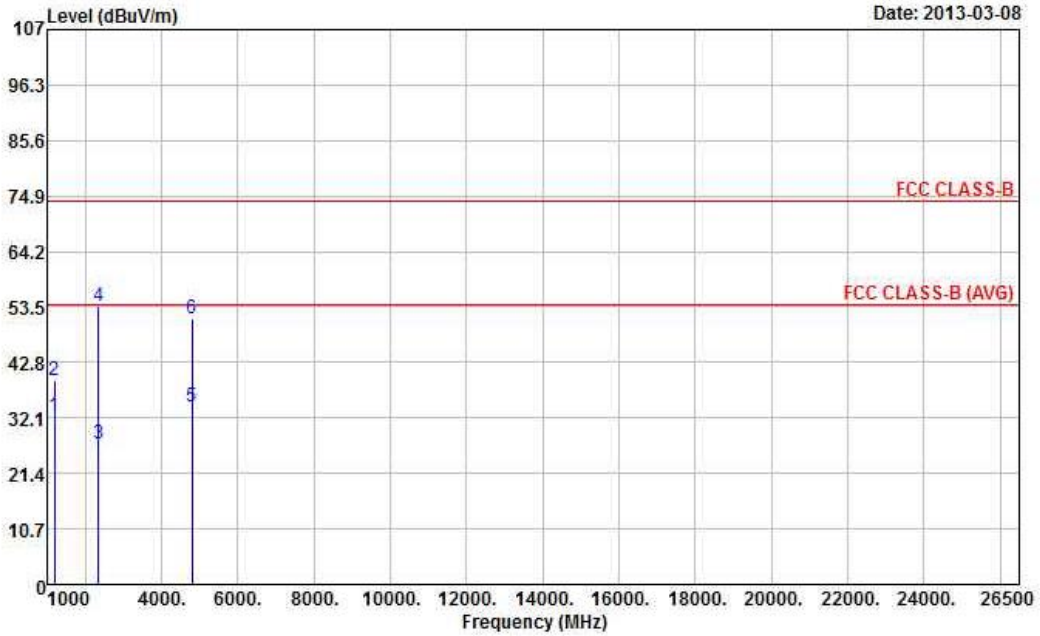
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

3.6.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)



Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	LE-1Mbps	Test Freq. (FX)	F1
Operating Mode	1	Polarization	H
Operating Function	USB Power & Radio link (BT), DC 3.3V		



	Freq	Level	Over Limit	Limit Line	ReadAntenna Level Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark	
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	1200.00	32.55	-21.45	54.00	39.11	27.94	3.14	37.64	---	---	Average
2	1200.00	39.46	-34.54	74.00	46.02	27.94	3.14	37.64	---	---	Peak
3	2358.00	27.18	-26.82	54.00	26.44	32.13	4.55	35.94	---	---	Average
4	2358.00	53.78	-20.22	74.00	53.04	32.13	4.55	35.94	---	---	Peak
5	4804.00	34.42	-19.58	54.00	28.62	34.26	6.50	34.96	---	---	Average
6	4804.00	51.35	-22.65	74.00	45.55	34.26	6.50	34.96	---	---	Peak

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

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

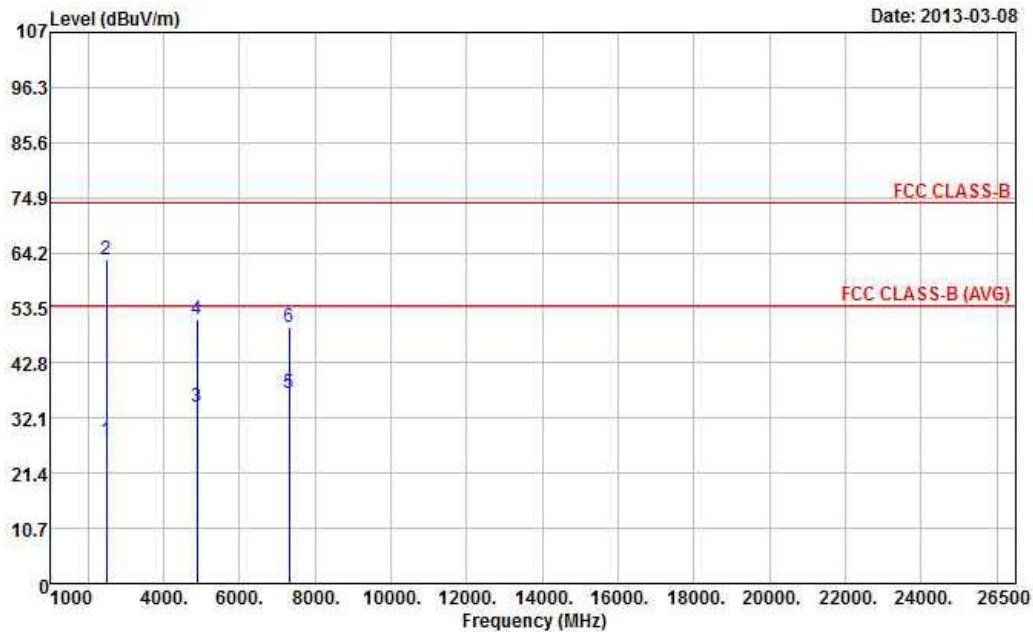
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

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

Note 5: Average emission setting: RBW=1MHz; VBW $\geq 1/T$, where T is "Pulse On Time", e.g., LE VBW $\geq 1/625\mu s$, VBW=3kHz.

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	LE-1Mbps	Test Freq. (FX)	F2
Operating Mode	1	Polarization	V
Operating Function	USB Power & Radio link (BT), DC 3.3V		



	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	A/Pos	T/Pos	Remark
	MHz	dBuV/m	Limit	Line	Level	Loss	Factor	cm	deg	
1	2483.50	27.68	-26.32	54.00	26.59	32.28	4.63	35.82	---	Average
2	2483.50	62.76	-11.24	74.00	61.67	32.28	4.63	35.82	---	Peak
3	4880.00	34.29	-19.71	54.00	28.46	34.28	6.53	34.98	---	Average
4	4880.00	51.29	-22.71	74.00	45.46	34.28	6.53	34.98	---	Peak
5	7320.00	37.09	-16.91	54.00	27.66	36.04	8.42	35.03	---	Average
6	7320.00	49.84	-24.16	74.00	40.41	36.04	8.42	35.03	---	Peak

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

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

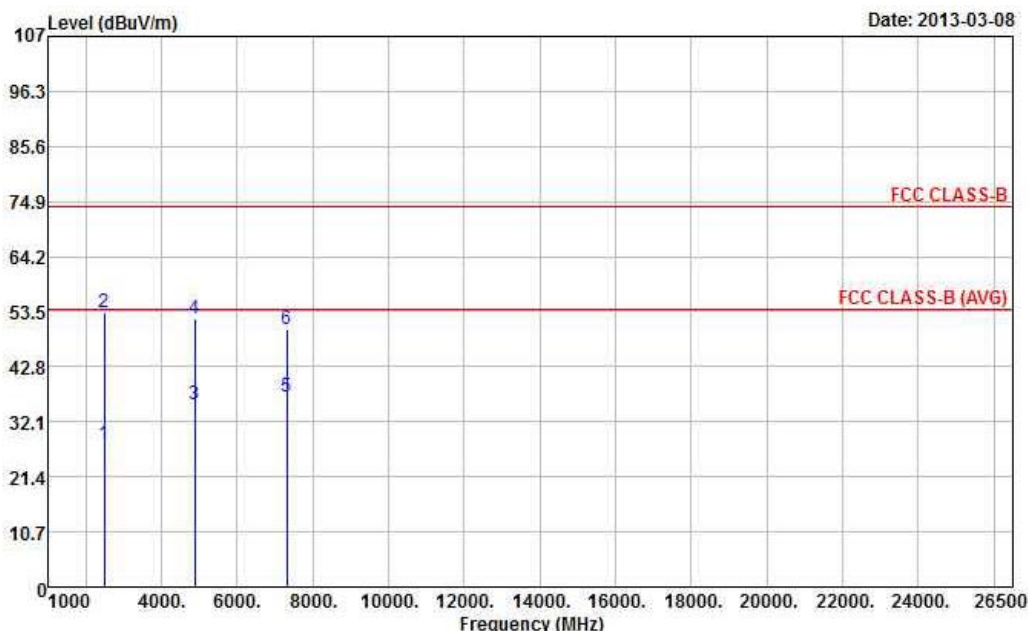
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

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

Note 5: Average emission setting: RBW=1MHz; VBW $\geq 1/T$, where T is "Pulse On Time", e.g., LE VBW $\geq 1/625\mu s$, VBW=3kHz.

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	LE-1Mbps	Test Freq. (FX)	F2
Operating Mode	1	Polarization	H
Operating Function	USB Power & Radio link (BT), DC 3.3V		



	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	A/Pos	T/Pos	Remark
	MHz	dBuV/m	Limit	Line	Level	Loss	Factor	cm	deg	
1	2483.50	27.71	-26.29	54.00	26.62	32.28	4.63	35.82	---	Average
2	2483.50	53.34	-20.66	74.00	52.25	32.28	4.63	35.82	---	Peak
3	4880.00	35.40	-18.60	54.00	29.57	34.28	6.53	34.98	---	Average
4	4880.00	52.29	-21.71	74.00	46.46	34.28	6.53	34.98	---	Peak
5	7320.00	37.05	-16.95	54.00	27.62	36.04	8.42	35.03	---	Average
6	7320.00	50.17	-23.83	74.00	40.74	36.04	8.42	35.03	---	Peak

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

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

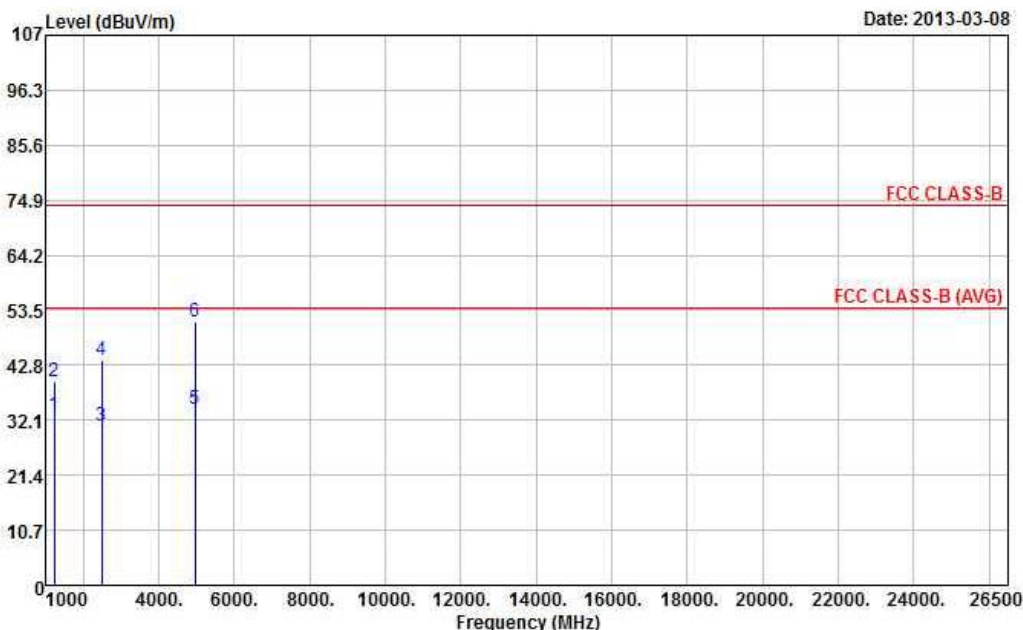
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

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

Note 5: Average emission setting: RBW=1MHz; VBW $\geq 1/T$, where T is "Pulse On Time", e.g., LE VBW $\geq 1/625\mu s$, VBW=3kHz.

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	LE-1Mbps	Test Freq. (FX)	F3
Operating Mode	1	Polarization	V
Operating Function	USB Power & Radio link (BT), DC 3.3V		



	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	A/Pos	T/Pos	Remark
	MHz	dBuV/m	Limit	Line	Level	Loss	Factor	cm	deg	
			dB	dBuV/m	dBuV	dB	dB			
1	1240.00	33.19	-20.81	54.00	39.58	27.95	3.19	37.53	---	Average
2	1240.00	39.66	-34.34	74.00	46.05	27.95	3.19	37.53	---	Peak
3	2495.00	31.02	-22.98	54.00	29.90	32.29	4.64	35.81	---	Average
4	2495.00	43.66	-30.34	74.00	42.54	32.29	4.64	35.81	---	Peak
5	4960.00	34.16	-19.84	54.00	28.29	34.29	6.57	34.99	---	Average
6	4960.00	51.12	-22.88	74.00	45.25	34.29	6.57	34.99	---	Peak

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

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

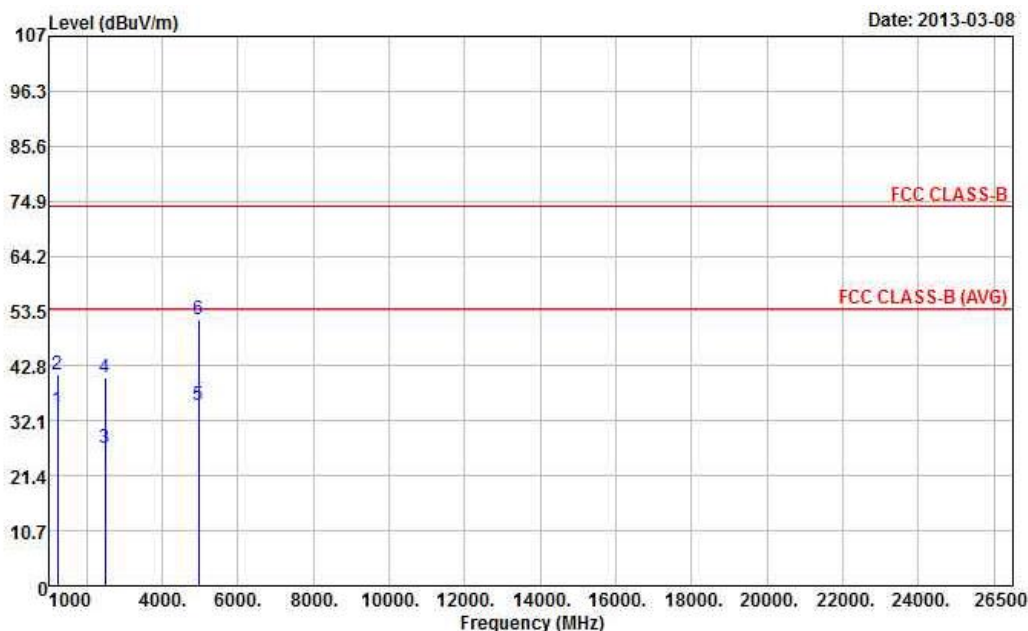
Note 3: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

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

Note 5: Average emission setting: RBW=1MHz; VBW $\geq 1/T$, where T is "Pulse On Time", e.g., LE VBW $\geq 1/625\mu s$, VBW=3kHz.

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	LE-1Mbps	Test Freq. (FX)	F3
Operating Mode	1	Polarization	H
Operating Function	USB Power & Radio link (BT), DC 3.3V		



	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	A/Pos	T/Pos	Remark
	MHz	dBuV/m	Limit	Line	Level	Loss	Factor	cm	deg	
			dB	dBuV/m	dBuV	dB/m	dB	dB		
1	1240.00	34.15	-19.85	54.00	40.54	27.95	3.19	37.53	---	Average
2	1240.00	41.10	-32.90	74.00	47.49	27.95	3.19	37.53	---	Peak
3	2495.00	26.85	-27.15	54.00	25.73	32.29	4.64	35.81	---	Average
4	2495.00	40.41	-33.59	74.00	39.29	32.29	4.64	35.81	---	Peak
5	4960.00	35.20	-18.80	54.00	29.33	34.29	6.57	34.99	---	Average
6	4960.00	51.96	-22.04	74.00	46.09	34.29	6.57	34.99	---	Peak

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

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

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

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

Note 5: Average emission setting: RBW=1MHz; VBW $\geq 1/T$, where T is "Pulse On Time", e.g., LE VBW $\geq 1/625\mu s$, VBW=3kHz.

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	Nov. 22, 2012	Conduction (CO04-HY)
LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	8127-477	9kHz ~ 30MHz	Jan. 21, 2013	Conduction (CO04-HY)
LISN (Support Unit)	EMCO	3810/2NM	9703-1839	9kHz ~ 30MHz	Apr. 20, 2012	Conduction (CO04-HY)
RF Cable-CON	HUBER+SUHNER	RG213/U	7.61183201e+012	9kHz ~ 30MHz	Nov. 09, 2012	Conduction (CO04-HY)
EMI Filter	LINDGREN	LRE-2030	2651	< 450 Hz	N/A	Conduction (CO04-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum Analyzer	R&S	FSP 30	100023/030	9KHz ~ 30GHz	Apr. 27, 2012	Conducted (TH01-HY)
DC Power Source	G.W.	GPC-6030D	C671845	DC 1V ~ 60V	Jun. 19, 2012	Conducted (TH01-HY)
Temp. and Humidity Chamber	Giant Force	GTH-225-20-SP-SD	MAA1112-007	-20 ~ 100°C	Nov. 21, 2012	Conducted (TH01-HY)
Signal Generator	R&S	SMR40	100116	10MHz ~ 40GHz	Jun. 26, 2012	Conducted (TH01-HY)
Power Sensor	Anritsu	MA2411B	1027452	300MHz ~ 40GHz	Sep. 08, 2012	Conducted (TH01-HY)
Power Meter	Anritsu	ML2495A	1124009	300MHz ~ 40GHz	Sep. 08, 2012	Conducted (TH01-HY)
RF Cable-2m	HUBER+SUHNER	SUCOFLEX_104	SN 345675/4	1GHz ~ 26.5GHz	NA	Conducted (TH01-HY)
RF Cable-3m	HUBER+SUHNER	SUCOFLEX_104	SN 345669/4	1GHz ~ 26.5GHz	NA	Conducted (TH01-HY)

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

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
AC Power Source	G.W	APS-9102	EL920581	AC 0V ~ 300V	Jul. 02, 2012	Conducted (TH01-HY)

Note: calibration interval of instruments listed above is two year.



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum Analyzer	R&S	FSP	100055	9Kz – 40GHz	Jun. 06, 2012	Radiation (03CH05-HY)
Receiver	R&S	ESIB26	100337	20Hz – 26.5GHz	Jun. 21, 2012	Radiation (03CH05-HY)
3m Semi Anechoic Chamber	TDK	SAC-3M	03CH05-HY	30 MHz - 1 GHz 3m	N/A	Radiation (03CH05-HY)
Amplifier	COM-POWER	PA-103	161050	1 MHz ~ 1 GHz	Mar. 20, 2012	Radiation (03CH05-HY)
Amplifier	Agilent	8449B	3008A02665	1GHz – 26.5 GHz	Aug. 28, 2012	Radiation (03CH05-HY)
Horn Antenna	ETS-LINDGREN	3117	66584	1GHz~18GHz	Aug. 09, 2012	Radiation (03CH05-HY)
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA 9170517	18G~40G	Jan. 14, 2013	Radiation (03CH05-HY)
RF Cable-R03m	Jye Bao	RG142	03CH05-HY	30 MHz - 1 GHz	Oct. 14, 2012	Radiation (03CH05-HY)
RF Cable-HIGH	SUHNER	SUCOFLEX104	03CH05-HY	1GHz~40GHz	Oct. 14, 2012	Radiation (03CH05-HY)
Bilog Antenna	SCHAFFNER	CBL6111C	2725	30 MHz - 1 GHz	Oct. 06, 2012	Radiation (03CH05-HY)
Turn Table	HD	HD100	420/611	0 - 360 degree	N/A	Radiation (03CH05-HY)
Antenna Mast	HD	HD100	240/666	1 m - 4 m	N/A	Radiation (03CH05-HY)

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

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Loop Antenna *(note 1)	R&S	HFH2-Z2	860004/0001	9 kHz - 30 MHz	Jul. 03, 2012	Radiation (03CH05-HY)

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

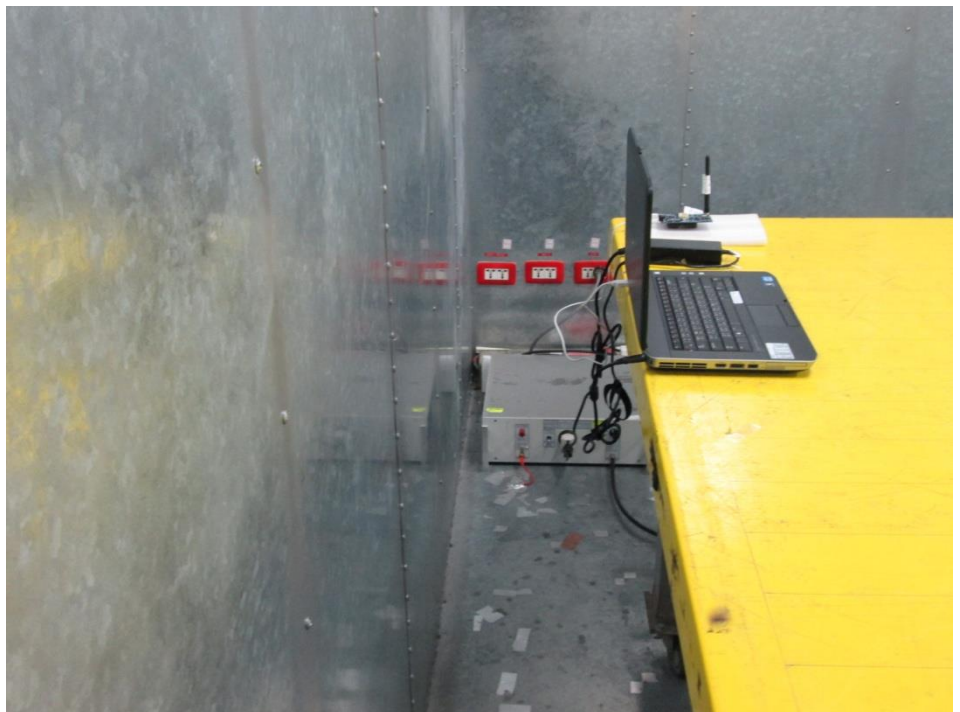
Appendix A. TEST PHOTOS

1 Photographs of Conducted Emissions Test Configuration

FRONT VIEW



REAR VIEW



SIDE VIEW



CLOSE VIEW

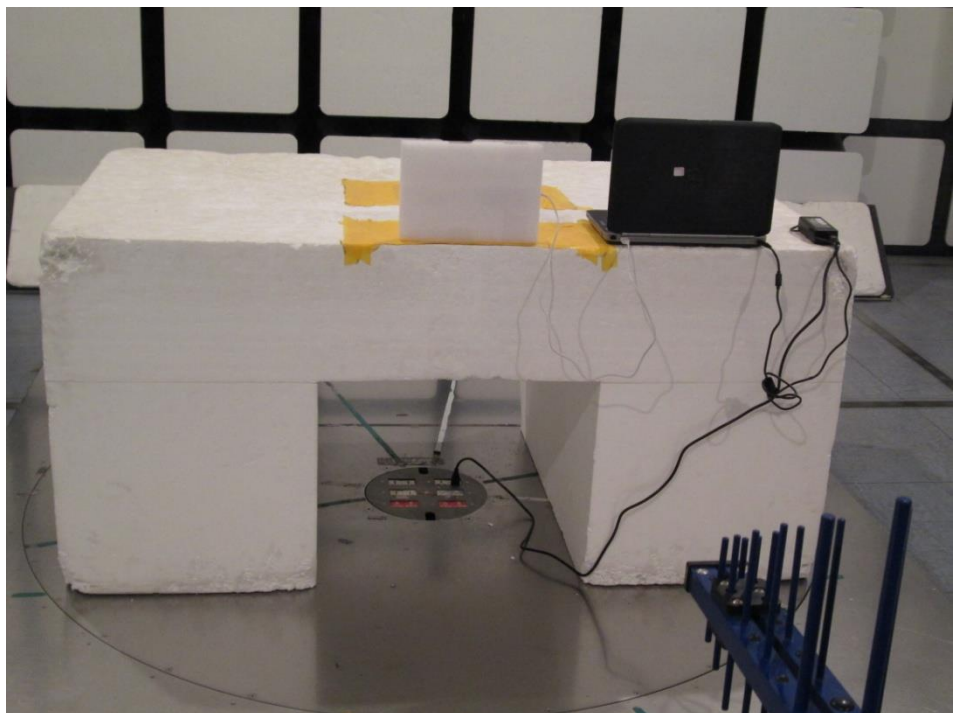


2 Photographs of Radiated Emissions Test Configuration For radiated emission below 1GHz

FRONT VIEW



REAR VIEW

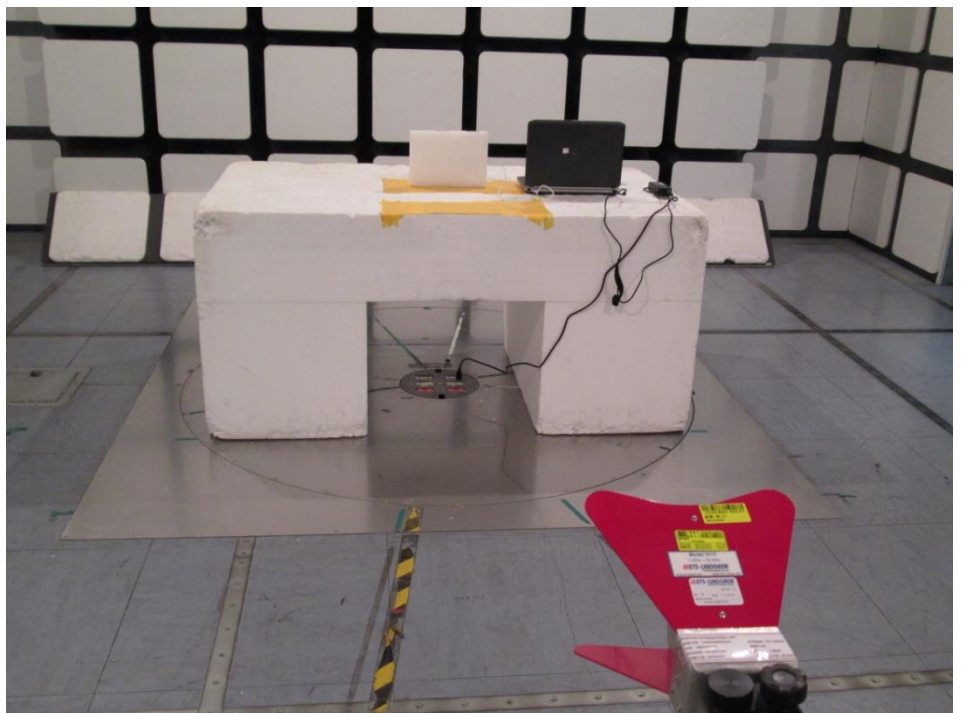


For radiated emission above 1GHz

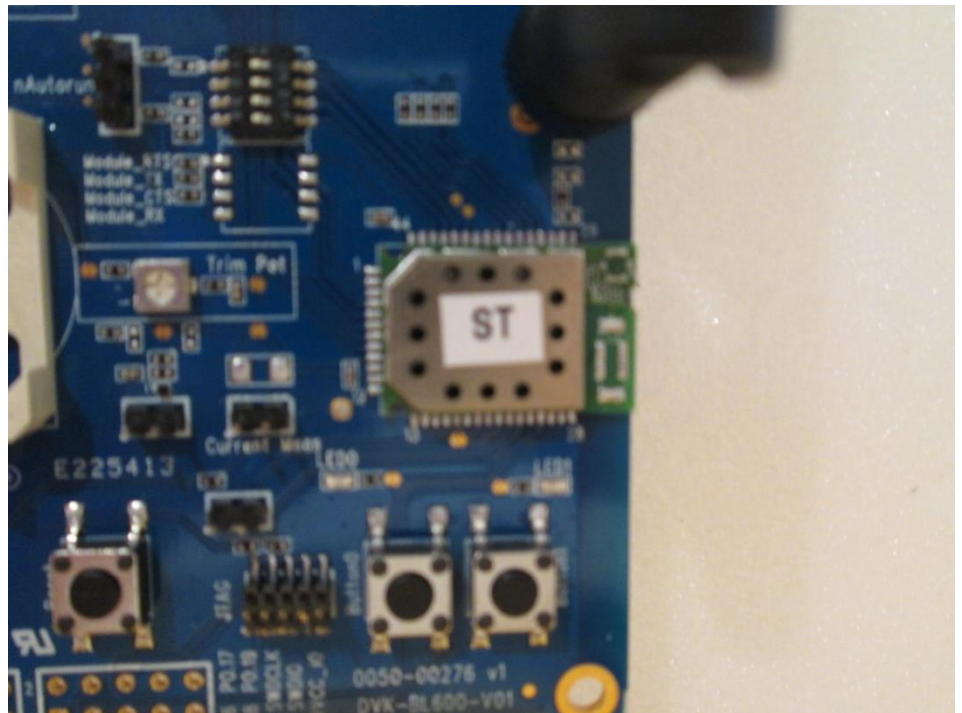
FRONT VIEW



REAR VIEW



CLOSE VIEW



CLOSE VIEW

