

FCC Test Report

Equipment : CEIVA Energy Home Area Network Gateway
Brand Name : CEIVA
Model No. : GWY558
Marketing Name : CEIVAGATEWAY
FCC ID : 2ABKI-GWY558
Standard : 47 CFR FCC Part 15.247
Operating Band : 2400 MHz – 2483.5 MHz
FCC Classification : DTS
Applicant : CEIVA Logic, Inc
214 E Magnolia Blvd, Burbank,
CA 91502, USA
Manufacturer : Quanta Computer Inc.
No. 188, Wenhwa 2nd Rd.
Kueishan Hsiang Tao Yuan Shien
R.O.C. Taiwan

The product sample received on Dec. 27, 2013 and completely tested on Feb. 21, 2014. 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:

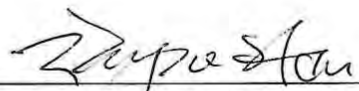

Wayne Hsu / Assistant Manager



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Summary of Test Result

Conformance Test Specifications					
Report Clause	Ref. Std. Clause	Description	Measured	Limit	Result
1.1.2	15.203	Antenna Requirement	Antenna connector mechanism complied	FCC 15.203	Complied
3.1	15.207	AC Power-line Conducted Emissions	[dBuV]: 0.172154MHz 40.01 (Margin 14.85dB) - AV 46.95 (Margin 17.91dB) - QP	FCC 15.207	Complied
3.2	15.247(a)	6dB Bandwidth	6dB Bandwidth Unit [MHz]: 1.57	≥500kHz	Complied
3.3	15.247(b)	RF Output Power (Maximum Peak Conducted Output Power)	Power [dBm]: 11.08	Power [dBm]:30	Complied
3.4	15.247(d)	Power Spectral Density	PSD [dBm/100kHz]: -12.72	PSD [dBm/3kHz]:8	Complied
3.5	15.247(c)	Transmitter Bandedge Emissions	Restricted Bands [dBuV/m at 3m]: 2483.50MHz 69.67 (Margin 4.33dB) - PK 51.05 (Margin 2.95dB) - AV	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied
3.6	15.247(c)	Transmitter Unwanted Emissions	Restricted Bands [dBuV/m at 3m]: 4950MHz 59.85 (Margin 14.15dB) - PK 50.16 (Margin 3.84dB) - AV	Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209	Complied

Revision History

[illegible]

1 General Description

1.1 Information

The equipment is CEIVA Energy Home Area Network Gateway. There are two types of this product. One is device equipped with ERT (Electronics report tooling) and the other is not. ERT functions only as receivers. Two types are tested in this report. For more detailed features description, please refer to the manufacturer's specifications or user's manual.

1.1.1 RF General Information

RF General Information						
Frequency Range (MHz)	Modulation	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N _{TX})	RF Output Power (dBm)	Co-location
2400-2483.5	O-QPSK	2405-2475	11-25 [15]	1	11.08	Yes
Note 1: RF output power specifies that Maximum Peak Conducted Output Power. Note 2: 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 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	Printed	4.28

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:

1.1.3 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)
☒ 100%	0.00

1.1.4 EUT Operational Condition

Supply Voltage	☒ AC mains	☐ DC	
Type of DC Source	☐ Internal DC supply	☒ External DC adapter	☐ Li-on Battery

1.2 Accessories And Support Equipment

Accessories Information				
AC Adapter	Brand Name	Asian Power Devices INC.	Model Name	WA-13B05FU
	Power Rating	I/P: 100-240V ~ 0.5A 50/60Hz ; O/P: 5V --- 2.5A		
	Power cord	1.5 meter, non-shielded cable, 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	E5500

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 662911

1.4 Testing Location Information

Testing Location			
☒	HWA YA	ADD : No. 52, Hwa Ya 1 st 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
AC Conduction		CO04-HY	Zeus
RF Conducted		TH01-HY	Sky
Radiated Emission		03CH03-HY	Leo
			Test Environment
			20.8°C / 46%
			22.3°C / 61%
			20.1°C / 50%

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

2 Test Configuration of EUT

2.1 The Worst Case Modulation Configuration

Worst Modulation Used for Conformance Testing		
Modulation Mode	Transmit Chains (N _{TX})	RF Output Power (dBm)
O-QPSK	1	11.08
Note 1: RF output power specifies that Maximum Peak Conducted Output Power.		

2.2 Test Channel Frequencies Configuration

Test Channel Frequencies Configuration	
Modulation Mode	Test Channel Frequencies (MHz)
O-QPSK	2405-(F1), 2440-(F2), 2475-(F3)

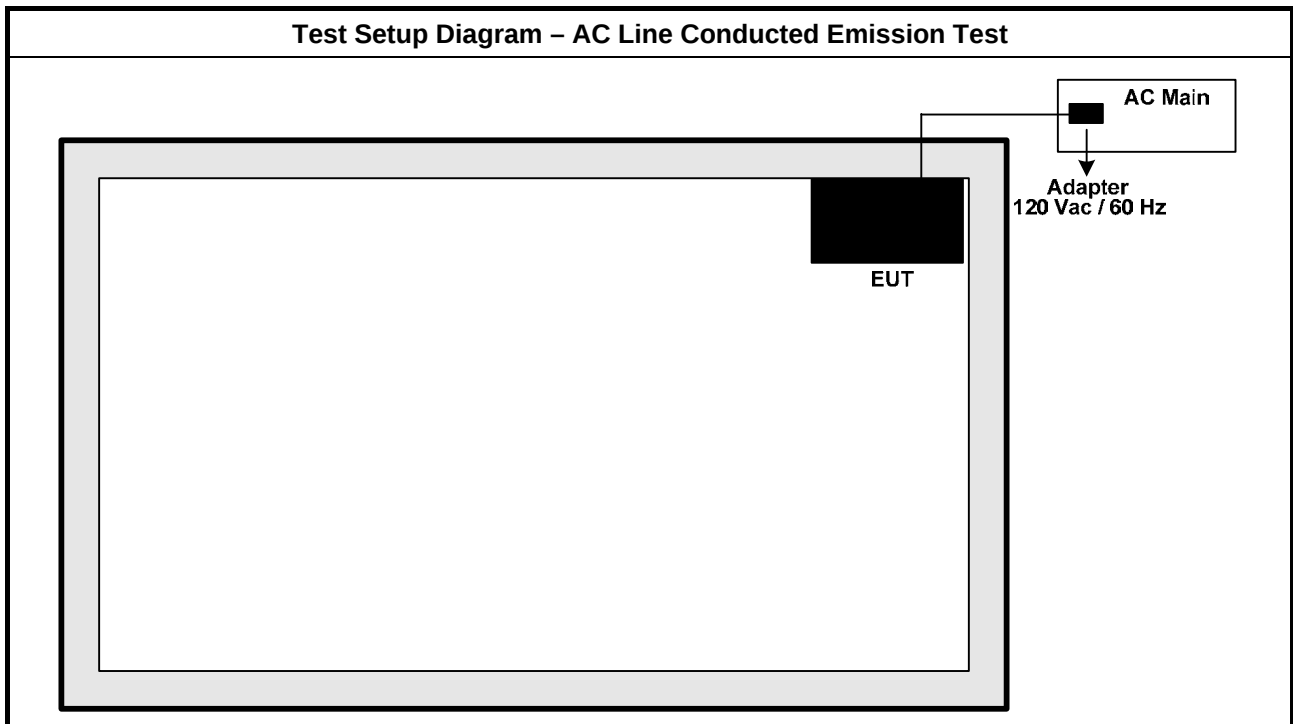
2.3 The Worst Case Measurement Configuration

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 ERT via AC Power & Radio link
2	EUT without ERT via AC Power & Radio link
Operating mode 1 was the worst case and it was record in this test report.	

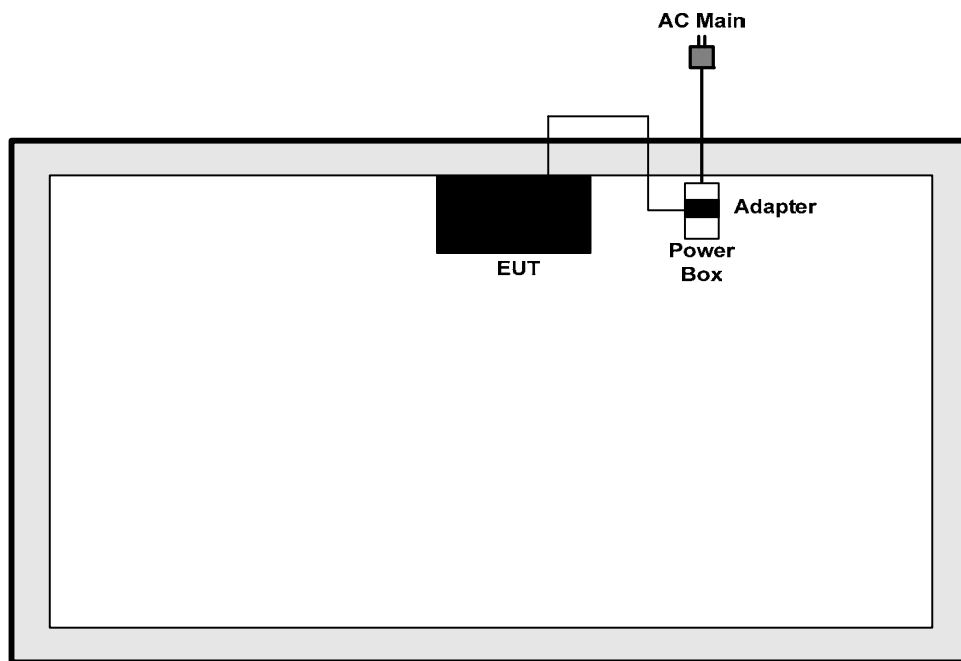
The Worst Case Mode for Following Conformance Tests	
Tests Item	RF Output Power, Power Spectral Density, 6 dB Bandwidth
Test Condition	Conducted measurement at transmit chains
Modulation Mode	O-QPSK

The Worst Case Mode for Following Conformance Tests			
Tests Item	Transmitter Radiated Unwanted Emissions Transmitter Radiated Bandedge Emissions		
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.		
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 plane is Z. ☐ EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions. EUT shall be performed two or three orthogonal planes.		
Operating Mode	☒ 1. EUT with ERT via AC Power & Radio link ☒ 2. EUT without ERT via AC Power & Radio link Operating mode 1 was the worst case and it was recorded in this test report.		
Modulation Mode	O-QPSK		
Orthogonal Planes of EUT	X Plane 	Y Plane 	Z Plane 

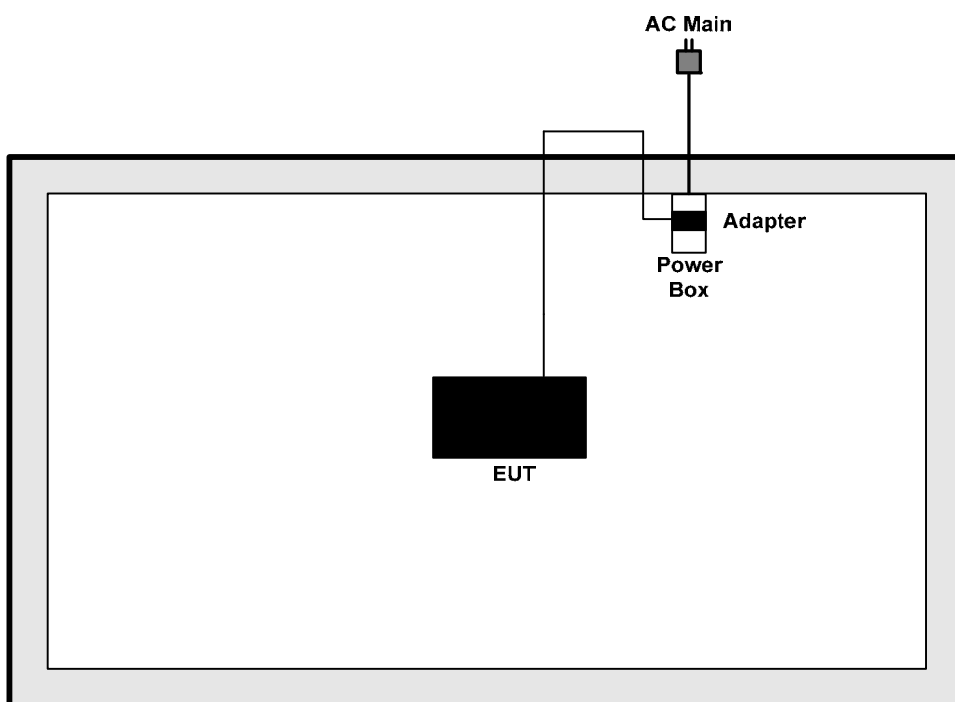
2.4 Test Setup Diagram



Test Setup Diagram - Radiated Test (Below 1GHz)



Test Setup Diagram - Radiated Test (Above 1GHz)



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.

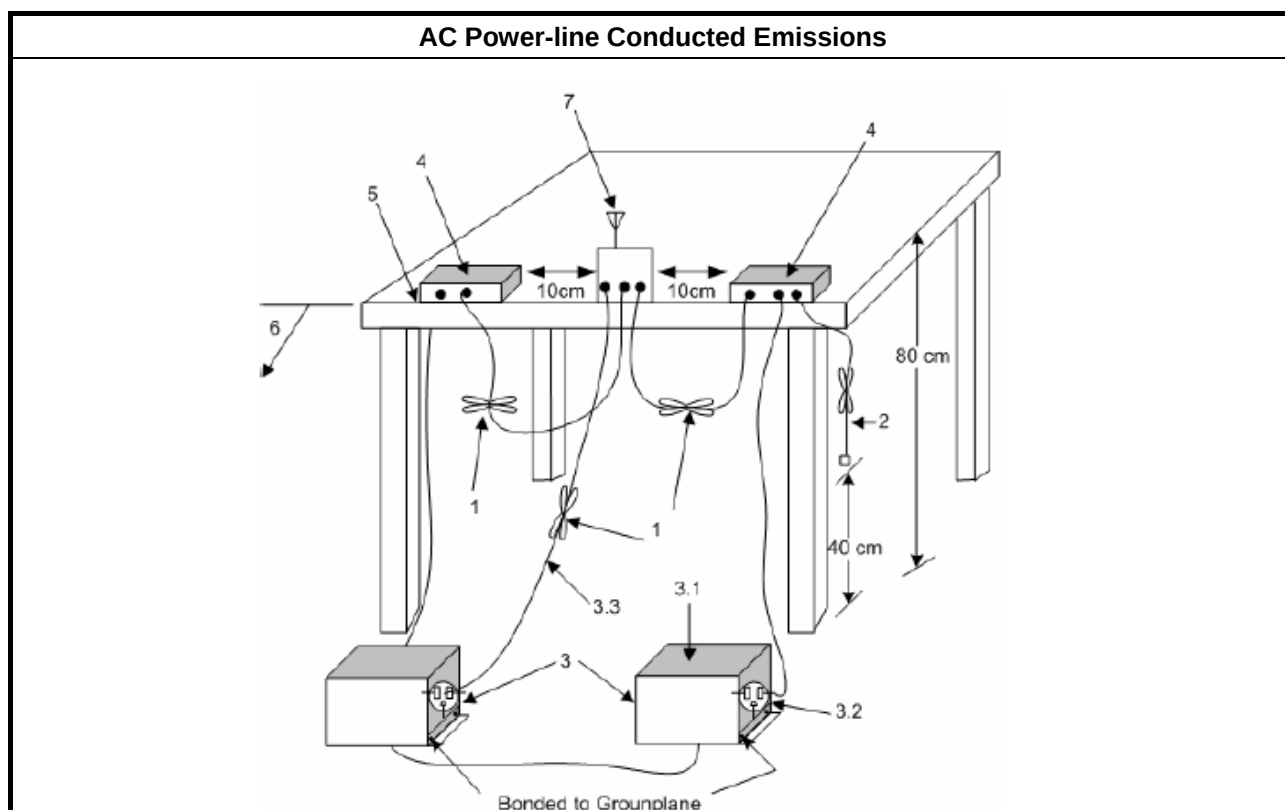
3.1.2 Measuring Instruments

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

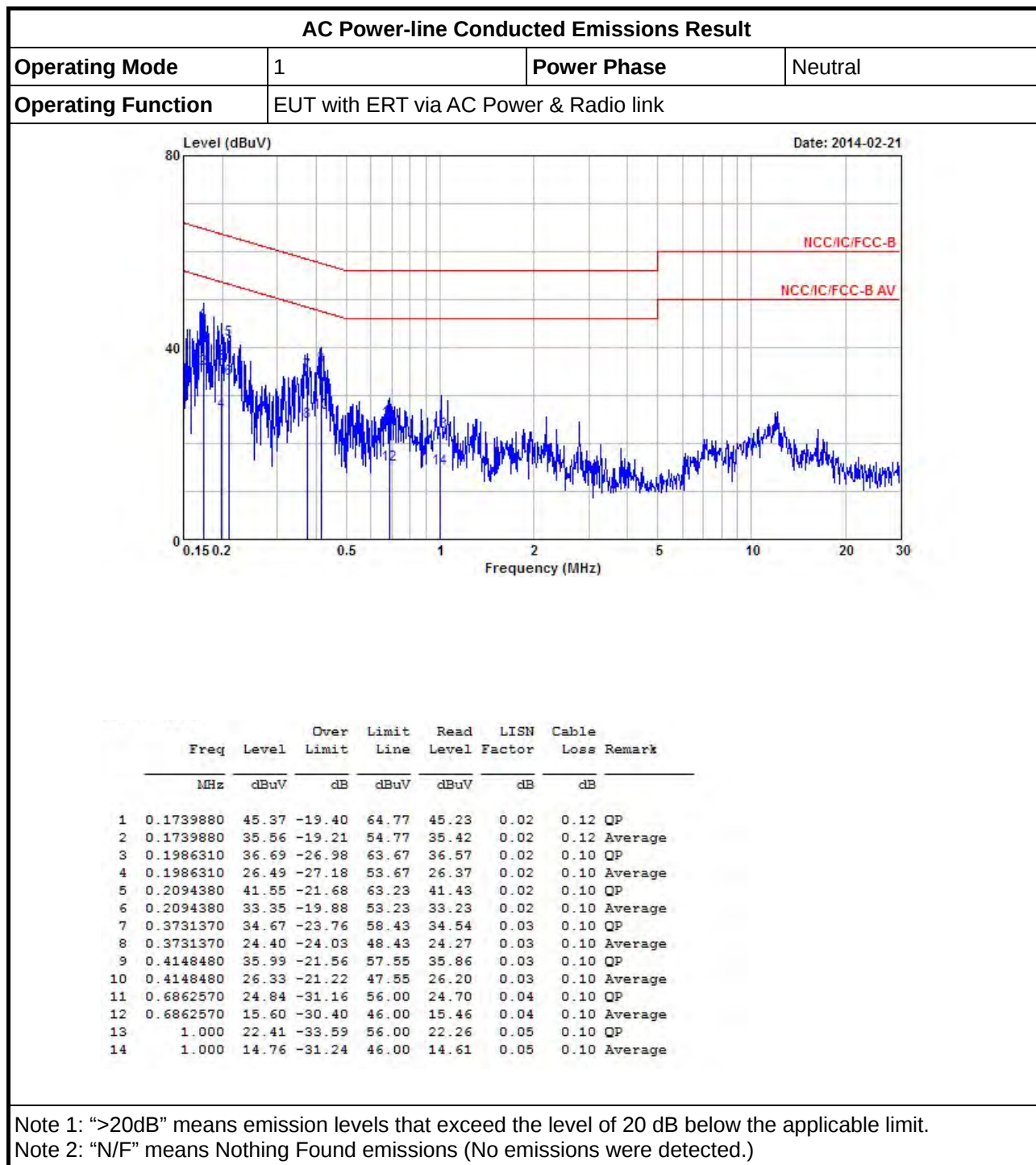
3.1.3 Test Procedures

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

3.1.4 Test Setup

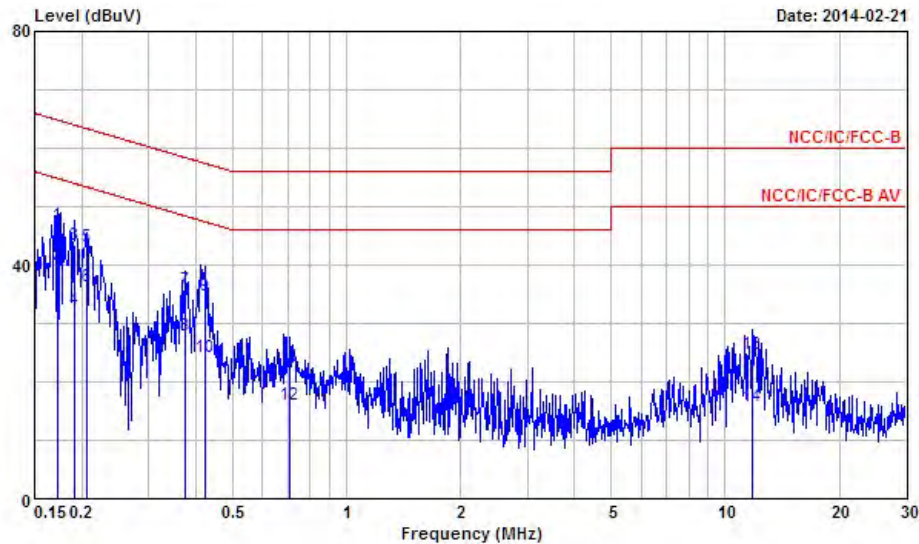


3.1.5 Test Result of AC Power-line Conducted Emissions



AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	EUT with ERT via AC Power & Radio link		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.1721540	46.95	-17.91	64.86	46.80	0.03	0.12	QP
2	0.1721540	40.01	-14.85	54.86	39.86	0.03	0.12	Average
3	0.1903870	43.42	-20.60	64.02	43.28	0.03	0.11	QP
4	0.1903870	32.46	-21.56	54.02	32.32	0.03	0.11	Average
5	0.2061360	43.28	-20.08	63.36	43.15	0.03	0.10	QP
6	0.2061360	36.44	-16.92	53.36	36.31	0.03	0.10	Average
7	0.3751190	35.69	-22.70	58.39	35.56	0.03	0.10	QP
8	0.3751190	27.99	-20.40	48.39	27.86	0.03	0.10	Average
9	0.4214950	34.64	-22.78	57.42	34.51	0.03	0.10	QP
10	0.4214950	24.33	-23.09	47.42	24.20	0.03	0.10	Average
11	0.7084240	22.68	-33.32	56.00	22.53	0.05	0.10	QP
12	0.7084240	16.10	-29.90	46.00	15.95	0.05	0.10	Average
13	11.810	24.68	-35.32	60.00	24.32	0.22	0.14	QP
14	11.810	15.79	-34.21	50.00	15.43	0.22	0.14	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.

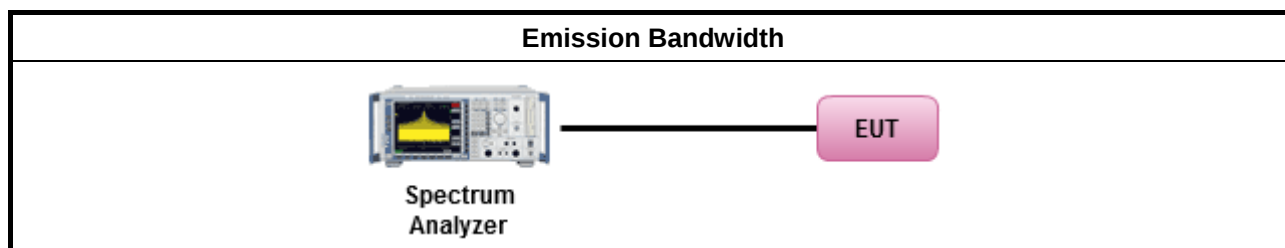
3.2.2 Measuring Instruments

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 8.1 Option 1 for 6 dB bandwidth measurement.
☐ Refer as FCC KDB 558074, clause 8.2 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.

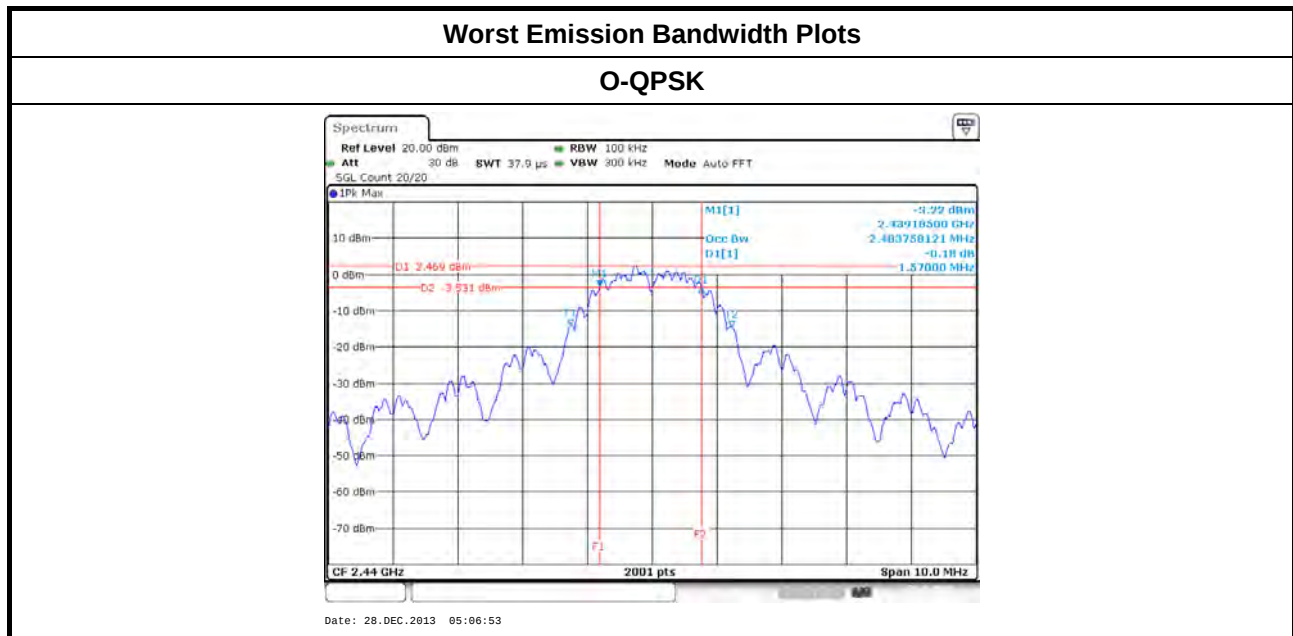
3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Emission Bandwidth Result				
Condition			Emission Bandwidth (MHz)	
Modulation Mode	N _{TX}	Freq. (MHz)	99% Bandwidth	6dB Bandwidth
O-QPSK	1	2405	2.42	1.70
O-QPSK	1	2440	2.48	1.57
O-QPSK	1	2475	2.51	1.60
Limit			N/A	≥500 kHz
Result			Complied	

Note 1: N_{TX} = Number of Transmit Chains



3.3 RF Output Power

3.3.1 RF Output Power Limit

RF Output Power Limit	
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
☐	Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
☐	Smart antenna system (SAS):
☐	Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
☐	Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
☐	Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8$ dB dBm
e.i.r.p. Power Limit:	
☒ 2400-2483.5 MHz Band	
☒	Point-to-multipoint systems (P2M): $P_{eirp} \leq 36$ dBm (4 W)
☐	Point-to-point systems (P2P): $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX}])$ dBm
☐	Smart antenna system (SAS)
☐	Single beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
☐	Overlap beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
☐	Aggregate power on all beams: $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX} + 8])$ dBm
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.	

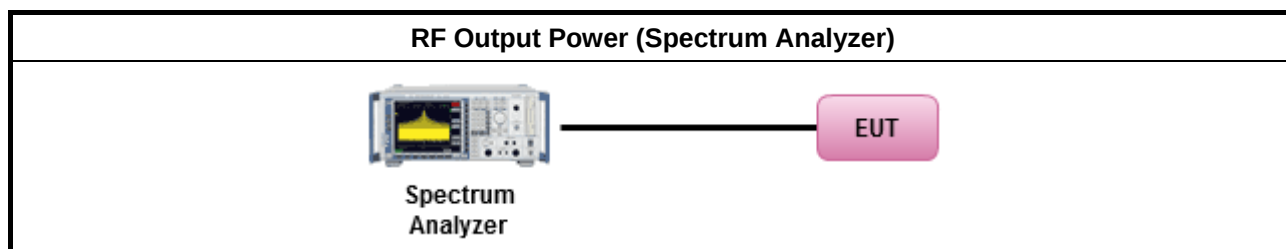
3.3.2 Measuring Instruments

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 FCC KDB 558074, clause 9.1.1 Option 1 (RBW ≥ EBW method).
☒	Refer as FCC KDB 558074, clause 9.1.2 Option 2 (integrated band power method).
☐	Refer as FCC KDB 558074, clause 9.1.3 Option 2 (peak power meter for VBW ≥ DTS BW)
☒	Maximum Conducted Output Power
	[duty cycle ≥ 98% or external video / power trigger]
☒	Refer as FCC KDB 558074, clause 9.2.2.2 Method AVGSA-1 (spectral trace averaging).
☐	Refer as FCC KDB 558074, clause 9.2.2.3 Method AVGSA-1 Alt. (slow sweep speed)
	duty cycle < 98% and average over on/off periods with duty factor
☐	Refer as FCC KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging).
☐	Refer as FCC KDB 558074, clause 9.2.2.5 Method AVGSA-2 Alt. (slow sweep speed)
	RF power meter and average over on/off periods with duty factor or gated trigger
☐	Refer as FCC KDB 558074, clause 9.2.3 Method AVGPM (using an RF average power meter).
☒	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.
☐	The EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
☐	If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \dots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$

3.3.4 Test Setup



3.3.5 Test Result of Maximum Peak Conducted Output Power

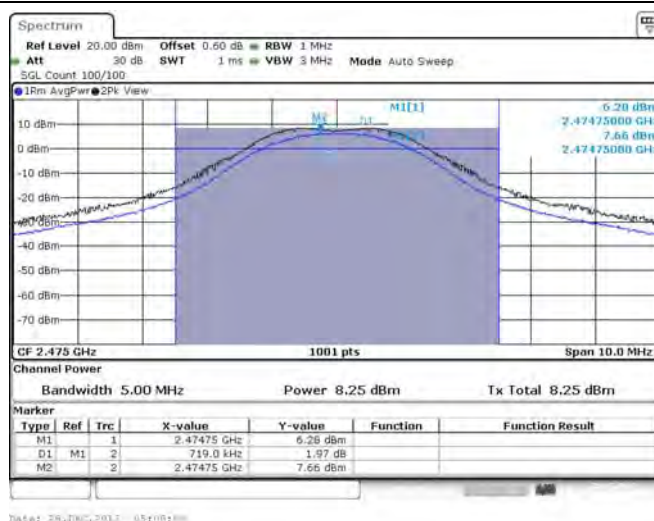
Maximum Peak Conducted Output Power Result							
Condition			RF Output Power (dBm)				
Modulation Mode	N _{TX}	Freq. (MHz)	RF Output Power	Power Limit	Ant. Gain (dBi)	EIRP Power	EIRP Limit
O-QPSK	1	2405	9.51	30.00	4.28	13.79	36.00
O-QPSK	1	2440	10.35	30.00	4.28	14.63	36.00
O-QPSK	1	2475	11.08	30.00	4.28	15.36	36.00
Result			Complied				

3.3.6 Test Result of Maximum Conducted Output Power

Maximum Conducted Output Power							
Condition			RF Output Power (dBm)				
Modulation Mode	N _{TX}	Freq. (MHz)	RF Output Power	Power Limit	Ant. Gain (dBi)	EIRP Power	EIRP Limit
O-QPSK	1	2405	6.73	30.00	4.28	11.01	36.00
O-QPSK	1	2440	7.52	30.00	4.28	11.80	36.00
O-QPSK	1	2475	8.25	30.00	4.28	12.53	36.00
Result			Complied				

Worst RF Output Power Plots

O-QPSK



3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

Power Spectral Density Limit	
☒	Power Spectral Density (PSD) $\leq$ 8 dBm/3kHz

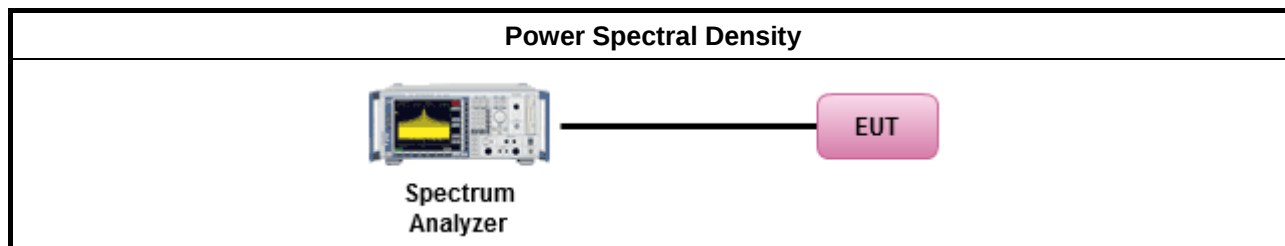
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

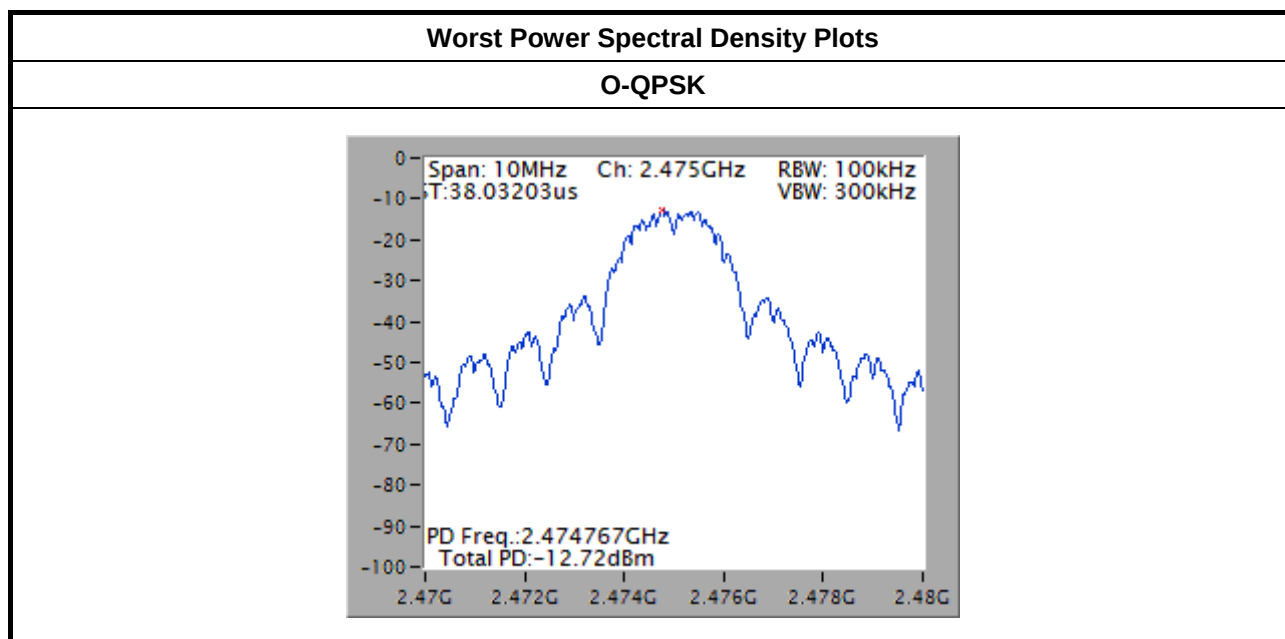
Test Method	
☒	Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).
☒	Refer as FCC KDB 558074, clause 10.2 Method PKPSD (RBW=3-100kHz;detector=peak).. [duty cycle $\geq$ 98% or external video / power trigger]
☒	Refer as FCC KDB 558074, clause 10.3 Method AVGPS-1 (spectral trace averaging).
☐	Refer as FCC KDB 558074, clause 10.4 Method AVGPS-1 Alt. (slow sweep speed) duty cycle < 98% and average over on/off periods with duty factor
☐	Refer as FCC KDB 558074, clause 10.5 Method AVGPS-2 (spectral trace averaging).
☐	Refer as FCC KDB 558074, clause 10.6 Method AVGPS-2 Alt. (slow sweep speed)
☒	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.
☐	The EUT supports multiple transmit chains using options given below:
☐	Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the N _{TX} output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.
☐	Option 2: Measure and add 10 log(N) dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with 10 log(N). Or each transmit chains shall be add 10 log(N) to compared with the limit.

3.4.4 Test Setup



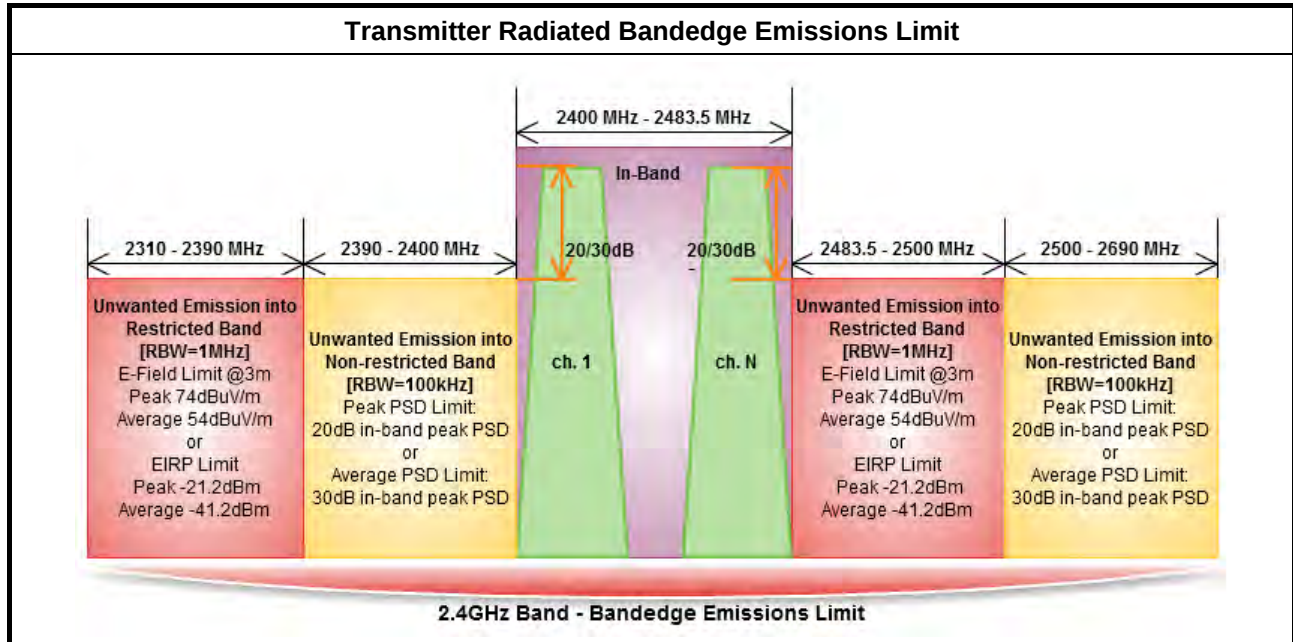
3.4.5 Test Result of Power Spectral Density

Power Spectral Density Result				
Modulation Mode	N _{TX}	Freq. (MHz)	Power Spectral Density (dBm/100kHz)	Power Limit (dBm/3kHz)
O-QPSK	1	2405	-14.98	8
O-QPSK	1	2440	-14.26	8
O-QPSK	1	2475	-12.72	8
Result			Complied	
Note 1: PSD = sum each transmit chains by bin-to-bin PSD				



3.5 Transmitter Bandedge Emissions

3.5.1 Transmitter Radiated Bandedge Emissions Limit



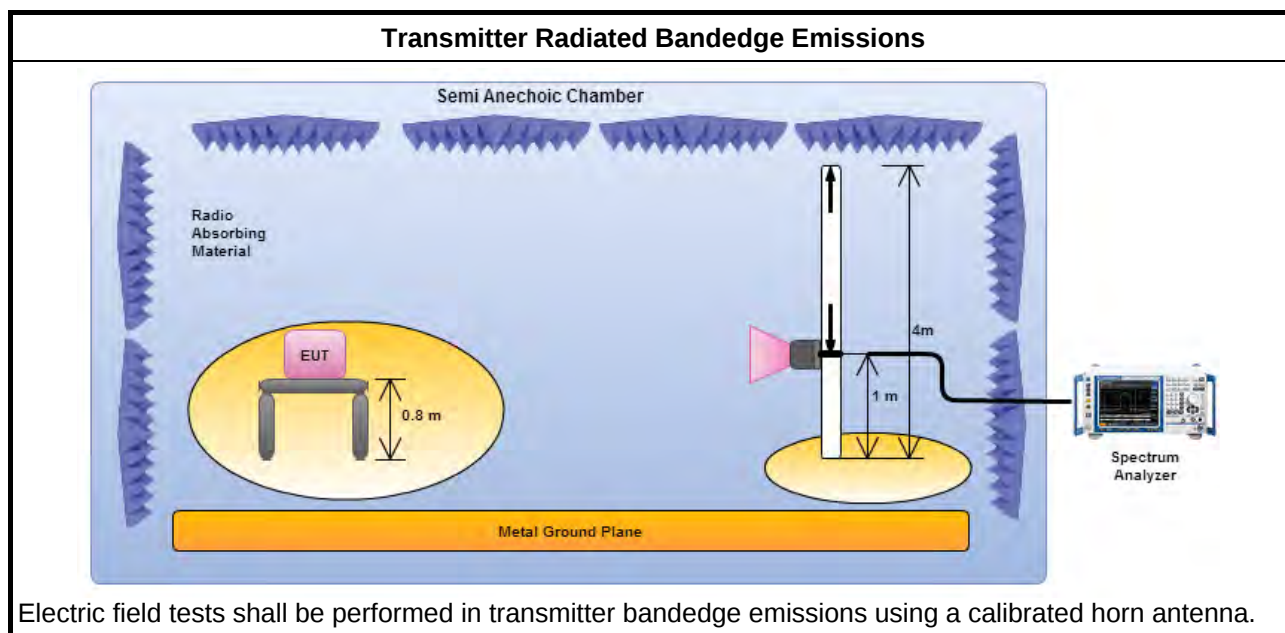
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method	
☒	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:
☒	Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands.
☒	Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
☐	Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq 98\%$)
☐	Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
☐	Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW $\geq 1/T$).
☒	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 FCC KDB 558074, clause 11.3 and 12.2.4 measurement procedure peak limit.
☒	For the transmitter bandedge emissions shall be measured using following options below:
☐	Refer as FCC KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
☒	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.
☒	For radiated measurement, refer as FCC KDB 558074, clause 12.2.7.

3.5.4 Test Setup



3.5.5 Transmitter Radiated Bandedge Emissions

2400-2483.5MHz 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.
O-QPSK	2405	100.09	2400.00	62.95	37.14	20	V
O-QPSK	2475	110.04	2542.00	62.97	47.07	20	V
Note 1: Measurement worst emissions of receive antenna polarization							

2400-2483.5MHz 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.
O-QPSK	2405	3	2379.56	59.09	74	2390.00	46.02	54	V
O-QPSK	2475	3	2483.52	69.67	74	2483.50	51.05	54	V
Note 1: Measurement worst emissions of receive antenna polarization.									
Note 2: If duty cycle < 100%, average emission = peak emission + 20 log (duty cycle).									

3.6 Transmitter 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.

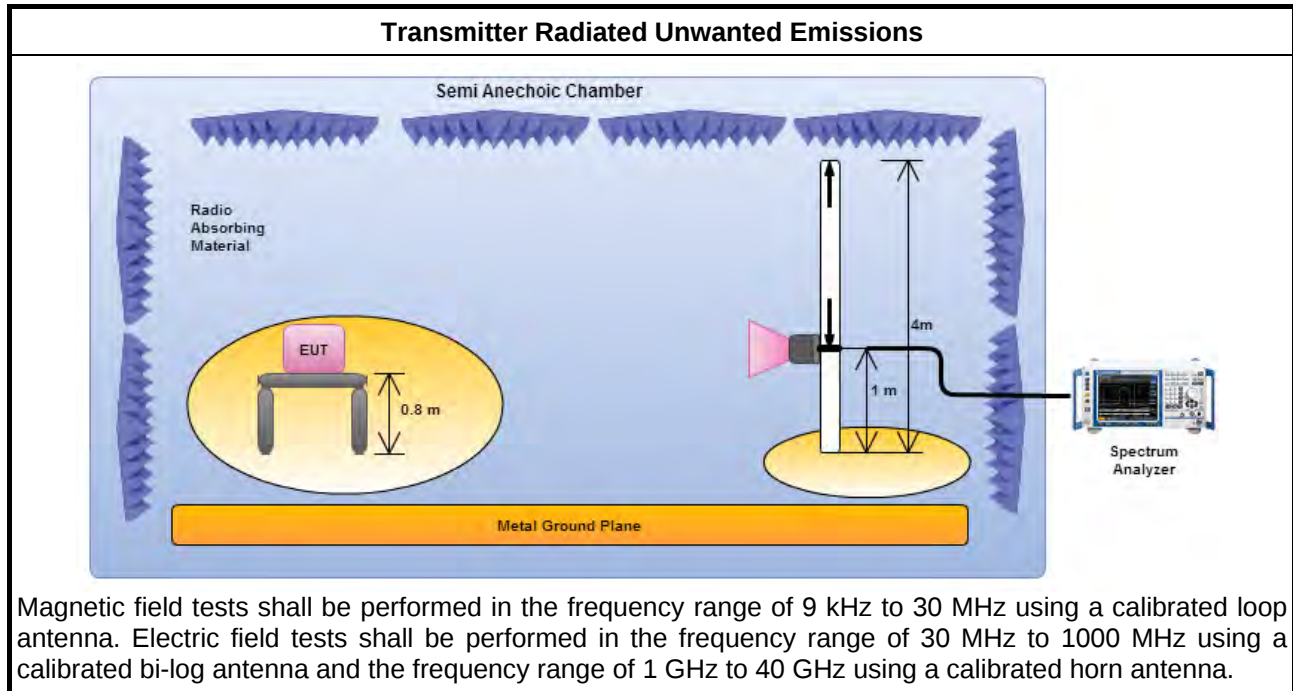
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

Test Method	
☒	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:
☒	Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands.
☒	Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
☐	Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq$ 98%)
☐	Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
☐	Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW $\geq$ 1/T).
☒	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 FCC KDB 558074, clause 11.3 and 12.2.4 measurement procedure peak limit.
☒	Refer as FCC KDB 558074, clause 12.2.3 measurement procedure Quasi-Peak limit.
☒	For radiated measurement, refer as FCC KDB 558074, clause 12.2.7.
☒	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.

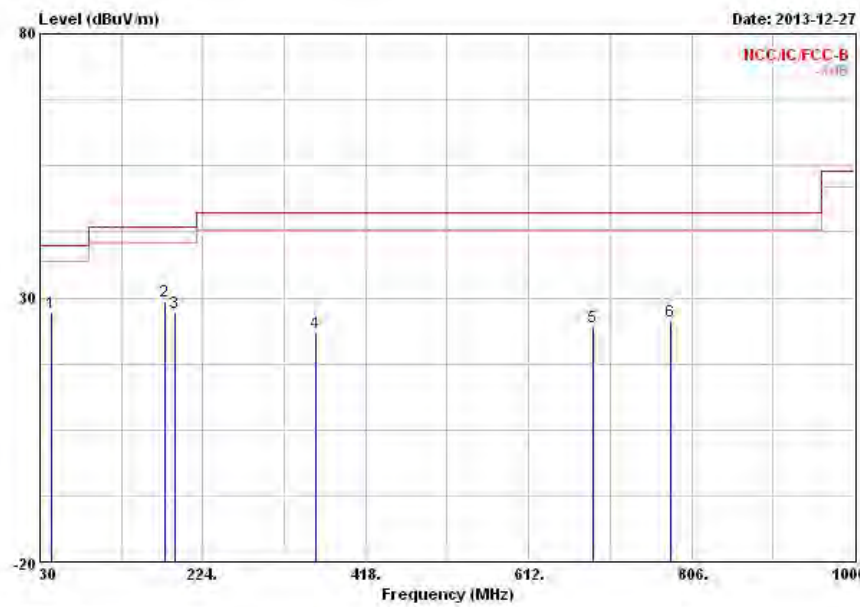
3.6.4 Test Setup



3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

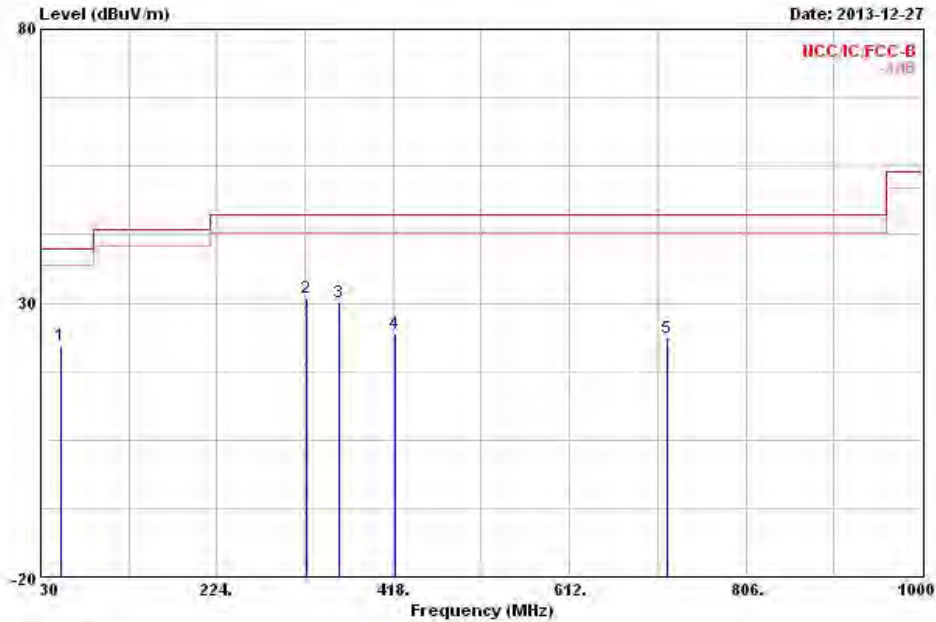
All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

3.6.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Transmitter Radiated Unwanted Emissions (Below 1GHz)																																																																																																													
Operating Mode		1				Polarization			V																																																																																																				
Operating Function		EUT with ERT via AC Power & Radio link																																																																																																											
Level (dBuV/m)  Frequency (MHz) Date: 2013-12-27 HCC/IC/FCC-B																																																																																																													
<table><tr><th></th><th>Freq</th><th>Level</th><th>Over</th><th>Limit</th><th>ReadAntenna</th><th>Cable</th><th>Preamp</th><th></th><th>Ant</th><th>Table</th></tr><tr><th></th><th>MHz</th><th>dBuV/m</th><th>Limit</th><th>Line</th><th>Level</th><th>Factor</th><th>Loss</th><th>Factor</th><th>Remark</th><th>Pos</th></tr><tr><th></th><th>MHz</th><th>dBuV/m</th><th>dB</th><th>dBuV/m</th><th>dBuV</th><th>dB/m</th><th>dB</th><th>dB</th><th></th><th>deg</th></tr><tr><td>1</td><td>43.580</td><td>27.22</td><td>-12.78</td><td>40.00</td><td>42.92</td><td>10.82</td><td>1.07</td><td>27.59</td><td>Peak</td><td>---</td></tr><tr><td>2</td><td>179.380</td><td>29.25</td><td>-14.25</td><td>43.50</td><td>44.72</td><td>9.42</td><td>2.19</td><td>27.08</td><td>Peak</td><td>---</td></tr><tr><td>3</td><td>191.020</td><td>27.14</td><td>-16.36</td><td>43.50</td><td>42.77</td><td>9.13</td><td>2.27</td><td>27.03</td><td>Peak</td><td>---</td></tr><tr><td>4</td><td>358.830</td><td>23.34</td><td>-22.66</td><td>46.00</td><td>32.56</td><td>14.67</td><td>3.16</td><td>27.05</td><td>Peak</td><td>---</td></tr><tr><td>5</td><td>688.630</td><td>24.57</td><td>-21.43</td><td>46.00</td><td>29.33</td><td>18.68</td><td>4.51</td><td>27.95</td><td>Peak</td><td>---</td></tr><tr><td>6</td><td>780.780</td><td>25.41</td><td>-20.59</td><td>46.00</td><td>28.63</td><td>19.79</td><td>4.82</td><td>27.83</td><td>Peak</td><td>---</td></tr></table>												Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp		Ant	Table		MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Remark	Pos		MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		deg	1	43.580	27.22	-12.78	40.00	42.92	10.82	1.07	27.59	Peak	---	2	179.380	29.25	-14.25	43.50	44.72	9.42	2.19	27.08	Peak	---	3	191.020	27.14	-16.36	43.50	42.77	9.13	2.27	27.03	Peak	---	4	358.830	23.34	-22.66	46.00	32.56	14.67	3.16	27.05	Peak	---	5	688.630	24.57	-21.43	46.00	29.33	18.68	4.51	27.95	Peak	---	6	780.780	25.41	-20.59	46.00	28.63	19.79	4.82	27.83	Peak	---
	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp		Ant	Table																																																																																																			
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Remark	Pos																																																																																																			
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		deg																																																																																																			
1	43.580	27.22	-12.78	40.00	42.92	10.82	1.07	27.59	Peak	---																																																																																																			
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4	358.830	23.34	-22.66	46.00	32.56	14.67	3.16	27.05	Peak	---																																																																																																			
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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	1	Polarization	H
Operating Function	EUT with ERT via AC Power & Radio link		



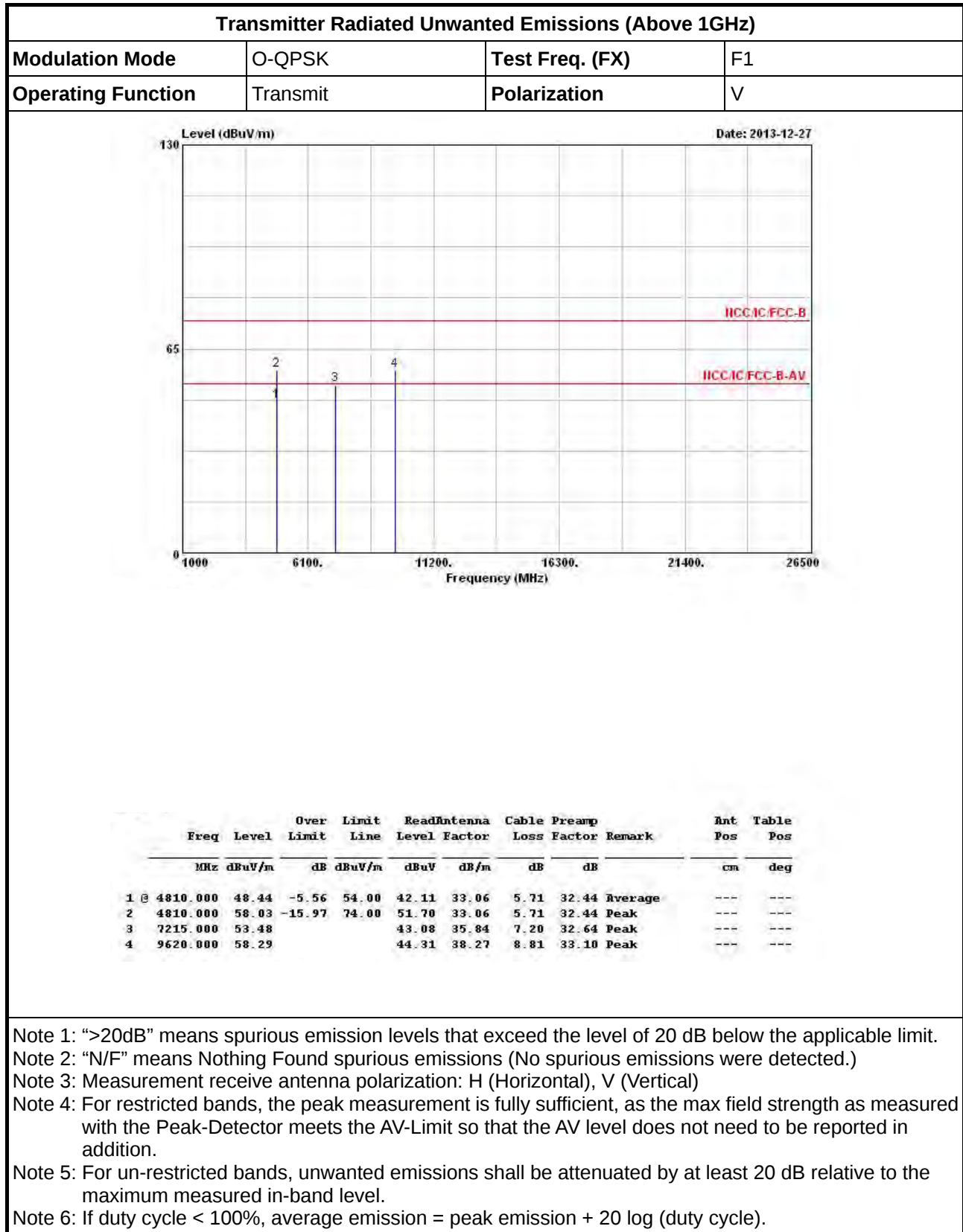
	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1	52.310	22.15	-17.85	40.00	40.72	7.84	1.16	27.57	Peak	---	---
2	322.940	30.82	-15.18	46.00	40.92	13.70	3.00	26.80	Peak	---	---
3	358.830	30.13	-15.87	46.00	39.35	14.67	3.16	27.05	Peak	---	---
4	419.940	24.41	-21.59	46.00	31.98	16.48	3.40	27.45	Peak	---	---
5	719.670	23.66	-22.34	46.00	27.77	19.20	4.60	27.91	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.)

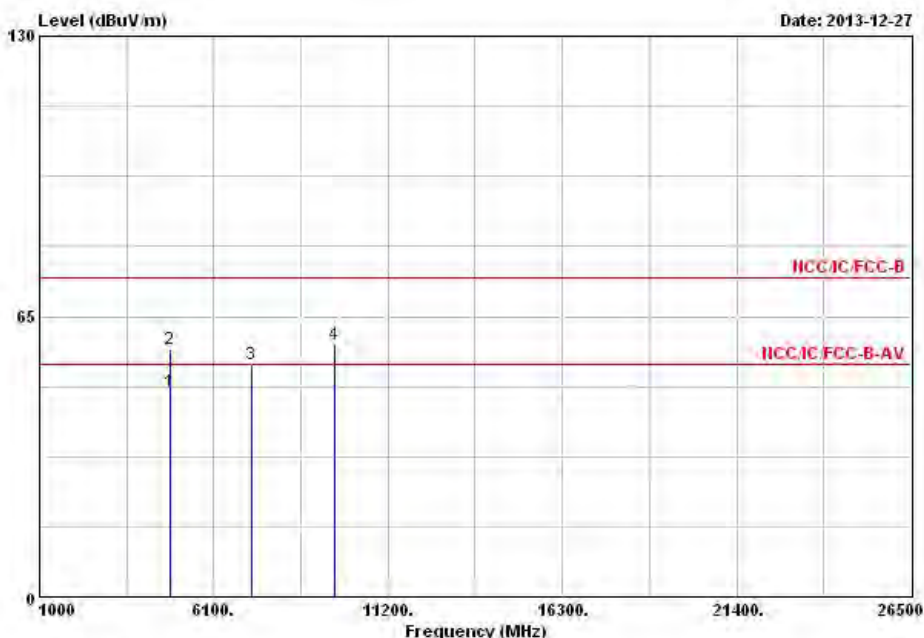
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

3.6.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)



Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	O-QPSK	Test Freq. (FX)	F1
Operating Function	Transmit	Polarization	H



Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1 @ 4810.000	47.45	-6.55	54.00	41.12	33.06	5.71	32.44	Average	---	---
2 4810.000	57.47	-16.53	74.00	51.14	33.06	5.71	32.44	Peak	---	---
3 7215.000	53.78			43.38	35.84	7.20	32.64	Peak	---	---
4 9620.000	58.48			44.50	38.27	8.81	33.10	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)

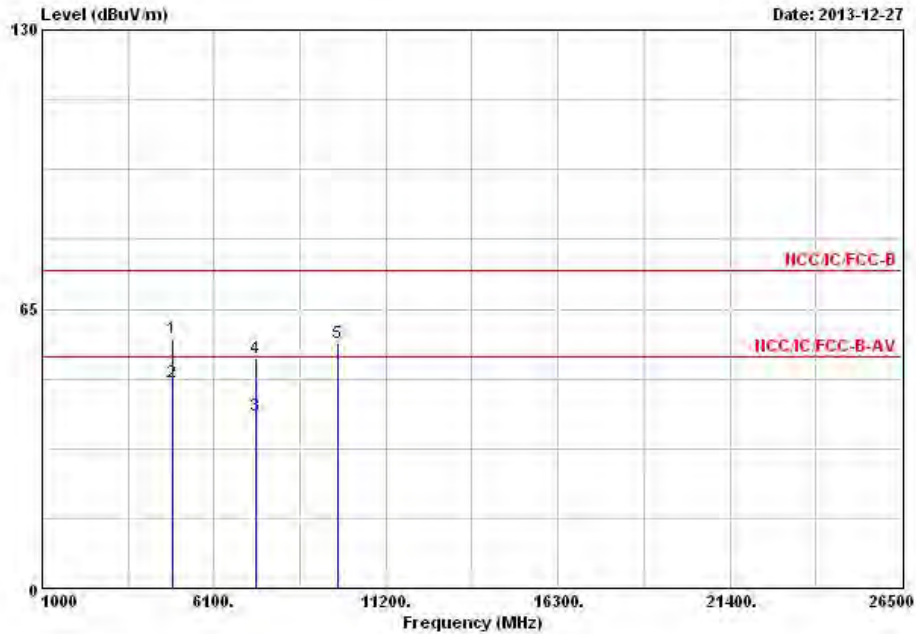
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Note 6: If duty cycle < 100%, average emission = peak emission + 20 log (duty cycle).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	O-QPSK	Test Freq. (FX)	F2
Operating Function	Transmit	Polarization	V



	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1	4880.000	58.17	-15.83	74.00	51.69	33.18	5.72	32.42	Peak	---	---
2	4880.000	48.04	-5.96	54.00	41.56	33.18	5.72	32.42	Average	---	---
3	7320.000	40.15	-13.85	54.00	29.45	36.09	7.28	32.67	Average	---	---
4	7320.000	53.64	-20.36	74.00	42.94	36.09	7.28	32.67	Peak	---	---
5	9760.000	57.09			42.84	38.57	8.76	33.08	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)

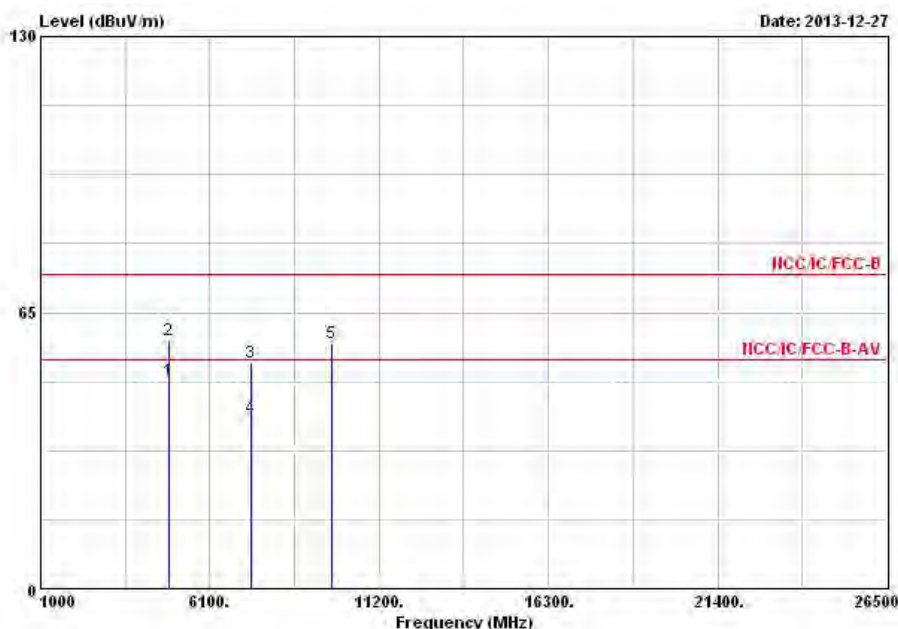
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Note 6: If duty cycle < 100%, average emission = peak emission + 20 log (duty cycle).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	O-QPSK	Test Freq. (FX)	F2
Operating Function	Transmit	Polarization	H



	Freq	Level	Over Limit	Limit Line	ReadAntenna	Cable	Preamp		Ant	Table
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	Pos	Pos
1	4880.000	48.86	-5.14	54.00	42.38	33.18	5.72	32.42	Average	---
2	4880.000	58.52	-15.48	74.00	52.04	33.18	5.72	32.42	Peak	---
3	7320.000	53.16	-20.84	74.00	42.46	36.09	7.28	32.67	Peak	---
4	7320.000	40.26	-13.74	54.00	29.56	36.09	7.28	32.67	Average	---
5	9760.000	57.85			43.60	38.57	8.76	33.08	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)

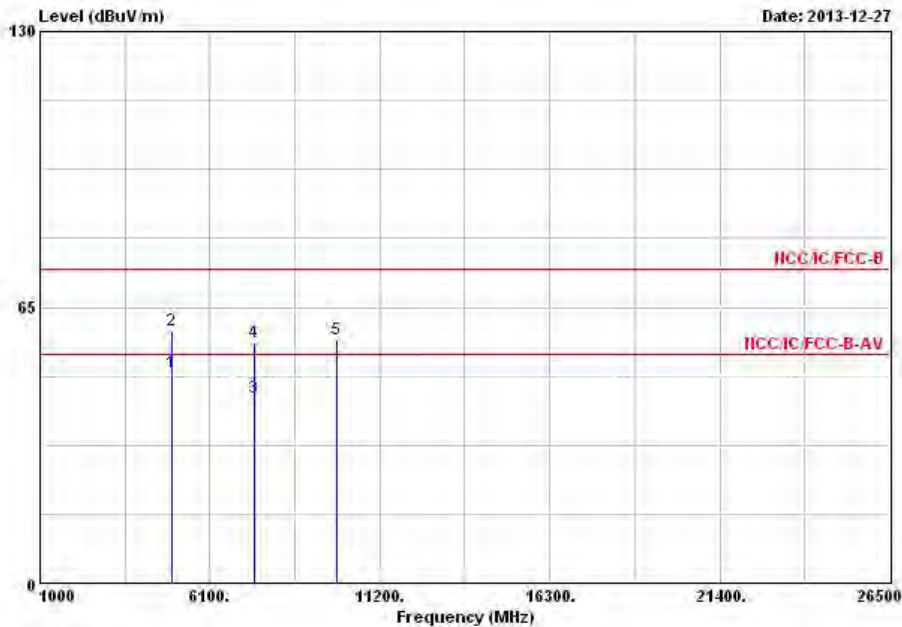
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Note 6: If duty cycle < 100%, average emission = peak emission + 20 log (duty cycle).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	O-QPSK	Test Freq. (FX)	F3
Operating Function	Transmit	Polarization	V



	Freq	Level	Over Limit	Limit Line	Read Antenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1	4950.000	49.64	-4.36	54.00	43.00	33.31	5.74	32.41	Average	---	---
2	4950.000	59.69	-14.31	74.00	53.05	33.31	5.74	32.41	Peak	---	---
3	7425.000	43.80	-10.20	54.00	32.80	36.33	7.37	32.70	Average	---	---
4	7425.000	56.64	-17.36	74.00	45.64	36.33	7.37	32.70	Peak	---	---
5	9900.000	57.35			42.79	38.91	8.72	33.07	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)

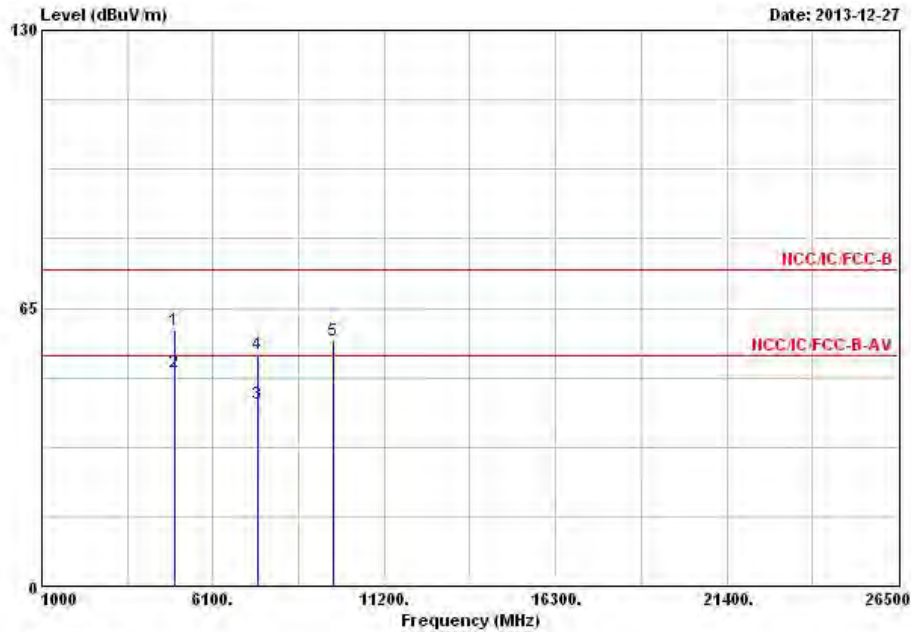
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Note 6: If duty cycle < 100%, average emission = peak emission + 20 log (duty cycle).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	O-QPSK	Test Freq. (FX)	F3
Operating Function	Transmit	Polarization	H



Freq	Level	Over Limit	Limit Line	ReadAntenna	Cable	Preamp			Ant	Table
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	Remark	Pos	Pos
1	4950.000	59.85	-14.15	74.00	53.21	33.31	5.74	32.41 Peak	---	---
2 @	4950.000	50.16	-3.84	54.00	43.52	33.31	5.74	32.41 Average	---	---
3	7425.000	42.73	-11.27	54.00	31.73	36.33	7.37	32.70 Average	---	---
4	7425.000	54.12	-19.88	74.00	43.12	36.33	7.37	32.70 Peak	---	---
5	9700.000	57.59			43.44	38.46	8.78	33.09 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)

Note 4: 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 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Note 6: If duty cycle < 100%, average emission = peak emission + 20 log (duty cycle).

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	Mar. 25, 2013	Conduction (CO04-HY)
LISN (Support Unit)	EMCO	3810/2NM	9703-1839	9kHz ~ 30MHz	Apr. 18, 2013	Conduction (CO04-HY)
RF Cable-CON	HUBER+SUHNER	RG213/U	7.61183201e+012	9kHz ~ 30MHz	Oct. 30, 2013	Conduction (CO04-HY)
EMI Filter	LINDGREN	LRE-2030	2651	< 450 Hz	N/A	Conduction (CO04-HY)

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	Feb. 11, 2013	Conducted (TH01-HY)

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. 30, 2013	Radiation (03CH03-HY)
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	May 03, 2013	Radiation (03CH03-HY)
Amplifier	Agilent	8449B	3008A02120	1GHz ~ 26.5GHz	Aug. 20, 2013	Radiation (03CH03-HY)
Spectrum	R&S	FSP40	100004	9kHz ~ 40GHz	Mar. 11, 2013	Radiation (03CH03-HY)
Bilog Antenna	SCHAFFNER	CBL 6112D	22237	30MHz ~ 1GHz	Sep. 21, 2013	Radiation (03CH03-HY)
Horn Antenna	EMCO	3115	6741	1GHz ~ 18GHz	May 31, 2013	Radiation (03CH03-HY)
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz ~ 40GHz	Jan. 11, 2013	Radiation (03CH03-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	Nov. 16, 2013	Radiation (03CH03-HY)
RF Cable-high	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz ~ 40GHz	Dec. 11, 2013	Radiation (03CH03-HY)
Turn Table	EM Electronics	EM Electronics	060615	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
Antenna Mast	MF	MF-7802	MF780208179	1 ~ 4 m	N/A	Radiation (03CH03-HY)

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	9kHz ~ 30MHz	Dec. 02, 2012	Radiation (03CH03-HY)

Note: Calibration Interval of instruments listed above is two year