

FCC Test Report

Equipment : 802.11 bgn PCIe Module
Brand Name : FreeWave
Model No. : W2400-01
FCC ID : KNYASM1101CR
Standard : 47 CFR FCC Part 15.247
Operating Band : 2400 MHz – 2483.5 MHz
Equipment Class : DTS
Applicant : FreeWave Technologies Inc.
5395 Pearl Parkway, Suite 100,
Boulder, CO 80301, U.S.A.

The product sample received on Jul. 06, 2013 and completely tested on Aug. 08, 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:


Gary Chang / 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]: 0.484MHz 36.87 (Margin 9.40dB) - AV 43.25 (Margin 13.02dB) - QP	FCC 15.207	Complied
3.2	15.247(a)	6dB Bandwidth	6dB Bandwidth Unit [MHz] 20M: 17.62 / 40M: 36.41	≥500kHz	Complied
3.3	15.247(b)	RF Output Power (Maximum Conducted (Average) Output Power)	Power [dBm]: 27.86	Power [dBm]: 30	Complied
3.4	15.247(e)	Power Spectral Density	PSD [dBm/30kHz]: 4.13	PSD [dBm/3kHz]: 4.23	Complied
3.5	15.247(d)	Emissions in non-restricted frequency bands	Out-of -band emissions are 30dB below the highest power	Non-Restricted Bands: > 30 dBc Restricted Bands: FCC 15.209	Complied
3.6	15.247(d)	Transmitter Radiated Unwanted Emissions	Restricted Bands [dBuV/m at 3m]: 2483.50MHz 52.99 (Margin 1.01dB) - AV	Non-Restricted Bands: > 30 dBc Restricted Bands: FCC 15.209	Complied

1 General Description

1.1 Information

1.1.1 RF General Information

RF General Information						
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N _{TX})	RF Output Power (dBm)	Co-location
2400-2483.5	b	2412-2462	1-11 [11]	1 / 3	23.55 / 27.86	N/A
2400-2483.5	g	2412-2462	1-11 [11]	1 / 3	23.04 / 25.80	N/A
2400-2483.5	n (HT-20)	2412-2462	1-11 [11]	1 / 3	23.02 / 26.41	N/A
2400-2483.5	n (HT-40)	2422-2452	3-9 [7]	1 / 3	16.92 / 19.00	N/A

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.
 Note 2: 802.11b uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.
 Note 3: 802.11g/n uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.

1.1.2 Antenna Information

Antenna Category	
<input type="checkbox"/>	Equipment placed on the market without antennas
<input type="checkbox"/>	Integral antenna (antenna permanently attached)
<input type="checkbox"/>	Temporary RF connector provided
<input type="checkbox"/>	No temporary RF connector provided Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.
<input checked="" type="checkbox"/>	External antenna (dedicated antennas)
<input type="checkbox"/>	Single power level with corresponding antenna(s).
<input type="checkbox"/>	Multiple power level and corresponding antenna(s).
<input checked="" type="checkbox"/>	RF connector provided
<input type="checkbox"/>	Unique antenna connector. (e.g., MMCX, U.FL, IPX, and RP-SMA, RP-N type...)
<input checked="" type="checkbox"/>	Standard antenna connector. (e.g., SMA, N, BNC, and TNC type...)

Antenna General Information							
No.	Ant. Cat.	Model	Ant. Type	Gain (dBi)	Manufacturer	Transmit Chains (N _{TX})	Application
1	External	YA240016	Yagi	16	V-POL Base Station	1	P to MP
2	External	ZDAQJ2400-12	Omni	12	ZDA Communications US LLC.	1	P to MP
3	External	PA2418014V	Panel	14	V-POL Base Station	1	P to MP
4	External	ZDAGP2400-24-8	Dish	24	ZDA Communications US LLC.	1	P to P
5	External	98618MNXX001	Dipole	5	Master Wave Technology Co.,Ltd	3	P to MP

Note: The antennas are professionally installed.

1.1.3 Type of EUT

Identify EUT	
EUT Serial Number	N/A
Presentation of Equipment	<input type="checkbox"/> Production ; <input checked="" type="checkbox"/> Pre-Production ; <input type="checkbox"/> Prototype
Type of EUT	
<input type="checkbox"/>	Stand-alone
<input type="checkbox"/>	Combined (EUT where the radio part is fully integrated within another device) Combined Equipment - Brand Name / Model No.: ...
<input checked="" type="checkbox"/>	Plug-in radio
<input type="checkbox"/>	Other:

1.1.4 Test Signal Duty Cycle

Operated Mode for Worst Duty Cycle	
<input type="checkbox"/>	Operated normally mode for worst duty cycle
<input checked="" type="checkbox"/>	Operated test mode for worst duty cycle
Test Signal Duty Cycle (x)	Power Duty Factor [dB] – (10 log 1/x)
<input checked="" type="checkbox"/> 100% - IEEE 802.11b	0
<input checked="" type="checkbox"/> 98.26% - IEEE 802.11g	0.08
<input checked="" type="checkbox"/> 98.14% - IEEE 802.11n (HT-20)	0.08
<input checked="" type="checkbox"/> 95.26% - IEEE 802.11n (HT-40)	0.21

1.1.5 EUT Operational Condition

Supply Voltage	<input type="checkbox"/> AC mains	<input checked="" type="checkbox"/> DC (5 Vdc)	
Type of DC Source	<input type="checkbox"/> Internal DC supply	<input type="checkbox"/> External DC adapter	<input checked="" type="checkbox"/> From Host



1.2 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	Remarks
1	Notebook	DELL	E6430	DoC
2	Power Supply	GW	GPL-6030D	--
3	Extender card	N/A	adapter	N/A

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
- ◆ FCC KDB 412172

1.4 Testing Location Information

Testing Location				
<input checked="" type="checkbox"/>	Sporton Lab	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-318-0055		
<input checked="" type="checkbox"/>	ICC Lab	ADD : No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsein 333, Taiwan (R.O.C.) TEL : 886-3-271-8666 FAX : 886-3-318-0155		
Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-HY	Ian Du	23°C / 62%	Jul. 31, 2013
*AC Conduction	CO01-WS	Skys Huang	23°C / 53%	Aug. 08, 2013
*Radiated Emission	03CH01-WS	Skys Huang	24°C / 67%	Jul. 09 ~ Jul. 26, 2013
Test site registered number [657002] with FCC. Test site registered number [10807A-1] with IC.				

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

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

1.5 Measurement Uncertainty

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

Measurement Uncertainty			
Test Item		Uncertainty	Limit
AC power-line conducted emissions		±2.80 dB	N/A
Emission bandwidth, 6dB bandwidth		±1.42 %	N/A
RF output power, conducted		±0.63 dB	N/A
Power density, conducted		±0.81 dB	N/A
All emissions, radiated	30 – 1000 MHz	±3.9 dB	N/A
	Above 1GHz	±4.2 dB	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			
Modulation Mode	Transmit Chains (N _{TX})	Data Rate / MCS	Worst Data Rate / MCS
11b,1-11Mbps	1	1-11 Mbps	1 Mbps
11g,6-54Mbps	1	6-54 Mbps	6 Mbps
HT-20	1	M0-7	MCS 0
HT-40	1	M0-7	MCS 0

Worst Modulation Used for Conformance Testing			
Modulation Mode	Transmit Chains (N _{TX})	Data Rate / MCS	Worst Data Rate / MCS
11b,1-11Mbps	3	1-11 Mbps	1 Mbps
11g,6-54Mbps	3	6-54 Mbps	6 Mbps
HT-20	3	M0-23	MCS 0
HT-40	3	M0-23	MCS 0

2.2 Test Channel Frequencies Configuration

Test Channel Frequencies Configuration	
IEEE Std. 802.11	Test Channel Frequencies (MHz)
b, g, n (HT-20)	2412-(F1), 2437-(F2), 2462-(F3)
n (HT-40)	2422-(F4), 2437-(F5), 2452-(F6)

2.3 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter (2400-2483.5MHz band)							
Operating Mode	1 (Ant. 1, Yagi antenna)						
Test Software Version	ART2-GUI V2.3						
Modulation Mode	N _{TX}	Test Frequency (MHz)					
		NCB: 20MHz			NCB: 40MHz		
		2412	2437	2462	2422	2437	2452
11b	1	11.5	16	12	-	-	-
11g	1	13.5	16.5	13	-	-	-
HT-20,M0-7	1	12.5	16.5	11.5	-	-	-
HT-40,M0-7	1	-	-	-	6.5	12	7



The Worst Case Power Setting Parameter (2400-2483.5MHz band)							
Operating Mode	2 (Ant. 2, Omni antenna)						
Test Software Version	ART2-GUI V2.3						
Modulation Mode	N _{TX}	Test Frequency (MHz)					
		NCB: 20MHz			NCB: 40MHz		
		2412	2437	2462	2422	2437	2452
11b	1	17.5	23	21	-	-	-
11g	1	19	22.5	16	-	-	-
HT-20,M0-7	1	18	22.5	15	-	-	-
HT-40,M0-7	1	-	-	-	13	16	10

The Worst Case Power Setting Parameter (2400-2483.5MHz band)							
Operating Mode	3 (Ant. 3, Panel antenna)						
Test Software Version	ART2-GUI V2.3						
Modulation Mode	N _{TX}	Test Frequency (MHz)					
		NCB: 20MHz			NCB: 40MHz		
		2412	2437	2462	2422	2437	2452
11b	1	16	18	16.5	-	-	-
11g	1	15.5	21	15	-	-	-
HT-20,M0-7	1	15	21	14	-	-	-
HT-40,M0-7	1	-	-	-	9.5	15	9

The Worst Case Power Setting Parameter (2400-2483.5MHz band)							
Operating Mode	4 (Ant. 4, Dish antenna)						
Test Software Version	ART2-GUI V2.3						
Modulation Mode	N _{TX}	Test Frequency (MHz)					
		NCB: 20MHz					
		2412		2437		2462	
11b	1	1		1.5		1	
11g	1	0.5		2		0	
HT-20,M0-7	1	0.5		2		0	

Note : HT40 mode is disabled by software for this mode.






The Worst Case Power Setting Parameter (2400-2483.5MHz band)							
Operating Mode	5 (Ant. 5, Dipole antenna)						
Test Software Version	ART2-GUI V2.3						
Modulation Mode	N_{TX}	Test Frequency (MHz)					
		NCB: 20MHz			NCB: 40MHz		
		2412	2437	2462	2422	2437	2452
11b	3	18.5	25	22	-	-	-
11g	3	16	20.5	16	-	-	-
HT-20,M0-23	3	14.5	21	14.5	-	-	-
HT-40,M0-23	3	-	-	-	9	13	9

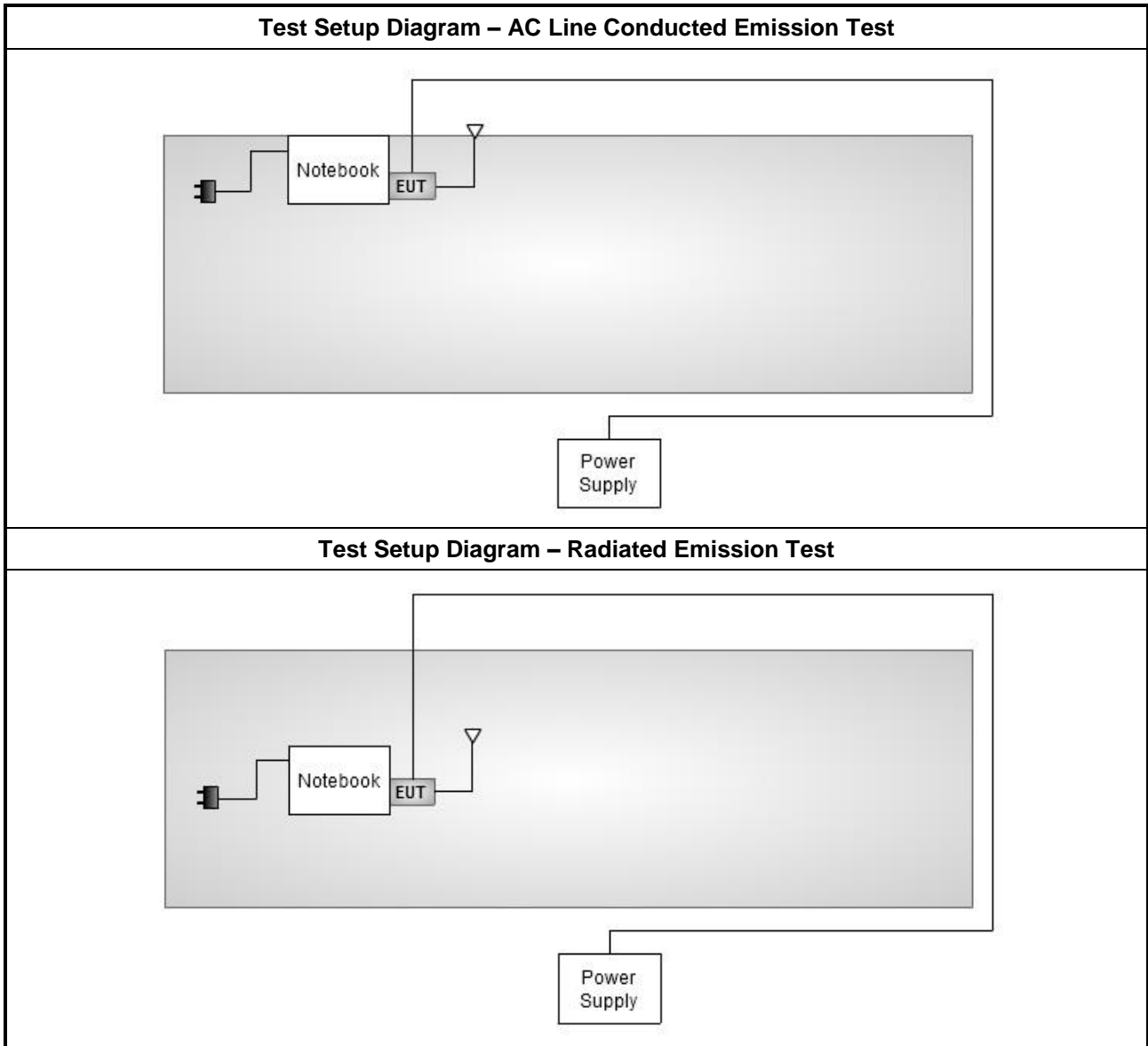
2.4 The Worst Case Measurement Configuration

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	Radio link (WLAN) with Ant. 1
2	Radio link (WLAN) with Ant. 2
3	Radio link (WLAN) with Ant. 3
4	Radio link (WLAN) with Ant. 4
5	Radio link (WLAN) with Ant. 5

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	11b, 11g, HT-20, HT-40

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	<input type="checkbox"/> EUT will be placed in fixed position.		
	<input type="checkbox"/> EUT will be placed in mobile position and operating multiple positions. EUT shall be performed three orthogonal planes. The worst planes is X.		
	<input checked="" type="checkbox"/> EUT will be operating multiple positions. EUT shall be performed two or three orthogonal planes. The worst plane is X.		
Operating Mode	<input checked="" type="checkbox"/> 1. Radio link (WLAN) with Ant. 1		
	<input checked="" type="checkbox"/> 2. Radio link (WLAN) with Ant. 2		
	<input checked="" type="checkbox"/> 3. Radio link (WLAN) with Ant. 3		
	<input checked="" type="checkbox"/> 4. Radio link (WLAN) with Ant. 4		
	<input checked="" type="checkbox"/> 5. Radio link (WLAN) with Ant. 5		
Modulation Mode	11b, 11g, HT-20, HT-40		
Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane
			

2.5 Test Setup Diagram



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

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

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

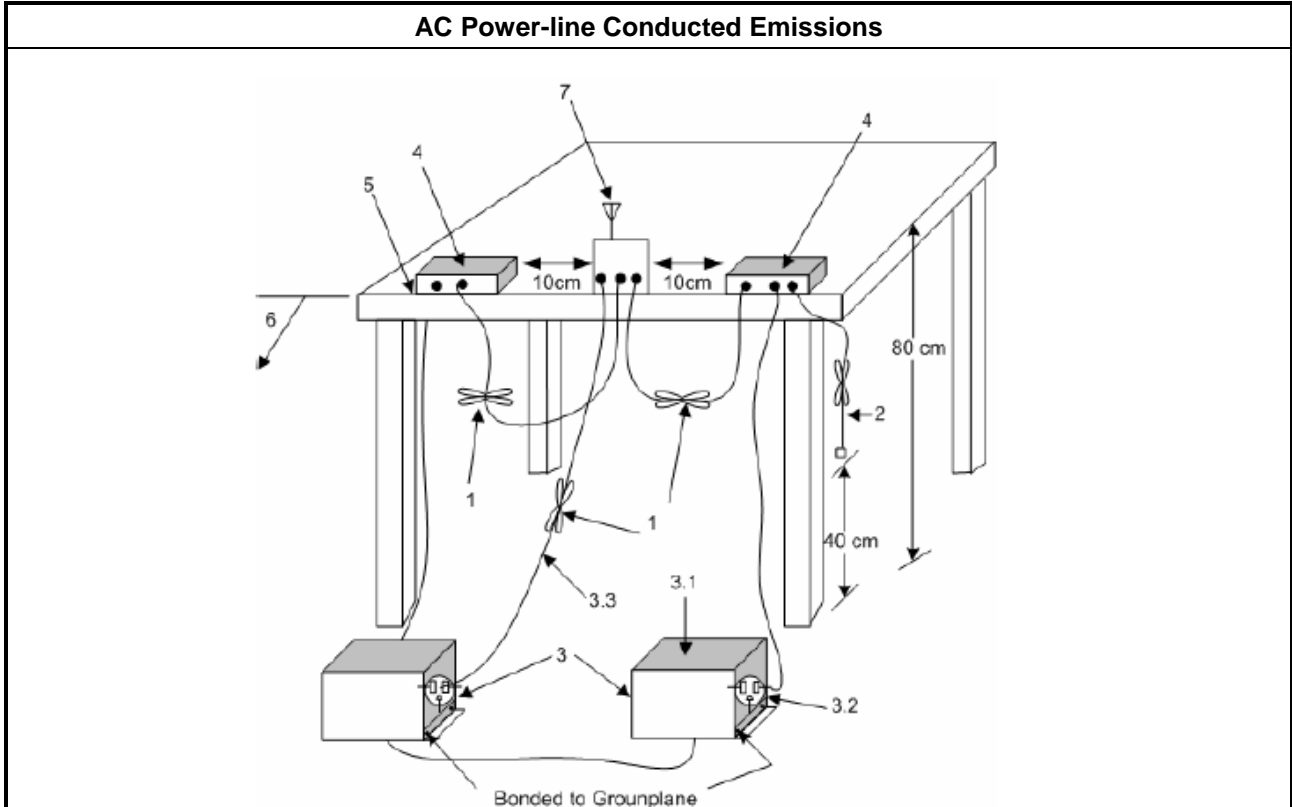
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

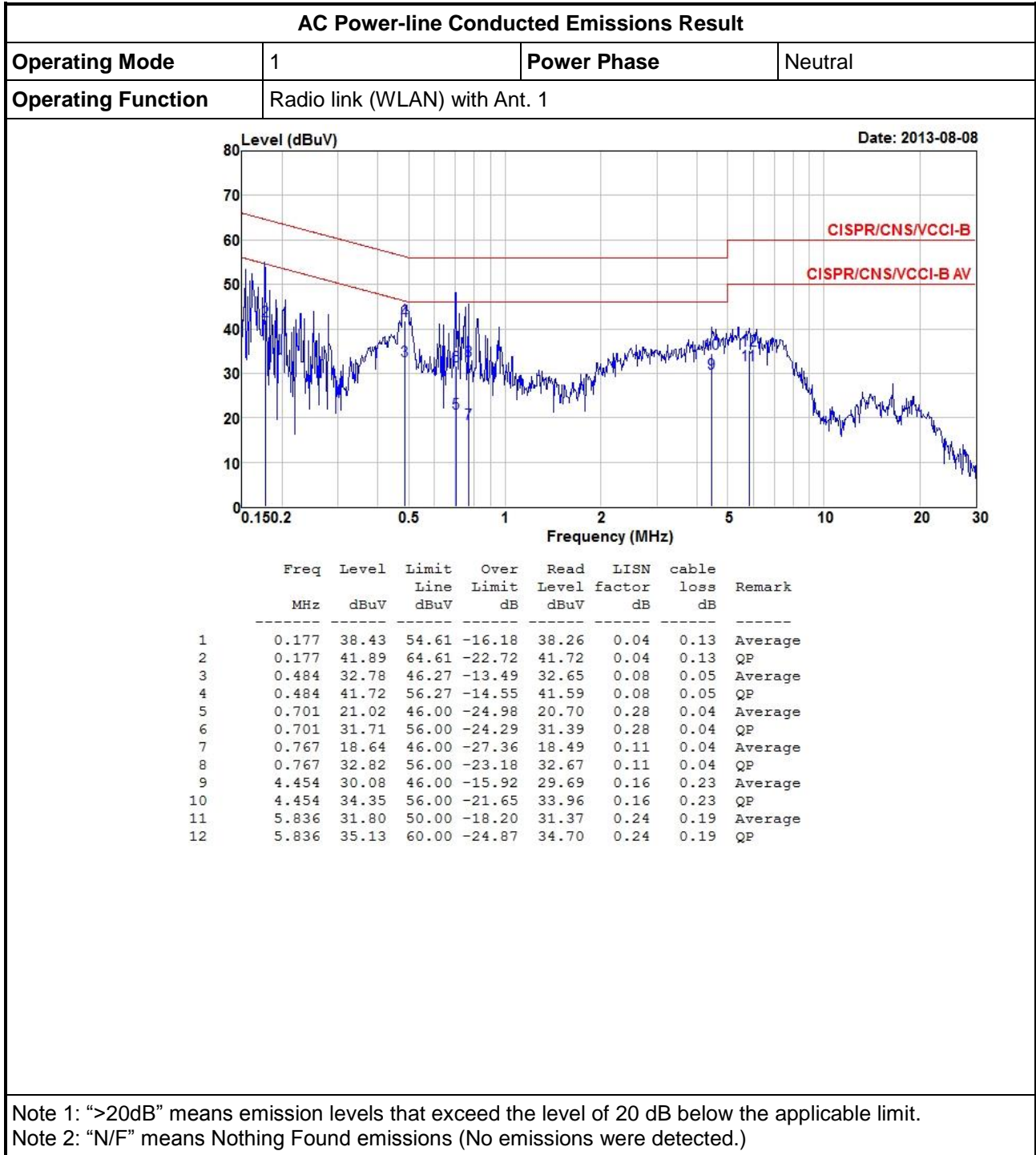
Test Method
<input checked="" type="checkbox"/> Refer as ANSI C63.10-2009, clause 6.2 for AC power-line conducted emissions.

3.1.4 Test Setup





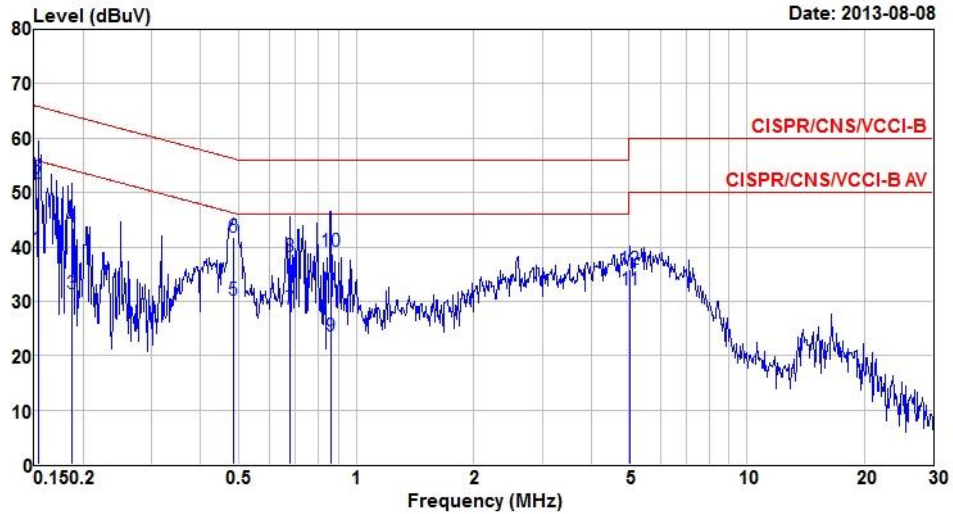
3.1.5 Test Result of AC Power-line Conducted Emissions





AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	Radio link (WLAN) with Ant. 1		



	Freq	Level	Limit	Over	Read	LISN	cable	
	MHz	dBuV	Line	Limit	Level	factor	loss	Remark
			dBuV	dB	dBuV	dB	dB	
1	0.153	39.73	55.82	-16.09	39.61	0.05	0.07	Average
2	0.153	51.68	65.82	-14.14	51.56	0.05	0.07	QP
3	0.187	31.41	54.15	-22.74	31.21	0.05	0.15	Average
4	0.187	43.60	64.15	-20.55	43.40	0.05	0.15	QP
5	0.484	30.20	46.27	-16.07	30.07	0.08	0.05	Average
6	0.484	41.70	56.27	-14.57	41.57	0.08	0.05	QP
7	0.679	28.58	46.00	-17.42	28.44	0.10	0.04	Average
8	0.679	38.26	56.00	-17.74	38.12	0.10	0.04	QP
9	0.862	23.56	46.00	-22.44	23.39	0.13	0.04	Average
10	0.862	39.14	56.00	-16.86	38.97	0.13	0.04	QP
11	5.031	32.05	50.00	-17.95	31.63	0.21	0.21	Average
12	5.031	35.88	60.00	-24.12	35.46	0.21	0.21	QP

Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.
 Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)

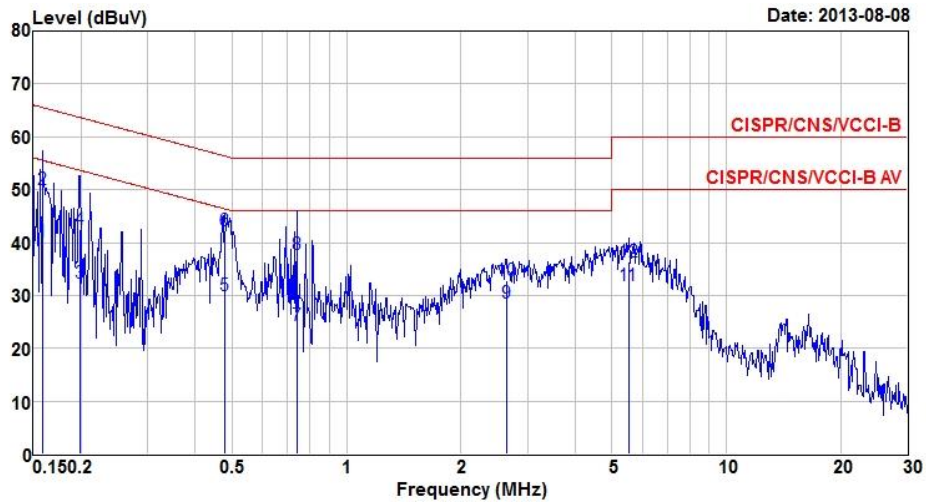


AC Power-line Conducted Emissions Result			
Operating Mode	2	Power Phase	Neutral
Operating Function	Radio link (WLAN) with Ant. 2		
<div style="text-align: right;">Date: 2013-08-08</div> <p>The graph displays the conducted emission levels in dBuV across a frequency range from 0.150.2 MHz to 30 MHz. Two red lines represent the CISPR/CNS/VCCI-B and CISPR/CNS/VCCI-B AV limits. The blue line shows the measured emission levels, which generally stay below the limits, with some peaks around 0.161 MHz and 0.484 MHz.</p>			



AC Power-line Conducted Emissions Result

Operating Mode	2	Power Phase	Line
Operating Function	Radio link (WLAN) with Ant. 2		

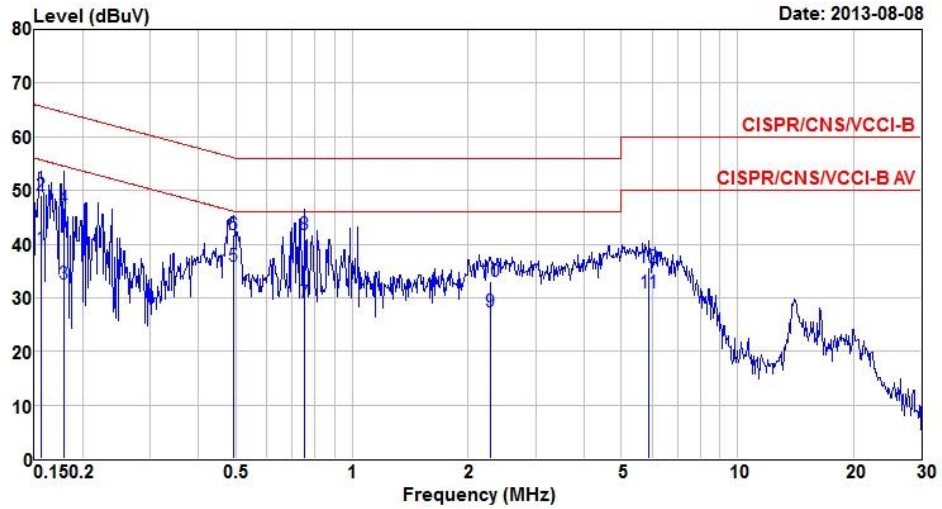


	Freq	Level	Limit	Over	Read	LISN	cable	Remark
	MHz	dBuV	Line	Limit	Level	factor	loss	
			dBuV	dB	dBuV	dB	dB	
1	0.158	40.12	55.56	-15.44	39.99	0.05	0.08	Average
2	0.158	50.11	65.56	-15.45	49.98	0.05	0.08	QP
3	0.199	32.45	53.67	-21.22	32.22	0.05	0.18	Average
4	0.199	42.47	63.67	-21.20	42.24	0.05	0.18	QP
5	0.479	30.07	46.36	-16.29	29.94	0.08	0.05	Average
6	0.479	42.30	56.36	-14.06	42.17	0.08	0.05	QP
7	0.739	24.34	46.00	-21.66	24.19	0.11	0.04	Average
8	0.739	37.67	56.00	-18.33	37.52	0.11	0.04	QP
9	2.636	28.48	46.00	-17.52	28.09	0.20	0.19	Average
10	2.636	32.89	56.00	-23.11	32.50	0.20	0.19	QP
11	5.535	31.88	50.00	-18.12	31.45	0.24	0.19	Average
12	5.535	36.40	60.00	-23.60	35.97	0.24	0.19	QP

Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.
 Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)



AC Power-line Conducted Emissions Result			
Operating Mode	3	Power Phase	Neutral
Operating Function	Radio link (WLAN) with Ant. 3		

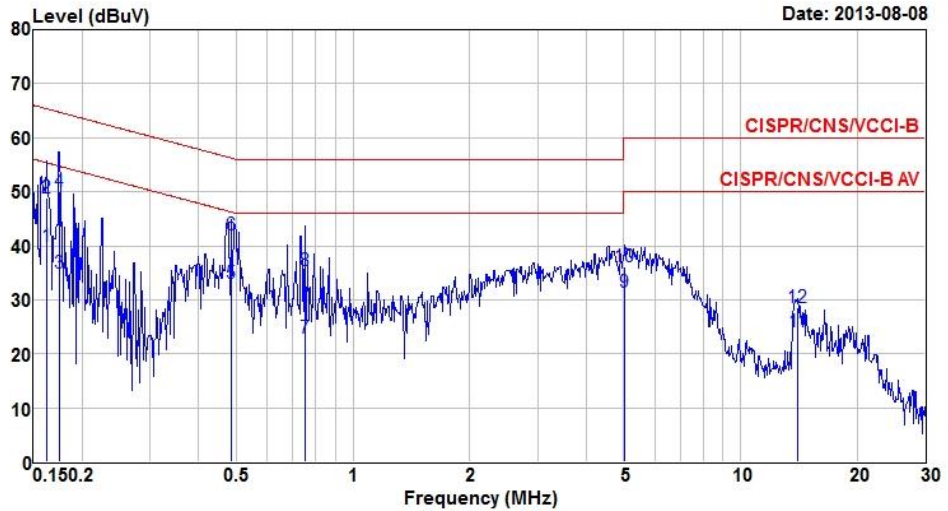


	Freq	Level	Limit	Over	Read	LISN	cable	Remark
	MHz	dBuV	Line	Limit	Level	factor	loss	
			dBuV	dB	dBuV	dB	dB	
1	0.156	39.19	55.69	-16.50	39.08	0.04	0.07	Average
2	0.156	49.11	65.69	-16.58	49.00	0.04	0.07	QP
3	0.179	32.68	54.55	-21.87	32.51	0.04	0.13	Average
4	0.179	46.76	64.55	-17.79	46.59	0.04	0.13	QP
5	0.491	35.83	46.14	-10.31	35.70	0.08	0.05	Average
6	0.491	41.72	56.14	-14.42	41.59	0.08	0.05	QP
7	0.755	28.93	46.00	-17.07	28.78	0.11	0.04	Average
8	0.755	41.88	56.00	-14.12	41.73	0.11	0.04	QP
9	2.285	27.45	46.00	-18.55	27.08	0.19	0.18	Average
10	2.285	33.10	56.00	-22.90	32.73	0.19	0.18	QP
11	5.898	30.86	50.00	-19.14	30.43	0.24	0.19	Average
12	5.898	35.54	60.00	-24.46	35.11	0.24	0.19	QP

Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.
 Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)



AC Power-line Conducted Emissions Result			
Operating Mode	3	Power Phase	Line
Operating Function	Radio link (WLAN) with Ant. 3		

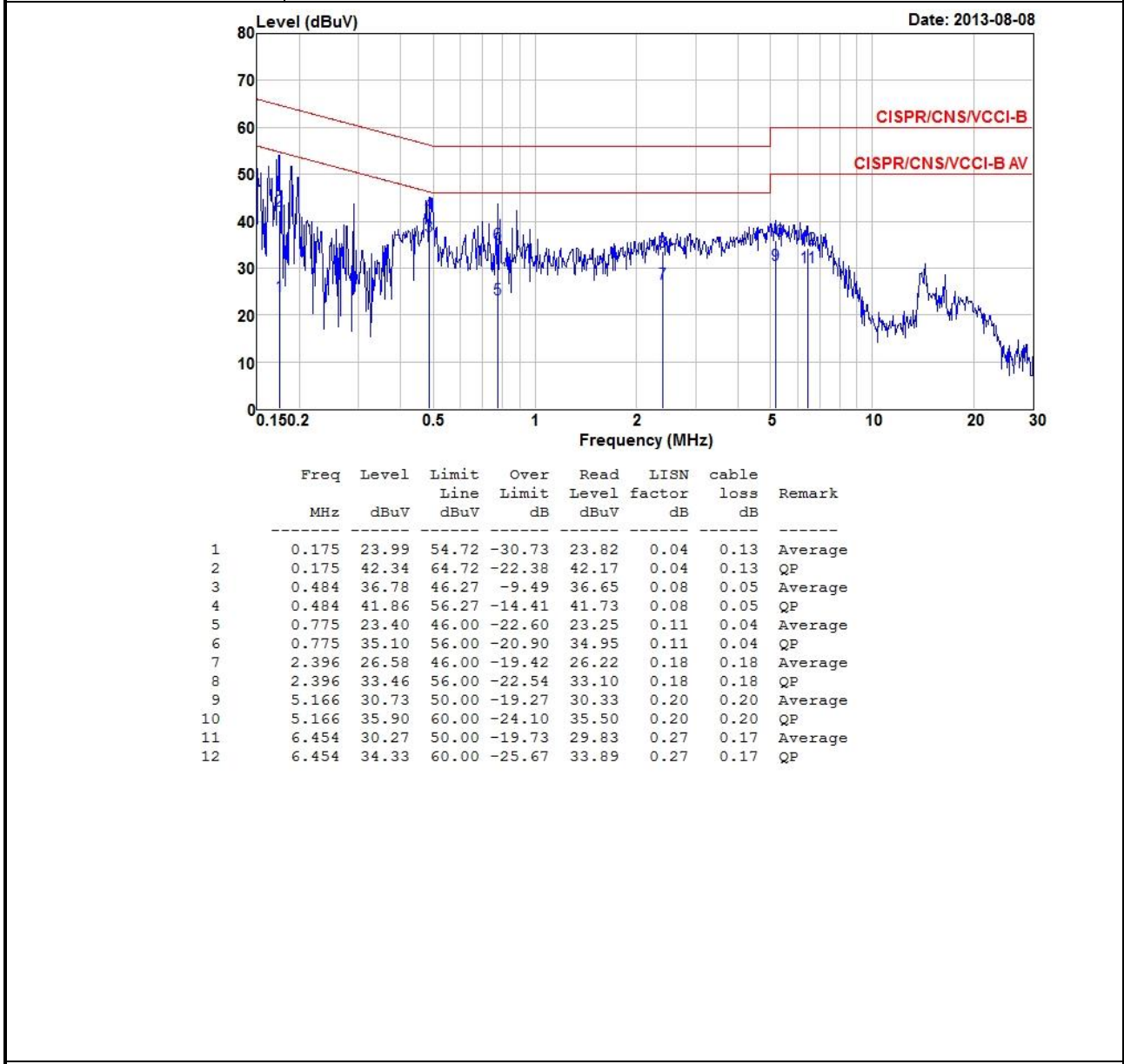


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.162	39.91	55.34	-15.43	39.77	0.05	0.09	Average
2	0.162	48.97	65.34	-16.37	48.83	0.05	0.09	QP
3	0.175	34.89	54.72	-19.83	34.71	0.05	0.13	Average
4	0.175	50.05	64.72	-14.67	49.87	0.05	0.13	QP
5	0.484	32.97	46.27	-13.30	32.84	0.08	0.05	Average
6	0.484	41.96	56.27	-14.31	41.83	0.08	0.05	QP
7	0.751	22.91	46.00	-23.09	22.76	0.11	0.04	Average
8	0.751	35.50	56.00	-20.50	35.35	0.11	0.04	QP
9	5.031	31.40	50.00	-18.60	30.98	0.21	0.21	Average
10	5.031	36.10	60.00	-23.90	35.68	0.21	0.21	QP
11	14.063	24.06	50.00	-25.94	23.05	0.88	0.13	Average
12	14.063	28.45	60.00	-31.55	27.44	0.88	0.13	QP

Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.
 Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)



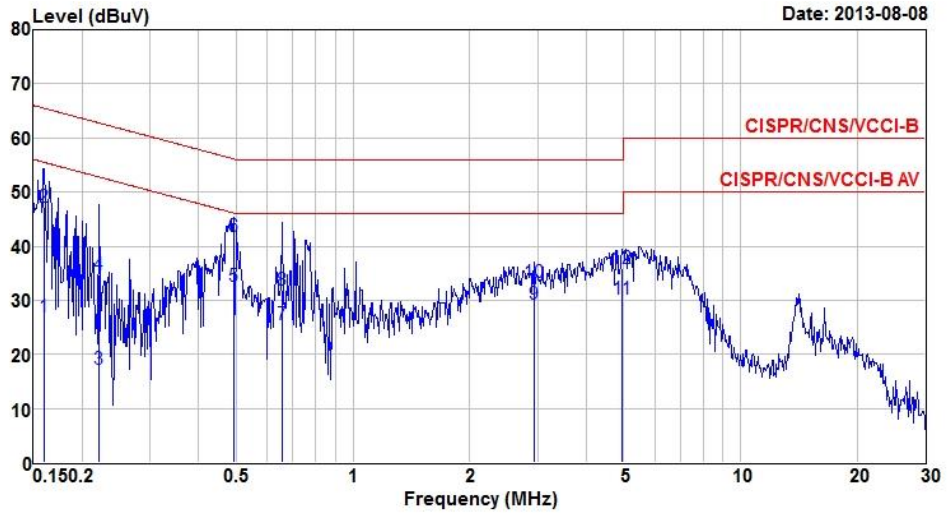
AC Power-line Conducted Emissions Result			
Operating Mode	4	Power Phase	Neutral
Operating Function	Radio link (WLAN) with Ant. 4		



Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.
 Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)



AC Power-line Conducted Emissions Result			
Operating Mode	4	Power Phase	Line
Operating Function	Radio link (WLAN) with Ant. 4		



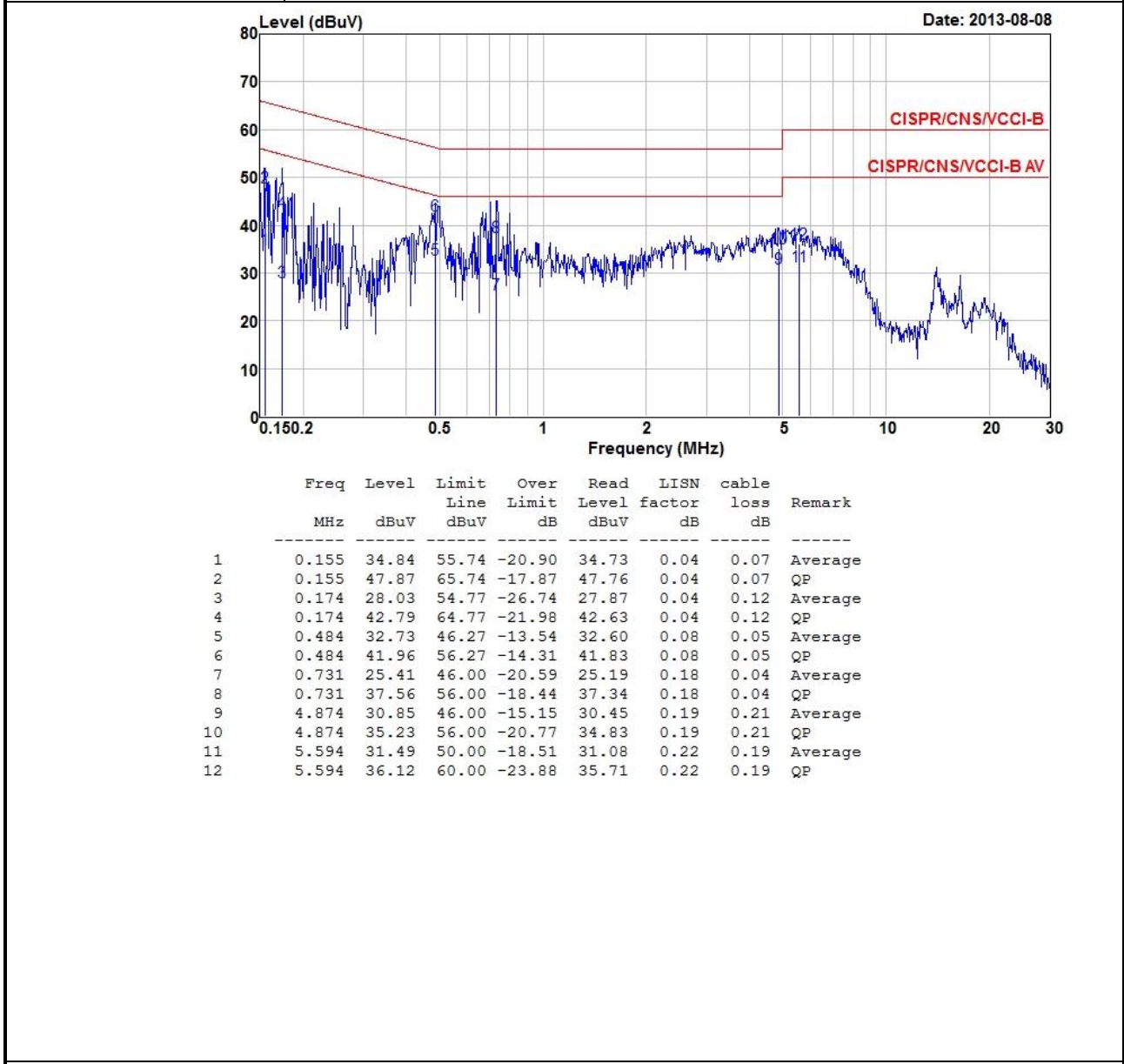
	Freq MHz	Level dBuV	Limit dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.160	26.94	55.47	-28.53	26.80	0.05	0.09	Average
2	0.160	47.21	65.47	-18.26	47.07	0.05	0.09	QP
3	0.221	17.34	52.79	-35.45	17.13	0.05	0.16	Average
4	0.221	34.59	62.79	-28.20	34.38	0.05	0.16	QP
5	0.491	32.59	46.14	-13.55	32.46	0.08	0.05	Average
6	0.491	41.74	56.14	-14.40	41.61	0.08	0.05	QP
7	0.658	25.56	46.00	-20.44	25.42	0.10	0.04	Average
8	0.658	31.86	56.00	-24.14	31.72	0.10	0.04	QP
9	2.931	29.23	46.00	-16.77	28.84	0.19	0.20	Average
10	2.931	33.32	56.00	-22.68	32.93	0.19	0.20	QP
11	4.952	30.27	46.00	-15.73	29.85	0.21	0.21	Average
12	4.952	35.84	56.00	-20.16	35.42	0.21	0.21	QP

Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.
 Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)



AC Power-line Conducted Emissions Result

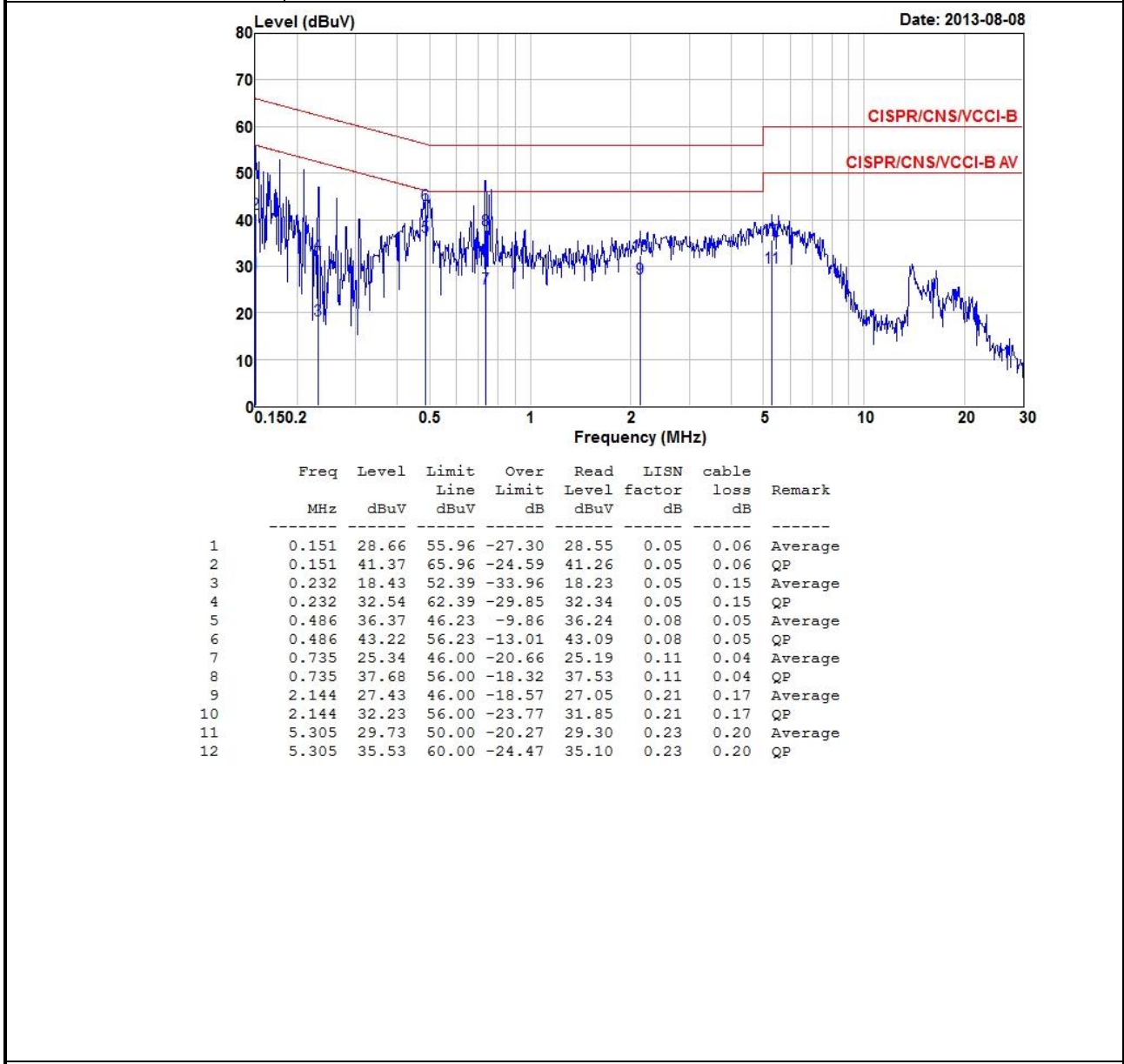
Operating Mode	5	Power Phase	Neutral
Operating Function	Radio link (WLAN) with Ant. 5		



Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.
 Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)



AC Power-line Conducted Emissions Result			
Operating Mode	5	Power Phase	Line
Operating Function	Radio link (WLAN) with Ant. 5		



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:	
<input checked="" type="checkbox"/>	6 dB bandwidth \geq 500 kHz.

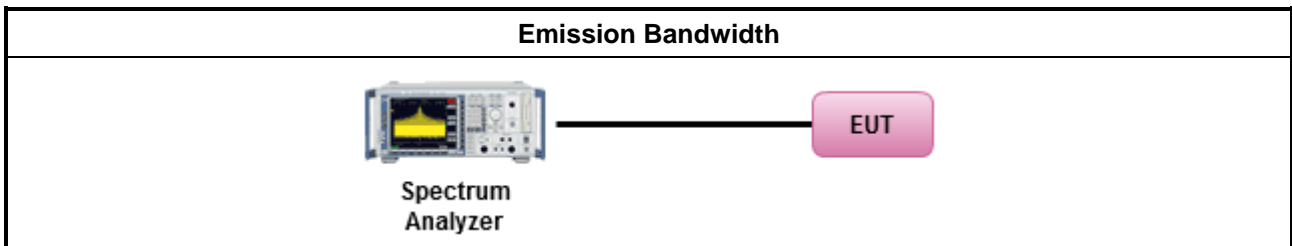
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	For the emission bandwidth shall be measured using one of the options below:
<input checked="" type="checkbox"/>	Refer as FCC KDB 558074, clause 8.1 Option 1 for 6 dB bandwidth measurement.
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.2 Option 2 for 6 dB bandwidth measurement.
<input type="checkbox"/>	Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.
<input checked="" type="checkbox"/>	For conducted measurement.
<input checked="" type="checkbox"/>	The EUT supports single transmit chain and measurements performed on this transmit chain.
<input type="checkbox"/>	The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.
<input checked="" type="checkbox"/>	The EUT supports multiple transmit chains using options given below:
<input type="checkbox"/>	Option 1: Multiple transmit chains measurements need to be performed on one of the active transmit chains (antenna outputs). All measurement had be performed on transmit chains 1.
<input checked="" type="checkbox"/>	Option 2: Multiple transmit chains measurements need to be performed on each transmit chains individually (antenna outputs). All measurement had be performed on all transmit chains.

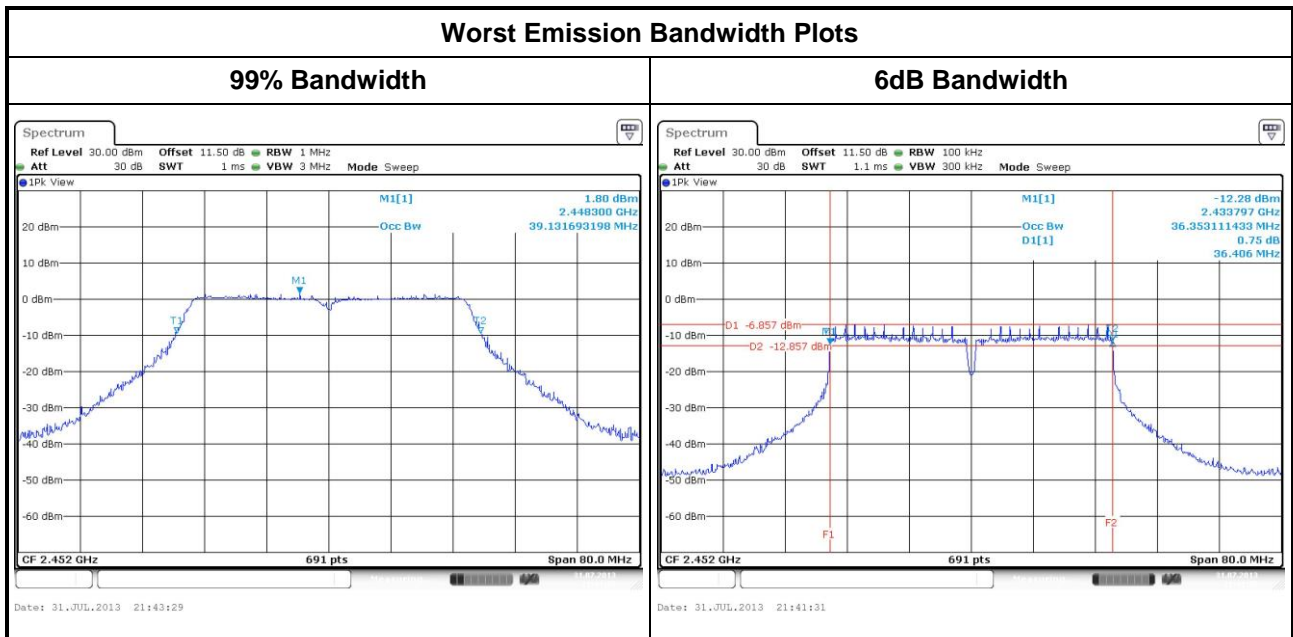
3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Emission Bandwidth Result										
Operating Mode		1								
Condition			Emission Bandwidth (MHz)							
Modulation Mode	N _{TX}	Freq. (MHz)	99% Bandwidth				6dB Bandwidth			
			Chain-Port 1	Chain-Port 2	Chain-Port 3	-	Chain-Port 1	Chain-Port 2	Chain-Port 3	-
11b	1	2412	13.89	-	-	-	10.09	-	-	-
11b	1	2437	13.95	-	-	-	10.09	-	-	-
11b	1	2462	13.89	-	-	-	10.09	-	-	-
11g	1	2412	17.13	-	-	-	16.35	-	-	-
11g	1	2437	17.13	-	-	-	16.35	-	-	-
11g	1	2462	17.19	-	-	-	16.35	-	-	-
HT-20	1	2412	18.18	-	-	-	17.57	-	-	-
HT-20	1	2437	18.23	-	-	-	17.62	-	-	-
HT-20	1	2462	18.18	-	-	-	17.57	-	-	-
HT-40	1	2422	38.90	-	-	-	36.29	-	-	-
HT-40	1	2437	39.13	-	-	-	36.41	-	-	-
HT-40	1	2452	39.13	-	-	-	36.41	-	-	-
Limit			N/A				≥500 kHz			
Result			Complied							

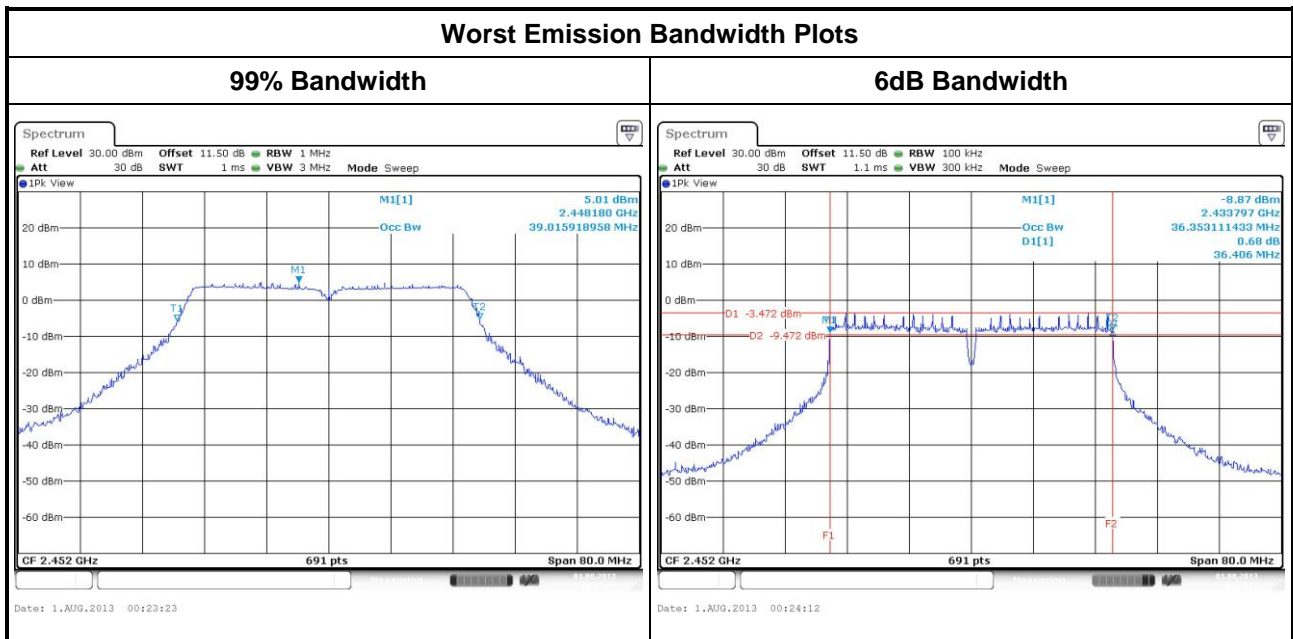
Note 1: N_{TX} = Number of Transmit Chains





Emission Bandwidth Result										
Operating Mode		2								
Condition		Emission Bandwidth (MHz)								
Modulation Mode	N _{TX}	Freq. (MHz)	99% Bandwidth				6dB Bandwidth			
			Chain-Port 1	Chain-Port 2	Chain-Port 3	-	Chain-Port 1	Chain-Port 2	Chain-Port 3	-
11b	1	2412	13.89	-	-	-	10.09	-	-	-
11b	1	2437	13.95	-	-	-	10.09	-	-	-
11b	1	2462	13.89	-	-	-	10.03	-	-	-
11g	1	2412	17.19	-	-	-	16.35	-	-	-
11g	1	2437	17.25	-	-	-	16.35	-	-	-
11g	1	2462	17.19	-	-	-	16.35	-	-	-
HT-20	1	2412	18.18	-	-	-	17.57	-	-	-
HT-20	1	2437	18.23	-	-	-	17.62	-	-	-
HT-20	1	2462	18.23	-	-	-	17.62	-	-	-
HT-40	1	2422	39.02	-	-	-	36.41	-	-	-
HT-40	1	2437	39.02	-	-	-	36.41	-	-	-
HT-40	1	2452	39.02	-	-	-	36.41	-	-	-
Limit		N/A				≥500 kHz				
Result		Complied								

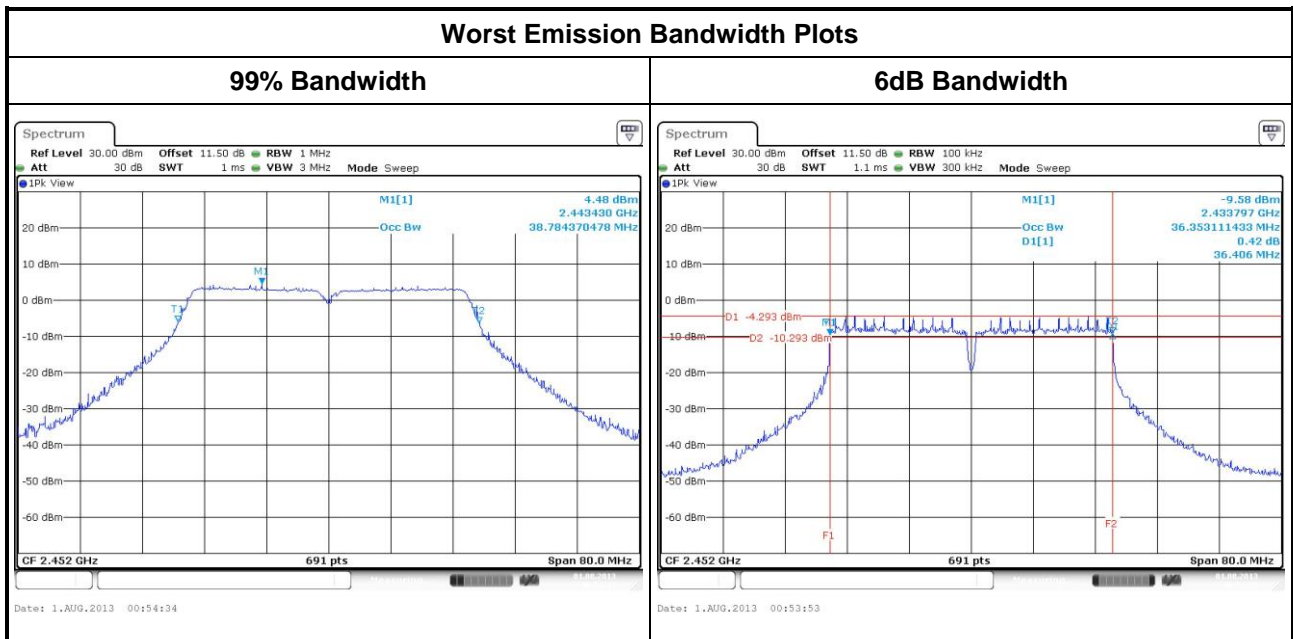
Note 1: N_{TX} = Number of Transmit Chains





Emission Bandwidth Result										
Operating Mode		3								
Condition			Emission Bandwidth (MHz)							
Modulation Mode	N _{TX}	Freq. (MHz)	99% Bandwidth				6dB Bandwidth			
			Chain-Port 1	Chain-Port 2	Chain-Port 3	-	Chain-Port 1	Chain-Port 2	Chain-Port 3	-
11b	1	2412	13.89	-	-	-	10.09	-	-	-
11b	1	2437	13.95	-	-	-	10.09	-	-	-
11b	1	2462	13.89	-	-	-	10.09	-	-	-
11g	1	2412	17.19	-	-	-	16.35	-	-	-
11g	1	2437	17.25	-	-	-	16.35	-	-	-
11g	1	2462	17.13	-	-	-	16.35	-	-	-
HT-20	1	2412	18.18	-	-	-	17.57	-	-	-
HT-20	1	2437	18.23	-	-	-	17.62	-	-	-
HT-20	1	2462	18.18	-	-	-	17.51	-	-	-
HT-40	1	2422	38.78	-	-	-	36.29	-	-	-
HT-40	1	2437	38.78	-	-	-	36.41	-	-	-
HT-40	1	2452	38.78	-	-	-	36.41	-	-	-
Limit			N/A				≥500 kHz			
Result			Complied							

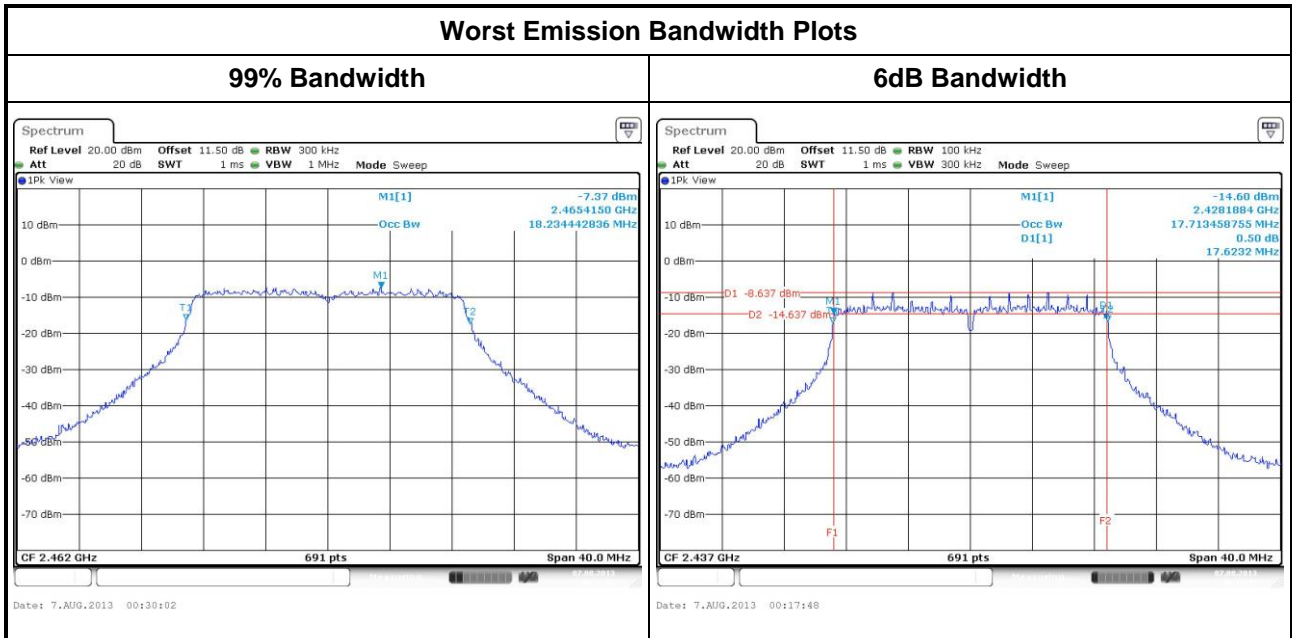
Note 1: N_{TX} = Number of Transmit Chains





Emission Bandwidth Result										
Operating Mode		4								
Condition		Emission Bandwidth (MHz)								
Modulation Mode	N _{TX}	Freq. (MHz)	99% Bandwidth				6dB Bandwidth			
			Chain-Port 1	Chain-Port 2	Chain-Port 3	-	Chain-Port 1	Chain-Port 2	Chain-Port 3	-
11b	1	2412	13.89	-	-	-	10.03	-	-	-
11b	1	2437	13.89	-	-	-	10.09	-	-	-
11b	1	2462	13.89	-	-	-	10.09	-	-	-
11g	1	2412	17.13	-	-	-	16.35	-	-	-
11g	1	2437	17.13	-	-	-	16.35	-	-	-
11g	1	2462	17.13	-	-	-	16.35	-	-	-
HT-20	1	2412	18.23	-	-	-	17.57	-	-	-
HT-20	1	2437	18.23	-	-	-	17.62	-	-	-
HT-20	1	2462	18.23	-	-	-	17.51	-	-	-
Limit		N/A				≥500 kHz				
Result		Complied								

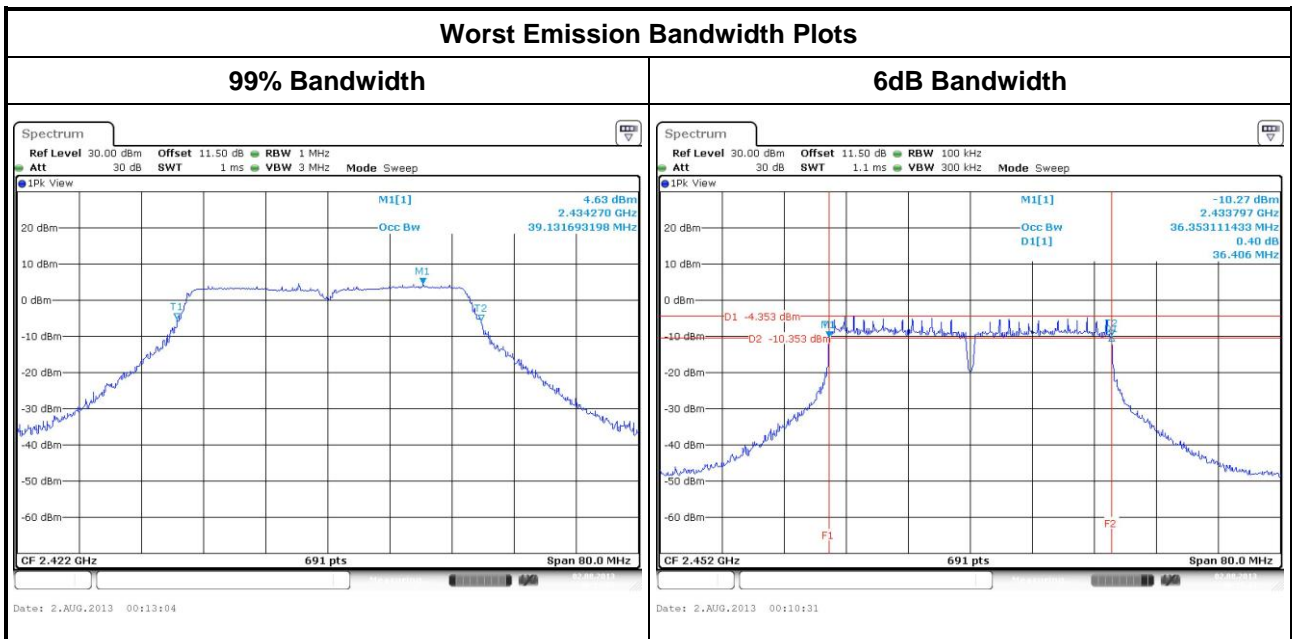
Note 1: N_{TX} = Number of Transmit Chains





Emission Bandwidth Result										
Operating Mode		5								
Condition		Emission Bandwidth (MHz)								
Modulation Mode	N _{TX}	Freq. (MHz)	99% Bandwidth				6dB Bandwidth			
			Chain-Port 1	Chain-Port 2	Chain-Port 3	-	Chain-Port 1	Chain-Port 2	Chain-Port 3	-
11b	3	2412	13.89	13.95	13.89	-	10.09	10.03	10.09	-
11b	3	2437	14.07	14.12	14.01	-	9.80	10.09	10.09	-
11b	3	2462	13.95	13.84	13.89	-	10.09	10.03	10.03	-
11g	3	2412	17.19	17.02	16.90	-	16.29	16.29	16.29	-
11g	3	2437	17.13	17.02	16.85	-	16.29	16.29	16.29	-
11g	3	2462	17.19	17.02	16.85	-	16.35	16.41	16.35	-
HT-20	3	2412	18.23	18.00	18.00	-	17.57	17.57	17.57	-
HT-20	3	2437	18.23	18.18	17.95	-	17.57	17.57	17.33	-
HT-20	3	2462	18.29	18.12	18.06	-	17.57	17.57	17.57	-
HT-40	3	2422	39.13	38.55	38.32	-	36.29	36.29	36.06	-
HT-40	3	2437	38.90	38.44	38.21	-	36.41	36.06	36.29	-
HT-40	3	2452	39.02	38.55	38.44	-	36.41	36.29	36.41	-
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	
<input checked="" type="checkbox"/> 2400-2483.5 MHz Band:	
<input checked="" type="checkbox"/>	If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)
<input type="checkbox"/>	Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ dBm
<input checked="" type="checkbox"/>	Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
<input type="checkbox"/>	Smart antenna system (SAS):
<input type="checkbox"/>	Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
<input type="checkbox"/>	Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
<input type="checkbox"/>	Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8$ dBm
e.i.r.p. Power Limit:	
<input checked="" type="checkbox"/> 2400-2483.5 MHz Band	
<input checked="" type="checkbox"/>	Point-to-multipoint systems (P2M): $P_{eirp} \leq 36$ dBm (4 W)
<input checked="" type="checkbox"/>	Point-to-point systems (P2P): $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX}])$ dBm
<input type="checkbox"/>	Smart antenna system (SAS)
<input type="checkbox"/>	Single beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
<input type="checkbox"/>	Overlap beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
<input type="checkbox"/>	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.	

RF Output Power Limit - IC	
Maximum Peak Conducted Output Power or Maximum Conducted Output Power Limit and e.i.r.p.	
<input checked="" type="checkbox"/> 2400-2483.5 MHz Band:	
<input checked="" type="checkbox"/>	Point-to-multipoint systems (P2M): $P_{Out} \leq 30$ dBm (1 W); $P_{eirp} \leq 36$ dBm (4 W)
<input checked="" type="checkbox"/>	Point-to-point systems (P2P): If $P_{eirp} > 36$ dBm, $G_{TX} \leq P_{Out}$
<input type="checkbox"/>	Smart antenna system (SAS): If $P_{eirp} > 36$ dBm, $G_{TX} \leq P_{Out}$
<input type="checkbox"/>	Single beam: follow P2M, P2P limits
<input type="checkbox"/>	Overlap beam: follow P2M limit
<input type="checkbox"/>	Aggregate power on all beams: follow P2M limit + 8dB
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.	

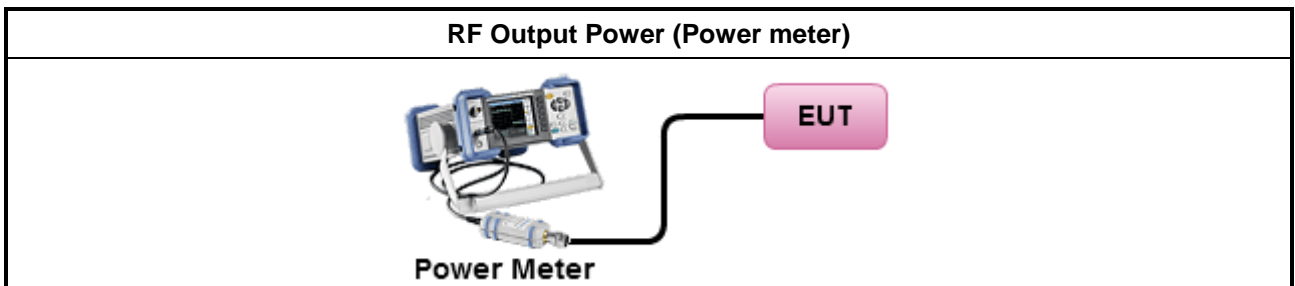
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
<input type="checkbox"/>	Maximum Peak Conducted Output Power
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 9.1.1 Option 1 (RBW ≥ EBW method).
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 9.1.2 Option 2 (integrated band power method).
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 9.1.3 Option 3 (peak power meter for VBW ≥ DTS BW)
<input checked="" type="checkbox"/>	Maximum Conducted (Average) Output Power
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 9.2.2.2 Method AVGSA-1 (spectral trace averaging).
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 9.2.2.3 Method AVGSA-1 Alt. (slow sweep speed)
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging).
<input type="checkbox"/>	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
<input checked="" type="checkbox"/>	Refer as FCC KDB 558074, clause 9.2.3 Method AVGPM-G (using a gated RF average power meter)
<input checked="" type="checkbox"/>	For conducted measurement.
<input checked="" type="checkbox"/>	The EUT supports single transmit chain and measurements performed on this transmit chain.
<input type="checkbox"/>	The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.
<input checked="" type="checkbox"/>	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.
<input checked="" type="checkbox"/>	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 Directional Gain for Power Measurement

Directional Gain (DG) Result					
Operating Mode		1			
Transmit Chains No.		1	-	-	-
Maximum G _{ANT} (dBi)		16	-	-	-
Modulation Mode	DG (dBi)	N _{TX}	N _{SS}	STBC	Array Gain (dB)
11b,1-11Mbps	16	1	1	-	-
11g,6-54Mbps	16	1	1	-	-
HT-20,M0-M7	16	1	1	-	-
HT-40,M0-M7	16	1	1	-	-

Note: Antenna gain= 16 dBi > 6dBi , Power Limit shall be reduced to 30dBm – (16 dBi – 6 dBi) = 20 dBm

Directional Gain (DG) Result					
Operating Mode		2			
Transmit Chains No.		1	-	-	-
Maximum G _{ANT} (dBi)		12	-	-	-
Modulation Mode	DG (dBi)	N _{TX}	N _{SS}	STBC	Array Gain (dB)
11b,1-11Mbps	12	1	1	-	-
11g,6-54Mbps	12	1	1	-	-
HT-20,M0-M7	12	1	1	-	-
HT-40,M0-M7	12	1	1	-	-

Note: Antenna gain= 12 dBi > 6dBi , Power Limit shall be reduced to 30dBm – (12 dBi – 6 dBi) = 24 dBm



Directional Gain (DG) Result					
Operating Mode		3			
Transmit Chains No.		1	-	-	-
Maximum G _{ANT} (dBi)		14	-	-	-
Modulation Mode	DG (dBi)	N _{TX}	N _{SS}	STBC	Array Gain (dB)
11b,1-11Mbps	14	1	1	-	-
11g,6-54Mbps	14	1	1	-	-
HT-20,M0-M7	14	1	1	-	-
HT-40,M0-M7	14	1	1	-	-

Note: Antenna gain= 14 dBi > 6dBi , Power Limit shall be reduced to 30dBm – (14 dBi – 6 dBi) = 22 dBm

Directional Gain (DG) Result					
Operating Mode		4			
Transmit Chains No.		1	-	-	-
Maximum G _{ANT} (dBi)		24	-	-	-
Modulation Mode	DG (dBi)	N _{TX}	N _{SS}	STBC	Array Gain (dB)
11b,1-11Mbps	24	1	1	-	-
11g,6-54Mbps	24	1	1	-	-
HT-20,M0-M7	24	1	1	-	-

Note: This antenna is used for fixed operation and Antenna gain= 24 dBi > 6dBi , Power Limit shall be reduced to 30dBm – (24 dBi – 6 dBi) / 3 = 24 dBm



Directional Gain (DG) Result					
Operating Mode		5			
Transmit Chains No.		1	2	3	-
Maximum G _{ANT} (dBi)		5	5	5	-
Modulation Mode	DG (dBi)	N _{TX}	N _{SS}	STBC	Array Gain (dB)
11b,1-11Mbps	5	3	1	-	-
11g,6-54Mbps	5	3	1	-	-
HT-20,M0-M23	5	3	1	-	-
HT-40,M0-M23	5	3	1	-	-

Note 1: For CDD transmissions, directional gain is calculated as power measurements:
Directional Gain (DG) = G_{ANT} + Array Gain, where Array Gain is as follows:
Array Gain = 0 dB (i.e., no array gain) for N_{TX} ≤ 4;
Directional Gain = 5 dBi + 0dB = 5dBi < 6dBi, Power limit reduction is not required

3.3.6 Test Result of Maximum Conducted Output Power

Maximum Conducted Output Power											
Operating Mode		1									
Condition			RF Output Power (dBm)								
Modulation Mode	N _{TX}	Freq. (MHz)	Chain Port 1	Chain Port 2	Chain Port 3	-	Sum Chain	Power Limit	DG (dBi)	EIRP Power	EIRP Limit
11b	1	2412	11.94	-	-	-	11.94	20.00	16.00	27.94	36.00
11b	1	2437	16.44	-	-	-	16.44	20.00	16.00	32.44	36.00
11b	1	2462	13.15	-	-	-	13.15	20.00	16.00	29.15	36.00
11g	1	2412	14.47	-	-	-	14.47	20.00	16.00	30.47	36.00
11g	1	2437	17.25	-	-	-	17.25	20.00	16.00	33.25	36.00
11g	1	2462	14.48	-	-	-	14.48	20.00	16.00	30.48	36.00
HT-20	1	2412	13.68	-	-	-	13.68	20.00	16.00	29.68	36.00
HT-20	1	2437	16.95	-	-	-	16.95	20.00	16.00	32.95	36.00
HT-20	1	2462	12.92	-	-	-	12.92	20.00	16.00	28.92	36.00
HT-40	1	2422	7.60	-	-	-	7.60	20.00	16.00	23.60	36.00
HT-40	1	2437	13.28	-	-	-	13.28	20.00	16.00	29.28	36.00
HT-40	1	2452	7.68	-	-	-	7.68	20.00	16.00	23.68	36.00
Result			Complied								

Maximum Conducted Output Power											
Operating Mode		2									
Condition			RF Output Power (dBm)								
Modulation Mode	N _{TX}	Freq. (MHz)	Chain Port 1	Chain Port 2	Chain Port 3	-	Sum Chain	Power Limit	DG (dBi)	EIRP Power	EIRP Limit
11b	1	2412	18.07	-	-	-	18.07	24.00	12.00	30.07	36.00
11b	1	2437	23.55	-	-	-	23.55	24.00	12.00	35.55	36.00
11b	1	2462	21.93	-	-	-	21.93	24.00	12.00	33.93	36.00
11g	1	2412	19.97	-	-	-	19.97	24.00	12.00	31.97	36.00
11g	1	2437	23.04	-	-	-	23.04	24.00	12.00	35.04	36.00
11g	1	2462	17.42	-	-	-	17.42	24.00	12.00	29.42	36.00
HT-20	1	2412	19.32	-	-	-	19.32	24.00	12.00	31.32	36.00
HT-20	1	2437	23.02	-	-	-	23.02	24.00	12.00	35.02	36.00
HT-20	1	2462	16.23	-	-	-	16.23	24.00	12.00	28.23	36.00
HT-40	1	2422	14.44	-	-	-	14.44	24.00	12.00	26.44	36.00
HT-40	1	2437	16.92	-	-	-	16.92	24.00	12.00	28.92	36.00
HT-40	1	2452	10.74	-	-	-	10.74	24.00	12.00	22.74	36.00
Result			Complied								



Maximum Conducted Output Power											
Operating Mode		3									
Condition			RF Output Power (dBm)								
Modulation Mode	N _{TX}	Freq. (MHz)	Chain Port 1	Chain Port 2	Chain Port 3	-	Sum Chain	Power Limit	DG (dBi)	EIRP Power	EIRP Limit
11b	1	2412	16.63	-	-	-	16.63	22.00	14.00	30.63	36.00
11b	1	2437	18.16	-	-	-	18.16	22.00	14.00	32.16	36.00
11b	1	2462	17.38	-	-	-	17.38	22.00	14.00	31.38	36.00
11g	1	2412	16.24	-	-	-	16.24	22.00	14.00	30.24	36.00
11g	1	2437	21.66	-	-	-	21.66	22.00	14.00	35.66	36.00
11g	1	2462	16.62	-	-	-	16.62	22.00	14.00	30.62	36.00
HT-20	1	2412	16.09	-	-	-	16.09	22.00	14.00	30.09	36.00
HT-20	1	2437	21.65	-	-	-	21.65	22.00	14.00	35.65	36.00
HT-20	1	2462	15.24	-	-	-	15.24	22.00	14.00	29.24	36.00
HT-40	1	2422	11.26	-	-	-	11.26	22.00	14.00	25.26	36.00
HT-40	1	2437	16.09	-	-	-	16.09	22.00	14.00	30.09	36.00
HT-40	1	2452	10.07	-	-	-	10.07	22.00	14.00	24.07	36.00
Result			Complied								

Maximum Conducted Output Power											
Operating Mode		4									
Condition			RF Output Power (dBm)								
Modulation Mode	N _{TX}	Freq. (MHz)	Chain Port 1	Chain Port 2	Chain Port 3	-	Sum Chain	Power Limit	DG (dBi)	EIRP Power	EIRP Limit
11b	1	2412	1.52	-	-	-	1.52	24.00	24.00	25.52	48.00
11b	1	2437	1.64	-	-	-	1.64	24.00	24.00	25.64	48.00
11b	1	2462	1.32	-	-	-	1.32	24.00	24.00	25.32	48.00
11g	1	2412	1.24	-	-	-	1.24	24.00	24.00	25.24	48.00
11g	1	2437	2.02	-	-	-	2.02	24.00	24.00	26.02	48.00
11g	1	2462	0.75	-	-	-	0.75	24.00	24.00	24.75	48.00
HT-20	1	2412	1.25	-	-	-	1.25	24.00	24.00	25.25	48.00
HT-20	1	2437	1.97	-	-	-	1.97	24.00	24.00	25.97	48.00
HT-20	1	2462	0.71	-	-	-	0.71	24.00	24.00	24.71	48.00
Result			Complied								



Maximum Conducted Output Power											
Operating Mode		5									
Condition			RF Output Power (dBm)								
Modulation Mode	N _{TX}	Freq. (MHz)	Chain Port 1	Chain Port 2	Chain Port 3	-	Sum Chain	Power Limit	DG (dBi)	EIRP Power	EIRP Limit
11b	3	2412	18.37	18.62	19.04	-	23.46	30.00	5.00	28.46	36.00
11b	3	2437	22.68	22.84	23.67	-	27.86	30.00	5.00	32.86	36.00
11b	3	2462	22.14	21.32	21.63	-	26.48	30.00	5.00	31.48	36.00
11g	3	2412	16.82	16.93	17.13	-	21.73	30.00	5.00	26.73	36.00
11g	3	2437	20.44	21.23	21.36	-	25.80	30.00	5.00	30.80	36.00
11g	3	2462	16.76	16.03	16.02	-	21.06	30.00	5.00	26.06	36.00
HT-20	3	2412	15.37	15.12	15.11	-	19.97	30.00	5.00	24.97	36.00
HT-20	3	2437	21.35	21.84	21.71	-	26.41	30.00	5.00	31.41	36.00
HT-20	3	2462	15.42	14.71	14.63	-	19.71	30.00	5.00	24.71	36.00
HT-40	3	2422	10.08	9.97	10.19	-	14.85	30.00	5.00	19.85	36.00
HT-40	3	2437	14.13	14.25	14.29	-	19.00	30.00	5.00	24.00	36.00
HT-40	3	2452	9.38	10.12	9.87	-	14.57	30.00	5.00	19.57	36.00
Result			Complied								

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

Power Spectral Density Limit
<input checked="" type="checkbox"/> Power Spectral Density (PSD) \leq 8 dBm/3kHz

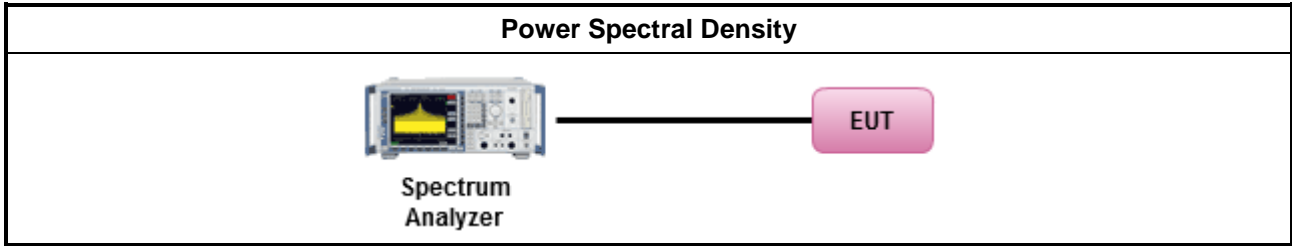
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method
<input checked="" type="checkbox"/> 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:
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.2 Method PKPSD (RBW=30kHz; detector=peak)..
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 10.3 Method AVGPSD-1 (spectral trace averaging). For 11b / g / HT20 mode
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.4 Method AVGPSD-1 Alt. (slow sweep speed)
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.5 Method AVGPSD-2 (spectral trace averaging).
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 10.6 Method AVGPSD-2 Alt. (slow sweep speed) For HT40 mode
<input checked="" type="checkbox"/> For conducted measurement.
<input checked="" type="checkbox"/> The EUT supports single transmit chain and measurements performed on this transmit chain.
<input type="checkbox"/> The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.
<input checked="" type="checkbox"/> The EUT supports multiple transmit chains using options given below:
<input checked="" type="checkbox"/> 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.
<input type="checkbox"/> 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.

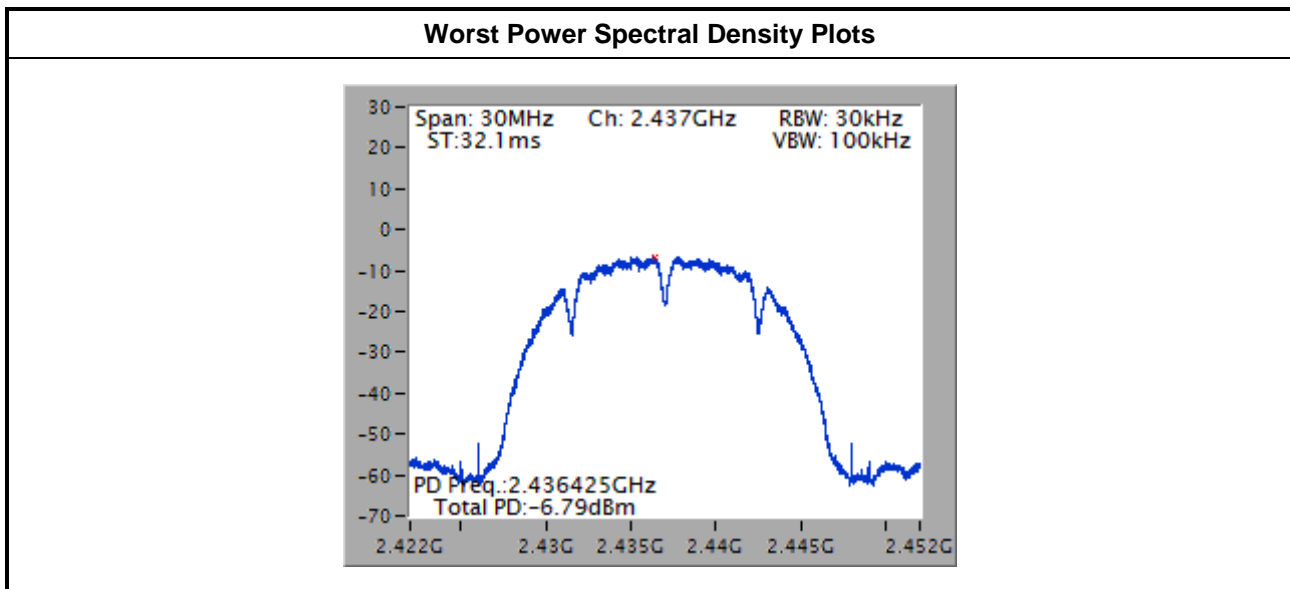
3.4.4 Test Setup



3.4.5 Test Result of Power Spectral Density

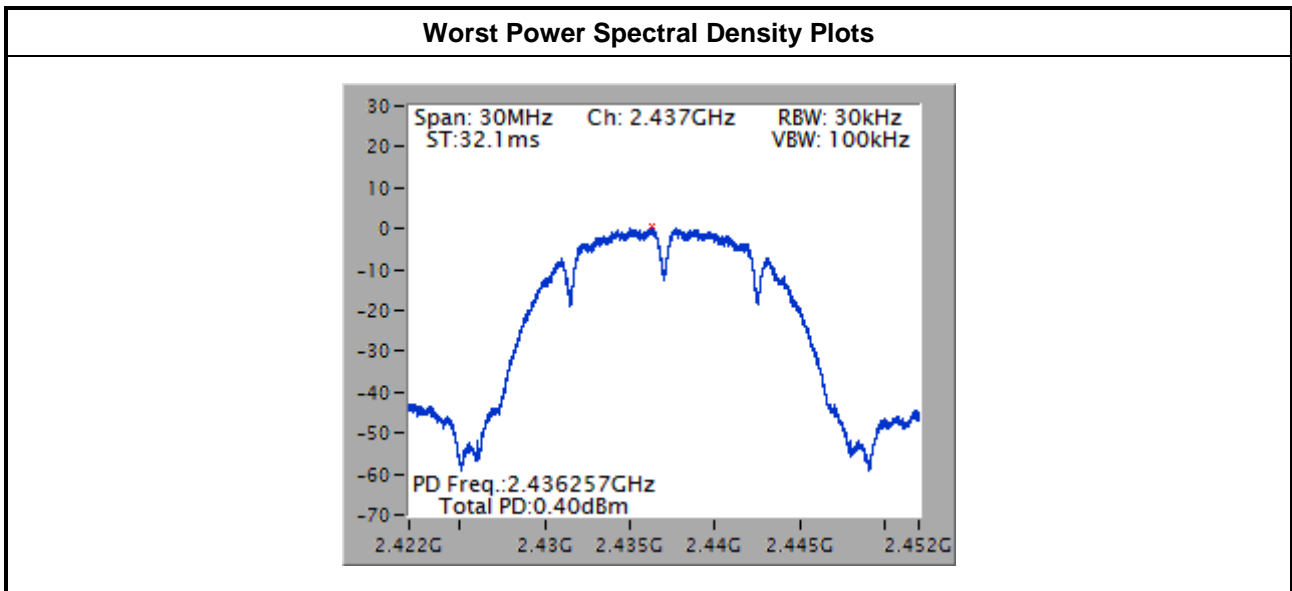
Power Spectral Density Result				
Operating Mode		1		
Condition		Power Spectral Density		
Modulation Mode	N _{TX}	Freq. (MHz)	Sum Chain (dBm/30kHz)	Power Limit (dBm/3kHz)
11b	1	2412	-10.44	-2.00
11b	1	2437	-6.79	-2.00
11b	1	2462	-9.31	-2.00
11g	1	2412	-9.99	-2.00
11g	1	2437	-7.91	-2.00
11g	1	2462	-10.16	-2.00
HT-20	1	2412	-11.26	-2.00
HT-20	1	2437	-8.06	-2.00
HT-20	1	2462	-11.54	-2.00
HT-40	1	2422	-20.18	-2.00
HT-40	1	2437	-14.87	-2.00
HT-40	1	2452	-19.99	-2.00
Result		Complied		

Note: Antenna gain= 16 dBi > 6dBi , Limit shall be reduced to 8dBm – (16 dBi – 6 dBi) = -2 dBm



Power Spectral Density Result				
Operating Mode		2		
Condition		Power Spectral Density		
Modulation Mode	N _{TX}	Freq. (MHz)	Sum Chain (dBm/30kHz)	Power Limit (dBm/3kHz)
11b	1	2412	-4.83	2.00
11b	1	2437	0.40	2.00
11b	1	2462	-0.82	2.00
11g	1	2412	-4.90	2.00
11g	1	2437	-1.83	2.00
11g	1	2462	-7.50	2.00
HT-20	1	2412	-5.61	2.00
HT-20	1	2437	-2.52	2.00
HT-20	1	2462	-8.50	2.00
HT-40	1	2422	-13.33	2.00
HT-40	1	2437	-10.95	2.00
HT-40	1	2452	-17.04	2.00
Result		Complied		

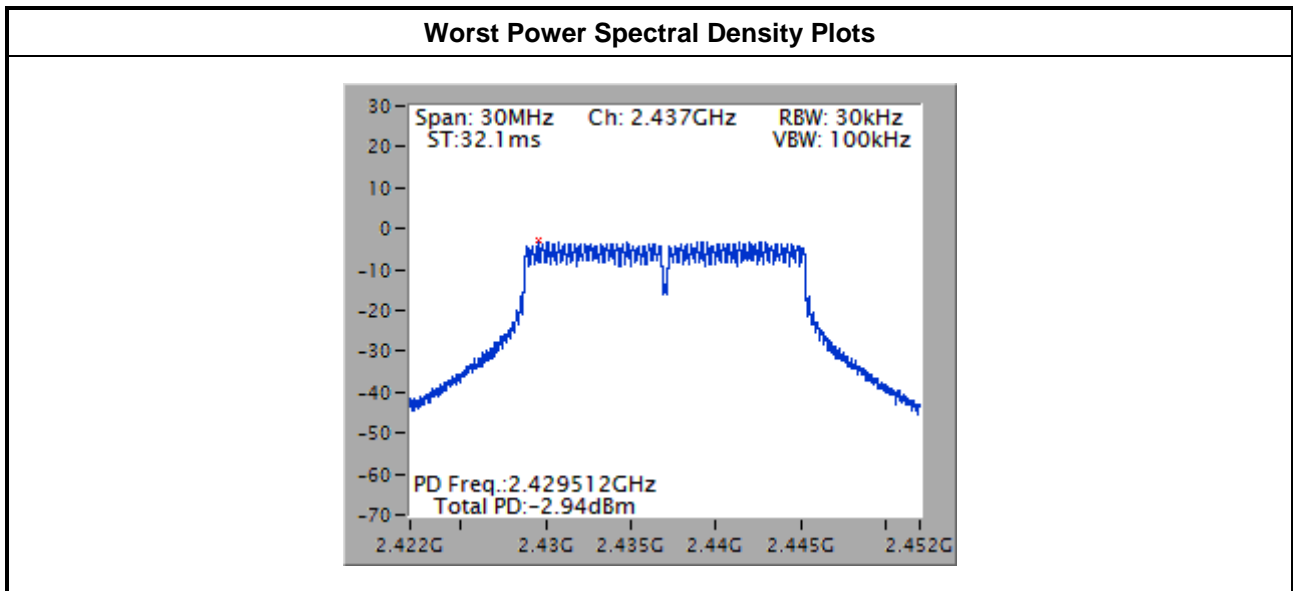
Note: Antenna gain= 12 dBi > 6dBi , Limit shall be reduced to 8dBm – (12 dBi – 6 dBi) = 2 dBm





Power Spectral Density Result				
Operating Mode		3		
Condition		Power Spectral Density		
Modulation Mode	N _{TX}	Freq. (MHz)	Sum Chain (dBm/30kHz)	Power Limit (dBm/3kHz)
11b	1	2412	-5.66	0.00
11b	1	2437	-4.33	0.00
11b	1	2462	-5.02	0.00
11g	1	2412	-8.30	0.00
11g	1	2437	-2.94	0.00
11g	1	2462	-8.49	0.00
HT-20	1	2412	-9.24	0.00
HT-20	1	2437	-3.09	0.00
HT-20	1	2462	-9.63	0.00
HT-40	1	2422	-16.82	0.00
HT-40	1	2437	-11.85	0.00
HT-40	1	2452	-17.70	0.00
Result		Complied		

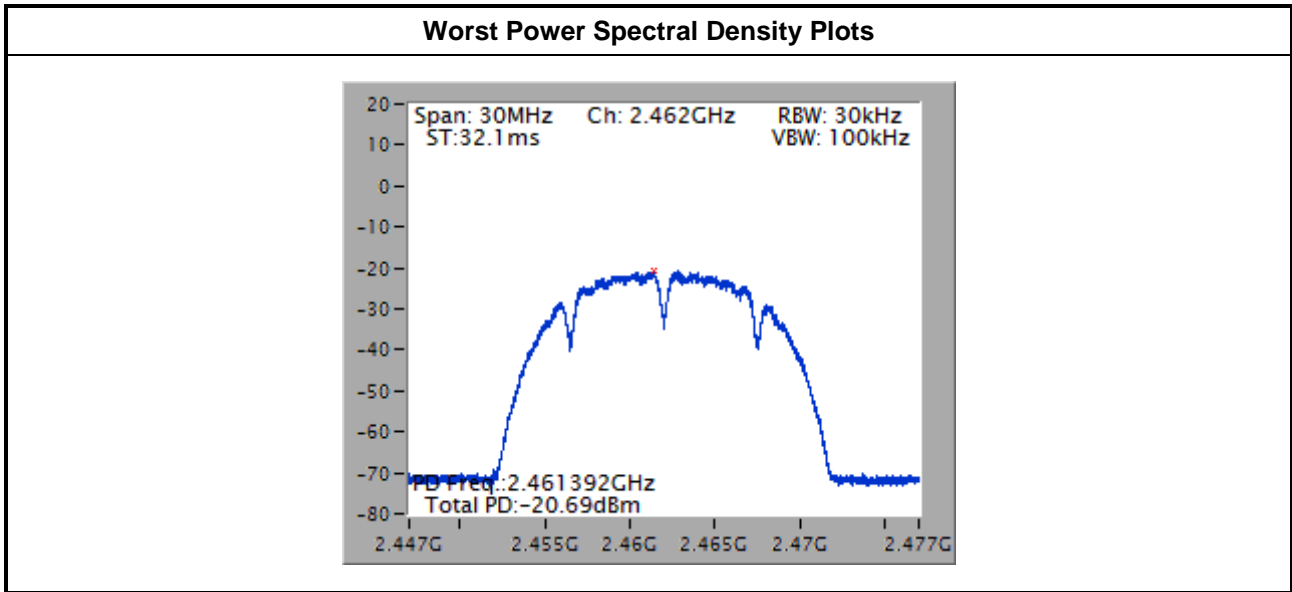
Note: Antenna gain= 14 dBi > 6dBi , Limit shall be reduced to 8dBm – (14 dBi – 6 dBi) = 0 dBm





Power Spectral Density Result				
Operating Mode		4		
Condition		Power Spectral Density		
Modulation Mode	N _{TX}	Freq. (MHz)	Sum Chain (dBm/30kHz)	Power Limit (dBm/3kHz)
11b	1	2412	-21.17	-10.00
11b	1	2437	-21.36	-10.00
11b	1	2462	-20.69	-10.00
11g	1	2412	-22.82	-10.00
11g	1	2437	-21.75	-10.00
11g	1	2462	-22.75	-10.00
HT-20	1	2412	-23.25	-10.00
HT-20	1	2437	-22.10	-10.00
HT-20	1	2462	-23.65	-10.00
Result		Complied		

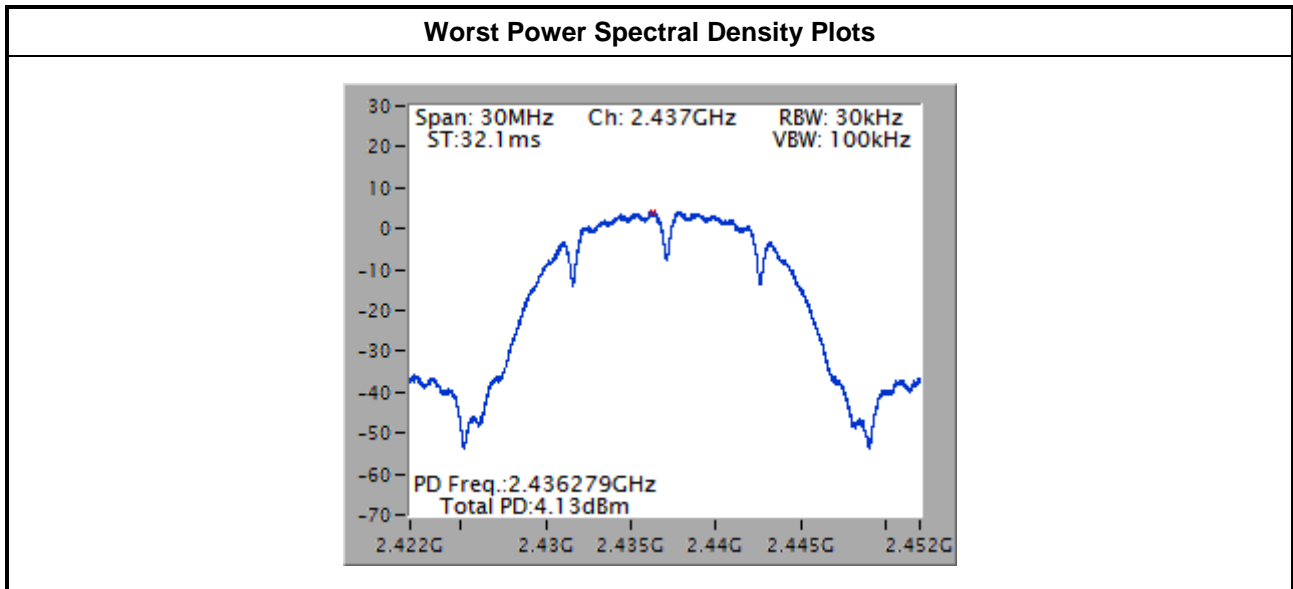
Note: Antenna gain= 24 dBi > 6dBi , Limit shall be reduced to 8dBm – (24 dBi – 6 dBi) = -10 dBm





Power Spectral Density Result				
Operating Mode		5		
Condition		Power Spectral Density		
Modulation Mode	N _{TX}	Freq. (MHz)	Sum Chain (dBm/30kHz)	Power Limit (dBm/3kHz)
11b	3	2412	-0.30	4.23
11b	3	2437	4.13	4.23
11b	3	2462	2.79	4.23
11g	3	2412	-3.78	4.23
11g	3	2437	0.01	4.23
11g	3	2462	-4.19	4.23
HT-20	3	2412	-5.45	4.23
HT-20	3	2437	0.32	4.23
HT-20	3	2462	-5.92	4.23
HT-40	3	2422	-13.28	4.23
HT-40	3	2437	-9.20	4.23
HT-40	3	2452	-13.25	4.23
Result		Complied		

Note: Directional gain= 5+10 * log(3/1) = 9.77 dBi > 6dBi , Limit shall be reduced to 8dBm - (9.77dBi - 6 dBi) = 4.23 dBm



3.5 Emissions in non-restricted frequency bands

3.5.1 Emissions in non-restricted frequency bands limit

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

3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

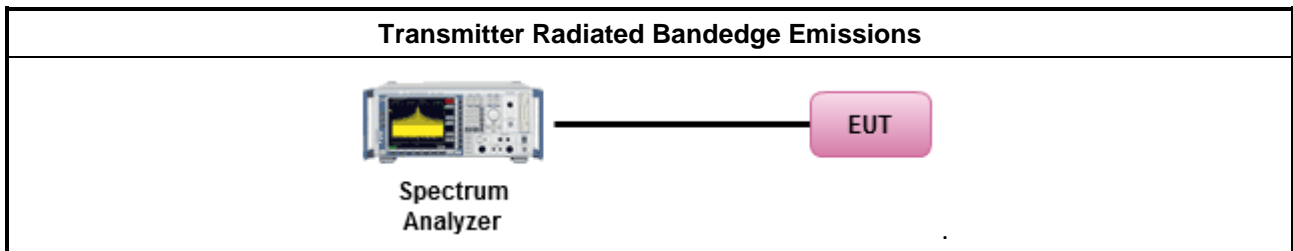
Reference level measurement

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

Emission level measurement

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

3.5.4 Test Setup

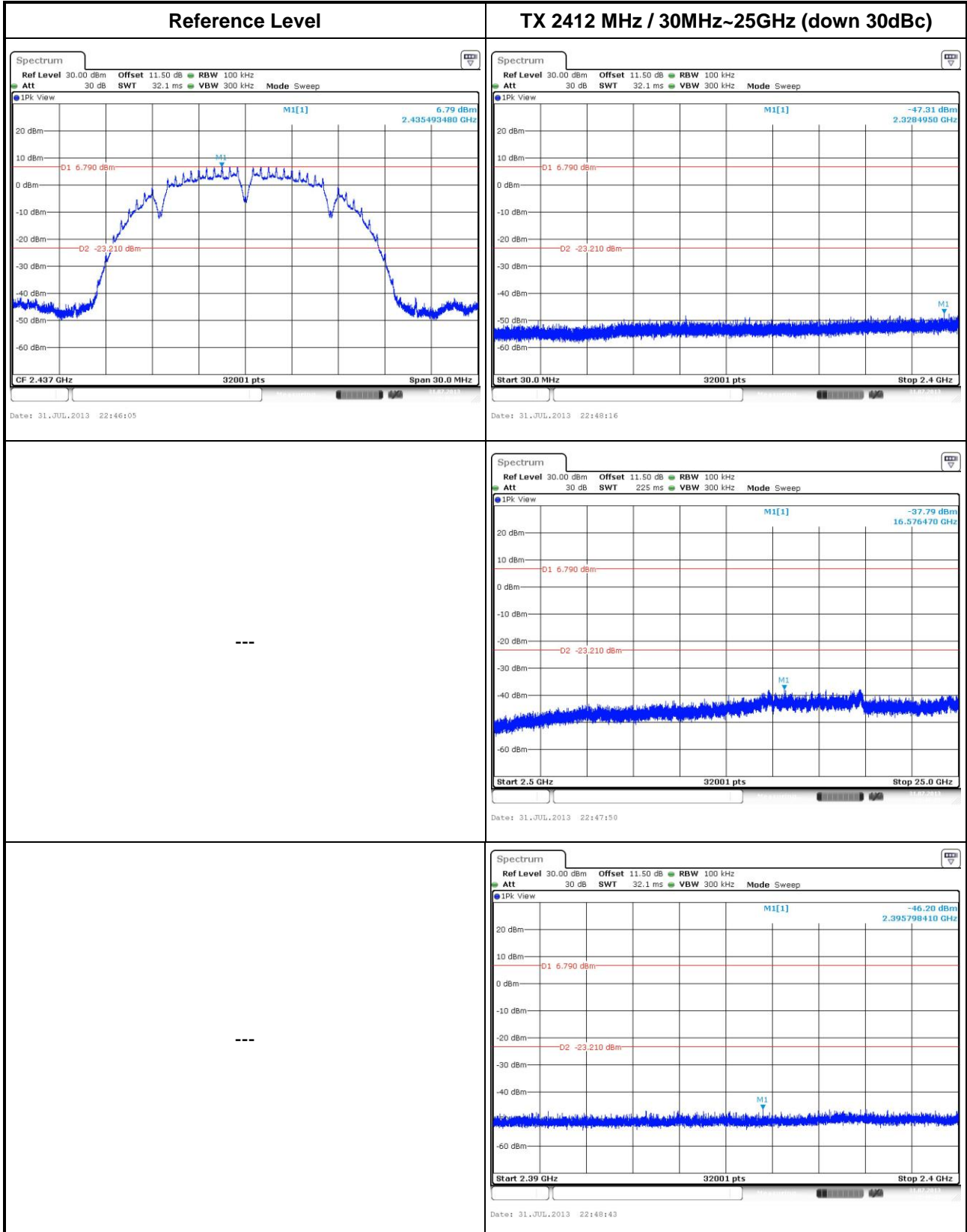


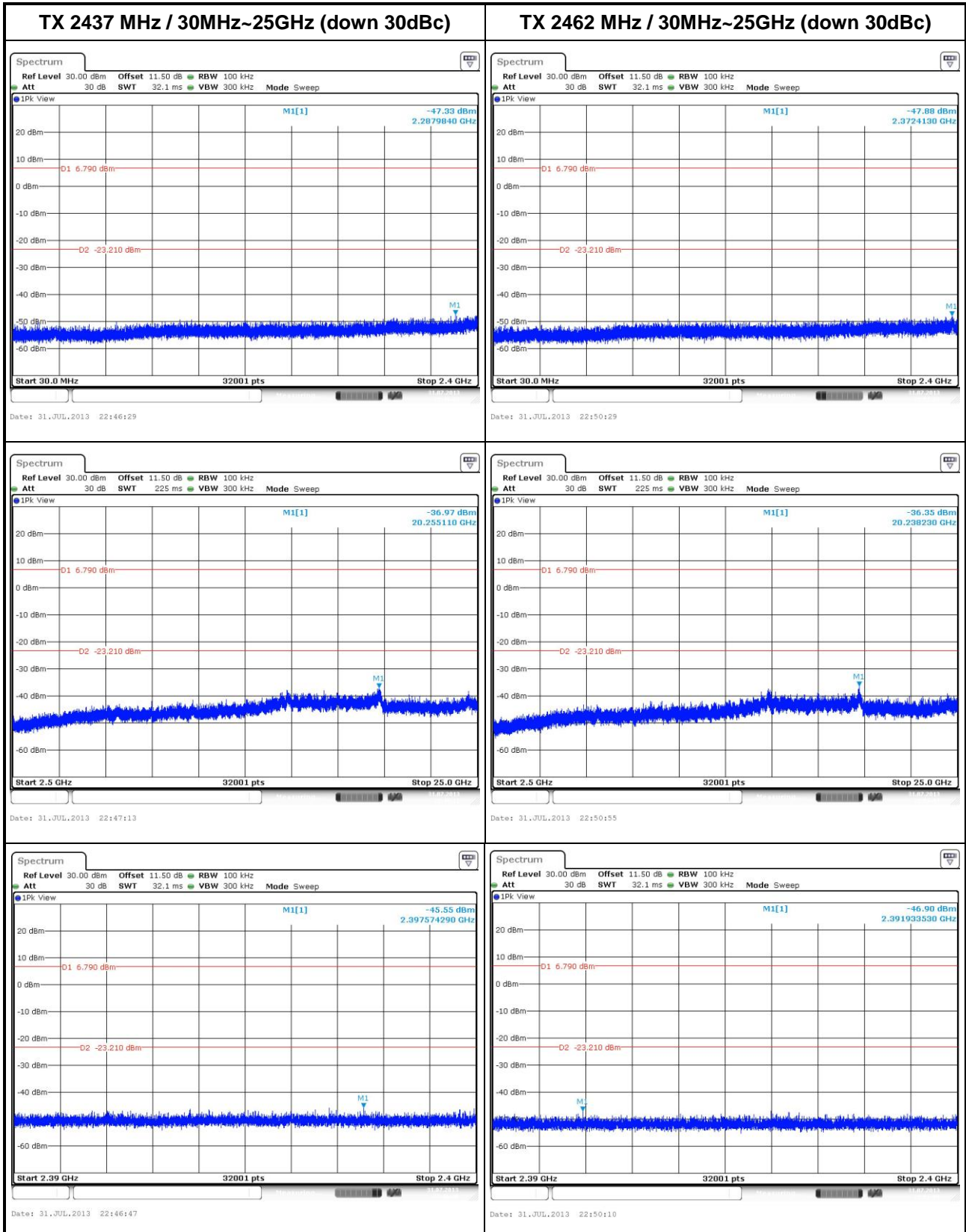
3.5.5 Test Result of Emissions in non-restricted frequency bands

This test item is performed on each TX output individually without summing or adding $10 \log(N_{ANT})$ since measurements are made relative to the in-band emissions on the individual outputs. Only worst test result of each operating mode is presented.



Operating mode 1
802.11b







802.11g

