



FCC CFR47 PART 15 SUBPART C

**CLASS II PERMISSIVE CHANGE
TEST REPORT**

FOR

**Digital Transmission System (DTS)
Wireless Network Adapter Module**

MODEL NUMBER: WL13A

FCC ID: ACJ9TGWL13A

REPORT NUMBER: 10286843H-A-R2

ISSUE DATE: May 21, 2014

Prepared for

**PANASONIC CORPORATION OF NORTH AMERICA
ONE PANASONIC WAY, 4B-8
SECAUCUS, NEW JERSEY 07094, U.S.A.**

Prepared by

**UL Japan, Inc.
Ise HQ EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
TEL: +81 596 24 8999
FAX: +81 596 24 8124**



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.

*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
<http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

Revision History

Rev.	Issue Date	Revisions	Revised By
--	05/13/14	Initial Issue	T.Hatakeda
1	05/20/14	Addition of Antenna port test This report is a revised version of 10286843H-A. 10286843H-A is replaced with this report.	T.Hatakeda
2	05/21/14	Addition of explanatory note for external antenna. This report is a revised version of 10286843H-A-R1. 10286843H-A-R1 is replaced with this report.	T.Hatakeda

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. MEASURING INSTRUMENT CALIBRATION	5
4.2. SAMPLE CALCULATION	5
4.3. MEASUREMENT UNCERTAINTY	6
5. EQUIPMENT UNDER TEST	7
5.1. DESCRIPTION OF EUT	7
5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE	7
5.3. MAXIMUM AVERAGE OUTPUT POWER	7
5.4. DESCRIPTION OF ADDING ANTENNA	7
5.5. SOFTWARE AND FIRMWARE	7
5.6. WORST-CASE CONFIGURATION AND MODE	8
5.7. DESCRIPTION OF TEST SETUP	9
6. TEST AND MEASUREMENT EQUIPMENT	11
7. RADIATED TEST RESULTS	12
7.1. LIMITS AND PROCEDURE	12
7.2. TRANSMITTER ABOVE 1 GHz (worst-case modes)	13
7.3. WORST-CASE BELOW 1 GHz	24
7.4. AC MAINS LINE CONDUCTED EMISSIONS	25
8. ANTENNA PORT TEST RESULTS	27
8.1. OUTPUT POWER	27
8.2. AVERAGE POWER	29
9. SETUP PHOTOS	30

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: PANASONIC CORPORATION OF NORTH AMERICA
ONE PANASONIC WAY, 4B-8
SECAUCUS, NEW JERSEY 07094, U.S.A.

EUT DESCRIPTION: Digital Transmission System (DTS)
Wireless Network Adapter Module

MODEL: WL13A

SERIAL NUMBER: 4CTSA00054

DATE TESTED: April 25 and 28, 2014

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass

UL Japan, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Japan, Inc based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Japan, Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Japan, Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL Japan, Inc. By:

Tested By:



Takahiro Hatakeda
Leader
Consumer Technology Division



Shinya Watanabe
Engineer
Consumer Technology Division

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN.

UL Japan, Inc. is accredited by NVLAP, Laboratory Code 200572-0
The full scope of accreditation can be viewed at
<http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Test room (semi-anechoic chamber)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.5dB
No.3	3.6dB
No.4	3.5dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(±dB)				(1m*)(±dB)		(0.5m*)(±dB)
	9kHz -30MHz	30MHz - 300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

*3m/1m/0.5m = Measurement distance

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The model WL13A, hereafter referred to as EUT, is a PCIe small form factor IEEE802.11a/b/g/n/ac + Bluetooth wireless network adapter module. The module will support MIMO (2x2) for 802.11n/ac modes and MISO (1x2) for 802.11a/b/g modes and utilizes DSSS and OFDM modulation techniques. Bluetooth operates with basic, EDR and BLE modes as SISO (1x1). When Bluetooth is operational WiFi operates as SISO (1x1).

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding 2.4GHz external antenna. External antenna was used for the test as a substitute for Internal Main antenna and supports only SISO mode.

5.3. MAXIMUM AVERAGE OUTPUT POWER

The transmitter has a maximum average conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412-2462	802.11b	14.1	25.94
2412-2462	802.11g	14.5	28.38
2412-2462	802.11n-20	14.6	28.58
2422-2452	802.11n-40	14.7	29.51

5.4. DESCRIPTION OF ADDING ANTENNA

The Whip antenna with 5dBi in 2.4GHz is added.

5.5. SOFTWARE AND FIRMWARE

The test utility software used during testing was DRTU, version. 1.7.3-859.

5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. Radiated Emissions below 1 GHz was performed with EUT set to transmit at the channel with highest output power.

Worst-case data rates used per input from the client are as follows:

11b: 1Mbps
11g: 6Mbps
11n HT20: MCS4
11n HT40: MCS4

Worst-case modes were selected for Band edge and Harmonics based on an investigation of the original reports, as shown in the summary table below:

Worst-case Modes to test

2.4GHz		
Low Band edge	High Band edge	Harmonics
11n 40M	11g	11n 40M
Antenna A	Antenna A	Antenna A
Channel 3	Channel 11	Channel 6

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Car Mounter	HAVIS	DS-PAN-701-2	PREPR0D SAMPLE3	DoC
AC Adapter	Panasonic	CF-AA643C M11	64B3CM224300756C	DoC
Antenna	SAGA DENSHI KOGYO CO., LTD	24KX2	-	-
Laptop	Panasonic	FZ-G1	4CTSA00054	DoC

I/O CABLES

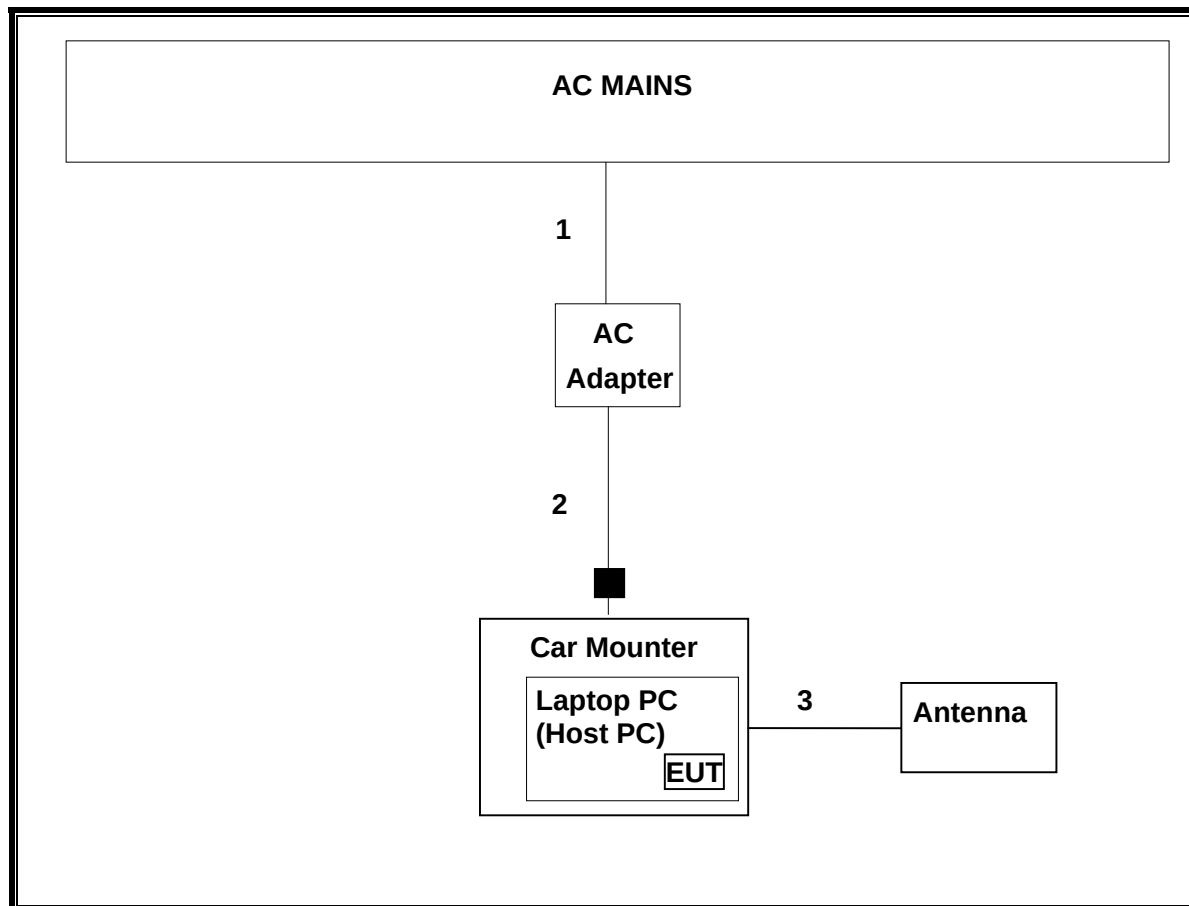
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Un-Shielded	180 cm	N/A
2	DC	1	DC	Un-Shielded	90 cm	N/A
3	Antenna	1	Antenna	Shielded	240 cm	N/A

TEST SETUP

The EUT is installed in a Car Mounter during the tests.

A laptop computer was used to configure the EUT to continuously transmit at a specified output power or continuously receive on the channel specified in the test data. For transmit modes the worst case was evaluated.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE / CE	2013/06/30 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE / CE	2014/02/20 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE / CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE / CE	-
MRENT-116	Spectrum Analyzer	Agilent	E4440A	MY46187620	RE	2014/03/05 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2014/02/21 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2013/11/27 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2014/01/21 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2014/02/21 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE / CE	2013/06/11 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2013/10/13 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2013/10/13 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2013/11/26 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2013/09/12 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2013/05/30 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	8127364	CE	2014/01/27 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2014/01/29 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2014/02/20 * 12
MOS-23	Thermo-Hygrometer	Custom	CTH-201	0004	AT	2013/12/17 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2013/10/21 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2013/10/21 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2014/03/13 * 12

7. RADIATED TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and power averaging for average measurements.

The bandedge is investigated with the transmitter set to the lowest and highest channels in the 2.4 GHz band.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the middle channel in the 2.4GHz n-40 band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

7.2. TRANSMITTER ABOVE 1 GHz (worst-case modes)

HARMONICS AND SPURIOUS EMISSIONS

Test place Ise HQ EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10286843H
Date 04/28/2014
Temperature/ Humidity 22 deg. C / 33% RH
Engineer Shinya Watanabe
(1-26.5GHz)
Mode 11n-40 Tx 2437MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	4874.000	PK	-	32.0	4.4	33.9	-	-	73.9	-	No Signal
Hori	7311.000	PK	-	35.8	5.3	33.8	-	-	73.9	-	No Signal
Hori	9748.000	PK	-	38.3	6.1	34.5	-	-	73.9	-	No Signal
Hori	4874.000	AV	-	32.0	4.4	33.9	-	-	73.9	-	No Signal
Hori	7311.000	AV	-	35.8	5.3	33.8	-	-	73.9	-	No Signal
Hori	9748.000	AV	-	38.3	6.1	34.5	-	-	73.9	-	No Signal
Vert	4874.000	PK	-	32.0	4.4	33.9	-	-	73.9	-	No Signal
Vert	7311.000	PK	-	35.8	5.3	33.8	-	-	73.9	-	No Signal
Vert	9748.000	PK	-	38.3	6.1	34.5	-	-	73.9	-	No Signal
Vert	4874.000	AV	-	32.0	4.4	33.9	-	-	73.9	-	No Signal
Vert	7311.000	AV	-	35.8	5.3	33.8	-	-	73.9	-	No Signal
Vert	9748.000	AV	-	38.3	6.1	34.5	-	-	73.9	-	No Signal

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor (AV)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz $20\log(3.0\text{m}/1.0\text{m})= 9.5\text{dB}$

BAND EDGE

Test place Ise HQ EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10286843H
Date 04/28/2014
Temperature/ Humidity 22 deg. C / 33% RH
Engineer Shinya Watanabe
(1-26.5GHz)
Mode 11b Tx 2412MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	59.7	27.0	2.4	34.7	-	54.4	73.9	19.5	
Hori	2390.000	AV	51.2	27.0	2.4	34.7	-	45.9	53.9	8.0	
Vert	2390.000	PK	58.1	27.0	2.4	34.7	-	52.8	73.9	21.1	
Vert	2390.000	AV	50.3	27.0	2.4	34.7	-	45.0	53.9	8.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor (AV)

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	103.4	27.0	2.4	34.7	98.1	-	-	Carrier
Hori	2400.000	PK	58.1	27.0	2.4	34.7	52.8	78.1	25.3	
Vert	2412.000	PK	102.5	27.0	2.4	34.7	97.2	-	-	Carrier
Vert	2400.000	PK	57.1	27.0	2.4	34.7	51.8	77.2	25.4	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

Test place Ise HQ EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10286843H
Date 04/28/2014
Temperature/ Humidity 22 deg. C / 33% RH
Engineer Shinya Watanabe
(1-26.5GHz)
Mode 11b Tx 2462MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	56.2	26.9	2.5	34.7	-	50.9	73.9	23.0	
Hori	2483.500	AV	47.9	26.9	2.5	34.7	-	42.6	53.9	11.3	
Vert	2483.500	PK	55.0	26.9	2.5	34.7	-	49.7	73.9	24.2	
Vert	2483.500	AV	46.1	26.9	2.5	34.7	-	40.8	53.9	13.1	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor (AV)

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)= 9.5dB$

Test place Ise HQ EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10286843H
Date 04/28/2014
Temperature/ Humidity 22 deg. C / 33% RH
Engineer Shinya Watanabe
(1-26.5GHz)
Mode 11g Tx 2412MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	72.4	27.0	2.4	34.7	-	67.1	73.9	6.8	
Hori	2390.000	AV	55.5	27.0	2.4	34.7	-	50.2	53.9	3.7	
Vert	2390.000	PK	69.7	27.0	2.4	34.7	-	64.4	73.9	9.5	
Vert	2390.000	AV	52.2	27.0	2.4	34.7	-	46.9	53.9	7.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor (AV)

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m) = 9.5dB$

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	101.9	27.0	2.4	34.7	96.6	-	-	Carrier
Hori	2400.000	PK	74.8	27.0	2.4	34.7	69.5	76.6	7.1	
Vert	2412.000	PK	98.9	27.0	2.4	34.7	93.6	-	-	Carrier
Vert	2400.000	PK	71.9	27.0	2.4	34.7	66.6	73.6	7.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

Test place Ise HQ EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10286843H
Date 04/28/2014
Temperature/ Humidity 22 deg. C / 33% RH
Engineer Shinya Watanabe
(1-26.5GHz)
Mode 11g Tx 2462MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	73.0	26.9	2.5	34.7	-	67.7	73.9	6.2	
Hori	2483.500	AV	54.5	26.9	2.5	34.7	-	49.2	53.9	4.7	
Vert	2483.500	PK	70.9	26.9	2.5	34.7	-	65.6	73.9	8.3	
Vert	2483.500	AV	54.2	26.9	2.5	34.7	-	48.9	53.9	5.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor (AV)

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)= 9.5dB$

Test place Ise HQ EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10286843H
Date 04/28/2014
Temperature/ Humidity 22 deg. C / 33% RH
Engineer Shinya Watanabe
(1-26.5GHz)
Mode 11n20 Tx 2412MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	70.5	27.0	2.4	34.7	-	65.2	73.9	8.7	
Hori	2390.000	AV	58.2	27.0	2.4	34.7	0.28	53.2	53.9	0.7	*
Vert	2390.000	PK	70.2	27.0	2.4	34.7	-	64.9	73.9	9.0	
Vert	2390.000	AV	56.6	27.0	2.4	34.7	0.28	51.6	53.9	2.3	*

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor (AV)

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB

*Not Out of Band emission (Leakage Power).

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	101.2	27.0	2.4	34.7	95.9	-	-	Carrier
Hori	2400.000	PK	72.2	27.0	2.4	34.7	66.9	75.9	9.0	
Vert	2412.000	PK	99.5	27.0	2.4	34.7	94.2	-	-	Carrier
Vert	2400.000	PK	69.2	27.0	2.4	34.7	63.9	74.2	10.3	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

Test place Ise HQ EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10286843H
Date 04/28/2014
Temperature/ Humidity 22 deg. C / 33% RH
Engineer Shinya Watanabe
(1-26.5GHz)
Mode 11n20 Tx 2462MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	65.9	26.9	2.5	34.7	-	60.6	73.9	13.3	
Hori	2483.500	AV	53.0	26.9	2.5	34.7	0.28	48.0	53.9	5.9	*
Vert	2483.500	PK	63.7	26.9	2.5	34.7	-	58.4	73.9	15.5	
Vert	2483.500	AV	49.3	26.9	2.5	34.7	0.28	44.3	53.9	9.6	*

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor (AV)

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)= 9.5dB$

*Not Out of Band emission (Leakage Power).

Test place Ise HQ EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10286843H
Date 04/28/2014
Temperature/ Humidity 22 deg. C / 33% RH
Engineer Shinya Watanabe
(1-26.5GHz)
Mode 11n40 Tx 2422MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	65.8	27.0	2.4	34.7	-	60.5	73.9	13.4	
Hori	2390.000	AV	58.2	27.0	2.4	34.7	0.52	53.4	53.9	0.5	*
Vert	2390.000	PK	64.7	27.0	2.4	34.7	-	59.4	73.9	14.5	
Vert	2390.000	AV	57.2	27.0	2.4	34.7	0.52	52.4	53.9	1.5	*

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor (AV)

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m) = 9.5dB$

*Not Out of Band emission (Leakage Power).

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2422.000	PK	95.4	27.0	2.5	34.7	90.2	-	-	Carrier
Hori	2400.000	PK	60.6	27.0	2.4	34.7	55.3	70.2	14.9	
Vert	2422.000	PK	94.9	27.0	2.5	34.7	89.7	-	-	Carrier
Vert	2400.000	PK	59.2	27.0	2.4	34.7	53.9	69.7	15.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

Test place Ise HQ EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10286843H
Date 04/28/2014
Temperature/ Humidity 22 deg. C / 33% RH
Engineer Shinya Watanabe
(1-26.5GHz)
Mode 11n40 Tx 2452MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	63.0	26.9	2.5	34.7	-	57.7	73.9	16.2	
Hori	2483.500	AV	51.1	26.9	2.5	34.7	0.52	46.3	53.9	7.6	*
Vert	2483.500	PK	61.8	26.9	2.5	34.7	-	56.5	73.9	17.4	
Vert	2483.500	AV	50.4	26.9	2.5	34.7	0.52	45.6	53.9	8.3	*

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor (AV)

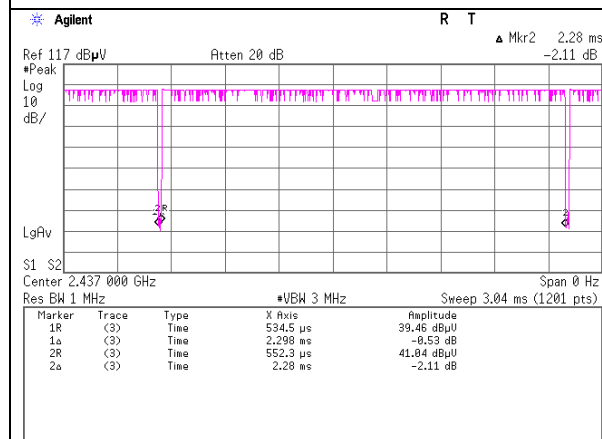
Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)= 9.5dB$

*Not Out of Band emission (Leakage Power).

DUTY

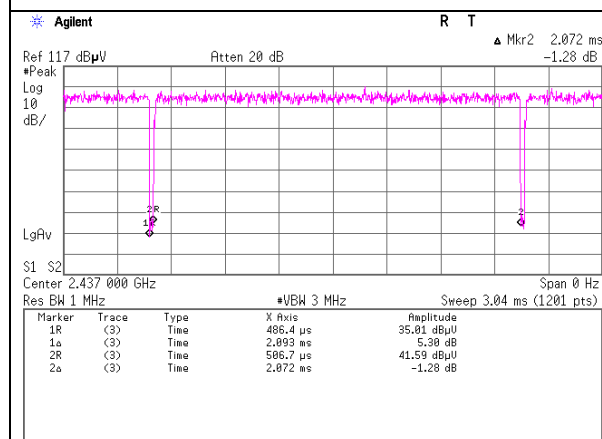
11b 1Mbps

$$\begin{aligned} \text{Tx on} / (\text{Tx on} + \text{Tx off}) &= 0.992 \\ \text{Tx on} / (\text{Tx on} + \text{Tx off}) * 100 &= 99.2 \% \end{aligned}$$



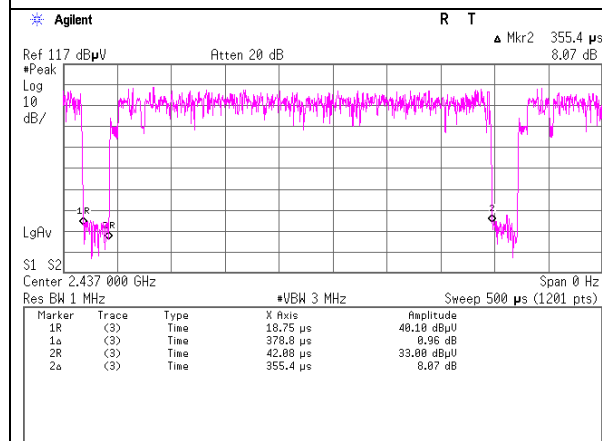
11g 6Mbps

$$\begin{aligned} \text{Tx on} / (\text{Tx on} + \text{Tx off}) &= 0.990 \\ \text{Tx on} / (\text{Tx on} + \text{Tx off}) * 100 &= 99.0 \% \end{aligned}$$



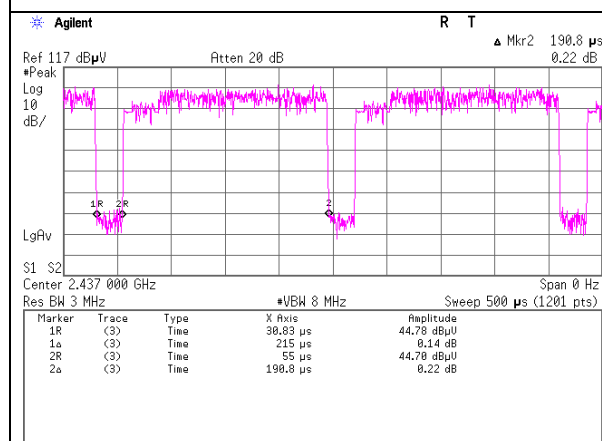
11n20 MCS4

Tx on / (Tx on + Tx off) = 0.938
Tx on / (Tx on + Tx off) * 100 = 93.8 %
Duty factor = $10 * \log (378.8 / 355.4) = 0.28 \text{ dB}$



11n40 MCS4

Tx on / (Tx on + Tx off) = 0.887
Tx on / (Tx on + Tx off) * 100 = 88.7 %
Duty factor = $10 * \log (215 / 190.8) = 0.52 \text{ dB}$



7.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)

DATA OF RADIATED EMISSION TEST

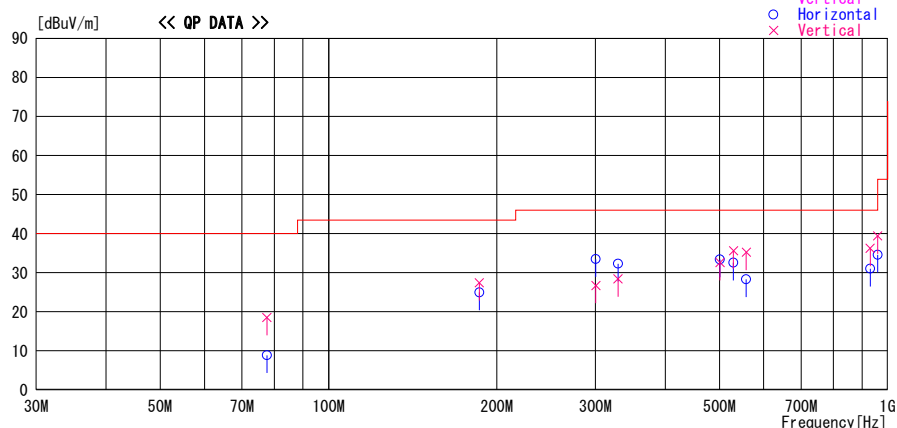
UL Japan, Inc. Head Office EMC Lab. No. 2 Semi Anechoic Chamber
Date : 2014/04/28

Report No. : 10286843H
Power : AC 120V / 60Hz
Temp./Humi. : 22deg.C / 33% RH
Engineer : Shinya Watanabe

Mode / Remarks : Tx 11n40 MCS4 2437MHz

LIMIT : FCC15.247(d) 3m. below 1GHz:QP, above 1GHz:PK

All other spurious emissions were less than 20dB for the limit.



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
77.615	23.8	QP	6.4	-21.4	8.8	36	265	Hori.	40.0	31.2	
77.615	33.5	QP	6.4	-21.4	18.5	271	100	Vert.	40.0	21.5	
186.142	28.5	QP	16.2	-19.8	24.9	127	100	Hori.	43.5	18.6	
186.142	31.0	QP	16.2	-19.8	27.4	0	100	Vert.	43.5	16.1	
300.700	38.2	QP	14.2	-18.9	33.5	0	100	Hori.	46.0	12.5	
300.700	31.4	QP	14.2	-18.9	26.7	0	204	Vert.	46.0	19.3	
329.324	36.2	QP	15.2	-19.1	32.3	0	100	Hori.	46.0	13.7	
329.324	32.3	QP	15.2	-19.1	28.4	311	143	Vert.	46.0	17.6	
501.131	34.6	QP	18.1	-19.3	33.4	348	149	Hori.	46.0	12.6	
501.131	33.8	QP	18.1	-19.3	32.6	350	100	Vert.	46.0	13.4	
529.773	33.2	QP	18.6	-19.2	32.6	0	145	Hori.	46.0	13.4	
529.773	36.2	QP	18.6	-19.2	35.6	0	100	Vert.	46.0	10.4	
558.408	28.4	QP	19.0	-19.1	28.3	0	266	Hori.	46.0	17.7	
558.408	35.3	QP	19.0	-19.1	35.2	0	100	Vert.	46.0	10.8	
930.678	25.0	QP	22.5	-16.5	31.0	224	235	Hori.	46.0	15.0	
930.678	30.2	QP	22.5	-16.5	36.2	0	100	Vert.	46.0	9.8	
959.314	28.0	QP	22.9	-16.3	34.6	299	155	Hori.	46.0	11.4	
959.314	32.8	QP	22.9	-16.3	39.4	0	100	Vert.	46.0	6.6	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz--:HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

7.4. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

ANSI C63.4

LIMIT

§15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

RESULTS

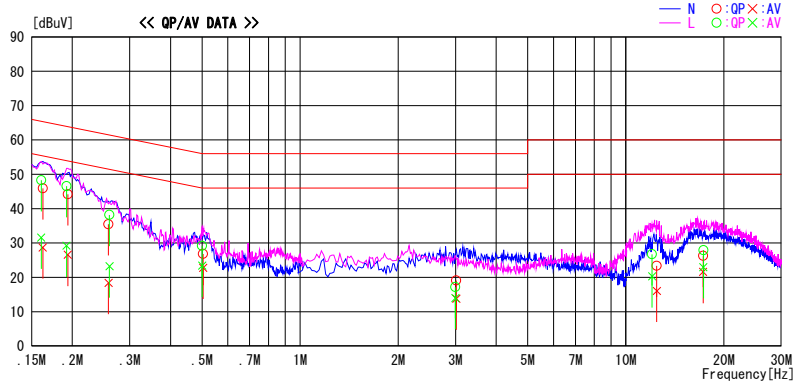
WORST EMISSIONS

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. TSE HQ EMC Lab. No.2 Semi Anechoic Chamber
Date : 2014/04/28

Report No. : 10286843H
Power : AC 120V / 60Hz
Temp./Humi. : 22deg. C / 33% RH
Engineer : Shinya Watanabe

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.16220	32.7	15.5	13.2	45.9	28.7	65.4	55.4	19.5	26.7	N	
0.19359	31.0	13.4	13.2	44.2	26.6	63.9	53.9	19.7	27.3	N	
0.25810	22.3	5.2	13.2	35.5	18.4	61.5	51.5	26.0	33.1	N	
0.50393	13.6	9.6	13.2	26.8	22.8	56.0	46.0	29.2	23.2	N	
3.01575	5.5	0.2	13.6	19.1	13.8	56.0	46.0	36.9	32.2	N	
12.43653	8.9	1.6	14.5	23.4	16.1	60.0	50.0	36.6	33.9	N	
17.26280	11.4	6.7	14.9	26.3	21.6	60.0	50.0	33.7	28.4	N	
0.16046	35.1	18.4	13.2	48.3	31.6	65.4	55.4	17.1	23.8	L	
0.19184	33.4	16.0	13.2	46.6	29.2	64.0	54.0	17.4	24.8	L	
0.25984	25.0	10.0	13.2	38.2	23.2	61.4	51.4	23.2	28.2	L	
0.50044	16.0	10.2	13.2	29.2	23.4	56.0	46.0	26.8	22.6	L	
2.99757	3.6	0.4	13.6	17.2	14.0	56.0	46.0	38.8	32.0	L	
12.03937	12.2	5.8	14.5	26.7	20.3	60.0	50.0	33.3	29.7	L	
17.30295	13.0	8.1	14.9	27.9	23.0	60.0	50.0	32.1	27.0	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT=READING+C.F (LISN LOSS + ATT LOSS + CABLE LOSS)
Except for the above table : adequate margin data below the limits.

8. ANTENNA PORT TEST RESULTS

8.1. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

Peak power is measured using a wide bandwidth Peak Power Meter.

RESULTS

11b 1Mbps

Freq. [MHz]	Reading PK [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	1.15	5.46	10.00	16.6	45.81	30.00	1000	13.39
2437	1.13	5.46	10.00	16.6	45.60	30.00	1000	13.41
2462	1.11	5.46	10.00	16.6	45.39	30.00	1000	13.43

11g 6Mbps

Freq. [MHz]	Reading PK [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	1.00	5.46	10.00	16.5	44.26	30.00	1000	13.54
2437	4.71	5.46	10.00	20.2	103.99	30.00	1000	9.83
2462	1.23	5.46	10.00	16.7	46.67	30.00	1000	13.31

11n20 MCS4

Freq. [MHz]	Reading PK [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	1.72	5.46	10.00	17.2	52.24	30.00	1000	12.82
2437	5.55	5.46	10.00	21.0	126.18	30.00	1000	8.99
2462	2.25	5.46	10.00	17.7	59.02	30.00	1000	12.29

11n40 MCS4

Freq. [MHz]	Reading PK [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2422	0.82	5.46	10.00	16.3	42.46	30.00	1000	13.72
2437	6.03	5.46	10.00	21.5	140.93	30.00	1000	8.51
2452	1.75	5.46	10.00	17.2	52.60	30.00	1000	12.79

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

8.2. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

11b 1Mbps

Freq. [MHz]	Reading AV [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]
2412	-1.35	5.46	10.00	14.1
2437	-1.32	5.46	10.00	14.1
2462	-1.36	5.46	10.00	14.1

11g 6Mbps

Freq. [MHz]	Reading AV [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]
2412	-4.34	5.46	10.00	11.1
2437	-0.93	5.46	10.00	14.5
2462	-4.27	5.46	10.00	11.2

11n20 MCS0

Freq. [MHz]	Reading AV [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]
2412	-4.46	5.46	10.00	11.0
2437	-0.90	5.46	10.00	14.6
2462	-4.25	5.46	10.00	11.2

11n40 MCS0

Freq. [MHz]	Reading AV [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]
2422	-5.35	5.46	10.00	10.1
2437	-0.76	5.46	10.00	14.7
2452	-4.38	5.46	10.00	11.1

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator