



**FCC CFR47 PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 8**

**CERTIFICATION TEST REPORT**

**FOR**

**RFID MODULE**

**MODEL NUMBER: RI11A**

**FCC ID: ACJ9TGRI11A**

**REPORT NUMBER: 11J13821-1**

**ISSUE DATE: JUNE 09, 2011**

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

*Prepared by*  
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**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	06/09/11	Initial Issue	F. Ibrahim



# 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:** RFID MODULE

**MODEL:** RI11A

**SERIAL NUMBER:** 1DKSA00084 (CONDUCTED); 1DKSA00072(RADIATED)

**DATE TESTED:** MAY 17 TO MAY 25, 2011

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Pass
INDUSTRY CANADA RSS-210 Issue 8, Annex 2	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

Compliance Certification Services (UL CCS) 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 CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

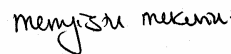
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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 CCS By:



FRANK IBRAHIM  
EMC SUPERVISOR  
UL CCS

Tested By:



MENGISTU MEKURIA  
EMC ENGINEER  
UL CCS

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 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:

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

### 4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is an RFID module that is embedded inside Panasonic laptop. The radio module is manufactured by NXP (former Philips Semiconductors).

### 5.2. MAXIMUM TRANSMITTER FIELD STRENGTH

The field strength of the transmitter is as follows:

Frequency Range (MHz)	Mode	Output Power (dBuV/m @ 30m)
13.56	Normal Mode	56.94

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a loop antenna.

### 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Panasonic Dashboard Ver.2.00L07

### 5.5. WORST-CASE CONFIGURATION AND MODE

To determine the worst-case, the EUT was investigated for X, Y, and Z orientations. After the investigation the Z-orientation turns out to be the worst-case. And all emission tests were performed on the Z-Orientation

### 5.6. MODIFICATIONS

No modifications were made during testing.

## 5.7. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC	PANASONIC	CF-AA6373A M1	6373AM110Z04805A	DoC

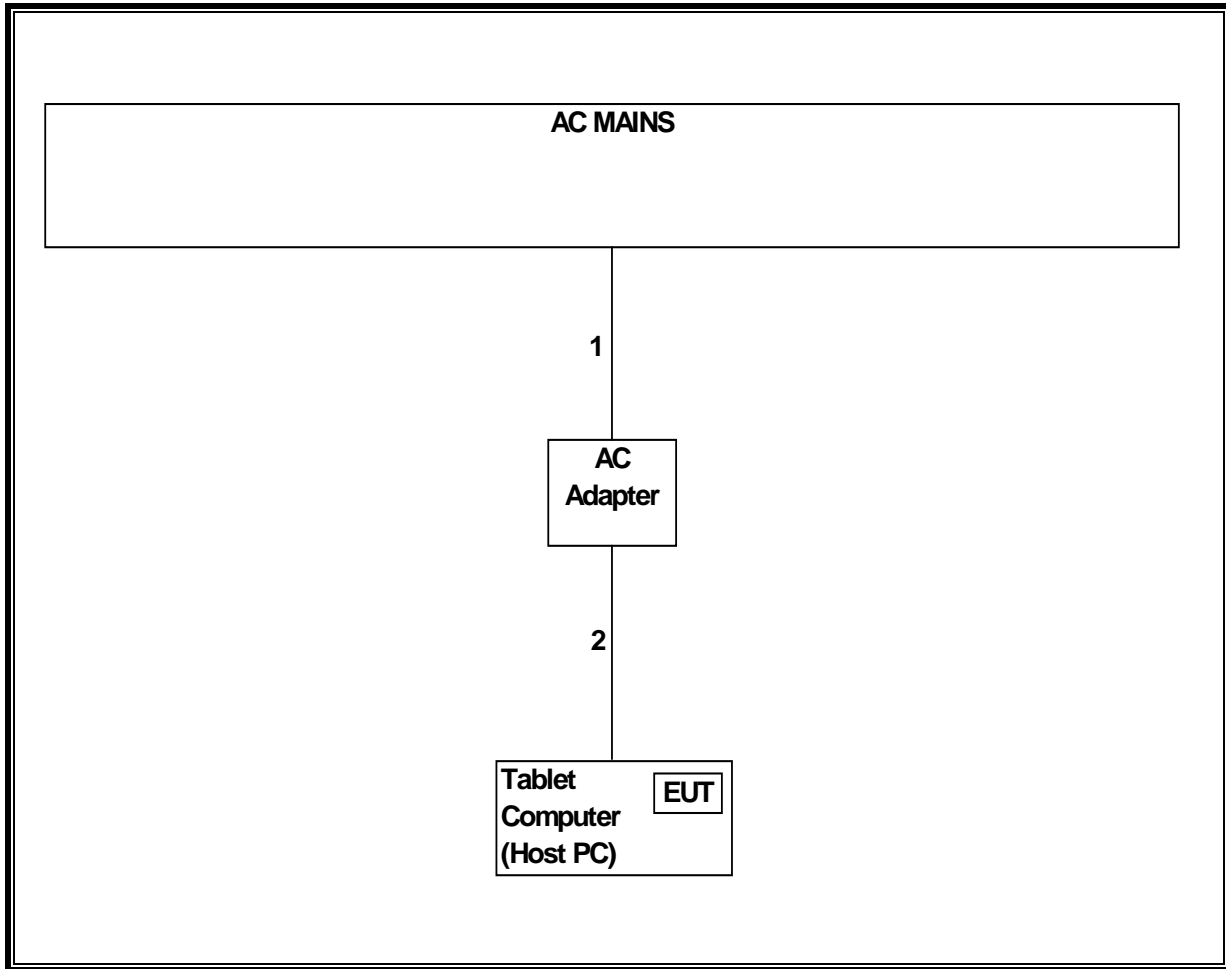
### I/O CABLES

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

**TEST SETUP**

The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	Asset	Cal Date	Cal Due
Antenna, Loop, 5 MHz	EMCO	6511	N02337	03/04/11	03/04/13
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/10	07/12/11
Antenna, Horn, 18 GHz	EMCO	3115	C00783	06/29/10	06/29/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/27/11	01/27/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	07/14/10	07/14/11
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/30/10	08/30/11
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	05/11/11	05/11/12
EMI Receiver, 6.5GHz	Agilent / HP	85462A	N/A	05/19/10	08/19/11
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	06/08/09	06/05/11
LISN, 30 MHz	FCC	3115	N02625	11/10/10	11/10/11
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	04/09/10	07/09/11

## 7. RADIATED EMISSION TEST RESULTS

### 7.1. LIMITS AND PROCEDURE

#### LIMIT

§15.225

IC RSS-210, Section 2.6 (Transmitter)

IC RSS-GEN, Section 6 (Receiver)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:

Limit (dBuV/m) = 20 log limit (uV/m)

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

### **TEST PROCEDURE**

ANSI C63.4

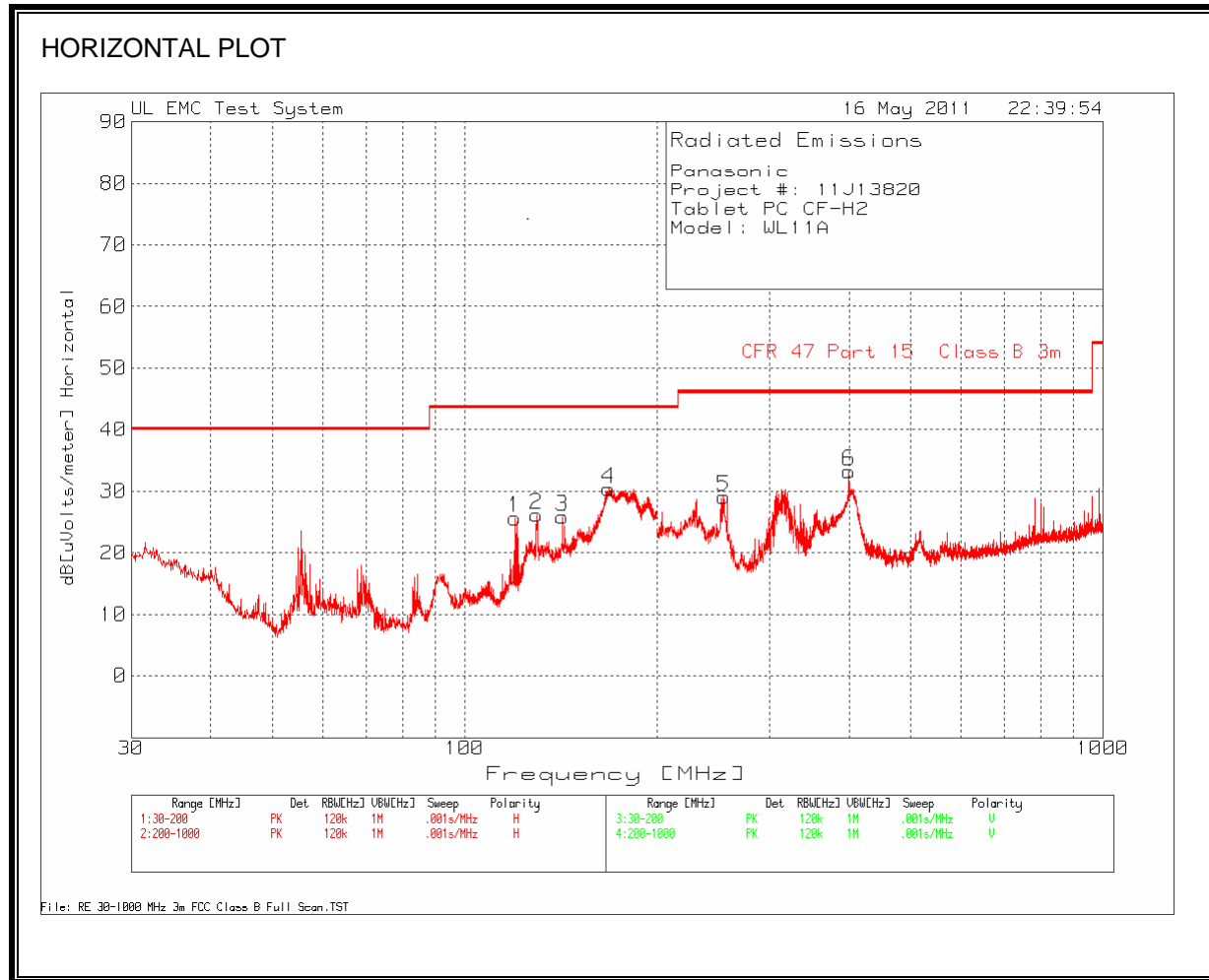
The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 30 MHz to 1000 MHz.

**RESULTS**

**7.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)**

FCC Part 15, Subpart B & C												10 Meter Distance Measurement At Open Field	
Company: PANASONIC Project #: 11J13821 Model #: RI11A Tester: MENGISTU MEKURIA Date: 05/25/2011													
Frequency (MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	AF (dB/m)	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes	
Loop Antenna Face On:													
13.56	65.47		N/A	10.56	-19.08	56.94	N/A	84.00	N/A	-27.1	N/A		
27.12	21.6		N/A	9.046	-19.08	11.56	N/A	29.54	N/A	-18.0	N/A		
Loop Antenna Face Off:													
13.56	65.11		N/A	10.56	-19.08	56.58	N/A	84.00	N/A	-27.4	N/A		
27.12	22.39		N/A	9.046	-19.08	12.35	N/A	29.54	N/A	-17.2	N/A		
* No more emissions were found up to 30MHz													
Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector.													
P.K. = Peak Q.P. = Quasi Peak Reading A.F. = Antenna factor													
Rev. 10.23.09													

### 7.3. TX SPURIOUS EMISSION 30 TO 1000 MHz (HORIZONTAL)

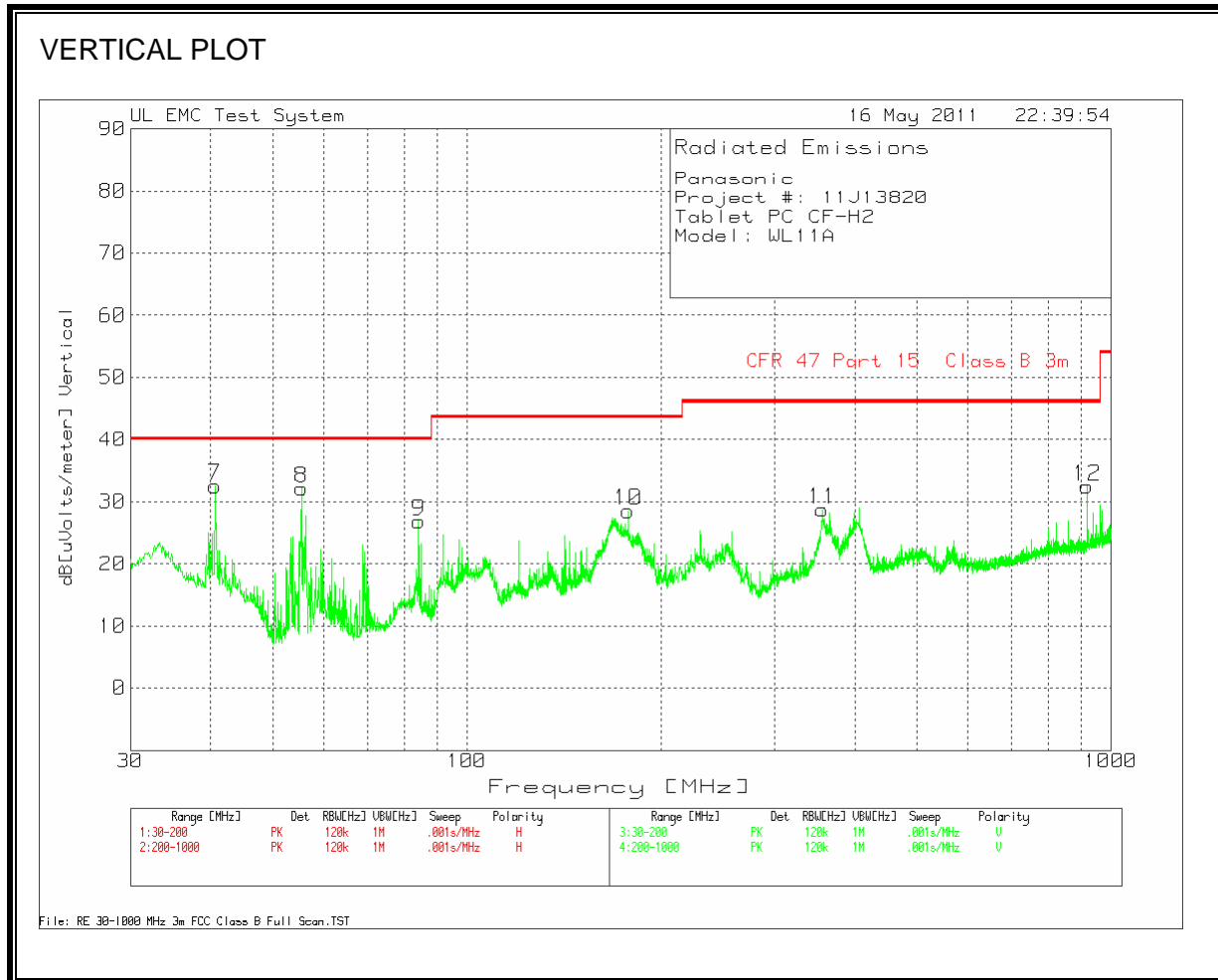


HORIZONTAL DATA

Panasonic  
 Project #: 11J13821  
 Tablet PC CF-H2  
 Model: RI11A

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level Limit:1 dB[uVolts/meter]	Height:	Margin [dB]
=====							
Horizontal: 30 - 1000MHz							
1	119.7151	39.63 PK	1.5	-15.5	25.63 43.5	400 Horz	-17.87
2	129.4853	40.07 PK	1.6	-15.5	26.17 43.5	400 Horz	-17.33
3	142.3138	40.26 PK	1.7	-16.1	25.86 43.5	400 Horz	-17.64
4	168.1409	47.4 PK	1.8	-18.8	30.4 43.5	400 Horz	-13.1
5	254.3638	43.72 PK	2.2	-16.8	29.12 46.0	200 Horz	-16.88
6	399.8668	44.44 PK	2.8	-14.0	33.24 46.0	100 Horz	-12.76

### 7.4. TX SPURIOUS EMISSION 30 TO 1000 MHz (VERTICAL)



VERTICAL DATA

Panasonic  
 Project #: 11J13821  
 Tablet PC CF-H2  
 Model: RI11A

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level Limit:1 dB[uVolts/meter]	Height:	Margin [dB]
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Vertical: 30 - 1000MHz

7	40.6197	47.31 PK	0.9	-15.7	32.51 40.0	100 Vert	-7.49
8	55.4023	52.57 PK	1.1	-21.5	32.17 40.0	100 Vert	-7.83
9	84.1179	47.46 PK	1.3	-21.9	26.86 40.0	100 Vert	-13.14
10	177.8261	45.22 PK	1.8	-18.5	28.52 43.5	100 Vert	-14.98
11	356.1626	40.63 PK	2.6	-14.5	28.73 46.0	100 Vert	-17.27
12	917.3884	35.07 PK	4.2	-6.8	32.47 46.0	100 Vert	-13.53

### 7.5. TX SPURIOUS EMISSIONS ABOVE 1 GHz

High Frequency Measurement																	
Compliance Certification Services, Fremont 5m Chamber																	
Company:		PANASONIC															
Project #:		11J13820															
Date:		5/25/2011															
Test Engineer:		MENGSTU MEKURIA															
Configuration:		EUT WITH AC ADAPTER															
Mode:		TX, RFID MODE															
<b>Test Equipment:</b>																	
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit					
T59; S/N: 3245 @3m			T145 Agilent 3008A0056									FCC Class B					
Hi Frequency Cables																	
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF		Reject Filter		Peak Measurements				
3' cable 22807700			12' cable 22807600			20' cable 22807500							RBW=VBW=1MHz				
Average Measurements																	
RBW=1MHz ; VBW=10Hz																	
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)		
1.653	3.0	56.0	32.2	26.3	3.1	-35.7	0.0	0.0	49.8	26.0	74	54	-24.2	-28.0	H		
2.267	3.0	49.6	30.3	28.0	3.7	-35.2	0.0	0.0	46.2	26.9	74	54	-27.8	-27.1	H		
3.187	3.0	45.8	29.5	30.4	4.5	-35.1	0.0	0.0	45.5	29.3	74	54	-28.5	-24.7	H		
1.407	3.0	50.0	30.4	25.4	2.8	-35.8	0.0	0.0	42.4	22.8	74	54	-31.6	-31.2	V		
Rev. 07.22.09																	
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit				
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit				
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit				
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit				
CL	Cable Loss					HPF	High Pass Filter										

## **7.6. RX SPURIOUS EMISSIONS ABOVE 1 GHz**

Note: Since the transmitter and receiver of the EUT are working simultaneously and the transmission spurious measured values are less than the receiver limit, one test was enough to cover both the transmitter and receiver spurious tests.

## 8. AC MAINS LINE CONDUCTED EMISSIONS

### LIMITS

§15.207  
 IC RSS-GEN, Section 7.2.2

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator 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 50µH/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 (dBµV)	
	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.

### TEST PROCEDURE

ANSI C63.4

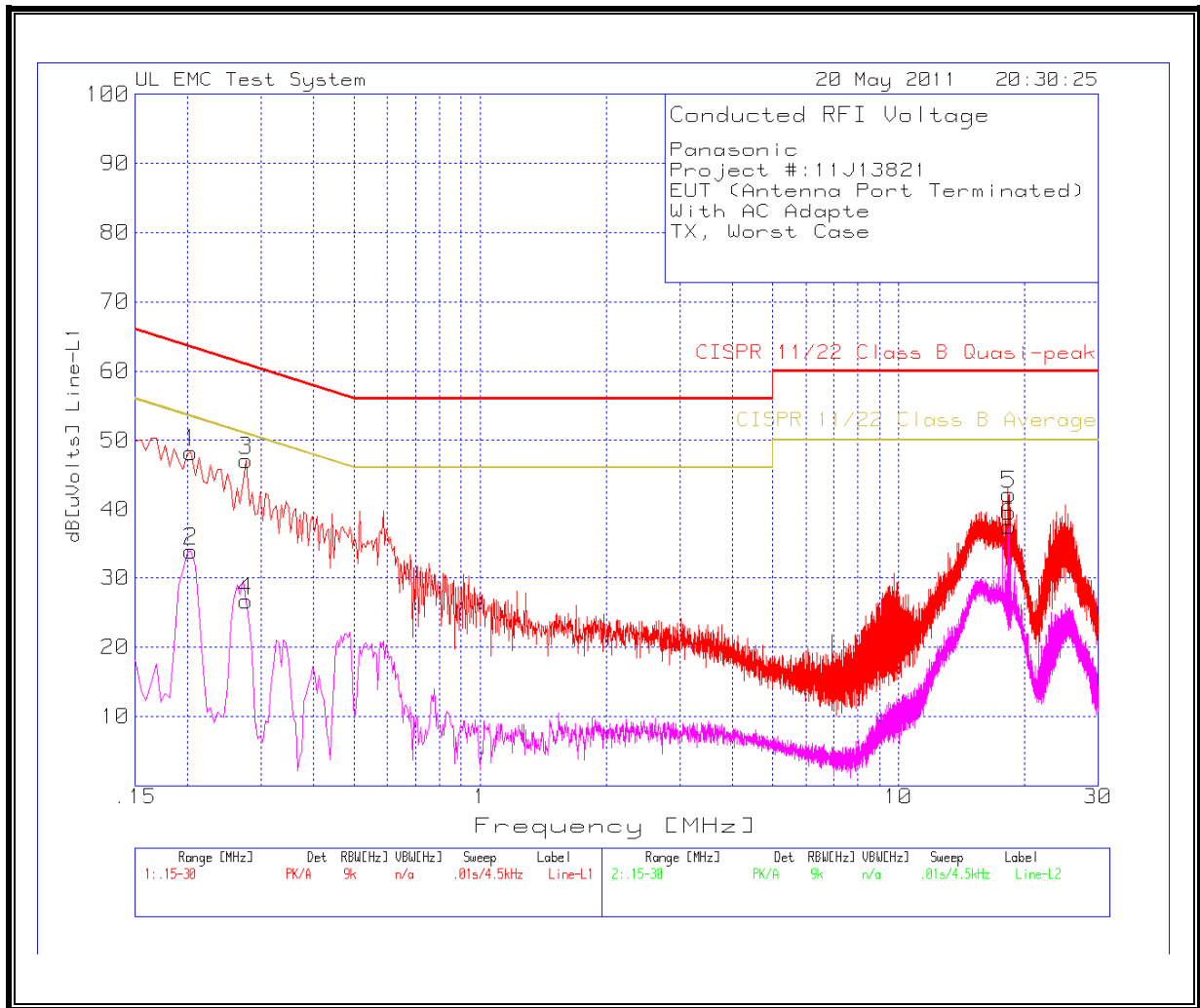
**RESULTS**

**6 WORST EMISSIONS**

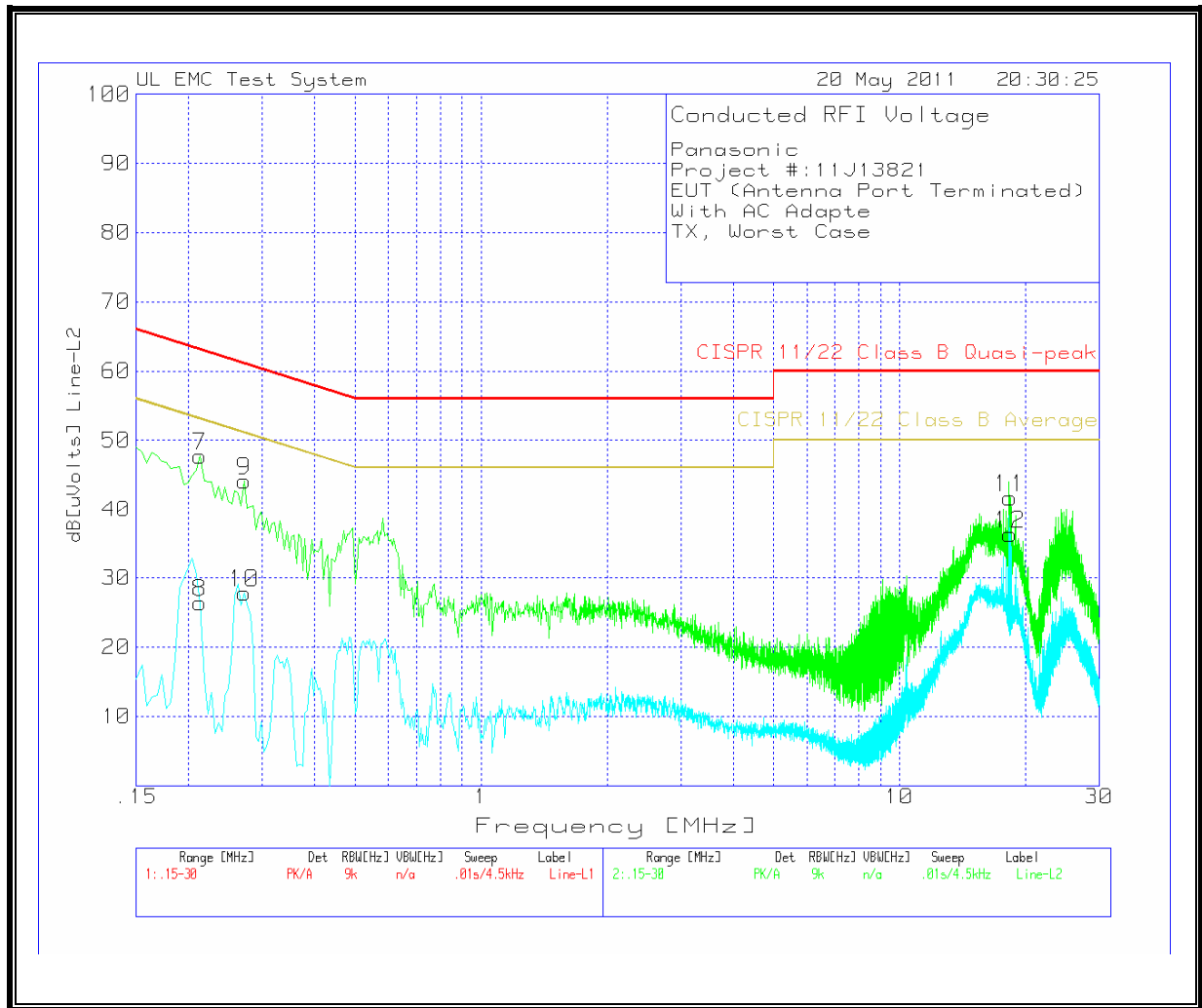
**ANTENNA PORT TERMINATED**

Panasonic									
Project #:11J13821									
EUT (Antenna Port Terminated) With AC Adapter									
TX, Worst Case									
Line-L1 .15 - 30MHz									
Test Freq	Meter Re	Detector	LISN [dB]	Conducte	dB[uVolts	CISPR 11/	Margin	CISPR 11/	Margin
0.204	48.26	PK	0	0	48.26	63.4	-15.14	53.4	-5.14
0.204	33.9	Av	0	0	33.9	-	-	53.4	-19.5
0.276	47.11	PK	0	0	47.11	60.9	-13.79	50.9	-3.79
0.276	26.62	Av	0	0	26.62	-	-	50.9	-24.28
18.366	42.25	PK	0	0	42.25	60	-17.75	50	-7.75
18.366	37.51	Av	0	0	37.51	-	-	50	-12.49
Line-L2 .15 - 30MHz									
Test Freq	Meter Re	Detector	LISN [dB]	Conducte	dB[uVolts	CISPR 11/	Margin	CISPR 11/	Margin
0.213	47.78	PK	0	0	47.78	63.1	-15.32	53.1	-5.32
0.213	26.39	Av	0	0	26.39	-	-	53.1	-26.71
0.2715	44.12	PK	0	0	44.12	61.1	-16.98	51.1	-6.98
0.2715	27.84	Av	0	0	27.84	-	-	51.1	-23.26
18.366	41.67	PK	0	0	41.67	60	-18.33	50	-8.33
18.366	36.32	Av	0	0	36.32	-	-	50	-13.68

**LINE 1 RESULTS**



**LINE 2 RESULTS**



## 9. FREQUENCY STABILITY

### LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.3.1 and 2.3.2

### RESULTS

Reference Frequency: EUT Channel 13.56 MHz @ 20°C				
Limit: $\pm 100$ ppm = 135.593 kHz				
Power Supply (Vac)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
115.00	50	13.5593457	-0.069	$\pm 100$
115.00	40	13.5592796	-0.020	$\pm 100$
115.00	30	13.5592396	0.010	$\pm 100$
<b>115.00</b>	<b>20</b>	<b>13.5592525</b>	<b>0.000</b>	<b><math>\pm 100</math></b>
115.00	10	13.5592363	0.012	$\pm 100$
115.00	0	13.5592277	0.018	$\pm 100$
115.00	-10	13.5592208	0.023	$\pm 100$
115.00	-20	13.5592032	0.036	$\pm 100$
97.15	20	13.5592517	0.001	$\pm 100$
132.25	20	13.5592527	0.000	$\pm 100$

## 10. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

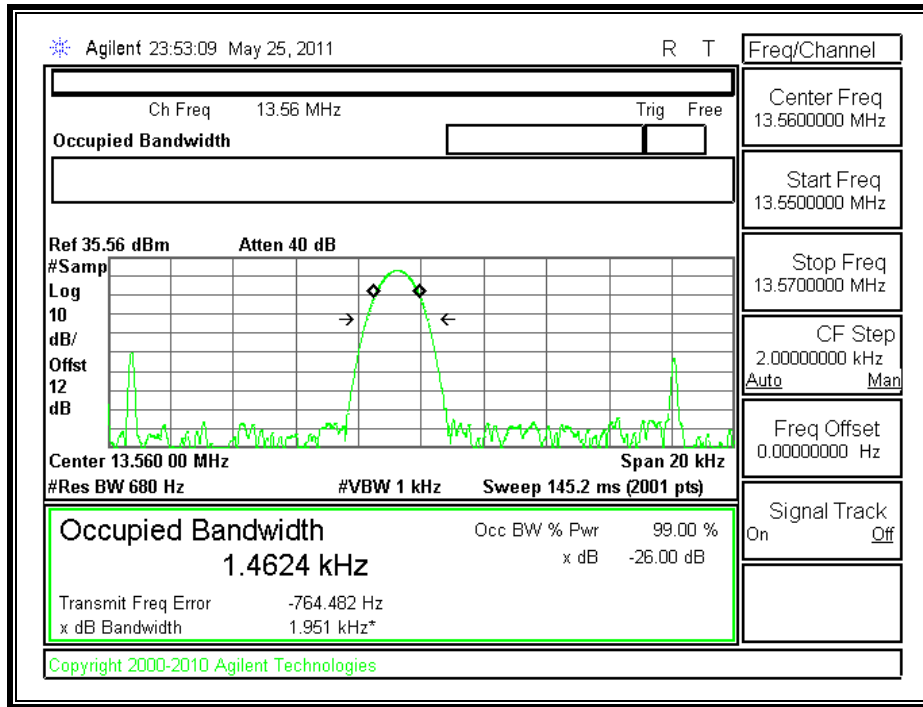
### TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

### RESULTS

Frequency (MHz)	99% Bandwidth (KHz)
13.56	1.4624

**99% BANDWIDTH**



# 11. MAXIMUM PERMISSIBLE EXPOSURE

## FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
30–300 .....	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

**IC RULES**

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

**Table 5  
 Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)**

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m <sup>2</sup> )	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> <sup>1.2</sup>
150 000–300 000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616 000 / <i>f</i> <sup>1.2</sup>

\* Power density limit is applicable at frequencies greater than 100 MHz.

- Notes:**
1. Frequency, *f*, is in MHz.
  2. A power density of 10 W/m<sup>2</sup> is equivalent to 1 mW/cm<sup>2</sup>.
  3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

## **EQUATIONS**

Power density is given by:

$$S = \text{EIRP} / (4 * \text{Pi} * \text{D}^2)$$

where

S = Power density in W/m<sup>2</sup>

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Power density in units of W/m<sup>2</sup> is converted to units of mW/cm<sup>2</sup> by dividing by 10.

Distance is given by:

$$D = \text{SQRT} (\text{EIRP} / (4 * \text{Pi} * S))$$

where

D = Separation distance in m

EIRP = Equivalent Isotropic Radiated Power in W

S = Power density in W/m<sup>2</sup>

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power \* Gain product (in linear units) of each transmitter.

$$\text{Total EIRP} = (P_1 * G_1) + (P_2 * G_2) + \dots + (P_n * G_n)$$

where

P<sub>x</sub> = Power of transmitter x

G<sub>x</sub> = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

## **LIMITS**

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm<sup>2</sup>

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m<sup>2</sup>

**RESULTS**

MPE is not required since the EIRP is less than 2.5W.