



Engineering and Testing for EMC and Safety Compliance

**CERTIFICATION APPLICATION REPORT  
FCC PART 15.247 CERTIFICATION & INDUSTRY CANADA CERTIFICATION**

<b>Test Lab:</b>  Rhein Tech Laboratories, Inc. 360 Herndon Parkway Suite 1400 Herndon, VA 20170		<b>Phone:</b> 703-689-0368 <b>Fax:</b> 703-689-2056 <b>Web Site:</b> <a href="http://www.rheintech.com">www.rheintech.com</a> <b>Email :</b> ATCBINFO@rheintech.com		<b>Applicant Information:</b>  Samsung Electro-Mechanics LTD. Contact: Jae-Jung Ko R&D Center, 4 <sup>th</sup> Floor 314, Maetan-3Dong, Paldal-Gu Paldal-Gu Suwon, Kyunggi-Do 442-743 Fax: 82-31-210-5529 Korea		<b>E-Mail:</b> <a href="mailto:kjimad@samsung.co.kr">kjimad@samsung.co.kr</a> <b>Phone:</b> 82-31-210-6779 or 2280	
<b>FCC ID:</b>	E2XSWL2200C	<b>GRANTEE FRN NUMBER:</b>	0006-9029-36				
<b>PLAT FORM:</b>	N/A	<b>RTL WORK ORDER NUMBER:</b>	2002125				
<b>MODEL(S):</b>	SWL-2200C	<b>RTL QUOTE NUMBER:</b>	QRTL02-487				
<b>DATE OF TEST REPORT:</b>	July 8, 2002						
<b>American National Standard Institute:</b>	ANSI C63.4, DA000705 for FHSS and fcc97114 for DSSS						
<b>FCC Classification:</b>	DSS Spread Spectrum Transmitter						
<b>FCC Rule Part(s):</b>	Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System						
<b>Industry Canada Standard:</b>	RSS-210: Low Power License-Exempt Radio Communication Devices (All Frequency Bands)						
<b>Digital Interface Information</b>	Digital Interface was found to be compliant						
<b>Receiver Information</b>	Receiver was found to be compliant						
<b>Frequency Range (MHz)</b>	<b>Output Power (W)</b>	<b>Freq. Tolerance</b>	<b>Emission Designator</b>				
2412-2462	0.0251	N/A	N/A				

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to, or exclusions from the FCC Part 2, FCC Part 15, Industry Canada RSS-210, ANSI C63.4, ANSI/TIA/EIA603, DA000705 for FHSS and fcc97114 for DSSS.

Signature: 

Date: July 8, 2002

Typed/Printed Name: Desmond A. Fraser

Position: President

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## 1 GENERAL INFORMATION

### SCOPE

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

IC RSS-210 Section 6.2.2(o): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

A direct sequence (DS) system is a spread spectrum (SS) system in which the carrier has been modulated by a high speed spreading code and an information data stream. The high-speed code sequence dominates the "modulating function" and is the direct cause of the wide spreading of the transmitted signal.

### TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

### RELATED SUBMITTAL(S)/GRANT(S)

This is an original application for Certification for the WLAN card M/N: SWL-2200C, FCC ID: E2XSWL-2200C. The IF, LO and up to the 2<sup>nd</sup> LO were investigated and tested.

## 2 TEST INFORMATION

### TEST JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions by orienting the Notebook computer so that its x, y, and z axis with respect to the EUT were aligned towards the direction of the test receiving antenna. Channel 1 at 2412 MHz, Channel 6 at 2437 MHz and channel 11 at 2462 MHz were tested and investigated from 9 kHz to 24 GHz. Data for all three channels are presented in this report.

The EUT contains an internal integral antenna; in order to complete the configuration required, the transmitter was tested in a Notebook computer. The integral antenna transmits, receives, and is connected to the only antenna port available. The worst-case data taken in this report represents the highest data rate at 11 MBPS. Data rates of 5.5 MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance. The change in envelope did not cause the EUT to be non-compliant in any of the aforementioned modes.

### EXERCISING THE EUT

The EUT was provided with the software to continuously transmit during testing. The carrier was also checked to verify that the information was being transmitted.

### TEST RESULT SUMMARY

**TABLE 2-1: TEST RESULT SUMMARY WITH FCC RULES AND REGULATIONS**

STANADARD	TEST	PASS/FAIL OR N/A
FCC 15.205	Compliance with the restricted Band Edge	Pass
FCC 15.207	Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.247(a)(2)	Modulated Bandwidth	Pass
FCC 15.247(b)	Power Output	Pass
FCC 15.247(c)	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	Power Spectral Density	Pass

## TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system are:

**TABLE 2-2: EQUIPMENT UNDER TEST (EUT)**

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
COMPACT FLASH WLAN CARD	Samsung Electro-Mechanics LTD.	SWL-2200C	N/A	E2X-SWL2200C	N/A	14561

**TABLE 2-3: EXTERNAL COMPONENTS IN TEST CONFIGURATION**

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
COMPACT FLASH ADAPTER	HMS	COMPACT FLASH ADAPTER	119	N/A	N/A	014558
NOTEBOOK PC	PANASONIC	CF-28	T0824ZA	DOC	N/A	013955
POWER SUPPLY	PANASONIC	CF-AA1639AM1	011213893A	N/A	UNSHILDED WITH FERRITE ON PC END	N/A
MODEM	US ROBOTICS	0413	000839032B26M4PN	N/A	SHIELDED I/O UNSHIELDED POWER	900407
PRINTER	HEWLETT PACKARD	C3941A	USCB233387	N/A	SHIELDED I/O UNSHIELDED POWER	900293

### CONFIGURATION OF TESTED SYSTEM

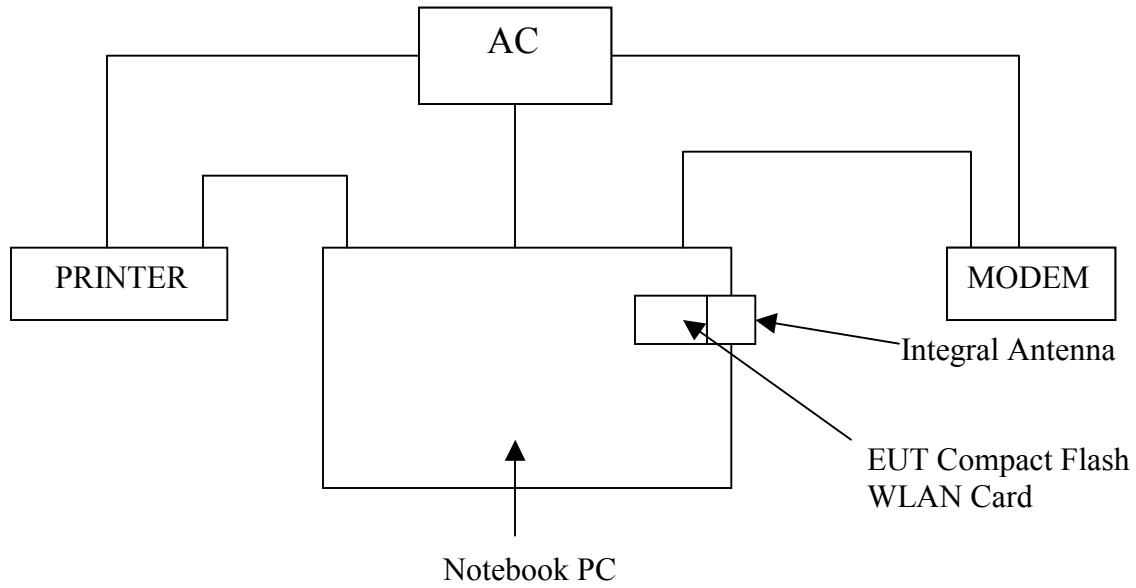


FIGURE 1: WORST CASE CONFIGURATION OF SYSTEM UNDER TEST



### 3 COMPLIANCE WITH THE RESTRICTED BAND EDGE - §15.205

#### TEST PROCEDURE

Compliance with the band edges was performed using the rules found in FCC parts 15.205 and 15.209 respectively. The final data derived below were from radiated measurements applying absolute detector values only. The data taken in this report represents the worst case at 11 MBPS. Data rates of 5.5MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance.

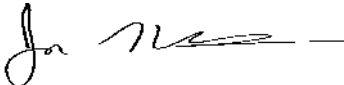
#### COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA

Operating Frequency (MHz): 2412-2462  
 Channel: 1 & 11  
 Distance: 3 meter  
 Limit: 54 dBuV/m

TABLE 3-1: COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA

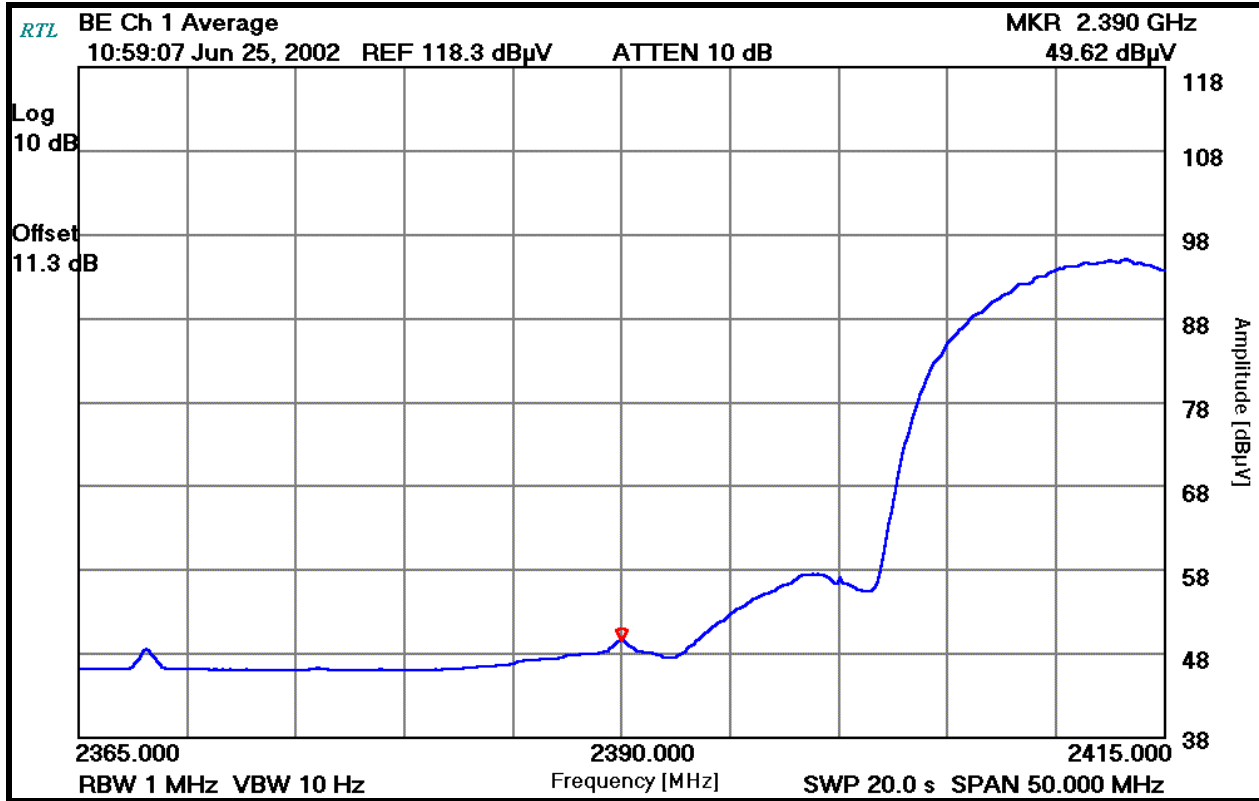
Channel Set to	Frequency tested MHz	Detector	Field Strength Level (dBμV/m)	Level Corrected (dBμV/m)	FCC Limit (dBμV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	38.3	49.6	54.0	-4.4
11	2483.5	Absolute measurement	39.3	50.6	54.0	-3.4

#### TEST PERSONNEL:

Jon Wilson		06/25/2002
Test Technician/Engineer	Signature	Date Of Test

Channel Number: 1  
Frequency (MHz): 2412  
Resolution Bandwidth (MHz): 1  
Video Bandwidth (Hz): 10  
Sweep Time (s): 20.0

PLOT 3-1: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1



TEST PERSONNEL:

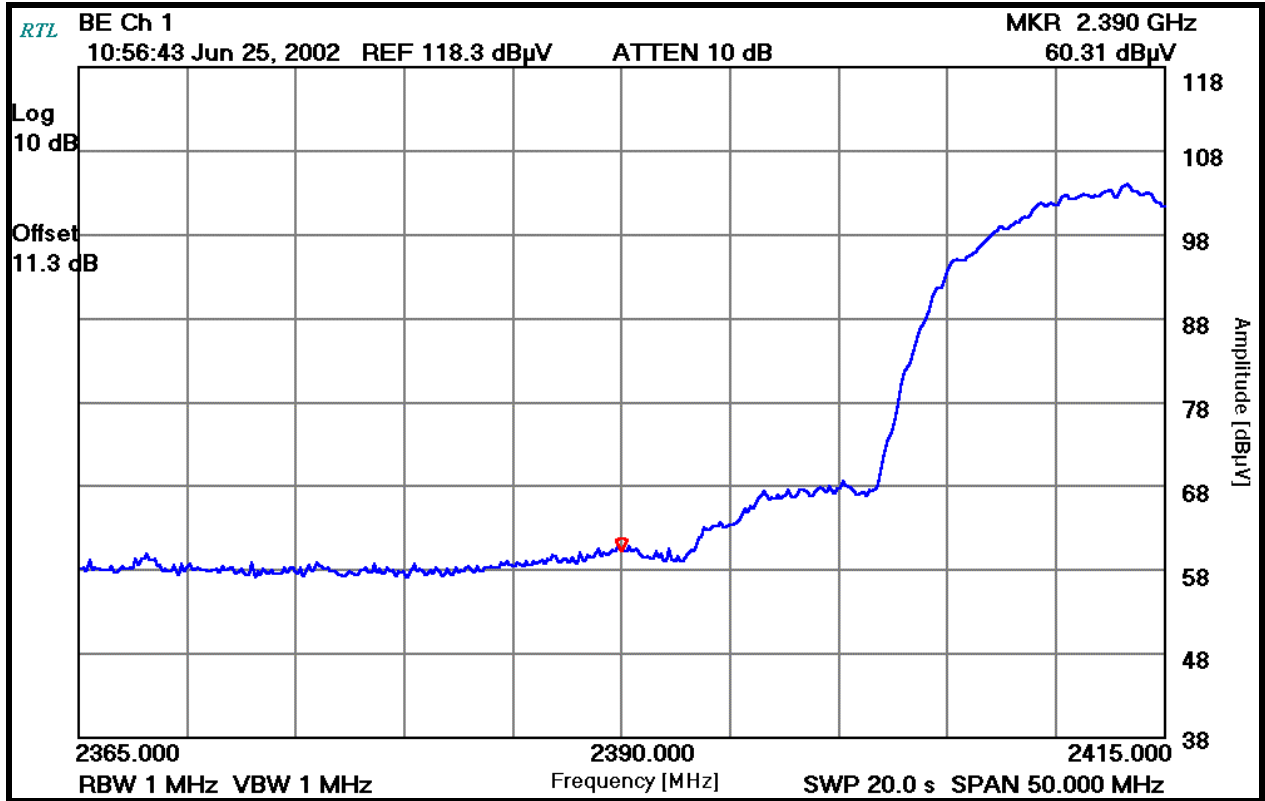
Jon Wilson  
Test Technician/Engineer

Signature

06/25/2002  
Date Of Test

Channel Number: 1  
Frequency (MHz): 2412  
Bandwidth Resolution (MHz): 1  
Video Bandwidth (MHz): 1  
Sweep Time (s): 20.0

**PLOT 3-2: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1**



**TEST PERSONNEL:**

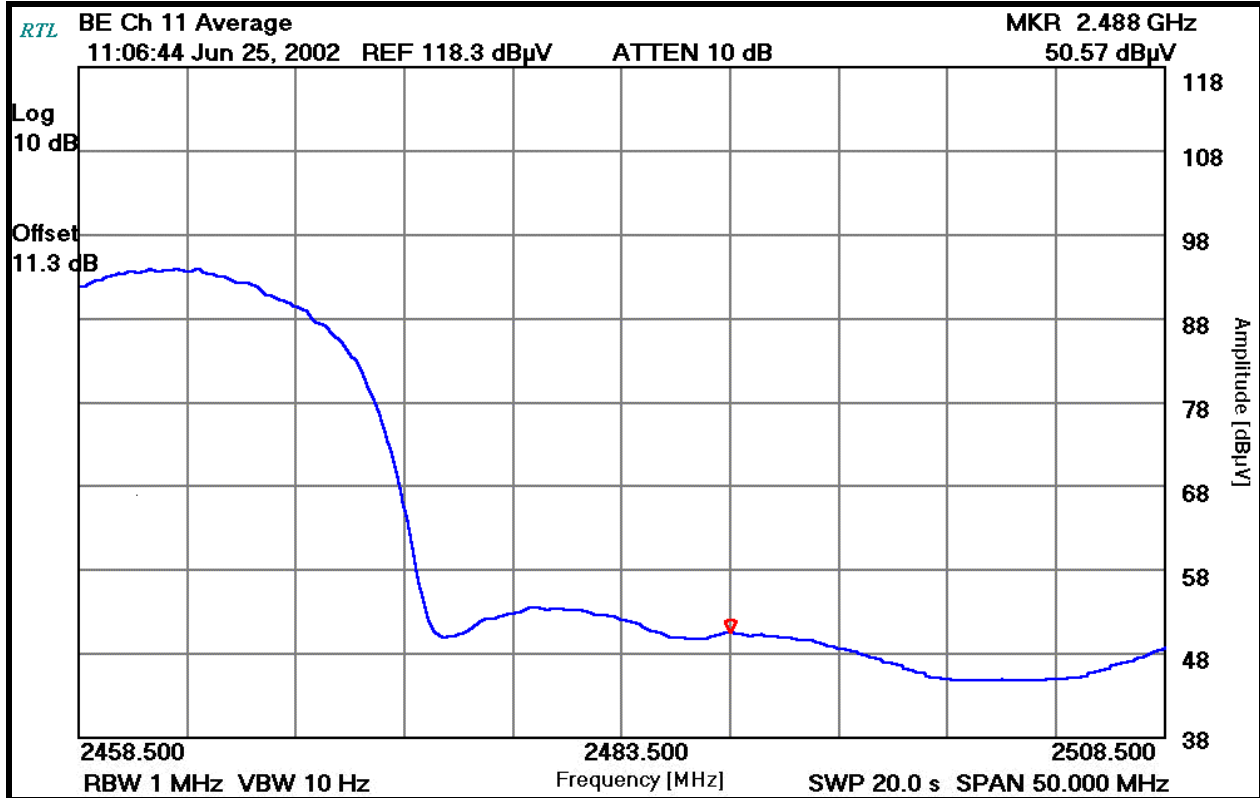
Jon Wilson  
Test Technician/Engineer

Signature

06/25/2002  
Date Of Test

Channel Number: 11  
Frequency (MHz): 2462  
Resolution Bandwidth (MHz): 1  
Video Bandwidth (Hz): 10  
Sweep Time (s): 20.0

PLOT 3-3: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11



TEST PERSONNEL:

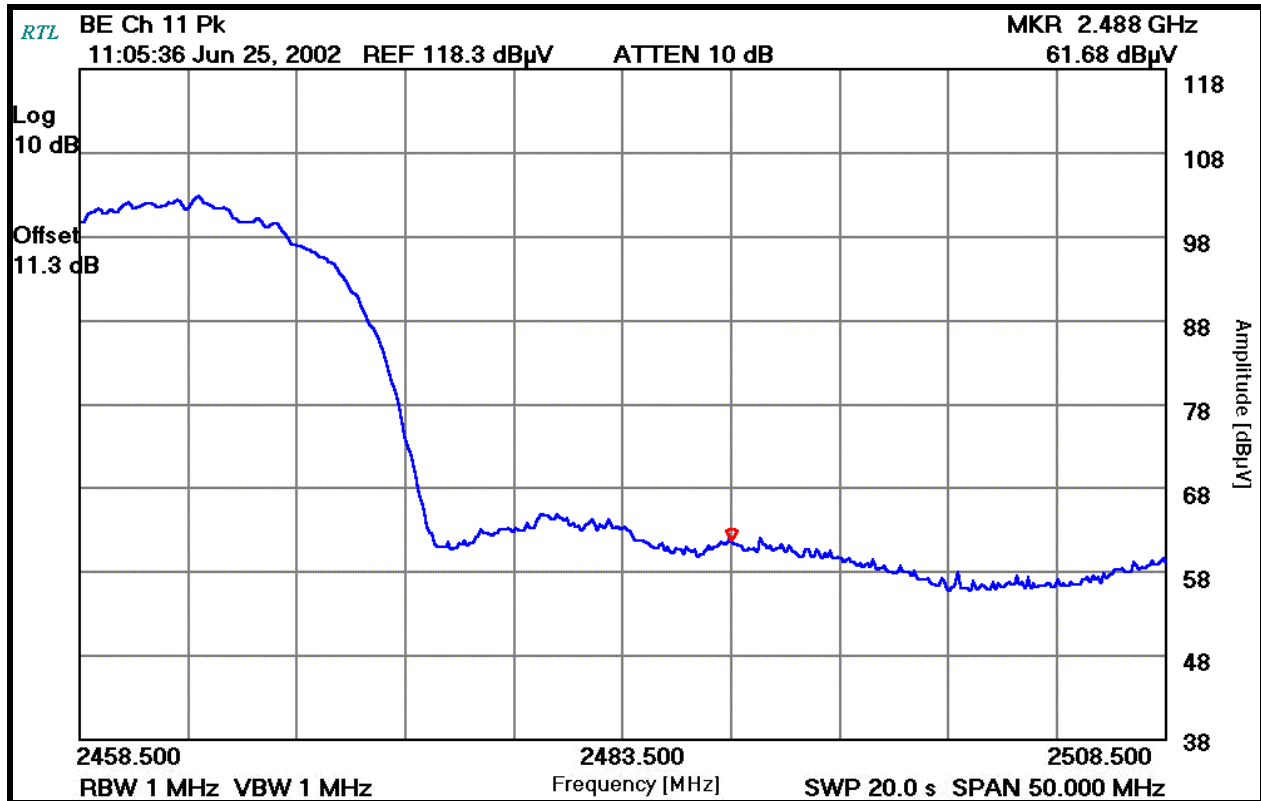
Jon Wilson  
Test Technician/Engineer

Signature

06/25/2002  
Date Of Test

Channel Number: 11  
Frequency (MHz): 2462  
Resolution Bandwidth (MHz): 1  
Video Bandwidth (Hz): 10  
Sweep Time (s): 20.0

**PLOT 3-4: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11**



**TEST PERSONNEL:**

Jon Wilson  
Test Technician/Engineer

Signature

06/25/2002  
Date Of Test

## 4 CONDUCTED LIMITS - §15.207

### TEST METHODOLOGY FOR CONDUCTED EMISSIONS MEASUREMENTS

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 400 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 400 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from (150/450) kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

*Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.*

### CONDUCTED EMISSION TEST

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emissions exceed the limit with the instrument set to the quasi-peak mode, then measurements are made in the average mode. If the quasi-peak measurement is at least 6dB higher than the amplitude in the average mode, the level measured in the quasi-peak mode may be reduced by 13dB before comparing it to the limit.

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 450 kHz to 30 MHz on the NEUTRAL SIDE and PHASE SIDE. The EUT was investigated and tested in channels 1, 6, and 11, data is provided for the worst case channel 1.

**TABLE 4-1: CONDUCTED SPURIOUS EMISSIONS TEST EQUIPMENT**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900931	HP	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771
900070	Solar		LISN	

**CONDUCTED EMISSION TEST DATA**

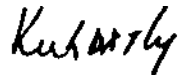
**TABLE 4-2: CONDUCTED EMISSIONS (NEUTRAL SIDE – LINE 1) TRANSMITTING CH 1**

Temperature: 72°F Humidity: 40%						
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.510	Pk	32.2	0.7	32.9	48.0	-15.1
0.860	Pk	28.0	0.7	28.7	48.0	-19.3
4.230	Pk	22.9	1.5	24.4	48.0	-23.6
20.840	Pk	23.4	3.2	26.6	48.0	-21.4
23.970	Pk	24.9	3.3	28.2	48.0	-19.8
27.990	Pk	27.3	3.6	30.9	48.0	-17.1

**TABLE 4-3: CONDUCTED EMISSIONS (HOT SIDE – LINE 2) TRANSMITTING CH 1**

Temperature: 72°F Humidity: 40%						
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.510	Pk	35.1	0.7	35.8	48.0	-12.2
3.820	Pk	24.1	1.4	25.5	48.0	-22.5
5.530	Pk	24.4	1.8	26.2	48.0	-21.8
23.970	Pk	22.3	3.3	25.6	48.0	-22.4
24.860	Pk	21.8	3.4	25.2	48.0	-22.8
27.990	Pk	22.5	3.5	26.0	48.0	-22.0

**TEST PERSONNEL:**



Kinh Ly		06/26/2002
Test Technician/Engineer	Signature	Date Of Test

**TABLE 4-4: CONDUCTED EMISSIONS (NEUTRAL SIDE – LINE 1) RECEIVING CH 1**

Temperature: 72°F Humidity: 42%						
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.570	Pk	32.3	0.7	33.0	48.0	-15.0
1.310	Pk	27.2	0.9	28.1	48.0	-19.9
4.530	Pk	21.7	1.5	23.2	48.0	-24.8
15.820	Pk	22.5	2.8	25.3	48.0	-22.7
21.110	Pk	28.7	3.2	31.9	48.0	-16.1
26.310	Pk	33.2	3.4	36.6	48.0	-11.4

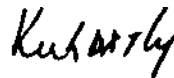
QP: RES. =100 kHz, VID= 100 kHz

**TABLE 4-5: CONDUCTED EMISSIONS (HOT SIDE – LINE 2) RECEIVING CH 1**

Temperature: 72°F Humidity: 42%						
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.630	Pk	32.6	0.7	33.3	48.0	-14.7
1.100	Pk	28.1	0.8	28.9	48.0	-19.1
3.970	Pk	23.2	1.4	24.6	48.0	-23.4
15.760	Pk	20.5	2.8	23.3	48.0	-24.7
21.080	Pk	27.4	3.2	30.6	48.0	-17.4
26.340	Pk	29.8	3.4	33.2	48.0	-14.8

QP: RES. =100 kHz, VID= 100 kHz

**TEST PERSONNEL:**



Kinh Ly  
 Test Technician/Engineer

Signature

06/26/2002  
 Date Of Test



## 5 RADIATED EMISSION LIMITS RECEIVER/DIGITAL INTERFACE - §15.209

### RADIATED EMISSION LIMITS TEST PROCEDURE

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands. The restricted bands are listed in Part 15.205. The maximum permitted average field strength for the restricted band is listed in Part 15.209. The IF, LO and up to the 2<sup>nd</sup> LO were investigated and tested. Channels 1, 6, and 11 were tested and investigated in the transmitting and receiving mode between 10kHz and 1GHz. The worst -case channel 1 in both transmitting and receiving modes is presented in the table below.

### RADIATED EMISSION LIMITS TEST DATA

TABLE 5-1: RADIATED EMISSIONS TRANSMITTING CH 1 (FCC B/3M)

Temperature: 76°F Humidity: 90%									
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
128.864	Qp	H	180	3.0	34.8	-8.6	26.2	43.5	-17.3
240.039	Qp	H	145	1.4	41.7	-8.8	32.9	46.0	-13.1
336.053	Qp	H	185	1.0	36.8	-4.8	32.0	46.0	-14.0
384.059	Qp	H	360	1.0	32.2	-2.9	29.3	46.0	-16.7
429.541	Qp	V	180	1.0	30.4	-1.4	29.0	46.0	-17.0
451.016	Qp	H	135	2.0	38.4	-0.9	37.5	46.0	-8.5
579.878	Qp	V	135	1.0	31.9	2.2	34.1	46.0	-11.9

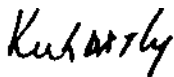
QP: RES. =1MHz, VID= 10Hz

TABLE 5-2: RADIATED EMISSIONS RECEIVING CH 1 (FCC B/3M)

Temperature: 76°F Humidity: 90%									
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
128.863	Qp	V	145	1.0	39.7	-8.2	31.5	43.5	-12.0
240.036	Qp	V	325	1.0	36.6	-8.8	27.8	46.0	-18.2
322.153	Qp	V	150	1.0	38.7	-5.4	33.3	46.0	-12.7
336.055	Qp	H	250	1.4	30.5	-4.8	25.7	46.0	-20.3
386.584	Qp	H	215	1.4	31.4	-2.8	28.6	46.0	-17.4
429.541	Qp	V	125	1.0	30.4	-1.4	29.0	46.0	-17.0
451.017	Qp	H	180	1.6	34.2	-0.9	33.3	46.0	-12.7

QP: RES. =1MHz, VID= 10Hz

### TEST PERSONNEL:



Kinh Ly

Test Technician/Engineer

Signature

06/26/2002

Date Of Test

## 6 RADIATED EMISSION LIMITS RADIATED HARMONICS - §15.247

### RADIATED EMISSION LIMITS TEST PROCEDURE

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands. The restricted bands are listed in Part 15.205. The maximum permitted average field strength for the restricted band is listed in Part 15.209. The EUT was tested in the X-Y, X-Z and Y-Z orthogonal plane.

Operating Frequency (MHz): 2412  
 Channel: 1  
 Measured Cond. Pwr. (dBm): 14.0

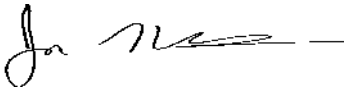
Antenna: Integral  
 Amp: Integral

**TABLE 6-1: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 1)**

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)
2412.000	Pk	V	71	1.0	90.5	11.3	101.8	Fundamental
2412.000	Av	V	71	1.0	83.1	11.3	94.4	Fundamental
2481.000	Pk	V	340	1.3	43.0	11.3	54.3	74.0
2481.000	Av	V	340	1.3	40.5	11.3	51.8	54.0
2503.000	Pk	V	342	1.1	45.0	11.3	56.3	74.0
2503.000	Av	V	342	1.1	37.6	11.3	48.9	54.0
2521.000	Pk	V	342	1.1	43.0	11.3	54.3	74.0
2521.000	Av	V	342	1.1	33.9	11.3	45.2	54.0
4824.000	Pk	H	100	1.2	31.0	13.8	44.8	74.0
4824.000	Av	H	100	1.2	29.7	13.8	43.5	54.0
7236.000	Pk	V	176	1.2	43.0	11.6	54.6	74.0
7236.000	Av	V	176	1.2	33.9	11.6	44.6	54.0
9648.000	Pk	H	88	1.0	34.0	15.8	49.8	74.0
9648.000	Av	H	88	1.0	33.8	15.8	49.6	54.0
12060.000	Av	H	-	1.0	>20dB			54.0
14472.000	Av	H	-	1.0	>20dB			54.0
16884.000	Av	H	-	1.0	>20dB			54.0
19296.000	Av	H	-	1.0	>20dB			54.0
21708.000	Av	H	-	1.0	>20dB			54.0
24120.000	Av	H	-	1.0	>20dB			54.0

Peak: Res. =1 MHz, VID= 1MHz; Average: Res. =1 MHz, VID= 10Hz; >20dB = 20dB or more under the FCC limit

#### TEST PERSONNEL:

Jon Wilson		06/26/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz): 2437  
 Channel: 6  
 Measured Cond. Pwr. (dBm): 14.0

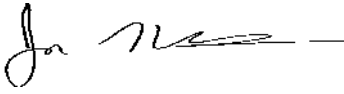
Antenna: Integral  
 Amp: Integral

**TABLE 6-2: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 6)**

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)
2437.000	Pk	V	71	1.0	90.5	11.3	101.8	Fundamental
2437.000	Av	V	71	1.0	83.7	11.3	95.0	Fundamental
2481.000	Pk	V	340	1.5	43.0	11.3	54.3	74.0
2481.000	Av	V	340	1.5	40.5	11.3	51.8	54.0
2504.000	Pk	V	342	1.1	45.0	11.3	56.3	74.0
2504.000	Av	V	342	1.1	37.6	11.3	48.9	54.0
2522.000	Pk	V	342	1.1	43.0	11.3	54.3	74.0
2522.000	Av	V	342	1.1	33.9	11.3	45.2	54.0
4874.000	Pk	H	105	1.3	31.7	13.9	45.6	74.0
4874.000	Av	H	105	1.3	29.9	13.9	43.8	54.0
7311.000	Pk	V	165	1.4	42.8	11.6	54.4	74.0
7311.000	Av	V	165	1.4	33.7	11.6	45.3	54.0
9748.000	Pk	H	85	1.0	33.8	15.5	49.3	75.0
9748.000	Av	H	85	1.0	33.6	15.5	49.1	54.0
12185.000	Av	H	-	1.0	>20dB			54.0
14622.000	Av	H	-	1.0	>20dB			54.0
17059.000	Av	H	-	1.0	>20dB			54.0
19496.000	Av	H	-	1.0	>20dB			54.0
21933.000	Av	H	-	1.0	>20dB			54.0
24370.000	Av	H	-	1.0	>20dB			54.0

Peak: Res. =1 MHz, VID= 1MHz; Average: Res. =1 MHz, VID= 10Hz; >20dB = 20dB or more under the FCC limit

**TEST PERSONNEL:**

Jon Wilson		06/26/2002
Test Technician/Engineer	Signature	Date Of Test

Operating Frequency (MHz): 2462  
 Channel: 11  
 Measured Cond. Pwr. (dBm): 14.0

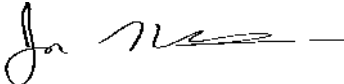
Antenna: Integral  
 Amp: Integral

**TABLE 6-3: RADIATED EMISSIONS HARMONICS/SPURIOUS (CHANNEL 11)**

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)
2462.000	Pk	V	73	1.0	90.5	11.3	101.8	Fundamental
2462.000	Av	V	73	1.0	82.2	11.3	93.5	Fundamental
2507.000	Pk	V	345	1.0	49.0	11.3	60.3	74.0
2507.000	Av	V	345	1.0	42.4	11.3	53.7	54.0
2530.000	Pk	V	350	1.0	47.0	11.3	58.3	74.0
2530.000	Av	V	350	1.0	40.2	11.3	51.5	54.0
2551.000	Pk	V	345	1.0	44.0	11.3	55.3	74.0
2551.000	Av	V	345	1.0	36.3	11.3	47.6	54.0
4924.000	Pk	H	100	1.2	32.0	13.8	45.8	74.0
4924.000	Av	H	100	1.2	30.4	13.8	44.2	54.0
7386.000	Pk	V	176	1.2	44.1	11.6	55.7	74.0
7386.000	Av	V	176	1.2	34.9	11.6	46.5	54.0
9848.000	Pk	H	88	1.0	35.1	16.2	51.3	74.0
9848.000	Av	H	88	1.0	34.5	16.2	50.7	54.0
12310.000	Av	H	-	1.0	>20dB			54.0
14772.000	Av	H	-	1.0	>20dB			54.0
17234.000	Av	H	-	1.0	>20dB			54.0
19696.000	Av	H	-	1.0	>20dB			54.0
22158.000	Av	H	-	1.0	>20dB			54.0
24620.000	Av	H	-	1.0	>20dB			54.0

Peak: Res. =1 MHz, VID= 1MHz; Average: Res. =1 MHz, VID= 10Hz; >20dB = 20dB or more under the FCC limit

**TEST PERSONNEL:**

Jon Wilson Test Technician/Engineer	 Signature	06/26/2002 Date Of Test
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**TEST EQUIPMENT USED FOR TESTING**

**TABLE 6-4: RADIATED SPURIOUS EMISSIONS TEST EQUIPMENT**

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771
900772	EMCO	3161-02	Horn ANTENNA (2-4 GHz)	900772
900321	EMCO	3161-03	Horn Antennas (4-8,2GHz)	9508-1020
900323	EMCO	3160-7	Horn Antennas (8,2-12,4 GHz)	9605-1054
900325	EMCO	3160-9	Horn Antennas (18 - 26.5 GHz)	9605-1051
900723	Miteq	NA	AMP 100MHz-26GHz	NA
900791	Schaffner - Chase	CBL6112	Antenna (25 MHz - 2 GHz)	2099

## 7 MODULATED BANDWIDTH - §15.247(A)(2)

### MODULATED BANDWIDTH TEST PROCEDURE

The minimum 6 dB bandwidth per FCC 15.247 (a)(2) was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The minimum 6 dB modulated bandwidths are the following:

### TEST EQUIPMENT USED FOR TESTING

TABLE 7-1: TEST EQUIPMENT USED FOR TESTING (MODULATED BANDWIDTH)

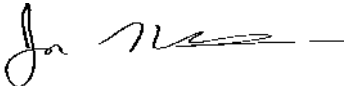
RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771

### MODULATED BANDWIDTH TEST DATA

TABLE 7-2: MINIMUM 6 DB MODULATED BANDWIDTHS

CHANNEL	6 dB BANDWIDTH (MHz)
1	10.62
6	11.02
11	10.42

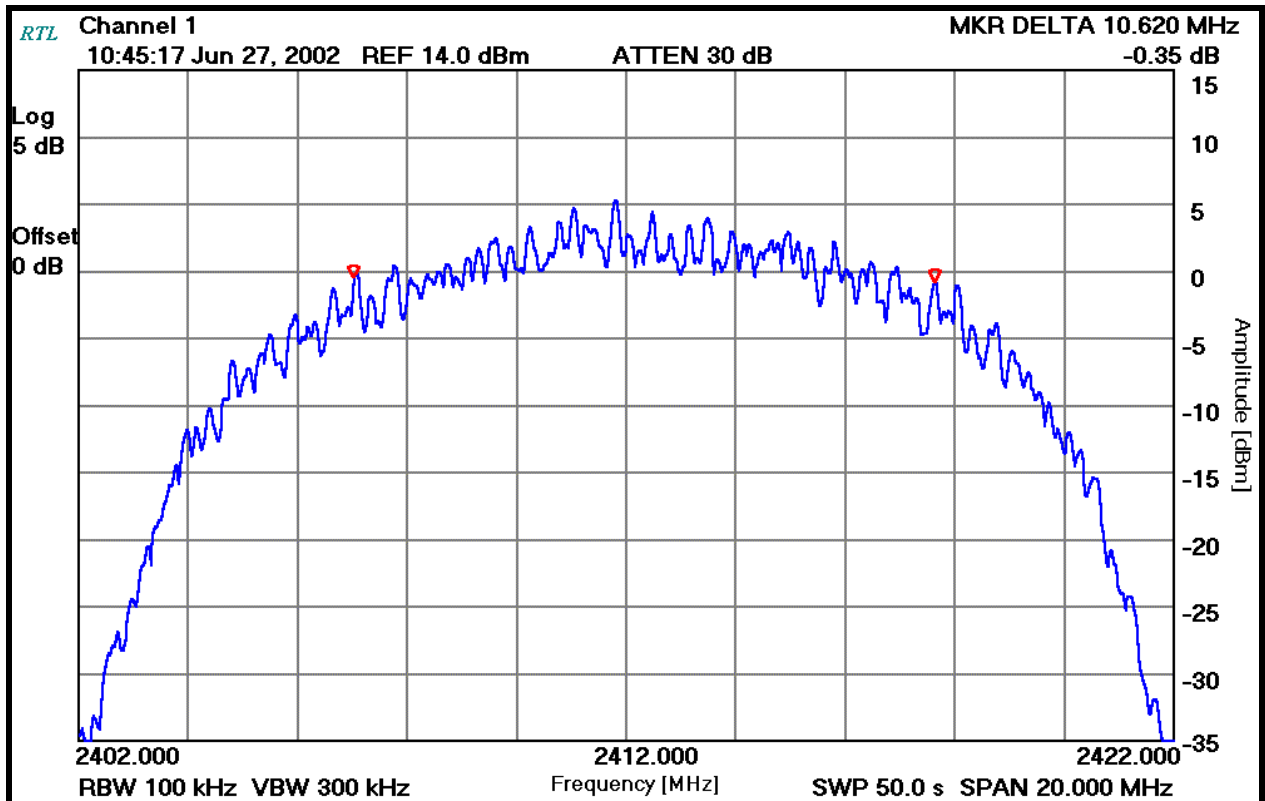
### TEST PERSONNEL:

Jon Wilson Test Technician/Engineer	 Signature	06/27/2002 Date Of Test
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### MODULATED BANDWIDTH PLOTS

Channel Number: 1  
Frequency (MHz): 2412  
Resolution Bandwidth (kHz): 100  
Video Bandwidth (kHz): 300  
Sweep Time (s): 50.0

PLOT 7-1: MODULATED BANDWIDTH CHANNEL 1



TEST PERSONNEL:

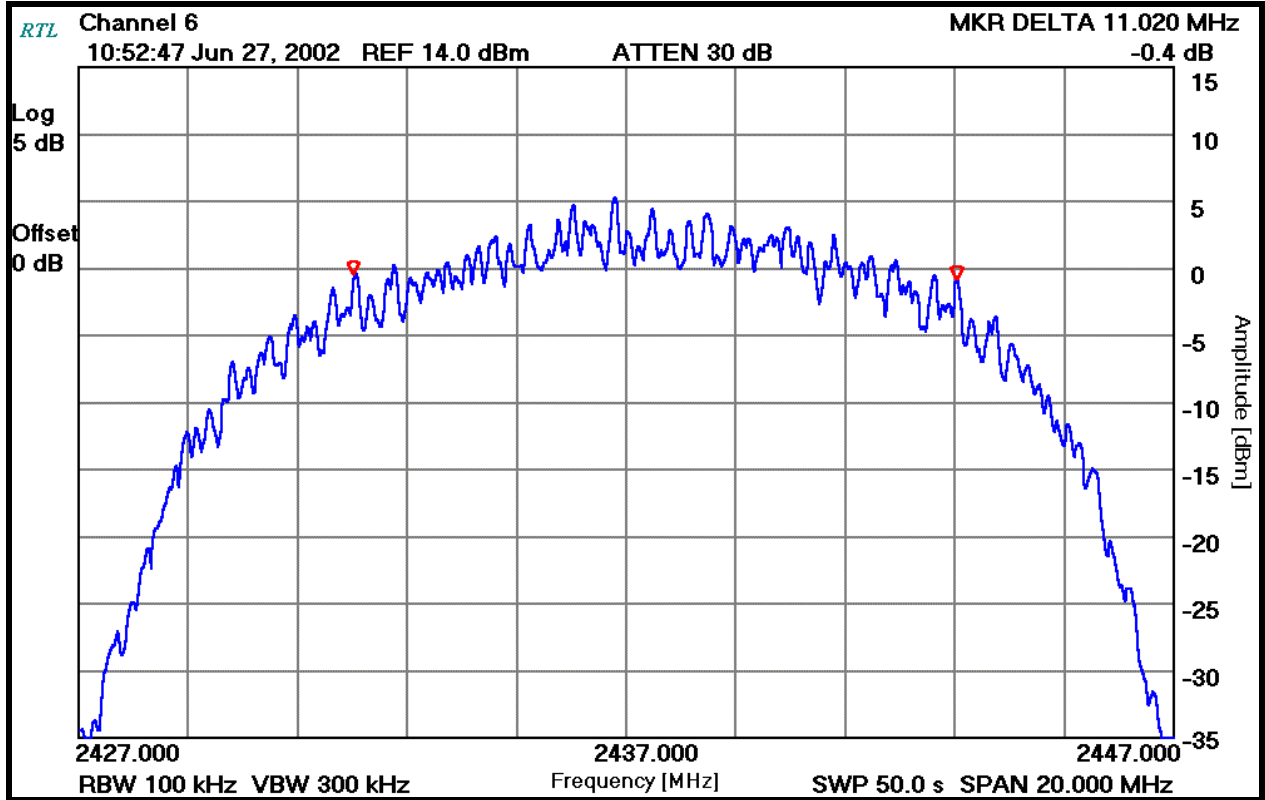
Jon Wilson  
Test Technician/Engineer

Signature

06/27/2002  
Date Of Test

Channel Number: 6  
Frequency (MHz): 2437  
Resolution Bandwidth (kHz): 100  
Video Bandwidth (kHz): 300  
Sweep Time (s): 50.0

PLOT 7-2: MODULATED BANDWIDTH CHANNEL 6



TEST PERSONNEL:

Jon Wilson  
Test Technician/Engineer

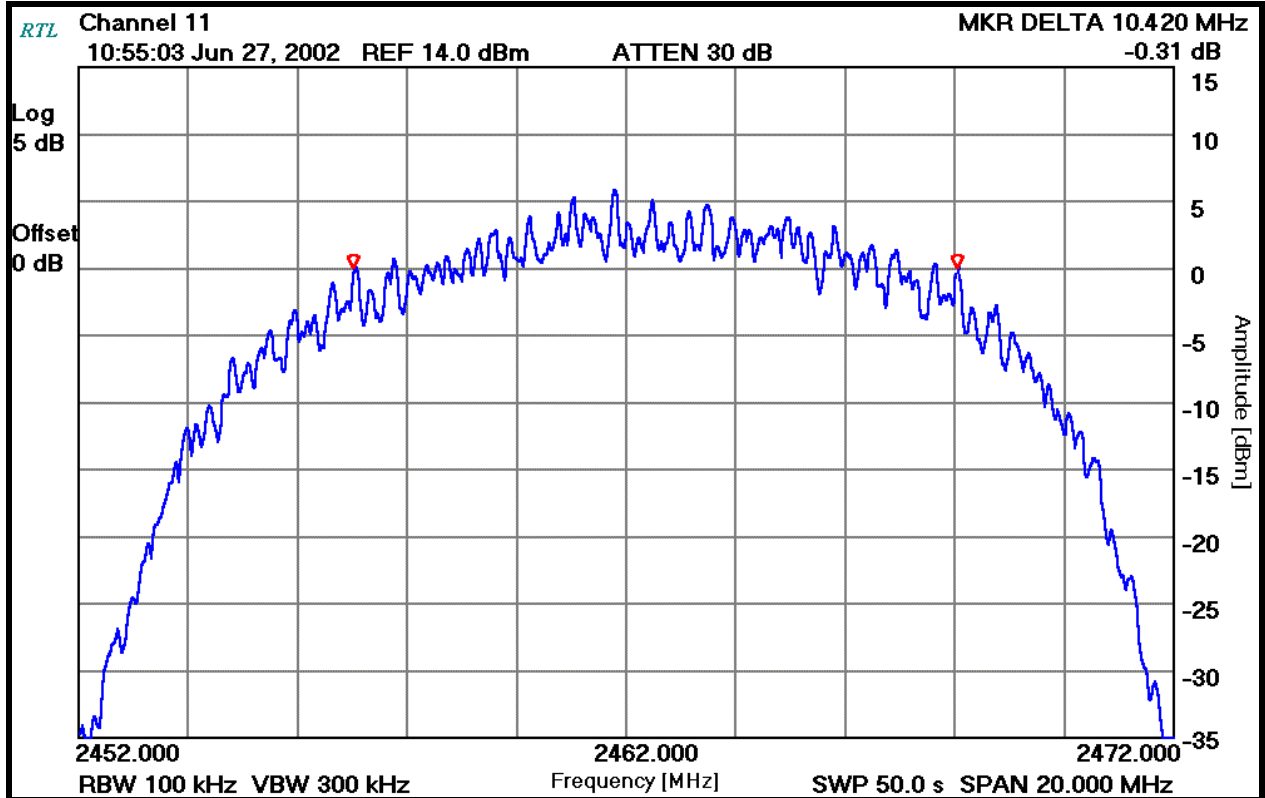
Signature

06/27/2002  
Date Of Test



Channel Number: 11  
Frequency (MHz): 2462  
Resolution Bandwidth (kHz): 100kHz  
Video Bandwidth (kHz): 300kHz  
Sweep Time (s): 50.0s

PLOT 7-3: MODULATED BANDWIDTH CHANNEL 11



TEST PERSONNEL:

Jon Wilson  
Test Technician/Engineer

Signature

06/27/2002  
Date Of Test

## 8 POWER OUTPUT - §15.247(B)

### POWER OUTPUT TEST PROCEDURE

The peak conducted output power of the EUT was measured using an Agilent 4416A EPM-P Series Power Meter with an E9323A Peak and Average Power Sensor. The EIRP measurement was performed as a radiated test using the substitution method

### TEST EQUIPMENT USED FOR TESTING

**TABLE 8-1: TEST EQUIPMENT USED FOR TESTING (RADIATED RF OUTPUT – EIRP)**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901186	Agilent Technologies	E9323A (50MHz-6GHz)	Peak & Avg. Power Sensor	US40410380
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771
900772	EMCO	3161-02	Horn ANTENNA (2-4 GHz)	900772
900723	Miteq	NA	AMP 100MHz-26GHz	NA
900814	Electro-Metrics	RGA-60	Double Ridges Guide Antenna (1-18 GHz)	2310

### POWER OUTPUT TEST DATA

**TABLE 8-2: POWER OUTPUT TEST DATA**

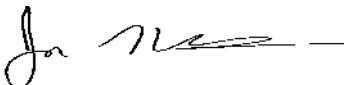
Operating Frequency (MHz): 2412MHz, 2437MHz, 2462MHz  
 Channel: 1, 6 & 11  
 Measured Cond. Pwr. (dBm): 14.0, 14.0 & 14.0  
 Modulation bandwidth: 11.02MHz  
 Antenna: Integral Antenna

**TABLE 8-3: POWER OUTPUT TEST DATA**

CHANNEL	POWER CONDUCTED OUTPUT (dBm)
1	14.0
6	14.0
11	14.0

\*Measurement accuracy is +/- 1.5 dB

### TEST PERSONNEL:

Jon Wilson		06/26/2002
Test Technician/Engineer	Signature	Date Of Test

## 9 ANTENNA CONDUCTED SPURIOUS EMISSIONS - §15.247(C)

### ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST PROCEDURES

Antenna conducted spurious emissions per FCC 15.247(c) was measured from the EUT antenna port using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The modulated carrier was identified at 2.412GHz for Channel 1, 2.437GHz for Channel 6, and 2.462GHz for Channel 11. See Antenna Conducted Spurious Emissions table. Channels 1, 6, and 11 were investigated and tested.

### ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA

Operating Frequency (MHz): 2412  
 Channel: 1  
 Measured Cond. Pwr. (dBm): 14.0  
 Limit: -13.8

TABLE 9-1: ANTENNA CONDUCTED SPURIOUS EMISSIONS

Frequency (MHz)	Measured Level (dBm)	Notch Filter Insertion Loss (dB)	Corrected Measured Level (dBm)	Margin (dB)
2412.000	6.2	N/A	N/A	Fundamental/Carrier
2345.900	-53.7	-25.2	-28.5	14.7
2455.900	-61.3	-31.8	-29.5	15.7
2478.500	-61.1	-25.2	-35.9	22.1
2500.000	-61.4	-25.2	-36.2	22.4
2521.000	-58.4	-14.6	-43.8	30.0
4824.000	-41.7	-0.5	-41.2	27.4
7236.000	-68.2	-4.9	-63.3	49.5
9648.000	-60.4	-8.6	-51.8	38.0
12060.000	-72.4	-7.1	-65.3	51.5
14472.000	-70.1	-4.3	-65.8	52.0
16884.000	-71.1	-7.0	-64.1	50.3
19296.000	-66.1	-7.8	-58.3	44.5
21708.000	-64.2	NF		
24120.000	-63.1	NF		

NF- Noise Floor

### TEST PERSONNEL:

Jon Wilson  
 Test Technician/Engineer



Signature

06/27/2002  
 Date Of Test

Operating Frequency (MHz): 2437  
 Channel: 6  
 Measured Cond. Pwr. (dBm): 14.0  
 Limit: -13.8

**TABLE 9-2: ANTENNA CONDUCTED SPURIOUS EMISSIONS**

Frequency (MHz)	Measured Level (dBm)	Notch Filter Insertion Loss (dB)	Corrected Measured Level (dBm)	Margin (dB)
2437.000	6.2	N/A	N/A	Fundamental/Carrier
2349.000	-53.6	-9.7	-43.2	39.4
2481.500	-54.2	-14.6	-38.9	25.1
2502.600	-52.4	-12.4	-39.7	25.9
2523.900	-51.2	-10.1	-40.8	27.0
4874.000	-52.2	-2.2	-50.7	36.9
7311.000	-63.3	-5.6	-58.4	44.6
9748.000	-55.4	-8.7	-46.8	33.0
12185.000	-61.7	-12.0	-51.1	37.3
14622.000	-59.9	-7.9	-55.1	41.3
17059.000	-61.3	-11.3	-54.7	40.9
19496.000	-55.9	-13.0	-46.7	32.9
21933.000	NF			
24370.000	NF			

NF = Noise Floor

**TEST PERSONNEL:**

Jon Wilson  
 Test Technician/Engineer



Signature

06/27/2002  
 Date Of Test

Operating Frequency (MHz): 2462  
 Channel: 11  
 Measured Cond. Pwr. (dBm): 14.0  
 Limit: -13.4

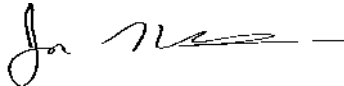
**TABLE 9-3: ANTENNA CONDUCTED SPURIOUS EMISSIONS**

Frequency (MHz)	Measured Level (dBm)	Notch Filter Insertion Loss (dB)	Corrected Measured Level (dBm)	Margin (dB)
2462.000	6.6	N/A	N/A	Fundamental
2351.900	-50.3	-8.9	-41.4	28.0
2505.800	-50.0	-16.6	-33.4	20.0
2527.700	-48.7	-12.7	-36.0	22.6
4924.000	-48.0	-1.7	-46.3	32.9
7386.000	-53.3	-3.9	-49.4	36.0
9848.000	-55.0	-7.0	-48.0	34.6
12310.000	-53.0	-13.8	-39.2	25.8
14772.000	-50.0	-8.3	-41.7	28.3
17234.000	-52.0	-7.2	-44.8	31.4
19696.000	-44.0	-11.3	-32.7	19.3
22158.000	NF			
24620.000	NF			

NF= Noise Floor

**TEST PERSONNEL:**

Jon Wilson  
 Test Technician/Engineer



Signature

06/27/2002  
 Date Of Test

## 10 POWER SPECTRAL DENSITY - §15.247(D)

### POWER SPECTRAL DENSITY TEST PROCEDURE

The Power spectral density per FCC 15.247(d) was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 30kHz, and the sweep time set at 1000 second. Since the EUT has an integral antenna, the test was performed as a radiated testing. The 6 dB value on the bandwidth plots were corrected using the site correction factor (i.e. cable loss, amplifier gain, and antenna factor) and the path loss at 3 meter distance; and referenced to the conducted power value measured in section 8 of this report. The spectral lines were resolved for the modulated carriers at 2.412GHz, 2.437GHz, and 2.463GHz respectively. These levels are well below the +8 dBm limit. See power spectral density table and plots.

### TEST EQUIPMENT USED FOR TESTING

TABLE 0-1: TEST EQUIPMENT USED FOR TESTING (POWER SPECTRAL DENSITY)

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771

### POWER SPECTRAL DENSITY TEST DATA

Operating Frequency (MHz): 2412, 2437 & 2462  
 Channel: 1, 6 & 11  
 Measured Cond. Pwr. (dBm): 14.0, 14.0, 14.0  
 Modulation Bandwidth: 11.02 MHz  
 Limit: +8dBm

TABLE 0-2: POWER SPECTRAL DENSITY

CHANNEL	POWER SPECTRAL DENSITY LIMIT = +8dBm
1	-9.5
6	-10.8
11	-10.4

### TEST PERSONNEL:

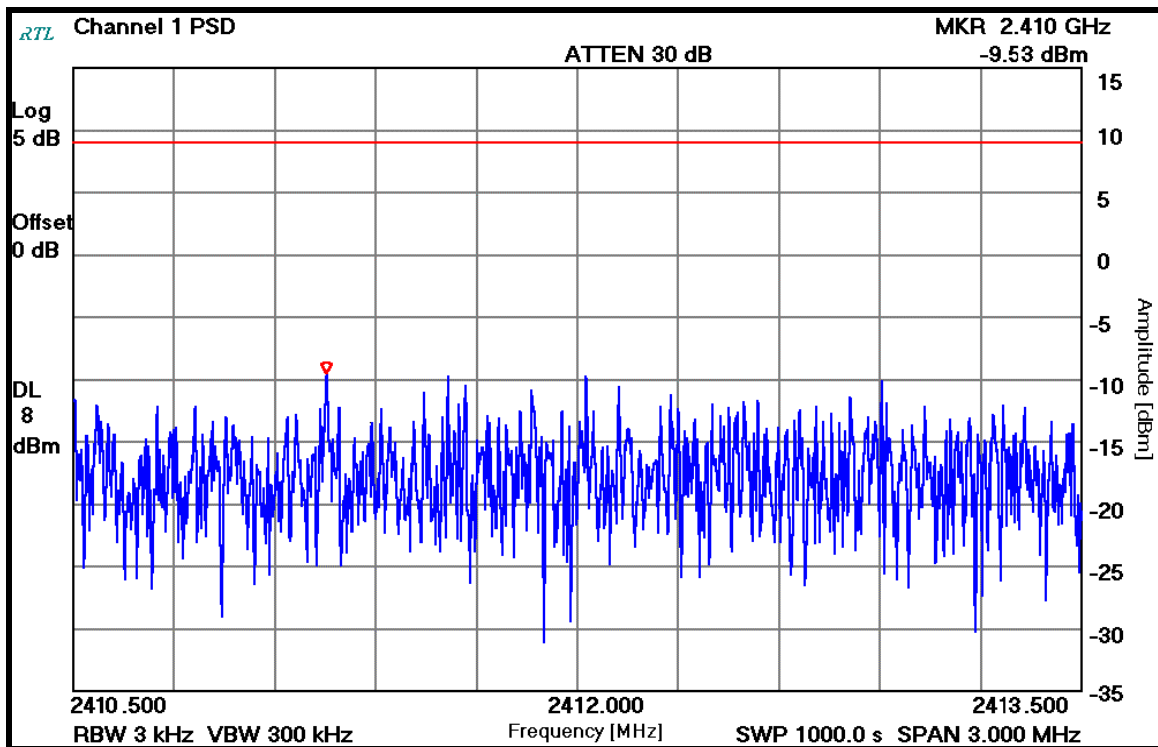
Franck Schuppis  
 Test Technician/Engineer

  
 Signature

4/04/2002  
 Date Of Test

Operating Frequency (MHz): 2412  
Channel: 1  
Measured Cond. Pwr. (dBm): 14.0  
Bandwidth Resolution (kHz): 3  
Bandwidth Video (kHz): 300  
Sweep Time (s): 1000.0

PLOT 0-1: POWER SPECTRAL DENSITY: CHANNEL 1



TEST PERSONNEL:

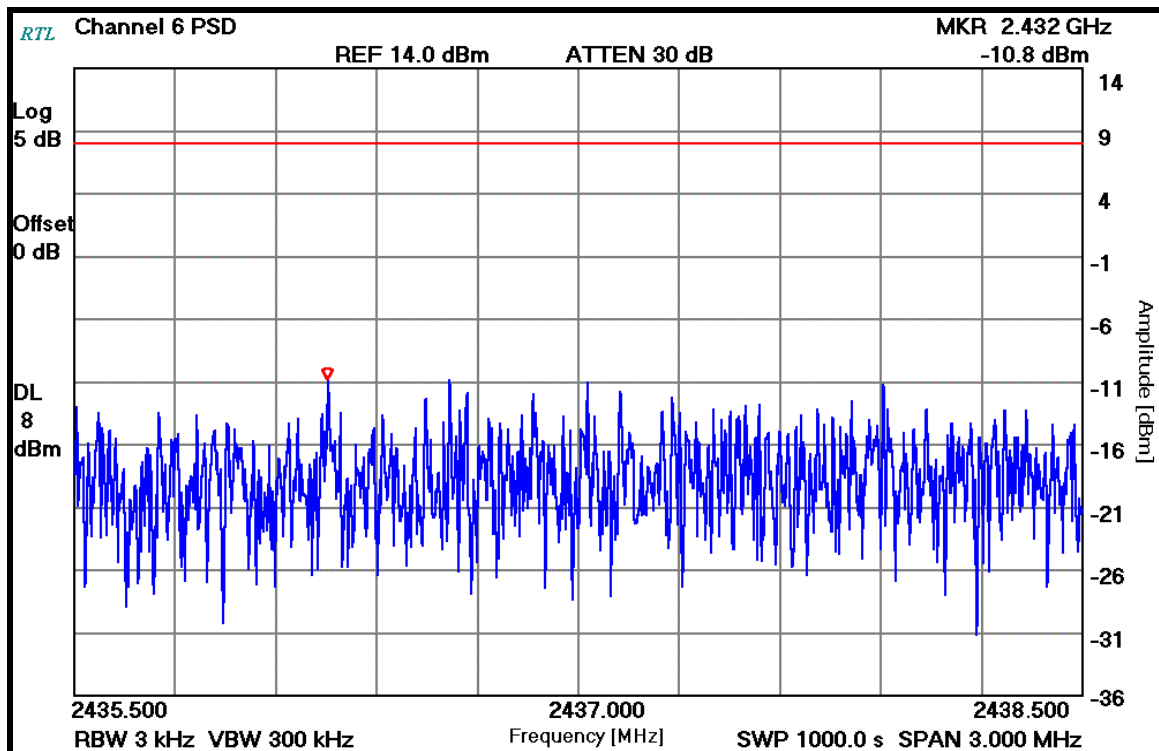
Jon Wilson  
Test Technician/Engineer

Signature

07/12/2002  
Date Of Test

Operating Frequency (MHz): 2437  
Channel: 6  
Measured Cond. Pwr. (dBm): 14.0  
Bandwidth Resolution (kHz): 3  
Bandwidth Video (kHz): 300  
Sweep Time (s): 1000.0

PLOT 0-2: POWER SPECTRAL DENSITY: CHANNEL 6



TEST PERSONNEL:

Jon Wilson  
Test Technician/Engineer

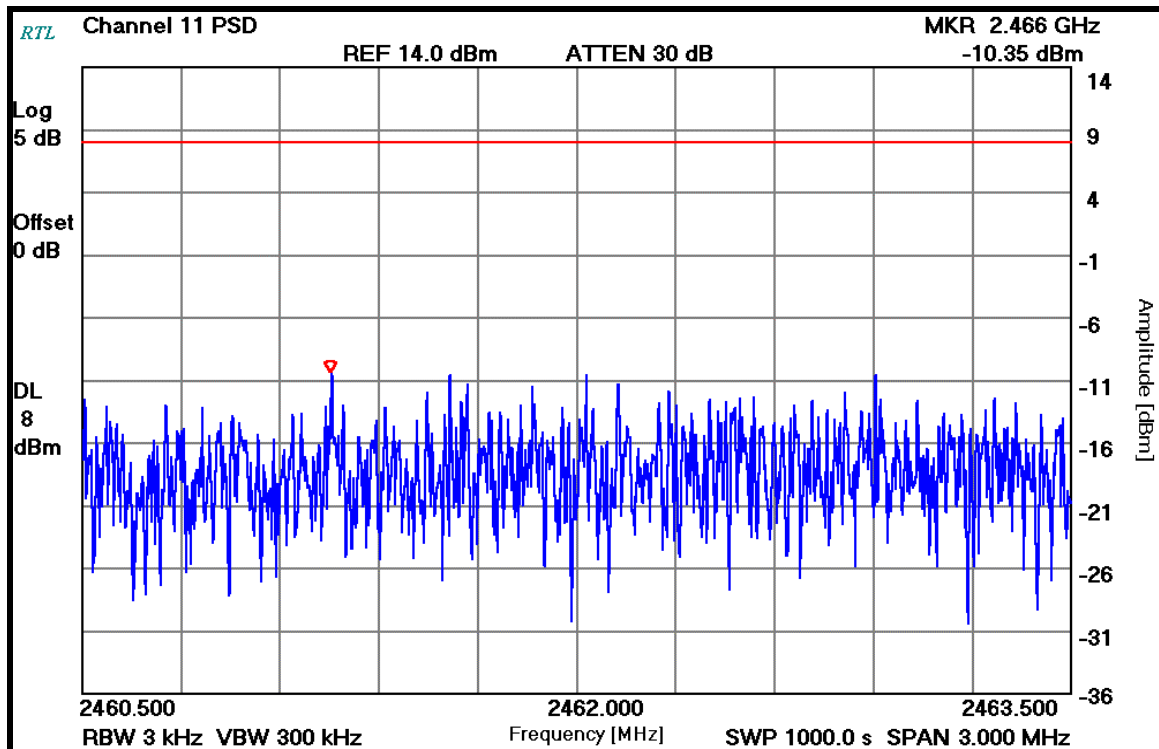
Signature

07/12/2002  
Date Of Test



Operating Frequency (MHz): 2462  
Channel: 11  
Measured Cond. Pwr. (dBm): 14.0  
Bandwidth Resolution (kHz): 3  
Bandwidth Video (kHz): 300  
Sweep Time (s): 1000.0

PLOT 0-3: POWER SPECTRAL DENSITY: CHANNEL 11



TEST PERSONNEL:

Jon Wilson  
Test Technician/Engineer

Signature

07/12/2002  
Date Of Test

Rhein Tech Laboratories  
360 Herndon Parkway  
Suite 1400  
Herndon, VA 20170  
<http://www.rheintech.com>

Report Number: 2002125  
FCC ID: E2X-SWL2200C  
Model: SWL-2200C  
FCC Standard: Part 15.247  
Industry Canada: RSS-210

## 11 CONCLUSION

The data in this measurement report shows that Samsung EMC Ltd. Model: SWL-2200C, FCC ID: E2XSWL-2200C, complies with all the requirements of Parts 2 and 15 of the FCC Rules and Industry Canada RSS-210.