



Engineering and Testing for EMC and Safety Compliance

APPLICATION FOR FCC CERTIFICATION

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

Samsung Electronics
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+82-31-200-7925

Model: Wireless LAN Card (Solo 5350)

FCC ID: A3L5350WL

July 30, 2001

| STANDARDS REFERENCED FOR THIS REPORT | |
|--------------------------------------|--|
| PART 2: 1999 | FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS |
| PART 15: 1999 | RADIO FREQUENCY DEVICES |
| FCC 97-114 | GUIDANCE ON MEASUREMENTS FOR DIRECT SEQUENCE SPREAD SPECTRUM SYSTEMS |
| ANSI C63.4-1992 | STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS |
| RSS-210; ISSUE 5 (DRAFT 3) | LOW POWER LICENCE-EXEMPT RADIOCOMMUNICATION DEVICES (ALL FREQUENCY BANDS) |
| RSS-102; ISSUE 1 (PROVISIONAL) | EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS WITH RESPECT TO HEALTH CANADA'S SAFETY CODE 6 FOR EXPOSURE OF HUMANS TO RADIO FREQUENCY FIELDS |

| Frequency Range | Conducted Output Power (W) | Freq. Tolerance | Emission Designator |
|------------------|----------------------------|-----------------|---------------------|
| 2410 to 2463 MHz | 0.031 | | |

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Document Number: 2001201 / QRTL01-196

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1 INTRODUCTION

The following Application for FCC Certification and Industry Canada for a Direct Sequence Spread Spectrum transmitter is prepared on behalf of *Samsung Electronics* in accordance with Part 15.247 of the Federal Communications Commissions and RSS-210 for Industry Canada. The Equipment Under Test (EUT) was the Samsung MPC13A-20, FCC ID: A3L5350WL. The test results reported in this document relate only to the item that was tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. These are explained in the appendix of this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated and conducted emissions measurement were performed manually at Rhein Tech, Incorporated. The radiated emissions measurements required by the rules were performed on the three meter, open field, test range maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. Complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission. The power line conducted emission measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. Rhein Tech, Labs, Inc. is on the FCC accepted lab list as a Facility available to do measurement work for others on a contract basis.

1.1 RELATED SUBMITTAL (S)/GRANT (S)

This is an original application for certification.

1.2 TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of 3 meters. Emissions above 1 GHz were video averaged.

1.3 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated March 3, 1994, submitted to and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).



2 SYSTEM TEST CONFIGURATION

2.1 JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst-case emission. Channel 1 at 2.410 GHz, Channel 6 at 2.437 GHz and Channel 11 at 2.463 GHz were tested and investigated from 9kHz to 24GHz. All three channels were investigated and tested. Data for all three channels are presented in this report.

To complete the configuration required by the FCC, the transmitter was tested in a note computer with an internal antenna connected to the antenna port similar to its intended use.

The EUT was investigated with the external antenna. The worst-case data taken in this report represents the highest data rate at 11 MBPS. Data rates of 5.5MBPS, 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.

2.2 EUT EXERCISE SOFTWARE

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.

2.3 SPECIAL ACCESSORIES

N/A.

2.4 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system (including inserted cards, which have grants) are:

TABLE 2-1: EQUIPMENT UNDER TEST (EUT)

| Part | Manufacturer | Model | Serial Number | FCC ID | Cable Description | RTL Bar Code |
|------------------------|--------------|-----------|---------------|---------|-------------------|--------------|
| MINI PCI WIRELESS WLAN | SAMSUNG | MPC13A-20 | N/A | A3LS590 | N/A | 13517 |

TABLE 2-2: EXTERNAL COMPONENTS USED IN TEST CONFIGURATION

| Part | Manufacturer | Model | Serial Number | FCC ID | Cable Description | RTL Bar Code |
|----------|--------------|-------|---------------|---------------|-------------------|--------------|
| COMPUTER | SAMUNG | SOLO | 5350PR102 | A3L5350015318 | AC/DC CONVERTER | |



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2.5 CONFIGURATION OF TESTED SYSTEM

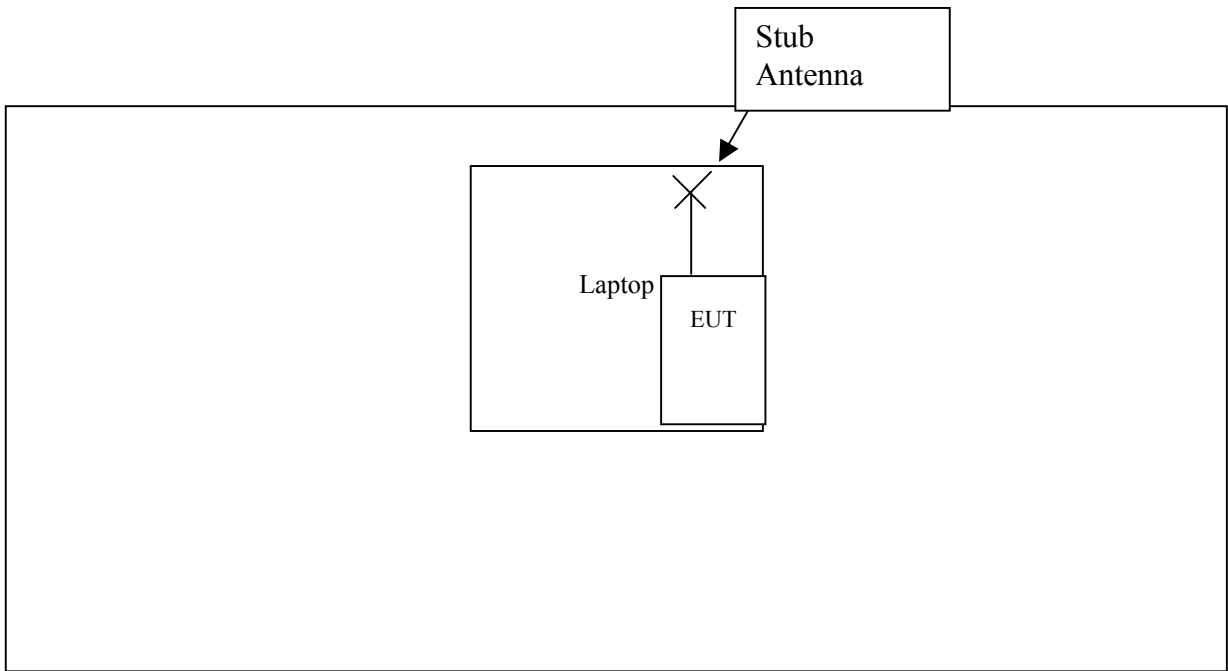


FIGURE 2-1: CONFIGURATION OF TESTED SYSTEM



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3 CONFORMANCE STATEMENT

| STANDARDS REFERENCED FOR THIS REPORT | |
|---------------------------------------|--|
| PART 2: 1999 | FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS |
| PART 15: 1999 | RADIO FREQUENCY DEVICES |
| FCC 97-114 | GUIDANCE ON MEASUREMENTS FOR DIRECT SEQUENCE SPREAD SPECTRUM SYSTEMS |
| ANSI C63.4-1992 | STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS |
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| Frequency Range | Conducted Output Power (W) | Freq. Tolerance | Emission Designator |
|------------------|----------------------------|-----------------|---------------------|
| 2410 to 2463 MHz | 0.031 | | |

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described above. Modifications were not made during testing to the equipment in order to achieve compliance with these standards.


Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.

Signature: 

Date: July 30, 2001

Typed/Printed Name: Bruno Clavier


Position: Vice President of Operation
(NVLAP Signatory)

Signature: 

Date: July 30, 2001

Typed/Printed Name: Rachid Sehb

Position: Test Engineer / Technician

 Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.



4 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FI(\text{dBuV/m}) = \text{SAR}(\text{dBuV}) + \text{SCF}(\text{dB/m})$$

FI = Field Intensity
SAR = Spectrum Analyzer Reading
SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

$$\text{SCF}(\text{dB/m}) = -\text{PG}(\text{dB}) + \text{AF}(\text{dB/m}) + \text{CL}(\text{dB})$$

SCF = Site Correction Factor
PG = Pre-amplifier Gain
AF = Antenna Factor
CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(\text{uV/m}) = 10^{\text{FI}(\text{dBuV/m})/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

$$49.3 \text{ dBuV} - 11.5 \text{ dB/m} = 37.8 \text{ dBuV/m}$$
$$10^{37.8/20} = 10^{1.89} = 77.6 \text{ uV/m}$$

EIRP calculation: Power from power meter in (dBm) + antenna gain in (dBi)



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5 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 7 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 7 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or average 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 range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

5.1 CONDUCTED EMISSIONS TEST

The following table lists worst-case conducted emission data. Specifically: Emission Frequency, Test Detector, Analyzer Reading, Site Correction Factor, corrected Emission Level, Quasi Peak Limit and Margin, and the Average Limit and Margin.

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.

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and HOT SIDE, herein referred to as L1 and L2, respectively.



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5.1.1 FCC PART 15 §15.107 CONDUCTED EMISSIONS TEST DATA

TABLE 5-1: FCC PART 15 §15.107 CONDUCTED EMISSIONS: NEUTRAL SIDE (LINE 1)

| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | Limit (dBuV) | Margin (dBuV) |
|--------------------------|---------------|-------------------------|-----------------------------|-----------------------|--------------|---------------|
| 0.789 | Pk | 44.9 | 0.7 | 45.6 | 48.0 | -2.4 |
| 1.096 | Pk | 44.8 | 0.8 | 45.6 | 48.0 | -2.4 |
| 1.344 | Pk | 44.4 | 0.9 | 45.3 | 48.0 | -2.7 |
| 1.363 | Pk | 43.6 | 0.9 | 44.5 | 48.0 | -3.5 |
| 2.904 | Pk | 40.9 | 1.4 | 42.3 | 48.0 | -5.7 |
| 5.800 | Pk | 33.8 | 1.9 | 35.7 | 48.0 | -12.3 |

(1)Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

SIGNATURE

JULY 30, 2001
 DATE OF TEST

TABLE 5-2: FCC PART 15 §15.107 CONDUCTED EMISSIONS: HOT SIDE (LINE 2)

| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | Limit (dBuV) | Margin (dBuV) |
|--------------------------|---------------|-------------------------|-----------------------------|-----------------------|--------------|---------------|
| 0.465 | Pk | 45.7 | 0.8 | 46.5 | 48.0 | -1.5 |
| 0.776 | Pk | 45.3 | 0.8 | 46.1 | 48.0 | -1.9 |
| 0.828 | Pk | 44.5 | 0.7 | 45.2 | 48.0 | -2.8 |
| 1.068 | Pk | 44.1 | 0.8 | 44.9 | 48.0 | -3.1 |
| 1.964 | Pk | 43.1 | 1.2 | 44.3 | 48.0 | -3.7 |
| 5.850 | Pk | 37.5 | 1.9 | 39.4 | 48.0 | -8.6 |
| 11.150 | Pk | 36.4 | 2.4 | 38.8 | 48.0 | -9.2 |

(1)Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

SIGNATURE

JULY 30, 2001
 DATE OF TEST

TABLE 5-3: TEST EQUIPMENT USED FOR TESTING (CONDUCTED EMISSIONS)

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



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6 FCC PART 15 §15.109 RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range; the EUT was scanned indoor at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. The range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report. . **For radiated measurements above 1 GHz, a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz are used.**

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.



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6.1 FCC PART 15 §15.109 RADIATED EMISSIONS TEST

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit.

6.1.1 FCC PART 15 §15.109 RADIATED EMISSION DIGITAL NOISE

| 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) |
|--------------------------|---------------|------------------------|-------------------------|--------------------|-------------------------|-------------------------------|-------------------------|----------------|-------------|
| 89.501 | Qp | V | 265 | 1.0 | 43.6 | -21.6 | 22.0 | 43.5 | -21.5 |
| 132.821 | Qp | V | 180 | 1.0 | 39.5 | -17.3 | 22.2 | 43.5 | -21.3 |
| 138.385 | Qp | V | 225 | 1.0 | 43.2 | -18.5 | 24.7 | 43.5 | -18.8 |
| 152.481 | Qp | H | 180 | 1.0 | 31.2 | -20.0 | 11.2 | 43.5 | -32.3 |
| 219.388 | Qp | V | 270 | 1.0 | 35.9 | -16.9 | 19.0 | 46.0 | -27.0 |
| 418.000 | Qp | H | 215 | 1.0 | 35.7 | -9.7 | 26.0 | 46.0 | -20.0 |
| 849.936 | Qp | V | 270 | 1.0 | 33.2 | -3.8 | 29.4 | 46.0 | -16.6 |

QUASI PEAK =120 KHZ

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

SIGNATURE

JULY 30, 2001
 DATE OF TEST

TABLE 6-1: TEST EQUIPMENT USED FOR TESTING (RADIATED EMISSIONS)

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number |
|-------------|-----------------|----------|--|---------------|
| 900931 | HP | 8566B | Spectrum Analyzer (100Hz – 22 GHz) | 3138A07771 |
| 901053 | Schaffner@Chase | CBL6112B | Bilog antenna (20 MHz - 2 GHz) | 2648 |
| 900323 | EMCO | 3161-03 | Horn Antennas (4-8,2GHz) | 9508-1020 |
| 900889 | HP | 85685A | RF Preselector for HP 8566B or 8568B (20Hz-2GHz) | 3146A01309 |



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7 FCC PART 15 §15.247(A)(2) MODULATED BANDWIDTH

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:

TABLE 7-1: FCC PART 15 §15.247(A)(2) MODULATED BANDWIDTH

| Channel | 6(dB) Bandwidth (MHz) |
|---------|-----------------------|
| 1 | 10.3 |
| 6 | 10.3 |
| 11 | 10.3 |

The 6dB bandwidth is listed in figures part 26.

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

SIGNATURE

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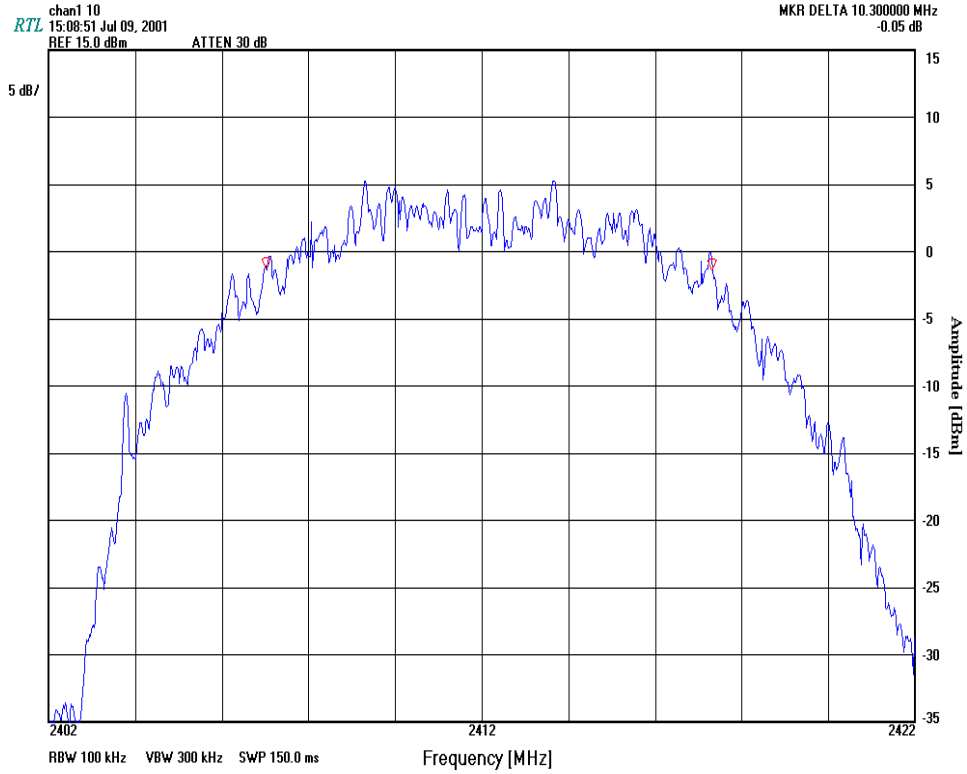
TABLE 7-2: TEST EQUIPMENT USED FOR TESTING (MODULATED BANDWIDTH)

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



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PLOT 7-1: FCC PART 15 §15.247(A)(2) MODULATED BANDWIDTH: CHANNEL 1



TEST PERSONNEL:

RACHID SEHB
TEST TECHNICIAN/ENGINEER

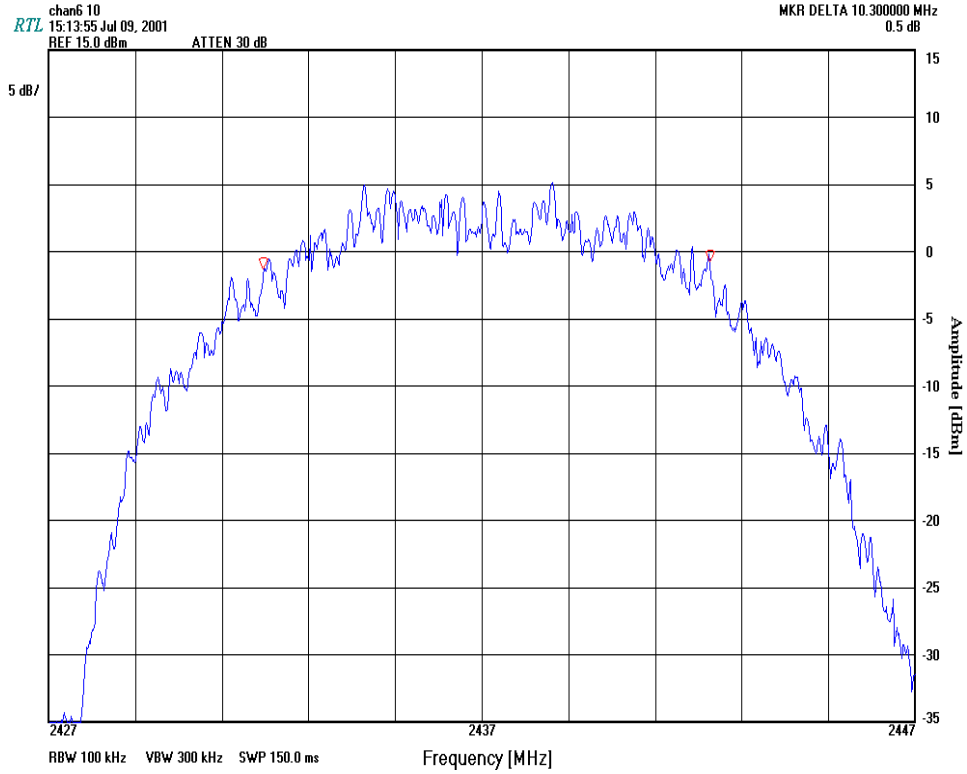
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PLOT 7-2: FCC PART 15 §15.247(A)(2) MODULATED BANDWIDTH: CHANNEL 6



TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

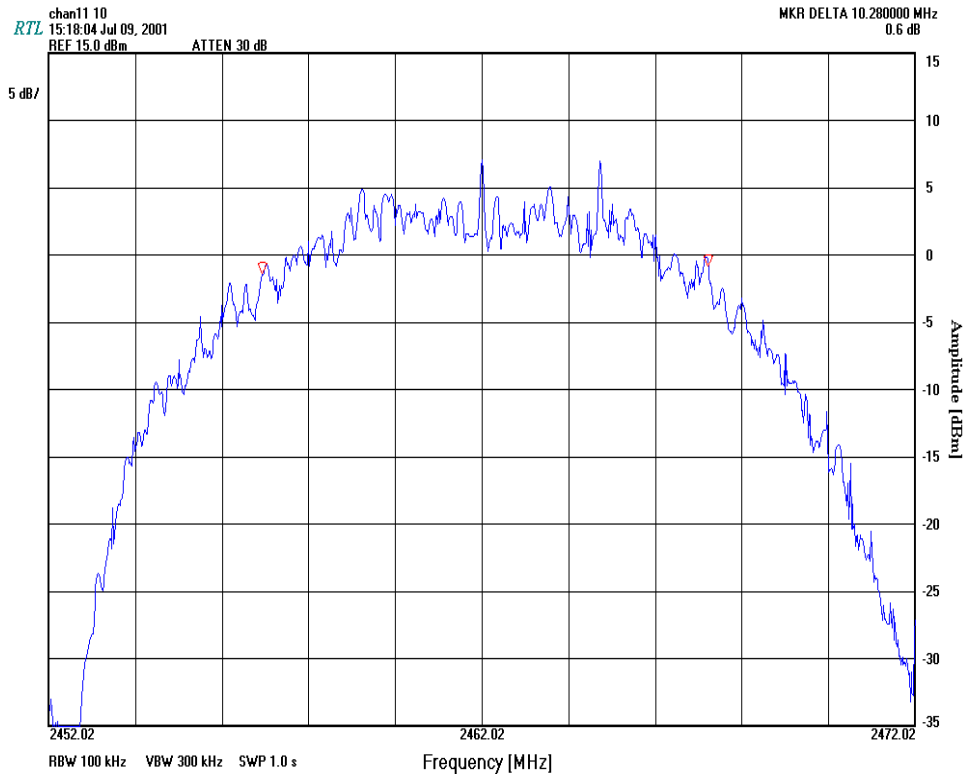
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PLOT 7-3: FCC PART 15 §15.247(A)(2) MODULATED BANDWIDTH: CHANNEL 11



TEST PERSONNEL:

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 TEST TECHNICIAN/ENGINEER

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8 FCC PART 15 §15.247(B) POWER OUTPUT

The power output per FCC 15.247(b) was measured on the EUT using an HP peak power meter. EIRP measurement was performed as a radiated test (substitution test).

TABLE 8-1: FCC PART 15 §15.247(B) POWER OUTPUT

| Channel | EIRP (dBm)* | Power conducted output (dBm) |
|---------|-------------|------------------------------|
| 1 | 14.5 | 15.0 |
| 6 | 13.5 | 14.8 |
| 11 | 13.6 | 15.0 |

*Measurement accuracy is +/- 1.5 dB

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

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TABLE 8-2: TEST EQUIPMENT USED FOR TESTING (RADIATED RF OUTPUT - EIRP)

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number |
|-------------|----------------------|---------------------|--|---------------|
| 900931 | HP | 8566B | Spectrum Analyzer (100Hz – 22 GHz) | 3138A07771 |
| 901186 | Agilent Technologies | E9323A (50MHz-6GHz) | Peak & Avg. Power Sensor | US40410380 |
| 901184 | Agilent Technologies | E4416A | EPM-P Power Meter, single channel | GB41050573 |
| 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 |



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9 FCC PART 15 §15.247(C) ANTENNA CONDUCTED SPURIOUS EMISSIONS

Antenna spurious emission 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 2.410GHz for Channel 1, 2.437GHz for Channel 6 and 2.463GHz for Channel 11. No other harmonics or spurs were found within 20 dB of the carrier level, and from 9kHz to the carriers 10th harmonic. See antenna conducted spurious noise table. Channels 1, 6, and 11 were investigated and tested.

TABLE 9-1: FCC PART 15 §15.247(C) ANTENNA CONDUCTED SPURIOUS EMISSIONS: CHANNEL 1

| Frequency (MHz) | Spurious level (dBm) | FCC Margin (dB) |
|-----------------|----------------------|-----------------|
| 22.1 | -44.1 | -28.4 |
| 33.1 | -54.1 | -38.4 |
| 349.5 | -59.2 | -43.5 |
| 432.4 | -47.1 | -31.4 |
| 704.0 | -46.1 | -30.4 |
| 886.0 | -43.1 | -27.4 |
| 1295.0 | -45.9 | -30.2 |
| 1868.0 | -54.5 | -38.8 |
| 48220.0 | -56.2 | -40.5 |
| 72380.0 | -58.6 | -42.9 |

TEST PERSONNEL:

RACHID SEHB
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TABLE 9-2: FCC PART 15 §15.247(C) ANTENNA CONDUCTED SPURIOUS EMISSIONS: CHANNEL 6

| Frequency (GHz) | Spurious level (dBm) | FCC Margin (dB) |
|-----------------|----------------------|-----------------|
| 350.1 | -59.4 | -43.7 |
| 428.6 | -47.2 | -31.5 |
| 464.0 | -47.8 | -32.1 |
| 704.0 | -47.1 | -31.4 |
| 885.0 | -43.4 | -27.7 |
| 1298.0 | -46.5 | -30.8 |
| 1403.0 | -48.9 | -33.2 |
| 1870.0 | -56.0 | -40.3 |
| 2395.2 | -58.0 | -42.3 |
| 4872.0 | -53.0 | -37.3 |
| 7307.0 | -57.7 | -42.0 |

TEST PERSONNEL:

RACHID SEHB
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TABLE 9-3: FCC PART 15 §15.247(C) ANTENNA CONDUCTED SPURIOUS EMISSIONS: CHANNEL 11

| Frequency (GHz) | Spurious level (dBm) | FCC Margin (dB) |
|-----------------|----------------------|-----------------|
| 350.1 | -59.1 | -43.1 |
| 436.4 | -46.7 | -30.7 |
| 704.2 | -48.2 | 32.2 |
| 885.5 | -43.5 | -27.5 |
| 1305.0 | -46.9 | -30.9 |
| 1432.0 | -49.4 | -33.4 |
| 1662.0 | -57.8 | -41.8 |
| 1860.0 | -56.4 | -40.4 |
| 2370.0 | -59.3 | -43.3 |
| 4923.0 | -45.0 | -29.0 |
| 7368.0 | -49.7 | -33.7 |

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

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 DATE OF TEST

TABLE 9-4: TEST EQUIPMENT USED FOR TESTING (ANTENNA CONDUCTED SPURIOUS EMISSIONS)

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



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10 FCC PART 15 §15.209(C) RADIATED SPURIOUS EMISSIONS

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

TABLE 10-1: 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) |
|--------------------------|---------------|------------------------|-------------------------|--------------------|-------------------------|-------------------------------|-------------------------|----------------|
| 2333.60 | Av | V | 90 | 1.2 | 31.0 | 0.0 | 31.0 | 54.0 |
| 2333.60 | PK | V | 90 | 1.2 | 42.0 | 0.0 | 42.0 | |
| 2342.60 | Av | V | 100 | 1.3 | 32.3 | 0.0 | 32.3 | 54.0 |
| 2342.60 | PK | V | 100 | 1.3 | 41.1 | 0.0 | 41.1 | |
| 2410.63 | Av | V | 90 | 1.2 | 90.2 | 0.0 | 90.2 | Fundamental |
| 2410.63 | PK | V | 90 | 1.2 | 98.1 | 0.0 | 98.1 | |
| 4822.50 | Av | H | 80 | 1.0 | 28.4 | 14.3 | 42.7 | 54.0 |
| 4822.50 | PK | H | 80 | 1.0 | 40.3 | 14.3 | 54.6 | |
| 7238.50 | Av | H | 90 | 1.0 | 32.7 | 20.3 | 53.0 | 54.0 |
| 7238.50 | PK | H | 90 | 1.0 | 45.2 | 20.3 | 65.5 | |
| 9648.00 | Av | H | 90 | 1.0 | 32.3 | | NF | 54.0 |
| 9648.00 | PK | H | 90 | 1.0 | 43.0 | | NF | |
| 12060.00 | Av | H | 90 | 1.0 | 35.4 | | NF | 54.0 |
| 12060.00 | PK | H | 90 | 1.0 | 47.1 | | NF | |

AVERAGE: RES. =1 MHz, VID= 10Hz; NF = NOISE FLOOR

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

SIGNATURE

JULY 30, 2001
 DATE OF TEST



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TABLE 10-2: 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) |
|----------------------------|---------------|------------------------|-------------------------|--------------------|-------------------------|-------------------------------|-------------------------|----------------|
| 2437.00 | AV | V | 95 | 1.5 | 89.9 | 0.0 | 89.9 | Fundamental |
| 2437.00 | PK | V | 95 | 1.5 | 98.6 | 0.0 | 98.6 | |
| 4872.00 | AV | V | 95 | 1.0 | 27.1 | 14.3 | 41.4 | 54.0 |
| 4872.00 | PK | V | 95 | 1.0 | 39.1 | 14.3 | 53.4 | |
| 7401.50 | AV | H | 10 | 1.0 | 33.5 | 20.3 | 53.8 | 54.0 |
| 7401.50 | PK | H | 10 | 1.0 | 45.3 | 20.3 | 65.6 | |
| 97512.00 | AV | H | 10 | 1.0 | 32.1 | | NF | 54.0 |
| 97512.00 | PK | H | 10 | 1.0 | 43.5 | | NF | |
| 12185.00 | AV | H | 10 | 1.0 | 35.4 | | NF | 54.0 |
| 12185.00 | PK | H | 10 | 1.0 | 46.5 | | NF | |

AVERAGE: RES. =1 MHz, VID= 10HZ; NF = NOISE FLOOR

TEST PERSONNEL:

RACHID SEHB
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TABLE 10-3: 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) |
|--------------------------|---------------|------------------------|-------------------------|--------------------|-------------------------|-------------------------------|-------------------------|----------------|
| 2351.60 | Av | V | 90 | 1.2 | 92.2 | 0.0 | 33.6 | 54.0 |
| 2351.60 | PK | V | 90 | 1.2 | 101.1 | 0.0 | 44.7 | |
| 2462.25 | Av | V | 270 | 1.2 | 33.6 | 0.0 | 92.2 | FUNDAMENTAL |
| 2462.25 | PK | V | 270 | 1.2 | 44.7 | 0.0 | 101.1 | |
| 4929.37 | Av | H | 90 | 1.0 | 28.0 | 14.3 | 42.3 | 54.0 |
| 4929.37 | PK | H | 90 | 1.0 | 37.7 | 14.3 | 52.0 | |
| 7394.07 | Av | H | 90 | 1.0 | 33.0 | 20.3 | 53.3 | 54.0 |
| 7394.07 | PK | H | 90 | 1.0 | 42.0 | 20.3 | 62.3 | |
| 9851,52 | Av | H | 90 | 1.0 | 33.6 | | NF | 54.0 |
| 9851,52 | PK | H | 135 | 1.0 | 43.8 | | NF | |
| 12314,40 | Av | H | 90 | 1.0 | 36.5 | | NF | 54.0 |
| 12314,40 | PK | H | 90 | 1.0 | 47.8 | | NF | |

AVERAGE: RES. =1 MHz, VID= 10Hz; NF = NOISE FLOOR

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

SIGNATURE

JULY 30, 2001
 DATE OF TEST

TABLE 10-4: TEST EQUIPMENT USED FOR TESTING (RADIATED SPURIOUS EMISSIONS)

| 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 |



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11 FCC PART 15 §15.247(D) POWER SPECTRAL DENSITY

The Power spectral density per FCC 15.247(d) was measured from the antenna port of the EUT using a 50 ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 3kHz, and the sweep time set at 17 second. The spectral lines were resolved for the modulated carriers at 2.410GHz, 2.437GHz and 2.463GHz respectively. These levels are well below the +8 dBm limit. See power spectral density table and plots.

TABLE 11-1: FCC PART 15 §15.247(D) POWER SPECTRAL DENSITY

| Channel | Power Spectral Density limit = +8dBm |
|---------|--------------------------------------|
| 1 | -1.2 |
| 6 | -1.3 |
| 11 | -2.2 |

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

SIGNATURE

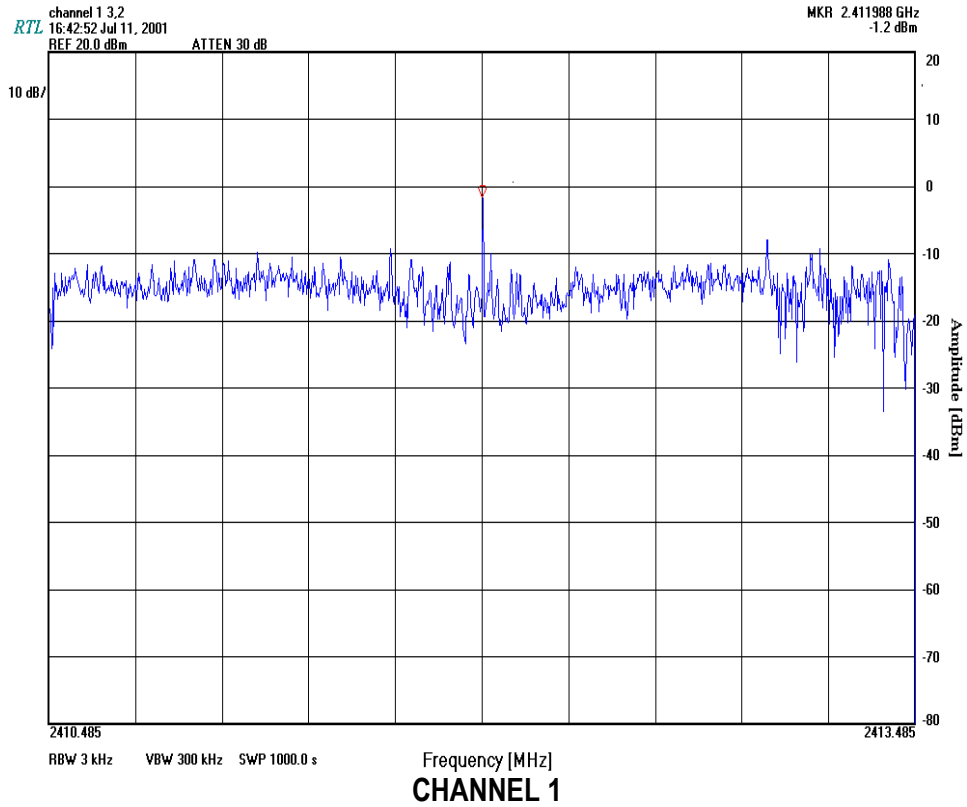
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12 SPECTRAL DENSITY PLOTS



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PLOT 12-1: FCC PART 15 §15.247(D) POWER SPECTRAL DENSITY: CHANNEL 1



TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

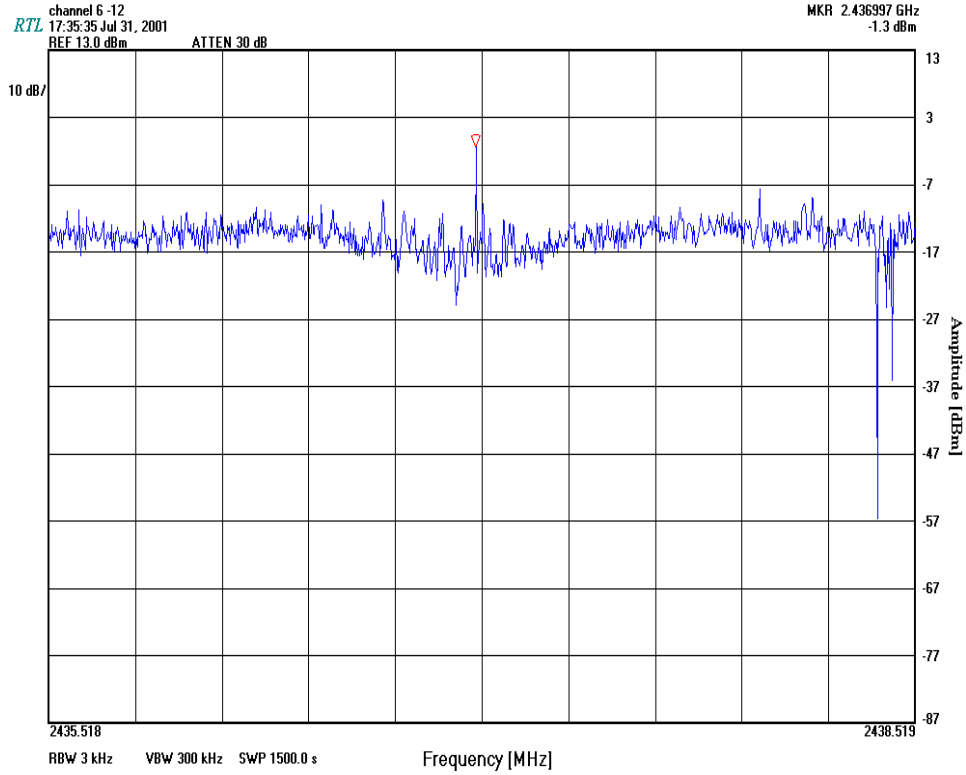
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PLOT 12-2: FCC PART 15 §15.247(D) POWER SPECTRAL DENSITY: CHANNEL 6



TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

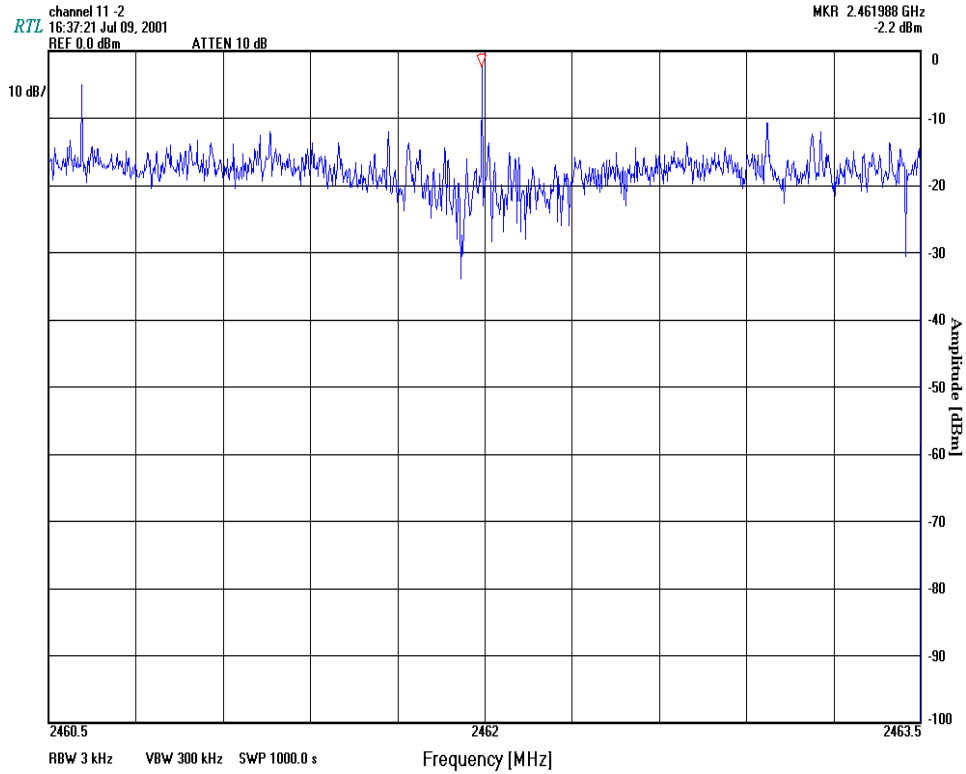
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PLOT 12-3: FCC PART 15 §15.247(D) POWER SPECTRAL DENSITY: CHANNEL 11



TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

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 DATE OF TEST

TABLE 12-1: 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 |



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13 FCC PART 15 §15.205 COMPLIANCE WITH THE RESTRICTED BAND EDGE

Compliance with the band edges was performed using the FCC's "Radiated Measurement at a Band Edge" guidance document. The final data derived below were from radiated measurements 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.

| Channel Set to | Frequency tested MHz | Detector | Field Strength Level (dBµV/m) | FCC Limit (dBµV/m) | FCC Margin (dB) |
|----------------|----------------------|----------|-------------------------------|--------------------|-----------------|
| 1 | 2390.0 | AV | 32.3 | 54.0 | -21.3 |
| | | PK | 45.4 | | |
| 11 | 2483.5 | AV | 35.7 | 54.0 | -18.3 |
| | | PK | 47.5 | | |

TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

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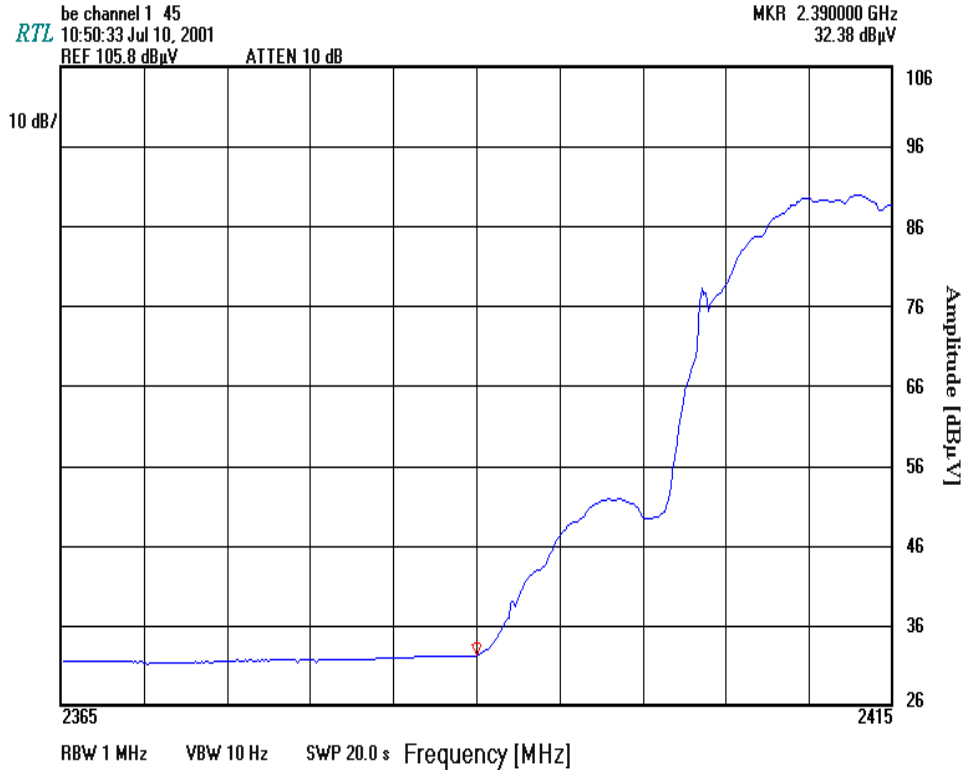
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PLOT 13-1:
 10HZ)

FCC PART 15 §15.205 BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 (RBW 1MHZ/VBW



TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

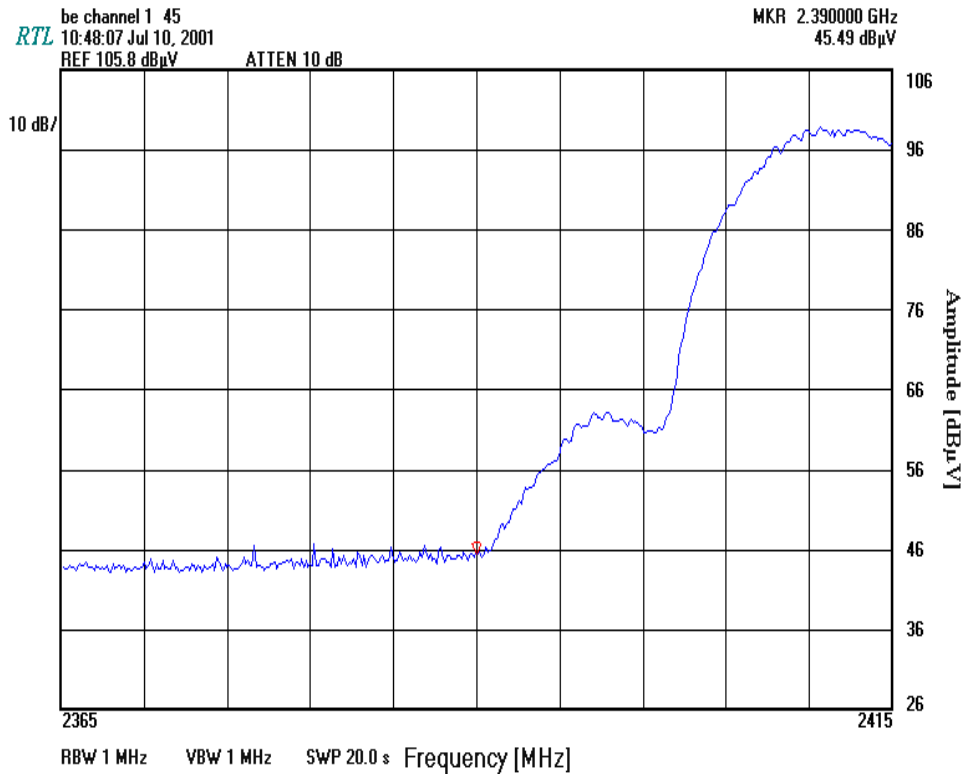
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PLOT 13-2: FCC PART 15 §15.205 BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 (RBW 1MHZ/VBW 1MHZ)



TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

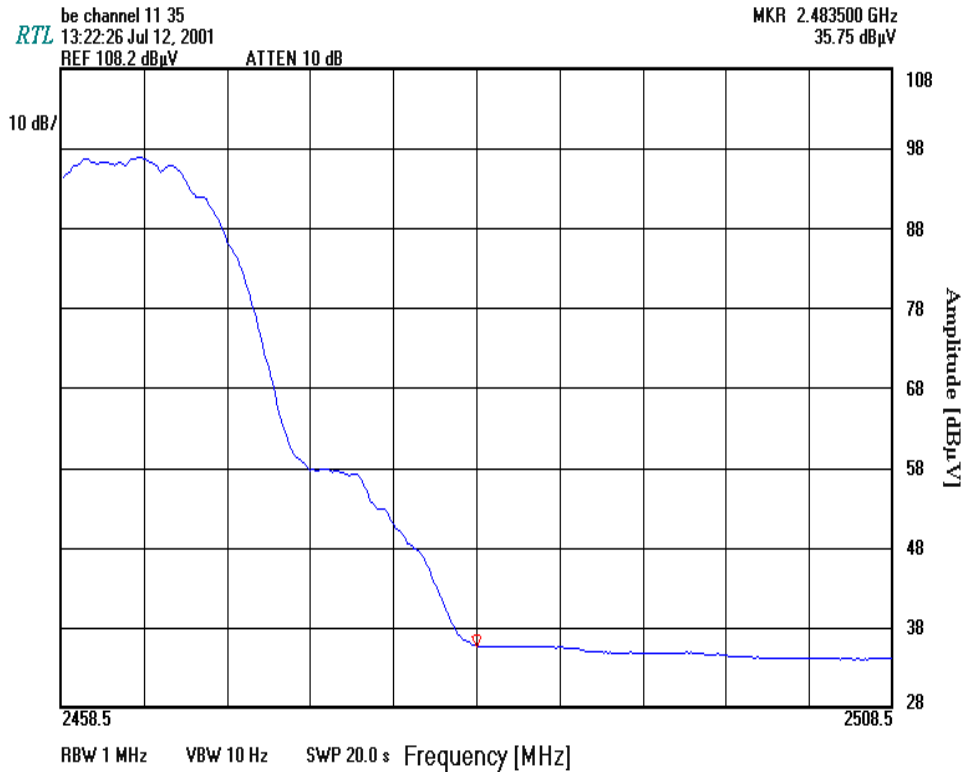
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PLOT 13-3: FCC PART 15 §15.205 BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 (RBW 1MHZ/VBW 10HZ)



TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

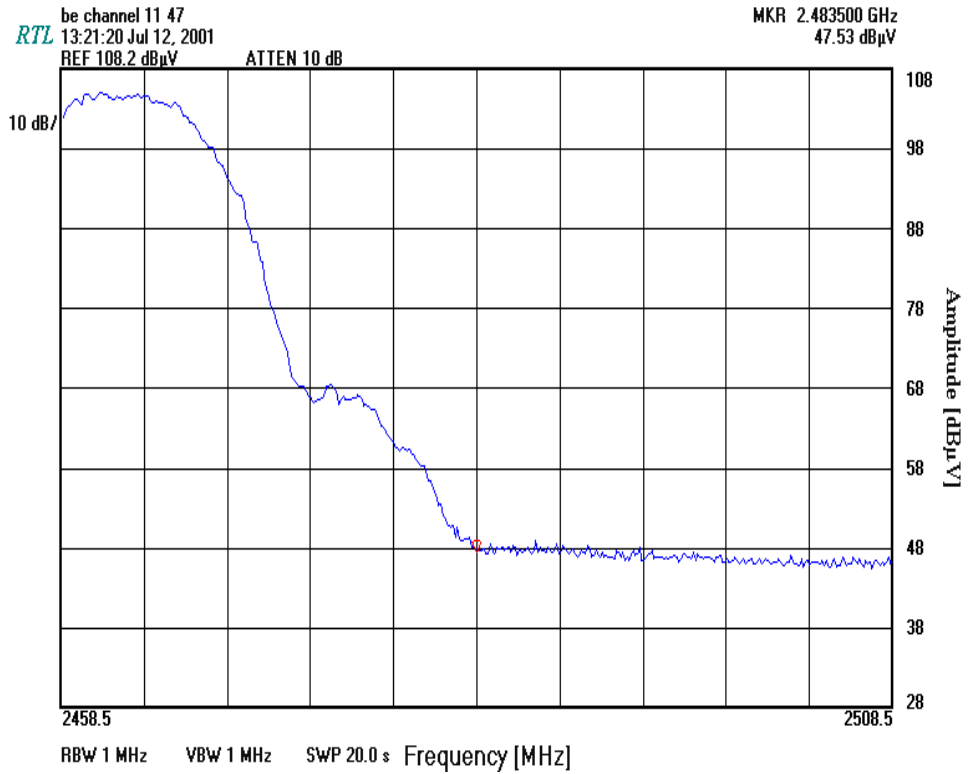
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PLOT 13-4: FCC PART 15 §15.205 BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 (RBW 1MHZ/VBW 1MHZ)



TEST PERSONNEL:

RACHID SEHB
 TEST TECHNICIAN/ENGINEER

SIGNATURE

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 DATE OF TEST