

Nemko Test Report: 4L0521RUS1Rev1

Applicant: Siemens Subscriber Networks
4849 Alpha Road
Dallas, TX 75244

**Equipment Under Test:
(E.U.T.)** Speedstream 6520 (unit tested)
Speedstream 6515 (variant)

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Direct Sequence Spread Spectrum Transmitters

Tested By: Nemko Dallas Inc.
802 N. Kealy
Lewisville, Texas 75057-3136

Authorized By: 
David Light, Lab Resource Manager

Date: 10/26/04

Total Number of Pages: 50

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EQUIPMENT: Speedstream 6520 and 6515

Section 1. Summary of Test Results

Manufacturer: Siemens Subscriber Networks
Model No.: Speedstream 6520 (unit tested)
Speedstream 6515 (variant)
Serial No.: None

REMARKS:

This report contains the test results for the Siemens Subscribers Networks Model Speedstream 6520/ Speedstream 6515. Power was provided by an external power adapter.

Model No's: Part No's:
Speedstream 6520 060-N650-Axx
Speedstream 6515 060-N550-Axx

The Speedstream 6520 is the base model. Model Speedstream 6515 is identical except that the USB is removed.

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.247 for Direct Sequence Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

- | | | | |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission | <input type="checkbox"/> | Production Unit |
| <input type="checkbox"/> | Class II Permissive Change | <input checked="" type="checkbox"/> | Pre-Production Unit |

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. NONE



NVLAP LAB CODE: 100426-0

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Summary Of Test Data

| NAME OF TEST | PARA. NO. | SPEC. | RESULT |
|---|--------------|-------------------------------------|----------|
| Powerline Conducted Emissions | 15.207(a) | 48 dB μ V | Complies |
| Minimum 6 dB Bandwidth | 15.247(a)(2) | >500 kHz | Complies |
| Maximum Peak Power Output | 15.247(b)(1) | <1 Watt | Complies |
| Spurious Emissions (Antenna Conducted) | 15.247(c) | -20 dBc/100kHz | Complies |
| Spurious Emissions (Restricted Bands) | 15.247(c) | < 74 dBuV/m Peak < 54 dBuV/m Avg | Complies |
| Peak Power Spectral Density | 15.247(d) | +8 dBm/3kHz | Complies |

Footnotes:

The device operates with either a maximum data rate of 11 Mbps (802.11b) or 54 Mbps (802.11g). It was determined that 802.11g mode represents worst-case operation. Data in this report is worst-case data with the device operating in the 802.11g mode.

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Band:

- 902 – 928 MHz
 2400 – 2483.5 MHz
 5725 – 5850 MHz

Channel Spacing:

5 MHz
Channels 1 - 11

User Frequency Adjustment:

Software controlled

EQUIPMENT CONFIGURATION LIST (HARDWARE/PERIPHERALS):

Place an "*" next to EUT and any item that is part of the EUT.

| Item | * | Generic Description | Manufacturer | Model No. | Serial # | Rev. | FCC ID Status ¹ |
|------|---|---------------------|----------------|---------------------|-------------|------|----------------------------|
| (A) | * | DSL Modem | Siemens | 6520 | 30-0610-004 | | |
| (B) | * | Power Supply | Hon-Kwang Elec | HKA-A15110 | | | |
| (C) | | ADSL Eval Module | TI | ATM25 Interface Mdl | B079783 | | |
| (D) | | | | | | | |
| (E) | | | | | | | |
| (F) | | | | | | | |
| (G) | | | | | | | |
| (H) | | | | | | | |
| (I) | | | | | | | |
| (J) | | | | | | | |
| (K) | | | | | | | |
| (L) | | | | | | | |

¹ **FCC ID STATUS**

- 1. FCC DOC
- 2. FCC A/B Verification
- 3. None - (If performing FCC testing, contact lab manager)
- 4. Certification (include FCC ID in parenthesis)

INTER-CONNECTION CABLES:

Place an "*" next to EUT and any item that is part of the EUT.

| Item | * | Cable Type | Manufacturer | Ln (m) | Term ² | Shield | Qty. |
|------|---|-----------------|--------------|--------|-------------------|--------|------|
| (1) | | Telephone Cable | Generic | 5 | 1 | No | 1 |
| (2) | | | | | | | |
| (3) | | | | | | | |
| (4) | | | | | | | |
| (5) | | | | | | | |
| (6) | | | | | | | |
| (7) | | | | | | | |
| (8) | | | | | | | |
| (9) | | | | | | | |
| (10) | | | | | | | |
| (11) | | | | | | | |
| (12) | | | | | | | |
| (13) | | | | | | | |

² **TERMINATION**

- 1. Peripheral
- 2. Loopback
- 3. EUT
- 4. Resistive
- 5. Remote Equipment
- 6. Other _____

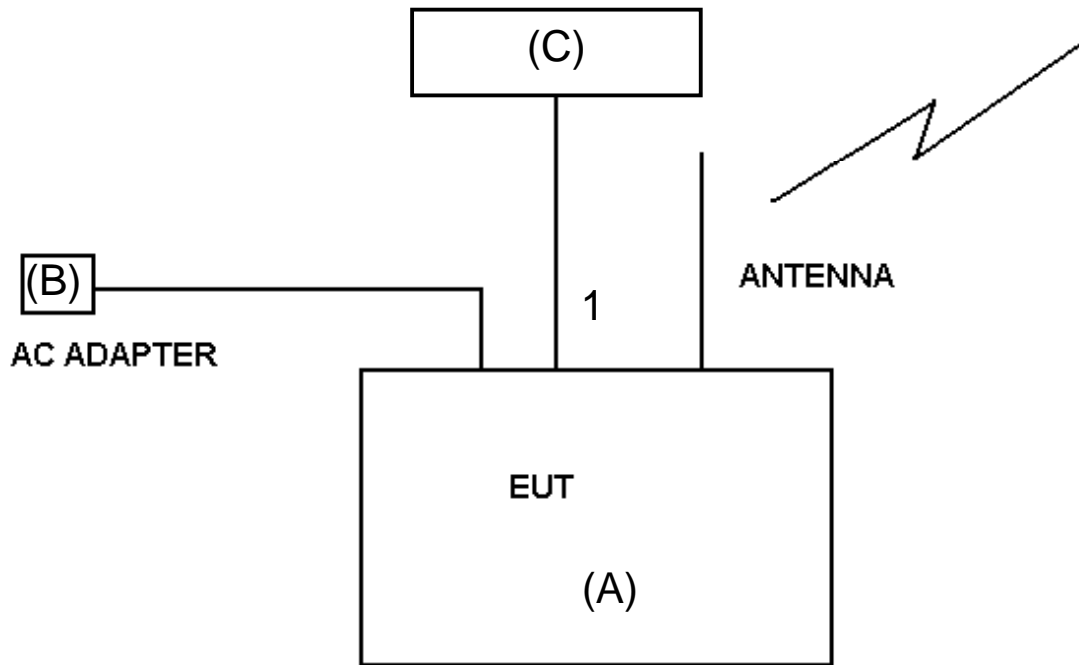
AC adapter specifications: 120 – 240 Vac Input, 12 Vdc Output, 1.25 A max.

EQUIPMENT: Speedstream 6520 and 6515

Description of EUT

The device is an ADSL/wireless 802.11 modem

System Diagram



Item C is a laptop computer (Dell Latitude Cpi model PPL, S/N. 0006692D with Power Supply PA-1700-05D, S/N. CN-D6G356), and Linksys model PCM200 ethernet card, S/N. A13A24402921

EQUIPMENT: Speedstream 6520 and 6515

Section 3. Powerline Conducted Emissions

| | |
|---|----------------------|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207(a) |
| TESTED BY: Eldon Berry | DATE: 8/9/04 |

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 1.7 dB

EQUIPMENT: Speedstream 6520 and 6515

Test Data – Powerline Conducted Emissions



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| Conducted Emissions | | | | | | | | | | | | | |
|-------------------------------|---|------------------|------------------------|--|--|--|--------------------------------------|-------------------------|--|--|--|------------|------------------------|
| Powerline Voltage Measurement | | | | | | | | | | | | | |
| Complete | <u> X </u> | | Job # : <u>4L0521E</u> | | | | | Test # : <u>CEPV-02</u> | | | | | |
| Preliminary | <u> </u> | | Page <u> 1 </u> | | | | | of <u> 1 </u> | | | | | |
| Client Name : | <u>Siemens Subscriber Networks</u> | | | | | | | | | | | | |
| EUT Name : | <u>Compact Wireless Gateway</u> | | | | | | | | | | | | |
| EUT Model # : | <u>060-N650-A01</u> | | | | | | | | | | | | |
| EUT Part # : | <u>None</u> | | | | | | | | | | | | |
| EUT Serial # : | <u>None</u> | | | | | | | | | | | | |
| EUT Config. : | <u>Connected to CO, Trained and communicating</u> | | | | | | | | | | | | |
| Specification : | <u>CFR 47, Part 15, Class B</u> | | | | | | Reference : <u>CISPR 22, Class B</u> | | | | | | |
| Transducer # : | <u> 969 </u> | Temp. (deg. C) : | <u> 23 </u> | | | | | | | | | Date : | <u>08/09/04</u> |
| HP Filter # : | <u> 1555 </u> | Humidity (%) : | <u> 44 </u> | | | | | | | | | Time : | <u>10:00</u> |
| Cable 1 # : | <u> 1506 </u> | EUT Voltage : | <u> 120 </u> | | | | | | | | | Staff : | <u>Eldon Berry</u> |
| Cable 2 # : | <u> 1019 </u> | EUT Frequency : | <u> 60 </u> | | | | | | | | | Location : | <u>Lab 2</u> |
| Detector 1 # : | <u> 966 </u> | Peak Bandwidth: | <u>10kHz</u> | | | | | | | | | Photo ID: | <u>4L0521E CEPV-02</u> |
| Detector 2 # : | <u> </u> | QP Bandwidth | <u>10kHz</u> | | | | | | | | | | |
| Limiter # : | <u> </u> | Avg. Bandwidth | <u>10kHz</u> | | | | | | | | | | |

| Meas. Freq. (MHz) | EUT Test Point | Detector Type (P,QP, A) | Limit Type (QP, A) | Meter Reading (dBuV) | Path Loss (dB) | Transducer Factor (dB) | Corrected Reading (dBuV) | Spec.limit (dBuV) | | CR/SL Diff. (dB) | Pass Fail Unc. | Comment |
|-------------------|----------------|-------------------------|--------------------|----------------------|----------------|------------------------|--------------------------|-------------------|--------|------------------|----------------|---------|
| | | | | | | | | Q.P. | Avg. | | | |
| 0.15 | Neut | QP | A | 49.5 | 0 | 0 | 49.5 | 66 | 56 | -6.5 | Pass | |
| 0.25 | Neut | QP | A | 46.0 | 0 | 0 | 46.0 | 61.76 | 51.757 | -5.8 | Pass | |
| 0.5 | Neut | QP | A | 35.5 | 0 | 0 | 35.5 | 56 | 46 | -10.5 | Pass | |
| 13.2 | Neut | QP | A | 29.0 | 0 | 0 | 29.0 | 60 | 50 | -21.0 | Pass | |
| 21.1 | Neut | QP | A | 27.5 | 0 | 0 | 27.5 | 60 | 50 | -22.5 | Pass | |
| 25.9 | Neut | QP | A | 28.5 | 0 | 0 | 28.5 | 60 | 50 | -21.5 | Pass | |
| | | | | | | | | | | | | |
| 0.15 | Line | QP | A | 49.5 | 0 | 0 | 49.5 | 66 | 56 | -6.5 | Pass | |
| 0.25 | Line | QP | A | 45.5 | 0 | 0 | 45.5 | 61.76 | 51.757 | -6.3 | Pass | |
| 0.5 | Line | QP | A | 33.5 | 0 | 0 | 33.5 | 56 | 46 | -12.5 | Pass | |
| 13.2 | Line | QP | A | 26.0 | 0 | 0 | 26.0 | 60 | 50 | -24.0 | Pass | |
| 21.1 | Line | QP | A | 28.5 | 0 | 0 | 28.5 | 60 | 50 | -21.5 | Pass | |
| 25.9 | Line | QP | A | 30.0 | 0 | 0 | 30.0 | 60 | 50 | -20.0 | Pass | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

..\EMCShare\AUTOMATED\DATASHTS\CEPV_Voltage Rev C.xl: Document Control #EMC DS EM COND VOLT

EQUIPMENT: Speedstream 6520 and 6515

Photos – Powerline Conducted Emissions

Front



Side



EQUIPMENT: [Speedstream 6520 and 6515](#)

Section 4. Minimum 6 dB Bandwidth

| | |
|--------------------------------------|-------------------------|
| NAME OF TEST: Minimum 6 dB Bandwidth | PARA. NO.: 15.247(a)(2) |
| TESTED BY: Brian Boyea | DATE: 8/31/04 |

Test Results: Complies.

Measurement Data: See 6 dB BW plots
Measured 6 dB bandwidth: 16.6 MHz Max
Channel Separation: 5 MHz

Test Data – Occupied Bandwidth



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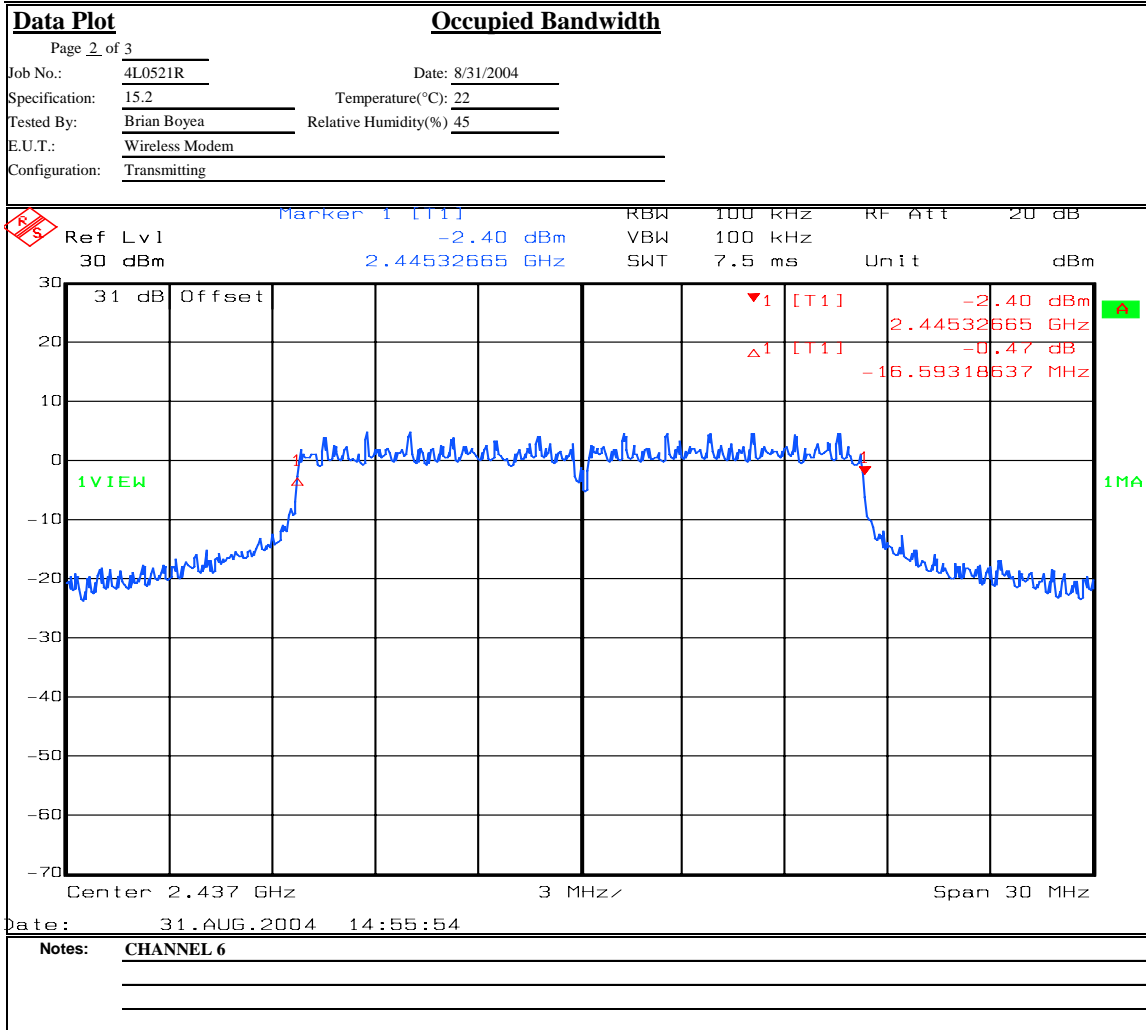
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| Data Plot | | Occupied Bandwidth | | Complete <u> X </u> | | | | | | | | | | | | | | | | | | | |
|--|----------------|-----------------------|-----------|--------------------------------|----------|---------|--------|-----|---------|--------|-------|--|-----------|--|--------|--|--|--|----------------|--|--------|--|----------|
| Page <u>1</u> of <u>3</u> | | | | Preliminary: <u> </u> | | | | | | | | | | | | | | | | | | | |
| Job No.: | 4L0521R | Date: | 8/31/2004 | | | | | | | | | | | | | | | | | | | | |
| Specification: | 15.247 | Temperature(°C): | 22 | | | | | | | | | | | | | | | | | | | | |
| Tested By: | Brian Boyea | Relative Humidity(%): | 45 | | | | | | | | | | | | | | | | | | | | |
| E.U.T.: | Wireless Modem | | | | | | | | | | | | | | | | | | | | | | |
| Configuration: | Transmitting | | | | | | | | | | | | | | | | | | | | | | |
| Sample Number: | _____ | | | | | | | | | | | | | | | | | | | | | | |
| Location: | Lab 1 | RBW: | 100 kHz | Measurement | | | | | | | | | | | | | | | | | | | |
| Detector Type: | Peak | VBW: | 100 kHz | Distance: | _____ m | | | | | | | | | | | | | | | | | | |
| Test Equipment Used | | | | | | | | | | | | | | | | | | | | | | | |
| Antenna: | _____ | Directional Coupler: | _____ | | | | | | | | | | | | | | | | | | | | |
| Pre-Amp: | _____ | Cable #1: | 1081 | | | | | | | | | | | | | | | | | | | | |
| Filter: | _____ | Cable #2: | _____ | | | | | | | | | | | | | | | | | | | | |
| Receiver: | 1036 | Cable #3: | _____ | | | | | | | | | | | | | | | | | | | | |
| Attenuator #1: | 1477 | Cable #4: | _____ | | | | | | | | | | | | | | | | | | | | |
| Attenuator #2: | 1065 | Mixer: | _____ | | | | | | | | | | | | | | | | | | | | |
| Additional equipment used: | _____ | | | | | | | | | | | | | | | | | | | | | | |
| Measurement Uncertainty: | +/-1.7 dB | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%; text-align: center;">Ref Lvl</td> <td style="width:35%; text-align: center;">30 dBm</td> <td style="width:15%; text-align: center;">RBW</td> <td style="width:15%; text-align: center;">100 kHz</td> <td style="width:15%; text-align: center;">RF Att</td> <td style="width:20%; text-align: center;">20 dB</td> </tr> <tr> <td></td> <td style="text-align: center;">-2.22 dBm</td> <td></td> <td style="text-align: center;">10 MHz</td> <td></td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;">2.42032665 GHz</td> <td></td> <td style="text-align: center;">7.5 ms</td> <td></td> <td style="text-align: center;">Unit dBm</td> </tr> </table> | | | | | | Ref Lvl | 30 dBm | RBW | 100 kHz | RF Att | 20 dB | | -2.22 dBm | | 10 MHz | | | | 2.42032665 GHz | | 7.5 ms | | Unit dBm |
| Ref Lvl | 30 dBm | RBW | 100 kHz | RF Att | 20 dB | | | | | | | | | | | | | | | | | | |
| | -2.22 dBm | | 10 MHz | | | | | | | | | | | | | | | | | | | | |
| | 2.42032665 GHz | | 7.5 ms | | Unit dBm | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| Date: 31.AUG.2004 13:22:21 | | | | | | | | | | | | | | | | | | | | | | | |
| Notes: CHANNEL 1 | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |



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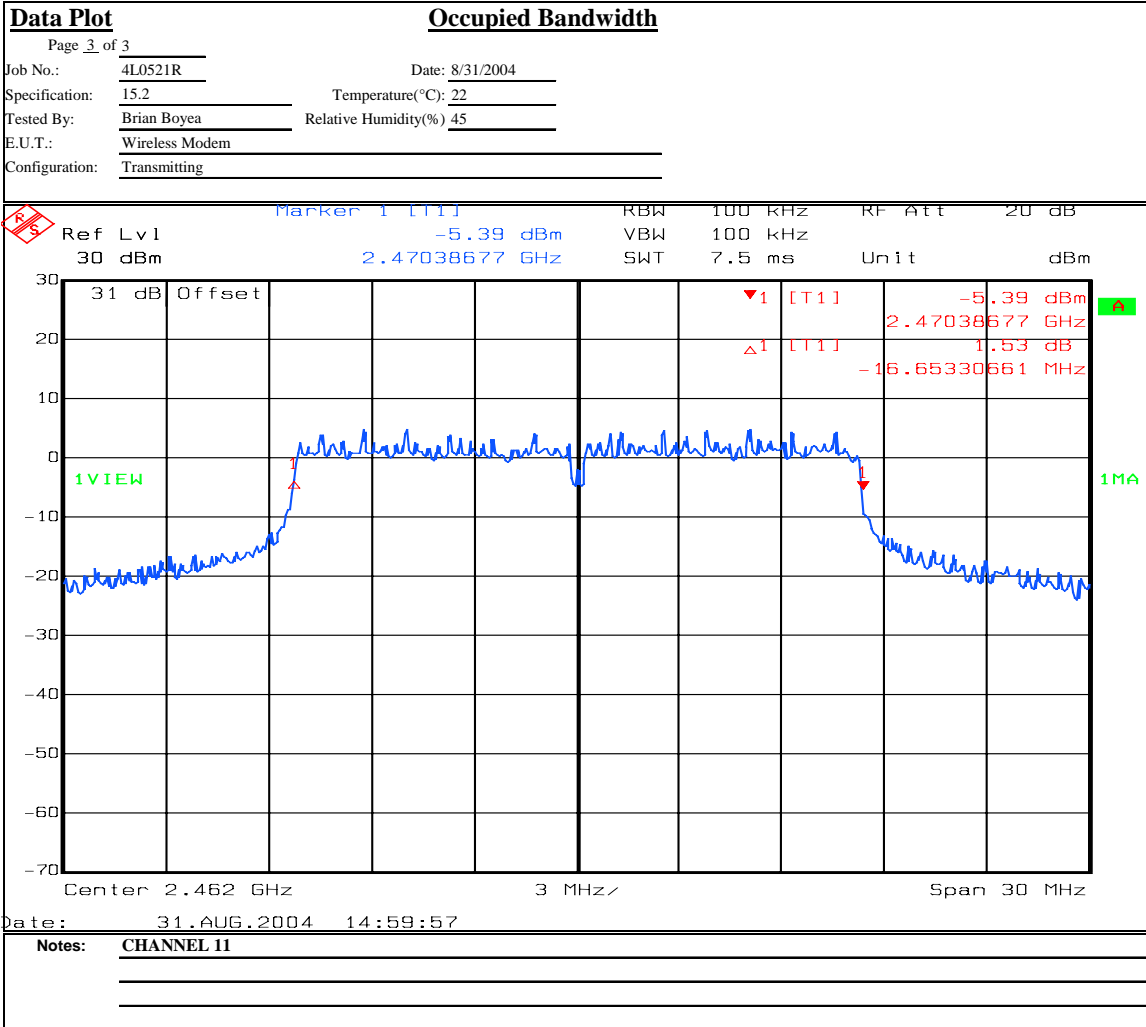
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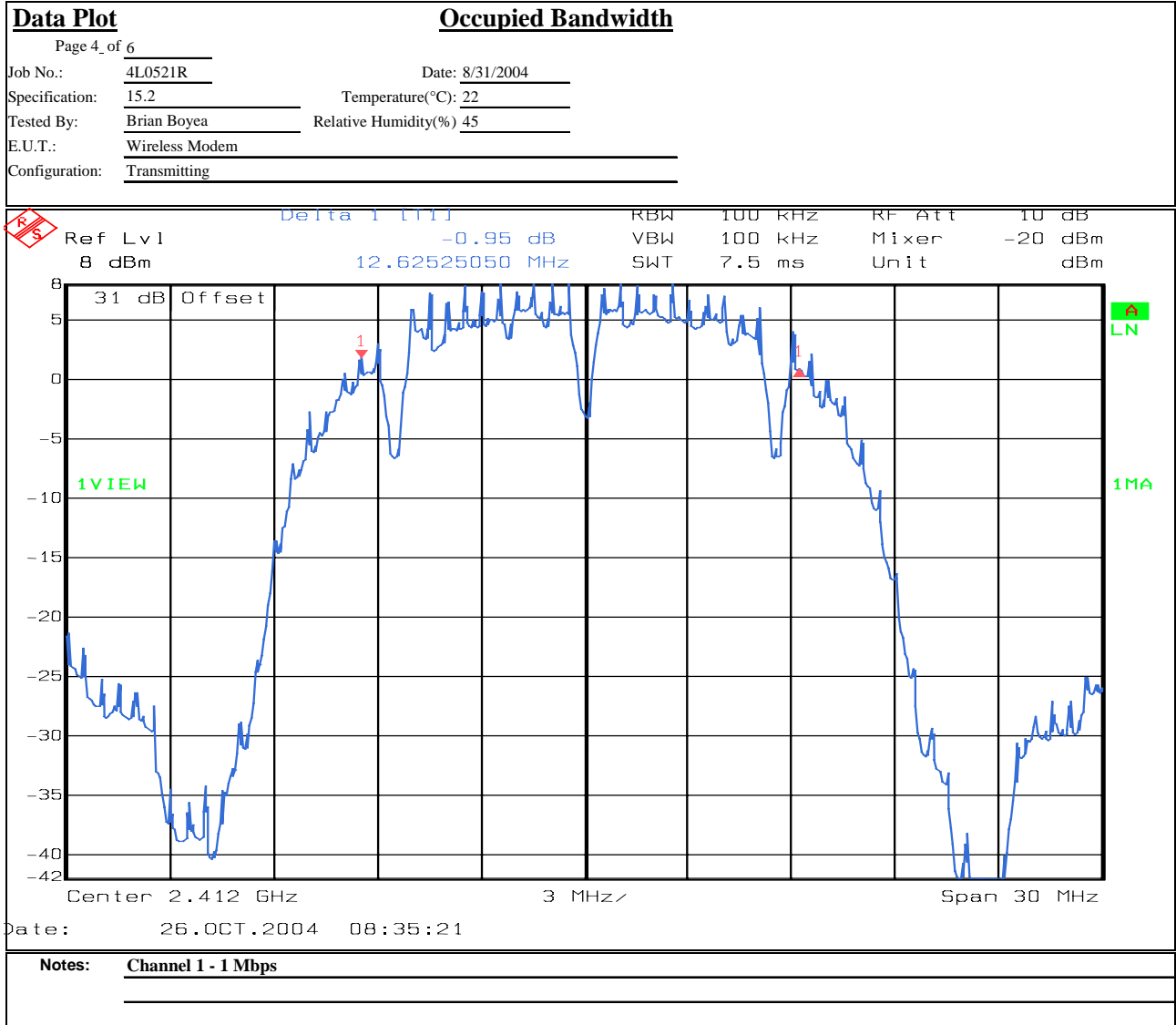




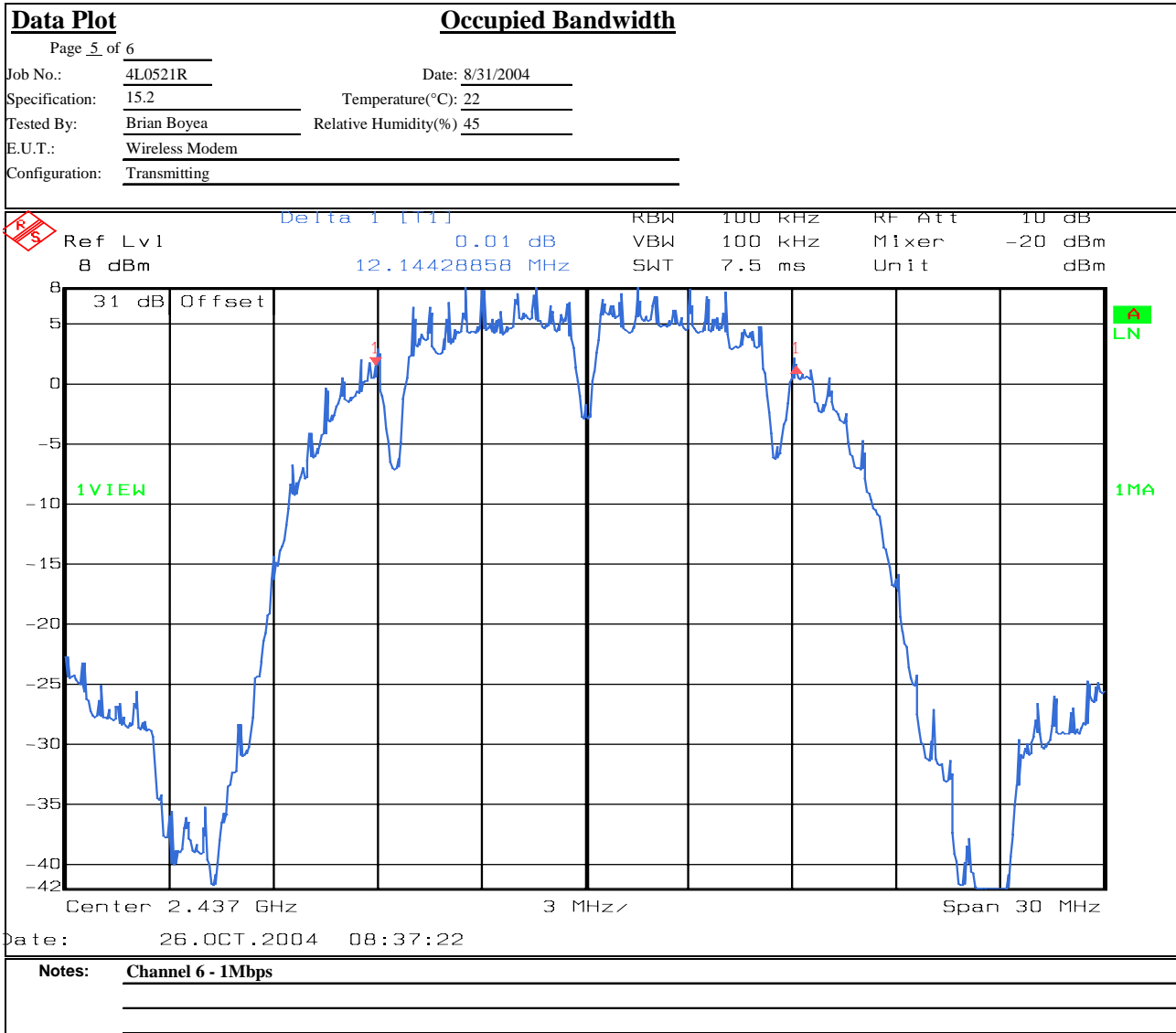
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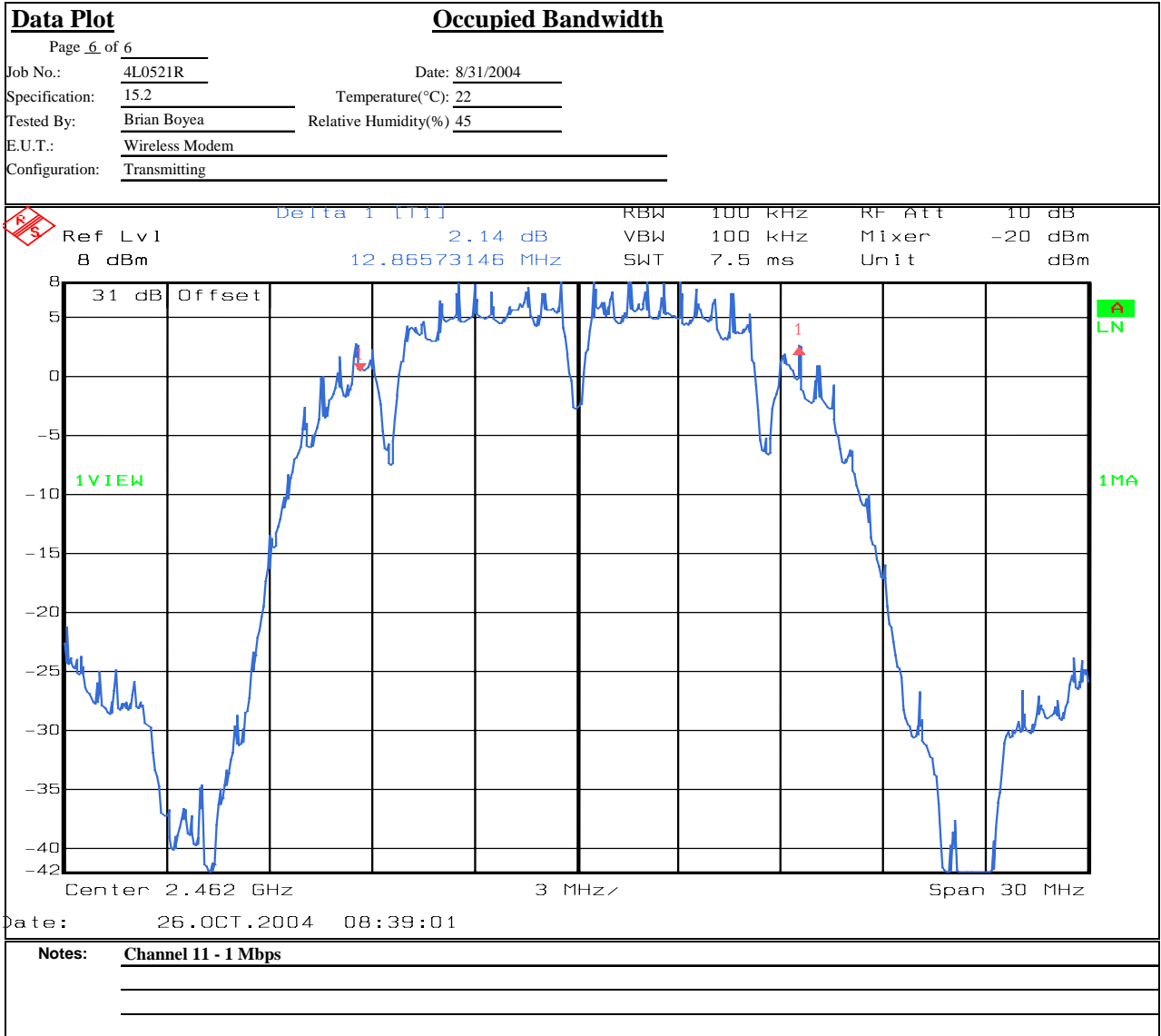




Test Data – Occupied Bandwidth



Test Data – Occupied Bandwidth



Section 5. Maximum Peak Output Power

| | |
|---|-------------------------|
| NAME OF TEST: Maximum Peak Output power | PARA. NO.: 15.247(b)(1) |
| TESTED BY: Brian Boyea | DATE: 8/31/04 |

Test Results: Complies.

Measurement Data:

Antennas:

| Frequency (MHz) | Conducted Power (dBm) | Antenna Type | Gain (dBi) | E.I.R.P. (dBm) |
|-----------------|-----------------------|--------------|------------|----------------|
| 2412 | 20.4 | Monopole | 2 | 22.4 |
| 2437 | 20.3 | Monopole | 2 | 22.3 |
| 2462 | 20.2 | Monopole | 2 | 22.2 |

Equipment Used: 1029, 1030, 1065, 1477, 1081

Measurement Uncertainty: +/- 0.7 dB

Temperature: °22C

Relative Humidity: 45%

Section 6. RF Exposure

| | |
|---------------------------|-------------------------|
| NAME OF TEST: RF Exposure | PARA. NO.: 15.247(b)(4) |
| TESTED BY: | DATE: |

Test Results: Complies.

Measurement Data:



Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4R^2}$$

where: S = power density
 P = power input to the antenna
 G = power gain of the antenna in the direction of interest relative to an isotropic radiator
 R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: 20.40 (dBm)
 Maximum peak output power at antenna input terminal: 109.6478 (mW)
 Antenna gain(typical): 2 (dBi)
 Maximum antenna gain: 1.584893 (numeric)
 Prediction distance: 20 (cm)
 Prediction frequency: 2400 (MHz)
 MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm²)
 Power density at prediction frequency: 0.034572 (mW/cm²)

EQUIPMENT: Speedstream 6520 and 6515

Section 7. Spurious Emissions (conducted)

| | |
|--|----------------------|
| NAME OF TEST: Spurious Emissions (conducted) | PARA. NO.: 15.247(c) |
| TESTED BY: Brian Boyea | DATE: 8/31/04 |

Test Results: Complies.

Measurement Data: See attached plots.

Test Data – Spurious Emissions at Antenna Terminal



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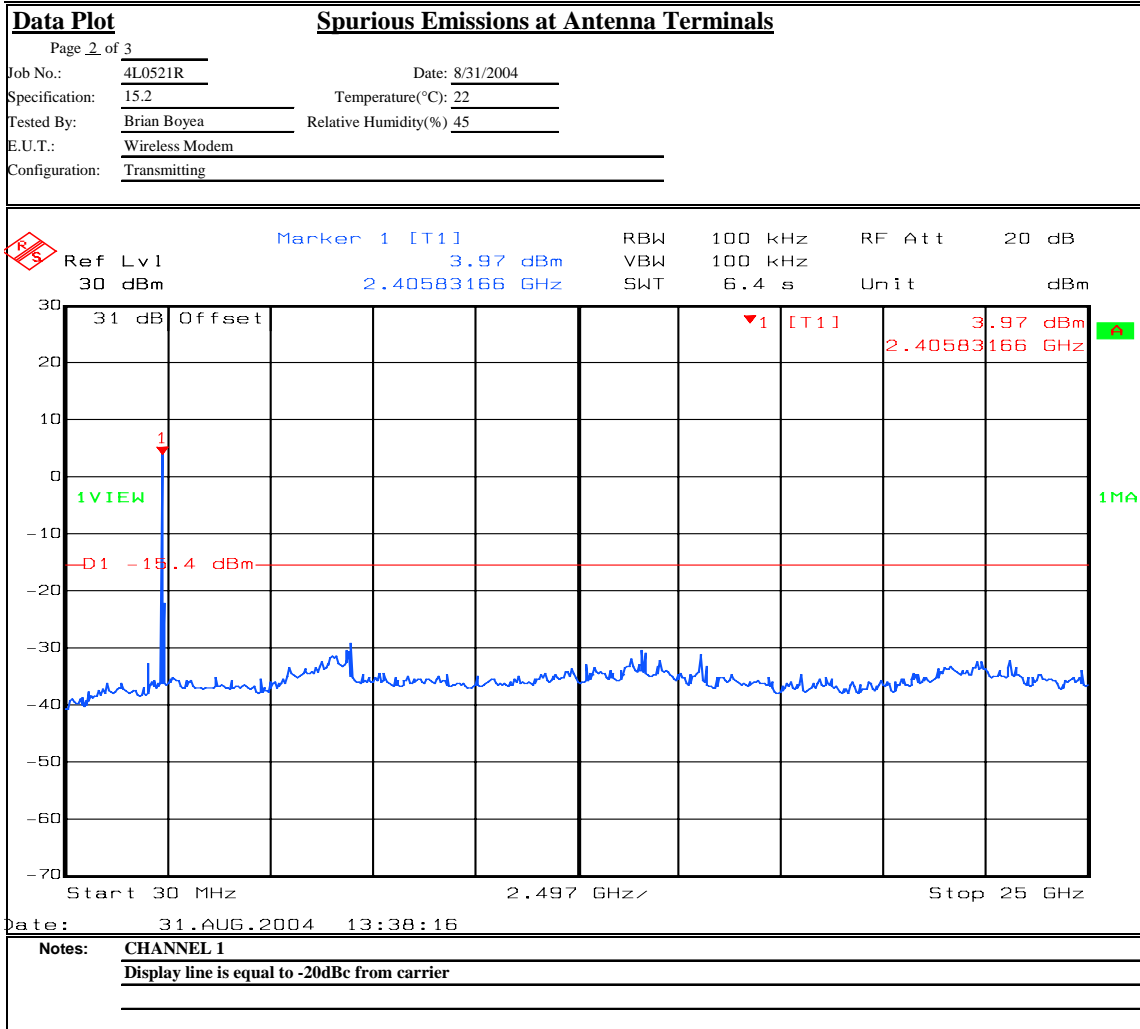
| Data Plot | | Spurious Emissions at Antenna Terminals | | | | | | | | | | | | | | | | | | | |
|---|----------------------------|---|---------|---------|--------------|-----|---------|--------|-------|--------|-----------|-----|---------|--|--|--|-----------------|-----|-------|------|-----|
| Page 1 of 3 | | Complete <u>X</u> | | | | | | | | | | | | | | | | | | | |
| Job No.: 4L0521R | Date: 8/31/2004 | Preliminary: _____ | | | | | | | | | | | | | | | | | | | |
| Specification: 15.247 | Temperature(°C): 22 | | | | | | | | | | | | | | | | | | | | |
| Tested By: Brian Boyea | Relative Humidity(%): 45 | | | | | | | | | | | | | | | | | | | | |
| E.U.T.: Wireless Modem | | | | | | | | | | | | | | | | | | | | | |
| Configuration: Transmitting | | | | | | | | | | | | | | | | | | | | | |
| Sample Number: _____ | | | | | | | | | | | | | | | | | | | | | |
| Location: Lab 1 | RBW: 100 kHz | Measurement | | | | | | | | | | | | | | | | | | | |
| Detector Type: Peak | VBW: 100 kHz | Distance: _____ m | | | | | | | | | | | | | | | | | | | |
| Test Equipment Used | | | | | | | | | | | | | | | | | | | | | |
| Antenna: _____ | Directional Coupler: _____ | | | | | | | | | | | | | | | | | | | | |
| Pre-Amp: _____ | Cable #1: 1081 | | | | | | | | | | | | | | | | | | | | |
| Filter: _____ | Cable #2: _____ | | | | | | | | | | | | | | | | | | | | |
| Receiver: 1036 | Cable #3: _____ | | | | | | | | | | | | | | | | | | | | |
| Attenuator #1: 1477 | Cable #4: _____ | | | | | | | | | | | | | | | | | | | | |
| Attenuator #2: 1065 | Mixer: _____ | | | | | | | | | | | | | | | | | | | | |
| Additional equipment used: _____ | | | | | | | | | | | | | | | | | | | | | |
| Measurement Uncertainty: +/-1.7 dB | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <tr> <td>Ref Lvl</td> <td>Delta 1 [T1]</td> <td>RBW</td> <td>100 kHz</td> <td>RF Att</td> <td>20 dB</td> </tr> <tr> <td>30 dBm</td> <td>-22.58 dB</td> <td>VBW</td> <td>100 kHz</td> <td></td> <td></td> </tr> <tr> <td></td> <td>-5.94589178 MHz</td> <td>SWT</td> <td>15 ms</td> <td>Unit</td> <td>dBm</td> </tr> </table> | | | | Ref Lvl | Delta 1 [T1] | RBW | 100 kHz | RF Att | 20 dB | 30 dBm | -22.58 dB | VBW | 100 kHz | | | | -5.94589178 MHz | SWT | 15 ms | Unit | dBm |
| Ref Lvl | Delta 1 [T1] | RBW | 100 kHz | RF Att | 20 dB | | | | | | | | | | | | | | | | |
| 30 dBm | -22.58 dB | VBW | 100 kHz | | | | | | | | | | | | | | | | | | |
| | -5.94589178 MHz | SWT | 15 ms | Unit | dBm | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| Date: 31.AUG.2004 13:34:23 | | | | | | | | | | | | | | | | | | | | | |
| Notes: CHANNEL 1 lower Bandedge | | | | | | | | | | | | | | | | | | | | | |

Test Data – Spurious Emissions at Antenna Terminal



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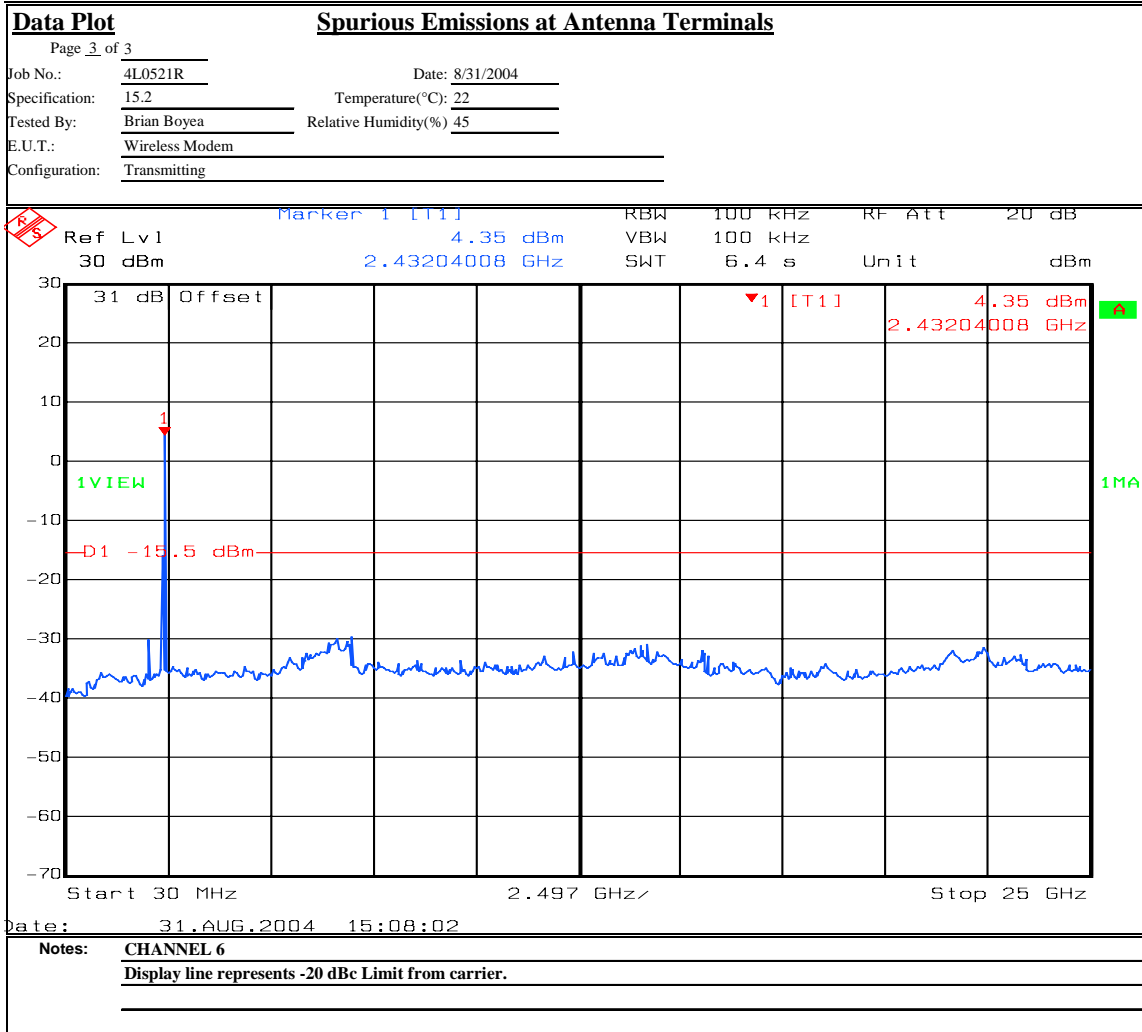


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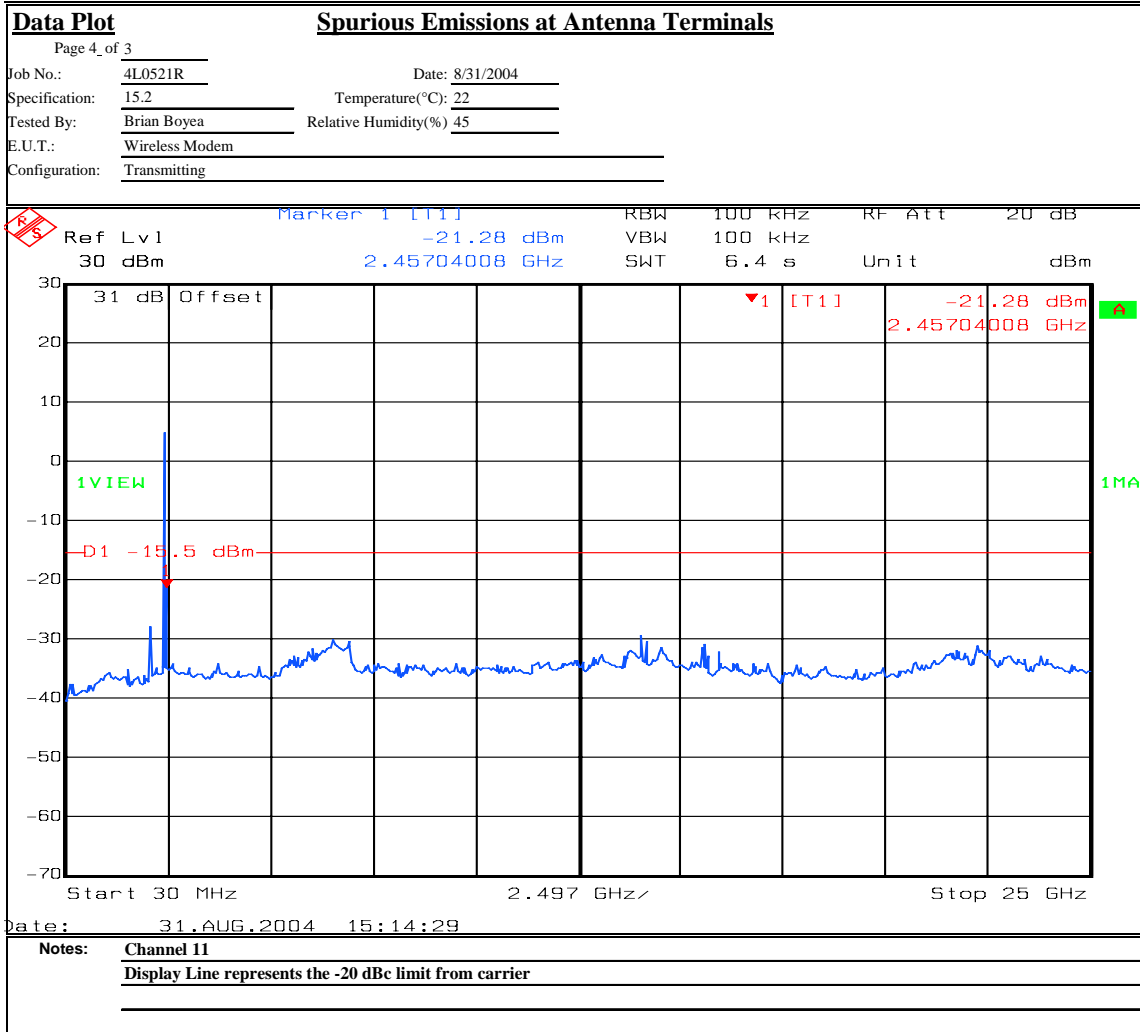


Test Data – Spurious Emissions at Antenna Terminal



Dallas Headquarters:
 802 N. Kealy
 Lewisville, TX 75057
 Tel: (972) 436-9600
 Fax: (972) 436-2667

Nemko Dallas, Inc.



Section 8. Radiated Emissions

| | |
|----------------------------------|-----------------------|
| NAME OF TEST: Radiated Emissions | PARA. NO.: 15.247 (c) |
| TESTED BY: Brian Boyea | DATE: 9/2/04 |

Test Results: Complies.

Measurement Data: See attached table.

Average measurements are taken with the RBW set to 1 MHz and VBW set to 10 Hz. If the Peak measured level meets the Average limit, the Average level is not reported.

Radiated Data

| Radiated Emissions | | | | | | | | |
|----------------------------|----------------------|----------------------|-----------------|-------------------|----------------------------|----------------|------------|----------------------|
| Page <u>1</u> of <u>2</u> | | | | | | | | |
| Job No.: | 4L0521R | Date: | 9/2/2004 | | | | | |
| Specification: | Temperature(°C): 23 | | | | | | | |
| Tested By: | Brian Boyea | Relative Humidity(%) | | 44 | | | | |
| E.U.T.: | _____ | | | | | | | |
| Configuration: | _____ | | | | | | | |
| Sample Number: | _____ | | | | | | | |
| Location: | AC 3 | RBW: | 1 MHz | | | | | |
| Detector Type: | Peak | VBW: | 1 MHz | | | | | |
| Test Equipment Used | | | | | | | | |
| Antenna: | 1304 | Directional Coupler: | #N/A | | | | | |
| Pre-Amp: | 1016 | Cable #1: | 1484 | | | | | |
| Filter: | #N/A | Cable #2: | 1485 | | | | | |
| Receiver: | 1464 | Cable #3: | #N/A | | | | | |
| Attenuator #1 | #N/A | Cable #4: | #N/A | | | | | |
| Attenuator #2: | #N/A | Mixer: | #N/A | | | | | |
| Additional equipment used: | _____ | | | | | | | |
| Measurement Uncertainty: | +/- .7 dB | | | | | | | |
| Frequency (GHz) | Meter Reading (dBuV) | Antenna Factor (dB) | Cable Loss (dB) | Pre-Amp Gain (dB) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Delta (dB) | Comment |
| 2.39 | 26 | 31.3 | 3.8 | 30 | 31.1 | 54 | -22.9 | Peak |
| 4.824 | 41.82 | 33.3 | 4.2 | 30.1 | 49.22 | 54 | -4.8 | |
| 12.0600 | 40.67 | 40.0 | 7.3 | 33.4 | 54.6 | 74 | -19.4 | |
| 12.0600 | 30.1 | 40.0 | 7.3 | 33.4 | 44.0 | 54 | -10.0 | |
| 14.472 | 38.55 | 41.7 | 7.2 | 30.6 | 56.9 | 74 | -17.2 | |
| 14.472 | 27.9 | 41.7 | 7.2 | 30.6 | 46.2 | 54 | -7.8 | Horizontal |
| 4.824 | 41.91 | 33.3 | 4.2 | 30.1 | 49.3 | 54 | -4.7 | |
| 12.0600 | 42.43 | 40.0 | 7.3 | 33.4 | 56.3 | 74 | -17.7 | |
| 12.0600 | 29.81 | 40.0 | 7.3 | 33.4 | 43.7 | 54 | -10.3 | |
| 14.472 | 38.83 | 41.7 | 7.2 | 30.6 | 57.1 | 74 | -16.9 | |
| 14.472 | 27.83 | 41.7 | 7.2 | 30.6 | 46.1 | 54 | -7.9 | Vertical Channel 1 |
| | | | | | | | | |
| 4.874 | 40.52 | 33.5 | 4.3 | 29.9 | 48.4 | 54 | -5.6 | |
| 7.311 | 39.2 | 36.1 | 5.2 | 34.2 | 46.3 | 54 | -7.7 | |
| 12.185 | 41.65 | 40.0 | 7.3 | 33.1 | 55.9 | 74 | -18.2 | |
| 12.185 | 30.73 | 40.0 | 7.3 | 33.1 | 44.9 | 54 | -9.1 | Vertical |
| 4.8740 | 43.22 | 33.5 | 4.3 | 29.9 | 51.1 | 54 | -2.9 | |
| 7.3110 | 39.61 | 36.1 | 5.2 | 34.2 | 46.7 | 54 | -7.3 | |
| 12.185 | 41.3 | 40.0 | 7.3 | 33.1 | 55.5 | 74 | -18.5 | |
| 12.1850 | 30.73 | 40.0 | 7.3 | 33.1 | 44.9 | 54 | -9.1 | Horizontal Channel 6 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Notes: | _____ | | | | | | | |

EQUIPMENT: Speedstream 6520 and 6515

Test Data - Radiated Emissions (continued)



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| | |
|------------------------------------|--------------------------------|
| <u>Radiated Spurious Emissions</u> | |
| Page <u>1</u> of <u>2</u> | Continuation Page |
| Job No.: 4L0521R | Date: 9/8/2004 |
| Specification: CFR 47, Part 15 | Temperature(°F): <u>72</u> |
| Tested By: <u>Brian Boyea</u> | Relative Humidity(%) <u>50</u> |
| E.U.T.: _____ | 0 |
| Configuration: _____ | 0 |

| Frequency (GHz) | Meter Reading (dBuV) | Antenna Factor (dB) | Cable Loss (dB) | Pre-Amp Gain (dB) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Delta (dB) | Comment |
|-----------------|----------------------|---------------------|-----------------|-------------------|----------------------------|----------------|------------|---------------------|
| 4.924 | 43.5 | 33.7 | 4.3 | 29.7 | 51.8 | 54 | -2.2 | |
| 7.386 | 39.46 | 36.2 | 6.2 | 34.1 | 47.8 | 54 | -6.2 | |
| 12.31 | 41.38 | 39.9 | 7.3 | 32.8 | 55.8 | 74 | -18.2 | |
| 12.31 | 30.45 | 39.9 | 7.3 | 32.8 | 44.9 | 54 | -9.2 | Horizontal |
| 4.924 | 42.2 | 33.7 | 4.3 | 29.7 | 50.5 | 54 | -3.5 | |
| 7.386 | 39.05 | 36.2 | 6.2 | 34.1 | 47.4 | 54 | -6.7 | |
| 12.31 | 41.03 | 39.9 | 7.3 | 32.8 | 55.4 | 74 | -18.6 | |
| 12.31 | 30.39 | 39.9 | 7.3 | 32.8 | 44.8 | 54 | -9.2 | Vertical Channel 11 |
| | | | | | | | | |
| 2.4835 | 25.76 | 28.2 | 3.1 | | 57.1 | 74 | -16.9 | |
| 2.4835 | 13.34 | 28.2 | 3.1 | | 44.6 | 54 | -9.4 | Vertical Channel 11 |
| 2.4835 | 25.13 | 28.2 | 3.1 | | 56.4 | 74 | -17.6 | |
| 2.4835 | 13.0 | 28.2 | 3.1 | | 44.3 | 54 | -9.7 | Horizontal |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Notes:

The spectrum was searched to the 10th harmonic of carrier. All emissions within 20 dB of the spec limit were reported.

Radiated Photos



Section 9. Peak Power Spectral Density

| | |
|---|----------------------|
| NAME OF TEST: Peak Power Spectral Density | PARA. NO.: 15.247(d) |
| TESTED BY: Brian Boyea | DATE: 8/31/04 |

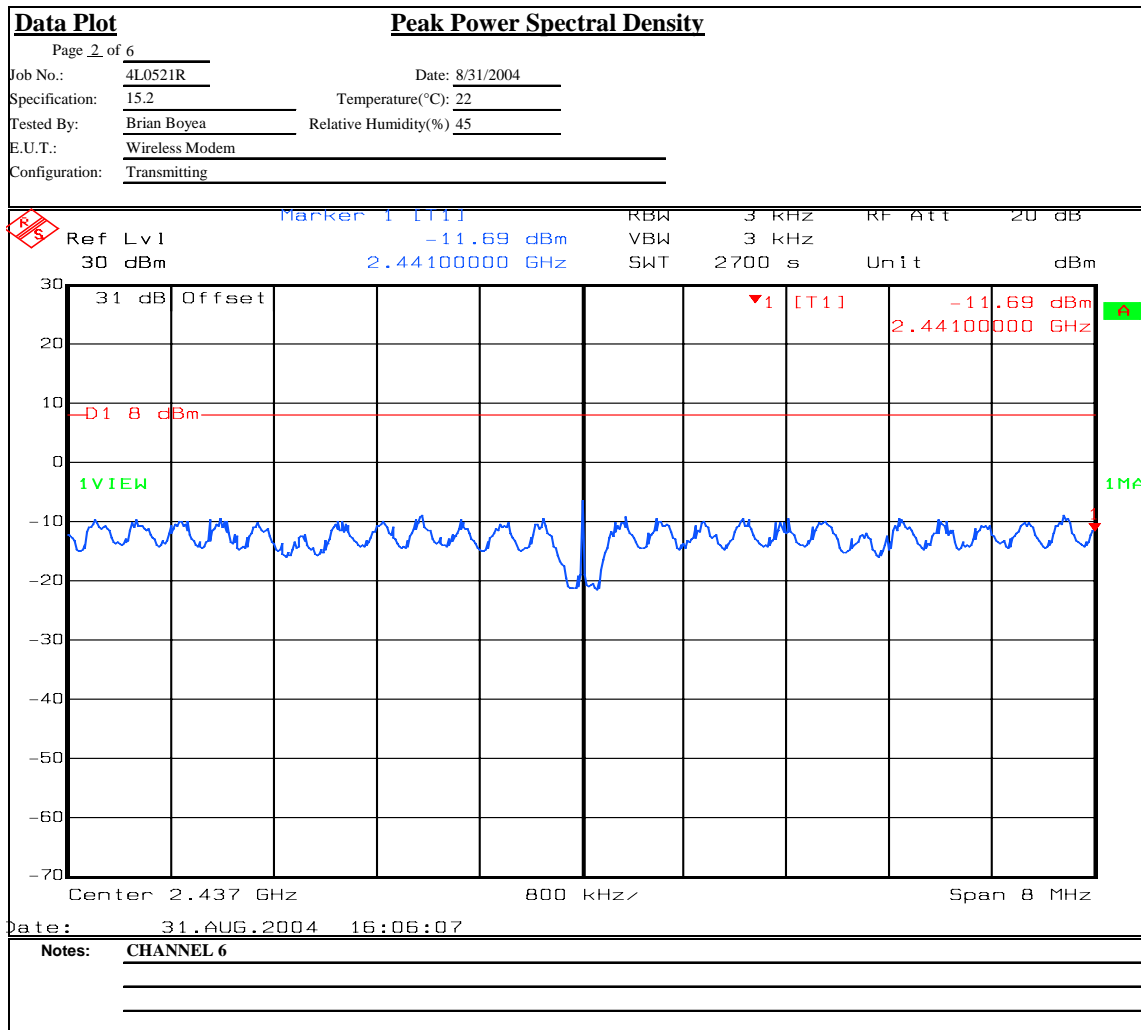
Test Results: Complies.

Measurement Data: See attached plots.

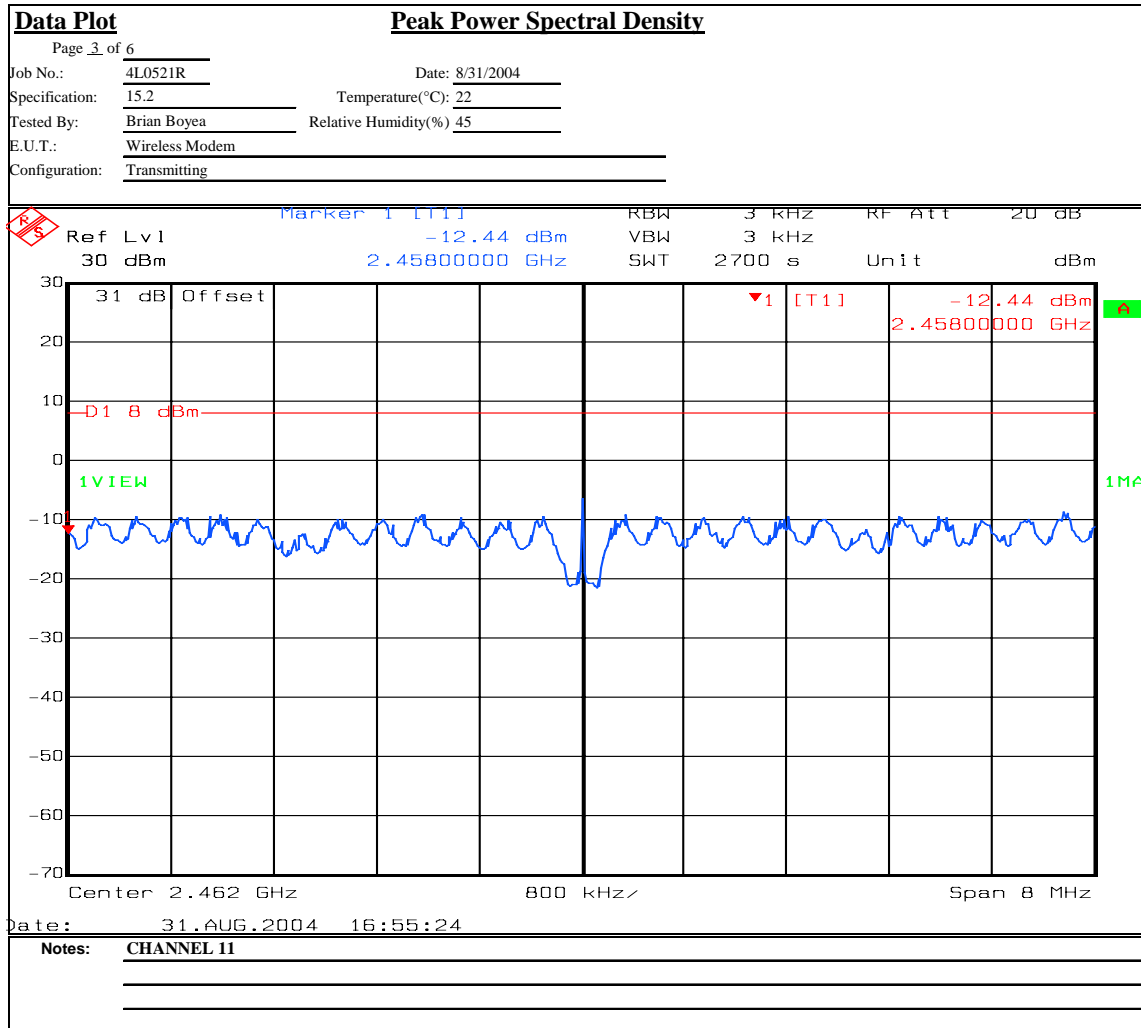
Test Data – Peak Power Spectral Density

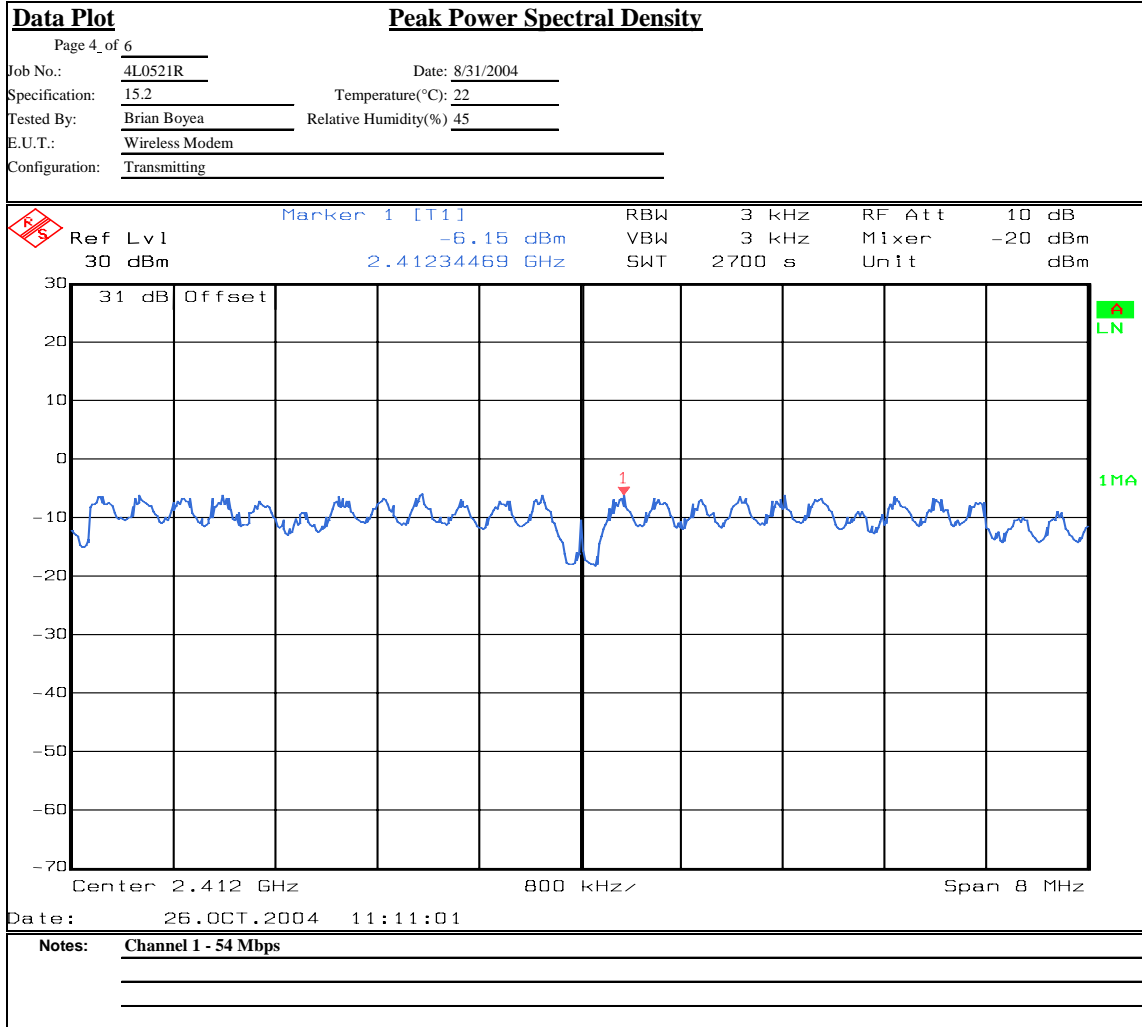
| <u>Data Plot</u> | | <u>Peak Power Spectral Density</u> | | | | | | | | | | |
|--|----------------------------|------------------------------------|--|----|-----------|--------------|----------------|-----------|----------|--|------------|--|
| Page 1 of 6 | | Complete <u> X </u> | | | | | | | | | | |
| Job No.: 4L0521R | Date: 8/31/2004 | Preliminary: _____ | | | | | | | | | | |
| Specification: 15.247 | Temperature(°C): 22 | | | | | | | | | | | |
| Tested By: Brian Boyea | Relative Humidity(%): 45 | | | | | | | | | | | |
| E.U.T.: Wireless Modem | _____ | | | | | | | | | | | |
| Configuration: Transmitting | _____ | | | | | | | | | | | |
| Sample Number: _____ | | | | | | | | | | | | |
| Location: Lab 1 | RBW: 3 kHz | Measurement | | | | | | | | | | |
| Detector Type: Peak | VBW: 3 kHz | Distance: _____ m | | | | | | | | | | |
| Test Equipment Used | | | | | | | | | | | | |
| Antenna: _____ | Directional Coupler: _____ | | | | | | | | | | | |
| Pre-Amp: _____ | Cable #1: 1081 | | | | | | | | | | | |
| Filter: _____ | Cable #2: _____ | | | | | | | | | | | |
| Receiver: 1036 | Cable #3: _____ | | | | | | | | | | | |
| Attenuator #1: 1477 | Cable #4: _____ | | | | | | | | | | | |
| Attenuator #2: 1065 | Mixer: _____ | | | | | | | | | | | |
| Additional equipment used: _____ | | | | | | | | | | | | |
| Measurement Uncertainty: +/-1.7 dB | | | | | | | | | | | | |
| <table border="0" style="width:100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; padding: 2px;">ES</td> <td style="padding: 2px;">RBW 3 kHz</td> <td style="padding: 2px;">RF Att 20 dB</td> </tr> <tr> <td style="padding: 2px;">Ref Lvl 30 dBm</td> <td style="padding: 2px;">VBW 3 kHz</td> <td style="padding: 2px;">Unit dBm</td> </tr> <tr> <td style="padding: 2px;"></td> <td style="padding: 2px;">SWT 2700 s</td> <td style="padding: 2px;"></td> </tr> </table> | | | | ES | RBW 3 kHz | RF Att 20 dB | Ref Lvl 30 dBm | VBW 3 kHz | Unit dBm | | SWT 2700 s | |
| ES | RBW 3 kHz | RF Att 20 dB | | | | | | | | | | |
| Ref Lvl 30 dBm | VBW 3 kHz | Unit dBm | | | | | | | | | | |
| | SWT 2700 s | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Center 2.412 GHz 800 kHz/ Span 8 MHz | | | | | | | | | | | | |
| Date: 31.AUG.2004 14:38:36 | | | | | | | | | | | | |
| Notes: CHANNEL 1 | | | | | | | | | | | | |
| _____ | | | | | | | | | | | | |
| _____ | | | | | | | | | | | | |
| _____ | | | | | | | | | | | | |

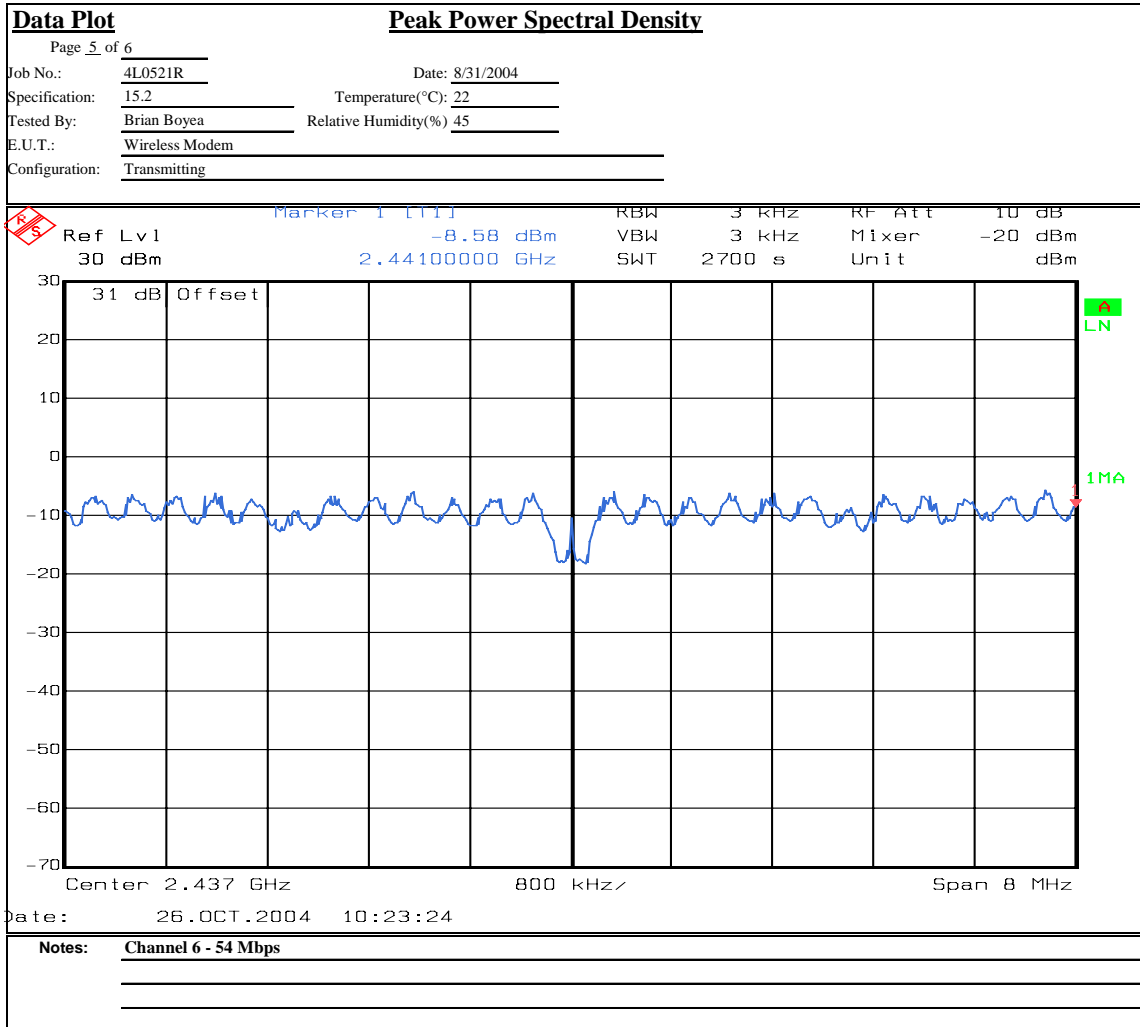
Test Data – Peak Power Spectral Density

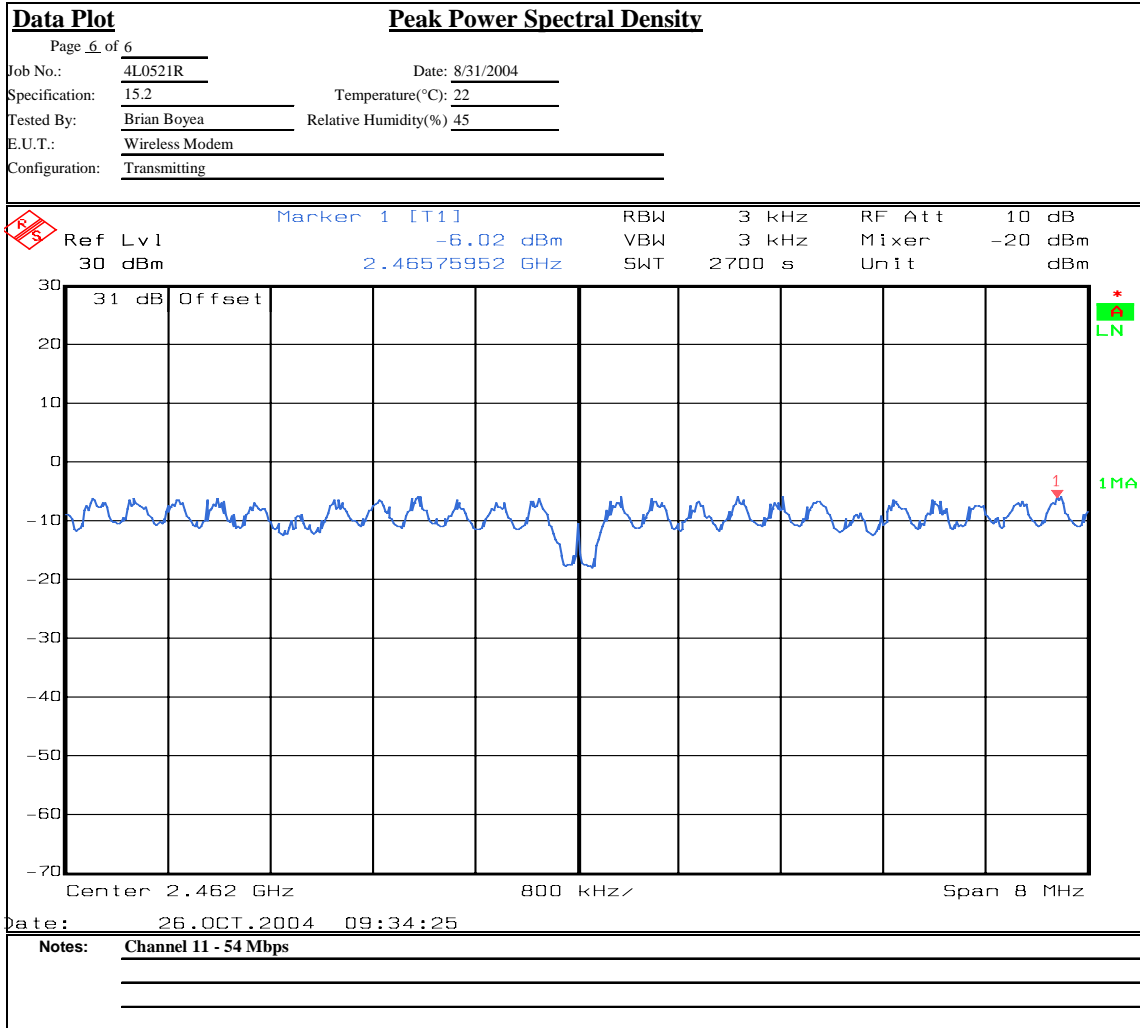


Test Data – Peak Power Spectral Density









Section 10. Test Equipment List

| Nemko ID | Description | Manufacturer Model Number | Serial Number | Calibration Date | Calibration Due |
|----------|---------------------------|------------------------------|---------------|------------------|-----------------|
| 1036 | SPECTRUM ANALYZER | ROHDE & SCHWARZ FSEK30 | 830844/006 | 03/22/04 | 03/23/06 |
| 1464 | Spectrum analyzer | Hewlett Packard 8563E | 3551A04428 | 07/30/04 | 07/31/06 |
| 1484 | Cable 2.0-18.0 Ghz | Storm PR90-010-072 | N/A | 08/26/04 | 08/26/05 |
| 1485 | Cable 2.0-18.0 Ghz | Storm PR90-010-216 | N/A | 08/02/04 | 08/02/05 |
| 1016 | Pre-Amp | HEWLETT PACKARD 8449A | 2749A00159 | 10/27/03 | 10/26/04 |
| 1304 | HORN ANTENNA | ELECTRO METRICS RGA-60 | 6151 | 09/22/03 | 09/22/05 |
| 1482 | Band Pass Filter | K & L 11SH10-4000/T12000-0/0 | 2 | Cal B4 Use | N/A |
| 1477 | 20db Attenuator DC 18 Ghz | MCL Inc. BW-S20W5 | NONE | CBU | N/A |
| 1065 | ATTENUATOR | NARDA 776B-10 | NONE | CBU | N/A |
| 1081 | CABLE 2m | Astrolab 32027-2-29094-72TC | N/A | 08/26/04 | 08/26/05 |
| 1029 | PEAK POWER METER | HP 8900D | 3303U0012 | 12/23/03 | 12/22/04 |
| 1030 | PEAK POWER SENSOR | HP 84811A | 2539A03573 | 12/23/03 | 12/22/04 |
| 969 | lisn | Schwarzbeck 8120 | 8120281 | 08/01/03 | 08/31/04 |
| 1555 | Filter high pass 5KHz | Solar Electronics 7930-5.0 | 933125 | 09/10/03 | 09/09/04 |
| 1506 | 1m Cable | KTL 0 | 0 | 06/09/04 | 06/09/05 |
| 1019 | CABLE, 9.5m | KTL RG223 | N/A | 07/27/04 | 07/27/05 |
| 966 | Receiver | Rohde & Schwartz ESH2 | 880370/029 | 09/17/03 | 09/16/04 |
| | | | | | |

ANNEX A - TEST DETAILS

| | |
|---|----------------------|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207(a) |
|---|----------------------|

Minimum Standard: Conducted Emissions (Mains Ports)

- Applicable Test Standard: CFR 47, FCC Pt 15, Subpart B
- The test set-up is as per the test configuration diagram.
- The E.U.T. is configured as typically used.
- The E.U.T. and any accessories are operated with typical load conditions.
- Conducted powerline measurements are made from 150 kHz to 30 MHz.
- For each current carrying conductor of each power cord associated with the E.U.T., the emission closest to the limit is recorded.
- Final measurements are made using a spectrum analyzer with 10 kHz RBW, peak detector.
- Any emissions that are close to the limit are measured using a test receiver with 10 kHz bandwidth, CISPR quasi-peak detector.

Specification Limits:

Limits for conducted disturbance at the mains ports

| Frequency Range (MHz) | Quasi-peak Limits (dBuV) | Average Limits (dBuV) |
|---|--------------------------|-----------------------|
| 0.15 to 0.50 | 66-56 | 56-46 |
| 0.50 to 5.00 | 56 | 46 |
| 5.00-30.0 | 60 | 50 |
| The limit decreases with the logarithm of the frequency in the range 0.15MHz to 0.5 MHz | | |

| |
|--------------------------------------|
| NAME OF TEST: Minimum 6 dB bandwidth |
|--------------------------------------|

| |
|-------------------------|
| PARA. NO.: 15.247(a)(2) |
|-------------------------|

Minimum Standard: The minimum 6 dB bandwidth shall be at least 500 kHz

NAME OF TEST: Maximum Peak Output Power

PARA. NO.: 15.247(b)(1)

Minimum Standard:

The maximum peak output power shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Direct Measurement Method For Detachable Antennas:

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load. The dBi gain of the antenna(s) employed shall be reported.

Calculation Of EIRP For Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

The RBW of the spectrum analyzer shall be set to a value greater than the measured 6 dB occupied bandwidth of the E.U.T.

Number of channels tested:

| Tuning range | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less | 1 | middle |
| 1 to 10 MHz | 2 | top and bottom |
| more than 10 MHz | 3 | top, middle, bottom |

EQUIPMENT: Speedstream 6520 and 6515

| | |
|---------------------------|-------------------------|
| NAME OF TEST: RF Exposure | PARA. NO.: 15.247(b)(4) |
|---------------------------|-------------------------|

Minimum Standard:

Systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines stipulated in 1.1307(b)(1) of CFR 47.

EQUIPMENT: Speedstream 6520 and 6515

| | |
|---|----------------------|
| NAME OF TEST: Spurious Emissions(conducted) | PARA. NO.: 15.247(c) |
|---|----------------------|

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

| Frequency (MHz) | Field Strength (µV/m @ 3m) | Field Strength (dB @ 3m) |
|-----------------|----------------------------|--------------------------|
| 30 - 88 | 100 | 40.0 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46.0 |
| Above 960 | 500 | 54.0 |

THE SPECTRUM IS SEARCHED TO THE 10th HARMONIC OF THE HIGHEST FREQUENCY GENERATED IN THE EUT.

Method Of Measurement:

30 MHz - 10th harmonic plot

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

Lower Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 902 MHz, 2400 MHz, or 5725 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level below center frequency.

Upper Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 928 MHz, 2483.5 MHz, or 5850 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level above center frequency.

Number of channels tested:

| Tuning range | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less | 1 | middle |
| 1 to 10 MHz | 2 | top and bottom |
| more than 10 MHz | 3 | top, middle, bottom |

| | |
|---|----------------------|
| NAME OF TEST: Radiated Spurious Emissions | PARA. NO.: 15.247(c) |
|---|----------------------|

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

| Frequency (MHz) | Field Strength ($\mu\text{V/m}$ @ 3m) | Field Strength (dB @ 3m) |
|-----------------|--|--------------------------|
| 30 - 88 | 100 | 40.0 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46.0 |
| Above 960 | 500 | 54.0 |

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

15.205 Restricted Bands

| MHz | MHz | MHz | GHz |
|-------------------|---------------------|---------------|-------------|
| 0.09-0.11 | 16.42-16.423 | 399.9-410 | 4.5-5.25 |
| 0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.125-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2655-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | Above 38.6 |
| 13.36-13.41 | 1718 | | |

Number of channels tested:

| Tuning range | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less | 1 | middle |
| 1 to 10 MHz | 2 | top and bottom |
| more than 10 MHz | 3 | top, middle, bottom |

| | |
|---|----------------------|
| NAME OF TEST: Transmitter Power Density | PARA. NO.: 15.247(d) |
|---|----------------------|

Minimum Standard: The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

Method Of Measurement: The spectrum analyzer is set as follows:

- RBW: 3 kHz
- VBW: >3 kHz
- Span: => measured 6 dB bandwidth
- Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is 1500/3 = 500 sec.
- LOG dB/div.: 2 dB

Note: For devices with spectrum line spacing =< 3 kHz, the RBW of the analyzer is reduced until the spectral lines are resolved. The measurement data is normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band in linear power units.

For Devices With Integral Antenna:

For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to a field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent isotropic radiated power using the same method as described for Peak Power output.

Number of channels tested:

| Tuning Range | Number Of Channels Tested | Channel Location In Band |
|------------------|---------------------------|--------------------------|
| 1 MHz or Less | 1 | Middle |
| 1 to 10 MHz | 2 | Top And Bottom |
| More Than 10 MHz | 3 | Top, Middle, Bottom |

| | |
|-------------------------------|----------------------|
| NAME OF TEST: Processing Gain | PARA. NO.: 15.247(e) |
|-------------------------------|----------------------|

Minimum Standard: The processing gain shall be at least 10 dB.

Method Of Measurement: The CW jamming margin method was used to determine the processing gain. A CW signal generator is stepped across the passband of the receiver in 50 kHz increments. At each point the signal generator level required to obtain the recommended bit error rate is recorded. The jammer to signal ratio (J/S) is then calculated. The worst 20% of the J/S points is discarded. The lowest remaining J/S ratio is used to calculate the processing gain.

Calculation Of Processing Gain:

The processing gain was determined by measuring the jamming margin of the E.U.T. and using the following formula:

$$\text{Jamming Margin} = G_p - (S/N)_{\text{out}} - L_{\text{sys}}$$

For a receiver using non-coherent detection the value $(S/N)_{\text{out}}$ is calculated using the formula:

$P_e = (1/2)\text{EXP}\{-E/2N_o\}$ where P_e is the probability of error (minimum Bit Error Rate required for proper operation).

E/N_o is $(S/N)_{\text{out}}$

for example, for a bit error rate of 10^{-4} a S/N ratio of 12.3 dB is required.

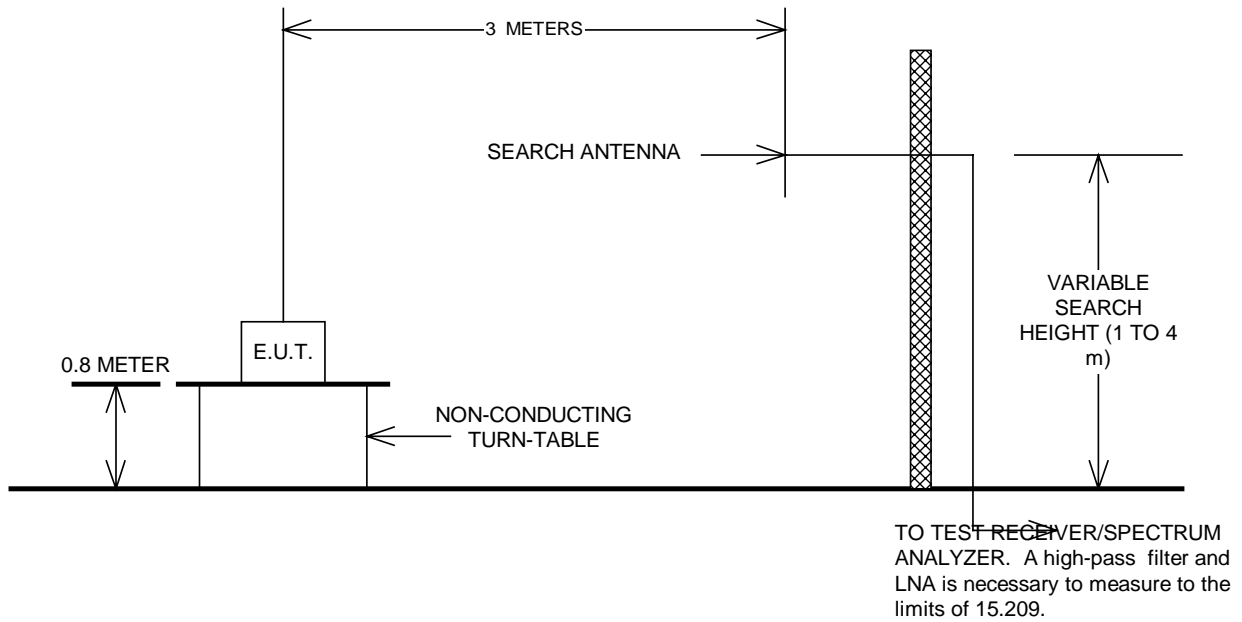
L_{sys} (system losses) is assumed to be 2 dB.

Therefore $G_p = M_j + (S/N)_{\text{out}} + L_{\text{sys}}$

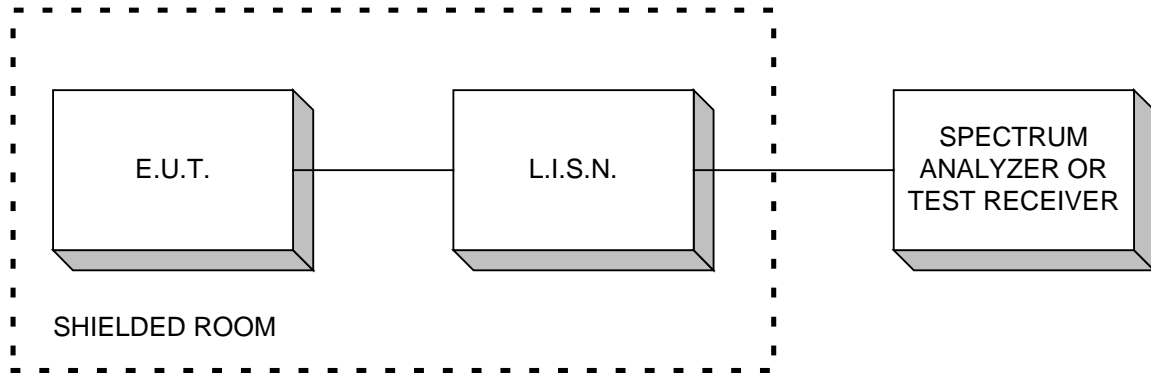
Measurement performed at a channel in the center of the operating band of the EUT.

ANNEX B - TEST DIAGRAMS

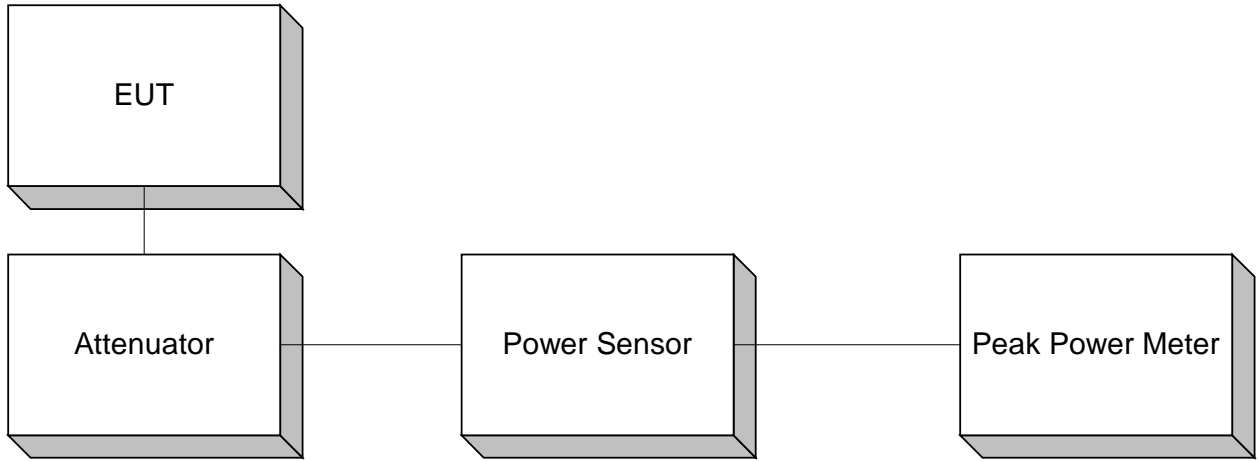
Test Site For Radiated Emissions



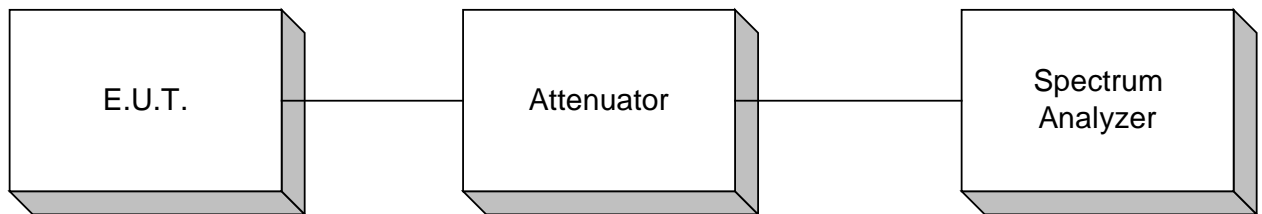
Conducted Emissions



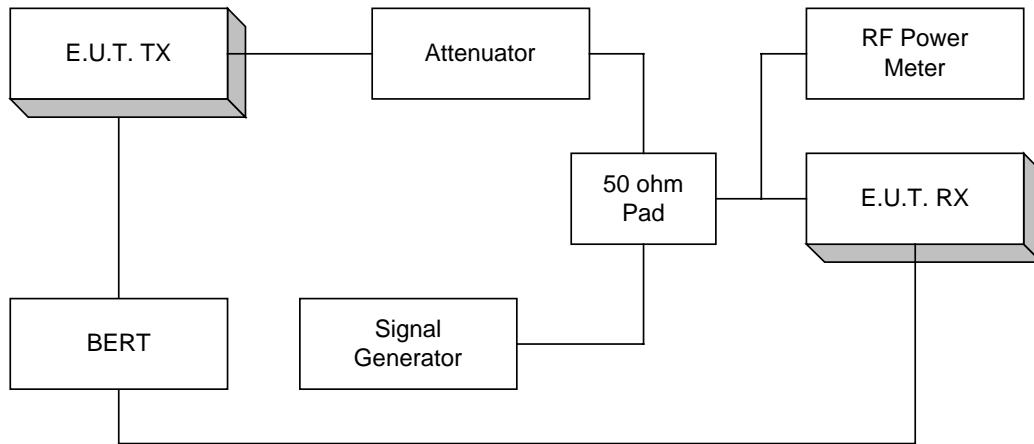
Peak Power At Antenna Terminals



**Minimum 6 dB Bandwidth
Peak Power Spectral Density
Spurious Emissions (conducted)**



Processing Gain



NOTE: This is a typical setup. The setup may vary slightly since many devices have BER test functions built into the device.