

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.

☒	New Submission	☐	Production Unit
☐	Class II Permissive Change	☒	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)							

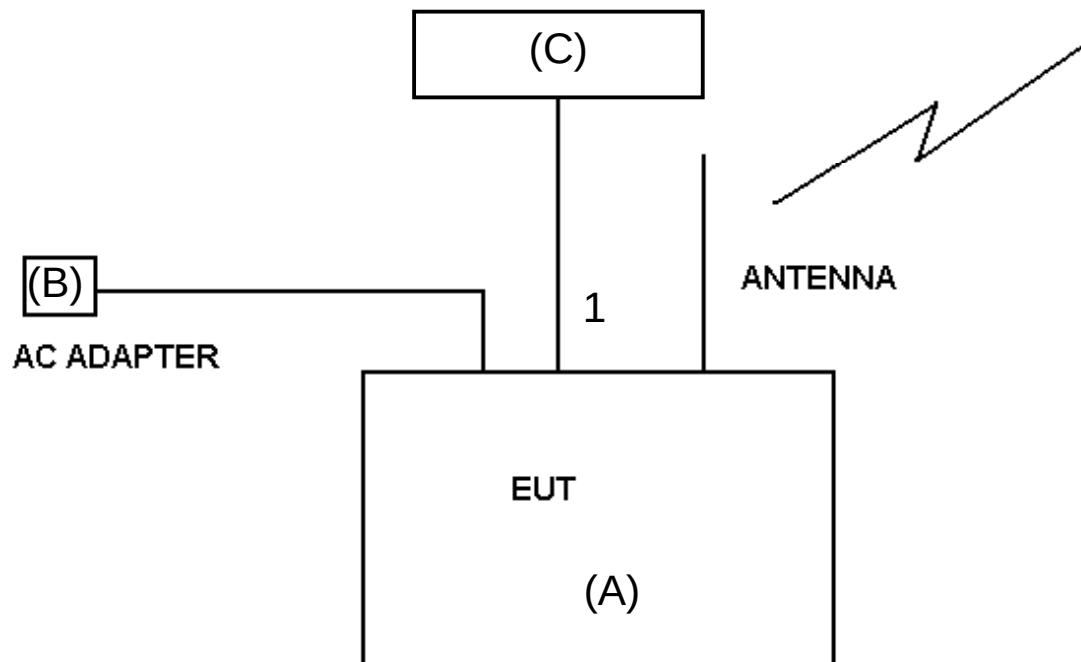
² TERMINATION

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.

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

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

Test Data – Powerline Conducted Emissions



NEMKO Dallas, Inc.

Dallas Headquarters:

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

Conducted Emissions

Powerline Voltage Measurement

Complete X Job # : 4L0521E Test # : CEPV-02
Preliminary Page 1 of 1

Client Name : Siemens Subscriber Networks
EUT Name : Compact Wireless Gateway
EUT Model # : 060-N650-A01
EUT Part # : None
EUT Serial # : None
EUT Config : Connected to CO, Trained and communicating

Specification : CFR 47, Part 15, Class B Reference : CISPR 22, Class B
Transducer # : 969 Temp. (deg. C) : 23 Date : 08/09/04
HP Filter # : 1555 Humidity (%) : 44 Time : 10:00
Cable 1 # : 1506 EUT Voltage : 120 Staff : Eldon Berry
Cable 2 # : 1019 EUT Frequency : 60 Location : Lab 2
Detector 1 # : 966 Peak Bandwidth: 10kHz Photo ID: 4L0521E CEPV-02
Detector 2 # : QP Bandwidth 10kHz
Limiter # : Avg. Bandwidth 10kHz

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\\AUTOMATE\\DATASHTS\\CEP_Voltage Rev C.xl Document Control #EMC DS EM COND VOLT

Photos – Powerline Conducted Emissions

Front



Side



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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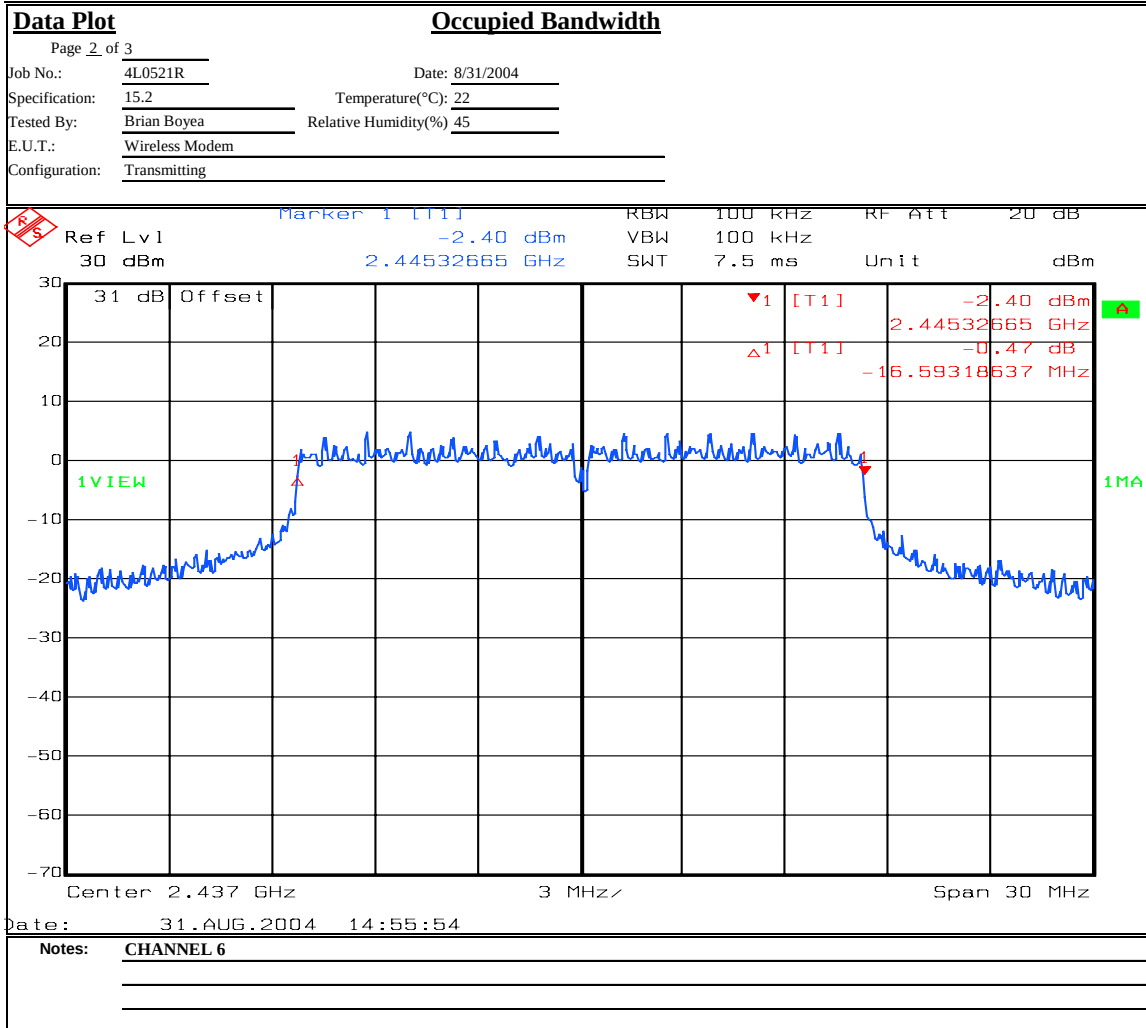
Data Plot		Occupied Bandwidth	
Page 1 of 3		Complete <u>X</u>	
Job No.:	4L0521R	Date:	8/31/2004
Specification:	15.247	Temperature(°C):	22
Tested By:	Brian Boyea	Relative Humidity(%):	45
E.U.T.:	Wireless Modem		
Configuration:	Transmitting		
Sample Number:			
Location:	Lab 1	RBW:	100 kHz
Detector Type:	Peak	VBW:	100 kHz
		Measurement 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		
Ref Lvl 30 dBm			
Marker 1 [T1] -2.22 dBm			
2.42032665 GHz			
RBW 100 kHz			
VBW 10 MHz			
SWT 7.5 ms			
Unit dBm			
Center 2.412 GHz			
3 MHz			
Span 30 MHz			
Date: 31.AUG.2004 13:22:21			
Notes: CHANNEL 1			



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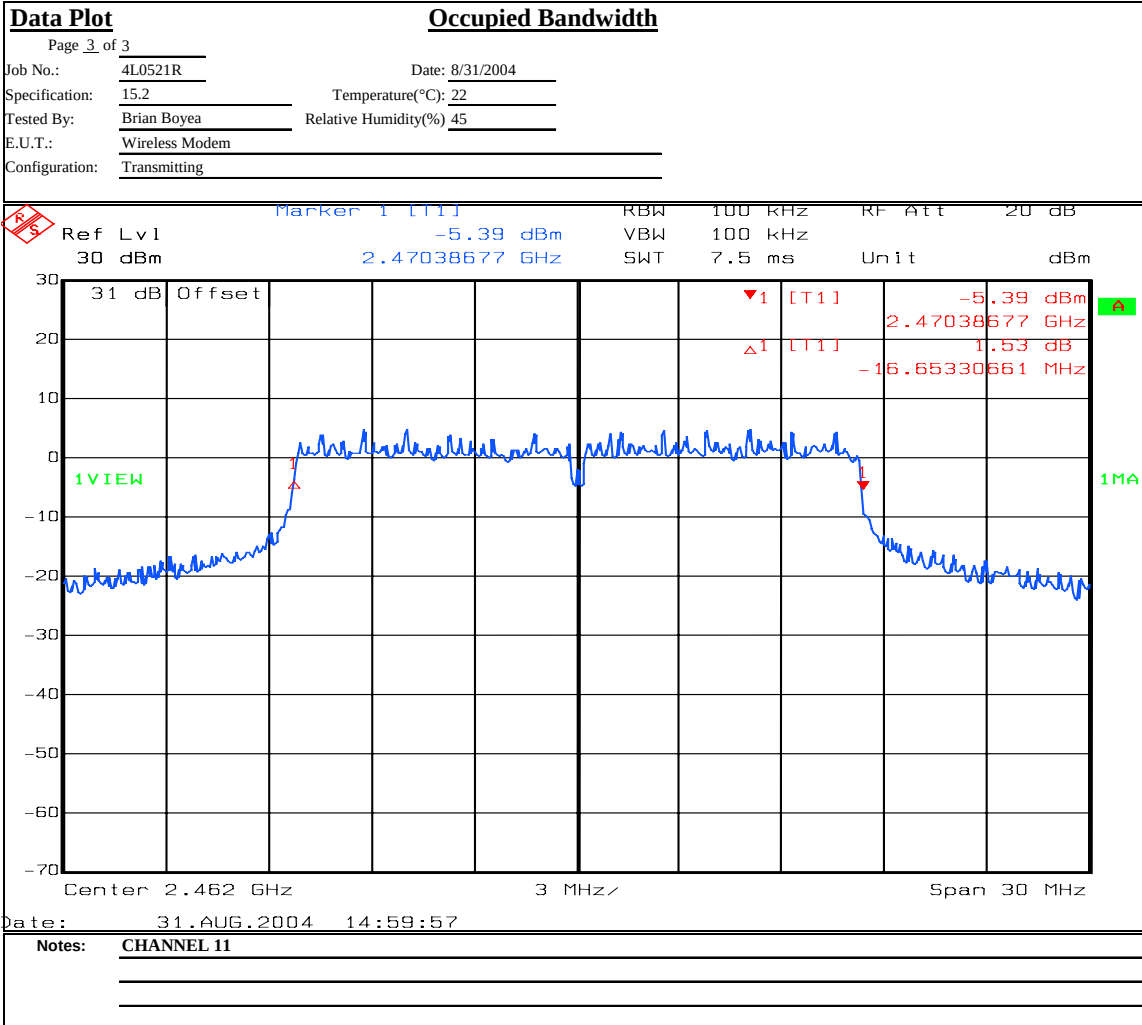


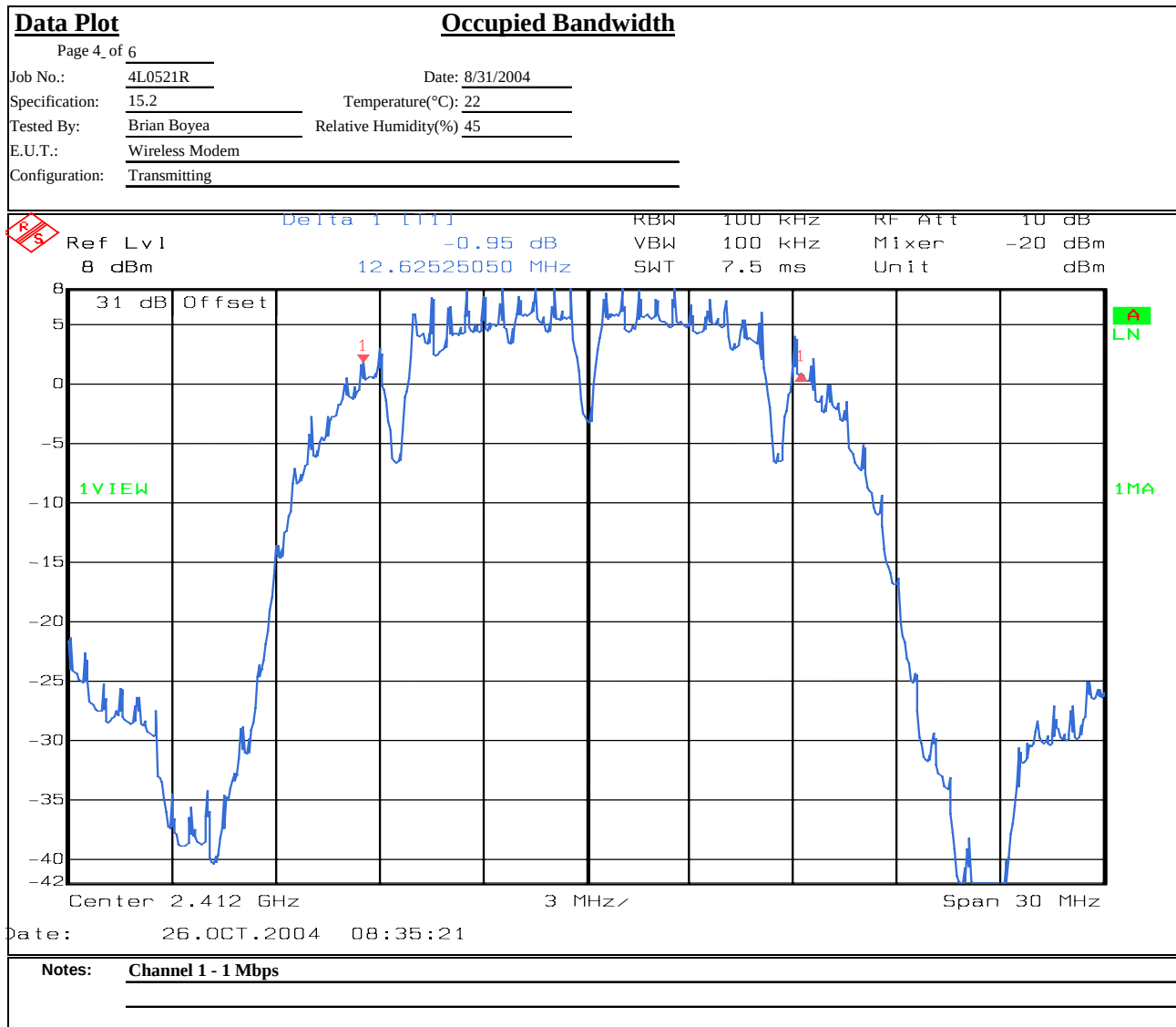


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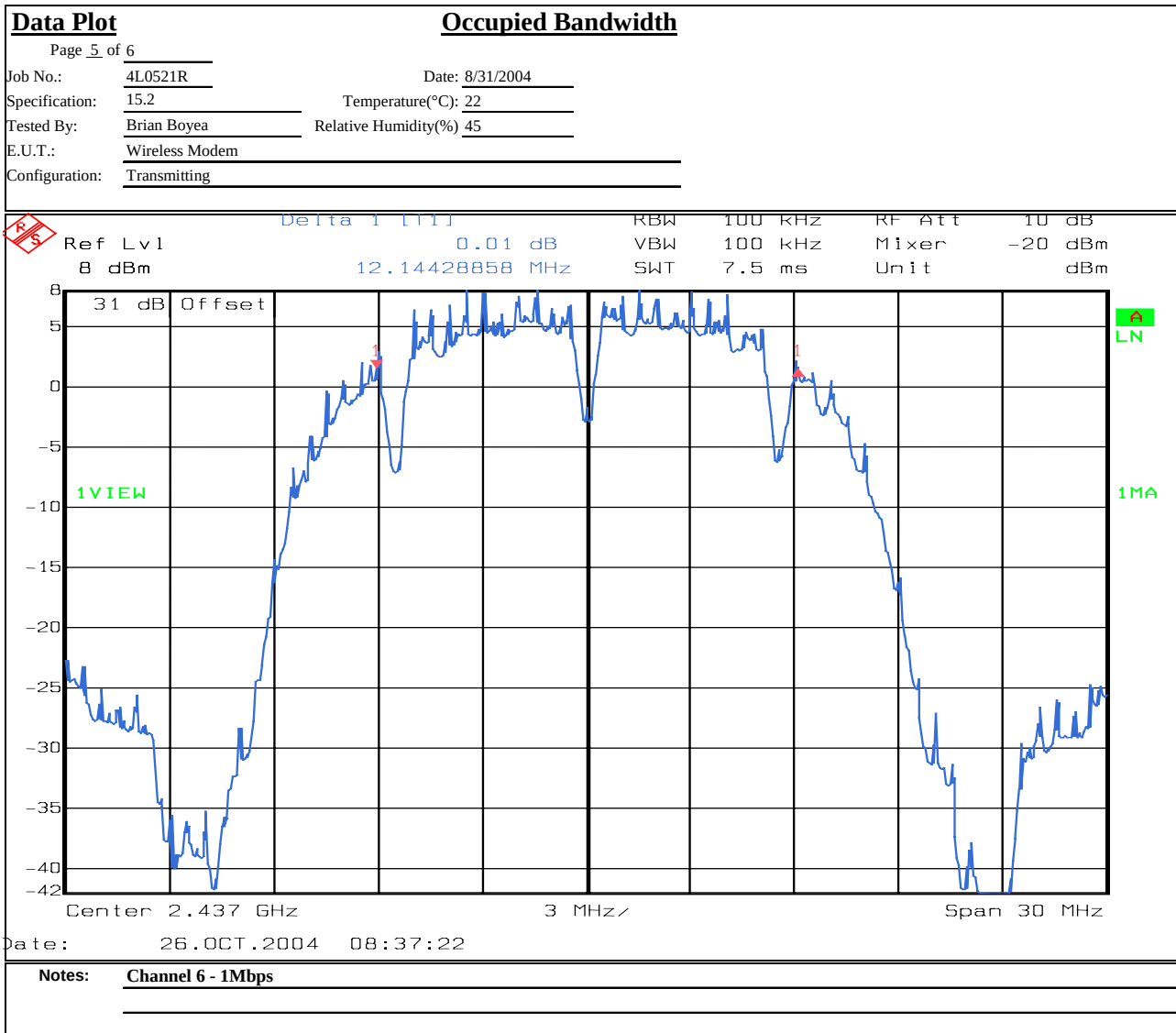
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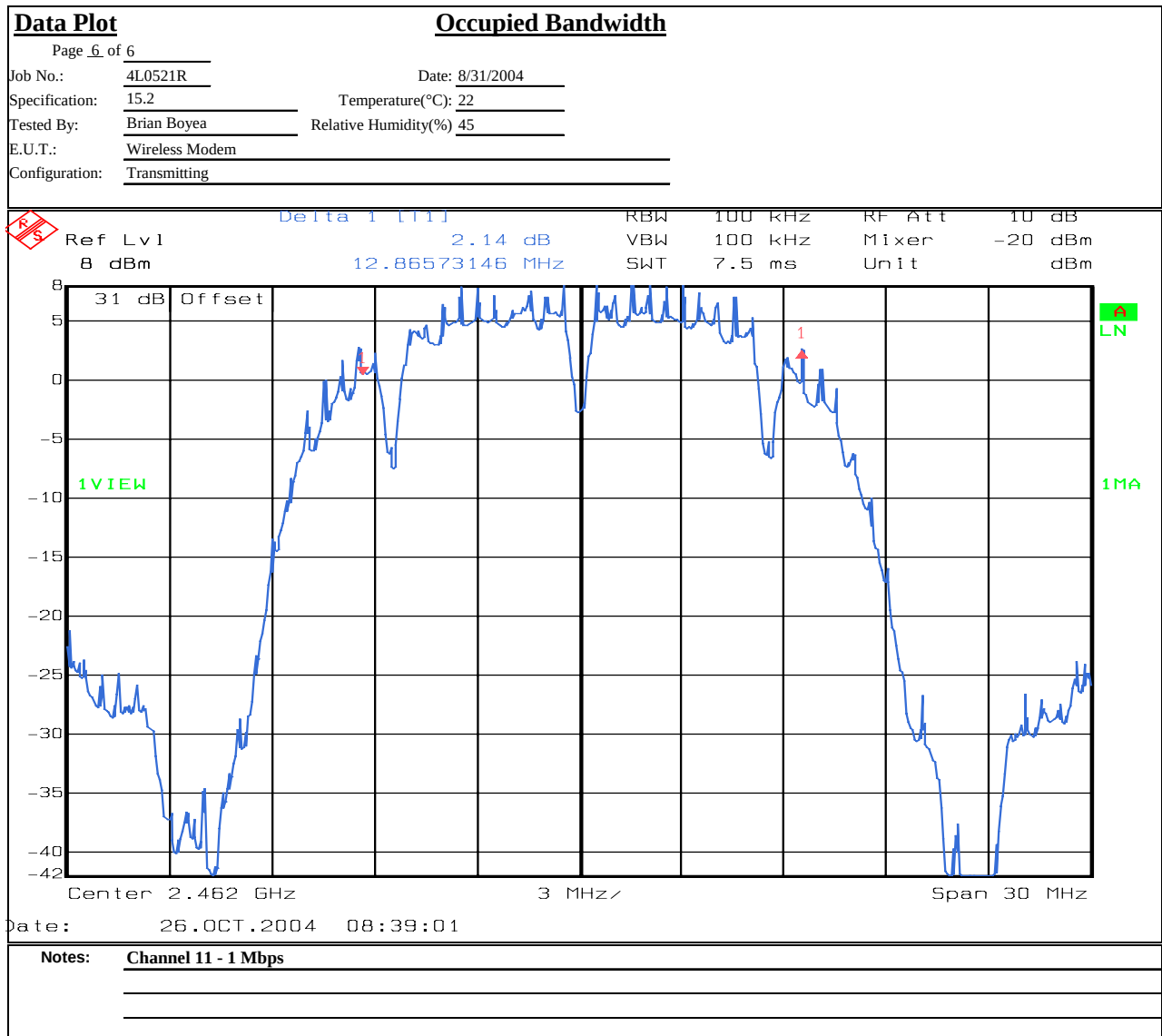




Test Data – Occupied Bandwidth



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

$$S \leq \frac{PG}{4\pi R^2}$$

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)

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.

EQUIPMENT: Speedstream 6520 and 6515

Test Data – Spurious Emissions at Antenna Terminal



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802 N. Kealy
Lewisville, TX 75057
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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			
Ref Lvl 30 dBm Delta 1 [T1] -22.58 dB -5.94589178 MHz RBW 100 kHz VBW 100 kHz SWT 15 ms RF Att 20 dB Unit dBm 31 dB Offset 1 VIEW 1MA ▼1 [T1] 4.60 dBm ▲1 [T1] -22.58 dB -5.94589178 MHz 2.40583166 GHz Center 2.4 GHz 6 MHz Span 60 MHz			

Date: 31.AUG.2004 13:34:23

Notes: CHANNEL 1

lower Bandedge

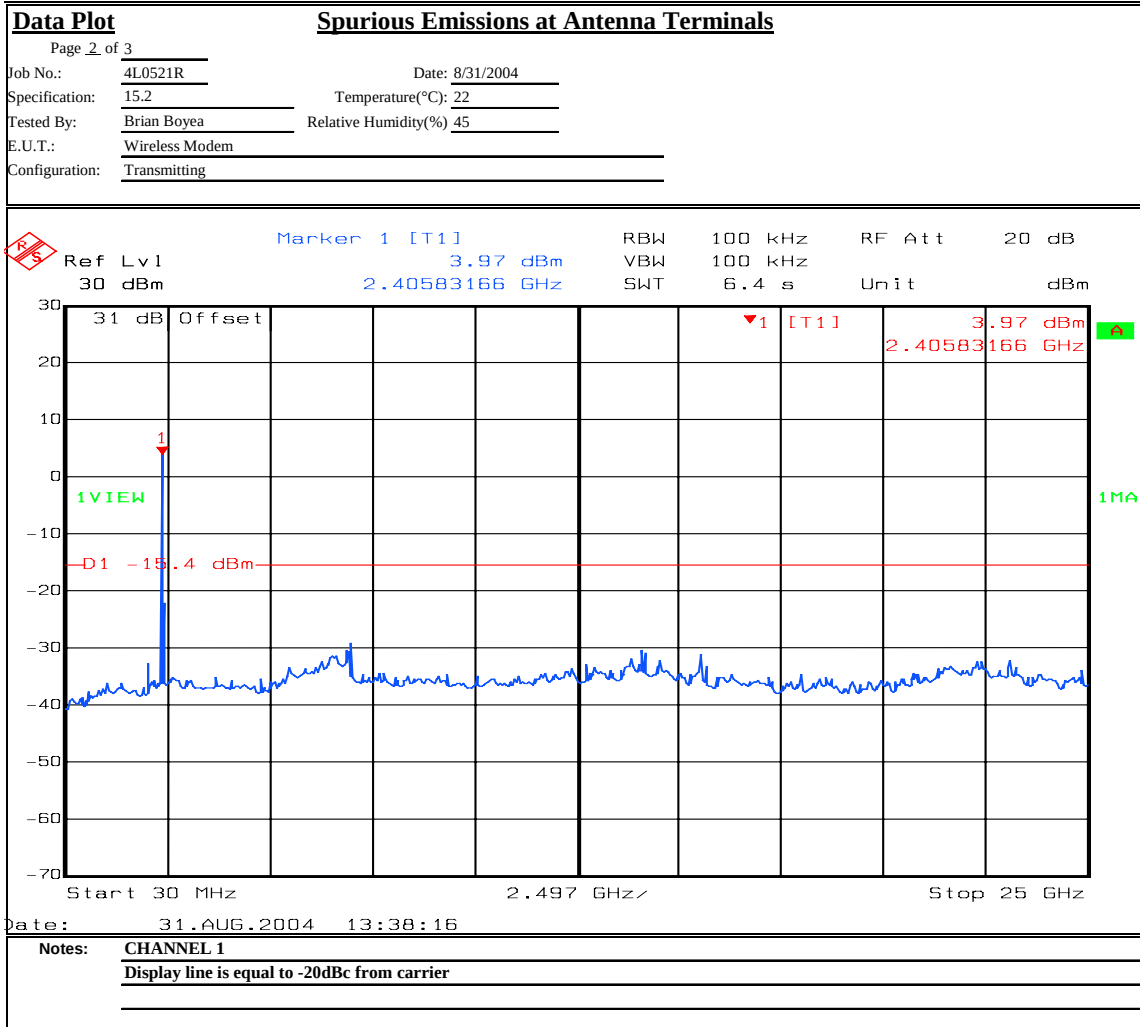
Test Data – Spurious Emissions at Antenna Terminal



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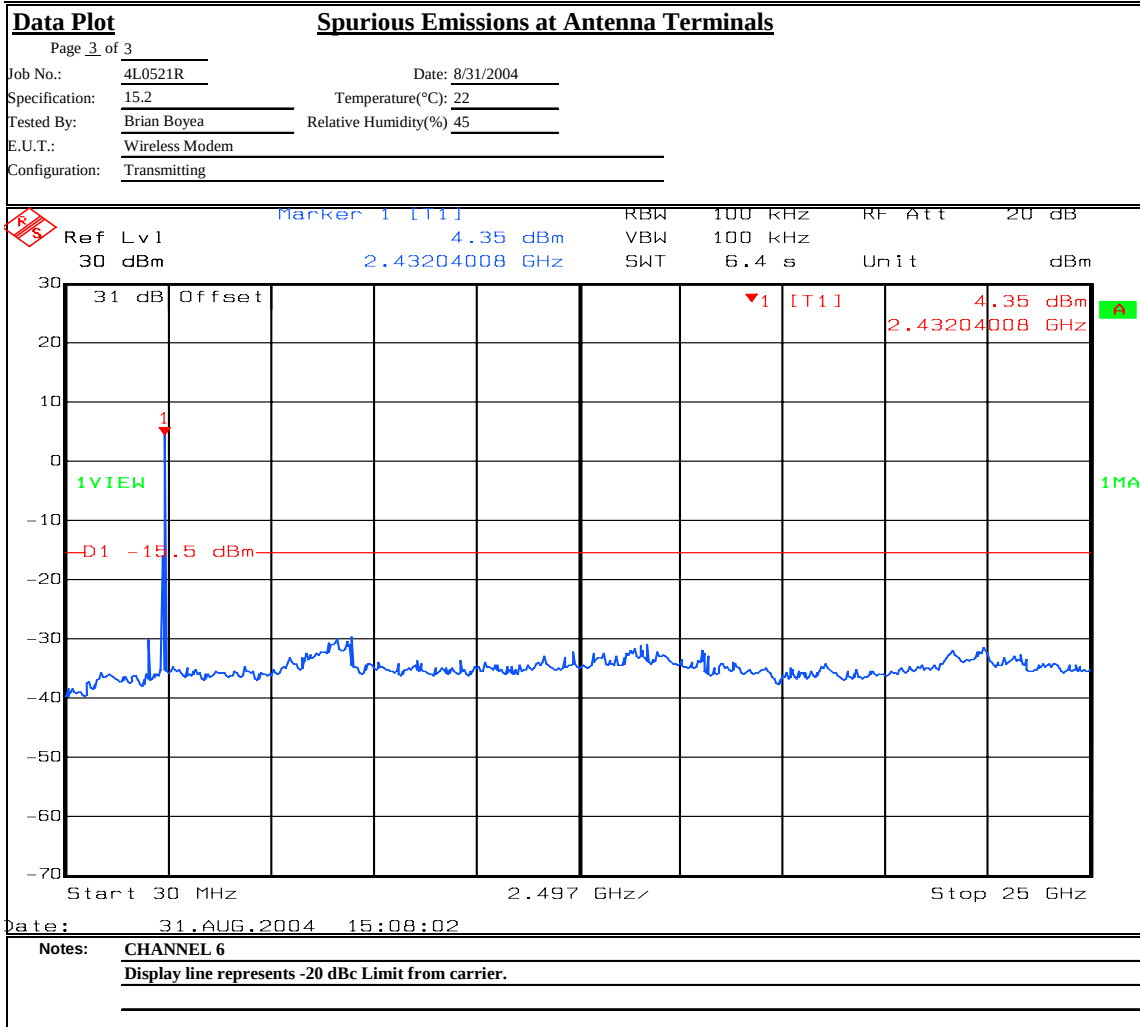


Test Data – Spurious Emissions at Antenna Terminal



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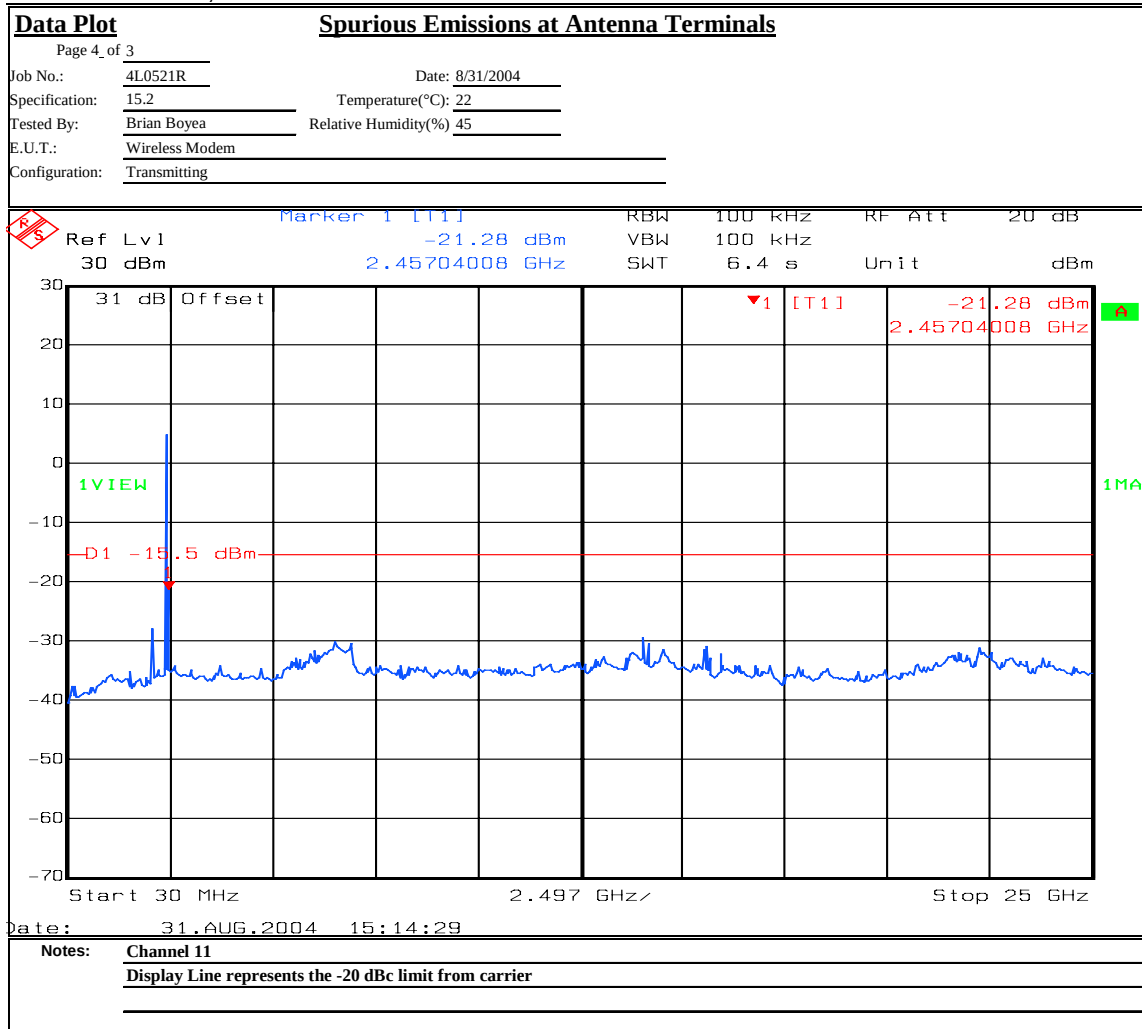


Test Data – Spurious Emissions at Antenna Terminal



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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 1 of 2								
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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Dallas Headquarters:

802 N. Kealy
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Tel: (972) 436-9600
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Page <u>1</u> of <u>2</u>		<u>Radiated Spurious Emissions</u>		Continuation Page	
Job No.:	4L0521R	Date:	9/8/2004		
Specification:	CFR 47, Part 15	Temperature(°F):	72		
Tested By:	Brian Boyea	Relative Humidity(%)	50		
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.

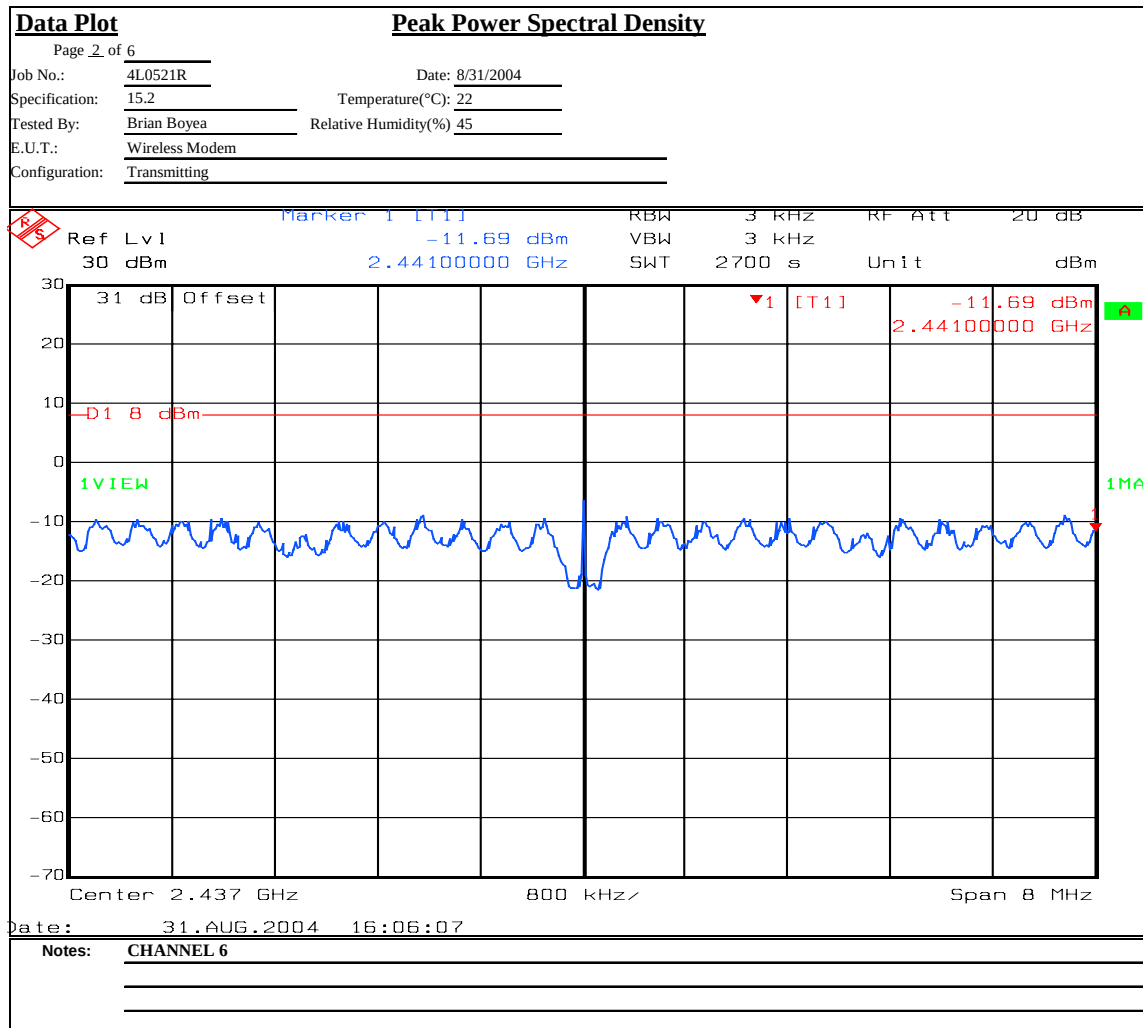
EQUIPMENT: Speedstream 6520 and 6515

REPORT NO.: 4L0521RUS1Rev1

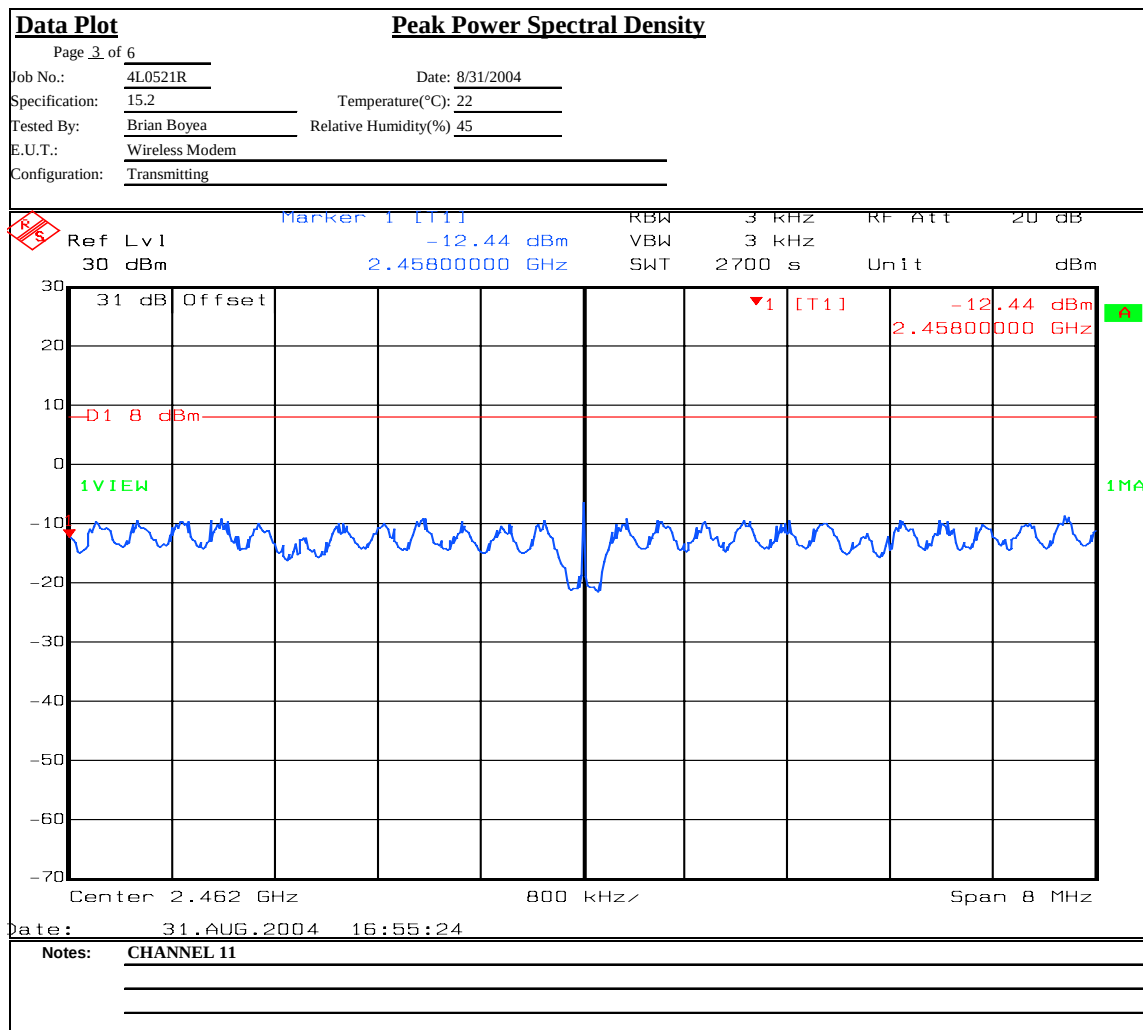
Test Data – Peak Power Spectral Density

Data Plot		Peak Power Spectral Density	
Page 1 of 6			
Job No.: 4L0521R	Date: 8/31/2004	Complete X	
Specification: 15.247	Temperature(°C): 22	Preliminary:	
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			
Ref Lvl 30 dBm RBW 3 kHz VBW 3 kHz SWT 2700 s RF Att 20 dB Unit dBm			
31 dB Offset D1 8 dBm 1MAX 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

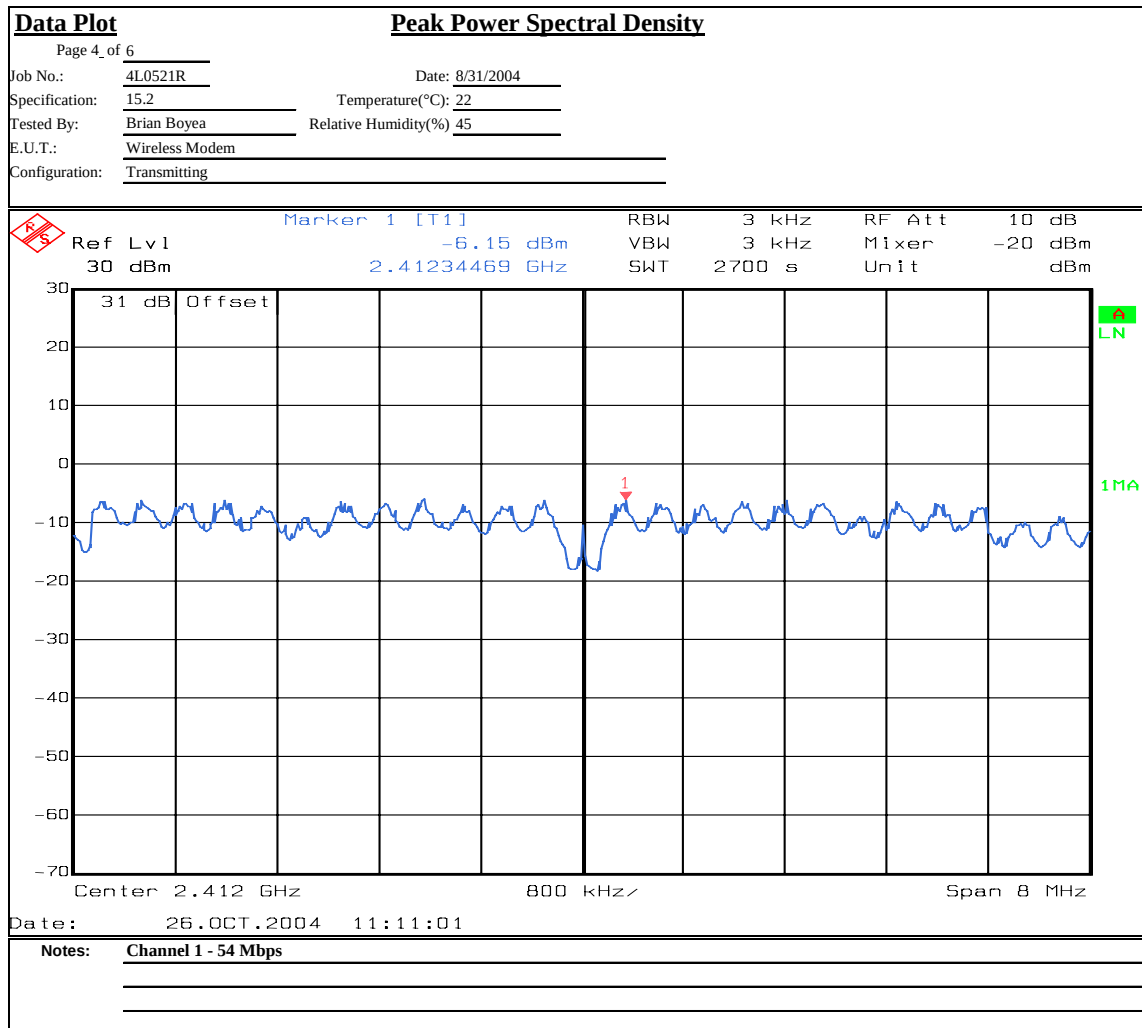


Test Data – Peak Power Spectral Density



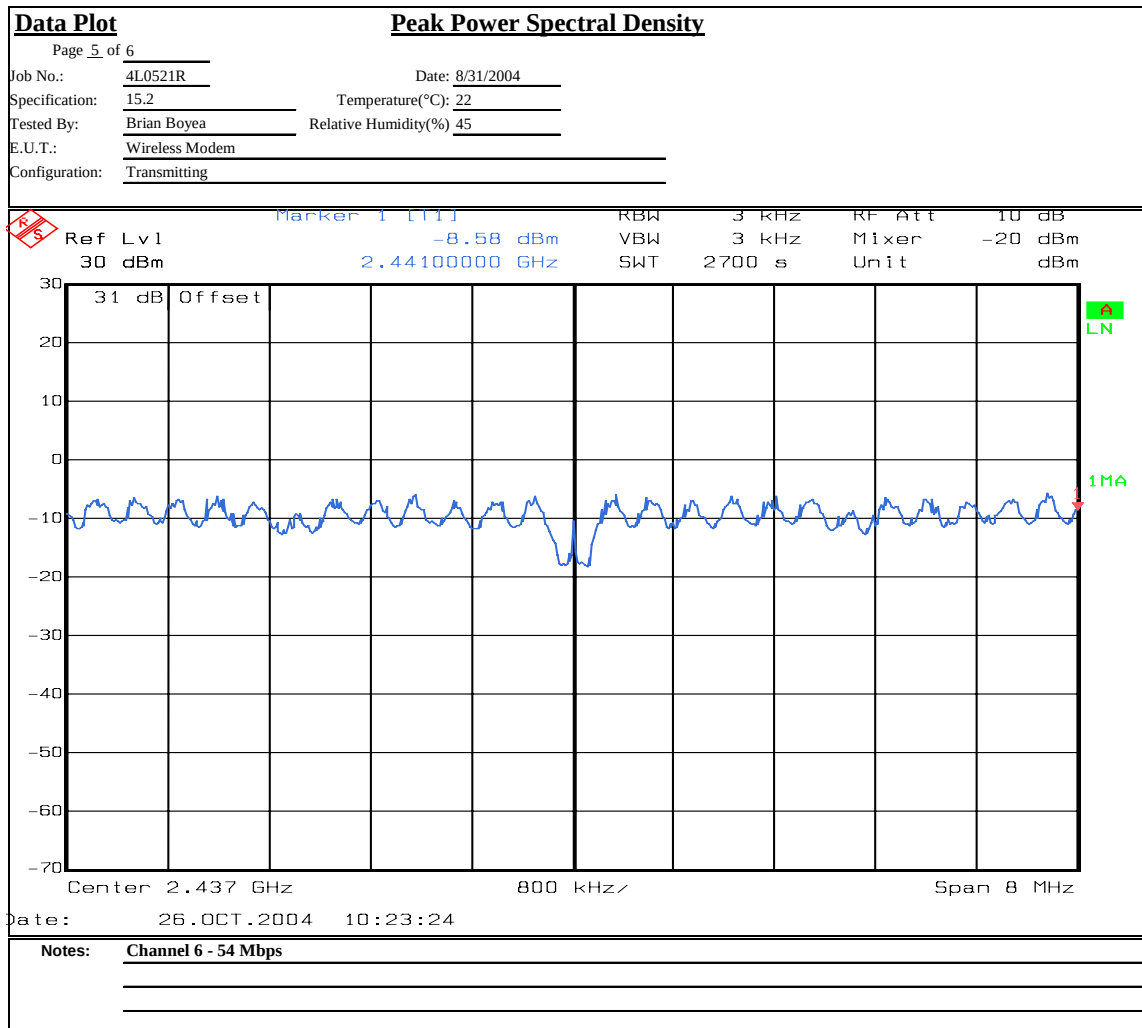
EQUIPMENT: Speedstream 6520 and 6515

REPORT NO.: 4L0521RUS1Rev1



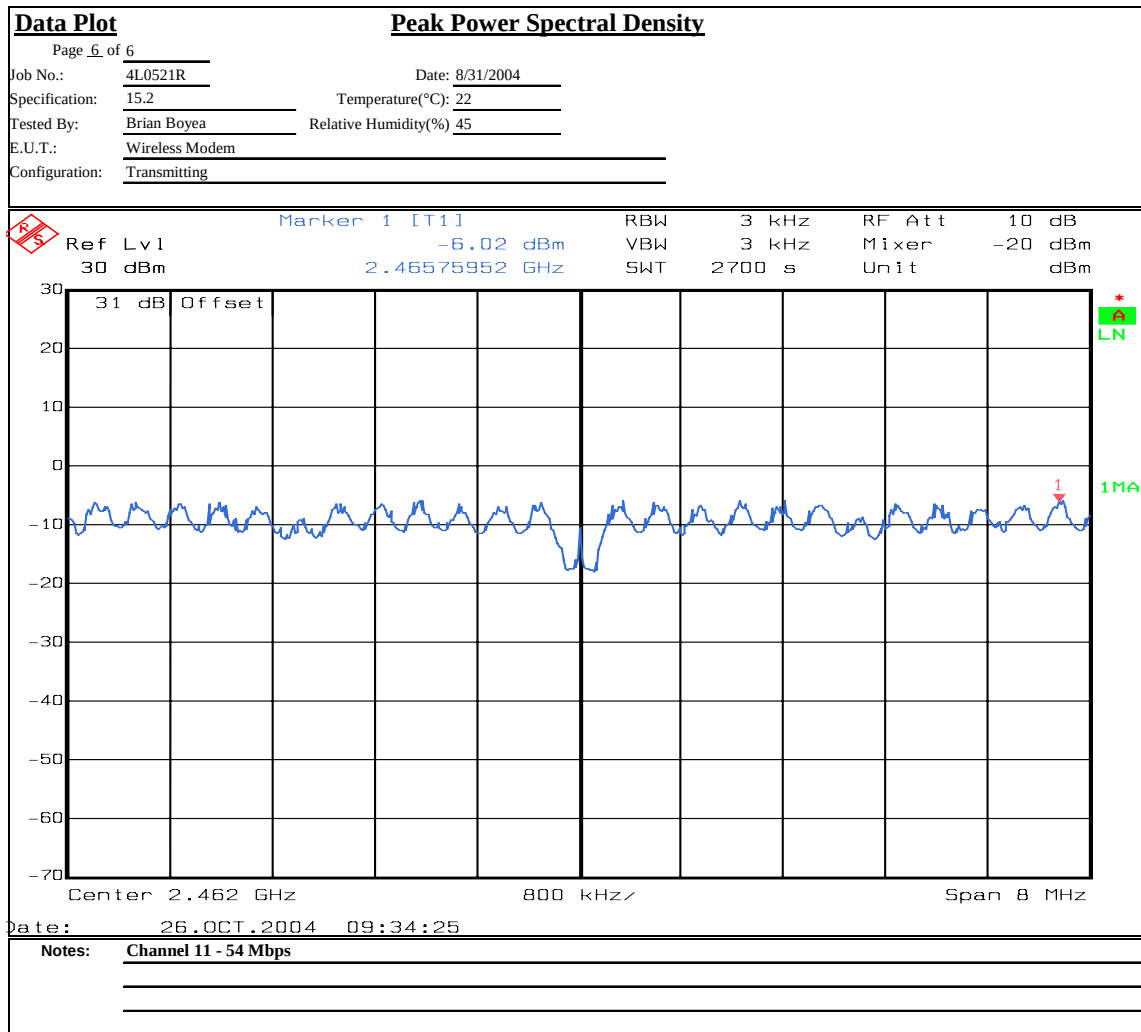
EQUIPMENT: Speedstream 6520 and 6515

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EQUIPMENT: Speedstream 6520 and 6515

REPORT NO.: 4L0521RUS1Rev1



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)
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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

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

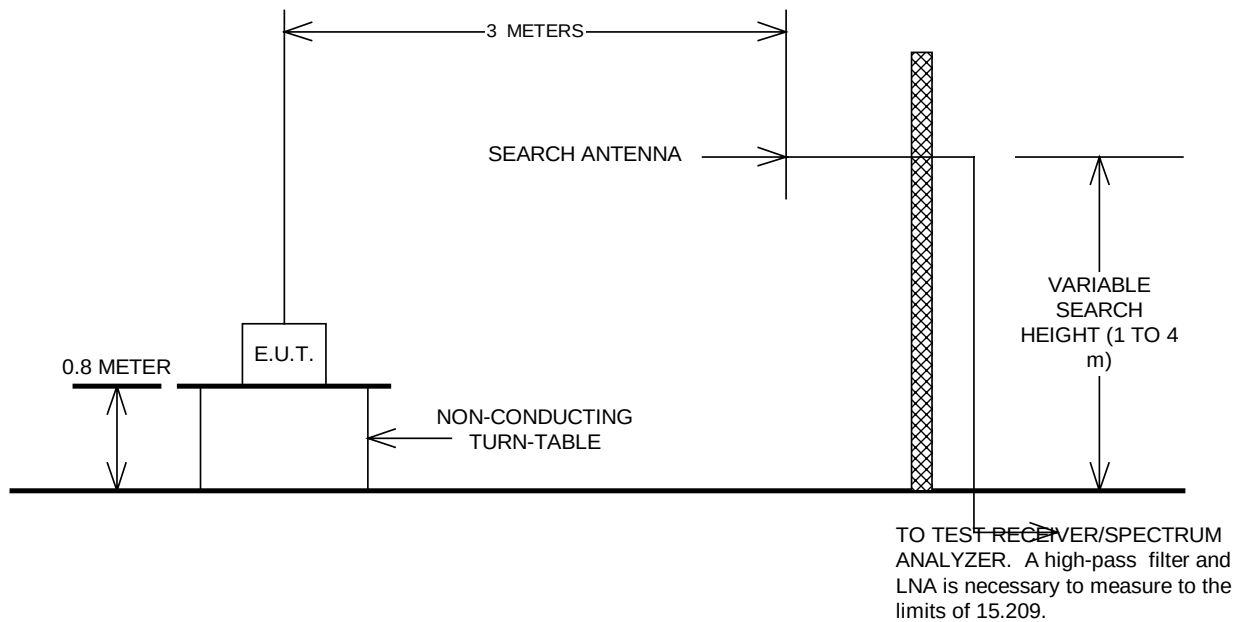
L_{sys} (system losses) is assumed to be 2 dB.

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

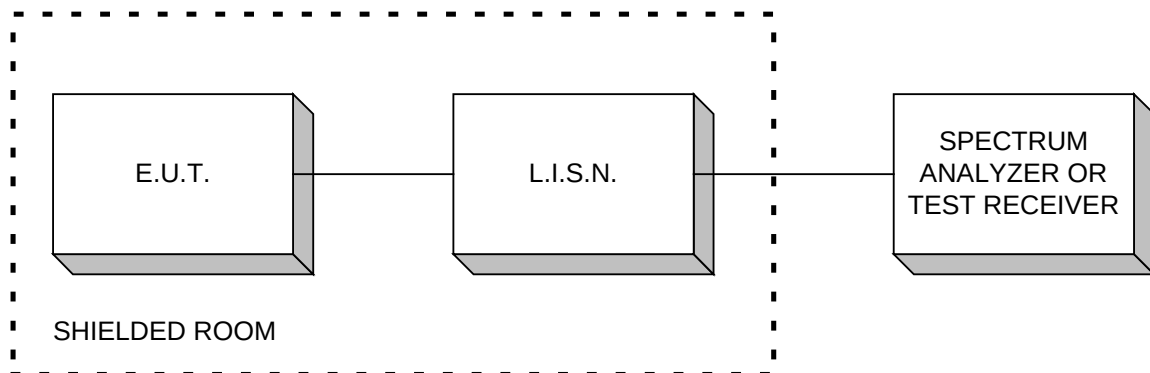
Measurement performed at a channel in the center of the operating band of the EUT.

ANNEX B - TEST DIAGRAMS

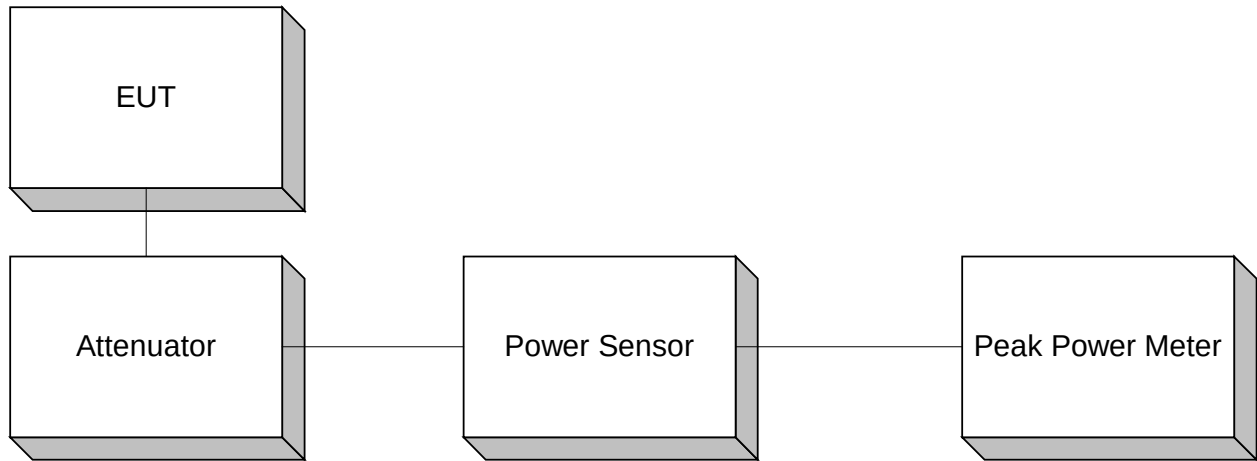
Test Site For Radiated Emissions



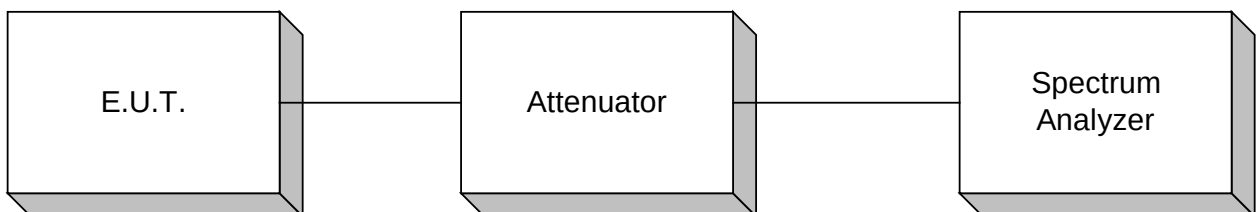
Conducted Emissions

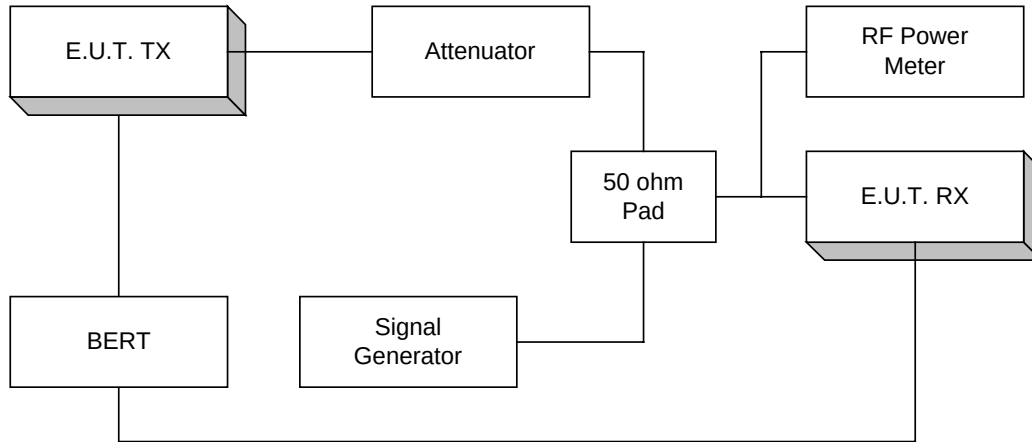


Peak Power At Antenna Terminals



**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.