



Nemko Test Report: 6L0211RUS1rev1

Applicant: Electronic Systems Technology, Inc.
415 North Quay Street, Building B-1
Kennewick, WA 99336
USA

**Equipment Under Test:
(E.U.T.)** 195Ep Wireless Modem

In Accordance With: **FCC Part 90, Subpart I**
Transmitters

Tested By: Nemko USA Inc.
802 N. Kealy
Lewisville, TX 75057-3136

Authorized By:

A handwritten signature in black ink, appearing to read 'Abe Cox', positioned above a vertical red line.

Abe Cox, Key Account Manager

Date: July 31, 2006

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EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Section 1. Summary of Test Results

Manufacturer: Electronic Systems Technology, Inc.

Model No.: 195Ep

Serial No.: E-13000

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 FCC Part 90, Subpart I.

- | | | | |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <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.

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EQUIPMENT: 195Ep Wireless Modem

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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
RF Power Output	90.205	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A
Modulation Limiting	TIA EIA-603.3.2.6	N/A
Occupied Bandwidth	90.210	Complies
Spurious Emissions at Antenna Terminals	90.210	Complies
Field Strength of Spurious Emissions	90.210	Complies
Frequency Stability	90.213	Complies
Transient Frequency Behavior	90.214	N/A

Footnotes For N/A's:

- (1) Since the E.U.T. is not a keyed carrier system, Transient Frequency Behavior was not performed.
- (2) The E.U.T. does not contain audio circuitry.

EQUIPMENT: 195Ep Wireless Modem

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Section 2. General Equipment Specification

Supply Voltage Input: 12 Vdc

Frequency Band 4950 to 4990 MHz

Frequency Range of Test Sample 4960 to 4980 MHz

Tunable Bands: 4960 to 4980 MHz (2 Channels)

Type(s) of Modulation:

F3E (Voice)	F1D	F2D	W7D (OFDM)	Other
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Emission Designator(s): 12M2W7D 16M6W7D

Output Impedance: 50 ohms

Channel Spacing(s): 20 MHz

Operator Selection of Operating Frequency: None

Power Output Adjustment Capability: None

EQUIPMENT: 195Ep Wireless Modem

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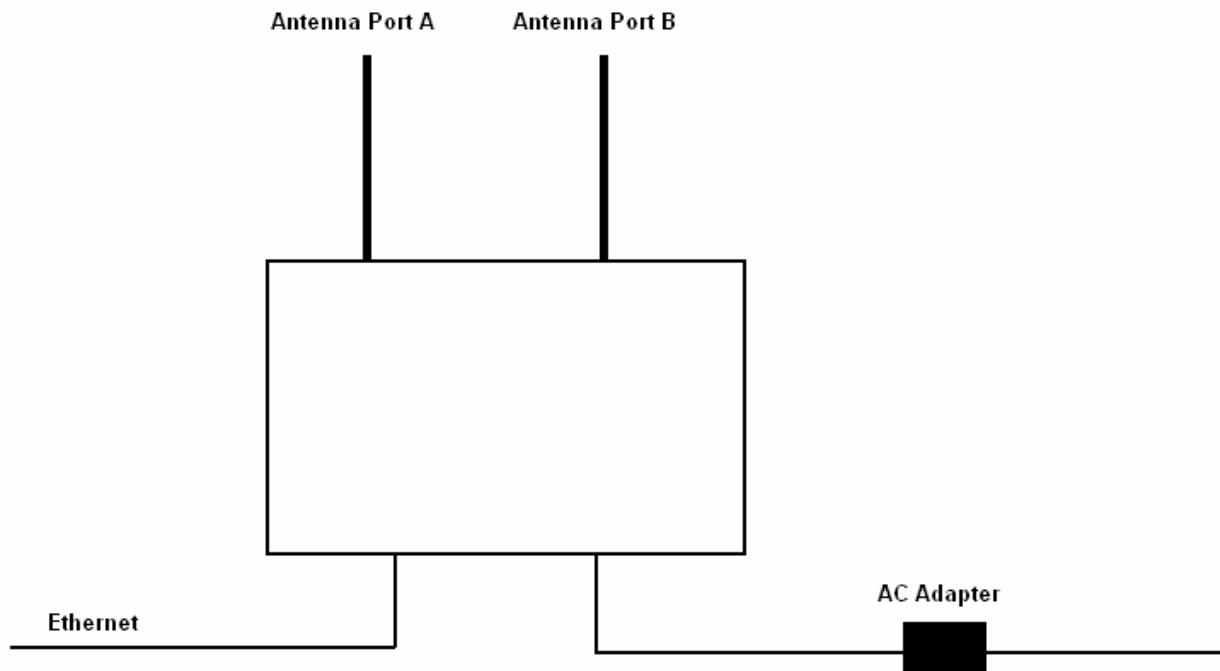
Operational Description

The 195Ep RF modem is a fully functional wireless LAN transceiver operating in the 4.940 – 4.990 GHz Public Safety band. The unit is typically used in law enforcement applications.

RF channels utilize 4.960 GHz and 4.980 GHz.

The modem has two RF antenna ports. Port 1 is a TX/RX port and port two is a receive only port.

System Diagram



EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 18 July 2006

Test Results: Complies.

Measurement Data:

Frequency (MHz)	Data Rate (Mbps)	Measured Power (dBm)	Measured Power (mW)
4960	11	29.87	970.5
4960	54	30.07	1016.2
4980	11	28.91	778.0
4980	54	30.8	1202.3

Equipment Used: 1604-1528-1036-1472

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 45 %

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 18 July 2006

Test Results: Complies.

Test Data: See attached graph(s).

Equipment Used: 1604-1528-1036-1472

**Measurement
Uncertainty:** +/- 1.7 dB

Temperature: 22 °C

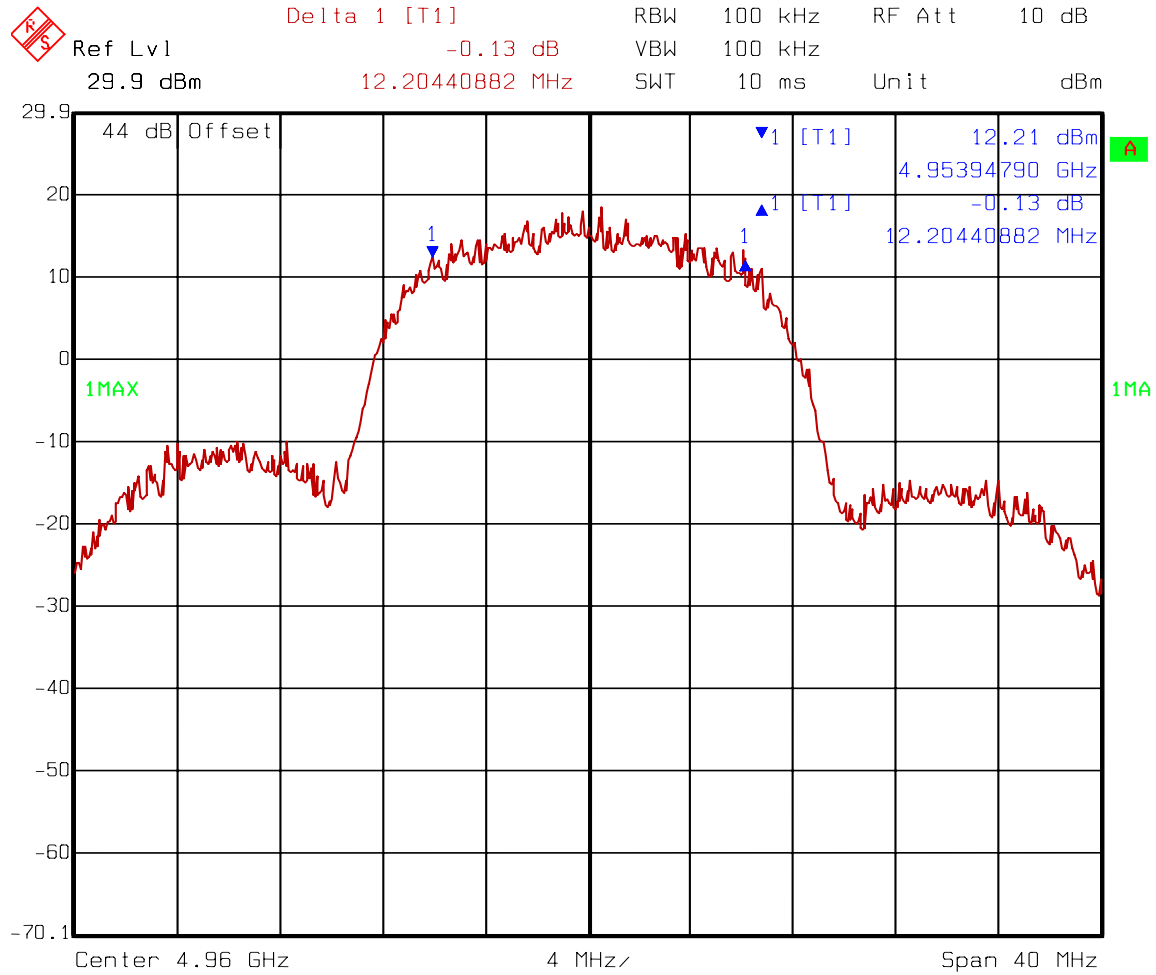
Relative Humidity: 45 %

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Occupied Bandwidth

11 Mbps

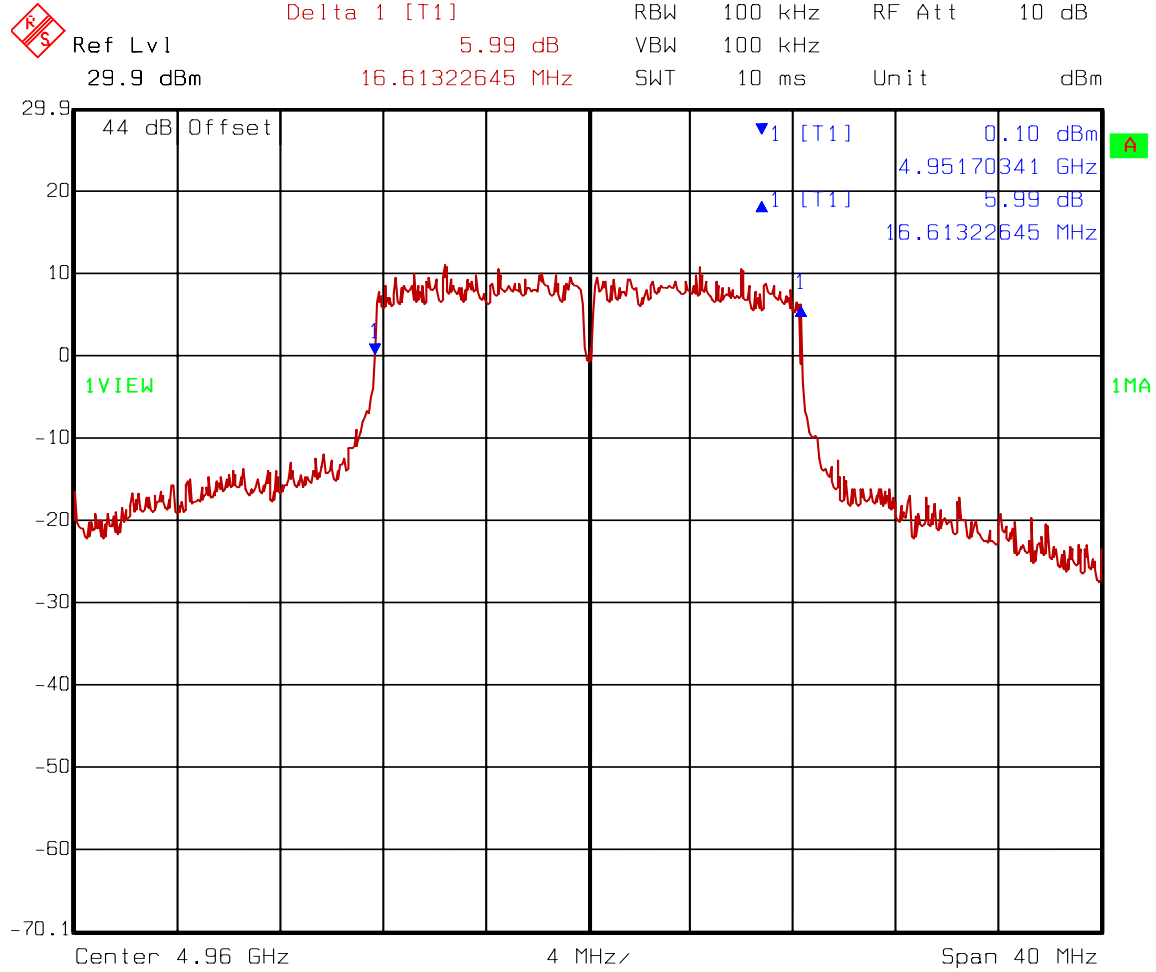


Date: 18.JUL.2006 14:50:44

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Occupied Bandwidth



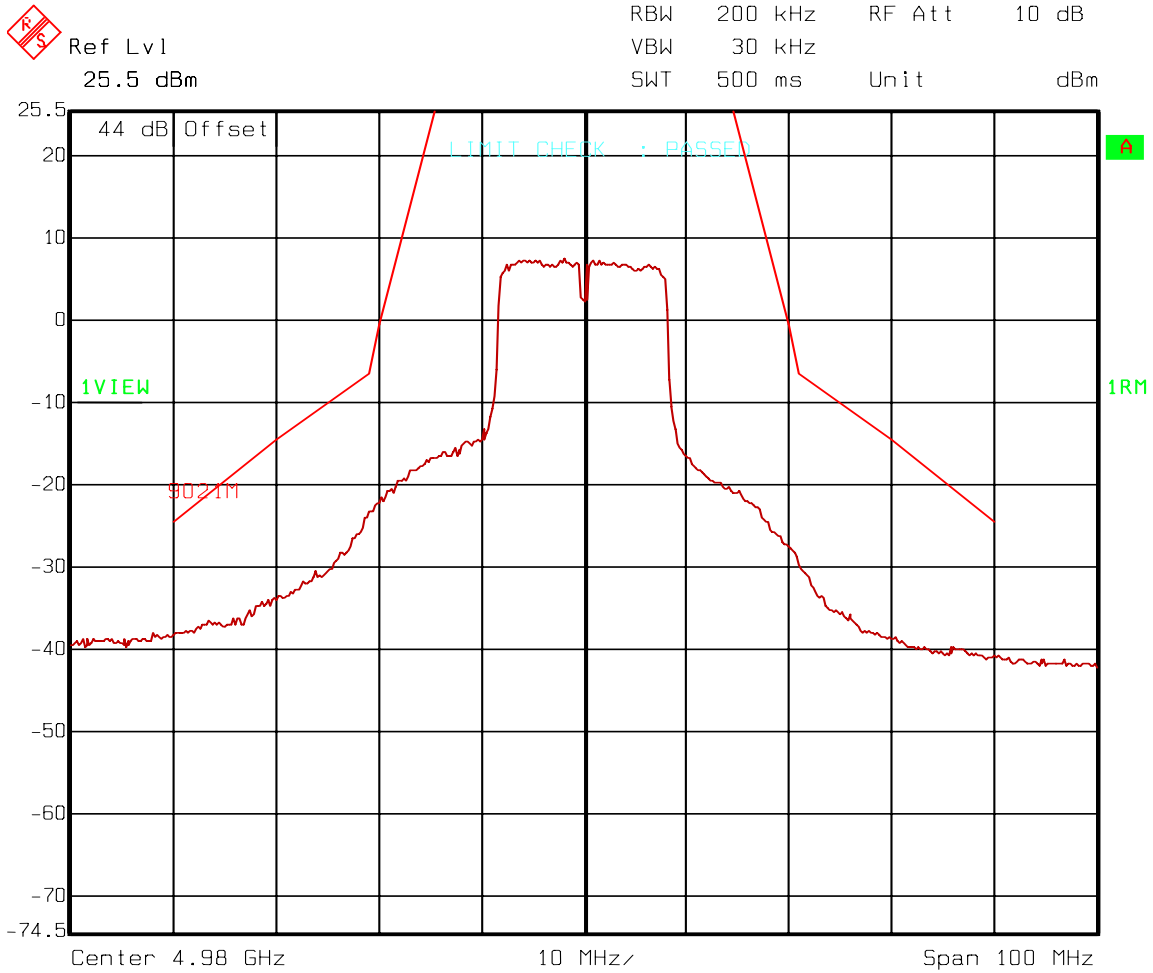
Date: 18.JUL.2006 14:52:21

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Occupied Bandwidth

4980 MHz 54 Mbps



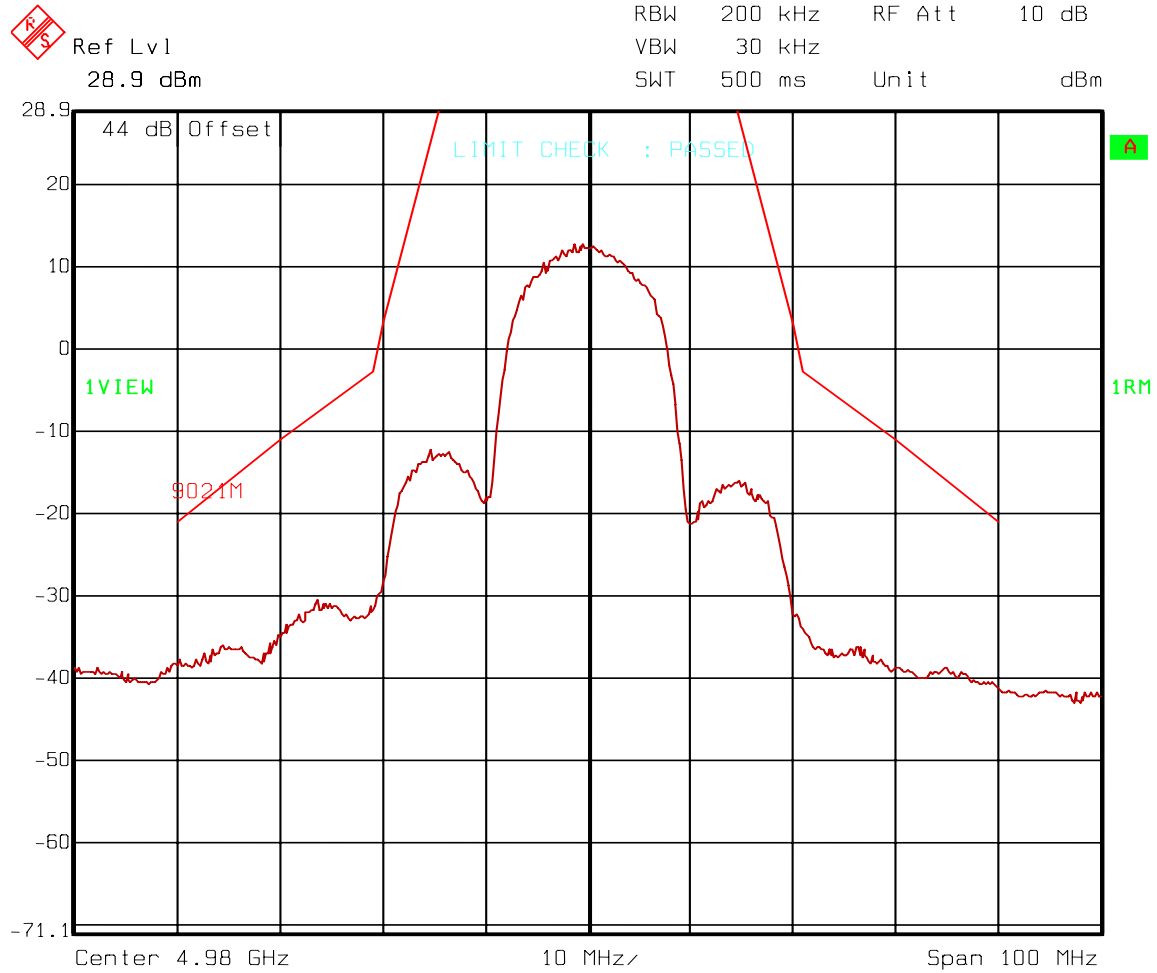
Date: 18.JUL.2006 14:05:51

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Occupied Bandwidth

4980 MHz 11 Mbps



Date: 18.JUL.2006 14:04:27

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

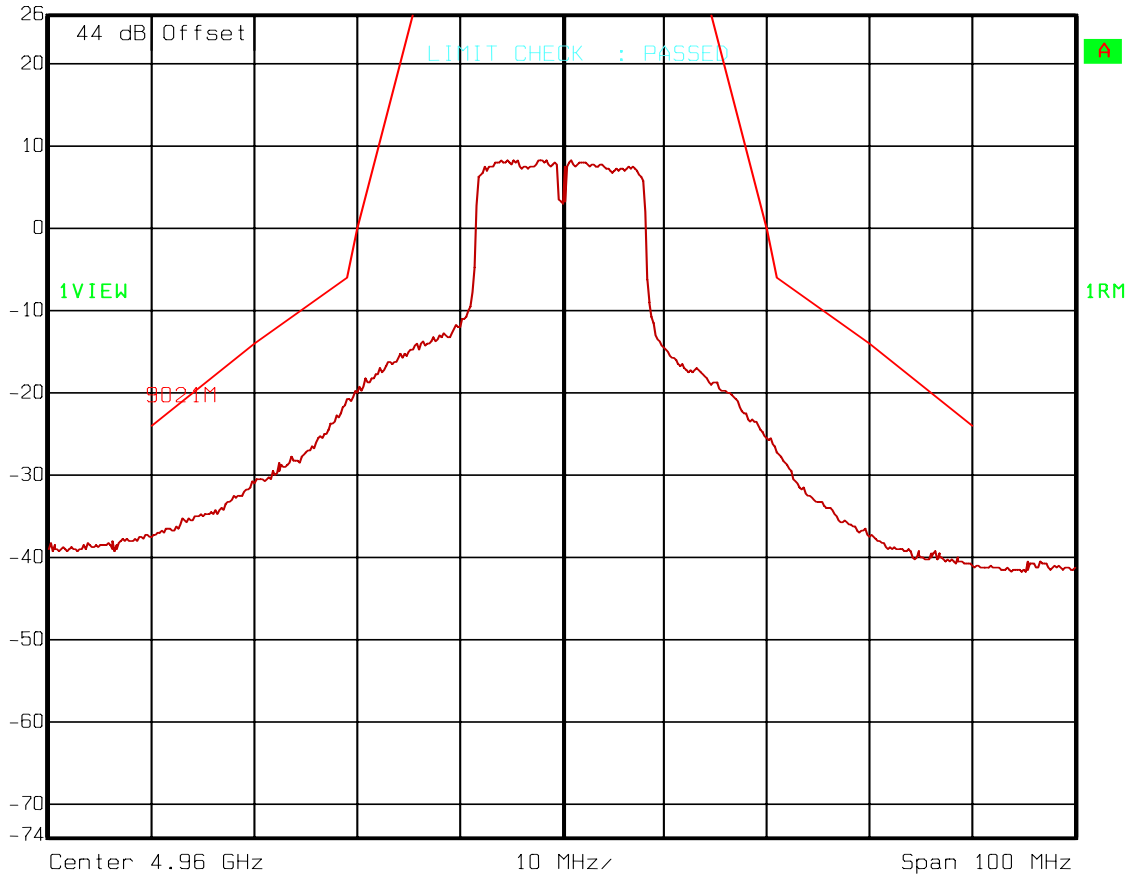
Test Data – Occupied Bandwidth

4960 MHz @ 54 Mbps



Ref Lvl
26 dBm

RBW 200 kHz RF Att 10 dB
VBW 30 kHz
SWT 500 ms Unit dBm



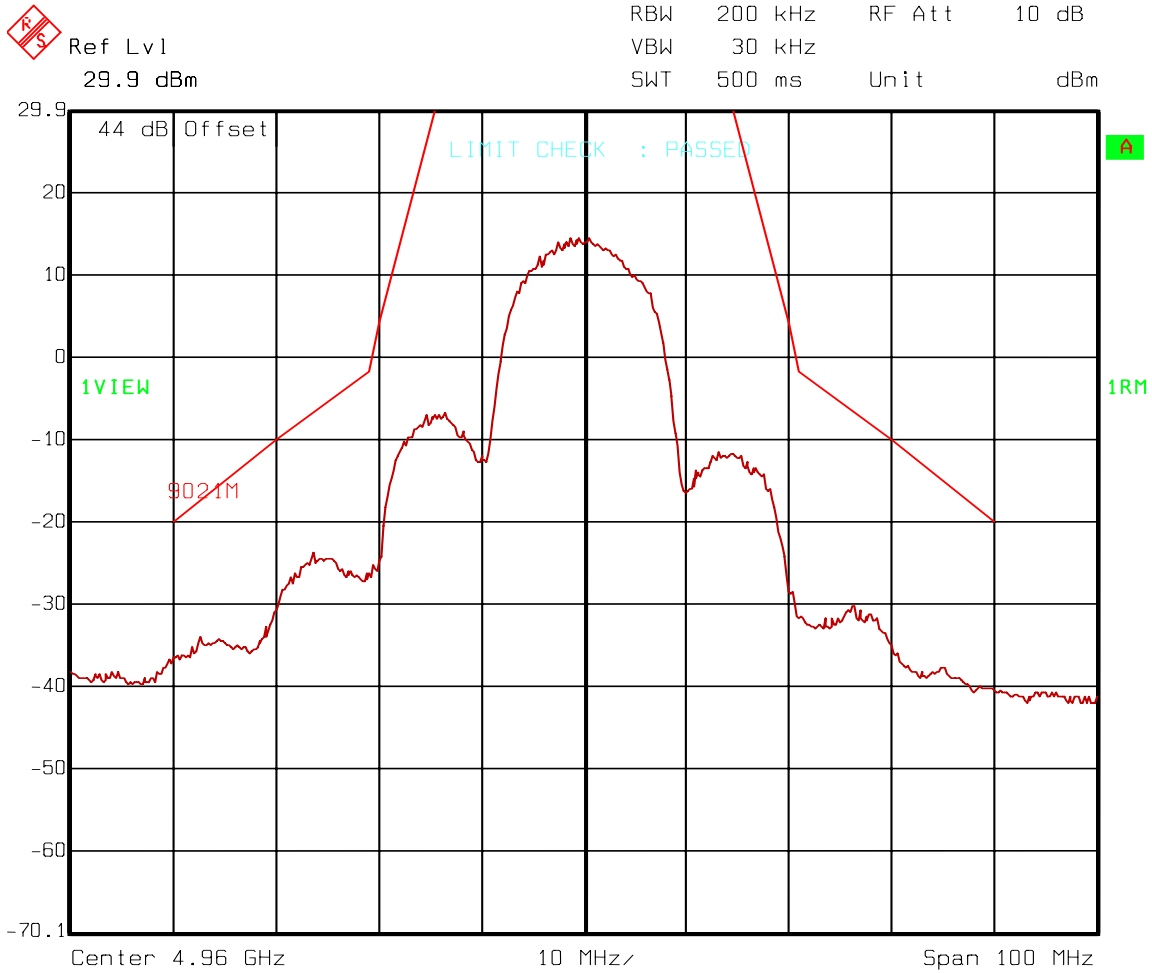
Date: 18.JUL.2006 14:07:33

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Occupied Bandwidth

4960 MHz @ 11 Mbps



Date: 18.JUL.2006 14:08:46

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 10 July 2006

Test Results: Complies.

Test Data: See attached graph(s).

Equipment Used: 1604-1528-1036-1472-1464-989

**Measurement
Uncertainty:** +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 45 %

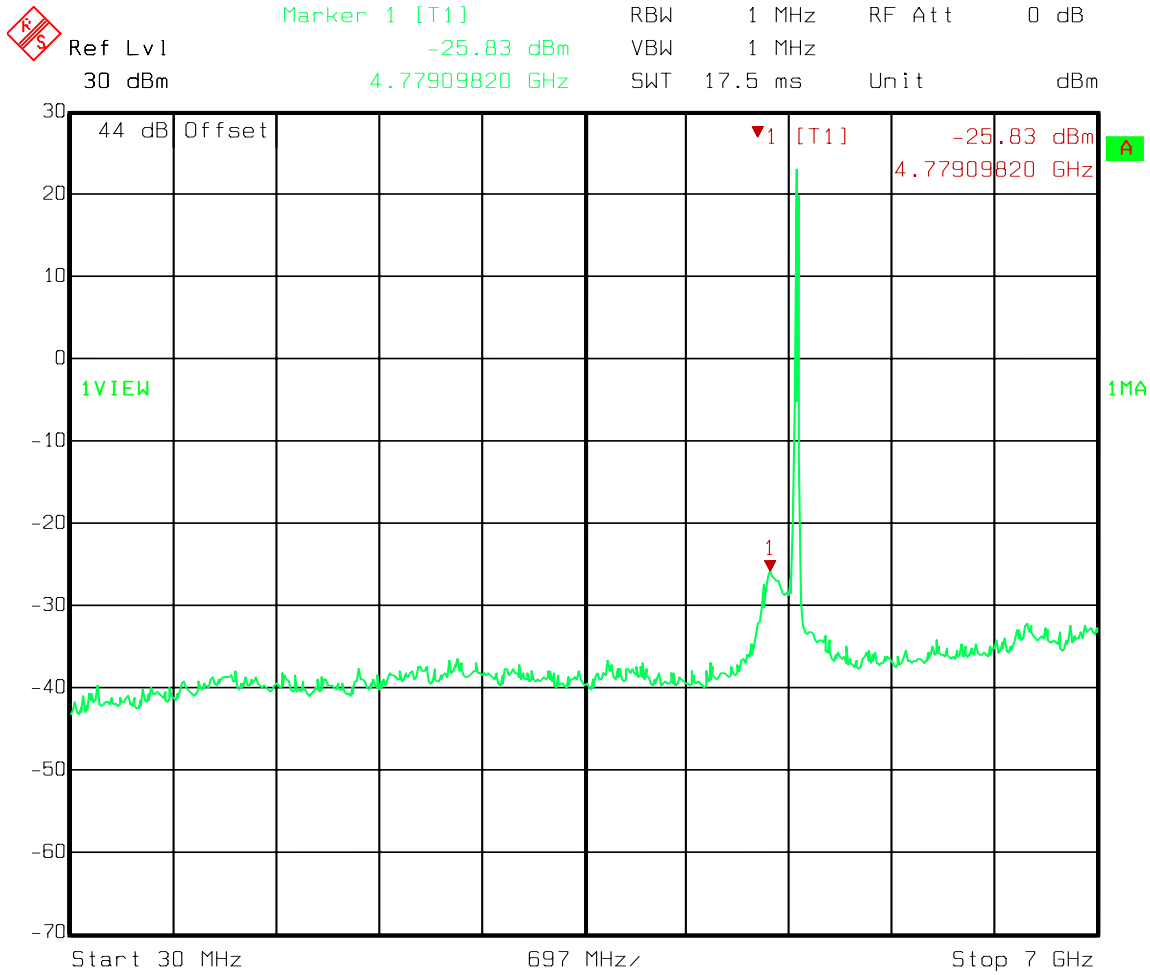
Note: The spectrum was searched from 30 MHz to 50 GHz. No emissions were detected above the second harmonic.

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Spurious Emissions at Antenna Terminals

APSE 11 Mbps
4960 MHz



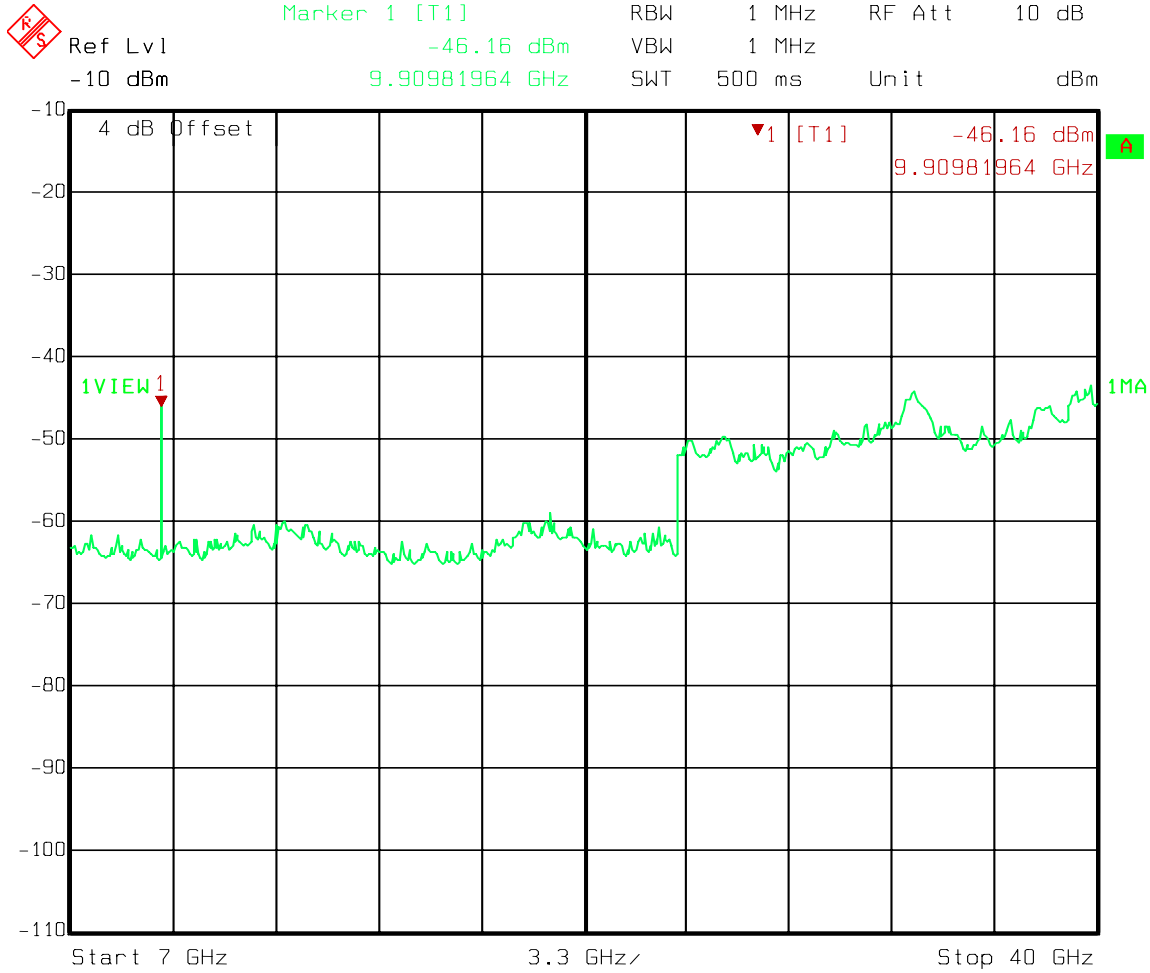
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EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Spurious Emissions at Antenna Terminals

APSE 11 Mbps
4960 MHz



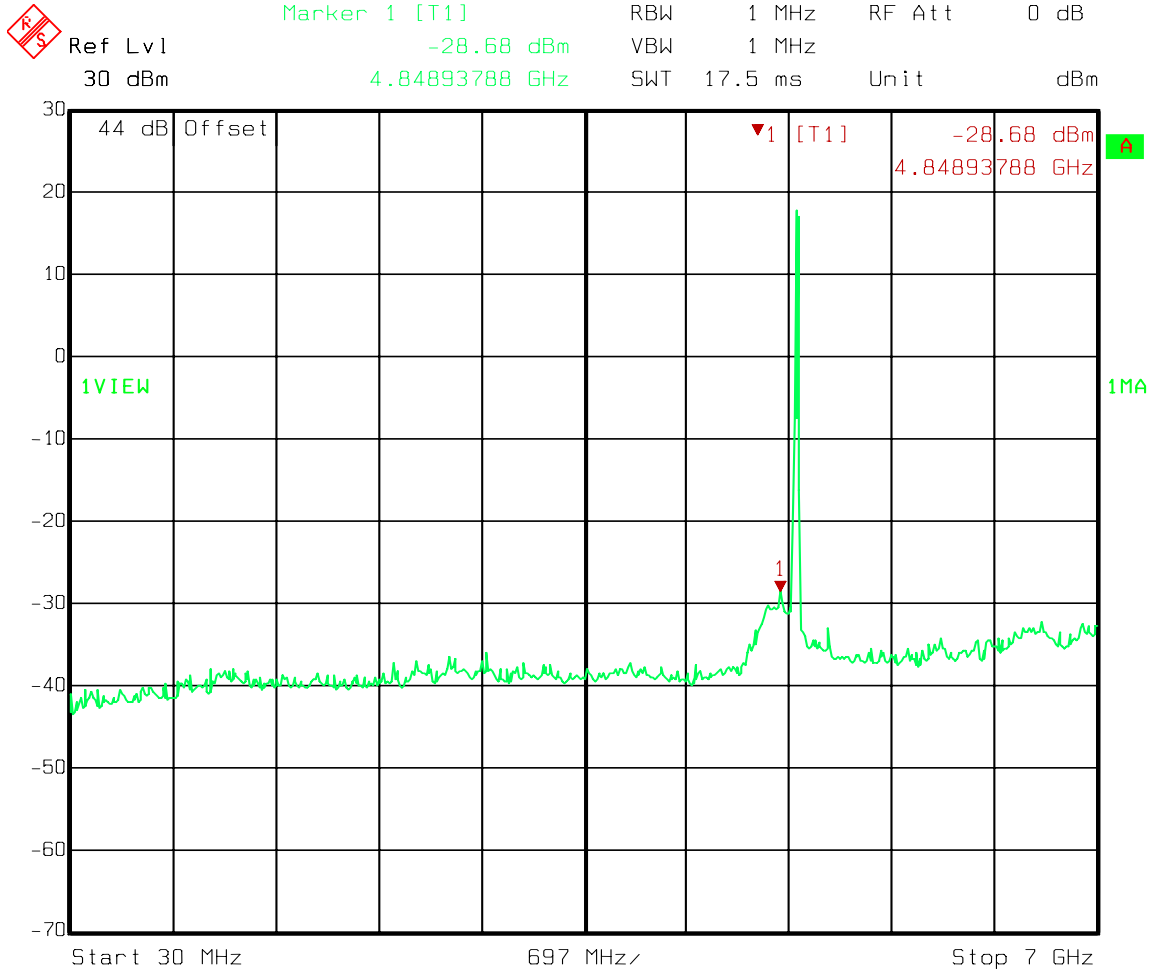
Date: 10.JUL.2006 11:45:39

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Spurious Emissions at Antenna Terminals

APSE 54 Mbps
4960 MHz



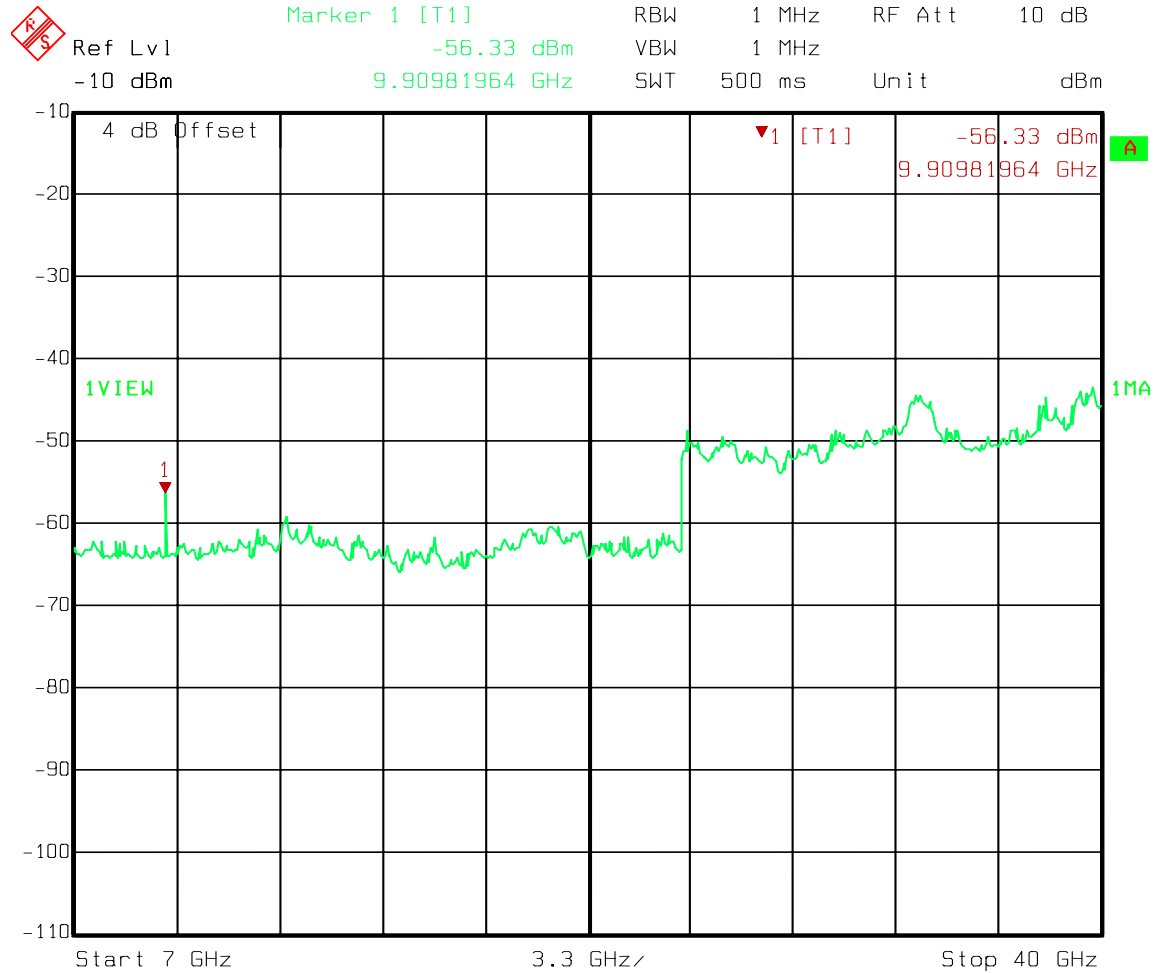
Date: 10.JUL.2006 11:31:22

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Spurious Emissions at Antenna Terminals

APSE 54 Mbps
4960 MHz



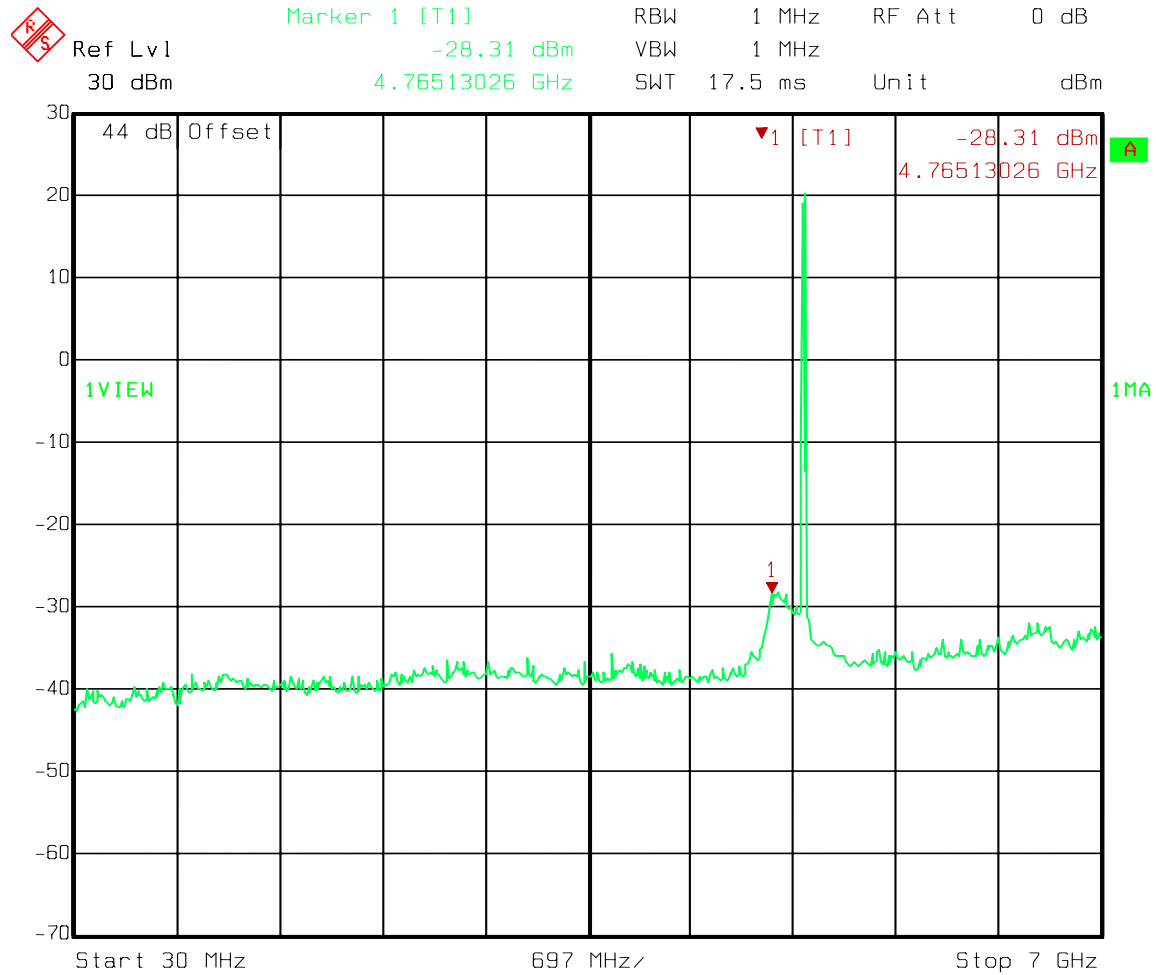
Date: 10.JUL.2006 11:47:14

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Spurious Emissions at Antenna Terminals

APSE 11 Mbps
4980 MHz



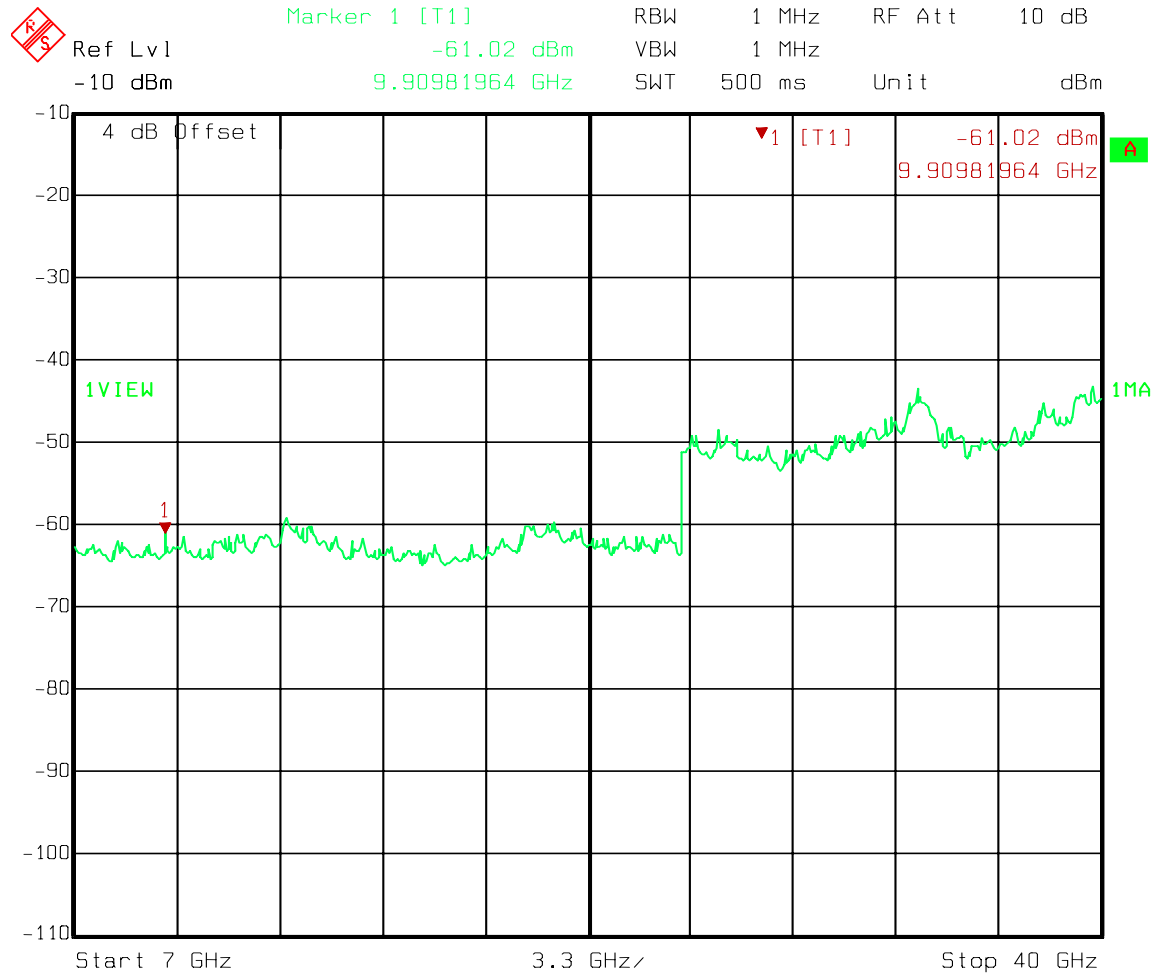
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EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Spurious Emissions at Antenna Terminals

APSE 11 Mbps
4980 MHz



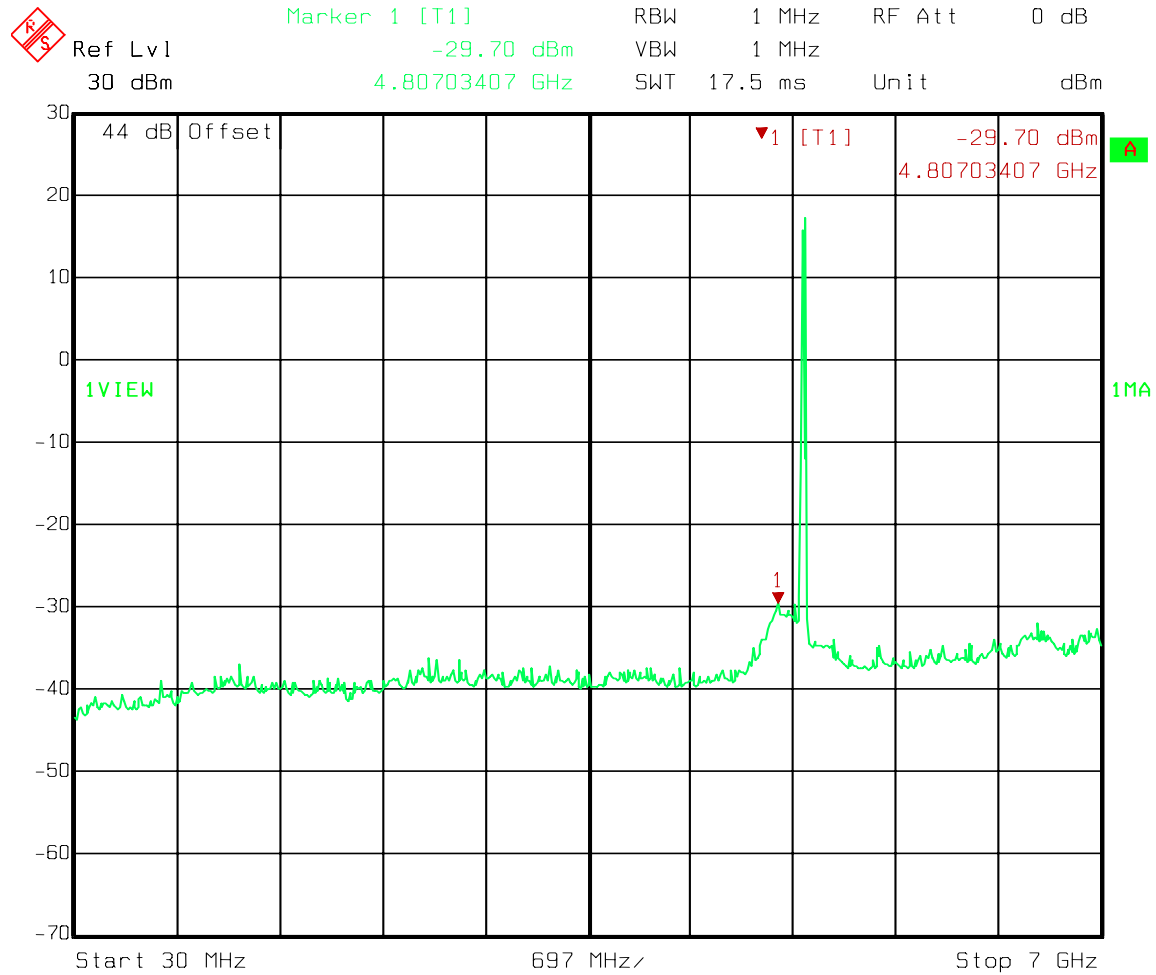
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EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Spurious Emissions at Antenna Terminals

APSE 54 Mbps
4980 MHz



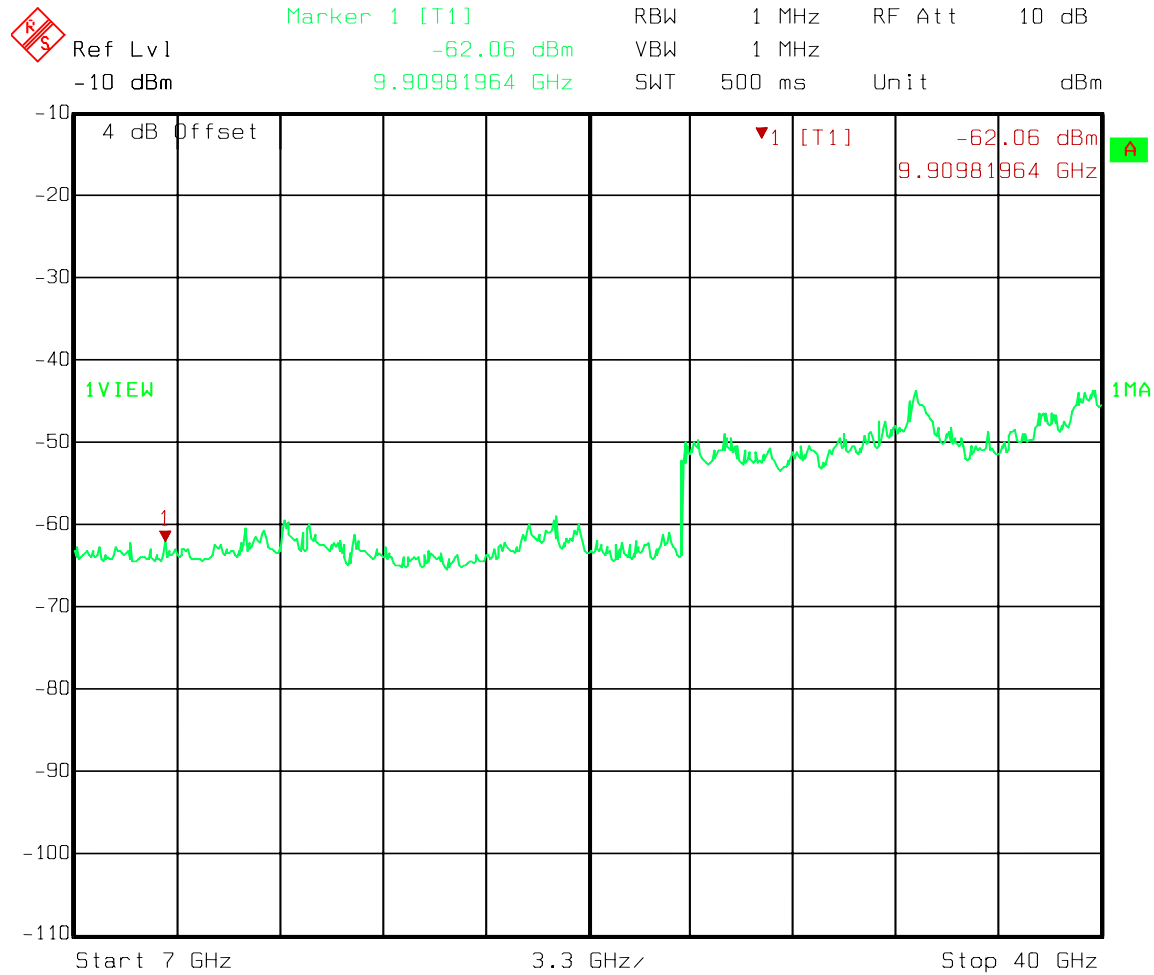
Date: 10.JUL.2006 11:33:57

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Spurious Emissions at Antenna Terminals

APSE 54 Mbps
4980 MHz



Date: 10.JUL.2006 11:49:29

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 10 July 2006

Test Results: Complies.

Test Data: The spectrum was searched from 30 MHz to 50 GHz. There were no emissions detected within 20 dB of the specification limit.

Spectrum analyzer settings: RBW = VBW = 1 MHz

Note: See page A5 for applicable limit.

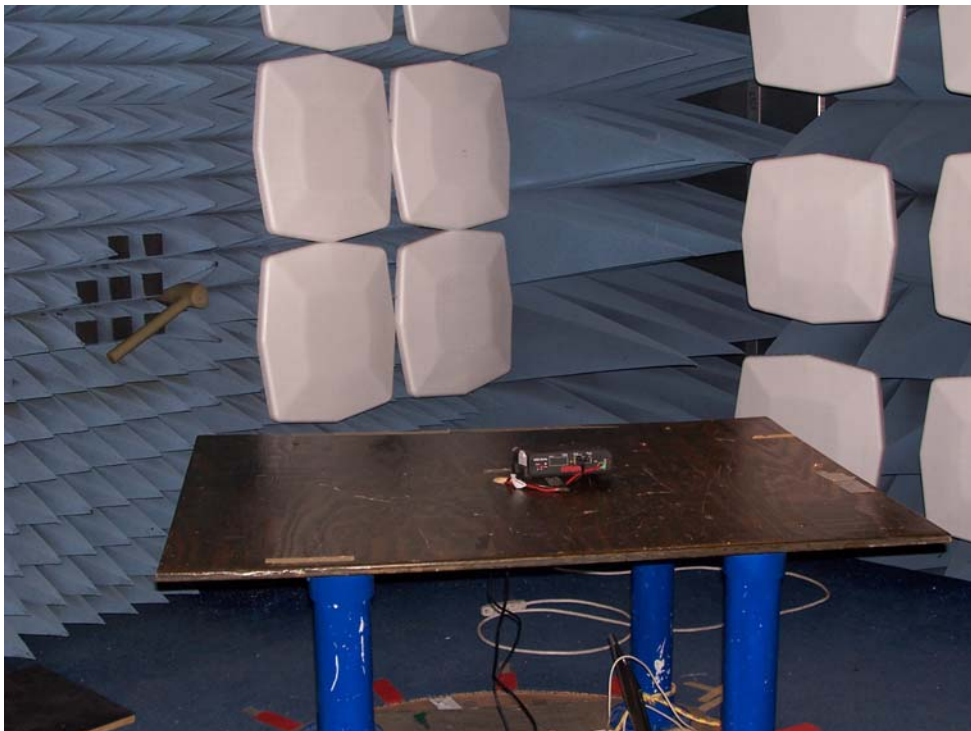
Equipment Used: 1464-989-991-992-984-983-993-1484-1485-759-760-791-1016

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 45 %

Photographs of Test Setup



EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 90.213(a)
TESTED BY: David Light	DATE: 17 July 2006

Test Results: Complies.

Measurement Data: See attached tables.

Equipment Used: 1604-1528-1465-283-1026

Measurement Uncertainty: 1×10^{-17} ppm

Temperature: 24 °C

Relative Humidity: 40 %

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Test Data – Frequency Stability

<u>Frequency Stability</u>							
Page <u>1</u> of <u>1</u>							
Job No.:	6L0211	Date:	7/17/2006				
Specification:	90.213	Temperature(°C):	24				
Tested By:	David Light	Relative Humidity(%):	40				
E.U.T.:	4.9 GHz Modem						
Configuration:	Tx CW						
Sample Number:	1						
Test Equipment Used							
Antenna:		Directional Coupler:					
Pre-Amp:		Cable #1:	1082				
Filter:		Cable #2:					
Receiver:	1026						
Attenuator #1:	1604						
Attenuator #2:	1469						
Chamber:	283						
Measurement Uncertainty:	1x10 ⁻¹⁷ ppm	Standard Test Frequency	4960.000000		MHz		
Temp (°C)	Measured Frequency (MHz)	Test Voltage	Frequency Error (Hz)	Limit (+/-Hz)	Error (ppm)	Comment	
20	4959.998962	120	-1038	Not defined	-0.21		
20	4959.999425	102.0	-575	Not defined	-0.12		
20	4959.999871	138.0	-129	Not defined	-0.03		
50	4960.005996	120	5996	Not defined	1.21		
40	4960.003629	120	3629	Not defined	0.73		
30	4960.002954	120	2954	Not defined	0.60		
10	4959.998241	120.0	-1759	Not defined	-0.35		
0	4959.996542	120.0	-3458	Not defined	-0.70		
-10	4960.000296	120.0	296	Not defined	0.06		
-20	4960.000500	120	500	Not defined	0.10		
-30	4960.000620	120	620	Not defined	0.12		
Notes:							

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

Section 8. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1604	ATTENUATOR	NARDA 776B-20	NONE	N/A	N/A
1528	CABLE 4M	Storm PR90-010-144	00-07-001	06/15/06	06/15/07
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	05/26/06	05/26/08
1472	20db Attenuator	Omni Spectra 20600-20db	NONE	CBU	N/A
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
989	HARMONIC MIXER	Hewlett Packard 11970U	2332A00116	01/00/00	N/A
991	Horn antenna	EMCO 3160-10	9704-1049	CNR	N/A
992	Horn antenna	EMCO 3160-09	9705-1079	CNR	N/A
984	HORN ANTENNA	MILLITECH NONE	NONE	CNR	N/A
983	PRE-AMP, 18-40 GHz	Nemko USA, Inc. BB1	1	11/11/05	11/11/06
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/01/05	08/02/07
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	04/20/06	04/20/07
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	02/13/06	02/13/07
760	Antenna biconical	Electro Metrics MFC-25	477	08/04/05	08/04/06
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	04/20/06	04/20/07
1484	Cable	Storm PR90-010-072	N/A	08/26/05	08/26/06
1485	Cable	Storm PR90-010-216	N/A	08/26/05	08/26/06
1026	FREQUENCY COUNTER	HEWLETT PACKARD 5350B	8232A01493	09/13/05	09/13/06
1465	10 db Attenuator DC 8.0 Ghz	Midwest Microwave 292/10db	NONE	CBU	N/A
283	Environmental Chamber with controller # 1189006	ENVIROTRONICS SH27 & 2030-22844	129010083	06/19/06	06/19/07

ANNEX A - TEST METHODOLOGIES

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

NAME OF TEST: RF Power Output**PARA. NO.: 2.985**

Minimum Standard: Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

Method Of Measurement:Detachable Antenna:

The peak power at antenna terminals is measured using a spectrum analyzer with channel power function. Channel power is integrated across the 6 dB bandwidth of the carrier. Power output is measured with the maximum rated input level.

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

EQUIPMENT: 195Ep Wireless Modem

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NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 2.991
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Test Method: RBW: 1% of emission bandwidth in the 0 - 1 GHz range.
1 MHz at frequencies above 1 GHz.

VBW: \Rightarrow RBW

The spectrum is searched up to 10 times the fundamental frequency.

EQUIPMENT: 195Ep Wireless Modem

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NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
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Minimum Standard: Para. No. 90.210, see table 1 below for applicable mask.

Table 1

Frequency Band (MHz)	Mask for equipment with Low Pass Filter	Mask for equipment without Low Pass Filter
Below 25	A or B	A or C
25 - 50	B	C
72 - 76	B	C
150 - 174	B, D or E	C, D or E
150 Paging only	B	C
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	B	H
806 - 821/ 851 - 866	B	G
821 - 824/ 866 - 869	B	H
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	B	G
Above 940	B	C
All other bands	B	C

EQUIPMENT: 195Ep Wireless Modem

PROJECT NO.: 6L0211RUS1rev1

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.993
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Minimum Standard: Para. No. 90.210, see table 1 for applicable mask.

Method of Measurement: TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

MASK	Spurious Limit	FS Limit Below 1 GHz	FS Limit Above 1 GHz
A,B,C,G,H,I	-13dBm	84.4 dB μ V/m@3m	82.2 dB μ V/m@3m
D,J	-20dBm	77.4 dB μ V/m@3m	75.2 dB μ V/m@3m
E,F,K	-25dBm	72.4 dB μ V/m@3m	70.2 dB μ V/m@3m

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NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
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Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 901	0.1	1.5	1.5
902 - 928	2.5	2.5	2.5
929 - 930	1.5	-	-
935 - 940	0.1	1.5	1.5
1427 - 1435	300	300	300
Above 2450	-	-	-

Nemko USA

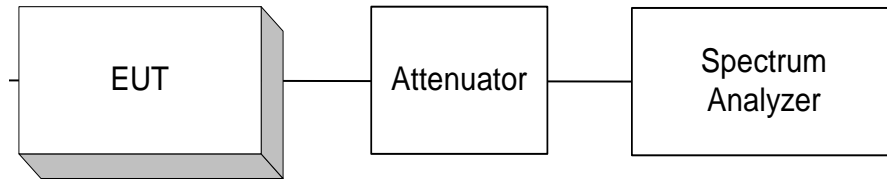
FCC PART 90, SUBPART I
TRANSMITTERS

EQUIPMENT: 195Ep Wireless Modem

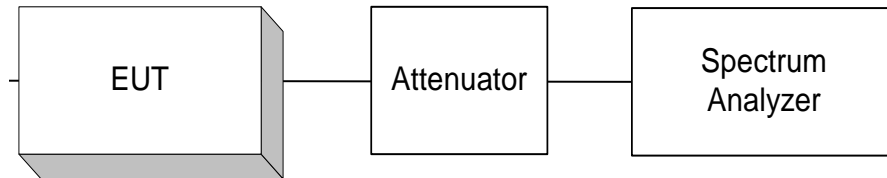
PROJECT NO.: **6L0211RUS1rev1**

ANNEX B - TEST DIAGRAMS

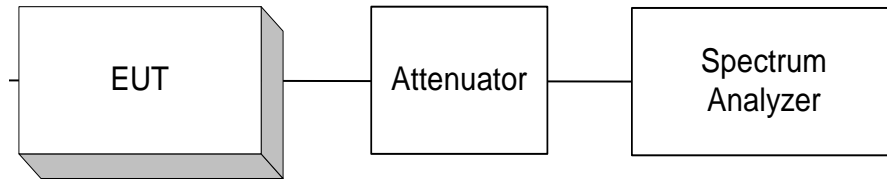
Para. No. 2.985 - R.F. Power Output



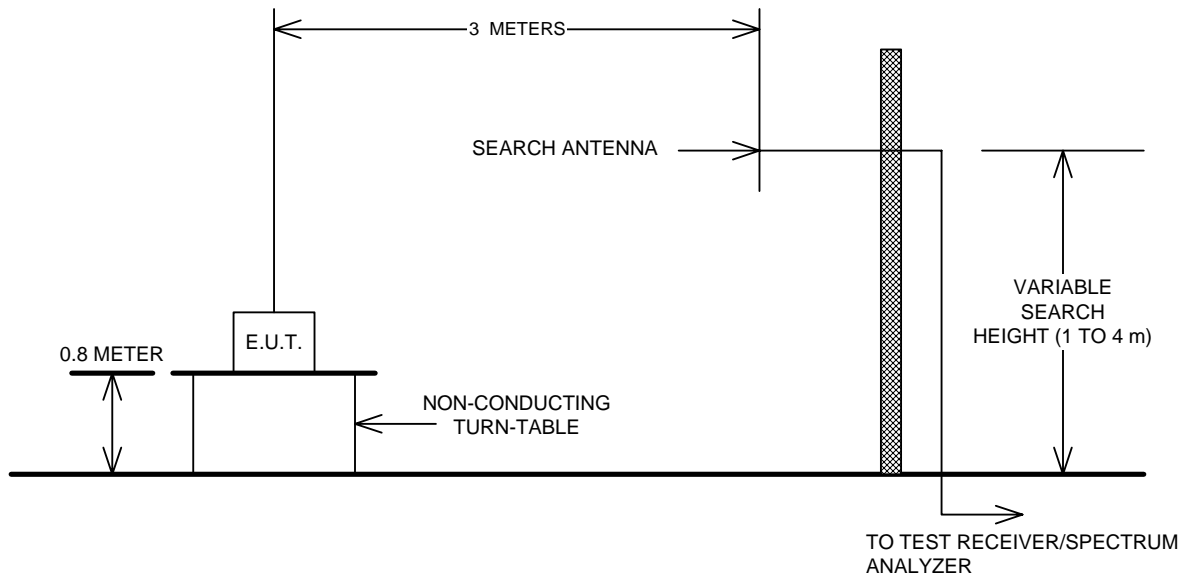
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



EQUIPMENT: 195Ep Wireless Modem

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Para. No. 2.995 - Frequency Stability

