Exhibit 6 – Test Report

SpectraPoint Wireless LLC
SP2000 Series Node Transmitter
FCC ID: NNSTX2000-HG-99

Model Number: TX2000-28-HG-510

Information Provided in this Exhibit:

Certification Test Report

This exhibit includes the Test Report for Certification testing performed on this Transmitter. The Certification test plan is included as Appendix F to this Test Report.

FCC Part 101 Certification Test Report for the SpectraPoint High Gain Node Transmitter (1 W)

Prepared for:

SpectraPoint Wireless LLC
1125 E. Collins Blvd.
Richardson, TX

Prepared by:

Motorola, SSG
8201 E. McDowell Rd.
Scottsdale, AZ

The Motorola SSG EMC/TEMPEST Laboratory is accredited through the

NVLAP

NVLAP Lab Code 100405-0

Prepared by:

Jim Dykema
Sr. Staff Engineer, EMC Group

Approved By:

Dwayne Awerkamp
Manager, EMC Group

Date : 26 Oct 1999
FCC ID:NNSTX2000-HG-99
Revision: -

Test Results Summary

Test Parameter	FCC Part 2 Paragraph Number	FCC Part 101 Paragraph Number	FCC Part 101 Limit	Test Results (Pass/Fail)
RF Power Output	2.1046	101.113	+30 dBW/MHz max. EIRP	Pass
Modulation Characteristics	2.1047	None	None	For Information Only
Occupied Bandwidth	2.1049	None	None	For Information Only
Spurious Emissions at Antenna Terminals	2.1051	101.111(a)(2) (ii) & (iii)	Refer to FCC Part 101	Pass
Field Strength of Spurious Emissions	2.1053	101.111(a)(2) (ii) & (iii)	Refer to FCC Part 101	Pass
Frequency Stability	2.1055	101.107	.001 %	Pass

Table of Contents

Tables

Appendices

1.0 Introduction

1.1 Facility Description

EMI testing of the SpectraPoint High Gain Node Transmitter (1 W) was performed at the Motorola Systems Solutions Group's (SSG) EMI/TEMPEST Test Laboratory. This test laboratory is located in the southeast wing of the Hayden building at 8201 E. McDowell Road, Scottsdale, AZ. The EMI/TEMPEST Test Laboratory is certified and accredited through the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP).

1.2 Quality System

The EMI/TEMPEST Test Laboratory maintains a Quality Manual that describes the quality assurance program of the EMC/TEMPEST Facility to set forth procedures covering all quality assurance functions. This manual has been constructed to reflect a quality program in compliance with the requirements of the following:

- National Institute of Standards & Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP)
- NIST/NVLAP EMC MIL-STD 462 Program Handbook (Apr. 1994)
- NVLAP EMC and Telecommunications FCC Methods Handbook 150-11 (Apr. 1995)
- MIL-Q-9858A, MIL-STD 461, 462, 463, 461D, 462D
- National Security Agency Technical and Security Requirements Document for the Endorsed TEMPEST Test Services Program, NSA TSRD No. 88-8B, 5 Oct. 1993
- System Solution Group of Motorola Quality Six Sigma Program.

1.3 Standard References

47 CFR 2	Code of Federal Regulations, Title 47, Part 2, "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
47 CFR 101	Code of Federal Regulations, Title 47, Part 101, "Fixed Microwave Devices"
C63.4-1992	American National Standards Institute (ANSI), "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
NFPA-70	National Electric Code (1996)
3215791	FCC Certification Test Plan for the High Gain Node Transmitter (1 W), dated 9/29/99

2.0 Equipment Under Test (EUT) Description

The SpectraPoint 1.0 Watt High Gain Node Transmitter is a block upconverter which translates L-Band (950 – 1950 MHz) intermediate frequency (I/F) signals to Ka-Band (27.5 to 28.35 GHz) and consists of an upconverter-power amplifier, a local oscillator, an electronics board, a waveguide filter, a horn antenna and a temperature-controlled radome. The unit is housed in an RF-tight enclosure to minimize unintentional RF radiation from the unit and also to minimize effects of RF radiation from other equipment in the operational environment.

In addition to the L-Band I/F signal input, the transmitter receives a 960 MHz Reference Tone to synchronize the Local Oscillator, a -48 Volt DC input power for the electronic circuitry and radome heater, and RS-485 command/control signals. The transmitter provides status upon command via the RS-485 bus.

For additional information on the High Gain Node Transmitter refer to "FCC Certification Test Plan for the High Gain Node Transmitter (1 W), dated 9/29/99". This test plan is included as Appendix F of this test report.

3.0 Test Procedure

The High Gain Node Transmitter is subject to FCC Part 101 and Part 2 for FCC Certification for units deployable in the United States. The following tests, as specified in FCC Part 2, with limits as defined in FCC Part 101, and shown in Table 3.0-1 below were performed on the High Gain Node Transmitter. The SpectraPoint-provided test plan ("FCC Certification Test Plan for the High Gain Node Transmitter (1 W)", dated 9/29/99) was used in performing FCC testing.

The transmitter was operated at its maximum rated output power (+30dBm) for all tests. The EUT's Model Number was W10297-001 Rev.3 H13/H8 and the serial number tested was 003.

Table 3.0-1 Tests Required for Certification of the SpectraPoint High Gain Node Transmitter

Test Parameter	FCC Part 2 Paragraph Number	FCC Part 101 Paragraph Number	FCC Part 101 Limit
RF Power Output	2.1046	101.113	+30 dBW/MHz max. EIRP
Modulation Characteristics	2.1047	None	None
Occupied Bandwidth	2.1049	None	None
Spurious Emissions at Antenna Terminals	2.1051	101.111(a)(2) (ii) & (iii)	Refer to FCC Part 101
Field Strength of Spurious Emissions	2.1053	101.111(a)(2) (ii) & (iii)	Refer to FCC Part 101
Frequency Stability	2.1055	101.107	.001 %

4.0 Test Results

4.1 RF Power Spectral Density Measurement Test Results

The maximum EIRP of the High Gain Node Transmitter, when operated at maximum rated output of +30 dBm and antenna gain of 22 dBi, is +22 dBW which is within the limit specified in Part 101 Paragraph 101.113 of +30 dBW/MHz.

The High Gain Node Transmitter meets the power density requirements of paragraph 101.113. Refer to Appendix A for the Power Spectral Density test summary table, individual data figures, and test setup photographs.

4.2 Occupied Bandwidth Measurement Tests Results

Refer to Appendix B for the Occupied Bandwidth test summary table, individual data figures, and test setup photographs.

4.3 Conducted Spurious Emissions – Antenna Port Measurement Test Results

The High Gain Node Transmitter meets the conducted spurious emission requirements of paragraph 101.111. Refer to Appendix C for the Conducted Spurious Emission test summary table, individual data figures, and test setup photographs.

4.4 Radiated Spurious Emissions Measurement Test Results

The High Gain Node Transmitter meets the radiated spurious emission requirements of paragraph 101.111. Refer to Appendix D for the Radiated Spurious Emission test summary table, individual data figures, and test setup photographs.

4.5 Frequency Stability Measurement Test Results

The High Gain Node Transmitter meets the frequency stability requirements of paragraph 101.107. Refer to Appendix E for the Frequency Stability test summary table, individual data figure, and test setup photographs.

5.0 Test Equipment

Table 5.0-1 Test Equipment List

MODEL	DESCRIPTION	MFG.	ASSET #	LAST	DUE
3142B	Antenna, BiConiLog	EMCO	G-47085	11-Mar-99	31-Mar-00
3115	Antenna, Horn 1.0-18 GHz	EMCO	G-43252	12-May-99	31-May-00
94626-1	Antenna, Horn 18-26.5 GHz	Eaton	G-27435	NCR	NCR
94627-1	Antenna, Horn 26.5-40 GHz	Eaton	G-41098	NCR	NCR
FS-Z16	Harmonic Mixer Set, 40 - 110 GHz	Rohde&Schwarz	G-53050	NCR	NCR
ESMI	Receiver, 20 Hz-26 GHz	Rohde&Schwarz	G-53133	27-Jan-99	31-Jan-00
ESI	Receiver, 20 Hz-40 GHz	Rohde&Schwarz	G-68094	28-Sep-99	30-Sep-00
83650B	Gen., Syn. Sweep 10 MHz - 50 GHz	H.P.	G-68452	12-Aug-99	31-Aug-00
6050A	Power Supply, 0-60 VDC	P.D.	T-12388	NCR	NCR
TX3	True RMS Multimeter	Tek.	T-46666	09-Sep-99	30-Sep-00
XL2300TK	Computer, Laptop	TwinHead	T-56978	NCR	NCR
8501A	Meter, Power	Wavetek	G-43373	12-Mar-99	31-Mar-00
8564E	Spectrum Analyzer, 40 GHz	H. P.	G66537	17-Sep-99	30-Sep-00
AMIQ	Modulation Generator	Rohde&Schwarz	831440/005	30-Jun-99	30-Jun-02
SMIQ	Signal Generator	Rohde&Schwarz	78257	22-Sep-99	30-Sep-00
SMIQ	Signal Generator	Rohde&Schwarz	76525	22-Sep-99	30-Sep-00
SMIQ	Signal Generator	Rohde&Schwarz	n/a	20-Feb-98	20-Feb-01

Appendix A

RF Power Measurements

Table A-1 Tests Results for RF Power Measurements on the SpectraPoint High Gain Node Transmitter

Data Rate	RF Freq. (GHz)	Measured RF Power Densitv (dBm/Hz)	Correction Factor (dBW/MHz)	Attenuation* (dB)	Antenna Gain. (dBi)	Corrected RF Power Densitv (dBW/MHz)	Limit (dBW/MHz)	Appendix Figure Number
40 Mbps (10.851 MSps)	27.520	-59.17	30	13.8	22	6.6	30	A - 1
40 Mbps (10.851 MSps)	27.680	-59.30	30	13.7	22	6.4	30	A - 2
40 Mbps (10.851 MSps)	27.840	-59.30	30	13.6	22	6.3	30	A - 3
40 Mbps	27.520	-62.17	30	13.8	22	3.6	30	A - 4
(10.851 MSps)	27.560	-62.50	30	13.8	22	3.3	30	
40 Mbps	27.520	-64.17	30	13.8	22	1.6	30	A - 5
(10.851 MSps)	27.560	-64.00	30	13.8	22	1.8	30	
	27.600	-64.00	30	13.8	22	1.8	30	
40 Mbps	27.760	-63.84	30	13.6	22	1.8	30	A - 6
(10.851 MSps)	27.800	-64.00	30	13.6	22	1.6	30	
	27.840	-64.17	30	13.6	22	1.5	30	
* Attenuation includes waveguide loss, waveguide adapter loss and cable loss								

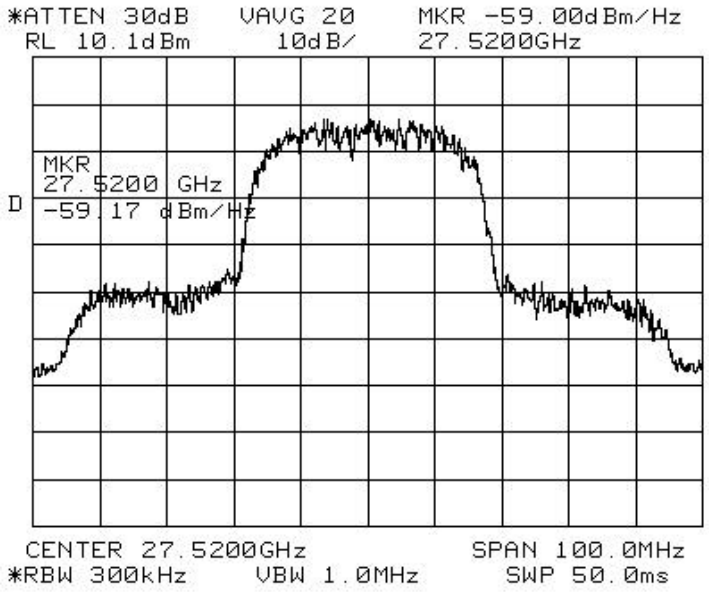


Figure A – 1 High Gain Node Transmitter; +30 dBm; 27.52 GHz; 45 Mbps.

Date : 26 Oct 1999
FCC ID: NNSTX2000-HG-99
Revision: -

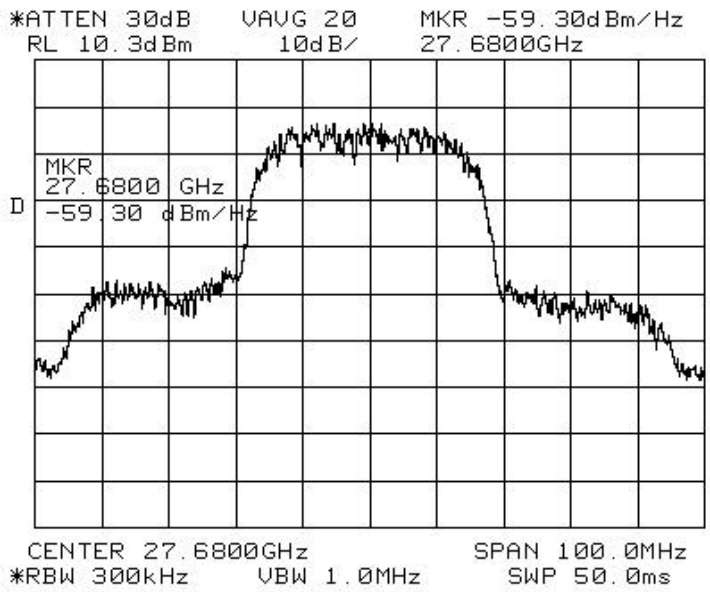


Figure A – 2 High Gain Node Transmitter; +30 dBm; 27.68 GHz; 45 Mbps.

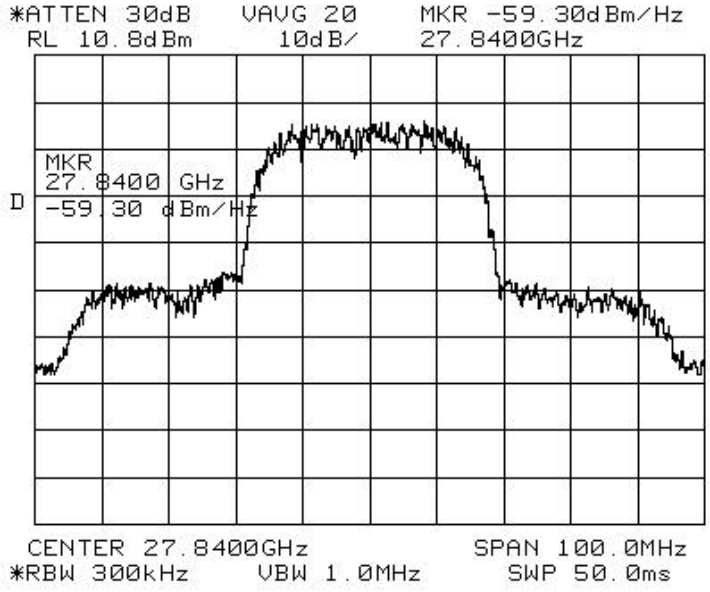


Figure A – 3 High Gain Node Transmitter; +30 dBm; 27.84 GHz; 45 Mbps.

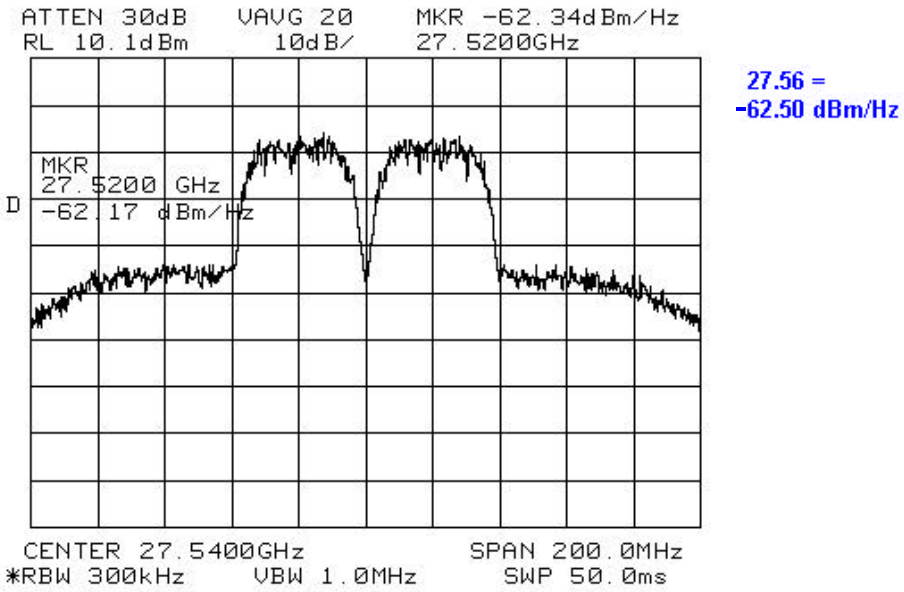


Figure A – 4 High Gain Node Transmitter; +30 dBm; 27.52 and 27.56 GHz; 45 Mbps.

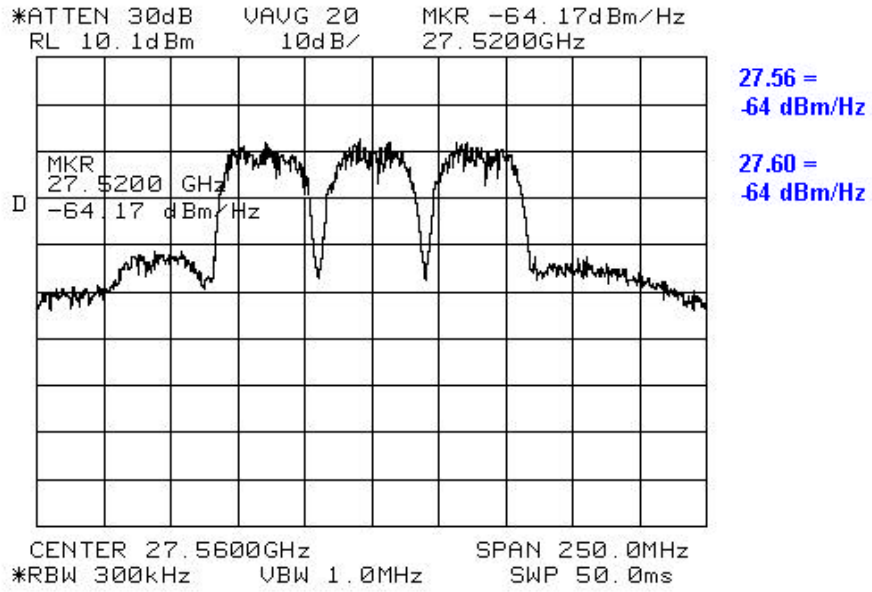


Figure A – 5 High Gain Node Transmitter; +30 dBm; 27.52, 27.56 and 27.58 GHz; 45 Mbps.

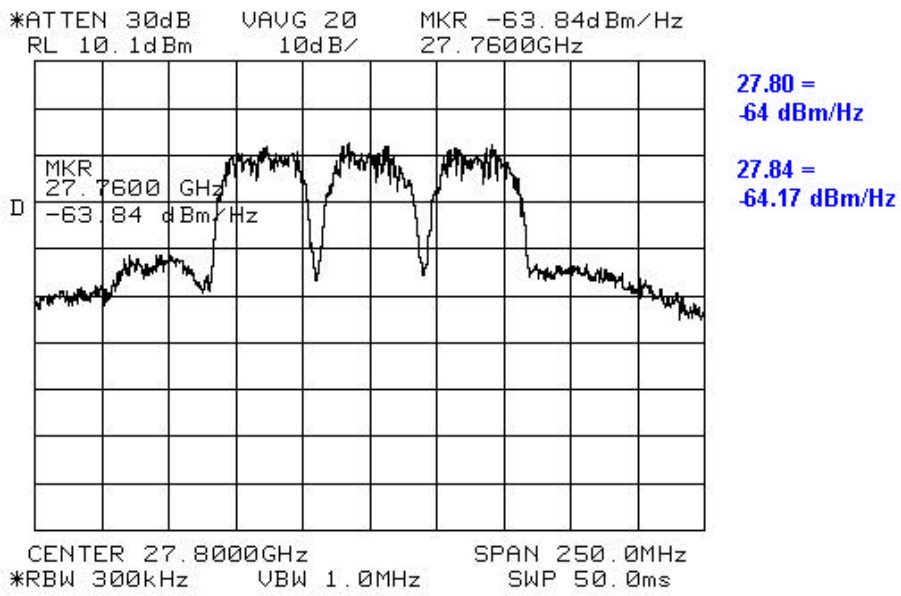


Figure A – 6 High Gain Node Transmitter; +30 dBm; 27.76, 27.80, and 27.84 GHz; 45 Mbps.

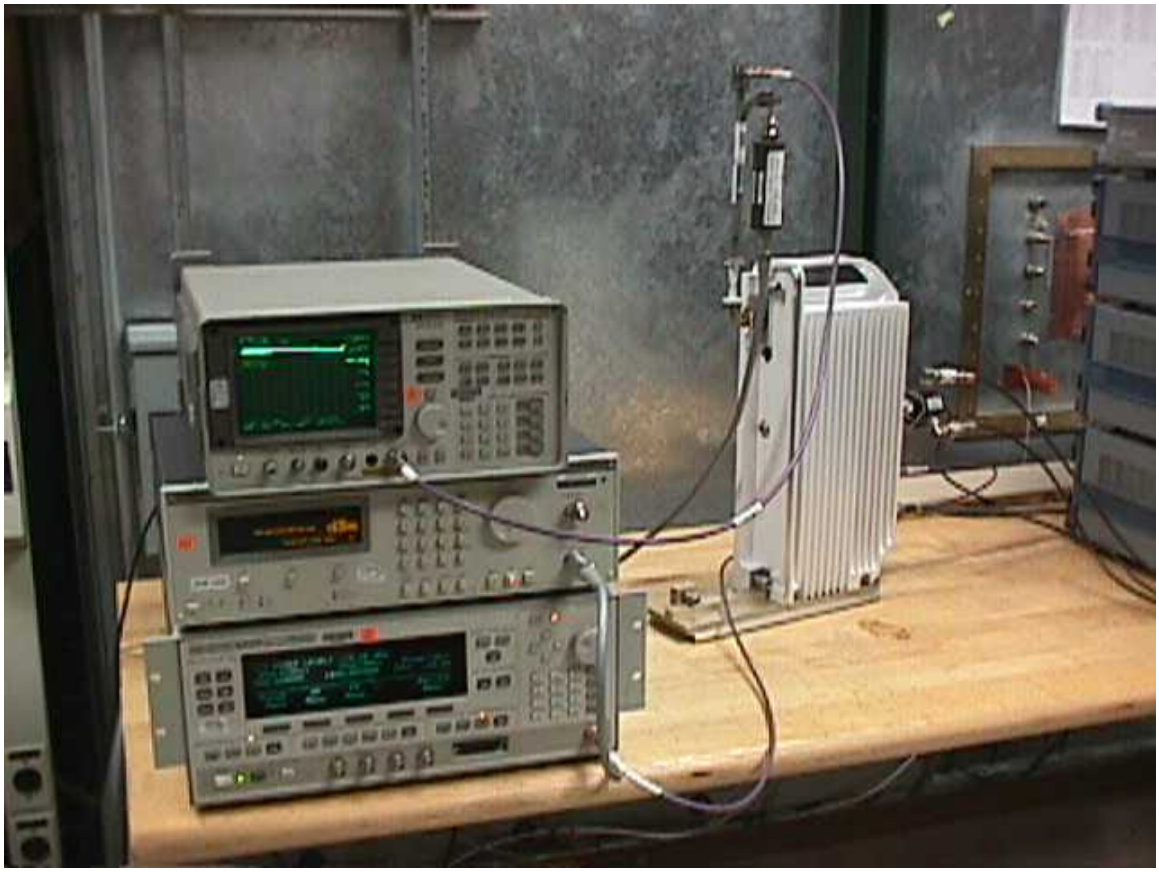


Figure A – 7 Test Setup for RF Power Spectral Density Measurements on the SpectraPoint High Gain Node Transmitter (view 1).

Figure A – 8 Test Setup for RF Power Spectral Density Measurements on the SpectraPoint High Gain Node Transmitter (view 2).

Appendix B

Occupied Bandwidth Measurements

Table B-1 Tests Results for Occupied Bandwidth Measurements on the SpectraPoint High Gain Node Transmitter

Data Rate (bits per sec.) (Symbols per sec.)	RF Frequency (GHz)	Measurement Bandwidth RBW/VBW (MHz/MHz)	99% Occupied Bandwidth (MHz)	Pass/Fail	Reference Figure
45 Mbps (27.9 MSps)	27.52	0.30/1.00	32.50	For Information Only	B - 1
45 Mbps (27.9 MSps)	27.68	0.30/1.00	32.83	For Information Only	B - 2
45 Mbps (27.9 MSps)	27.84	0.30/1.00	32.83	For Information Only	B - 3
45 Mbps (27.9 MSps)	27.52 27.56	0.30/1.00	72.33	For Information Only	B - 4
45 Mbps (27.9 MSps)	27.52 27.56 27.69	0.30/1.00	111.3	For Information Only	B - 5
45 Mbps (27.9 MSps)	27.76 27.80 27.84	0.30/1.00	112.5	For Information Only	B - 6

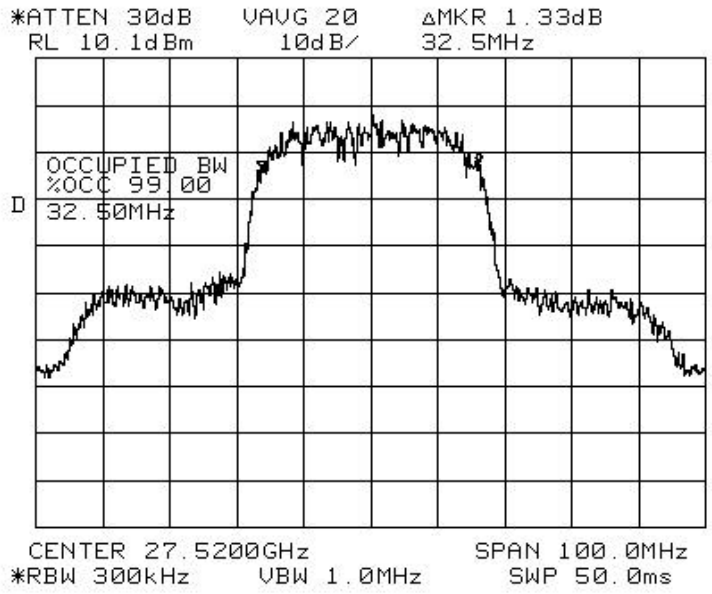


Figure B – 1 High Gain Node Transmitter; +30 dBm; 27.52 GHz; 45 Mbps.

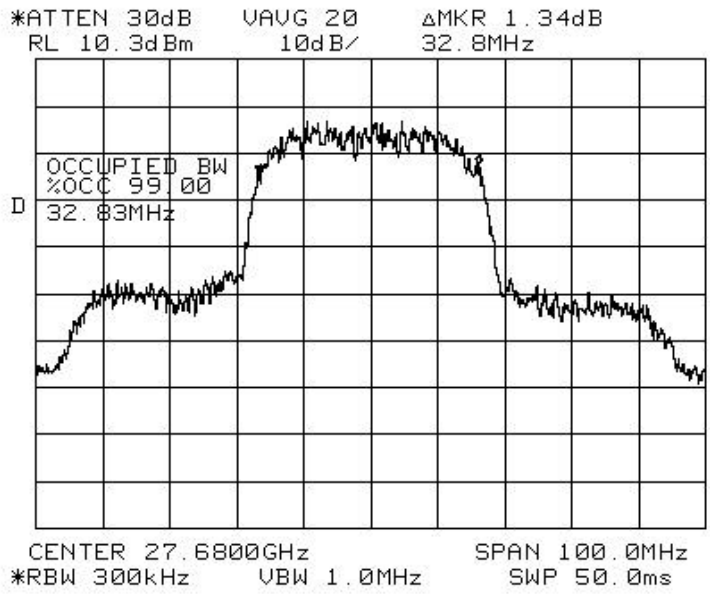


Figure B – 2 High Gain Node Transmitter; +30 dBm; 27.68 GHz; 45 Mbps.

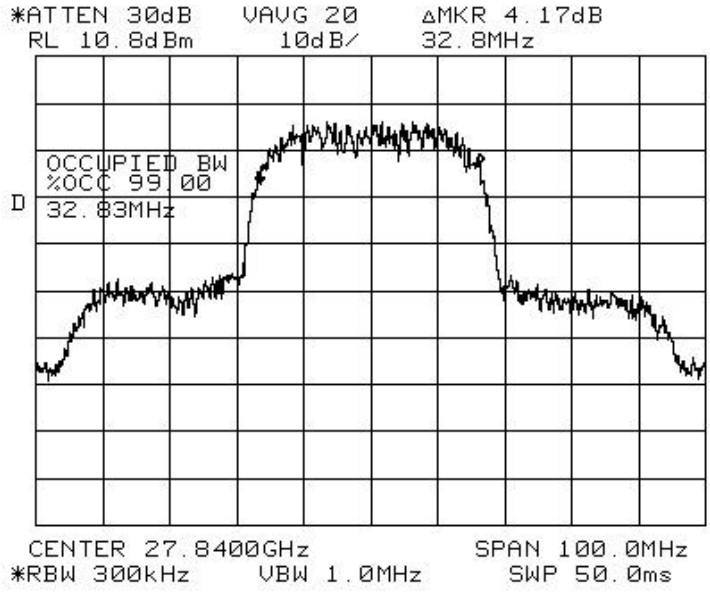


Figure B – 3 High Gain Node Transmitter; +30 dBm; 27.84 GHz; 45 Mbps.

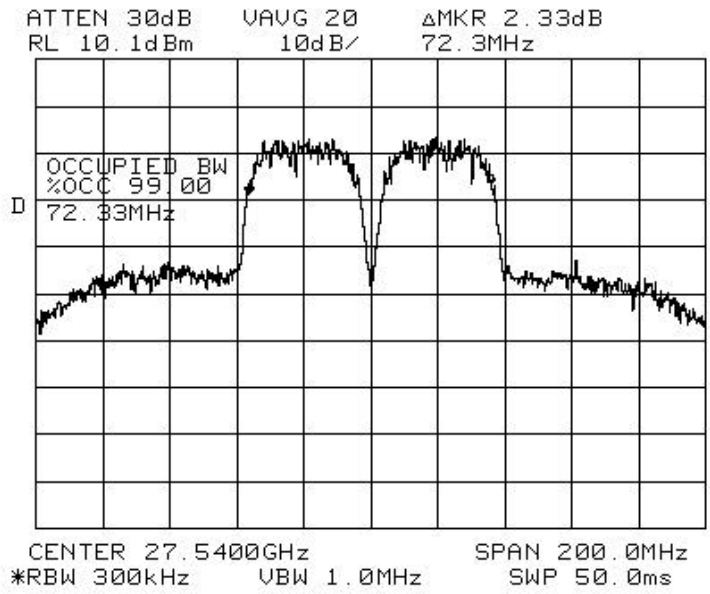


Figure B – 4 High Gain Node Transmitter; +30 dBm; 27.52 and 27.56 GHz; 45 Mbps.

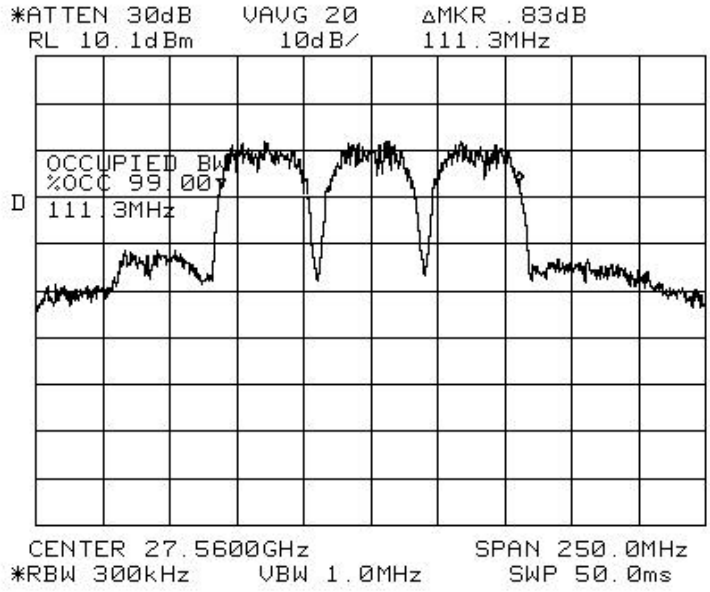


Figure B – 5 High Gain Node Transmitter; +30 dBm; 27.52, 27.56 and 27.60 GHz; 45 Mbps.

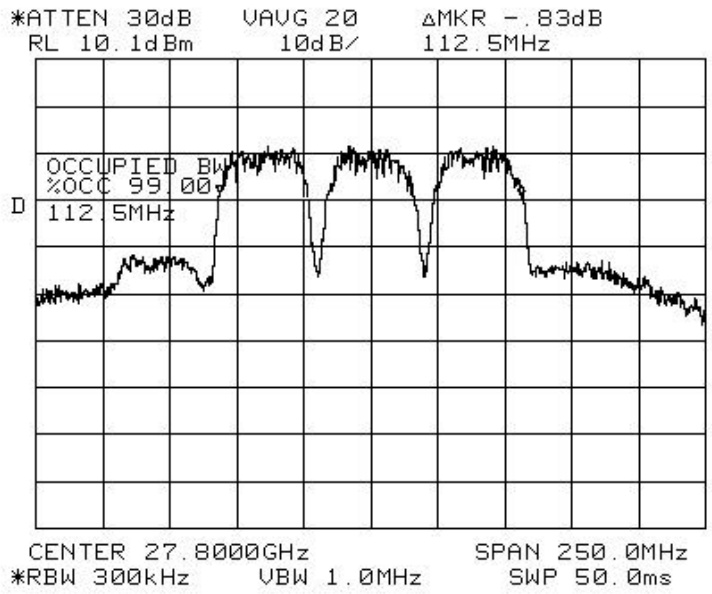


Figure B – 6 High Gain Node Transmitter; +30 dBm; 27.76, 27.80 and 27.84 GHz; 45 Mbps.

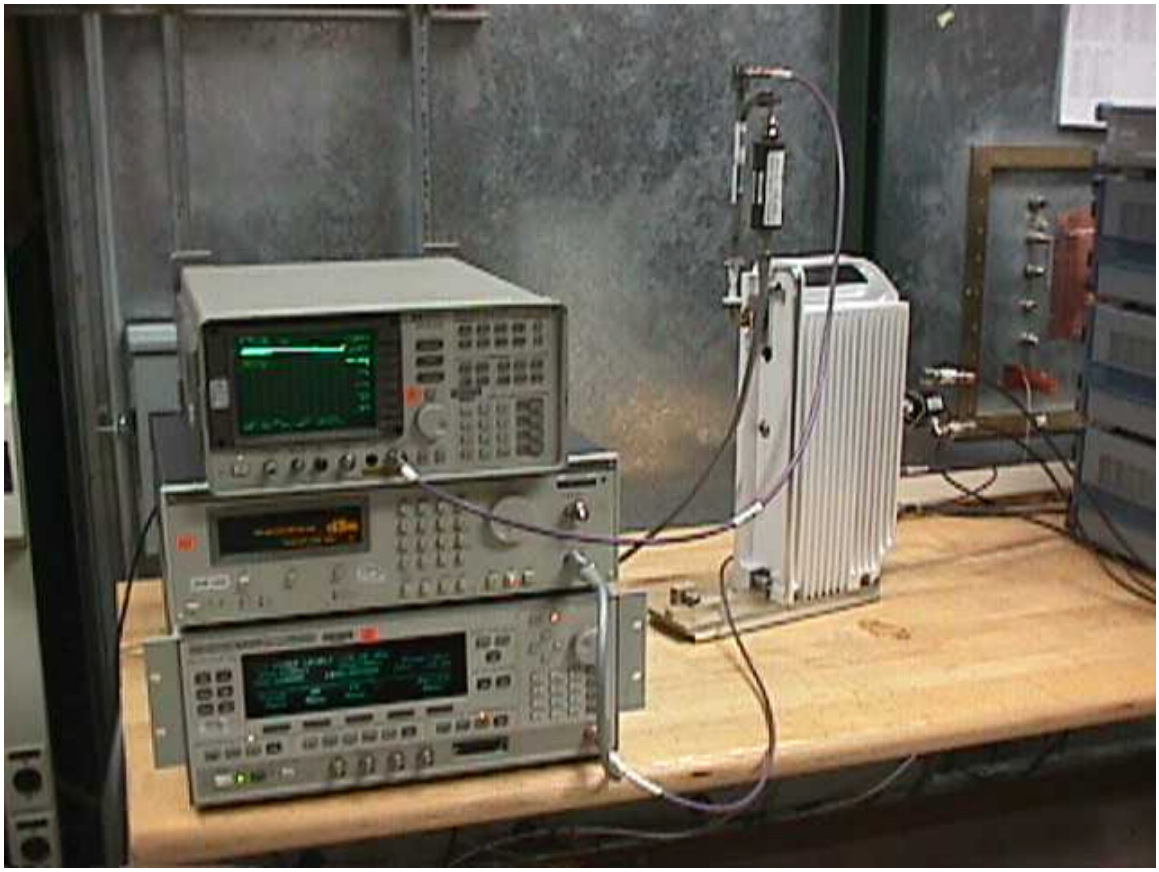


Figure B – 7 Test Setup for Occupied Bandwidth Measurements on the SpectraPoint High Gain Node Transmitter (view 1).

Date : 26 Oct 1999
FCC ID: NNSTX2000-HG-99
Revision: -

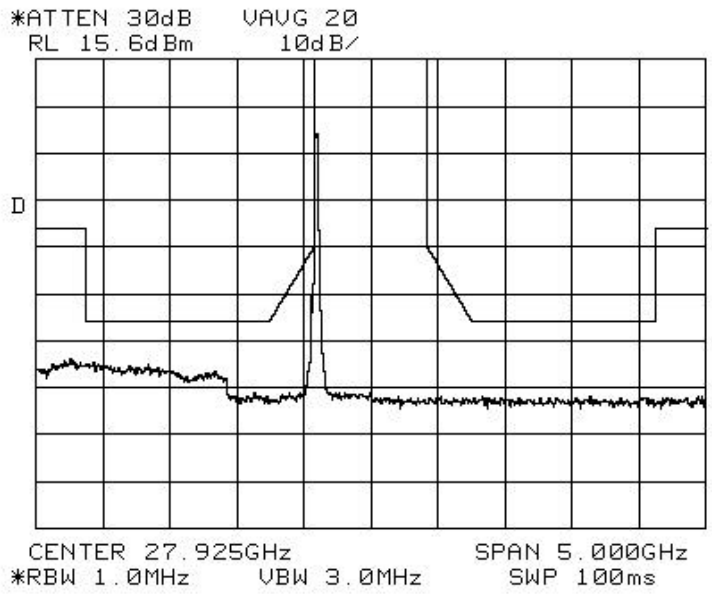
Figure B – 8 Test Setup for Occupied Bandwidth Measurements on the SpectraPoint High Gain Node Transmitter (view 2).

Appendix C

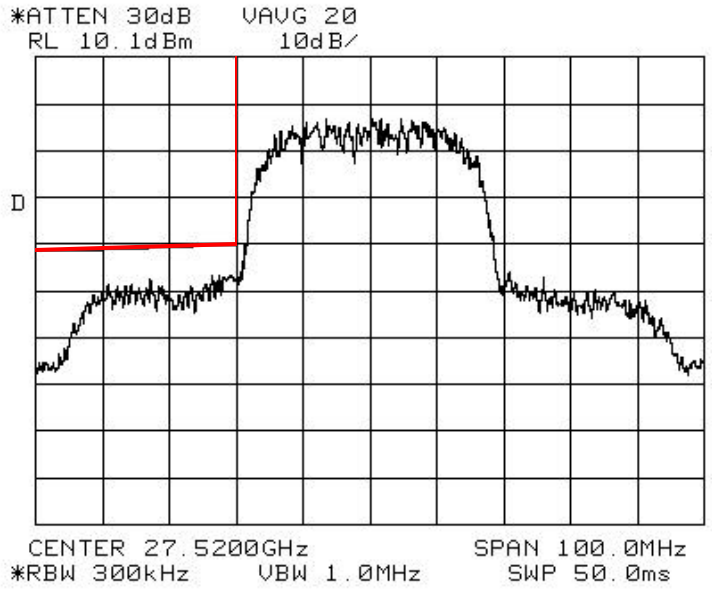
Antenna Terminal Conducted Spurious Emissions Measurement

Table C-1 Tests Results for Antenna Conducted Measurements on the SpectraPoint High Gain Node Transmitter

Data Rate (bits per sec.) (Symbols per sec.)	RF Transmit Frequency (GHz)	Test Frequency Range (GHz)	Pass /Fail	Reference Figure
45 Mbps (27.9 MSps)	27.52	10 – 25.8 25.8 – 30.05 30.05 – 40	Pass Pass Pass	C - 1
45 Mbps (27.9 MSps)	27.68	10 – 25.8 25.8 – 30.05 30.05 – 40	Pass Pass Pass	C - 2
45 Mbps (27.9 MSps)	27.84	10 – 25.8 25.8 – 30.05 30.05 – 40	Pass Pass Pass	C - 3
45 Mbps (27.9 MSps)	27.52 27.56	10 – 25.8 25.8 – 30.05 30.05 – 40	Pass Pass Pass	C - 4
45 Mbps (27.9 MSps)	27.52 27.56 27.69	10 – 25.8 25.8 – 30.05 30.05 – 40	Pass Pass Pass	C – 5
45 Mbps (27.9 MSps)	27.76 27.80 27.84	10 – 25.8 25.8 – 30.05 30.05 – 40	Pass Pass Pass	C - 6



a) Full span



b) Expanded view

Figure C – 1 High Gain Node Transmitter; +30 dBm; 27.52 GHz; 45 Mbps.

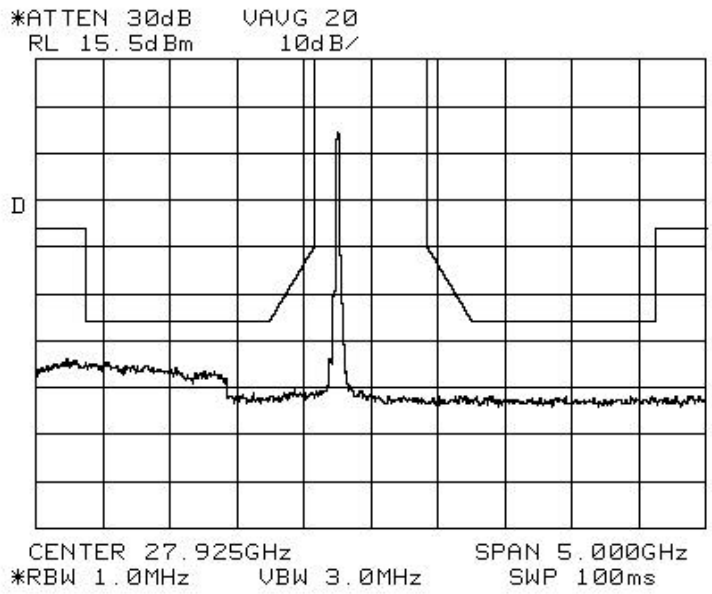


Figure C – 2 High Gain Node Transmitter; +30 dBm; 27.68 GHz; 45 Mbps.

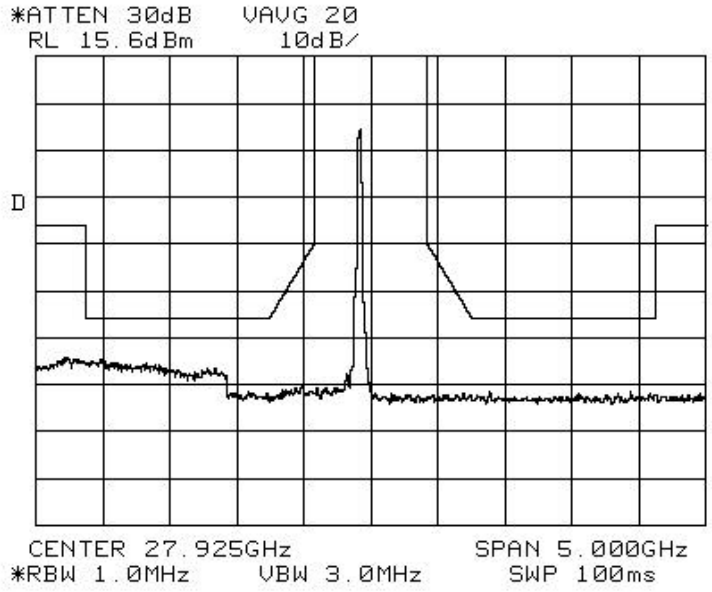
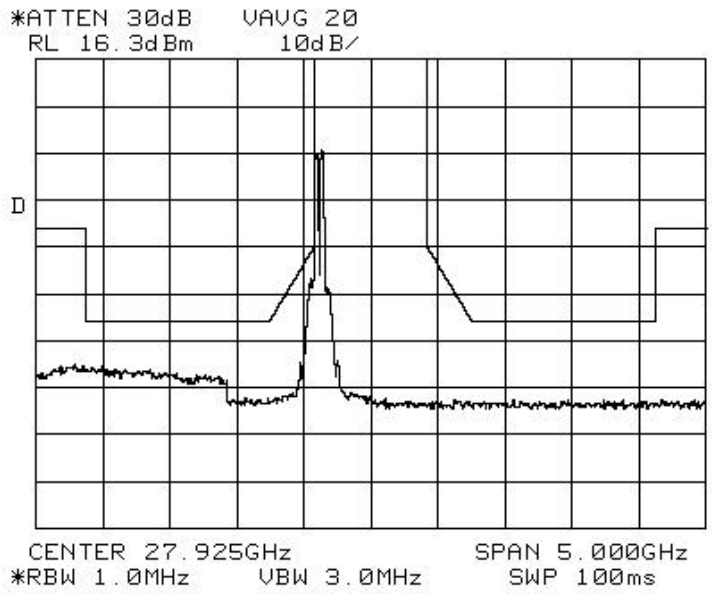
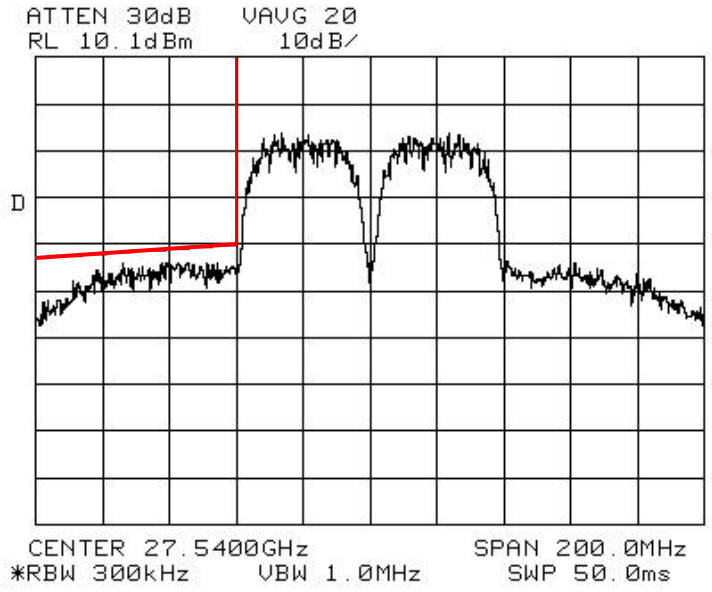


Figure C – 3 High Gain Node Transmitter; +30 dBm; 27.84 GHz; 45 Mbps.

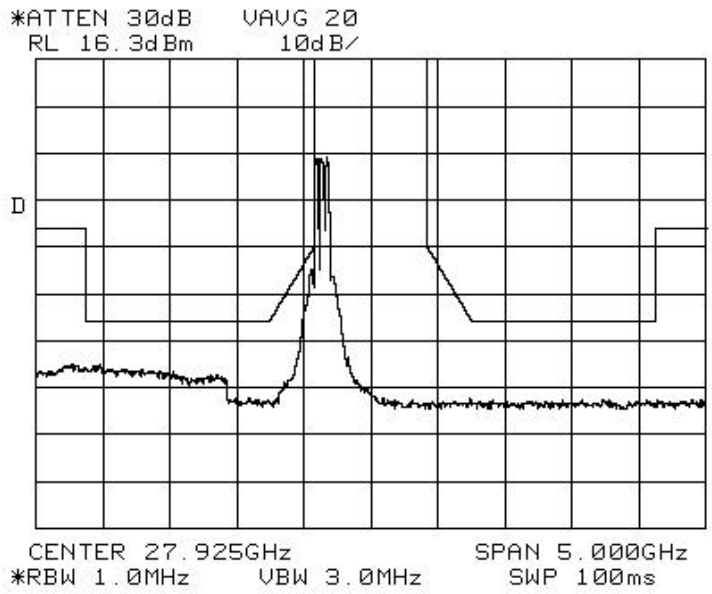


a) Full Span

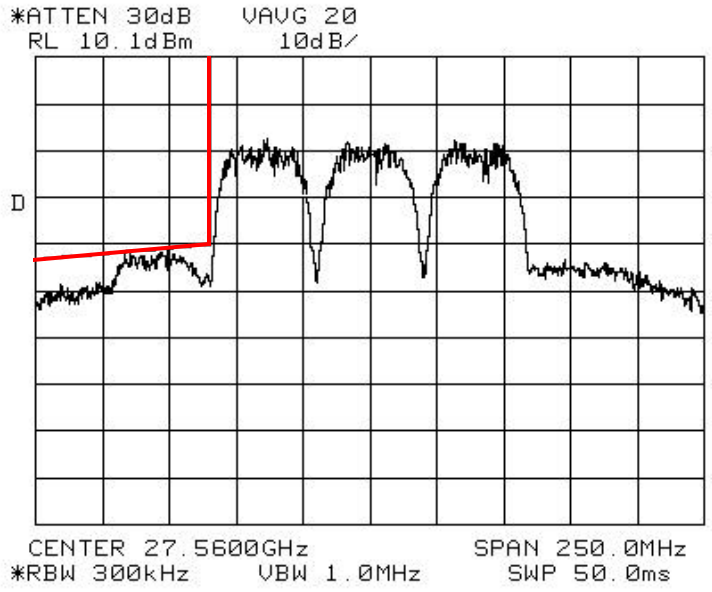


b) Expanded view

Figure C – 4 High Gain Node Transmitter; +30 dBm; 27.52 and 27.56 GHz; 45 Mbps.



a) Full span



b) Expanded view

Figure C – 5 High Gain Node Transmitter; +30 dBm; 27.52, 27.56 and 27.60 GHz; 45 Mbps.

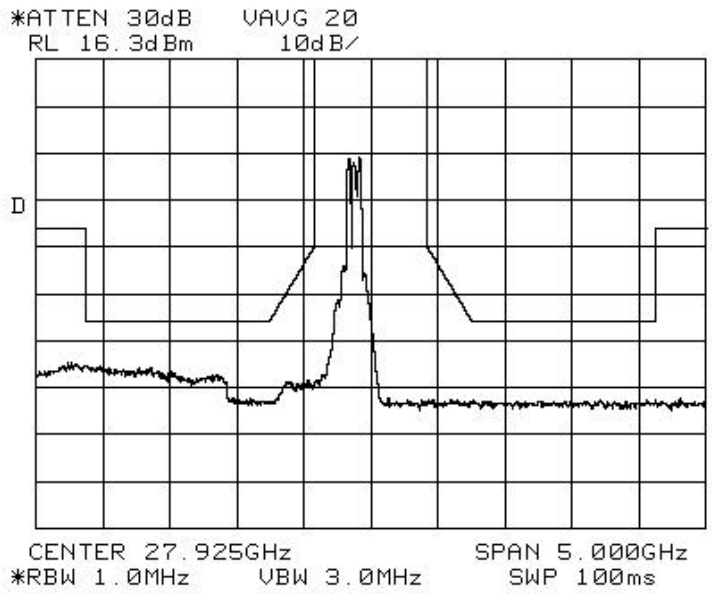


Figure C – 6 High Gain Node Transmitter; +30 dBm; 27.76, 27.80 and 27.84 GHz; 45 Mbps.

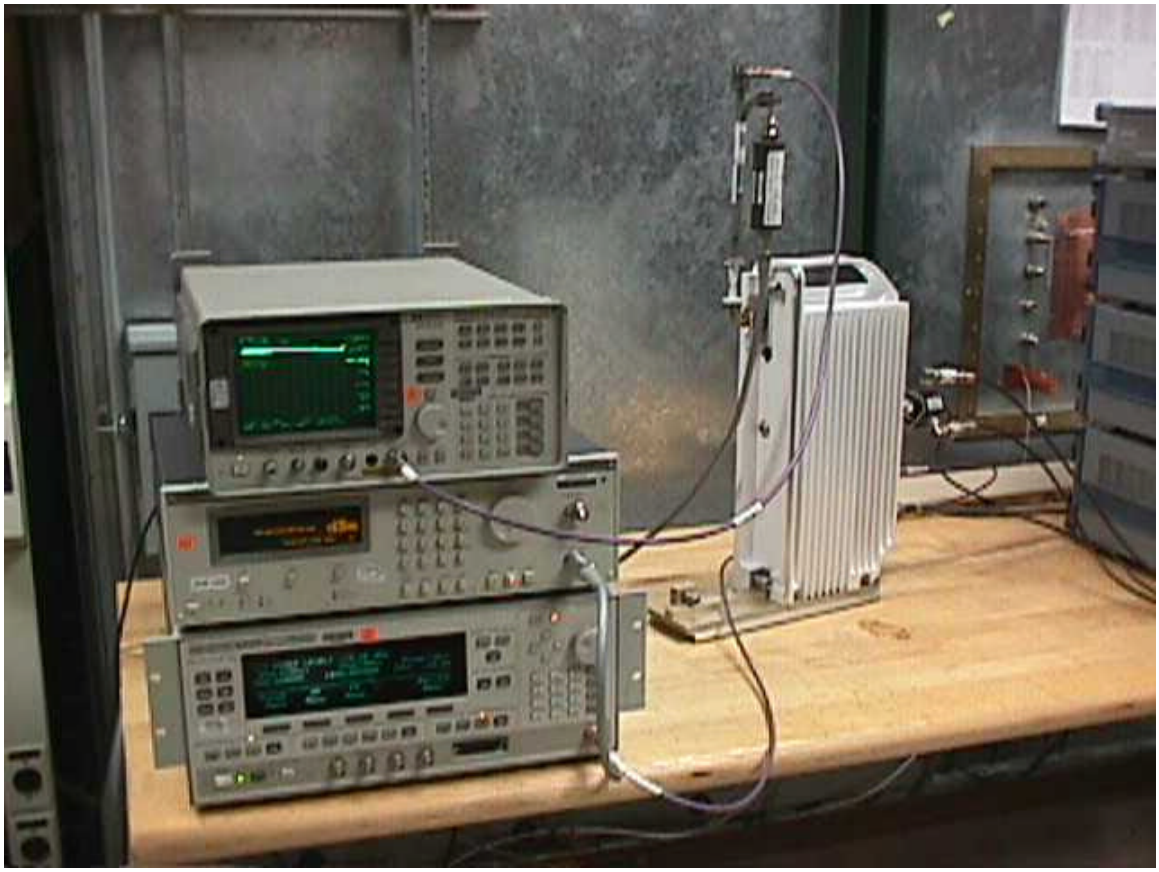


Figure C – 7 Test Setup for Antenna Conducted Measurements on the SpectraPoint High Gain Node Transmitter (view 1).

Figure C – 8 Test Setup for Antenna Conducted Measurements on the SpectraPoint High Gain Node Transmitter (view 2).

Appendix D

Radiated Spurious Emission Measurement

Table D – 1 Test Results for Radiated Spurios Emission Test

Data Rate (bits per second) (Symbols per second)	RF Transmit Frequency (GHz)	Test Frequency Range (GHz)	Measuring Instrument	Pass /Fail	Appendix Figure Number
45 Mbps (27.9 MSps)	27.52	.03 – 40.0	Rohde & Schwartz Receivers (ESI & EMSI)	Pass	D - 1
		40.0 – 100	Rohde & Schwartz ESMI with mixers	Pass	
45 Mbps (27.9 MSps)	27.68	.03 – 40.0	Rohde & Schwartz Receivers (ESI & EMSI)	Pass	D - 2
		40.0 – 100	Rohde & Schwartz ESMI with mixers	Pass	
45 Mbps (27.9 MSps)	27.84	.03 – 40.0	Rohde & Schwartz Receivers (ESI & EMSI)	Pass	D - 3
		40.0 – 100	Rohde & Schwartz ESMI with mixers	Pass	
45 Mbps (27.9 MSps)	27.52 27.56	.03 – 40.0	Rohde & Schwartz Receivers (ESI & EMSI)	Pass	D - 4
		40.0 – 100	Rohde & Schwartz ESMI with mixers	Pass	
45 Mbps (27.9 MSps)	27.52 27.56 27.60	.03 – 40.0	Rohde & Schwartz Receivers (ESI & EMSI)	Pass	D - 5
		40.0 – 100	Rohde & Schwartz ESMI with mixers	Pass	
45 Mbps (27.9 MSps)	27.76 27.80 27.84	.03 – 40.0	Rohde & Schwartz Receivers (ESI & EMSI)	Pass	D - 6
		40.0 – 100	Rohde & Schwartz ESMI with mixers	Pass	

Client : SpectraPoint Wireless, LLC Date : 10/21/99

EUT Model : High Gain Node Transmitter S/N : 003

EUT Configuration : Tx 27.52 GHz; +30 dBm Output Power; 45.0 Mbps

For frequencies >= -250% and <= 250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (MHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /MHz)	Limit (dBµV/m /MHz)	Comments

No emissions detected

For frequencies < -250% and > +250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (kHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /4kHz)	Limit (dBµV/m /4kHz)	Comments
55.04	16	3.0/3.0	1.25	2.5	41.3	61.1	84.4	Tx 2nd Harmonic
82.56	27	3.0/3.0	1.25	2.4	46.3	77.0	84.4	Tx 3rd Harmonic Rcv Noise

Figure D – 1 High Gain Node Transmitter; +30 dBm; 27.52 GHz; 45 Mbps.

Client : SpectraPoint Wireless, LLC Date : 10/21/99

EUT Model : High Gain Node Transmitter S/N : 003

EUT Configuration : Tx 27.68 GHz; +30 dBm Output Power; 45.0 Mbps

For frequencies >= -250% and <= 250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (MHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /MHz)	Limit (dBµV/m /MHz)	Comments

No emissions detected

For frequencies < -250% and > +250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (kHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /4kHz)	Limit (dBµV/m /4kHz)	Comments
55.36	11	3.0/3.0	1.25	2.5	41.3	56.1	84.4	Tx 2nd Harmonic Rcv Noise
83.04	27	3.0/3.0	1.25	2.4	46.3	77.0	84.4	Tx 3rd Harmonic Rcv Noise

Figure D – 2 High Gain Node Transmitter; +30 dBm; 27.68 GHz; 45 Mbps.

Client : SpectraPoint Wireless, LLC Date : 10/21/99

EUT Model : High Gain Node Transmitter S/N : 003

EUT Configuration : Tx 27.84 GHz; +30 dBm Output Power; 45.0 Mbps

For frequencies >= -250% and <= 250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (MHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /MHz)	Limit (dBµV/m /MHz)	Comments

No emissions detected

For frequencies < -250% and > +250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (kHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /4kHz)	Limit (dBµV/m /4kHz)	Comments
55.68	11	3.0/3.0	1.25	2.5	41.4	56.2	84.4	Tx 2nd Harmonic Rcv Noise
83.52	27	3.0/3.0	1.25	2.4	46.4	77.0	84.4	Tx 3rd Harmonic Rcv Noise

Figure D – 3 High Gain Node Transmitter; +30 dBm; 27.84 GHz; 45 Mbps.

Client : SpectraPoint Wireless, LLC Date : 10/22/99

EUT Model : High Gain Node Transmitter S/N : 003

EUT Configuration : Tx 27.52 and 27.56 GHz; +30 dBm Output Power; 45.0 Mbps

For frequencies >= -250% and <= 250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (MHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /MHz)	Limit (dBµV/m /MHz)	Comments

No emissions detected

For frequencies < -250% and > +250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (kHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /4kHz)	Limit (dBµV/m /4kHz)	Comments
55.04	11	3.0/3.0	1.25	2.5	41.3	56.1	84.4	Tx 2nd Harmonic Rcv Noise
82.56	27	3.0/3.0	1.25	2.4	46.3	77.0	84.4	Tx 3rd Harmonic Rcv Noise
55.12	11	3.0/3.0	1.25	2.5	41.3	56.1	84.4	Tx 2nd Harmonic Rcv Noise
82.68	27	3.0/3.0	1.25	2.4	46.3	77.0	84.4	Tx 3rd Harmonic Rcv Noise

Figure D – 4 High Gain Node Transmitter; +30 dBm; 27.52 and 27.56 GHz; 45 Mbps.

Client : SpectraPoint Wireless, LLC Date : 10/22/99

EUT Model : High Gain Node Transmitter S/N : 003

EUT Configuration : Tx 27.52, 27.56 and 27.60 GHz; +30 dBm Output Power; 45.0 Mbps

For frequencies >= -250% and <= 250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (MHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /MHz)	Limit (dBµV/m /MHz)	Comments

No emissions detected

For frequencies < -250% and > +250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (kHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /4kHz)	Limit (dBµV/m /4kHz)	Comments
55.04	11	3.0/3.0	1.25	2.5	41.3	56.1	84.4	Tx 2nd Harmonic Rcv Noise
82.56	27	3.0/3.0	1.25	2.4	46.3	77.0	84.4	Tx 3rd Harmonic Rcv Noise
55.12	11	3.0/3.0	1.25	2.5	41.3	56.1	84.4	Tx 2nd Harmonic Rcv Noise
82.68	27	3.0/3.0	1.25	2.4	46.3	77.0	84.4	Tx 3rd Harmonic Rcv Noise
55.2	11	3.0/3.0	1.25	2.5	41.3	56.1	84.4	Tx 2nd Harmonic Rcv Noise
82.8	27	3.0/3.0	1.25	2.4	46.3	77.0	84.4	Tx 3rd Harmonic Rcv Noise

Figure D – 5 High Gain Node Transmitter; +30 dBm; 27.52, 27.56 and 27.60 GHz; 45 Mbps.

Client : SpectraPoint Wireless, LLC Date : 10/22/99

EUT Model : High Gain Node Transmitter S/N : 003

EUT Configuration : Tx 27.76, 27.80 and 27.84 GHz; +30 dBm Output Power; 45.0 Mbps

For frequencies >= -250% and <= 250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (MHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /MHz)	Limit (dBµV/m /MHz)	Comments

No emissions detected

For frequencies < -250% and > +250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dBµV)	Measurement Bandwidth RBW/VBW (kHz)	Bandwidth Correction Factor (dB)	Cable Loss (dB)	Antenna Factor (dB)	Corrected Level (dBµV/m /4kHz)	Limit (dBµV/m /4kHz)	Comments
55.52	11	3.0/3.0	1.25	2.5	41.4	56.1	84.4	Tx 2nd Harmonic Rcv Noise
83.28	27	3.0/3.0	1.25	2.4	46.4	77.0	84.4	Tx 3rd Harmonic Rcv Noise
55.6	11	3.0/3.0	1.25	2.5	41.4	56.1	84.4	Tx 2nd Harmonic Rcv Noise
83.4	27	3.0/3.0	1.25	2.4	46.4	77.0	84.4	Tx 3rd Harmonic Rcv Noise
55.68	11	3.0/3.0	1.25	2.5	41.4	56.2	84.4	Tx 2nd Harmonic Rcv Noise
83.52	27	3.0/3.0	1.25	2.4	46.4	77.0	84.4	Tx 3rd Harmonic Rcv Noise

Figure D – 6 High Gain Node Transmitter; +30 dBm; 27.76, 27.80 and 27.84 GHz; 45 Mbps.

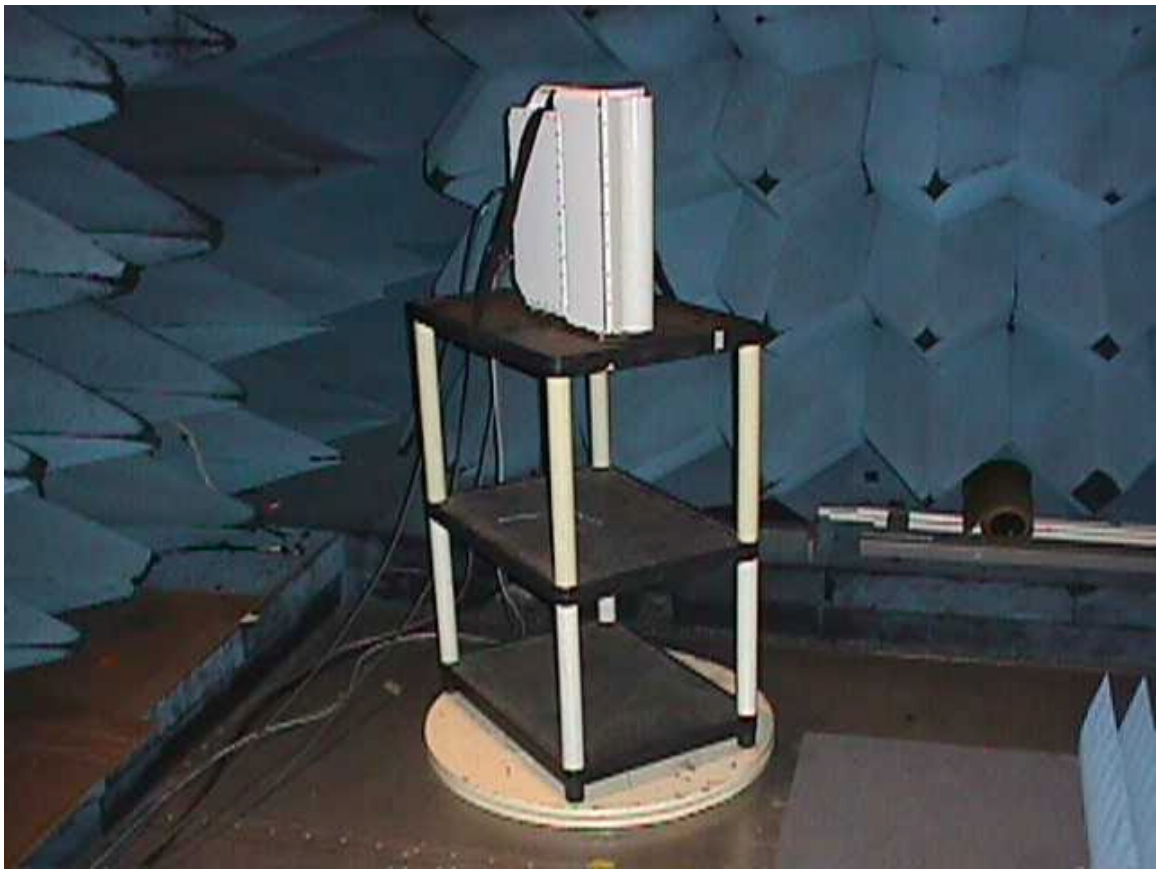


Figure D – 1 SpectraPoint High Gain Node Transmitter Setup for Radiated Spurious Emissions Testing

Figure D – 2 Setup of BiConiLog Antenna for Measurement of Radiated Spurious Emissions from the SpectraPoint High Gain Node Transmitter.

Appendix E

Frequency Stability Measurement

Table E – 1 Test Results forFrequency Stability Test

f_0	27.520000GHz		% Error		
°C	f @ -15% rated voltage in	f @ +15% rated voltage in	% Error @ -15% rated	% Error @ +15% rated	FCC Limit
-30	27.5200002	27.5200002	0.00000084	0.00000091	±.001%
-20	27.5200002	27.5200002	0.00000084	0.00000084	±.001%
-10	27.5200002	27.5200002	0.00000084	0.00000098	±.001%
0	27.5200002	27.5200002	0.00000084	0.00000084	±.001%
10	27.5200002	27.5200002	0.00000084	0.00000084	±.001%
20	27.5200002	27.5200002	0.00000084	0.00000084	±.001%
30	27.5200002	27.5200002	0.00000084	0.00000080	±.001%
40	27.5200002	27.5200002	0.00000084	0.00000084	±.001%
50	27.5200002	27.5200002	0.00000084	0.00000091	±.001%

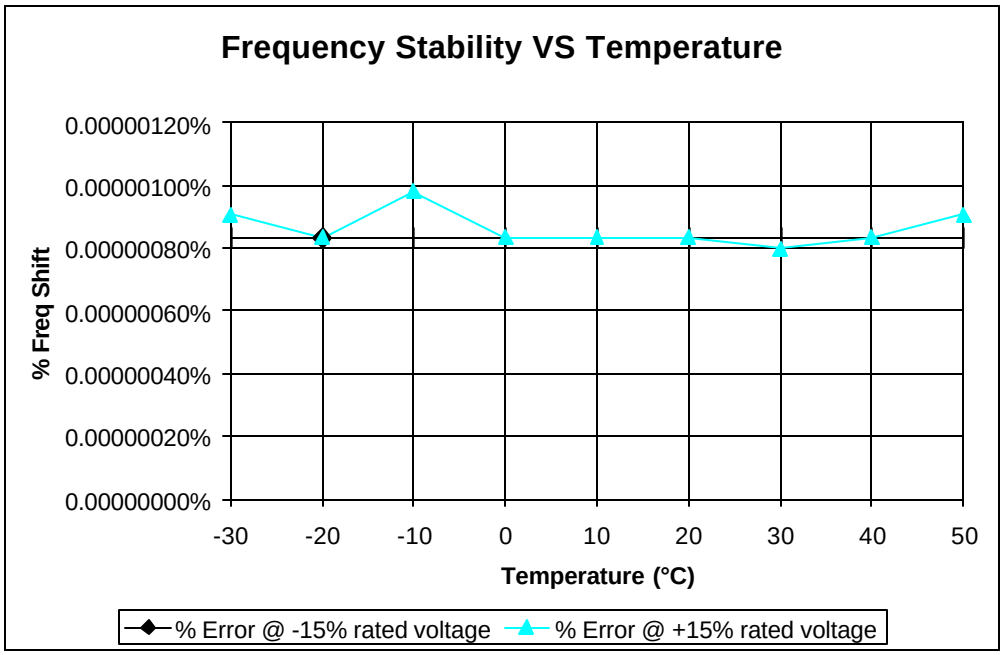


Figure E – 1 Frequency Stability Graph, SpectraPoint High Gain Node Transmitter

Date : 26 Oct 1999
FCC ID: NNSTX2000-HG-99
Revision: -

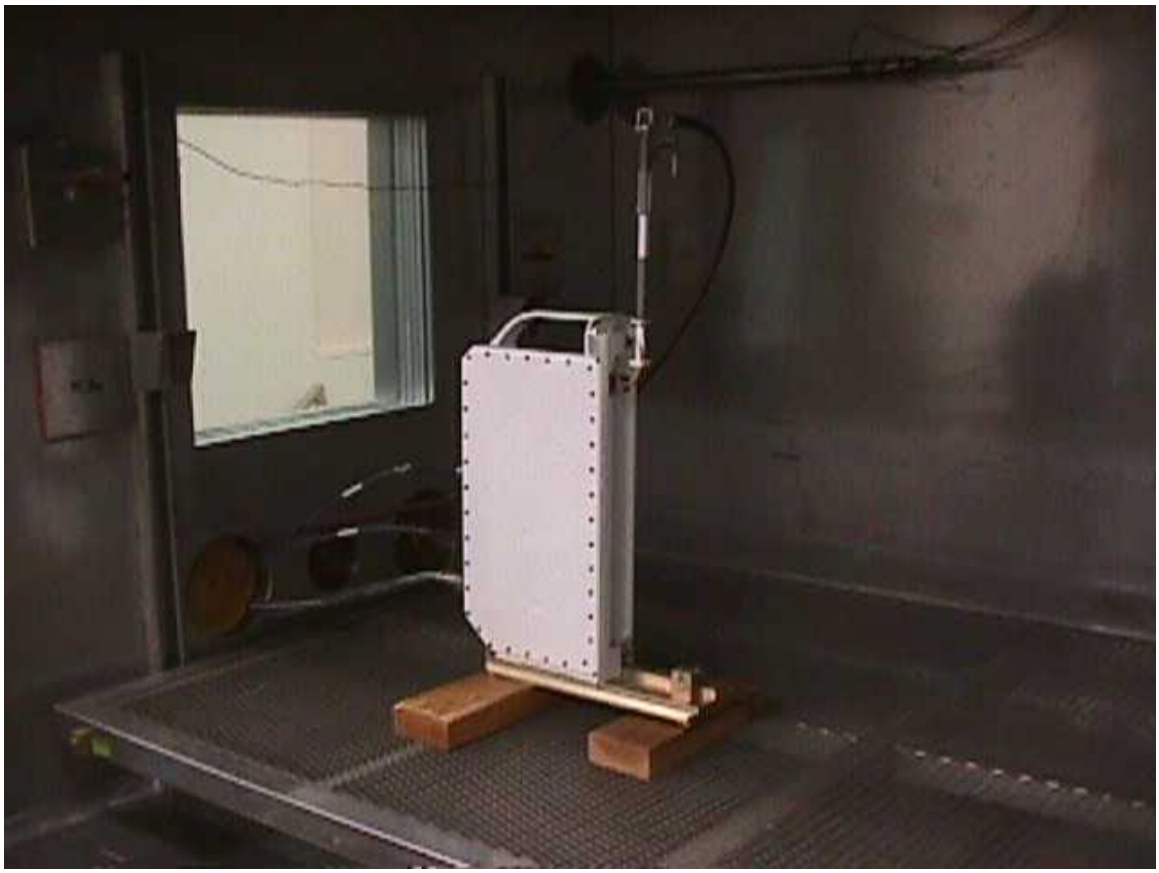


Figure E – 2 SpectraPoint High Gain Node Transmitter Setup for Frequency Stability Testing in the Temperature Chamber

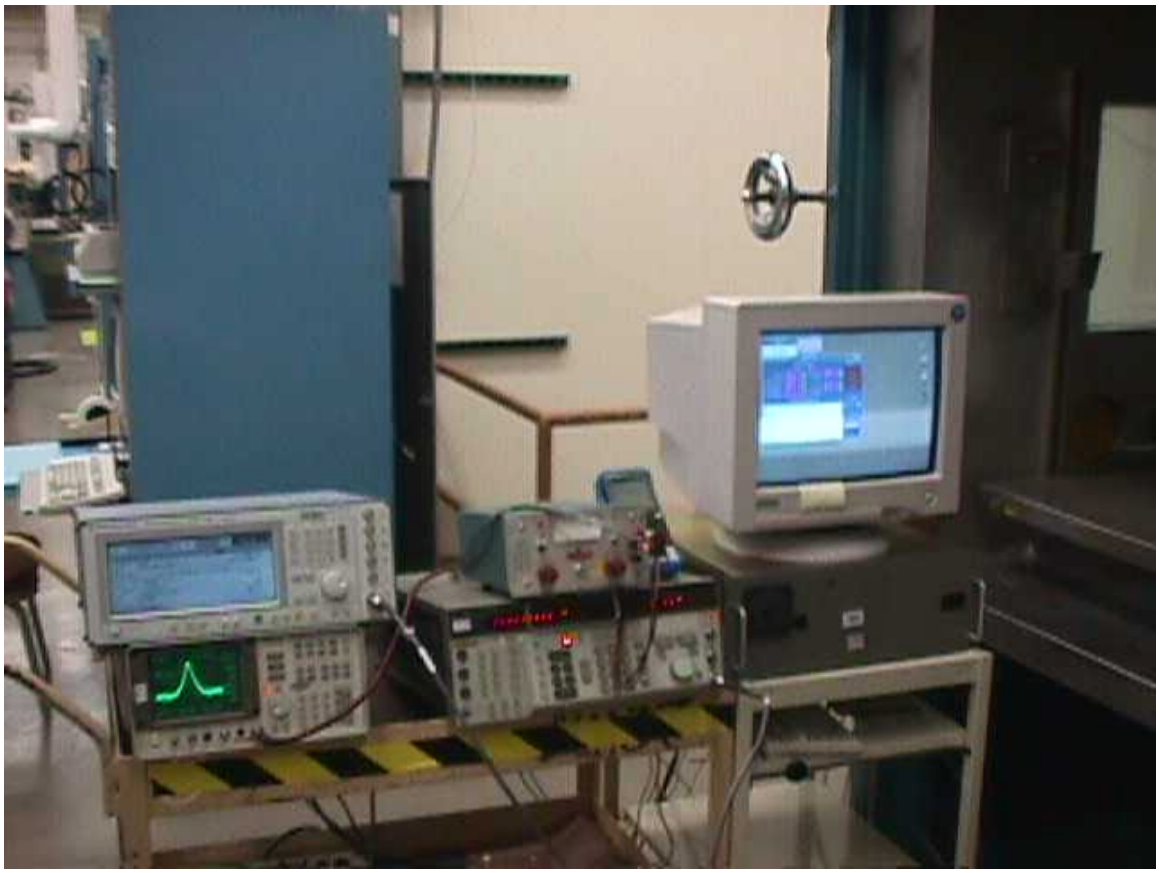


Figure E – 3 Test Equipment Setup for Frequency Stability Testing of the SpectraPoint High Gain Node Transmitter

Appendix F

FCC Certification Test Plan for the High Gain Node Transmitter (1 W)

FORMAL RELEASE

SpectraPoint Wireless LLC

Richardson, Texas

FCC Certification Test Plan For the High Gain Node Transmitter (1 W)

Approvals	Date		
Originator: Bill Paschetag		Title	**FCC Certification Test Plan For the High Gain Node Transmitter (1 W)**
Garrett Elworth		Size A	Doc No. **3215791**
Mike Grizzaffi		Scale None	Initial Release Date 9/29/99
John Finklea		Latest Revision -	Revision Release Date 9/29/99
Tom Jones			
Bill Myers			SIGNATURES ON FILE
Configuration Management: Keith Chatterton			

1.0 Introduction

This document presents the plan for conducting FCC Certification tests in accordance with FCC Parts 2 and 101 on the 1 Watt SpectraPoint High Gain Node Transmitter.

2.0 Reference Documents

47 CFR 2	Code of Federal Regulations, Title 47, Part 2, "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
47 CFR 101	Code of Federal Regulations, Title 47, Part 101, "Fixed Microwave Devices"
C63.4-1992	American National Standards Institute (ANSI), "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
NFPA-70	National Electric Code (1996)
3215042	Electro-magnetic Compatibility and Agency Design Requirements for SP2200

3.0 Description of Equipment

The SpectraPoint 1.0 Watt High Gain Node Transmitter is a block upconverter which translates L-Band (950 – 1950 MHz) intermediate frequency (I/F) signals to Ka-Band (27.5 to 28.35 GHz) and consists of an upconverter-power amplifier, a local oscillator, an electronics board, a waveguide filter, a horn antenna and a temperature-controlled radome. The unit is housed in an RF-tight enclosure to minimize unintentional RF radiation from the unit and also to minimize effects of RF radiation from other equipment in the operational environment.

In addition to the L-Band I/F signal input, the transmitter receives a 960 MHz Reference Tone to synchronize the Local Oscillator, -48 Volt DC input power for the electronic circuitry and radome heater and RS-485 command/control signals and provides status upon command via the RS-485 bus.

3.1 Transmitter Modulation

When installed in the SpectraPoint Local Multipoint Distribution System, the 1.0 Watt High Gain Node Transmitter may be operated with one of three different types of modulation -- CW, single-channel QPSK or multi-channel QPSK.

When operating CW, the transmitter will be provided a CW tone at 960 MHz to produce a "Pilot Tone" at 27.510 GHz. This pilot tone is used to synchronize the individual subscriber transceivers (SpectraPoint Customer Premises Equipment Roof Top Units).

When operating in a broadband mode, the transmitter will be provided with a wideband QPSK digitally-modulated input signal to produce a broadband transmission in the 27.520 to 27.860 GHz region. It is possible for the transmitter to have up to three contiguous wideband signals.

When installed in the SpectraPoint Local Multipoint Distribution System, the QPSK modulation bandwidth depends on the data rate, which is a function of basic data rate, the level of error correction required (Viterbi rate 1/2, 2/3, 3/4, 5/6 or 7/8) and "excess bandwidth" (or α, alpha) which will result in a bandwidth of from approximately 20 to 40 MHz per carrier. The transmitter may receive one, two or three QPSK-modulated I/F signals.

For Certification testing, the simulated QPSK signal will have the same maximum and minimum occupied bandwidths and amplitudes as the QPSK signal generated in the operational equipment (SpectraPoint Base Channel Group).

4.0 Certification Testing

The transmitter is subject to FCC Part 101 and Part 2 for FCC Certification for units deployable in the United States. The following tests, as specified in FCC Part 2, with limits as defined in FCC Part 101 shall be performed on the Transmitter.

FCC Part 2 Paragraph Number	Test Parameter	**FCC Part 101 Paragraph Number**	**FCC Part 101 Limit**
2.1046	RF Power Output	101.113	+30 dBW/MHz max. EIRP
2.1047	Modulation Characteristics	None	None
2.1049	Occupied Bandwidth	None	None
2.1051	Spurious Emissions at Antenna Terminals	101.111(a)(2) (ii) & (iii)	Refer to FCC Part 101
2.1053	Field Strength of Spurious Emissions	101.111(a)(2) (ii) & (iii)	Refer to FCC Part 101
2.1055	Frequency Stability	101.107	.001 %

4.1 Certification Test Method

The transmitter shall be tested with a simulated signal source of QPSK modulation derived from standard commercial test equipment (Rhode & Schwarz AMIQ and SMIQ). Setup of the modulation parameters for the AMIQ is provided in Table 4.1-1.

Table 4.1-1 Parameters for Rohde & Schwarz AMIQ Modulation Setup

AMIQ Window	**Parameter**	**Setting**
Data Source	PRBS	PRBS 9
Modulation	Coding	None
Modulation	Type	QPSK
Modulation	Sequence Length	10,000
Modulation	Filter Function	Root Cosine
Modulation	Window Function	Rect
Modulation	Symbol Rate	27.900 MHz
Modulation	Oversampling	3
Main	Sampling Rate	83.700MHz
Main	Samples	30,000

The Transmitter shall be commanded to the “normal test state” using the parameters of Table 4.1-2.

Table 4.1-2 SpectraPoint High Gain Transmitter Operating Mode Setup

Transmitter Parameter	Range	**Setting**
Set Light	On/Off	Don’t Care
ALC Mode	On/Off	Off
RF Bit Threshold	12.0 to 30.0 [dBm]	**Do not** press “Send”
Power Control	On/Off	On, press “Send”
Read from EPROM	0 to 255	**Do not** press “Send”
Store to EPROM	0 to 255	**Do not** press “Send”
LO Frequency	25880 – 27050 MHz	26550 MHz, press “Send”
IF Attenuation	0 – 40 [dB]	0 dB, press “Send”
RF Target	12.0 to 30.0 [dBm]	**Do not** press “Send”
IF Bit Threshold	-17.0 to 3.0 [dBm]	**Do not** press “Send”

Block diagrams of the general test configuration using the simulated signal source are shown in Figure 4.1-1 for antenna terminal conducted tests and in Figure 4.1-2 for radiated tests. A block diagram showing the test setup using three SMIQ Vector Signal Generators for multi-carrier test signal generation is shown in Figure 4.1-3.

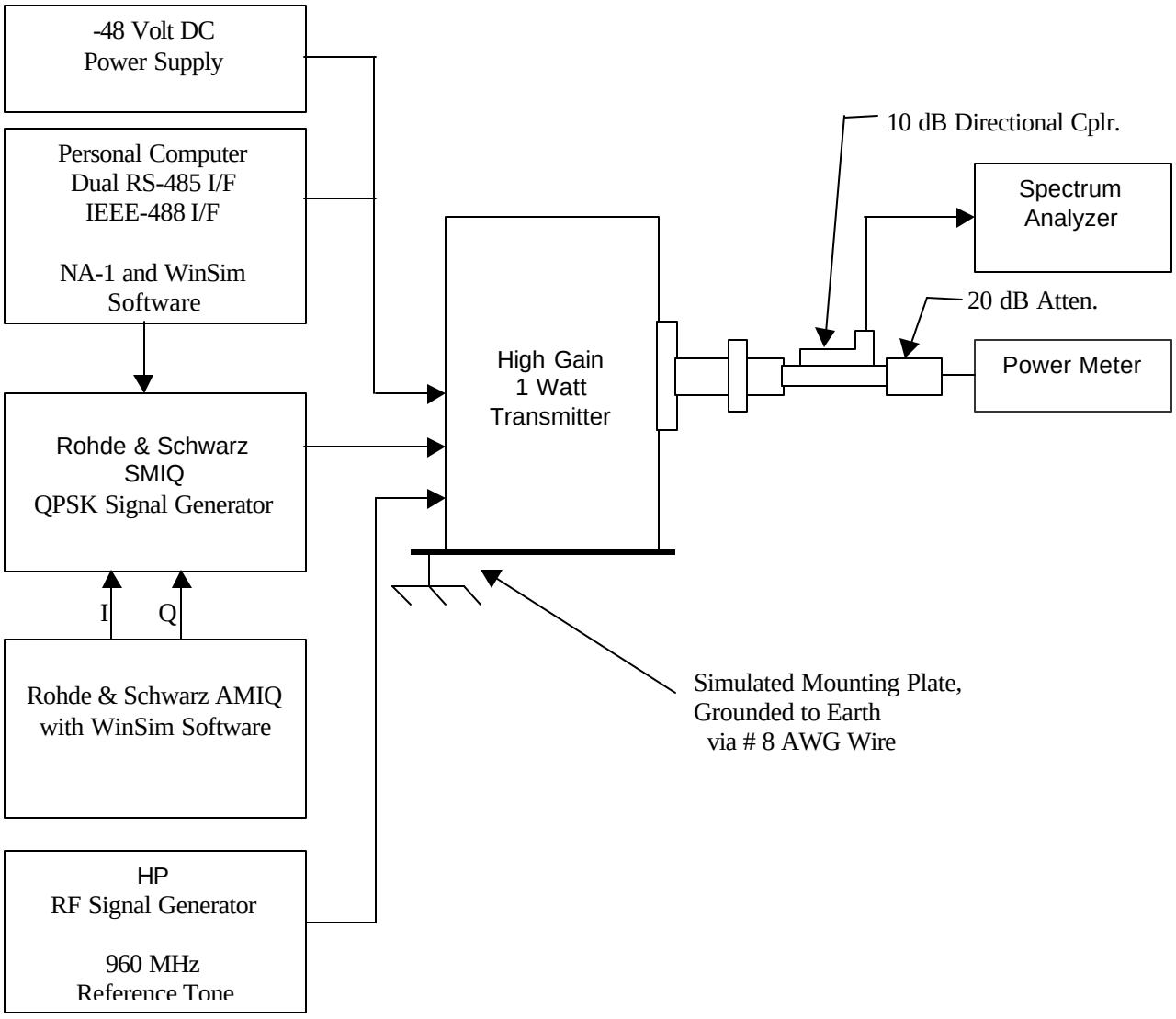


Figure 4.1-1 General Test Setup for Antenna Terminal Conducted Certification Tests

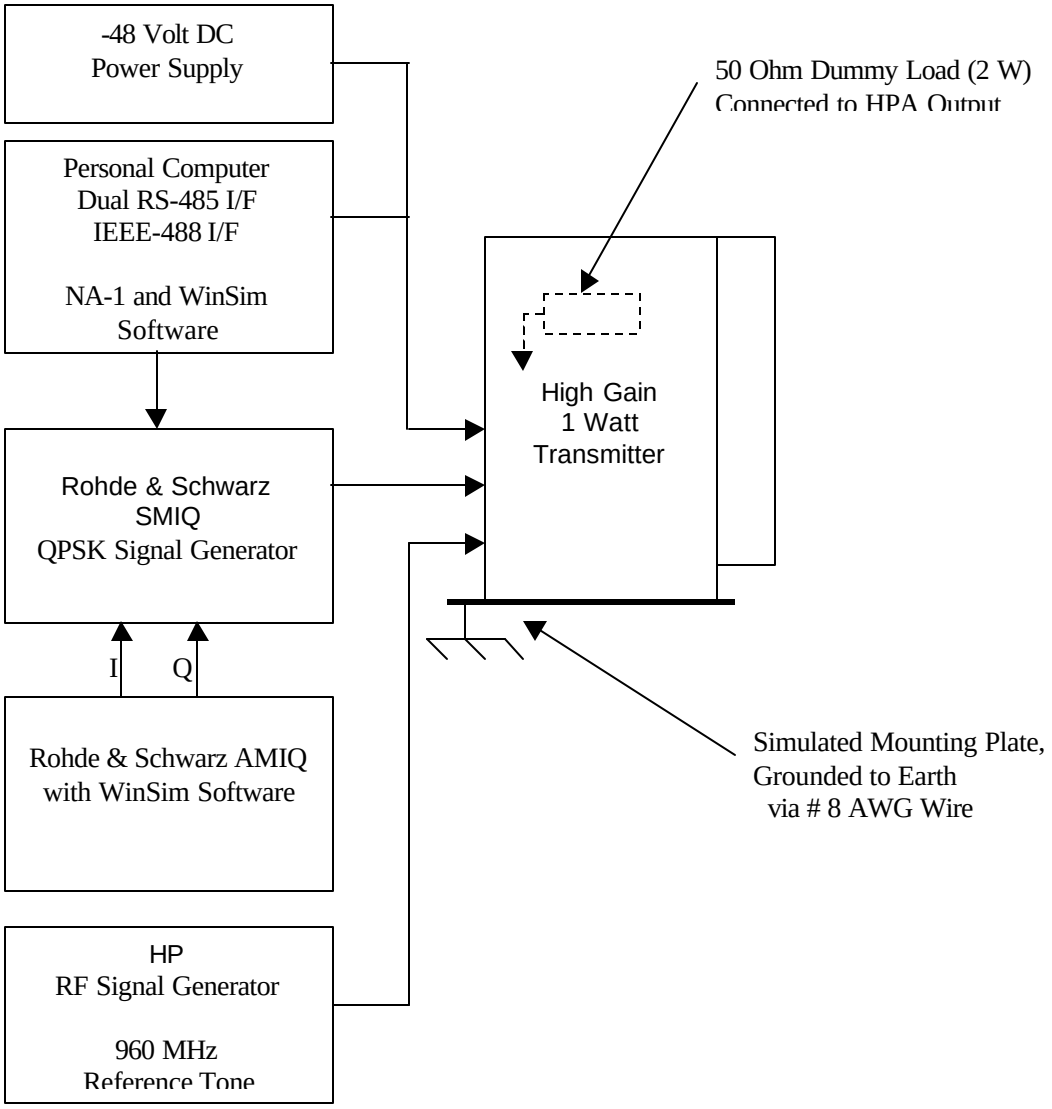


Figure 4.1-2 General Test Setup for Radiated Certification Tests

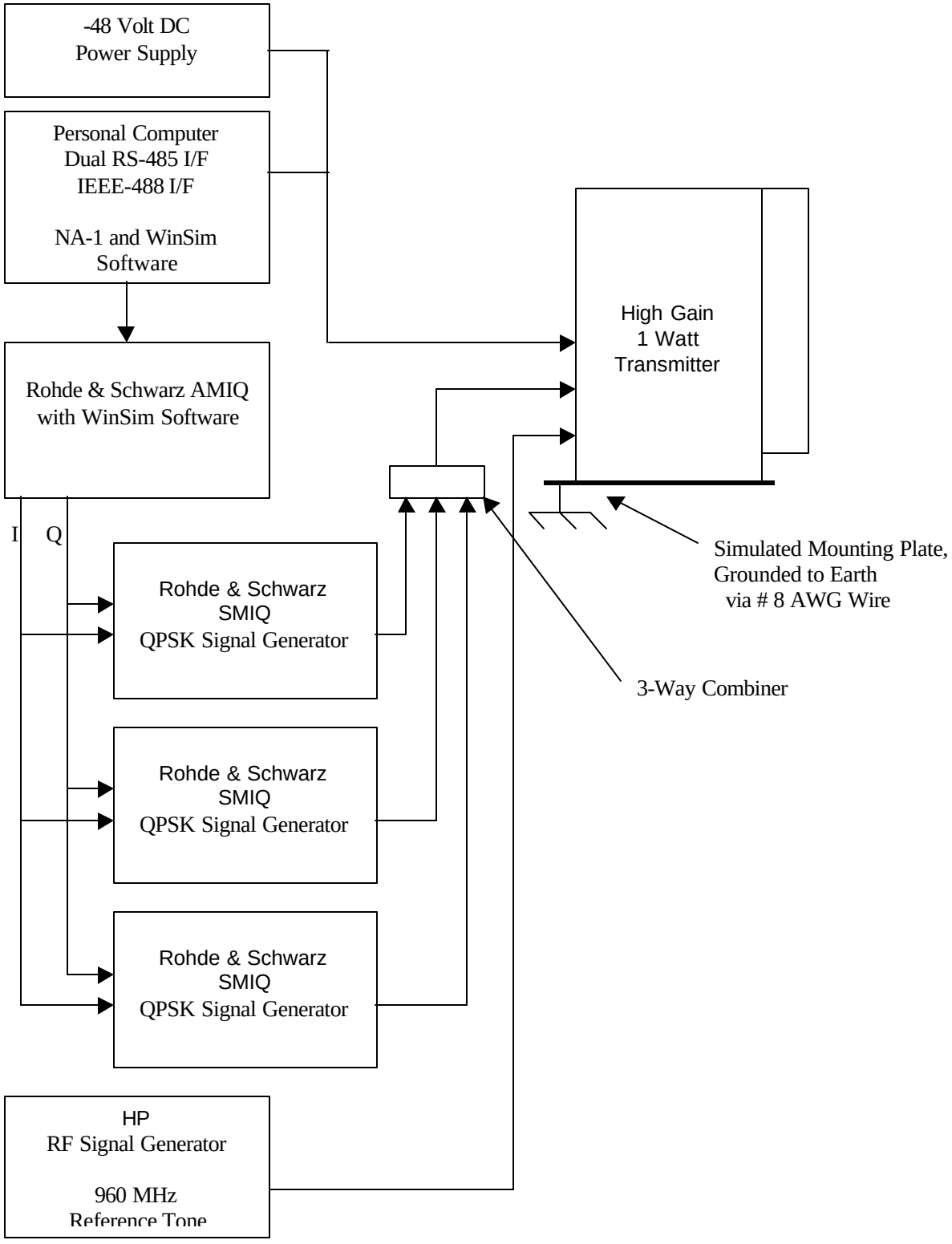


Figure 4.1-3 Operation of AMIQ and SMIQs for Multi-Channel Operation

The simulated signal source shall be tuned to the L-Band input IF frequencies per Table 4.1-3 to produce the corresponding Ka-Band RF output signals.

Table 4.1-3 SpectraPoint High Gain Transmitter L-Band and Microwave Operating Frequencies

QPSK Signal Source	Data Rate *	**I/F "Tuned" Frequency**	R/F "Tuned" Frequency
Rhode&Schwarz AMIQ/SMIQ	CW	960 MHz	27.510 GHz
Rhode&Schwarz AMIQ/SMIQ	45 Mbps	970 MHz	27.520 GHz
Rhode&Schwarz AMIQ/SMIQ	45 Mbps (27.9 MSps)	1140 MHz	27.690 GHz
Rhode&Schwarz AMIQ/SMIQ	45 Mbps (27.9 MSps)	1290 MHz	27.840 GHz
Rhode&Schwarz AMIQ/SMIQ	45 + 45 Mbps (2 @ 27.9 MSps)	970 + 1010 MHz	27.520 + 27.560 GHz
Rhode&Schwarz AMIQ/SMIQ	45 + 45 + 45 Mbps (3 @ 27.9 MSps)	970 + 1010 + 1050 MHz	27.520 + 27.560 + 27.600 GHz
Rhode&Schwarz AMIQ/SMIQ	45 + 45 + 45 Mbps (3 @ 27.9 MSps)	1210 + 1250 + 1290 MHz	27.760 + 27.800 + 27.840 GHz

* 25 MBps and 52 MBps are the specified minimum and maximum data rates for the Base Channel Group however the current band plan limits the data rate to only 45 Mbps.

The transmitter will be operated at its maximum rated output of 1.0 Watt (+30.0 dBm) for all certification tests. For radiated testing per 2.1053, the HPA shall be disconnected from the waveguide assembly and terminated into a 50 ohm load. The level of the input signal to produce a transmitter output power of 1.0 Watt will be computed using gain data.

4.2 Measurement of RF Power (FCC Part 2, Paragraph 2.1046)

> Note: This test may be performed concurrently with measurement of occupied bandwidth and antenna terminal conducted spurious emissions since these tests utilize the same setup.

The High Gain 1 Watt Transmitter and associated test equipment shall be set up per Figure 4.1-1:

- The antenna/radome assembly shall be removed from the transmitter to allow access to the waveguide transmit port; a WR28-to-K waveguide transition and directional coupler shall be installed to facilitate connection of the Power Meter and Spectrum Analyzer to the waveguide.
- An RF signal generator tuned to 960.00 MHz and set to a level of -7.5 +/- 2.5 dBm shall be applied to the Reference input of the transmitter.
- The RF power meter shall be connected to the "coupled" port of the directional coupler through a K-to-WR28 adapter.
- The Spectrum Analyzer shall be connected to the "through" port of the directional coupler through a K-to-WR28 adapter and 10 dB attenuator (to insure that the power input to the spectrum analyzer does not exceed +30 dBm).
- The I/F input signal frequency and level shall be set per Table 4.2-1 and output RF power verified using the RF power meter to be +30.0 +/- 0.5 dB at the RF output port of the transmitter.

Table 4.2-1 I/F Input Requirements for RF Power Test

Configuration	Test Frequency	I/F Power Input [1]
CW	27.510 GHz	-XX.X dBm @ 960 MHz
One 40 MHz "Channel"	27.520 GHz	-XX.X dBm @ 970 MHz
One 40 MHz "Channel"	27.680 GHz	-XX.X dBm @ 1130 MHz
One 40 MHz "Channel"	27.840 GHz	-XX.X dBm @ 1290 MHz
Two 40 MHz "Channels"	27.520 + 27.560 GHz	-XX.X dBm @ 970 MHz[2] -XX.X dBm @ 1010 MHz[2]
Three 40 MHz "Channels"	27.520 + 27.560 +27.600 GHz	-XX.X dBm @ 970 MHz[2] -XX.X dBm @ 1010 MHz[2] -XX.X dBm @ 1050 MHz[2]
Three 40 MHz "Channels"	27.760 + 27.800 + 27.840 GHz	-XX.X dBm @ 1210 MHz[2] -XX.X dBm @ 1250 MHz[2] -XX.X dBm @ 1290 MHz[2]

(1) "I/F Input Power" is the algebraic sum of the gain of the transmitter being tested and –30 dBm.

(2) Adjust I/F signal for each channel so that Power Spectral Density of output channels is equalized

4.2 Measurement of RF Power (FCC Part 2, Paragraph 2.1046) – Cont'd

- With power and the appropriate I/F and Reference signals applied to the transmitter, measure and record the output power of the transmitter as indicated on the RF power meter for each test frequency in terms of power (dBm).
- The measured RF output power level of the transmitter shall be verified to be +30.0 +/- 0.1 dBm, adjusting the SMIQ test generator output level as required.
- Measure the Power Spectral Density of the transmitter output using the Spectrum Analyzer in terms of power spectral density (dBW/MHz).
- When the transmitter power, in terms of dBW, is summed with the maximum specified antenna gain of 22.0 dBi, the EIRP shall not exceed FCC Part 101 limits of +30 dBW/MHz (paragraph 101.113).

This test satisfies EMC018 and EMC019 of requirements document 3215042.

4.3 Modulation Characteristics (FCC Part 2, Paragraph 2.1047)

The transmitter is a block upconverter which, when installed in the SpectraPoint 2200 System, translates an incoming L-Band QPSK-modulated signal from the SpectraPoint Base equipment (Base Channel Group) to Ka-Band (27500 to 28000 MHz). The input signal may be described as a QPSK-modulated signal having a 20-to-40 MHz occupied bandwidth, and center frequency (carrier) tunable between 950 and 1800 MHz. The data rate of the BCG can vary from 20 to 40 MHz depending on the type of plug-in interface cards installed and the degree of error correction applied. The modulated signal to the Roof Unit is root cosine filtered and has an excess bandwidth (alpha) of 0.35.

Commercial test equipment (Rhode and Schwarz AMIQ Modulation Generator, SMIQ Vector Signal Generator and WinSim software) shall be used to generate the modulated I/F input signal. DC power (-48 Volts DC) shall be provided by a commercial DC power supply. Operating commands to the transmitter (HPA on/off, I/F attenuation, Local Oscillator frequency) shall be provided via RS-485 bus by a personal computer running SpectraPoint NA1 software.

The occupied bandwidth and input power to the transmitter at each test frequency shall be measured and included in the test report. There is no specification limit on Modulation Characteristics except that the modulation source shall be representative of that used in an actual installation; this data is provided to provide a record of the test conditions.

This test satisfies EMC020 of requirements document 3215042.

4.4 Occupied Bandwidth (FCC Part 2, Paragraph 2.1049)

Note: This test may be performed concurrently with measurement of transmitter power and antenna terminal conducted spurious emissions since these tests utilize essentially the same setup.

The transmitter and associated test equipment shall be set up per Figure 4.1-1 and as in paragraph 4.1.

- The antenna/radome assembly shall be removed from the transmitter to allow access to the waveguide transmit port; a WR28-to-K waveguide transition and directional coupler shall be installed to facilitate connection of the Power Meter and Spectrum Analyzer to the waveguide.
- An RF signal generator tuned to 960.00 MHz and set to a level of -7.5 +/- 2.5 dBm shall be applied to the Reference input of the transmitter.
- The RF power meter shall be connected to the "coupled" port of the directional coupler through a K-to-WR28 adapter.
- The Spectrum Analyzer shall be connected to the "through" port of the directional coupler through a K-to-WR28 adapter and 10 dB attenuator (to insure that the power input to the spectrum analyzer does not exceed +30 dBm).
- The I/F input signal frequency and level shall be set per Table 4.4-1 and output RF power verified using the RF power meter to be +30.0 +/- 0.1 dB at the RF output port of the transmitter, adjusting the SMIQ test generator output level as required.

Table 4.4-1 I/F Input Requirements for Occupied Bandwidth Test

Configuration	Test Frequency	I/F Power Input [1]
One 40 MHz "Channel"	27.520 GHz	-XX.X dBm @ 970 MHz
One 40 MHz "Channel"	27.680 GHz	-XX.X dBm @ 1130 MHz
One 40 MHz "Channel"	27.840 GHz	-XX.X dBm @ 1290 MHz
Two 40 MHz "Channels"	27.520 + 27.560 GHz	-XX.X dBm @ 970 MHz[2] -XX.X dBm @ 1010 MHz[2]
Three 40 MHz "Channels"	27.520 + 27.560 +27.600 GHz	-XX.X dBm @ 970 MHz[2] -XX.X dBm @ 1010 MHz[2] -XX.X dBm @ 1050 MHz[2]
Three 40 MHz "Channels"	27.760 + 27.800 + 27.840 GHz	-XX.X dBm @ 1210 MHz[2] -XX.X dBm @ 1250 MHz[2] -XX.X dBm @ 1290 MHz[2]

[1] "I/F Input Power" is the algebraic sum of the gain of the transmitter being tested and –30 dBm.

[2] Adjust I/F signal for each channel so that the Power Spectral Density of output channels are equalized

4.4 Occupied Bandwidth (FCC Part 2, Paragraph 2.1049) – Cont'd

- With power applied to the transmitter and the transmitter setup per table 4.4-1, verify that the measured RF output power level is +30.0 +/- 0.5 dBm.
- Measure and record the 99% occupied bandwidth of the transmitter as indicated on the Spectrum Analyzer for each wideband test frequency.
- There is no specification limit on occupied bandwidth. This data is used to define the emission designator for Certification.

This test satisfies EMC021 requirements document 3215042.

4.5 Spurious Emissions at Antenna Terminals (FCC Part 2, Paragraph 2.1051)

Note: This test may be performed concurrently with measurement of power output and occupied bandwidth since these tests utilize the same setup.

The transmitter and associated test equipment shall be set up per Figure 4.1-1 and as in paragraph 4.1.

- The antenna/radome assembly shall be removed from the transmitter to allow access to the waveguide transmit port; a WR28-to-K waveguide transition and directional coupler shall be installed to facilitate connection of the Power Meter and Spectrum Analyzer to the waveguide.
- An RF signal generator tuned to 960.00 MHz and set to a level of -7.5 +/- 2.5 dBm shall be applied to the Reference input of the transmitter.
- The RF power meter shall be connected to the "coupled" port of the directional coupler through a K-to-WR28 adapter.
- The Spectrum Analyzer shall be connected to the "through" port of the directional coupler through a K-to-WR28 adapter and 10 dB attenuator (to insure that the power input to the spectrum analyzer does not exceed +30 dBm).
- The I/F input signal frequency and level shall be set per Table 4.4-1 and output RF power verified using the RF power meter to be +30.0 +/- 0.1 dB at the RF output port of the transmitter, adjusting the SMIQ test generator output level as required.

.

Table 4.5-1 Operating Configurations for Spurious Response Measurement

Configuration	Test Frequency	I/F Power Input [1]
One 40 MHz "Channel"	27.520 GHz	-XX.X dBm @ 970 MHz
One 40 MHz "Channel"	27.680 GHz	-XX.X dBm @ 1130 MHz
One 40 MHz "Channel"	27.840 GHz	-XX.X dBm @ 1290 MHz
Two 40 MHz "Channels"	27.520 + 27.560 GHz	-XX.X dBm @ 970 MHz[2] -XX.X dBm @ 1010 MHz[2]
Three 40 MHz "Channels"	27.520 + 27.560 +27.600 GHz	-XX.X dBm @ 970 MHz[2] -XX.X dBm @ 1010 MHz[2] -XX.X dBm @ 1050 MHz[2]
Three 40 MHz "Channels"	27.760 + 27.800 + 27.840 GHz	-XX.X dBm @ 1210 MHz[2] -XX.X dBm @ 1250 MHz[2] -XX.X dBm @ 1290 MHz[2]

[1] "I/F Input Power" is the algebraic sum of the gain of the transmitter being tested and –30 dBm.

[2] Adjust I/F signal for each channel so that the Power Spectral Density of output channels are equalized

4.5 Spurious Emissions at Antenna Terminals (FCC Part 2, Paragraph 2.1051) – Cont'd

- With power applied to the transmitter and the transmitter setup per table 4.5-1, verify that the measured RF output power level is +30.0 +/- 0.1 dBm.
- Measure and record the level of harmonic and spurious emissions at the waveguide port of the transmitter over the frequency range of 10 GHz to 100 GHz for the test configurations of Table 4.5-1.
- Record and save the spectrum analyzer scans for measurements with the transmitter operating at 27.520 GHz for proof of compliance at the LMDS lower band edge.

  If the transmitter is non-compliant with the requirements of FCC Part 101 at the band edge, increase the tuned frequency of the transmitter until compliance is achieved and note this tuned frequency as the "lowest tuned frequency permitted" for this transmitter.
- At each transmitter operating frequency, set the span of the spectrum analyzer to start at 25.8 GHz and stop at 30.8 GHz (i.e., span of 5 GHz) and display the limit mask (refer to paragraphs 4.5.1 and 4.5.2). Record and save the spectrum analyzer scans for measurements for proof of compliance at the LMDS over the +/- 250% bandwidth region.

This test satisfies EMC022 and EMC023 of requirements document 3215042.

4.5.1 Spurious Emissions Limits per FCC Part 2, Paragraph 2.1051

The limit for Spurious Emissions at the Antenna Terminals is defined by the emission mask of FCC Part 101 paragraph 101.111 (a) (2) (ii) and (iii):

- In any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent to and including 250 percent of the authorized bandwidth, extraneous emissions shall be attenuated relative to the maximum authorized signal level by:

  $11 + 0.4\,(\mathbf{P}-50) + 10\,\mathrm{Log}_{10}\,\mathbf{B}$ dB

  where: **P** is the Percentage of bandwidth away from tuned frequency

  B is the authorized bandwidth = 850 MHz (Part 101, Para. 101.109)
- In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth, extraneous emissions shall be attenuated relative to the maximum authorized signal level by:

  $43 + 10\,\mathrm{Log}_{10}$ (Mean Output Power in watts) dB but not exceeding 80 dB.

(For any transmitter, the limit beyond 250 % bandwidth is – 13 dBm/4kHz bandwidth).

4.5.2 Measurement of Antenna Terminal Conducted Spurious Emissions, 30 MHz to 100 GHz

The spurious emission limits as defined in Part 101 require two separate measurement methodologies. Within 1700 MHz of the 27.5-to-28.35 GHz LMDS authorized band (i.e., between 25.8 and 30.05 GHz), limits are in terms of power spectral density relative to a 1 MHz bandwidth. Beyond this region, i.e., between 30 MHz and 25.8 GHz and between 30.05 and 100 GHz, limits are in terms of power spectral density relative to a 4 kHz bandwidth.

a) Since the "antenna terminal" of the transmitter is a WR-28 waveguide (26.5 to 40 GHz), the cutoff of this port is approximately 17 GHz and testing from 30 MHz to approximately 10 GHz will not provide useful information. Therefore, antenna terminal conducted emission measurements will be performed from 10 GHz to 100 GHz.

b) In the regions of 10.0 to 25.8 GHz and from 30.05 to 100 GHz, measurements will be taken with a Resolution Bandwidth of 10 kHz and a Video Bandwidth of 30 kHz. For spurious emissions with a bandwidth greater than 4 kHz, a correction factor of -4.0 dB will be required to compensate for the bandwidth difference between the 10 kHz RBW and the 4kHz specified bandwidth. No bandwidth correction factor is appropriate for spurious emissions with a bandwidth less than 4 kHz, which includes cw.

   The limit for spurious emissions in this band is defined by the equation in Part 101 Paragraph 101.111 (a) (2) (iii) that equates to –13 dBm/4kHz.

c) In the region of 25.8 to 27.5 GHz and 28.35 to 30.05 GHz, measurements shall be taken with RBWs of 1 MHz, 100 kHz or 10 kHz, as required for very low level signals, to resolve the emission (VBW shall always be set to 3 times the RBW). For wideband spurious emissions (i.e., greater than 1 MHz), a bandwidth correction factor of 10 Log_{10} (1 MHz/ RBW) shall be applied. No bandwidth correction factor is appropriate for spurious emissions with a bandwidth less than 10 kHz, including cw.

   The limit for spurious emissions in this region is defined by the equation in Part 101 Paragraph 101.111 (a) (2) (ii) and is shown in Figure 4.5-1.

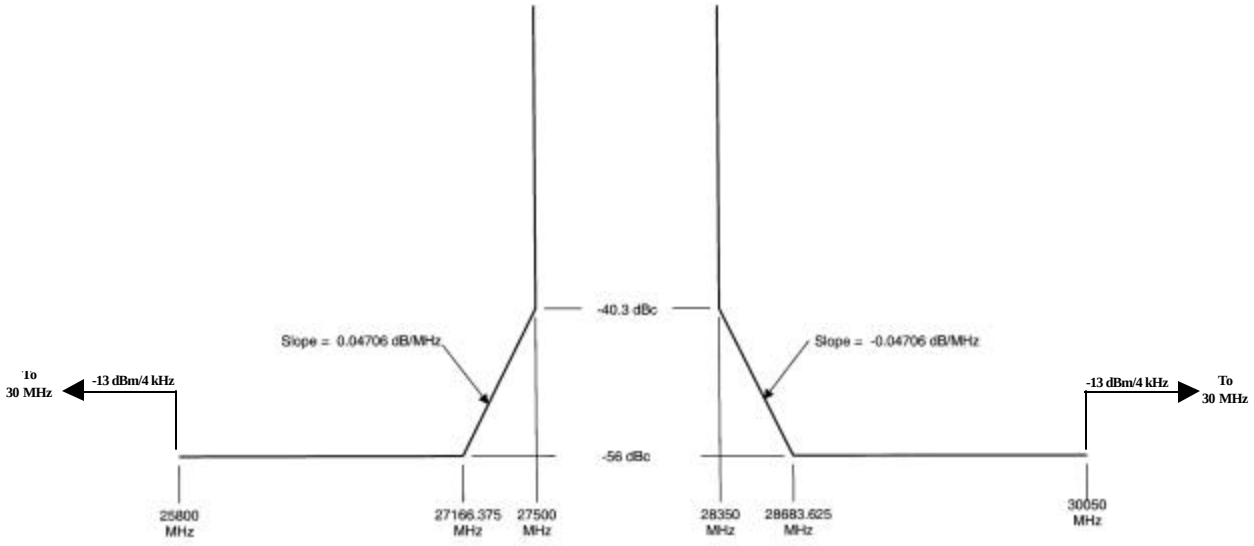


Figure 4.5-1 Emission Mask for Antenna Conducted Spurious Emissions

4.6 Field Strength of Spurious Emissions (FCC Part 2, Paragraph 2.1053)

The transmitter shall be installed on a platform simulating normal installation. The platform shall be positioned on a turntable so that the unit can be rotated to maximize radiated emissions from the unit.

- The simulated I/F signal and Reference signal sources shall be positioned well away from the transmitter and test antennas.
- The transmitter and associated test equipment shall be set up per Figure 4.1-2. A "dummy" RF load shall be install at the output of the HPA.
- The required I/F signal level at each operating frequency is dependent on the actual gain characteristics of the particular transmitter determined during factory testing and cable loss of the interconnecting I/F cable. The I/F input signal frequency and level shall be set per Table 4.6-1.
- At each operating frequency per Table 4.6-1, the transmitter shall be scanned from 30 MHz to 100 GHz at a test distance of 3 meters, rotating the turntable and repositioning the test antenna as required to maximize emissions. Measurements shall be taken with both vertical and horizontal polarizations of the test antenna. Specific emphasis shall be given to measurement of emissions at the Local Oscillator frequency (26.550 GHz), the tuned transmit frequency and their harmonics.

This test satisfies EMC024 and EMC025 of requirements document 3215042.

Table 4.6-1 Operating Configurations for Spurious Emissions Measurement

Configuration	Test Frequency	I/F Power Input [1]
CW	27.510 GHz	-XX.X dBm @ 960 MHz
One 40 MHz "Channel"	27.520 GHz	-XX.X dBm @ 970 MHz
Three 40 MHz "Channels"	27.520 + 27.560 +27.600 GHz	-XX.X dBm @ 970 MHz(2) -XX.X dBm @ 1010 MHz(2) -XX.X dBm @ 1050 MHz(2)
Three 40 MHz "Channels"	27.760 + 27.800 + 27.840 GHz	-XX.X dBm @ 1210 MHz(2) -XX.X dBm @ 1250 MHz(2) -XX.X dBm @ 1290 MHz(2)

[1] "I/F Input Power" is the algebraic sum of the gain of the transmitter being tested and –30 dBm.

4.6.1 Limit for Field Strength of Spurious Emissions

The emission limits for the transmitter are derived from the emission limitation requirements of FCC Part 101, Paragraph 101.111 (a) (2) (ii) and (iii) related to the measured field intensity of the transmitter at maximum rated power at the tuned frequency.

From 30 MHz to 25.8 GHz and from 30.05 to 100 GHz: The maximum acceptable level of emissions in any 4 kilohertz band is 43 + 10 Log_{10} (1 Watt) dB below the calculated field intensity produced by a 1 Watt signal applied to a tuned dipole antenna (Re: FCC Part 2, Paragraph 2.1053). At a test distance of 3 meters, the limit for Spurious Emissions from the transmitter is 84.4 dBμV/m/4kHz bandwidth.

4.6.1 Field Strength of Spurious Emissions (FCC Part 2, Paragraph 2.1053) (Cont'd)

From 20.8 GHz to 30.05 GHz: The maximum acceptable level of emissions in any 1 megahertz band is 11 + 0.4 (P – 50) + 10 Log_{10} B (but not greater than 56 dB) below the calculated field intensity produced by a 1 Watt signal applied to a tuned dipole antenna, where B is defined at the Authorized Bandwidth (850 MHz) and P is defined as the percentage of authorized bandwidth removed from the center frequency. This limit is shown graphically in Figure 4.6-1.

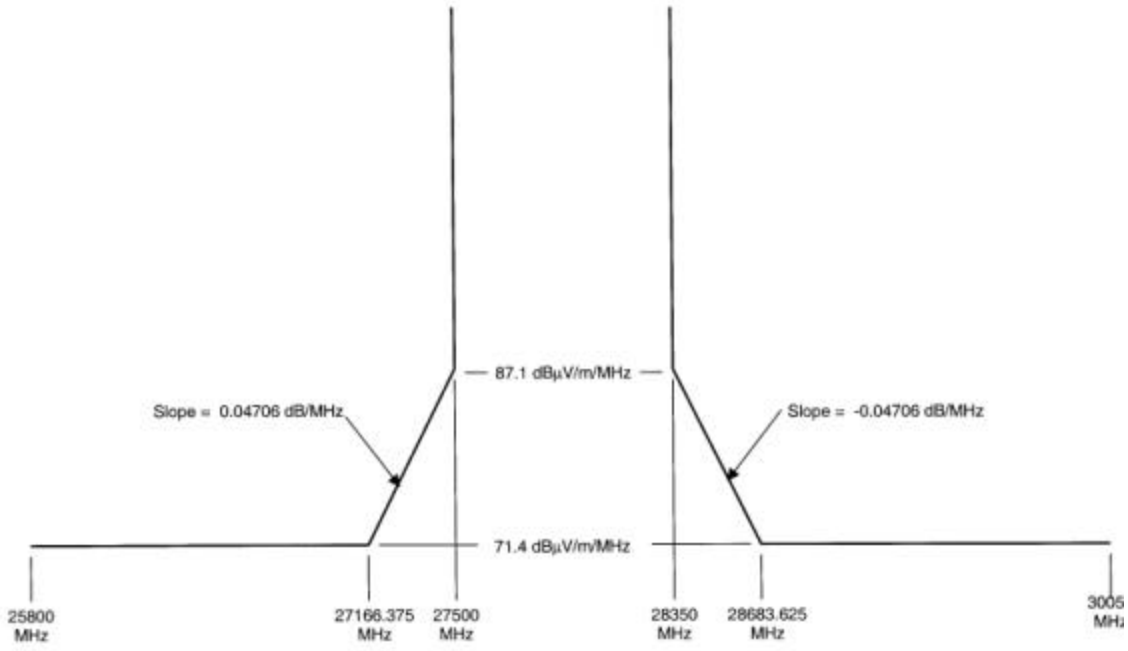


Figure 4.6-1 Limit for Radiated Spurious Emissions from a 1 Watt LMDS Transmitter within +/- 250 Percent Authorized Bandwidth of Center Frequency at a Test Distance of 3 Meters

4.7 Frequency Stability (FCC Part 2, Paragraph 2.1055)

The transmitter shall be tested for frequency stability when operated in a CW mode at maximum rated power over the temperature range of –30° to +50° C and over an input power voltage range of +/- 15%.

The radome/antenna assembly shall be removed to facilitate measurement and the transmitter shall be positioned in the temperature chamber. The signal source and monitoring equipment shall be configured as shown in Figure 4.7-1.

The temperature within the test chamber shall be set at the levels specified in FCC Part 2 and the unit allowed to operate at that temperature until stabilized. After the unit is temperature stabilized, the date, the time, the measured I/F input frequency, measured Reference frequency and measured transmitter output frequency shall be recorded.

At each temperature level, the DC power input to the transmitter shall be increased to -55.2 Volts DC (115% of its nominal voltage). The date, the time, the measured I/F input frequency, the measured pilot tone frequency and the measured transmitter output frequency shall be recorded. The DC power input to the transmitter shall then be reduced to –40.6 Volts DC (85% of its nominal voltage) and date, the time, the measured I/F input frequency, measured pilot tone frequency and measured transmitter output frequency shall be recorded. The DC power input to the transmitter shall then be returned to –48.0 Volts DC (its nominal voltage).

This test satisfies EMC026, EMC027 and EMC028 of requirements document 3215042.

4.7.1 Limit for Frequency Stability

The requirement of FCC Part 101 (Paragraph 101.107) is that the RF output frequency at the specified various temperatures and input voltages not vary greater than 0.001% over the temperature range and input voltage variation.

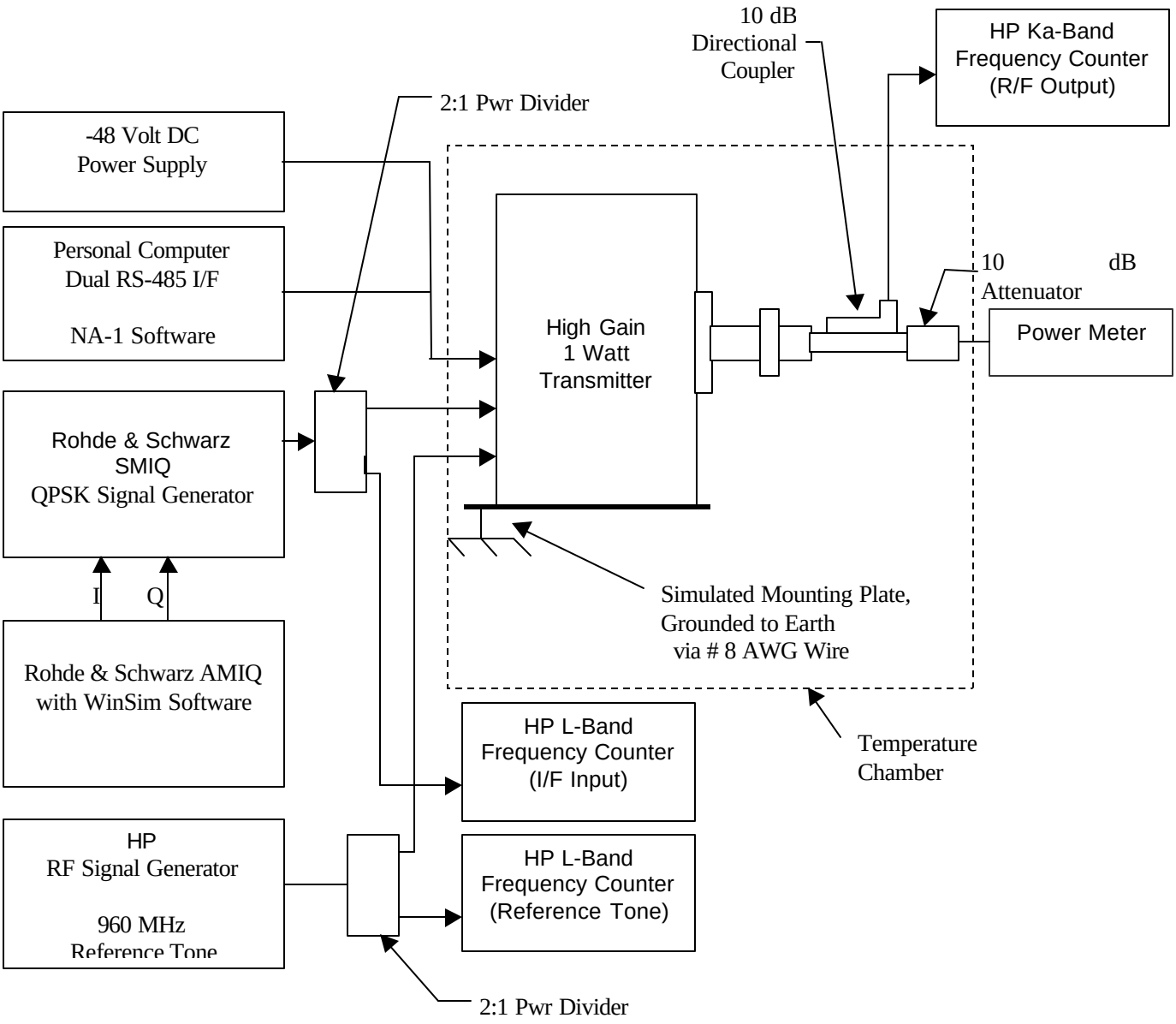


Figure 4.7-1 Setup of Signal Input and Monitoring Equipment for Stability Testing

5.0 Test Report

Test reports presenting the results of the FCC Type Acceptance tests on the transmitter shall be prepared in both document (hardcopy) and electronic (softcopy) format. Postscript document format (.pdf) is preferred for the softcopy version since this is a recommended format for submittal to FCC.