EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER

I. GENERAL INFORMATION

Requirement:	FCC
Test Requirements:	FCC Part 15

Applicant: Silver Spring Networks 575 Broadway Street Redwood City, CA 94063

FCC ID:	OWS-NIC515
IC:	5975A-NIC515
Model No.:	sBridge R1

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The Silver Spring Networks (SSN) NIC515 is a 900 MHz frequency hopping spread spectrum radio module for electric power meter communications use.

III. TEST DATES AND TEST LOCATION

Testing was performed on 31 March, 1 April, and 14 June 2010. 900 MHz radiated and AC line conducted emissions tests were performed at:

Compliance Certification Services 47173 Benicia Street Fremont, CA 94538

All antenna port conducted tests were performed at Silver Spring Networks.

J.M. Cohen____

T.N. Cokenias EMC Consultant/Agent for Silver Spring Networks

15 June 2010

15.203 Antenna connector requirement

The EUT uses an external omni-directional monopole antenna.

Antenna description	Mfr.	Model No.	Gain
Omni monople	SSN	n/a	3 dBi at 915 MHz

TEST PROCEDURES

All tests were performed in accordance with the applicable procedures called out in the following documents, unless otherwise noted:

FCC 47CFR15

RSS-210 Issue 7: Low power license exempt radio frequency devices (July 2007) RSS-212: Test Facilities and Test Methods for Radio Equipment

ANSI C63.4 – 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

For each radio, tests were performed at three frequencies:

900 MHz FHSS

Channel 0 (LOW) – 902.3 MHz Channel 43 (MID) -915.2 MHz Channel 82 (HIFH) – 926.9 MHz

Test Equipment

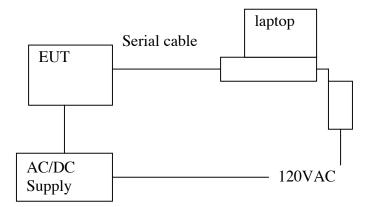
Compliance Certification Services:

TEST EQUIPMENT LIST								
Description	Manufacturer	Model	Asset Number	Cal Due				
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	08/24/10				
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/14/10				
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	07/06/10				
Antenna, Horn, 18 GHz	EMCO	3115	C00945	07/29/10				
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	08/04/10				

Silver Spring Networks:

Equipment	Mfr	Model	Serial No.	Cal Date
Spectrum analyzer	Agilent	E44053	MY45153391	07/23/10
Spectrum analyzer	Agilent	EXA	MY48030147	07/23/10

Test Set-up Diagram

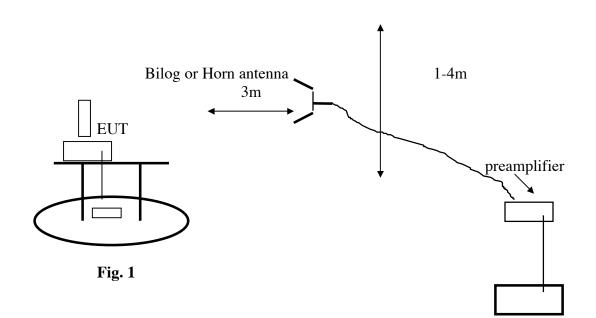


Support Equipment

Equipment	Mfr	Model	Asset No.
EUT AC/DC adapter	V-Infinity	HK-C112-A12	EPS120100UPS-P5P-KH
Laptop PC	Dell	PP01L	TW-0791UH1280-OC9-6558
PC AC/DC adapter	CUI Inc.	DSA-60W-20	2607HB

FREQUENCY HOPPING SPREAD SPECTRUM RADIO EMISSIONS

Silver Spring Networks FCC ID: OWS-NIC515 Model: sBridge R1 TEST RESULTS Radiated Test Set-up, 30 MHz-9.3 GHz



Test Procedures

Radiated emissions generated by the transmitter portion of the EUT were measured.

1. The EUT was placed on a wooden table resting on a turntable on the test site. The search antenna was placed 3m from the EUT. The EUT antenna was mounted in the with the EUT TX antenna pointed directly to the search antenna.

2. The turntable was slowly rotated to locate the direction of maximum emission at each emission falling in the restricted bands of 15.205.

3. Emissions were investigated to the 10th harmonic of the fundamental.

4. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data listed below.

Test Results: Worst-case results are presented. Refer to data sheets below. Restricted band emissions meet 54 dBuV/m. Other undesired emissions from the transmitter meet the -20 dBc requirement in 15.247(d).

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505 (1)	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
6.215 - 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	
13.36 - 13.41	322 - 335.4		

15.205 Restricted Frequency Bands

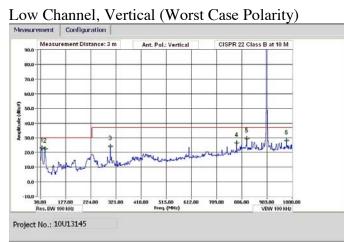
15.209 General Field Strength Limits

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

Radiated Emissions Above 1 GHz

GHz (m) dBuV ower=60	and Support anmit	Pre-ar T144 N	nplifer liteq 300	1-260												
Infiguration: EUT and St Iode: Continuous Tranmitest Iode: Continuous Tranmitest Horn 1-18GHz T73; S/N: 6717 @3m Hi Frequency Cables 3' cable 22807700 3' cable 22807700 GH (m) GHz (m) dBuV ower=60 a.annel 0: 902.3 MHz 707 3.0 3.0 44.3 414 3.0 452 707 3.0 52.1 414 3.0 44.3 94.4 746 3.0 576 3.0 661 3.0 661 3.0 746 3.0 746 3.0 661 3.0 661 3.0 707 3.0 3.0 44.4 746 3.0 61 3.0 707 3.0 707 3.0 746 3.0 746	and Support anmit	Pre-ar T144 N	nplifer	1-260												
Idee: Continuous Tranmitest Equipment: Horn 1-18GHz T73; S/N: 6717 @3m HI Frequency Cables I are cable 22807700 I a	anmit 42 1	Pre-ar T144 N	nplifer	1-260												
Bit Equipment: Horn 1-18GHz T73; S/N: 6717 @3m HI Frequency Cables 3' cable 22807700 If requency Cables 3' cable 22807700 If requency Cables 3' cable 22807700 If colspan="2">Cable 22807700 If colspan="2">Of colspan="2">Cable 22807700 If colspan="2">If colspan="2">Cable 22807700 If colspan="2">If colspan="2">Cable 22807700 If colspan="2">If colspan="2" If colspan="2" <td <="" colspan="2" t<="" th=""><th>12 07700 700 v Read Pk 1</th><th>. T144 N</th><th>-</th><th>1-260</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></td>	<th>12 07700 700 v Read Pk 1</th> <th>. T144 N</th> <th>-</th> <th>1-260</th> <th></th>		12 07700 700 v Read Pk 1	. T144 N	-	1-260										
Horn 1-18GHz T73; S/N: 6717 @3m HI Frequency Cables 3' cable 22807700 GHz (m) dBuT GHz (m) dBuT gene 22807700 Torn and colspan="2">Cable 22807700 GHz (m) dBuT dBuT <th c<="" th=""><th>07700 700 v</th><th>. T144 N</th><th>-</th><th>1-260</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th>	<th>07700 700 v</th> <th>. T144 N</th> <th>-</th> <th>1-260</th> <th></th>	07700 700 v	. T144 N	-	1-260											
Horn 1-18GHz T73; S/N: 6717 @3m HI Frequency Cables 3' cable 22807700 If mean end of the cable 22807700 Stable 22807700 GHz (m) dBut wer=60 hannel 0: 902.3 MHz 707 3.0 52.6 609 3.0 44.0 9707 3.0 44.0 9707 3.0 44.1 707 3.0 44.0 98.0 98.0 69.9 3.0 44.4 776 3.0 44.4 78.1 3.0 44.1 78.1 3.0 48.1 90.2 2 20 7 5 7 5 <th< th=""><th>07700 700 v</th><th>. T144 N</th><th>-</th><th>1-260</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th<>	07700 700 v	. T144 N	-	1-260												
T73; S/N: 6717 @3m Hi Frequency Cables 3' cable 2280770 3' cable 22807700 f Dist Read I GHz (m) dBuY 3' cable 22807700 3' cable 22807700 f Dist Read I GHz (m) dBuY year=60	07700 700 v	. T144 N	-	1-260												
Hi Frequency Cables 3' cable 22807700 G Dist Read I GHz (m) dBuY (m) 02.3 MHz 02.3 MHz 707 3.0 52.6 669 3.0 54.6 511 3.0 44.3 414 3.0 45.2 707 3.0 52.1 609 3.0 51.1 414 3.0 44.0 wer=60	07700 700		liteq 300	1-200	GHz	Pre-amp	lifer 26	-40GHz		Но	orn > 180	Hz				
H Frequency Cables 3' cable 2280770 3' cable 22807700 f Dist Read dBu7 dGHz (m) dBu7 dBu7 ower=60	07700 700			08A009	31 _								-	FCC 15.205		
3' cable 228077(0 3' cable 22807700 GHz (m) dBuV ower=60 0 hannel 0: 902.3 MHz 0 707 3.0 52.6 609 3.0 54.6 511 3.0 44.3 414 3.0 45.2 707 3.0 52.1 609 3.0 54.1 609 3.0 51.1 414 3.0 44.3 900 51.1 1.4 43.0 45.2 707 3.0 52.1 609 3.0 51.1 610 3.0 51.2 766 3.0 41.7 721 3.0 44.4 746 3.0 50.3 661 3.0 51.6 ower=27 1 hannel 82: 926.9 MHz 781 3.0 48.1 708 3.0 52.3	700 🔽		•					-								
3' cable 22807700 f Dist Read I GHz (m) dBuV (m) 902.3 MHz 000000000000000000000000000000000000	700 🔽	0 12'c	able 2	28076	500	20' cal	ole 22	807500		HPF	P	eject Filte	- Pe	ak Measurements		
f Dist Read I GHz (m) dBuV ower=60	Read Pk I											sject Fille	RI	BW=VBW=1MHz		
GHz (m) dBuV ower=60		_ 12' ca	ble 228	07600		20' cab	le 2280	7500	HP	F_1.5GHz	_		Ave	rage Measurements		
GHz (m) dBuV ower=60					-								RBW	=1MHz ; VBW=10Hz		
GHz (m) dBuV ower=60								~ .								
ower=60			AF	CL	Amp	D Corr	Fltr	Peak	Avg	Pk Lim	Avg Lim	Pk Mar	Avg Mar	Notes		
hannel 0: 902.3 MHz 707 3.0 52.6 609 3.0 54.6 511 3.0 44.3 707 3.0 45.2 707 3.0 45.2 707 3.0 44.4 3.0 44.3 51.1 707 3.0 45.2 707 3.0 45.2 707 3.0 45.2 609 3.0 51.1 414 3.0 44.0 ower=60	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)		
007 3.0 52.6 6099 3.0 54.6 511 3.0 44.3 414 3.0 45.2 707 3.0 52.1 6099 3.0 51.1 609 3.0 45.2 707 3.0 52.1 609 3.0 51.1 wer=60																
609 3.0 54.6 511 3.0 44.3 414 3.0 45.2 707 3.0 52.1 609 3.0 51.1 414 3.0 44.0 wer=60																
609 3.0 54.6 511 3.0 44.3 414 3.0 45.2 707 3.0 52.1 609 3.0 51.1 414 3.0 44.0 wer=60	52.6	40.5	20.1	41	27.4	0.0		40.0	45.0		54	25.1	0.1			
511 3.0 44.3 414 3.0 45.2 707 3.0 52.1 609 3.0 51.1 414 3.0 45.2 609 3.0 51.1 hannel 43: 915.2 MHz 746 3.0 746 3.0 55.1 661 3.0 55.2 766 3.0 44.4 746 3.0 55.7 76 3.0 44.4 746 3.0 55.1 661 3.0 51.6 wer=27 - - hannel 82: 926.9 MHz - 781 3.0 48.5 707 3.0 55.1 634 3.0 41.9 781 3.0 48.1 708 3.0 52.3		49.5	29.1	4.1	-37.4	0.0	0.6	48.9	45.9	74	54	-25.1	-8.1	<u>v</u> v		
414 3.0 45.2 707 3.0 52.1 609 3.0 51.1 414 3.0 44.0 ower=60 - - hannel 43: 915.2 MHz - - 746 3.0 52.3 661 3.0 51.6 ower=27 - - 781 3.0 48.5 707 3.0 48.1 707 3.0 48.5 707 3.0 48.5 707 3.0 48.5 707 3.0 48.5 707 3.0 48.5 707 3.0 48.5 707 3.0 48.5 708 3.0 52.3		52.3 33.9	31.4 32.7	4.8	-36.9 -36.5	0.0	0.6	54.5 46.6	52.2 36.3	74	54 54	-19.5 -27.4	-1.8 -17.7	v		
0707 3.0 52.1 6099 3.0 51.1 414 3.0 51.1 414 3.0 51.1 414 3.0 51.1 hannel 43: 915.2 MHz 746 3.0 746 3.0 52.3 661 3.0 55.7 766 3.0 44.4 746 3.0 50.3 661 3.0 51.6 ower=27 - - 781 3.0 48.5 707 3.0 55.1 634 3.0 44.5 781 3.0 44.7 708 3.0 52.3		37.5	33.8	6.2	-36.3	0.0	0.6	40.0	41.7	74	54	-27.4	-17.7	v		
609 3.0 51.1 414 3.0 44.0 ower=60	43.2	51.5	33.0	0.2	-30.3	0.0	0.5	47.4	41./	/4	34	-2-4.0	-14.5			
414 3.0 44.0 ower=60	52.1	49.0	29.1	4.1	-37.4	0.0	0.6	48.5	45.3	74	54	-25.5	-8.7	Н		
ower=60	51.1	47.5	31.4	4.8	-36.9	0.0	0.6	51.0	47.4	74	54	-23.0	-6.6	Н		
hannel 43: 915.2 MHz 746 3.0 52.3 661 3.0 55.7 756 3.0 41.7 746 3.0 50.3 661 3.0 51.6 ower=27	44.0	35.9	33.8	6.2	-36.3	0.0	0.5	48.2	40.1	74	54	-25.8	-13.9	Н		
hannel 43: 915.2 MHz 746 3.0 52.3 661 3.0 55.7 756 3.0 41.7 746 3.0 50.3 661 3.0 51.6 ower=27																
746 3.0 52.3 3661 3.0 55.7 576 3.0 41.7 321 3.0 44.4 30 56.6 50.3 661 3.0 51.6 ower=27																
661 3.0 55.7 576 3.0 41.7 321 3.0 44.4																
661 3.0 55.7 576 3.0 41.7 321 3.0 44.4	52.3	49.0	29.2	4.1	-37.4	0.0	0.6	48.9	45.5	74	54	-25.1	-8.5	v		
321 3.0 44.4 746 3.0 50.3 661 3.0 51.6 ower=27	55.7	53.5	31.5	4.9	-36.9	0.0	0.6	55.8	53.6	74	54	-18.2	-0.4	V		
746 3.0 50.3 661 3.0 \$1.6 ower=27	41.7	29.6	32.8	5.6	-36.5	0.0	0.6	44.2	32.1	74	54	-29.8	-21.9	v		
661 3.0 51.6 ower=27	44.4	32.5	35.3	7.3	-36.2	0.0	0.6	51.4	39.5	74	54	-22.6	-14.5	V		
661 3.0 51.6 ower=27			-					46.9								
ower=27		46.3 48.5	29.2 31.5	4.1	-37.4 -36.9	0.0	0.6 0.6	46.9	42.8 48.5	74 74	54 54	-27.1 -22.3	-11.2 -5.5	H H		
annel 82: 926.9 MHz 781 3.0 48.5 707 3.0 55.1 634 3.0 41.9 781 3.0 48.1 707 708 3.0 48.1	51.0	40.0	31.3	4.7	-30.9	0.0	0.0	31./	40.0	/-	34	-44.3	-0.0			
annel 82: 926.9 MHz 781 3.0 48.5 707 3.0 55.1 634 3.0 41.9 781 3.0 48.1 707 708 3.0 48.1											1					
707 3.0 55.1 634 3.0 41.9 781 3.0 48.1 708 3.0 52.3																
707 3.0 55.1 634 3.0 41.9 781 3.0 48.1 708 3.0 52.3																
634 3.0 41.9 781 3.0 48.1 708 3.0 52.3		43.4	29.3	4.2	-37.4	0.0	0.6	45.2	40.1	74	54	-28.8	-13.9	V (Power = 27)		
781 3.0 48.1 708 3.0 52.3		53.5 31.1	31.6 32.9	4.9 5.7	-36.8 -36.5	0.0	0.6 0.6	55.4 44.5	53.7 33.7	74 74	54 54	-18.6 -29.5	-0.3 -20.3	V (Power = 27) V (Power = 27)		
708 3.0 52.3	41.7	51.1	34.9	5.1	-30.5	0.0	0.0	44.3	33.1	/4	34	-49.5	-20.3	v (1 Ower = 27)		
708 3.0 52.3	48.1	42.4	29.3	4.2	-37.4	0.0	0.6	44.7	39.1	74	54	-29.3	-14.9	Н		
ev. 07.22.09	52.3	49.5	31.6	4.9	-36.8	0.0	0.6	52.5	49.8	74	54	-21.5	-4.2	Н		
ev. 07.22.09																
		ment Frequency			Amp	Preamp G					Avg Lim		eld Strength			
Dist Distance		to Antenna			D Corr			to 3 meters			Pk Lim		Strength Lin			
Read Analyze	easurement l stance to Ar	Reading			Avg	Average H	Field St	rength @ 3	m		Avg Mar	Margin vs.	Average Lir	nit		
					Peak			Field Streng			Pk Mar		Peak Limit			
CL Cable L	stance to Ar				HPF	High Pass						5				

Radiated Emissions Below 1 GHZ



Mid Channel, Vertical (Worst Case Polarity)



High Channel, Vertical (Worst Case Polarity)



20 dB Bandwidth

<u>LIMIT</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to approximately 5% of the 20 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

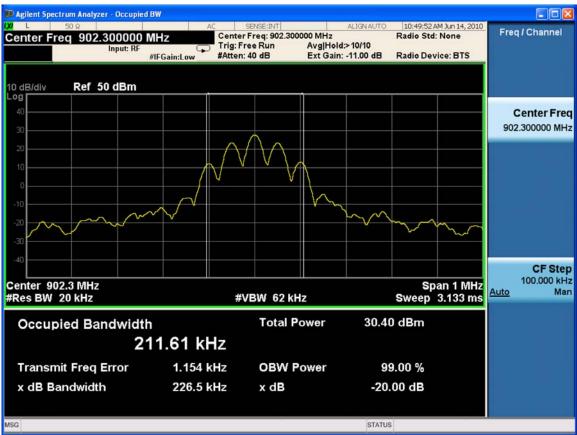
RESULTS

No non-compliance noted:

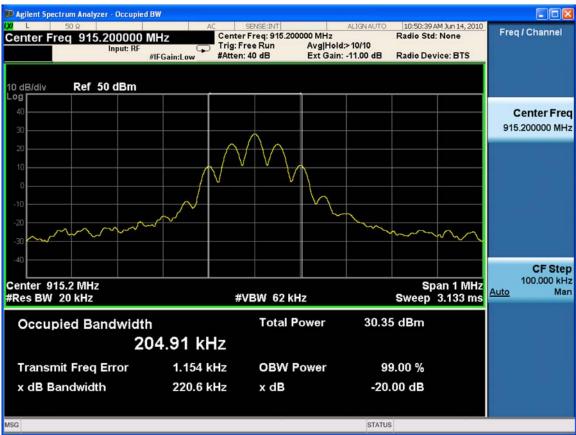
Channel	Frequency (MHz)	20 dB BW (kHz)	99% Occupied BW (kHz)
Low	902.3	226.5	212
Middle	915.2	220.6	205
High	926.9	204.1	193

Emission Designator: 212KF1D (maximum 99% BW: 212 kHz)

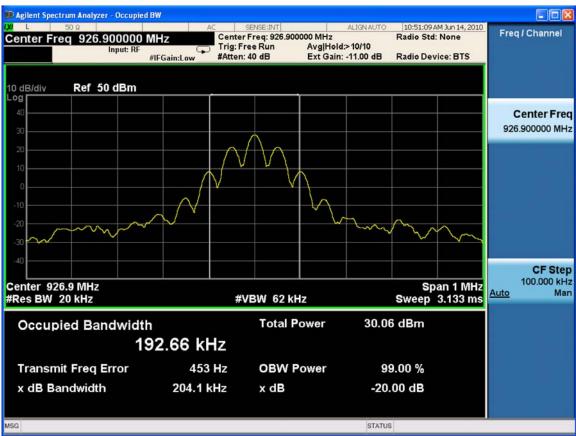
99% and 20 dB BANDWIDTH LOW CHANNEL



99% and 20 dB BANDWIDTH MID CHANNEL



99% and 20 dB BANDWIDTH HIGH CHANNEL



HOPPING FREQUENCY SEPARATION

LIMIT

\$15.247 (a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

TEST PROCEDURE

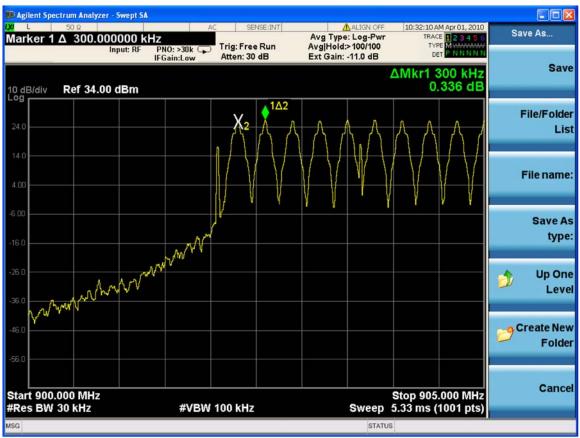
The transmitter output is connected to a spectrum analyzer. The RBW is set to 10 kHz and the VBW is set to 30 kHz. The sweep time is coupled.

RESULTS

No non-compliance noted:

The separation is 300 KHz.

HOPPING FREQUENCY SEPARATION



NUMBER OF HOPPING CHANNELS

LIMIT

\$15.247 (a) (1) (i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

TEST PROCEDURE

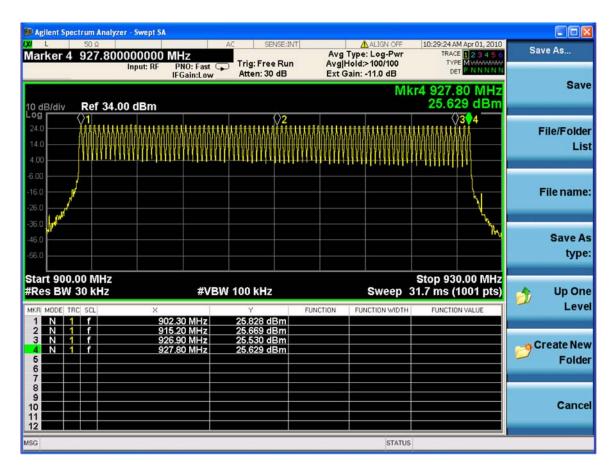
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 3 % of the span. The analyzer is set to Max Hold.

RESULTS

No non-compliance noted:

83 Channels observed, 902.3 – 926.9 MHz, the frequency range for FCC and IC compliance. The spectrum analyzer plot below shows 86 channels 902.3- 927.8 MHz, the full range of the product. The upper channels are used in Australia and other regulatory domains. The product software will limit operation to 902.3 – 926.9 MHz in the United States and Canada.

NUMBER OF HOPPING CHANNELS



AVERAGE TIME OF OCCUPANCY

LIMIT

§15.247 (a) (1) (i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 20 second scan, to enable resolution of each occurrence.

RESULTS

No non-compliance noted:

The on time for each pulse is 90 msec.

At a given frequency there is one pulse in 20 seconds.

Therefore, the average time of occupancy in the specified 20-second period is 90 msec.

Limit: Not to exceed 400 msec.

PULSE WIDTH

Agilent Spectrum Analyzer - Swept S/				
Marker 1 A 90.0000 ms Input: RF	PNO: >30k Trig: Free Run IFGain:Low Atten: 30 dB	Aug Type: Log-Pwr Ext Gain: -11.0 dB	11:21:11 AM Apr 01, 2010 TRACE 1 2 3 4 5 6 TYPE MUMUUUU DET P N N N N N	Save As
10 dB/div Ref 34.00 dBm		Δ	Mkr1 90.00 ms 0.978 dB	Save
24.0				File/Folde Lis
4.00				File name
-6.00				Save A type
36.0				Dp On Leve
46.0 wystęwastanie wystęwastanie wystęwastanie wystęwastanie w starowa w starowa w starowa w starowa w starowa 56.0	enthetimence-ketelsentiqueetherdy	142	howardyn ffan general ffan ffan ffan ffan ffan ffan ffan ff	Create Nev Folde
Center 915.200000 MHz Res BW 100 kHz	#VBW 100 kHz	Sweep	Span 0 Hz 1.000 s (1001 pts)	Cance
ISG		STATUS		

NUMBER OF PULSES IN 20 SECOND OBSERVATION PERIOD

L 50 Ω	AC SENSE:INT	ALIGN OFF	11:27:46 AM Apr 01, 2010	Save As
arker 1 2.72200 s	PNO: >30k 🎧 Trig: Line IFGain:Low Atten: 30 dB	Avg Type: Log-Pwr Ext Gain: -11.0 dB	TRACE 123456 TYPE MWWWWWW DET PNNNNN	
dB/div Ref 34.00 dBm			Mkr1 2.722 s 26.77 dBm	Sa
4.0				File/Fold Li
4.0				File nam
.0				Save typ
				ঠ Up O Le
0	no have been and a short	and and Born Brond	n Man halmadam	Create No. Fold
enter 915.200000 MHz es BW 30 kHz	#VBW 30 kHz	Sweep	Span 0 Hz 20.00 s (401 pts)	Can

PEAK OUTPUT POWER

PEAK POWER LIMIT

\$15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (2) For frequency hopping systems operating in the 902-928 MHz band, employing at least 50 hopping channels: 1 watt; and employing less than 50 hopping channels, but at least 25 hopping channels: 0.25 watt.

§15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 4 dBi, therefore the power limit is 30 dBm.

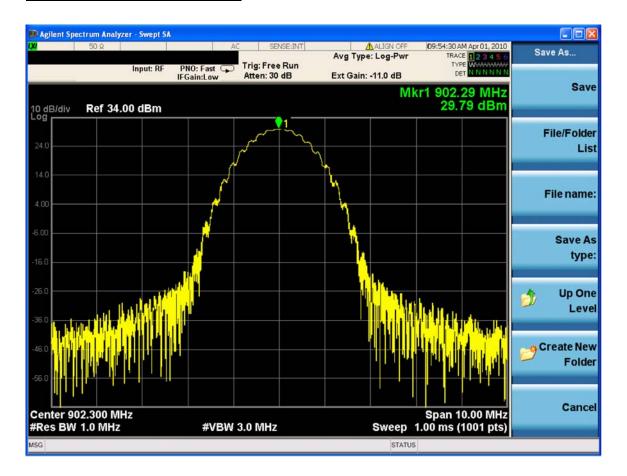
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

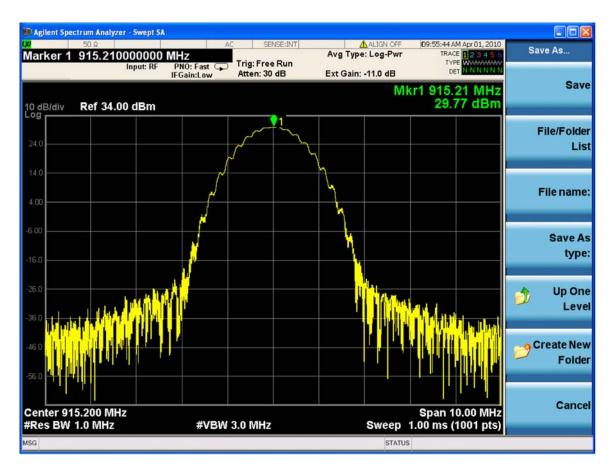
RESULTS

No non-compliance noted:

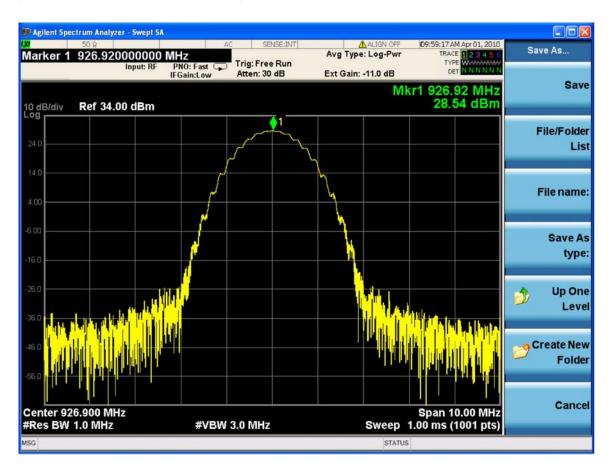
Channel	Frequency	P out
Low	902.3	29.79
Mid	915.2	29.77
High	926.9	28.54



OUTPUT POWER MID CHANNEL



OUTPUT POWER HIGH CHANNEL



MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

\$1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Lim	its for Occupational	/Controlled Exposu	res	
0.3–3.0 3.0–30 30–300 300–1500 1500–100,000	614 1842/f 61.4	1.63 4.89/f 0.163	*(100) *(900/f²) 1.0 f/300 5	6 6 6 8
(B) Limits	for General Populati	on/Uncontrolled Exp	posure	
0.3–1.34 1.34–30	614 824/f	1.63 2.19/f	*(100) *(180/f ²)	30 30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)-Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)	
30–300 300–1500	27.5	0.073	0.2 f/1500	30 30	
1500–100,000			1.0	30	

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their
employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure.
Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for
exposure or can not exercise control over their exposure.

exposure or can not exercise control over their exposure.

CALCULATIONS

E

Given

$$= \sqrt{(30 * P * G)} / d$$

and

 $S = E^{2}/3770$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

 $d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using:

P (mW) = P (W) / 1000 and d (cm) =100 * d (m) yields $d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$ $d = 0.282 * \sqrt{(P * G / S)}$ where d = distance in cm P = Power in mW G = Numeric antenna gain $S = \text{Power Density in mW/cm^2}$

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and G (numeric) = 10 ^ (G (dBi) / 10) yields $d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$ where d = MPE distance in cm P = Power in dBm

G = Antenna Gain in dBi

 $S = Power Density Limit in mW/cm^2$

Equation (1) and the measured peak power is used to calculate the MPE distance.

Equation (1)

LIMITS

From §1.1310 Table 1 (B), S = 0.6 mW/cm^2

RESULTS

No non-compliance noted:

Power Density	Output	Antenna	S, mW/cm2
Limit	Power	Gain	at 20cm
(mW/cm^2)	(dBm)	(dBi)	
0.6	29.79	3.00	0.31

MPE Distance: 15.87 cm

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in§15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

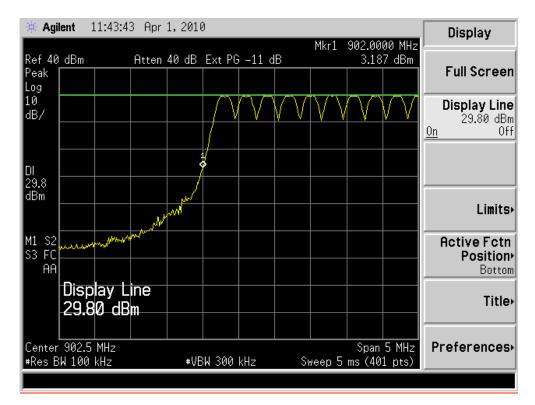
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

The spectrum from 30 MHz to 10 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

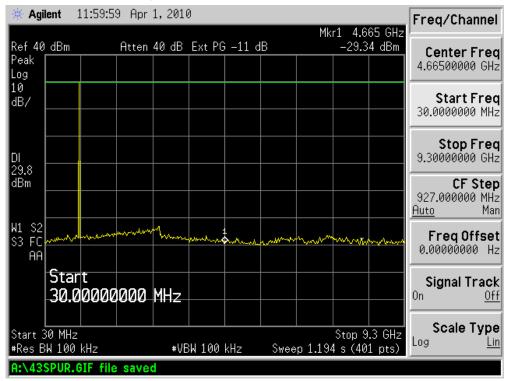
RESULTS

No non-compliance noted:

SPURIOUS EMISSIONS, LOW CHANNEL, HOPPING

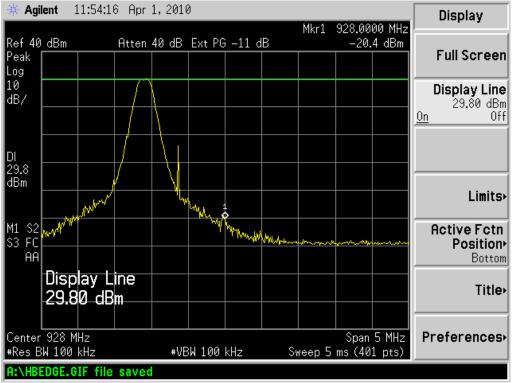


SPURIOUS EMISSIONS, LOW CHANNEL



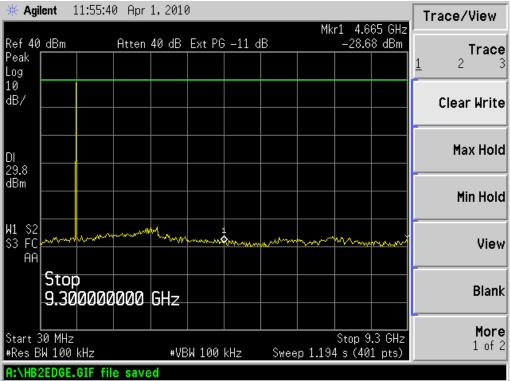
SPURIOUS EMISSIONS, MID CHANNEL

🔆 Agil	lent 🔅	11:59:1	1 Apr	1,2010)						Delete
D. C. 40	-ID		0	40 JD		· 11 .	ID	Mki		65 GHz	
Ref 40 Peak	авт		Htten	40 dB	EXt PG	-11 c	1D		-21.1	2 dBm	Delete Now
Log											
10 dB/											Type
											Screen
DI											Sort
29.8 dBm											
111 00				ž							
W1 S2 S3 FC	moran	man	www.new	mm	much	h	mm	- Martin	m	formant	
AA											
											Dir Un
											Dir Up
Start 3					11.1.00		<u>.</u>	- 1 10		.3 GHz	Dir Select
#Res B					W 100	KHZ	SWee	p 1.194	4 S (40	1 pts)	
HEASC	REN42	4.GIF f	ne del	eted							



SPURIOUS EMISSIONS, HIGH CHANNEL

SPURIOUS EMISSIONS, HIGH CHANNEL



4.4 POWERLINE CONDUCTED EMISSIONS

LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted I	.imit (dBuV)
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46 *
0.5-5	56	46
5-30	60	50

Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

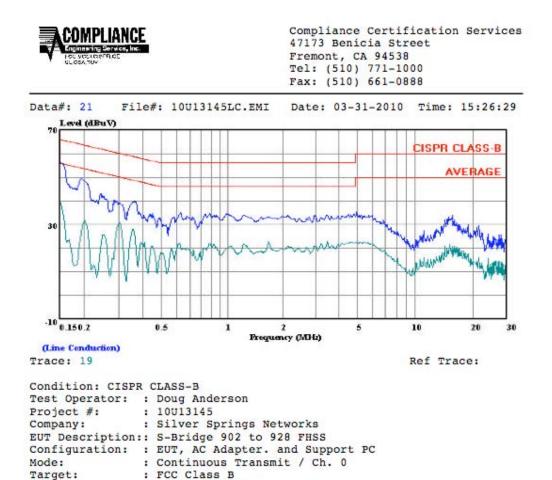
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

No non-compliance noted:

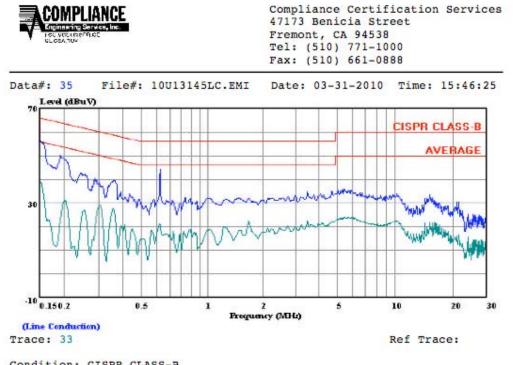
900 MHz FHSS, LINE 1 RESULTS

Voltage:



: 115VAC / 60Hz

: L1: Peak(Blue); Average (Green)



Condition: CISPR	CLASS-B
Test Operator:	: Doug Anderson
Project #:	: 10U13145
Company:	: Silver Springs Networks
EUT Description:	: S-Bridge 902 to 928 FHSS
Configuration:	: EUT, AC Adapter. and Support PC
Mode:	: Continuous Transmit / Ch. 0
Target:	: FCC Class B
	: 115VAC / 60Hz
	: L2: Peak(Blue); Average (Green)

Receiver Spurious Emissions

FCC Requirement: 15.111 Industry Canada: RSS-Gen Sec. 6(b)

Test Procedure

The spectrum analyzer is connected directly to the antenna port. The radio was placed into receive only operation at the same Low, Mid, and High channels tested for transmitter emissions.

Limits

30 – 1000 MHz : -57 dBm 1000 – 7000 MHz: -54 dBm

Test Results

All emissions more than 20 dB below limits. Refer to the spectrum analyzer plots below.

Model: sBridge R1

Low channel RX emissions 30-1000 MHz (recorded emission from nearby TX)



Low channel RX emissions 1000-7000 MHz

Agilent Spectrum Analyz	er - Swept SA								
Display Line -54.	00 dBm			E:INT		Lignauto	TRAC	M Jun 14, 2010	Trace/Det
10 dB/div Ref -19	Input: RF	PNO: Fast IFGain:High	#Atten: 0 di		Ext Gain:		Mkr1 9	ET BUNNING	Select Trace Trace 1
29.0									Clear Writ
49.0								-54 00 dBm	Trace Avera
59.0 -									Max Ho
79.0 m.l.s.in.liji.in.di.a.k	ng parting birds of the	all approved to a	whater you coughed	haran Bran	-Jacobinet of the	geren sinteri	Payal bergin and	r Alfrancistana	Min Ho
99.0									View/Blan Trace Or
Start 1.000 GHz #Res BW 1.0 MHz		#VBW	3.0 MHz			Sweep	Stop 7 10.0 ms (.000 GHz 1001 pts)	М о 1 о
sa						STATU	5		

reamp Gain -1.00 dl	3		ALIGNAUTO Avg Type: Log-Pwr	10:55:05 AM Jun 14, 2010 TRACE 1 2 3 4 5 6	Trace/Det
Input	: RF PNO: Fast 😱 IFGain:High	Trig: Free Run #Atten: 0 dB	Avg Hold>100/100 Ext Gain: -1.00 dB	TYPE MUMMMMM DET NNNNN	Select Trace
dB/div Ref -19.00 dB	Зm		Mk	r1 902.30 MHz -60.242 dBm	Trace
90					ClearWri
3.0					Trace Avera
9.0				1 -57.00 dBm	
9,0				ika.	MaxHe
0.0	in survey in the second	winder and a start	topowerhunder how with the	when how when	
9.0					Min He
.0.					
90					View/Blan
09					Trace O
					Mo
art 30.0 MHz es BW 3.0 MHz	VBW	0 MHz	Sweep 1	Stop 1.0000 GHz 1.00 ms (1001 pts)	1 0
3			STATUS		

Mid channel RX emissions 1000-7000 MHz

splay Line -54	00 dBm	A	C SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	10:57:49 AM 3un 14, 2010 TRACE 1 2 3 4 5 5	Trace/Det
spidy Ellie -54	Input: RF	PNO: Fast 😱 FGain:High	Trig: Free Run #Atten: 0 dB	Avg Hold: 25/100 Ext Gain: -1.00 dB	DET PINNNNN	Select Trace
dB/div Ref -19).00 dBm				Mkr1 902 MHz dBm	Trace
0						Clear Wri
0					.54.00 dBm	Trace Avera
0 0						Max Ho
o aferforsandraanse	almansharrow	hunte	where have been a series	aj initial protocol from deficiency	fore dal ⁱ na-trateir rutedingh	Min Ho
9						View/Blan Trace O
art 1.000 GHz es BW 1.0 MHz		#VBW	3.0 MHz	Sweep	Stop 7.000 GHz 10.0 ms (1001 pts)	Мс 1 с

Agilent Spectrum Analyzer - Swept				
L 50 R	AC SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	10:55:44 AM Jun 14, 2010 TRACE 2 3 4 5 6 TYPE MUMAAAAA	Trace/Det
Input: RF	PNO: Fast 😱 Trig: Free Run IFGain:High #Atten: 0 dB	Avg Hold:>100/100 Ext Gain: -1.00 dB	TYPE MULLOUND DET P NNNNN	Select Trace
0 dB/div Ref -19.00 dBm	Ĩ.	MI	r1 902.30 MHz -62.239 dBm	Trace
29.0				Clear Wri
19.0				Trace Avera
99.0			1 -57 00 dBm	Max He
9.0 Uparamentularh/willion-miser 9.0	ryadyadyadalayadilayadadaadhadadhadadhadaga	llingen eigen sich belacht auf vorhier die	raturest Surveyer	Min H
9,0				View/Blan
9.0				Trace C
tart 30.0 MHz es BW 3.0 MHz	VBW 50 MHz	Sweep	Stop 1.0000 GHz 1.00 ms (1001 pts)	Mc 1 c
sg		STATUS		

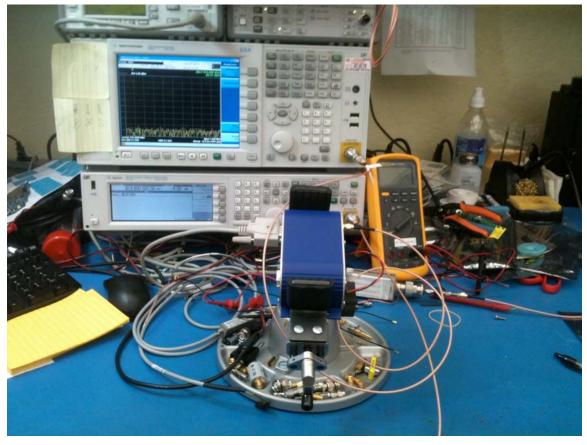
High channel RX emissions 30-1000 MHz (recorded emission from nearby TX)

High channel RX emissions 1000-7000 MHz

zer - Swept SA	
.00 dBm Avg Type: Log-Pwr TRAC Insuit RE DNO: Fast Trig: Free Run AvglHold>100/100 TYP	M 3un 14,2010 E 1 2 3 4 5 6 M M M M M M M FE M M M M M M FE P N N N N N
Mkr1 9	02 MHz Annotation
	Title
	Graticu <u>On</u> C
	Display Lin -54.00 dB On 0
water and and the second state and and and and and and a second state and a second state of the second state of	nentes configurations
	System Display Setting
Stop 7	.000 GHz
#VBW 3.0 MHz Sweep 10.0 ms (1001 pts)

SETUP PHOTOS

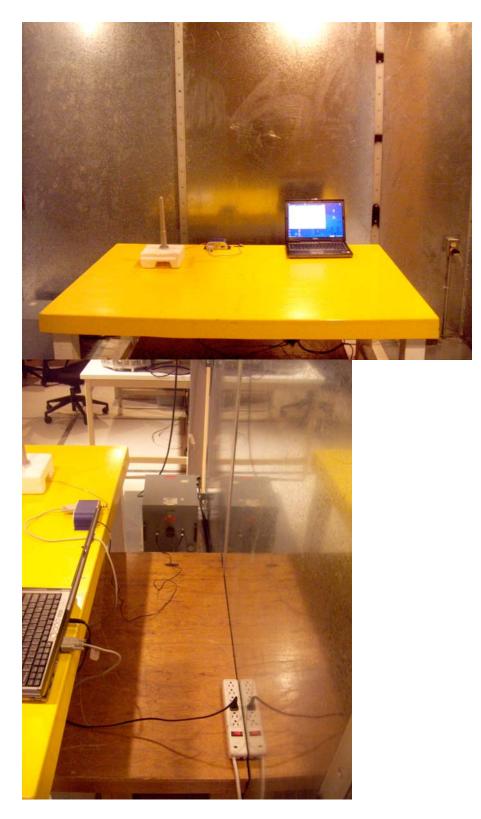
ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP, SILVER SPRING NETWORKS







POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP, CCS



END OF REPORT

Report Revision History

Revision	Revision Description	Pages	Revised by	Date
No.		Revised		
-	Original Issue		T. Cokenias	05/03/2010
Α	Add RX Spurious Data		T. Cokenias	06/15/2010
	Update occupied bandwidth plots			
	Change model number to sBridge R1			