EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER

I. GENERAL INFORMATION

Requirement:	FCC, Industry Canada
Test Requirements:	FCC: Part 2, Part 15 IC: RSS-Gen, RSS-210,
Applicant:	Silver Spring Networks 575 Broadway Street Redwood City, CA 94063
FCC ID:	**OWS-IMU517**
IC:	5975A-IMU517
Model No.:	IMU 200

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The Silver Spring Networks (SSN) IMU517 is a battery-operated radio module for gas meter communications use. The board incorporates a 900 MHz FHSS radio.

III. TEST DATES AND TEST LOCATION

Testing was performed on 7 and 17 September 2010. Antenna port conducted and radiated emissions tests were performed at:

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538

Hopping mode tests were performed at Silver Spring Networks on 27 September 2010.

T.N. Cokenias 24 February 2011
EMC Consultant/Agent for Silver Spring Networks

15.203 Antenna connector requirement

The EUT uses a custom permanently attached integral antenna,

Antenna description	Mfr.	Model No.	Gain
Built-in sheet metal electric meter	SSN	n/a	3 dBi at 902 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.

Tests were performed at three frequencies:

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

Test Equipment

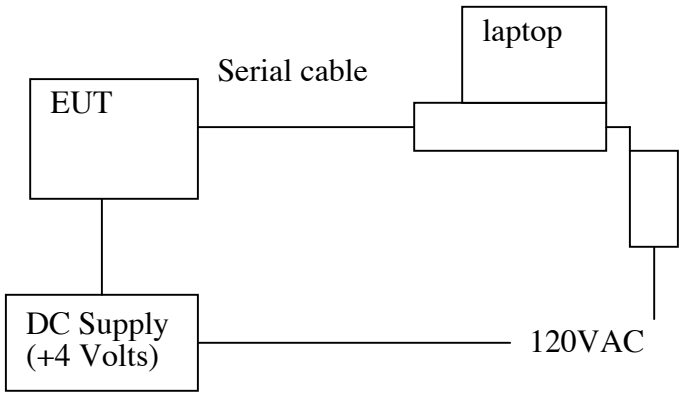
Compliance Certification Services:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset Number**	**Cal Due**
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	08/18/11
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/12/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/06/11
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/11
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/14/11
Power Meter	Agilent / HP	437B	N02778	08/11/12

Silver Spring Networks:

Equipment	Mfr	Model	Asset No.	Cal Due
Spectrum analyzer	Agilent	CXA	MY49370322	03/07/2011

Test Set-up Diagram



Support Equipment

Equipment	Mfr	Model	Asset No.
DC Power Supply	Agilent	E3610A	2844
Laptop PC	Dell	PP01L	TW-0791UH1280-OC9-6558
AC/DC adapter	CUI Inc.	DSA-60W-20	2607HB

FREQUENCY HOPPING SPREAD SPECTRUM RADIO EMISSIONS

TEST RESULTS

Radiated Test Set-up, 30 MHz-9.3 GHz

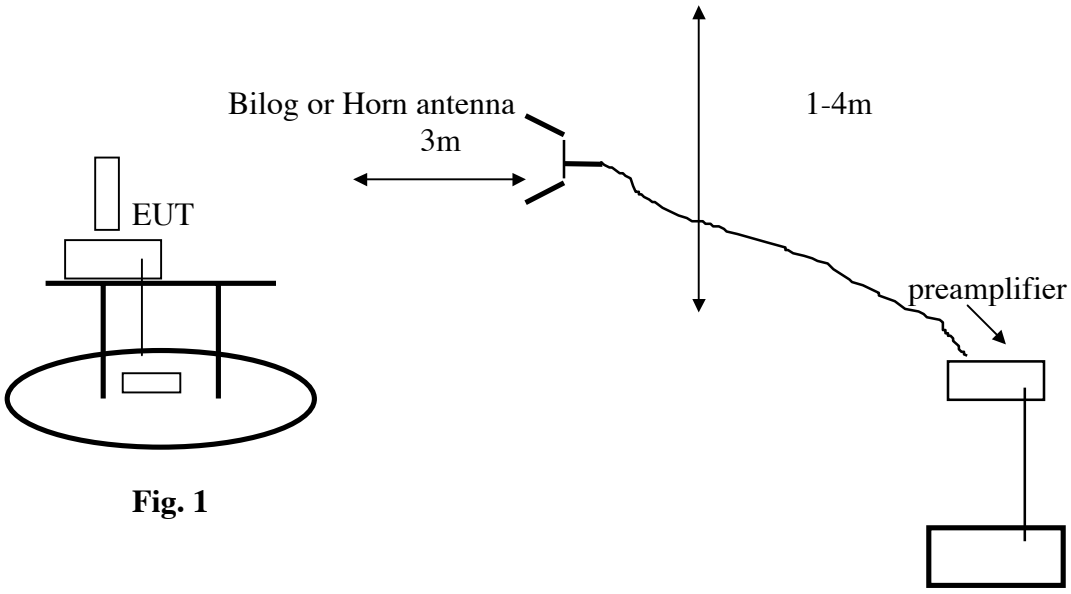


Fig. 1

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 10^{th} 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).

15.205 Restricted Frequency Bands

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		

15.209 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

Transmitter Radiated Emissions Above 1 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: William Zhuang
Date: 09/07/10
Project #: 10U13413
Company: Silver Spring Networks (T. Cokenias)
Test Target: FCC 15.205
Mode Oper: Tx On
Model Name: Actaris IMU

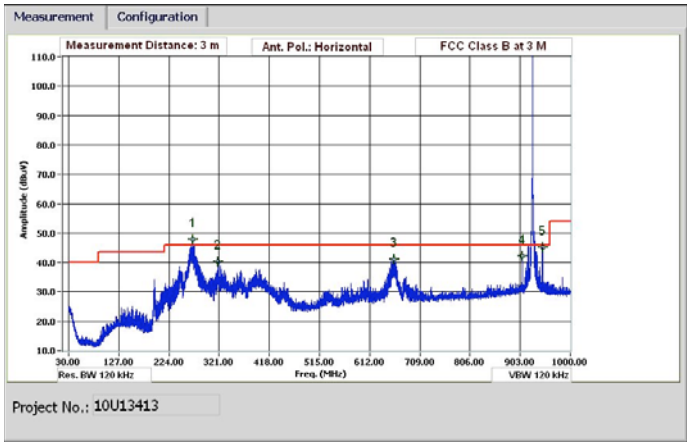
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch. 902.3 MHz													
2.707	3.0	52.8	29.1	4.1	-37.4	0.0	0.6	49.1	74.0	-24.9	V	P	
2.707	3.0	50.8	29.1	4.1	-37.4	0.0	0.6	47.2	54.0	-6.8	V	A	
2.707	3.0	49.7	29.1	4.1	-37.4	0.0	0.6	46.0	74.0	-28.0	H	P	
2.707	3.0	46.7	29.1	4.1	-37.4	0.0	0.6	43.1	54.0	-10.9	H	A	
3.609	3.0	53.6	31.4	4.8	-36.9	0.0	0.6	53.5	74.0	-20.5	V	P	
3.609	3.0	52.0	31.4	4.8	-36.9	0.0	0.6	51.9	54.0	-2.1	V	A	
3.609	3.0	47.5	31.4	4.8	-36.9	0.0	0.6	47.4	74.0	-26.6	H	P	
3.609	3.0	44.6	31.4	4.8	-36.9	0.0	0.6	44.5	54.0	-9.5	H	A	
4.511	3.0	44.3	32.7	5.6	-36.5	0.0	0.6	46.6	74.0	-27.4	H	P	
4.511	3.0	39.6	32.7	5.6	-36.5	0.0	0.6	42.0	54.0	-12.0	H	A	
4.511	3.0	48.5	32.7	5.6	-36.5	0.0	0.6	50.9	74.0	-23.1	V	P	
4.511	3.0	46.2	32.7	5.6	-36.5	0.0	0.6	48.5	54.0	-5.5	V	A	
5.414	3.0	47.6	33.8	6.2	-36.3	0.0	0.5	51.8	74.0	-22.2	V	P	
5.414	3.0	45.0	33.8	6.2	-36.3	0.0	0.5	49.3	54.0	-4.7	V	A	
5.414	3.0	41.8	33.8	6.2	-36.3	0.0	0.5	46.1	74.0	-27.9	H	P	
5.414	3.0	36.3	33.8	6.2	-36.3	0.0	0.5	40.5	54.0	-13.5	H	A	
8.121	3.0	39.2	36.4	7.7	-36.2	0.0	0.7	47.8	74.0	-26.2	H	P	
8.121	3.0	30.5	36.4	7.7	-36.2	0.0	0.7	39.1	54.0	-14.9	H	A	
8.121	3.0	45.3	36.4	7.7	-36.2	0.0	0.7	53.9	74.0	-20.1	V	P	
8.121	3.0	41.4	36.4	7.7	-36.2	0.0	0.7	50.0	54.0	-4.0	V	A	
9.023	3.0	43.4	37.2	8.2	-36.7	0.0	0.7	52.8	74.0	-21.2	V	P	
9.023	3.0	37.8	37.2	8.2	-36.7	0.0	0.7	47.2	54.0	-6.8	V	A	
9.023	3.0	37.5	37.2	8.2	-36.7	0.0	0.7	47.0	74.0	-27.0	H	P	
9.023	3.0	26.1	37.2	8.2	-36.7	0.0	0.7	35.5	54.0	-18.5	H	A	
Mid Ch. 915.2 MHz													
2.746	3.0	48.9	29.2	4.1	-37.4	0.0	0.6	45.4	74.0	-28.6	H	P	
2.746	3.0	45.2	29.2	4.1	-37.4	0.0	0.6	41.7	54.0	-12.3	H	A	
2.746	3.0	49.3	29.2	4.1	-37.4	0.0	0.6	45.8	74.0	-28.2	V	P	
2.746	3.0	46.1	29.2	4.1	-37.4	0.0	0.6	42.7	54.0	-11.3	V	A	
3.661	3.0	48.8	31.5	4.9	-36.9	0.0	0.6	48.9	74.0	-25.1	V	P	
3.661	3.0	45.4	31.5	4.9	-36.9	0.0	0.6	45.5	54.0	-8.5	V	A	
3.661	3.0	45.9	31.5	4.9	-36.9	0.0	0.6	46.0	74.0	-28.0	H	P	
3.661	3.0	41.6	31.5	4.9	-36.9	0.0	0.6	41.7	54.0	-12.3	H	A	
4.576	3.0	43.3	32.8	5.6	-36.5	0.0	0.6	45.8	74.0	-28.2	H	P	
4.576	3.0	38.1	32.8	5.6	-36.5	0.0	0.6	40.6	54.0	-13.4	H	A	
4.576	3.0	47.2	32.8	5.6	-36.5	0.0	0.6	49.7	74.0	-24.3	V	P	
4.576	3.0	44.6	32.8	5.6	-36.5	0.0	0.6	47.0	54.0	-7.0	V	A	
7.322	3.0	44.8	35.3	7.3	-36.2	0.0	0.6	51.8	74.0	-22.2	V	P	
7.322	3.0	41.0	35.3	7.3	-36.2	0.0	0.6	48.0	54.0	-6.0	V	A	
7.322	3.0	37.8	35.3	7.3	-36.2	0.0	0.6	44.7	74.0	-29.3	H	P	
7.322	3.0	28.1	35.3	7.3	-36.2	0.0	0.6	35.1	54.0	-18.9	H	A	
8.237	3.0	37.2	36.5	7.8	-36.3	0.0	0.7	45.9	74.0	-28.1	H	P	
8.237	3.0	26.3	36.5	7.8	-36.3	0.0	0.7	35.1	54.0	-18.9	H	A	
8.237	3.0	42.1	36.5	7.8	-36.3	0.0	0.7	50.8	74.0	-23.2	V	P	
8.237	3.0	36.5	36.5	7.8	-36.3	0.0	0.7	45.3	54.0	-8.7	V	A	
9.152	3.0	40.8	37.2	8.3	-36.7	0.0	0.7	50.3	74.0	-23.7	V	P	
9.152	3.0	33.7	37.2	8.3	-36.7	0.0	0.7	43.2	54.0	-10.8	V	A	
9.152	3.0	36.6	37.2	8.3	-36.7	0.0	0.7	46.1	74.0	-27.9	H	P	
9.152	3.0	24.5	37.2	8.3	-36.7	0.0	0.7	34.0	54.0	-20.0	H	A	
High Ch. 926.9 MHz													
2.781	3.0	49.2	29.3	4.2	-37.4	0.0	0.6	45.9	74.0	-28.1	H	P	
2.781	3.0	46.5	29.3	4.2	-37.4	0.0	0.6	43.1	54.0	-10.9	H	A	
2.781	3.0	53.1	29.3	4.2	-37.4	0.0	0.6	49.8	74.0	-24.2	V	P	
2.781	3.0	51.1	29.3	4.2	-37.4	0.0	0.6	47.8	54.0	-6.2	V	A	
3.708	3.0	43.4	31.6	4.9	-36.8	0.0	0.6	43.6	74.0	-30.4	V	P	
3.708	3.0	38.5	31.6	4.9	-36.8	0.0	0.6	38.8	54.0	-15.2	V	A	
3.708	3.0	44.9	31.6	4.9	-36.8	0.0	0.6	45.2	74.0	-28.8	H	P	
3.708	3.0	38.7	31.6	4.9	-36.8	0.0	0.6	39.0	54.0	-15.0	H	A	
4.635	3.0	38.9	32.9	5.7	-36.5	0.0	0.6	41.5	74.0	-32.5	H	P	
4.635	3.0	29.6	32.9	5.7	-36.5	0.0	0.6	32.2	54.0	-21.8	H	A	
4.635	3.0	43.0	32.9	5.7	-36.5	0.0	0.6	45.6	74.0	-28.4	V	P	
4.635	3.0	38.9	32.9	5.7	-36.5	0.0	0.6	41.5	54.0	-12.5	V	A	
7.415	3.0	41.3	35.5	7.3	-36.2	0.0	0.6	48.5	74.0	-25.5	V	P	
7.415	3.0	35.7	35.5	7.3	-36.2	0.0	0.6	42.9	54.0	-11.1	V	A	
7.415	3.0	37.2	35.5	7.3	-36.2	0.0	0.6	44.4	74.0	-29.6	H	P	
7.415	3.0	25.4	35.5	7.3	-36.2	0.0	0.6	32.6	54.0	-21.4	H	A	
8.342	3.0	38.3	36.6	7.8	-36.3	0.0	0.7	47.1	74.0	-26.9	V	P	
8.342	3.0	29.9	36.6	7.8	-36.3	0.0	0.7	38.7	54.0	-15.3	V	A	
8.342	3.0	37.1	36.6	7.8	-36.3	0.0	0.7	45.9	74.0	-28.1	H	P	
8.342	3.0	24.9	36.6	7.8	-36.3	0.0	0.7	33.7	54.0	-20.3	H	A	

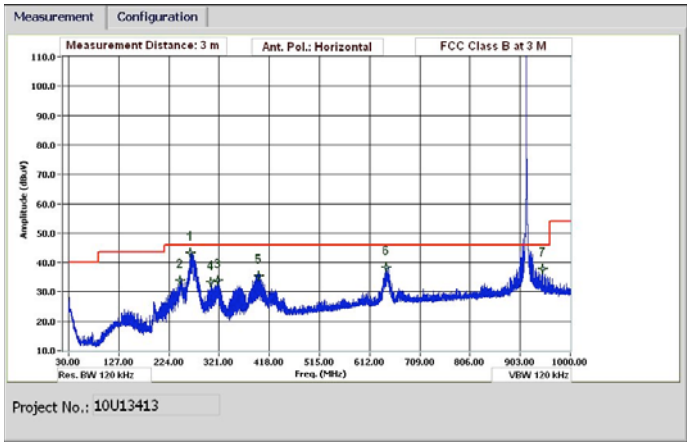
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

Radiated Emissions Below 1 GHZ

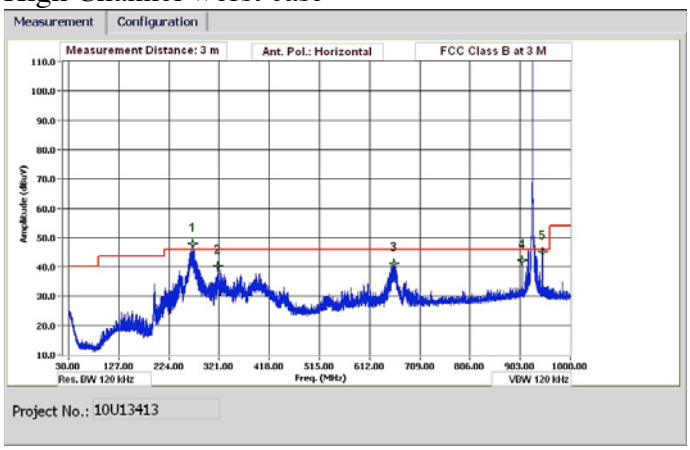
Low Channel worst case



Mid Channel worst case



High Channel worst case



30-1000MHz Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: William Zhuang
Date: 09/07/10
Project #: 10U13413
Company: Silver Spring Networks (T. Cokenias)
Test Target: FCC 15.205
Mode Oper: Tx On
Model Name: Actaris IMU

f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		
Read	Analyzer Reading	Filter	Filter Insert Loss		
AF	Antenna Factor	Corr.	Calculated Field Strength		
CL	Cable Loss	Limit	Field Strength Limit		

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Pad dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch. 902.3 MHz													
211.567	3.0	50.4	12.0	1.3	28.2	0.0	0.0	35.4	43.5	-8.1	V	P	
299.411	3.0	52.3	13.4	1.5	28.1	0.0	0.0	39.1	46.0	-6.9	V	P	
602.904	3.0	39.2	18.5	2.2	27.5	0.0	0.0	32.4	46.0	-13.6	V	P	
666.146	3.0	38.5	19.2	2.4	27.3	0.0	0.0	32.7	46.0	-13.3	V	P	
784.951	3.0	35.4	20.8	2.6	27.4	0.0	0.0	31.4	46.0	-14.6	V	P	
960.038	3.0	37.6	22.2	2.9	27.9	0.0	0.0	34.8	54.0	-19.2	V	P	
245.409	3.0	50.9	11.8	1.4	28.2	0.0	0.0	35.9	46.0	-10.1	H	P	
291.251	3.0	51.6	13.1	1.5	28.1	0.0	0.0	38.1	46.0	-7.9	H	P	
323.052	3.0	46.8	13.8	1.6	28.1	0.0	0.0	34.0	46.0	-12.0	H	P	
620.784	3.0	39.6	18.7	2.3	27.5	0.0	0.0	33.0	46.0	-13.0	H	P	
642.865	3.0	38.9	18.9	2.3	27.4	0.0	0.0	32.7	46.0	-13.3	H	P	
652.706	3.0	38.1	19.0	2.4	27.3	0.0	0.0	32.1	46.0	-13.9	H	P	
960.038	3.0	37.8	22.2	2.9	27.9	0.0	0.0	35.1	54.0	-18.9	H	P	
Mid Ch. 915.2 MHz													
245.529	3.0	49.0	11.8	1.4	28.2	0.0	0.0	33.9	46.0	-12.1	H	P	
266.41	3.0	57.7	12.3	1.4	28.2	0.0	0.0	43.3	46.0	-2.7	H	P	
305.051	3.0	46.3	13.5	1.5	28.1	0.0	0.0	33.2	46.0	-12.8	H	P	
318.972	3.0	46.8	13.7	1.6	28.1	0.0	0.0	34.0	46.0	-12.0	H	P	
397.335	3.0	47.0	14.9	1.8	28.1	0.0	0.0	35.6	46.0	-10.4	H	P	
644.665	3.0	44.6	18.9	2.3	27.4	0.0	0.0	38.4	46.0	-7.6	H	P	
947.198	3.0	40.6	22.1	2.9	27.9	0.0	0.0	37.8	46.0	-8.2	H	P	
30.6	3.0	34.0	19.8	0.5	28.4	0.0	0.0	26.0	40.0	-14.0	V	P	
268.81	3.0	50.5	12.4	1.4	28.2	0.0	0.0	36.2	46.0	-9.8	V	P	
395.655	3.0	40.3	14.9	1.8	28.1	0.0	0.0	28.9	46.0	-17.1	V	P	
644.785	3.0	37.6	18.9	2.3	27.4	0.0	0.0	31.5	46.0	-14.5	V	P	
883.235	3.0	37.5	21.7	2.8	27.7	0.0	0.0	34.3	46.0	-11.7	V	P	
947.198	3.0	39.7	22.1	2.9	27.9	0.0	0.0	36.9	46.0	-9.1	V	P	
High Ch. 926.9 MHz													
244.569	3.0	45.4	11.8	1.3	28.2	0.0	0.0	30.3	46.0	-15.7	V	P	
265.09	3.0	51.7	12.3	1.4	28.2	0.0	0.0	37.2	46.0	-8.8	V	P	
319.812	3.0	43.6	13.7	1.6	28.1	0.0	0.0	30.8	46.0	-15.2	V	P	
392.175	3.0	42.8	14.8	1.8	28.1	0.0	0.0	31.3	46.0	-14.8	V	P	
661.826	3.0	39.7	19.1	2.4	27.3	0.0	0.0	33.8	46.0	-12.2	V	P	
907.716	3.0	41.8	21.9	2.8	27.8	0.0	0.0	38.7	46.0	-7.3	V	P	
945.998	3.0	44.5	22.1	2.9	27.8	0.0	0.0	41.7	46.0	-4.3	V	P	
270.61	3.0	62.0	12.5	1.4	28.2	0.0	0.0	47.7	46.0	1.7	H	P	
270.61	3.0	57.5	12.5	1.4	28.2	0.0	0.0	43.2	46.0	-2.8	H	QP	
318.252	3.0	53.1	13.7	1.6	28.1	0.0	0.0	40.2	46.0	-5.8	H	P	
660.026	3.0	47.0	19.1	2.4	27.3	0.0	0.0	41.2	46.0	-4.8	H	P	
907.716	3.0	45.1	21.9	2.8	27.8	0.0	0.0	42.1	46.0	-3.9	H	P	
946.118	3.0	47.9	22.1	2.9	27.8	0.0	0.0	45.1	46.0	-0.9	H	P	

Rev. 1.27.09
Note: No other emissions were detected above the system noise floor.

Receiver Radiated Emissions

Below1GHz

30-1000MHz Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: **William Zhuang**
Date: **09/17/10**
Project #: **10U13413**
Company:
Test Target:
Mode Oper:

f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		
Read	Analyzer Reading	Filter	Filter Insert Loss		
AF	Antenna Factor	Corr.	Calculated Field Strength		
			Field Strength		
CL	Cable Loss	Limit	Limit		

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Pad dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP
30.24	3.0	29.5	20.2	0.5	29.7	0.0	0.0	20.5	40.0	-19.5	H	P
114.603	3.0	36.9	12.7	1.0	29.5	0.0	0.0	21.2	43.5	-22.3	H	P
143.165	3.0	36.7	13.0	1.1	29.3	0.0	0.0	21.5	43.5	-22.0	H	P
214.808	3.0	37.6	11.9	1.3	28.9	0.0	0.0	22.0	43.5	-21.5	H	P
243.369	3.0	37.6	11.8	1.4	28.8	0.0	0.0	22.0	46.0	-24.0	H	P
30.96	3.0	29.4	19.9	0.5	29.7	0.0	0.0	20.2	40.0	-19.8	V	P
56.641	3.0	45.6	7.9	0.6	29.6	0.0	0.0	24.5	40.0	-15.5	V	P
100.203	3.0	37.4	10.1	0.9	29.5	0.0	0.0	18.8	43.5	-24.7	V	P
195.367	3.0	36.1	11.6	1.3	28.9	0.0	0.0	20.0	43.5	-23.5	V	P
243.369	3.0	33.5	11.8	1.4	28.8	0.0	0.0	17.9	46.0	-28.1	V	P

Rev. 1.27.09
Note: No other emissions were detected above the system noise floor.

Above 1 GHz

All emissions to 9.3 GHz more than 20 dB below limits

20 dB Bandwidth

15.247(a)1(i)

LIMIT

500 kHz maximum

99% Bandwidth

RSS-210, RSS-Gen

LIMIT

None, for reporting purposes only

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The analyzer OCC BW function was activated to measure and display both the -20 dB and the 99% Occupied Bandwidth.

RESULTS

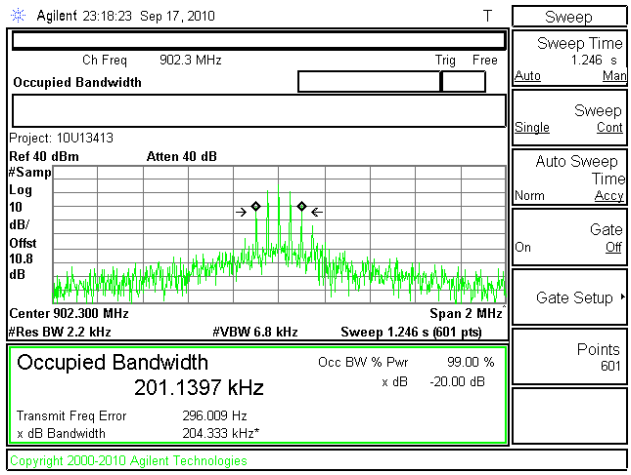
No non-compliance noted:

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	902.3	204.33
Middle	915.2	202.2
High	926.9	186.35

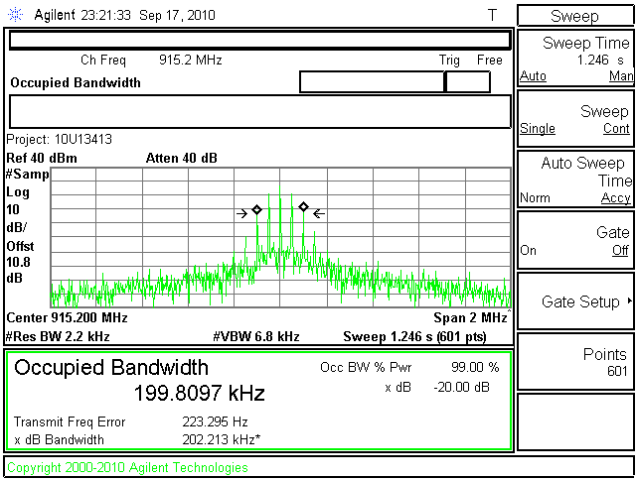
Channel	Frequency (MHz)	99% Occ BW (kHz)
Low	902.3	201.1
Middle	915.2	199.8
High	926.9	196.9

Emission Designator: 201KF1D

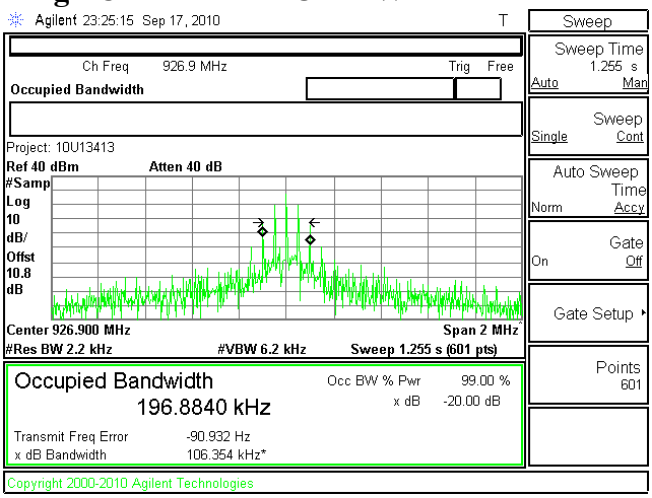
Low Channel 99% Occ BW



Mid Channel 99% Occ BW



High Channel 99% Occ BW



Emission designator: 201KF1D

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

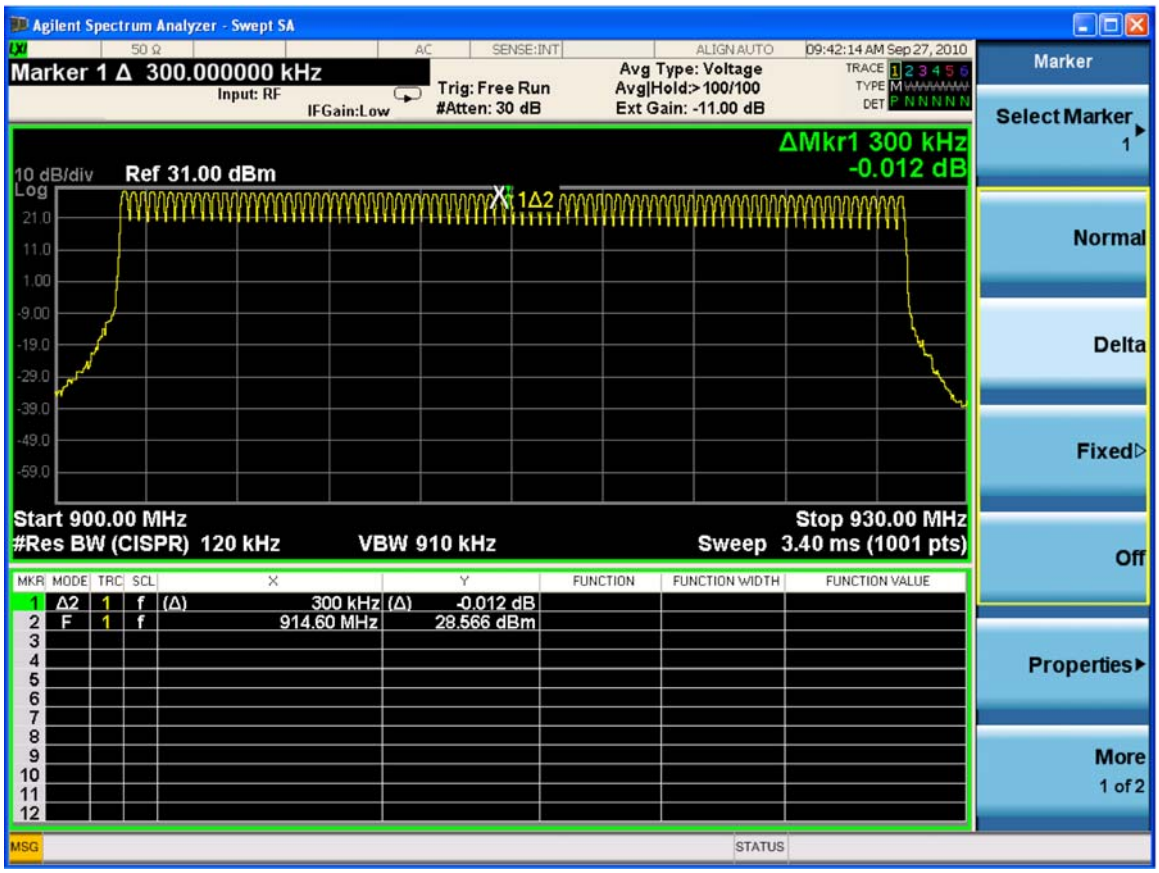
The transmitter output is connected to a spectrum analyzer. The RBW is set to 30 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

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 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

TEST PROCEDURE

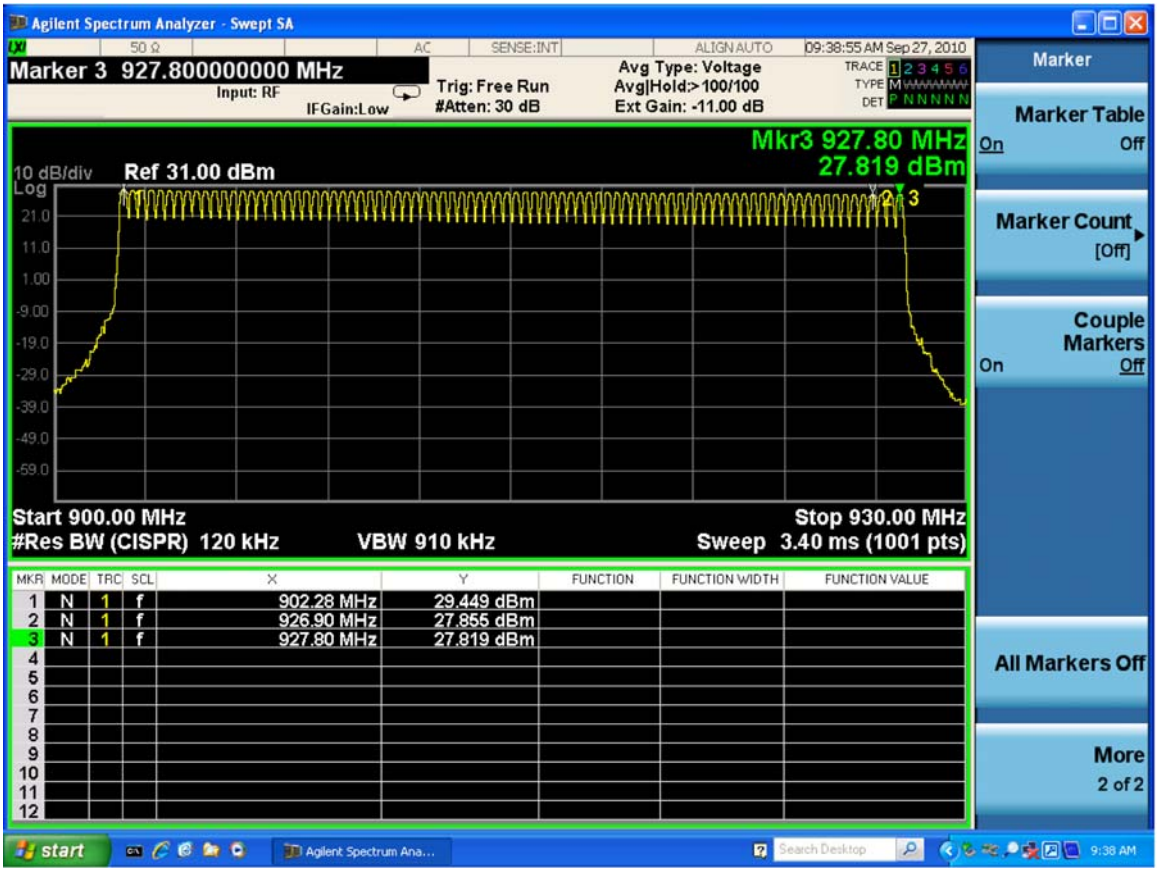
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 30 kHz. The analyzer is set to Max Hold.

RESULTS

No non-compliance noted:

86 channels total, channels 0-82 are US channels (902.3 – 926.9 MHz). Channels 43 – 86 are frequencies authorized for use in Australia.

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 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.

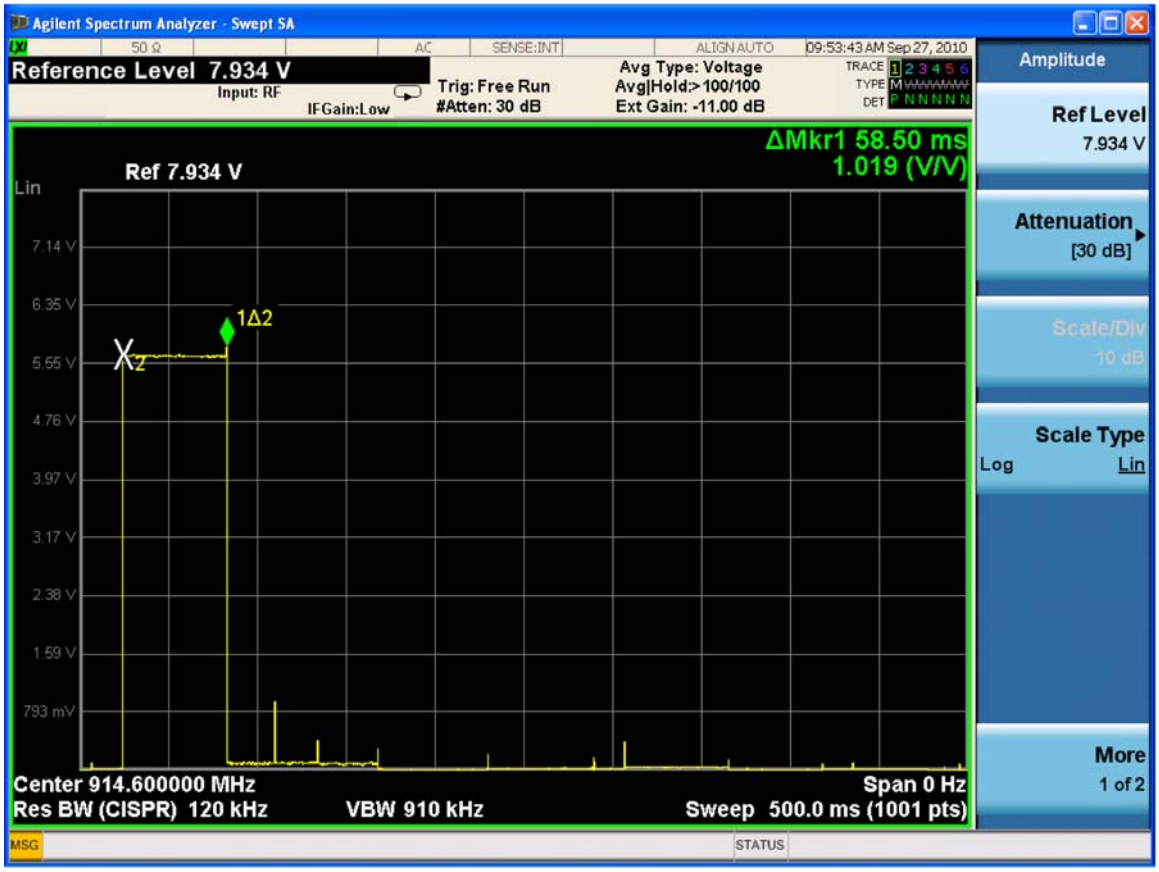
RESULTS

No non-compliance noted:

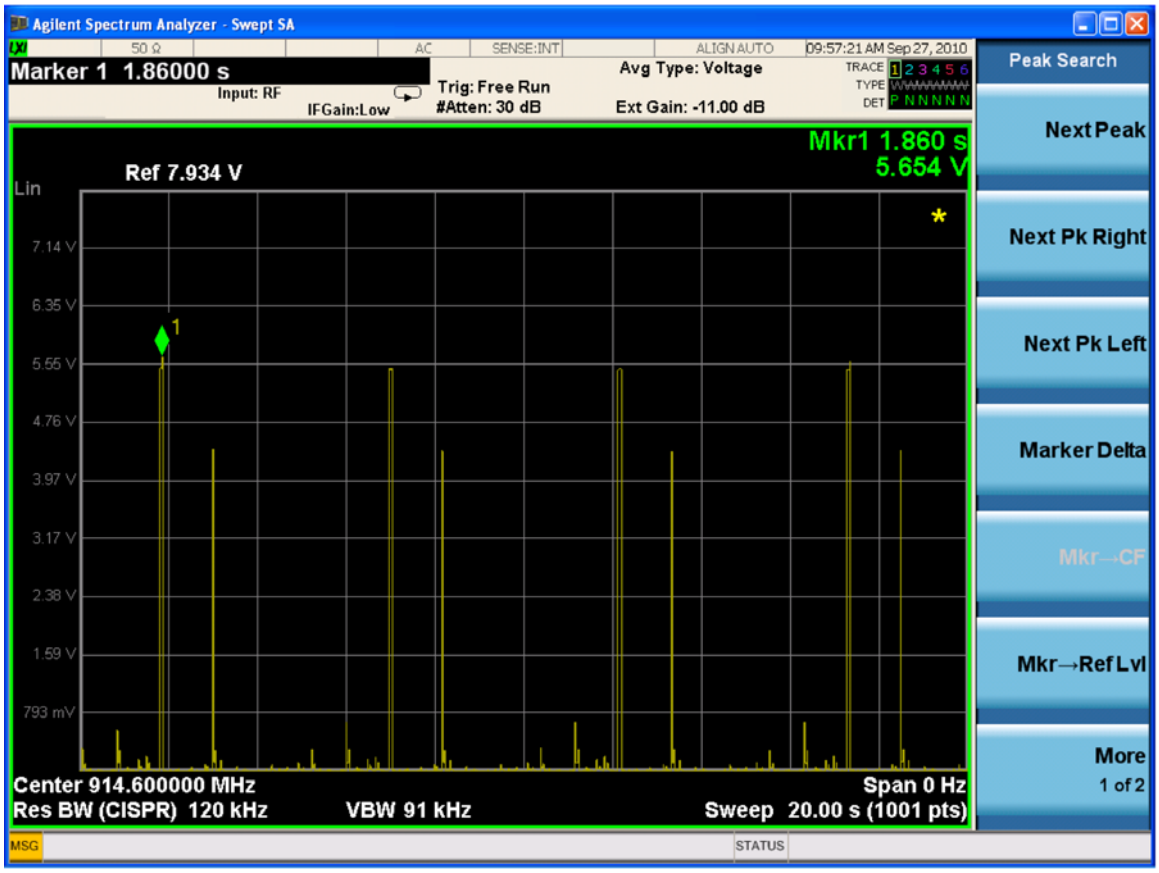
There are 4 pulses within the 20-second period. The on time for each pulse is 58.5 msec.

Therefore, the average time of occupancy in the specified 20-second period is 234 sec.

PULSE WIDTH


Agilent Spectrum Analyzer - Swept SA
50 Ω
AC
SENSE:INT
ALIGN AUTO
09:53:43 AM Sep 27, 2010
Reference Level 7.934 V
Input: RF
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Voltage
Avg|Hold:>100/100
Ext Gain: -11.00 dB
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
ΔMkr1 58.50 ms
1.019 (V/V)
Ref 7.934 V
Lin
7.14 V
6.35 V
5.55 V
4.76 V
3.97 V
3.17 V
2.38 V
1.59 V
793 mV
1Δ2
Center 914.600000 MHz
Res BW (CISPR) 120 kHz
VBW 910 kHz
Span 0 Hz
Sweep 500.0 ms (1001 pts)
Amplitude
Ref Level
7.934 V
Attenuation
[30 dB]
Scale/Div
10 dB
Scale Type
Log
Lin
More
1 of 2
MSG
STATUS

NUMBER OF PULSES IN 20 SECOND OBSERVATION PERIOD



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 0 dBi, therefore the power limit is 30 dBm.

TEST PROCEDURE

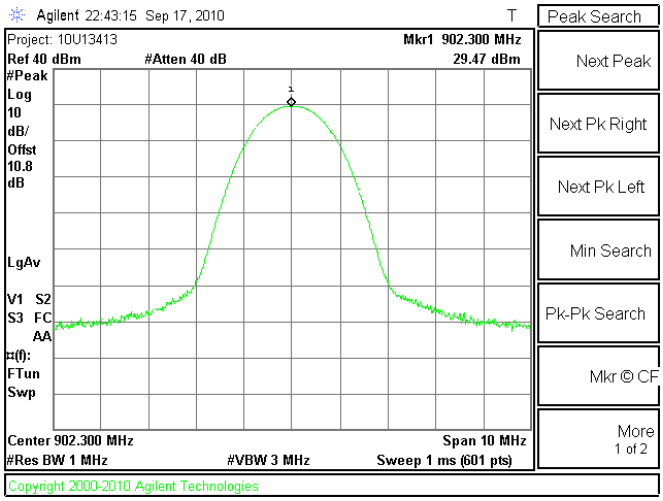
The transmitter output is connected to a spectrum analyzer and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

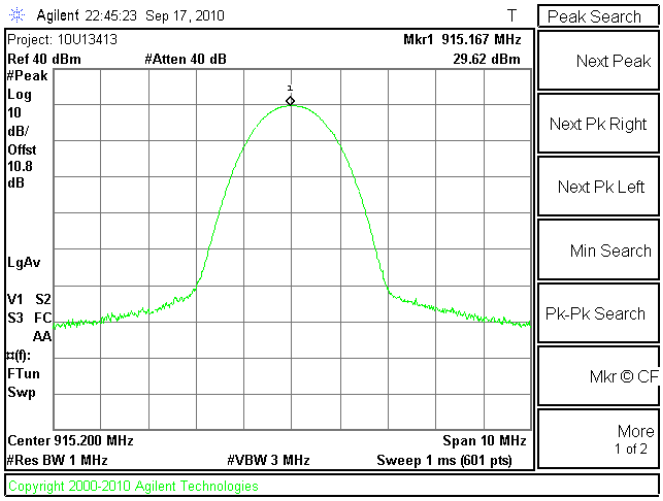
No non-compliance noted:

Channel	Frequency	P out
Low	902.3	29.47
Mid	915.2	29.62
High	926.9	29.73

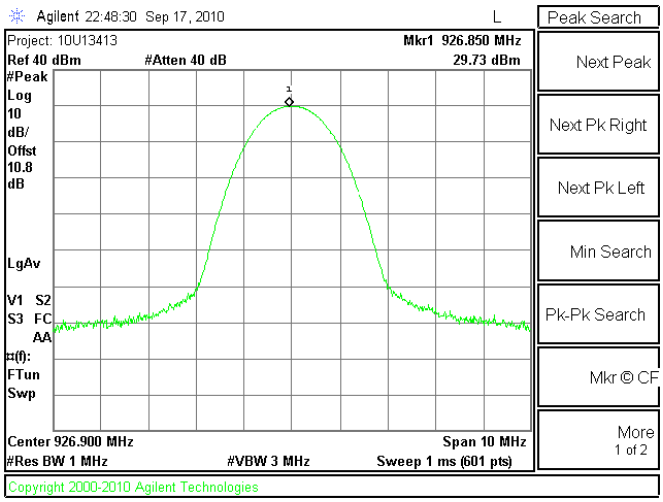
OUTPUT POWER LOW CHANNEL



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.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

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/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	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.

CALCULATIONS

Given

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

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 = 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

$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$ Equation (1)

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.

LIMITS

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

RESULTS

No non-compliance noted:

Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	S, mW/cm2 at 20cm
0.6	29.73	3.00	0.37

MPE Distance: 15.76 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

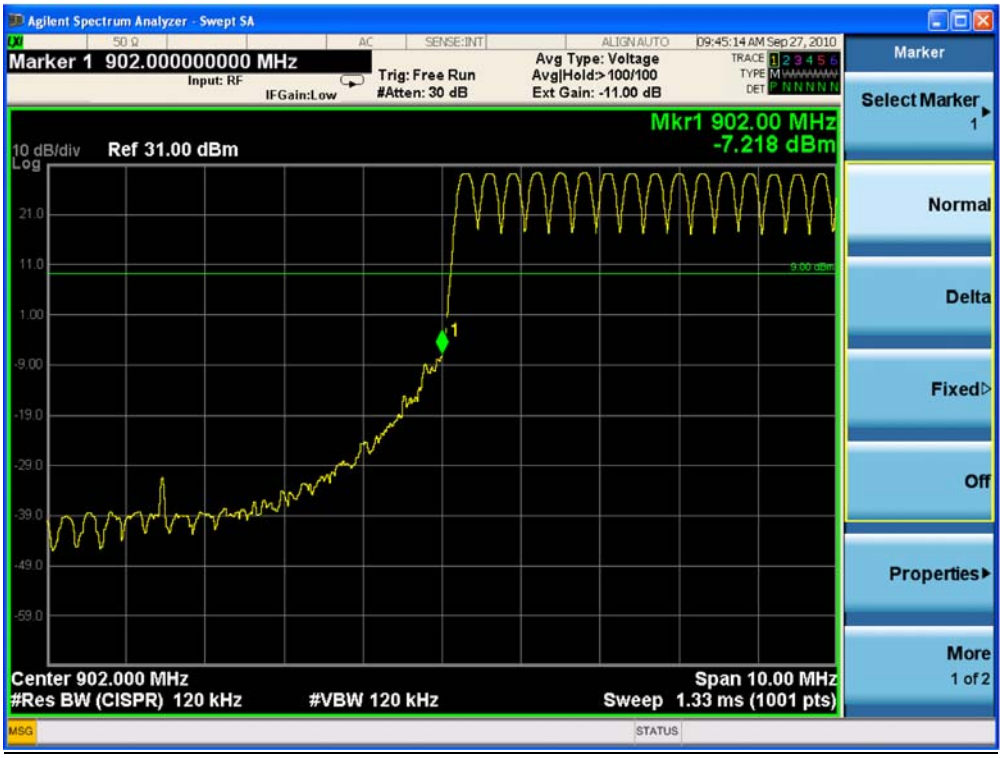
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

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

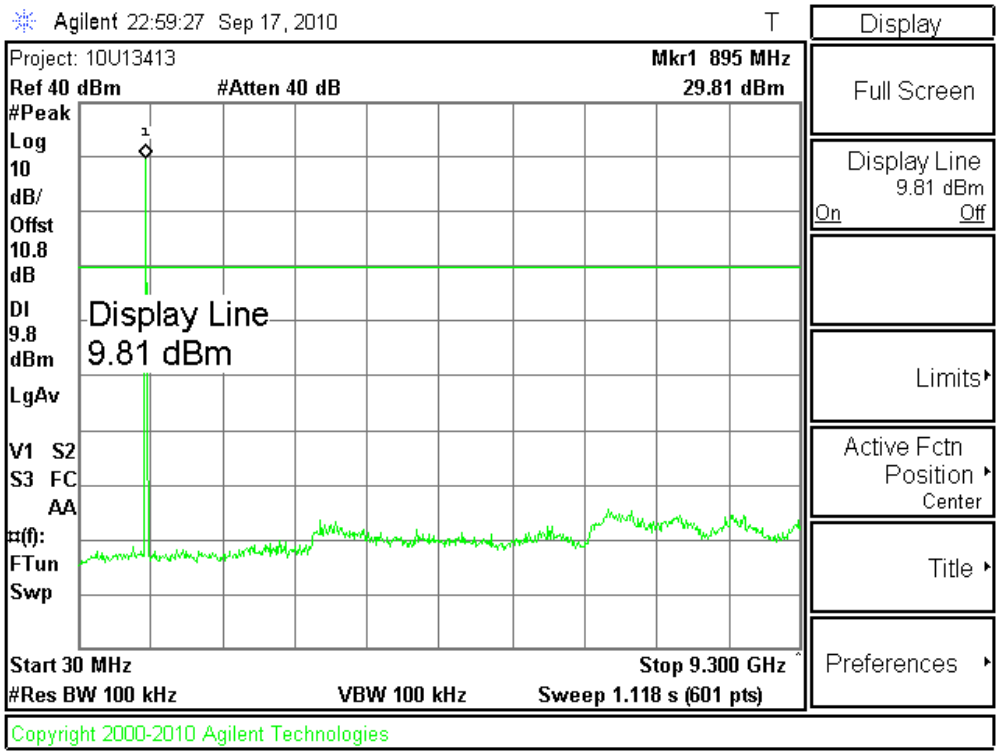
RESULTS

No non-compliance noted:

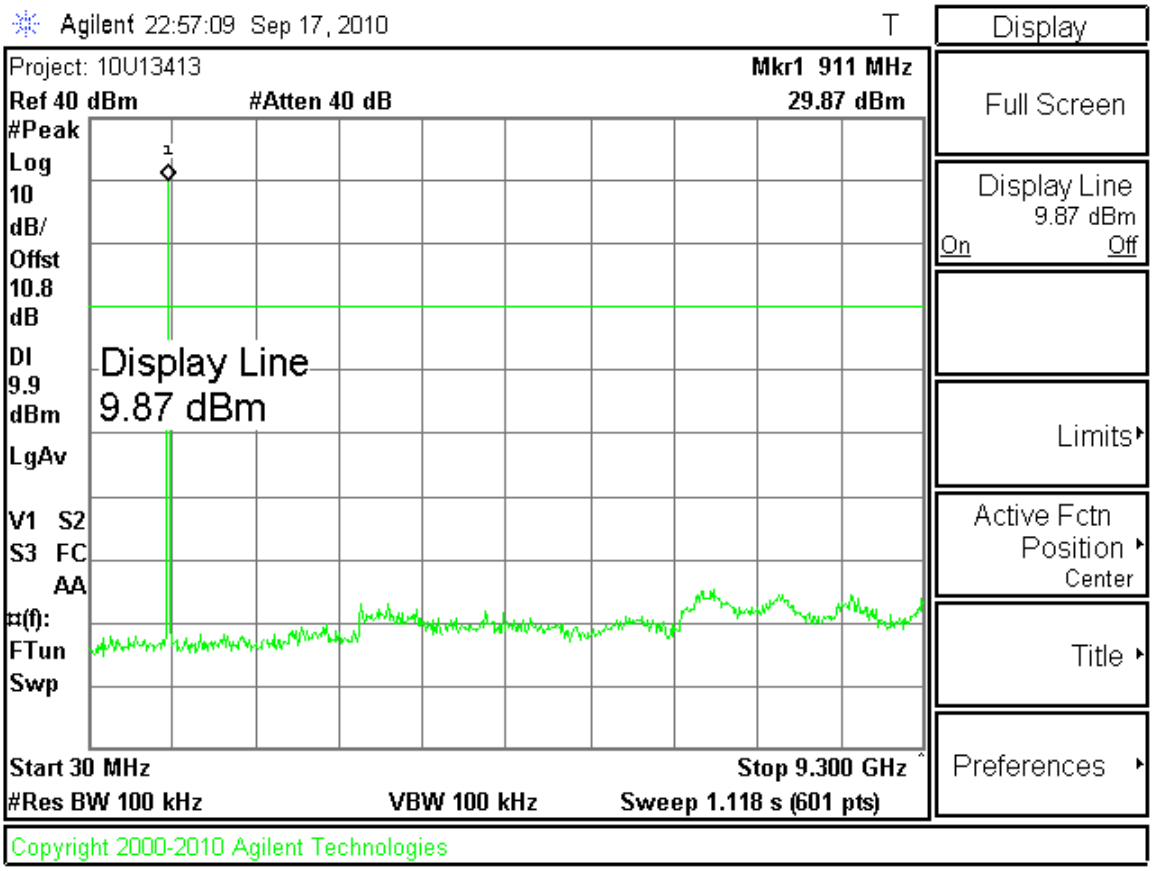
SPURIOUS EMISSIONS, LOW CHANNEL, HOPPING



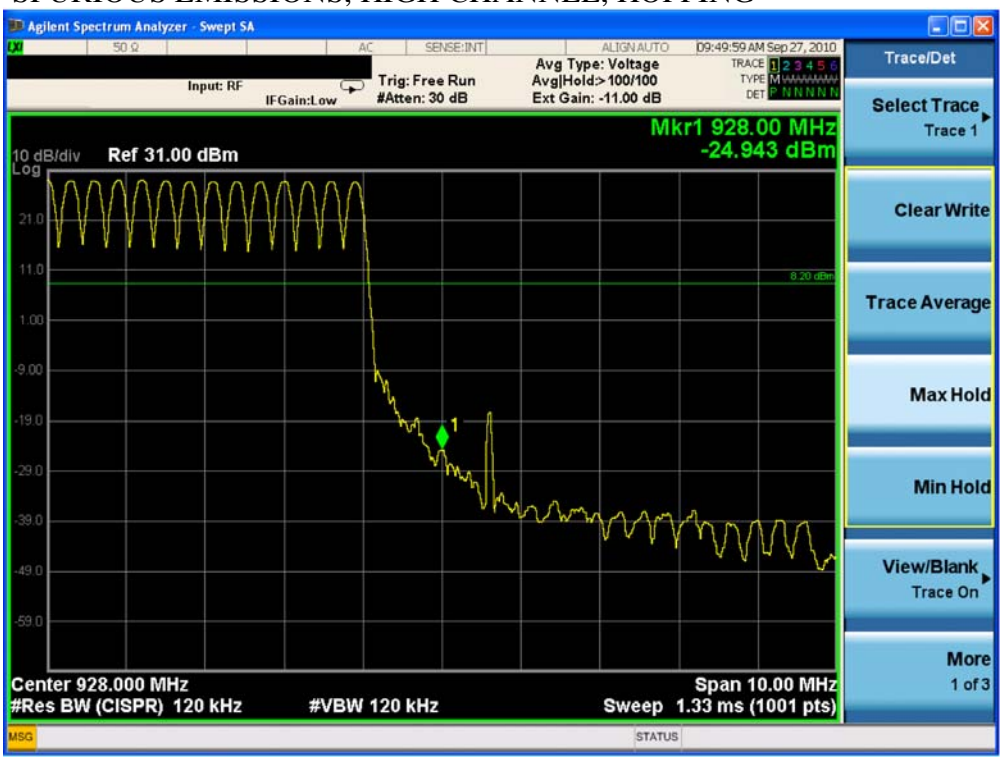
SPURIOUS EMISSIONS, LOW CHANNEL



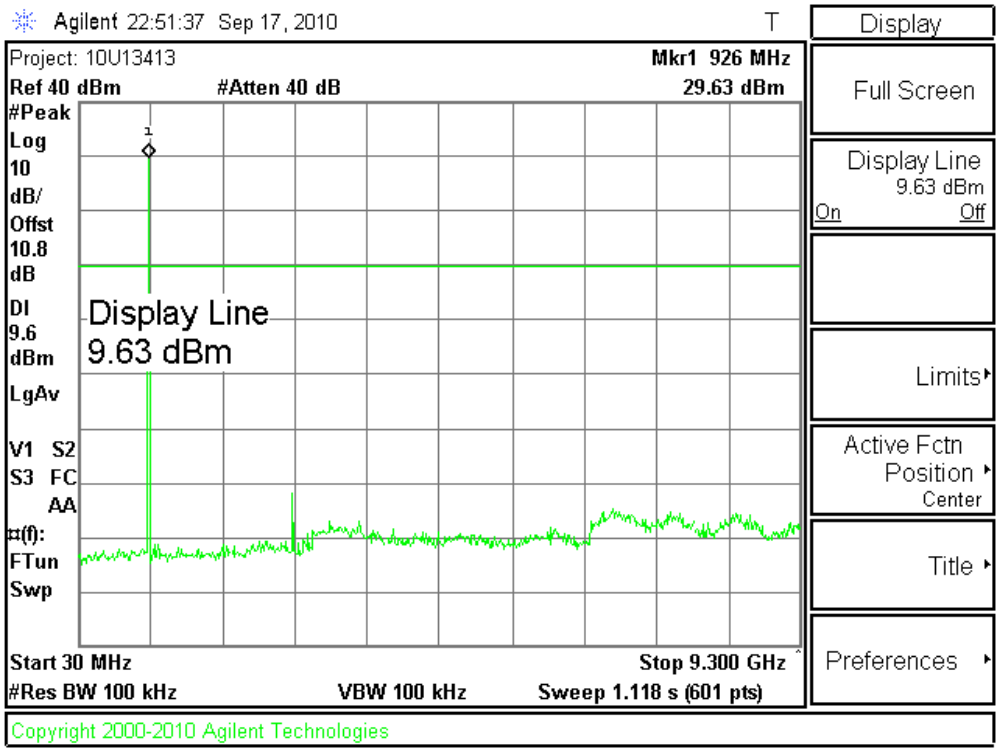
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL, HOPPING



SPURIOUS EMISSIONS, HIGH CHANNEL, HOPPING



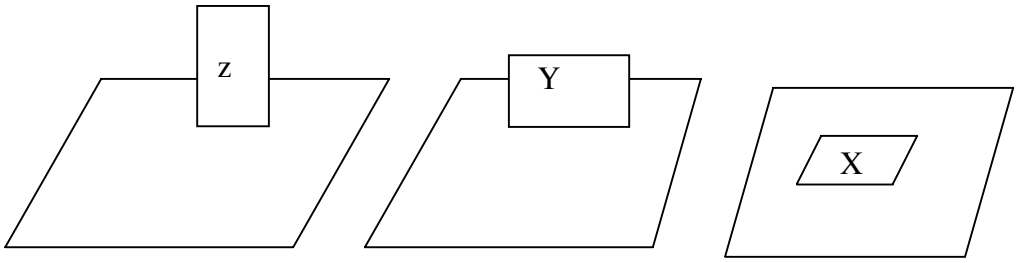
4.4 POWERLINE CONDUCTED EMISSIONS

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 μH/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.

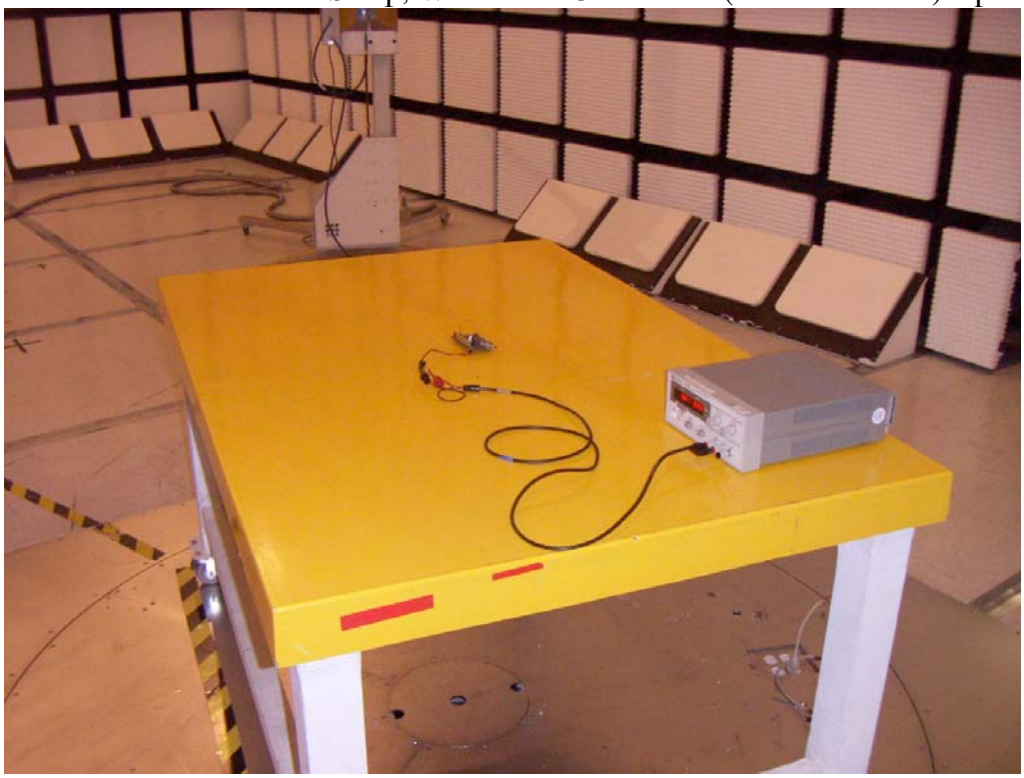
TEST NOT REQUIRED. EUT is battery powered only.

RADIATED RF MEASUREMENT SETUP

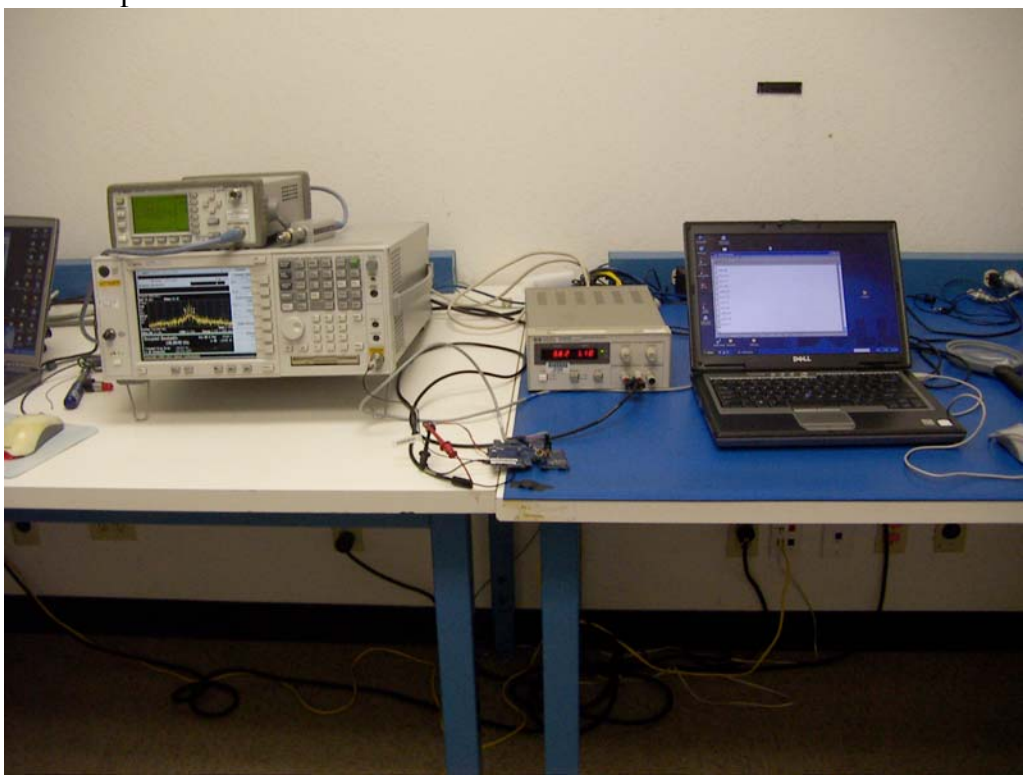


SETUP PHOTOS

Radiated Emissions Test Setup, Worst-case Orientation ("X" orientation) – power supply



Antenna port conducted emissions



END OF REPORT

Report Revision History

Revision No.	Revision Description	Pages Revised	Revised by	Date
-	Original Issue		T. Cokenias	12/06/2010
1	Correct model number		T. Cokenias	02/24/2011