FCC CFR47 PART 15 SUBPART C CERTIFICATION

TEST REPORT

FOR

DIGITAL SUN

EUT: WIRELESS IRRIGATION SYSTEM(RECEIVER)

MODEL: SS1000-R

FCC ID: RQT-DS-SS1000-R

REPORT NUMBER: 03U2423-1

ISSUE DATE: DECEMBER 18, 2003

Prepared for
DIGITAL SUN, INC.
5655 SILVER CREEK VALLEY ROAD, #434
SAN JOSE, CA. 95138,
USA

Prepared by
COMPLIANCE CERTIFICATION SERVICES
561F MONTEREY ROAD,
MORGAN HILL, CA 95037, USA
TEL: (408) 463-0885
FAX: (408) 463-0888

TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION 3

2. EUT DESCRIPTION 4

3. TEST METHODOLOGY 5

4. FACILITIES AND ACCREDITATION 5

5. CALIBRATION AND UNCERTAINTY 6

5.1. MEASURING INSTRUMENT CALIBRATION 6

5.2. MEASUREMENT UNCERTAINTY 6

5.3. TEST AND MEASUREMENT EQUIPMENT 7

6. SETUP OF EQUIPMENT UNDER TEST 8

7. APPLICABLE LIMITS AND TEST RESULTS 10

7.1. 99% BANDWIDTH 10

7.2. RADIATED EMISSIONS 12

7.2.1. TRANSMITTER RADIATED EMISSIONS 14

7.2.2. WORST-CASE RADIATED EMISSIONS BELOW 1 GHZ 17

7.3. POWERLINE CONDUCTED EMISSIONS 19

8. SETUP PHOTOS 23

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1. TEST RESULT CERTIFICATION

COMPANY NAME: DIGITAL SUN, INC.
5655 SILVER CREEK ROAD, #434
SAN JOSE, CA. 95138, USA

EUT DESCRIPTION: WIRELESS IRRIGATION SYSTEM(RECEIVER)

MODEL: SS1000-R

DATE TESTED: DECEMBER 9, 2003 – DECEMBER 10, 2003

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Approved & Released For CCS By:

THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

THANH NGUYEN
EMC TECHNICIAN
COMPLIANCE CERTIFICATION SERVICES

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2. EUT DESCRIPTION

Base has maximum radiated peak output power as follow:

UNIT	Frequency Band (MHz)	Peak Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)
BASE	915.2	79.02	94.00	14.98

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3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/1992, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

4. FACILITIES AND ACCREDITATION

The open area test sites and conducted measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

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LAB CODE:200065-0

No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

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5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

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5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST AND MEASUREMENT EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date
Amplifer 1-26GHz	Miteq	NSP2600-SP	92432	4/25/2004
Antenna, Horn 1-18GHz	EMCO	3115	6717	2/4/2004
Antenna, Bicon/Bilog 25-2000MHz	ARA	LPB-2520/A	1185	3/6/2004
EMI Receiver 9KHz-2.9GHz	HP	8542E	3942A00286	11/21/2004
LISN, 10KHz-30MHz	FCC	LISN 50/250-25-2	2023	10/13/2004
Line Filter	Lindgren	LMF-3489	497	CNR
LISN, 10KHz-30MHz	Solar	8012-50-R-24-BNC	837990	10/13/2004
EMI Receiver	R & S	ESHS20	827129/006	7/17/2004
Spectrum Analyzer	Agilent	E4440A	US41421507	5/8/2004
1.5GHz, HPF	MicroTronic	HPM3193	1	CNR

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6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	China	045-0200	N/A	N/A
AC Adapter	China	AC2650650	N/A	N/A
Sprinkler Timer	China	ISA 406	N/A	N/A

I/O CABLES

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	DC	2	DC	Un-Shielded	2m	Bundled AC Cable for LC test
2	Relay	2	Screws	Un-Shielded	0.3m	NA

TEST SETUP

The Probe is the stand-alone unit and the Base is connected to the Sprinkler timer, both were activate by program transmitting or receiving mode.

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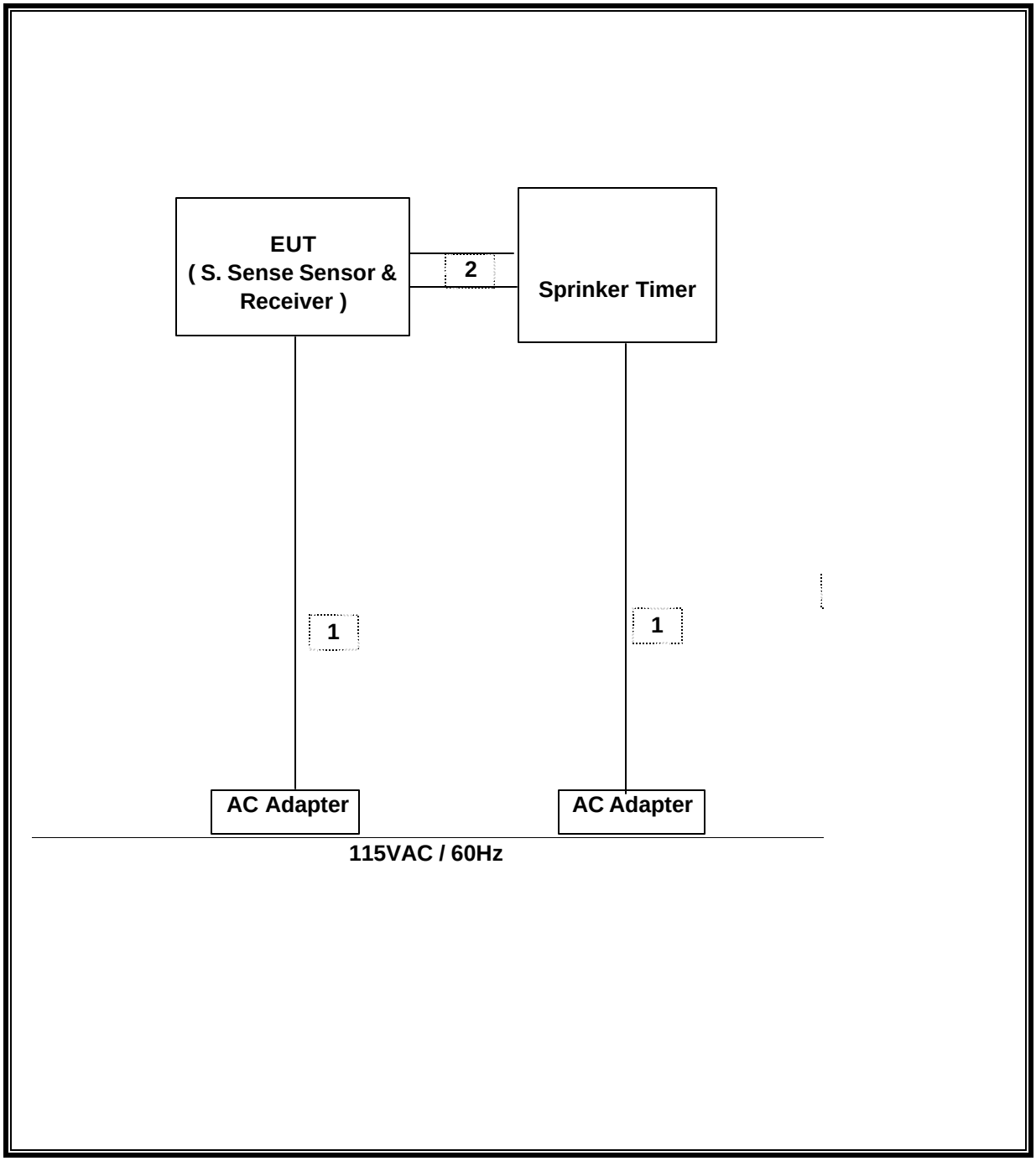
SETUP DIAGRAM FOR TESTS

BASE:



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7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS:

No non-compliance noted:

BASE UNIT

Frequency (MHz)	99% Bandwidth (MHz)
915	0.1161755

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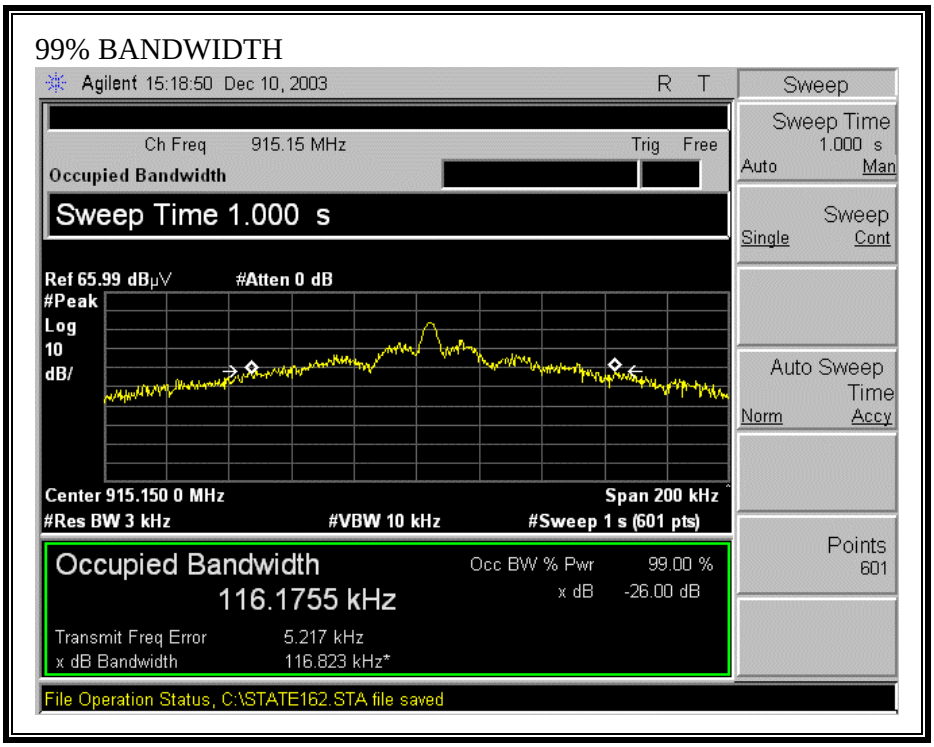
99% BANDWIDTH



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7.2. RADIATED EMISSIONS

LIMITS

§15.249 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 - 928 MHz	50	500
2400 - 2483.5 MHz	50	500
5725 - 5875 MHz	50	500
24.0 - 24.25 GHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 In the emission table above, the tighter limit applies at the band edges.

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TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane, the X, Y, and Z positions (if necessary) shall be tested and the worst case reported. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The transmitter shall be switched on with typical modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

RESULTS

No non-compliance noted:

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7.2.1. TRANSMITTER RADIATED EMISSIONS

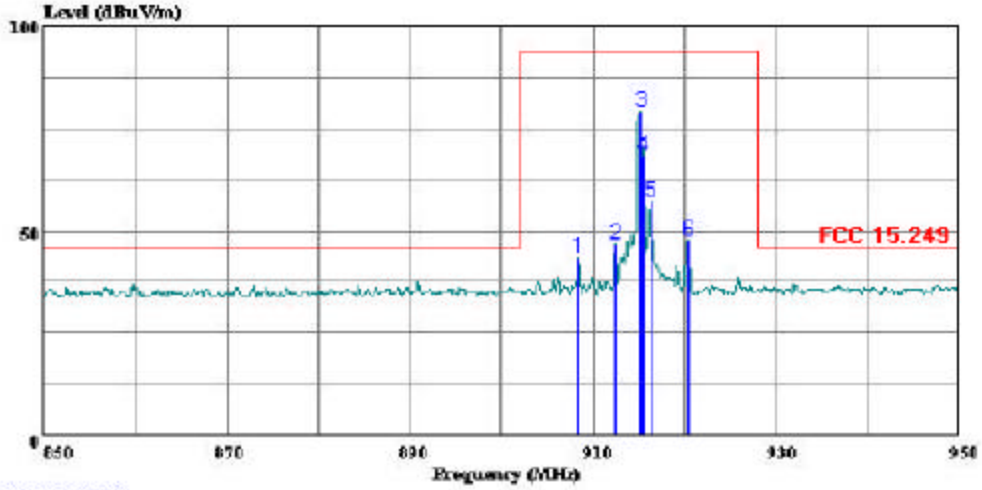
FUNDAMENTAL & RESTRICTED BANDEDGE

BASE:

(Vertical)

561F Monterey Road
San Jose, CA 95131
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 24 File#: FCC 15.249.EMI Date: 12-09-2003 Time: 21:19:52



(Audix & TC)

Trace: 23 Ref Trace:

	Freq	Remark	Read Level	Factor	Level	Limit Line	Over Limit
	MHz		dBuV	dB	dBuV/m	dBuV/m	dB
1	908.400	Peak	19.21	23.88	43.09	94.00	-50.91
2	912.400	Peak	22.77	23.92	46.69	94.00	-47.31
3	915.200	Peak	55.09	23.93	79.02	94.00	-14.98
4	915.400	Peak	44.26	23.92	68.18	94.00	-25.82
5	916.200	Peak	33.26	23.91	57.17	94.00	-36.83
6	920.400	Peak	23.55	23.97	47.52	94.00	-46.48

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(Horizontal)

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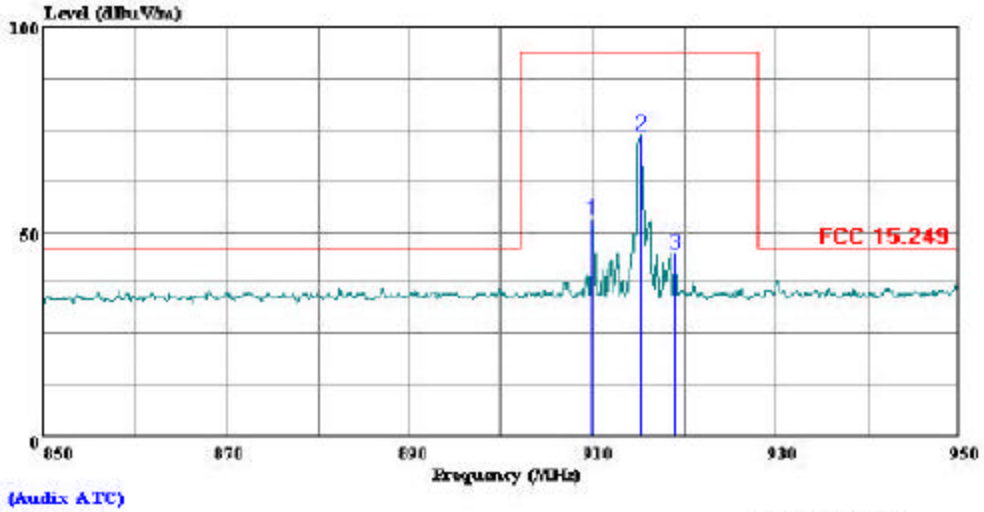
Data#: 17 File#: FCC 15.249.EMI Date: 12-09-2003 Time: 20:51:20



Trace: 16 Ref Trace:

	Freq	Remark	Read Level	Factor	Level	Limit Line	Over Limit
	MHz		dBuV	dB	dBuV/m	dBuV/m	dB
1	909.900	Peak	28.86	23.89	52.75	94.00	-41.25
2	915.200	Peak	49.46	23.93	73.39	94.00	-20.61
3	918.900	Peak	20.66	23.94	44.60	94.00	-49.40

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HARMONICS AND SPURIOUS EMISSIONS

BASE UNIT:

12/10/03 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr:Chin Pang
Project #:03U2423-1
Company:Digital Sun
EUT Descrip.:Wireless Irrigation System
EUT M/N:S. Sense
Test Target:FCC 15.249
Mode Oper:Tx

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifer 1-26GHz	Spectrum Analyzer	Horn > 18GHz
T73; S/N: 6717 @1m	T87 Miteq 924342	Agilent E4446A Analyzer	

Hi Frequency Cables
☐ (2 ft) ☑ (2 ~ 3 ft) ☐ (4 ~ 6 ft) ☑ (12 ft)

Peak Measurements:
1 MHz Resolution Bandwidth
1MHz Video Bandwidth

Average Measurements:
1 MHz Resolution Bandwidth
10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
915MHZ															
1.830	9.8	62.2	52.0	27.8	1.4	-43.3	0.0	1.0	49.1	38.9	74.0	54.0	-24.9	-15.1	V
1.830	9.8	61.5	51.2	27.8	1.4	-43.3	0.0	1.0	48.4	38.1	74.0	54.0	-25.6	-15.9	H
2.745	9.8	53.2	40.2	30.8	2.0	-43.2	0.0	1.0	43.8	30.8	74.0	54.0	-30.2	-23.2	V
2.745	9.8	51.6	39.3	30.8	2.0	-43.2	0.0	1.0	42.2	29.9	74.0	54.0	-31.8	-24.1	H

No other emissions were found above system noise floor up to 10th harmonic of fundamental frequency.

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

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7.2.2. WORST-CASE RADIATED EMISSIONS BELOW 1 GHZ

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

BASE UNIT:

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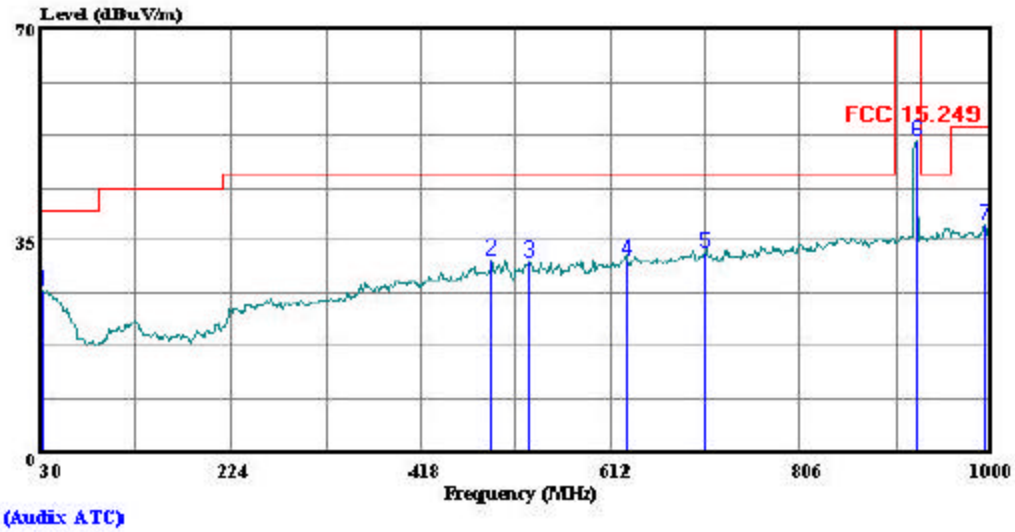
561F Monterey Road
San Jose, CA 95131
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 19 File#: FCC 15.249.EMI Date: 12-09-2003 Time: 20:56:02



Trace: 18 Ref Trace:

Condition: FCC 15.249 CHAMBER 030306 1185 HORIZONTAL
Test Eng: : Thanh Nguyen
Project #: : 03U2423-1
Company: : Digital SUN
EUT: : S.Sensor Probe & Receiver
: WireLess Irrigation System
Model No: : TBD
Configuration: : EUT Stand Alone
Target of Test: : FCC Part 15.249
Mode of Operation: Tx

Page: 1

	Freq MHz	Remark	Read Level dBuV	Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB
1	31.940	Peak	9.01	17.53	26.54	40.00	-13.46
2	489.780	Peak	13.13	18.66	31.79	46.00	-14.21
3	528.580	Peak	12.17	19.28	31.45	46.00	-14.55
4	629.460	Peak	11.28	20.58	31.85	46.00	-14.15
5	709.000	Peak	11.66	21.44	33.10	46.00	-12.90
6	924.340	Peak	27.59	23.99	51.58	94.00	-42.42
7	994.180	Peak	12.97	24.64	37.61	54.00	-16.39

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SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

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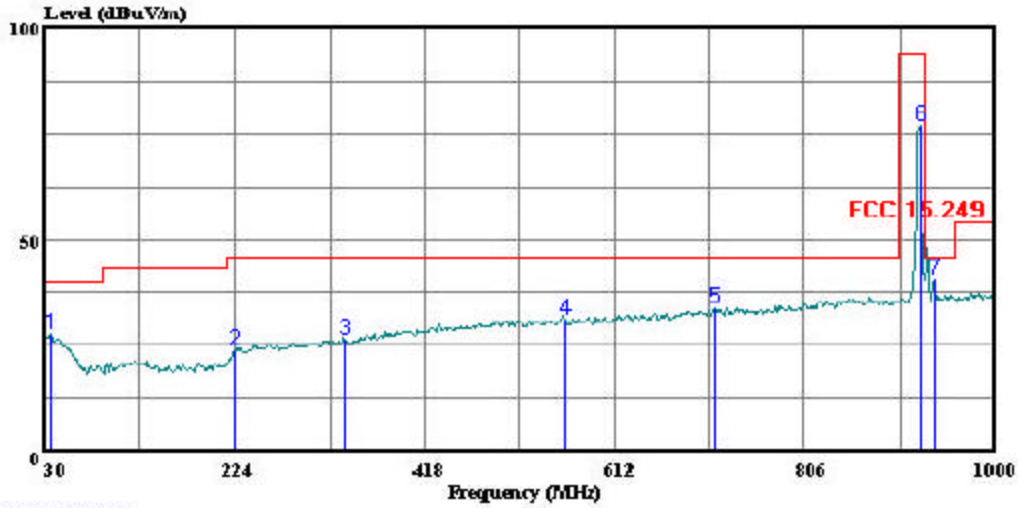
Data#: 22 File#: FCC 15.249.EMI Date: 12-09-2003 Time: 21:05:27



(Audix ATC)
Trace: 20 Ref Trace:

Condition: FCC 15.249 CHAMBER 030306 1185 VERTICAL
Test Eng: : Thanh Nguyen
Project #: : 03U2423-1
Company: : Digital SUN
EUT: : S.Sensor Probe & Receiver
: WireLess Irrigation System
Model No: : TBD
Configuration: : EUT Stand Alone
Target of Test: : FCC Part 15.249
Mode of Operation: Tx

Page: 1

	Freq MHz	Remark	Read Level dBuV	Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB
1	35.820	Peak	10.06	17.51	27.57	40.00	-12.43
2	224.970	Peak	12.07	11.92	24.00	46.00	-22.00
3	335.550	Peak	11.64	14.84	26.48	46.00	-19.52
4	562.530	Peak	11.54	19.73	31.27	46.00	-14.73
5	714.820	Peak	12.06	21.53	33.59	46.00	-12.41
6	924.340	Peak	53.17	23.99	77.16	94.00	-16.84
7	938.890	Peak	16.59	24.17	40.76	46.00	-5.24

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7.3. 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.

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

Frequency of Emission (MHz)	Conducted Limit (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:

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6 WORST EMISSIONS

BASE UNIT:

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.27	30.46	--	--	0.00	62.69	52.69	-32.23	-22.23	L1
0.52	22.64	--	--	0.00	56.00	46.00	-33.36	-23.36	L1
24.14	18.10	--	--	0.00	60.00	50.00	-41.90	-31.90	L1
0.22	30.12	--	--	0.00	64.00	54.00	-33.88	-23.88	L2
0.55	22.64	--	--	0.00	56.00	46.00	-33.36	-23.36	L2
0.81	20.36	--	--	0.00	56.00	46.00	-35.64	-25.64	L2
6 Worst Data									

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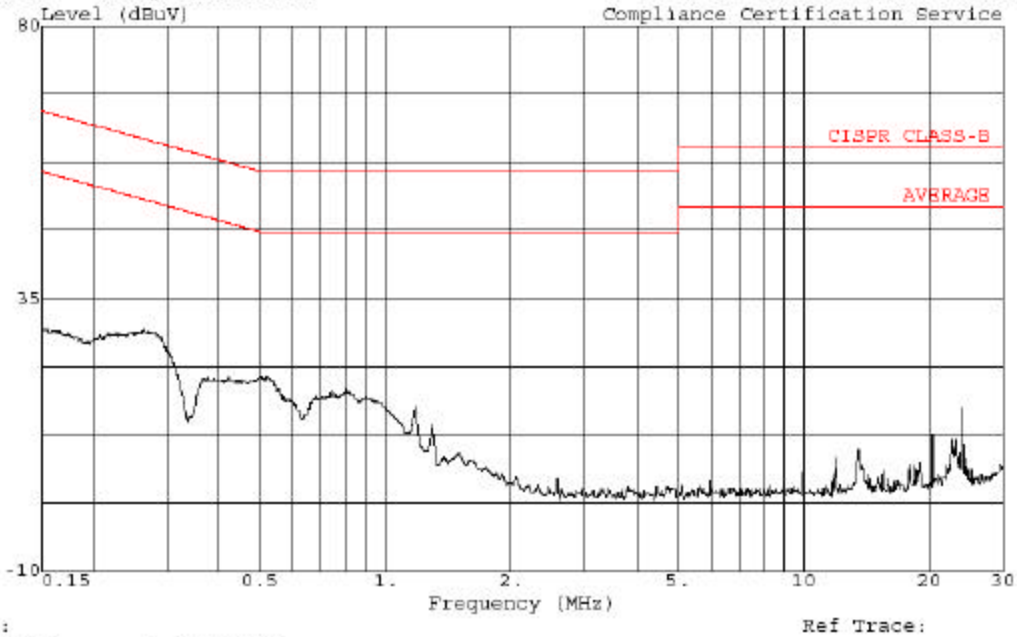
BASE:

LINE 1 RESULT

COMPLIANCE Engineering Services, Inc.

561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 3 File#: 2423LC.EMI Date: 12-10-2003 Time: 13:59:48



Trace: Ref Trace:

Project #	: 03U2423-1
Test Operator	: Chin Pang
Company	: Digital Sun
EUT	: Wireless Irrigation System
Model	: S. Sense
Configuration	: EUT only
Mode of Operation	: Tx
Target of Test	: EN55022 Class B
Voltage	: 115VAC/60Hz
	: L1: Peak (Black)

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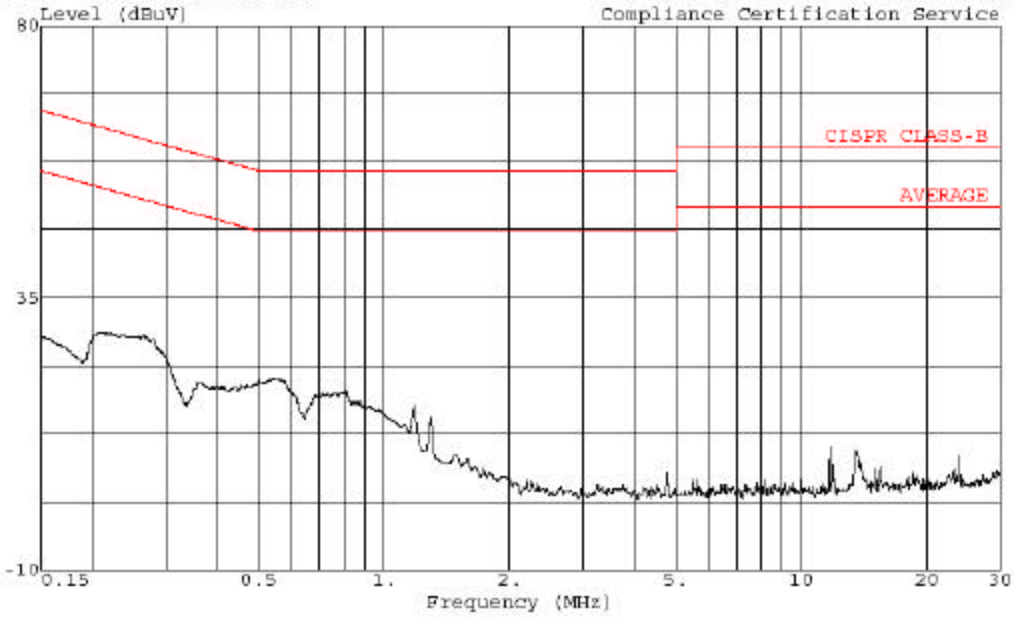
LINE 2 RESULTS

COMPLIANCE Engineering Services, Inc.
561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 6 File#: 2423LC.EMI Date: 12-10-2003 Time: 14:14:21
Compliance Certification Service



Trace: Ref Trace:

Project #	: 03U2423-1
Test Operator	: Chin Pang
Company	: Digital Sun
EUT	: Wireless Irrigation System
Model	: S. Sense
Configuration	: EUT only
Mode of Operation	: Tx
Target of Test	: EN55022 Class B
Voltage	: 115VAC/60Hz
	: L2: Peak (Black)

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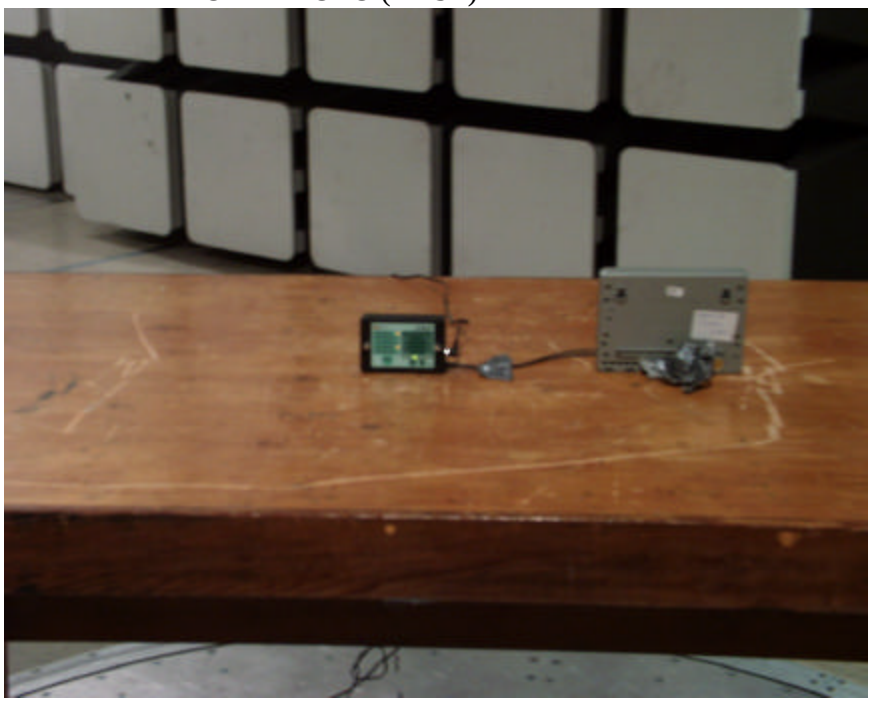
8. SETUP PHOTOS

RADIATED MEASUREMENT SETUP

RADIATED FRONT PHOTO (BASE)



COMPLIANCE CERTIFICATION SERVICES DOCUMENT NO: CCSUP4031A
561F MONTEREY ROAD, MORGAN HILL, CA 95037 USA TEL: (408) 463-0885 FAX: (408) 463-0888

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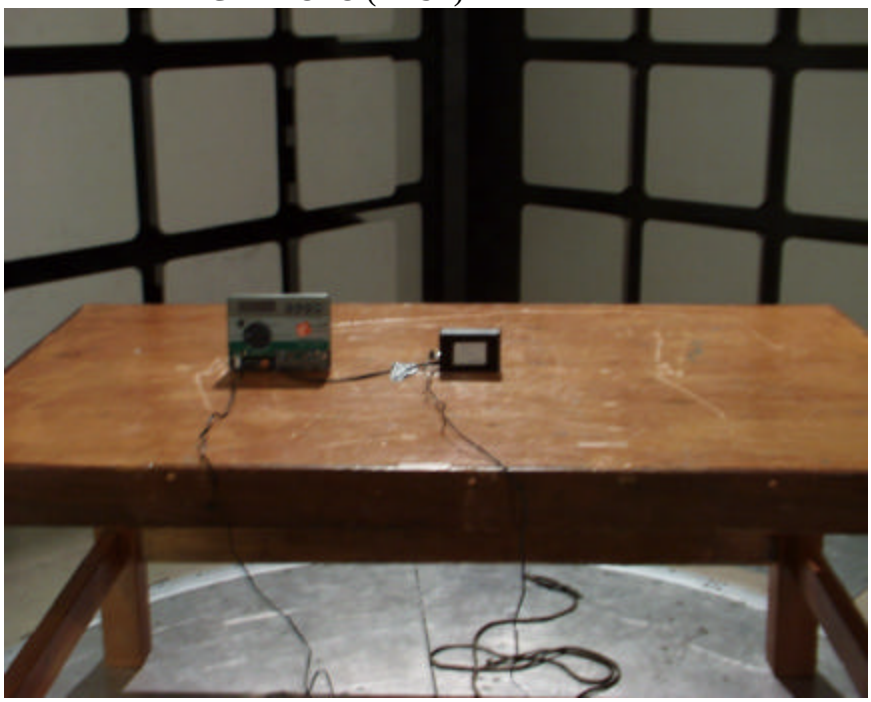
RADIATED BACK PHOTO (BASE)



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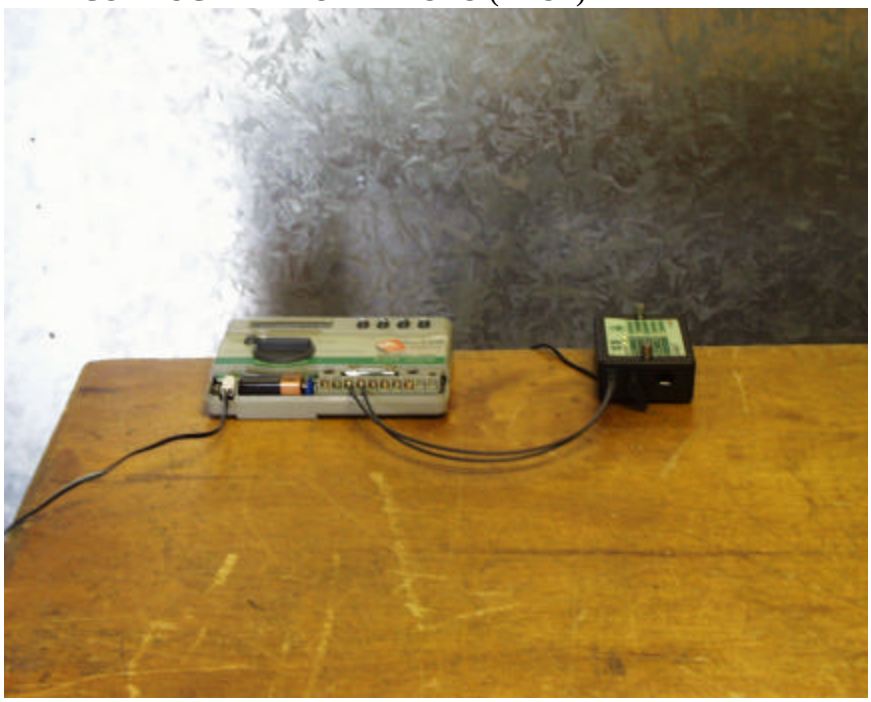
POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO (BASE)



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LINE CONDUCTED BACK PHOTO (BASE)

END OF REPORT

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