Emissions Test Report
Test Report #: 3056237.01
Project #s: 3056237
Date of Report: March 23, 2004
Revised: March 23, 2004
Date of Test: March 22-23, 2004

Testing performed on the
Remote Control Transmitter
Model: SOMFY
to
FCC Part 15.231 Emissions Requirements for Periodic Transmitters
and
FCC Part 15 Emissions Requirements for Unintentional Radiators
for
Harmonic Design, Inc.

Test Performed by:
Intertek – ETL SEMKO
70 Codman Hill Road
Boxborough, MA, 01719

Test Authorized by:
Harmonic Design, Inc.
12190 Tech Center Drive
Poway, CA 92064

3/24/04	Nicholas Abbondante, Test Engineer
3/30/04	Michael Murphy, Staff Engineer, EMC

This report is for the exclusive use of ITS's Client and is provided pursuant to the agreement between ITS and its Client. ITS's responsibility and liability are limited to the terms and conditions of the agreement. ITS assumes no liability to any party, other than to the client in accordance with the agreement, for any loss, expense, or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the ITS name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by ITS. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an ITS certification program.

Table of Contents

1.0 Summary of Tests 3

2.0 General Description 3
2.1 Product Description 3
2.2 Related Submittal(s) Grants 3
2.3 Test Facility 4
2.4 Test Equipment and Support Equipment 5

3.0 Bandwidth 6
3.1 Test Procedure 6
3.2 Test Results 6

4.0 Radiated Field Strength 7
4.1 Test Procedure 7
4.2 Test Results 7
4.3 Sample Calculation 9
4.4 Configuration Photographs – Radiated Emissions 10

5.0 Line-Conducted Emissions 11
5.1 Test Procedure 11
5.2 Test Results 11
5.3 Sample Calculation 12
5.4 Configuration Photographs – Line-Conducted Emissions 13

1.0 Summary of Tests

Remote Control Transmitter
Serial #: HDEC-9501 0327 02144
Model #: SOMFY

FCC RULE	DESCRIPTION OF TEST	RESULTS	REPORT PAGE
FCC § 15.231(c)	Bandwidth	Passed	6
FCC §2.1053, §15.109, §15.205, §15.209, §15.231(b)	Radiated Field Strength	Passed	7
FCC § 15.107, § 15.207	Line-Conducted Emissions	Passed	12

2.0 General Description

2.1 Product Description

The EUT is a transmitter intended to control lighting and shades. It sends control and identification signals only. The transmitter fundamental frequency is 433.42 MHz. EUT was activated for all testing from new batteries.

The EUT has been tested at the request of

Company:	Harmonic Design, Inc. 12190 Tech Center Drive Poway, CA, 92064
Name of contact:	Mr. Eric Hauck
Telephone:	(858) 391-9085
Fax:	(858) 391-9087

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

Site 2C (Middle Site) is a 3m and 10m sheltered EMI measurement range located in a light commercial environment in Boxborough, Massachusetts. It meets the technical requirements of ANSI C63.4-1992 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets of metal are screwed in place with stainless steel round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. A copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

2.4 Test Equipment and Support Equipment

Test Equipment

Description	Manufacturer	Model Number	ITS ID	Serial Number	Cal Due Date
Antenna	EMCO	3142	LOG2	9711-1223	11/05/2004
Spectrum Analyzer	Agilent	E7405A	AGL001	US40240205	07/02/2004
High Frequency Cable	Megaphase	TM40 K1K1 80	CBL027	CBL027	11/11/2004
Horn Antenna	EMCO	3115	HORN1	9512-4632	10/24/2004

Support Equipment			
Description	**Manufacturer**	**Model Number**	**Serial Number**
EUT was tested standalone			

Cables					
Quantity	**Type**	**Length (m)**	**Shielding**	**Ferrite**	**Connector Type**
There were no cables associated with the EUT					

3.0 Bandwidth
FCC § 15.231(c)

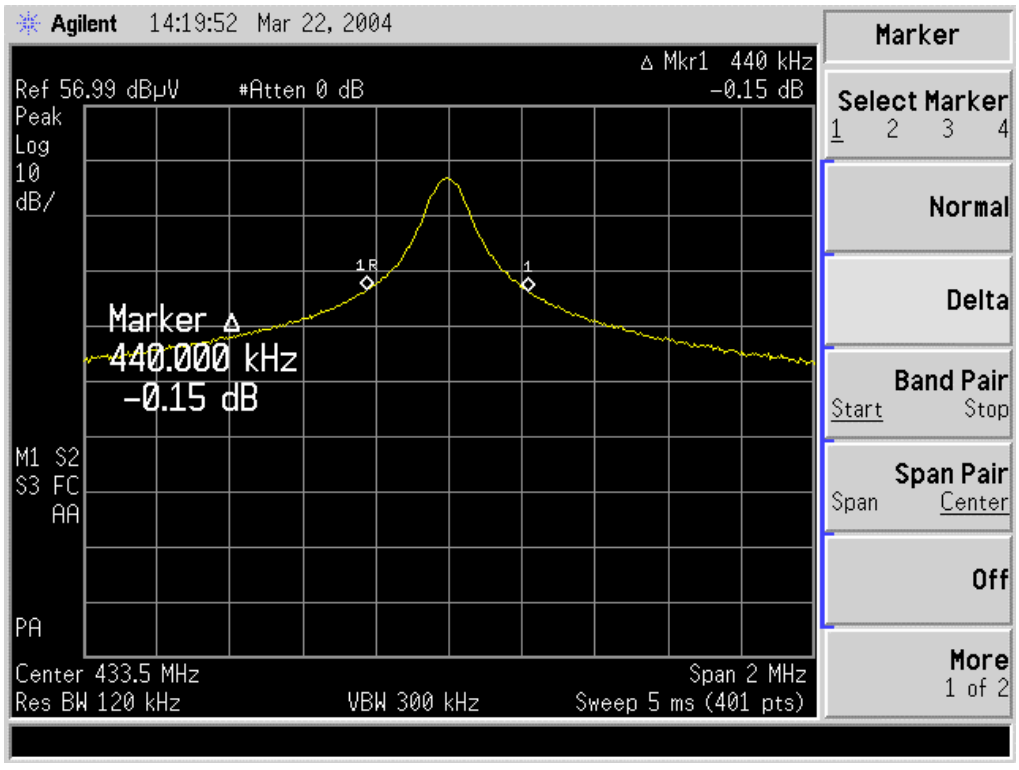
3.1 Test Procedure

The EUT was set to transmit continuously and the bandwidth was measured 20 dB down from the peak using the marker delta function. Resolution and Video bandwidth were set to 120 kHz and 300 kHz respectively.

Requirement: The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier. The operating frequency is 433.42 MHz therefore the limit is 1084 kHz.

3.2 Test Results

Results: Pass			
Performed March 22, 2004	Equipment: AGL001, LOG2		
Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)
433.42 MHz	433.42	440	1084



4.0 Radiated Field Strength

FCC §2.1053, §15.205, §15.209, §15.231(b)

4.1 Test Procedure

The transmitter was placed on a wooden turntable and the transmitter was activated. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The EUT was investigated in three orthogonal axes. The Peak Field Strength (FS) in the frequency range up to the tenth harmonic of the fundamental frequency was measured, as well as the associated average value.

Requirement: For a periodic transmitter, spurious emissions must be attenuated below the level of the fundamental emissions by not less than 20 dB. The fundamental field strength is based on the frequency of operation, 433.42 MHz, and corresponds to an average limit of 81.1 dBuV/m. In the restricted bands of 15.205, compliance with the stricter general limits of 15.209 is required corresponding to an average limit of 54 dBuV/m above 1 GHz. When average values are used to demonstrate compliance, peak values of the emissions must also meet a limit 20 dB higher than the average limit.

4.2 Test Results

Performed March 22-23, 2004 Equipment: AGL001, HORN1, LOG2, CBL027

Results: Pass

Radiated Emissions / Interference

Company: Harmonic Design, Inc. Model #: SOMFY
Engineer: Nicholas Abbondante Location: Site 2 Serial #: HDEC-9501 0327 02144
Project #: 3056237 Pressure: 1007 mB Receiver: Agilent E7405A
Date: 03/23/04 Temp: 20c Antenna: LOG2 11-20-04 V3.ant LOG2 11-20-04 H3.ant
Standard: FCC Part 15 Subpart B Humidity: 24% PreAmp: None
Class: B Group: None Cable(s): Site2, 3M Floor 9-22-04.cbl None
Limit Distance: 3 meters Test Distance: 3 meters
Voltage/Frequency: Battery Frequency Range: 30 MHz - 1 GHz

	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	
PK	V	85.330	18.8	7.9	0.3	0.0	0.0	27.0	81.1	-54.1	
AVG	V	85.330	6.8	7.9	0.3	0.0	0.0	14.9	61.1	-46.2	
PK	V	115.000	13.6	7.5	0.3	0.0	0.0	21.4	43.5	-22.1	restricted
AVG	V	115.000	3.1	7.5	0.3	0.0	0.0	10.9	43.5	-32.6	restricted
PK	V	127.600	16.2	6.8	0.3	0.0	0.0	23.3	43.5	-20.2	restricted
AVG	V	127.600	-0.5	6.8	0.3	0.0	0.0	6.6	43.5	-36.9	restricted
PK	H	433.420	49.4	17.0	0.8	0.0	0.0	67.2	101.1	-33.9	
AVG	H	433.420	41.7	17.0	0.8	0.0	0.0	59.5	81.1	-21.6	
PK	V	740.700	10.7	21.1	1.1	0.0	0.0	32.9	81.1	-48.2	
AVG	V	740.700	6.0	21.1	1.1	0.0	0.0	28.2	61.1	-32.9	
PK	H	867.000	17.4	23.3	1.1	0.0	0.0	41.8	81.1	-39.3	
AVG	H	867.000	10.1	23.3	1.1	0.0	0.0	34.5	61.1	-26.6	

Radiated Emissions / Interference

Company:	Harmonic Design, Inc.	Model #:	SOMFY
Engineer:	Nicholas Abbondante	Location: Site 2	Serial #: HDEC-9501 0327 02144
Project #:	3056237	Pressure: 1018 mB	Receiver: HP 8542E
Date:	03/23/04	Temp: 19c	Antenna: HORN1 10-24-04 V3.ant HORN1 10-24-04 H3.ant
Standard:	FCC Part 15 Subpart B	Humidity: 24%	PreAmp: None
Class:	B	Group: None	Cable(s): CBL027 11-11-2004.cbl None
Limit Distance:	3 meters	Test Distance:	3 meters
Voltage/Frequency:	Battery	Frequency Range:	1 GHz - 4.3342 GHz

	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	
PK	V	1300.260	19.5	26.7	2.1	0.0	0.0	48.3	74.0	-25.7	restricted
AVG	V	1300.260	10.1	26.7	2.1	0.0	0.0	38.8	54.0	-15.2	restricted
PK	V	1733.680	11.2	28.1	2.5	0.0	0.0	41.8	81.1	-39.3	
AVG	V	1733.680	-0.9	28.1	2.5	0.0	0.0	29.7	61.1	-31.4	
PK	V	2167.100	11.3	29.7	2.8	0.0	0.0	43.8	81.1	-37.3	
AVG	V	2167.100	-0.8	29.7	2.8	0.0	0.0	31.7	61.1	-29.4	
PK	V	2602.000	11.5	30.9	3.1	0.0	0.0	45.5	81.1	-35.6	
AVG	V	2602.000	-0.2	30.9	3.1	0.0	0.0	33.8	61.1	-27.3	
PK	V	3900.000	16.5	34.6	3.9	0.0	0.0	55.1	74.0	-18.9	restricted
AVG	V	3900.000	12.6	34.6	3.9	0.0	0.0	51.2	54.0	-2.8	restricted
PK	V	4336.000	21.5	35.0	4.2	0.0	0.0	60.7	74.0	-13.3	restricted
AVG	V	4336.000	12.2	35.0	4.2	0.0	0.0	51.4	54.0	-2.6	restricted

4.3 Sample Calculation

The following is how net radiated field strength readings were determined:

NF = RF + AF + CF - PF - AVF - DF

Where,

NF = Net Reading in dBµV/m
RF = Reading from receiver in dBµV
AF = Antenna Correction Factor in dB(1/m)
CF = Cable Correction Factor in dB
PF = Pre-Amplifier Correction Factor in dB
AVF = Duty Cycle Correction Factor in dB (only if applicable)
DF = Distance Factor in dB (using 20 dB/decade unless otherwise specified)

To convert from dBµV/m to µV/m or mV/m the following was used:

$UF = 10^{(NF / 20)}$

Where,

UF = Net Reading in µV/m

Example:

NF = RF + AF + CF - PF - AVF - DF = 62.9 + 13.7 + 2.1 - 16.1 - 0.0 - 10.5 = 52.1 dBµV/m

$UF = 10^{(52.1\ dB\mu V / 20)} = 403\ \mu V/m$

4.4 Configuration Photographs – Radiated Emissions

Radiated Spurious Test Setup, Front View

Radiated Spurious Test Setup, Back View

5.0 Line-Conducted Emissions

FCC § 15.107, § 15.207

5.1 Test Procedure

Conducted emissions are measured in the frequency range of 150 kHz to 30 MHz on AC power lines. Interference voltages are measured with a LISN and a spectrum analyzer or receiver. The handset and base were placed 40cm from a vertical ground plane on a non-conductive table at an 80cm height over a conductive ground plane.

Requirement: Line-conducted emissions must not exceed the CISPR 22 limits.

Frequency (MHz)	**Class B Limit dB(µV)**	
	Quasi-Peak	Average
0.150 – 0.5	66 – 56*	56 – 46*
0.5– 5	56	46
5– 30	60	50

*-Decreases linearly with the logarithm of the frequency

5.2 Test Results

Results: N/A

Testing was not performed as the EUT is battery powered.

5.3 Sample Calculation

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF

Where,

NF = Net Reading in dBµV
RF = Reading from receiver in dBµV
LF = LISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBµV to µV or mV the following was used:

$UF = 10^{(NF / 20)}$

Where,

UF = Net Reading in µV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBµV

$UF = 10^{(48.1\ dB\mu V / 20)} = 254\ \mu V/m$

5.4 Configuration Photographs – Line-Conducted Emissions

N/A – Battery Powered