ITS Intertek Testing Services
ETL SEMKO

Test Report
for
Acumen Inc.
on the
Wireless Fireplace Remote Control
Model: EON/CLAPT-01
to
FCC Part 15.231 Emissions Requirements for Periodic Transmitters
and
FCC Part 15 Emissions Requirements for Unintentional Radiators

FCC ID: EPKEONCLAPT

Test Report #: 3045840.01
Date of Report: October 3, 2003
Revised: September 2, 2004
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Date of Test: October 2, 2003, September 2, 2004

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Wireless Fireplace Remote Control
Serial No.: Testing Model July 29, 2003
Model No.: EON/CLAPT-01

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2.0 General Description

2.1 Product Description

The EUT is a hand-held remote control used to control a fireplace. It uses a periodic transmitter to transmit command codes to turn the fireplace on or off, or to change flame height, etc. The transmitter fundamental frequency is 350 MHz. EUT activated for all testing from new batteries.

The EUT has been tested at the request of

Company: Acumen Inc.
101A Executive Drive Suite 200
Sterling, VA, 20166
Name of contact: George Carrigan
Telephone: (703) 904-0405
Fax: (703) 904-0218

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

October 2, 2003 Test Equipment

Description	Manufacturer	Model Number	ITS ID	Serial Number	Cal Due Date
Antenna	EMCO	3142	LOG4	9711-1225	02/18/2004
Spectrum Analyzer	Rohde & Schwarz	FSEK-30	ROS001	100225	05/26/2004
High Frequency Cable	Megaphase	TM40 K1K1 80	CBL029	CBL029	11/13/2003
Horn Antenna	EMCO	3115	HORN1	9512-4632	10/31/2003

September 2, 2004 Test Equipment

Description	Manufacturer	Model Number	ITS ID	Serial Number	Cal Due Date
Attenuator, 20 dB	Mini Circuits	20 dB, 50 Ohm	DS24	DS24	01/15/2005
LISN, 50 uH, 0.01 – 50 MHz, 24A	Solar Electronics	9252-50-R-24-BNC	LISN11	941713	06/06/2005
Cable, BNC-BNC, 10m long	Alpha	RG-58C/U	CBL10MS3	CBL10MS3	01/15/2005
Spectrum Analyzer	Hewlett Packard	8591E	SA0003	3346A02319	07/23/2005
Spectrum Analyzer	Rohde & Schwarz	FSEK-30	ROS001	100225	06/04/2005

Support Equipment			
Description	**Manufacturer**	**Model Number**	**Serial Number**
Remote Control Charger	Acumen, Inc.	EON/CAL-CA-01	Eng01
EUT was tested standalone except during line-conducted emissions when it was inserted into the charger unit.			

Cables					
Quantity	**Type**	**Length (m)**	**Shielding**	**Ferrite**	**Connector Type**
1	AC Mains	2	None	None	Plastic
There were no cables associated with the EUT; the above listed AC cable belongs to the Remote Control Charger support equipment					

3.0 Bandwidth

FCC § 15.231(c)

3.1 Test Procedure

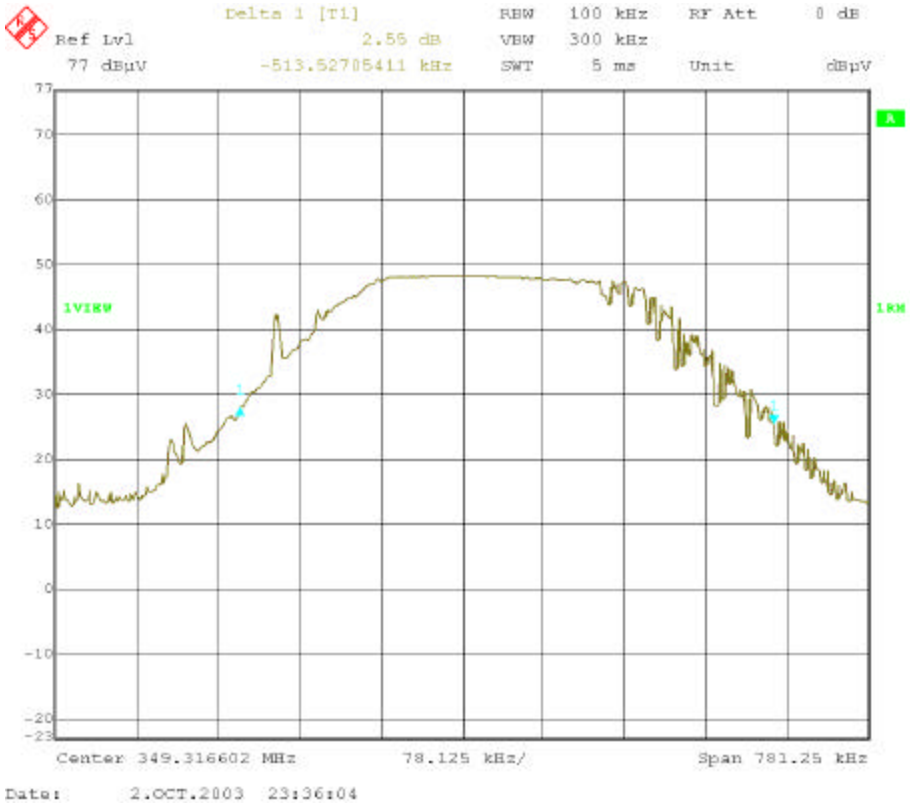
The EUT was set to transmit continuously and the bandwidth was measured 20 dB down from the peak using the marker delta function. Resolution and Video bandwidth were set to 100 kHz and 300 kHz respectively.

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 350 MHz therefore the limit is 875 kHz.

3.2 Test Results

Results: Pass

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)
350 MHz	350	514	875



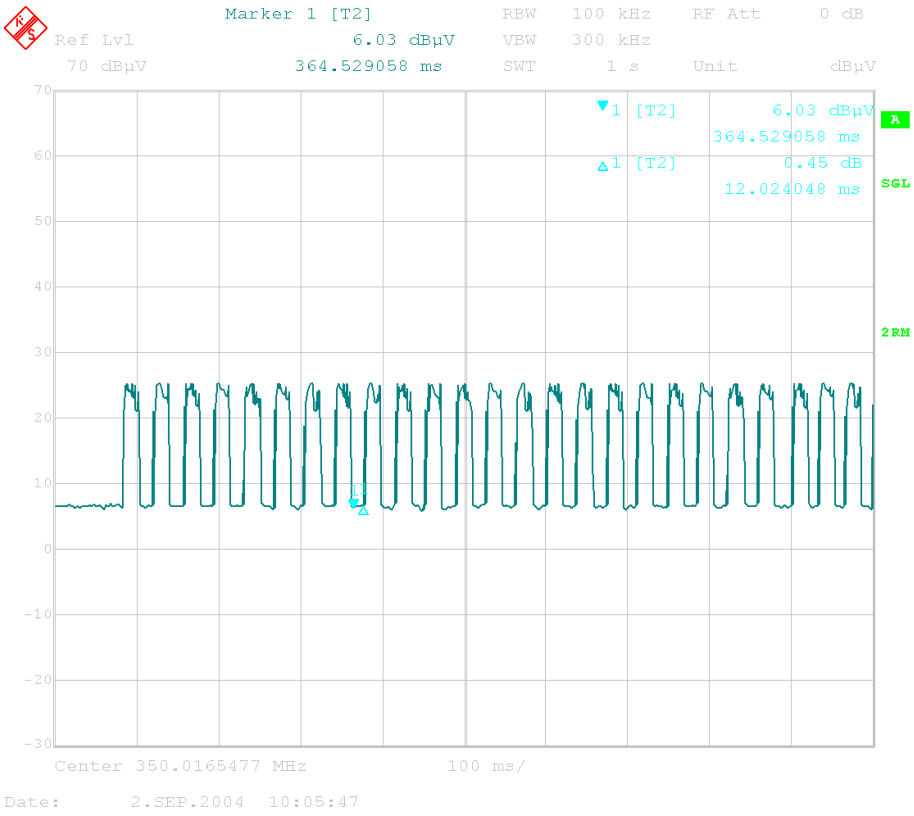
4.0 Radiated Field Strength

FCC §2.1053, §15.109, §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 10 meters from the EUT below 1 GHz, and 3 meters from the EUT above 1 GHz. 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 Field Strength (FS) in the frequency range up to the tenth harmonic of the fundamental frequency was measured.

Part 15.231 Requirement: For a periodic transmitter, spurious emissions must be attenuated below the level of the fundamental emissions by not less than 20 dB. In the restricted bands of 15.205, compliance with the stricter general limits of 15.209 is required. The only harmonics observed above 1 GHz fell in restricted bands, therefore a table showing compliance of all spurious emissions with the 15.209 limits is provided. A duty cycle correction factor was applied to the measured peak fundamental field strength to show compliance to the fundamental field strength limit. The duty cycle correction factor was determined based on the worst-case off-time during a 100 ms interval of the transmission burst. A plot of the transmission burst is shown, using 100 ms/division scaling on the x-axis. The off-time between words in the transmission is shown to be 12.024 ms, with a minimum of two intervals of off-time in any 100 ms of the burst. This corresponds to a worst-case value of 75.9% of on-time in any 100 ms interval of transmission and a duty cycle correction factor of –2.38 dB.



Part 15 Unintentional Radiators Requirement: For the receivers and digital devices, the spurious emissions must

meet the general limits of 15.109 Class B, which correspond to the general limits of 15.209. A table showing compliance of all spurious emissions with the 15.109 limits is provided.

Frequency Range (MHz)	Field Strength (dBmV/m)	Measurement Distance (m)
30-88	40.0	3
88-216	43.5	3
216-960	46.0	3
Above 960	54.0	3

4.2 Test Results

Results: Pass

Radiated Emissions / Interference

Company: Acumen Inc. Model #: EON/CLAPT-01
Engineer: Nicholas Abbondante Location: Site 2 Serial #: Testing Model July 29, 2003
Project #: 3045840 Pressure: 1003mb Receiver: R&S FSEK-30
Date: 10/02/03 Temp: 19c Antenna: LOG4 2-18-04 V10.ant LOG4 2-18-04 H10.ant
Standard: FCC Part 15 Subpart B & C Humidity: 55% PreAmp: None
Class: B Group: None Cable(s): Site2, 10M Floor 3-22-04.cbl CBL029 11-13-03.cbl
Limit Distance: 3 meters Test Distance: 10 meters
Voltage/Frequency: Battery Frequency Range: 30 MHz - 3.5 GHz

Emissions taken using a peak detector

	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	
Tx Freq	V	349.300	48.7	15.5	3.6	0.0	-10.5	78.2	97.5	-19.3	
	Tx average is equal to the peak field strength adjusted by the 2.38 dB duty cycle correction factor										
Tx AVG	V	349.300	48.7	15.5	3.6	0.0	-10.5	75.8	77.5	-1.7	+
	V	45.900	2.3	9.6	1.1	0.0	-10.5	23.5	40.0	-16.5	
	V	74.100	6.5	6.7	1.4	0.0	-10.5	25.1	40.0	-14.9	
	V	170.800	5.5	9.3	2.3	0.0	-10.5	27.6	43.5	-15.9	
	V	394.700	3.7	16.7	3.8	0.0	-10.5	34.6	46.0	-11.4	
	V	518.100	5.0	19.1	4.4	0.0	-10.5	38.9	46.0	-7.1	
	V	700.000	6.0	21.9	5.5	0.0	-10.5	43.9	46.0	-2.1	+
	Switched to HORN1 and CBL029 only; 3m distance, 1 MHz BW, Peak Detector										
	V	1050.000	26.6	25.8	0.8	0.0	0.0	53.2	54.0	-0.8	+
	V	1399.000	15.1	26.8	1.0	0.0	0.0	42.9	54.0	-11.1	

+ - Note that these emissions fall within our range of radiated measurement uncertainty of +/- 4 dB.

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,

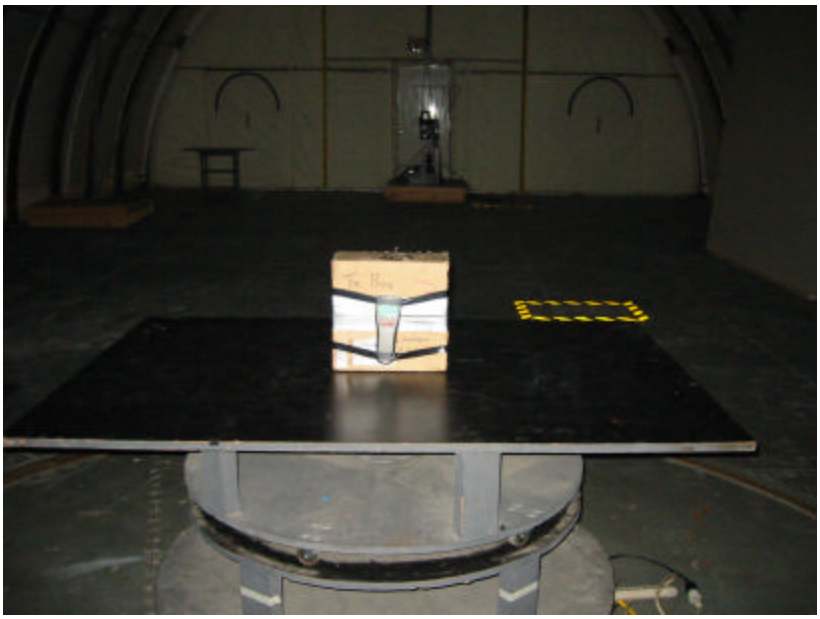
UF = Net Reading in µV/m

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(㎷)**	
	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: Pass

Conducted Emissions / Interference

Company: Acumen, Inc. Model #: EON/Clapt-01
Engineer: Nicholas Abbondante Location: Site 2 Serial #: Testing Model July 29, 2003
Project #: 3045840 Pressure: 1009 mB Receiver: HP 8591E
Date: 09/02/04 Temp: 19c Cable: CBL10MS3 1-15-05.cbl
Standard: FCC Part 15/Cispr22 Humidity: 56% LISN 1, 2: LISN11 [1] 6-06-05.lsn LISN11 [2] 6-06-05.lsn
Class: B Group: None LISN 3, N: None None
Preamp: None Attenuator: DS24 1-15-05.att
Voltage/Frequency: 120V/60Hz Frequency Range: 150 kHz - 30 MHz
Net is the sum of worst-case lisn, cable, & attenuator losses, preamp gain, and initial reading

Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Neutral dB(uV)	Quasi-Peak Net dB(uV)	Quasi-Peak Limit dB(uV)	Quasi-Peak Margin dB
0.180	19.8	19.5			42.6	64.5	-21.9
0.205	18.3	16.0			41.1	63.4	-22.3
0.615	8.8	8.6			30.5	56.0	-25.5
1.510	8.0	7.9			29.0	56.0	-27.0
8.250	2.1	2.6			23.8	60.0	-36.2
25.720	1.1	1.2			23.0	60.0	-37.0

Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Neutral dB(uV)	Average Net dB(uV)	Average Limit dB(uV)	Average Margin dB
0.180	13.4	13.2			36.2	54.5	-18.3
0.205	11.6	12.2			34.9	53.4	-18.5
0.615	1.9	1.1			23.6	46.0	-22.4
1.510	0.8	0.7			21.8	46.0	-24.2
8.250	-5.1	-5.3			21.0	50.0	-29.0
25.720	-5.8	-4.9			21.4	50.0	-28.6

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