Emissions Test Report
Test Report #: 3055865.02
Project #s: 3055865
Date of Report: July 6, 2004

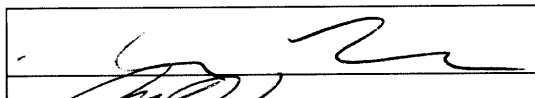
Date of Test: March 3 and June 30, 2004

Testing performed on the
Smoke Detector Transmitter
Model: AT410
to
FCC Part 15.231 Emissions Requirements for Periodic Transmitters
and
FCC Part 15 Emissions Requirements for Unintentional Radiators
for
Lifeline Systems, Inc.

FCC ID: BDZAT410

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

Test Authorized by:
Lifeline Systems, Inc.
111 Lawrence Street
Framingham, MA 01702

	Nicholas Abbondante, Test Engineer
	Michael Murphy, Staff Engineer, EMC

1.0 Summary of Tests

Smoke Detector Transmitter
Serial #: ISN 2004022701A (ITS Assigned, March 3 Test)
A135 (Lifeline Assigned, June 30 Test)
Model #: AT410

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	N/A	12

2.0 General Description

2.1 Product Description

The EUT is a transmitter intended to be connected to a hard-wired smoke detector in such a way that when the smoke detector is triggered, it will then trigger the transmitter which will send a transmission to the Lifeline Help Desk. The transmitter fundamental frequency is 312 MHz. EUT was activated for all testing from new batteries.

The EUT has been tested at the request of

Company: Lifeline Systems, Inc.
111 Lawrence Street
Framingham, MA, 01702-8156
Name of contact: Mr. Clyde Dottin
Telephone: (508) 988-1313
Fax: (240) 536-3263

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

Site 1; Site 2
The emissions 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
Antenna	EMCO	3142	LOG1	9701-1116	10/17/2004
Spectrum Analyzer	Agilent	E7405A	AGL001	US40240205	07/02/2004
EMI Receiver and RF Filter	Hewlett Packard	HP 8542E	REC2/RECFL2	3520A00125	12/18/2004
High Frequency Cable	Megaphase	TM40 K1K1 80	CBL028	CBL028	11/11/2004
Horn Antenna	EMCO	3115	HORN2	9602-4675	09/03/2004

Support Equipment			
Description	**Manufacturer**	**Model Number**	**Serial Number**
Firex Hardwired Smoke Detector	Firex	120-1072C	N/L
EUT was tested standalone initially on March 3, however during retest on June 30 it was wired to a smoke detector			

Cables					
Quantity	**Type**	**Length (m)**	**Shielding**	**Ferrite**	**Connector Type**
2	DC Signal	2-3”	None	None	Plastic
There were no cables associated with the EUT during initial testing on March 3, however during retesting on June 30 the EUT was wired.					

3.0 Bandwidth

FCC § 15.231(c)

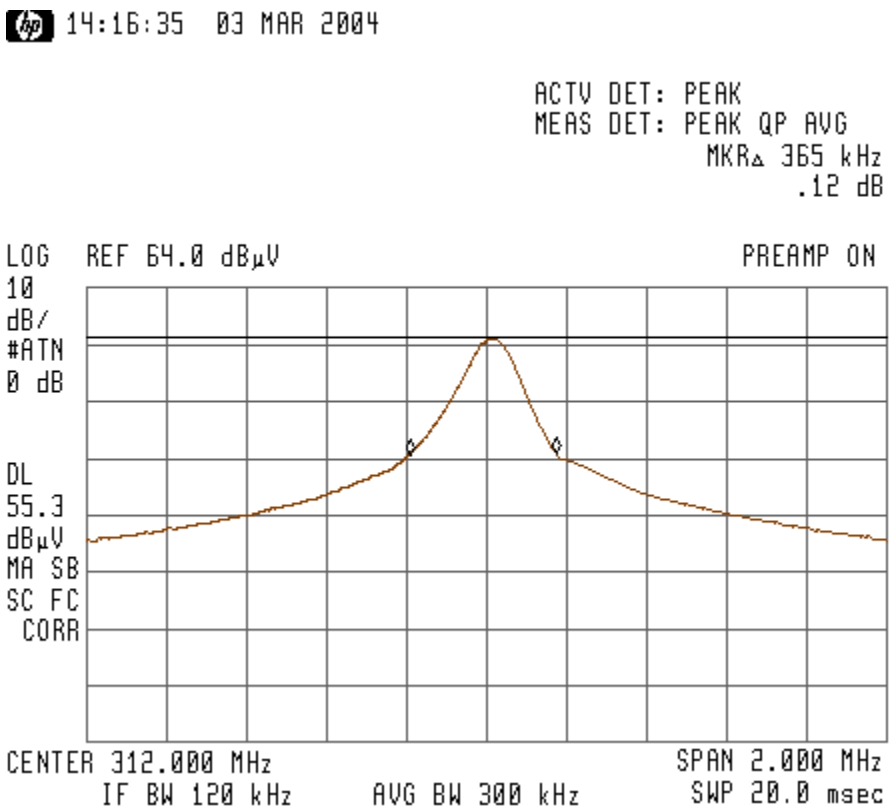
3.1 Test Procedure

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 312 MHz therefore the limit is 780 kHz.

3.2 Test Results

Results: Pass			
Performed March 3, 2004	Equipment: REC2, RECFL2, LOG2		
Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)
312 MHz	312	365	780



4.0 Radiated Field Strength

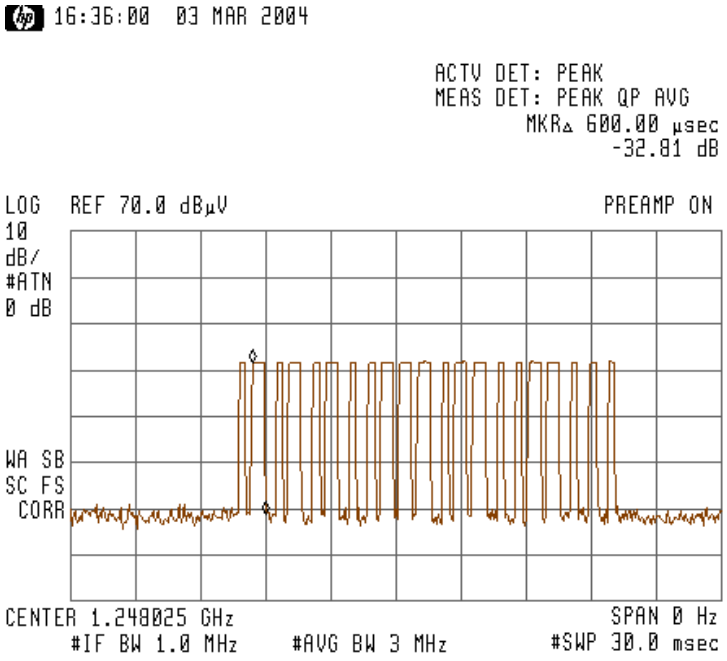
FCC §2.1053, §15.205, §15.209, §15.231(b)

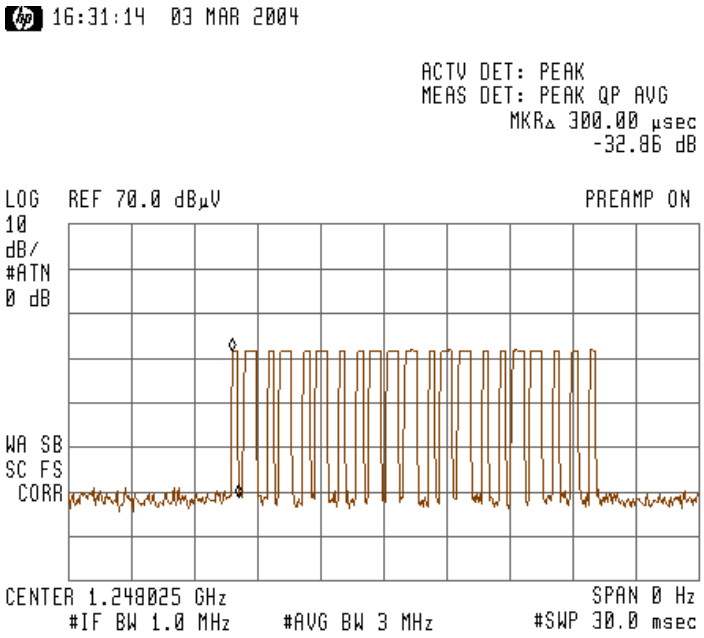
4.1 Test Procedure

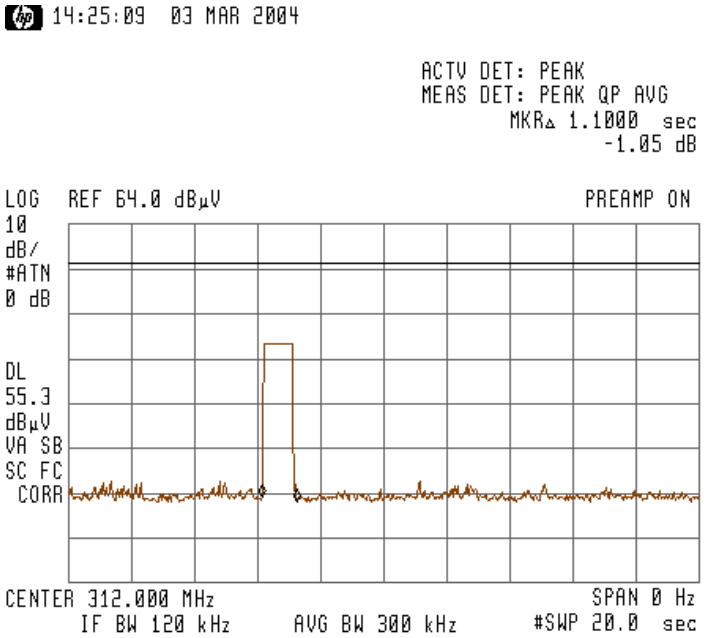
The transmitter was placed on a wooden turntable and the transmitter was activated. During testing on June 30, the EUT was wired directly to a hardwired smoke detector to populate cable I/Os correctly and terminate them with the correct devices. The smoke detector was plugged into 120VAC during testing. 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 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, and the duty cycle was calculated to determine average values.

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, 312 MHz, and corresponds to an average limit of 75.4 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







Note that the EUT shuts off after 1.1 seconds and that there are 11 300us pulses and 10 600us pulses corresponding to 9.3ms of on time in a pulse train. Pulse trains occur at greater than 100ms intervals so the duty cycle is 9.3%. This corresponds to a duty cycle correction factor of –20.6 dB, rounded down to –20 dB.

Performed March 3, 2004 Equipment: REC2, RECFL2, HORN2, LOG2, CBL028

Results: Pass

Radiated Emissions / Interference

Company: Lifeline Systems — Model #: AT 410
Engineer: Nicholas Abbondante — Location: Site 1 & 2 — Serial #: ISN 2004022701A (ITS Assigned) A135
Project #: 3055865 — Pressure: 1009 mB — Receiver: HP 8542E Agilent E7405A
Date: 03/03/04 06/30/04 — Temp: 22c — Antenna: HORN2 9-3-04 V3m.ant HORN2 9-3-04 H3m.ant
Standard: FCC Part 15 Subpart C — Humidity: 27% — PreAmp: None
Class: None — Group: None — Cable(s): CBL028 11-11-2004.cbl None
Limit Distance: 3 meters — Test Distance: 3 meters
Voltage/Frequency: Fresh 9V Battery — Frequency Range: 30 MHz - 3.12 GHz
10m distance and antenna LOG2(3/3) or LOG1(6/30) <1 GHz; 3m distance and antenna HORN2 >1 GHz

	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Duty Cycle Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	
PK	V	312.000	57.9	14.2	2.9	0.0	-10.5	85.5	95.4	-9.9	
AVG	V	312.000	57.9	14.2	2.9	-20.0	-10.5	65.5	75.4	-9.9	
AVG	V	936.000	25.0	23.6	5.5	-20.0	-10.5	44.6	55.4	-10.8	
PK	V	936.000	25.0	23.6	5.5	0.0	-10.5	64.6	75.4	-10.8	
AVG	V	1248.000	44.0	26.3	2.0	-20.0	0.0	52.4	55.4	-3.0	*
PK	V	1248.000	44.0	26.3	2.0	0.0	0.0	72.4	75.4	-3.0	*
AVG	V	1560.000	41.3	27.1	2.3	-20.0	0.0	50.7	54.0	-3.3	restricted
PK	V	1560.000	41.3	27.1	2.3	0.0	0.0	70.7	74.0	-3.3	restricted
AVG	V	1872.000	28.8	28.4	2.6	-20.0	0.0	39.8	55.4	-15.6	
PK	V	1872.000	28.8	28.4	2.6	0.0	0.0	59.8	75.4	-15.6	
AVG	V	2184.000	23.1	29.4	2.8	-20.0	0.0	35.3	55.4	-20.1	
PK	V	2184.000	23.1	29.4	2.8	0.0	0.0	55.3	75.4	-20.1	
AVG	V	2496.000	28.6	30.0	3.0	-20.0	0.0	41.6	54.0	-12.4	restricted
PK	V	2496.000	28.6	30.0	3.0	0.0	0.0	61.6	74.0	-12.4	restricted
AVG	V	2808.000	21.0	30.9	3.3	-20.0	0.0	35.2	54.0	-18.8	restricted
PK	V	2808.000	21.0	30.9	3.3	0.0	0.0	55.2	74.0	-18.8	restricted

* - 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,

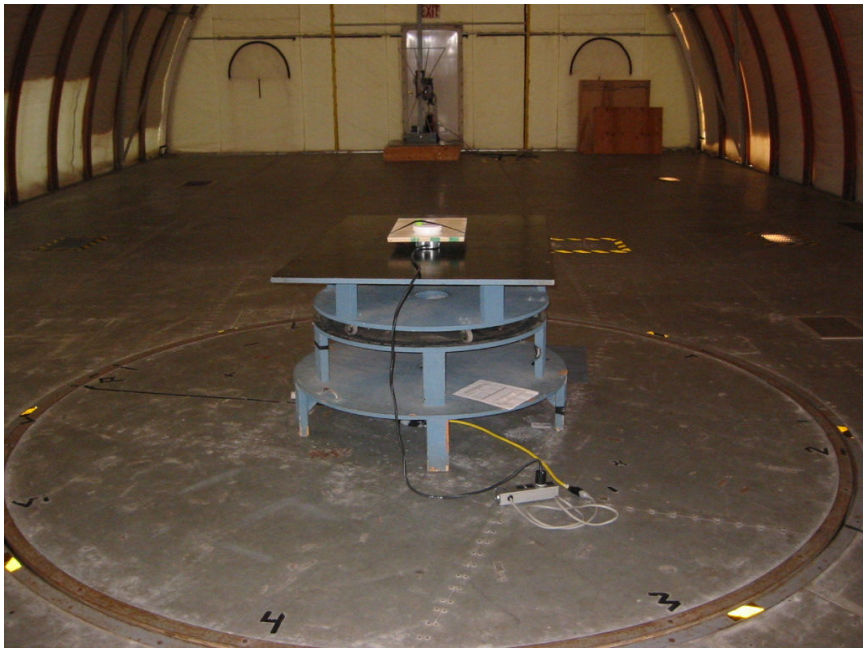
UF = Net Reading in μV/m

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(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. The hardwired smoke detector attached to the EUT derived power from the AC line, but the EUT did not derive power from the smoke detector. All connections between the EUT and the smoke detector were for signal purposes to simulate actual operation.

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