ITS Intertek Testing Services
ETL SEMKO

EXHIBIT 2

Test Report

Lifelines Systems Inc.

FCC Part 15 Application
For
Class II Permissive Change
(Low Power Transmitter)

Personal Help Buttons
Models: SL324/CL324

FCC ID: BDZ135BD

October 5, 2001

Report Prepared by: _____ Date: 10/18/2001
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Sr. Project Engineer

Reviewed by: _____ Date: 10/18/2001
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EMC Supervisor

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1.0 General Description

1.1 Product Description

The SL324 and CL324 Personal Help Buttons (PHB) utilize a common PCB assembly, designed for wrist wear and pendant wear respectively. The performance characteristics are identical.

1.2 Related Submittals / Changes

There are no related submittals for this application.

SL324 and CL324 combine the RF circuit of the SL318/CL320 with the 20 bit transmission format of the SA400. Like the SA400, the SL324 and CL324 use a PIC12C508microcontroller to provide the logic for alarm transmissions and periodic status reporting of battery condition.

1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in a semi-anechoic chamber. The procedures for maximizing emissions as described in this report were followed. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The Duluth 10-meter chamber site is located at 1950 Evergreen Blvd., Suite 100, Duluth, Georgia. The test site is a 10-meter semi-anechoic chamber. The site meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 1992. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

1.5 Test Equipment List

The following test equipment was used during testing:

Duluth Test Equipment for Radiated Emissions				
Description	**Make**	**Model**	**Serial #**	**Cal Date**
EMI Receiver	HP	85462A	3410A00173	3/20/01
RF Filter Selector	HP	85460A	3448A00203	3/20/01
BiLog Antenna	Chase	2622	CBL6112B	8/14/01
Cable	N/A	Cable N2	ITS# 211999a2	6/5/01
Cable	N/A	CableTW2	ITS# 211411	6/5/01

*** All calibrations are on 12-month cycles unless otherwise indicated**

2.0 System Test Configuration

2.1 Justification

During testing, the transmitter was mounted to a cardboard box, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

The device was powered from a new battery.

2.2 EUT Exercising Software

There was no special software to exercise the device. For simplicity of testing, the EUT was configured to transmit continuously.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

2.4 Equipment Modification

Any modifications installed previous to testing by Lifeline Systems Inc. will be incorporated in each production model sold/leased in the United States.

There were no modifications installed by Intertek Testing Services.

2.5 Support Equipment List and Description

The information for all equipment, plus descriptions of all cables used in the tested system are:

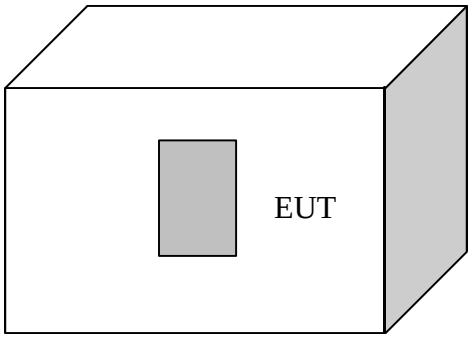
None

Cables:

None

2.6 Test Configuration Block Diagram

Figure 2.6 Configuration of Tested System



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3.0 Emission Results

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dB❍V/m
RA = Receiver Amplitude (including preamplifier) in dB❍V
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

FS = RR + LF
Where FS = Field Strength in dB❍V/m
RR = RA - AG in dB❍V
LF = CF + AF in dB

Assume a receiver reading of 52.0 dB❍V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB❍V/m. This value in dB❍V/m was converted to its corresponding level in ❍V/m.

RA = 52.0 dB❍V/m
AF = 7.4 dB RR = 23.0 dB❍V
CF = 1.6 dB LF = 9.0 dB
AG = 29.0 dB
FS = RR + LF
FS = 23 + 9 = 32 dB❍V/m

Level in ❍V/m = Common Antilogarithm [(32 dB❍/V/m)/20] = 39.8 ❍V/m

3.2 Radiated Emission Test Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 0.2 dB

Readings under 1GHz are Peak
Readings over 1GHz are Peak

Test Personnel: _____

Matthew Van Steen, Project Engineer

Date: 10/18/01

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Company: **Lifeline Systems**
Model: **SL324/C2324**
Job No.: **3006512**
Date: 10/05/01
Standard: FCC Part 15.231
Class: C Group: None
Notes: Antena Pol = Horizontal, Fundamental Freq.

Tested by: David J. Schramm
Location: Duluth
Detector: HP8546
Antenna: CHAS2622
PreAmp: HP-1G
Cable(s): CABLETT4 CABLETW1
Distance: **10**

Orientation	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	
1	312.062	70.6	14.9	4.4	25.6	0.0	64.4	75.4	-11.0	
2	312.062	81.4	14.9	4.4	25.6	0.0	75.2	75.4	-0.2	*
3	312.062	73.5	14.9	4.4	25.6	0.0	67.3	75.4	-8.1	

Company: **Lifeline Systems**
Model: **SL324/C2324**
Job No.: **3006512**
Date: 09/10/01
Standard: FCC Part 15
Class: C Group: None
Notes: Antenna Pol = Horizontal

Tested by: Matthew Van Steen
Location: Duluth
Detector: HP8546
Antenna: CHAS2622
PreAmp: HP-1G
Cable(s): CABLETW3 CABLEN2
Distance: **3**

*added HP 1G pre-amp

1	624.120	53.4	18.8	3.8	27.1	5.7	43.2	55.4	-12.2	
2	624.120	56.6	18.8	3.8	27.1	5.7	46.5	55.4	-8.9	
3	624.120	50.6	18.8	3.8	27.1	5.7	40.4	55.4	-15.0	
1	936.200	59.4	20.7	4.9	26.4	5.7	52.9	55.4	-2.5	
2	936.200	60.5	20.7	4.9	26.4	5.7	54.1	55.4	-1.3	*
3	936.200	59.3	20.7	4.9	26.4	5.7	52.8	55.4	-2.6	

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Company: **Lifeline Systems**
Model: **SL324/C2324**
Job No.: **3006512**
Date: 09/06/01
Standard: FCC Part 15
Class: C Group: None
Notes: Antenna Pol = Horizontal

Tested by: Matthew Van Steen
Location: Duluth
Detector: HP8546
Antenna: AHSYS571
PreAmp: Hp1-26g
Cable(s): CABLETW2 CABLEN2
Distance: **3**

EUT Pos. (1/2/3)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Average Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB
1	1248.000	56.2	25.5	6.0	38.2	5.7	43.8	55.4	-11.6
2	1248.000	64.4	25.5	6.0	38.2	5.7	52.0	55.4	-3.4
3	1248.000	61.2	25.5	6.0	38.2	5.7	48.8	55.4	-6.6
1	1560.000	62.5	26.5	6.9	37.7	5.7	52.6	55.4	-2.8
2	1560.000	63.0	26.5	6.9	37.7	5.7	53.1	55.4	-2.3
3	1560.000	57.4	26.5	6.9	37.7	5.7	47.5	55.4	-7.9
1	1872.000	55.5	28.7	7.6	37.4	5.7	48.7	55.4	-6.7
2	1872.000	56.5	28.7	7.6	37.4	5.7	49.7	55.4	-5.7
3	1872.000	55.0	28.7	7.6	37.4	5.7	48.2	55.4	-7.2
1	2184.000	55.6	30.2	8.8	37.2	5.7	51.7	55.4	-3.7
2	2184.000	54.8	30.2	8.8	37.2	5.7	50.9	55.4	-4.5
3	2184.000	53.3	30.2	8.8	37.2	5.7	49.4	55.4	-6.0
1	2496.000	45.1	31.2	9.8	36.9	5.7	43.5	55.4	-11.9
2	2496.000	45.7	31.2	9.8	36.9	5.7	44.1	55.4	-11.3
3	2496.000	45.4	31.2	9.8	36.9	5.7	43.8	55.4	-11.6
1	2808.000	45.7	32.2	10.9	36.9	5.7	46.2	55.4	-9.2
2	2808.000	46.8	32.2	10.9	36.9	5.7	47.3	55.4	-8.1
3	2808.000	47.4	32.2	10.9	36.9	5.7	47.9	55.4	-7.5
1	3120.000	42.8	32.5	12.0	36.9	5.7	44.7	55.4	-10.7
2	3120.000	43.3	32.5	12.0	36.9	5.7	45.2	55.4	-10.2
3	3120.000	43.2	32.5	12.0	36.9	5.7	45.1	55.4	-10.3

3.3 Line Conducted Emission Test Data

Note: Line Conducted Emission testing was not required for this device since it is battery powered and does not connect to the AC Mains.

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4.0 Transmitter Information

This miscellaneous information includes details of the test procedures, measured bandwidth, and calculation of factors such as pulse desensitization and averaging factor.

4.1 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under FCC Part 15 rules.

The transmitting equipment under test (EUT) is attached to a cardboard box and placed on a wooden table approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The cardboard box is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode or average mode (see attached data table). If peak measurements are taken for comparison with the average limit, they are corrected by measuring the duty cycle of the equipment under test and subtracting the corresponding average factor in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in section 4.3.

The frequency range scanned is from the lowest radio frequency signal generated, but not lower then 9kz in the device up to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 450 KHz to 30 MHz.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Measurements were made as described in ANSI C63.4: 1992.

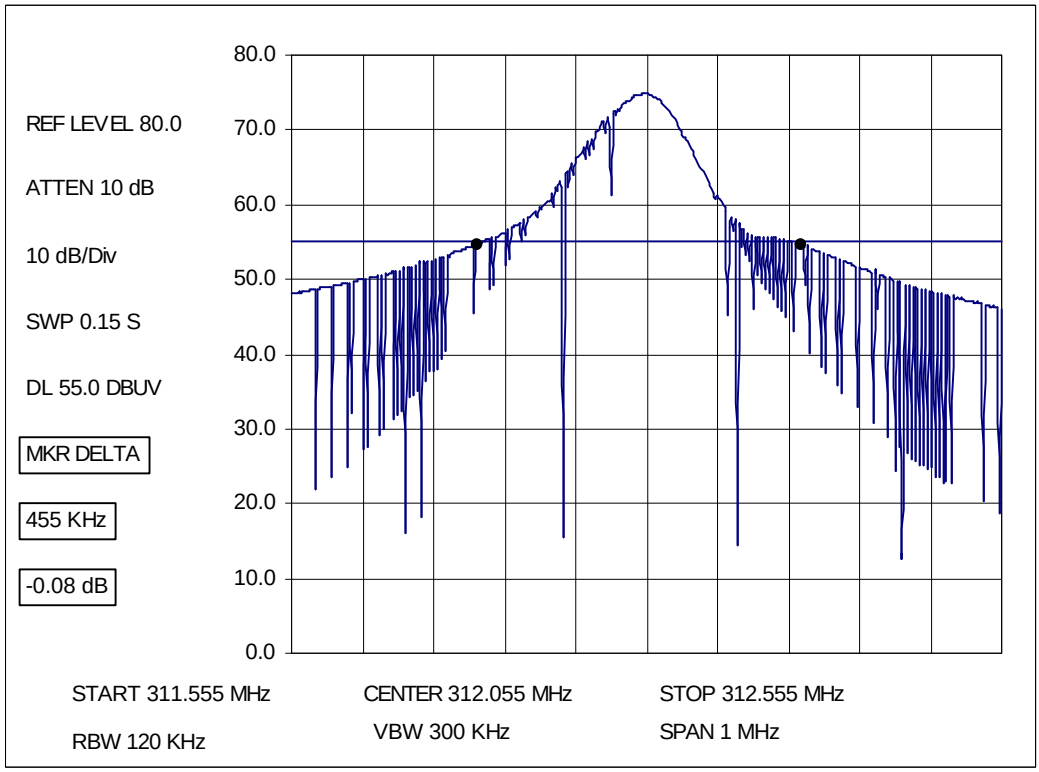
The resolution bandwidth used for measurement of radiated signal strength was 100 KHz or greater below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor readings in the forbidden bands and above 1 GHz, signals may be acquired at a distance of one meter or less. All measurements are taken at three meters unless otherwise noted on the data tables.

Frequency Stability is not specified for this device.

4.2 Measured Bandwidth

The plot on this page shows the fundamental emission when modulated with a worst-case bit sequence. From the plot, the bandwidth is observed to be **455 kHz,** at 20 dBc. The bandwidth limit is **780.1 kHz**. The unit meets the FCC Part 15 bandwidth requirements.



4.3 Calculation of Average Factor

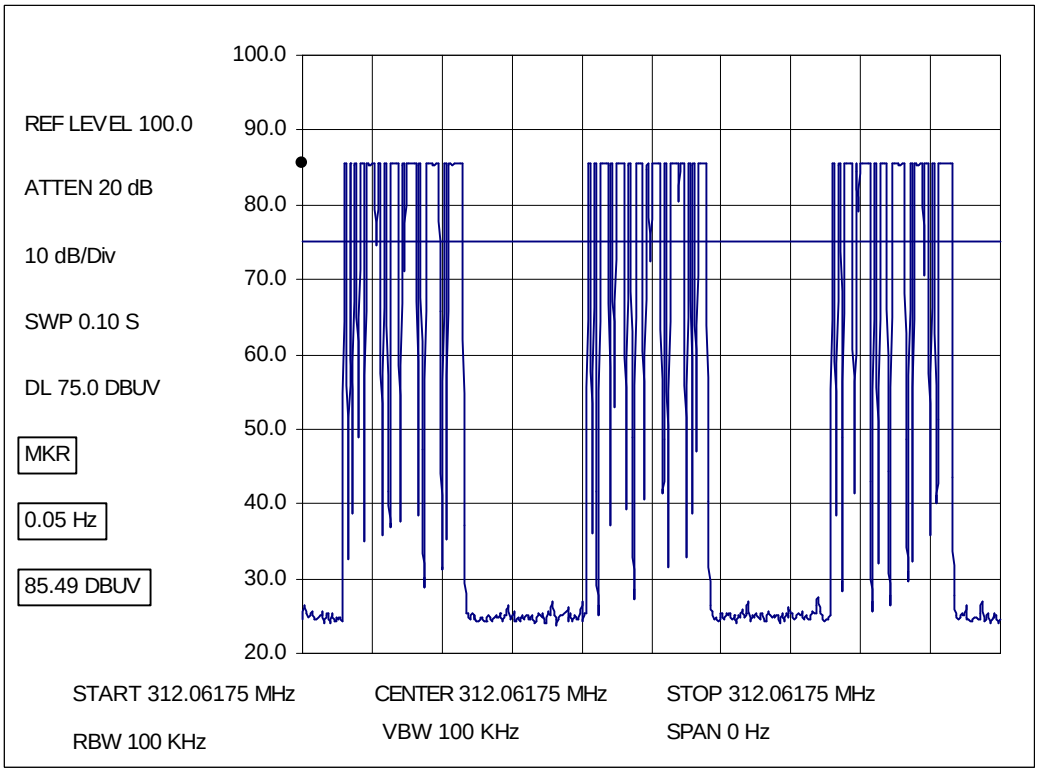
Averaging factor in dB = 20 log (duty cycle)

The specification for output field strengths in accordance with FCC Part 15 specifies measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation. The duty cycle is measured by placing the spectrum analyzer in zero span (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

During testing, a worst-case duty cycle of 51.45 ms was observed. A plot of the worst-case duty cycle as observed during testing is included on this page.

Therefore, the averaging factor is found by 20 $\log_{10}$ (51.45/100) = **-5.7 dB**.



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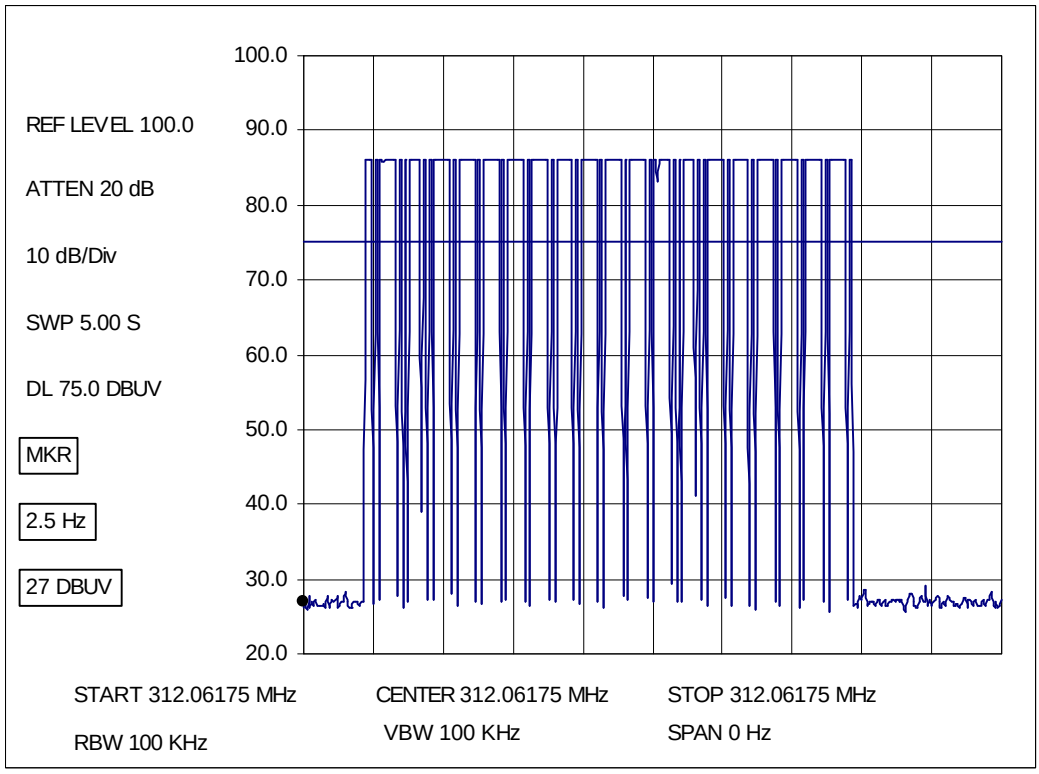
4.4 Operating Characteristics and Holdover Time

This device is designed for momentary operation and is described in Section 15.231 of the FCC Rules. This device can only be activated manually. When activated manually this device will automatically deactivate within not more than five seconds of being released per 15.231(a)(1).

This device is deactivated at any time the button is not pressed.

This device does not employ periodic supervisory transmissions.