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August 6, 2003

American TCB
6731 Whittier Ave.
Suite C110
McLean VA. 22101

Gentlemen:

The enclosed documents constitute a formal submittal and application for a Grant of Equipment Authorization pursuant to Subpart C of Part 15 of FCC Rules (CFR 47) regarding intentional radiators. Data within this report demonstrates that the equipment tested complies with the FCC limits for intentional radiators.

Elliott Laboratories, as duly authorized agent prepared this submittal. A copy of the letter of our appointment as agent is enclosed.

If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

Sincerely,

Mark Briggs
Director of Engineering

MB/jls
Enclosures: Agent Authorization Letter
Emissions Test Report with Exhibits

File: R52212

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Electromagnetic Emissions Test Report and Request for Class II Permissive Change pursuant to FCC Part 15, Subpart C (15.225) FCC Part 15, Subpart B (Class B Digital Device) Industry Canada RSS 210 Issue 5 for an Intentional Radiator on the LeapFrog Model: Cash Register

FCC ID:	QDX2025001
GRANTEE:	LeapFrog 130-D Knowles Drive Los Gatos, CA. 95032
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	August 6, 2003
FINAL TEST DATE:	July 28 and August 4, 2003
AUTHORIZED SIGNATORY:	Mark Briggs Director of Engineering

ACCREDITED

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SCOPE

An electromagnetic emissions test has been performed on the LeapFrog model Cash Register pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators, RSS-210 Issue 5 for licence-exempt low power devices and Subpart B of Part 15 of FCC Rules for digital devices. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The device under test has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada and FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the LeapFrog model Cash Register and therefore apply only to the tested sample. The sample was selected and prepared by Jim Cordova of LeapFrog

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules, Subpart B of Part 15 of FCC Rules and RSS-210 Issue 5 for license-exempt low power devices for the radiated and conducted emissions of digital devices and intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units which are subsequently manufactured.

SUMMARY OF RESULTS

The results summary below contains the highest measurements with respect to the specified limits. The complete data is contained in an appendix of this report.

FCC Part 15 Section	RSS 210 Section	Description	Measured Value (Margin)	Limit	Result
15.225a		Output Field Strength	35.9dBuV/m @ 13.560 MHz	10,000 microvolts/m (80 dBuV/m) QP @ 30 metres	Complies (Note 1)
	6.2.2e	Output Field Strength	35.9dBuV/m @ 13.560 MHz	15.5 millivolts/m (84 dBuV/m) QP @ 30 metres	Complies (Note 1)
	6.2.2e	Field Strength Fc ±150 kHz,	N/A – fundamental signal below limit	334 microvolts/m (50.5 dBuV/m) @ 30 m	Complies
	6.2.2e	Field Strength - Fc ± 150 kHz to Fc ±450 kHz		106 microvolts/m (40.5 dBuV/m) @ 30 m	Complies
15.225b and 15.109c		Spurious emissions outside of the allocated band and digital device emissions	36.8 dBuV/m @ 474.564 MHz (-9.2dB)	FCC 15.209 FCC 15.109 Class B RSS-210 Tables 3, 7	Complies
15.225 c	6.2.2e	Frequency Stability	Not evaluated, the proposed changes do not affect frequency stability	±0.01% (±100 ppm) Temperatures of -20°C, to +50°C 85% to 115% voltage variations.	N/A
15.107 / 15.207 c	6.2.2e	AC Conducted Emissions	-	Not applicable – device is battery powered	N/A

Note 1: Measurement made using a peak detector and 9kHz measurement bandwidth rather than a QP detector.

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	0.15 to 30	± 1.9
Radiated Emissions	30 to 1000	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The LeapFrog model Cash Register is an educational toy that incorporates an RF ID reader to read passive tags at 13.56 MHz. Normally, the EUT would be placed on a tabletop during operation. The EUT was, therefore, treated as tabletop equipment during testing to simulate the end-user environment. The EUT operates from 4.5 VDC via internal batteries.

The sample was received on June 3, 2003 and tested on July 28 and August 4, 2003.

The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Leapfrog	Cash Register	RF ID reader	N/A	QDX2025001

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 33 cm wide by 16.8 cm deep by 19.8 cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

No support equipment was used during emissions testing.

EUT INTERFACE PORTS

No interface ports were used during emissions testing.

EUT OPERATION DURING TESTING

Continuously transmitting at 13.56 MHz

ANTENNA REQUIREMENTS

The antenna is incorporated into the circuit board.

PROPOSED MODIFICATION DETAILS

GENERAL

This section details the modifications to the Leapfrog model Cash Register being proposed. All performance and construction deviations from the characteristics originally reported to the FCC are addressed

Leapfrog propose the following changes in the Cash Register's RFID Scanner circuit to improve manufacturing yield:

- The tank capacitance value (parallel combination of C1 and C2) of the antenna circuit will be changed from a fixed value to a determine-in-test value that achieves resonance at the 13.56 MHz carrier frequency. This change allows the factory to tune the antenna tank circuit to remove the effect of component tolerances, and obtain more consistent performance.
- A small capacitor (C2) will be added across Q3 to improve signal linearity. This reduces the level of radiated harmonics by several dB.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on July 28 and August 4, 2003at the Elliott Laboratories Open Area Test Site #1 & 3 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Federal Communications Commission. In accordance with Industry Canada rules detailed in RSS 210 Issue 5 and RSS-212, construction, calibration, and equipment data for the test sites have been filed with the Federal Communications Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

Measurement bandwidths (video and resolution) are set in accordance with FCC procedures for the type of radio being tested.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions from the AC power port are given in units of microvolts and the limits for radiated electric field emissions are given in units of microvolts per meter at a specified test. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m).

For reference, converting the voltage and electric field strength specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. Conversion of power specification limits from linear units (in milliwatts) to decibel form (in dBm) is accomplished by taking the base ten logarithm, then multiplying by 10.

FCC 15.255 and RSS 210 FUNDAMENTAL SIGNAL LIMITS

Operating Frequency (MHz)	RSS 210 6.2.2(e) Limit	FCC Part 15.255 Limit
13.553 – 13.567	84 dBuV/m @ 30m	80 dBuV/m @ 30m

RSS 210 AND FCC 15.247 SPURIOUS RADIATED EMISSIONS LIMITS

The limits for unwanted (spurious) emissions from the transmitter are:

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
0.009 to 0.490 2	400/F(kHz) @ 300m	52 - 20 Log[f(kHz)] @ 300m
0.490 to 1.705	24000/F(kHz) @ 30m	87.6 - 20 Log[f(kHz)] @ 30m
1.705 to 30.0	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

FCC AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in FCC Part 15.207.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

RSS-210 SECTION 6.6 AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in Industry Canada RSS-210 section 6.6.

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20\text{LOG}_{10} (D_m/D_s)$$

Note – for frequencies below 30MHz the correction factor is either calculated from measurements at two different distances or the factor is calculated using:

$$F_d = \mathbf{40}\text{LOG}_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Magnetic Emissions, 04-Aug-03
Engineer: alacourse

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Solar Electronics	Loop Antenna	7334-1	377	12	1/30/2003	1/30/2004
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	12	12/27/2002	12/27/2003

Radiated Emissions, 30 - 1000 MHz, 28-July-03
Engineer: alacourse

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Biconical Antenna, 30-300 MHz	3110B	363	24	5/28/2002	5/28/2004
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	12	10/30/2002	10/30/2003
Rohde & Schwarz	Test Receiver, 20-1300MHz	ESVP	273	12	2/13/2003	2/13/2004

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T51273 6 Pages

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EMC Test Data

Client:	Leapfrog	Job Number:	J51237
Model:	Cash Register	T-Log Number:	T51273
		Account Manager:	Rob Holt
Contact:	Jim Cordova		
Emissions Spec:	FCC 15.225	Class:	Radio
Immunity Spec:	-	Environment:	

EMC Test Data

For The

Leapfrog

Model

Cash Register

Date of Last Test: 8/4/2003

Client:	Leapfrog	Job Number:	J51237
Model:	Cash Register	T-Log Number:	T51273
		Account Manager:	Rob Holt
Contact:	Jim Cordova		
Emissions Spec:	FCC 15.225	Class:	Radio
Immunity Spec:	-	Environment:	

EUT INFORMATION

General Description

The EUT is a RF ID reader which is designed to be used in educational toy units. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The EUT operates on a 4.5 VDC.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Leapfrog	Cash Register	RF ID reader	N/A	QDX2025001

EUT Enclosure

The EUT enclosure is primarily constructed of plastic. It measures approximately 33 cm wide by 16.8 cm deep by 19.8 cm

Modification History

Mod. #	Test	Date	Modification
1			

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.

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EMC Test Data

Client:	Leapfrog	Job Number:	J51237
Model:	Cash Register	T-Log Number:	T51273
		Account Manager:	Rob Holt
Contact:	Jim Cordova		
Emissions Spec:	FCC 15.225	Class:	Radio
Immunity Spec:	-	Environment:	

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
None				

EUT Operation During Emissions

Continously transmitting at 13.56 MHz

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EMC Test Data

Client:	Leapfrog	Job Number:	J51237
Model:	Cash Register	T-Log Number:	T51273
		Account Manager:	Rob Holt
Contact:	Jim Cordova		
Spec:	FCC 15.225	Class:	Radio

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 7/28/03 & 8/4/2003 Config. Used: 1
Test Engineer: Adam LaCourse Config Change: None
Test Location: SVOATS #3 & SVOATS #1 EUT Voltage: Battery Operated

Testing above 30MHz was performed on SVOATS #3 on 7/28/03. Testing below 30MHz was performed on SVOATS #1 on 8/4/2003

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

For the fundamental emission below 30 MHz the measurement antenna was located 5 and 10 meters from the EUT as noted. Radiated magnetic field measurements were made with the loop antenna located one meter above the ground plane. The loop was rotated from 0 to 90 degrees to maximized pickup field strength. Harmonics below 30 MHz was performed at 3 meters, readings were extrapolated to the specified distance as stated in 15.209, and measured with a loop antenna. Measurements above 30 MHz were performed at 3 meters per 15.209 and measured with a Biconical or log periodic antenna.

Ambient Conditions:

Temperature: 24.4 °C
Rel. Humidity: 48 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, Fundamental Measurement	15.225	Pass	-44.1dB @ 13.560 MHz
2	RE, Harmonics of Fundamental plus Digital Device	15.209	Pass	-9.2dB @ 474.564MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Leapfrog	Job Number:	J51237
Model:	Cash Register	T-Log Number:	T51273
		Account Manager:	Rob Holt
Contact:	Jim Cordova		
Spec:	FCC 15.225	Class:	Radio

Run #1: Fundamental Field Strength
EUT Loop antenna, Asset #1299, was elevated 1.00 meters from ground plane.

Frequency MHz	Reading dBµV	AF dB	Level dBuV/m	AF dB	Level dBuA/m	Detector	Distance (m)	Comments
13.560	31.2	0.0	**31.2**	-51.5	-20.3	Pk	5.0	Open Loop (device standing)
13.560	23.2	0.0	**23.2**	-51.5	-28.3	Pk	10.0	Open Loop (device standing)

AF: Antenna Factor - factor is included in the measured reading via receiver software.

Data Summary - Extrapolation Factor (Device standing)

Freq (MHz)	Level At Test Distance @5m		@10m	
	dBuV/m	dBuA/m	dBuV/m	dBuA/m
13.56	**31.2**	-20.3	**23.2**	-28.3

Extrapolation Factors For Fundamental Signal
The following extrapolation factors are calculated by dividing the difference between the field strengths at the two distances by the log (base ten) of the ratio of the two distances.

5m to 10m -26.6

The equation used for extrapolation is:

Extrapolation =[(Fm - F) / Log (Dm/Ds)] dB

Where:

Fm = measured field strength in dBuV/m or dBuA/m
Ds is the specification test distance
Dm is the actual measurement distance used

The calculated extrapolation factor of -26.6 dB was used for extrapolating the fundamental signal level from the measurement taken at 10m to a 30m distance. Final measurements were performed with device standing up, since this will be the normal use of the product.

Fundamental Measurement

Freq (MHz)	Level (dBuV/m)	Limit dBuV/m	Margin dB	Comment
13.56	35.9	80.0	-44.1	Fundamental at 30m using extrapolation factor of -26.6 dB per decade of distance (Note 1)

Note 1 : Peak Measurement at 10m was used as the worst case.

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EMC Test Data

Client:	Leapfrog	Job Number:	J51237
Model:	Cash Register	T-Log Number:	T51273
		Account Manager:	Rob Holt
Contact:	Jim Cordova		
Spec:	FCC 15.225	Class:	Radio

Run #2 Radiated Harmonic Emissions, 27-135.6 MHz and Digital Device emissions, 30 - 1000 MHz

FCC Part 15.209 Harmonics

Freq (MHz)	Level (dBuV/m)	Limit dBuV/m	Margin dB	Comment
27.000	7.2	29.5	-22.3	Field strength extrapolated to 30m (Note 1& 3)

Notes:

Note 1: Harmonics were measured at a distance of 10 meters from the EUT. Field strength at 10m was 16.7dBuV/m.
Note 2 : Peak Measurement at 10m was used as the worst case.
Note 3: Extrapolation factor of 20Log(Test Distance/Specification Distance) was used to correct to 30 Meters - more realistic than the 40dB/decade factor allowed in FCC Part 15.

Frequency	Level	Pol	FCC B / 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
474.564	36.8	V	46.0	-9.2	QP	20	1.0	Signal Sub
460.998	35.8	V	46.0	-10.2	QP	231	1.2	
460.998	35.0	H	46.0	-11.0	QP	186	1.0	
81.356	27.3	h	40.0	-12.7	QP	163	4.0	
515.234	30.6	V	46.0	-15.4	QP	40	1.0	
67.800	21.7	v	40.0	-18.3	QP	231	1.0	
54.238	20.7	v	40.0	-19.3	QP	261	1.2	
135.593	22.9	h	43.5	-20.6	QP	174	1.8	
40.675	17.2	v	40.0	-22.8	QP	155	1.0	
54.238	16.2	h	40.0	-23.8	QP	107	1.0	
108.478	18.6	h	43.5	-24.9	QP	360	1.9	
40.675	14.9	h	40.0	-25.1	QP	360	2.6	
122.040	16.8	h	43.5	-26.7	QP	42	1.6	
81.356	11.3	v	40.0	-28.7	QP	234	2.3	
135.593	14.5	v	43.5	-29.0	QP	101	1.4	
108.478	13.4	v	43.5	-30.1	QP	80	2.3	
122.040	11.2	v	43.5	-32.3	QP	54	1.0	

Note 1:	No visible signal, ambient noise at 35.6 dB

EXHIBIT 3: Test Configuration Photographs

2 Pages

EXHIBIT 4: Proposed FCC ID Label & Label Location

These remain unchanged from the original application

EXHIBIT 5: Detailed Photographs of LeapFrog Model Cash RegisterConstruction

The external appearance of the device remains unchanged from that reported for the original application for the device. Internal photographs showing the rf circuit board are included in this application as they are affected by the proposed changes.

1 Page

EXHIBIT 6: Operator's Manual for LeapFrog Model Cash Register

This remains unchanged from the original application

EXHIBIT 7: Block Diagram of LeapFrog Model Cash Register

This remains unchanged from the original application

EXHIBIT 8: Schematic Diagrams for LeapFrog Model Cash Register

Schematics are included in this application as they are affected by the proposed changes.

EXHIBIT 9: Theory of Operation for LeapFrog Model Cash Register

This remains unchanged from the original application