

Testing Tomorrow's Technology

Application for

**US Code Title 47, Part 2, Subpart J, Certification
With**

**Part 15, Subpart C, for Intentional Radiators Section 15.249 Intentional Radiator
Operating within the Band 2400 MHz to 2483.5 MHz.**

For the

Ventriloscope ARX Unit

Manufactured by

Lecat's Ventriloscope, LLC

UST Project: 08-0170

Issue Date: September 9, 2008

3505 Francis Circle Alpharetta, GA 30004

PH: 770-740-0717 Fax: 770-740-1508

www.ustech-lab.com



I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: SA Sawyer

Name: Stephen A. Sawyer

Title: Chief Compliance Engineer

Date: September 9, 2008

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MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: Lecat's Ventriloscope, LLC

MODEL: Ventriloscope ARX Unit

FCC ID: WNT-VENT - R

DATE: September 9, 2008

This report concerns (check one): Original grant X
Class II change _____

Equipment type: **Intentional Radiator Operating within the bands 2400-2483.5 MHz**

Deferred grant requested per 47 CFR 0.457(d) (1) (ii)? yes _____ No X

If yes, defer until: _____
date

N.A. agrees to notify the Commission by N.A.
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

SUMMARY OF TEST REQUIREMENTS

<u>FCC Requirement</u>	<u>Title</u>	<u>Disposition</u>
15.107	Unintentional Radiator Power Line Conducted Emissions	Pass
15.207	Intentional Radiator Power Line Conducted Emissions	N/A
15.109	Unintentional Radiator Radiated Emissions	Pass
15.209	Intentional Radiator Radiated Emissions	Pass
15.249(a)	Fundamental Field Strength	Pass
15.249(d)	Band Edge Measurements	Pass

N/A = Not applicable for this unit.

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Letter of Agency Agreement

1 General Information

1.1 Product Description

The Equipment under Test (EUT) is the receiver Unit of a one-way (half duplex) digital wireless audio transfer system called VentriloScope, a portable 2.4 GHz frequency hopping spread spectrum (FHSS) transceiver system manufactured by Lecat's

Ventriloscope, LLC. The system consists of a transmitting unit called the ATX (Audio Transmitter) having both a ISM band transmitter and receiver and a receiving unit called an ARX (Audio Receiver) having both a ISM band transmitter and receiver. The ATX transmits streaming audio from an embedded MP3 player or other similar device over the air to the ARX unit using the 2.4 GHz to 2.4835 GHz band ISM frequencies. The ARX unit receives the audio and places it into a stethoscope like device for passing heart and bronchial sounds to a medical student. It also transmits ISM band acknowledgements back to the ATX receiver. Twelve (12) individual sounds are transmitted based upon the position of 3 switches. The transmitter can also send sound from a separate audio device attached to it. Finally, the transmitter also allows for an output connector to play the sounds through an amplifier or head phones. The ARX unit also sends acknowledgement packets back to the ATX unit. Both the ATX unit and the ARX unit use the same identical 2.4 GHz wireless audio streamer chip-set, the Nordic Semiconductor nRF24Z1.

1.2 Related Submittal(s)/Grant(s)

The EUT will be used to receive audible data. The transceiver presented in this report will be used with other like transceivers. Both the ATX unit and ARX unit have transmitters and receivers. Though the ATX and ARX are Frequency Hopping Spread Spectrum transceivers, they are not being certified under CFR 15.247 because their pseudorandom hopping routines do not fit the FCC definition of pseudorandom. They are instead being presented under the requirements of CFR 15.249.

The EUT is subject to the following authorizations:

- a) Certification as a transceiver.
- b) Verification as a digital device and receiver.

The ATX unit, FCC ID: WNT-VENTRILOSCOPE, will also gain its distinct certification from the FCC in a parallel process as well as Verification as a digital device with receiver.

The information contained in this report is presented for the certification & verification authorization(s) for the ARX EUT.

2 Tests and Measurements

2.1 Configuration of Tested System

The sample was setup and tested per ANSI C63.4, *Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Frequency Range of 9 kHz to 40 GHz (2003)*. Conducted and radiated emissions data were taken with the EMC test receiver (or spectrum analyzer's) resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. A Block diagram of the tested system is shown in Figure 3. Test configuration photographs for spurious and fundamental emissions are shown in Figures 6 - 9.

2.2 EUT Characterization

The sample used for testing was received by US Tech on June 26, 2008 in good condition.

2.3 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and registered with the FCC under designation number US5117. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 2982A-1.

2.4 Test Equipment

Table 1 describes test equipment used to evaluate this product.

2.5 Modifications to EUT

No modifications were made by US Tech to bring the EUT into compliance with FCC Part 15, Subpart B, Class B Limits for the receiver and digital portion of the EUT or the Subpart C, Transmitter requirements.

2.6 Measurement Standards (CFR 15.31)

Intentional and unintentional radiators are to use the methods of ANSI C63.4 – 2003. Measurements were made on an Open Area Test Site (OATS) wherever possible. For battery powered equipment, new (or fully charged) batteries were used.

2.6 Measurement Standards (CFR 15.31) (Cont'd)

Section 15.31(m) indicates that because the EUT System operates over the 2.4 GHz to 2.4835 GHz ISM band, measurements must be made near the bottom of the band (around 2.405 GHz for example) and in the middle of the band (2.441 GHz) as well as near the top of the band (2.480 GHz).

2.7 Frequency Range of Radiated Measurements (CFR 15.33)

2.7.1 Intentional Radiators

The spectrum was investigated from the lowest RF signal generated without going below 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency (24.835 GHz maximum).

2.7.2 Unintentional Radiators

The spectrum was investigated from the lowest RF signal generated without going below the lowest frequency for which an emissions limit is specified (30 MHz) to the 5th harmonic of the highest fundamental frequency of the digital device (5 GHz maximum).

2.8 Measurement Detector Function and Bandwidth (CFR 15.35)

On any frequency below 1000 MHz, the limits shown are based upon measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths. On frequencies above 1000 MHz, the radiation limits are based upon the use of measuring instrumentation employing an average detector function.

When average detector measurements are specified for use, including emission measurements below 1000 MHz, there is also a corresponding limit for Peak detector measurements having a limit of 20 dB above the corresponding average limit unless a different peak emission limit is specified. Measurements above 1000 MHz utilize a minimum resolution bandwidth of 1 MHz.

When radiated emissions limits are expressed in terms of the average value of the emission and pulsed operation is employed, the measurement field strength is determined by averaging over one complete pulse train (Duty Cycle) including blanking intervals for pulse trains up to 0.1 second in duration. The exact method of calculating the average field strength is included in paragraph 2.10 of this report.

2.9 Antenna Requirement (CFR 15.203)

The intentional radiator is designed to assure that no antenna other than that furnished by the manufacturer is used with the device. The use of a permanently attached antenna is considered sufficient to comply with this requirement. Below is a table of the permanently attached antenna used with this system and its characteristics. If, in the future, additional antennas are contemplated for use, they must be formally evaluated and approved for suitability to these requirements.

Table 1. Ventriloscope ARX Unit Antenna.

Manufacturer	Model Number	Antenna Type	Frequency Range	Peak Gain dB _i	Impedance Ohms
Fractus	FR05-S1-N-0-102	Compact Chip	2.4 – 2.5 GHz	> 1.1	50 Unbalanced

2.10 ARX Duty Cycle Correction Factor

Because the EUT is not transmitting continuously, a duty cycle factor can be derived from measured peak data and applied for recording average data and comparing it to the average limits.

From Figures 1 and 2 below:

There are two pulses of 220 uS each, therefore the Duty Cycle correction factor is:

$$(2 \times 220) \text{ uS} = 440 \text{ uS} \text{ Then, } 20 \log (0.0044) =$$

$$= -47.1 \text{ dB}$$

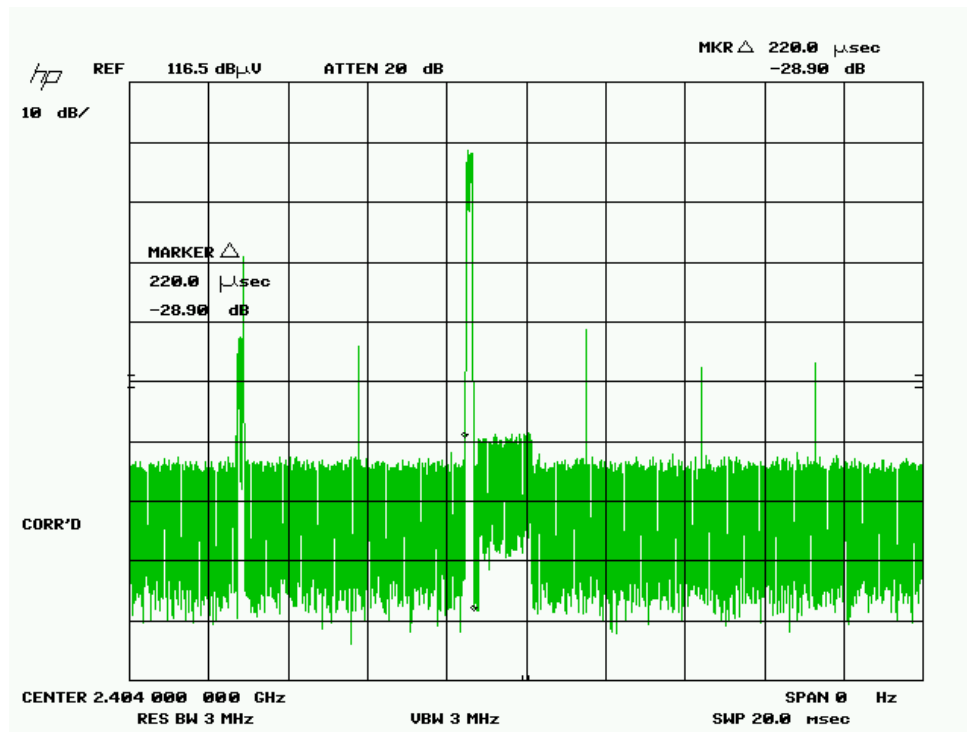


Figure 1(a). ARX Transmitter Pulse Width (Longer Pulses).

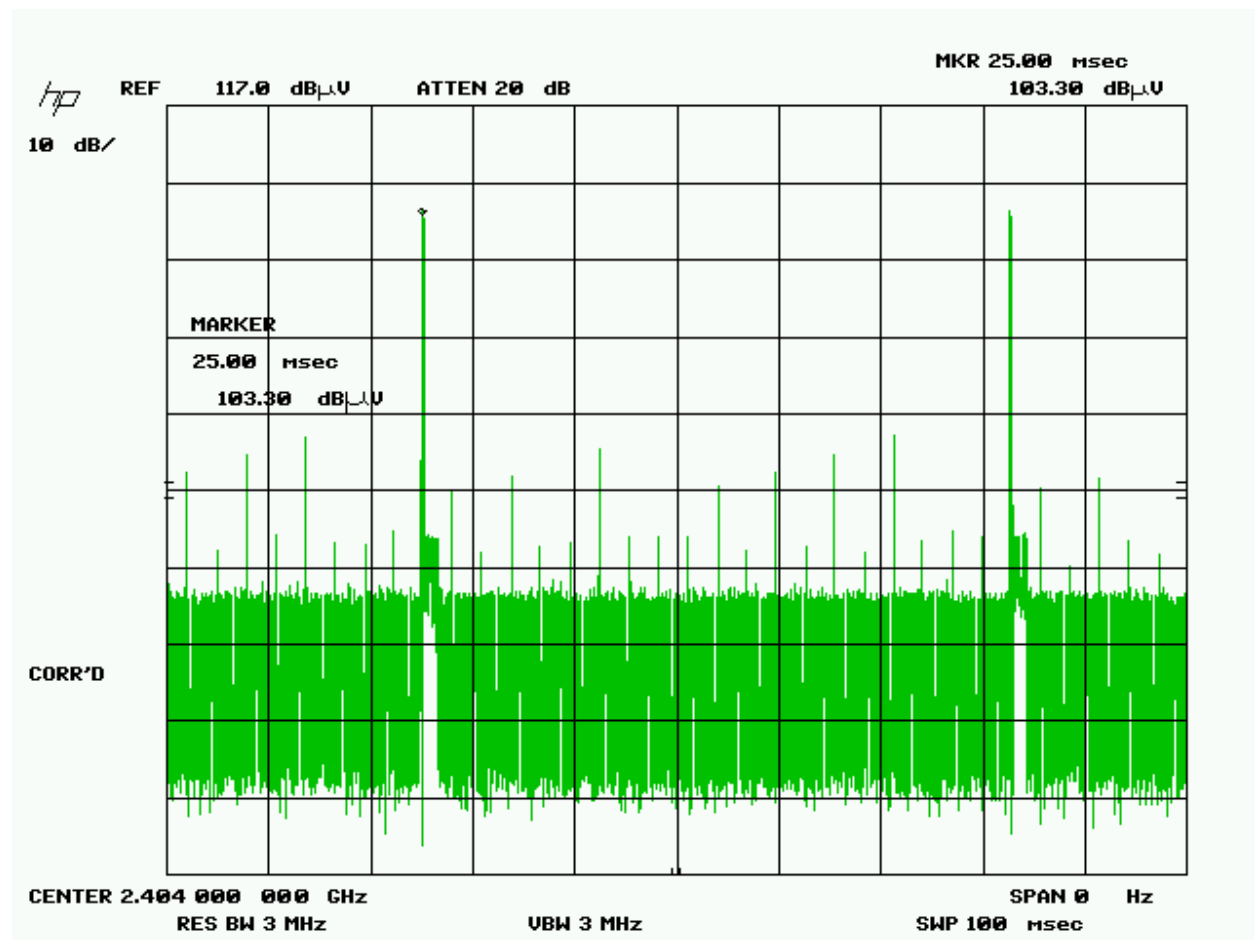


Figure 2. ARX Pulses in 100 mSec period.

2.11 Unintentional Radiator Power Line Conducted Emissions (CFR 15.107)

The ARX unit was set-up and measured for conducted power line emissions. The measurement setup and test procedures were in accordance with ANSI C63.4, paragraph 7. The ARX unit was connected to its power adapter (Motorola model FMP5202A AC power Supply) for measurement. By design, the EUT operating state is such that it is restricted to the battery charge mode only and does not transmit (or receive) while connected to AC power.

Measurements were made over the 150 kHz to 30 MHz frequency range for the ARX unit. The measurement receiver was connected to the RF (receiver) Port on the LISN and each power lead was individually measured. Test results are shown on Tables 2 and 3 for the ARX unit.

Table 2. ARX Power Line (Hot Line) Average Conducted Emissions Data, Class B.

Test Date: July 22, 2008
UST Project: 08-0170
Customer: Lecat's Ventriloscope LLC
Model: Ventriloscope ARX Unit

ARX Average Power Line Conducted Emissions							
Test By: KM	Test: FCC Power Line Conducted Emissions 150 KHz – 30 MHz , Hot Phase			Client: Lecat's Ventriloscope LLC			
	Project: 08-0170	Sect. 15.107 Class: B		Model: Ventriloscope ARX Unit EUT in Charge Mode Only.			
Frequency (MHz)	Test Data (dBuV)	IL+CL -PA (dB)	Results (dBuV)	AVG Limits (dBuV)	Phase /Neutral	Margin (dB)	PK / QP
0.20	46.1	-0.3	45.8	53.8	Phase	8.0	PK
0.389	44.2	0.0	44.2	48.7	Phase	4.5	PK
0.501	42.3	0.0	42.3	46.0	Phase	3.7	PK
1.16	41.6	0.0	41.6	46.0	Phase	4.4	PK
5.21	37.6	0.2	37.8	50.0	Phase	12.2	PK
23.4	34.9	0.5	35.4	50.0	Phase	14.6	PK

Tested from 150 kHz to 30 MHz.

SAMPLE CALCULATIONS: at 0.20 MHz, 46.1 dBuV + (- 0.3) = 45.8 dBuV

Tester

Signature: _____



Name: Keyvan Muvahhed

Table 3. ARX Average Power Line (Neutral) Conducted Emissions Data, Class B

Test Date: July 22, 2008
UST Project: 08-0170
Customer: Lecat's Ventriloscope LLC
Model: Ventriloscope ARX Unit

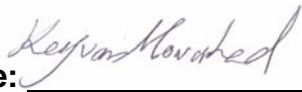
ARX Average Power Line Conducted Emissions							
Test By: KM	Test: FCC Conducted Emissions 150 KHz – 30 MHz, Neutral			Client: Lecat's Ventriloscope LLC			
	Project: 08-0170	Sect. 15.107 Class: B		Model: Ventriloscope ARX Unit			
Frequency (MHz)	Test Data (dBuV)	IL+CL -AMP (dB)	Corrected Results (dBuV)	Avg Limits (dBuV)	Phase	Margin (dB)	PK / QP/ Avg DET
0.155	49.2	-0.1	49.1	54.3	Neutral	5.2	PK
0.365	48.2	-0.1	48.1	48.6	Neutral	0.5	PK
0.502	45.7	-0.0	45.7	46.0	Neutral	0.3	PK
1.15	42.3	0.0	42.3	46.0	Neutral	3.7	PK
5.345	37.3	0.3	37.6	50.0	Neutral	12.4	PK
23.42	35.5	0.5	36.0	50.0	Neutral	14.0	PK

Tested from 150 kHz to 30 MHz.

SAMPLE CALCULATIONS: at 1.15 MHz, 42.3 dBuV + 0.0 dB = 42.3 dBuV

Tester

Signature:



Name: Keyvan Muvahhed

2.12 Intentional Radiator Power Line Conducted Emissions (CFR 15.207)

The EUT power lines were tested for the Receiver and digital mode in paragraph 2.11 above. The transmitter was covered at the same time because when the EUT is connected to the power lines through its battery charger, the EUT is inhibited from transmitting or receiving. It can only charge the battery. Therefore, additional test data is not available.

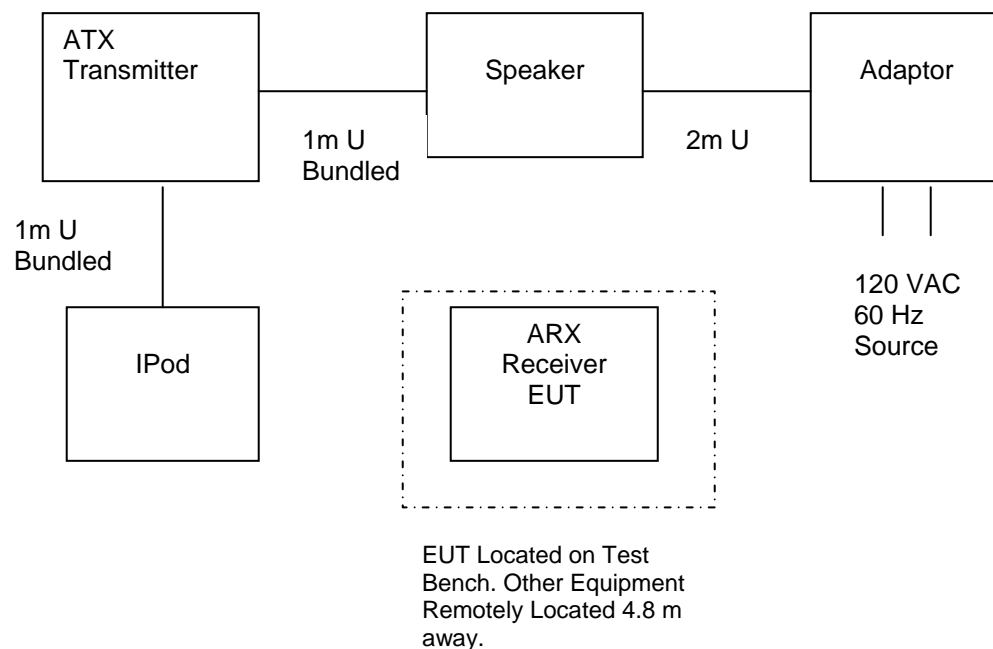


Figure 3. Test Configuration

Table 4. EUT and Peripherals

Test Date: June 27 through July 22, 2008
UST Project: 08-0170
Customer: Lecat's Ventriloscope LLC
Model: Ventriloscope ARX Unit

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
ATX Transmitter Lecat's Ventriloscope LLC	Ventriloscope ATX Unit (Source)	None	WNT-VENTRILOSCOPE	None
ARX Receiver Lecat's Ventriloscope LLC	Ventriloscope ARX Unit (EUT)	None	WNT-VENTRILOSCOPE-R	None
AC Adapter ALTEC Lansing	AL664	None	None	2m U P 120 VAC/ 60 Hz Direct Plug- in
Speaker ALTEC Lansing	None	None	None	1m bundled U
iPod Apple	A1199	YU7063WUVQ5	None	1m bundled U
AC Power Supply Motorola	FMP5202A	None	None	1 m U P 120 VAC, 60 Hz

U = Unshielded; P = Power Leads

Table 5. Test Instruments.

EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	1/15/08
SIGNAL GENERATOR	8648B	HEWLETT-PACKARD	3642U01679	10/30/07
RF PREAMP	8447D	HEWLETT-PACKARD	2944A06291	10/30/07
BICONICAL ANTENNA	3110B	EMCO	9307-1431	11/15/07
LOG PERIODIC	3146	EMCO	9110-3236	11/21/07
LISN (x 2) 9247-50-TS-50-N	9247	SOLAR ELE.	955824 & 955825	4/2/08
HORN ANTENNA	3115	EMCO	9107-3723	10/16/06 2 Yr.
MICROWAVE PREAMP	8449B	HEWLETT PACKARD	3008A00480	8/21/07
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

Note: The calibration interval of the above test instruments is 12 months unless stated otherwise, and all calibrations are traceable to NIST/USA.

2.13 Unintentional Radiator Radiated Emissions (CFR 15.109)

Radiated emissions within the band 30 MHz to 25 GHz were measured with a spectrum analyzer via a pre-amplifier by connecting the spectrum analyzer to a receiving antenna spaced three (3) meters from the EUT. The spectrum analyzer was set for a 50 Ω input impedance with the VBW set to \geq the RBW bandwidth. The antenna was raised and lowered over a span of 4 meters in order to maximize the signal coming from the EUT. Similarly, the turntable was rotated through 360 degrees in the same maximizing effort. Also the EUT was scanned for a maxima when placed in each of the three mutually exclusive orthogonal planes. The results of the measurements are given in Tables 6 and 7 and Figures 3 and 6 through 9.

2.14 Intentional Radiator Radiated Emissions (CFR 15.249(a), (e))

The EUT frequency hopping was stopped and it was placed into a continuous transmit mode of operation. A preliminary scan was performed on the EUT to find signal frequencies that were caused by the ARX transmitter part of the product. Radiated measurements below 1 GHz were tested with a RBW = 120 kHz. Radiated measurements above 1 GHz were measured using a RBW = VBW = 1 MHz. Test data are found in Tables 8 and 9.

Table 6. Unintentional Radiator Peak Radiated Emissions (CFR 15.109).

Peak ARX Radiated Emissions, Digital Device and Receiver							
KM	Test By: Test: Radiated Emissions- 30 MHz to 25 GHz			Client: Lecat's Ventriloscope LLC			
	Project: 08-0119	Requirement 15.109, Class: B		Model: Ventriloscope ARX Unit Non modulated transmit mode			
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB)	Results (dBuV/m)	Peak Limits (dBuV/m)	Distance / Polarity (meters)	Margin (dB)	Detector PK / QP
240	17	15.2	32.2	46	3/Horiz	13.8	PK
293	11.0	17.7	28.7	46	3/Vert	17.3	PK
300	9.0	18.5	27.5	46	3/Vert	18.5	PK
316	11.8	18.1	29.9	46	3/Vert	16.1	PK
338	9.0	17.8	26.8	46	3/Vert	19.2	PK
2895	55.2	-2.4	52.8	74	3/Vert	21.2	PK

Tested from 30 MHz to 25 GHz.
Data corrected by 1.0 dB for loss of high pass filter.

SAMPLE CALCULATION:
RESULTS at 2895 MHz, = 55.2 dBuV + (-2.4) dB/m = 52.8 dBuV/m

Test Date: July 8, 2008

Tester

Signature: _____

Name: Keyvan Muvahhed


Table 7. Unintentional Radiator ARX Average Radiated Emissions (CFR 15.109)

Average ARX Radiated Emissions, Digital Device and Receiver							
Test By: KM	Test: Radiated Emissions- 30 MHz to 25 GHz			Client: Lecat's Ventriloscope LLC			
	Project: 08-0170	Requirement CFR 15.109		Model: Ventriloscope ARX Unit Non modulated transmit mode			
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA-DC (dB)	Results (dBuV/m)	Limits AVG (dBuV/m)	Distance / Polarity (meters)	Margin (dB)	Detector PK / QP
2895	55.2	-2.4	52.8	54	3/Vert	1.2	PK

Tested from 30 MHz to 25 GHz
 Data corrected by 1.0 dB for loss of high pass filter.

SAMPLE CALCULATION:
 RESULTS = 55.2 dBuV – 37.7dB/m = 17.5 dBuV/m @ 3m

Test Date: July 8, 2008

Tester
 Signature:  _____

Name: Keyvan Muvahhed

Table 8. Peak Fundamental and Harmonics, ARX (CFR15.249 (a))

ARX Radiated Fundamental and Harmonics Emissions							
Test By: DA	Test: Fundamental and Harmonics- above 1 GHz CFR 15.249 (a)			Client: Lecat's Ventriloscope LLC			
	Project: 08-0170	Class:		Model: Ventriloscope ARX Unit			
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Peak Limits (dBuV/m)	Distance / Polarity (Meters)	Margin (dB)	Det PK / QP
LOW BAND							
2404.12	105.5	-6.2	99.3	114.0	3m./HORZ	14.7	PK
4807.13	62.8	1.9	64.7	74.0	3m./HORZ	9.7	PK
7208.6	42.0	6.8	39.3**	74.0	1m./HORZ	34.7	PK
9613.64	44.5	10.8	45.8**	74.0	1m./HORZ	28.2	PK
12020.0	44.1	15.7	50.3**	74.0	1m./HORZ	23.7	PK
MID BAND							
2441.3	105.6	-6.1	99.5	114.0	3m./HORZ	14.5	PK
4880.89	61.3	2.2	63.5	74.0	3m./VERT	10.5	PK
7321.36	42.4	7.2	40.1**	74.0	1m./HORZ	33.9	PK
9761.64	44.7	11.0	46.2**	74.0	1m./VERT	27.8	PK
12202.28	44.0	16.0	50.5**	74.0	1m./HORZ	23.5	PK
HIGH BAND							
2477.3	103.5	-6.0	97.5	114.0	3m./VERT	16.5	PK
4954.92	59.8	2.5	62.3	74.0	3m./HORZ	11.7	PK
7434.0	42.5	7.6	40.6**	74.0	1m./HORZ	33.4	PK
9909.6	47.4	11.3	49.2**	74.0	1m./HORZ	24.8	PK
12390.16	44.5	16.3	51.3**	74.0	1m./HORZ	22.7	PK

Tested from 2 GHz to 25 GHz.

Data corrected by 1.0 dB for loss of high pass filter, except for fundamental

** Conversion from 1 meter distance to 3 meters = - 9.5 dB

SAMPLE CALCULATION:

RESULTS: At 7208.6 MHz, = 42.0 dBuV+6.8 dB/m -9.5 dB = 39.3 dBuV/m @ 3m

Test Date: September 4, 2008

Tester *Daniel Aparaschivei*
Signature: _____

Name: Daniel Aparaschivei

Table 9. Average Radiated Fundamental and Harmonics Emissions, ARX, (CFR 15.35(b), 15.249(a))

Average ARX Radiated Fundamental and Harmonics Emissions							
Test By: D.A.	Test: Fundamental and Harmonics- Above 1 GHz to 25 GHz			Client: Lecat's Ventriloscope LLC			
	Project: 08-0170	Average		Model: Ventriloscope ARX Unit			
Frequency MHz	Test Data dBuV	AF+CL-PA-DC dB/m	Corrected Results dBuV/m	AVG Limits dBuV/m	Distance/ Polarization	Margin dB	PK / QP /AVG
LOW BAND							
2404.12	98.5	-40.9	57.6	94	3m./HORZ	36.4	PK
4807.13	60.5	-33.0	27.5	54	3m./HORZ	26.5	PK
7208.6	47.6	-28.2	19.4	54	3m./HORZ	34.6	PK
9613.64	47.0	-24.9	22.1	54	3m./HORZ	31.9	PK
12020.0	45.8	-31.4	14.4	54	3m./HORZ	39.6	PK
MID BAND							
2441.3	94.5	-40.9	53.6	94	3m./HORZ	40.4	PK
4880.89	61.1	-32.6	28.5	54	3m./VERT	25.5	PK
7321.36	48.0	-27.8	20.2	54	3m./HORZ	33.8	PK
9761.64	46.8	-24.1	22.7	54	3m./VERT	31.3	PK
12202.28	44.0	-31.1	12.9	54	3m./VERT	41.1	PK
HIGH BAND							
2477.31	95.0	-40.9	54.1	94	3m./VERT	39.9	PK
4954.92	58.1	-32.4	25.7	54	3m./HORZ	28.3	PK
7434.00	50.2	-27.4	22.8	54	3m./HORZ	31.2	PK
9909.6	48.4	-23.9	24.5	54	3m./HORZ	29.5	PK
12390.16	44.5	-30.8	13.7	54	3m./HORZ	40.3	PK

Data corrected by 1.0 dB for loss of high pass filter, except for fundamental

Duty Cycle, DC = -47.1 dB

SAMPLE CALCULATION: at 2404.12 MHz, = 98.5 dBuV– 40.9 dB/m = 57.9 dBuV/m @ 3m

Tester

Signature:

Daniel Aparaschivei

Name: Daniel Aparaschivei

2.15 Band Edge Measurements (CFR15.249 (d))

Band Edge measurements were made at a Low Channel and High Channel peak for the highest EUT related emission outside the upper and lower occupied band edges. A measurement was made of the fundamental and the emission was measured using a peak setting. A Resolution Bandwidth of $> 1\%$ of the emission bandwidth was used. This procedure was repeated for the other channel.

The limits were derived as follows:

2.15.1 High Band Edge

Above 2483.5 MHz the limit per section 15.249(d) is 50 db below the fundamental or the value expressed by CFR 15.209 (54 dBuV/m) whichever requires the lesser attenuation.

The High Channel fundamental recorded in Table 9 is 65.8 dBuV/m.

$65.8 \text{ dBuV/m} - 50 \text{ dB} = 15.8 \text{ dBuV/m}$ which is lower than the 54 dBuV/m limit of CFR 15.209, therefore the limit of 15.209 prevails.

2.15.2 Low Band Edge

The low channel fundamental recorded in Table 9 is 69.4 dBuV/m

$69.4 \text{ dBuV/m} - 50 \text{ dB} = 19.4 \text{ dBuV/m}$ which is lower than the 54 dBuV/m limit of CFR 15.209, therefore the limit of 15.209 prevails.

There are no non-harmonic ARX transmitter emissions outside of the specified frequency band up to 24,835 MHz or down to 30 MHz that are within 20 dB of the 15.209 limit.