Radio Test Report
Class II Permissive Change/Re-Assessment

FCC Part 90 and RSS 119
450 MHz to 512 MHz)

Model: LCT450

COMPANY:	GE MDS LLC 175 Science Parkway Rochester, NY 14620
TEST SITE(S):	Elliott Laboratories 41039 Boyce Road. Fremont, CA. 94538-2435
REPORT DATE:	September 23, 2011
FINAL TEST DATES:	August 22, 23, 31, September 1 and 21, 2011
TOTAL NUMBER OF PAGES:	45

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A2LA ACCREDITED
Testing Cert #2016.01

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	09-22-2011	First release	

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SCOPE

Tests have been performed on the GE MDS LLC model LCT450, pursuant to the relevant requirements of the following standard(s) in order to obtain device certification against the regulatory requirements of the Federal Communications Commission and Industry Canada.

- Code of Federal Regulations (CFR) Title 47 Part 2
- Industry Canada RSS-Gen Issue 3
- CFR 47 Part 90 (Private Land Mobile Radio Service)
- RSS-119, Issue 10, April 2010 (Land Mobile and Fixed Radio Transmitters and Receivers Operating the Frequency Range 27.41 to 960 MHz)

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in Elliott Laboratories test procedures:

ANSI C63.4:2003
ANSI TIA-603-C August 17, 2004

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

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 GE MDS LLC model LCT450 and therefore apply only to the tested sample. The sample was selected and prepared by Dennis McCarthy of GE MDS LLC.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, the device requires certification. Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's 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.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of GE MDS LLC model LCT450 complied with the requirements of the standards and frequency bands declared in the scope of this test report.

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS

FCC Part 90 and RSS119

FCC	Canada	Description	Measured	Limit	Result
Transmitter Modulation, output power and other characteristics					
§2.1033 (c) (5)		Frequency range(s)	450-512 MHz	450-512 MHz	Pass
	RSP 100 7.2 (a) RSS 119	Frequency range(s)	450-470 MHz	450-470 MHz	Pass
§2.1033 (c) (6) §2.1033 (c) (7) §2.1046 § 90.279 § 90.205(g)		RF power output at the antenna terminals	30.0 dBm to 44.5 dBm	47 dBm	Pass
	RSP 100 7.2 (a) RSS 119 SRSP 501	RF power output (ERP)	36.8 dBm to 51 dBm	51 dBm (ERP)	Pass
§2.1033 (c) (4) §2.1047 § 90.207	RSP 100 7.2 (b) (iii) RSS 119	Emission types	FSK (F1D, F2D, F3D)	Any type	Pass
		Emission mask	Refer to Plots	C, D and E	Pass
	RSS GEN 4.4.1 RSS 119	99% Bandwidth	10.4 kHz 6.3 kHz 3.9 kHz	20 kHz 11.25 kHz 6 kHz	Pass
§2.1049 § 90.209		Occupied Bandwidth	10.4 kHz 6.3 kHz 3.9 kHz	20 kHz 11.25 kHz 6 kHz	Pass
Transmitter spurious emissions					
§2.1051 §2.1057 §90.210	RSS-119 4.2	At the antenna terminals (Mask E limit)[2]	-23.6 dBm	-65dBc or -25dBm	Pass
§2.1053 §2.1057 §90.210	RSS-119 4.2	Field strength (Mask E limit)[1]	-26.6 dBm (ERP)	-65 dBc or -25 dBm	Pass
Receiver spurious emissions					
15.109	RSS GEN 7.2.3 Table 1	Field strength	40.3 dBuV/m	See limit table on page 18	Pass
Other details					
§2.1055 §90.213	RSS 119 5.3	Frequency stability	0.34 ppm	0.5 ppm for base stations with 6.25 kHz spacing	Pass
§90.214	RSS 119 5.9	Transient Frequency Behavior	Same as original filing	Refer to standard	Pass
§2.1093	RS 102	RF Exposure	-	Considered at Licensing	Pass
§2.1033 (c) (8)	RSP 100 7.2 (a)	Final radio frequency amplifying circuit's dc voltages and currents for normal operation over the power range	Same as original filing	-	-
-	-	Antenna Gain	9 dBi	-	-

Notes

1. Spurious emissions performed at maximum power and complied with the –25dBm or -65dBc Mask E limit.

MEASUREMENT UNCERTAINTIES

ISO/IEC 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 (based on a coverage factor (k=2) and were calculated in accordance with NAMAS document NIS 81 and M3003.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF frequency	Hz	25 to 7,000 MHz	1.7×10^{-7}
RF power, conducted	dBm	25 to 7,000 MHz	± 0.52 dB
Conducted emission of transmitter	dBm	25 to 40,000 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 40,000 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 40,000 MHz	± 2.5 dB
Radiated emission (field strength)	dBμV/m	25 to 1,000 MHz 1 to 40 GHz	± 3.6 dB ± 6.0 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The GE MDS LLC model LCT450 is a narrowband wireless transceiver which is designed to transmit and receive data in the 450 to 512 MHz band. Normally, the EUT would be placed on a tabletop or in a rack during operation. The EUT was, therefore, placed on a table during emissions testing to simulate the end user environment. The electrical rating of the EUT is 13.8vdc, 9 Amps.

The sample was received on August 22, 2011 and tested on August 22, 23, 31, September 1 and 21, 2011. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
GE MDS LLC	LCT450	Digital UHF Radio	Not serialized	E5MDS-LCT450

OTHER EUT DETAILS

The EUT can be used with antennas up to 9 dBi.

ENCLOSURE

The EUT enclosure is primarily constructed of die cast metal. It measures approximately 15.0cm wide by 17.0cm deep by 5.0cm high.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at Elliott.

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Power Designs Inc.	6150D	Power Supply	-	-

No remote support equipment was used during testing.

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Antenna	50 ohm Termination	-	-	-
Data Interface	Unterminated	DB25	Shielded	2
DC Power	13.8V DC Source	2 wire	Unshielded	2

Note: The console port was not connected during testing except to configure the radio. GE MDS LLC stated that this port is for configuration purposes and therefore would not normally be connected.

EUT OPERATION

During emissions testing the EUT was set to continuous transmit mode either unmodulated or modulated as required for testing.

TESTING

GENERAL INFORMATION

Antenna port measurements were taken at the Elliott Laboratories test site located at 41039 Boyce Road, Fremont, CA 94538-2435.

Radiated spurious emissions measurements were taken at the Elliott Laboratories Anechoic Chambers and/or Open Area Test Site(s) listed below. The sites conform to the requirements of ANSI C63.4: 2003 *American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz* and CISPR 16-1-4:2007 - *Specification for radio disturbance and immunity measuring apparatus and methods Part 1-4: Radio disturbance and immunity measuring apparatus Ancillary equipment Radiated disturbances*. They are on file with the FCC and industry Canada.

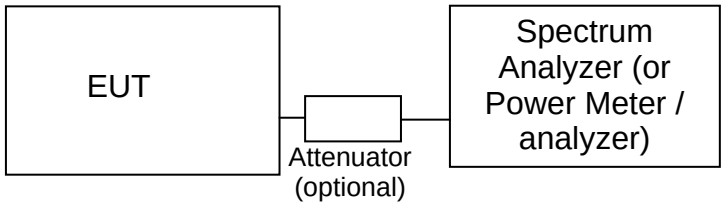
Site	Registration Numbers		Location
	FCC	Canada	
Chamber 3	769238	IC 2845B-3	41039 Boyce Road Fremont, CA 94538-2435
Chamber 5	211948	IC 2845B-5	

In the case of Open Area Test Sites, ambient levels are at least 6 dB below the specification limits with the exception of predictable local TV, radio, and mobile communications traffic.

Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements.

RF PORT MEASUREMENT PROCEDURES

Conducted measurements are performed with the EUT's rf input/output connected to the input of a spectrum analyzer, power meter or modulation analyzer. When required an attenuator, filter and/or dc block is placed between the EUT and the spectrum analyzer to avoid overloading the front end of the measurement device. Measurements are corrected for the insertion loss of the attenuators and cables inserted between the rf port of the EUT and the measurement equipment.



Test Configuration for Antenna Port Measurements

For devices with an integral antenna the output power and spurious emissions are measured as a field strength at a test distance of (typically) 3m and then converted to an eirp using a substitution measurement (refer to RADIATED EMISSIONS MEASUREMENTS). All other measurements are made as detailed below but with the test equipment connected to a measurement antenna directed at the EUT.

OUTPUT POWER

Output power is measured using a power meter and an average sensor head, a spectrum analyzer or a power meter and peak power sensor head as required by the relevant rule part(s). Where necessary measurements are gated to ensure power is only measured over periods that the device is transmitting.

Power measurements made directly on the rf power port are, when appropriate, converted to an EIRP by adding the gain of the highest gain antenna that can be used with the device under test, as specified by the manufacturer.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN. The measurement bandwidth is set to be at least 1% of the instrument's frequency span.

CONDUCTED SPURIOUS EMISSIONS

Initial scans are made using a peak detector (RBW=VBW) and using scan rates to ensure that the EUT transmits before the sweep moves out of each resolution bandwidth (for transmit mode measurements). Where the limits are expressed as an average power the spectrum analyzer is tunes to that frequency with a narrow span (wide enough to capture the emission and its sidebands) and the resolution and video bandwidths are adjusted as required by the reference measurement standards. For transmitter measurements the appropriate detector (average, peak, normal ,sample, quasi-peak) is used when making measurements for licensed devices. For receiver conducted spurious measurements the detector is set to peak.

TRANSMITTER MASK MEASUREMENTS

The transmitter mask measurements are made using resolution bandwidths as specified in the pertinent rule part(s). Where narrower bandwidths are used the measurement is corrected to account for the reduced bandwidth by either using the adjacent channel power function of the spectrum analyzer to sum the power across the required measurement bandwidth. The frequency span of the analyzer is set to ensure the fundamental signal and all significant sidebands are displayed.

The top of the mask may be set by the total output power of the signal, the power of the unmodulated signal or the peak value of the signal in the reference bandwidth being used for the mask measurement.

FREQUENCY STABILITY

The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The temperature is varied across the specified frequency range in 10 degree increments with frequency measurements made at each temperature step. The EUT is allowed enough time to stabilize at each temperature variation.

The spectrum analyzer is configured to give a 5- or 6-digit display for the marker-frequency function. The spectrum analyzer's built-in frequency counter is used to measure the maximum deviation of the fundamental frequency at each temperature. Where possible the device is set to transmit an unmodulated signal. Where this is not possible the frequency drift is determined by finding a stable point on the signal (e.g. the null at the centre of an OFDM signal) or by calculating a centre frequency based on the upper and lower XdB points (where X is typically 6dB or 10dB) on the signal's skirts.

TRANSIENT FREQUENCY BEHAVIOR:

The TIA/EIA 603 procedure is used to determine compliance with transient frequency timing requirements as the radio is keyed on and off.

The EUTs rf output is connected via a combiner/splitter to the test receiver/spectrum analyzer and to a diode detector. The test receiver or spectrum analyzer video output is connected to an oscilloscope, which is triggered by the output from the diode detector.

Plots showing Ton, T1, and T2 are made when turning on the transmitter and showing T3 when turning off the transmitter.

RADIATED EMISSIONS MEASUREMENTS

Receiver radiated spurious emissions measurements are made in accordance with ANSI ANSI C63.4:2003 by measuring the field strength of the emissions from the device at a specific test distance and comparing them to a field strength limit. Where the field strength limit is specified at a longer distance than the measurement distance the measurement is extrapolated to the limit distance.

Transmitter radiated spurious emissions are initially measured as a field strength. The eirp or erp limit as specified in the relevant rule part(s) is converted to a field strength at the test distance and the emissions from the EUT are then compared to that limit. Emissions within 20dB of this limit are the subjected to a substitution measurement.

All radiated emissions measurements are performed in two phases. A preliminary scan of emissions is conducted in either an anechoic chamber or on an OATS during which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed across the complete frequency range of interest and at each operating frequency identified in the reference standard. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. Initial scans are made using a peak detector (RBW=VBW) and using scan rates to ensure that the EUT transmits before the sweep moves out of each resolution bandwidth (for transmit mode).

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. For transmitter spurious emissions, where the limit is expressed as an effective radiated power, the eirp or erp is converted to a field strength limit.

Final measurements are made on an OATS or in a semi-anechoic chamber at the significant frequencies observed during the preliminary scan(s) using the same process of rotating the EUT and raising/lowering the measurement antenna to find the highest level of the emission. The field strength is recorded and, for receiver spurious emissions, compared to the field strength limit. For the final measurement the appropriate detectors (average, peak, normal, sample, quasi-peak) are used. For receiver measurements below 1GHz the detector is a Quasi-Peak detector, above 1GHz a peak detector is used and the peak value (RB=VB=1MHz) and average value (RB=1MHz, VB=10Hz) are recorded.

For transmitter spurious emissions, the radiated power of all emissions within 20dB of the calculated field strength limit are determined using a substitution measurement. The substitution measurement is made by replacing the EUT with an antenna of known gain (typically a dipole antenna or a double-ridged horn antenna), connected to a signal source. The output power of the signal generator is adjusted until the maximum field strength from the substitution antenna is similar to the field strength recorded from the EUT. The erp of the EUT is then calculated.

INSTRUMENTATION

An EMI receiver as specified in CISPR 16-1-1 is used for radiated emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 7000 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.

For measurements above the frequency range of the receivers and for all conducted measurements a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis.

Measurement bandwidths for the test instruments are set in accordance with the requirements of the standards referenced in this document.

Software control is used to correct the measurements for transducer factors (e.g. antenna) and the insertion loss of cables, attenuators and other series elements to obtain the final measurement value. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are exported in a graphic and/or tabular format, as appropriate.

FILTERS/ATTENUATORS

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

ANTENNAS

A combination of biconical, log periodic or bi-log antennas are used to cover the range from 30 MHz to 1000 MHz. Broadband antennas or tuned dipole antennas are used over the entire 25 to 1000 MHz frequency range as the reference antenna for substitution measurements.

Above 1000 MHz, a dual-ridge guide horn antenna or octave horn antenna are used as reference and measurement antennas.

The antenna calibration factors are included in site factors that are programmed into the test receivers and instrument control software when measuring the radiated field strength.

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.

Table mounted devices are placed on a non-conductive table at a height of 80 centimeters above the floor. Floor mounted equipment is 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. The EUT is positioned on a motorized turntable to allow it to be rotated during testing to determine the angel with the highest level of emissions.

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS - CONDUCTED SPURIOUS EMISSIONS

Measurements are compared directly to the conducted emissions specification limit (decibel form). The calculation is as follows:

$$R_r - S = M$$

where:

R_r = Measured value in dBm
S = Specification Limit in dBm
M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS –RADIATED FIELD STRENGTH

Measurements of radiated field strength are compared directly to the specification limit (decibel form). The receiver and/or control software 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 is sued when measurements are made at a test distance that is different to the specified limit distance by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB
D_m = Measurement Distance in meters
D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

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

SAMPLE CALCULATIONS –RADIATED POWER

The erp/eirp limits for transmitter spurious measurements are converted to a field strength in free space using the following formula:

$$E = \frac{\sqrt{30\ P\ G}}{d}$$

where:

E = Field Strength in V/m
P = Power in Watts
G = Gain of isotropic antenna (numeric gain) = 1
D = measurement distance in meters

The field strength limit is then converted to decibel form (dBuV/m) and the margin of a given emission peak relative to the limit is calculated (refer to *SAMPLE CALCULATIONS –RADIATED FIELD STRENGTH*).

When substitution measurements are required (all signals with less than 20dB of margin relative to the calculated field strength limit) the eirp of the spurious emission is calculated using:

$$P_{EUT} = P_S - (E_S - E_{EUT})$$

and

$$P_S = G + P_{in}$$

where:

P_S = effective isotropic radiated power of the substitution antenna (dBm)
P_{in} = power input to the substitution antenna (dBm)
G = gain of the substitution antenna (dBi)
E_S = field strength the substitution antenna (dBm) at eirp P_S
E_{EUT} = field strength measured from the EUT

Where necessary the effective isotropic radiated power is converted to effective radiated power by subtracting the gain of a dipole (2.2dBi) from the eirp value.

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

Appendix A Test Equipment Calibration Data

Radio Antenna Port (Power and Spurious Emissions), 22, 23-Aug-11

Manufacturer	Description	Model	Asset #	Cal Due
Agilent	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	1/26/2012

Radiated Emissions, 30 - 5,120 MHz, 31-Aug-11

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/6/2012
Rohde & Schwarz	Power Meter, Dual Channel	NRVD	1071	5/26/2012
Rohde & Schwarz	Power Sensor 100 uW - 2 Watts (w/ 20 dB pad, SN BJ5155)	NRV-Z32	1536	9/13/2011
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/22/2012
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	4/13/2012
Anritsu	Anritsu 68347C Signal Generator, 10MHz-20GHz	68347C	1785	11/22/2011
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	2197	12/29/2011
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	2237	7/14/2012

Radiated Emissions, 30 - 1,536 MHz, 01-Sep-11

Manufacturer	Description	Model	Asset #	Cal Due
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1657	5/28/2012
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	4/6/2012
Com-Power Corp.	Preamplifier, 30-1000 MHz	PA-103A	2359	2/15/2012

Radio Antenna Port (Mask & Bandwidth), 21-Sep-11

Manufacturer	Description	Model	Asset #	Cal Due
Agilent	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	1/26/2012

Appendix B Test Data

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Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		-
Emissions Standard(s):	FCC Part 90	Class:	-
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

GE MDS LLC

Model

LCT450

Date of Last Test: 9/21/2011

Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

RSS 119 and FCC Part 90

Power, Mask, Occupied Bandwidth and Spurious Emissions

Test Specific Details

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

General Test Configuration

With the exception of the radiated spurious emissions tests, all measurements are made with the EUT's rf port connected to the measurement instrument via an attenuator or dc-block if necessary. All amplitude measurements are adjusted to account for the attenuation between EUT and measuring instrument. For frequency stability measurements the EUT was place inside an environmental chamber.

Radiated measurements are made with the EUT located on a non-conductive table, 3m from the measurement antenna.

Ambient Conditions:

Temperature: 23 °C

Rel. Humidity: 38 %

Summary of Results

Run #	Spacing	Test Performed	Limit	Pass / Fail	Result / Margin
1	12.5 kHz	Output Power	50 Watts	Pass	29.5 Watts
2	6.25, 12.5 & 25 kHz	Spectral Mask	Within Mask	Pass	Within Mask
3	6.25 kHz 12.5 kHz 25 kHz	99% or Occupied Bandwidth	6.0 kHz 11.25 kHz 20.0 kHz	Pass	3.9 kHz 6.3 kHz 10.4 kHz
4	25 kHz	Spurious Emissions (conducted)	-25dBm or 65 dBc	Pass	-23.6 dBm @ 1024.12 MHz (-2.9 dB)
5	25 kHz	Spurious emissions (radiated)	-25dBm	Pass	-26.6 dBm @ 1883 MHz (-1.6dB)
6	25 kHz	Radiated emissions (Rx)	RSS-119	Pass	40.3dBµV/m @ 237.23MHz (-5.7dB)

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:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Run #1: Output Power

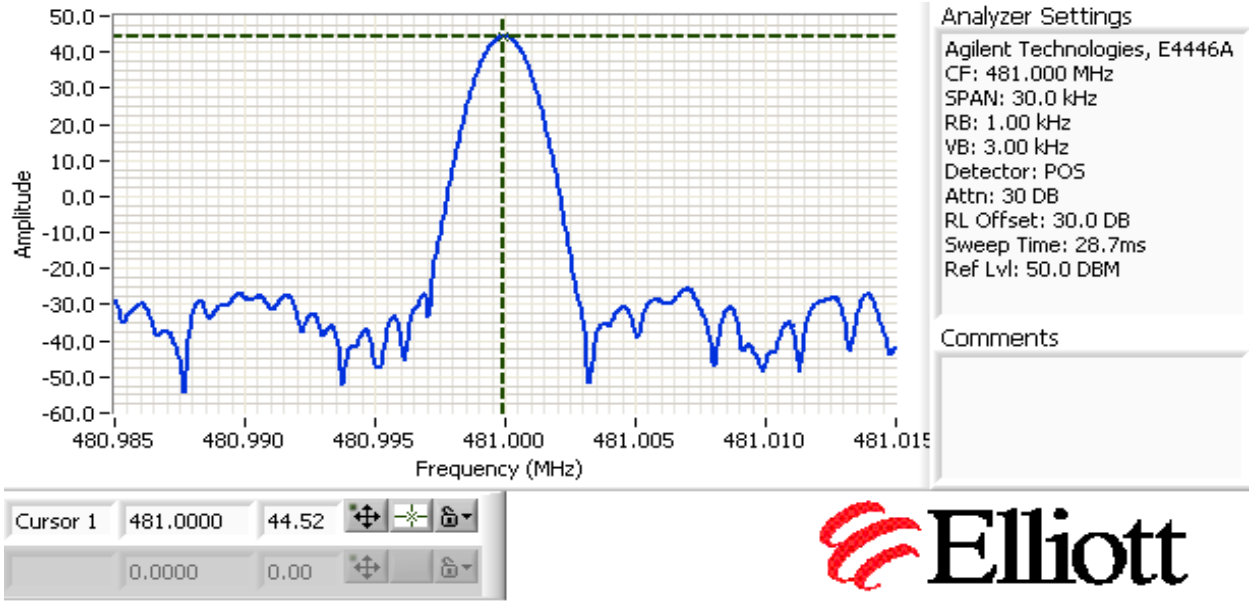
Date: 8/23/2011 Engineer: David Bare Location: Fremont EMC Lab #4

Cable Loss: 0.2 dB Attenuator: 30.0 dB Total Loss: 30.2 dB

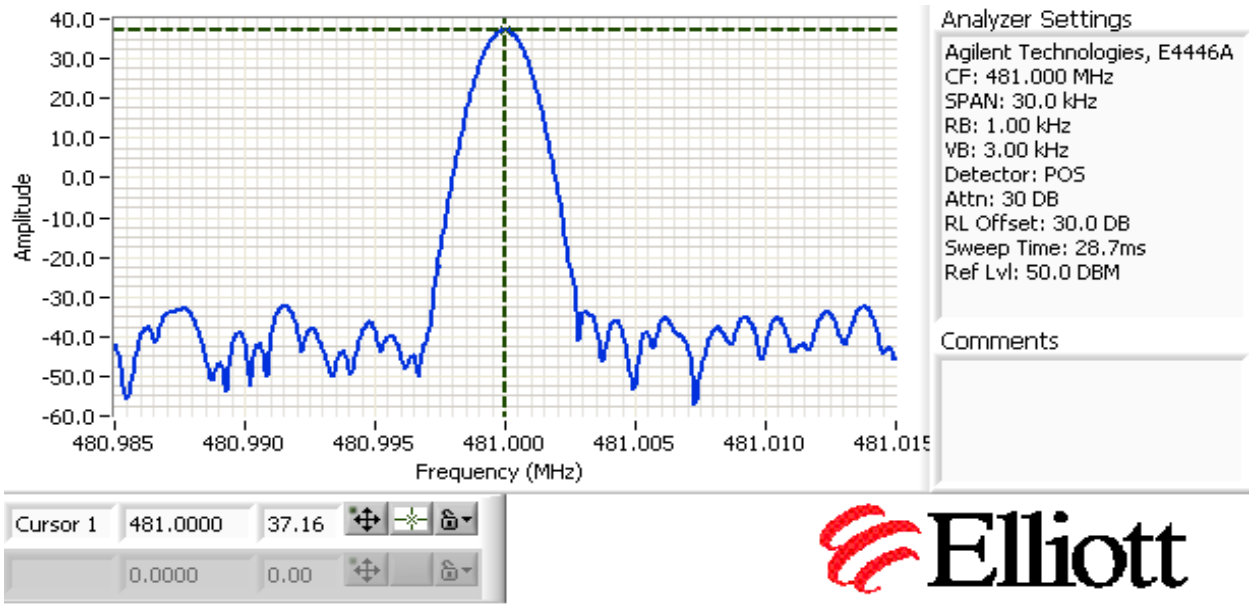
Cable ID(s): EL 439 Attenuator IDs: 1878 & 2101

Power Setting[2]	Frequency (MHz)	Output Power (dBm) [1]	Output Power mW	Antenna Gain (dBi)	Result	EIRP dBm	EIRP W
5	450	37.0	5011.9	9.0	Pass	46.0	39.811
5	481	37.2	5248.1	9.0	Pass	46.2	41.687
5	512	36.9	4897.8	9.0	Pass	45.9	38.905
30	450	44.1	25704.0	9.0	Pass	53.1	204.174
30	481	44.5	28183.8	9.0	Pass	53.5	223.872
30	512	44.3	26915.3	9.0	Pass	53.3	213.796

Note 1:	Output power measured using a spectrum analyzer (see plot below for highest) with RBW=1 kHz, VB= 3kHz, peak detector
Note 2:	Power setting - the software power setting used during testing, included for reference only.



Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

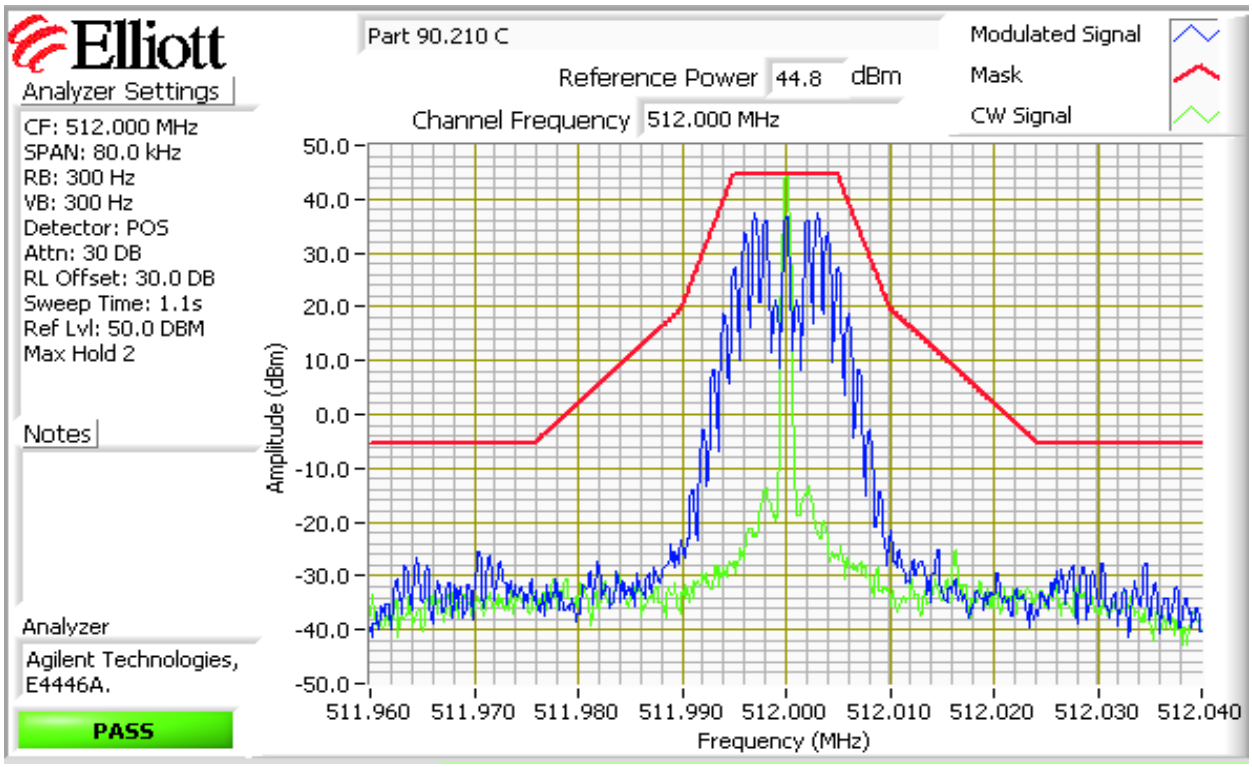


Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

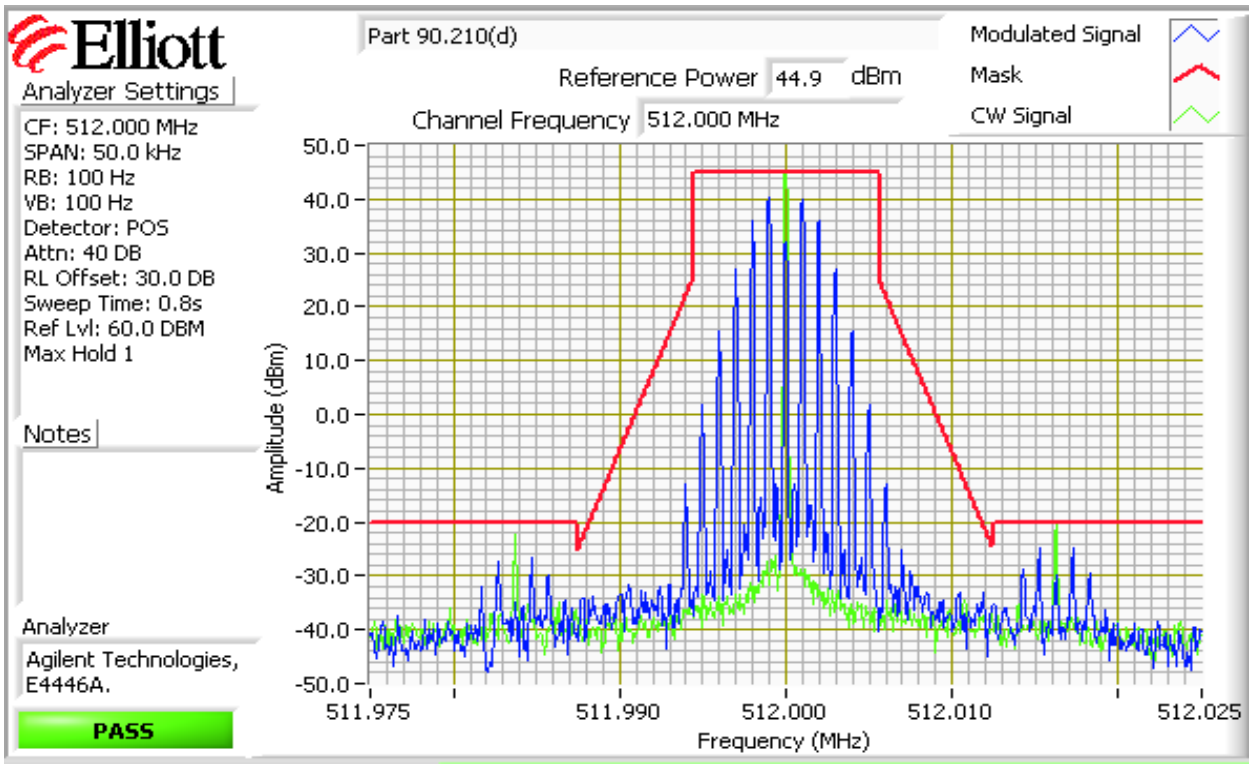
Run #2: Spectral Mask, FCC Part 90 Mask D

Date: 8/23/2011 & 9/21/11 Engineer: David Bare Location: Fremont EMC Lab #4

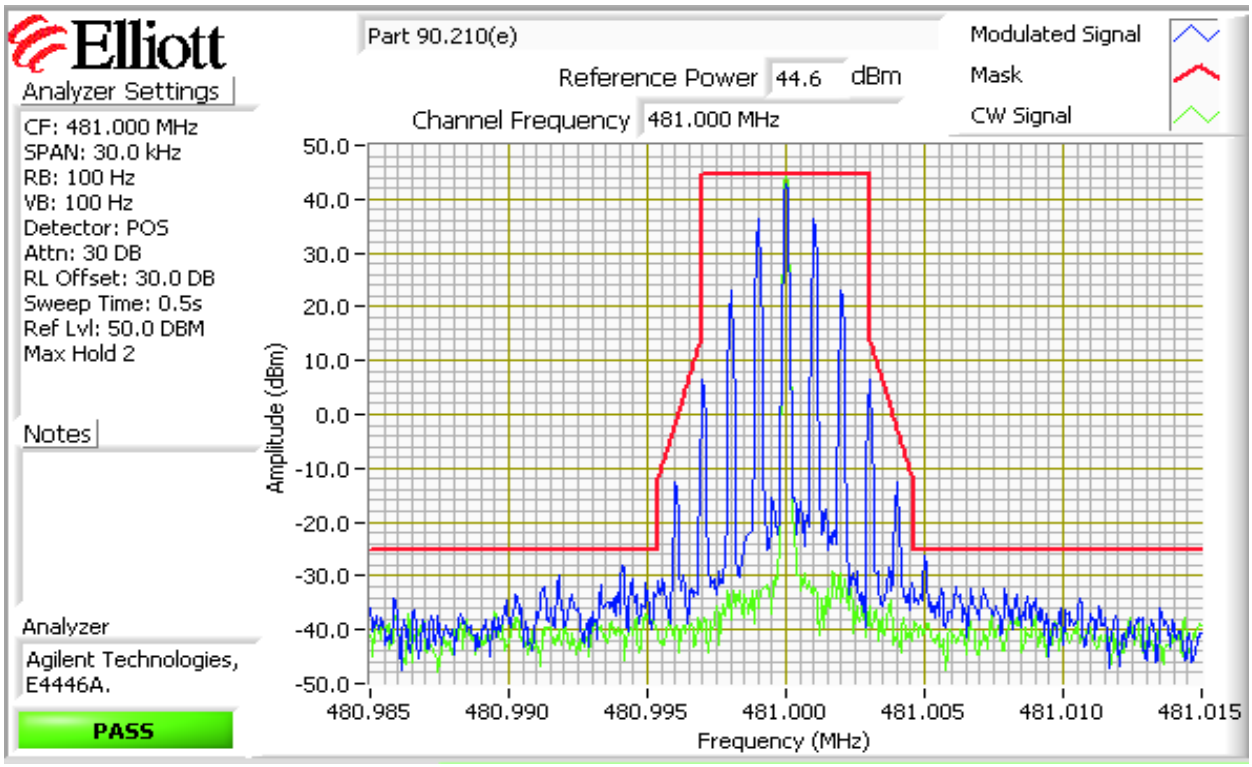
Note 1:	RB=VB=100Hz or RBW=VBW=300Hz per ANSI TIA-604C Top of mask based on unmodulated radio power.



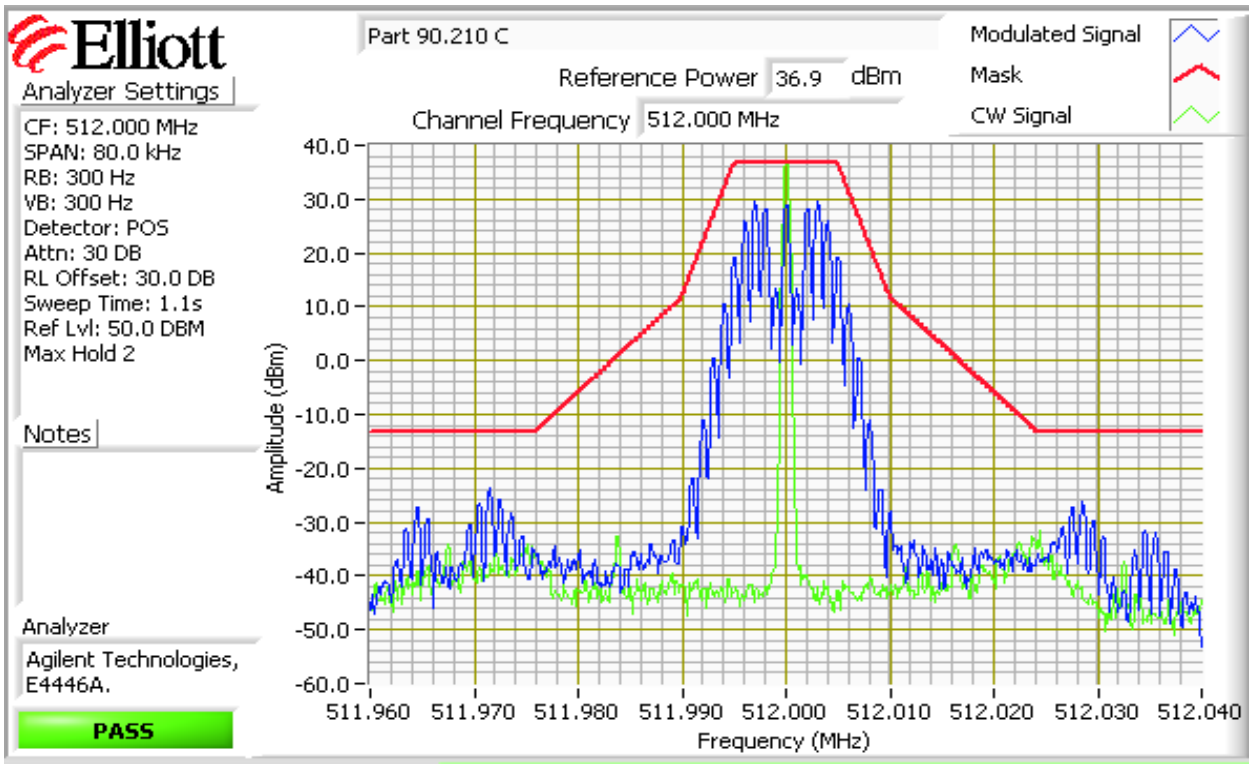
Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A



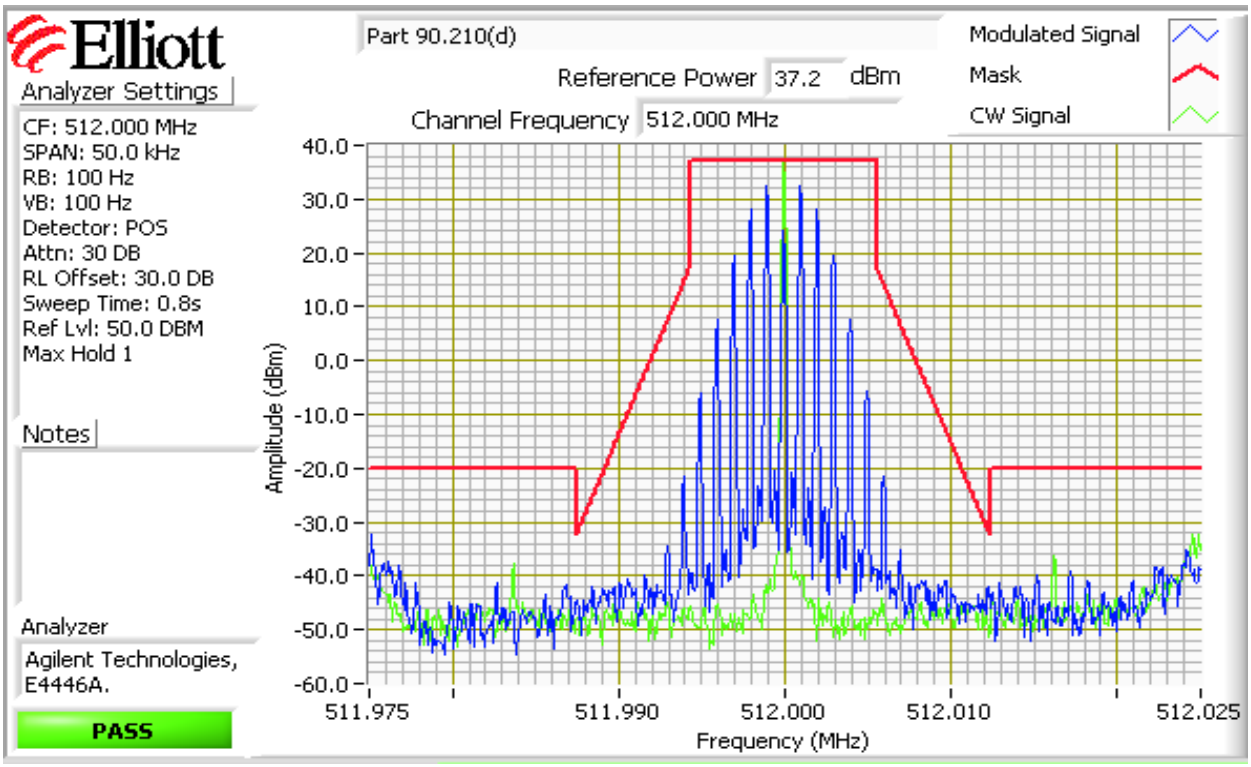
Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A



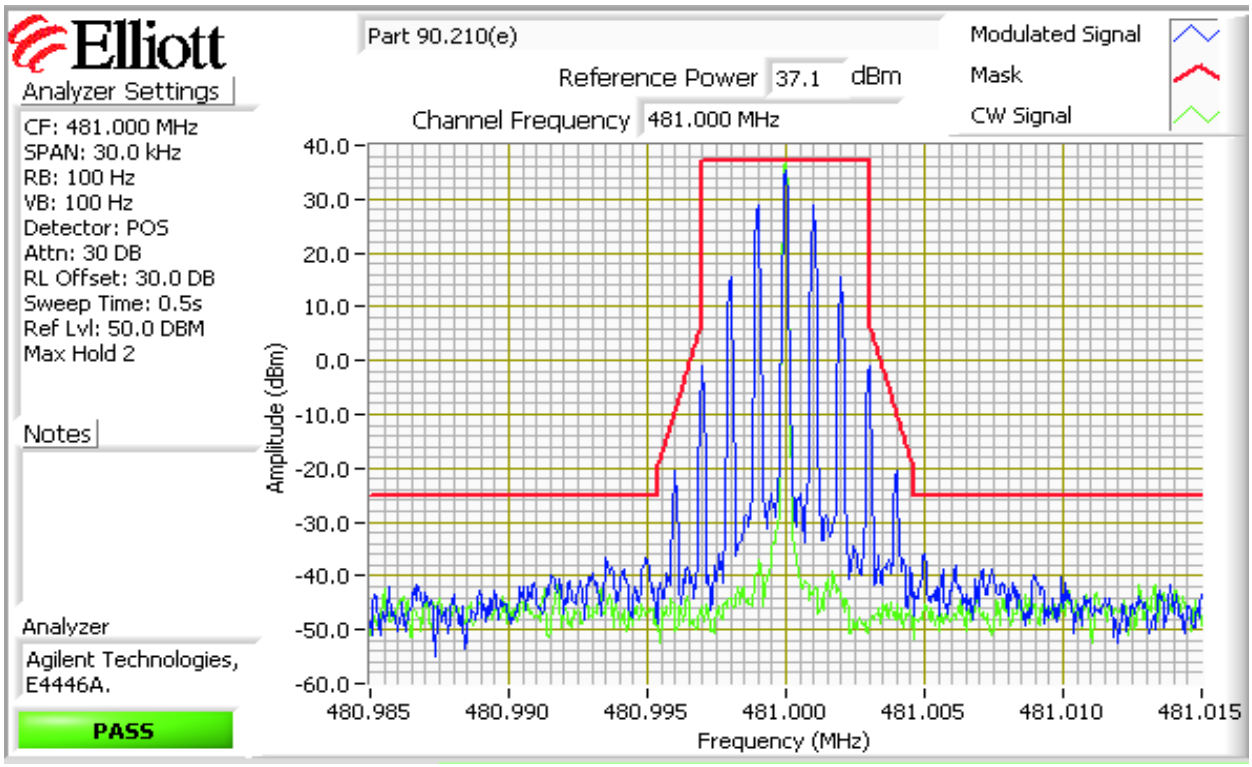
Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A



Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A



Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A



Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Run #3: Signal Bandwidth

Date: 8/22/2011 & 9/21/11 Engineer: David Bare Location: Fremont EMC Lab #4

Run #3a: Signal Bandwidth, 25kHz

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 99%
30	450	300 Hz	10.4
30	481	300 Hz	10.3
30	512	300 Hz	10.4

Run #3b: Signal Bandwidth, 12.5kHz

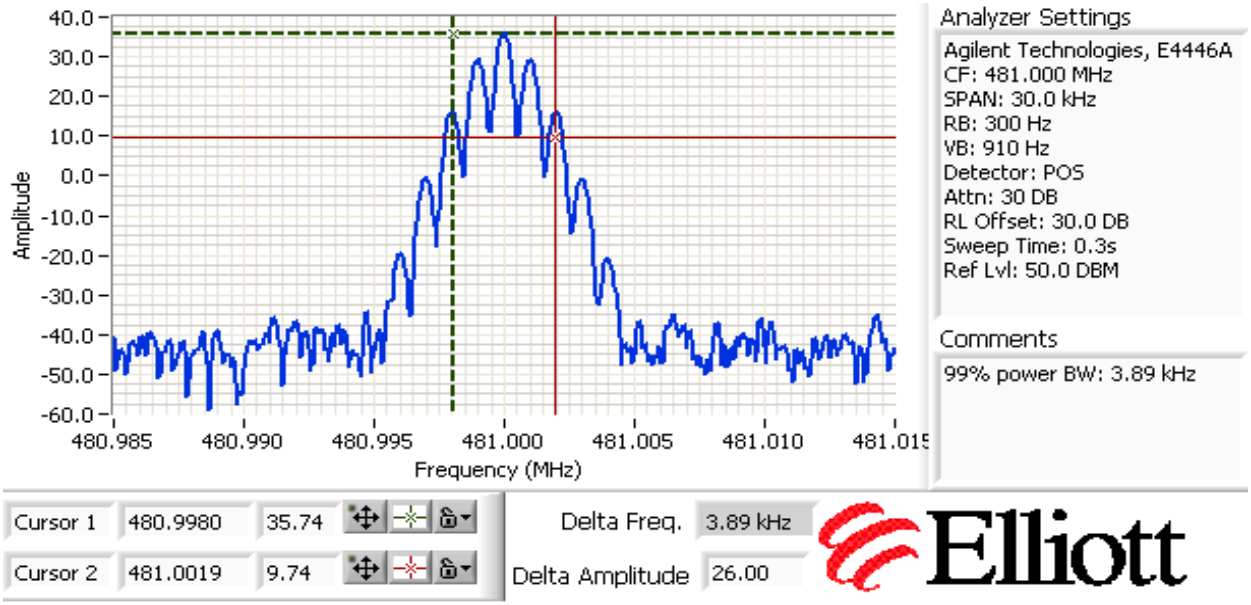
Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 99%
30	450	300 Hz	6.3
30	481	300 Hz	6.2
30	512	300 Hz	6.3

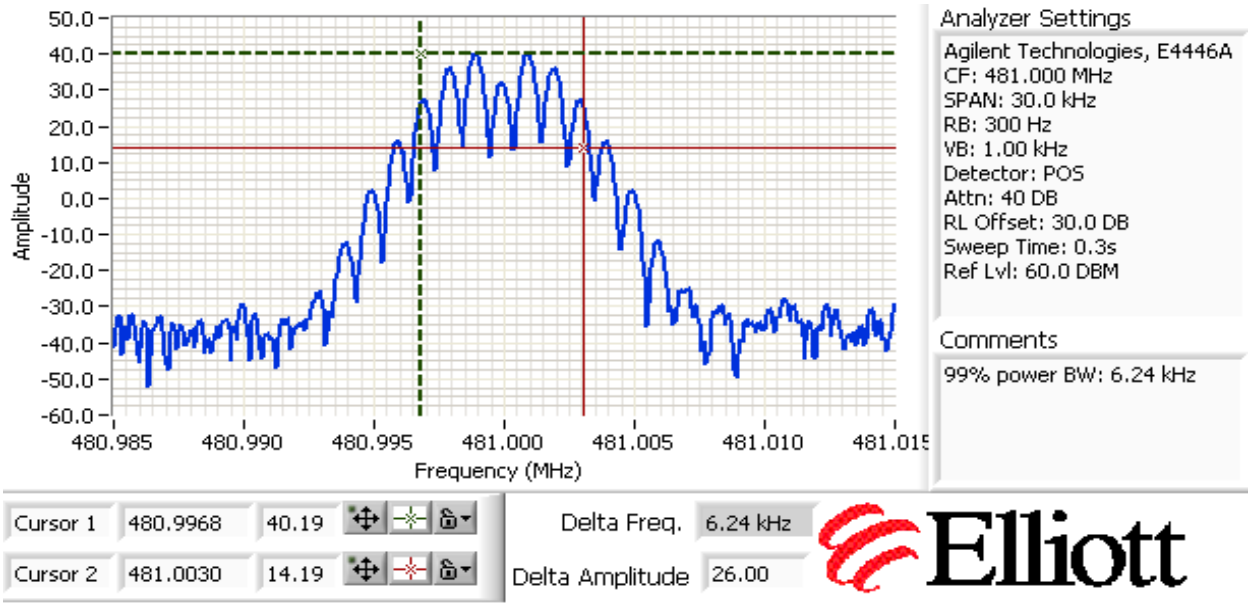
Run #3c: Signal Bandwidth, 6.25kHz

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 99%
30	450	300 Hz	3.9
30	481	300 Hz	3.9
30	512	300 Hz	3.9

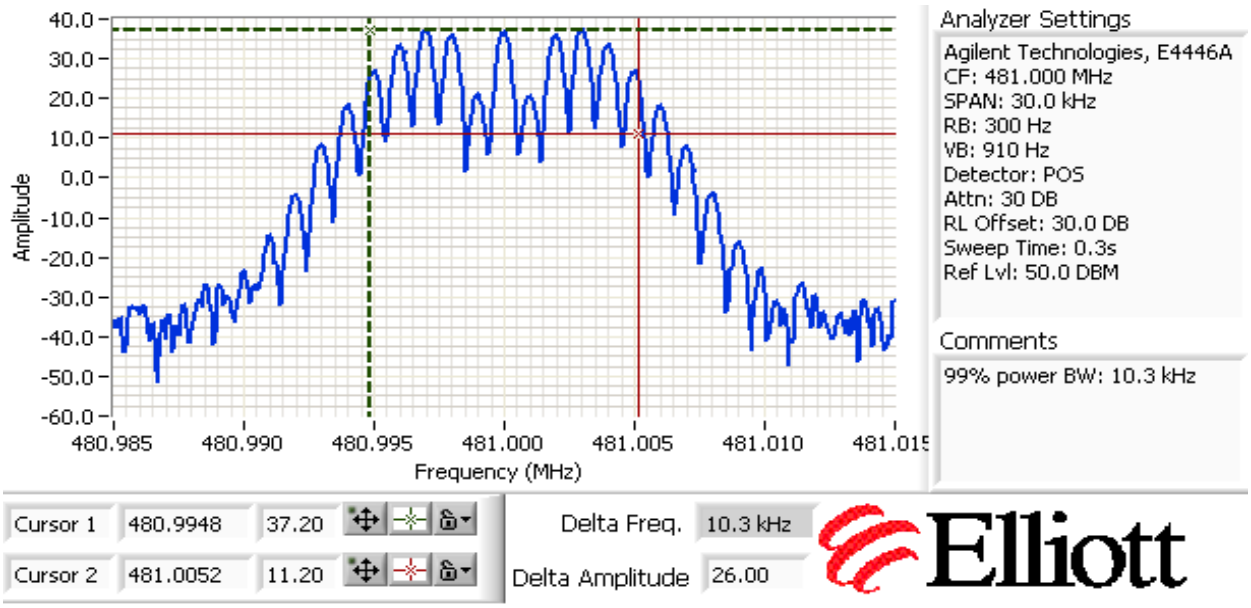
Note 1:	99% bandwidth measured in accordance with RSS GEN, with RB > 1% of the span and VB > 3xRB

Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A





Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A



Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Run #4: Out of Band Spurious Emissions, Conducted

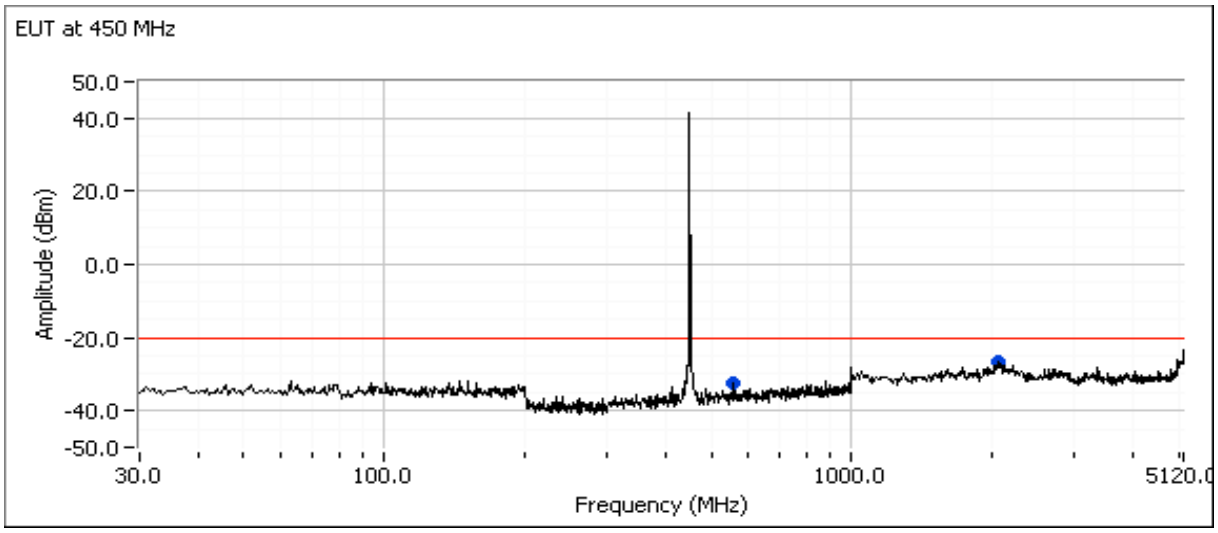
Date: 8/31/2011 Engineer: David Bare Location: Fremont EMC Lab #4

Frequency (MHz)	Limit	Result
450	-25 dBm or 65 dBc	Pass
481	-25 dBm or 65 dBc	Pass
512	-25 dBm or 65 dBc	Pass

The limit is taken from FCC Part 90 Mask E

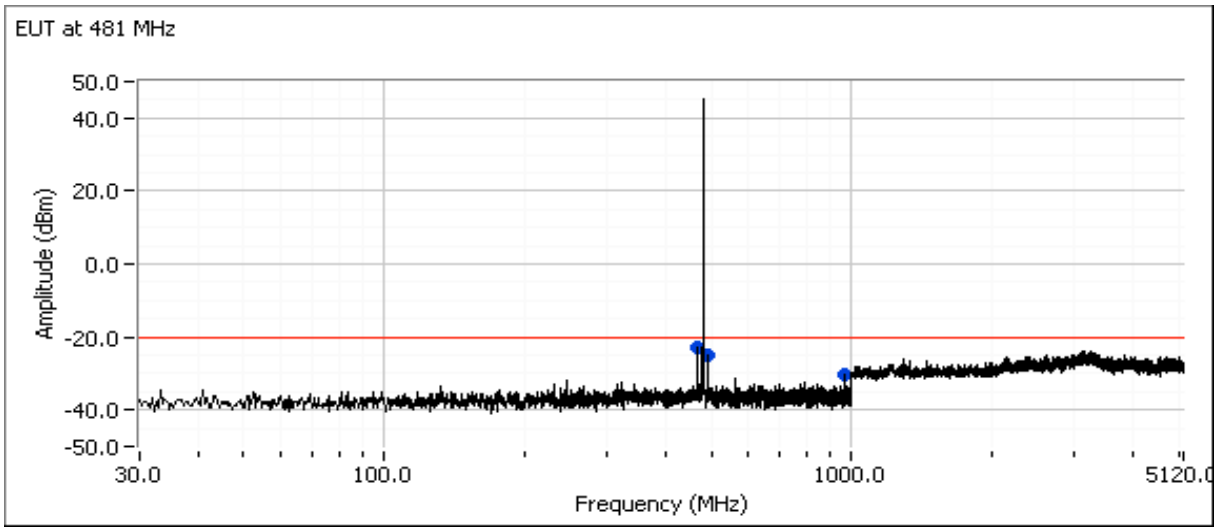
Frequency MHz	Level dBm	Port	FCC Part 90 Limit	FCC Part 90 Margin	Detector QP/Ave	Comments	EUT Freq
559.763	-32.5	RF Port	65dBc	-11.6	PK	PK (CISPR)-RB 120 kHz; VB: 1 MHz	450
2051.570	-26.8	RF Port	65dBc	-5.9	PK	PK (CISPR)-RB 1 MHz; VB: 8 MHz	450
468.780	-24.1	RF Port	65dBc	-3.6	PK	PK (CISPR)-RB 120 kHz; VB: 1 MHz	481
493.199	-24.9	RF Port	65dBc	-4.4	PK	PK (CISPR)-RB 120 kHz; VB: 1 MHz	481
962.022	-29.4	RF Port	65dBc	-8.9	PK	PK (CISPR)-RB 120 kHz; VB: 1 MHz	481
429.810	-24.7	RF Port	65dBc	-4.0	PK	PK (CISPR)-RB 120 kHz; VB: 1 MHz	512
594.191	-25.1	RF Port	65dBc	-4.4	PK	PK (CISPR)-RB 120 kHz; VB: 1 MHz	512
1024.120	-23.6	RF Port	65dBc	-2.9	PK	PK (CISPR)-RB 1 MHz; VB: 8 MHz	512

Plot for low channel, power setting(s) = 30

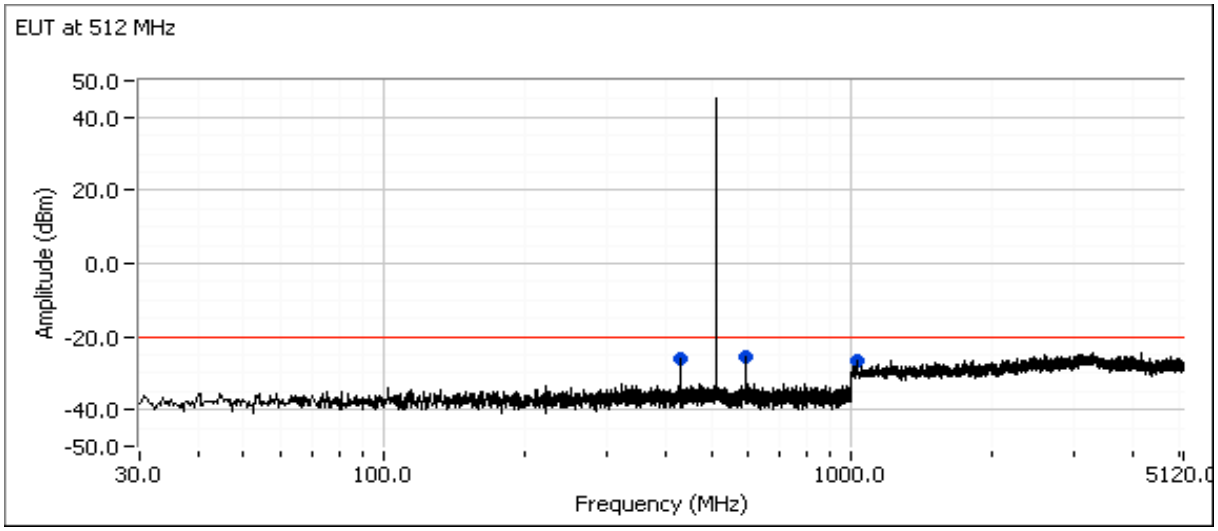


Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Plots for center channel, power setting(s) = 30



Plots for high channel, power setting(s) = 30



Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Run #5: Out of Band Spurious Emissions, Radiated

Conducted limit (dBm): -25
Approximate field strength limit @ 3m: 70.3

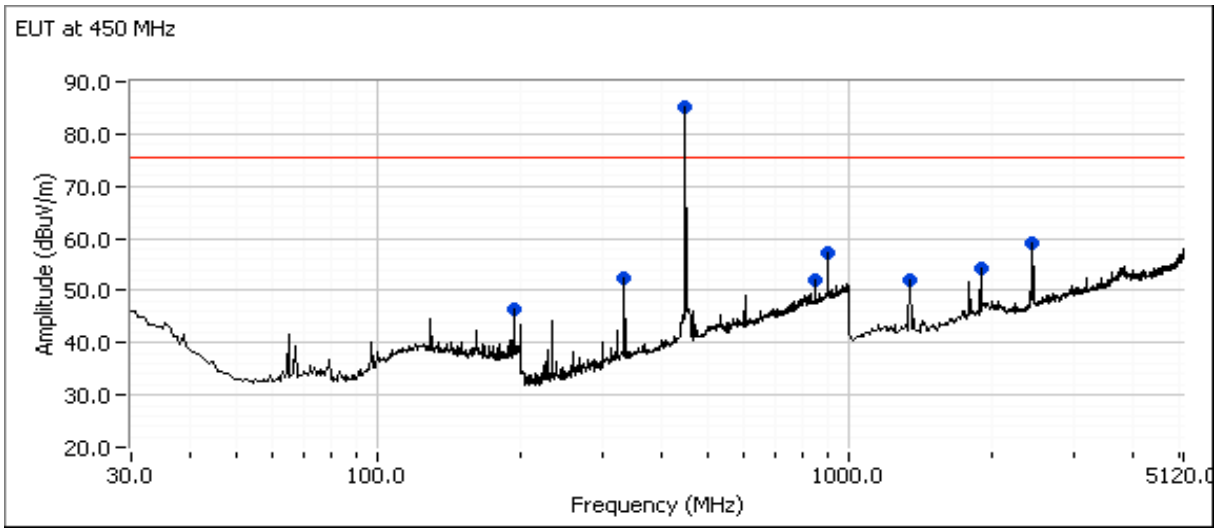
The limit is taken from FCC Part 90 Mask E
Run #5a - Preliminary measurements
Date: 8/31/2011 Engineer: D. Bare / R. Varelas Location: Fremont Chamber #3

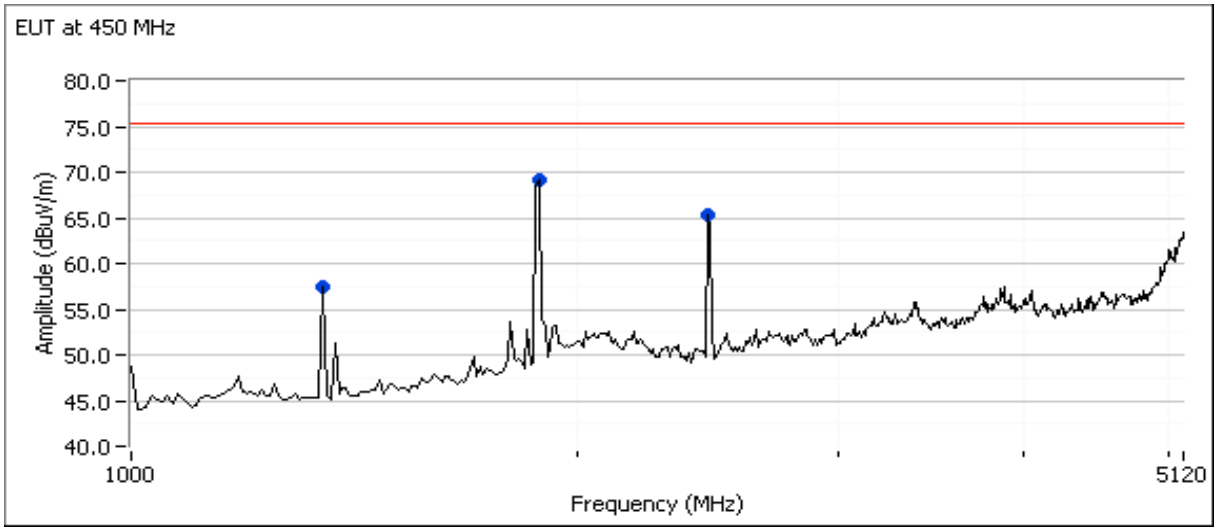
Frequency	Level	Pol	FCC Part 90		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
194.097	46.5	V	70.3	-23.8	Peak	103	1.0		450
334.133	52.4	V	70.3	-17.9	Peak	248	1.5		450
845.770	52.0	V	70.3	-18.3	Peak	25	1.5		450
900.008	57.3	V	70.3	-13.0	Peak	155	1.0		450
1349.990	57.5	H	70.3	-12.8	Peak	156	1.0		450
1881.620	69.2	H	70.3	-1.1	Peak	53	1.3		450
2450.490	65.3	H	70.3	-5.0	Peak	103	1.6		450
1443.000	60.5	H	70.3	-9.8	Peak	95	1.0		481
1883.000	72.3	H	70.3	2.0	Peak	8	1.3		481
2447.160	62.5	V	70.3	-7.8	Peak	252	1.3		481
191.242	44.3	H	70.3	-26.0	Peak	278	1.5		481
333.667	47.2	V	70.3	-23.1	Peak	206	1.0		481
962.124	58.1	H	70.3	-12.2	Peak	76	1.0		481
233.988	43.6	V	70.3	-26.7	Peak	155	1.0		512
333.667	49.6	V	70.3	-20.7	Peak	107	1.0		512
1016.510	67.5	H	70.3	-2.8	Peak	161	1.0		512
1536.670	71.3	H	70.3	1.0	Peak	103	1.0		512
2444.890	62.8	V	70.3	-7.5	Peak	11	1.3		512

Note 1:	The field strength limit in the tables above was calculated from the erp/eirp limit detailed in the standard using the free space propagation equation: $E=\sqrt{(30PG)}/d$. This limit is conservative - it does not consider the presence of the ground plane and, for erp limits, the dipole gain (2.2dBi) has not been included. The erp or eirp for all signals with less than 20dB of margin relative to this field strength limit is determined using substitution measurements.
Note 2:	Measurements are made with the antenna port terminated.

Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Plots for low channel, power setting(s) = 30

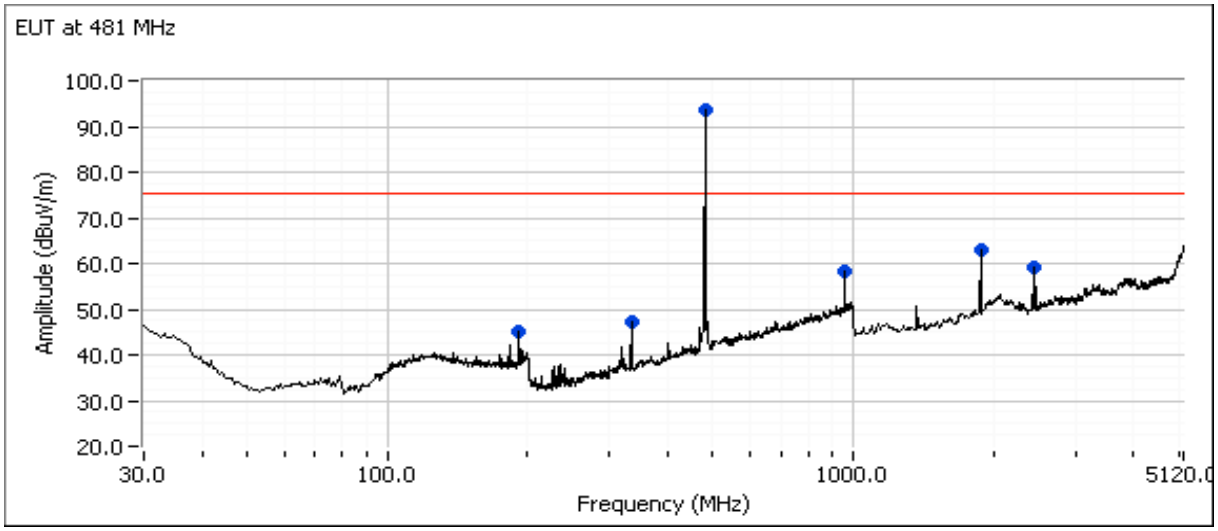


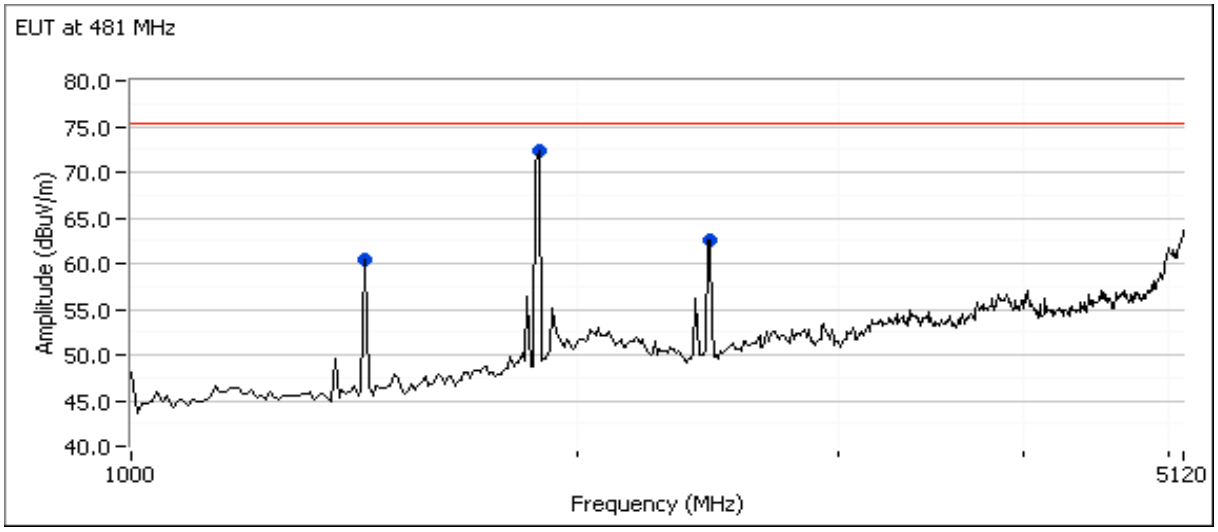


Note: Remeasured above 1GHz as the EUT had timed out prior to completing initial plot

Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Plots for center channel, power setting(s) = 30

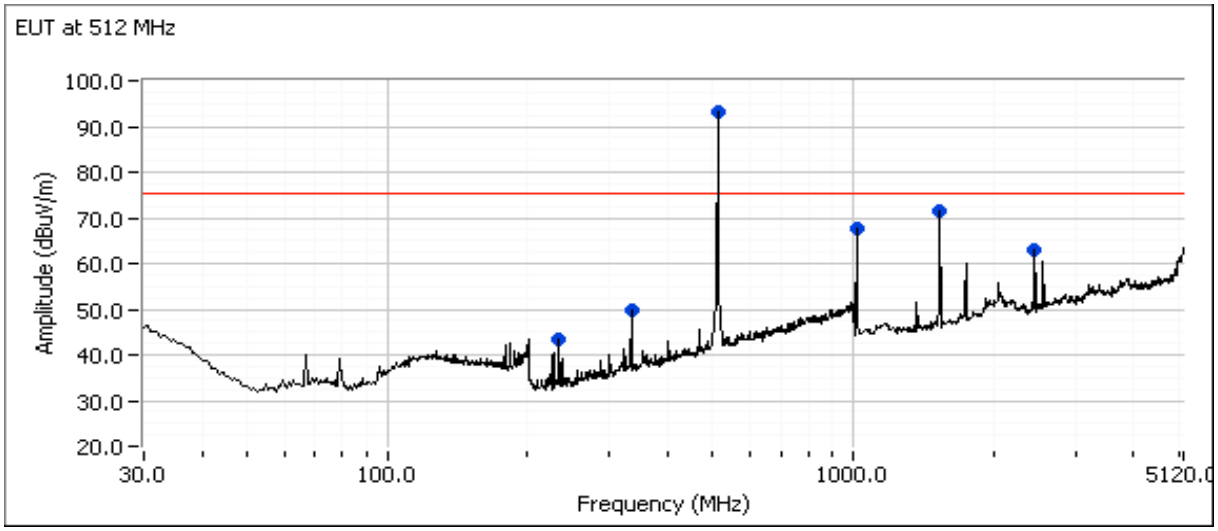




Note: Remeasured above 1GHz as the EUT had timed out prior to completing initial plot

Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Plots for high channel, power setting(s) = 30



Run #5b: - EUT Field Strength Measurements and Substitution Measurements

Date: 8/31/2011 Engineer: Rafael Varelas Location: FT Chamber #3

EUT Field Strength

Frequency	Level	Pol	FCC Part 90		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
2450.490	65.3	H	70.3	-5.0	Peak	103	1.6		450
1883.000	72.3	H	70.3	2.0	Peak	8	1.3		481
1536.670	71.3	H	70.3	1.0	Peak	103	1.0		512
1443.000	60.5	H	70.3	-9.8	Peak	95	1.0		481
1349.990	57.5	H	70.3	-12.8	Peak	156	1.0		450
1024.510	67.5	H	70.3	-2.8	Peak	161	1.0		512
962.124	58.1	H	70.3	-12.2	Peak	76	1.0		481
900.008	57.3	V	70.3	-13.0	Peak	155	1.0		450

Note 1:	The field strength limit in the tables above was calculated from the erp/eirp limit detailed in the standard using the free space propagation equation: E=√(30PG)/d. This limit is conservative - it does not consider the presence of the ground plane and, for erp limits, the dipole gain (2.2dBi) has not been included. The erp or eirp for all signals with less than 20dB of margin relative to this field strength limit is determined using substitution measurements.
Note 2:	Measurements are made with the antenna port terminated.

Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Substitution measurements
Horizontal

Frequency	Substitution measurements			Site	EUT measurements			eirp Limit	erp Limit	Margin
MHz	Pin[1]	Gain[2]	FS[3]	Factor[4]	FS[5]	eirp (dBm)	erp (dBm)	dBm	dBm	dB
2450.490	-16.3	9.5	90.0	96.8	65.3	-31.5	-33.7		-25.0	-8.7
1883.000	-15.2	8.0	89.5	96.7	72.3	-24.4	-26.6		-25.0	-1.6
1536.670	-14.6	8.4	89.9	96.1	71.3	-24.8	-27.0		-25.0	-2.0
1443.000	-14.5	7.8	90.1	96.8	60.5	-36.3	-38.5		-25.0	-13.5
1349.990	-14.3	7.2	89.8	96.9	57.5	-39.4	-41.6		-25.0	-16.6
1024.510	-13.7	6.1	88.9	96.5	67.5	-29.0	-31.2		-25.0	-6.2
962.124	-13.5	6.5	92.3	99.3	58.1	-41.2	-43.4		-25.0	-18.4

Vertical

Frequency	Substitution measurements			Site	EUT measurements			eirp Limit	erp Limit	Margin
MHz	Pin[1]	Gain[2]	FS[3]	Factor[4]	FS[5]	eirp (dBm)	erp (dBm)	dBm	dBm	dB
900.008	-13.4	6.7	90.4	97.1	57.3	-39.8	-42.0		-25.0	-17.0

Note 1:	Pin is the input power (dBm) to the substitution antenna
Note 2:	Gain is the gain (dBi) for the substitution antenna.
Note 3:	FS is the field strength (dBuV/m) measured from the substitution antenna.
Note 4:	Site Factor - this is the site factor to convert from a field strength in dBuV/m to an eirp in dBm.
Note 5:	EUT field strength as measured during initial run.

Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

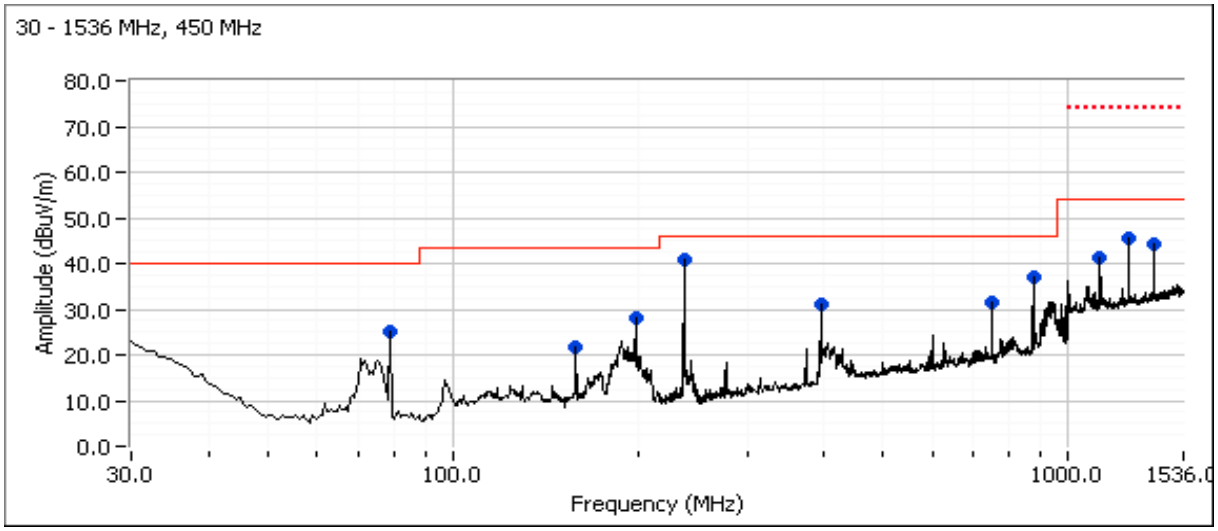
Run #6: Radiated Emissions, 30 - 1,536 MHz, Rx mode

Date: 9/1/2011 Engineer: Rafael Varelas Location: Fremont Chamber #5

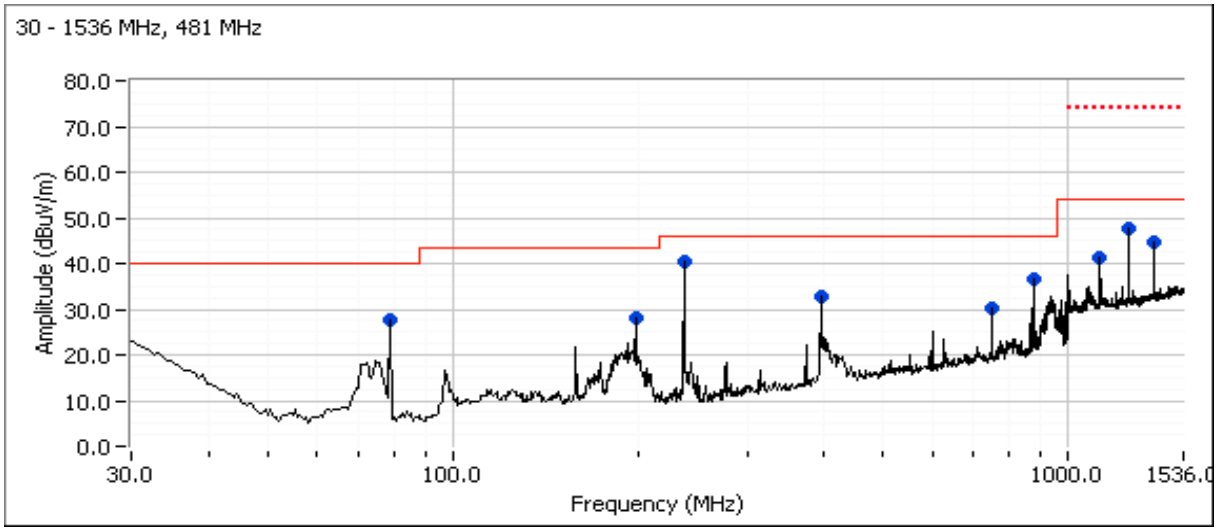
Frequency	Level	Pol	RSS-119		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
237.230	40.3	H	46.0	-5.7	QP	160	1.0	QP (1.00s)	481
237.230	39.9	H	46.0	-6.1	QP	182	1.0	QP (1.00s)	450
875.004	39.4	H	46.0	-6.6	QP	182	1.3	QP (1.00s)	450
875.004	39.1	H	46.0	-6.9	QP	178	1.2	QP (1.00s)	512
237.230	38.8	H	46.0	-7.2	QP	184	1.0	QP (1.00s)	512
875.004	38.4	H	46.0	-7.6	QP	180	1.3	QP (1.00s)	481
1250.010	44.6	H	54.0	-9.4	AVG	199	1.2	AVG (0.10s)	450
1249.960	44.6	H	54.0	-9.4	AVG	195	1.2	AVG (0.10s)	481
1250.010	44.4	H	54.0	-9.6	QP	224	1.4	QP (1.00s)	512
1374.990	43.6	H	54.0	-10.4	AVG	202	1.0	AVG (0.10s)	481
79.082	29.3	H	40.0	-10.7	Peak	360	2.0		512
1375.030	43.0	H	54.0	-11.0	AVG	202	1.0	AVG (0.10s)	450
1375.010	42.9	H	54.0	-11.1	AVG	230	1.3	AVG (0.10s)	512
79.078	27.7	H	40.0	-12.3	Peak	360	2.5		481
1125.020	41.7	H	54.0	-12.3	Peak	207	1.0		512
1125.000	41.4	H	54.0	-12.6	Peak	207	1.0		481
1124.600	41.3	H	54.0	-12.7	Peak	207	1.0		450
395.380	32.6	H	46.0	-13.4	Peak	173	1.0		481
749.998	32.3	H	46.0	-13.7	QP	198	1.7	QP (1.00s)	450
395.380	30.9	H	46.0	-15.1	Peak	188	1.0		450
749.998	30.8	H	46.0	-15.2	Peak	197	1.5		512
197.696	28.2	H	43.5	-15.3	Peak	237	1.5		450
197.696	28.0	H	43.5	-15.5	Peak	266	1.5		481
750.020	30.4	H	46.0	-15.6	Peak	203	1.5		481
395.380	29.3	H	46.0	-16.7	Peak	192	1.0		512
79.078	21.9	V	40.0	-18.1	QP	99	1.0	QP (1.00s)	450
1250.010	53.9	H	74.0	-20.1	PK	199	1.2	PK (0.10s)	450
1249.960	53.6	H	74.0	-20.4	PK	195	1.2	PK (0.10s)	481
1375.010	53.5	H	74.0	-20.5	PK	230	1.3	PK (0.10s)	512
1374.990	53.2	H	74.0	-20.8	PK	202	1.0	PK (0.10s)	481
1375.030	53.1	H	74.0	-20.9	PK	202	1.0	PK (0.10s)	450
158.154	21.9	H	43.5	-21.6	Peak	225	2.0		450
1250.010	52.4	H	74.0	-21.6	PK	224	1.4	PK (0.10s)	512

Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Plots for low channel

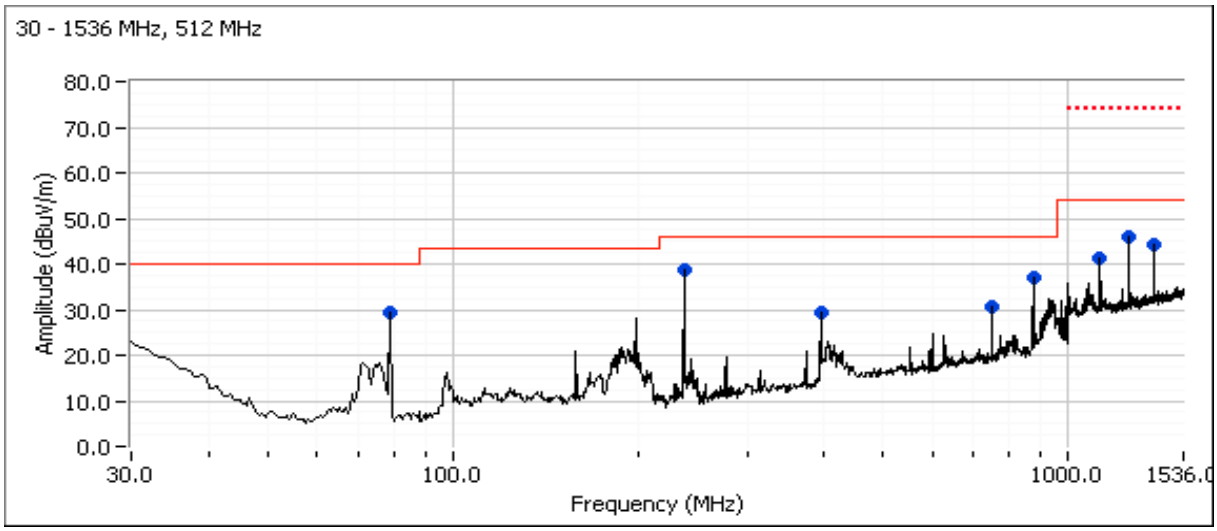


Plots for center channel



Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Plots for high channel



Client:	GE MDS LLC	Job Number:	J84169
Model:	LCT450	T-Log Number:	T84382
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90	Class:	N/A

Run #7: Temperature Vs. Frequency (Fixed stations in the 450-512 MHz band)

Drift	Freq.	Limit
(ppm)	(MHz)	(Hz)
0.5	481.00	240.5

Temperature	Reference Frequency	Measured frequency	Drift	Limit
(Celsius)	(MHz)	(MHz)	(Hz)	(Hz)
-30	480.999730	480.999616	114	240.5
-20	480.999730	480.999625	105	240.5
-10	480.999730	480.999744	14	240.5
0	480.999730	480.999783	53	240.5
10	480.999730	480.999892	162	240.5
20	480.999730	480.999730	0	240.5
30	480.999730	480.999893	163	240.5
40	480.999730	480.999804	74	240.5
50	480.999730	480.999624	106	240.5

Run #2: Voltage Vs. Frequency

Nominal Voltage is 13.8Vdc.

Voltage	Reference Frequency	Frequency Drift	Drift	Limit
(Dc)	(MHz)	(MHz)	(Hz)	(Hz)
85%	480.999706	480.999693	13	0.0
115%	480.999706	480.999658	48	0.0

Worst case drift: 163.0 Hz
0.34 ppm

End of Report

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