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Radio Test Report

FCC Part 80, 95 and RSS-131
(216 MHz to 219 MHz)

Models: ENET-L2T, ENET-L2TU, ENET-L2U

COMPANY:	GE MDS LLC 175 Science Parkway Rochester, NY 14620
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
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REVISION HISTORY

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-	February 5, 2015	First release	
1	February 24, 2015	Revised to correct typos	David Guidotti
2	March 6, 2015	Clarified when note 5 applied in the output power table of the test data.	David Guidotti

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SCOPE

Tests have been performed on the GE MDS LLC model ENET-L2T, 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
- RSS-Gen Issue 4, November 2014
- CFR 47 Part 80 (Stations In The Maritime Services), Subpart J—Public Coast Stations (AMTS)
- CFR 47 Part 95 (Personal Radio Service), Subpart F – 218-219 MHz Service
- Industry Canada RSS-Gen Issue 3, December 2010
- RSS-131 Issue 2, Rev. 1 July 2003 (Zone Enhancers for the Land Mobile Service)

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 National Technical Systems - Silicon Valley test procedures:

ANSI C63.4:2009
ANSI TIA-603-C August 17, 2004
FCC Public Notice, DA-02-1097, May 10, 2002 *Guidance on Certification of Linear Power Amplifiers used with Cellular and PCS Transmitters*

The linear amplifier 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 ENET-L2T 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 ENET-L2T 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 80, 95 and RSS-131

FCC	Canada	Description	Measured	Limit	Result
Transmitter Modulation, output power and other characteristics					
§2.1033 (c) (5) § 80.385 § 95.853	RSS-131	Frequency range(s)	216- 220 MHz 218-219 MHz	216- 220 MHz 218-219 MHz	Pass
§2.1033 (c) (6) §2.1033 (c) (7) § 2.1046 § 80.215(h)(5) § 95.855	RSS-131	RF power output at the antenna terminals	40-45.6 dBm 35.5 - 42.6dBm	47 dBm (cond) 36 and 43 (erp)	Pass
§2.1033 (c) (4) § 2.1047 §	RSS-131	Emission mask	No change from original filing		
§ 2.1049	RSS-GEN 6.6 RSS-131	Occupied Bandwidth	No change from original filing		
Transmitter spurious emissions					
§ 2.1051 § 2.1057	RSS-131	At the antenna terminals	-30.1 dBµV/m @ 1554.7 MHz (-5.9 dB) dBm	-25 dBm	Pass
§ 2.1053 § 2.1057	RSS-131	Field strength	-29.3dBm @ 1512 MHz (-4.3dB)	-25 dBm	Pass
Other details					
§ 2.1055 § 80.209	RSS-131	Frequency stability	N/A for Amplifiers		
§ 2.1093	RSS-102	RF Exposure	No change from original filing		
§2.1033 (c) (8)		Final radio frequency amplifying circuit's dc voltages and currents for normal operation over the power range	No change from original filing		
Notes					

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
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 models ENET-L2TU, ENET-L2T and ENET-L2U are a single channel RF amplifiers that are designed to boost RF power of an external radio in the frequency range of 216 to 222 MHz. Since the EUT would be placed on a tabletop during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 13.8 Volts DC.

The sample was received on January 19, 2015 and tested on January 19 and 21, 2015. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
GE MDS	ENET-L2T	RF Amplifier	None	E5MDS-ENETL2TU

OTHER EUT DETAILS

The following EUT details should be noted: The ENET-L2TU had previously been tested and approved for operation from 220-222 MHz under FCC Part 90 and RSS-131. This report is for extending the frequency range to 216 MHz and to add operation per FCC Parts 80 and 95 and extend the frequency range for RSS-131 and add two model numbers for Industry Canada, ENET-L2T and ENET-L2U. The antennas used with the ENET-L2T are selected at the time of installation based on the License.

ENCLOSURE

The EUT enclosure is primarily constructed of sheet metal. It measures approximately 10 cm wide by 10 cm deep by 3.5 cm high. .

MODIFICATIONS

No modifications were made to the EUT during the time the product was at National Technical Systems - Silicon Valley.

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
GE MDS	2710	Used as a signal source	1207721	-
JFW Industries Inc.	50DR-001	Step attenuator	-	-

The following equipment was used as remote support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
Dell	Inspiron 2200	Laptop	-	-
CoolGear	210759	Serial-to-USB converter	-	-

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
RF in	GE MDS 2710 (via att.)	RF Cable	Shielded	0.8
RF out	RF Attenuator	RF Cable	Shielded	1.5
DC Power	DC Power Supply	Power cable	Unshielded	1

Additional on Support Equipment

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
RG 11 Serial	Serial-to-USB converter	Serial Data	Shielded	0.8
Serial-to-USB converter	Laptop	USB cable	Shielded	0.2
DC Power	DC Power Supply	Power cable	Unshielded	1

EUT OPERATION

During emissions testing the EUT was set to provide a nominal 4 watts, 20 watts or 40 watts depending on FCC Rule part. The input was connected to a transceiver to provide the RF signal for the amplifier.

TESTING

GENERAL INFORMATION

Antenna port measurements were taken at the National Technical Systems - Silicon Valley test site located at 41039 Boyce Road, Fremont, CA 94538-2435.

Radiated spurious emissions measurements were taken at the National Technical Systems - Silicon Valley Anechoic Chambers and/or Open Area Test Site(s) listed below. The sites conform to the requirements of ANSI C63.4: 2014 *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.

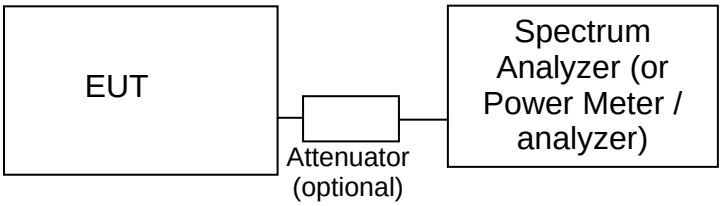
Site	Designation / Registration Numbers		Location
	FCC	Canada	
Chamber 5	US0027	IC 2845B-5	41039 Boyce Road Fremont, CA 94538-2435

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 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

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
RF Conducted Emisisons, 19-Jan-15					
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	4/8/2014	4/8/2015
Radiated Emissions, 30 - 2,200 MHz, 21-Jan-15					
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1549	5/30/2013	5/30/2015
Com-Power	Preamplifier, 30-1000 MHz	PA-103	1632	7/6/2014	7/6/2015
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/11/2014	2/11/2015
Substitution Measurements, 21-Jan-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	786	12/20/2013	12/20/2015
Fluke	Signal Generator, 100KHz - 2100MHz	6062A	852		N/A
Rohde & Schwarz	Power Meter, Dual Channel, DC to 40 GHz, 100 pW to 30 W, 9 kHz to 3 GHz, 200µV to 1000V	NRVD	1787	1/5/2015	1/5/2016
Compliance Design	Tuned Dipole Antenna	Roberts (400-1000MHz)	1896	1/2/2014	1/2/2016
Rohde & Schwarz	Power Sensor, 1 nW-20 mW, 10 MHz-18 GHz, 50ohms	NRV-Z1	2114	10/10/2014	10/10/2015
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/11/2014	2/11/2015

Appendix B Test Data

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Client:	GE MDS LLC	Job Number:	J97156
Product	ENET-L2T	T-Log Number:	T97159
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	
Emissions Standard(s):	FCC part 80 and 95, RSS-131	Class:	A
Immunity Standard(s):		Environment:	Radio

EMC Test Data

For The

GE MDS LLC

Product

ENET-L2T

Date of Last Test: 1/21/2015

Client:	GE MDS LLC	Job Number:	J97156
Model:	ENET-L2T	T-Log Number:	T97159
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	-
Standard:	FCC part 80 and 95, RSS-131	Class:	N/A

RSS-131 and FCC Parts 80 and 90

Power, Occupied Bandwidth, Frequency Stability 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

Alll 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.

Previously, this product had been tested and approved for operation from 220-222 MHz under FCC Part 90 and RSS-131 (Elliott project J69344). These tests are to extend the frequency range to 216 MHz and to add operation per FCC Part 80 and 95.

Ambient Conditions:

Temperature: 20-22 °C
Rel. Humidity: 30-45 %

Summary of Results

Run #			Test Performed	Limit	Pass / Fail	Result / Margin
1			Output Power	Part 80 - 50 Watts	Pass	36.31 Watts
1			Output Power	Part 95 - 20 Watts ERP	Pass	18.20 Watts e.r.p.
1			Output Power	Part 95 - 4 Watts ERP	Pass	3.55 Watts e.r.p.
2			Spurious Emissions (conducted)	-25 dBm	Pass	-30.1 dBµV/m @ 1554.7 MHz (-5.9 dB)

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:	J97156
Model:	ENET-L2T	T-Log Number:	T97159
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	-
Standard:	FCC part 80 and 95, RSS-131	Class:	N/A

Run #1: Output Power

Date of Test: 19-Jan-15 Config. Used: 1

Test Engineer: Deniz Demirci Config Change: None

Test Location: FT Lab#4b EUT Voltage: 13.8 VDC

Cable Loss: 0.1 dB Attenuator: 30.0 dB Total Loss: 30.1 dB

Cable ID(s): EL535 Attenuator IDs: 150-SA-FFN-30

Power Setting[2]	Frequency (MHz)	Output Power (dBm)[1]	Output Power W	Antenna Gain (dBi)	Result	ERP dBm	ERP W	
Max	216	45.6	36.31	2.2	Pass	50.0	100.00	Part 80.215(h)(5) (pwr)
Max	218	45.6	36.31	2.2	Pass	50.0	100.00	Part 80.215(h)(5) (pwr)
Max[4]	218	35.5	3.55	-2.1	Pass	35.6	3.63	Part 95.855 (erp)mobile
Max[5]	218	42.6	18.07	-2.1	Pass	42.7	18.49	Part 95.855 (erp) fixed
Max[4]	219	35.5	3.55	-2.1	Pass	35.6	3.63	Part 95.855 (erp)mobile
Max[5]	219	42.6	18.20	-2.1	Pass	42.7	18.62	Part 95.855 (erp) fixed

Note 1:	Output power measured using a spectrum analyzer with RBW=0.1 MHz, VB=0.3 MHz, Peak detector
Note 2:	Power setting - Input RF power to the amplifier = 29 dBm
Note 3:	Power setting and antenna gain/cable loss are determined by the professional installer based on the license allocation. Part 80.215(h)(5) allows 50 watts and Part 95.855 allows 20 watts ERP for fixed stations and 4 watts ERP for mobile stations.
Note 4:	Output power measured using a 3 dB attenuator to simulate antenna cable loss and with input power adjusted for a maximum output of <4 watts.
Note 5:	Output power measured with input power adjusted for a maximum output of <20 watts.

Client:	GE MDS LLC	Job Number:	J97156
Model:	ENET-L2T	T-Log Number:	T97159
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	-
Standard:	FCC part 80 and 95, RSS-131	Class:	N/A

Run #2: Out of Band Spurious Emissions, Conducted

Date of Test: 19-Jan-15 Config. Used: 1

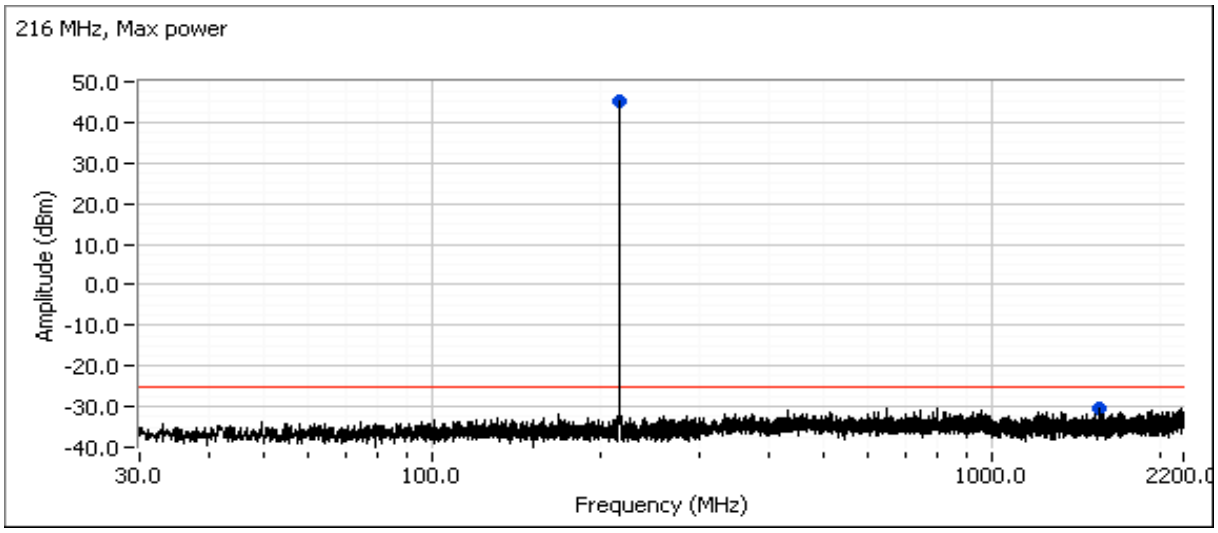
Test Engineer: Deniz Demirci Config Change: None

Test Location: FT Lab#4b EUT Voltage: 13.8 VDC

Frequency (MHz)	Limit	Result
216	-25 dBm	pass

The limit is taken from FCC Part 90 Mask E

Plots for low channel, power setting(s) = 45.6 dBm



Spurious Emissions

Frequency	Level	Pol	FCC Par 90		Detector	Azimuth	Height	Comments	Orientation
MHz	dBm	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
216.002	45.2	RF Port	-	-	Peak	-	-	Carrier signal	
1554.730	-30.1	RF Port	-25.0	-5.9	Peak			Maximim noise floor reading	

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Standard:	FCC part 80 and 95, RSS-131	Class:	N/A

Radiated 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

The EUT was located on the turntable for radiated emissions testing.
The test distance and extrapolation factor (if applicable) are detailed under each run description.
Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.
Previously, this product had been tested and approved for operation from 220-222 MHz under FCC Part 90 and RSS-131 (Elliott project J69344). These tests are to extend the frequency range to 216 MHz and to add operation per FCC Part 80 and 95.

Date of Test: 1/21/2015
Test Engineer: David Bare
Test Location: Fremont Chamber #5

Config. Used: 1
Config Change: Laptop and cable to 2710 radio removed after configuration of the 2710, Output calbe length changed to 1.5m
EUT Voltage: 13.8VDC

Ambient Conditions:

Temperature: 20 °C
Rel. Humidity: 33 %

Summary of Results

Run #	Test Performed	Limit	Result	Value / Margin
2	Transmitter Radiated Spurious Emissions, 30 - 2,220 MHz	FCC Part 80, 95, and RSS-131	Pass	-29.3dBm @ 1512 MHz (-4.3dB)

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.

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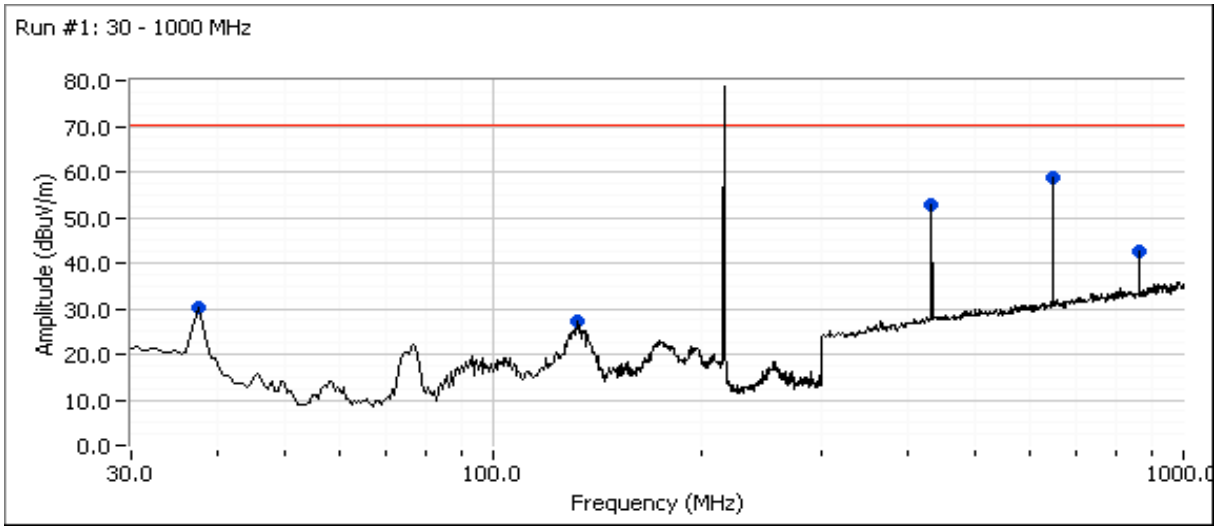
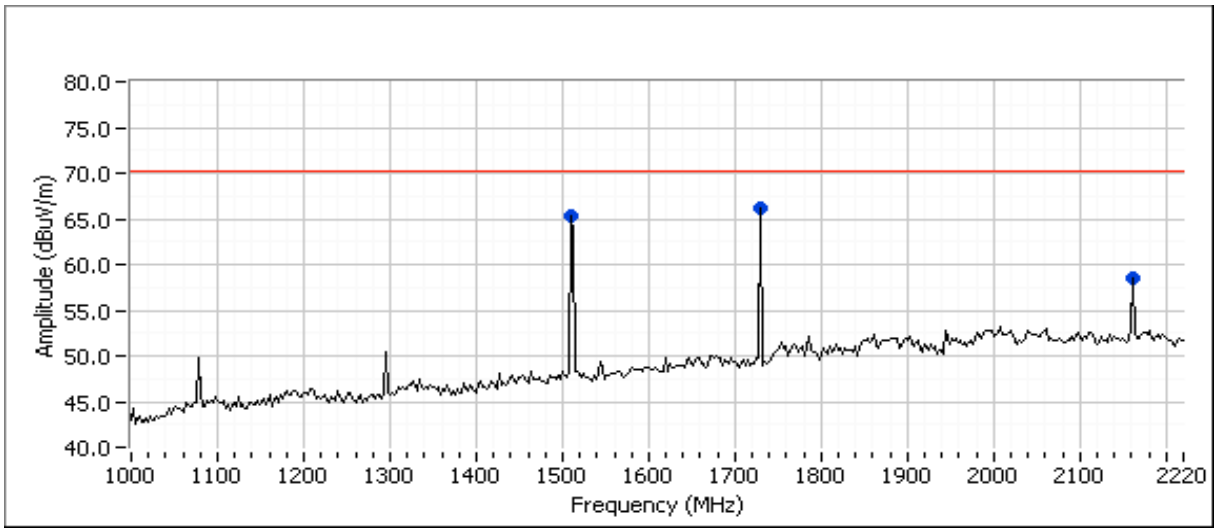
Standard:	FCC part 80 and 95, RSS-131	Class:	N/A

Run #1: Preliminary Radiated Emissions, 30 2200 MHz, Transmitter Spurious Emissions
EUT operating at 216 MHz at 36.3 Watts output.

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 2,220 MHz	3	3	0.0

The limit is taken from FCC Part 90 Mask E (Attenuation of 55+10*log(P) = -25 dBm)





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Model:	ENET-L2T	T-Log Number:	T97159
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Contact:	Dennis McCarthy	Project Coordinator:	-
Standard:	FCC part 80 and 95, RSS-131	Class:	N/A

Low Channel, 216 MHz

Frequency	Level	Pol	FCC Part 80, 95 Limit		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
132.128	27.1	V	70.2	-43.1	Peak	344	1.0	
37.725	30.1	V	70.2	-40.1	Peak	13	1.0	
432.000	52.9	V	70.2	-17.3	Peak	304	1.5	
648.000	58.8	V	70.2	-11.4	Peak	239	1.0	
864.000	42.5	H	70.2	-27.7	Peak	147	2.5	
1080.000	49.8	V	70.2	-20.4	Peak	112	1.0	
1296.000	50.5	V	70.2	-19.7	Peak	112	1.5	
1512.000	65.4	H	70.2	-4.8	Peak	75	3.5	
1728.000	66.2	V	70.2	-4.0	Peak	142	1.0	
2160.000	58.5	V	70.2	-11.7	Peak	290	1.5	

Note 1:	Emission at fundamental exceeds limit and is not measured since it is not a spurious emission.

Run #2: Maximized Readings from Run #1

Spurious Emissions

Frequency	Level	Pol	FCC Part 80, 95 Limit		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
432.000	53.1	V	70.2	-17.1	PK	311	1.4	PK (0.10s)
648.000	59.0	V	70.2	-11.2	PK	241	1.0	PK (0.10s)
864.000	47.5	H	70.2	-22.7	PK	151	2.4	PK (0.10s)
1296.000	54.9	V	70.2	-15.3	PK	103	1.4	PK (0.10s)
1512.000	68.9	H	70.2	-1.3	PK	63	3.3	PK (0.10s)
1728.000	68.0	V	70.2	-2.2	PK	149	1.0	PK (0.10s)
2160.000	62.1	V	70.2	-8.1	PK	295	1.8	PK (0.10s)

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.
Note 3:	Peak detector used

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Standard:	FCC part 80 and 95, RSS-131	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
864.000	-41.7	2.1	54.9	94.5	47.5	-47.0	-49.2		-25.0	-24.2
1512.000	-41.2	8.4	63.2	96.0	68.9	-27.1	-29.3		-25.0	-4.3

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
432.000	-40.7	2.1	56.5	95.1	53.1	-42.0	-44.2		-25.0	-19.2
648.000	-40.8	2.1	57.0	95.7	59.0	-36.7	-38.9		-25.0	-13.9
1296.000	-41.1	7.3	62.5	96.3	54.9	-41.4	-43.6		-25.0	-18.6
1728.000	-41.3	8.8	62.9	95.4	68.0	-27.4	-29.6		-25.0	-4.6
2160.000	-41.3	8.8	63.4	95.9	62.1	-33.8	-36.0		-25.0	-11.0

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 erp in dBm.
Note 5:	EUT field strength as measured during initial run.

End of Report

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