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Radio Test Report

FCC Parts 24 and 101 and RSS 119
(930 To 941 MHz, 928 -960 MHz)

Model: Orbit Radio Card SDM9

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
REPORT DATE:	February 12, 2014
FINAL TEST DATES:	December 16, 17 and 19, 2013 and January 13 and February 7, 2014
TOTAL NUMBER OF PAGES:	68

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ACCREDITED
Testing Cert #0214.26

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	February 12, 2014	First release	

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SCOPE

Tests have been performed on the GE MDS LLC model Orbit Radio Card SDM9, 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, December 2010
- RSS-119, Issue 11, June 2011 (Land Mobile and Fixed Radio Transmitters and Receivers Operating the Frequency Range 27.41 to 960 MHz)
- CFR 47 Part 24 Subpart D (Narrowband PCS)
- CFR 47 Part 101 Fixed Microwave 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

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 Orbit Radio Card SDM9 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 Orbit Radio Card SDM9 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 101 and RSS-119

FCC	Canada	Description	Measured	Limit	Result
Transmitter Modulation, output power and other characteristics					
§2.1033 (c) (5) § 101.101	RSP 100 7.2 (a) SRSP-504, -505, -506, -507	Frequency range(s)	928-960 MHz	928 – 960 MHz	Complies
§2.1033 (c) (6) §2.1033 (c) (7) §2.1046 § 101.113	RSP 100 7.2 (a) RSS 119 5.4 SRSP-504, -505, -506, -507	RF power output at the antenna terminals	20dBm to 40.1dBm	47 dBm EIRP[1]	Complies
§2.1033 (c) (4) §2.1047 §101.111(a)(5) & (a)(6)	RSP 100 7.2 (b) (iii) RSS 119 5.5 (masks D G & J)	Emission types	F1D, F2D, F3D	-	-
		Emission mask	Within Masks	Within Masks	Complied
	RSS GEN 4.4.1 RSS 119 5.5	99% Bandwidth	10.6 kHz 16.2 kHz 28.5 kHz	11.25 kHz 20 kHz 50 kHz[2]	Complies
§2.1049 § 101.109		Occupied Bandwidth	10.6 kHz 16.2 kHz 28.5 kHz	200 kHz	Complies
Transmitter spurious emissions					
§2.1051 §2.1057	RSS-119 5.8	At the antenna terminals	-24.8 dBm	-13 dBm	Complies
§2.1053 §2.1057	RSS-119 5.8	Field strength	-14.0 dBm	-13 dBm	Complies
Other details					
§2.1055 §101.107	RSS-119 5.3	Frequency stability	0.4 ppm	1.5 ppm	Complies
§2.1093	RS 102	RF Exposure	Refer to separate MPE Calc exhibit		
§2.1033 (c) (8)	RSP 100 7.2 (a)		Final radio frequency amplifying circuit's dc voltage = +15 Vdc , current = 3A dc	-	-
-	-	Antenna Gain	9.15dBi	-	-

Notes
1 – Power is adjusted to comply with 47dBm EIRP power limitation as needed depending on antenna gain.
2 – Aggregated occupied BW per RSS-119 clause 5.6.

FCC Part 24D (Base Station)

FCC		Description	Measured	Limit	Result
Transmitter Modulation, output power and other characteristics					
§2.1033 (c) (5) §24.129		Frequency Range	930 – 931 MHz 940 – 941 MHz	930 - 931 MHz\ 940 – 941 MHz	Complies
§2.1033 (c) (6) §2.1033 (c) (7) §2.1046 § 24.132		RF power output at the antenna terminals	20 dBm to 40.1dBm	65.4 dBm ERP	Complies
§2.1033 (c) (4) §2.1047 § 24.133(a)(1) and (a)(2)		Emission types	F1D, F2D, F3D	-	-
		Emission mask	Within mask	Within Mask	Complies
§2.1049 §24.131		Occupied Bandwidth	5.76 kHz 7.12 kHz 15.1 kHz 25.3 kHz	10 kHz 10 kHz 20 kHz 45 kHz	Complies
Transmitter spurious emissions					
§2.1051 §2.1057 §24.133		At the antenna terminals	-24.0 dBm	-13 dBm	Complies
§2.1053 §2.1057 §24.133		Field strength	-18.8 dBm	-13 dBm	Complies
Other details					
§2.1055 §24.135		Frequency stability	0.4 ppm	1.0 ppm	Complies
§2.1093		RF Exposure	Refer to separate MPE Calc exhibit		
§2.1033 (c) (8)		Final radio frequency amplifying circuit's dc voltage is +15 Vdc @ 3A Final currents for normal operation over the power range (Radio Module) 2A @ +24 Vdc		-	-
-	-	Antenna Gain	9.15dBi	-	-
Notes					

EXTREME CONDITIONS

Frequency stability is determined over extremes of temperature and voltage. The extremes of voltage were 85 to 115 percent of the nominal value.

The extremes of temperature were -30°C to +50°C as specified in FCC §2.1055(a)(1).

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 Orbit Radio Card SDM9 is a radio module that is designed to be used in a GE MDS LLC SD Master Station chassis. It operates in 928-960 MHz bands for FCC Part 101 and in the 930-931 and 940-941 MHz bands under Part 24. The EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 24 Volts DC, 2.5 Amps.

The sample was received on December 16, 2013 and tested on December 16, 17 and 19, 2013 and January 13 and February 7, 2014. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
GE MDS LLC	SDM9	Orbit Radio Module	2519103 778123	E5MDS-SDM9 IC ID: 101D-SDM9

OTHER EUT DETAILS

The radio can operate on 6.25, 12.5, 25 or 50 kHz channel spacing (F1D, F2D and F3D modulations) depending on rule part licensing.

ENCLOSURE

The EUT has no enclosure. It is designed to be installed within the enclosure of a host computer.

MODIFICATIONS

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

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Power Designs	6150D	Power supply	2884	-

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

Company	Model	Description	Serial Number	FCC ID
Dell	Latitude D620	Laptop	1949	-

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Tx	Attenuator	Coax	Shielded	0.3
Rx	Un-terminated	Coax	Shielded	0.3
Fixture DC	Power Supply	Two wire	Unshielded	1.3
Fixture Serial	Laptop	Multiwire	Shielded	2

Note: The serial cable and laptop were disconnected after programming the radio during radiated testing.

EUT OPERATION

During emissions testing the EUT was configured to transmit continuously on the selected frequency and modulation or without modulation at rated power. During receiver and unintentional emissions testing, the radio was set for receive mode.

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: 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.

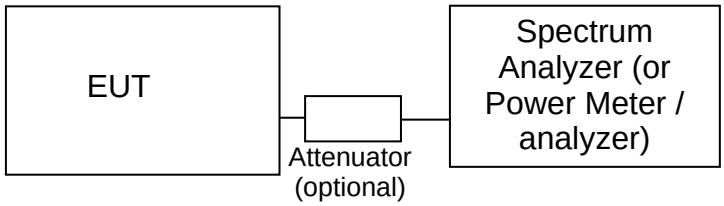
Site	Registration Numbers		Location
	FCC	Canada	
Chamber 3	769238	IC 2845B-3	41039 Boyce Road Fremont, CA 94538-2435
Chamber 4	211948	IC 2845B-4	
Chamber 5	211948	IC 2845B-5	
Chamber 7	A2LA Accredited	IC 2845B-7	

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. 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), 16-Dec-13

Manufacturer	Description	Model	Asset #	Cal Due
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	1/28/2014

Radiated Emissions, 30 - 1,000 MHz, 17-Dec-13

Manufacturer	Description	Model	Asset #	Cal Due
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	8/9/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	6/8/2014

Radiated Emissions, 1000 - 10,000 MHz, 17-Dec-13

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/19/2014
Hewlett Packard	High Pass filter, 1.5 GHz (Blu System)	P/N 84300-80037 (84125C)	1389	5/14/2014
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	8/24/2014

Radiated Emissions, 1,000 - 10,000 MHz, 19-Dec-13

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	10/31/2014
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/19/2014
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	9/14/2014
Hewlett Packard	High Pass filter, 1.5 GHz (Blu System)	P/N 84300-80037 (84125C)	1389	5/14/2014

Radiated Emissions, 30 - 1,000 MHz, 19-Dec-13

Manufacturer	Description	Model	Asset #	Cal Due
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	8/9/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	6/8/2014

Radio Antenna Port (Power and Spurious Emissions), 13-Jan-14

Manufacturer	Description	Model	Asset #	Cal Due
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	1/28/2014

Radio Antenna Port (Power and Spurious Emissions), 07-Feb-14

Manufacturer	Description	Model	Asset #	Cal Due
Agilent Technologies	PXA Spectrum Analyzer S/N MY53310386	9030 PXA	-	1/16/2016

Appendix B Test Data

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Client:	GE MDS LLC	Job Number:	J93834
Product	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Emissions Standard(s):	FCC Parts 24 and 101, RSS-119	Class:	A
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

GE MDS LLC

Product

Radio Card SDM9

Date of Last Test: 2/7/2014

Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

RSS 119 and FCC Part 24

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

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: 18-23 °C

Rel. Humidity: 30-40 %

Summary of Results

Run #			Test Performed	Limit	Pass / Fail	Result / Margin
1			Output Power	None	Pass	40.1 dBm (10.2W)
2			Spectral Mask	Within Mask	Pass	Refer to table
3			99% or Occupied Bandwidth		-	Refer to table
4			Spurious Emissions (conducted)	-13 dBm	Pass	-24.0 dBm @ 717.31 MHz (-4.0 dB)
5			Spurious emissions (radiated)	-13 dBm	Pass	-18.8 dBm @ 2790.03 MHz (-5.8 dB)
6			Frequency Stability	1 ppm	Pass	0.4 ppm

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.

Radio Test Data

Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #1: Output Power

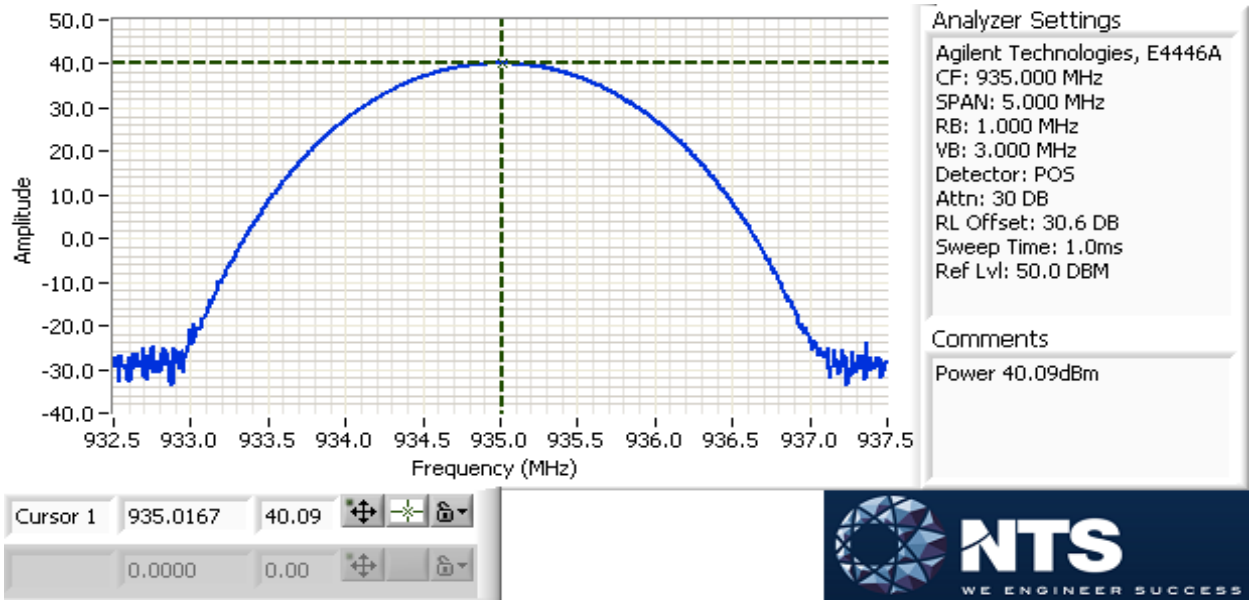
Date: 12/16/2013 Engineer: Jack Liu Location: FT Chamber # 4A

Cable Loss: 0.60 dB Attenuator: 30.0 dB Total Loss: 30.60 dB

Cable ID(s): EL540+ Customer cable Attenuator IDs: 1878+ 2098

Power Setting[2]	Frequency (MHz)	Output Power (dBm)[1]	W
40	930	39.9	9.7
40	935	40.1	10.2
40	941	40.1	10.2

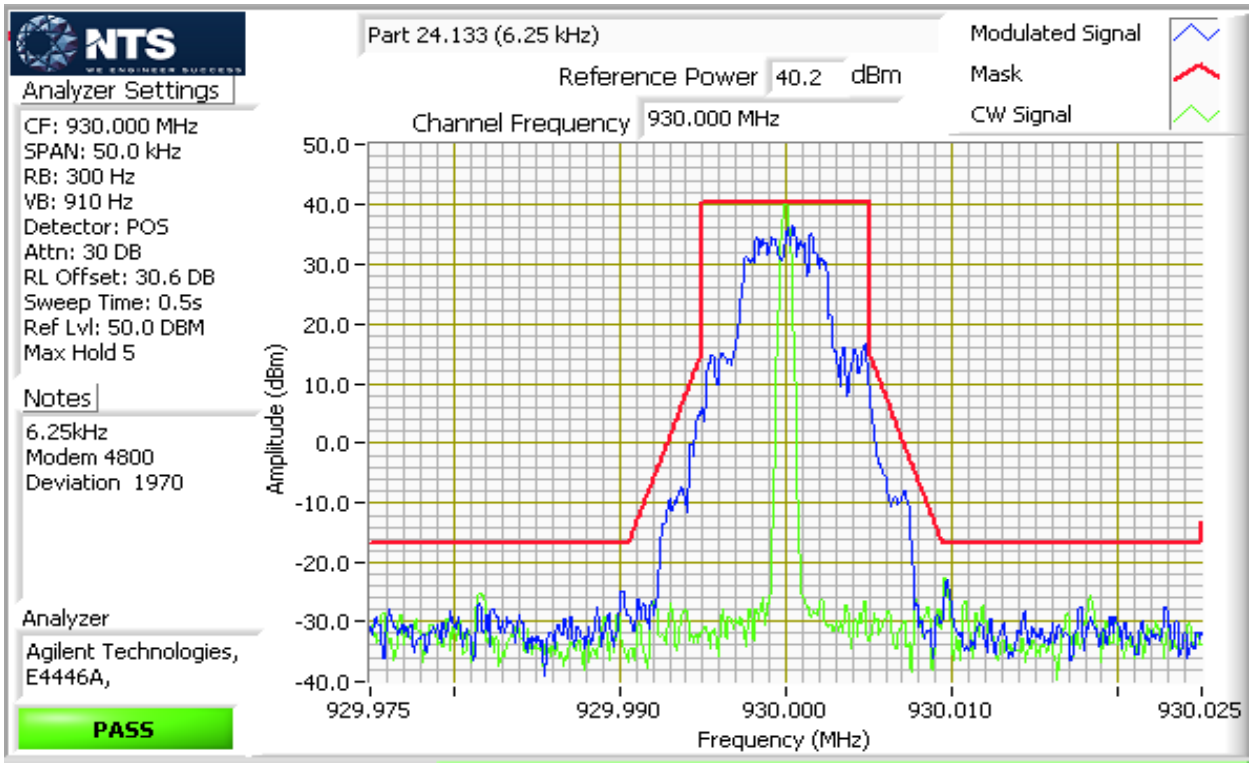
Note 1:	Output power measured using a spectrum analyzer (see plots below) with RBW=1MHz, VB=3 MHz, Peak detector
Note 2:	Power setting - the software power setting used during testing, included for reference only.



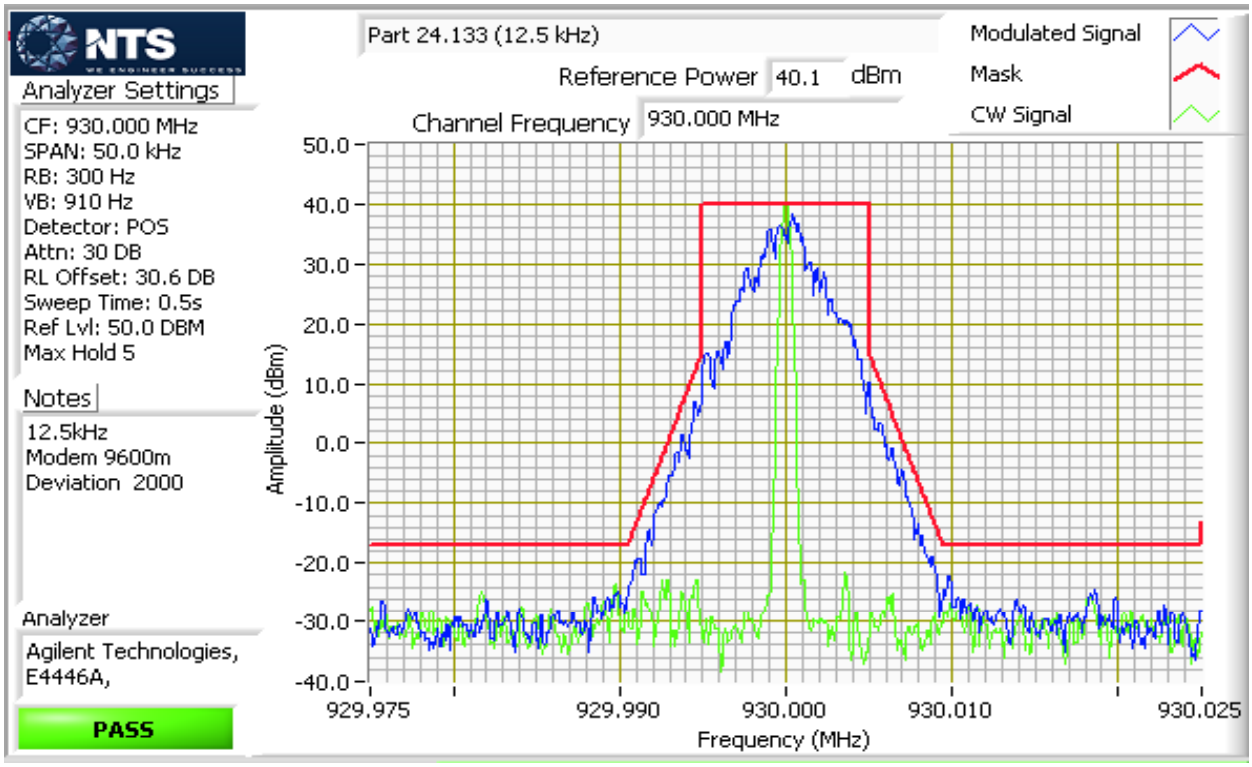
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #2: Spectral Mask, FCC Part 24.133 Masks (a)(1) and (a)(2)

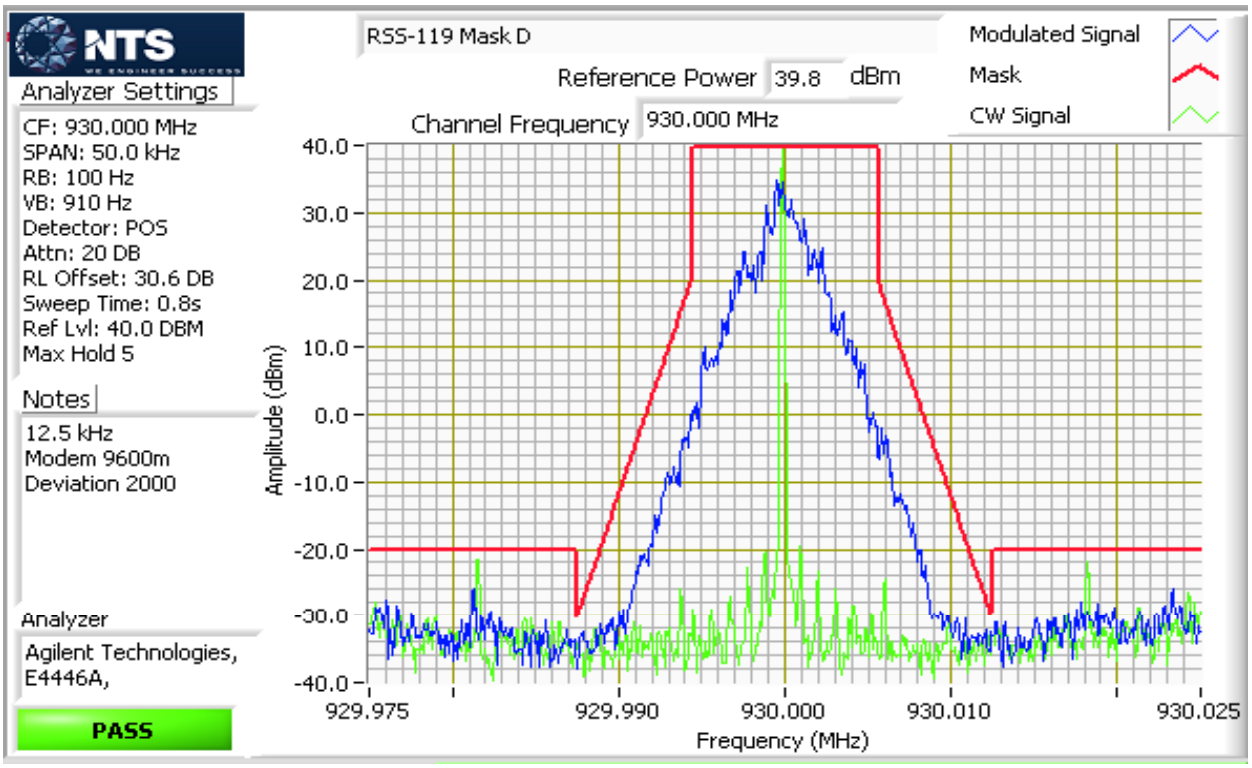
Date: 12/16/2013 Engineer: Jack Liu Location: FT Chamber # 4A



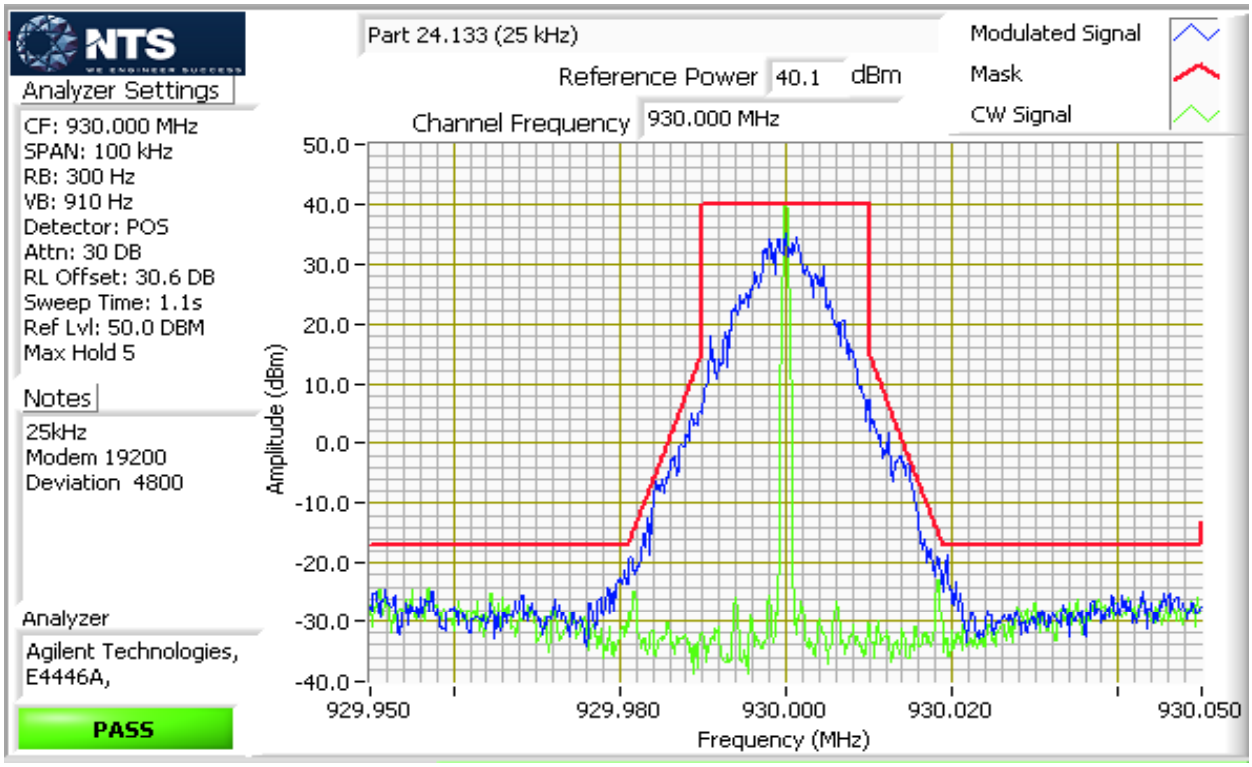
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



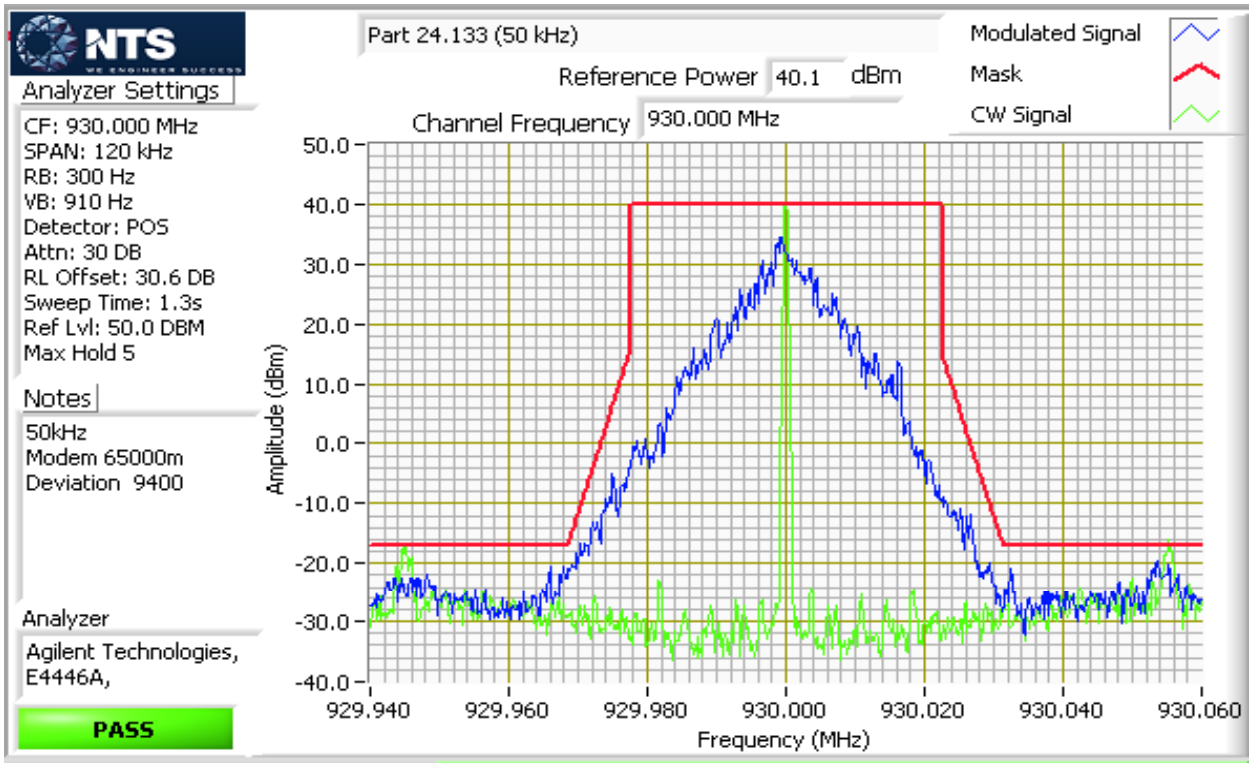
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #3: Signal Bandwidth

Date: 12/16/2013 Engineer: Jack Liu Location: FT Chamber # 4A

6.25kHz Modem 4800 Deviation 1970

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 26dB	99%
40	930	240Hz		5.76

12.5kHz Modem 9600m Deviation 2000

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 26dB	99%
40	930	470Hz		7.12

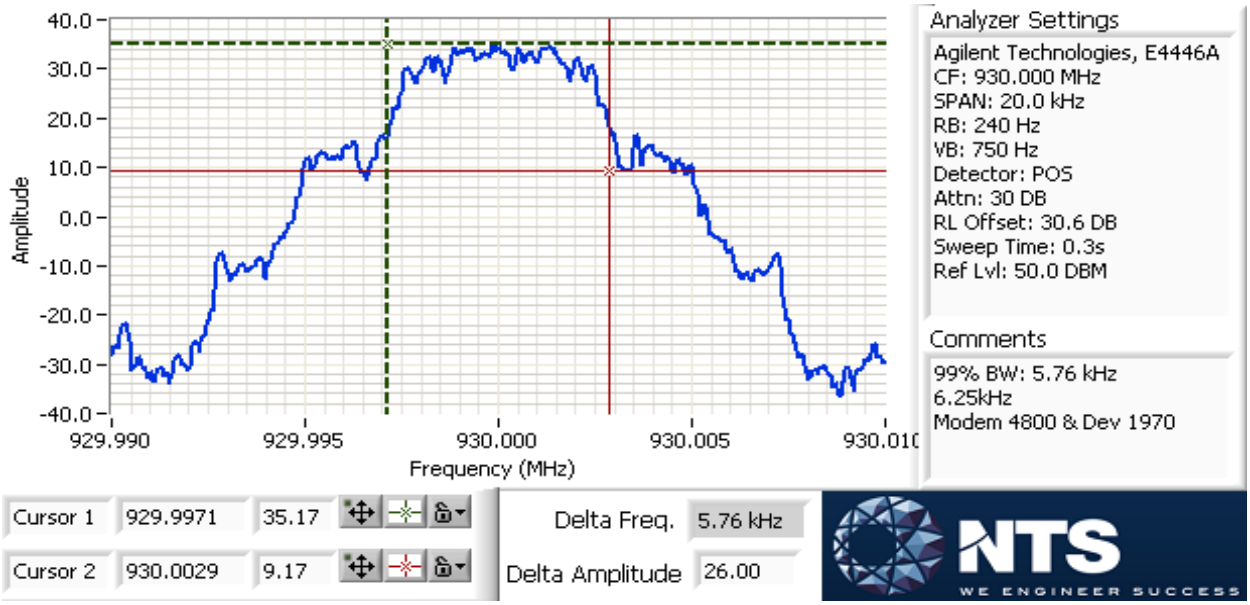
25kHz Modem 19200 Deviation 4800

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 26dB	99%
40	930	620Hz		15.1

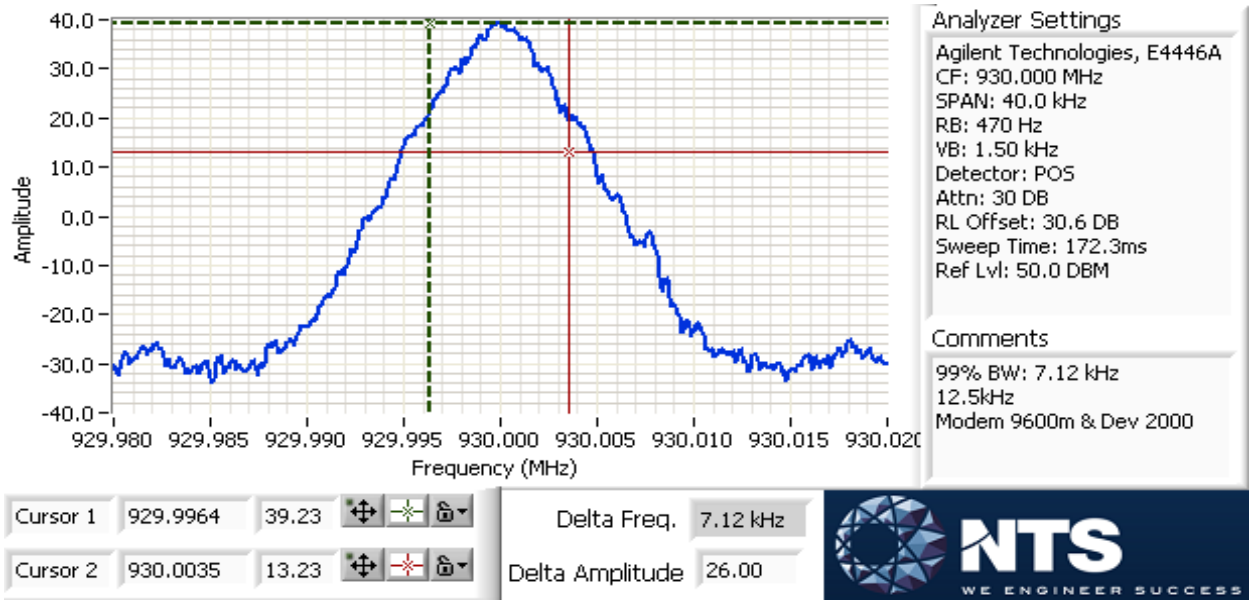
50kHz Modem 65000m Deviation 9400

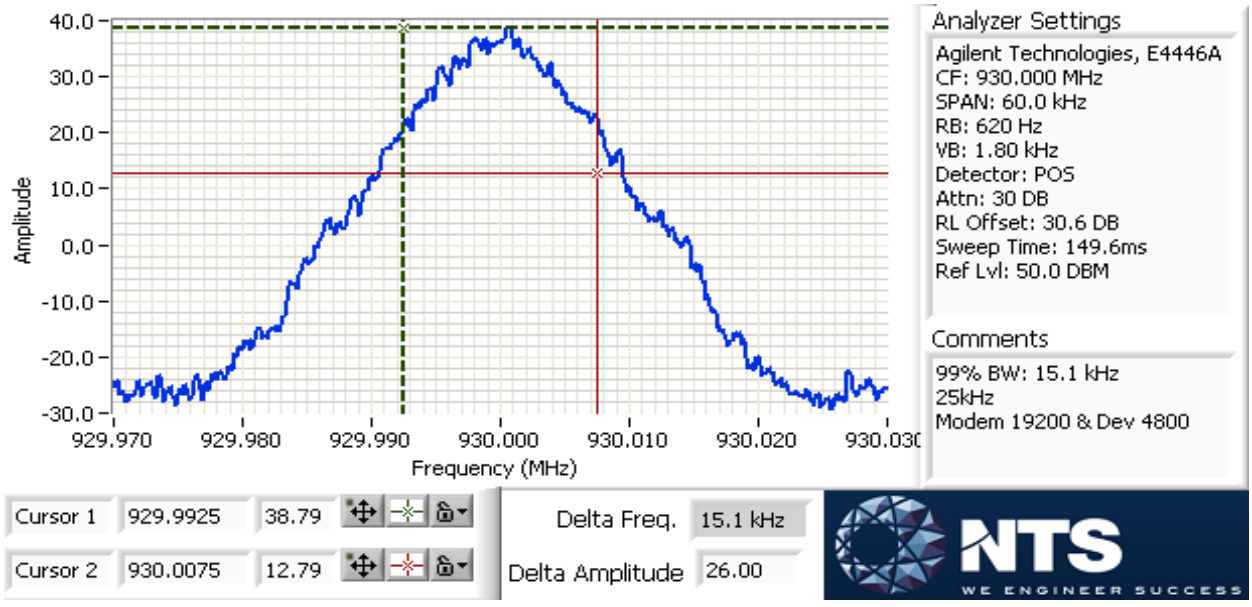
Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 26dB	99%
40	930	1kHz		25.3

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

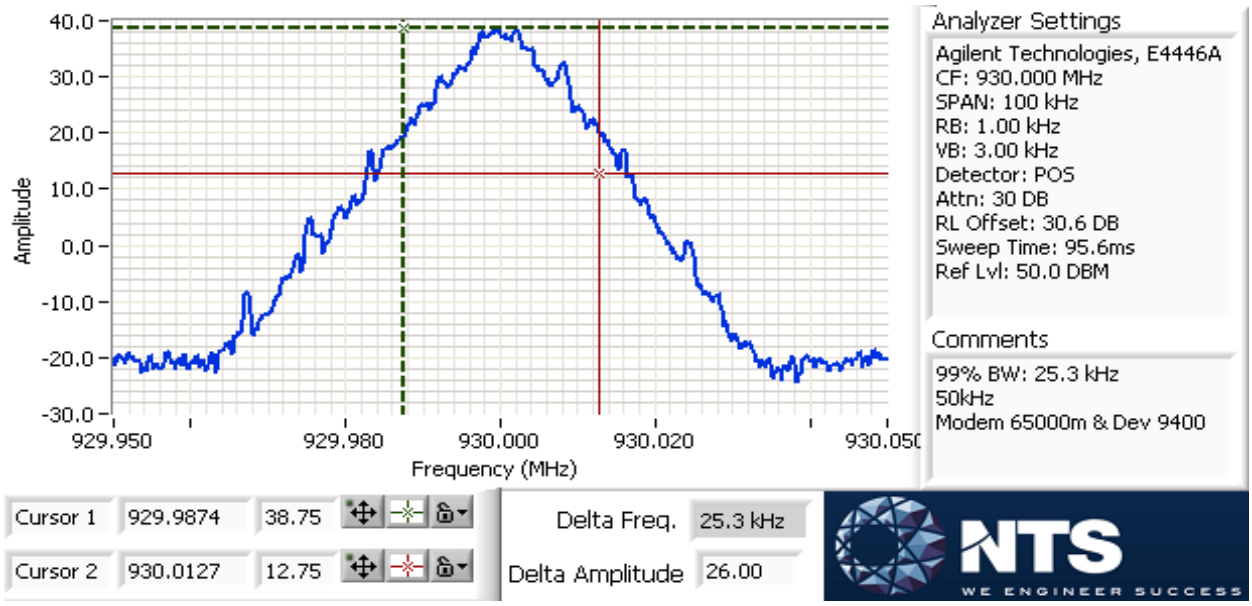


Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A





Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

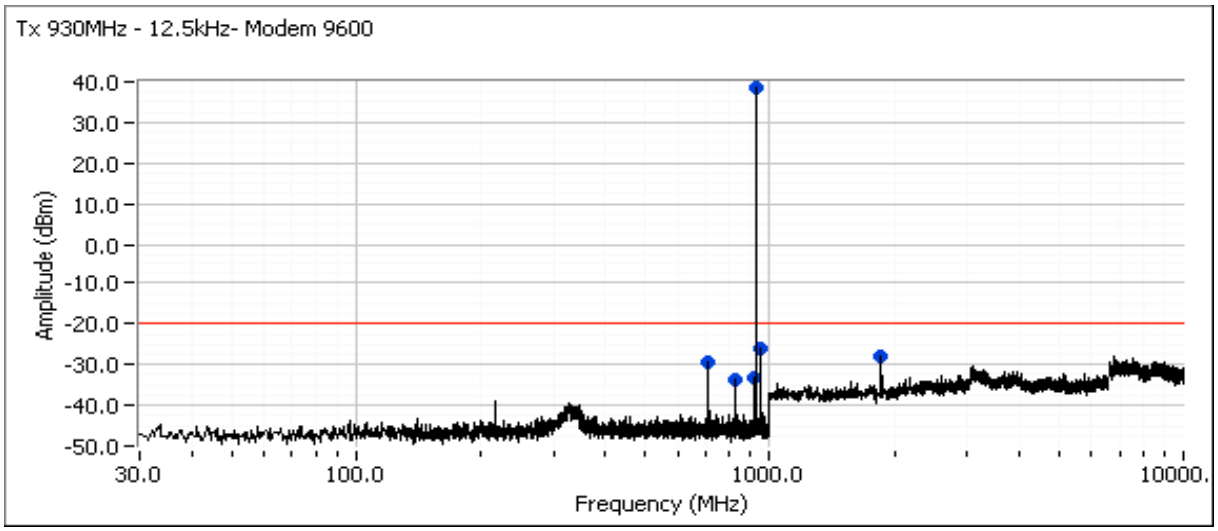
Run #4: Out of Band Spurious Emissions, Conducted

Date: 12/16/2013 Engineer: Jack Liu Location: FT Chamber # 4A

Frequency (MHz)	Limit	Result
930	-20	Pass
935	-20	Pass
941	-20	Pass

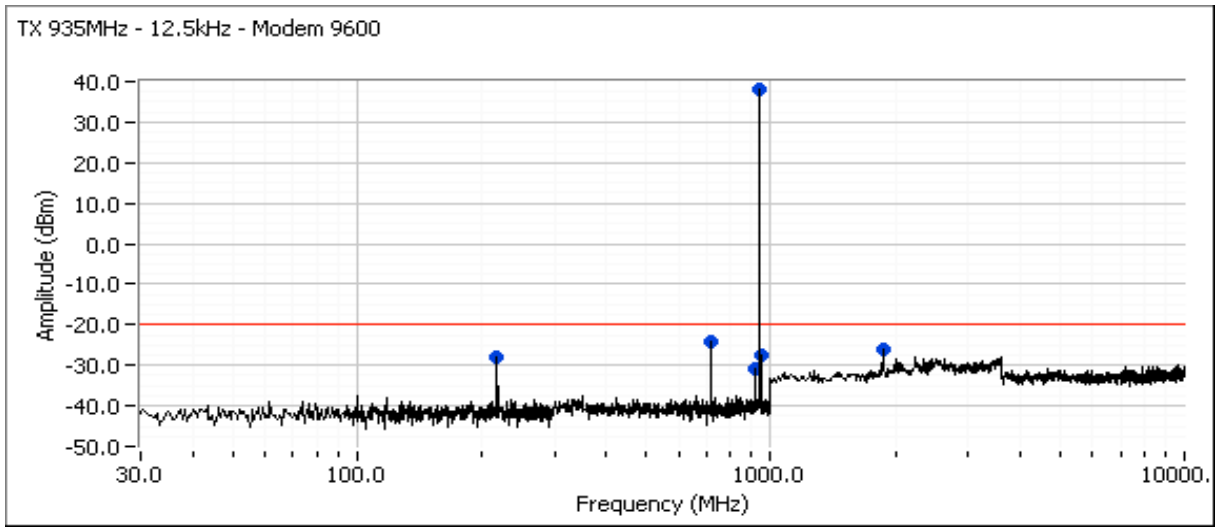
The limit is taken from FCC Part 24 Masks

Plots for low channel, power setting(s) = 40

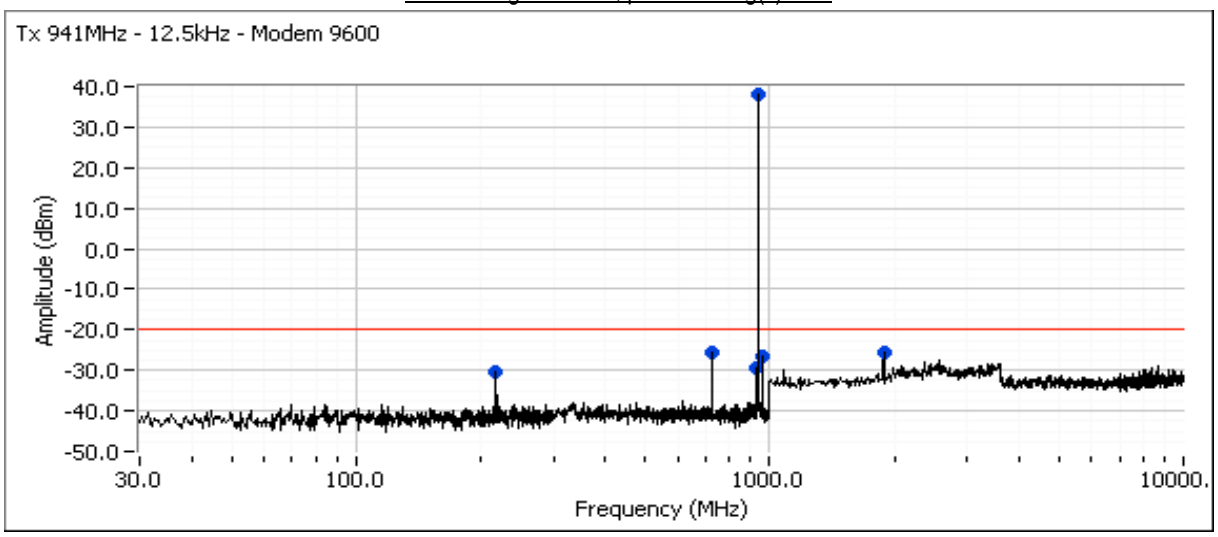


Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Plots for center channel, power setting(s) = 40



Plots for high channel, power setting(s) = 40



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Frequency MHz	Level dBm	Port	FCC Part 24 Limit	FCC Part 24 Margin	Detector	Channel	Mode	Comments
712.004	-29.4	RF Port	-20.0	-9.4	Peak	930MHz	Modem 9600	
820.992	-33.7	RF Port	-20.0	-13.7	Peak	930MHz	Modem 9600	
912.008	-33.2	RF Port	-20.0	-13.2	Peak	930MHz	Modem 9600	
948.001	-26.0	RF Port	-20.0	-6.0	Peak	930MHz	Modem 9600	
1859.950	-27.9	RF Port	-20.0	-7.9	Peak	930MHz	Modem 9600	
218.221	-28.0	RF Port	-20.0	-8.0	Peak	935MHz	Modem 9600	
717.308	-24.0	RF Port	-20.0	-4.0	Peak	935MHz	Modem 9600	
916.987	-30.8	RF Port	-20.0	-10.8	Peak	935MHz	Modem 9600	
954.006	-27.5	RF Port	-20.0	-7.5	Peak	935MHz	Modem 9600	
1865.380	-26.0	RF Port	-20.0	-6.0	Peak	935MHz	Modem 9600	
218.221	-30.6	RF Port	-20.0	-10.6	Peak	941MHz	Modem 9600	
722.917	-25.4	RF Port	-20.0	-5.4	Peak	941MHz	Modem 9600	
923.718	-29.3	RF Port	-20.0	-9.3	Peak	941MHz	Modem 9600	
959.615	-26.5	RF Port	-20.0	-6.5	Peak	941MHz	Modem 9600	
1884.620	-25.6	RF Port	-20.0	-5.6	Peak	941MHz	Modem 9600	

Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #5: Out of Band Spurious Emissions, Radiated

Conducted limit (dBm): -13
Approximate field strength limit @ 3m: 84.4

The limit is taken from FCC Part 24 Masks
Run #5a - Preliminary measurements - chamber scans

Date: 12/16/2013, 12/19/2013 Engineer: Rafael Varelas, Deniz Demirci Location: FT Chamber #4

Frequency	Level	Pol	FCC Part 24		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
101.924	42.4	H	84.4	-42.0	Peak	238	2.5		Low, 930MHz
199.118	40.8	H	84.4	-43.6	Peak	130	1.0		Low, 930MHz
444.048	42.9	H	84.4	-41.5	Peak	135	2.0		Low, 930MHz
930.000	108.4	H	-	-	Peak	317	1.5	Fundamental	Low, 930MHz
1039.030	56.0	V	84.4	-28.4	Peak	85	1.0		Low, 930MHz
1860.050	67.1	H	84.4	-17.3	PK	233	1.4		Low, 930MHz
2790.030	77.9	V	84.4	-6.5	PK	279	1.0		Low, 930MHz
3720.170	68.3	V	84.4	-16.1	PK	291	1.0		Low, 930MHz
5580.040	62.9	H	84.4	-21.5	PK	243	1.5		Low, 930MHz
103.868	42.0	H	84.4	-42.4	Peak	234	3.0		Center, 935MHz
193.287	39.8	H	84.4	-44.6	Peak	124	1.5		Center, 935MHz
444.048	39.8	H	84.4	-44.6	Peak	294	2.0		Center, 935MHz
935.000	107.6	H	-	-	Peak	317	1.5	Fundamental	Center, 935MHz
1044.010	56.4	V	84.4	-28.0	Peak	91	1.0		Center, 935MHz
1870.090	67.5	V	84.4	-16.9	PK	268	1.3		Center, 935MHz
2805.030	76.9	V	84.4	-7.5	PK	148	1.0		Center, 935MHz
3740.080	70.2	V	84.4	-14.2	PK	290	1.0		Center, 935MHz
5610.090	63.0	H	84.4	-21.4	PK	230	1.2		Center, 935MHz

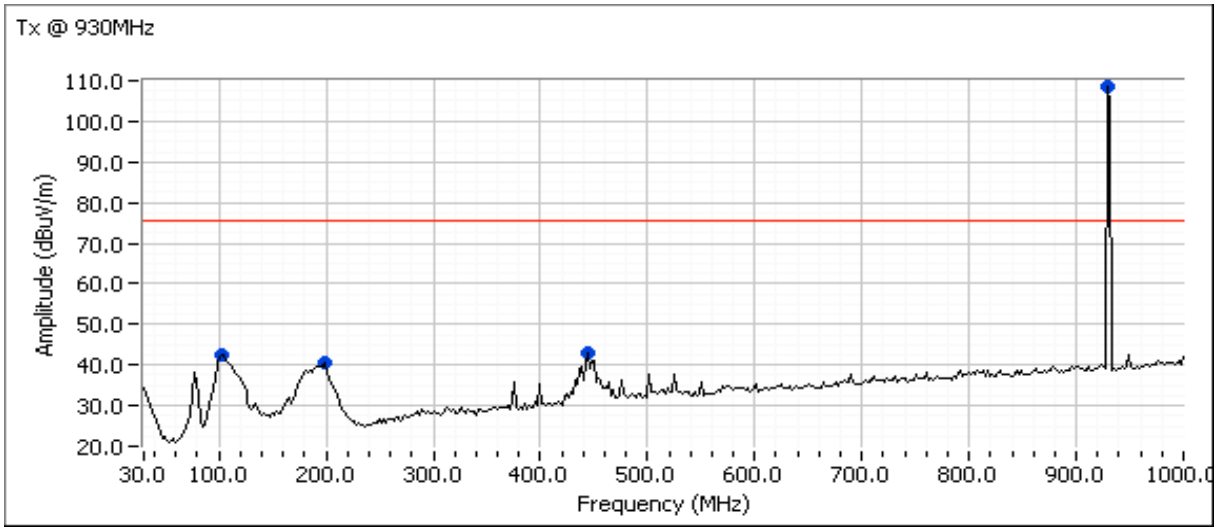
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #5 continued

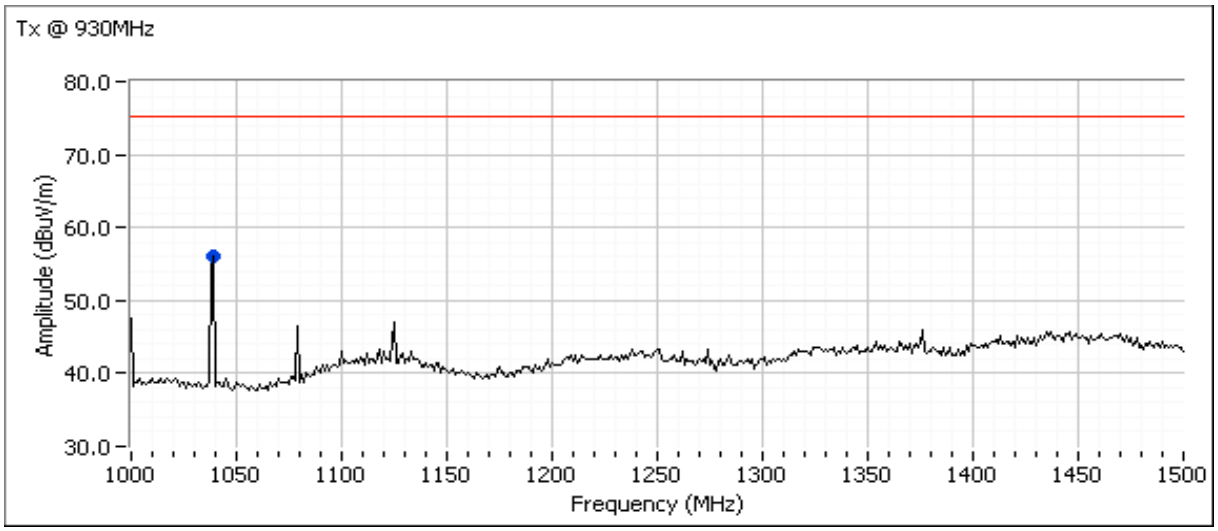
Frequency	Level	Pol	FCC Part 24		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
103.868	41.7	H	84.4	-42.7	Peak	234	3.0		High, 941MHz
193.287	39.1	H	84.4	-45.3	Peak	139	1.5		High, 941MHz
451.824	42.0	H	84.4	-42.4	Peak	274	2.0		High, 941MHz
941.000	107.6	H	-	-	Peak	313	1.5	Fundamental	High, 941MHz
1050.010	56.5	V	84.4	-27.9	Peak	84	1.0		High, 941MHz
1882.060	64.7	V	84.4	-19.7	PK	263	1.7		High, 941MHz
2823.040	77.7	V	84.4	-6.7	PK	264	1.0		High, 941MHz
3764.090	73.0	V	84.4	-11.4	PK	288	1.2		High, 941MHz

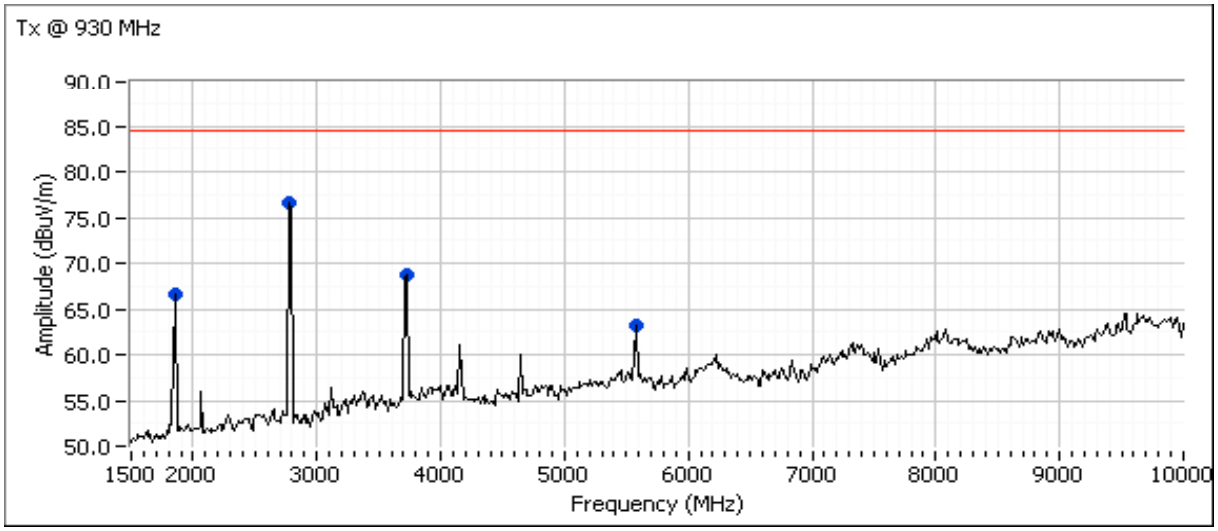
Note 1:	The field strength limit in the tables above was calculated from the erp/eirp limit detailed in the standard using the free space propagation equation: E=√(30PG)/d. This limit is conservative - it does not consider the presence of the ground plane and, for erp limits, the dipole gain (2.2dBi) 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.

Plots for 930 MHz channel, power setting(s) = 40



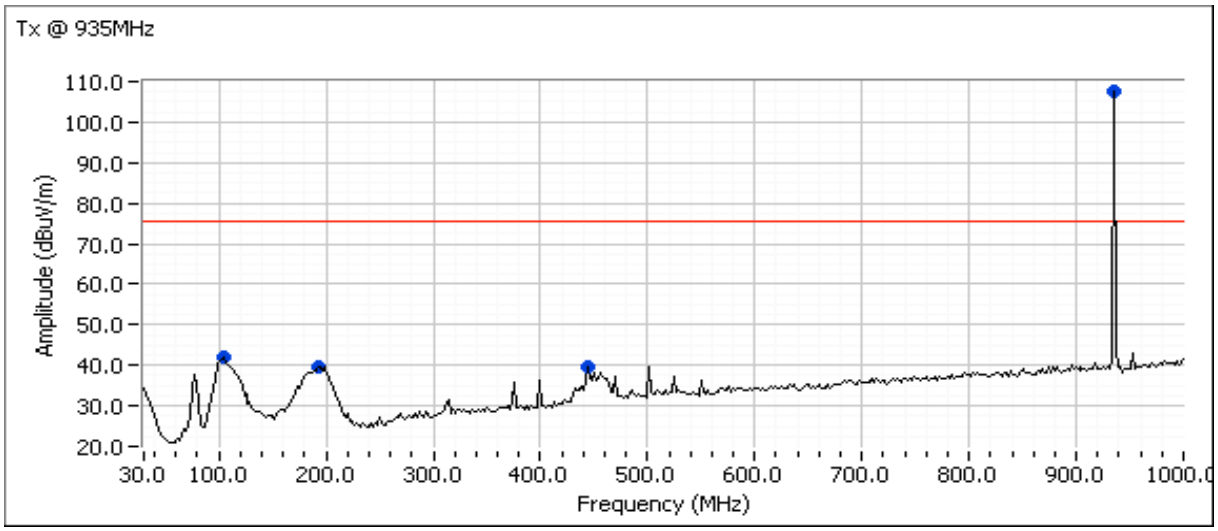
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

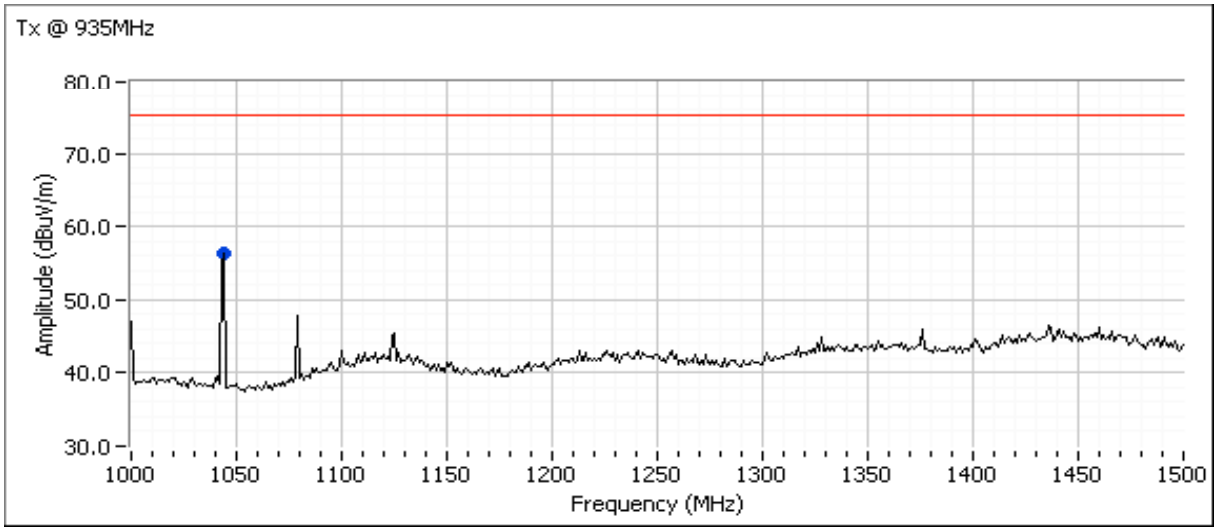




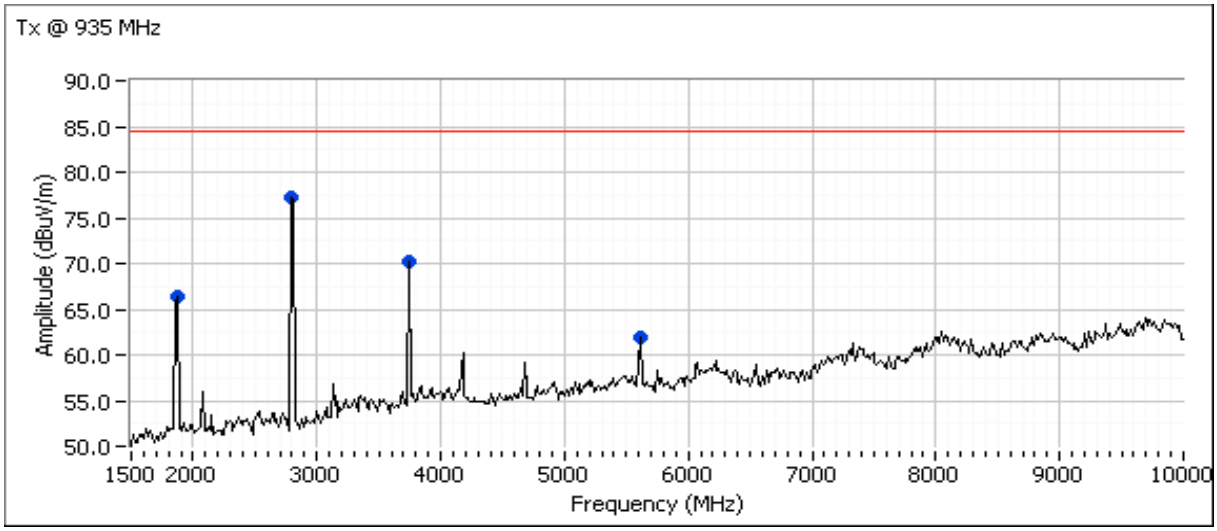
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Plots for 935 MHz channel, power setting(s) =40

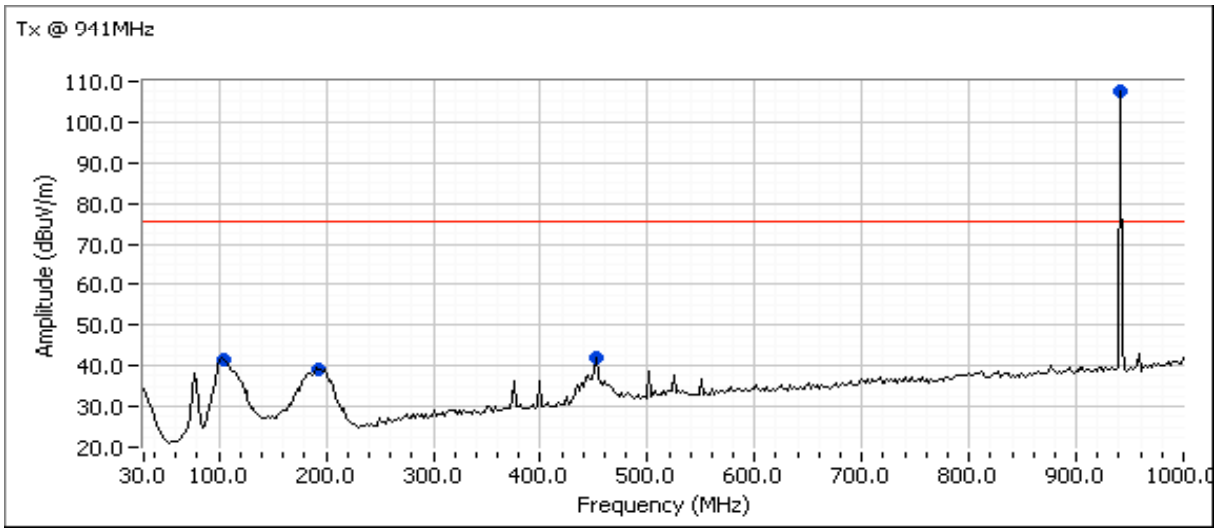




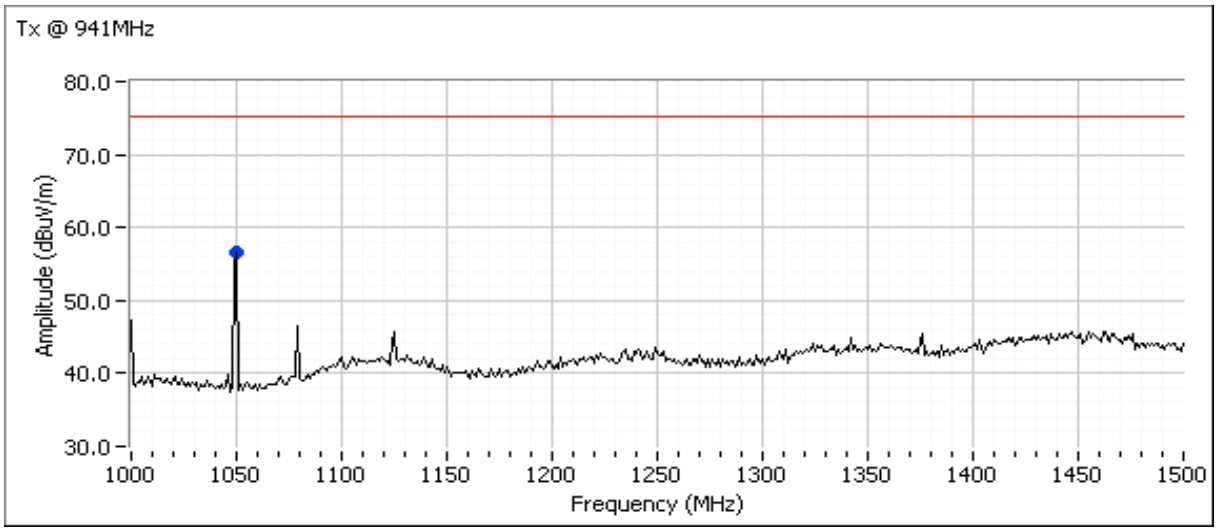
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

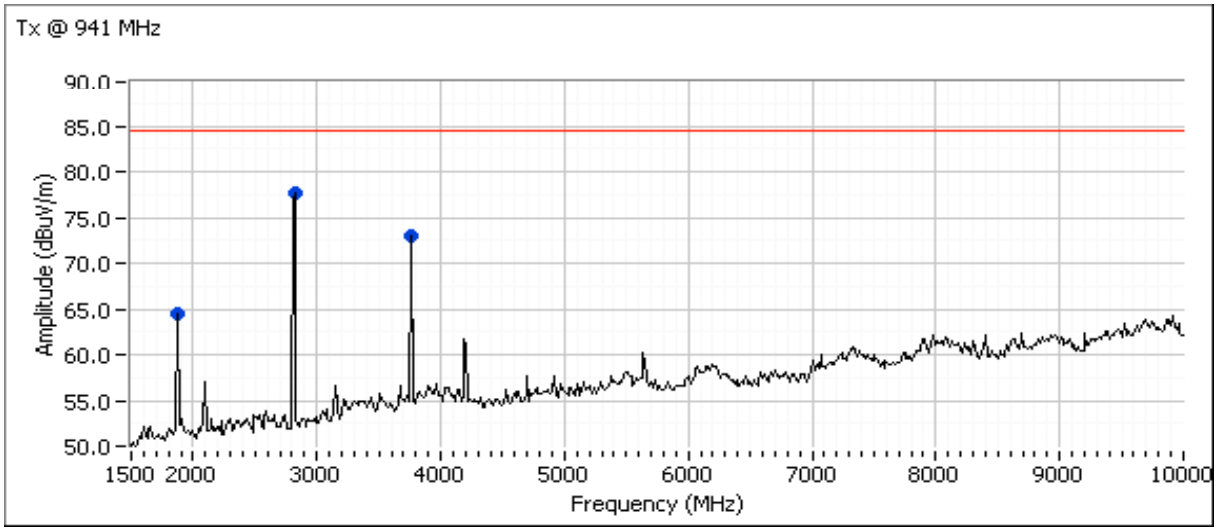


Plots for 941 MHz channel, power setting(s) = 40



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A





Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #5b: Final Field Strength Measurements and Substitution Measurements

Date: 12/19/2013 Engineer: David Bare Location: Fremont Chamber #4

EUT Field Strength

Frequency	Level	Pol	FCC Part 24		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
1860.050	67.1	H	84.4	-17.3	PK	233	1.4	RB 1 MHz;VB 3 MHz;Pe	930
2790.030	77.9	V	84.4	-6.5	PK	279	1.0	RB 1 MHz;VB 3 MHz;Pe	930
3720.170	68.3	V	84.4	-16.1	PK	291	1.0	RB 1 MHz;VB 3 MHz;Pe	930
1870.090	67.5	V	84.4	-16.9	PK	268	1.3	RB 1 MHz;VB 3 MHz;Pe	935
2805.030	76.9	V	84.4	-7.5	PK	148	1.0	RB 1 MHz;VB 3 MHz;Pe	935
3740.080	70.2	V	84.4	-14.2	PK	290	1.0	RB 1 MHz;VB 3 MHz;Pe	935
1882.060	64.7	V	84.4	-19.7	PK	263	1.7	RB 1 MHz;VB 3 MHz;Pe	941
2823.040	77.7	V	84.4	-6.7	PK	264	1.0	RB 1 MHz;VB 3 MHz;Pe	941
3764.090	73.0	V	84.4	-11.4	PK	288	1.2	RB 1 MHz;VB 3 MHz;Pe	941

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:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	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
1860.050	-10.1	8.2	94.0	95.9	67.1	-28.8	-31.0		-13.0	-18.0

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
2790.030	-10.1	10.0	94.4	94.5	77.9	-16.6	-18.8		-13.0	-5.8
3720.170	-9.9	9.4	94.8	95.3	68.3	-27.0	-29.2		-13.0	-16.2
1870.090	-10.1	8.2	93.8	95.7	67.5	-28.2	-30.4		-13.0	-17.4
2805.030	-10.1	10.0	94.3	94.4	76.9	-17.5	-19.7		-13.0	-6.7
3740.080	-9.9	9.4	94.2	94.7	70.2	-24.5	-26.7		-13.0	-13.7
1882.060	-10.1	8.2	94.1	96.0	64.7	-31.3	-33.5		-13.0	-20.5
2823.040	-10.1	10.0	94.4	94.5	77.7	-16.8	-19.0		-13.0	-6.0
3764.090	-9.9	9.4	94.1	94.6	73.0	-21.6	-23.8		-13.0	-10.8

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:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #6: Frequency Stability

Date: 12/17/2013 Engineer: David W. Bare, R. Varelas Location: Fremont Lab #6

Nominal Frequency: 929.99976 MHz

Frequency Stability Over Temperature

The EUT was soaked at each temperature for a minimum of 30 minutes prior to making the measurements to ensure the EUT and chamber had stabilized at that temperature.

Temperature	Frequency Measured	Drift	
(Celsius)	(MHz)	(Hz)	(ppm)
-30	930.000160	400	0.4
-20	930.000080	320	0.3
-10	929.999920	160	0.2
0	929.999760	0	0.0
10	929.999679	-81	-0.1
20	929.999760	0	0.0
30	929.999599	-161	-0.2
40	929.999519	-241	-0.3
50	929.999439	-321	-0.3
	Worst case:	400	0.4

Frequency Stability Over Input Voltage

Nominal Voltage is 24Vdc.

Voltage	Frequency Measured	Drift	
(Dc)	(MHz)	(Hz)	(ppm)
21.5	929.999519	-241	-0.3
27.6	929.999519	-241	-0.3
	Worst case:	-241	0.4

Note 1:	Maximum drift of fundamental frequency before it shut down at 21.3 Vdc was 0 Hz.

Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

RSS 119 and FCC Part 101

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

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: 18-23 °C

Rel. Humidity: 30-40 %

Summary of Results

Run #			Test Performed	Limit	Pass / Fail	Result / Margin
1			Output Power	None	Pass	40.1 dBm (10.2W)
2			Spectral Mask	Within Mask	Pass	Refer to table
3			99% or Occupied Bandwidth		-	Refer to table
4			Spurious Emissions (conducted)	-13 dBm	Pass	-24.8dBm @ 947.28 MHz (-4.8 dB)
5			Spurious emissions (radiated)	-13 dBm	Pass	in progress
6			Frequency Stability	1 ppm	Pass	0.4 ppm

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.

Radio Test Data

Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #1: Output Power

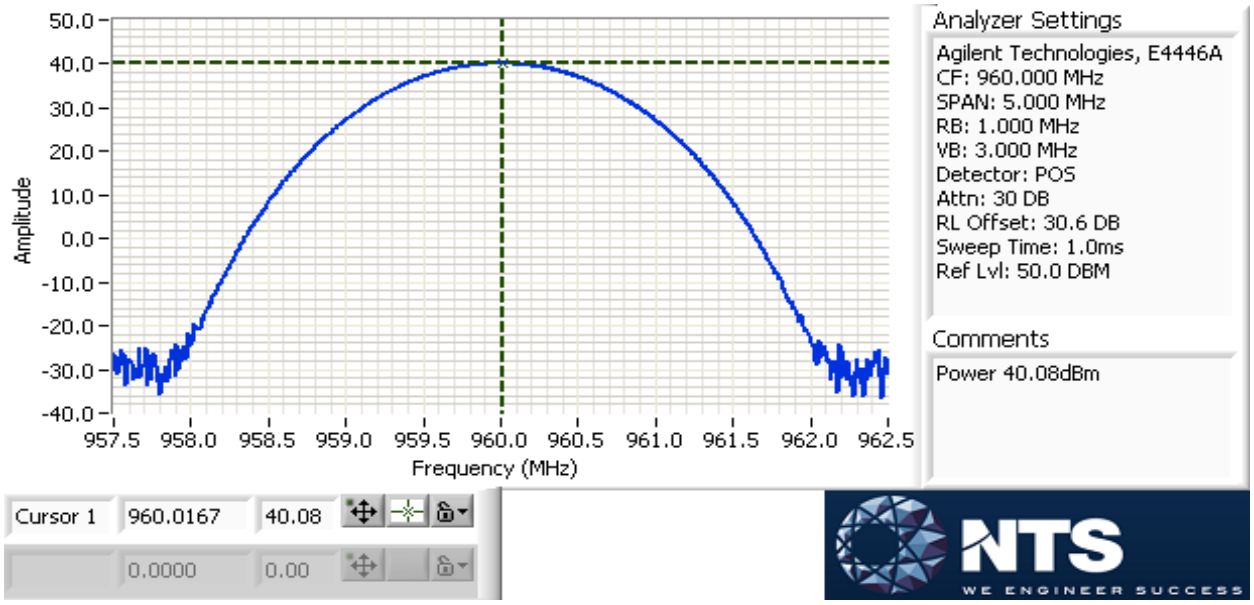
Date: 12/16/2013 Engineer: Jack Liu Location: FT Chamber # 4A

Cable Loss: 0.60 dB Attenuator: 30.0 dB Total Loss: 30.60 dB

Cable ID(s): EL540+ Customer cable Attenuator IDs: 1878+ 2098

Power Setting[2]	Frequency (MHz)	Output Power (dBm)[1]	W
40	928	39.8	9.5
40	941	40.1	10.2
40	953	40.0	10.0
40	960	40.1	10.2

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

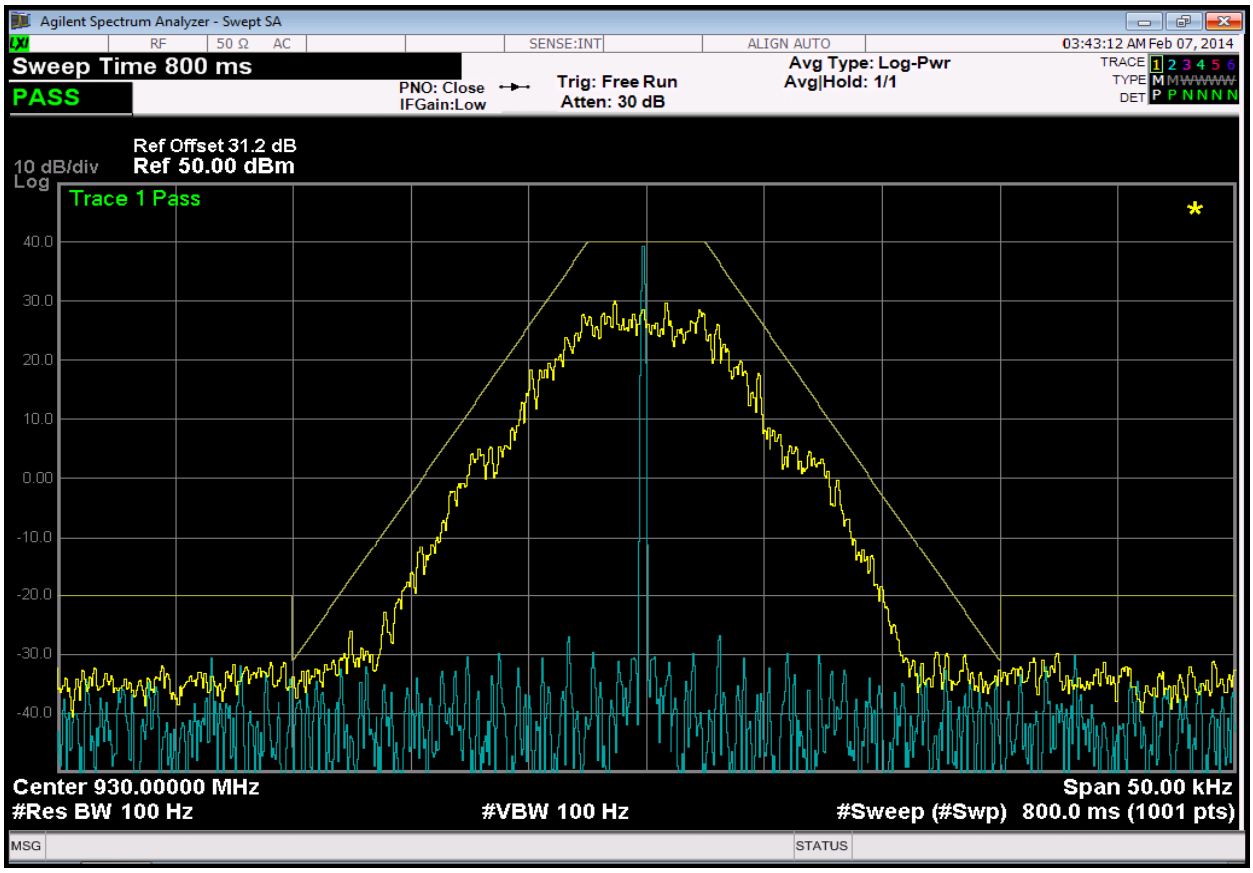


Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #2: Spectral Mask, FCC Part 101.111 Masks (a)(5) and (a)(6)

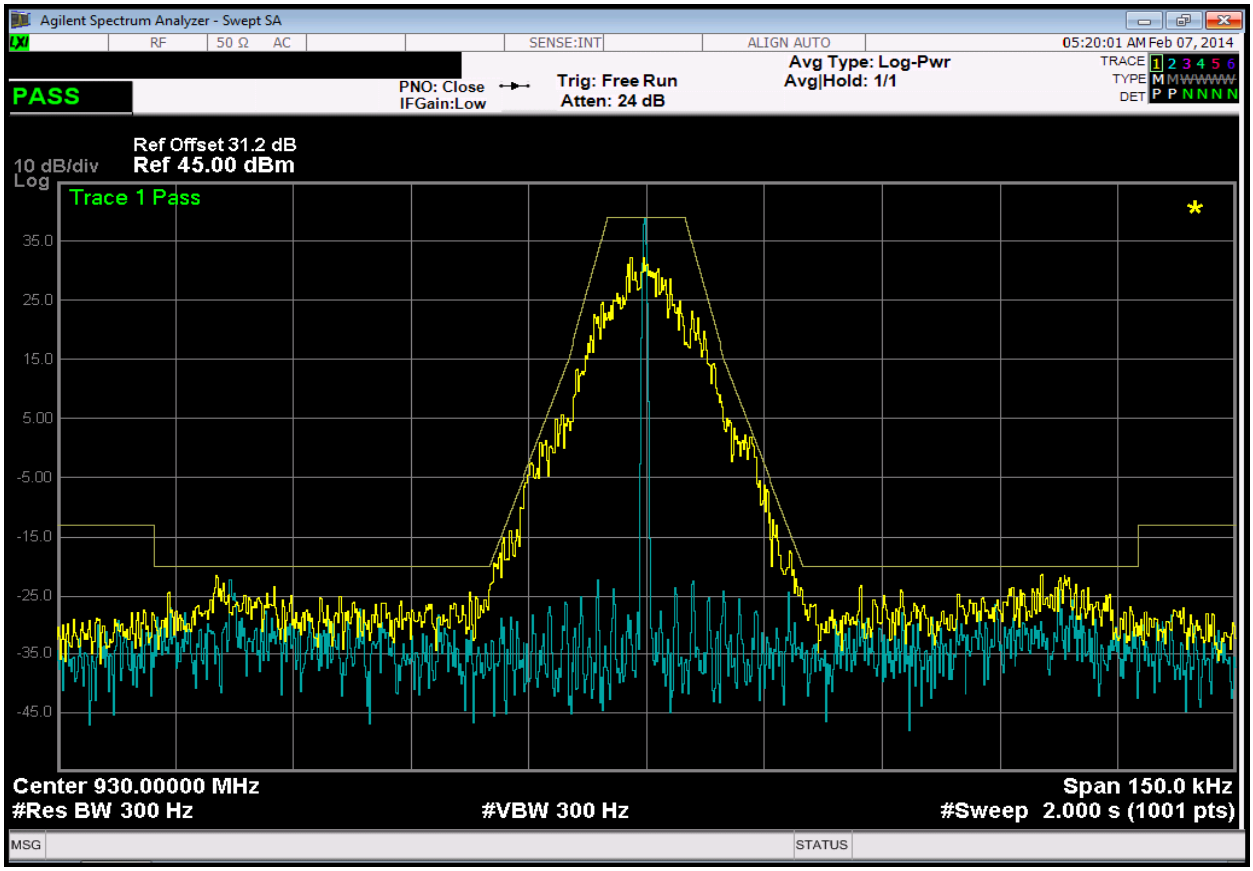
Date: 2/7/2014 Engineer: Jon Vilagy Location: GE MDS

Note: These tests were performed by GE MDS at their facility in Rochester, New York.



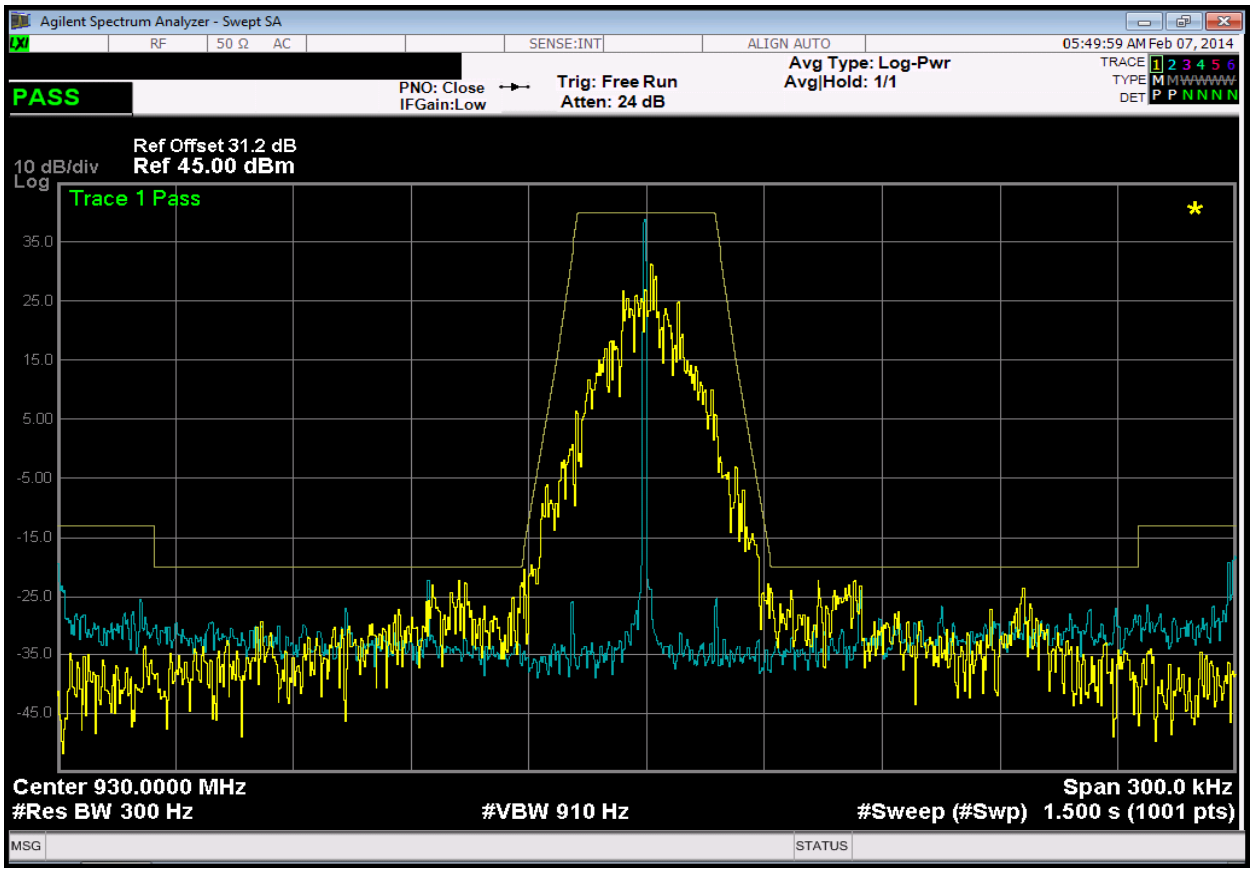
12.5 kHz Channels

Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



25 kHz Channels

Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



50 kHz Channels

Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #3: Signal Bandwidth

Date: 2/7/2014 Engineer: Jon Vilagy Location: GE MDS

Note: These tests were performed by GE MDS at their facility in Rochester, New York.

12.5kHz Modem 9600m Deviation 2000

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 26dB	99%
40	930	470 Hz		10.6

25kHz Modem 19200 Deviation 4800

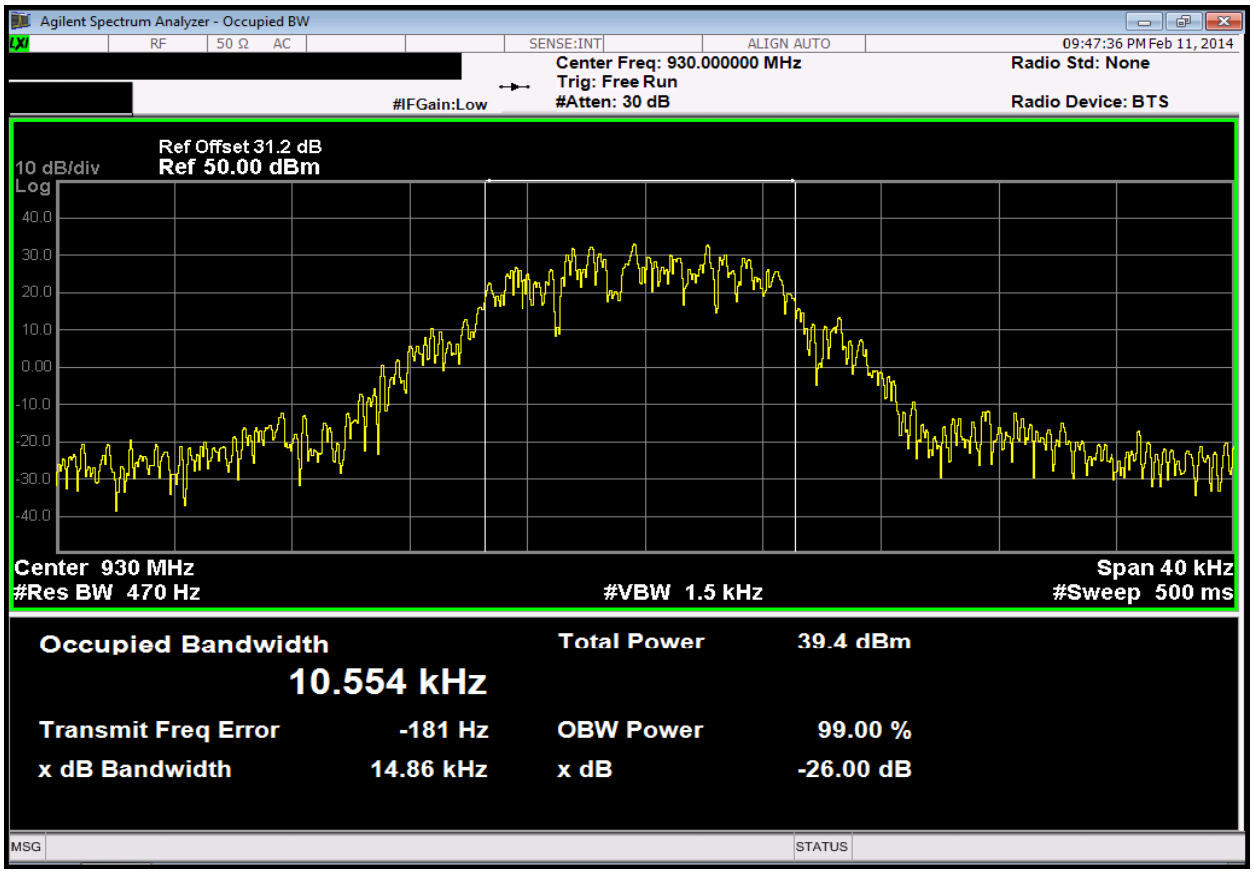
Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 26dB	99%
40	930	300 Hz		16.2

50kHz Modem 65000m Deviation 9400

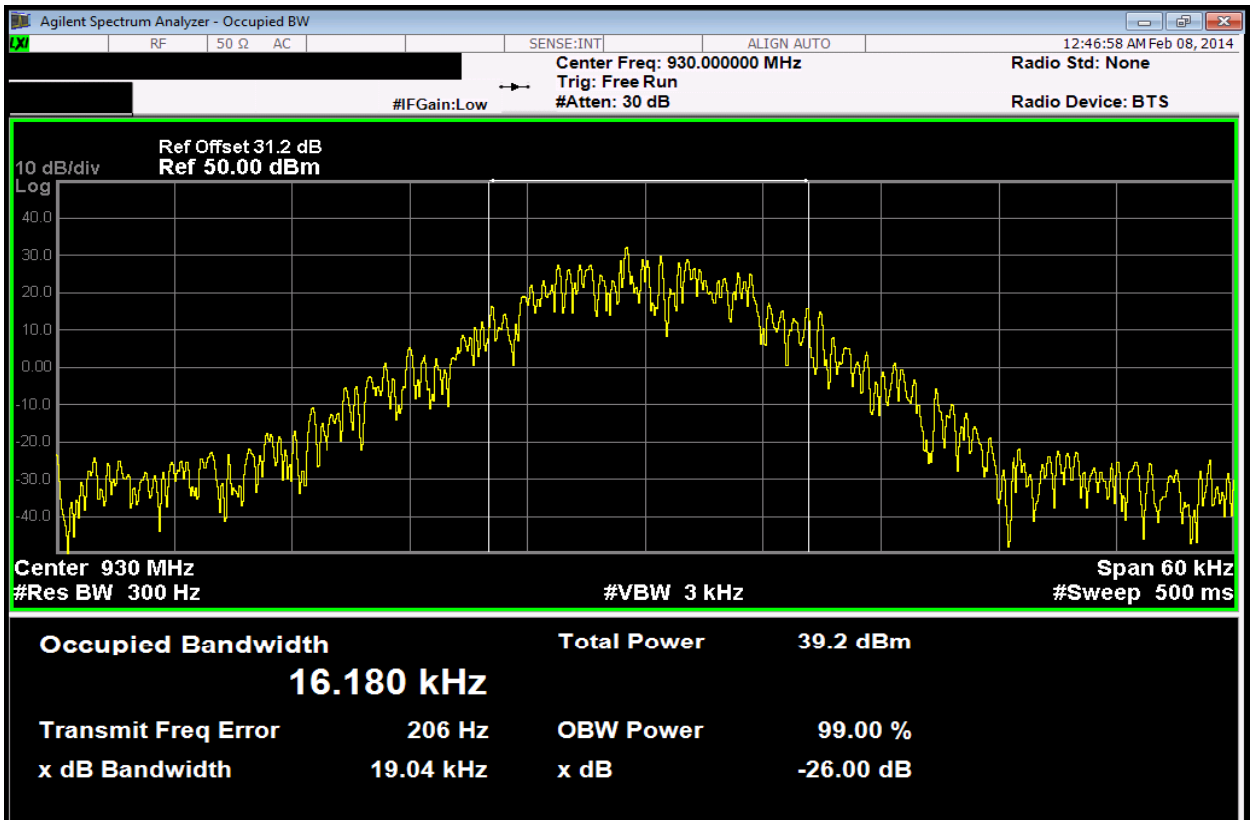
Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (kHz) 26dB	99%
40	930	1kHz		28.5

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

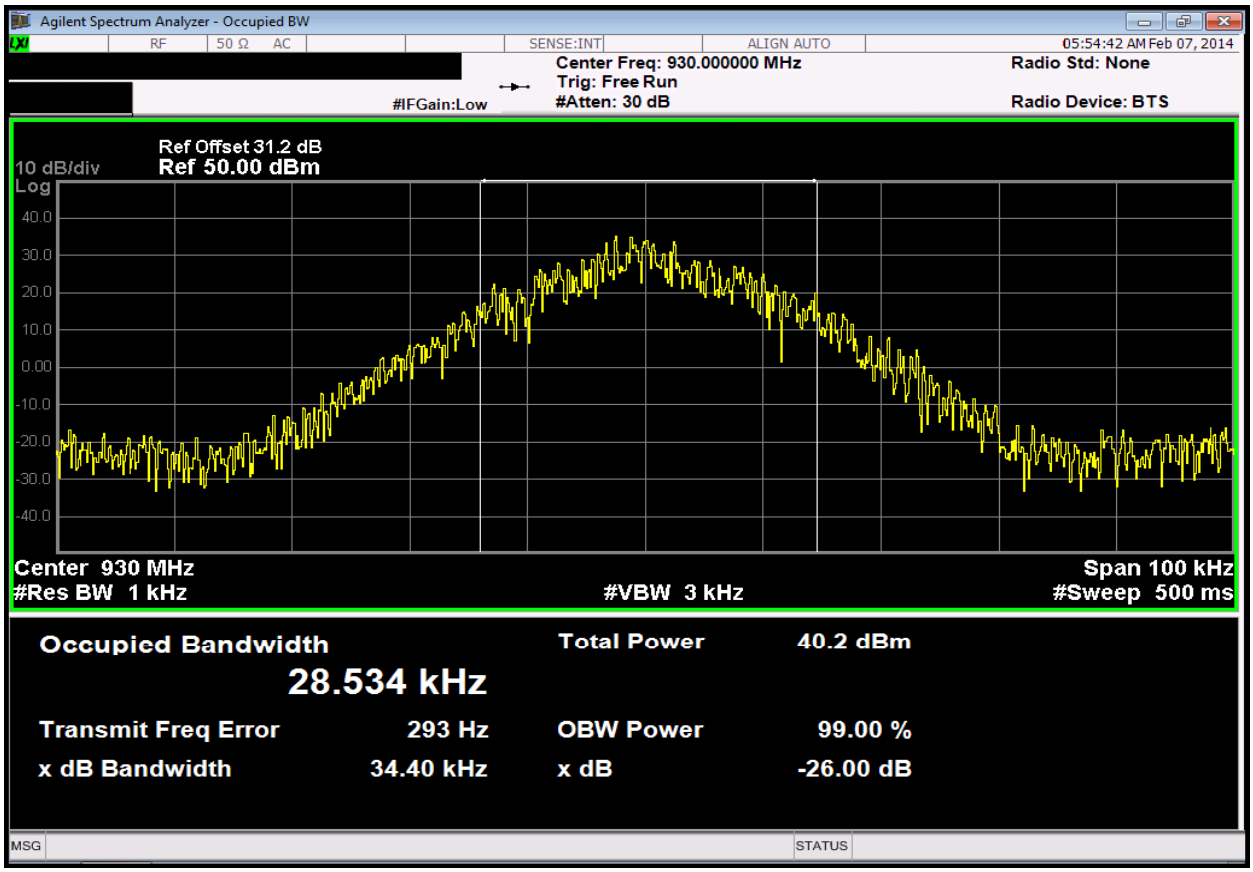
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

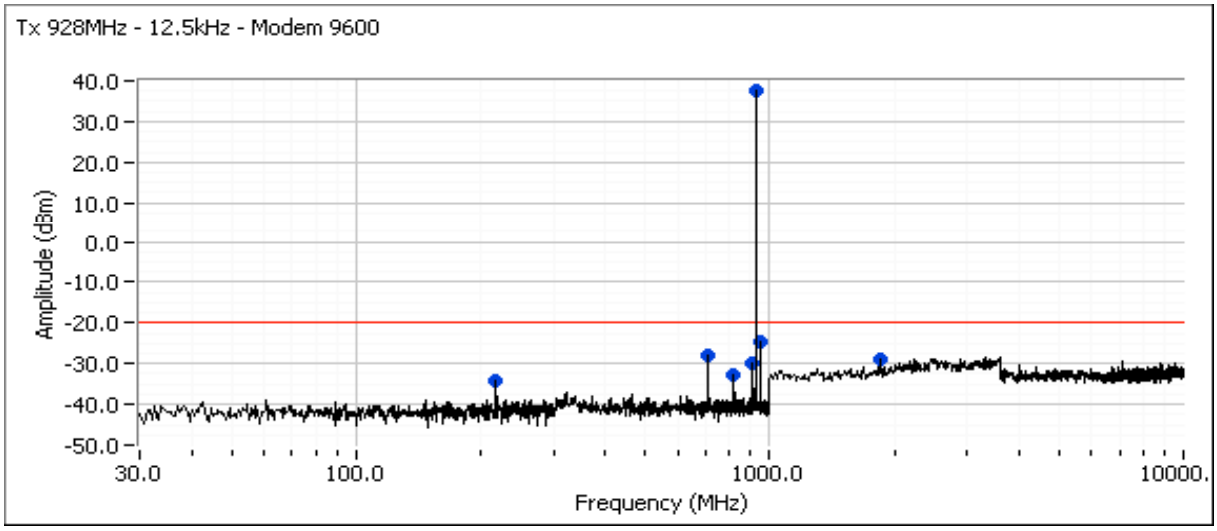
Run #4: Out of Band Spurious Emissions, Conducted

Date: 12/18/2013 Engineer: Rafael Varelas Location: FT Lab #6

Frequency (MHz)	Limit	Result
928	-20	Pass
941	-20	Pass
953	-20	Pass
960	-20	Pass

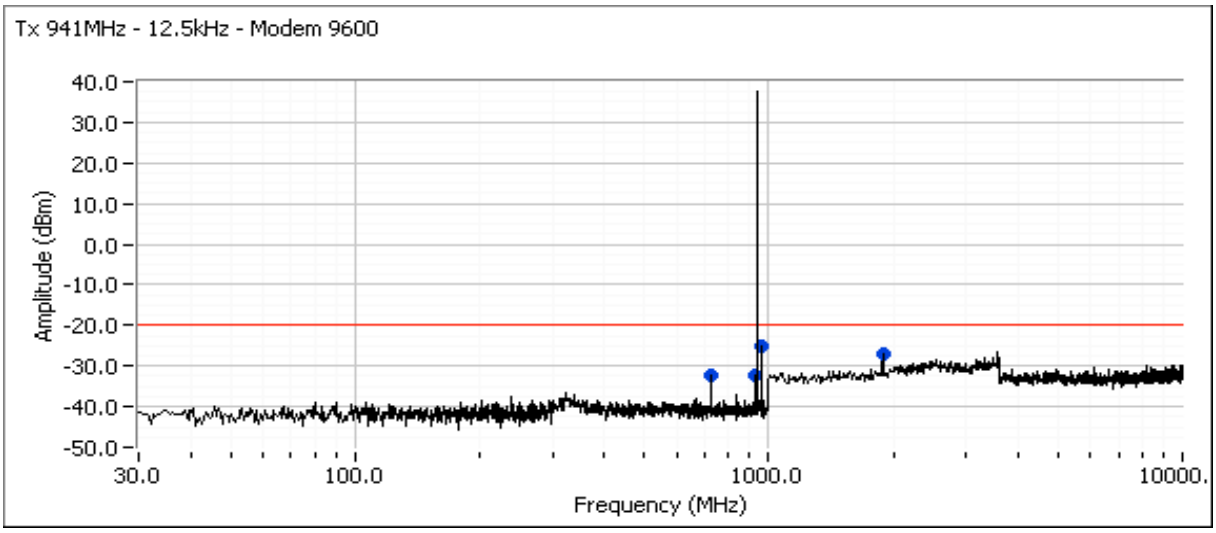
The limit is taken from FCC Part 101 Masks

Plot for 928 MHz channel, power setting(s) = 40

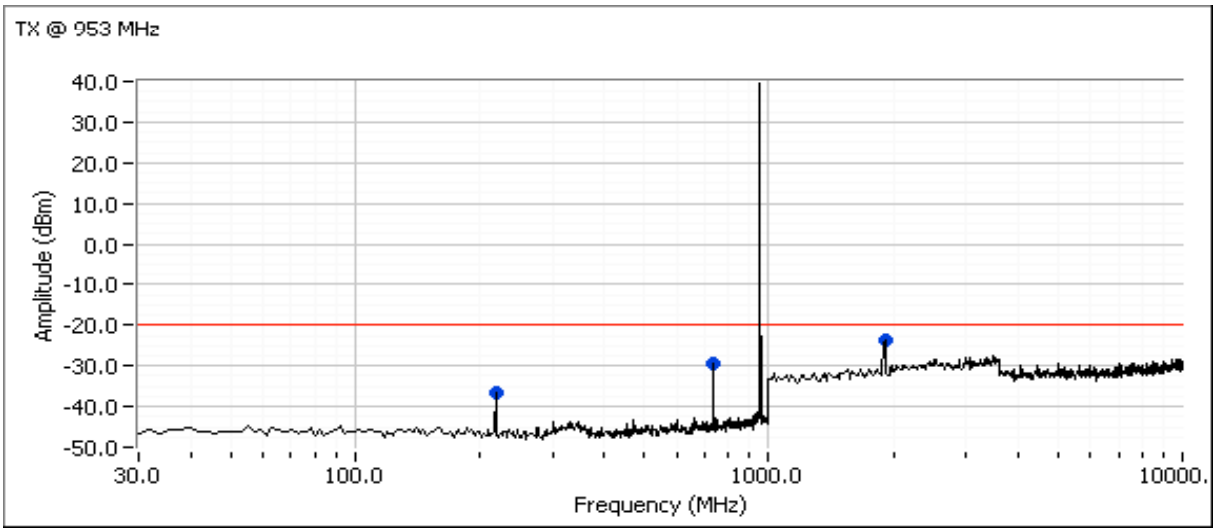


Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Plot for 941 Mhz channel, power setting(s) = 40

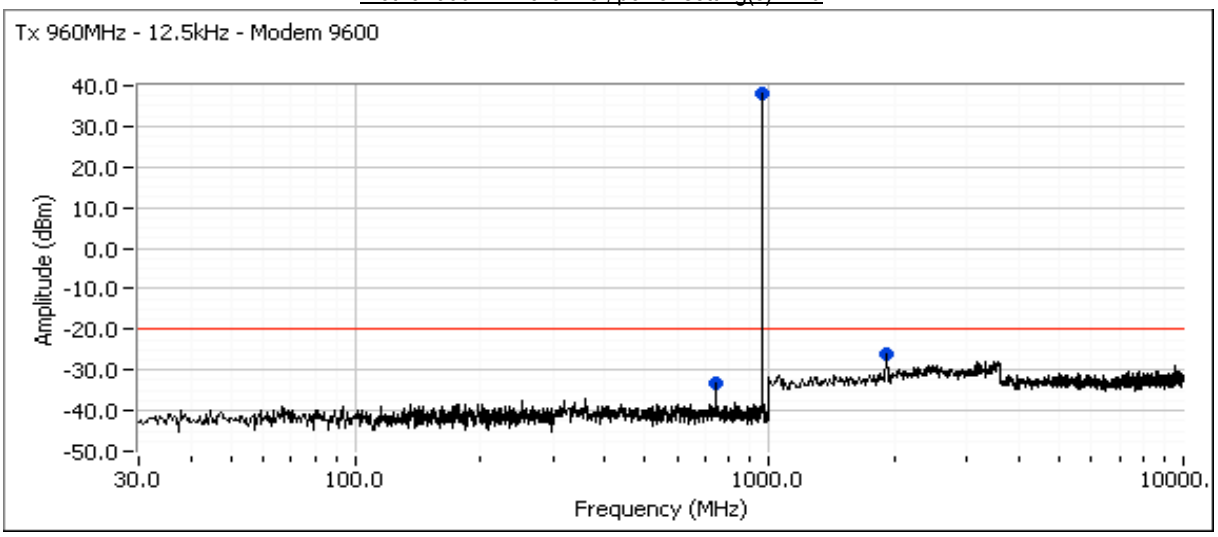


Plot for 953 MHz channel, power setting(s) = 40



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Plot for 960 MHz channel, power setting(s) = 40



Frequency MHz	Level dBm	Port	Limit	Margin	Detector	Channel	Mode	Comments
947.276	-24.8	RF Port	-20.0	-4.8	Peak	928MHz	Modem 9600	
218.221	-34.2	RF Port	-20.0	-14.2	Peak	928MHz	Modem 9600	
710.577	-28.2	RF Port	-20.0	-8.2	Peak	928MHz	Modem 9600	
819.391	-32.9	RF Port	-20.0	-12.9	Peak	928MHz	Modem 9600	
911.378	-29.9	RF Port	-20.0	-9.9	Peak	928MHz	Modem 9600	
947.276	-24.8	RF Port	-20.0	-4.8	Peak	928MHz	Modem 9600	
1855.770	-28.9	RF Port	-20.0	-8.9	Peak	928MHz	Modem 9600	
722.917	-32.4	RF Port	-20.0	-12.4	Peak	941MHz	Modem 9600	
923.718	-32.1	RF Port	-20.0	-12.1	Peak	941MHz	Modem 9600	
959.615	-25.1	RF Port	-20.0	-5.1	Peak	941MHz	Modem 9600	
1884.620	-26.8	RF Port	-20.0	-6.8	Peak	941MHz	Modem 9600	
741.987	-33.2	RF Port	-20.0	-13.2	Peak	960MHz	Modem 9600	
1923.080	-26.0	RF Port	-20.0	-6.0	Peak	960MHz	Modem 9600	
218.000	-36.8	RF Port	-20.0	-16.8	Peak	953 MHz	Modem 9600	
735.000	-29.4	RF Port	-20.0	-9.4	Peak	953 MHz	Modem 9600	
1906.000	-23.6	RF Port	-20.0	-3.6	Peak	953 MHz	Modem 9600	

NTS WE ENGINEER SUCCESS

Radio Test Data

Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #5: Out of Band Spurious Emissions, Radiated

Conducted limit (dBm): -13
Approximate field strength limit @ 3m: 84.4

The limit is taken from FCC Part 101 Masks
Run #5a - Preliminary measurements - chamber scans
Date: 12/19/2013 Engineer: David Bare Location: Fremont Chamber #4

Frequency	Level	Pol	FCC Part 101		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
101.924	41.5	H	84.4	-42.9	Peak	239	3.0		Low, 928MHz
199.118	39.9	H	84.4	-44.5	Peak	132	1.0		Low, 928MHz
455.711	39.3	H	84.4	-45.1	Peak	120	2.0		Low, 928MHz
928.000	106.3	H	-	-	Peak	317	1.5	Fundamental	Low, 928MHz
1037.020	56.4	V	84.4	-28.0	Peak	81	1.0		Low, 928MHz
2784.450	82.0	V	84.4	-2.4	Peak	40	1.0		Low, 928MHz
3711.230	64.9	H	84.4	-19.5	Peak	46	1.3		Low, 928MHz
4640.180	63.5	V	84.4	-20.9	Peak	256	1.0		Low, 928MHz
103.868	41.7	H	84.4	-42.7	Peak	234	3.0		Mid, 941MHz
193.287	39.1	H	84.4	-45.3	Peak	139	1.5		Mid, 941MHz
451.824	42.0	H	84.4	-42.4	Peak	274	2.0		Mid, 941MHz
941.000	107.6	H	-	-	Peak	313	1.5	Fundamental	Mid, 941MHz
1050.010	56.5	V	84.4	-27.9	Peak	84	1.0		Mid, 941MHz
1882.060	64.7	V	84.4	-19.7	PK	263	1.7		Mid, 941MHz
2823.040	77.7	V	84.4	-6.7	PK	264	1.0		Mid, 941MHz
3764.090	73.0	V	84.4	-11.4	PK	288	1.2		Mid, 941MHz
36.009	46.1	V	83.4	-37.3	Peak	342	1.0		Mid,/High, 953 MHz
1062.010	56.1	V	84.4	-28.3	Peak	147	1.0		Mid,/High, 953 MHz
2858.750	78.9	V	84.4	-5.5	Peak	260	1.0		Mid,/High, 953 MHz
3812.000	75.5	H	84.4	-8.9	Peak	243	1.5		Mid,/High, 953 MHz

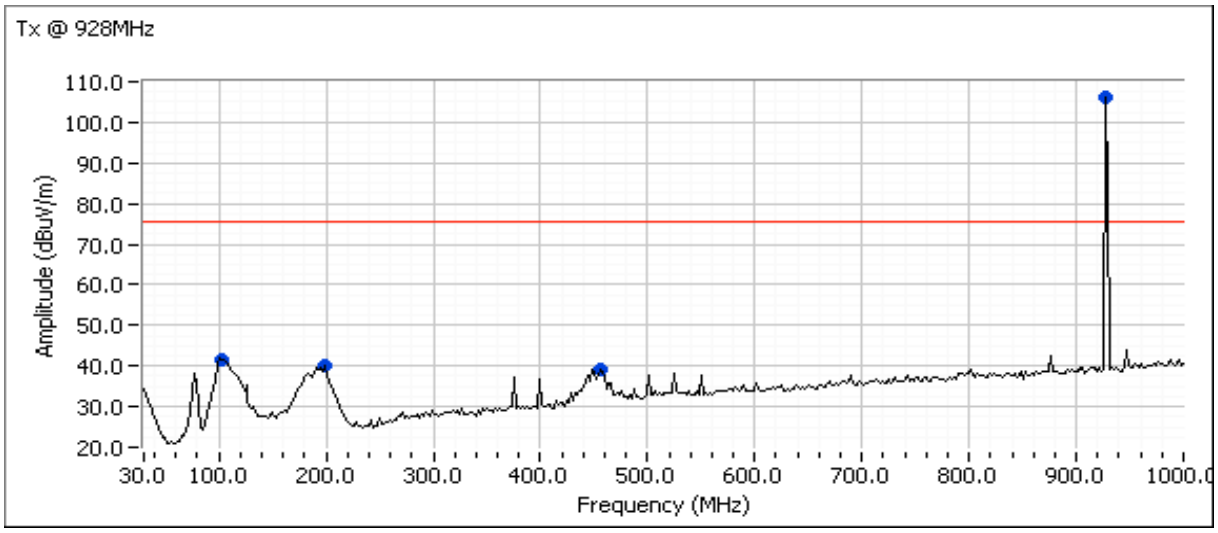
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #5 continued

Frequency	Level	Pol	FCC Part 101		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
103.868	41.6	H	84.4	-42.8	Peak	239	3.0		High, 960MHz
199.118	39.4	H	84.4	-45.0	Peak	144	1.5		High, 960MHz
453.768	40.2	H	84.4	-44.2	Peak	279	2.0		High, 960MHz
961.122	106.5	H	-	-	Peak	50	1.5	Fundamental	High, 960MHz
1068.990	57.9	V	84.4	-26.5	Peak	83	1.0		High, 960MHz
1920.020	67.0	V	84.4	-17.4	Peak	129	1.5		High, 960MHz
2879.830	77.7	V	84.4	-6.7	Peak	279	1.0		High, 960MHz
3840.050	82.0	H	84.4	-2.4	Peak	229	2.0		High, 960MHz
4800.010	70.6	H	84.4	-13.8	Peak	188	1.3		High, 960MHz
5760.180	73.8	V	84.4	-10.6	Peak	106	1.3		High, 960MHz
6720.210	65.9	H	84.4	-18.5	Peak	224	1.3		High, 960MHz
7680.160	71.9	H	84.4	-12.5	Peak	215	1.3		High, 960MHz

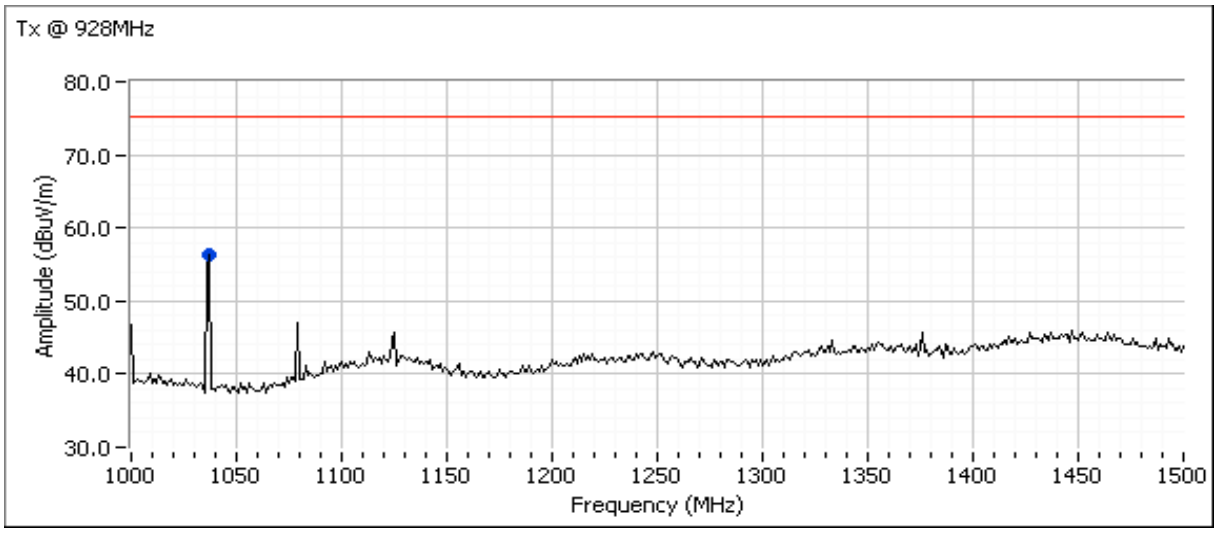
Note 1:	The field strength limit in the tables above was calculated from the erp/eirp limit detailed in the standard using the free space propagation equation: E=√(30PG)/d. This limit is conservative - it does not consider the presence of the ground plane. The erp or eirp for all signals with less than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

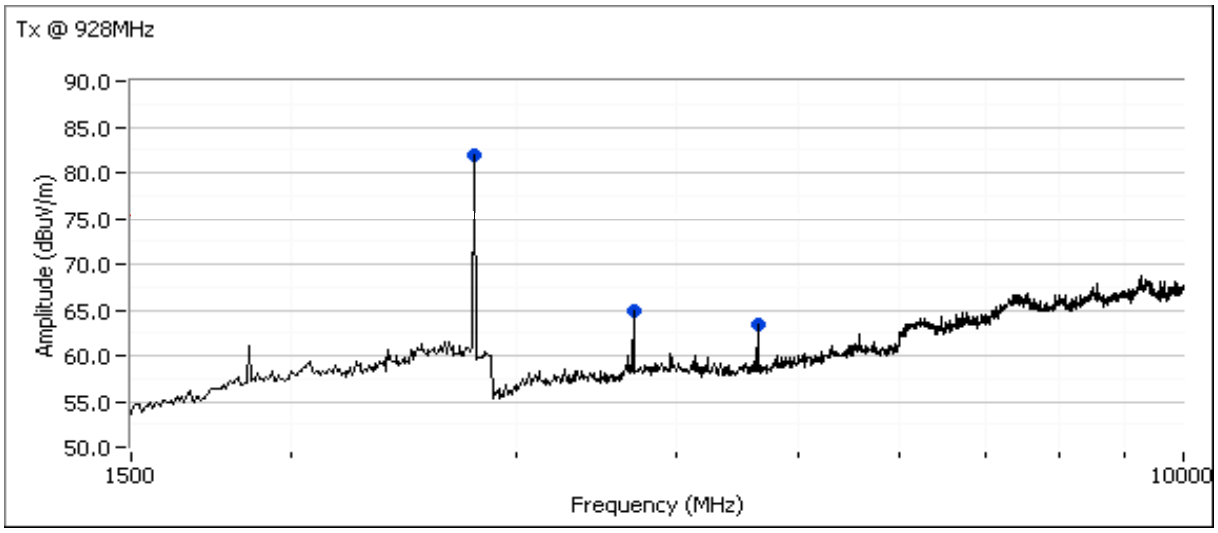
Plots for 928 MHz channel, power setting(s) = 40



Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

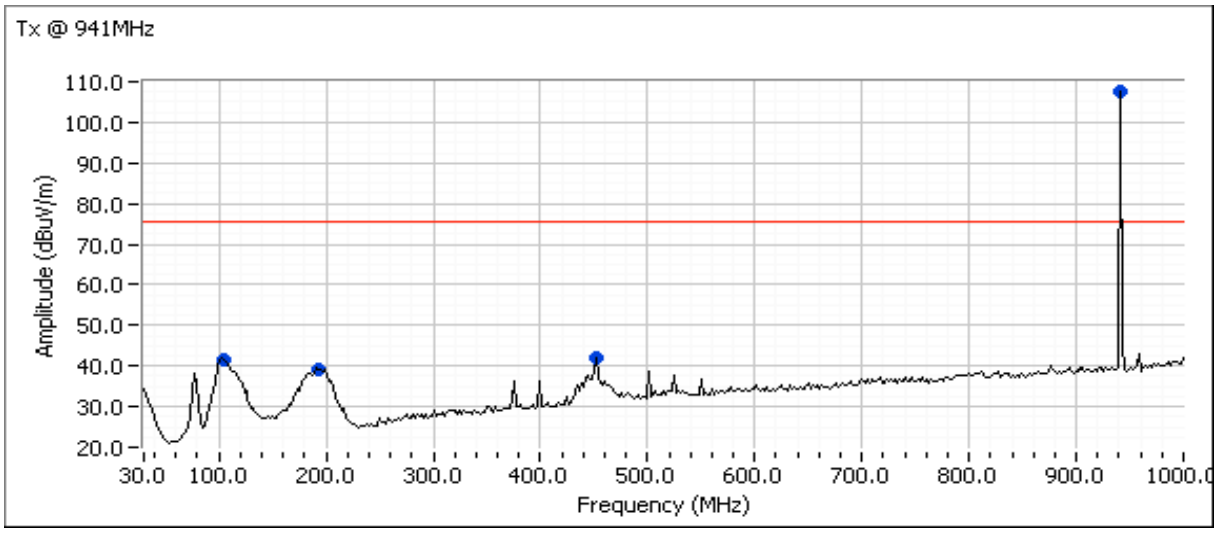
Plots for 928 MHz channel, power setting(s) = 40

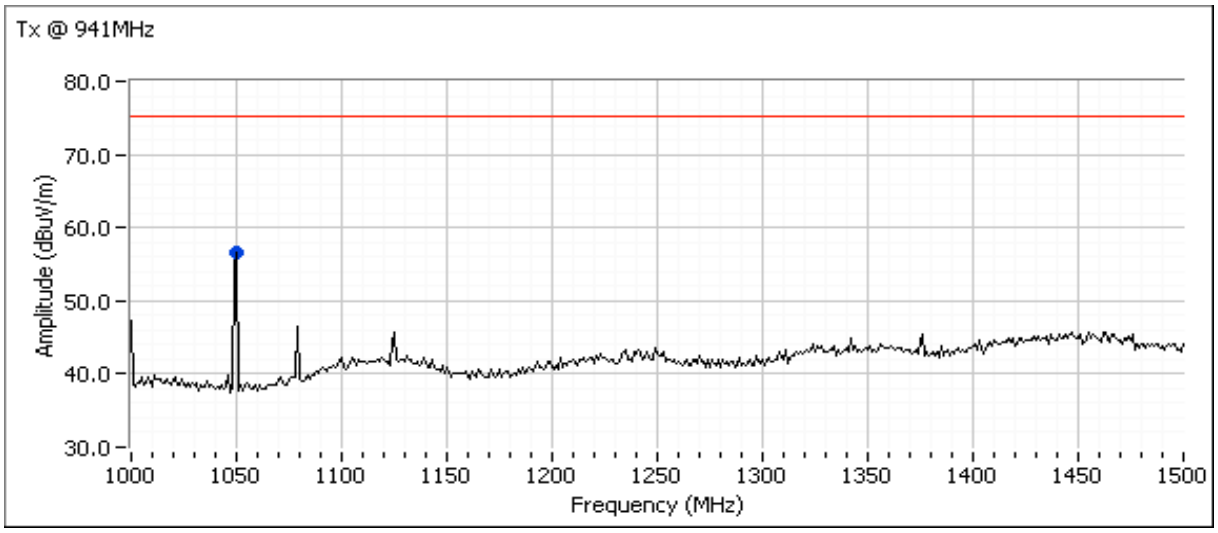




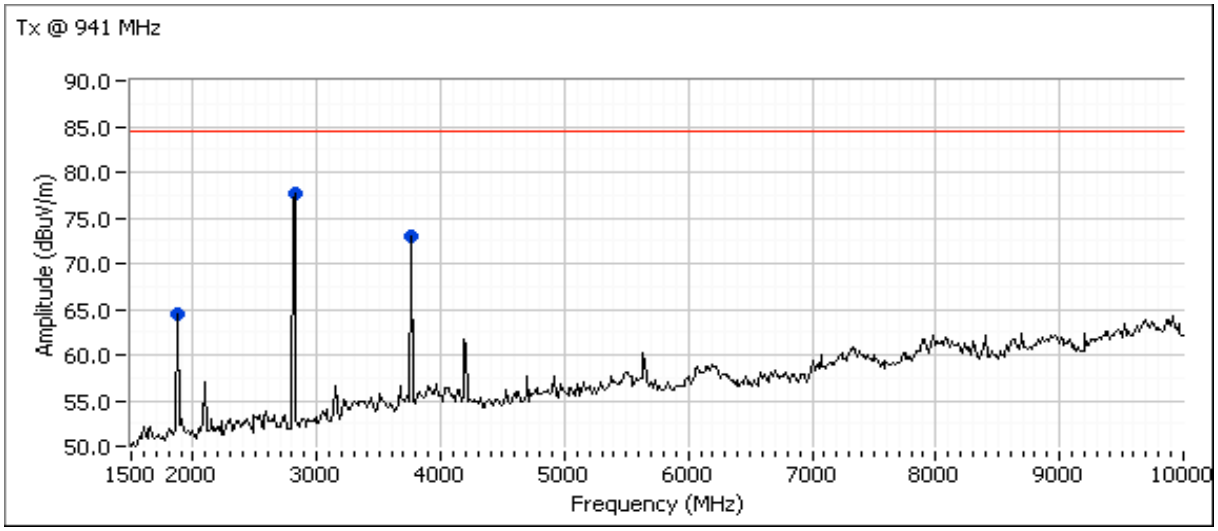
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Plots for 941 MHz channel, power setting(s) = 40

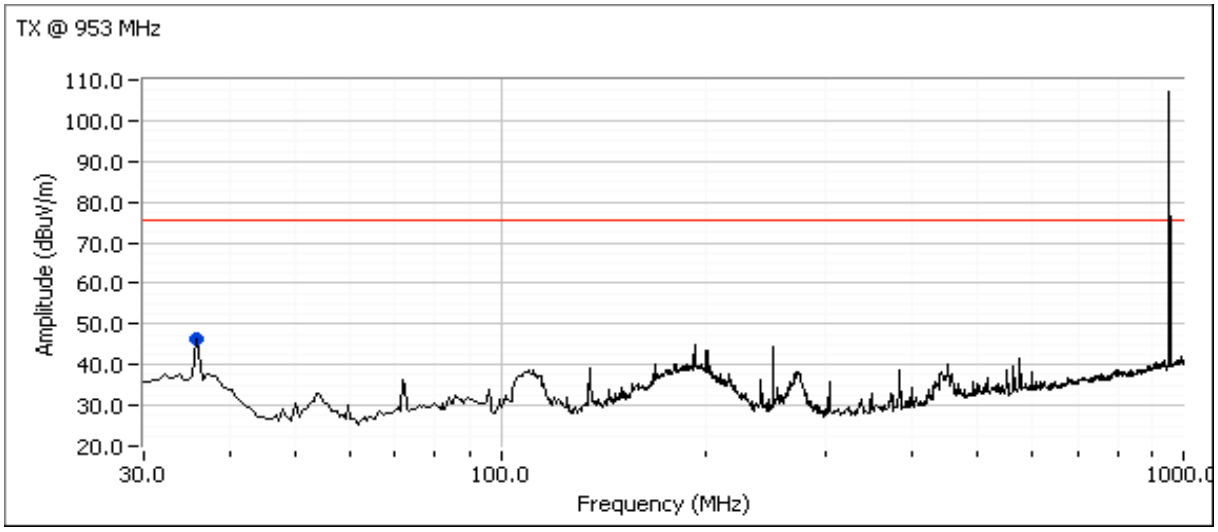




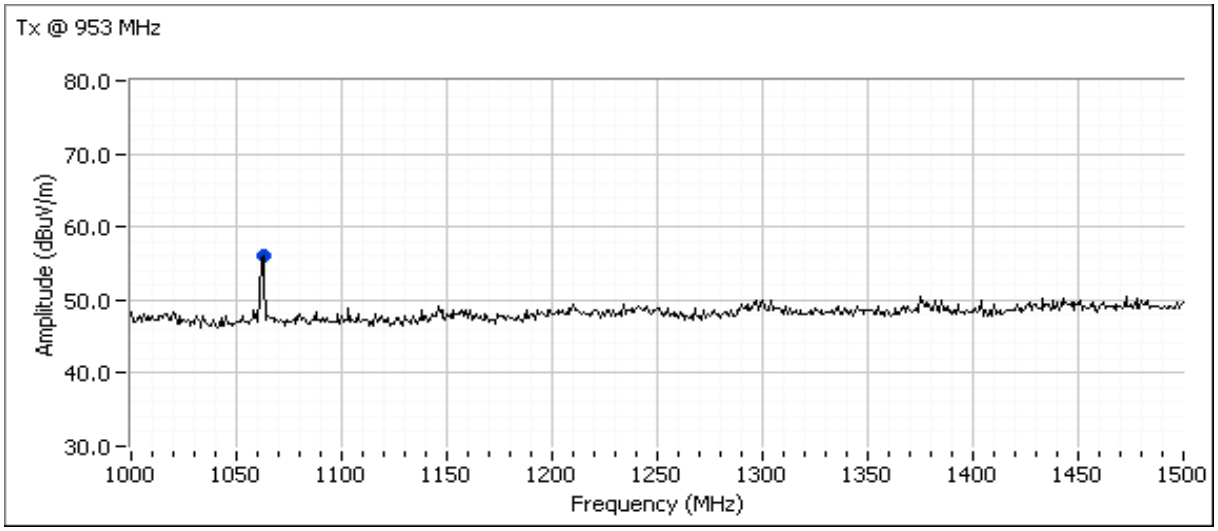
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

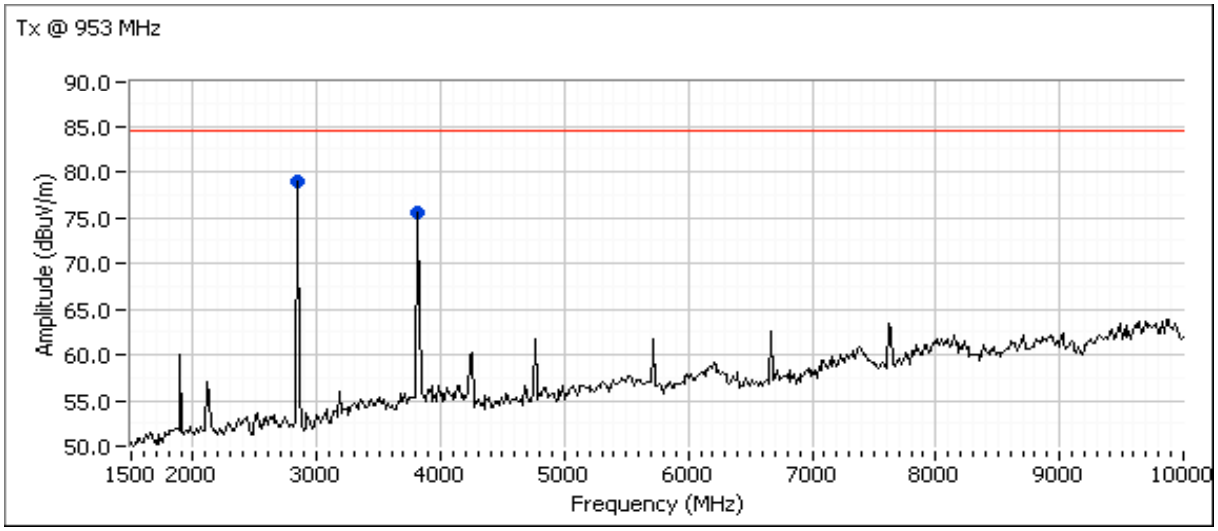


Plots for 953 MHz channel, power setting(s) = 40



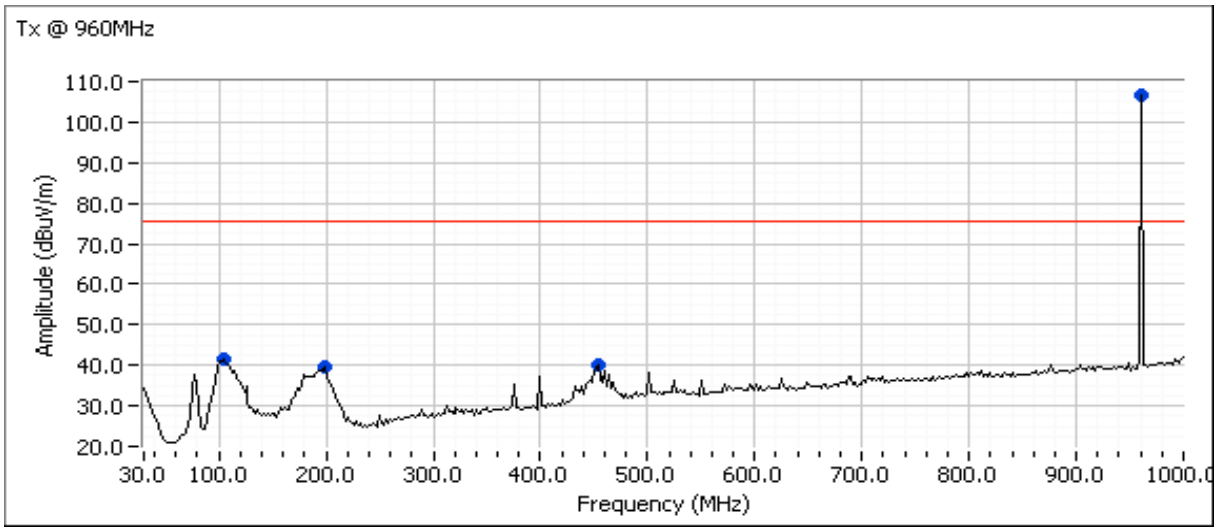
Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

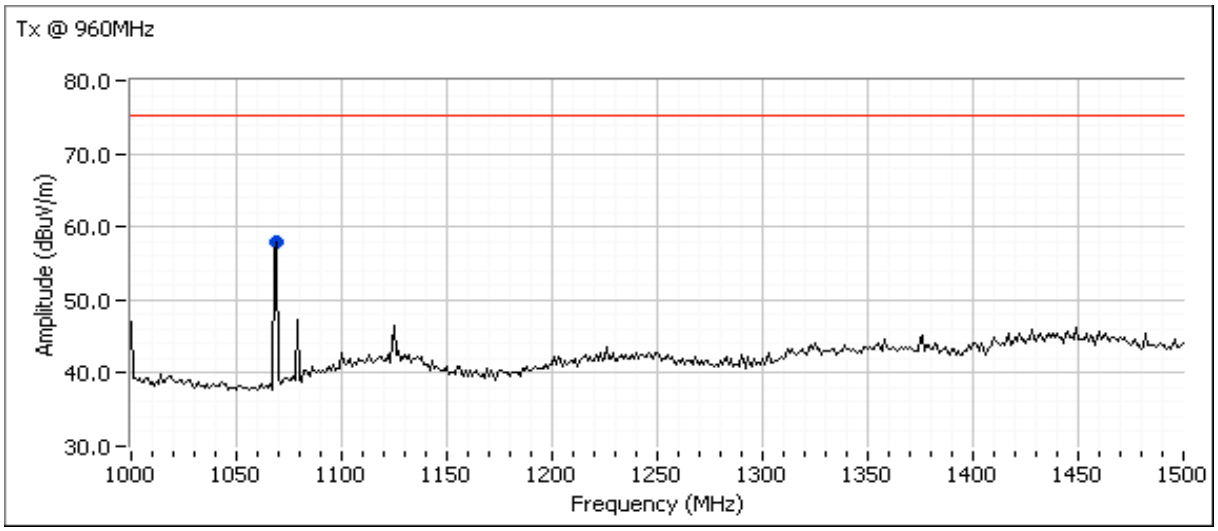




Client:	GE MDS LLC	Job Number:	J93834
Model:	Radio Card SDM9	T-Log Number:	T93925
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Plots for 960 MHz channel, power setting(s) = 40





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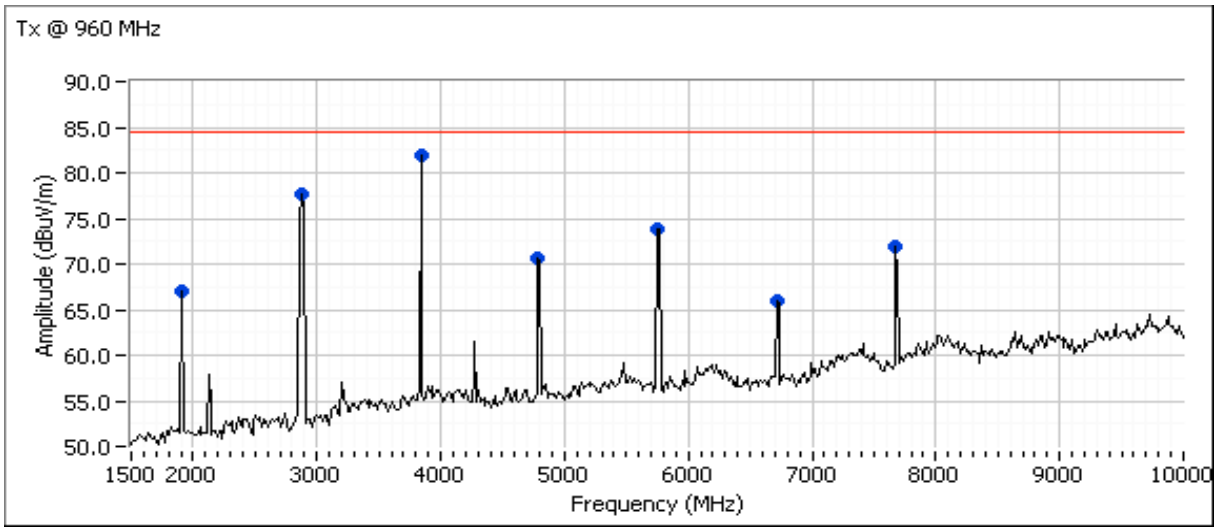
		Project Manager:	Christine Krebill
Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A



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Contact:	Dennis McCarthy	Project Coordinator:	Irene Rademacher
Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

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

Date: 12/19/2013 Engineer: David Bare Location: Frement Chamber #4

EUT Field Strength

Frequency	Level	Pol	FCC Part 101		Detector	Azimuth	Height	Comments	Channel
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
1037.020	61.5	V	84.4	-22.9	PK	82	1.0	PK (0.10s)	928
2784.070	82.7	V	84.4	-1.7	PK	43	1.0	RB 1 MHz;VB 3 MHz;Pe	928
3712.010	71.6	H	84.4	-12.8	PK	39	1.0	RB 1 MHz;VB 3 MHz;Pe	928
4640.280	71.7	V	84.4	-12.7	PK	256	1.1	RB 1 MHz;VB 3 MHz;Pe	928
1050.010	61.0	V	84.4	-23.4	PK	67	1.0	PK (0.10s)	941
1882.060	64.7	V	84.4	-19.7	PK	263	1.7	RB 1 MHz;VB 3 MHz;Pe	941
2823.040	77.7	V	84.4	-6.7	PK	264	1.0	RB 1 MHz;VB 3 MHz;Pe	941
3764.090	73.0	V	84.4	-11.4	PK	288	1.2	RB 1 MHz;VB 3 MHz;Pe	941
2859.030	81.2	V	84.4	-3.2	PK	268	1.0	RB 1 MHz;VB 3 MHz;Pe	953
3812.100	79.9	H	84.4	-4.5	PK	238	1.4	RB 1 MHz;VB 3 MHz;Pe	953
1068.990	62.8	V	84.4	-21.6	PK	79	1.0	PK (0.10s)	960
1919.980	68.5	V	84.4	-15.9	Peak	134	1.5	RB 1 MHz;VB 3 MHz;Pe	960
2880.000	82.6	V	84.4	-1.8	PK	262	1.0	RB 1 MHz;VB 3 MHz;Pe	960
3840.050	82.5	H	84.4	-1.9	PK	231	1.9	RB 1 MHz;VB 3 MHz;Pe	960
4799.960	73.4	H	84.4	-11.0	PK	238	1.4	RB 1 MHz;VB 3 MHz;Pe	960
5760.160	74.2	V	84.4	-10.2	PK	232	1.3	RB 1 MHz;VB 3 MHz;Pe	960
6720.210	68.0	H	84.4	-16.4	Peak	260	1.2	RB 1 MHz;VB 3 MHz;Pe	960
7679.990	74.4	H	84.4	-10.0	PK	224	1.6	RB 1 MHz;VB 3 MHz;Pe	960
				0.0					

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. 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.

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Standard:	FCC Parts 24 and 101, RSS-119	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
3712.010	-9.9	9.4	94.8	95.3	71.6	-23.7	-25.9		-13.0	-12.9
3812.100	-9.9	9.4	94.6	95.1	79.9	-15.2	-17.4		-13.0	-4.4
3840.050	-9.9	9.4	94.0	94.5	82.5	-12.0	-14.2		-13.0	-1.2
4799.960	-9.8	10.8	94.4	93.4	73.4	-20.0	-22.2		-13.0	-9.2
5760.160	-9.7	11.4	94.1	92.4	74.2	-18.2	-20.4		-13.0	-7.4

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
2784.070	-10.1	10.0	94.4	94.5	82.7	-11.8	-14.0		-13.0	-1.0
4640.280	-9.8	11.0	94.2	93.0	71.7	-21.3	-23.5		-13.0	-10.5
1882.060	-10.1	8.2	94.1	96.0	64.7	-31.3	-33.5		-13.0	-20.5
2823.040	-10.1	10.0	94.4	94.5	77.7	-16.8	-19.0		-13.0	-6.0
3764.090	-9.9	9.4	94.1	94.6	73.0	-21.6	-23.8		-13.0	-10.8
2859.030	-10.1	10.0	94.5	94.6	81.2	-13.4	-15.6		-13.0	-2.6
1919.980	-10.1	8.2	93.1	95.0	68.5	-26.5	-28.7		-13.0	-15.7
2880.000	-10.1	10.0	94.4	94.5	82.6	-11.9	-14.1		-13.0	-1.1

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.

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Standard:	FCC Parts 24 and 101, RSS-119	Class:	N/A

Run #6: Frequency Stability

Date: 12/17/2013 Engineer: David W. Bare, R. Varelas Location: Fremont Lab #6

Nominal Frequency: 929.99976 MHz

Frequency Stability Over Temperature

The EUT was soaked at each temperature for a minimum of 30 minutes prior to making the measurements to ensure the EUT and chamber had stabilized at that temperature.

Temperature	Frequency Measured	Drift	
(Celsius)	(MHz)	(Hz)	(ppm)
-30	930.000160	400	0.4
-20	930.000080	320	0.3
-10	929.999920	160	0.2
0	929.999760	0	0.0
10	929.999679	-81	-0.1
20	929.999760	0	0.0
30	929.999599	-161	-0.2
40	929.999519	-241	-0.3
50	929.999439	-321	-0.3
	Worst case:	400	0.4

Frequency Stability Over Input Voltage

Nominal Voltage is 24Vdc.

Voltage	Frequency Measured	Drift	
(Dc)	(MHz)	(Hz)	(ppm)
21.5	929.999519	-241	-0.3
27.6	929.999519	-241	-0.3
	Worst case:	-241	0.4

Note 1:	Maximum drift of fundamental frequency before it shut down at 21.3 Vdc was 0 Hz.

End of Report

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