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Electromagnetic Emissions Test Report In Accordance With Industry Canada Radio Standards Specification 119 Issue 6, FCC Part 90 on the GE MDS LLC Transmitter Model: SD4

FCC ID NUMBER:	E5MDS-SD4
UPN:	101D-SD4
GRANTEE:	GE MDS LLC 175 Science Parkway Rochester, NY 14620
TEST SITE:	Elliott Laboratories 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	November 4, 2008
FINAL TEST DATE:	October 31, 2008
AUTHORIZED SIGNATORY:	David W. Bare Chief Engineer

ACCREDITED

Testing Cert #2016-01

REVISION HISTORY

Revision #	Date	Comments	Modified By
1	December 2, 2008	Initial Release	-

TABLE OF CONTENTS

COVER PAGE **1**

REVISION HISTORY **2**

TABLE OF CONTENTS **3**

FCC CERTIFICATION INFORMATION **4**

DECLARATIONS OF COMPLIANCE **6**

SCOPE **7**

OBJECTIVE **7**

SUMMARY OF TEST RESULTS **8**

PART 90 AND RSS-119 TEST SUMMARY 8

MEASUREMENT UNCERTAINTIES **8**

EQUIPMENT UNDER TEST (EUT) DETAILS **9**

GENERAL 9
OTHER EUT DETAILS 9
ENCLOSURE 9
MODIFICATIONS 9
SUPPORT EQUIPMENT 10
EUT INTERFACE PORTS 10
EUT OPERATION DURING TESTING 10

TEST SITE **10**

GENERAL INFORMATION 10
CONDUCTED EMISSIONS CONSIDERATIONS 10

MEASUREMENT INSTRUMENTATION **11**

RECEIVER SYSTEM 11
INSTRUMENT CONTROL COMPUTER 11
PEAK POWER METER 11
FILTERS/ATTENUATORS 11
INSTRUMENT CALIBRATION 11

TEST PROCEDURES **12**

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS **16**

RADIATED EMISSIONS SPECIFICATION LIMITS 16
CALCULATIONS – EFFECTIVE RADIATED POWER 16
EXHIBIT 1: Test Equipment Calibration Data *1*
EXHIBIT 2: Test Data Log Sheets *2*
EXHIBIT 3: Installation Guide GE MDS LLC Model SD4 ..... *3*

FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2, Subpart J, Section 2.1033(C) & to Industry Canada RSP-100.

2.1033(c)(1) Applicant:

GE MDS LLC
175 Science Parkway
Rochester, NY 14620

2.1033(c)(2) & RSP-100 (4) FCC ID: FCC ID: E5MDS-SD4
UPN: 101D-SD4

2.1033(c)(3) & RSP-100 (7.2(a)) Instructions/Installation Manual

Please refer to Exhibit 7: User Manual

2.1033(c)(4) & RSP-100 (7.2(b)(iii)) Type of emissions

FCC 90 & RSS-119**: F1D, F2D, F3D**
Necessary bandwidth (2M + 2DK): 6.25kHz channels
6.0 kHz
Refer to separate attestation regarding derivation of necessary bandwidth.

2.1033(c)(5) & RSP-100 (7.2(a)) Frequency Range

FCC 90 & RSS-119**: 406.1 - 512**

2.1033(c)(6) & RSP-100 (7.2(a)) Range of Operation Power

FCC 90 & RSS-119**: 0.1 - 5 Watts**

2.1033(c)(7) & RSP-100 (7.2(a)) Maximum FCC & IC Allowed Power Level

FCC 90 & RSS-119**:** 90.205(g)(h)(i): Depends on frequency and antenna height.

2.1033(c)(8) & RSP-100 (7.2(a)) Applied voltage and currents into the final transistor elements

The final RF stage output amplifier operates at 13.8vdc and draws 1.5adc

2.1033(c)(9) & RSP-100 (7.2(a)) Tune-up Procedure

There is no tune up procedure since is a digital radio. All settings and calibration are done in the factory and stored in memory.

2.1033(c)(10) & RSP 100 (7.2(a)) Schematic Diagram of the Transmitter

No change from original certification

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Frequency Stabilization

No change from original certification

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Suppression of Spurious radiation

No change from original certification

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Modulation

No change from original certification

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Power

No change from original certification

2.1033(c)(11) & RSP-100 (7.2(g)) Photographs or Drawing of the Equipment Identification Plate or Label

No change from original certification

2.1033(c)(12) & RSP-100 (7.2(c)) Photographs of equipment

No change from original certification

2.1033(c)(13) & RSP-100 (7.2(a)) Equipment Employing Digital Modulation & 90.203 (Certification Requirements)

90.203(J)(5) Applications for part 90 certification of transmitters designed to operate on frequencies in the 150.8– 162.0125 MHz, 173.2–173.4 MHz, and/or 421–512 MHz bands, received on or after January 1, 2005, must include a certification that the equipment meets a spectrum efficiency standard of one voice channel per 6.25 kHz of channel bandwidth. Additionally, if the equipment is capable of transmitting data, has transmitter output power greater than 500 mW, and has a channel bandwidth of more than 6.25 kHz, the equipment must be capable of supporting a minimum data rate of 4800 bits per second per 6.25 kHz of channel bandwidth.

See separate letter addressing spectrum efficiency.

2.1033(c)(14) & RSP-100 (7.2(b)(ii)) Data taken per Section 2.1046 to 2.1057 and RSS-133 issue 2, Rev. 1.

Refer to Exhibit 2

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:
SD4

Manufacturer:
GE MDS LLC
175 Science Parkway
Rochester, NY 14620

Tested to applicable standards:
RSS-119, Issue 6 (Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz).
FCC Part 90 (Private Land Mobile Radio Service)

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of TIA/EIA-603 and the specific RSS standards applicable to this device); and that the equipment performed in accordance with the data submitted in this report.

Signature	
Name	David W. Bare
Title	Chief Engineer Elliott Laboratories
Address	684 W. Maude Ave Sunnyvale, CA 94086 USA
Date:	November 4, 2008

Maintenance of compliance with the above standards 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.).

SCOPE

FCC Part 90 & IC RSS-119 testing was performed for the equipment mentioned in this report. The equipment was tested in accordance with the procedures specified in Sections 2.1046 to 2.1057 of the FCC Rules & IC RSS-119. TIA-603 was also used as a test procedure guideline to perform some of the required tests.

The intentional radiator above was tested in a simulated typical installation to demonstrate compliance with the relevant FCC & RSS performance and procedural standards.

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

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

OBJECTIVE

The primary objective of the manufacturer is compliance with the FCC Part 90 & IC RSS-119. Certification of these devices is required as a prerequisite to marketing as defined in Section 2.1033 & RSP-100.

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

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product that 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.).

SUMMARY OF TEST RESULTS

Part 90 and RSS-119 Test Summary[1]

Measurement Required	FCC Part 2 & 90 Sections	RSS-119 Section	Test Performed	Measured Value	Test Procedure Used	Result
Modulation Tested	CPFSK	CPFSK	-	-	-	-
Conducted RF power output	2.1046 / 90.279 & 90.205(g)	6.2	Conducted Output Power Test	37.4dBm (5.5 Watts)	B	Complies
Spurious emissions at antenna Port	2.1051/ 90.210(d)	6.3 & 6.4(d)	Emission Limits and/or Unwanted Emission 30MHz – 5.12GHz (**Antenna Conducted**)	All spurious emissions < -25dBm	J	Complies
Occupied Bandwidth	2.1049/ 90.210(c) & (d)	6.4(c) & 6.4(d)	Emission Mask and 99% Bandwidth	Refer to Plots	C & D	Complies
Frequency stability	2.1055 / 90.213	7	Frequency Vs. Temperature	169 Hz	K	Complies
Frequency stability	2.1055 / 90.213	7	Frequency Vs. Voltage	169 Hz	L & M	Complies
Transient Frequency Behavior	90.214	6.5	Transient Behavior	Refer to Plots	I	Complies
Exposure to Mobile devices	2.1091	9	Exposure of Humans to RF Fields	N/A	-	

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below were calculated using the approach described in CISPR 16-4-2:2003 using a coverage factor of k=2, which gives a level of confidence of approximately 95%. The levels were found to be below levels of *U*cispr and therefore no adjustment of the data for measurement uncertainty is required.

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

[1] Only these tests were performed based on the change to add 6.25 channels to the existing 12.5 and 25 kHz channels

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The GE MDS LLC model SD4 is an industrial radio operating in the 406-416, 421-430 and 450-512 MHz bands. Since the EUT would be placed on a table top during operation, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 13.8 Volts DC, 2 Amps.

The sample was received on October 31, 2008 and tested on October 31, 2008. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
GE MDS LLC	SD4	Industrial Radio	-	E5MDS-SD4

OTHER EUT DETAILS

The following EUT details should be noted: Two versions of the radio are used to cover the two bands. Different lumped element parts are used for the TX Filter. The radio can operate on 6.25, 12.5 and 25 kHz channels (F1D, F2D and F3D modulations).

ENCLOSURE

The EUT enclosure is primarily constructed of aluminum. It measures approximately 16 cm wide by 12 cm deep by 4 cm high.

MODIFICATIONS

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

SUPPORT EQUIPMENT

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

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PPX	Computer	F89AV	DoC
HP	6654A	Power Supply	US36390821	-

No remote support equipment was used during emissions testing.

EUT INTERFACE PORTS

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

Port	Connected to	Description	Shielded or Unshielded	Length (m)
COM 1	Computer	Multiwire	Shielded	2.0
COM 2	-	-	-	-
DC Power	DC power Supply	two wire	Unshiedled	3.0

Note: The COM1 port is not normally connected during use as this port is for configuring the radio. The user uses the COM2 port for the data into the radio link.

EUT OPERATION DURING TESTING

During emissions testing the EUT was set to transmit on the desired channel at the power level indicated either unmodulated or modulated as needed using the attached computer.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on October 31, 2008 at Elliott Laboratories located at 684 West Maude Avenue, Sunnyvale, California.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing are performed in conformance with Section 2 of FCC Rules. Measurements are made with the EUT connected to a spectrum analyzer through an attenuator to prevent overloading the analyzer.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

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

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

INSTRUMENT CONTROL COMPUTER

A personal computer is utilized to record the receiver measurements of the field strength at the antenna, which is then compared directly with the appropriate specification limit. The receiver is programmed with appropriate factors to convert the received voltage into filed strength at the antenna. Results are printed in a graphic and/or tabular format, as appropriate.

The test receiver also provides a visual display of the signal being measured.

PEAK POWER METER

A peak power meter and thermister mount may be used for output power measurements from transmitters as they provide a broadband indication of the power output.

FILTERS/ATTENUATORS

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

INSTRUMENT CALIBRATION

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

TEST PROCEDURES

General: For Transmitters with detachable antenna, direct measurements for output power, modulation characterization, occupied bandwidth, and frequency stability are performed with the antenna port of the EUT connected to either the power meter, modulation analyzer, or spectrum analyzer via a suitable attenuator and/or filter. The attenuators and/or filters are used to ensure that the transmitter fundamental will not overload the front end of the measurement instrument.

Procedure B – Power Measurement (Conducted Method): The following procedure was used for transmitters that do use external antennas.

1) Set the EUT to maximum power and to the lowest channel.
2) Either a power meter or a spectrum analyzer was used to measure the power output.
3) If a spectrum analyzer was used a resolution and video bandwidth 10kHz was used to measure the power output. Corrected for any external attenuation used for the protection of the input of analyzer. In addition, For CDMA or TDMA modulations set spectrum analyzer resolution to 1MHz and video to 30 kHz. Use video averaging with a 100-sample rate.
4) If a power meter was used, corrected for any external attenuation used for the protection of the input of the sensor head. Also set the power sensor correction by setting up the frequency range that will be measured.
5) Repeat this for the high channel and all modulations that will be used and all output ports used for transmission

Procedure C - Occupied Bandwidth (Conducted Method): Either for analog, digital, or data modulations, occupied bandwidth was performed. The EUT was set to transmit the appropriate modulation at maximum power. The bandwidth was measured using following methods:

1) The built-in 99% function of the spectrum analyzer was used.
2) If the built-in 99% is not available then the following method is used:

   26-dB or 20-dB was subtracted to the maximum peak of the emission. Then the display line function was used, in conjunction with the marker delta function, to measure the emissions bandwidth.

3) For the above two methods a resolution and video bandwidth of 100 or 300 Hz was used to measure the emission's bandwidth.

Procedure D - Occupied Bandwidth (Conducted Emission Mask): Either for analog, digital, or data modulations, emission mask was performed. The EUT was set to transmit the appropriate modulation at maximum power. The following method was used:

1) The EUT was connected directly to the spectrum analyzer and used an attenuator to protect the input of the analyzer. The EUT antenna was removable, so conducted measurements was performed. The EUT was set to transmit continuous packets of data and the Fundamental Frequency set to the middle of the EUT frequency range.

2) Since EUT is designed with a 12.5 kHz channel Section 90.210 (d)(1)(2)(3) was used to show compliance to the emission mask.

3) Any emission must be attenuated below the power (P) as follow:

90.210 (d)(1): 5.625 kHz: 0 dB

90.210(d)(2): 5.625 kHz: 20 dB
12.5 kHz: 70 dB

90.210(d)(3): more than 12.5 kHz: -20 dBm (50+10*log(P))

The following Resolution and Video bandwidth was used to show compliance for the above requirement: 100 Hz.

4) Since EUT is designed with a 25 kHz channel Section 90.210 (c)(1)(2)(3) was used to show compliance to the emission mask.

5) Any emission must be attenuated below the power (P) as follow:

90.210 (c)(1): 5 kHz but no more then 10kHz: 83*log(F_d / 5) dB

90.210(c)(2): 10kHz but no more then 250%: At least 29 log (fd 2/11) dB or 50 dB, whichever is the lesser attenuation

90.210(c)(3): more than 250%: -13 dBm (43+10*log(P))

The following Resolution and Video bandwidth was used to show compliance for the above requirement: 300 Hz.

Procedure H - Other Types of Equipment: Either digital or data modulated signals were simulated, by software or external sources, to performed the required tests. The EUT was set to transmit the appropriate digital modulation.

Procedure I – Transient Frequency Behavior: The TIA/EIA 603 procedure was used to determine compliance to radio being keyed on and off.

1) Connected the Test Receiver DOP or Video Output to Channel 1 of the oscilloscope. The output of the RF crystal detector was connected to Auxiliary channel 1, which served as a trigger input. The output of the combiner was connected to the Test Receiver.
2)
3) Set the EUT to maximum power and connected as illustrated above. Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at 6.25kHz, 12.5 kHz, or 25 kHz deviation and set its output to –100 dBm, then turn on the EUT.
4)
5) The Combiner output side was connected to the Test Receiver, which was used to measure the Power. Used enough external attenuation so that the output at the combiner was set to 40 dB below the maximum input of the Test Receiver, then turn off the EUT.
6)
7) Set the signal generator output to the same level in step 3. This level was maintained for the remainder of the test.
8)
9) Set the horizontal sweep rate on the storage oscilloscope to 10 milliseconds per division and adjusted the display to continuously view the 1 kHz tone from the DOP or Video Output. Adjusted the vertical amplitude control to display the 1 kHz at +/- 4 divisions vertically centered on the display.
10)
11) Set the oscilloscope to trigger at the AUX channel 1 input port.
12)
13) Removed enough external attenuation so that the input to the RF detector and combiner is increased by 30 dB.
14)
15) Turn on the transmitter and plotted the result for Ton, T1, and T2.
16)
17) Set the oscilloscope to trigger in decreasing magnitude from the RF crystal detector.
18)
19) Turn off the transmitter and plotted the result for T3.

Procedure J – Antenna Conducted Emissions: For spurious emission measurements at the antenna terminal the following procedure was performed:

1) Set the transmitting signal at the middle of the operating range of the transmitter, as specified in the standard. Power is set to maximum and then to minimum.
2) Set the spectrum analyzer display line function to –20-dBm.
3) Set the spectrum analyzer bandwidth to 10kHz <1GHz and 1 MHz >1GHz.
4) For the spectrum analyzer, the start frequency was set to 30 MHz and the stop frequency set to the 10^{th} harmonic of the fundamental. All spurious or intermodulation emission must not exceed the –20dBm limit.
5) Steps 1 to 4 were repeated for all modulations and output ports that will be used for transmission.

Procedure K - Frequency Stability: The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The spectrum analyzer is configured to give a 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. The Temperature chamber was varied from –30 to +50° C (or +60° C for some IC RSS standards, if applicable) in 10 degrees increment. The EUT was allowed enough time to stabilize for each temperature variation.

Procedure L - Frequency Stability: For AC or DC operated devices the nominal voltage is varied to 85% and to 115% at either room temperature or at a controlled +20°C temperature.

Procedure M - Frequency Stability: For battery-powered devices the voltage battery end-point is determined by reducing the dc voltage until the unit ceases to function. This is performed at either room temperature or at a controlled +20°C temperature.

Procedure N - Field Strength Measurement: The EUT was set on the turntable and the search antenna position 3 meters away. The output antenna terminal was terminated with a 50-ohm terminator. The EUT was set at the middle of the frequency band and set at maximum output power.

For the first scan, a pre-liminary measurement is performed. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. One or more of these is with the antenna polarized vertically while the one or more of these are with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

For the final measurement, Substitution method is performed on spurious emissions not being 20-dB below the calculated radiated limit. Substitution method is performed by replacing the EUT with a horn antenna and signal generator. The horn antenna factors can be reference to a half-wave dipole in dBi. The signal generator power level was adjusted until a similar level, which was measured on the first scan, is achieved on the spectrum analyzer. The level on the signal generator is than added to the antenna factor, in dBi, which will give the corrected value.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

RADIATED EMISSIONS SPECIFICATION LIMITS

The limits for radiated emissions are based on the power of the transmitter at the operating frequency. Data is measured in the logarithmic form of decibels relative to one milliwatt (dBm) or one microvolt/meter (dBuV/m,). The field strength of the emissions from the EUT is measured on a test site with a receiver.

Below is a formula example used to calculate the attenuation requirement, relative to the transmitters power output, in dBuV/m. For this example an operating power range of 3 watts is used. The radiated emissions limit for spurious signals outside of the assigned frequency block is $55+10\text{Log}_{10}$(mean output power in watts) dB below the measured amplitude at the operating power.

CALCULATIONS – EFFECTIVE RADIATED POWER

$$E(V/m) = \frac{\sqrt{30 * P * G}}{d}$$

E= Field Strength in V/m
P= Power in Watts (for this example we use 3 watts)
G= Gain of antenna in numeric gain (Assume 1.64 for ERP)
d= distance in meters

$$E(V/m) = \frac{\sqrt{30 * 3 \text{ watts} * 1.64 \text{ dB}}}{3 \text{ meters}}$$

20 * log (4.049 V/m * 1,000,000) = 132.14 dBuV/m @ 3 meters

FCC Rules request an attenuation of 43 + 10 log (3) or 47.8 dB for all emissions outside the assigned block, the limit for spurious and harmonic emissions is:

132.1 dBuV/m – 47.8 dB = 84.3 dBuV/m @ 3 meter.

Note: Substitution Method is performed for spurious emission not being 20-dB below the calculated field strength.

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radio Antenna Port (Power and Spurious Emissions), 31-Oct-08
Engineer: David Bare

Manufacturer	Description	Model #	Asset #	Cal Due
Rohde & Schwarz	Power Sensor 100 uW - 2 Watts	NRV-Z32	1423	07-Nov-08
Rohde & Schwarz	Power Meter, Dual Channel	NRVD	1539	12-Sep-09
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40)	8564E	CH5273	20-Nov-08

Radiated Emissions, 30 - 5,200 MHz, 31-Oct-08
Engineer: David Bare

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54	26-Mar-09
EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	364	13-Dec-08
Hewlett Packard	Microwave Preamplifier 0.5-26.5 GHz	83017A	1257	28-Mar-09
EMCO	Antenna, Horn, 1-18 GHz	3117	1662	11-Apr-10
Hewlett Packard	Preamplifier, 100 kHz - 1.3 GHz	8447D OPT 010	1826	29-May-09
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40)	8564E	CH5273	20-Nov-08

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T73579 11 Pages

Client:	GE MDS LLC	Job Number:	J73440
Model:	SD4	T-Log Number:	T73579
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Emissions Standard(s):	FCC Part 90, RSS-119	Class:	-
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

GE MDS LLC

Model

SD4

Date of Last Test: 10/31/2008

Client:	GE MDS LLC	Job Number:	J73440
Model:	SD4	T-Log Number:	T73579
		Account Manger:	Susan Pelzl
Contact:	Dennis McCarthy		
Emissions Standard(s):	FCC Part 90, RSS-119	Class:	-
Immunity Standard(s):	-	Environment:	Radio

EUT INFORMATION

The following information was collected during the test session(s).

General Description

The EUT is a industrial radio operating in the 406-416, 421-430 and 450-512 MHz bands. Since the EUT would be placed on a table top during operation, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 13.8 Volts DC, 2 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
GE MDS LLC	SD4	Industrial Radio	-	E5MDS-SD4

Other EUT Details

The following EUT details should be noted: Two versions of the radio are used to cover the two bands. Different lumped element parts are used for the TX Filter. The radio can operate on 6.25, 12.5 and 25 kHz channels (F1D, F2D and F3D modulations).

EUT Antenna (Intentional Radiators Only)

The EUT antenna is a determined at the time of licensing.

EUT Enclosure

The EUT enclosure is primarily constructed of aluminum. It measures approximately 16 cm wide by 12 cm deep by 4 cm high.

Modification History

Mod. #	Test	Date	Modification
1			No modifications were made to the EUT during testing.
2			
3			

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

Client:	GE MDS LLC	Job Number:	J73440
Model:	SD4	T-Log Number:	T73579
		Account Manger:	Susan Pelzl
Contact:	Dennis McCarthy		
Emissions Standard(s):	FCC Part 90, RSS-119	Class:	-
Immunity Standard(s):	-	Environment:	Radio

Test Configuration #1

The following information was collected during the test session(s).

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PPX	Computer	F89AV	DoC
HP	6654A	Power Supply	US36390821	-

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
-	-	-	-	-

Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
COM 1	Computer	Multiwire	Shielded	2.0
COM 2	-	-	-	-
DC Power	DC power Supply	two wire	Unshiedled	3.0

Note: The COM1 port is not normally connected during use as this port is for configuring the radio. The user uses the COM2 port for the data into the radio link.

EUT Operation During Emissions Tests

During emissions testing the EUT was set to transmit on the desired channel at the power level indicated either unmodulated or modulated as needed using the attached computer.

Client:	GE MDS LLC	Job Number:	J73440
Model:	SD4	T-Log Number:	T73579
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90, RSS-119	Class:	N/A

RSS 119 and FCC Part 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

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: 19 °C

Rel. Humidity: 52 %

Summary of Results

Run #	Spacing		Test Performed	Limit	Pass / Fail	Result / Margin
1	6.25 kHz		Output Power	Determined at time of Licensing	-	5.5 watts
2	6.25 kHz		Spectral Mask	Within Mask 90.210(e)	Pass	See Plot
3	6.25 kHz		99% or Occupied Bandwidth	6 KHz	Pass	3.69 kHz
4	6.25 kHz		Spurious Emissions (conducted)	-25dBm	Pass	-25.7dBm @ 900.000MHz (-0.7dB)
5	6.25 kHz		Transient Frequency Behaviour	Per 90.214	Pass	-

Modifications Made During Testing

No modifications were made to the EUT during testing

Describe modifications here

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	GE MDS LLC	Job Number:	J73440
Model:	SD4	T-Log Number:	T73579
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90, RSS-119	Class:	N/A

Run #1: Output Power

Date of Test: 10/31/2008
Test Engineer: David Bare
Test Location: Chamber 2

Power settings from 20 to 37 are available corresponding to 0.1 to 5 Watts.

Power Setting[2]	Frequency (MHz)	Output Power (dBm) [1]	Output Power W	Antenna Gain (dBi)	Result	EIRP dBm	EIRP W
37	512	37.0	5.0	16.5	Pass	53.5	223.872
37	450	37.4	5.5	16.5	Pass	53.9	245.471
37	406	36.8	4.8	16.5	Pass	53.3	213.796

Note 1:	Output power measured using a peak power meter
Note 2:	Power setting - the software power setting used during testing, included for reference only.

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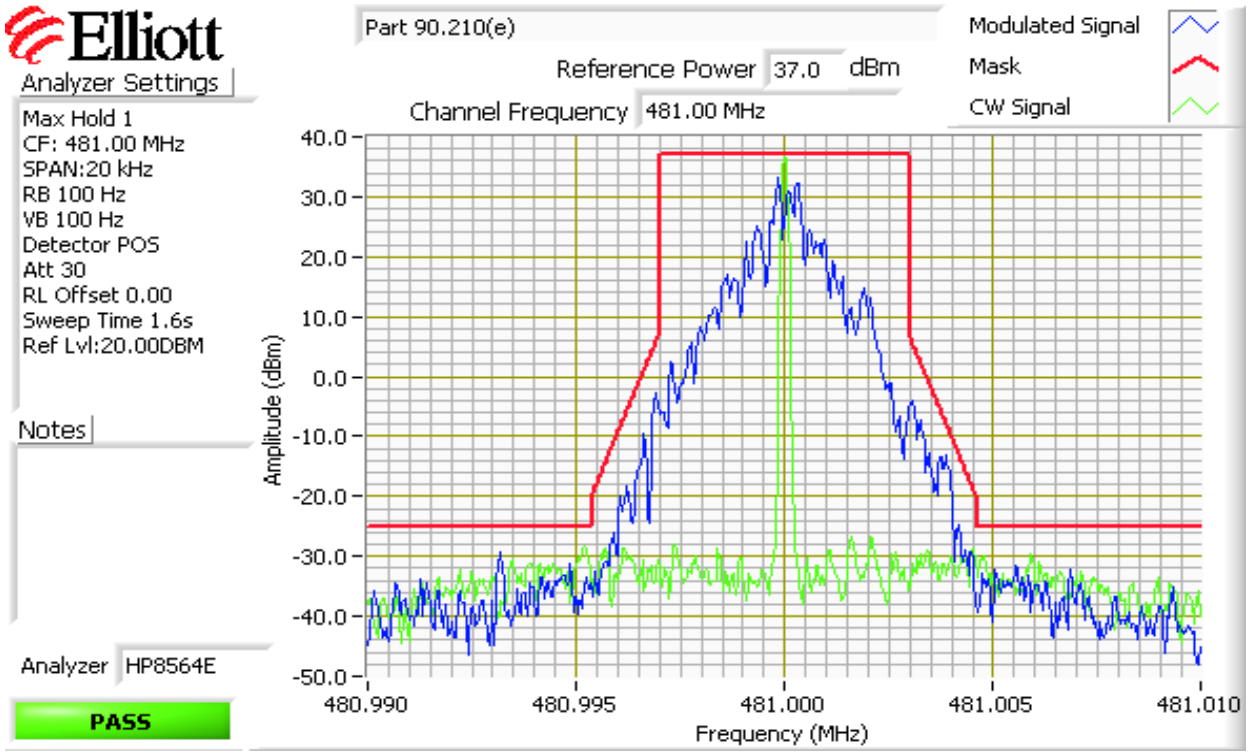
Run #2: Spectral Mask, FCC Part 90 Mask E, 6.25KHz channel spacing

Date of Test: 10/31/2008
Test Engineer: David Bare
Test Location: Chamber 2



Note 1:	Mask reference level based on CW level.

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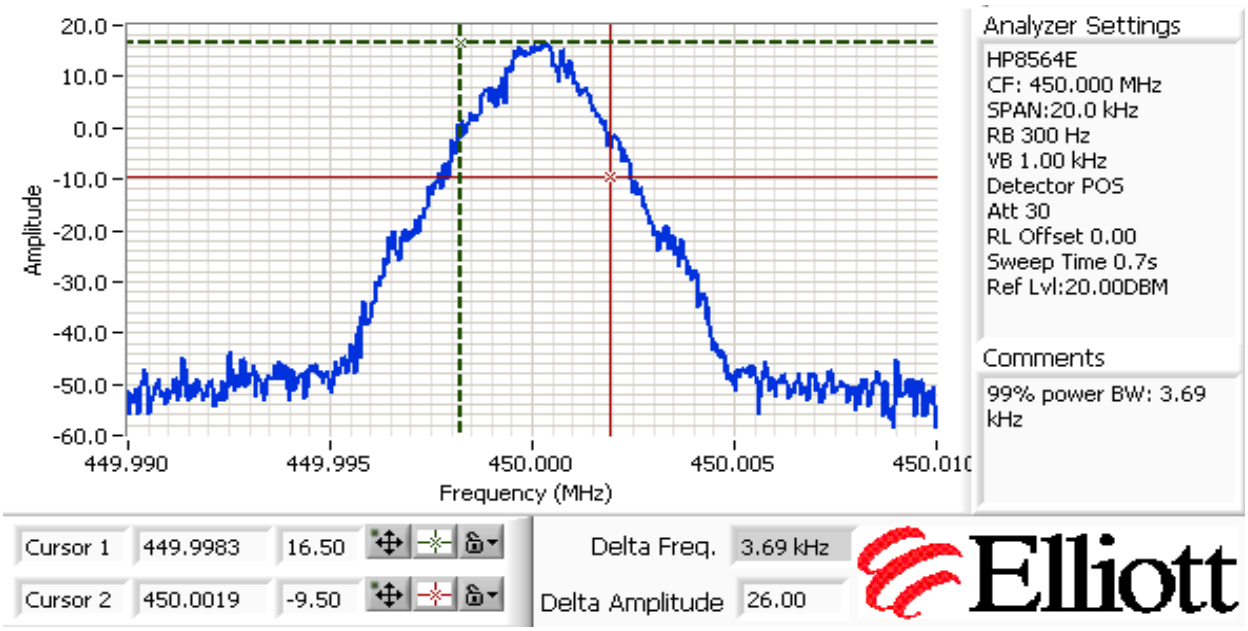
Standard:	FCC Part 90, RSS-119	Class:	N/A

Run #3: Signal Bandwidth (6KHz Authorized BW)

Date of Test: 10/31/2008
Test Engineer: David Bare
Test Location: Chamber 2

Power Setting	Frequency (MHz)	Span (kHz)	Resolution Bandwidth	Bandwidth (kHz) 26dB	99%
37	406	20	300 Hz		3.66
37	450	20	300 Hz		3.69
37	512	20	300 Hz		3.56



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

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Standard:	FCC Part 90, RSS-119	Class:	N/A

Run #4: Out of Band Spurious Emissions, Conducted

Date of Test: 10/31/2008
Test Engineer: David Bare
Test Location: Chamber 2

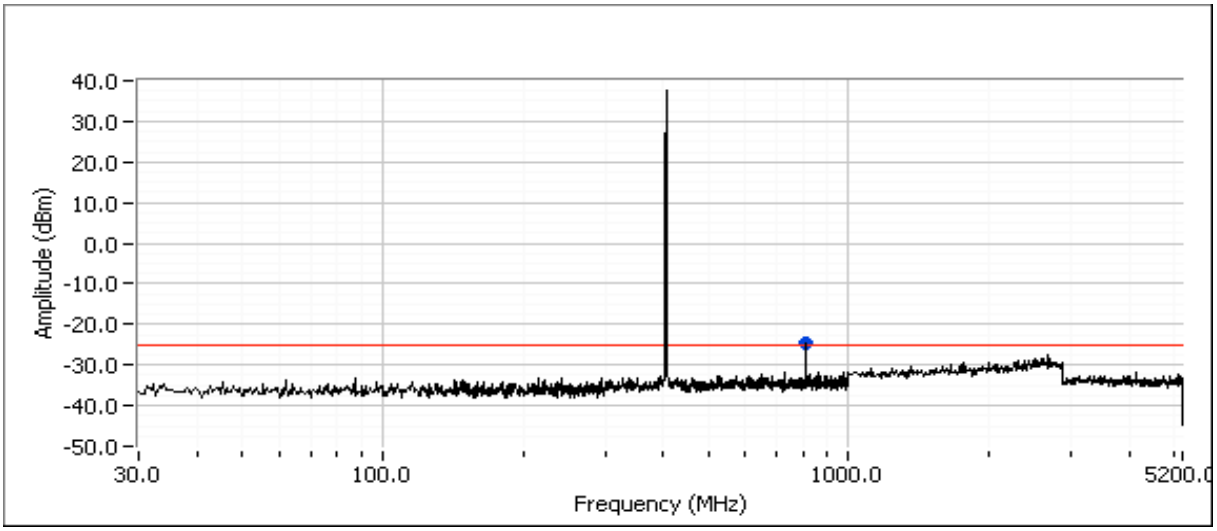
The limit is taken from FCC Part 90 Mask E

Run #1a: 406.1 MHz

Frequency MHz	Level dBm	Port	FCC Part 90 Limit	FCC Part 90 Margin	Detector	Channel	Mode	Comments
900.000	-25.7	RF Port	-25.0	-0.7	PK	450.0	-	RB 100 kHz; VB: 100 kHz
1024.000	-26.0	RF Port	-25.0	-1.0	PK	512.0	-	RB 100 kHz; VB: 100 kHz
812.000	-26.2	RF Port	-25.0	-1.2	PK	406.0	-	RB 100 kHz; VB: 100 kHz
1350.000	-32.1	RF Port	-25.0	-7.1	PK	450.0	-	RB 100 kHz; VB: 100 kHz
1536.000	-32.5	RF Port	-25.0	-7.5	PK	512.0	-	RB 100 kHz; VB: 100 kHz
2250.000	-32.9	RF Port	-25.0	-7.9	PK	450.0	-	RB 100 kHz; VB: 100 kHz
2560.000	-33.4	RF Port	-25.0	-8.4	PK	512.0	-	RB 100 kHz; VB: 100 kHz
1218.000	-35.6	RF Port	-25.0	-10.6	PK	406.0	-	RB 100 kHz; VB: 100 kHz
2030.020	-37.2	RF Port	-25.0	-12.2	PK	406.0	-	RB 100 kHz; VB: 100 kHz

Note 1:	Altough the plots show the 2nd harmonic above the limit, the actual levels are as recored in the table above. This is due to the use of less attenution for the plots to show more dynamic range which causes a slight overload of the spectrum analyzer. 6dB more attenuation was added for the final measurements in the table.

Plot for low channel, power setting(s) = 37



Client:	GE MDS LLC	Job Number:	J73440
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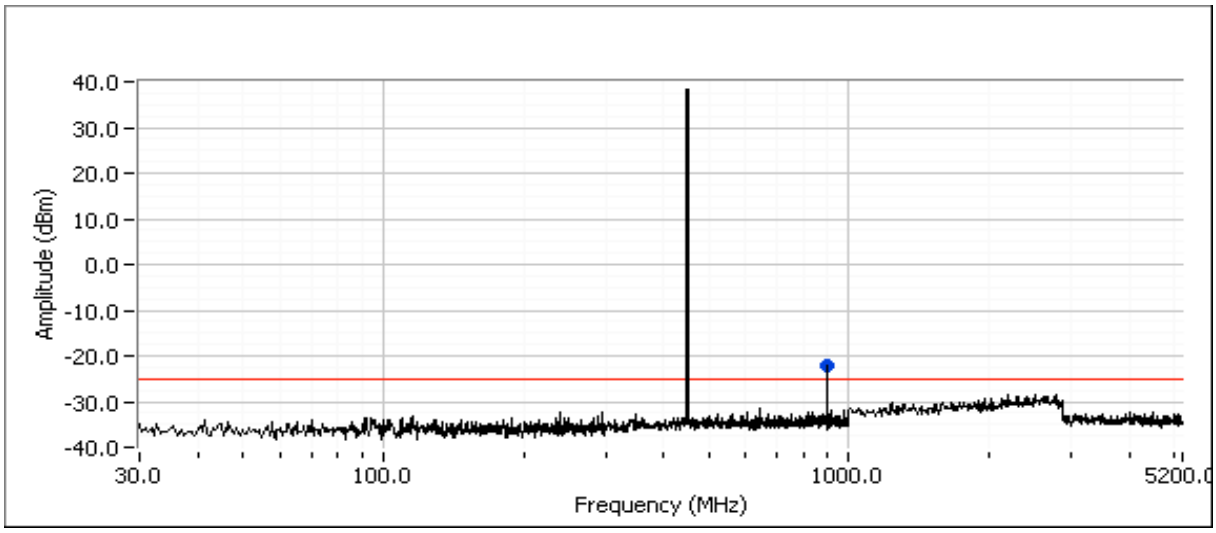
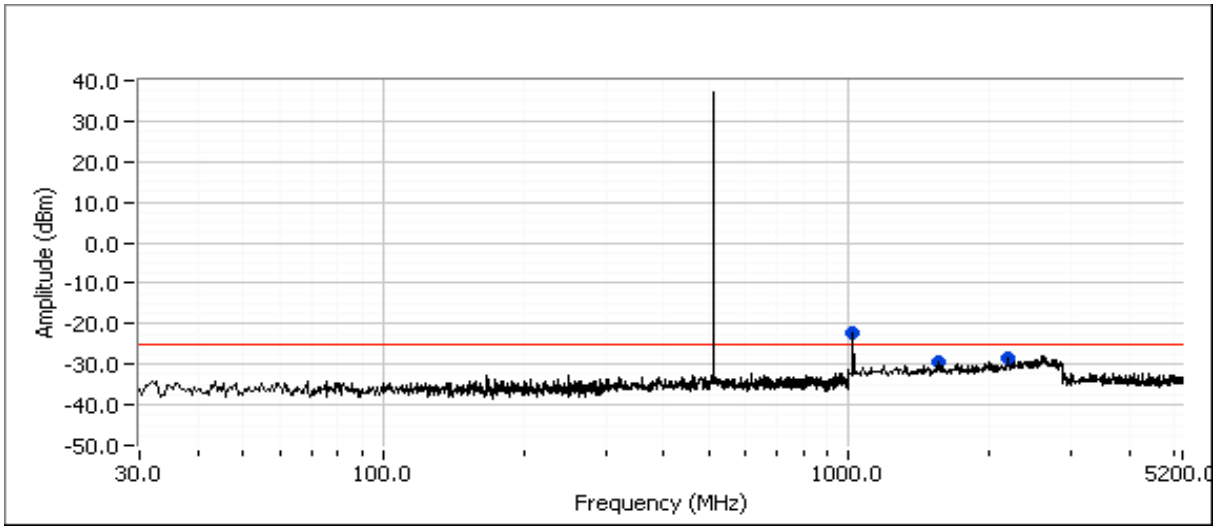
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90, RSS-119	Class:	N/A

Plot for center channel, power setting(s) = 37



Plot for high channel, power setting(s) = 37

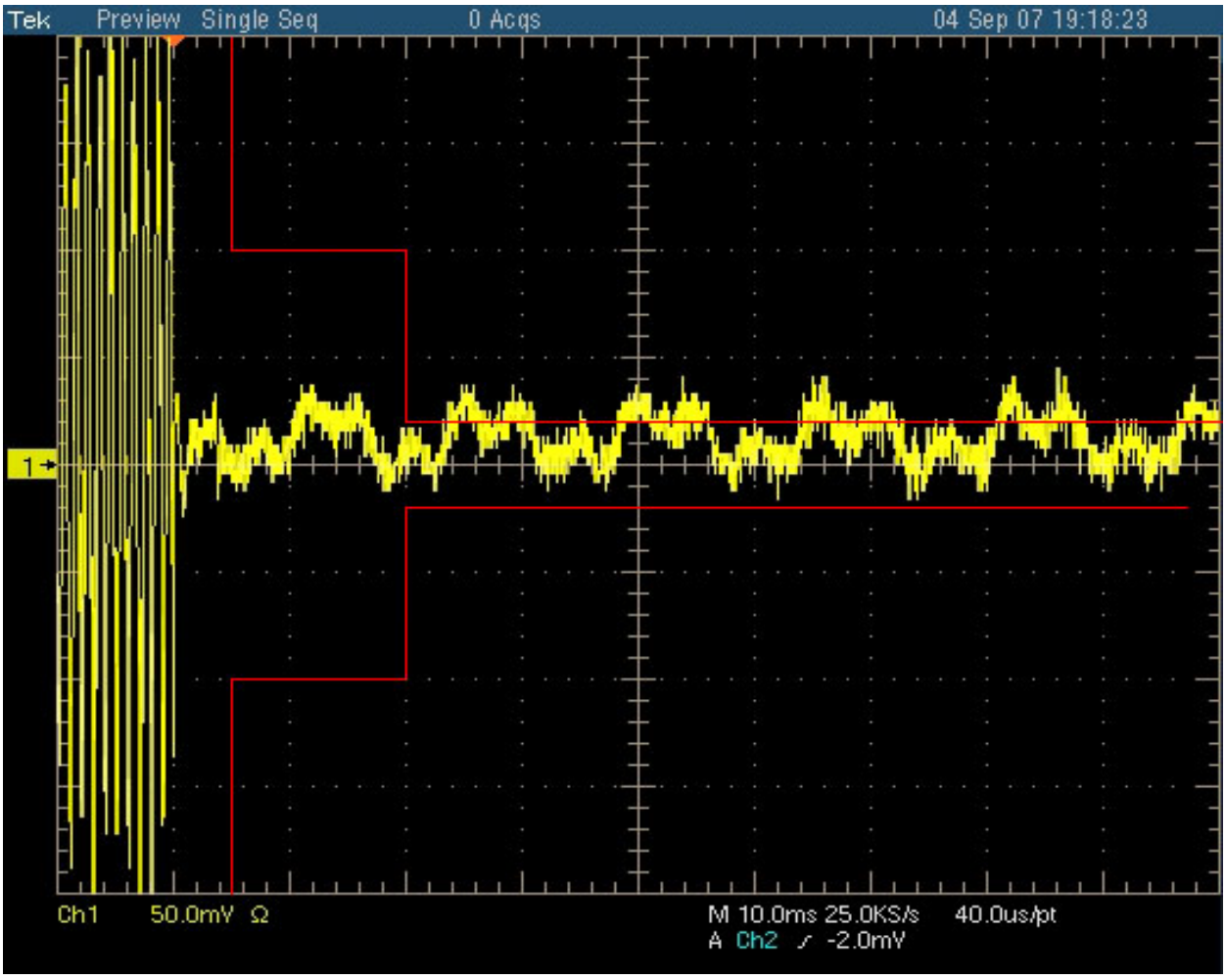


Client:	GE MDS LLC	Job Number:	J73440
Model:	SD4	T-Log Number:	T73579
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90, RSS-119	Class:	N/A

Run #6: Transient Frequency Behavior

Date of Test: 10/31/2008
Test Engineer: David Bare
Test Location: Chamber 2

Run #6a
Carrier Frequency: 450 MHz
Channel Spacing: 6.25 kHz
Modulation: 4800F
Description: Switch on condition ton, t1, and t2



Client:	GE MDS LLC	Job Number:	J73440
Model:	SD4	T-Log Number:	T73579
		Account Manager:	Susan Pelzl
Contact:	Dennis McCarthy		
Standard:	FCC Part 90, RSS-119	Class:	N/A

Run #6b
Carrier Frequency: 450 MHz
Channel Spacing: 6.25 kHz
Modulation: 4800F
Description: Switch off condition t3 and toff

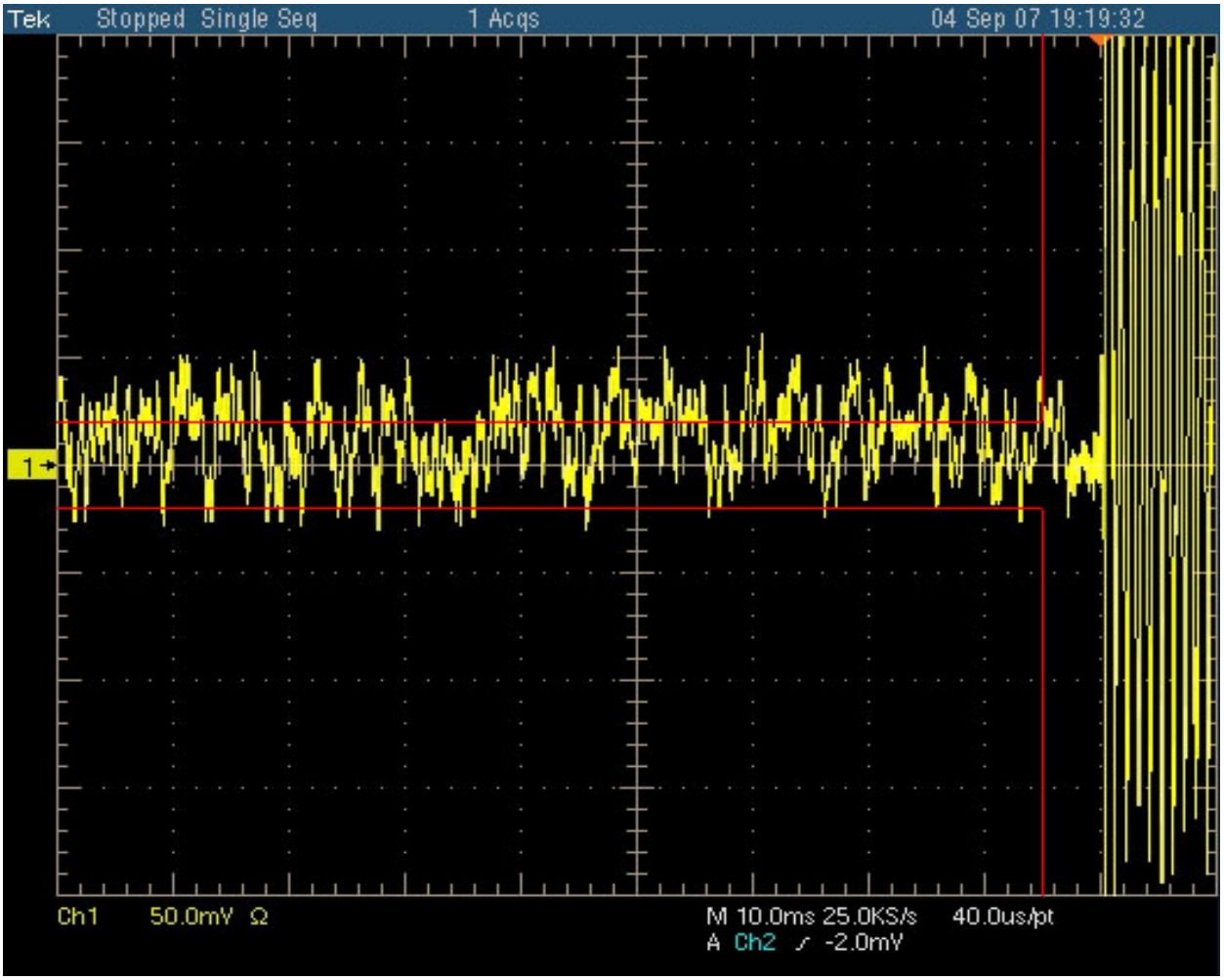


EXHIBIT 3: Installation Guide GE MDS LLC Model SD4

Uploaded as A Separate Attachment