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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization Class II Permissive Change pursuant to Industry Canada RSS-Gen Issue 2 / RSS 210 Issue 7 FCC Part 15 Subpart C on the GE MDS LLC Transmitter Model: MDSEL805

UPN:	3738A-12122
FCC ID:	E5MDS-EL805
GRANTEE:	GE MDS LLC 175 Science Parkway Rochester, NY 14620
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	December 1, 2007
FINAL TEST DATE:	September 24, October 11, October 24 and November 15, 2007

AUTHORIZED SIGNATORY: _____

Mark E. Hill
Staff Engineer

ACCREDITED
2016-01

REVISION HISTORY

Revision #	Date	Comments	Modified By
1	December 7, 2007	Initial Release	David Guidotti

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SCOPE

An electromagnetic emissions test has been performed on the GE MDS LLC model MDSEL805 pursuant to the following rules:

Industry Canada RSS-Gen Issue 2
RSS 210 Issue 7 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

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

ANSI C63.4:2003

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

The test results recorded herein are based on a single type test of the GE MDS LLC model MDSEL805 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, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

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 MDSEL805 complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 2
RSS 210 Issue 7 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart B (Receivers)
FCC Part 15 Subpart C

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.).

TEST RESULTS SUMMARY

DIGITAL TRANSMISSION SYSTEMS (902 – 928 MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 210 A8.2	Digital Modulation	Systems uses DSSS techniques	-	Complies
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth	-	>500kHz	Note 1
	RSP100	99% Bandwidth	-	Information only	Note 1
15.247 (b) (3)	RSS 210 A8.2 (4)	Output Power, 902 – 928 MHz	Power level was verified to ensure output was equivalent to granted levels	1Watt, EIRP limited to 4 Watts.	-
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density	-	8dBm/3kHz	Note 1
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions 30MHz – 9.28 GHz	-	< -20dBc	Note 1
15.247(c) / 15.209	RSS 210 A8.5 Table 2, 3	Radiated Spurious Emissions 30MHz – 9.28 GHz	50.4dBµV/m (331.1µV/m) @ 7312.0MHz (-3.6dB)	15.207 in restricted bands, all others < -20dBc	Complies

Note 1: Test/Evaluation not performed. Not applicable to a permissive change for a new antenna.

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	EUT is professionally installed		Complies
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	28.5dBµV/m (26.6µV/m) @ 84.000MHz (-11.5dB)		Complies
15.207	RSS GEN Table 2	AC Conducted Emissions	-	-	Note 1
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in Exhibit 11, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
	RSP 100 RSS GEN 7.1.5	User Manual		Statement required regarding non-interference	Complies
	RSP 100 RSS GEN 7.1.5	User Manual		Statement required regarding detachable antenna	Complies

Note 1: Test/Evaluation not performed. Not applicable to a permissive change for a new antenna.

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 and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	0.015 to 30	± 3.0
Radiated Emissions	30 to 1000	± 3.6
Radiated Emissions	1000 to 40000	± 6.0

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The GE MDS LLC model MDSEL805 is a 902-928 MHz FHSS radio that is designed to provide a radio communications link. 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 6-30 Volts DC.

The sample was received on September 24, 2007 and tested on September 24, October 11, October 24 and November 15, 2007. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
GE MDS	MDSEL805	902-928 MHz radio	1634192	E5MDS-EL805

OTHER EUT DETAILS

The EUT requires professional installation and therefore is exempt from the requirement of 15.203. The output power is configured for each antenna to ensure the EIRP does not exceed 4 Watts, and the output power at the rf connector cannot exceed the maximum value reported in this test data. Radiated emissions were measured with the output power set to maximum and with the EUT antennas connected via a short length of cable, with negligible loss at the fundamental frequency.

ANTENNA SYSTEM

The antenna system used with the GE MDS LLC model MDSEL805 is Katherein, model OGB9-915, Omnidirectional antenna, 9 dBd (11.2 dBi).

ENCLOSURE

The EUT enclosure is primarily constructed of die cast aluminum. It measures approximately 13 cm wide by 9 cm deep by 3.5 cm high.

MODIFICATIONS

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

SUPPORT EQUIPMENT

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

Manufacturer	Model	Description	Serial Number	FCC ID
TopWard	3603D	DC Power Supply	-	-
Dell	-	Laptop	-	DoC

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Diag – RJ11	Dell Laptop USB via serial to USB adapter	4 wire	Unshielded	2.0
DC Power	DC Power Supply	2 wire	Unshielded	2.0
RF Port	Antenna	Coax	Shielded	1.0
Serial - DB9	Not Connected			

EUT OPERATION

The EUT was configured to continuously transmit on the desired frequency. The output power level was also adjusted, as needed.

PROPOSED MODIFICATION DETAILS

GENERAL

This section details the modifications to the GE MDS LLC model MDSEL805 being proposed. All performance and construction deviations from the characteristics originally reported to the FCC are addressed

The only change to the system is the addition of a new antenna. Katherein, model OGB9-915, Omnidirectional antenna, 9 dBd (11.2 dBi).

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on September 24, October 11, October 24 and November 15, 2007 at the Elliott Laboratories Open Area Test Site #Chambers 3 and 4 or semi anechoic chamber #Chambers 3 and 4 located at 684 West Maude Avenue, Sunnyvale, California or 41039 Boyce Road, Fremont, California Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission.

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure 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 CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak 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. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

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

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

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. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be 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. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

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 exhibit of this report contains the list of test equipment used and calibration information.

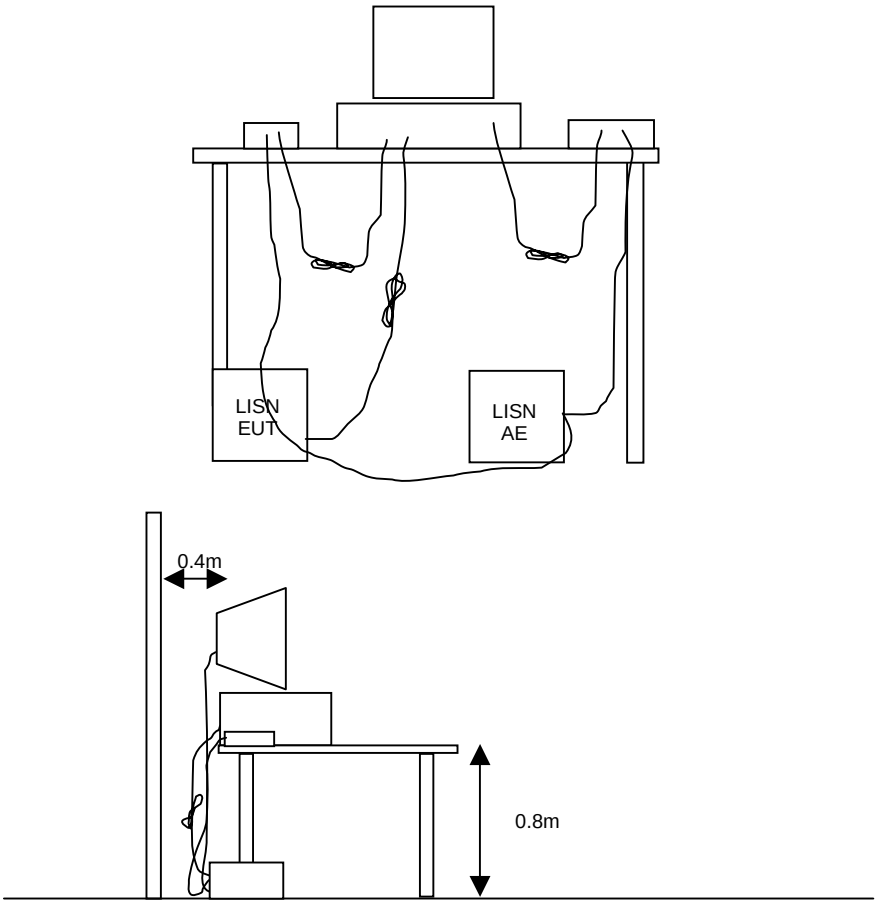
TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

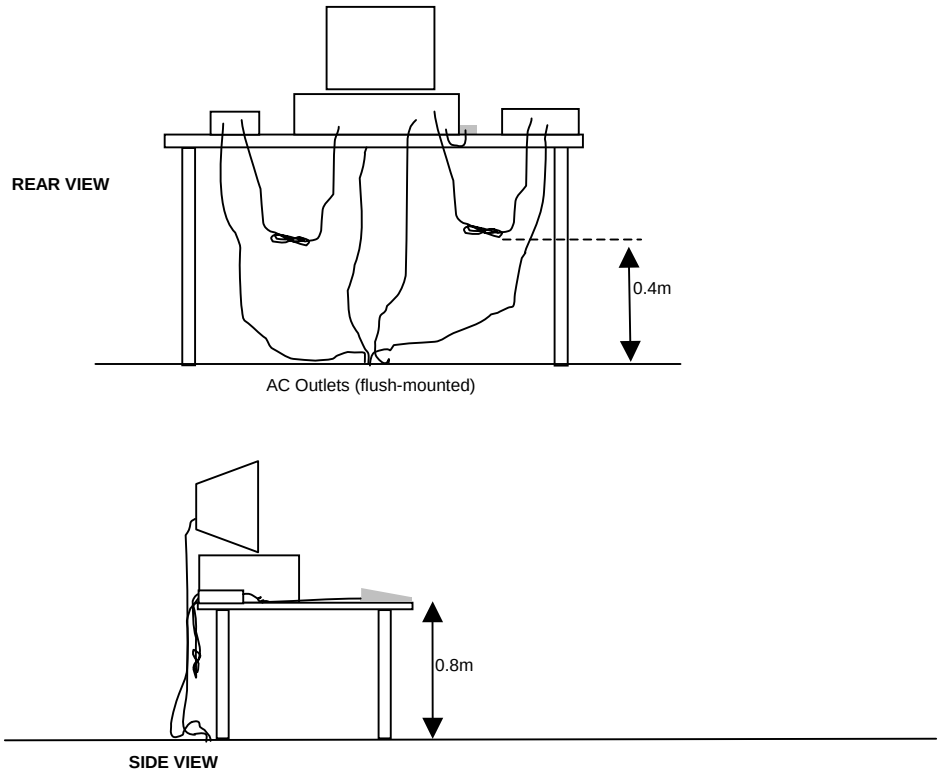


A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

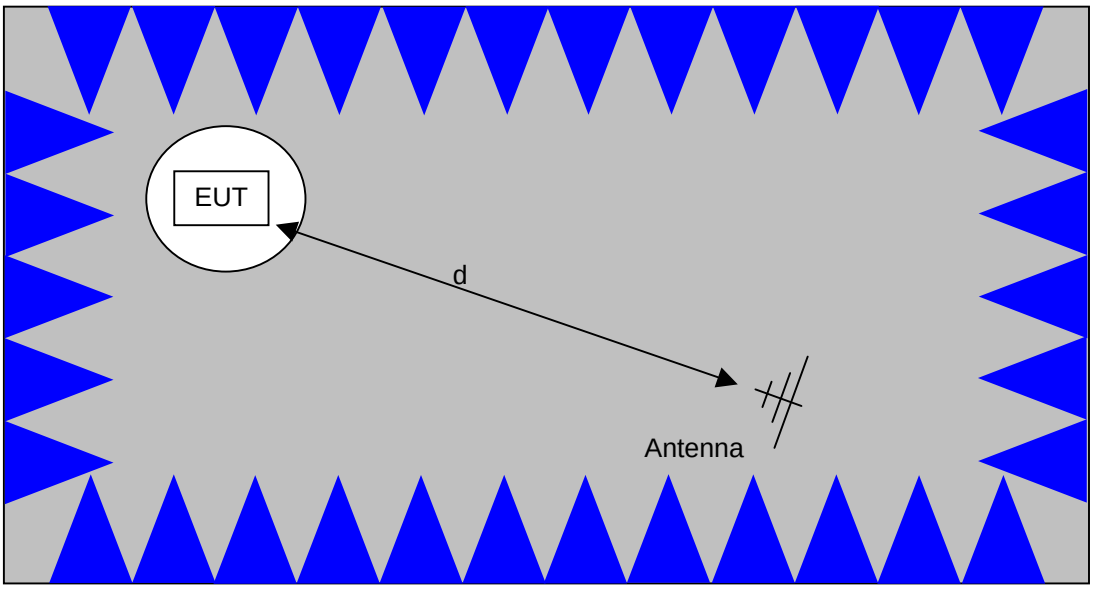
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.

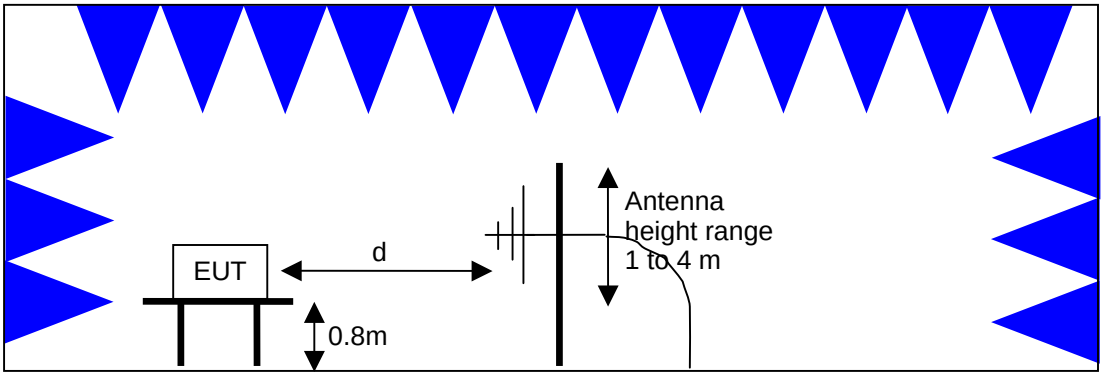


Typical Test Configuration for Radiated Field Strength Measurements



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

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 limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

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

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

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally 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, when used for electric field measurements above 30MHz, is calculated 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:

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

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

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 - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of 3m from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{3} \text{ microvolts per meter}$$

where P is the eirp (Watts)

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 30 - 12,000 MHz, 19-Sep-07
Engineer: Suhaila Khushzad

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	16-Mar-08
EMCO	Antenna, Horn, 1-18 GHz	3115	786	28-Nov-07
Hewlett Packard	EMC Spectrum Analyzer, 9 KHz-26.5 GHz	8593EM	1141	30-Oct-07
Hewlett Packard	High Pass filter, 1.5 GHz (Purple System)	P/N 84300-80037 (84125C)	1769	08-Nov-07

Radiated Emissions, 1500 - 10,000 MHz, 24-Sep-07
Engineer: Suhaila Khushzad

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	16-Mar-08
EMCO	Antenna, Horn, 1-18 GHz	3115	786	28-Nov-07
Hewlett Packard	EMC Spectrum Analyzer, 9 KHz-26.5 GHz	8593EM	1141	30-Oct-07
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	12-Apr-08
Hewlett Packard	High Pass filter, 1.5 GHz (Purple System)	P/N 84300-80037 (84125C)	1769	08-Nov-07

Radiated Emissions, 30 - 2,800 MHz, 11-Oct-07
Engineer: skhushzad

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	29-May-08
EMCO	Antenna, Horn, 1-18GHz	3115	868	26-Apr-08
Hewlett Packard	EMC Spectrum Analyzer, 9 KHz-26.5 GHz	8593EM	1141	30-Oct-07

Radiated Emissions, 30 - 1,000 MHz, 15-Nov-07
Engineer: David Bare

Manufacturer	Description	Model #	Asset #	Cal Due
Rohde & Schwarz	Test Receiver, 9 kHz-2750 MHz	ESCS 30	1337	21-Sep-08
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	03-Jan-08
EMCO	Biconical Antenna, 30-300 MHz	3110B	1498	20-Mar-08

EXHIBIT 2: Test Measurement Data

12 Pages

Elliott	EMC Test Data

Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		-
Emissions Standard(s):	15.209, 15.247, RSS 210	Class:	-
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

GE MDS LLC

Model

MDSEL805 (FCC ID: E5MDS-EL805)

Date of Last Test: 10/24/2007

Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manger:	Susan Pelzl
Contact:	Dennis Mccathy		
Emissions Standard(s):	15.209, 15.247, RSS 210	Class:	-
Immunity Standard(s):	-	Environment:	-

EUT INFORMATION

General Description

The EUT is a 902-928 MHz FHSS radio that is designed to provide a radio communications link. 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 6-30 Volts DC.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
GE MDS	MDSEL805	902-928 MHz radio		E5MDS-EL805

EUT Antenna (Intentional Radiators Only)

The EUT antenna is Katherein, model OGB9-915, Omnidirectional antenna, 9 dBd (11.2 dBi).

The EUT requires professional installation and therefore is exempt from the requirement of 15.203. The output power is configured for each antenna to ensure the EIRP does not exceed 4 Watts, and the output power at the rf connector cannot exceed the maximum value reported in this test data. Radiated emissions were measured with the output power set to maximum and with the EUT antennas connected via a short length of cable, with negligible loss at the fundamental frequency.

EUT Enclosure

The EUT enclosure is primarily constructed of die cast aluminum. It measures approximately 13 cm wide by 9 cm deep by 3.5 cm high.

Modification History

Mod. #	Test	Date	Modification
1	Receive Spurious Emissions	11/15/2007	Added 0.1uf cap across power input pins

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

Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manger:	Susan Pelzl
Contact:	Dennis Mccathy		
Emissions Standard(s):	15.209, 15.247, RSS 210	Class:	-
Immunity Standard(s):	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
TopWard	3603D	DC Power Supply	-	-
Dell	-	Laptop	-	DoC

Remote Support Equipment

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

Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Diag – RJ11	Dell Laptop USB via serial to USB adapter	4Wire	Unshielded	2.0
DC Power	DC Power Supply	2Wire	Unshielded	2.0
RF Port	Antenna	Coax	Shielded	1.0
Serial - DB9	Not Connected	-	-	-

EUT Operation During Emissions Tests

The EUT was configured to continuously transmit on the desired frequency. The output power level was also adjusted, as needed.

Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		
Standard:	15.209, 15.247, RSS 210	Class:	N/A

RSS 210 and FCC 15.247 Radiated 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.

Date of Test: 9/24/2007
Test Engineer: Suhaila Khushzad
Test Location: Fremont Chamber #3
Config. Used: 1
Config Change: None
EUT Voltage: 15.7V DC

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running on top of the groundplane or routed in overhead in the GR-1089 test configuration.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 21.9 °C
Rel. Humidity: 47 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	RE, 1500 - 10000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	50.4dBµV/m (331.1µV/m) @ 7312.0MHz (-3.6dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

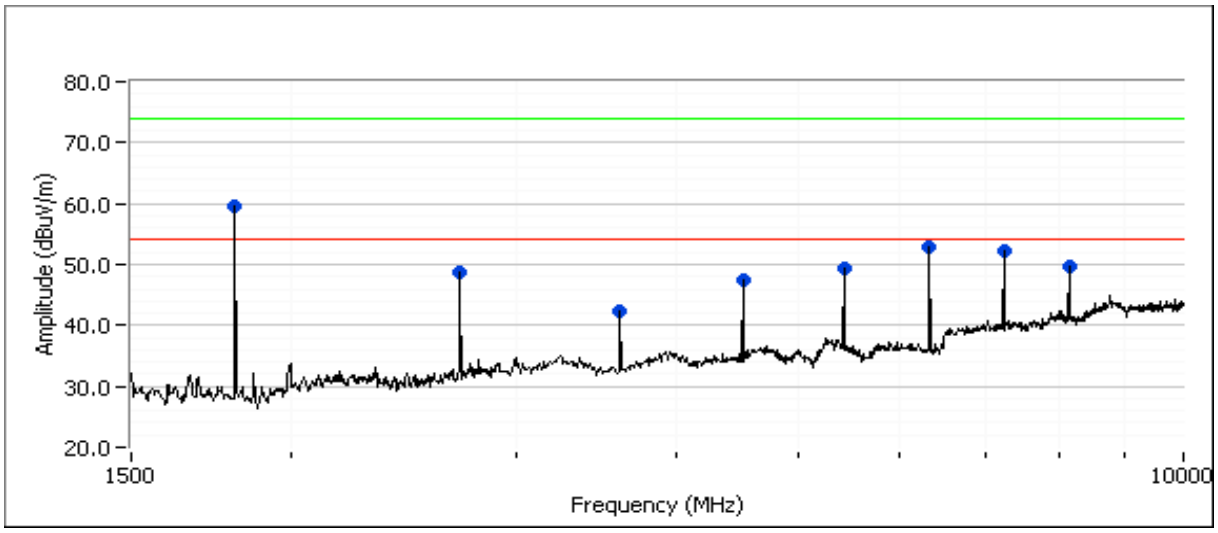
Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		
Standard:	15.209, 15.247, RSS 210	Class:	N/A

Run # 1a: Radiated Spurious Emissions, 1500 - 10000 MHz. Transmit Mode
Low Channel @ 903 MHz (Power setting: 30dBm) with 9dBd Omni antenna, Cable Loss = 10.2dB
Fundamental Signal Field Strength: Peak value measured in 100kHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
903.000	133.5	V	-	-	Pk	308	1.6	RB = VB = 100kHz
903.000	105.5	H	-	-	Pk	213	1.0	RB = VB = 100kHz

Fundamental emission level @ 3m in 100kHz RBW:	133.5	dBµV/m
Limit for emissions outside of restricted bands:	113.5	dBµV/m

Limit is -20dBc (Peak power measurement)



Run # 1a Con't On Next Page

Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		
Standard:	15.209, 15.247, RSS 210	Class:	N/A

Run # 1a: Radiated Spurious Emissions, 1500 - 10000 MHz. Transmit Mode
Low Channel @ 903 MHz (Power setting: 30dBm) with 9dBd Omni antenna, Cable Loss = 10.2dB
Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2708.920	48.2	H	54.0	-5.8	AVG	178	1.0	
5417.990	47.8	H	54.0	-6.2	AVG	180	1.0	
4514.900	46.7	V	54.0	-7.3	AVG	19	1.0	
7223.930	45.7	V	54.0	-8.3	AVG	11	1.3	
8145.700	33.0	V	54.0	-21.0	AVG	167	1.0	
5417.990	50.7	H	74.0	-23.3	PK	180	1.0	
2708.920	50.5	H	74.0	-23.5	PK	178	1.0	
7223.930	50.5	V	74.0	-23.5	PK	11	1.3	
4514.900	49.3	V	74.0	-24.7	PK	19	1.0	
3615.710	25.9	V	54.0	-28.1	AVG	148	1.0	
8145.700	44.5	V	74.0	-29.5	PK	167	1.0	
3615.710	37.0	V	74.0	-37.0	PK	148	1.0	
1806.040	59.7	V	113.5	-53.8	Peak	14	1.3	
6321.050	52.9	V	113.5	-60.6	Peak	275	1.9	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental and measured in 100kHz.

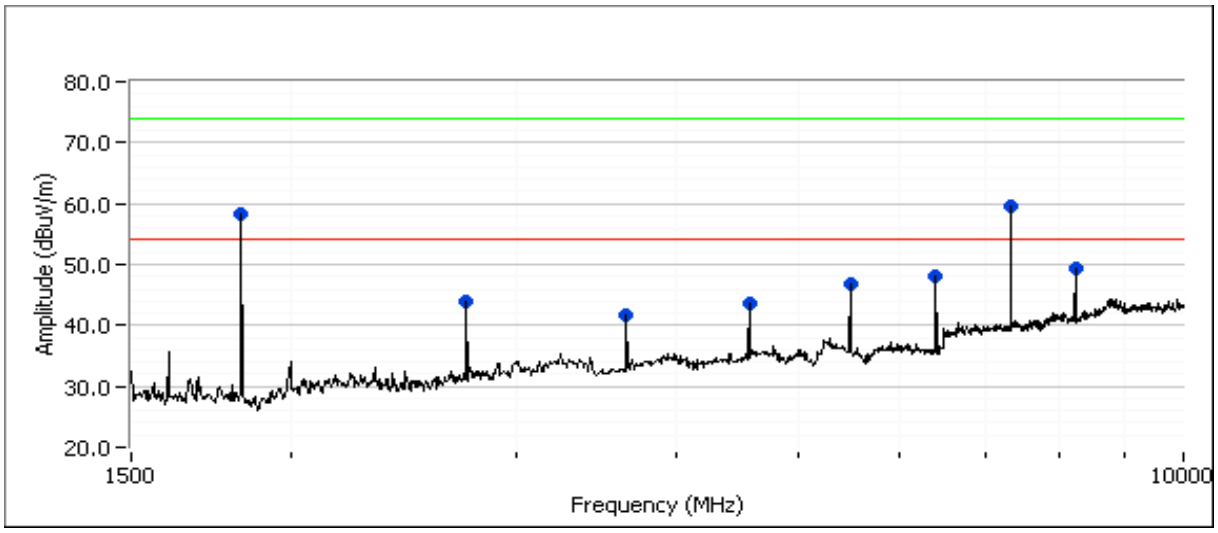
Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		
Standard:	15.209, 15.247, RSS 210	Class:	N/A

Run # 1b: Radiated Spurious Emissions, 1500 - 10000 MHz. Transmit Mode
Center Channel @ 914 MHz (Power setting: 30dBm) with 9dBd Omni antenna, Cable Loss = 10.2dB
Fundamental Signal Field Strength: Peak and average values measured in 1 MHz, and peak value measured in 100kHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
914.000	132.1	V	-	-	Pk	303	1.5	RB = VB = 100kHz
914.000	108.5	H	-	-	Pk	180	1.0	RB = VB = 100kHz

Fundamental emission level @ 3m in 100kHz RBW:	132.1	dBµV/m
Limit for emissions outside of restricted bands:	112.1	dBµV/m

Limit is -20dBc (Peak power measurement)



Run # 1b Con't On Next Page

Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		
Standard:	15.209, 15.247, RSS 210	Class:	N/A

Run # 1b: Radiated Spurious Emissions, 1500 - 10000 MHz. Transmit Mode
Center Channel @ 914 MHz (Power setting: 30dBm) with 9dBd Omni antenna, Cable Loss = 10.2dB
Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7311.990	50.4	V	54.0	-3.6	AVG	330	1.3	Power Setting 26
8225.970	50.1	H	54.0	-3.9	AVG	161	1.0	
3655.980	42.1	V	54.0	-11.9	AVG	177	1.2	
2741.950	41.0	H	54.0	-13.0	AVG	208	1.0	
7311.990	53.1	V	74.0	-20.9	PK	330	1.3	Power Setting 26
8225.970	52.8	H	74.0	-21.2	PK	161	1.0	
4573.630	27.7	V	54.0	-26.3	AVG	0	1.3	
3655.980	45.4	V	74.0	-28.6	PK	177	1.2	
2741.950	44.5	H	74.0	-29.5	PK	208	1.0	
4573.630	38.5	V	74.0	-35.5	PK	0	1.3	
1828.030	58.4	V	112.1	-53.7	Peak	235	1.3	
6398.040	48.2	V	112.1	-63.9	Peak	337	1.6	
5484.080	46.8	V	112.1	-65.3	Peak	188	2.2	
7311.960	57.4	V	54.0	3.4	AVG	302	1.6	
7311.960	58.9	V	74.0	-15.1	PK	302	1.6	
7311.980	55.5	V	54.0	1.5	AVG	307	1.6	Power Setting 28
7311.980	57.4	V	74.0	-16.6	PK	307	1.6	Power Setting 28
7311.990	50.4	V	54.0	-3.6	AVG	330	1.3	Power Setting 26
7311.990	53.1	V	74.0	-20.9	PK	330	1.3	Power Setting 26

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental and measured in 100kHz.

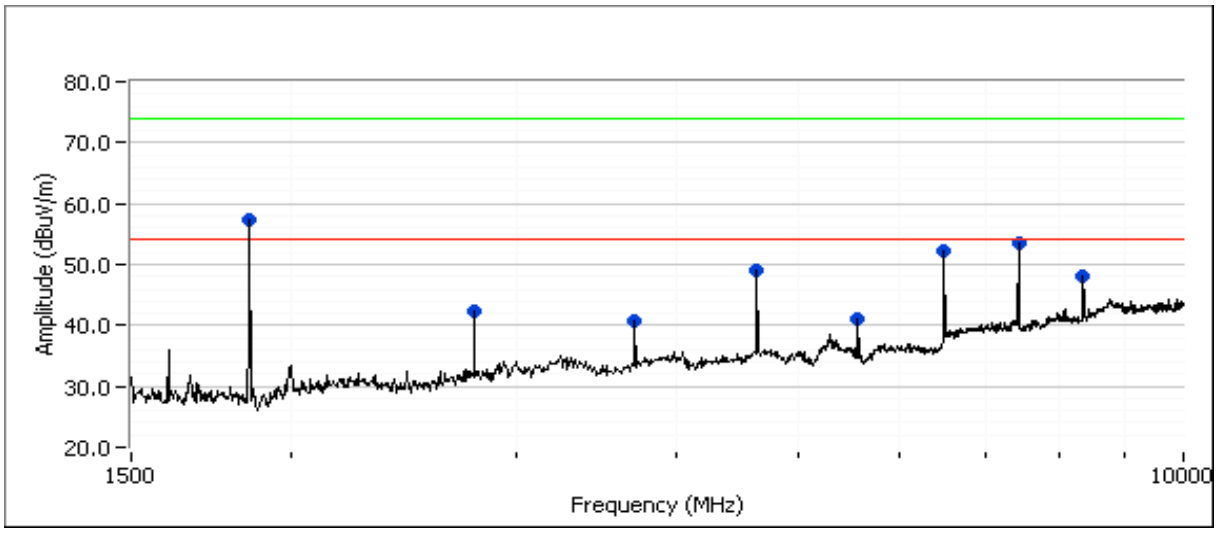
Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		
Standard:	15.209, 15.247, RSS 210	Class:	N/A

Run # 1c: Radiated Spurious Emissions, 1500 - 10000 MHz. Transmit Mode
High Channel @ 927 MHz (Power setting: 26dBm) with 9dBd Omni antenna, Cable Loss = 10.2dB
Fundamental Signal Field Strength: Peak and average values measured in 1 MHz, and peak value measured in 100kHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
927.000	132.0	V	-	-	Pk	302	1.7	RB = VB = 100kHz
927.000	108.5	H	-	-	Pk	237	1.2	RB = VB = 100kHz

Fundamental emission level @ 3m in 100kHz RBW:	132	dBµV/m
Limit for emissions outside of restricted bands:	112	dBµV/m

Limit is -20dBc (Peak power measurement)



Run # 1c Con't On Next Page

Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		
Standard:	15.209, 15.247, RSS 210	Class:	N/A

Run # 1c: Radiated Spurious Emissions, 1500 - 10000 MHz. Transmit Mode
High Channel @ 927 MHz (Power setting: 26dBm) with 9dBd Omni antenna, Cable Loss = 10.2dB
Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4634.980	48.5	V	54.0	-5.5	AVG	271	1.4	
7415.990	44.3	V	54.0	-9.7	AVG	219	2.2	
960.000	43.0	V	54.0	-11.0	QP	302	1.2	
960.000	42.8	H	54.0	-11.2	QP	237	1.7	
8354.280	33.5	V	54.0	-20.5	AVG	234	1.2	
4634.980	50.9	V	74.0	-23.1	PK	271	1.4	
7415.990	49.1	V	74.0	-24.9	PK	219	2.2	
3723.540	26.8	V	54.0	-27.2	AVG	219	1.3	
2786.350	25.7	H	54.0	-28.3	AVG	173	1.0	
8354.280	44.6	V	74.0	-29.4	PK	234	1.2	
3723.540	38.3	V	74.0	-35.7	PK	219	1.3	
2786.350	36.8	H	74.0	-37.2	PK	173	1.0	
1854.040	57.5	V	112.0	-54.5	Peak	104	1.0	
6488.960	52.3	V	112.0	-59.7	Peak	47	1.0	
6492.870	52.1	V	112.0	-59.9	Peak	47	1.0	
5561.980	41.0	V	112.0	-71.0	Peak	161	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental and measured in 100kHz.

Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		
Standard:	15.209, 15.247, RSS 210	Class:	N/A

RSS 210 and FCC 15.247 Radiated Spurious Emissions

Test Specific Details

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

Date of Test: 10/24/2007 Config. Used:
Test Engineer: Suhaila Khushzad Config Change:
Test Location: Fremont Chamber #4 EUT Voltage: 15V DC

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running on top of the groundplane or routed in overhead in the GR-1089 test configuration.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 24.5 °C
Rel. Humidity: 36 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	RE, 30 - 2800 MHz - Spurious Emissions	RSS 210	Pass	28.5dBµV/m (26.6µV/m) @ 84.000MHz (-11.5dB)

Modifications Made During Testing

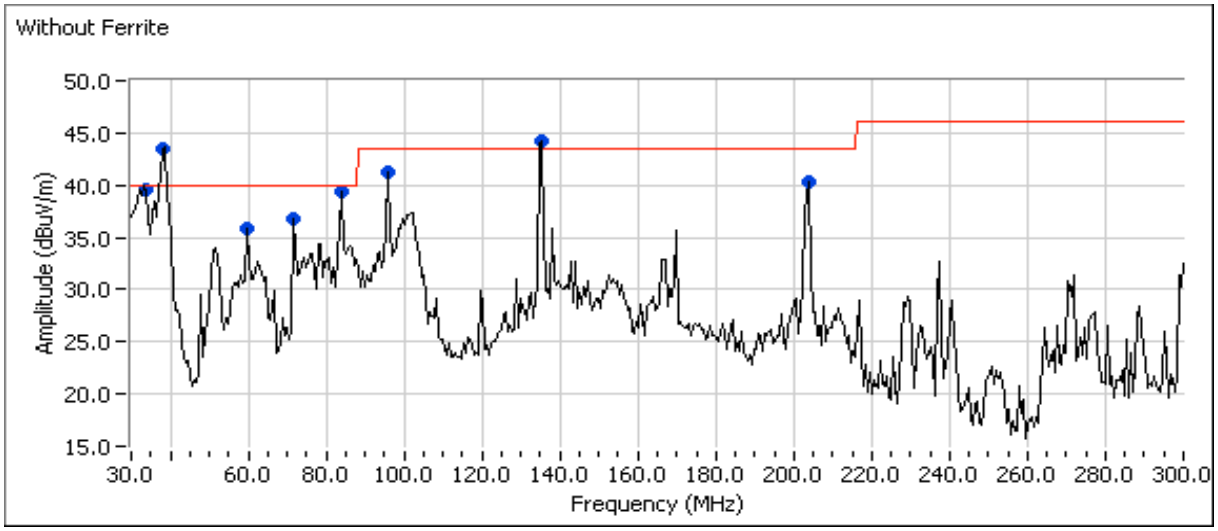
Modifications are detailed under each run description.

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	GE MDS LLC	Job Number:	J69050
Model:	MDSEL805 (FCC ID: E5MDS-EL805)	T-Log Number:	T69273
		Account Manager:	Susan Pelzl
Contact:	Dennis Mccathy		
Standard:	15.209, 15.247, RSS 210	Class:	N/A

Run # 1a: Radiated Spurious Emissions, 30 - 1000 MHz. Rx Mode
Center Channel @ 914 MHz, with 9dBd Omni antenna, Cable Loss = 10.2dB
Without Ferrite



Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
38.598	41.4	V	40.0	1.4	QP	252	1.0	
84.022	39.4	V	40.0	-0.6	QP	100	1.0	
135.162	42.2	H	43.5	-1.3	QP	90	2.0	
33.864	37.9	V	40.0	-2.1	QP	231	1.0	
96.027	40.4	V	43.5	-3.1	QP	98	1.0	
72.018	34.9	V	40.0	-5.1	QP	180	3.0	
60.015	33.9	V	40.0	-6.1	QP	100	1.0	
203.332	35.5	H	43.5	-8.0	QP	92	1.5	
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.							

Measurements repeated on 11/15/07 after adding 0.1uF cap across the power input pins.

Frequency	Level	Pol	15.109		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
84.000	28.5	V	40.0	-11.5	QP	185	1.0	
135.165	27.2	V	43.5	-16.3	QP	0	1.0	
38.527	18.5	V	40.0	-21.5	QP	169	1.0	
Note 1:	A scan was also performed to determine if other frequencies in this band had changed. All emissions were found to be lower than observed without the capacitor.							

EXHIBIT 3: Photographs of Test Configurations

2 Pages

EXHIBIT 4: Proposed FCC ID Label & Label Location

EXHIBIT 5: Detailed Photographs of GE MDS LLC Model MDSEL805Construction

Pages

EXHIBIT 6: Operator's Manual for GE MDS LLC Model MDSEL805

Pages

EXHIBIT 7: Block Diagram of GE MDS LLC Model MDSEL805

Pages

EXHIBIT 8: Schematic Diagrams for GE MDS LLC Model MDSEL805

Pages

EXHIBIT 9: Theory of Operation for GE MDS LLC Model MDSEL805

Pages

EXHIBIT 10: Advertising Literature

Pages

EXHIBIT 11: RF Exposure Information

Pages