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Electromagnetic Emissions Test Report In Accordance With Industry Canada FCC Part 80 on the Microwave Data Systems Transmitter Model: MDS2710A/C

FCC ID NUMBER:	E5MDS-2710AC
GRANTEE:	Microwave Data Systems 175 Science Parkway Rochester, NY 14620
TEST SITE:	Elliott Laboratories, Inc. 41039 Boyce Road Fremont, CA 41039
REPORT DATE:	July 27, 2005
FINAL TEST DATE:	August 27, August 28, August 30 and August 31, 2004
AUTHORIZED SIGNATORY:	Juan Martinez Senior EMC Engineer

ACCREDITED

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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:

Microwave Data Systems
175 Science Parkway
Rochester, NY 14620

2.1033(c)(2) & RSP-100 (4) FCC ID: E5MDS-2710AC

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

Please refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure

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

FCC 80**: 11K0F3D, 11K0F3E, 9K13F2D, 9K13F1D**
FCC 80**: 11K0F3D, 11K0F3E, 16K8F2D, 16K8F1D**

Analog: 2(D)+2(M) = 2(2.5) + 2(3) = 11kHz
Data: 12.5kHz channel (99% BW) = 9.13 kHz
Data: 25kHz channel (99% BW)= 16.8 kHz

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

FCC 80**: 216 – 220 MHz**

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

FCC 80**: 0.09 - 2.0 Watts**

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

FCC 80**:** Maximum power is 2 watt

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

+5Vdc, 1amp

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

Please refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure

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

Refer to Exhibit 6: Schematic diagram

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

Please refer to Exhibit 6: Schematic diagram.

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

Please refer to Exhibit 6: Schematic diagram.

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

Refer to Exhibit 6: Schematic diagram.

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

Refer to Exhibit 6: Schematic diagram.

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

Refer to Exhibit 4

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

Refer to Exhibit 5

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

N/A

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:
MDS2710A/C

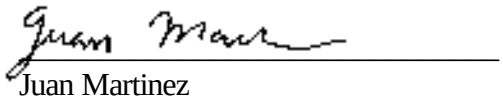
Manufacturer:
Microwave Data Systems
175 Science Parkway
Rochester, NY 14620

Tested to applicable standards:
FCC Part 80 (Marine)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC4549_**3** Dated March 5, 2003
Departmental Acknowledgement Number: IC4549_**5** Dated March 5, 2003
Departmental Acknowledgement Number: IC2845-**2** Dated August 8, 2001

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 Juan Martinez
Title Senior EMC Engineer
Elliott Laboratories Inc.
Address 684 W. Maude Ave
Sunnyvale, CA 94086
USA

Date: September 8, 2004

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 80 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. 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 80. 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 80 Test Summary

Measurement Required	FCC Part 2 & 80 Sections	Test Performed	Measured Value	Test Procedure Used	Result
Modulation Tested	GMSK & Analog	-	-	-	-
Modulation characteristics	2.1047/	Modulated with appropriated signal	-	H	-
Radiated RF power output (ERP/EIRP)	2.1046 / 80.215	Radiated Output Power Test	-	-	-
Conducted RF power output	2.1046 / 80.215	Conducted Output Power Test	33dBm (2 Watts)	B	Complies
Spurious emissions at antenna Port	2.1051/ 80.211(f)	Emission Limits and/or Unwanted Emission 30MHz – 5GHz (**Antenna Conducted**)	All spurious emissions < -20dBm	J	Complies
Occupied Bandwidth	2.1049/ 80.211(f)	Emission Mask and 99% Bandwidth	Refer to Plots	C & D	Complies
Field strength of spurious radiation	2.1053 / 80.211(f)	Radiated Spurious Emissions 30MHz – 5GHz	-54.4 dBuV/m @ 660.5 MHz (-23.9 dB)	N	Complies
Frequency stability	2.1055 / 80.209	Frequency Vs. Temperature	117 Hz	K	Complies
Frequency stability	2.1055 / 80.209	Frequency Vs. Voltage	25 Hz	L & M	Complies
Exposure to Mobile devices	2.1091	Exposure of Humans to RF Fields	MPE Calculation	-	
Receiver	15.109	Receiver Spurious Emissions	21.6 dBuV/m @ 216 MHz (-21.2 dB)	N/A	Complies

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 are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

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

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Microwave Data Systems model MDS2710A/C is a VHF modem that operates in the 216 - 220 Mhz band. There are two versions of the device, one with a data rate of 9600 bps and a channel spacing of 12.5kHz, the other with a 19200bps data rate and channel spacing of 25kHz. Both versions are very similar, with differences only in the software and changes to the passive IF receive filters. The devices can operate in both simplex (tx and rx frequencies the same) and half-duplex mode (tx and rx on different channels).
Normally, the EUT could be mounted to the wall or to the Remote Terminal Unit (RTU) it is used with. The EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 10.5 - 16 Vdc, 2.5 Amps.

The sample was received on August 27, 2004 and tested on August 27, August 28, August 30 and August 31, 2004. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Microwave Data Systems	MDS 2710 A	9600bps VHF Modem	1207721	E5MDS-2710AC
Microwave Data Systems	MDS 2710 C	19200bps VHF Modem	1248407	E5MDS-2710AC

ENCLOSURE

The EUT enclosure is primarily constructed of metal. It measures approximately 14 cm wide by 17 cm deep by 5 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
Microwave Data Systems	TT1EAR2-2	Handheld terminal	HH171101

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)
EUT Diag	Handheld terminal		Unshielded	2
EUT Data Interface	Resisitve termination		Shielded	3

Note: The Diag port is used for configuring the radio and would not be connected during normal operation. It was connected during testing for convenience to be able to set the operating mode.

Note: The Data Interface port would connect to a remote terminal unit or master system, which is typically a complex monitoring system (for the remote terminal) or server system (for the master system). These were not available as support equipment and so a resistive load was used to simulate the electrical connection to the terminal device.

EUT OPERATION DURING TESTING

The device was configured to transmit or receive on the channel specified in the test description. The antenna port was terminated in a 50-ohm load during radiated emissions tests and connected to the analyzer, via a suitable attenuator, for receive mode tests.

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TEST SITE

GENERAL INFORMATION

Final test measurements were taken on August 27, August 28, August 30 and August 31, 2004 at the Elliott Laboratories Chamber 2 located at 684 West Maude Avenue, Sunnyvale, California and Chamber 4 located at 41039 Boyce Road, Fremont, California. Pursuant to Section 2.948 of the FCC Rules, construction, calibration, and equipment data has been filed with the Commission.

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.

RADIATED EMISSIONS CONSIDERATIONS

Radiated measurements are performed in an open field environment or Anechoic Chamber. The test site is maintained free of conductive objects within the CISPR 16-1 defined elliptical area.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 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.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers

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.

The requirements of ANSI C63.4 were used for configuration of the equipment turntable. It 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 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 2MHz and video to 3 MHz.
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 (b)(1)(2)(3) & RSS-119 (I) was used to show compliance to the emission mask.

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

3) Since EUT is designed with a 25 kHz channel Section 90.210 (b)(1)(2)(3) & RSS-119 (I) was used to show compliance to the emission mask.

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 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 10th 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 transmit antenna and signal generator. The substitution antenna can be reference to a half-wave dipole in dBi. The signal generator is then set to a fix output level of either –10 or –20dBm. This is then injected into the substitution antenna. The field strength produced by the substitution antenna is then measured. This measured value is then used to determine the conversion factor to convert the EUTs field strength levels to a dBm value.

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) 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.

3) 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.

4) Set the signal generator output to the same level in step 3. This level was maintained for the remainder of the test.

5) 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.

6) Set the oscilloscope to trigger at the AUX channel 1 input port.

7) Removed enough external attenuation so that the input to the RF detector and combiner is increased by 30 dB.

8) Turn on the transmitter and plotted the result for **Ton**, **T1**, and **T2**.

9) Set the oscilloscope to trigger in decreasing magnitude from the RF crystal detector.

10) Turn off the transmitter and plotted the result for **T3**.

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 $43+10\text{Log}_{10}$ (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

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T56950 31 Pages

Elliott

EMC Test Data

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Project Engineer	Juan Martinez
Contact:	Dennis McCarthy		
Emissions Spec:	Part 80	Class:	Radio
Immunity Spec:	N/A	Environment:	-

EMC Test Data

For The

Microwave Data Systems

Model

MDS2710A/C

Date of Last Test: 10/29/2004

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Emissions Spec:	Part 80	Class:	Radio
Immunity Spec:	N/A	Environment:	-

EUT INFORMATION

General Description

The EUT is a VHF modem that operates in the 216 - 220 Mhz band. There are two versions of the device, one with a data rate of 9600 bps and a channel spacing of 12.5kHz, the other with a 19200bps data rate and channel spacing of 25kHz. Both versions are very similar, with differences only in the software and changes to the passive IF receive filters. The devices can operate in both simplex (tx and rx frequencies the same) and half-duplex mode (tx and rx on different channels).
Normally, the EUT could be mounted to the wall or to the Remote Terminal Unit (RTU) it is used with. The EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 10.5 - 16 Vdc, 2.5 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Microwave Data	MDS 2710 A	9600bps VHF Modem	1207721	E5MDS-2710AC
Microwave Data	MDS 2710 C	19200bps VHF Modem	1248407	E5MDS-2710AC

Other EUT Details

EUT Enclosure

The EUT enclosure is primarily constructed of metal. It measures approximately 14 cm wide by 17 cm deep by 5 cm high.

Modification History

Mod. #	Test	Date	Modification
1			
2			
3			

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

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Emissions Spec:	Part 80	Class:	Radio
Immunity Spec:	N/A	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Microwave Data Systems	TT1EAR2-2	Handheld terminal	HH171101	N/A

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
EUT Diag	Handheld terminal	RJ-11	Unshielded	2
EUT Data Interface	Resisitve termination	Multiwire	Shielded	3

Note: The Diag port is used for configuring the radio and would not be connected during normal operation. It was connected during testing for convenience to be able to set the operating mode.
Note: The Data Interface port would connect to a remote terminal unit or master system, which is typically a complex monitoring system (for the remote terminal) or server system (for the master system). These were not available as support equipment and so a resistive load was used to simulate the electrical connection to the terminal device.

EUT Operation During Emissions

The device was configured to transmit or receive on the channel specified in the test description. The antenna port was terminated in a 50-ohm load during radiated emissions tests and connected to the analyzer, via a suitable attenuator, for receive mode tests.

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Radio Performance Test - FCC 80

RF Port Measurements (25kHz Channel)

Test Specifics

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: 8/31/2004
Test Engineer: Juan Martinez
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 13Vdc

General Test Configuration

The EUT's rf port was connected to the measurement instrument's rf port, via an attenuator or dc-block if necessary.

Ambient Conditions:

Temperature: 18 °C
Rel. Humidity: 40 %

Summary of Results

Run #	Test Performed	Limit	Result	Value / Margin
1	Output Power	80.215	Pass	33 dBm
2	Modulation Limiting	802.211(f)	Pass	Refer to run
3	Emission Mask	802.211(f)	Pass	Refer to run
4	Conducted spurious emissions, 30MHz - 2300MHz, Transmit mode	802.211(f)	Pass	Refer to run

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:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #1: Power Measurements

Freq.	Setting	Pmeas	Duty Cycle	Pout
216	33	33.0	1	33.0
217	33	33.0	1	33.0
217	20	19.6	1	19.6
220	33	32.8	1	32.8

Setting: software power setting of EUT
Pmeas: Measured output power (average)
Duty Cycle: Duty cycleof transmissions (1 = 100%)

Run #2: Modulation Limiting (Total Deviation +/-2.5 kHz)
Frequency: 218 MHz

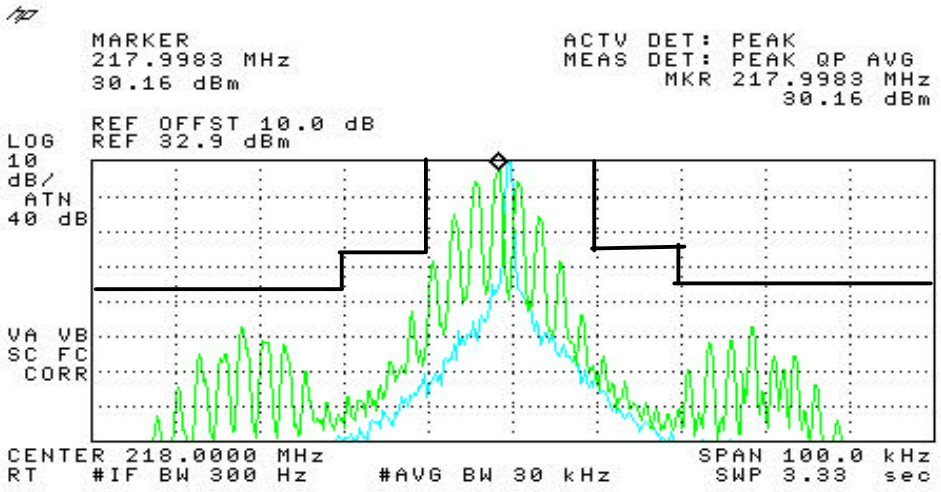
	300 Hz	1kHz	2.5 kHz	3 kHz
	(dBm)	(dBm)	(dBm)	(dBm)
10%	-21.0	-21.1	-19.8	-20.1
20%	-21.8	-21.5	-18.4	-19.5
30%	-22.0	-22.0	-18.1	-19.1
40%	-15.8	-18.4	-18.0	-18.4
50%	-15.3	-18.1	-17.9	-18.0
60%	-15.4	-18.0	-17.7	-17.2
70%	-15.1	-17.9	-17.2	-17.1
80%	N/A	-17.7	-17.0	N/A
90%	N/A	-17.2	N/A	N/A
100%	N/A	-17.0	N/A	N/A
110%	N/A	N/A	N/A	N/A
120%	N/A	N/A	N/A	N/A

Note: N/A - Input level was increased but modulation deviation remained constant.

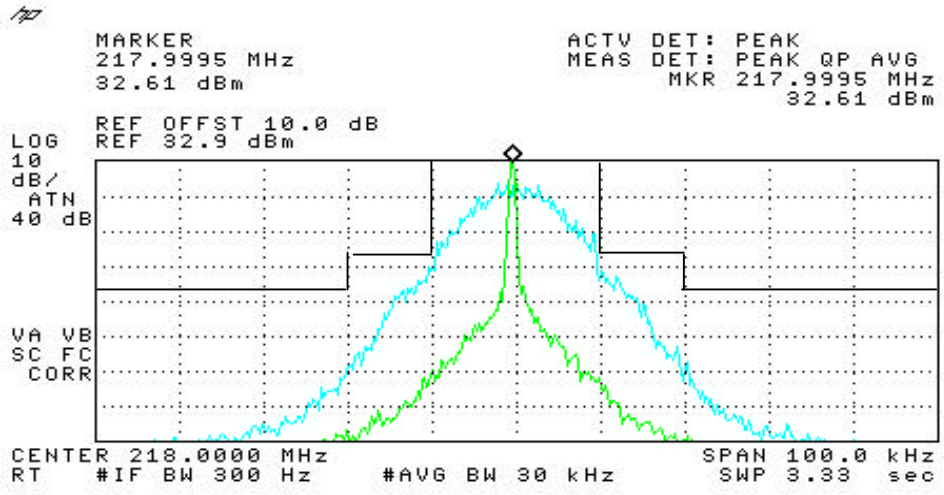
Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #3: Emission Mask

Analog Plot (11K0F3D, 11K0F3E)



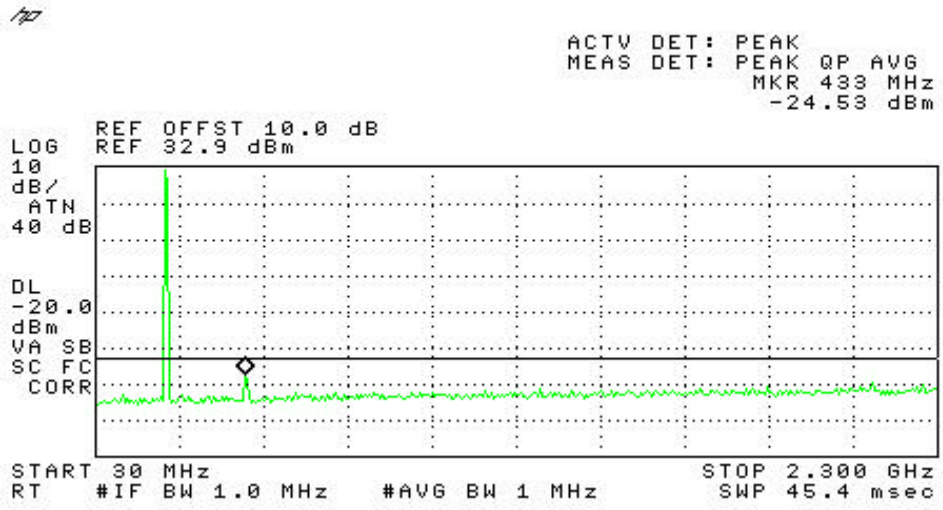
Data Plot (16K8F1D, 16K8F2D)



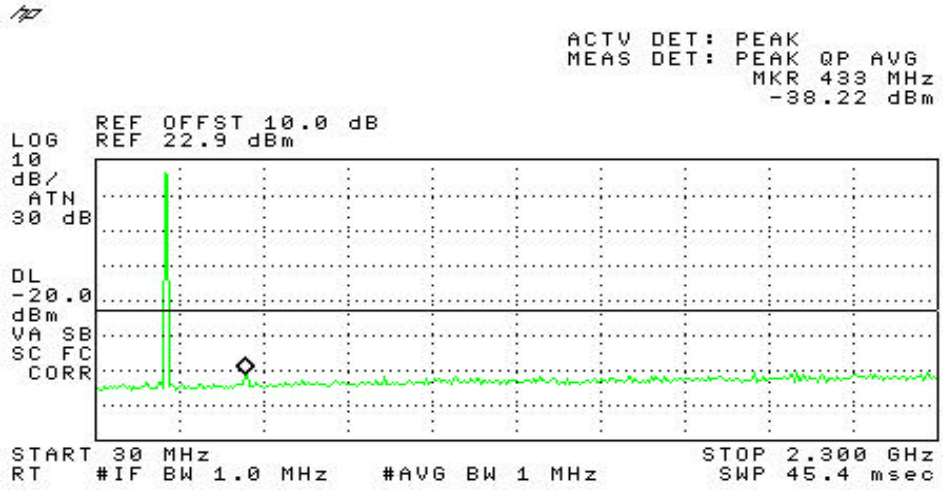
Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #4a: Antenna Port Conducted Spurious Emissions, Transmit Mode, 30 - 2300 MHz. EUT on 216MHz

PWR = 33



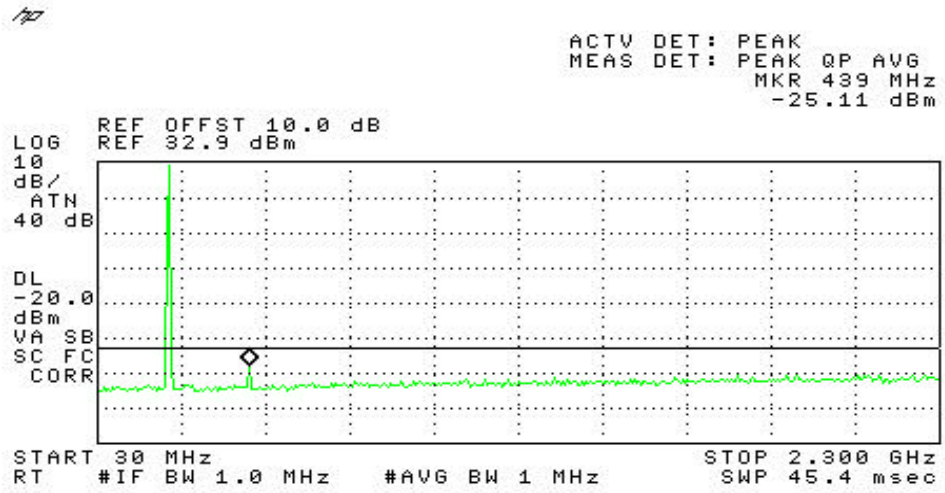
PWR = 20



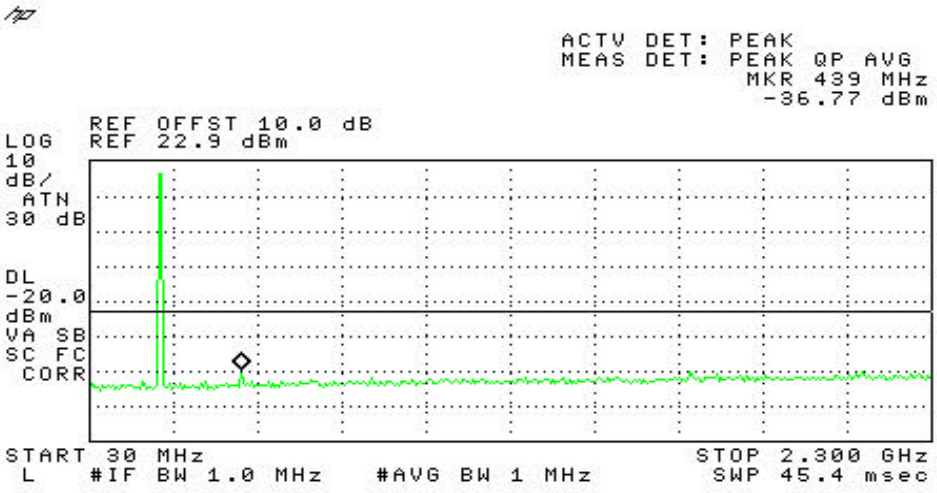
Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #4b: Antenna Port Conducted Spurious Emissions, Transmit Mode, 30 - 2300 MHz. EUT on 217 MHz

PWR = 33



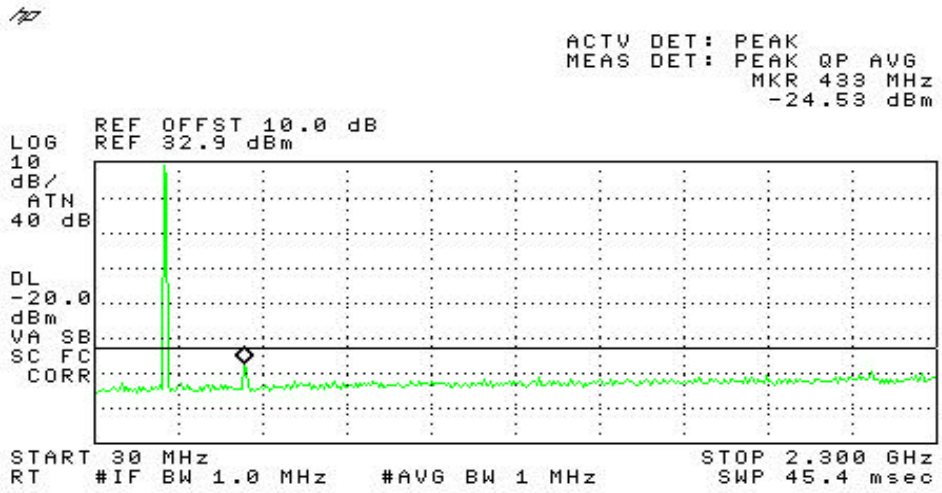
PWR = 20



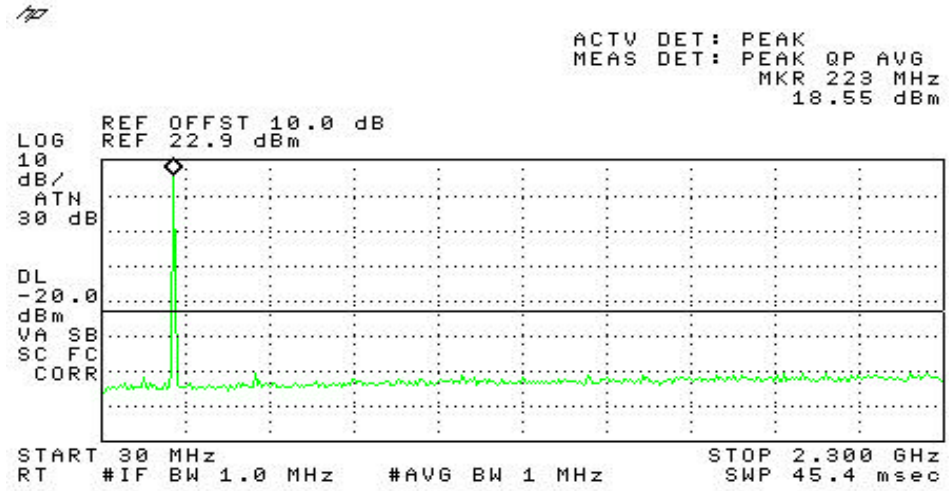
Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

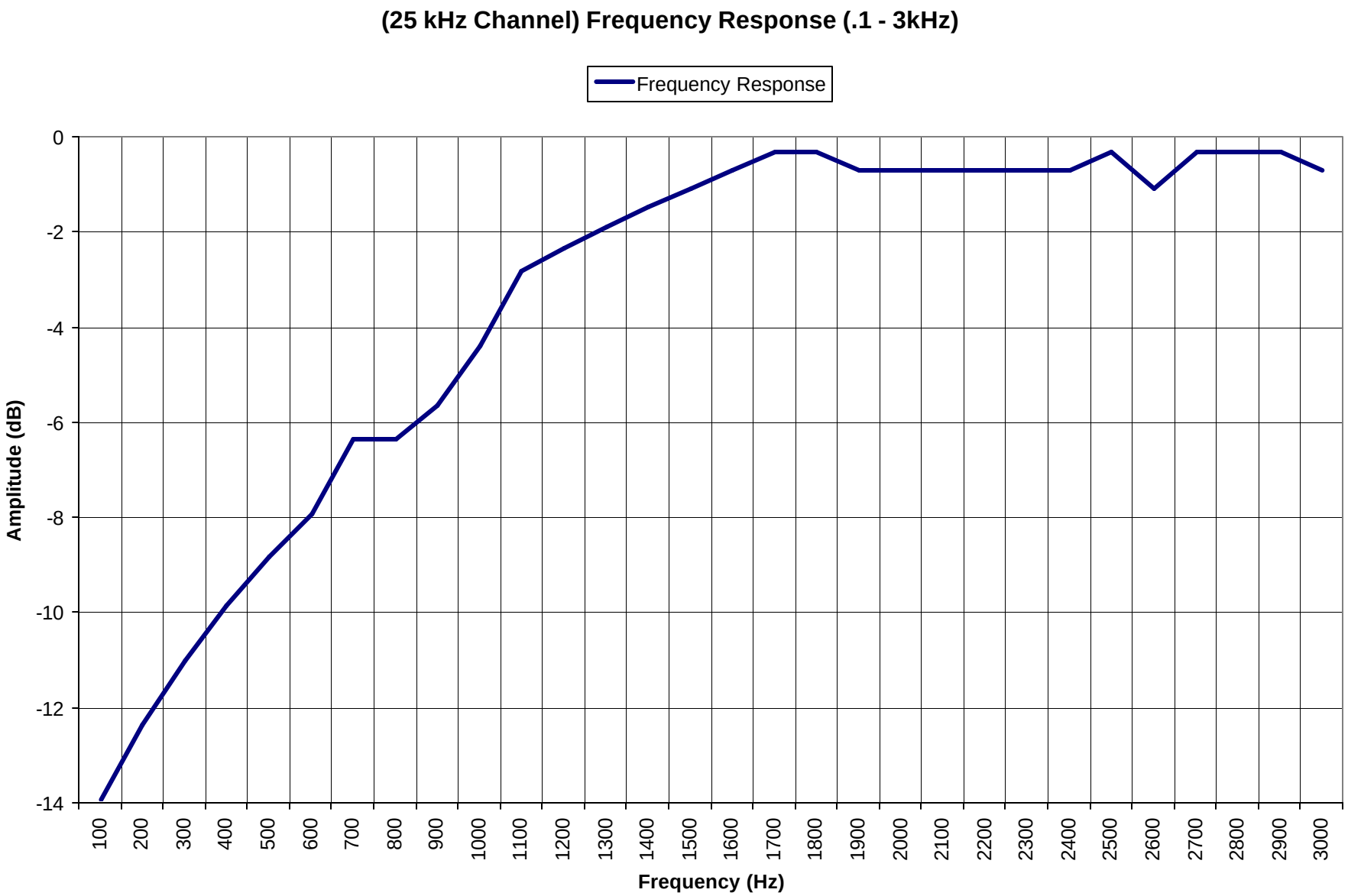
Run #4c: Antenna Port Conducted Spurious Emissions, Transmit Mode, 30 - 2300 MHz. EUT on 220 MHz

PWR = 33

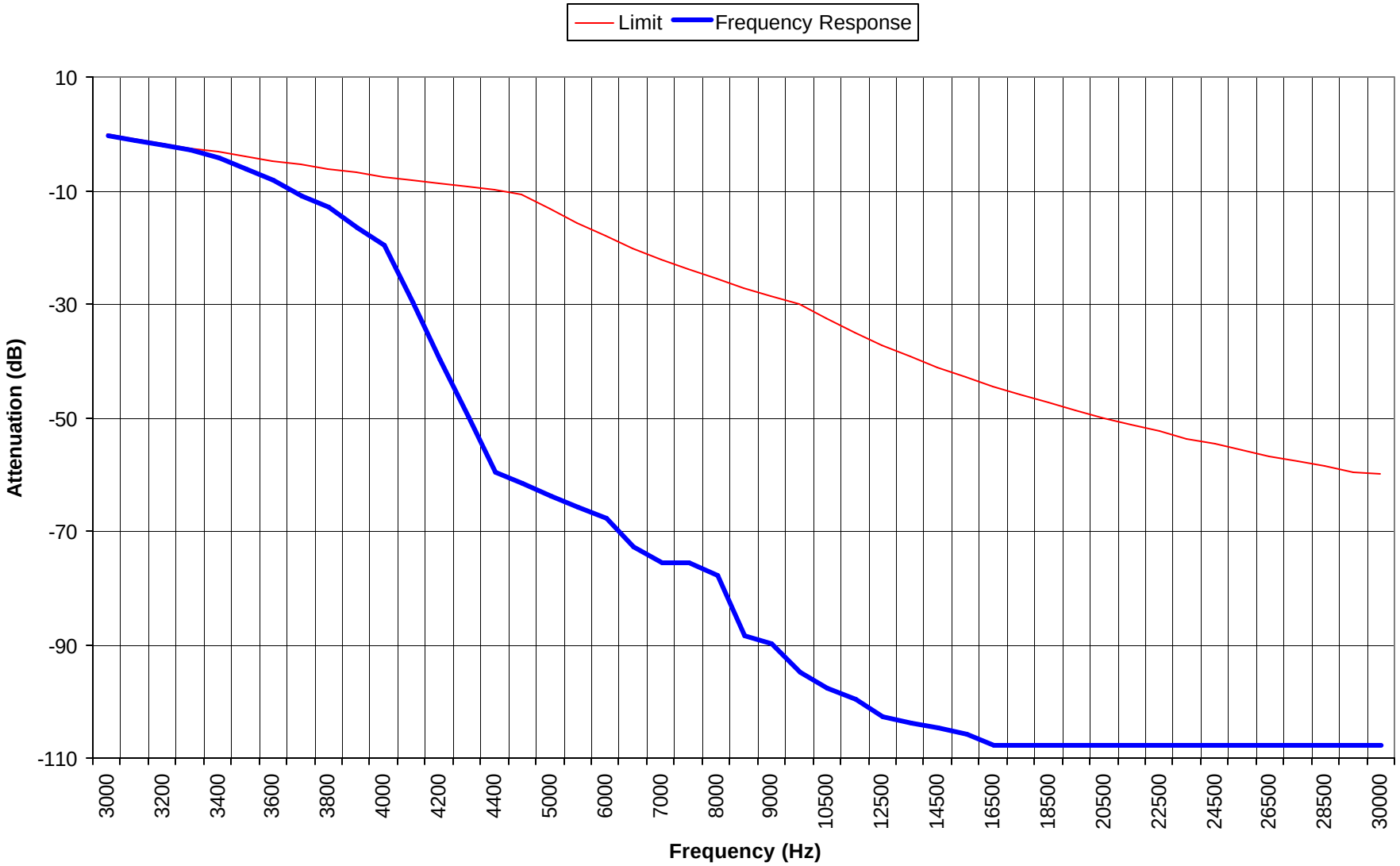


PWR = 20




(25 kHz Channel) Frequency Response (.1 - 3kHz)
Frequency Response
Amplitude (dB)
0
-2
-4
-6
-8
-10
-12
-14
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
Frequency (Hz)

(25kHz Channel) Frequency Response (3 - 30Khz)



Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Radio Performance Test - FCC 80

RF Port Measurements (12.5 kHz Channel)

Test Specifics

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: 8/31/2004
Test Engineer: Juan Martinez
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 13Vdc

General Test Configuration

The EUT's rf port was connected to the measurement instrument's rf port, via an attenuator or dc-block if necessary.

Ambient Conditions:

Temperature: 18 °C
Rel. Humidity: 40 %

Summary of Results

Run #	Test Performed	Limit	Result	Value / Margin
1	Output Power	80.215	Pass	33 dBm
2	Modulation Limiting	802.211(f)	Pass	Refer to run
3	Emission Mask	802.211(f)	Pass	Refer to run
4	Conducted spurious emissions, 30MHz - 2300MHz, Transmit mode	802.211(f)	Pass	Refer to run

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:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #1: Power Measurements

Freq.	Setting	Pmeas	Duty Cycle	Pout
216	33	33.0	1	33.0
217	33	33.0	1	33.0
217	20	19.6	1	19.6
220	33	32.8	1	32.8

Setting: software power setting of EUT
Pmeas: Measured output power (average)
Duty Cycle: Duty cycleof transmissions (1 = 100%)

Run #2: Modulation Limiting (Total Deviation +/- 2.6 kHz)
Frequency: 218 MHz

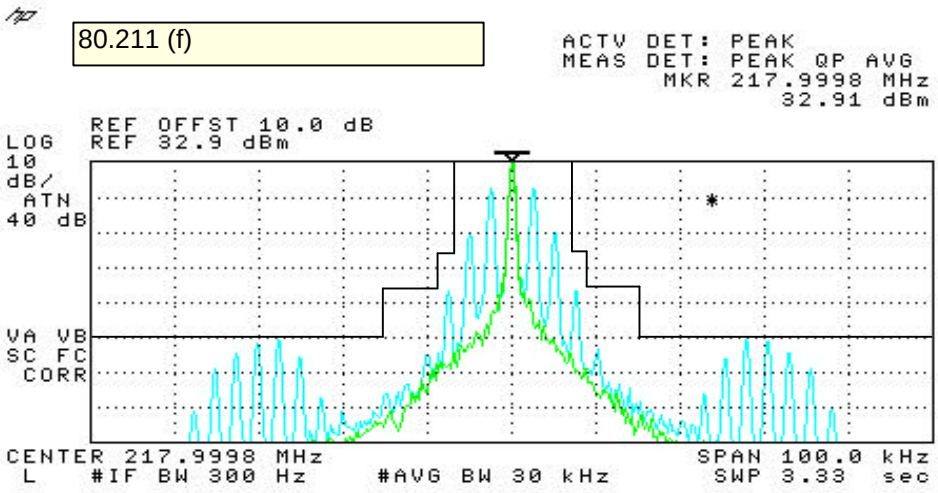
	300 Hz	1kHz	2.5 kHz	3 kHz
	(dBm)	(dBm)	(dBm)	(dBm)
10%	-21.0	-23.0	-22.1	-20.1
20%	-21.8	-22.4	-21.7	-20.0
30%	-22.0	-22.0	-21.0	-19.4
40%	-15.8	-18.4	-19.2	-18.7
50%	-15.3	-18.1	-18.4	-18.1
60%	-15.4	-18.0	-18.1	-17.5
70%	-15.1	-17.9	-17.5	-17.4
80%	N/A	-17.7	N/A	N/A
90%	N/A	-17.2	N/A	N/A
100%	N/A	-17.0	N/A	N/A
110%	N/A	N/A	N/A	N/A
120%	N/A	N/A	N/A	N/A

Note: N/A - Input level was increased but modulation deviation remained constant.

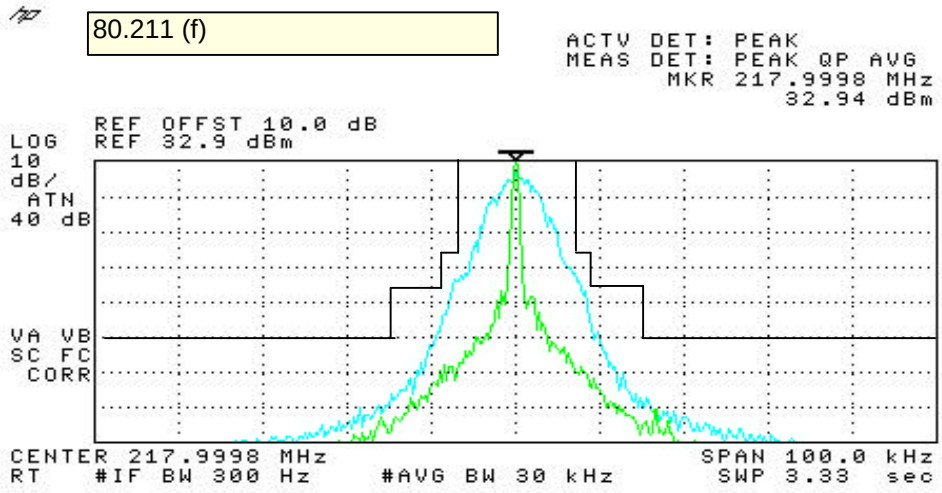
Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #3: Emission Mask

Analog Plot (11K0F3D, 11K0F3E)



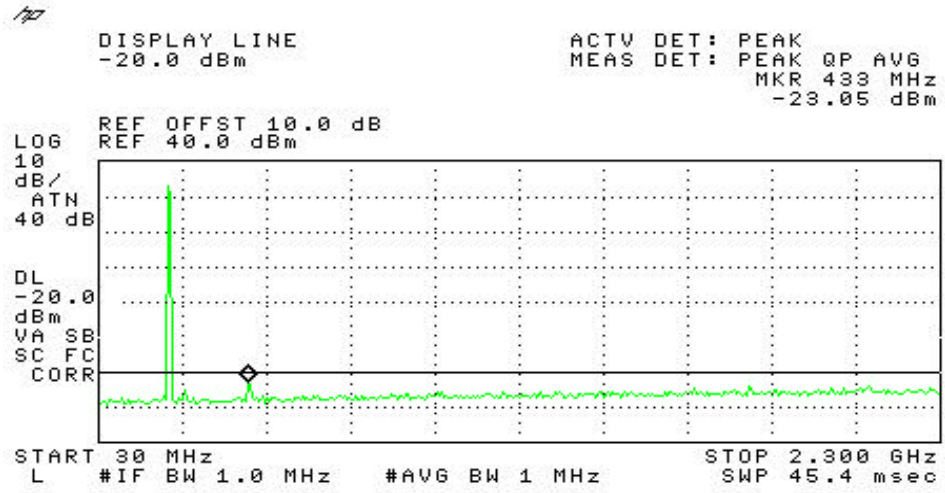
Data Plot (9K13F1D, 9K13F2D)



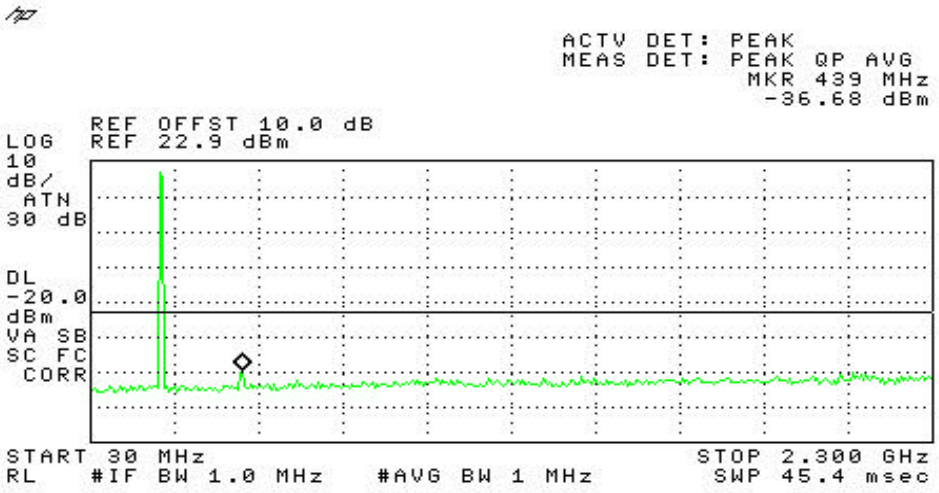
Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #4a: Antenna Port Conducted Spurious Emissions, Transmit Mode, 30 - 2300 MHz. EUT on 216 MHz

PWR = 33



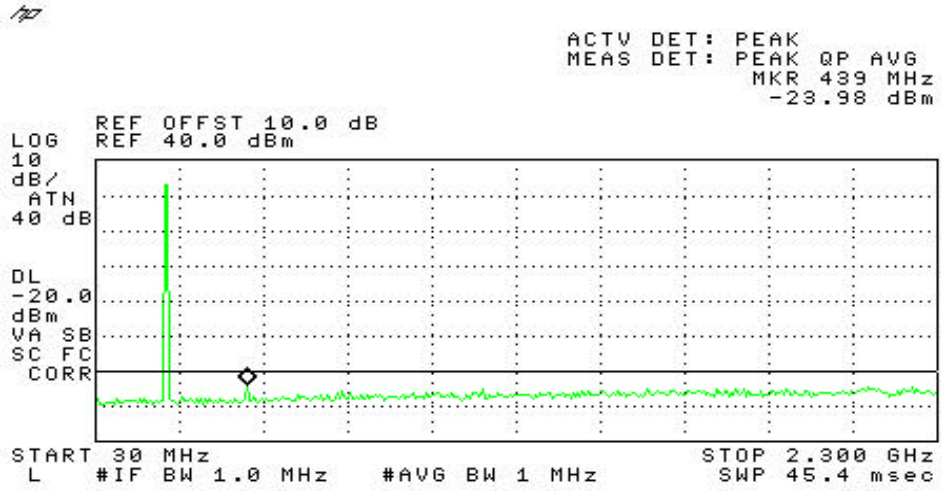
PWR = 20



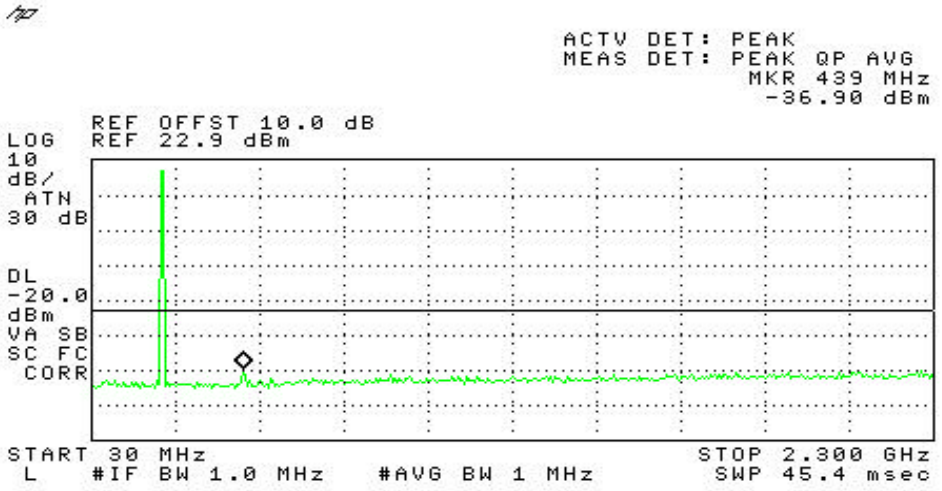
Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #4b: Antenna Port Conducted Spurious Emissions, Transmit Mode, 30 - 2300 MHz. EUT on 217 MHz

PWR = 33



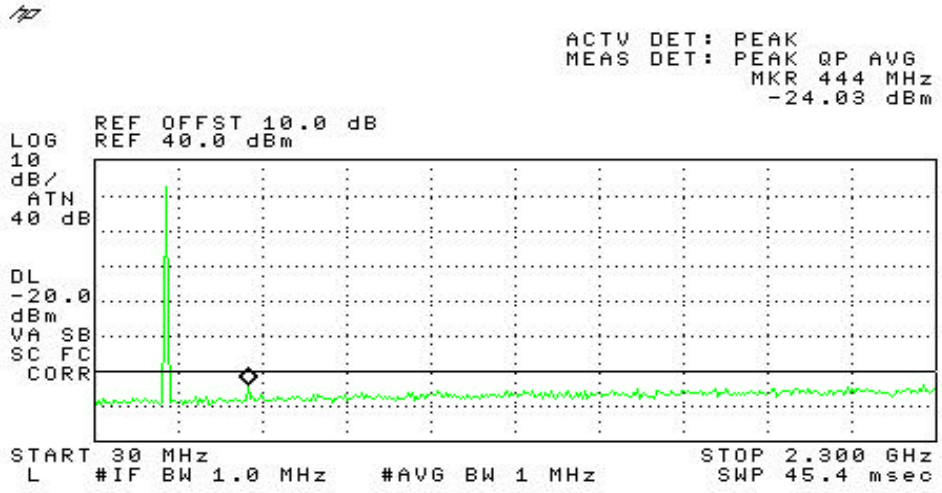
PWR = 20



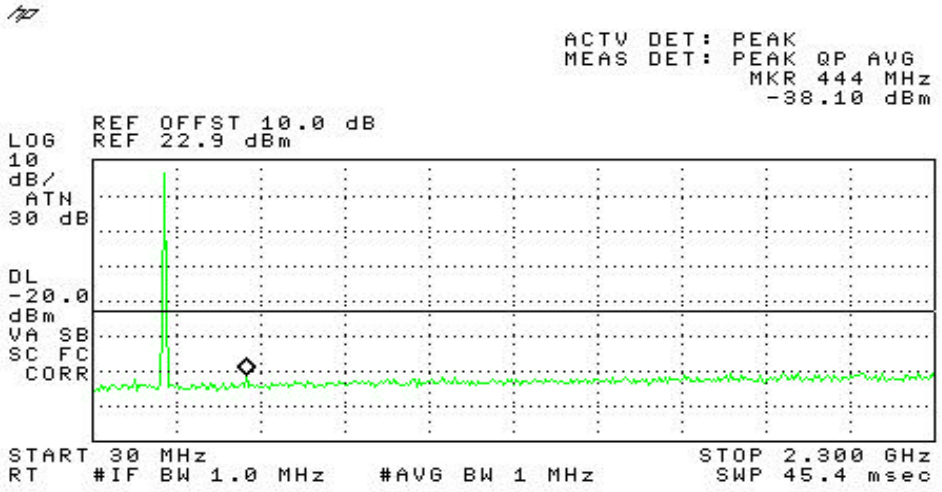
Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #4c: Antenna Port Conducted Spurious Emissions, Transmit Mode, 30 - 2300 MHz. EUT on 220MHz

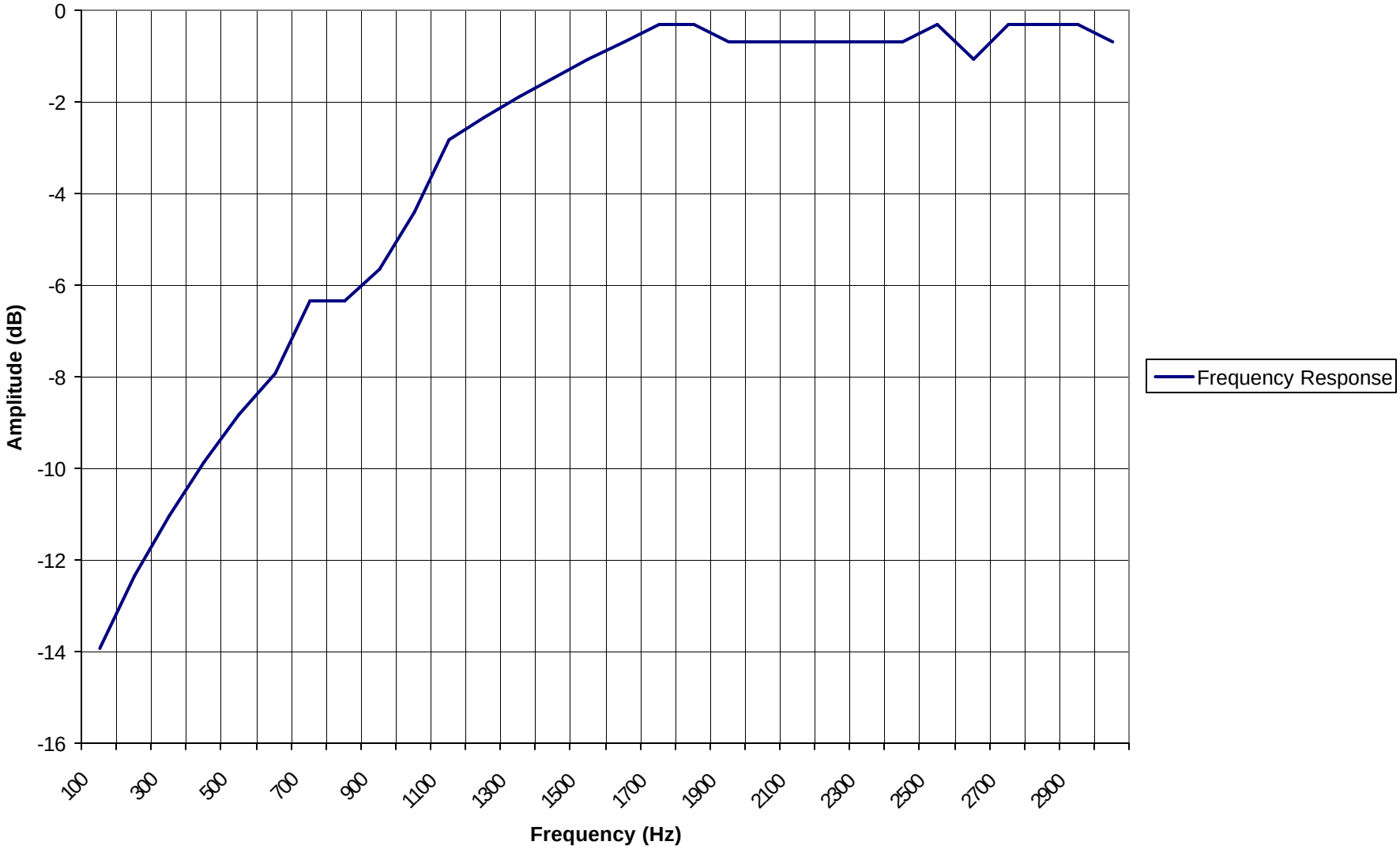
PWR = 33



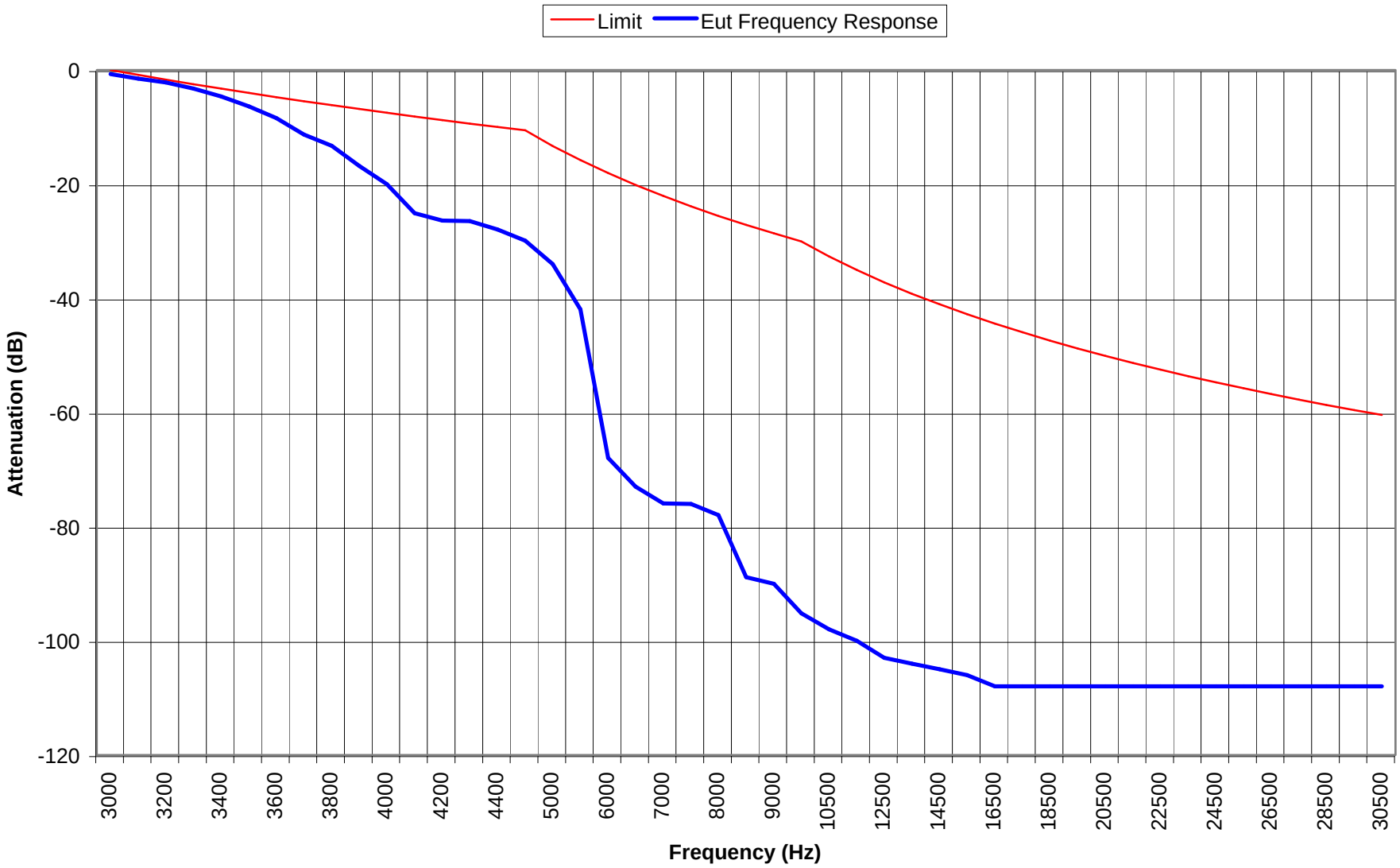
PWR = 20



(12.5 kHz Channel) Frequency Response (.1 - 3 kHz)



(12.5 kHz Channel) 3 - 30kHz response



Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Radiated Spurious Emissions, Part 80

Test Specifics

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: 8/28/2004
Test Engineer: Juan Martinez
Test Location: Fremont Chamber #4
Config. Used: 1
Config Change: None
EUT Voltage: 13.4Vdc

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

The measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 17 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 3000 MHz - Spurious Emissions Transmit Mode (216 MHz)	80.211(f)	Pass	-28.2dB @ 1511.3MHz
2	RE, 30 - 3000 MHz - Spurious Emissions Transmit Mode (217 MHz)	80.211(f)	Pass	-25.3dB @ 1085.0MHz
3	RE, 30 - 3000 MHz - Spurious Emissions Transmit Mode (220 MHz)	80.211(f)	Pass	-23.9dB @ 660.5 MHz

Modifications Made During Testing:

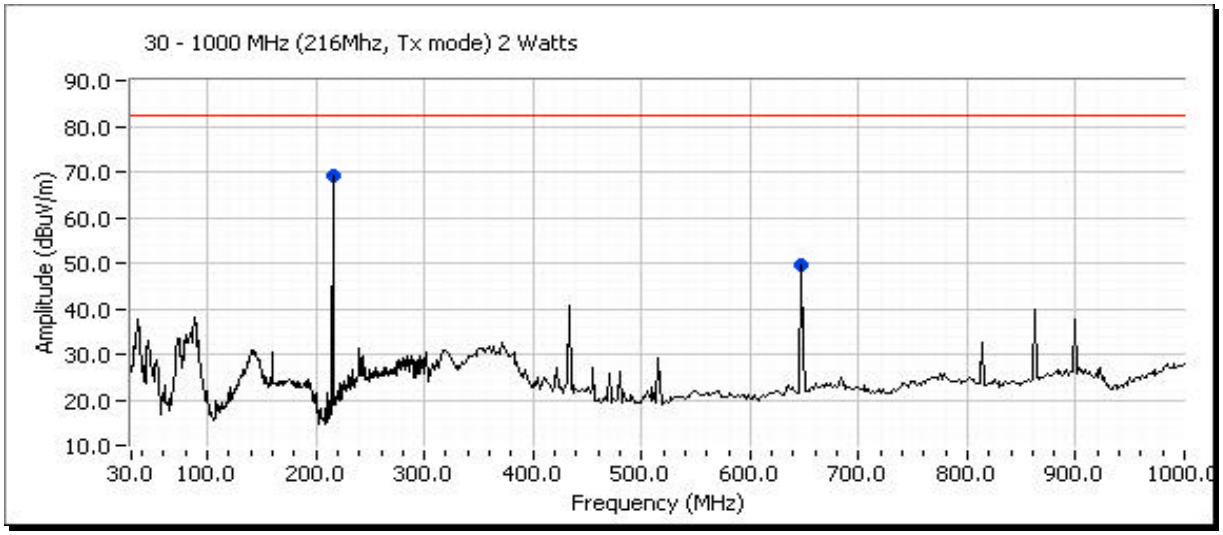
No modifications were made to the EUT during testing

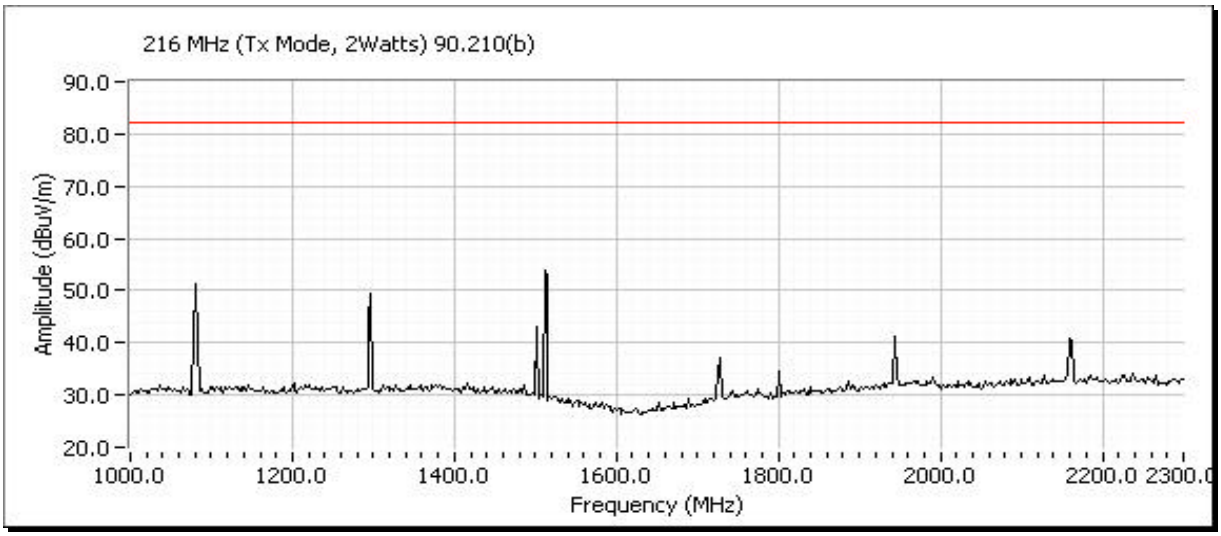
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #1a: Radiated Spurious Emissions, Transmit Mode, 30 - 2300 MHz. EUT @ 216 MHz



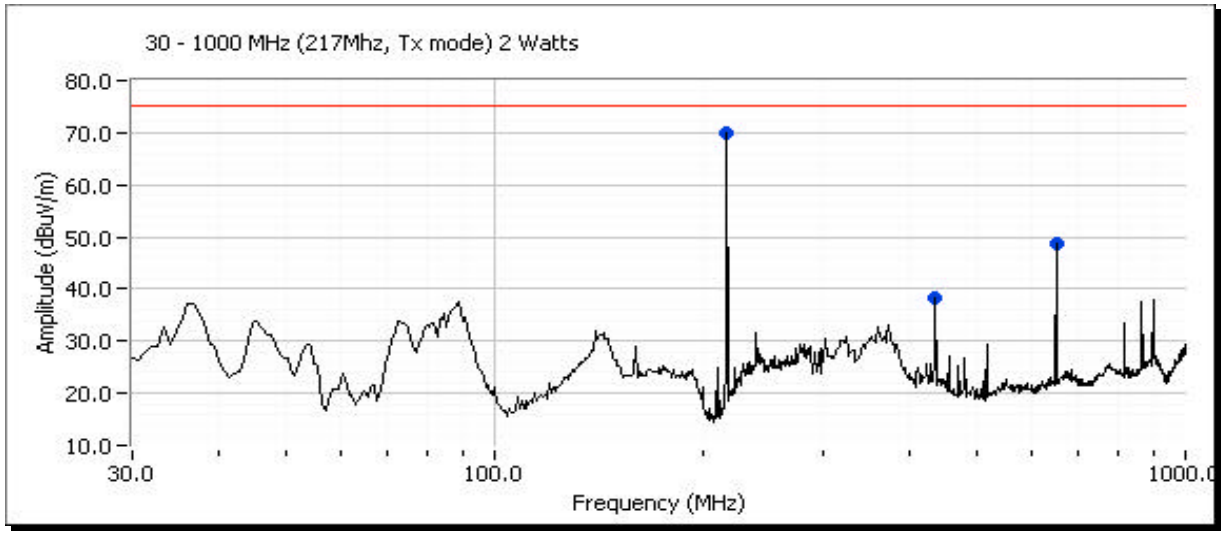


Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Frequency	Level	Pol	Part 80[Note 1]		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1511.333	54.0	V	82.2	-28.2	Peak	163	1.8	RBW=VBW=1MHz
1080.167	51.1	V	82.2	-31.1	Peak	196	1.2	RBW=VBW=1MHz
1296.833	49.6	H	82.2	-32.6	Peak	110	1.4	RBW=VBW=1MHz
1944.667	41.4	H	82.2	-40.8	Peak	206	1.2	RBW=VBW=1MHz
646.500	49.5	H	82.2	-32.7	Peak	215	1.0	RBW=VBW=100kHz

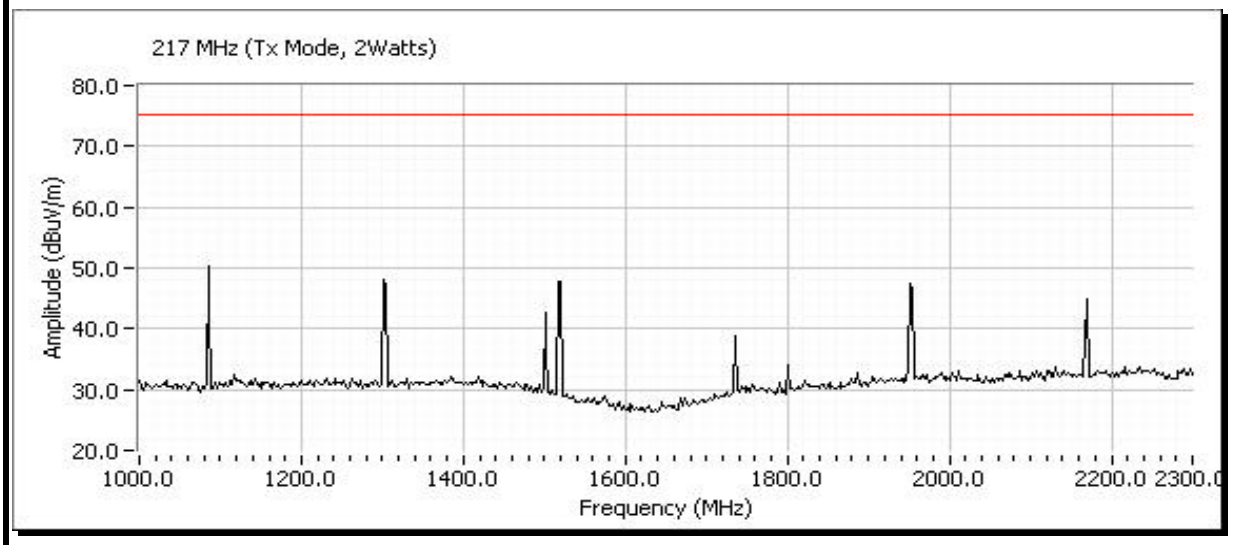
Note 1:	The limit in the table above is an approximate field strength limit. It has been calculated form the erp or eirp limit detailed in the EN standard using Friis' equation for free space propagation: E = 30PG/d . This limit is a conservative limit because it does not consider the presence of the ground plane. The actual signal level, in terms of erp or eirp, is determined from a substitution measurement for all signals with less than 20dB of margin relative to the calculated field strength limit.

Run #1b: Radiated Spurious Emissions, Transmit Mode, 30 - 2300 MHz. EUT @ 217 MHz



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

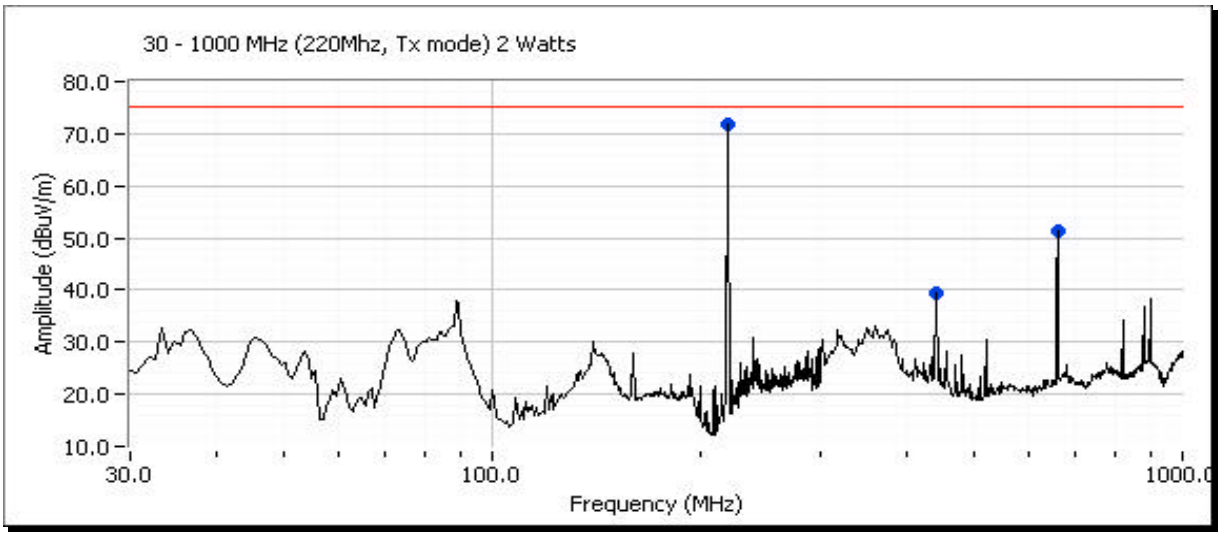


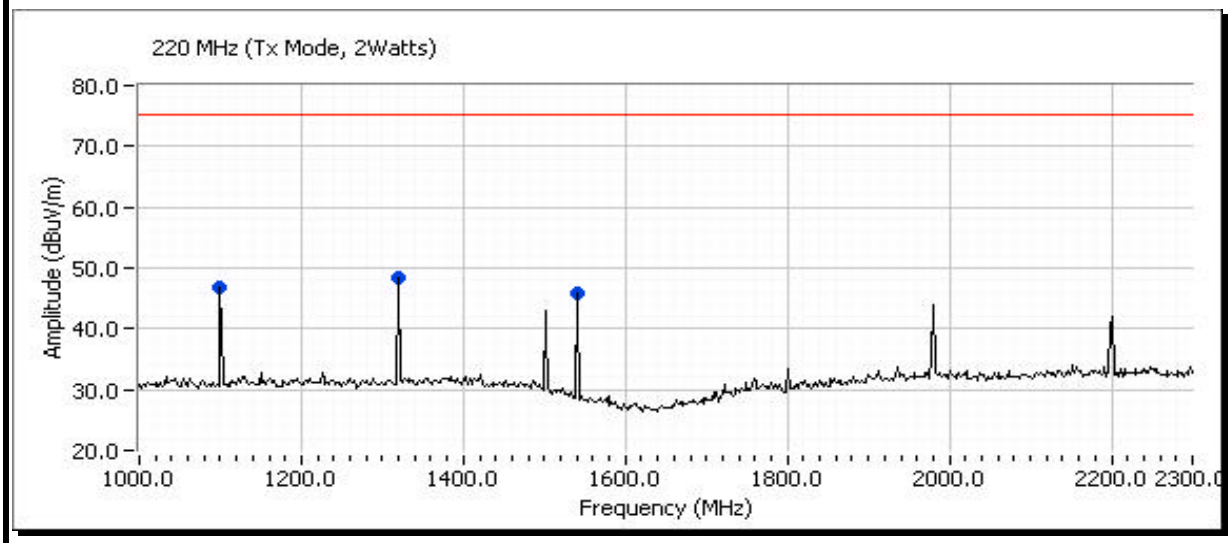
Frequency	Level	Pol	Part 80[Note 1]		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1085.000	50.0	V	75.3	-25.3	Peak	110	1.7	RBW=VBW=1MHz
1080.167	48.3	V	75.3	-27.0	Peak	142	1.0	RBW=VBW=1MHz
1519.000	47.2	H	75.3	-28.1	Peak	108	1.0	RBW=VBW=1MHz
1953.000	47.3	H	75.3	-28.0	Peak	120	1.5	RBW=VBW=1MHz
434.750	38.2	H	75.3	-37.1	Peak	86	1.0	RBW=VBW=100kHz
650.000	48.6	H	75.3	-26.7	Peak	215	1.0	RBW=VBW=100kHz

Note 1:	The limit in the table above is an approximate field strength limit. It has been calculated form the erp or eirp limit detailed in the EN standard using Friis' equation for free space propagation: E = 30PG/d . This limit is a conservative limit because it does not consider the presence of the ground plane. The actual signal level, in terms of erp or eirp, is determined from a substitution measurement for all signals with less than 20dB of margin relative to the calculated field strength limit.

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #1b: Radiated Spurious Emissions, Transmit Mode, 30 - 2300 MHz. EUT @ 220 MHz





Elliott

EMC Test Data

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Frequency	Level	Pol	Part 80[Note 1]		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1099.667	46.9	V	75.3	-28.4	Peak	157	1.2	RBW=VBW=1MHz
1320.667	48.3	H	75.3	-27.0	Peak	150	1.0	RBW=VBW=1MHz
1539.500	45.8	V	75.3	-29.5	Peak	175	1.6	RBW=VBW=1MHz
660.500	51.4	H	75.3	-23.9	Peak	213	1.0	RBW=VBW=100kHz
440.000	39.2	H	75.3	-36.1	Peak	115	2.0	RBW=VBW=100kHz

Note 1:	The limit in the table above is an approximate field strength limit. It has been calculated form the erp or eirp limit detailed in the EN standard using Friis' equation for free space propagation: E = 30PG/d . This limit is a conservative limit because it does not consider the presence of the ground plane. The actual signal level, in terms of erp or eirp, is determined from a substitution measurement for all signals with less than 20dB of margin relative to the calculated field strength limit.

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Radio Performance Test - Part 80
Frequency Stability

Test Specifics

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: 9/3/2004
Test Engineer: Juan Martinez
Test Location: Environmental Chamber

Config. Used: 1
Config Change: None
EUT Voltage: 13Vdc

General Test Configuration

The EUT's rf port was connected to the measurement instrument's rf port, via an attenuator or dc-block if necessary. EUT was place inside an environmental chamber.

Summary of Results

Run #	Test Performed	Limit	Result	Value / Margin
1-2	Frequency and Voltage Stability	Part 80.209	Pass	Refer to individual runs

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:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	N/A

Run #1: Temperature Vs. Frequency

Drift	Freq.	Limit
(ppm)	(MHz)	(Hz)
5	218.00	1090.0

Temperature	Reference Frequency	Frequency Drift	Drift	Limit
(Celsius)	(MHz)	(MHz)	(Hz)	(Hz)
-30	218.000063	218.000100	37	1090.0
-20	218.000063	218.000180	117	1090.0
-10	218.000063	218.000038	-25	1090.0
0	218.000063	218.000050	-13	1090.0
10	218.000063	218.000050	-13	1090.0
20	218.000063	218.000063	0	1090.0
30	218.000063	218.000088	25	1090.0
40	218.000063	218.000050	-13	1090.0
50	218.000063	217.999975	-88	1090.0

Run #2: Voltage Vs. Frequency

Nominal Voltage is 13Vdc.

Voltage	Reference Frequency	Frequency Drift	Drift	Limit	Comment
(Dc)	(MHz)	(MHz)	(Hz)	(Hz)	
85%	218.000063	218.000038	-25	1090.0	11.1
115%	218.000063	218.000050	-13	1090.0	15.0

Battery endpoint is 8.92 Vdc

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	Radio

Radiated Emissions

Test Specifics

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: 8/30/2004
Test Engineer: Vishal Narayan
Test Location: SVOATS #1

Config. Used: 1
Config Change: None
EUT Voltage: 13V DC

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

Unless otherwise specified, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 2.3 GHz.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 18 °C
Rel. Humidity: 84 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 -1000 MHz, Preliminary Scan	FCC B	Pass	-11.5dB @ 33.175MHz
2	RE, 30 - 1000MHz, Maximized Emissions	FCC B	Pass	-8.8dB @ 33.175MHz
3	RE, 1000 - 2300 MHz, Maximized Emissions	FCC B	Pass	-10.7dB @ 1510.0MHz
4	RE, 30 -1000 MHz, Preliminary Scan	FCC B	Pass	-9.0dB @ 33.175MHz
5	RE, 30 - 1000MHz, Maximized Emissions	FCC B	Pass	-7.7dB @ 33.175MHz
6	RE, 1000 - 2300 MHz, Maximized Emissions	FCC B	Pass	-4.0dB @ 1510.0MHz

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Model:	MDS2710A/C	T-Log Number:	T56950
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Spec:	Part 80	Class:	Radio

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.

Run #1: Preliminary Radiated Emissions, 30-1000 MHz
Digital/Receive Mode (Receive mode at 216 MHz)

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
33.175	28.5	V	40.0	-11.5	QP	340	1.0	
88.260	30.0	V	43.5	-13.5	QP	0	1.0	
82.943	26.5	V	40.0	-13.5	QP	270	1.0	
33.175	25.0	H	40.0	-15.0	QP	360	1.2	
82.943	20.0	H	40.0	-20.0	QP	280	1.2	
155.008	22.9	H	43.5	-20.6	QP	100	1.4	
216.000	22.3	H	43.5	-21.2	QP	150	1.6	
900.560	23.2	V	46.0	-22.8	QP	0	1.0	
88.260	19.5	H	43.5	-24.0	QP	250	1.6	
155.008	17.5	V	43.5	-26.0	QP	0	1.0	
432.000	20.0	V	46.0	-26.0	QP	300	1.0	
216.000	16.0	V	43.5	-27.5	QP	310	1.6	

Run #2: Maximized Readings From Run #1
Digital/Receive Mode (Receive mode at 216 MHz)

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
33.175	31.2	V	40.0	-8.8	QP	360	1.0	
88.260	30.0	V	43.5	-13.5	QP	0	1.0	
82.943	26.5	V	40.0	-13.5	QP	270	1.0	
33.175	25.0	H	40.0	-15.0	QP	360	1.2	
82.943	20.0	H	40.0	-20.0	QP	280	1.2	
155.008	22.9	H	43.5	-20.6	QP	100	1.4	

Elliott

EMC Test Data

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	Radio

Run #3: Maximized readings, 1000 - 2300 MHz
Measurements made at 3m per FCC requirements.
Receive Mode (Receive mode at 216 MHz)

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1510.000	43.3	H	54.0	-10.7	Avg	360	1.2	
1510.000	43.2	V	54.0	-10.8	Avg	80	1.0	
1510.000	30.5	H	74.0	-43.5	Pk	360	1.2	
1510.000	30.4	V	74.0	-43.6	Pk	80	1.0	

Run #4: Preliminary Radiated Emissions, 30-1000 MHz
Receive Mode (Receive mode at 220 MHz)

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
33.175	31.0	V	40.0	-9.0	QP	180	1.0	
88.260	27.0	V	43.5	-16.5	QP	0	11.0	
82.943	21.0	V	40.0	-19.0	QP	180	1.0	
88.260	22.0	H	43.5	-21.5	QP	300	1.4	
155.008	21.5	V	43.5	-22.0	QP	334	1.0	
33.175	18.0	H	40.0	-22.0	QP	60	1.6	
82.943	18.0	H	40.0	-22.0	QP	0	1.4	
900.560	23.2	V	46.0	-22.8	QP	0	1.0	
220.000	21.7	H	46.0	-24.3	QP	140	1.6	
155.008	18.0	H	43.5	-25.5	QP	360	1.0	
220.000	17.0	V	46.0	-29.0	QP	80	1.0	
440.000	15.3	V	46.0	-30.7	QP	0	1.0	

Client:	Microwave Data Systems	Job Number:	J56783
Model:	MDS2710A/C	T-Log Number:	T56950
		Account Manager:	Juan Martinez
Contact:	Dennis McCarthy		
Spec:	Part 80	Class:	Radio

Run #5: Maximized Readings From Run #1
Receive Mode (Receive mode at 220 MHz)

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
33.175	32.3	V	40.0	-7.7	QP	180	1.0	
88.260	27.0	V	43.5	-16.5	QP	0	11.0	
82.943	21.0	V	40.0	-19.0	QP	180	1.0	
88.260	22.0	H	43.5	-21.5	QP	300	1.4	
155.008	21.5	V	43.5	-22.0	QP	334	1.0	
33.175	18.0	H	40.0	-22.0	QP	60	1.6	

Run #6: Maximized readings, 1000 - 2300 MHz
Measurements made at 3m per FCC requirements.
Receive Mode (Receive mode at 220 MHz)

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1510.000	50.0	V	54.0	-4.0	Avg	250	1.0	
1510.000	48.1	H	54.0	-5.9	Avg	170	1.0	
1510.000	45.4	V	74.0	-28.6	Pk	250	1.0	
1510.000	42.2	H	74.0	-31.8	Pk	170	1.0	

EXHIBIT 3: Test Configuration Photographs

Not changed from original application

EXHIBIT 4: Theory of Operation Microwave Data Systems Model MDS2710A/C

No changed from original application

EXHIBIT 5: Proposed FCC ID Label & Label Location

No changed from original application

EXHIBIT 6: Detailed Photographs Microwave Data Systems Model MDS2710A/C

No changed from original application

EXHIBIT 7: Installation Guide Microwave Data Systems Model MDS2710A/C

No changed from original application

EXHIBIT 8: Block Diagram Microwave Data Systems Model MDS2710A/C

No changed from original application

EXHIBIT 9: Schematic Diagrams Microwave Data Systems Model MDS2710A/C

No changed from original application

EXHIBIT 10: RF Exposure Information

No changed from original application