Elliott Laboratories Inc.
www.elliottlabs.com
684 West Maude Avenue
Sunnyvale, CA 94085-3518
408-245-7800 Phone
408-245-3499 Fax

February 18, 2003

American TCB
6731 Whittier Avenue
Suite C110
McLean VA 22101

Gentlemen:

The enclosed documents constitute a formal submittal and application for a Grant of Equipment Authorization pursuant to Subpart C of Part 15 of FCC Rules (CFR 47) regarding intentional radiators. Data within this report demonstrates that the equipment tested complies with the FCC limits for intentional radiators.

Elliott Laboratories, as duly authorized agent prepared this submittal. A copy of the letter of our appointment as agent is enclosed.
If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

Sincerely,

Mark Briggs
Director of Engineering

MB/dmg
Enclosures: Application Fee
FCC Form 731
Agent Authorization Letter
Emissions Test Report with Exhibits

File: R50214

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February 18, 2003

Certification and Engineering Bureau
Industry Canada
Spectrum Engineering Branch
3701 Carling Avenue, Building 94
Ottawa, Canada
K2H 8S2

Gentlemen:

The enclosed documents constitute a formal submittal and application for Certification pursuant to RSS-210 and RSP-100 regarding low power, license-exempt radio communications devices. Data within this report demonstrates that the equipment tested complies with the RSS-210, Issue 5 (November 2001) limits for such devices.

Elliott Laboratories, as duly authorized agent prepared this submittal. A copy of the letter of our appointment as agent is enclosed. Please also find enclosed a check in the amount of US $318 to cover the assessment fee (CDN$ 470.00) and certification fee (CDN$45.00). An additional 2% surcharge was added to the exchange rate of CDN$1.00= US$318 to cover banking charges.

If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

Sincerely,

Mark Briggs

Mark Briggs
Director of Engineering

MB/dmg
Enclosures: Application Form
Application Fee
Agent Authorization Letter
Emissions Test Report with Appendices

File: R50214

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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C and RSS – 210 Specifications for an Intentional Radiator on the Microwave Data Systems Model: Carrier Wave 500

FCC ID:	E5MDS-CW500
GRANTEE:	Microwave Data Systems 175 Science Parkway Rochester, NY 14620
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	February 18, 2003
FINAL TEST DATE:	Febraury 10 and February 11, 2003
AUTHORIZED SIGNATORY:	Mark Briggs Director of Engineering

ACCREDITED

Equipment Name and Model:

Transceiver, Carrier Wave 500

Manufacturer:

Microwave Data Systems

Tested to applicable standard:
RSS210, Issue 5, February 1996
Low Power License-Exempt Radio Communication Devices

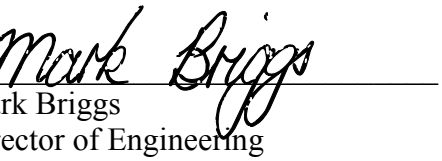
Test Report Prepared For:
Dennis McCarthy
Microwave Data Systems
175 Science Parkway
Rochester, NY 14620
USA

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 **SV3**, Dated July 3, 1997

Declaration of Compliance

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 ANSI C63.4 as detailed in section 5.3 of RSS-210, Issue 5); and that the equipment performed in accordance with the data submitted in this report.

Signature 
Name Mark Briggs
Title Director of Engineering
Elliott Laboratories Inc.
Address 684 W. Maude Ave
Sunnyvale, CA 94086
USA

Date: February 18, 2003

TABLE OF CONTENTS

SCOPE

An electromagnetic emissions test has been performed on the Microwave Data Systems model Carrier Wave 500 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC 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 Microwave Data Systems model Carrier Wave 500 and therefore apply only to the tested sample. The sample was selected and prepared by Dennis McCarthy of Microwave Data Systems.

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization 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, which are subsequently manufactured.

STATEMENT OF COMPLIANCE

The tested sample of Microwave Data Systems model Carrier Wave 500 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC 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.).

SUMMARY OF RESULTS

OPERATION IN THE 5725 – 5850 MHz BAND

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
15.247(a)	6.6.2(o)	Digital Modulation	Systems uses Direct Sequence Spread Spectrum techniques	System must utilize a digital transmission technology	Complies
-	6.6.2 (o) (b)	Processing Gain	As per communication from Industry Canada, this requirement has been withdrawn		
15.247 (a) (2)	-	6dB Bandwidth	37.7 MHz	Minimum allowed is 500kHz	Complies
15.247 (b) (3) 15.247 (b)(4) (ii)	-	Output Power	25.1 dBm (0.3236 Watts) EIRP = 64.5 W	Transmitters can employing antennas with directional gain greater then 6 dBi without any corresponding reduction in transmitter peak output power	Complies
-	6.2.2(o)(b)	Output Power	25.1 dBm (0.3236 Watts) EIRP = 64.5 W	Transmitters can employing antennas with directional gain greater then 6 dBi without any corresponding reduction in transmitter peak output power	Complies
15.247(d)	6.2.2 (o)(b)	Power Spectral Density	.33dBm/MHz	Maximum permitted is 8dBm/3kHz	Complies
15.247(c)	6.2.2(e) (1)	Spurious Emissions – Antenna Conducted 30MHz – 25GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc. Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207	Complies
15.247(c) / 15.209	6.2.2(e) (1)	Radiated Spurious Emissions 30MHz – 25GHz	51.2 dBuV/m @ 17,531 MHz (-2.8 dB)		Complies
15.207	6.6	AC Conducted Emissions	N/A EUT is DC operated	N/A EUT is DC operated	Complies
15.247 (b) (5)		RF Exposure Requirements	MPE Exposure		
15.203	6.2.2(o) (e2)	RF Connector	Professional installation	Professional installation	Complies

EIRP calculated using antenna gain of 23dBi in the 5.7 GHz band

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 Carrier Wave 500 is an ISM Band Radio, which is designed to FCC part 15 license free applications. Normally, the IDU (indoor unit) would be placed on a tabletop during operation. The IDU was, therefore, treated as tabletop equipment during testing to simulate the end user environment. The electrical rating of the IDU is -33 to -72 V DC @ 1.5 Amps.

The ODU (outdoor unit) is tower mounted during normal operation. The ODU was, therefore, treated as Tower mounted equipment during testing to simulate the end user environment. The ODU gets its DC voltages from the IDU.

The sample was received on February 10, 2003 and tested on Febraury 10 and February 11, 2003. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
MDS/ Carrier Wave 500/ ISM Band Radio	-

ENCLOSURE

The IDU enclosure is primarily constructed of fabricated sheet steel. It measures approximately 17" wide by 18" deep by 4" high

The ODU enclosure is primarily constructed of diecast aluminum. It measures approximately 15" wide by 15" deep by 4" high.

MODIFICATIONS

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

SUPPORT EQUIPMENT

No local equipment was used during emissions testing.

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

Manufacturer/Model/Description	Serial Number
Kepco/4822M/DC power supply	P185238

EXTERNAL I/O CABLING

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

Cable Description	Length (m)	From Unit/Port	To Unit/Port
Mutliwire	2	F1 (A)	Terminated
Mutliwire	2	F1 (B)	Terminated
RJ45	2	Ch 1	Terminated
RJ45	2	Ch 2	Terminated
RJ45	2	Ch 3	Terminated
RJ45	2	Ch 4	Terminated
Coaxial	1.5	RF out	External Antenna
2 wire	30	DC input	DC Power Source

TEST SOFTWARE

EUT was operating at maximum power at a set channel. Internal software was used to exercise the ports.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on Febraury 10 and February 11, 2003 at the Elliott Laboratories Open Area Test Site # 3 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC 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 FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. 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. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

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.

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.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and 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.

POWER METER

A power meter and thermister mount are used for all direct 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 LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude 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 entire 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.

ANSI C63.4 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 FCC requires 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, 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.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is 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.

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. 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. Emissions, which have values close to the specification limit, may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

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:

CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, if the amplitude measured in the quasi-peak mode is at least 6 dB higher than the amplitude measured in the average mode, the level measured in the quasi-peak mode may be reduced by 13 dB before comparing it to the limit.

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, 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

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

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 30 - 40000 MHz, 11-Feb-03
Engineer: mfaustino

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Biconical Antenna, 30-300 MHz	3110B	1320	12	6/3/02	6/3/03
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	487	12	4/22/02	4/22/03
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	12	10/30/02	10/30/03
Filtek	High Pass Filter, 1GHz	HP12/1000-5AB	1343	12	10/17/02	10/17/03
Hewlett Packard	Microwave EMI test system (SA40, 9Hz - 40GHz), system 2	84125C	1410	12	4/2/02	4/2/03
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	1/24/03	1/24/04
Hewlett Packard	Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	12	11/19/02	11/19/03
Rohde & Schwarz	Test Receiver, 20-1300MHz	ESVP	213	12	7/22/02	7/22/03

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T50130 17 Pages

Elliott

EMC Test Data

Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Emissions Spec:	FCC part 15.247	Class:	-
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

MDS

Model

Carrier Wave 500

Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Emissions Spec:	FCC part 15.247	Class:	-
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is a ISM Band Radio which is designed to FCC part 15 license free applications. Normally, the IDU (indoor unit) would be placed on a table top during operation. The IDU was, therefore, treated as table-top equipment during testing to simulate the end user environment. The electrical rating of the IDU is -33 to -72 V DC @ 1.5 Amps.

The ODU (outdoor unit) is tower mounted during normal operation. The ODU was, therefore, treated as Tower mounted equipment during testing to simulate the end user environment. The ODU gets it DC voltages from the IDU.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
MDS	Carrier Wave 500	ISM Band Radio	N/A	TBD

Other EUT Details

EUT Enclosure

The IDU enclosure is primarily constructed of fabricated sheet steel. It measures approximately 17" wide by 18" deep by 4" high

The ODU enclosure is primarily constructed of diecast aluminum. It measures approximately 15" wide by 15" deep by 4" 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:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Emissions Spec:	FCC part 15.247	Class:	-
Immunity Spec:	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Kepco	4822M	DC power supply	P185238	N/A

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
F1 (A)	Terminated	Multiwire	Shielded	2
F1 (B)	Terminated	Multiwire	Shielded	2
Ch1	Terminated	RJ45	Ushielded	2
Ch2	Terminated	RJ45	Ushielded	2
Ch3	Terminated	RJ45	Ushielded	2
Ch4	Terminated	RJ45	Ushielded	2
RF Out	External Antenna	Coaxial	Shielded	1.5
DC Input	DC power source	2 wire	Ushielded	30

Note: The Consolde port was not connected as the manufacturer stated that this is for configuration purpose and therefore would not normally be connected.

EUT Operation During Emissions

EUT was operating at maximum power at a set channel. Internal software was used to exercise the ports.

Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

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: 2/10/03
Test Engineer: Marissa Faustino/Jmartinez
Test Location: SVOATS #3
Config. Used: 1
Config Change: None
EUT Voltage: -48Vdc

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT.
When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 12°C
Rel. Humidity: 56%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1a-1c	RE, 30 - 40000 MHz - Spurious Emissions In Restricted Bands	FCC Part 15.209 / 15.247(c)	Pass	-2.8dB @ 17531 MHz
2	6dB Bandwidth	15.247(a)	Pass	37.7 MHz
3	Output Power	15.247(b)	Pass	25.1 dBm
4	Power Spectral Density (PSD)	15.247(d)	Pass	.33 dBm/MHz
5	Out of Band	15.247(c)	Pass	Refer to Plots

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:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

Run #1a: Radiated Spurious Emissions, 30-40000 MHz. Low Channel @ 5731 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	123.6	93.9
Limit for emissions outside of restricted bands:	103.6 dBµV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11462.00	58.7	V	74.0	-15.3	Pk	240	1.2	
11462.00	45.7	V	54.0	-8.3	Avg	240	1.2	
17193.00	65.6	V	74.0	-8.4	Pk	360	1.4	
17193.00	48.8	V	54.0	-5.2	Avg	360	1.4	
11462.00	57.8	H	74.0	-16.2	Pk	47	1.0	
11462.00	45.8	H	54.0	-8.2	Avg	47	1.0	
17193.00	65.5	H	74.0	-8.5	Pk	286	1.0	
17193.00	48.8	H	54.0	-5.2	Avg	286	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.

Run #1b: Radiated Spurious Emissions, 30-40000 MHz. Middle Channel @ 5768.7 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	124	95.4
Limit for emissions outside of restricted bands:	104 dBµV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11537.00	59.0	V	74.0	-15.0	Pk	251	1.2	
11537.00	45.7	V	54.0	-8.3	Avg	251	1.2	
17306.00	65.4	V	75.0	-9.6	Pk	265	1.6	
17306.00	49.5	V	54.0	-4.5	Avg	265	1.6	
11537.00	58.5	H	76.0	-17.5	Pk	256	1.0	
11537.00	45.3	H	54.0	-8.7	Avg	256	1.0	
17306.00	65.5	H	77.0	-11.5	Pk	247	1.0	
17306.00	49.5	H	54.0	-4.5	Avg	247	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.

Elliott

EMC Test Data

Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

Run #1c: Radiated Spurious Emissions, 30-40000 MHz. High Channel @ 5843.7 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	125	96.3
Limit for emissions outside of restricted bands:	105 dBµV/m	

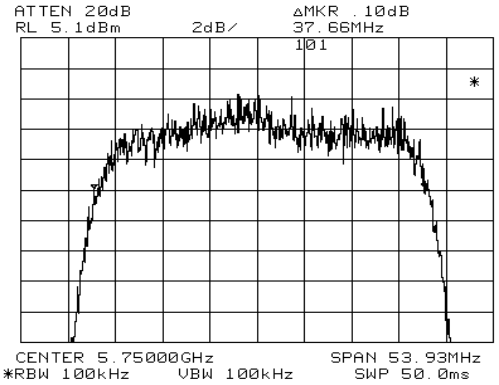
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11687.00	58.9	V	74.0	-15.1	Pk	35	1.6	
11687.00	46.3	V	54.0	-7.7	Avg	35	1.6	
17531.00	66.3	V	75.0	-8.7	Pk	164	1.1	
17531.00	51.2	V	54.0	-2.8	Avg	164	1.1	
11687.00	59.9	H	76.0	-16.1	Pk	0	1.0	
11687.00	46.5	H	54.0	-7.5	Avg	0	1.0	
17531.00	68.4	H	77.0	-8.6	Pk	267	1.1	
17531.00	50.9	H	54.0	-3.1	Avg	267	1.1	

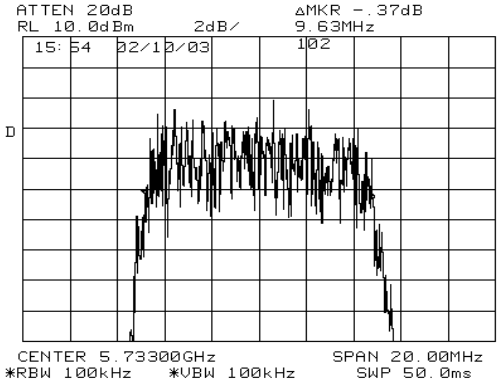
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

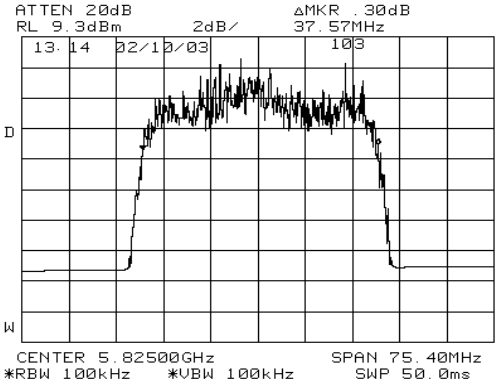
Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

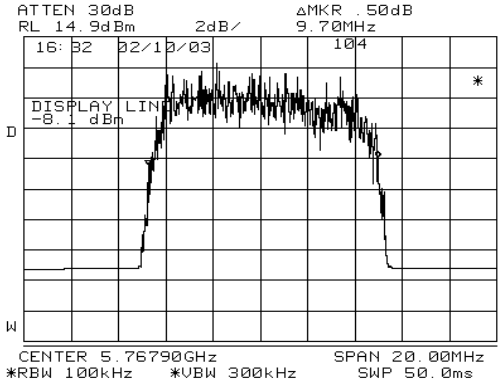
Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	6dB Signal Bandwidth	Graph reference #		
A	5750	100kHz	37.7		101	
1A	5733	100kHz	9.6		102	
4A	5768	100kHz	9.7		104	
B	5825	100kHz	37.6		103	
4B	5843.7	100kHz	9.1		105	

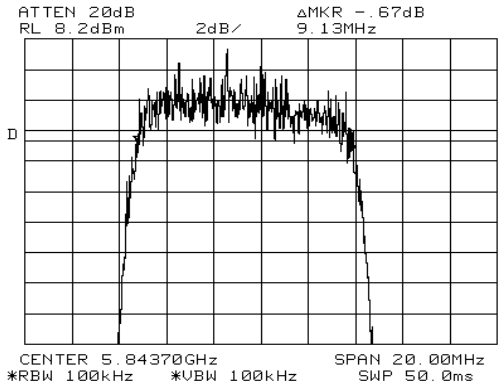








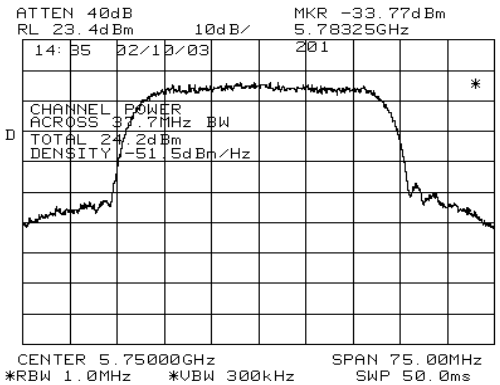
Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

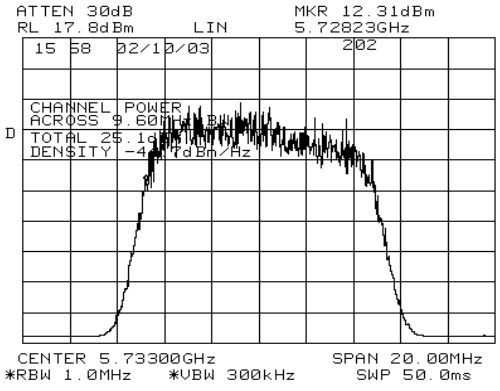


<--105

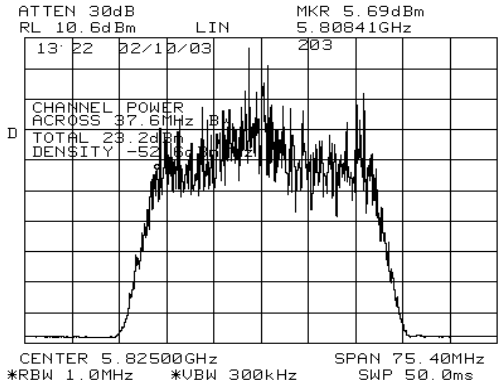
Run #3: Output Power

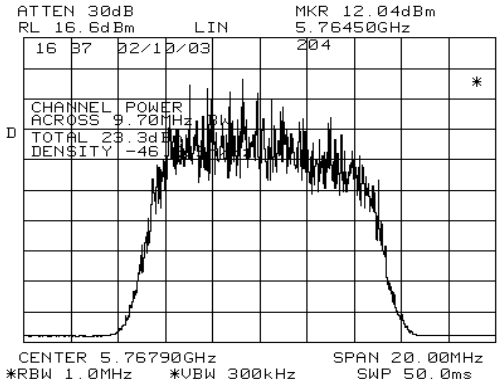
Channel	Frequency (MHz)	Res BW	Output Power	Graph reference #		
A	5750	1MHz	24.2		201	
1A	5733	1MHz	25.1		202	
4A	5768	1MHz	23.3		204	
B	5825	1MHz	23.2		203	
4B	5768	1MHz	22.9		205	

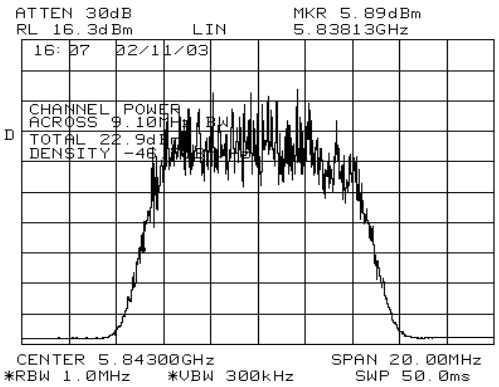




Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A





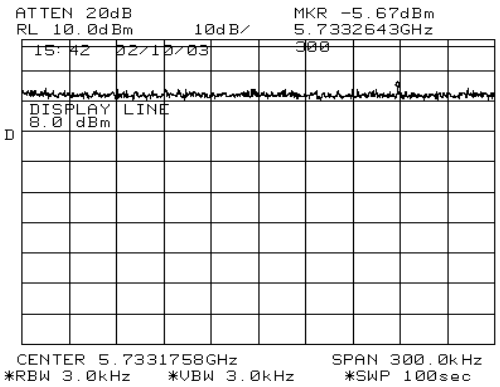


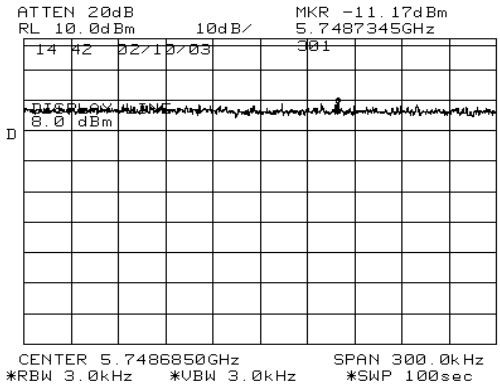
<--205

Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

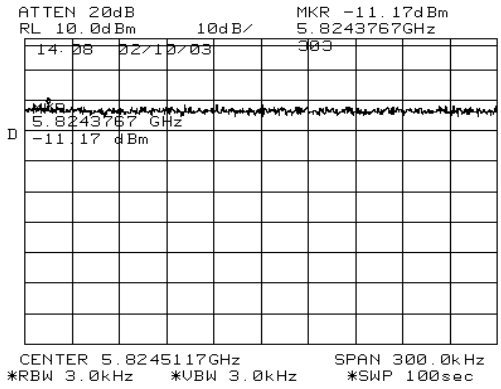
Run #4: Power Spectral Density

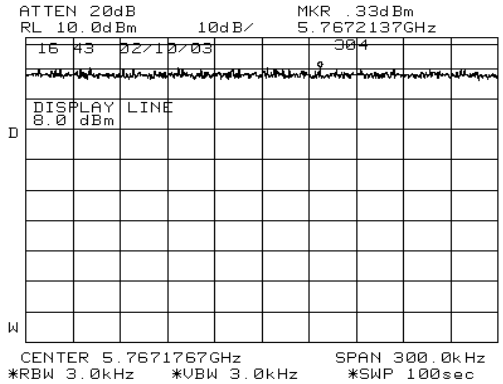
Channel	Frequency (MHz)	Res BW	P.S.D. (averaged over 1 second in a 3kHz bandwidth)	Graph reference #		
1A	5733	3kHz	-5.7		300	
4A	5768	3kHz	0.33		304	
A	5750	3kHz	-11.2		301	
B	5825	3kHz	-11.2		303	
4B	5843.7	3kHz	-0.2		305	

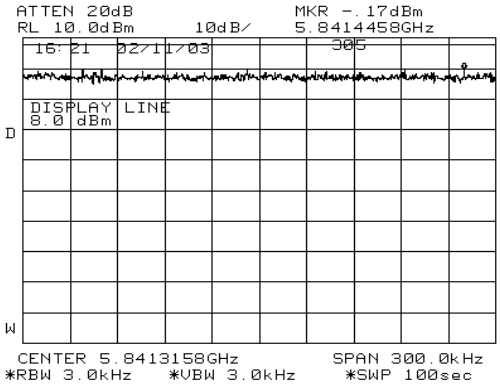




Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A



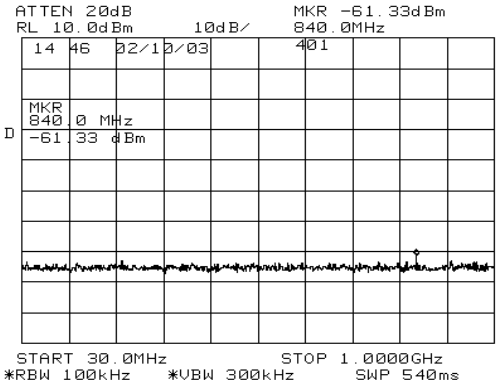


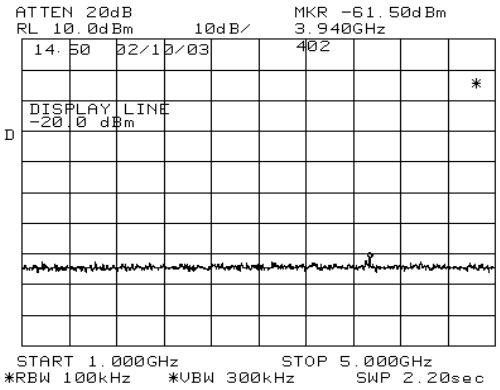


Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

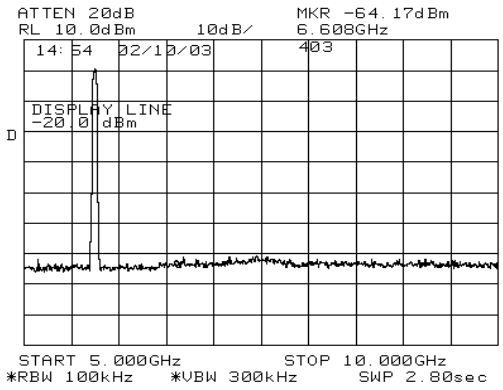
Run #5: Out-of-band Conducted Spurious Emissions

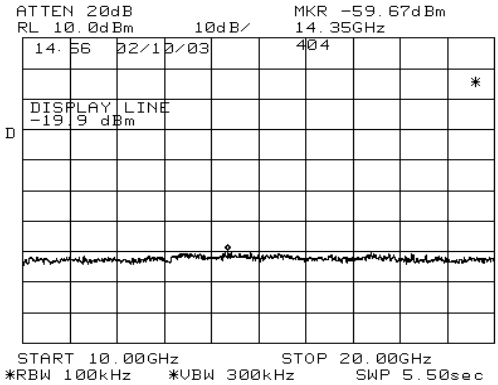
Channel	Frequency (MHz)	Notes	Graph reference #s
A	5750	All out of band signals in any 100kHz bandwidth were more than 20dB below the fundamental signal level.	401, 402, 403, 404, 405,
1A	5733		406, 407, 408, 409, 410
B	5825		411, 412, 413, 414, 415,
4B	5843.7		416, 417, 418, 419, 420,
4A	5768		421, 422, 423, 424, 425,

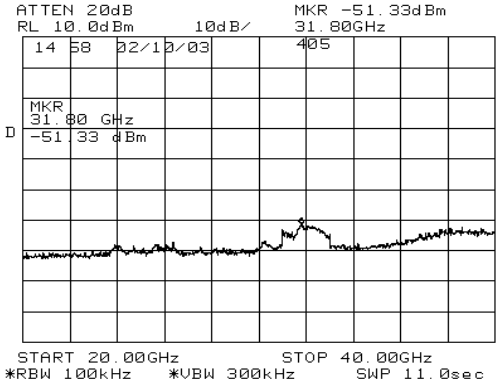


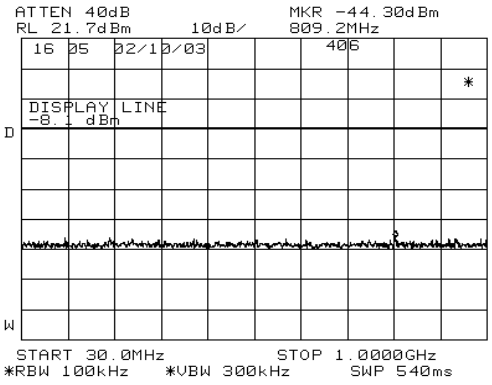


Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

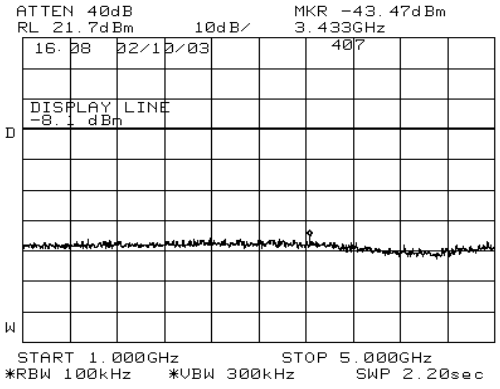


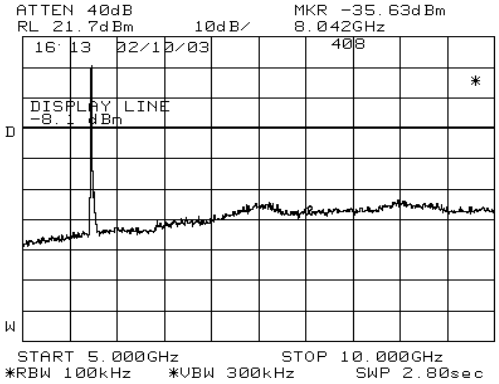


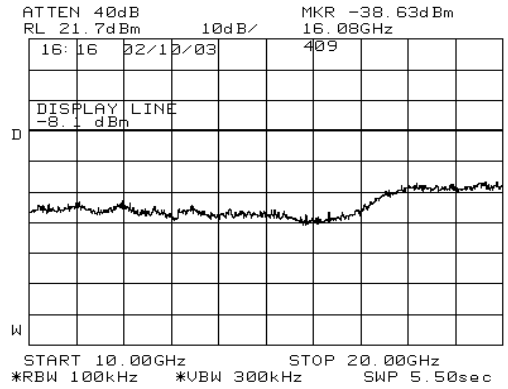


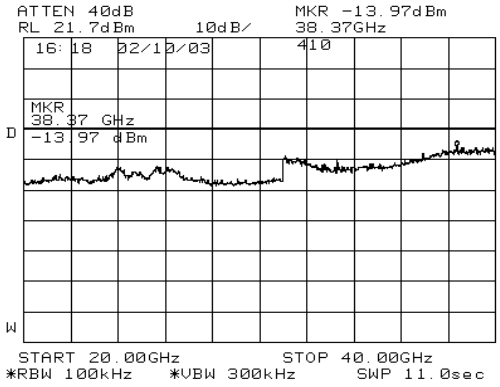


Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

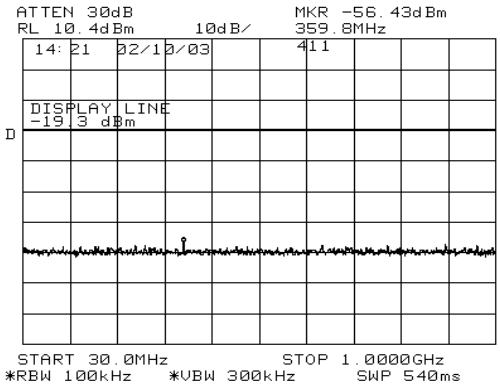


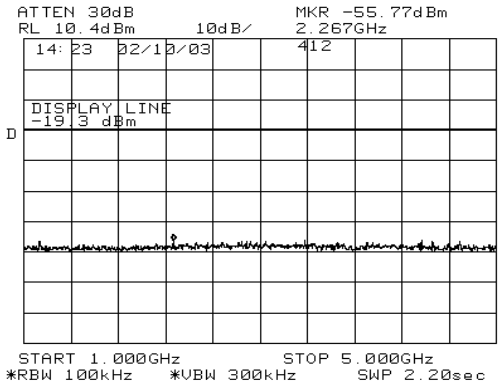


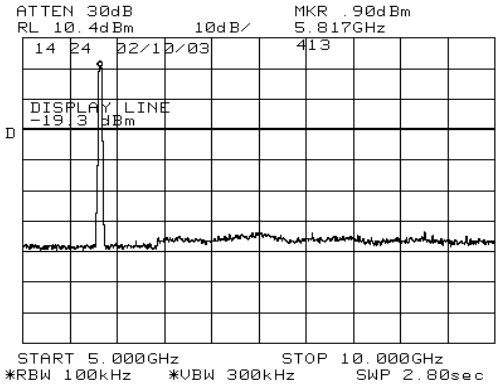


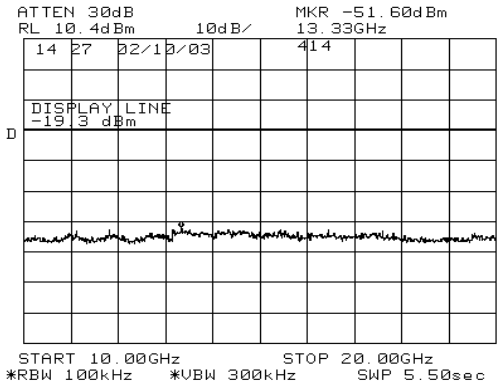


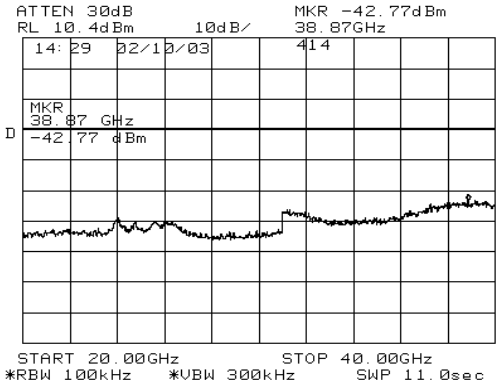
Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A





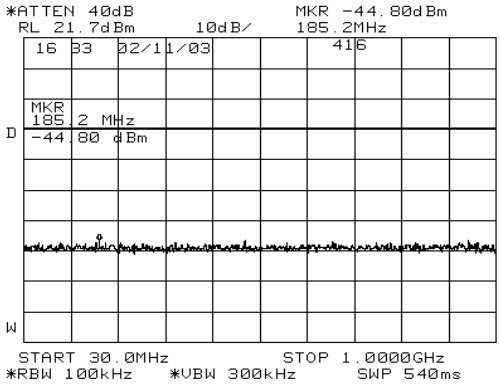


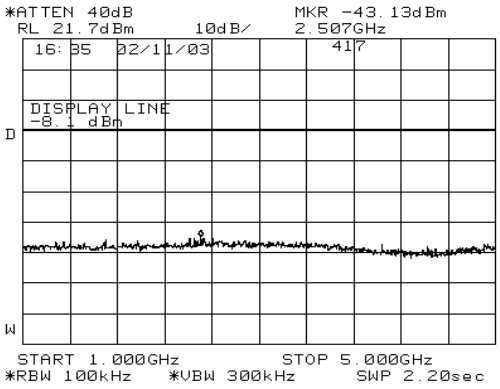


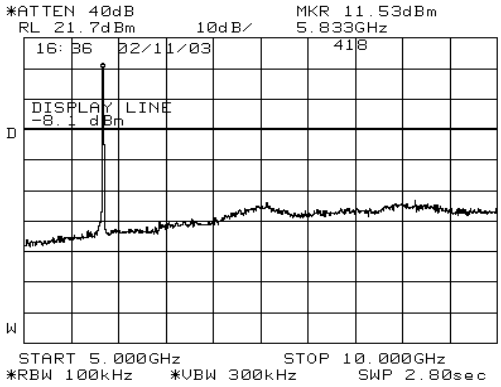


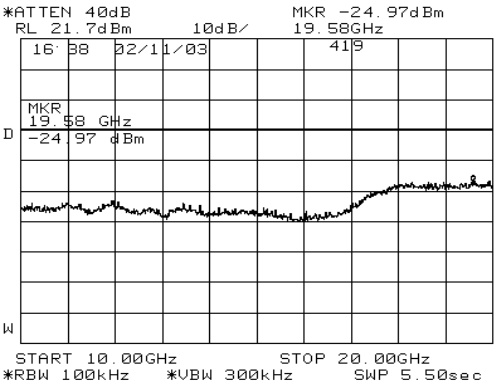
<---Graph mis-labeled. Actually Graph # 415

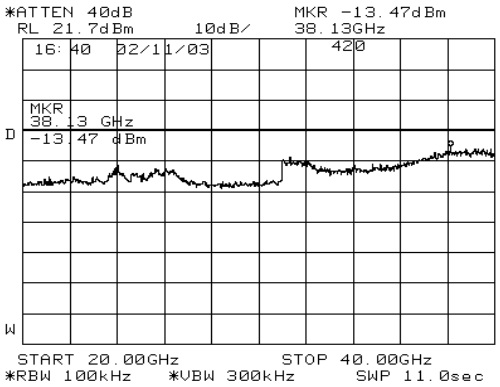
Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A

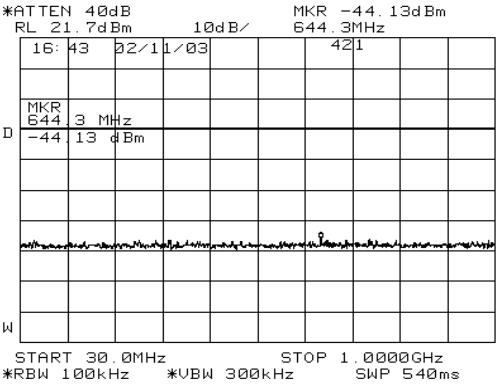












Client:	MDS	Job Number:	J50087
Model:	Carrier Wave 500	T-Log Number:	T50130
		Proj Eng:	-
Contact:	-		
Spec:	FCC part 15.247	Class:	N/A