

***Electromagnetic Emissions Test Report
In Accordance With,
FCC Part 101
on the
Microwave Data Systems
Transmitter
Model: PUMA 4 ODUs***

FCC ID NUMBER: E5MDS-Series6

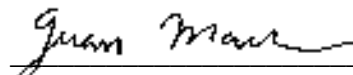
GRANTEE: Microwave Data Systems
175 Science Parkway
Rochester, NY 14620

TEST SITE: Elliott Laboratories, Inc.
684 W. Maude Avenue
Sunnyvale, CA 94086

REPORT DATE: July 5, 2006

FINAL TEST DATE: June 27, June 28 and June 29, 2006

AUTHORIZED SIGNATORY:



Juan Martinez
Senior EMC Engineer



2016-01

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TABLE OF CONTENTS

COVER PAGE.....	1
TABLE OF CONTENTS.....	2
FCC CERTIFICATION INFORMATION.....	3
DECLARATIONS OF COMPLIANCE.....	5
SCOPE.....	6
OBJECTIVE.....	6
SUMMARY OF TEST RESULTS.....	7
PART 101 TEST SUMMARY	7
MEASUREMENT UNCERTAINTIES	8
EQUIPMENT UNDER TEST (EUT) DETAILS	9
GENERAL.....	9
OTHER EUT DETAILS	9
EUT ANTENNA DETAILS	9
ENCLOSURE.....	9
MODIFICATIONS.....	9
SUPPORT EQUIPMENT.....	11
EUT INTERFACE PORTS.....	11
EUT OPERATION DURING TESTING.....	11
TEST SITE.....	12
GENERAL INFORMATION.....	12
CONDUCTED EMISSIONS CONSIDERATIONS	12
RADIATED EMISSIONS CONSIDERATIONS.....	12
MEASUREMENT INSTRUMENTATION.....	13
RECEIVER SYSTEM.....	13
INSTRUMENT CONTROL COMPUTER	13
PEAK POWER METER.....	13
FILTERS/ATTENUATORS	13
ANTENNAS.....	14
ANTENNA MAST AND EQUIPMENT TURNTABLE	14
INSTRUMENT CALIBRATION.....	14
TEST PROCEDURES	15
SPECIFICATION LIMITS AND SAMPLE CALCULATIONS	19
RADIATED EMISSIONS SPECIFICATION LIMITS.....	19
CALCULATIONS – EFFECTIVE RADIATED POWER.....	19
EXHIBIT 1: Test Equipment Calibration Data.....	1
EXHIBIT 2: Test Data Log Sheets	2
EXHIBIT 3: Test Configuration Photographs.....	3
EXHIBIT 4: Theory of Operation Microwave Data Systems Model PUMA 4 ODUs.....	4
EXHIBIT 5: Proposed FCC ID Label & Label Location	5
EXHIBIT 6: Detailed Photographs Microwave Data Systems Model PUMA 4 ODUs.....	6
EXHIBIT 7: Installation Guide Microwave Data Systems Model PUMA 4 ODUs.....	7
EXHIBIT 8: Block Diagram Microwave Data Systems Model PUMA 4 ODUs.....	8
EXHIBIT 9: Schematic Diagrams Microwave Data Systems Model PUMA 4 ODUs.....	9

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-Series6

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 PART 101: **5MD7W, 10MD7W, 30MD7W**

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

FCC PART 101: **5925 - 6421MHz**

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

FCC PART 101: **27.4 dBm (5 MHz), 24.7 dBm (10 MHz), 26.1 dBm (30 MHz)**

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

FCC PART 101.113: **85 dBm**

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

10Vdc, .2 amps

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

Radio contains two VCO's at 2025 MHz and 3800 MHz.

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

Modulation is control by DSP

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

Radio power is control by DSP

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

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:

PUMA 4 ODUs

Manufacturer:

Microwave Data Systems
175 Science Parkway
Rochester, NY 14620

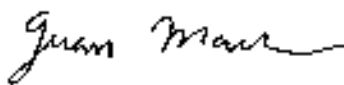
Tested to applicable standards:

FCC Part 101 (Fixed Microwave Services)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 SV2 Dated August 16, 2007

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: July 5, 2006

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 101 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 101. 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 101. 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 101 Test Summary**

Measurement Required	FCC Part 2 & 101 Sections	Test Performed	Measured Value	Test Procedure Used	Result
Modulation Tested	64-QAM	-	-	-	-
Modulation characteristics	2.1047/	Modulated with appropriated signal	-	H	-
Radiated RF power output (ERP/EIRP)	2.1046 / 101.113	Radiated Output Power Test	-	-	-
Conducted RF power output	2.1046 / 101.113	Conducted Output Power Test	27.4 dBm (.55 Watts)	B	Complies
Spurious emissions at antenna Port	2.1051/ 101.111(a)(2)(iii)	Emission Limits and/or Unwanted Emission 30MHz – 40GHz (Antenna Conducted)	All spurious emissions < -13dBm	J	Complies
Occupied Bandwidth	2.1049/ 101.111(a)(2)(i)	Emission Mask and 99% Bandwidth	Refer to Plots	C & D	Complies
Field strength of spurious radiation	2.1053 / 101.111(a)(2)(iii)	Radiated Spurious Emissions 30MHz – 40GHz	36.5 dBuV/m @ 10519.04 MHz (-45.8 dB)	N	Complies
Frequency stability	2.1055 / 101.107	Frequency Vs. Temperature	+ 1.4 ppm	K	Complies
Frequency stability	2.1055 / 101.107	Frequency Vs. Voltage	0 ppm	L & M	Complies
Exposure to Mobile devices	2.1091	Exposure of Humans to RF Fields	N/A	-	

MEASUREMENT UNCERTAINTIES

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

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

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

The Microwave Data Systems model PUMA 4 ODU is a ODU (Outdoor Unit) licensed transmitter that is designed to provide high speed data for point to point applications. The EUT would normally be placed on a tower or pole in a fixed location therefore, the EUT was treated as table-top equipment during testing. The electrical rating of the EUT is -48Vdc Volts , 1 Amps.

The sample was received on June 27, 2006 and tested on June 27, June 28 and June 29, 2006. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Microwave Data System	Puma	ODU (HH band)	1475627	
Microwave Data System	Puma	ODU (HL band)	1475626	
Microwave Data System	Puma	ODU (LH band)	1475624	
Microwave Data System	Puma	ODU (LL band)	1475625	

OTHER EUT DETAILS

The radio can be configured with one of two different VCO/Filter combinations and with one of two different Duplexers. This gives a total of four different configurations to handle the different combinations of transmit/receive bands designated as follows:

HH Band: TX 6240 - 6421MHz; RX 5988 - 6169 MHz

HL Band: TX 5988 - 6169 MHz; RX 6240 - 6421 MHz

LH Band: TX 6181 - 6362 MHz; RX 5929 - 6110 MHz

LL Band: TX 5929 - 6110 MHz; RX 6181 - 6362 MHz

EUT ANTENNA DETAILS

The EUT is designed to be used with fixed-mounted, high-gain parabolic dish antennas. The Outdoor Unit (ODU) containing the transmitter is intended to be mounted alongside the antenna.

ENCLOSURE

The EUT enclosure is primarily constructed of metal and plastic. It measures approximately 37 cm wide by 7 cm deep by 40 cm high.

MODIFICATIONS

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

specifications.

SUPPORT EQUIPMENT

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

Manufacturer	Model	Description	Serial Number	FCC ID
Microwave Data Systems	MDS 5800	IDU	1234567	E5MDS-5800-2

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

Manufacturer	Model	Description	Serial Number	FCC ID
IBM	Thinkpad	Laptop		

EUT INTERFACE PORTS

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

Port	Connected to	Description	Shielded or Unshielded	Length (m)
IDU AC Power	AC Mains	3 wire	Unshielded	1.8
IF	IDU	Coaxial	Shielded	3.0
IDU Ethernet	Laptop	Cat 5	Unshielded	10.0

Note: The BNC ports were not connected during testing. The manufacturer stated that these are for antenna alignment purposes and therefore would not normally be connected during normal operation.

EUT OPERATION DURING TESTING

During testing the EUT was set to continuously transmit at the specified data rate and on the specified channel at maximum output power. For radiated measurements the antenna port was terminated into a 50-ohm load.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on June 27, June 28 and June 29, 2006 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, 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 field 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 TURNABLE

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 C63.4:2003 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 1MHz and video to 30 kHz. Use video averaging with a 100-sample rate.
- 4) If a power meter was used, corrected for any external attenuation used for the protection of the input of the sensor head. Also set the power sensor correction by setting up the frequency range that will be measured.
- 5) Repeat this for the high channel and all modulations that will be used and all output ports used for transmission

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

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

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

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

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

- 1) The EUT was connected directly to the spectrum analyzer and used an attenuator to protect the input of the analyzer. The EUT antenna was removable, so conducted measurements was performed. The EUT was set to transmit continuous packets of data and the Fundamental Frequency set to the appropriate channel of the EUT frequency range.
- 2) A mask was created to show that the fundamental signal energy is within.

Video bandwidth was used to show compliance for the above requirement: 10k 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 -13-dBm .
- 3) Set the spectrum analyzer bandwidth to $10\text{kHz} < 1\text{GHz}$ and $1\text{ MHz} > 1\text{GHz}$.
- 4) For the spectrum analyzer, the start frequency was set to 30 MHz and the stop frequency set to the 10^{th} harmonic of the fundamental. All spurious or intermodulation emission must not exceed the -13dBm 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 $+50^{\circ}\text{C}$ (or $+60^{\circ}\text{C}$ 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 $+20^{\circ}\text{C}$ 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 $+20^{\circ}\text{C}$ temperature.

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

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

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

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS**RADIATED EMISSIONS SPECIFICATION LIMITS**

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

Below is a formula example used to calculate the attenuation requirement, relative to the transmitters power output, in dBuV/m. For this example an operating power range of 3 watts is used. The radiated emissions limit for spurious signals outside of the assigned frequency block is $43 + 10 \log_{10}$ (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

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

$$20 * \log (4.049 \text{ V/m} * 1,000,000) = 132.14 \text{ dBuV/m @ 3 meters}$$

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:

$$132.1 \text{ dBuV/m} - 47.8 \text{ dB} = 84.3 \text{ dBuV/m @ 3 meter.}$$

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

Radiated Emissions, 30 - 40,000 MHz, 28-Jun-06**Engineer: Mark Briggs**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Asset #</u>	<u>Cal Due</u>
Rohde & Schwarz	Power Meter, Dual Channel	NRVD	1071	28-Sep-06
EMCO	Antenna, Horn, 18-26.5 GHz (SA40 30Hz)	3160-09 (84125C)	1150	12-Sep-06
EMCO	Antenna, Horn, 26.5-40 GHz (SA40 30Hz)	3160-10 (84125C)	1151	12-Sep-06
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FMT (SA40) Blue	8564E (84125C)	1393	10-Nov-06
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	10-May-07
Rohde & Schwarz	Attenuator, 20 dB , 50 Ω , 10W, DC-18 GHz	20dB, 10W, Type N	1795	31-Jan-07

Conducted Emissions - AC Power Ports, 29-Jun-06**Engineer: David Bare**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Asset #</u>	<u>Cal Due</u>
Elliott Laboratories	LISN, FCC / CISPR	LISN-4, OATS	362	07-Jul-06
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	372	06-Sep-06
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FMT (SA40) Blue	8564E (84125C)	1393	10-Nov-06

Frequency Stability, 29-Jun-06**Engineer: David Bare**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Asset #</u>	<u>Cal Due</u>
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FMT (SA40) Blue	8564E (84125C)	1393	10-Nov-06

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T64472 39 Pages



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	Test-Log Number:	T64472
		Project Manager:	Esther Zhu
Contact:	Greg Mills		
Emissions Spec:	Part 101	Class:	Radio
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Microwave Data Systems

Model

PUMA 4 ODU's

Date of Last Test: 6/29/2006



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	Test-Log Number:	T64472
		Project Manager:	Esther Zhu
Contact:	Greg Mills		
Emissions Spec:	Part 101	Class:	Radio
Immunity Spec:	-	Environment:	-

EUT INFORMATION

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

General Description

The EUT is a ODU (Outdoor Unit) licensed transmitter that is designed to provide high speed data for point to point applications. The EUT would normally be placed on a tower or pole in a fixed location therefore, the EUT was treated as table-top equipment during testing. The electrical rating of the EUT is -48Vdc Volts , 1 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Microwave Data System	Puma	ODU (HH band)	1475627	
Microwave Data System	Puma	ODU (HL band)	1475626	
Microwave Data System	Puma	ODU (LH band)	1475624	
Microwave Data System	Puma	ODU (LL band)	1475625	

Other EUT Details

The radio can be configured with one of two different VCO/Filter combinations and with one of two different Duplexers. This gives a total of four different configurations to handle the different combinations of transmit/receive bands designated as follows:

HH Band: TX 6240 - 6421MHz; RX 5988 - 6169 MHz

HL Band: TX 5988 - 6169 MHz; RX 6240 - 6421 MHz

LH Band: TX 6181 - 6362 MHz; RX 5929 - 6110 MHz

LL Band: TX 5929 - 6110 MHz; RX 6181 - 6362 MHz

EUT Antenna Details

The EUT is designed to be used with fixed-mounted, high-gain parabolic dish antennas. The Outdoor Unit (ODU) containing the transmitter is intended to be mounted alongside the antenna.

EUT Enclosure

The EUT enclosure is primarily constructed of metal and plastic. It measures approximately 37 cm wide by 7 cm deep by 40 cm high.



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
		Project Manager:	Esther Zhu
Contact:	Greg Mills		
Emissions Spec:	Part 101	Class:	Radio
Immunity Spec:	-	Environment:	-

Test Configuration #1

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

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Microwave Data Systems	MDS 5800	IDU	1234567	E5MDS-5800-2

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
IBM	Thinkpad	Laptop		

Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
IDU AC Power	AC Mains	3 wire	Unshielded	1.8
IF	IDU	Coaxial	Shielded	3.0
IDU Ethernet	Laptop	Cat 5	Unshielded	10.0

Note: The BNC ports were not connected during testing. The manufacturer stated that these are for antenna alignment purposes and therefore would not normally be connected during normal operation.

EUT Operation For Part 101 Measurements

During testing the EUT was set to continuously transmit at the specified data rate and on the specified channel at maximum output power. For radiated measurements the antenna port was terminated into a 50-ohm load.



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

FCC 101 Antenna Port Measurements Power, Bandwidth and Spurious 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: 6/27/2006
Test Engineer: Juan Martinez
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: -48Vdc from host IDU

General Test Configuration

The EUT was connected to the spectrum analyzer or power meter via a suitable attenuator.

All measurements have been corrected to allow for the external attenuators used.

Ambient Conditions:
Temperature: 22 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Output Power	101.113	Pass	27.4 dBm
1	Emission Mask	101.111(a)(2)(i)	Pass	Refer to plots
2	99% Bandwidth	101.109	Pass	Refer to run
3	Spurious emissions	101.111(a)(2)(iii)	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.



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Run #1: Output Power & Emission Mask

Summary

Freq. (MHz)	Gmax dBi	Power ¹ (dBm)	BW (MHz)	Limit (dBm)	PSD ² (dBm)	PSD limit (MHz)	Data Rate Mbps	Plot #	Mask
6110.75		27.4	5.0	85.0			18.5	Plot #1	Pass
6165.10		25.6	5.0	85.0			18.5	Plot #2	Pass
6362.79		25.2	5.0	85.0			18.5	Plot #3	Pass
6417.14		23.5	5.0	85.0			18.5	Plot #4	Pass
5935.32		24.2	10.0	85.0			44.7	Plot #5	Pass
6162.63		24.7	10.0	85.0			44.7	Plot #6	Pass
6187.36		23.8	10.0	85.0			44.7	Plot #7	Pass
6414.67		24.2	10.0	85.0			44.7	Plot #8	Pass
5945.20		26.1	30.0	85.0			134.0	Plot #9	Pass
6152.75		24.6	30.0	85.0			134.0	Plot #10	Pass
6197.24		25.1	30.0	85.0			134.0	Plot #11	Pass
6404.79		24.1	30.0	85.0			134.0	Plot #12	Pass

Note 1	Average power measured using a power meter with average power sensor
Note 2	Average power measured from integration over emission bandwidth with a spectrum analyzer, RB=1MHz, VB=3MHz, Sample detector and VIDEO averaging.



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 1



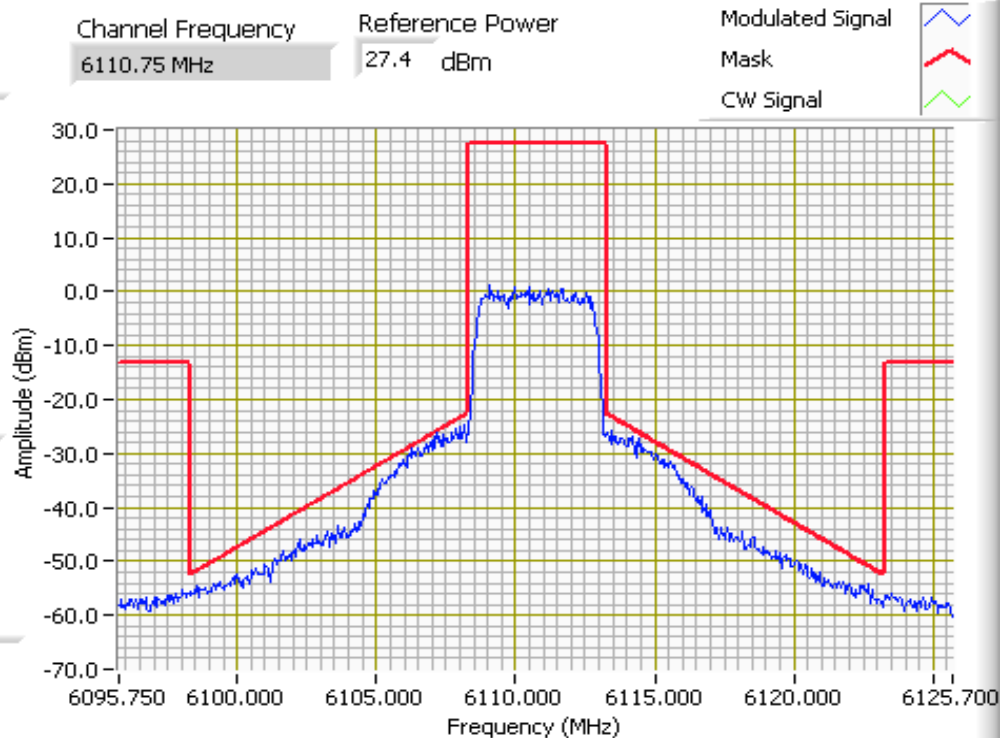
Analyzer Settings

CF: 6110.75 MHz
SPAN: 30.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 0.8s
Ref Lvl: 20.00 DBM
VAVG 50

Notes

Analyzer HP8564E,

PASS





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 2



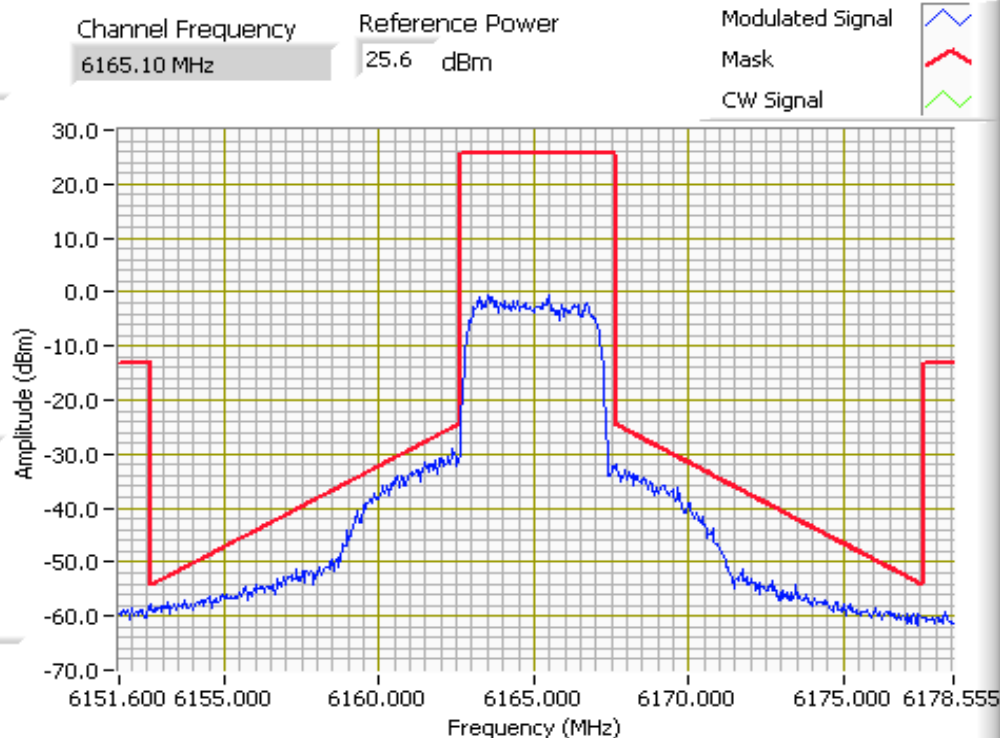
Analyzer Settings

CF: 6165.10 MHz
SPAN: 27.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 0.7s
Ref Lvl: 20.00 DBM
VAVG 60

Notes

Analyzer HP8564E,

PASS





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 3



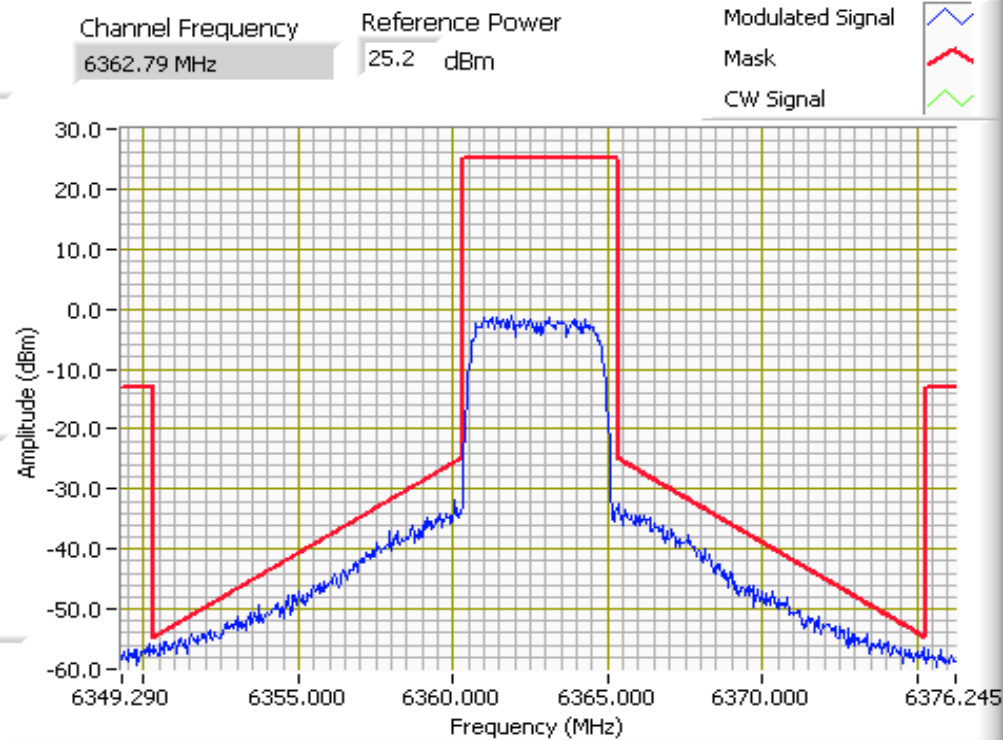
Analyzer Settings

CF: 6362.79 MHz
SPAN: 27.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 0.7s
Ref Lvl: 20.00 DBM
VAVG 50

Notes

Analyzer HP8564E,

PASS





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 4



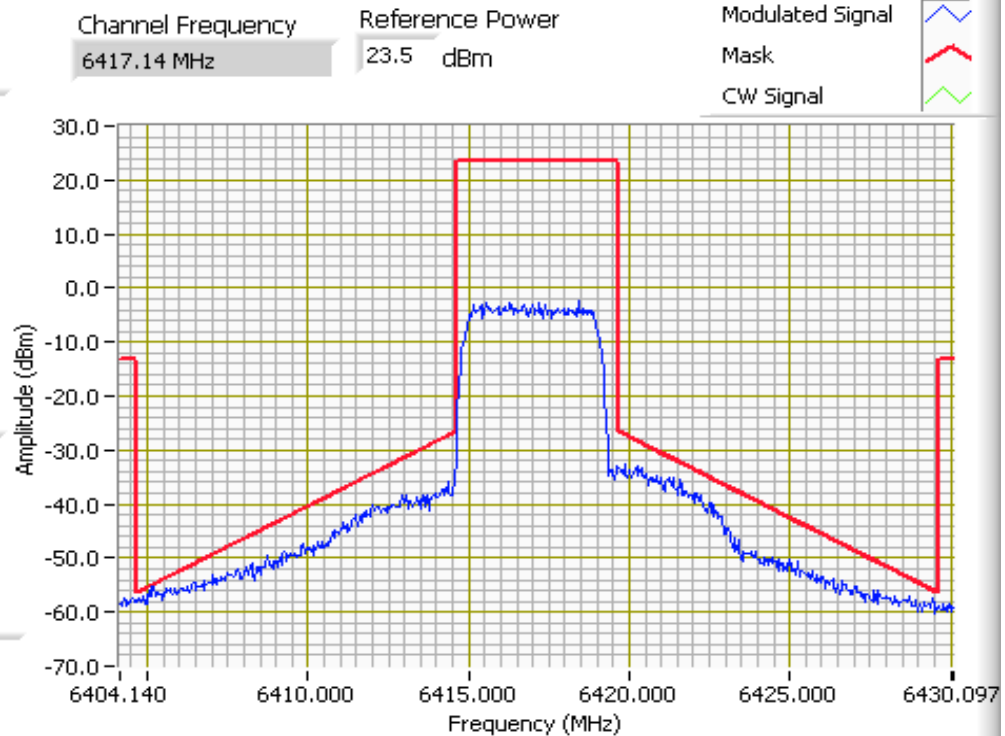
Analyzer Settings

CF: 6417.14 MHz
SPAN: 26.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 0.7s
Ref Lvl: 20.00DBM
VAVG 50

Notes

Analyzer HP8564E,

PASS





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 5



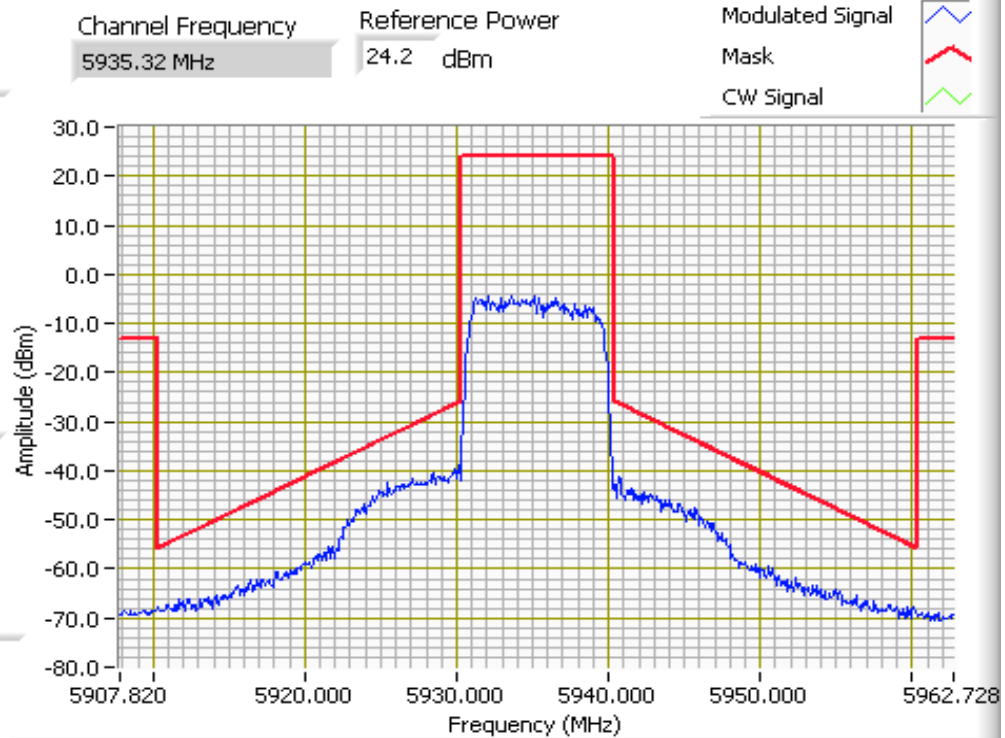
Analyzer Settings

CF: 5935.32 MHz
SPAN: 55.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 20
RL Offset 0.00
Sweep Time 1.4s
Ref Lvl: 10.00DBM
VAVG 50

Notes

Analyzer HP8564E,

PASS





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 6



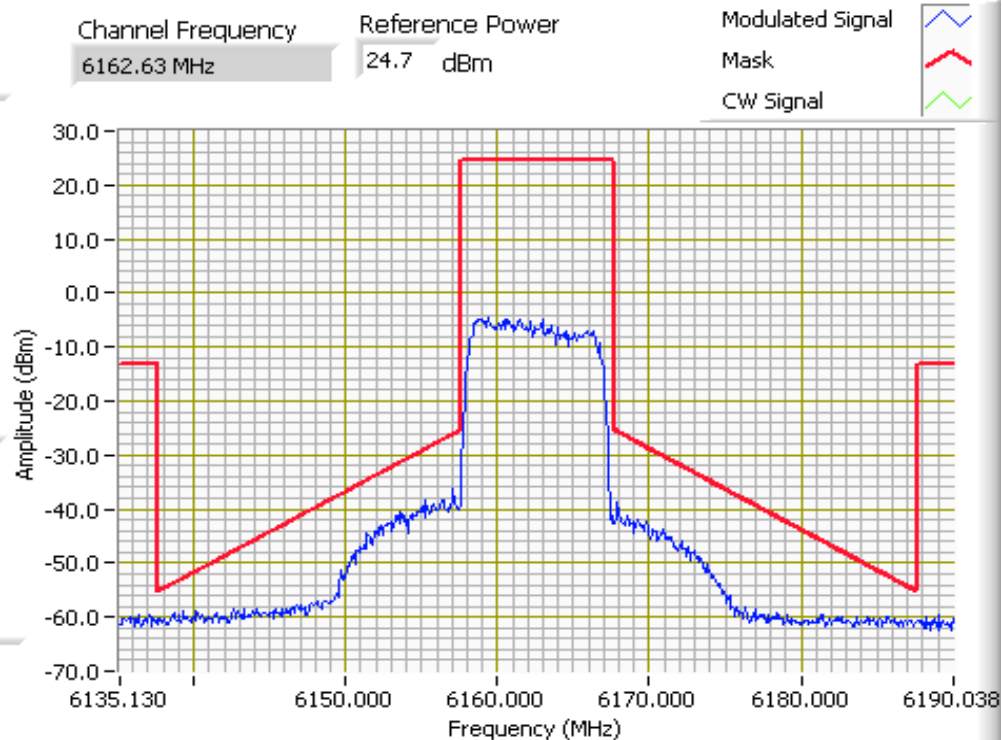
Analyzer Settings

CF: 6162.63 MHz
SPAN: 55.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 1.4s
Ref Lvl: 20.00 DBM
VAVG 50

Notes

Analyzer HP8564E,

PASS





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 7



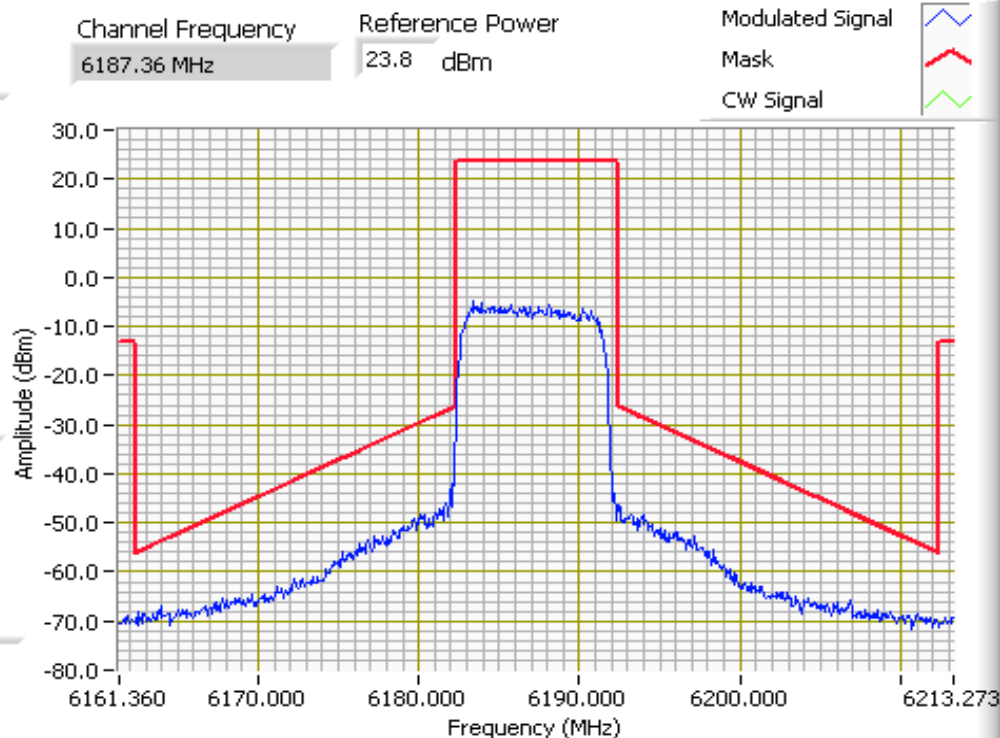
Analyzer Settings

CF: 6187.36 MHz
SPAN: 52.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 20
RL Offset 0.00
Sweep Time 1.3s
Ref Lvl: 10.00dBm
VAVG 50

Notes

Analyzer HP8564E,

PASS





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 8



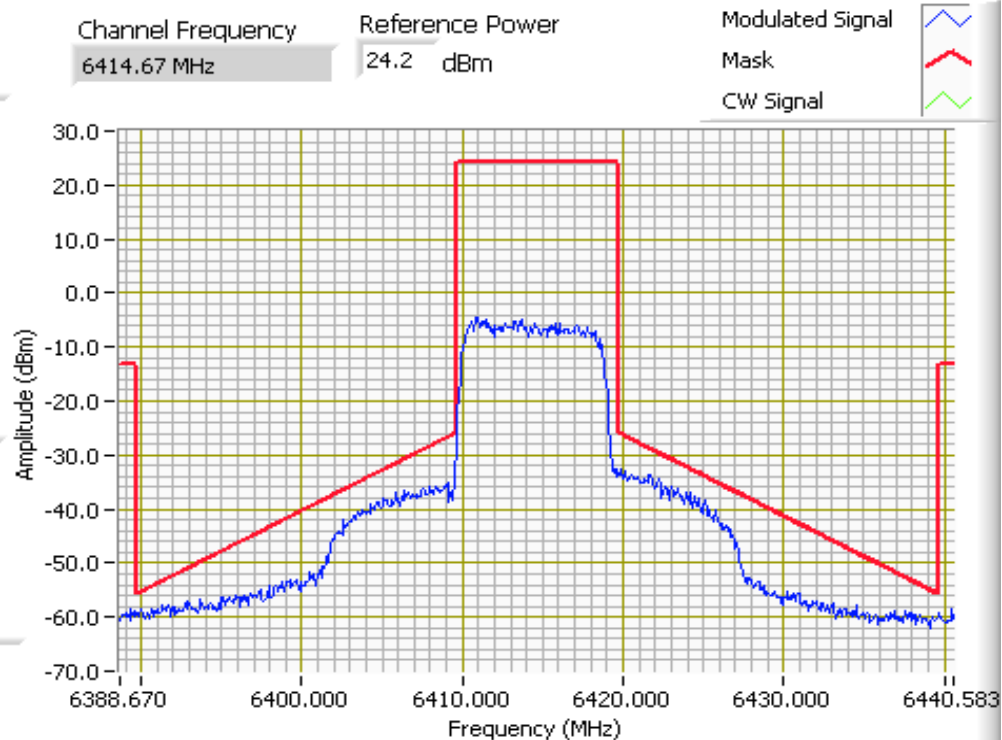
Analyzer Settings

CF: 6414.67 MHz
SPAN: 52.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 1.3s
Ref Lvl: 20.00 DBM
VAVG 50

Notes

Analyzer HP8564E,

PASS





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 9



Analyzer Settings

CF: 5945.20 MHz
SPAN: 175.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 20
RL Offset 0.00
Sweep Time 4.4s
Ref Lvl: 10.00dBm
VAVG 50

Notes

Analyzer HP8564E,

PASS

Channel Frequency

5945.20 MHz

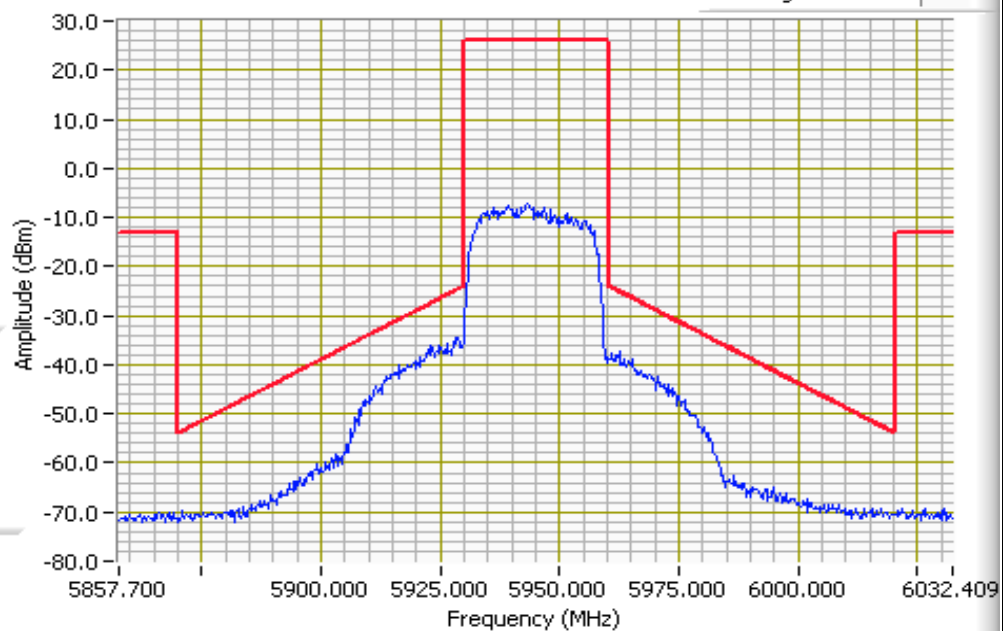
Reference Power

26.1 dBm

Modulated Signal

Mask

CW Signal



Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 10



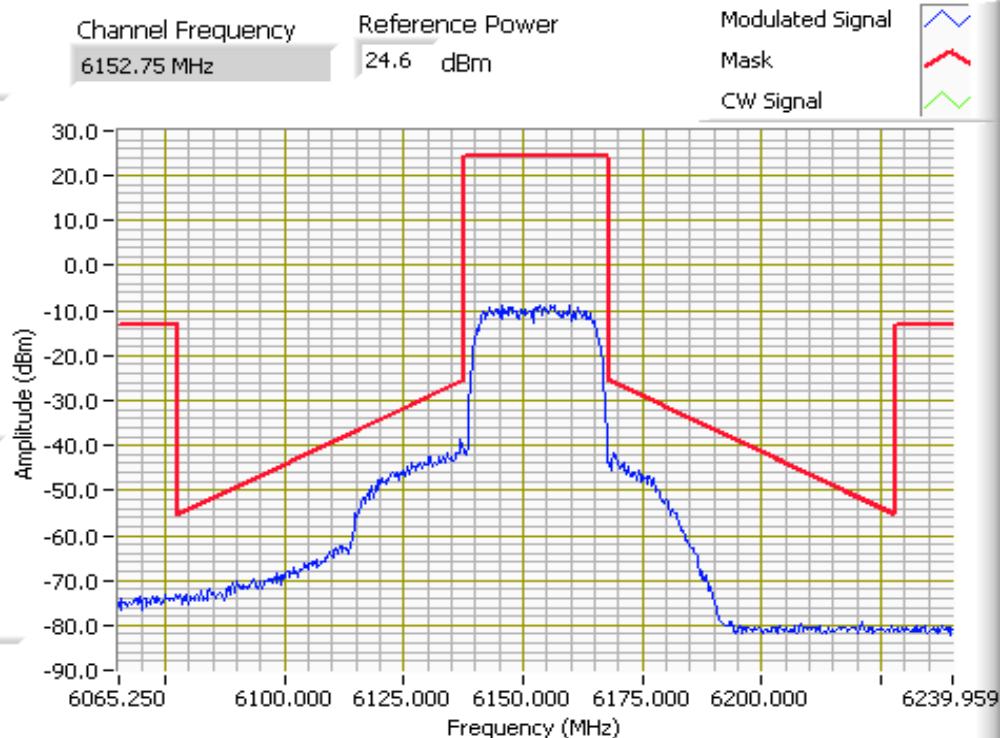
Analyzer Settings

CF: 6152.75 MHz
 SPAN: 175.00 MHz
 RB 10 kHz
 VB 10 kHz
 Detector POS
 Att 10
 RL Offset 0.00
 Sweep Time 4.4s
 Ref Lvl: 0.00DBM
 VAVG 50

Notes

Analyzer HP8564E,

PASS





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 11



Analyzer Settings

CF: 6197.24 MHz
SPAN: 175.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 10
RL Offset 0.00
Sweep Time 4.4s
Ref Lvl: 0.00DBM
VAVG 50

Notes

Analyzer HP8564E,

PASS

Channel Frequency

6197.24 MHz

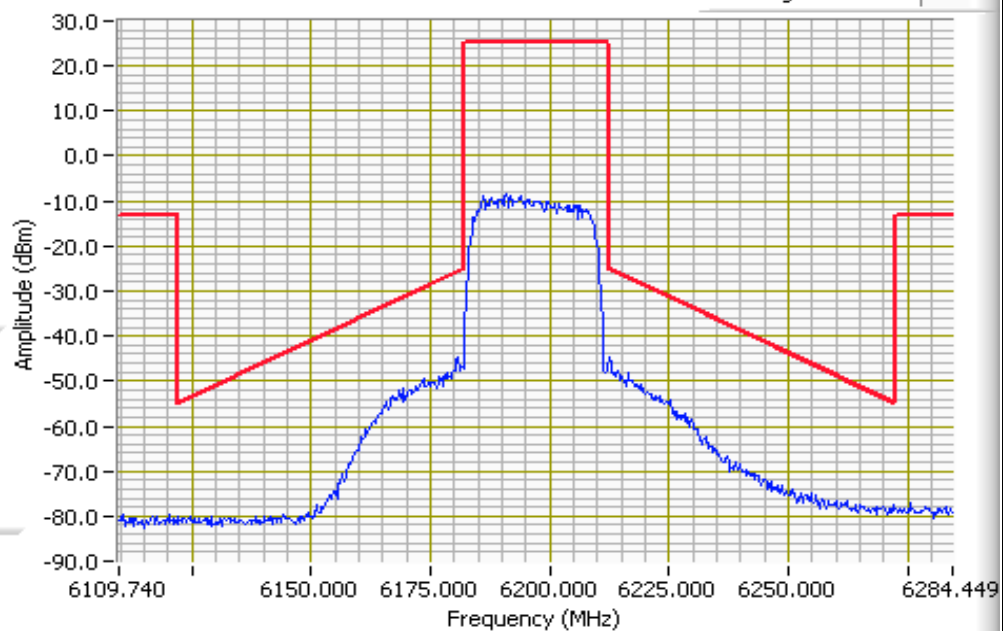
Reference Power

25.1 dBm

Modulated Signal

Mask

CW Signal





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 12



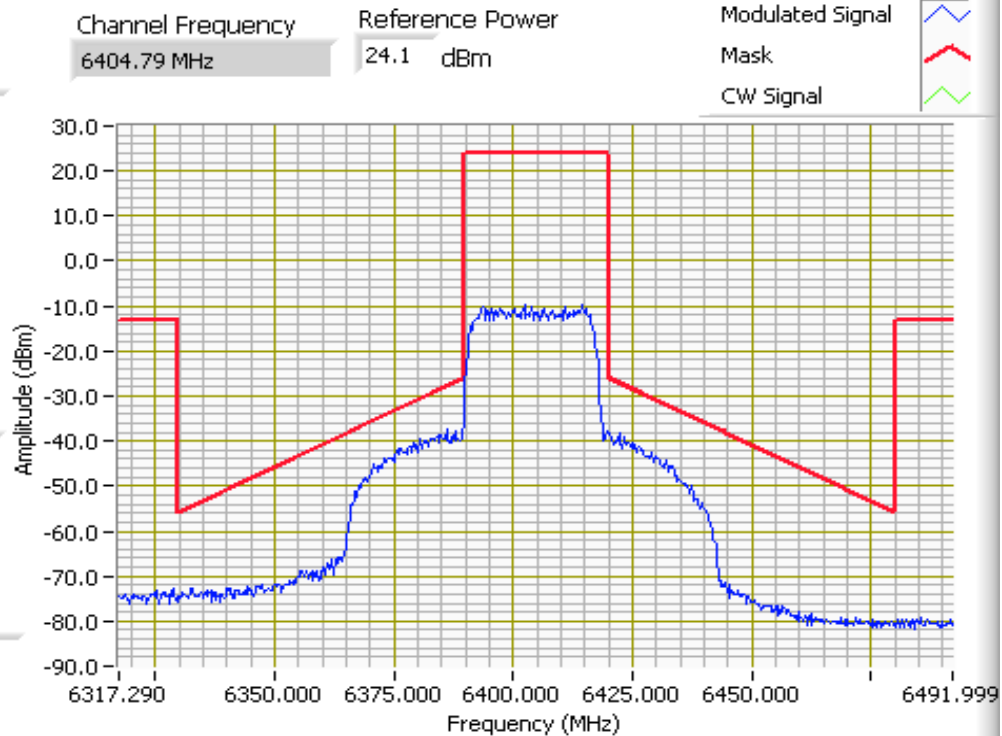
Analyzer Settings

CF: 6404.79 MHz
SPAN: 175.00 MHz
RB 10 kHz
VB 10 kHz
Detector POS
Att 10
RL Offset 0.00
Sweep Time 4.4s
Ref Lvl: 0.00 DBM
VAVG 50

Notes

Analyzer HP8564E,

PASS

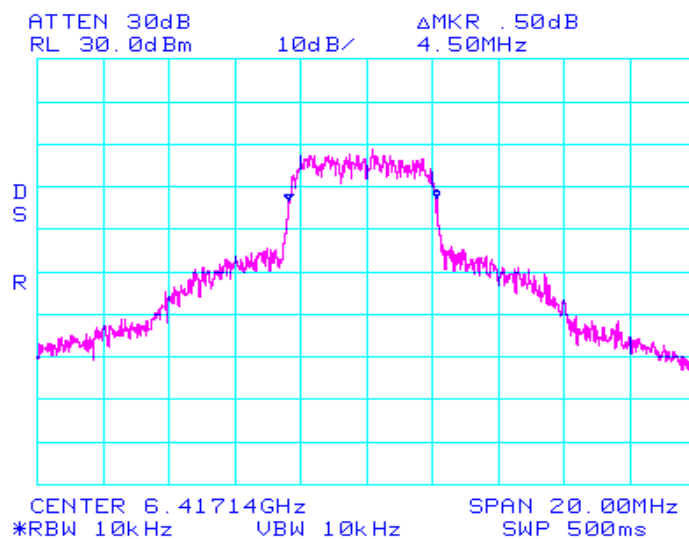


Run #2: Signal Bandwidth

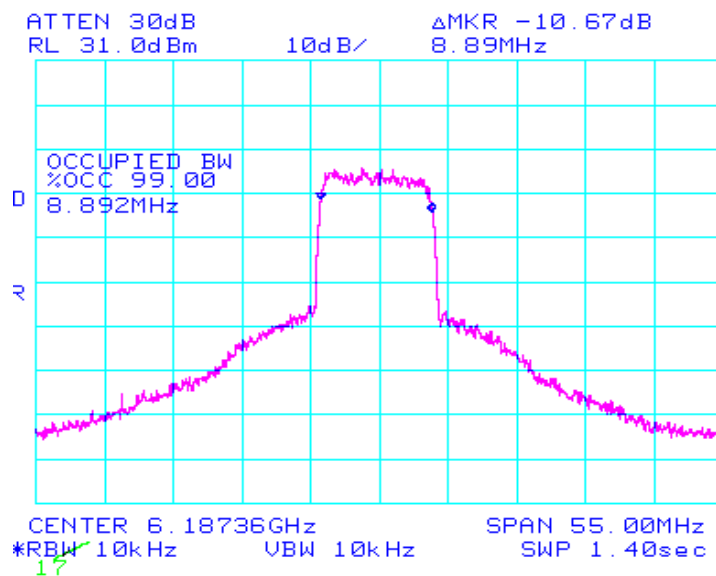
Data Rate	Frequency (MHz)	Resolution Bandwidth	Bandwidth (MHz)		
			6dB	99%	
18.5	6417.14	10 kHz	-	4.5	Plot# 1
44.7	6187.36	10 kHz	-	8.9	Plot# 2
134.0	6197.24	10 kHz	-	26	Plot# 3

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 1

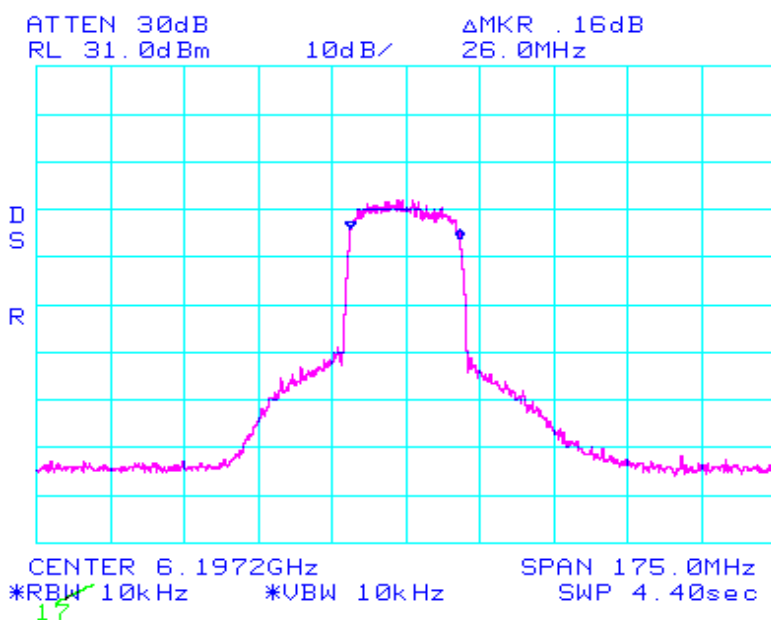


Plot# 2



Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Plot# 3





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Run #3: Out of Band Spurious Emissions

Channel BW (MHz)	Frequency (MHz)	Limit	Result
5	6110.75	-13dBm	Pass
5	6165.10	-13dBm	Pass
5	6362.79	-13dBm	Pass
5	6417.14	-13dBm	Pass

Channel BW (MHz)	Frequency (MHz)	Limit	Result
10	5935.32	-13dBm	Pass
10	6162.63	-13dBm	Pass
10	6187.36	-13dBm	Pass
10	6414.67	-13dBm	Pass

Channel BW (MHz)	Frequency (MHz)	Limit	Result
30	5945.20	-13dBm	Pass
30	6152.75	-13dBm	Pass
30	6197.24	-13dBm	Pass
30	6404.79	-13dBm	Pass

Graphs show the measurements made using RB=VB=1MHz. One plot shows the complete spectrum, the second shows the spectrum immediately above and below the channel, with the -13dBm limit for frequencies separated from the center frequency by more than 250% of the channel bandwidth (5MHz, 10MHz or 30 MHz).

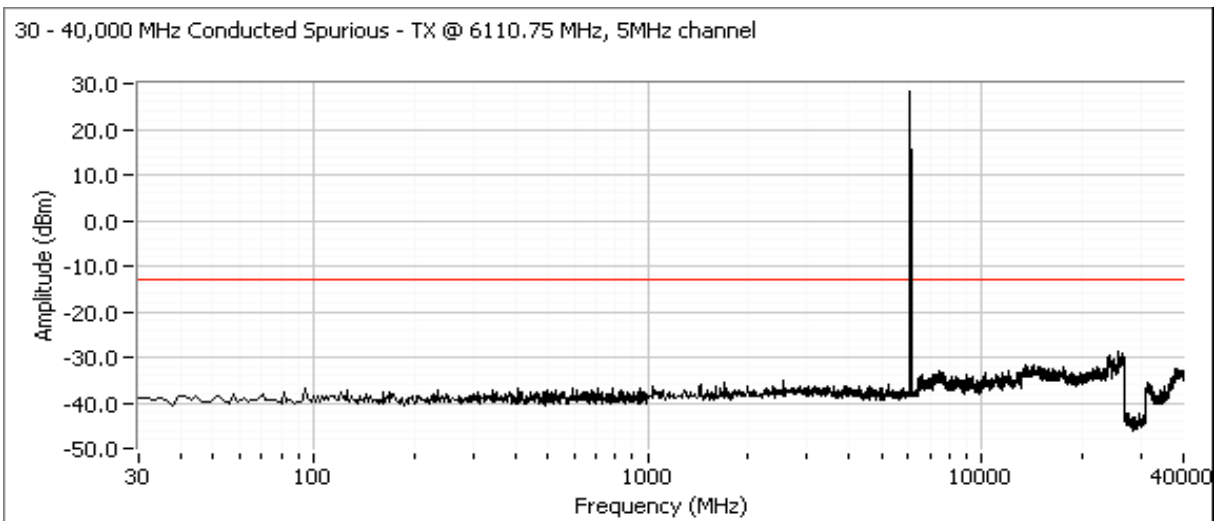
Frequency MHz	Level dBm	Line	FCC		Detector	Comments
			Limit	Margin		
6299.790	-25.8	RF Port	-13.0	-12.8	1MHz PK	Tx @ 6362.79, 5 MHz channel
6105.620	-26.8	RF Port	-13.0	-13.8	1MHz PK	Tx @ 5935.32, 10 MHz channel



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 6110.75 MHz, 5 MHz Channel



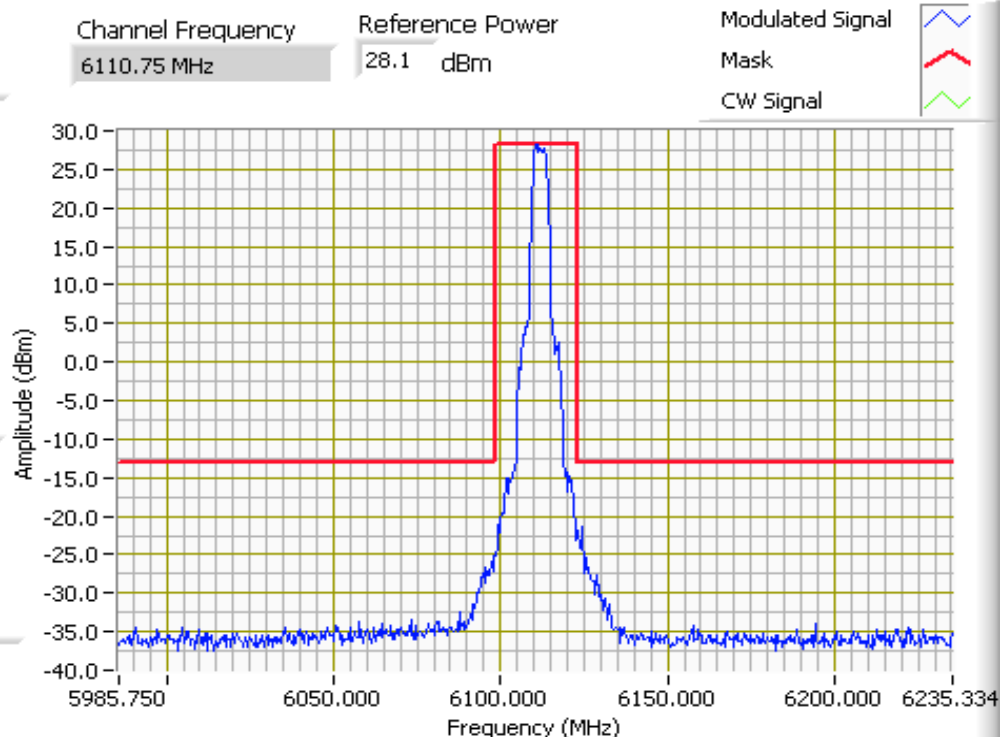
Analyzer Settings

CF: 6110.75 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 20.00DBM

Notes

Analyzer HP8564E,

PASS

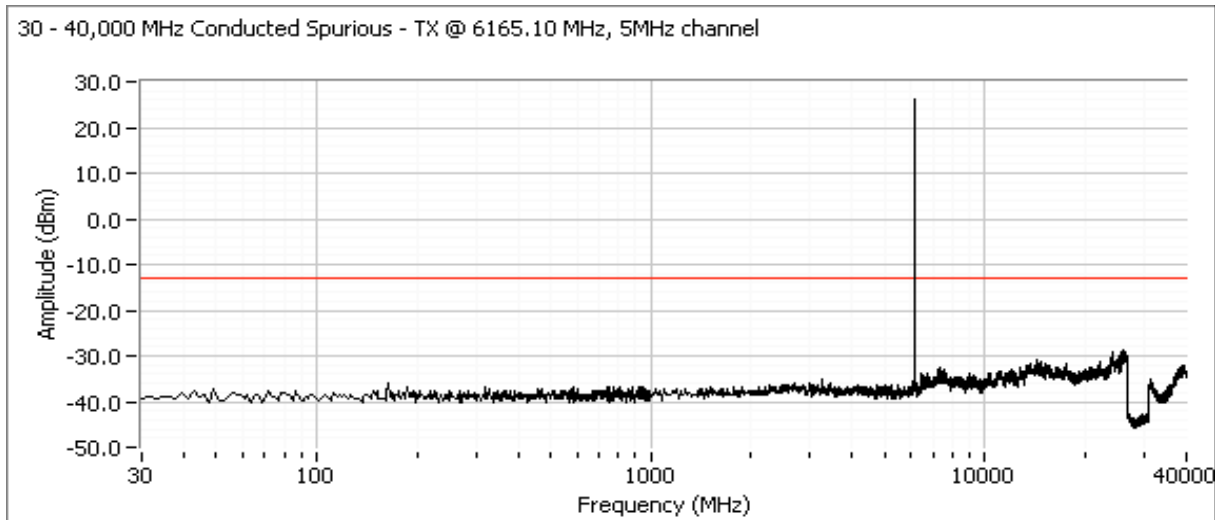




EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots -6165.10 MHz, 5 MHz Channel



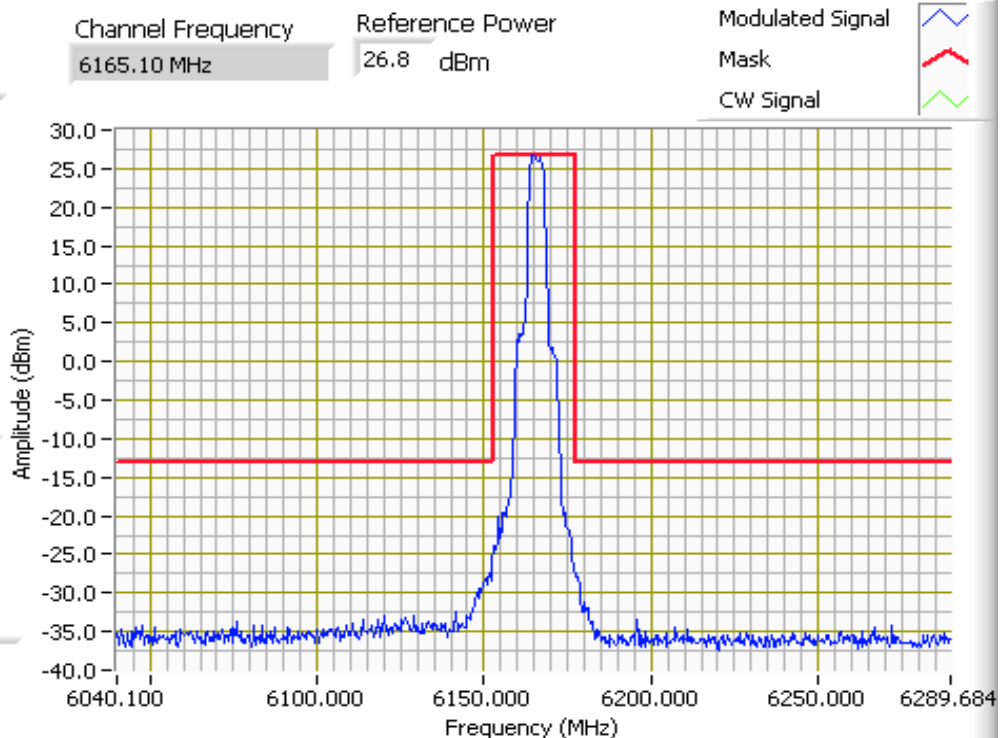
Analyzer Settings

CF: 6165.10 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 20.00dBm

Notes

Analyzer HP8564E,

PASS



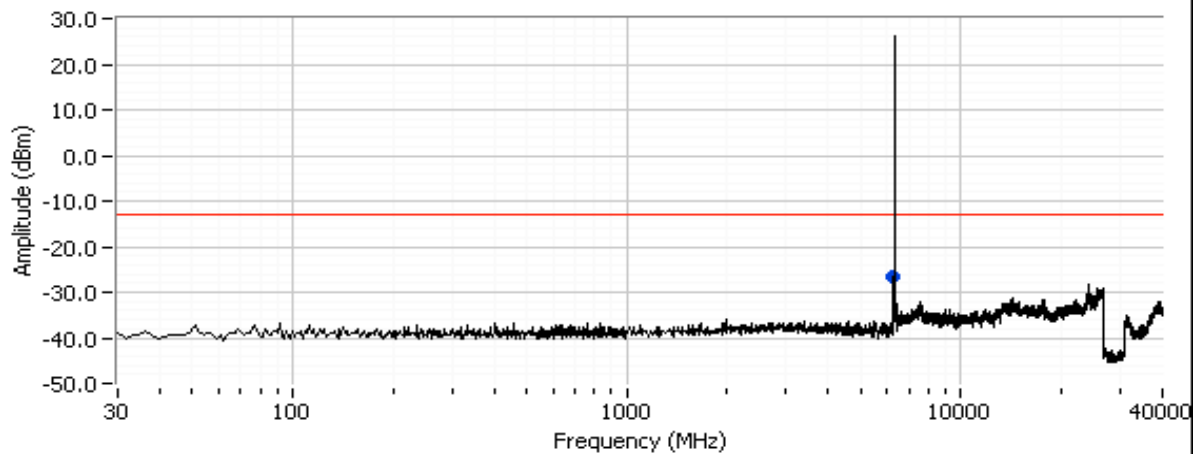


EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 6362.79 MHz, 5 MHz Channel

30 - 40,000 MHz Conducted Spurious - TX @ 6362.79 MHz, 5MHz channel



Analyzer Settings

CF: 6362.79 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 20.00dBm

Notes

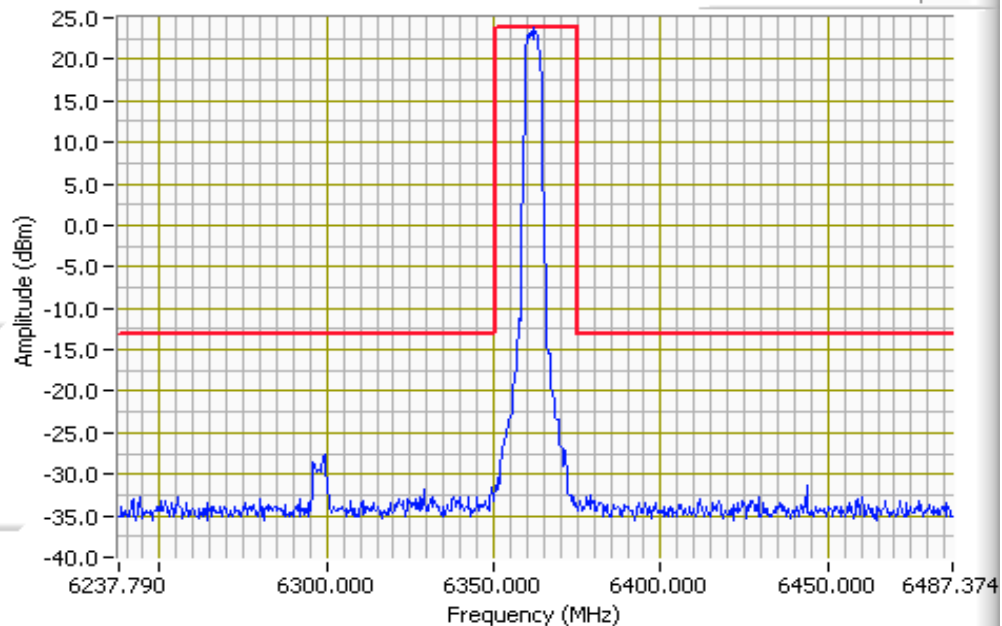
Analyzer HP8564E,

PASS

Channel Frequency
6362.79 MHz

Reference Power
23.8 dBm

Modulated Signal
Mask
CW Signal



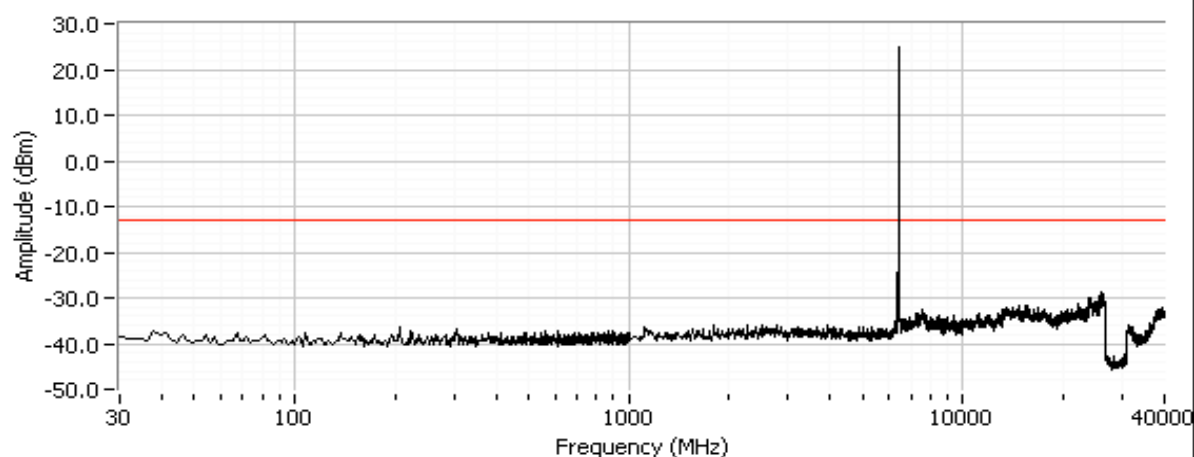


EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 6417.14 MHz, 5 MHz Channel

30 - 40,000 MHz Conducted Spurious - TX @ 6417.14 MHz, 5MHz channel



Analyzer Settings

CF: 6417.14 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 20.00DBM

Notes

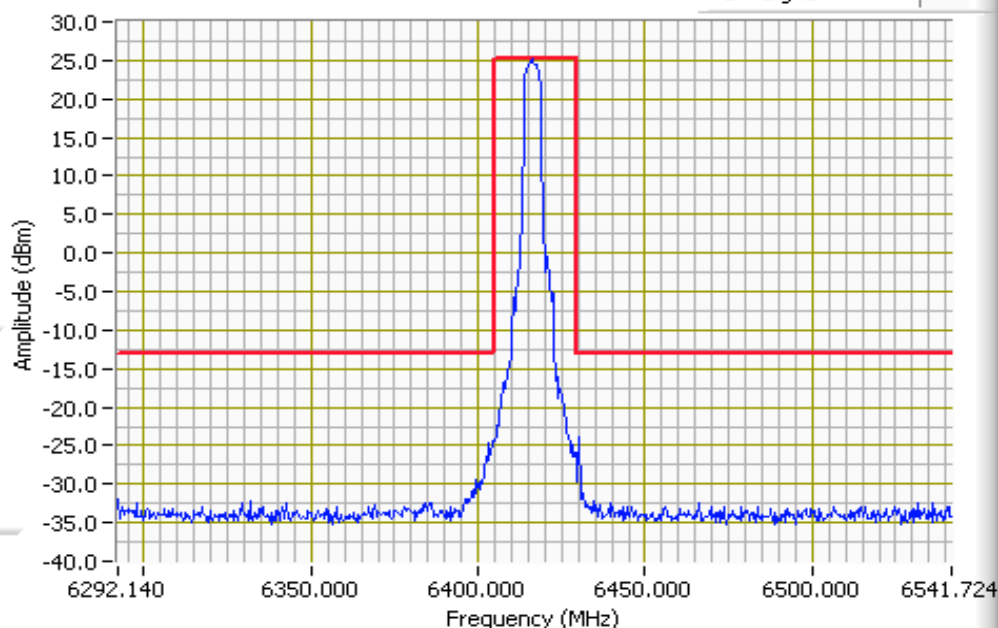
Analyzer HP8564E,

PASS

Channel Frequency
6417.14 MHz

Reference Power
25.3 dBm

Modulated Signal
Mask
CW Signal

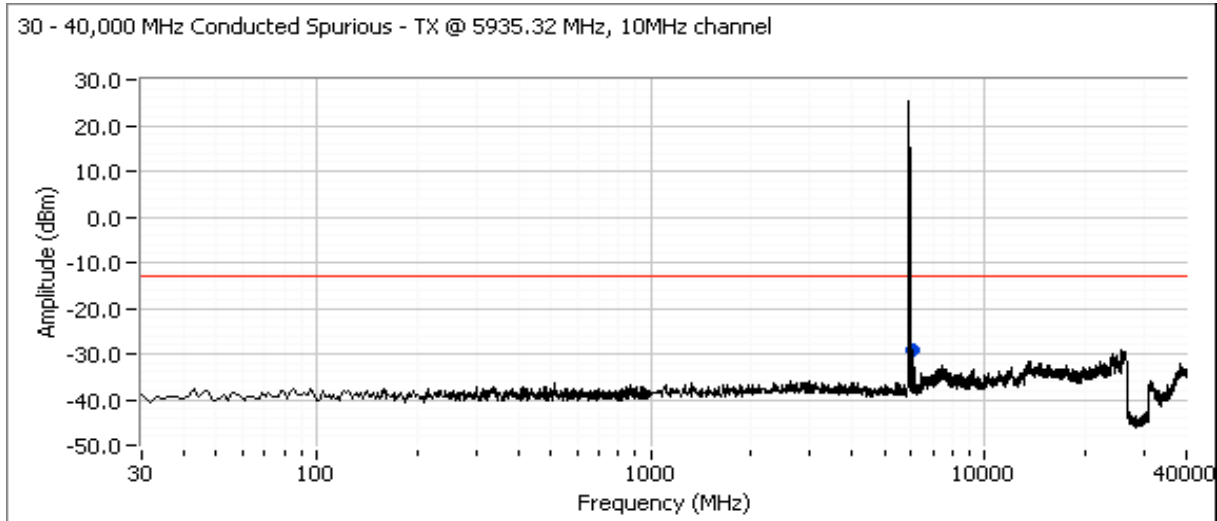




EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 5935.32 MHz, 10 MHz Channel



Analyzer Settings

CF: 5935.32 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 20
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 10.00DBM

Notes

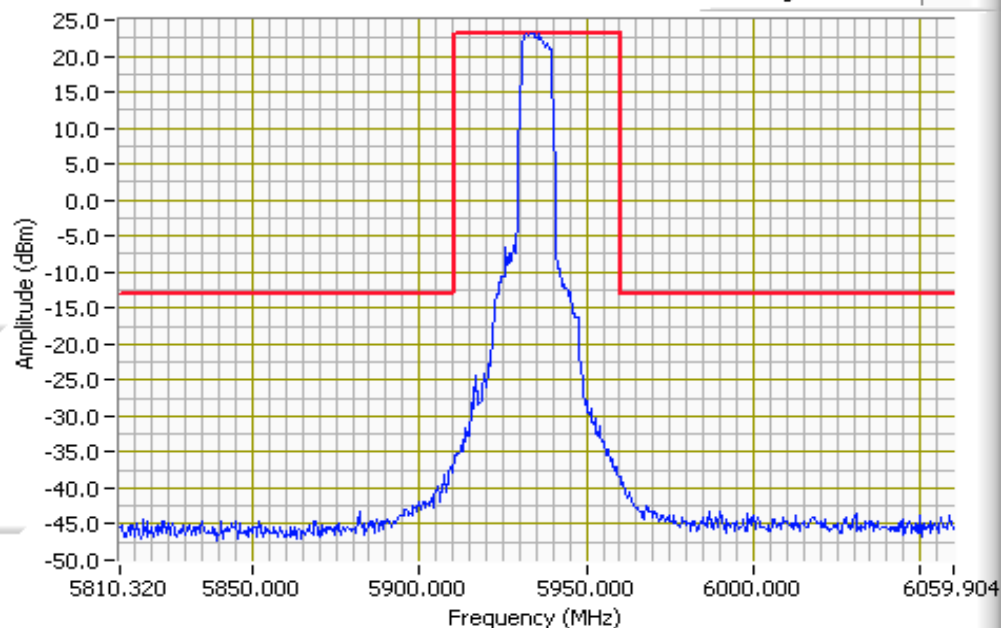
Analyzer HP8564E,

PASS

Channel Frequency
5935.32 MHz

Reference Power
23.2 dBm

Modulated Signal
Mask
CW Signal



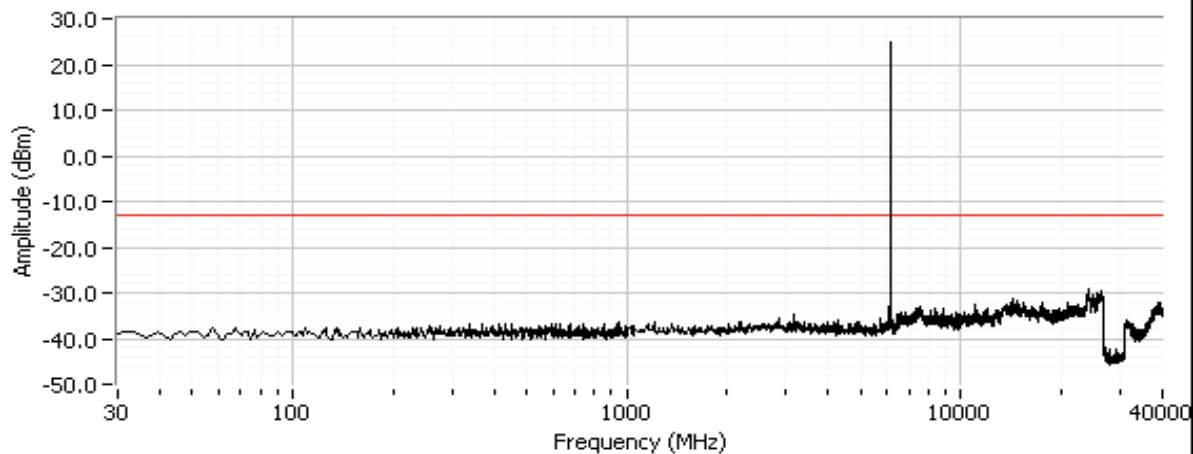


EMC Test Data

Client: Microwave Data Systems	Job Number: J64345
Model: PUMA 4 ODU's	T-Log Number: T64472
Contact: Greg Mills	Account Manager: Esther Zhu
Spec: Part 101	Class: N/A

Out-of-Band Spurious Plots - 6162.63 MHz, 10 MHz Channel

30 - 40,000 MHz Conducted Spurious - TX @ 6162.63 MHz, 10MHz channel



Analyzer Settings

CF: 6162.63 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 20.00DBM

Notes

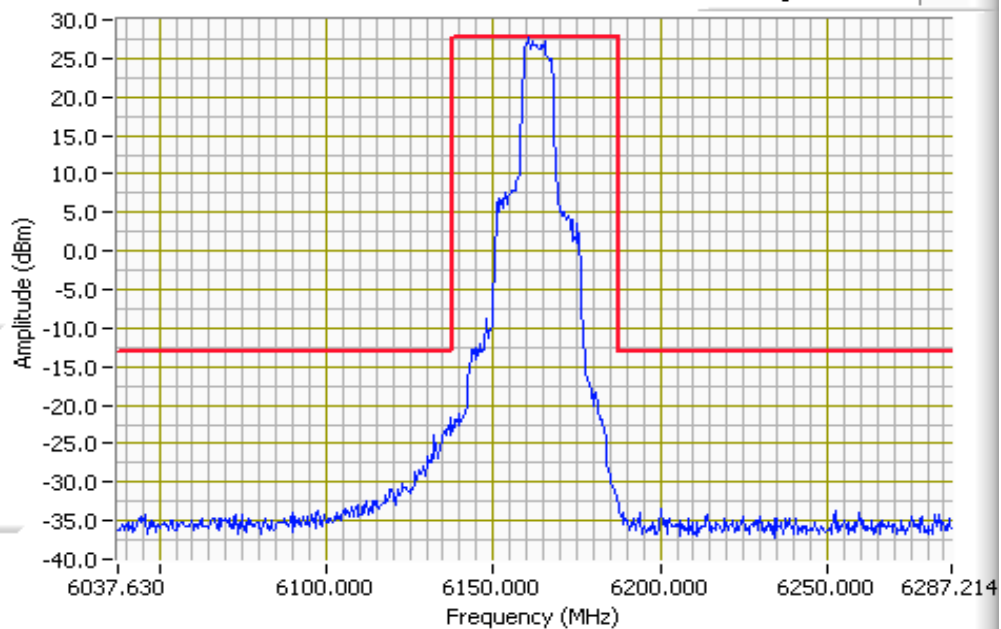
Analyzer HP8564E,

PASS

Channel Frequency
6162.63 MHz

Reference Power
27.7 dBm

Modulated Signal
Mask
CW Signal



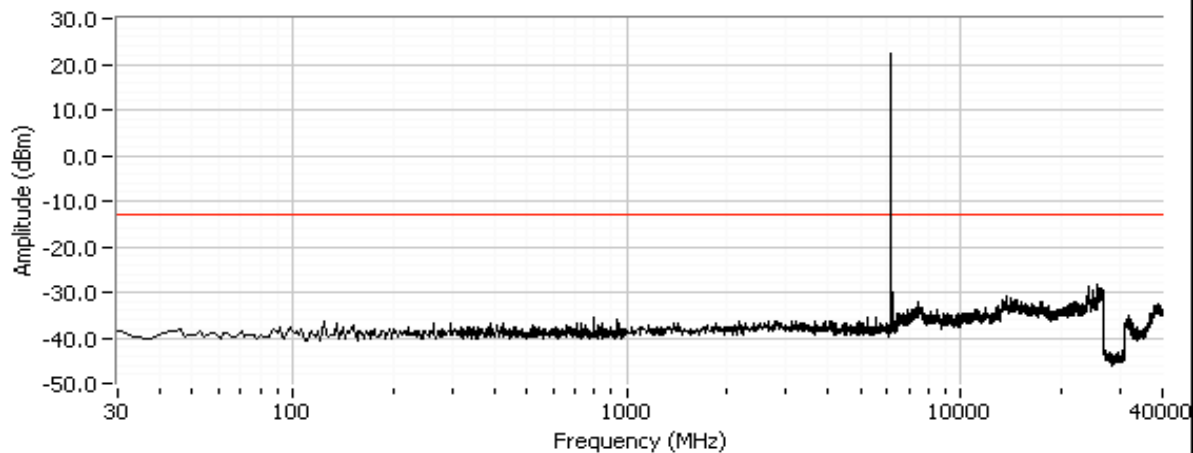


EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 6187.36 MHz, 10 MHz Channel

30 - 40,000 MHz Conducted Spurious - TX @ 6187.36 MHz, 10MHz channel



Analyzer Settings

CF: 6187.36 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 20
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 10.00DBM

Notes

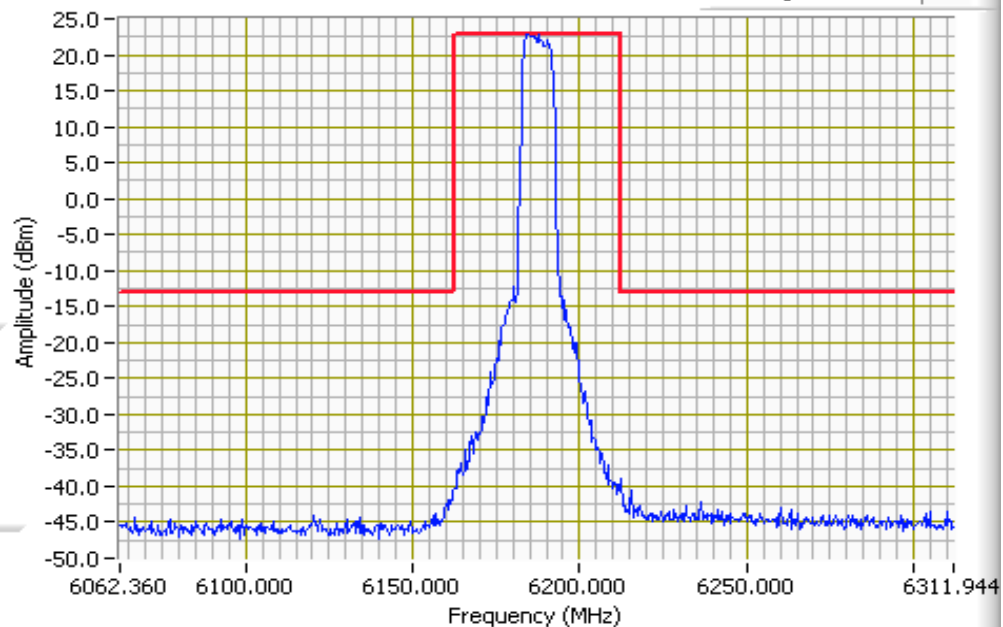
Analyzer HP8564E,

PASS

Channel Frequency
6187.36 MHz

Reference Power
22.8 dBm

Modulated Signal
Mask
CW Signal

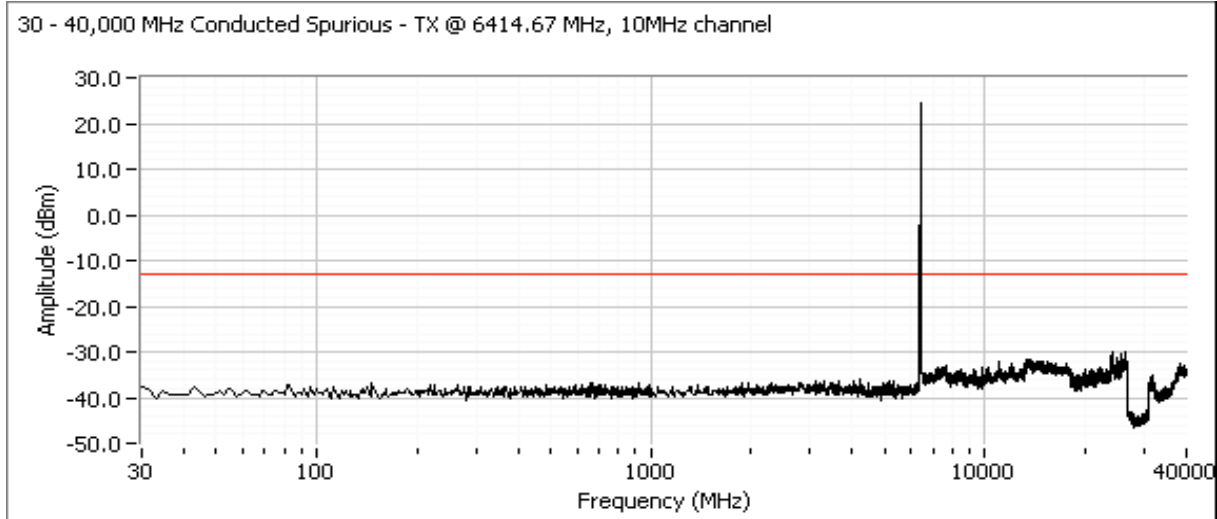




EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 6414.67 MHz, 10 MHz Channel



Analyzer Settings

CF: 6414.67 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 20.00DBM

Notes

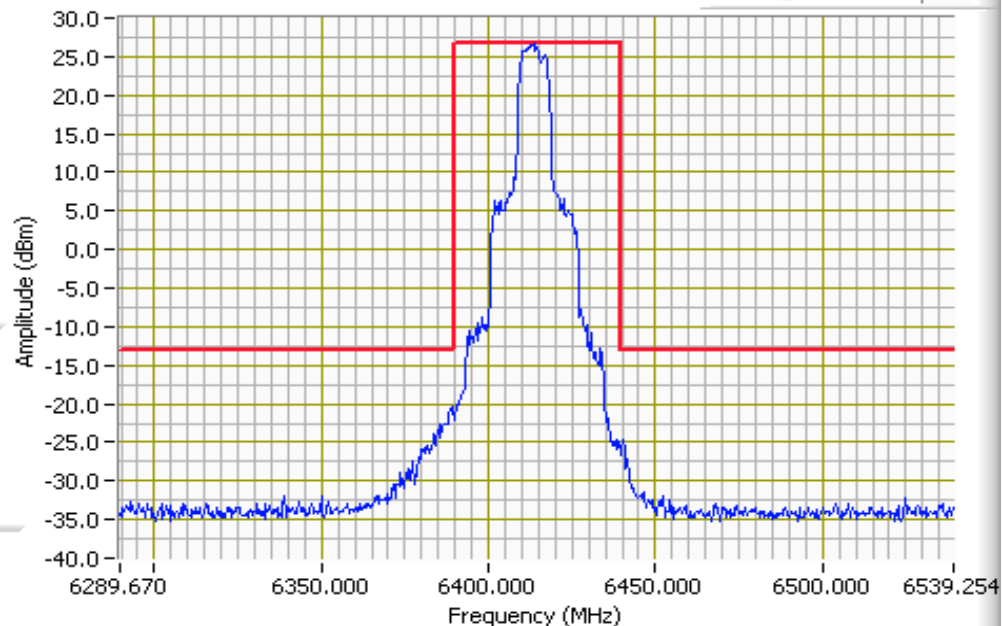
Analyzer HP8564E,

PASS

Channel Frequency
6414.67 MHz

Reference Power
26.7 dBm

Modulated Signal
Mask
CW Signal



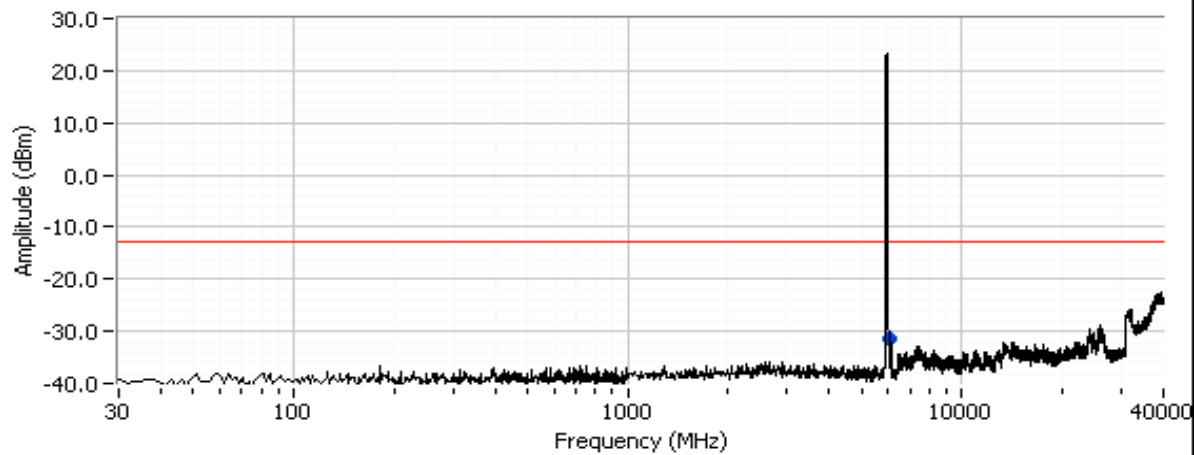


EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 5945.20 MHz, 30 MHz Channel

30 - 40,000 MHz Conducted Spurious - TX @ 5945.20 MHz



Analyzer Settings

CF: 5945.20 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 20
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 10.00dBm

Notes

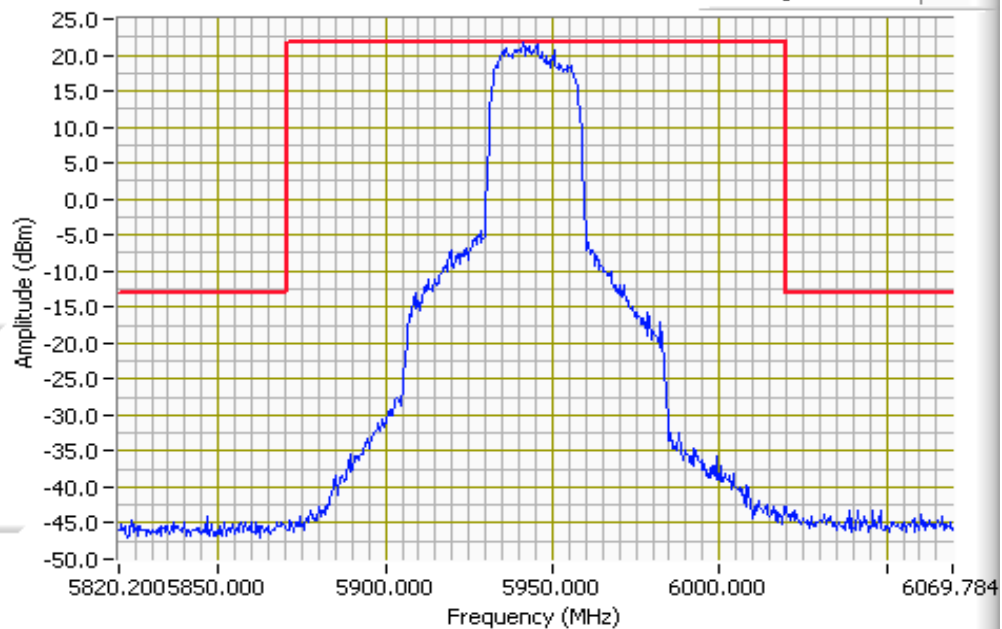
Analyzer HP8564E,

PASS

Channel Frequency
5945.20 MHz

Reference Power
21.7 dBm

Modulated Signal
Mask
CW Signal



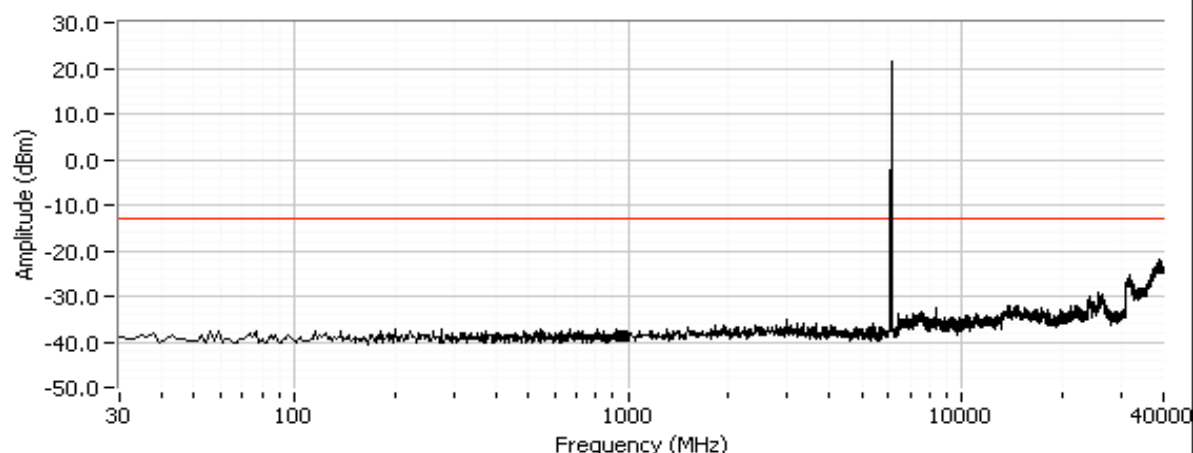


EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 6152.75 MHz, 30 MHz Channel

30 - 40,000 MHz Conducted Spurious - TX @ 6152.75 MHz



Analyzer Settings

CF: 6152.75 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 30
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 10.80DBM

Notes

Analyzer HP8564E,

PASS

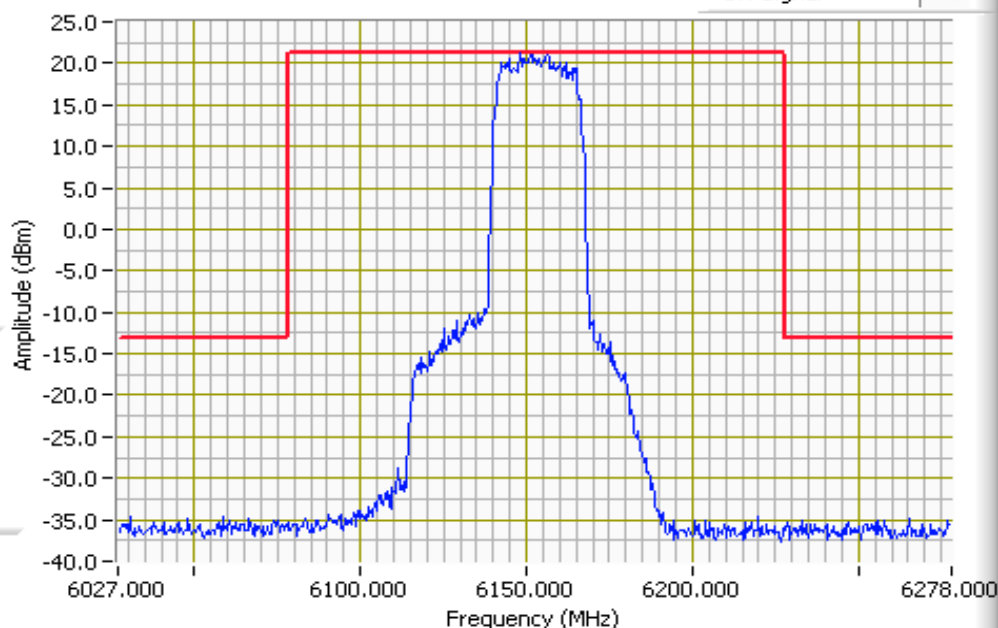
Channel Frequency
6152.75 MHz

Reference Power
21.2 dBm

Modulated Signal

Mask

CW Signal

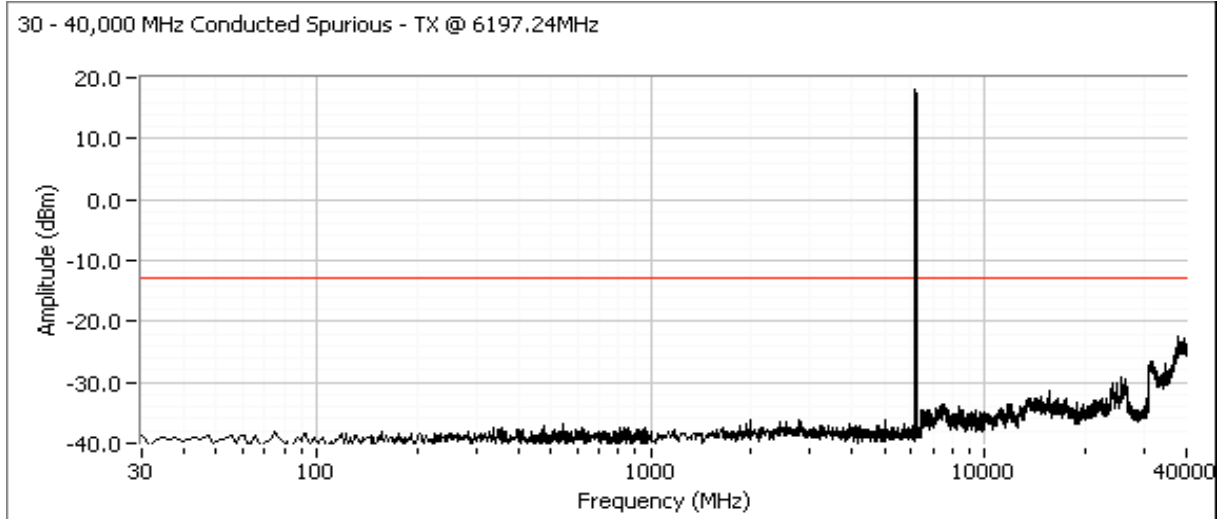




EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 6197.24 MHz, 30 MHz Channel



Analyzer Settings

CF: 6197.24 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 20
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 10.00DBM

Notes

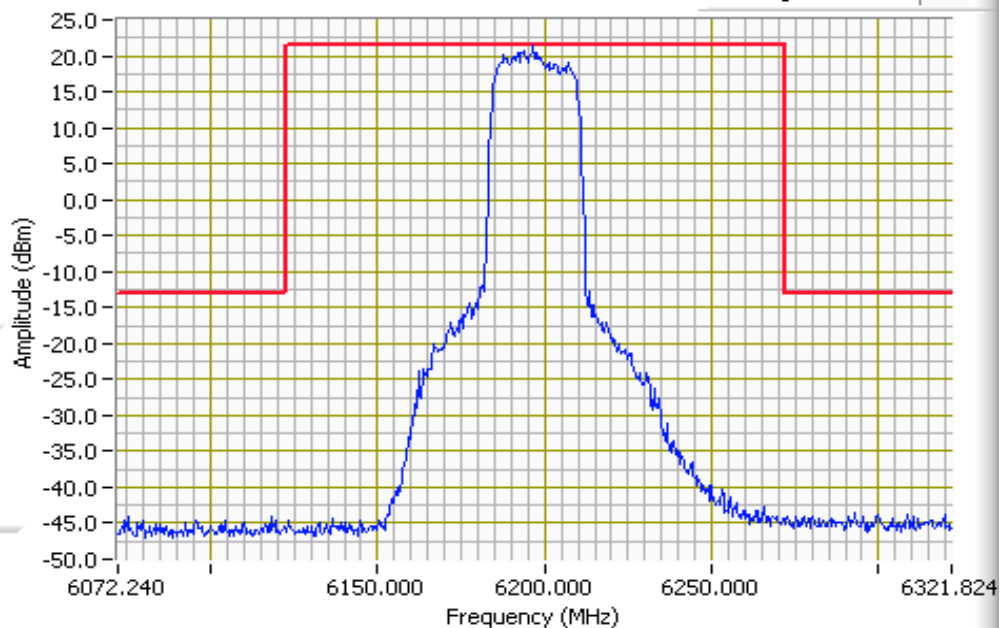
Analyzer HP8564E,

PASS

Channel Frequency
6197.24 MHz

Reference Power
21.5 dBm

Modulated Signal
Mask
CW Signal

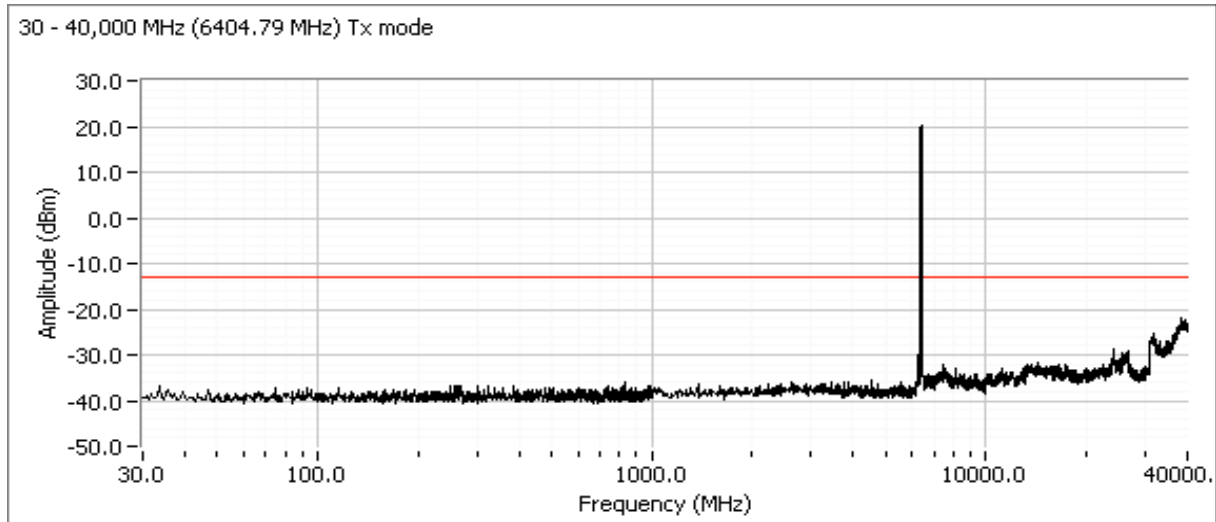




EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	N/A

Out-of-Band Spurious Plots - 6404.79 MHz, 30 MHz Channel



Analyzer Settings

CF: 6404.79 MHz
SPAN: 250.00 MHz
RB 1.000 MHz
VB 1.000 MHz
Detector POS
Att 20
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl: 10.00dBm

Notes

Analyzer HP8564E,

PASS

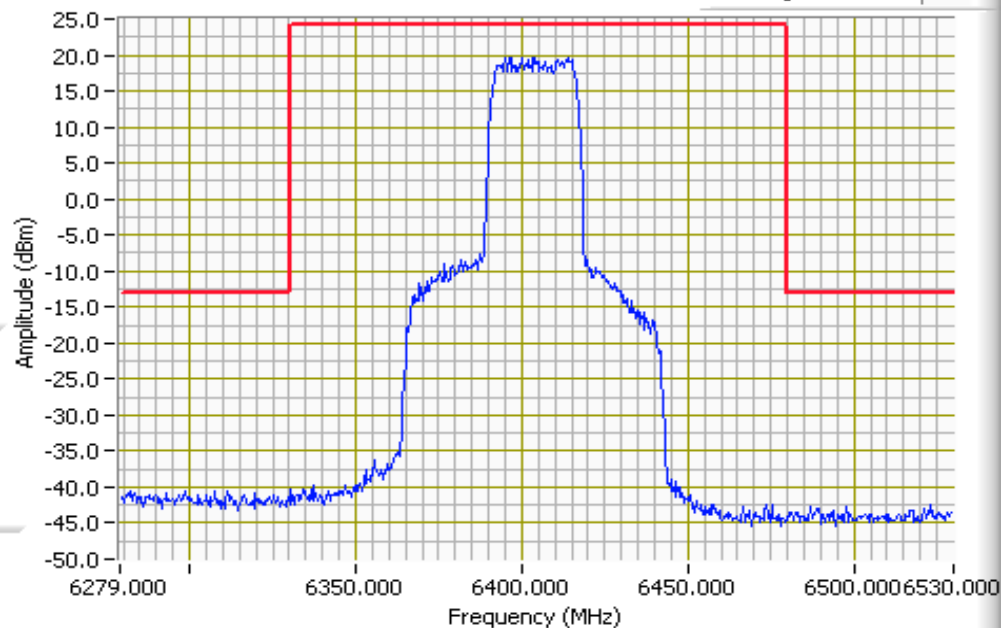
Channel Frequency
6404.79 MHz

Reference Power
24.1 dBm

Modulated Signal

Mask

CW Signal





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	Radio

Radiated Emissions (FCC 101.111)

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: 6/28/2006
Test Engineer: Mehran Birgani
Test Location: SVOATS #2

Config. Used: 1
Config Change: IDU located remotely
Host Unit Voltage -48Vdc from host IDU

General Test Configuration

The EUT was located on the turntable for radiated emissions testing. Remote support equipment was located approximately 30 meters from the test area with all I/O connections running on top of the groundplane routed overhead.

The test distance and extrapolation factor (if used) are detailed under each run description.

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.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:
Temperature: 22 °C
Rel. Humidity: 66 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	RE, 30 -40000 MHz, Maximized emissions	FCC 101.111	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.



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	Radio

Run #1: Preliminary Radiated Emissions, 30-40000 MHz

A near field scan of the EUT was performed to determine if there were any significant emissions. The only frequency detected in this frequency range from the EUT was at 10519 MHz.

Run #2: Maximized Radiated Emissions, 30-40000 MHz

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 40000 MHz	3	3	0

Frequency	Level	Pol	FCC 101.111		Detector	Azimuth	Height	Comments
MHz	dBμV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
10518.980	36.2	V	82.3	-46.1	AVG	30	1.8	30MHz
10519.040	36.5	H	82.3	-45.8	AVG	193	1.0	30MHz
10518.930	36.4	H	82.3	-45.9	AVG	190	1.0	10MHz
10518.610	36.2	V	82.3	-46.1	AVG	187	1.0	10MHz
10518.890	36.0	V	82.3	-46.3	AVG	212	1.0	5MHz
10519.330	36.0	H	82.3	-46.3	AVG	236	1.0	5MHz



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	Radio

Conducted Emissions - Power Ports

Test Specifics

Objective:

Date of Test: 6/29/2006
Test Engineer: David Bare
Test Location: SVOATS #2

Config. Used: 1
Config Change: No laptop connected
EUT Voltage: -48Vdc from IDU

General Test Configuration

The EUT and host system were located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN.

Ambient Conditions:

Temperature: 17 °C
Rel. Humidity: 80 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, Host IDU AC Power, 120V/60Hz	FCC Class A	Pass	46.8dBμV @ 1.400MHz (-13.2dB)

Modifications Made During Testing:

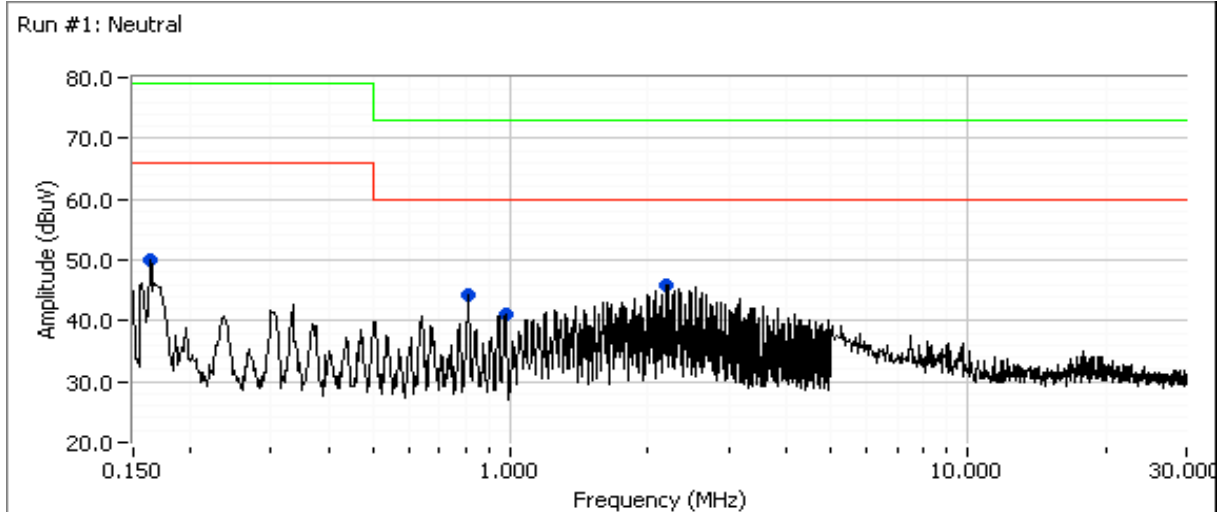
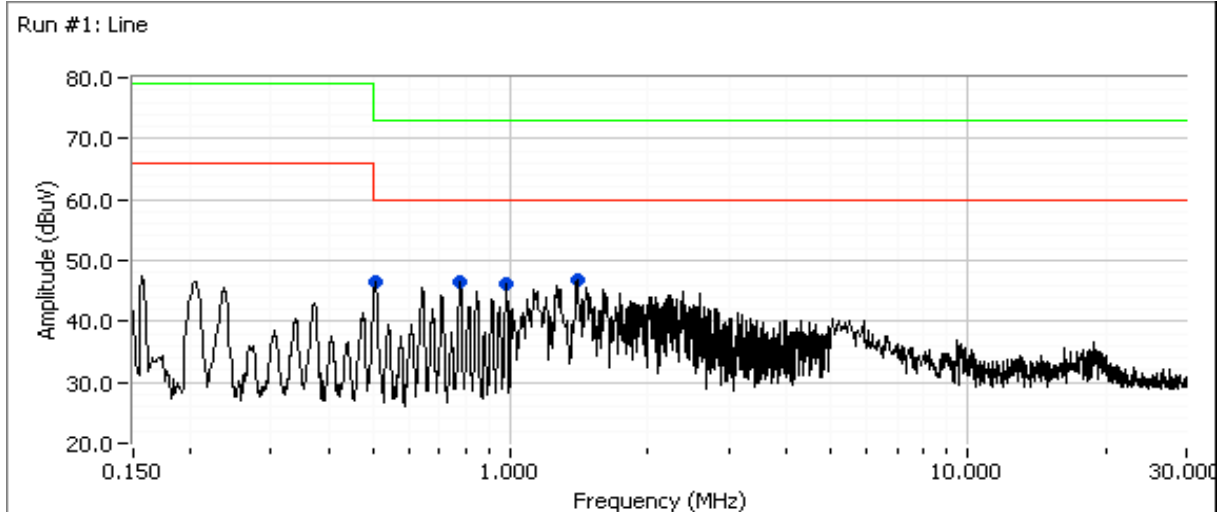
No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	Radio

Run #1: AC Power Port Conducted Emissions of Host IDU, 0.15 - 30MHz, 120V/60Hz





EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	Radio

Run #1: AC Power Port Conducted Emissions of Host IDU, 0.15 - 30MHz, 120V/60Hz

Frequency MHz	Level dBμV	AC Line	FCC Class A		Detector QP/Ave	Comments
			Limit	Margin		
1.400	46.8	Neutral	60.0	-13.2	Peak	Peak reading compared to average limit
0.507	46.5	Neutral	60.0	-13.5	Peak	Peak reading compared to average limit
0.775	46.4	Neutral	60.0	-13.6	Peak	Peak reading compared to average limit
0.979	46.3	Neutral	60.0	-13.7	Peak	Peak reading compared to average limit
2.200	46.0	Neutral	60.0	-14.0	Peak	Peak reading compared to average limit
0.810	44.1	Neutral	60.0	-15.9	Peak	Peak reading compared to average limit
0.163	49.9	Neutral	66.0	-16.1	Peak	Peak reading compared to average limit
0.976	41.0	Neutral	60.0	-19.0	Peak	Peak reading compared to average limit



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	Radio

Radio Performance Test - Part 101 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: 6/29/2006

Config. Used: 1

Test Engineer: David Bare

Config Change: None

Test Location: Environmental Chamber

EUT Voltage: -48Vdc from host IDU

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. The EUT was placed inside an environmental chamber.

Summary of Results

Run #	Test Performed	Limit	Result	Value / Margin
1, 2	Frequency Stability Over Temperature and Voltage	Part 101	Pass	+1.4/-0.3ppm

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.



EMC Test Data

Client:	Microwave Data Systems	Job Number:	J64345
Model:	PUMA 4 ODU's	T-Log Number:	T64472
Contact:	Greg Mills	Account Manager:	Esther Zhu
Spec:	Part 101	Class:	Radio

Run #1: Temperature Vs. Frequency

Specification is 0.005% or 50ppm

T (°C)	Ref Frequency ¹ (MHz)	Frequency at T (MHz)	Drift (Hz)	Drift (ppm)
-30	6412.197260	6412.205925	8665	1.4
-20	6412.197260	6412.205579	8319	1.3
-10	6412.197260	6412.205079	7819	1.2
0	6412.197260	6412.202079	4819	0.8
10	6412.197260	6412.199829	2569	0.4
20	6412.197260	6412.197260	0	0.0
30	6412.197260	6412.195083	-2177	-0.3
40	6412.197260	6412.195583	-1677	-0.3
50	6412.197260	6412.200167	2907	0.5
Frequency drift:			+8665/-2177Hz	+1.4/-0.3ppm

Note 1: Ref. Frequency: Frequency measured at 20°C and nominal input voltage(s). EUT transmitting CW signal.
Measurements made with RB=1kHz, VB=3kHz, Span = 10kHz.

Run #2: Voltage Vs. Frequency

Nominal Voltage is: 48 Vdc

Voltage	Ref Frequency ¹ (MHz)	Frequency Drift (MHz)	Drift (Hz)	Drift (ppm)	Comment
(Dc)	(MHz)	(MHz)	(Hz)	(ppm)	
85%	6412.197260	6412.197335	75	0.0	40.8 v
115%	6412.197260	6412.197177	-83	0.0	55.2 v
Frequency drift:			+75/-83Hz	+0.0/-0.0ppm	

Note 1: Ref. Frequency: Frequency measured at 20°C and nominal input voltage(s). EUT transmitting CW signal.
Measurements made with RB=1kHz, VB=3kHz, Span = 10kHz.

EXHIBIT 3: Test Configuration Photographs

Uploaded as A Separate Attachment

EXHIBIT 4: Theory of Operation Microwave Data Systems Model PUMA 4 ODUs

Uploaded as A Separate Attachment

EXHIBIT 5: Proposed FCC ID Label & Label Location

Uploaded as A Separate Attachment

EXHIBIT 6: Detailed Photographs Microwave Data Systems Model PUMA 4 ODUs

Uploaded as A Separate Attachment

EXHIBIT 7: Installation Guide Microwave Data Systems Model PUMA 4 ODUs

Uploaded as A Separate Attachment

EXHIBIT 8: Block Diagram Microwave Data Systems Model PUMA 4 ODUs

Uploaded as A Separate Attachment

EXHIBIT 9: Schematic Diagrams Microwave Data Systems Model PUMA 4 ODU's

Uploaded as A Separate Attachment