

**M. Flom Associates, Inc. - Global Compliance Center**

3356 North San Marcos Place, Suite 107, Chandler, Arizona 85225-7176

www.mflom.com general@mflom.com (480) 926-3100, FAX: 926-3598

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Date: April 16, 2001  
Submitted: April 23, 2001

Federal Communications Commission  
Via: Electronic Filing

Attention: Authorization & Evaluation Division

Applicant: Modular Mining Systems Inc  
Equipment: 301805 (Repeater) 301582 (Mobile)  
FCC ID: FJ6-301582  
FCC Rules: 15.247, Confidentiality

Gentlemen:

Please refer to the email of March 29<sup>th</sup>, 2001 from Joe Dichoso in which he advises that one identifier can be assigned to the repeater and mobile units.

Based on that information, attached please find Application Form 731, filing fees, Test Data Report for both and enumerated on the Table of Contents, together with required documentation.

We trust the same is in order. Should you desire any further information, kindly contact the writer who is authorized to as agent.

Thanks in advance for your information and advice.

Best personal regards,

A handwritten signature in black ink, reading "M. Flom P. Eng.", is written over a horizontal line.

Morton Flom, P. Eng.

enclosure(s)  
cc: Applicant  
MF/cvr

LIST OF EXHIBITS  
(FCC **CERTIFICATION** (TRANSMITTERS) - REVISED 9/28/98)

APPLICANT: Modular Mining Systems Inc

FCC ID: FJ6-301582

BY APPLICANT:

- |    |  |   |
|----|--|---|
| 1. | LETTER OF AUTHORIZATION  | * |
| 2. | IDENTIFICATION DRAWINGS  | * |
|    | <input checked="" type="checkbox"/> ID LABEL                         |   |
|    | <input checked="" type="checkbox"/> LOCATION INFO                    |   |
|    | <input checked="" type="checkbox"/> ATTESTATION STATEMENT(S)         |   |
|    | <input checked="" type="checkbox"/> LOCATION OF COMPLIANCE STATEMENT |   |
| 3. | DOCUMENTATION: 2.1033(b)   |   |
|    | MANUALS: Spread Spectrum Radio System and                            |   |
|    | Radio SW Operation Instruction                                       | * |
|    | OPERATIONAL DESCRIPTION  | * |
|    | BLOCK DIAGRAM  | * |
|    | SCHEMATIC DIAGRAM  | * |
|    | EXTERNAL PHOTOGRAPHS   | * |
|    | INTERNAL PHOTOGRAPHS   | * |
|    | PARTS LIST   | * |
|    | TUNE UP INFO   | * |
|    | ACTIVE DEVICES   | * |
| 4. | FUNCTIONAL SPECIFICAITONS, ELECTRICAL & MECHANICAL                   |   |
|    | SPECIFICATIONS, and DSSS RADIO SPECIFICATIONS                        | * |
| 5. | PROCESING GAIN: Harris Semiconductor                                 | * |

BY M.F.A. INC.

- A. TESTIMONIAL & STATEMENT OF CERTIFICATION
- B. STATEMENT OF QUALIFICATIONS



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T R A N S M I T T E R      C E R T I F I C A T I O N

of

FCC ID: FJ6-301582  
MODEL: 301805 (Repeater)

to

FEDERAL COMMUNICATIONS COMMISSION

Rule Part(s) 15.247, Confidentiality

DATE OF REPORT: April 16, 2001

ON THE BEHALF OF THE APPLICANT:

Modular Mining Systems Inc

AT THE REQUEST OF:

P.O. 4500012536

Modular Mining Systems Inc  
3289 East Hemisphere Loop  
Tucson, AZ 85706-5028

Attention of: (520) 746-9127; FAX: 889-5790 (Headquarters)  
Lyle V Johnson, Vice President, Product Eng'g  
Romer Johnson, Supervisor, Product Design  
(520) 806-3603; FAX: 3344  
Email: johnsonr@mmsi.com  
and/or Eric Gustafson, Senior RF Systems Engineer  
Email: eric@mmsi.com  
(520) 806-3235; FAX: -3344

SUPERVISED BY:

A handwritten signature in black ink, reading 'M. Flom P. Eng.', is positioned above the printed name of the supervisor.

Morton Flom, P. Eng.

THE APPLICANT HAS BEEN CAUTIONED AS TO THE FOLLOWING:

15.21 INFORMATION TO USER.

The users manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) SPECIAL ACCESSORIES.

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

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<b>MOBILE RADIO TEST DATA</b>		
2.1033(c)	General Information Required	32
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15.247(d)	Transmitter Power Density	55
15.247(e)	Processing Gain (Summary)	55

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*Required information per ISO/IEC Guide 25-1990, paragraph 13.2:*

a) TEST REPORT

b) Laboratory: M. Flom Associates, Inc.  
(FCC: 31040/SIT) 3356 N. San Marcos Place, Suite 107  
(Canada: IC 2044) Chandler, AZ 85225

c) Report Number: d0140005

d) Client: Modular Mining Systems Inc  
3289 East Hemisphere Loop  
Tucson, AZ 85706-5028

e) Identification: 301805 (Repeater) 301582 (Mobile)  
FCC ID: FJ6-301582  
Description: 2.4Ghz Radio

f) EUT Condition: Not required unless specified in individual tests.

g) Report Date: April 16, 2001  
EUT Received: March 12, 2001

h, j, k): As indicated in individual tests.

i) Sampling method: No sampling procedure used.

l) Uncertainty: In accordance with MFA internal quality manual.

m) Supervised by:



Morton Flom, P. Eng.

n) Results: The results presented in this report relate only to the item tested.

o) Reproduction: This report must not be reproduced, except in full, without written permission from this laboratory.

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LIST OF GENERAL INFORMATION REQUIRED FOR CERTIFICATION

IN ACCORDANCE WITH FCC RULES AND REGULATIONS,  
VOLUME II, PART 2 AND TO

15.247, Confidentiality

Sub-part 2.1033

(c)(1): NAME AND ADDRESS OF APPLICANT:

Modular Mining Systems Inc  
3289 East Hemisphere Loop  
Tucson, AZ 85706-5028

MANUFACTURER:

Applicant

(c)(2): FCC ID: FJ6-301582

MODEL NO: 301805 (Repeater)

(c)(3): INSTRUCTION MANUAL(S):

PLEASE SEE ATTACHED EXHIBITS

(c)(4): TYPE OF EMISSION: N/A

(c)(5): FREQUENCY RANGE, MHz: 2412 to 2457

(c)(6): POWER RATING, Watts: 0.0361 EIRP  
       \_\_\_ Switchable \_\_\_ Variable x N/A

(c)(7): MAXIMUM POWER RATING, Watts: 50 mv/m @ 3m

15.203: ANTENNA REQUIREMENT:

\_\_\_ The antenna is permanently attached to the EUT  
 \_\_\_ The antenna uses a unique coupling  
x The EUT must be professionally installed  
 \_\_\_ The antenna requirement does not apply

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Subpart 2.1033 (continued)

(c)(8): VOLTAGES & CURRENTS IN ALL ELEMENTS IN FINAL R. F. STAGE,  
INCLUDING FINAL TRANSISTOR OR SOLID STATE DEVICE:

COLLECTOR CURRENT, A = per manual  
COLLECTOR VOLTAGE, Vdc = per manual  
SUPPLY VOLTAGE, Vdc = 24

(c)(9): TUNE-UP PROCEDURE:

PLEASE SEE ATTACHED EXHIBITS

(c)(10): CIRCUIT DIAGRAM/CIRCUIT DESCRIPTION:

Including description of circuitry & devices provided for  
determining and stabilizing frequency, for suppression of  
spurious radiation, for limiting modulation and limiting  
power.

PLEASE SEE ATTACHED EXHIBITS

(c)(11): LABEL INFORMATION:

PLEASE SEE ATTACHED EXHIBITS

(c)(12): PHOTOGRAPHS:

PLEASE SEE ATTACHED EXHIBITS

(c)(13): DIGITAL MODULATION DESCRIPTION:

     ATTACHED EXHIBITS  
  x   N/A

(c)(14): TEST AND MEASUREMENT DATA:






FOLLOWS



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M. Flom Associates, Inc. is accredited by the American Association for Laboratory Accreditation (A2LA) as shown in the scope below.

 <p><b>THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION</b></p> <p><b>ACCREDITED LABORATORY</b></p> <p>A2LA has accredited</p> <p><b>M. FLOM ASSOCIATES, INC.</b> <b>Chandler, AZ</b></p> <p>for technical competence in the field of</p> <p><b>Electrical (EMC) Testing</b></p> <p>The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002.</p> <p>Presented this 2<sup>nd</sup> day of March, 2001.</p> <div style="display: flex; justify-content: space-between; align-items: center;">  <div>               President              For the Accreditation Council              Certificate Number 1008.01              Valid to December 31, 2002           </div> </div> <p>For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation</p>	 <p><b>American Association for Laboratory Accreditation</b></p> <p><u>SCOPE OF ACCREDITATION TO ISO/IEC 17025:1999</u></p> <p>M. FLOM ASSOCIATES, INC. Electronic Testing Laboratory 3356 North San Marcos Place, Suite 107 Chandler, AZ 85225 Morton Flom Phone: 480 926 3100</p> <p><b>ELECTRICAL (EMC)</b></p> <p>Valid to: December 31, 2002 Certificate Number: 1008-01</p> <p>In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following <u>electromagnetic compatibility tests</u>:</p> <table border="0"> <thead> <tr> <th style="text-align: left;">Tests</th> <th style="text-align: left;">Standard(s)</th> </tr> </thead> <tbody> <tr> <td>RF Emissions</td> <td>FCC Part 15 (Subparts B and C) using ANSI C63.4-1992; CISPR 11; CISPR 13; CISPR 14; CISPR 22; EN 55011; EN 55013; EN 55014; EN 55022; EN 50081-1; EN 50081-2; ICES-003; AS/NZS 1044; AS/NZS 1053; AS/NZS 3548; AS/NZS 4251.1; CNS 13438</td> </tr> <tr> <td>Harmonic Currents</td> <td>EN 61000-3-2</td> </tr> <tr> <td>Fluctuation and Flicker</td> <td>EN 61000-3-3</td> </tr> <tr> <td>RF Immunity</td> <td>EN: 50082-1, 50082-2 (both excluding "Power Frequency Magnetic Field Immunity" and "Voltage Dips, Short Interruptions, and Line Voltage Variations"); AS/NZS 4251.1</td> </tr> <tr> <td>Radiated Susceptibility</td> <td>EN 61000-4-3; ENV 50140; ENV 50204; IEC 1000-4-3; IEC 801-3</td> </tr> <tr> <td>EFT</td> <td>EN 61000-4-4; IEC 1000-4-4; IEC 801-4</td> </tr> <tr> <td>Surge</td> <td>EN 61000-4-5; ENV 50142; IEC 1000-4-5; IEC 801-5</td> </tr> <tr> <td>47 CFR (FCC)</td> <td>2, 21, 22, 23, 24, 74, 80, 87, 90, 95, 97</td> </tr> </tbody> </table> <div style="text-align: right;">  </div> <p>5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974</p>	Tests	Standard(s)	RF Emissions	FCC Part 15 (Subparts B and C) using ANSI C63.4-1992; CISPR 11; CISPR 13; CISPR 14; CISPR 22; EN 55011; EN 55013; EN 55014; EN 55022; EN 50081-1; EN 50081-2; ICES-003; AS/NZS 1044; AS/NZS 1053; AS/NZS 3548; AS/NZS 4251.1; CNS 13438	Harmonic Currents	EN 61000-3-2	Fluctuation and Flicker	EN 61000-3-3	RF Immunity	EN: 50082-1, 50082-2 (both excluding "Power Frequency Magnetic Field Immunity" and "Voltage Dips, Short Interruptions, and Line Voltage Variations"); AS/NZS 4251.1	Radiated Susceptibility	EN 61000-4-3; ENV 50140; ENV 50204; IEC 1000-4-3; IEC 801-3	EFT	EN 61000-4-4; IEC 1000-4-4; IEC 801-4	Surge	EN 61000-4-5; ENV 50142; IEC 1000-4-5; IEC 801-5	47 CFR (FCC)	2, 21, 22, 23, 24, 74, 80, 87, 90, 95, 97
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47 CFR (FCC)	2, 21, 22, 23, 24, 74, 80, 87, 90, 95, 97																		

"This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this report have been determined in accordance with the laboratory's terms of accreditation unless stated otherwise in the report."

Should this report contain any data for tests for which we are not accredited, or which have been undertaken by a subcontractor that is not A2LA accredited, such data would not covered by this laboratory's A2LA accreditation.

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Sub-part  
2.1033(b):TEST AND MEASUREMENT DATA

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.1031, 2.1033, 2.1035, 2.1041, 2.1043, 2.1045, and the following individual Parts:

- \_\_\_\_\_ 15.209 Radiated emission limits; general requirements
- \_\_\_\_\_ 15.211 Tunnel radio systems
- \_\_\_\_\_ 15.213 Cable locating equipment
- \_\_\_\_\_ 15.214 Cordless telephones
- \_\_\_\_\_ 15.217 Operation in the band 160-190 kHz
- \_\_\_\_\_ 15.219 Operation in the band 510-1705 kHz
- \_\_\_\_\_ 15.221 Operation in the band 525-1705 kHz (leaky coax)
- \_\_\_\_\_ 15.223 Operation in the band 1.705-10 MHz
- \_\_\_\_\_ 15.225 Operation in the band 13.553-13.567 MHz
- \_\_\_\_\_ 15.227 Operation in the band 26-27.28 MHz (remote control)
- \_\_\_\_\_ 15.229 Operation in the band 40.66-40.70 MHz
- \_\_\_\_\_ 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz
- \_\_\_\_\_ 15.233 Operation within the bands 43.71-44.49, 46.60-46.98 MHz 48.75-49.51 MHz and 49.66-50.0 MHz
- \_\_\_\_\_ 15.235 Operation within the band 49.82-49.90 MHz
- \_\_\_\_\_ 15.237 Operation within the bands 72.0-73.0 MHz, 74.6-74.8 MHz and 75.2-76.0 MHz (auditory assistance)
- \_\_\_\_\_ 15.239 Operation in band 88-108 MHz
- \_\_\_\_\_ 15.241 Operation in the band 174-216 MHz (biomedical)
- \_\_\_\_\_ 15.243 Operation in the band 890-940 MHz (materials)
- \_\_\_\_\_ 15.245 Operation within the bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz, and 24075-24175 MHz (filed disturbance sensors)
- x \_\_\_\_\_ 15.247 Operation within bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz (spread spectrum)
- \_\_\_\_\_ 15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz
- \_\_\_\_\_ 15.251 Operation within the bands 2.9-3.26 GHz, 3.267-3.332 GHz, 3.339-3.3458 GHz, and 3.358-3.6 GHz (vehicle identification systems)
- \_\_\_\_\_ 15.321 Specific requirements for asynchronous devices operating in the 1910-1920 MHz and 2390-2400 MHz bands (Unlicensed PCS)
- \_\_\_\_\_ 15.323 Specific requirements for isochronous devices operating in the 1920-1930 MHz sub-band (Unlicensed PCS)

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STANDARD TEST CONDITIONS  
and  
ENGINEERING PRACTICES

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.4-1992/2000, section 6.1.9, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104 °F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst case measurements.

PAGE NO. 7 of 58.  
NAME OF TEST: Maximum Peak Output Power  
SPECIFICATION: 47 CFR 15.247(b)  
SPEC. LIMIT:  $\leq 1$  Watt peak (0.25 if <50 Hopping Channels)  
TEST EQUIPMENT: Attached

MEASUREMENT DATA

ANTENNA GAIN, dBi = 6 dBi net  
 PEAK OUTPUT POWER, Watts = 0.036  
 WORST CASE FOR  
 ALL CHANNELS

RADIATED:

g0130071: 2001-Mar-14 Wed 12:01:00

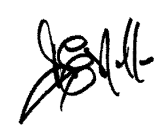
FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	METER, dBuV	CF, dB	uV/m @ 3m	EIRP dBm	EIRP, W
2412.000000	2412.830000	65.31	45.27	338064.84	15.4	0.03444
2432.000000	2433.000000	65.36	45.4	345143.74	15.5	0.03606
2457.000000	2455.050000	62.37	45.54	248599.36	12.7	0.018497

NOTE: Antenna Gain: 1) Repeater = 8 dBi  
 Loss through 24 ft, LMR400 Cable = 2 dB  
 Net Gain = 6 dBi

Conducted Values:

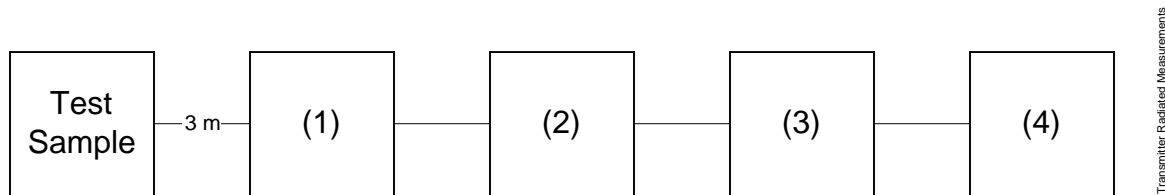
MHz	dBm	Watts
2412	24.6	0.2884
2432	24.3	0.2691
2457	23.6	0.2290

PERFORMED BY:

  
 Doug Noble, B.A.S. E.E.T.

PAGE NO.

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TRANSMITTER RADIATED MEASUREMENTS

Asset	Description (as applicable)	s/n
(1)	<u>TRANSDUCER</u>	
i00091	Emco 3115	001469
i00089	Apriel Log Periodic	001500
i00088	EMCO 3301-B Biconical	2336
(2)	<u>HIGH PASS FILTER</u>	
i00	Narda $\mu$ PAD (In-Band Only)	
i00	Trilithic (Out-Of-Band Only)	
(3)	<u>PREAMP</u>	
i00028	HP 8449 (+30 dB)	2749A00121
(4)	<u>SPECTRUM ANALYZER</u>	
i00048	HP 8566B	2511A01467
i00057	HP 8557A	1531A00191
i00029	HP 8563E	3213A00104

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TEST SETUP: Radiated Emissions  
g0130031: 2001-Mar-15 Thu 10:39:11  
STATE: 0:General



TEST SETUP: Radiated Emissions  
g0130032: 2001-Mar-15 Thu 10:39:11  
STATE: 0:General




PAGE NO. 10 of 58.

NAME OF TEST: Out of Band Emissions

SPECIFICATION: 47 CFR 15.247(c)

SPURIOUS EMISSIONS g0130087:2001-Mar-14 Wed 15:23:00

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	METER, dBuV	CF, dB	uV/m @ 3m	EIRP dBm	EIRP, W
2412.000000	4824.000000	23	8.88	39.26	-63.3	0.0000000047
2412.000000	4824.100000	36.33	8.88	182.18	-50	0.00000001
2432.000000	4864.033333	22.17	8.96	36.02	-64.1	0.0000000039
2432.000000	4864.066667	37.67	8.96	214.54	-48.6	0.000000014
2457.000000	4914.016667	23.17	9.05	40.83	-63	0.0000000005
2457.000000	4914.100000	36.17	9.05	182.39	-50	0.00000001
2412.000000	7236.000000	21.67	13.05	54.45	-60.5	0.0000000089
2412.000000	7236.016667	33.33	13.05	208.45	-48.8	0.000000013
2432.000000	7296.033333	31.67	13.15	174.18	-50.4	0.0000000091
2432.000000	7296.033333	21.83	13.15	56.1	-60.2	0.0000000096
2457.000000	7371.016667	32.83	13.27	201.84	-49.1	0.000000012
2457.000000	7371.016667	22.17	13.27	59.16	-59.8	0.000000001
2412.000000	9648.016667	22.33	15.71	79.8	-57.2	0.0000000019
2412.000000	9648.016667	31.17	15.71	220.8	-48.3	0.000000015
2432.000000	9728.033333	22.33	15.78	80.45	-57.1	0.000000002
2432.000000	9728.033333	32.83	15.78	269.46	-46.6	0.000000022
2457.000000	9828.016667	23	15.86	87.7	-56.4	0.0000000023
2457.000000	9828.016667	32.83	15.86	271.96	-46.5	0.000000022
2412.000000	12060.016667	32.33	17.43	307.61	-45.5	0.000000028
2412.000000	12060.016667	22.17	17.43	95.5	-55.6	0.0000000028
2432.000000	12160.033333	29.83	17.16	223.61	-48.2	0.000000015
2432.000000	12160.033333	22.17	17.16	92.58	-55.9	0.0000000026
2457.000000	12285.016667	22.17	16.8	88.82	-56.3	0.0000000023
2457.000000	12285.016667	31.5	16.8	260.02	-46.9	0.00000002
2412.000000	14472.016667	23.17	18.42	120.09	-53.6	0.0000000044
2412.000000	14472.016667	34.17	18.42	426.09	-42.6	0.000000055
2432.000000	14592.033333	23	18.37	117.08	-53.9	0.0000000041
2432.000000	14592.033333	29.83	18.37	257.04	-47	0.00000002
2457.000000	14742.016667	33.5	18.32	389.94	-43.4	0.000000046
2457.000000	14742.016667	23.33	18.32	120.92	-53.6	0.0000000044
2412.000000	16884.016667	31.17	19.58	344.75	-44.5	0.000000035
2412.000000	16884.016667	23.17	19.58	137.25	-52.5	0.0000000056
2432.000000	17024.033333	29.67	19.87	299.92	-45.7	0.000000027
2432.000000	17024.033333	23	19.87	139.16	-52.4	0.0000000058
2457.000000	17199.016667	22.83	20.34	144.05	-52.1	0.0000000062
2457.000000	17199.016667	31.83	20.34	405.98	-43.1	0.000000049



PERFORMED BY:

Doug Noble, B.A.S. E.E.T.

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NAME OF TEST: Out of Band Emissions

SPECIFICATION: 47 CFR 15.247(c), 15.209(a)

SPEC. LIMIT: See Below

TEST EQUIPMENT: As per previous page

SEARCH ANTENNAS: 10 kHz - 32 MHz: LOOP 94598-1  
 32 MHz - 1 GHz: SINGER DM105,T<sub>1</sub>T<sub>2</sub>T<sub>3</sub>  
 1 GHz - 18 GHz: EMCO 3115

### LIMIT

In any 100 kHz bandwidth outside these frequency bands, radio frequency power that is produced by the modulation products of the spreading sequence, information sequence, and the carrier frequency shall be either

at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power

or

shall not exceed the general levels specified in 15.209(a),

whichever results in the lesser attenuation.

All other emissions outside these bands shall not exceed the general radiated emission limits specified in 15.209(a).

### MEASUREMENTS PROCEDURE:

At first, bench tests were performed to locate the emissions at the antenna terminals.

In the field, tests were conducted over the range shown. The test sample was set up on a wooden turntable above ground, and at a distance of three meters from the antenna connected to the spectrum analyzer.

In order to obtain the maximum response at each frequency, the turntable was rotated, and the search antenna was raised and lowered. The EUT was also adjusted for maximum response.

The field strength was calculated from:

$$E \text{ } \mu\text{V/m @ 3 m} = \text{LOG}_{10}^{-1}(\text{dBm} + 107 + \text{A.F.} + \text{C.L.})$$

The following results are worst case conditions. Tests were conducted in Horizontal and Vertical polarization modes.

MEASUREMENT RESULTS: ATTACHED



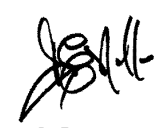
PAGE NO. 12 of 58.

NAME OF TEST: Out of Band Emissions  
 g0130080: 2001-Mar-14 Wed 13:50:00  
 STATE: 1:Lower Bandedge

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	METER dBuV	CF, dB	uV/m @ 3m	EIRP dBuV	MARGIN dB	*PEAK AVERAGE
2412.000000	2376.500000	7.41	44.93	414	-42.9	-1.7	AVERAGE
2412.000000	2376.580000	19.56	44.93	1676.87	-30.7	10.5	PEAK
2412.000000	2378.000000	19.81	44.95	1729.82	-30.5	10.8	PEAK
2412.000000	2378.000000	7.33	44.95	411.15	-42.9	-1.7	AVERAGE
2412.000000	2379.500000	7.35	44.96	412.57	-42.9	-1.7	AVERAGE
2412.000000	2379.580000	18.84	44.96	1548.82	-31.4	9.8	PEAK
2412.000000	2381.000000	18.38	44.98	1472.31	-31.9	9.4	PEAK
2412.000000	2381.000000	7.37	44.98	414.48	-42.9	-1.7	AVERAGE
2412.000000	2382.430000	7.34	44.99	413.52	-42.9	-1.7	AVERAGE
2412.000000	2382.650000	20.3	45.01	1842.89	-29.9	11.3	PEAK
2412.000000	2384.000000	18.67	45.02	1529.33	-31.5	9.7	PEAK
2412.000000	2384.000000	7.41	45.02	418.31	-42.8	-1.6	AVERAGE
2412.000000	2385.500000	7.35	45.04	416.39	-42.8	-1.6	AVERAGE
2412.000000	2385.500000	20.36	45.04	1862.09	-29.8	11.4	PEAK
2412.000000	2387.000000	19.53	45.05	1694.34	-30.6	10.6	PEAK
2412.000000	2387.000000	7.42	45.05	420.24	-42.8	-1.5	AVERAGE
2412.000000	2388.430000	7.34	45.07	417.35	-42.8	-1.6	AVERAGE
2412.000000	2388.500000	19.2	45.07	1634.93	-31	10.3	PEAK
2412.000000	2390.000000	18.83	45.08	1568.56	-31.3	9.9	PEAK
2412.000000	2390.000000	7.34	45.08	417.83	-42.8	-1.6	AVERAGE

\*PEAK AND AVERAGE VALUES

PERFORMED BY:

  
 Doug Noble, B.A.S. E.E.T.

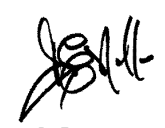
PAGE NO. 13 of 58.

NAME OF TEST: Out of Band Emissions  
 g0130083: 2001-Mar-14 Wed 14:31:00  
 STATE: 1:Upper bandedge

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	METER dBuV	CF, dB	uV/m @ 3m	EIRP dBuV	MARGIN dB	PEAK AVERAGE
2457.000000	2483.500000	18.57	45.72	1638.7	-30.9	10.3	PEAK
2457.000000	2483.500000	7.33	45.72	449.26	-42.2	-1	AVERAGE
2457.000000	2484.850000	7.17	45.73	441.57	-42.3	-1.1	AVERAGE
2457.000000	2484.930000	17.62	45.73	1470.62	-31.9	9.4	PEAK
2457.000000	2486.500000	18.42	45.74	1614.36	-31.1	10.2	PEAK
2457.000000	2486.500000	7.14	45.74	440.55	-42.3	-1.1	AVERAGE
2457.000000	2487.930000	18.92	45.75	1711.99	-30.6	10.7	PEAK
2457.000000	2488.080000	7.12	45.75	440.05	-42.4	-1.1	AVERAGE
2457.000000	2489.500000	18.05	45.75	1548.82	-31.4	9.8	PEAK
2457.000000	2489.500000	7.09	45.75	438.53	-42.4	-1.2	AVERAGE
2457.000000	2491.080000	7.09	45.77	439.54	-42.4	-1.1	AVERAGE
2457.000000	2491.080000	18.26	45.77	1590.38	-31.2	10	PEAK
2457.000000	2492.500000	18.19	45.77	1577.61	-31.3	10	PEAK
2457.000000	2492.500000	7.12	45.77	441.06	-42.3	-1.1	AVERAGE
2457.000000	2493.850000	19.1	45.79	1755.9	-30.3	10.9	PEAK
2457.000000	2494.000000	7.08	45.79	440.05	-42.4	-1.1	AVERAGE
2457.000000	2495.500000	18.06	45.79	1557.76	-31.4	9.9	PEAK
2457.000000	2495.500000	7.13	45.79	442.59	-42.3	-1.1	AVERAGE
2457.000000	2497.150000	7.11	45.81	442.59	-42.3	-1.1	AVERAGE
2457.000000	2497.380000	19.45	45.81	1832.31	-30	11.3	PEAK

\*PEAK AND AVERAGE VALUES

PERFORMED BY:

  
 Doug Noble, B.A.S. E.E.T.

PAGE NO. 14 of 58.

NAME OF TEST: Restricted Bands of Operation

SPECIFICATION: 47 CFR 15.205

TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE

The EUT was set up on a three meter open field site according to the procedure on ANSI C63.4.

Sensitivity of system was measured:

Below 2 GHz:

CISPR Bandwidths	= 8 dB $\mu$ V
1 MHz RBW, 1 MHz VBW	= 12 dB $\mu$ V
1 MHz RBW, 10 Hz VBW	= 3 dB $\mu$ V

Above 2 GHz:

1 MHz RBW, 1 MHz VBW	= 33 dB $\mu$ V
1 MHz RBW, 10 Hz VBW	= 22 dB $\mu$ V

Sensitivity of system with preamps:

Below 2 GHz:

Preamps are not used in this range.

Above 2 GHz:

Peak	= 3 dB $\mu$ V
Average	= -8 dB $\mu$ V

Cable Loss:

915 MHz	= -0.8 dB $\mu$ V
2450 MHz	= -3 dB $\mu$ V

Note:

dB loss vs. frequency included in programmed software.

Reference Level Offset:

set @ 1 dB, accounts for cable and connector loss.

TEST RESULTS: No harmonic or spurious emissions were detected in the restricted bands in excess of the limits of 15.205. System measurement sensitivity was -130 dBm.



PERFORMED BY:

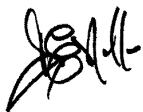
Doug Noble, B.A.S. E.E.T.

PAGE NO. 15 of 58.  
NAME OF TEST: Emissions At Band Edges  
SPECIFICATION: 47 CFR  
TEST EQUIPMENT: As for "Out of Band Emissions"

MEASUREMENT RESULTS

ATTACHED

PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.

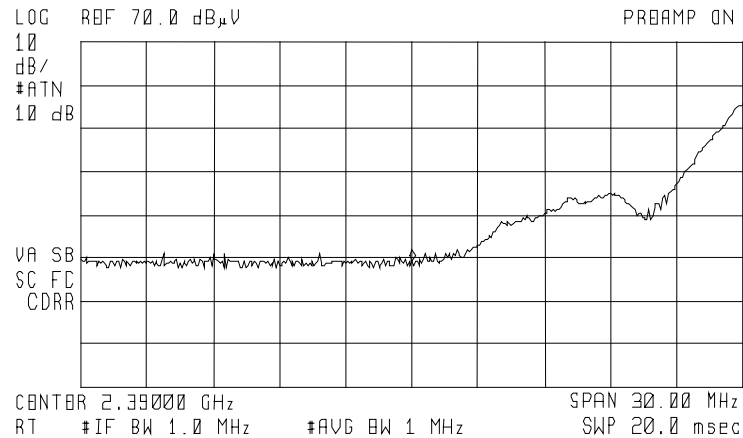
PAGE NO.

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NAME OF TEST: Emission at Band Edges (Conducted)  
g0130079: 2001-Mar-14 Wed 14:04:00  
STATE: 0:Lower Bandedge



ACTV DET: PBAK  
MEAS DET: PBAK QP AVG  
MKR 2.39000 GHz  
19.06 dBμV



PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.

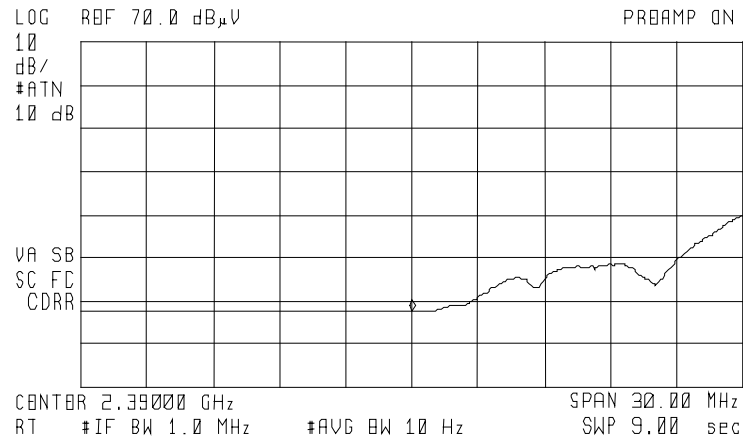
PAGE NO.

17 of 58.

NAME OF TEST: Emission at Band Edges (Conducted)  
g0130078: 2001-Mar-14 Wed 14:03:00  
STATE: 0:Lower Bandedge



ACTV DET: PBAK  
MEAS DET: PBAK QP AVG  
MKR 2.39000 GHz  
7.34 dBμV



PERFORMED BY:

Doug Noble, B.A.S. E.E.T.

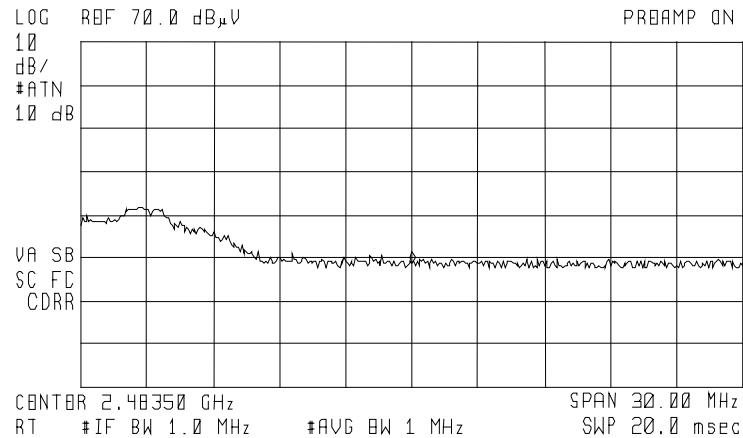
PAGE NO.

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NAME OF TEST: Emission at Band Edges (Conducted)  
g0130081: 2001-Mar-14 Wed 14:33:00  
STATE: 0:Upper Bandedge



ACTV DET: PBAK  
MEAS DET: PBAK QP AVG  
MKR 2.48350 GHz  
18.57 dBμV



PERFORMED BY:

Doug Noble, B.A.S. E.E.T.

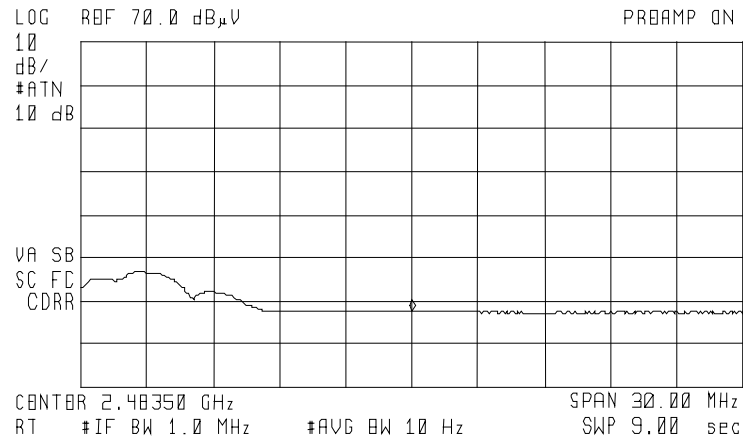
PAGE NO.

19 of 58.

NAME OF TEST: Emission at Band Edges (Conducted)  
g0130082: 2001-Mar-14 Wed 14:37:00  
STATE: 0:Upper Bandedge



ACTV DET: PBAK  
MEAS DET: PBAK QP AVG  
MKR 2.48350 GHz  
7.33 dBμV



PERFORMED BY:

Doug Noble, B.A.S. E.E.T.



PAGE NO. 20 of 58.  
NAME OF TEST: Allowed Occupied Bandwidth  
SPECIFICATION: 47 CFR 15.247(a)(2)  
TEST EQUIPMENT: As per attached page

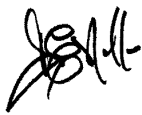
LIMITS

<u>RULE</u>	<u>TYPE</u>	<u>BANDS (MHz)</u>	<u>LIMIT (kHz)</u>
15.247(a)(1)(i)	F.H.	902-928	20 dB BW $\leq$ 500
15.247(a)(1)(ii)	F.H.	2400-2483.5, 5725-5850	20 dB BW $\leq$ 1000
15.247(a)(2)	D.S.	ALL	6 dB BW $\geq$ 500

MEASUREMENT DATA

MEASURED BANDWIDTH, mHz = 10.31  
 RESULTS = ATTACHED

PERFORMED BY:

  
 Doug Noble, B.A.S. E.E.T.

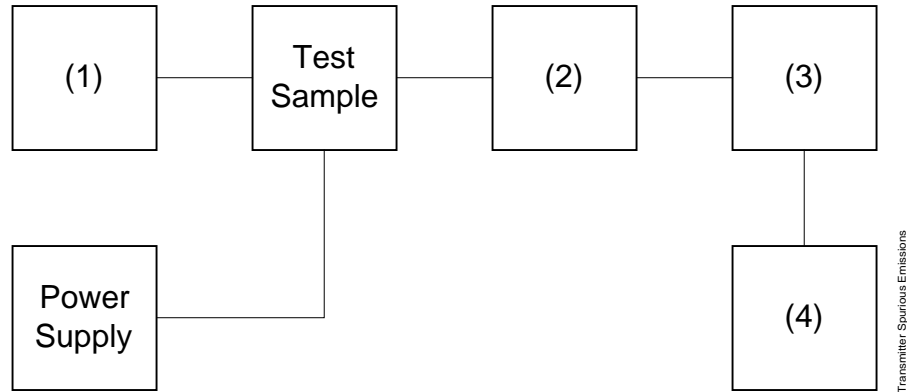
PAGE NO.

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TRANSMITTER SPURIOUS EMISSION

TEST A. OCCUPIED BANDWIDTH (IN-BAND SPURIOUS)

TEST B. OUT-OF-BAND SPURIOUS

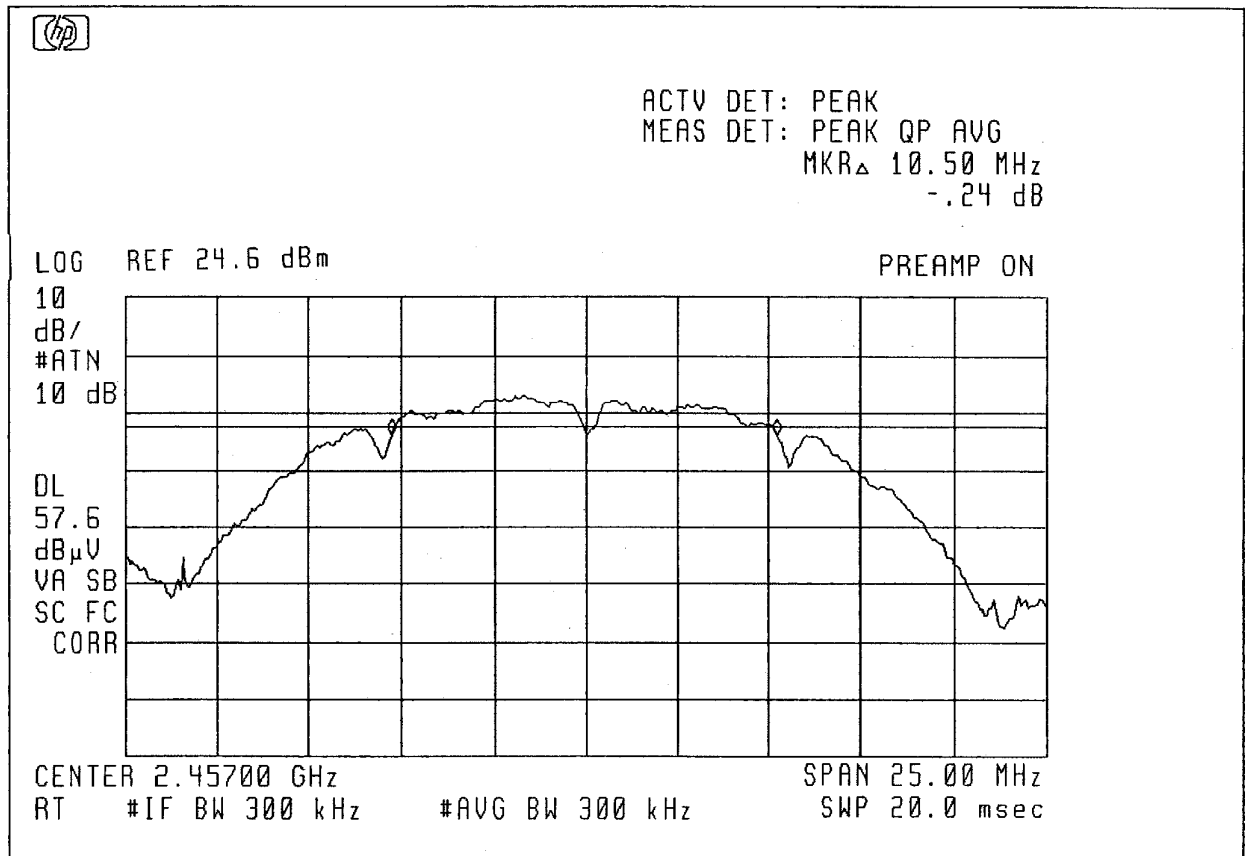


Asset Description (as applicable)	s/n
(1) <u>AUDIO OSCILLATOR/GENERATOR</u>	
i00010 HP 204D	1105A04683
i00017 HP 8903A	2216A01753
i00012 HP 3312A	1432A11250
(2) <u>COAXIAL ATTENUATOR</u>	
i00122 Narda 766-10	7802
i00123 Narda 766-10	7802A
i00069 Bird 8329 (30 dB)	1006
i00113 Sierra 661A-3D	1059
(3) <u>FILTERS; NOTCH, HP, LP, BP</u>	
i00126 Eagle TNF-1	100-250
i00125 Eagle TNF-1	50-60
i00124 Eagle TNF-1	250-850
(4) <u>SPECTRUM ANALYZER</u>	
i00048 HP 8566B	2511A01467
i00029 HP 8563E	3213A00104


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## EMISSIONS

MODULAR MINING SYSTEMS, 301805 (Base)  
2001-MAR-30, 13:34, FRIPOWER: HIGH  
MODULATION: 2 MB/SEC PSUDEO RANDOM DATA  
REMARK: 15.247 (2) (I) 6DB BANDWIDTH

PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.

PAGE NO.

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## EMISSIONS

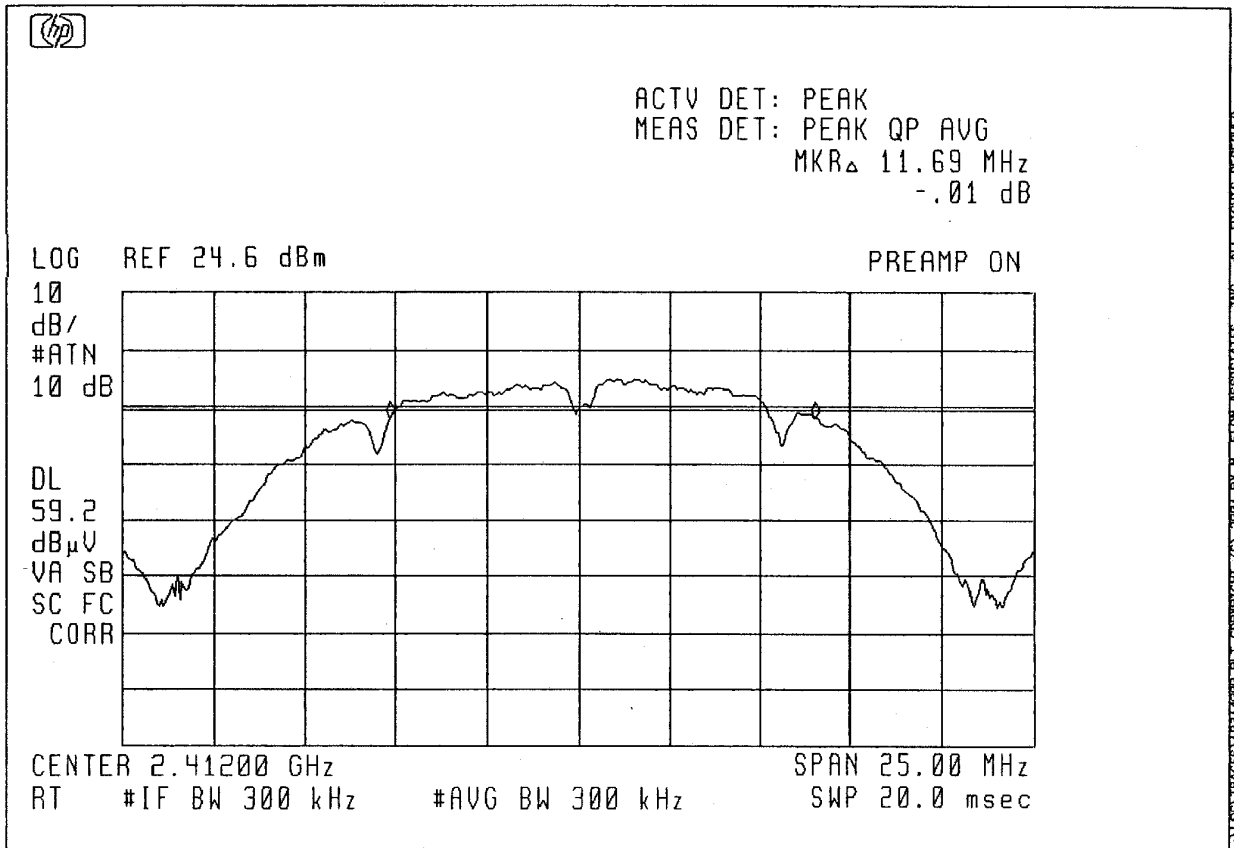
MODULAR MINING SYSTEMS, 301805 (Base)

2001-MAR-30, 13:36, FRI

POWER: HIGH

MODULATION: 2 MB/SEC PSUDEO RANDOM DATA

REMARK: 15.247 (2) (I) 6DB BANDWIDTH



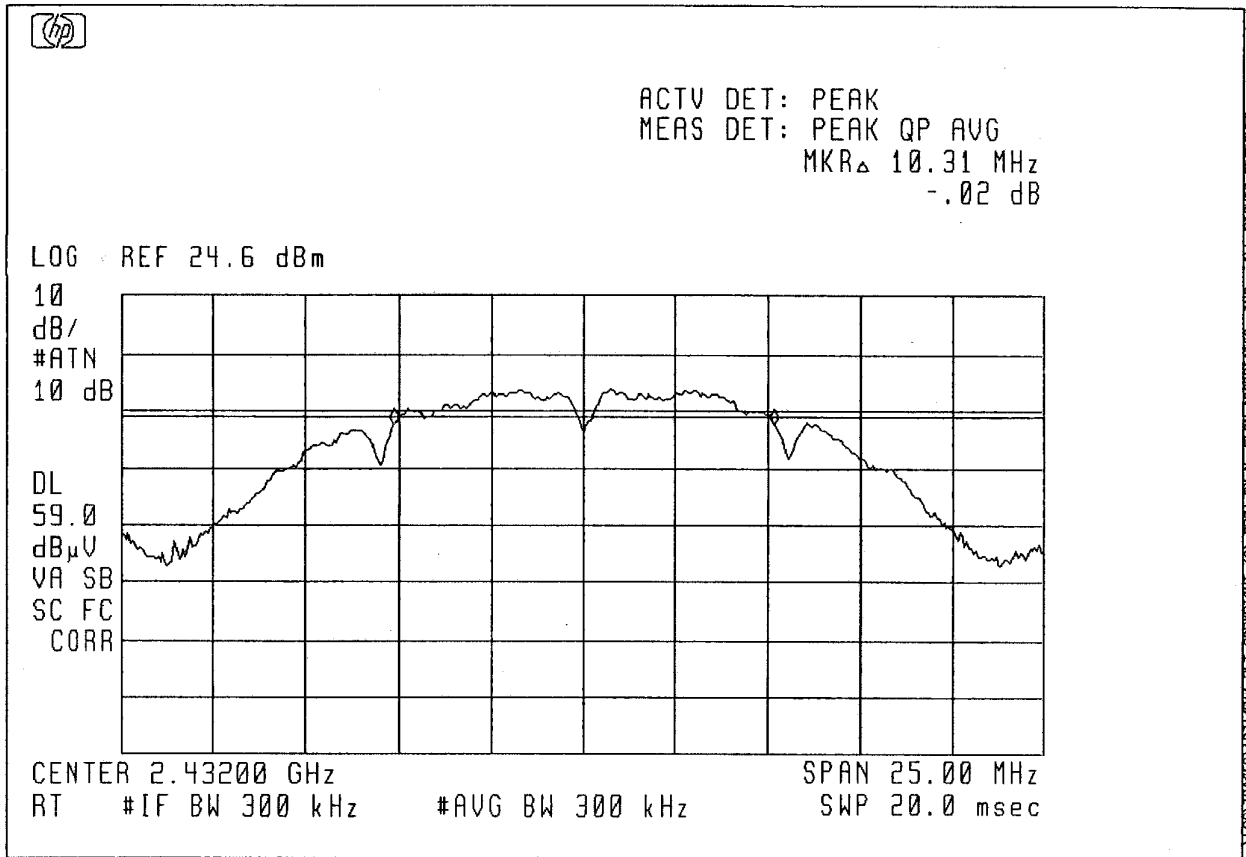
PERFORMED BY:

Doug Noble, B.A.S. E.E.T.

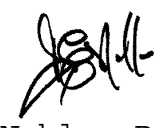
PAGE NO.

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## EMISSIONS

MODULAR MINING SYSTEMS, 301805 (Base)  
2001-MAR-30, 13:31, FRIPOWER: HIGH  
MODULATION: 2 MB/SEC PSUDEO RANDOM DATA  
REMARK: 15.247 (2) (I) 6DB BANDWIDTH

PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.

PAGE NO.

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## EMISSIONS

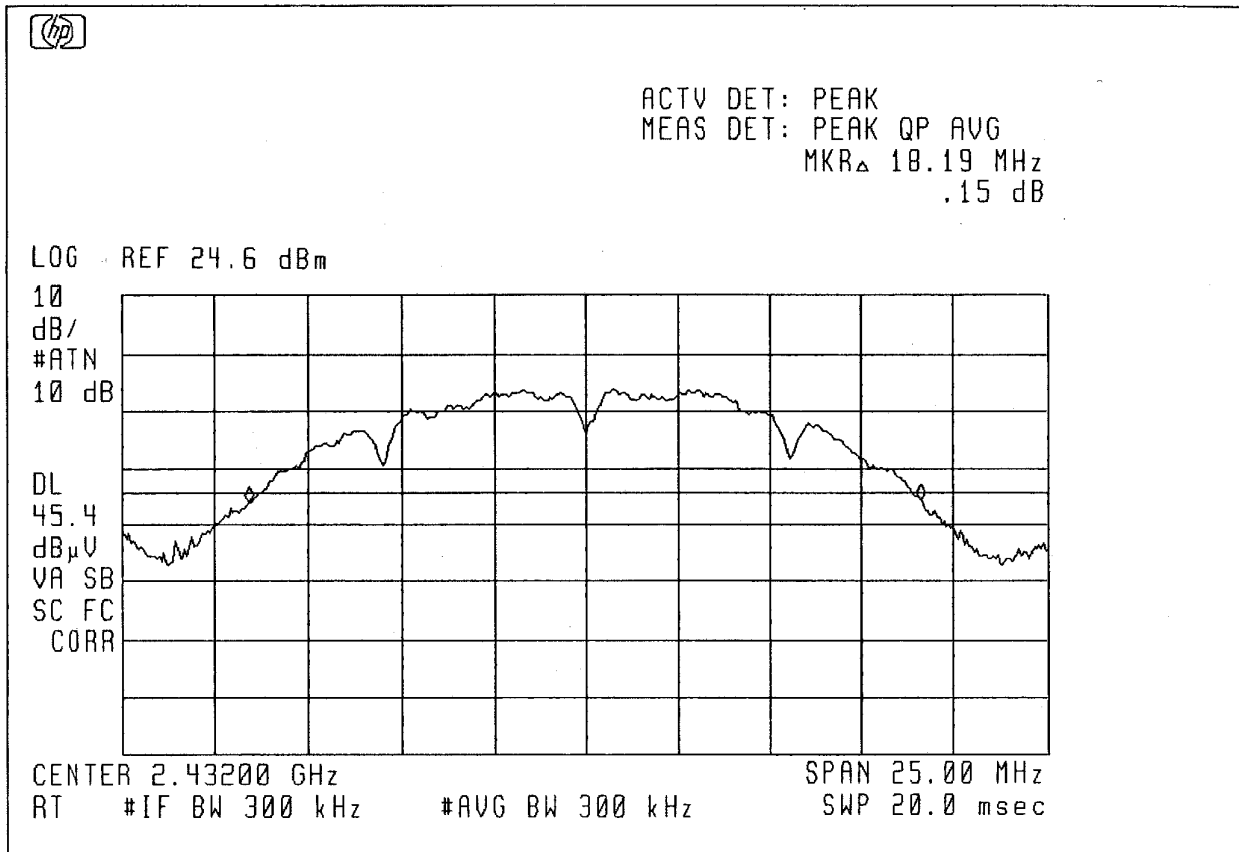
MODULAR MINING SYSTEMS, 301805 (Base)

2001-MAR-30, 13:33, FRI


POWER: HIGH

MODULATION: 2 MB/SEC PSUDEO RANDOM DATA

REMARK: 15.247 (A) (1) (I) 20 DB BANDWIDTH



PERFORMED BY:

  
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PAGE NO.

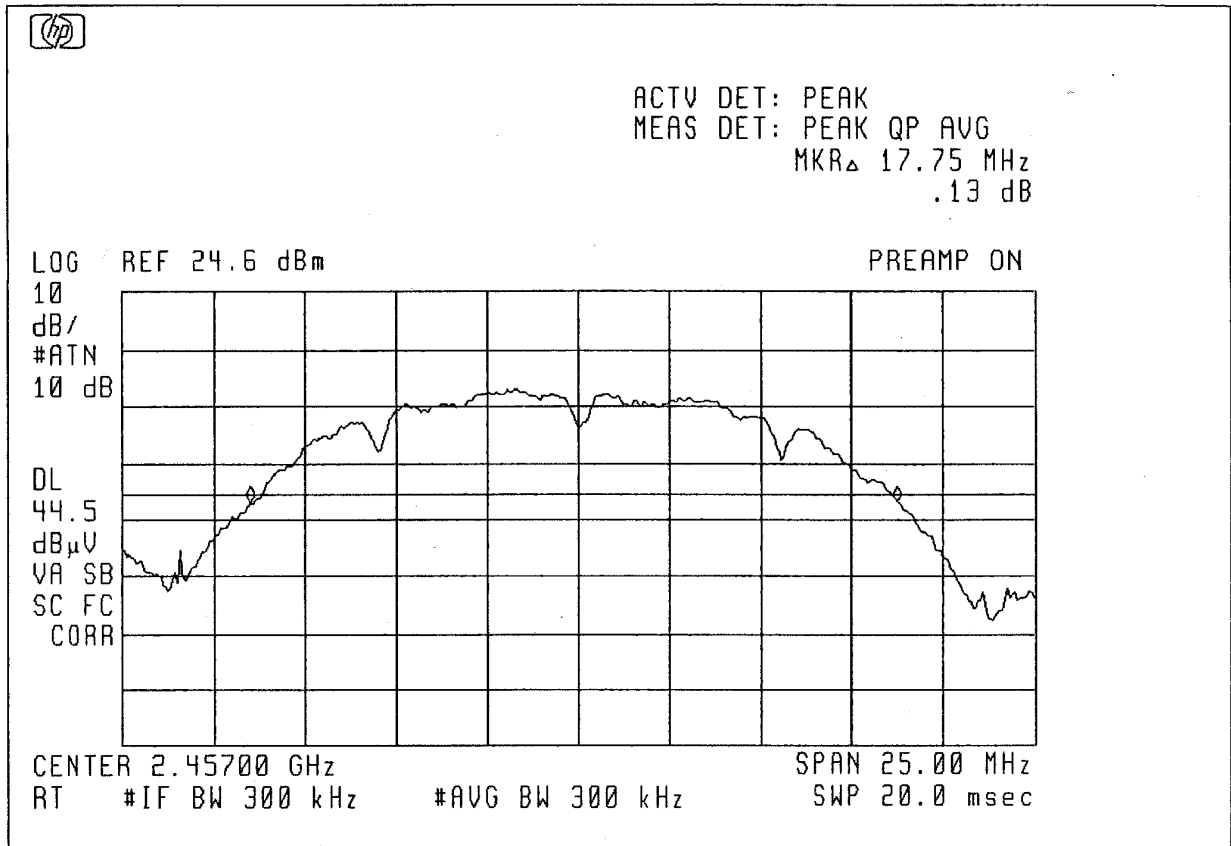
26 of 58.

## EMISSIONS

MODULAR MINING SYSTEMS, 301805 (Base)

2001-MAR-30, 13:34, FRI

POWER: HIGH  
MODULATION: 2 MB/SEC PSUDEO RANDOM DATA  
REMARK: 15.247 (A) (1) (I) 20DB BANDWIDTH



PERFORMED BY:

Doug Noble, B.A.S. E.E.T.

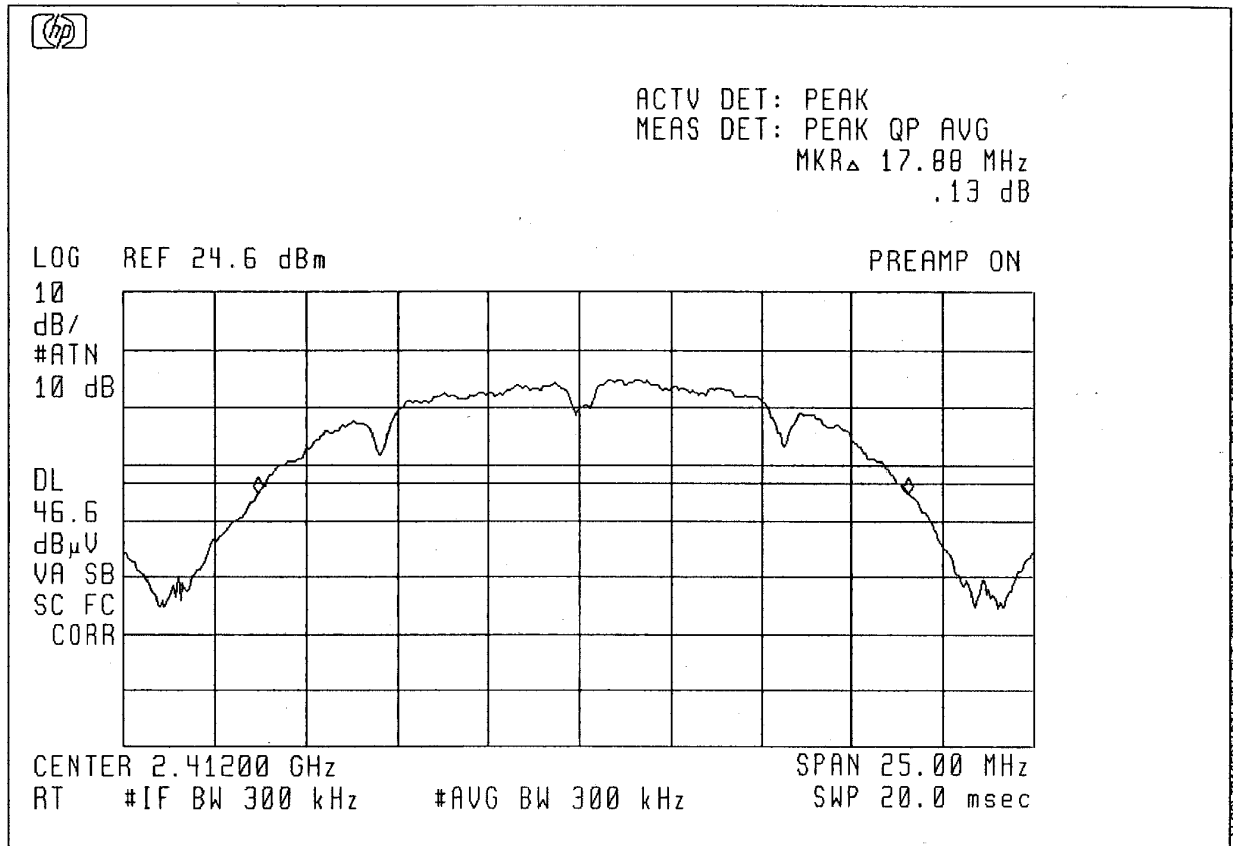
PAGE NO.

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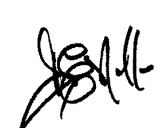
## EMISSIONS

MODULAR MINING SYSTEMS, 301805(Base)  
2001-MAR-30, 13:30, FRI

POWER: HIGH  
MODULATION: 2 MB/SEC PSUDEO RANDOM DATA  
REMARK: 15.247 (A) (1) (I) 20DB BANDWIDTH



PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.



PAGE NO. 28 of 58.

NAME OF TEST: Spread Spectrum Technology  
Direct Sequence Systems

15.247(a)(2) Minimum 6 dB Bandwidth

RESULTS: Please see results for "Allowed Occupied Bandwidth"

15.247(d) Transmitter Power Density

LIMIT: The transmitter power density peak over any 1 second interval shall not be greater than 8 dBm in any 3 kHz Bandwidth within these bands.

RESULTS: Please see attached plots.  
Transmitter Power Density, dBm = 3.7

15.247(e) Processing Gain

LIMIT: The processing gain shall be  $\geq 10$  dB

RESULTS: See Applicant's statement

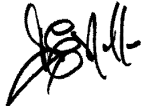
Pseudorandom Sequence Description

RESULTS: See Applicant's statement

Chip Rate

RESULTS: See Applicant's statement

PERFORMED BY:

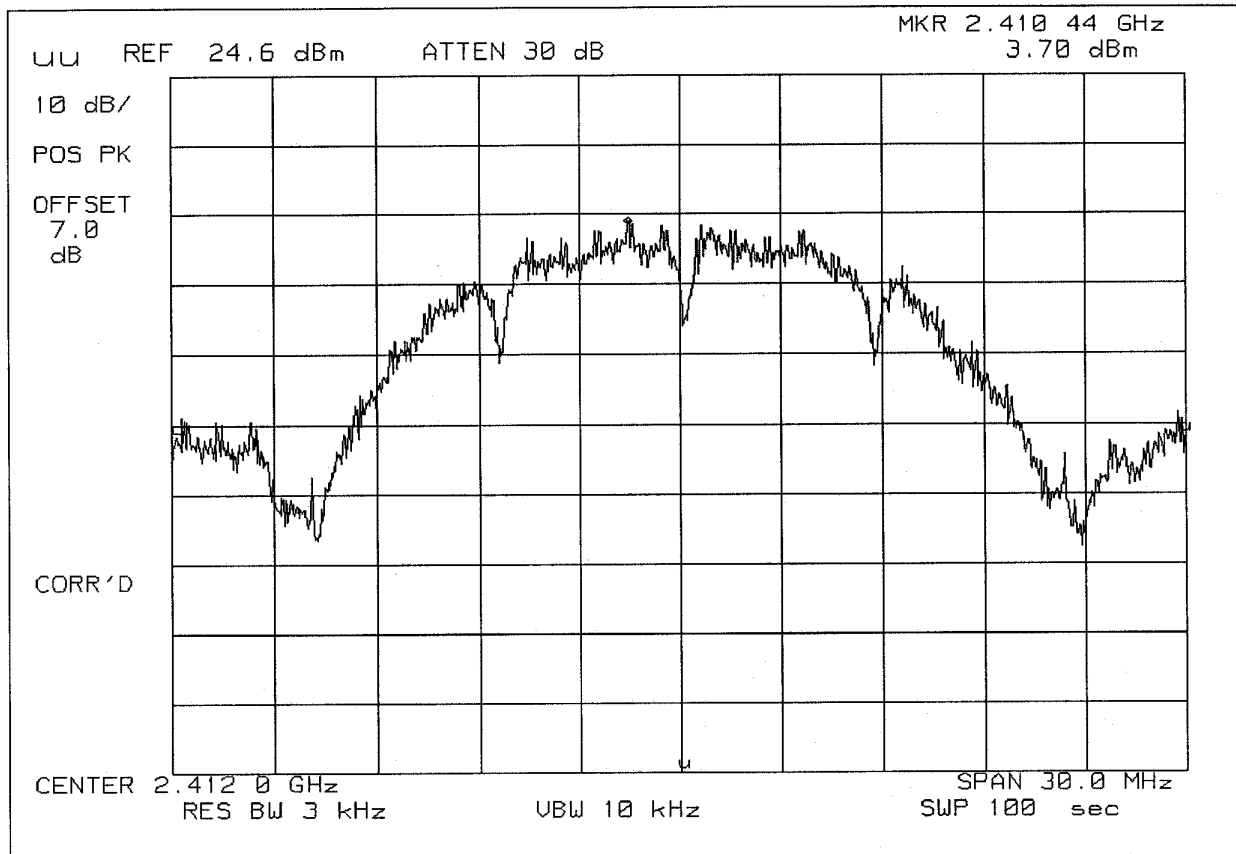
  
Doug Noble, B.A.S. E.E.T.

PAGE NO.

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SPECTRUM ANALYZER PRESENTATION  
MODULAR MINING SYSTEMS, 301805 (Base)  
2001-MAR-16, 16:37, FRI

POWER: HIGH  
MODULATION: 2 MB/SEC PSUDEO RANDOM DATA CH 2412  
REMARK: 15.247 (D) SPECTRAL POWER DENSITY



PERFORMED BY:

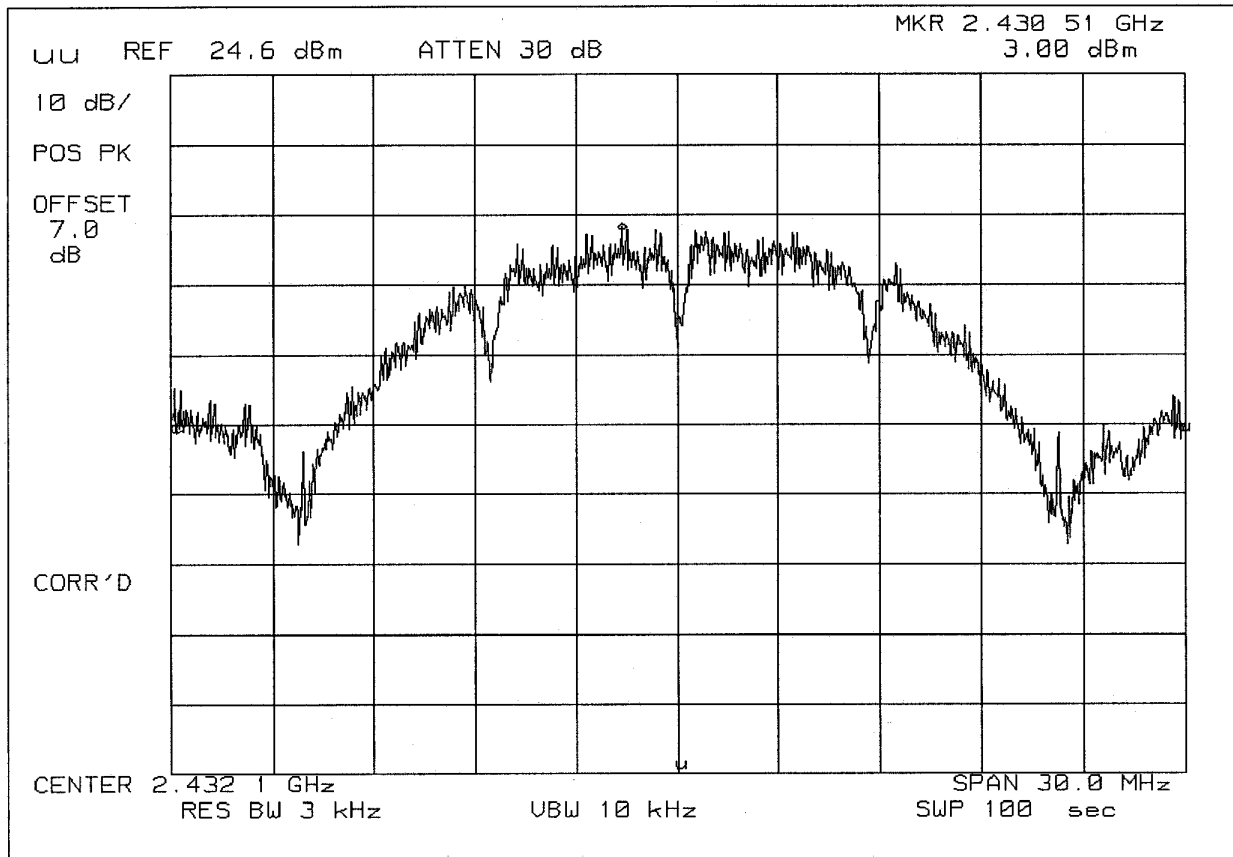
Doug Noble, B.A.S. E.E.T.

PAGE NO.


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SPECTRUM ANALYZER PRESENTATION  
MODULAR MINING SYSTEMS, 301805 (Base)  
2001-MAR-16, 16:30, FRI

POWER: HIGH  
MODULATION: 2 MB/SEC PSUDEO RANDOM DATA CH 2432  
REMARK: 15.247 (D) SPECTRAL POWER DENSITY



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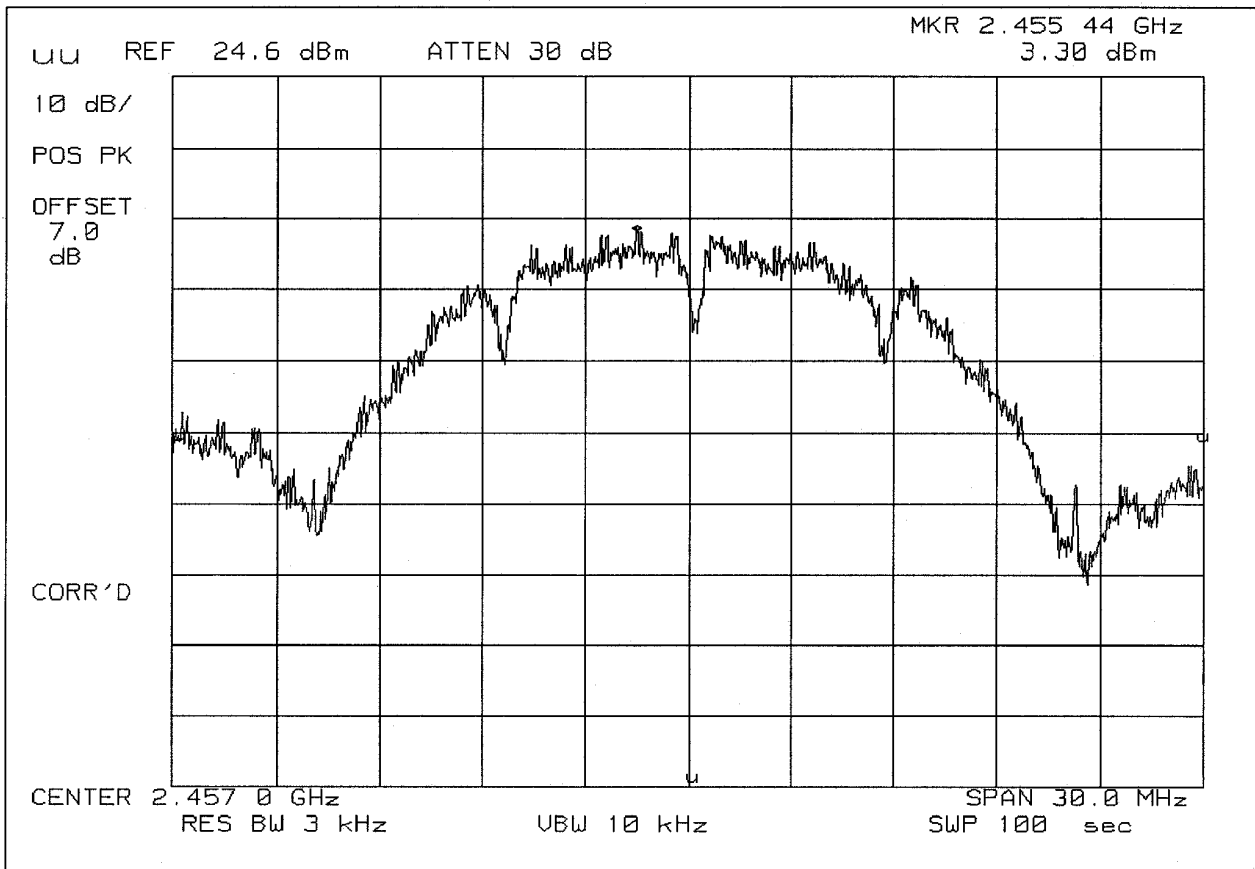
  
Doug Noble, B.A.S. E.E.T.

PAGE NO.

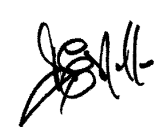
31 of 58.

SPECTRUM ANALYZER PRESENTATION  
MODULAR MINING SYSTEMS, 301805 (Base)  
2001-MAR-16, 16:42, FRI

POWER: HIGH  
MODULATION: 2 MB/SEC PSUDEO RANDOM DATA CH 2457  
REMARK: 15.247 (D) SPECTRAL POWER DENSITY



PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.



**M. Flom Associates, Inc. - Global Compliance Center**  
3356 North San Marcos Place, Suite 107, Chandler, Arizona 85225-7176  
www.mflom.com general@mflom.com (480) 926-3100, FAX: 926-3598

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PAGE NO.

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T R A N S M I T T E R      C E R T I F I C A T I O N

of

FCC ID: FJ6-301582  
MODEL: 301582 (Mobile)

to

FEDERAL COMMUNICATIONS COMMISSION

Rule Part(s) 15.247, Confidentiality

DATE OF REPORT: April 16, 2001

ON THE BEHALF OF THE APPLICANT:

Modular Mining Systems Inc

AT THE REQUEST OF:

P.O. 4500012536

Modular Mining Systems Inc  
3289 East Hemisphere Loop  
Tucson, AZ 85706-5028

Attention of: (520) 746-9127; FAX: 889-5790 (Headquarters)  
Lyle V Johnson, Vice President, Product Eng'g  
Romer Johnson, Supervisor, Product Design  
(520) 806-3603; FAX: 3344  
Email: johnsonr@mmsi.com  
and/or Eric Gustafson, Senior RF Systems Engineer  
Email: eric@mmsi.com  
(520) 806-3235; FAX: -3344

SUPERVISED BY:

A handwritten signature in black ink, reading 'M. Flom P. Eng'. The signature is written in a cursive, stylized script.

Morton Flom, P. Eng.

PAGE NO. 33 of 58.

LIST OF GENERAL INFORMATION REQUIRED FOR CERTIFICATION

IN ACCORDANCE WITH FCC RULES AND REGULATIONS,  
VOLUME II, PART 2 AND TO

15.247, Confidentiality

Sub-part 2.1033

(c)(1): NAME AND ADDRESS OF APPLICANT:

Modular Mining Systems Inc  
3289 East Hemisphere Loop  
Tucson, AZ 85706-5028

MANUFACTURER:

Applicant

(c)(2): FCC ID: FJ6-301582

MODEL NO: 301582 (Mobile)

(c)(3): INSTRUCTION MANUAL(S):

PLEASE SEE ATTACHED EXHIBITS

(c)(4): TYPE OF EMISSION: N/A

(c)(5): FREQUENCY RANGE, MHz: 2412 to 2457

(c)(6): POWER RATING, Watts: 0.038 EIRP  
       \_\_\_ Switchable \_\_\_ Variable x N/A

(c)(7): MAXIMUM POWER RATING, Watts: 50 mv/m @ 3m

15.203: ANTENNA REQUIREMENT:

\_\_\_ The antenna is permanently attached to the EUT  
 \_\_\_ The antenna uses a unique coupling  
x The EUT must be professionally installed  
 \_\_\_ The antenna requirement does not apply

PAGE NO. 34 of 58.  
NAME OF TEST: Maximum Peak Output Power  
SPECIFICATION: 47 CFR 15.247(b)  
SPEC. LIMIT:  $\leq 1$  Watt peak (0.25 if <50 Hopping Channels)  
TEST EQUIPMENT: Attached

MEASUREMENT DATA

ANTENNA GAIN, dBi = 6 dBi  
 PEAK OUTPUT POWER, Watts = 0.038  
 WORST CASE FOR  
 ALL CHANNELS

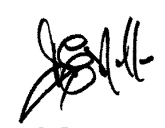
RADIATED:  
 g0130050: 2001-Mar-13 Tue 10:32:00

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	METER dBuV	CF, dB	uV/m @ 3m	EIRP dBm	MARGIN dB	EIRP, W
2412.000000	2413.000000	64.48	45.27	307255.74	14.5	55.8	0.0286
2432.000000	2433.130000	66.17	45.4	378878.53	16.3	57.6	0.0380
2457.000000	2455.880000	65.93	45.54	374541.55	16.2	57.5	0.0376

Conducted:

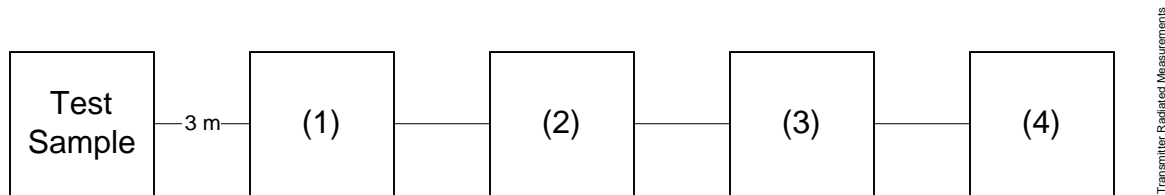
MHz	dBm	Watts
2412	24.6	0.288
2432	24.3	0.269
2457	23.6	0.229

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PAGE NO.

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TRANSMITTER RADIATED MEASUREMENTS

Asset	Description (as applicable)	s/n
(1)	<u>TRANSDUCER</u>	
i00091	Emco 3115	001469
i00089	Apriel Log Periodic	001500
i00088	EMCO 3301-B Biconical	2336
(2)	<u>HIGH PASS FILTER</u>	
i00	Narda $\mu$ PAD (In-Band Only)	
i00	Trilithic (Out-Of-Band Only)	
(3)	<u>PREAMP</u>	
i00028	HP 8449 (+30 dB)	2749A00121
(4)	<u>SPECTRUM ANALYZER</u>	
i00048	HP 8566B	2511A01467
i00057	HP 8557A	1531A00191
i00029	HP 8563E	3213A00104



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TEST SETUP: Radiated Emissions  
g0130031: 2001-Mar-15 Thu 10:39:11  
STATE: 0:General



TEST SETUP: Radiated Emissions  
g0130032: 2001-Mar-15 Thu 10:39:11  
STATE: 0:General



PAGE NO. 37 of 58.

NAME OF TEST: Out of Band Emissions

SPECIFICATION: 47 CFR 15.247(c)

SPURIOUS EMISSIONS g0130060: 2001-Mar-13 Tue 12:53:00

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	METER dBuV	CF, dB	uV/m @ 3m	EIRP dBm	MARGIN dB
2412.000000	4823.925000	29	8.88	78.34	-57.3	-44.3
2412.000000	4824.016667	48.67	8.88	754.22	-37.7	-24.7
2432.000000	4863.938500	27.33	8.96	65.24	-58.9	-45.9
2432.000000	4864.018500	46.5	8.96	592.93	-39.8	-26.7
2457.000000	4914.004667	38.5	9.05	238.51	-47.7	-34.7
2457.000000	4914.008000	23	9.05	40.04	-63.2	-50.2
2412.000000	7235.166667	24.83	13.05	78.34	-57.3	-44.3
2412.000000	7236.916667	39.67	13.05	432.51	-42.5	-29.5
2432.000000	7296.855166	21.5	13.15	54.01	-60.6	-47.6
2432.000000	7299.755166	36.5	13.16	304.09	-45.6	-32.5
2457.000000	7371.018000	18.83	13.27	40.27	-63.1	-50.1
2457.000000	7371.018000	30.17	13.27	148.59	-51.8	-38.8
2412.000000	9648.000000	33.5	15.71	288.74	-46	-33
2412.000000	9648.023334	46.83	15.71	1339.68	-32.7	-19.7
2432.000000	9728.033499	43.17	15.78	886.14	-36.3	-23.3
2432.000000	9728.036832	30	15.78	194.54	-49.4	-36.4
2457.000000	9828.028000	20.83	15.86	68.31	-58.5	-45.5
2457.000000	9828.028000	32.83	15.86	271.96	-46.5	-33.5
2412.000000	12060.014167	19.33	17.43	68.87	-58.5	-45.4
2412.000000	12060.014167	30.67	17.43	254.1	-47.1	-34.1
2432.000000	12160.036832	19.67	17.16	69.42	-58.4	-45.4
2432.000000	12160.036832	31.17	17.16	260.92	-46.9	-33.9
2457.000000	12285.028000	19.67	16.8	66.6	-58.8	-45.7
2457.000000	12285.028000	32	16.8	275.42	-46.4	-33.4
2412.000000	14472.014167	19	18.42	74.3	-57.8	-44.8
2412.000000	14472.014167	29	18.42	234.96	-47.8	-34.8
2432.000000	14592.051832	19.17	18.37	75.34	-57.7	-44.7
2432.000000	14592.051832	32	18.37	329.99	-44.9	-31.8
2457.000000	14742.028000	18.83	18.32	72.03	-58.1	-45.1
2457.000000	14742.028000	30.33	18.32	270.71	-46.6	-33.6
2412.000000	16884.014167	19	19.58	84.92	-56.6	-43.6
2412.000000	16884.014167	30.5	19.58	319.15	-45.1	-32.1
2432.000000	17024.051832	18.83	19.87	86.1	-56.5	-43.5
2432.000000	17024.051832	30.5	19.87	329.99	-44.9	-31.8
2457.000000	17199.028000	18.67	20.34	89.23	-56.2	-43.2
2457.000000	17199.028000	29.83	20.34	322.48	-45.1	-32

\*PEAK AND AVERAGE VALUES

PAGE NO. 38 of 58.

NAME OF TEST: Out of Band Emissions

SPECIFICATION: 47 CFR 15.247(c), 15.209(a)

SPEC. LIMIT: See Below

TEST EQUIPMENT: As per previous page

SEARCH ANTENNAS: 10 kHz - 32 MHz: LOOP 94598-1  
 32 MHz - 1 GHz: SINGER DM105,T<sub>1</sub>T<sub>2</sub>T<sub>3</sub>  
 1 GHz - 18 GHz: EMCO 3115

### LIMIT

In any 100 kHz bandwidth outside these frequency bands, radio frequency power that is produced by the modulation products of the spreading sequence, information sequence, and the carrier frequency shall be either

at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power

or

shall not exceed the general levels specified in 15.209(a),

whichever results in the lesser attenuation.

All other emissions outside these bands shall not exceed the general radiated emission limits specified in 15.209(a).

### MEASUREMENTS PROCEDURE:

At first, bench tests were performed to locate the emissions at the antenna terminals.

In the field, tests were conducted over the range shown. The test sample was set up on a wooden turntable above ground, and at a distance of three meters from the antenna connected to the spectrum analyzer.

In order to obtain the maximum response at each frequency, the turntable was rotated, and the search antenna was raised and lowered. The EUT was also adjusted for maximum response.

The field strength was calculated from:

$$E \text{ } \mu\text{V/m @ 3 m} = \text{LOG}_{10}^{-1}(\text{dBm} + 107 + \text{A.F.} + \text{C.L.})$$

The following results are worst case conditions. Tests were conducted in Horizontal and Vertical polarization modes.

MEASUREMENT RESULTS: ATTACHED

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NAME OF TEST: Out of Band Emissions


g0130053: 2001-Mar-13 Tue 11:59:00

STATE: 1:Lower Bandedge

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	METER dBuV	CF, dB	uV/m @ 3m	EIRP dBm	MARGIN dB	*PEAK AVERAGE
2412.000000	2376.500000	17.67	44.93	1348.96	-32.6	8.6	PEAK
2412.000000	2376.500000	5.93	44.93	349.14	-44.4	-3.1	AVERAGE
2412.000000	2378.000000	5.92	44.95	349.54	-44.4	-3.1	AVERAGE
2412.000000	2378.000000	17.55	44.95	1333.52	-32.7	8.5	PEAK
2412.000000	2379.280000	17.93	44.96	1394.76	-32.3	8.9	PEAK
2412.000000	2379.580000	6.03	44.96	354.41	-44.2	-3	AVERAGE
2412.000000	2381.000000	17.15	44.98	1277.91	-33.1	8.1	PEAK
2412.000000	2381.080000	6	44.98	354	-44.2	-3	AVERAGE
2412.000000	2382.730000	7.09	45.01	402.72	-43.1	-1.9	AVERAGE
2412.000000	2383.250000	19.81	45.01	1741.81	-30.4	10.8	PEAK
2412.000000	2384.000000	6.88	45.02	393.55	-43.3	-2.1	AVERAGE
2412.000000	2384.000000	17.26	45.02	1300.17	-32.9	8.3	PEAK
2412.000000	2385.730000	19.15	45.04	1619.94	-31	10.2	PEAK
2412.000000	2385.730000	7.83	45.04	440.05	-42.4	-1.1	AVERAGE
2412.000000	2386.780000	20.41	45.05	1874.99	-29.8	11.5	PEAK
2412.000000	2387.000000	7.38	45.05	418.31	-42.8	-1.6	AVERAGE
2412.000000	2388.500000	6.76	45.07	390.39	-43.4	-2.2	AVERAGE
2412.000000	2388.580000	19.03	45.07	1603.25	-31.1	10.1	PEAK
2412.000000	2390.000000	6.76	45.08	390.84	-43.4	-2.2	AVERAGE
2412.000000	2390.000000	18	45.08	1425.61	-32.1	9.1	PEAK

\*PEAK AND AVERAGE VALUES

PERFORMED BY:

  
 Doug Noble, B.A.S. E.E.T.

PAGE NO.

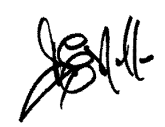
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NAME OF TEST: Out of Band Emissions  
 g0130056: 2001-Mar-13 Tue 12:25:00  
 STATE: 1:Upper Bandedge

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	METER, dBuV	CF, dB	uV/m @ 3m	EIRP dBm	MARGIN dB	*PEAK AVERAGE
2457.000000	2483.500000	17.67	45.72	1477.41	-31.8	9.4	PEAK
2457.000000	2483.500000	7.03	45.72	434.01	-42.5	-1.3	AVERAGE
2457.000000	2485.000000	6.11	45.73	390.84	-43.4	-2.2	AVERAGE
2457.000000	2485.000000	17.45	45.73	1442.12	-32	9.2	PEAK
2457.000000	2486.500000	18.16	45.74	1566.75	-31.3	9.9	PEAK
2457.000000	2486.500000	6.51	45.74	409.73	-43	-1.8	AVERAGE
2457.000000	2487.700000	18.74	45.75	1676.87	-30.7	10.5	PEAK
2457.000000	2488.000000	6	45.75	386.81	-43.5	-2.3	AVERAGE
2457.000000	2489.500000	17.17	45.75	1399.59	-32.3	8.9	PEAK
2457.000000	2489.500000	6.14	45.75	393.1	-43.3	-2.1	AVERAGE
2457.000000	2490.630000	18.13	45.77	1566.75	-31.3	9.9	PEAK
2457.000000	2490.930000	6.16	45.77	394.91	-43.3	-2.1	AVERAGE
2457.000000	2492.500000	17.73	45.77	1496.24	-31.7	9.5	PEAK
2457.000000	2492.500000	6.11	45.77	392.64	-43.3	-2.1	AVERAGE
2457.000000	2493.930000	6.67	45.79	419.76	-42.8	-1.5	AVERAGE
2457.000000	2494.000000	18.99	45.79	1733.8	-30.4	10.8	PEAK
2457.000000	2495.500000	18.2	45.79	1583.07	-31.2	10	PEAK
2457.000000	2495.500000	6.02	45.79	389.49	-43.4	-2.2	AVERAGE
2457.000000	2496.930000	6.23	45.81	399.94	-43.2	-2	AVERAGE
2457.000000	2497.080000	19.2	45.81	1780.33	-30.2	11	PEAK

\*PEAK AND AVERAGE VALUES

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NAME OF TEST: Restricted Bands of Operation

SPECIFICATION: 47 CFR 15.205

TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE

The EUT was set up on a three meter open field site according to the procedure on ANSI C63.4.

Sensitivity of system was measured:

Below 2 GHz:

CISPR Bandwidths	= 8 dB $\mu$ V
1 MHz RBW, 1 MHz VBW	= 12 dB $\mu$ V
1 MHz RBW, 10 Hz VBW	= 3 dB $\mu$ V

Above 2 GHz:

1 MHz RBW, 1 MHz VBW	= 33 dB $\mu$ V
1 MHz RBW, 10 Hz VBW	= 22 dB $\mu$ V

Sensitivity of system with preamps:

Below 2 GHz:

Preamps are not used in this range.

Above 2 GHz:

Peak	= 3 dB $\mu$ V
Average	= -8 dB $\mu$ V

Cable Loss:

915 MHz	= -0.8 dB $\mu$ V
2450 MHz	= -3 dB $\mu$ V

Note:

dB loss vs. frequency included in programmed software.

Reference Level Offset:

set @ 1 dB, accounts for cable and connector loss.

TEST RESULTS: No harmonic or spurious emissions were detected in the restricted bands in excess of the limits of 15.205. System measurement sensitivity was -130 dBm.



PERFORMED BY:

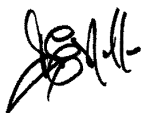
Doug Noble, B.A.S. E.E.T.

PAGE NO. 42 of 58.  
NAME OF TEST: Emissions At Band Edges  
SPECIFICATION: 47 CFR  
TEST EQUIPMENT: As for "Out of Band Emissions"

MEASUREMENT RESULTS

ATTACHED

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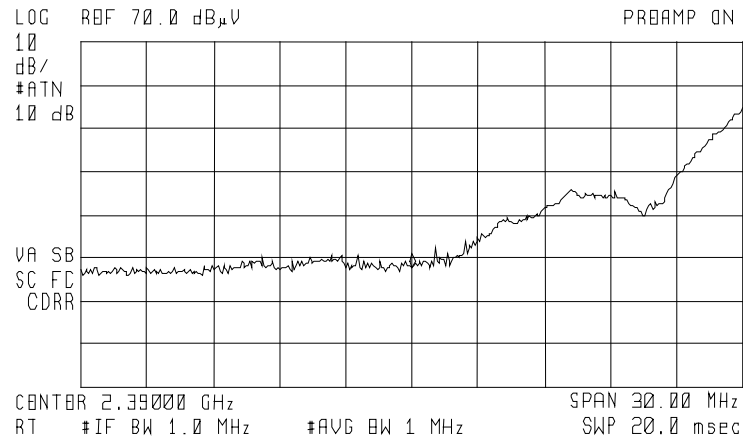
PAGE NO.

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NAME OF TEST: Emission at Band Edges (Conducted)  
g0130058: 2001-Mar-13 Tue 12:43:00  
STATE: 0:Lower Bandedge



ACTV DET: PBAK  
MEAS DET: PBAK QP AVG  
MKR 2.39000 GHz  
18.00 dBμV



PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.



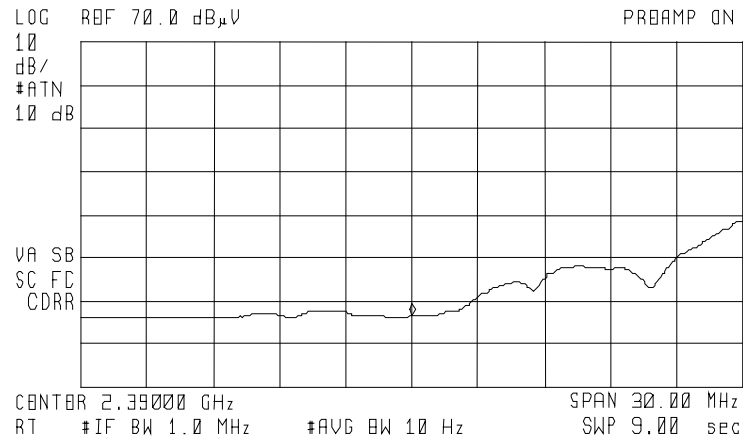
PAGE NO.

44 of 58.


NAME OF TEST: Emission at Band Edges (Conducted)  
g0130059: 2001-Mar-13 Tue 12:44:00  
STATE: 0:Lower Bandedge



ACTV DET: PBAK  
MEAS DET: PBAK QP AVG  
MKR 2.39000 GHz  
6.50 dBμV



PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.

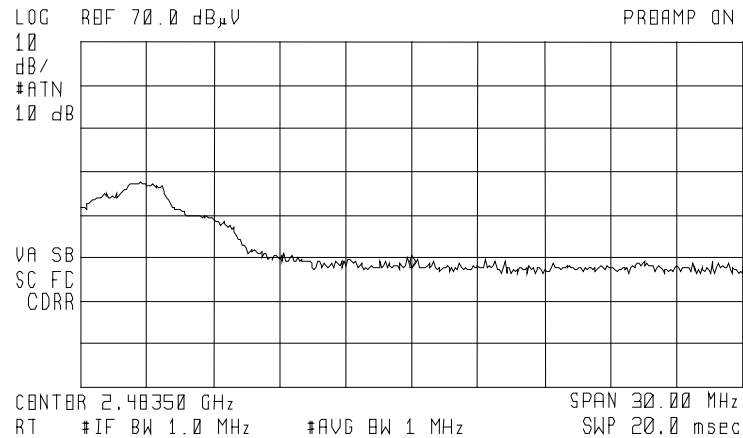
PAGE NO.

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NAME OF TEST: Emission at Band Edges (Conducted)  
g0130054: 2001-Mar-13 Tue 12:28:00  
STATE: 0:Upper Bandedge



ACTV DET: PBAK  
MEAS DET: PBAK QP AVG  
MKR 2.48350 GHz  
17.67 dBμV



PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.

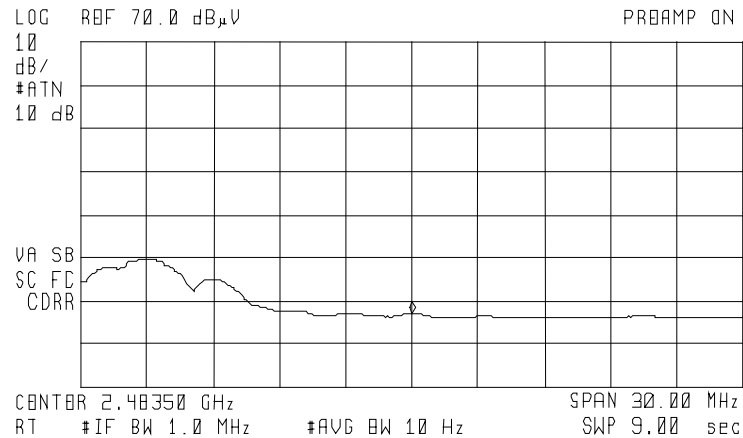
PAGE NO.

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NAME OF TEST: Emission at Band Edges (Conducted)  
g0130055: 2001-Mar-13 Tue 12:30:00  
STATE: 0:Upper Bandedge



ACTV DET: PBAK  
MEAS DET: PBAK QP AVG  
MKR 2.48350 GHz  
7.03 dBμV



PERFORMED BY:

Doug Noble, B.A.S. E.E.T.

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NAME OF TEST: Allowed Occupied Bandwidth

SPECIFICATION: 47 CFR 15.247(a)(2)

TEST EQUIPMENT: As per attached page

LIMITS

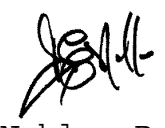
<u>RULE</u>	<u>TYPE</u>	<u>BANDS (MHz)</u>	<u>LIMIT (kHz)</u>
15.247(a)(1)(i)	F.H.	902-928	20 dB BW $\leq$ 500
15.247(a)(1)(ii)	F.H.	2400-2483.5, 5725-5850	20 dB BW $\leq$ 1000
15.247(a)(2)	D.S.	ALL	6 dB BW $\geq$ 500

MEASUREMENT DATA

MEASURED BANDWIDTH, mHz = 9.23

RESULTS = ATTACHED

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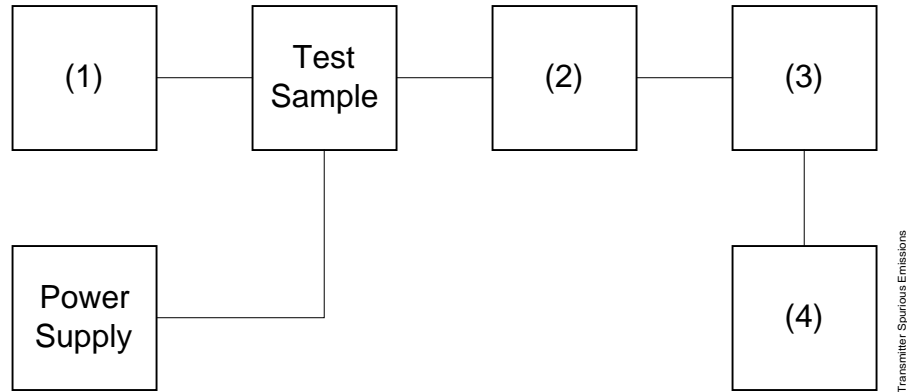
PAGE NO.

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TRANSMITTER SPURIOUS EMISSION

TEST A. OCCUPIED BANDWIDTH (IN-BAND SPURIOUS)

TEST B. OUT-OF-BAND SPURIOUS



Asset Description (as applicable)	s/n
(1) <u>AUDIO OSCILLATOR/GENERATOR</u>	
i00010 HP 204D	1105A04683
i00017 HP 8903A	2216A01753
i00012 HP 3312A	1432A11250
(2) <u>COAXIAL ATTENUATOR</u>	
i00122 Narda 766-10	7802
i00123 Narda 766-10	7802A
i00069 Bird 8329 (30 dB)	1006
i00113 Sierra 661A-3D	1059
(3) <u>FILTERS; NOTCH, HP, LP, BP</u>	
i00126 Eagle TNF-1	100-250
i00125 Eagle TNF-1	50-60
i00124 Eagle TNF-1	250-850
(4) <u>SPECTRUM ANALYZER</u>	
i00048 HP 8566B	2511A01467
i00029 HP 8563E	3213A00104

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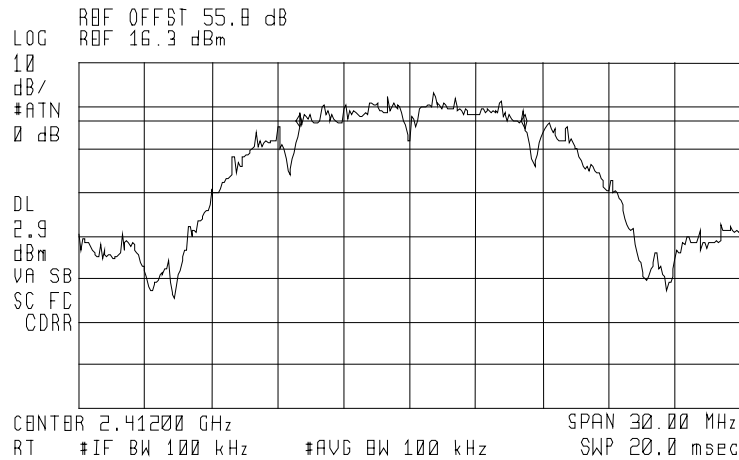
NAME OF TEST: Emission Masks (Occupied Bandwidth)  
 Indicating 6/20 dB Bandwidth

g0130102: 2001-Mar-16 Fri 12:24:00

STATE: 2:High Power



ACTV DET: PBAK  
 MEAS DET: PBAK QP AVG  
 MKRΔ 10.20 MHz  
 -.36 dB



POWER:

HIGH

MODULATION:

2 MB/SEC PSUDEO RANDOM DATA

CH. 2412

15.247 (2) (I) 6 DB

BANDWIDTH

PERFORMED BY:

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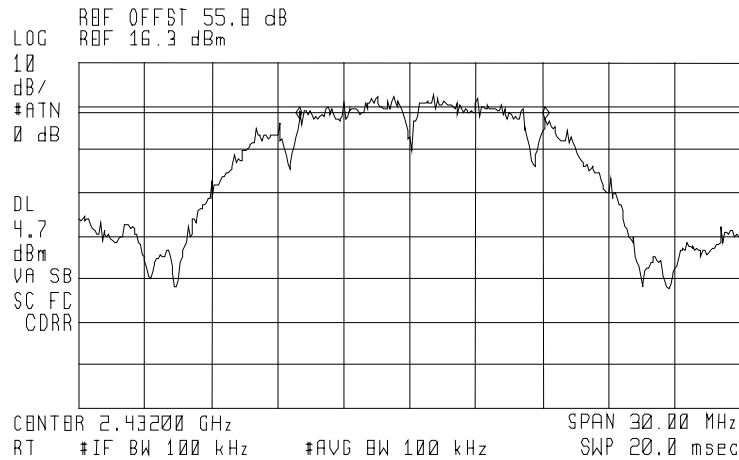
NAME OF TEST: Emission Masks (Occupied Bandwidth)  
 Indicating 6/20 dB Bandwidth

g0130097: 2001-Mar-16 Fri 11:55:00

STATE: 2:High Power



ACTV DET: PBAK  
 MEAS DET: PBAK QP AVG  
 MKRΔ 11.18 MHz  
 .08 dB



POWER:

HIGH

MODULATION:

2 MB/SEC PSUDEO RANDOM DATA  
 CH. 2432  
 15.247 (2) (I) 6DB  
 BANDWIDTH

PERFORMED BY:

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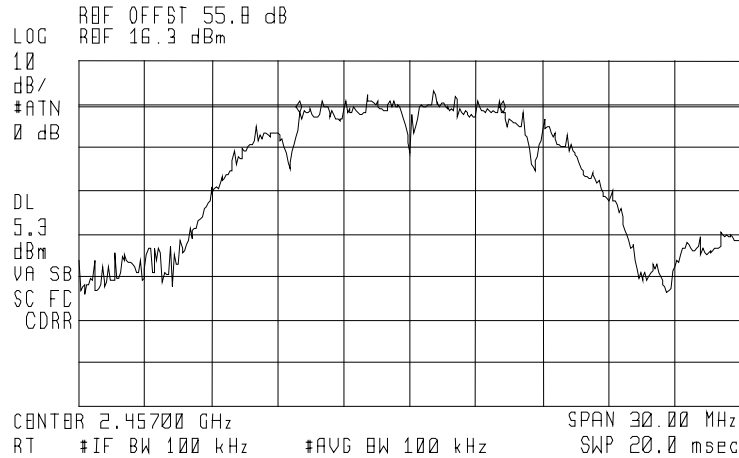
NAME OF TEST: Emission Masks (Occupied Bandwidth)  
 Indicating 6/20 dB Bandwidth

g0130103: 2001-Mar-16 Fri 12:34:00

STATE: 2:High Power



ACTV DET: PBAK  
 MEAS DET: PBAK QP AVG  
 MKR  $\Delta$  9.23 MHz  
 -.13 dB



POWER:

HIGH

MODULATION:

2 MB/SEC PSUDEO RANDOM DATA

CH. 2457

15.247 (2) (I) 6 DB

BANDWIDTH

PERFORMED BY:

Doug Noble, B.A.S. E.E.T.



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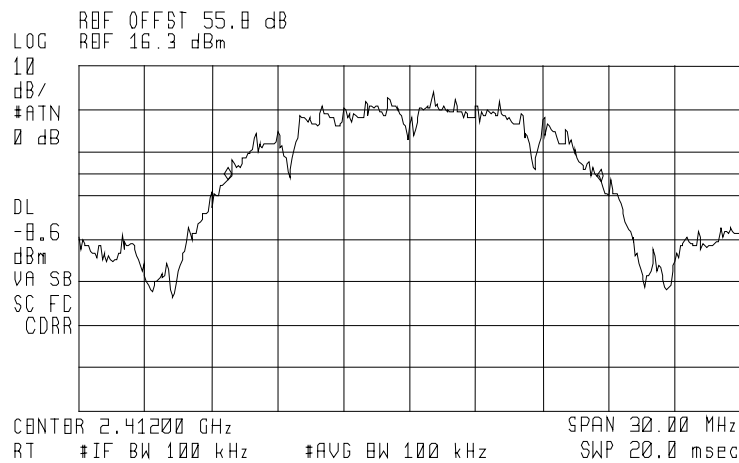
NAME OF TEST: Emission Masks (Occupied Bandwidth)  
 Indicating 6/20 dB Bandwidth

g0130101: 2001-Mar-16 Fri 12:22:00

STATE: 2:High Power



ACTV DET: PBAK  
 MEAS DET: PBAK QP AVG  
 MKRΔ 16.00 MHz  
 -.46 dB



POWER:

HIGH

MODULATION:

2 MB/SEC PSUDEO RANDOM DATA  
 CH. 2412  
 15.247 (A) (1) (I) 20 DB  
 BANDWIDTH

PERFORMED BY:

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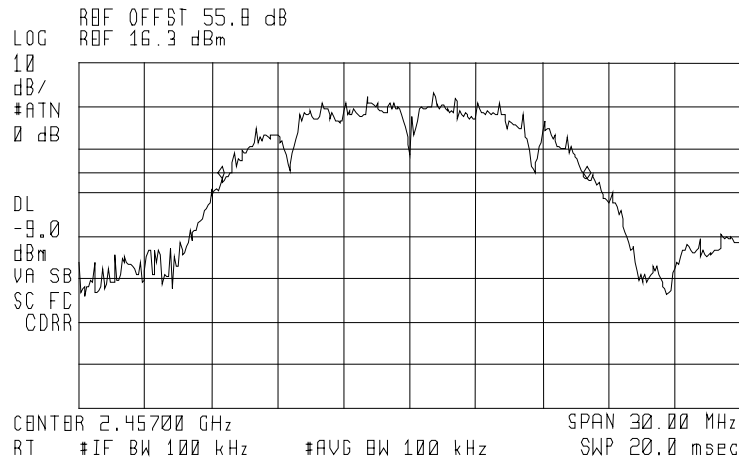
NAME OF TEST: Emission Masks (Occupied Bandwidth)  
 Indicating 6/20 dB Bandwidth

g0130104: 2001-Mar-16 Fri 12:35:00

STATE: 2:High Power



ACTV DET: PBAK  
 MEAS DET: PBAK QP AVG  
 MKRΔ 15.50 MHz  
 .07 dB



POWER:

HIGH

MODULATION:

2 MB/SEC PSUDEO RANDOM DATA  
 CH. 2457  
 15.247 (A) (1) (I) 20 DB  
 BANDWIDTH

PERFORMED BY:

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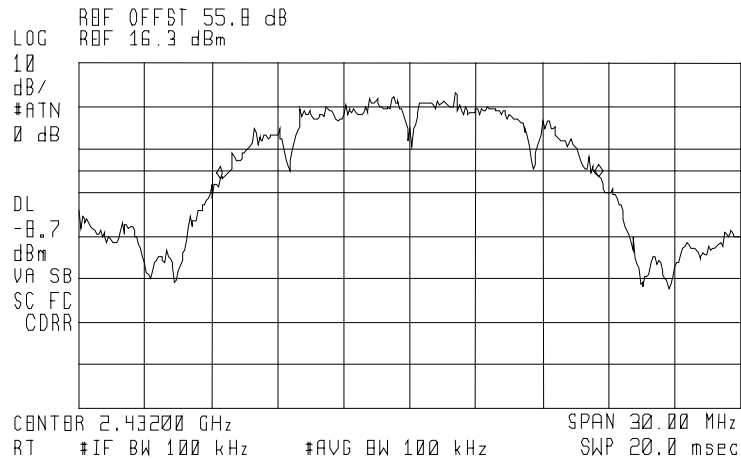
NAME OF TEST: Emission Masks (Occupied Bandwidth)  
 Indicating 6/20 dB Bandwidth

g0130098: 2001-Mar-16 Fri 11:56:00

STATE: 2:High Power



ACTV DET: PBAK  
 MEAS DET: PBAK QP AVG  
 MKRΔ 17.18 MHz  
 .27 dB



POWER:

HIGH

MODULATION:

2 MB/SEC PSUDEO RANDOM DATA  
 CH. 2432  
 15.247 (A) (1) (I) 20DB  
 BANDWIDTH

PERFORMED BY:

Doug Noble, B.A.S. E.E.T.

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NAME OF TEST: Spread Spectrum Technology  
Direct Sequence Systems

15.247(a)(2) Minimum 6 dB Bandwidth

RESULTS: Please see results for "Allowed Occupied Bandwidth"

15.247(d) Transmitter Power Density

LIMIT: The transmitter power density peak over any 1 second interval shall not be greater than 8 dBm in any 3 kHz Bandwidth within these bands.

RESULTS: Please see attached plots.  
Transmitter Power Density, dBm = -2.79

15.247(e) Processing Gain

LIMIT: The processing gain shall be  $\geq 10$  dB

RESULTS: See Applicant's statement

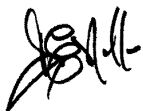
Pseudorandom Sequence Description

RESULTS: See Applicant's statement

Chip Rate

RESULTS: See Applicant's statement

PERFORMED BY:

  
Doug Noble, B.A.S. E.E.T.

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NAME OF TEST:

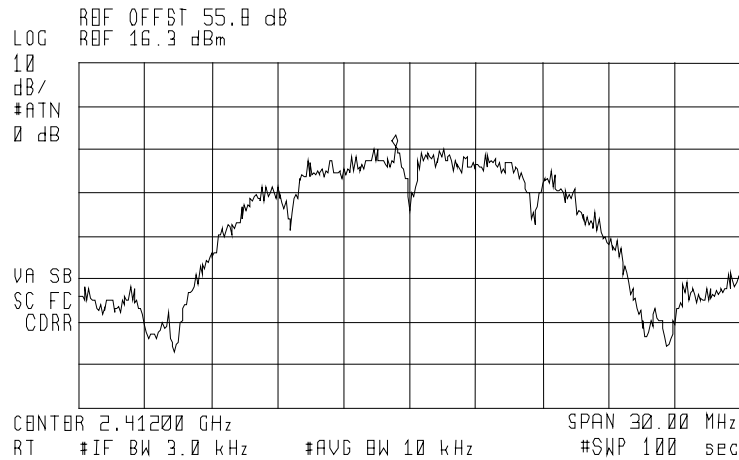
Spectrum Analyzer plots indicating  
TRANSMITTER POWER DENSITY

g0130100: 2001-Mar-16 Fri 12:18:00

STATE: 2:High Power



ACTV DET: PBAK  
 MEAS DET: PBAK QP AVG  
 MKR 2.41133 GHz  
 -3.57 dBm



POWER:

HIGH

MODULATION:

2 MB/SEC PSUDEO RANDOM DATA  
 CH. 2412  
 SPECTRAL POWER DENSITY

PERFORMED BY:

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NAME OF TEST:

Spectrum Analyzer plots indicating  
TRANSMITTER POWER DENSITY

g0130099: 2001-Mar-16 Fri 12:01:00

STATE: 2:High Power



ACTV DET: PBAK  
 MEAS DET: PBAK QP AVG  
 MKR 2.43133 GHz  
 -2.79 dBm



POWER:

HIGH

MODULATION:

2 MB/SEC PSUDEO RANDOM DATA  
 CH. 2432  
 SPECTRAL POWER DENSITY

PERFORMED BY:

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NAME OF TEST:

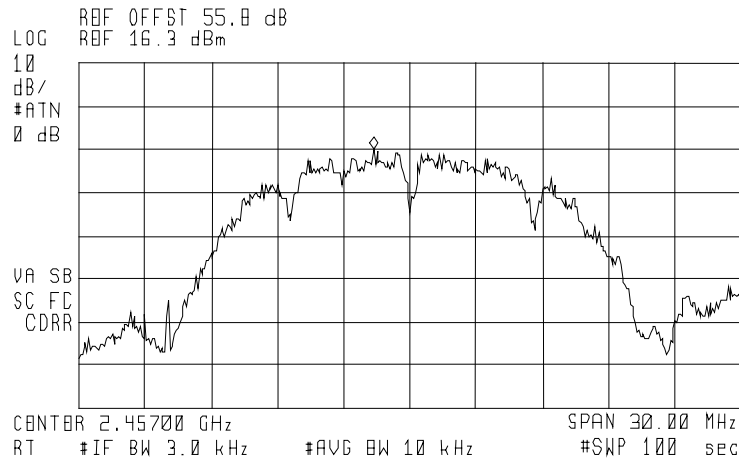
Spectrum Analyzer plots indicating  
TRANSMITTER POWER DENSITY

g0130105: 2001-Mar-16 Fri 12:44:00

STATE: 2:High Power



ACTV DET: PBAK  
 MEAS DET: PBAK QP AVG  
 MKR 2.45535 GHz  
 -3.83 dBm



POWER:

HIGH

MODULATION:

2 MB/SEC PSUDEO RANDOM DATA  
 CH. 2457  
 SPECTRAL POWER DENSITY

PERFORMED BY:  
 END

OF

Doug Noble, B.A.S. E.E.T.  
 TEST REPORT

RADIATED MEASUREMENTS  
FOR PART 15 TRANSMITTERS W/ INTEGRAL ANTENNAS

Radiated Measurements

<u>RANGE OF MEASUREMENT</u>	<u>SPECIFICATION</u>	<u>RESOLUTION B/W</u>	<u>VIDEO B/A</u>
30 to 1000 MHz	CISPR	≥100 kHz	≥100 kHz
>1000 MHz	FCC, 15.37(b)	1 MHz	≥1 MHz
(if averaging)	FCC, 15.37(b)	1 MHz	10 Hz

Measuring Equipment

a. ANTENNAS:

EMCO 3109	20 - 300 MHz
APREL AALP2001	200 - 1000 MHz
APREL AAB20200	20 - 200 MHz
APREL AAH118	1 - 18 GHz

b. INSTRUMENTS:

HP8566B	Spectrum Analyzer
HP85685A	Preselector, w/ preamp below 2 GHz
HP85650A	Quasi Peak Adapter
HP8449	Preamp, above 2 GHz
HP8563E	Spectrum Analyzer, above 2 GHz

All test instrumentation is calibrated every January and every July. In addition, all test instrumentation is calibrated daily, or as required by the manufacturer. A Calibration Agreement is maintained with Hewlett Packard.

Occupied Bandwidth

Occupied Bandwidth is measured as a radiated signal without attenuators and/or filter. RBW, VBW and scan settings as shown were set to produce a meaningful result in accordance with ANSI C63.4, Section 13.1.7.

Part 15.21, Information to User

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly avoided by the party responsible for compliance could void the user's authority to operate the equipment.



## § 15.205 Restricted Bands of Operation

(a) Except as shown in paragraph (b) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69625	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-339.4	3600-4400	(2)
13.36-13.41			

Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz. Above 38.6

TESTIMONIAL  
AND  
STATEMENT OF CERTIFICATION

THIS IS TO CERTIFY THAT:

1. THAT the application was prepared either by, or under the direct supervision of, the undersigned.
2. THAT the technical data supplied with the application was taken under my direction and supervision.
3. THAT the data was obtained on representative units, randomly selected.
4. THAT, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.

CERTIFYING ENGINEER:

A handwritten signature in black ink, reading "M. Flom P. Eng.", with a horizontal line drawn underneath the signature.

Morton Flom, P. Eng.