

DATE: 26 May 2008

I.T.L. (PRODUCT TESTING) LTD.
FCC EMC/Radio Test Report
for
Ophir Optronics Ltd.

Equipment under test:

Laser Power Meter

Quasar 7Z01300

Written by:

Evan Ever

E. Ever, Documentation

Approved by:

A. Gurewitz for A. Gurewitz

A. Gurewitz, Test Engineer

Approved by:

I. Raz

I. Raz, EMC Laboratory Manager

This report must not be reproduced, except in full, without the written permission of I.T.L. (Product Testing) Ltd.

This report relates only to items tested.

Measurement/Technical Report for Ophir Optronics Ltd.

Laser Power Meter

Quasar 7Z01300

FCC ID: V6XQSR

26 May 2008

This report concerns: Original Grant x Class II change

Class B verification X Class A verification _____ Class I change

Equipment type: Direct Sequence Spread Spectrum Transmitter

Request Issue of Grant:

x Immediately upon completion of review

Limits used:

CISPR 22 _____ Part 15 x

Measurement procedure used is ANSI C63.4-2003.

Application for Certification

prepared by:

Ishaishou Raz

ITL (Product Testing) Ltd.

Kfar Bin Nun

D.N. Shimshon 99780

Israel

e-mail Sraz@itl.co.il

Applicant for this device:

(different from "prepared by")

Ephraim Greenfield

Ophir Optronics Ltd.

Jerusalem 91450

6 Hartum St. POB 45021, Har Hotzvim

Israel

Tel: +972-2-5484408

Fax: +972-2-5822338

e-mail: Ephraim.Greenfield@ophiropt.com

TABLE OF CONTENTS

1. GENERAL INFORMATION	5
1.1 Administrative Information	5
1.2 List of Accreditations	6
1.3 Product Description	7
1.4 Test Methodology	7
1.5 Test Facility	7
1.6 Measurement Uncertainty	7
2. SYSTEM TEST CONFIGURATION	8
2.1 Justification	8
2.2 EUT Exercise Software	8
2.3 Special Accessories	8
2.4 Equipment Modifications	8
2.5 Configuration of Tested System	9
3. THEORY OF OPERATION	10
3.1 Theory of Operation	10
3.2 Field Strength Calculation	10
4. SPURIOUS RADIATED EMISSION IN THE RESTRICTED BAND, ABOVE 1 GHZ 2.4GHZ TRANSMITTER	11
4.1 Radiated Emission Above 1 GHz	11
4.2 Test Data	18
4.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz	19
5. NUMBER OF HOPPING FREQUENCIES	20
5.1 Test Specification	20
5.2 Test Procedure	20
5.3 Results table	23
5.4 Test Instrumentation Used, Radiated Measurements	24
6. DWELL TIME ON EACH CHANNEL	25
6.1 Test procedure	25
6.2 Results table	27
6.3 Test Instrumentation Used, Radiated Measurements	28
7. CHANNEL FREQUENCY SEPARATION	29
7.1 Test procedure	29
7.2 Results table	30
7.3 Test Instrumentation Used, Radiated Measurements	31
8. MAXIMUM TRANSMITTED PEAK POWER OUTPUT 2.4 GHZ TRANSMITTER	32
8.1 Test procedure	32
8.2 Results table	34
8.3 Test Equipment Used	35
9. PEAK POWER OUTPUT OUT OF 2400-2483.5 MHZ BAND 2.4 GHZ TRANSMITTER	36
9.1 Test procedure	36
9.2 Results table	49
9.3 Test Equipment Used	50
10. 20 DB BANDWIDTH	51
10.1 Test procedure	51
10.2 Results table	53
10.3 Test Equipment Used	54
11. BAND EDGE SPECTRUM	55
11.1 Test procedure	55
11.2 Results table	58
11.3 Test Equipment Used	59
12. ADDITIONAL SPURIOUS RADIATED EMISSION IN THE RESTRICTED BAND, ABOVE 1 GHZ 2.4GHZ TRANSMITTER	60
12.1 Radiated Emission Above 1 GHz	60
12.2 Test Data	67
12.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz	68
13. R.F EXPOSURE/SAFETY CALCULATION	69
14. APPENDIX A - CORRECTION FACTORS	70

14.1	Correction factors for CABLE.....	70
14.2	Correction factors for CABLE.....	71
14.3	Correction factors for CABLE.....	72
14.4	Correction factors for CABLE.....	73
12.6	Correction factors for LOG PERIODIC ANTENNA.....	74
14.5	Correction factors for LOG PERIODIC ANTENNA.....	75
14.6	Correction factors for BICONICAL ANTENNA.....	76
14.7	Correction factors for BICONICAL ANTENNA.....	77
14.8	Correction factors for Double-Ridged Waveguide Horn.....	78
14.9	Correction factors for Horn Antenna.....	79
14.10	Correction factors for Horn Antenna.....	80
14.11	Correction factors for ACTIVE LOOP ANTENNA	81

1. General Information

1.1 Administrative Information

Manufacturer: Ophir Optronics Ltd.

Manufacturer's Address: Hartum 6,
Har Hotzvim
Jerusalem 91450
Israel
Tel: +972-2-5484408
Fax: +972-2-5822338

Manufacturer's Representative: Julian Marsden

Equipment Under Test (E.U.T): Laser Power Meter

Equipment Model No.: Quasar 7Z01300

Equipment Serial No.: 333020

Date of Receipt of E.U.T: 13.04.08

Start of Test: 13.04.08

End of Test:

Test Laboratory Location: I.T.L (Product Testing) Ltd.
Kfar Bin Nun,
ISRAEL 99780

Test Specifications: See Section 2

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The Ophir Optronics "Quasar" 7Z01300 device, referred to as the "EUT" in this report, is a measurement device for measuring the power or energy of a laser. It connects to any one of a wide range of Ophir standard smart-head detectors (or "heads") such as Thermopile (the most common), Photodiode or Pyroelectric heads. The Quasar 7Z01300 processes the analog input from the detector and produces a digital output. The Quasar uses a Bluetooth connection to transfer the digital measurement data from the head direct to a PC. It is classified as a "Class 1" Bluetooth Device.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Testing was also performed according to DA 00-705 March 30, 2000 concerning frequency hopping spread spectrum systems. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing August 22, 2006).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ± 4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. System Test Configuration

2.1 **Justification**

The Quasar 7Z01300 was configured for testing in a typical mode (as a customer would normally use it). During the test process all the Quasar functions operated and were configured for the maximum transmit power. Radiated emission screening was performed in 3 orthogonal orientations. The worst-case orientation was the horizontal position. Activating all the Quasar 7Z01300 functions is the full operating mode.

2.2 **EUT Exercise Software**

In normal use the Quasar 7Z01300 can be set into "Continuous Send" mode where it transmits the data direct to the PC continuously, with no data flowing the other way. This is the worst-case transmit mode used by the Quasar in normal operation, and it can be switched on using the "Winpack" test software provided to the test house.

In addition, the NXP Bluetooth Module is provided by the manufacturer with a special test mode which allows the module to be placed in special "transmit only" modes, used for testing the RF Emissions. This test mode is set using the "AT+BTTX" command, and is fully described in the manual for the module provided by NXP. It allows the selection of different hopping modes, test scenarios, transmission frequencies, packet types and so on. This command is controlled on the Quasar using a special version software package "Winpack" provided to the test house for this purpose, including instructions on how to use the software and how to set the various parameters.

2.3 **Special Accessories**

No special accessories were needed to achieve compliance.

2.4 **Equipment Modifications**

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

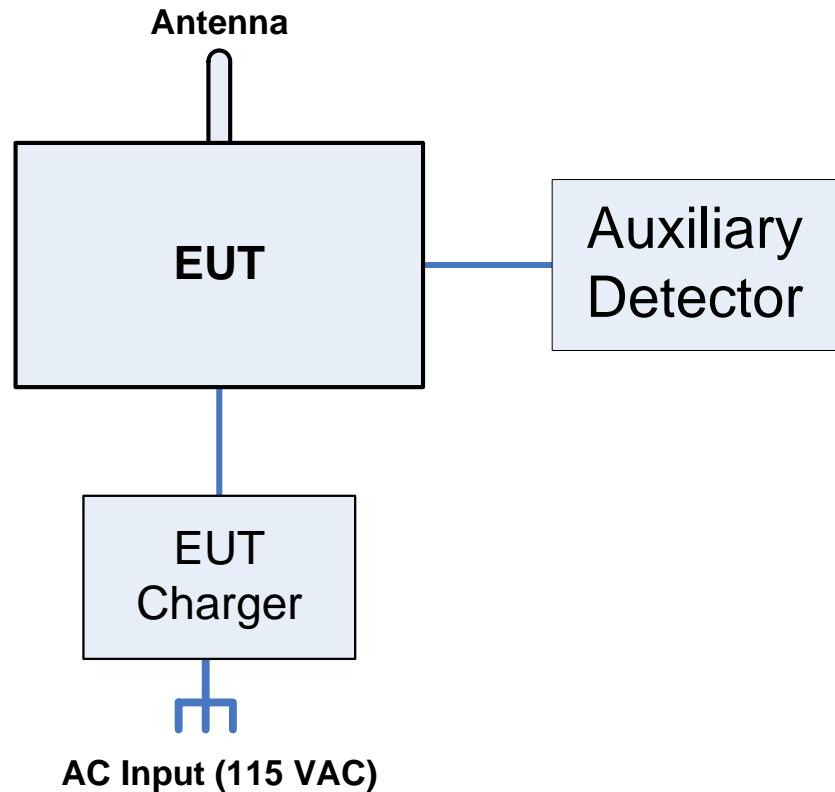


Figure 1. Photo of Tested System

3. Theory of Operation

3.1 Theory of Operation

The Quasar 7Z01300 device belongs to Ophir's line of laser power and energy measurement instruments. Utilizing smart head technology, the device supports the complete line of Ophir thermopile, photodiode, PD10, and pyroelectric smart head detectors. Combining the proven microprocessor based measurement technology of Ophir's Nova, Nova II, Vega and LaserStar instruments with a USB delivery to your PC, the USBI and Pulsar devices provide highly accurate measurements together with an easy-to-use graphical interface. In addition, the Quasar device provides a wireless connection to your PC using Bluetooth™ technology. Some applications include:

- Peak-to-peak stability of energy pulses.
- Power drift of CW lasers over time.
- Graphical display of dB loss measured in a fiber optic cable.
- Logging energy of rapidly pulsing lasers at 1000Hz or more.

3.2 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{v}/\text{m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

FS:	Field Strength [dB μ v/m]
RA:	Receiver Amplitude [dB μ v]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

4. Spurious Radiated Emission in the Restricted Band, Above 1 GHz 2.4GHz Transmitter With ANT-2.4-CW-RCS Antenna

4.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used.

During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 10 Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

Radiated Emission Above 1 GHz

ANT-2.4-CW-RCS Antenna

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Peak
 Operation Frequency: CH0 2402 MHz

Freq. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2390.00	H	62.7*	74.0	-11.3
2390.00	V	65.3*	74.0	-8.7
4804.00	H	54.0*	74.0	-20.0
4804.00	V	50.2*	74.0	-23.8
7206.00	H	58.6*	74.0	-15.4
7206.00	V	58.8*	74.0	-15.2

**Figure 2. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RCS Antenna

E.U.T Description Laser Power Meter

Type Quasar 7Z01300

Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Average
 Operation Frequency: CH0 2402 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
2390.00	H	44.6*	54.0	-9.4
2390.00	V	44.8*	54.0	-9.2
4804.00	H	34.4*	54.0	-19.6
4804.00	V	33.9*	54.0	-20.1
7206.00	H	41.3*	54.0	-12.7
7206.00	V	41.2*	54.0	-12.8

**Figure 3. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL
 Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RCS Antenna

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Peak
 Operation Frequency: CH46 2448 MHz

Freq. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
4896.00	H	57.3*	74.0	-16.7
4896.00	V	53.2*	74.0	-20.8
7344.00	H	63.3*	74.0	-10.7
7344.00	V	63.0*	74.0	-11.0

**Figure 4. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RCS Antenna

E.U.T Description Laser Power Meter

Type Quasar 7Z01300

Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz

Test Distance: 3 meters Detector: Average

Operation Frequency: CH46 2448 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
4896.00	H	34.8*	54.0	-19.2
4896.00	V	34.6*	54.0	-19.4
7344.00	H	42.3*	54.0	-11.7
7344.00	V	42.3*	54.0	-11.7

**Figure 5. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RCS Antenna

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Peak
 Operation Frequency: CH79 2481 MHz

Freq. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2484.00	H	69.7*	74.0	-4.3
2484.00	V	69.4*	74.0	-4.6
4962.00	H	59.1*	74.0	-14.9
4962.00	V	56.4*	74.0	-17.6
7443.00	H	63.5*	74.0	-10.5
7443.00	V	59.0*	74.0	-15.0

**Figure 6. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RCS Antenna

E.U.T Description Laser Power Meter

Type Quasar 7Z01300

Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical

Frequency range: 1.0 GHz to 25.0 GHz

Test Distance: 3 meters

Detector: Average

Operation Frequency: CH79 2481 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
2484.00	H	46.6*	54.0	-7.4
2484.00	V	45.2*	54.0	-8.8
4962.00	H	35.2*	54.0	-18.8
4962.00	V	35.0*	54.0	-19.0
7443.00	H	43.5*	54.0	-10.5
7443.00	V	42.4*	54.0	-11.6

**Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Average**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

4.2 **Test Data**

E.U.T. Description: Laser Power Meter

Model No.: Quasar 7Z01300

Serial Number: 333020

Specification: FCC Part 15, Subpart C, 15.247(a) (1)

JUDGEMENT: Passed by 4.3 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C.

for 2402.00 MHz, 8.7 dB margin at 2390.00 MHz frequency, vertical polarization.

for 2448.00 MHz, 10.7 dB margin at 7344.00 MHz frequency, horizontal polarization.

for 2481.00 MHz, 4.3 dB margin at 2484.00 MHz frequency, horizontal polarization.

TEST PERSONNEL:

Tester Signature:  for A. Gurewitz Date: 26.05.2008
Typed/Printed Name: A. Gurewitz

4.3 **Test Instrumentation Used, Radiated Measurements Above 1 GHz**

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
RF Section	HP	85420E	3427A00103	November 12, 2007	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	February 4,2007	2 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 16, 2008	2 year
Horn Antenna	ARA	SWH-28	1008	December 8, 2006	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 2, 2007	1 year
Low Noise Amplifier	Sophia Wireless	LNA-28-B	0232	January 9, 2008	1 year
Spectrum Analyzer	HP	8592L	3926A01204	March 5, 2008	1 year

5. Number of Hopping Frequencies

Section 15.247(a)(1)(iii)

5.1 ***Test Specification***

F.C.C., Part 15, Subpart C

5.2 ***Test Procedure***

The E.U.T. was set to hopping mode.

The E.U.T. antenna terminal was connected to the spectrum analyzer through a
an appropriate coaxial cable.

The spectrum analyzer was set to the following parameters:

Span: Every 40 MHz Frequency

Band of Operation: 2402-2481 MHz

RBW: 100kHz

VBW: 300kHz

Detector Function: Peak

Trace: Maximum Hold

The number of hopping frequencies is $21+20+20+18 = 79$ (See plots).

Number of Hopping Frequencies

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

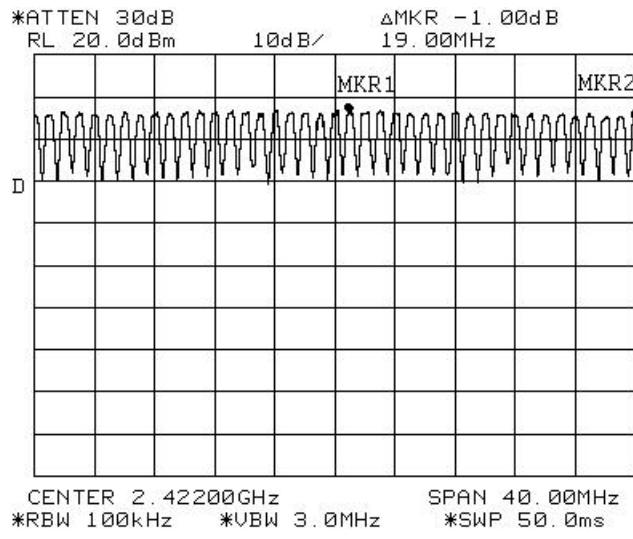
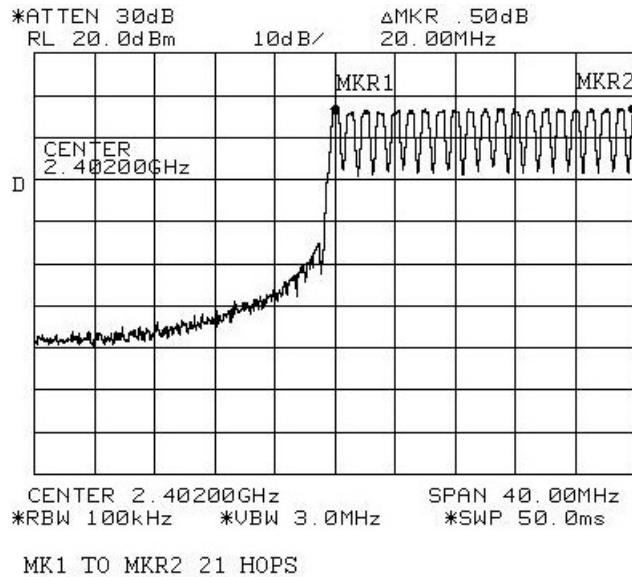


Figure 8.

Figure 9. 2.422 GHz

Number of Hopping Frequencies

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

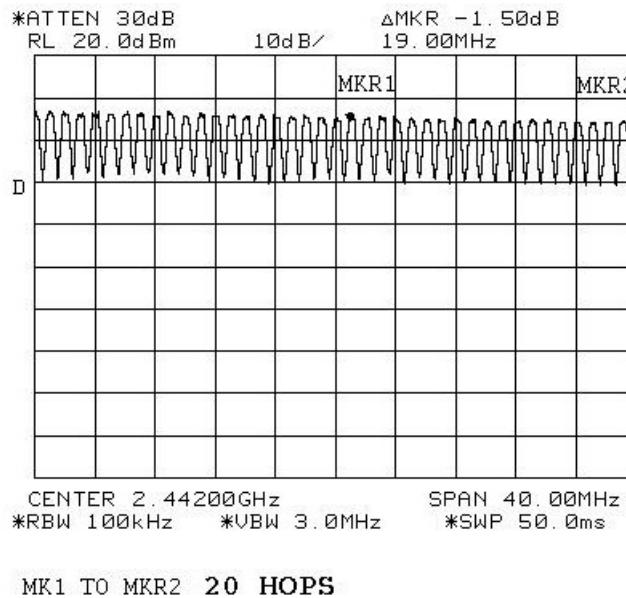


Figure 10. 2.442 GHz

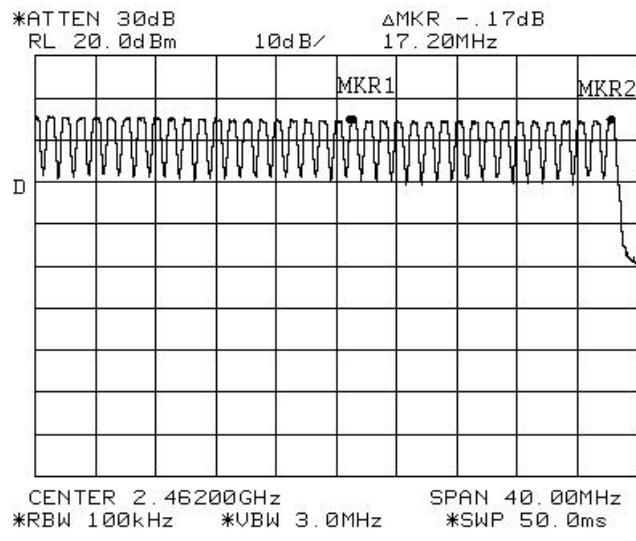


Figure 11. 2.462 GHz

5.3 Results table

E.U.T. Description: Laser Power Meter
Model No.: Quasar 7Z01300
Serial Number: 333020
Specification: FCC Part 15, Subpart C, 15.247(a)(1)(iii)

Number of Hopping Frequencies	Specification
79	>75

Figure 12 Number of Hopping Frequencies

TEST PERSONNEL:

Tester Signature:  for A. Gurewitz

Date: 26.05.2008

Typed/Printed Name: A. Gurewitz

5.4 **Test Instrumentation Used, Radiated Measurements**

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

6. Dwell Time on Each Channel

Section 15.247(a)(1)(iii)

6.1 Test procedure

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

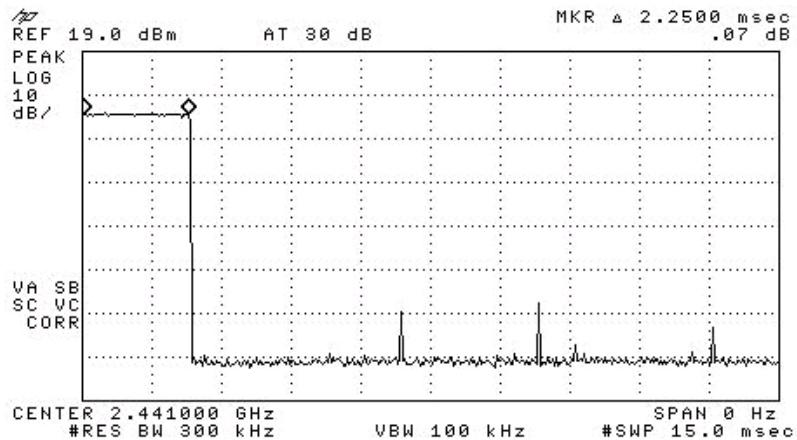


Figure 13. Emission Width 2441.0-2443.0 MHz.

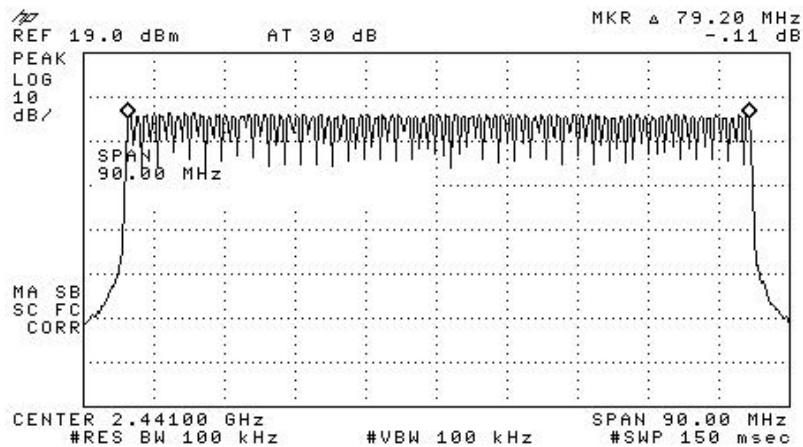
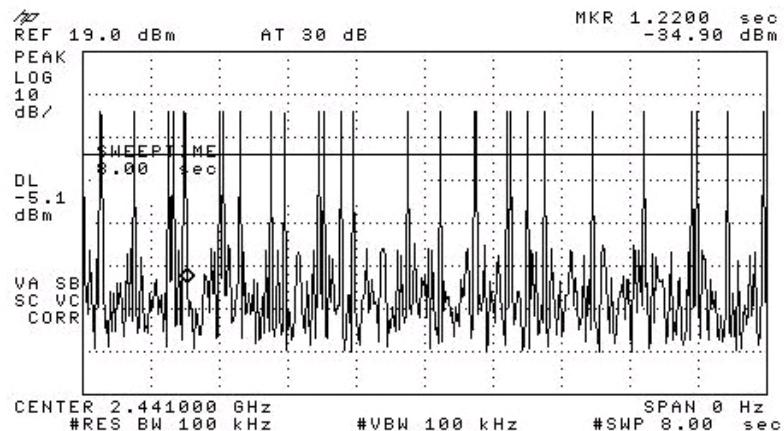


Figure 14. 79 Channel Display

Dwell Time On Each Channel

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020



**Figure 15. Number of channels in 8 sec= 27,
 Number of channels in 32 sec= 27x4= 104.**

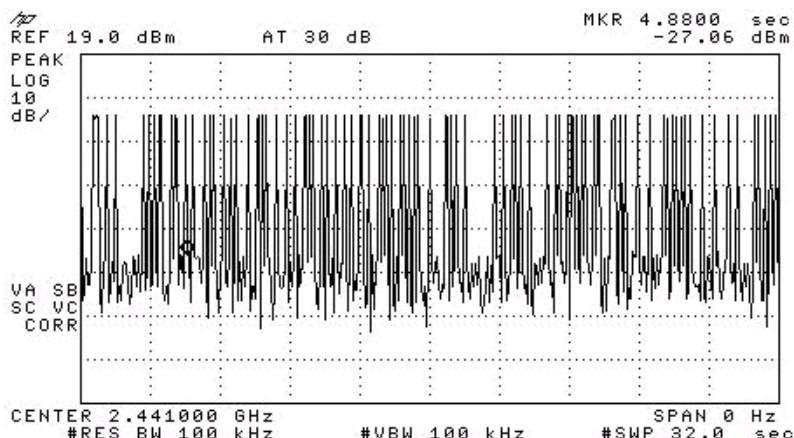


Figure 16. Number of channels in 32 SEC, total view

6.2 **Results table**

E.U.T. Description: Laser Power Meter

Model No.: Quasar 7Z01300

Serial Number: 333020

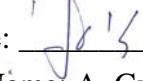
Specification: FCC Part 15, Subpart C, 15.247(a)(1)(iii)

JUDGEMENT: Passed

Number of channels in 8 sec= 27

Number of channels in 32 sec= $27 \times 4 = 104$

TEST PERSONNEL:

Tester Signature:  for A. Gurewitz

Date: 26.05.2008

Typed/Printed Name: A. Gurewitz

6.3 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Last Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
RF Section	HP	85420E	3427A00103	November 12, 2007	1 year
Antenna Bi-conical	ARA	BCD 235/B	1041	March 22, 2007	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 22, 2007	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2007	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

7. Channel Frequency Separation

7.1 ***Test procedure***

The E.U.T. was set to hopping mode.

The E.U.T. antenna terminal was connected to the spectrum analyzer through an appropriate coaxial cable.

The spectrum analyzer was set to the following parameters:

Span: 2 MHz

RBW: 10kHz

VBW: 10kHz

Detector Function: Peak

Trace: Maximum Hold

The marker delta function to determine the separation between the peaks of the adjacent channels was used.

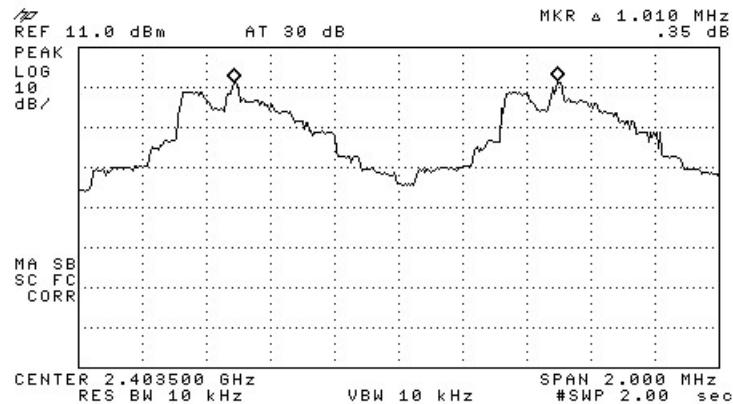


Figure 17. 2441.0-2443.0 MHz.

7.2 Results table

E.U.T. Description: Laser Power Meter
Model No.: Quasar 7Z01300
Serial Number: 333020
Specification: FCC Part 15, Subpart C (15.247(a) (1)

Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
1010.0	>810	200

Figure 18 Channel Frequency Separation

JUDGEMENT: Passed by 200 kHz

TEST PERSONNEL:

Tester Signature:  for A. Gurewitz

Date: 26.05.2008

Typed/Printed Name: A. Gurewitz

7.3 **Test Instrumentation Used, Radiated Measurements**

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

8. Maximum Transmitted Peak Power Output

2.4 GHz Transmitter

8.1 *Test procedure*

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an appropriate coaxial cable=0.8dB. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 3.0 MHz RBW. Peak power level was measured at selected operation frequencies.

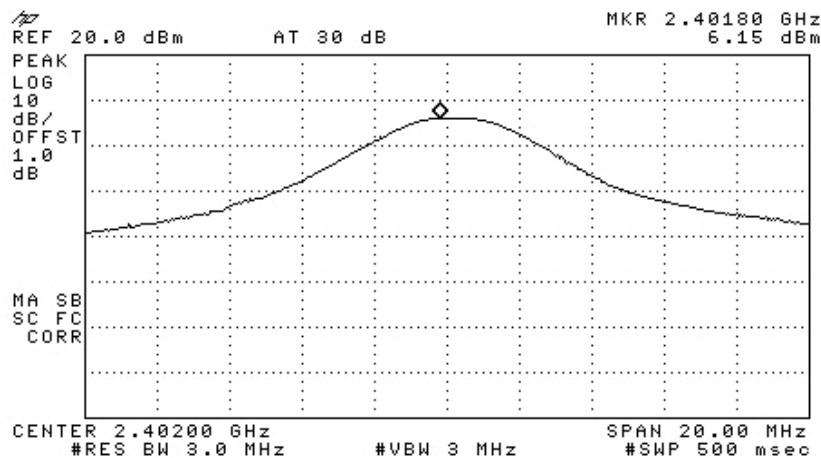


Figure 19 Peak Power at CH0 2402 MHz

Maximum Transmitted Peak Power Output

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

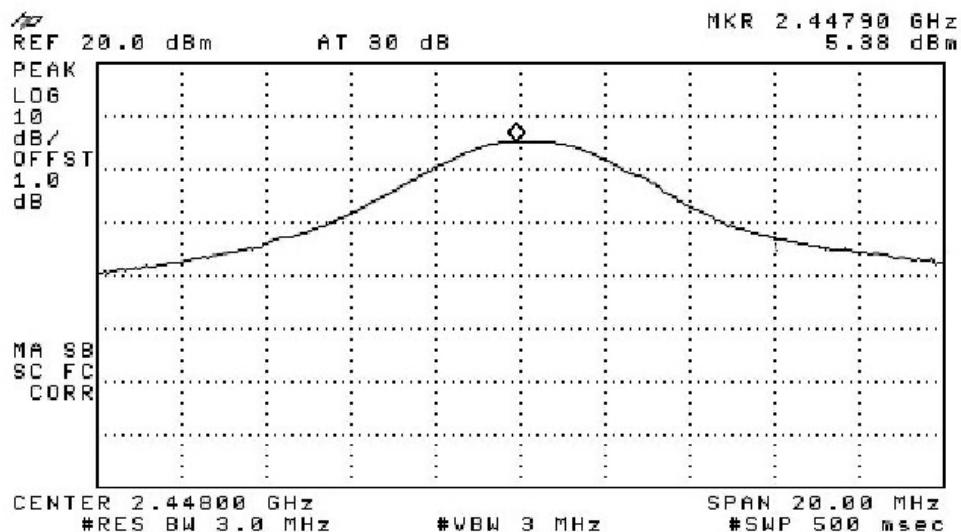


Figure 20 Peak Power at CH46 2448 MHz

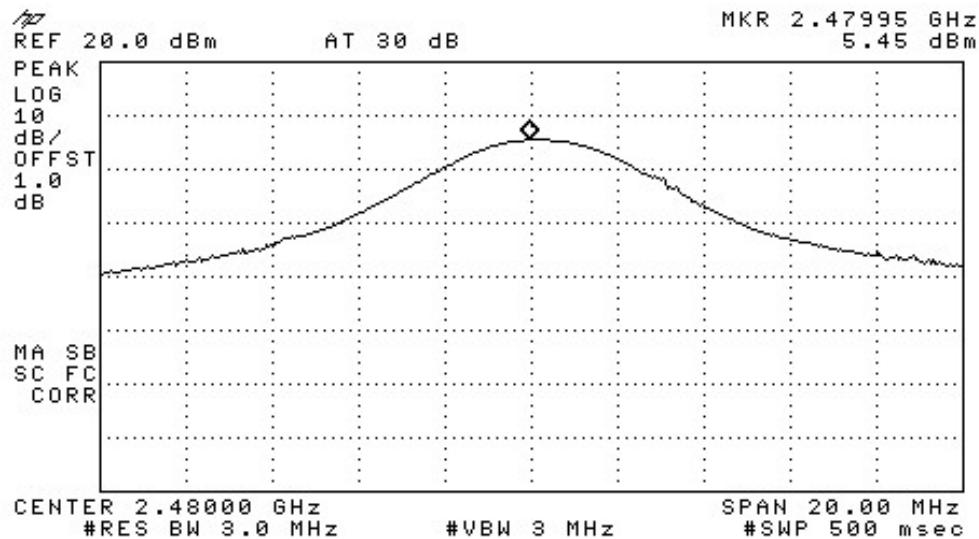


Figure 21 Peak Power at CH79 2480 MHz

8.2 Results table

E.U.T. Description: Laser Power Meter

Model No.: Quasar 7Z01300

Serial Number: 333020

Specification: F.C.C. Part 15, Subpart C

Operation Frequency (MHz)	Peak Power Output (dBm)	Specification (dBm)	Margin (dB)
2402.0	+6.2	30.0	-23.8
2448.0	+5.4	30.0	-24.6
2481.0	+5.5	30.0	-24.5

Figure 22 Maximum Peak Power Output

Note: Antenna Gain is 7 dBi

JUDGEMENT: Passed by 23.8 dB

TEST PERSONNEL:

Tester Signature:  for A. Gurewitz Date: 26.05.2008

Typed/Printed Name: A. Gurewitz

8.3 **Test Equipment Used.**

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

9. Peak Power Output Out of 2400-2483.5 MHz Band 2.4 GHz Transmitter

9.1 *Test procedure*

The E.U.T. antenna terminal was connected to the spectrum analyzer through an appropriate coaxial cable. The spectrum analyzer was set to 1 kHz RBW for the frequency range 9 kHz to 500 kHz, and 100 kHz RBW for the frequency range 500 kHz to 25.0 GHz. The frequency range from 9 kHz to 25.0 GHz was scanned. The level of spectrum components out of the 2400-2481 MHz was measured at the selected operation frequencies.

Peak Power Output

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

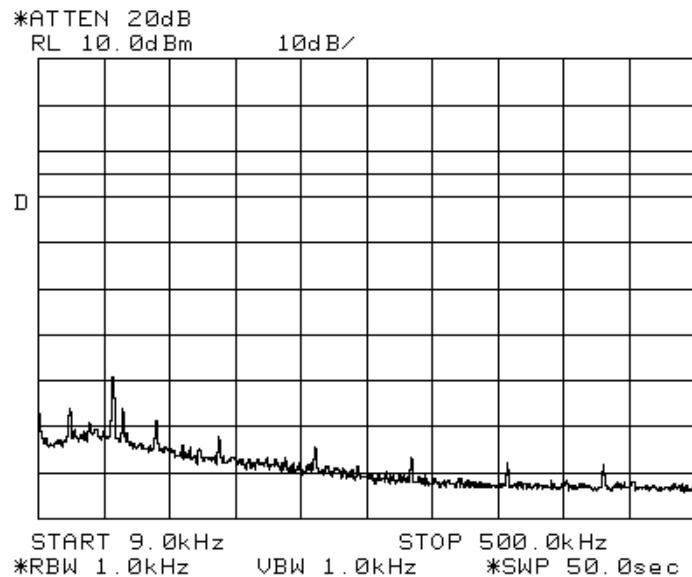


Figure 23 —CH0 2402 MHz (Ref line is -20 dbc)

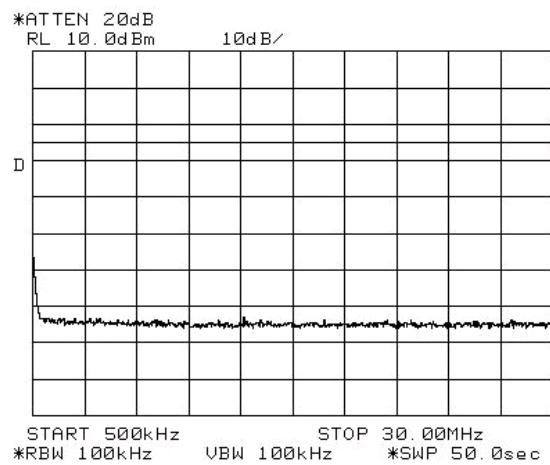


Figure 24 — CH0 2402 MHz (Ref line is -20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

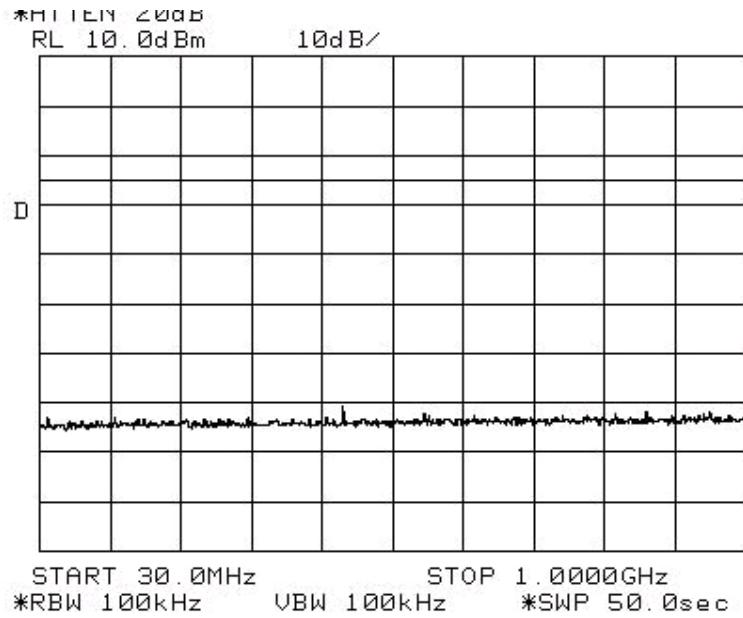


Figure 25 — CH0 2402 MHz (Ref line is -20 dbc)

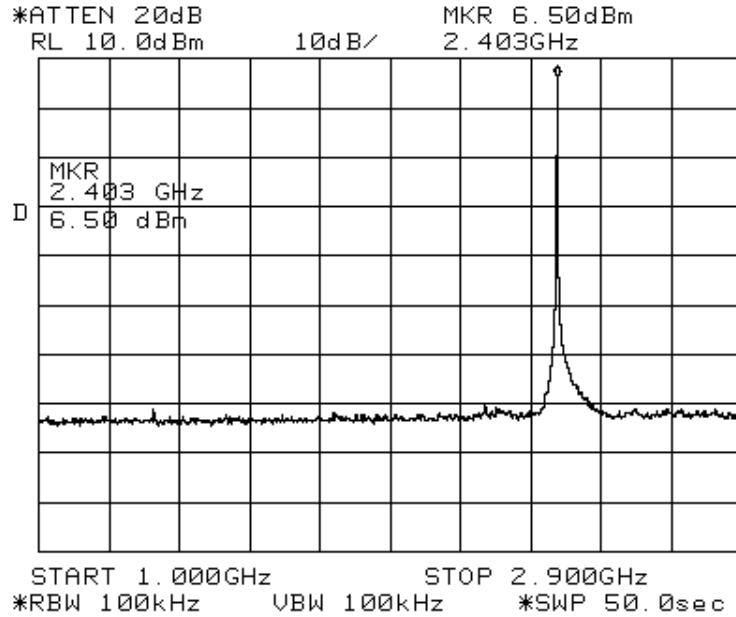


Figure 26 — CH0 2402 MHz (Ref line is -20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

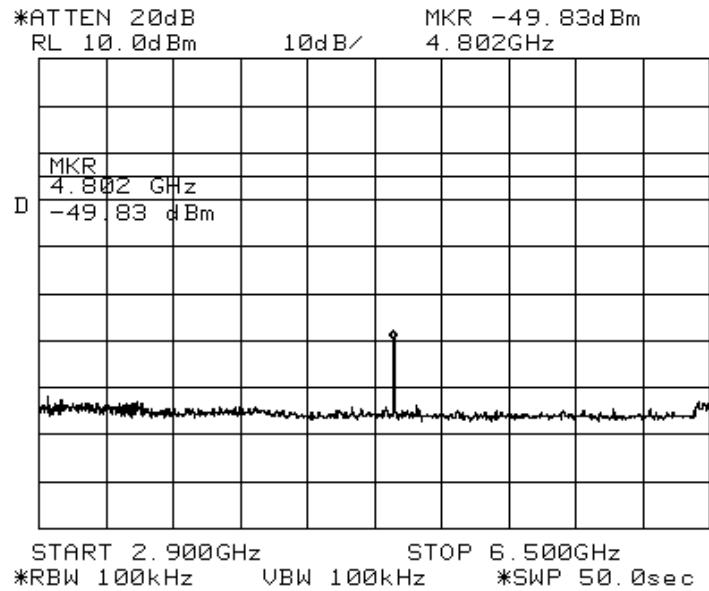


Figure 27 — CH0 2402 MHz (Ref line is -20 dbc)

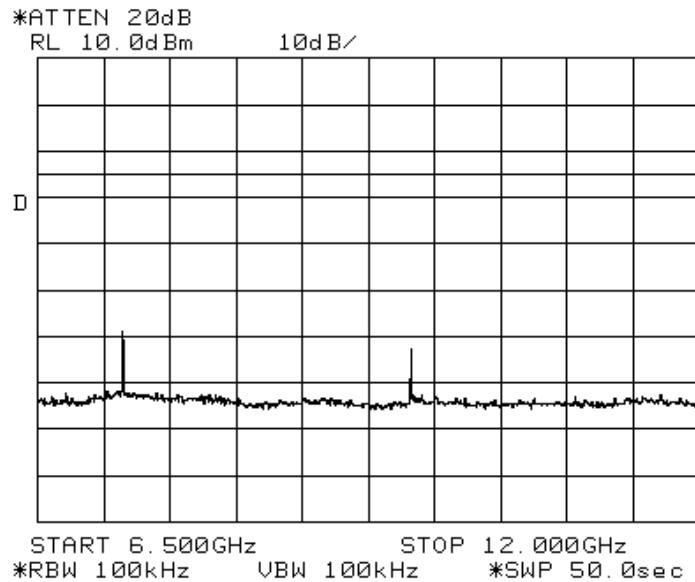


Figure 28 — CH0 2402 MHz (Ref line is -20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

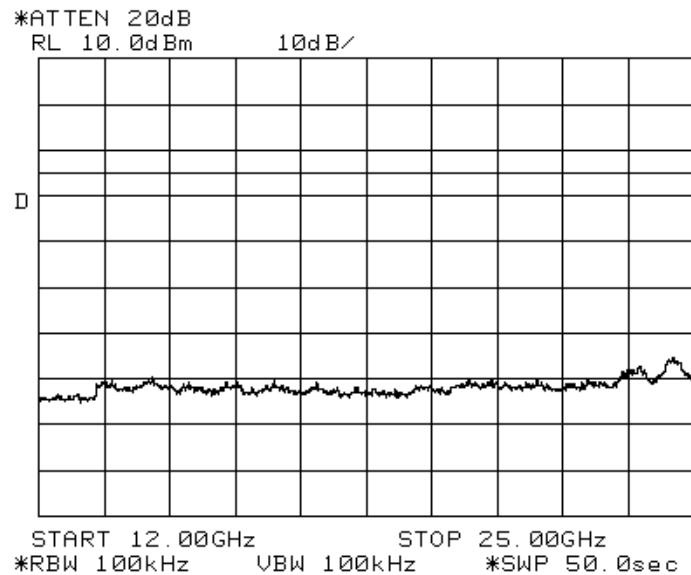


Figure 29 — CH0 2402 MHz (Ref line is -20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

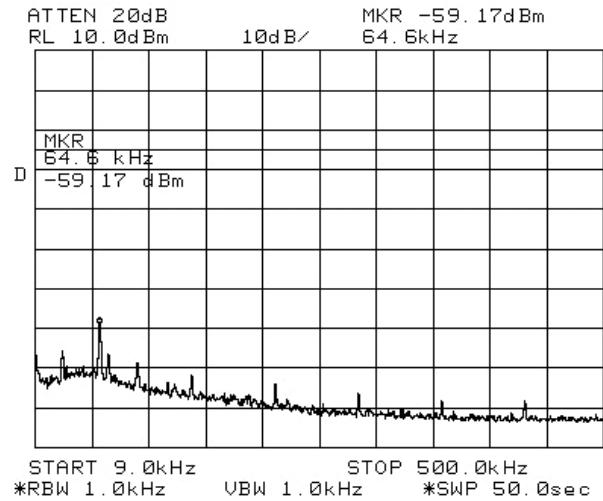


Figure 30 — CH46 2448 MHz (Ref line is –20 dbc)

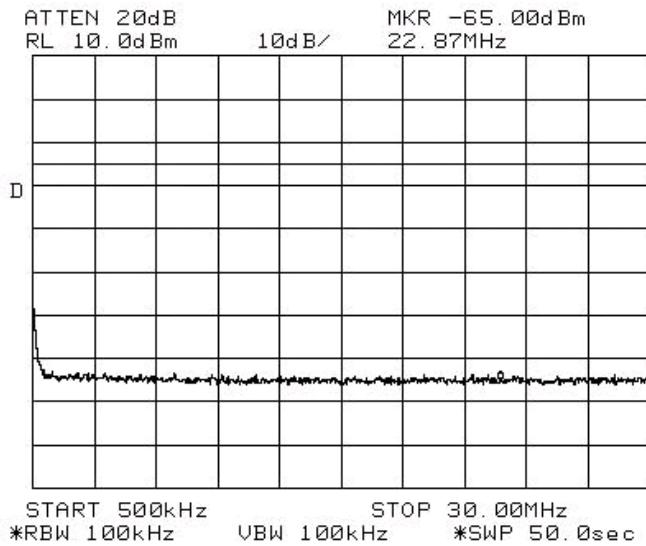


Figure 31 — CH46 2448 MHz (Ref line is –20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

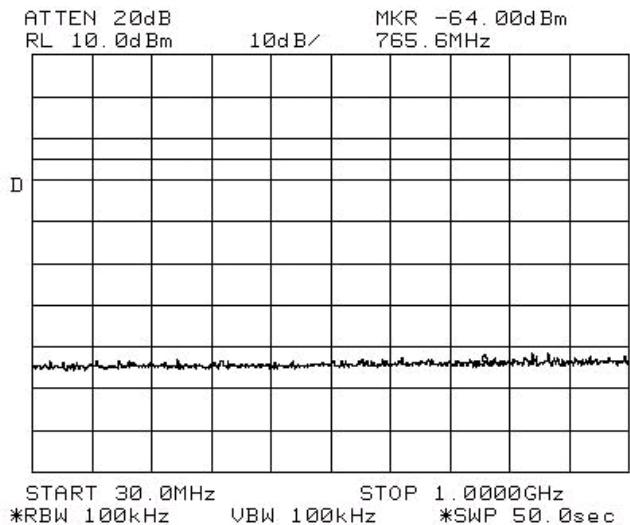


Figure 32 — CH46 2448 MHz (Ref line is –20 dbc)

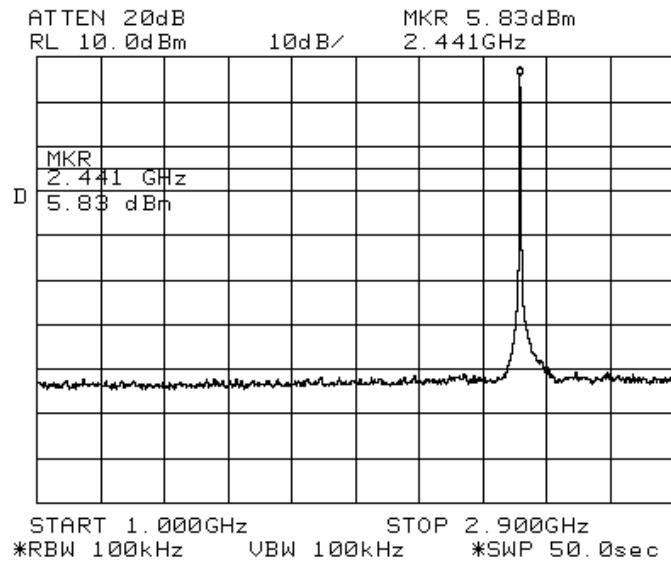


Figure 33 — CH46 2448 MHz (Ref line is -20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

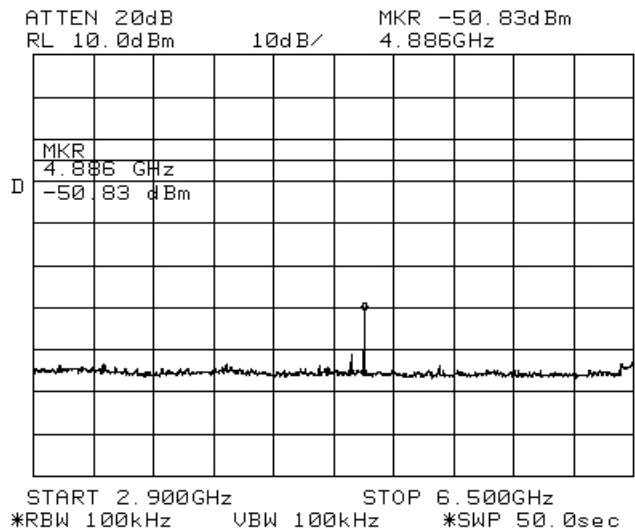


Figure 34 — CH46 2448 MHz (Ref line is -20 dbc)

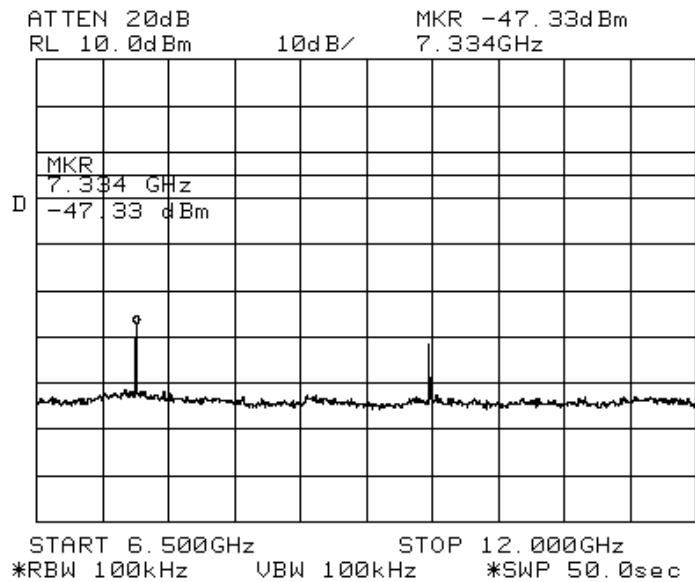


Figure 35 — CH46 2448 MHz (Ref line is -20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

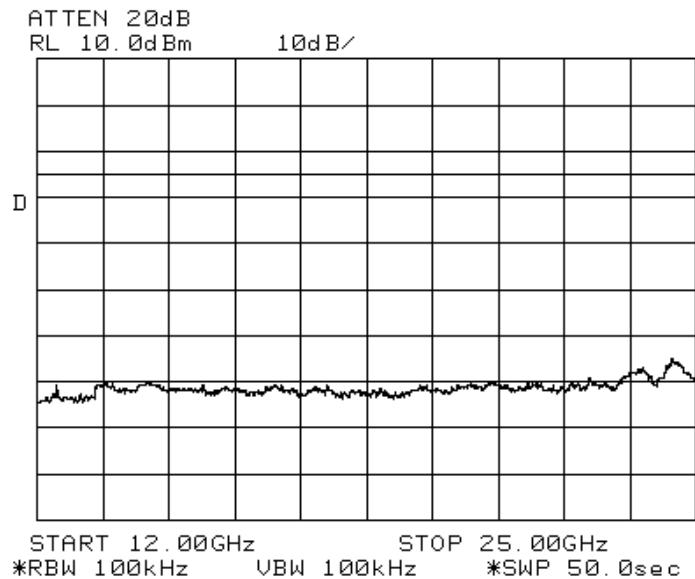


Figure 36 — CH46 2448 MHz (Ref line is -20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

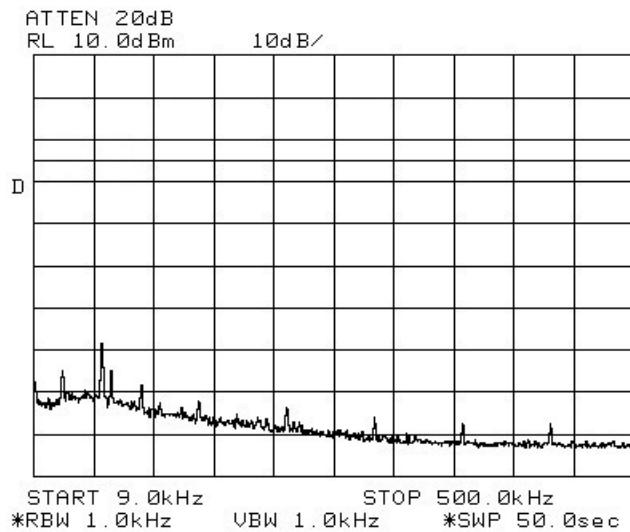


Figure 37 — CH79 2481 MHz (Ref line is –20 dbc)

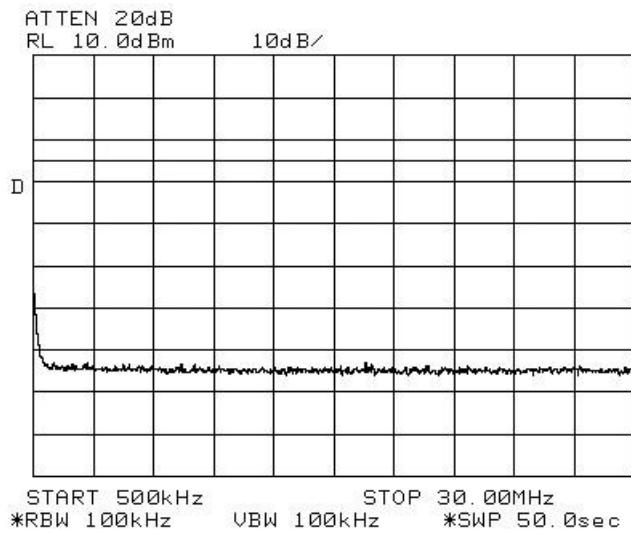


Figure 38 — CH79 2481 MHz (Ref line is –20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

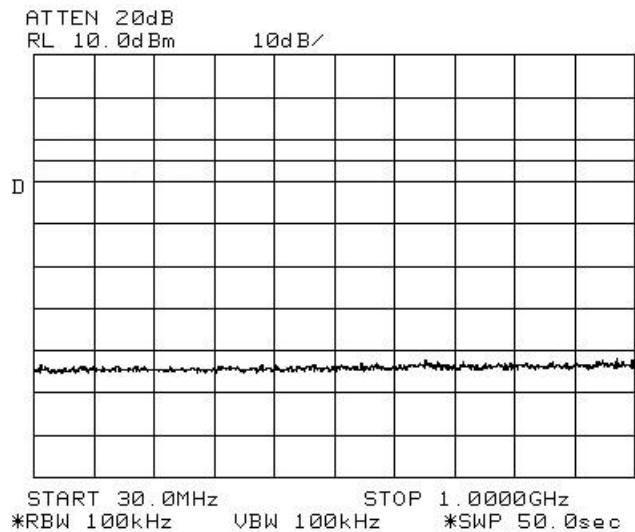


Figure 39 — CH79 2481 MHz (Ref line is -20 dbc)

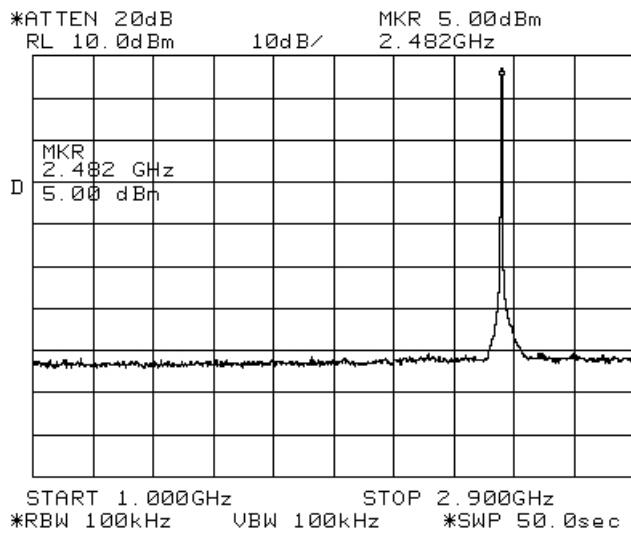


Figure 40 — CH79 2481 MHz (Ref line is -20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

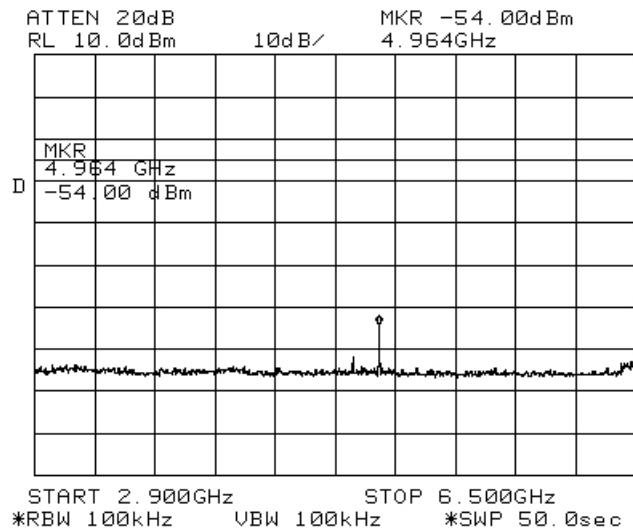


Figure 41 — CH79 2481 MHz (Ref line is -20 dbc)

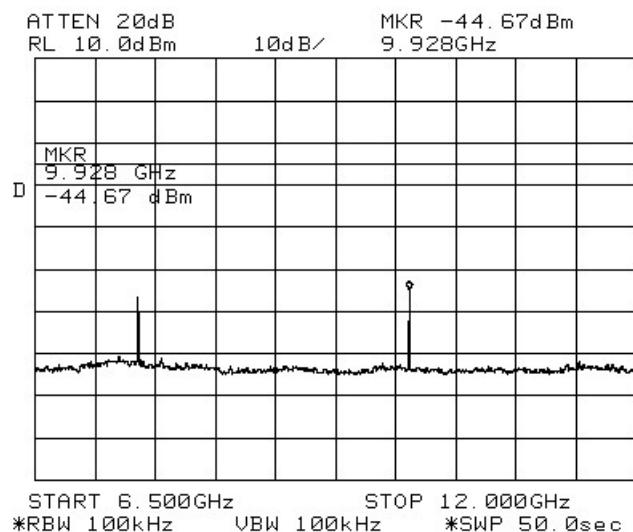


Figure 42 — CH79 2481 MHz (Ref line is -20 dbc)

Peak Power Output

E.U.T Description Laser Power Meter

Type Quasar 7Z01300

Serial Number: 333020

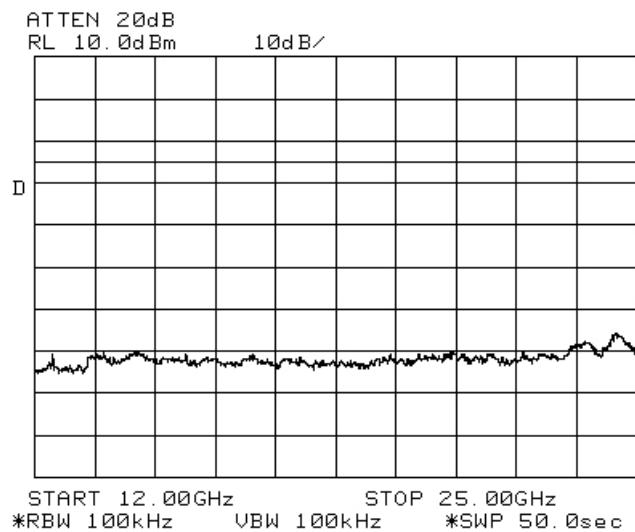


Figure 43 — CH79 2481 MHz (Ref line is -20 dbc)

9.2 Results table

E.U.T Description: Laser Power Meter

Model No.: Quasar 7Z01300

Serial Number: 333020

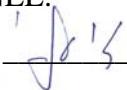
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
2402.0	49.8	20.0	29.8
2448.0	50.0	20.0	30.0
2481.0	44.7	20.0	27.7

Figure 44 Peak Power Output of 2400.0-2480.0 MHz Band

JUDGEMENT: Passed by 27.7 dB

TEST PERSONNEL:

Tester Signature:  for A. Gurewitz Date: 26.05.2008

Typed/Printed Name: A. Gurewitz

9.3 **Test Equipment Used.**

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

10. 20 dB Bandwidth

10.1 Test procedure

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an appropriate coaxial cable. The spectrum analyzer was set to 30 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 20 dB below maximum peak power was measured and recorded.

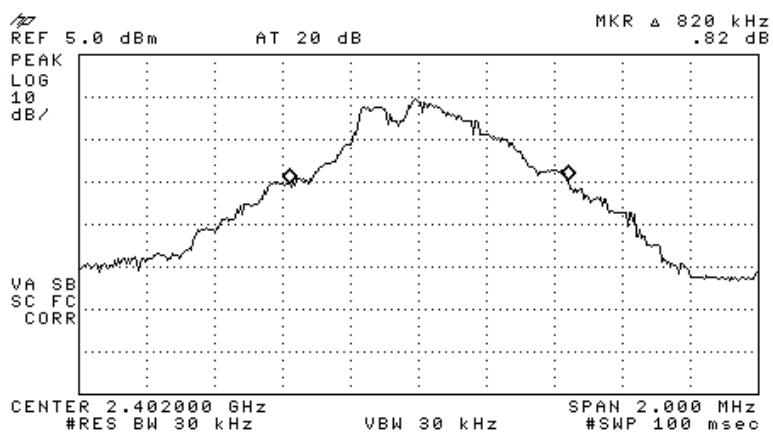


Figure 45 — 2402.0 MHz

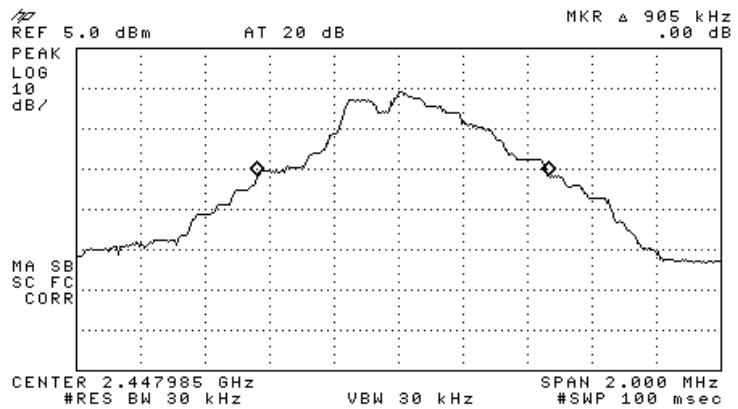


Figure 46 — 2448.0 MHz

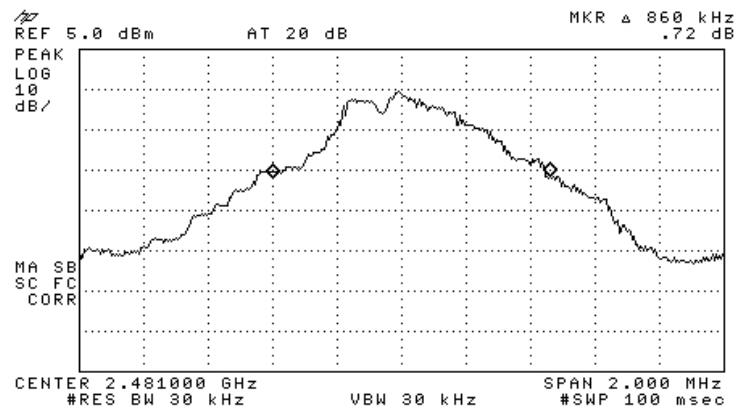


Figure 47 — 2448.0 MHz

10.2 Results table

E.U.T Description: Laser Power Meter

Model No.: Quasar 7Z01300

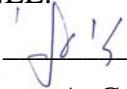
Serial Number: 333020

Specification: FCC Part 15, Subpart C (15.247-a2)

Operation Frequency (MHz)	Reading (kHz)
2402.0	828
2448.0	905
2481.0	860

Figure 48 20 dB Bandwidth

TEST PERSONNEL:

Tester Signature:  for A. Gurewitz

Date: 26.05.2008

Typed/Printed Name: A. Gurewitz

10.3 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

11. Band Edge Spectrum

[In Accordance with section 15.247(c)]

11.1 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency (2402.0 MHz) the middle operation frequency (2440.0 MHz) and the highest operation frequency (2481.0 MHz) in which the E.U.T. is planned to be used.

The E.U.T. antenna terminal was connected to the spectrum analyzer through an appropriate coaxial cable. The spectrum analyzer was set to 100 kHz resolution BW. Maximum power level below 2402 MHz and above 2481 MHz was measured relative to power level at 2402 MHz and 2481 MHz correspondingly.

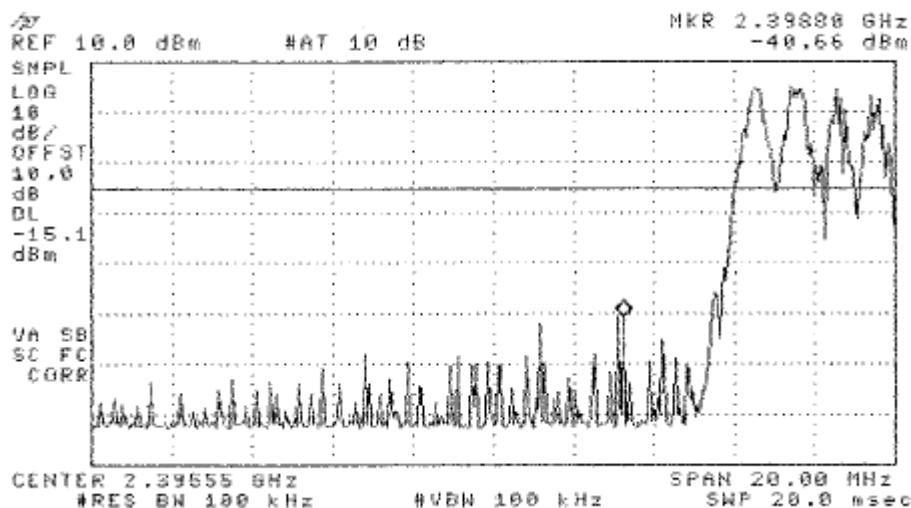


Figure 49 — F_{low} (-40.0 dBm)

Band Edge Spectrum

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

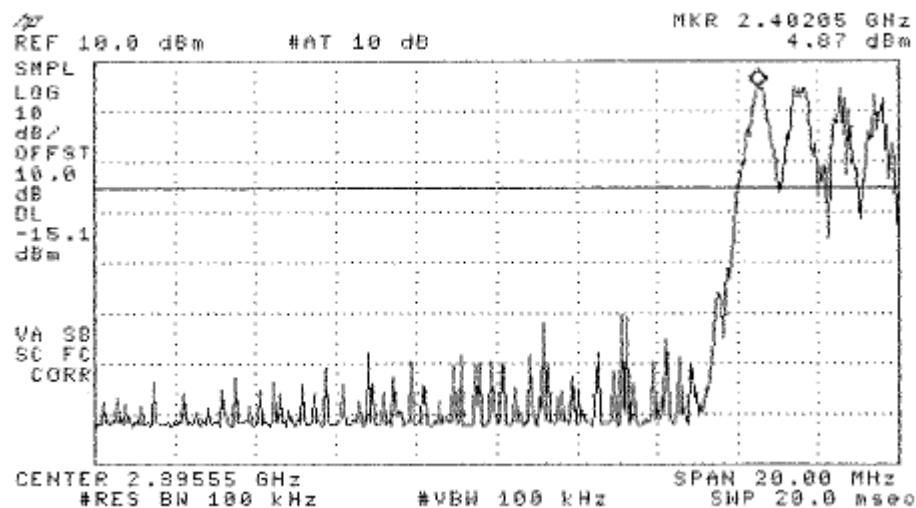


Figure 50 — F_{low} Peak

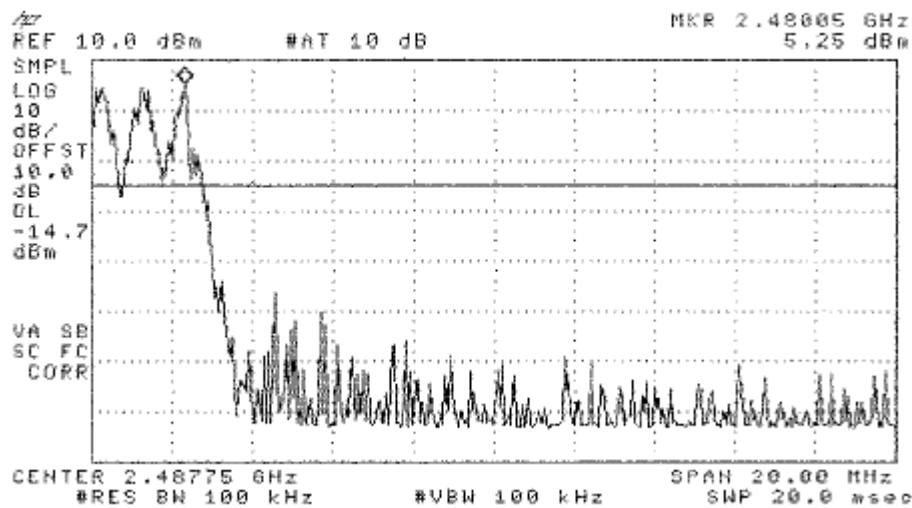


Figure 51 — F_{up} Peak

Band Edge Spectrum

E.U.T Description Laser Power Meter
Type Quasar 7Z01300
Serial Number: 333020

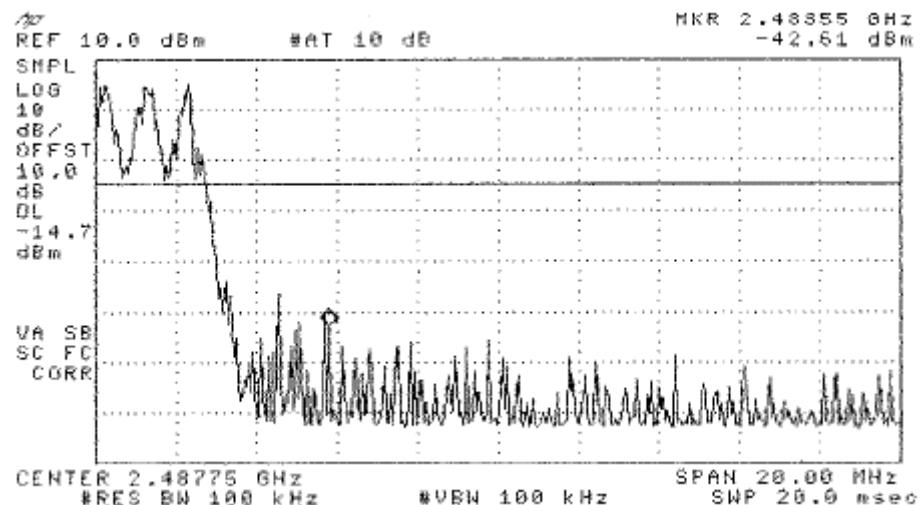


Figure 52 — F_{up} (-42.61 dBm)

11.2 Results table

E.U.T Description: Laser Power Meter

Model No.: Quasar 7Z01300

Serial Number: 333020

Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
2402.0	2402.5	-31.1	-14.7	16.4
2440.0	2480.9	-29.9	-14.7	15.2
2481.0	2484.0	-42.6	-14.7	27.9

Figure 53 Band Edge Spectrum

JUDGEMENT: Passed by 15.2 dB

TEST PERSONNEL:

Tester Signature: A. Gurewitz for A. Gurewitz Date: 26.05.2008
Typed/Printed Name: A. Gurewitz

11.3 **Test Equipment Used.**

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 54 Test Equipment Used

12. Additional Spurious Radiated Emission in the Restricted Band, Above 1 GHz 2.4GHz Transmitter With ANT-2.4-CW-RH Antenna

12.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used.

During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 10 Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

Radiated Emission Above 1 GHz

ANT-2.4-CW-RH Antenna

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Peak
 Operation Frequency: CH0 2402 MHz

Freq. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2390.00	H	64.7	74.0	-9.3
2390.00	V	63.4	74.0	-10.6
4804.00	H	50.3*	74.0	-23.7
4804.00	V	53.3*	74.0	-20.7
7206.00	H	60.4*	74.0	-13.6
7206.00	V	58.0*	74.0	-16.0

**Figure 55. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RH Antenna

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Average
 Operation Frequency: CH0 2402 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
2390.50	H	41.2	54.0	-12.8
2390.00	V	47.8	54.0	-6.2
4804.00	H	34.8*	54.0	-19.2
4804.00	V	34.7*	54.0	-19.3
7206.00	H	42.0*	54.0	-12.0
7206.00	V	42.0*	54.0	-12.0

**Figure 56. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RH Antenna

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Peak
 Operation Frequency: CH46 2448 MHz

Freq. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
4896.00	H	53.2*	74.0	-20.8
4896.00	V	52.5*	74.0	-21.5
7344.00	H	61.5*	74.0	-12.5
7344.00	V	60.0*	74.0	-14.0

**Figure 57. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RH Antenna

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Average
 Operation Frequency: CH46 2448 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
4896.00	H	35.3*	54.0	-18.7
4896.00	V	35.0*	54.0	-19.0
7344.00	H	41.5*	54.0	-12.5
7344.00	V	41.3*	54.0	-12.7

**Figure 58. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RH Antenna

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Peak
 Operation Frequency: CH79 2481 MHz

Freq. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2483.50	H	65.8*	74.0	-8.2
2483.50	V	66.9*	74.0	-7.1
4962.00	H	65.8*	74.0	-8.2
4962.00	V	51.7*	74.0	-22.3
7443.00	H	62.5*	74.0	-11.5
7443.00	V	59.2*	74.0	-14.5

**Figure 59. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

ANT-2.4-CW-RH Antenna

E.U.T Description Laser Power Meter
 Type Quasar 7Z01300
 Serial Number: 333020

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Average
 Operation Frequency: CH79 2481 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
2483.50	H	44.8*	54.0	-9.2
2483.50	V	50.2*	54.0	-3.8
4962.00	H	50.2*	54.0	-3.8
4962.00	V	34.5*	54.0	-19.5
7443.00	H	42.3*	54.0	-11.7
7443.00	V	43.0*	54.0	-11.0

Figure 60. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

12.2 **Test Data**

E.U.T. Description: Laser Power Meter

Model No.: Quasar 7Z01300

Serial Number: 333020

Specification: FCC Part 15, Subpart C (15.247(a) (1)

JUDGEMENT: Passed by 3.8 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C.

for 2402.00 MHz, 6.2 dB margin at 2483.50 MHz frequency, for both horizontal and vertical polarizations.

for 2448.00 MHz, 12.5 dB margin at 7344.00 MHz frequency, horizontal polarization.

for 2481.00 MHz, 3.8 dB margin at 4962.00 MHz frequency, horizontal polarization and 3.8 dB margin at 2483.50 MHz frequency, vertical polarization.

TEST PERSONNEL:

Tester Signature:  for A. Gurewitz Date: 26.05.2008
Typed/Printed Name: A. Gurewitz

12.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
RF Section	HP	85420E	3427A00103	November 12, 2007	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	February 4,2007	2 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 16, 2008	2 year
Horn Antenna	ARA	SWH-28	1008	December 8, 2006	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 2, 2007	1 year
Low Noise Amplifier	Sophia Wireless	LNA-28-B	0232	January 9, 2008	1 year
Spectrum Analyzer	HP	8592L	3926A01204	March 5, 2008	1 year

13. R.F Exposure/Safety Calculation

ANT-2.4-CW-RCS

15.247 (i)

Typical use of the E.U.T. is measuring the power or energy of a laser. The typical placement of the E.U.T. is either hand-held or tabletop. The typical distance between the E.U.T. and the user in the worst case application, is <2.5 cm.

Calculation of Maximum Permissible Exposure (MPE)
Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2448 MHz is: $1 \frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t - Transmitted Power 3.45 mW (Peak) = 5.38dBm

G_t - Antenna Gain, -1.20 dBi

R- Distance from Transmitter using 1 m worst case

(c) The peak power density is:

$$S_p = \frac{3.45}{4\pi(100)^2} = 2.75 \times 10^{-5} \frac{mW}{cm^2}$$

(d) The duty cycle of transmission in actual worst case is 8%.

The average power is:

$$P_{AV} = \frac{3.45 \times 1.2}{1000} = 0.0041mW$$

(e) The averaged power density of the E.U.T. is:

$$S_{AV} = \frac{0.004}{4\pi(100)^2} = 3.2 \times 10^{-8} \frac{mW}{cm^2}$$

(f) This is 3 orders of magnitude below the FCC limit.

14. APPENDIX A - CORRECTION FACTORS

14.1 *Correction factors for*

CABLE

**from EMI receiver
to test antenna
at 3 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 27 meters.
3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

14.2 Correction factors for

CABLE

from EMI receiver
to test antenna
at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.
2. The overall length of the cable is 10 meters.

14.3 Correction factors for

CABLE from spectrum analyzer to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.
2. The cable is used for measurements above 2.9 GHz.
3. The overall length of the cable is 10 meters.

14.4 Correction factors for

**CABLE
from EMI receiver
to test antenna
at 10 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	9.8
20.0	0.8	1400.0	10.0
30.0	0.9	1600.0	11.3
40.0	1.2	1800.0	12.2
50.0	1.4	2000.0	13.1
60.0	1.6	2300.0	14.5
70.0	1.8	2600.0	15.9
80.0	1.9	2900.0	16.4
90.0	2.0		
100.0	2.1		
150.0	2.6		
200.0	3.2		
250.0	3.8		
300.0	4.2		
350.0	4.6		
400.0	5.1		
450.0	5.3		
500.0	5.6		
600.0	6.3		
700.0	7.0		
800.0	7.6		
900.0	8.0		
1000.0	8.7		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 34 meters.
3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".

12.6 Correction factors for LOG PERIODIC ANTENNA
Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. Antenna serial number is 1038.
2. The above lists are located in file number 38M30.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.
3. The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".

14.5 Correction factors for

LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. Antenna serial number is 253.
2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.
3. The files mentioned above are located on the disk marked "Antenna Factors".

14.6 Correction factors for

BICONICAL ANTENNA

**Type BCD-235/B,
at 3 meter range**

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.
2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

**14.7 Correction factors for BICONICAL ANTENNA
Type BCD-235/B,
10 meter range**

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. Antenna serial number is 1041.
2. The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

14.8 Correction factors for Double-Ridged Waveguide Horn

**Model: 3115, S/N 29845
at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENN A Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

14.9 Correction factors for

Horn Antenna

**Model: SWH-28
at 1 meter range.**

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

14.10 Correction factors for

**Horn Antenna
Model: V637**

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0

14.11 Correction factors for ACTIVE LOOP ANTENNA

Model 6502

S/N 9506-2950

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2