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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C (15.247) DTS Specifications and Industry Canada RSS 210 Issue 5 for an Intentional Radiator on the Unigen Corporation Model: JUNO-PAL

FCC ID:	R8KUGWN2USHN33
UPN:	5125A-UGWN2US
GRANTEE:	Unigen Corporation 45388 Warm Springs Blvd Fremont, CA 94539
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	July 11, 2005
FINAL TEST DATE:	June 20 and July 1, 2005
AUTHORIZED SIGNATORY:	Mark Briggs Principal Engineer

ACCREDITED
2016-01

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:
JUNO-PAL

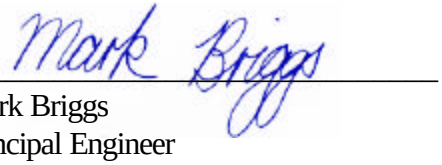
Manufacturer:
Unigen Corporation
45388 Warm Springs Blvd
Fremont, CA 94539

Tested to applicable standards:
RSS-210, Issue 5, November 2001 (Low Power License-Exempt Radiocommunication Devices)
FCC Part 15.247 (DTS)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 **SV2** Dated August 12, 2001

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of ANSI C63.4:2003 as detailed in section 5.3 of RSS-210, Issue 5); and that the equipment performed in accordance with the data submitted in this report.

Signature	
Name	Mark Briggs
Title	Principal Engineer
Company	Elliott Laboratories Inc.
Address	684 W. Maude Ave Sunnyvale, CA 94086 USA
Date:	July 11, 2005

Maintenance of compliance with the above standards is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

TABLE OF CONTENTS

SCOPE

An electromagnetic emissions test has been performed on the Unigen Corporation model JUNO-PAL pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators and RSS-210 Issue 5 for licence-exempt low power devices. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4:2003 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Unigen Corporation model JUNO-PAL and therefore apply only to the tested sample. The sample was selected and prepared by Mark Morrissey of Unigen Corporation

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules and RSS-210 Issue 5 for license-exempt low power devices for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units which are subsequently manufactured.

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
15.247(a)	6.2.2(o)(b)	Digital Modulation	Systems uses DSSS techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	6.2.2(o)(b)	6dB Bandwidth	867kHz @ 2402MHz	Minimum allowed is 500kHz	Complies
	RSP 100	99% Bandwidth	2.125 MHz (26dB bandwidth)	For information only	Complies
15.247 (b) (3)	6.2.2(o)(b)	Output Power, 2400 - 2483.5 MHz	17.1 dBm (0.051 Watts) EIRP = 0.08 W	Multi-point applications: Maximum permitted is 1Watt, with EIRP limited to 4 Watts.	Complies
15.247(d)	6.2.2(o)(b)	Power Spectral Density	7.93 dBm / 3kHz	Maximum permitted is 8dBm/3kHz	Complies
15.247(c)	6.2.2(o)(e1)	Antenna Port Spurious Emissions – 30MHz – 26 GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
15.247(c) / 15.209		Radiated Spurious Emissions – 30MHz – 26 GHz	53.9dBµV/m (493.7µV/m) @ 2483.5MHz (-0.1dB)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc	Complies
15.207		AC Conducted Emissions	10.5dBµV (3.3µV) @ 1.497MHz (-35.5dB)		Complies
	6.6	AC Conducted Emissions	16.0dBµV @ 17.898MHz (-32.0dB)		Complies
15.247 (b) (5)		RF Exposure Requirements	MPE distance < 20cm	Requires 20cm separation distance	Complies
15.203		RF Connector	Non-standard Hirose connector	Unique antenna connection required for user-installed applications.	Complies

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

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

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Unigen Corporation model JUNO-PAL is a Direct Sequence Spread Spectrum Radio which is designed to operate in the 2400 - 2483.5MHz band. The EUT is a module and so was tested without an enclosure and mounted to a test fixture to allow control and configuration of the device.

The sample was received on June 20, 2005 and tested on June 20 and July 1, 2005. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Unigen	JUNO-PAL	2.4GHz wireless module	0526-57629	R8KUGWN2USHN33

ENCLOSURE

The EUT does not have an enclosure as it is designed to be installed within the enclosure of a host device.

MODIFICATIONS

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

SUPPORT EQUIPMENT

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

Manufacturer	Model	Description	Serial Number	FCC ID
Unigen		Interface Board		
Unigen		Battery pack		
Topward	3603D	Power Supply	677301	

The battery pack was used for raidted emissions tests. The AC-DC bench supply was used for AC conducted emissions tests.

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Antenna port	Antenna	Coax	Shielded	0.2
DC in	Battery pack or dc power supply	2 wire	Unshielded	0.2

EUT OPERATION DURING TESTING

For Tx testing: the EUT was transmitting continuously on either the low, 2402MHz, the middle, 2442MHz, or the High, 2479 MHz channel. For RX testing the EUT was set to continuously receive on either the low, middle or high channels.

ANTENNA REQUIREMENTS

The antenna connects to the EUT via a non-standard Hirose coaxial connector, thereby meeting the requirements of FCC 15.203.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on June 20 and July 1, 2005 at the Elliott Laboratories Open Area Test Site #2 and 3 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Federal Communications Commission. In accordance with Industry Canada rules detailed in RSS 210 Issue 5 and RSS-212, construction, calibration, and equipment data for the test sites have been filed with the Federal Communications Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

POWER METER

A power meter and peak power sensor are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

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

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003 , and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

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

Measurement bandwidths (video and resolution) are set in accordance with FCC procedures for the type of radio being tested.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions from the AC power port are given in units of microvolts, the limits for radiated electric field emissions are given in units of microvolts per meter at a specified test distance and the output power limits are given in temrs of Watts, milliwatts or dBm. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp) the following formula is used to determine the field strength limit in terms of microvolts per meter at a distance of 3m from the equipment under test:

$$E = \frac{1000000 \text{ v } 30\ P}{3} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For reference, converting the voltage and electric field strength specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. Conversion of power specification limits from linear units (in milliwatts) to decibel form (in dBm) is accomplished by taking the base ten logarithm, then multiplying by 10.

FCC 15.407 (a)and RSS 210 (o) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watts (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watts (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watts (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

RSS 210 (o) AND FCC 15.247 SPURIOUS RADIATED EMISSIONS LIMITS

T limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands detailed in Part 15.205 and for all spurious emissions from the receiver are:

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level.

FCC 15.205 AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in FCC Part 15.205.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

RSS-210 SECTION 6.6 AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in Industry Canada RSS-210 section 6.6.

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4:2003 , 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 30 - 26500MHz, 29-Jun-05
Engineer: Mehran Birgani

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	26-Apr-06
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	08-Nov-05
Hewlett Packard	High Pass filter, 3.5GHz	P/N 84300-80038	1157	28-Apr-06
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	28-Mar-06

Conducted Emissions - AC Power Ports, 01-Jul-05
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	23-May-06
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1398	11-Feb-06
Fischer Custom Comm.	LISN, Freq. 0.9 -30 MHz,16 Amp	FCC-LISN-50/250-16-2	1079	01-Jul-05

Frequency Range, Output Power, PSD, 08-Jul-05
Engineer: Mark Briggs

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	787	17-Dec-05
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz), Sunnyvale	84125C	1149	11-Jul-05
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1422	01-Nov-05
Rohde & Schwarz	Power Sensor, 1uW-100mW, DC-18 GHz, 50ohm	NRV-Z51	1535	22-Sep-05

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T60140 18 Pages

Elliott

EMC Test Data

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	
Contact:	Mark Morrissey		
Emissions Spec:	FCC 15.247 / EN 300 328	Class:	-
Immunity Spec:	EN 301 489-17	Environment:	-

EMC Test Data

For The

Unigen

Model

Wireless USB with PA

Date of Last Test: 8/23/2005

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	
Contact:	Mark Morrissey		
Emissions Spec:	FCC 15.247 / EN 300 328	Class:	-
Immunity Spec:	EN 301 489-17	Environment:	-

EUT INFORMATION

General Description

The EUT is a Direct Sequence Spread Spectrum Radio which is designed to operate in the 2400 - 2483.5MHz band. The EUT is a module and so was tested without an enclosure and mounted to a test fixture to allow control and configuration of the device.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Unigen	JUNO-PAL	2.4GHz wireless module	0526-57629	R8KUGWN2USHN33
Unigen	AIRBASE/AIRANT	2.4GHz wireless module	n/a	n/a

Second unit was used for immunity testing and was in receive-only mode.

EUT Antenna

The antenna connects to the EUT via a non-standard Hirose coaxial connector, thereby meeting the requirements of FCC 15.203.

EUT Enclosure

The EUT does not have an enclosure as it is designed to be installed within the enclosure of a host device.

Modification History

Mod. #	Test	Date	Modification
1			

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

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	
Contact:	Mark Morrissey		
Emissions Spec:	FCC 15.247 / EN 300 328	Class:	-
Immunity Spec:	EN 301 489-17	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
		Interface Board		
		Battery pack		
Topward	3603D	Power Supply	677301	

The battery pack was used for raidted emissions tests. The AC-DC bench supply was used for AC conducted emissions tests.

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Antenna port	Antenna	Coax	Shielded	0.2
DC in	Battery pack / DC power source	2 wire	Unshielded	0.2

EUT Operation During Emissions Tests

For Tx testing: the EUT was transmitting continuously on either the low, 2402MHz, the middle, 2442MHz, or the High, 2479 MHz channel. For RX testing the EUT was set to continuously receive on either the low, middle or high channels.

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	-

Conducted Emissions - Power Ports

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 7/1/2005
Test Engineer: Chris Byleckie
Test Location: SVOATS #2
Config. Used: 1
Config Change: See run
EUT Voltage: Refer to individual run

General Test Configuration

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

Ambient Conditions:

Temperature: 22 °C
Rel. Humidity: 63 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 120V/60Hz	FCC 15.207	Pass	10.5dBµV (3.3µV) @ 1.497MHz (-35.5dB)
1	CE, AC Power, 120V/60Hz	RSS 210	Pass	16.0dBµV @ 17.898MHz (-32.0dB)

Modifications Made During Testing:

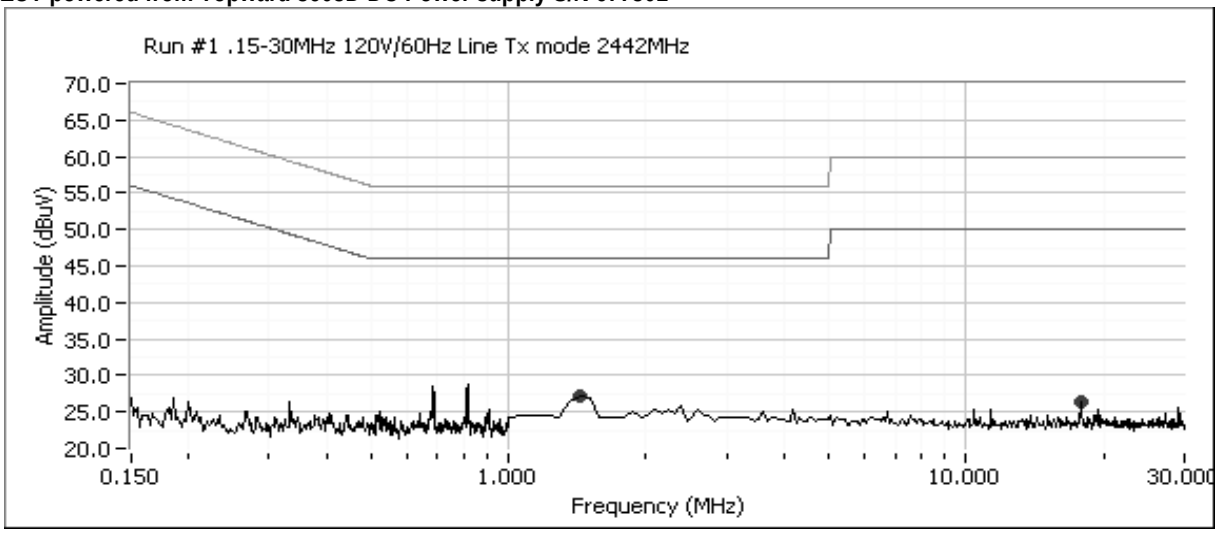
No modifications were made to the EUT during testing

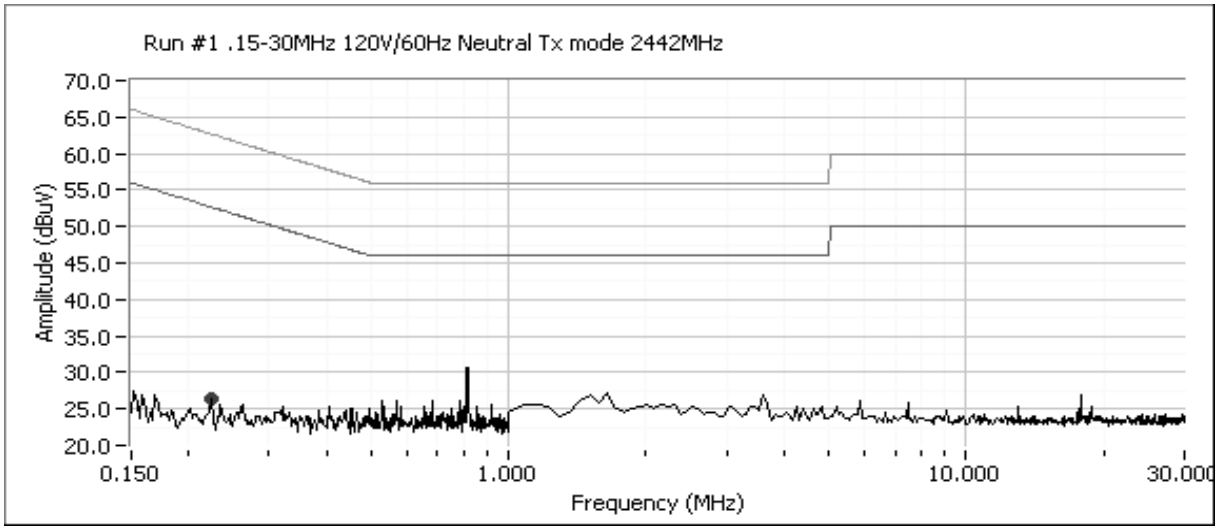
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	-

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz
EUT powered from Topward 3603D DC Power supply S/N 677301





Run #1 continued on next apge

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	-

Run #1 continued

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.334	23.0	Line 1	49.4	-26.4	Peak	
1.497	23.8	Line 1	46.0	-22.2	Peak	
17.900	27.1	Line 1	50.0	-22.9	Peak	
0.226	23.1	Neutral	52.7	-29.6	Peak	
3.633	22.1	Neutral	46.0	-23.9	Peak	
17.795	28.5	Neutral	50.0	-21.5	Peak	

Final quasi-peak and average readings

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
1.497	10.5	Line	46.0	-35.5	Average	
1.497	12.7	Line	56.0	-43.3	QP	
17.898	6.3	Line	50.0	-43.7	Average	
17.898	16.0	Line	60.0	-44.0	QP	
17.898	5.5	Neutral	50.0	-44.5	Average	
17.898	14.5	Neutral	60.0	-45.5	QP	
3.633	-2.0	Neutral	46.0	-48.0	Average	
3.633	3.5	Neutral	56.0	-52.5	QP	
0.334	-6.2	Line	49.4	-55.6	Average	
0.226	-4.0	Neutral	52.6	-56.6	Average	
0.334	-2.1	Line	59.4	-61.5	QP	
0.226	0.8	Neutral	62.6	-61.8	QP	

Final quasi-peak and average readings

Frequency	Level	AC	RSS 210		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
17.898	16.0	Line	48.0	-32.0	QP	
17.898	14.5	Neutral	48.0	-33.5	QP	
1.497	12.7	Line	48.0	-35.3	QP	
3.633	3.5	Neutral	48.0	-44.5	QP	

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

FCC 15.247 DTS - Power, Bandwidth and Spurious Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/20/2005, 6/29/2005
Test Engineer: C. Byleckie, M Birgani
Test Location: Chamber #2, SV #3
Config. Used: #1
Config Change: -
EUT Voltage: Battery

General Test Configuration

The EUT was located on the turntable for radiated spurious emissions testing and connected to the 2dBi antenna.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 22 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	30 - 25000 MHz, Spurious Emissions In Restricted Bands	FCC Part 15.209 / 15.247(c)	Pass	53.9dBµV/m (493.7µV/m) @ 2483.5MHz (-0.1dB)
2	6dB Bandwidth	15.247(a)	Pass	867kHz @ 2402MHz
3	Output Power	15.247(b)	Pass	17.1dBm
4	Power Spectral Density (PSD)	15.247(d)	Pass	7.93dBm @ 2479MHz

Modifications Made During Testing:

Modifications are detailed under each run description.

Deviations From The Standard

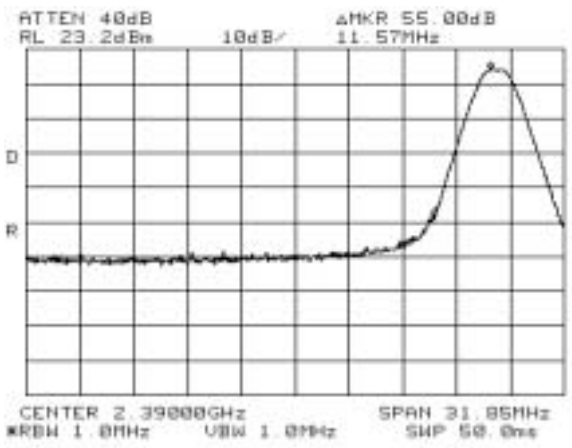
No deviations were made from the requirements of the standard.

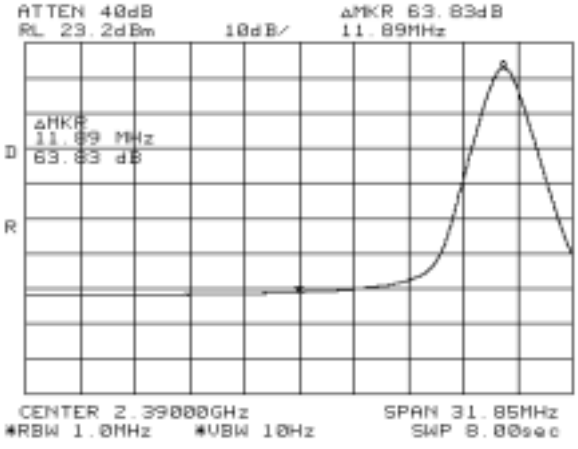
Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

Run #1a: Radiated Spurious Emissions, 30 - 26000 MHz. Low Channel @ 2402 MHz
Fundamental signal level

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2402.220	108.1	H	-	-	AVG	350	1.8	Low Channel Fundmental
2402.220	108.9	H	-	-	PK	350	1.8	Low Channel Fundmental
2402.150	115.0	V	-	-	AVG	3	1.4	Low Channel Fundmental
2402.150	116.7	V	-	-	PK	3	1.4	Low Channel Fundmental

Marker delta measurements to Calculate band Edge Field Strength





The highest signal level in the restricted bands above and below the allocated band was at the band edge. The highest peak and average field strengths in the restricted band are calculated from the field strength of the fundamental by subtracting a correction factor. The typical factor is the difference between the highest peak and average in band signal level and the highest peak and average restricted band levels.

Marker Deltas	
Peak	Average
55.0	63.8

Band Edge Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2390.000	51.2	v	54.0	-2.8	Avg	3	1.4	
2390.000	61.7	v	74.0	-12.3	Pk	3	1.4	

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

Other spurious emissions:

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
12004.75	38.8	H	54.0	-15.2	AVG	0	1.0	5th Harmonic
12017.24	38.8	H	54.0	-15.2	AVG	19	1.0	5th Harmonic
7206.560	37.1	H	54.0	-16.9	AVG	350	1.2	3rd Harmonic
7205.890	35.6	V	54.0	-18.4	AVG	20	1.1	3rd Harmonic
4803.920	32.0	H	54.0	-22.0	AVG	350	1.3	2rd Harmonic
4804.790	31.6	V	54.0	-22.4	AVG	170	1.1	2rd Harmonic
12017.24	50.4	H	78.0	-27.6	PK	19	1.0	5th Harmonic
12004.75	48.7	H	79.0	-30.3	PK	0	1.0	5th Harmonic
7206.560	46.5	H	77.0	-30.6	PK	350	1.2	3rd Harmonic
7205.890	45.4	V	76.0	-30.6	PK	20	1.1	3rd Harmonic
4803.920	41.8	H	74.0	-32.2	PK	350	1.3	2rd Harmonic
4804.790	41.3	V	75.0	-33.7	PK	170	1.1	2rd Harmonic

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

Run #1b: Radiated Spurious Emissions, 30 - 25000 MHz. Center Channel @ 2442 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
12206.40	38.9	H	54.0	-15.1	AVG	117	1.2	Standing up
7318.910	34.9	H	54.0	-19.1	AVG	355	1.0	Standing up (noise floor)
7328.400	34.9	V	54.0	-19.1	AVG	30	1.1	Lay down (Noise floor)
7318.610	34.9	V	54.0	-19.1	AVG	183	1.3	Standing up (noise floor)
4887.940	32.0	H	54.0	-22.0	AVG	193	1.0	Standing up
4887.370	32.0	V	54.0	-22.0	AVG	0	1.0	Standing up
12206.40	49.4	H	74.0	-24.6	PK	117	1.2	Standing up
7318.610	45.4	V	74.0	-28.6	PK	183	1.3	Standing up (noise floor)
7318.910	45.0	H	74.0	-29.0	PK	355	1.0	Standing up (noise floor)
7328.400	44.5	V	74.0	-29.5	PK	30	1.1	Lay down (Noise floor)
4887.940	42.3	H	74.0	-31.7	PK	193	1.0	Standing up
4887.370	41.5	V	74.0	-32.5	PK	0	1.0	Standing up

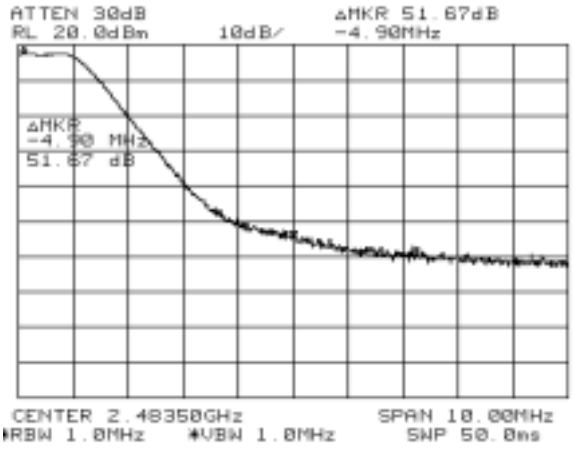
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20 dB below the level of the fundamental.

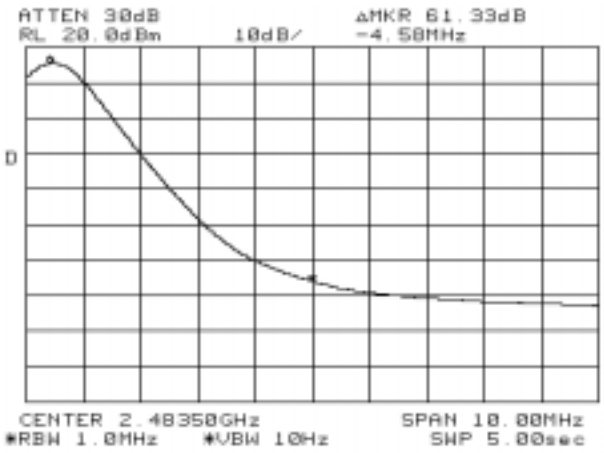
Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

Run #1c: Radiated Spurious Emissions, 30 - 25000 MHz. High Channel @ 2479 MHz
Fundamental signal level

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2480.110	115.2	V	-	-	AVG	17	1.4	RB=1MHz, VB=1MHz
2480.110	116.0	V	-	-	PK	17	1.4	RB=1MHz, VB=10Hz
2480.110	103.5	H	-	-	AVG	231	1.8	RB=1MHz, VB=1MHz
2480.110	105.0	H	-	-	PK	231	1.8	RB=1MHz, VB=10Hz

Marker delta measurements to Calculate band Edge Field Strength





The highest signal level in the restricted bands above and below the allocated band was at the band edge. The highest peak and average field strengths in the restricted band are calculated from the field strength of the fundamental by subtracting a correction factor. The typical factor is the difference between the highest peak and average in band signal level and the highest peak and average restricted band levels.

Marker Deltas	
Peak	Average
51.7	61.33

Band Edge Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	53.9	V	54.0	-0.1	Avg	17	1.4	
2483.500	64.3	V	74.0	-9.7	Pk	17	1.4	

Elliott

EMC Test Data

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

Other spurious emissions:

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
12397.49	39.0	H	54.0	-15.0	AVG	0	1.2	5th Harmonic
12396.55	39.0	V	54.0	-15.0	AVG	138	1.1	5th Harmonic
7439.96	35.5	H	54.0	-18.5	AVG	0	1.0	3rd Harmonic
7443.45	35.5	V	54.0	-18.5	AVG	152	1.2	3rd Harmonic
4953.25	32.1	V	54.0	-21.9	AVG	281	1.2	2nd Harmonic
4961.46	32.0	H	54.0	-22.0	AVG	120	1.2	2nd Harmonic
12397.49	49.1	H	74.0	-24.9	PK	0	1.2	5th Harmonic
12396.55	49.0	V	74.0	-25.0	PK	138	1.1	5th Harmonic
7443.45	45.7	V	74.0	-28.3	PK	152	1.2	3rd Harmonic
7439.96	45.6	H	74.0	-28.4	PK	0	1.0	3rd Harmonic
4953.25	42.1	V	74.0	-31.9	PK	281	1.2	2nd Harmonic
4961.46	42.1	H	74.0	-31.9	PK	120	1.2	2nd Harmonic

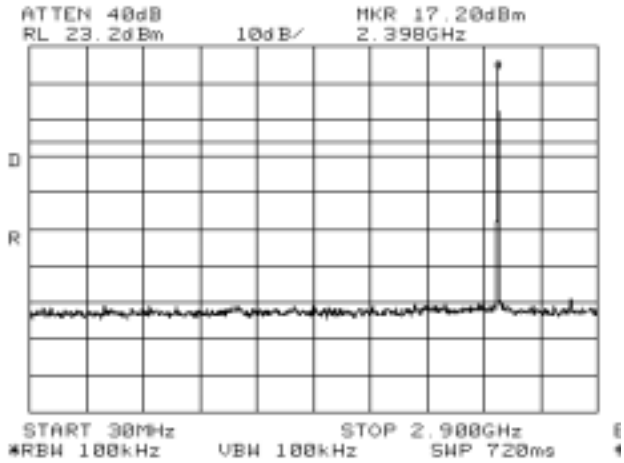
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

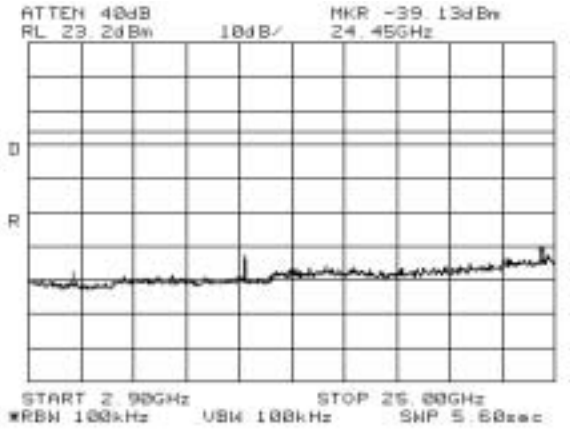
Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

Run #1d: Antenna Conducted Spurious Emissions, 30 - 25000 MHz.

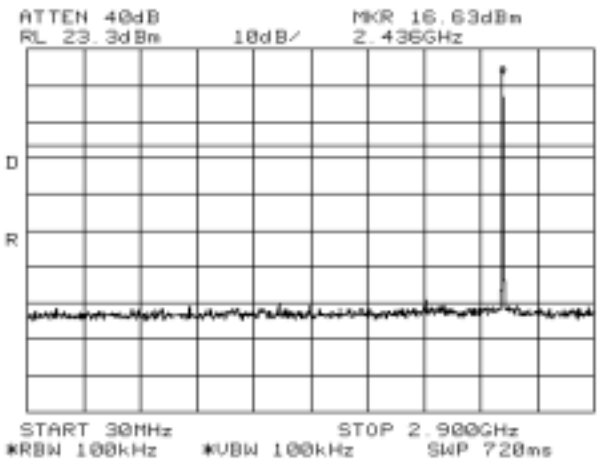
Refer to plots below. Scans made using RBW=VB=100 KHz with the limit line set at 20dB below the highest in-band signal level.

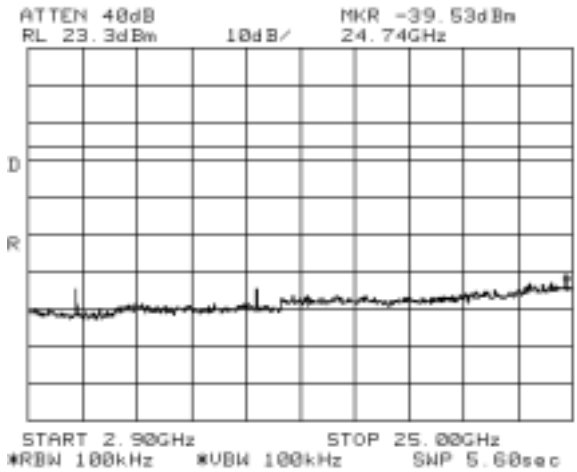
2402MHz





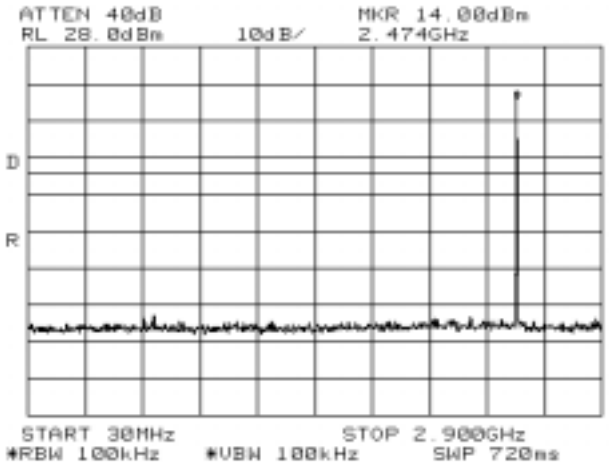
2442MHz

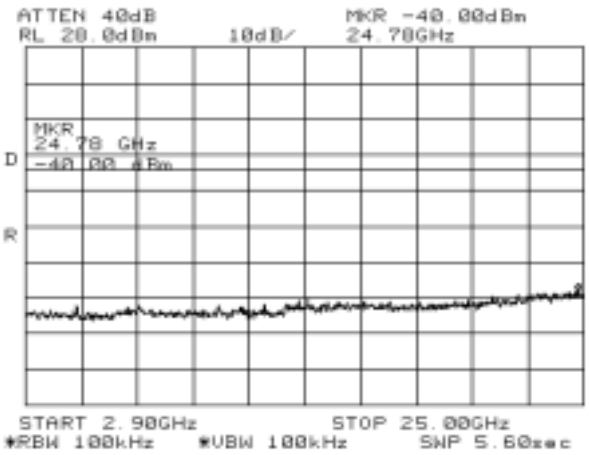




Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

2478MHz

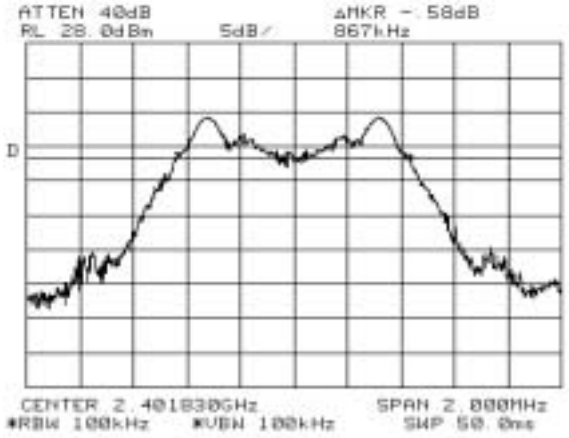


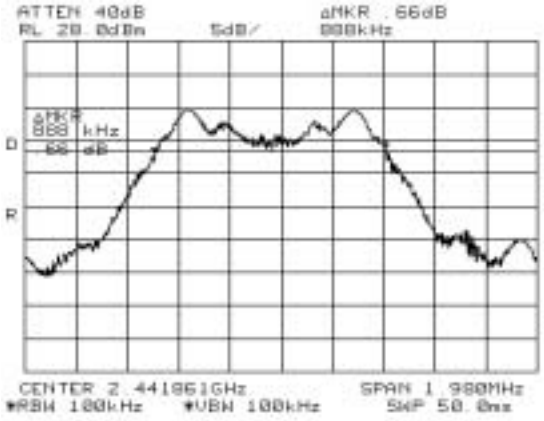


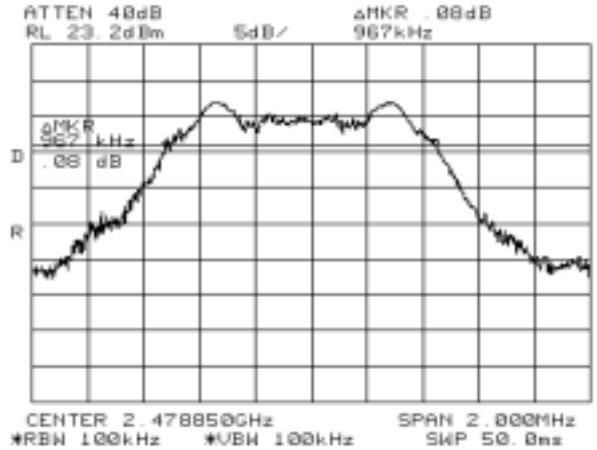
Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

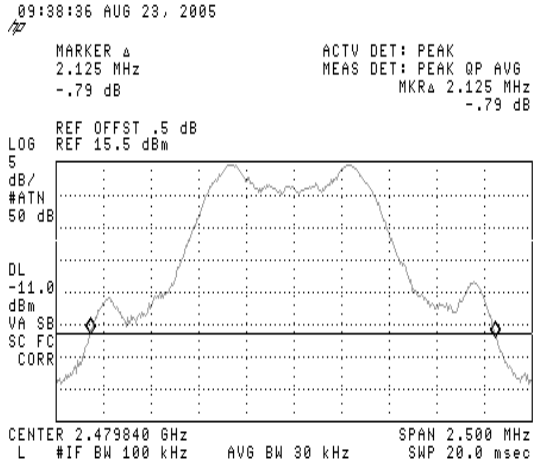
Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	6dB Signal Bandwidth	26dB Signal Bandwidth
Low	2402	100kHz	867kHz	3.275MHz
Mid	2442	100kHz	888kHz	2.78MHz
High	2479	100kHz	967kHz	3.30MHz









26dB bandwidth: 2.125 MHz (information only)

Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

Run #3: Output Power

Maximum antenna gain: 2 dBi

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	EIRP (W)
Low	2402	17.1	0.051	0.0813
Mid	2442	17.1	0.051	0.0813
High	2479	17.1	0.051	0.0813

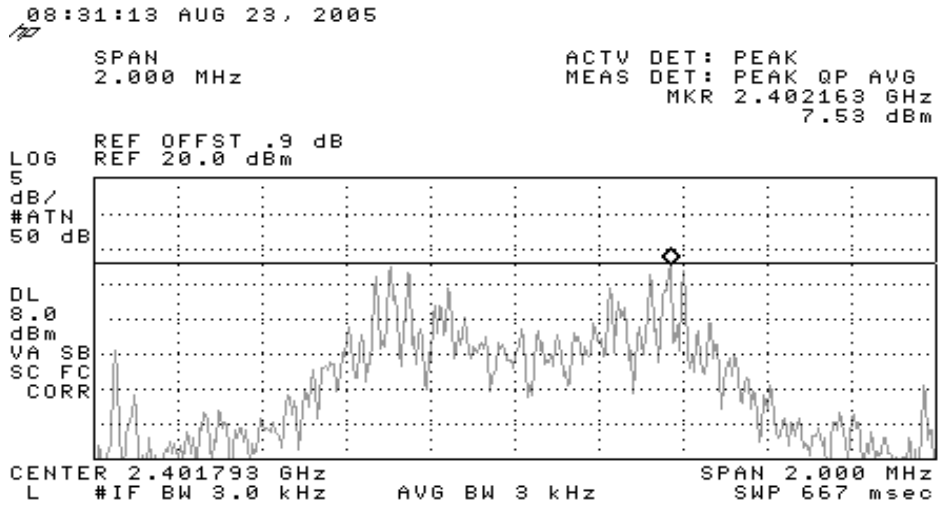
Note 1:	Output power measured using a peak power meter

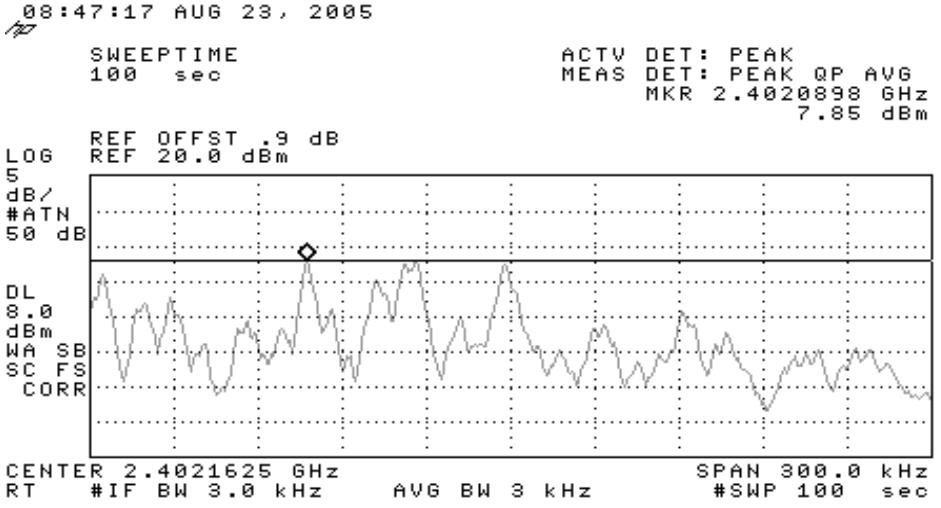
Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A

Run #4: Power Spectral Density - Performed 8/23/2005
Maximum permitted is 8dBm/3kHz

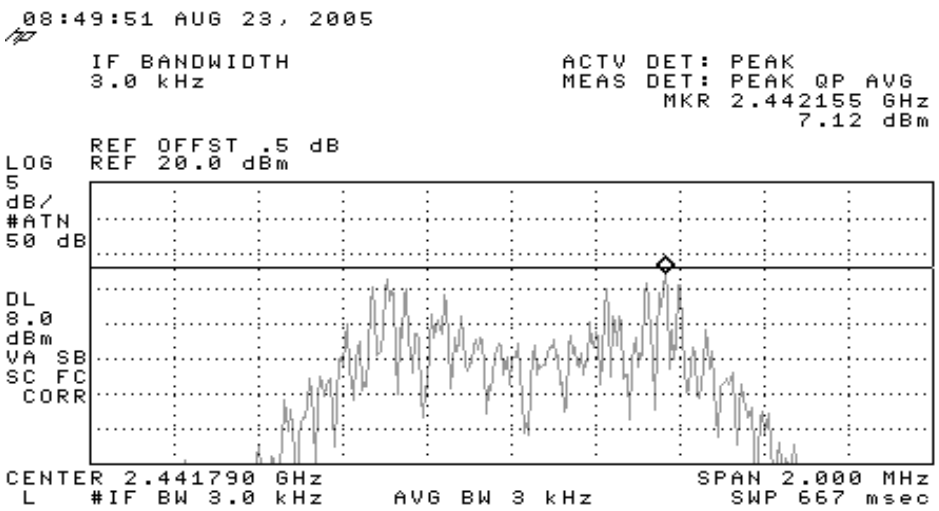
Channel	Frequency (MHz)	Res BW	P.S.D. (averaged over 1 second in a 3kHz bandwidth)
Low	2402.0898	3 kHz	7.85
Mid	2442.1235	3 kHz	7.93
High	2479.5013	3 kHz	7.46

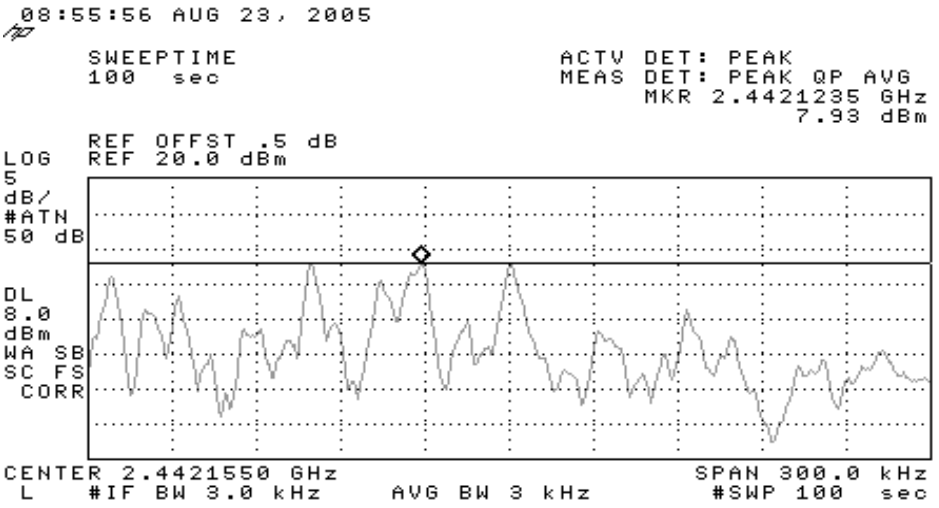
Plots show an expanded view to determine frequency of highest PSD (mutliple sweeps with a 3kHz bandwidth) and then the actual measurement made with a dwell time of at least 1 second per 3kHz at the frequency with the highest PSD observed in the first plot.



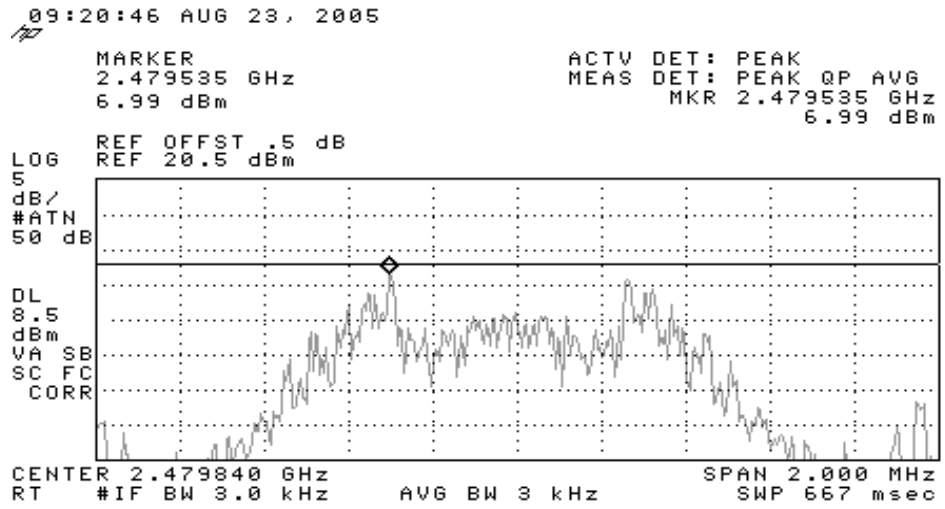


Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A





Client:	Unigen	Job Number:	J60079
Model:	Wireless USB with PA	T-Log Number:	T60140
		Account Manager:	-
Contact:	Mark Morrissey		
Spec:	FCC 15.247 / EN 300 328	Class:	N/A



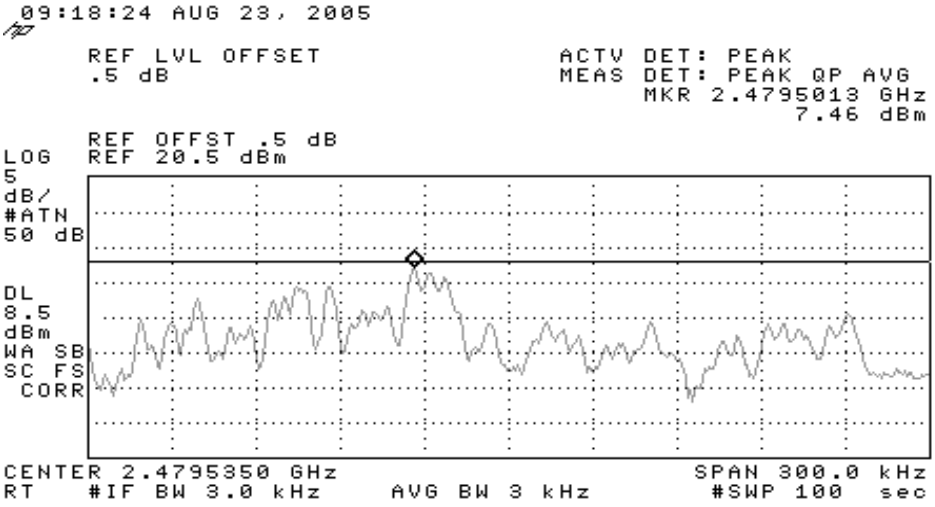


EXHIBIT 3: Test Configuration Photographs

2 Pages

The EUT was tested in two orientations – flat and upright. The photographs show both of these orientations.

EXHIBIT 4: Proposed FCC ID Label & Label Location

EXHIBIT 5: Detailed Photographs of Unigen Corporation Model JUNO-PAL Construction

Pages

EXHIBIT 6: Operator's Manual for Unigen Corporation Model JUNO-PAL

Pages

EXHIBIT 7: Block Diagram of Unigen Corporation Model JUNO-PAL

Pages

EXHIBIT 8: Schematic Diagrams for Unigen Corporation Model JUNO-PAL

Pages

EXHIBIT 9: Theory of Operation for Unigen Corporation Model JUNO-PAL

Pages

EXHIBIT 10: Advertising Literature

Pages

EXHIBIT 11: RF Exposure Information

Pages