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May 12, 2004

Mark Morrissey
Unigen
45388 Warm Springs Blvd
Fremont, CA 94539

Subject: EMC Test Report, UGWR2USxxxx

Dear Mr. Morrissey:

A report has been created detailing the results of the electromagnetic compatibility testing performed on the UGWR2USxxxx. Please find this report enclosed. Please file the test report with the other documents contained in your technical file.

These actions will bring the EN 300 328 project on the UGWR2USxxxx to a close. In the future, if you intend to make any changes to the UGWR2USxxxx, please call us prior to making these changes to discuss the possible impact to the EN 300 328 status.

If you have any questions, please don't hesitate to call us at 408-245-7800.

Sincerely,


Mark Briggs
Vice President of Engineering

MB/dmg
Enclosure: Test Report

***Electromagnetic Compatibility Test Report
For
EN 300 328 V1.4.1
“Electromagnetic compatibility and Radio Spectrum
Matters (ERM); Wieband Transmission systems; Data
transmission equipment operating in the 2,4 GHz ISM
band and using spread spectrum modulation
techniques;
Harmonized EN covering essential requirements under
article 3.2 of the R&TTE Directive”.
on the
Unigen
Model: UGWR2USxxxx***

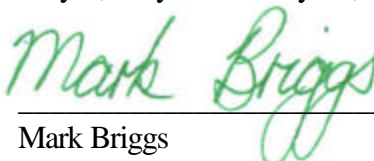
MANUFACTURER: Unigen
45388 Warm Springs Blvd
Fremont, CA 94539

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

REPORT DATE: May 12, 2004

FINAL TEST DATE: May 4, May 6 and May 10, 2004

AUTHORIZED SIGNATORY:



Mark Briggs
Vice President of Engineering



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SCOPE

The European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI) publish standards regarding the electromagnetic compatibility of electronic devices. Electromagnetic compatibility tests have been performed on the Unigen model UGWR2USxxxx in accordance with these standards.

Electromagnetic compatibility test data has been taken pursuant to the relevant requirements of EN 300 328 V1.4.1, "Electromagnetic compatibility and Radio Spectrum Matters (ERM); Wideband Transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive".

Tests were performed in accordance with these standards together with the current published versions of the basic standards referenced in EN 300 328 as outlined in Elliott Laboratories test procedures. The test data has been provided as an appendix to this report for reference.

The test results recorded herein are based on a single type test of the Unigen model UGWR2USxxxx and therefore apply only to the tested sample. The sample was selected and prepared by Mark Morrissey of Unigen.

OBJECTIVE

The objective of the manufacturer is to comply with EN 300 328. In the case of most equipment, this document requires testing to other EN specifications.

In order to demonstrate compliance, the manufacturer or a contracted laboratory makes measurements and takes the necessary steps to ensure that the equipment complies with the appropriate technical standards.

STATEMENT OF COMPLIANCE

The tested sample of Unigen Corporation model UGWR2USxxxx complied with the relevant requirements of EN 300 328 V1.4.1 based on classification of the system by the manufacturer in accordance with the guidelines of EN 300 328 V1.4.1.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product that could result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different enclosure, different line filter or power supply, harnessing and/or interface cable changes, etc.).

DEVIATIONS FROM THE STANDARD

No deviations were made from the EN 300 328 V1.4.1 standard:

PERFORMANCE ASSESSMENT

The Unigen Corporation model UGWR2USxxxx primary function is to provide a low-power wireless USB interface using FHSS modulation. All other characteristics of the product tested are detailed in the remainder of this report.

EMC TEST RESULTS

The following tests were performed on the Unigen Corporation model UGWR2USxxxx. The actual test results and associated performance criteria are contained within an appendix of this report.

| Section | Description | Measured | Limit | Result |
|---------|---|-----------------------------|--|----------|
| 4.2.1 | Effective Radiated Power (over normal and extreme conditions) | 13 dBm | 100mw (20dBm) | Complies |
| 4.2.2 | Peak Power Density | 6.8 dBm / 1MHz | 20 dBm / 100kHz (FHSS) 10 dBm/1MHz (Other Modulation) | Complies |
| 4.2.3 | Frequency Range (over normal and extreme conditions) | 2400.575 MHz - 2478.718 MHz | 2400 MHz – 2483.5 MHz | Complies |
| 4.2.4 | Transmit Mode Spurious Emissions (conducted) | -13.2dB @ 2073.5MHz | EN 300 328 V1.4.1 Tables 1 and 2 | Complies |
| 4.2.4 | Transmit Mode Spurious Emissions (radiated) | -4.6 dB @ 4804 MHz | EN 300 328 V1.4.1 Tables 1 and 2 | Complies |
| 4.2.5 | Stand-By/Receive Mode Spurious Emissions (conducted) | -21.6dB @ 10529.4MHz | EN 300 328 V1.4.1 Tables 3 and 4 | Complies |
| 4.2.5 | Stand-By/Receive Mode Spurious Emissions (radiated) | -4.9 @ 177.01 MHz | EN 300 328 V1.4.1 Tables 3 and 4 | 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 (based on a coverage factor ($k=2$)) and were calculated in accordance with NAMAS document NIS 81 and M3003.

| Measurement Type | Measurement Unit | Frequency Range | Expanded Uncertainty |
|-----------------------------------|------------------|-----------------|----------------------|
| RF frequency | Hz | 25 to 7000 MHz | 1.7×10^{-7} |
| RF power, conducted | dB | 25 to 7000 MHz | ± 0.52 dB |
| Conducted emission of transmitter | dB | 25 to 12750 MHz | ± 0.7 dB |
| Conducted emission of receiver | dB | 25 to 12750 MHz | ± 0.7 dB |
| Radiated emission of transmitter | dB | 25 to 12750 MHz | ± 2.5 dB |
| Radiated emission of receiver | dB | 25 to 12750 MHz | ± 2.5 dB |

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

The Unigen Corporation model UGWR2USxxxx is a 2.4GHz wireless module which is designed to be integrated in various OEM products. The EUT was placed in a test fixture and the test fixture was treated as table-top equipment during testing. The electrical rating of the test fixture with the module installed is 4.7 Vdc, 0.23 Amps. The electrical rating for the module is 3.3Vdc \pm 0.3Vdc, 0.16 Amps

The sample was received on May 4, 2004 and tested on May 4, May 6 and May 10, 2004. The EUT consisted of the following component(s):

| Manufacturer | Model | Description | Serial Number |
|--------------|----------------------|-------------|---------------|
| Unigen | Cypress Wireless USB | Modular | N/A |

OTHER EUT DETAILS

Any details including receiver class and power class, channel separation, frequency range or ranges, antennas used etc.

ENCLOSURE

The EUT does not have an enclosure as it is designed to be installed within the enclosure of the final product.

MODIFICATIONS

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

SUPPORT EQUIPMENT

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

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------|--------------|---------------|--------|
| Topward | 3603D | Power Supply | N/A | N/A |
| IBM | 2647 | Laptop | 78-7PX8M | DoC |

No equipment was used as remote support equipment for testing.

EUT INTERFACE PORTS

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

| Port | Connected To | Cable(s) | | |
|--------|--------------|-------------|------------------------|-----------|
| | | Description | Shielded or Unshielded | Length(m) |
| RS-232 | Laptop | Multiwire | Shielded | 5 |
| DC | DC Supply | 2 wire | unshielded | 1 |

EUT OPERATION

Transmitting at full power on low, middle, and high channels. It was also Receiving on low and high channels.

EMISSIONS TEST SITE**GENERAL INFORMATION**

Final test measurements were taken on May 4, May 6 and May 10, 2004 at the Elliott Laboratories Test Site(s) listed below. The test sites contain separate areas for radiated and conducted emissions testing. The sites conform to the requirements of CISPR 16-1:1999. They are registered with the VCCI and are on file with the FCC. Ambient levels are at least 6 dB below the specification limits with the exception of predictable local TV, radio, and mobile communications traffic. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements.

| | Site | VCCI Registration # | Location |
|---|-----------|---------------------|---|
| ■ | SVOATS #1 | R458 | 684 West Maude Avenue, Sunnyvale CA 94086-3518 |
| ■ | SVOATS #1 | C469 | |

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions measurements are performed with the EUT's rf input/output connected to the input of a spectrum analyzer. When required an attenuator or dc block is placed between the EUT and the spectrum analyzer.

RADIATED EMISSIONS CONSIDERATIONS

CISPR has determined that radiated measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an Open Area Test Site or anechoic chamber, as defined in CISPR 16-1 and Annex A of EN 300 220-3. The test site is maintained free of conductive objects within the CISPR defined elliptical area.

EMISSIONS 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. Measurements are made using a 100kHz resolution bandwidth and peak detector..

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.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & 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 runs automated data collection programs that control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

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 25 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 25 to 1000 MHz frequency range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors that are 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.

EN 300 328 specifies that the test height above ground for non-body worn devices shall be 150 centimeters. Floor mounted equipment will 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.

EMISSIONS TEST PROCEDURES

EUT AND CABLE PLACEMENT

The standards require 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 EN 300 220-3, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS (ANTENNA)

Conducted emissions are measured at the output of the device using a RF cable and attenuator if required.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases. 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 25 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 that 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 that have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBm

S = Specification Limit in dBm

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to a converted specification limit (decibel form). The conversion uses the effective radiated power limit specified in the EN 300 220-1 to calculate the expected field strength in free space using the following formula.

$$E(\text{V/m}) = \frac{\sqrt{30 * P * G}}{d}$$

E= Field Strength in V/m

P= Power in Watts

G= Gain of antenna in numeric gain (1 used for EIRP, 1.64 used for ERP)

d= distance in meters

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

$$M = R_C - L_S$$

where:

R_C = Corrected Receiver Reading in dBuV/m

L_S = Calculated specification Limit in dBuV/m

M = Margin in dB Relative to Spec

A substitution measurement is performed for spurious emissions that are within 20dB of the calculated field strength limit and for the measurement of the fundamental signal from a transmitter.

APPENDIX A: Test Equipment Calibration Data

2 Pages

Conducted Emissions - AC Power Ports, 04-May-04**Engineer: Juan Martinez**

| <u>Manufacturer</u> | <u>Description</u> | <u>Model #</u> | <u>Asset #</u> | <u>Cal Due</u> |
|----------------------|--|------------------|----------------|----------------|
| Elliott Laboratories | FCC / CISPR LISN | LISN-3, OATS | 304 | 01-Jul-05 |
| Solar Electronics | Support Equipment LISN, 0.150-30.0 MHz | 8012-50-R-24-BNC | 305 | 08-Apr-05 |
| Rohde & Schwarz | Test Receiver, 9kHz-2750MHz | ESCS 30 | 1337 | 05-Jan-05 |
| Rohde& Schwarz | Pulse Limiter | ESH3 Z2 | 1593 | 04-May-05 |

Radiated Emissions, 30 - 12,500 MHz, 06-May-04**Engineer: David Bare**

| <u>Manufacturer</u> | <u>Description</u> | <u>Model #</u> | <u>Asset #</u> | <u>Cal Due</u> |
|----------------------|---|----------------|----------------|----------------|
| EMCO | Biconical Antenna, 30-300 MHz | 3110B | 801 | 13-May-04 |
| Hewlett Packard | Microwave Preamplifier, 1-26.5GHz | 8449B | 870 | 12-Jan-05 |
| Hewlett Packard | EMC Spectrum Analyzer, 9KHz-26.5GHz | 8593EM | 1141 | 23-Mar-05 |
| Hewlett Packard | High Pass filter, 3.5GHz | 84300-80038 | 1157 | 12-Apr-05 |
| EMCO | Horn Antenna, D. Ridge 1-18GHz | 3115 | 1242 | 09-Oct-04 |
| Rohde & Schwarz | Test Receiver, 9kHz-2750MHz | ESCS 30 | 1337 | 05-Jan-05 |
| EMCO | Log Periodic Antenna, 0.2-2 GHz | 3148 | 1347 | 28-Oct-04 |
| EMCO | Log Periodic Antenna, 0.3-1 GHz | 3146A | 364 | 19-Sep-04 |
| Elliott Laboratories | Biconical Antenna, 30-300 MHz | EL30.300 | 54 | 21-Jan-05 |
| Rohde & Schwarz | Power Sensor, 1uW-100mW, DC-18 GHz, 50ohm | NRV-Z51 | 1070 | 25-Mar-05 |
| Rohde & Schwarz | Power Meter, Dual Channel | NRVD | 1539 | 25-Mar-05 |
| ETS-Lindgren | Horn Antenna, D. Ridge 1-18GHz | 3117 | 1662 | 30-Mar-05 |

Radio Antenna Port (Power and Frequency Range), 10-May-04**Engineer: dbare**

| <u>Manufacturer</u> | <u>Description</u> | <u>Model #</u> | <u>Asset #</u> | <u>Cal Due</u> |
|---------------------|---|----------------|----------------|----------------|
| Hewlett Packard | EMC Spectrum Analyzer 9kHz - 6.5GHz | 8595EM | 780 | 26-Feb-05 |
| Tektronix | Oscilloscope 500MHz DSO | TDS520 | 1000 | 30-Sep-04 |
| Rohde & Schwarz | Power Sensor, 1uW-100mW, DC-18 GHz, 50ohm | NRV-Z51 | 1070 | 25-Mar-05 |
| Rohde & Schwarz | Power Meter, Dual Channel | NRVD | 1071 | 28-Aug-04 |
| Hewlett Packard | Signal Generator (sweep) 0.01 - 26.5 GHz | 8340A | 1244 | N/A |

FCC Radiated Emission 1000 - 26,0000 MHz, 11-May-04**Engineer: Juan Martinez**

| <u>Manufacturer</u> | <u>Description</u> | <u>Model #</u> | <u>Asset #</u> | <u>Cal Due</u> |
|---------------------|-------------------------------------|----------------|----------------|----------------|
| Hewlett Packard | Microwave Preamplifier, 1-26.5GHz | 8449B | 785 | 23-Jan-05 |
| Hewlett Packard | EMC Spectrum Analyzer, 9KHz-26.5GHz | 8593EM | 1141 | 23-Mar-05 |
| EMCO | Horn Antenna, D. Ridge 1-18GHz | 3115 | 1242 | 09-Oct-04 |

Antenna Conducted Emissions, 11-May-04**Engineer: Juan Martinez**

| <u>Manufacturer</u> | <u>Description</u> | <u>Model #</u> | <u>Asset #</u> | <u>Cal Due</u> |
|---------------------|-------------------------------------|----------------|----------------|----------------|
| Hewlett Packard | EMC Spectrum Analyzer, 9KHz-26.5GHz | 8593EM | 1141 | 23-Mar-05 |

Ch# 2 Pre-Scan, 11-May-04**Engineer: Juan Martinez**

| <u>Manufacturer</u> | <u>Description</u> | <u>Model #</u> | <u>Asset #</u> | <u>Cal Due</u> |
|----------------------|-------------------------------------|----------------|----------------|----------------|
| Elliott Laboratories | Log Periodic Antenna 300-1000 MHz | EL300.1000 | 297 | 21-Jan-05 |
| Elliott Laboratories | Biconical Antenna, 30-300 MHz | DM-105-T1 | 382 | 09-Sep-04 |
| Hewlett Packard | EMC Spectrum Analyzer 9kHz - 6.5GHz | 8595EM | 780 | 26-Feb-05 |
| EMCO | Horn Antenna, D. Ridge 1-18GHz | 3115 | 786 | 29-Oct-04 |
| Hewlett Packard | Microwave Preamplifier, 1-26.5GHz | 8449B | 870 | 12-Jan-05 |
| Hewlett Packard | RF Preamplifier, 100 kHz - 1.3 GHz | 8447E | 1606 | 22-Jul-04 |

Radiated Emissions, 1,000 - 26,500 MHz, 20-Oct-04**Engineer: Mark Briggs**

| <u>Manufacturer</u> | <u>Description</u> | <u>Model #</u> | <u>Asset #</u> | <u>Cal Due</u> |
|---------------------|-------------------------------------|----------------|----------------|----------------|
| Hewlett Packard | Microwave Preamplifier, 1-26.5GHz | 8449B | 785 | 23-Jan-05 |
| EMCO | Horn Antenna, D. Ridge 1-18GHz | 3115 | 786 | 29-Oct-04 |
| Hewlett Packard | EMC Spectrum Analyzer 9kHz - 6.5GHz | 8595EM | 787 | 10-Dec-04 |
| Hewlett Packard | EMC Spectrum Analyzer, 9KHz - 22GHz | 8593EM | 1319 | 20-Nov-04 |

Conducted Emissions - RF port, 25-Oct-04

Engineer: David Bare

| <u>Manufacturer</u> | <u>Description</u> | <u>Model #</u> | <u>Asset #</u> | <u>Cal Due</u> |
|---------------------|-----------------------------------|----------------|----------------|----------------|
| Rohde & Schwarz | Power Meter, Dual Channel | NRVD | 1071 | 22-Sep-05 |
| Rohde & Schwarz | Peak Power Sensor 100uW - 2 Watts | NRV-Z32 | 1536 | 22-Apr-05 |

APPENDIX B: Test Data Log Sheets

ELECTROMAGNETIC COMPATABILITY

TEST LOGS

T55453 22 Pages



EMC Test Data

| | | | |
|-----------------|-----------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| | | Account Manager: | Susan Pelzl |
| Contact: | Mark Morrissey | | |
| Emissions Spec: | FCC 15.247, RSS-210, EN 300 | Class: | Radio |
| Immunity Spec: | EN 301 489-17 | Environment: | - |

EMC Test Data

For The

Unigen Corporation

Model

UGWR2USxxxx

Date of Last Test: 5/7/2004



EMC Test Data

| | | | |
|-----------------|---------------------------------|----------------|-----------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | | Mark Morrissey | Account Manger: |
| Emissions Spec: | FCC 15.247, RSS-210 , EN 300 32 | Class: | Radio |
| Immunity Spec: | EN 301 489-17 | Environment: | - |

EUT INFORMATION

General Description

The EUT is a 2.4GHz wireless module which is designed to be integrated in various OEM products. The EUT was placed in a test fixture and the test fixture was treated as table-top equipment during testing. The electrical rating of the test fixture with the module installed is 4.7 Vdc, 0.23 Amps. The electrical rating for the module is 3.3Vdc ±0.3Vdc, 0.16 Amps

Equipment Under Test

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------------|-------------|---------------|----------------|
| Unigen | UGWR2USxxxx | Modular | N/A | R8KUGWR2USXXXX |

EUT Enclosure

The EUT does not have an enclosure as it is designed to be installed within the enclosure of the final product.

Modification History

| Mod. # | Test | Date | Modification |
|--------|------|------|--------------|
| 1 | | | |

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



EMC Test Data

| | | | |
|-----------------|---------------------------------|-----------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manger: | Susan Pelzl |
| Emissions Spec: | FCC 15.247, RSS-210 , EN 300 32 | Class: | Radio |
| Immunity Spec: | EN 301 489-17 | Environment: | - |

Test Configuration #1

Local Support Equipment

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------|--------------|---------------|--------|
| Topward | 3603D | Power Supply | N/A | N/A |
| IBM | 2647 | Lapotp | 78-7PX8M | DoC |

Remote Support Equipment

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------|-------------|---------------|--------|
| None | | | | |

EUT Interface Ports

| EUT Port | Connected To | Cable(s) | | |
|----------|--------------|-------------|------------------------|------------|
| | | Description | Shielded or Unshielded | Length (m) |
| RS-232 | Laptop | Multiwire | Shielded | 5 |
| DC | DC Supply | 2 wire | unshielded | 1 |

EUT Operation During Radio Emissions

Transmitting at full power on low, middle, and high channels. It was also Receiving on low and high channels.



EMC Test Data

| | | | |
|-----------------|--------------------------------|-----------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manger: | Susan Pelzl |
| Emissions Spec: | FCC 15.247, RSS-210, EN 300 32 | Class: | Radio |
| Immunity Spec: | EN 301 489-17 | Environment: | - |

EUT Operation During Immunity

Transmitting at full power on low, middle, and high channels. It was also Receiving on low and high channels.

Performance Criteria for Immunity

Criterion A:

During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the test the EUT shall not unintentionally transmit or change its operating state and stored data.

In the EUT's Transmit Mode, the 2400MHz carrier frequency was monitored on Elliott's remote Spectrum Analyzer for any carrier dropouts. In the EUT's Receive Mode the spectrum of 2000 to 2900 MHz was being monitored for the presence of any carrier, which would indicate the EUT going into a transmit mode.

Criterion B:

Degradation of performance or loss of function is allowed during the test. During the test the EUT shall not unintentionally transmit or change its operating state and stored data. The EUT shall recover without operator intervention if functionality is lost during the test.

In the EUT's Transmit Mode, the 2400MHz carrier frequency was monitored on Elliott's remote Spectrum Analyzer for any carrier dropouts. In the EUT's Receive Mode the spectrum of 2000 to 2900 MHz was being monitored for the presence of any carrier, which would indicate the EUT going into a transmit mode.



EMC Test Data

| | | | |
|----------|----------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| | | Account Manager: | Susan Pelzl |
| Contact: | Mark Morrissey | | |
| Spec: | FCC 15.247, RSS-210 , EN 300 328 | Class: | Radio |

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: 5/4/2004 | Config. Used: 1 |
| Test Engineer: Juan Martinez | Config Change: None |
| Test Location: SVOATS #1 | PS Voltage: 120V/60Hz |

General Test Configuration

For tabletop equipment, the EUT and power supply were located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment.

Ambient Conditions: Temperature: 22 °C
 Rel. Humidity: 49 %

Summary of Results

| Run # | Test Performed | Limit | Result | Margin |
|-------|------------------------|------------|--------|--------|
| 1 | CE, AC Power,120V/60Hz | CISPR 22 B | Pass | |

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

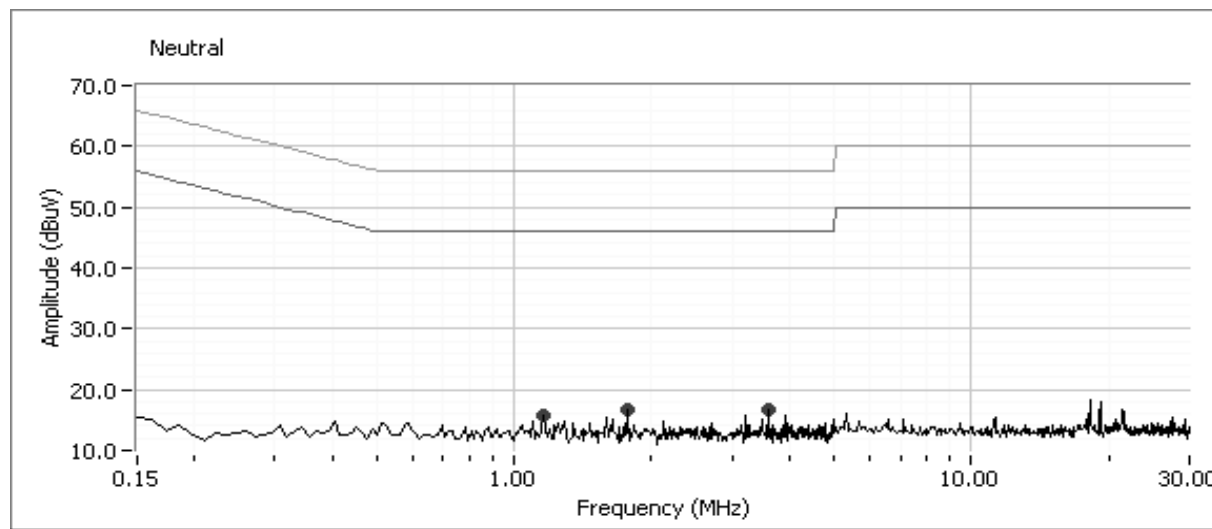
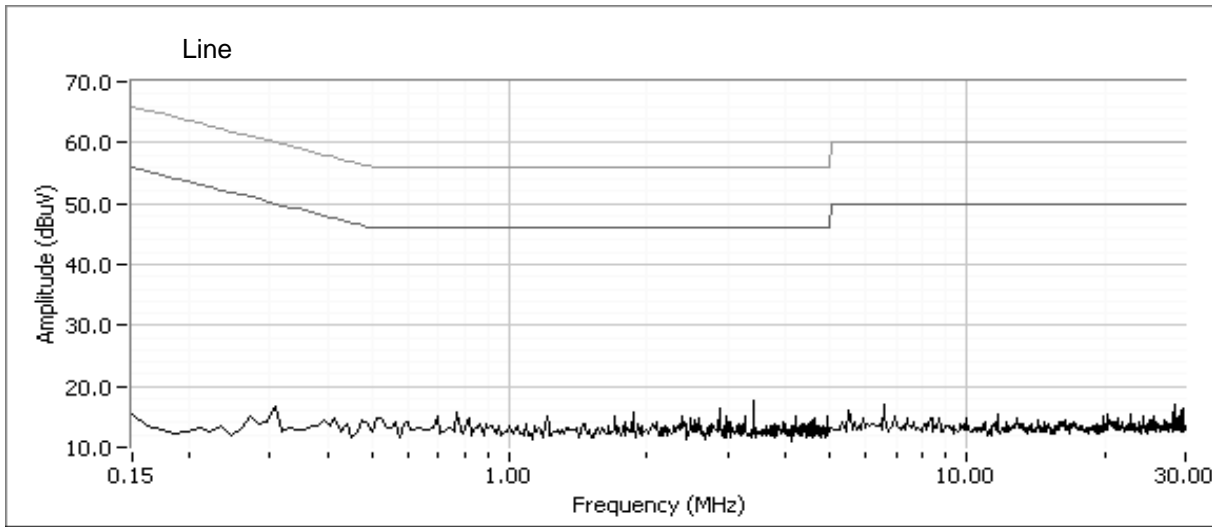
No deviations were made from the requirements of the standard.



EMC Test Data

| | |
|---------------------------------------|------------------------------|
| Client: Unigen Corporation | Job Number: J55447 |
| Model: UGWR2USxxx | T-Log Number: T55453 |
| Contact: Mark Morrissey | Account Manager: Susan Pelzl |
| Spec: FCC 15.247, RSS-210, EN 300 328 | Class: Radio |

Run #1: AC Power Port Conducted Emissions on the power supply, 0.15 - 30MHz,1230V/60Hz





EMC Test Data

| | | | |
|----------|----------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manager: | Susan Pelzl |
| Spec: | FCC 15.247, RSS-210 , EN 300 328 | Class: | Radio |

Run #1: AC Power Port Conducted Emissions on the power supply, 0.15 - 30MHz,1230V/60Hz

| Frequency MHz | Level dB μ V | AC Line | CISPR 22 B | | Detector QP/Ave | Comments |
|------------------|---------------------|------------|------------|--------|--------------------|----------|
| | | | Limit | Margin | | |
| 1.763 | 16.7 | Neutral | 46.0 | -29.3 | Peak | |
| 3.594 | 16.7 | Neutral | 46.0 | -29.3 | Peak | |
| 0.793 | 16.2 | Line 1 | 46.0 | -29.8 | Peak | |
| 1.156 | 15.9 | Neutral | 46.0 | -30.2 | Peak | |
| 1.375 | 15.8 | Line 1 | 46.0 | -30.2 | Peak | |
| 6.563 | 17.1 | Line 1 | 50.0 | -32.9 | Peak | |



EMC Test Data

| | | | |
|----------|----------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| | | Account Manager: | Susan Pelzl |
| Contact: | Mark Morrissey | | |
| Spec: | FCC 15.247, RSS-210 , EN 300 328 | Class: | N/A |

Radiated Spurious Emissions, EN 300 328 (Final)

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: 5/6/2004
Test Engineer: David Bare
Test Location: SVOATS #1

Config. Used: 1
Config Change: None
EUT Voltage: 5Vdc

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

The measurement antenna was located 3 meters from the EUT.

Ambient Conditions: Temperature: 19 °C
 Rel. Humidity: 46 %

Summary of Results

| Run # | Test Performed | Limit | Result | Margin |
|-------|--|------------|--------|--------------------|
| 1-2 | RE, 30 - 12,750 MHz - Spurious Emissions Transmit Mode | EN 300 328 | Pass | -4.6 dB @ 4804 MHz |
| 3-4 | RE, 30 - 12,750 MHz - Spurious Emissions Recieve Mode | EN 300 328 | Pass | -4.9 @ 177.01 MHz |

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.



EMC Test Data

| | | | |
|----------|----------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manager: | Susan Pelzl |
| Spec: | FCC 15.247, RSS-210 , EN 300 328 | Class: | N/A |

Run #1: Radiated Spurious Emissions, Transmit Mode, 30 - 12,750 MHz. EUT @ 2402 MHz

| Frequency MHz | Level dB μ V/m | Pol v/h | EN 300 328 ^{Note 1} | | Detector Pk/QP/Avg | Azimuth degrees | Height meters | Comments |
|------------------|-----------------------|------------|------------------------------|--------|-----------------------|--------------------|------------------|----------|
| | | | Limit | Margin | | | | |
| 4804.000 | 59.5 | H | 65.2 | -5.7 | Peak | 150 | 1.5 | |
| 4804.000 | 57.4 | V | 65.2 | -7.8 | Peak | 60 | 1.5 | |
| 6902.500 | 48.8 | H | 65.2 | -16.4 | Peak | 0 | 1.5 | |

Note 1: The limit in the these tables is an approximate field strength limit. It has been calculated form the erp or eirp limit detailed in the EN standard using Friis' equation for free space propagation: $E = 30PG/d$. This limit is a conservative limit because it does not consider the presence of the ground plane. The actual signal level, in terms of erp or eirp, is determined from a substitution measurement for all signals with less than 10dB of margin relative to the calculated field strength limit.

Signal substitution with horn 1242

| Frequency MHz | Pin (dBm) | Pol v/h | Gain (dBi) | EIRP dBm | Limit dBm | Margin dB | Comments |
|------------------|--------------|------------|---------------|-------------|--------------|--------------|----------|
| 4804.000 | -43.8 | H | 9.2 | -34.6 | -30.0 | -4.6 | |
| 4804.000 | -47.4 | V | 9.2 | -38.2 | -30.0 | -8.2 | |
| 6902.500 | -55.1 | H | 10.1 | -45.0 | -30.0 | -15.0 | |

Note 1: Pin is the input power (dBm) to the substitution antenna

Note 2: Gain is the gain (dBi) for the substitution antenna. A dipole has a gain of 2.2dBi.

Note 3: The signal generator was adjusted (Pin) till the value field strenght, measured from the EUT, was achived.



EMC Test Data

| | | | |
|----------|----------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manager: | Susan Pelzl |
| Spec: | FCC 15.247, RSS-210 , EN 300 328 | Class: | N/A |

Run #2: Radiated Spurious Emissions, Transmit Mode, 30 - 12,750 MHz. EUT @ 2477 MHz

| Frequency MHz | Level dB μ V/m | Pol v/h | EN 300 328 ^{Note 1} | | Detector Pk/QP/Avg | Azimuth degrees | Height meters | Comments |
|------------------|-----------------------|------------|------------------------------|--------|-----------------------|--------------------|------------------|----------|
| | | | Limit | Margin | | | | |
| 4955.350 | 53.8 | H | 65.2 | -11.4 | Peak | 270 | 1.5 | |
| 4955.350 | 54.7 | V | 66.2 | -11.5 | Peak | 120 | 1.3 | |
| 10288.75 | 52.5 | V | 65.2 | -12.7 | Peak | 0 | 1.5 | |

Note 1: The limit in the these tables is an approximate field strength limit. It has been calculated form the erp or eirp limit detailed in the EN standard using Friis' equation for free space propagation: $E = 30PG/d$. This limit is a conservative limit because it does not consider the presence of the ground plane. The actual signal level, in terms of erp or eirp, is determined from a substitution measurement for all signals with less than 10dB of margin relative to the calculated field strength limit.

Signal substitution with horn 1242

| Frequency MHz | Pin (dBm) | Pol v/h | Gain (dBi) | EIRP dBm | Limit dBm | Margin dB | Comments |
|------------------|--------------|------------|---------------|-------------|--------------|--------------|----------|
| 4955.350 | -51.0 | H | 9.2 | -41.8 | -30.0 | -11.8 | |
| 4955.350 | -51.0 | V | 9.2 | -41.8 | -30.0 | -11.8 | |
| 10288.750 | -57.9 | V | 11.4 | -46.5 | -30.0 | -16.5 | |

Note 1: Pin is the input power (dBm) to the substitution antenna

Note 2: Gain is the gain (dBi) for the substitution antenna. A dipole has a gain of 2.2dBi.

Note 3: The signal generator was adjusted (Pin) till the value field strenght, measured from the EUT, was achived.



EMC Test Data

| | | | |
|----------|---------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manager: | Susan Pelzl |
| Spec: | FCC 15.247, RSS-210, EN 300 328 | Class: | N/A |

Run #3: Radiated Spurious Emissions, Receive Mode, 30 - 12,750 MHz. EUT @ 2402 MHz

| Frequency MHz | Level dB μ V/m | Pol v/h | EN 300 328 ^{Note 1} | | Detector Pk/QP/Avg | Azimuth degrees | Height meters | Comments |
|------------------|-----------------------|------------|------------------------------|--------|-----------------------|--------------------|------------------|----------|
| | | | Limit | Margin | | | | |
| 38.147 | 14.4 | V | 38.2 | -23.8 | Peak | 0 | 1.0 | |
| 177.010 | 21.8 | V | 38.2 | -16.4 | Peak | 50 | 1.0 | |
| 216.727 | 23.6 | V | 38.2 | -14.6 | Peak | 140 | 1.0 | |
| 216.727 | 25.6 | H | 38.2 | -12.6 | Peak | 90 | 1.2 | |

Note 1: The limit in the these tables is an approximate field strength limit. It has been calculated from the erp or eirp limit detailed in the EN standard using Friis' equation for free space propagation: $E = 30PG/d$. This limit is a conservative limit because it does not consider the presence of the ground plane. The actual signal level, in terms of erp or eirp, is determined from a substitution measurement for all signals with less than 10dB of margin relative to the calculated field strength limit.

Signal substitution with Bicon 54

| Frequency MHz | Pin (dBm) | Pol v/h | Gain (dBi) | EIRP dBm | Limit dBm | Margin dB | Comments |
|------------------|--------------|------------|---------------|-------------|--------------|--------------|----------|
| 177.0100 | -60.9 | V | -1.0 | -61.9 | -57.0 | -4.9 | |
| 216.7270 | -62.8 | H | 0.3 | -62.5 | -55.0 | -7.5 | |
| 216.7270 | -64.6 | V | 0.3 | -64.3 | -56.0 | -8.3 | |
| 38.1470 | -67.0 | V | -11.2 | -78.2 | -57.0 | -21.2 | |

Note 1: Pin is the input power (dBm) to the substitution antenna

Note 2: Gain is the gain (dBi) for the substitution antenna. A dipole has a gain of 2.2dBi.

Note 3: The signal generator was adjusted (Pin) till the value field strenght, measured from the EUT, was achived.



EMC Test Data

| | | | |
|----------|---------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manager: | Susan Pelzl |
| Spec: | FCC 15.247, RSS-210, EN 300 328 | Class: | N/A |

Run #4: Radiated Spurious Emissions, Receive Mode, 30 - 12,750 MHz. EUT @ 2477 MHz

| Frequency MHz | Level dB μ V/m | Pol v/h | EN 300 328 ^{Note 1} | | Detector Pk/QP/Avg | Azimuth degrees | Height meters | Comments |
|------------------|-----------------------|------------|------------------------------|--------|-----------------------|--------------------|------------------|----------|
| | | | Limit | Margin | | | | |
| 30.000 | 16.8 | V | 38.2 | -21.4 | Peak | 0 | 1.0 | |
| 176.820 | 22.0 | V | 38.2 | -16.2 | Peak | 150 | 1.0 | |
| 176.820 | 22.0 | H | 38.2 | -16.2 | Peak | 0 | 1.0 | |
| 604.500 | 24.0 | V | 38.2 | -14.2 | Peak | 0 | 1.0 | |
| 217.650 | 25.6 | V | 38.2 | -12.6 | Peak | 0 | 1.0 | |

Note 1: The limit in these tables is an approximate field strength limit. It has been calculated from the erp or eirp limit detailed in the EN standard using Friis' equation for free space propagation: $E = 30PG/d$. This limit is a conservative limit because it does not consider the presence of the ground plane. The actual signal level, in terms of erp or eirp, is determined from a substitution measurement for all signals with less than 10dB of margin relative to the calculated field strength limit.

Signal substitution with Bicon 54 and LogP 364

| Frequency MHz | Pin (dBm) | Pol v/h | Gain (dBi) | EIRP dBm | Limit dBm | Margin dB | Comments |
|------------------|--------------|------------|---------------|-------------|--------------|--------------|----------|
| 176.82 | -61.9 | V | -1.0 | -62.9 | -57.0 | -5.9 | |
| 217.65 | -63.6 | V | 0.3 | -63.3 | -55.0 | -8.3 | |
| 604.5 | -70.7 | V | 5.6 | -65.1 | -54.0 | -11.1 | |
| 176.82 | -68.8 | H | -1.0 | -69.8 | -56.0 | -13.8 | |
| 30 | -62.1 | V | -12.5 | -74.6 | -57.0 | -17.6 | |

Note 1: Pin is the input power (dBm) to the substitution antenna

Note 2: Gain is the gain (dBi) for the substitution antenna. A dipole has a gain of 2.2dBi.

Note 3: The signal generator was adjusted (Pin) till the value field strength, measured from the EUT, was achieved.



EMC Test Data

| | | | |
|----------|----------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| | | Account Manager: | Susan Pelzl |
| Contact: | Mark Morrissey | | |
| Spec: | FCC 15.247, RSS-210 , EN 300 328 | Class: | N/A |

Run #1: Power Measurements - Spread Spectrum (Direct Spread Spectrum)

Initial measurements made on the center channel to determine the data rate with the highest output power. All final measurements made with device operating at the highest power level.

| | | |
|------|------|------|
| Rate | Pout | Mode |
| | 7.2 | N/A |

Measurements at ambient temperature, lowest, center and highest operating frequencies.

Modified EUT output filter to use 2.7nH and 2 pF caps. Original used 2.2nH inductor and 1.5pF caps.

| Frequency MHz ⁶ | Pmeas dBm | PSD ¹ dBm | Gain ² dBi | Duty Cycle ³ | EIRP ⁴ | | Limit | | Margin | |
|-------------------------------|--------------|-------------------------|--------------------------|----------------------------|-------------------|-----|-------|------------------|--------|------|
| | | | | | Power | PSD | Power | PSD ⁵ | Power | PSD |
| 2402.000 | 7.2 | 4.8 | 2.0 | 1.0 | 9.2 | 6.8 | 20.0 | 10.0 | -10.8 | -3.2 |
| 2477.000 | 4.7 | 2.7 | 2.0 | 1.0 | 6.7 | 4.7 | 20.0 | 10.0 | -13.3 | -5.3 |

- Note 1: Power measured using a wideband, calibrated RF power meter with a thermocouple detector (or an equivalent thereof). PSD measured using a thermocouple detector (or an equivalent thereof) connected to the IF output of the spectrum analyzer, with the analyzer set for RB= 1MHz, VB = 1MHz and positive peak detector.
- Note 2: Gain is the maximum gain of the antenna assembly that can be used with the EUT at this power level.
- Note 3: Duty Cycle - the duty cycle of the transmitter during the power measurement [time on / (time off + time on)]
- Note 4: EIRP levels are the measured levels corrected for duty cycle [10log(duty cycle)] and EUT antenna gain.
- Note 5: Power spectral density is limited to 10mW/MHz (10dBm/MHz) for digital modulation.
- Note 6: Frequency recorded is the frequency for the highest PSD for the channel tested.



EMC Test Data

| | | | |
|----------|----------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manager: | Susan Pelzl |
| Spec: | FCC 15.247, RSS-210 , EN 300 328 | Class: | N/A |

Run #2: Frequency Range at normal conditions:

| Voltage (dc) | Temp (°C) | Frequency Range | | Limit |
|-----------------|--------------|----------------------|----------------------|-----------------|
| | | F _L (MHz) | F _H (MHz) | >2400 & 2483.5< |
| 4.7 | 20 | 2400.73 | 2479.07 | Pass |

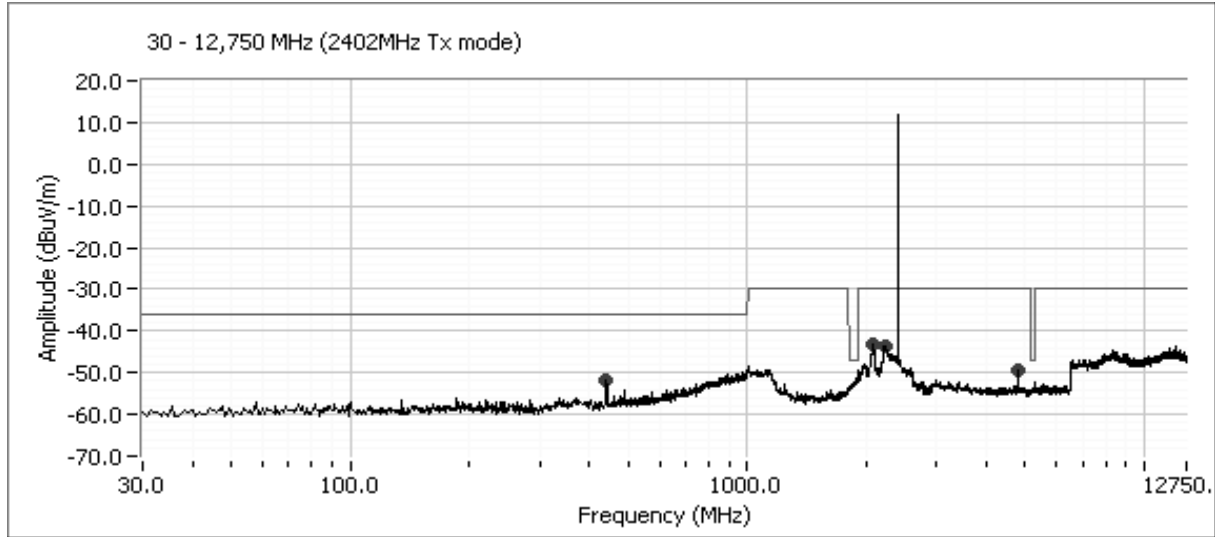
F_L: The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the power envelope, where the output power drops below the level of -80 dBm/Hz e.i.r.p. spectral power density (-30 dBm if measured in a 100 kHz bandwidth). Place the spectrum analyser in video averaging mode with a minimum of 50 sweeps.



EMC Test Data

| | |
|---------------------------------------|------------------------------|
| Client: Unigen Corporation | Job Number: J55447 |
| Model: UGWR2USxxxx | T-Log Number: T55453 |
| Contact: Mark Morrissey | Account Manager: Susan Pelzl |
| Spec: FCC 15.247, RSS-210, EN 300 328 | Class: N/A |

Run #3a: Antenna Port Conducted Spurious Emissions, Transmit Mode, 30 - 12,750 MHz. EUT on lowest channel



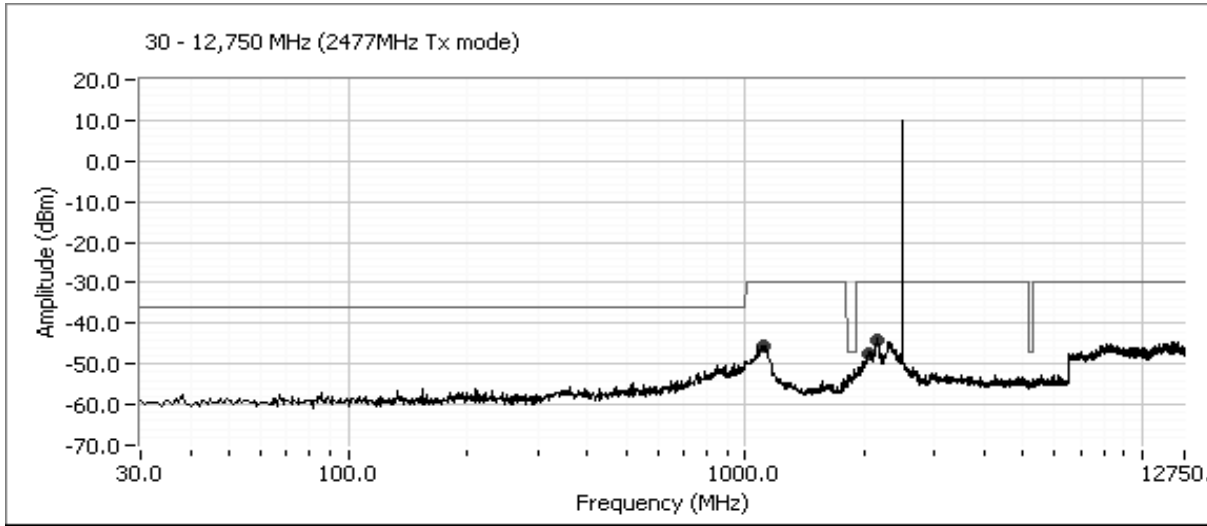
| Frequency MHz | Level dBm | Port | EN 300 328 Tx ^{Note 1} | | Detector | Comments |
|------------------|--------------|---------|---------------------------------|--------|----------|----------------|
| | | | Limit | Margin | | |
| 2073.500 | -43.2 | RF Port | -30.0 | -13.2 | Peak | RB=VB = 100KHz |
| 2230.250 | -43.5 | RF Port | -30.0 | -13.5 | Peak | RB=VB = 100KHz |
| 441.750 | -52.0 | RF Port | -36.0 | -16.0 | Peak | RB=VB = 100KHz |
| 443.500 | -54.0 | RF Port | -36.0 | -18.0 | Peak | RB=VB = 100KHz |
| 4808.000 | -49.5 | RF Port | -30.0 | -19.5 | Peak | RB=VB = 100KHz |



EMC Test Data

| | |
|---------------------------------------|------------------------------|
| Client: Unigen Corporation | Job Number: J55447 |
| Model: UGWR2USxxxx | T-Log Number: T55453 |
| Contact: Mark Morrissey | Account Manager: Susan Pelzl |
| Spec: FCC 15.247, RSS-210, EN 300 328 | Class: N/A |

Run #3b: Antenna Port Conducted Spurious Emissions, Transmit Mode, 30 - 12750 MHz. EUT on highest channel



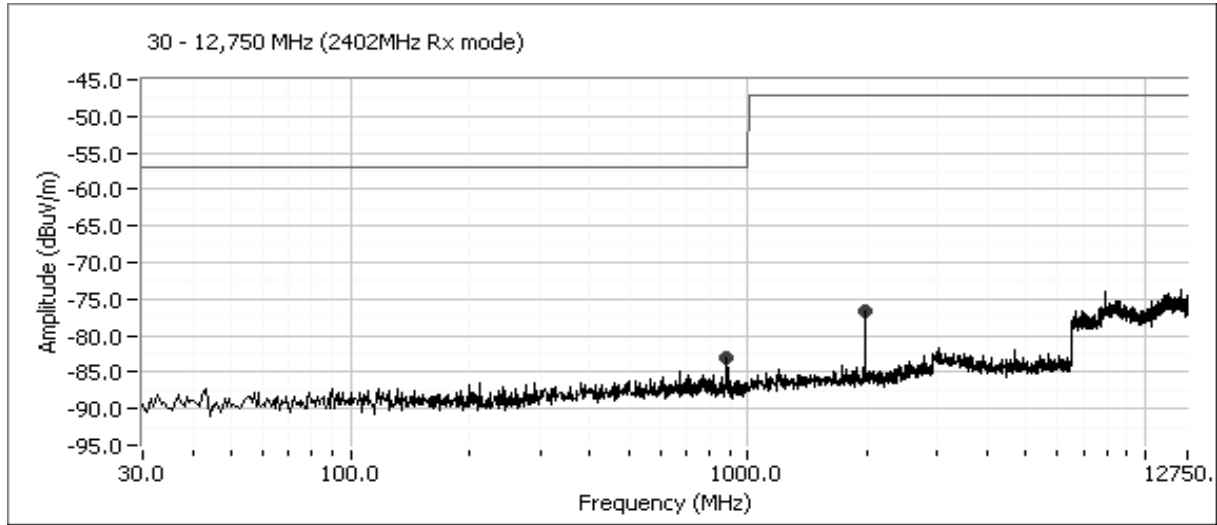
| Frequency MHz | Level dBm | Port | EN 300 328 Tx ^{Note 1} | | Detector | Comments |
|------------------|--------------|---------|---------------------------------|--------|----------|----------------|
| | | | Limit | Margin | | |
| 1109.250 | -45.4 | RF Port | -30.0 | -15.4 | Peak | RB=VB = 100KHz |
| 2045.000 | -47.4 | RF Port | -30.0 | -17.4 | Peak | RB=VB = 100KHz |
| 2149.500 | -44.2 | RF Port | -30.0 | -14.2 | Peak | RB=VB = 100KHz |



EMC Test Data

| | |
|--|------------------------------|
| Client: Unigen Corporation | Job Number: J55447 |
| Model: UGWR2USxxxx | T-Log Number: T55453 |
| Contact: Mark Morrissey | Account Manager: Susan Pelzl |
| Spec: FCC 15.247, RSS-210 , EN 300 328 | Class: N/A |

Run #4a: Antenna Port Conducted Spurious Emissions, Receive Mode, 30 - 12750 MHz. EUT on lowest channel



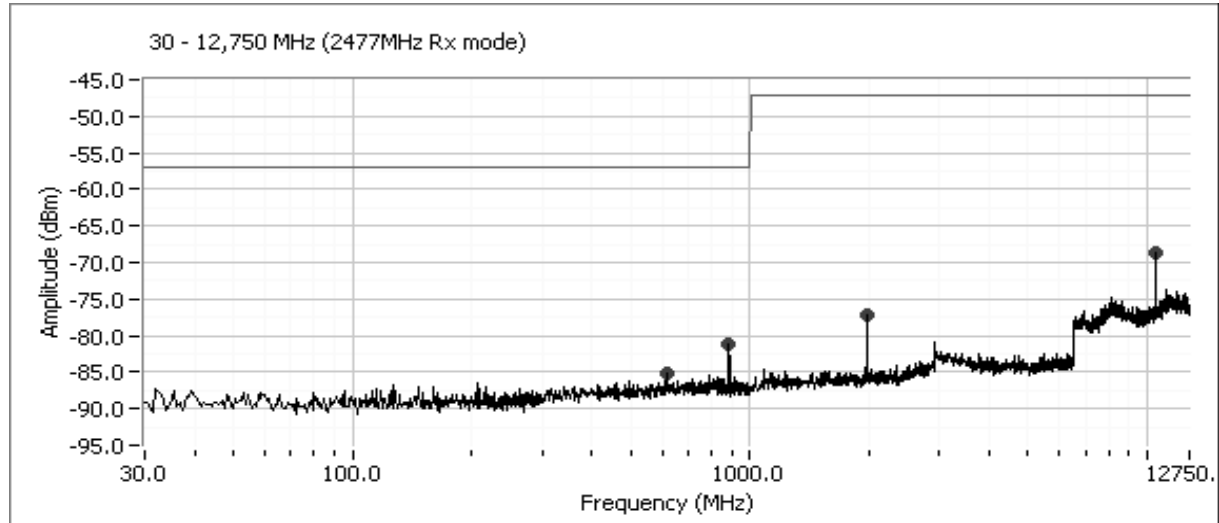
| Frequency MHz | Level dBm | Port | EN 300 XXX ^{Note 1} | | Detector | Comments |
|------------------|--------------|---------|------------------------------|--------|----------|----------|
| | | | Limit | Margin | | |
| 888.000 | -82.6 | RF Port | -57.0 | -25.6 | Peak | |
| 1978.500 | -76.2 | RF Port | -47.0 | -29.2 | Peak | |



EMC Test Data

| | |
|---------------------------------------|------------------------------|
| Client: Unigen Corporation | Job Number: J55447 |
| Model: UGWR2USxxxx | T-Log Number: T55453 |
| Contact: Mark Morrissey | Account Manager: Susan Pelzl |
| Spec: FCC 15.247, RSS-210, EN 300 328 | Class: N/A |

Run #4b: Antenna Port Conducted Spurious Emissions, Receive Mode, 30 - 12750 MHz. EUT on highest channel



| Frequency MHz | Level dBm | Port | EN 300 328 Rx ^{Note 1} | | Detector | Comments |
|------------------|--------------|---------|---------------------------------|--------|----------|----------------|
| | | | Limit | Margin | | |
| 10529.38 | -68.6 | RF Port | -47.0 | -21.6 | Peak | RB=VB = 100KHz |
| 886.250 | -81.2 | RF Port | -57.0 | -24.2 | Peak | RB=VB = 100KHz |
| 615.000 | -85.1 | RF Port | -57.0 | -28.1 | Peak | RB=VB = 100KHz |
| 1978.500 | -77.1 | RF Port | -47.0 | -30.1 | Peak | RB=VB = 100KHz |



EMC Test Data

| | | | |
|----------|----------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| | | Account Manager: | Susan Pelzl |
| Contact: | Mark Morrissey | | |
| Spec: | FCC 15.247, RSS-210 , EN 300 328 | Class: | N/A |

Radio Performance Test - EN 300 328 v1.4.1

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: 5/10/2004 | Config. Used: 1 |
| Test Engineer: David Bare | Config Change: None |
| Test Location: Environmental Chamber | EUT Voltage: 4.7 |

General Test Configuration

The EUT's rf port was connected to the measurement instrument's rf port, via an attenuator or dc-block if necessary.

| | | |
|----------------------------|----------------|-------|
| Ambient Conditions: | Temperature: | 20 °C |
| | Rel. Humidity: | 46 % |

Summary of Results

| Run # | Test Performed | Limit | Result | Value / Margin |
|-------|--|------------|--------|-------------------------|
| 1 | Output Power at normal & extreme conditions | EN 300 328 | Pass | Refer to individual run |
| 2 | Frequency Range over normal & extreme conditions | EN 300 328 | Pass | Refer to individual run |

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.



EMC Test Data

| | | | |
|----------|---------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manager: | Susan Pelzl |
| Spec: | FCC 15.247, RSS-210, EN 300 328 | Class: | N/A |

Run #1: Power Measurements - Spread Spectrum (Digital Modulation)

The EUT has a single data rate. All measurements made with device operating at the highest power level.

Modified EUT output filter to use 2.7nH and 2 pF caps. Original used 2.2nH inductor and 1.5pF caps.

The EUT operates at 3.3V, the evaluation board used during testing provides 3.3V from a 4-12V input.

Measurements at ambient temperature, 4.7VDC

| Frequency MHz ⁶ | Pmeas dBm | Psub ⁵ dbm | Gain ² dBi | Duty Cycle ³ | EIRP ⁴ | | Limit | | Margin | |
|-------------------------------|--------------|--------------------------|--------------------------|----------------------------|-------------------|------|-------|------|--------|-------|
| | | | | | Power | Psub | Power | Psub | Power | Psub |
| 2401.620 | 8.2 | 8.1 | 2.0 | 1.0 | 10.2 | 10.1 | 20.0 | 21.0 | -9.8 | -10.9 |
| 2477.630 | 6.3 | 5.8 | 2.0 | 1.0 | 8.3 | 7.8 | 20.0 | 21.0 | -11.7 | -13.2 |

Measurements at -20C, 4V

| Frequency MHz ⁶ | Pmeas dBm | Psub ⁵ dbm | Gain ² dBi | Duty Cycle ³ | EIRP ⁴ | | Limit | | Margin | |
|-------------------------------|--------------|--------------------------|--------------------------|----------------------------|-------------------|------|-------|------|--------|-------|
| | | | | | Power | Psub | Power | Psub | Power | Psub |
| 2401.620 | 11.1 | 11.0 | 2.0 | 1.0 | 13.1 | 13.0 | 20.0 | 21.0 | -6.9 | -8.0 |
| 2477.630 | 8.5 | 8.3 | 2.0 | 1.0 | 10.5 | 10.3 | 20.0 | 21.0 | -9.5 | -10.7 |

Measurements at -20C, 12VDC

| Frequency MHz ⁶ | Pmeas dBm | Psub ⁵ dbm | Gain ² dBi | Duty Cycle ³ | EIRP ⁴ | | Limit | | Margin | |
|-------------------------------|--------------|--------------------------|--------------------------|----------------------------|-------------------|------|-------|------|--------|-------|
| | | | | | Power | Psub | Power | Psub | Power | Psub |
| 2401.620 | 11.1 | 11.0 | 2.0 | 1.0 | 13.1 | 13.0 | 20.0 | 21.0 | -6.9 | -8.0 |
| 2477.630 | 8.5 | 8.3 | 2.0 | 1.0 | 10.5 | 10.3 | 20.0 | 21.0 | -9.5 | -10.7 |

Measurements at 55C, 4V

| Frequency MHz ⁶ | Pmeas dBm | Psub ⁵ dbm | Gain ² dBi | Duty Cycle ³ | EIRP ⁴ | | Limit | | Margin | |
|-------------------------------|--------------|--------------------------|--------------------------|----------------------------|-------------------|------|-------|------|--------|-------|
| | | | | | Power | Psub | Power | Psub | Power | Psub |
| 2401.620 | 6.7 | 6.8 | 2.0 | 1.0 | 8.7 | 8.8 | 20.0 | 21.0 | -11.3 | -12.2 |
| 2477.630 | 4.4 | 4.2 | 2.0 | 1.0 | 6.4 | 6.2 | 20.0 | 21.0 | -13.6 | -14.8 |

Measurements at 55C, 12VDC

| Frequency MHz ⁶ | Pmeas dBm | Psub ⁵ dbm | Gain ² dBi | Duty Cycle ³ | EIRP ⁴ | | Limit | | Margin | |
|-------------------------------|--------------|--------------------------|--------------------------|----------------------------|-------------------|------|-------|------|--------|-------|
| | | | | | Power | Psub | Power | Psub | Power | Psub |
| 2401.620 | 6.7 | 6.8 | 2.0 | 1.0 | 8.7 | 8.8 | 20.0 | 21.0 | -11.3 | -12.2 |
| 2477.630 | 4.4 | 4.2 | 2.0 | 1.0 | 6.4 | 6.2 | 20.0 | 21.0 | -13.6 | -14.8 |

- Note 1: Power measured using a wideband, calibrated RF power meter with a thermocouple detector (Average).
- Note 2: Gain is the maximum gain of the antenna assembly that can be used with the EUT at this power level.
- Note 3: Duty Cycle - the duty cycle of the transmitter during the power measurement [time on / (time off + time on)]
- Note 4: EIRP levels are the measured levels corrected for duty cycle [10log(duty cycle)] and EUT antenna gain.
- Note 5: Peak power observed using a diode detector. A substitution source was set to provide equivalent peak power into the diode detector. The output of the substitution source was measured with a RF power meter.
- Note 6: Frequency recorded is the frequency for the highest PSD for the channel tested.



EMC Test Data

| | | | |
|----------|----------------------------------|------------------|-------------|
| Client: | Unigen Corporation | Job Number: | J55447 |
| Model: | UGWR2USxxxx | T-Log Number: | T55453 |
| Contact: | Mark Morrissey | Account Manager: | Susan Pelzl |
| Spec: | FCC 15.247, RSS-210 , EN 300 328 | Class: | N/A |

Run #1b: Frequency Range at normal conditions:

| Voltage (dc) | Temp (°C) | Frequency Range | | Limit |
|--------------|-----------|----------------------|----------------------|-----------------|
| | | F _L (MHz) | F _H (MHz) | >2400 & 2483.5< |
| 4 | 20 | 2400.600 | 2478.663 | Pass |

Note: The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the power envelope, where the output power drops below the level of -80 dBm/Hz e.i.r.p. spectral power density (-30 dBm if measured in a 100 kHz bandwidth). The spectrum analyzer was set to video averaging mode with a minimum of 50 sweeps.

Run #2: Frequency Range over extremes:

| Voltage | Temp | Frequency Range | | Limit |
|---------|--------|----------------------|----------------------|-----------------|
| | | F _L (MHz) | F _H (MHz) | >2400 & 2483.5< |
| 4 | -20 °C | 2400.638 | 2478.718 | Pass |
| 12 | -20 °C | 2400.633 | 2478.713 | Pass |
| 4 | 55 °C | 2400.575 | 2478.638 | Pass |
| 12 | 55 °C | 2400.575 | 2478.663 | Pass |

Note 1: Voltage extremes are as follows:
 AC-powered equipment +/-10% of nominal;
 Lead-Acid Battery 1.3 and 0.9 times nominal;
 Leclanché or lithium type battery: 0.85 and 1.15 times the nominal voltage of the battery;
 Mercury or nickel-cadmium type of battery: 0.9 times and 1.15 times the nominal voltage of the battery;
 All others - manufacturer declared values for extremes.

Note 2: Temperature extremes are as follows:
 Unrestricted use: -20°C to +55°C
 Indoor Use only: 0°C to +35°C
 All others - manufacturer declared values for extremes based on operating range of host or equipment.

Note 3: Extremes used were based on the manufacturers declared voltage levels for the evaluation board.