Engineering and Testing for EMC and Safety Compliance

# TYPE CERTIFICATION REPORT

**VEGA Grieshaber KG**
**Am Hohenstein 113**
**77761 Schiltach**
**Germany**

**MODELS: VEGAPULS 61 & VEGAPULS 62 & VEGAPULS 63**
**FCC ID: O6QPULS616263**
**IC: 3892A-PS616263**

**July 30, 2005**

| Standards Referenced for this Report | |
|---|---|
| Part 2: 2001 | Frequency Allocations and Radio Treaty Matters; General Rules and Regulations |
| Part 15: 2001 | Radio Frequency Devices - §15.209: Radiated Emissions Limits |
| RSS-210 | Low Power License-Exempt Radio Communication Devices (All Frequency Bands) |
| ANSI C63.4-2003 | Standard Format Measurement/Technical Report Personal Computer and Peripherals |

| Frequency Range | Output Power (W) Conducted | Frequency Tolerance (ppm) | Emission Designator |
|---|---|---|---|
| 26 GHz | | N/A | 2G3P0N |

**REPORT PREPARED BY TEST ENGINEER: DESMOND FRASER**

*Document Number: 2005169/QRTL05-304*



360 Herndon Parkway
Suite 1400
Herndon, VA 20170
Phone: 703-689-0368 Fax: 703-689-2056

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# 1 General Information

The following Type Certification Report is prepared on behalf of Vega Grieshaber KG in accordance with the Federal Communications Commission and Industry Canada Rules and Regulations. The Equipment Under Test (EUT) were Models VEGAPULS 61, VEGAPULS 62, and VEGAPULS 63; FCC ID: O6QPULS616263. The test results reported in this document relate only to the items tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47, Industry Canada RSS-210, and ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 2003. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

## 1.1 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated March 3, 2000, submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

## 1.2 Related Submittal(s)/Grant(s)

This is an original application report.

## 2 Conformance Statement

| Standards Referenced for This Report | |
|---|---|
| Part 2: 2001 | Frequency Allocations and Radio Treaty Matters; General Rules and Regulations |
| Part 15: 2001 | Radio Frequency Devices - §15.209: Radiated Emissions Limits |
| RSS-210 | Low Power License-Exempt Radio Communication Devices (All Frequency Bands) |
| ANSI C63.4-2003 | Standard Format Measurement/Technical Report Personal Computer and Peripherals |

| Frequency Range | Output Power (W) Conducted | Frequency Tolerance (ppm) | Emission Designator |
|---|---|---|---|
| 26 GHz | | N/A | N/A |

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the above standards for Certification methodology.

Signature:_____ Date: July 30, 2005

Typed/Printed Name: Desmond Fraser Position: President

Signature:_____ Date: July 30, 2005

Typed/Printed Name: Desmond Fraser Position: Test Engineer

NVLAP *Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 200061-0.*

**Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.**

## 3 Exercising the EUT

The EUT was configured to continuously transmit at 100% duty cycle in measurement mode where the device maintains its full power.
The normal operating measurement mode is a radar pulse with a duty cycle less than 1: 100. By configuring the unit to transmit continuously in the continuous measurement mode desensitization factor was not required. This approach was used because the EUT produces extremely low output power. The EUT was setup at an antenna to EUT test distance of **0.03 m** in order to achieve sufficient dynamic range including the use of harmonic mixer as a result of the carrier low output power. The unit's spurious emissions were also investigated and tested in the restricted and non restricted band from 9 KHz to 110GHz. The tests were performed with the EUT polarized horizontally and vertically in order to determine worst-case emissions. The EUT supports only one channel at 26.0 GHz.

## 4 Conducted Limits - §15.207

Conducted emissions were performed on the EUT using an off-the-shelf 24 volt power supply. The general conducted limit under Part 15.207 was applied. The EUT was investigated and tested with four housings, namely Stainless Steel, Aluminum, Double Chamber Aluminum, and Plastic. The Plastic housing configuration demonstrated the worst case results. The data below is for the worst case configuration of the four antenna configurations.

### 4.1 Conducted Emission Limits Test Data

**Table 4-1: Conducted Emissions Limits Test Data – Neutral Conductor**

| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | CISPR A QP Limit (dBuV) | CISPR A QP Margin (dBuV) | CISPR A AV Limit (dBuV) | CISPR A AV Margin (dBuV) | Pass/ Fail |
|---|---|---|---|---|---|---|---|---|---|
| 0.270 | Pk | 53.6 | 1.3 | 54.9 | 61.1 | -6.2 | 51.1 | 3.8 | Pass |
| 1.220 | Pk | 47.7 | 1.0 | 48.7 | 56.0 | -7.3 | 46.0 | 2.7 | Pass |
| 2.600 | Pk | 42.2 | 1.5 | 43.7 | 56.0 | -12.3 | 46.0 | -2.3 | Pass |
| 7.850 | Pk | 34.0 | 2.5 | 36.5 | 60.0 | -23.5 | 50.0 | -13.5 | Pass |
| 21.460 | Pk | 32.9 | 4.0 | 36.9 | 60.0 | -23.1 | 50.0 | -13.1 | Pass |
| 22.600 | Pk | 34.6 | 4.1 | 38.7 | 60.0 | -21.3 | 50.0 | -11.3 | Pass |
| 29.340 | Pk | 28.6 | 4.5 | 33.1 | 60.0 | -26.9 | 50.0 | -16.9 | Pass |

**Table 4-2: Conducted Emissions Limits Test Data – Phase Conductor**

| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | CISPR A QP Limit (dBuV) | CISPR A QP Margin (dBuV) | CISPR A AV Limit (dBuV) | CISPR A AV Margin (dBuV) | Pass/ Fail |
|---|---|---|---|---|---|---|---|---|---|
| 0.240 | Pk | 41.9 | 1.4 | 43.3 | 62.1 | -18.8 | 52.1 | -8.8 | Pass |
| 1.220 | Pk | 37.2 | 1.0 | 38.2 | 56.0 | -17.8 | 46.0 | -7.8 | Pass |
| 2.720 | Pk | 42.6 | 1.5 | 44.1 | 56.0 | -11.9 | 46.0 | -1.9 | Pass |
| 3.490 | Pk | 38.9 | 1.6 | 40.5 | 56.0 | -15.5 | 46.0 | -5.5 | Pass |
| 7.850 | Pk | 32.7 | 2.5 | 35.2 | 60.0 | -24.8 | 50.0 | -14.8 | Pass |
| 22.480 | Pk | 36.3 | 4.1 | 40.4 | 60.0 | -19.6 | 50.0 | -9.6 | Pass |

**TEST PERSONNEL:**

Desmond Fraser
Test Engineer


Signature

January 6, 2005
Date of Test

# 5 Radiated Emission Limits - §15.209; IC RSS-210 Issue 6 Section 2.6 General Field Strength Level

## 5.1 Radiated Emission Limits Test Procedure

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands were investigated from 0.009 kHz to 110 GHz, C63.4 2003 was the standard used for the test. The restricted bands are listed in Part 15.205. The maximum permitted average field strength for the restricted band is listed in Part 15.209. The EUT was tested in three orthogonal planes namely X, Y, and Z. The test antenna was horizontally and vertically polarized during testing. The general limit under part 15.209 was applied for all frequencies 0.009 kHz to 110 GHz per FCC 15.209. There was no spurious noise detected from 0.009 kHz to 110 GHz except the carrier at 26 GHz. The EUT was investigated and tested with four housings namely: Stainless Steel, Aluminum, Double Chamber Aluminum, and Plastic. The Plastic housing configuration demonstrated the worst case results. The data below is for the worst case configuration and four antenna configurations.

## 5.2 Field Strength Calculation

The field strength is calculated by adding the antenna factor and cable factor from the measured Spectrum Analyzer reading.

Spectrum Analyzer Level Corrected (dBuV/m) = Spectrum Analyzer Level (dBuV/m) + AF (dB/m) + CL (dB)

AF = antenna factor
CL = cable loss

## 5.3 Duty Cycle Calculation

Pulse width = 600 pS
Pulse period = 280 nS

Duty Cycle = 20*Log 0.6/280 = 53.4dB

### 5.4 Radiated Emission Limits Test Data

**Table 5-1: Field Strength of Carrier with 19.5 dBi Rod Antenna with Plastic Housing**

| Frequency (GHz) | Detector | Antenna POL | Spectrum Analyzer Level (dBuV) | Cable Loss (dB) | Antenna Gain | Spectrum Analyzer Level Corrected (dBuV/m) | FCC Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 26 | Peak | | 5.20 (1,2,3) | 1 | 16.8 | | 74.0 | |
| 26 | Avg | H | 5.20 (1,2,3), | 1 | 16.8 | 23.0 | 54.0 | -31.0 |

Note 1: Corrected by -40dB due to 3 centimeters antenna test distance
Note 2: The mixer conversion loss is factored within the Spectrum Analyzer level reading
Note 3: Duty cycle correction was not used in the final calculation

**Table 5-2: Field Strength of Carrier with 21.2 dBi Rod Antenna with Plastic Housing**

| Frequency (GHz) | Detector | Antenna POL | Spectrum Analyzer Level (dBuV) | Cable Loss (dB) | Antenna Gain | Spectrum Analyzer Level Corrected (dBuV/m) | FCC Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 26 | Peak | | 11.4 (1,2,3) | 1 | 16.8 | 29.2 | 74.0 | |
| 26 | Avg | V | 11.4 (1,2,3) | 1 | 16.8 | 29.2 | 54.0 | -24.8 |

Note 1: Corrected by -40dB due to 3 centimeters antenna test distance
Note 2: The mixer conversion loss factor is within the Spectrum Analyzer level reading
Note 3: Duty cycle correction was not used in the final calculation

**Table 5-3: Field Strength of Carrier with 19.0 dBi Horn Antenna with Plastic Housing**

| Frequency (GHz) | Detector | Antenna POL | Spectrum Analyzer Level (dBuV) | Cable Loss (dB) | Antenna Gain | Spectrum Analyzer Level Corrected (dBuV/m) | FCC Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 26 | Peak | | 6.20 (1,2,3) | 1 | 16.8 | 24.0 | 74.0 | |
| 26 | Avg | H | 6.20 (1,2,3) | 1 | 16.8 | 24.0 | 54.0 | -34.0 |

Note 1: Corrected by -40dB due to 3 centimeters antenna test distance
Note 2: The mixer conversion loss is factored within the Spectrum Analyzer level reading
Note 3: Duty cycle correction was not used in the final calculation

**Table 5-4: Field Strength of Carrier with 24.7 dBi Horn Antenna with Plastic Housing**

| Frequency (GHz) | Detector | Antenna POL | Spectrum Analyzer Level (dBuV) | Cable Loss (dB) | Antenna Gain | Spectrum Analyzer Level Corrected (dBuV/m) | FCC Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 26 | Peak | | 12.5 (1,2,3) | 1 | 16.8 | 30.3 | 74.0 | -43.7 |
| 26 | Avg | H | 12.5 (1,2,3) | 1 | 16.8 | 30.3 | 54.0 | -23.7 |

Note 1: Corrected by -40dB due to 3 centimeters antenna test distance
Note 2: The mixer conversion loss is factored within the Spectrum Analyzer level reading
Note 3: Duty cycle correction was not used in the final calculation

**Table 5-5: Field Strength of Carrier with 33 dBi Parabolic Antenna with Plastic Housing – 26.0 GHz**

| Frequency (GHz) | Detector | Antenna POL | Spectrum Analyzer Level (dBuV) | Cable Loss (dB) | Antenna Gain dB/m | Spectrum Analyzer Level Corrected (dBuV/m) | FCC Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 26.0 | Peak | H | 25.2 (1,3) | 1 | 16.8 | 42.0 | 74.0 | -32.0 |
| 26.0 | Avg | H | -28.2 (1,2), | 1 | 16.8 | -11.4 | 54.0 | -65.4 |
| 26.0 | Peak | V | 5.2 (1,3) | 1 | 16.8 | 23.0 | 74.0 | -51.0 |
| 26.0 | Avg | V | -48.2 (1,2), | 1 | 16.8 | - 30.4 | 54.0 | -84.4 |

Note 1: The mixer conversion loss plus cable loss is factored within the Spectrum Analyzer level reading shown on plot.
Note 2: 53.4 dB duty cycle correction factor is used in the final calculation found in the table above.
Note 3: The plot data is corrected by 20 dB from 20Log 0.3/3 test distance to limit distance ratio in the table above.

**Table 5-6: Field Strength of Carrier with 33 dBi Parabolic Antenna with Plastic Housing – 0.009-110 GHz**

| Frequency (GHz) | Detector | Antenna POL | Spectrum Analyzer Level (dBuV) | Cable Loss (dB) | Antenna Gain | Spectrum Analyzer Level Corrected (dBuV/m) | FCC Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.009-110 | Peak | -(4)- | --- | 1 | 16.8 | | 74.0 | |
| 0.009-110 | Avg | -(4)- | --- | 1 | 16.8 | -- | 54.0 | --- |

Note 4: No emission above the noise floor detected.

**Table 5-7: Field Strength of Carrier with All Antennas with Plastic Housing**

| Frequency (GHz) | Detector | Antenna POL | Spectrum Analyzer Level (dBuV) | Cable Loss (dB) | Antenna Gain | Spectrum Analyzer Level Corrected (dBuV/m) | FCC Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.009-110 | Peak | -(4)- | --- | 1 | 16.8 | --- | 74.0 | --- |
| 0.009-110 | Avg | -(4)- | --- | 1 | 16.8 | --- | 54.0 | --- |

Note 4: No emission above the noise floor detected

**TEST PERSONNEL:**

| Desmond Fraser |  | January 6 & June 18, 2005 |
|---|---|---|
| Test Engineer | Signature | Date of Test |

## 5.5 Test Equipment Used for Testing

**Table 5-8: Radiated Spurious Emissions Test Equipment**

| RTL ASSET # | MANUFACTURER | MODEL | PART TYPE | SERIAL NUMBER | Calibration Due Date |
|---|---|---|---|---|---|
| 900717 | Hewlett Packard | 11970U | Harmonic Mixer (40 - 60 GHz) | 2332A01110 | 2/19/06 |
| 901218 | EMCO | 3160-09 | Horn Antenna (18 - 6 GHz) | 960281-003 | 6/14/06 |
| 900392 | Hewlett Packard | 1197OK | Harmonic Mixer (18 - 26 GHz ) | 3525A00159 | 2/01/06 |
| 900715 | Hewlett Packard | 11970V | Harmonic Mixer (50 - 75 GHz) | 2521A00512 | 7/19/05 |
| 900716 | Hewlett Packard | 11970W | Harmonic Mixer (75 - 110 GHz) | 2521A00710 | 6/08/06 |
| 900126 | Hewlett Packard | 11970A | Harmonic Mixer (26 - 40 GHz) | 2332A01199 | 6/08/06 |
| 900056 | ATM | 19-443-6 | Horn Antenna (40 – 60 GHz) | 8041704-01 | 6/08/06 |
| 901218 | EMCO | 3160-09 | Horn Antenna (25 - 40 GHz) | 960452-007 | 6/08/06 |
| 900826 | ATM | 08-443-6 | Horn Antenna (90 – 140 GHz) | 8041904-01 | 6/08/06 |
| 900719 | ATM | 05-443-6 | Horn Antenna (140 – 220 GHz) | 50685 | 6/08/06 |
| 90066 | ATM | 10-443-6 | Horn Antenna (75 – 110 GHz) | 805 1905-1 | 6/08/06 |
| 901262 | EMCO | 3160-9 | Horn Antenna (1 – 18 GHz) | 6748 | 2/04/06 |
| 900723 | Hewlett Packard | | Amplifier (1 GHz – 26 GHz) | NA | 6/08/06 |
| 900744 | Olsen | Mixer | 90 - 220 GHz | F80814-1 | 1/04/06 |
| 900744 | Olsen | Mixer | 140 - 220 GHz | G80814-1 | 1/04/06 |
| 900444 | Miteq | Amplifier | 30 – 1000 MHz | PR1040 | 6/08/06 |
| 900791 | Schaffner-Chase | CBL6112 | Antenna (25 MHz - 2 GHz) | 2099 | 7/07/05 |
| 900151 | Rohde & Schwarz | HFH2-Z2 | 9 kHz - 30 MHz loop antenna | 827525 | 8/09/05 |
| 900772 | EMCO | 3161-02 | 2 – 4 GHz | 9804-1044 | 7/08/05 |
| 900321 | EMCO | 3161-03 | 4 - 8.2 GHz | 9508-1020 | 7/08/05 |
| 900323 | EMCO | 3161-07 | 8.2 – 12 GHz | 9508-1054 | 7/08/05 |

## 6 Tested System Details

Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

**Table 6-1: Equipment Under Test (EUT)**

| DESCRIPTION | MANUFACTURER | MODEL | SERIAL NO. | FCC ID | CABLE DESCRIPTIONS | RTL BAR CODE |
|---|---|---|---|---|---|---|
| Transmitter (EUT) | VEGA Grieshaber | VEGAPULS61/62/63 | N/A | O6QPULS616263 | Unshielded | 15198 |
| Antenna | Vega Grieshaber | 19.5 dBi Rod | N/A | N/A | N/A | 15316 |
| Antenna | Vega Grieshaber | 21.2 dBi Rod | N/A | N/A | N/A | 15197 |
| Antenna | Vega Grieshaber | 19.0 dBi Horn | N/A | N/A | N/A | 15165 |
| Antenna | Vega Grieshaber | 24.7 dBi Horn | N/A | N/A | N/A | 15425 |
| Antenna | VEGA Grieshaber | 33 dBi Parabolic | N/A | N/A | N/A | N/A |

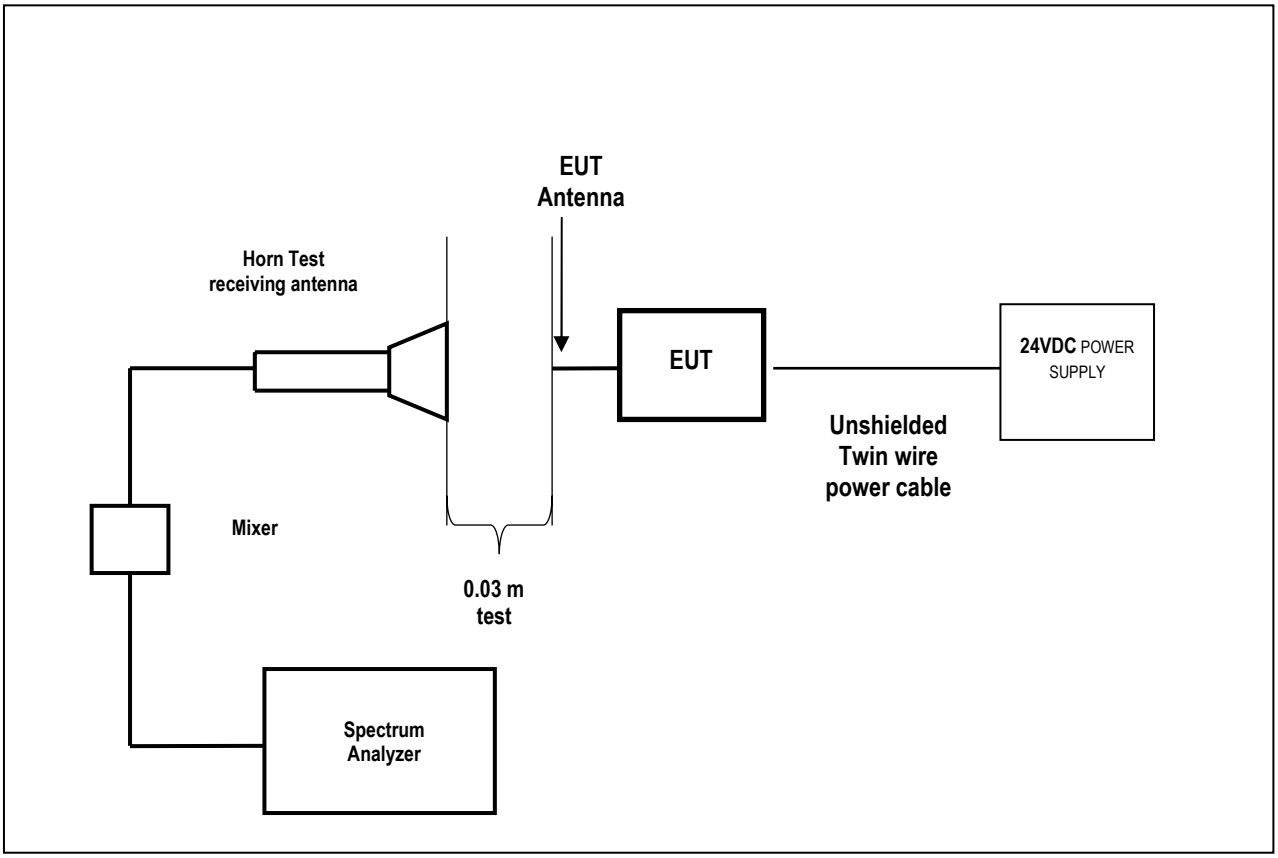
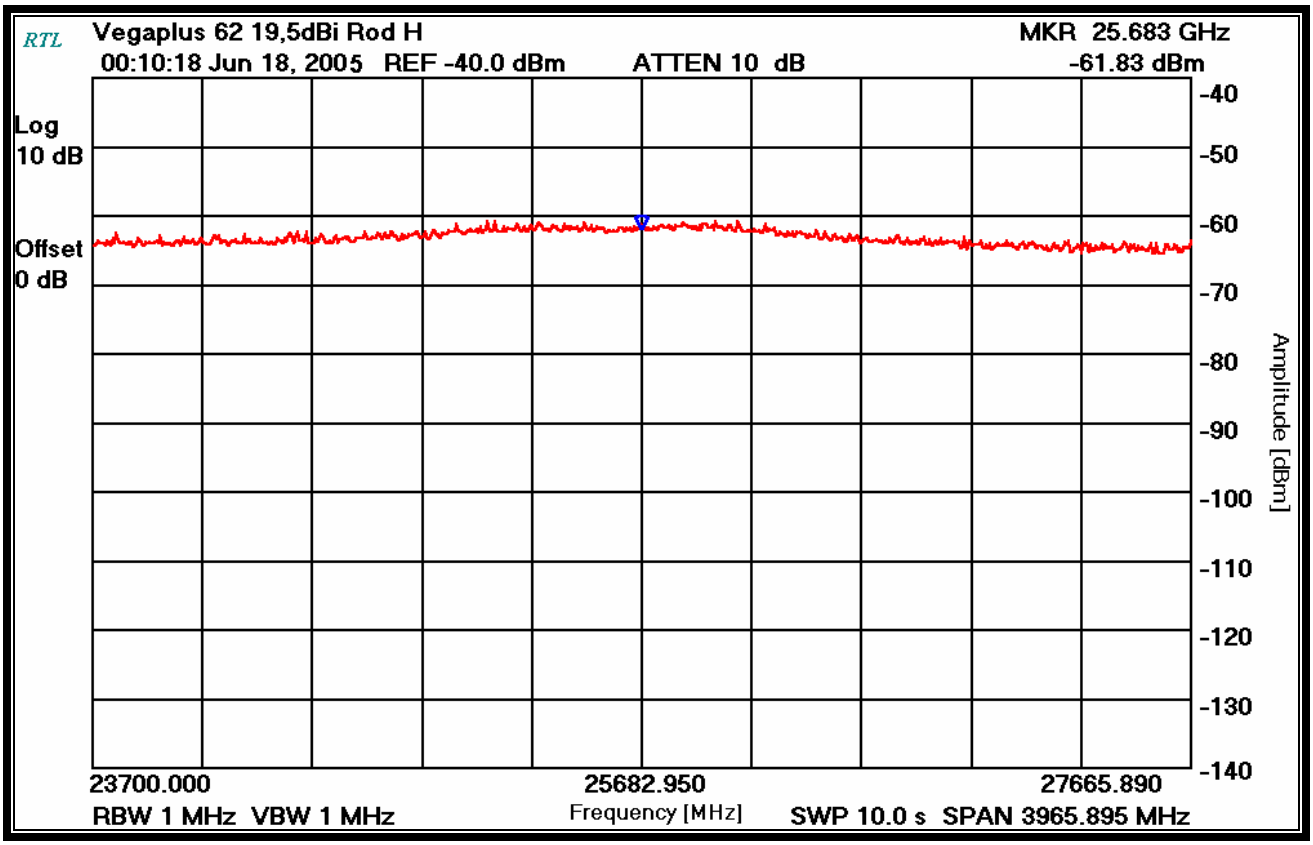
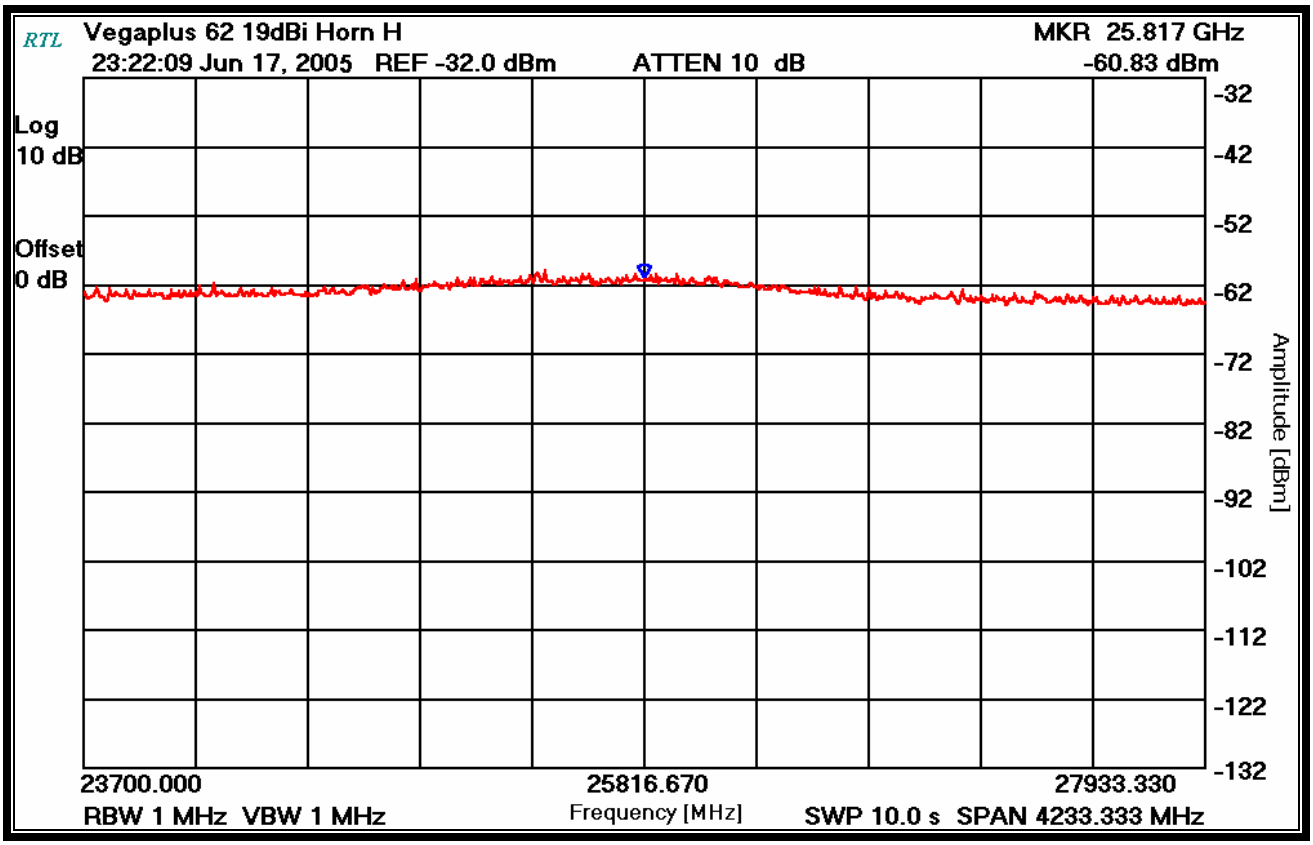



**Figure 6-1: Configuration of Tested System**

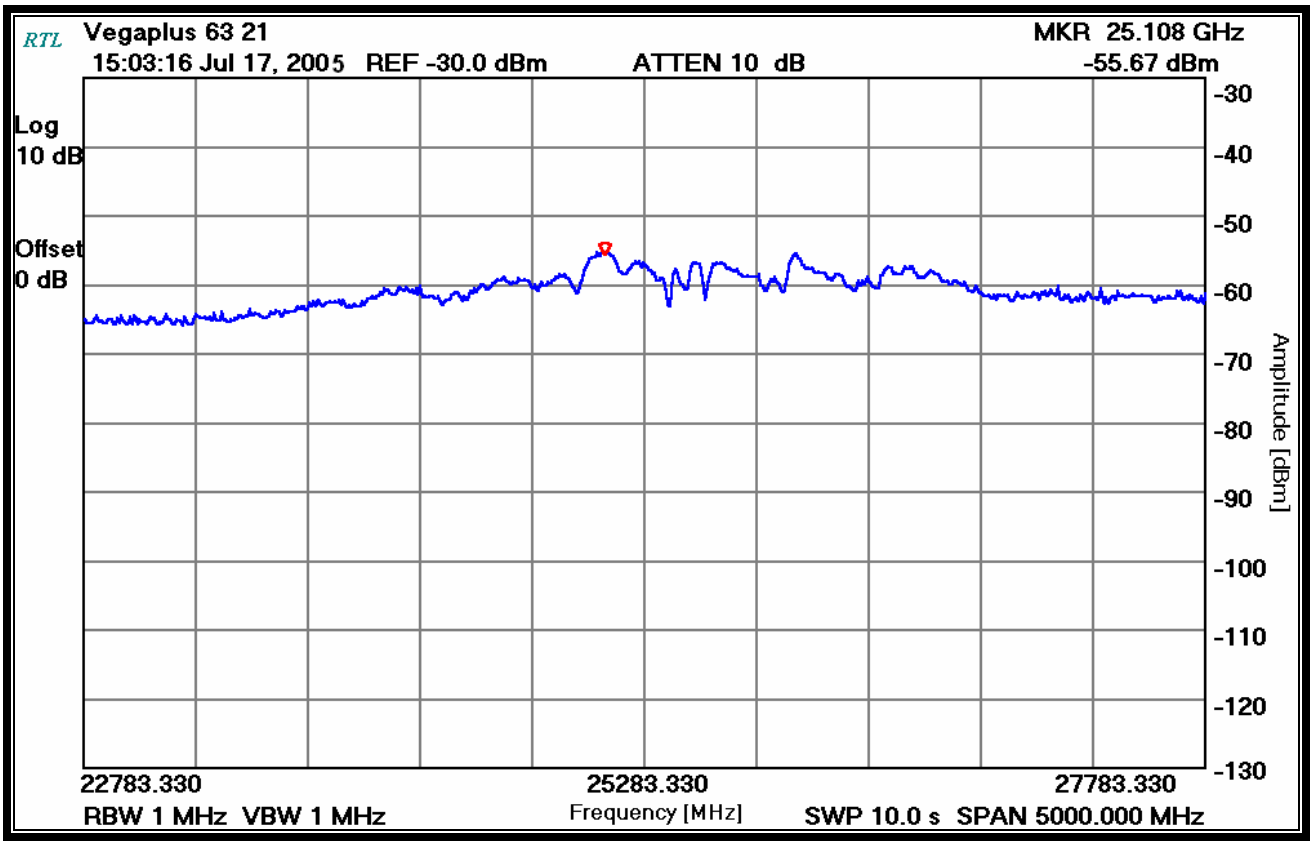
## 7 Test Plots



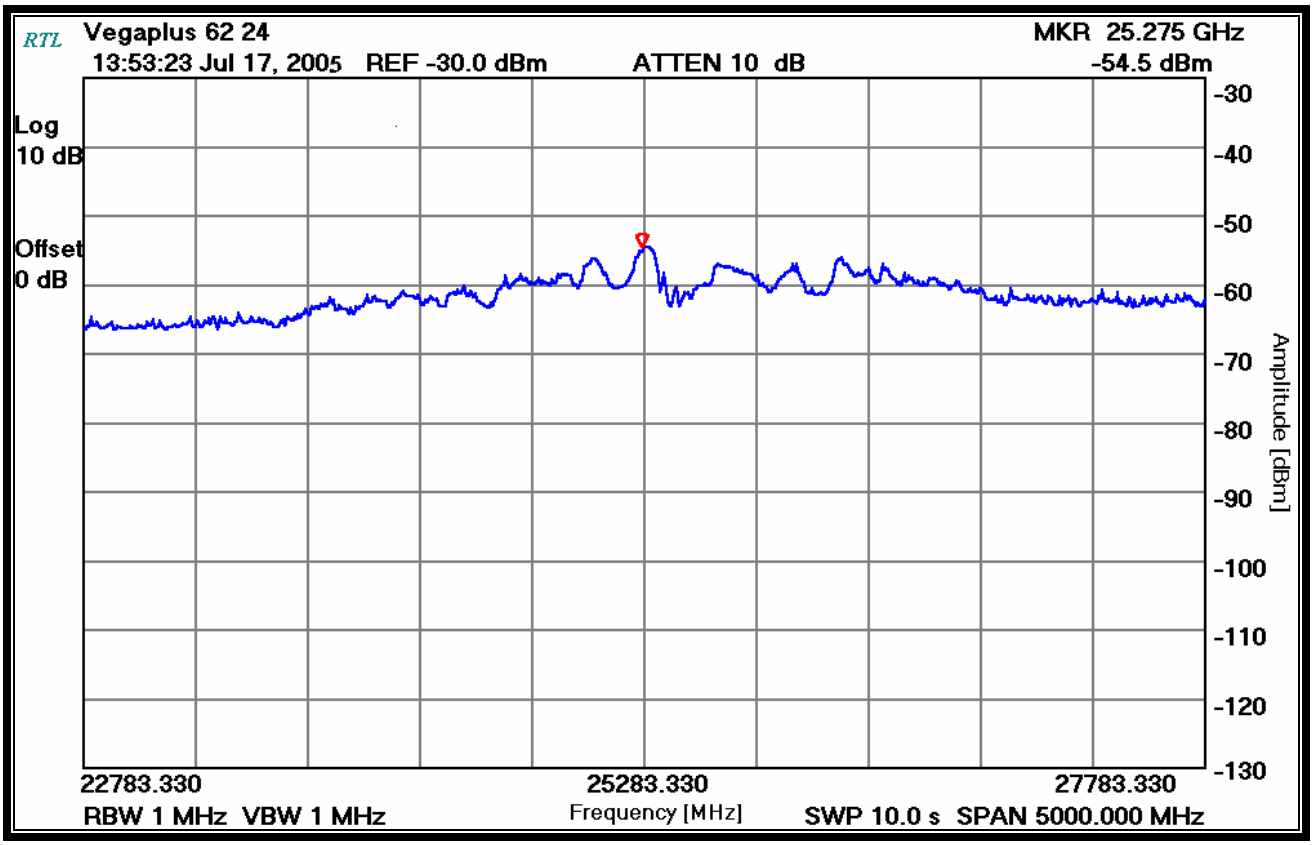

**Plot 7-1: EUT 19.5 dBi Rod Antenna 100% Duty Cycle Mode**



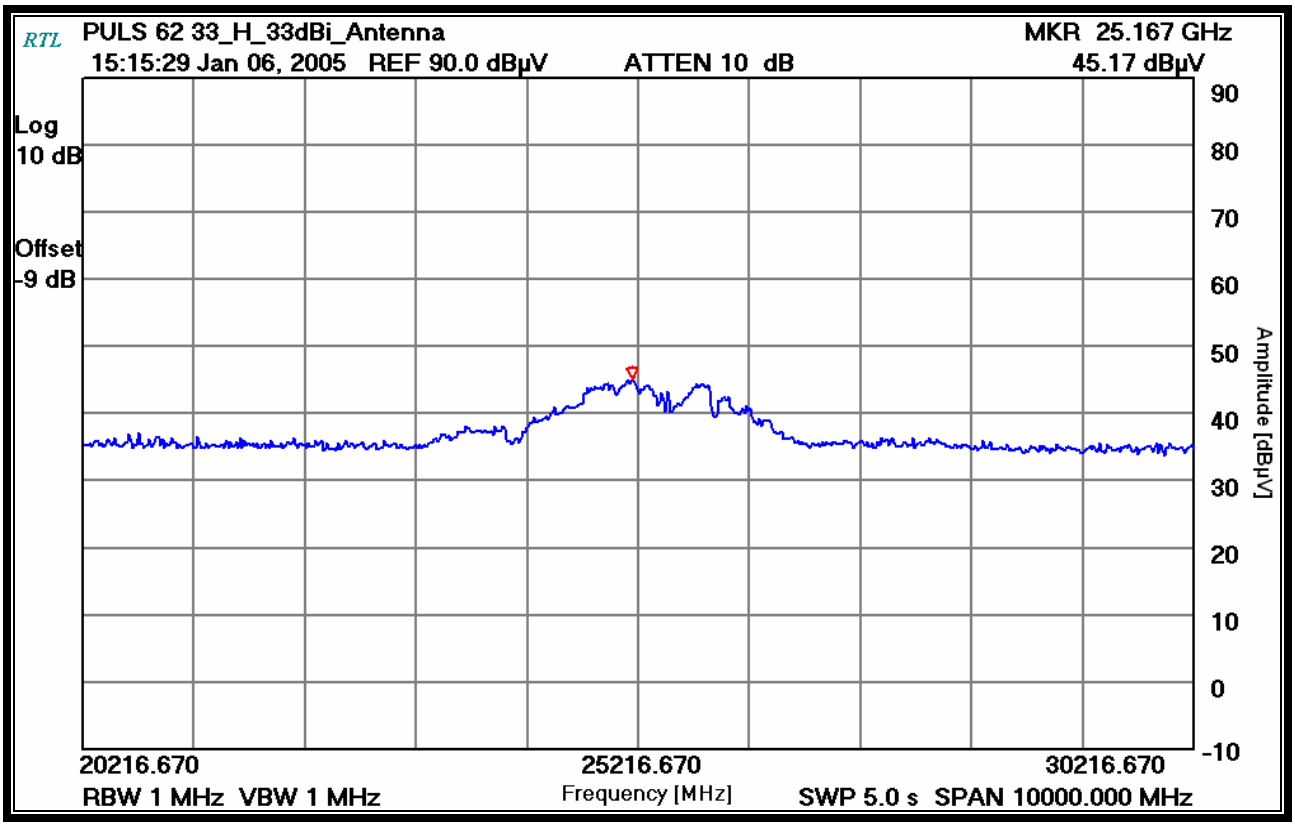

**Plot 7-2: EUT 19.0 dBi Horn Antenna 100% Duty Cycle Mode**



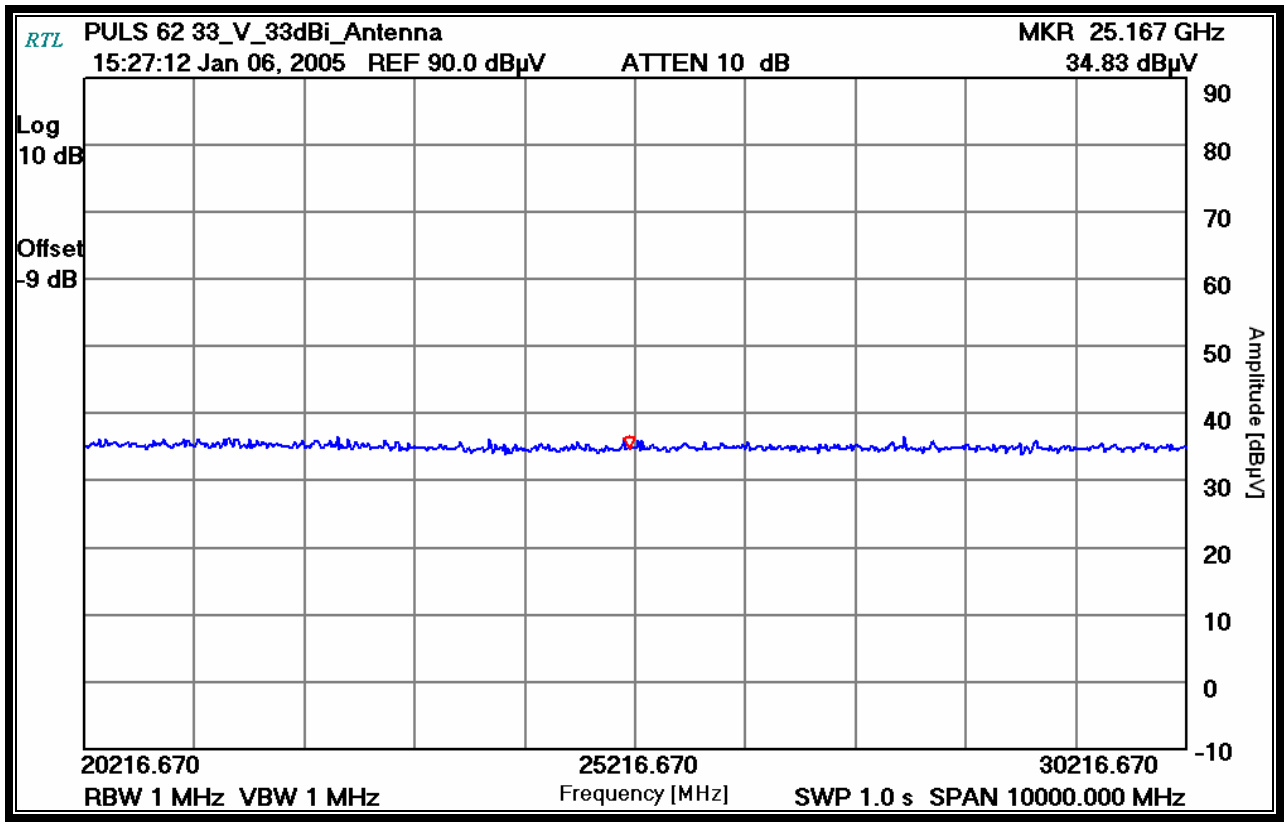

**Plot 7-3: EUT 21.2 dBi Rod Antenna 100% Duty Cycle Mode**




**Plot 7-4: EUT 24.7 dBi Horn Antenna 100% Duty Cycle Mode**




**Plot 7-5: EUT 33 dBi Parabolic Antenna 100% Duty Cycle Peak Mode H Pol**




**Plot 7-6: EUT 33 dBi Parabolic Antenna 100% Duty Cycle Peak Mode V Pol**

## 8 Conclusion

The data in this measurement report shows that the Vega Grieshaber KG, Inc., Models VEGAPULS61/62/63, FCC ID: O6QPULS616263, complies with all the requirements of Parts 2, and 15 of the FCC Rules and Regulations, and Industry Canada RSS-210.