| | |
|---|---|
| **Nemko Test Report:** | 116344-1TRFWL |
| **Applicant:** | G-Wave Inc.<br>15 Ron's Edge Road<br>Springfield, New Jersey<br>07081 |
| **Apparatus:** | BDA-UHF-4/4W-70-A |
| **FCC ID:** | Q8KUHF4W70 |
| **In Accordance With:** | FCC Part 90, Boosters<br>Private Land Mobile Radio Services |
| **Authorized By:** |  <br>Andrey Adelberg, EMC/Wireless Specialist |
| **Date:** | November 27, 2008 |
| **Total Number of Pages:** | 21 |

Nemko Canada Inc.
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Ottawa, Ontario
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# TABLE OF CONTENTS

# Section 1 : Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90. Conducted measurements were performed in accordance with ANSI TIA-603-B-2002. Radiated tests were conducted is accordance with ANSI C63.4-2003.

The assessment summary is as follows:

| | |
|---|---|
| **Apparatus Assessed:** | BDA-UHF-4/4W-70-A |
| **Specification:** | FCC Part 90 |
| **Compliance Status:** | Complies |
| **Exclusions:** | None |
| **Non-compliances:** | None |
| **Report Release History:** | Original Release |
| **Test Location:** | Nemko Canada Inc.<br>303 River Road<br>Ottawa, Ontario<br>K1V 1H2 |
| **Registration Number:** | 176392 (3m Semi-Anechoic Chamber) |
| **Tests Performed By:** | Jason Nixon, Wireless/Telecom Specialist |
| **Test Dates:** | November 13 to 14, 2008 |

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

# Section 2 : Equipment Under Test

## 2.1 Identification of Equipment Under Test (EUT)

The following information identifies the EUT under test:

| | |
|---|---|
| Type of Equipment: | UHF Booster |
| Brand Name: | G-Wave |
| Model Name or Number: | BDA-UHF-4/4W-70-A |
| Serial Number: | 08101004 |
| Nemko Sample Number: | 1 |
| FCC ID: | Q8KUHF4W70 |
| Date of Receipt: | November 5, 2008 |

## 2.2 Accessories

No accessories were used during this assessment.

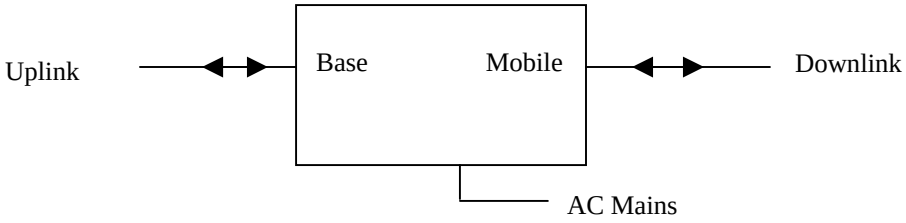
## 2.3 EUT Description

The EUT is a UHF booster. It has an internal 2MHz filter which can be tuned to cover any channel section form 406-512MHz.

## 2.4 Technical Specifications of the EUT

| | |
|---|---|
| **Operating Band:** | 406.1-454MHz, 456-462.5375MHz, 462.7375-467.5375MHz, 467.7375-512MHz |
| **Modulation:** | FM Voice, FSK Data and PM Voice |
| **Emission Designator:** | F3E, F1D, G3E |
| **Power Supply Requirements:** | 120VAC, 60Hz |

## 2.5 EUT Setup diagram




## 2.6 Operation of the EUT during testing

The EUT is a bi-directional signal booster. Signals are transmitted into the Uplink or Downlink path and measured on the opposite side.

## 2.7 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

# Section 3 : Test Conditions

## 3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 2 Subpart J, Equipment Authorization Procedures
FCC Part 90 Private Land Mobile Radio Services
FCC 2-11-04/EAB/RF Amplifier, Booster, and Repeater Reminder Sheet

## 3.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

## 3.3 Test Environment

All tests were performed under the following environmental conditions:

| | | |
|---|---|---|
| Temperature range | : | 15 – 30 $^{o}$C |
| Humidity range | : | 20 - 75 % |
| Pressure range | : | 86 - 106 kPa |
| Power supply range | : | +/- 5% of rated voltages |

## 3.4 Measurement Uncertainty

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95% and can be found in Nemko Canada document MU-003.

## 3.5 Test Equipment

| Equipment | Manufacturer | Model No. | Asset/Serial No. | Cal. Date | Next Cal. |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSU46 | FA001877 | Aug 28/08 | Aug 28/09 |
| Signal Generator | Rohde & Schwarz | SMIQ03E | FA001269 | Aug 18/08 | Aug 18/09 |
| Signal Generator | Rohde & Schwarz | SMIQ06B | FA001878 | Sept 12/08 | Sept 12/09 |
| Power Meter | HP | E4418B | FA001413 | Jun 05/08 | Jun 05/09 |
| Power Sensor | HP | 8487A | FA001908 | Jun 05/08 | Jun 05/09 |
| Attenuator | Narda | 776B-20 | FA001153 | COU | COU |
| Attenuator | Narda | 769-20 | FA001394 | COU | COU |
| 3m EMI Test Chamber | TDK | SAC-3 | FA002047 | May 06/08 | May 06/09 |
| Bilog | Sunol | JB3 | FA002108 | Jan. 21/08 | Jan. 21/09 |
| Flush Mount Turntable | Sunol | FM2022 | FA002082 | NCR | NCR |
| Controller | Sunol | SC104V | FA002060 | NCR | NCR |
| Mast | Sunol | TLT2 | FA002061 | NCR | NCR |
| LISN | Rohde & Schwarz | ENV216 | FA002023 | Sept. 02/08 | Sept. 02/09 |
| Receiver/Spectrum Analyzer | Rohde & Schwarz | ESU 26 | FA002043 | Dec. 07/07 | Dec. 07/08 |
| 50 Coax cable | HUBER + SUHNER | None | FA002022 | July 07/08 | July 07/09 |
| 50 Coax cable | HUBER + SUHNER | None | FA002074 | July 07/08 | July 07/09 |
| International Power Supply | California Inst. | 3001i | FA001021 | Jan. 16/08 | Jan. 16/09 |
| Horn Antenna #2 | EMCO | 3115 | FA000825 | Jan. 15/08 | Jan. 15/09 |
| 1 – 18 GHz Amplifier | JCA | JCA118-503 | FA002091 | Oct 2/08 | Oct 2/09 |

COU – Calibrate on Use
NCR – No Calibration Required

# Section 4 : Results Summary

This section contains the following:

FCC Part 90 : Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No : not applicable / not relevant.

Y Yes : Mandatory i.e. the apparatus shall conform to these tests.

N/T Not Tested, mandatory but not assessed. (See Report Summary)

## 4.1 FCC Part 90 : Test Results

| Clause | Test Method | Test Description | Required | Result |
|---|---|---|---|---|
| 90.205 | 2.1046 | Output power | Y | PASS |
| 90.210 | 2.1051 | Conducted spurious emissions | Y | PASS |
| 90.210 | 2.1053 | Radiated spurious emissions | Y | PASS |
| 90.213 | 2.1055 | Frequency stability | Y[1] | PASS |
| 90.214 | — | Transient Behavior | N | |
| 90.219 | — | Use of boosters | Y[2] | PASS |
| 2-11-04/EAB/RF | 2.1049 | Occupied bandwidth | Y | PASS |
| 2-11-04/EAB/RF | — | Out of band rejection | Y | PASS |

Notes:

[1] The EUT does not have any frequency determining or frequency translation circuitry.
[2] The EUT has a maximum output power of 31dBm, a maximum antenna gain of 8dBi and a minimum cable loss of 2dB. The maximum output power ERP is 31 + 8 – 2.15 – 2= 34.85dBm, or 3.05W ERP which is below the 5W allowed in 90.219.

# Appendix A : Test Results

## Clause 90.205 Output Power

Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation. Except where otherwise specifically provided for, the maximum power that will be authorized for new stations authorized after August 16, 1995 is as follows in FCC Part 90.205(a) through (r).

**Test Results:** Pass

| Band | Measured Power (dBm) 1 Carrier | Measured Power (dBm) 2 Carriers |
|---|---|---|
| Uplink | 31.47 | 30.52 |
| Downlink | 30.40 | 29.17 |

1 Carrier was set to 1dB compression point.
2 Carriers were set to 1dB compression point –3dB

## Clause 90.210 Conducted Spurious Emissions

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere, the Table in 90.210 specifies the emission masks for equipment operating in the frequency bands governed under this part.

**Test Results:** Pass

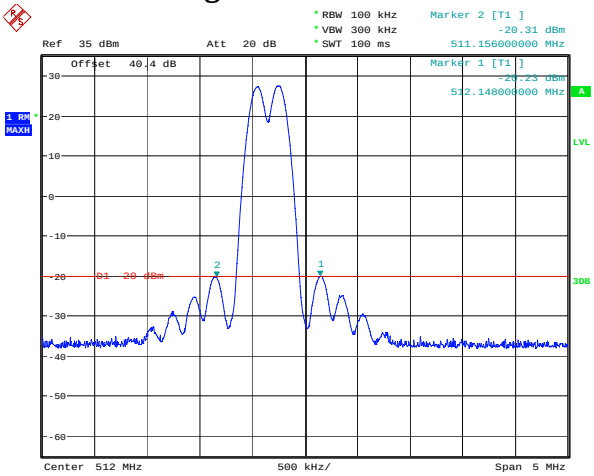
**Additional Observations:**

Measurements were assessed against the requirements of 90.210 Mask D.

Measurements for conducted spurious were performed on low, mid and high channels in each direction and only worst-case results are presented.

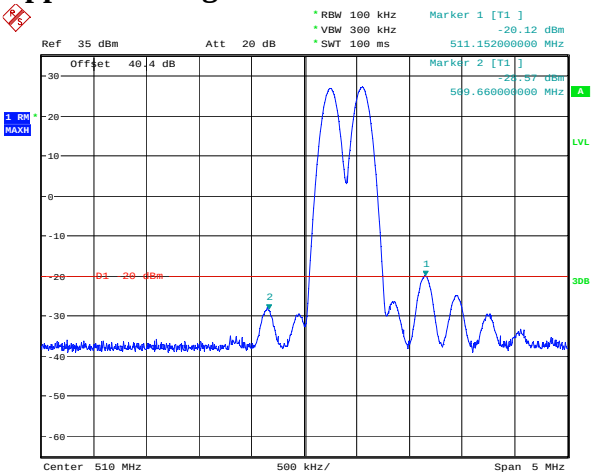
All measurements were performed using CW carriers set to 1dB compression point –3dB.

## Uplink
### Lower Bandedge



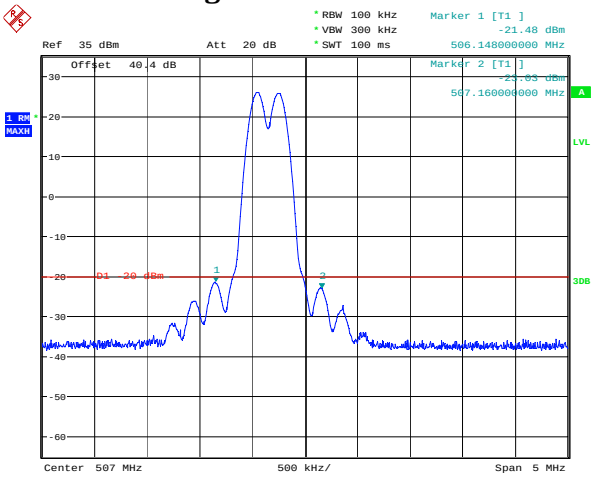

Date: 11.DEC.2008 10:50:19

### Upper Bandedge



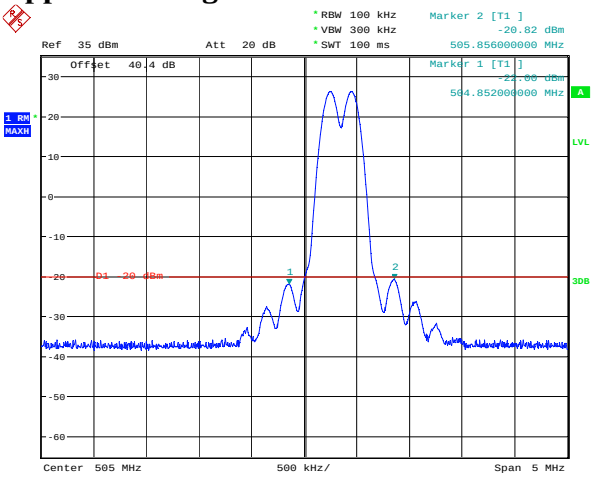

Date: 11.DEC.2008 10:49:09

## Downlink
### Lower Bandedge




Date: 11.DEC.2008 13:04:24

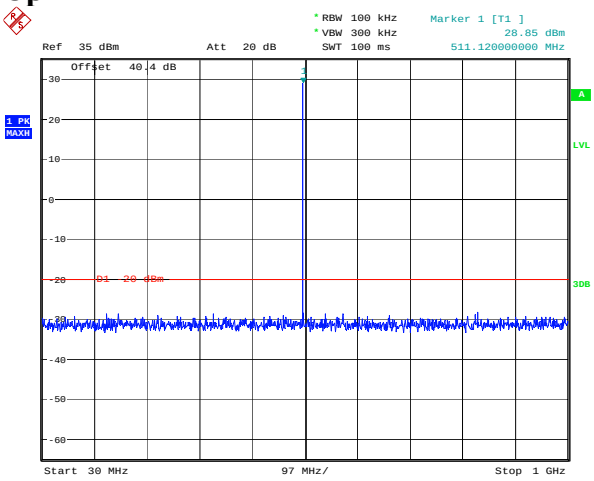
### Upper Bandedge




Date: 11.DEC.2008 13:05:58

## Conducted Emissions

### Uplink

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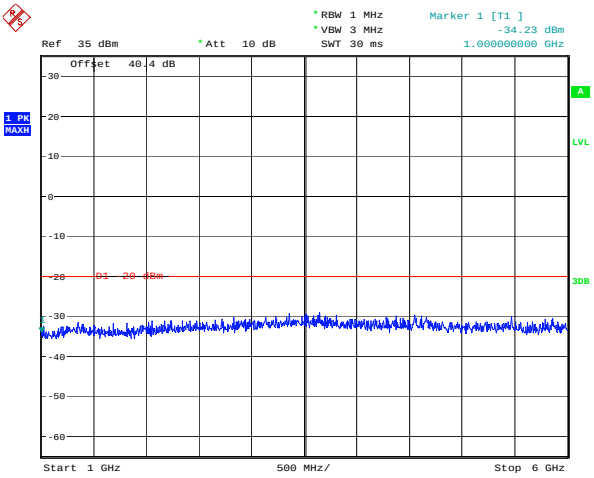
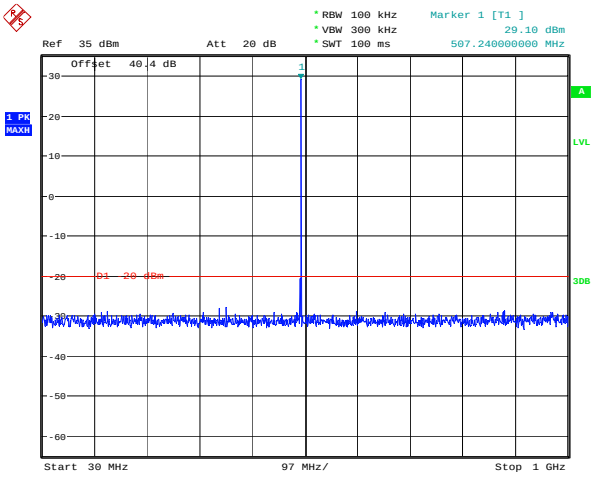
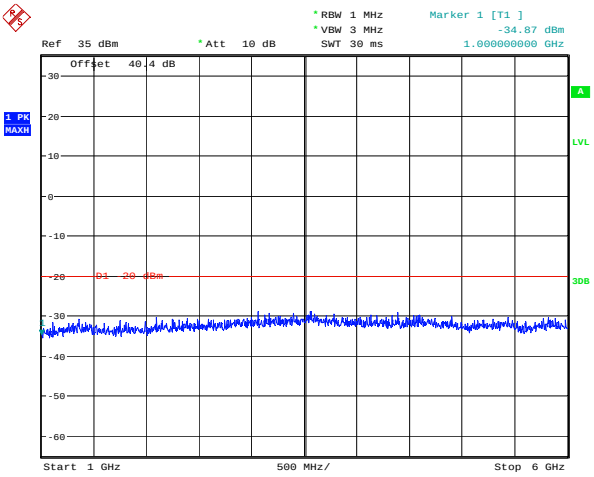



Date: 11.DEC.2008 13:10:27

### Downlink




Date: 11.DEC.2008 13:08:00




Date: 11.DEC.2008 13:08:35

## Clause 90.210 Radiated Spurious Emissions

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere, the Table below specifies the emission masks for equipment operating in the frequency bands governed under this part.

**Test Results:** Pass

**Additional Observations:**

The spectrum was searched from 30MHz to 6GHz and there were no spurious emissions detected within 20dB below the limit.

Measurements were performed using low, mid and high channels in each direction.

All measurements were performed using a Peak Detector with 100kHz RBW below 1GHz and a 1MHz RBW above 1GHz at a distance of 3 meters.

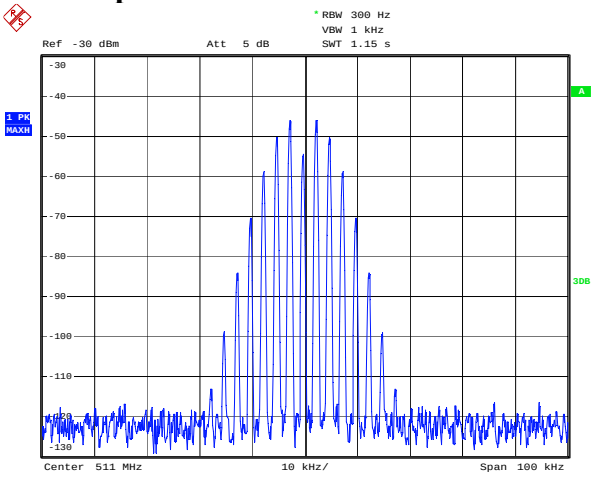
## Clause 2-11-04/EAB/RF Occupied Bandwidth

Using an RBW of 300Hz or 1% of the emission bandwidth, The spectral shape of the output should look similar to the input for all modulations.

**Test Results:** Pass

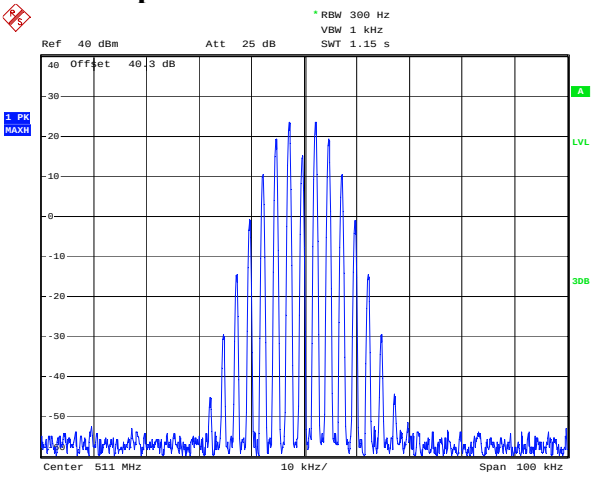
### Uplink

### FM – Input



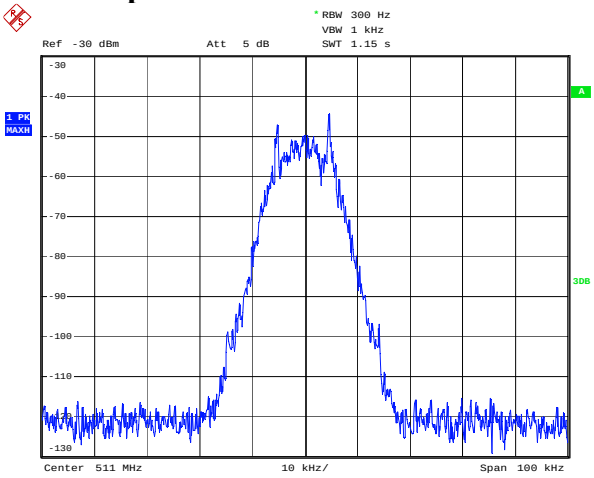

Date: 11.DEC.2008 07:38:45

### FM – Output



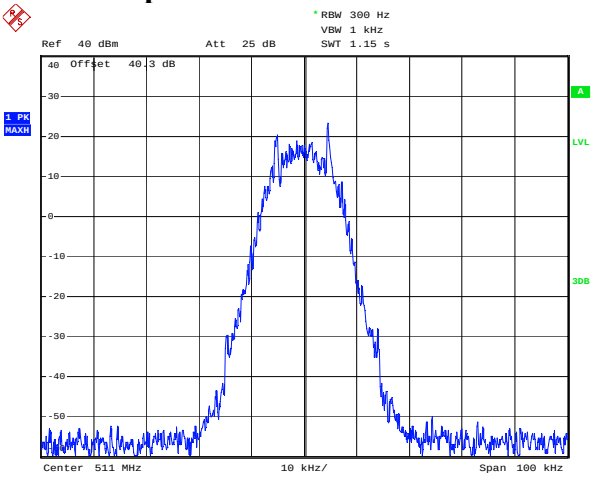

Date: 11.DEC.2008 07:35:50

## FSK – Input



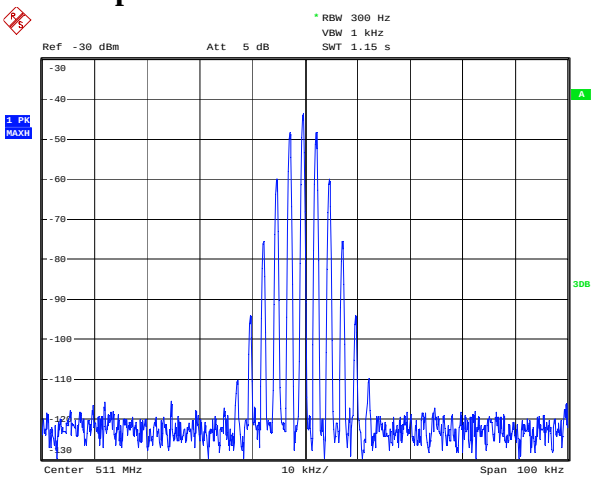

Date: 11.DEC.2008 07:38:15

## FSK - Output



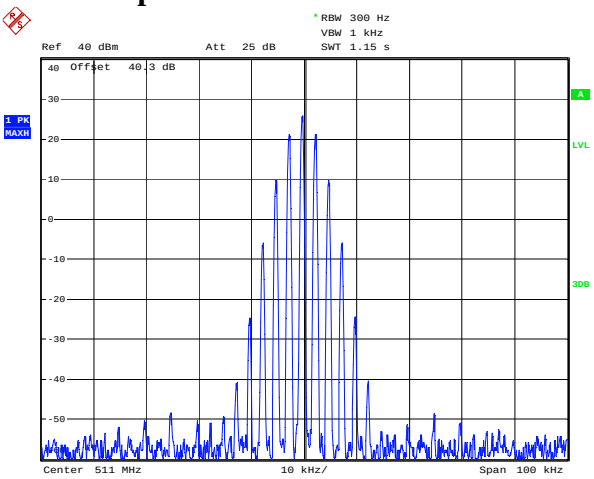

Date: 11.DEC.2008 07:37:18

## PM – Input




Date: 11.DEC.2008 07:38:31

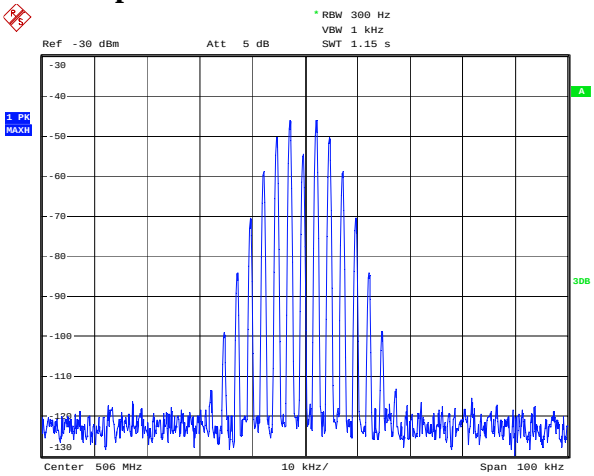
## PM – Output




Date: 11.DEC.2008 07:36:15

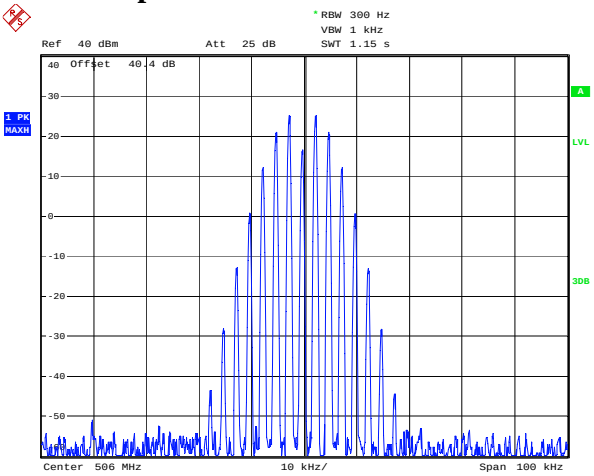
## Downlink

### FM – Input



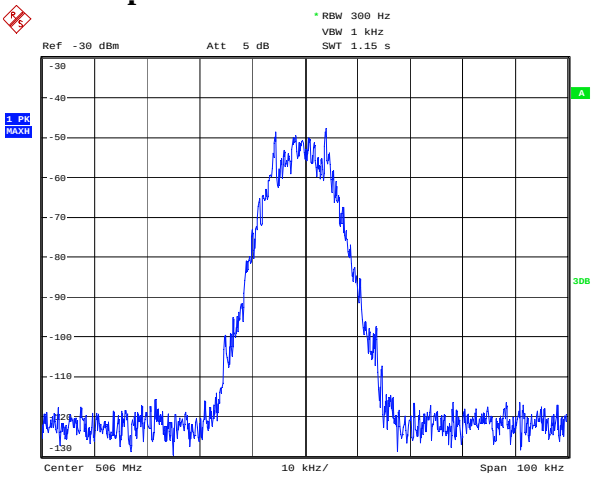

Date: 11.DEC.2008 07:48:13

### FM – Output



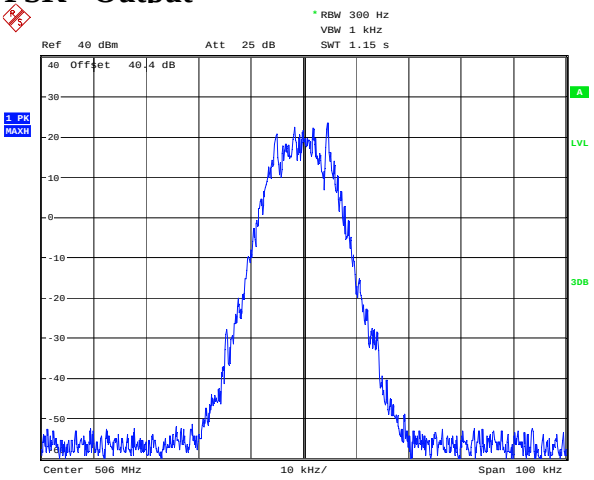

Date: 11.DEC.2008 07:46:17

### FSK – Input



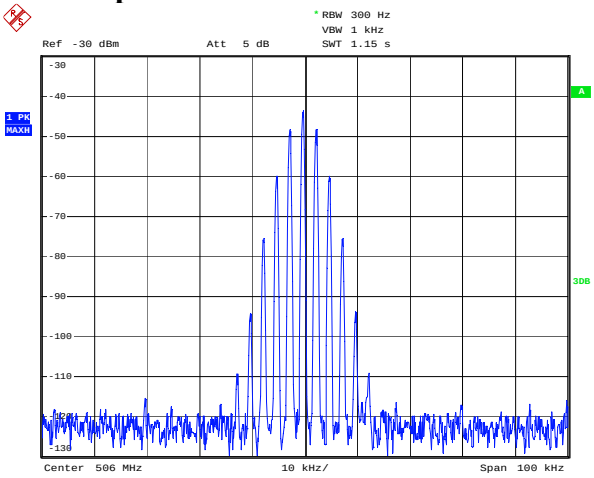

Date: 11.DEC.2008 07:47:43

### FSK - Output



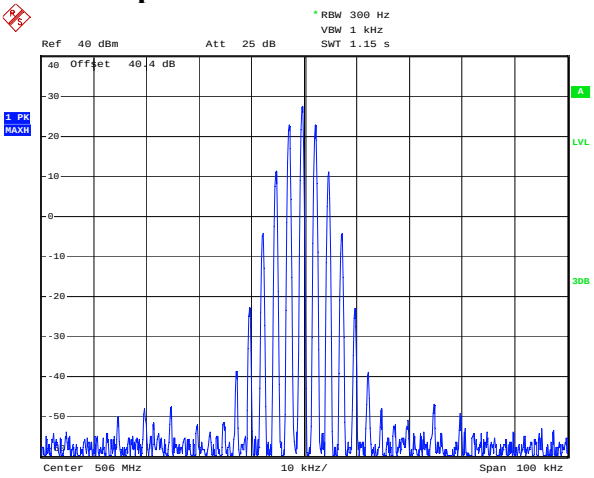

Date: 11.DEC.2008 07:46:51

## PM – Input




Date: 11.DEC.2008 07:47:56

## PM – Output



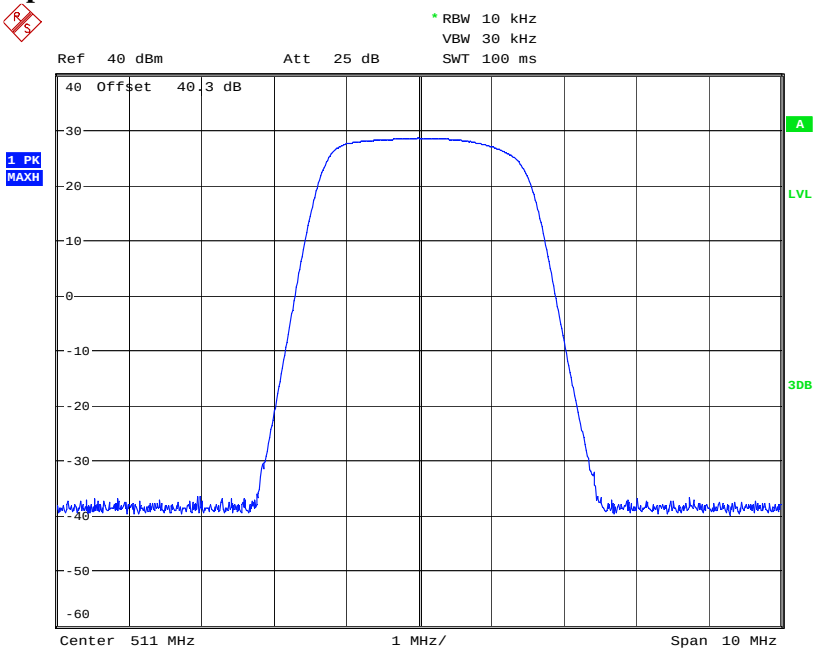

Date: 11.DEC.2008 07:46:34

## Clause 2-11-04/EAB/RF Out of Band Rejection

| |
|---|
| Plots showing the filter frequency response. |

**Test Results:** Pass

## Uplink

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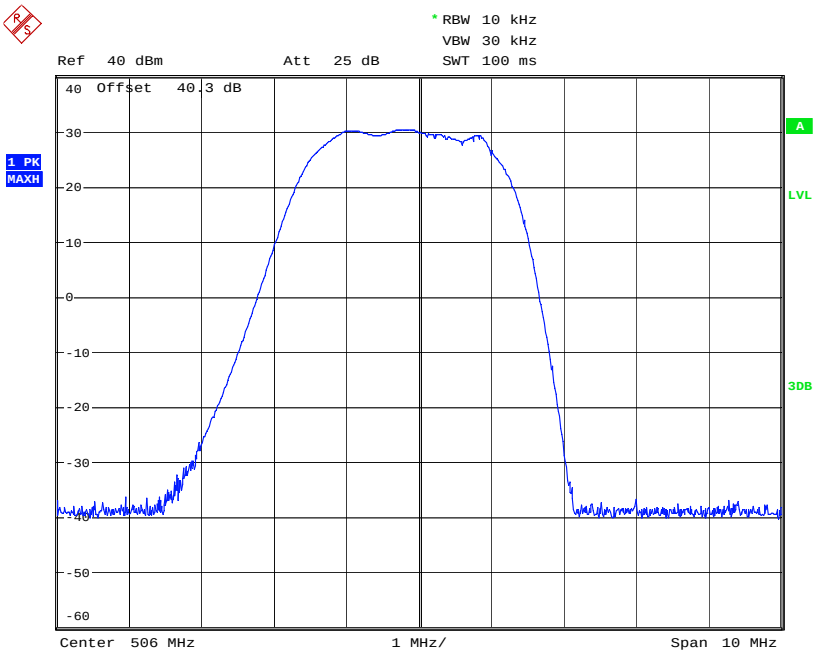
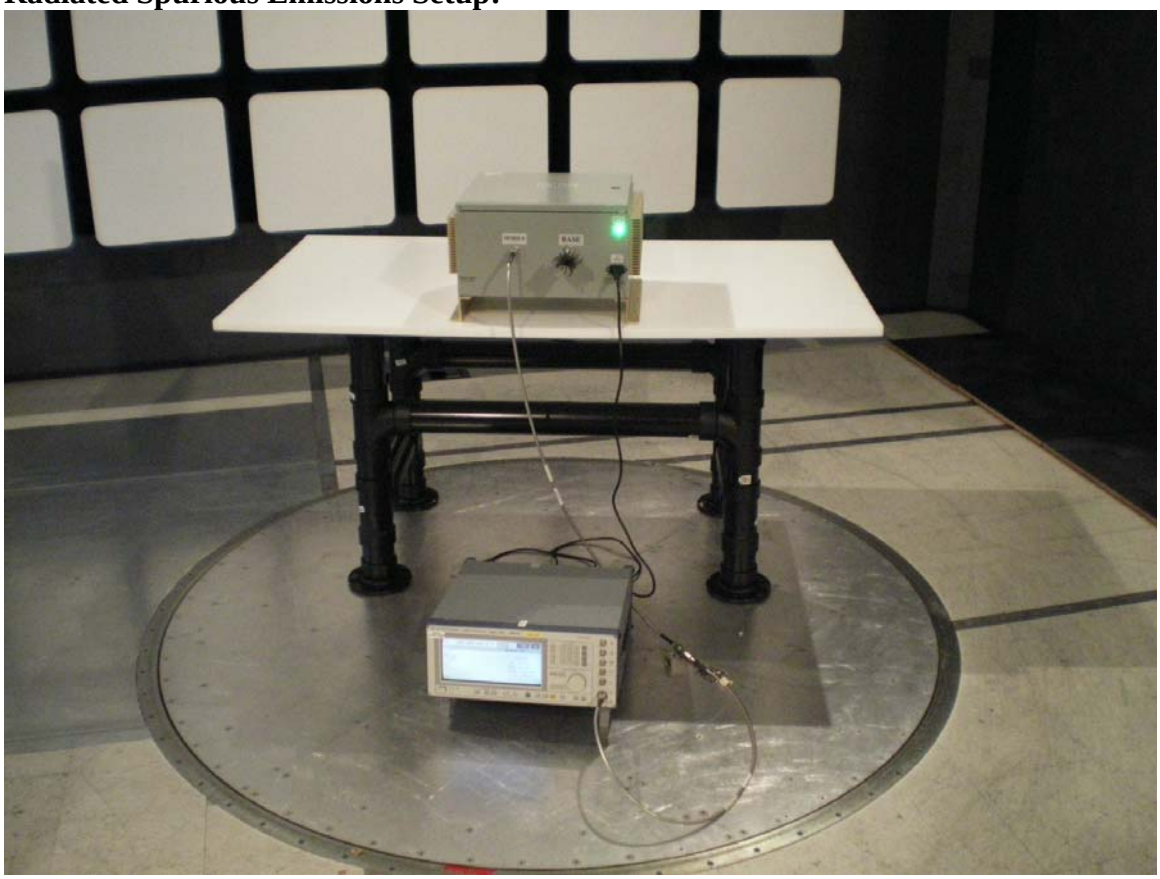
## Downlink




Date: 11.DEC.2008 07:11:35

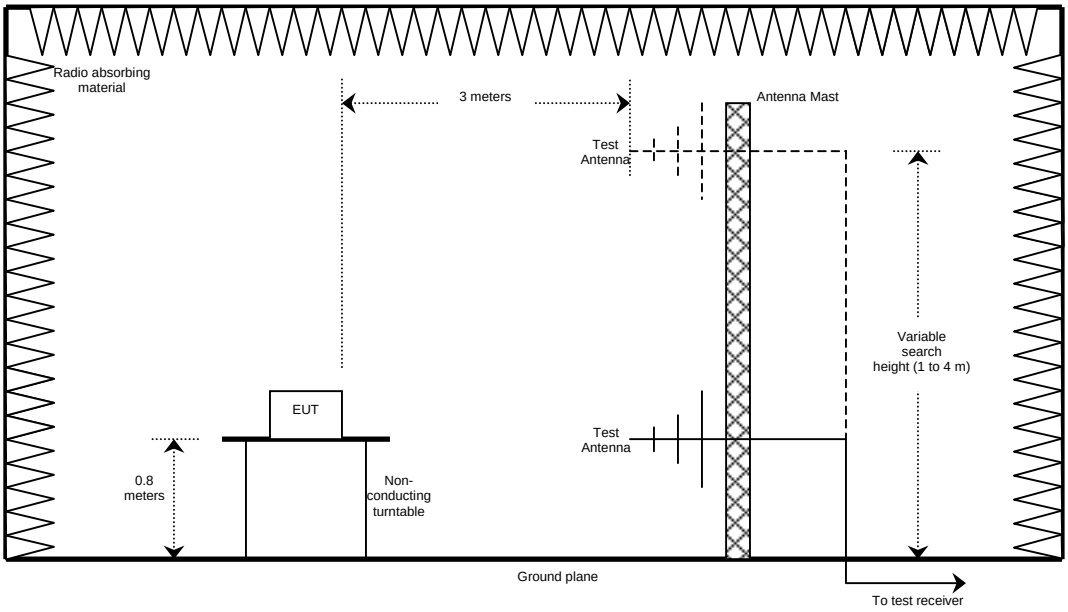
# Appendix B : Setup Photographs

**Radiated Spurious Emissions Setup:**



# Appendix C : Block Diagram of Test Setups

## Radiated Emissions above 30MHz Test Site




## Conducted Emissions, Output power, Occupied Bandwidth and Out of Band Rejection