



**Test Report:** 5W43362.1


**Applicant:** G-wave Inc.  
15 Ron's Edge Road  
Springfield, New Jersey  
07081

**Apparatus:** BDA-SMR-1/25W-90-O

**FCC ID:** Q8KSMR25W90

**In Accordance With:** FCC Part 90, Boosters  
Private Land Mobile Radio Services

**Tested By:** Nemko Canada Inc.  
303 River Road  
Ottawa, Ontario  
K1V 1H2

**Authorized By:**   
Sim Jagpal, Resource Manager

**Date:** December 16, 2005

**Total Number of Pages:** 29

## 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 in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

<b>Apparatus Assessed:</b>	BDA-SMR-1/25W-90-O
<b>Specification:</b>	FCC Part 90 Private Land Mobile Radio Services
<b>Compliance Status:</b>	Complies
<b>Exclusions:</b>	None
<b>Non-compliances:</b>	None
<b>Report Release History:</b>	Original Release

Author: Jason Nixon, Telecom Specialist

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.

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

## TABLE OF CONTENTS

<b>Report Summary .....</b>	<b>2</b>
<b>Section 1 : Equipment Under Test.....</b>	<b>4</b>
1.1 Product Identification .....	4
1.2 Samples Submitted for Assessment.....	4
1.3 Theory of Operation .....	4
1.4 Technical Specifications of the EUT .....	5
1.5 Block Diagram of the EUT.....	5
<b>Section 2 : Test Conditions.....</b>	<b>6</b>
2.1 Specifications .....	6
2.2 Deviations From Laboratory Test Procedures .....	6
2.3 Test Environment .....	6
2.4 Test Equipment.....	6
<b>Section 3 : Observations .....</b>	<b>7</b>
3.1 Modifications Performed During Assessment .....	7
3.2 Record Of Technical Judgements .....	7
3.3 EUT Parameters Affecting Compliance .....	7
3.4 Test Deleted.....	7
3.5 Additional Observations .....	7
<b>Section 4 : Results Summary .....</b>	<b>8</b>
4.1 FCC Part 90 : Test Results .....	9
<b>Appendix A : Test Results.....</b>	<b>10</b>
Clause 90.205 Output Power .....	10
Clause 90.210 Conducted Spurious Emissions.....	11
Clause 90.210 Radiated Spurious Emissions .....	18
Clause 2-11-04/EAB/RF Occupied Bandwidth .....	19
Clause 2-11-04/EAB/RF Out of Band Rejection .....	26
<b>Appendix B : Setup Photographs .....</b>	<b>28</b>
<b>Appendix C : Block Diagram of Test Setups.....</b>	<b>29</b>

## **Section 1 : Equipment Under Test**

### **1.1 Product Identification**

The Equipment Under Test was identified as follows:

BDA-SMR-1/25W-90-O

### **1.2 Samples Submitted for Assessment**

The following samples of the apparatus have been submitted for type assessment:

<b>Sample No.</b>	<b>Description</b>	<b>Serial No.</b>
2	BDA-SMR-1/25W-90-O Bi-Directional Amplifier	_____

The first samples were received on: April 21, 2005

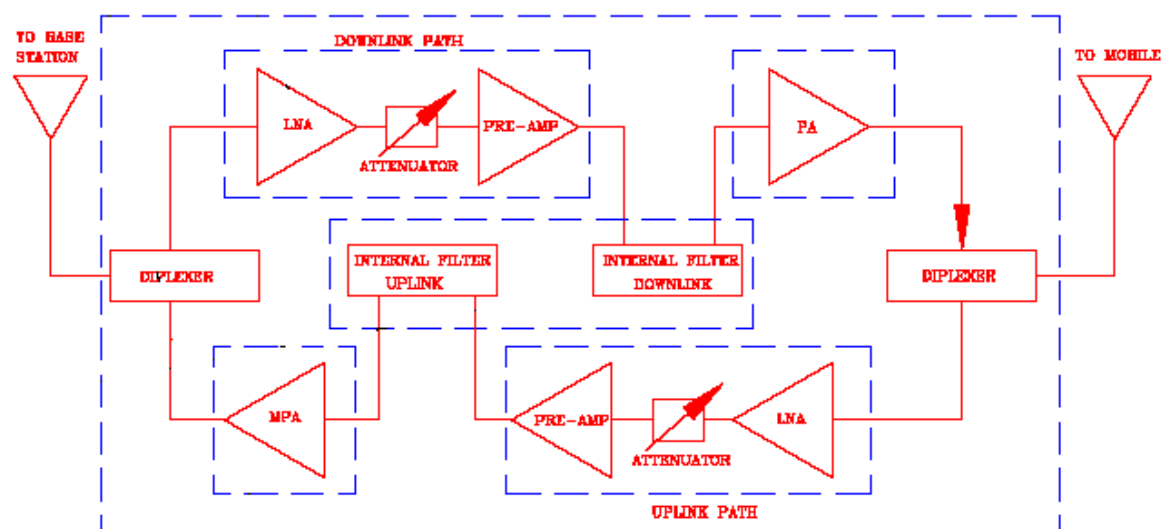
### **1.3 Theory of Operation**

The BDA Downlink path receives RF signals from the base station and amplifies and transmits them to the subscriber. The BDA Uplink path receives RF signals from the subscriber and amplifies and transmits them to the base station. The Uplink and Downlink occupy two distinct frequency bands. For example, the SMR frequency bands are as follows: *806-821 MHz for the Uplink and 851-866 MHz for the Downlink*. Two duplexers isolate the paths and route each signal to the proper amplifying channel.

## 1.4 Technical Specifications of the EUT

<b>Manufacturer:</b>	G-Wave Inc.
<b>Operating Frequency:</b>	Uplink: 806-821MHz Downlink: 851-866MHz
<b>Emission Designator:</b>	D7W, F2D
<b>Rated Power:</b>	Uplink: 0.316W(25dBm) Downlink: 3.16W (35dBm)
<b>Measured Power:</b>	Uplink: 0.214W Downlink: 3.436W
<b>Rated Gain:</b>	90dB
<b>Modulation:</b>	2FSK, 4FSK, QAM
<b>Power Supply:</b>	120VAC, 60Hz

## 1.5 Block Diagram of the EUT



## Section 2 : Test Conditions

### 2.1 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

### 2.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

### 2.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range : 15 – 30 °C  
 Humidity range : 20 - 75 %  
 Pressure range : 86 - 106 kPa  
 Power supply range : +/- 5% of rated voltages

### 2.4 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Hewlett-Packard	8565E	FA000981	March 10/05	March 10/06
Signal Generator	Rohde & Schwarz	SMIQ03	FA001091	Sept. 25/03	Sept. 25/06
Signal Generator	Rohde & Schwarz	SMIQ03E	FA001269	Feb 3/05	Feb 3/06
Power Meter	HP	E4418B	FA001413	May 17/05	May 17/06
Power Sensor	HP	8487A	FA001908	Mar 10/05	Mar 10/06
20dB Attenuator	Narda	769-20	FA001394	COU	COU
10dB Attenuator	Weinschel Corp.	47-10-34	FA001739	COU	COU
10dB Attenuator	Weinschel Corp.	47-10-34	FA001740	COU	COU
Spectrum Analyzer	Hewlett-Packard	8566B	FA001309	May 18/05	May 18/06
Spectrum Analyzer Display	Hewlett-Packard	85662A	FA001309	May 18/05	May 18/06
Horn Antenna #2	EMCO	3115	FA000825	Dec. 14/04	Dec. 14/05
Bilog	Schaffner	CBL6112B	FA001504	NCR	NCR
1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	July 14/05	July 14/06
2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	July 14/05	July 14/06
4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001497	July 14/05	July 14/06
5.0 – 18.0 GHz Amplifier	NARDA	DWT-186N23U40	FA001409	COU	COU

## **Section 3 : Observations**

### **3.1 Modifications Performed During Assessment**

The following modification was performed during this assessment:

#### **3.2.1 Modification state 1**

As originally submitted the Booster was found to be non-compliant with the 3<sup>rd</sup> order intermodulation requirements for the downlink. The output power was reduced from 5W to 3.16W and the Downlink was retested and found to be fully compliant.

### **3.2 Record Of Technical Judgements**

No technical judgements were made during the assessment.

### **3.3 EUT Parameters Affecting Compliance**

The user of the apparatus could not alter parameters that would affect compliance.

### **3.4 Test Deleted**

No Tests were deleted from this assessment.

### **3.5 Additional Observations**

There were no additional observations made during this assessment.

## **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 section 3.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus in its final modification state.



**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	N (1)	
90.214	—	Transient Behavior	N (2)	
90.219	—	Use of boosters	Y	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 contain any frequency translating circuitry.
- (2) The EUT does transmit in the 150-174 MHz and 421-512 MHz frequency bands.

## 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 Conditions:

<b>Sample Number:</b>	2	<b>Temperature:</b>	24
<b>Date:</b>	December 9, 2005	<b>Humidity:</b>	18
<b>Modification State:</b>	1	<b>Tester:</b>	Jason Nixon
		<b>Laboratory:</b>	Wireless

#### Test Results:

Band	Rated Power (dBm)	Measured Power (dBm)
Uplink (2FSK)	25dBm	24.21dBm
Uplink (4FSK)	25dBm	24.22dBm
Uplink (QAM)	25dBm	23.37dBm
Downlink (2FSK)	35dBm	35.05dBm
Downlink (4FSK)	35dBm	35.13dBm
Downlink (QAM)	35dBm	35.36dBm

Power Measurements were performed using a single carrier at the 1dB compression point.

**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 below specifies the emission masks for equipment operating in the frequency bands governed under this part.

**Test Conditions:**

<b>Sample Number:</b>	2	<b>Temperature:</b>	24
<b>Date:</b>	December 9, 2005	<b>Humidity:</b>	18
<b>Modification State:</b>	1	<b>Tester:</b>	Jason Nixon
		<b>Laboratory:</b>	Wireless

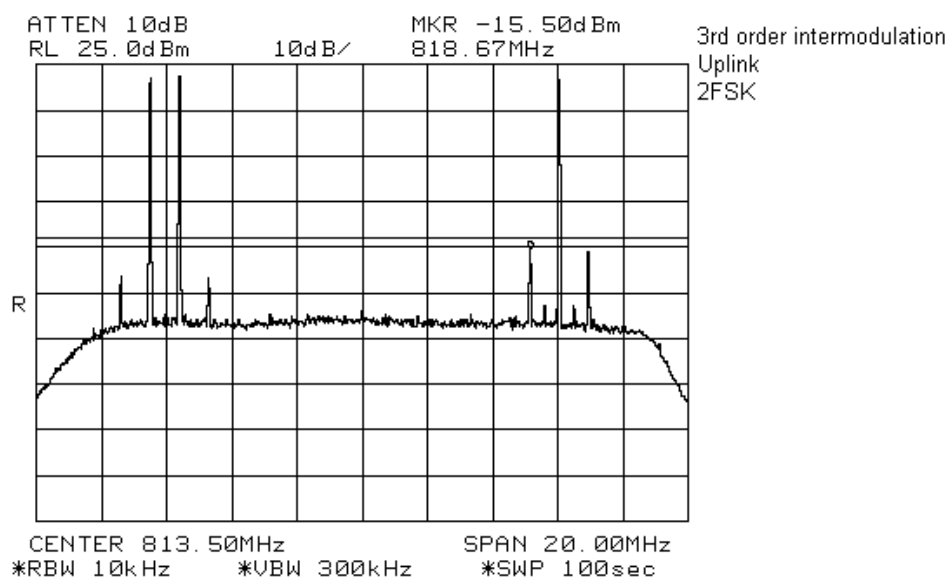
**Test Results:**

See Attached Plots.

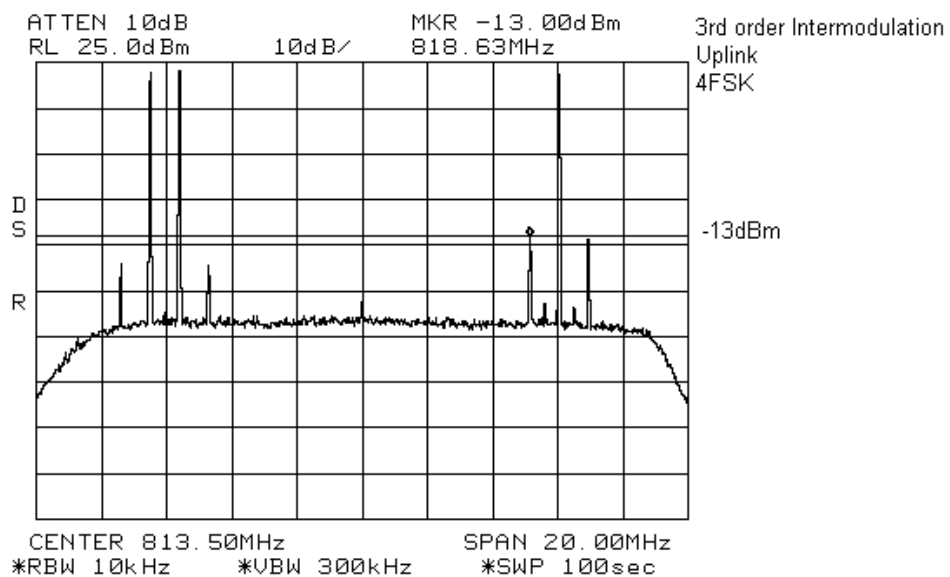
**Additional Observations:**

Conducted spurious measurements were performed at low, mid and high channels for all modulation types and only the worst case have been included.

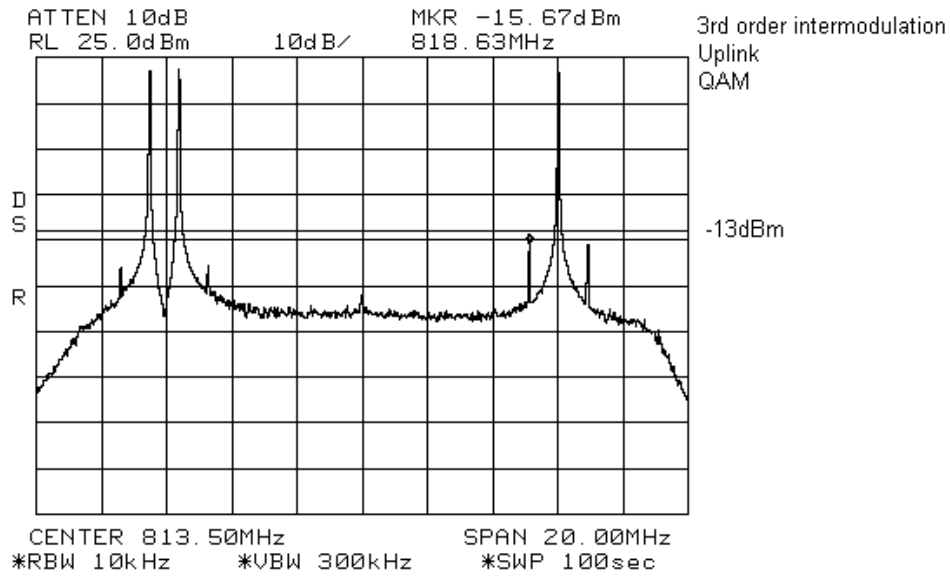
### Uplink 2FSK 3<sup>rd</sup> order Intermodulation



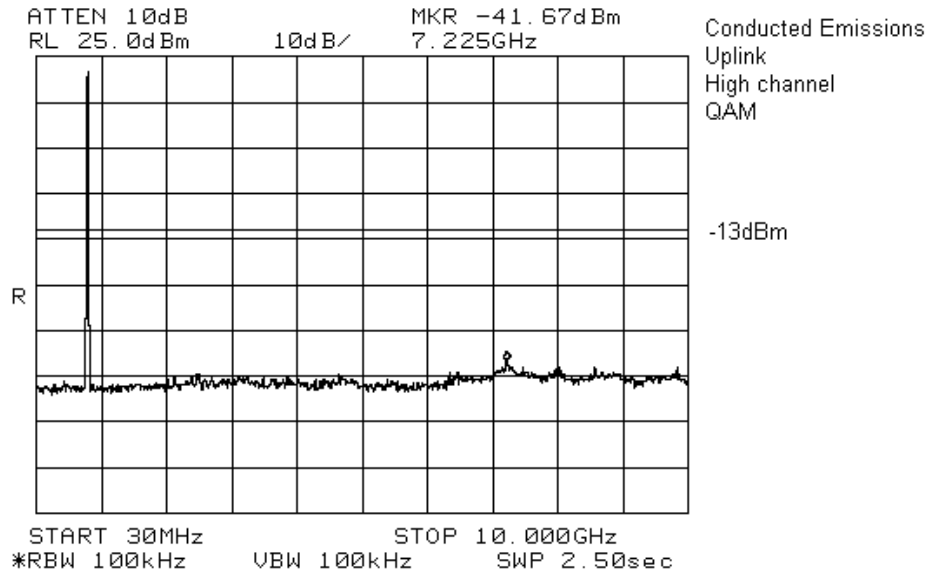
### Uplink 4FSK 3<sup>rd</sup> order Intermodulation



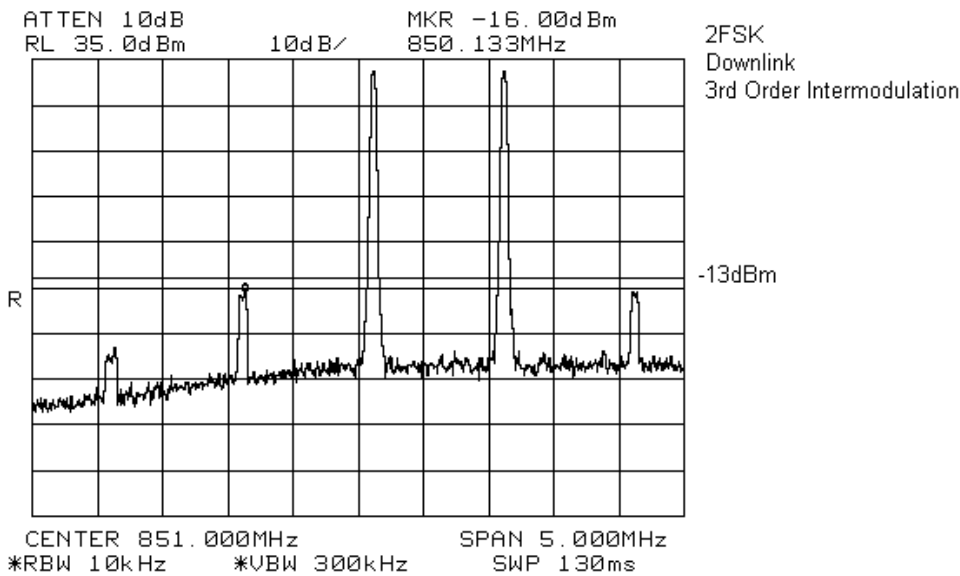
### Uplink QAM 3<sup>rd</sup> order Intermodulation



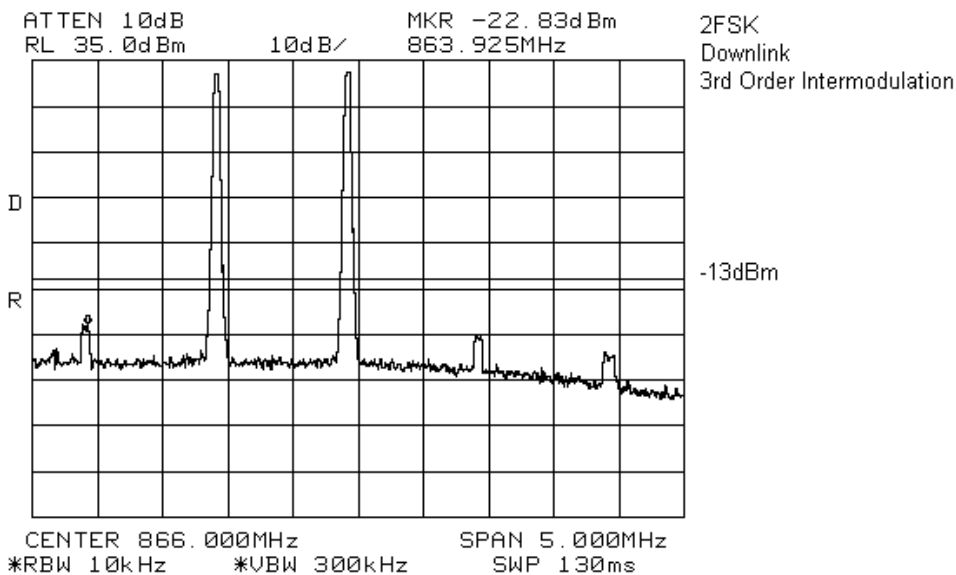
### Uplink Conducted Emissions – Worst-case

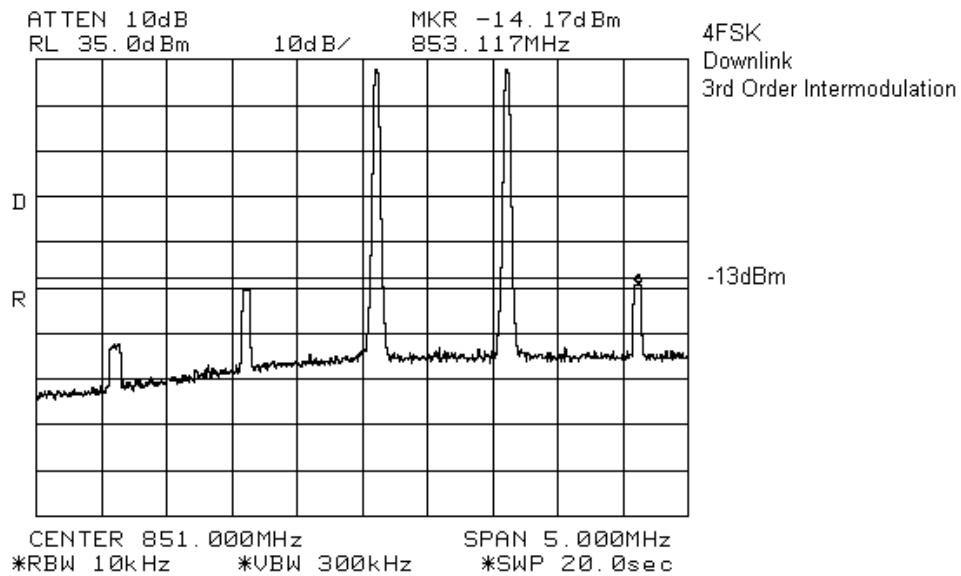
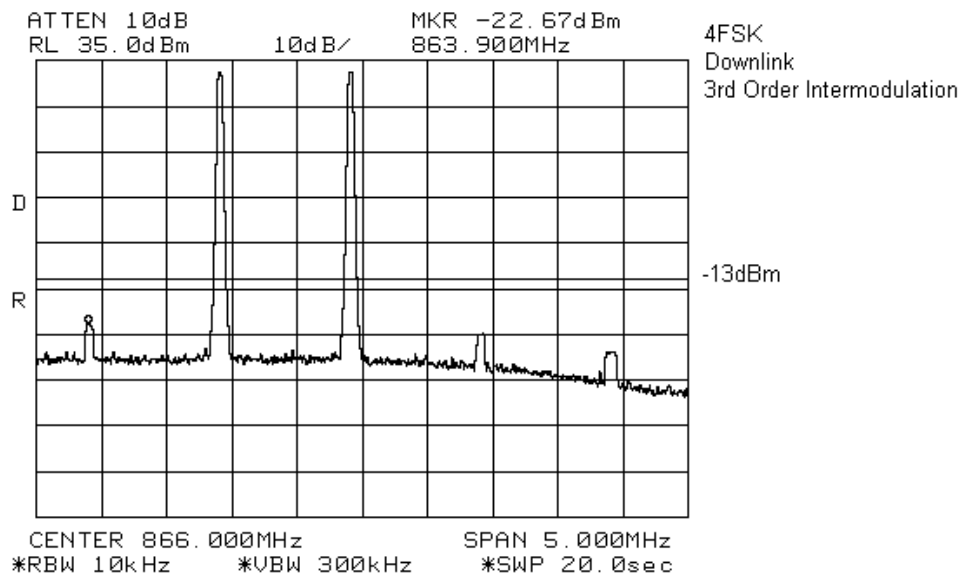


Downlink 2FSK 3<sup>rd</sup> Order Intermodulation – Low Bandedge

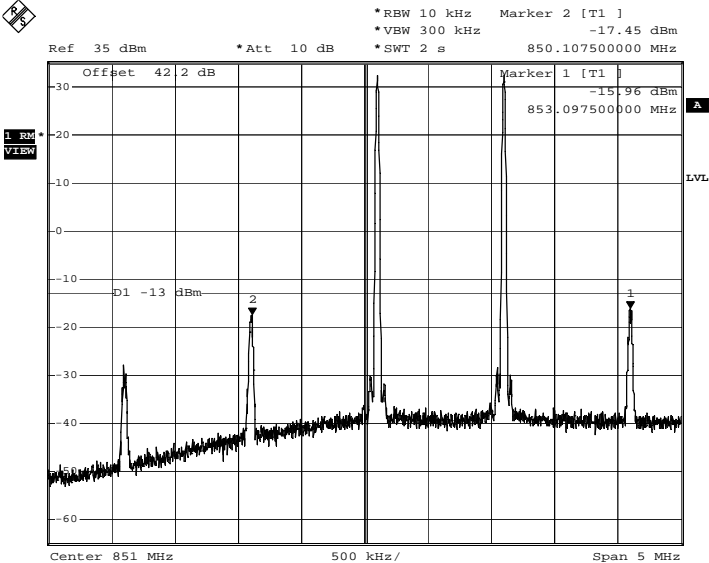


Downlink 2FSK 3<sup>rd</sup> Order Intermodulation – High Bandedge



**Downlink 4FSK 3<sup>rd</sup> Order Intermodulation – Low Bandedge****Downlink 4FSK 3<sup>rd</sup> Order Intermodulation – High Bandedge**

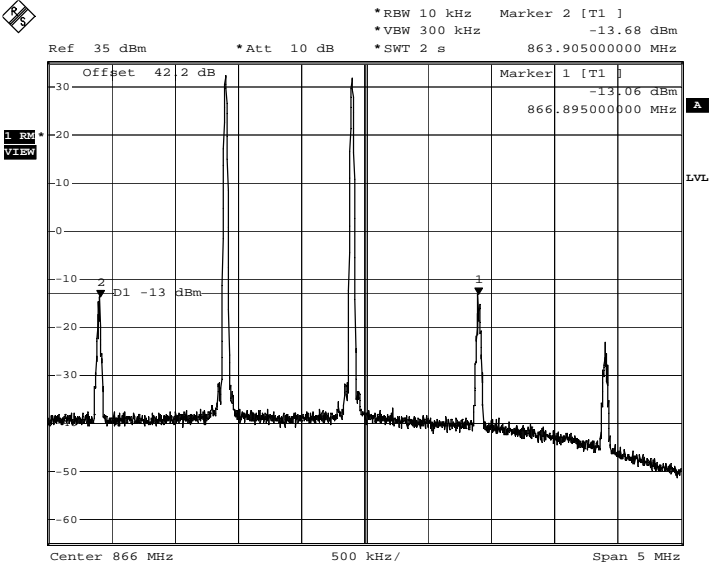
Downlink QAM 3<sup>rd</sup> Order Intermodulation – Low Bandedge



QAM 3rd Order Intermodulation

Date: 9.DEC.2005 20:06:05

Downlink QAM 3<sup>rd</sup> Order Intermodulation – High Bandedge

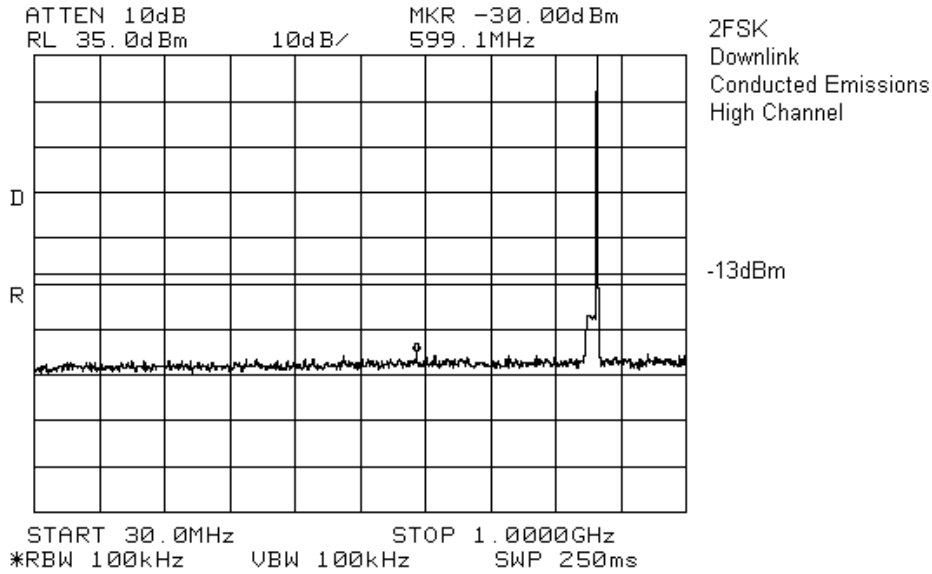


QAM 3rd Order Intermodulation

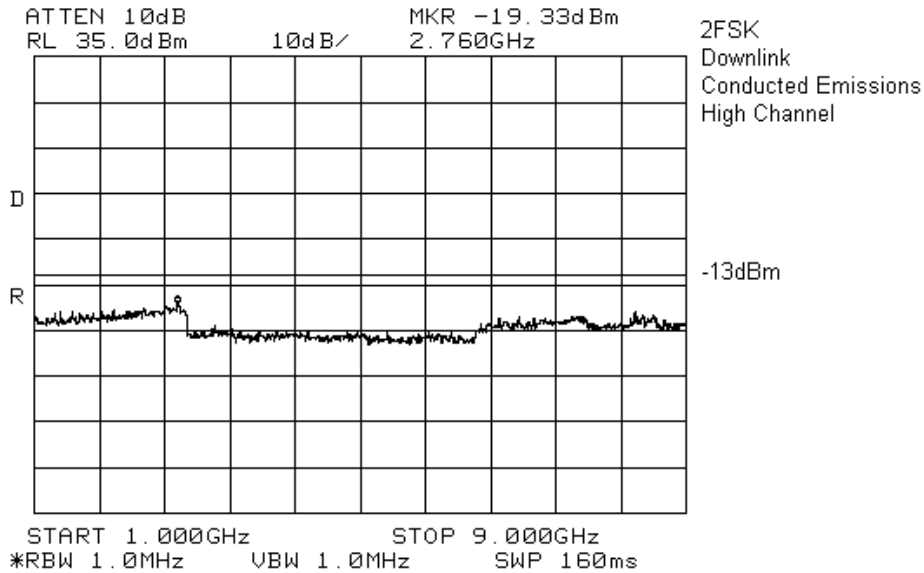
Date: 9.DEC.2005 21:12:42



### Downlink Conducted Emissions – Low frequencies



### Downlink Conducted Emissions – High frequencies



**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 Conditions:**

<b>Sample Number:</b>	2	<b>Temperature:</b>	10
<b>Date:</b>	December 13, 2005	<b>Humidity:</b>	18
<b>Modification State:</b>	1	<b>Tester:</b>	Jason Nixon
		<b>Laboratory:</b>	OATS

**Test Results:**

No Emissions within 20dB below the limit were detected.

**Additional Observations:**

The Spectrum was searched from 30MHz to the 9GHz Harmonic.

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 Conditions:**

<b>Sample Number:</b>	2	<b>Temperature:</b>	24
<b>Date:</b>	December 9, 2005	<b>Humidity:</b>	18
<b>Modification State:</b>	1	<b>Tester:</b>	Jason Nixon
		<b>Laboratory:</b>	Wireless

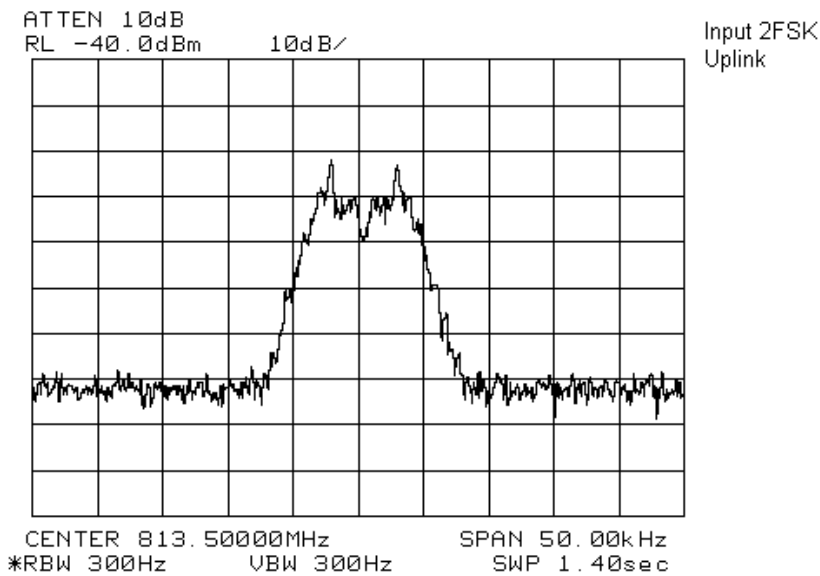
**Test Results:**

See Attached Plots.

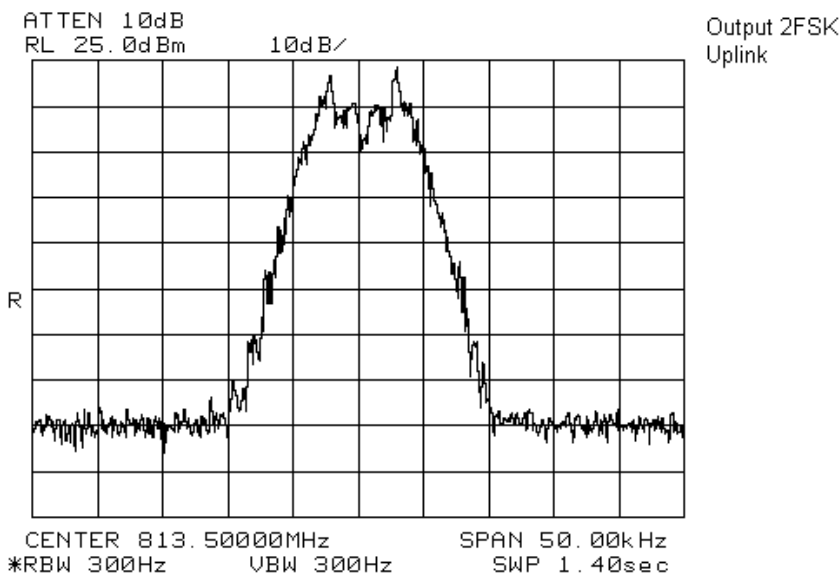
**Additional Observations:**

None

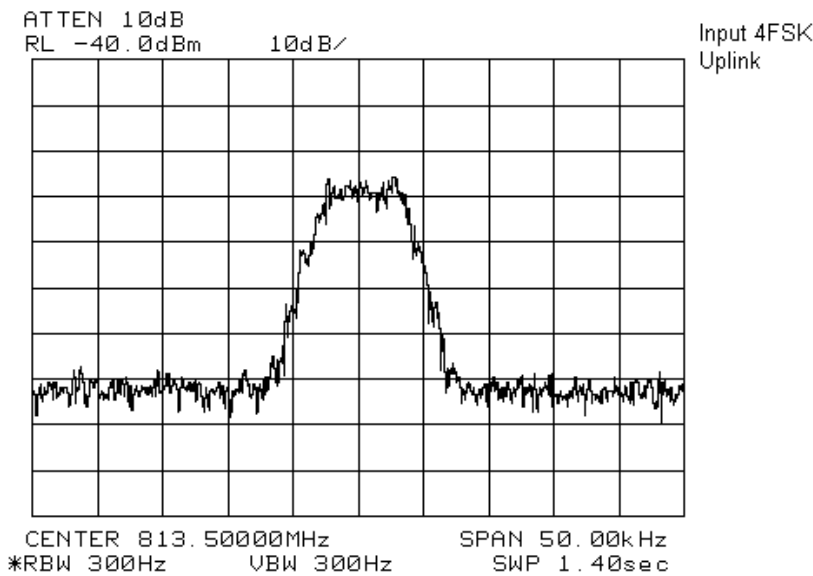
Uplink 2FSK Input



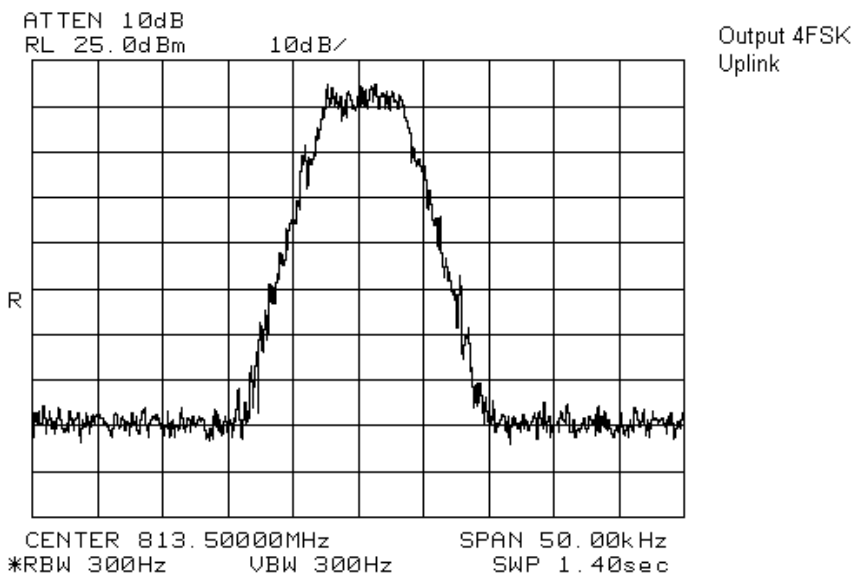
Uplink 2FSK Output



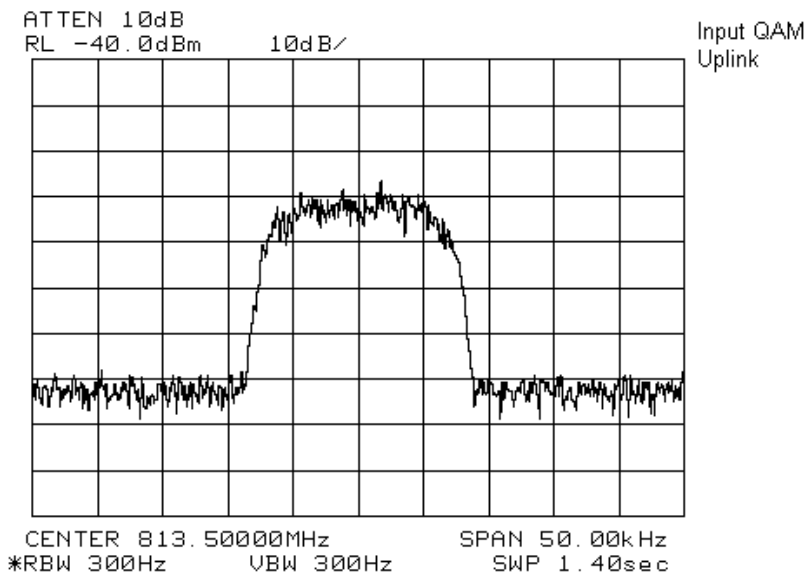
Uplink 4FSK Input



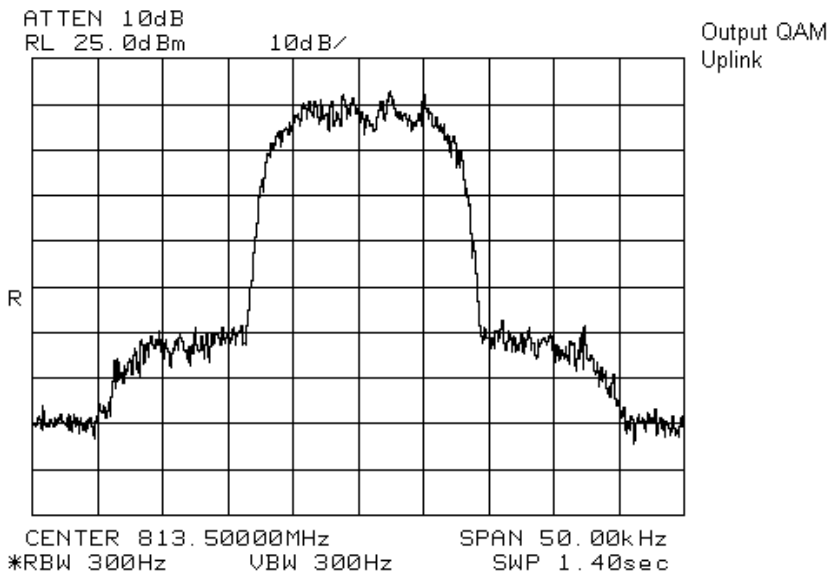
Uplink 4FSK Output



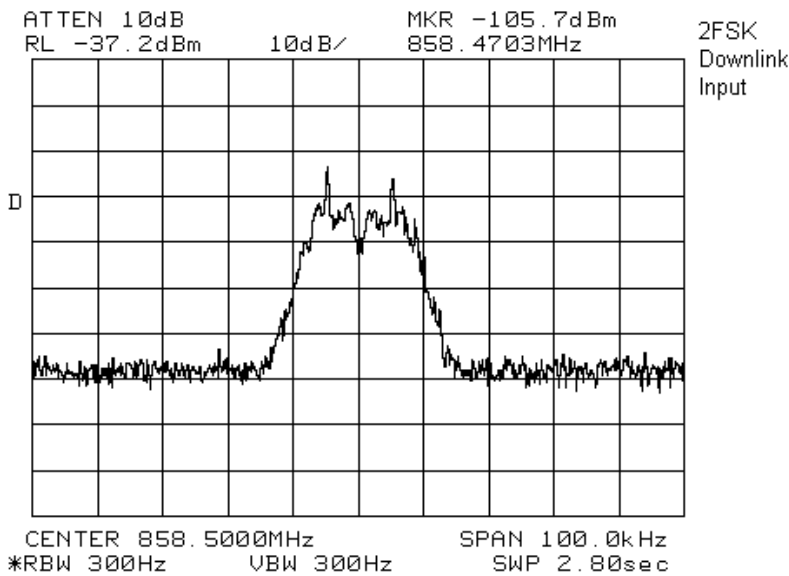
Uplink QAM Input



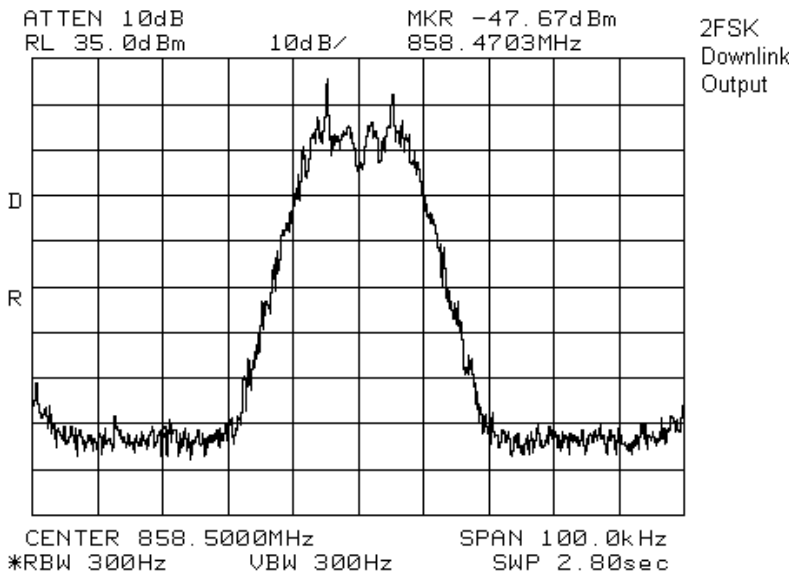
Uplink QAM Output



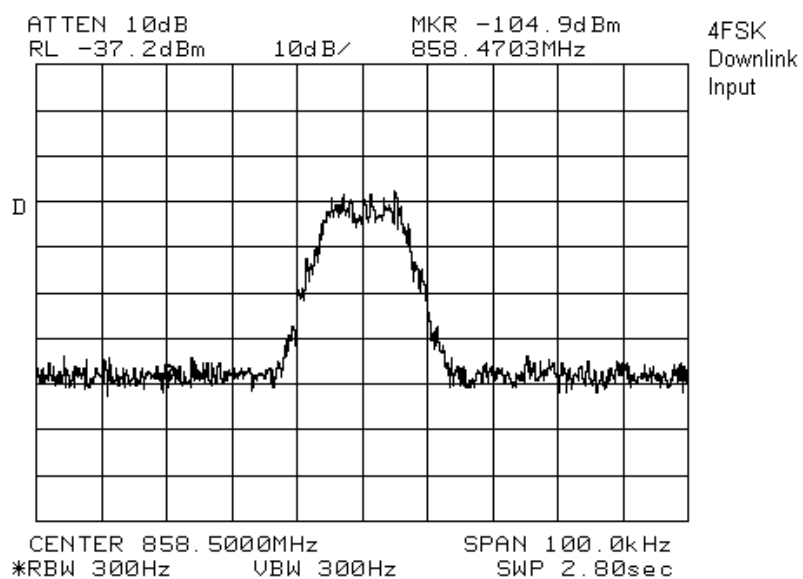
Downlink 2FSK Input



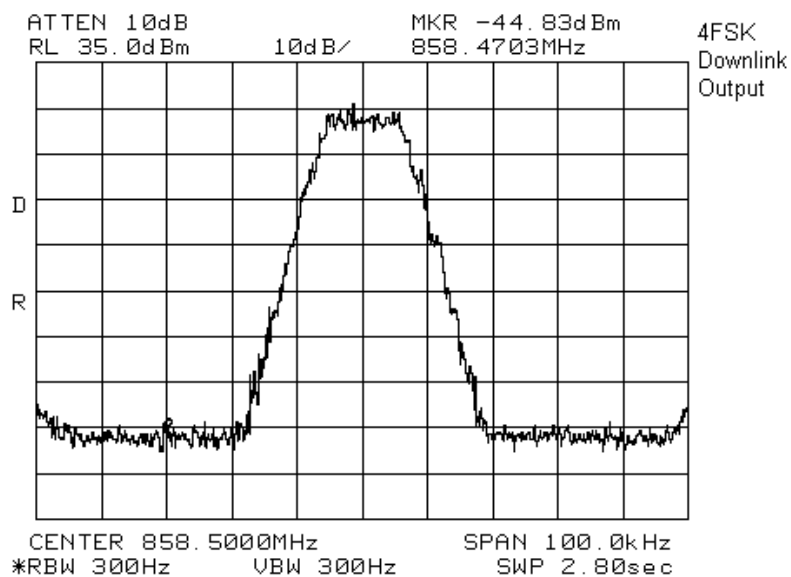
Downlink 2FSK Output



### Downlink 4FSK Input

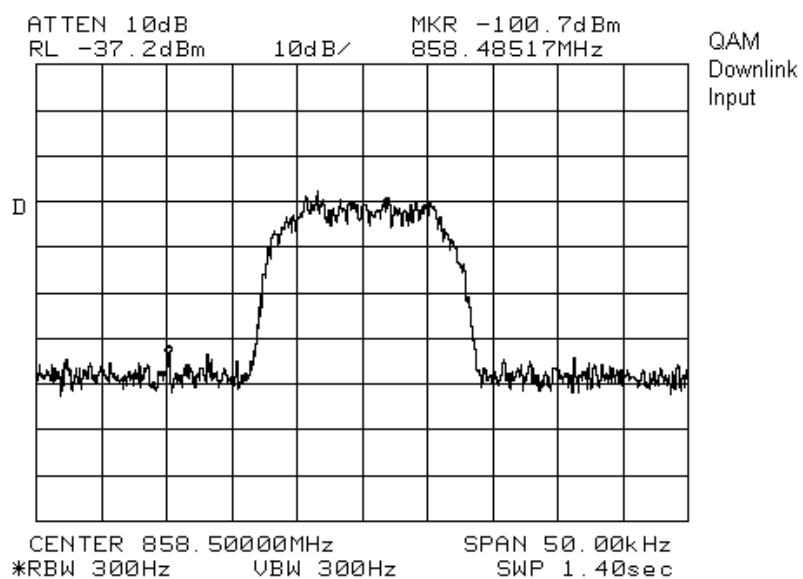


### Downlink 4FSK Output

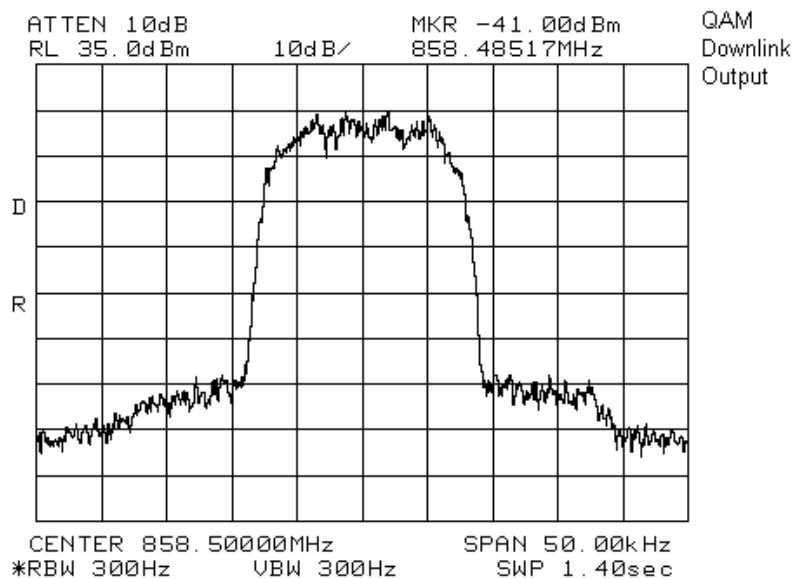




### Downlink QAM Input



### Downlink QAM Output



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

Plots showing the filter frequency response.
--

**Test Conditions:**

<b>Sample Number:</b>	2	<b>Temperature:</b>	25
<b>Date:</b>	May 19, 2005	<b>Humidity:</b>	26
<b>Modification State:</b>	0	<b>Tester:</b>	Jason Nixon
		<b>Laboratory:</b>	Wireless

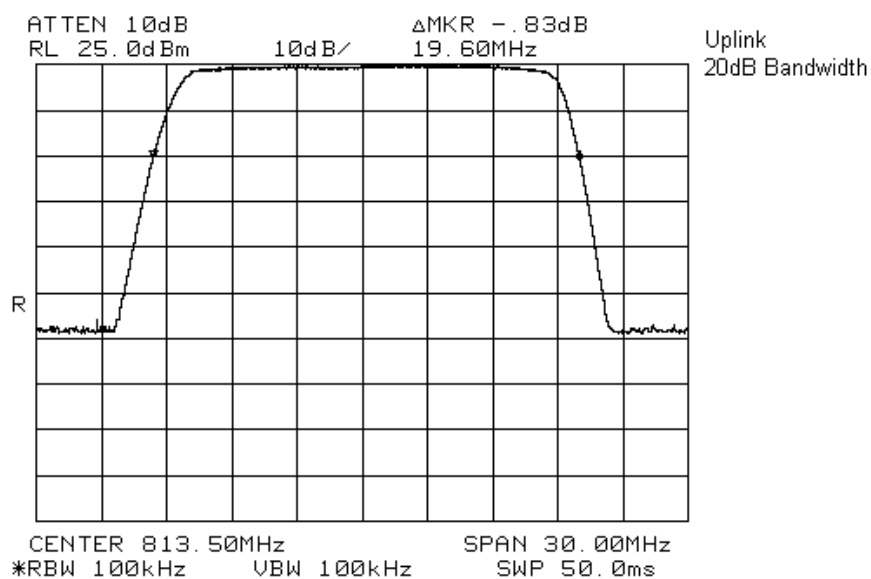
**Test Results:**

See Attached Plots.

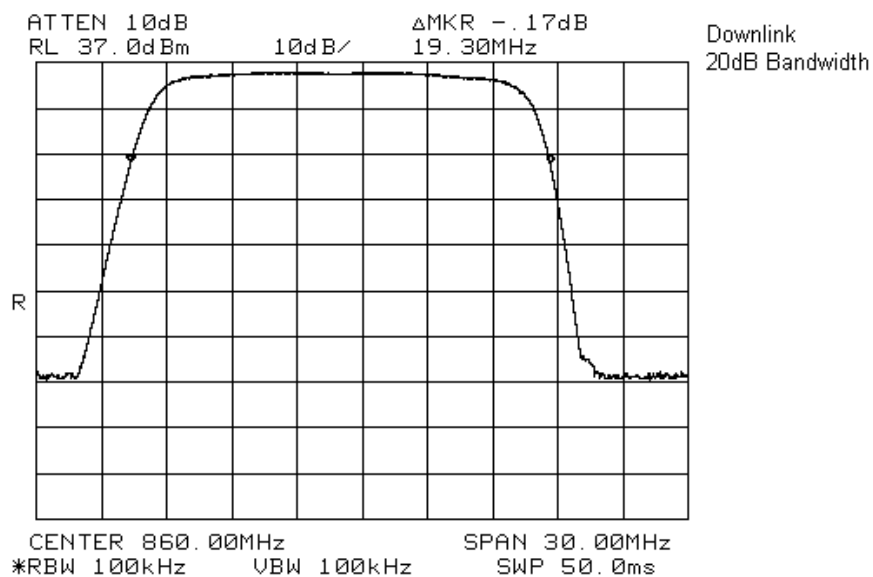
**Additional Observations:**

None

## Uplink

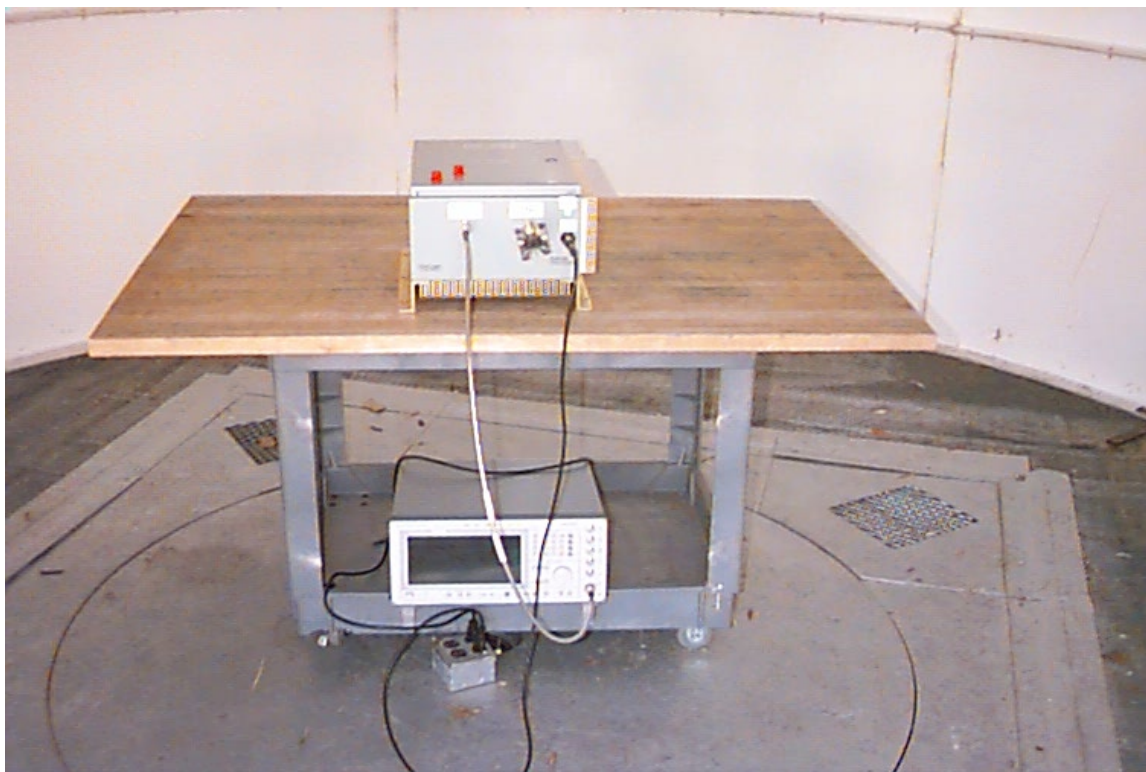


## Downlink



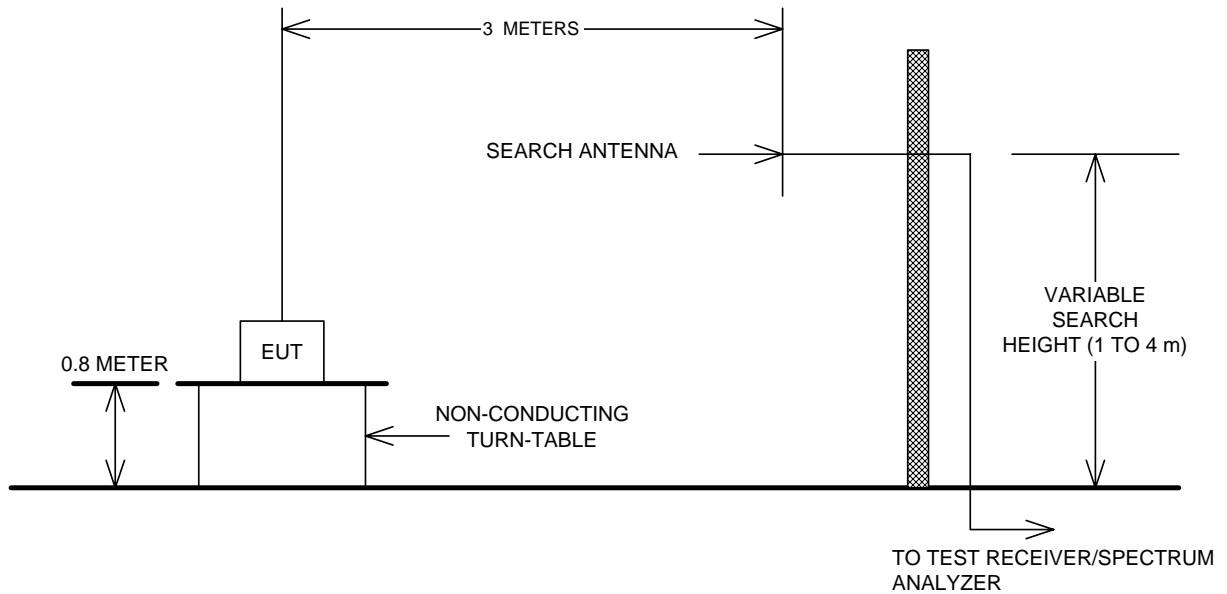
## **Appendix B : Setup Photographs**

### **Radiated Spurious Emissions Setup:**



## Appendix C : Block Diagram of Test Setups

### Test Site For Radiated Emissions



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

