



Nemko

Test Report:

5W42638

Applicant:

Radio Frequency Systems
29 Research Parkway
Wallingford, CT
06492 USA

Apparatus:

48960 Signal Booster

FCC ID:

IWD48960

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:

Jin Xu, Wireless Specialist

Date:

11 May 2005

Total Number of Pages:

28

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:

Apparatus Assessed:	48960 Signal Booster
Specification:	FCC Part 90 Private Land Mobile Radio Services
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	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

Report Summary.....	2
Section 1 : Equipment Under Test.....	4
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
Section 2 : Test Conditions.....	6
2.1 Specifications	6
2.2 Deviations From Laboratory Test Procedures	6
2.3 Test Environment	6
2.4 Test Equipment.....	6
Section 3 : Observations	7
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
Section 4 : Results Summary	8
4.1 FCC Part 90 : Test Results	9
Appendix A : Test Results.....	10
Appendix B : Setup Photographs	27
Appendix C : Block Diagram of Test Setups.....	28

Section 1 : Equipment Under Test

1.1 Product Identification

The Equipment Under Test was identified as follows:

48960 Signal Booster

1.2 Samples Submitted for Assessment

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

Sample No.	Description	Serial No.
3	48960 Signal Booster	001

The first samples were received on: April 7, 2005

1.3 Theory of Operation

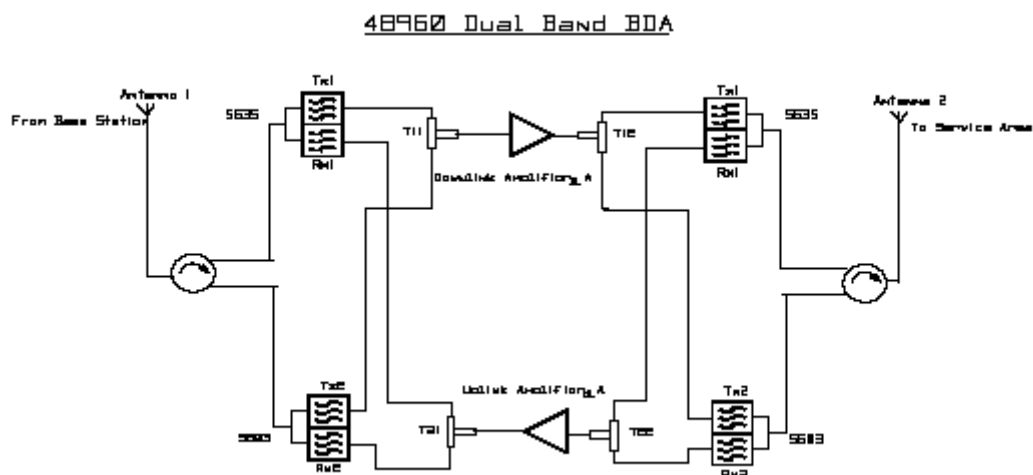
The 48900 bi-directional amplifiers/ repeaters/signal boosters are designed and optimized for low cost, high reliability, and ease of use. They are designed to enhance radio communication in buildings, basements, tunnels and other RF shielded environments. The 48960 is tuned for 800 Mhz SMR band and the 900 Mhz SMR band.

These units work by receiving and amplifying the base TX signals via a donor antenna directed at the desired base site. This RF path is called the downlink. The amplified base TX signal is re-radiated via antenna(s) or radiating cable into the Service Area. Subscriber mobile RF signals are received by the same service area radiating elements and amplified in the uplink RF path to be radiated back to the base via the donor antenna.

1.4 Technical Specifications of the EUT

Manufacturer:	Radio Frequency Systems		
Operating Frequency:	Uplink:	806-824MHz	
		896-902MHz	
	Downlink:	851-869MHz	
		935-941MHz	
Emission Designator:	GXW		
Rated Power:	Uplink:	0.08W	
	Downlink:	0.08W	
Measured Power:	Uplink:	0.099W (19.37dBm)	
	Downlink:	0.086W (19.95dBm)	
Rated Gain:	65dB		
Modulation:	iDEN		

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	Rohde & Schwarz	FSP	100101	Oct 15/04	Oct 15/05
Power Meter	HP	E4418B	FA001413	May 26/04	May 26/05
Power Sensor	HP	8487A	FA001741	June 9/04	June 9/05
Signal Generator	Rohde & Schwarz	SMIQ 06B	FA001878	May 18/04	May 18/05
Signal Generator	Rohde & Schwarz	SMIQ 03	FA001091	Aug 20/04	Aug 20/05
Receiver	Rohde & Schwarz	ESVS-30	FA001437	July 26/04	July 26/05
Biconical (1) Antenna	EMCO	3109	FA000805	April 22/05	April 22/06
Horn Antenna #1	EMCO	3115	FA000649	Dec. 22/04	Dec. 22/05
1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	June 18/04	June 18/05
2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	June 18/04	June 18/05
4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001497	June 18/04	June 18/05

Section 3 : Observations

3.1 Modifications Performed During Assessment

No modifications were performed during assessment.

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.

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 as originally submitted.

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 apparatus does not contain any frequency translating circuitry.
- (2) The apparatus does not operate in the 150-174 MHz and 421-512 MHz frequency bands

Appendix A : Test Results

Criteria: 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:

Sample Number:	3	Temperature:	27
Date:	May 9, 2005	Humidity:	30
Modification State:	0	Tester:	Jason Nixon
		Laboratory:	Wireless

Test Results:

Band	Rated Power (dBm)	Measured Power (dBm)
Uplink 806-824MHz	19	19.37
Uplink 896-902MHz	19	19.36
Downlink 851-869MHz	19	19.95
Downlink 935-941MHz	19	19.81

Criteria: 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:

Sample Number:	3	Temperature:	27
Date:	May 9, 2004	Humidity:	30
Modification State:	0	Tester:	Jason Nixon
		Laboratory:	Wireless

Test Results:

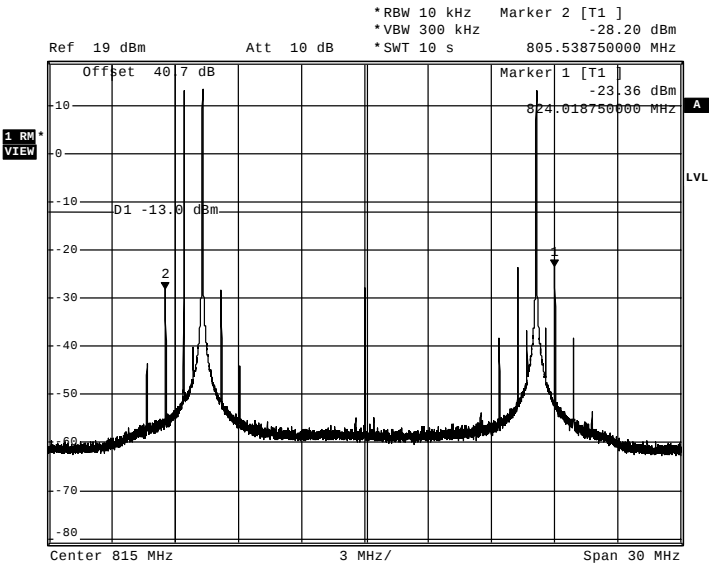
See Attached Plots.

Additional Observations:

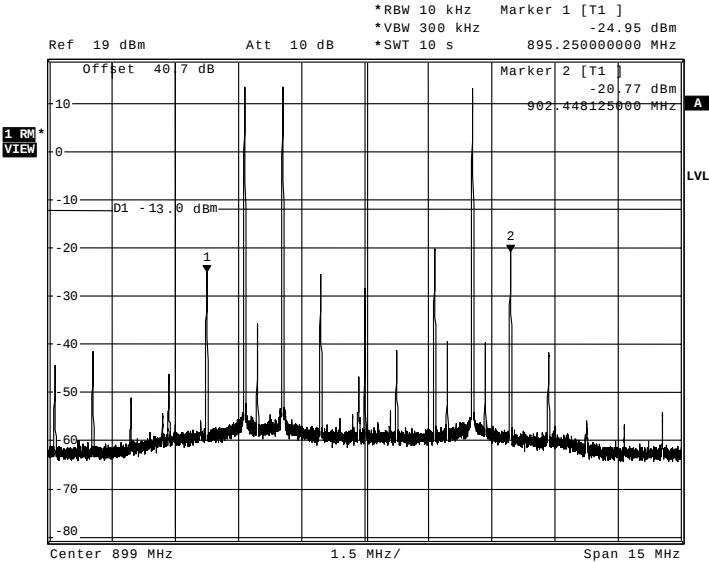
Measurements for conducted emissions outside the operating band were performed at the low, mid and high channels and only the worst case from each band has been included.

The spectrum was searched from 30MHz to 10GHz.

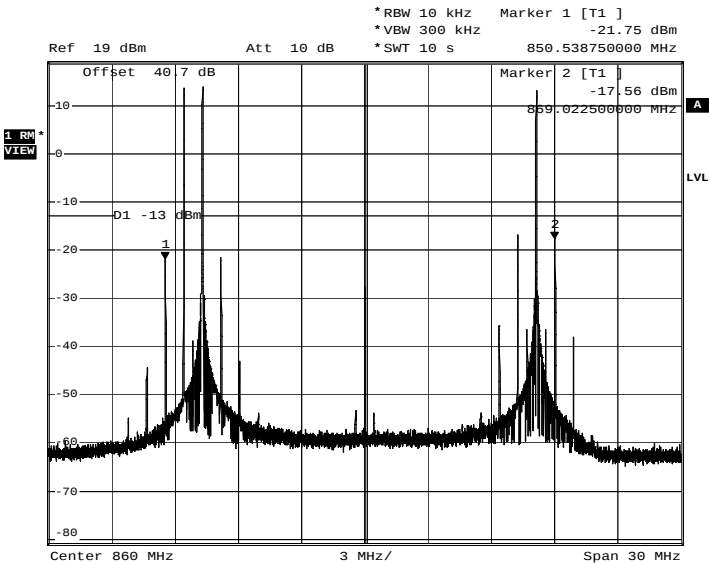
Uplink 3rd Order Intermodulation 806-824MHz Band



Uplink 3rd Order Intermodulation 896-902MHz Band



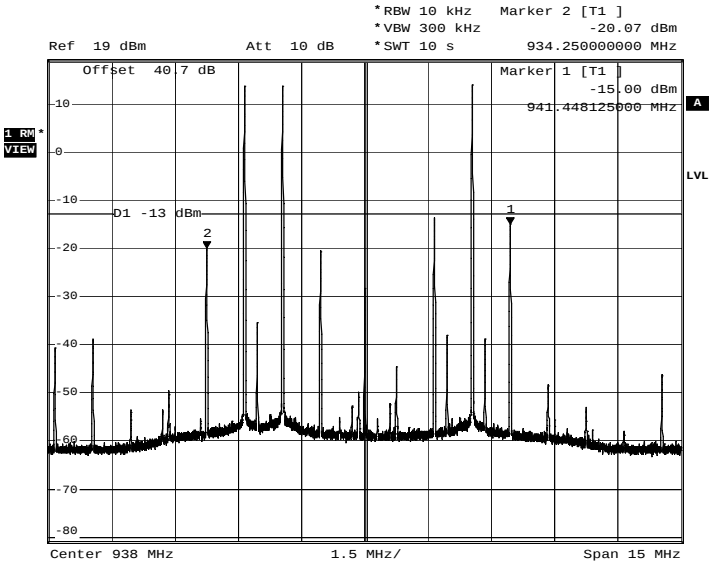
Downlink 3rd Order Intermodulation 851-869MHz Band



Downlink 851-869MHz Band

Date: 9.MAY.2005 15:24:22

Downlink 3rd Order Intermodulation 935-941MHz Band

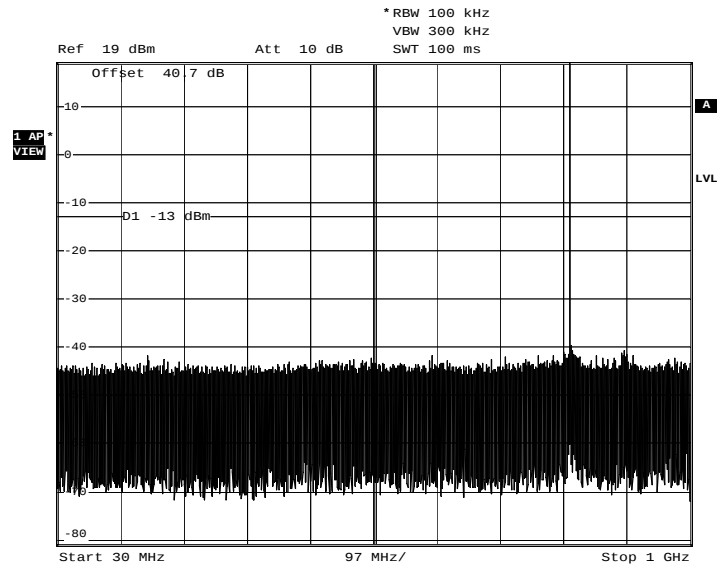


Downlink 935-941MHz Band

Date: 9.MAY.2005 15:16:18

Conducted Spurious Emissions

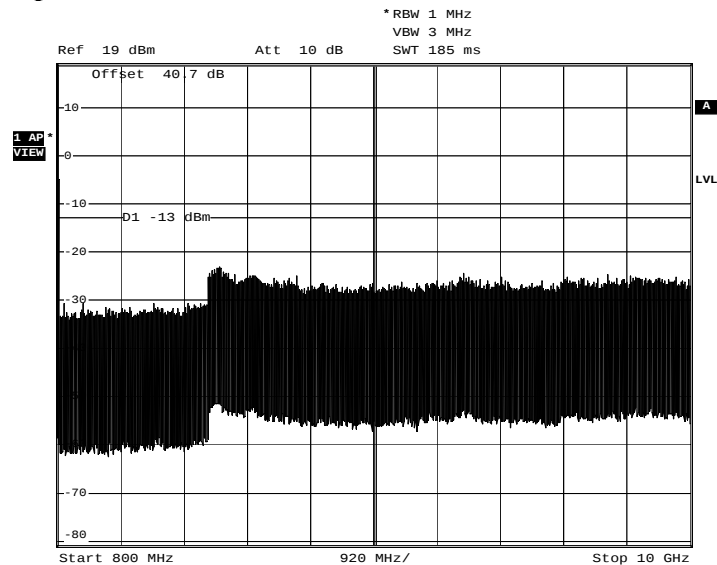
Uplink 806-824MHz Band Conducted Emissions – Low



Uplink 806-824MHz Band

Date: 10.MAY.2005 10:49:34

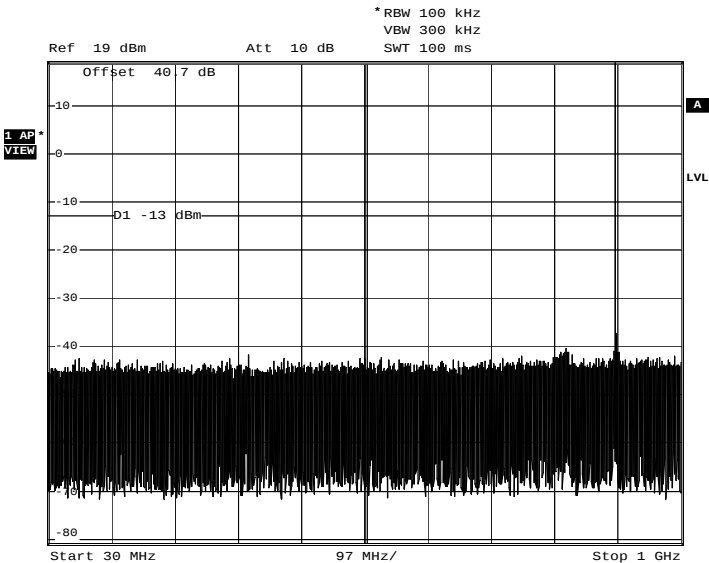
Uplink 806-824MHz Band Conducted Emissions - High



Uplink 806-824MHz Band

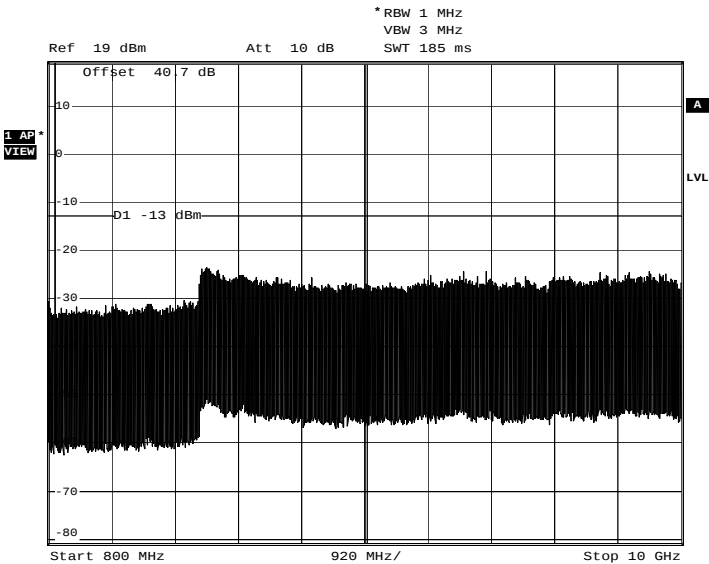
Date: 10.MAY.2005 10:40:54

Uplink 896-902MHz Band Conducted Emissions - Low



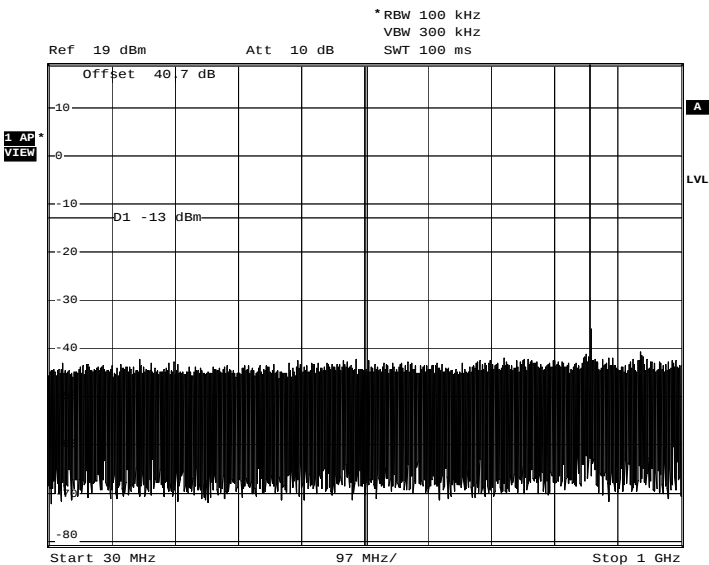
Uplink 896-902MHz Band
Date: 10.MAY.2005 10:45:21

Uplink 896-902MHz Band Conducted Emissions - High



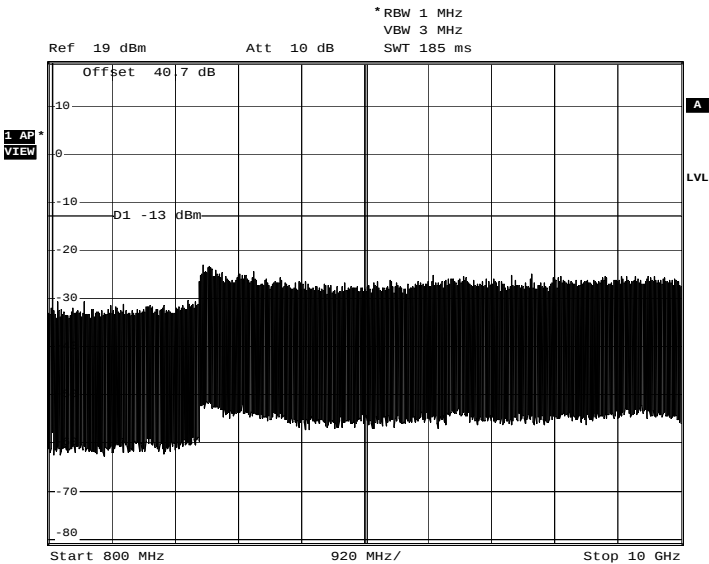
Uplink 896-902MHz Band
Date: 10.MAY.2005 10:43:04

Downlink 851-869MHz Band Conducted Emissions - Low



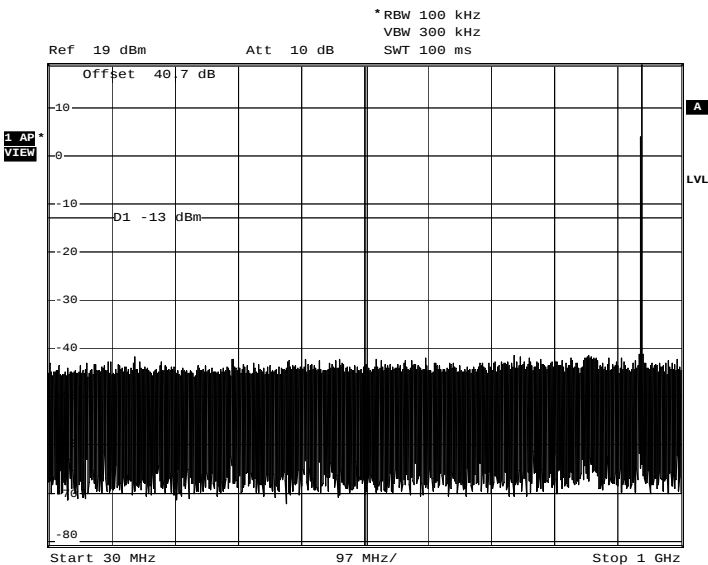
Downlink 851-869MHz Band
Date: 10.MAY.2005 10:19:59

Downlink 851-869MHz Band Conducted Emissions - High



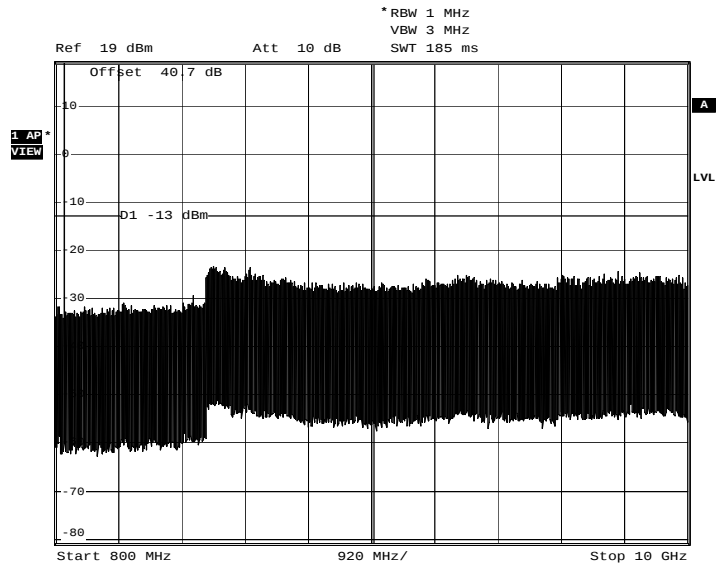
Downlink 851-869MHz Band
Date: 10.MAY.2005 10:31:00

Downlink 935-941MHz Band Conducted Emissions - Low



Downlink 935-941MHz Band
Date: 10.MAY.2005 10:21:49

Downlink 935-941MHz Band Conducted Emissions - High



Downlink 935-941MHz Band
Date: 10.MAY.2005 10:25:11

Criteria: 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:

Sample Number:	3	Temperature:	22
Date:	May 10, 2005	Humidity:	22
Modification State:	0	Tester:	Jason Nixon
		Laboratory:	OATS

Test Results:

See Attached Table for Results

Additional Observations:

No emissions were detected within 20dB below the limit.

The spectrum was searched from 30MHz to 10GHz using a low, mid and high channel.

Criteria: 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:

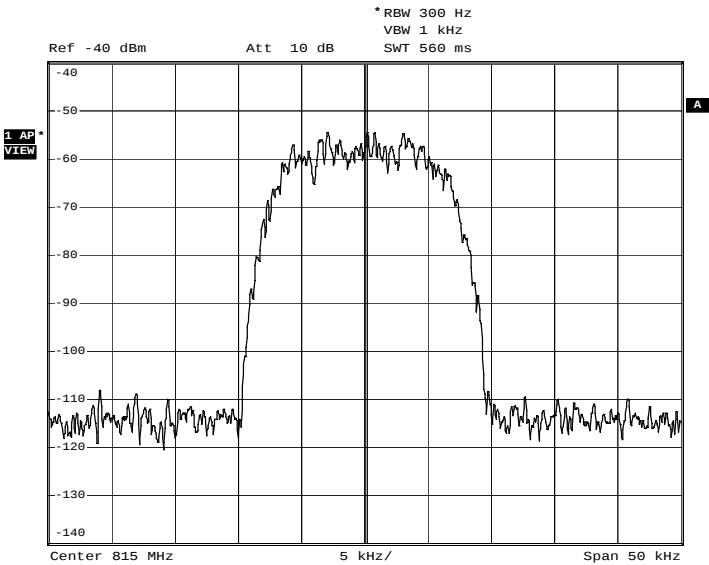
Sample Number:	3	Temperature:	22
Date:	May 10, 2005	Humidity:	37
Modification State:	0	Tester:	Jason Nixon
		Laboratory:	Wireless

Test Results:

See Attached Plots.

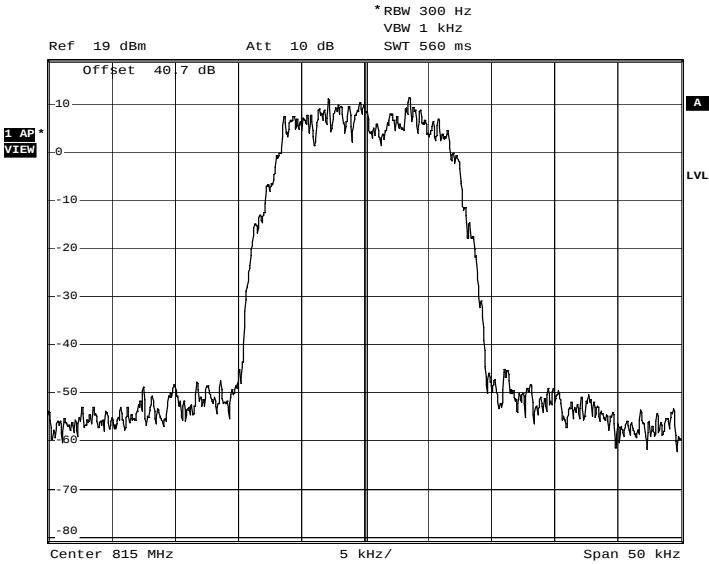
Additional Observations:

Uplink 806-824MHz Band Input



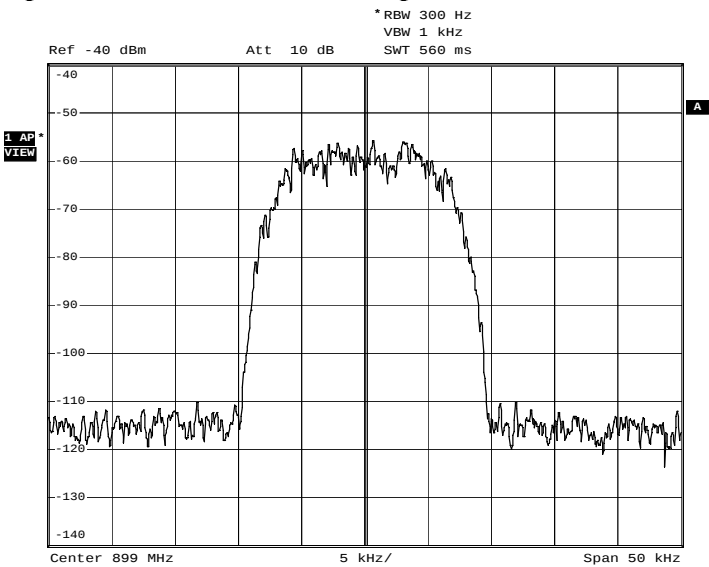
Uplink 806-824MHz Band
Date: 10.MAY.2005 11:05:03

Uplink 806-824MHz Band Output



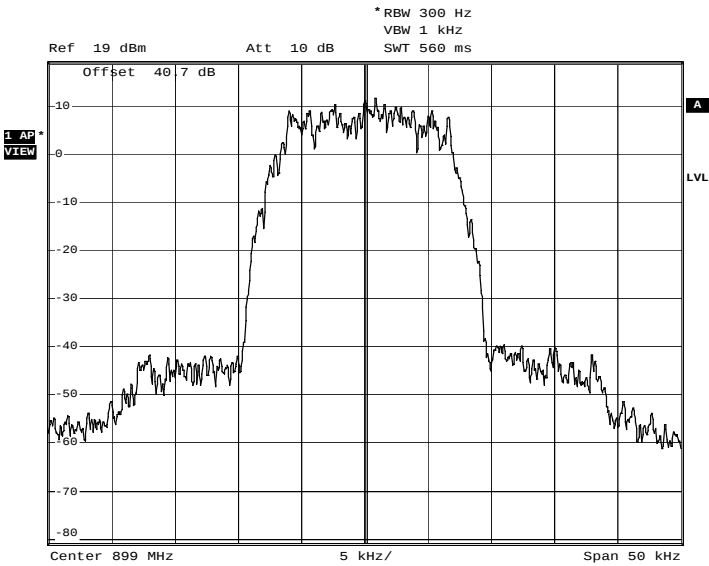
Uplink 806-824MHz Band
Date: 10.MAY.2005 10:56:18

Uplink 896-902MHz Band Input



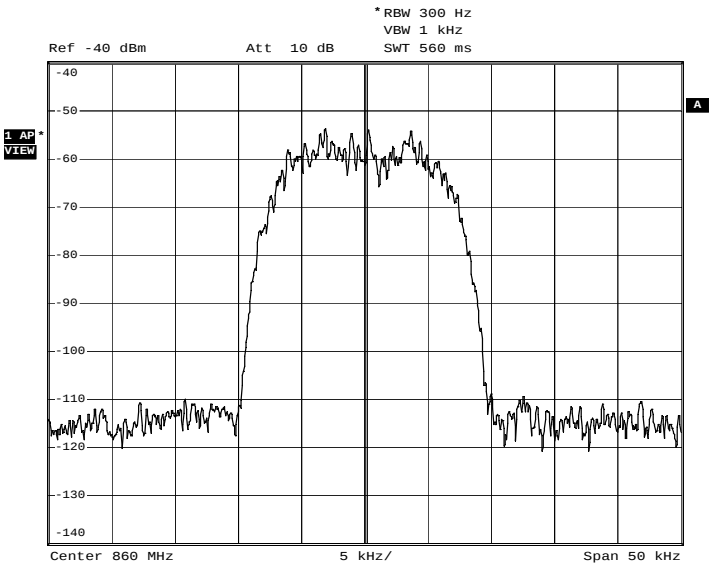
Uplink 896-902MHz Band
Date: 10.MAY.2005 11:04:24

Uplink 896-902MHz Band Output



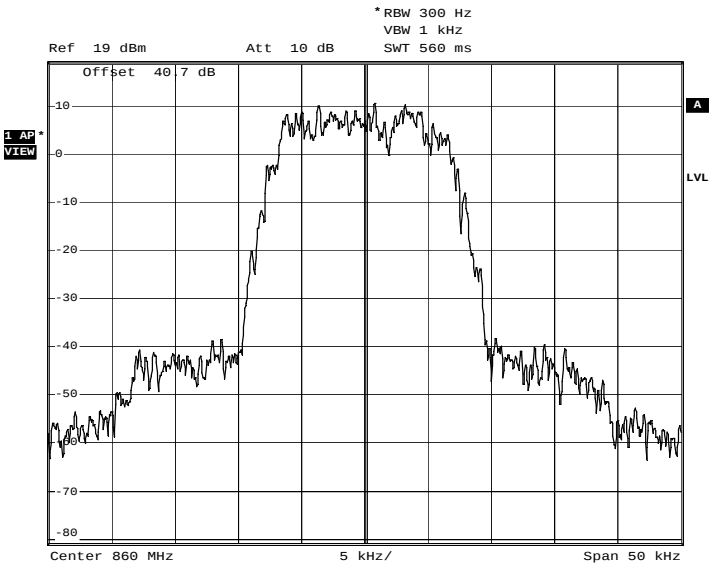
Uplink 896-902MHz Band
Date: 10.MAY.2005 10:57:13

Downlink 851-869MHz Band Input



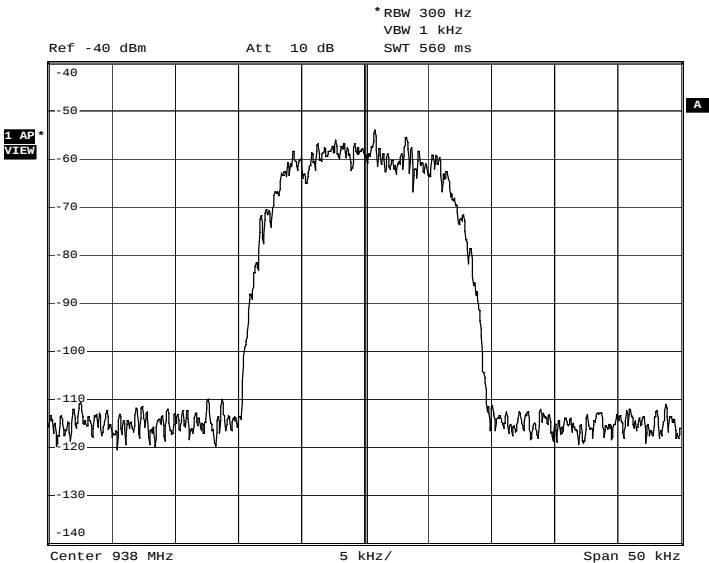
Downlink 851-869MHz Band
Date: 10.MAY.2005 11:02:23

Downlink 851-869MHz Band Output



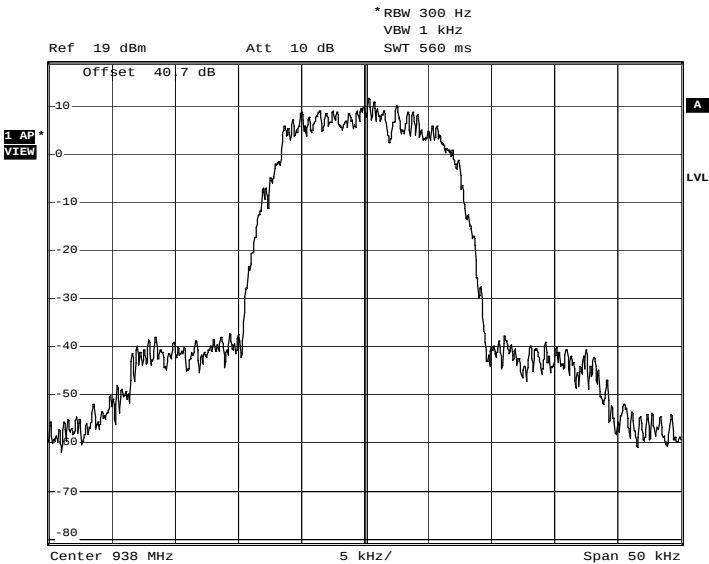
Downlink 851-869MHz Band
Date: 10.MAY.2005 11:00:07

Downlink 935-941MHz Band Input



Downlink 935-941MHz Band
Date: 10.MAY.2005 11:03:16

Downlink 935-941MHz Band Output



Downlink 935-941MHz Band
Date: 10.MAY.2005 10:59:16

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

Plots showing the filter frequency response.
--

Test Conditions:

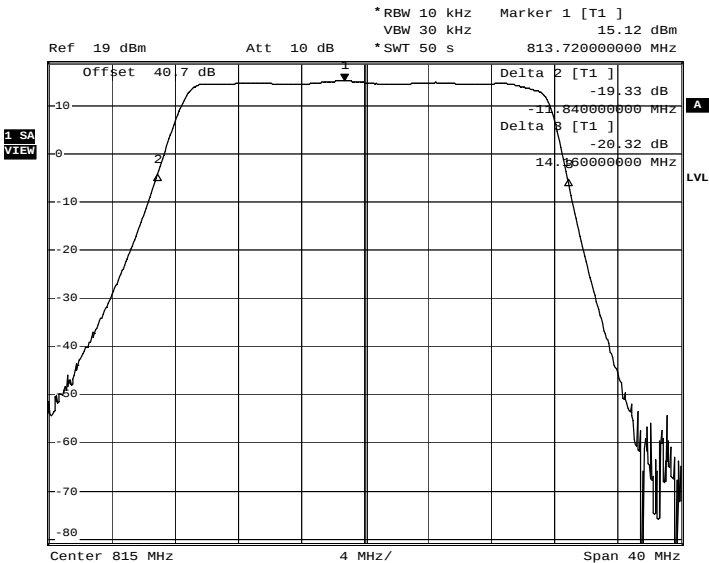
Sample Number:	3	Temperature:	22
Date:	May 10, 2005	Humidity:	37
Modification State:	0	Tester:	Jason Nixon
		Laboratory:	Wireless

Test Results:

See Attached Plots.

Additional Observations:

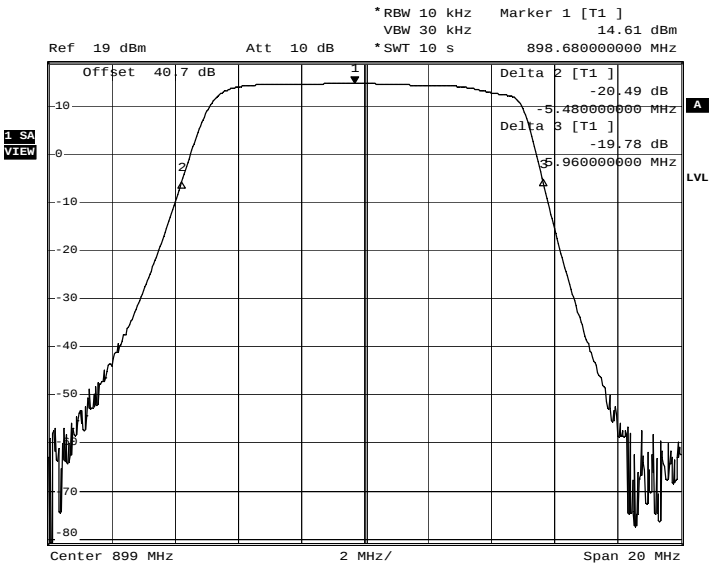
Uplink 806-824MHz Band 20dB Bandwidth



Uplink 806-824MHz Band

Date: 10.MAY.2005 09:54:44

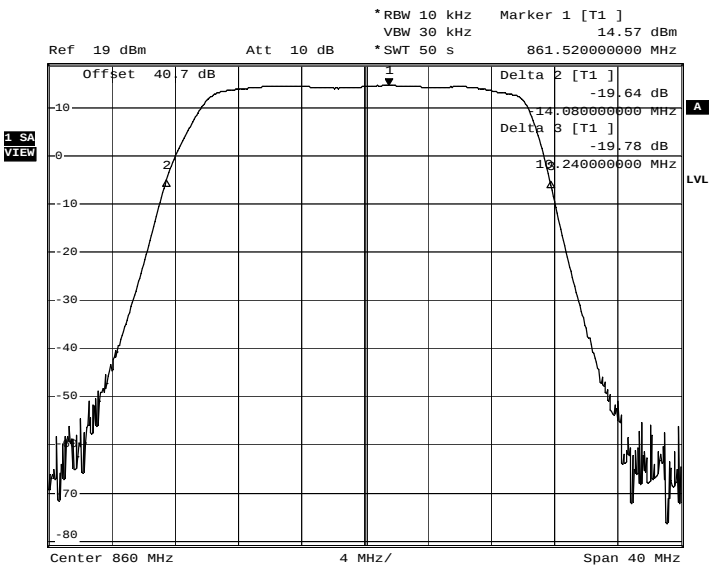
Uplink 896-902MHz Band 20dB Bandwidth



Uplink 896-902MHz Band

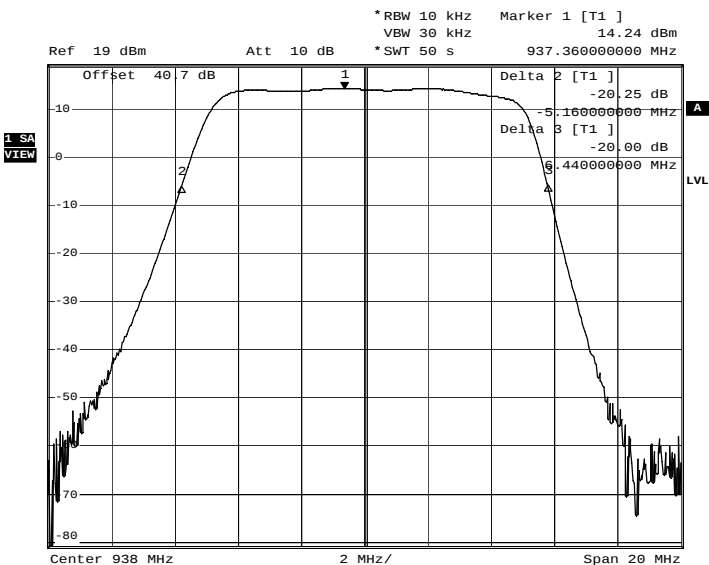
Date: 10.MAY.2005 09:12:29

Downlink 851-869MHz Band 20dB Bandwidth



Downlink 851-869MHz Band
Date: 10.MAY.2005 10:02:25

Downlink 935-941MHz Band 20dB Bandwidth



Downlink 935-941MHz Band
Date: 10.MAY.2005 10:07:03

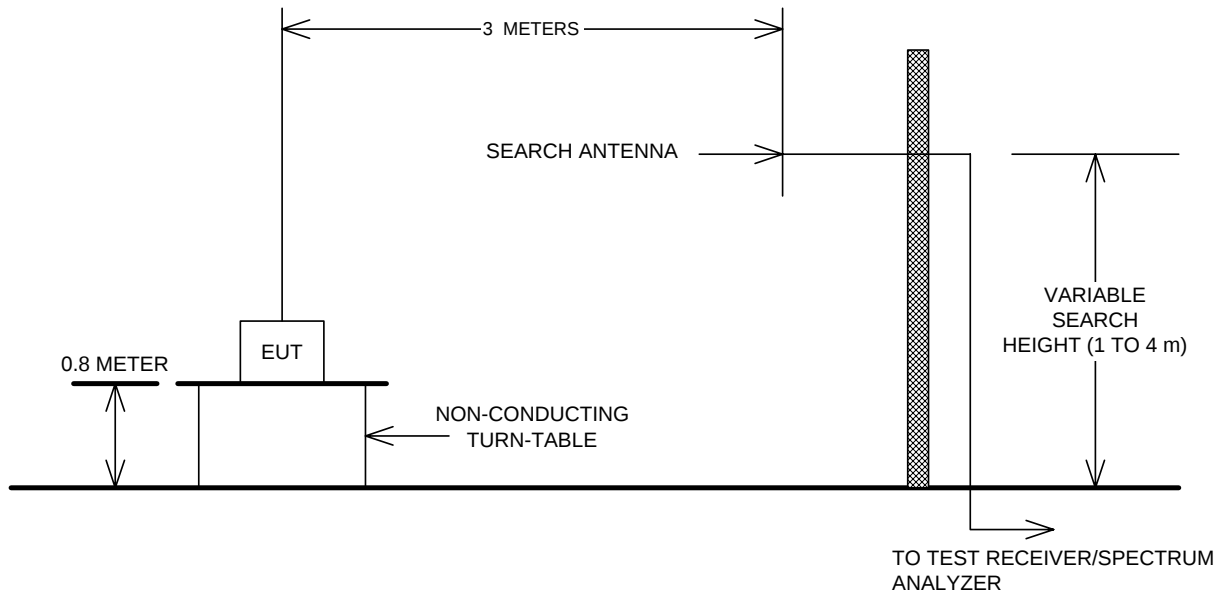
Appendix B : Setup Photographs

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

