Standards Council of Canada
Accredited Laboratory
Scope of Accreditation 75

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 75

TM

Test Report:	4W34277
Applicant:	Codan Limited 81 Graves Street Newton SA 5074, Australia
Equipment Under Test: (EUT)	2110 SSB Transceiver
FCC ID:	DYY2110
In Accordance With:	**FCC Part 90**
Tested By:	Nemko Canada Inc. 303 River Road, R.R. 5 Ottawa, Ontario K1V 1H2
Authorized By:	Sim Jagpal, Resource Manager
Date:	4 February 2005
Total Number of Pages:	32

Table of Contents

Section 1. Summary Of Test Results

General

All measurements are traceable to national standards.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90.

☒	New Submission	☒	Production Unit
☐	Class II Permissive Change	☐	Pre-Production Unit

T	N	B	Equipment Code

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".

TESTED BY: _____ DATE: 4 February 2005
Jason Nixon, Telecom Specialist

Summary Of Test Data

Name Of Test	Para. No.	Result
RF Power Output	2.1046	Complies
Audio Frequency Response	2.1047	Complies
Audio Low-Pass Filter Response	2.1047	N/A (1)
Modulation Limiting	2.1047	Complies
Occupied Bandwidth	2.1049	Complies
Spurious Emissions at Antenna Terminals	2.1051	Complies
Field Strength of Spurious Emissions	2.1053	Complies
Frequency Stability	2.1055	Complies
Transient Frequency Behavior	90.214	N/A (2)

Footnotes For N/A's:

(1) The apparatus is not required to have a low-pass filter.

(2) The apparatus does not operate in the required frequency range.

Test Conditions:

Indoor	Temperature:	24°C
	Humidity:	12%
Outdoor	Temperature:	12°C
	Humidity:	63%

Section 2. General Equipment Specification

Manufacturer:	Codan Limited
Model No.:	2110 SSB Transceiver
Serial No.:	0502993A0002
Date Received In Laboratory:	December 2, 2004
Nemko Identification No.:	1
Power Supply:	12 VDC (Battery Pack)
Frequency Range:	**Tx:** 1.6MHz to 30MHz **Rx:** 250kHz to 30MHz
Number of Channels:	400
Emission Designator:	J3E, J2B, H3E
Output Impedance:	50ohms
Power Output (Manufacturer's Rating):	25W PEP, 44dBm
Channel Spacing:	2.8 or 3kHz
Type of Modulation:	SSB suppressed carrier SSB suppressed carrier with Morse code SSB Full carrier
Operator Selection of Operating Frequency:	Performed using front panel.

Section 3. RF Power Output

Para. No.: 2.1046

Test Performed By: Jason Nixon	**Date of Test: January 17, 2005**

Minimum Standard: 90.205(a), 1000W Max PEP

Test Results: Complies.
The RF output power is within 1 dB of the manufacturer's rating of RF power output. The maximum RF power output is 28.2 Watts PEP. This is 15.5dB below the specification limit. The power was determined by direct measurement using a spectrum analyzer set to 100 kHz RBW/VBW with positive peak max hold detector function.

Measurement Data:
Measured at antenna terminal. PEP using two tones.
Rated RF Output Power: 25 Watts PEP, 44dBm
Measured using 400 Hz and 1800 Hz tones adjusted for rated RF output power.

TX 1.65 MHz		TX 15.6 MHz		TX 29.9 MHz	
44.5dBm	28.2 Watts	44.0dBm	25.0 Watts	44.2dBm	26.3 Watts

Section 4. Audio Frequency Response

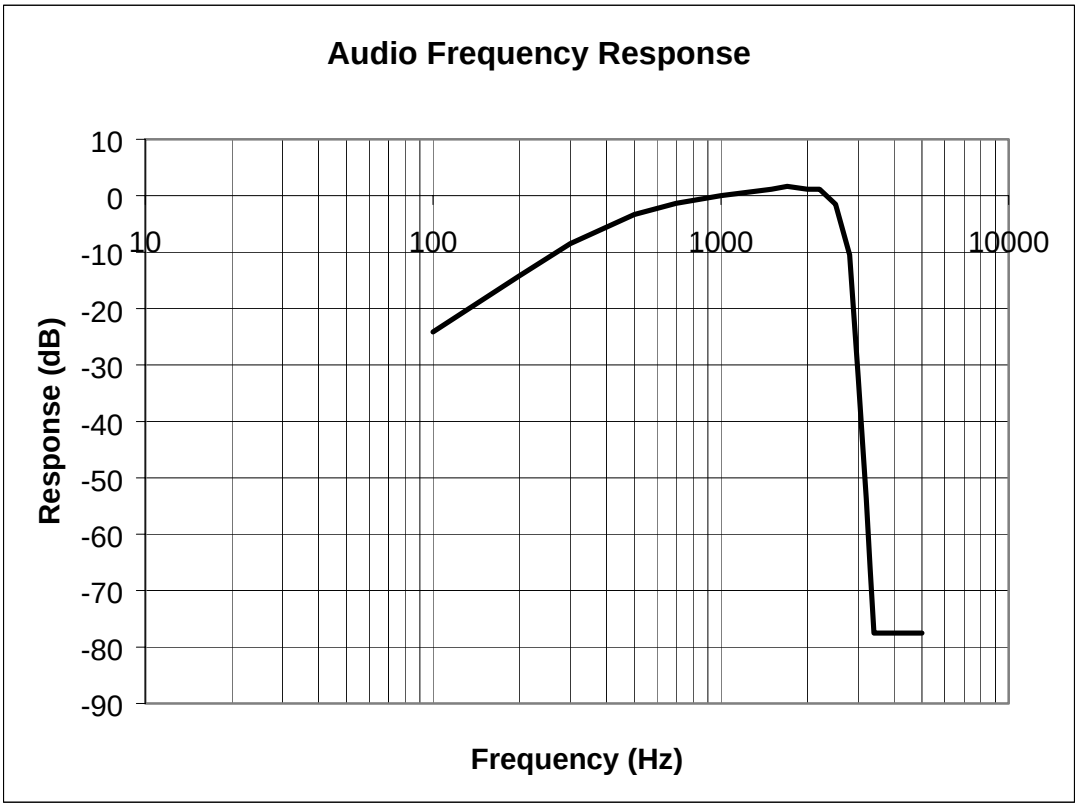
Para. No.: 2.1047

Test Performed By: Jason Nixon	**Date of Test: January 17, 2005**

Minimum Standard: N/A

Test Results: See attached graph.

Measurement Data:



Section 5. Modulation Limiting

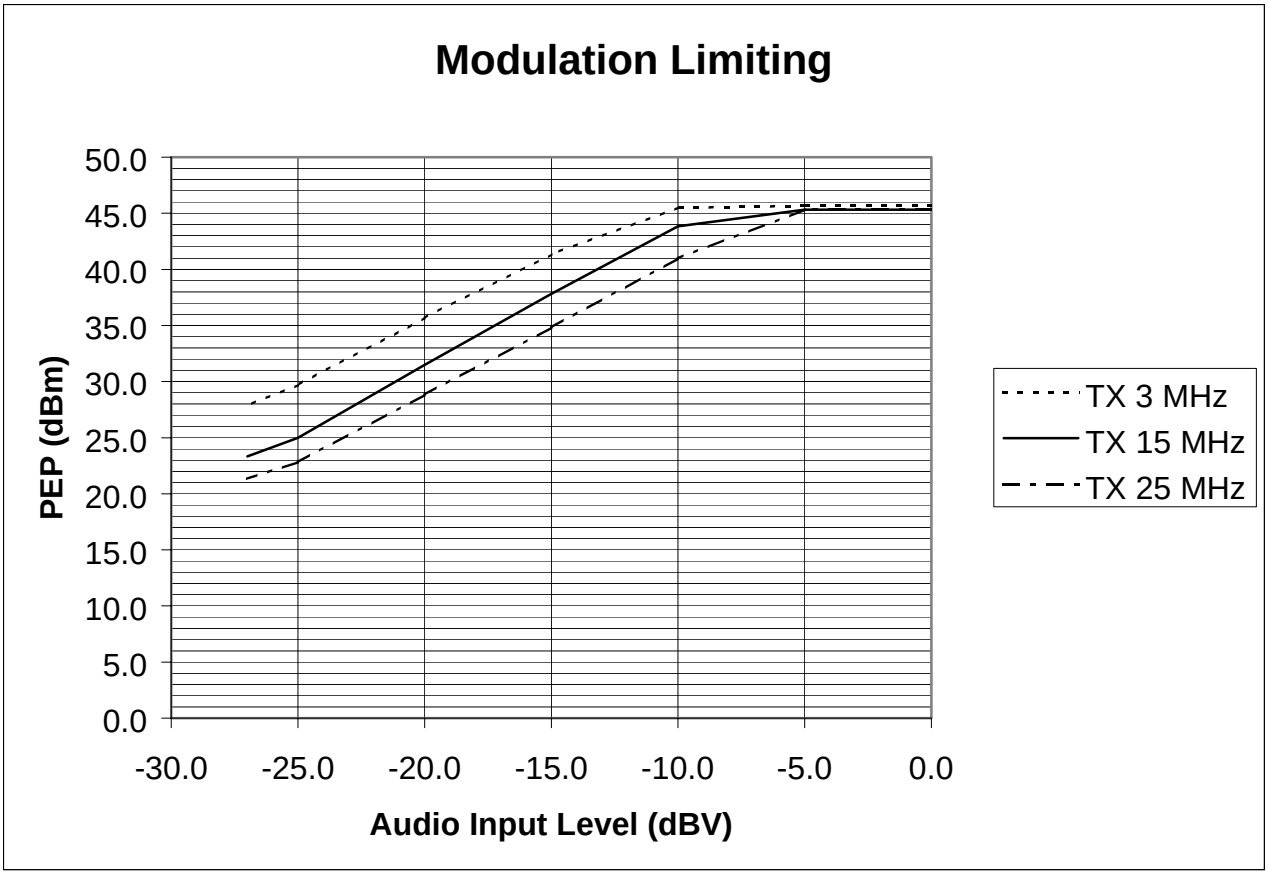
Para. No.: 2.1047

Test Performed By: Jason Nixon	**Date of Test: January 18, 2005**

Minimum Standard: N/A

Test Results: See attached graph.

Measurement Data: See attached graph.



Section 6. Occupied Bandwidth

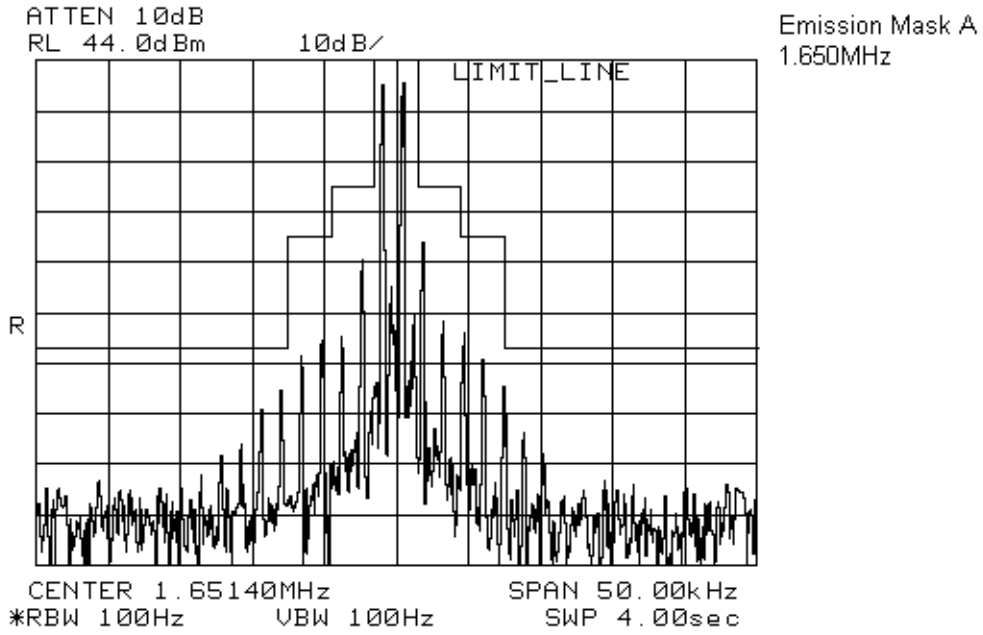
Para. No.: 2.1049

Test Performed By: Jason Nixon	**Date of Test: January 17, 2005**

Minimum Standard: 90.210(a)

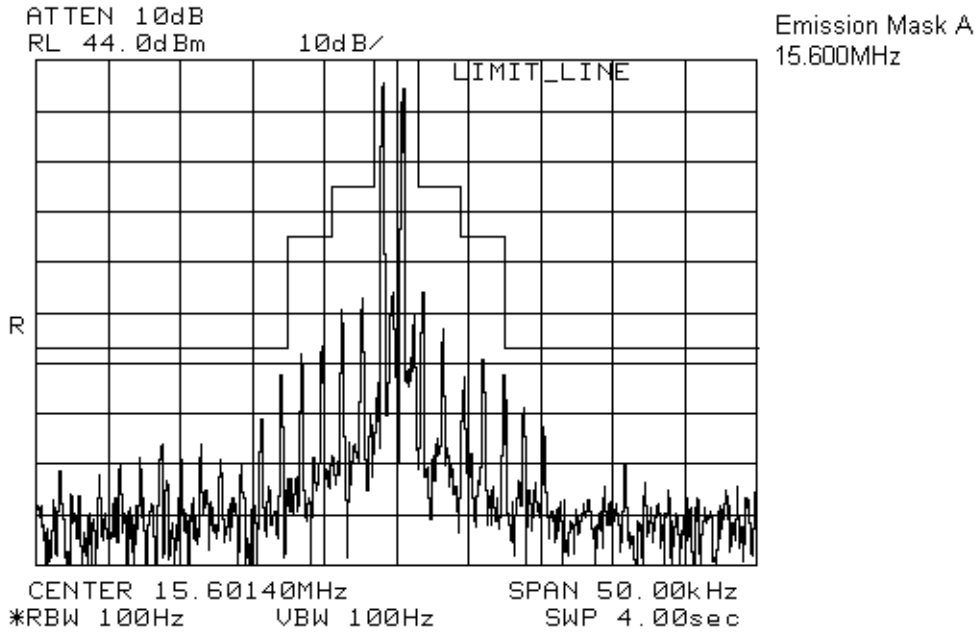
Test Results: Complies

Test Data: See attached graphs.



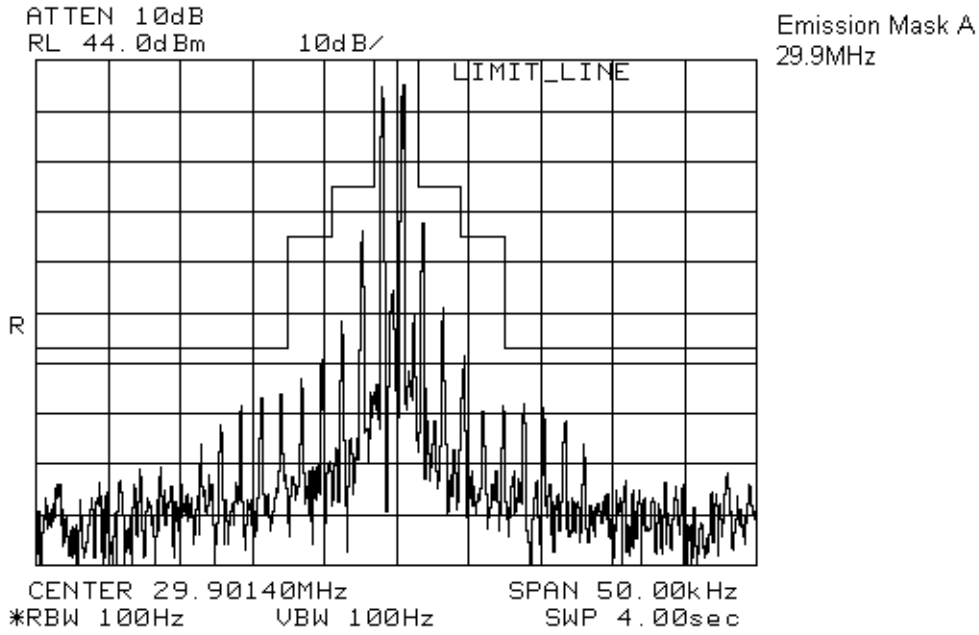
Occupied Bandwidth

Emission Mask A,
Two Tone Modulation 400 Hz, 1800 Hz
Input levels set to 10dB above level required for Max PEP
25 Watts PEP
Authorized Bandwidth 3 kHz
$Fc = 1.65 MHz$
$AssignedFrequency = Fc + 1400 Hz$



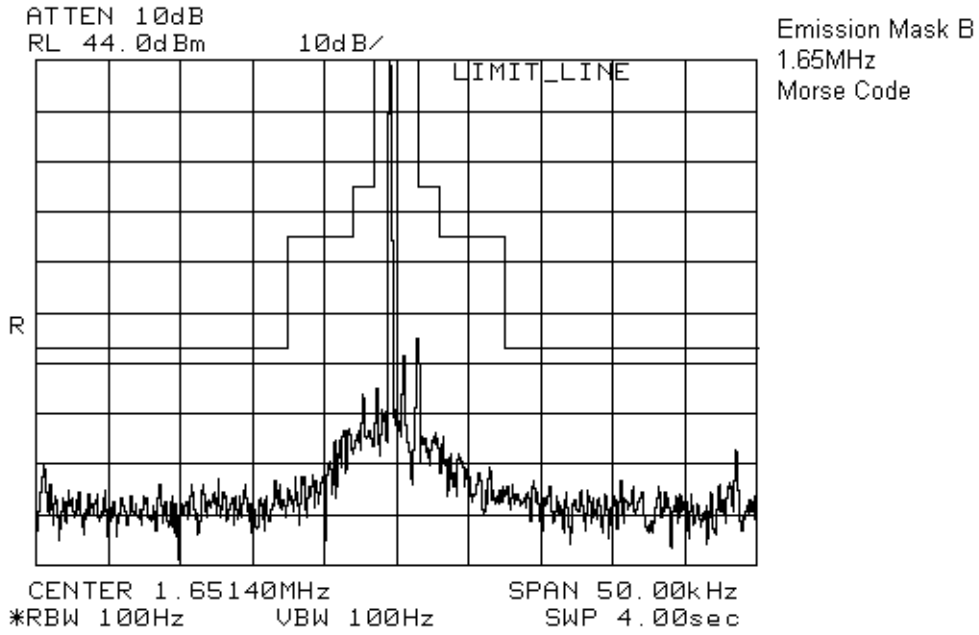
Occupied Bandwidth

Emission Mask A,
Two Tone Modulation 400 Hz, 1800 Hz
Input levels set to 10dB above level required for Max PEP
25 Watts PEP
Authorized Bandwidth 3 kHz
$Fc = 15.6MHz$
$AssignedFrequency = Fc + 1400Hz$



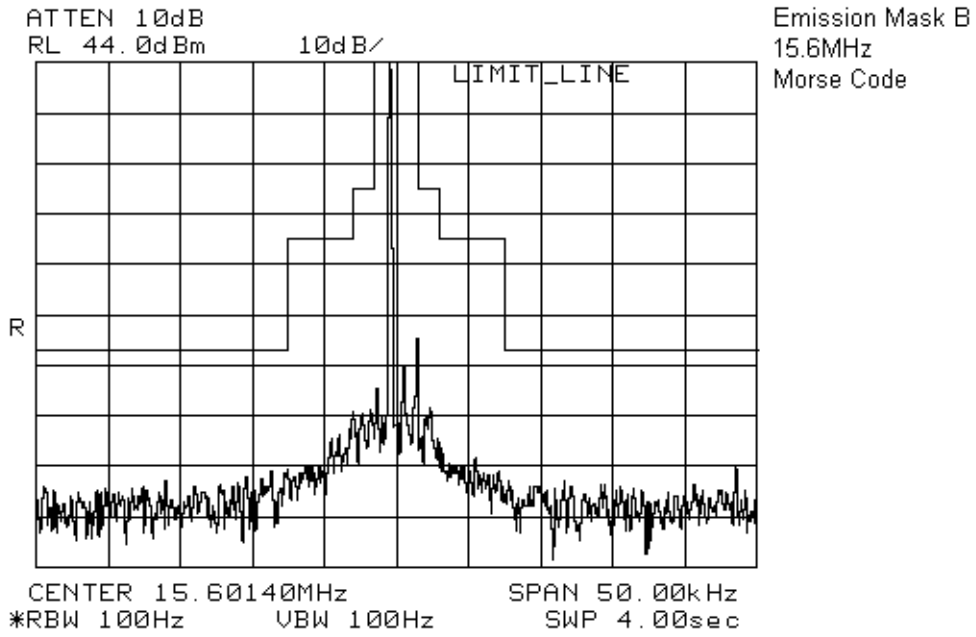
Occupied Bandwidth

Emission Mask A,
Two Tone Modulation 400 Hz, 1800 Hz
Input levels set to 10dB above level required for Max PEP
25 Watts PEP
Authorized Bandwidth 3 kHz
$Fc = 29.9MHz$
$AssignedFrequency = Fc + 1400Hz$



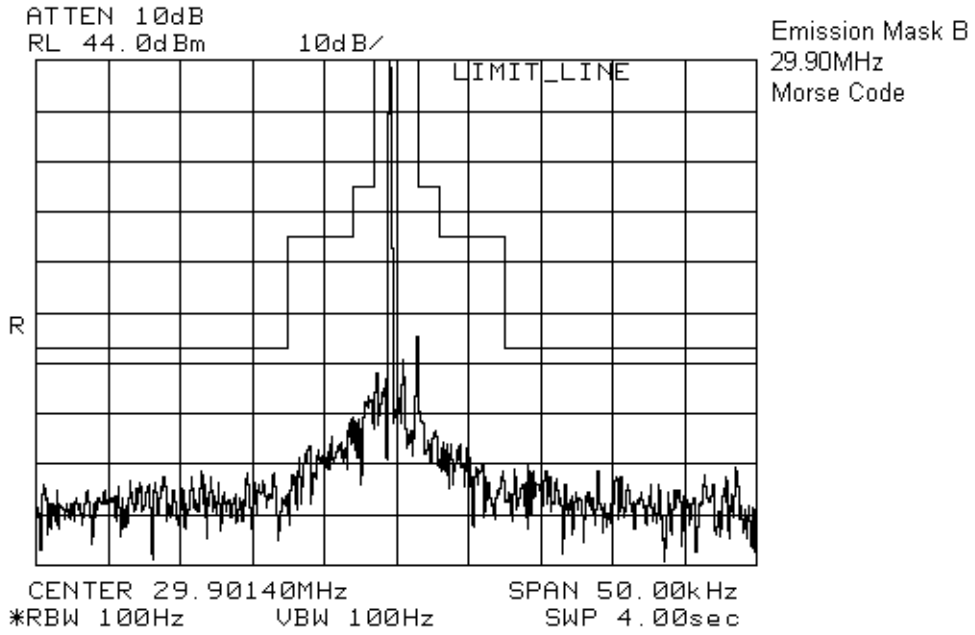
Occupied Bandwidth

Emission Mask B,
Morse Code
Authorized Bandwidth 3 kHz
$Fc = 1.65 MHz$
$AssignedFrequency = Fc + 1400 Hz$



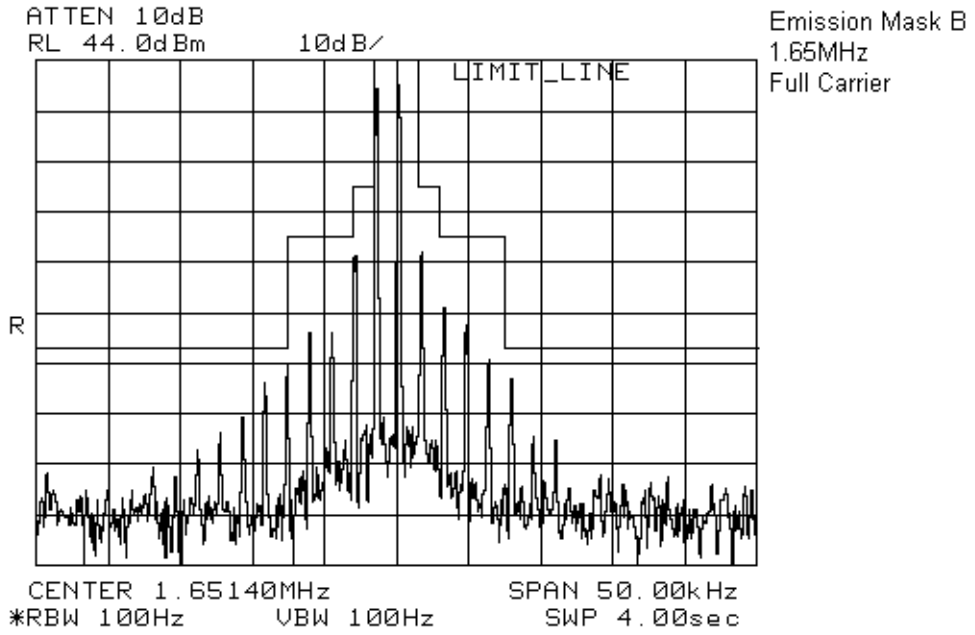
Occupied Bandwidth

Emission Mask B,
Morse Code
Authorized Bandwidth 3 kHz
$Fc = 15.6 MHz$
$AssignedFrequency = Fc + 1400 Hz$



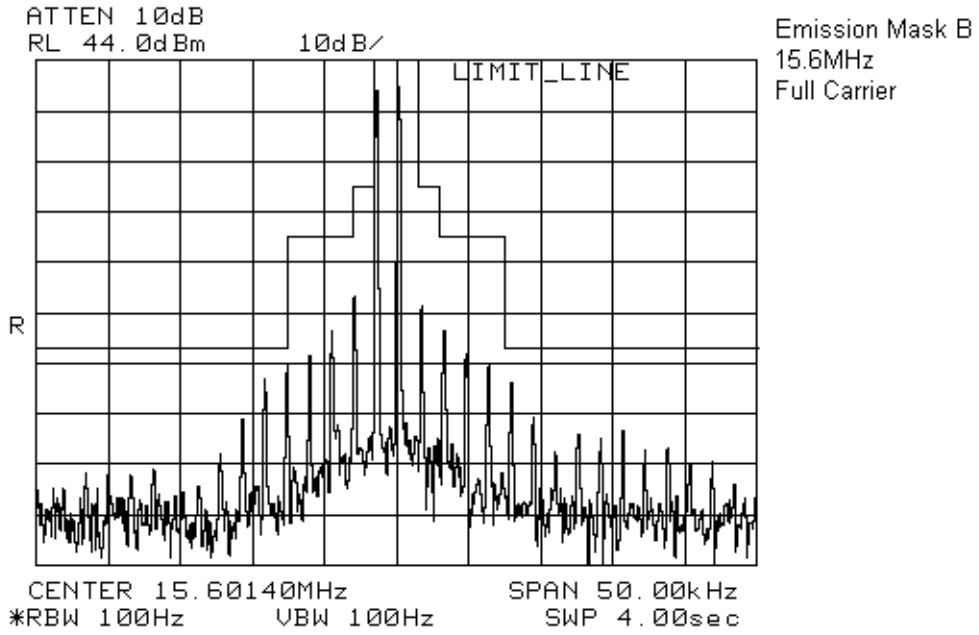
Occupied Bandwidth

Emission Mask B,
Morse Code
Authorized Bandwidth 3 kHz
$Fc = 29.9MHz$
$AssignedFrequency = Fc + 1400Hz$



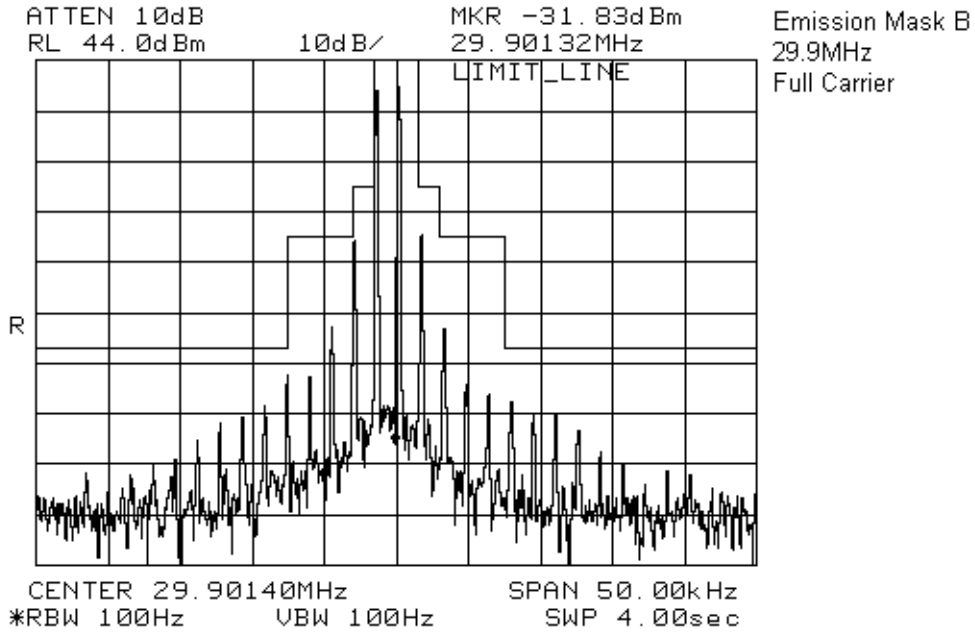
Occupied Bandwidth

Emission Mask B,
Single Tone Modulation 1500 Hz
Input level set to 10dB above level required for Max PEP
25 Watts PEP
Authorized Bandwidth 3 kHz
$Fc = 1.65 MHz$
$AssignedFrequency = Fc + 1400 Hz$



Occupied Bandwidth

Emission Mask B,
Single Tone Modulation 1500 Hz
Input level set to 10dB above level required for Max PEP
25 Watts PEP
Authorized Bandwidth 3 kHz
$Fc = 15.6 MHz$
$AssignedFrequency = Fc + 1400 Hz$



Occupied Bandwidth

Emission Mask B,
Single Tone Modulation 1500 Hz
Input level set to 10dB above level required for Max PEP
25 Watts PEP
Authorized Bandwidth 3 kHz
$Fc = 29.9MHz$
$AssignedFrequency = Fc + 1400Hz$

Section 7. Spurious Emissions at Antenna Terminals

Para. No.: 2.1051

Test Performed By: Jason Nixon	**Date of Test: January 17, 2005**

Minimum Standard: 90.210(a)(3), -13dBm
90.210(a), Carrier Suppression, N < -40 dB

Test Results: Complies

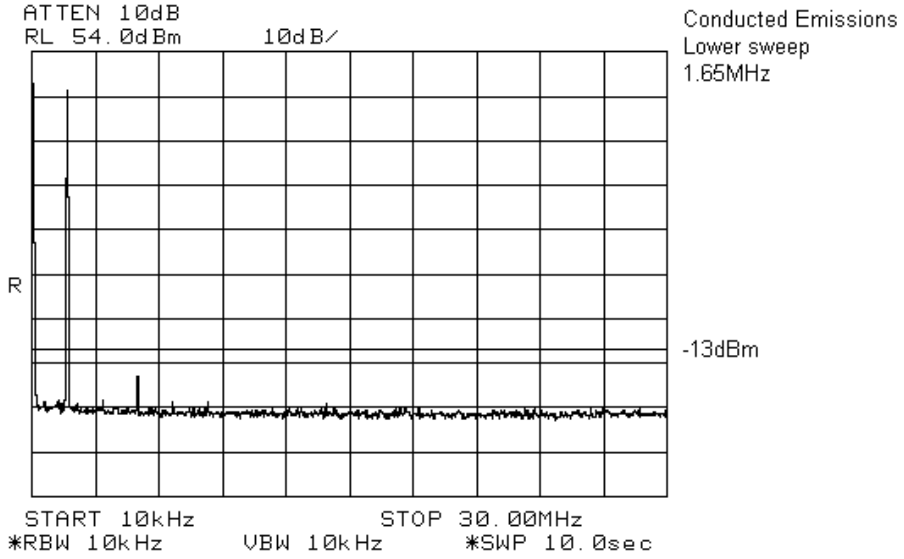
The strongest emission is –18dBm at 14.95MHz. This is 5dB below the specification limit.

The level N (dB) of the carrier with respect to peak envelope power is –62.7 dB. This is 22.7 dB below the specification limit.

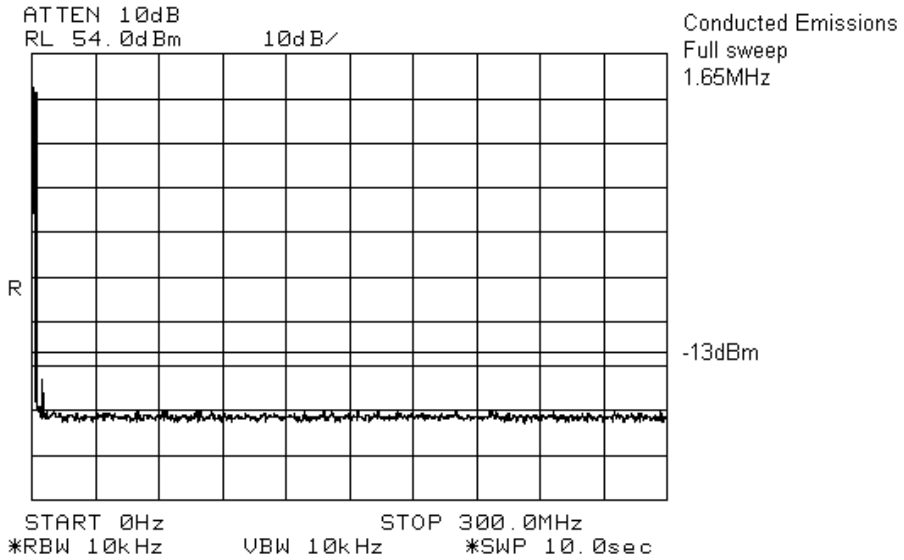
Test Data: See attached graphs and tabulated data.

All emissions were measured using the following input criteria:
Two Tone Modulation 400 Hz, 1800 Hz
Input level set to 10dB above the level required for Max PEP
25 Watts PEP

Conducted Emissions Low Band

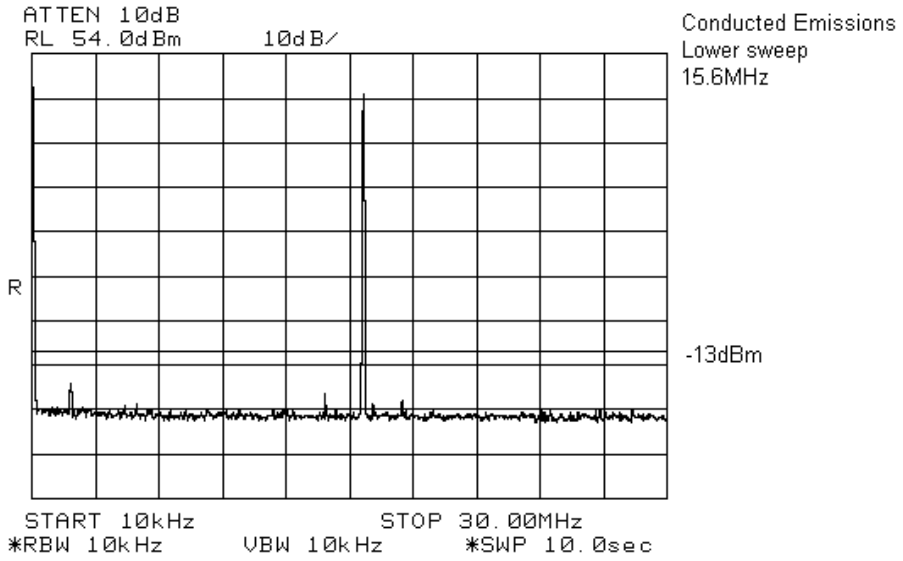


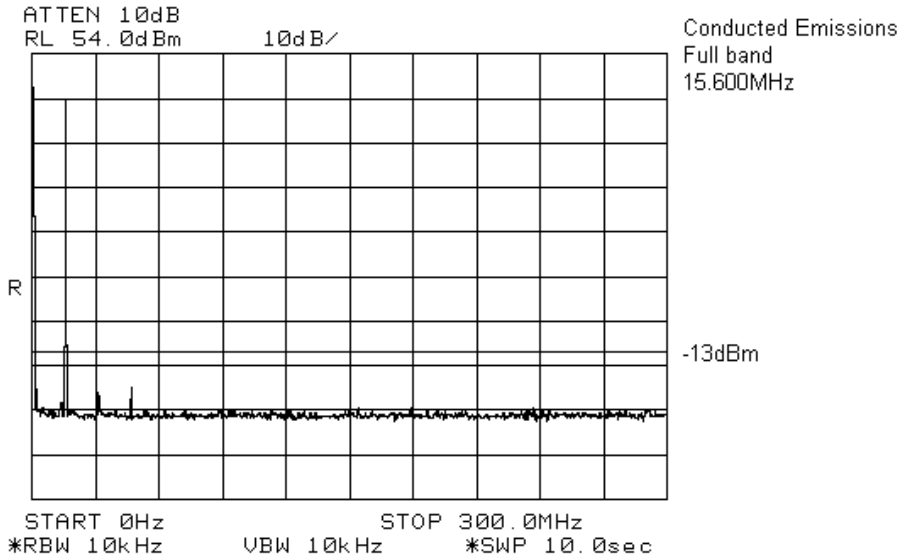
Conducted Emissions
Lower sweep
1.65MHz



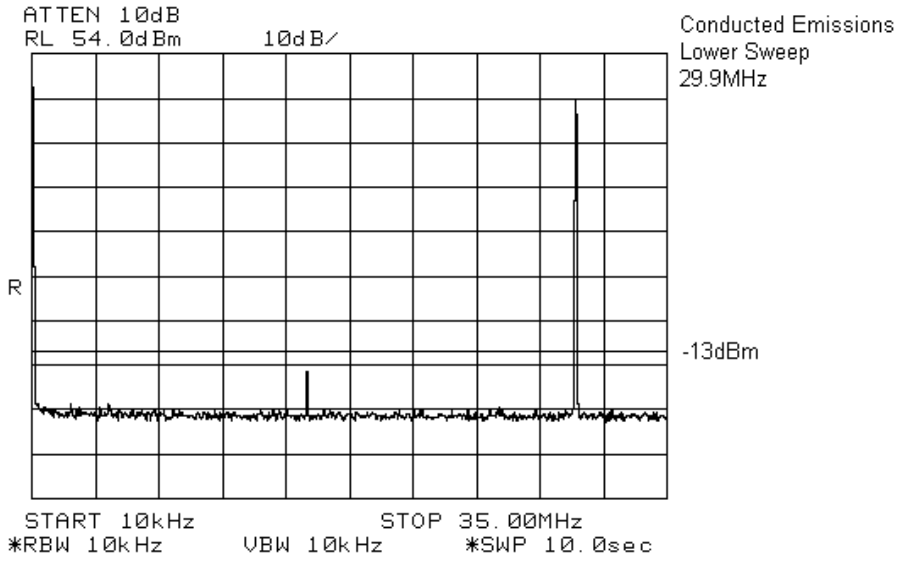
Conducted Emissions
Full sweep
1.65MHz

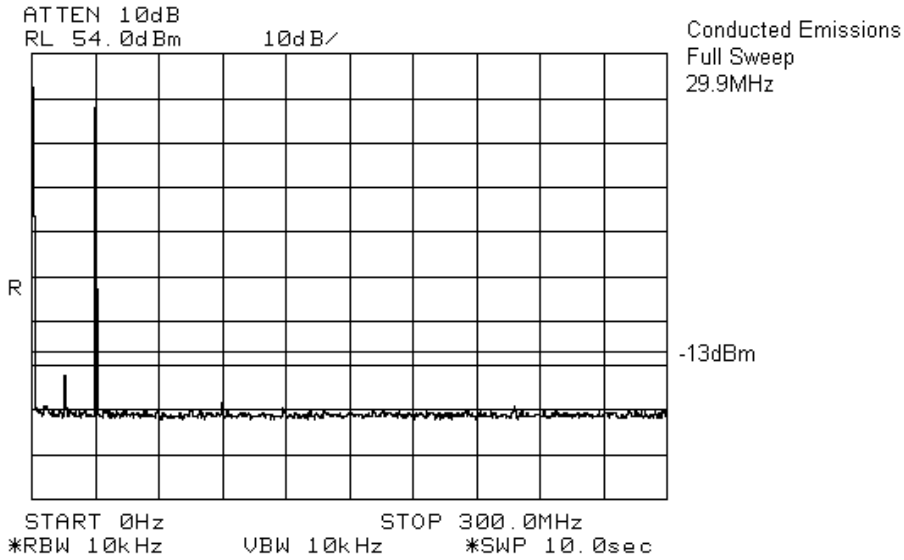
Conducted Emissions Mid Band



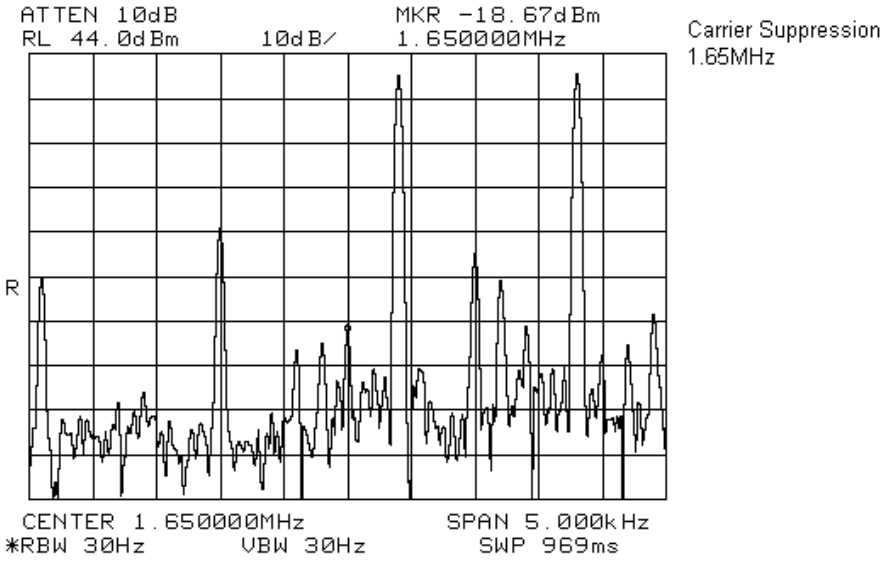


Conducted Emissions High Band



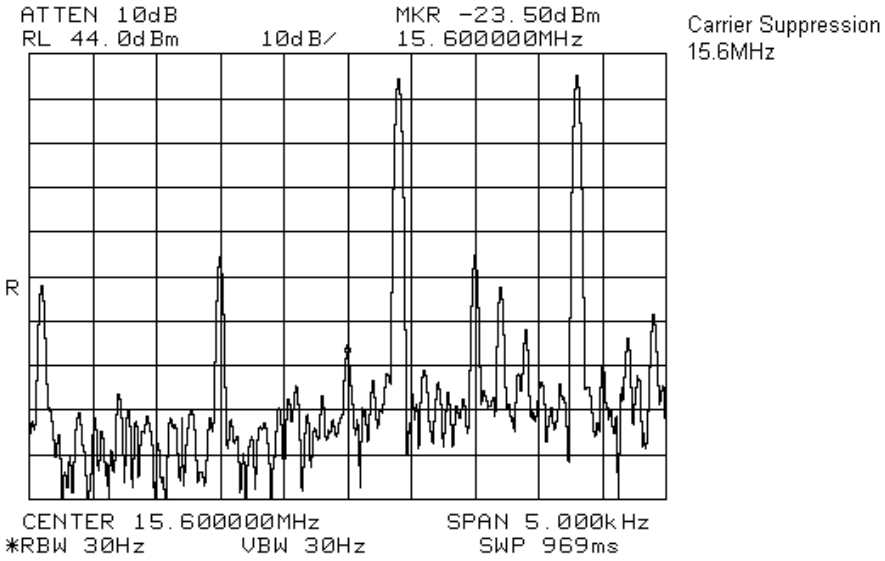


Carrier Suppression Low band



Carrier Suppression
Limit N < -40 dB
Two Tone Modulation 400 Hz, 1800 Hz
TX 1.65 MHz, 25 Watts PEP
$N = -18.7 - 44 = -62.7dB$

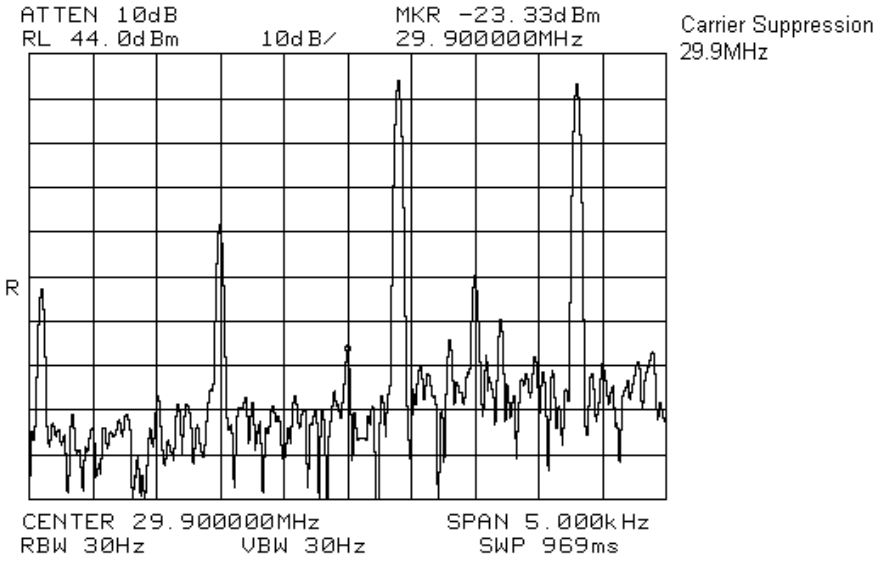
Carrier Suppression Mid band



Carrier Suppression

Limit N < -40 dB
Two Tone Modulation 400 Hz, 1800 Hz
TX 15.6 MHz, 25 Watts PEP
$N = -23.5 - 44 = -67.5dB$

Carrier Suppression High band



Carrier Suppression

Limit N < -40 dB
Two Tone Modulation 400 Hz, 1800 Hz
TX 29.9 MHz, 25 Watts PEP
$N = -23.3 - 44 = -67.3dB$

Section 8. Field Strength of Spurious Emissions

Para. No.: 2.1053

Test Performed By: Jason Nixon	**Date of Test: January 17, 2005**

Minimum Standard: 90.210(a)(3), -13dBm

Test Results: Complies.
The strongest emission is –32.9dBm ERP at 46.8 MHz. This is 19.9 dB below the specification limit.

Radiated Emission Test Setup
Two Tone Modulation 400 Hz, 1800 Hz
Input levels set to 10 dB above the required level for Max PEP
TX 15.6 MHz, 25 Watts PEP

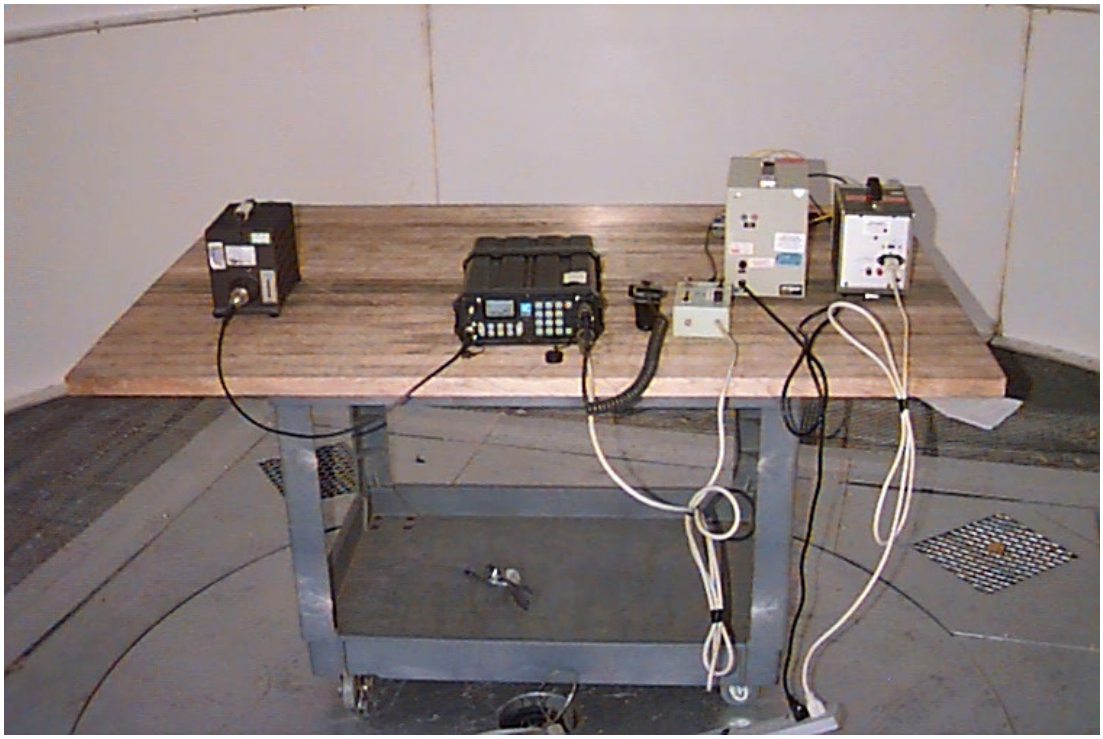
Test Data:

Frequency (MHz)	Pol*	Received Signal (dBuV)	Conversion Factor (dB) **	Emission Level ERP (dBm)	ERP Limit (dBm)	Margin (dB)
46.8000	V	45.2	-88.4	-43.2	-13.0	30.2
46.8000	H	49.7	-82.6	-32.9	-13.0	19.9

* V Denotes Vertical Polarization
*H Denotes Horizontal Polarization
** Includes cable losses
30MHz to 300MHz
Measured: 3 m Open Area Test Site
Biconical Antenna
9kHz to 30MHz
Measured: 3 m indoor semi-anechoic
Active loop antenna
8564E Spectrum Analyzer, All readings are peak, 100 kHz RBW
Two Tone Modulation 400 Hz, 1800 Hz, 10 dB Overdrive
TX 15.6 MHz, 25 Watts PEP, 44 dBm
The spectrum was searched from 9kHz to 300MHz. All emissions, except those which are more than 20dB below the specified limit were investigated for comparison to the specification limit.

Setup Photographs

Front view



Rear view

Section 9. Frequency Stability

Para. No.: 2.1055

Test Performed By: Jason Nixon	**Date of Test: December 21, 2004**

Minimum Standard: 90.213(a), ±100ppm

Test Results: Complies.
The maximum frequency drift is 0.06ppm.

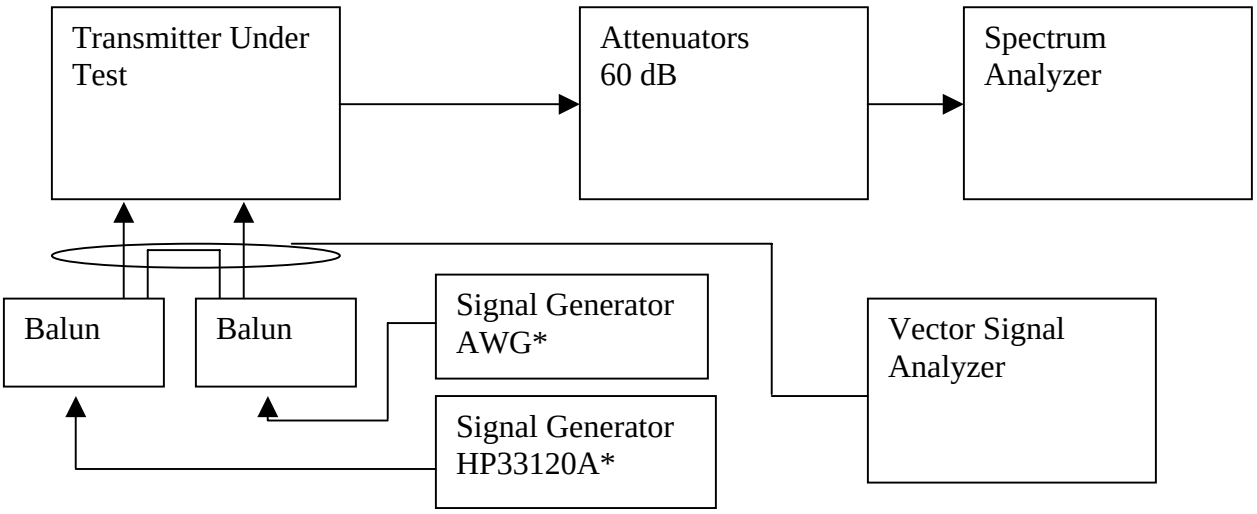
Test Data:

Standard Test Frequency: 15.6MHz, Modulated with 1800Hz
Standard Test voltage: 12VDC

Test Condition	Frequency (MHz)	Frequency Drift (Hz)
+50°C, 12 VDC	15.601801	1
+40°C, 12 VDC	15.601799	1
+30°C, 12 VDC	15.601799	1
+20°C, 13.8 VDC	15.601799	1
+20°C, 12 VDC	15.601799	1
+20°C, 10.2 VDC	15.601799	1
+10°C, 12 VDC	15.601801	1
0°C, 12 VDC	15.601801	1
-10°C, 12 VDC	15.601799	1
-20°C, 12 VDC	15.601799	1
-30°C, 12 VDC	15.601799	1

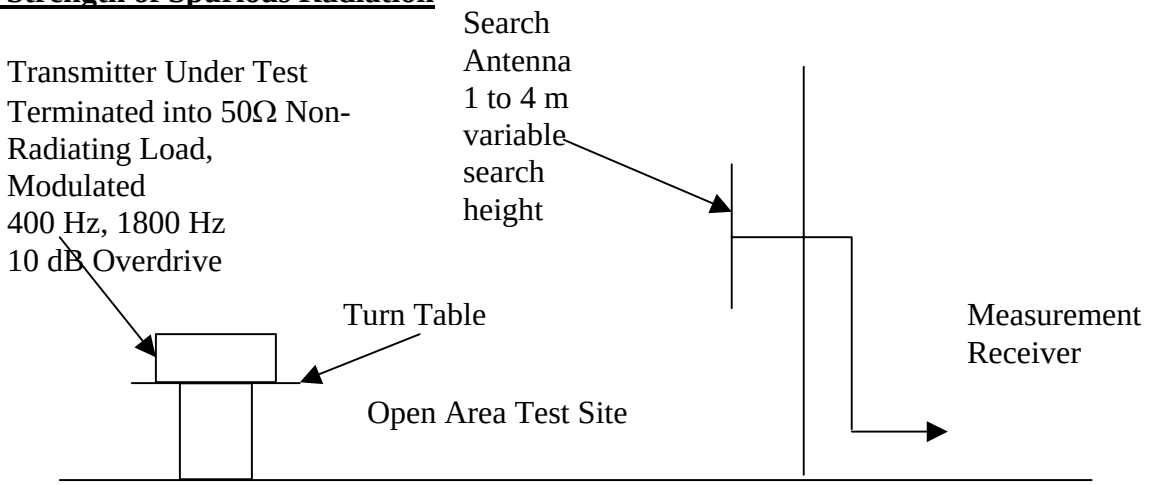
Section 10. Block Diagrams

- **RF Output Power**
- **Audio Frequency Response**
- **Modulation Limiting**
- **Occupied Bandwidth**
- **Spurious Emissions at Antenna Terminals**
- **Carrier Suppression**
- **Field Strength of Spurious Radiation**



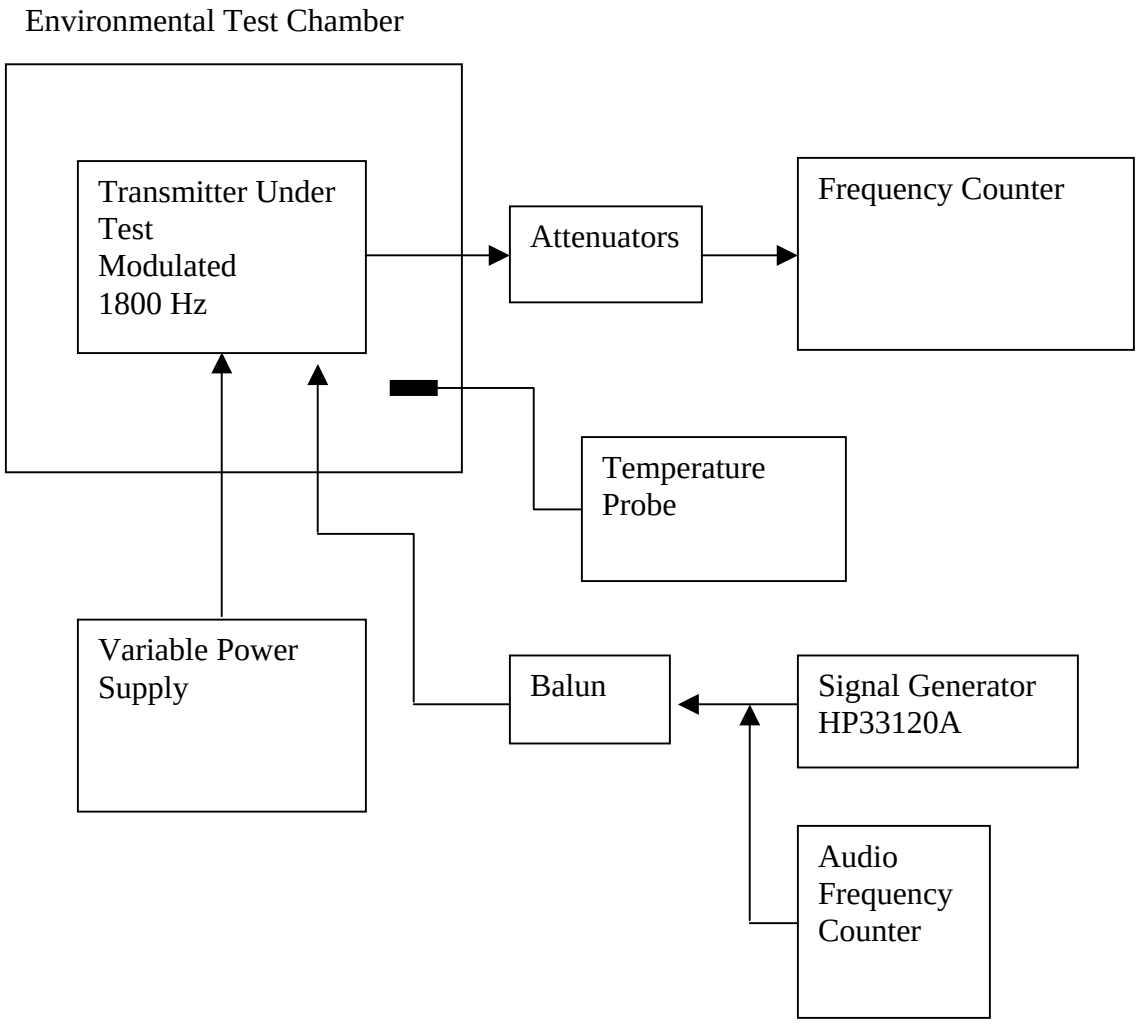
*Replaced with GW and HP209A for radiated emissions test.

Field Strength of Spurious Radiation



Emission levels are measured in terms of ERP. Emissions are maximized along 360° azimuth and further maximized by raising and lowering the search antenna from 1 to 4 m. The transmitter under test is replaced with a dipole antenna and calibrated signal generator. The level and frequency of the signal generator are adjusted in order to reproduce the previously detected emission and maximized by varying the height of the search antenna. This procedure is performed both horizontal and vertical polarization of the detected signal. This test procedure is adopted from ANSI/TIA-603.

Frequency Stability



Section 11. Test Equipment List

Test Equipment	Fixed Asset Number/Serial Number
Narda 20 dB Attenuator	FA001394
Narda 20 dB Attenuator	FA001153
Narda 10 dB Attenuator	SN9709
Narda 10 dB Attenuator	SN9707
Sierra 50Ω Load	FA000764
Environmental Test Chamber	FA001030
Variable Power Supply	FA000206
HP33120A	FA001082
AWG	FA001529
Balun	FA001258
Balun	FA001259
HP 8564E Spectrum Analyzer	S/N: 3943A01298
Vector Signal Analyzer	FA001149
GW Oscillator	FA001034
HP209A Oscillator	FA000101
Biconical Antenna 1	FA000805
HP 34401A Audio Frequency Counter	FA001077
HP5350A Frequency Counter	FA000086
Fluke 16 Temperature Probe	FA001831