



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

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Table of Contents

Section 1. Summary Of Test Results3

Section 2. General Equipment Specification.....5

Section 3. RF Power Output.....6

Section 4. Audio Frequency Response7

Section 5. Modulation Limiting.....8

Section 6. Occupied Bandwidth9

Section 7. Spurious Emissions at Antenna Terminals19

Section 8. Field Strength of Spurious Emissions26

Section 9. Frequency Stability28

Section 10. Block Diagrams29

Section 11. Test Equipment List32

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

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



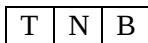
Production Unit



Class II Permissive Change



Pre-Production Unit



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: _____

Jason Nixon, Telecom Specialist

DATE: 4 February 2005

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This report applies only to the items tested.

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

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%

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

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.

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Section 3. RF Power Output

Para. No.: 2.1046

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

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Section 4. Audio Frequency Response

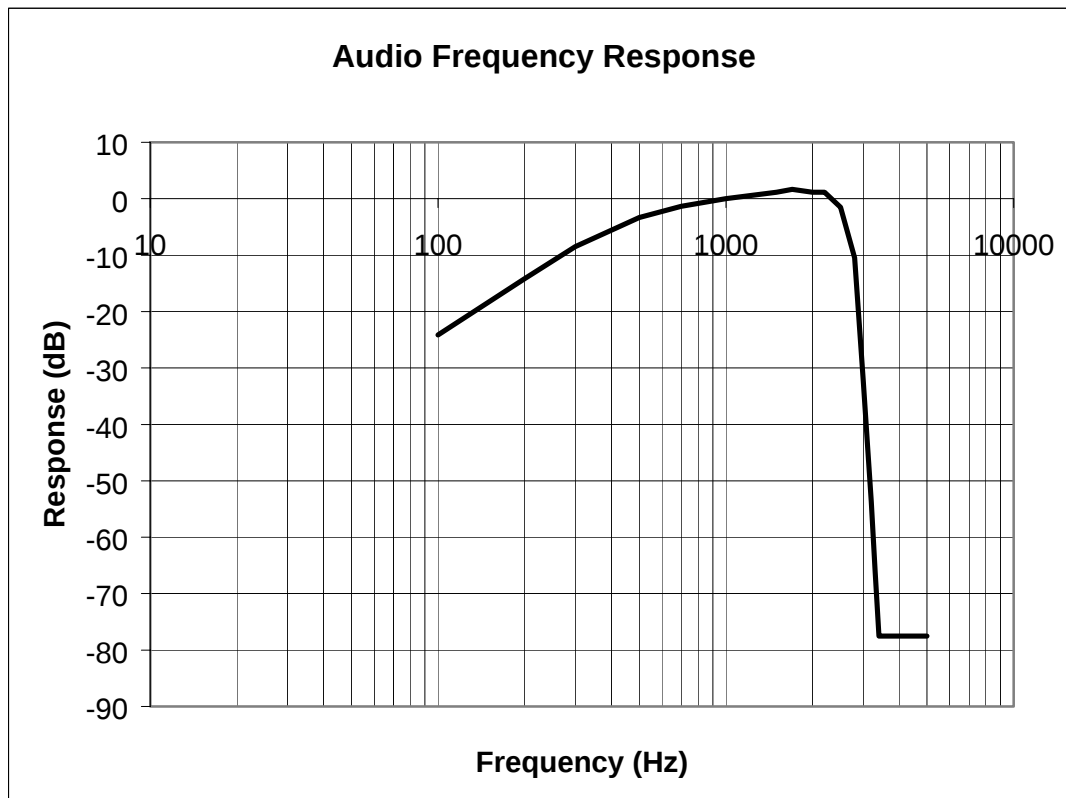
Para. No.: 2.1047

Test Performed By: Jason Nixon	Date of Test: January 17, 2005
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Minimum Standard: N/A

Test Results: See attached graph.

Measurement Data:



EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Section 5. Modulation Limiting

Para. No.: 2.1047

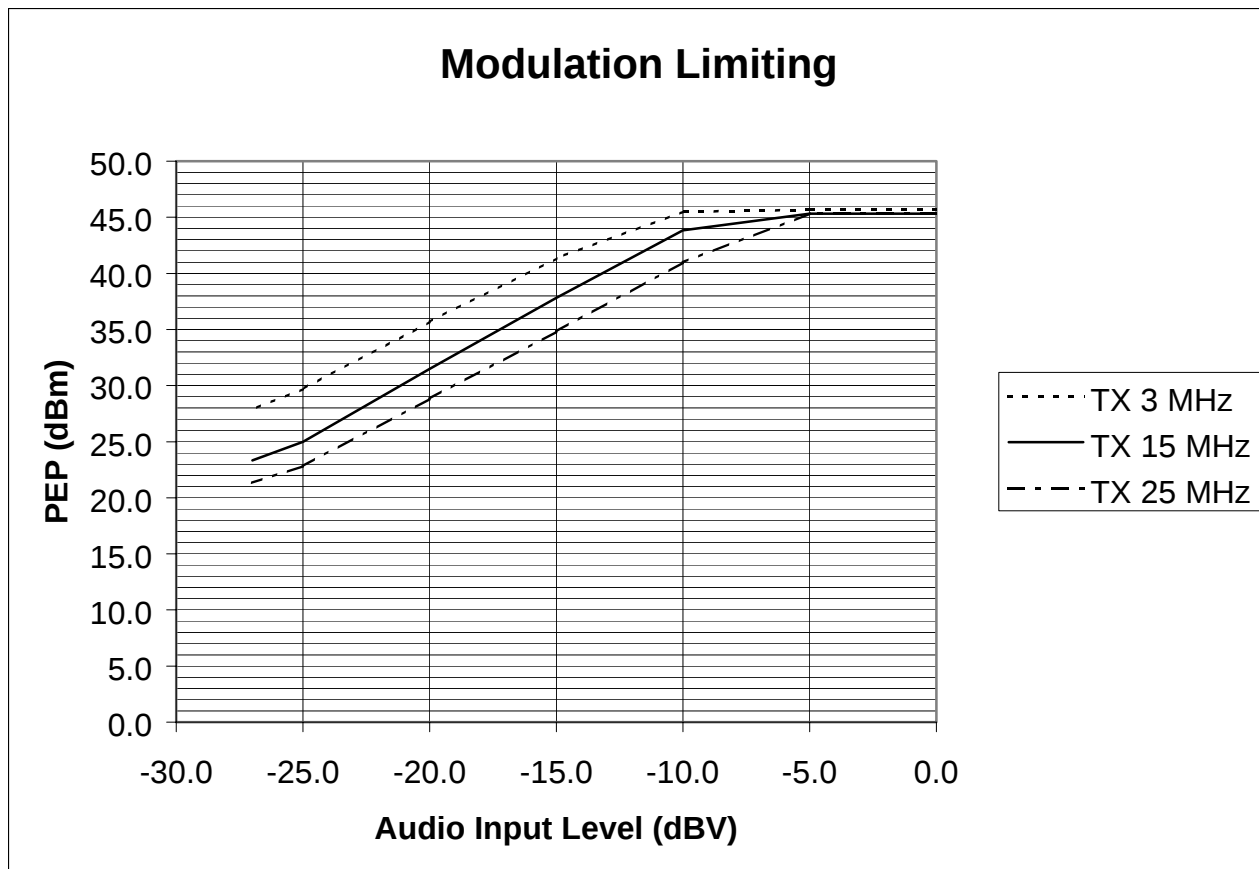
Test Performed By: Jason Nixon

Date of Test: January 18, 2005

Minimum Standard: N/A

Test Results: See attached graph.

Measurement Data: See attached graph.



EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Section 6. Occupied Bandwidth

Para. No.: 2.1049

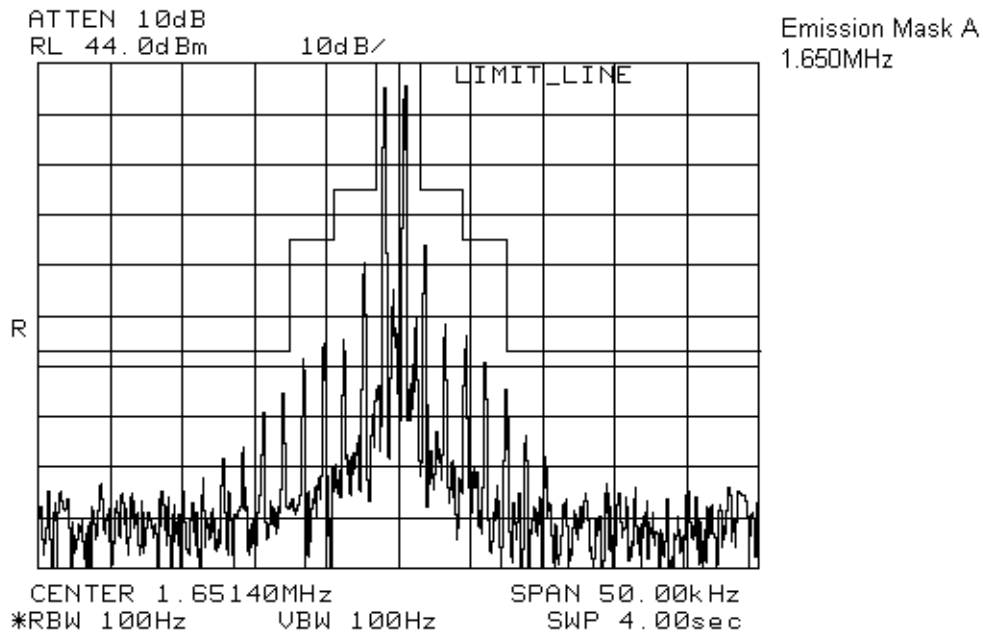
Test Performed By: Jason Nixon	Date of Test: January 17, 2005
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Minimum Standard: 90.210(a)

Test Results: Complies

Test Data: See attached graphs.

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110



Occupied Bandwidth

Emission Mask A,

Two Tone Modulation 400 Hz, 1800 Hz

Input levels set to 10dB above level required for Max PEP

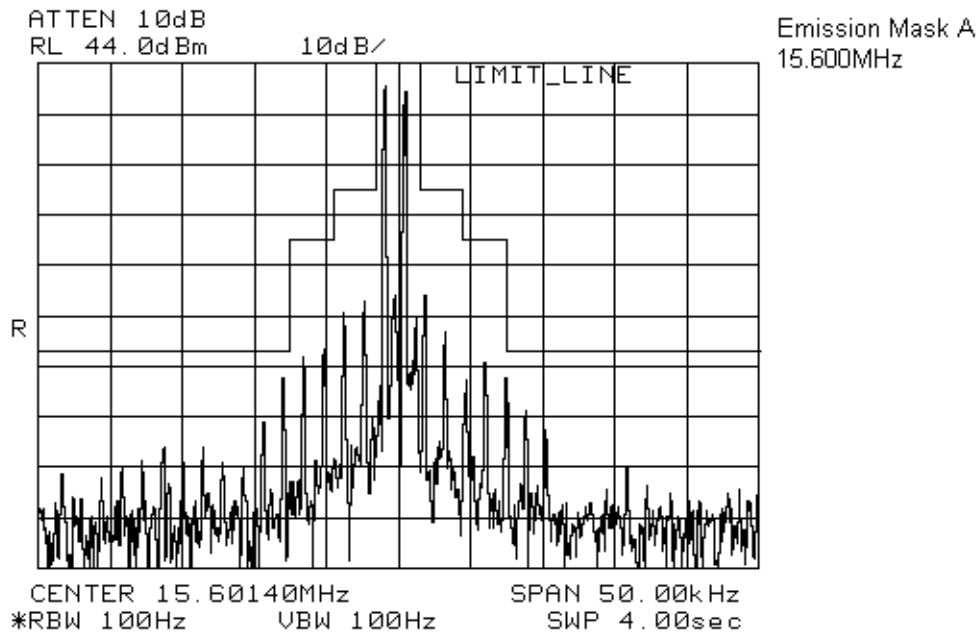
25 Watts PEP

Authorized Bandwidth 3 kHz

$F_c = 1.65\text{MHz}$

$\text{AssignedFrequency} = F_c + 1400\text{Hz}$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110



Occupied Bandwidth

Emission Mask A,

Two Tone Modulation 400 Hz, 1800 Hz

Input levels set to 10dB above level required for Max PEP

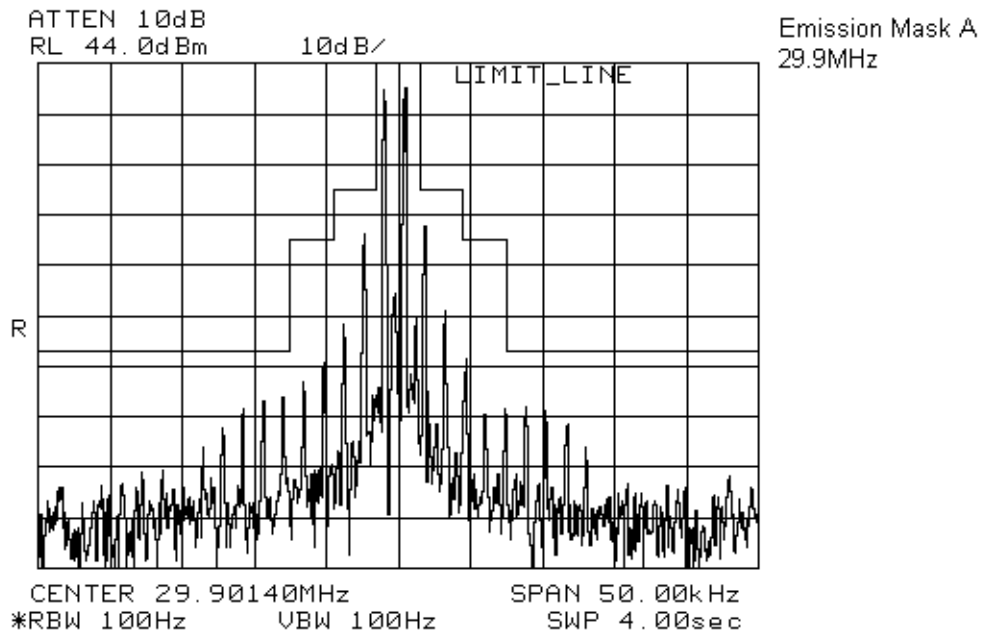
25 Watts PEP

Authorized Bandwidth 3 kHz

$F_c = 15.6\text{MHz}$

$\text{AssignedFrequency} = F_c + 1400\text{Hz}$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110



Occupied Bandwidth

Emission Mask A,

Two Tone Modulation 400 Hz, 1800 Hz

Input levels set to 10dB above level required for Max PEP

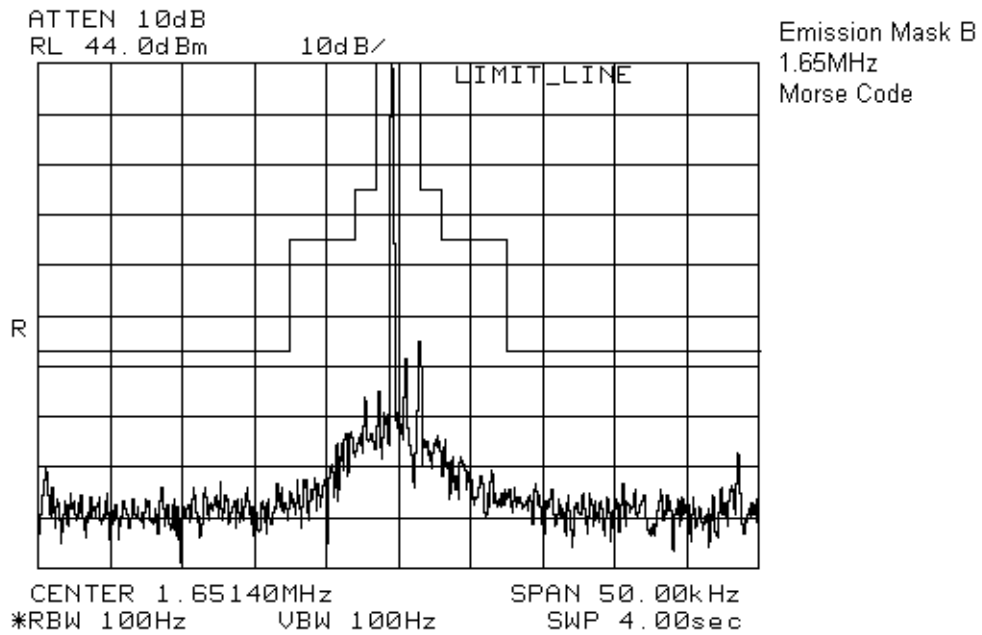
25 Watts PEP

Authorized Bandwidth 3 kHz

$F_c = 29.9\text{MHz}$

$\text{AssignedFrequency} = F_c + 1400\text{Hz}$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110



Occupied Bandwidth

Emission Mask B,

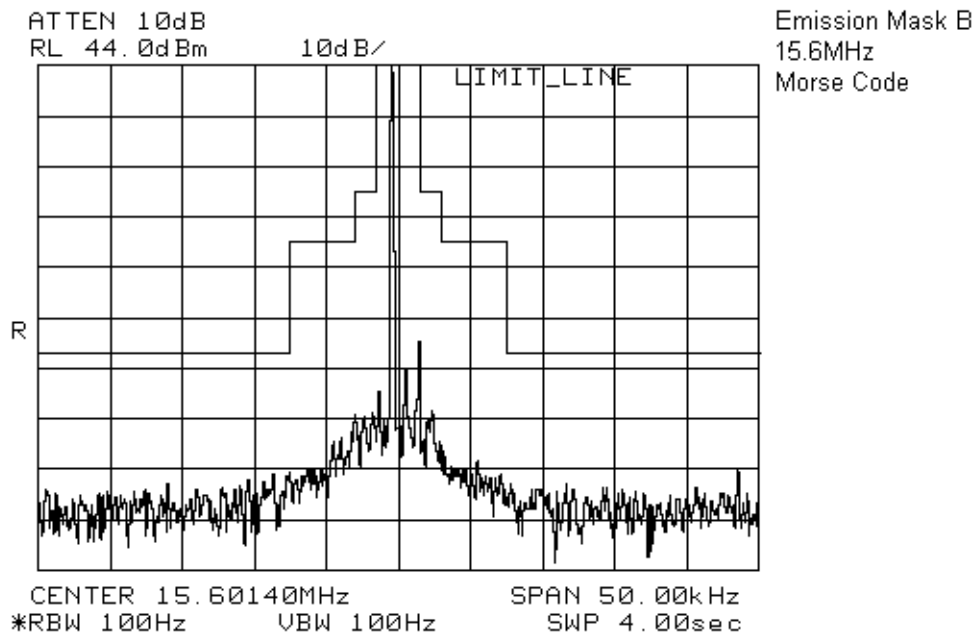
Morse Code

Authorized Bandwidth 3 kHz

$F_c = 1.65\text{MHz}$

$\text{AssignedFrequency} = F_c + 1400\text{Hz}$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110



Occupied Bandwidth

Emission Mask B,

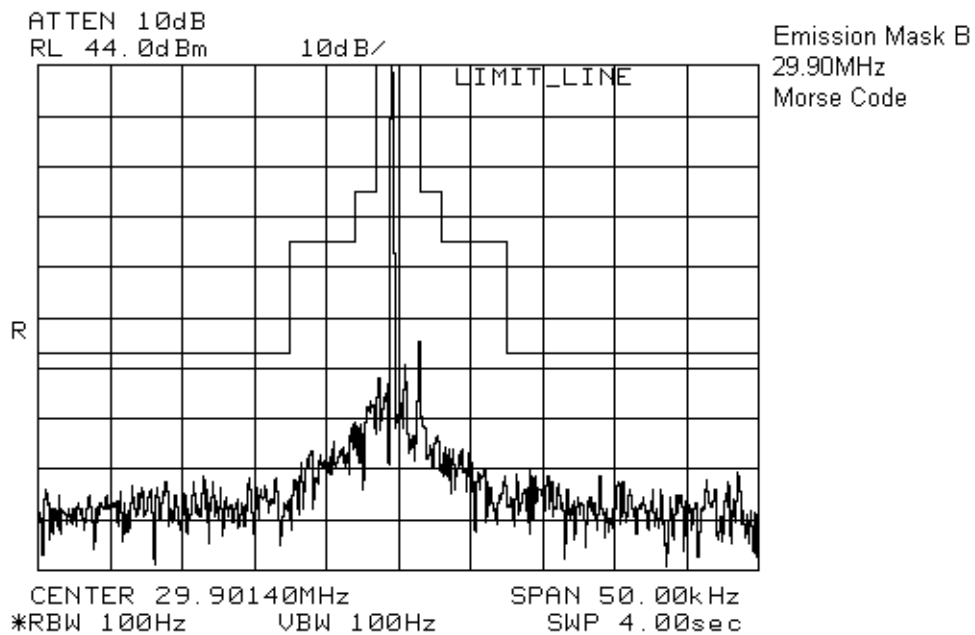
Morse Code

Authorized Bandwidth 3 kHz

$F_c = 15.6\text{MHz}$

$\text{AssignedFrequency} = F_c + 1400\text{Hz}$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110



Occupied Bandwidth

Emission Mask B,

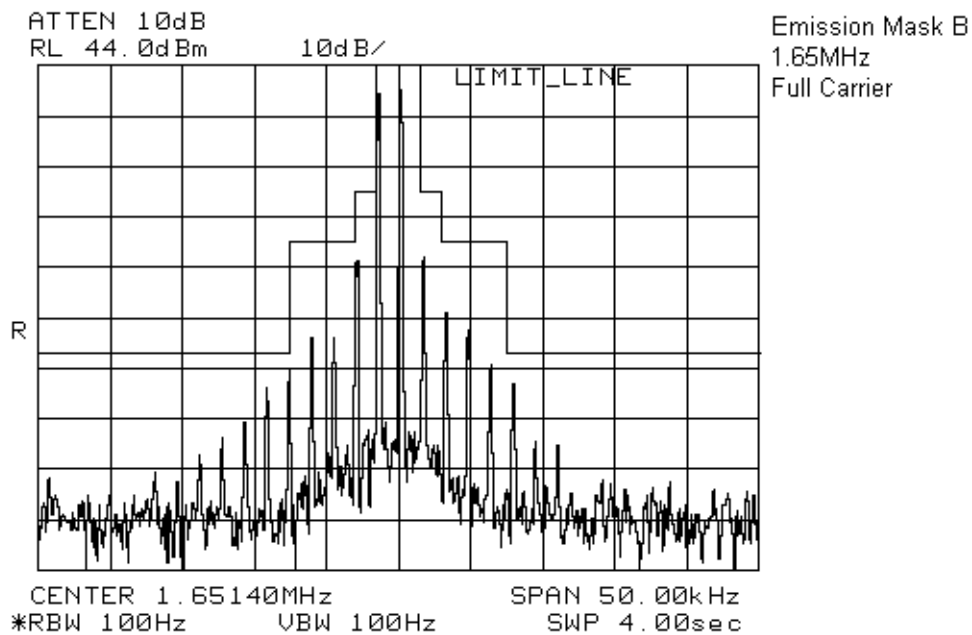
Morse Code

Authorized Bandwidth 3 kHz

$F_c = 29.9\text{MHz}$

$\text{AssignedFrequency} = F_c + 1400\text{Hz}$

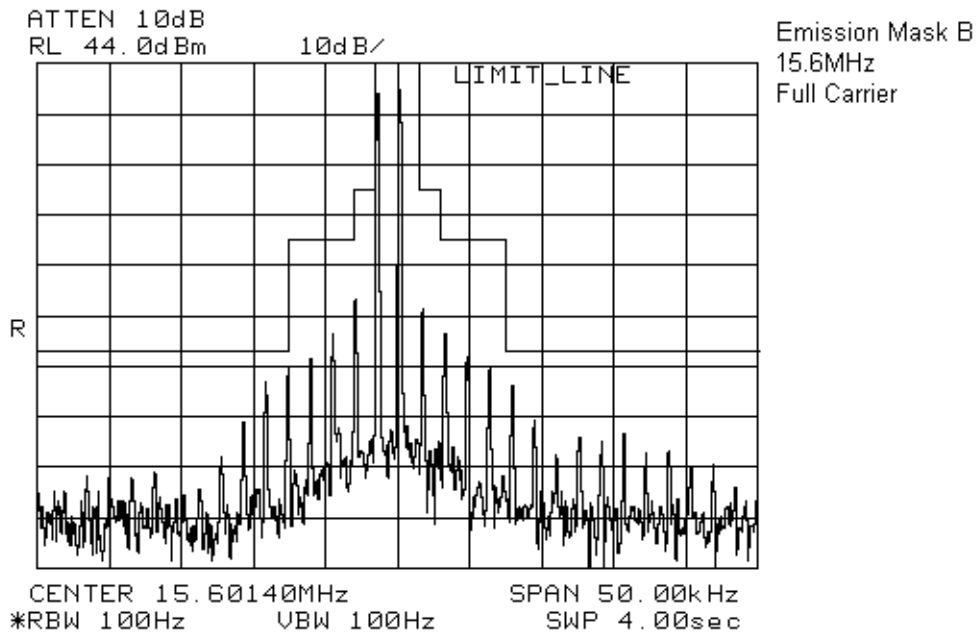
EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110



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
 $F_c = 1.65\text{MHz}$
 $\text{AssignedFrequency} = F_c + 1400\text{Hz}$

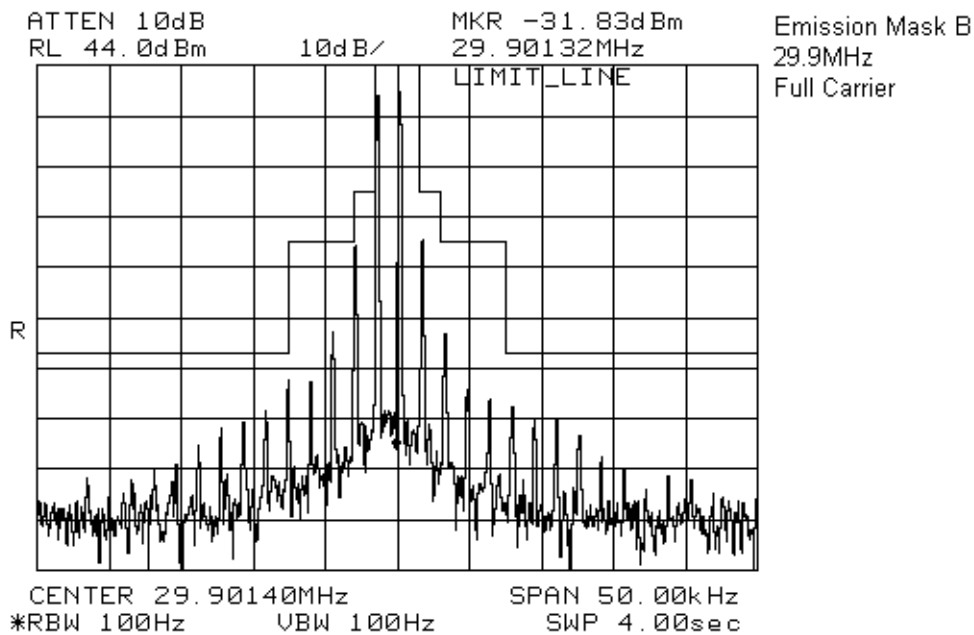
EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110



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
 $F_c = 15.6\text{MHz}$
 $\text{AssignedFrequency} = F_c + 1400\text{Hz}$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110



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
 $F_c = 29.9\text{MHz}$
 $\text{AssignedFrequency} = F_c + 1400\text{Hz}$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Section 7. Spurious Emissions at Antenna Terminals

Para. No.: 2.1051

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

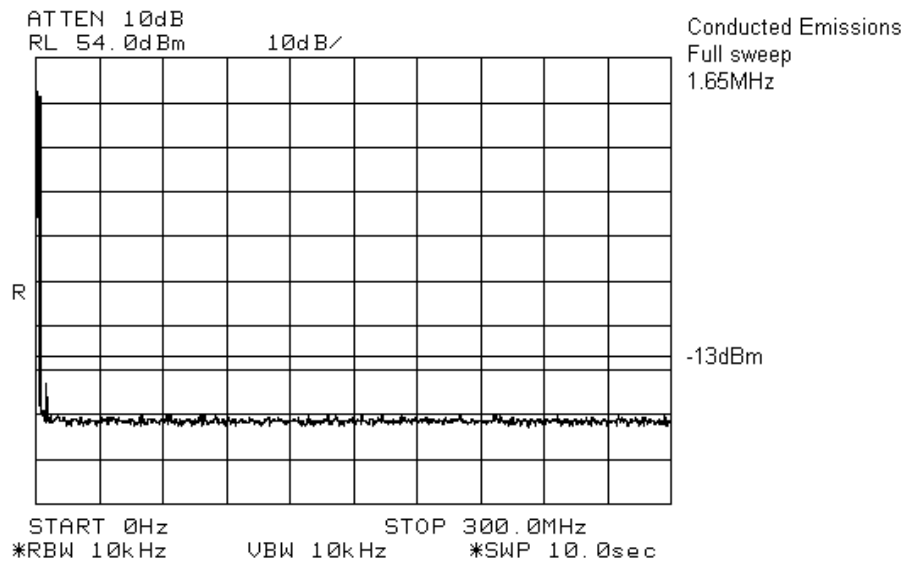
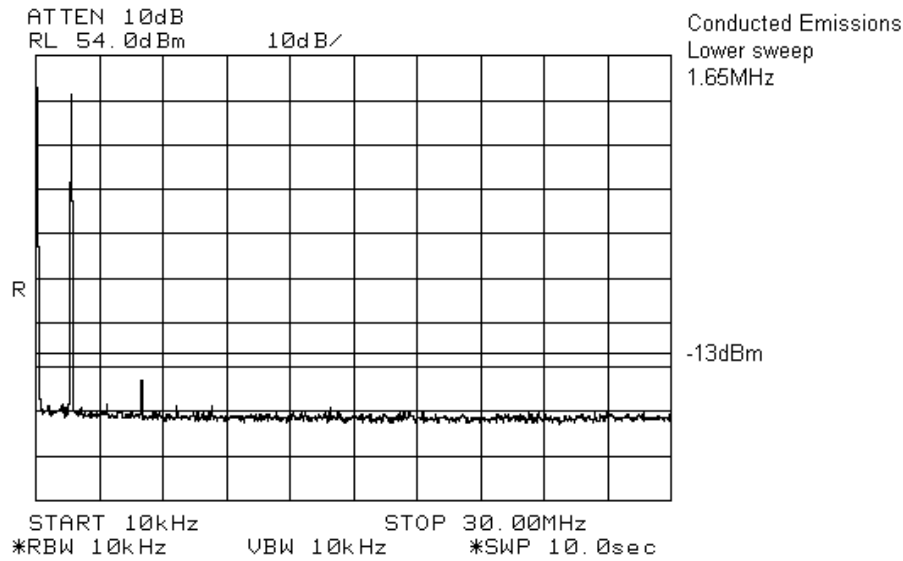
The level N (dB) of the carrier with respect to peak envelope power is -62.7 dB. This is 22.7 dB below the specification limit.

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

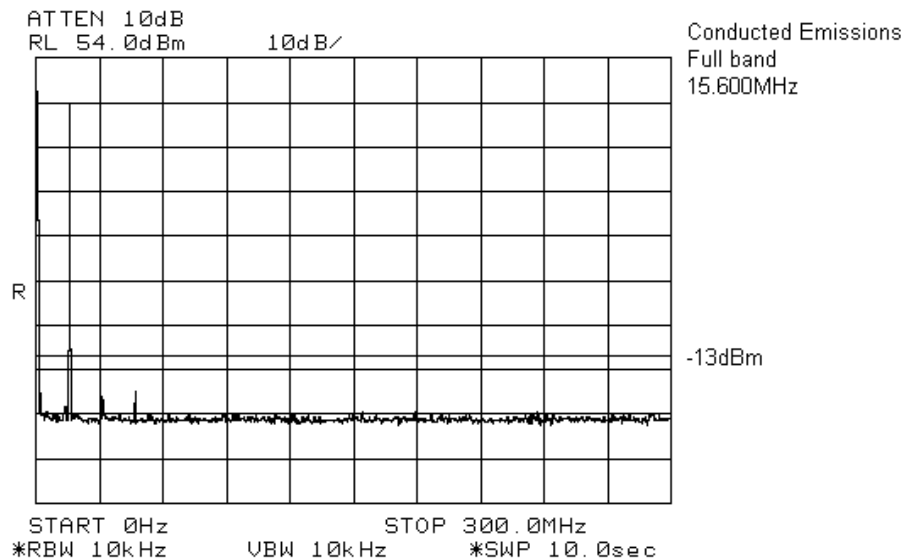
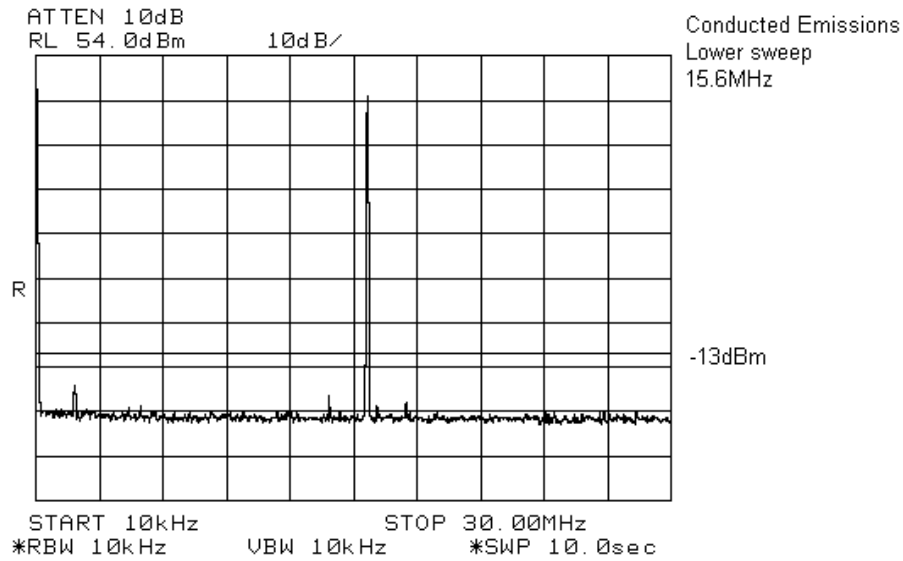
EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Conducted Emissions Low Band



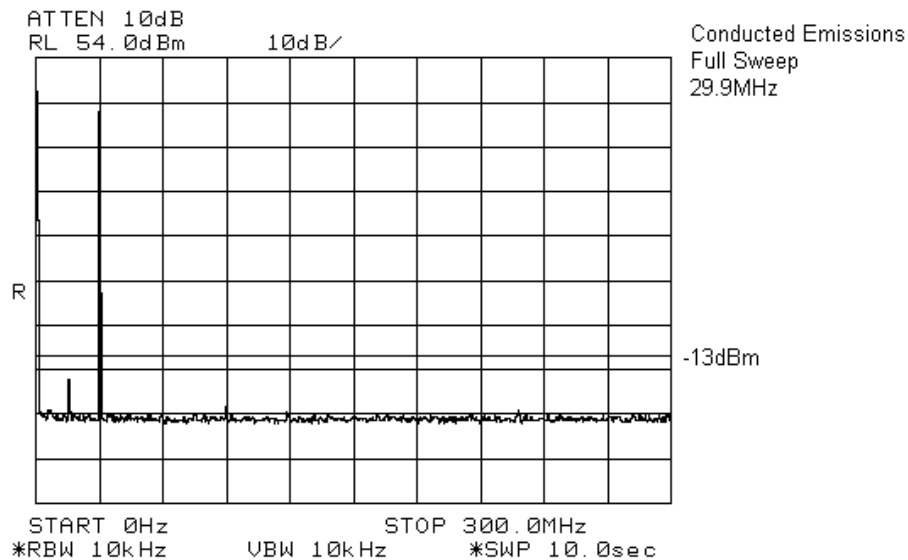
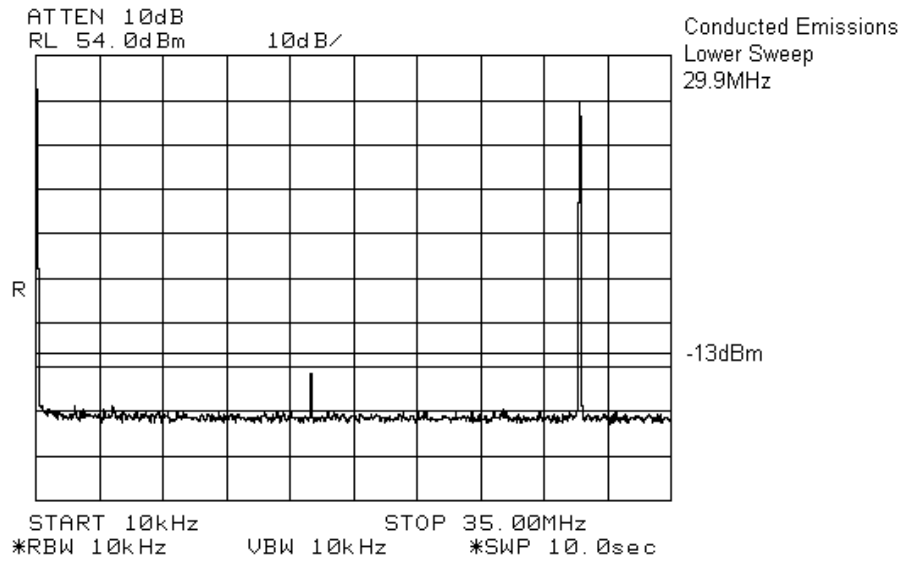
EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Conducted Emissions Mid Band



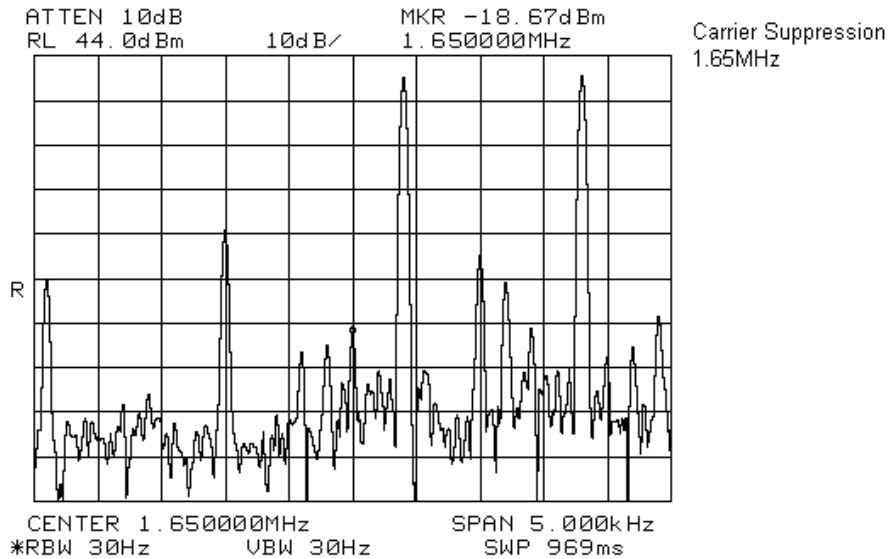
EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Conducted Emissions High Band



EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Carrier Suppression Low band



Carrier Suppression

Limit N < -40 dB

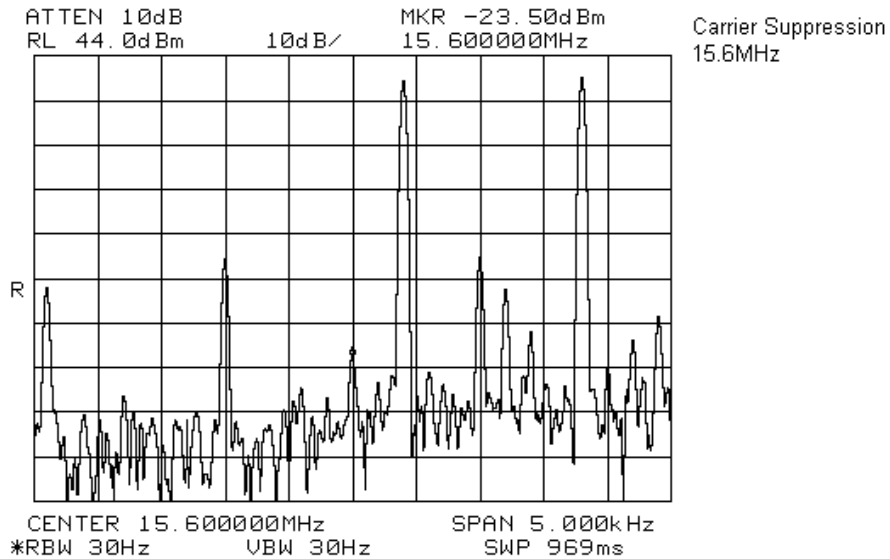
Two Tone Modulation 400 Hz, 1800 Hz

TX 1.65 MHz, 25 Watts PEP

$$N = -18.7 - 44 = -62.7 \text{ dB}$$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Carrier Suppression Mid band



Carrier Suppression

Limit N < -40 dB

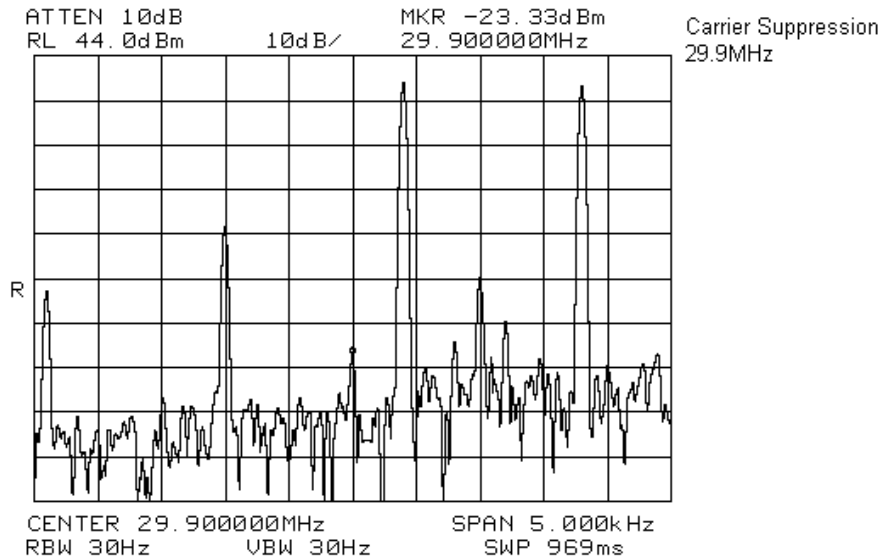
Two Tone Modulation 400 Hz, 1800 Hz

TX 15.6 MHz, 25 Watts PEP

$N = -23.5 - 44 = -67.5\text{dB}$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Carrier Suppression High band



Carrier Suppression

Limit N < -40 dB

Two Tone Modulation 400 Hz, 1800 Hz

TX 29.9 MHz, 25 Watts PEP

$$N = -23.3 - 44 = -67.3dB$$

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

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

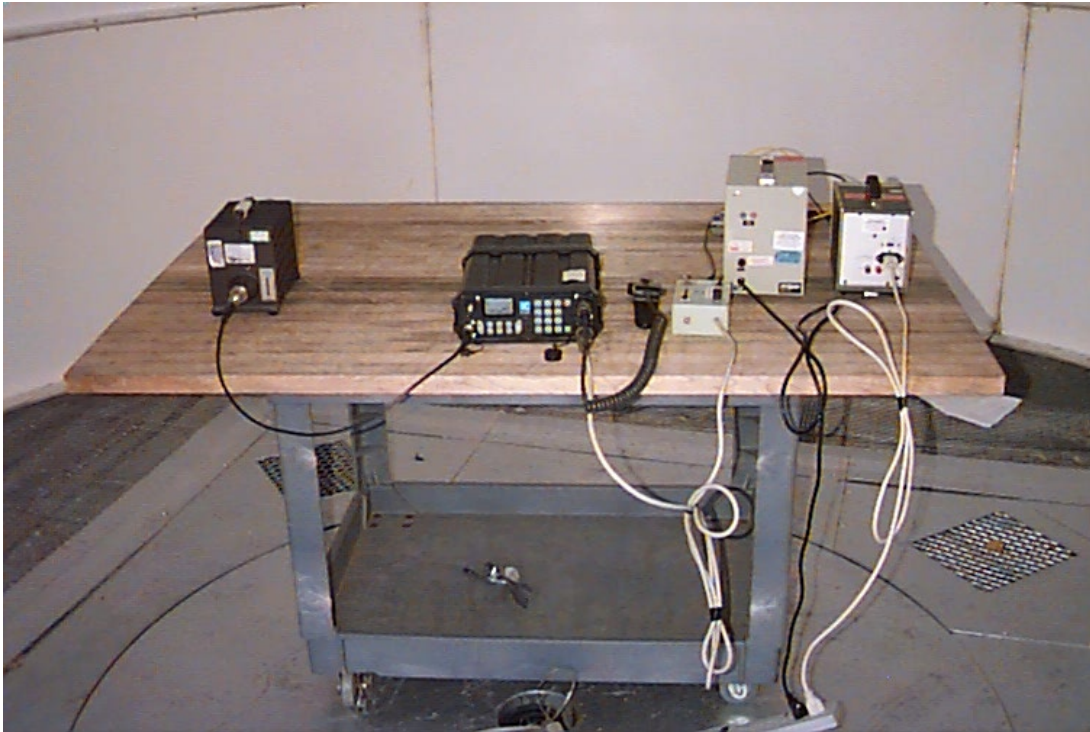
Two Tone Modulation 400 Hz, 1800 Hz, 10 dB Overdrive

TX 15.6 MHz, 25 Watts PEP, 44 dBm

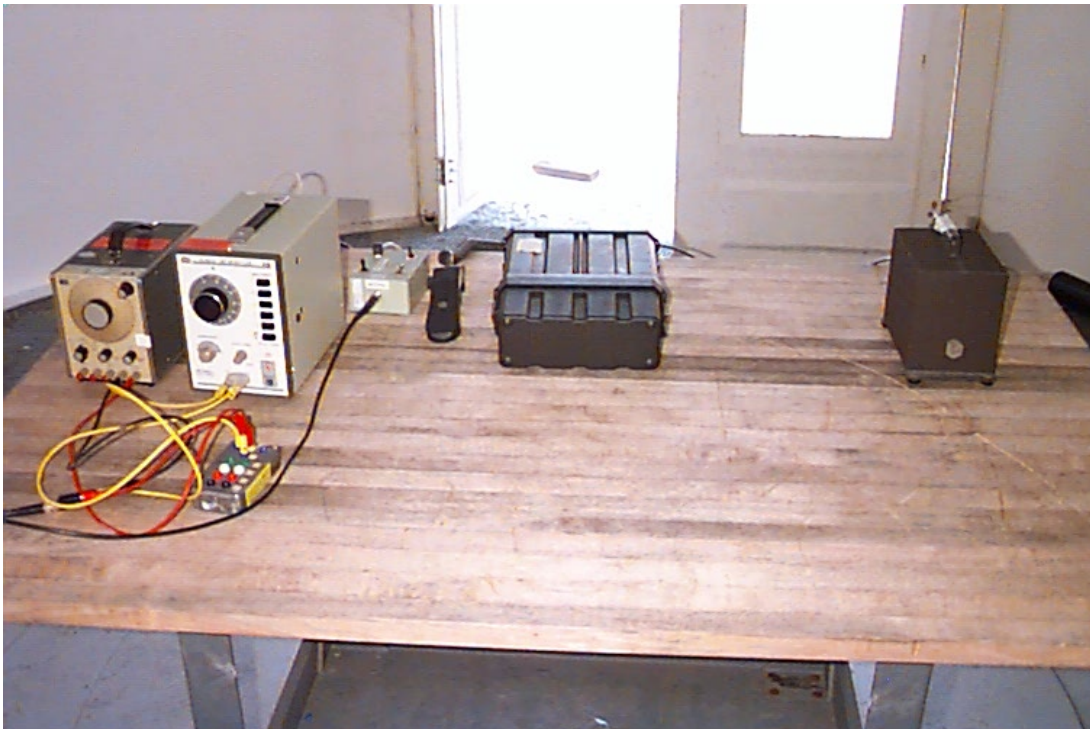
The spectrum was searched from 9kHz to 300MHz. All emissions, except those which are more than 20dB below the specified limit were investigated for comparison to the specification limit.

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Setup Photographs
Front view



Rear view



EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Section 9. Frequency Stability

Para. No.: 2.1055

Test Performed By: Jason Nixon	Date of Test: December 21, 2004
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Minimum Standard: 90.213(a), ± 100 ppm

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

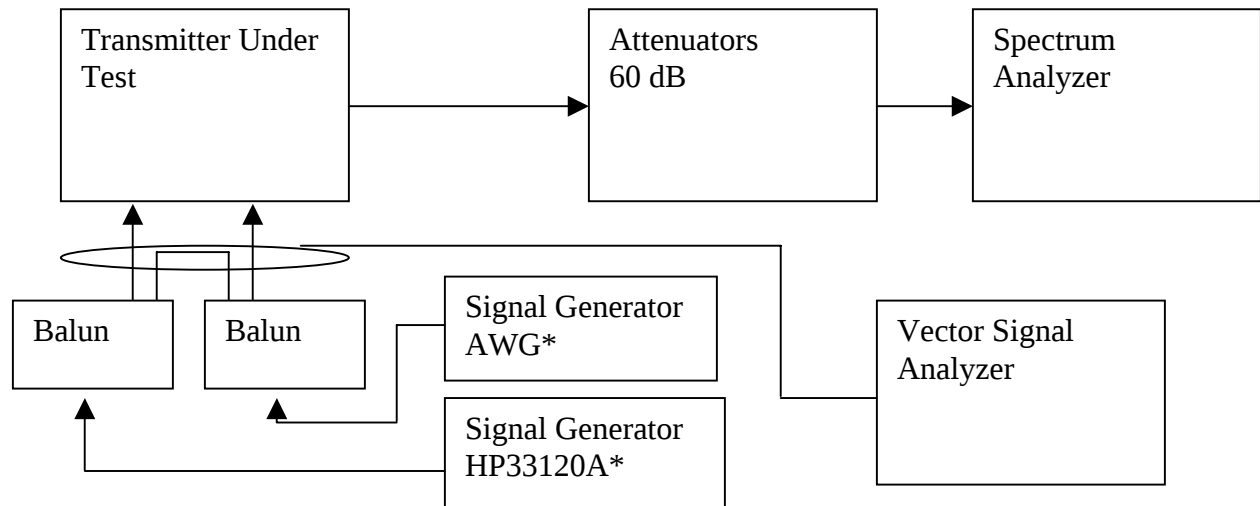
Test Data:
Standard Test Frequency: 15.6MHz, Modulated with 1800Hz
Standard Test voltage: 12VDC

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

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Section 10. Block Diagrams

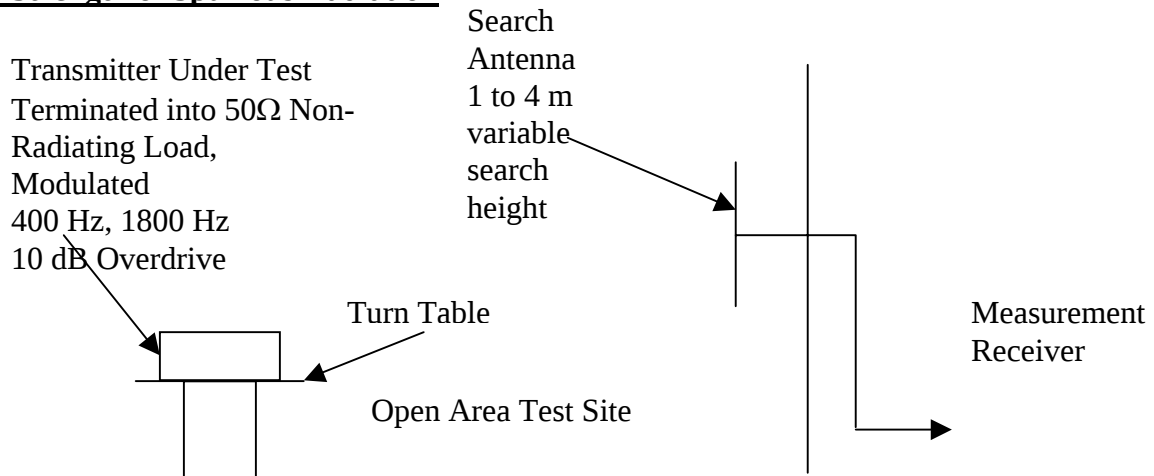
- ❑ RF Output Power
- ❑ Audio Frequency Response
- ❑ Modulation Limiting
- ❑ Occupied Bandwidth
- ❑ Spurious Emissions at Antenna Terminals
- ❑ Carrier Suppression
- ❑ Field Strength of Spurious Radiation



*Replaced with GW and HP209A for radiated emissions test.

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

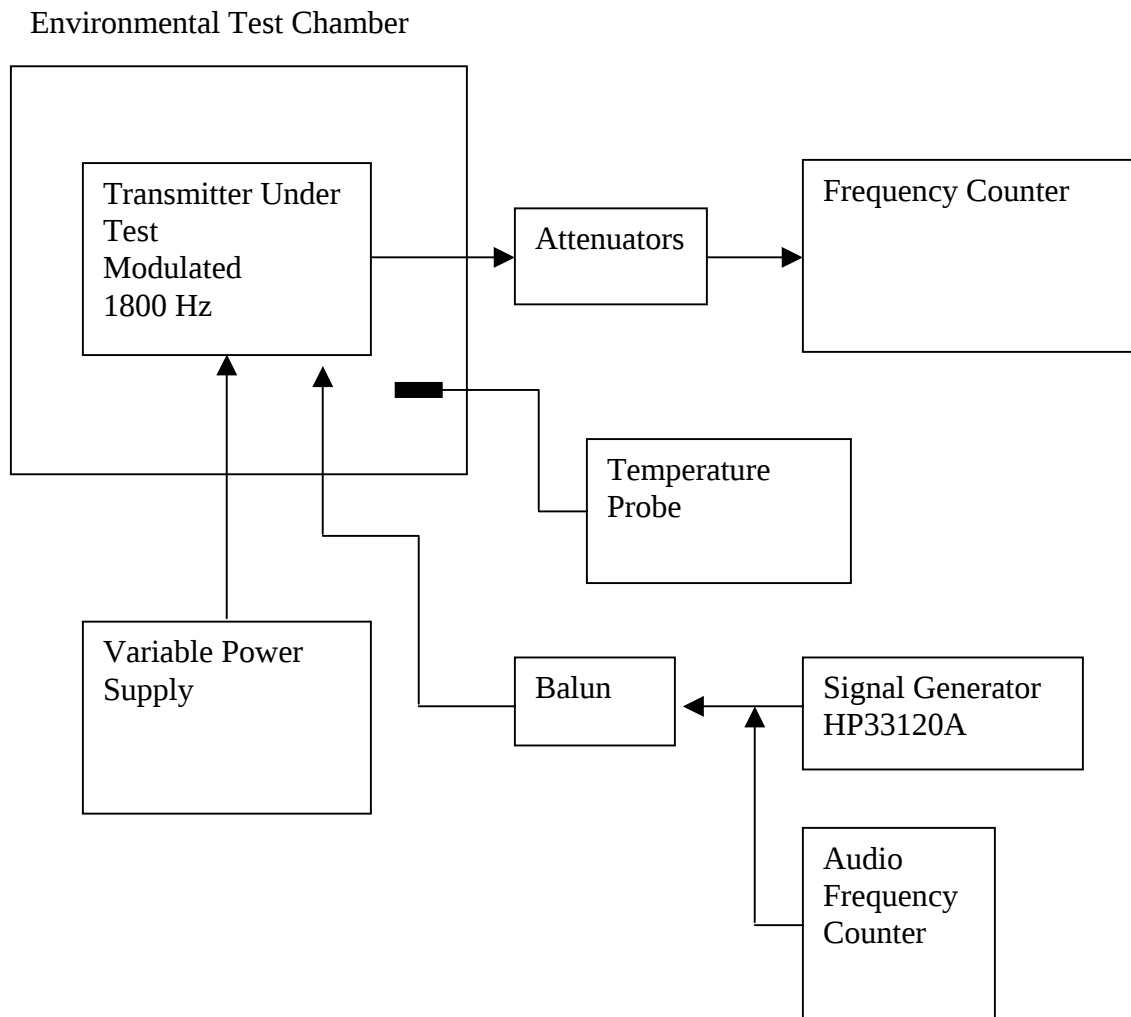
Field Strength of Spurious Radiation



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.

EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

Frequency Stability



EQUIPMENT: 2110 SSB Transceiver
FCC ID: DYY2110

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