

KTL Test Report: 8R01233

Applicant: Cellwave - Corvallis
4100 S.W. Research Way
Corvallis, OR
97333
USA

**Equipment Under Test:
(E.U.T.)** Bi-Directional Amplifier CDMA Single Channel

FCC ID: IWDBDA48660

In Accordance With: **FCC Part 24, Subpart E**
Broadband PCS Repeaters

Tested By: KTL Ottawa Inc.
3325 River Road, R.R. 5
Ottawa, Ontario K1V 1H2

Authorized By:

T. Tidwell, Laboratory Manager

Date:

Total Number of Pages: 60

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EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Section 1. Summary of Test Results

Manufacturer: Cellwave - Corvallis

Model No.: Intelli BDA

Serial No.: None

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 24, Subpart E.



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".



NVLAP LAB CODE: 100351-0

TESTED BY: _____ DATE: _____
Wayne Clarke, Technologist

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EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	24.232	100W	0.2	Complies
Occupied Bandwidth (CDMA)	24.238	Input/Output	Graph	Complies
Occupied Bandwidth (GSM)	24.238	Input/Output	N/A	N/A
Occupied Bandwidth (NADC)	24.238	Input/Output	N/A	N/A
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	<-28 dBm	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	<-28 dBm	Complies
Frequency Stability	24.235		N/A	N/A

Footnotes For N/A's:**Test Conditions:**

Indoor Temperature: 22 °C
 Humidity: 30 %

Outdoor Temperature: 3 °C
 Humidity: 80 %

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Section 2. General Equipment Specification

Supply Voltage Input:	120 VAC, 60 Hz		
Frequency Range:	Downlink:	1930 to 1990 MHz	
Frequency Range:	Uplink:	1850 to 1910 MHz	
Type of Modulation and Designator:	CDMA (F9W)	GSM (GXW)	NADC (DXW)
	☒	☐	☐
AGC Threshold:	+23 dBm		
Output Impedance:	50 ohm		
Gain:	65 dB		
Max Input Power:	-35 dBm		
RF Output (Rated):	Single:	+23 dBm	
	Composite:	N/A	
Frequency Translation:	F1-F1	F1-F2	N/A
	☒	☐	☐
Band Selection:	Software	Duplexer Change	Fullband Coverage
	☒	☐	☐

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Description of Modifications For Class II Permissive Change

NOT APPLICABLE

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Modifications Made During Testing

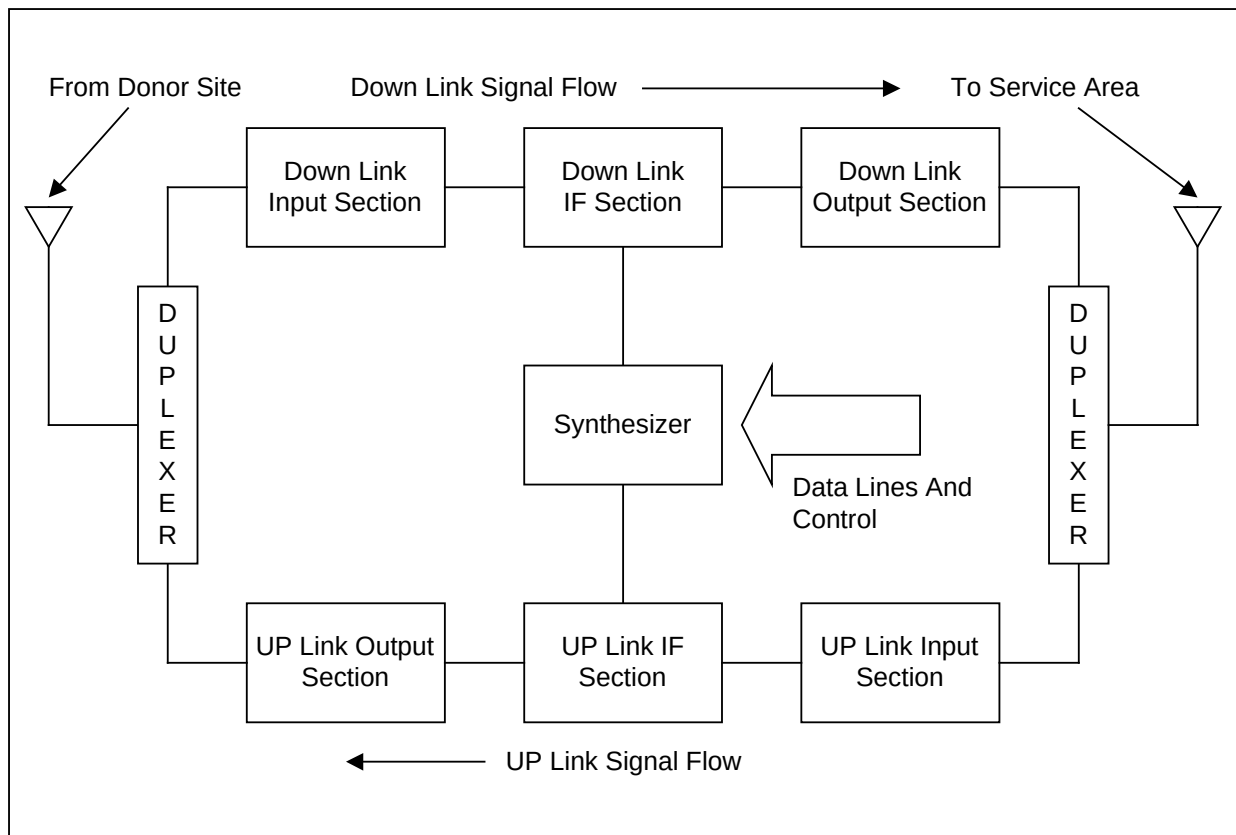
NOT APPLICABLE

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Theory of Operation

The E.U.T. is a single channel CDMA PCS Bi-Directional Amplifier. The incoming signal is filtered through a duplexer, then through an input stage, then through IF section for down conversion, filtering and amplification and back to the original frequency.

System Diagram



EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Wayne Clarke	DATE: March 19, 1999

Test Results: Complies.**Measurement Data:**

	Modulation Type	Per Channel Output Power (dBm)	Composite Output Power (dBm)
Uplink	CDMA	23.02	N/A
Downlink	CDMA	23.08	N/A

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

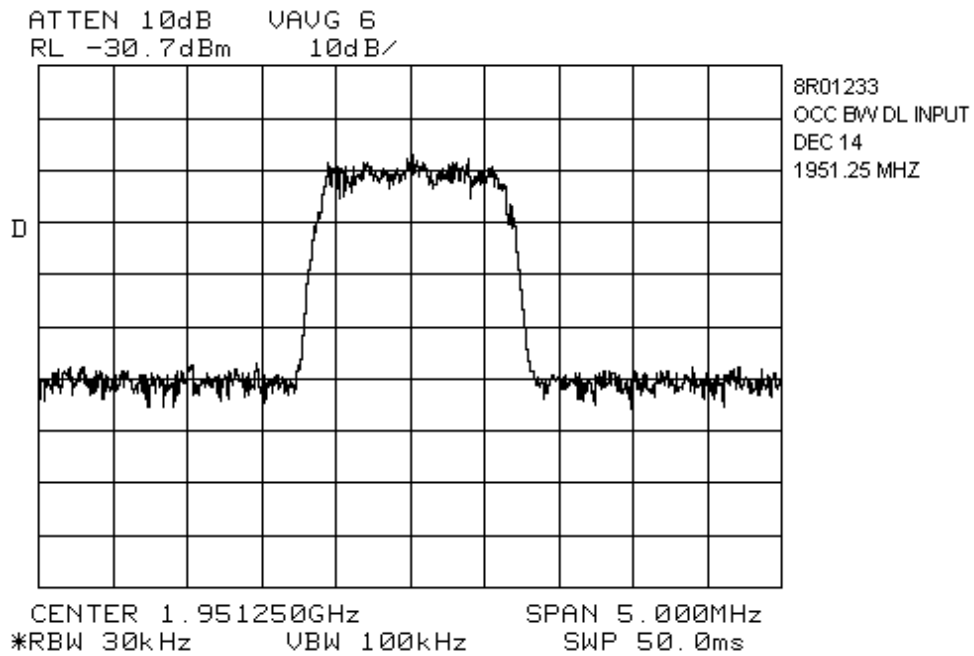
Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth (CDMA)	PARA. NO.: 2.917(c)
TESTED BY: Wayne Clarke	DATE: March 22, 1999

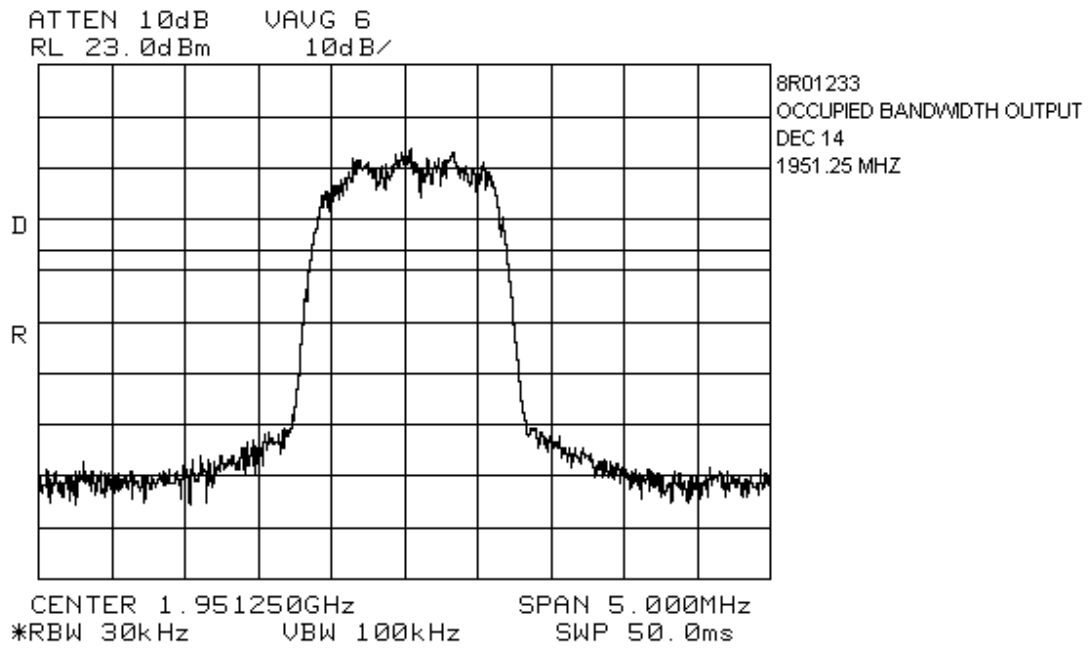
Test Results: Complies.

Test Data: See attached graph(s).

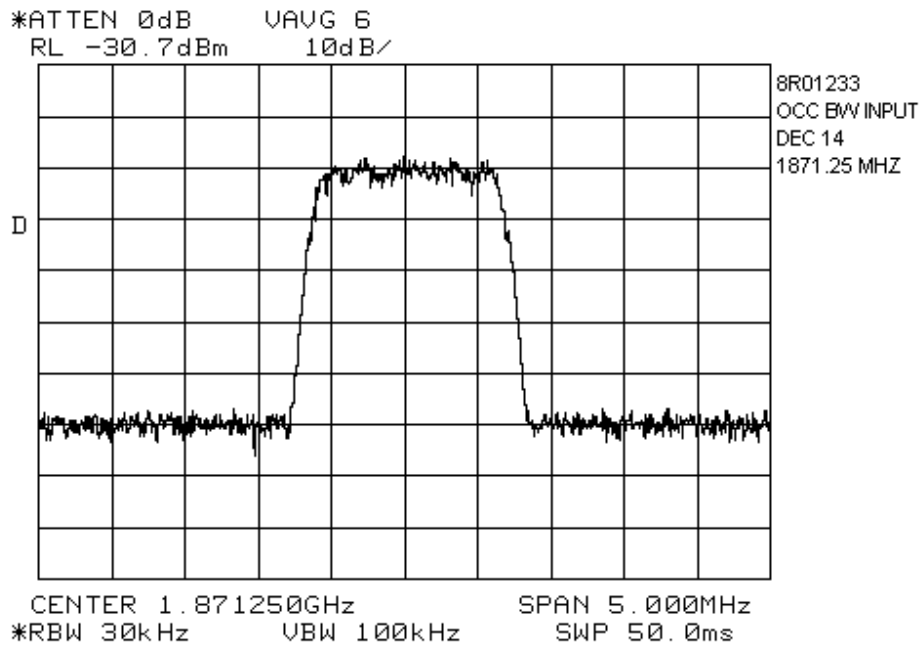
EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660



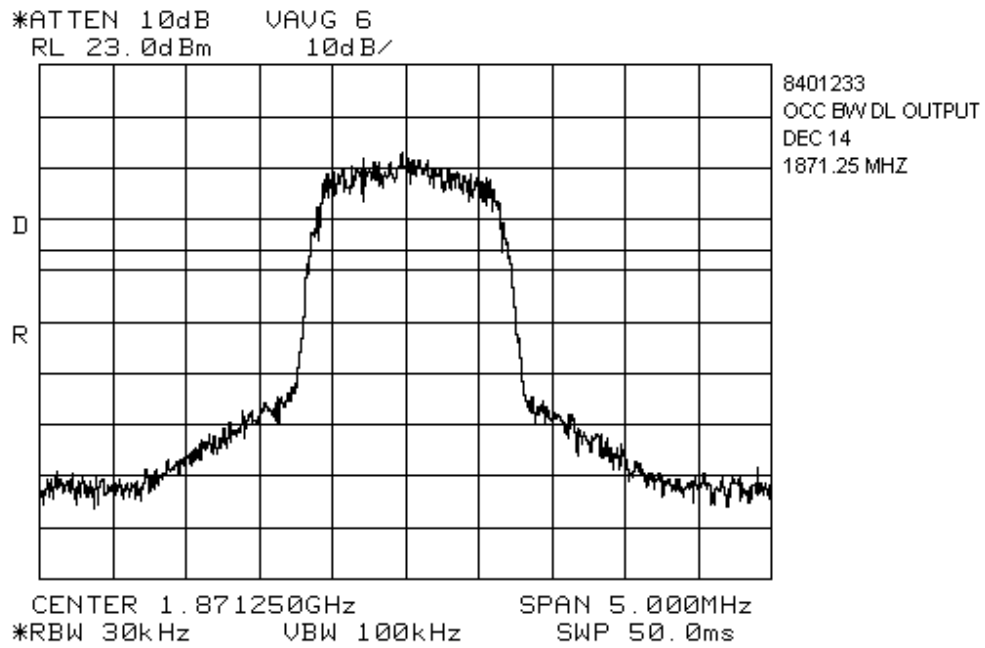
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EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

NAME OF TEST: Occupied Bandwidth (GSM)	PARA. NO.: 2.917(c)
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.

Test Data: See attached graph(s).

NOT APPLICABLE

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

NAME OF TEST: Occupied Bandwidth (NADC)

PARA NO.: 2.917(c)

TESTED BY:

DATE:

Test Results:

Complies/Does Not Comply.

Test Data:

See attached graphs).

NOT APPLICABLE

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Section 5. Spurious Emissions at Antenna Terminals

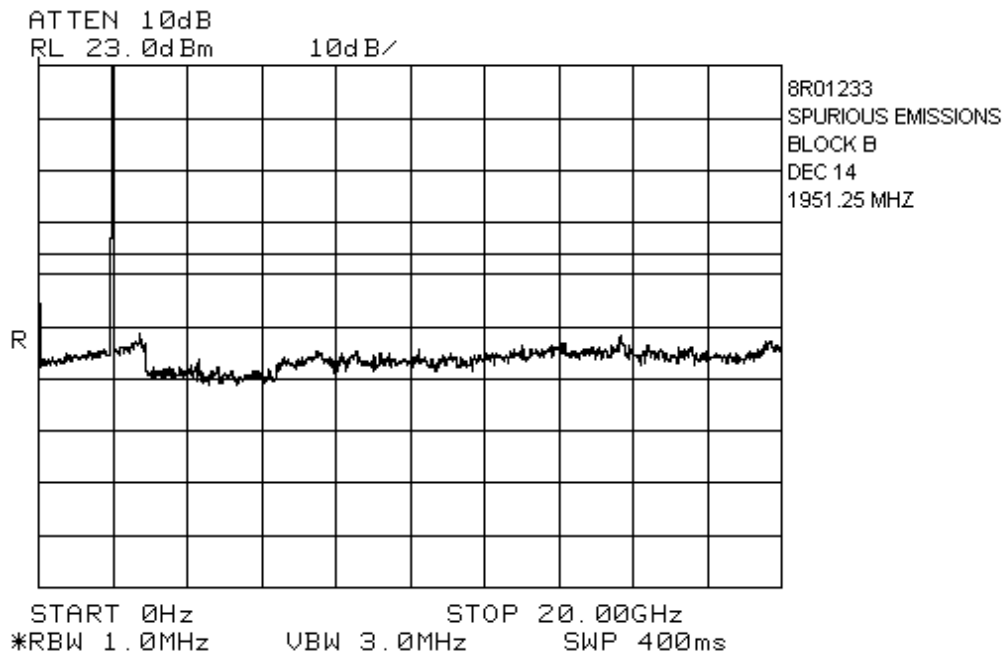
NAME OF TEST: Spurious Emissions @ Antenna Terminals PARA. NO.: 2.917(e)

TESTED BY: Wayne Clarke DATE: March 22, 1999

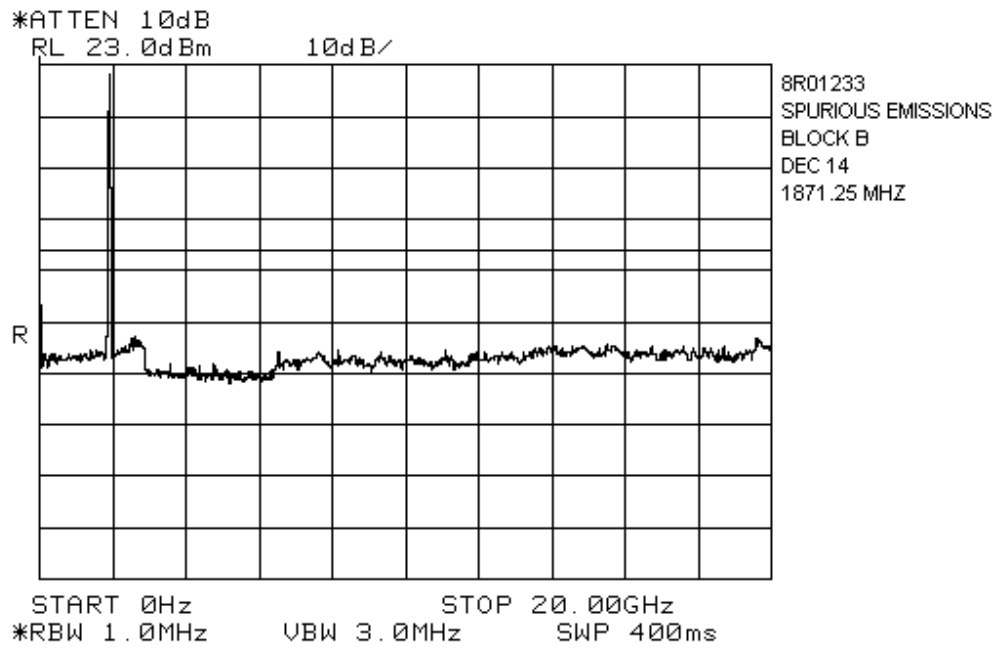
Test Results: Complies.**Test Data:**

NAME OF TEST	WORST-CASE SPURIOUS LEVEL(dBm)
0 to 20 GHz spurious (Uplink)	<-28
0 to 20 GHz spurious (Downlink)	<-28

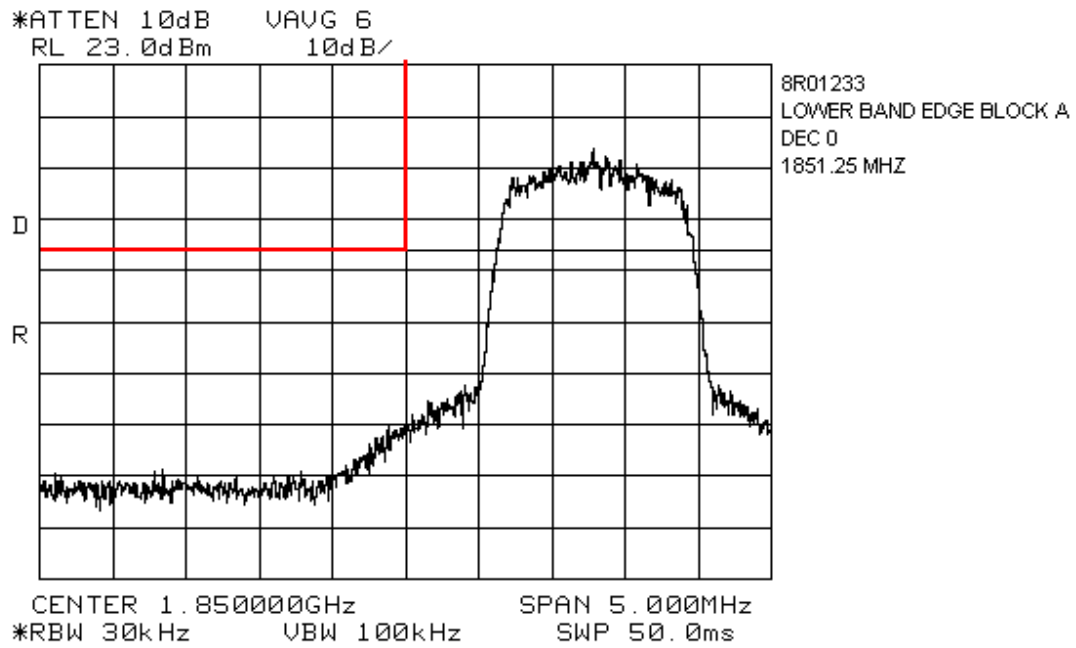
EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660



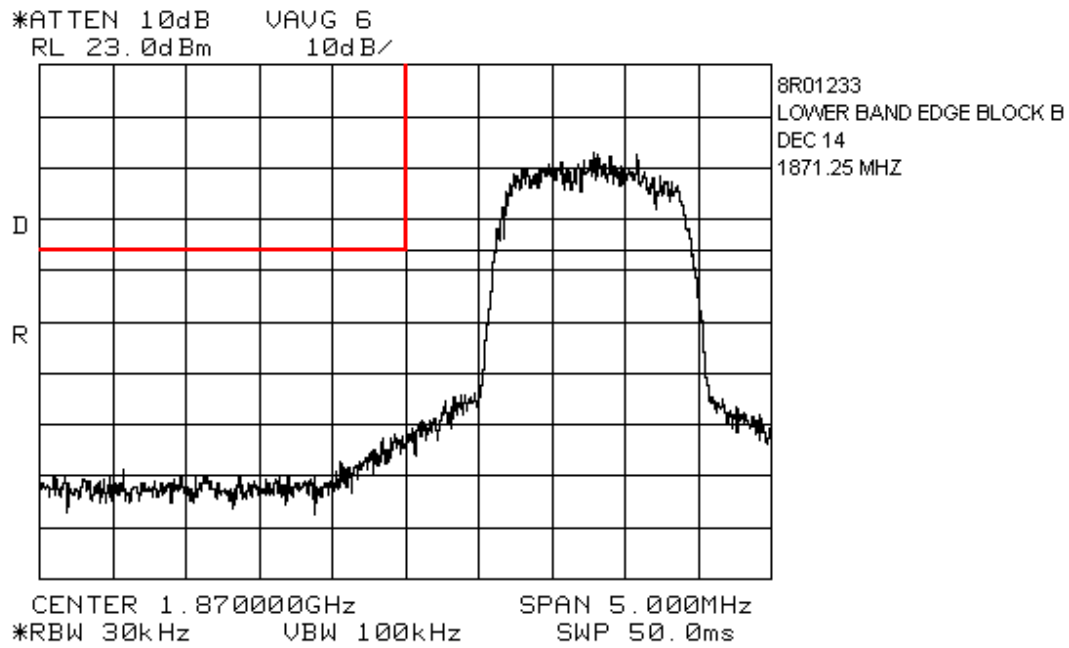
EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660



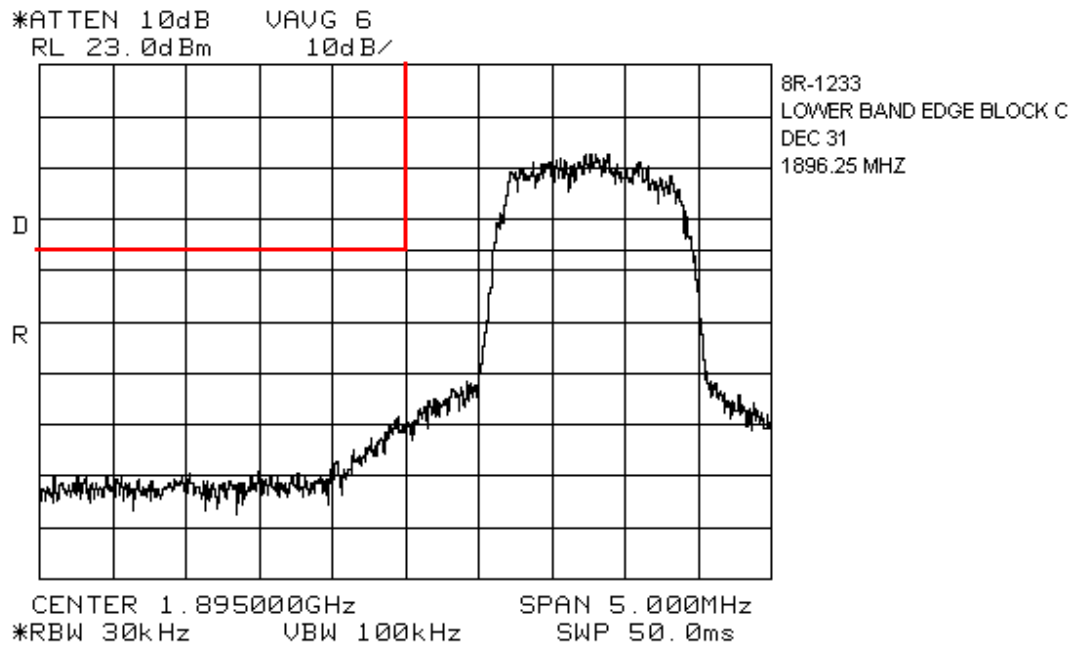
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FCC ID: IWDBDA48660



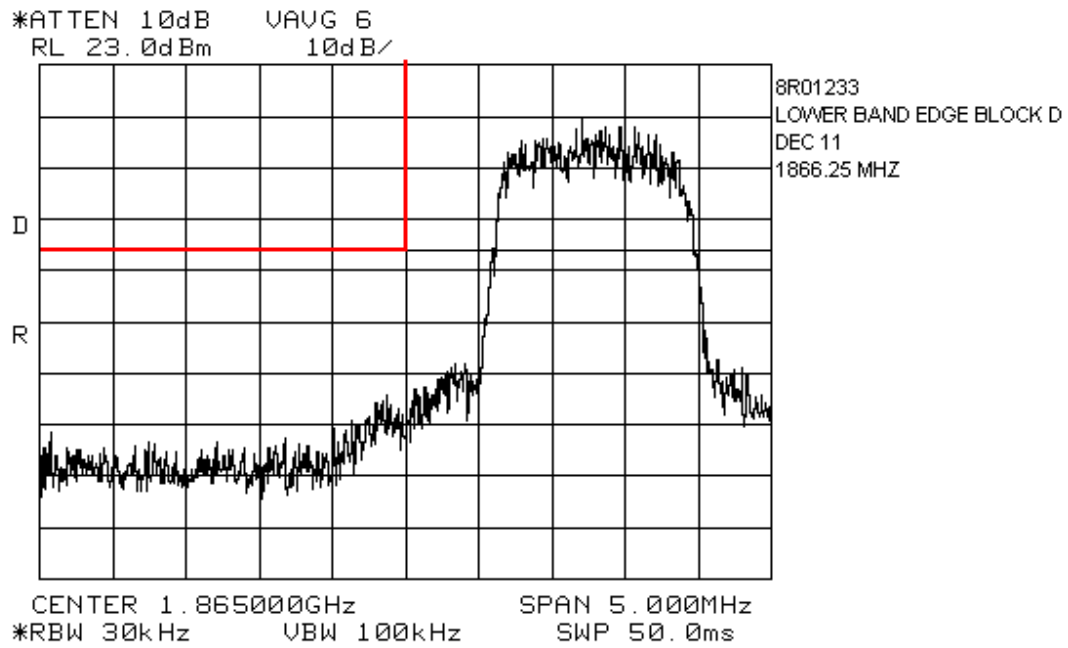
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FCC ID: IWDBDA48660



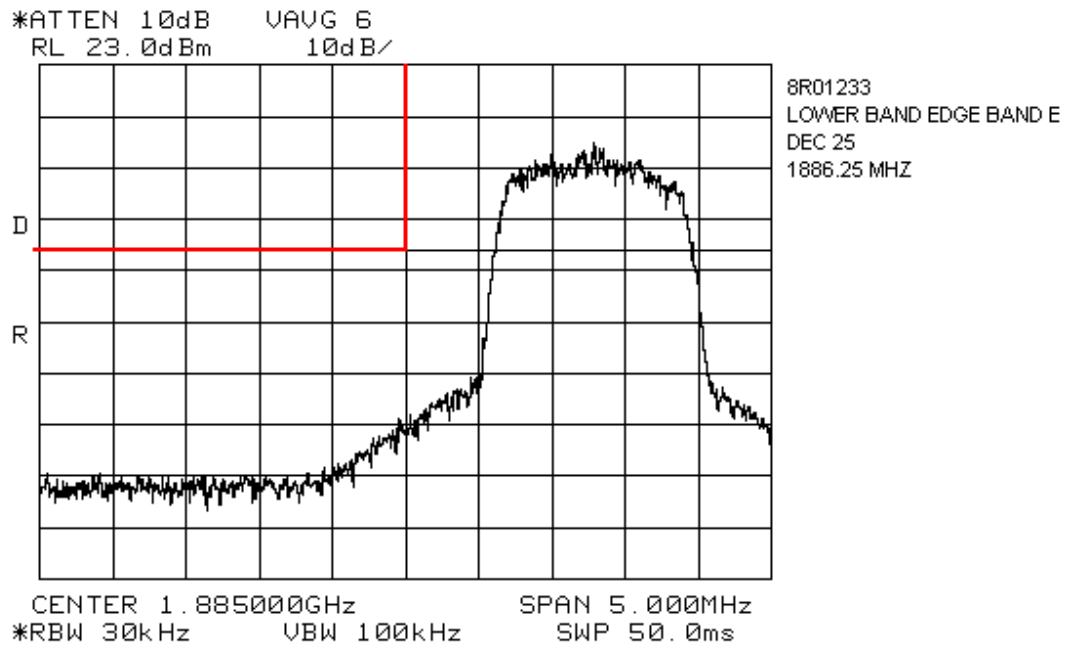
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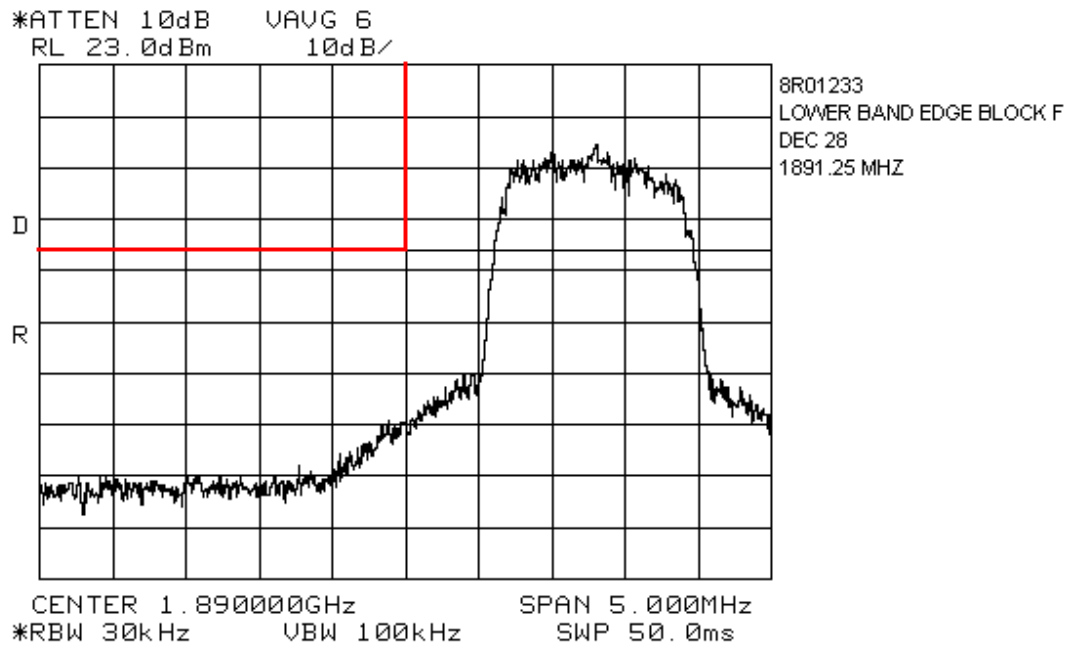
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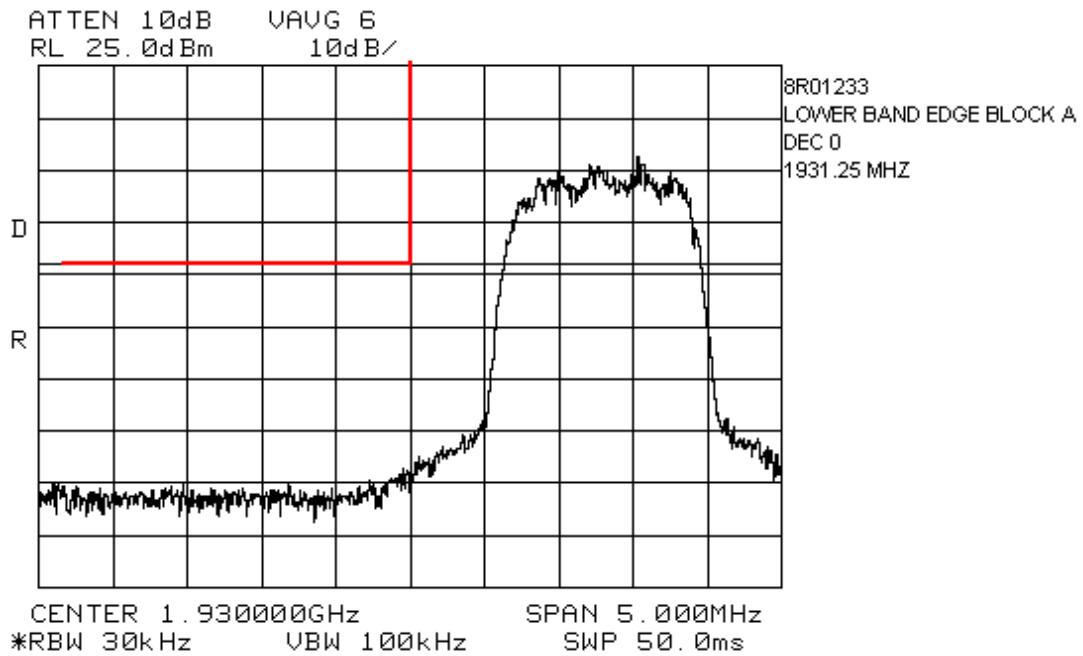
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FCC ID: IWDBDA48660



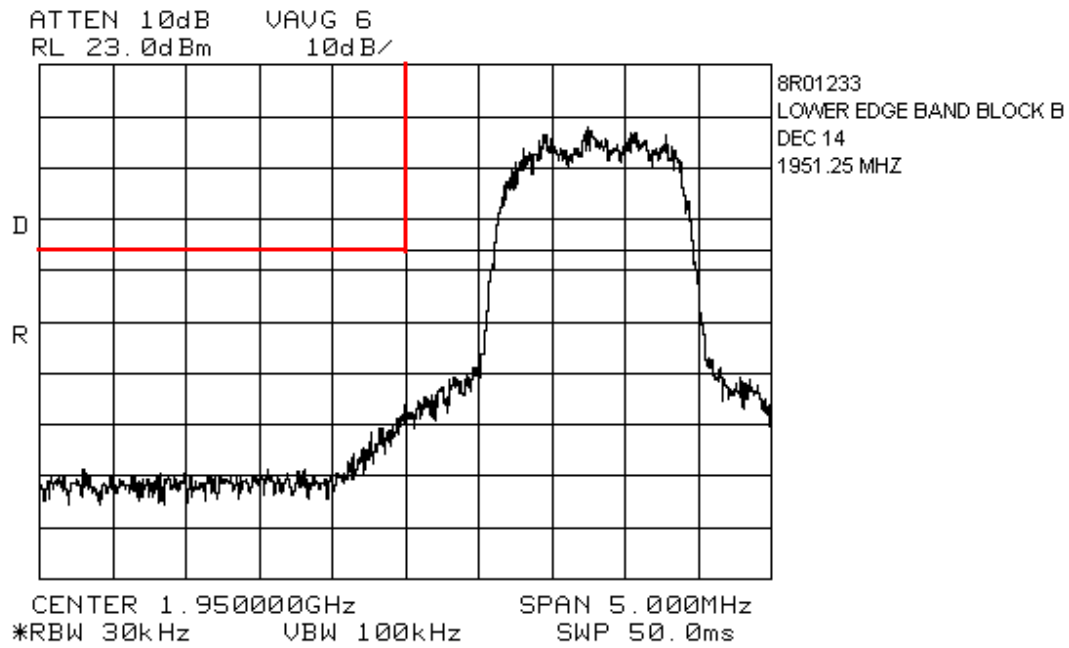
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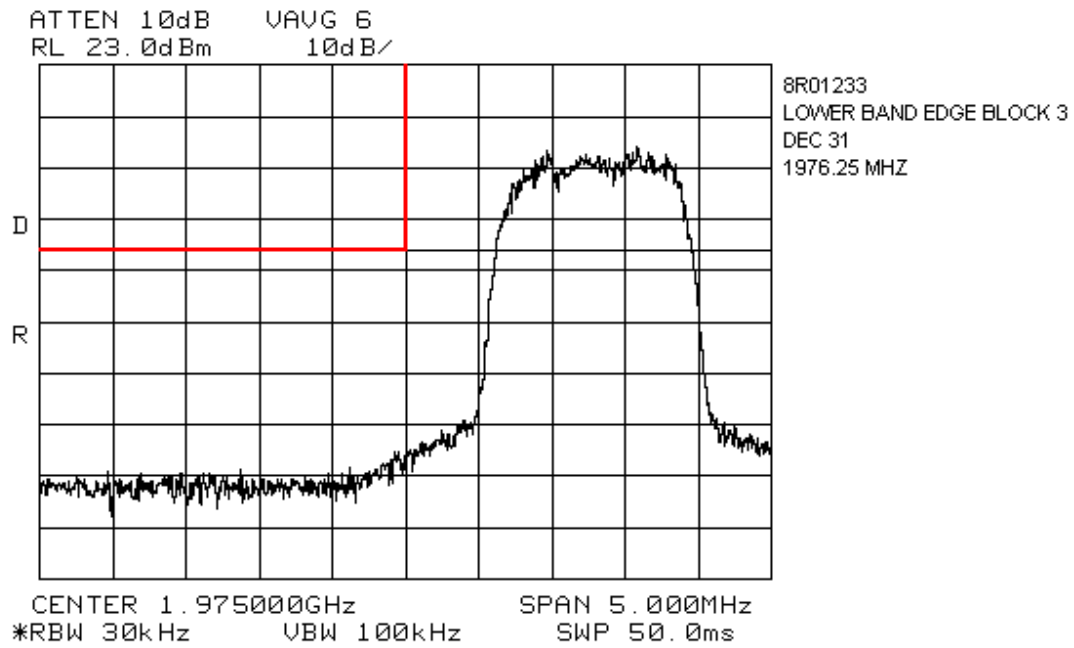
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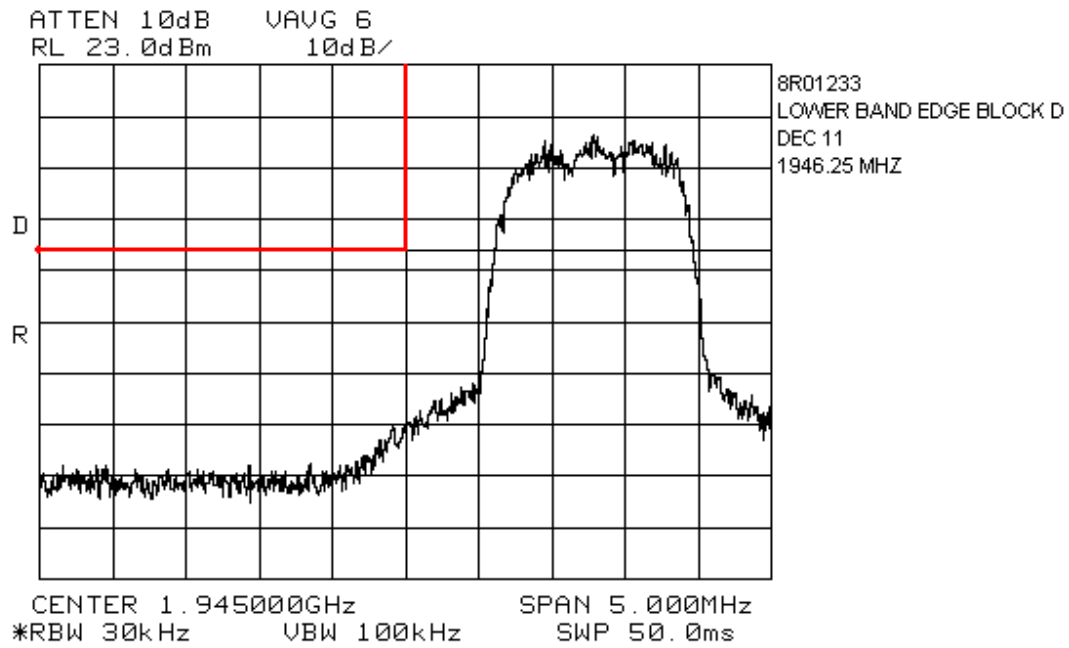
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FCC ID: IWDBDA48660



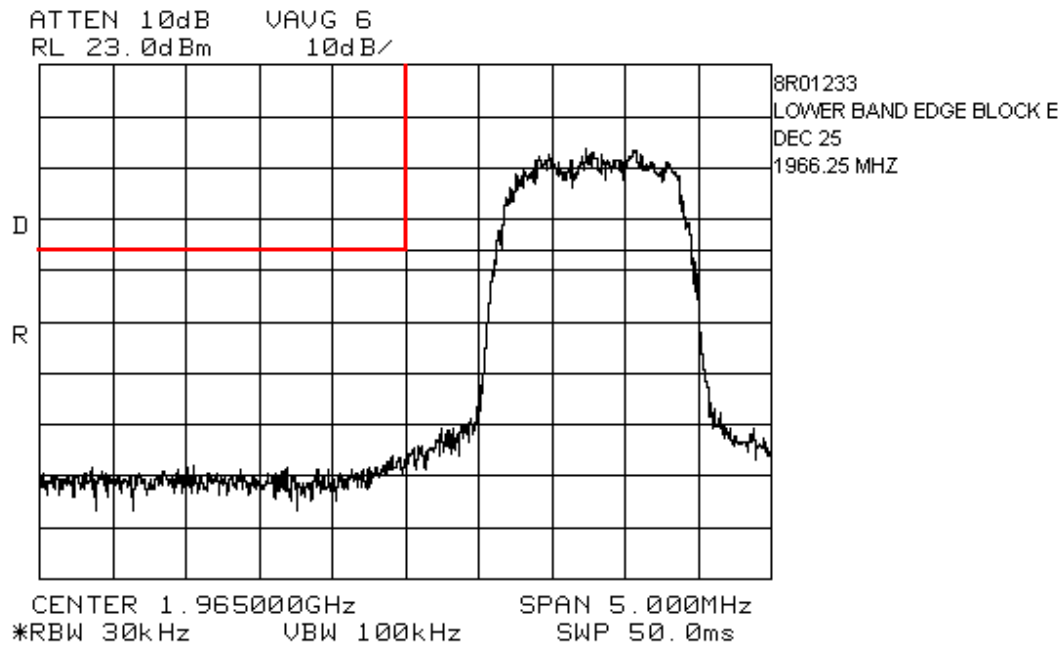
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FCC ID: IWDBDA48660



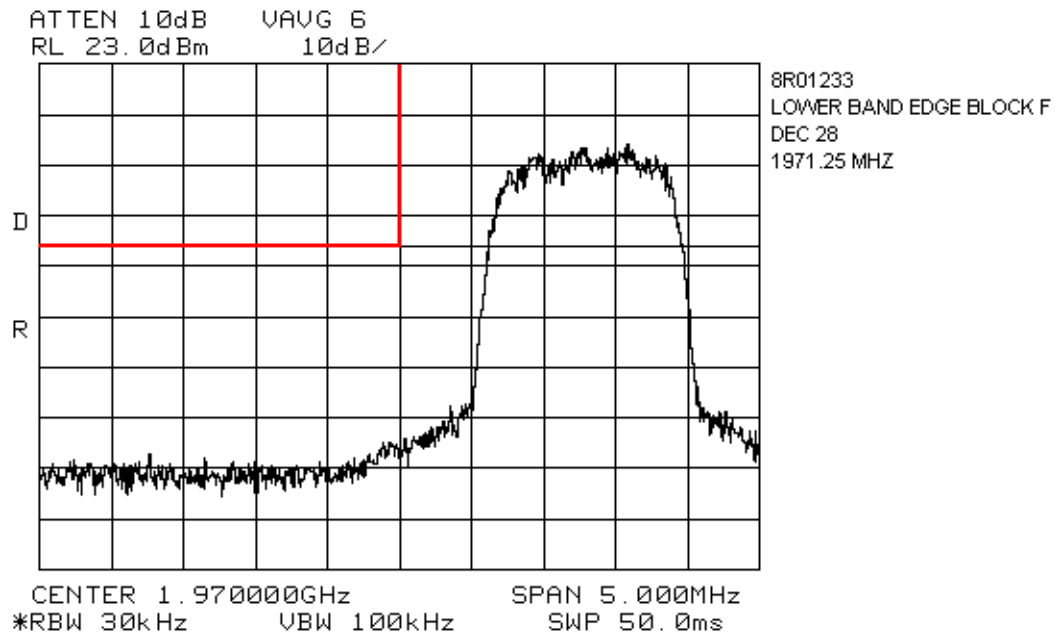
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FCC ID: IWDBDA48660



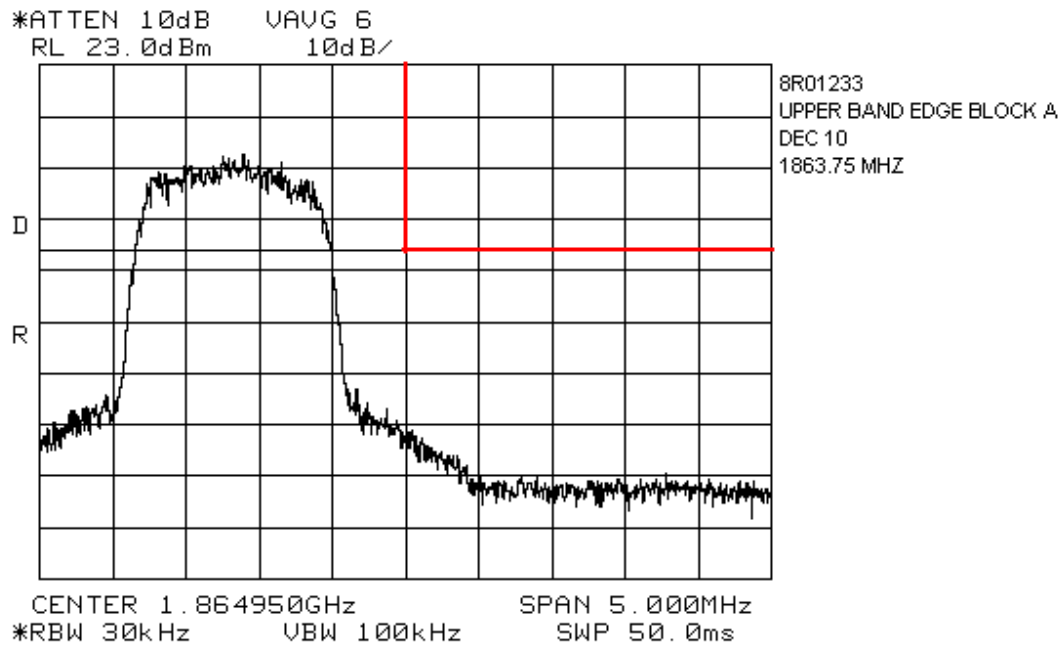
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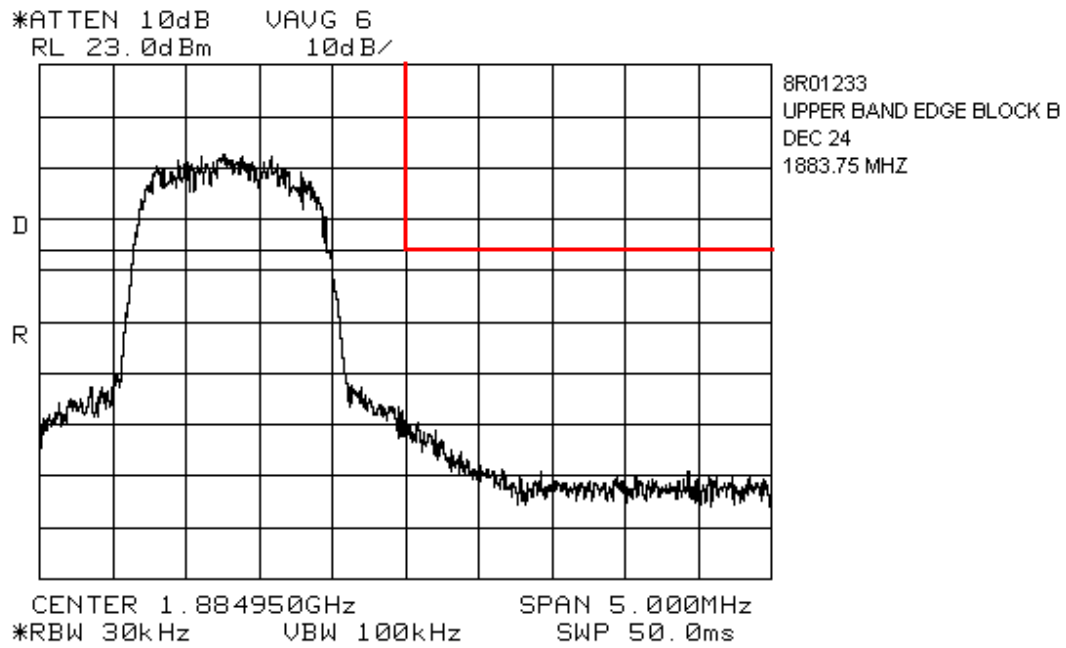
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FCC ID: IWDBDA48660



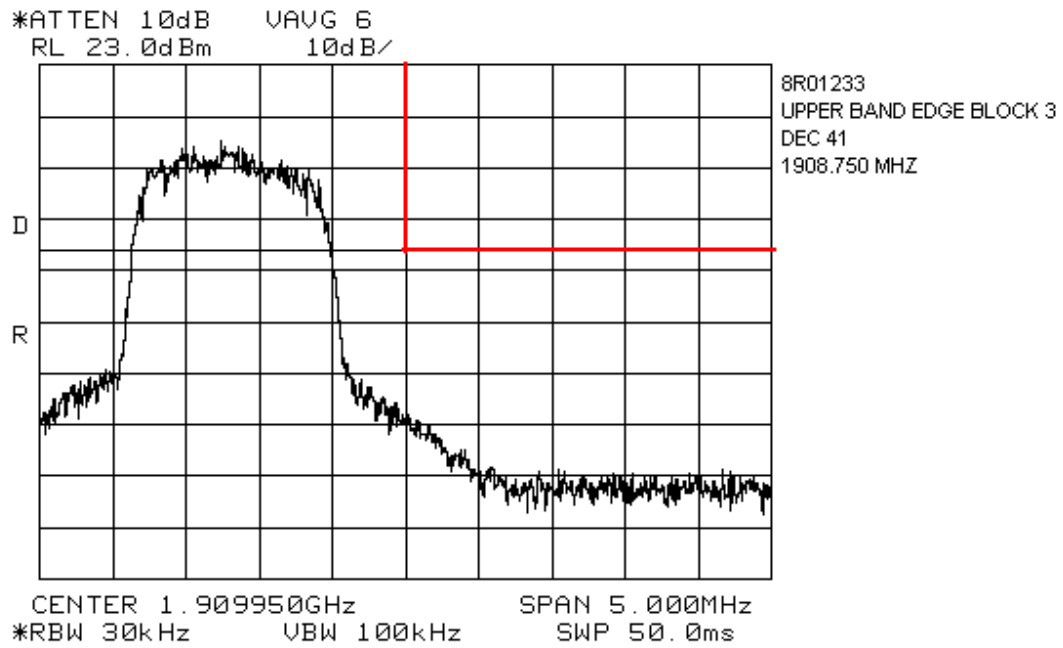
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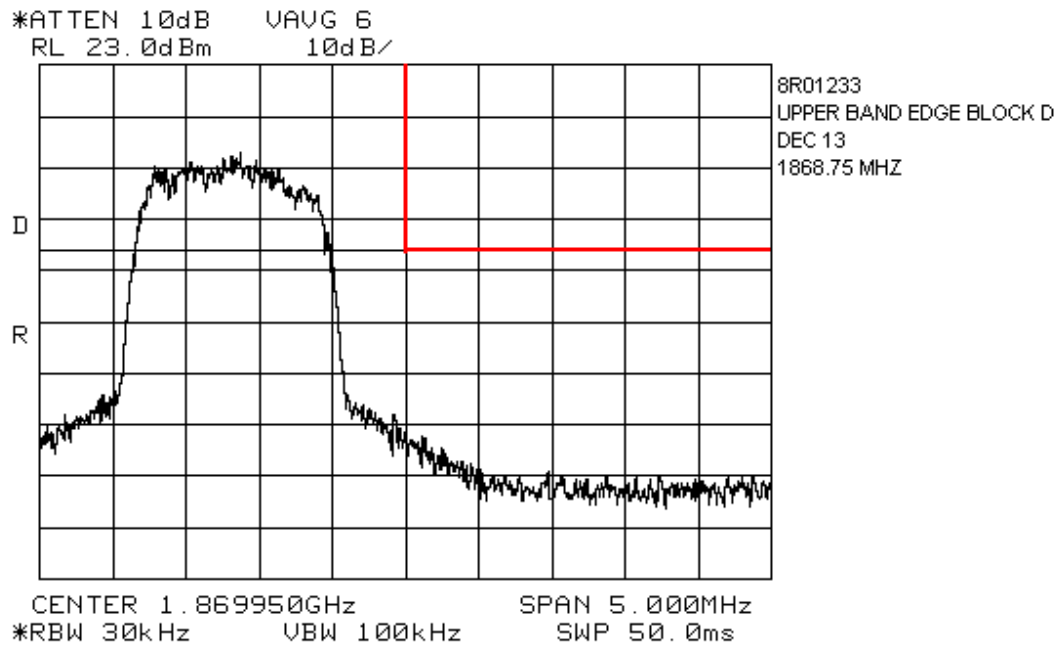
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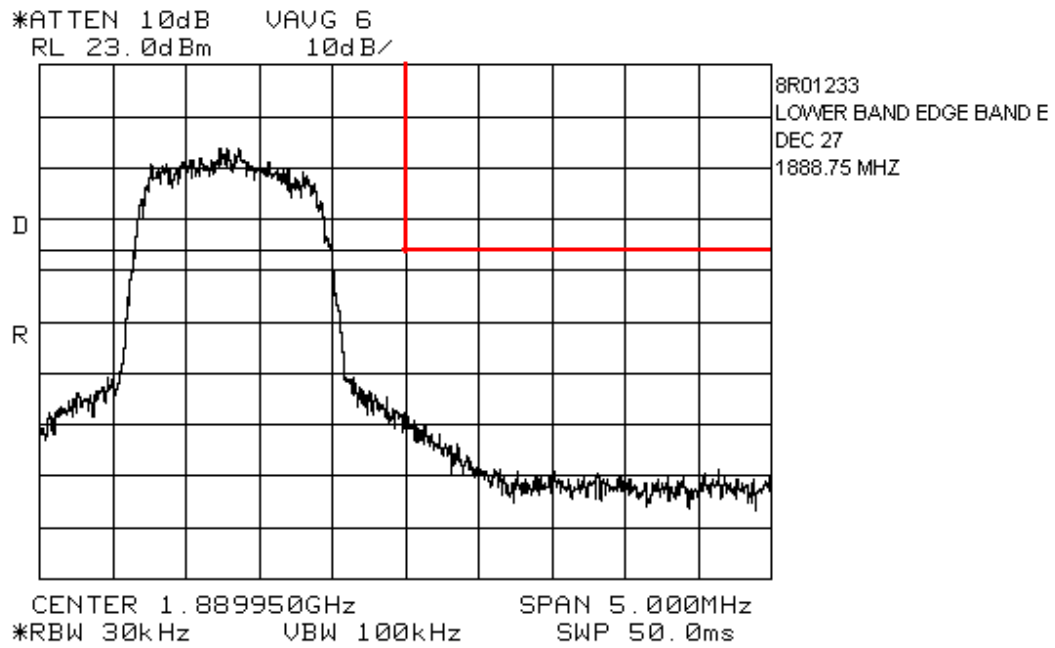
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FCC ID: IWDBDA48660



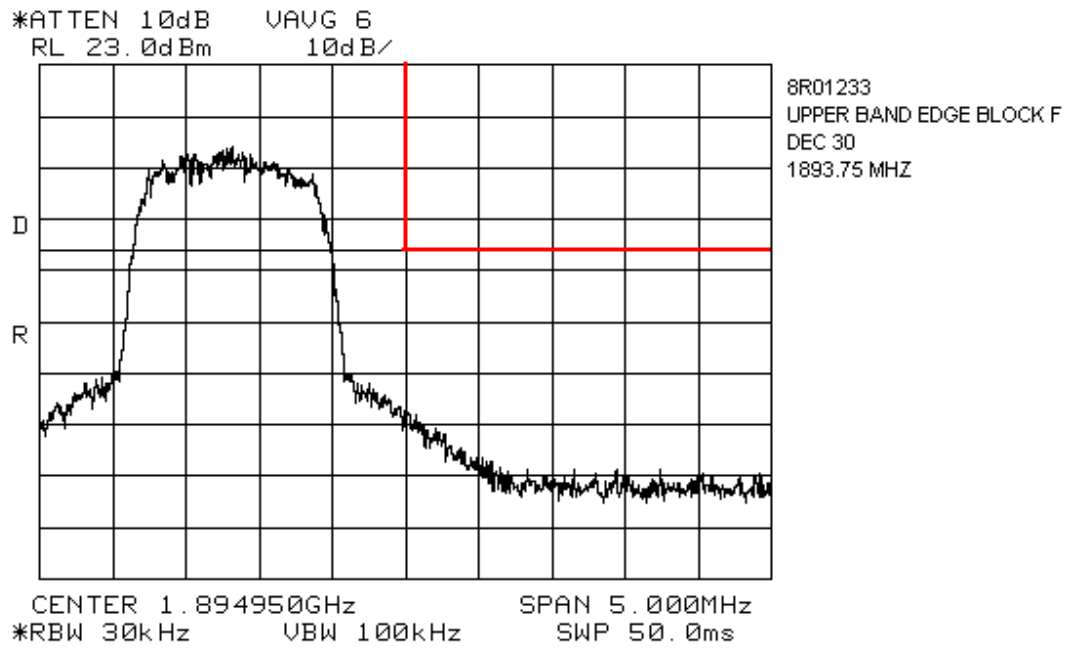
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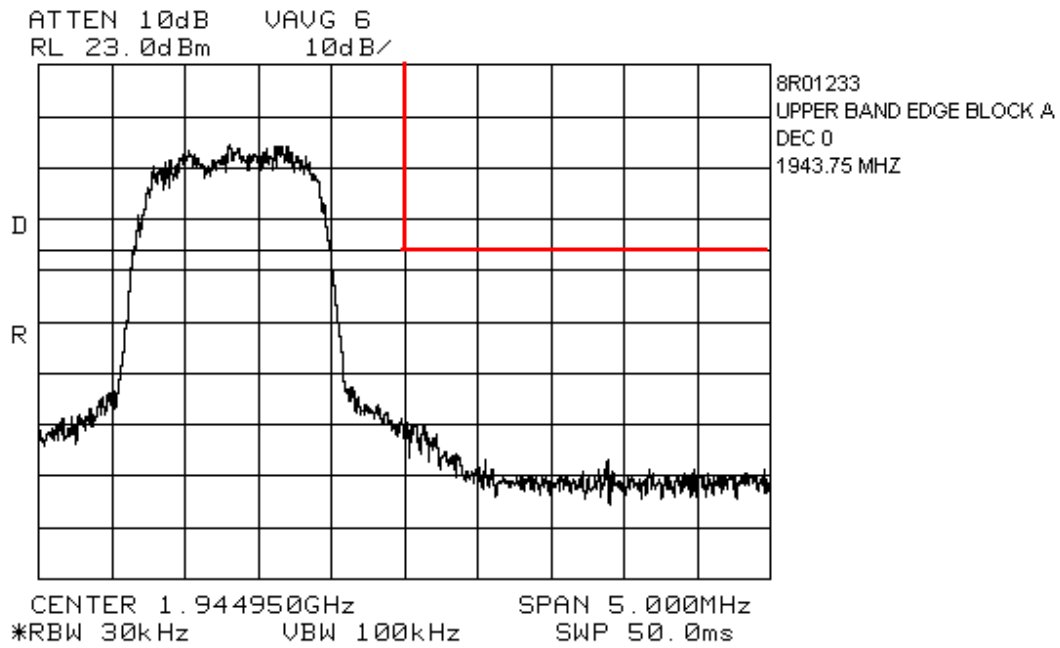
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FCC ID: IWDBDA48660



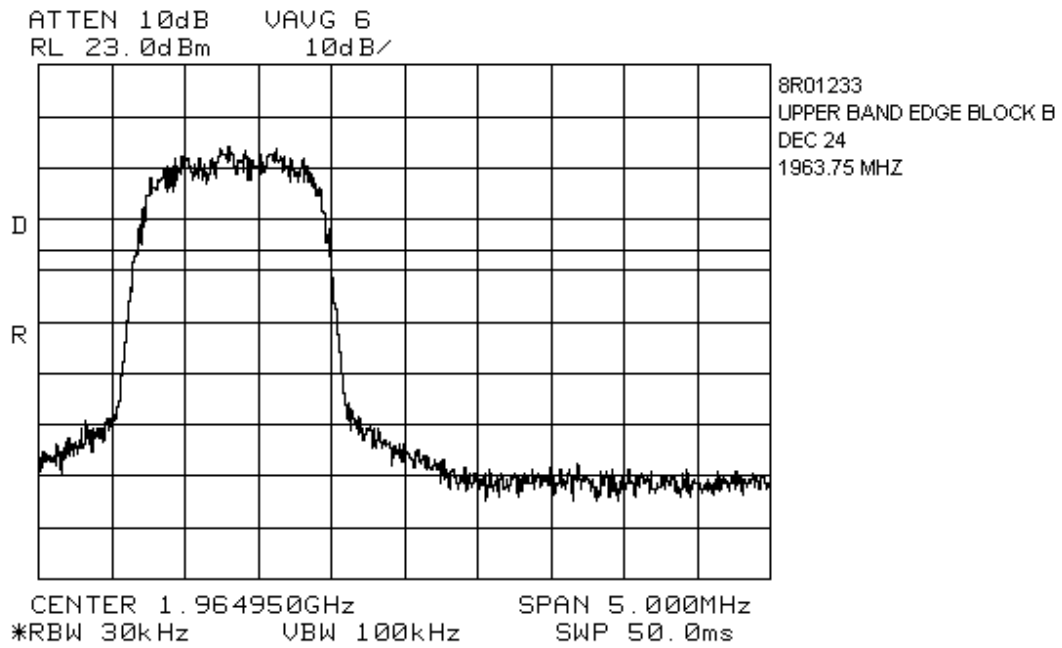
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FCC ID: IWDBDA48660



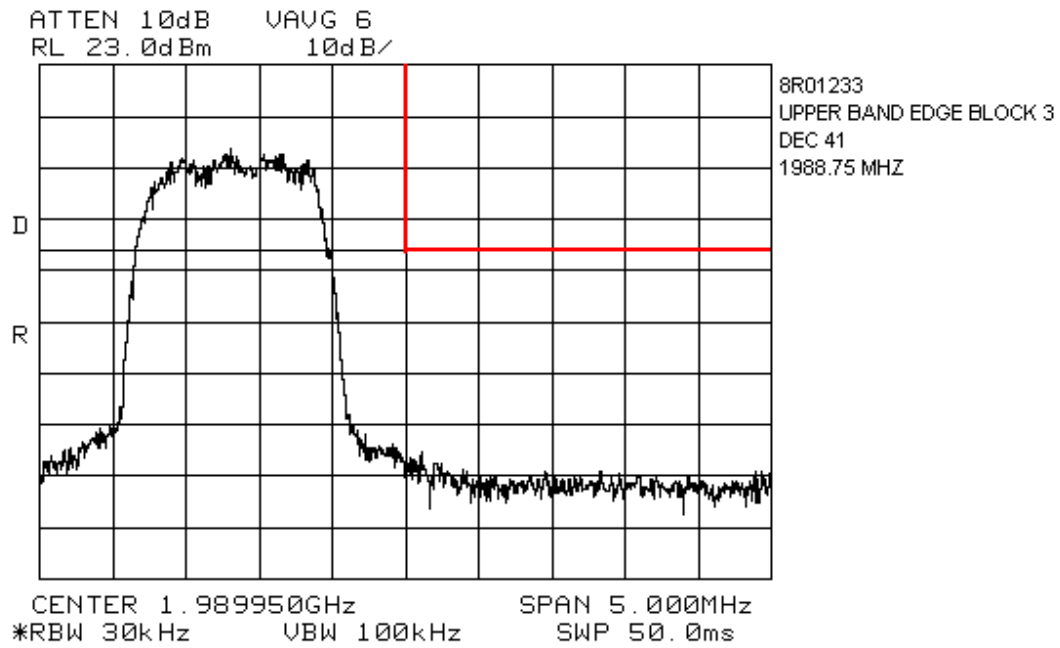
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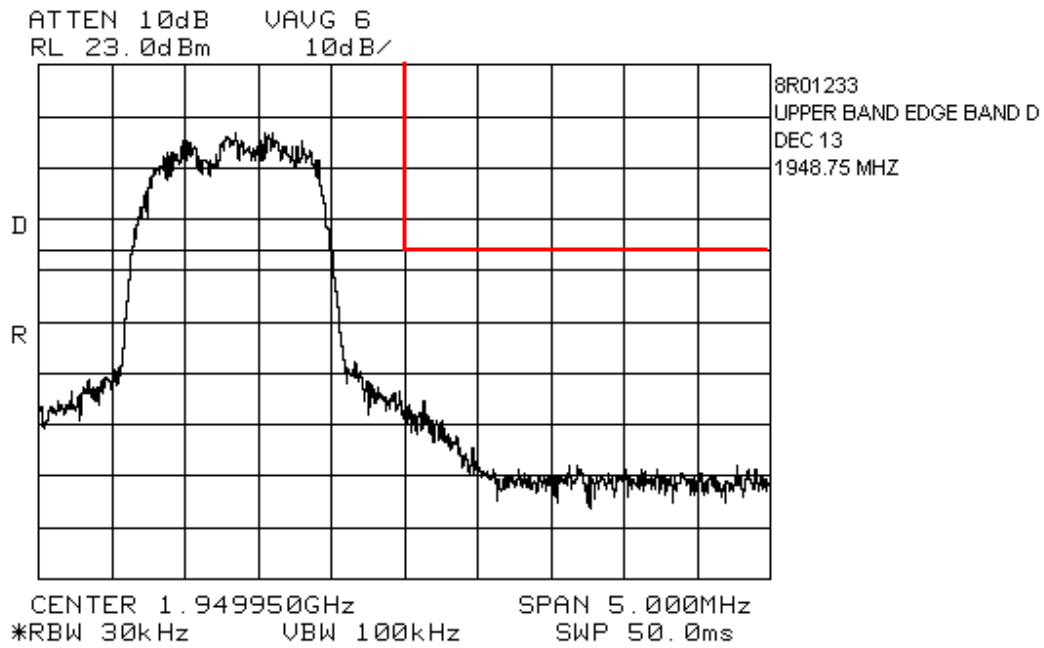
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FCC ID: IWDBDA48660



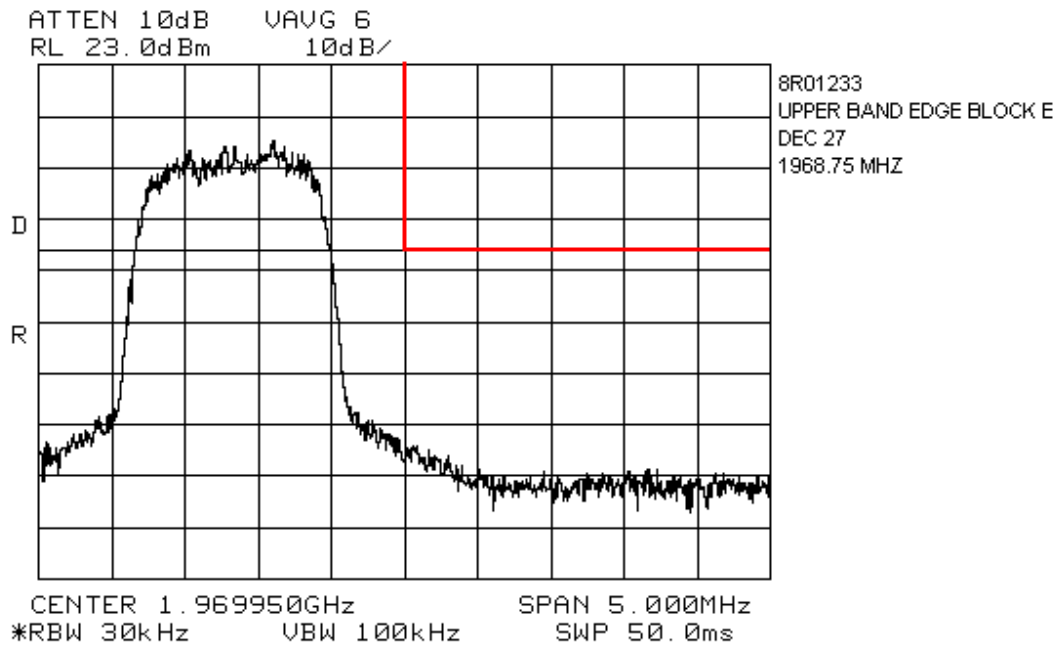
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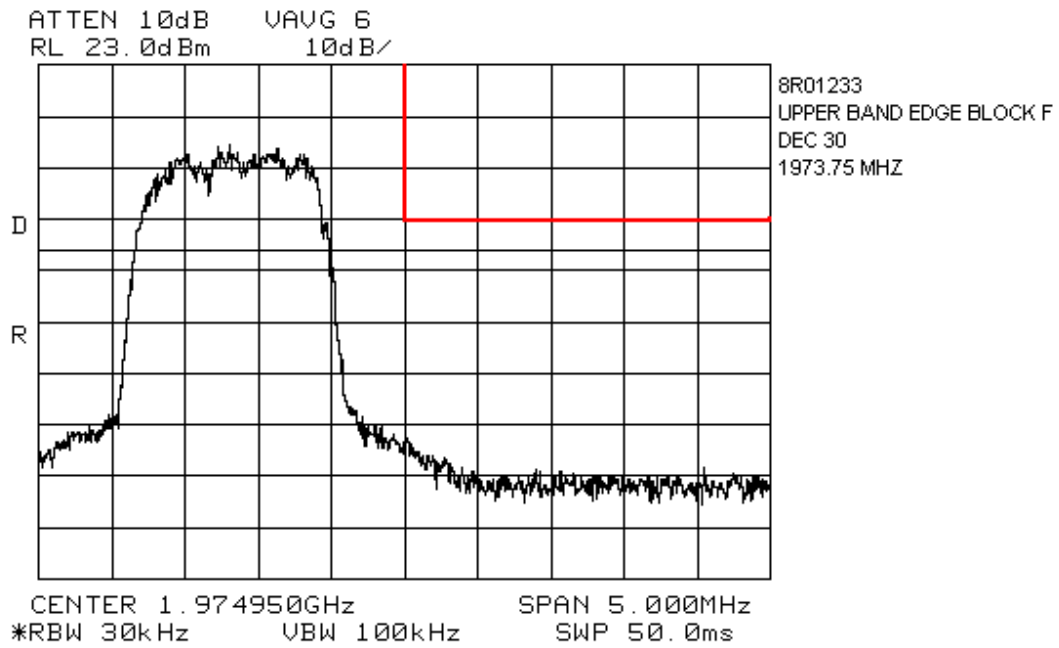
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FCC ID: IWDBDA48660

Section 6. Field Strength of Spurious

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.917(e)
TESTED BY: Wayne Clarke	DATE: March 23, 1999

Test Results: Complies. There were no emissions detected within 20 dB of the
82.3 dB μ V/m limit.

Test Data:

FCC ID: IWDBDA48660

Test Data - Radiated Emissions – Uplink

[illegible]

FCC ID: IWDBDA48660

Test Data - Radiated Emissions – Downlink

[illegible]

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Photographs of Test Setup

Front View



Rear View



EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 24.235
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.

Measurement Data: Standard Test Frequency _____ MHz
 Standard Test Voltage _____ Vdc

NOT APPLICABLE

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Section 8. Test Equipment List

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	May 20/98	May 20/99	
	Plotter	Hewlett Packard	7470A	2308A30807	NCR	NCR	
1 Year	Spectrum Analyzer-1	Hewlett Packard	8566B	2311A02238	Oct. 22/98	Oct. 22/99	
1 Year	Spectrum Analyzer Display-1	Hewlett Packard	8566B	2314A04759	Oct. 22/98	Oct. 22/99	
1 Year	Quasi-peak adapter-1	Hewlett-Packard	85650A	2043A00302	Oct. 22/98	Oct. 22/99	
1 Year	RF Millivoltmeter	Rohde & Schwarz	URV5	FA000420	July 23/98	July 23/99	
1 Year	Insertion Unit	Rohde & Schwarz	URV5-Z4	FA000905	July 23/98	July 23/99	
1 Year	LISN	Rohde & Schwarz	ESH2-Z5	890485/017	July 23/98	July 23/99	
1 Year	LISN(peripheral)	Tegam	95300-50	T-109014/15	July 24/98	July 24/99	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	

NA: Not Applicable
NCR: No Cal Required

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

ANNEX A
TEST METHODOLOGIES

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
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Minimum Standard:

Para. No.24.232. Base stations are limited to 1640 watts peak E.I.R.P. with an antenna height up to 300 meters HAAT. In no case may the peak output power of a base station transmitter exceed 100 watts.

Method Of Measurement:Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
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Minimum Standard:

Para. No. 24.238(b). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB.

Method Of Measurement:CDMA

Spectrum analyzer settings:

RBW: 30 kHz

VBW: $\geq$ RBW

Span: 5 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

GSM

RBW: 3 kHz

VBW: $\geq$ RBW

Span: 2 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

NADC

RBW: 1 kHz

VBW: $\geq$ RBW

Span: 1 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

NAME OF TEST: Spurious Emission at Antenna Terminals	PARA. NO.: 2.991
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Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Method Of Measurement:

Spectrum analyzer settings:

CDMA

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 30 kHz (< 1 MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: 6 Sweeps

GSM

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: Disabled

NADC

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: Disabled

To demonstrate compliance at band edges the frequency of the input signal is set to the lowest and highest assigned channel and the center frequency of the spectrum analyzer is set to the upper and lower edges of the appropriate frequency block.

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 2.993
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Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Calculation Of Field Strength Limit

An example of attenuation requirement of $43 + 10 \log P$ is equivalent to -13 dBm (5×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4\pi R^2 = E^2/120\pi$$

For emissions ≤ 1 GHz:

$G = 1.64$ (Dipole Gain)

$P = 10^{-5}$ Watts (Maximum spurious output power)

$R = 3\text{m}$ (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R}$$

$$E = \frac{\sqrt{30 \times 1.64 \times 5 \times 10^{-5}}}{3} = 0.016533 \text{ V / m} = 84.4 \text{ dB}\mu\text{V / m}$$

For emissions > 1 GHz:

$G = 1$ (Isotropic Gain)

$P = 1 \times 10^{-5}$ Watts (Maximum spurious output power)

$R = 3\text{m}$ (Measurement Distance)

$$E = 84.4 - 20 \log \sqrt{1.64} = 82.3 \text{ dB}\mu\text{V / m} @ 3\text{m}$$

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
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Minimum Standard: Para. No. 24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Method Of Measurement:

Frequency Stability With Voltage Variation

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the signal generator. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation

The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

KTL Ottawa

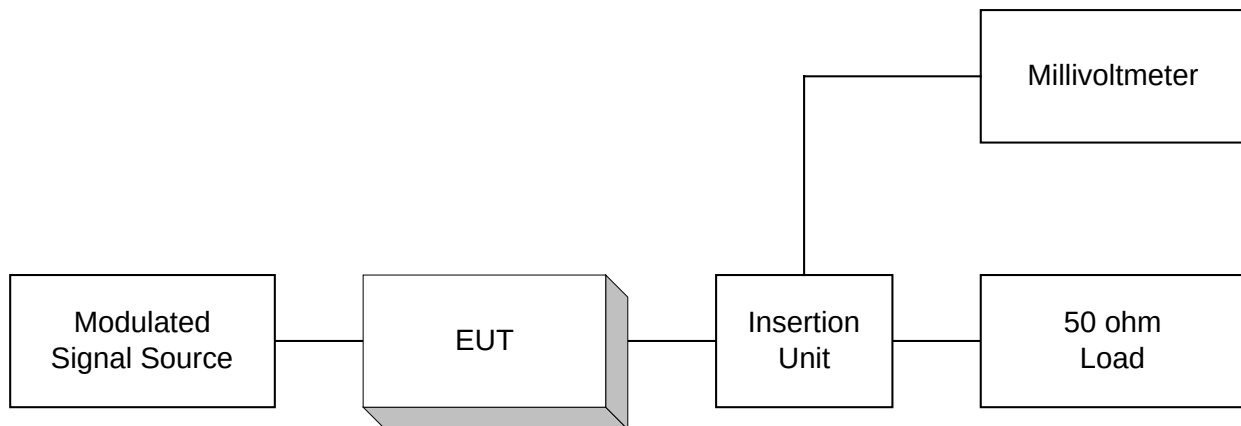
FCC PART 24, SUBPART E
BROADBAND PCS REPEATERS
PROJECT NO.: 8R01233
ANNEX B

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

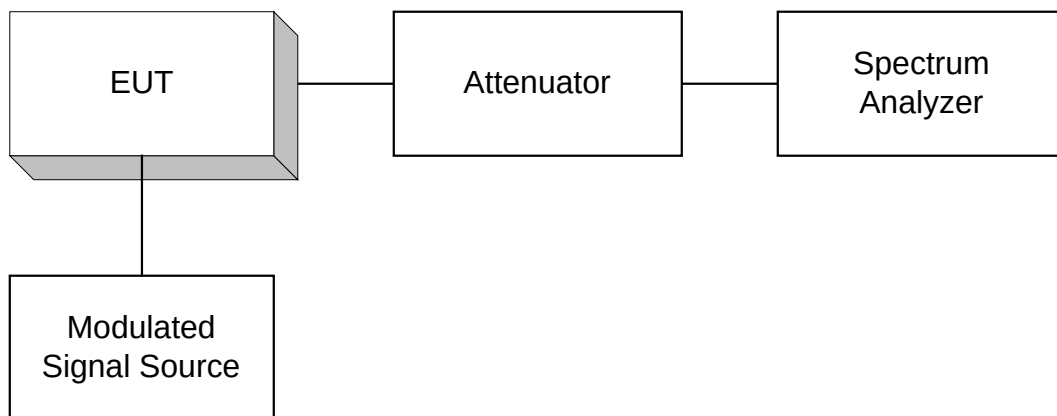
ANNEX B
TEST DIAGRAMS

EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Para. No. 2.985 - R.F. Power Output

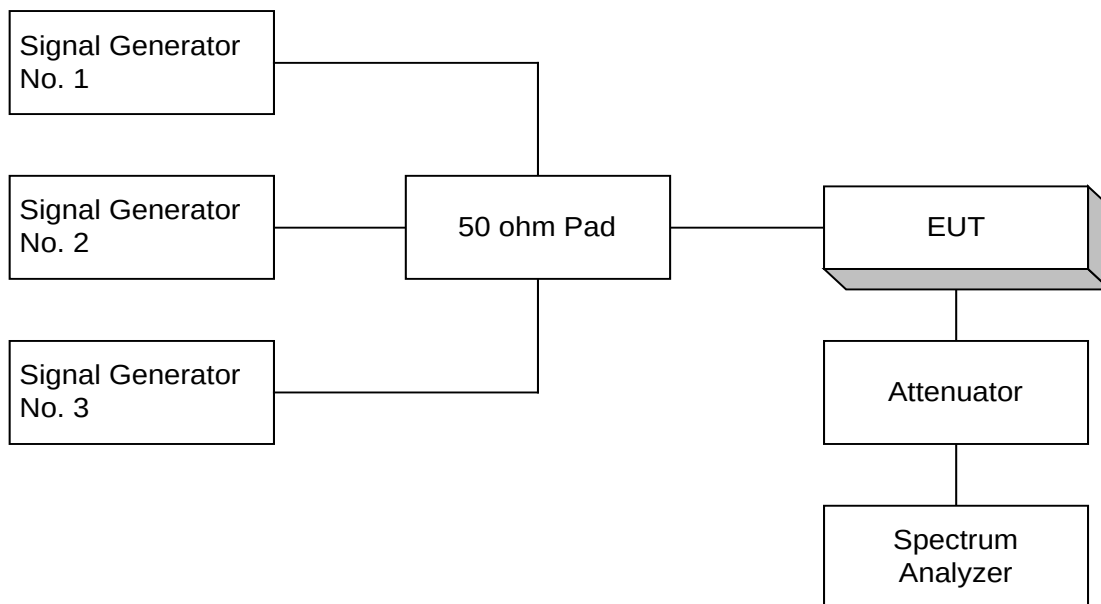
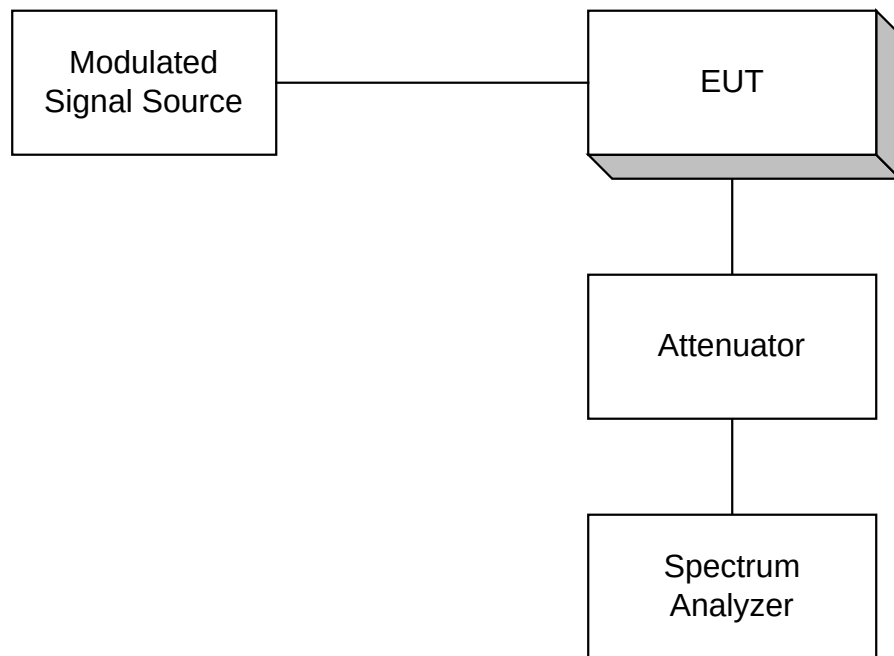


Para. No. 2.989 - Occupied Bandwidth



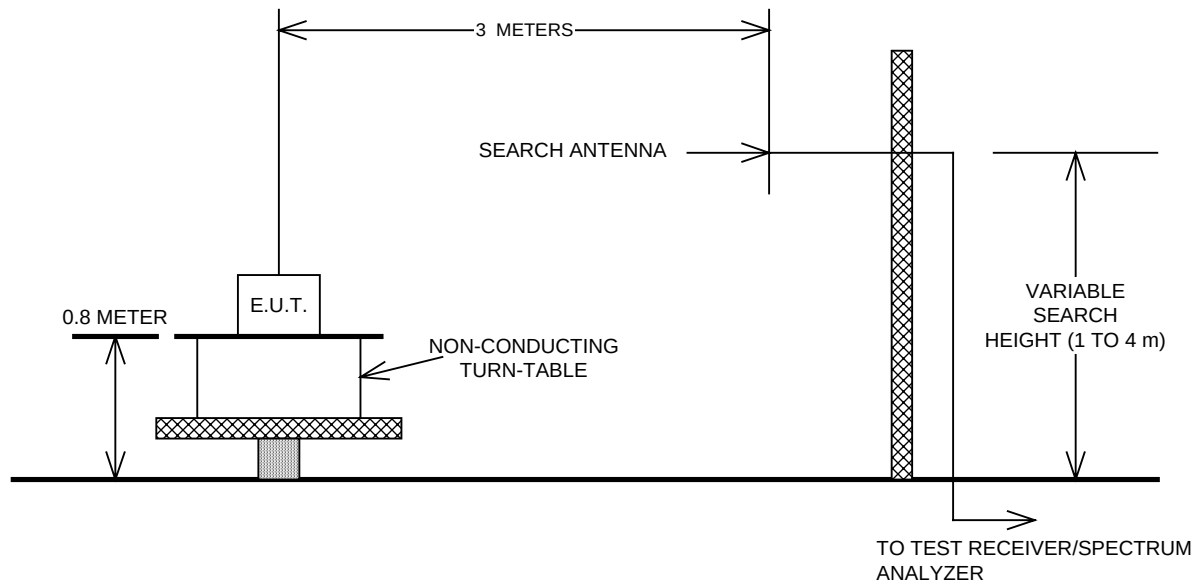
EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Para. No. 2.991 Spurious Emissions at Antenna Terminals



EQUIPMENT: Bi-Directional Amplifier CDMA Single Channel
FCC ID: IWDBDA48660

Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

