

KTL Ottawa

Safety - EMI - Telecom - ISO Guide 25

ENGINEERING TEST REPORT

ON:

**THE COM DEV PHASE GROUP WIRELESS SYSTEMS
"INDOOR DISTRIBUTION SYSTEM DIRECT MODEM"**

FCC ID: N2F102136

**IN ACCORDANCE WITH:
FCC PART 24, SUBPART E
BROADBAND PCS REPEATERS**

PROJECT NO.: 8R00086

TESTED FOR:

COM DEV PHASE GROUP WIRELESS SYSTEMS
30 MACNAUGHTON AVENUE
MONCTON, N.B.
E1H 2R6

TESTED BY:

KTL OTTAWA INC.
3325 RIVER ROAD, R.R. 5
OTTAWA, ONTARIO K1V 1H2



NVLAP LAB CODE: 100351-0

MAY 1998

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This report applies only to the items tested.

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- R.F. Power Output
- Occupied Bandwidth
- Spurious Emissions at Antenna Terminals
- Field Strength of Spurious
- Frequency Stability

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Section 1. Summary of Test Results

Manufacturer: COM DEV Phase Group Wireless Systems

Model No.:	BSR	Model No.:	102011	Serial No.:	QUAL 9805001
	LE		102000		QUAL 9805002
	SPL		102023		QUAL 9805002

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

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: _____
Kevin Carr, Technologist

TECHNICAL REVIEW: _____ DATE: _____
Tom Tidwell, Technologist

APPROVED BY: _____ DATE: _____
W. Waterhouse, RF Engineering Lab Manager

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	24.232	100W	0.170 mW	Complies
Occupied Bandwidth (CDMA)	24.238	Input/Output	Plots	Complies
Occupied Bandwidth (GSM)	24.238	Input/Output	Plots	Complies
Occupied Bandwidth (NADC)	24.238	Input/Output	Plots	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	Plots	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	Chart	Complies
Frequency Stability	24.235	N/A	N/A	N/A

Footnotes For N/A's: The E.U.T. contains common ref. for up/down conversions.

Test Conditions: Temperature: 23 °C
Humidity: 30 %

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Section 2. General Equipment Specification

Supply Voltage Input:		120 VAC, 60 Hz		
Frequency Range:	Downlink:	1930.0 to 1944.95 MHz		
Frequency Range:	Uplink:	Not Applicable		
20 dB Bandwidth:		Not Applicable		
Type of Modulation and Designator:		CDMA (F9W) <input checked="" type="checkbox"/>	GSM (GXW) <input checked="" type="checkbox"/>	NADC (DXW) <input checked="" type="checkbox"/>
AGC Threshold:		Not Applicable		
Output Impedance:		50 ohm		
Gain:		-12 (Nominal)		
Max Input Power:		30 dBm		
RF Output (Rated):		23.7 dBm		
	Single:	23.7 dBm		
	Composite:	20.7 dBm / 2 Channel		
Frequency Translation:		F1-F1 <input checked="" type="checkbox"/>	F1-F2 <input type="checkbox"/>	N/A <input type="checkbox"/>
Band Selection:		Software <input type="checkbox"/>	Duplexer Change <input checked="" type="checkbox"/>	Fullband Coverage <input checked="" type="checkbox"/>

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Description of Modifications For Class II Permissive Change

NOT APPLICABLE

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Modifications Made During Testing

NOT APPLICABLE

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

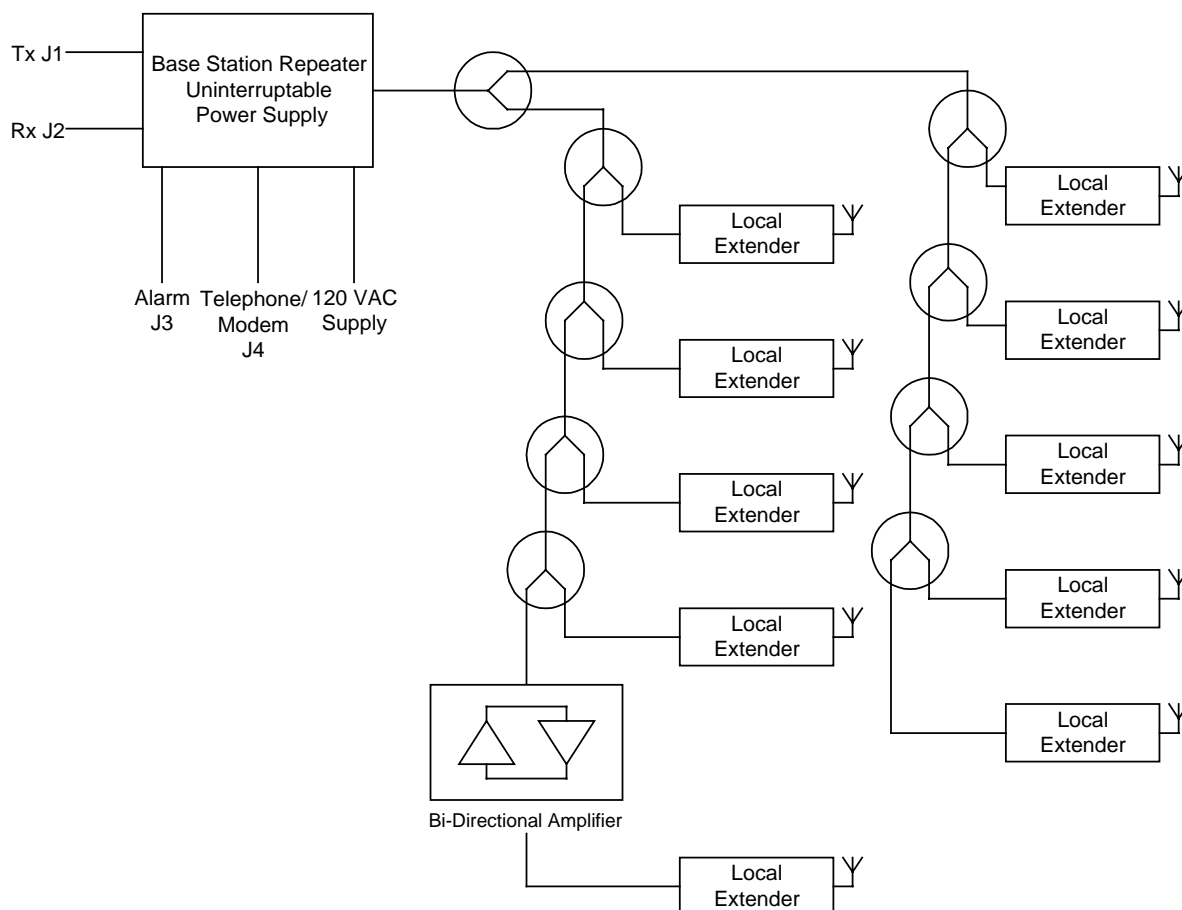
Theory of Operation

The BSR is an indoor bi-directional repeater, designed to provide solutions to building penetration losses. The uplink is hardwired to the base station. Each indoor distribution system is composed of a base station repeater, incorporating IF conversion, RF transmission, alarm controller electronics and a number of local extenders; incorporating IF conversion, amplification and antennae. The BSR system also includes a battery back-up system.

Application Specific Test Set-Up

For ease of testing the Passive 30 dB antenna was removed so the maximum I/P signal could be applied to the E.U.T. The uplink path was not tested because it is hardwired to the base station.

System Diagram



EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

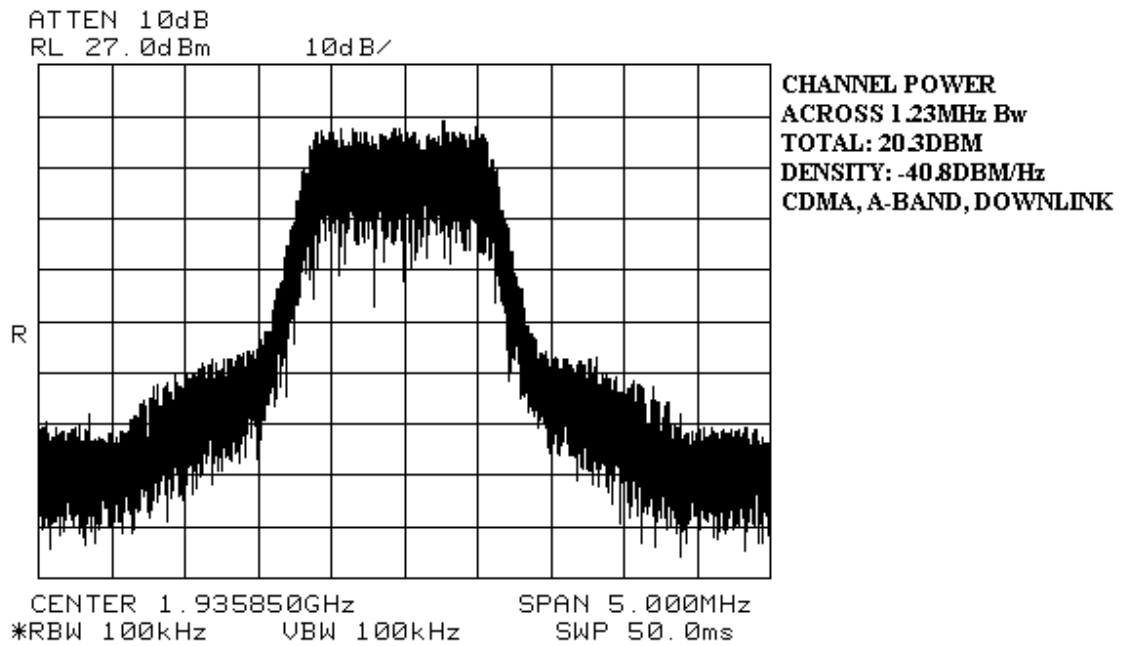
Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Kevin Carr	DATE: May 29, 1998

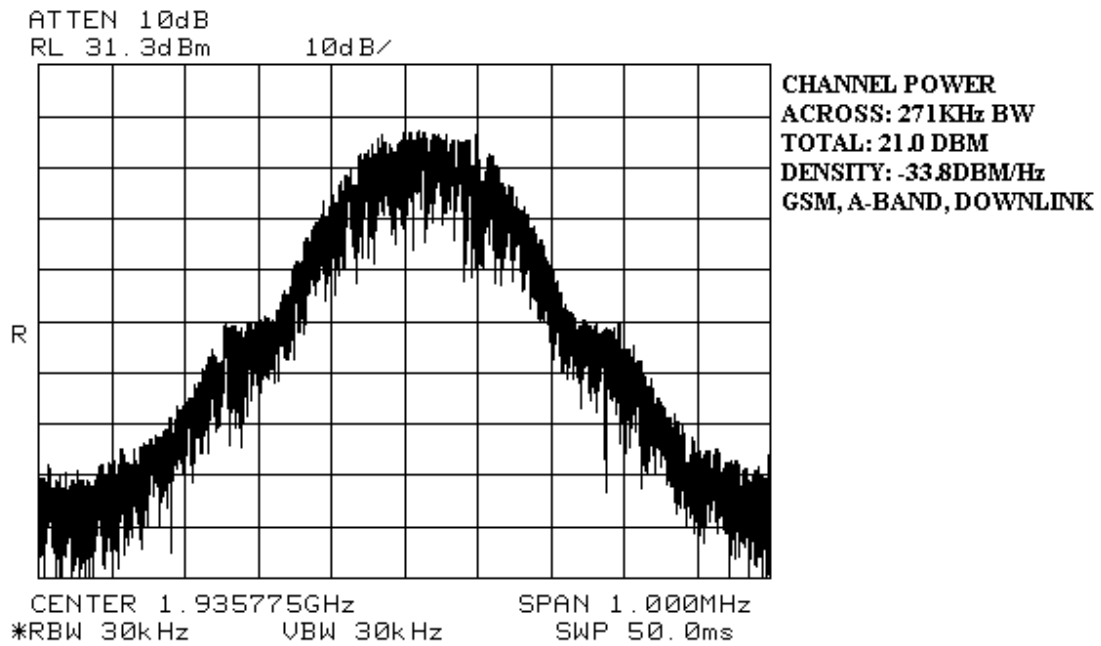
Test Results: Complies.**Measurement Data:**

	Modulation Type	Per Channel Output Power (dBm)	Composite Output Power (dBm)
Uplink	CDMA	N/A	N/A
Downlink	CDMA	20.3 / 2 Channel	23.3
Uplink	GSM	N/A	N/A
Downlink	GSM	20.0 / 2 Channel	23.0
Uplink	NADC	N/A	N/A
Downlink	NADC	20.7 / 2 Channel	23.7

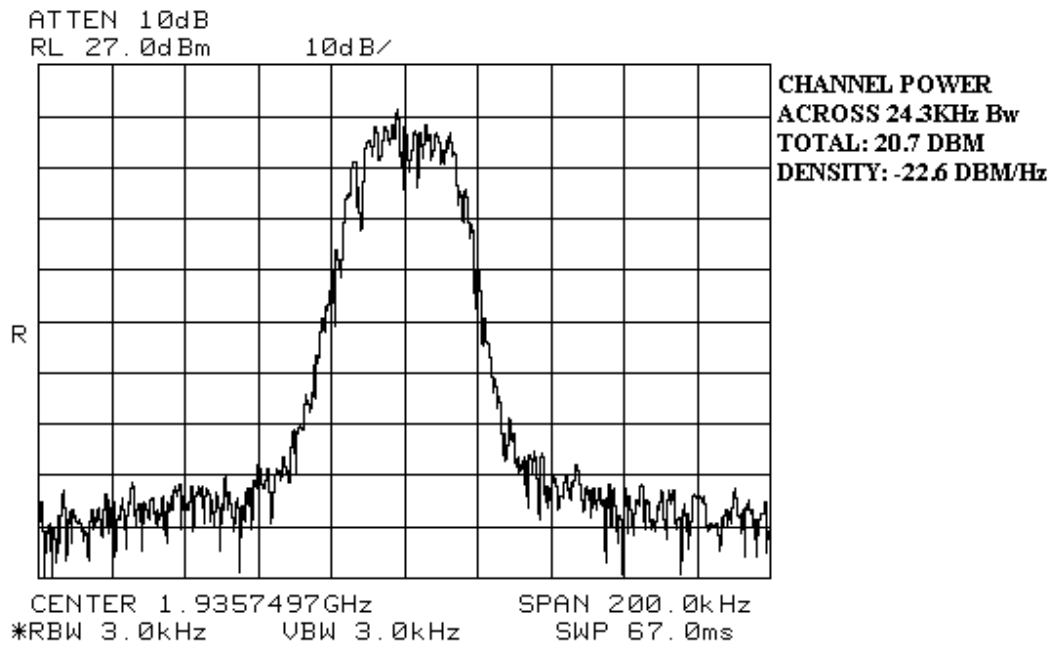
EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136



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FCC ID: N2F102136

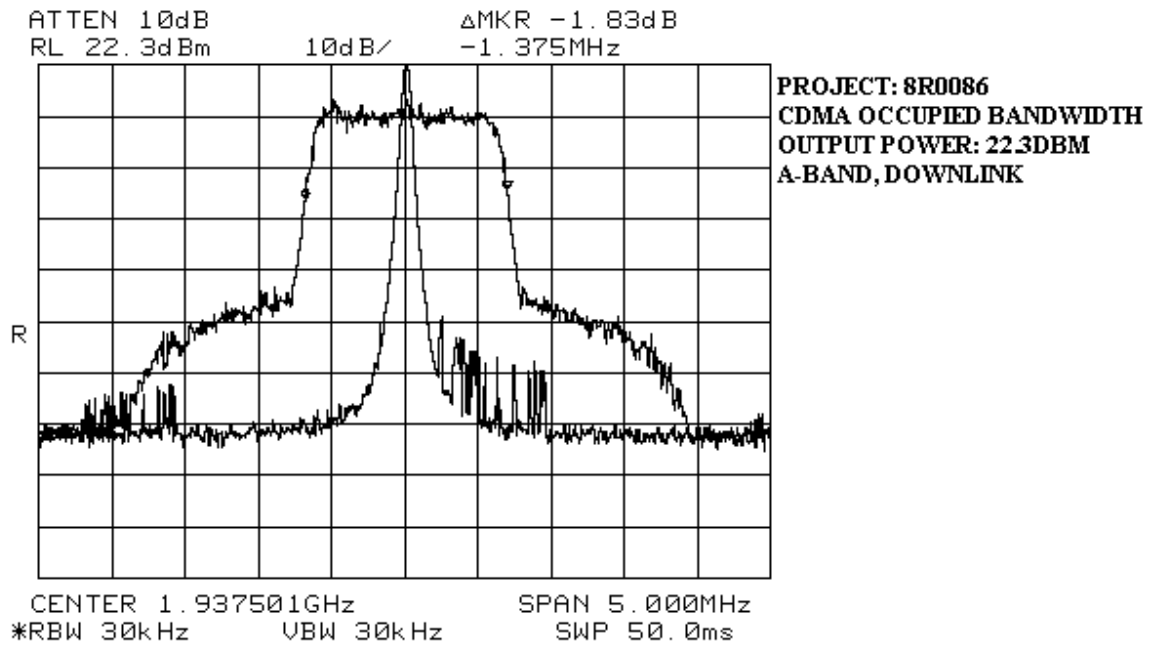
Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth (CDMA)	PARA. NO.: 2.917(c)
TESTED BY: Kevin Carr	DATE: May 29, 1998

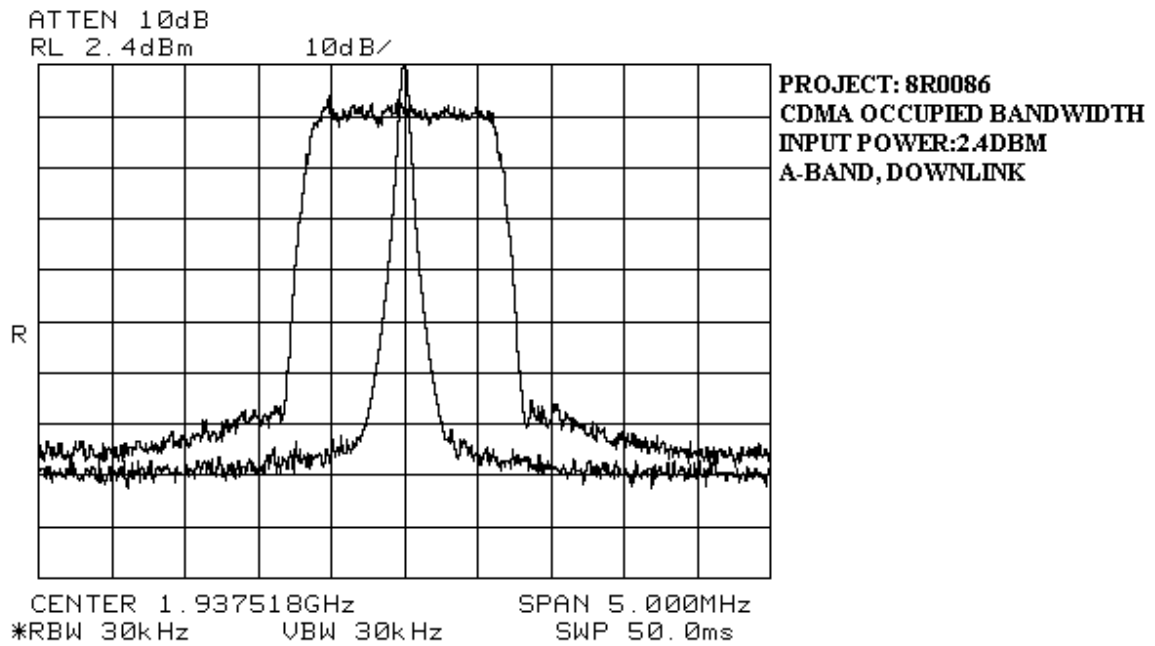
Test Results: Complies.

Test Data: See attached graph(s).

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136



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FCC ID: N2F102136



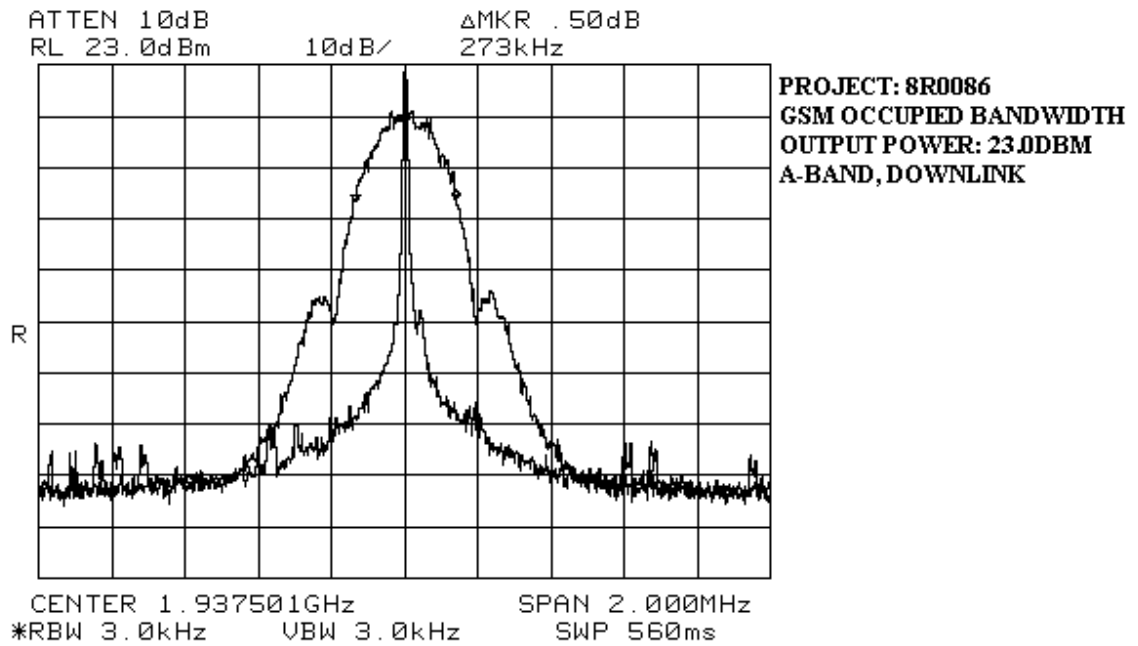
EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

NAME OF TEST: Occupied Bandwidth (GSM)	PARA. NO.: 2.917(c)
TESTED BY: Kevin Carr	DATE: May 29, 1998

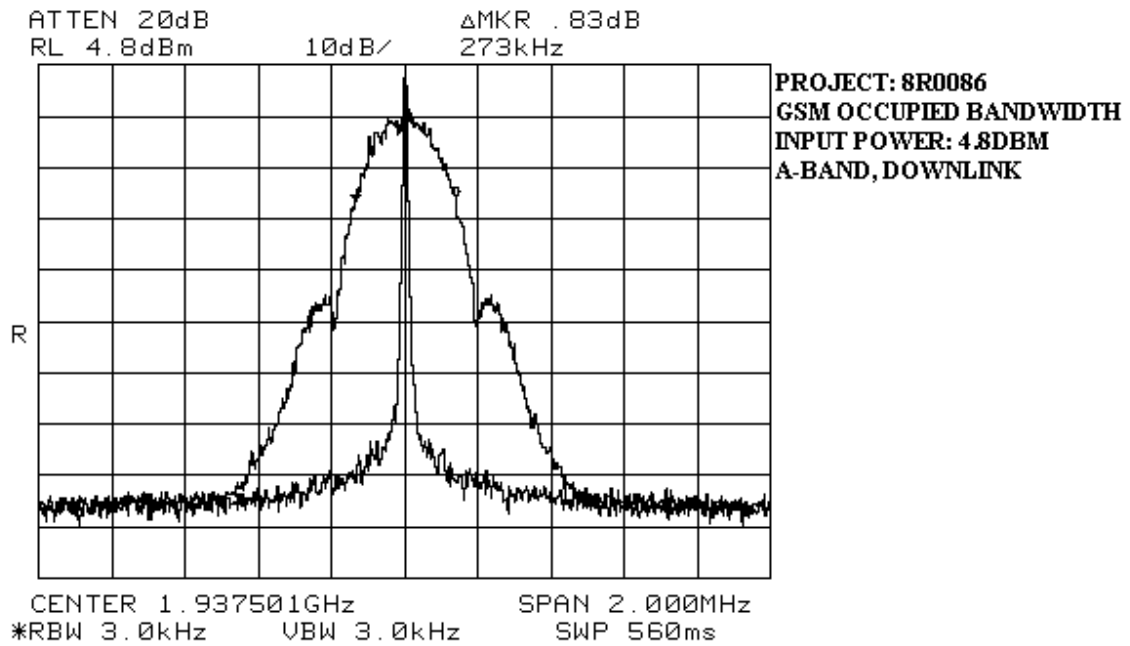
Test Results: Complies.

Test Data: See attached graph(s).

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136



EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136



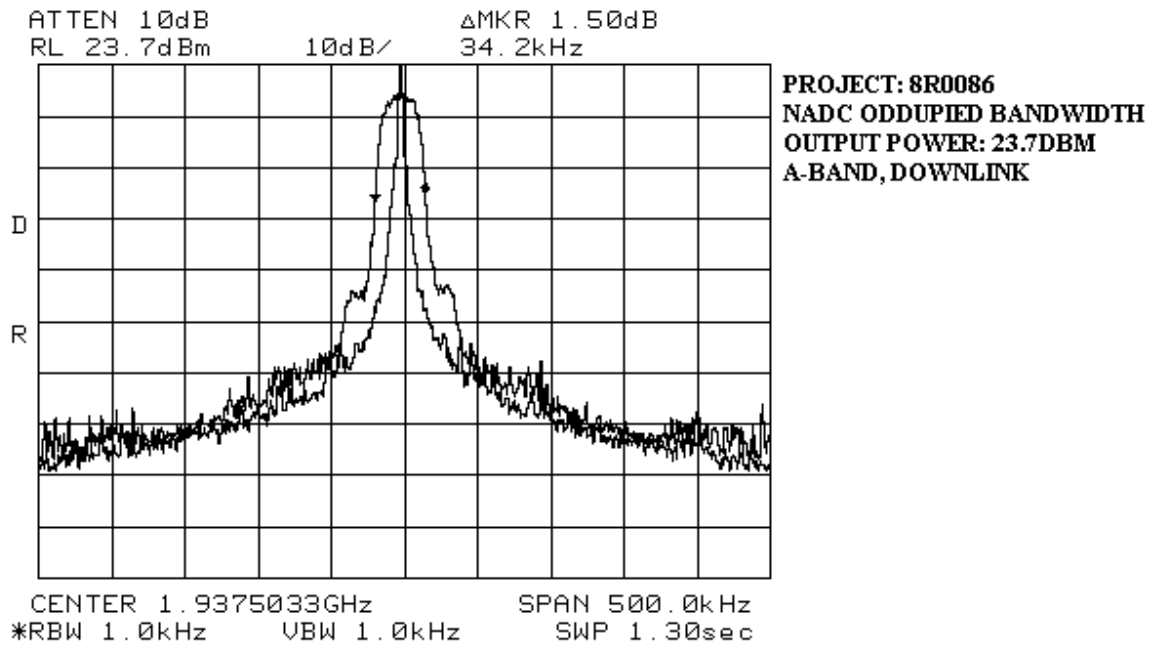
EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

NAME OF TEST: Occupied Bandwidth (NADC)	PARA. NO.: 2.917(c)
TESTED BY: Kevin Carr	DATE: May 29, 1998

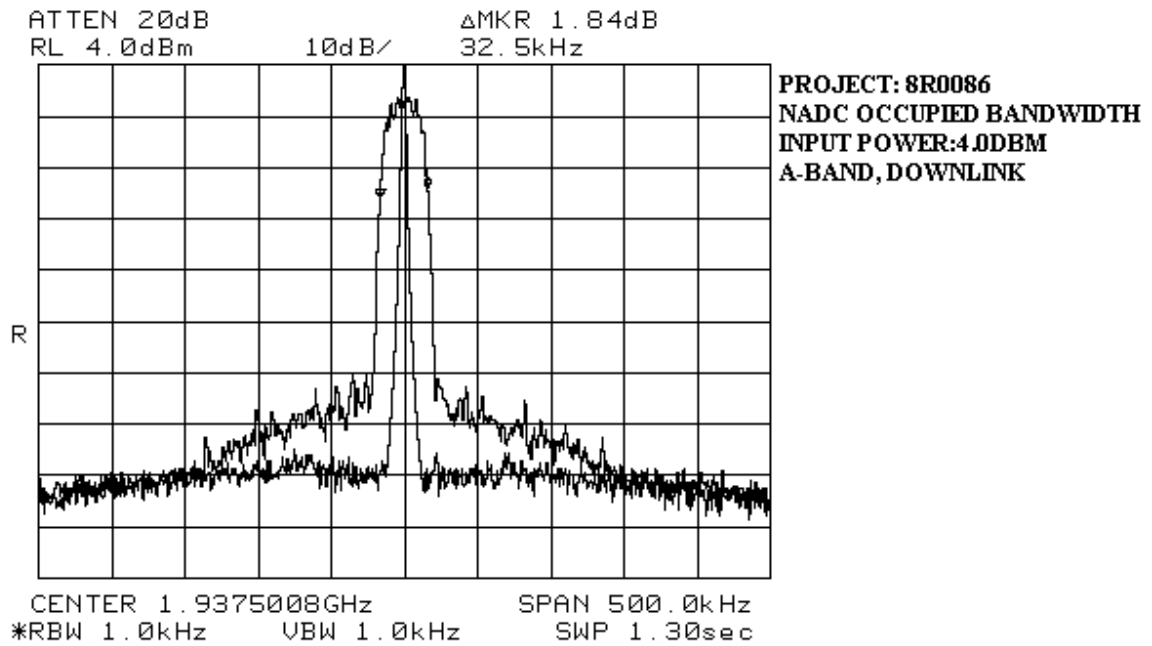
Test Results: Complies.

Test Data: See attached graph(s).

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136



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FCC ID: N2F102136



EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Section 5. Spurious Emissions at Antenna Terminals

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

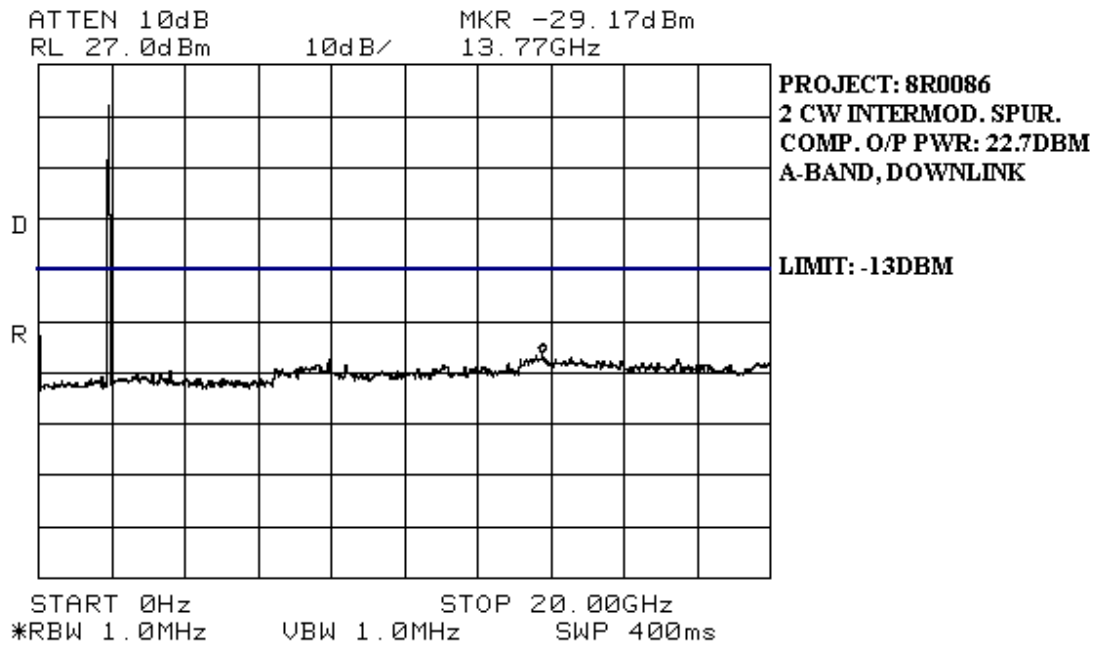
TESTED BY: Kevin Carr

DATE: May 28, 1998

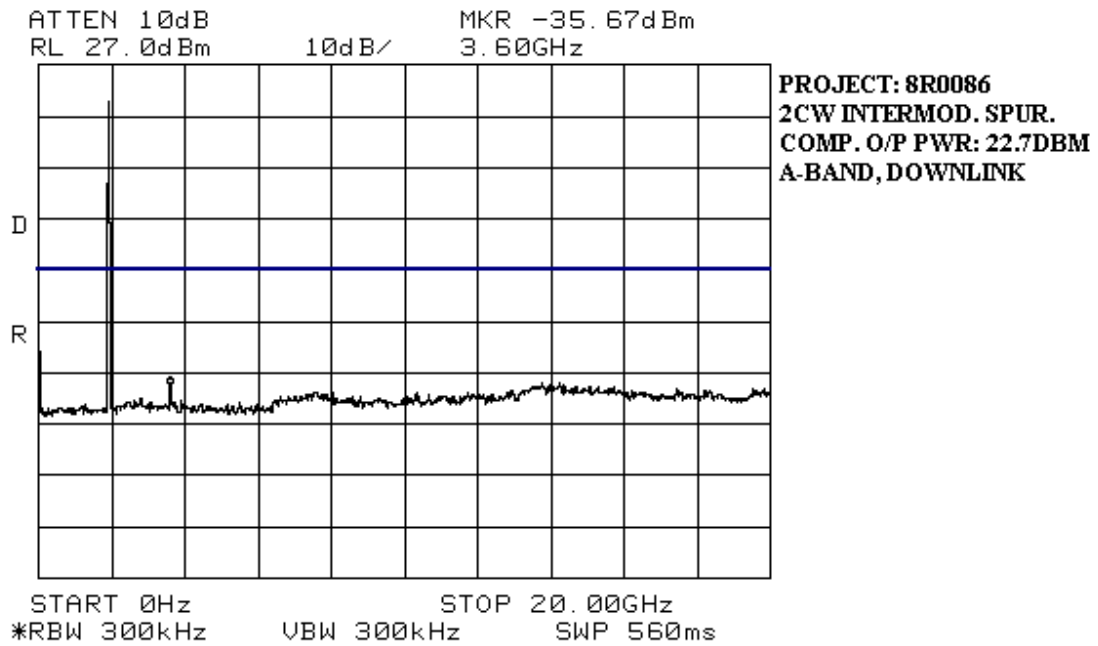
Test Results: Complies.**Test Data:**

NAME OF TEST	WORST-CASE SPURIOUS LEVEL(dBm)
0 to 20 GHz spurious (Uplink)	N/A
0 to 20 GHz spurious (Downlink)	-29.17
3 - signal intermodulation (Uplink)	N/A
3 - signal intermodulation (Downlink)	-13.17
Lower band edge spurious (Uplink)	N/A
Lower band edge spurious (Downlink)	-23.0
Upper band edge spurious (Uplink)	N/A
Upper band edge spurious (Downlink)	-21.0

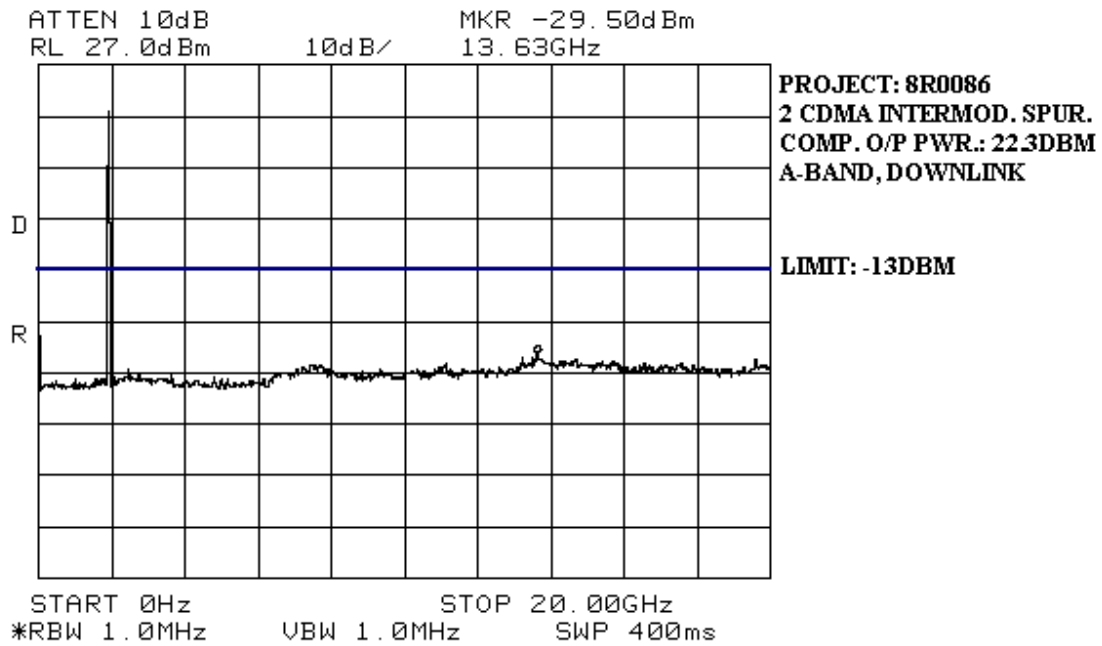
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FCC ID: N2F102136



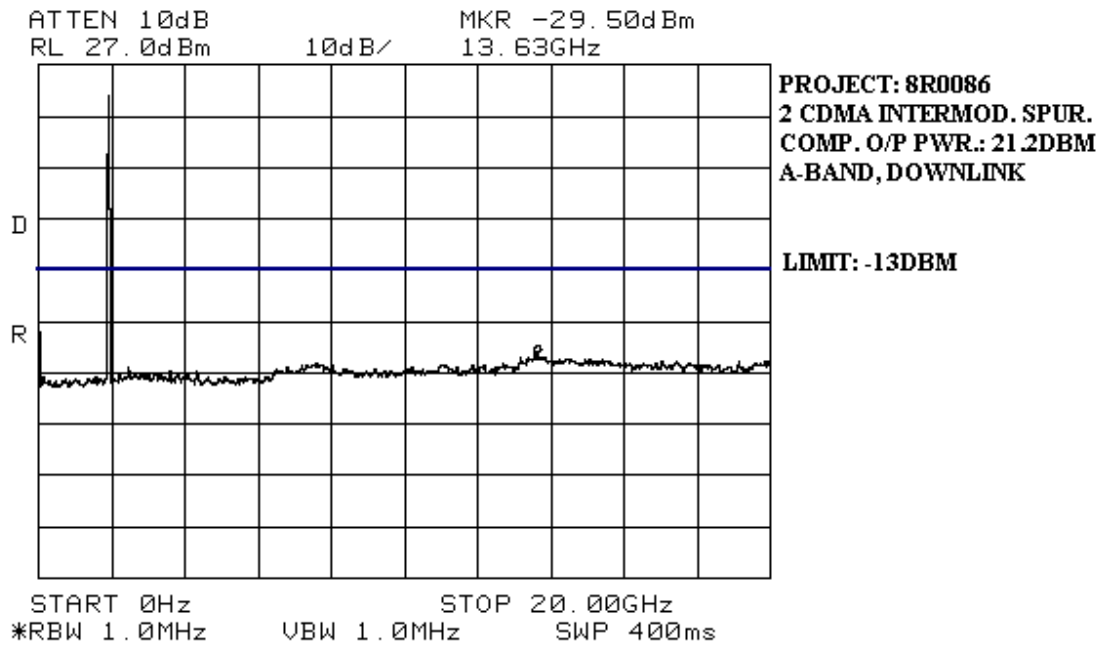
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FCC ID: N2F102136



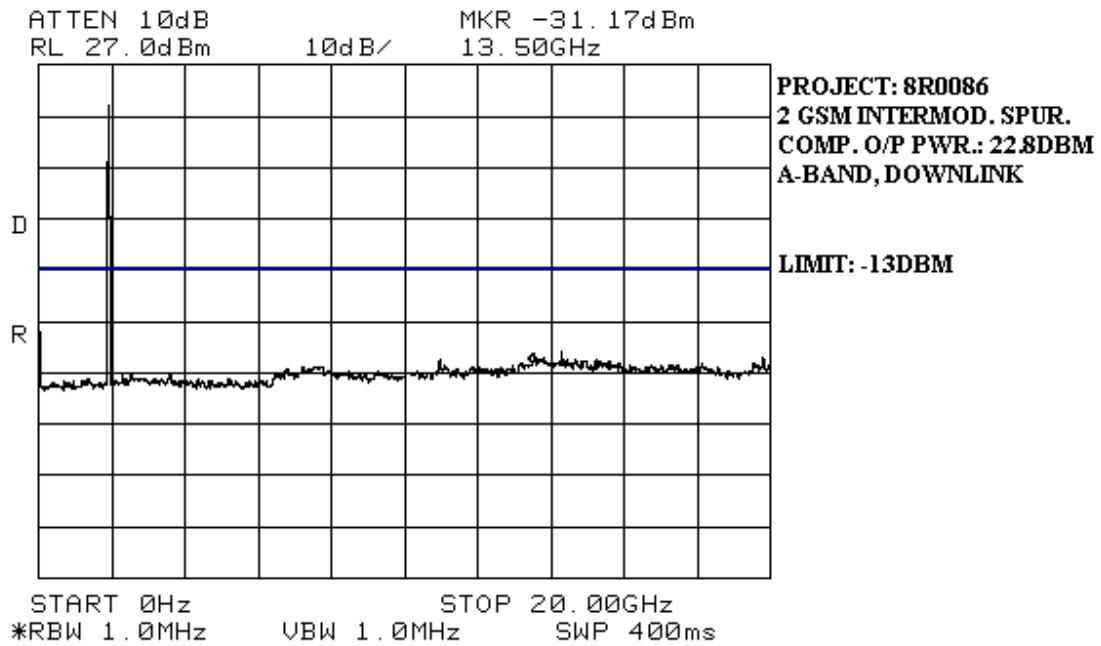
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FCC ID: N2F102136



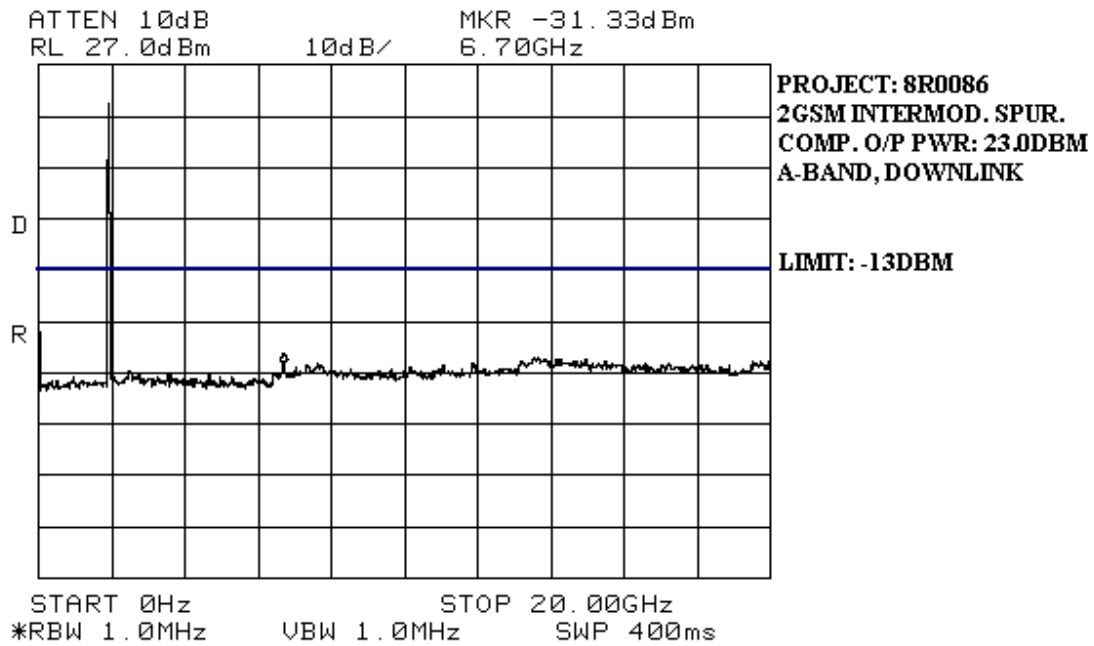
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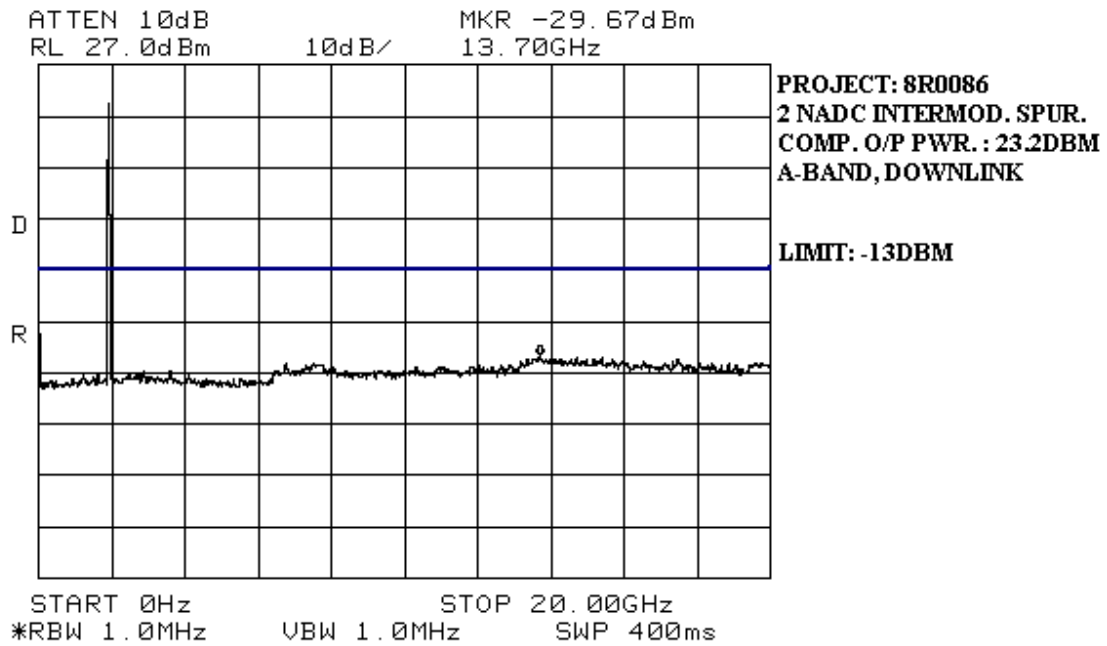
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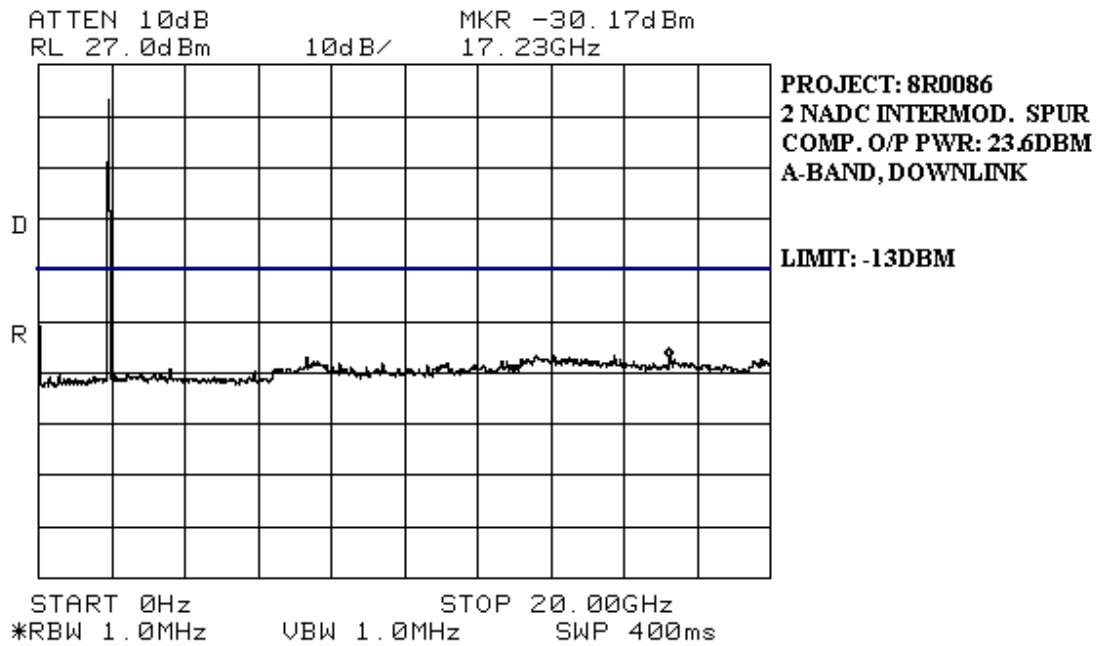
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FCC ID: N2F102136



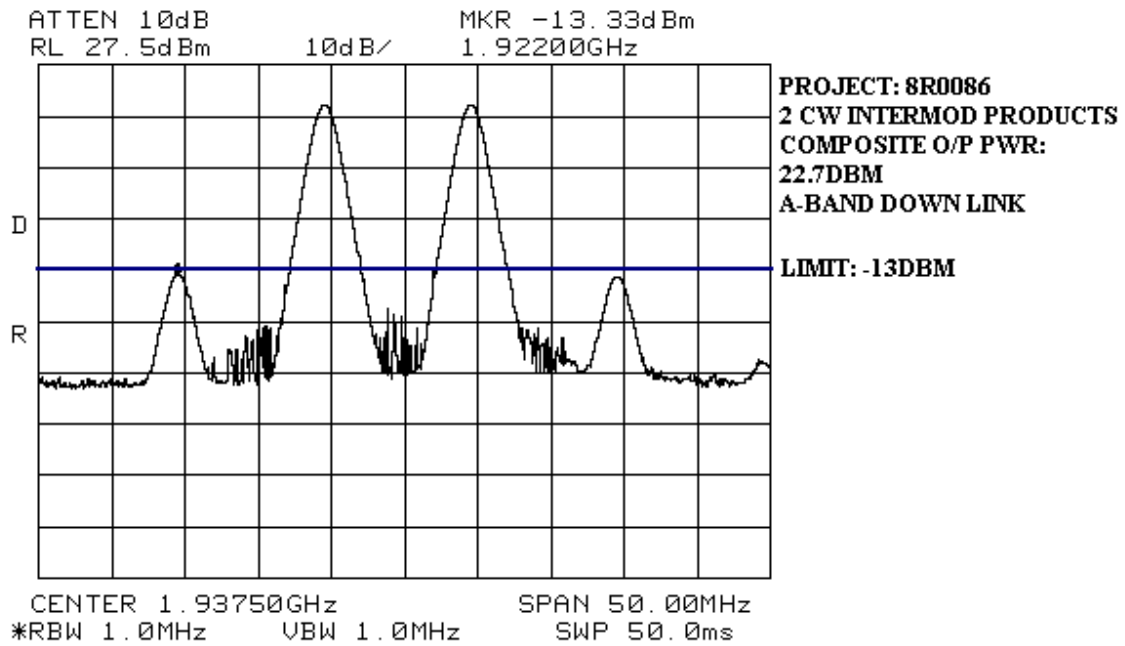
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FCC ID: N2F102136



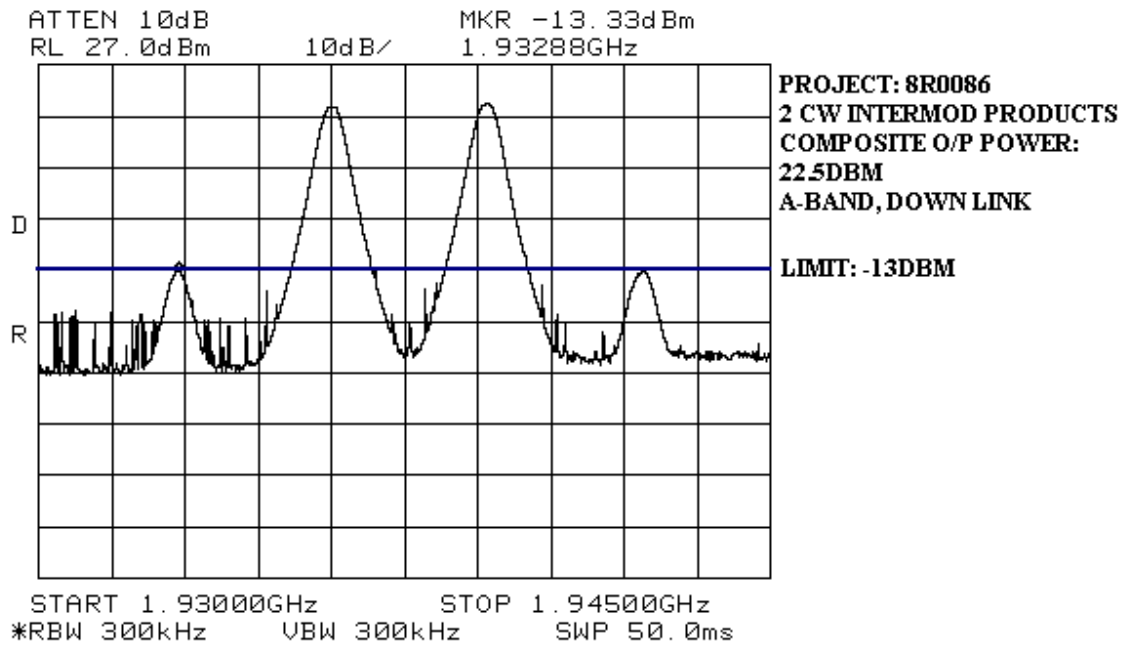
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FCC ID: N2F102136



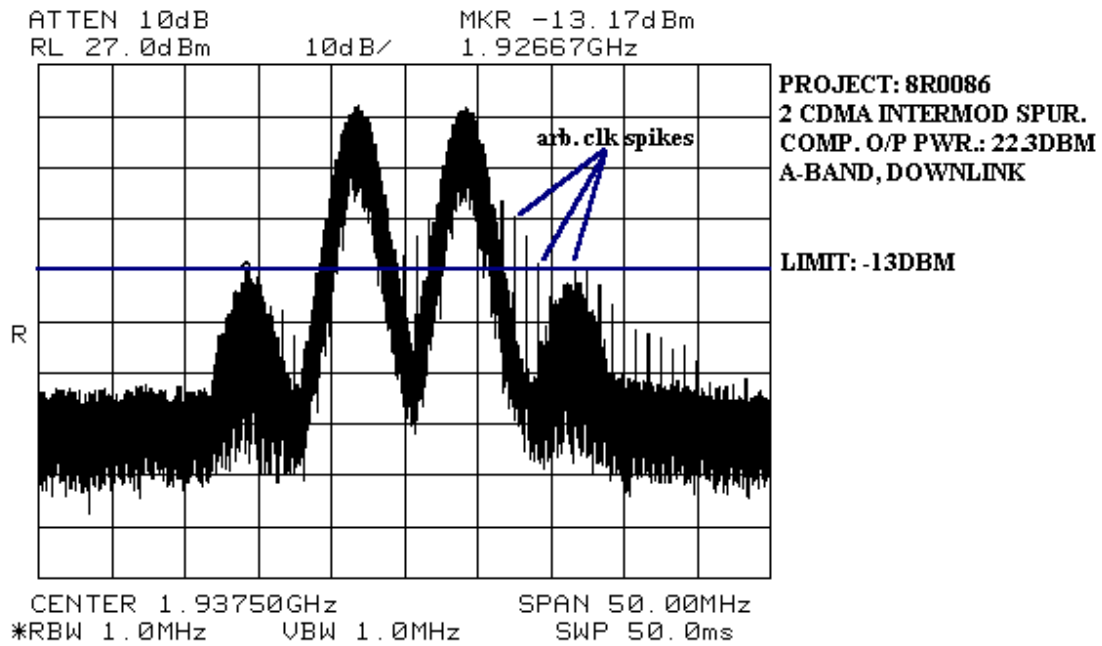
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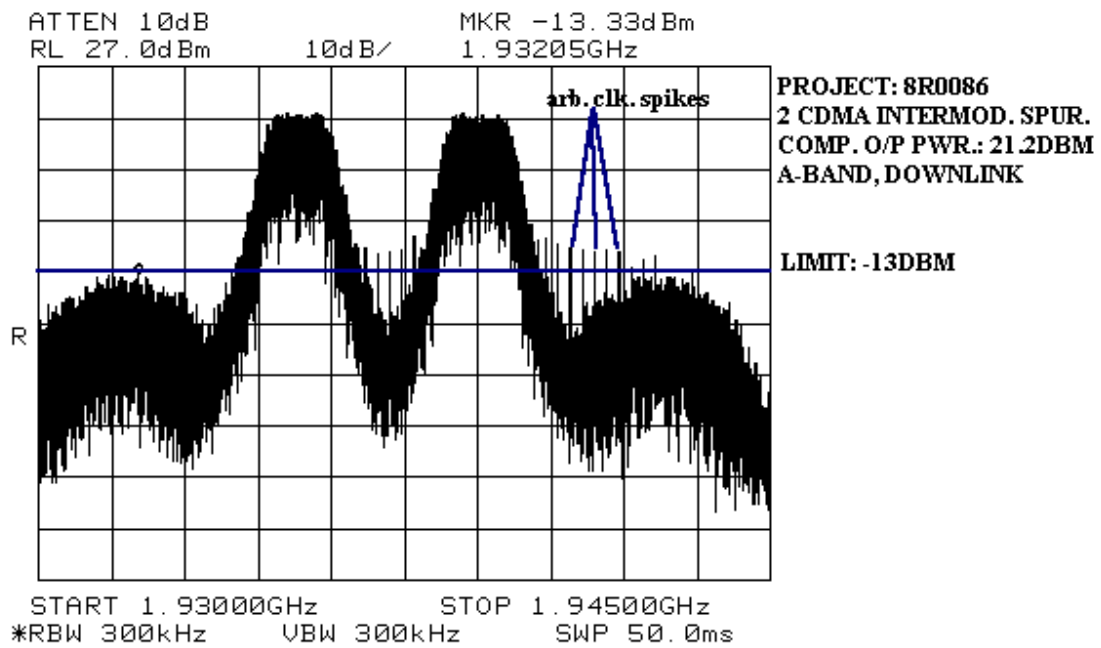
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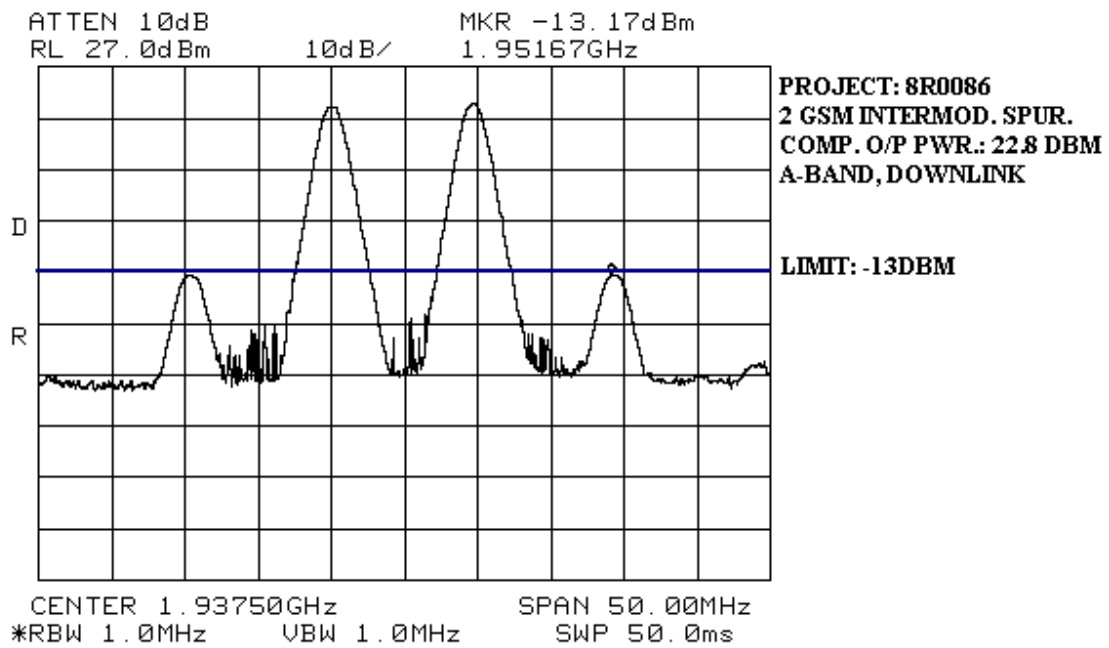
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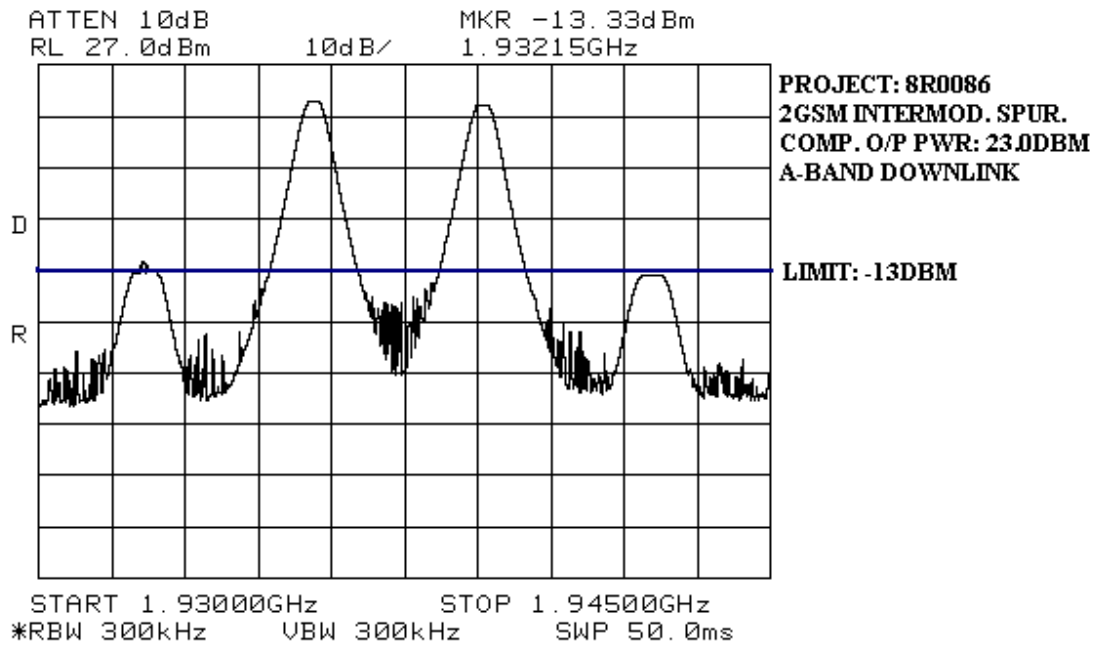
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FCC ID: N2F102136



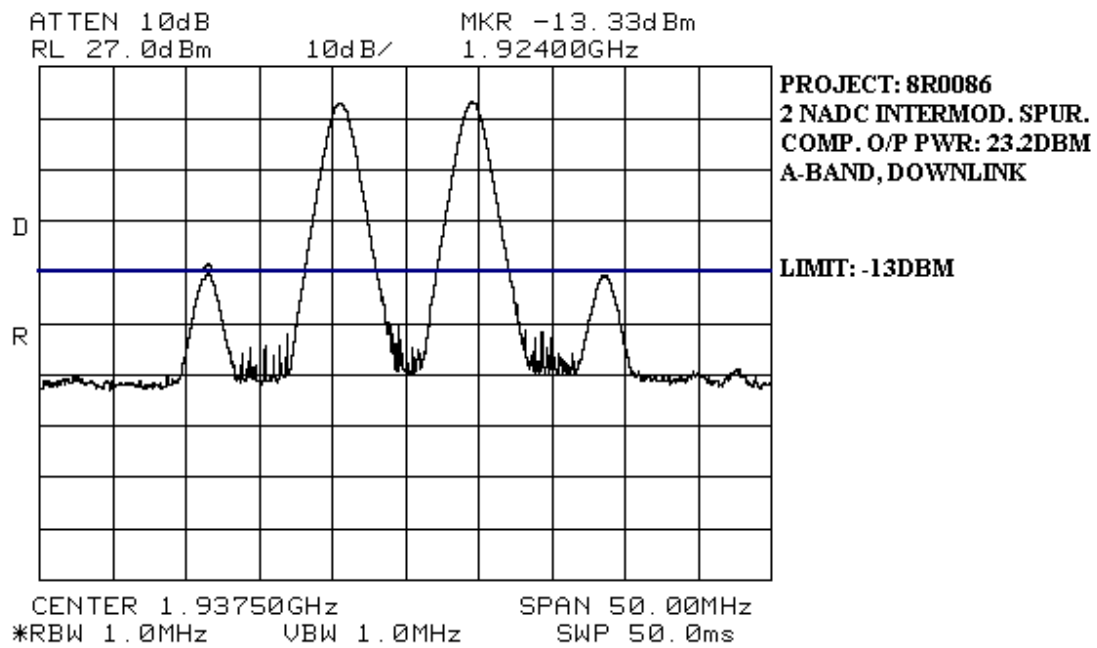
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FCC ID: N2F102136



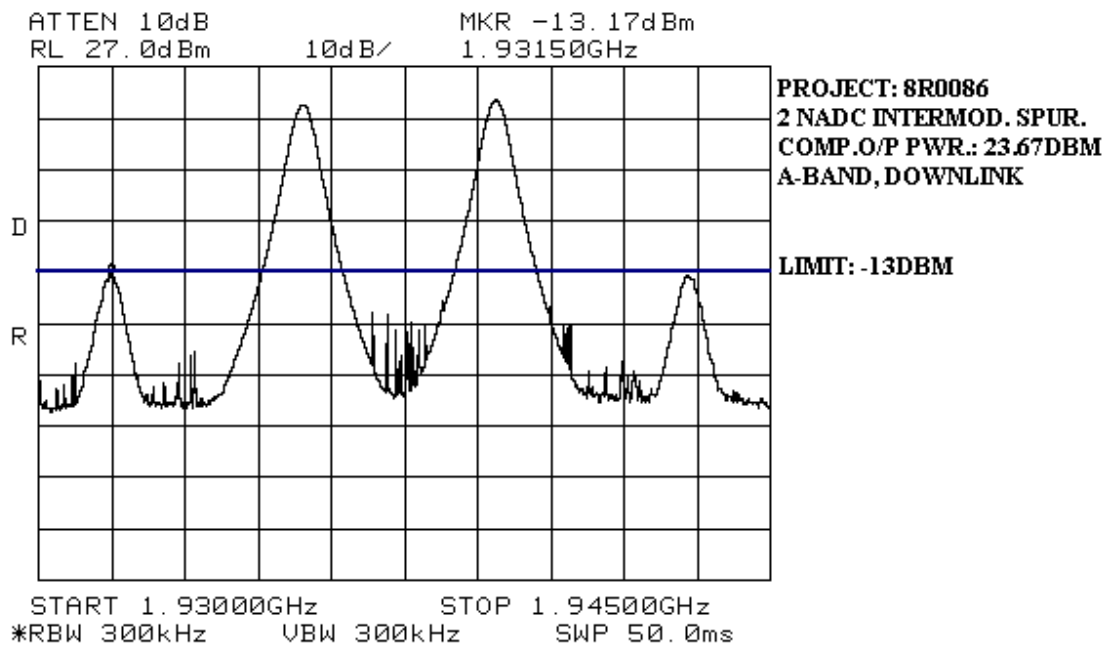
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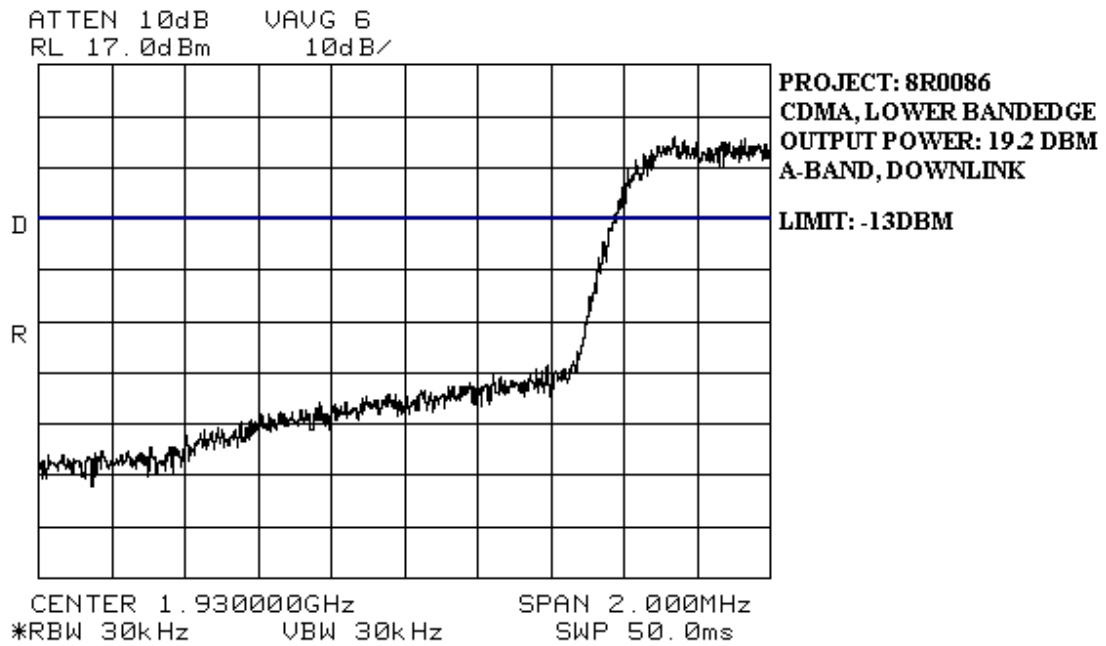
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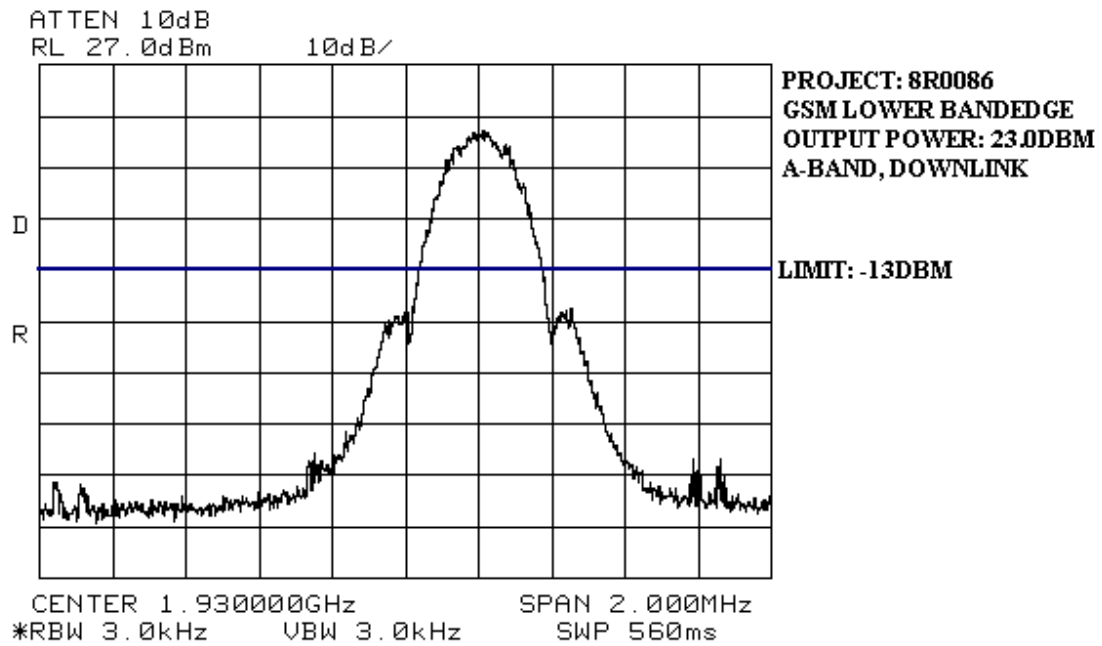
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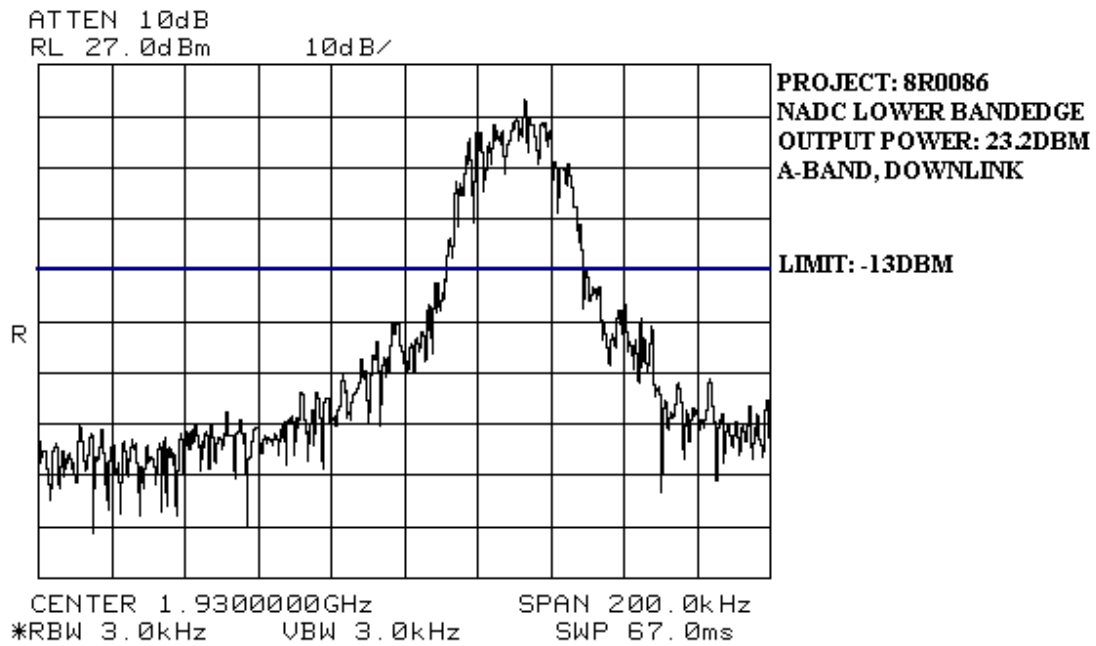
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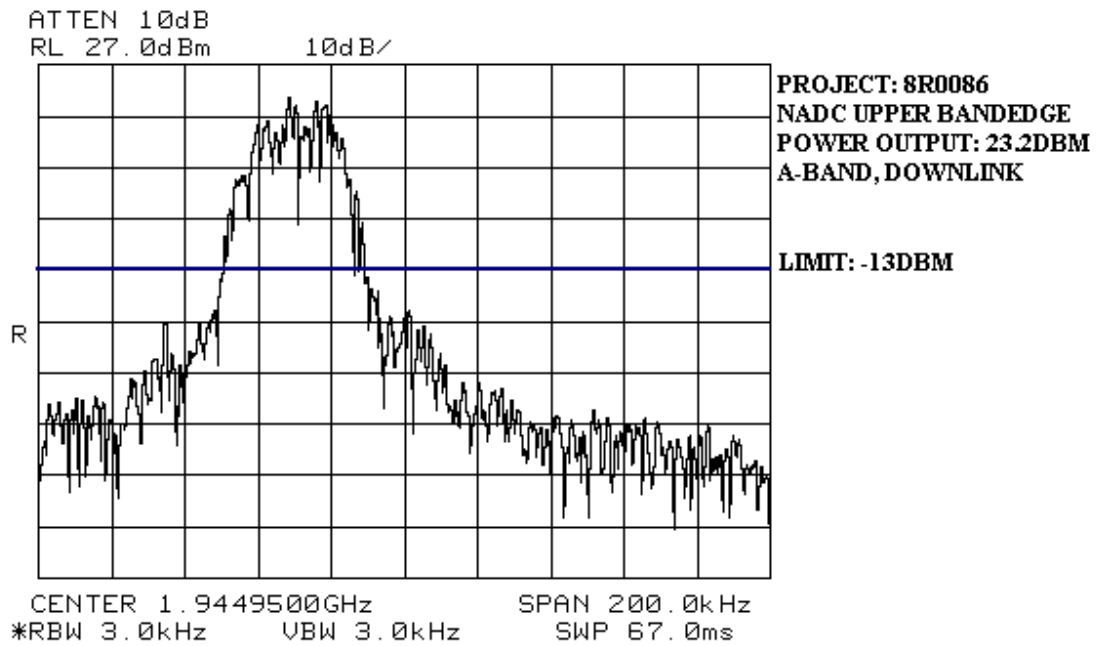
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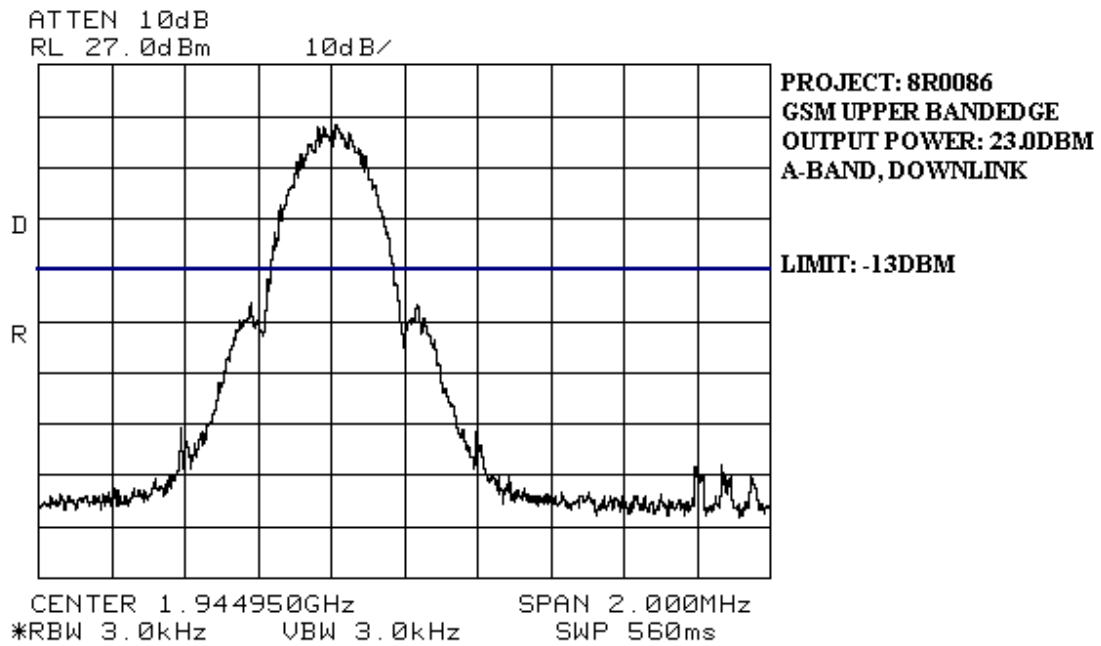
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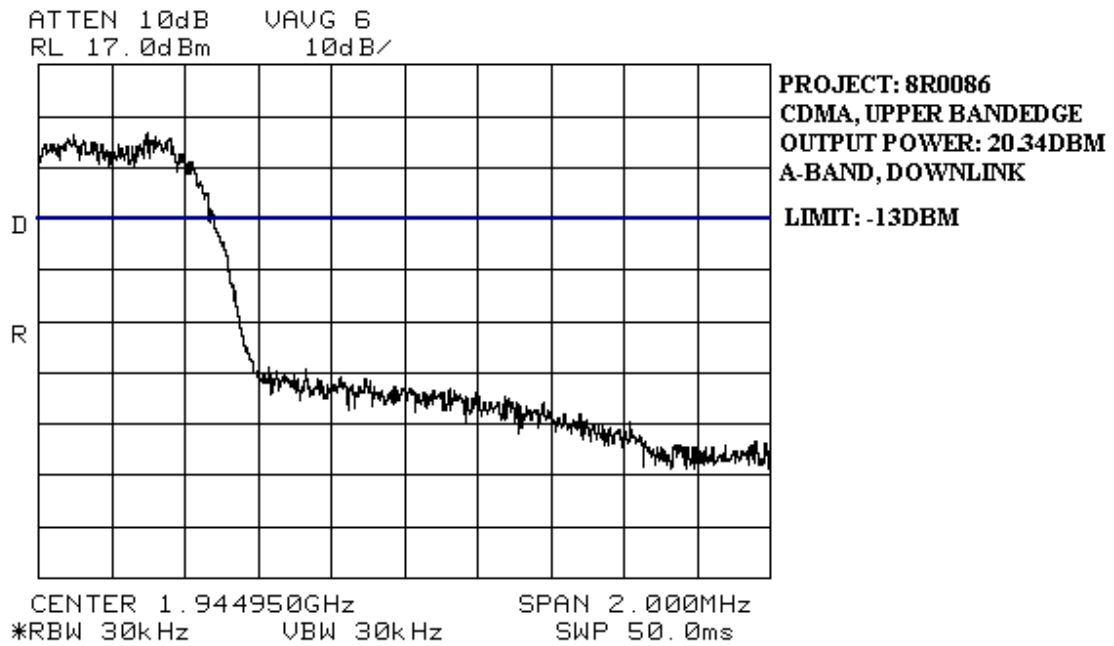
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FCC ID: N2F102136

Section 6. Field Strength of Spurious

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.917(e)
TESTED BY: Kevin Carr	DATE: May 29, 1998

Test Results: Complies.
The maximum field strength is 79.6 dB μ V/m @ 3m.

Test Data: See attached table.

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Test Data - Radiated Emissions - Uplink

Test Distance (meters) : 3		Range: A Tower		Receiver: Other		RBW: 1 MHz VBW: 1 MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
300.0	B/C1	V			14.7	22.1			36.8	84.4	47.6
300.0	B/C1	H			11.0	22.1			33.1	84.4	51.3
366.93	L/P	V			14.6	19.6			34.2	84.4	50.2
366.93	L/P	H			13.0	19.6			32.6	84.4	51.8
390.04	L/P	V			25.4	20.1			45.5	84.4	38.9
390.04	L/P	H			22.9	20.1			43.0	84.4	41.4
500.02	L/P	V			17.6	23.4			41.0	84.4	43.4
500.02	L/P	H			17.2	23.4			40.6	84.4	43.8
3875.0	Hrn2	V			44.9	39.4	-45.0		39.3	82.3	43.0
3875.0	Hrn2	H			44.9	39.4	-45.0		39.3	82.3	43.0
5812.5	Hrn2	V			48.1	43.3	-45.4		46.0	82.3	36.3
5812.5	Hrn2	H			46.0	43.3	-45.4		43.9	82.3	38.4
7750.0	Hrn2	V			45.6	47.9	-45.8		47.7	82.3	34.6
7750.0	Hrn2	H			45.0	47.9	-45.8		47.1	82.3	35.2
9687.5	Hrn2	V			44.3	51.5	-44.2		51.6	82.3	30.7
9687.5	Hrn2	H			44.2	51.5	-44.2		51.5	82.3	30.8
11625.0	Hrn2	V			45.0	54.1	-43.6		55.5	82.3	26.8
11625.0	Hrn2	H			44.4	54.1	-43.6		54.9	82.3	27.4
13562.5	Hrn2	V			15.4	64.2			79.6	82.3	2.7
13562.5	Hrn2	H			15.4	64.2			79.6	82.3	2.7
15500.0	Hrn2	V			9.6	76.5			86.1	82.3	(3.8)
15500.0	Hrn2	H			9.6	76.5			86.1	82.3	(3.8)
17437.5	Hrn2	V			48.5	67.5			116.0	82.3	(33.7)
17437.5	Hrn2	H			48.6	67.5			116.1	82.3	(33.8)
13562.5	Hrn2	V			37.4	64.2			101.6	82.3	(19.3)
13562.5	Hrn2	H			37.5	64.2			101.7	82.3	(19.4)
15500.0	Hrn2	V			38.0	76.5			114.5	82.3	(32.2)
15500.0	Hrn2	H			38.2	76.5			114.7	82.3	(32.4)
17437.5	Hrn2	V			38.1	67.5			105.6	82.3	(23.3)
17437.5	Hrn2	H			38.2	67.5			105.7	82.3	(23.4)
Notes: The spectrum was search up to the 10 th harmonic of the fundamental frequency. B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole * Includes cable loss when amplifier is not used. ** Includes cable loss. () Denotes failing emission level.											

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[illegible]

The spectrum was search up to the 10th harmonic of the fundamental frequency.
 B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
 * Includes cable loss when amplifier is not used.
 ** Includes cable loss.
 () Denotes failing emission level.

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EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Photographs of Test Setup

FRONT VIEW

REAR VIEW

KTL Ottawa

FCC PART 24, SUBPART E
BROADBAND PCS REPEATERS
PROJECT NO.: 8R00086

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Pre-Scan Data

INSERT PRESCAN GRAPHS

KTL Ottawa

FCC PART 24, SUBPART E
BROADBAND PCS REPEATERS
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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: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Section 8. Test Equipment List

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
1 Year	Attenuator	Narda	765-20	9510	July 23/97	July 23/98	
1 Year	RF Millivoltmeter	Rohde & Schwarz	URV5	FA000420	July 23/97	July 23/98	
1 Year	Insertion Unit	Rohde & Schwarz	URV5-Z4	FA000905	July 23/97	July 23/98	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	
1 Year	Biconical (1) Antenna	EMCO	3109	9204-2708	July 11/97	July 11/98	
	50 Ω Termination	Wiltron	26N50	605248	N/A	N/A	
1 Year	50 ohm Combiner Pad	Mini Circuits	ZA3PD-2	9746	Dec. 12/97	Dec. 12/98	
1 Year	Low Noise Amplifier	Avantek	AWT-8035	1005	Oct. 24/97	Oct. 24/98	
1 Year	Low Noise Amplifier	DBS Microwave	DWT-13035	9623	Oct. 24/97	Oct. 24/98	
1 Year	Signal Generator	Rohde & Schwarz	SM1Q03	1084-8004-03	Sept. 18/97	Sept. 18/98	
1 Year	Arbitrary Waveform Gen.	Sony/Tektronix	AWG2021	J310495	May 15/97	July 31/98	
3 Year	Standard Gain Horn	Electro-Metrics	SH-50/60-1	FA000479	July 29/97	July 29/00	
3 Year	Signal Generator	Rohde & Schwarz	SME3	DE14439	June 6/96	June 29/99	
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	3404A000881	Feb. 27/98	Feb. 27/99	

NA: Not Applicable
NCR: No Cal Required

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

ANNEX A
TEST METHODOLOGIES

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

NAME OF TEST: RF Power Output**PARA. NO.: 2.985****Test Conditions:** Standard Temperature & Humidity
Standard Test Voltage**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: Indoor Distribution System Direct Modem
FCC ID: N2F102136

NAME OF TEST: Occupied Bandwidth**PARA. NO.: 2.989**

Test Conditions: Standard Temperature & Humidity
Standard Test Voltage

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: Indoor Distribution System Direct Modem
FCC ID: N2F102136

NAME OF TEST: Spurious Emission at Antenna Terminals	PARA. NO.: 2.991
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Test Conditions: Standard Temperature & Humidity
Standard Test Voltage

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: Indoor Distribution System Direct Modem
FCC ID: N2F102136

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 2.993
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Test Conditions: Outdoor Range
Standard Test Voltage

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)

$R = 3$ 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)

$R = 3$ m (Measurement Distance)

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

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
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Test Conditions: As per measurement data.

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

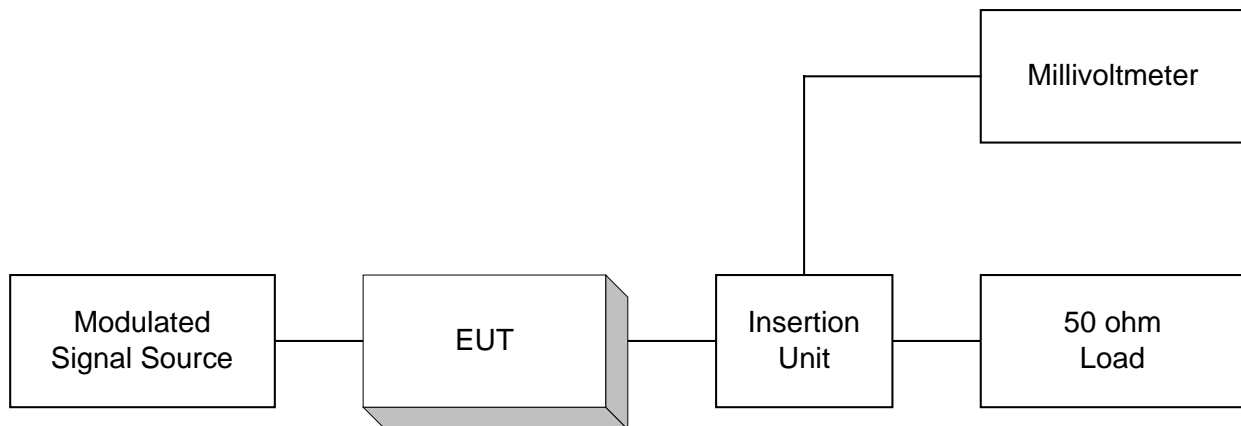
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

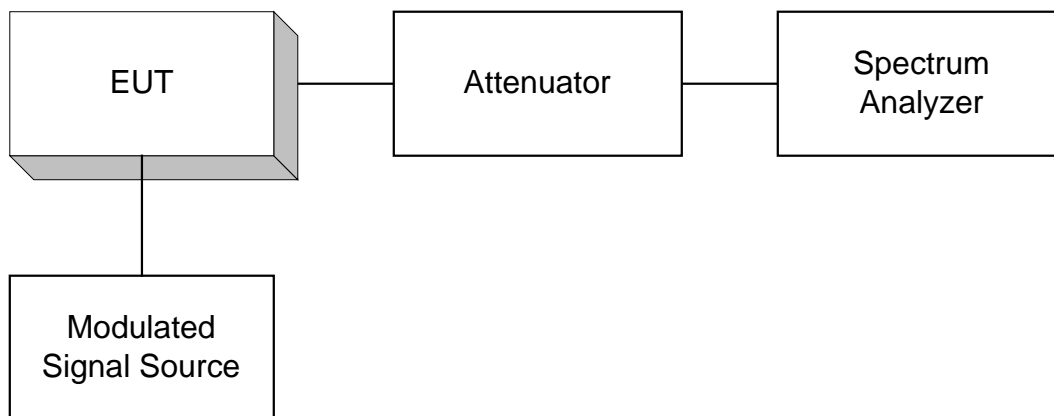
ANNEX B
TEST DIAGRAMS

EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

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

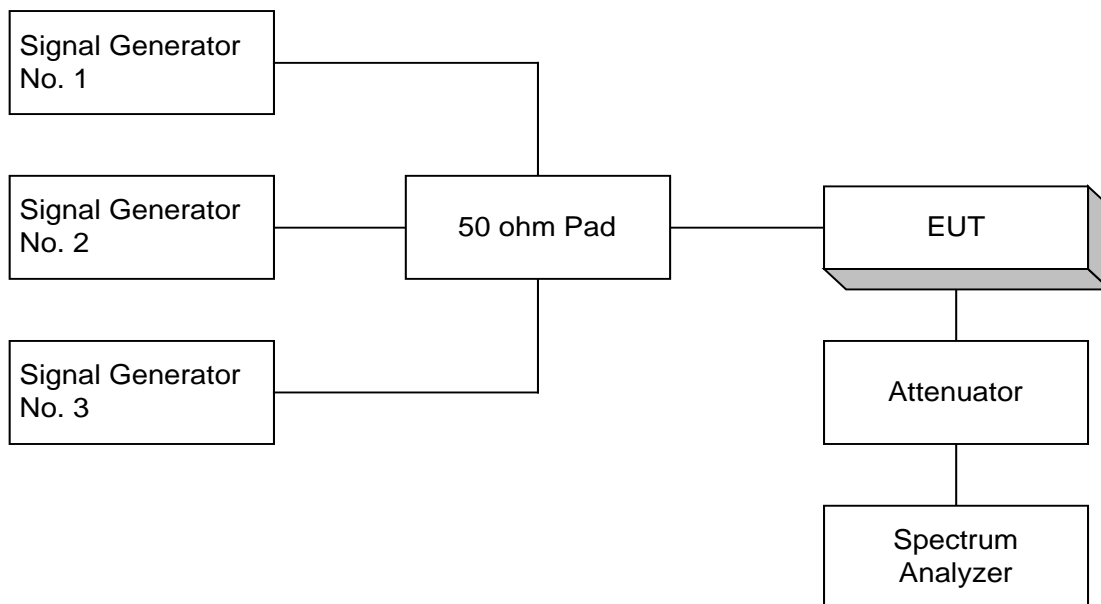
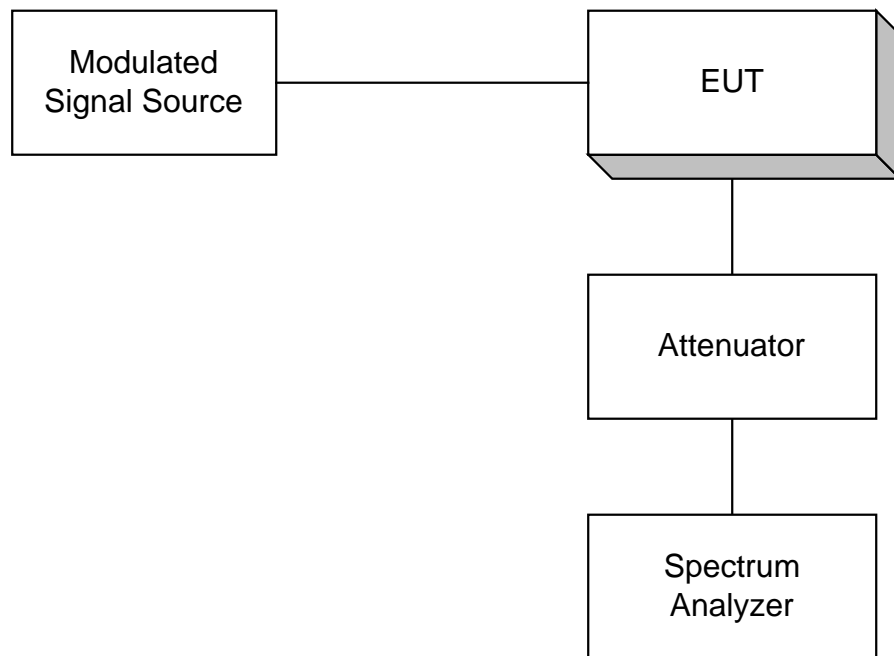


Para. No. 2.989 - Occupied Bandwidth



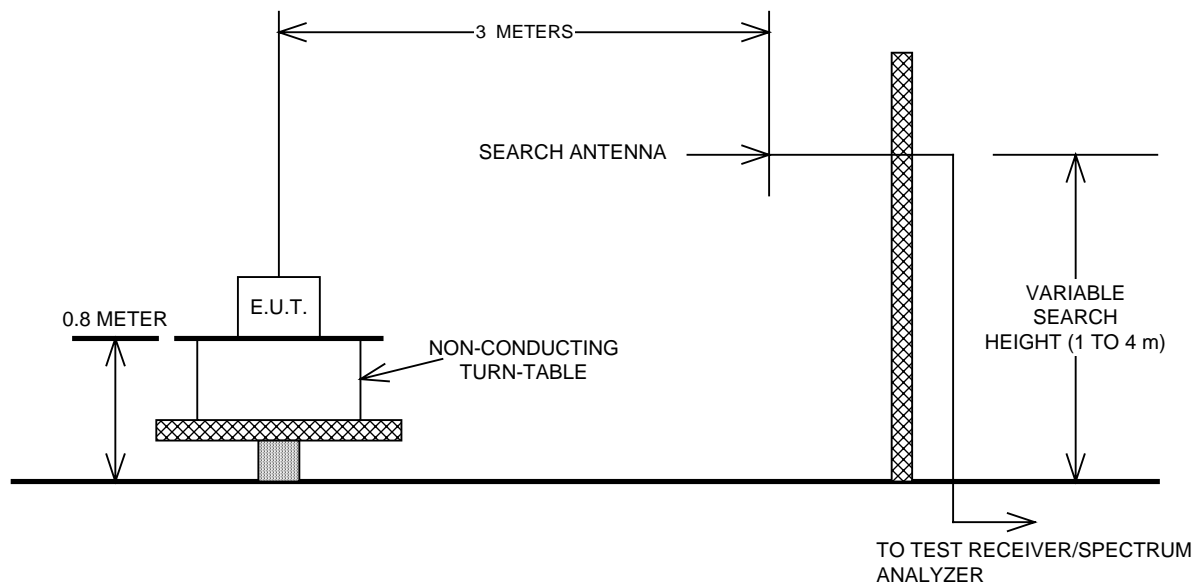
EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Para. No. 2.991 Spurious Emissions at Antenna Terminals



EQUIPMENT: Indoor Distribution System Direct Modem
FCC ID: N2F102136

Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

