

KTL Test Report: 8R01061

Applicant: Allen Telecom Group
140 Vista Centre Drive
Forest, Virginia
24551

**Equipment Under Test:
(E.U.T.)** TFB 1915 Booster Amp

FCC ID: BCR-BCEL-1915BA

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

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

Authorized By: _____
T. Tidwell, Wireless Group Manager

Date: _____

Total Number of Pages: 86

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Table of Contents

Section 1. Summary of Test Results

- General
- Summary of Test Data

Section 2. General Equipment Specification

- Specifications
- Description of Modifications for Class II Permissive Change
- Modifications Made During Testing
- Theory of Operation
- System Diagram

Section 3. RF Power Output

- Test Results
- Measurement Data
- Power Over Bandwidth Graphs

Section 4. Occupied Bandwidth

- Occupied Bandwidth (CDMA)
 - Test Results
 - CDMA Input and Output Graphs
- Occupied Bandwidth (GSM)
 - Test Results
 - GSM Input and Output Graphs
- Occupied Bandwidth (NADC)
 - Test Results
 - NADC Input and Output Graphs

Section 5. Spurious Emissions at Antenna Terminals

- Test Results
- Test Data
- Graphs

Section 6. Field Strength of Spurious

- Test Results
- Test Data
- Test Data - Radiated Emissions - Uplink
- Test Data - Radiated Emissions - Downlink
- Photographs of Test Setup
- Pre-Scan Data

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Table of Contents, continued

Section 7. Frequency Stability

Test Results
Measurement Data
Graphs

Section 8. Test Equipment List

Annex A - Test Methodologies

RF Power Output
Occupied Bandwidth (CDMA)
Occupied Bandwidth (GSM)
Occupied Bandwidth (NADC)
Spurious Emission at Antenna Terminals
Field Strength of Spurious
Frequency Stability

Annex B - Test Diagrams

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

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Section 1. Summary of Test Results

Manufacturer: Allen Telecom Group

Model No.: TFB 1915

Serial No.: Demo 1

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



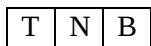
Production Unit



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: _____
Kevin Carr, Technologist

TECHNICAL REVIEW: _____ DATE: _____

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This report applies only to the items tested.

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	24.232	100W	0.012W	Complies
Occupied Bandwidth (CDMA)	24.238	N/A	Plot	Complies
Occupied Bandwidth (GSM)	24.238	N/A	Plot	Complies
Occupied Bandwidth (NADC)	24.238	N/A	Plot	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	-13.0 dBm	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	-30.3 dBm	Complies
Frequency Stability	24.235	± 0.05 ppm	N/A	N/A

Footnotes For N/A's:

Test Conditions: **LAB:** Temperature: 19 °C
 Humidity: 27 %

OATS: Temperature: -10 °C
 Humidity: 20 %

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Section 2. General Equipment Specification

Supply Voltage Input: 120 VAC, 60 Hz

Frequency Range(s): 1850 – 1910 MHz / 1930 – 1990 MHz

Type of Modulation and Designator:	CDMA (F9W)	GSM (GXW)	NADC (DXW)
	☒	☒	☒

Emission & Bandwidth Designator: Not Applicable

Output Impedance: 50 ohm

RF Output (Rated): 0.012 W

Band Selection:	Software	Duplexer Change	Fullband Coverage
	☐	☐	☒

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Description of Modifications For Class II Permissive Change

NOT APPLICABLE

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Modifications Made During Testing

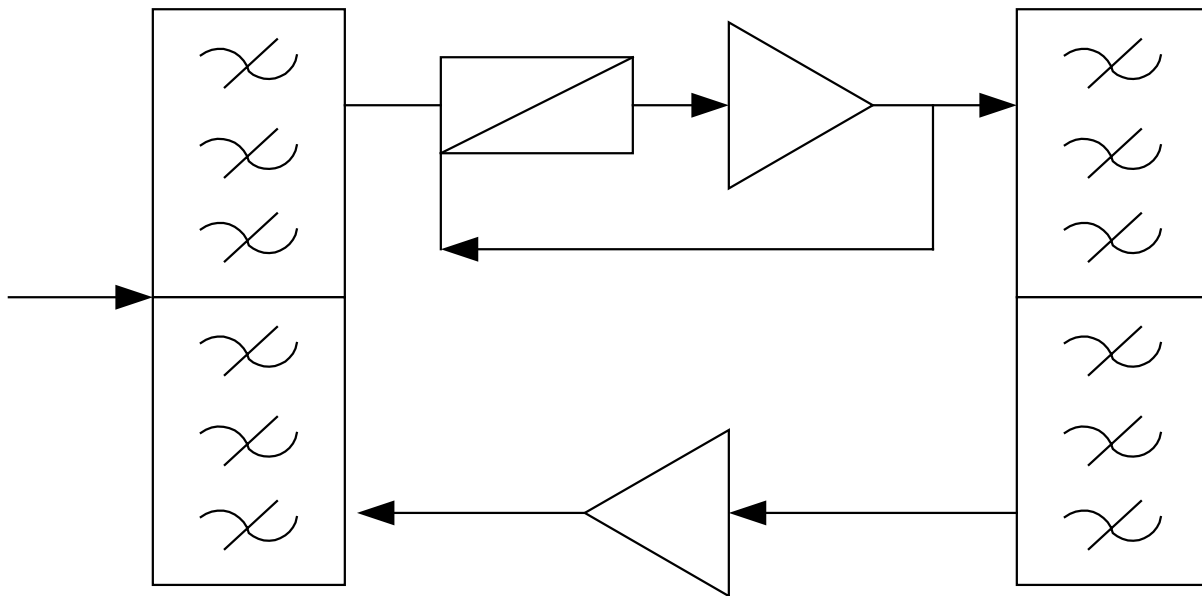
NOT APPLICABLE

EQUIPMENT: TFB 1915 Booster Amp
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System Description

The RF Booster Units TFB are intended to enhance the transmit power capabilities of the Brite Cell remote transceivers.

System Diagram



EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Kevin Carr	DATE: December 7, 1998

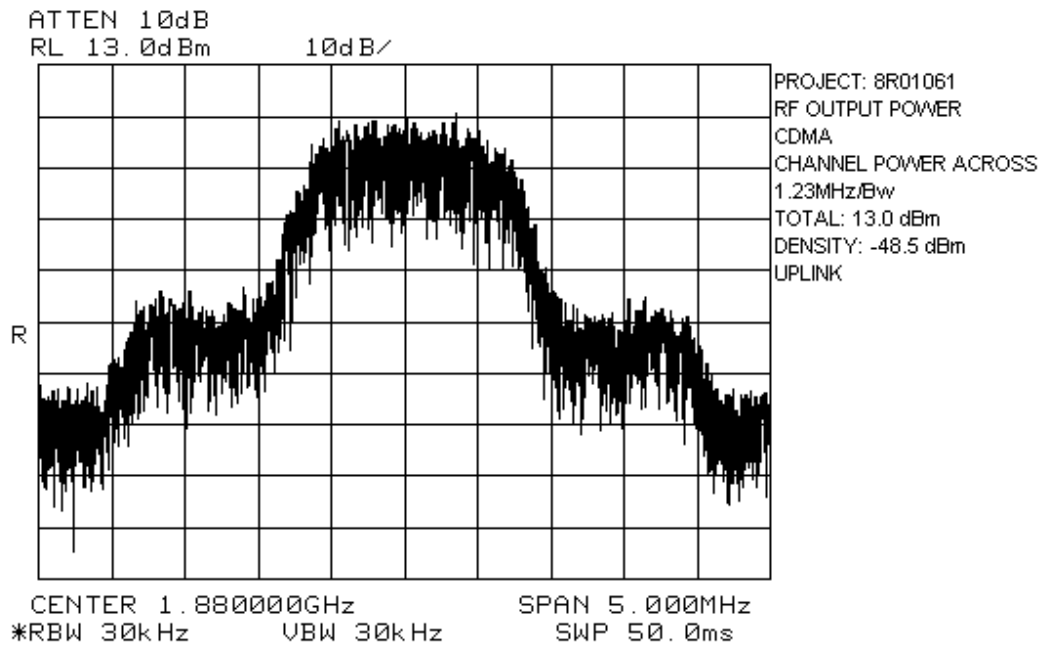
Test Results: Complies.**Measurement Data:** **Uplink**

Modulation Type	Output Power (dBm)	Output Power (w)
CDMA	13.0	0.0200
GSM	13.5	0.0224
NADC	11.0	0.0126

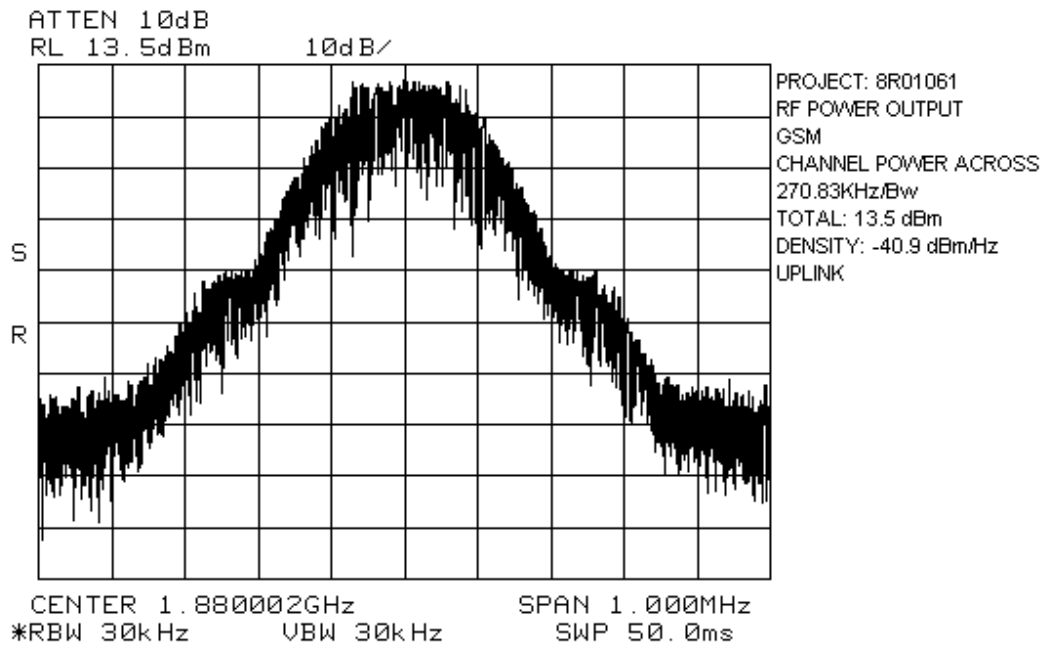
Downlink

Modulation Type	Output Power (dBm)	Output Power (w)
CDMA	18.2	0.0661
GSM	18.0	0.0631
NADC	17.7	0.0589

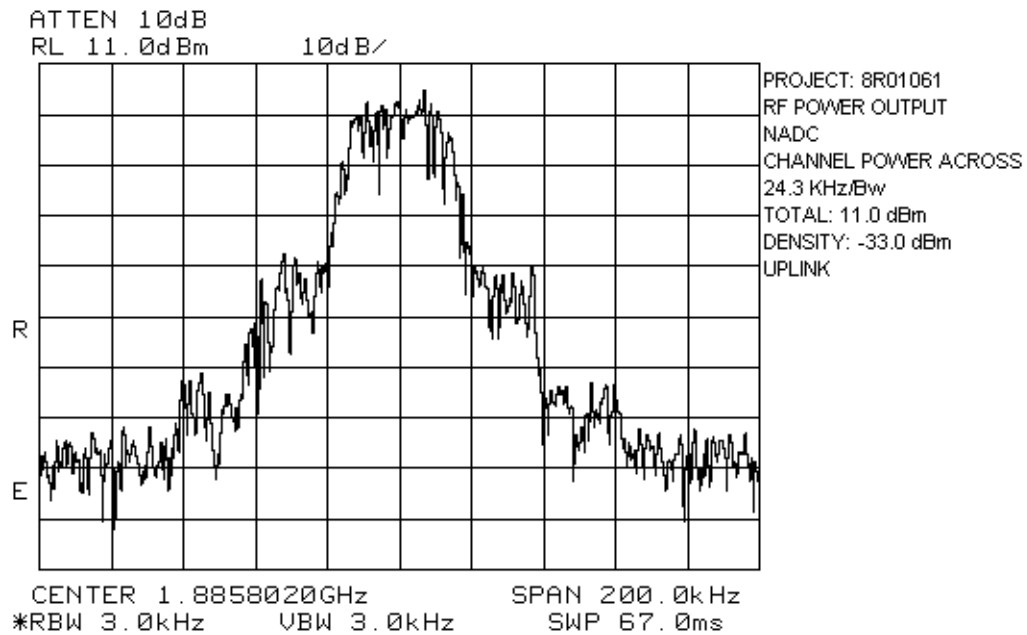
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FCC ID: BCR-BCEL-1915BA



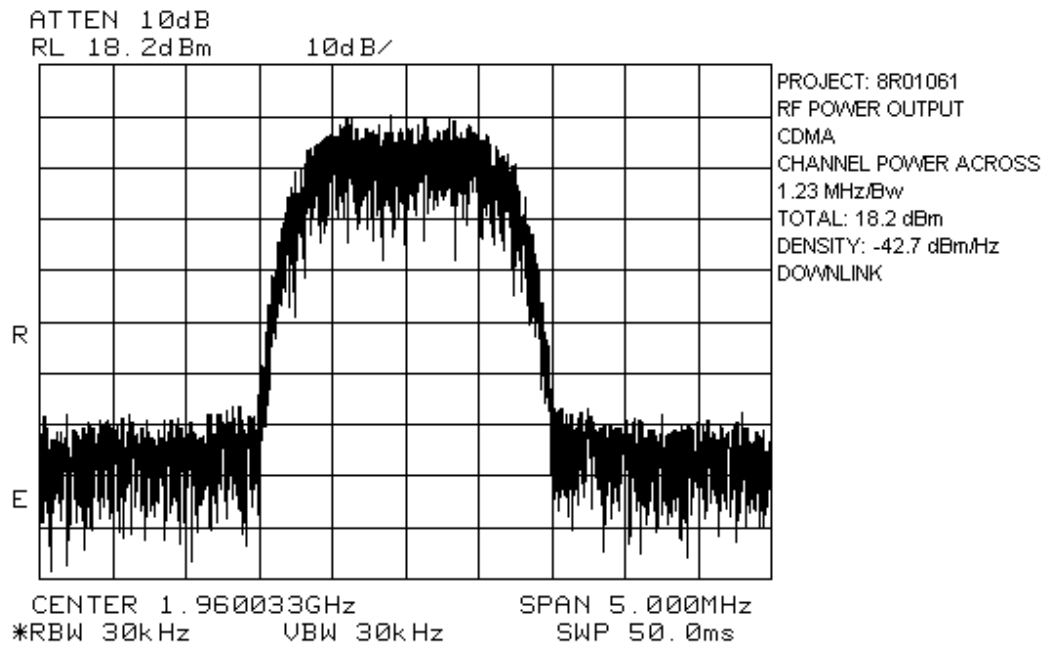
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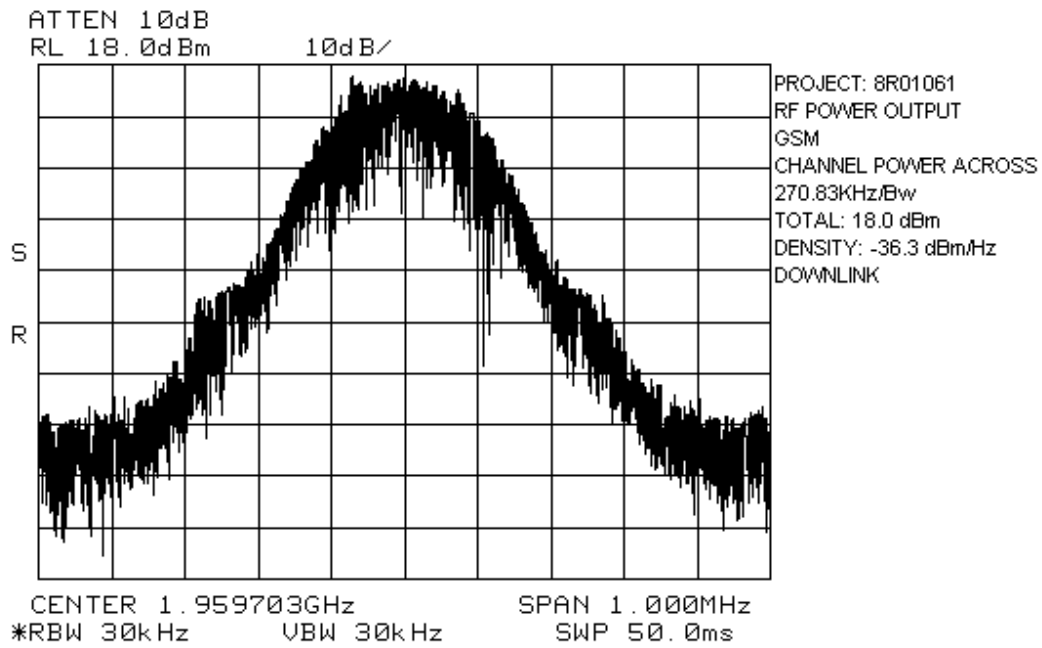
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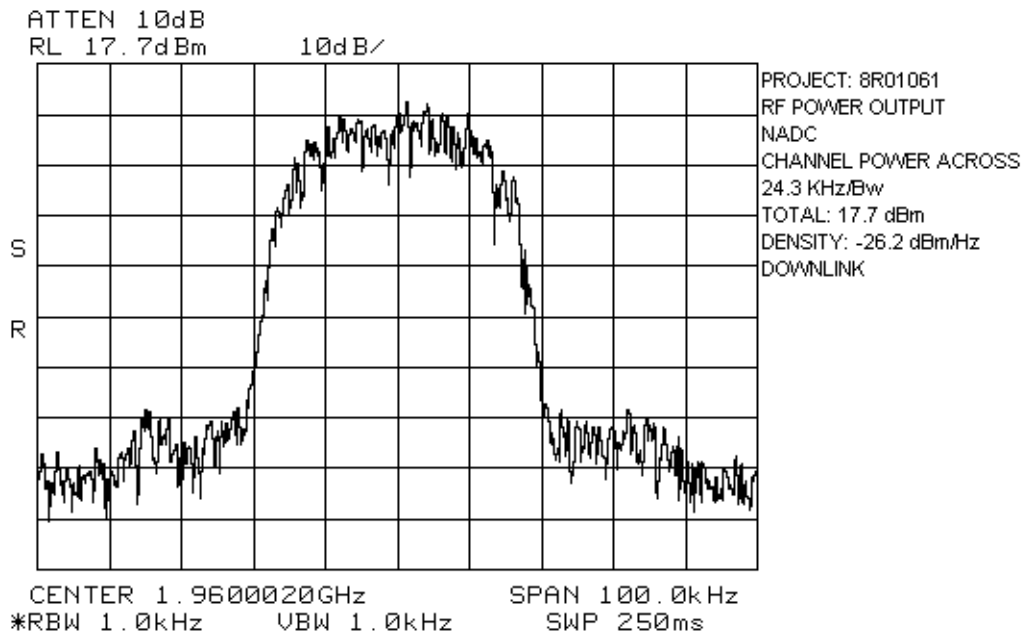
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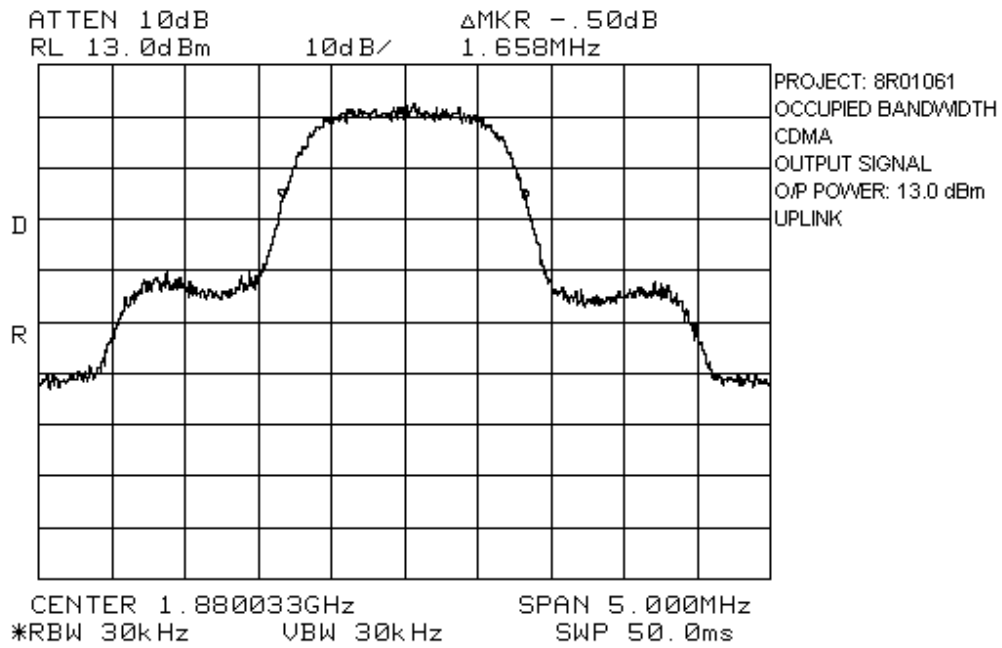
Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth (CDMA)	PARA. NO.: 2.917(c)
TESTED BY: Kevin Carr	DATE: December 7, 1998

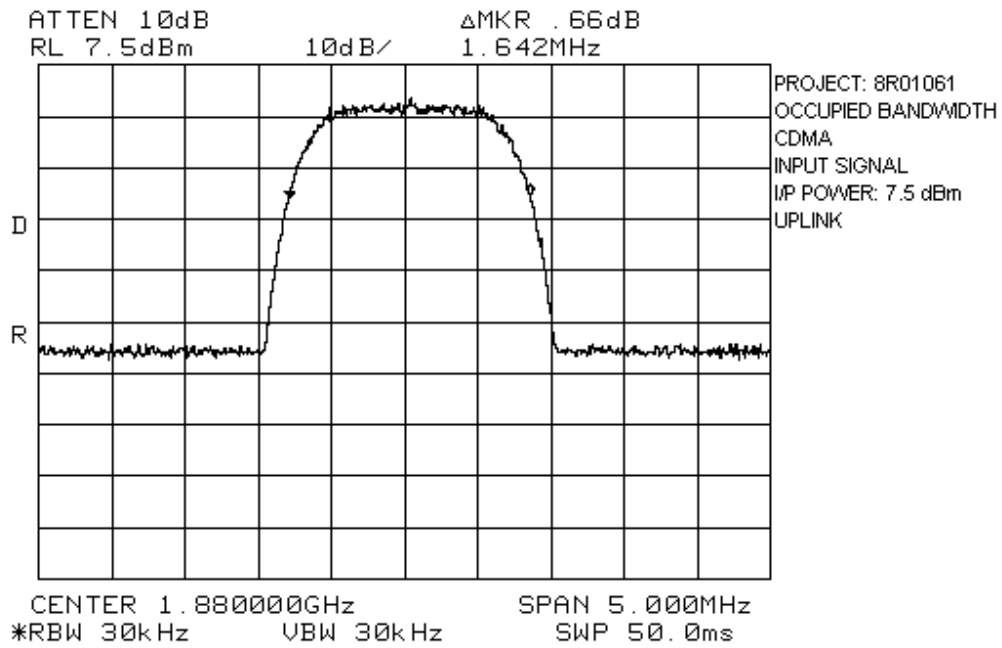
Test Results: Complies.

Test Data: See attached graph(s).

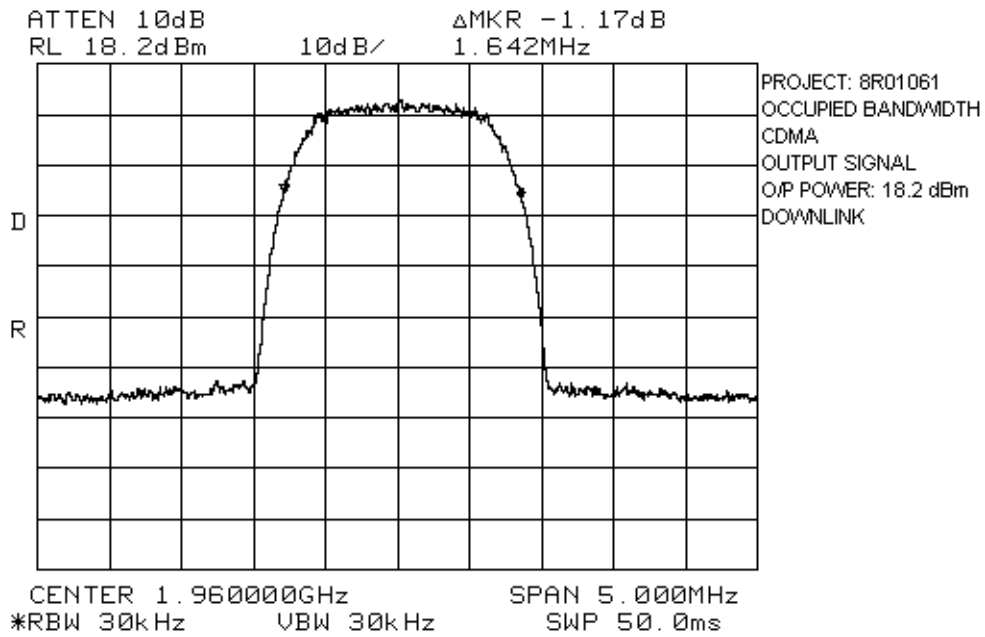
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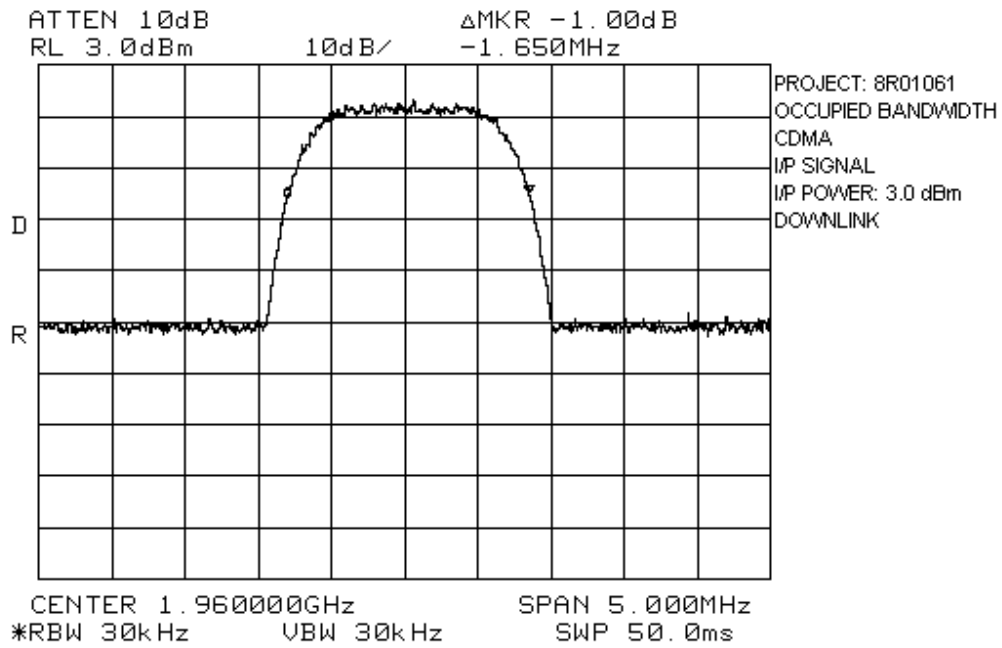
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BROADBAND PCS BASE STATION
PROJECT NO.: 8R01061

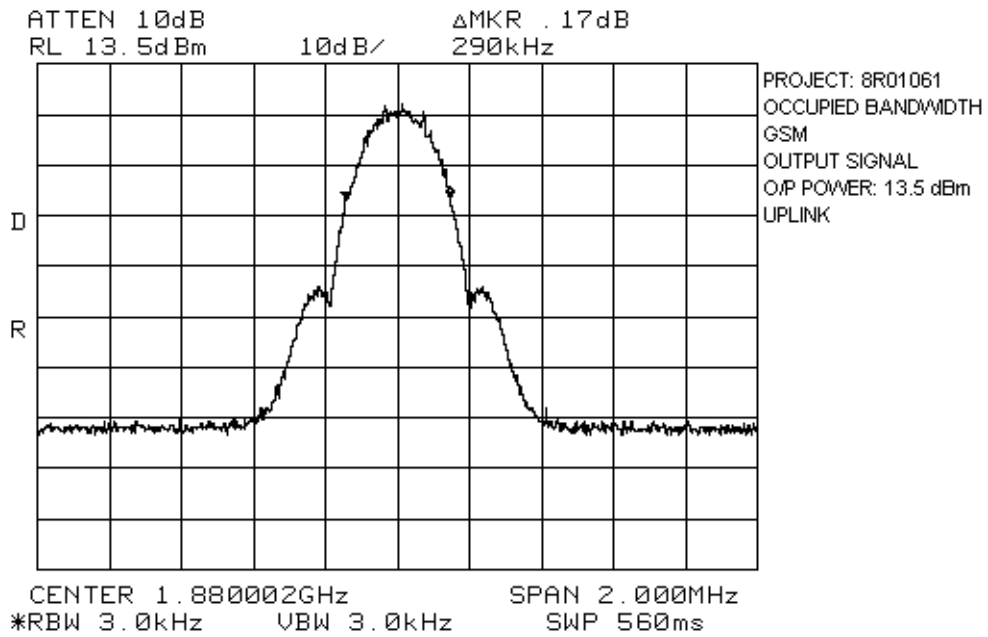
EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

NAME OF TEST: Occupied Bandwidth (GSM)	PARA. NO.: 2.917(c)
TESTED BY: Kevin Carr	DATE: December 22, 1998

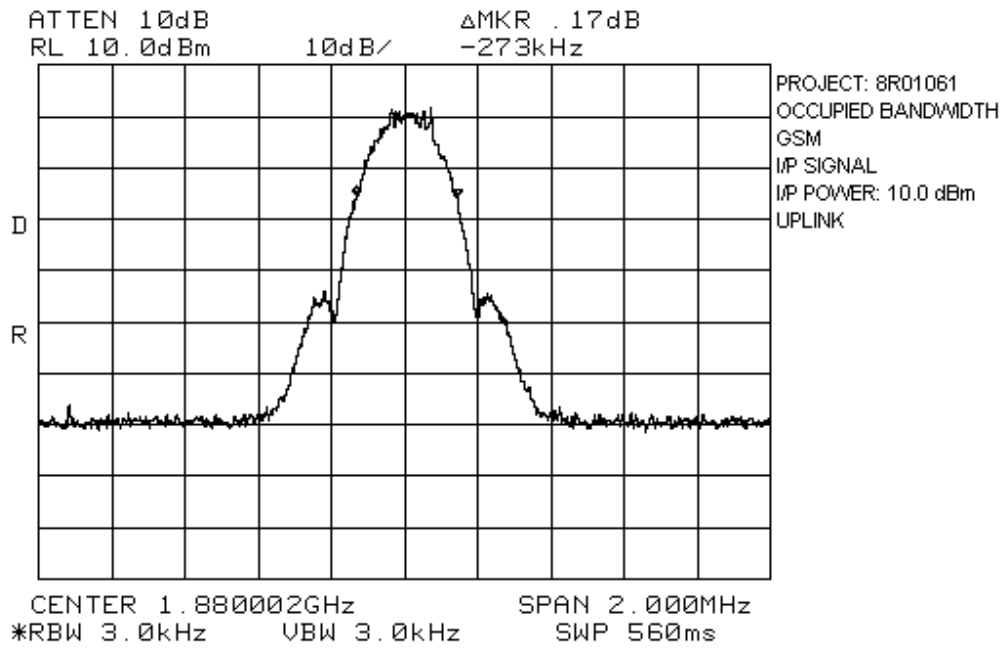
Test Results: Complies.

Test Data: See attached graph(s).

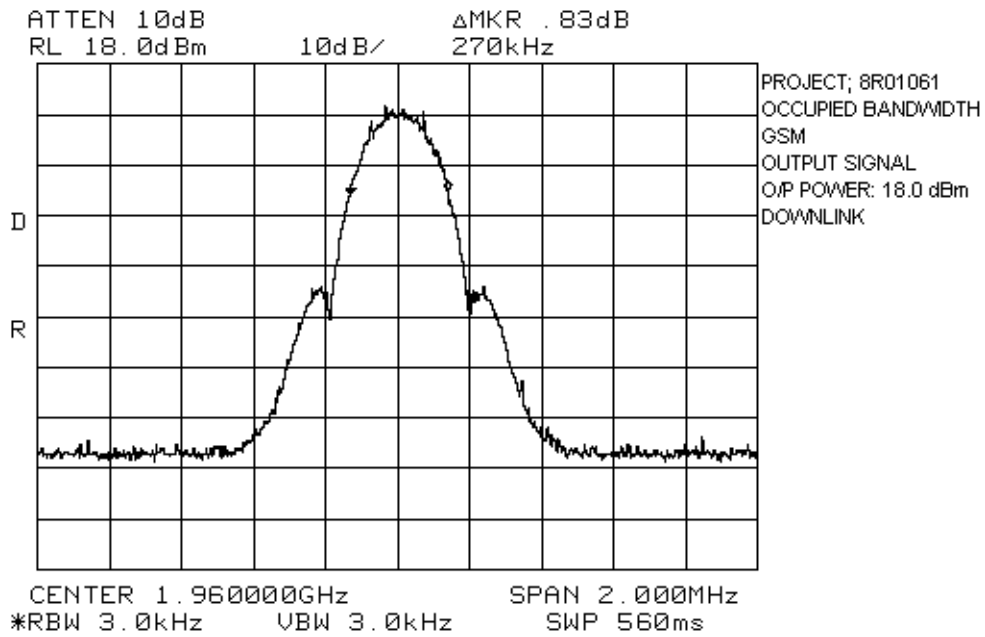
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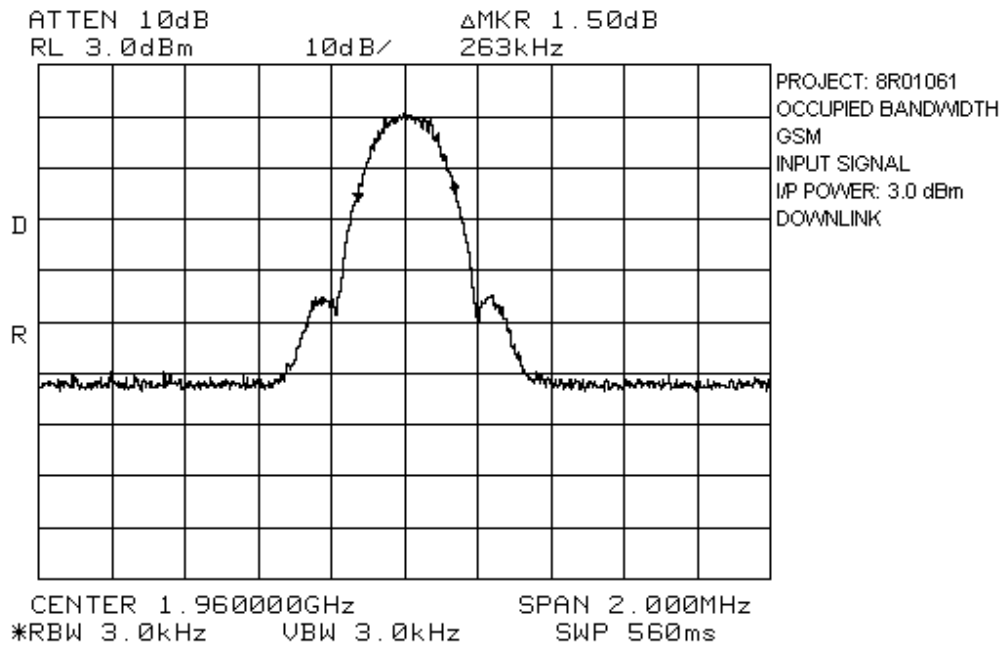
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FCC ID: BCR-BCEL-1915BA



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FCC ID: BCR-BCEL-1915BA



EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA



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FCC PART 24, SUBPART E
BROADBAND PCS BASE STATION
PROJECT NO.: 8R01061

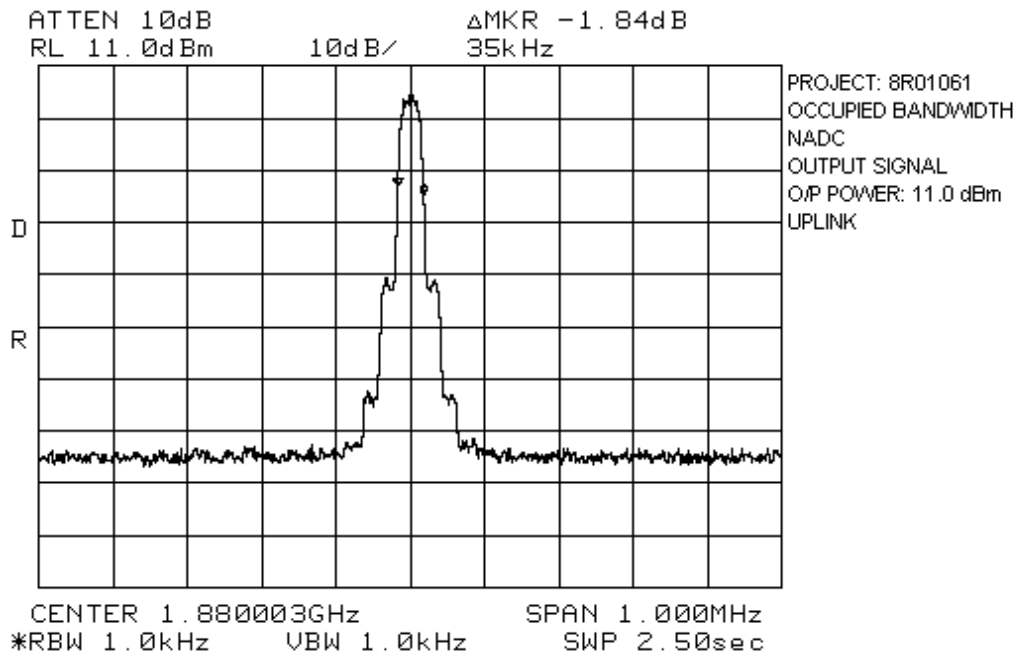
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FCC ID: BCR-BCEL-1915BA

NAME OF TEST: Occupied Bandwidth (NADC)	PARA. NO.: 2.917(c)
TESTED BY: Kevin Carr	DATE: December 22, 1998

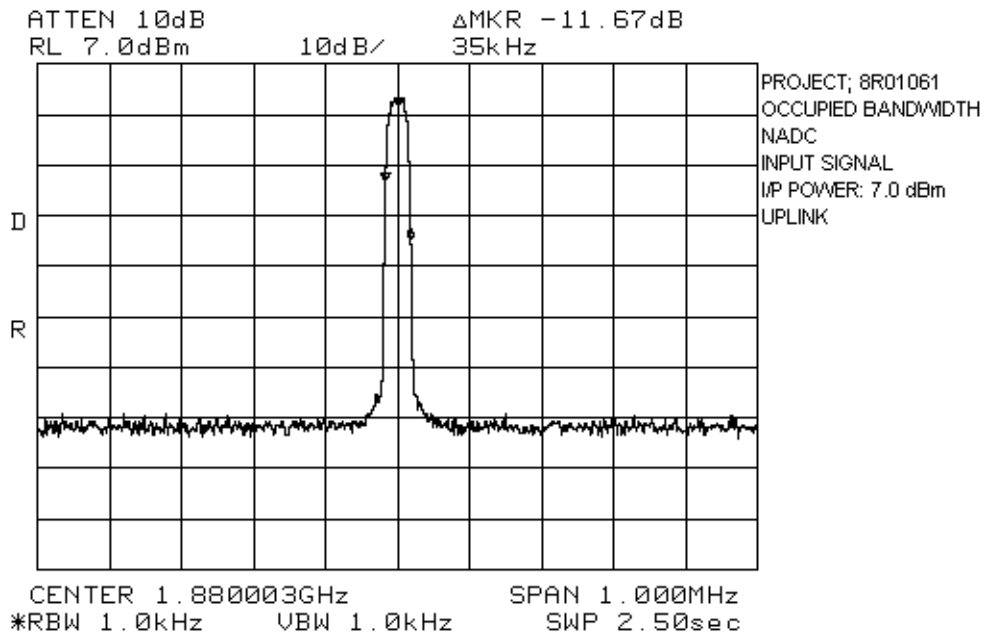
Test Results: Complies.

Test Data: See attached graph(s).

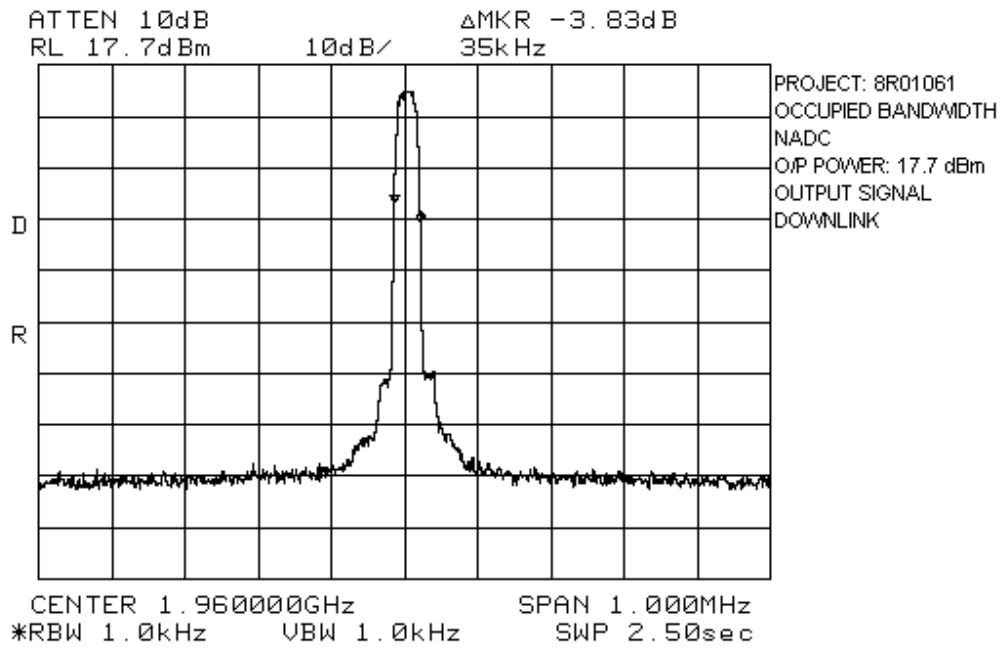
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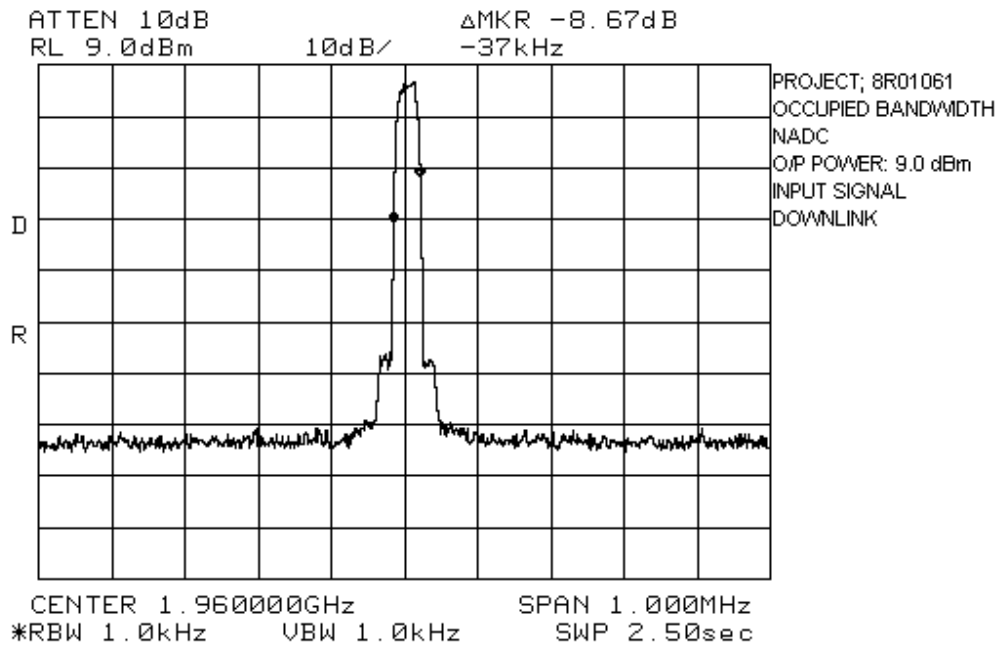
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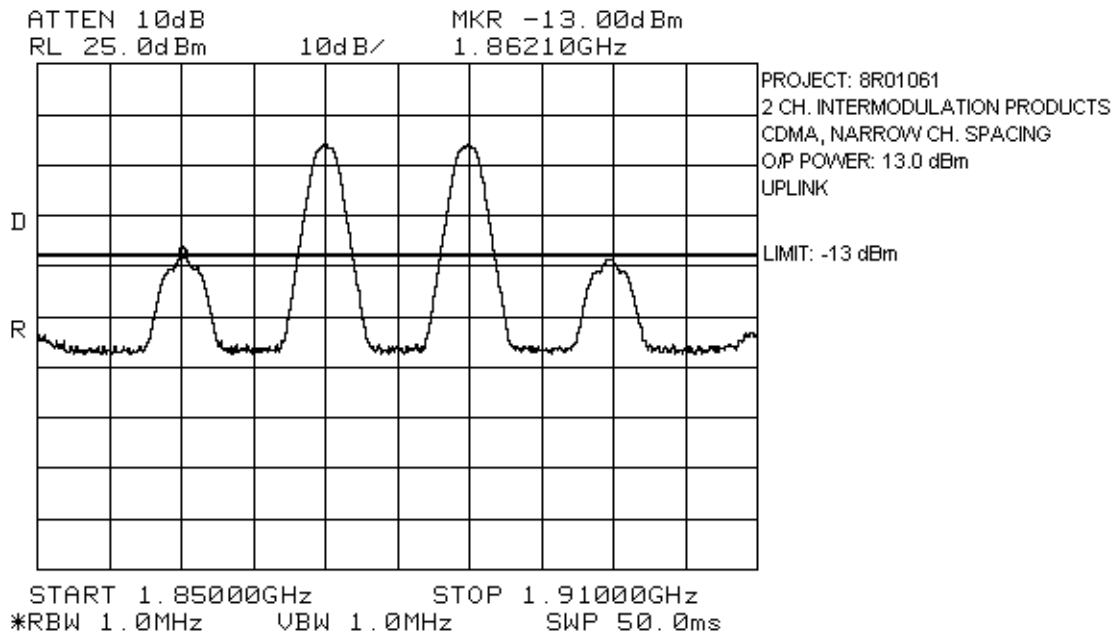
Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.917(e)
TESTED BY: Kevin Carr	DATE: December 22, 1998

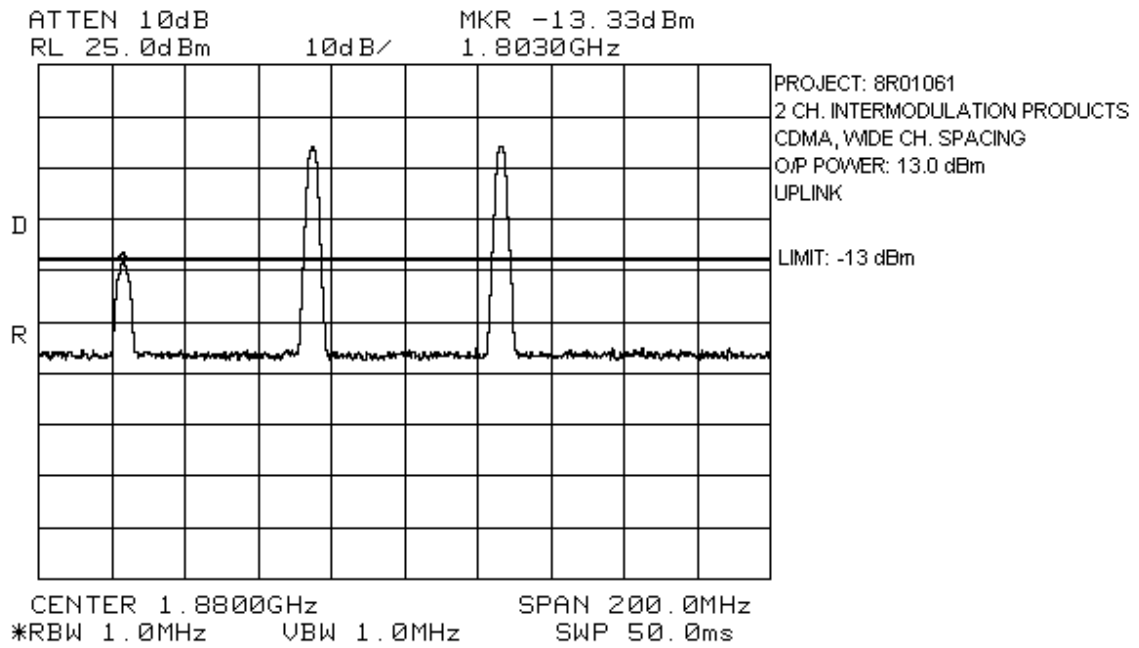
Test Results: Complies.**Test Data:**

NAME OF TEST	WORST-CASE SPURIOUS LEVEL(dBm)
0 to 20 GHz Spurious	-13.0
Lower Band Edge	-26.8
Upper Band Edge	-18.5

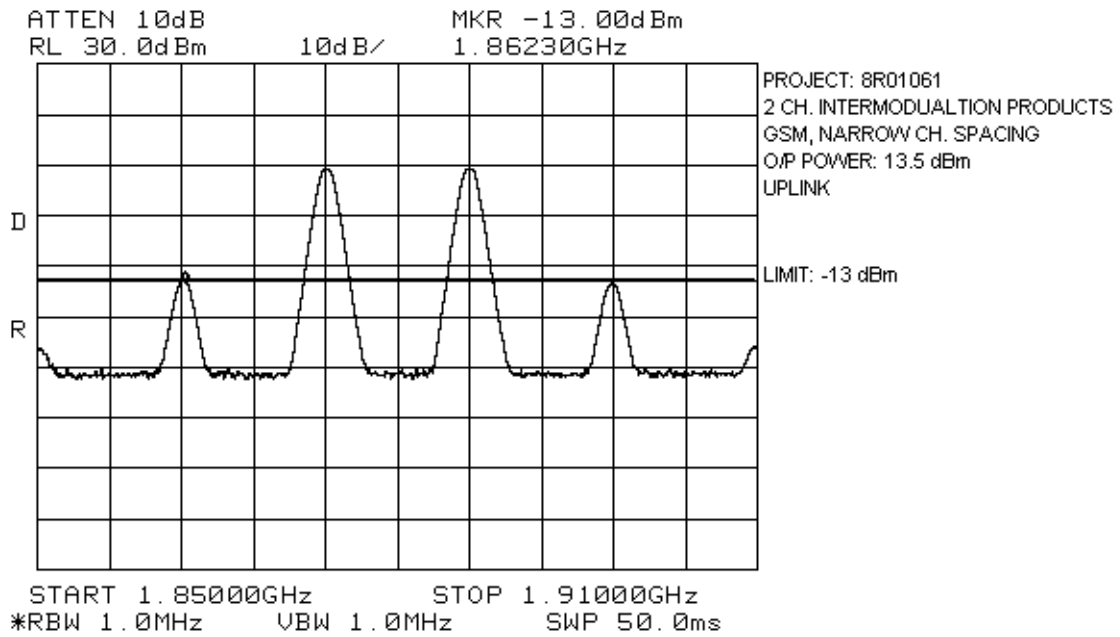
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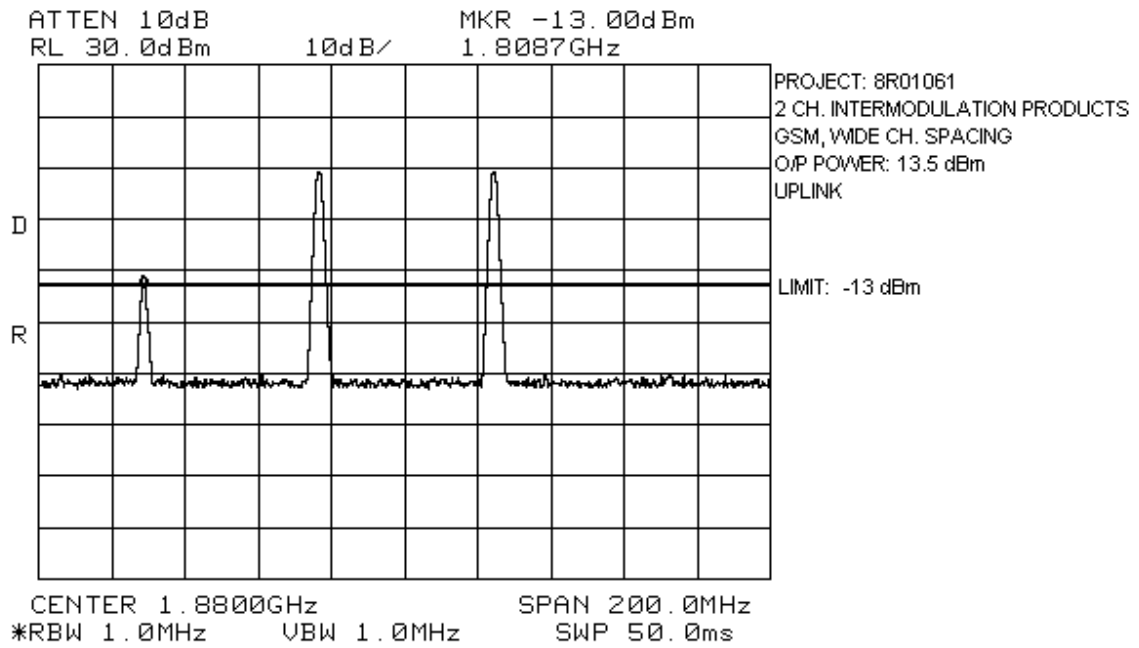
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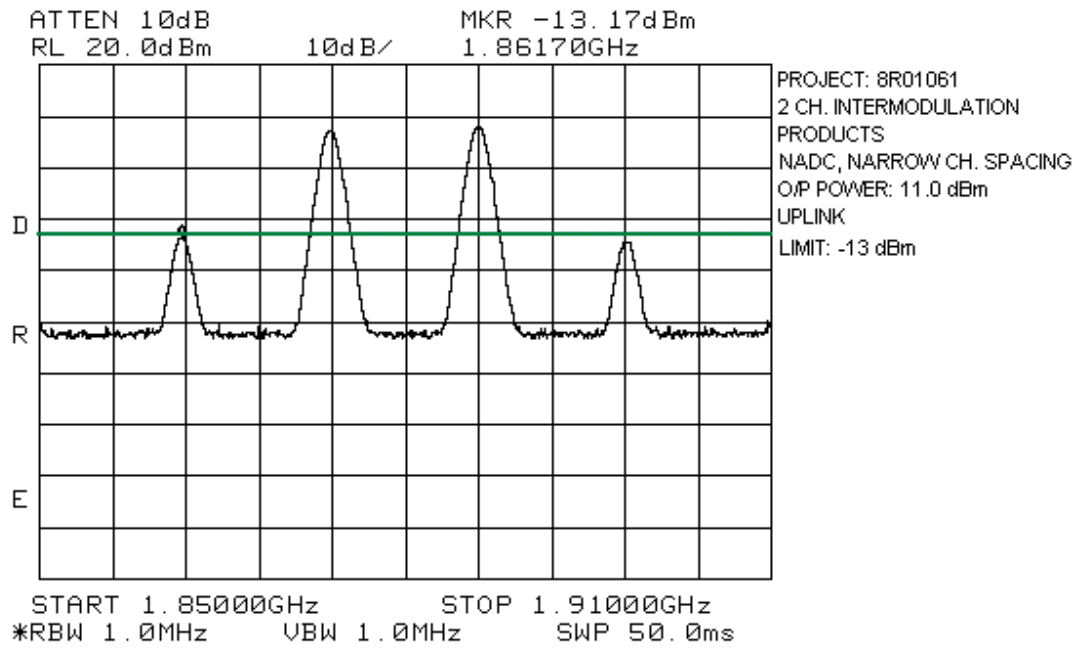
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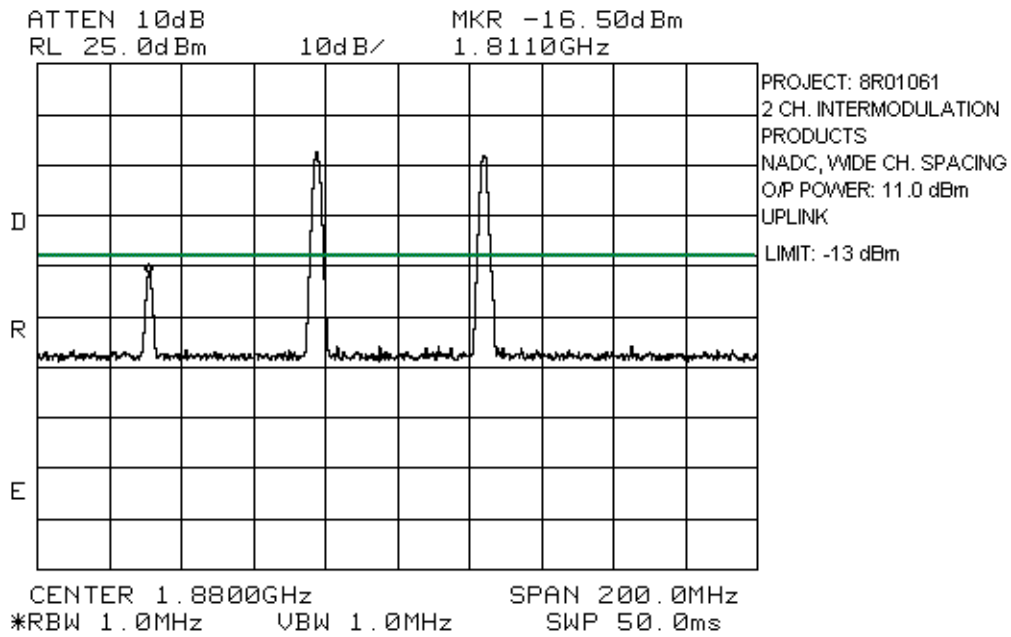
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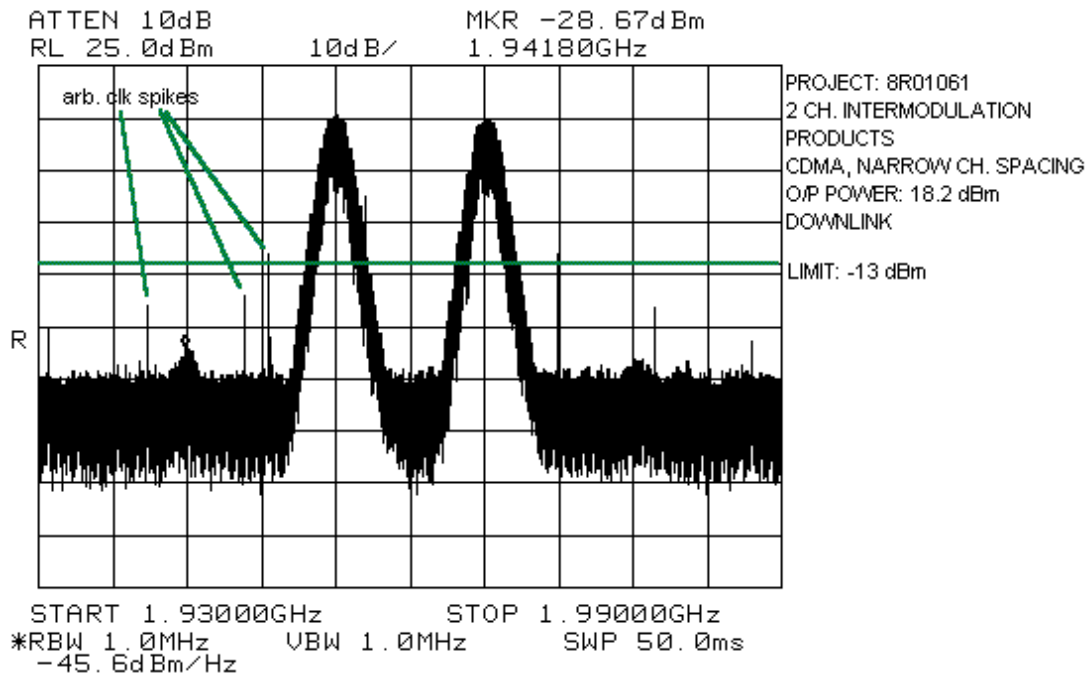
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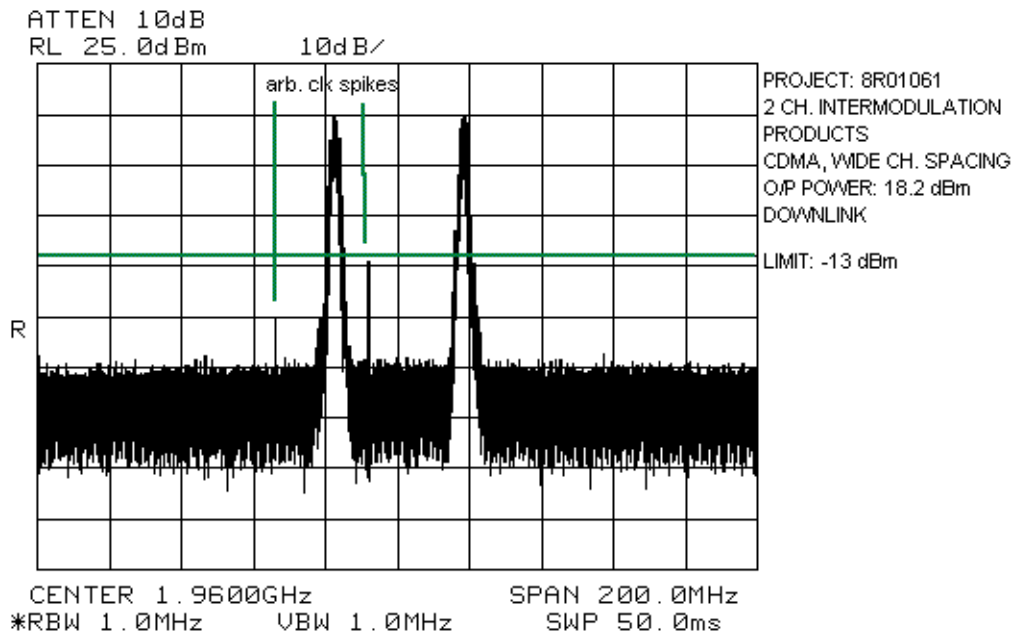
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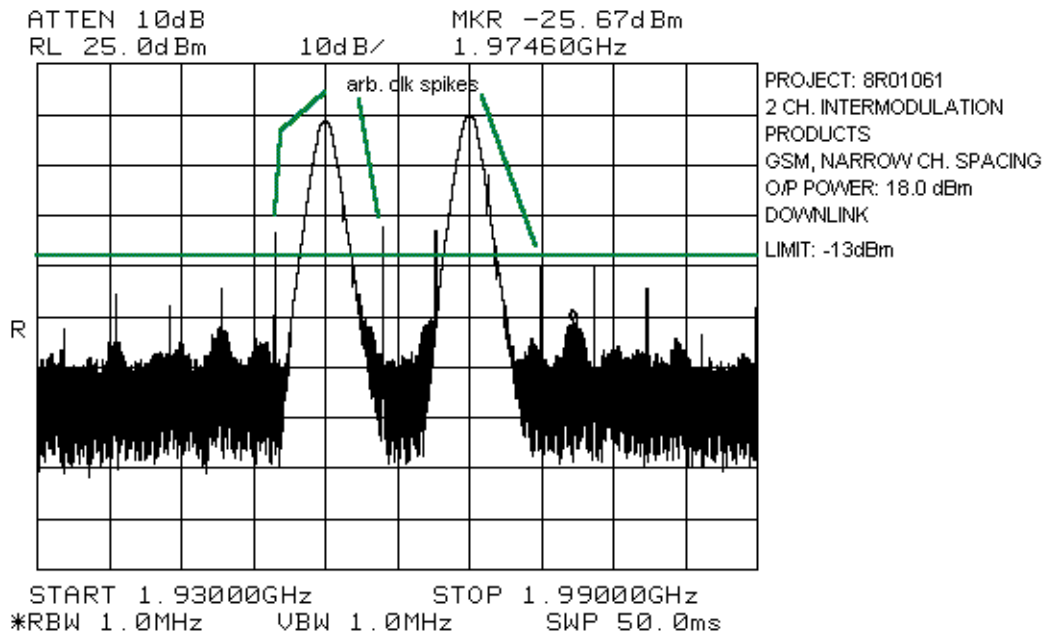
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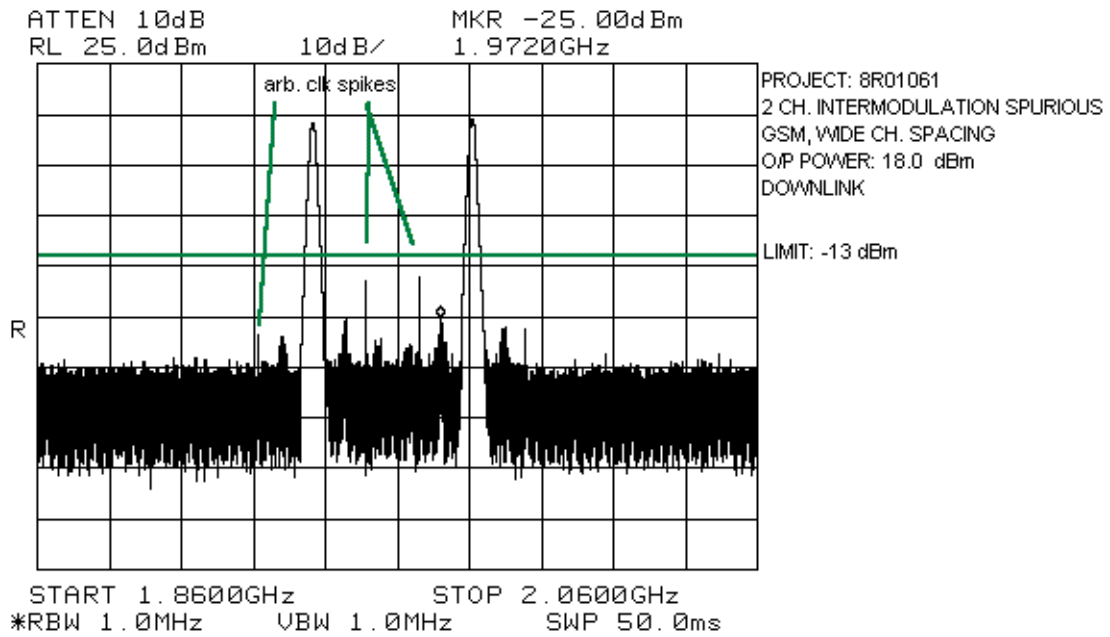
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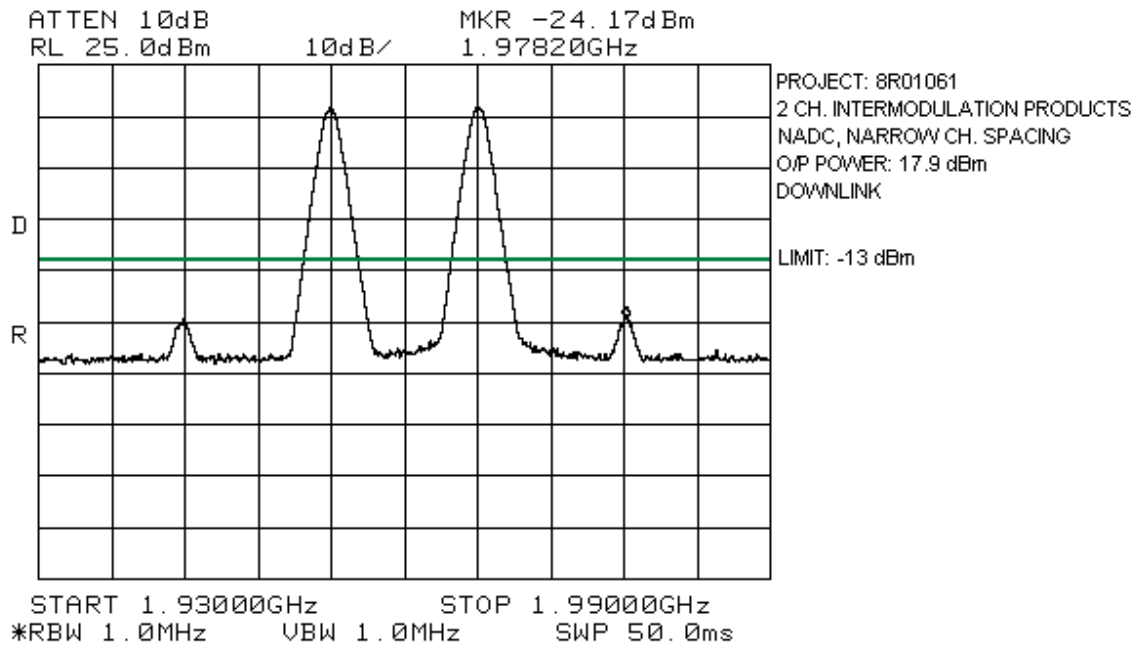
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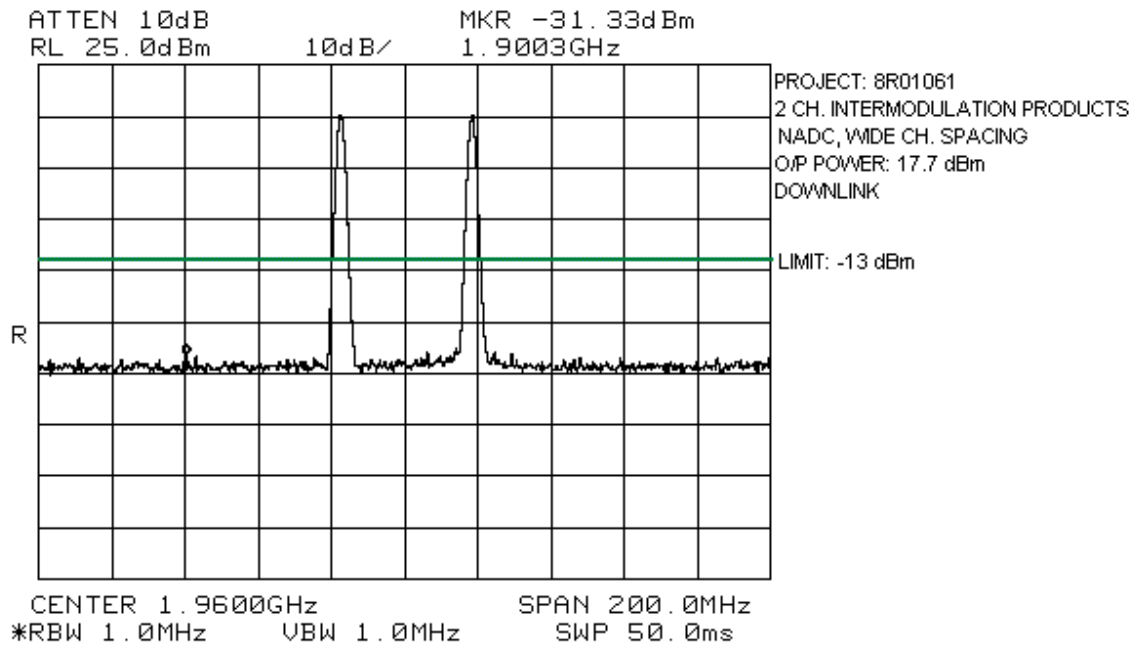
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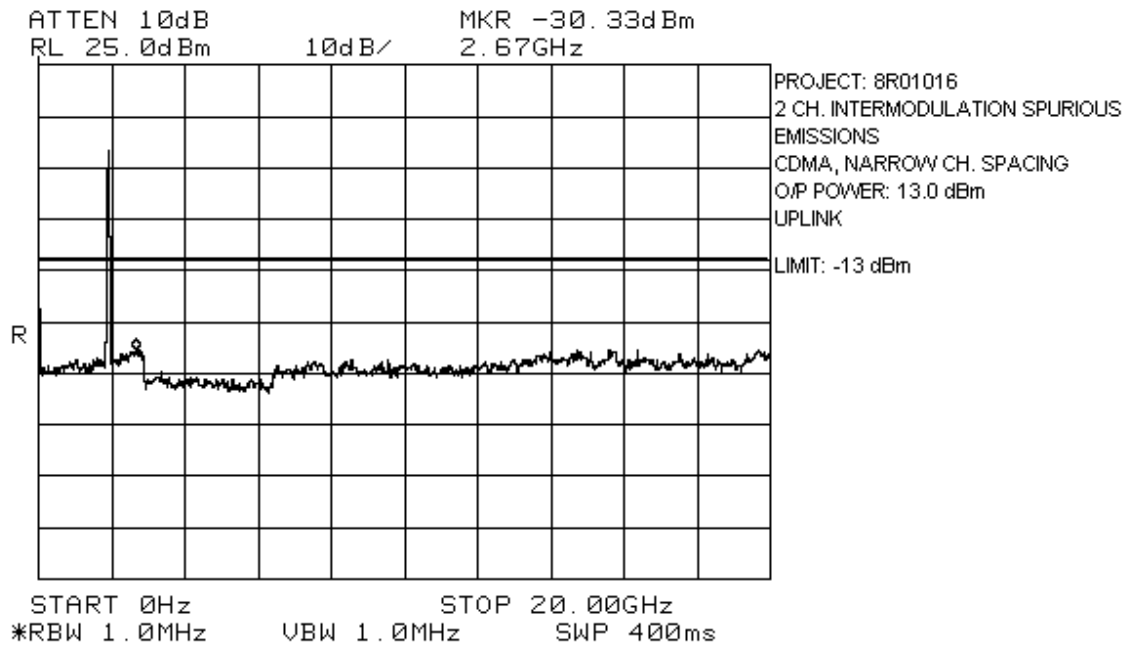
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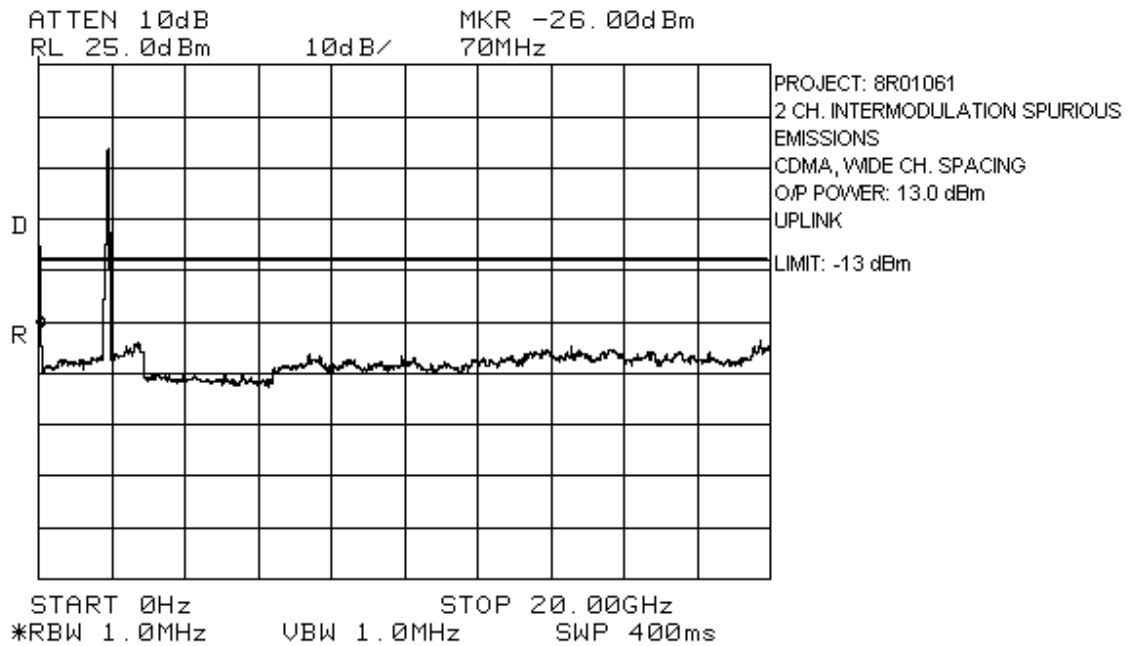
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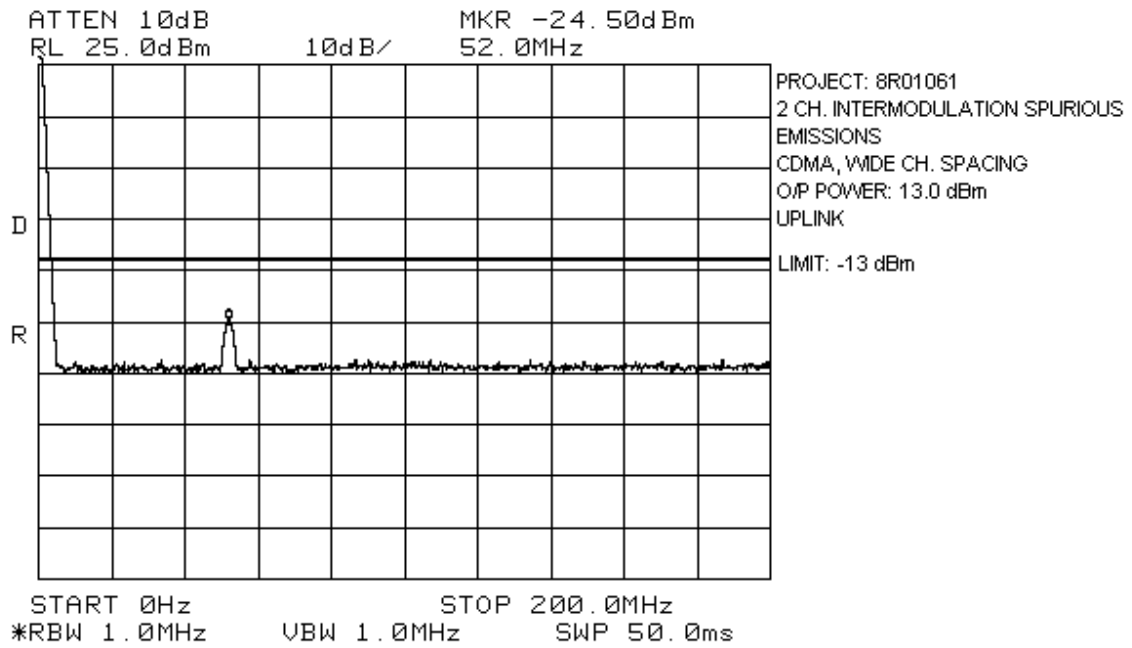
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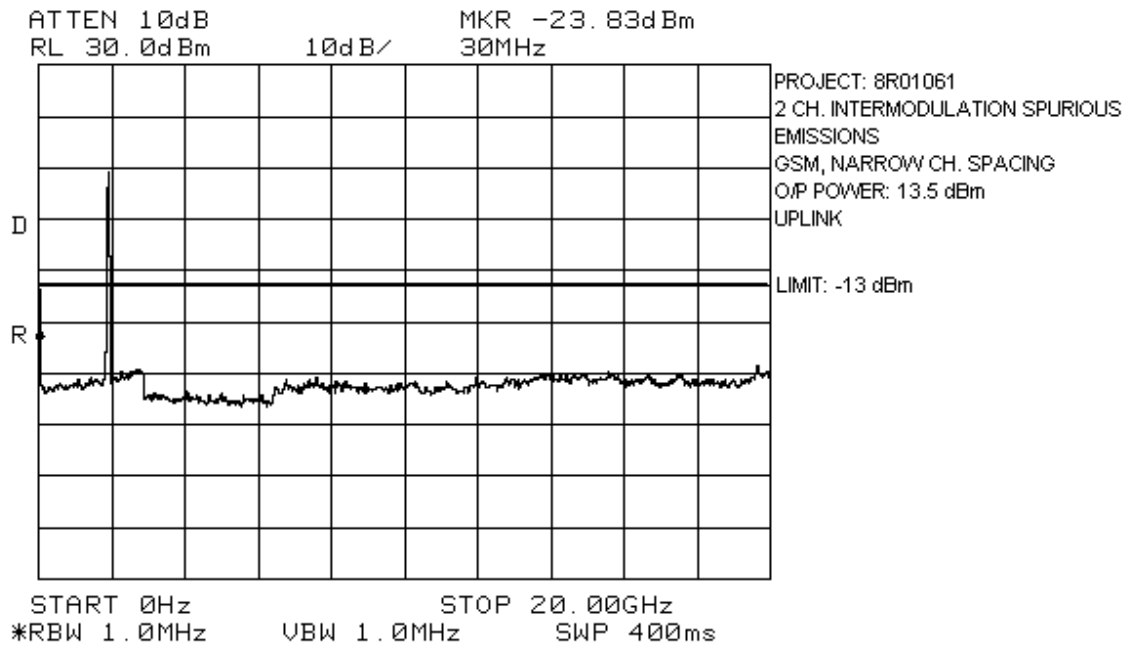
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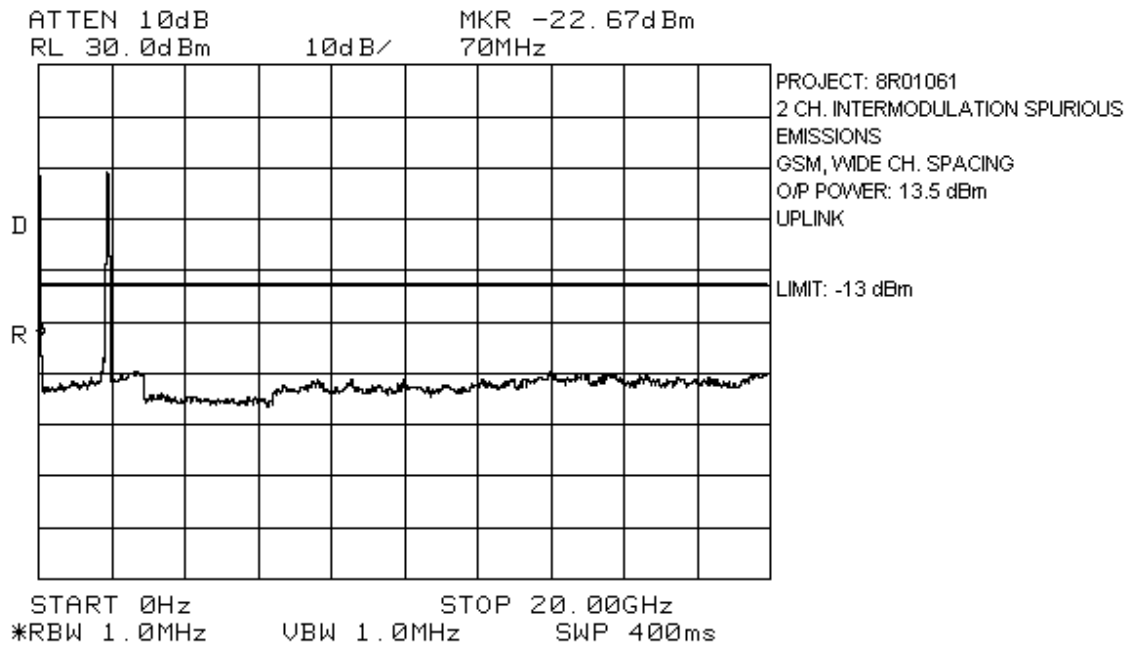
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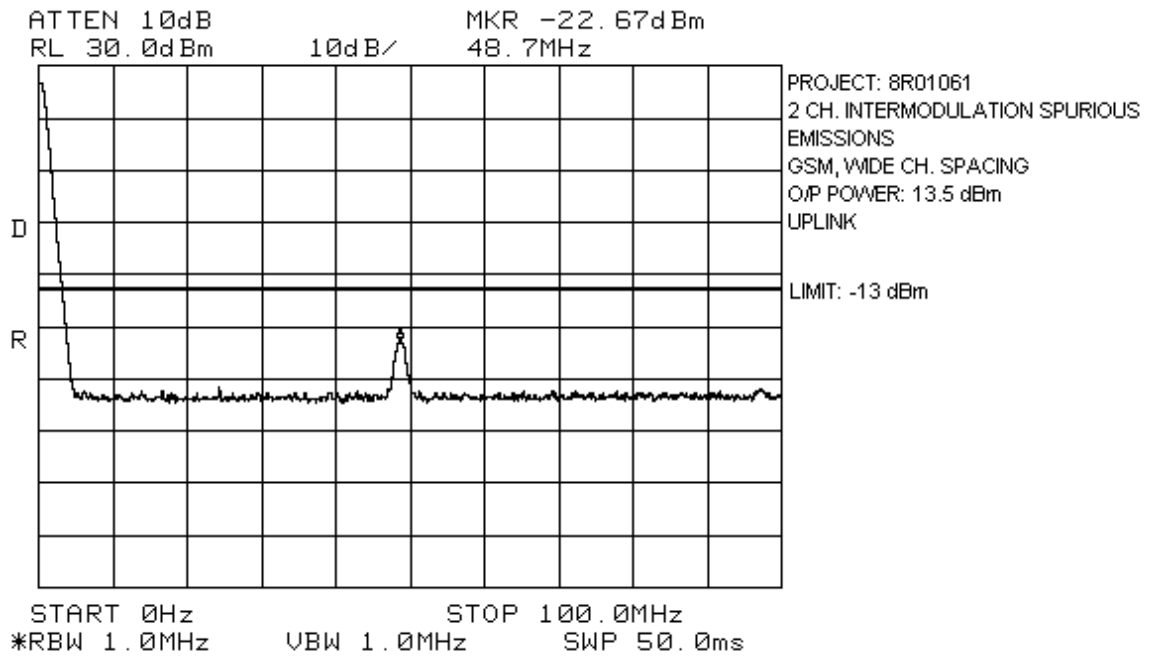
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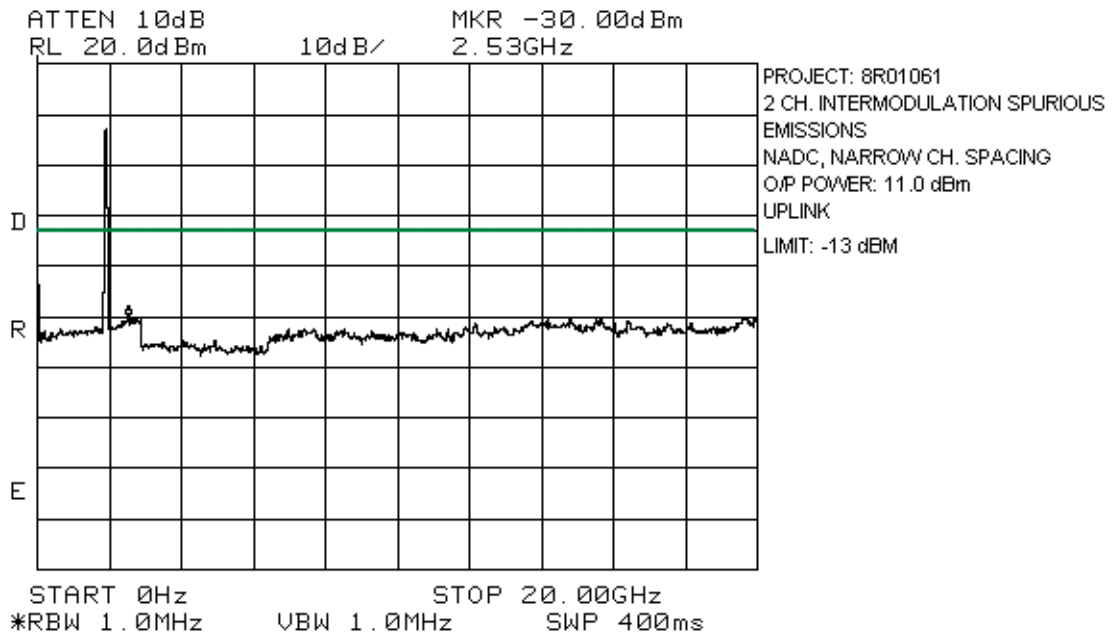
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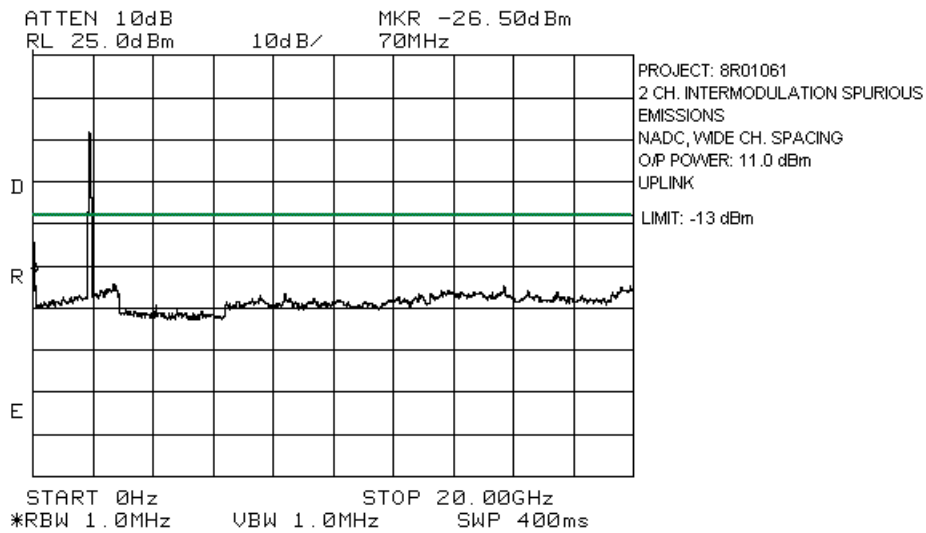
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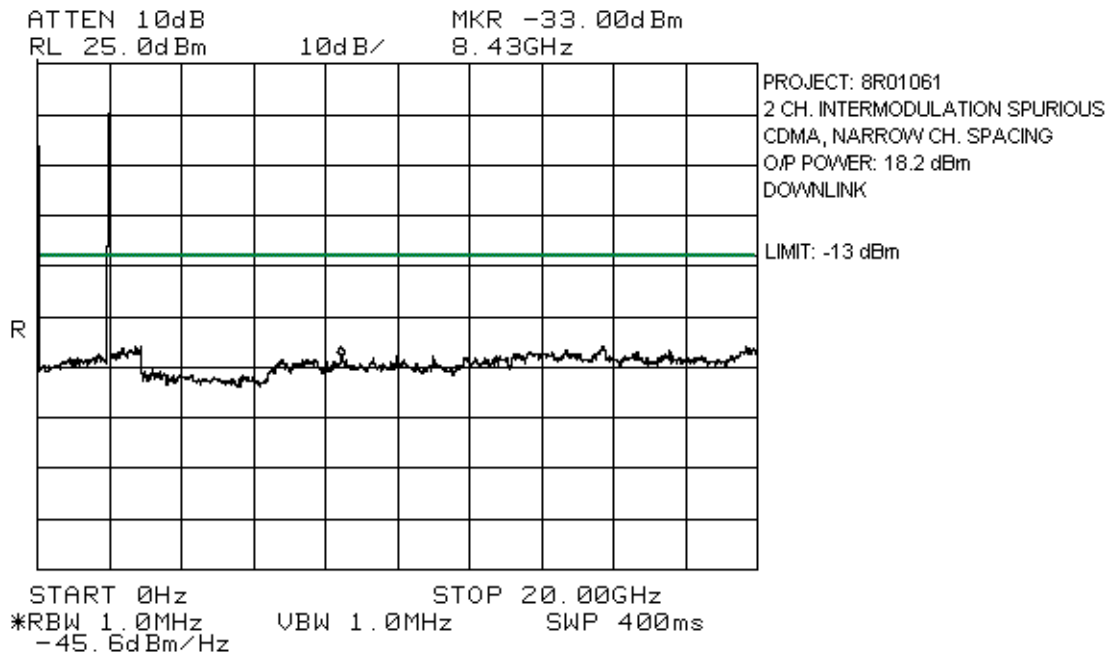
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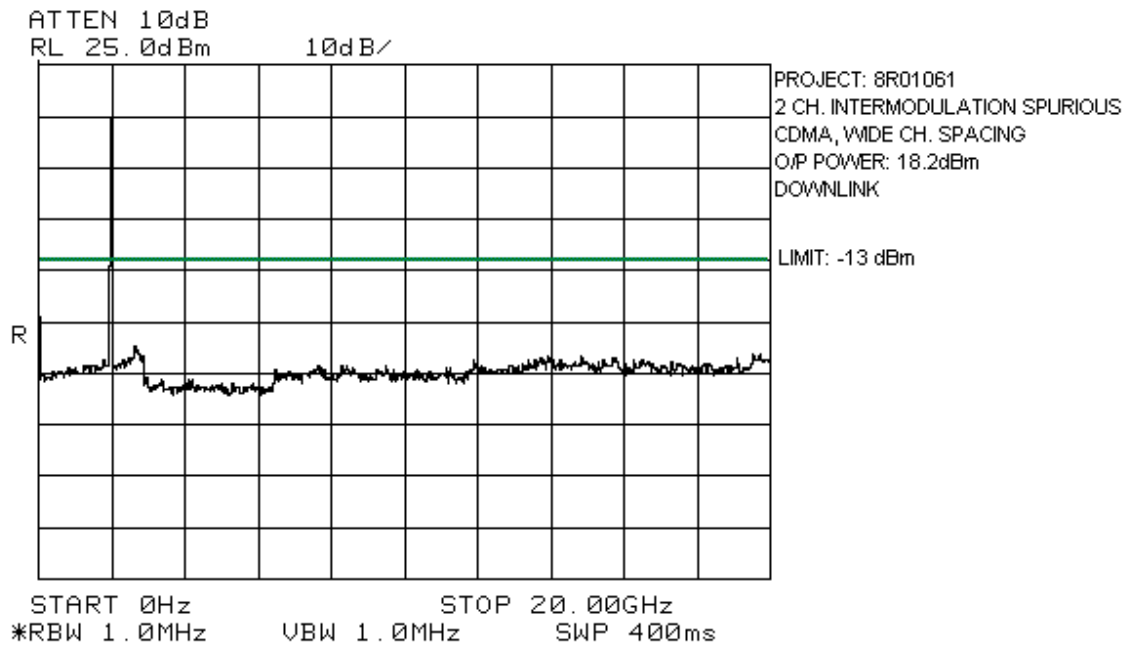
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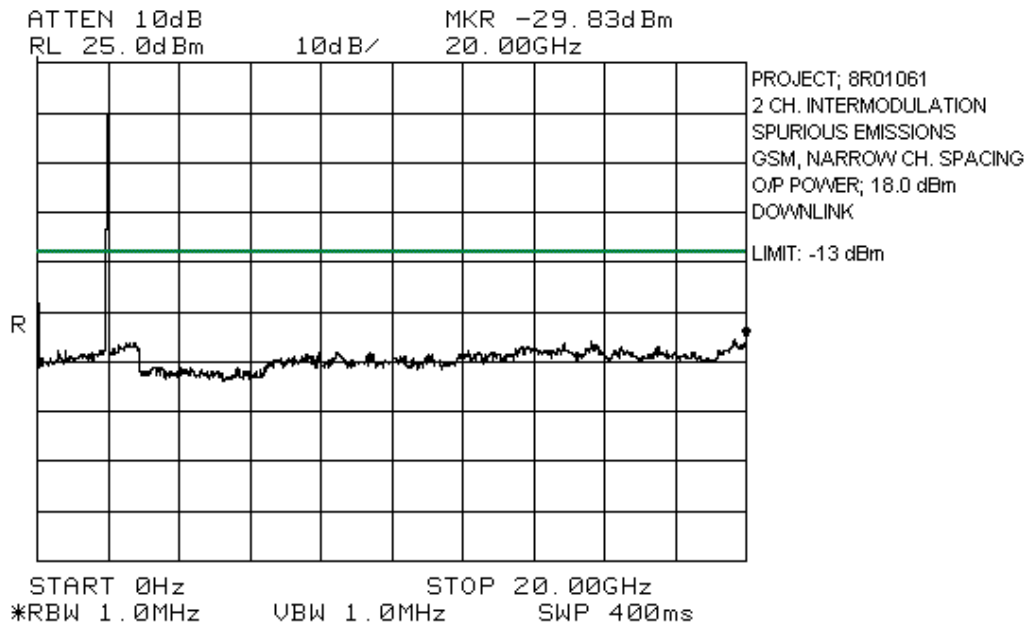
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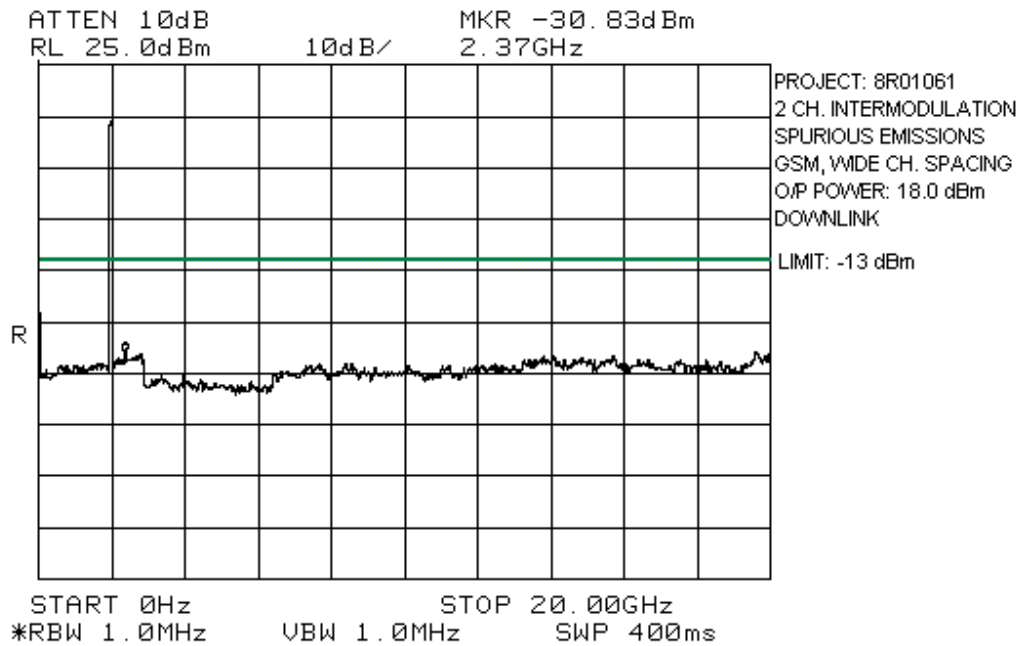
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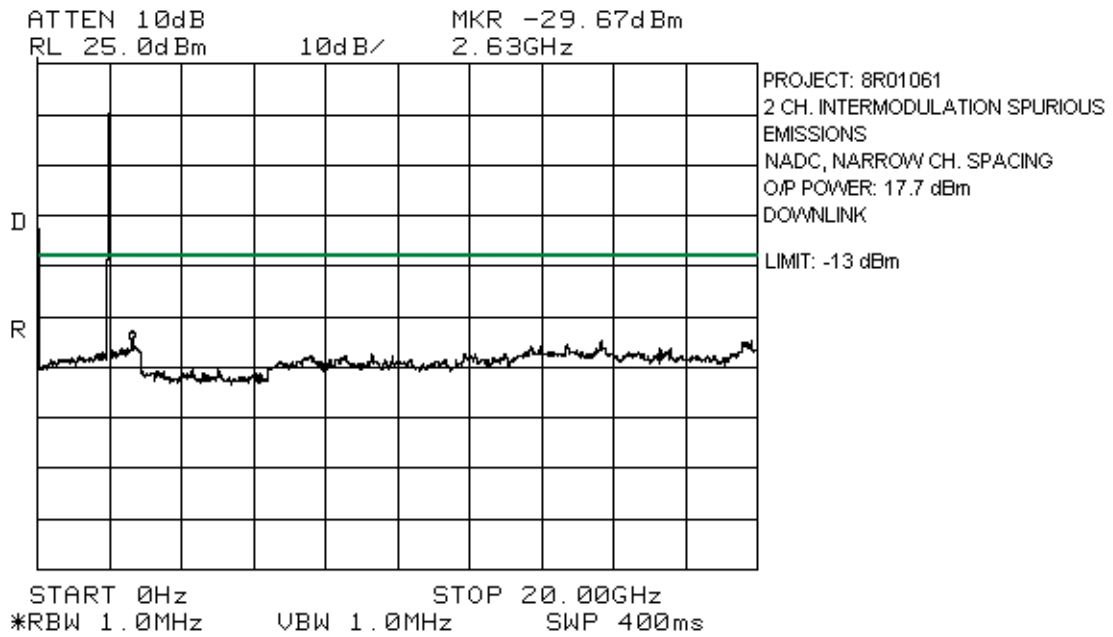
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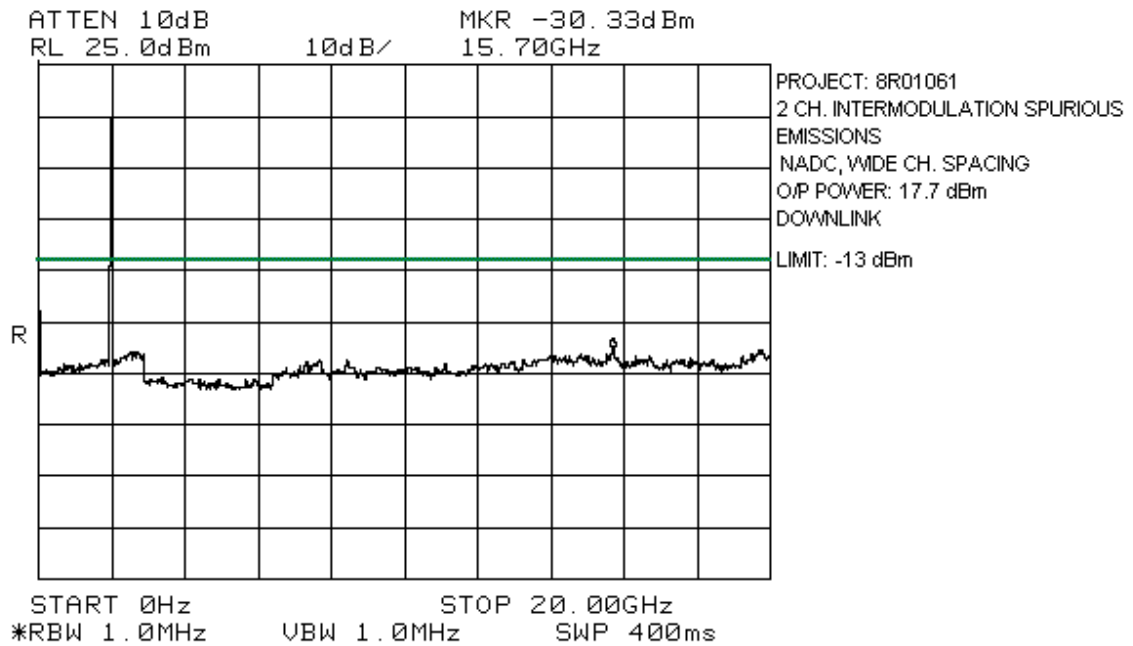
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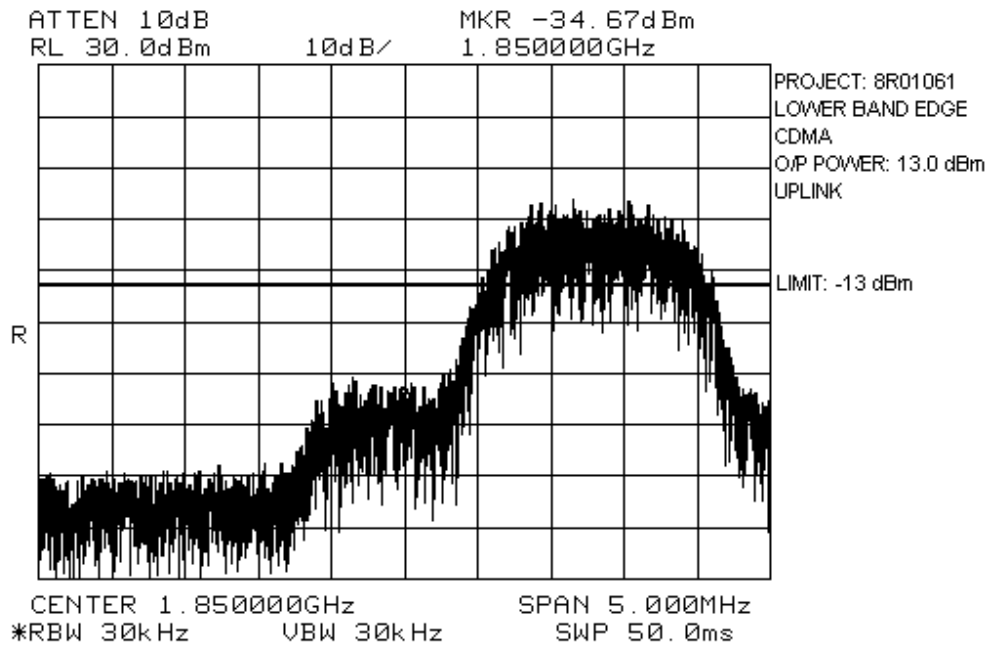
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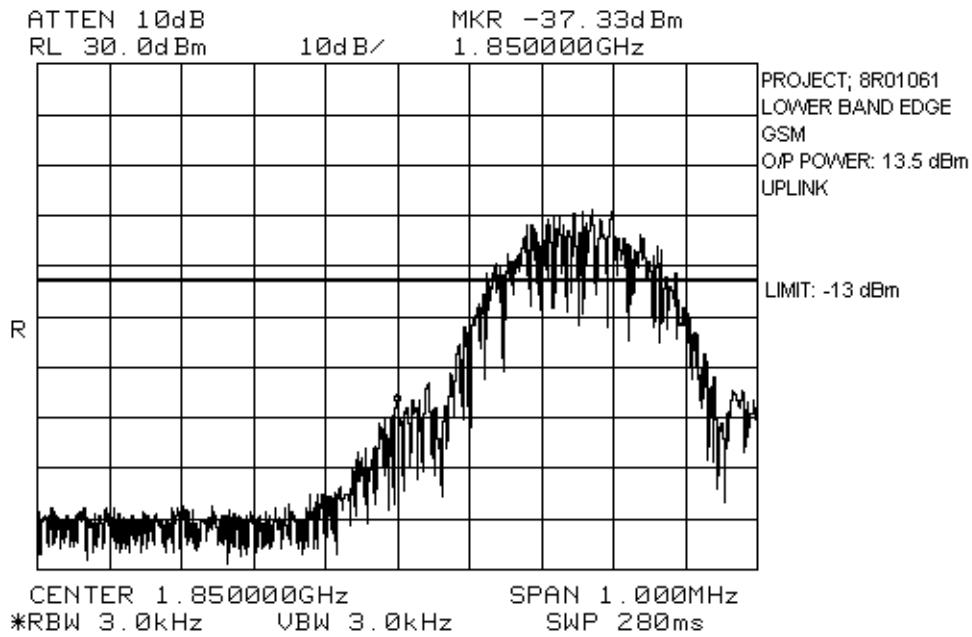
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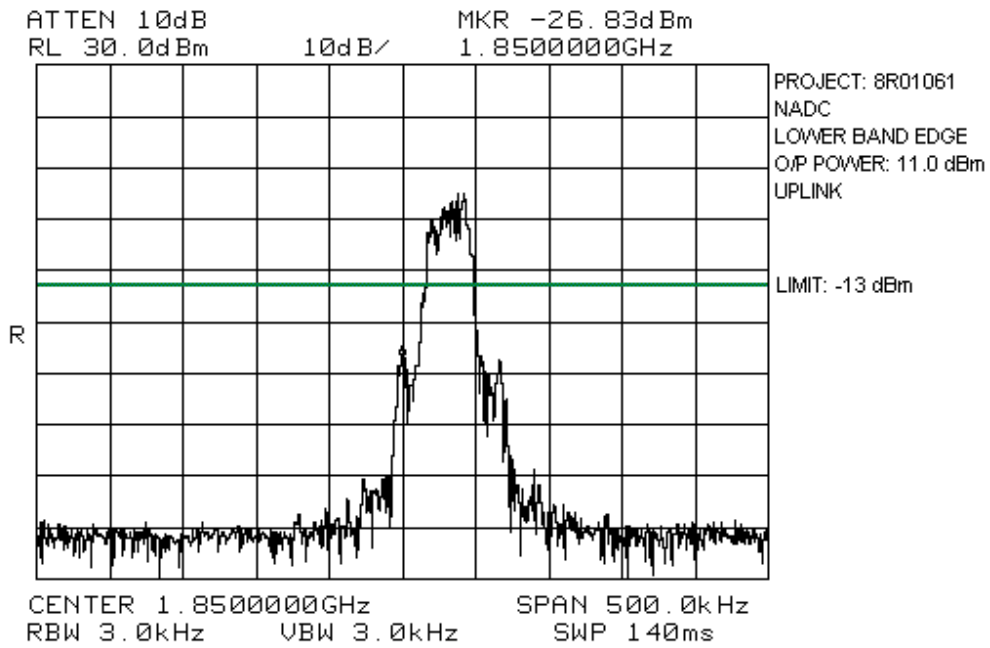
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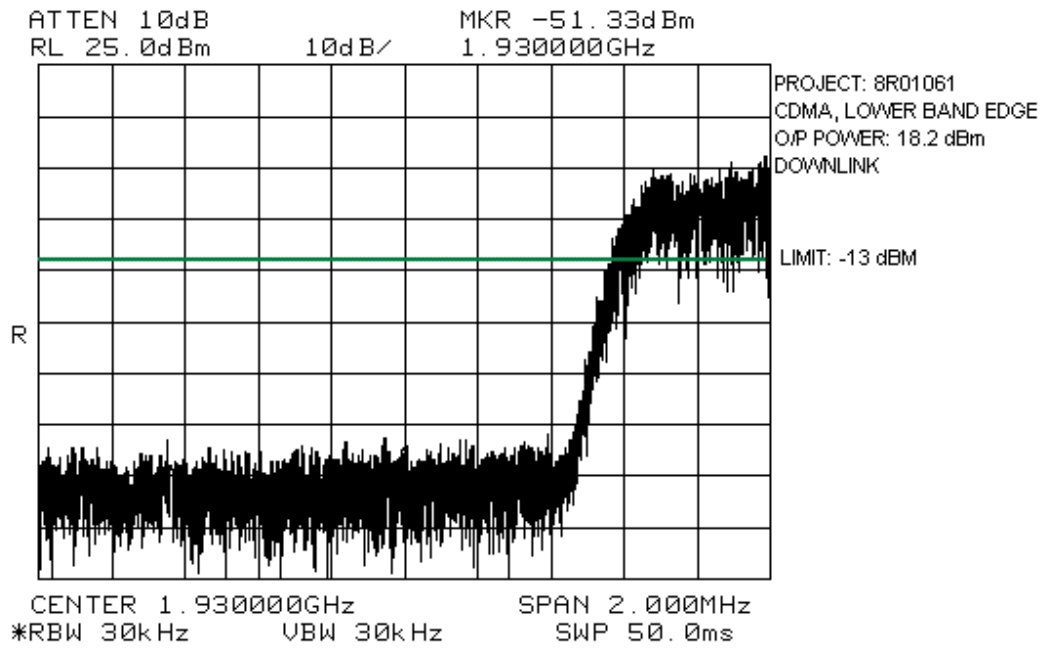
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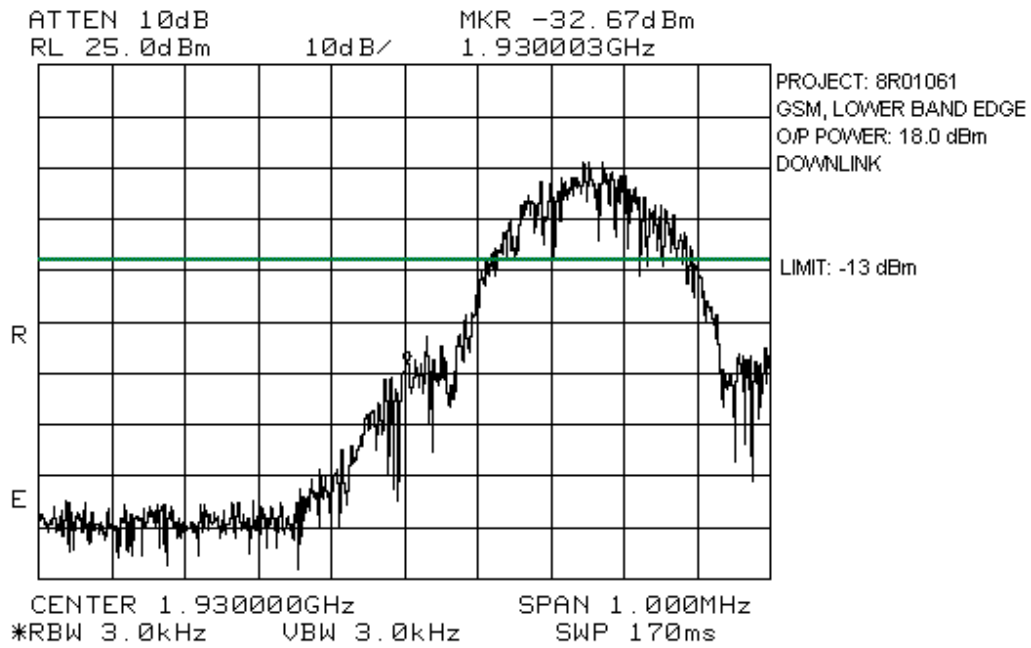
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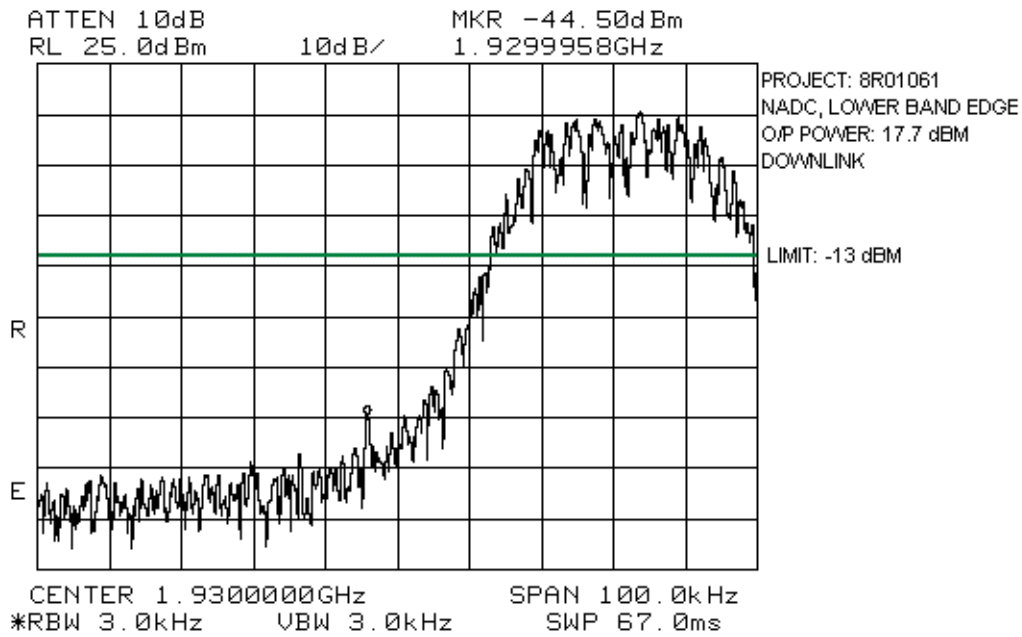
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FCC ID: BCR-BCEL-1915BA



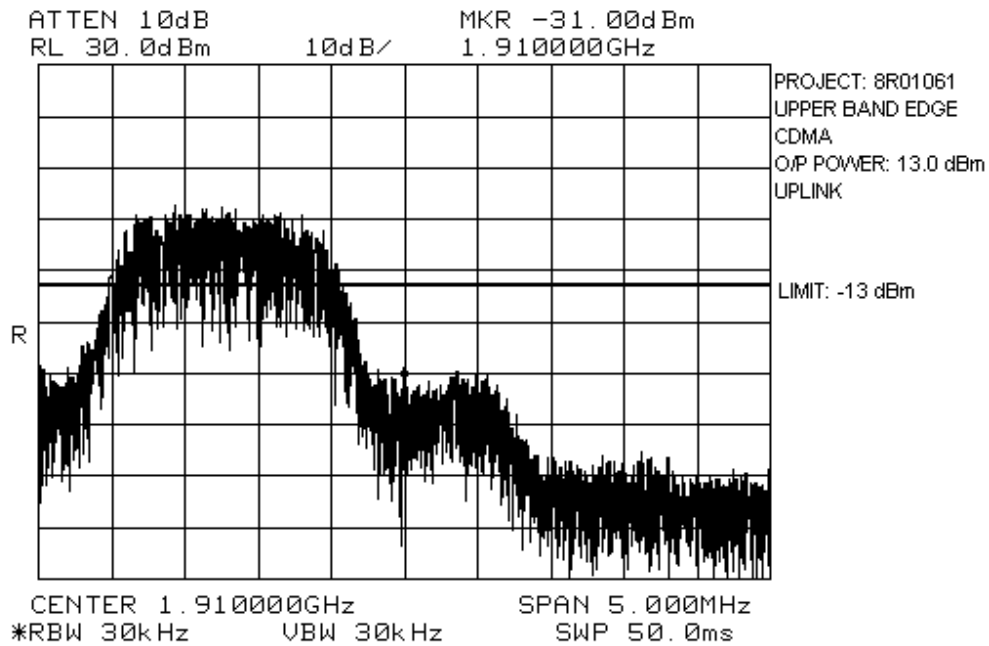
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FCC ID: BCR-BCEL-1915BA



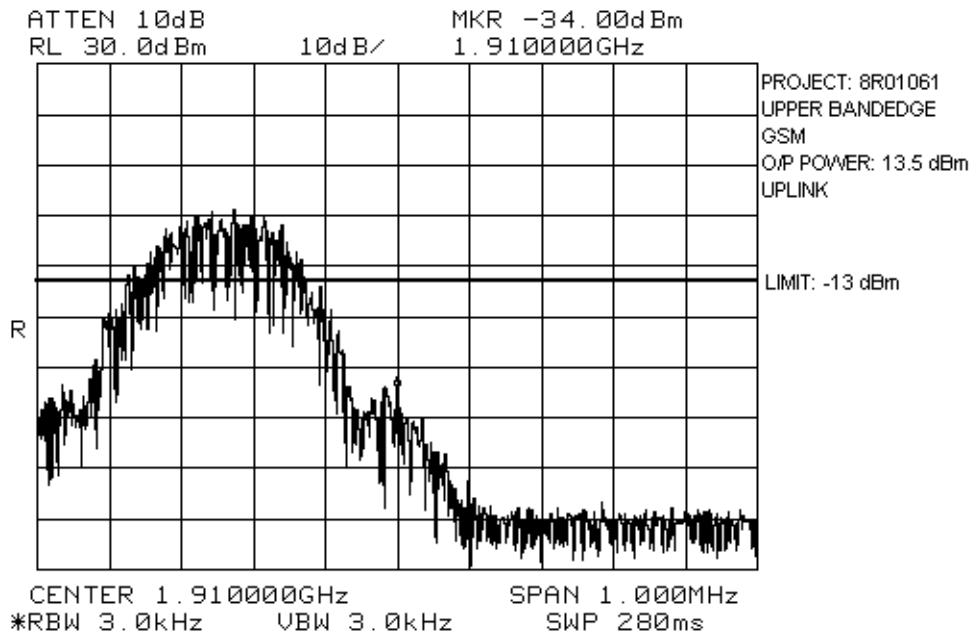
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FCC ID: BCR-BCEL-1915BA



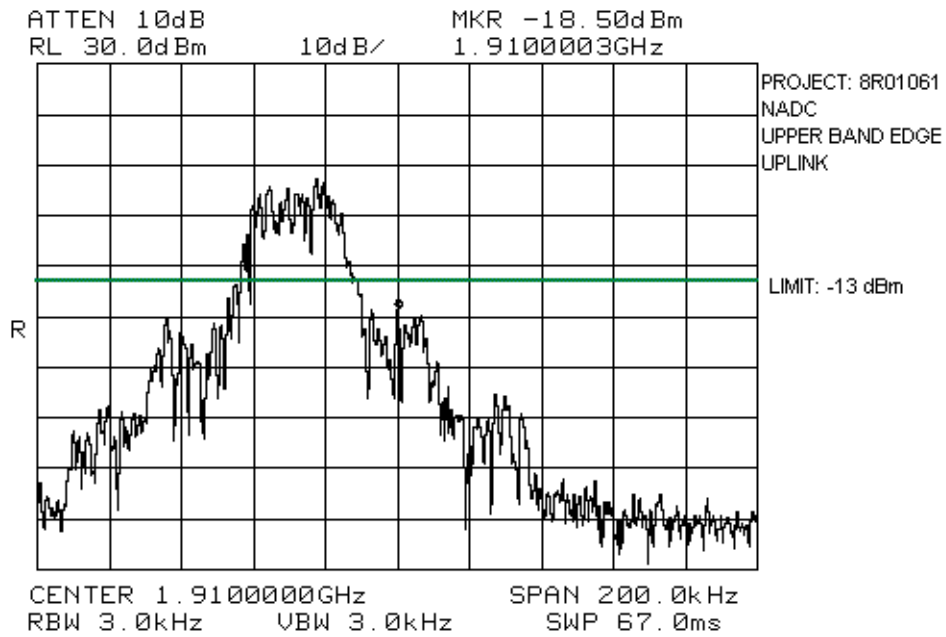
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FCC ID: BCR-BCEL-1915BA



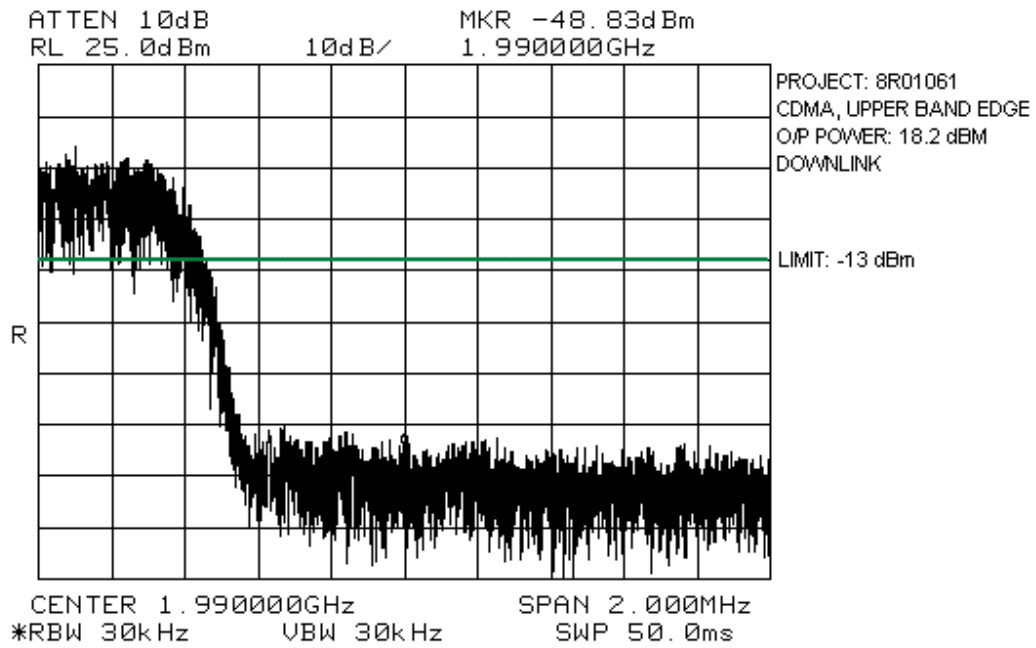
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FCC ID: BCR-BCEL-1915BA



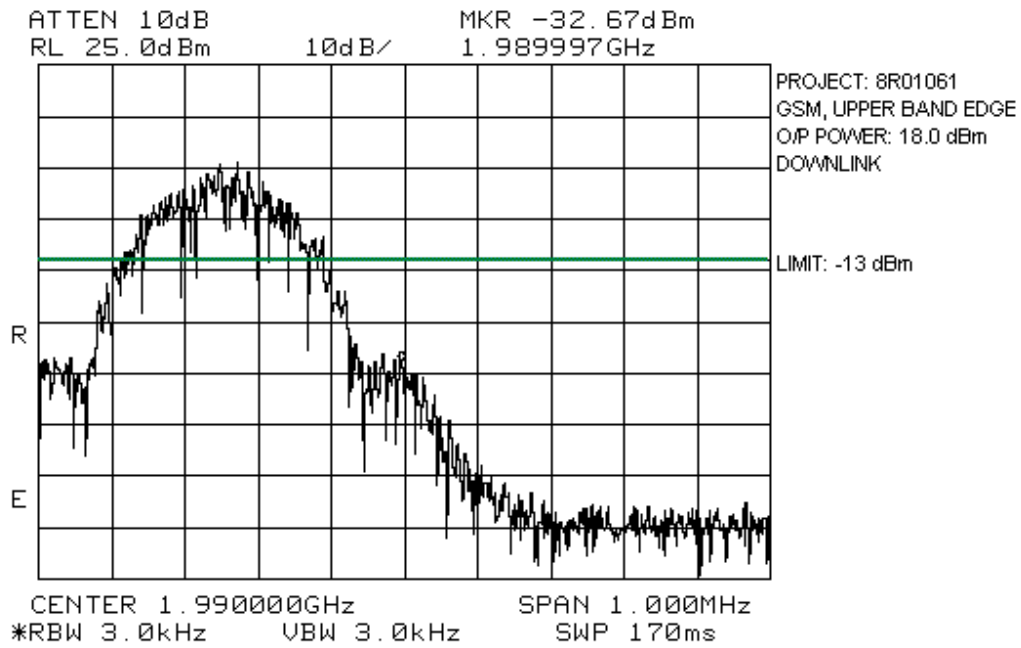
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FCC ID: BCR-BCEL-1915BA



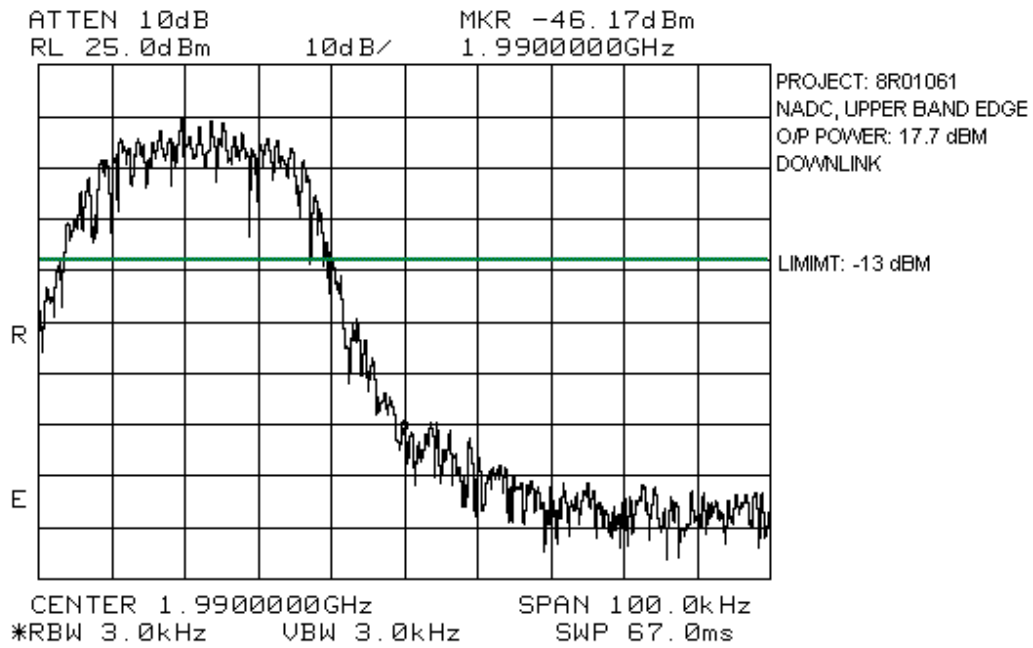
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FCC ID: BCR-BCEL-1915BA



EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA



EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA



EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.917(e)
TESTED BY: Kevin Carr	DATE: January 4, 1999

Test Results: Complies.
The maximum field strength is 64.96 dB μ V/m @ 3m.

Test Data:

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Test Data - Radiated Emissions: Uplink

Test Distance (meters) : 3		Range:		Receiver: HP 8565 E		RBW(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)
3760.0	H2	V			74.7	32.6	42.4		64.9	82.3	17.4
3760.0	H2	H			72.3	32.6	42.4		62.5	82.3	19.8
5640.0	H2	V			70.3	35.0	44.4		58.5	82.3	23.8
5640.0	H2	H			67.8	35.0	44.4		58.4	82.3	23.9
7520.0	H2	V			62.0	36.8	43.6		55.2	82.3	27.1
7520.0	H2	H			62.3	36.8	43.6		55.5	82.3	26.8
9400.0	H2	V			63.7	38.3	43.4		58.6	82.3	23.7
9400.0	H2	H			63.8	38.3	43.4		58.7	82.3	23.6
11280.0	H2	V			54.3	38.7	43.5		49.5	82.3	32.8
11280.0	H2	H			54.0	38.7	43.5		49.2	82.3	33.1
13160.0	H2	V			27.5	40.3		-9.54	58.3	82.3	24.0
13160.0	H2	H			29.0	40.3		-9.54	59.76	82.3	22.5
15040.0	H2	V			29.2	39.0		-9.54	58.66	82.3	23.6
15040.0	H2	H			28.0	39.0		-9.54	57.46	82.3	24.8
16920.0	H2	V			27.2	41.9		-9.54	59.56	82.3	22.7
16920.0	H2	H			27.3	41.9		-9.54	59.66	82.3	22.6
18800.0	SH50-1	V			27.8	40.37		-9.54	58.63	82.3	23.7
18800.0	SH50-1	H			27.0	40.37		-9.54	57.86	82.3	24.4

Notes:

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.

Measurements incorporating Dist. Connection were taken at 1 meter.

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Test Data - Radiated Emissions: Downlink

Test Distance (meters) : 3		Range:		Receiver: HP 8565 E		RBW(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)
3920.0	H2	V			62.0	33.7	42.6		53.1	82.3	29.2
3920.0	H2	H			63.7	33.7	42.6		54.8	82.3	27.5
5880.0	H2	V			48.5	36.3	44.5		40.3	82.3	42.0
5880.0	H2	H			48.7	36.3	44.5		40.5	82.3	41.8
7840.0	H2	V			47.2	38.4	43.7		41.9	82.3	40.4
7840.0	H2	H			45.7	38.4	43.7		40.4	82.3	41.9
9800.0	H2	V			47.2	39.8	44.3		42.7	82.3	39.6
9800.0	H2	H			49.0	39.8	44.3		44.5	82.3	37.8
11760.0	H2	V			45.7	39.9	43.8		41.8	82.3	40.5
11760.0	H2	H			46.0	39.9	43.8		42.1	82.3	40.2
13720.0	H2	V			24.33	41.5		-9.54	56.29	82.3	26.0
13720.0	H2	H			25.0	41.5		-9.54	56.96	82.3	25.3
15680.0	H2	V			25.83	39.5		-9.54	55.79	82.3	26.5
15680.0	H2	H			25.7	39.5		-9.54	55.66	82.3	26.6
17640.0	H2	V			30.0	44.5		-9.54	64.96	82.3	17.3
17640.0	H2	H			28.8	44.5		-9.54	63.76	82.3	18.5
19600.0	SH50-1	V			30.6	40.46		-9.54	61.52	82.3	20.8
19600.0	SH50-1	H			30.7	40.46		-9.54	61.62	82.3	20.7
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. Measurements incorporating Dist. Connection were taken at 1 meter.											

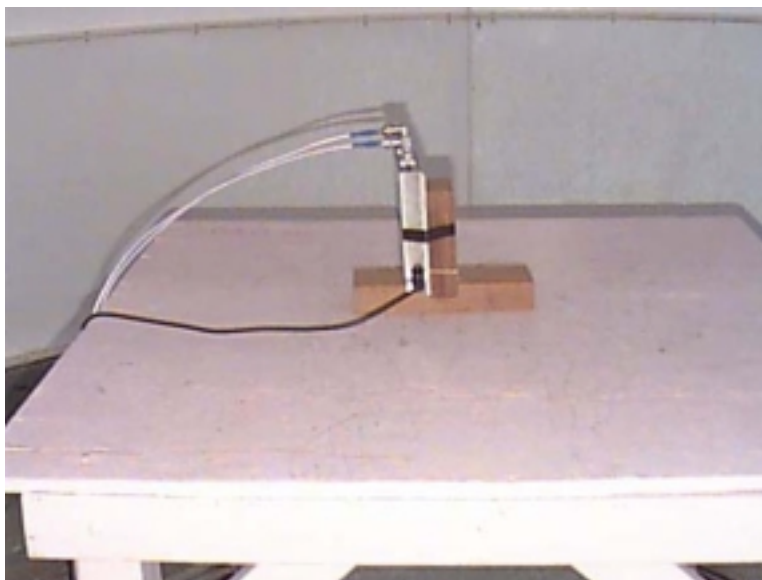
EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Photographs of Test Setup

Front View



Rear View



EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

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: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

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	
1 Year	Spectrum Analyzer-2	Hewlett Packard	8566B	1950A00400	July 22/98	July 22/99	
1 Year	Spectrum Analyzer Display-2	Hewlett Packard	85662A	1950A01177	July 22/98	July 22/99	
1 Year	Quasi Peak Adaptor-2	Hewlett Packard	85650A	2251A00620	July 22/98	July 22/99	
	Power Supply	Astron	VS-50M	8405071	NCR	NCR	
1 Year	Attenuator	Narda	768-20	9507	July 24/98	July 24/99	
1 Year	Attenuator	Narda	765-20	9510	July 24/98	July 24/99	
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	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	
1 Year	50 ohm Combiner Pad	Mini Circuits	ZA3PD-2	9746	July 23/98	July 23/99	
1 Year	Low Noise Amplifier	Avantek	AWT-8035	1005	Aug. 4/98	Aug. 4/99	
1 Year	Low Noise Amplifier	DBS Microwave	DWT-13035	9623	Aug. 4/98	Aug. 4/99	
1 Year	Signal Generator	Rohde & Schwarz	SM1Q03	1084-8004-03	July 23/98	July 23/99	
1 Year	Arbitrary Waveform Gen.	Sony/Tektronix	AWG2021	J310495	NCR	NCR	
3 Year	Standard Gain Horn	Electro-Metrics	SH-50/60-1	FA000479	July 29/97	July 29/00	
3 Year	RF Generator	Rohde & Schwarz	SME3	DE14439	June 29/96	June 29/99	
1 Year	RF Amp.	Comtest	GPA301	BCS320-1040	NCR	NCR	

NA: Not Applicable
NCR: No Cal Required

KTL Ottawa

FCC PART 24, SUBPART E
BROADBAND PCS BASE STATION
PROJECT NO.: 8R01061
ANNEX A

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

ANNEX A
TEST METHODOLOGIES

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
--------------------------------------	-------------------------

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: CDMA Per ANSI/J-STD-014
TDMA Per ANSI/J-STD-010

Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter or a spectrum analyzer.

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: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

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

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 Per ANSI/J-STD-014

Spectrum analyzer settings:

RBW: 30 kHz

VBW: $\geq$ RBW

Span: 5 MHz

Sweep: Auto

GSM Per ANSI/J-STD-010

RBW: 3 kHz

VBW: $\geq$ RBW

Span: 2 MHz

Sweep: Auto

NADC Per IS-136

RBW: 1 kHz

VBW: $\geq$ RBW

Span: 1 MHz

Sweep: Auto

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

NAME OF TEST: Spurious Emission at Antenna Terminals	PARA. NO.: 2.991
---	-------------------------

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 Per ANSI/J-STD-014RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 30 kHz (< 1 MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: 6 SweepsGSM Per ANSI/J-STD-010RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: DisabledNADC Per IS-136RBW: 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: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

NAME OF TEST: Field Strength of Spurious Radiation**PARA. NO.: 2.993**

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)

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

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
--	-------------------------

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: CDMA Per ANSI/J-STD-014
TDMA Per ANSI/J-STD-010
NADC Per IS-136

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. 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.

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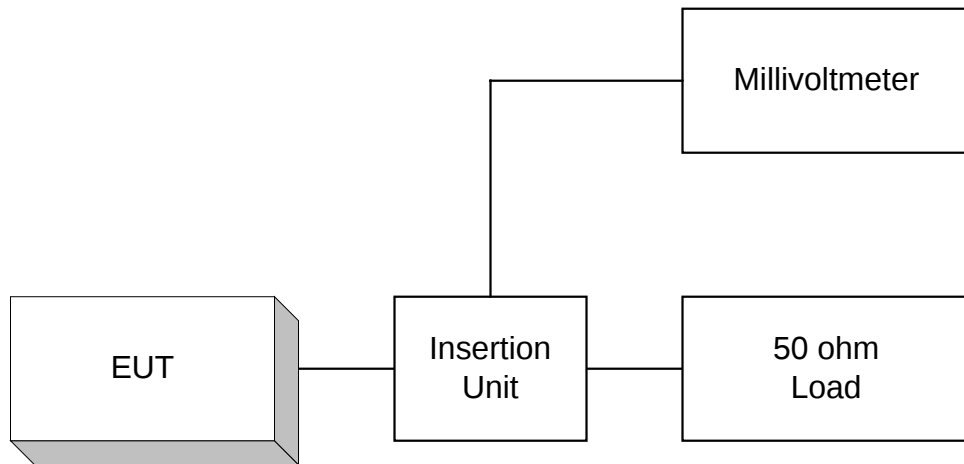
FCC PART 24, SUBPART E
BROADBAND PCS BASE STATION
PROJECT NO.: 8R01061
ANNEX B

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

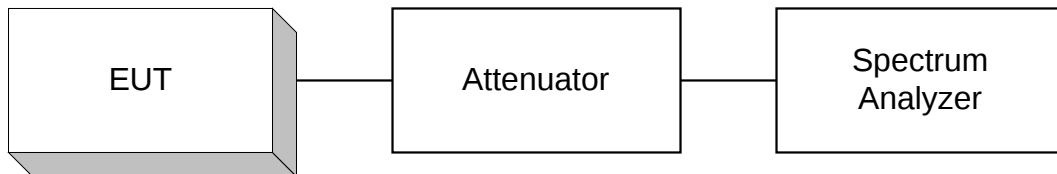
ANNEX B
TEST DIAGRAMS

EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

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

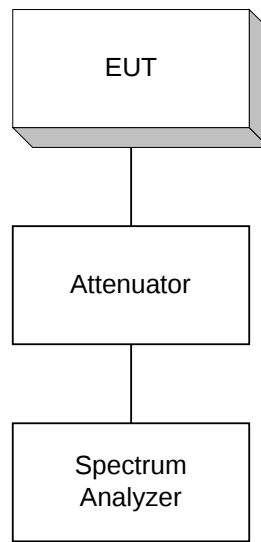


Para. No. 2.989 - Occupied Bandwidth

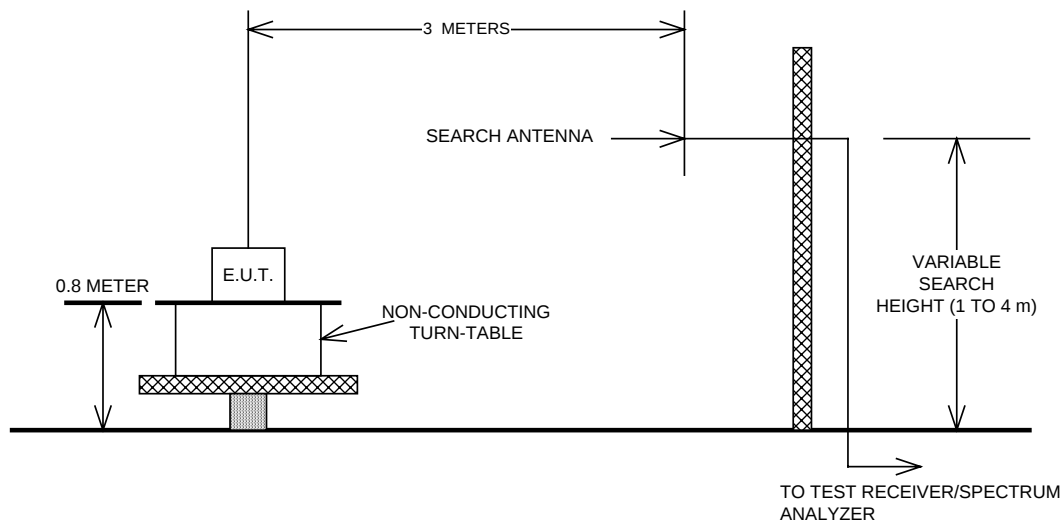


EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Para. No. 2.991 Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



EQUIPMENT: TFB 1915 Booster Amp
FCC ID: BCR-BCEL-1915BA

Para. No. 2.995 - Frequency Stability

