

Test Report Summary FCC CFR 47, Part 22 Subpart H Cellular Radiotelephone Service

Manufacturer:	ADC Telecommunications
Name of Equipment:	<u> Bi-Directional Amplifier – Cellular</u>
Model Number(s):	RPT-SBAAA12000
Manufacturer's Address:	<u>P.O. Box 1101</u> Minneapolis, MN 55440-1101
Test Report Number:	<u>MN070817-RX</u>
Test Date(s):	<u>4 and 5 September, 2007 (ETL)</u> 29 August, 2007 (ADC)

According to testing performed at Intertek, the above-mentioned unit is in accordance with the applicable electromagnetic compatibility (EMC) portions of the requirements defined in FCC Part 22.

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

All testing was done in accordance with the Federal Communications Commission's CFR 47 Part 22 and the EUT fulfills the requirements of the Federal Communications Commission's CFR 47 Part 22.

Date:	7 September, 200

Location: Intertek Testing Services (ETL) 7250 Hudson Blvd., Suite 100 Oakdale, MN 55128 Phone: (651) 730-1188 Fax: (651) 730-1282

Testing Conducted by (ADC): And Report Written by: ADC Telecommunications 5341 12th Ave E Shakopee, MN 55379 Phone: (952) 403-8340 Fax: (952) 403-8858

Mark F. Mesha

Mark F. Miska Compliance Engineer

ADC Telecommunications

1 of 99 MN070817-RX



EMC Emission – TEST REPORT

Test Report File Number:	MN070817-RX Date of Issue: 7 September, 2007			
Model Number(s):	RPT-SBAAA12000			
Product Name:	<u>Bi-Directio</u>	nal Amplifier – Ce	llular	
Product Type:	<u>Amplifier</u>			
Applicant:	ADC Teleco	ommunications		
Manufacturer:	ADC Teleco	ommunications		
License Holder:	ADC Telecommunications			
Address:	P.O. Box 1101 <u>Minneapolis, MN 55440-1101</u>			
Test Result:		Positive	Negative	
Test Project Number: Reference(s)		<u>3132442MIN-00</u>	<u>1</u>	
Total pages including Appendices:		<u>99</u>		



Table of Contents

1.0	Revision Description	4
2.0	Documentation	4
2.1	Test Regulations	4
2.2	Test Operation Mode	5
2.3	Configuration of the device under test:	5
2.4		
2.5	EUT Specifications and Requirements:	5
2.6	Cables:	5
2.7	Power Requirements:	
2.8	Typical Installation and/or Operating Environment:	5
2.9	Other Special Requirements:	5
2.1	0 EUT Software:	5
2.1	1 EUT System Components	6
2.1	2 Support Equipment	6
2.1	3 Deviations from standard:	6
2.1	4 Test Specification Deviations; Additions to or Exclusions from:	6
2.1	5 General Remarks:	6
2.1	6 Summary:	6
2.1	7 The equipment under test does	6
3.0	Test set-Up Drawings and Photos	7
3.1	Test set-up photo, radiated emissions	7
3.2		
3.3	Test Set-up Drawings	9
4.0	Test Results 1	1
4	.1.1 22.913 Effective radiated power limits	1
4	.1.2 22.355 Frequency tolerance	
4	.1.3 22.917 Emission limitations cellular	
5.0	Appendix A 1	4
6.0	Appendix B	
7.0	Appendix C	8



1.0 **REVISION DESCRIPTION**

Rev	Total Pages	Date	Description
Α	99	September 7, 2007	Original Release

2.0 DOCUMENTATION

2.1 Test Regulations

22.355	Frequency tolerance
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22.913 Effective radiated power limits

22.917 Emission limitations for cellular

The emissions tests were performed according to the following regulations:

FCC Part 22

- FCC Part 24
- ^D FCC Part 90
- ^D IC RSS-131 Issue 2

Environmental Conditions in the lab:

ADC	<u>ETL</u>
Temperature: 25° C	15-35° C
Relative Humidity: 28%	30-60%
Atmospheric Pressure: 95.8 kPa	86-106 kPa

Power Supply Utilized:

Power Supply System	: 1 phase, 60 Hz, 120 VAC
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2.2 Test Operation Mode

- ^D Standby
- Test Program
- ^D Practice Operation
- Max composite in and out

2.3 Configuration of the device under test:

Normal Operation - Cellular - 824 to 849 MHz

2.4 Product Options:

None

2.5 EUT Specifications and Requirements:

Length: 8.75" Width: 8.0" Height: 2.5" Weight: 7.85 pounds

2.6 Cables:

Cable Type	Cable Type Length		То
RF	> 3M	Ancillary Equip	EUT
RF	< 3M	EUT	50 Ohm Load
Power	< 3M	Power	Input Power

2.7 Power Requirements:

Voltage: 120 VAC Amps: 0.8 A

2.8 Typical Installation and/or Operating Environment:

Indoor only. System is typically employed as an indoor repeater.

2.9 Other Special Requirements:

None

2.10 EUT Software:

Revision Level: Version 1.0.0 Description: Repeater PC Program. System Management Software

2.11 EUT System Components

Description	Model #	Serial #	FCC ID #
BDA	RPT-SBAAA12000	None	

2.12 Support Equipment

Description	Manufacturer	Model #	FCC ID #
Power Meter	HP	EPM-441A	
Signal Generator	Agilent	E4438C	
Attenuator	Aeroflex	49-30-33	

2.13 Deviations from standard:

Modifications required to pass:

^D As indicated on the data sheet(s)

None

2.14 Test Specification Deviations; Additions to or Exclusions from:

- ^D As indicated in the Test Plan
- None

2.15 General Remarks:

None.

2.16 Summary:

The requirements according to the technical regulations are

met

□ not Met

2.17 The equipment under test does

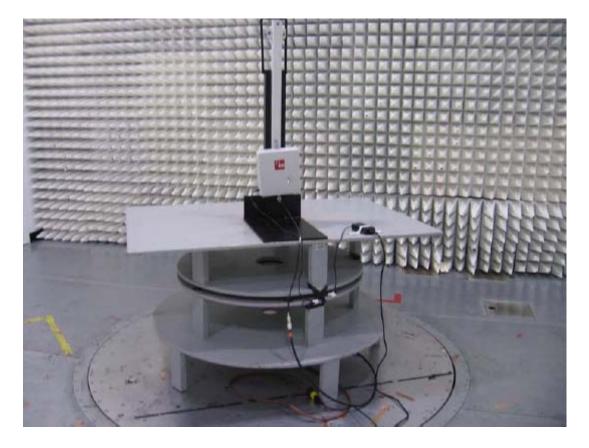
• fulfill the general approval requirements mentioned on page 4.

^D not fulfill the general approval requirements mentioned on page 4.

3.0 TEST SET-UP DRAWINGS AND PHOTOS

Back to Table of Contents:

3.1 Test set-up photo, radiated emissions



3.2 Test set-up photo, radiated emissions



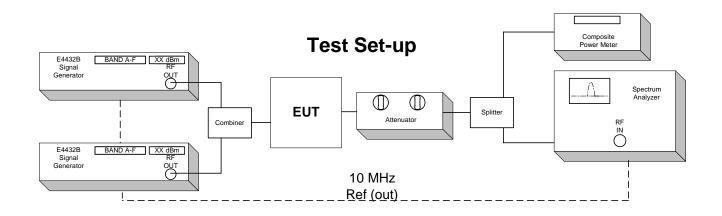
Conducted and Radiated Emission Limits Test for ADC Inc.

Conducted Output Power Test for ADC Inc

Inter-Modulation Test for ADC Inc.

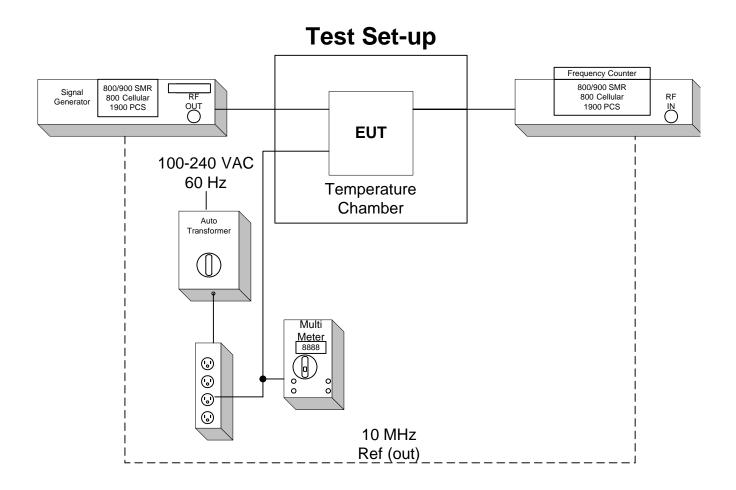
Occupied Bandwidth Modulation Test for ADC Inc.

Bi-Directional Amplifier – Cellular Model Number RPT-SBAAA12000



Frequency Tolerance Test for ADC Inc. Bi-Directional Amplifier – Cellular Model Number RPT-SBAAA12000

EUT is specified for indoor use only with temperature range of -5° to +45° C, and was tested with its range.



4.0 TEST RESULTS

4.1.1 22.913 Effective radiated power limits

Test Summary:

- The requirements are: MET NOT MET
- Minimum margin of compliance is 38.17 dB at 824.2 MHz (TDMA)

Test Location:

^D ETL (Oakdale, MN)

ADC facility (Shakopee, MN)

Test Distance:

- [□] 3 Meters
- ^D 10 Meters

Conducted measurement

Test Equipment (ADC):

Equipment	Manufacturer	Model	ADC Serial Number	Calibration Due.
Attenuator	Aeroflex	49-30-33	N/A	CNR
Spectrum Analyzer	HP	8563E	MC27690	11-22-07
Power Meter	HP	EPM-441A	MC27670	9-20-07
Signal Generator	Agilent	E4437B	83781	6-13-08

Equipment with a Calibration Not Required (CNR) listing is verified and compensated for with NIST traceable calibrated equipment.

ADC Telecommunications

Test Limit:

500 Watts or 57 dBm Limit

Test Data:

See page 40

Test Engineer: Mark F. Miska **Date:** 29 August, 2007

Back to Table of Contents:

4.1.2 22.355 Frequency tolerance

Test Summary:

- The requirements are: **MET D** NOT MET
- The fundamental emission stays within the authorized frequency block.
- Frequency measured over a temperature range of -5 to 45° C and an input voltage range of 100 to 240 VAC.

Test Location:

^D ETL (Oakdale, MN)

ADC facility (Shakopee, MN)

Test Equipment (ADC):

Equipment	Manufacturer	Model	ADC Serial Number	Calibration Due.
Multimeter	Fluke	87	MC19056	8-20-08
Frequency Counter	HP	5347A	MC27548	2-18-08
Variable Auto Transformer	Staco	1520CT	MC44655	CNR
Signal Generator	Agilent	E4437B	83781	6-13-08

Equipment with a Calibration Not Required (CNR) listing is verified and compensated for with NIST traceable calibrated equipment.

Test Limit:

TABLE C-1.—FREQUENCY TOLERANCE FOR TRANSMITTERS IN THE PUBLIC MOBILE SERVICES

Frequency range (MHz)	Base, fixed (ppm)	Mobile ≤3 watts (ppm)	Mobile <=3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	n/a	n/a
929 to 960	1.5	n/a	n/a
2110 to 2220	10.0	n/a	n/a

Test Data:

See page 80

Test Engineer: Mark F. Miska **Date:** 29 August, 2007

Back to Table of Contents:

4.1.3 22.917 Emission limitations cellular

Test Summary:

- The requirements are: **MET D** NOT MET
- Out of band emissions were less than -13 dBm.
- Outside the emission bandwidth of the carrier, all emissions are attenuated at least 26 dB below the transmitter power.

Test Location:

^D ETL (Oakdale, MN)

ADC facility (Shakopee, MN)

Test Equipment (ADC):

<u> </u>	/•			
Equipment	Manufacturer	Model	ADC Serial Number	Calibration Due.
Spectrum Analyzer	HP	8563E	MC27690	11-22-07
Power Meter	HP	EPM-441A	MC27670	9-20-07
Multimeter	Fluke	87	MC19056	8-20-08
Frequency Counter	HP	5347A	MC27548	2-18-08
Temperature Chamber	Ecosphere		MC21679	1-11-08
Variable Auto	Staco	1520CT	MC44655	CNR
Transformer				
Signal Generator	Agilent	E4437B	83781	6-13-08
Signal Generator	Agilent	E4436B	1283112C	4-4-08
Power Supply	Xantrex	HPD 60-5	MC27764	6-25-08

Power SupplyXantrexHPD 60-5MC277646-25-08Equipment with a Calibration Not Required (CNR) listing is verified and compensated for with NIST traceable calibrated
equipment.

Test Equipment (Intertek):

Equipment	Manufacturer	Model	Serial No.	Cal. Due.
Spectrum Analyzer	Rohde & Schwarz	FSP 40	100024	08/08
Spectrum Analyzer	Rohde & Schwarz	ESCI	100358	04/08
Instrument Control	TILE!	Ver. 3.4 K.15	N/A	N/A
Antenna	Schaffner-Chase	Bicono-Log	2468	07/08
Antenna	EMCO	Horn 3115	9507-4513	01/08
Pre-Amp	MITEQ	AMF-5D	1122951	04/08

Test Limit:

Out of band emissions: Attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB, or -13 dBm.

Outside of the carrier emissions bandwidth: 26 dB below the transmitter power

Test Data:

<u>Conducted Emissions</u>, pages 15 – 39 <u>Intermodulation Test</u>, pages 41 – 71 <u>Occupied Bandwidth</u>, pages 72 – 79 Radiated Emissions, pages 81 – 97 (<u>Appendix B</u>) Test Engineer: Mark F. Miska Date: 29 August, 2007 Date: 29 August, 2007 Date: 29 August, 2007

Back to Table of Contents:

APPENDIX A

Test Data

Back to Table of Contents:

Test Engineer: Mark F. Miska Date: 29 August, 2007

Conducted Emission Limits Test for ADC Inc. Bi-Directional Amplifier – Cellular Model Number RPT-SBAAA12000

Back

The out of band emissions were measured directly from the EUT antenna output with a spectrum analyzer from 30 MHz to the 10th harmonic of the highest carrier frequency. Test signals used are FM, TDMA, GSM, EDGE, CDMA, EVDO, and W-CDMA. The different signals were input one at a time to the EUT. In all cases, the out of band emissions were less than -13 dBm from the equation

(19dBm - [43 + 10log(0.08W)])

Band edge compliance is also demonstrated using a FM, TDMA, GSM, EDGE, CDMA, EVDO, and W-CDMA signal at the upper and lower limits of the band.

Industry practice has generally set the input signal power level. Test signal used was \approx -47 dBm input to EUT. Industry practice has generally set the output signal power level.

EUT: Range: 100 - 240 VAC Tested @: 120 VAC Tested @: 0.8 A

Application details for 2.1033(c)(10), and 2.1033(c)(13):

The input to the unit has a digital attenuation chip (ALC) to provide protection from overdrive

The circuit detects the power level of the final stage amplifier and compares with the pre-set value.

If the detected value is bigger than the pre-set, ALC will increase the attenuation until the detect value is on level with pre-set value. If the detected value is smaller than the pre-set, ALC will decrease the attenuation until the detect value is on level with pre-set value. With above mentioned functions, the ALC circuit maintains the output power level at +13dBm (pre-set value). Single channel operation, or multi-channel operation will not exceed nominal gain of the system.

The frequency stability is derived from two 13MHz TCVCXOs (RTVS-104), separate for the Forward and Reverse paths. These each feed two PLLs for the IF down conversion.

The spurious limitation uses ALC to help suppress in-band spurious by preventing final stage amplifier overdrive, while the duplex filter suppresses out-of-band spurious. Internal to the electronics, the use of SAW filters provides for higher Q roll-off at band edges.

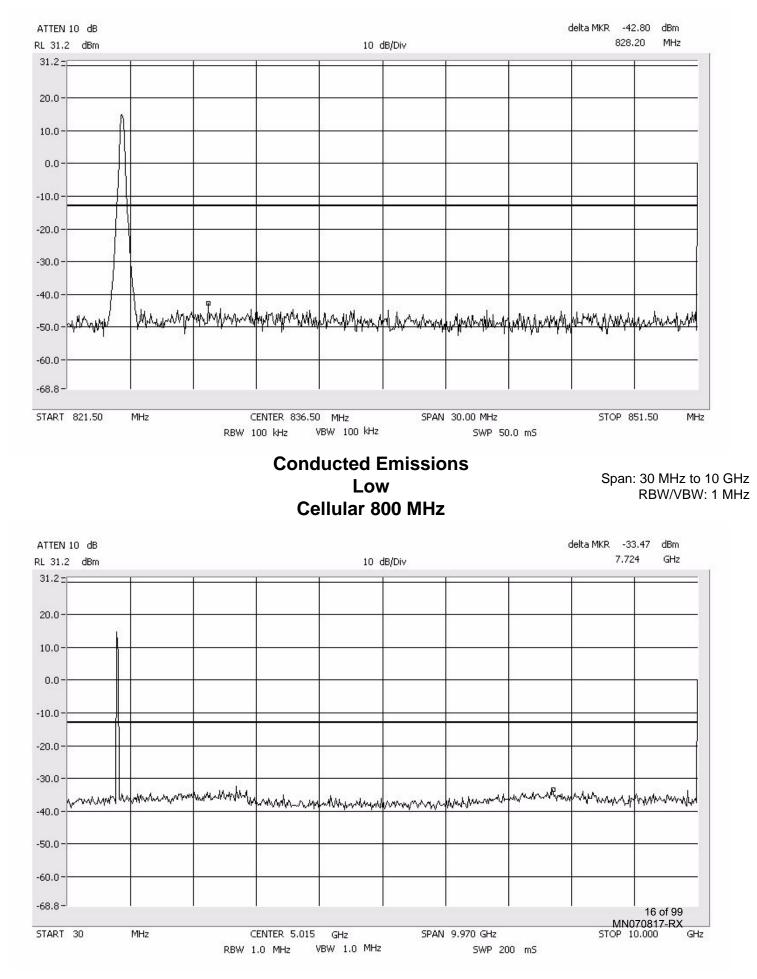
This equipment does not modulate the RF, so there is no modulation limiter. This equipment does not change the modulation of the RF or the occupied bandwidth of any channel. It transports the signal, as is, over an optical link. The RF input is not changed in the RF output.

This is a constant gain device, so the setup controls the output. There is an overdrive and overpower limit control that prevents excess power.

Results: Pass (See plots)

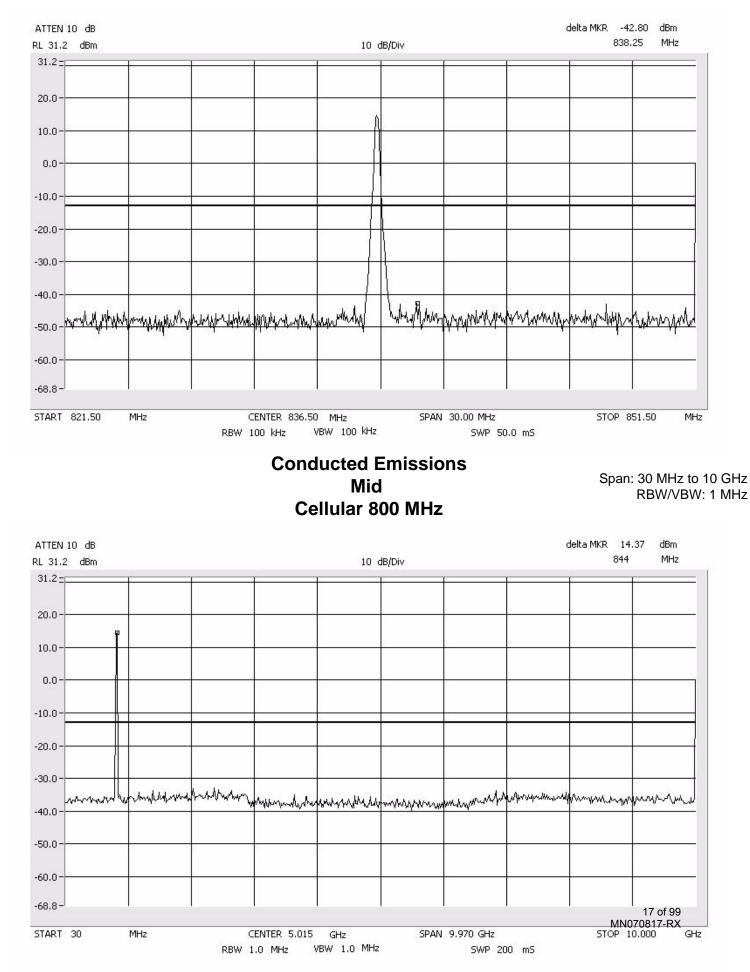
Conducted Emissions Low Cellular 800 MHz

Center: 836.5 MHz Span: 30 MHz RBW/VBW: 100 kHz



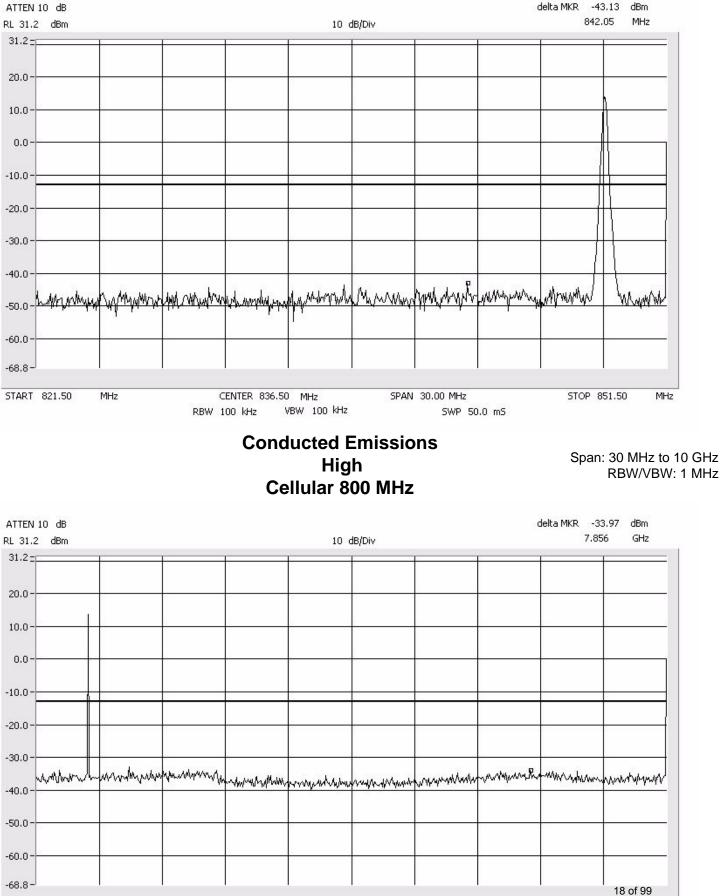
Conducted Emissions Mid Cellular 800 MHz

Center: 836.5 MHz Span: 30 MHz RBW/VBW: 100 kHz



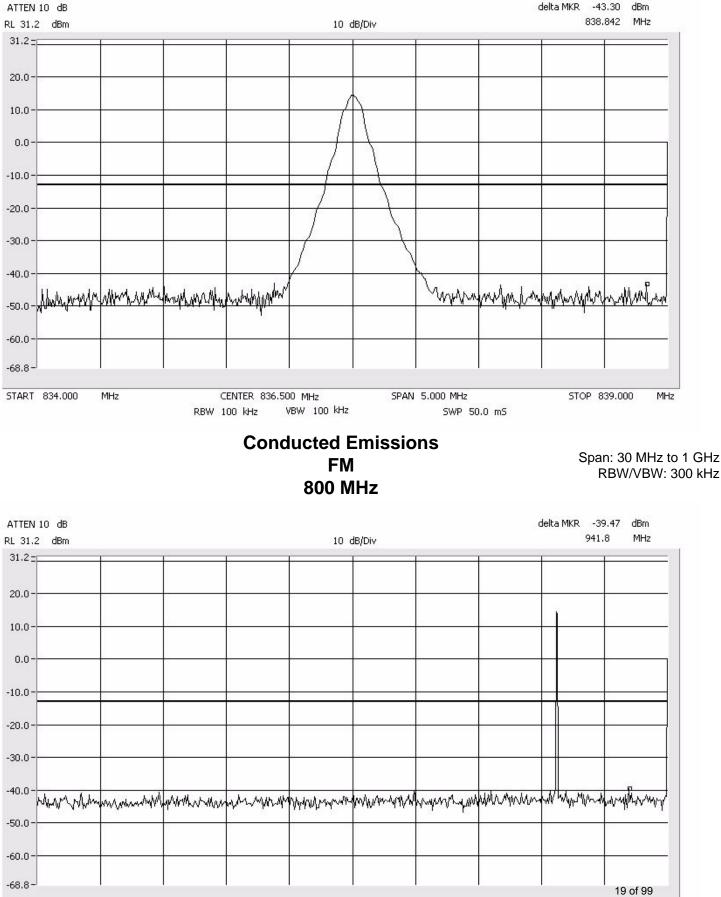
Conducted Emissions High Cellular 800 MHz

Center: 836.5 MHz Span: 30 MHz RBW/VBW: 100 kHz



Conducted Emissions FM 800 MHz

Mid Band Span: 5 MHz RBW/VBW: 100 kHz



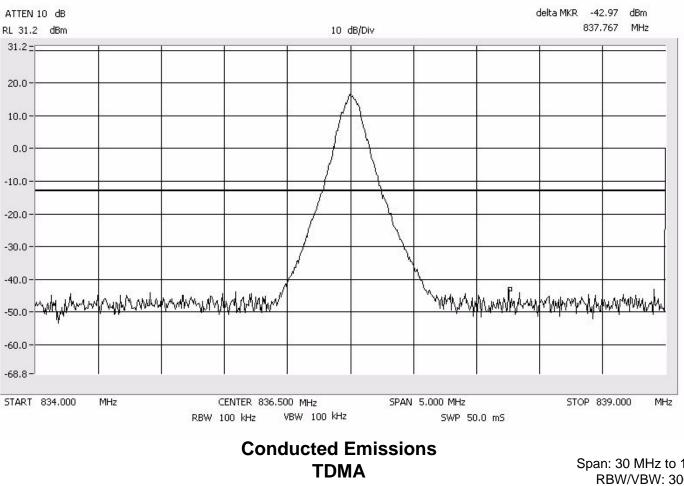
MN070817-RX STOP 1.0000 GHz

Conducted Emissions FM 800 MHz

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START	1.000	GHz	C RBW 1	ENTER 5.500 .0 MHz V	GHz 'BW 1.0 MHz		9.000 GHz SWP 18	0 mS	STOP 1	0.000 GHz

Conducted Emissions TDMA 800 MHz

Mid Band Span: 5 MHz RBW/VBW: 100 kHz



800 MHz

Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz

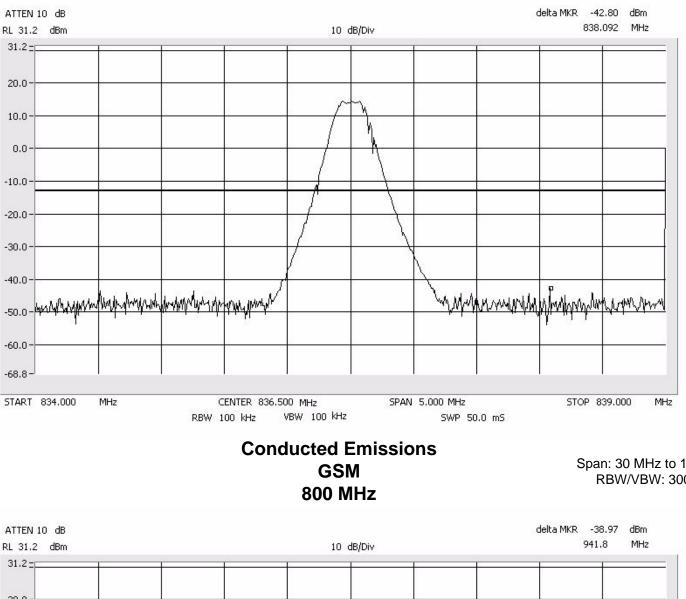
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Conducted Emissions TDMA 800 MHz

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-60.0-		p	29	78	23					<u>.</u>
-68.8-										
START 1	1.000	GHz		ENTER 5.500 .0 MHz V	GHz /BW 1.0 MHz		9.000 GHz SWP 18	0 mS	STOP 1	0.000 GHz

Conducted Emissions GSM 800 MHz

Mid Band Span: 5 MHz RBW/VBW: 100 kHz



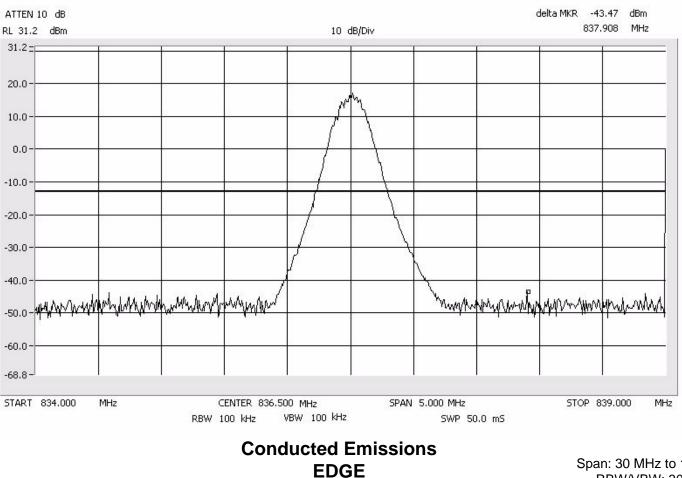
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz

ATTEN 10 dB							0	delta M	MKR -38		
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68.8-									MNI0	23 of 99	
5TART 30.0	MHz	C RBW 3	ENTER 515.0 00 kHz /	MHz /BW 300 kHz	SPAN	970.0 MHz SWP 50).0 mS		STOP 1.		GHz

Conducted Emissions GSM 800 MHz

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-68.8-										
START	1.000	GHz	C RBW 1	ENTER 5.500 .0 MHz V	GHz 'BW 1.0 MHz		9.000 GHz SWP 18	0 mS	STOP 1	0.000 GHz

Conducted Emissions EDGE 800 MHz



800 MHz

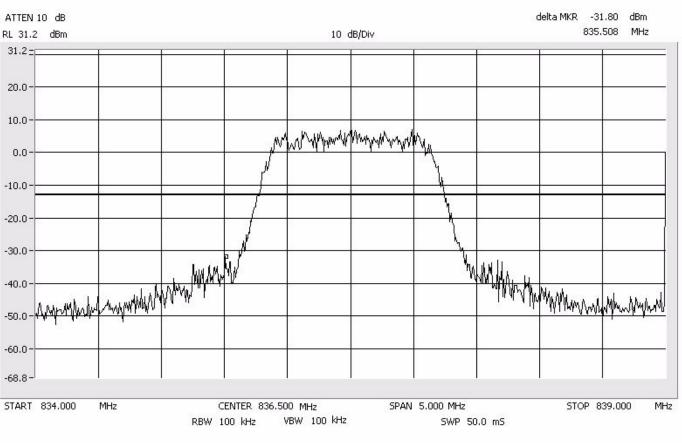
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz

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START 30.0	MHz	C RBW 3	ENTER 515.0 00 kHz V	MHz /BW 300 kHz	SPAN	970.0 MHz SWP 50).0 mS		MN0 STOP 1	70817-RX

Conducted Emissions EDGE 800 MHz

	110 dB							c	lelta MKR -33 7.12	
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-68.8-										
START	1.000	GHz		ENTER 5.500 .0 MHz \	GHz /BW 1.0 MHz		9.000 GHz SWP 18	0 mS	STOP 1	0.000 GHz

Conducted Emissions CDMA 800 MHz



Conducted Emissions CDMA 800 MHz

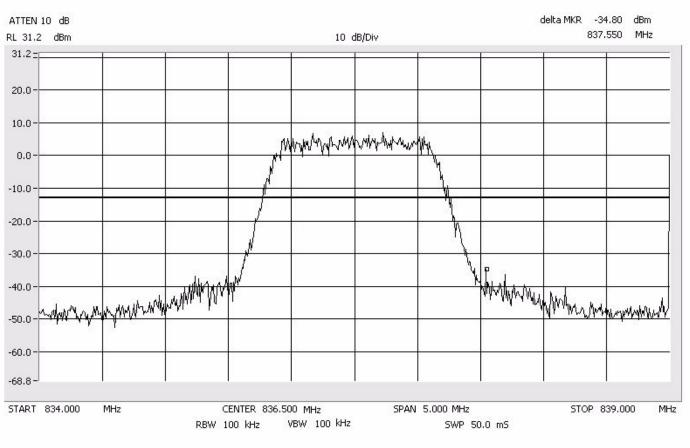
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz

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68.8-											27 of 9	99
)70817-F	RX
START	30.0	MHz	C RBW 3	ENTER 515.0 00 kHz V	MHz /BW 300 kHz	SPAN	970.0 MHz SWP 50).0 mS		STOP 1	.0000	GHz

Conducted Emissions CDMA 800 MHz

ATTEN 10 dB					delta MKR -32.80 dBm 10 dB/Div 1.870 GHz					
RL 31.2					10 0		1.870 GHz			
31.2 =										<u> </u>
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-60.0-		22	23	28	28					<u> </u>
-68,8-										
START	1.000	GHz	C RBW 1	ENTER 5.500 .0 MHz V	GHz 'BW 1.0 MHz		9.000 GHz SWP 18	0 mS	STOP 1	0.000 GHz

Conducted Emissions EVDO 800 MHz



Conducted Emissions EVDO 800 MHz

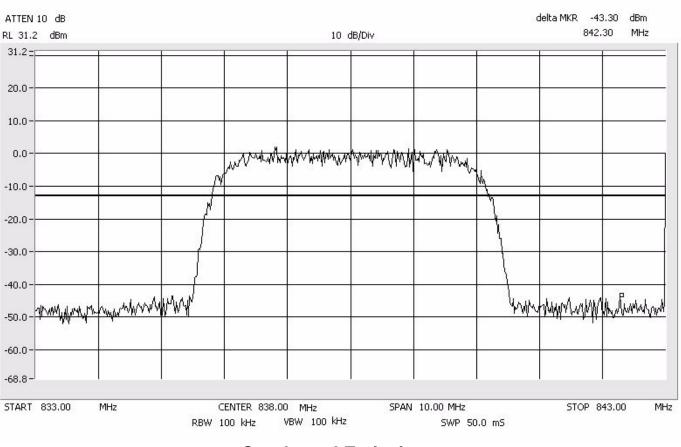
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz

ATTEN 10 dB			delta MKR -39.63 dBm 747.8 MHz
RL 31.2 dBm	10 dB/Div		747.0 MHz
31.2			
20.0 -			
10.0-			1
0.0-			
10.0-			
20.0-			
30.0-			
40.0 - mundhing all who had which the mark day	when many many many many many many		man man man
50.0 -		<u> </u>	
60.0-			
68.8-			29 of 99
START 30.0 MHz	CENTER 515.0 MHz SPA	AN 970.0 MHz	MN070817-RX STOP 1.0000 GF

Conducted Emissions EVDO 800 MHz

ATTEN RL 31.:	10 dB 2 dBm				10 .	dB/Div		c	delta MKR -3 2.7	
31.2 =		1	-				-	-		+
20.0-	90.	62	his .	he i						
10.0-	<u></u>									-
0.0-	<u></u>		s	2	2					
10.0-			8	2	5					
20.0-	3	21-		1.1	2	3	2	č		
30.0-			1 n.		-					
40.0-	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	harden	Www.Whymp.vw	Muraham	hammen	manyman	Whenterner	and Maderson A	marthand	Managapart
50.0-	8	24. 72	61 2			3	2	č	2	
60.0-	82		2	2	2					
68.8-										
TART	1.000	GHz	C RBW 1	ENTER 5.500 .0 MHz \	GHz /BW 1.0 MHz		9.000 GHz SWP 18	10 mS	STOP :	10.000 GH:

Conducted Emissions W-CDMA 800 MHz



Conducted Emissions W-CDMA 800 MHz

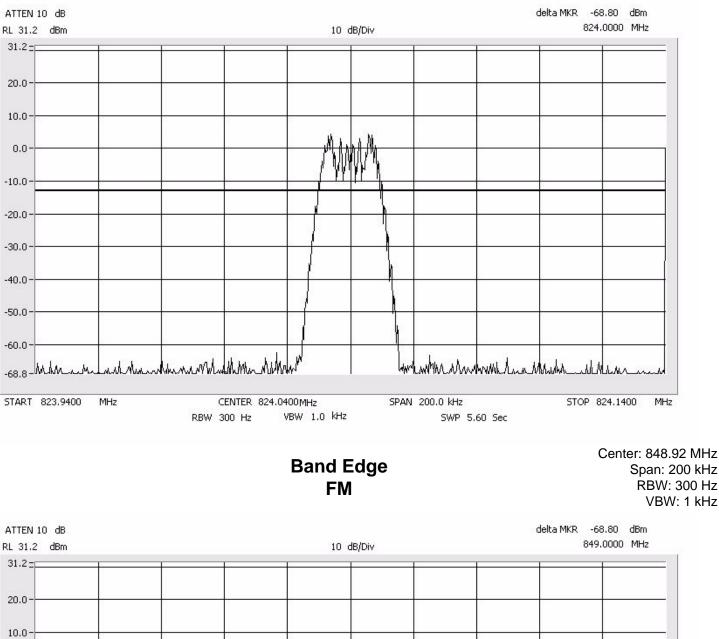
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz

delta MKR -39.13 dBm ATTEN 10 dB 518.2 MHz RL 31.2 dBm 10 dB/Div 31.2 ± 20.0-10.0 0.0 -10.0--20.0 -30.0 -40.0 have a second the second of the second and the second and the second and the second of the second and the secon -50.0 -60.0 -68.8-31 of 99 MN070817-RX START 30.0 MHz CENTER 515.0 SPAN 970.0 MHz STOP 1.0000 GHz MHz VBW 300 kHz RBW 300 kHz SWP 50.0 mS

Conducted Emissions W-CDMA 800 MHz

ATTEN 10 dB						delta MKR -33.47 dBr 10 dB/Div 6.685 GH					
RL 31.					10 0	1B/Div			0,00	o anz	
31.2 =											
20.0-			N 5. 197	N 5.	2.5						
10.0-								:			
0.0-											
-10.0-		8									
-20.0-		2					-				
-30.0-				6			φ.				
-40.0-	www.www.www.ww	-gr-gh-wh-wr-arm	"how why	Wannahaa	mmmmmm	m.m.m.	manhama	www.	Manappanan	mmmmmm	
-50.0-		2		6.1. 							
-60.0-	<u></u>	20	2	23	22					<u>i b</u> e	
-68.8-											
START	1.000	GHz		ENTER 5.500 .0 MHz V	GHz /BW 1.0 MHz		9.000 GHz SWP 18	0 mS	STOP 1	0.000 GHz	

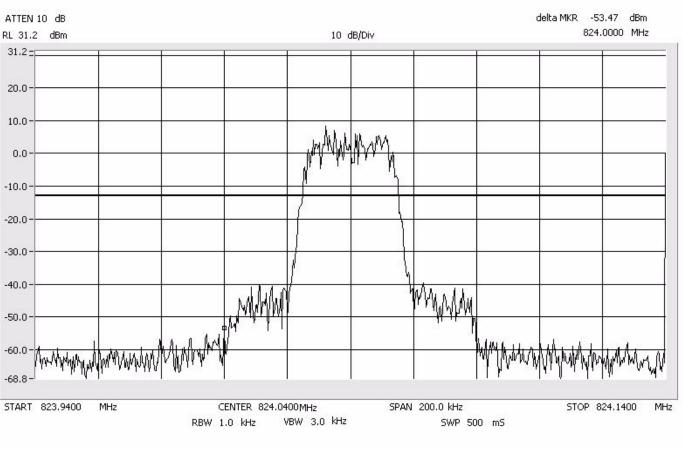
Band Edge FM



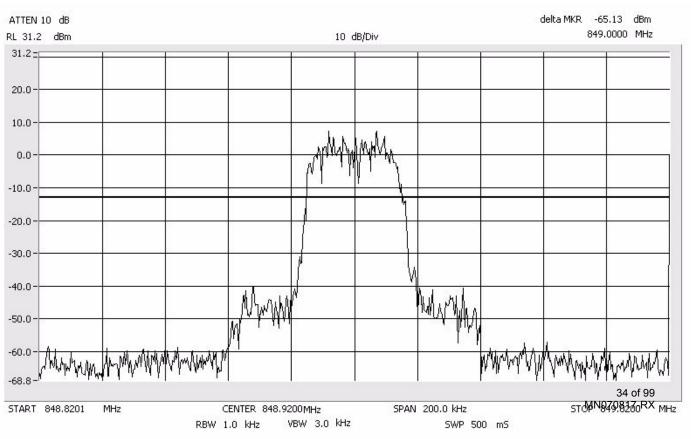
20.0-		2. 								
10.0-	8	2				8				
0.0-					Mu	NAM				
-10.0-		1	1		<u>/ \/\/</u>	<u>йМ, И</u>	-			
-20.0-					(·		i di secondo
-30.0-			(3).	p	_					
-40.0-	<u></u>					<u> </u>	-			
-50.0-			6.5		_	<u> </u>			-	e de la companya de la
-60.0-										
-68.8-	h	للملك	Muhun	shinwandik	لىر	I M		لسلسط	1	33 of 99
START	848.8201	MHz		CENTER 848.920	00MHz	SPA	N 200.0 kHz		STOPINS	79.8170RX MHz

RBW 300 Hz

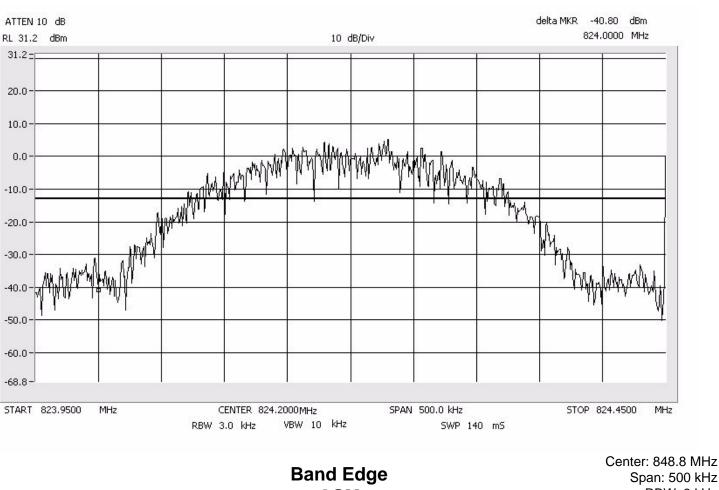
Band Edge TDMA



Band Edge TDMA Center: 848.92 MHz Span: 200 kHz RBW: 1 kHz VBW: 3 kHz



Band Edge GSM

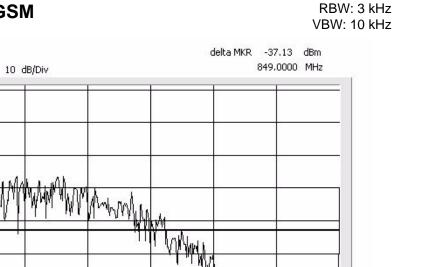


GSM

ATTEN 10 dB

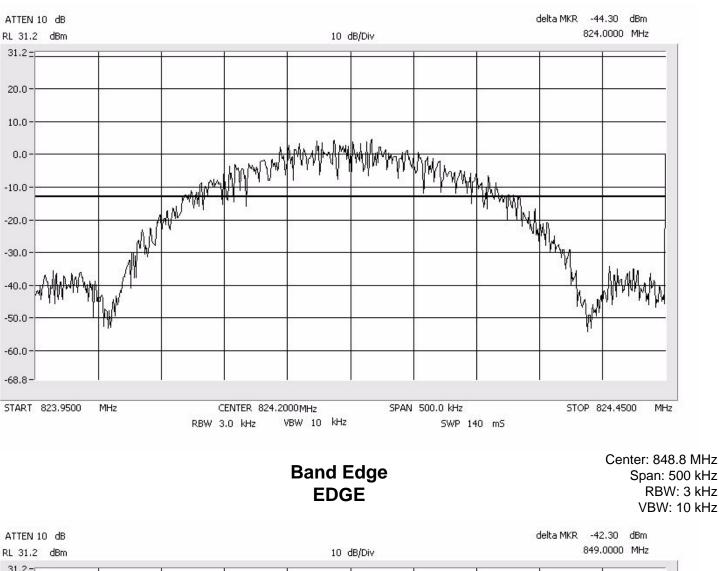
RL 31.2 dBm

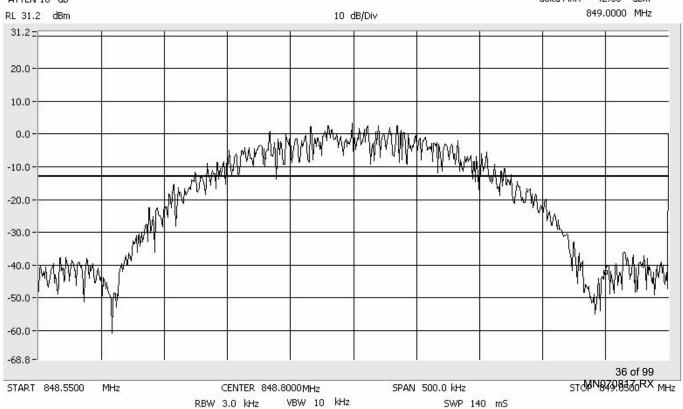
31.2 =



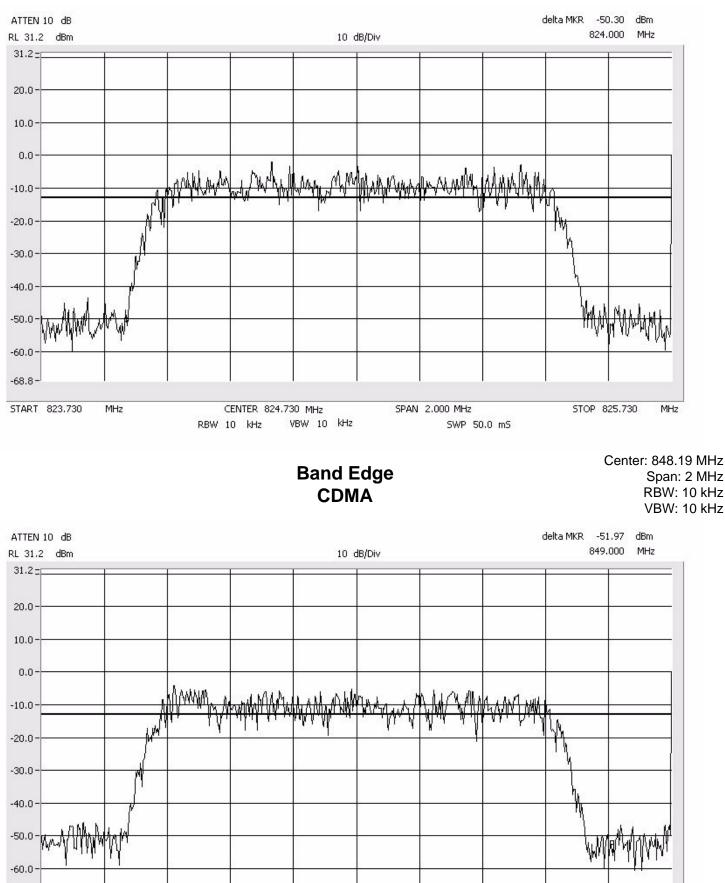
20.0 10.0 0.0 -10.0 -20.0 -30.0 -40.0 -50.0 -60.0 -68.8-35 of 99 STOPNOTO BETORX MHZ START 848.5500 MHz CENTER 848.8000MHz SPAN 500.0 kHz VBW 10 kHz RBW 3.0 kHz SWP 140 mS

Band Edge EDGE





Band Edge CDMA



CENTER 848.190 MHz SPAN 2.000 MHz RBW 10 kHz VBW 10 kHz SWP 50.0 mS

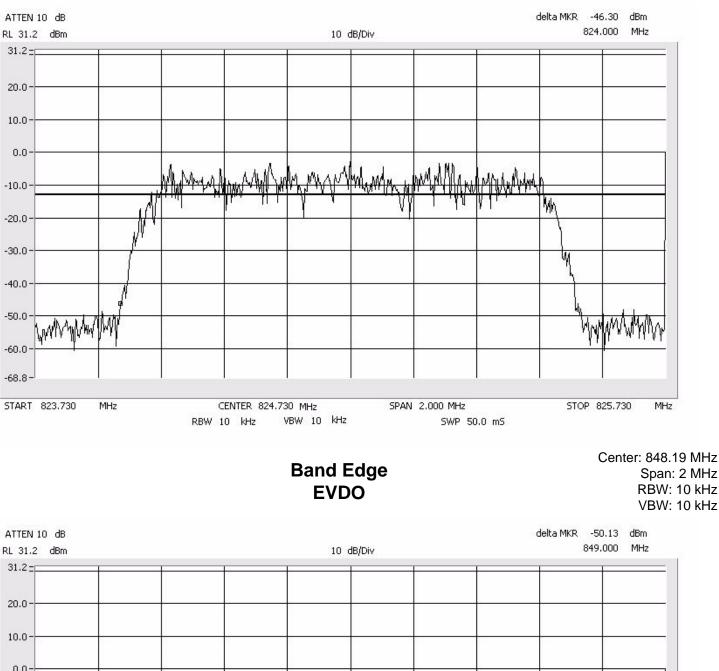
-68.8-

START 847.190

MHz

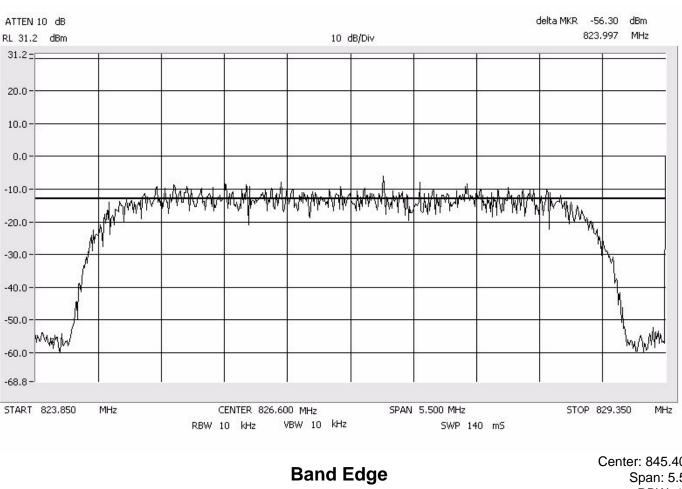
Band Edge EVDO

Center: 824.73 Span: 2 MHz RBW: 10 kHz VBW: 10 kHz

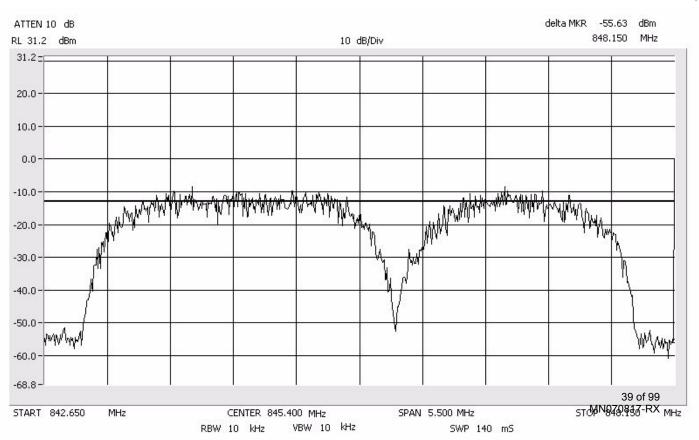


0.0 -10.0 -20.0 -30.0 -40.0 -50.0 MMMM M -60.0 -68.8-38 of 99 ST MAN 979 847-RX MHz START 847.190 MHz CENTER 848.190 MHz SPAN 2.000 MHz RBW 10 kHz VBW 10 kHz SWP 50.0 mS

Band Edge W-CDMA



W-CDMA



Center: 845.40 MHz Span: 5.5 MHz RBW: 10 kHz VBW: 10 kHz

Conducted Output Power Test for ADC Inc. Bi-Directional Amplifier – Cellular Model Number RPT-SBAAA12000

Back

846.4 MHz

*Note: The EUT is a fixed repeater and not a base station.

This measurement was made as a direct conducted emission measurement. The output from the EUT antenna connector was connected to the power meter. The carrier output, below, was conducted using a single FM, TDMA, GSM, EDGE, CDMA, EVDO, and W-CDMA signal generator. The power meter level was offset to compensate for attenuators and cable loss between the EUT and the power meter.

A signal was used at the low, mid and high parts of the selected band. The power meter level was offset by 31.2 dB to compensate for attenuators and cable loss between the EUT and the power meter.

FM	71.94 mWatts	GSM	68.07 mWatts
Carrier Frequency	Carrier Output	Carrier Frequency	Carrier Output
824.2 MHz	<u>18.13</u> dBm	824.2 MHz	<u>18.33</u> dBm
836.5 MHz	<u>18.57</u> dBm	836.5 MHz	<u>18.15</u> dBm
848.8 MHz	<u>18.10</u> dBm	848.8 MHz	<u>18.17</u> dBm
TDMA	76.38 mWatts	EDGE	73.62 mWatts
Carrier Frequency	Carrier Output	Carrier Frequency	Carrier Output
824.2 MHz	<u>18.83</u> dBm	824.2 MHz	<u>18.67</u> dBm
836.5 MHz	<u>18.67</u> dBm	836.5 MHz	<u>18.25</u> dBm
848.8 MHz	<u>18.33</u> dBm	848.8 MHz	<u>18.23</u> dBm
CDMA	73.28 mWatts	EVDO	66.83 mWatts
Carrier Frequency	Carrier Output	Carrier Frequency	Carrier Output
824.8 MHz	<u>18.27</u> dBm	824.8 MHz	<u>18.13</u> dBm
836.5 MHz	<u>18.57</u> dBm	836.5 MHz	<u>18.10</u> dBm
848.2 MHz	<u>18.65</u> dBm	848.2 MHz	<u>18.25</u> dBm
W-CDMA	69.82 mWatts		
Carrier Frequency	Carrier Output		
826.6 MHz	<u>18.17</u> dBm		
836.5 MHz	<u>18.25</u> dBm		

18.44 dBm