



Test Report Summary

FCC CFR 47, Part 22

Subpart H Cellular Radiotelephone Service

Manufacturer: ADC Telecommunications

Name of Equipment: FlexWave™ URH Host

Model Number(s): FWU-28400000HU

Manufacturer's Address: P.O. Box 1101
Minneapolis, MN 55440-1101

Test Report Number: MN080828 Cellular

Test Date(s): 13-15 August, 2008 (ETL)
26 August, 2008 (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: 28 August, 2008

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

ADC Telecommunications
1187 Park Place
Shakopee, MN 55379
Phone: (952) 403-8340

Testing Conducted by (ADC):
And Report Written by:


Mark F. Miska
Compliance Engineer



EMC Emission – T E S T R E P O R T

Test Report File Number: MN080828_Cellular **Date of Issue:** 28 August, 2008

Model Number(s): FWU-28400000HU

Product Name: FlexWave™ URH Host

Product Type: Repeater

Applicant: ADC Telecommunications

Manufacturer: ADC Telecommunications

License Holder: ADC Telecommunications

Address: P.O. Box 1101
Minneapolis, MN 55440-1101

Test Result: **Positive** Negative

Test Project Number: 3158189MIN-002
Reference(s)

Total pages including Appendices: 83



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2.0 REVISION DESCRIPTION

Rev	Total Pages	Date	Description
A	83	28 August, 2008	Original Release

3.0 DOCUMENTATION

3.1 Test Regulations

22.355 Frequency Tolerance
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
- FCC Part 90
- IC RSS-131 Issue 2

Environmental Conditions in the lab:

ADC

Temperature: 29° C
Relative Humidity: 29%
Atmospheric Pressure: 98.4 kPa

ETL

15-35° C
30-60%
86-106 kPa

Power Supply Utilized:

Power Supply System : 48 VDC

3.2 Test Operation Mode

- Standby
- Test Program
- Practice Operation

■ Max composite in and out

3.3 Configuration of the Device Under Test:

Normal Operation – Cellular - 824 to 849 MHz

3.4 Product Options:

None

3.5 EUT Specifications and Requirements:

Length: 9.0"

Width: 17.5"

Height: 5.25"

Weight: 17.0 pounds

3.6 Cables:

Cable Type	Length	From	To
CAT-V	> 3M	Ancillary Equip	EUT
RF	< 3M	EUT	50 Ohm Load
Power	< 3M	Power	Input Power
RF	< 3M	Ancillary Equip	EUT

3.7 Power Requirements:

Voltage: 48 VDC

Amps: 3.5 A

3.8 Typical Installation and/or Operating Environment:

Indoor. System is typically employed as an indoor repeater.

3.9 Other Special Requirements:

None

3.10 EUT Software:

Revision Level: Version V.6 or greater

Description: Internet Explorer

3.11 EUT System Components

Description	Model #	Serial #	FCC ID #
URH	FWU-84D323002110RU	None	

3.12 Support Equipment

Description	Manufacturer	Model #	FCC ID #
Power Meter	HP	EPM-441A	
Signal Generator	Agilent	E4438C	

3.13 Deviations from Standard:

Modifications required to pass:

- As indicated on the data sheet(s)

- None**

Test Specification Deviations; Additions to or Exclusions from:

- As indicated in the Test Plan

- None**

3.14 General Remarks:

None.

3.15 Summary:

The requirements according to the technical regulations are

- met**

- not Met

The equipment under test does

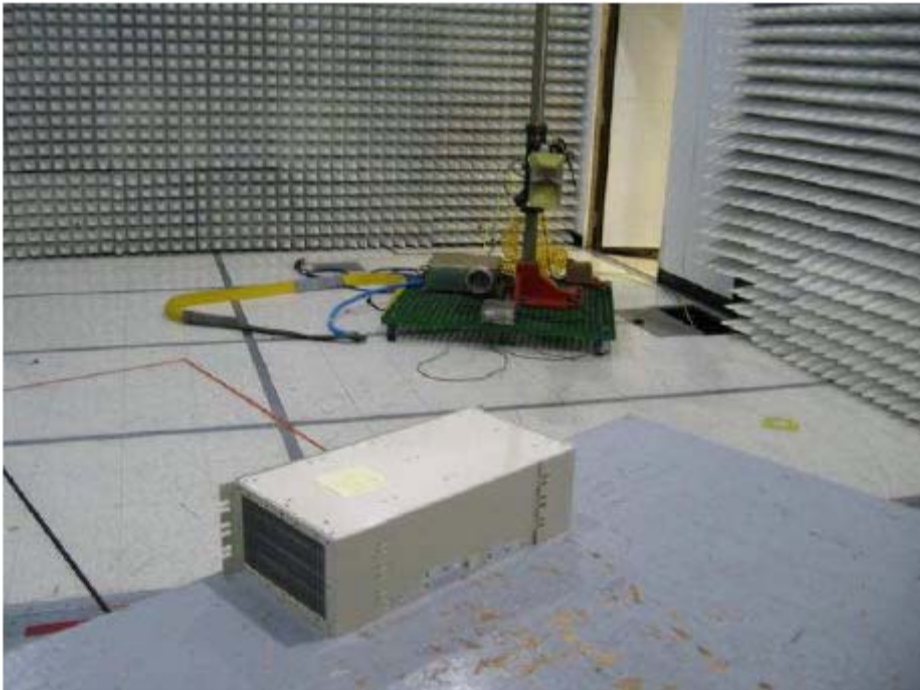
- fulfill the general approval requirements mentioned in Section 3.1.**

- not fulfill the general approval requirements mentioned in Section 3.1.

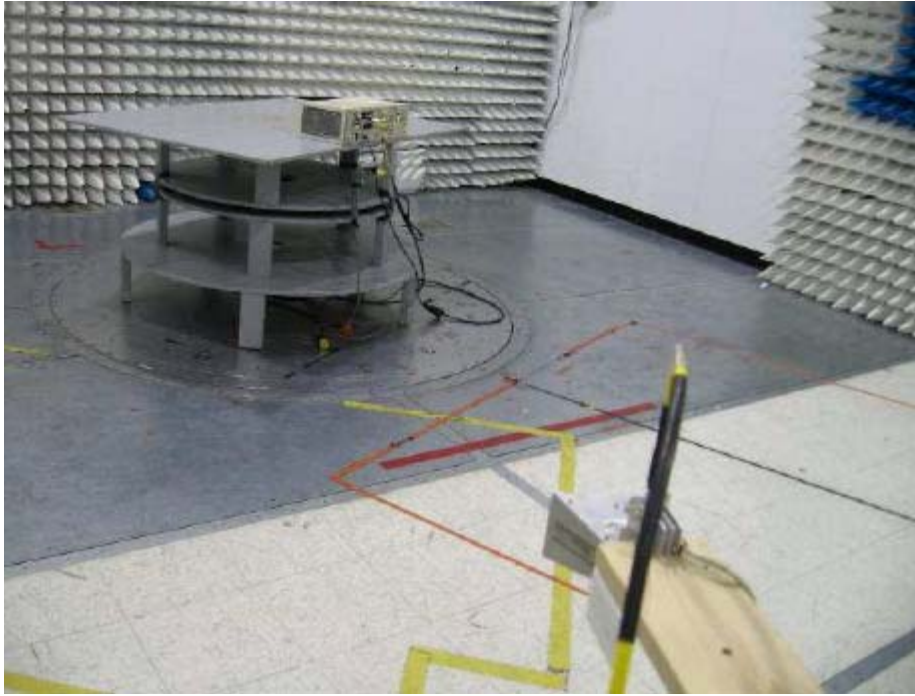
4.0 TEST SET-UP DRAWINGS AND PHOTOS

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4.1 Test Set-up Photo, Radiated Emissions



4.2 Test Set-up Photo, Radiated Emissions



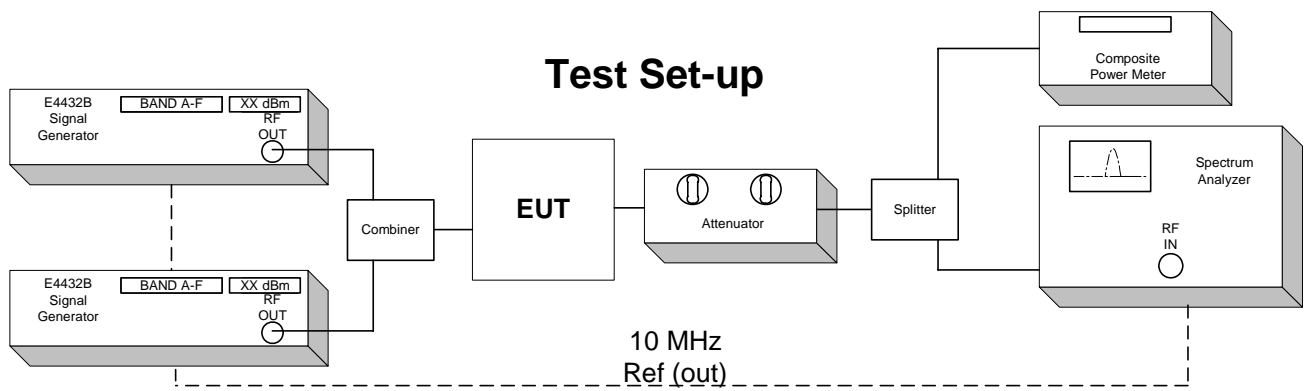
4.3 Test Set-up Drawings

Conducted and Radiated Emission Limits Test

Conducted Output Power Test

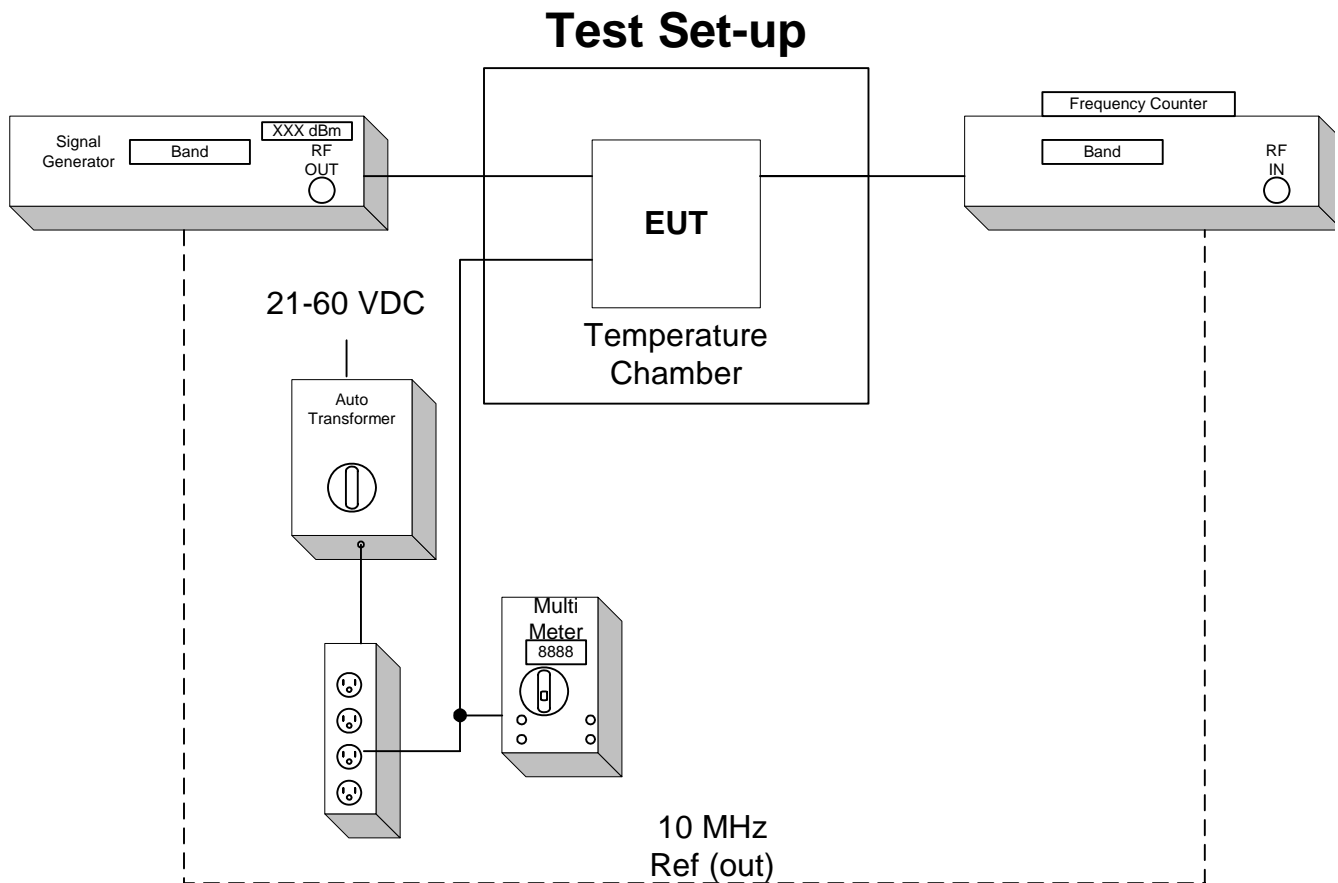
Inter-Modulation Test

Occupied Bandwidth Modulation Test



Frequency Tolerance Test

EUT is specified for indoor use only with temperature range of -0° to $+50^{\circ}$ C, and was tested with its range.



5.0 TEST RESULTS

5.1.1 22.913 Effective Radiated Power Limits

Test Summary:

- The requirements are: **MET** NOT MET
- Minimum margin of compliance is 57.28 dB at 1860.0 MHz (W-CDMA)

Test Location:

- ETL (Oakdale, MN)
- ADC facility (Shakopee, MN)**

Test Distance:

- 3 Meters
- 10 Meters
- Conducted measurement**

Test Equipment (ADC):

1, 2, 6, 7, 13

Test Limit:

500 Watts or 57 dBm Limit

Test Data:

[Conducted Output Power; Section 7.2](#)

[Table of Contents; Section 1.0](#)

Test Engineer: Mark F. Miska

Date: 26 August, 2008

5.1.2 22.355 Frequency Tolerance

Test Summary:

- The requirements are: ■ **MET** □ NOT MET
- The fundamental emission stays within the limit.
- Frequency measured over a temperature range of 0 to 50° C and an input voltage range of 21 to 60 VDC.

Test Location:

□ ETL (Oakdale, MN)

■ **ADC facility (Shakopee, MN)**

Test Equipment (ADC):

3, 4, 5, 6, 9, 13

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:

[Frequency Stability; Section 7.3](#)

[Table of Contents; Section 1.0](#)

Test Engineer: Mark F. Miska

Date: 26 August, 2008

5.1.3 22.917 Emission Limitations Cellular

Test Summary:

- The requirements are: ▪ **MET** □ 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:

□ ETL (Oakdale, MN)

▪ **ADC facility (Shakopee, MN)**

Test Equipment (ADC):

1, 2, 6, 7, 13

Test Limit:

Out of band emissions:

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

Outside of the carrier emissions bandwidth:

26 dB below the transmitter power

Test Data:

[Conducted Emissions; Section 7.1](#)

[Intermodulation; Section 7.4](#)

[Occupied Bandwidth; Section 7.5](#)

Radiated Emissions; ([Appendix B](#))

[Table of Contents; Section 1.0](#)

Test Engineer: Mark F. Miska

Date: 26 August, 2008

Date: 26 August, 2008

Date: 26 August, 2008

6.0 TEST EQUIPMENT

[Table of Contents: Section 1.0](#)

Number	Description	Manufacturer	Model	ADC Serial Number	Cal Due	Used
1	Spectrum Analyzer	HP	8563E	MC27690	6-5-09	<input checked="" type="checkbox"/>
2	Power Meter	HP	EPM-441A	MC27670	10-9-08	<input checked="" type="checkbox"/>
3	Multimeter	Fluke	79111	MC34730	6-24-10	<input checked="" type="checkbox"/>
4	Frequency Counter	HP	5347A	MC27548	1-16-09	<input checked="" type="checkbox"/>
5	Temperature Chamber	Thermotron	SM-32C	MC18966	4-8-09	<input checked="" type="checkbox"/>
6	Signal Generator	Agilent	E4437B	967974	1-15-10	<input checked="" type="checkbox"/>
7	Signal Generator	Agilent	E4438C	1013210	2-9-09	<input checked="" type="checkbox"/>
8	Attenuator	Huber Suhner	6810.17.A	N/A	CNR	<input type="checkbox"/>
9	Variable Auto Transformer	Staco	1520CT	MC44655	CNR	<input checked="" type="checkbox"/>
10	Digital Barometer	Fisher Scientific	02-403	MC50719	10-28-09	<input checked="" type="checkbox"/>
11	Data Acquisition Unit	Fluke	Hydra	MC27549	10-8-08	<input type="checkbox"/>
12	Attenuator	Aeroflex	49-30-33	N/A	CNR	<input type="checkbox"/>
13	Attenuator	Aeroflex	86-30-12	N/A	CNR	<input checked="" type="checkbox"/>
14	LNA	Lucix Corp	C020200L 1603	N/A	CNR	<input type="checkbox"/>

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

7.0

APPENDIX A

Conducted Emissions Test Data

[Table of Contents: Section 1.0](#)

Test Engineer: Mark F. Miska

7.1 Conducted Emission Limits Test

[Table of Contents: Section 1.0](#)

[Back to Emission Limits: Section 5.1.3](#)

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 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

$$(19\text{dBm} - [43 + 10\log(0.08\text{W})])$$

Band edge compliance is also demonstrated using a FM, TDMA, GSM, EDGE, CDMA 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 -30 dBm input to DHU. Industry practice has generally set the output signal power level.

Universal Radio Head (URH):

Range: 100 - 240 VAC

Tested @: 120 VAC

Tested @: 5.8 A

Digital Host Unit (DHU):

Range: 21-60 VDC

Tested @: 48 VDC

Tested @: 3.5 A

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

The input to the host unit has a digital attenuation chip (ALC) to provide protection from overdrive with 5-10 millisecond attack time / 100 millisecond decay time and 31 dB of head room, such that single channel operation, or multi-channel operation will not exceed nominal gain of the system.

The frequency stability is derived by the BTS, base transceiver station. This product uses internal frequency stability to keep the signal inside our filter bandwidths. This means that the frequency can change, but the frequency that transmits is still at the original frequency. The remote system uses the data over the fiber optic path to phase/frequency lock to the host. The purpose is to frequency lock the up- and down-conversion local oscillators, and thereby eliminate any end-to-end frequency shift.

The spurious limitation is completed with the duplexer. The ALC also suppresses in-band spurious by preventing PA overdrive, while the duplexer suppresses out-of-band spurious. Internal to the electronics, the use of SAW filters provides for higher Q roll-off at band edges.

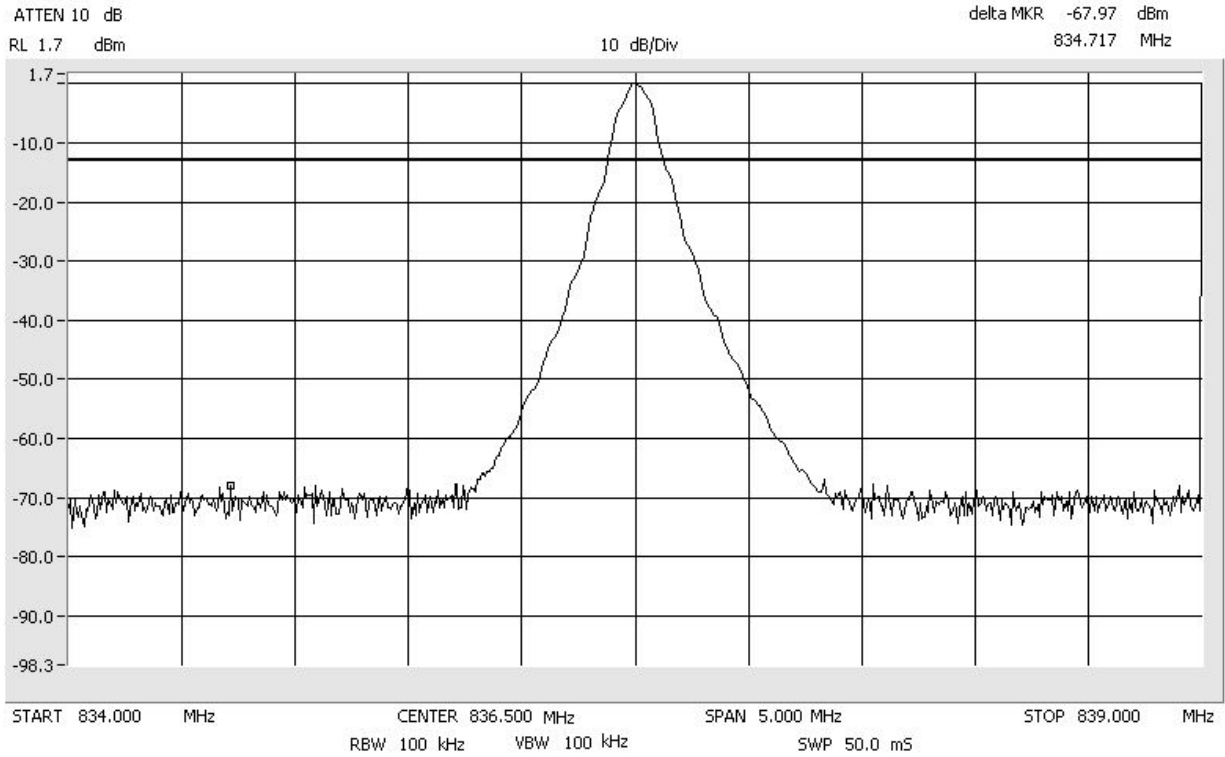
This equipment does not modulate the RF, so there is no modulation limiter. This equipment does not change the modulation of the RF or the occupied bandwidth of any channel. It transports the signal, as is, over an optical link. The RF input is not changed in the RF output.

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

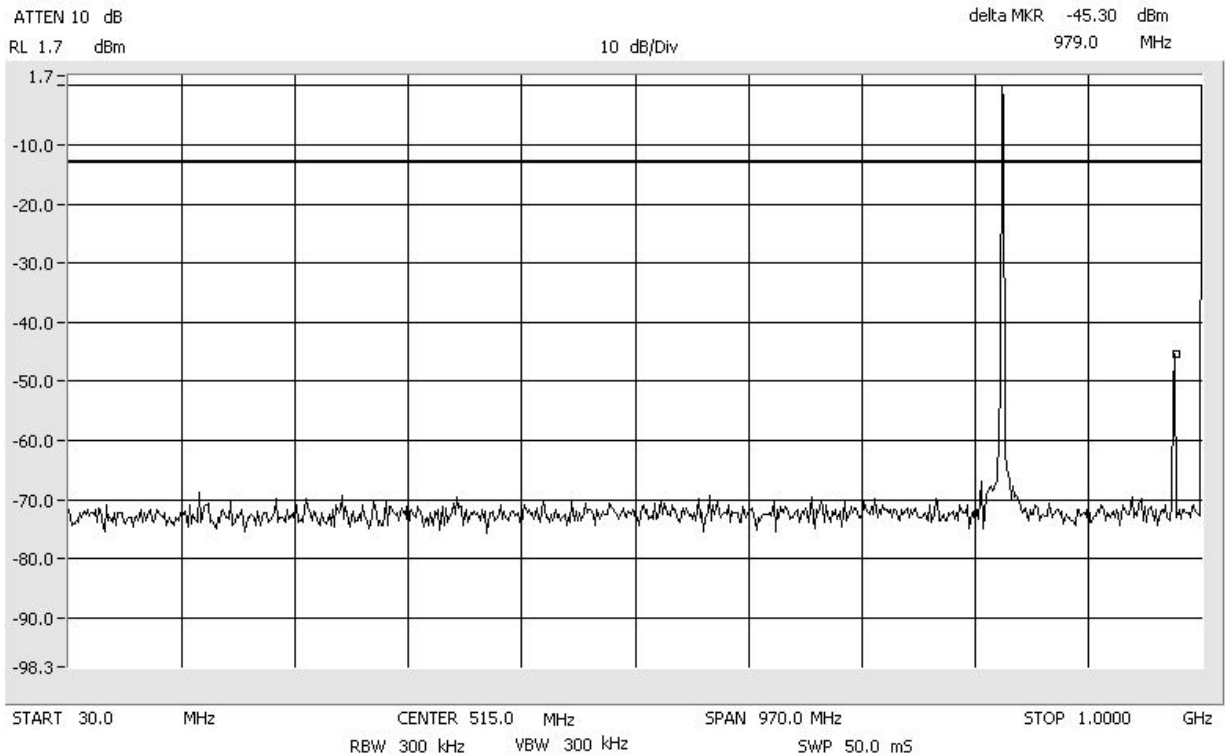
Results:

Pass (See plots)

Conducted Emissions FM CELLULAR
Center: 836.5 MHz Span: 5 MHz RBW/VBW: 100 kHz



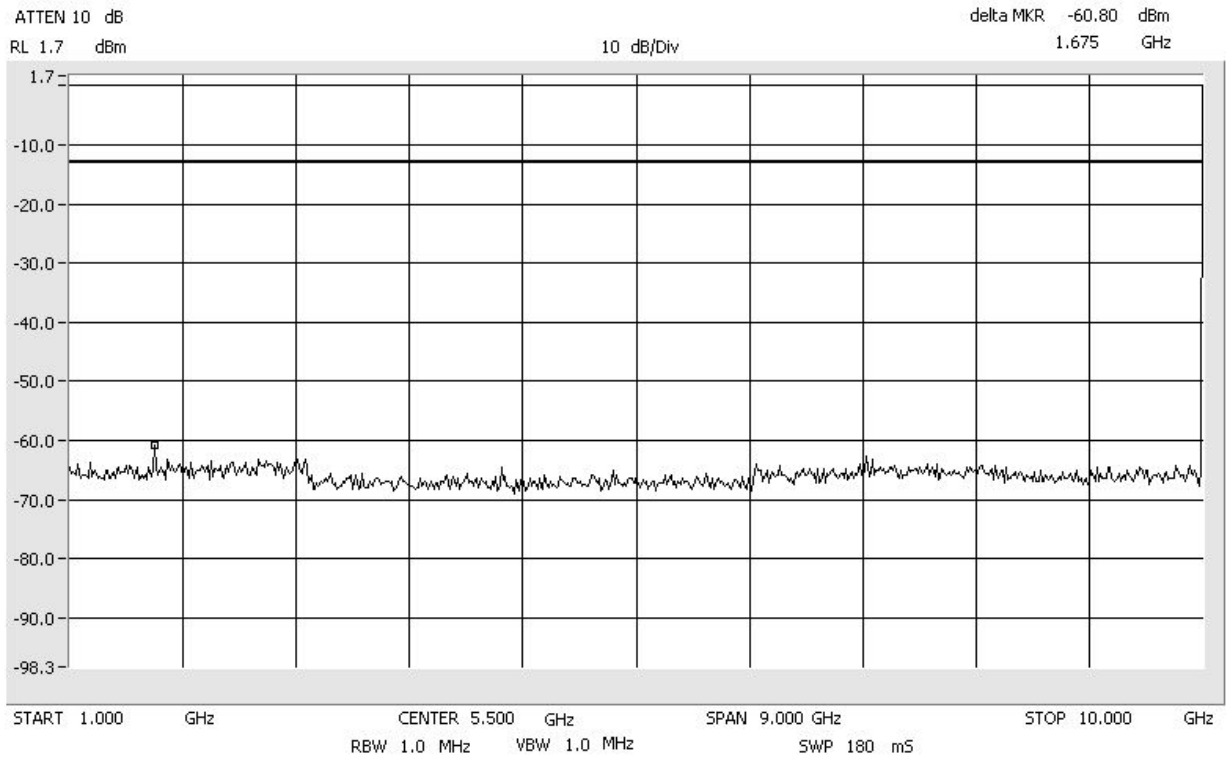
Conducted Emissions FM CELLULAR
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz



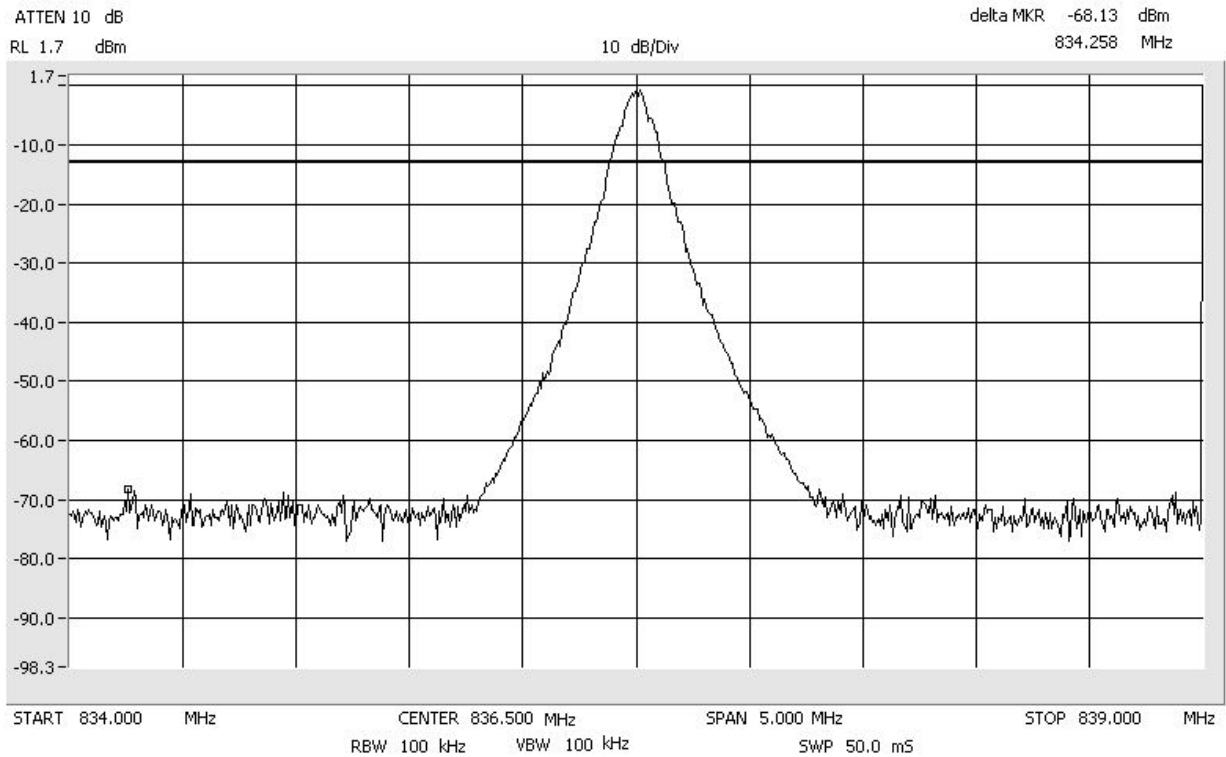
Conducted Emissions
Span: 1 GHz to 10 GHz

FM

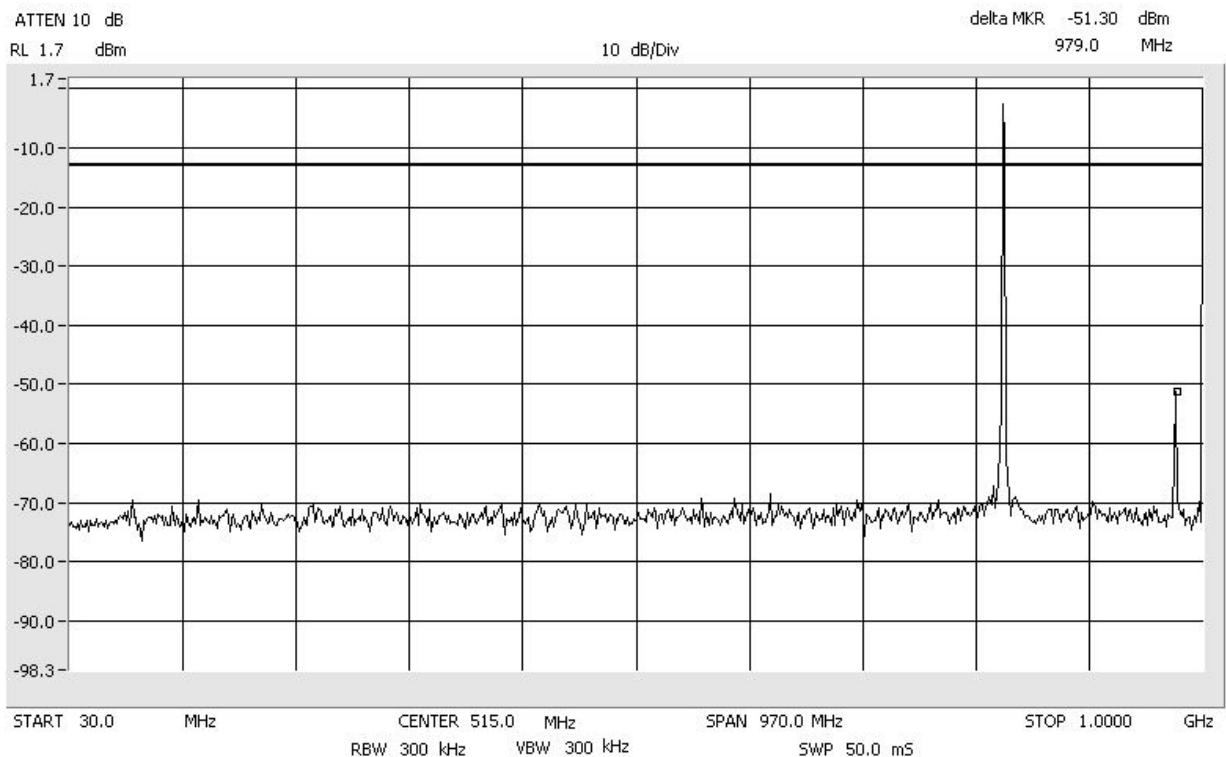
CELLULAR
RBW/VBW: 1 MHz



Conducted Emissions TDMA CELLULAR
Center: 836.5 MHz Span: 5 MHz RBW/VBW: 100 kHz

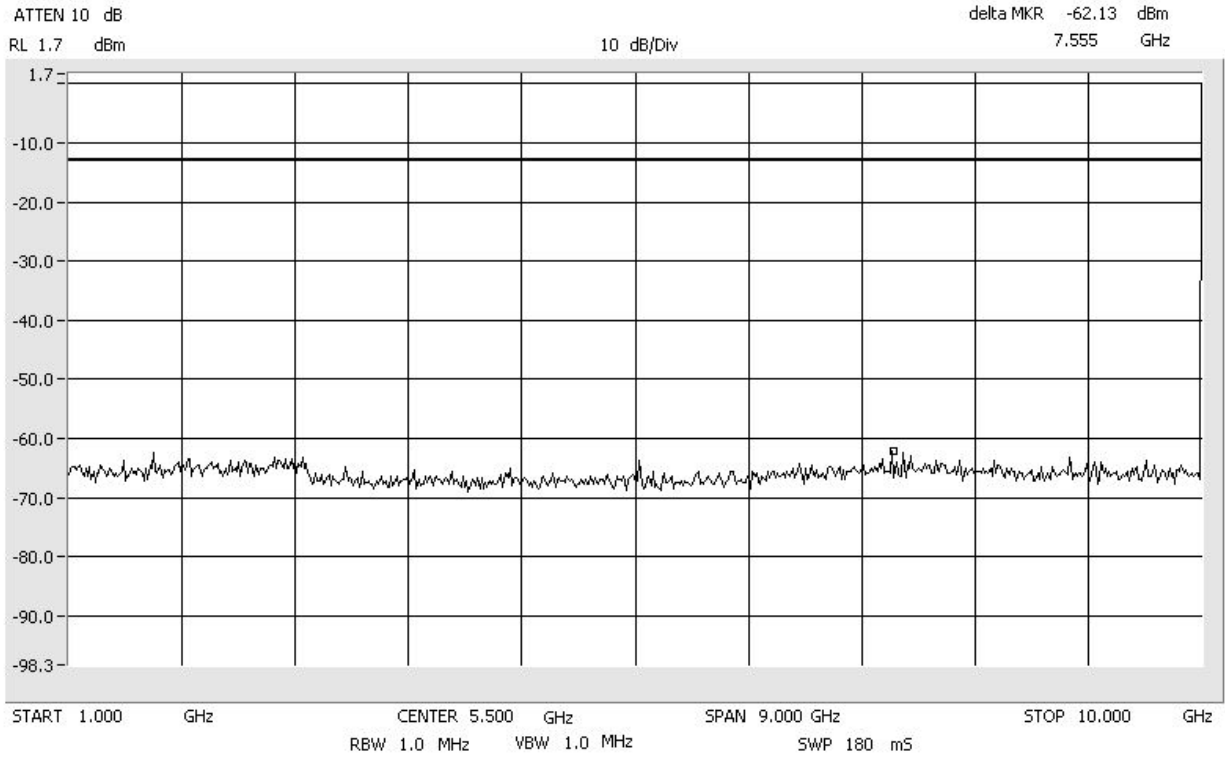


Conducted Emissions TDMA CELLULAR
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz

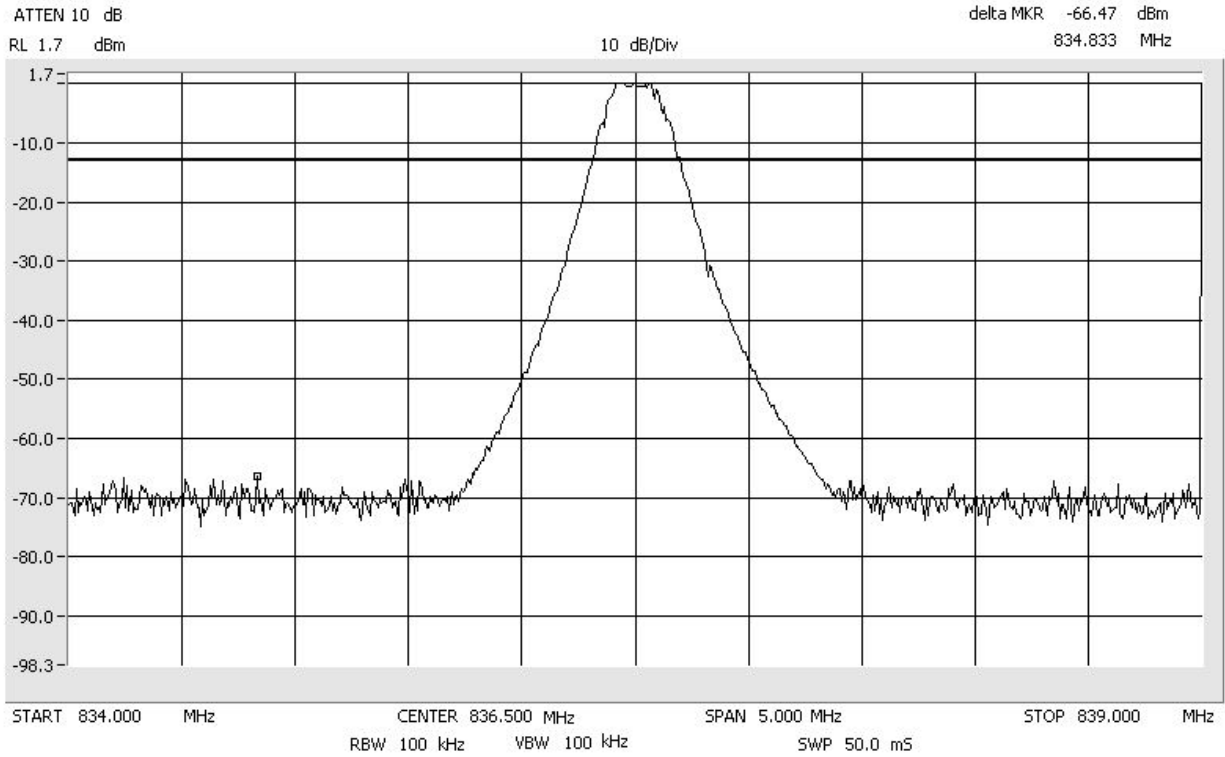


Conducted Emissions
Span: 1 GHz to 10 GHz

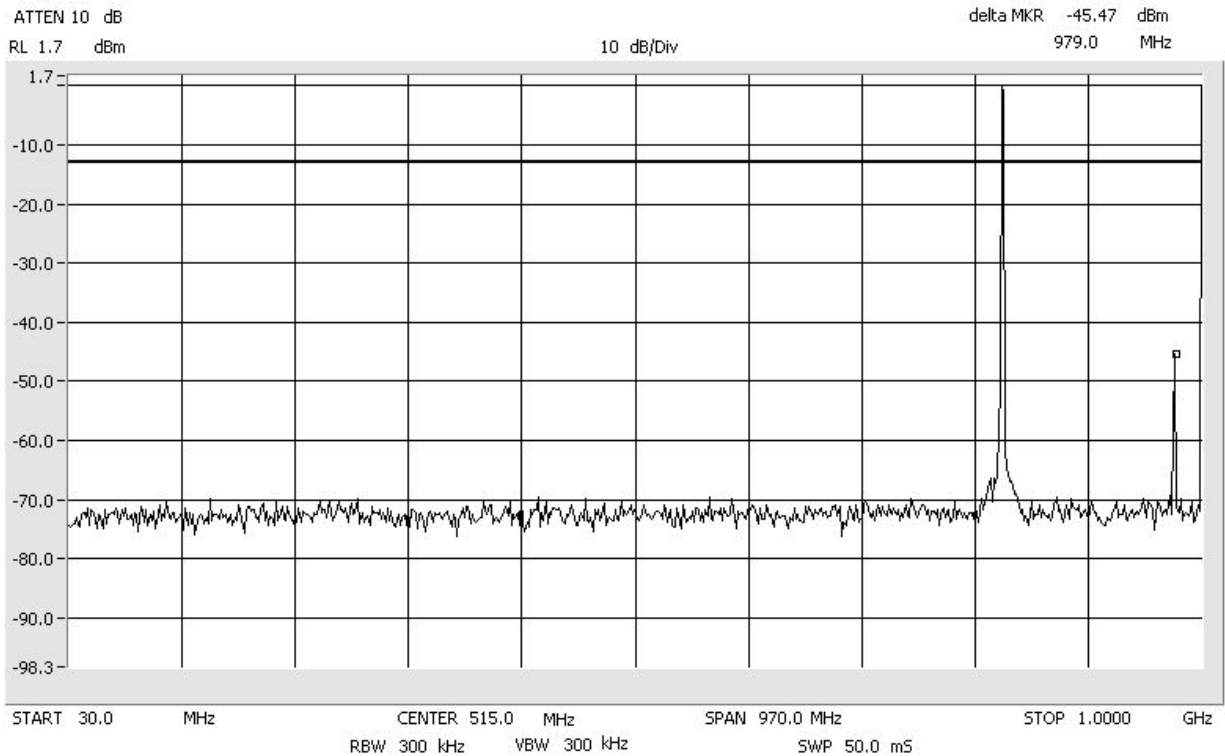
TDMA CELLULAR
RBW/VBW: 1 MHz



Conducted Emissions GSM CELLULAR
Center: 836.5 MHz Span: 5 MHz RBW/VBW: 100 kHz

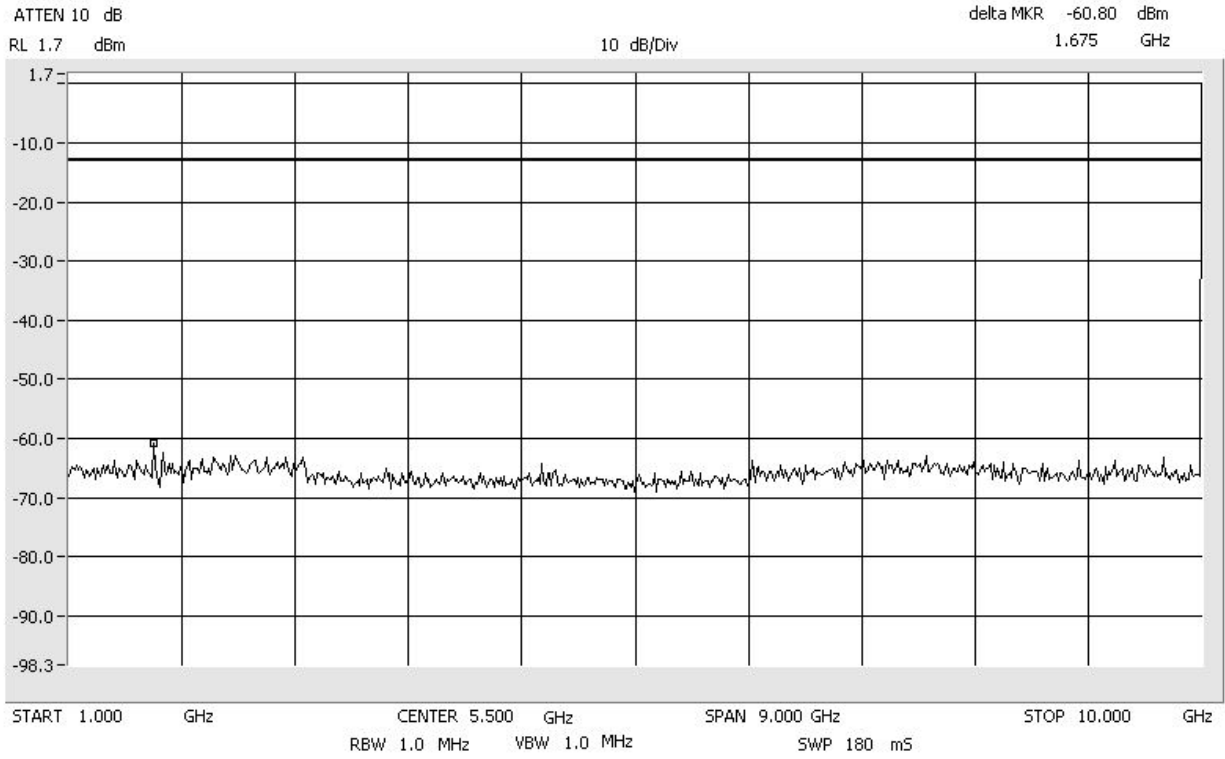


Conducted Emissions GSM CELLULAR
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz

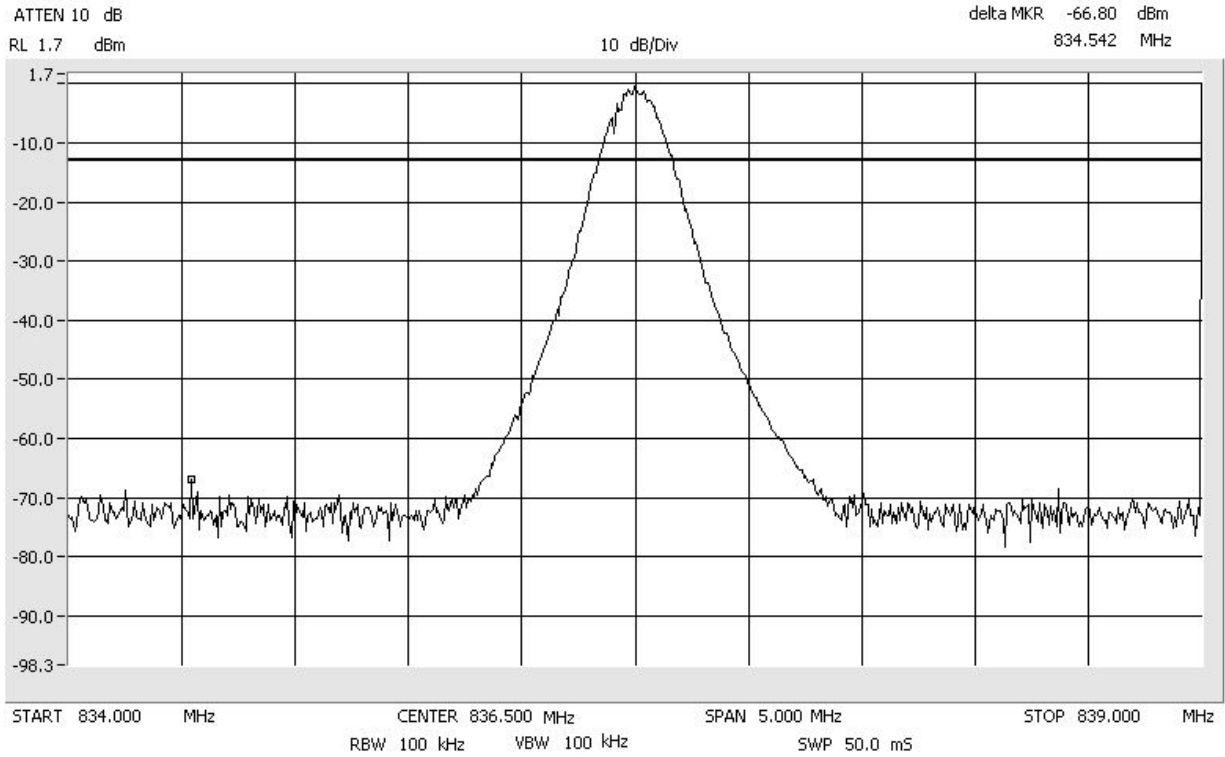


Conducted Emissions
Span: 1 GHz to 10 GHz

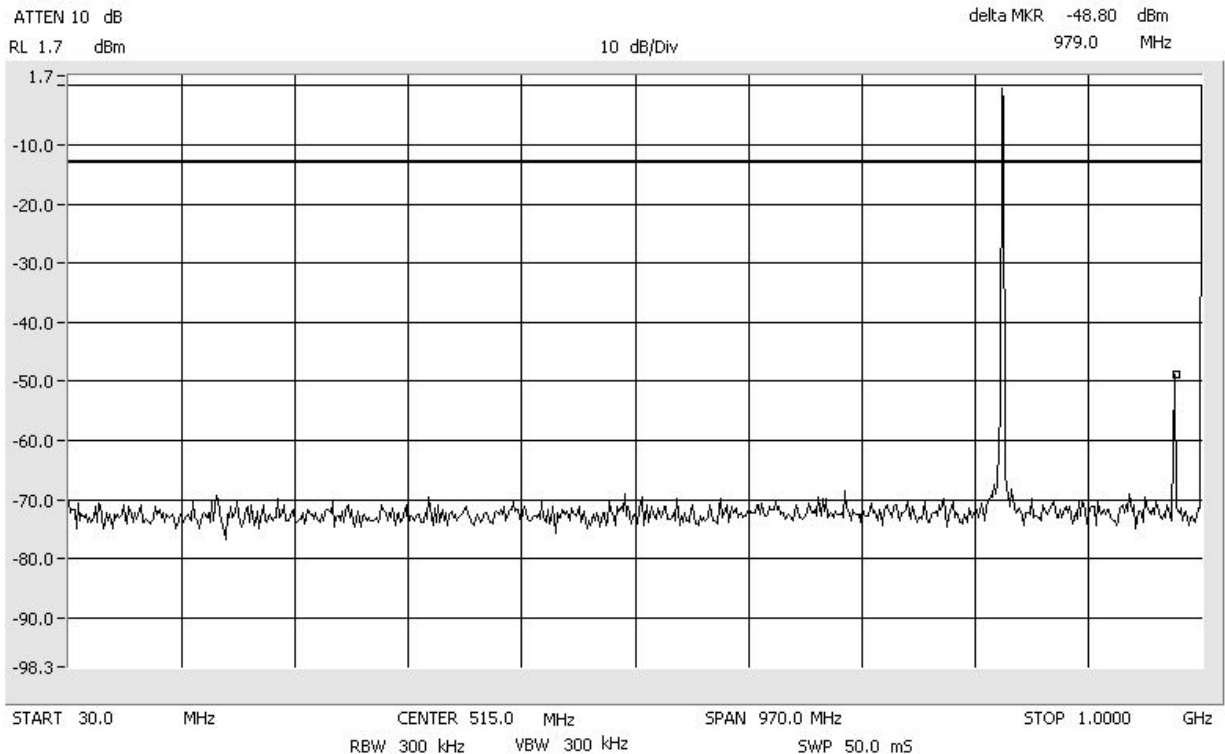
GSM CELLULAR
RBW/VBW: 1 MHz



Conducted Emissions EDGE CELLULAR
Center: 836.5 MHz Span: 5 MHz RBW/VBW: 100 kHz

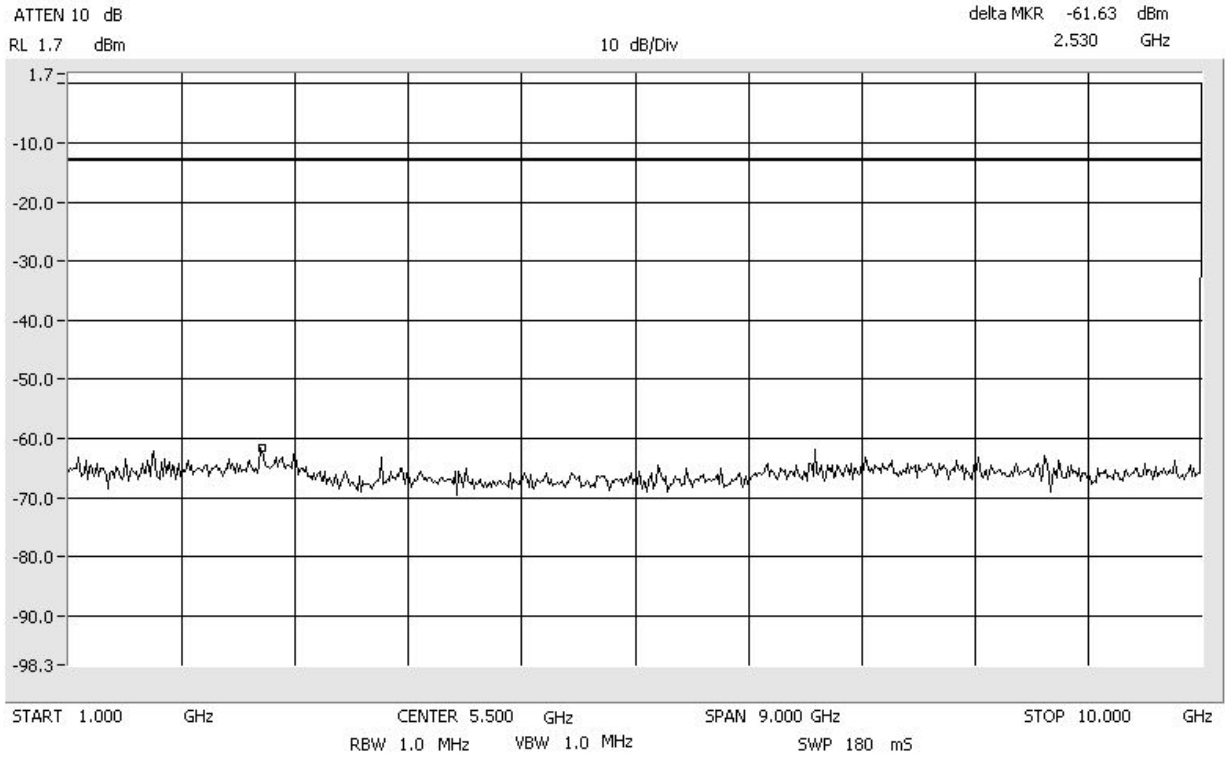


Conducted Emissions EDGE CELLULAR
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz

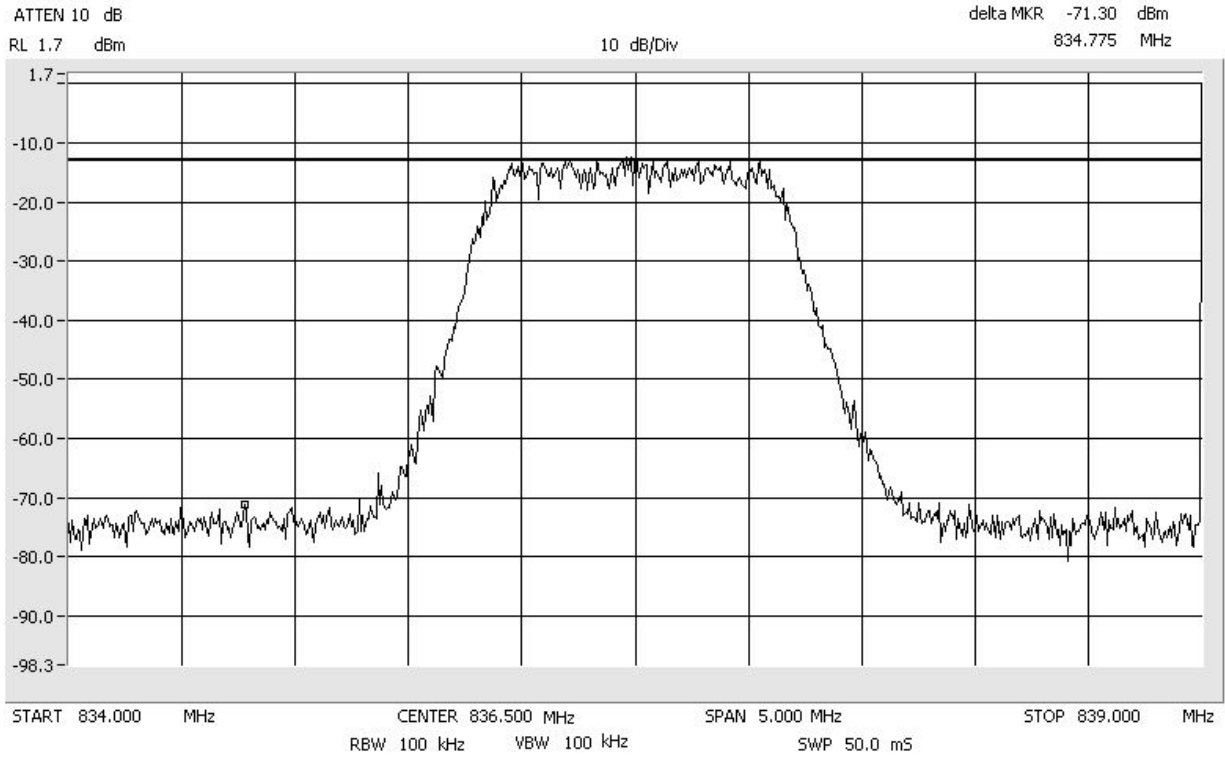


Conducted Emissions
Span: 1 GHz to 10 GHz

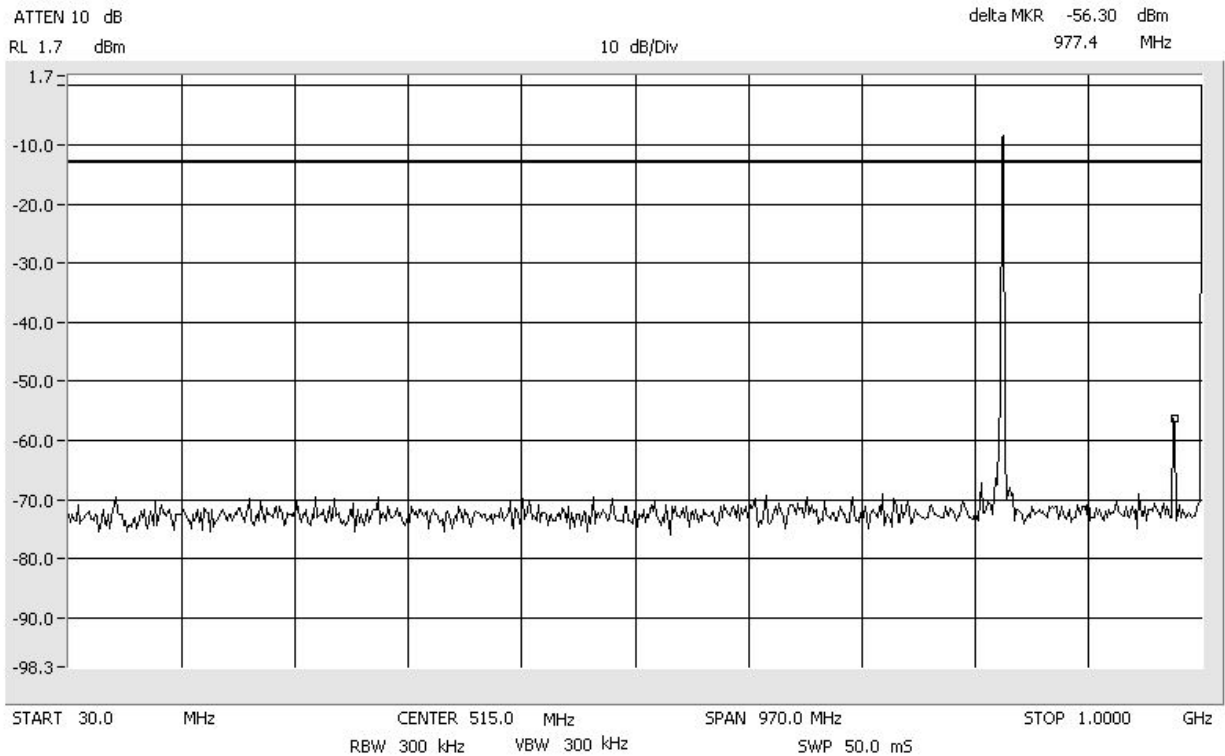
EDGE CELLULAR
RBW/VBW: 1 MHz



Conducted Emissions CDMA CELLULAR
Center: 836.5 MHz Span: 5 MHz RBW/VBW: 100 kHz

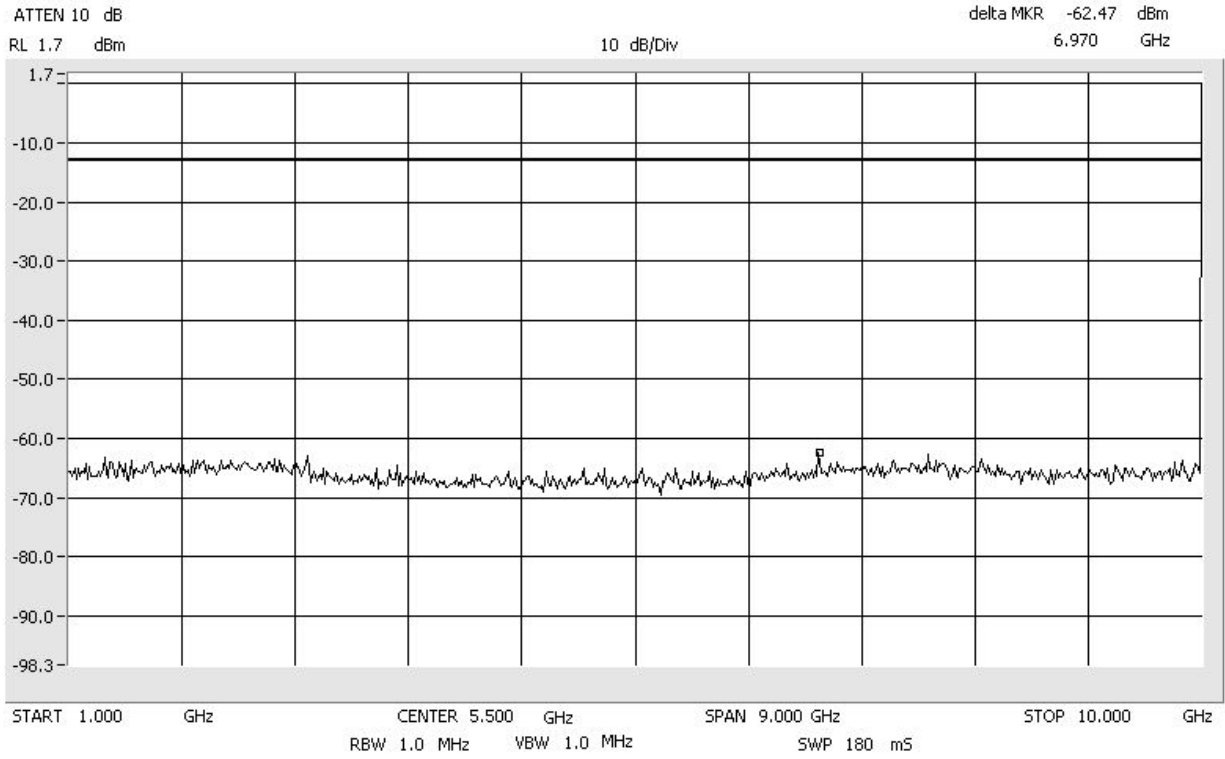


Conducted Emissions CDMA CELLULAR
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz



Conducted Emissions
Span: 1 GHz to 10 GHz

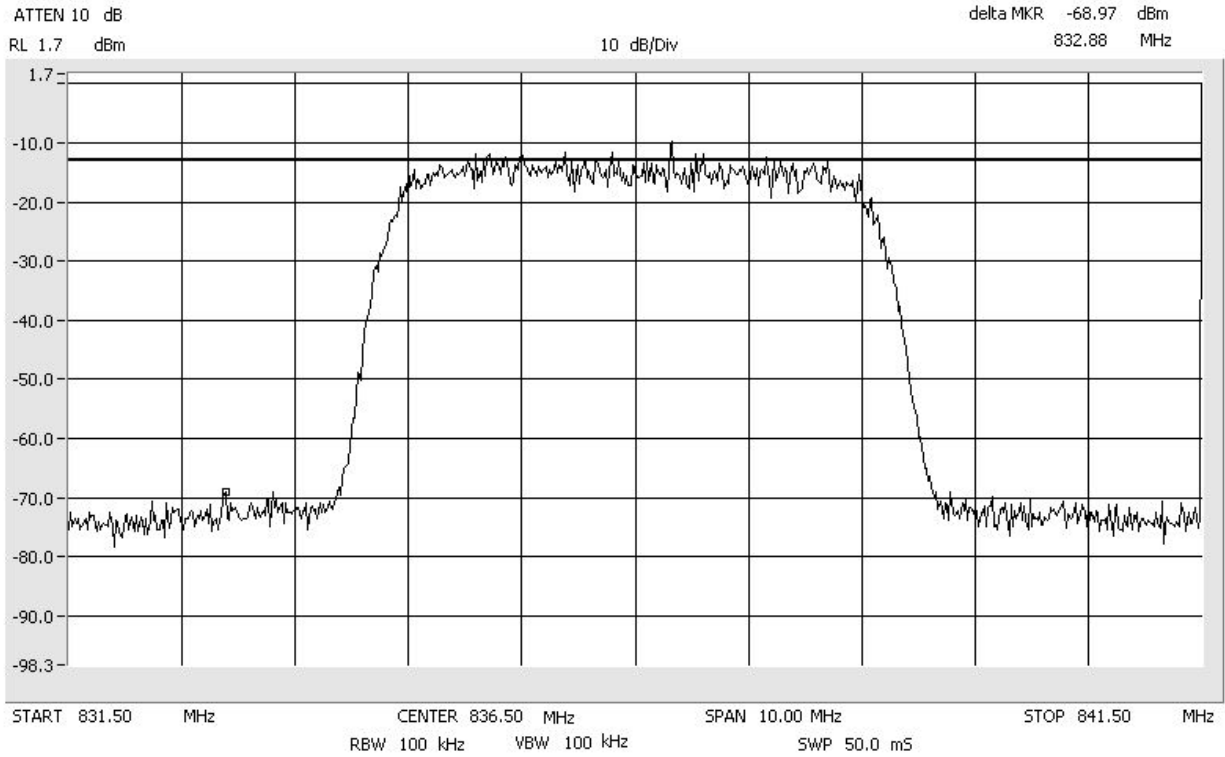
CDMA CELLULAR
RBW/VBW: 1 MHz



Conducted Emissions
Center: 836.5 MHz

WCDMA
Span: 10 MHz

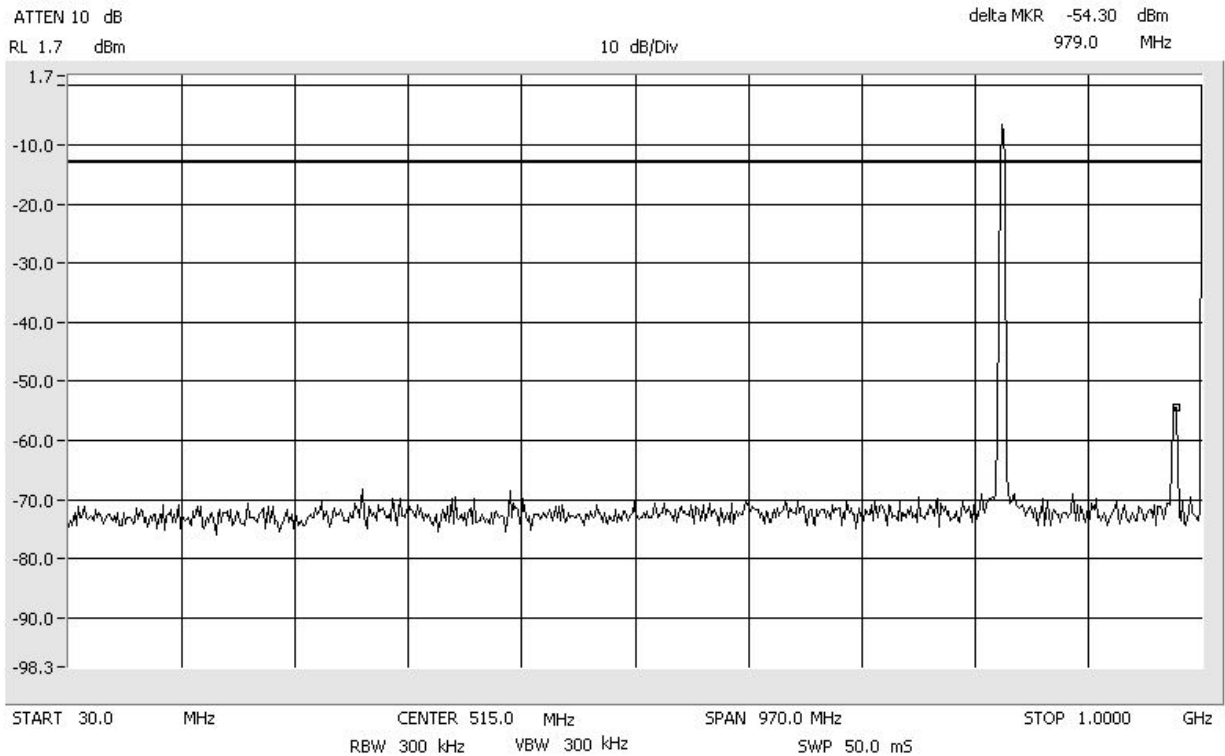
CELLULAR
RBW/VBW: 100 kHz



Conducted Emissions
Span: 30 MHz to 1 GHz

WCDMA

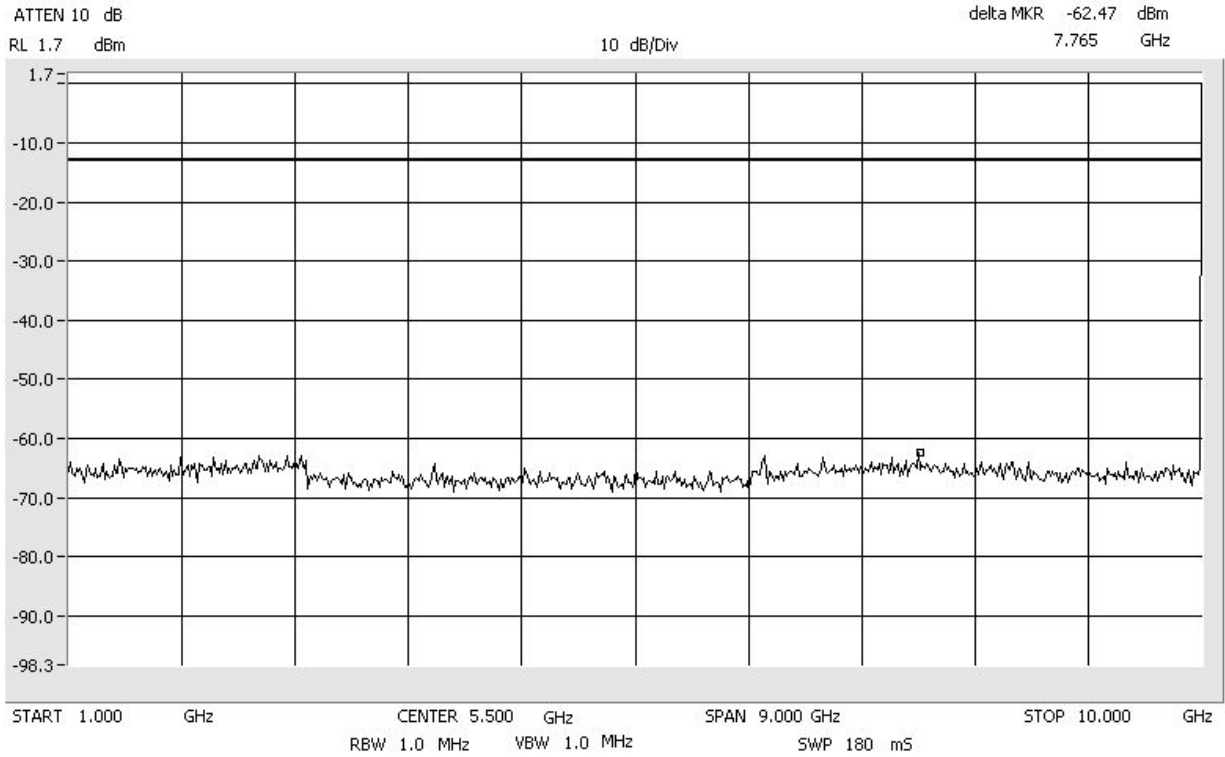
CELLULAR
RBW/VBW: 300 kHz



Conducted Emissions
Span: 1 GHz to 10 GHz

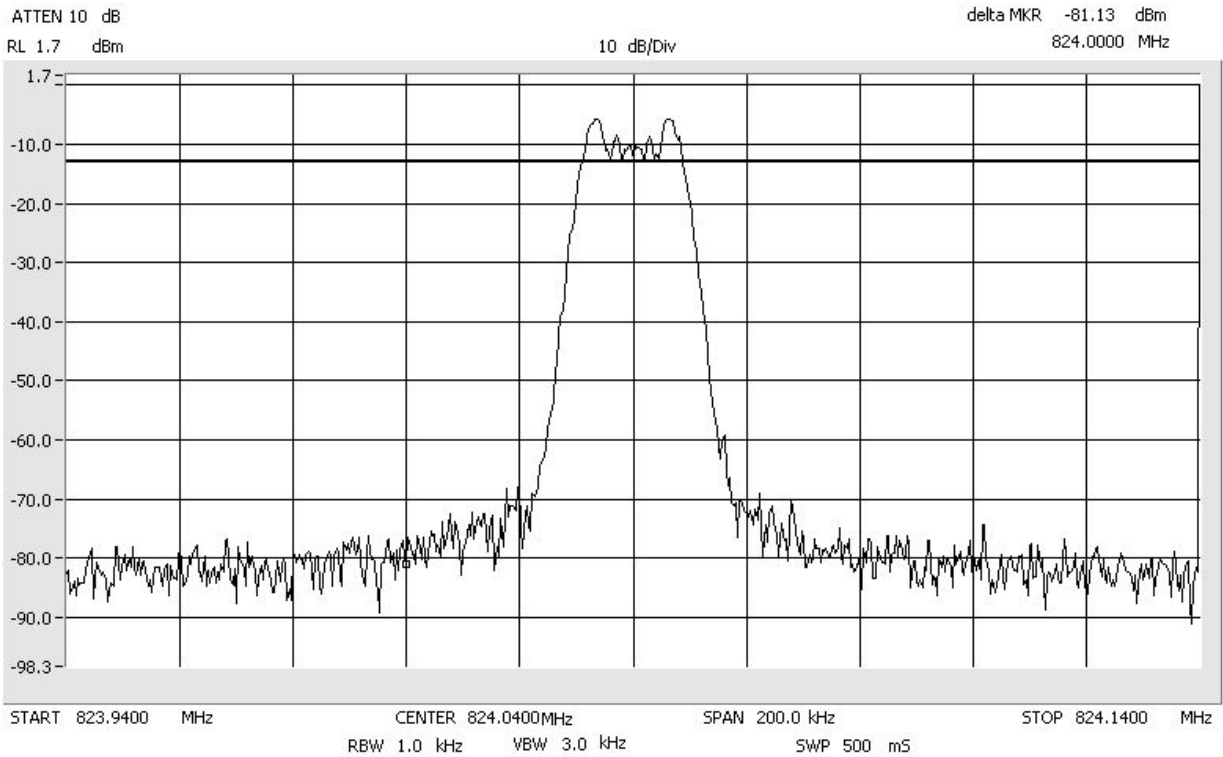
WCDMA

CELLULAR
RBW/VBW: 1 MHz



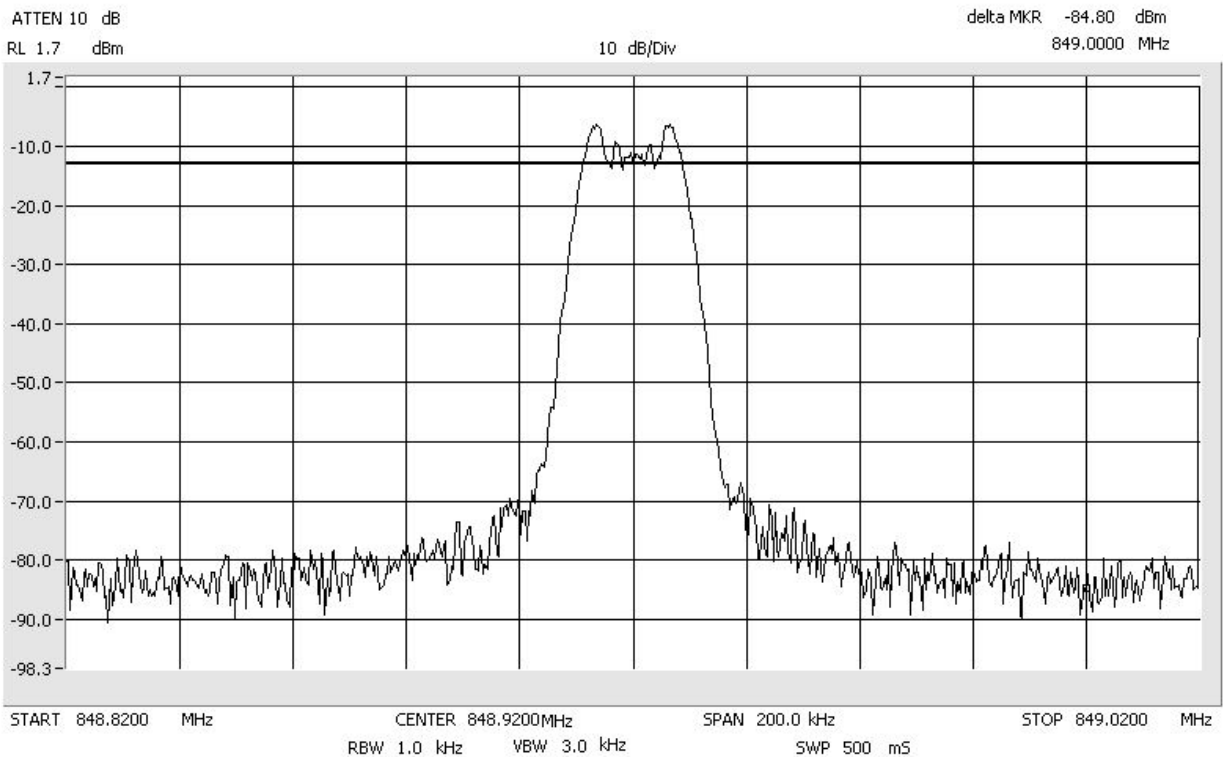
Band_Edge
Center: 824.04 MHz Span: 200 kHz

FM
RBW: 1 kHz VBW: 3 kHz



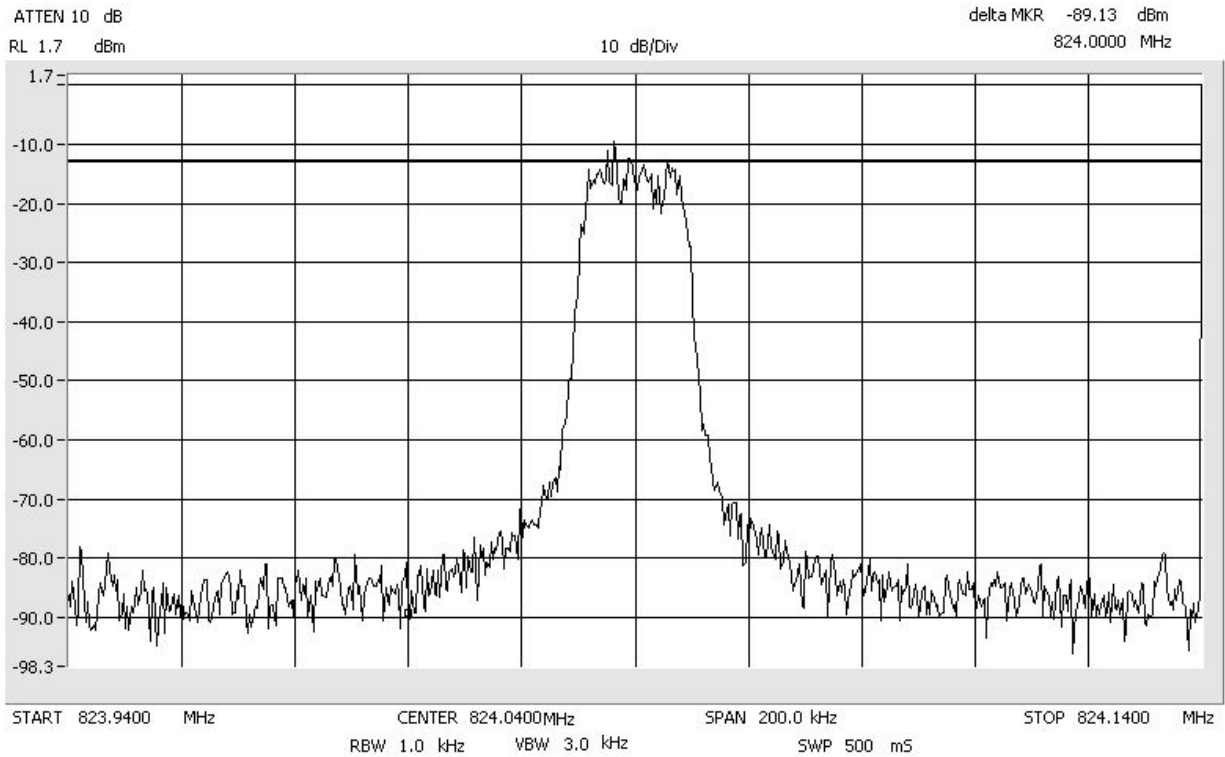
Band_Edge
Center: 848.92 MHz Span: 200 kHz

FM
RBW: 1 kHz VBW: 3 kHz



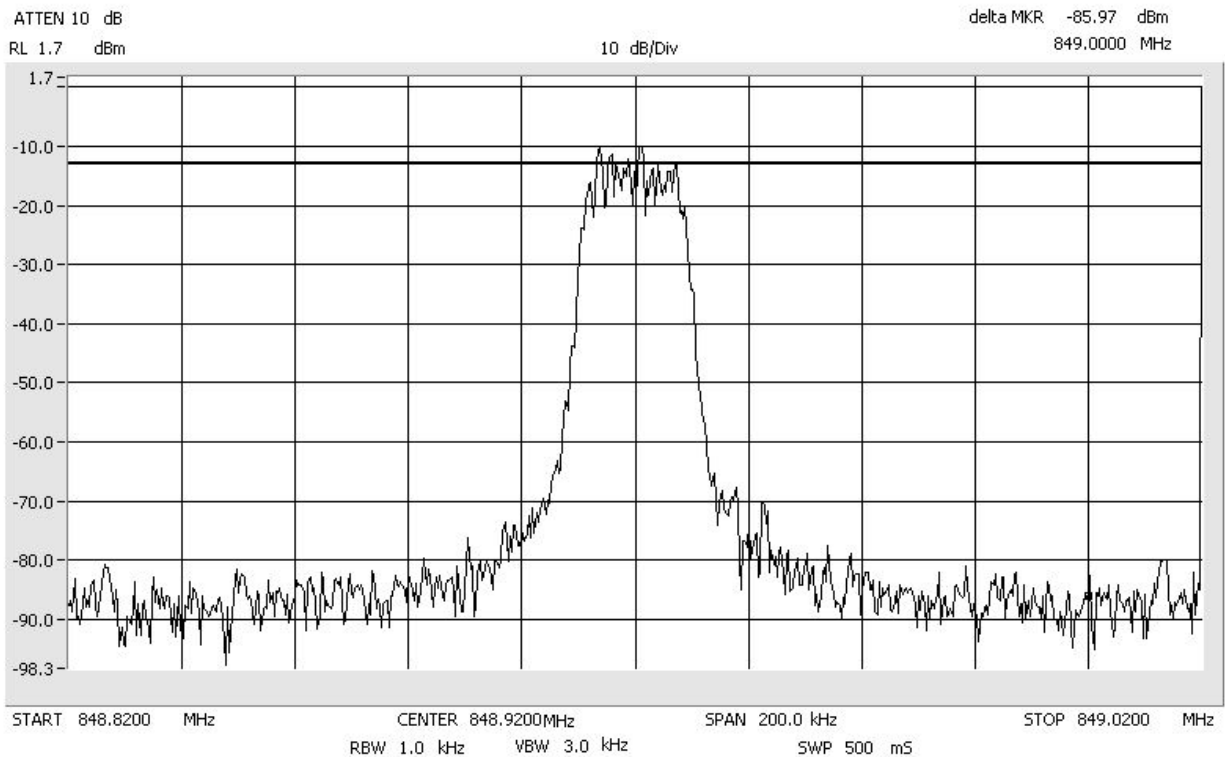
Band_Edge
Center: 824.04 MHz Span: 200 kHz

TDMA
RBW: 1 kHz VBW: 3 kHz



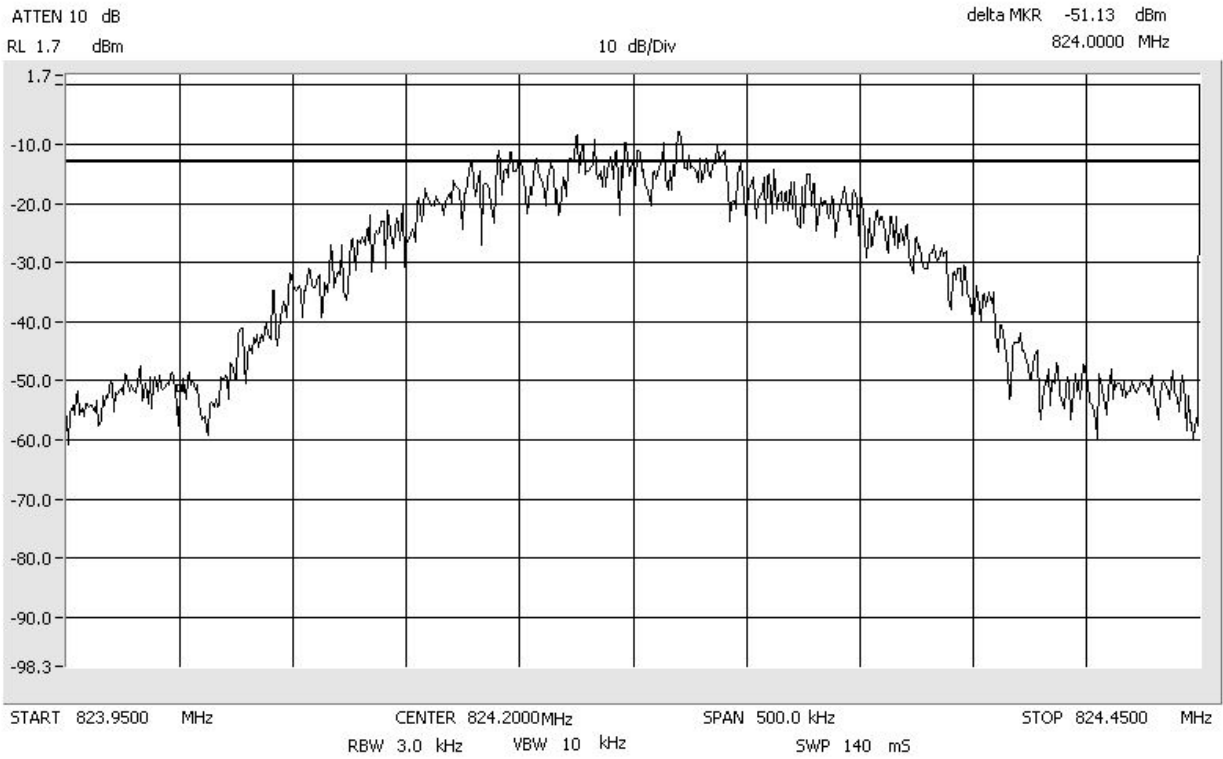
Band_Edge
Center: 848.92 MHz Span: 200 kHz

TDMA
RBW: 1 kHz VBW: 3 kHz



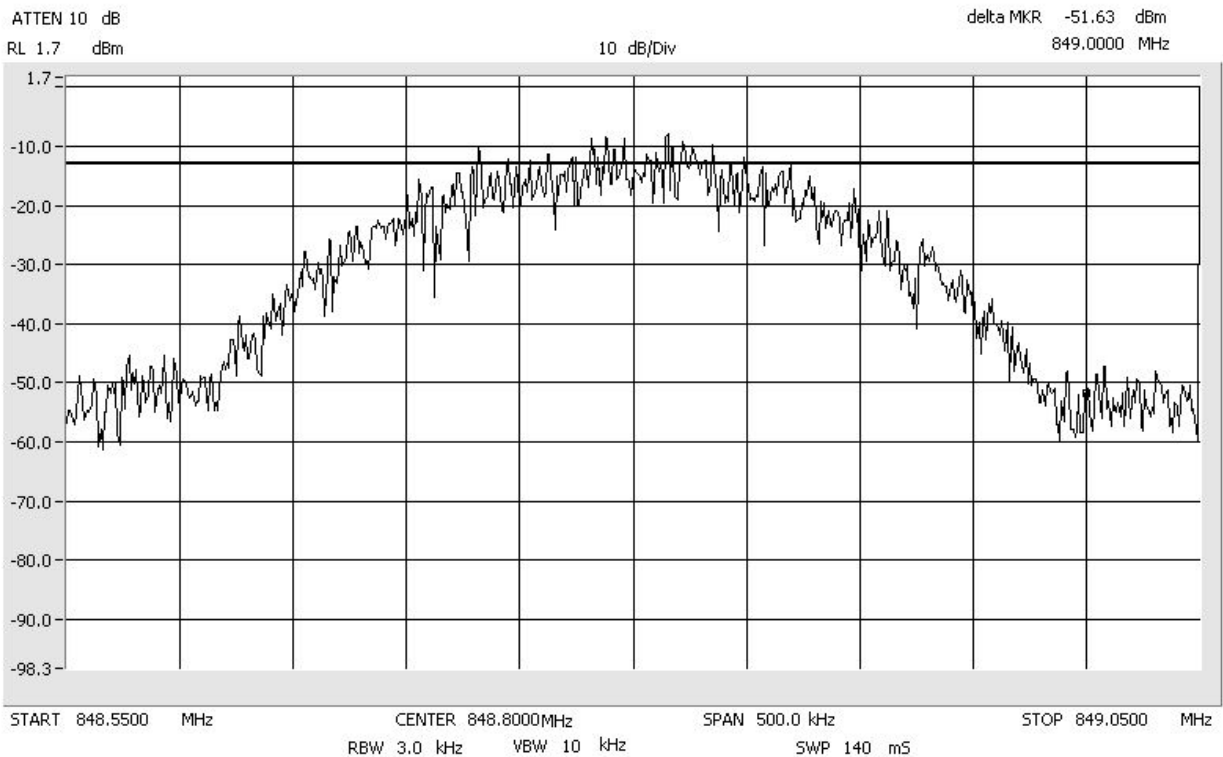
Band_Edge
Center: 824.2 MHz Span: 500 kHz

GSM
RBW: 3 kHz VBW: 10 kHz



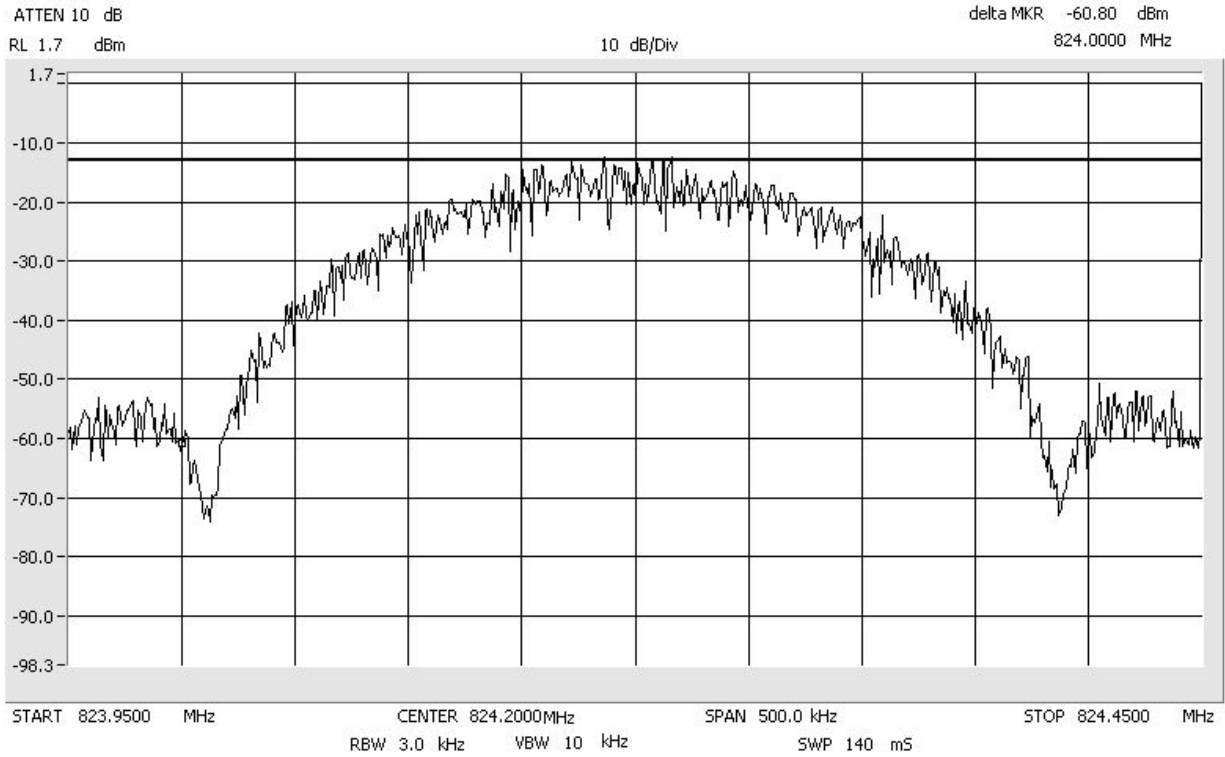
Band_Edge
Center: 848.8 MHz Span: 500 kHz

GSM
RBW: 3 kHz VBW: 10 kHz



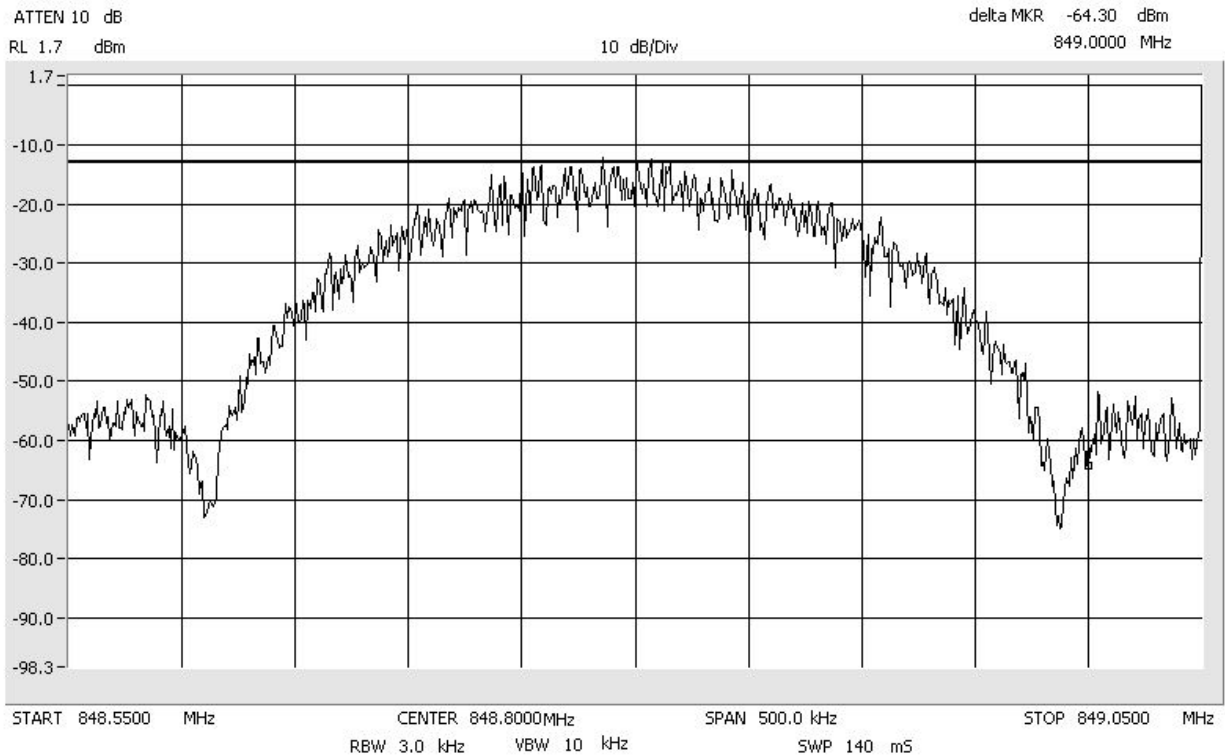
Band_Edge
Center: 824.2 MHz Span: 500 kHz

EDGE
RBW: 3 kHz VBW: 10 kHz



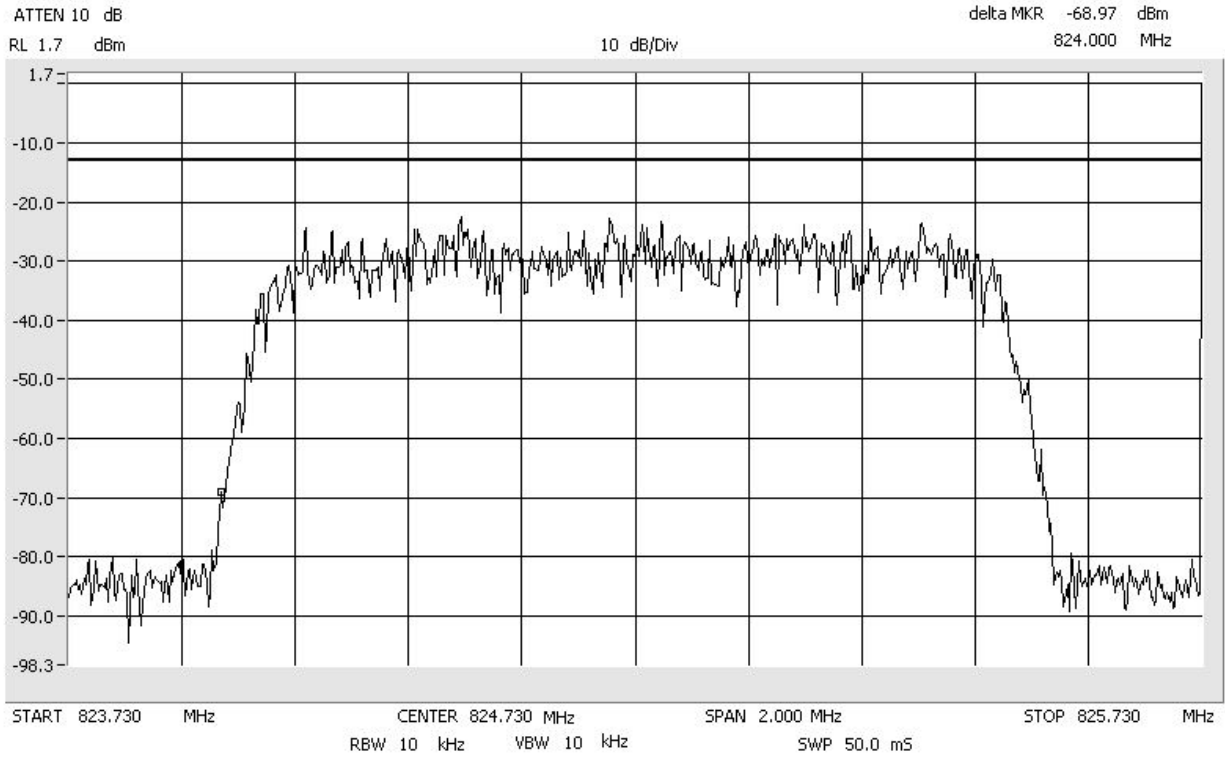
Band_Edge
Center: 848.8 MHz Span: 500 kHz

EDGE
RBW: 3 kHz VBW: 10 kHz



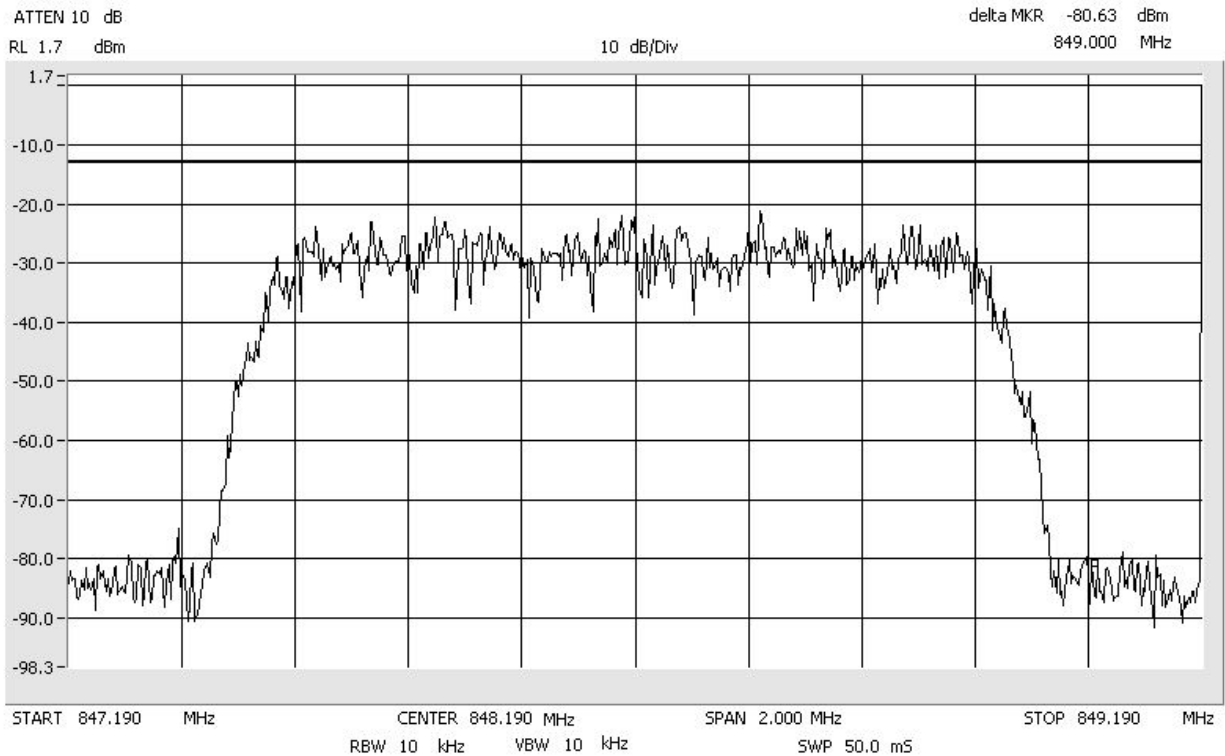
Band_Edge
Center: 824.73 MHz Span: 2 MHz

CDMA
RBW: 10 kHz VBW: 10 kHz



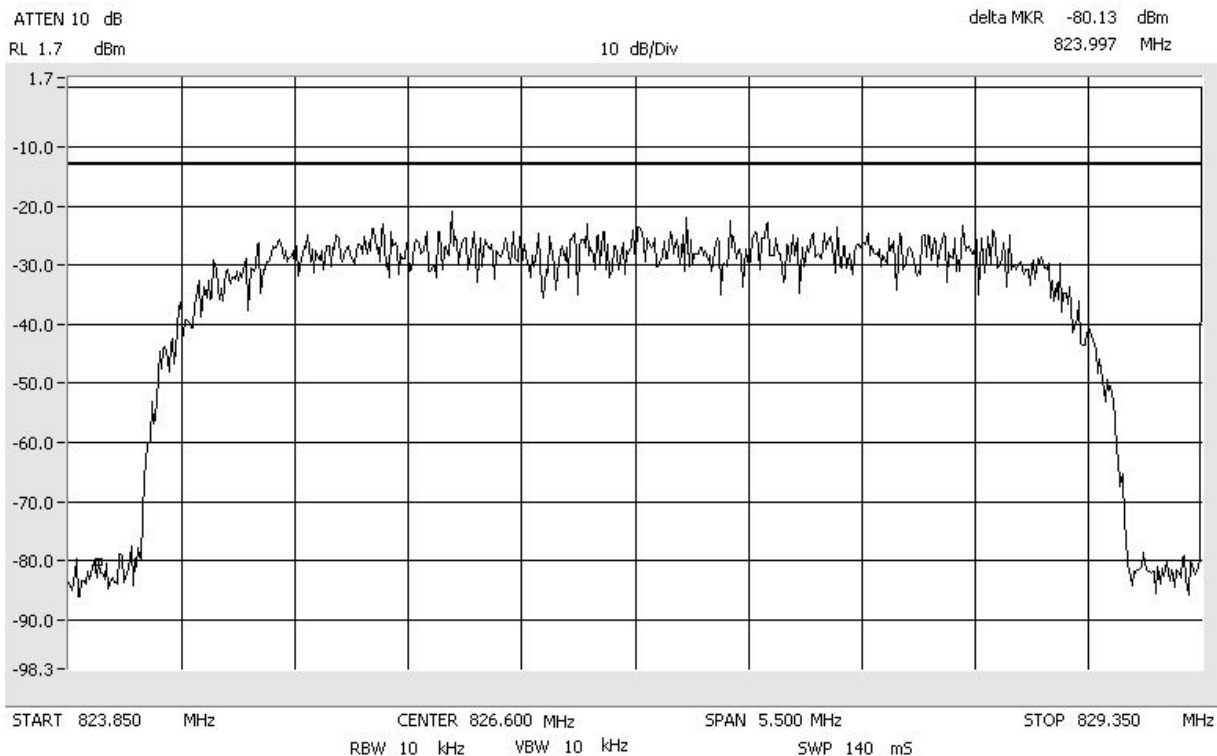
Band_Edge
Center: 848.19 MHz Span: 2 MHz

CDMA
RBW: 10 kHz VBW: 10 kHz



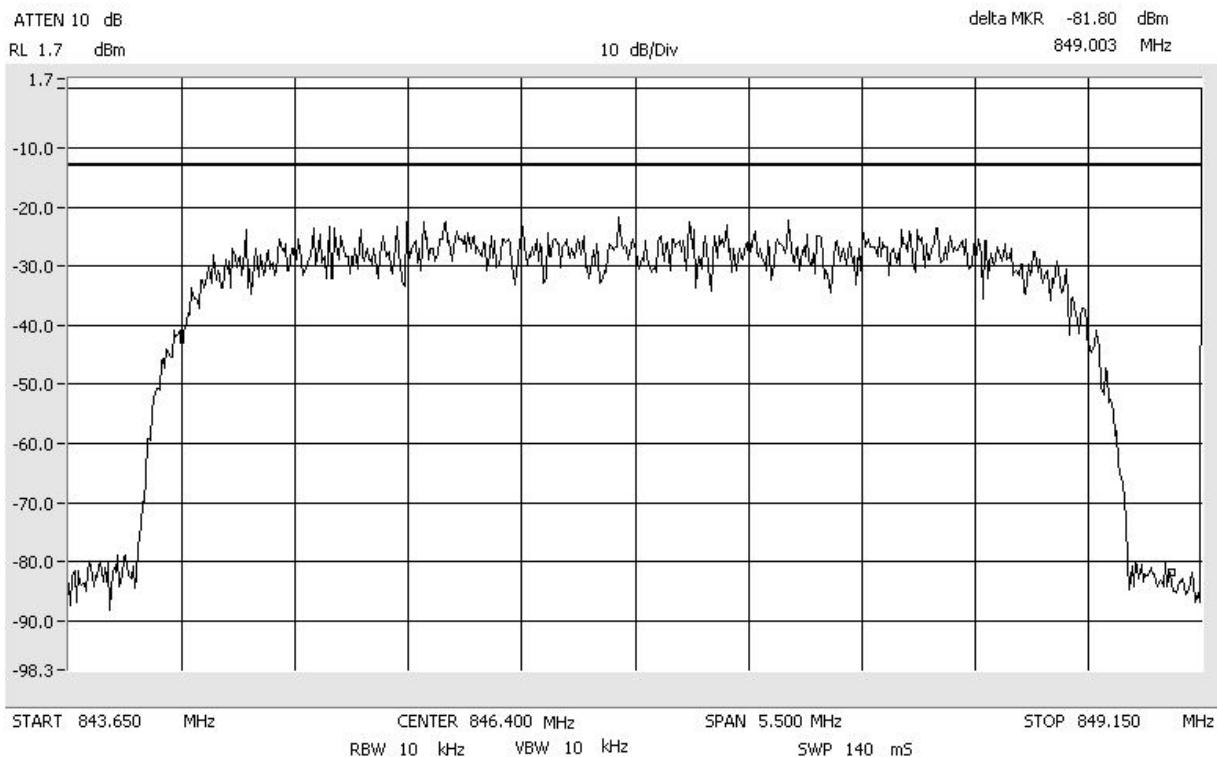
Band_Edge
Center: 826.6 MHz Span: 5.5 MHz

WCDMA
RBW: 10 kHz VBW: 10 kHz



Band_Edge
Center: 846.4 MHz Span: 5.5 MHz

WCDMA
RBW: 10 kHz VBW: 10 kHz



7.2 Conducted Output Power Test

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[Back to Conducted Output Power: Section 5.1.1](#)

*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 and W-CDMA signal. 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 1.6 dB to compensate for cable loss between the EUT and the power meter.

<u>FM</u>	<u>0.857 mWatts</u>
Carrier Frequency	Carrier Output
1850.2 MHz	-0.83 dBm
1860.0 MHz	-0.68 dBm
1909.8 MHz	-0.67 dBm

<u>TDMA</u>	<u>0.897 mWatts</u>
Carrier Frequency	Carrier Output
1850.2 MHz	-0.47 dBm
1860.0 MHz	-0.97 dBm
1909.8 MHz	-1.13 dBm

<u>GSM</u>	<u>0.832 mWatts</u>
Carrier Frequency	Carrier Output
1850.2 MHz	-0.80 dBm
1860.0 MHz	-0.83 dBm
1909.8 MHz	-0.87 dBm

<u>EDGE</u>	<u>0.839 mWatts</u>
Carrier Frequency	Carrier Output
1850.2 MHz	-0.87 dBm
1860.0 MHz	-0.76 dBm
1909.8 MHz	-0.98 dBm

<u>CDMA</u>	<u>0.879 mWatts</u>
Carrier Frequency	Carrier Output
1850.8 MHz	-0.85 dBm
1860.0 MHz	-0.77 dBm
1909.2 MHz	-0.56 dBm

<u>W-CDMA</u>	<u>0.938 mWatts</u>
Carrier Frequency	Carrier Output
1852.6 MHz	-0.55 dBm
1860.0 MHz	-0.28 dBm
1907.4 MHz	-1.07 dBm

7.3 Frequency Stability Test

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HOST	REMOTE			
Input Voltage	Input Voltage	Carrier Frequency	Measured Frequency	Meets Requirements?
21 VDC	100 VAC	824.200 MHz	824.200 MHz	Yes
48 VDC	170 VAC	824.200 MHz	824.200 MHz	Yes
60 VDC	240 VAC	824.200 MHz	824.200 MHz	Yes
21 VDC	100 VAC	836.500 MHz	836.500 MHz	Yes
48 VDC	170 VAC	836.500 MHz	836.500 MHz	Yes
60 VDC	240 VAC	836.500 MHz	836.500 MHz	Yes
21 VDC	100 VAC	848.800 MHz	848.800 MHz	Yes
48 VDC	170 VAC	848.800 MHz	848.800 MHz	Yes
60 VDC	240 VAC	848.800 MHz	848.800 MHz	Yes
Temperature		Carrier Frequency	Measured Frequency	Meets Requirements?
0 Deg. C		824.200 MHz	824.200 MHz	Yes
10 Deg. C		824.200 MHz	824.200 MHz	Yes
20 Deg. C		824.200 MHz	824.200 MHz	Yes
30 Deg. C		824.200 MHz	824.200 MHz	Yes
40 Deg. C		824.200 MHz	824.200 MHz	Yes
50 Deg. C		824.200 MHz	824.200 MHz	Yes
0 Deg. C		836.500 MHz	836.500 MHz	Yes
10 Deg. C		836.500 MHz	836.500 MHz	Yes
20 Deg. C		836.500 MHz	836.500 MHz	Yes
30 Deg. C		836.500 MHz	836.500 MHz	Yes
40 Deg. C		836.500 MHz	836.500 MHz	Yes
50 Deg. C		836.500 MHz	836.500 MHz	Yes
0 Deg. C		848.800 MHz	848.800 MHz	Yes
10 Deg. C		848.800 MHz	848.800 MHz	Yes
20 Deg. C		848.800 MHz	848.800 MHz	Yes
30 Deg. C		848.800 MHz	848.800 MHz	Yes
40 Deg. C		848.800 MHz	848.800 MHz	Yes
50 Deg. C		848.800 MHz	848.800 MHz	Yes

7.4 Intermodulation Test

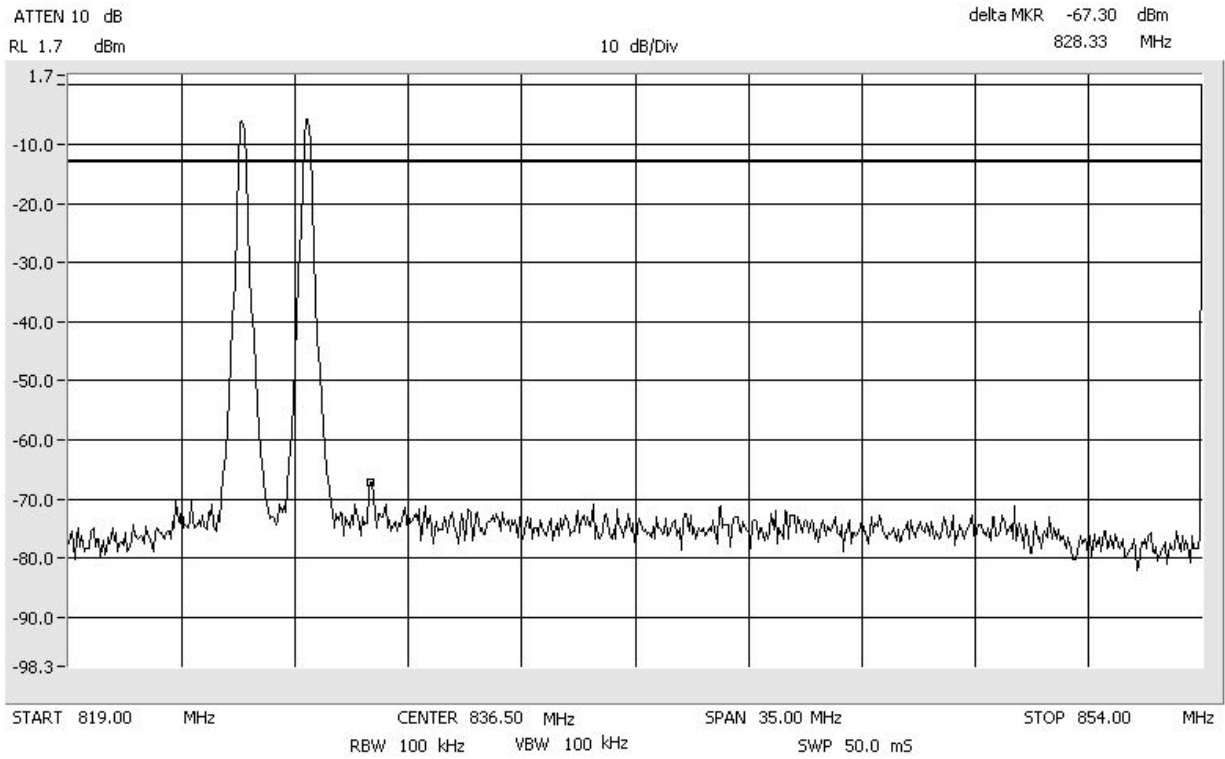
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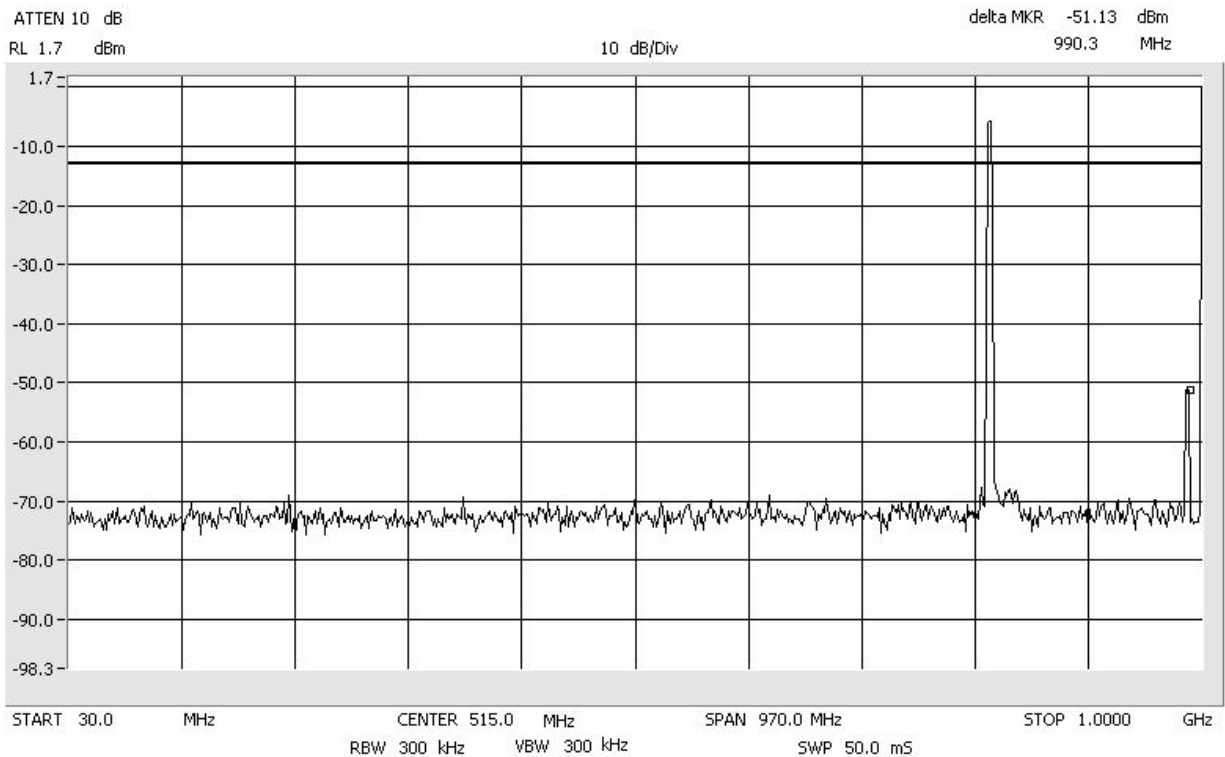
The inter-modulation products test was performed for the EUT. Three tests were performed with the modulation type. Test 1 was with 2 signals input to the EUT at lower end channels. Test 2 was with 2 signals input to the EUT at upper end channels. Test 3 was with 2 signals input to the EUT at upper and lower end channels. The modulation types tested were FM, TDMA, GSM, EDGE, CDMA and W-CDMA. An investigation was made from 30 MHz to the 10th Harmonic of the highest fundamental frequency (~10 GHz). The following plots show the results.

Results:
(See Plots)

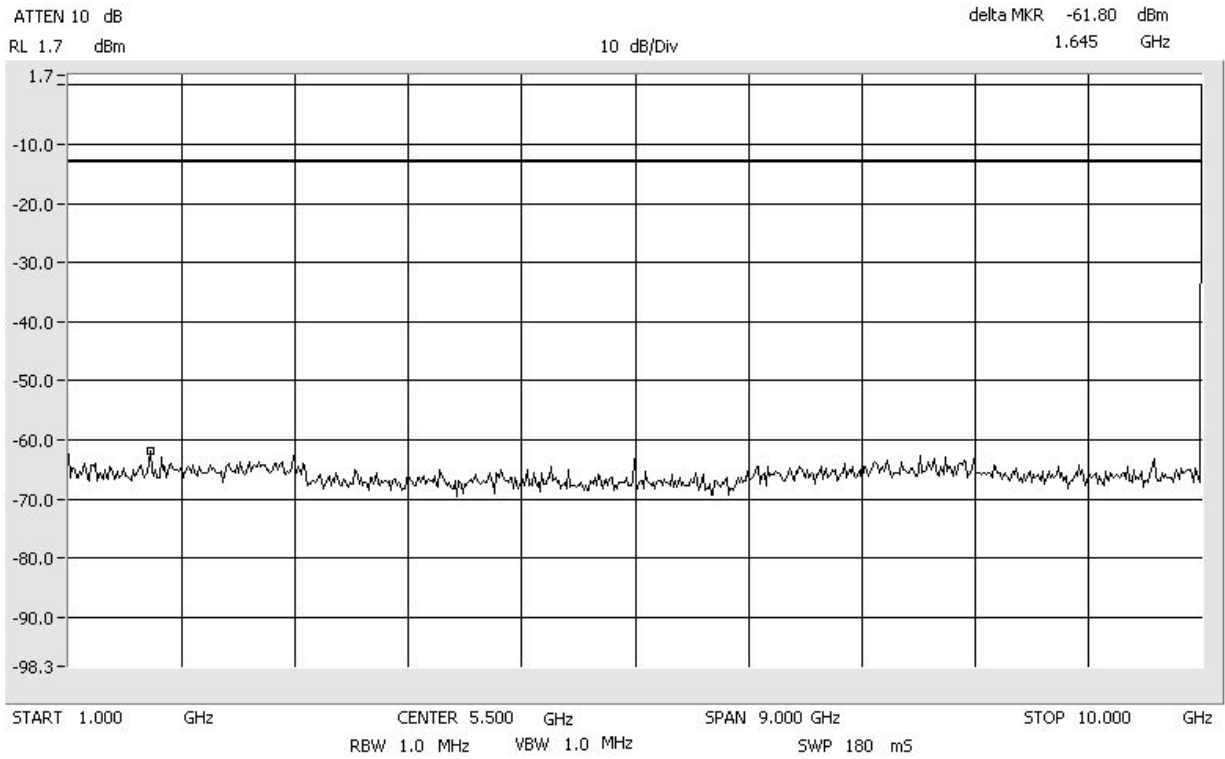
Intermodulation FM_Low CELLULAR
Center: 836.5 MHz Span: 35 MHz RBW/VBW: 100 kHz



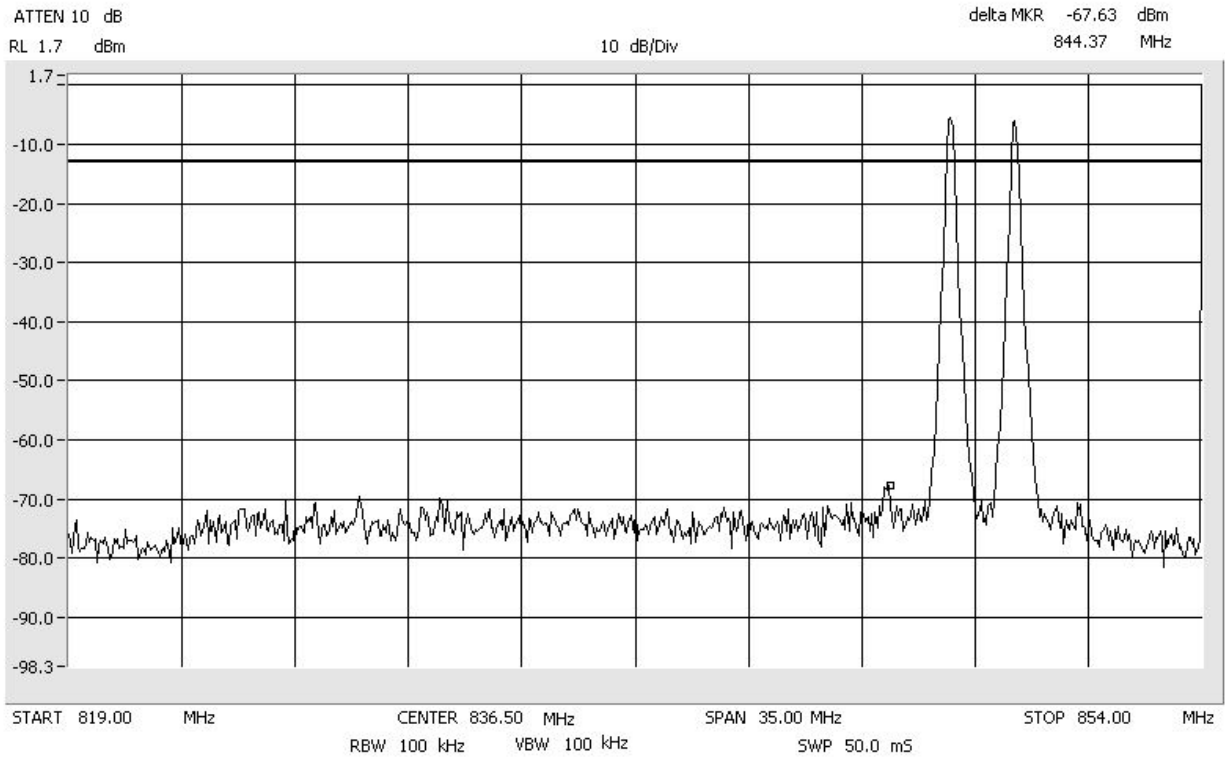
Intermodulation FM_Low CELLULAR
Span: 30 MHz to 1 GHz RBW/VBW: 300 kHz



Intermodulation FM_Low CELLULAR
Span: 1 GHz to 10 GHz RBW/VBW: 1 MHz



Intermodulation FM_High CELLULAR
Center: 836.5 MHz Span: 35 MHz RBW/VBW: 100 kHz



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

