



Test Report Summary

FCC CFR 47, Part 22

Subpart H Cellular Radiotelephone Service

Manufacturer: ADC Telecommunications

Name of Equipment: FlexWave™ URH – Cellular

Model Number(s): FWU-220000002110RU

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

Test Report Number: MN071128

Test Date(s): 21 November, 2007 (ETL)
19 November, 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: 28 November, 2007

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

ADC Telecommunications
5341 12th Ave E
Shakopee, MN 55379
Phone: (952) 403-8340
Fax: (952) 403-8858

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: MN071128 **Date of Issue:** 28 November, 2007

Model Number(s): FWU-220000002110RU

Product Name: FlexWave™ URH – Cellular

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: 3136761MIN-001
Reference(s)

Total pages including Appendices: 134



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1.0 REVISION DESCRIPTION

Rev	Total Pages	Date	Description
A	134	28 November, 2007	Original Release

2.0 DOCUMENTATION

2.1 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: 25° C
Relative Humidity: 23%
Atmospheric Pressure: 97.7 kPa

ETL

15-35° C
30-60%
86-106 kPa

Power Supply Utilized:

Power Supply System : 1 phase, 60 Hz, 120 VAC

2.2 Test Operation Mode

- Standby
- Test Program
- Practice Operation
- **Max composite in and out**

2.3 Configuration of the device under test:

Normal Operation – Cellular - 869 to 894 MHz

2.4 Product Options:

None

2.5 EUT Specifications and Requirements:

Length: 16.0"
Width: 17.0"
Height: 29.0"
Weight: 190 pounds

2.6 Cables:

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

2.7 Power Requirements:

Voltage: 120 VAC
Amps: 5.8 A

2.8 Typical Installation and/or Operating Environment:

Outdoor/Indoor. System is typically employed as an outdoor repeater.

2.9 Other Special Requirements:

None

2.10 EUT Software:

Revision Level: Version V.6 or greater
Description: Internet Explorer

2.11 EUT System Components

Description	Model #	Serial #	FCC ID #
URH	FWU-220000002110RU	None	

2.12 Support Equipment

Description	Manufacturer	Model #	FCC ID #
Power Meter	HP	EPM-441A	
Signal Generator	Agilent	E4438C	
Attenuator	Aeroflex	86-30-12	

2.13 Deviations from standard:

Modifications required to pass:

☐ As indicated on the data sheet(s)

■ **None**

2.14 Test Specification Deviations; Additions to or Exclusions from:

☐ 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.**

☐ not fulfill the general approval requirements mentioned on page 4.

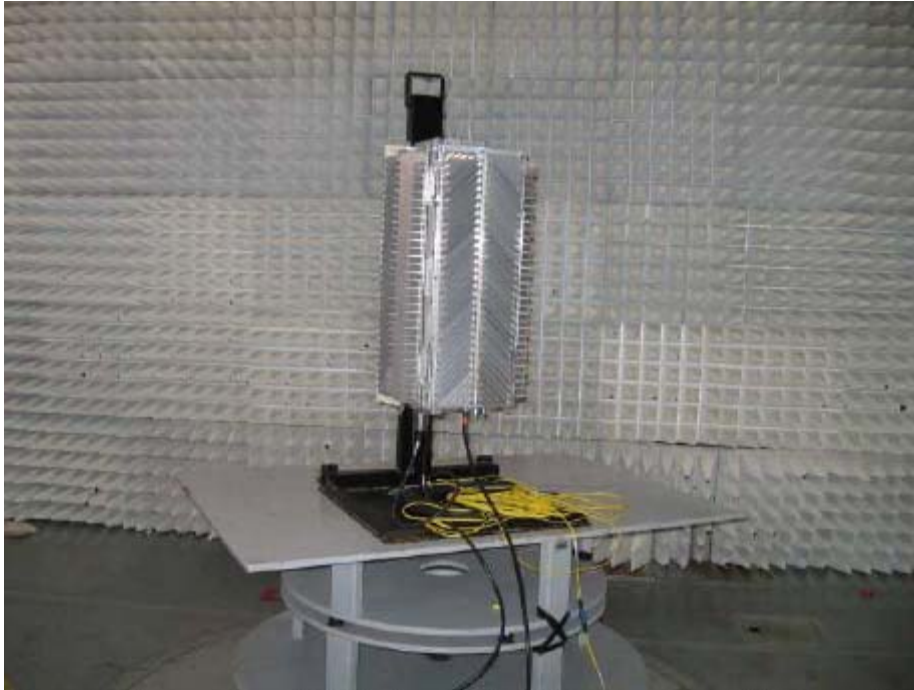
3.0 TEST SET-UP DRAWINGS AND PHOTOS

[Back to Table of Contents:](#)

3.1 Test set-up photo, radiated emissions



3.2 Test set-up photo, radiated emissions



3.3 Test Set-up Drawings

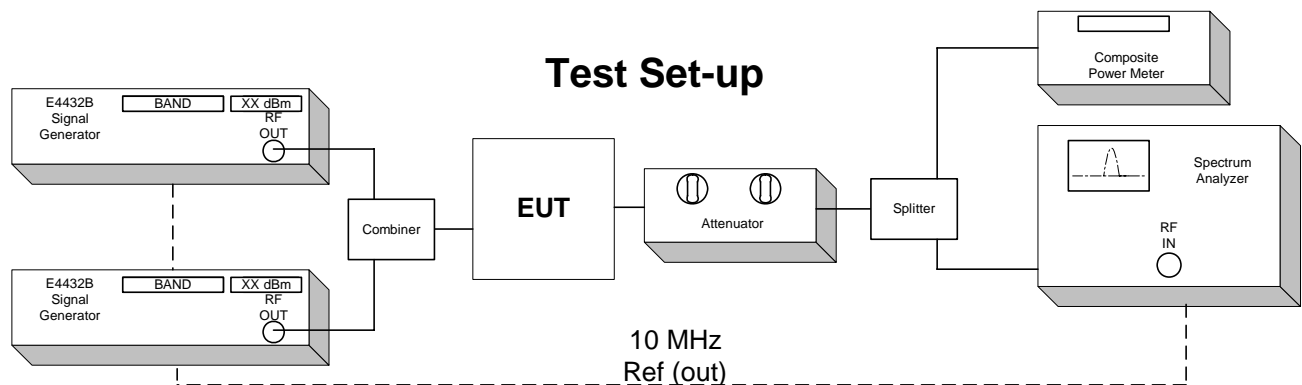
Conducted and Radiated Emission Limits Test for ADC Inc

Conducted Output Power Test for ADC Inc

Inter-Modulation Test for ADC Inc

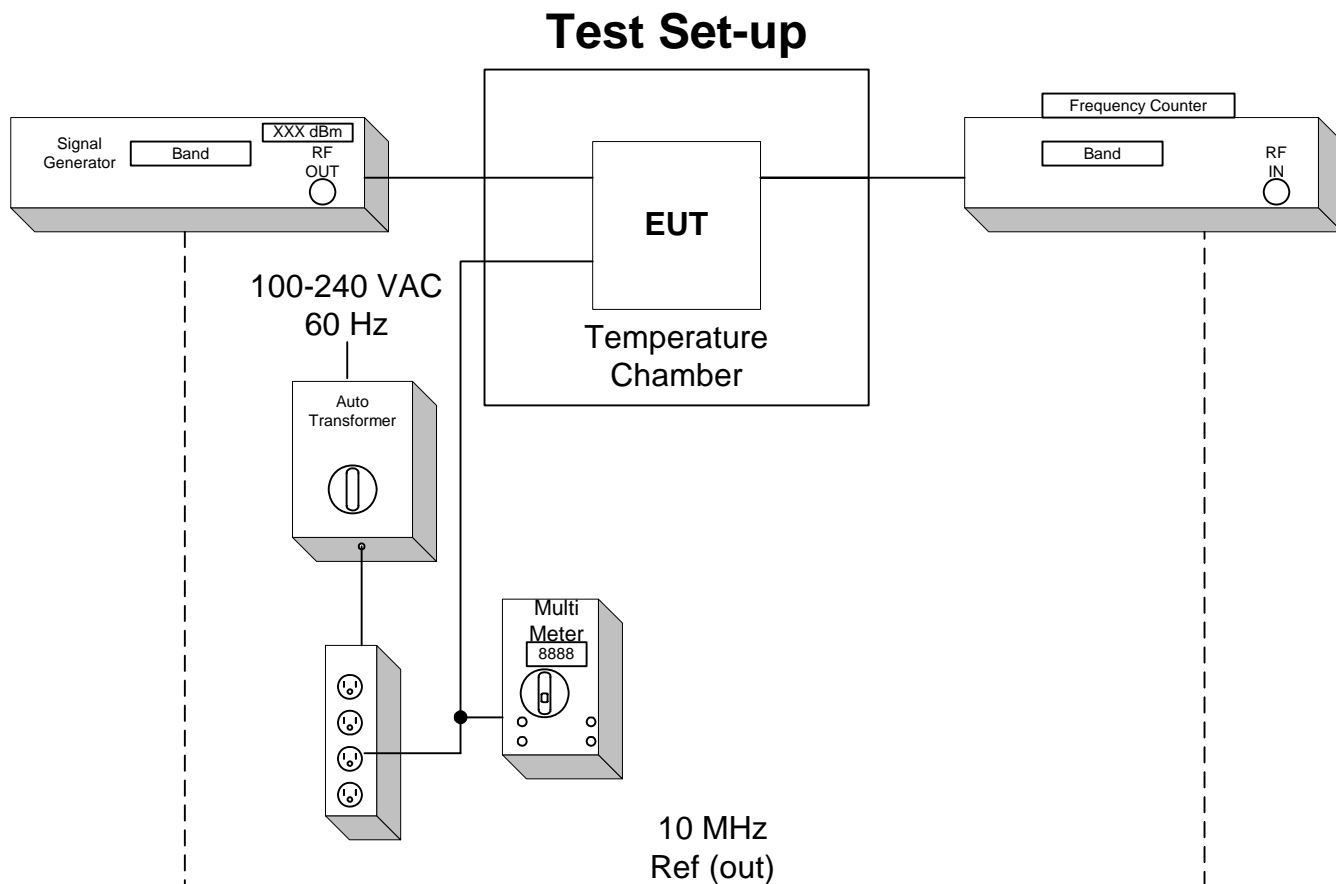
Occupied Bandwidth Modulation Test for ADC Inc

FlexWave™ URH - Cellular Model Number FWU-220000002110RU



Frequency Tolerance Test for ADC Inc FlexWave™ URH - Cellular Model Number FWU-220000002110RU

EUT is specified for outdoor use with temperature range of -30° to +50° 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 16.75 dB at 869.2 MHz (TDMA)

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:

[See page](#) 44

Test Engineer: Mark F. Miska

Date: 28 November, 2007

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4.1.2 22.355 Frequency tolerance

Test Summary:

- The requirements are: **■ MET** **□ NOT MET**
- The fundamental emission stays within the authorized frequency block.
- Frequency measured over a temperature range of –30 to 50° C and an input voltage range of 100 to 240 VAC.

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:

[See page](#) 114

Test Engineer: Mark F. Miska

Date: 28 November, 2007

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4.1.3 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](#), pages 16 – 43

[Intermodulation Test](#), pages 45 – 105

[Occupied Bandwidth](#), pages 106 – 113

Radiated Emissions, pages 115 – 132 ([Appendix B](#))

Test Engineer: Mark F. Miska

Date: 28 November, 2007

Date: 28 November, 2007

Date: 28 November, 2007

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5.0 TEST EQUIPMENT

Number	Description	Manufacturer	Model	ADC Serial Number	Cal Due	Used
1	Spectrum Analyzer	HP	8563E	MC27690	1-22-08	<input checked="" type="checkbox"/>
2	Power Meter	HP	EPM-441A	MC27670	10-9-08	<input checked="" type="checkbox"/>
3	Multimeter	Fluke	87	MC17932	8-1-08	<input checked="" type="checkbox"/>
4	Frequency Counter	HP	5347A	MC27548	1-18-08	<input checked="" type="checkbox"/>
5	Temperature Chamber	Thermotron	SM-32C	MC18966	4-9-08	<input checked="" type="checkbox"/>
6	Signal Generator	Agilent	E4437B	967974	1-6-08	<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	CNR	<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.

Test Data

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Test Engineer: Mark F. Miska

Date: 28 November, 2007

Conducted Emission Limits Test for ADC Inc.

FlexWave™ URH - Cellular

Model Number FWU-220000002110RU

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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

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

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.

The Host unit connects directly to the BTS via coax. The Host unit does not connect to an antenna or amplifier, thus it is a Part 15 device and has been tested and is compliant as such. No FCC ID is necessary.

Industry practice has generally set the input signal power level. Test signal used was \approx -25 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 @: 4.55 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.

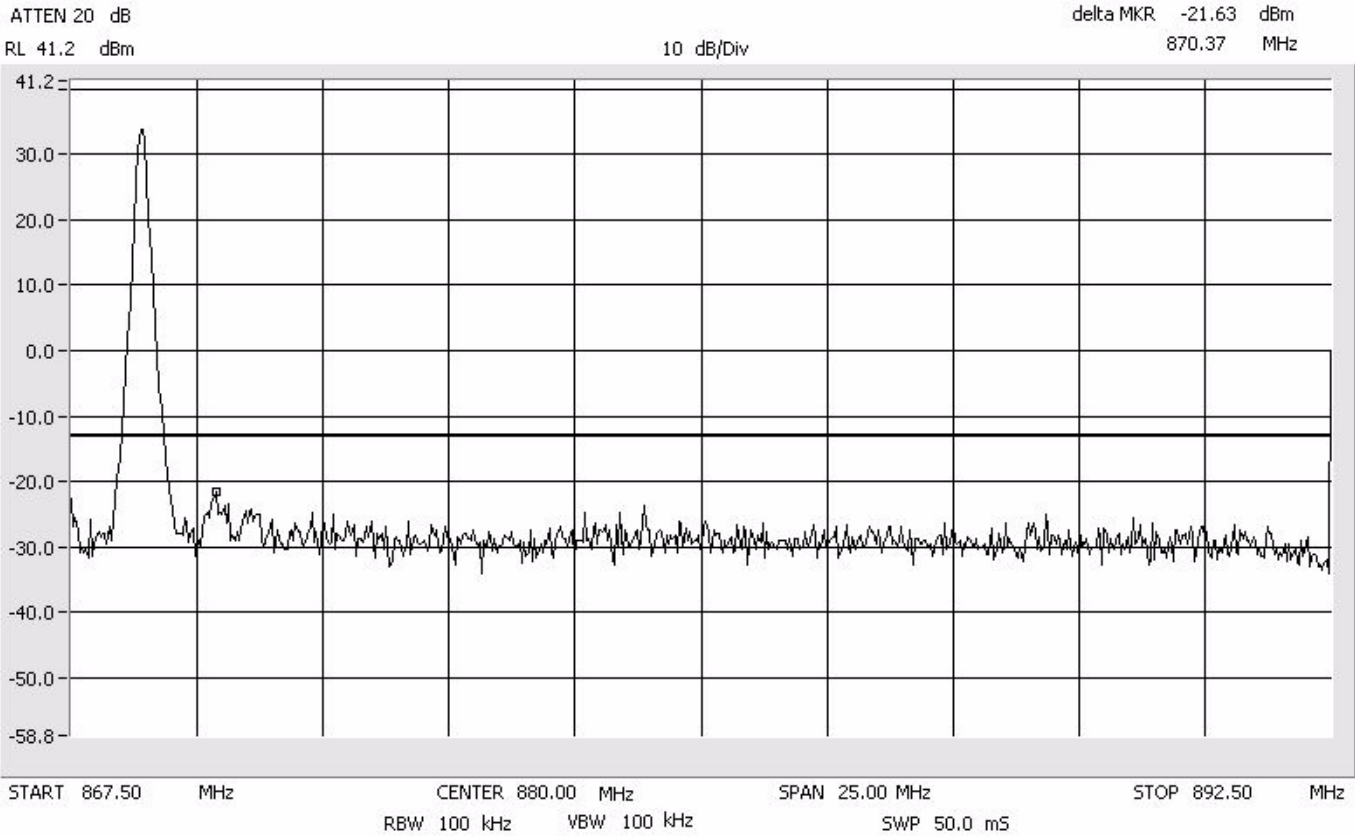
Results:

Pass (See plots)

A Band

Conducted Emissions
Low
Cellular 800 MHz

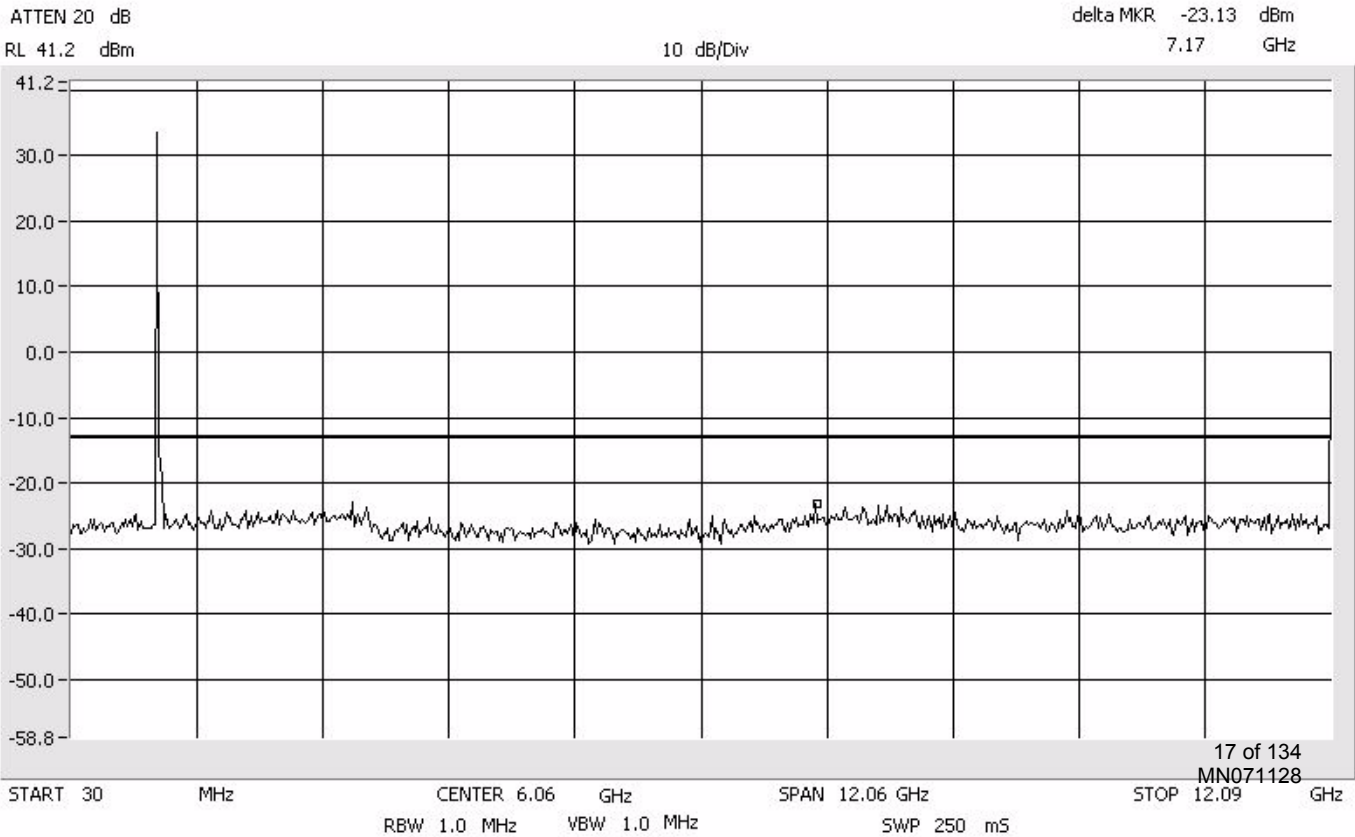
Center: 880.0 MHz
Span: 25 MHz
RBW/VBW: 100 kHz



A Band

Conducted Emissions
Low
Cellular 800 MHz

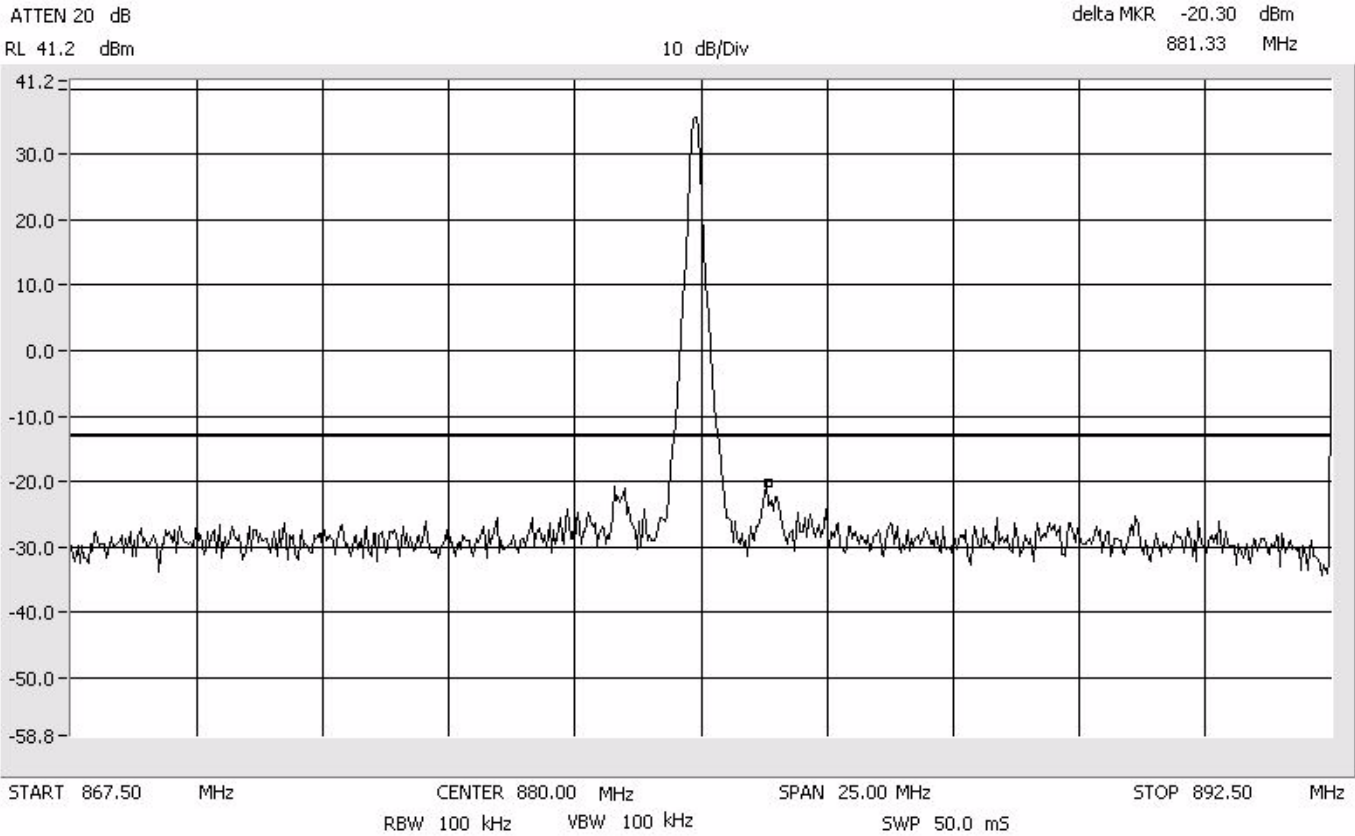
Span: 30 MHz to 10 GHz
RBW/VBW: 1 MHz



A Band

Conducted Emissions
Mid
Cellular 800 MHz

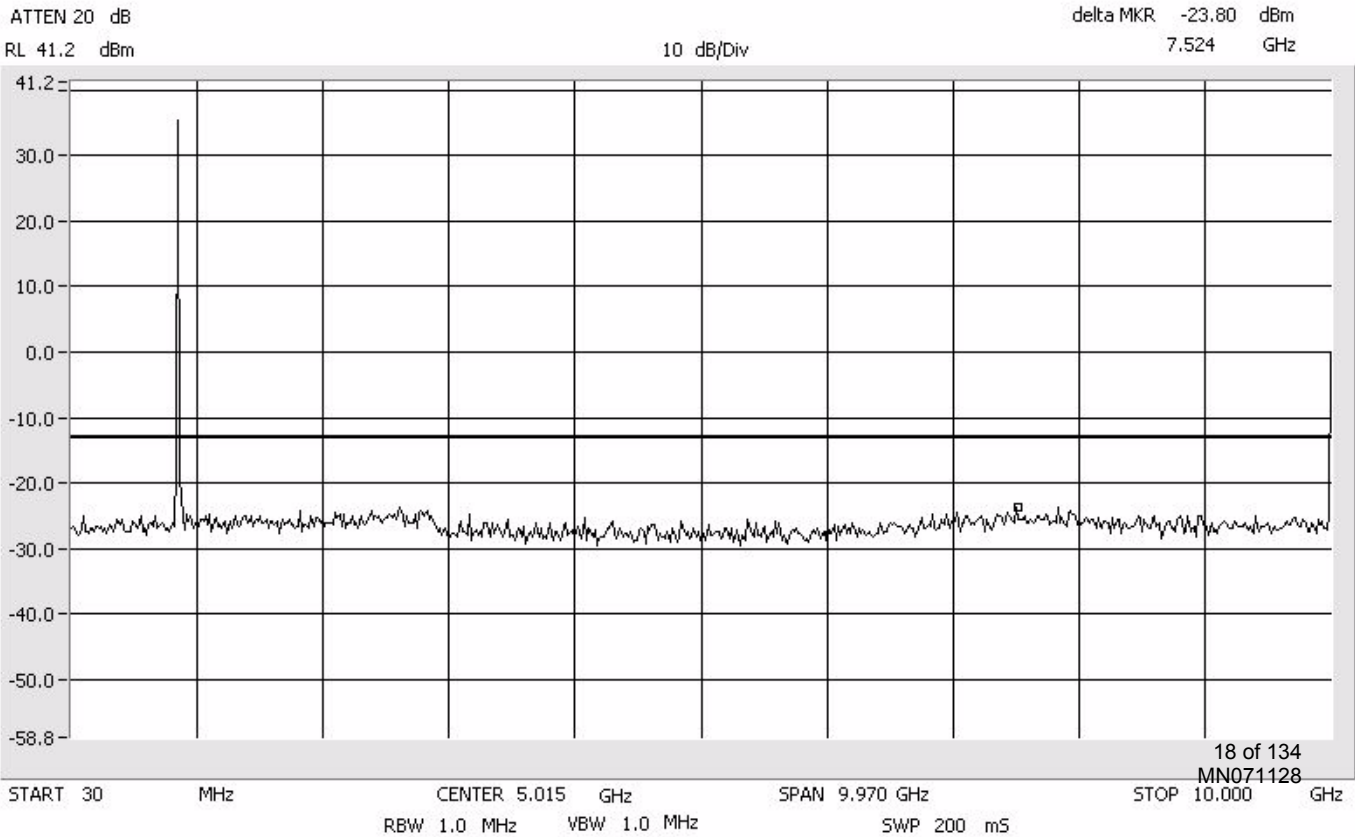
Center: 880.0 MHz
Span: 25 MHz
RBW/VBW: 100 kHz



A Band

Conducted Emissions
Mid
Cellular 800 MHz

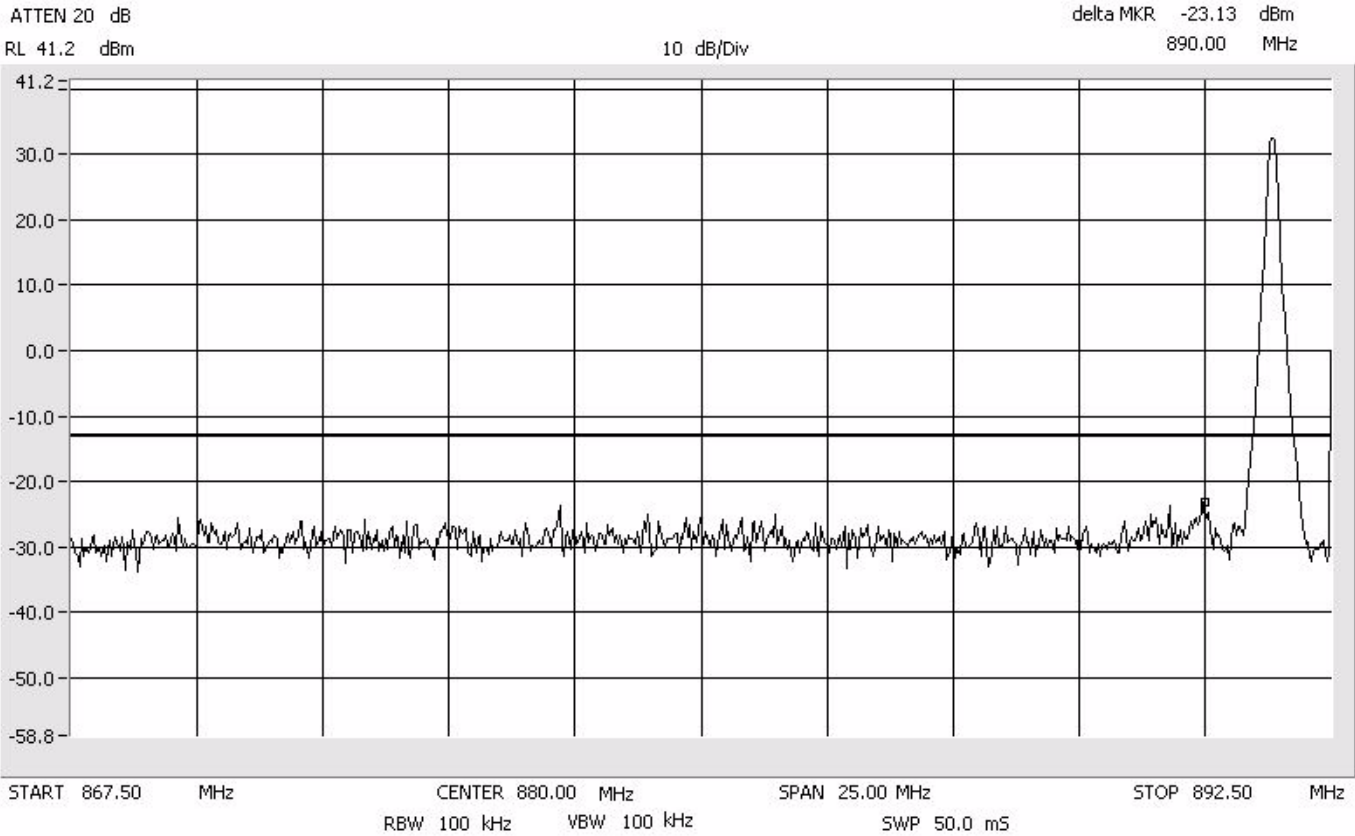
Span: 30 MHz to 10 GHz
RBW/VBW: 1 MHz



A Band

Conducted Emissions
High
Cellular 800 MHz

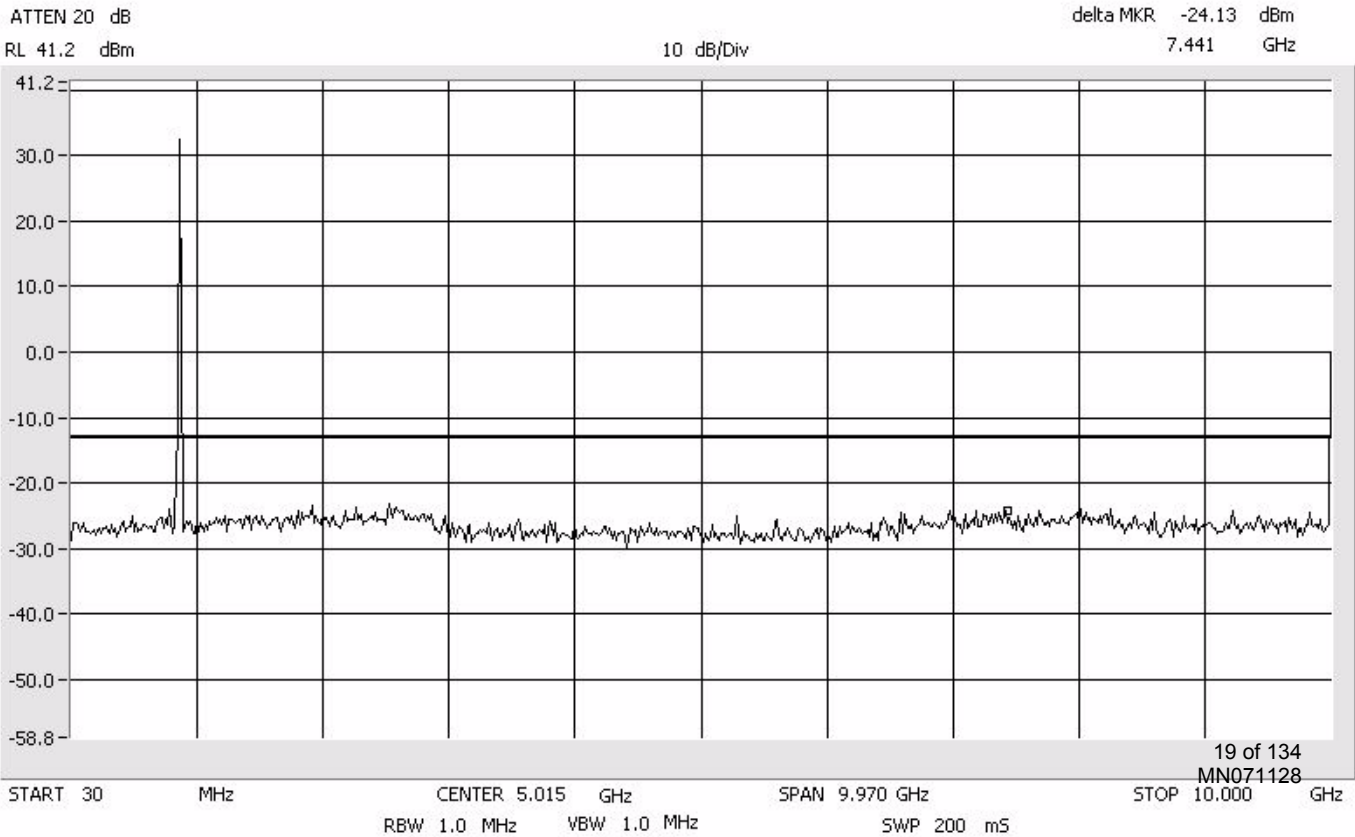
Center: 880.0 MHz
Span: 25 MHz
RBW/VBW: 100 kHz



A Band

Conducted Emissions
High
Cellular 800 MHz

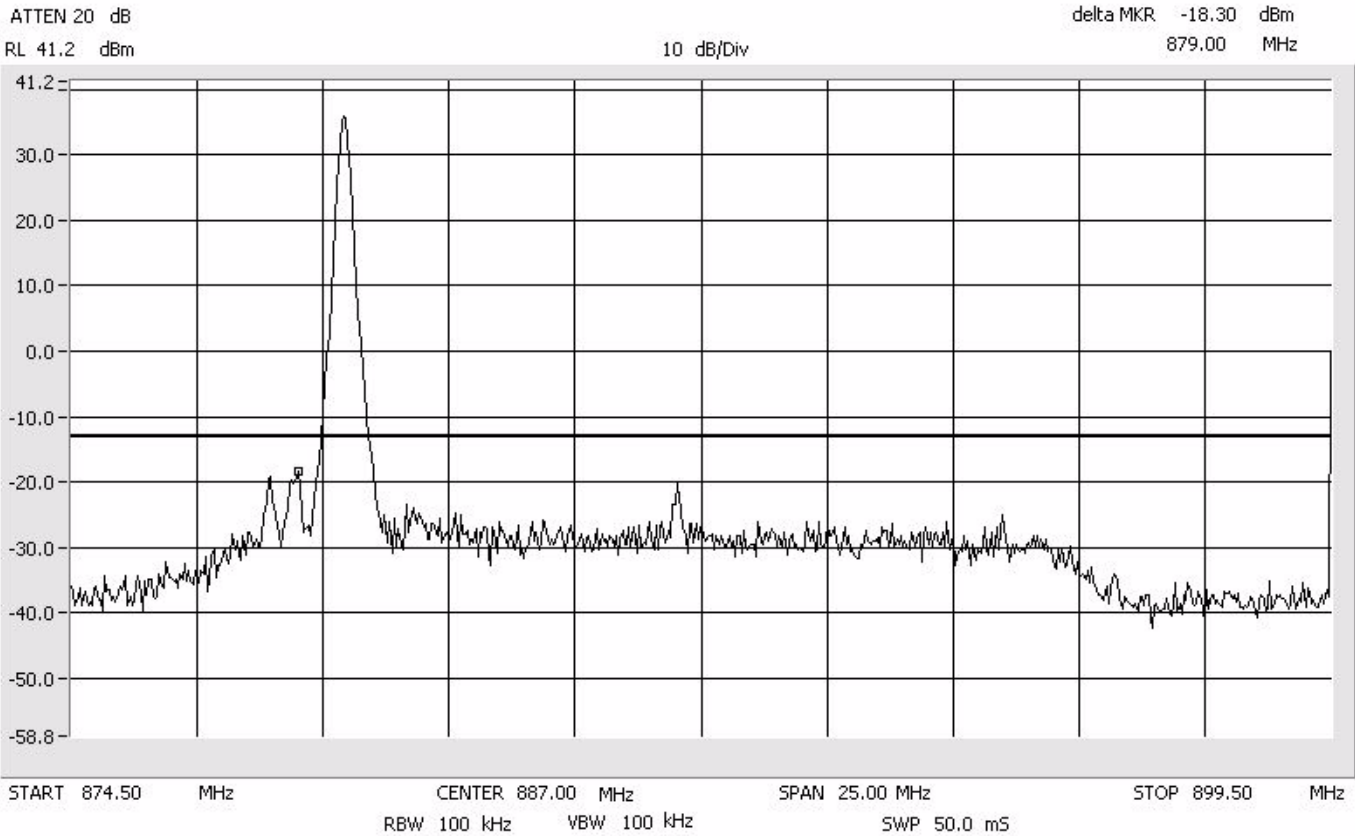
Span: 30 MHz to 10 GHz
RBW/VBW: 1 MHz



B Band

Conducted Emissions
Low
Cellular 800 MHz

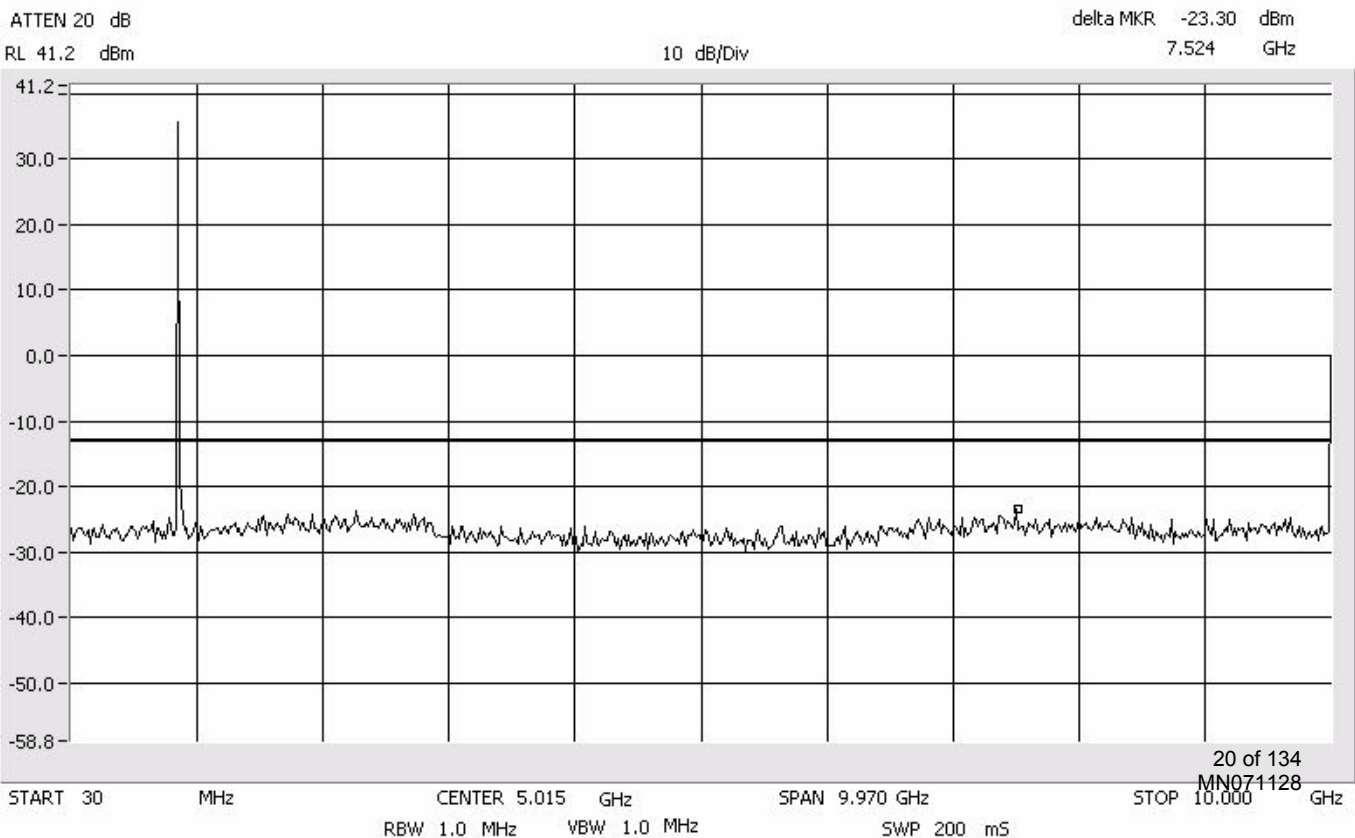
Center: 887.0 MHz
Span: 25 MHz
RBW/VBW: 100 kHz



B Band

Conducted Emissions
Low
Cellular 800 MHz

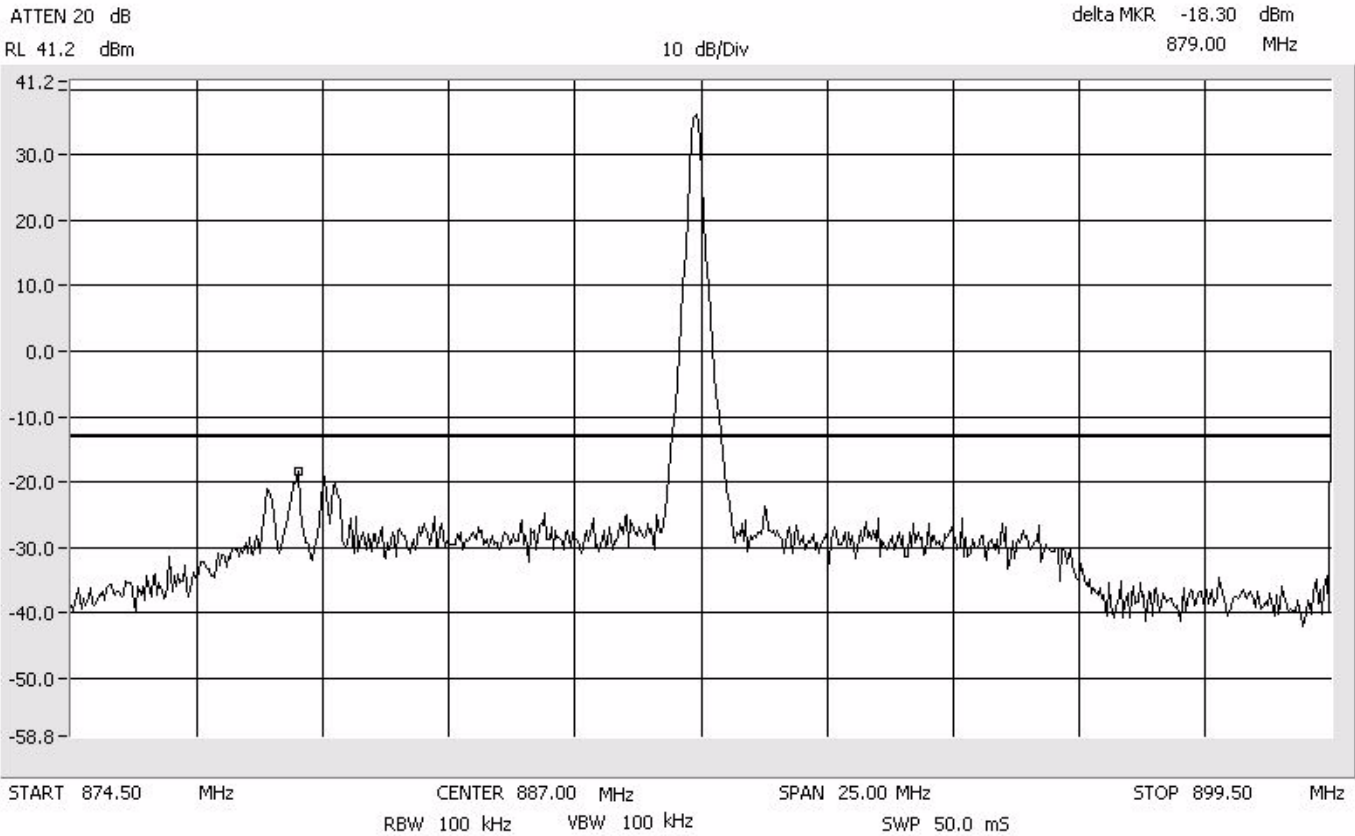
Span: 30 MHz to 10 GHz
RBW/VBW: 1 MHz



B Band

Conducted Emissions
Mid
Cellular 800 MHz

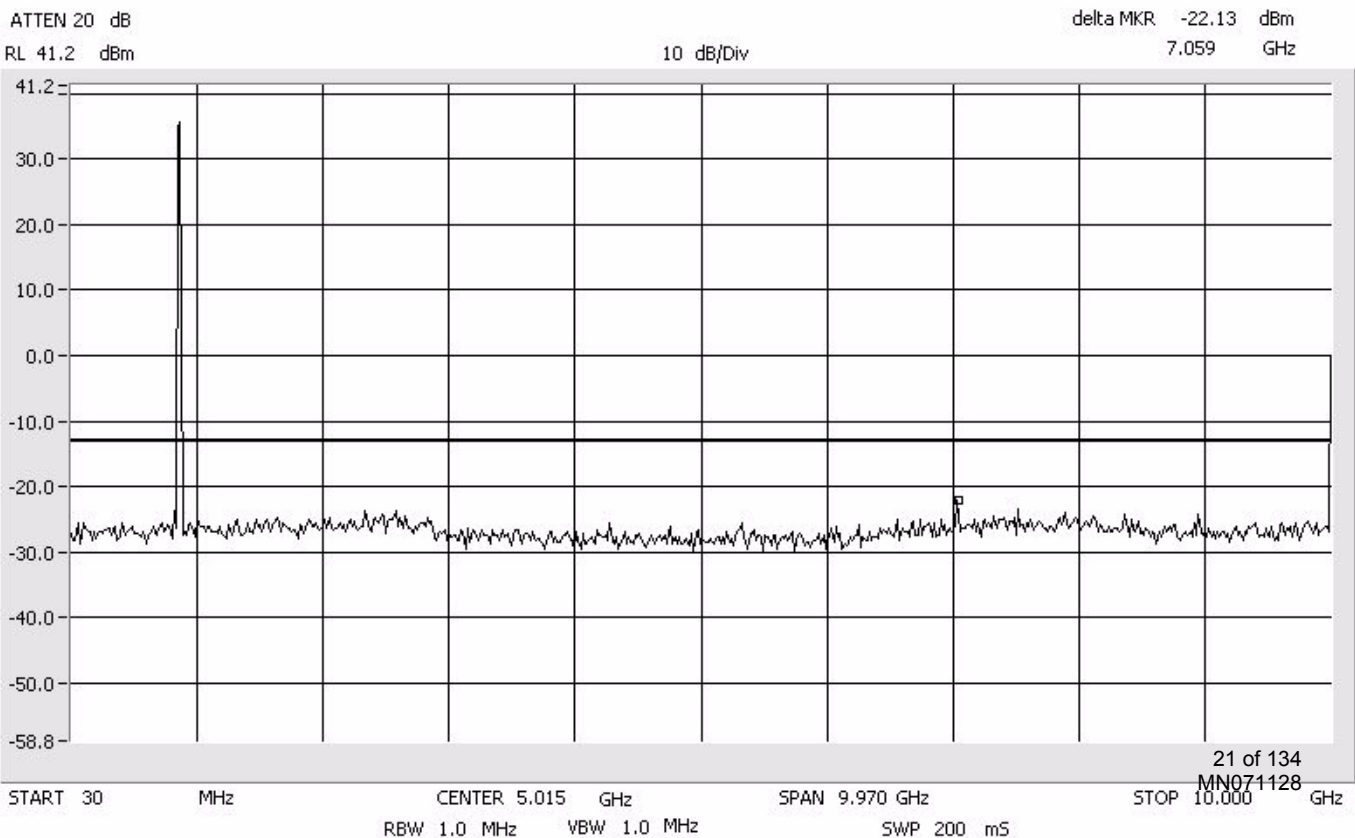
Center: 887.0 MHz
Span: 25 MHz
RBW/VBW: 100 kHz



B Band

Conducted Emissions
Mid
Cellular 800 MHz

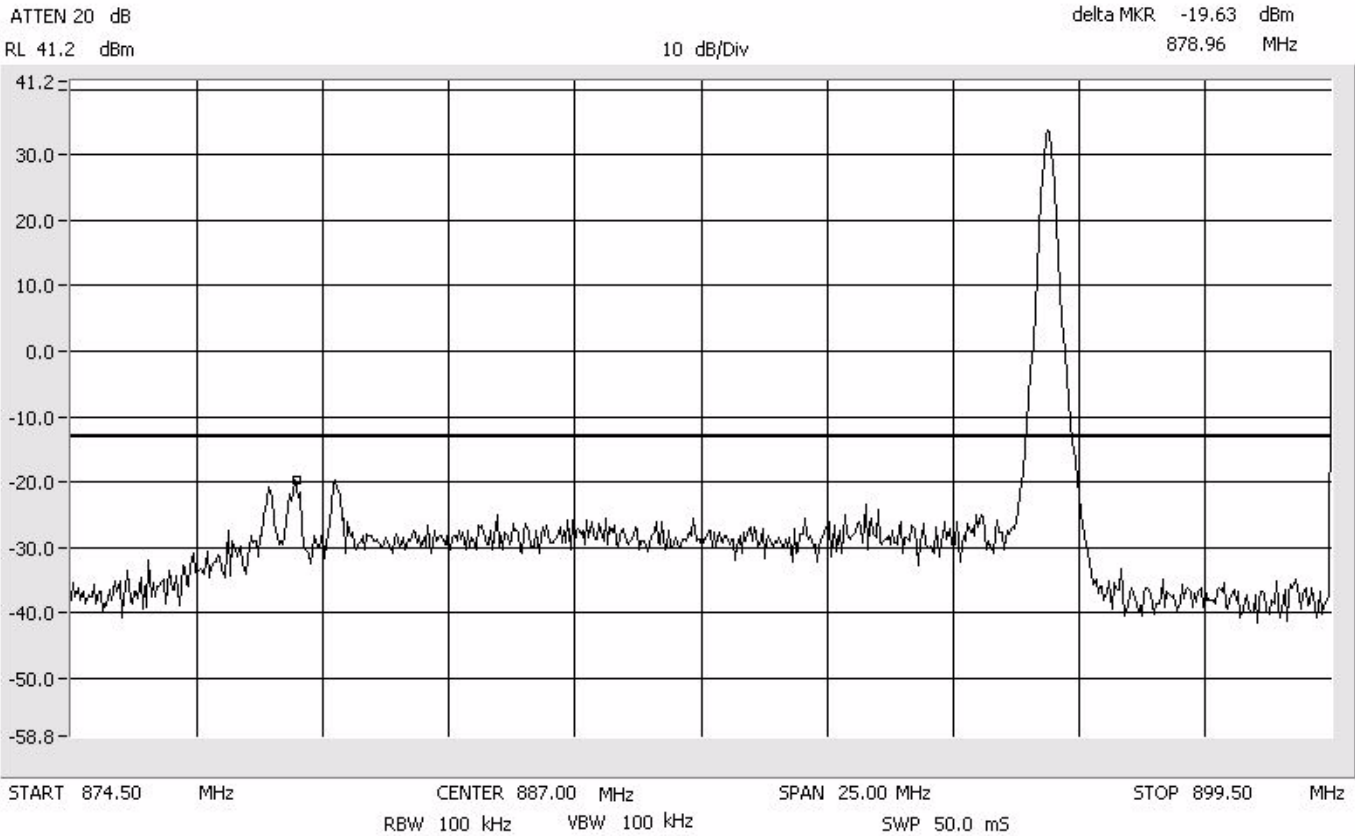
Span: 30 MHz to 10 GHz
RBW/VBW: 1 MHz



B Band

Conducted Emissions
High
Cellular 800 MHz

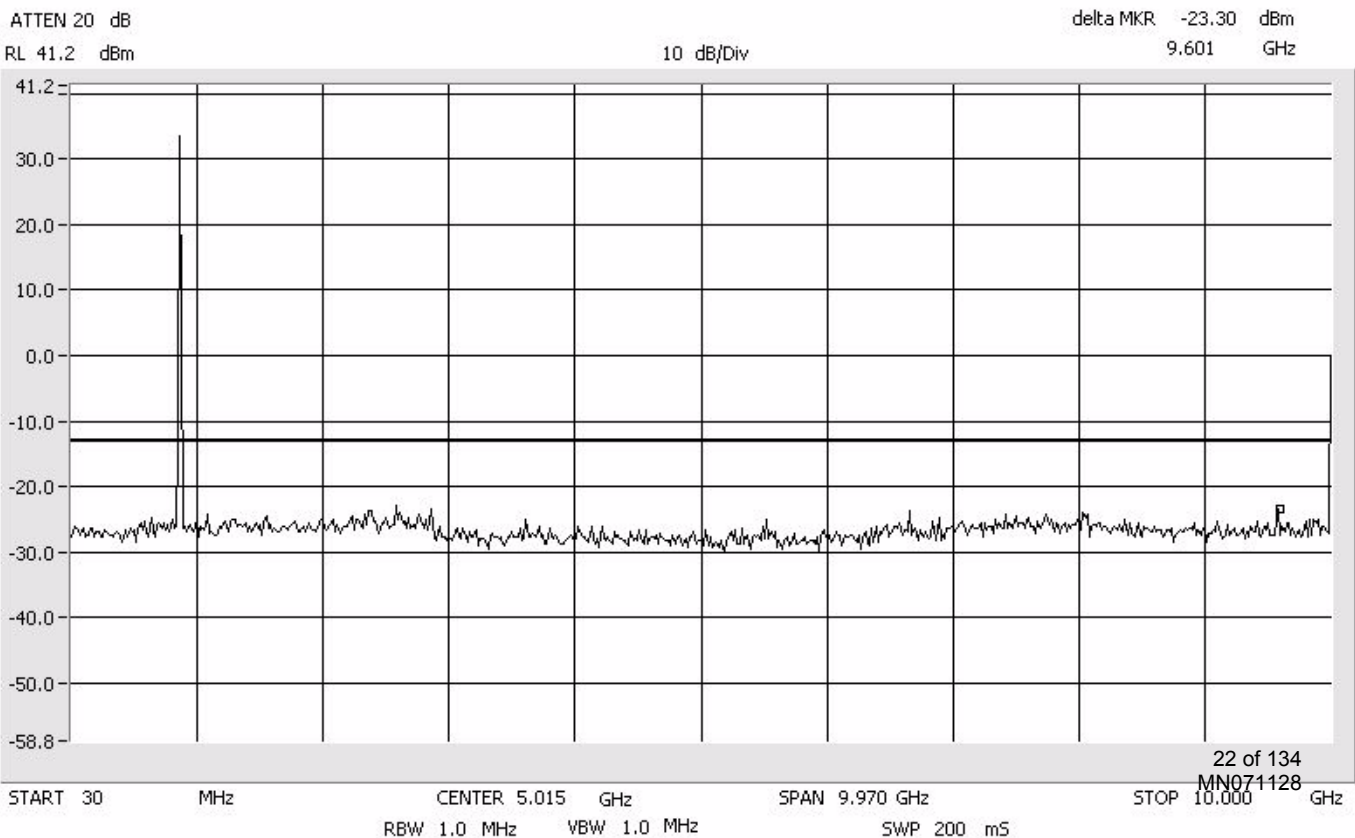
Center: 887.0 MHz
Span: 25 MHz
RBW/VBW: 100 kHz



B Band

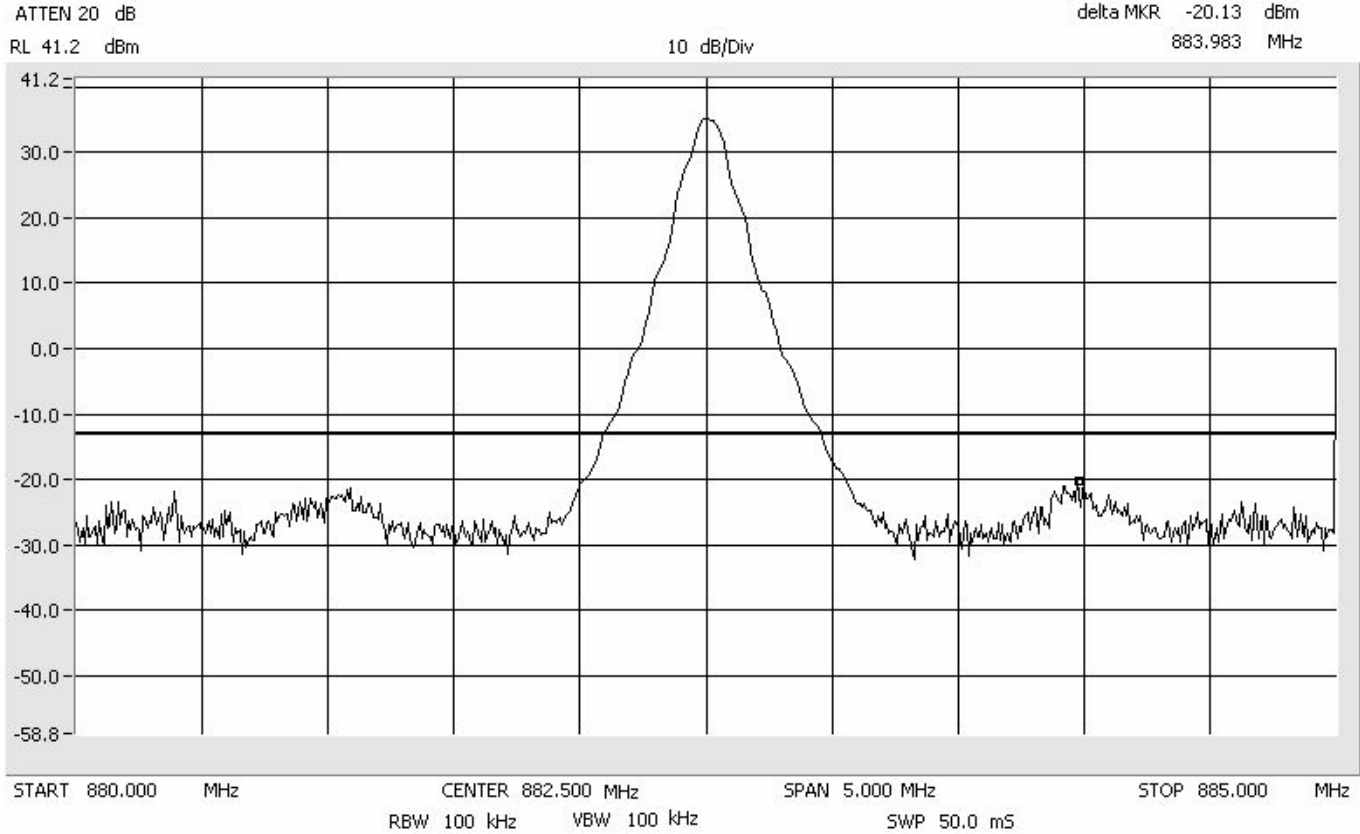
Conducted Emissions
High
Cellular 800 MHz

Span: 30 MHz to 10 GHz
RBW/VBW: 1 MHz



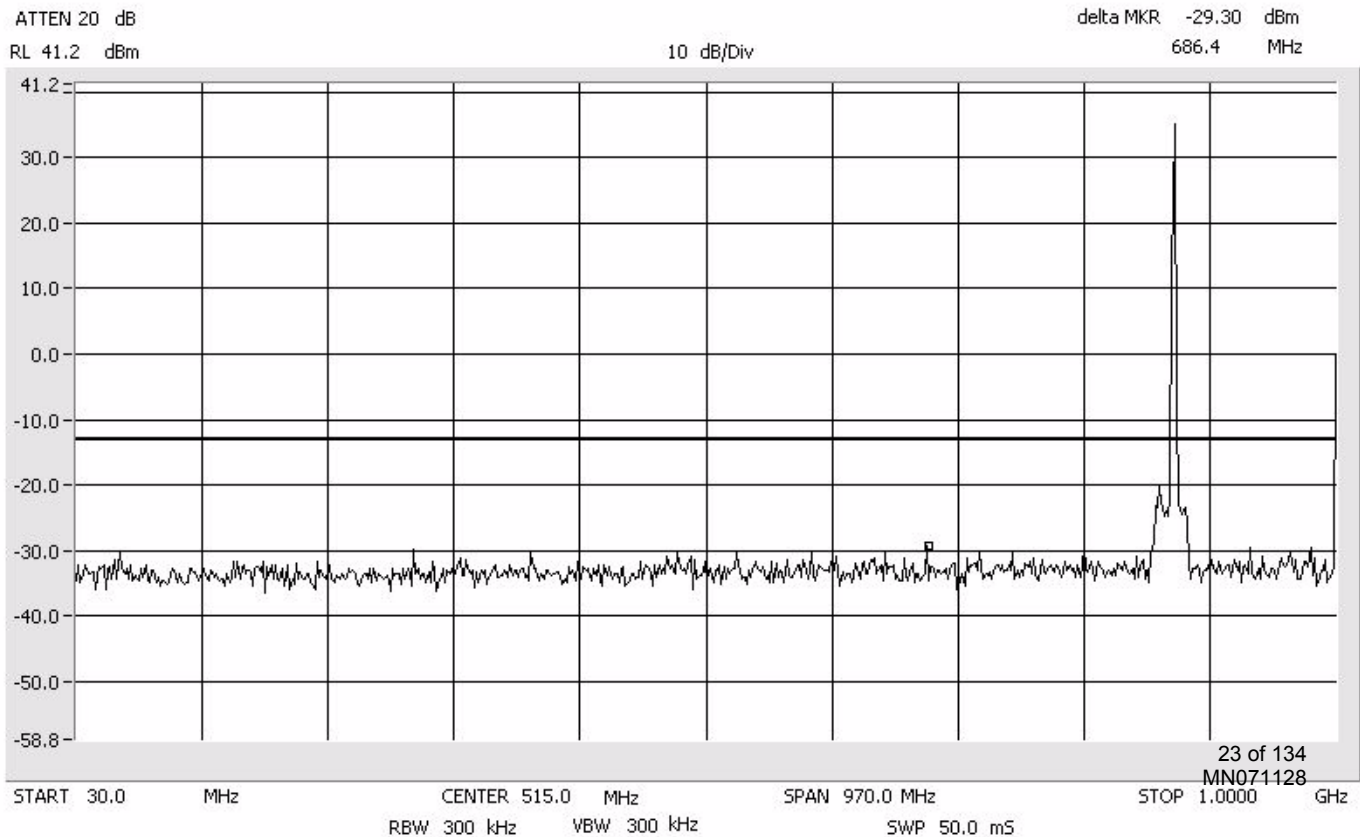
Conducted Emissions FM 800 MHz

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



Conducted Emissions FM 800 MHz

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

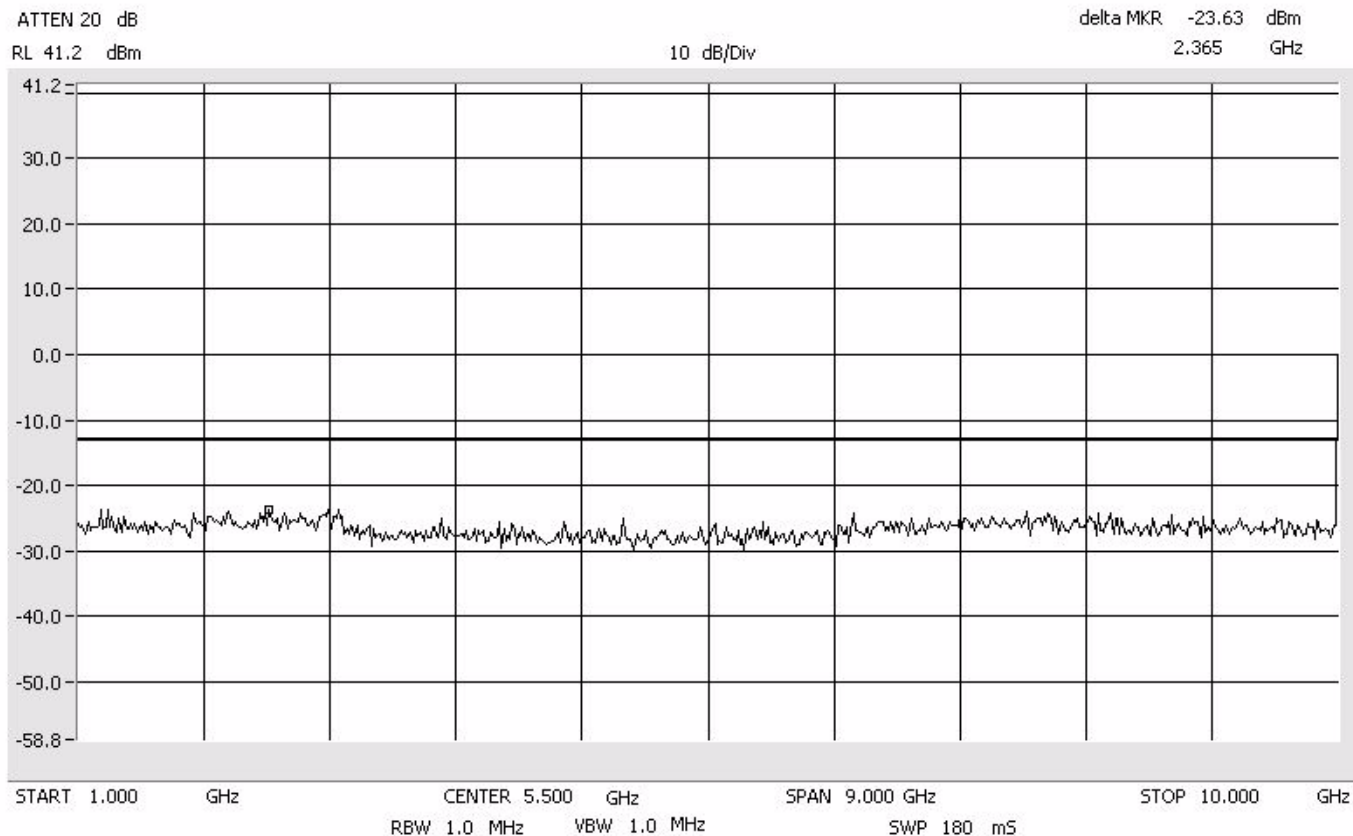


Conducted Emissions

FM

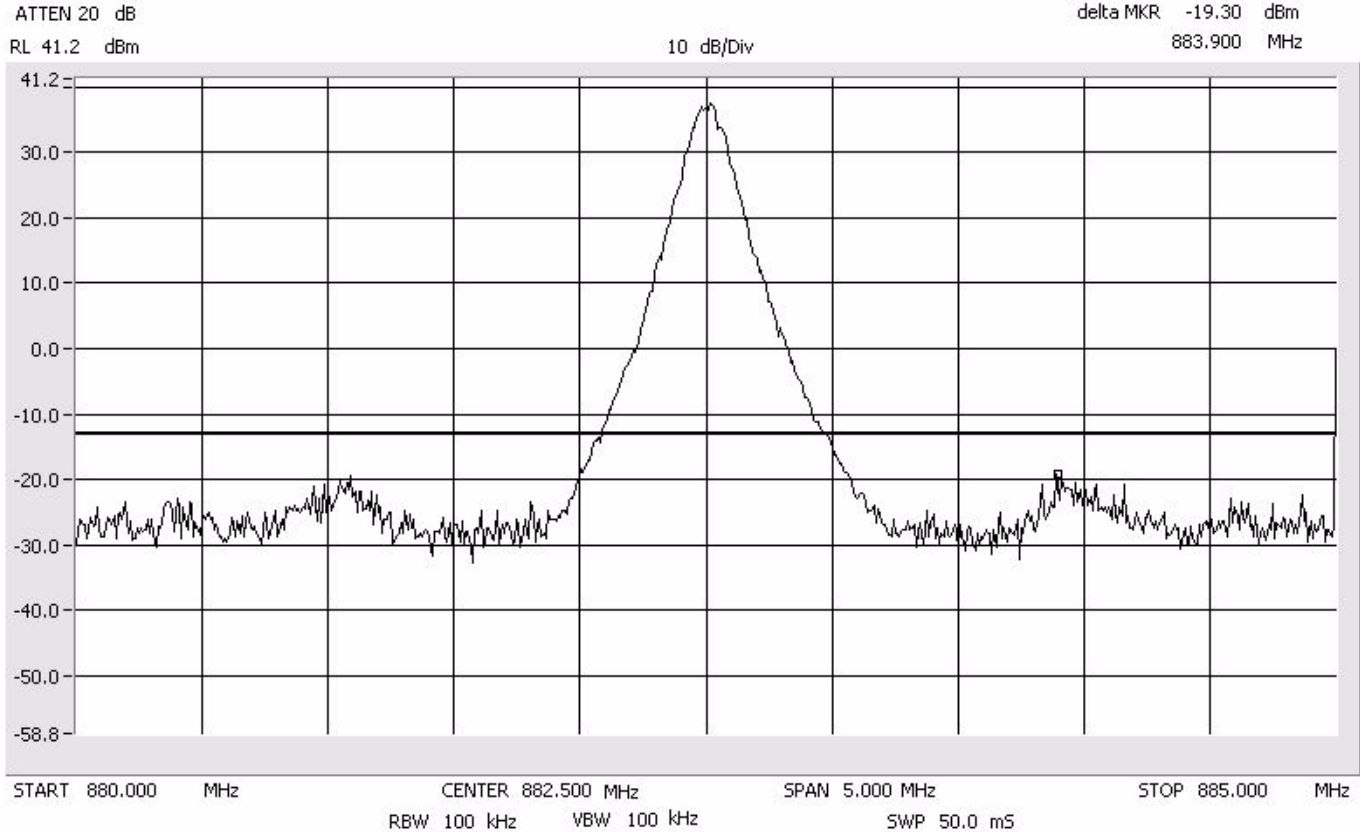
800 MHz

1 GHz to 10 GHz
RBW/VBW: 1 MHz



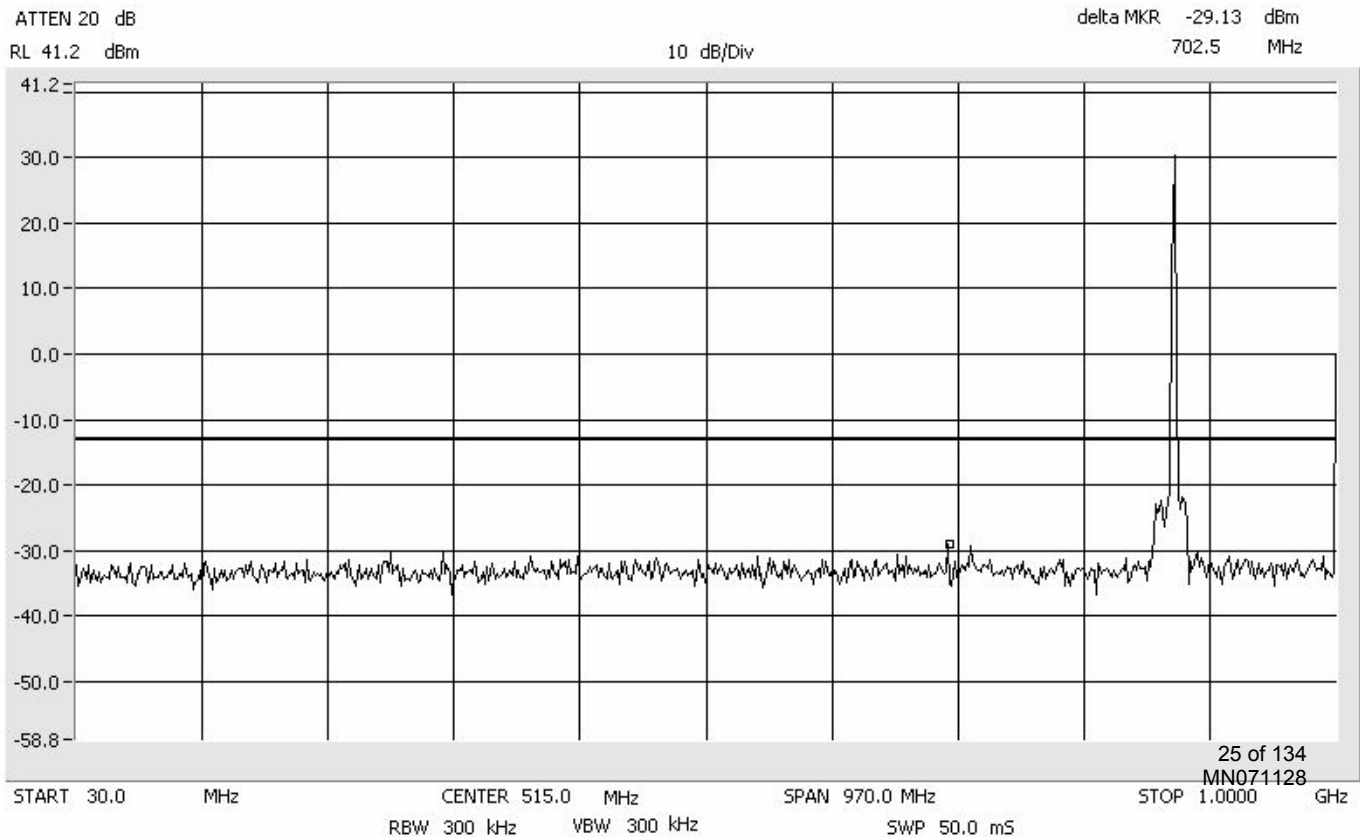
Conducted Emissions TDMA 800 MHz

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



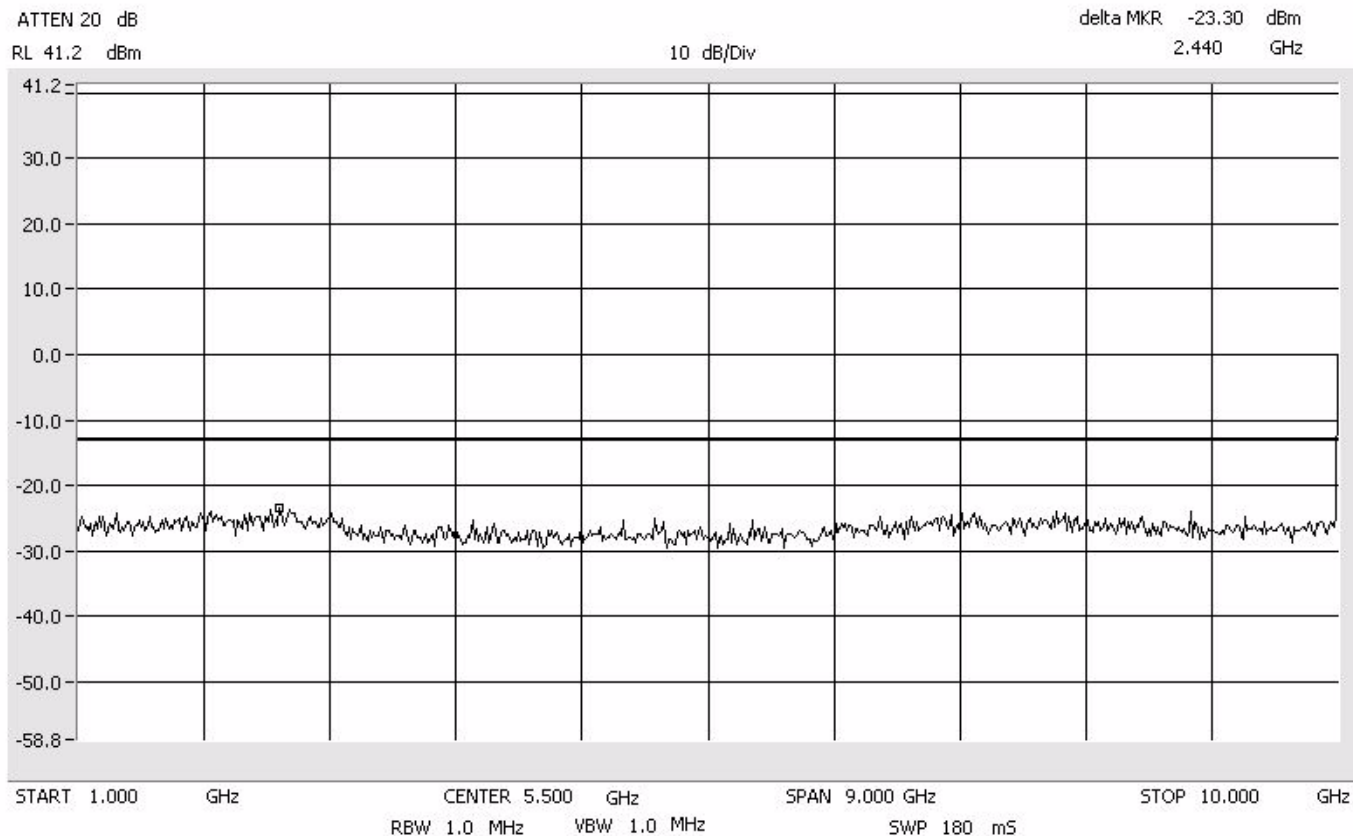
Conducted Emissions TDMA 800 MHz

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



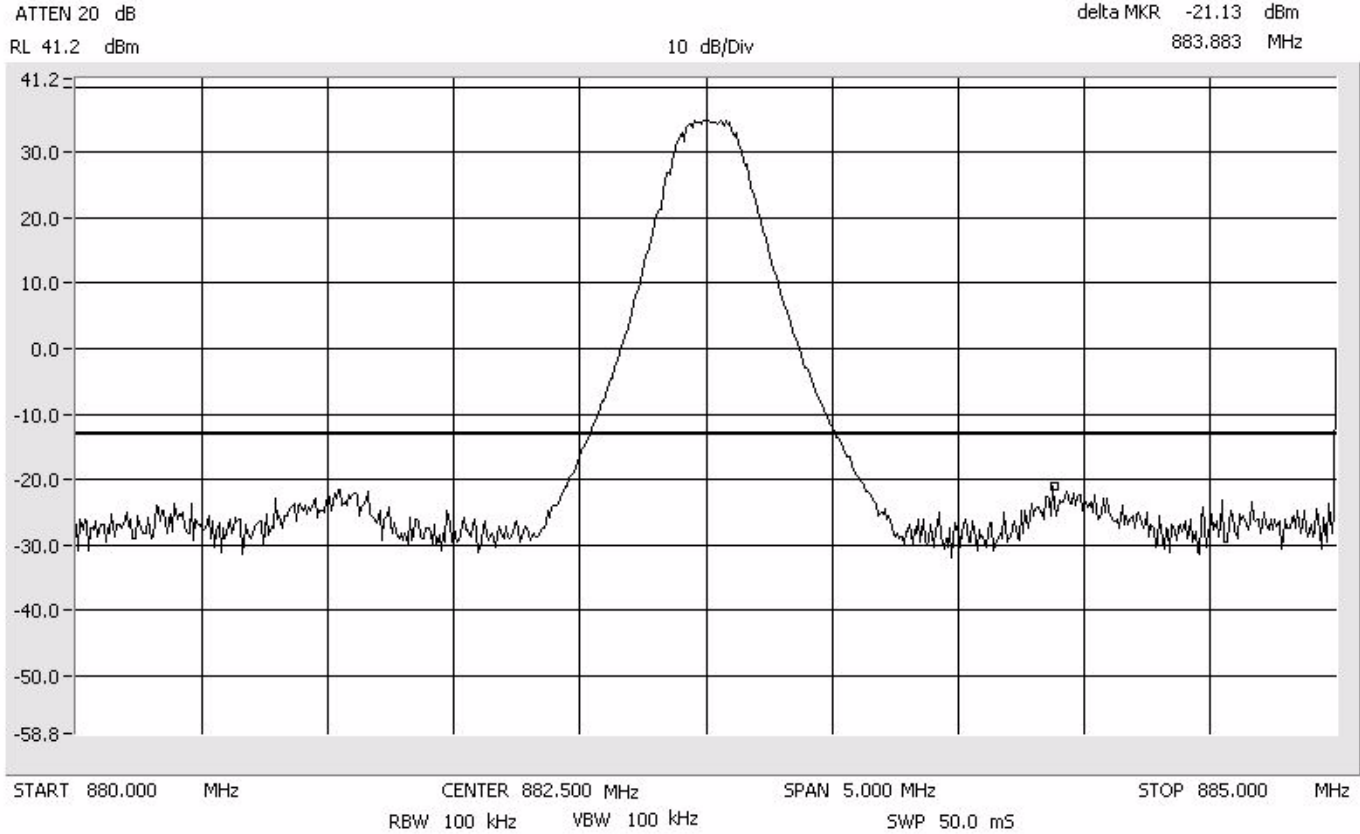
Conducted Emissions TDMA 800 MHz

1 GHz to 10 GHz
RBW/VBW: 1 MHz



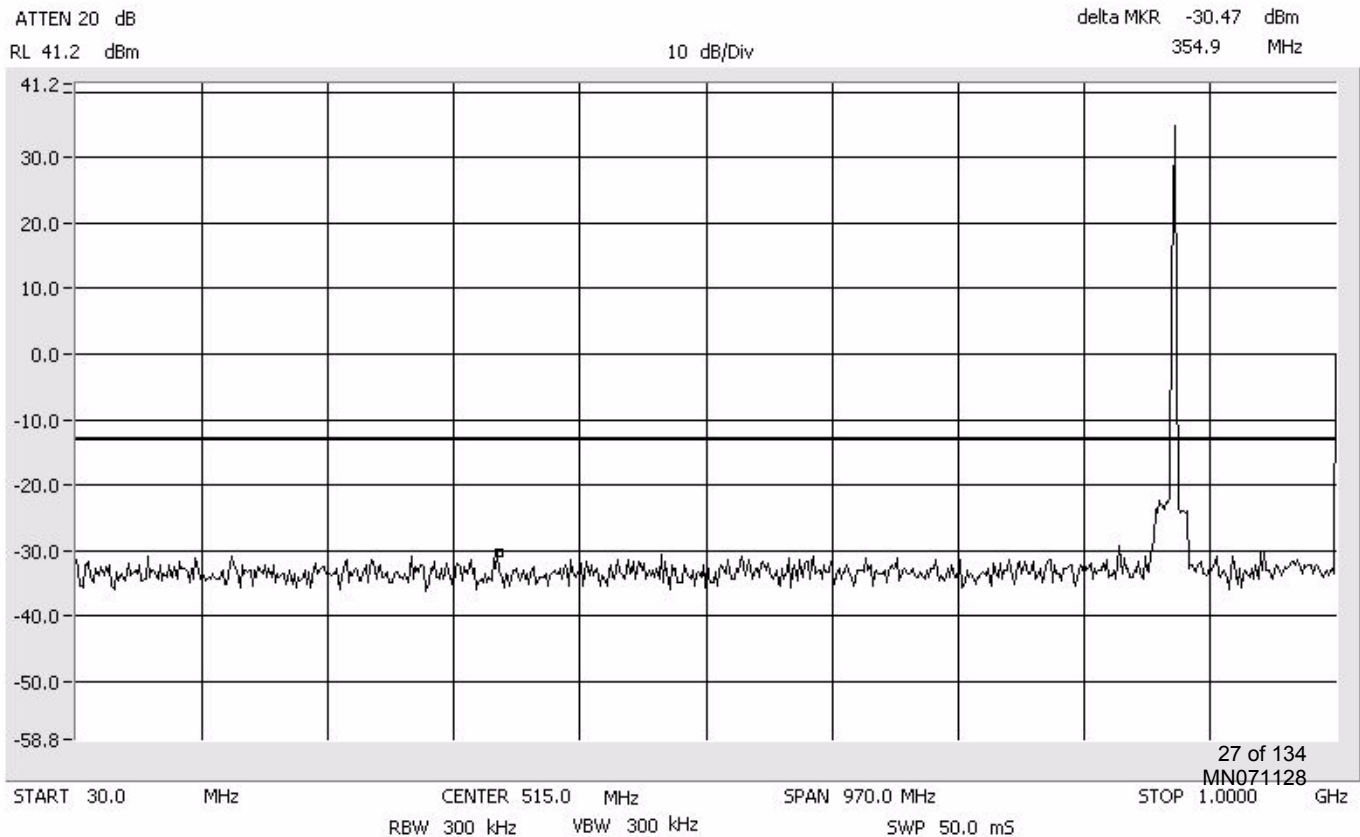
Conducted Emissions GSM 800 MHz

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



Conducted Emissions GSM 800 MHz

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

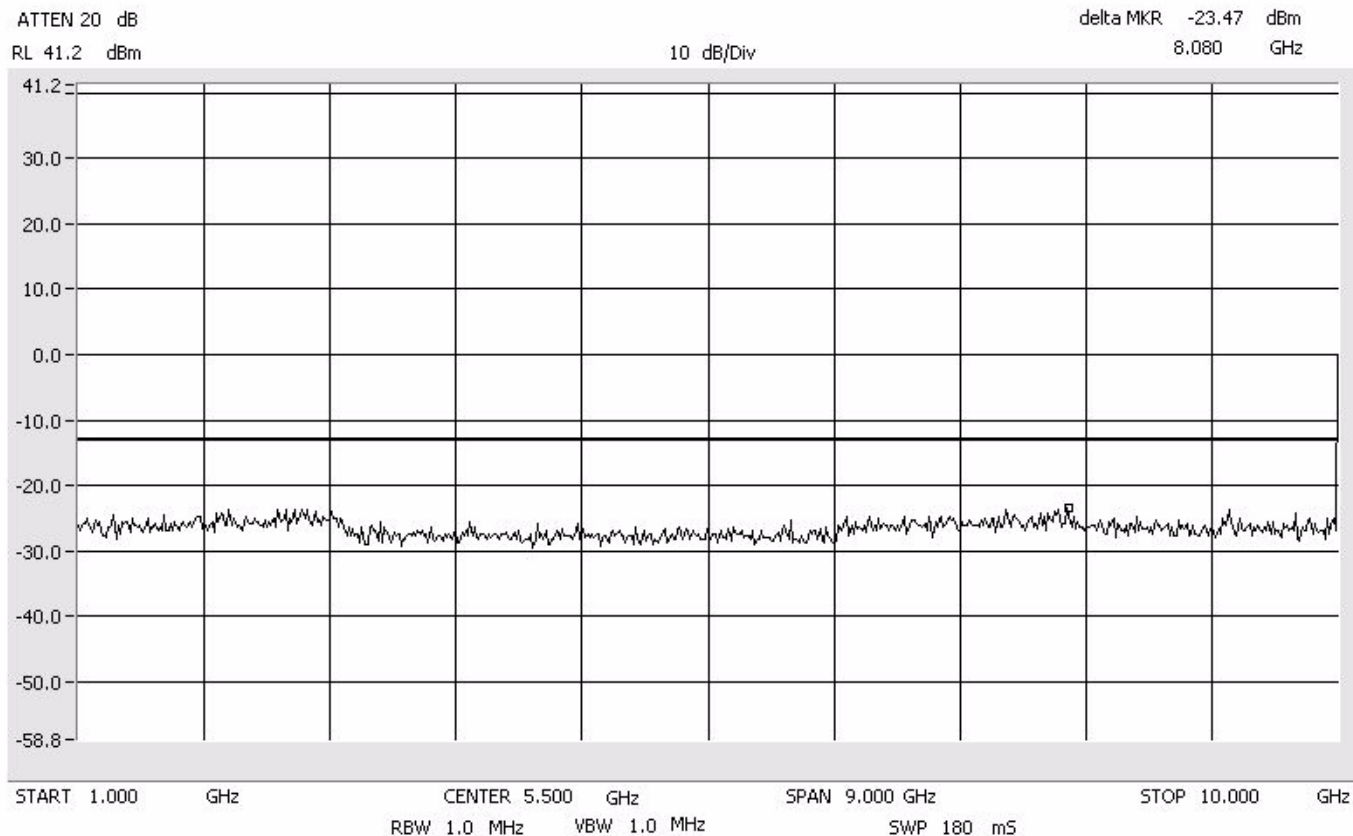


Conducted Emissions

GSM

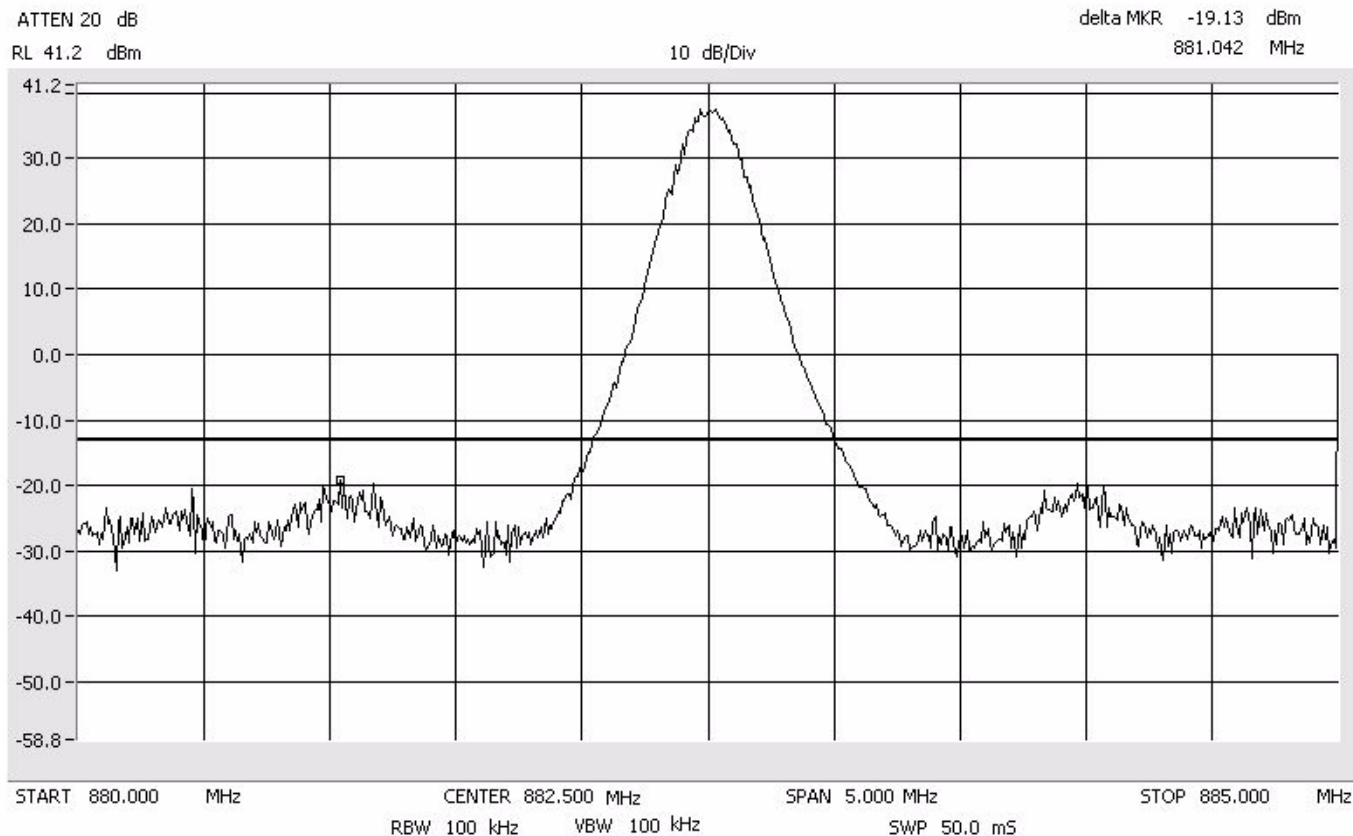
800 MHz

1 GHz to 10 GHz
RBW/VBW: 1 MHz



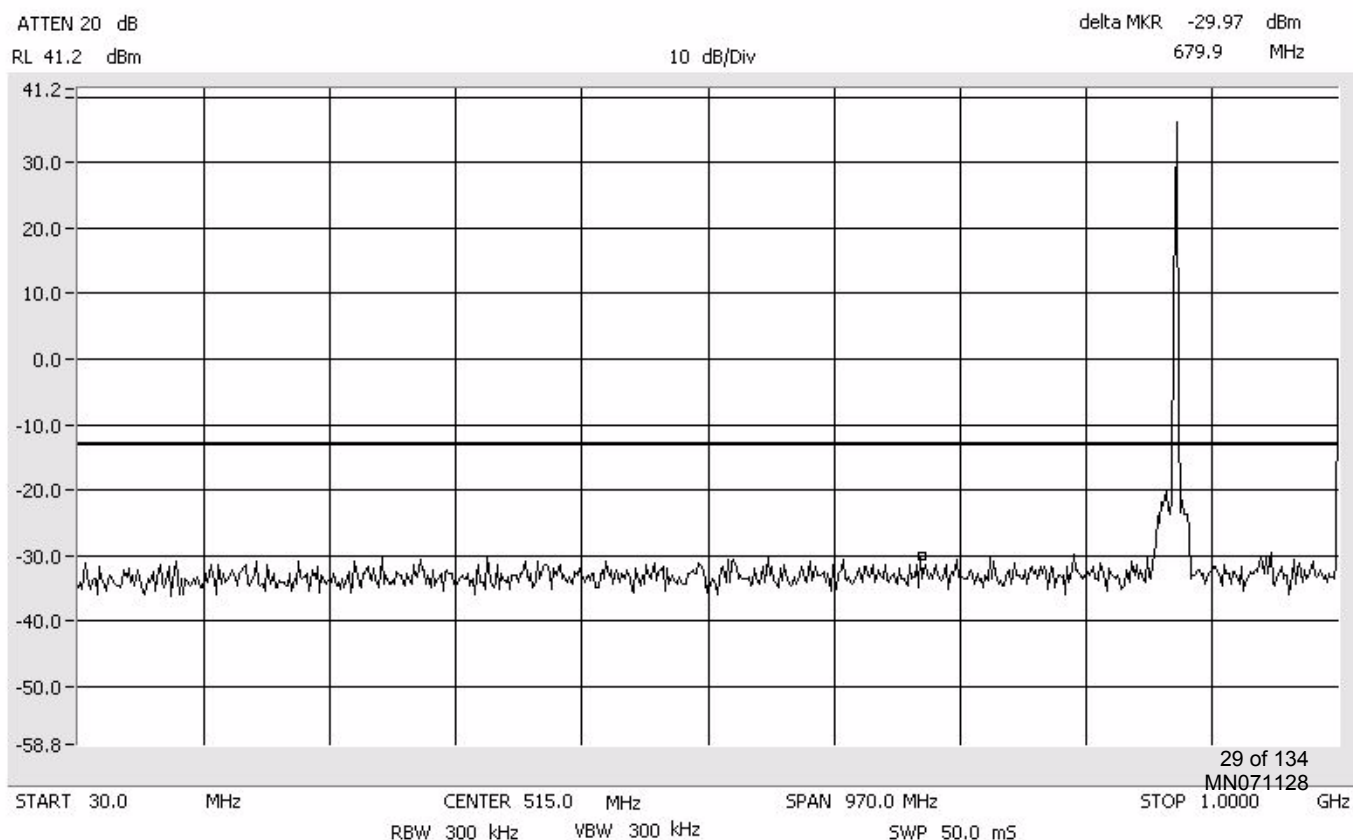
Conducted Emissions EDGE 800 MHz

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



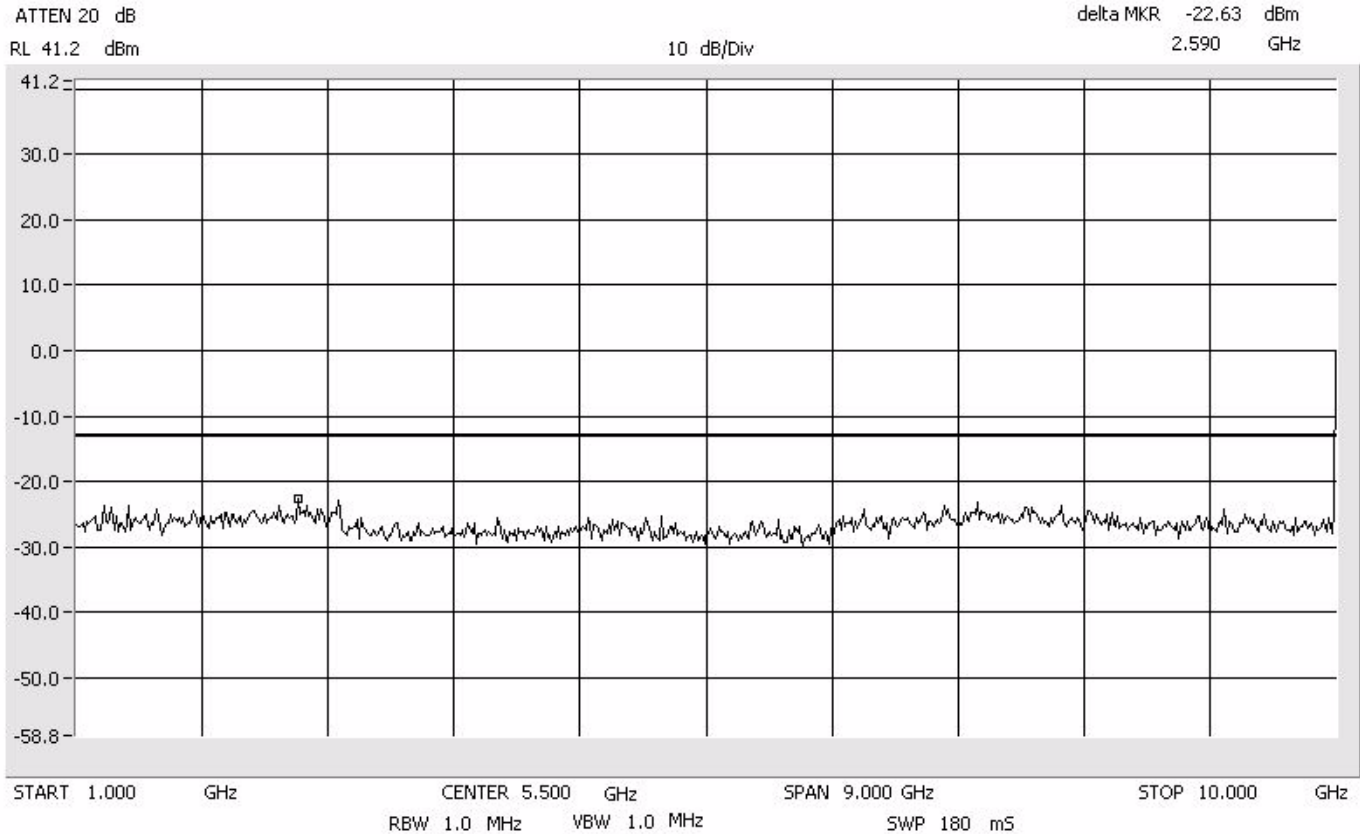
Conducted Emissions EDGE 800 MHz

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



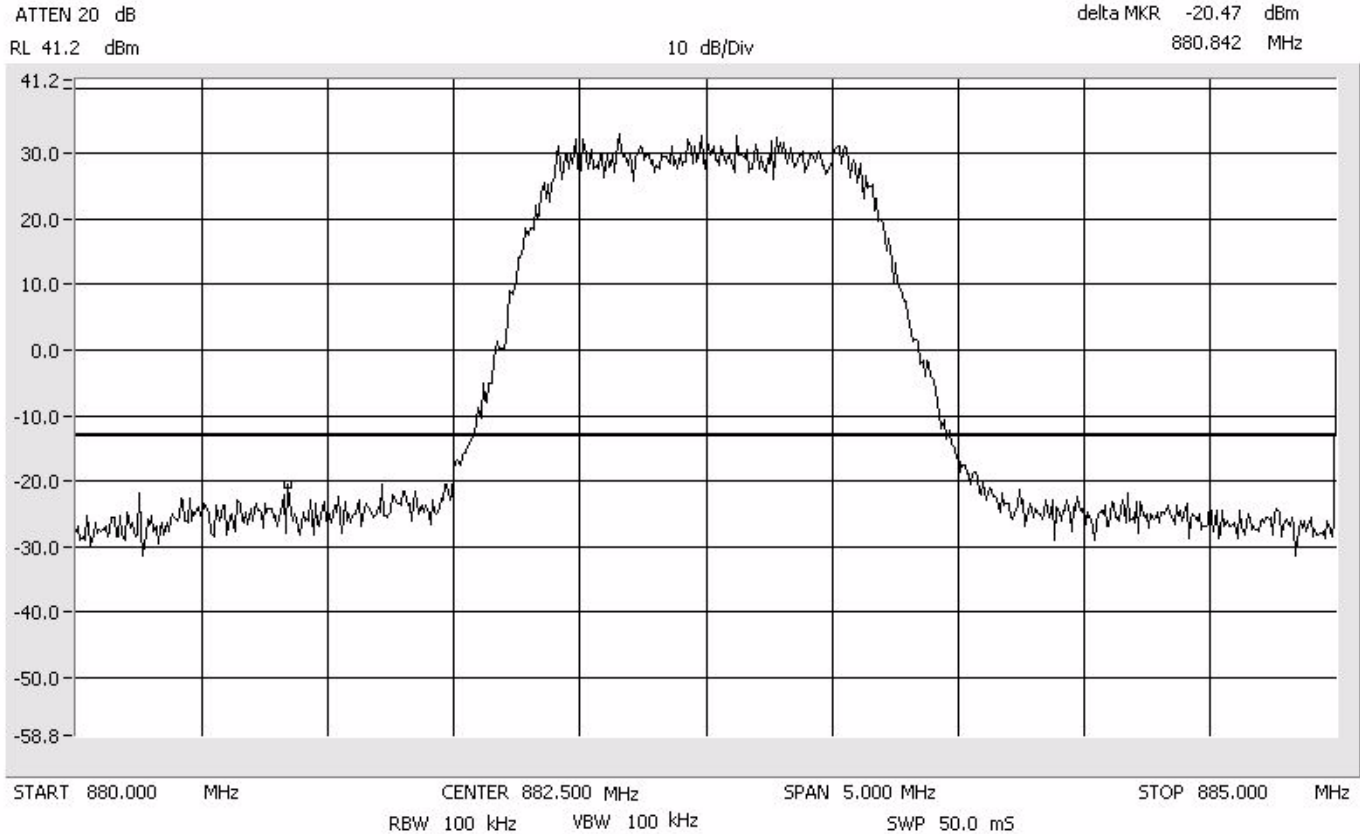
Conducted Emissions EDGE 800 MHz

1 GHz to 10 GHz
RBW/VBW: 1 MHz



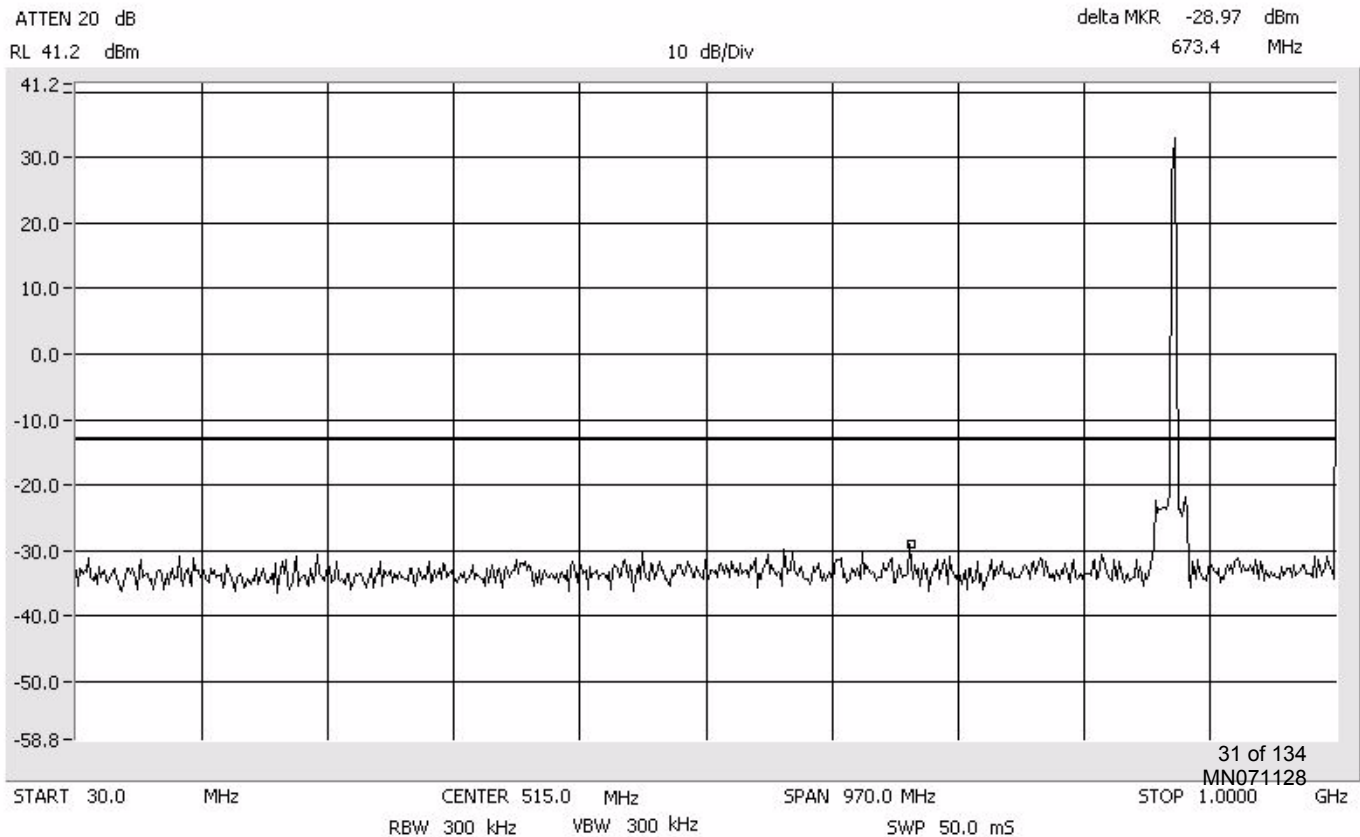
Conducted Emissions CDMA 800 MHz

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



Conducted Emissions CDMA 800 MHz

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

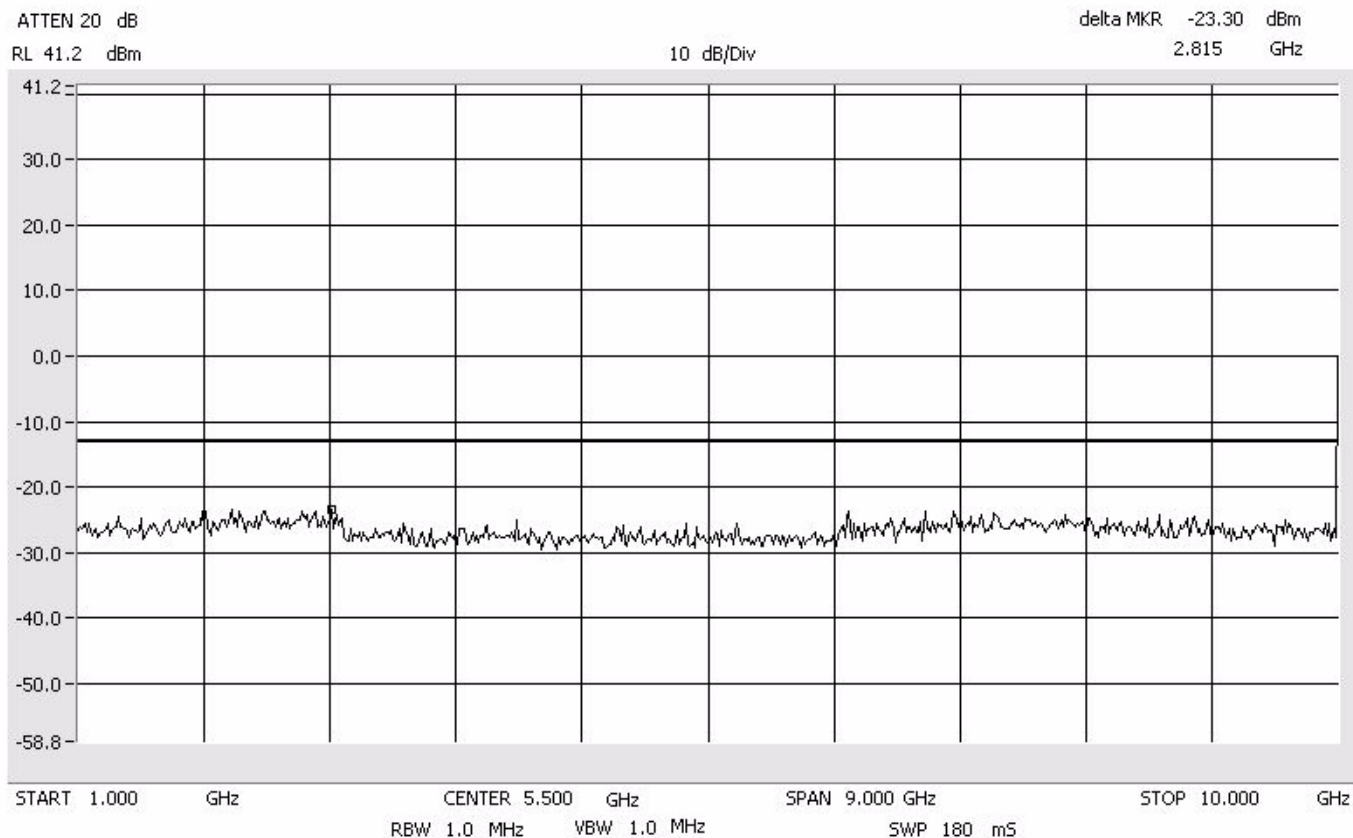


Conducted Emissions

CDMA

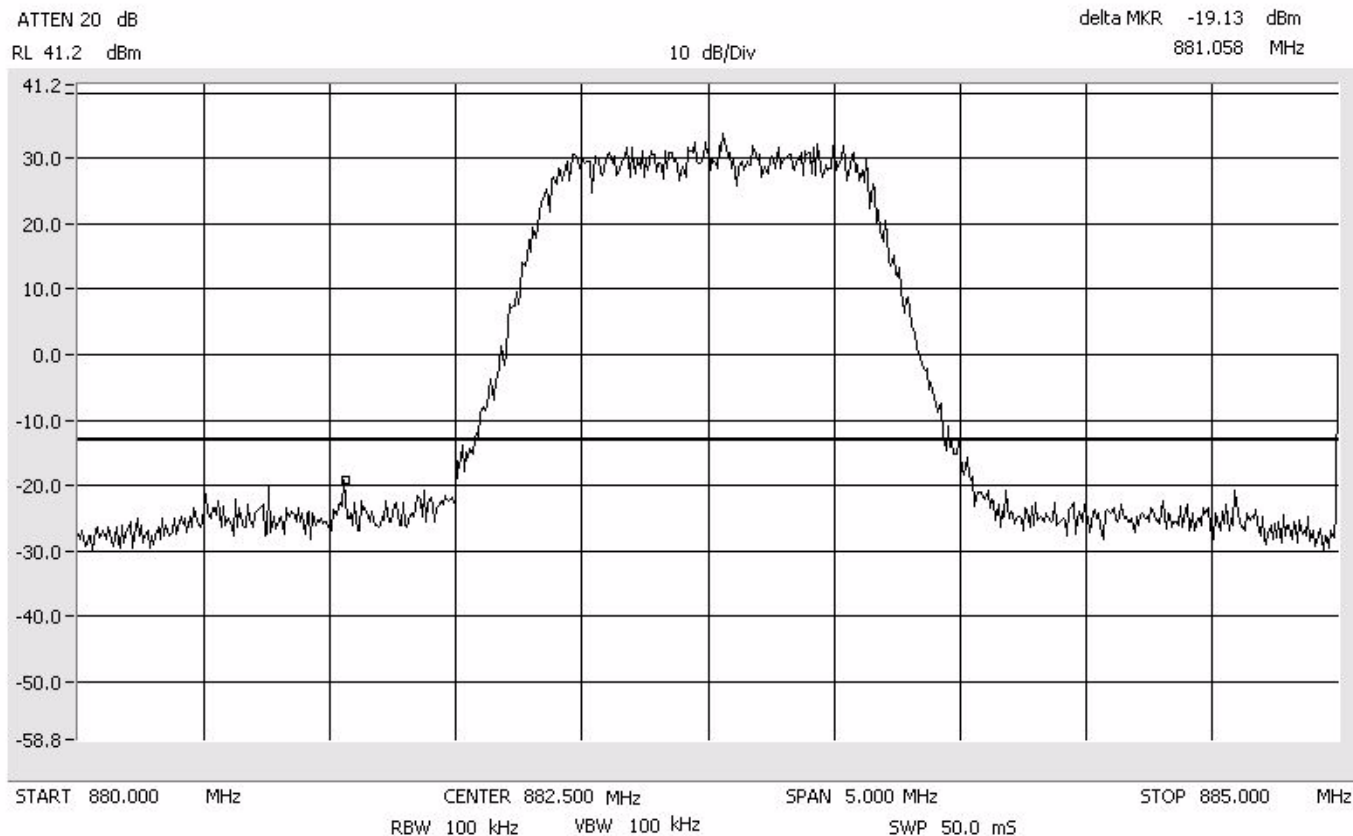
800 MHz

1 GHz to 10 GHz
RBW/VBW: 1 MHz



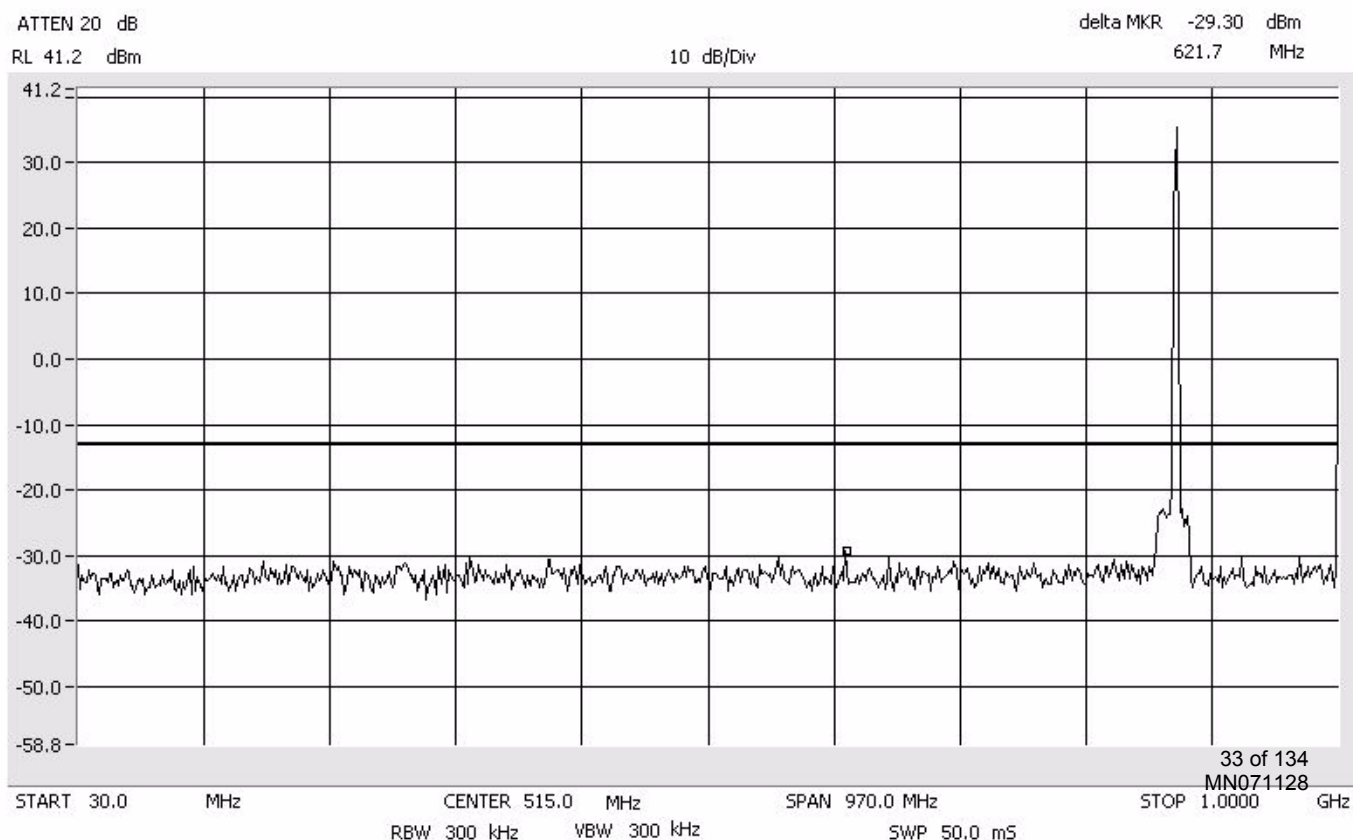
Conducted Emissions EVDO 800 MHz

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



Conducted Emissions EVDO 800 MHz

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

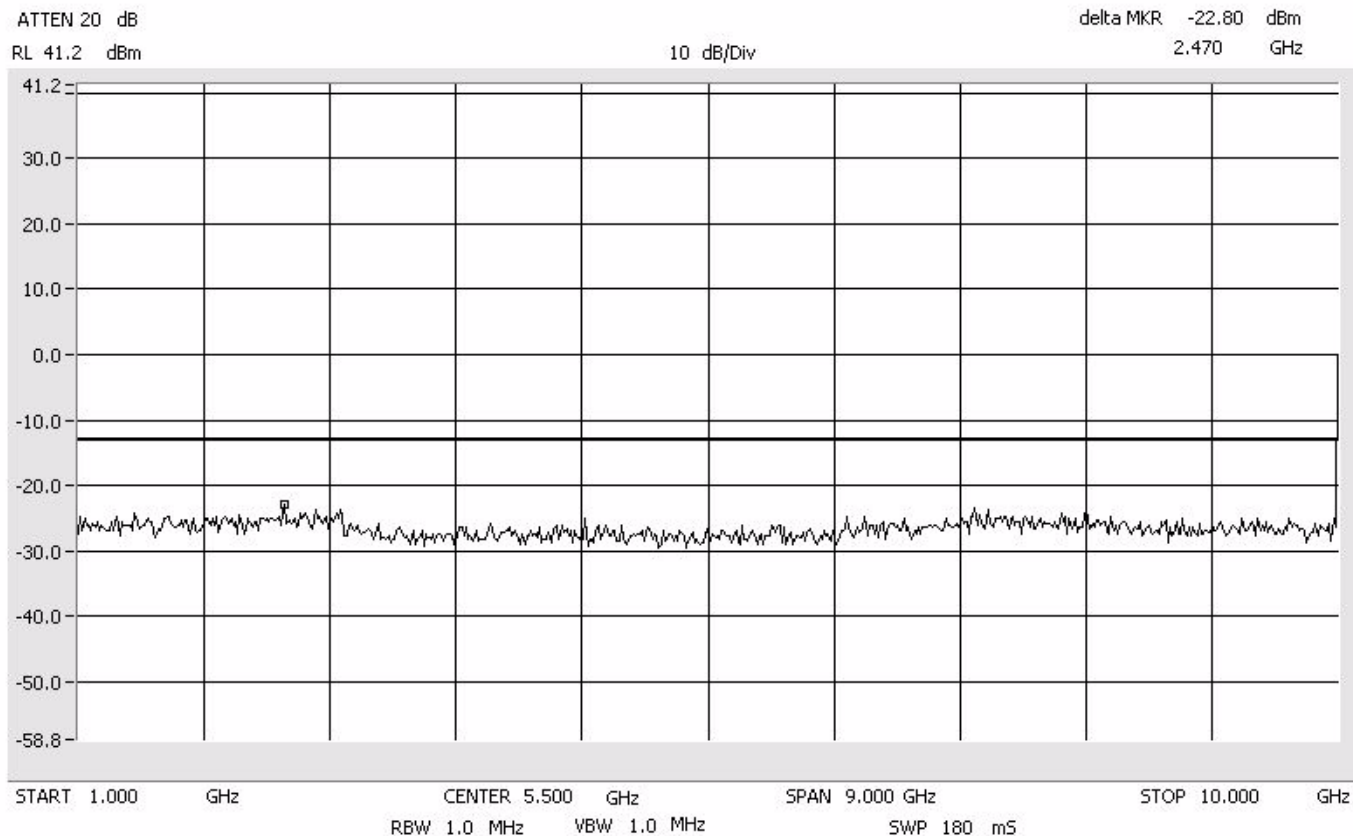


Conducted Emissions

EVDO

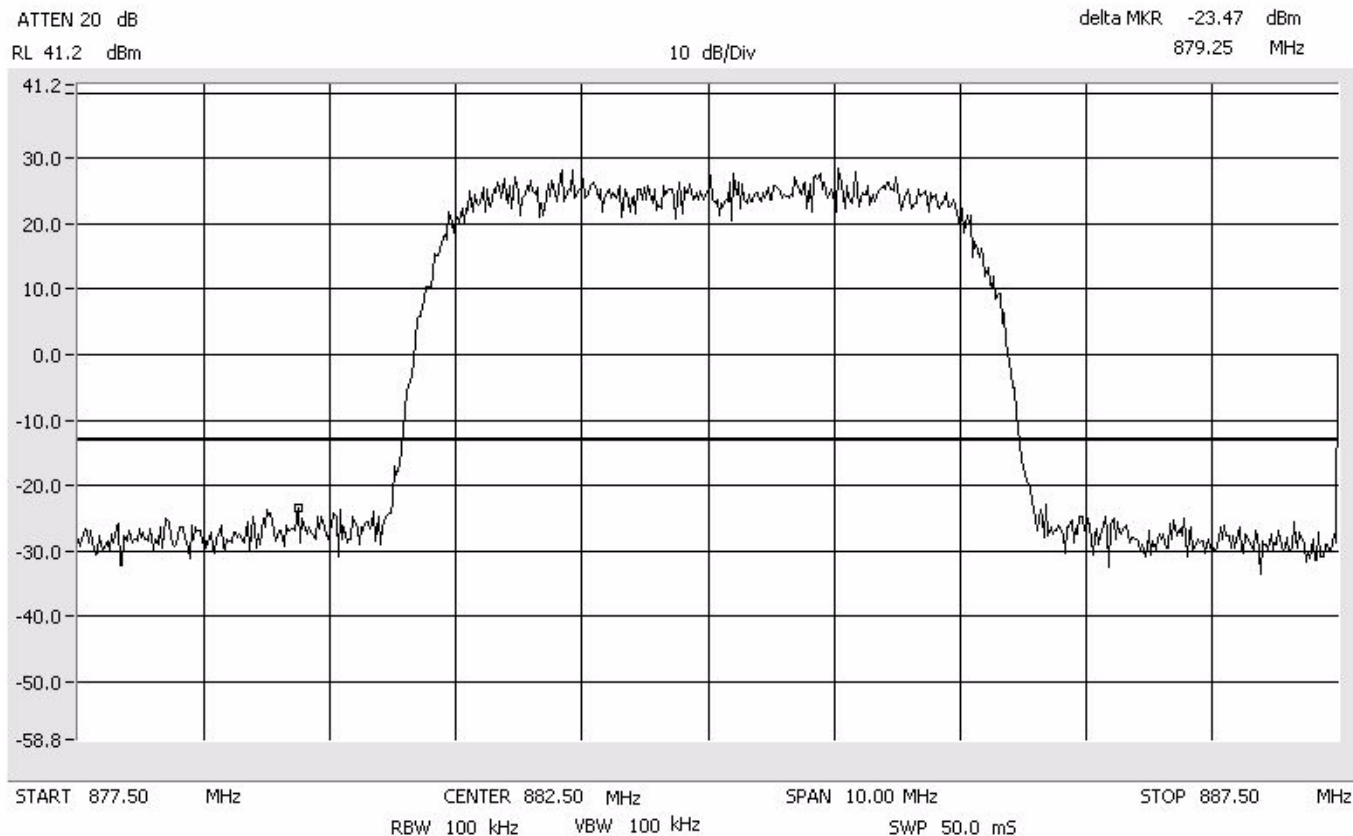
800 MHz

1 GHz to 10 GHz
RBW/VBW: 1 MHz



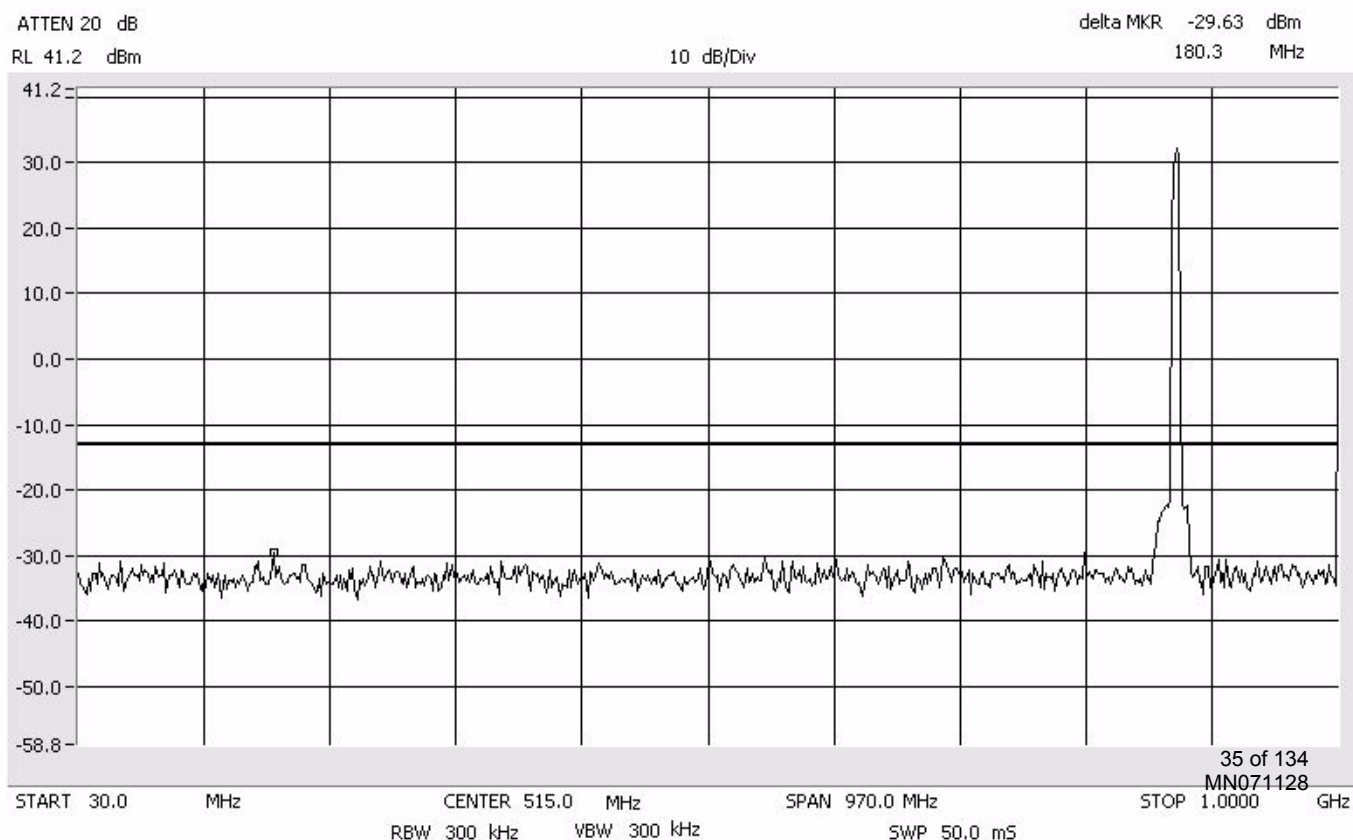
Conducted Emissions W-CDMA 800 MHz

Mid Band
Span: 10 MHz
RBW/VBW: 100 kHz



Conducted Emissions W-CDMA 800 MHz

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

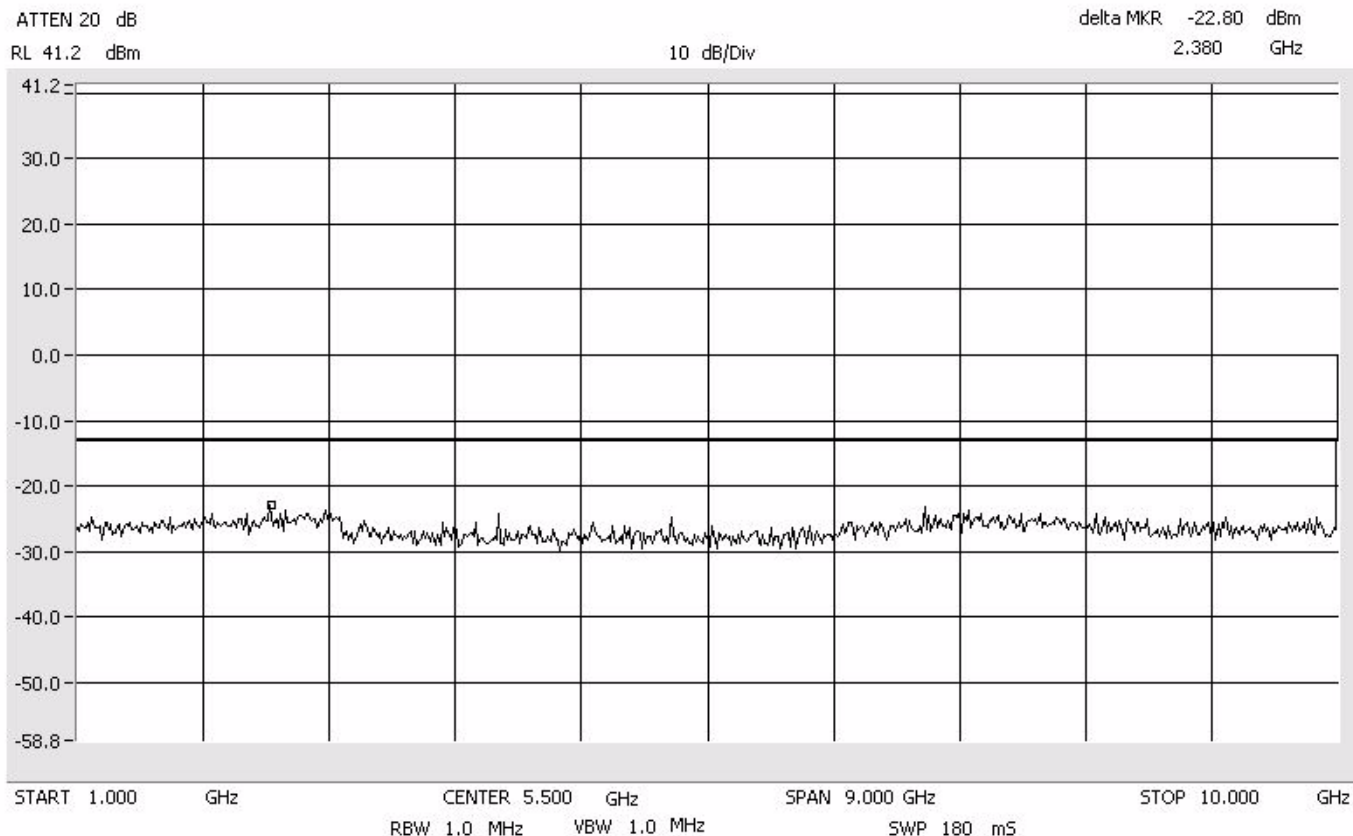


Conducted Emissions

W-CDMA

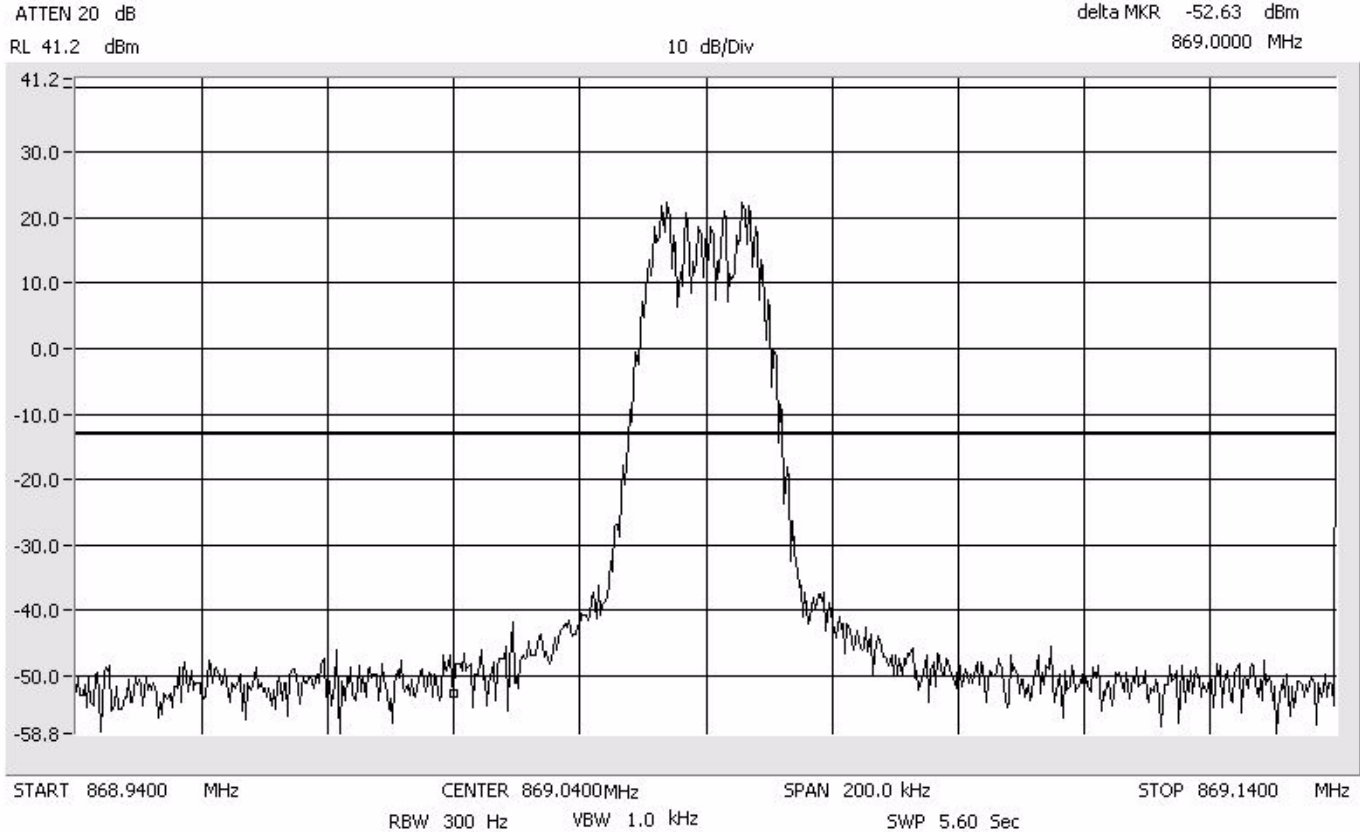
800 MHz

1 GHz to 10 GHz
RBW/VBW: 1 MHz



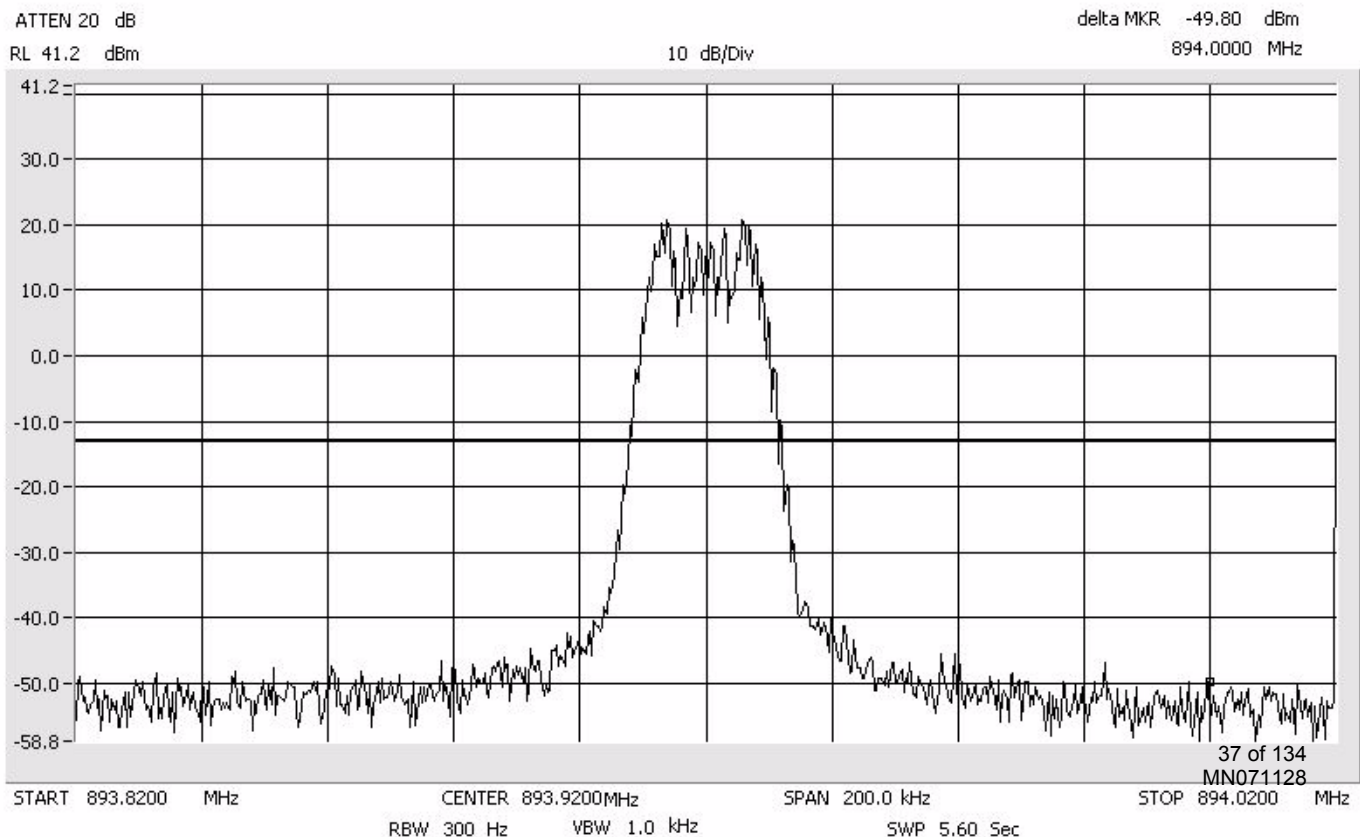
Band Edge FM

Center: 869.04 MHz
Span: 200 kHz
RBW: 300 Hz
VBW: 1 kHz



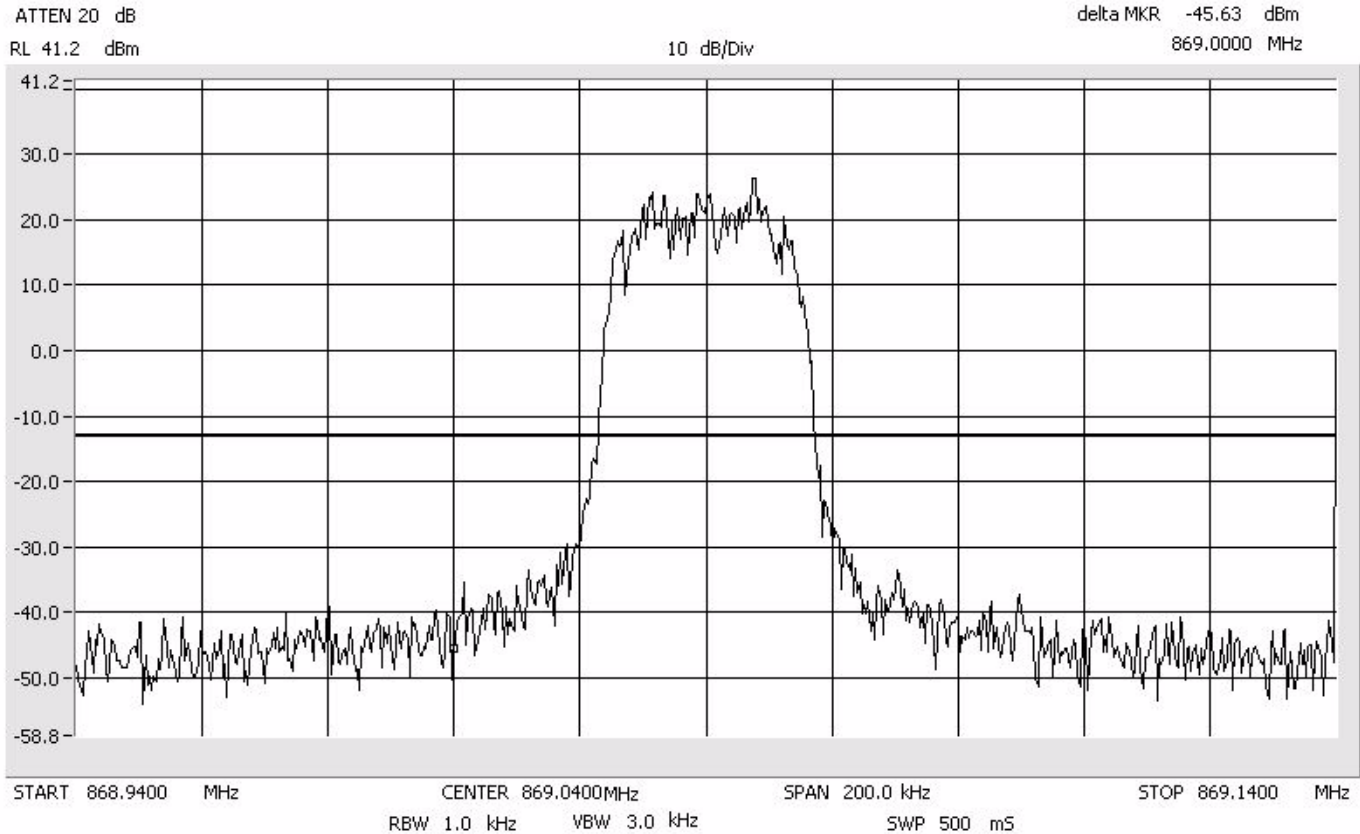
Band Edge FM

Center: 893.92 MHz
Span: 200 kHz
RBW: 300 Hz
VBW: 1 kHz



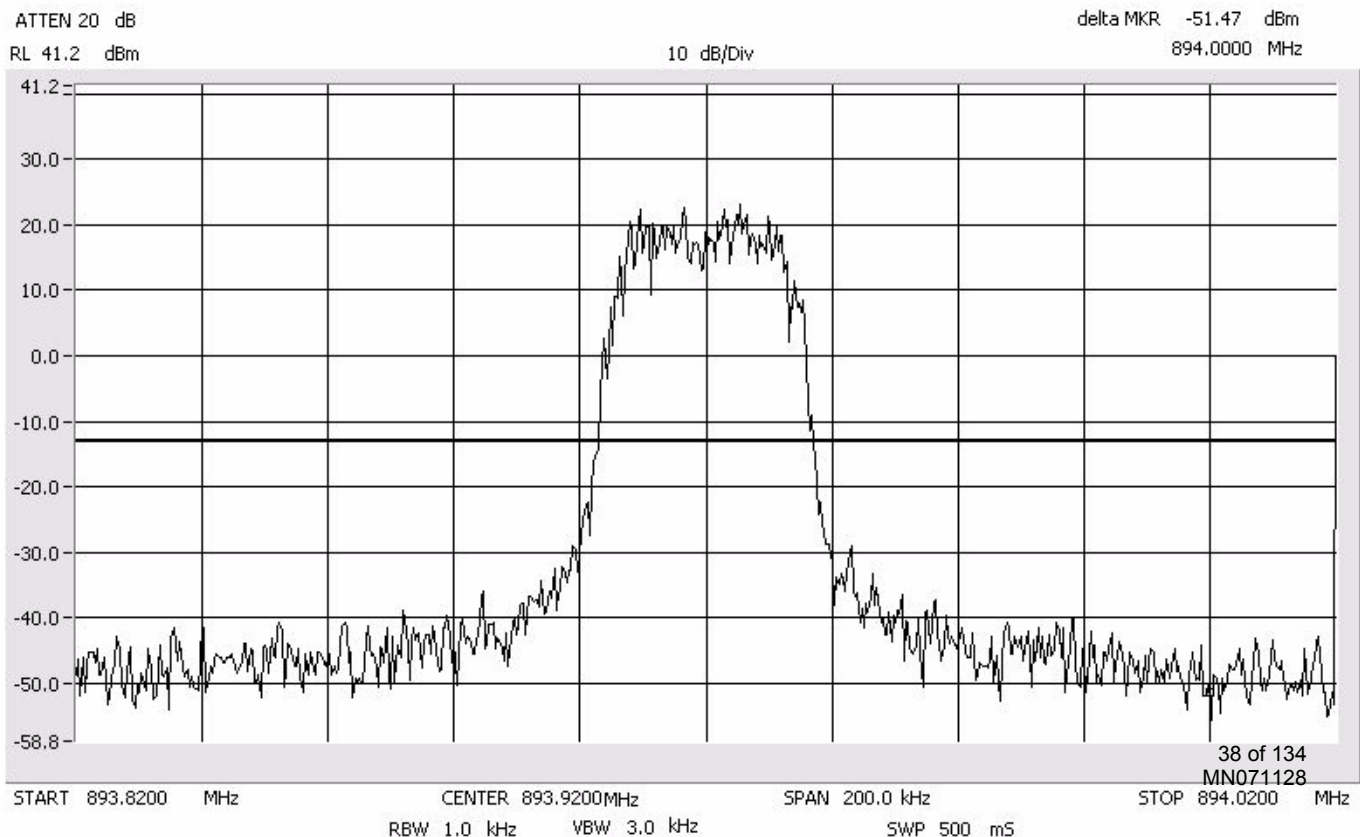
Band Edge TDMA

Center: 869.04 MHz
Span: 200 kHz
RBW: 1 kHz
VBW: 3 kHz



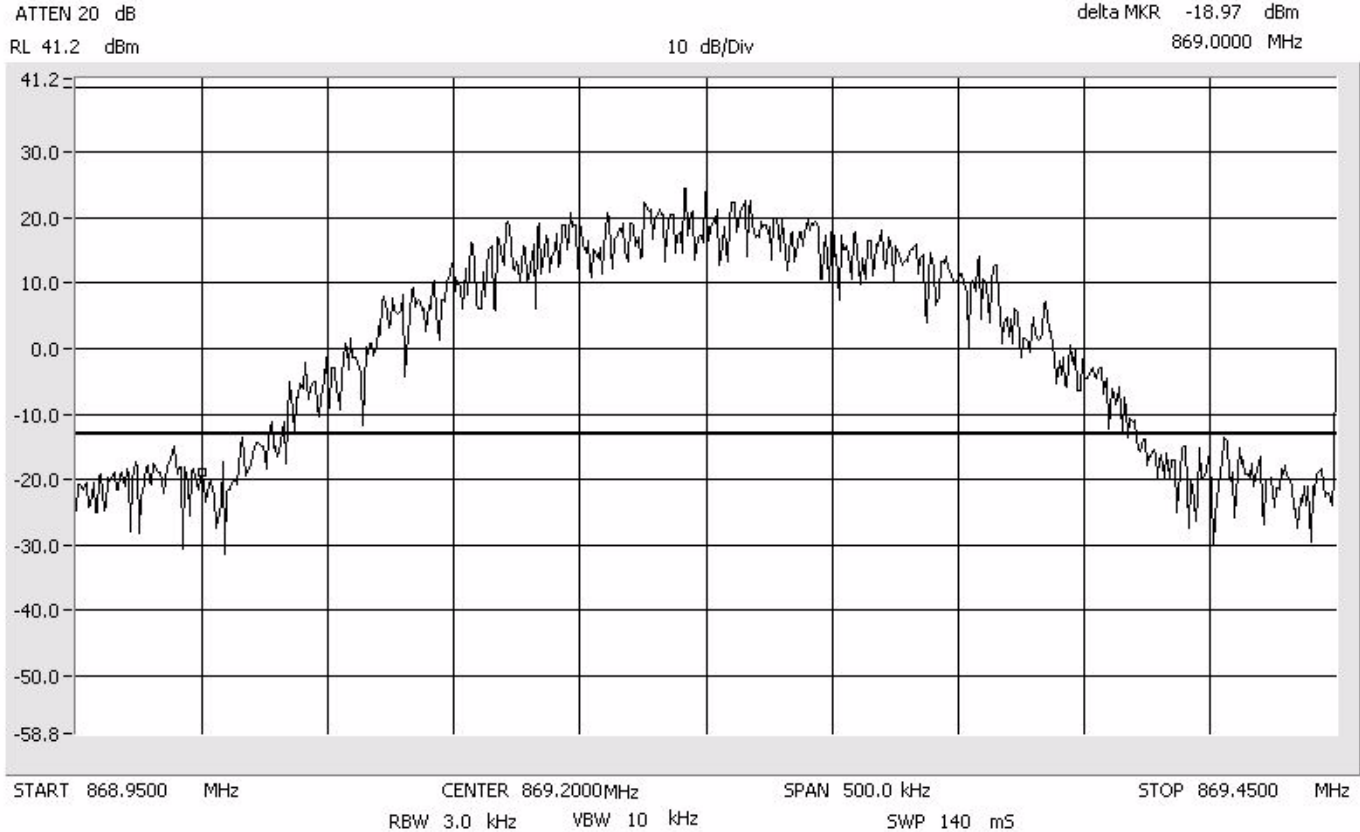
Band Edge TDMA

Center: 893.92 MHz
Span: 200 kHz
RBW: 1 kHz
VBW: 3 kHz



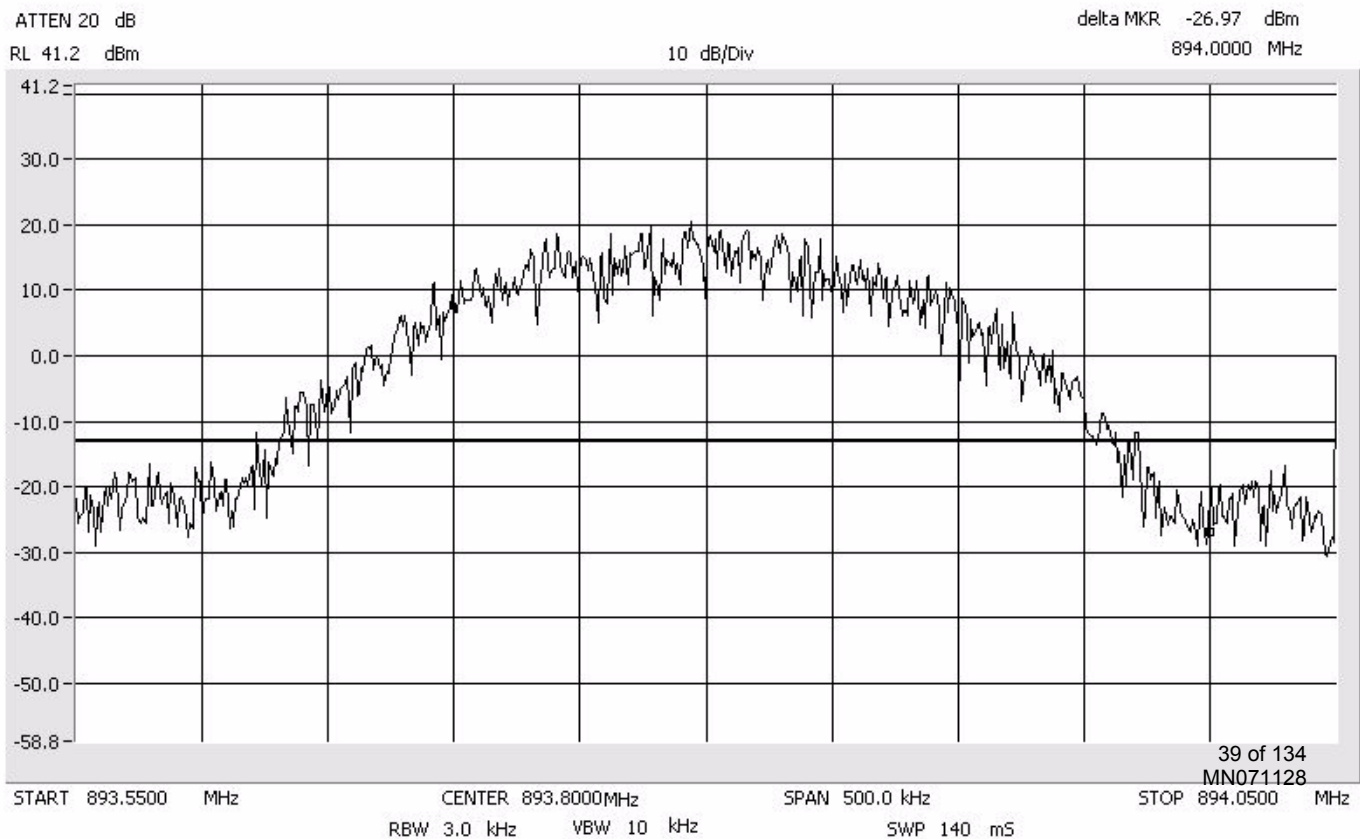
Band Edge GSM

Center: 869.2 MHz
Span: 500 kHz
RBW: 3 kHz
VBW: 10 kHz



Band Edge GSM

Center: 893.8 MHz
Span: 500 kHz
RBW: 3 kHz
VBW: 10 kHz



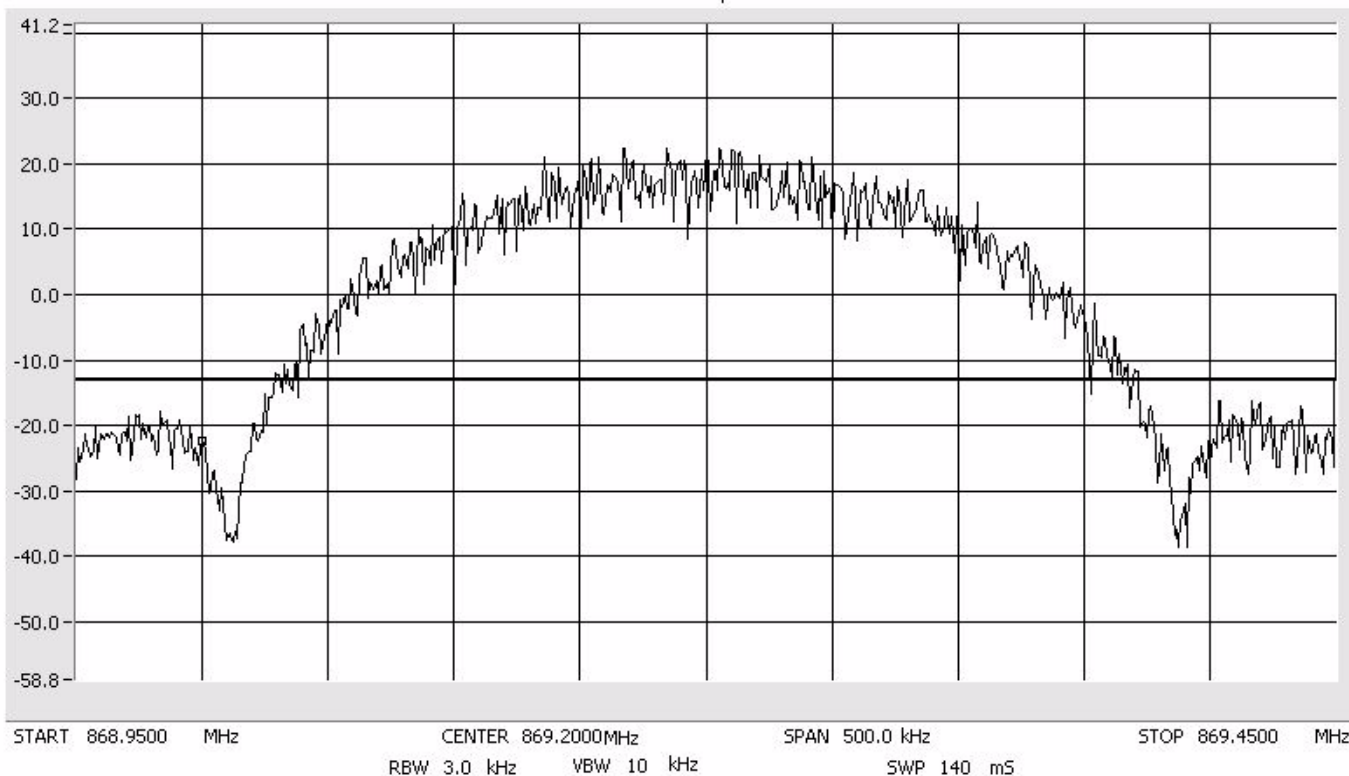
Band Edge EDGE

Center: 869.2 MHz
Span: 500 kHz
RBW: 3 kHz
VBW: 10 kHz

ATTEN 20 dB
RL 41.2 dBm

delta MKR -22.47 dBm
869.0000 MHz

10 dB/Div



Band Edge EDGE

Center: 893.8 MHz
Span: 500 kHz
RBW: 3 kHz
VBW: 10 kHz

ATTEN 20 dB
RL 41.2 dBm

delta MKR -27.13 dBm
894.0000 MHz

10 dB/Div

