Test Report Summary
FCC CFR 47, Part 27
Wireless Communications Service

Manufacturer: ADC Telecommunications

Name of Equipment: FlexWave™ URH – AWS

Model Number(s): FWU-A40000002110RU

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

Test Report Number: MN080229

Test Date(s): 19 February, 2008 (ETL)
22 February, 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 27.

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 27 and the EUT fulfills the requirements of the Federal Communications Commission's CFR 47 Part 27.

Date: 29 February, 2008

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: MN080229 **Date of Issue:** 29 February, 2008

Model Number(s): FWU-A40000002110RU

Product Name: FlexWave™ URH – AWS

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: 3145093MIN-001

Reference(s)

Total pages including Appendices: 126

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1.0 REVISION DESCRIPTION

Rev	Total Pages	Date	Description
A	126	29 February, 2008	Original Release

2.0 DOCUMENTATION

2.1 Test Regulations

27.50 Power limits
27.53 Emission limits
27.54 Frequency stability

The emissions tests were performed according to the following regulations:

☐ FCC Part 22

☐ FCC Part 24

■ **FCC Part 27**

☐ FCC Part 90

☐ IC RSS-131 Issue 2

Environmental Conditions in the lab:

ADC	**ETL**
Temperature: 24º C	15-35º C
Relative Humidity: 22%	30-60%
Atmospheric Pressure: 97.7 kPa	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 – AWS – 2110 to 2155 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-A40000002110RU	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**

Test Specification Deviations; Additions to or Exclusions from:

☐ As indicated in the Test Plan

■ **None**

2.14 General Remarks:

None.

2.15 Summary:

The requirements according to the technical regulations are

■ **met**

☐ not Met

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

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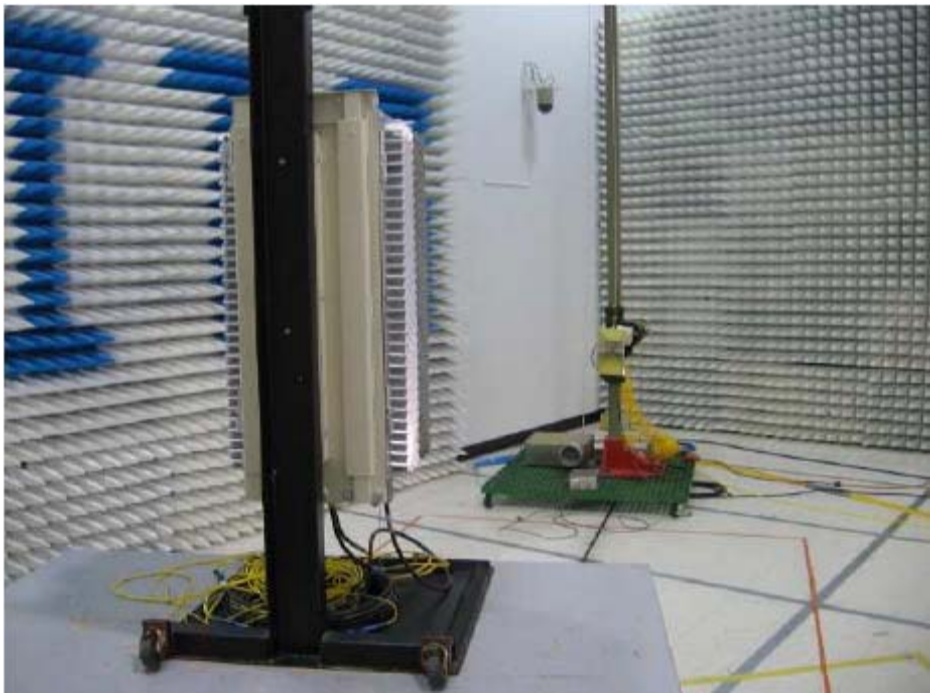
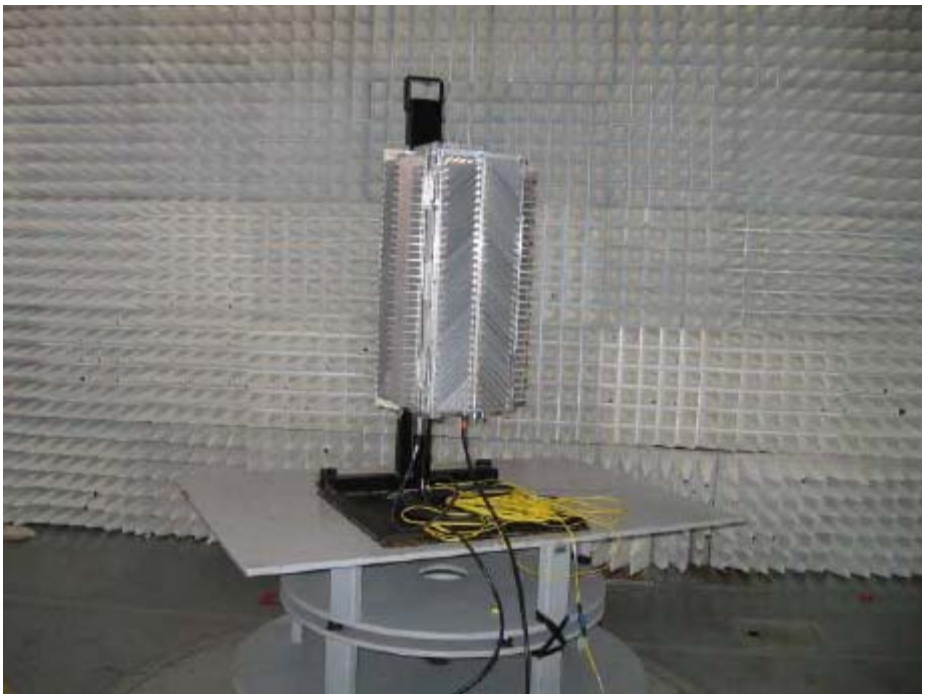
3.1 Test set-up photo, radiated emissions



3.2 Test set-up photo, radiated emissions



3.3 Test Set-up Drawings

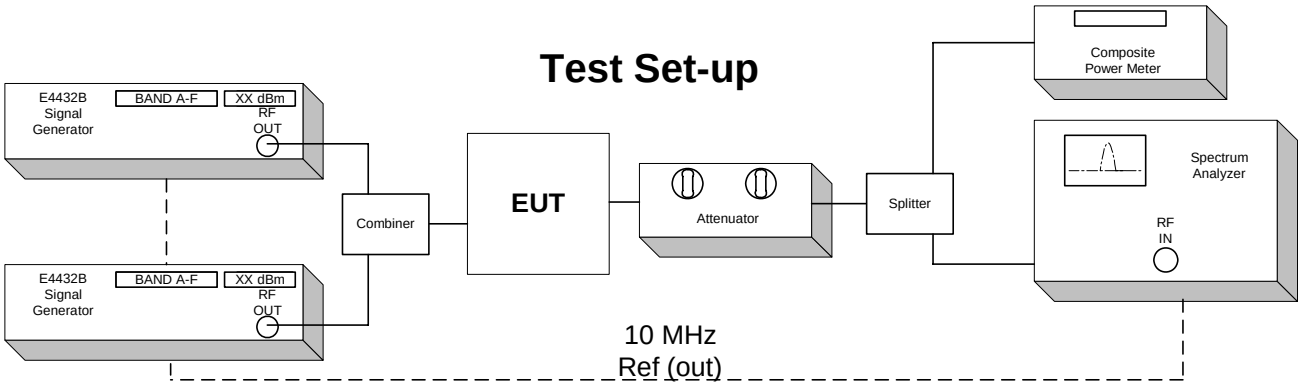
Conducted and Radiated Emission Limits Test for ADC Inc

Conducted Output Power Test for ADC Inc

Inter-Modulation Test for ADC Inc

Occupied Bandwidth Modulation Test for ADC Inc

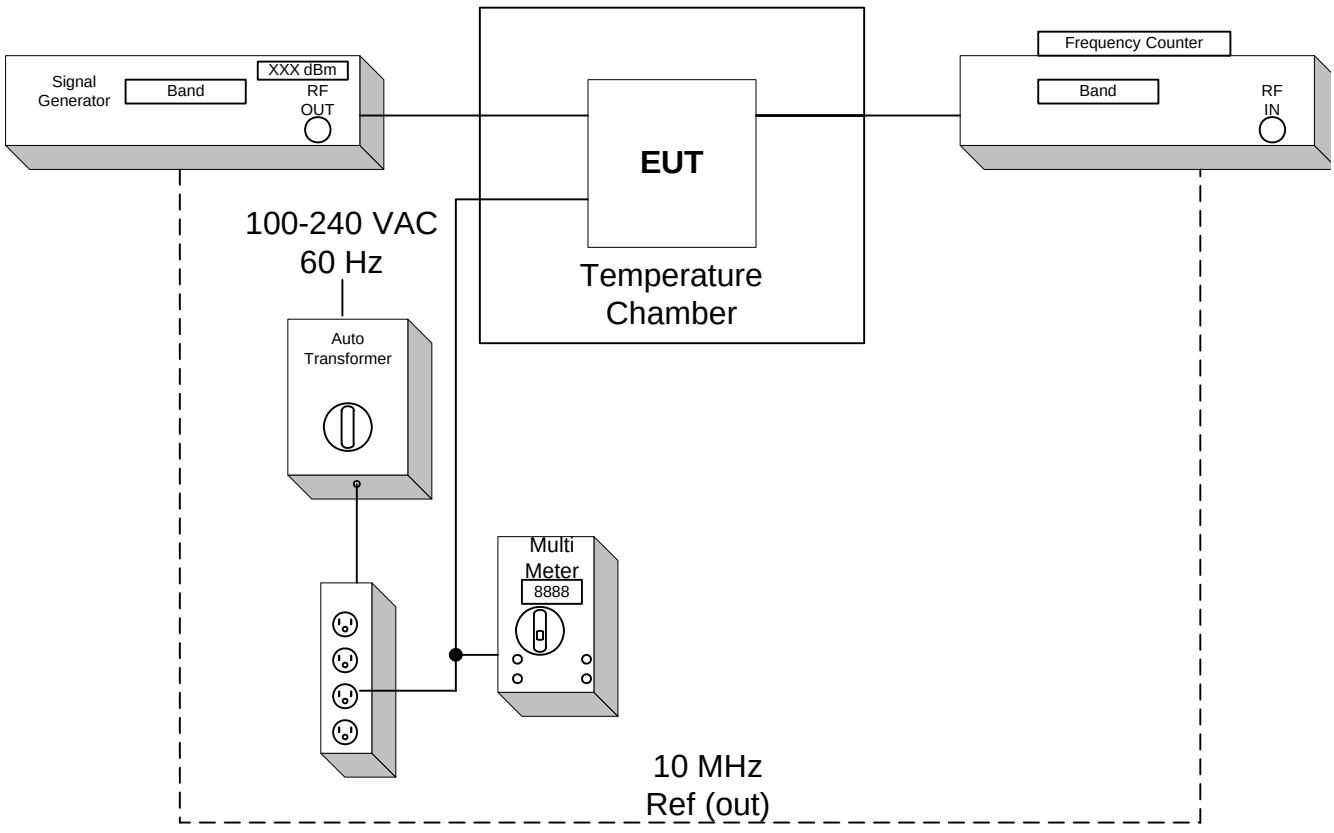
FlexWave™ URH – AWS
Model Number FWU-A40000002110RU



Frequency Tolerance Test for ADC Inc.
FlexWave™ URH – AWS
Model Number FWU-A40000002110RU

EUT is specified for outdoor use with temperature range of -30° to +55° C, and was tested with its range.

Test Set-up



4.0 TEST RESULTS

4.1.1 27.50 RF Power Limits

Test Summary:

- The requirements are: ■ **MET** □ NOT MET
- Minimum margin of compliance is 5.01 dB at 2132.5 MHz (GSM)

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:
100 Watts or 50 dBm Limit

Test Data:
See page 41

Test Engineer: Mark F. Miska
Date: 22 February, 2008

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4.1.2 27.54 Frequency Stability

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 50º 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:
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Data:
See page 98

Test Engineer: Mark F. Miska
Date: 22 February, 2008

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4.1.3 27.53 Emission Limitations

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 + 10log(P) dB, or –13 dBm.

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

Test Data:
Conducted Emissions, pages 16 – 40
Intermodulation Test, pages 42 – 90
Occupied Bandwidth, pages 91 – 97
Radiated Emissions, pages 99 – 124 (Appendix B)

Test Engineer: Mark F. Miska
Date: 22 February, 2008
Date: 22 February, 2008
Date: 22 February, 2008

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5.0 TEST EQUIPMENT

Number	Description	Manufacturer	Model	ADC Serial Number	Cal Due	Used
1	Spectrum Analyzer	HP	8563E	MC27690	7-18-08	☒
2	Power Meter	HP	EPM-441A	MC27670	10-9-08	☒
3	Multimeter	Fluke	87	MC17932	8-1-08	☒
4	Frequency Counter	HP	5347A	MC27548	1-16-09	☒
5	Temperature Chamber	Thermotron	SM-32C	MC18966	4-9-08	☒
6	Signal Generator	Agilent	E4437B	967974	1-15-10	☒
7	Signal Generator	Agilent	E4438C	1013210	2-9-09	☒
8	Attenuator	Huber Suhner	6810.17.A	N/A	CNR	☐
9	Variable Auto Transformer	Staco	1520CT	MC44655	CNR	☒
10	Digital Barometer	Fisher Scientific	02-403	MC50719	10-28-09	☒
11	Data Acquisition Unit	Fluke	Hydra	MC27549	10-8-08	☐
12	Attenuator	Aeroflex	49-30-33	N/A	CNR	☐
13	Attenuator	Aeroflex	86-30-12	N/A	CNR	☒
14	LNA	Lucix Corp	C020200L 1603	N/A	CNR	☐

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

6.0 APPENDIX A

Test Data

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Test Engineer: Mark F. Miska

Conducted Emission Limits Test for ADC Inc
FlexWave™ URH - AWS
Model Number FWU-A40000002110RU

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 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 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 ≈ -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.

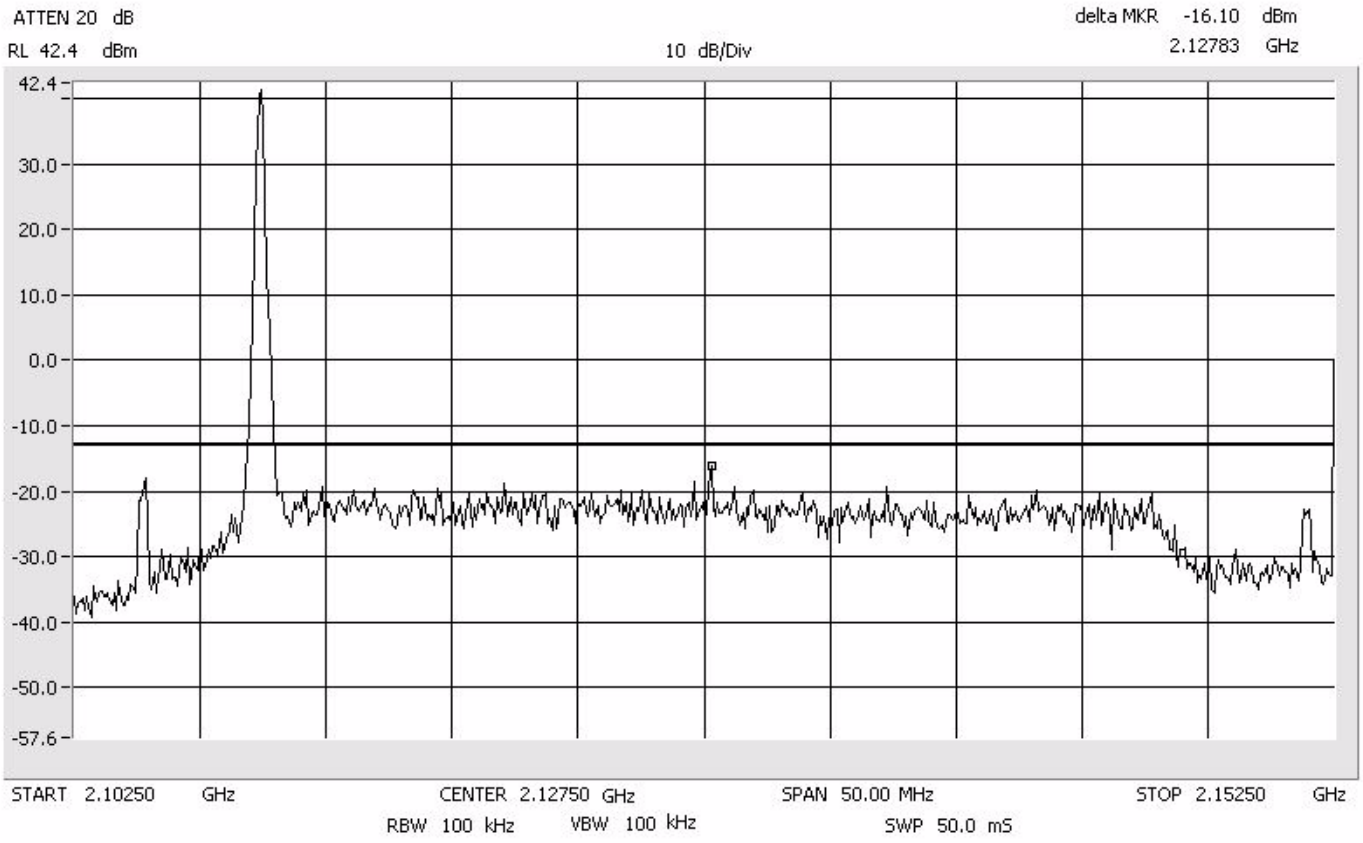
This equipment does not modulate the RF, so there is no modulation limiter. This equipment does not change the modulation of the RF or the occupied bandwidth of any channel. It transports the signal, as is, over an optical link. The RF input is not changed in the RF output.

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)

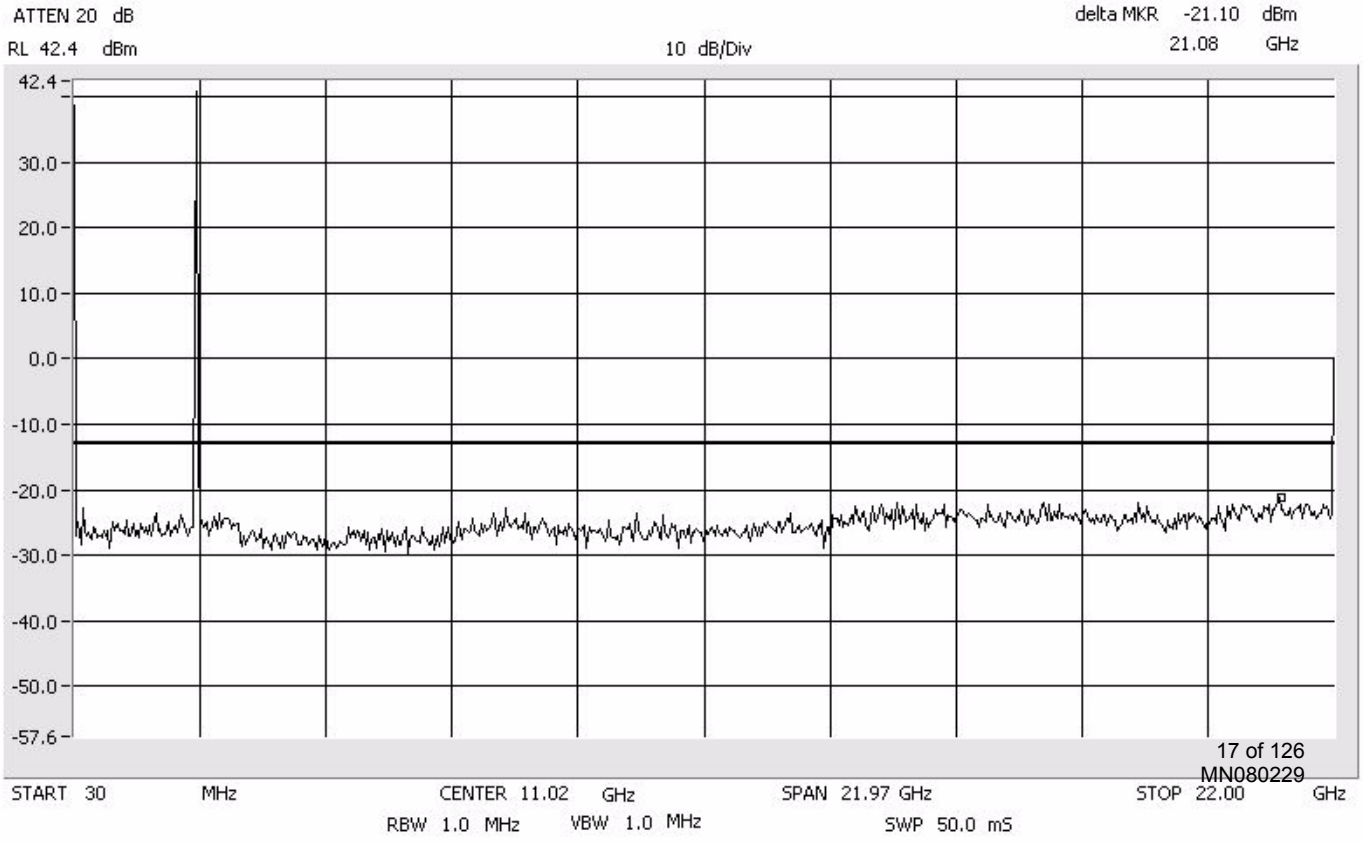
Conducted Emissions
Lower Band
Low
AWS

Center: 2127.5 MHz
Span: 50 MHz
RBW/VBW: 100 kHz



Conducted Emissions
Lower Band
Low
AWS

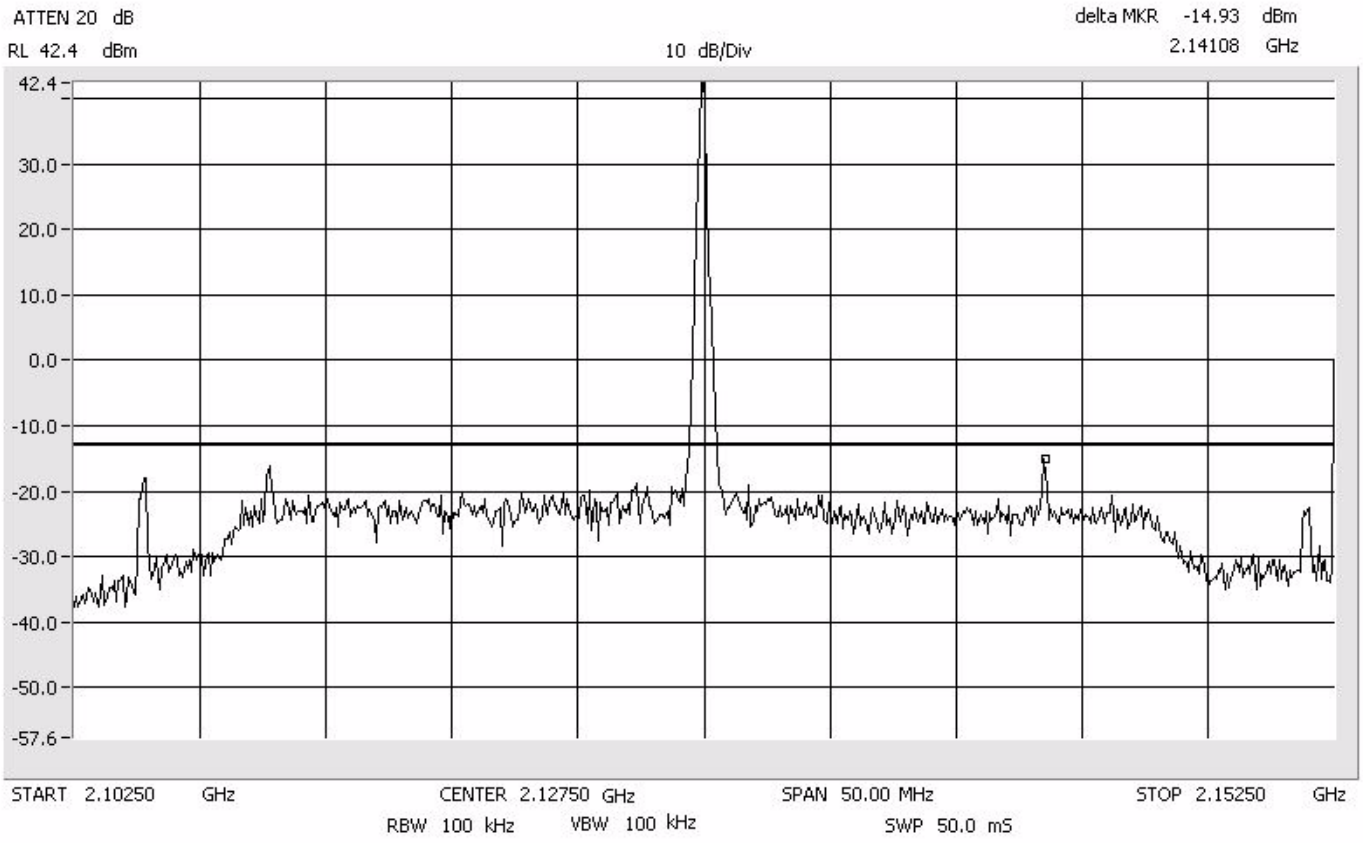
Span: 30 MHz to 22 GHz
RBW/VBW: 1 MHz



Lower Band

Conducted Emissions
Mid
AWS

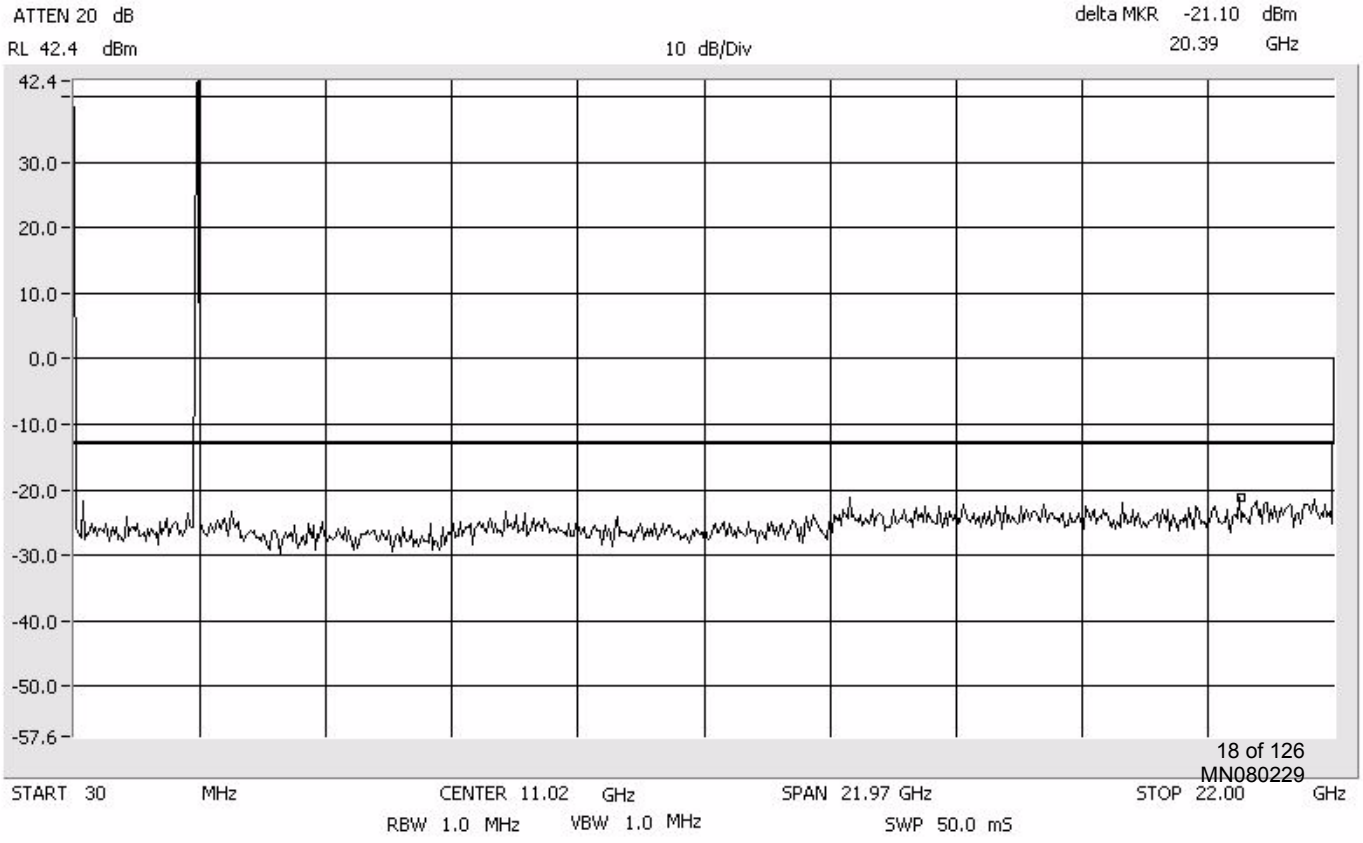
Center: 2127.5 MHz
Span: 50 MHz
RBW/VBW: 100 kHz



Lower Band

Conducted Emissions
Mid
AWS

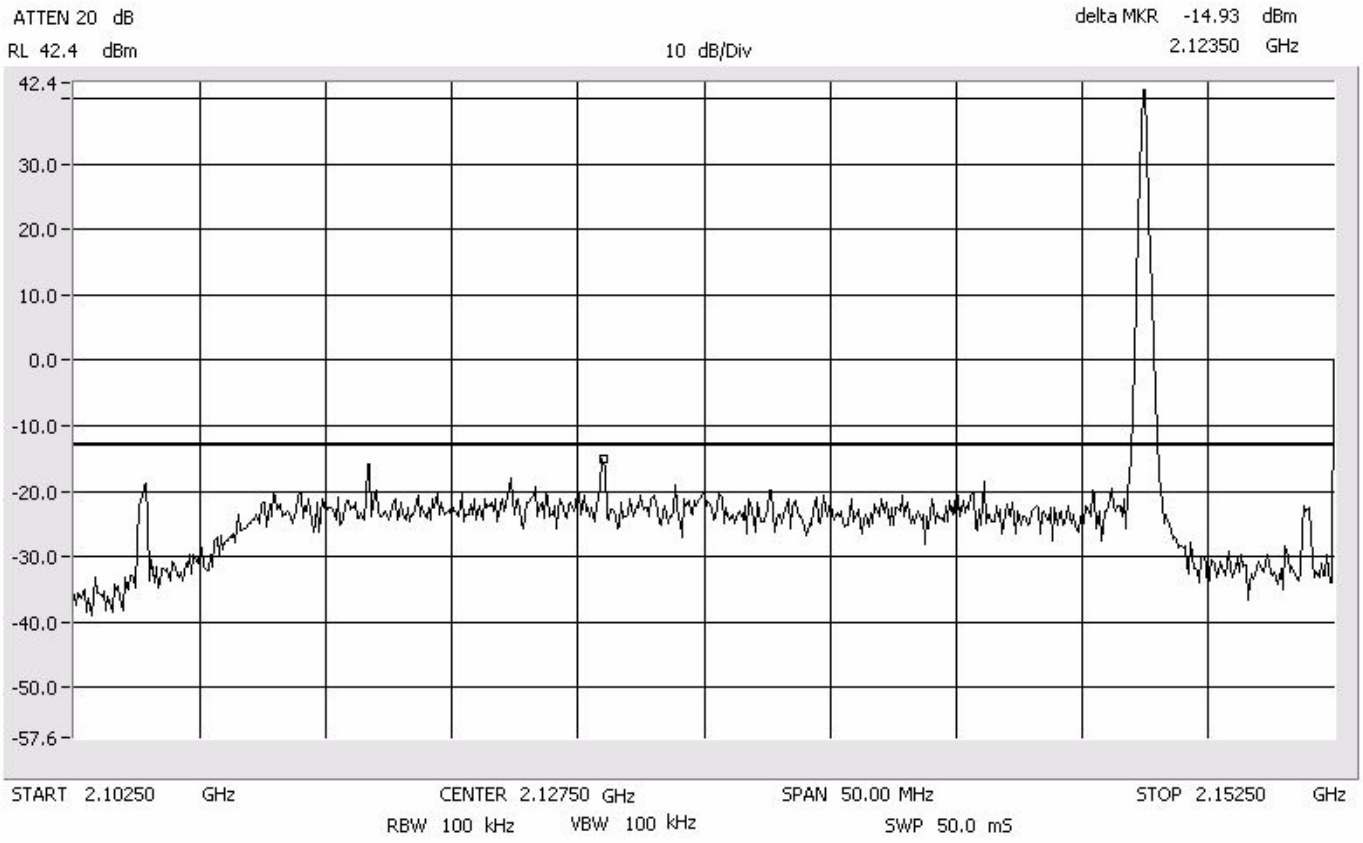
Span: 30 MHz to 22 GHz
RBW/VBW: 1 MHz



Conducted Emissions
High
AWS

Lower Band

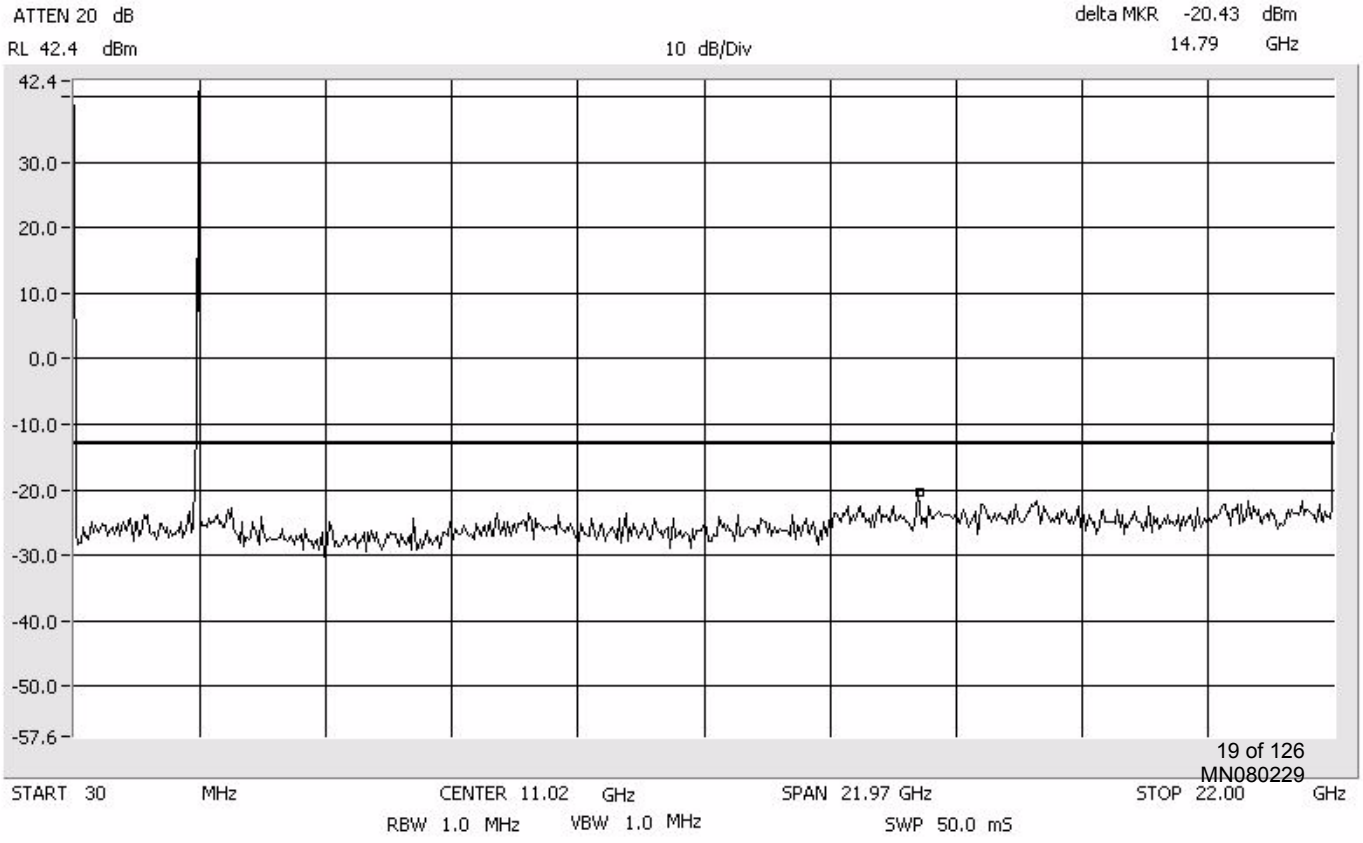
Center: 2127.5 MHz
Span: 50 MHz
RBW/VBW: 100 kHz



Conducted Emissions
High
AWS

Lower Band

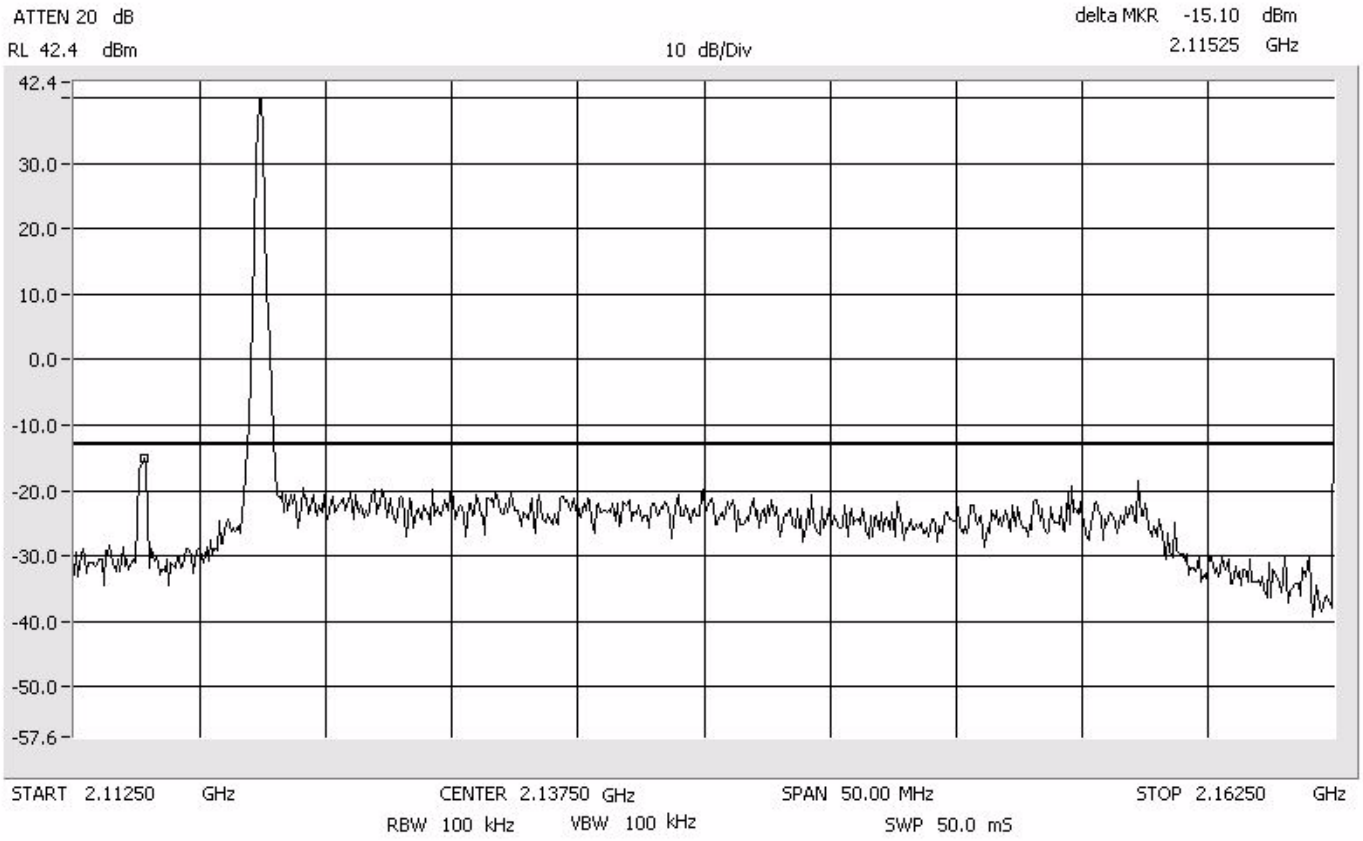
Span: 30 MHz to 22 GHz
RBW/VBW: 1 MHz



Upper Band

Conducted Emissions
Low
AWS

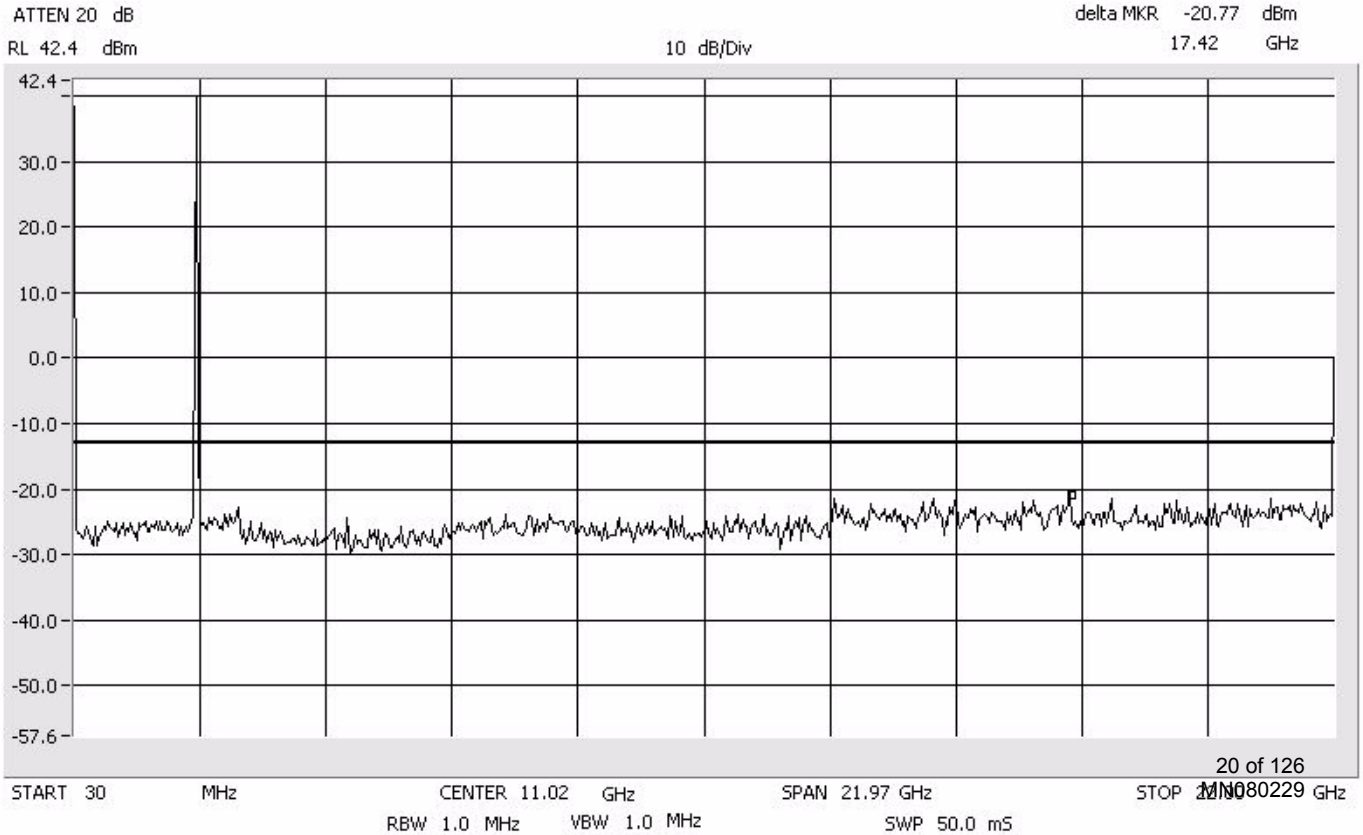
Center: 2137.5 MHz
Span: 50 MHz
RBW/VBW: 100 kHz



Upper Band

Conducted Emissions
Low
AWS

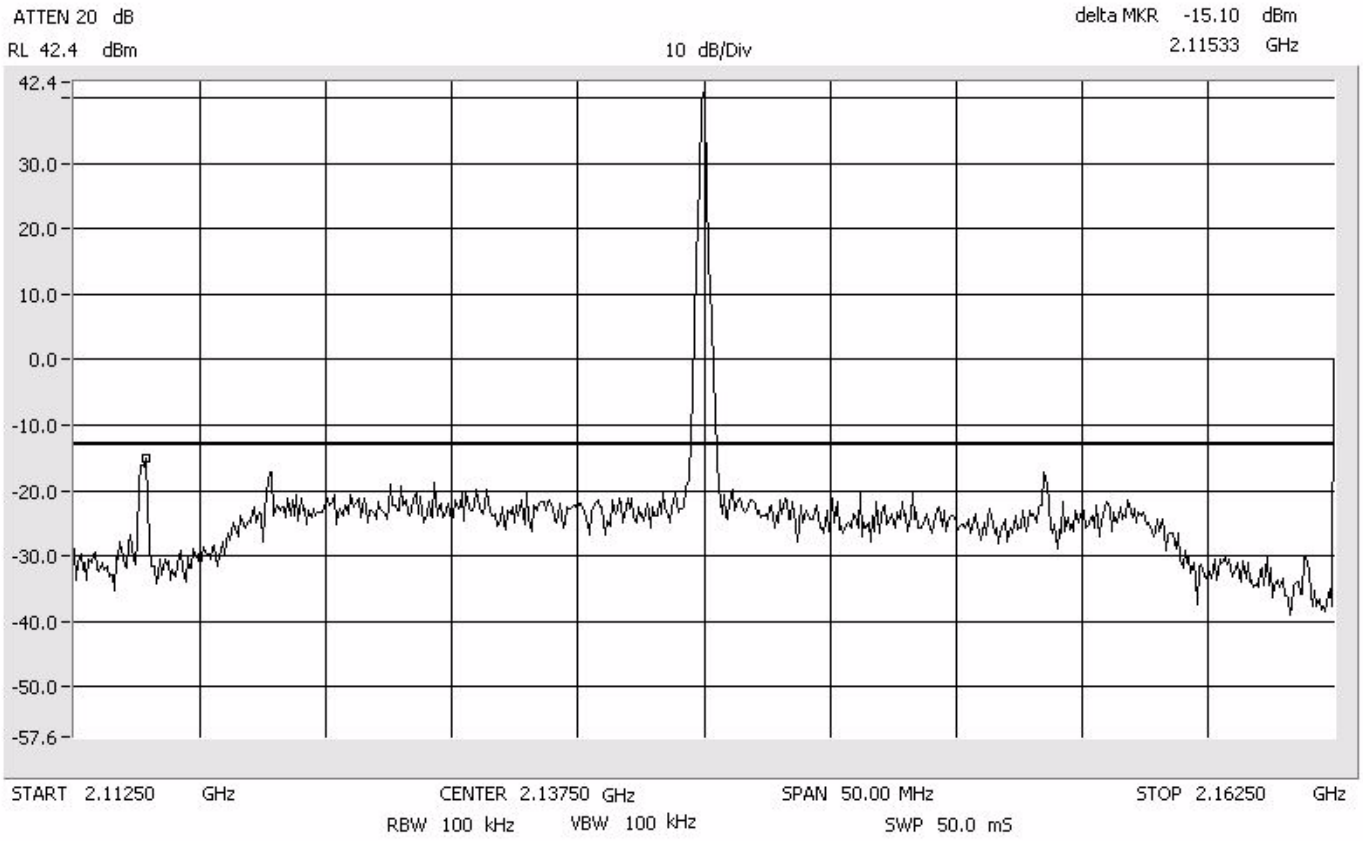
Span: 30 MHz to 22 GHz
RBW/VBW: 1 MHz



Upper Band

Conducted Emissions
Mid
AWS

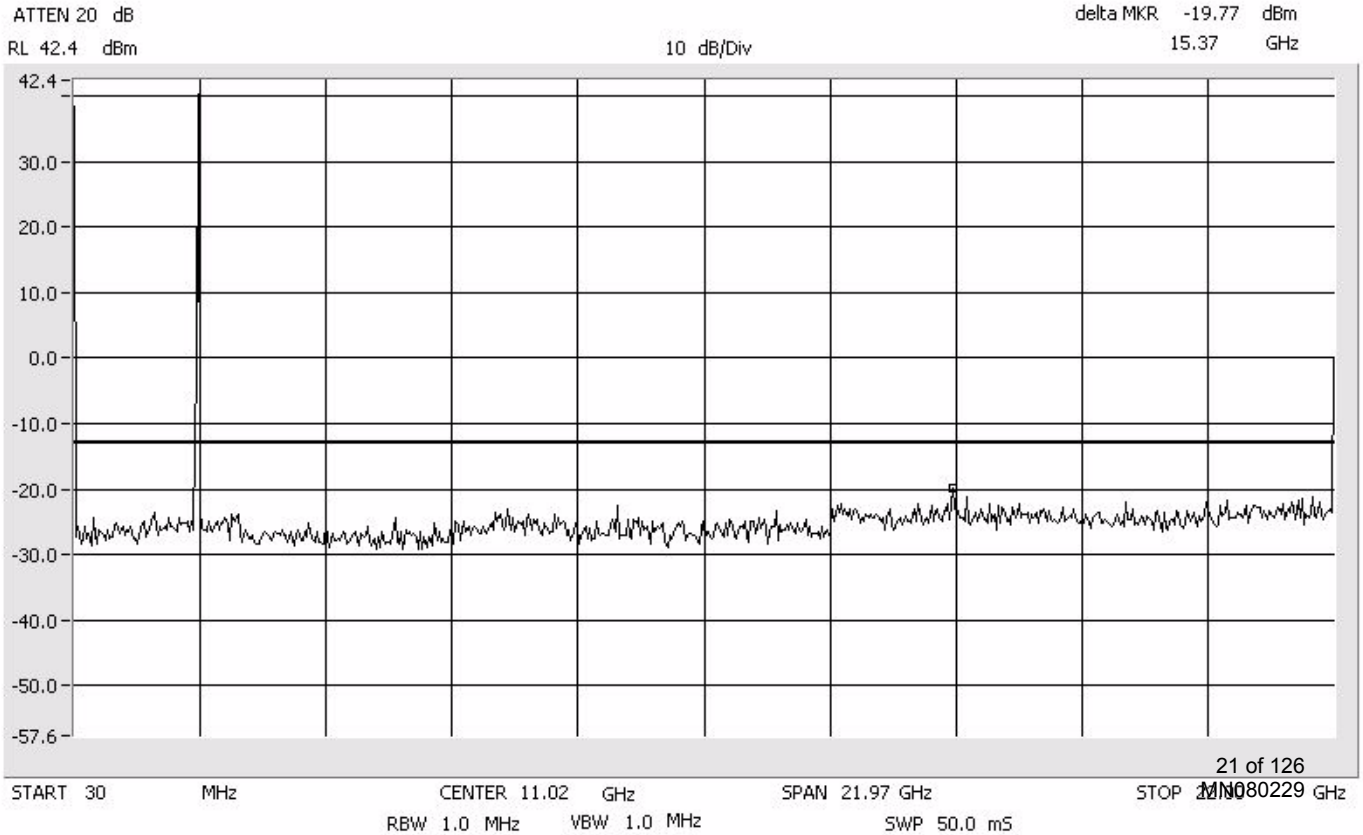
Center: 2137.5 MHz
Span: 50 MHz
RBW/VBW: 100 kHz



Upper Band

Conducted Emissions
Mid
AWS

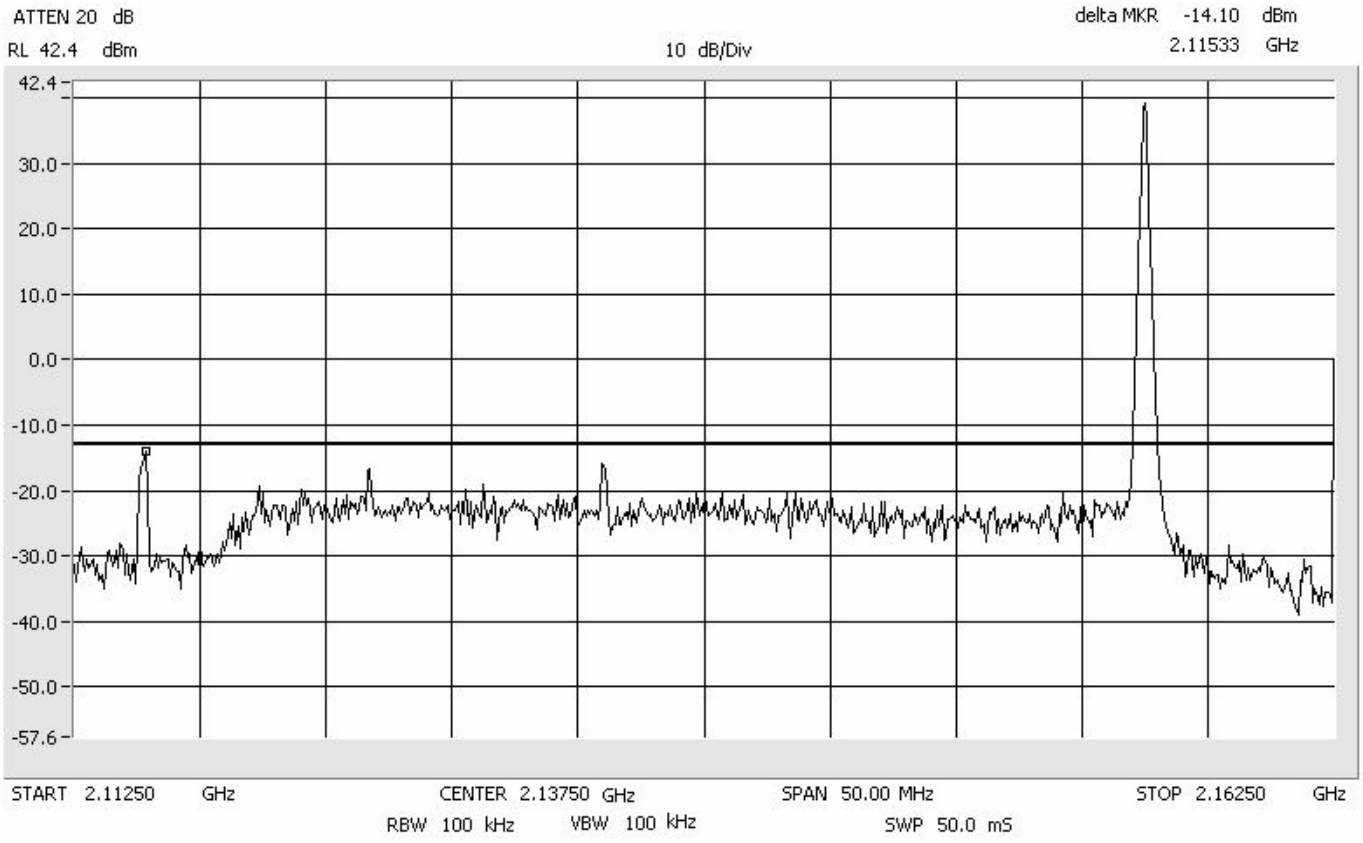
Span: 30 MHz to 22 GHz
RBW/VBW: 1 MHz



Upper Band

Conducted Emissions
High
AWS

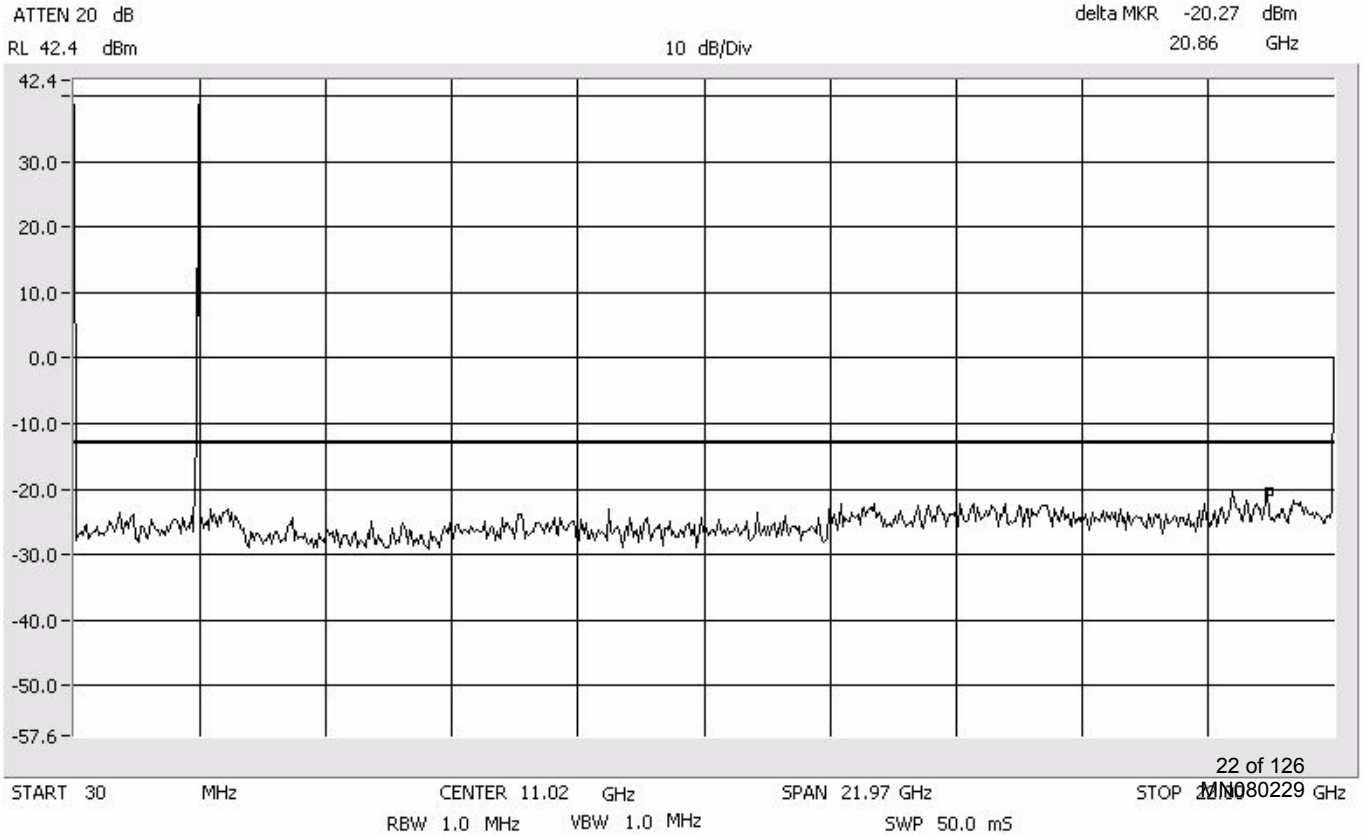
Center: 2137.5 MHz
Span: 50 MHz
RBW/VBW: 100 kHz



Upper Band

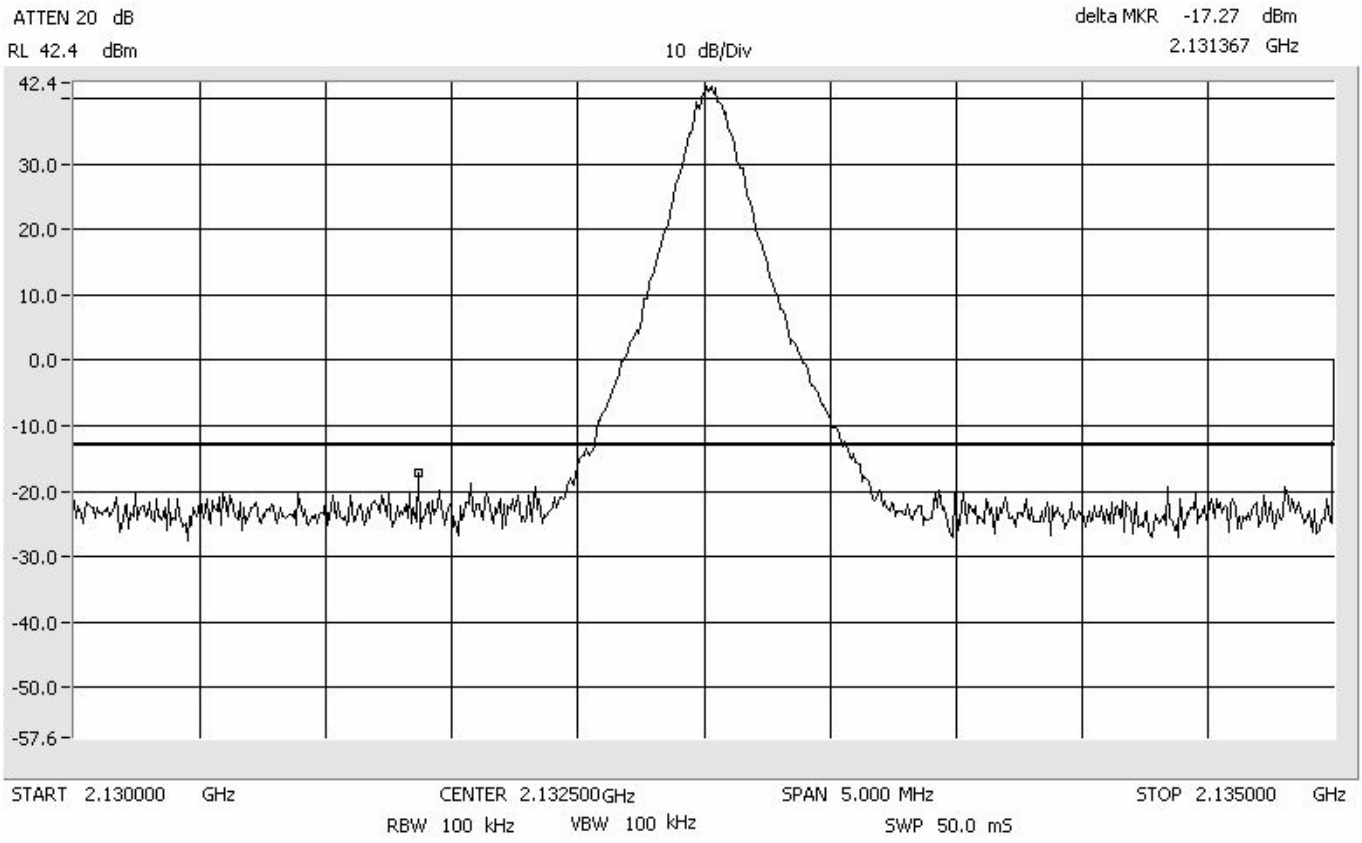
Conducted Emissions
High
AWS

Span: 30 MHz to 22 GHz
RBW/VBW: 1 MHz



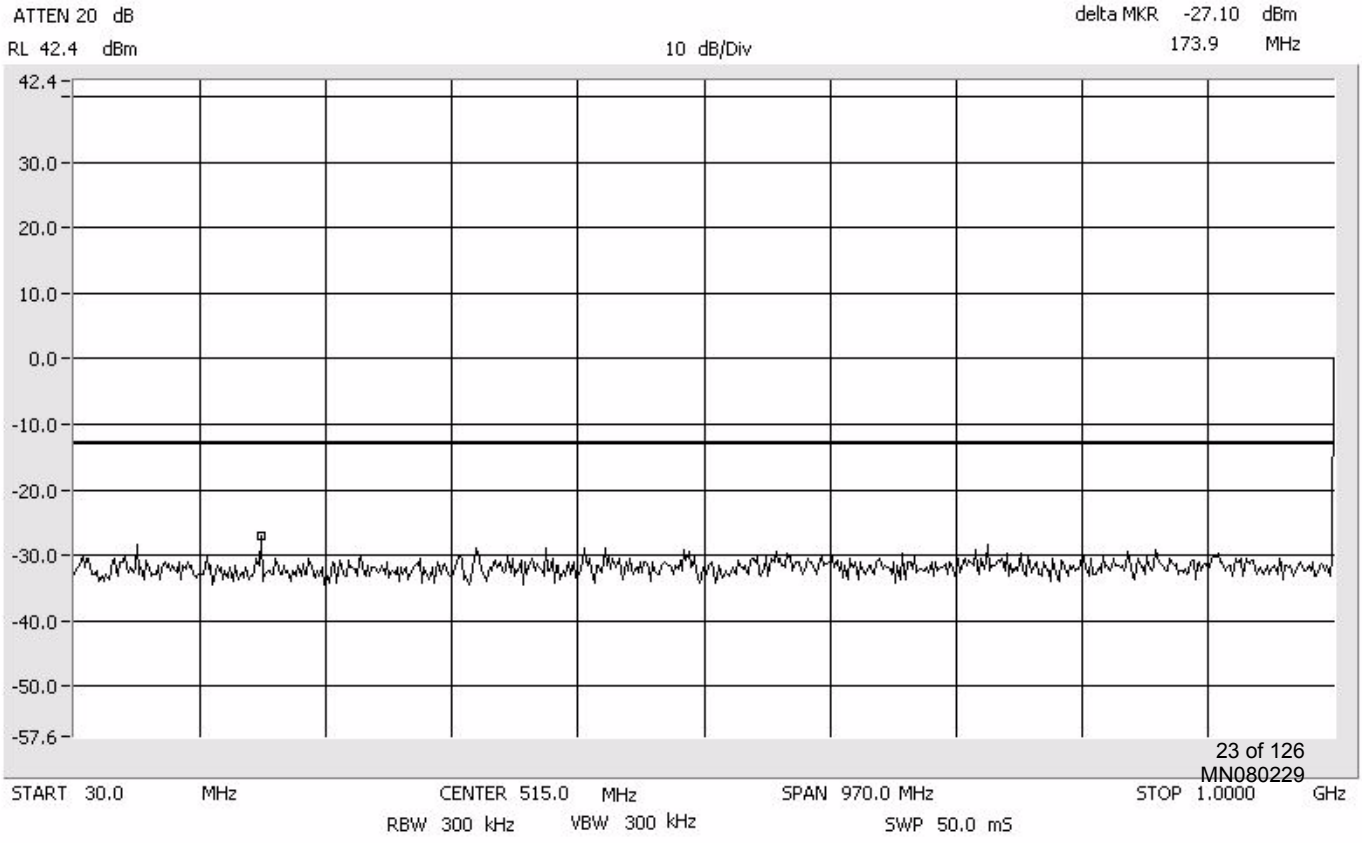
Conducted Emissions
TDMA
AWS

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



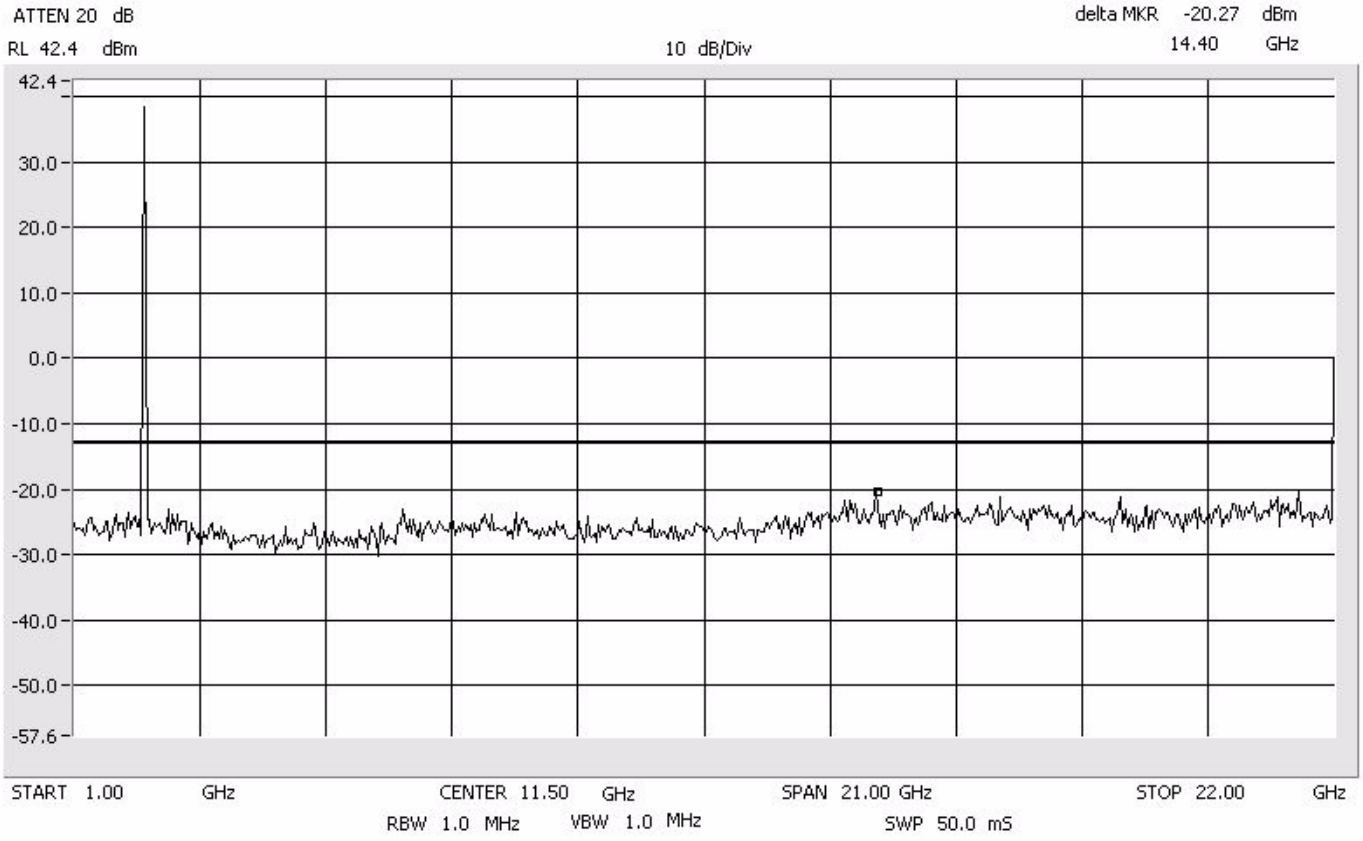
Conducted Emissions
TDMA
AWS

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



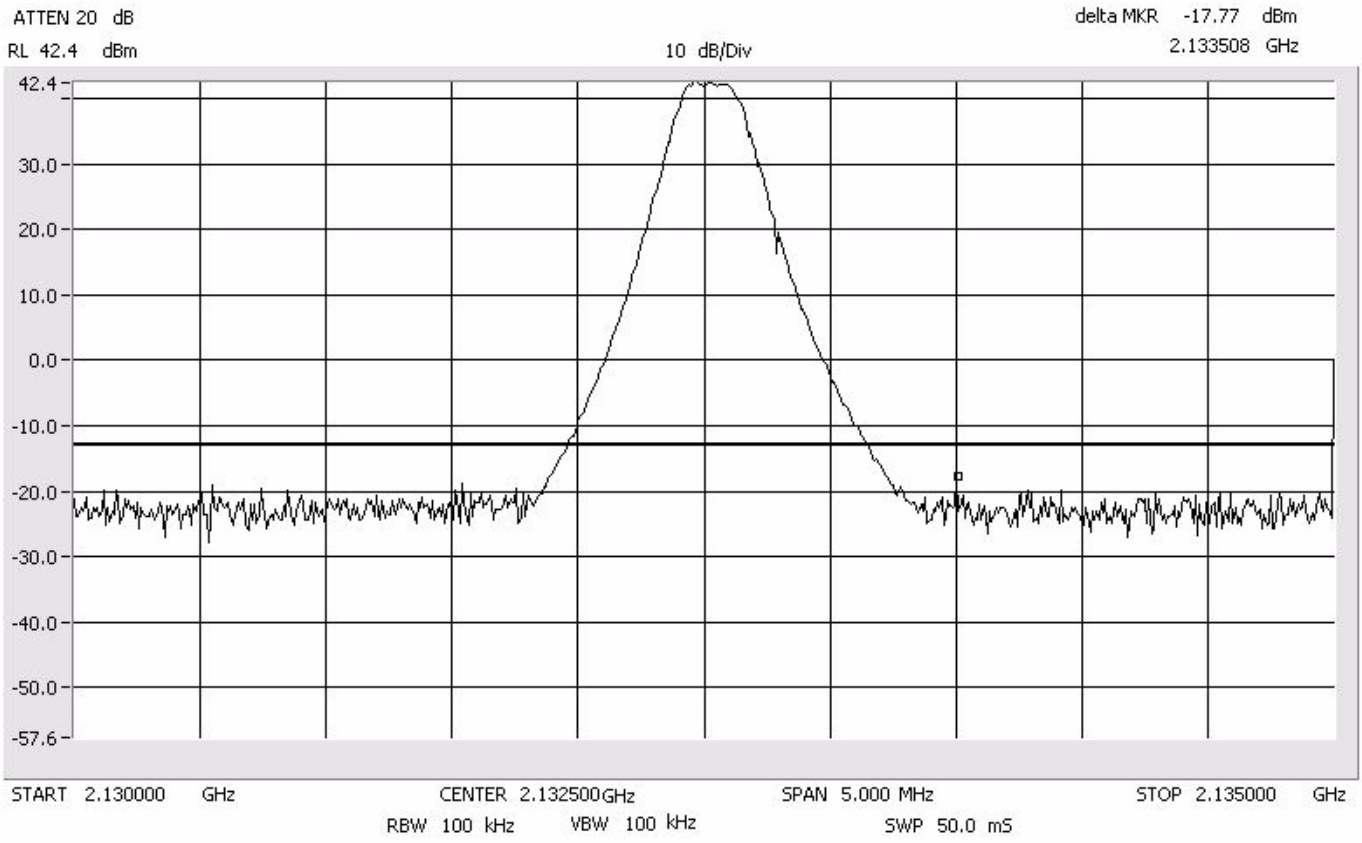
Conducted Emissions
TDMA
AWS

1 GHz to 22 GHz
RBW/VBW: 1 MHz



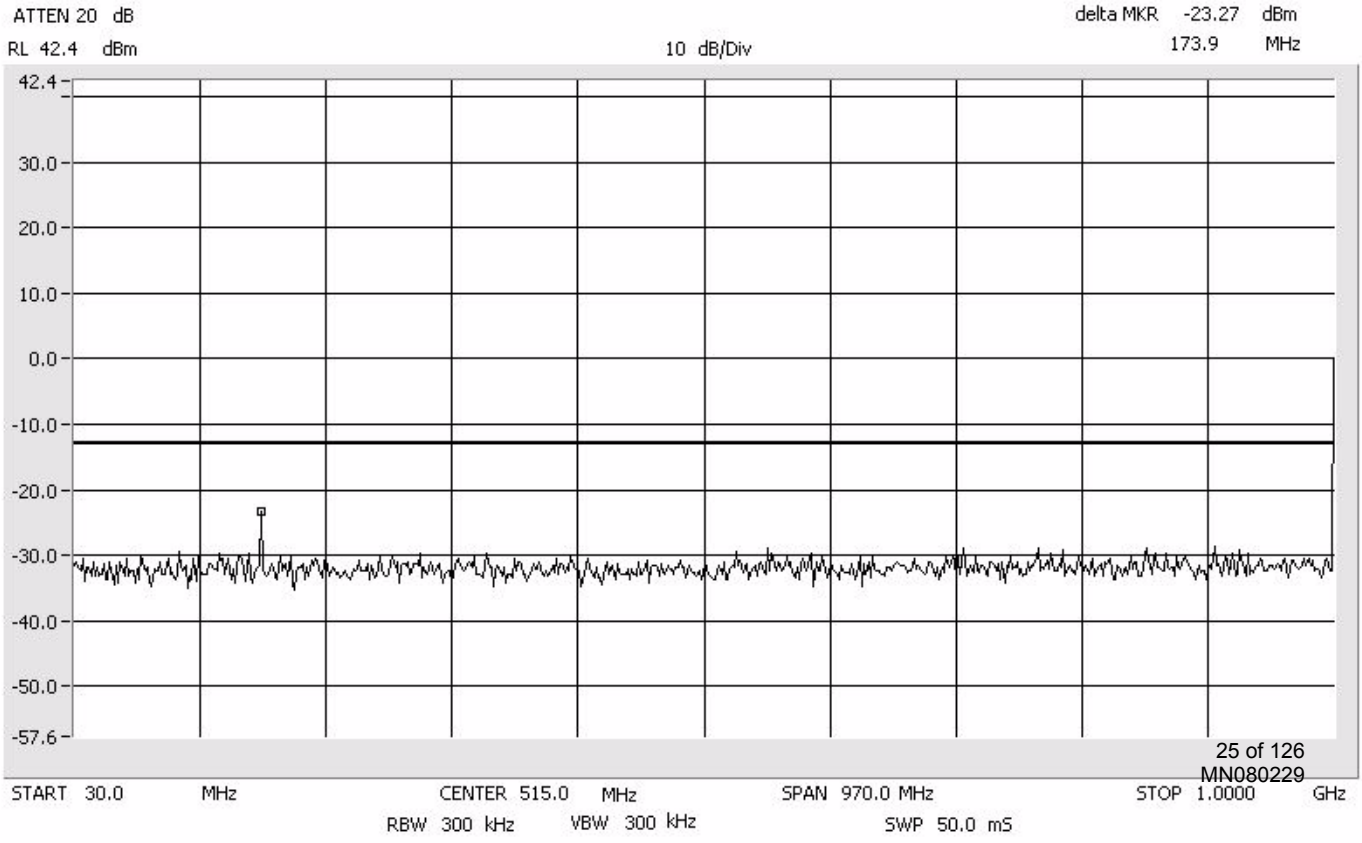
Conducted Emissions
GSM
AWS

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



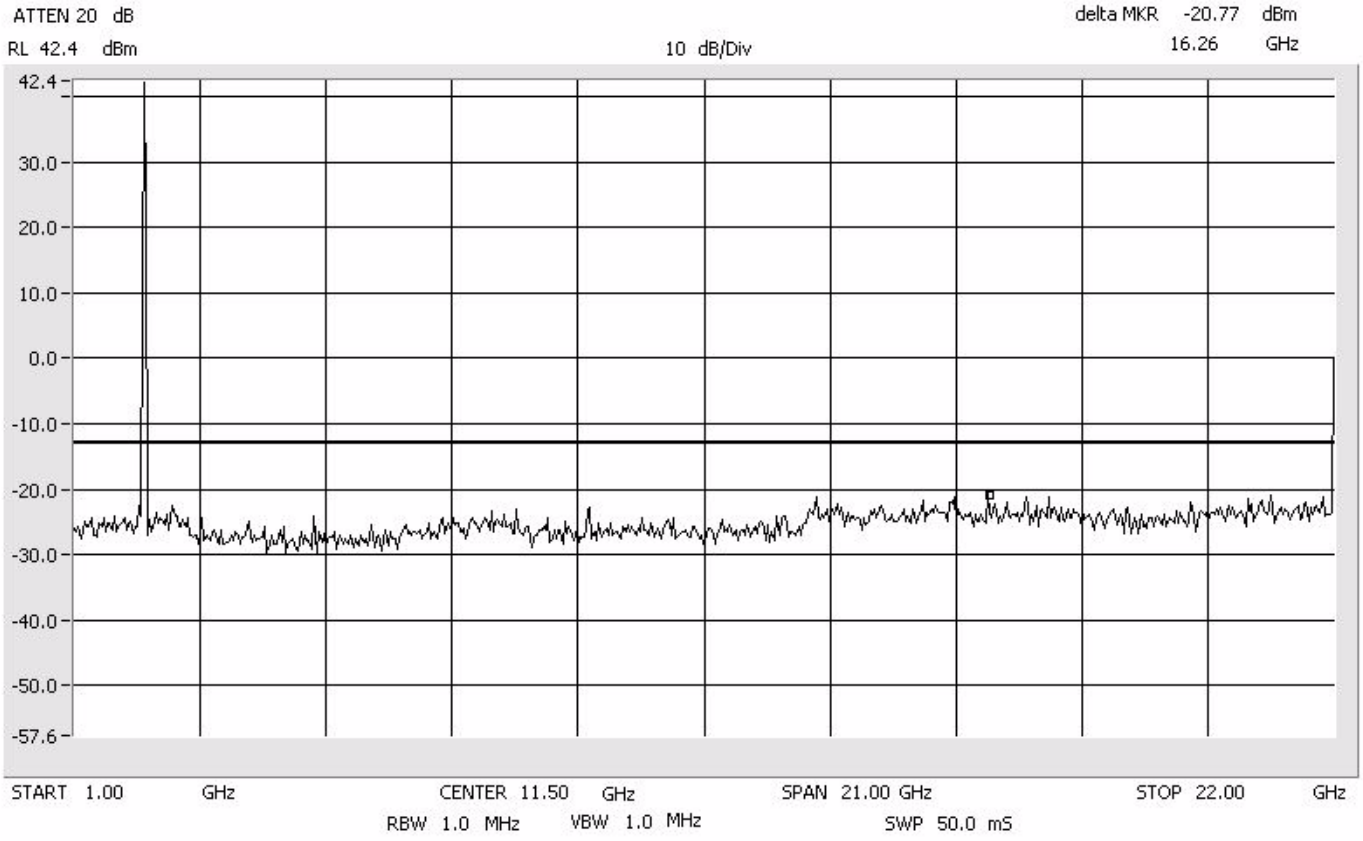
Conducted Emissions
GSM
AWS

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



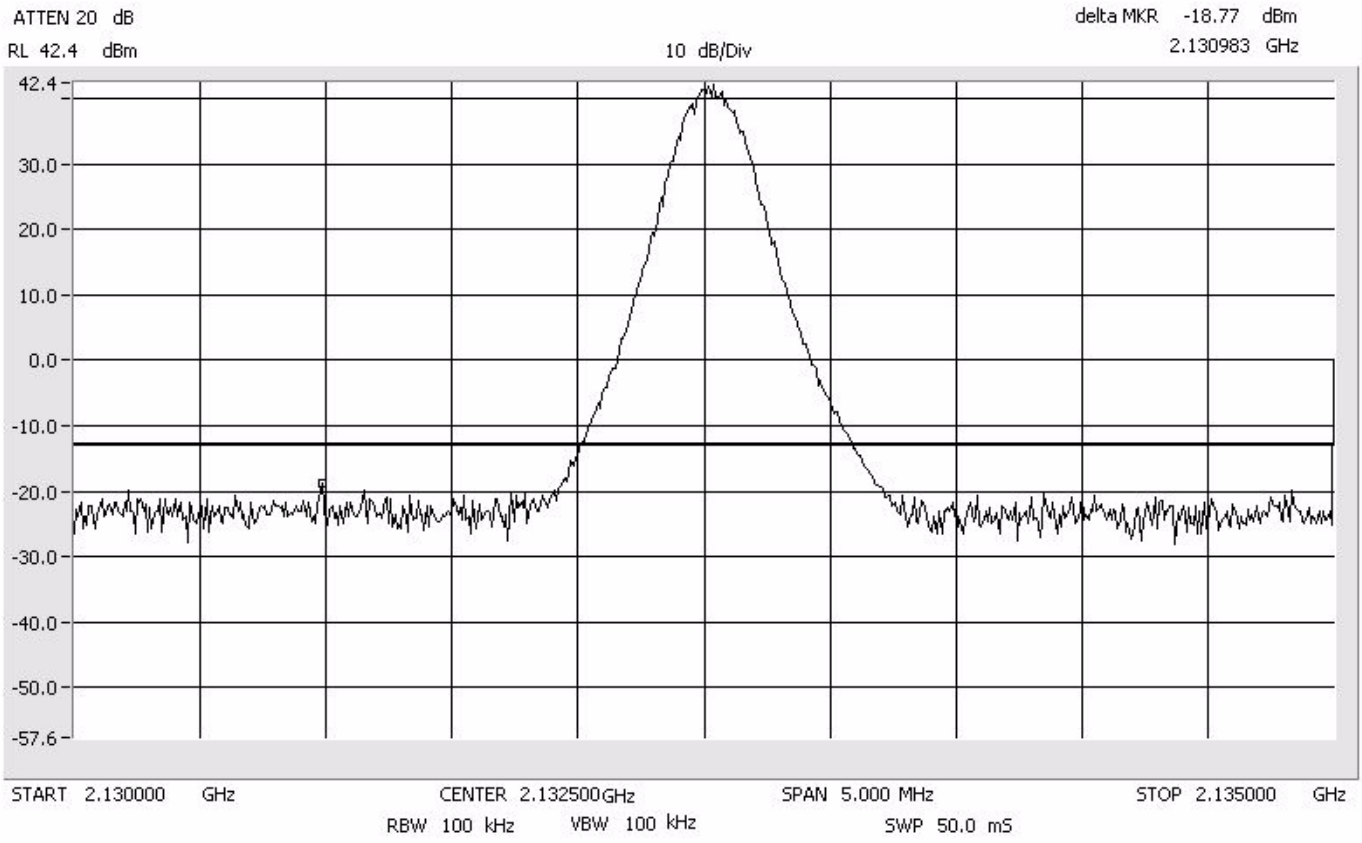
Conducted Emissions
GSM
AWS

1 GHz to 22 GHz
RBW/VBW: 1 MHz



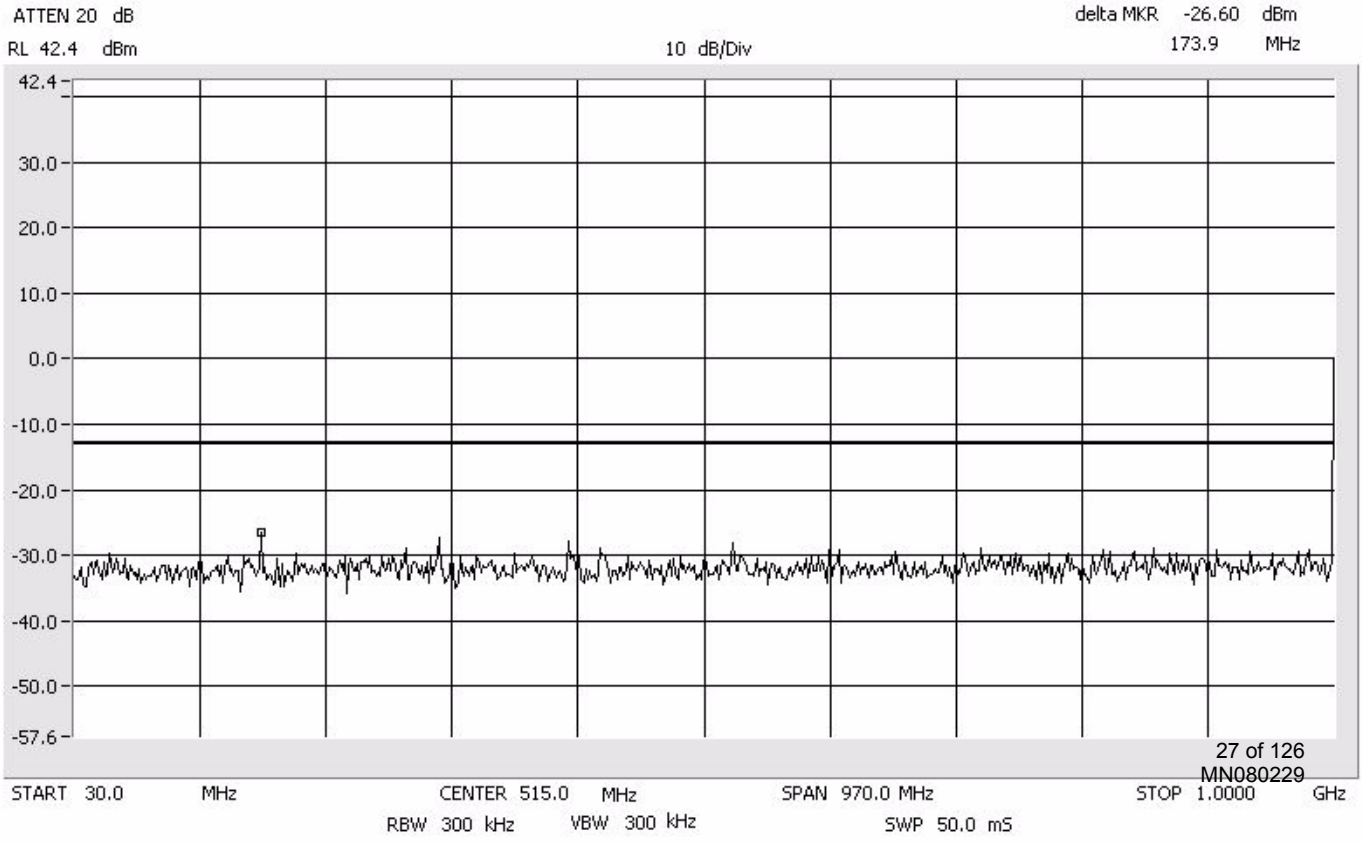
Conducted Emissions
EDGE
AWS

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



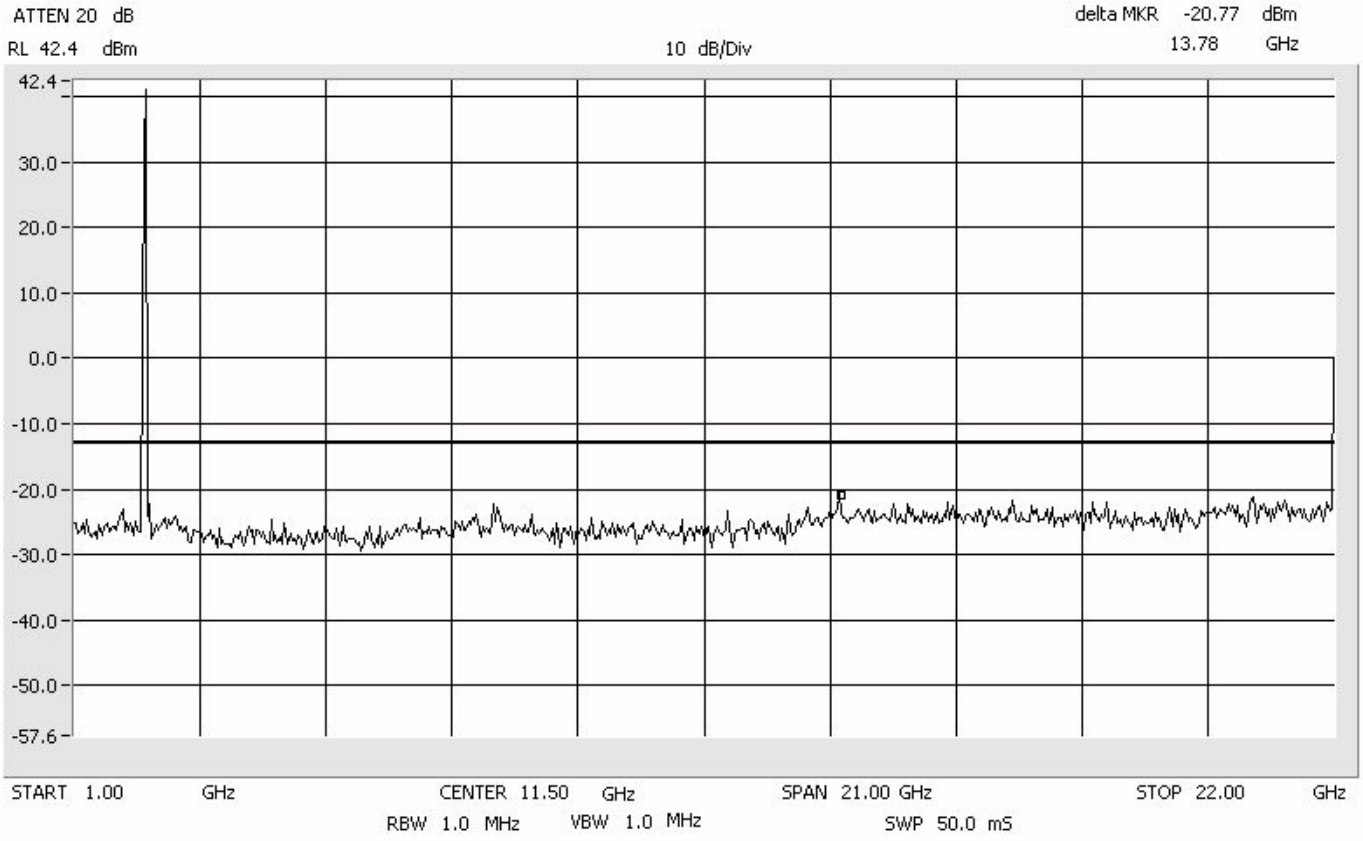
Conducted Emissions
EDGE
AWS

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



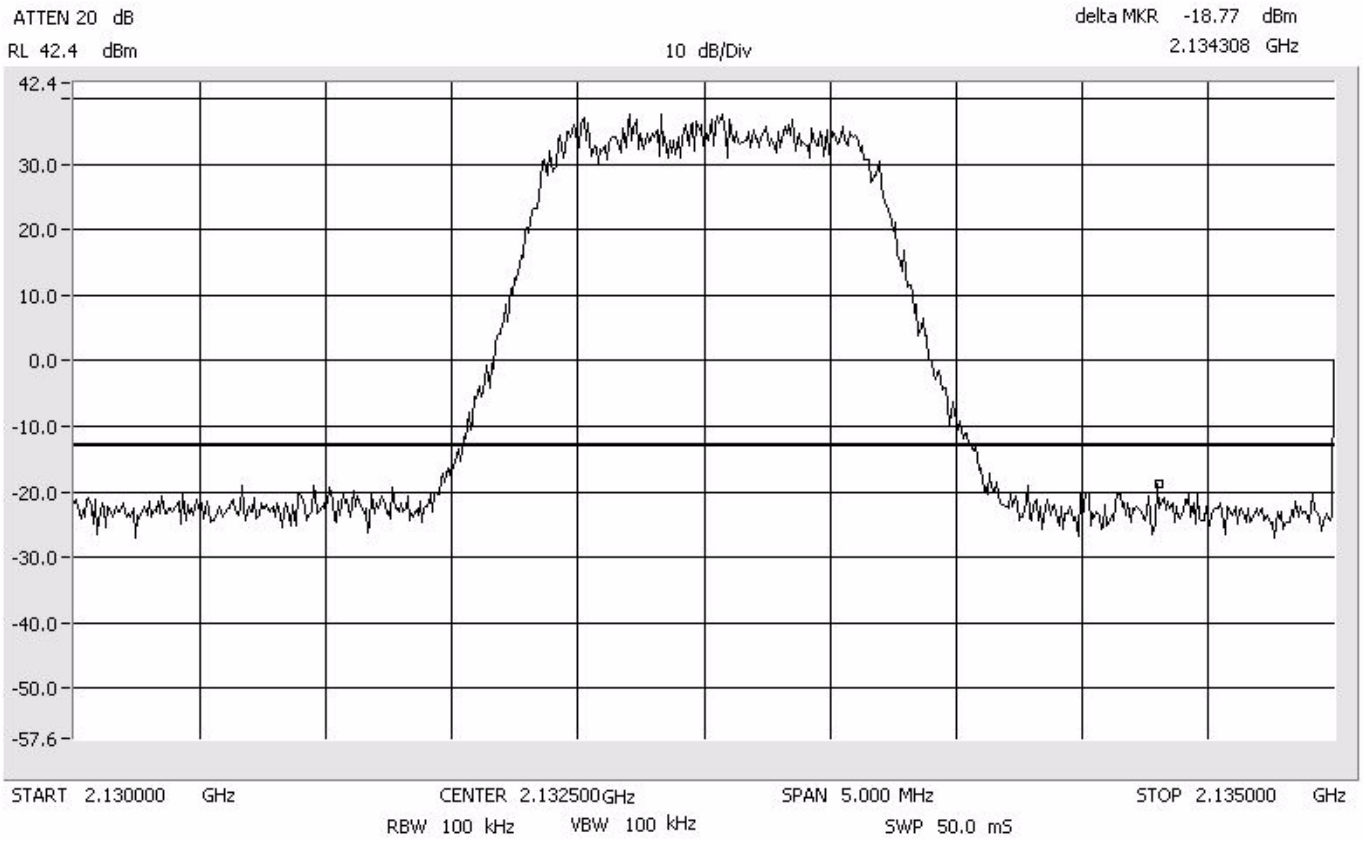
Conducted Emissions
EDGE
AWS

1 GHz to 22 GHz
RBW/VBW: 1 MHz



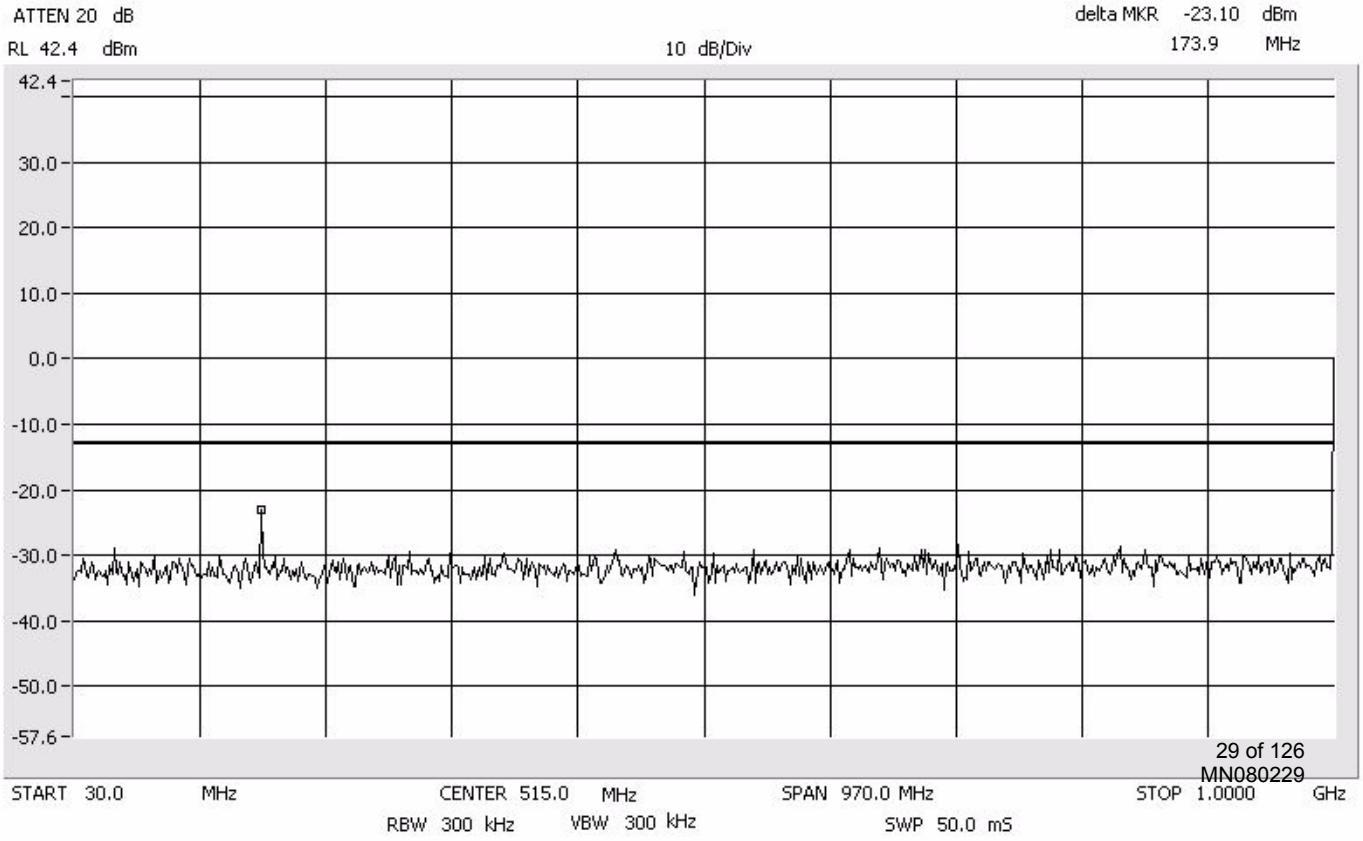
Conducted Emissions
CDMA
AWS

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



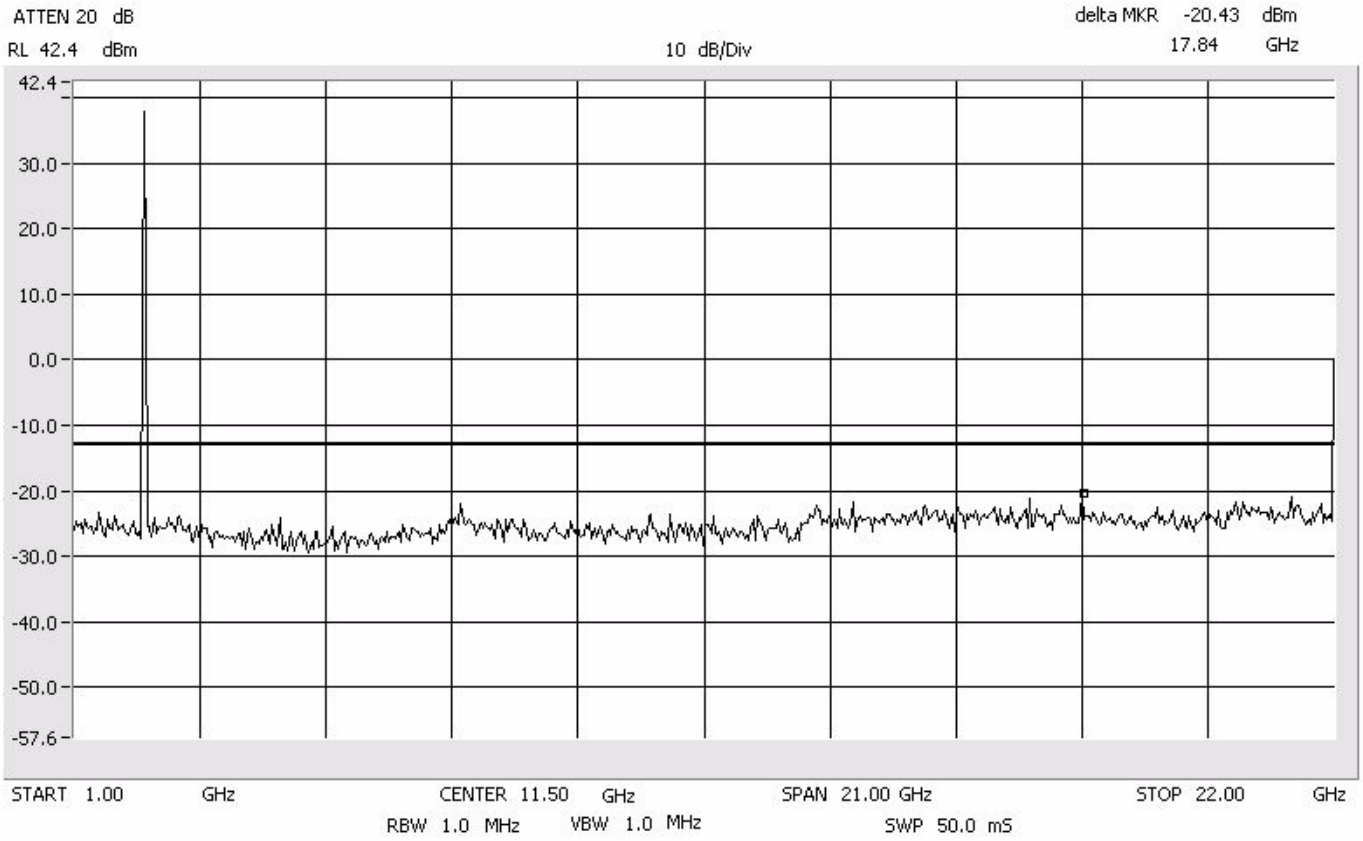
Conducted Emissions
CDMA
AWS

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



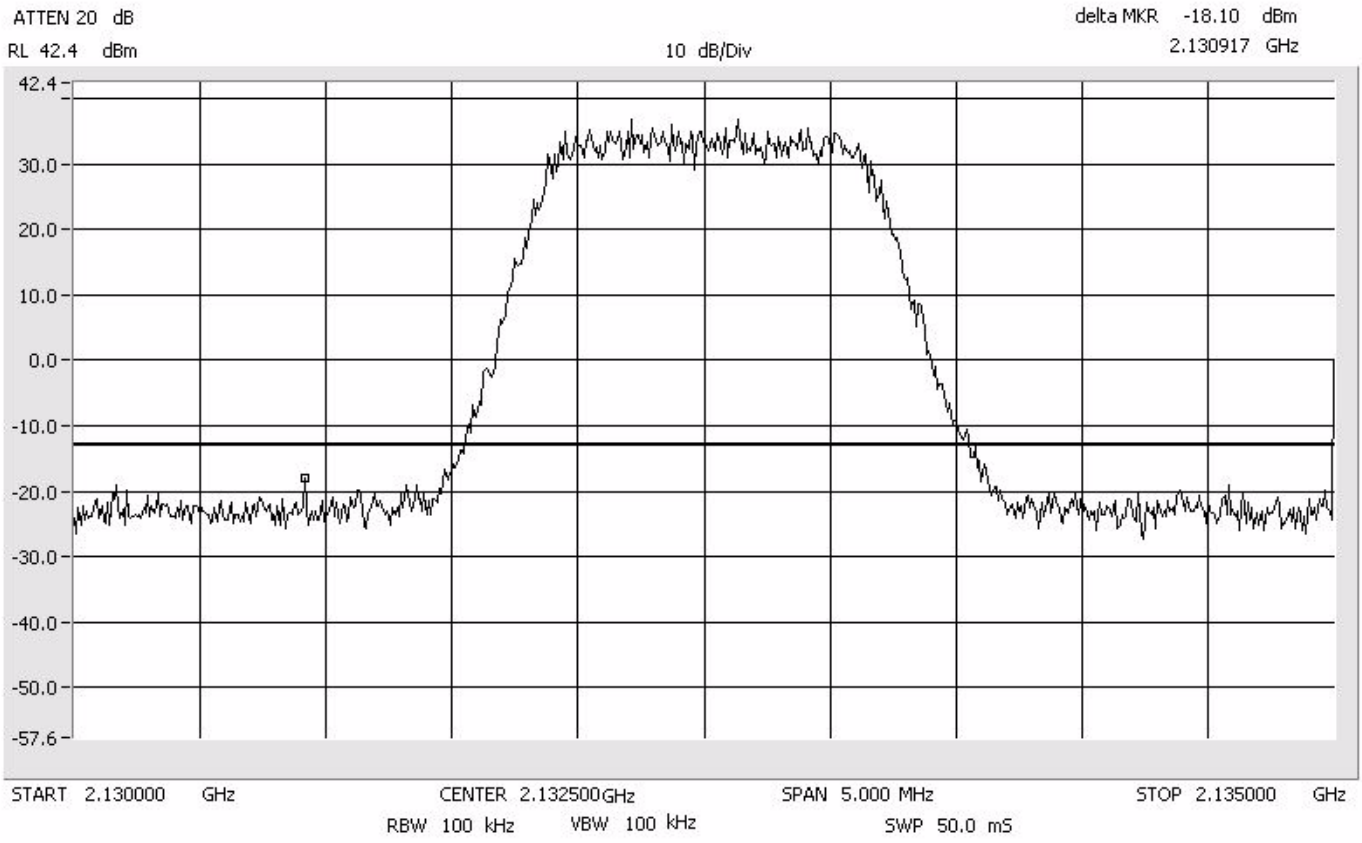
Conducted Emissions
CDMA
AWS

1 GHz to 22 GHz
RBW/VBW: 1 MHz



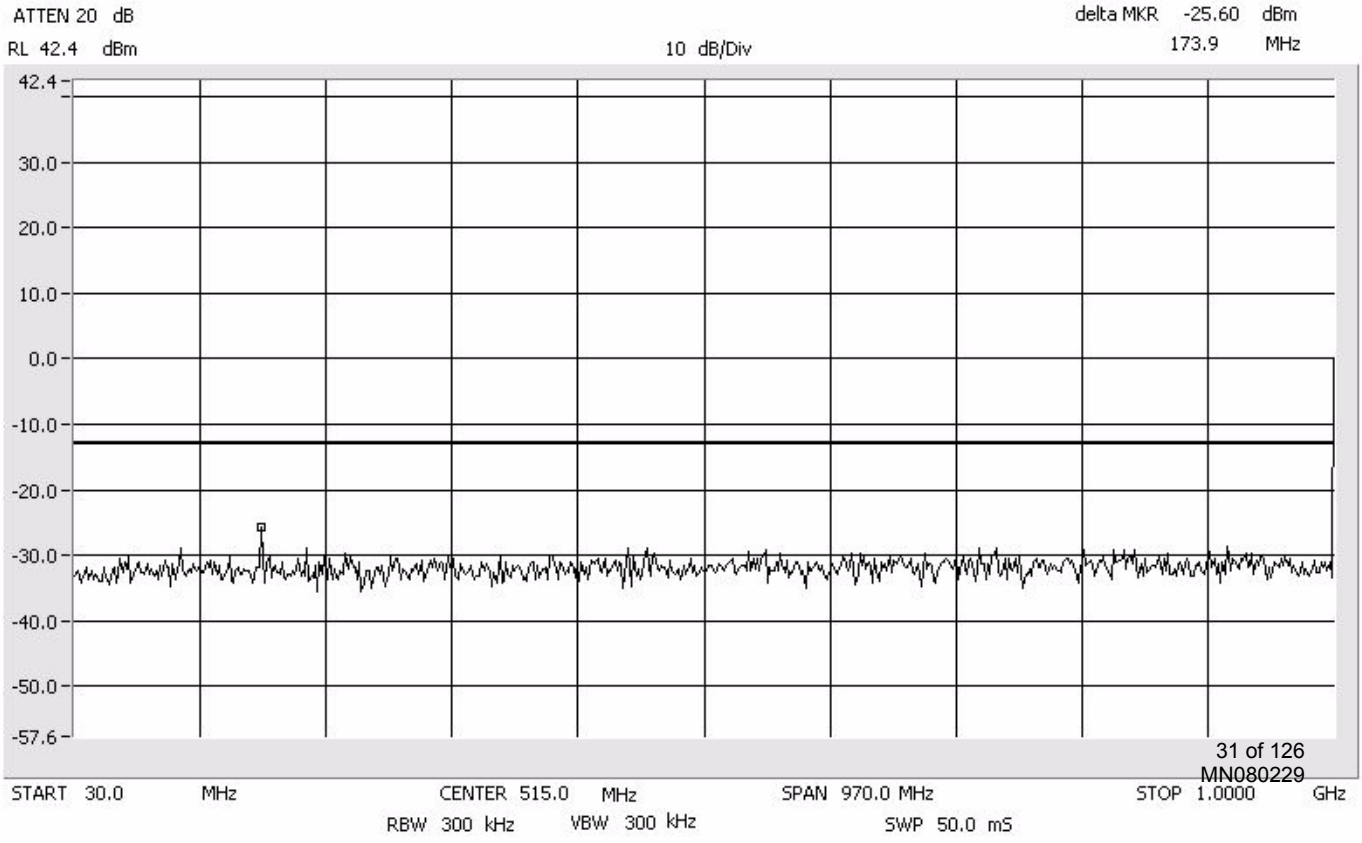
Conducted Emissions
EVDO
AWS

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



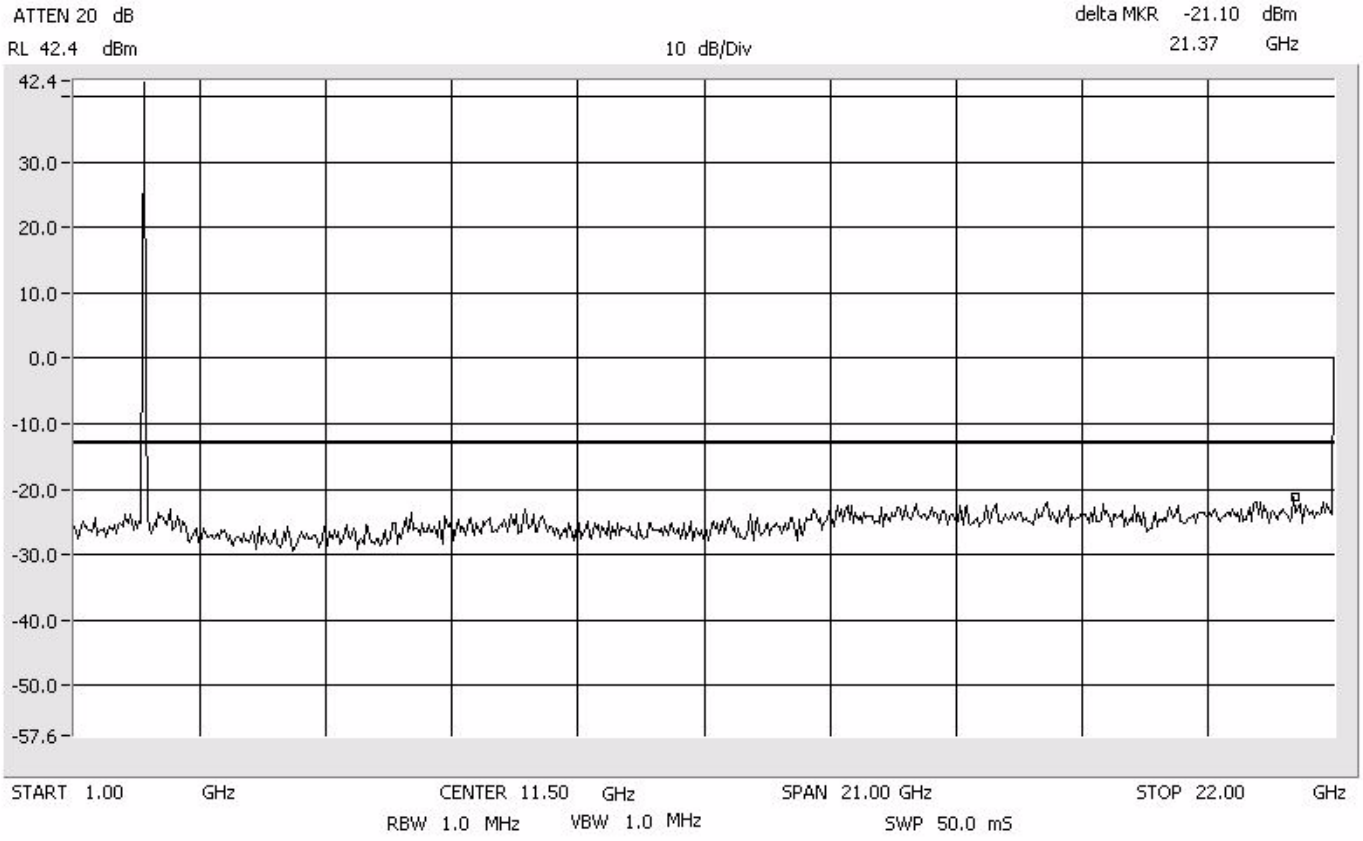
Conducted Emissions
EVDO
AWS

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



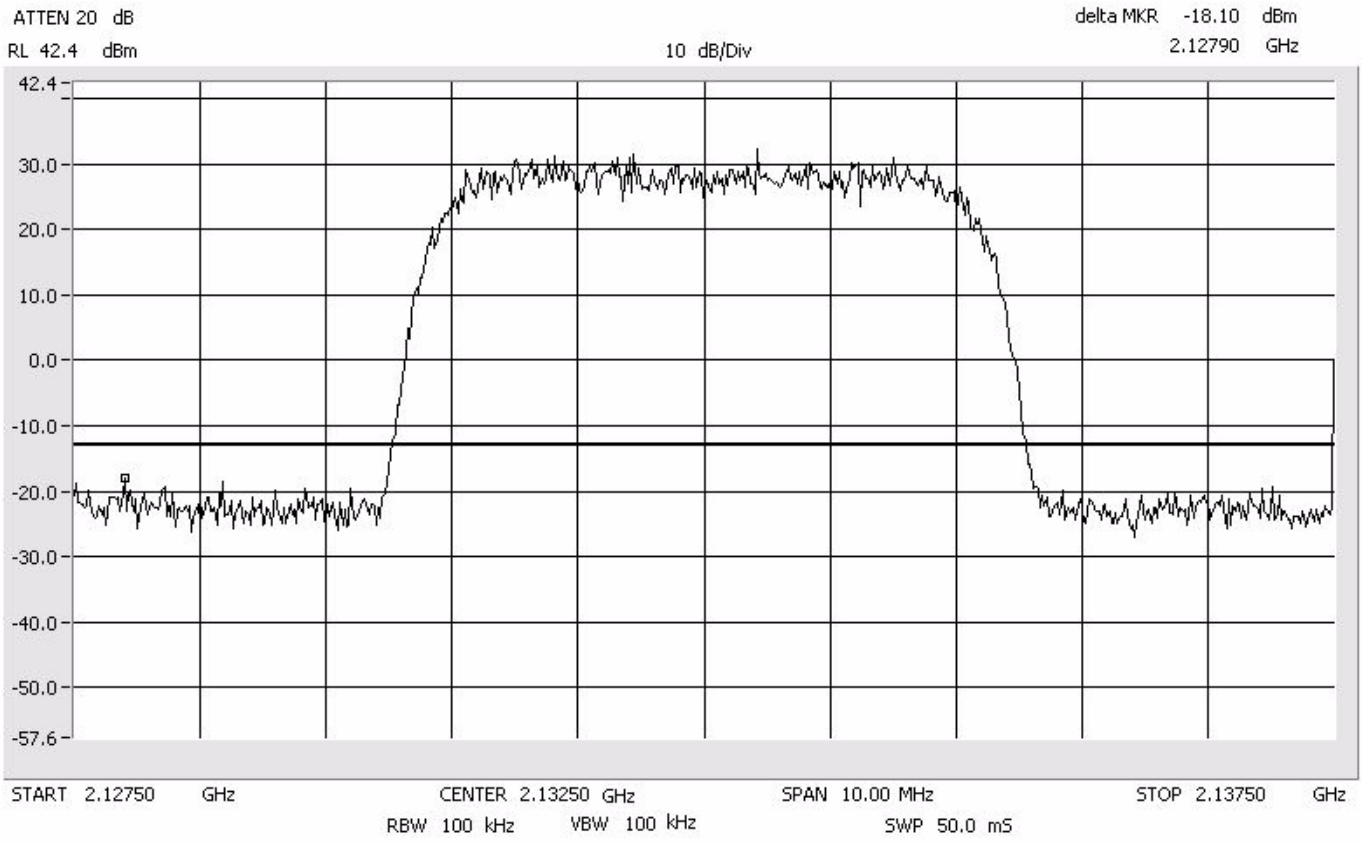
Conducted Emissions
EVDO
AWS

1 GHz to 22 GHz
RBW/VBW: 1 MHz



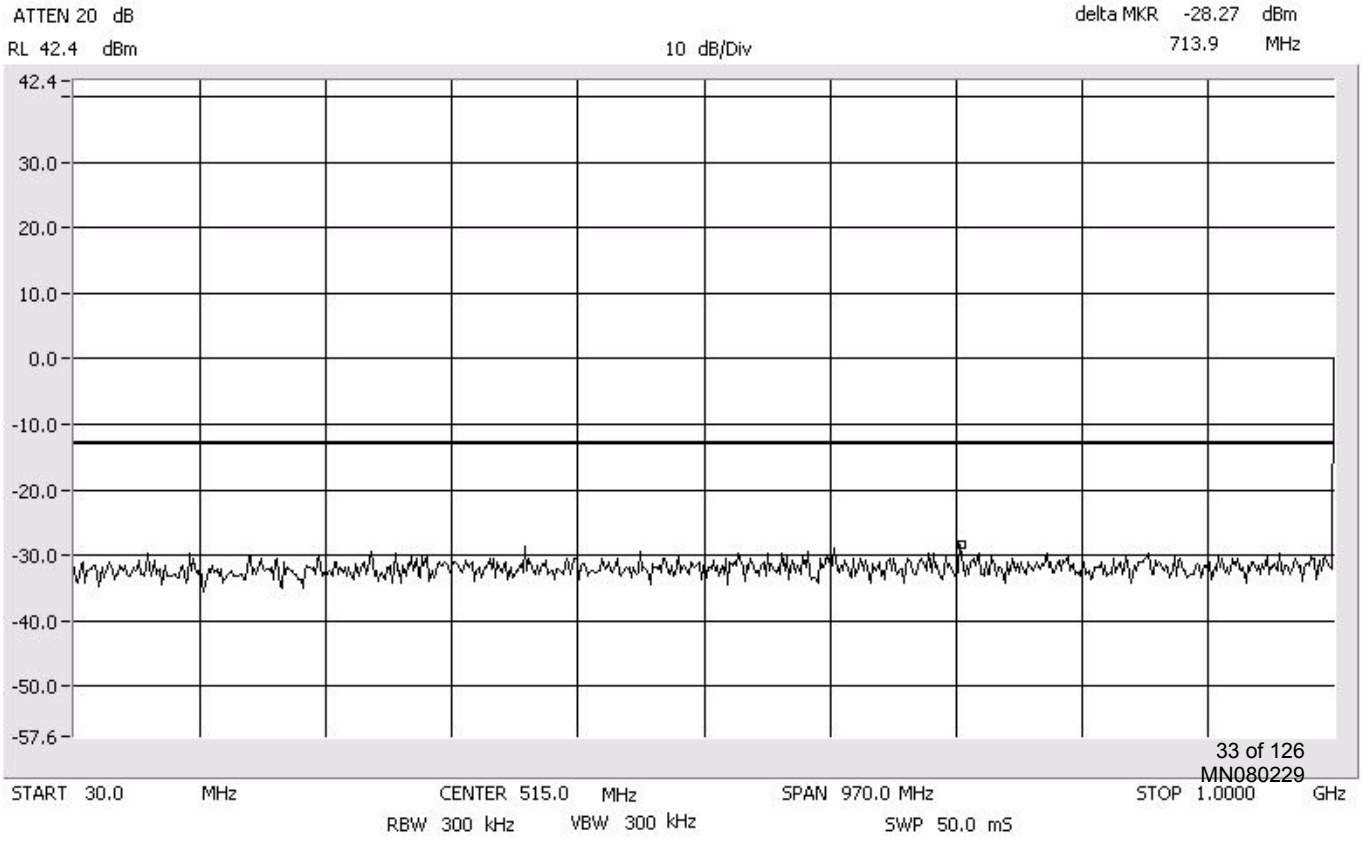
Conducted Emissions
W-CDMA
AWS

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



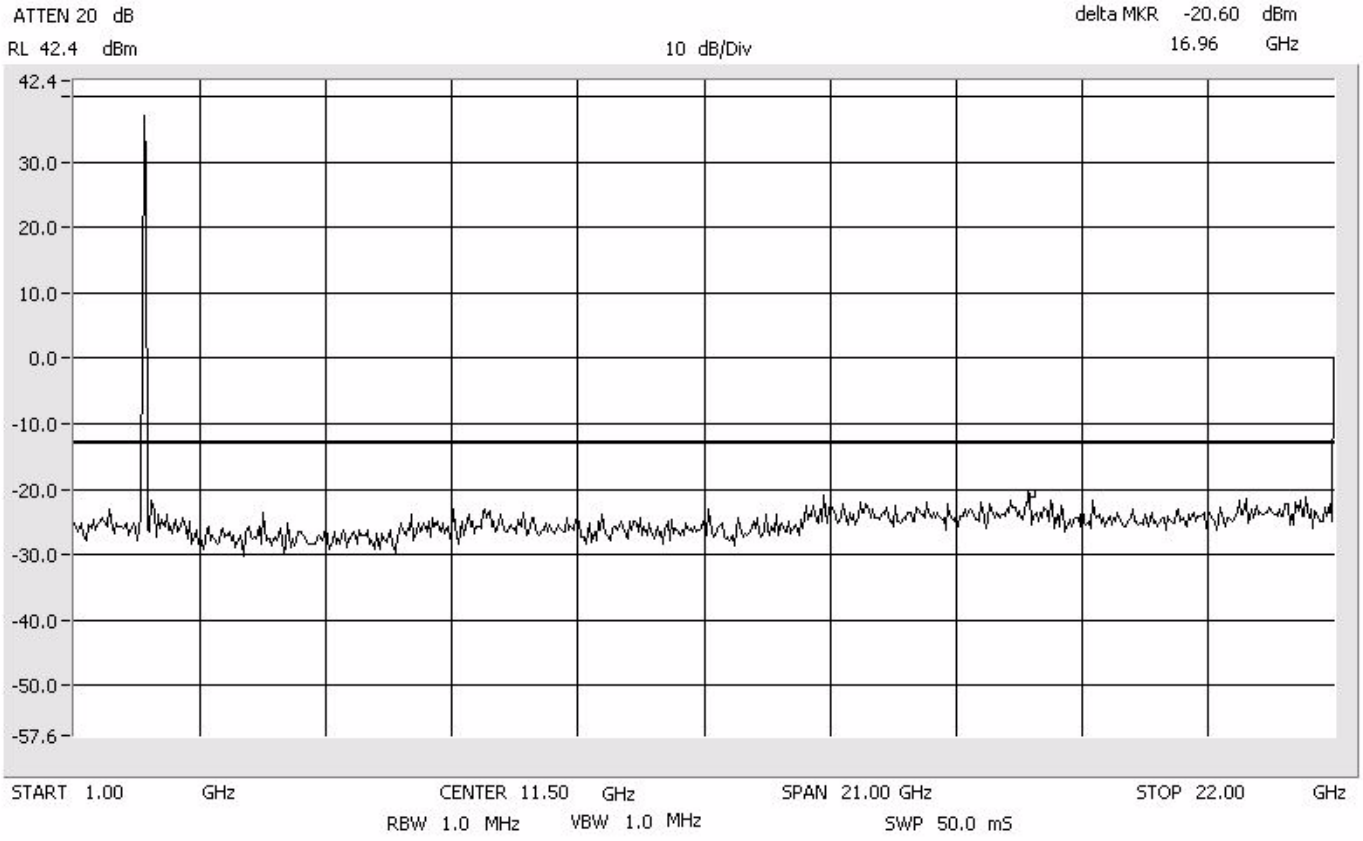
Conducted Emissions
W-CDMA
AWS

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



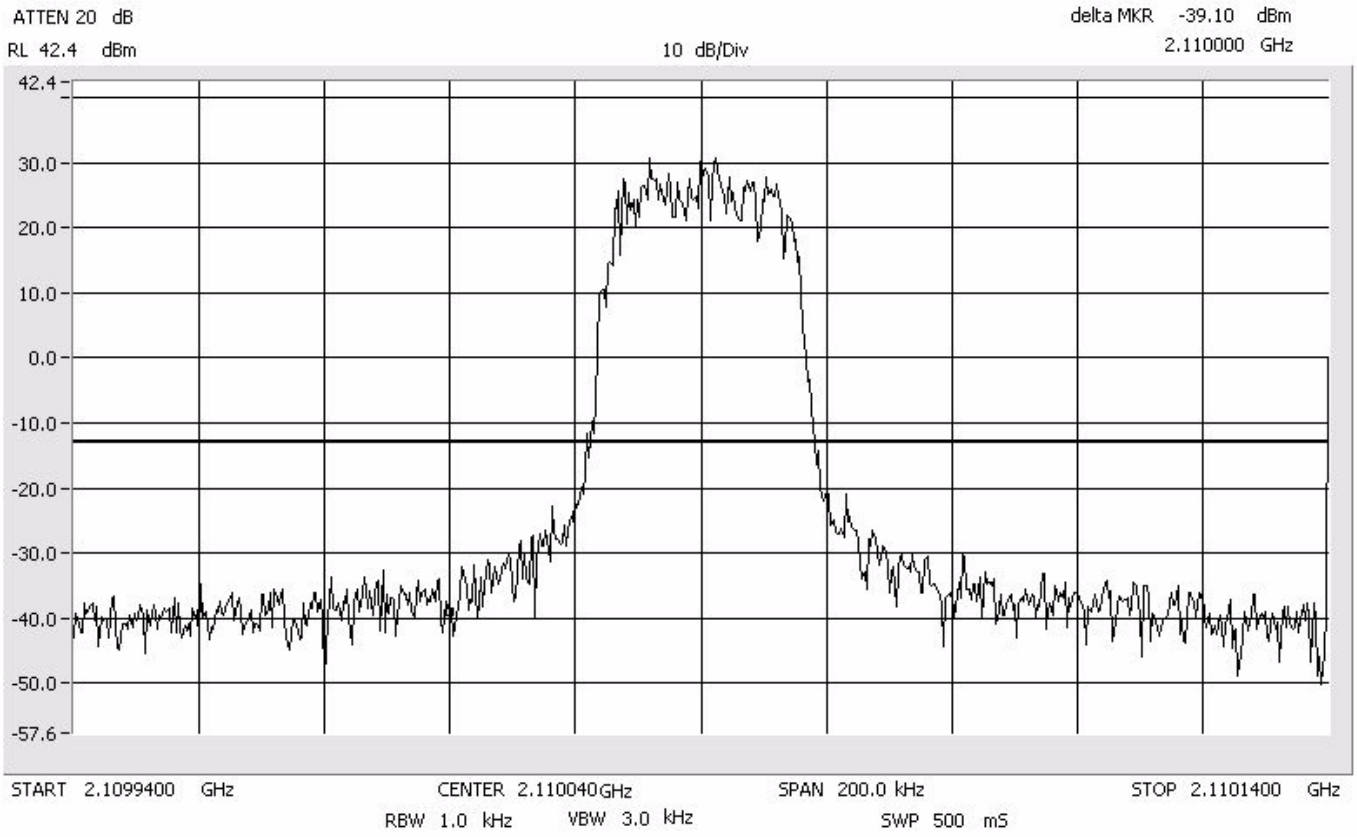
Conducted Emissions
W-CDMA
AWS

1 GHz to 22 GHz
RBW/VBW: 1 MHz



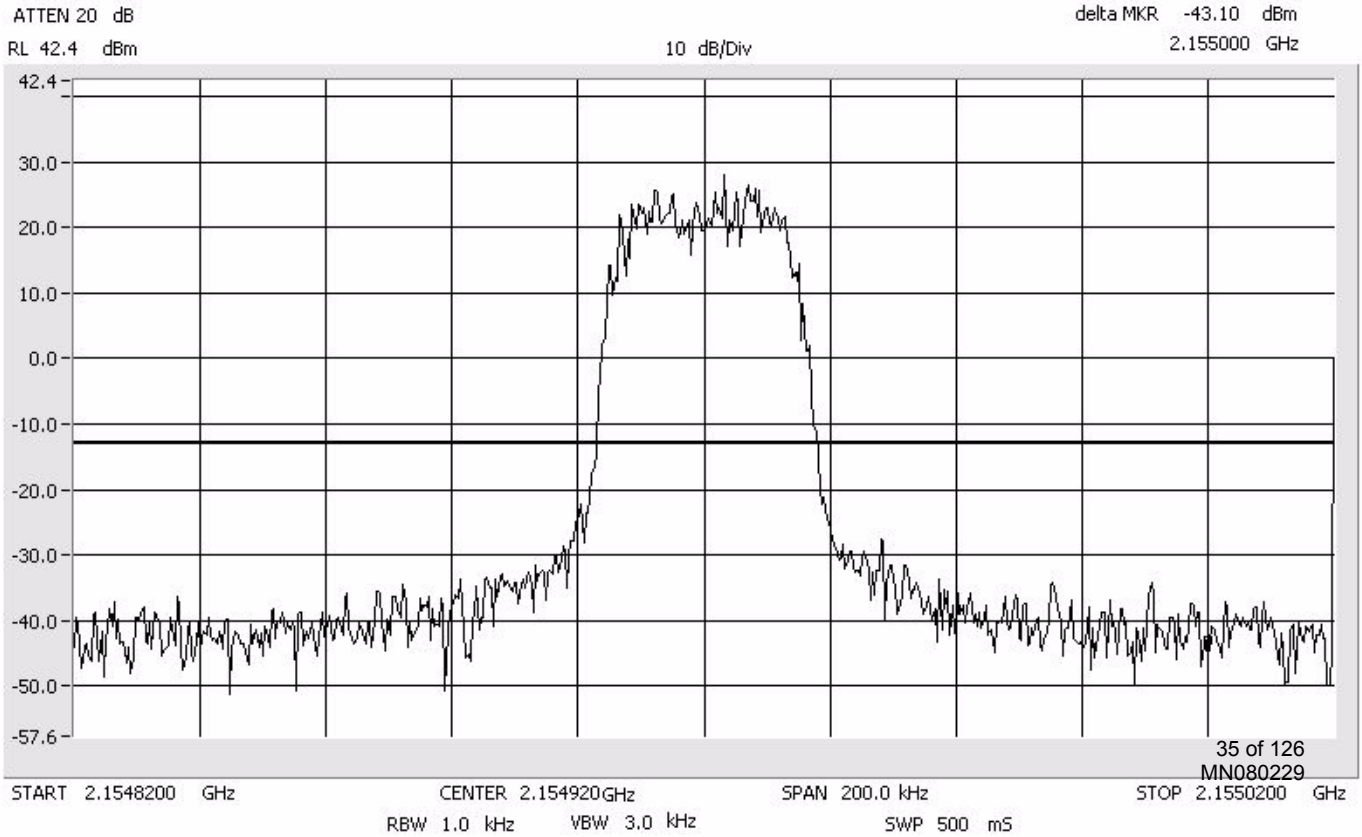
Band Edge
TDMA

Center: 2110.04
Span: 200 kHz
RBW: 1 kHz
VBW: 3 kHz



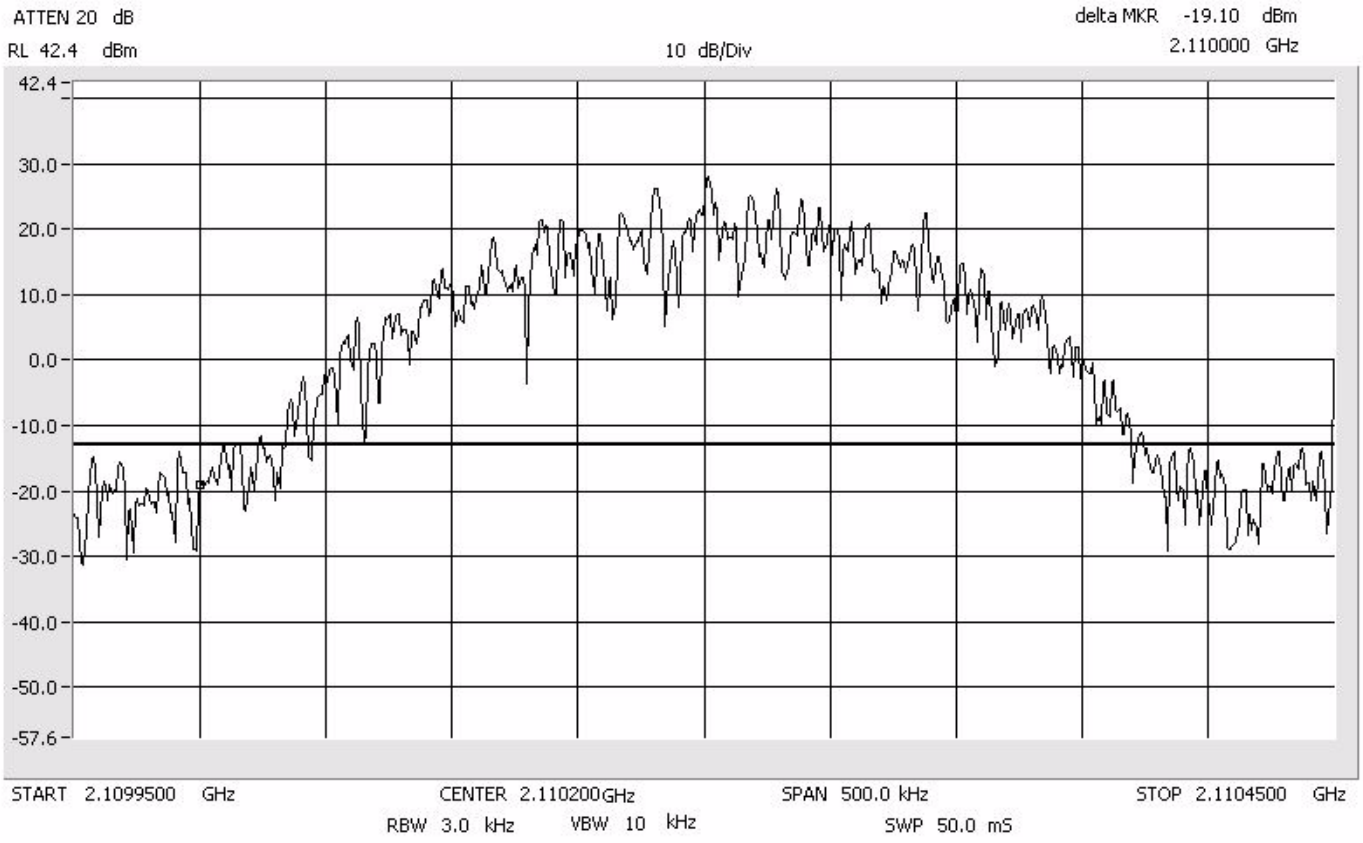
Band Edge
TDMA

Center: 2154.92 MHz
Span: 200 kHz
RBW: 1 kHz
VBW: 3 kHz



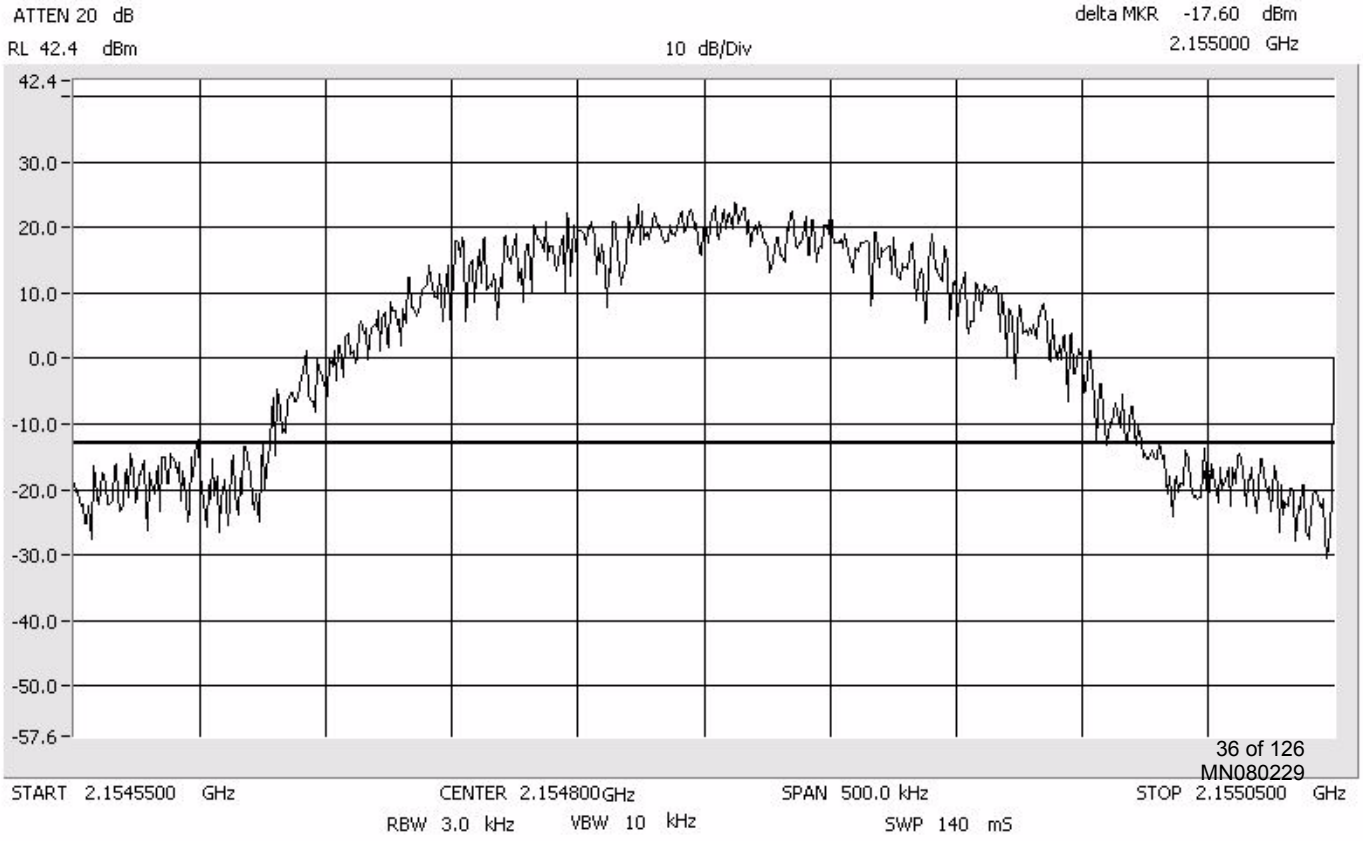
Band Edge
GSM

Center: 2110.20
Span: 500 kHz
RBW: 3 kHz
VBW: 10 kHz



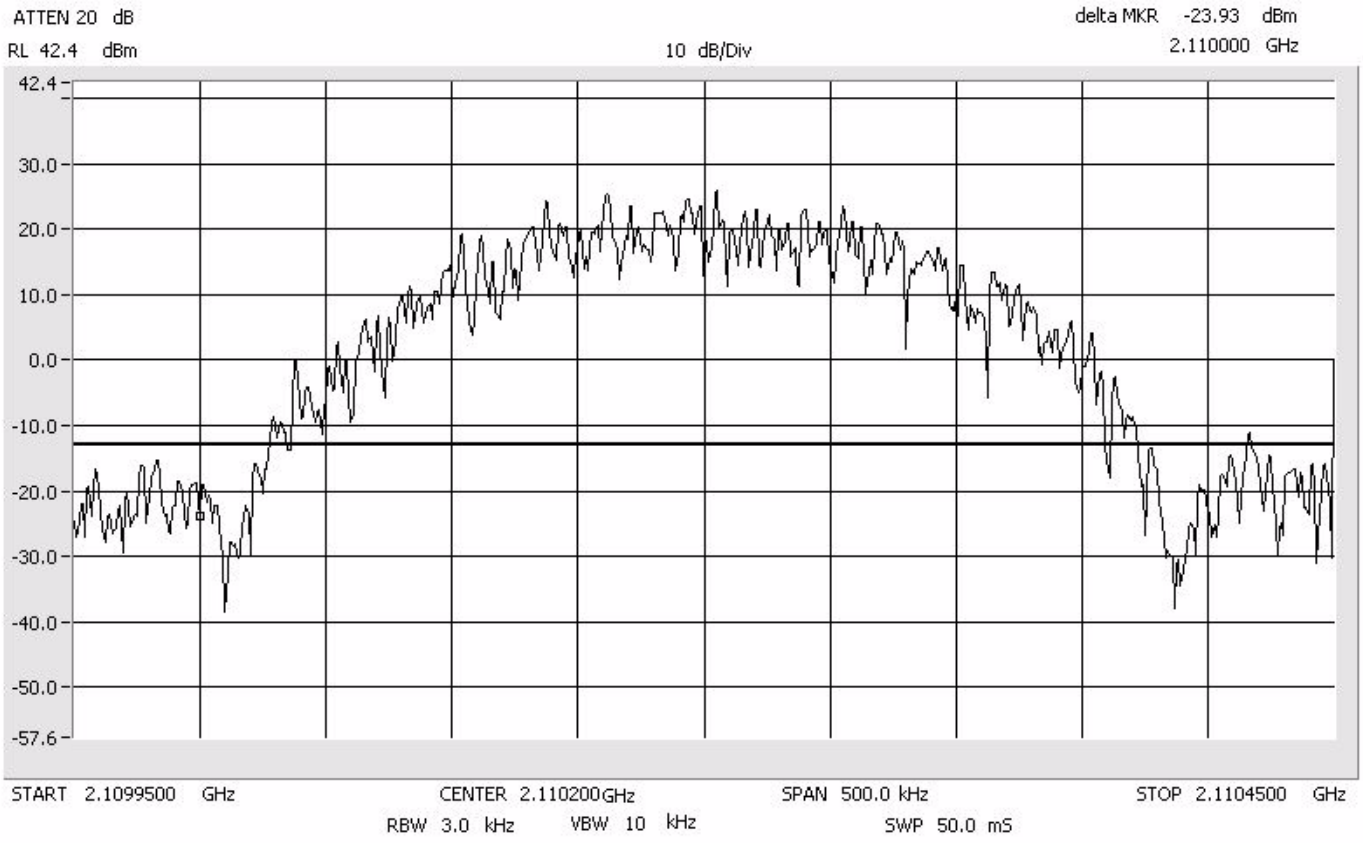
Band Edge
GSM

Center: 2154.80 MHz
Span: 500 kHz
RBW: 3 kHz
VBW: 10 kHz



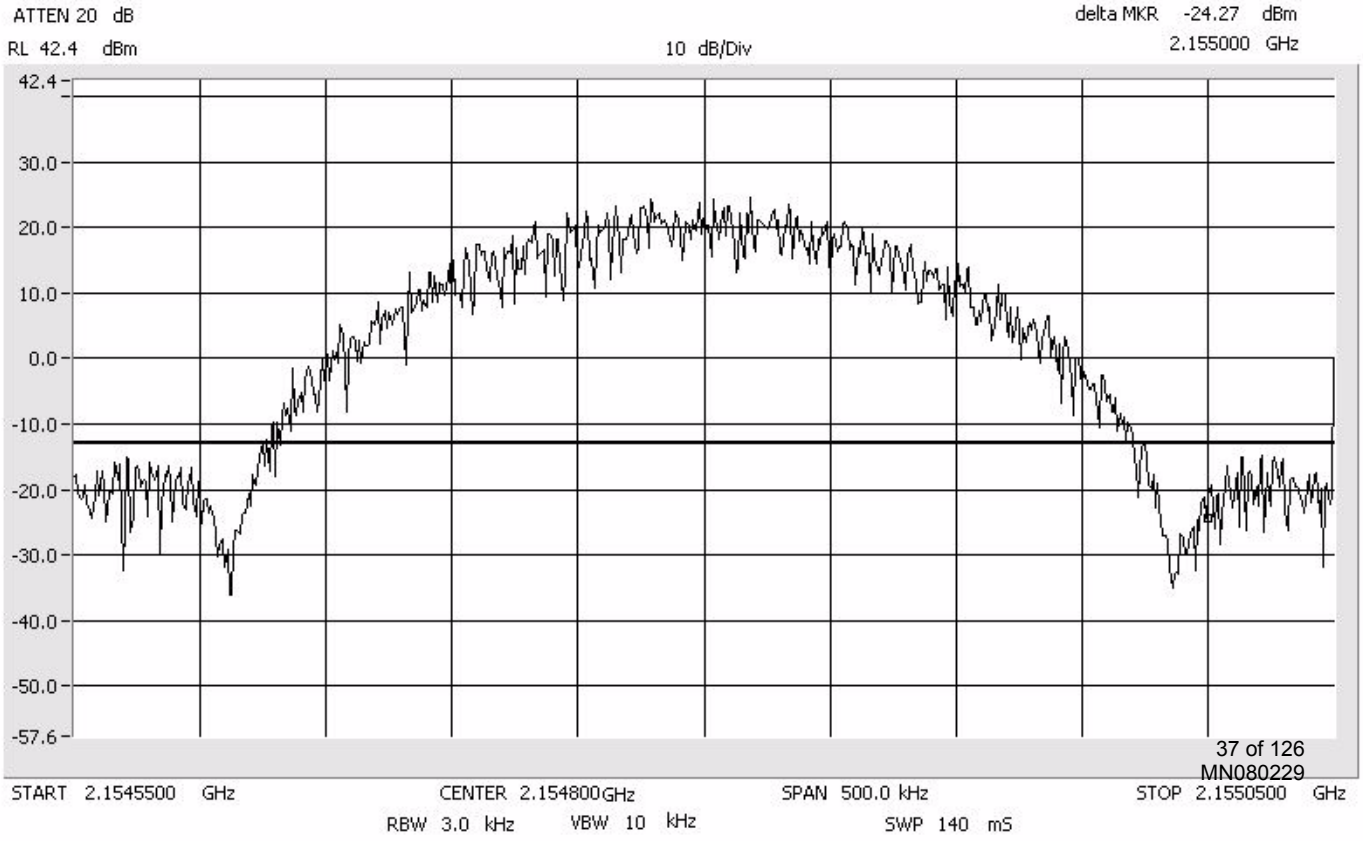
Band Edge
EDGE

Center: 2110.20
Span: 500 kHz
RBW: 3 kHz
VBW: 10 kHz



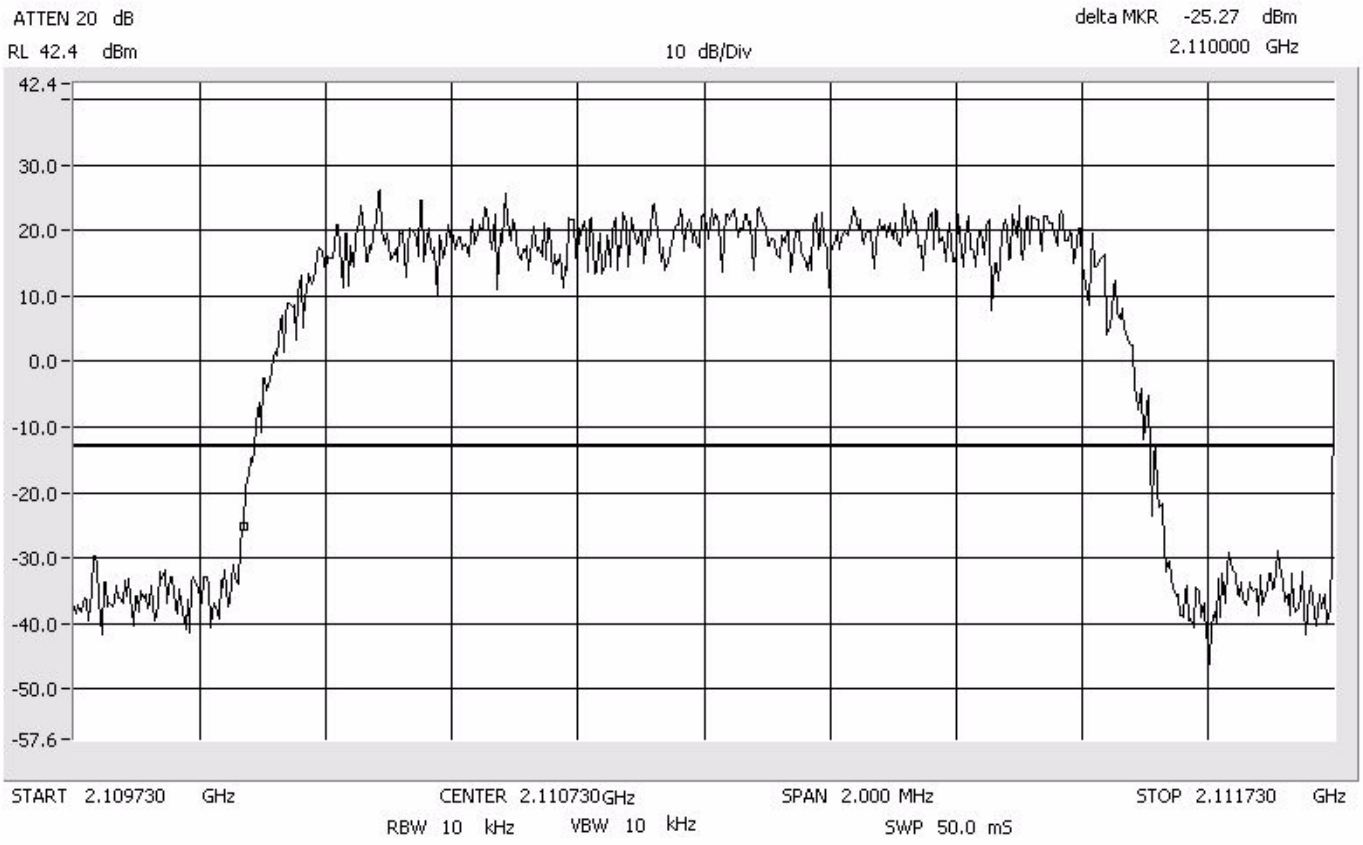
Band Edge
EDGE

Center: 2154.80 MHz
Span: 500 kHz
RBW: 3 kHz
VBW: 10 kHz



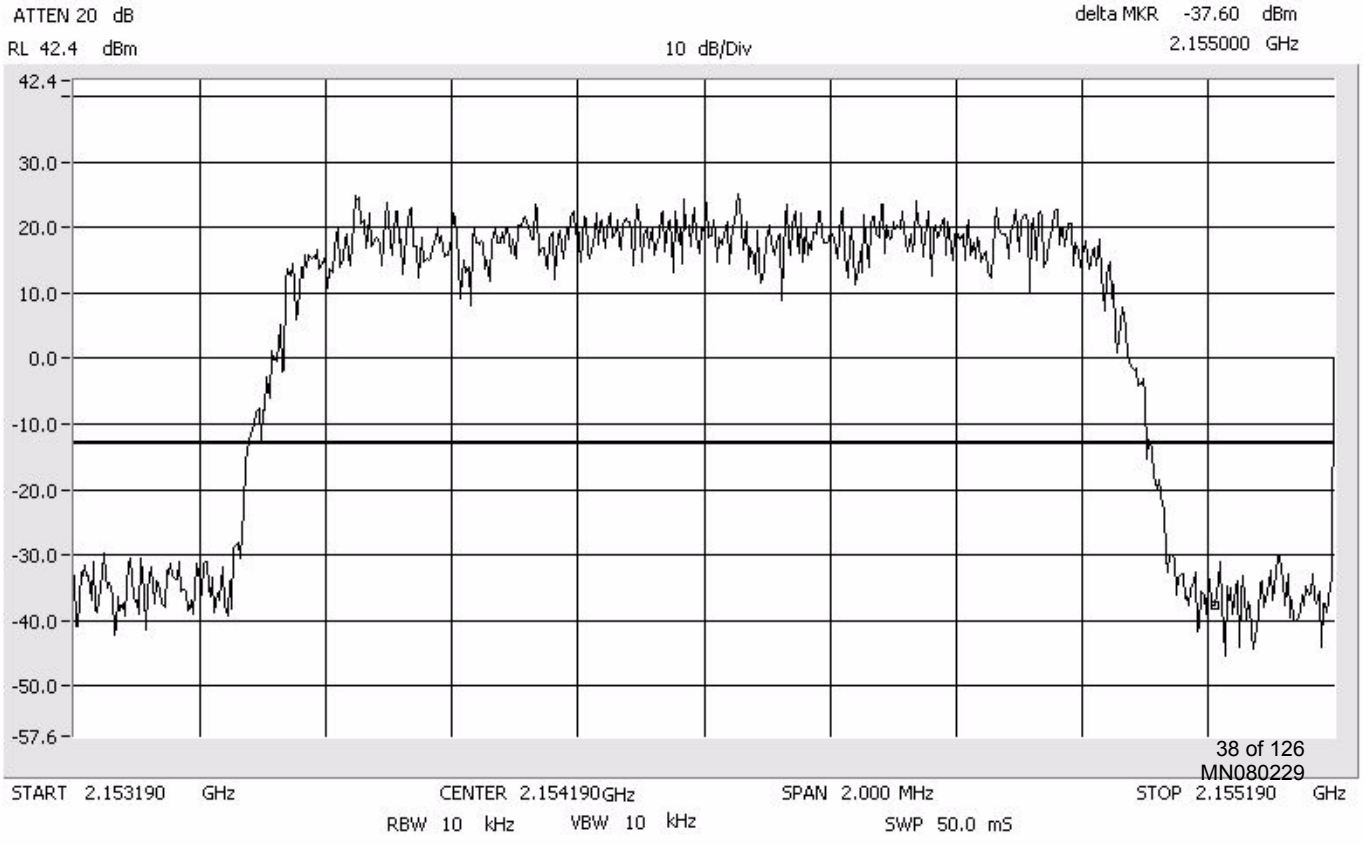
Band Edge
CDMA

Center: 2110.73
Span: 2 MHz
RBW: 10 kHz
VBW: 10 kHz



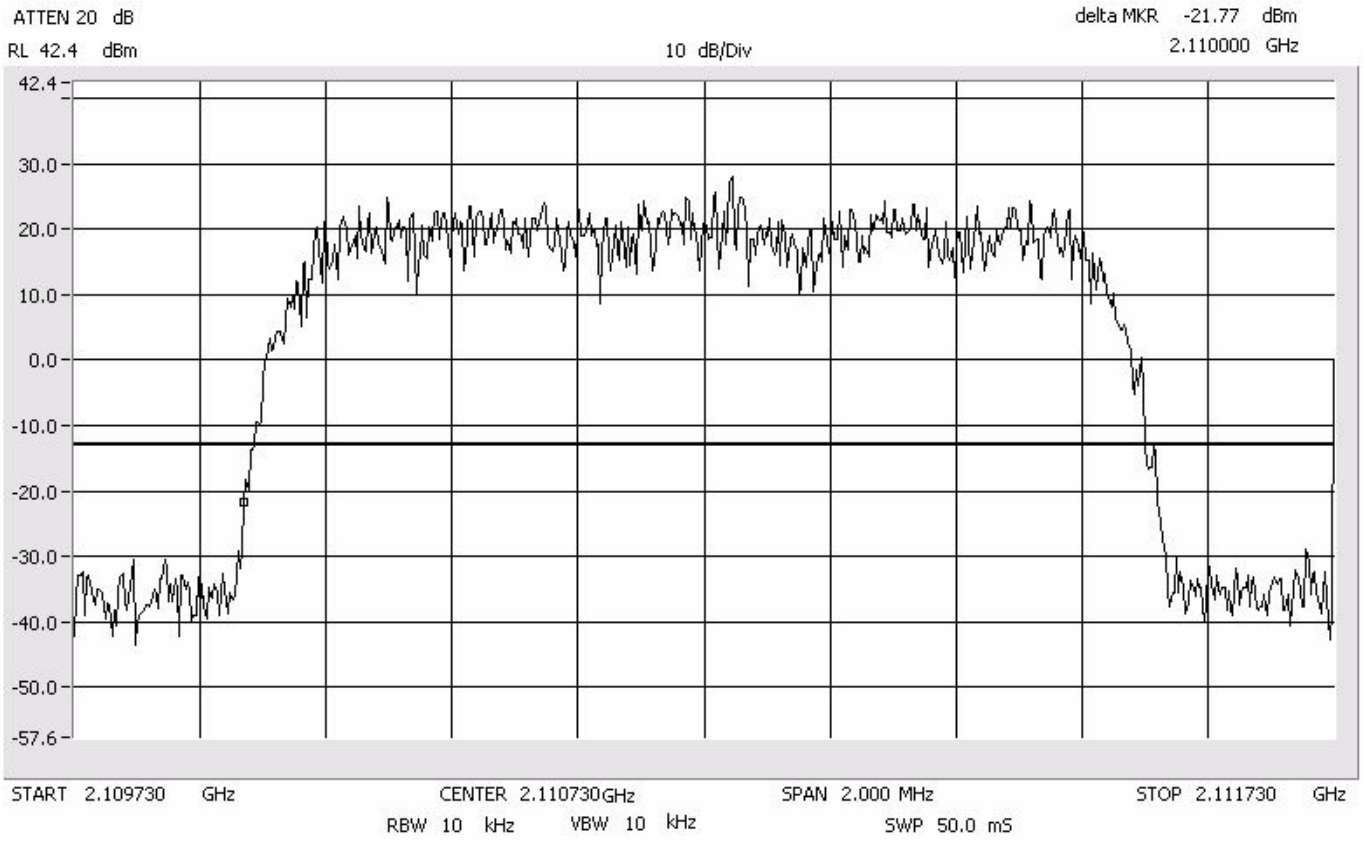
Band Edge
CDMA

Center: 2154.19 MHz
Span: 2 MHz
RBW: 10 kHz
VBW: 10 kHz



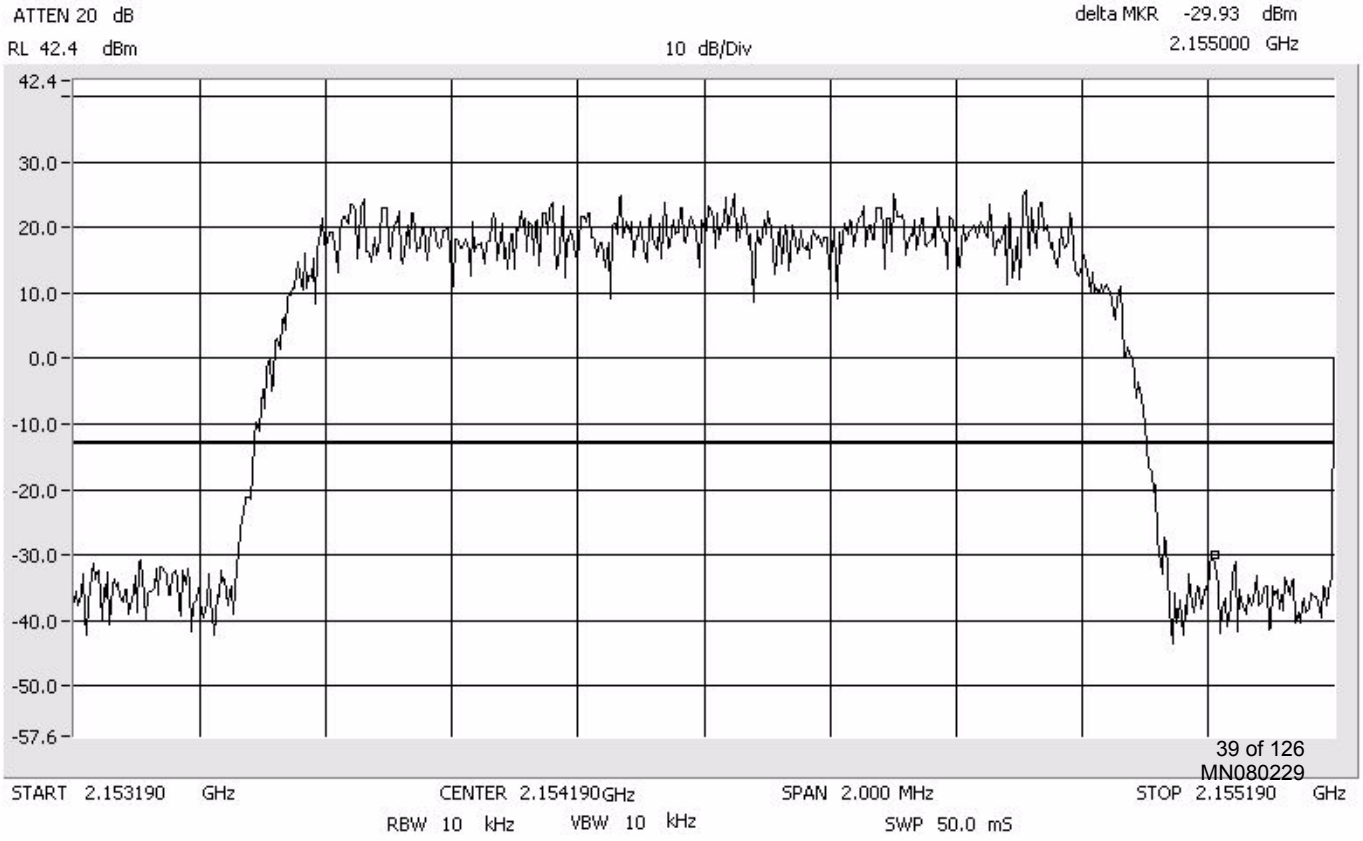
Band Edge
EVDO

Center: 2110.73
Span: 2 MHz
RBW: 10 kHz
VBW: 10 kHz



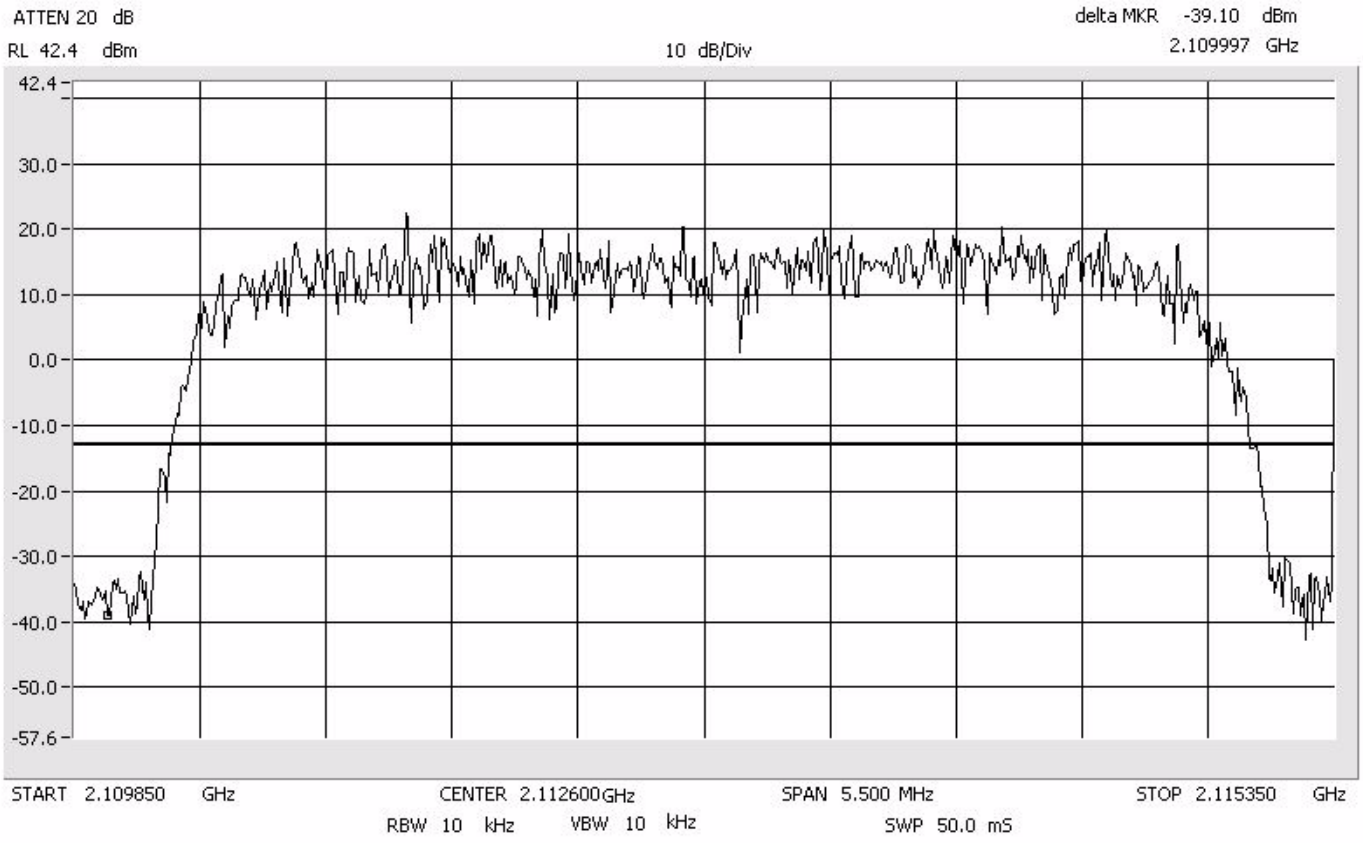
Band Edge
EVDO

Center: 2154.19 MHz
Span: 2 MHz
RBW: 10 kHz
VBW: 10 kHz



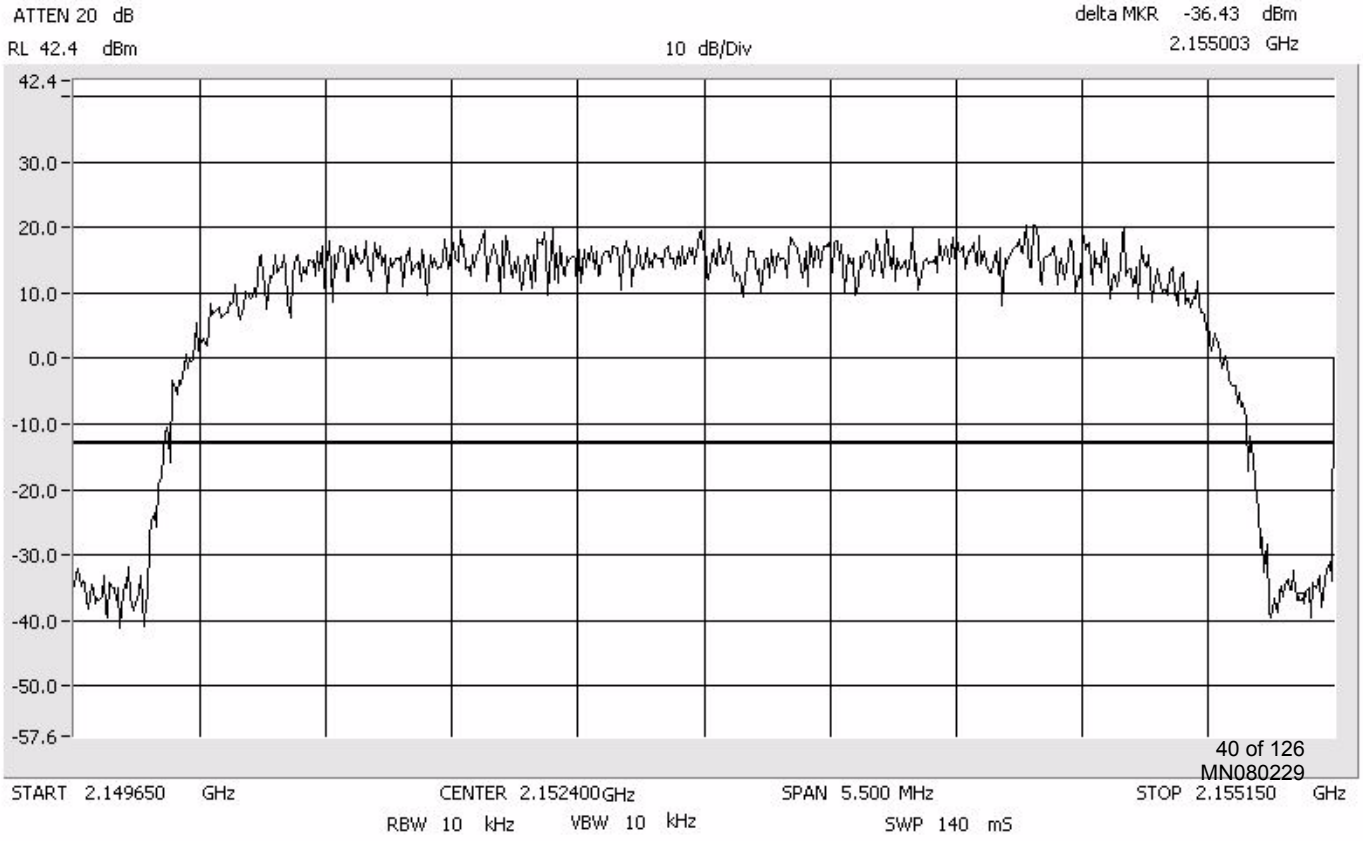
Band Edge
W-CDMA

Center: 2112.60
Span: 5.5 MHz
RBW: 10 kHz
VBW: 10 kHz



Band Edge
W-CDMA

Center: 2152.40 MHz
Span: 5.5 MHz
RBW: 10 kHz
VBW: 10 kHz



Conducted Output Power Test for ADC Inc
FlexWave™ URH - AWS
Model Number FWU-A40000002110RU

Back

*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 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 42.4 dB to compensate for attenuators and cable loss between the EUT and the power meter.

TDMA	**29.38 Watts**
Carrier Frequency	Carrier Output
2110.2 MHz	44.43 dBm
2132.5 MHz	44.68 dBm
2154.8 MHz	44.57 dBm

GSM	**31.55 Watts**
Carrier Frequency	Carrier Output
2110.2 MHz	44.67 dBm
2132.5 MHz	44.99 dBm
2154.8 MHz	44.63 dBm

EDGE	**28.44 Watts**
Carrier Frequency	Carrier Output
2110.2 MHz	44.17 dBm
2132.5 MHz	44.54 dBm
2154.8 MHz	44.23 dBm

CDMA	**29.44 Watts**
Carrier Frequency	Carrier Output
2110.8 MHz	44.69 dBm
2132.5 MHz	44.50 dBm
2154.2 MHz	44.26 dBm

EVDO	**28.71 Watts**
Carrier Frequency	Carrier Output
2110.8 MHz	44.58 dBm
2132.5 MHz	44.34 dBm
2154.2 MHz	44.47 dBm

4

W-CDMA	**29.85 Watts**
Carrier Frequency	Carrier Output
2112.6 MHz	44.65 dBm
2132.5 MHz	44.75 dBm
2152.4 MHz	44.25 dBm

Intermodulation Test for ADC Inc
FlexWave™ URH - AWS
Model Number FWU-A40000002110RU

Back

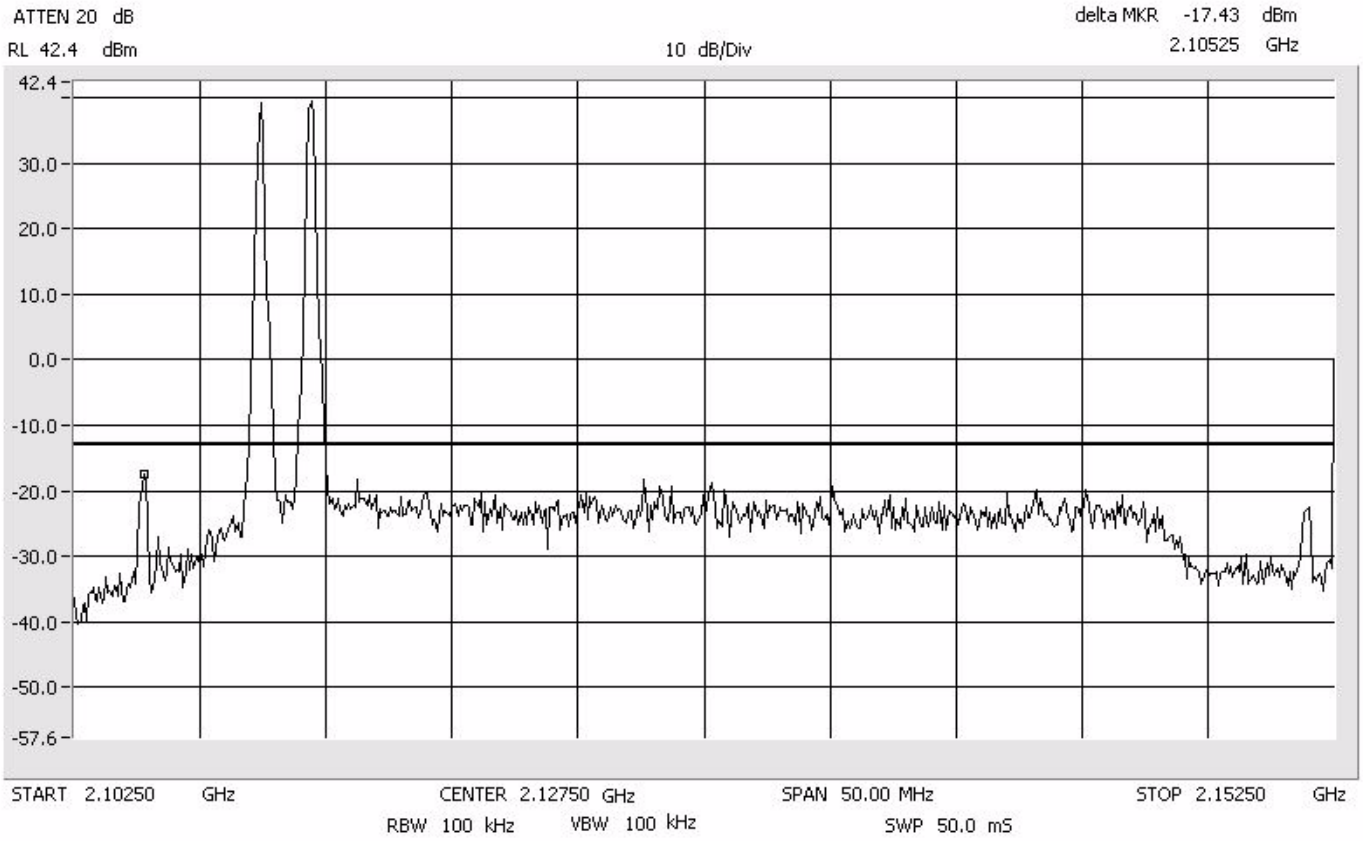
The inter-modulation products test was performed for the EUT. Three tests were preformed with the modulation type. Test 1 was with 2 signals input to the EUT at lower end channels. Test 2 was with 2 signals input to the EUT at upper end channels. Test 3 was with 2 signals input to the EUT at upper and lower end channels. The modulation types tested were TDMA, GSM, EDGE, CDMA, EVDO, and W-CDMA. An investigation was made from 30 MHz to the 10^{th} Harmonic of the highest fundamental frequency (~22 GHz). The following plots show the results. Modulation types EVDO and CDMA have the same mask and intermodulation properties.

Results:
(See Plots)

TDMA
Lower Band

Intermodulation
Close - Lower
AWS

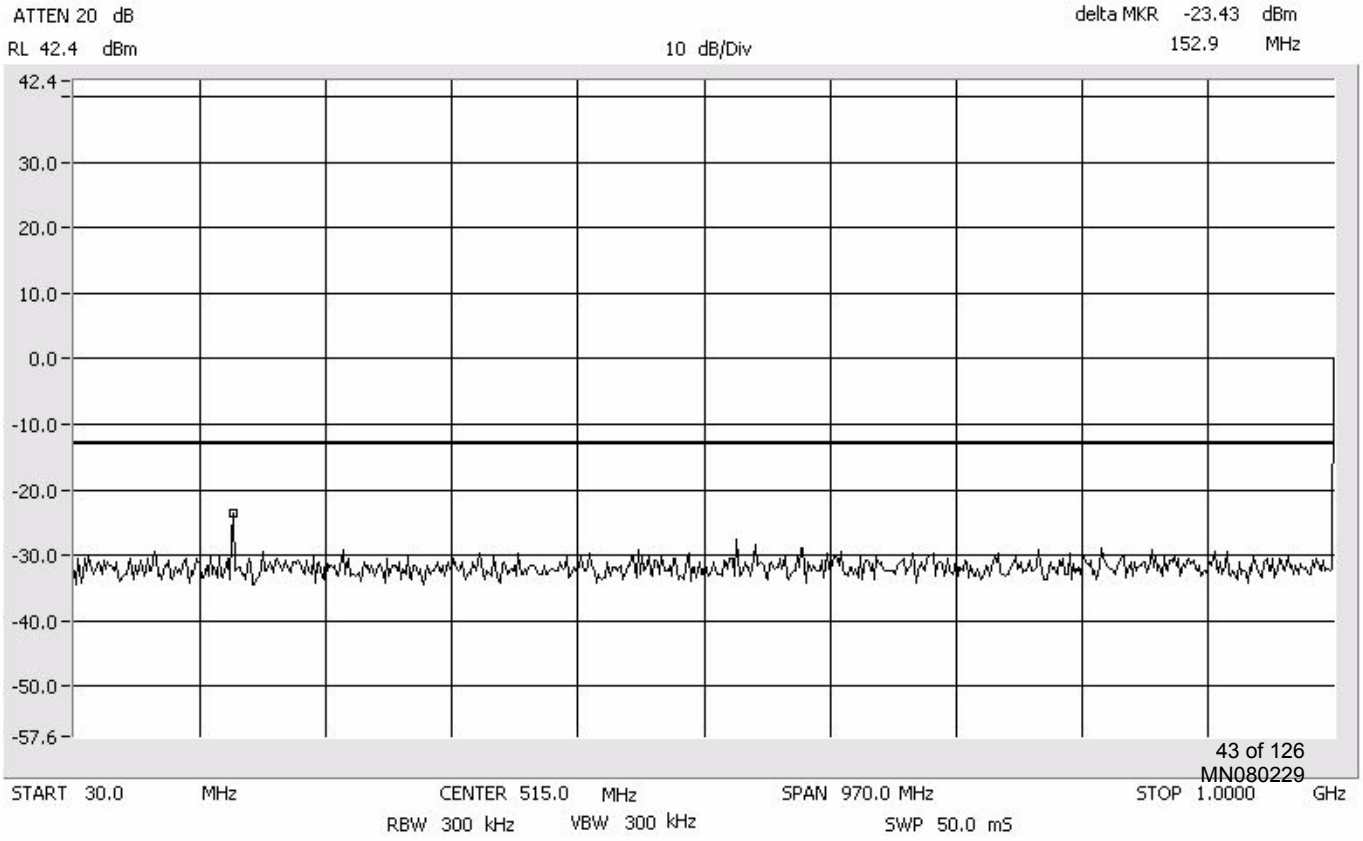
Center: 2127.5 MHz
Span: 50 MHz
RBW/VBW: 100 kHz



TDMA
Lower Band

Intermodulation
Close - Lower
AWS

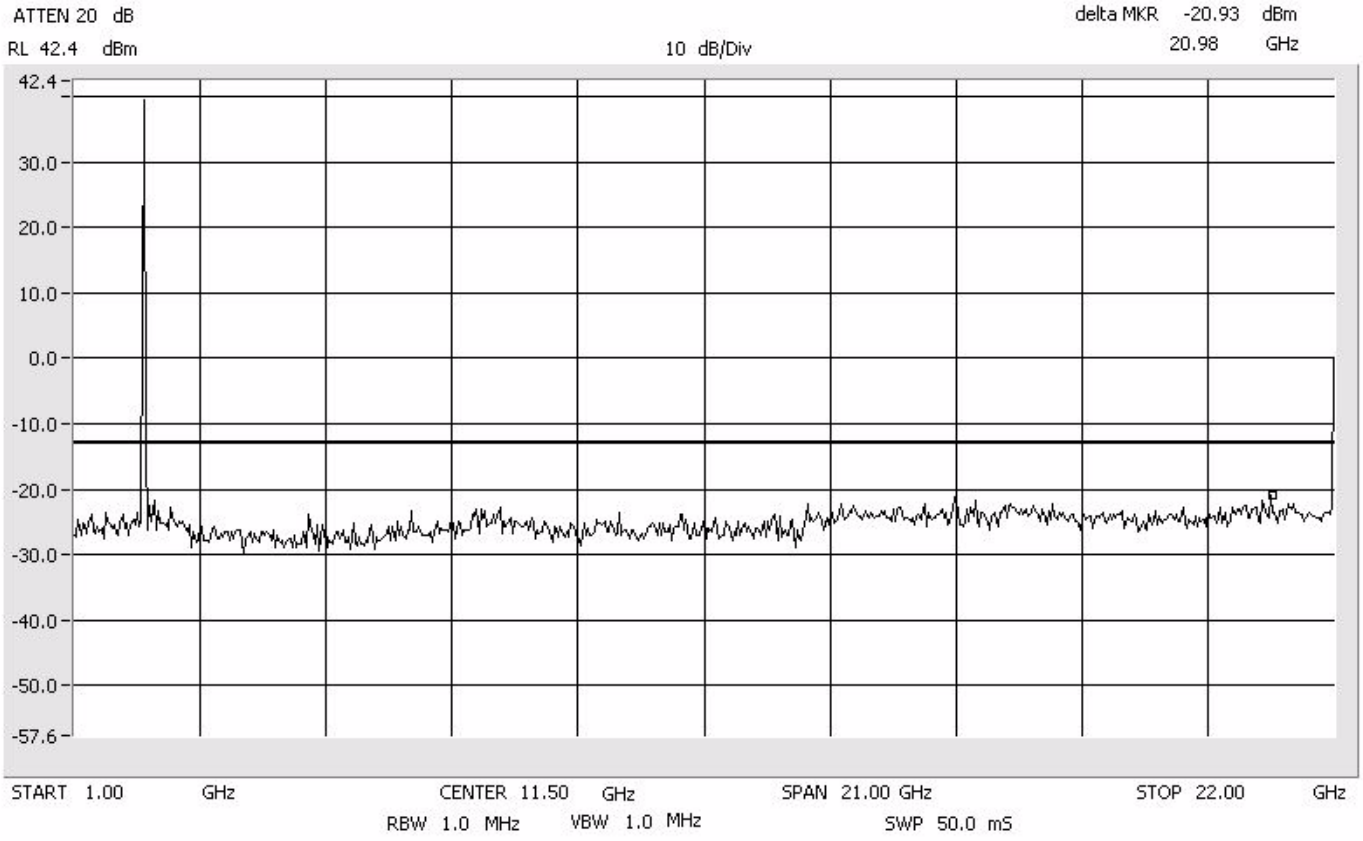
Span: 30 MHz to 1 GHz
RBW/VBW: 300 kHz



TDMA
Lower Band

Intermodulation
Close - Lower
AWS

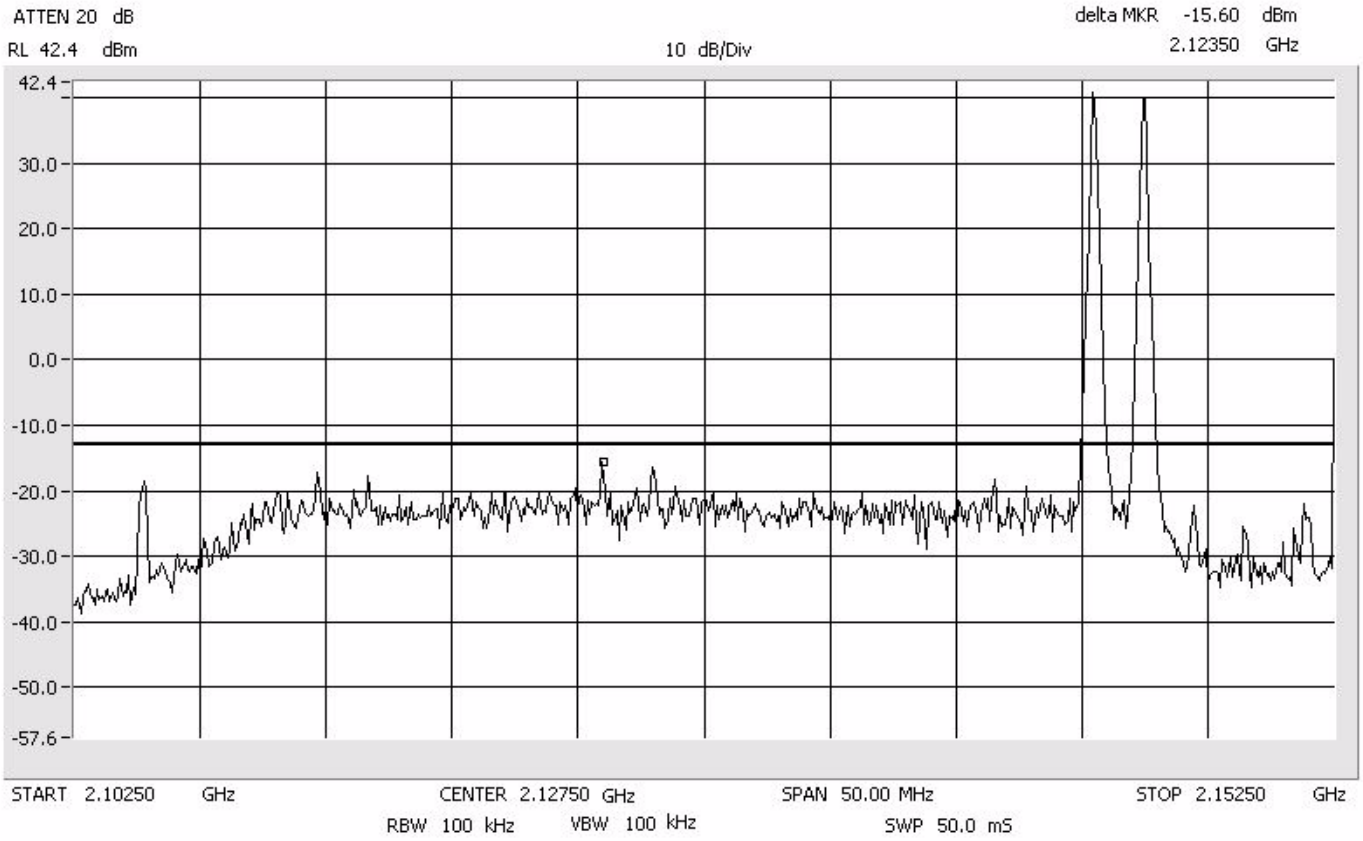
Span: 1 GHz to 22 GHz
RBW/VBW: 1 MHz



TDMA
Lower Band

Intermodulation
Close - Upper
AWS

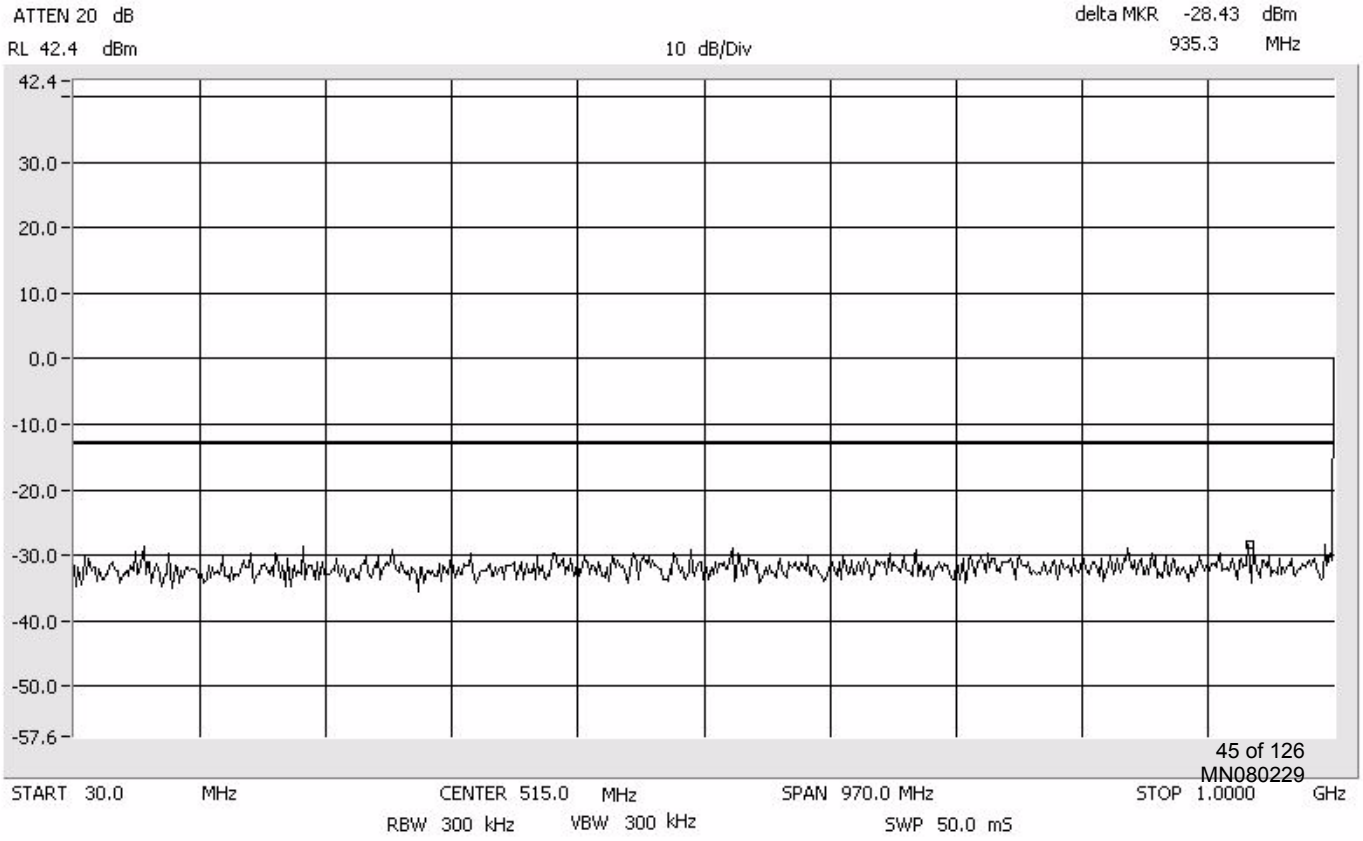
Center: 2127.5 MHz
Span: 50 MHz
RBW/VBW: 100 kHz



TDMA
Lower Band

Intermodulation
Close - Upper
AWS

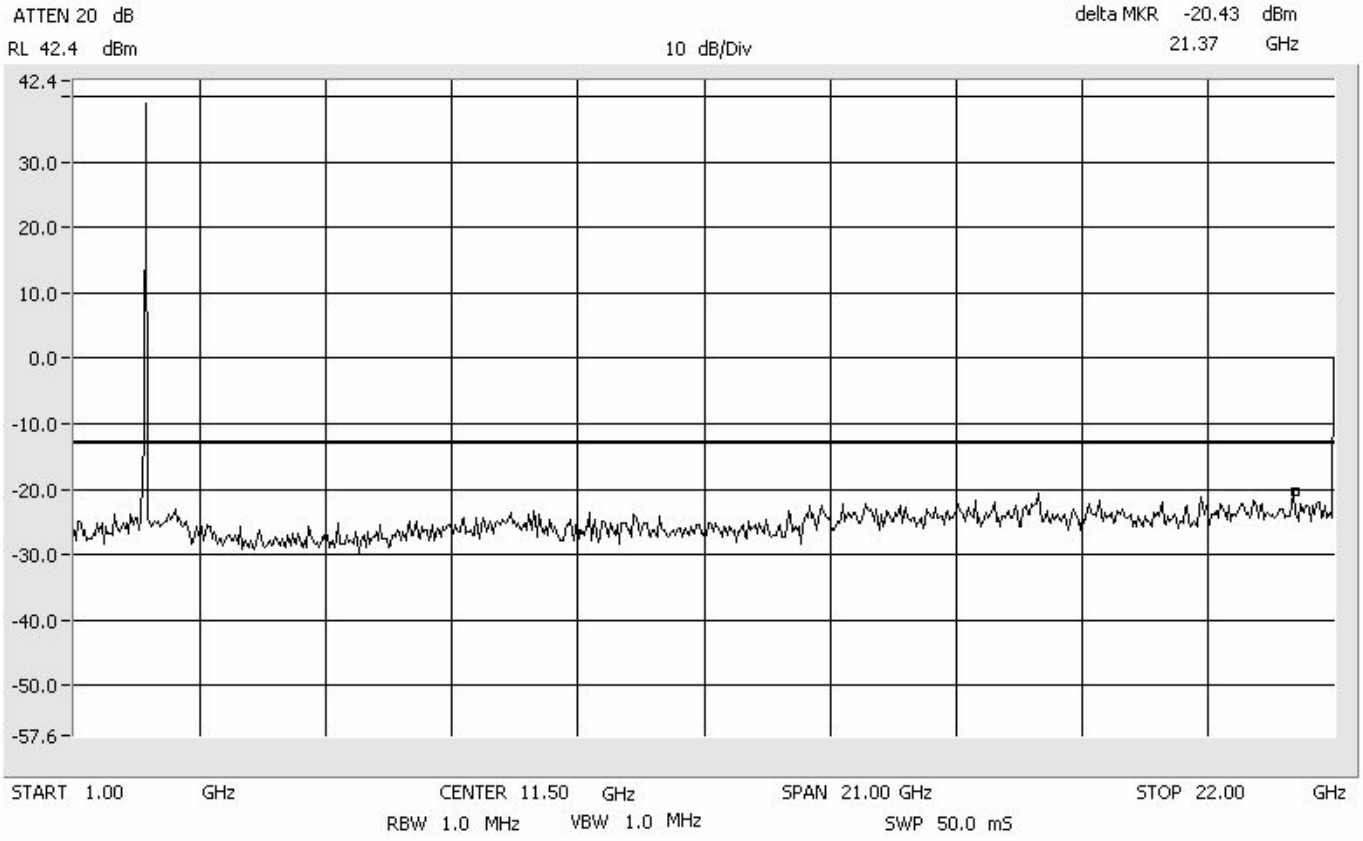
Span: 30 MHz to 1 GHz
RBW/VBW: 300 kHz



TDMA
Lower Band

Intermodulation
Close - Upper
AWS

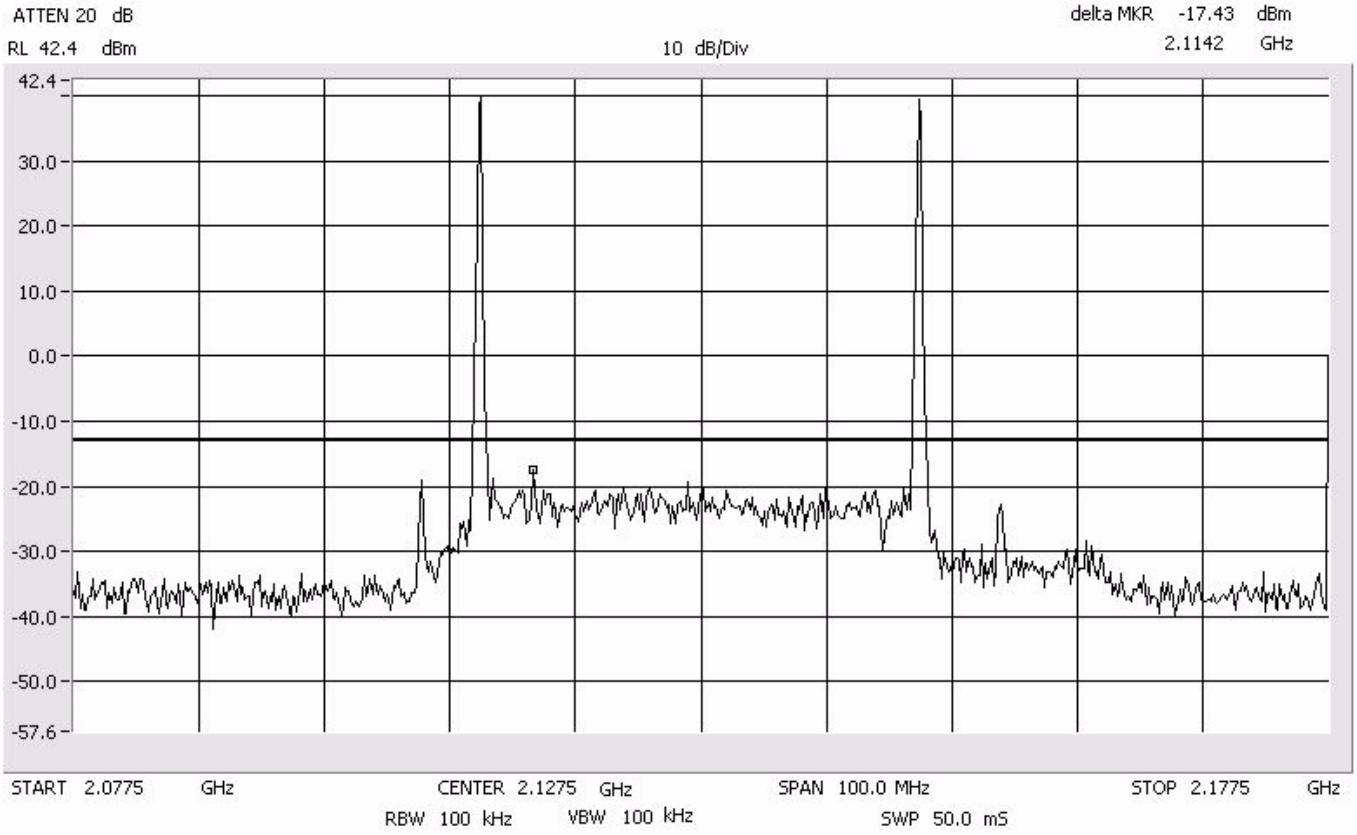
Span: 1 GHz to 22 GHz
RBW/VBW: 1 MHz



TDMA
Lower Band

Intermodulation
Apart
AWS

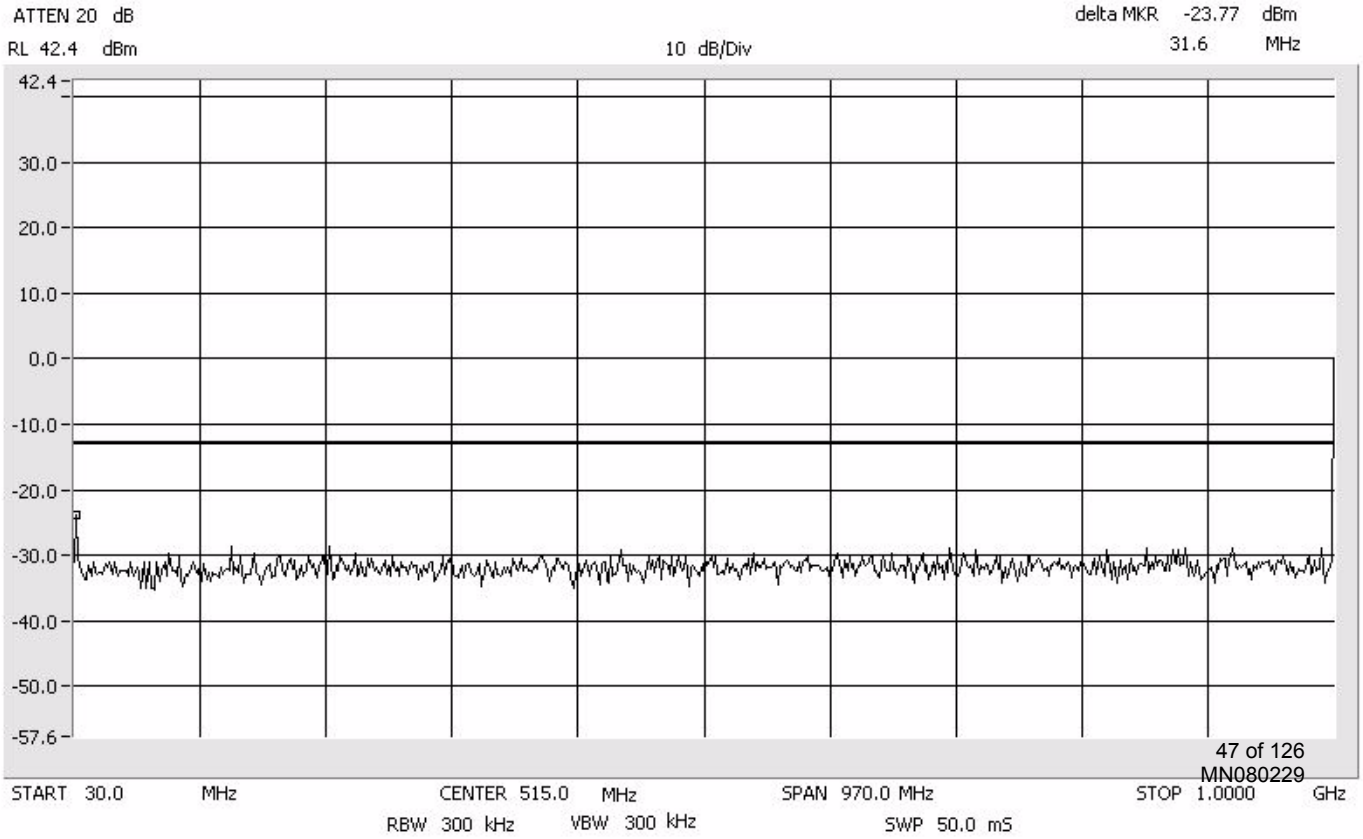
Center: 2127.5 MHz
Span: 100 MHz
RBW/VBW: 100 kHz



TDMA
Lower Band

Intermodulation
Apart
AWS

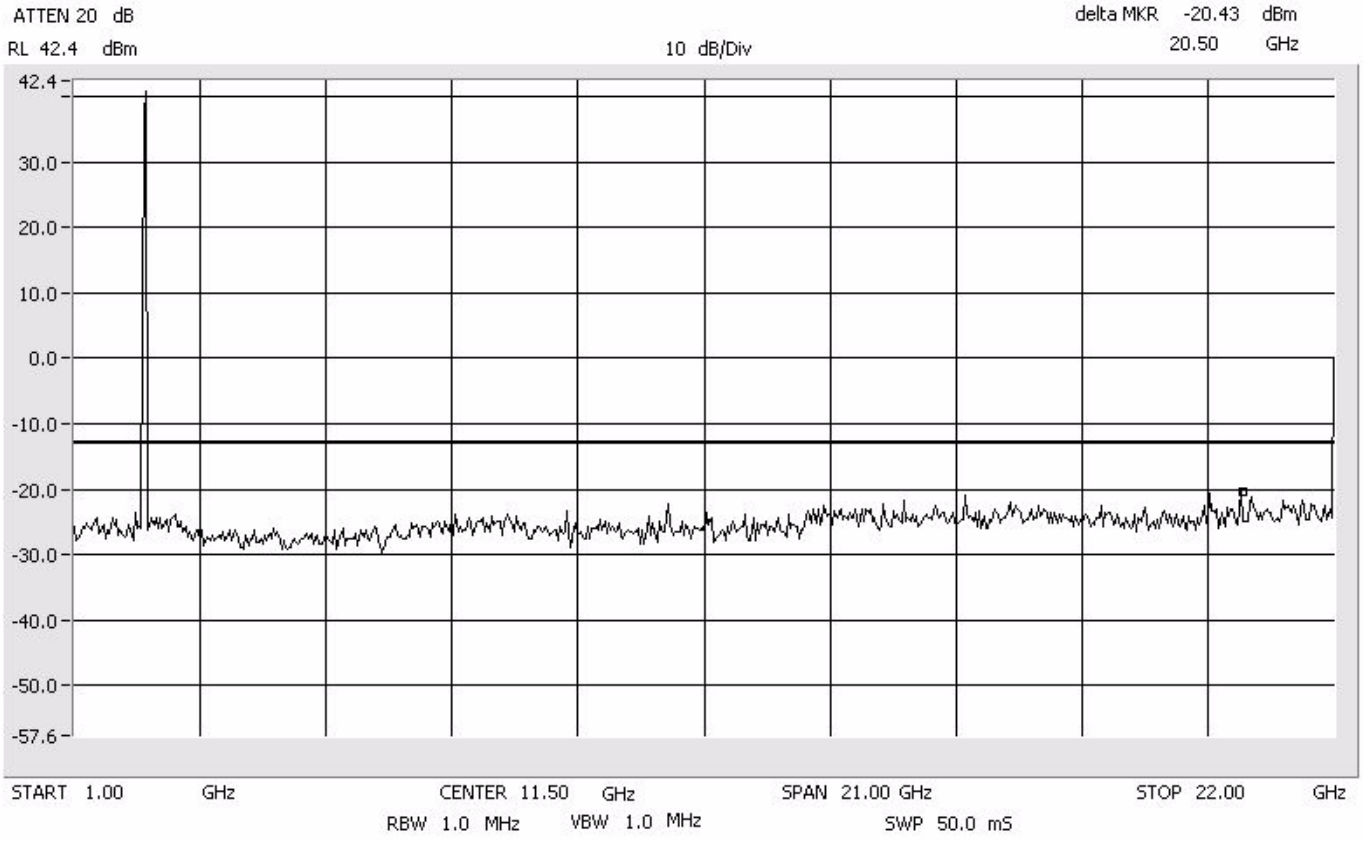
Span: 30 MHz to 1 GHz
RBW/VBW: 300 kHz



TDMA
Lower Band

Intermodulation
Apart
AWS

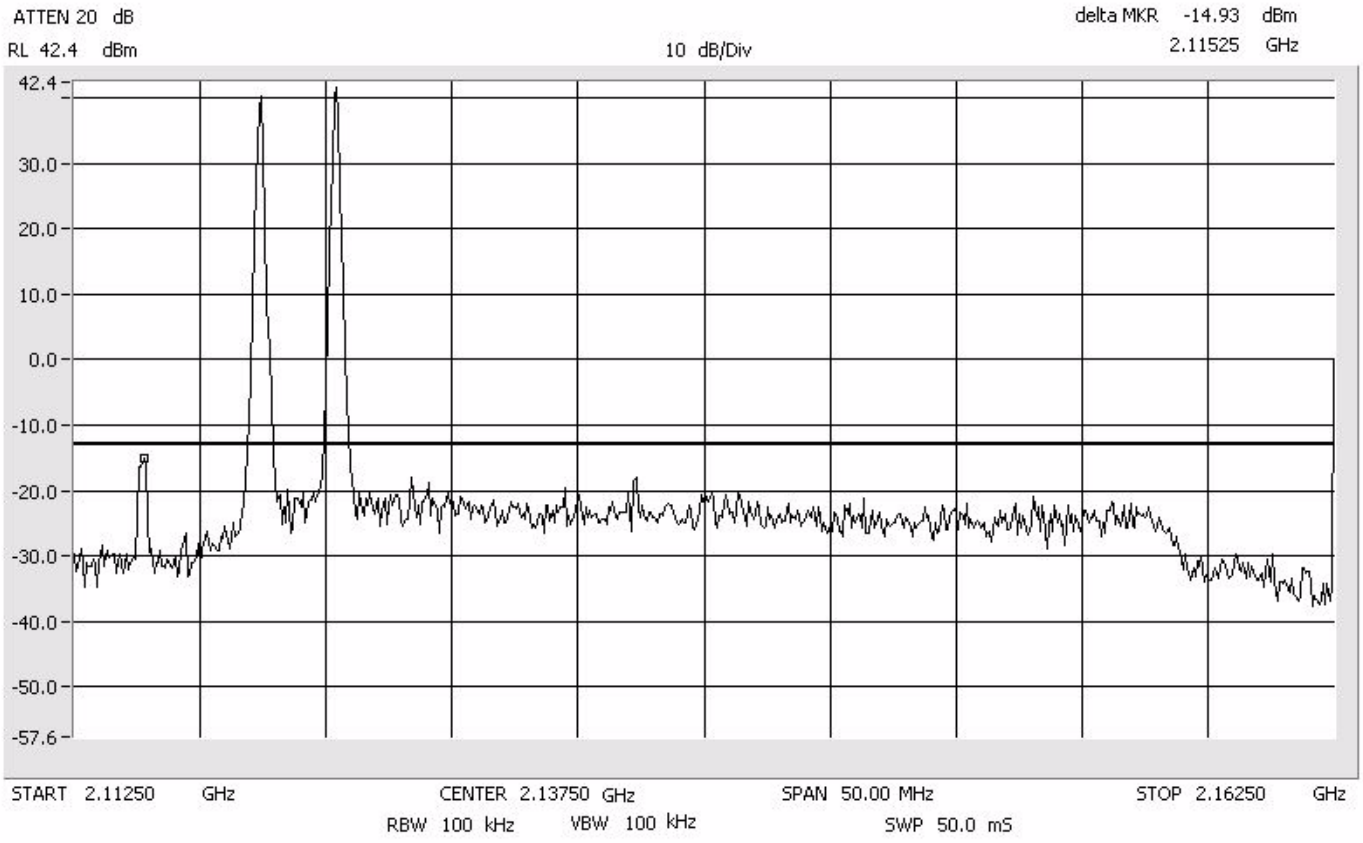
Span: 1 GHz to 22 GHz
RBW/VBW: 1 MHz



TDMA
Upper Band

Intermodulation
Close - Lower
AWS

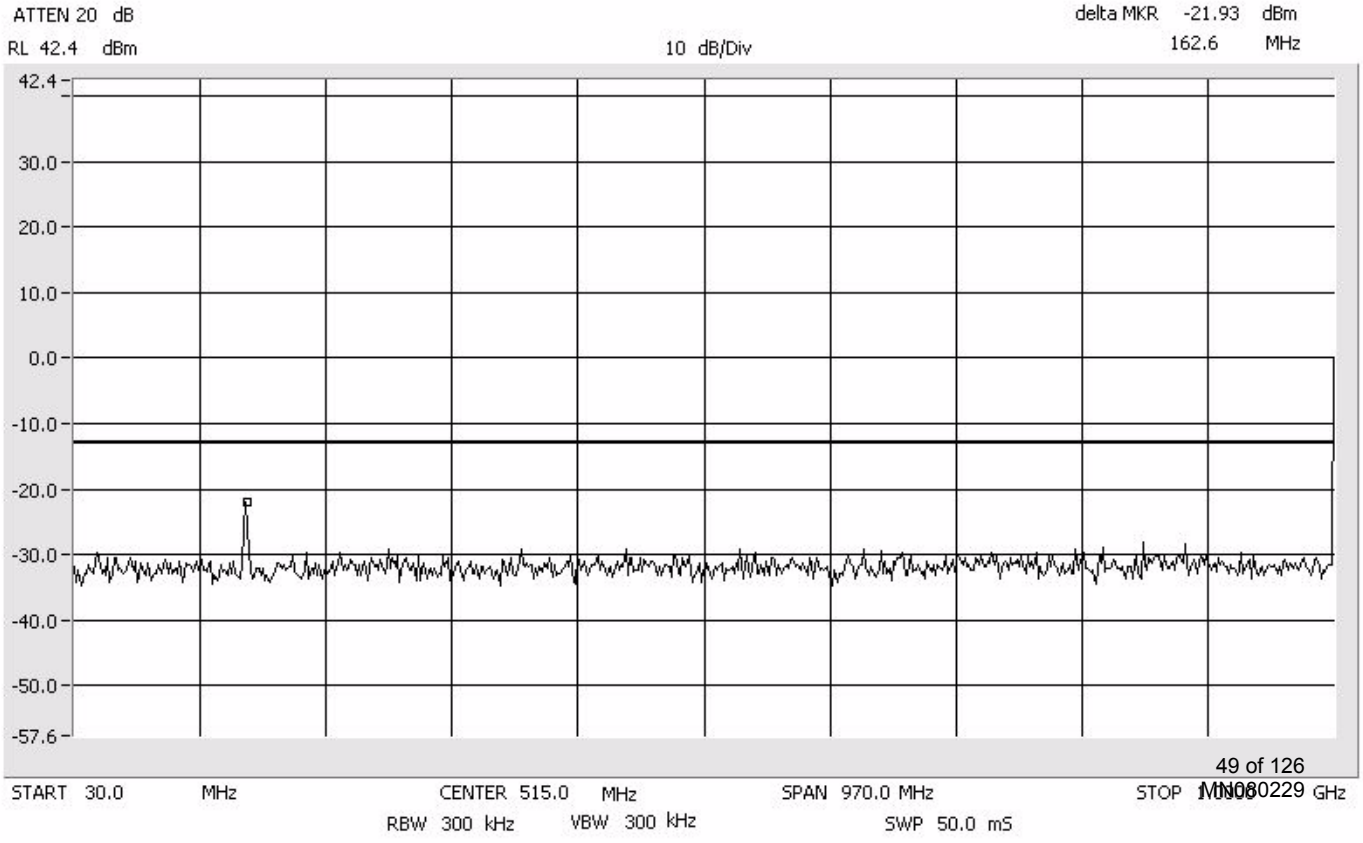
Center: 2137.5 MHz
Span: 50 MHz
RBW/VBW: 100 kHz



TDMA
Upper Band

Intermodulation
Close - Lower
AWS

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



TDMA
Upper Band

Intermodulation
Close - Lower
AWS

Span: 1 GHz to 22 GHz
RBW/VBW: 1 MHz