



# Test Report Summary

## FCC CFR 47, Part 27

### Wireless Communications Service

**Manufacturer:** ADC Telecommunications

**Name of Equipment:** InterReach® Fusion Remote Access Unit

**Model Number(s):** FSN-2500-1-WMAX

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

**Test Report Number:** MN080326

**Test Date(s):** 21 March, 2008 (ETL)  
25 March, 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: 26 March, 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 12<sup>th</sup> Ave E  
Shakopee, MN 55379  
Phone: (952) 403-8340  
Fax: (952) 403-8858

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

  
Mark F. Miska  
Mark F. Miska  
Compliance Engineer



## **EMC Emission – T E S T R E P O R T**

**Test Report File Number:** MN080326 **Date of Issue:** 26 March, 2008

**Model Number(s):** FSN-2500-1-WMAX

**Product Name:** InterReach® Fusion Remote Access Unit

**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:** 3147568MIN-001  
**Reference(s)**

**Total pages including Appendices:** 101



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## 1.0 REVISION DESCRIPTION

Rev	Total Pages	Date	Description
A	101	26 March, 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**

Temperature: 22° C  
Relative Humidity: 24%  
Atmospheric Pressure: 97.5 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 – 2630 to 2690 MHz – Transmit (TX) and Receive (RX)

## 2.4 Product Options:

None

## 2.5 EUT Specifications and Requirements:

Length: 11.13"

Width: 11.25"

Height: 2.13"

Weight: 5 pounds

## 2.6 Cables:

Cable Type	Length	From	To
RF	> 3M	Ancillary Equip	EUT
RF	< 3M	EUT	50 Ohm Load
Power (2)	< 3M	Power	Input Power (Ancillary)
Coax (75 Ohm)	> 3M	Ancillary Equip	EUT
Optical	< 3M	Ancillary Equip	Ancillary Equip

## 2.7 Power Requirements:

Voltage: 54 VDC

Amps: 1.1 A

## 2.8 Typical Installation and/or Operating Environment:

Indoor. System is typically employed as an indoor 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 #
Main Hub	FSN-1-MH-1-WMAX	None	
Expansion Hub	FSN-EH-1-WMAX	None	
Remote Access Unit	FSN-2500-1-WMAX	None	

### 2.12 Support Equipment

Description	Manufacturer	Model #	FCC ID #
Power Meter	HP	EPM-441A	
Signal Generator	Agilent	E4438C	
Signal Generator	Agilent	N5182A	

### 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

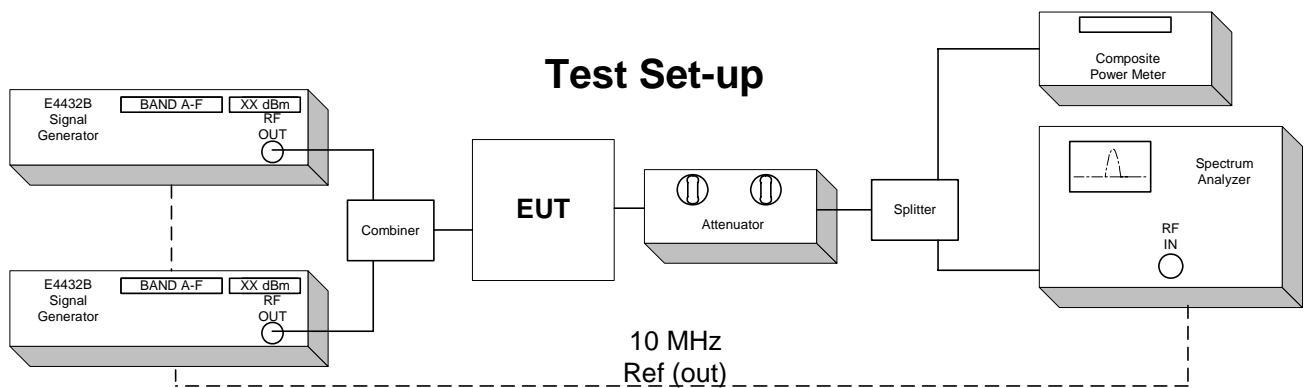
### Inter-Modulation Test for ADC Inc

### Occupied Bandwidth Modulation Test for ADC Inc

InterReach® Fusion Main Hub  
Model Number FSN-1-MH-1-WMAX

InterReach® Fusion Expansion Hub  
Model Number FSN-EH-1-WMAX

InterReach® Fusion Remote Access Unit  
Model Number FSN-2500-1-WMAX



# Frequency Tolerance Test for ADC Inc.

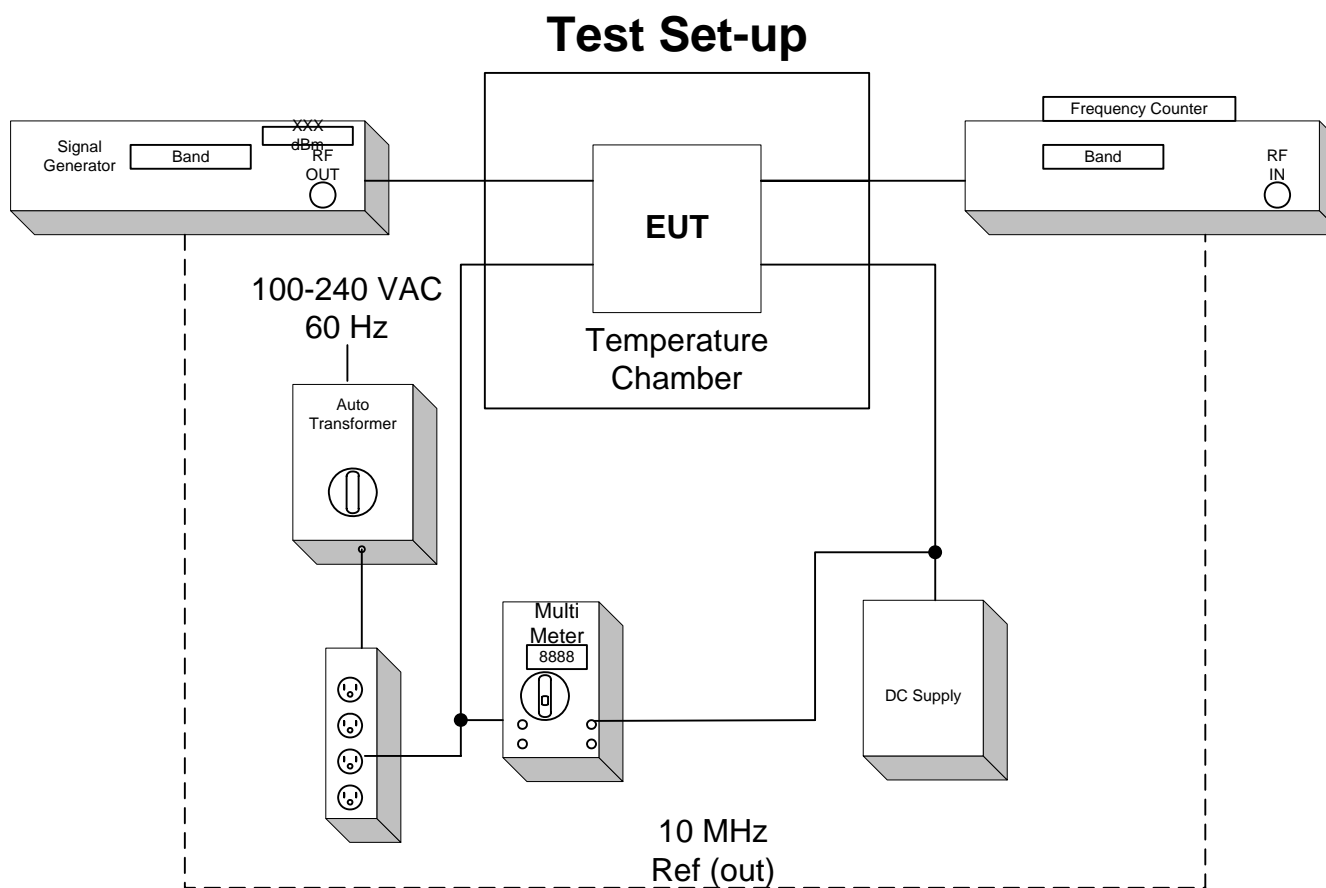
InterReach® Fusion Main Hub  
Model Number FSN-1-MH-1-WMAX

InterReach® Fusion Expansion Hub  
Model Number FSN-EH-1-WMAX

InterReach® Fusion Remote Access Unit  
Model Number FSN-2500-1-WMAX

The Main Hub and Expansion Hub EUT are specified for indoor use with temperature range of 0° to +45° C, and were tested within their range.

The Remote Access Unit EUT is specified for indoor use with temperature range of -25° to +45° C, and was tested with its range.



## 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 13.0 dB at 2635.0 MHz (64QAM)

#### 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, 15

#### Test Limit:

Less than 3 Watts ERP or 34.77 dBm Limit

#### Test Data:

[See page](#) 35

**Test Engineer:** Mark F. Miska

**Date:** 25 March, 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 –25 to 45° 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, 15

##### **Test Limit:**

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

##### **Test Data:**

[See page 66](#)

**Test Engineer:** Mark F. Miska

**Date:** 25 March, 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, 15

##### **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 – 34

[Intermodulation Test](#), pages 36 – 60

[Occupied Bandwidth](#), pages 61 – 65

Radiated Emissions, pages 67 – 99 ([Appendix B](#))

**Test Engineer:** Mark F. Miska

**Date:** 25 March, 2008

**Date:** 25 March, 2008

**Date:** 25 March, 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	<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	1-16-09	<input checked="" type="checkbox"/>
5	Temperature Chamber	Thermotron	SM-32C	MC18966	4-9-08	<input checked="" type="checkbox"/>
6	Signal Generator	Agilent	E4437B	967974	1-15-10	<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 type="checkbox"/>
14	LNA	Lucix Corp	C020200L 1603	N/A	CNR	<input type="checkbox"/>
15	Signal Generator	Agilent	N5182A	LGC-522	6-6-08	<input checked="" type="checkbox"/>

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

**InterReach® Fusion Main Hub  
Model Number FSN-1-MH-1-WMAX**

**InterReach® Fusion Expansion Hub  
Model Number FSN-EH-1-WMAX**

**InterReach® Fusion Remote Access Unit  
Model Number FSN-2500-1-WMAX**

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The out of band emissions were measured directly from the EUT antenna output in the RX and TX path using a spectrum analyzer from 30 MHz to the 10<sup>th</sup> harmonic of the highest carrier frequency. Test signals used are 64QAM and QPSK. 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 64QAM and QPSK signal at the upper and lower limits of the band.

The Main Hub and Expansion units are Part 15 devices and have been tested and are compliant as such.

Industry practice has generally set the input signal power level. Test signal used was  $\approx 0$  dBm input to Main Hub in the TX Path. Industry practice has generally set the input signal power level. Test signal used was  $\approx -33$  dBm input to RAU in the RX Path. Industry practice has generally set the output signal power level.

Main Hub:	Expansion Hub:	Remote Access Unit (RAU):
Range: 100 - 240 VAC	Range: 100 - 240 VAC	Range: 54 VDC
Tested @: 120 VAC	Tested @: 120 VAC	Tested @: 54 VDC
Tested @: 0.4 A	Tested @: 0.9 A	Tested @: 1.1 A

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

System Power is limited by a limiting attenuation chip (ALC) in WiMAX Main Hub with 30 dB of head room. Single channel operation, or multi-channel operation will not exceed nominal gain of the system.

PLL creates all the Local Oscillators that convert signal to IF and RF signals. When PLL is unlocked the band is shut down, this is to avoid transmission of any incorrect frequency.

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 CW - TX

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

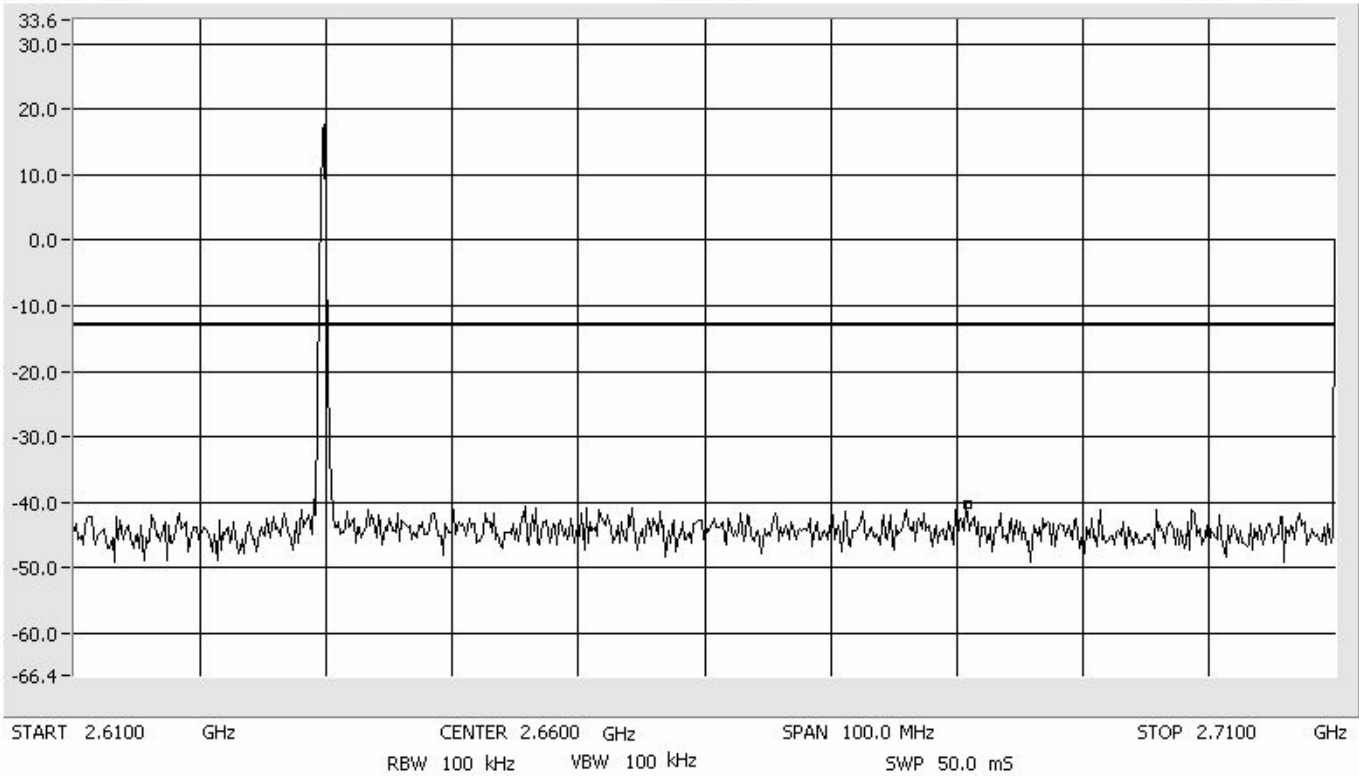
ATTEN 40 dB

delta MKR -40.40 dBm

RL 33.6 dBm

10 dB/Div

2.6808 GHz



# Conducted Emissions Low CW - TX

Span: 30 MHz to 26.5 GHz  
RBW/VBW: 1 MHz

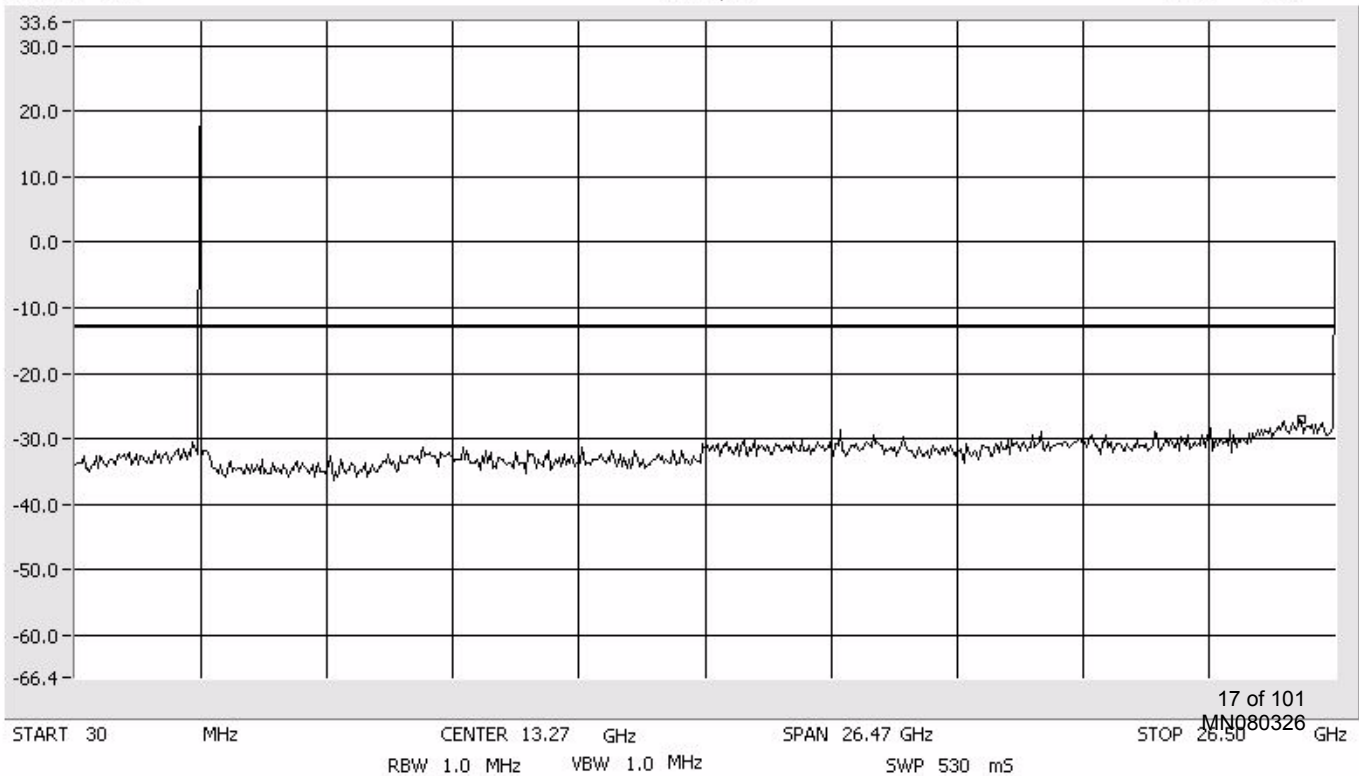
ATTEN 40 dB

delta MKR -27.07 dBm

RL 33.6 dBm

10 dB/Div

25.79 GHz



# Conducted Emissions Mid CW - TX

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

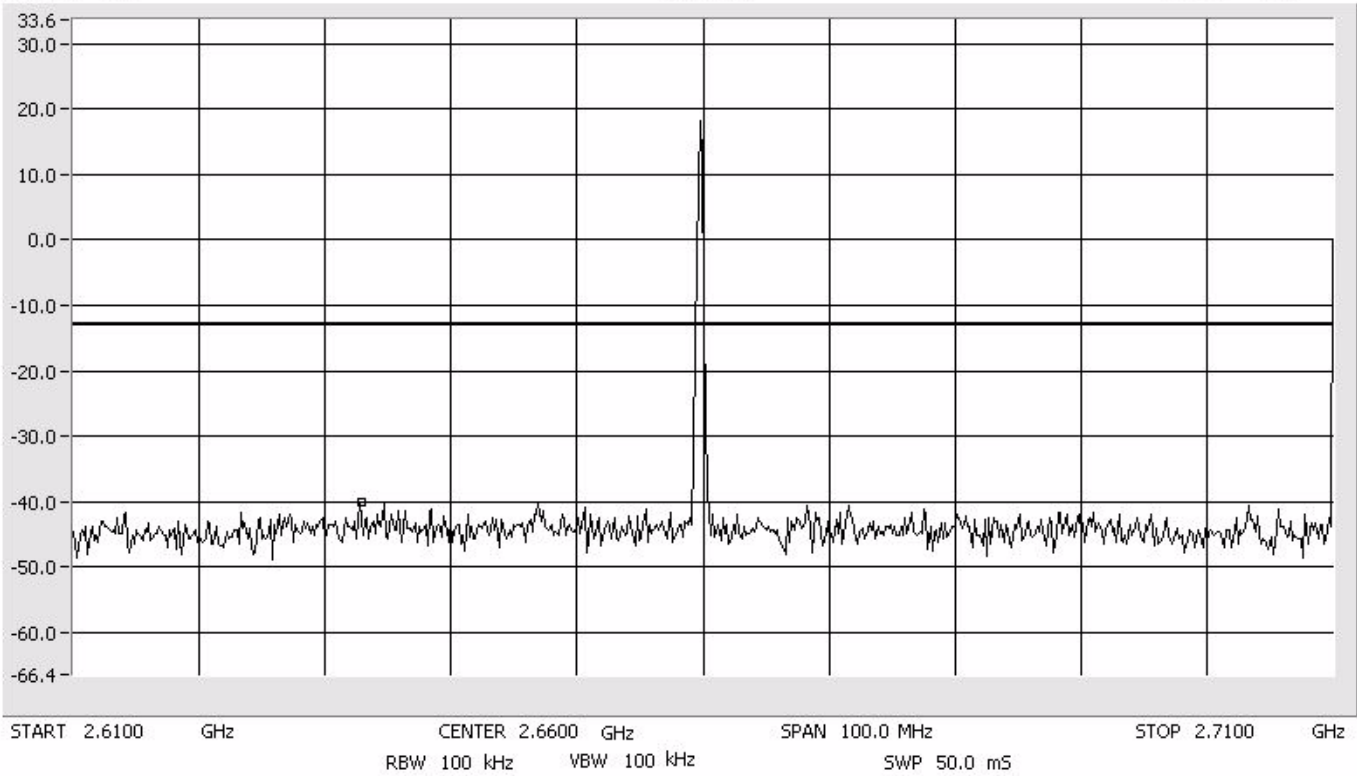
ATTEN 40 dB

delta MKR -40.07 dBm

RL 33.6 dBm

10 dB/Div

2.6328 GHz



# Conducted Emissions Mid CW - TX

Span: 30 MHz to 26.5 GHz  
RBW/VBW: 1 MHz

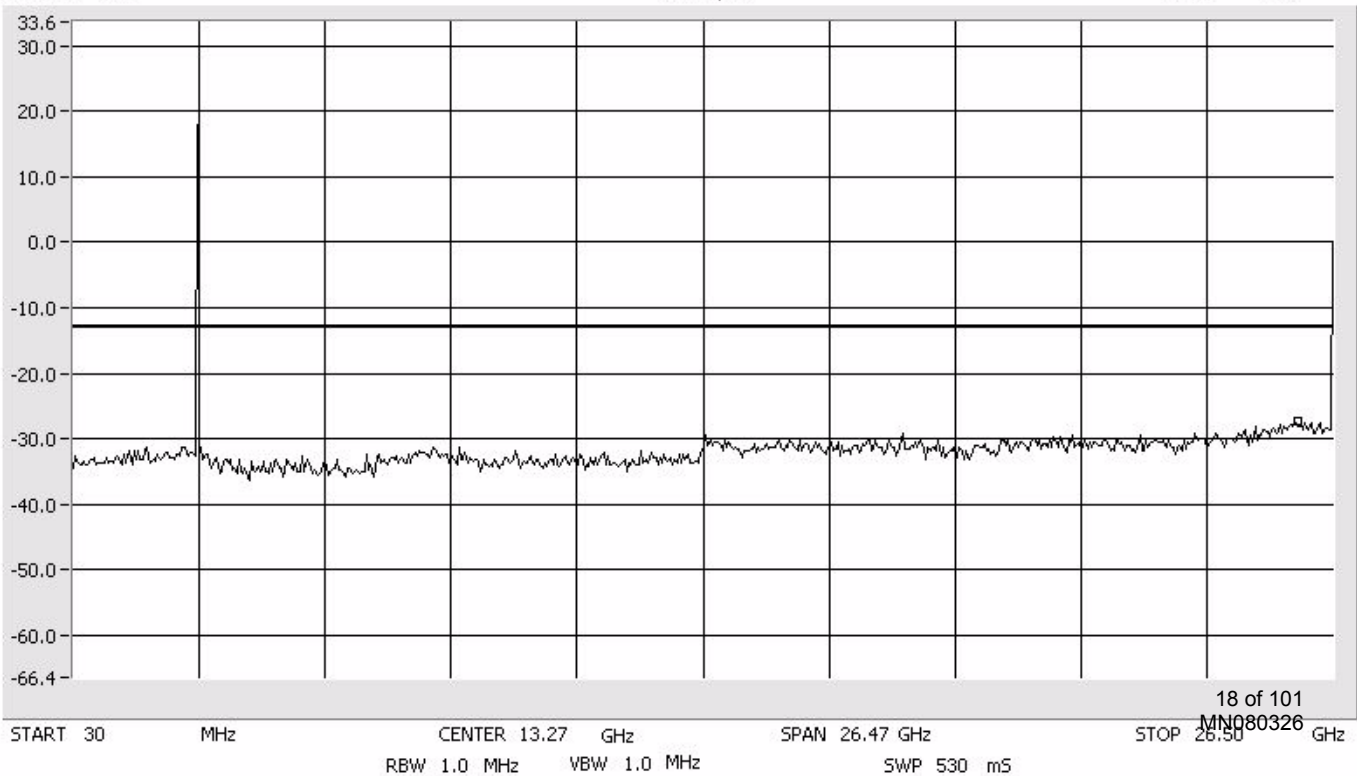
ATTEN 40 dB

delta MKR -27.23 dBm

RL 33.6 dBm

10 dB/Div

25.75 GHz



# Conducted Emissions High CW - TX

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

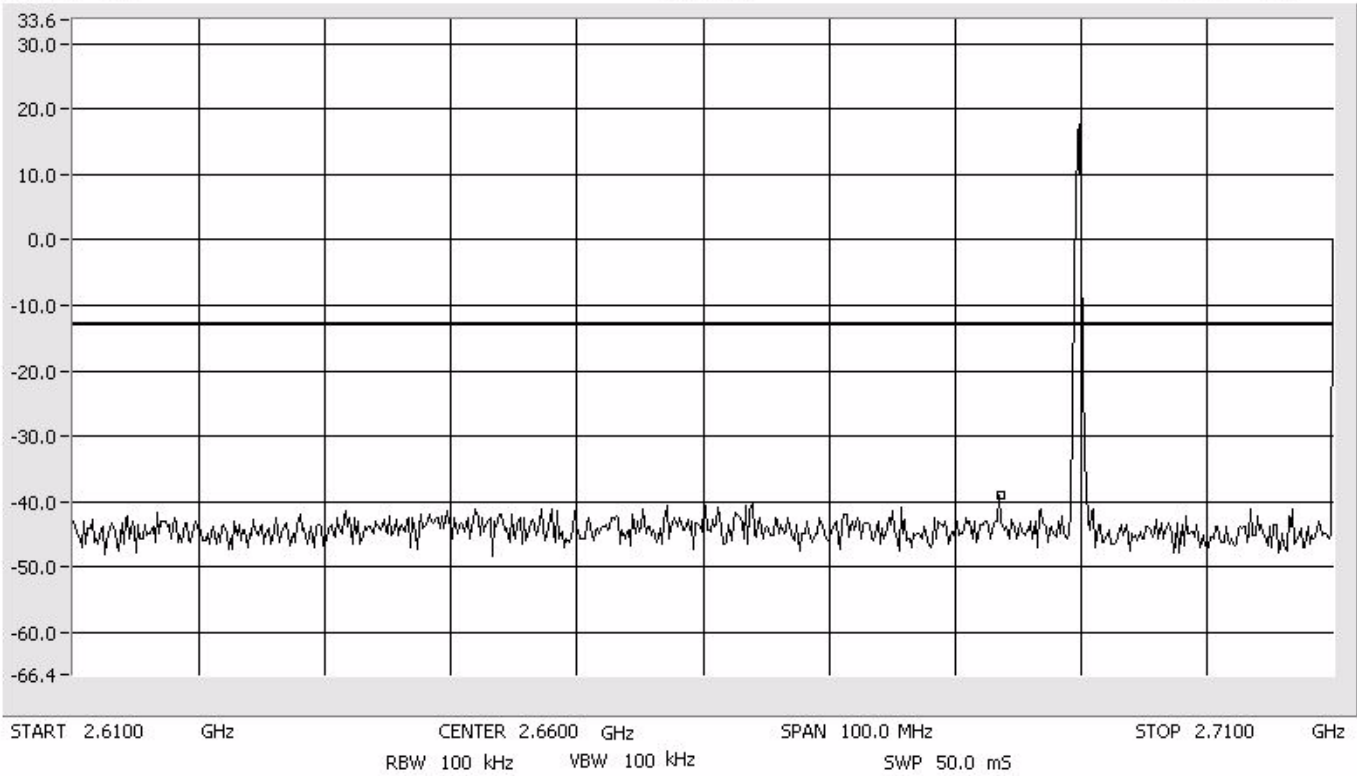
ATTEN 40 dB

delta MKR -39.07 dBm

RL 33.6 dBm

10 dB/Div

2.6837 GHz



# Conducted Emissions High CW - TX

Span: 30 MHz to 26.5 GHz  
RBW/VBW: 1 MHz

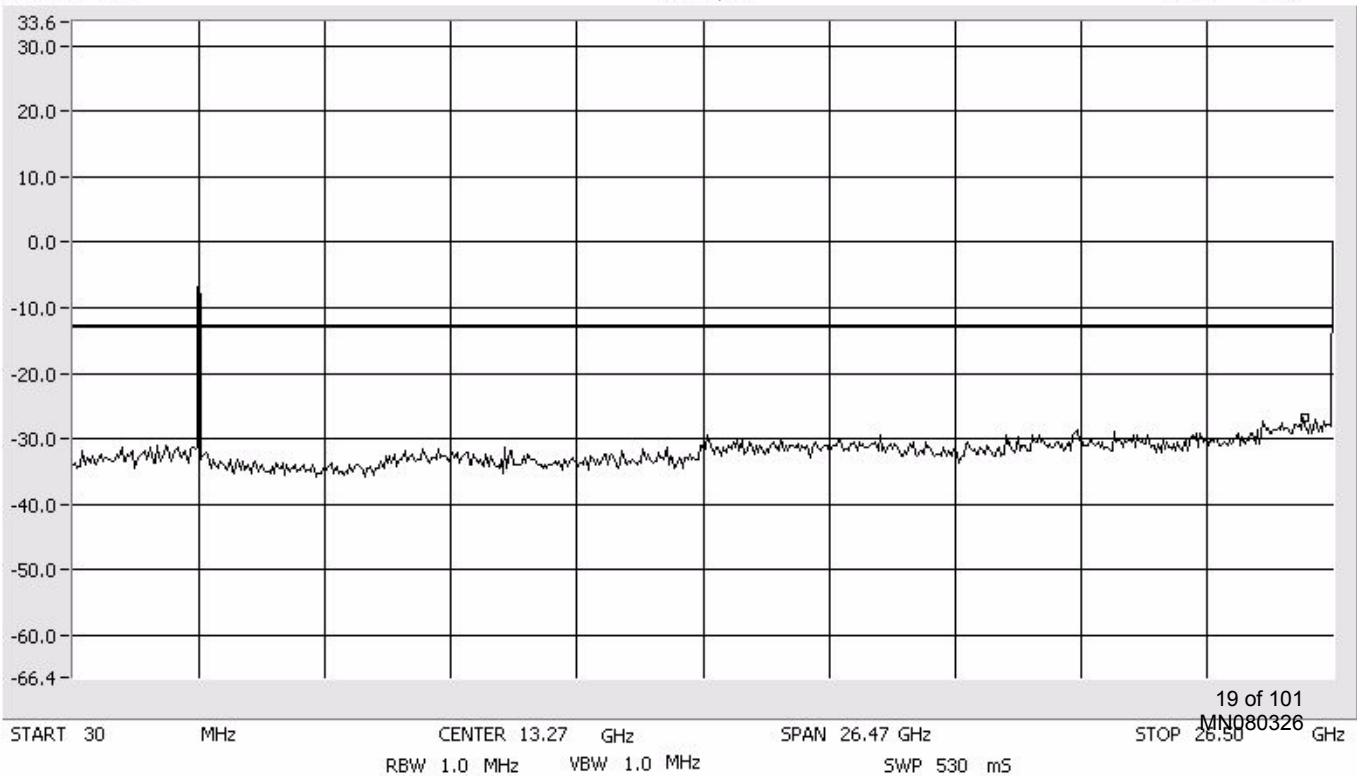
ATTEN 40 dB

delta MKR -26.73 dBm

RL 33.6 dBm

10 dB/Div

25.93 GHz



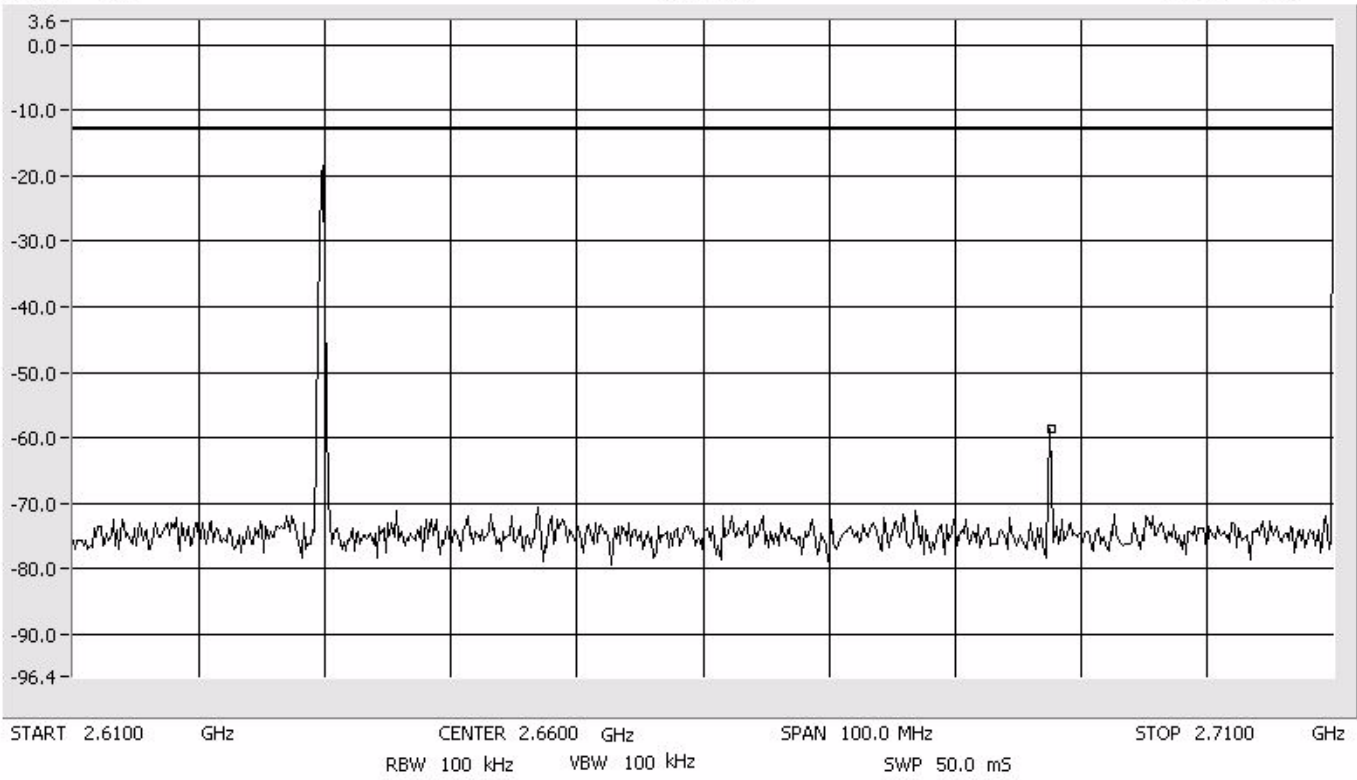
# Conducted Emissions Low CW - RX

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -58.57 dBm  
2.6877 GHz

10 dB/Div



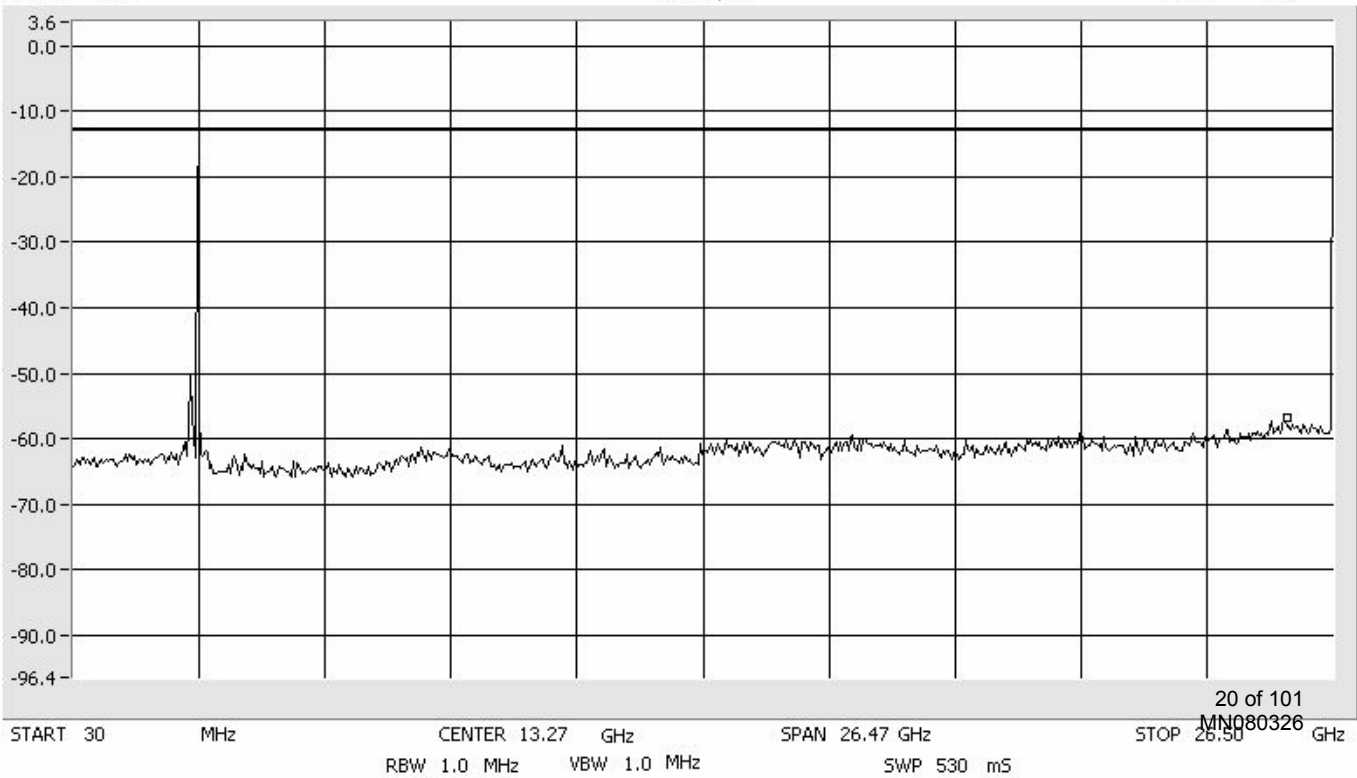
# Conducted Emissions Low CW - RX

Span: 30 MHz to 26.5 GHz  
RBW/VBW: 1 MHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -56.73 dBm  
25.53 GHz

10 dB/Div



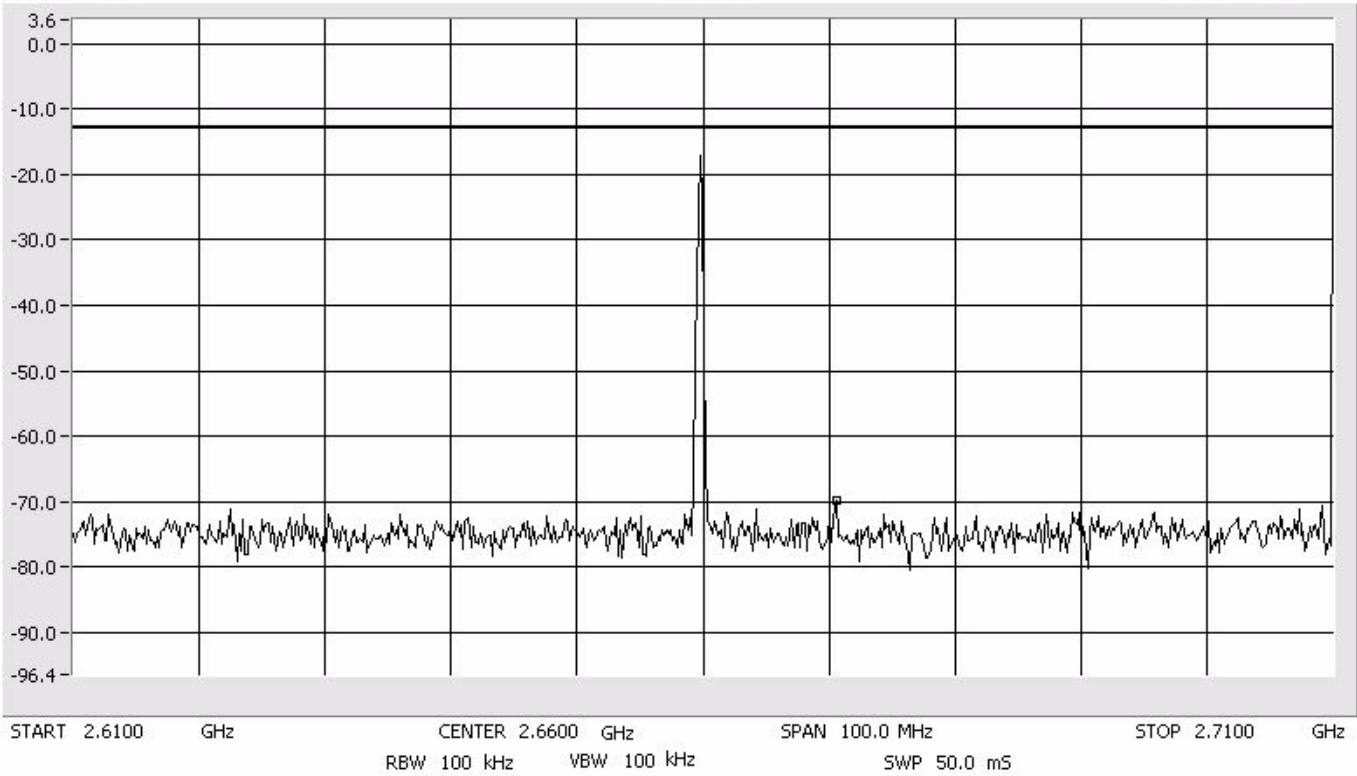
# Conducted Emissions Mid CW - RX

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -69.90 dBm  
2.6707 GHz

10 dB/Div



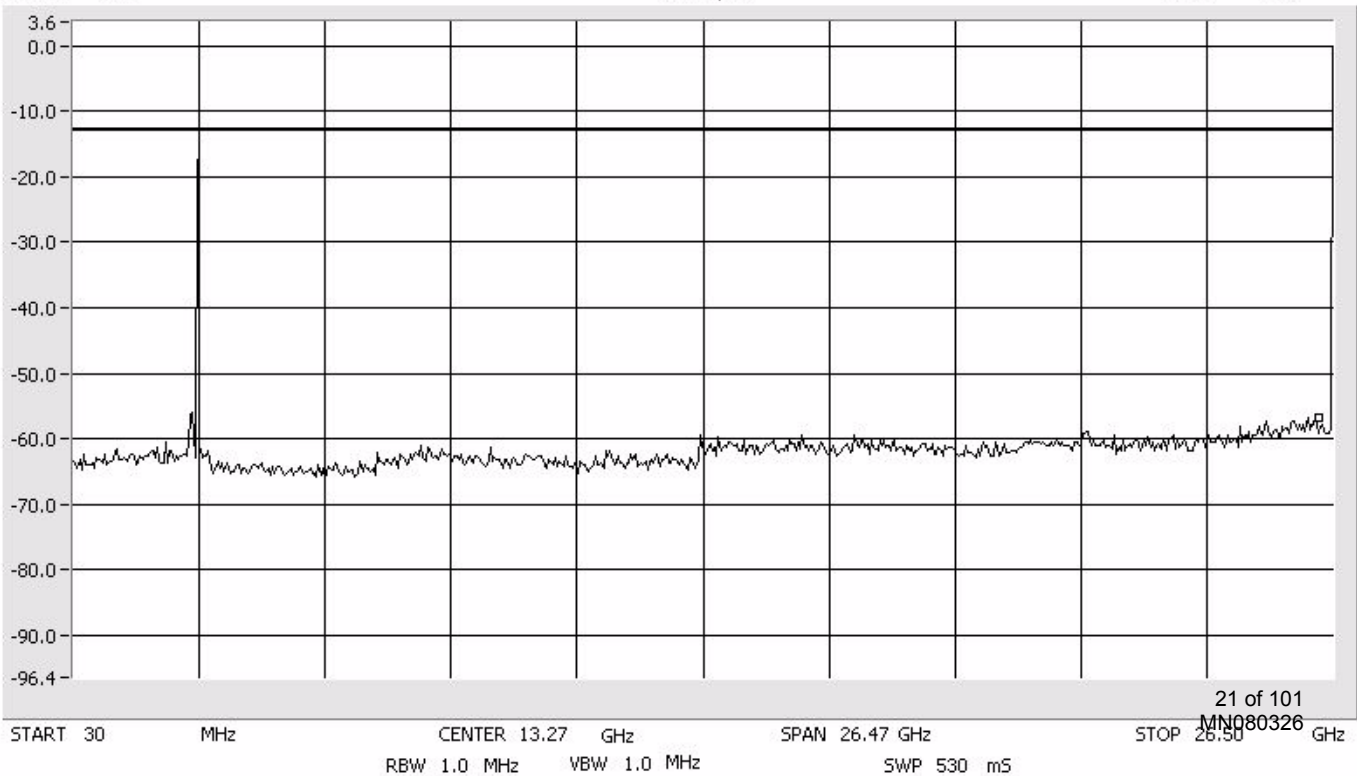
# Conducted Emissions Mid CW - RX

Span: 30 MHz to 26.5 GHz  
RBW/VBW: 1 MHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -56.73 dBm  
26.19 GHz

10 dB/Div



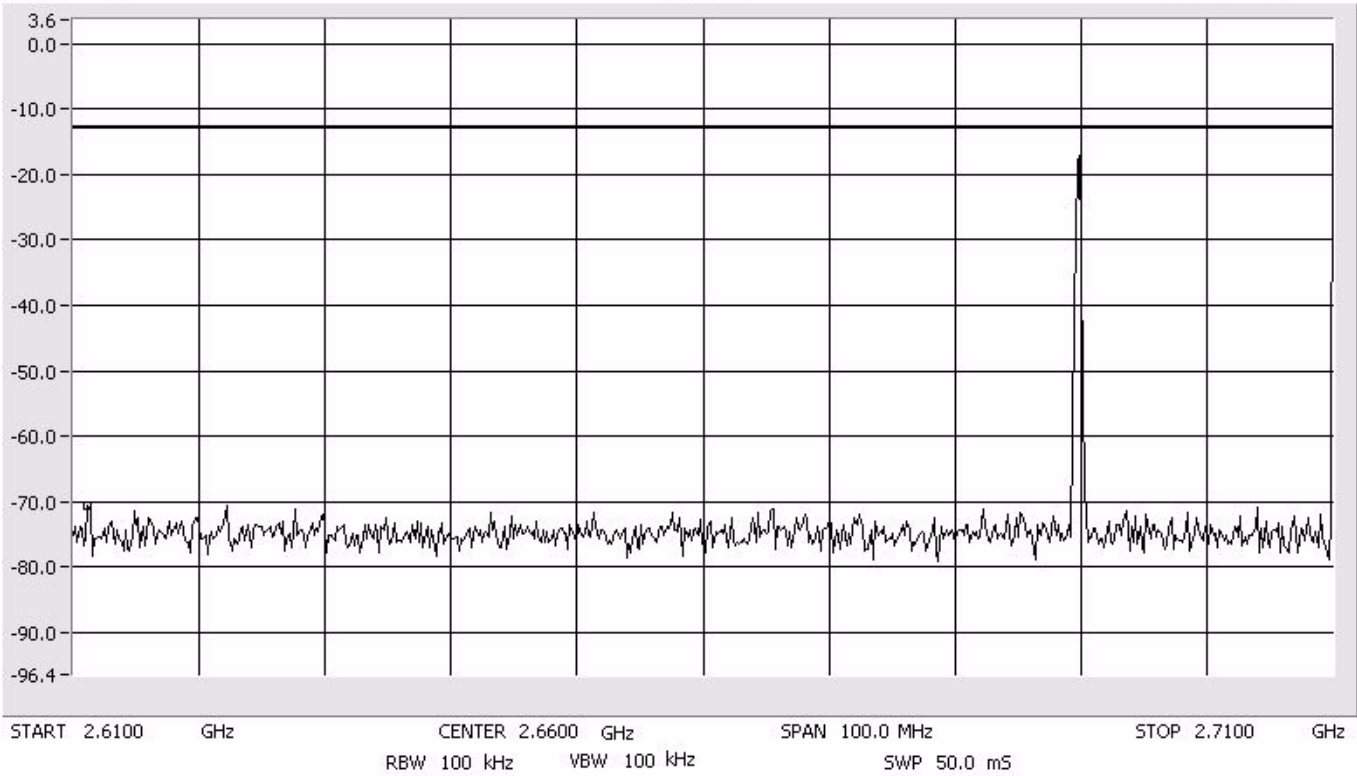
# Conducted Emissions High CW - RX

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

10 dB/Div

delta MKR -70.73 dBm  
2.6112 GHz



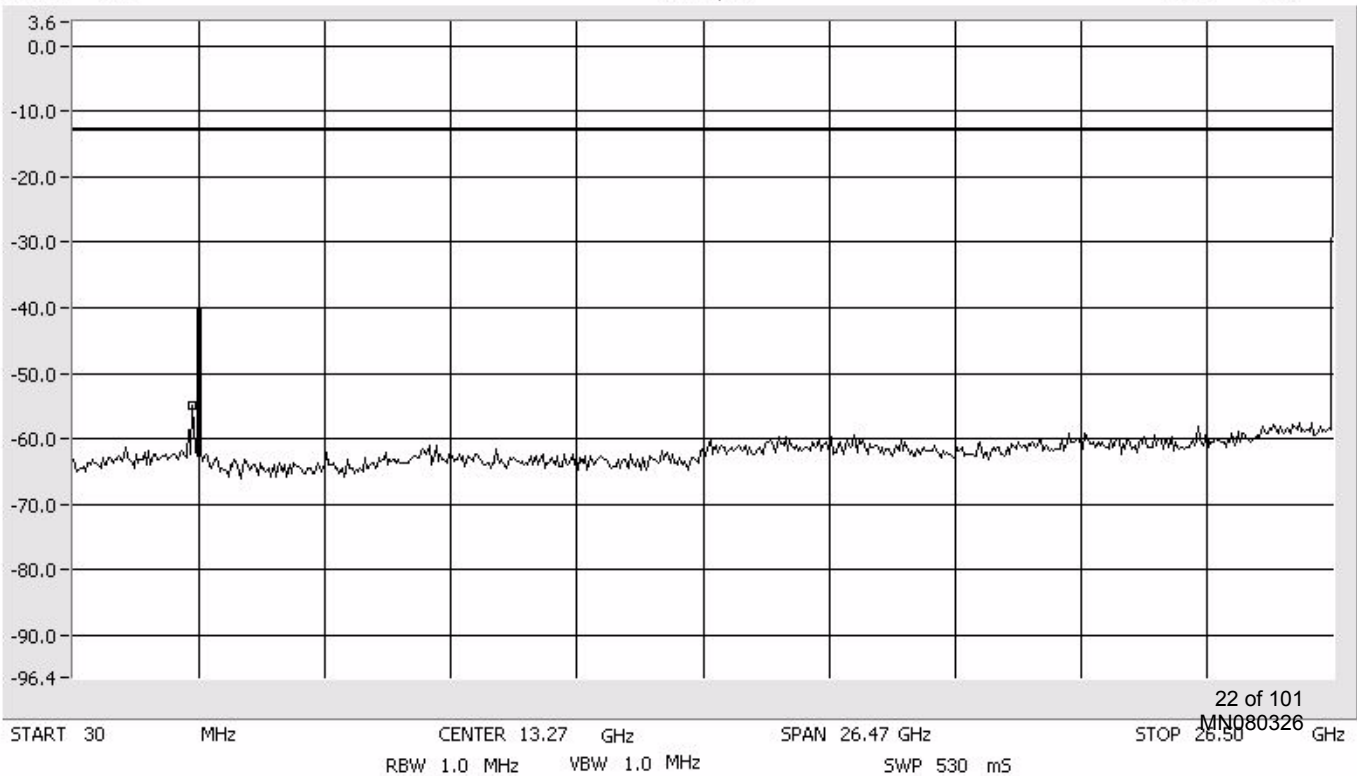
# Conducted Emissions High CW - RX

Span: 30 MHz to 26.5 GHz  
RBW/VBW: 1 MHz

ATTEN 10 dB  
RL 3.6 dBm

10 dB/Div

delta MKR -54.90 dBm  
2.54 GHz



# Conducted Emissions TX WiMax - 64QAM

Center: 2660.0 MHz  
Span: 20 MHz  
RBW/VBW: 100 kHz

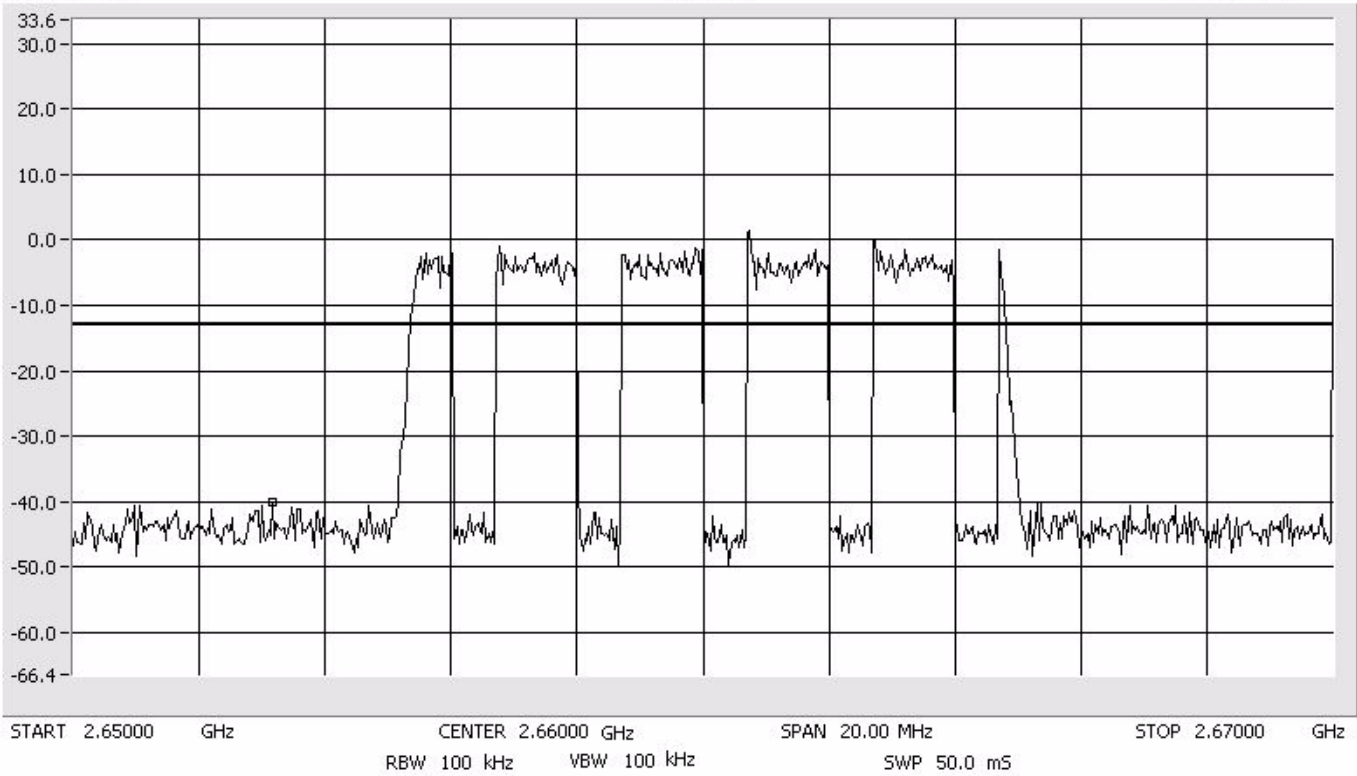
ATTEN 40 dB

delta MKR -40.07 dBm

RL 33.6 dBm

10 dB/Div

2.65317 GHz



# Conducted Emissions TX WiMax - 64QAM

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

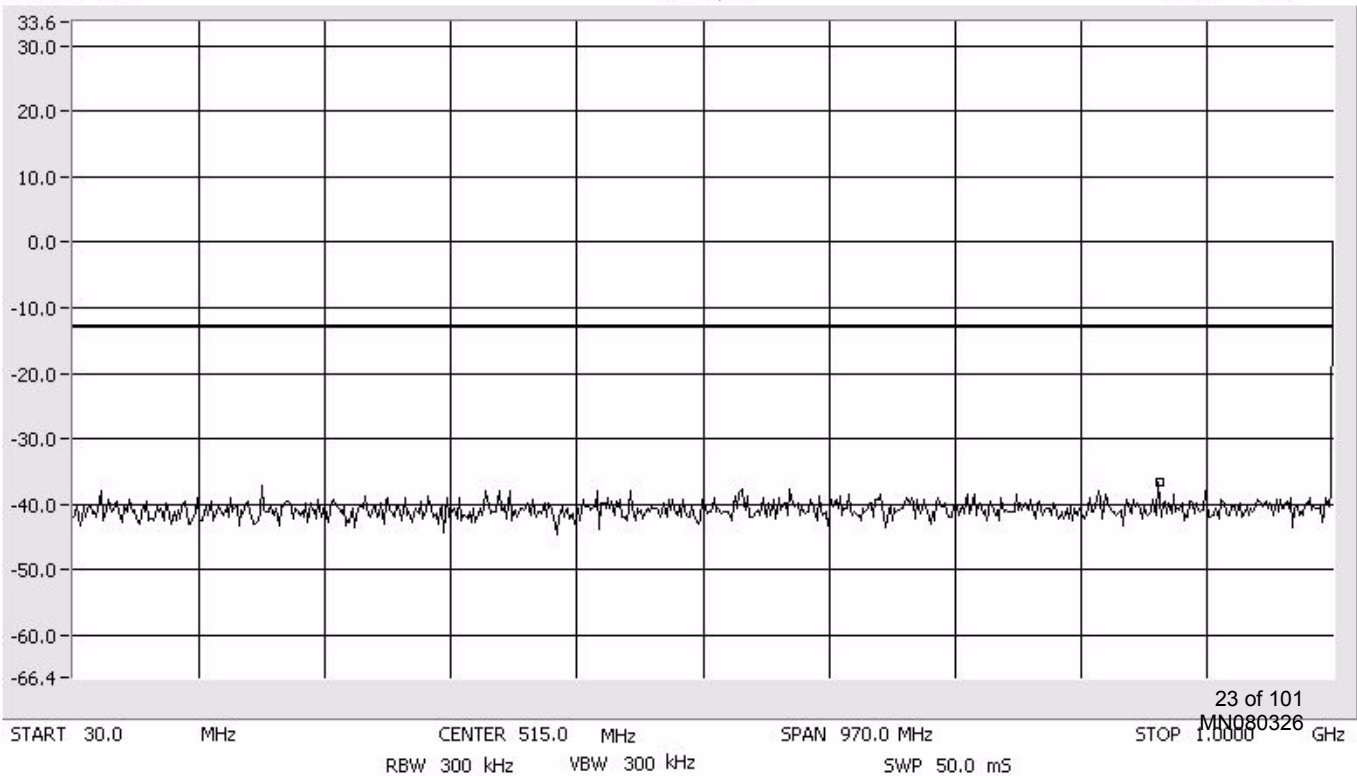
ATTEN 40 dB

delta MKR -36.73 dBm

RL 33.6 dBm

10 dB/Div

867.4 MHz



# Conducted Emissions TX WiMax - 64QAM

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

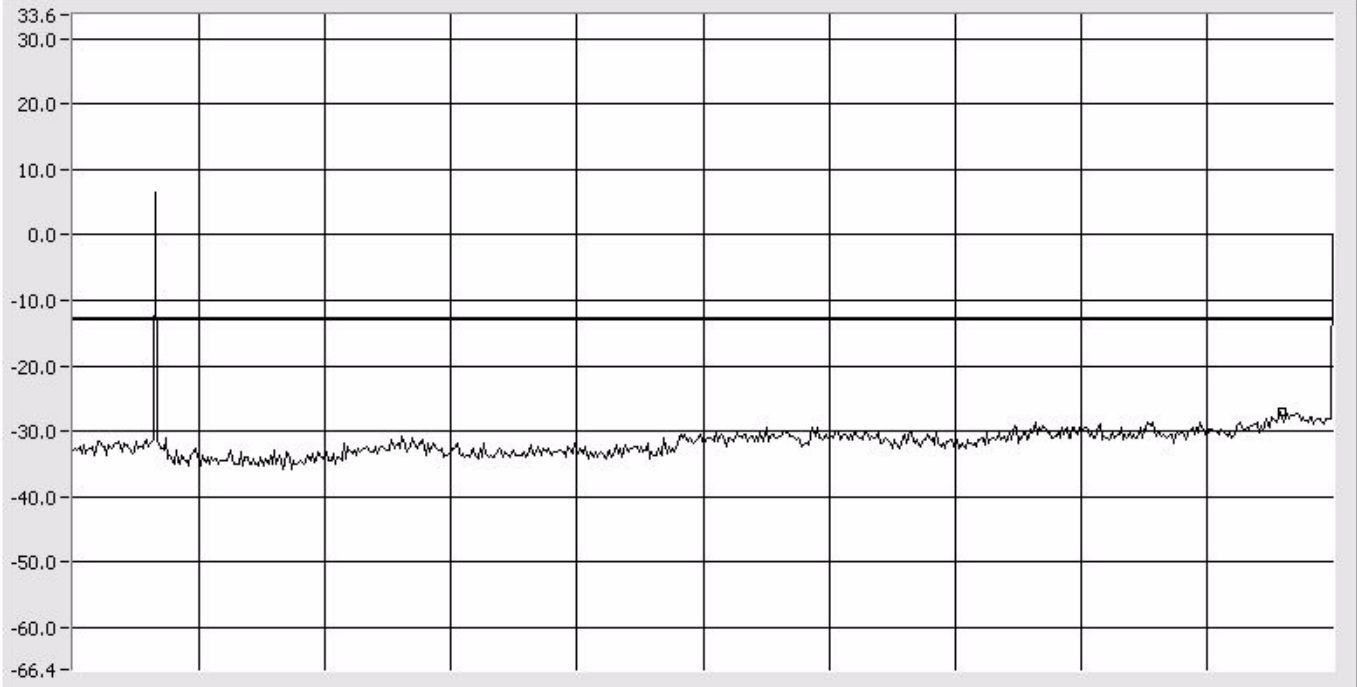
ATTEN 40 dB

delta MKR -27.07 dBm

RL 33.6 dBm

10 dB/Div

25.48 GHz



START 1.00 GHz      CENTER 13.75 GHz      SPAN 25.50 GHz      STOP 26.50 GHz  
RBW 1.0 MHz      VBW 1.0 MHz      SWP 510 mS



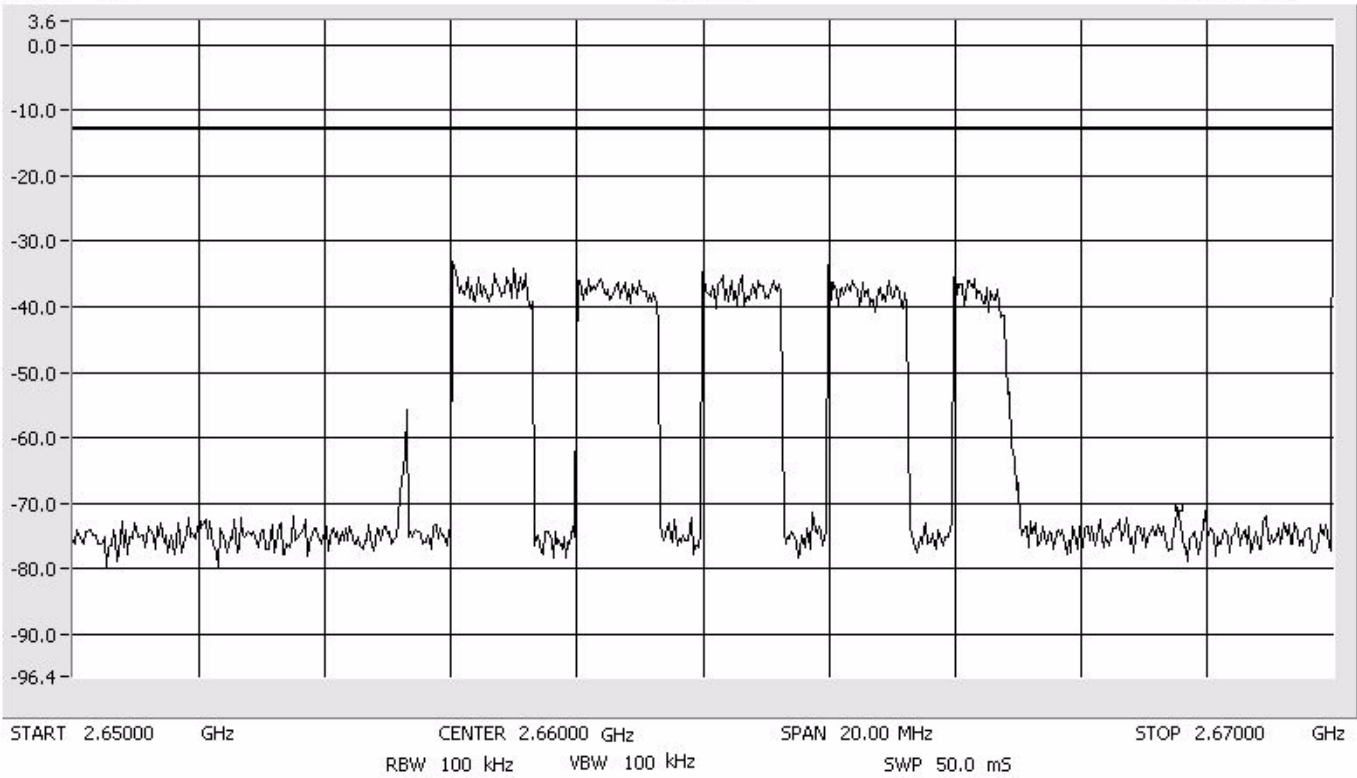
# Conducted Emissions RX WiMax - 64QAM

Center: 2660.0 MHz  
Span: 20 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -70.57 dBm  
2.66757 GHz

10 dB/Div



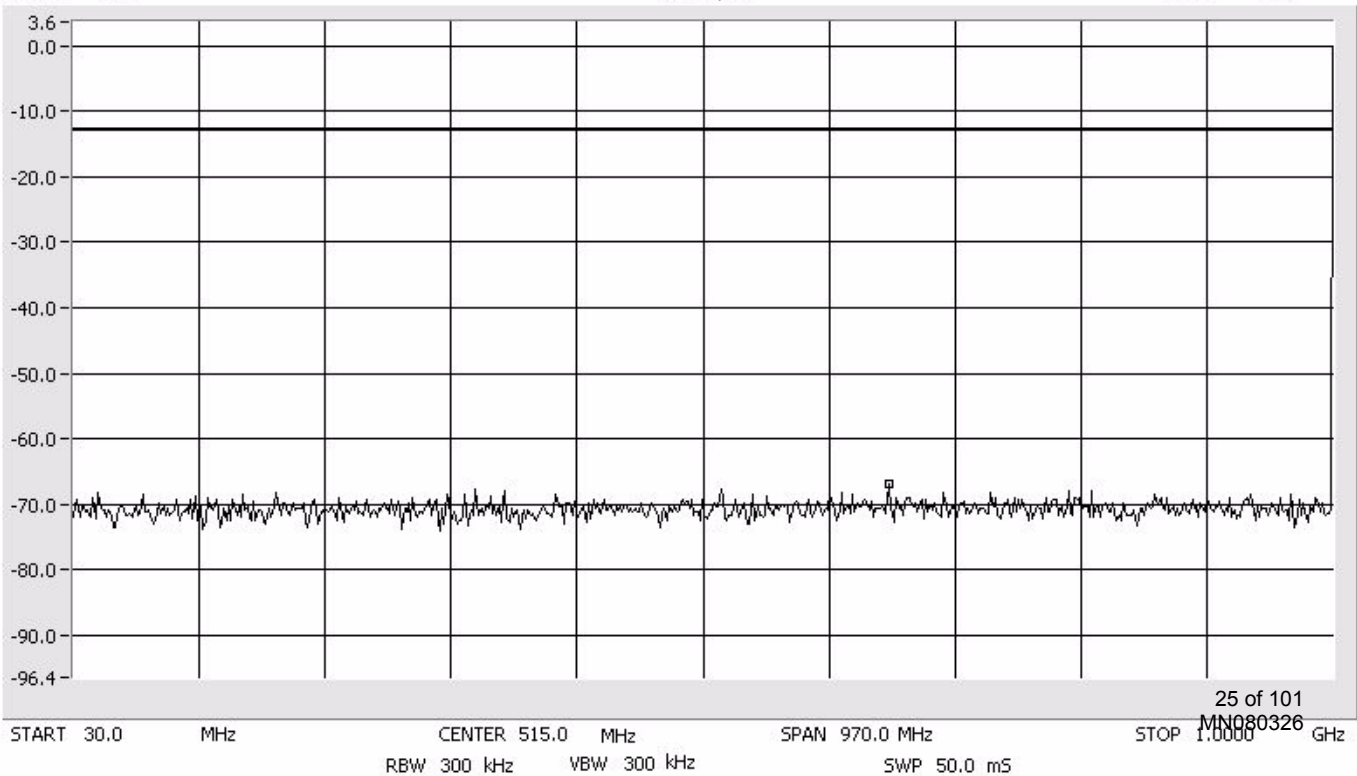
# Conducted Emissions RX WiMax - 64QAM

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

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -66.90 dBm  
658.9 MHz

10 dB/Div



# Conducted Emissions RX WiMax - 64QAM

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

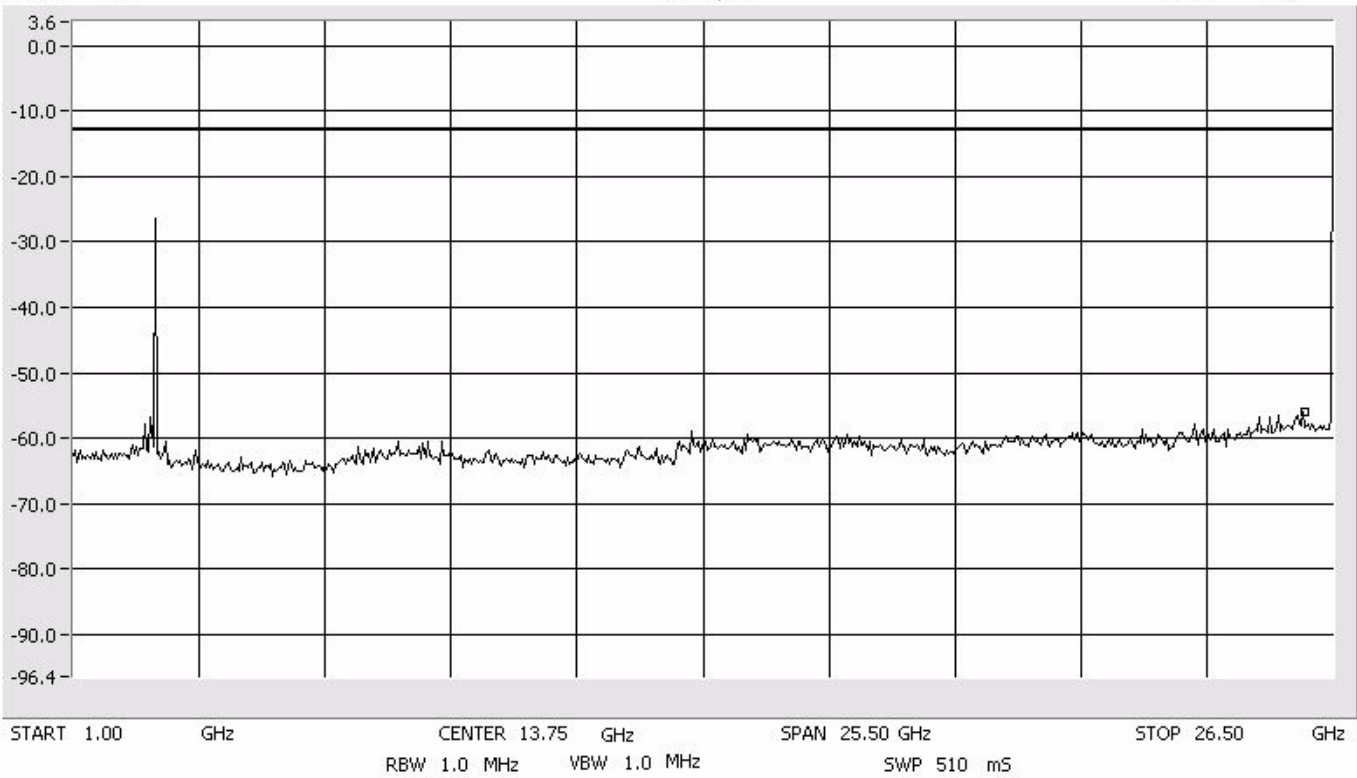
ATTEN 10 dB

delta MKR -55.90 dBm

RL 3.6 dBm

10 dB/Div

25.95 GHz



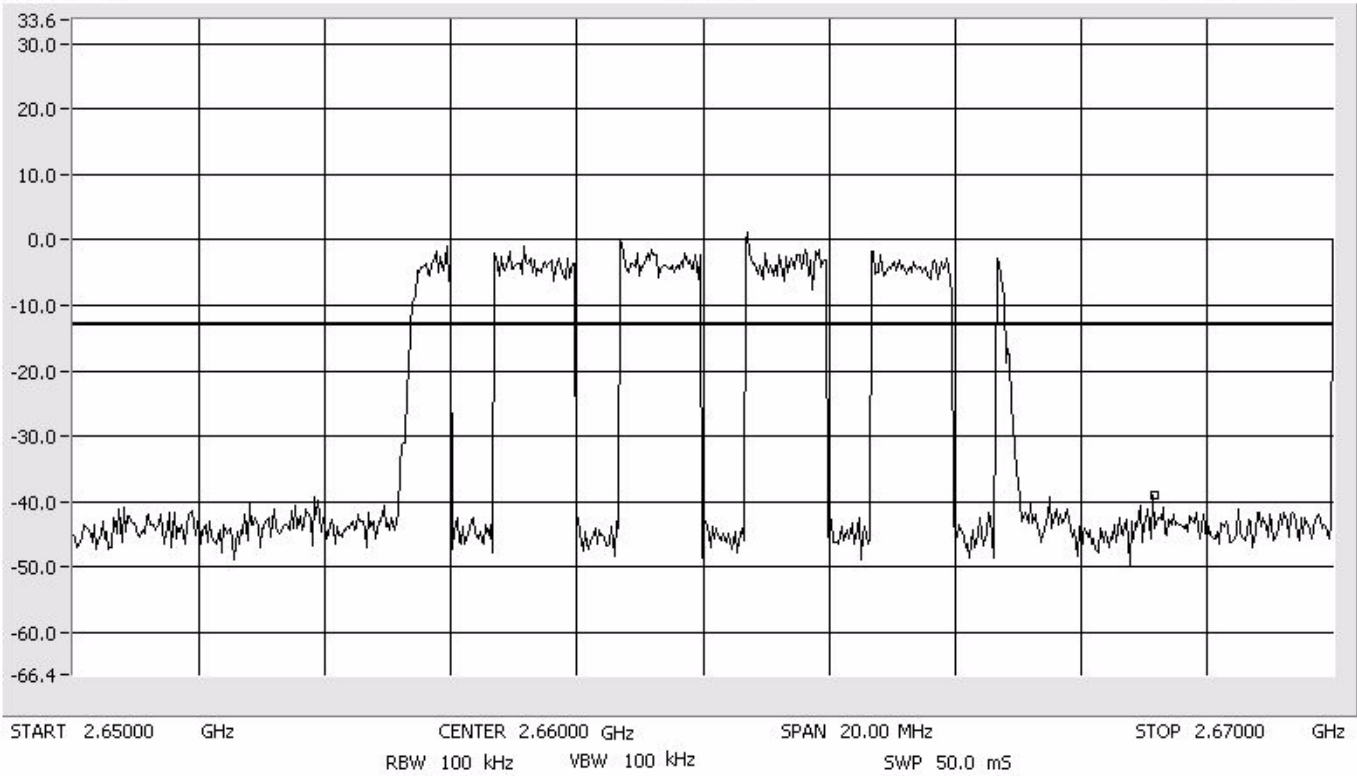
# Conducted Emissions TX WiMax - QPSK

Center: 2660.0 MHz  
Span: 20 MHz  
RBW/VBW: 100 kHz

ATTEN 40 dB  
RL 33.6 dBm

delta MKR -39.07 dBm  
2.66717 GHz

10 dB/Div



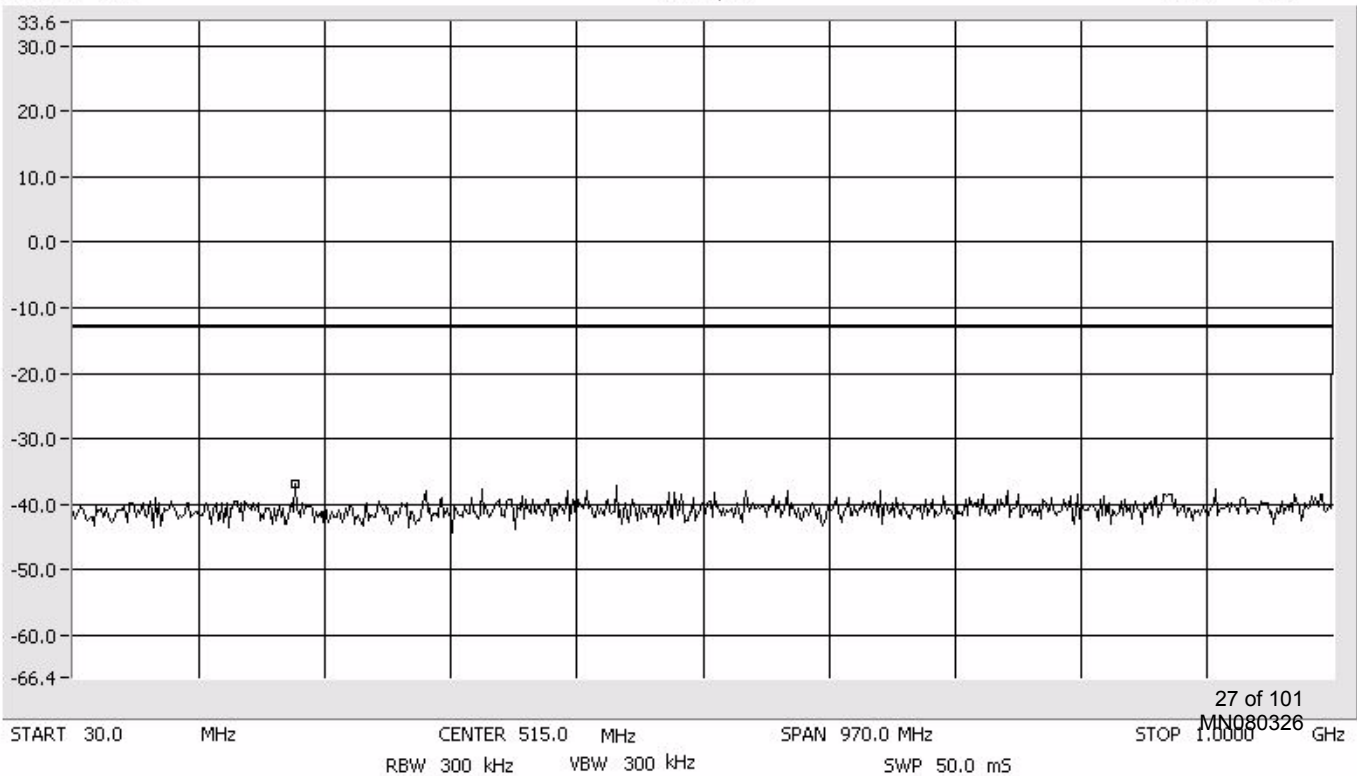
# Conducted Emissions TX WiMax - QPSK

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

ATTEN 40 dB  
RL 33.6 dBm

delta MKR -36.90 dBm  
201.4 MHz

10 dB/Div



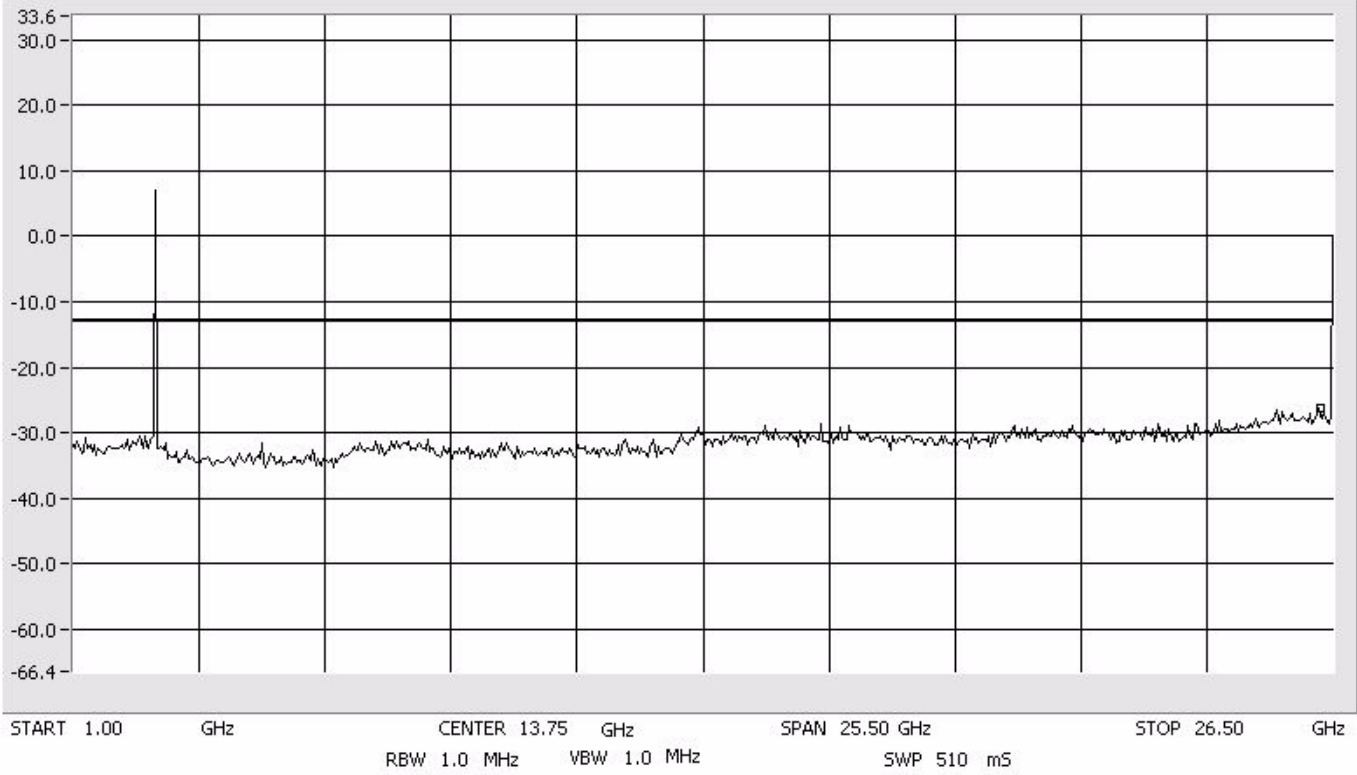
# Conducted Emissions TX WiMax - QPSK

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

ATTEN 40 dB  
RL 33.6 dBm

delta MKR -26.23 dBm  
26.25 GHz

10 dB/Div



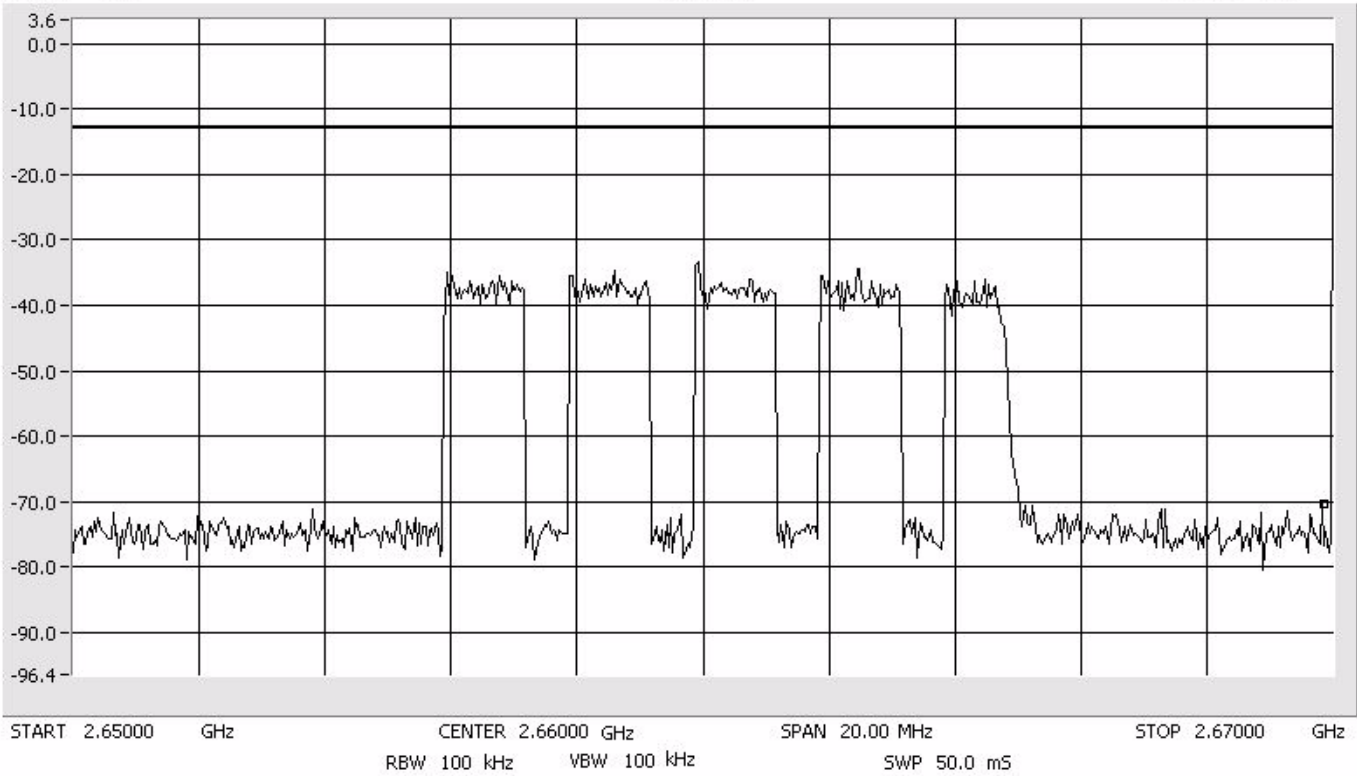
# Conducted Emissions RX WiMax - QPSK

Center: 2660.0 MHz  
Span: 20 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -70.40 dBm  
2.66987 GHz

10 dB/Div



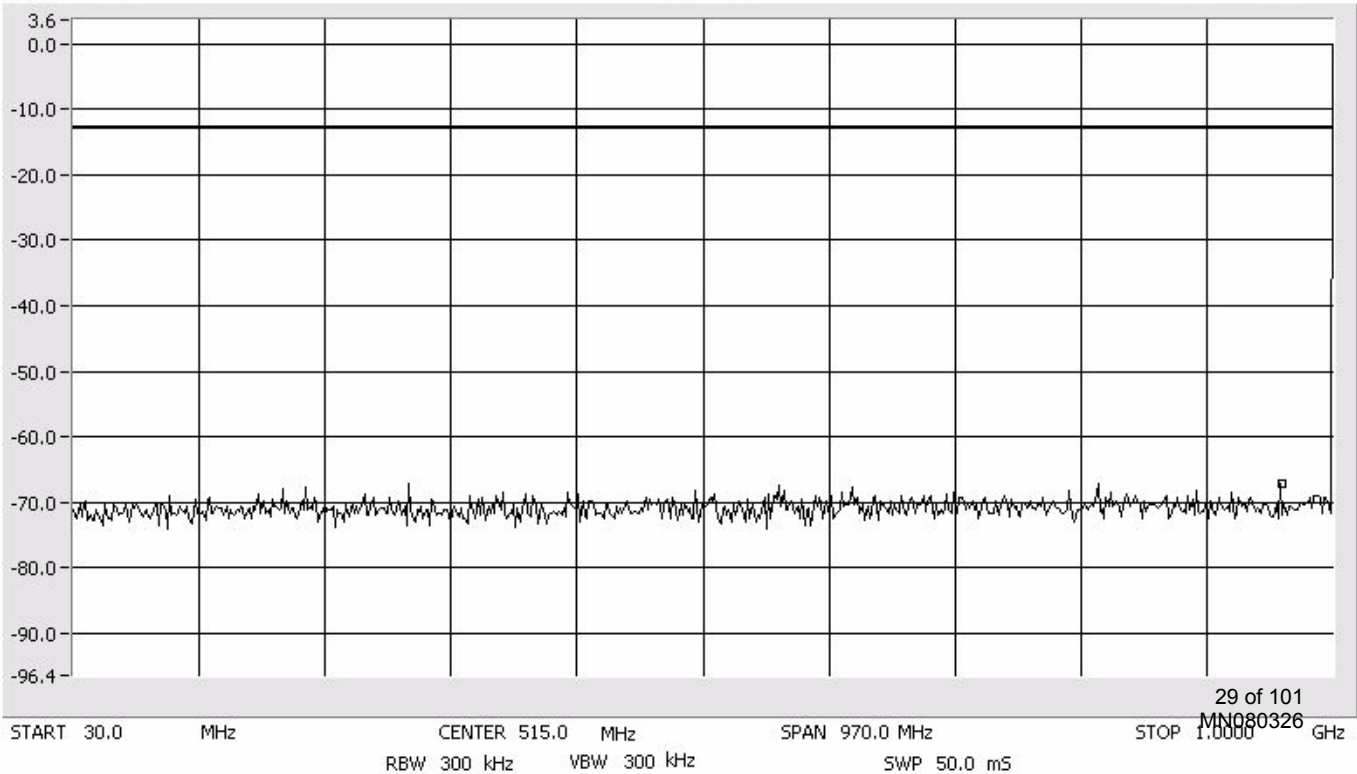
# Conducted Emissions RX WiMax - QPSK

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

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -67.07 dBm  
961.2 MHz

10 dB/Div



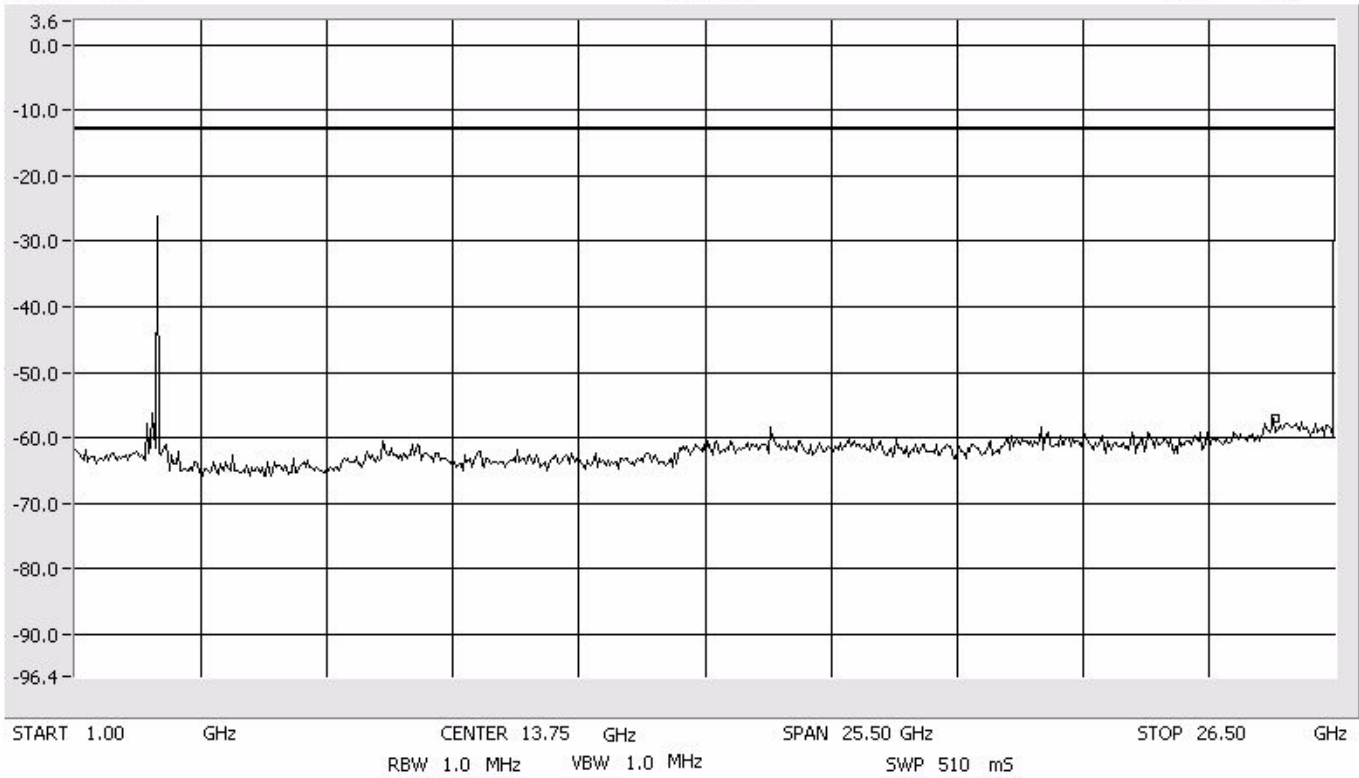
# Conducted Emissions RX WiMax - QPSK

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

ATTEN 10 dB  
RL 3.6 dBm

10 dB/Div

delta MKR -57.07 dBm  
25.31 GHz



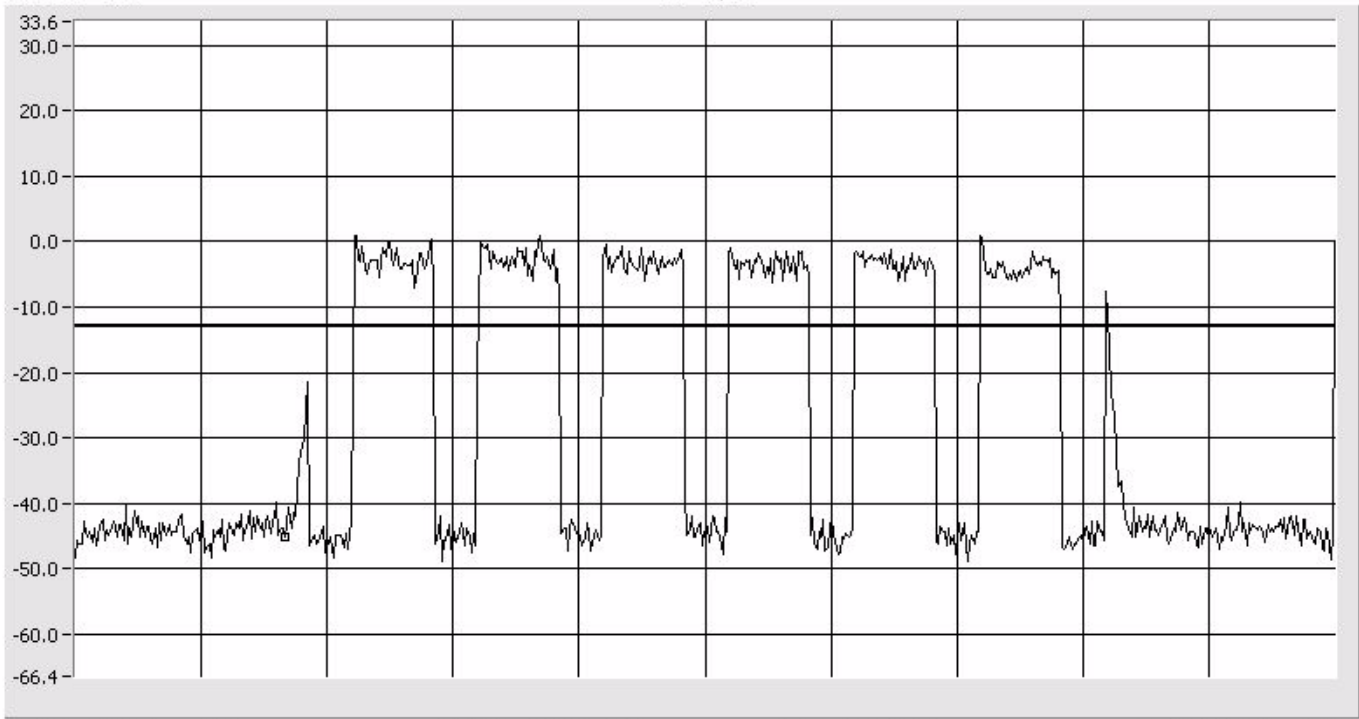
# Band Edge 64QAM - TX

Center: 2635.0 MHz  
Span: 15 MHz  
RBW: 100 kHz  
VBW: 100 kHz

ATTEN 40 dB  
RL 33.6 dBm

delta MKR -45.23 dBm  
2.63000 GHz

10 dB/Div



START 2.62750 GHz CENTER 2.63500 GHz SPAN 15.00 MHz STOP 2.64250 GHz  
RBW 100 kHz VBW 100 kHz SWP 50.0 mS

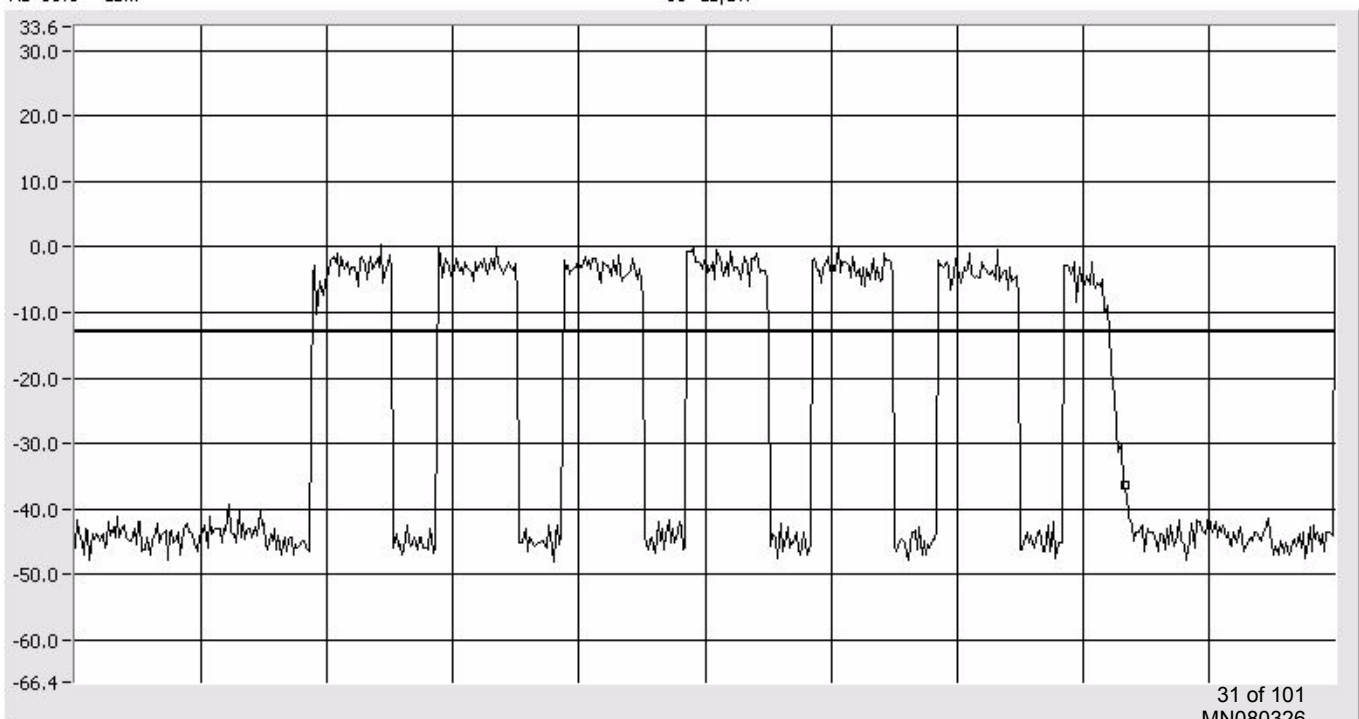
# Band Edge 64QAM - TX

Center: 2685.0 MHz  
Span: 15 MHz  
RBW: 100 kHz  
VBW: 100 kHz

ATTEN 40 dB  
RL 33.6 dBm

delta MKR -36.40 dBm  
2.69000 GHz

10 dB/Div



START 2.67750 GHz CENTER 2.68500 GHz SPAN 15.00 MHz STOP 2.69250 GHz  
RBW 100 kHz VBW 100 kHz SWP 50.0 mS

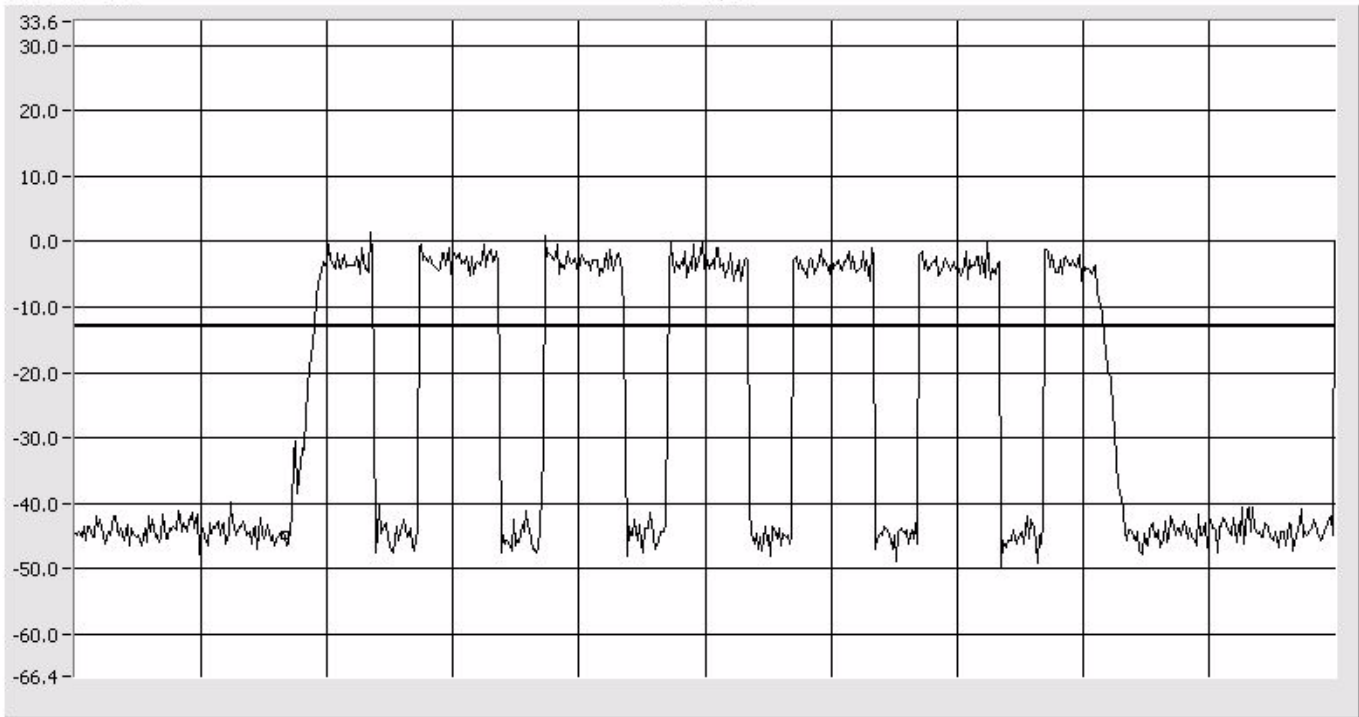
# Band Edge QPSK - TX

Center: 2635.0 MHz  
Span: 15 MHz  
RBW: 100 kHz  
VBW: 100 kHz

ATTEN 40 dB  
RL 33.6 dBm

delta MKR -44.90 dBm  
2.63000 GHz

10 dB/Div



START 2.62750 GHz CENTER 2.63500 GHz SPAN 15.00 MHz STOP 2.64250 GHz  
RBW 100 kHz VBW 100 kHz SWP 50.0 mS

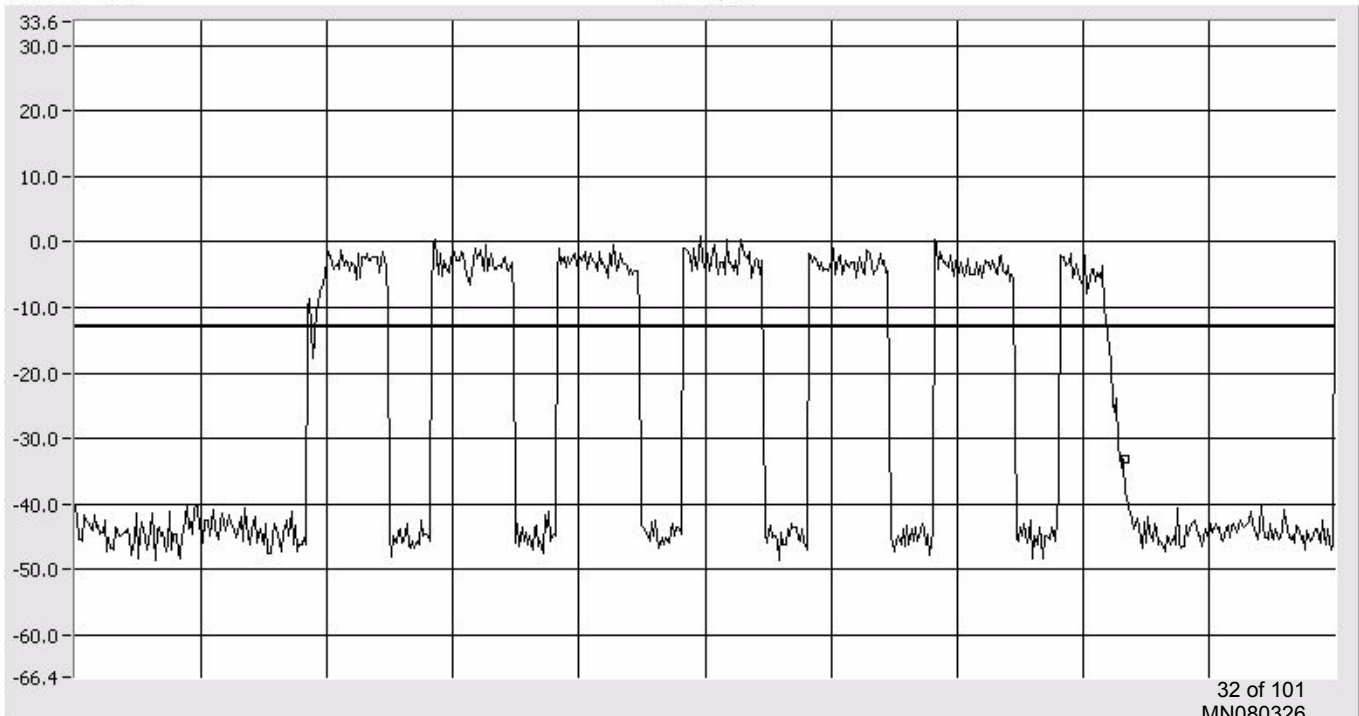
# Band Edge QPSK - TX

Center: 2685.0 MHz  
Span: 15 MHz  
RBW: 100 kHz  
VBW: 100 kHz

ATTEN 40 dB  
RL 33.6 dBm

delta MKR -33.23 dBm  
2.69000 GHz

10 dB/Div



START 2.67750 GHz CENTER 2.68500 GHz SPAN 15.00 MHz STOP 2.69250 GHz  
RBW 100 kHz VBW 100 kHz SWP 50.0 mS



# Band Edge 64QAM - RX

Center: 2635.0 MHz  
Span: 15 MHz  
RBW: 100 kHz  
VBW: 100 kHz

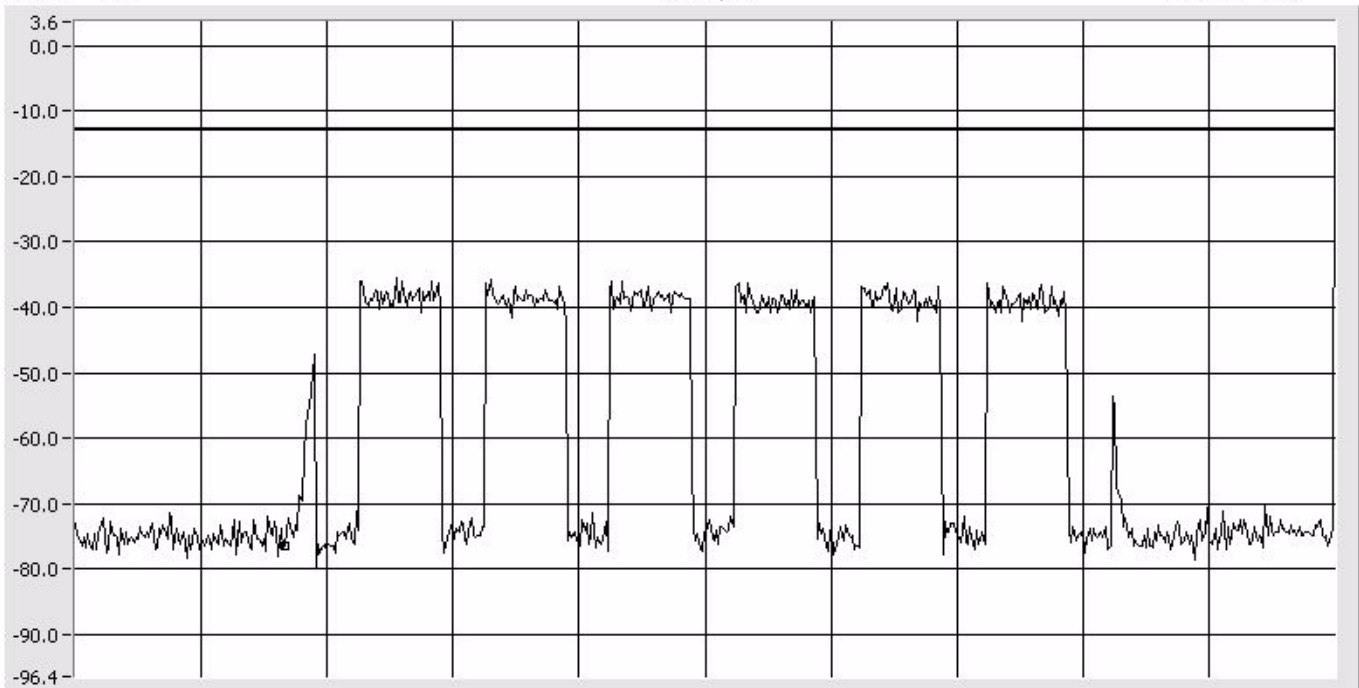
ATTEN 10 dB

delta MKR -76.57 dBm

RL 3.6 dBm

10 dB/Div

2.63000 GHz



START 2.62750 GHz CENTER 2.63500 GHz SPAN 15.00 MHz STOP 2.64250 GHz  
RBW 100 kHz VBW 100 kHz SWP 50.0 mS

# Band Edge 64QAM - RX

Center: 2685.0 MHz  
Span: 15 MHz  
RBW: 100 kHz  
VBW: 100 kHz

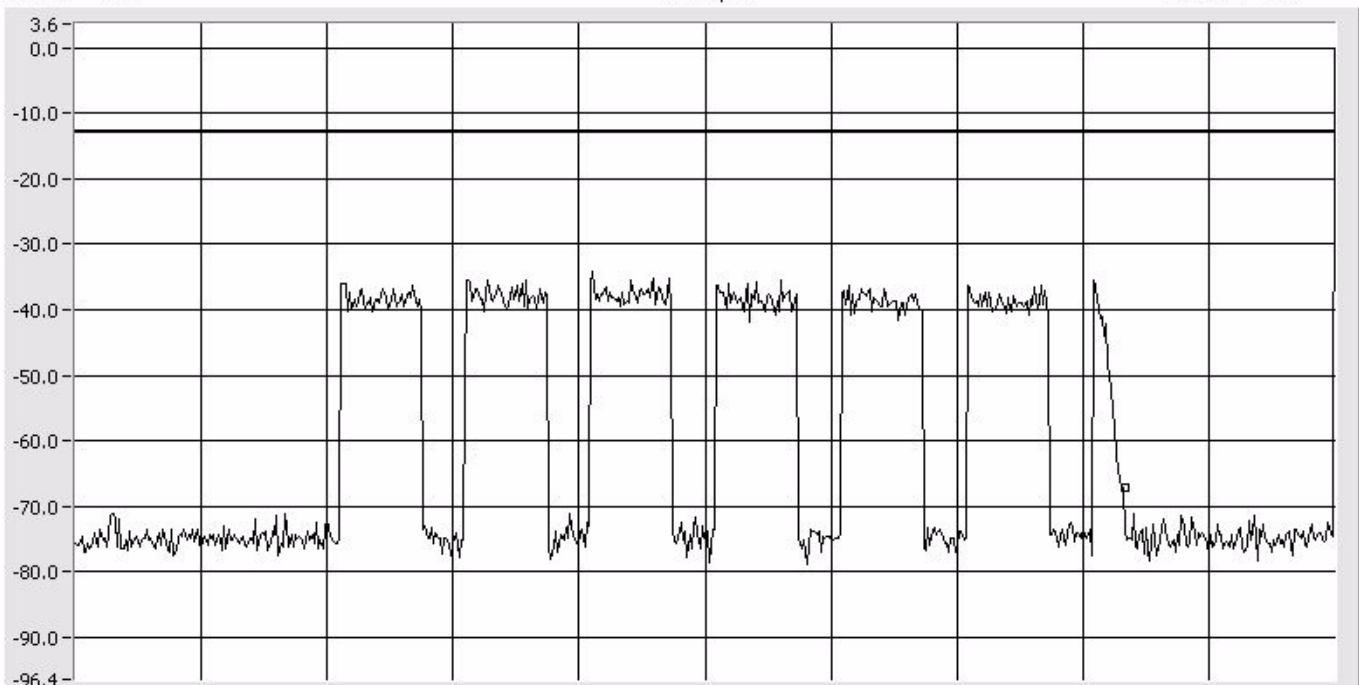
ATTEN 10 dB

delta MKR -67.23 dBm

RL 3.6 dBm

10 dB/Div

2.69000 GHz



START 2.67750 GHz CENTER 2.68500 GHz SPAN 15.00 MHz STOP 2.69250 GHz  
RBW 100 kHz VBW 100 kHz SWP 50.0 mS

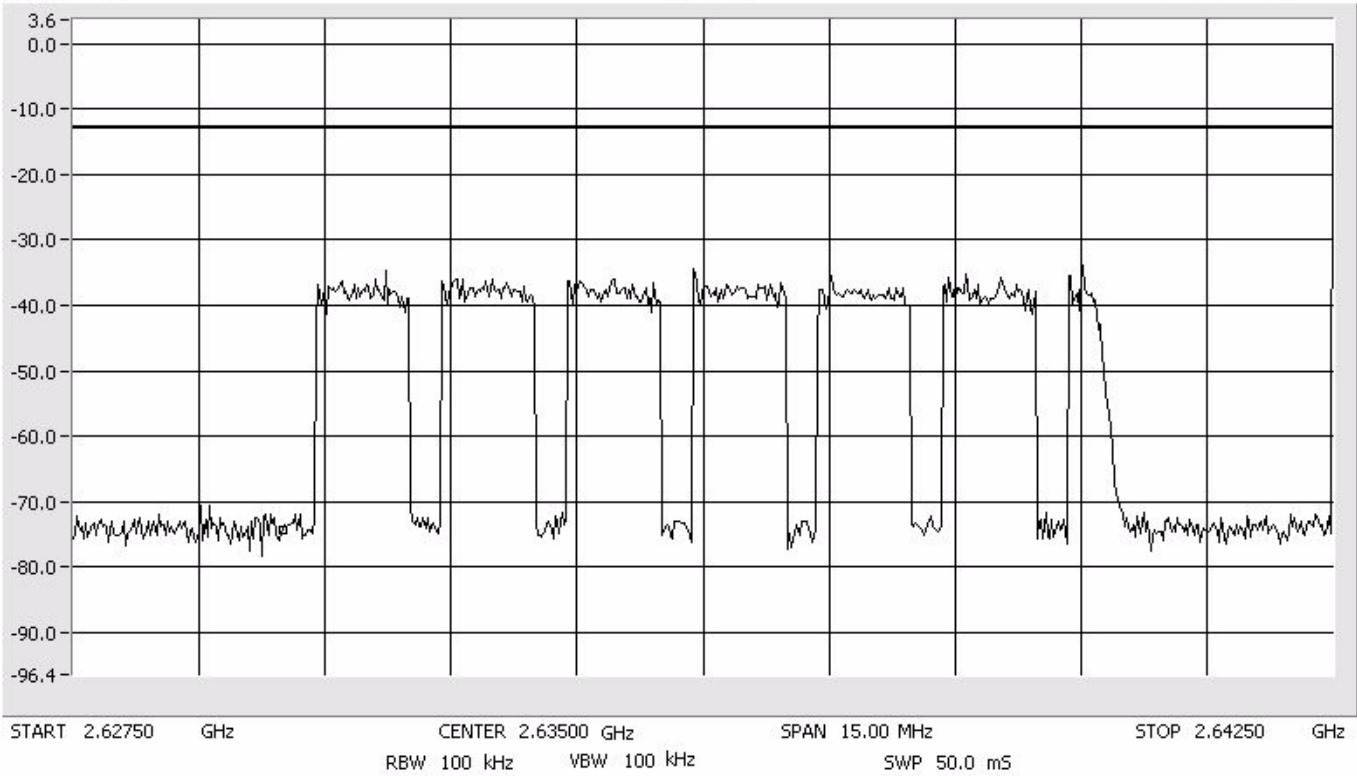
# Band Edge QPSK - RX

Center: 2635.0 MHz  
Span: 15 MHz  
RBW: 100 kHz  
VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -74.40 dBm  
2.63000 GHz

10 dB/Div



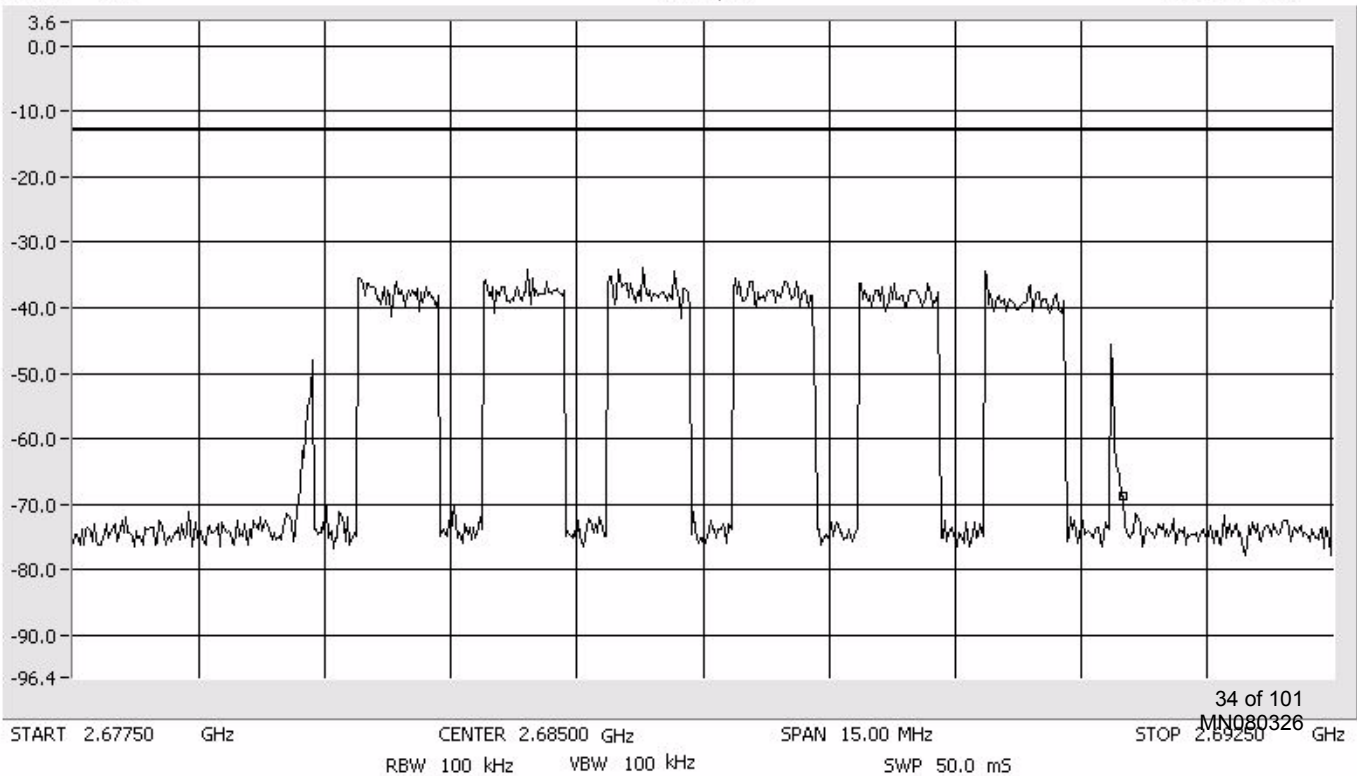
# Band Edge QPSK - RX

Center: 2685.0 MHz  
Span: 15 MHz  
RBW: 100 kHz  
VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -68.73 dBm  
2.69000 GHz

10 dB/Div



**Conducted Output Power Test for ADC Inc  
InterReach® Fusion Main Hub  
Model Number FSN-1-MH-1-WMAX**

**InterReach® Fusion Expansion Hub  
Model Number FSN-EH-1-WMAX**

**InterReach® Fusion Remote Access Unit  
Model Number FSN-2500-1-WMAX**

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\*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 64QAM and QPSK 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 2.3 dB to compensate for cable loss between the EUT and the power meter.

<u>64QAM - TX</u>	<u>0.15 Watts</u>
Carrier Frequency	Carrier Output
2635.0 MHz	<u>21.77</u> dBm
2660.0 MHz	<u>20.43</u> dBm
2685.0 MHz	<u>19.77</u> dBm

<u>QPSK - TX</u>	<u>0.14 Watts</u>
Carrier Frequency	Carrier Output
2635.0 MHz	<u>21.23</u> dBm
2660.0 MHz	<u>21.52</u> dBm
2685.0 MHz	<u>20.89</u> dBm

<u>64QAM - RX</u>	<u>0.018 mWatts</u>
Carrier Frequency	Carrier Output
2635.0 MHz	<u>-18.57</u> dBm
2660.0 MHz	<u>-17.23</u> dBm
2685.0 MHz	<u>-18.17</u> dBm

<u>QPSK - RX</u>	<u>0.019 mWatts</u>
Carrier Frequency	Carrier Output
2635.0 MHz	<u>-17.28</u> dBm
2660.0 MHz	<u>-17.19</u> dBm
2685.0 MHz	<u>-18.05</u> dBm

**Intermodulation Test for ADC Inc  
InterReach® Fusion Main Hub  
Model Number FSN-1-MH-1-WMAX**

**InterReach® Fusion Expansion Hub  
Model Number FSN-EH-1-WMAX**

**InterReach® Fusion Remote Access Unit  
Model Number FSN-2500-1-WMAX**

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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 64QAM and QPSK. An investigation was made from 30 MHz to the 10<sup>th</sup> Harmonic of the highest fundamental frequency (~26.5 GHz). The following plots show the results.

Results:  
(See Plots)

TX

# Intermodulation Close - Lower WiMax - 64QAM

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

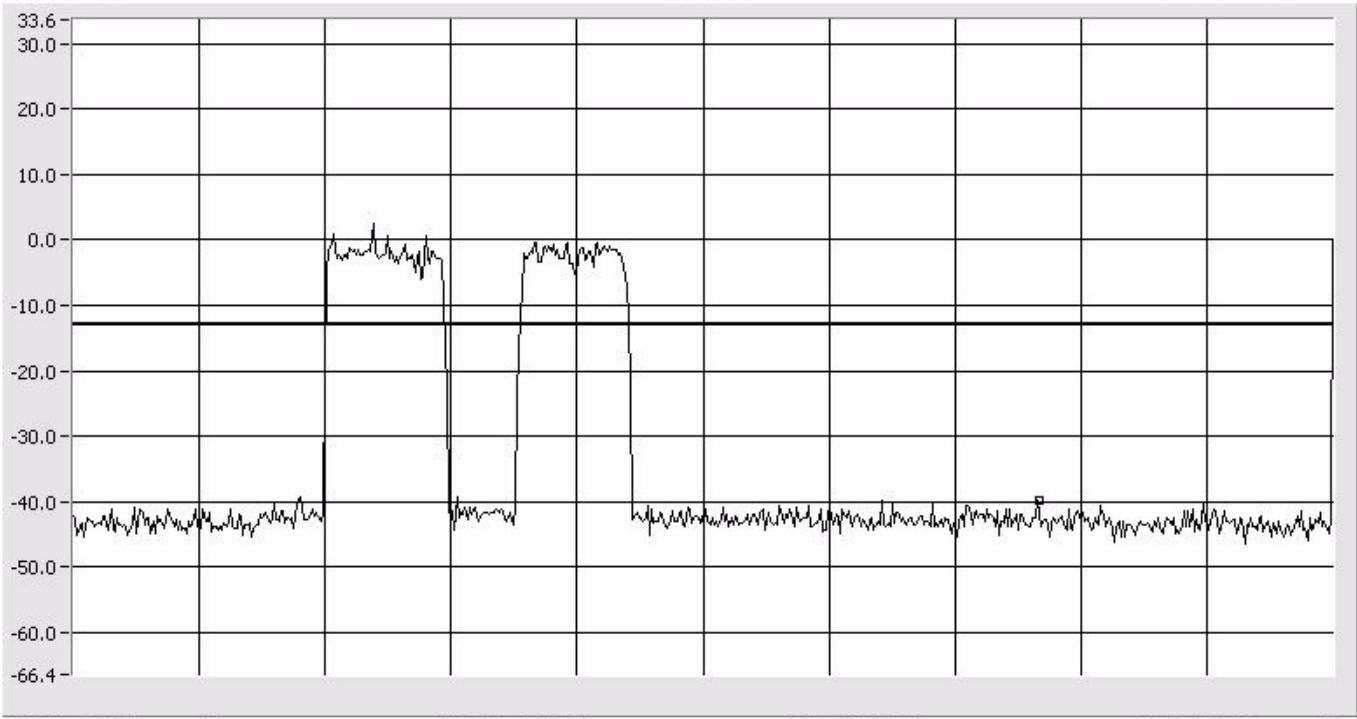
ATTEN 40 dB

delta MKR -39.73 dBm

RL 33.6 dBm

10 dB/Div

2.6867 GHz



START 2.6100 GHz CENTER 2.6600 GHz SPAN 100.0 MHz STOP 2.7100 GHz  
RBW 100 kHz VBW 100 kHz SWP 50.0 mS

TX

# Intermodulation Close - Lower WiMax - 64QAM

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

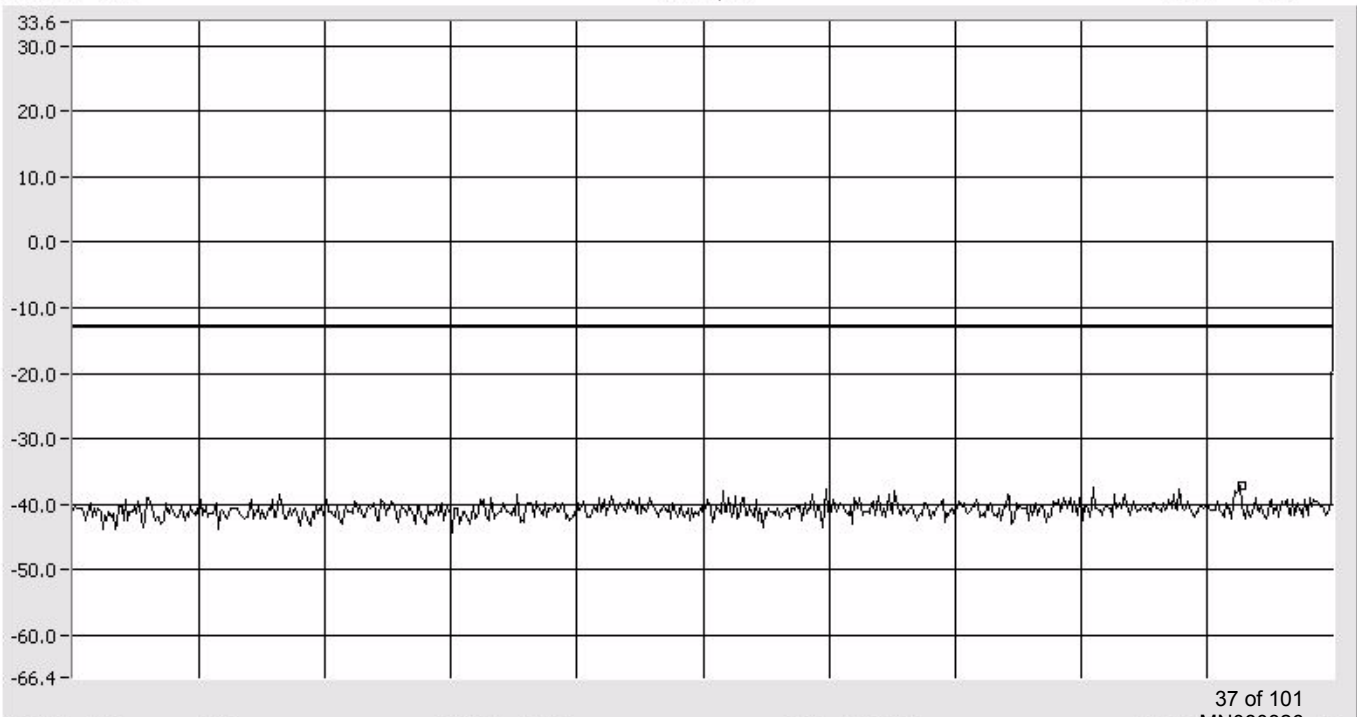
ATTEN 40 dB

delta MKR -37.23 dBm

RL 33.6 dBm

10 dB/Div

930.5 MHz



START 30.0 MHz CENTER 515.0 MHz SPAN 970.0 MHz STOP 1.000 GHz  
RBW 300 kHz VBW 300 kHz SWP 50.0 mS

TX

# Intermodulation Close - Lower WiMax - 64QAM

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

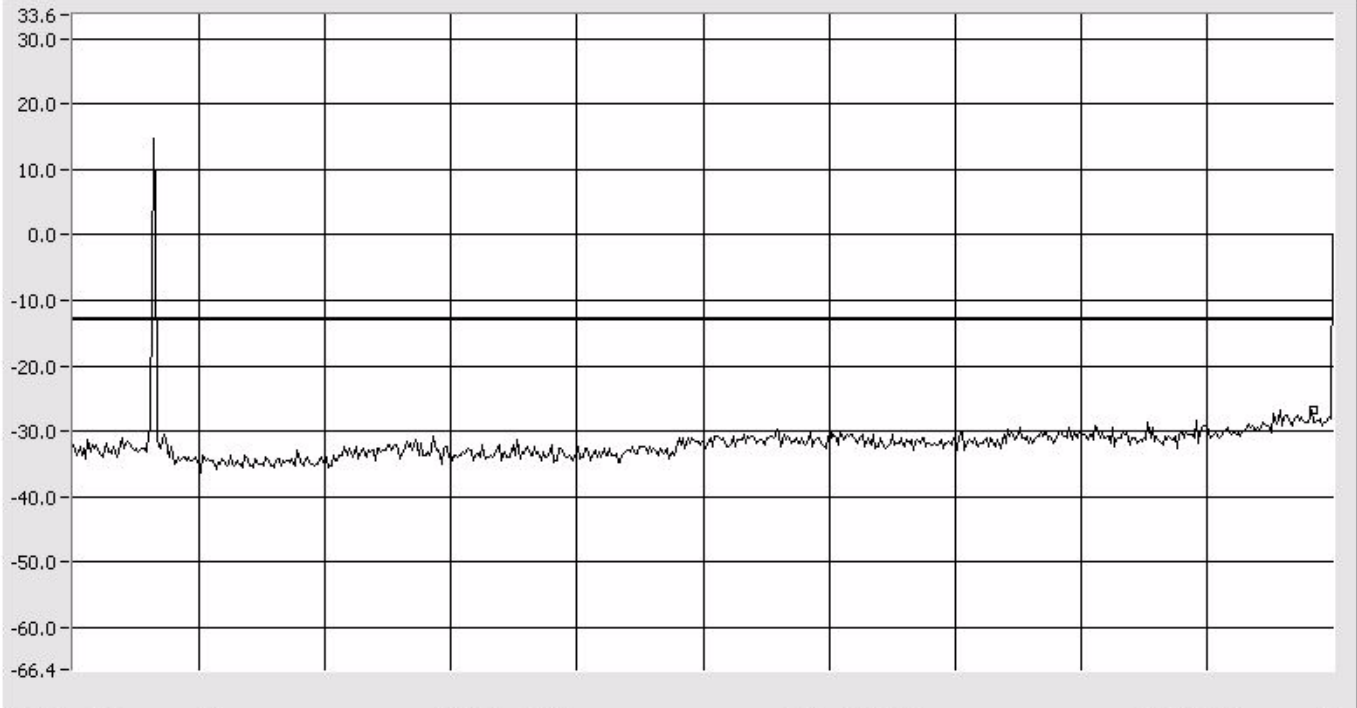
ATTEN 40 dB

delta MKR -26.73 dBm

RL 33.6 dBm

10 dB/Div

26.12 GHz

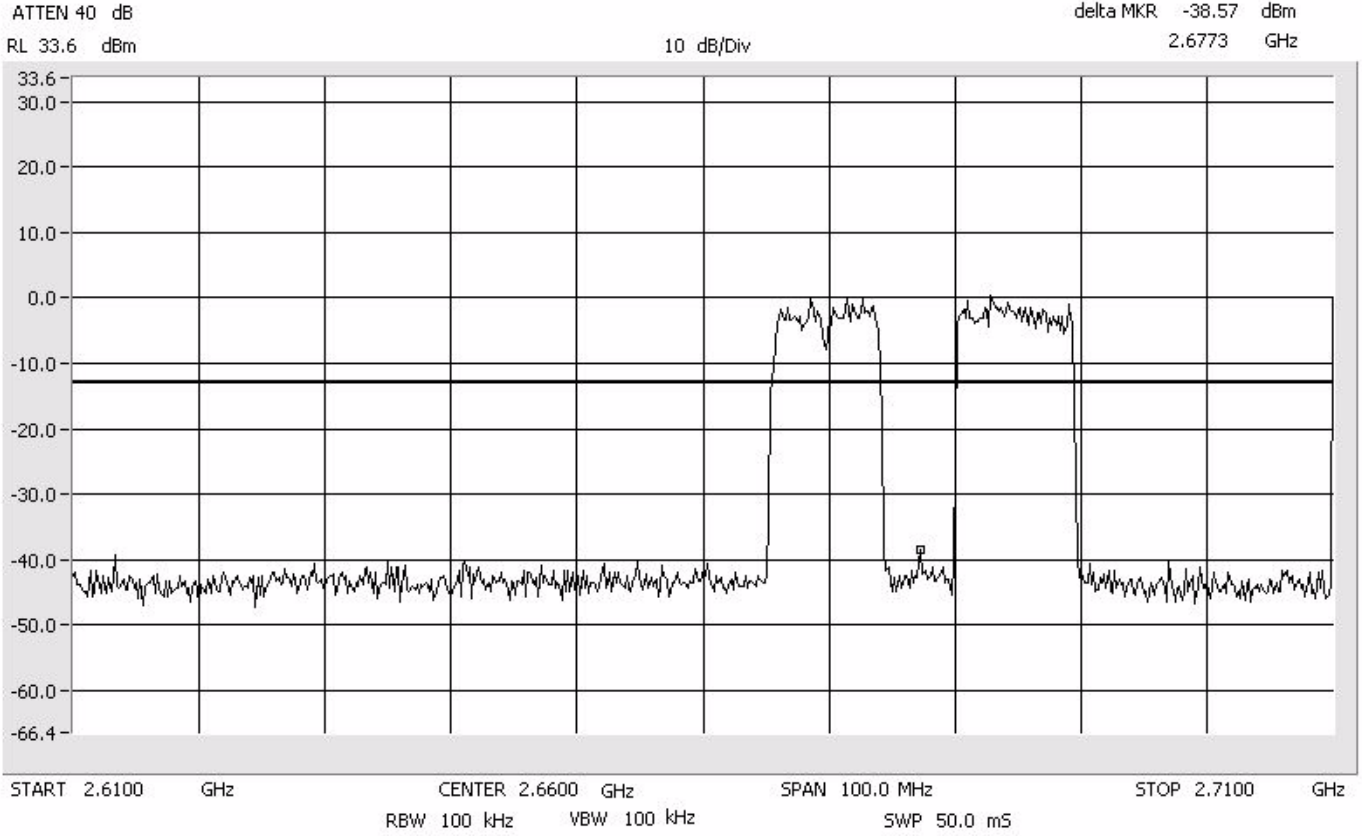


START 1.00 GHz      CENTER 13.75 GHz      SPAN 25.50 GHz      STOP 26.50 GHz  
RBW 1.0 MHz      VBW 1.0 MHz      SWP 510 mS

TX

# Intermodulation Close - Upper WiMax - 64QAM

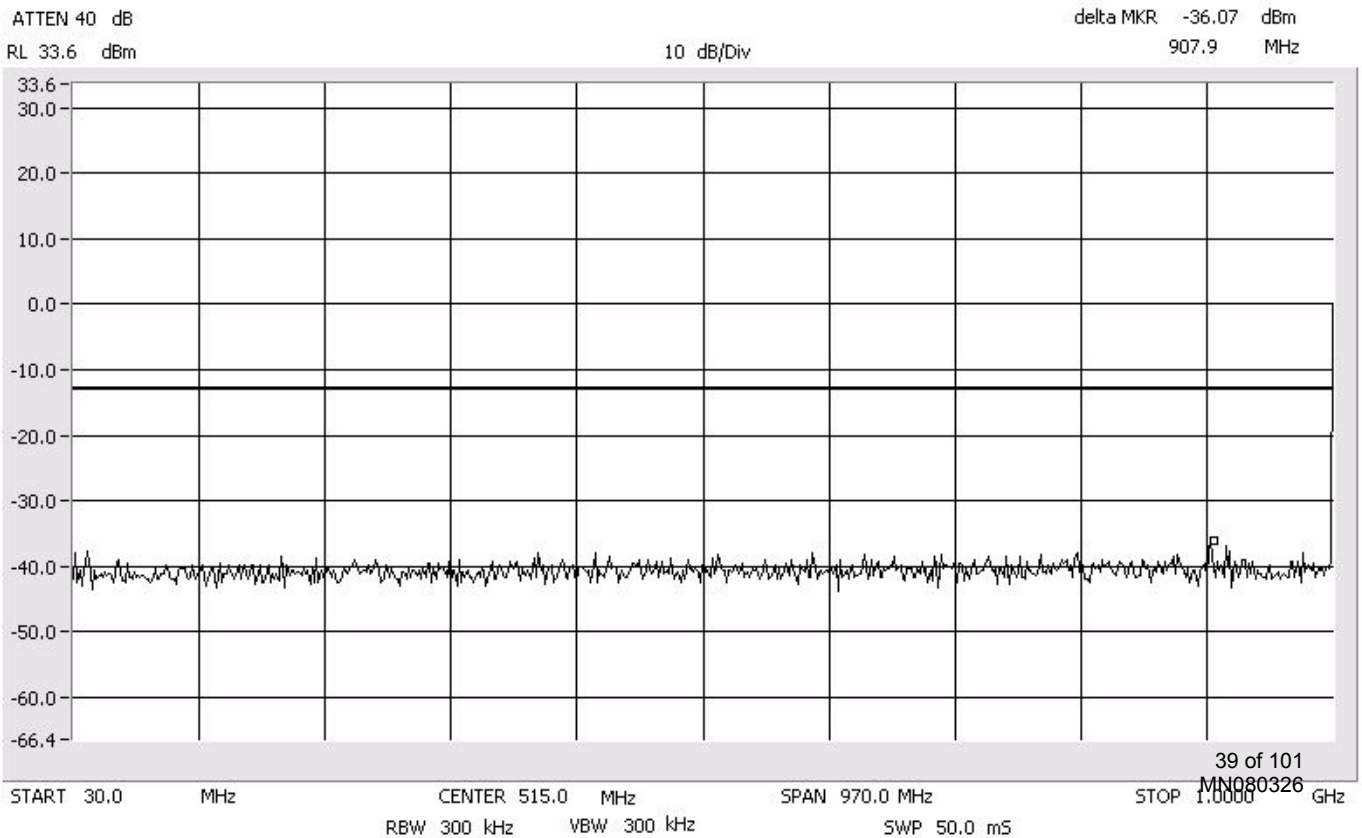
Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz



TX

# Intermodulation Close - Upper WiMax - 64QAM

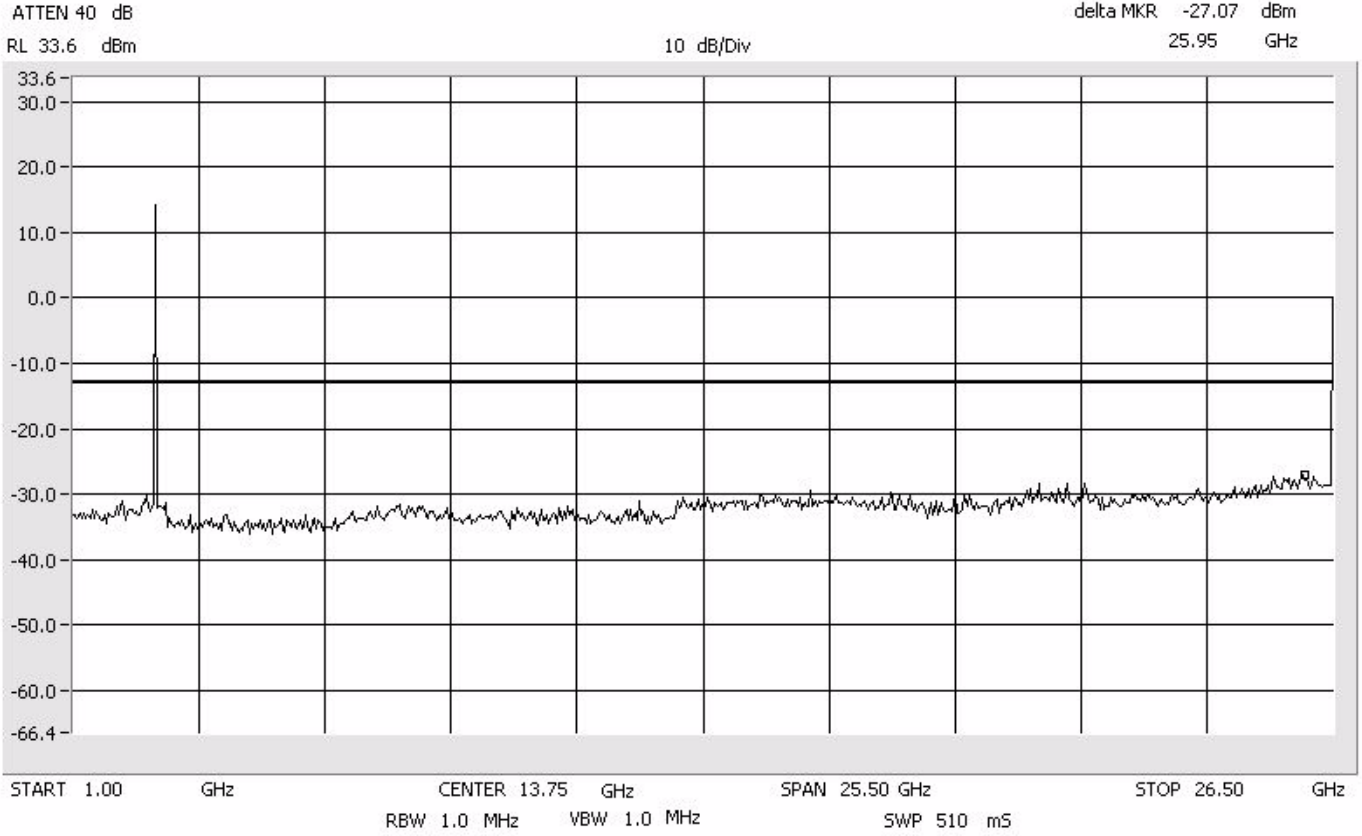
Span: 30 MHz to 1 GHz  
RBW/VBW: 300 kHz



TX

# Intermodulation Close - Upper WiMax - 64QAM

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz





TX

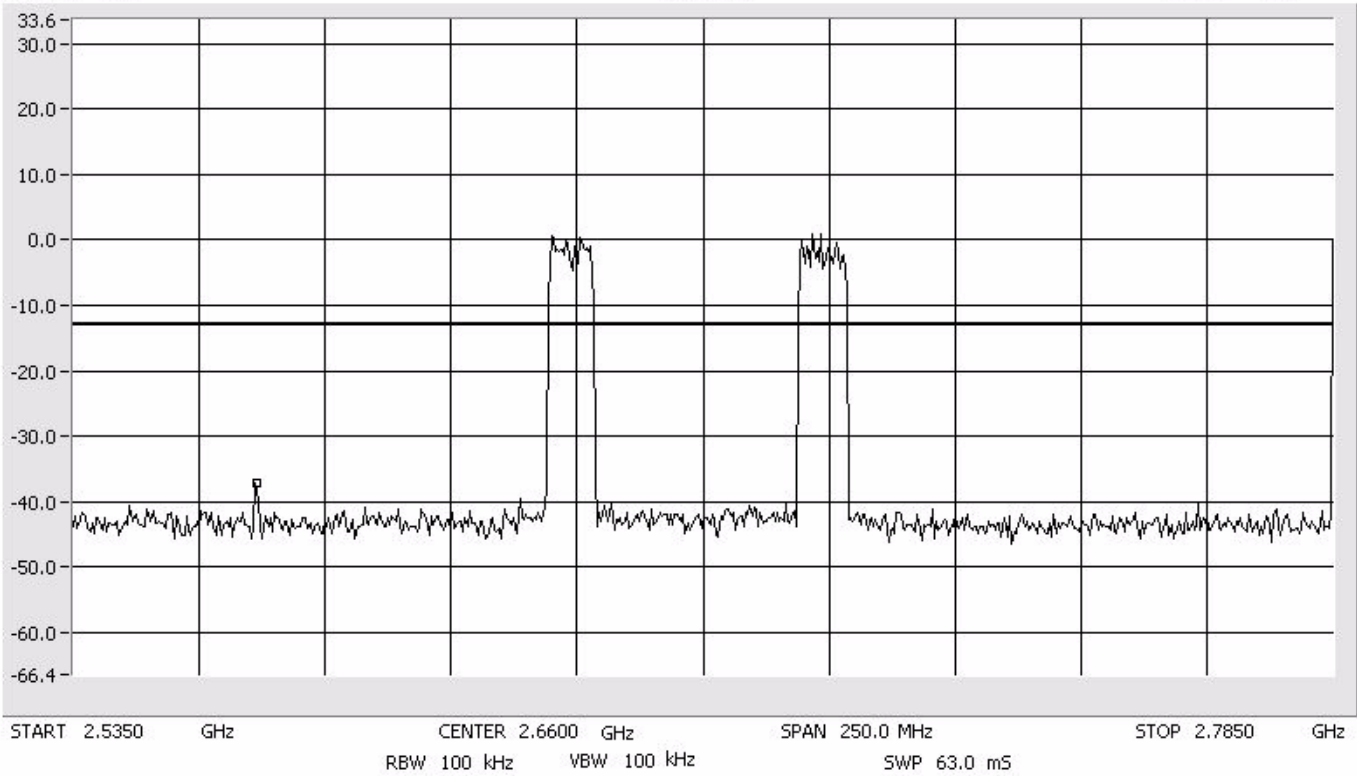
# Intermodulation Apart WiMax - 64QAM

Center: 2660.0 MHz  
Span: 250 MHz  
RBW/VBW: 100 kHz

ATTEN 40 dB  
RL 33.6 dBm

delta MKR -37.23 dBm  
2.5713 GHz

10 dB/Div



TX

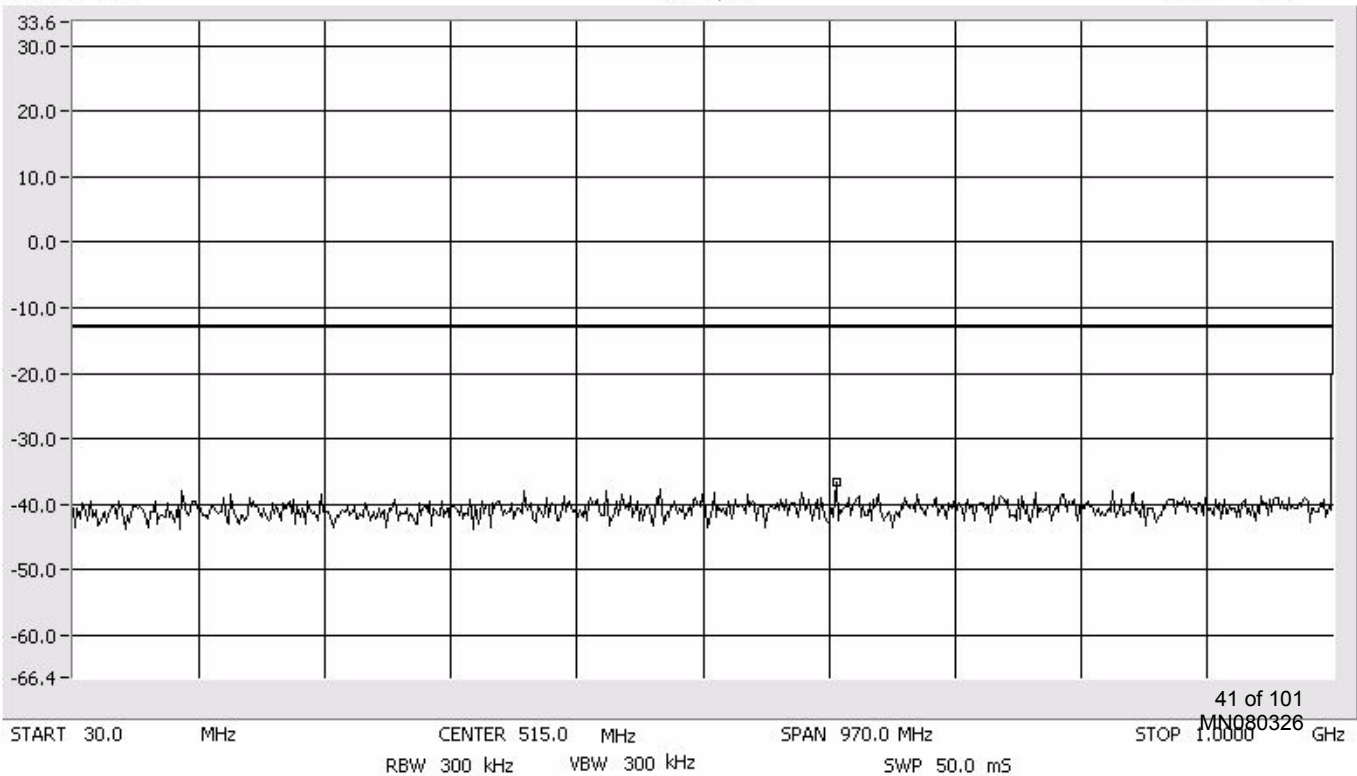
# Intermodulation Apart WiMax - 64QAM

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

ATTEN 40 dB  
RL 33.6 dBm

delta MKR -36.73 dBm  
618.5 MHz

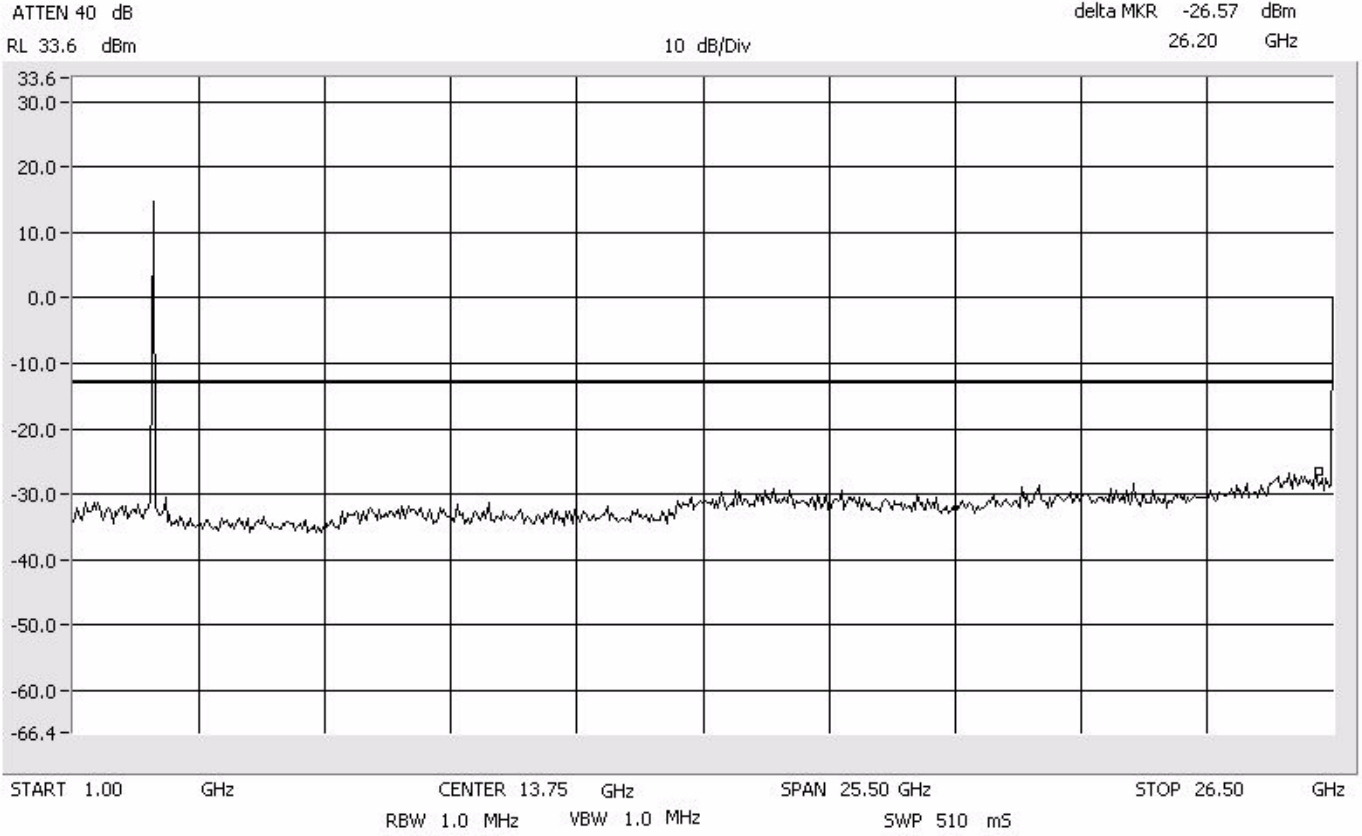
10 dB/Div



TX

# Intermodulation Apart WiMax - 64QAM

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz



RX

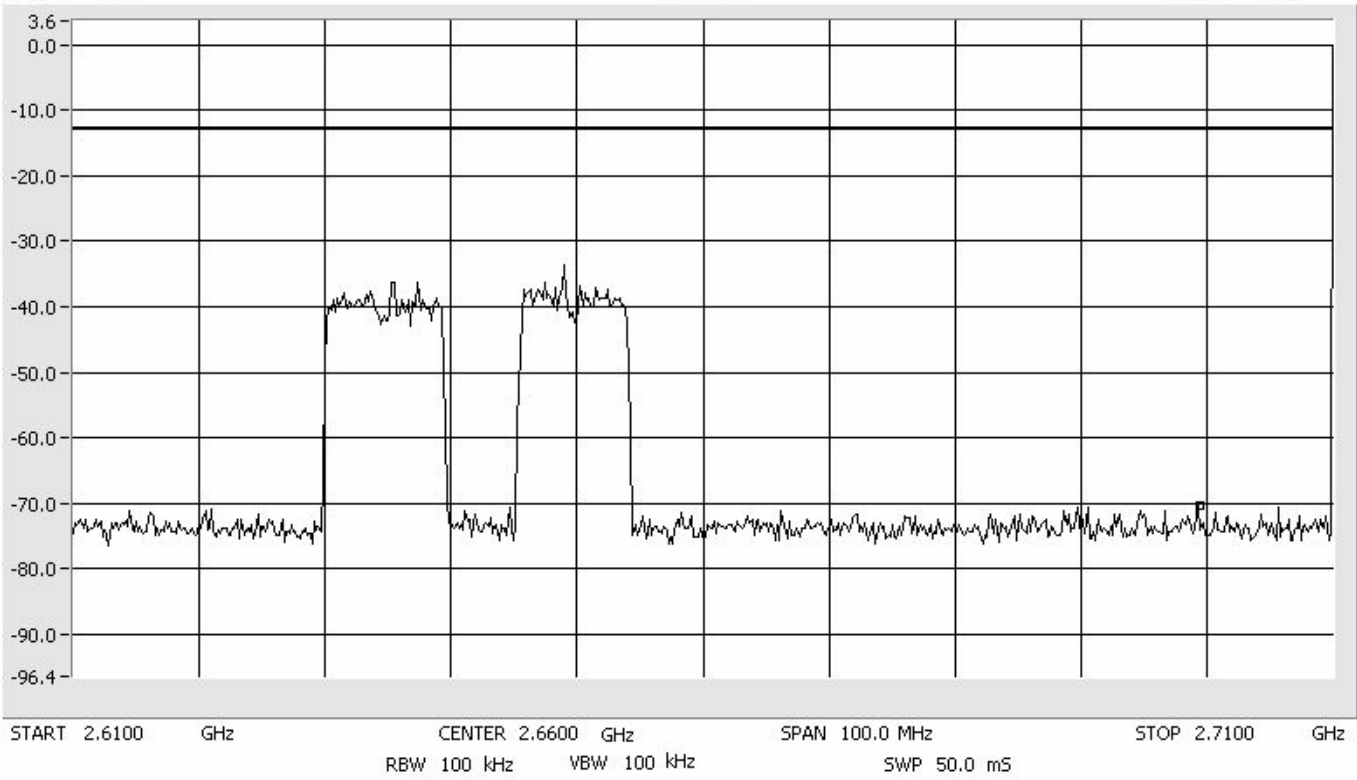
# Intermodulation Close - Lower WiMax - 64QAM

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -70.23 dBm  
2.6995 GHz

10 dB/Div



RX

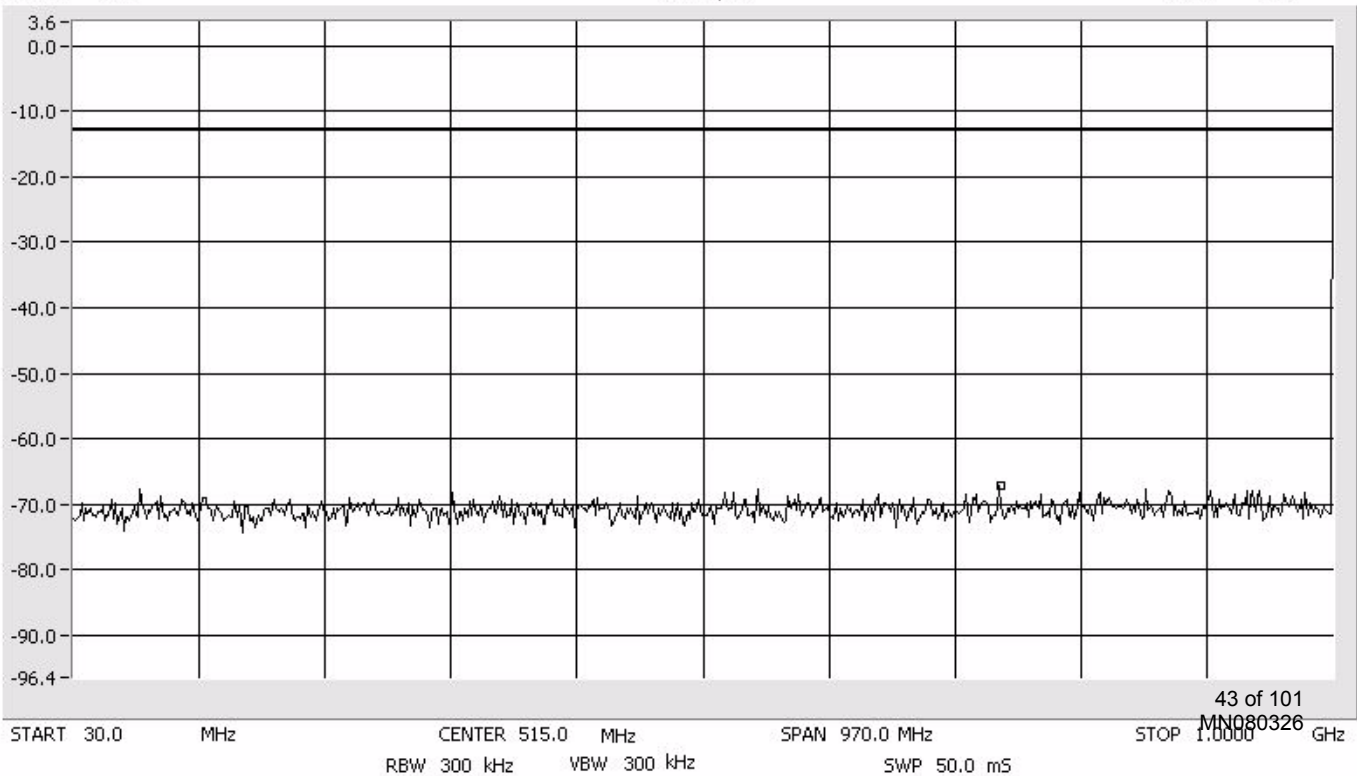
# Intermodulation Close - Lower WiMax - 64QAM

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

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -67.07 dBm  
744.6 MHz

10 dB/Div



RX

# Intermodulation Close - Lower WiMax - 64QAM

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

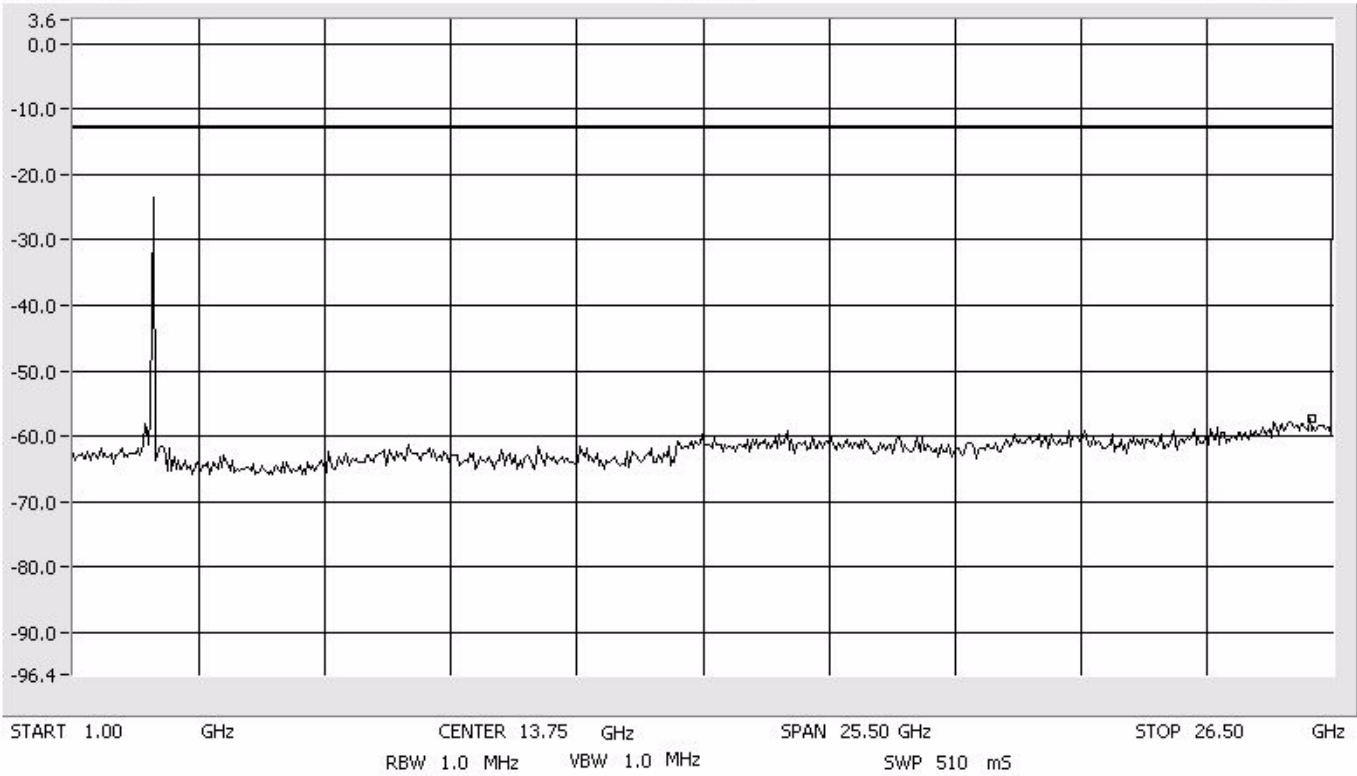
ATTEN 10 dB

delta MKR -57.40 dBm

RL 3.6 dBm

10 dB/Div

26.07 GHz



RX

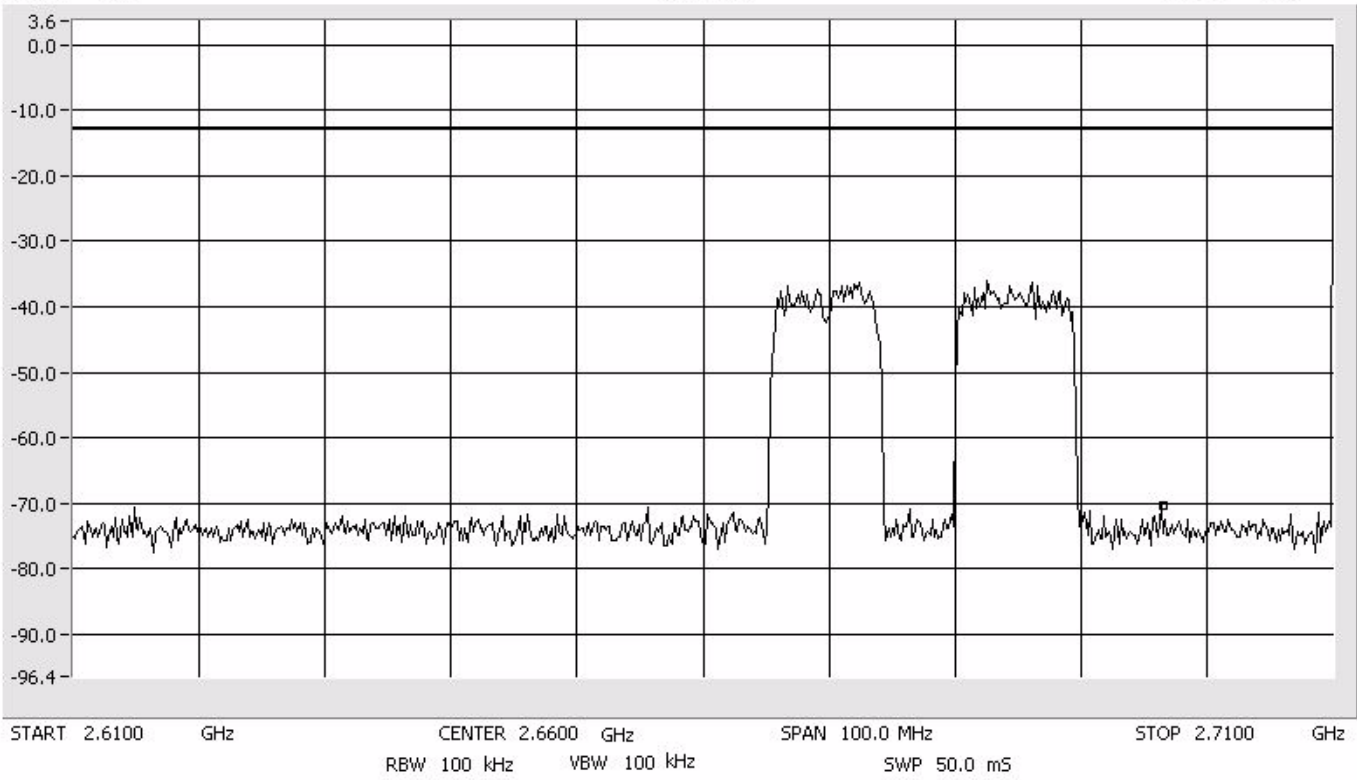
# Intermodulation Close - Upper WiMax - 64QAM

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -70.40 dBm  
2.6965 GHz

10 dB/Div



RX

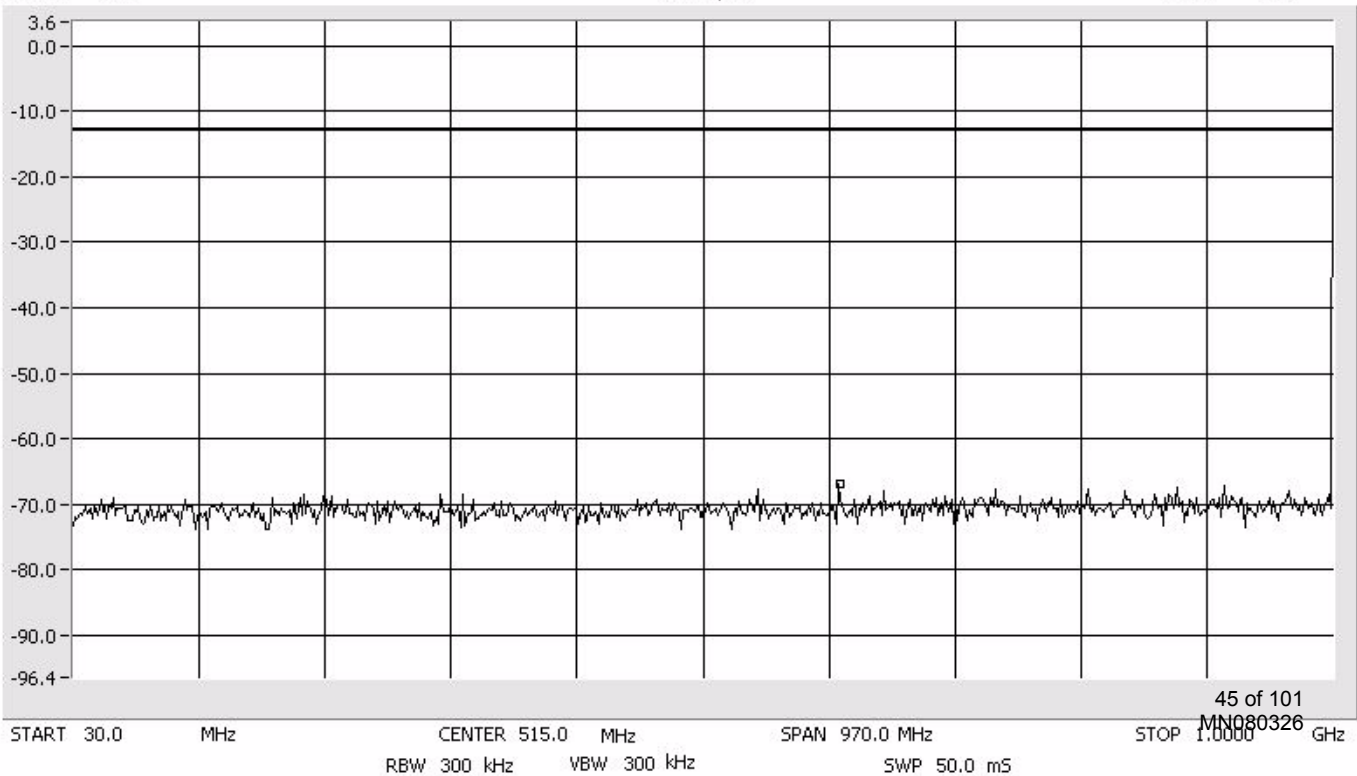
# Intermodulation Close - Upper WiMax - 64QAM

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

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -66.90 dBm  
620.1 MHz

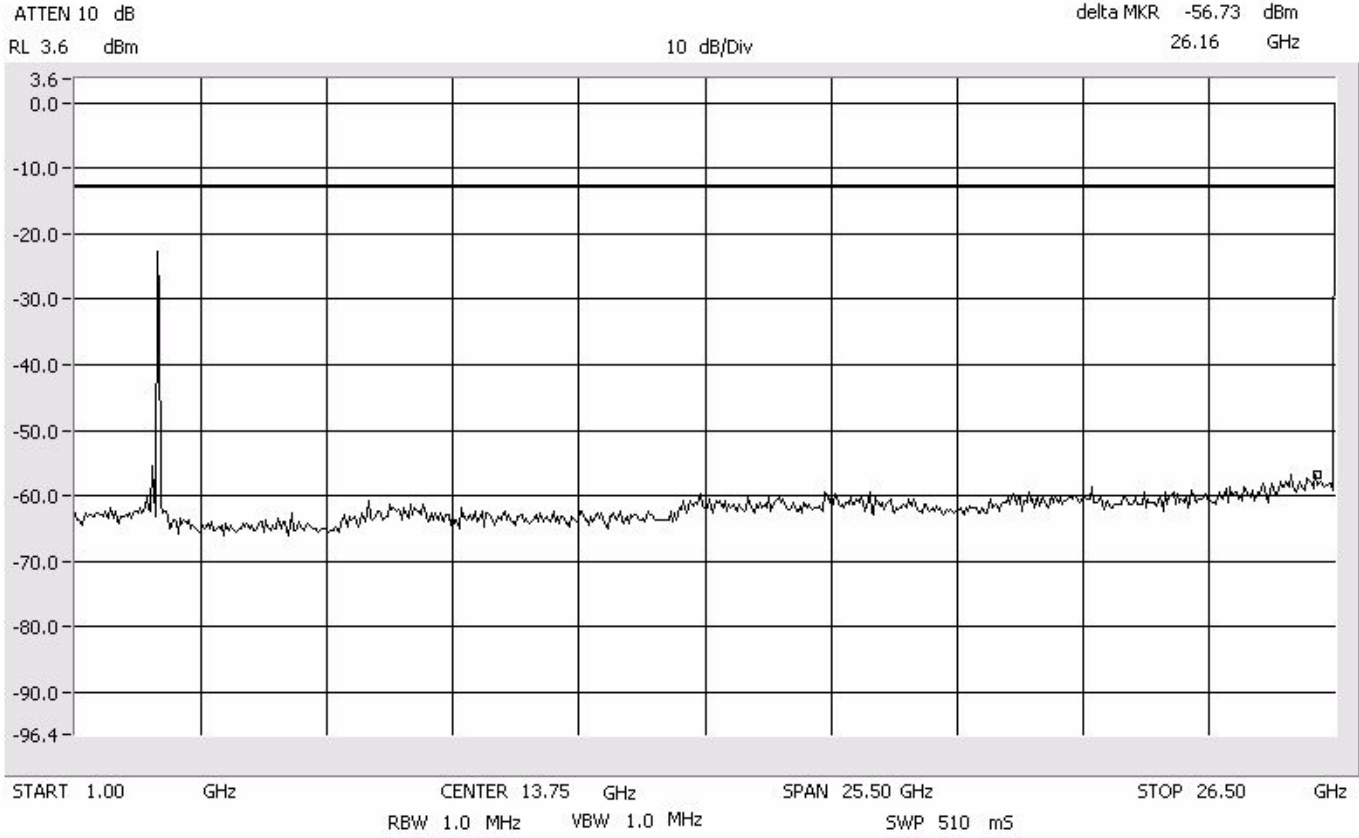
10 dB/Div



RX

# Intermodulation Close - Upper WiMax - 64QAM

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz



RX

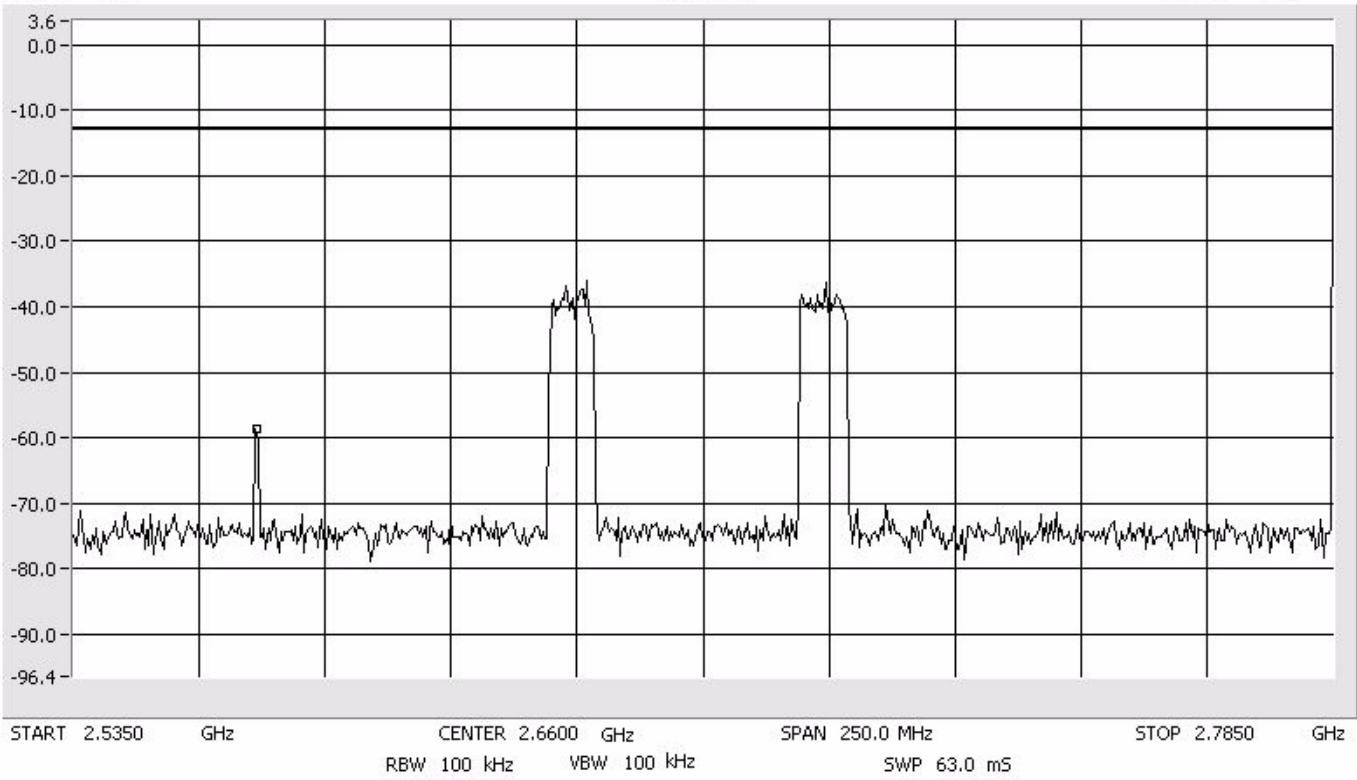
# Intermodulation Apart WiMax - 64QAM

Center: 2660.0 MHz  
Span: 250 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -58.57 dBm  
2.5713 GHz

10 dB/Div



RX

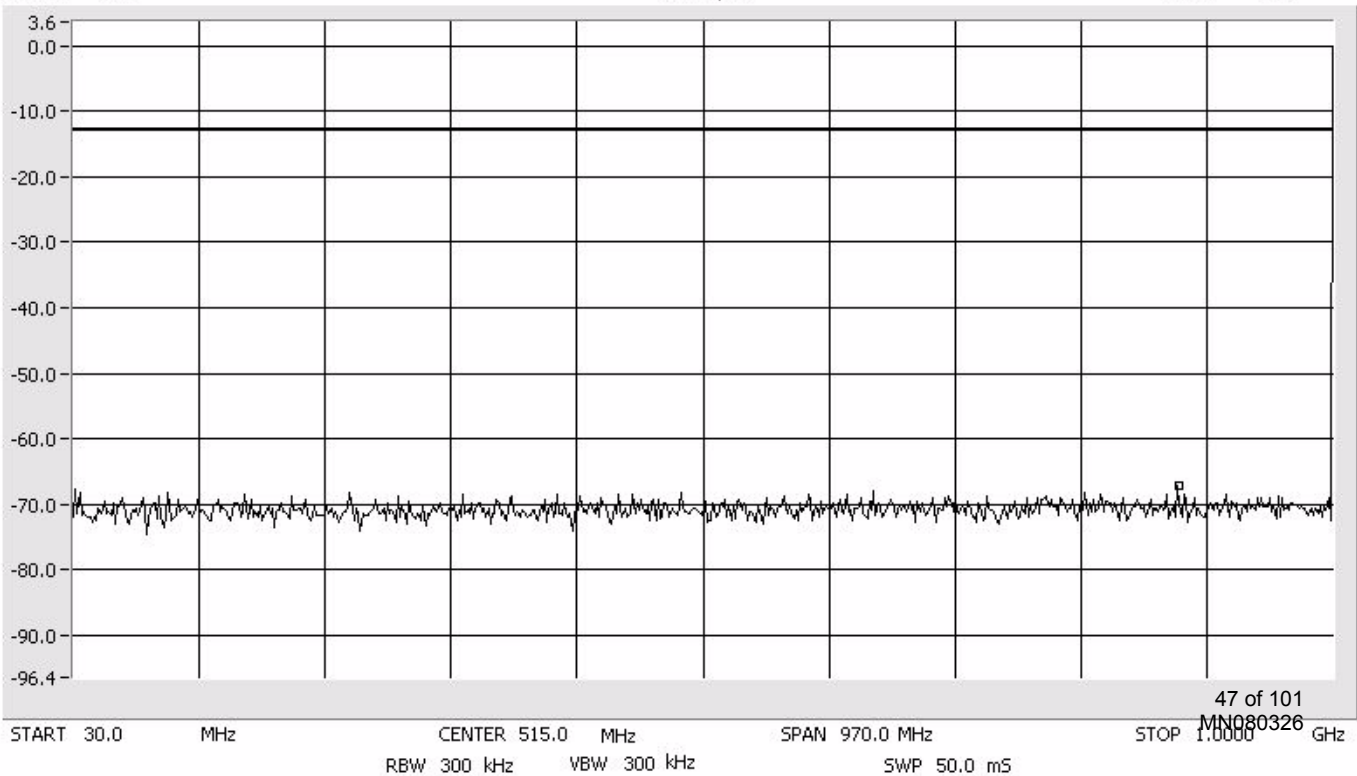
# Intermodulation Apart WiMax - 64QAM

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

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -67.07 dBm  
882.0 MHz

10 dB/Div



RX

# Intermodulation Apart WiMax - 64QAM

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

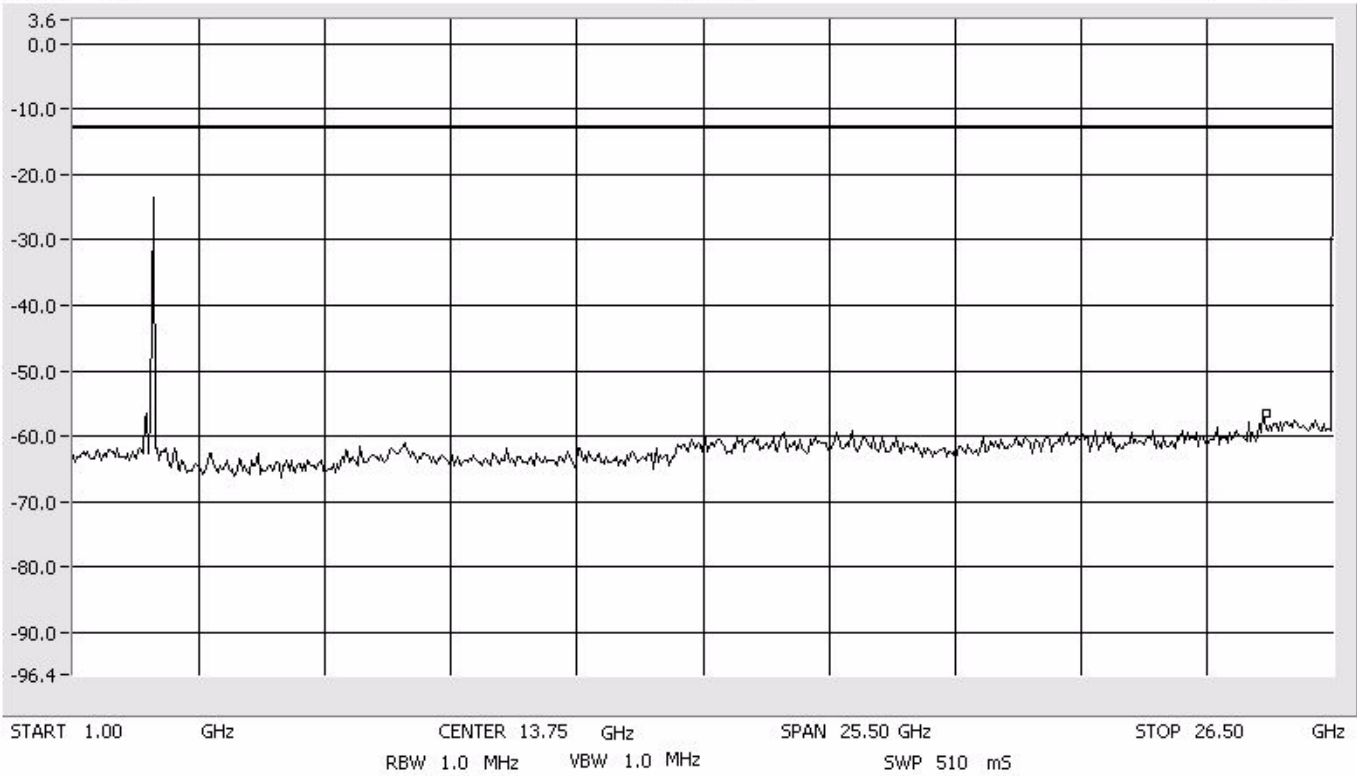
ATTEN 10 dB

delta MKR -56.40 dBm

RL 3.6 dBm

10 dB/Div

25.14 GHz

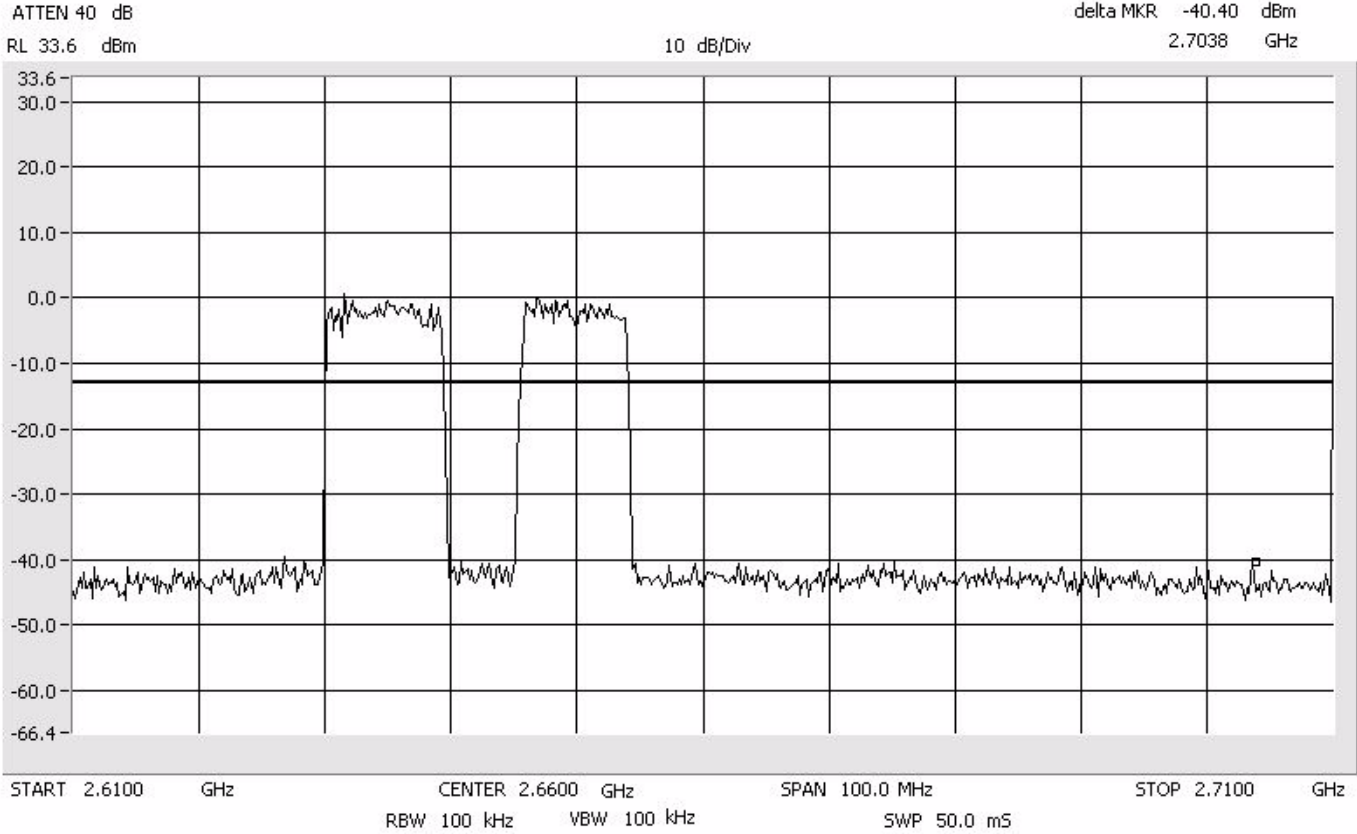




TX

# Intermodulation Close - Lower WiMax - QPSK

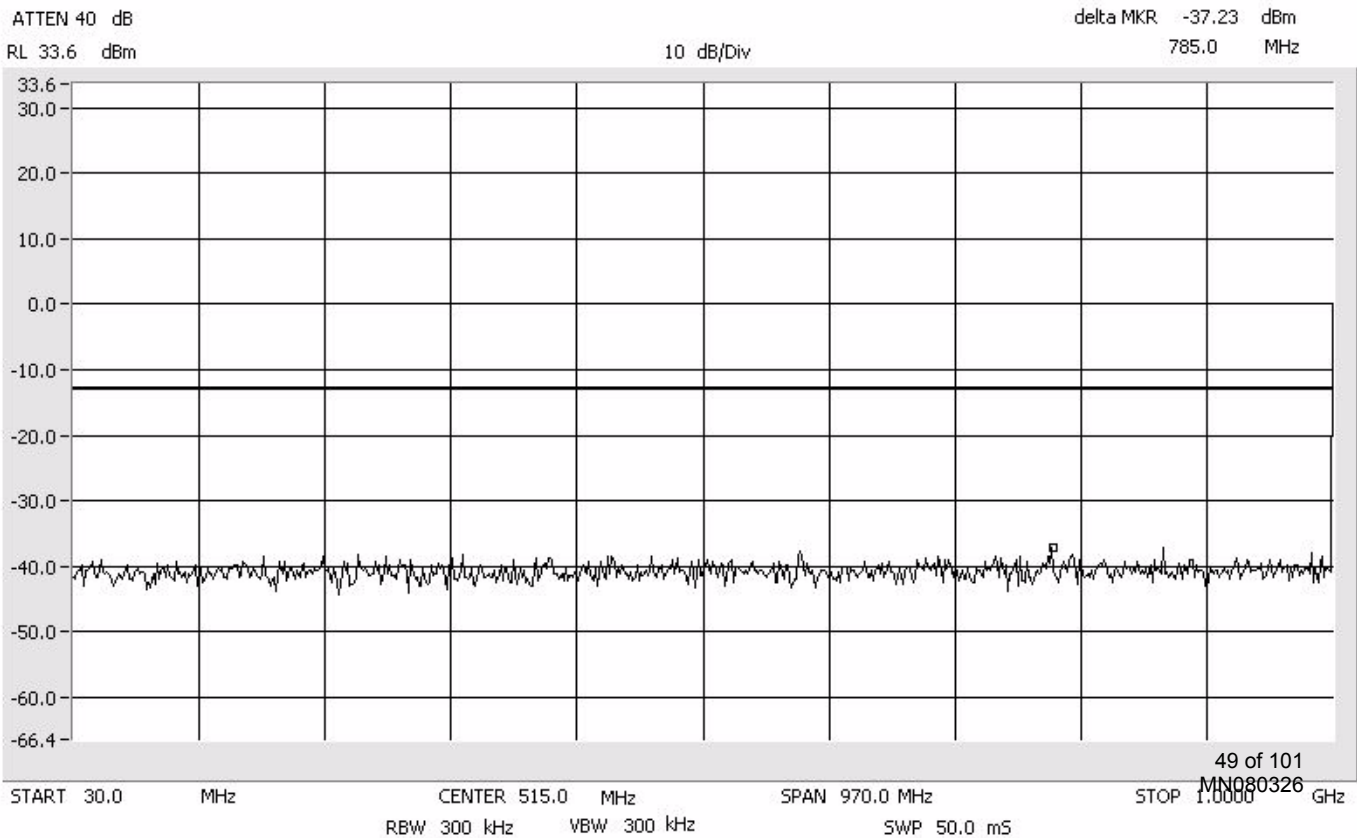
Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz



TX

# Intermodulation Close - Lower WiMax - QPSK

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



TX

# Intermodulation Close - Lower WiMax - QPSK

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

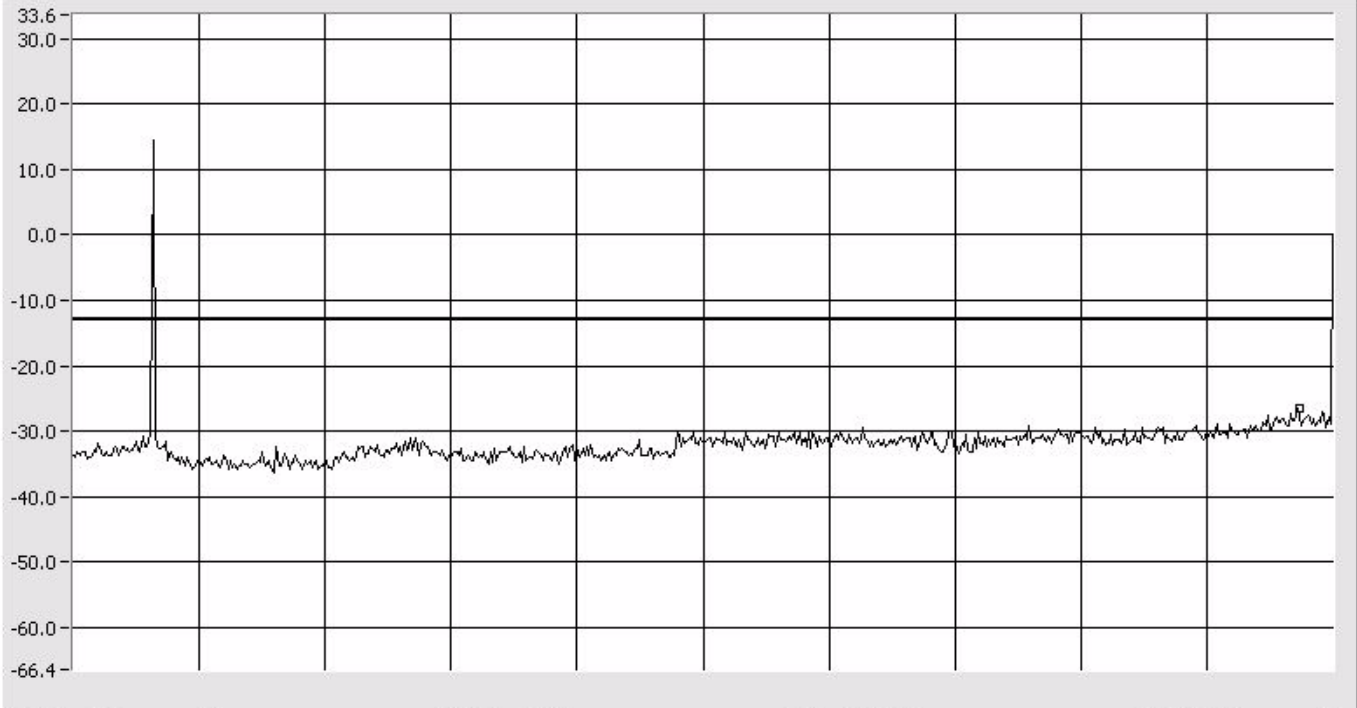
ATTEN 40 dB

delta MKR -26.40 dBm

RL 33.6 dBm

10 dB/Div

25.82 GHz

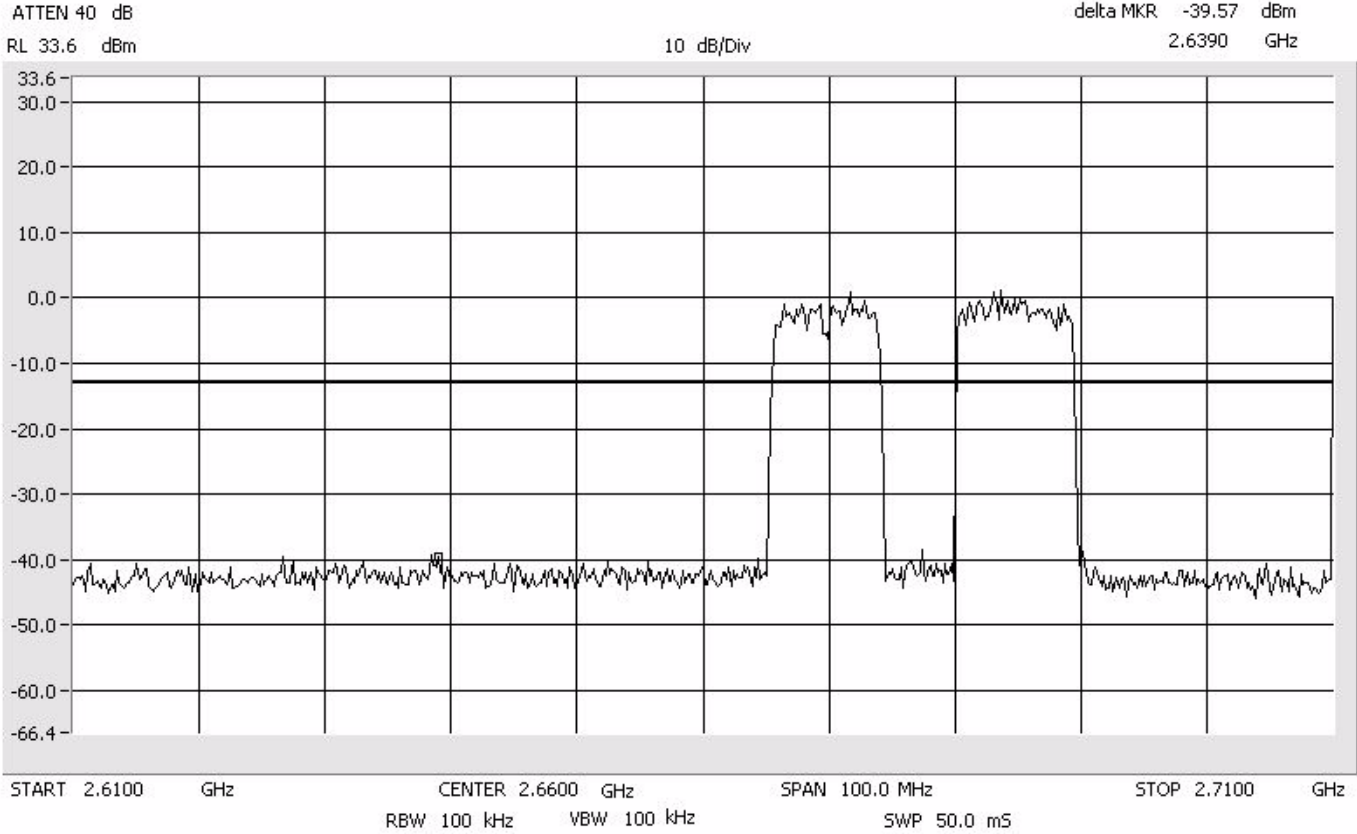


START 1.00 GHz      CENTER 13.75 GHz      SPAN 25.50 GHz      STOP 26.50 GHz  
RBW 1.0 MHz      VBW 1.0 MHz      SWP 510 mS

TX

# Intermodulation Close - Upper WiMax - QPSK

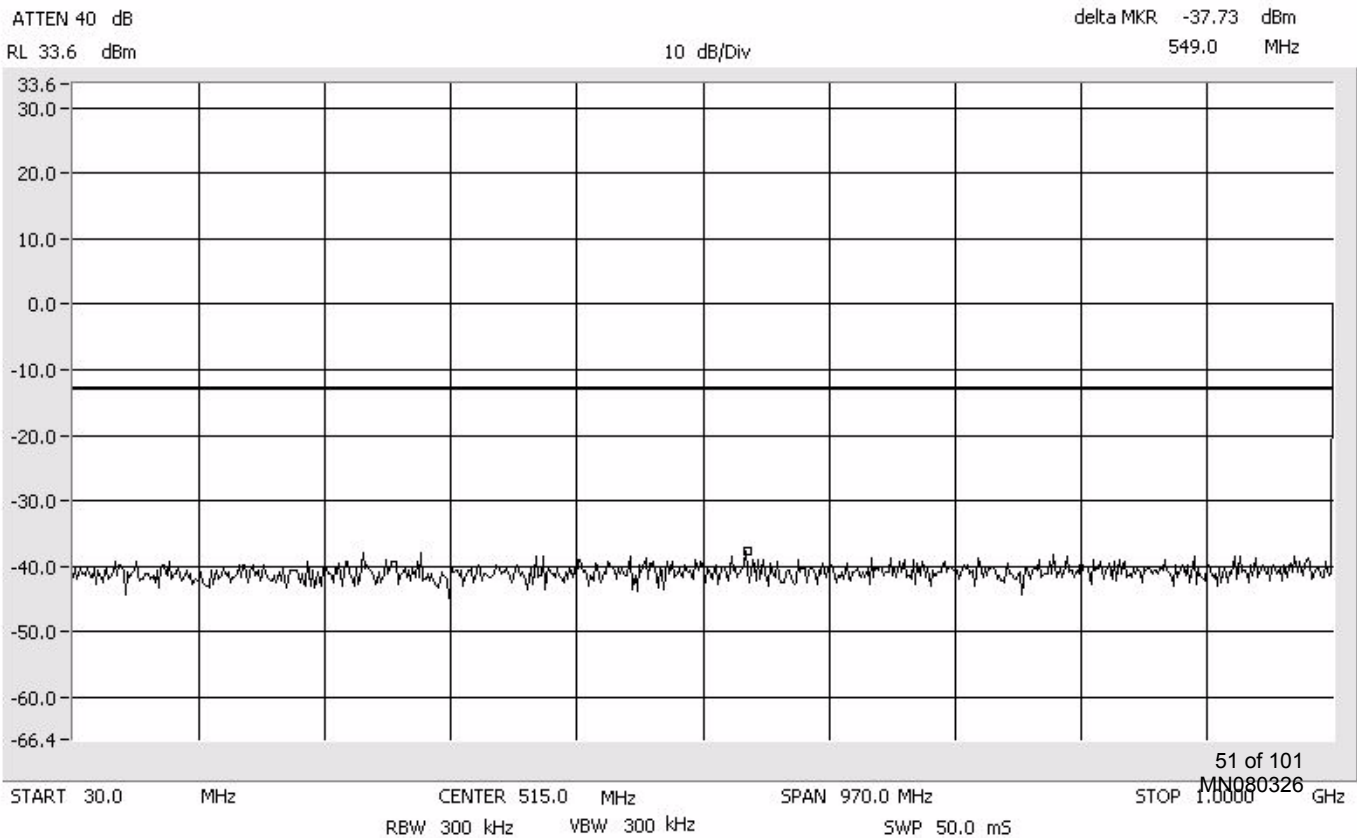
Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz



TX

# Intermodulation Close - Upper WiMax - QPSK

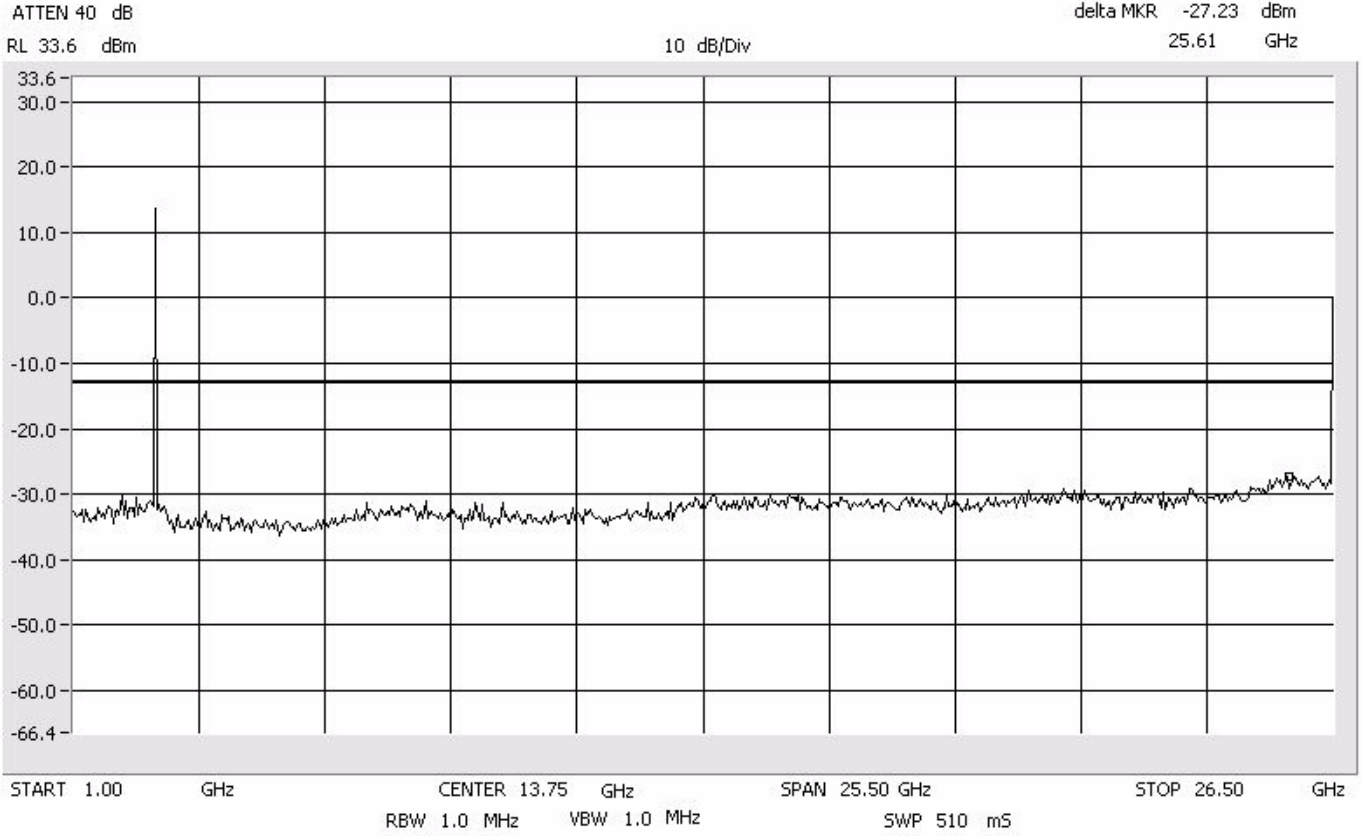
Span: 30 MHz to 1 GHz  
RBW/VBW: 300 kHz



TX

# Intermodulation Close - Upper WiMax - QPSK

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz



TX

# Intermodulation Apart WiMax - QPSK

Center: 2660.0 MHz  
Span: 250 MHz  
RBW/VBW: 100 kHz

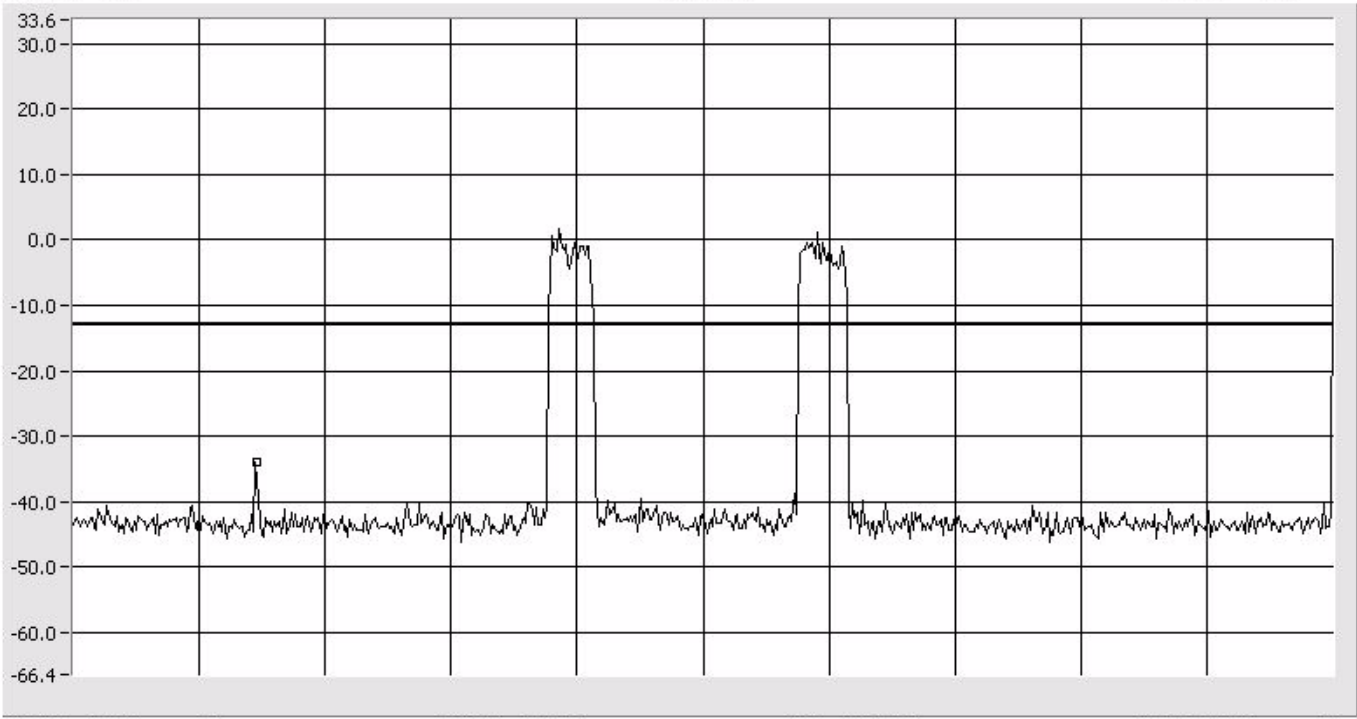
ATTEN 40 dB

delta MKR -34.07 dBm

RL 33.6 dBm

10 dB/Div

2.5713 GHz



START 2.5350 GHz CENTER 2.6600 GHz SPAN 250.0 MHz STOP 2.7850 GHz  
RBW 100 kHz VBW 100 kHz SWP 63.0 mS

TX

# Intermodulation Apart WiMax - QPSK

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

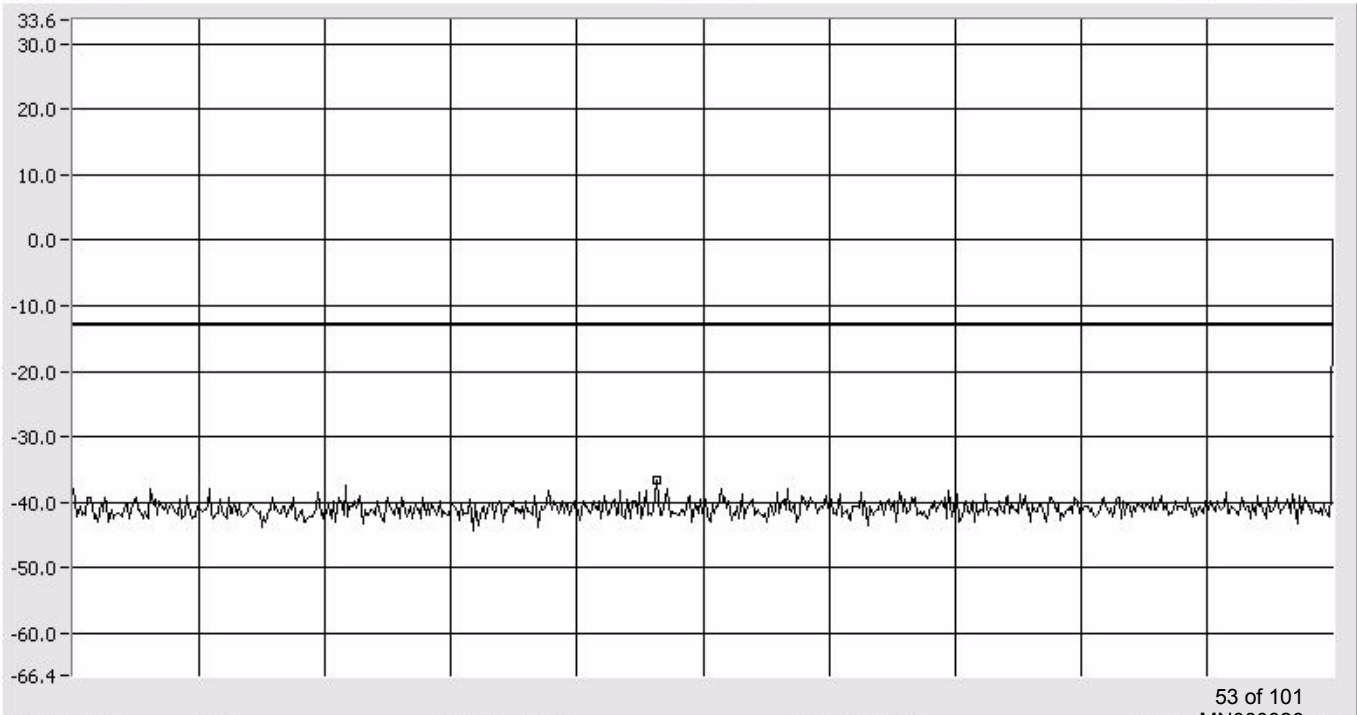
ATTEN 40 dB

delta MKR -36.57 dBm

RL 33.6 dBm

10 dB/Div

479.4 MHz

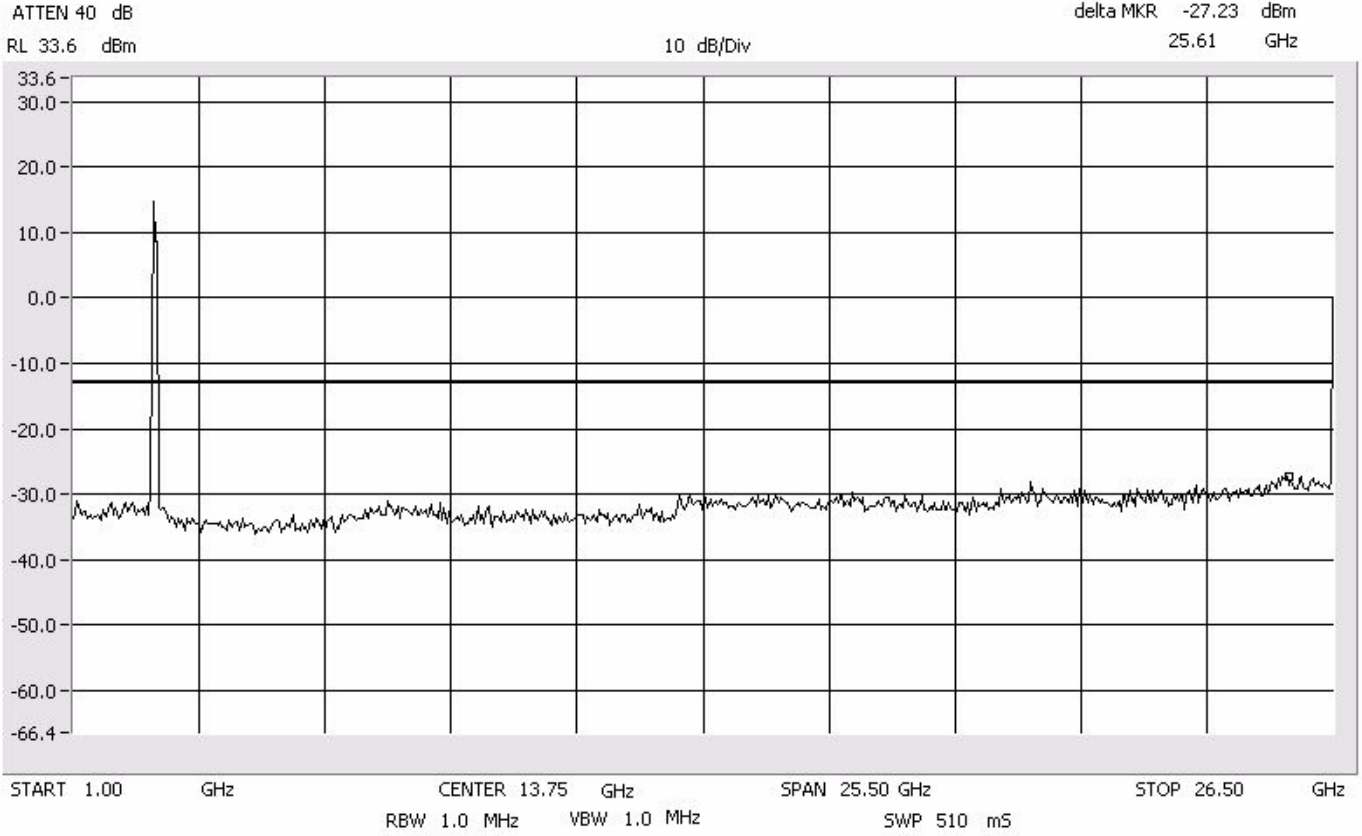


START 30.0 MHz CENTER 515.0 MHz SPAN 970.0 MHz STOP 1.000 GHz  
RBW 300 kHz VBW 300 kHz SWP 50.0 mS

TX

# Intermodulation Apart WiMax - QPSK

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz



RX

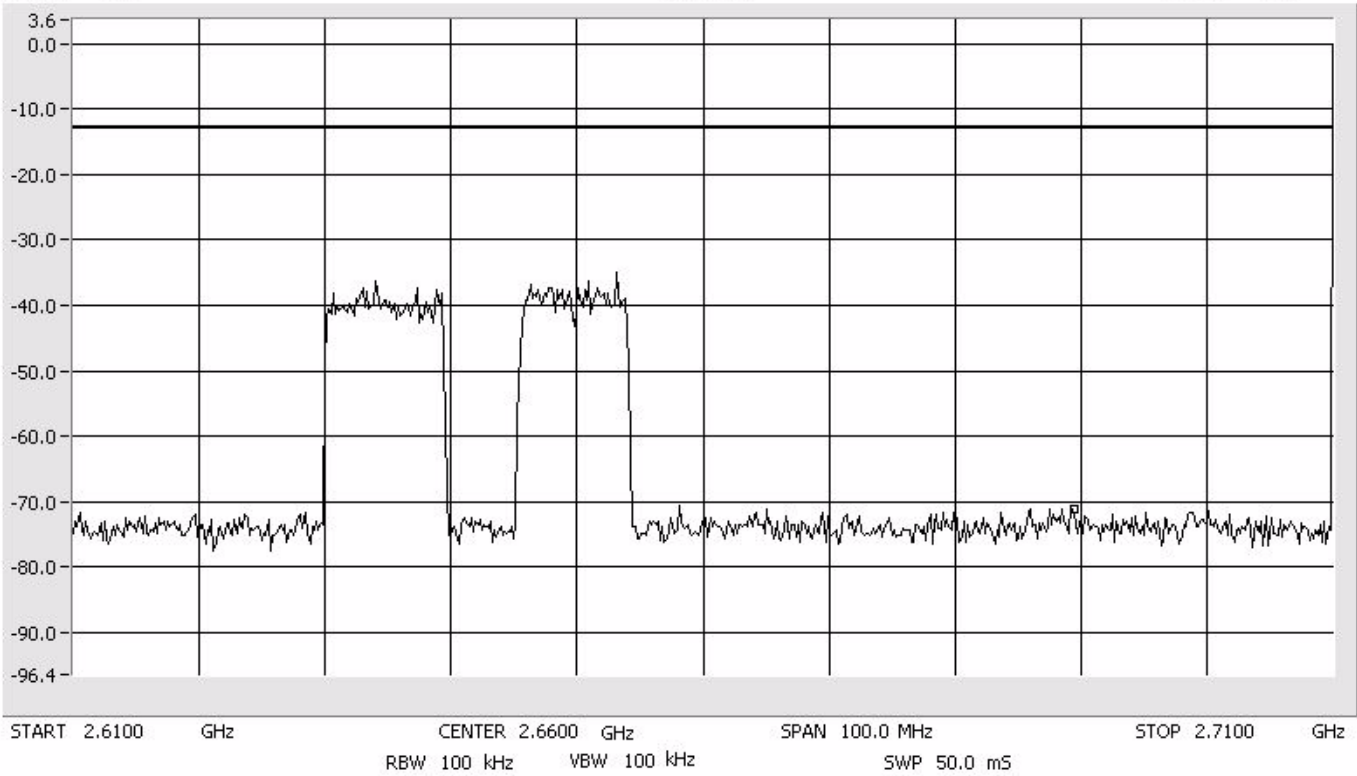
# Intermodulation Close - Lower WiMax - QPSK

Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -71.07 dBm  
2.6895 GHz

10 dB/Div



RX

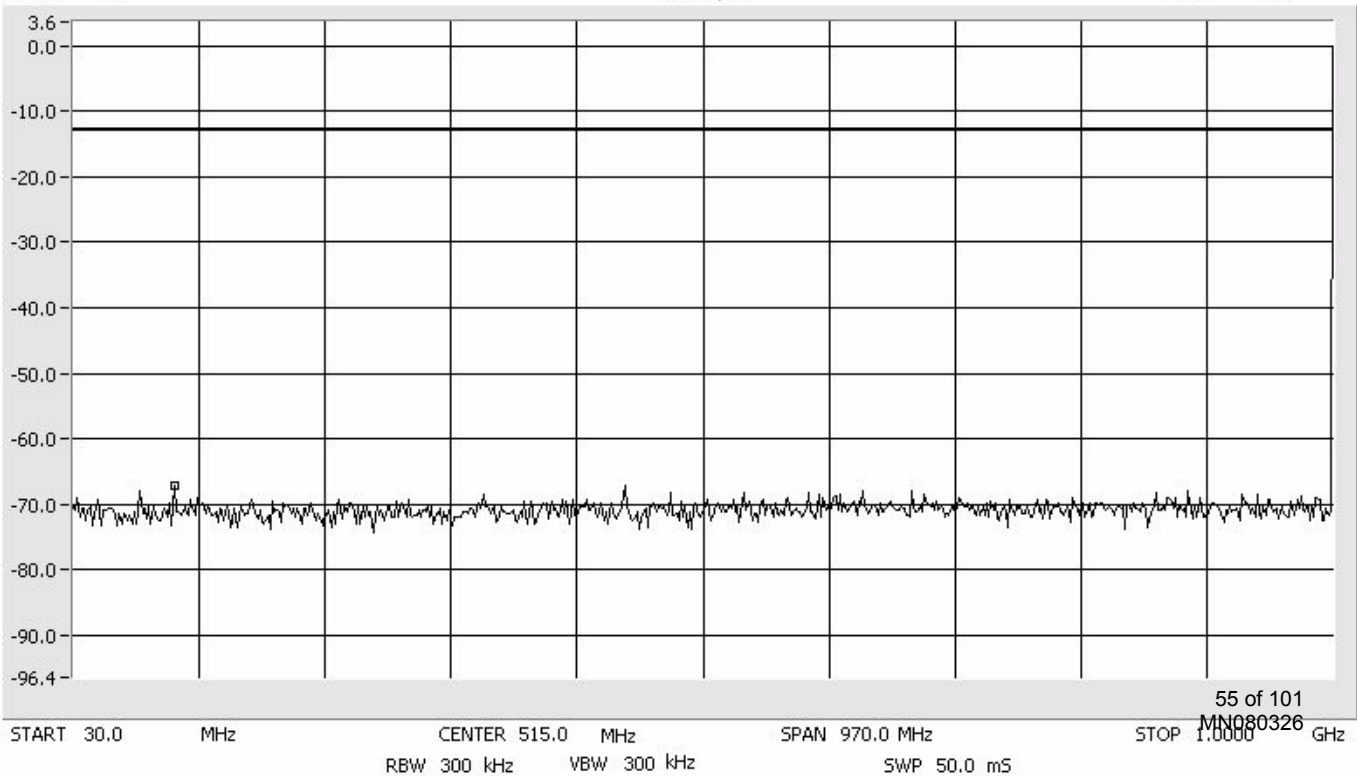
# Intermodulation Close - Lower WiMax - QPSK

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

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -67.07 dBm  
107.6 MHz

10 dB/Div



RX

# Intermodulation Close - Lower WiMax - QPSK

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

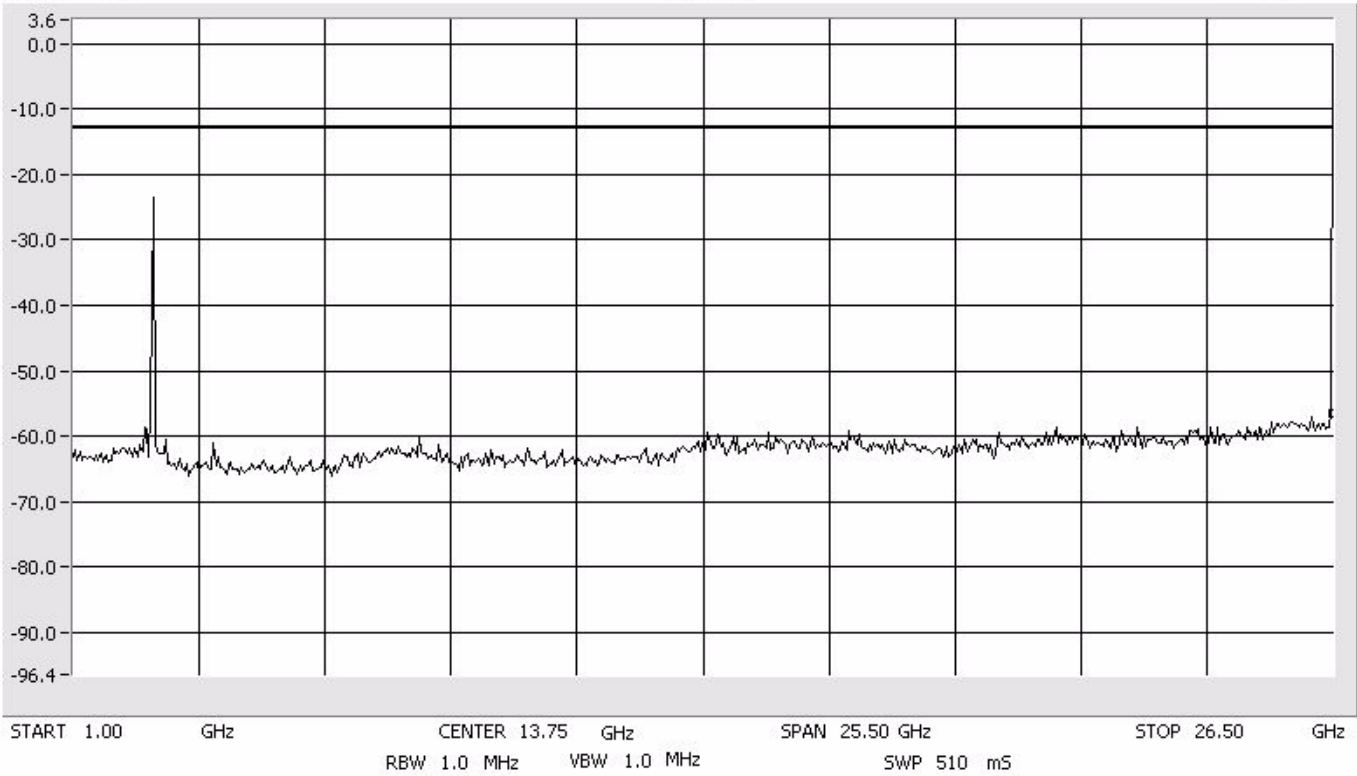
ATTEN 10 dB

delta MKR -56.40 dBm

RL 3.6 dBm

10 dB/Div

26.50 GHz

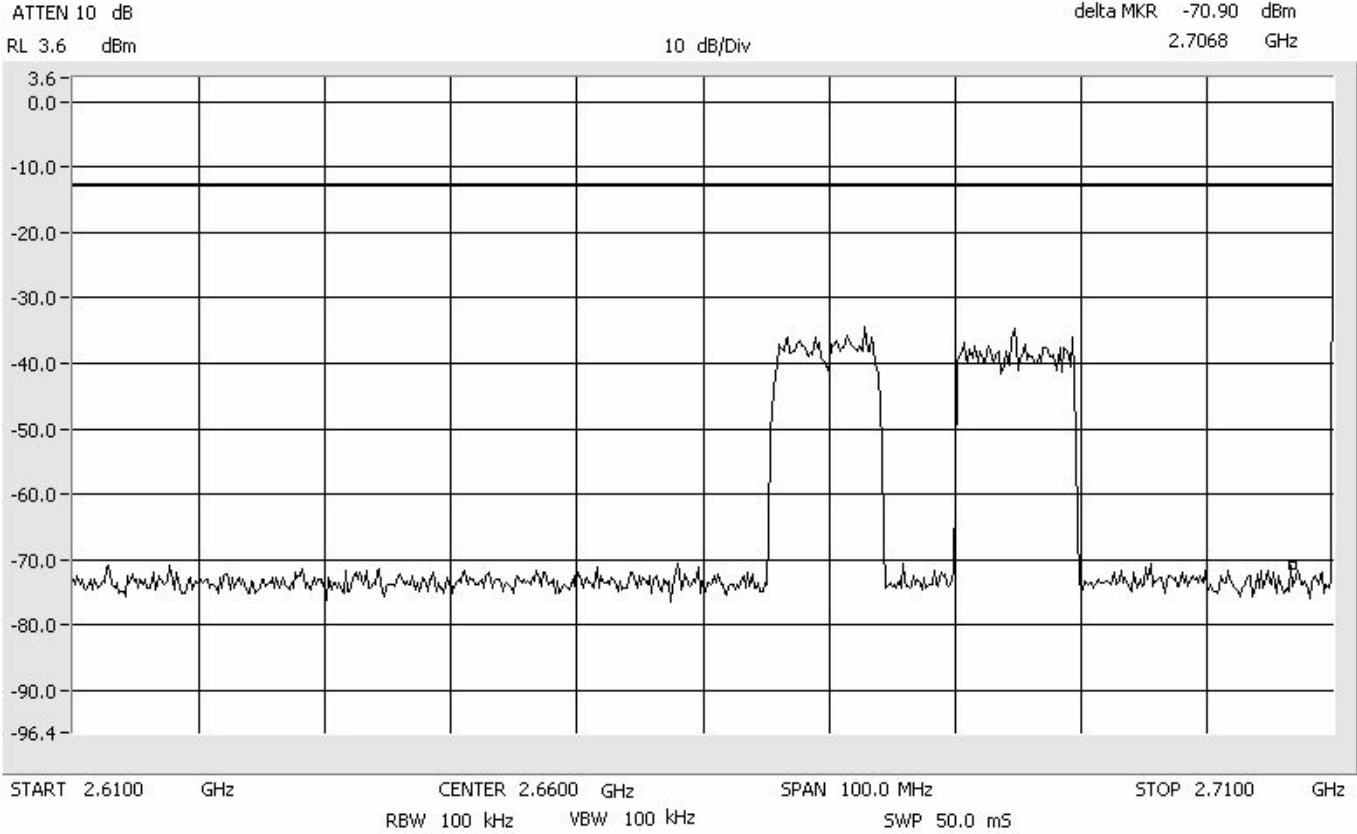




RX

# Intermodulation Close - Upper WiMax - QPSK

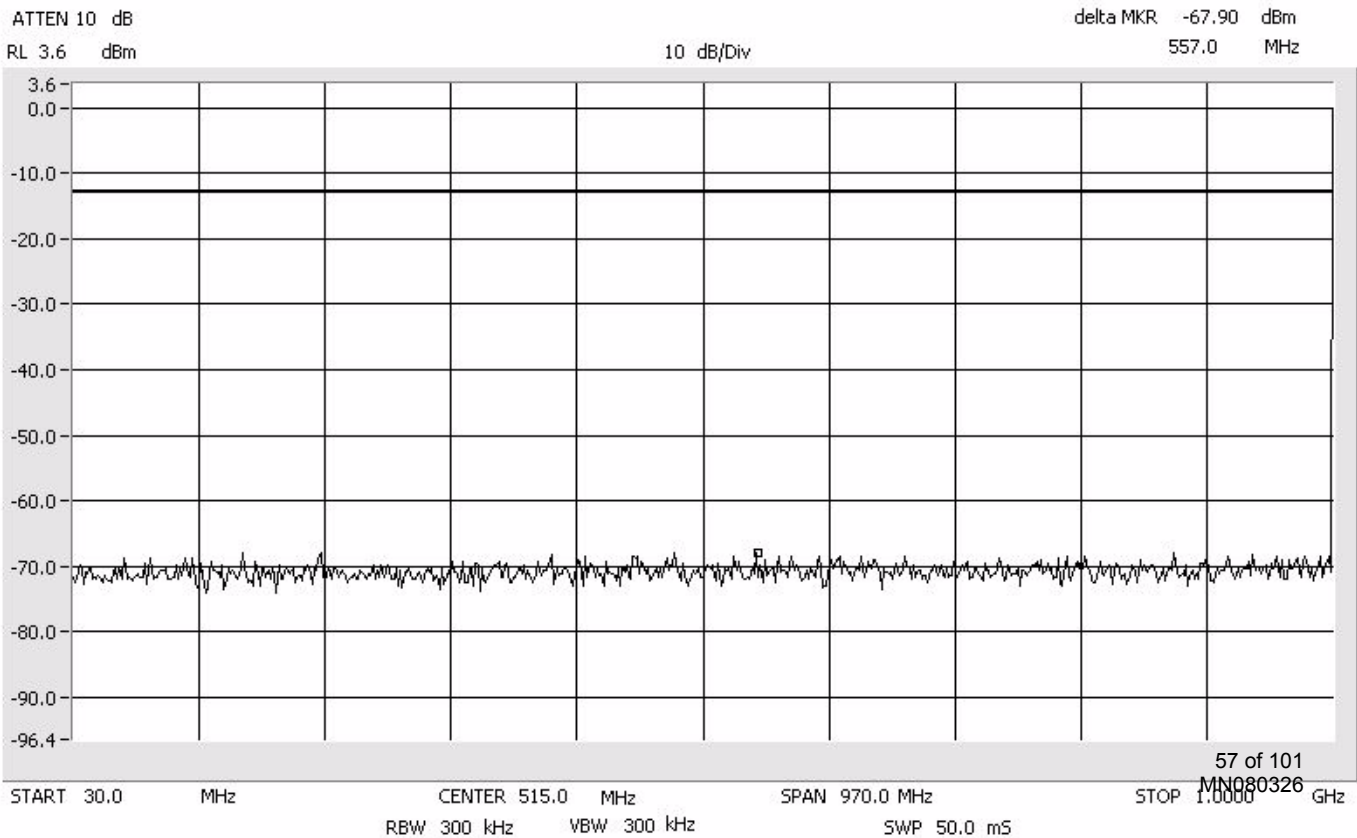
Center: 2660.0 MHz  
Span: 100 MHz  
RBW/VBW: 100 kHz



RX

# Intermodulation Close - Upper WiMax - QPSK

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



RX

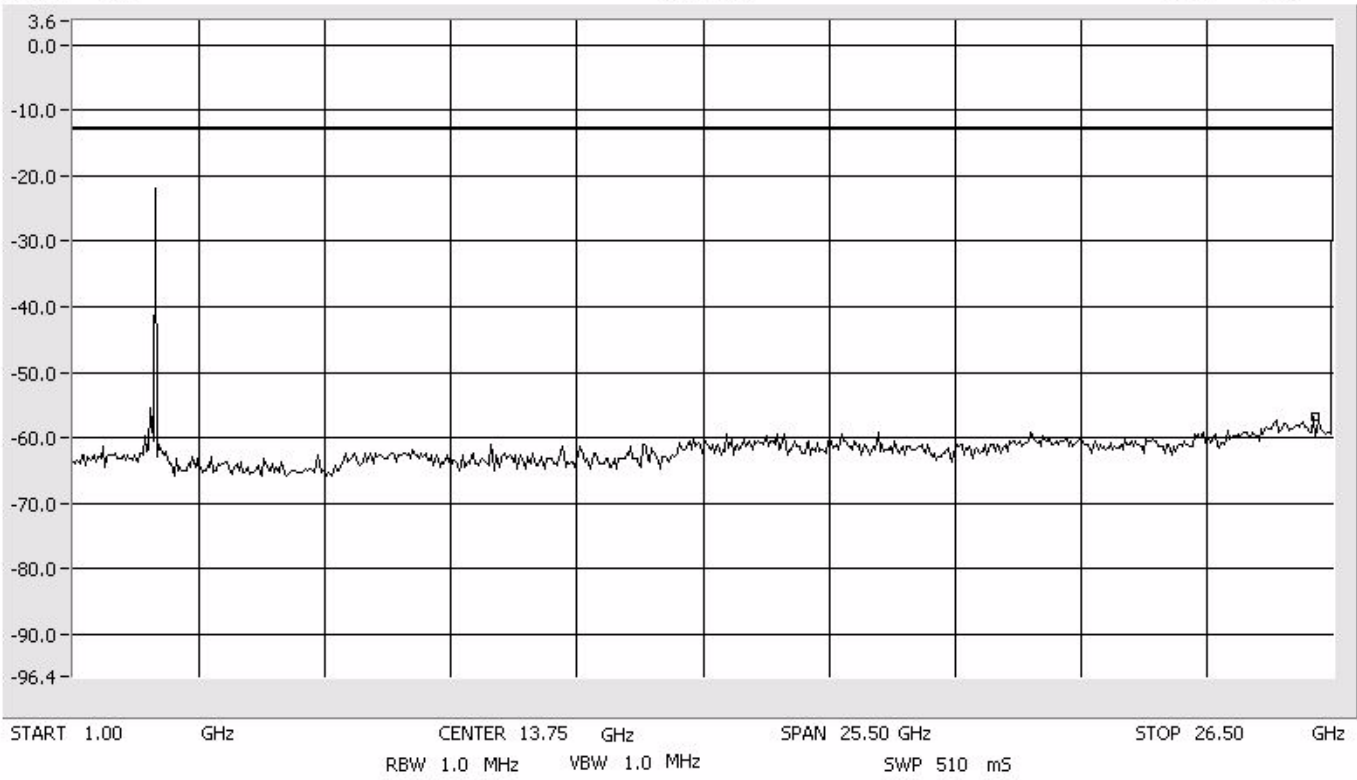
# Intermodulation Close - Upper WiMax - QPSK

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -56.73 dBm  
26.16 GHz

10 dB/Div



RX

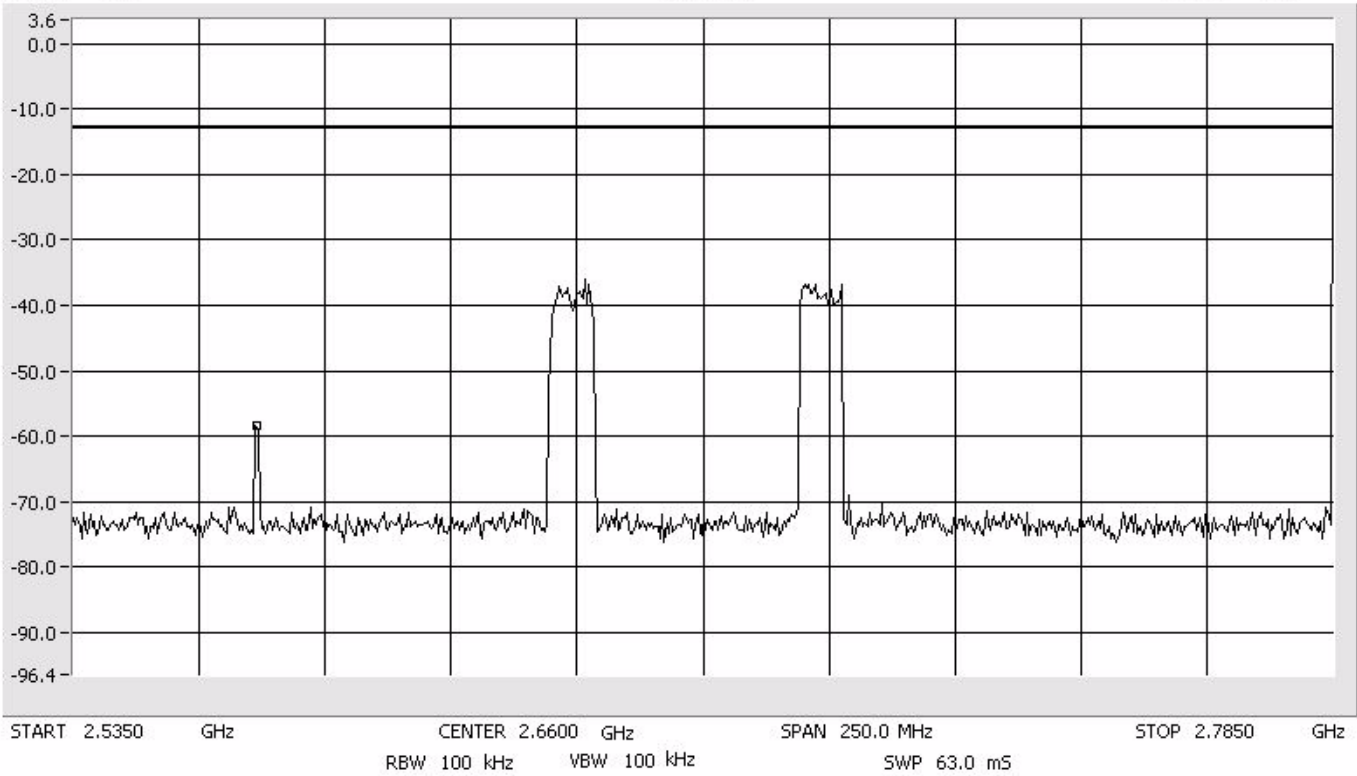
# Intermodulation Apart WiMax - QPSK

Center: 2660.0 MHz  
Span: 250 MHz  
RBW/VBW: 100 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -58.40 dBm  
2.5713 GHz

10 dB/Div



RX

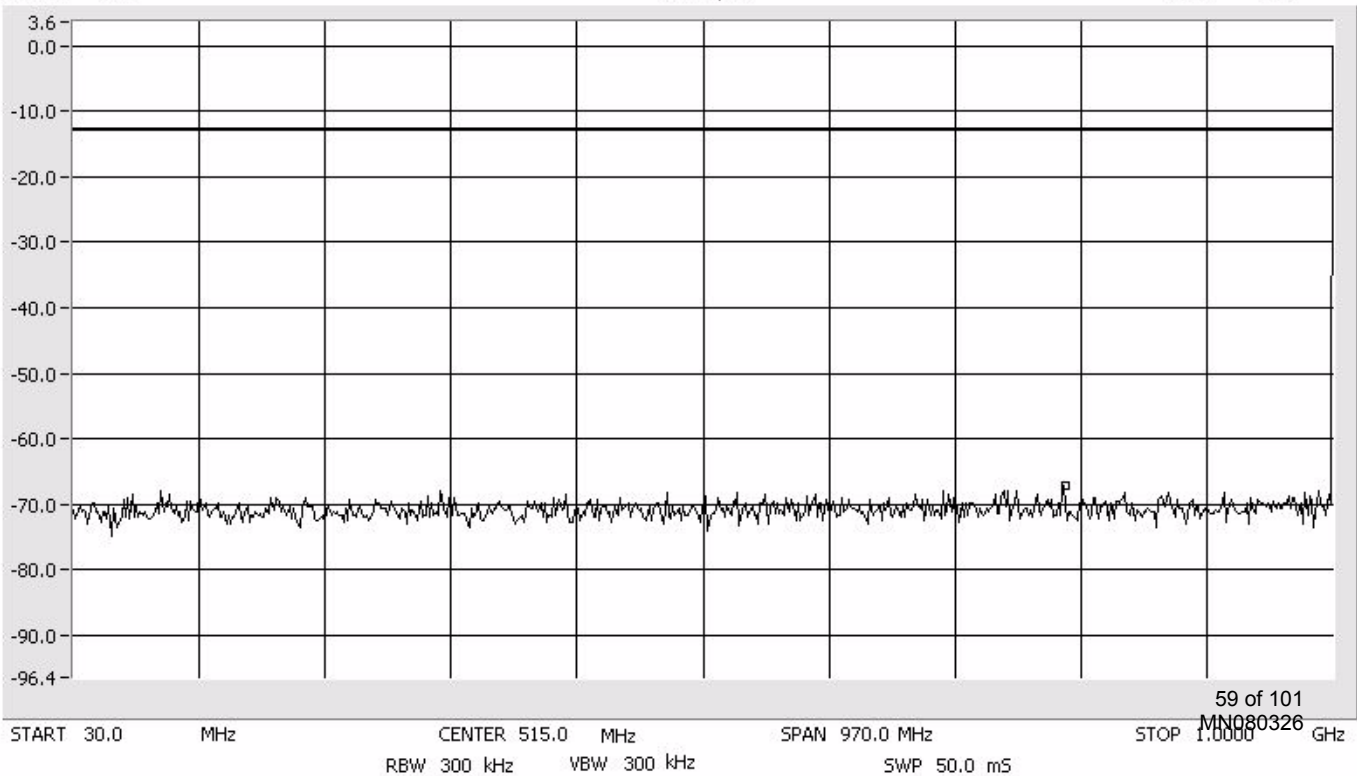
# Intermodulation Apart WiMax - QPSK

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

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -67.07 dBm  
794.7 MHz

10 dB/Div



RX

# Intermodulation Apart WiMax - QPSK

Span: 1 GHz to 26.5 GHz  
RBW/VBW: 1 MHz

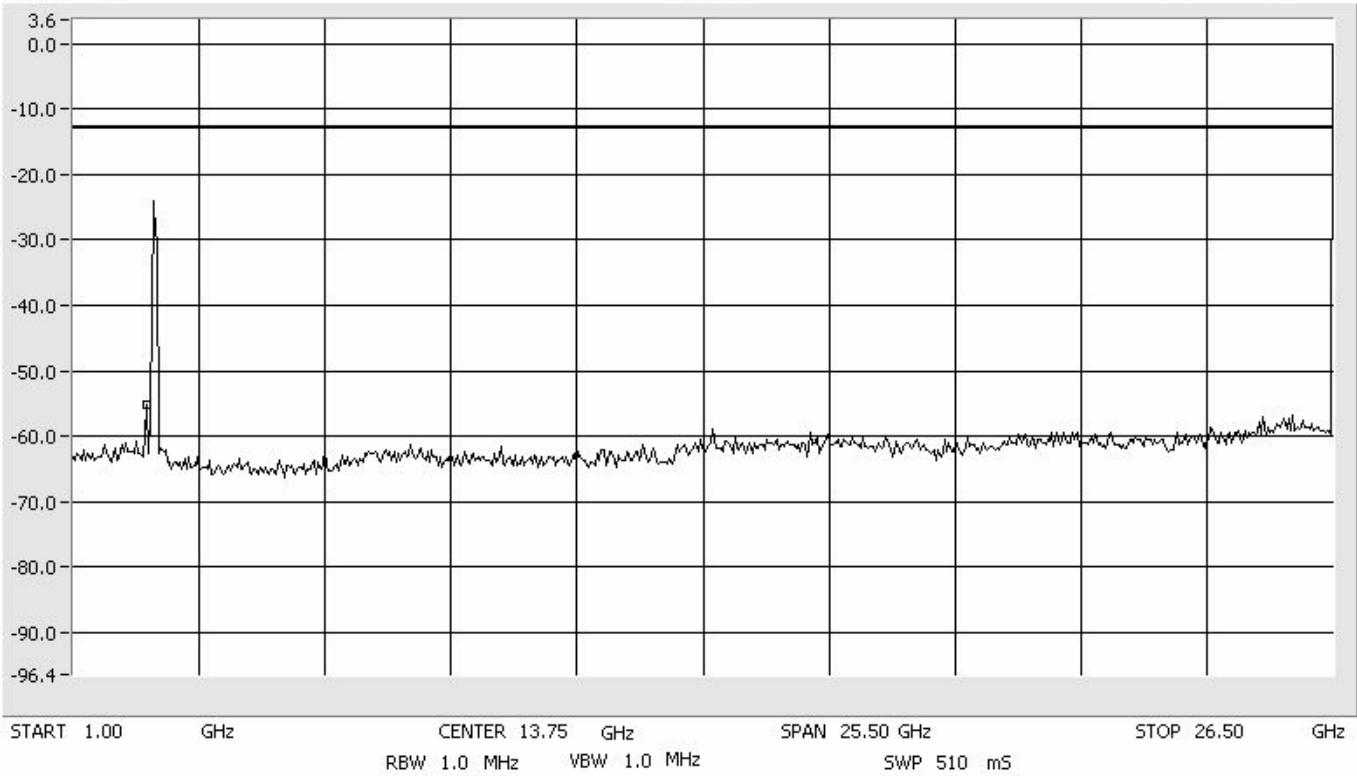
ATTEN 10 dB

delta MKR -55.07 dBm

RL 3.6 dBm

10 dB/Div

2.49 GHz



## **Occupied Bandwidth Modulation Test for ADC Inc**

**InterReach® Fusion Main Hub**

**Model Number FSN-1-MH-1-WMAX**

**InterReach® Fusion Expansion Hub**

**Model Number FSN-EH-1-WMAX**

**InterReach® Fusion Remote Access Unit**

**Model Number FSN-2500-1-WMAX**

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An input/output Occupied Bandwidth test was done with modulation types: 64QAM and QPSK. The purpose was to determine the amount of distortion added to different types of modulation schemes by the EUT. The following plots show input signals vs. output signals.

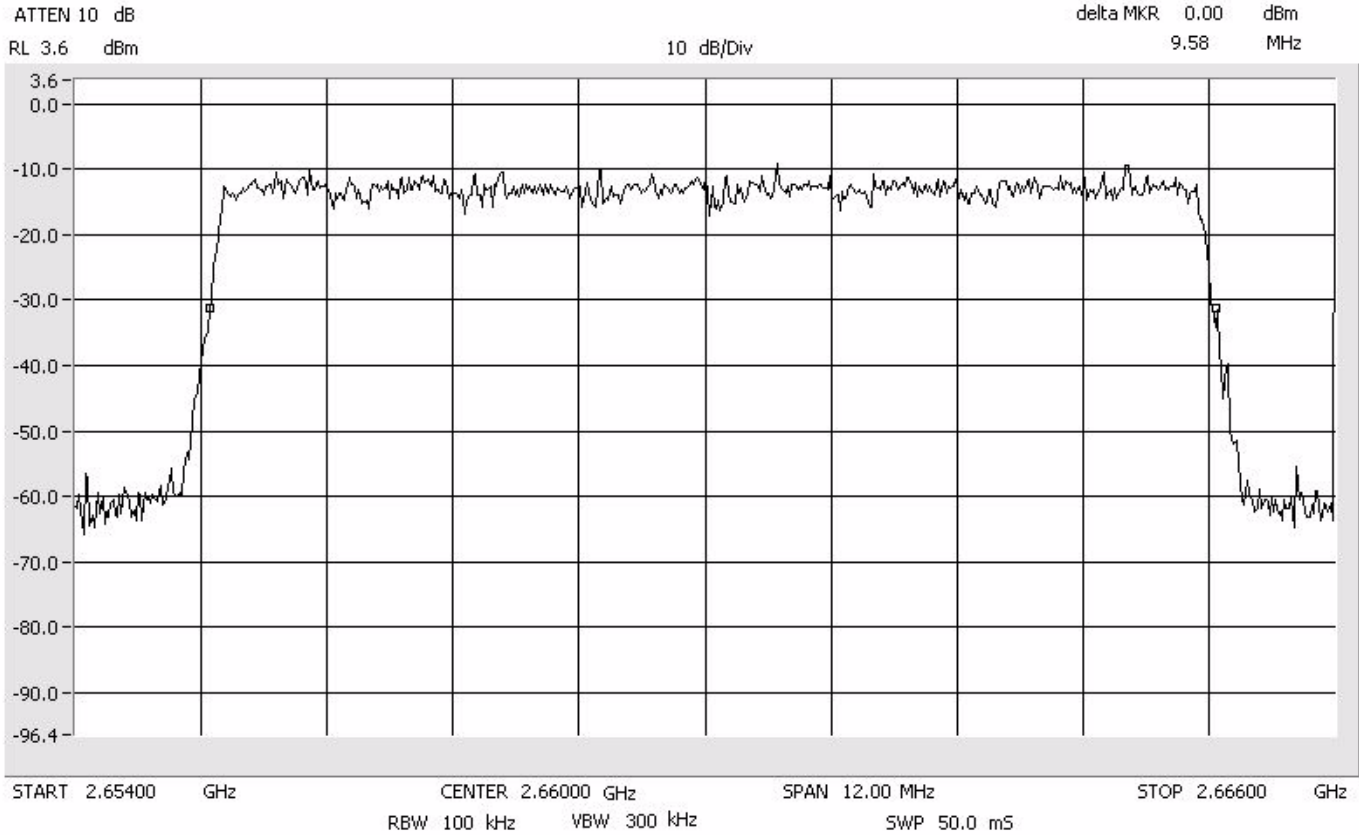
The resolution bandwidth is reduced to 1% of the estimated emission bandwidth and the video bandwidth is set to 3 times the resolution bandwidth. The markers are moved to the -20 dB points (from the previously established center frequency level) on either side of center frequency.

### **Results:**

Pass (see plots)

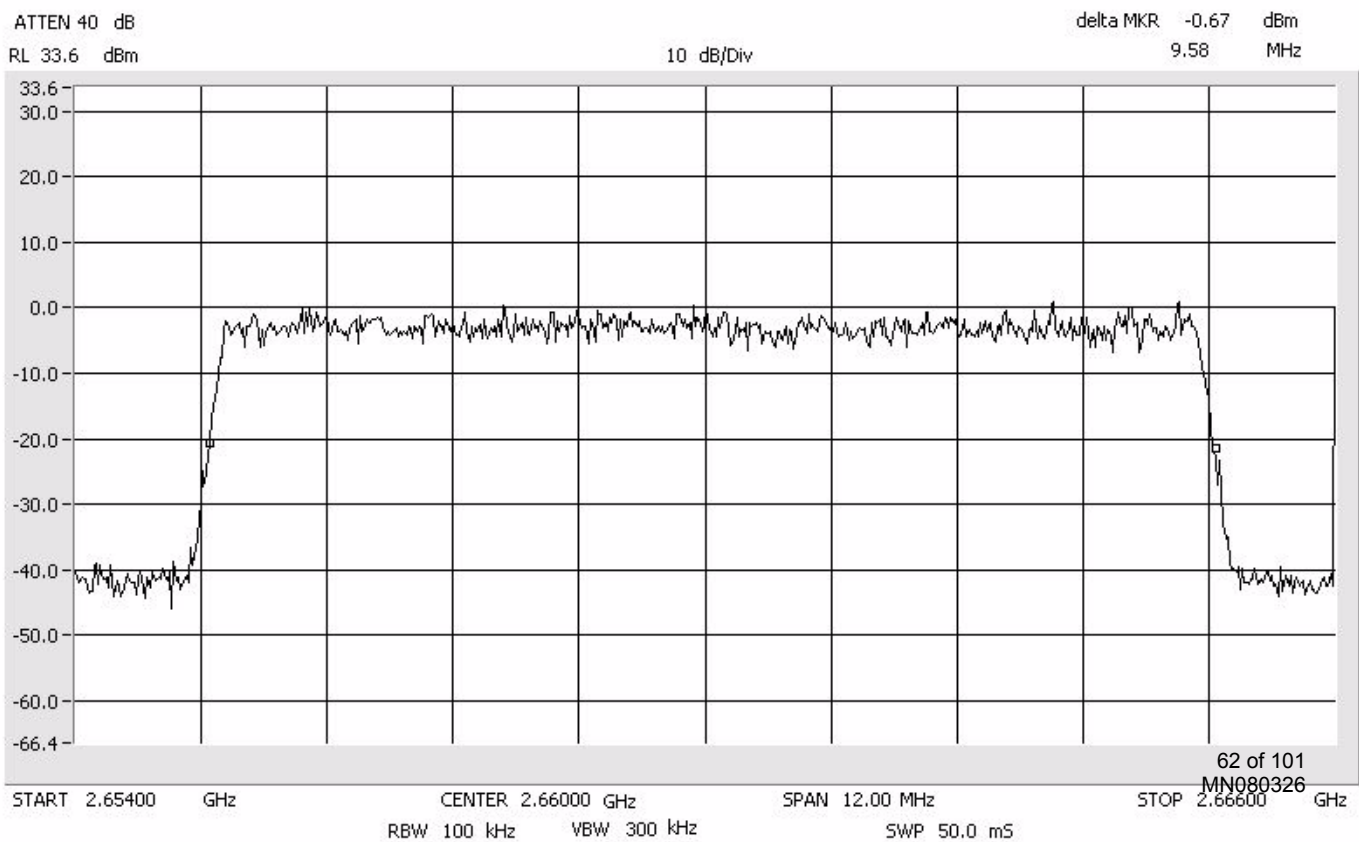
# Occupied Bandwidth 64QAM Signal In - TX

Span: 12.0 MHz  
RBW: 100 kHz  
VBW: 300 kHz



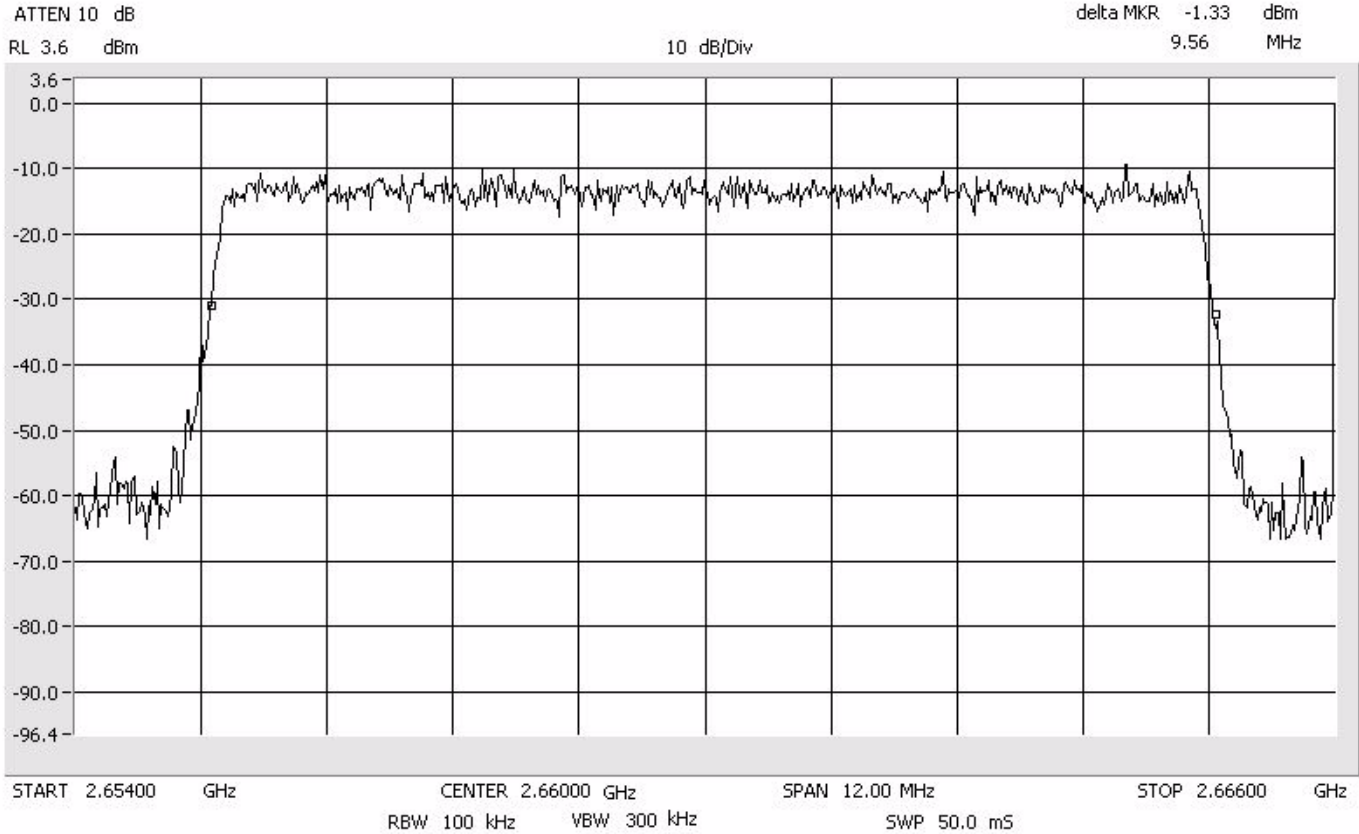
# Occupied Bandwidth 64QAM Signal Out - TX

Span: 12.0 MHz  
RBW: 100 kHz  
VBW: 300 kHz



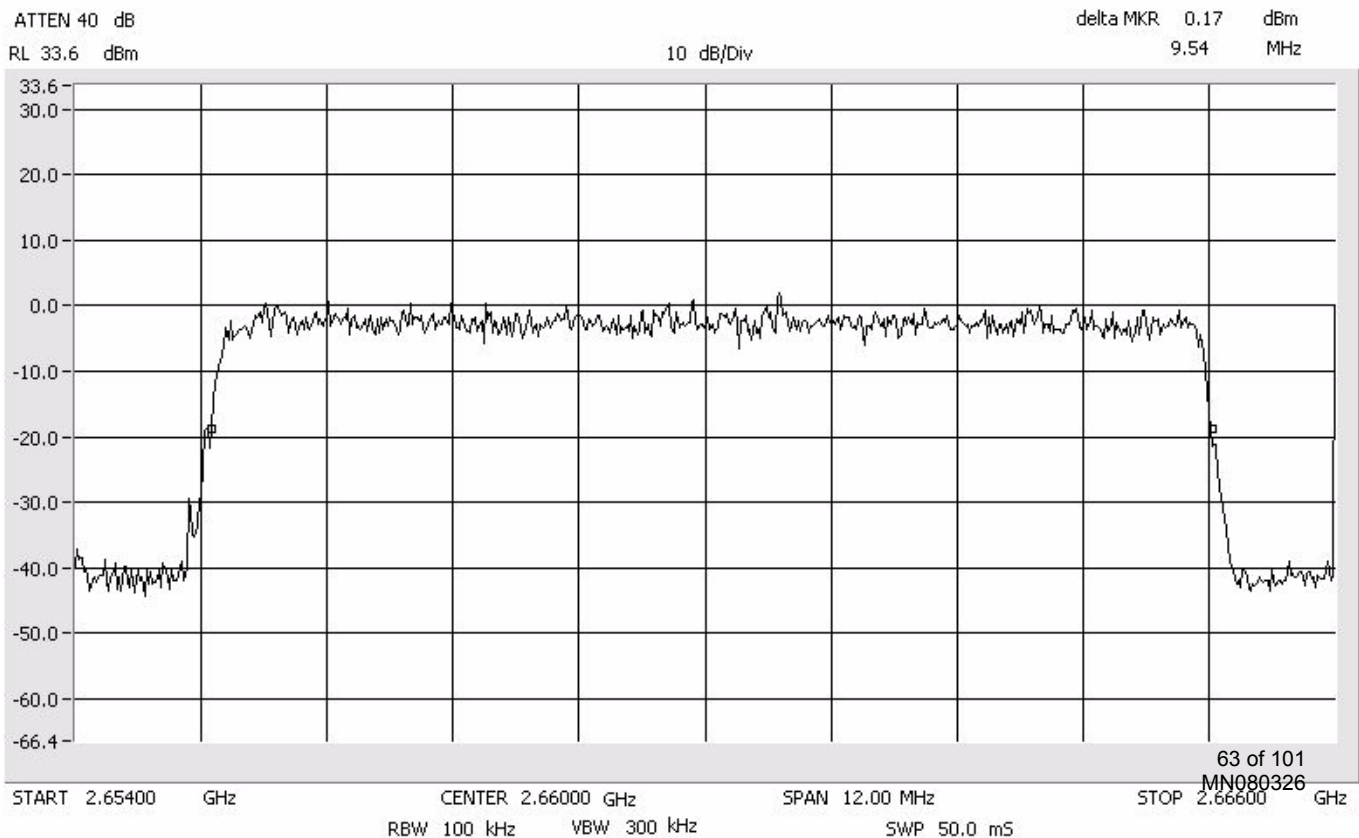
# Occupied Bandwidth QPSK Signal In - TX

Span: 12.0 MHz  
RBW: 100 kHz  
VBW: 300 kHz



# Occupied Bandwidth QPSK Signal Out - TX

Span: 12.0 MHz  
RBW: 100 kHz  
VBW: 300 kHz



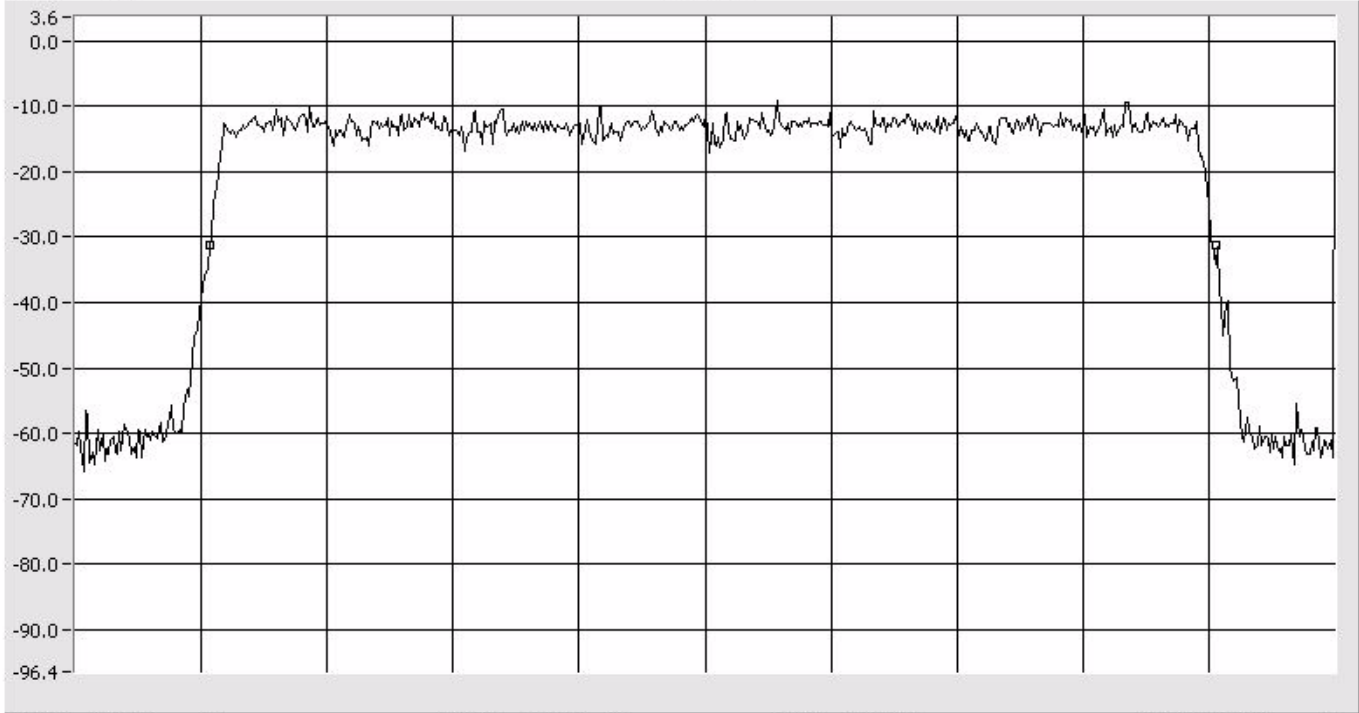
# Occupied Bandwidth 64QAM Signal In - RX

Span: 12.0 MHz  
RBW: 100 kHz  
VBW: 300 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR 0.00 dBm  
9.58 MHz

10 dB/Div



START 2.65400 GHz CENTER 2.66000 GHz SPAN 12.00 MHz STOP 2.66600 GHz  
RBW 100 kHz VBW 300 kHz SWP 50.0 mS

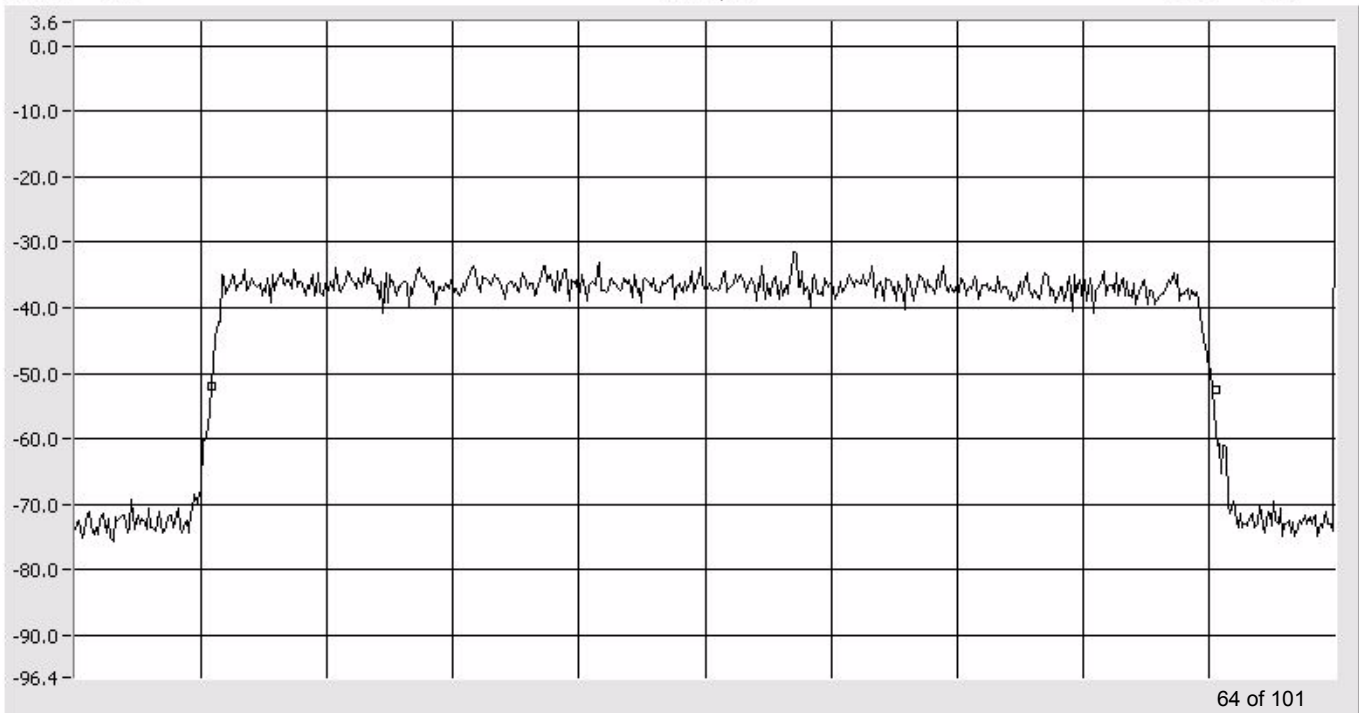
# Occupied Bandwidth 64QAM Signal Out - RX

Span: 12.0 MHz  
RBW: 100 kHz  
VBW: 300 kHz

ATTEN 10 dB  
RL 3.6 dBm

delta MKR -0.50 dBm  
9.56 MHz

10 dB/Div

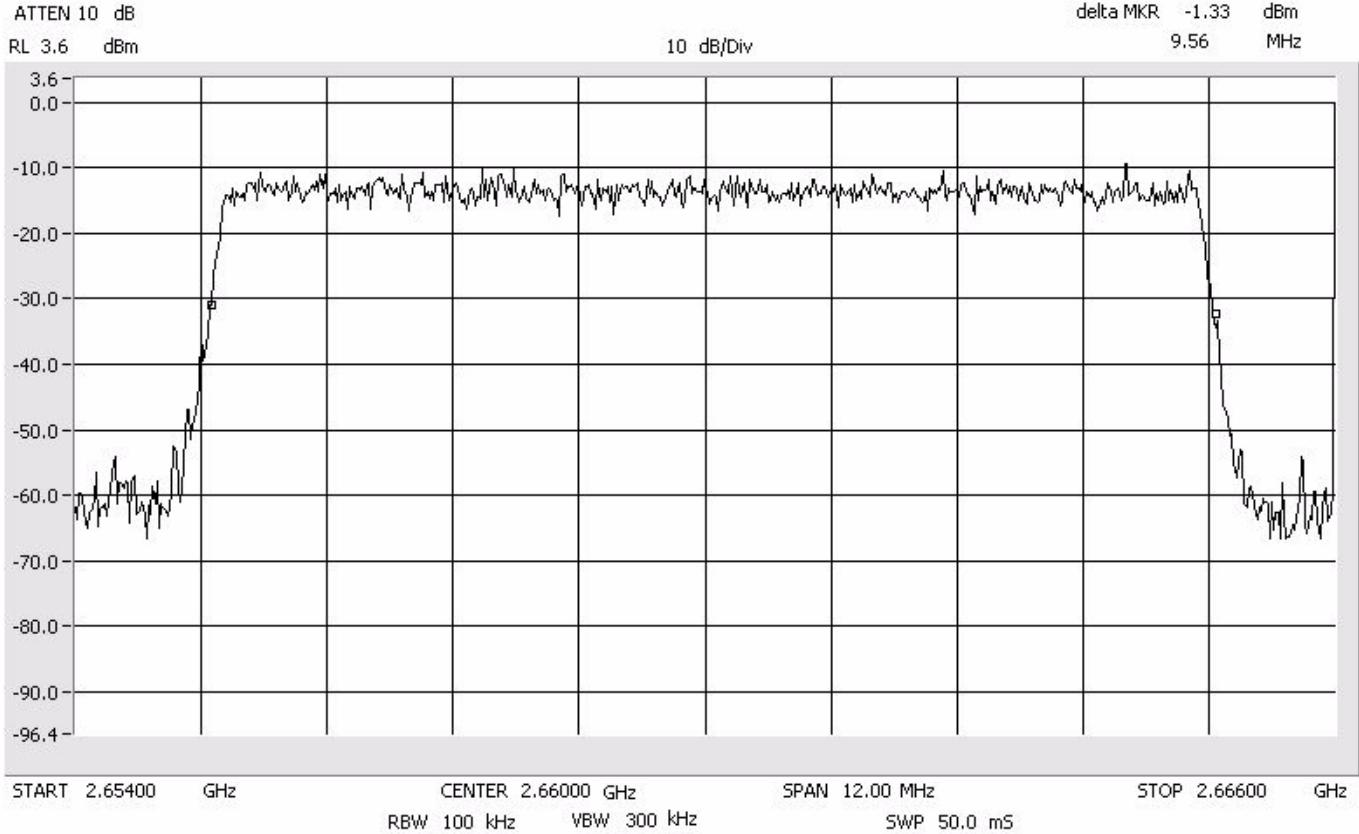


START 2.65400 GHz CENTER 2.66000 GHz SPAN 12.00 MHz STOP 2.66600 GHz  
RBW 100 kHz VBW 300 kHz SWP 50.0 mS



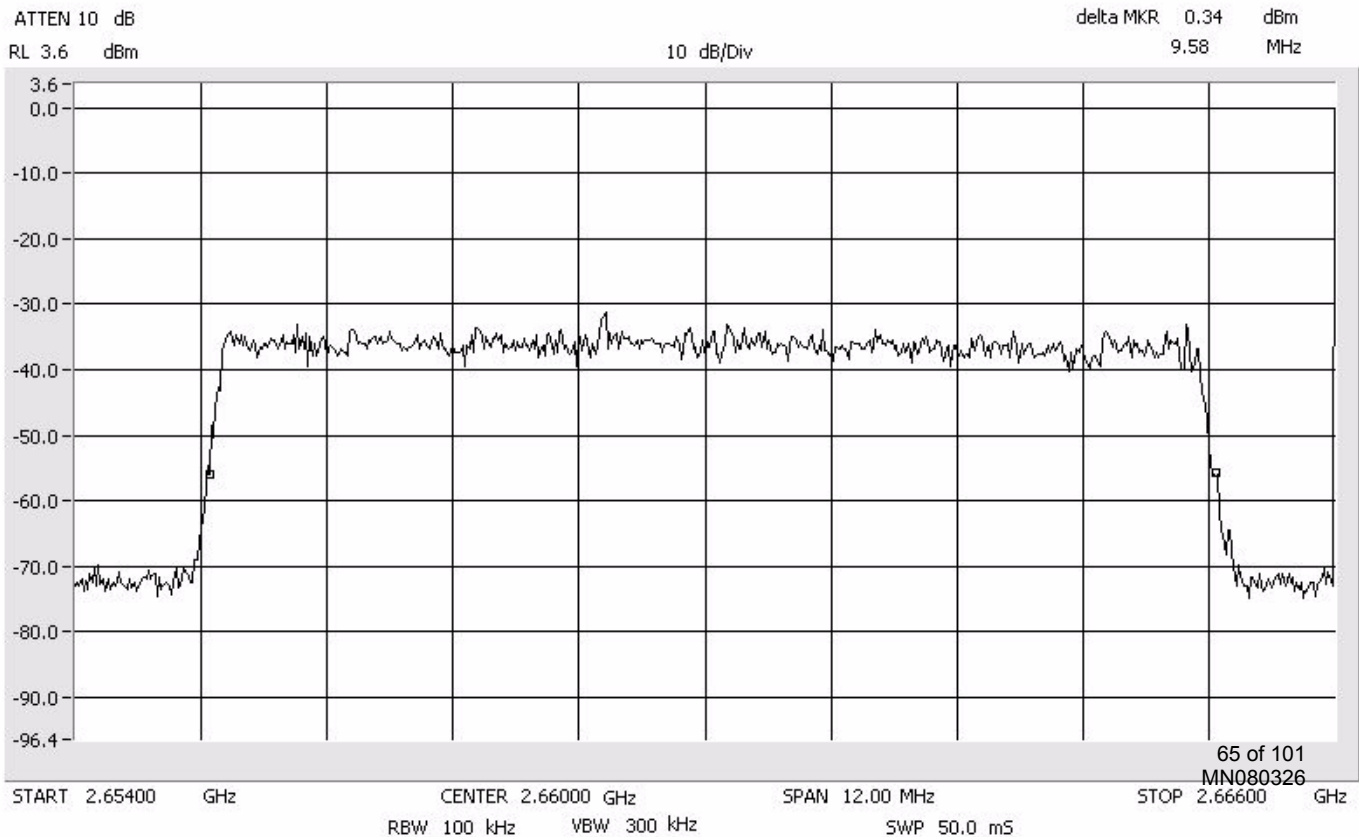
# Occupied Bandwidth QPSK Signal In - RX

Span: 12.0 MHz  
RBW: 100 kHz  
VBW: 300 kHz



# Occupied Bandwidth QPSK Signal Out - RX

Span: 12.0 MHz  
RBW: 100 kHz  
VBW: 300 kHz



# Frequency Tolerance Test for ADC Inc

InterReach® Fusion Main Hub

InterReach® Fusion Expansion Hub

Model Number FSN-1-MH-1-WMAX

Model Number FSN-EH-1-WMAX

InterReach® Fusion Remote Access Unit

Model Number FSN-2500-1-WMAX

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EUT WIMAX (2.5 GHz)

Host/Expansion	RAU			
Input Voltage	Input Voltage	Carrier Frequency	Measured Frequency	Meets Requirements?
100 VAC	45.9 VDC	2630.200 MHz	2630.200 MHz	Yes
170 VAC	54 VDC	2630.200 MHz	2630.200 MHz	Yes
240 VAC	62.1 VDC	2630.200 MHz	2630.200 MHz	Yes
100 VAC	45.9 VDC	2660.000 MHz	2660.000 MHz	Yes
170 VAC	54 VDC	2660.000 MHz	2660.000 MHz	Yes
240 VAC	62.1 VDC	2660.000 MHz	2660.000 MHz	Yes
100 VAC	45.9 VDC	2689.800 MHz	2689.800 MHz	Yes
170 VAC	54 VDC	2689.800 MHz	2689.800 MHz	Yes
240 VAC	62.1 VDC	2689.800 MHz	2689.800 MHz	Yes
Temperature		Carrier Frequency	Measured Frequency	Meets Requirements?
-25 Deg. C		2630.200 MHz	2630.200 MHz	Yes
-20 Deg. C		2630.200 MHz	2630.200 MHz	Yes
-10 Deg. C		2630.200 MHz	2630.200 MHz	Yes
0 Deg. C		2630.200 MHz	2630.200 MHz	Yes
10 Deg. C		2630.200 MHz	2630.200 MHz	Yes
20 Deg. C		2630.200 MHz	2630.200 MHz	Yes
30 Deg. C		2630.200 MHz	2630.200 MHz	Yes
40 Deg. C		2630.200 MHz	2630.200 MHz	Yes
45 Deg. C		2630.200 MHz	2630.200 MHz	Yes
-25 Deg. C		2660.000 MHz	2660.000 MHz	Yes
-20 Deg. C		2660.000 MHz	2660.000 MHz	Yes
-10 Deg. C		2660.000 MHz	2660.000 MHz	Yes
0 Deg. C		2660.000 MHz	2660.000 MHz	Yes
10 Deg. C		2660.000 MHz	2660.000 MHz	Yes
20 Deg. C		2660.000 MHz	2660.000 MHz	Yes
30 Deg. C		2660.000 MHz	2660.000 MHz	Yes
40 Deg. C		2660.000 MHz	2660.000 MHz	Yes
45 Deg. C		2660.000 MHz	2660.000 MHz	Yes
-25 Deg. C		2689.800 MHz	2689.800 MHz	Yes
-20 Deg. C		2689.800 MHz	2689.800 MHz	Yes
-10 Deg. C		2689.800 MHz	2689.800 MHz	Yes
0 Deg. C		2689.800 MHz	2689.800 MHz	Yes
10 Deg. C		2689.800 MHz	2689.800 MHz	Yes
20 Deg. C		2689.800 MHz	2689.800 MHz	Yes
30 Deg. C		2689.800 MHz	2689.800 MHz	Yes
40 Deg. C		2689.800 MHz	2689.800 MHz	Yes
45 Deg. C		2689.800 MHz	2689.800 MHz	Yes

Intertek Test Data

[Back to Test Data:](#)[Back to Table of Contents:](#)**Test Engineer:** Uri Spector**Date:** 21 March, 2008**Test Procedure:**

Test measurements were made in accordance with ANSI C63.4-2003, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

**Test Site Location:**

The test site is a 3 meter Semi-Anechoic Chamber, constructed by Panashield™ Inc. and located inside the building at 7250 Hudson Blvd. Suite 100, Oakdale, MN 55128.

**Test Site Description:**

The 3 meter Semi-Anechoic Chamber is constructed of Panabolt™ modular RF shielding and self-supported with structural steel designed for the local seismic zone rating. The chamber has the nominal size of 20' wide x 29' long x 18' high. All walls and ceiling of the chamber are treated with FFG-1000 Ferrite Grid absorber which was developed specifically to meet international requirements for EMC anechoic chambers for emissions and immunity measurements. To meet high frequency testing white HY-35 hybrid absorber is mounted on the ferrites in specular regions of the chamber.

The chamber has a 2 meter diameter ANSI test volume area and meets the requirements of ANSI C63.4 (1992), EN55022, and FCC Part 15 standards for testing at a 3 meter path length.

FCC Registration Number: 90706

IC Registration Number: 4359



## TEST DATA

Test Data Number: 3147568MIN-001  
Project Number: 3147568

Testing performed on the  
LGC WMAX Optical Repeater

To  
47 CFR, Part 27

For  
ADC Telecommunications Inc.

Test Performed by:  
Intertek Testing Services NA, Inc.  
7250 Hudson Blvd., Suite 100  
Oakdale, MN 55128

Test Authorized by:  
ADC Telecommunications Inc.  
5341 12<sup>th</sup> Avenue East  
Shakopee, MN 55379

Prepared by: *U. Spector*  
Uri Spector

Date: March 21, 2008

Reviewed by: *N. Shpilsher*  
Norman Shpilsher

Date: March 21, 2008



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## 1.0 DESCRIPTION OF THE SAMPLE (EUT)

<b>Model:</b>	LGC WMAX Optical Repeater
<b>Type of EUT:</b>	Optical Repeater
<b>Serial Number:</b>	N/A
<b>Company:</b>	ADC Telecommunications Inc.
<b>Customer:</b>	Mr. Mark Miska
<b>Address:</b>	1187 Park Place Shakopee, MN 55379
<b>Phone:</b>	952-403-8340
<b>Fax:</b>	952-403-8858
<b>Test Standards:</b>	<input type="checkbox"/> EN 55022:2006, Class <input type="checkbox"/> EN 55011:1998 + A1:1999 + A2:2002, Group, Class <input checked="" type="checkbox"/> 47 CFR, Part 27:2007 <input type="checkbox"/> 47 CFR, Part 15:2007, §15.109, Class <input type="checkbox"/> EN 55014-1:2000 + A1:2001 + A2:2002 <input type="checkbox"/> EN 61326-1:2006 <input type="checkbox"/> Class for Radiated and Conducted Emissions <input type="checkbox"/> EN 60601-1-2:2001 +A1:2006 <input type="checkbox"/> Class Radiated and Conducted Emissions <input type="checkbox"/> EN 61000-6-3:2001 <input type="checkbox"/> EN 61000-6-4:2001 <input type="checkbox"/> EN 61000-3-2:2006 <input type="checkbox"/> EN 61000-3-3:1995 +A1:2001 +A2:2006 <input type="checkbox"/> Other

## 2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST STANDARD	TEST	RESULT
Part 27	Spurious Enclosure Radiated Emissions	Pass

### 2.1 Statement of the Measurement Uncertainty

**Note:** The measured result in this report is within the specification limits by more than the measurement uncertainty; the measured result indicates that the product tested complies with the specification limit.

The expanded uncertainty ( $k = 2$ ) for radiated emissions from 30 to 1000 MHz has been determined to be:  $\pm 4$  dB at 10m and  $\pm 5.4$  dB at 3m

The expanded uncertainty ( $k = 2$ ) for conducted emissions from 150 kHz to 30 MHz has been determined to be:  $\pm 2.6$  dB

General notes:

1. Test was performed with the EUT tuned to the low frequency (2630MHz), middle frequency (2660MHz), and upper frequency (2690MHz) of the operating band, and also tested in Rx and Tx modes. Testing was performed in frequency range from 30MHz to 26.5GHz.
2. The EUT Antenna Port was terminated with 50Ohm terminator. The signal generator, Fiber Optic Interface Device (Support Equipment) was located outside of the test site.
3. The Spurious Radiated Power limits of -13dBm was correlated with field strength reference level of 82.2dB $\mu$ V/m during field strength measurements at 3m measurement distance.



### 3.0 TEST RESULTS

Tables 1 to 6 show detected Radiated Emissions. Emissions. No emissions above the floor noise were detected in frequency range above 18GHz. See Graphs 25 to 36.

Graphs 1 to 36 show the EUT peak Radiated Emissions.

No emissions were chosen for substitution measurements as the maximum emission is more than 20dB below the reference limit.

#### TILE Instrument Control System EMI Measurement Software

**Radiated Emissions from 30MHz to 1GHz**

**Date:** 3/21/2008

**Company:** ADC Telecommunications  
**Model:** LGC WMAX Optical Repeater  
**Test Engineer:** Uri Spector/Simon Khazon  
**Special Info:** 2630MHz  
**Standard:** FCC Part 27  
**Test Site:** 3m Anechoic Chamber, 3m measurement distance  
**Note:** The table shows the worst case radiated emissions  
 Measurements were taken using a Peak detector

**Table # 1**

Frequency	Ant. Polarity	Peak Reading dBµV	Ant.Factor dB1/m	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
<b>Rx Mode</b>						
30.97 MHz	V	14.7	20.0	34.7	82.2	-47.5
77.765 MHz	V	30.9	8.7	39.6	82.2	-42.6
98.508 MHz	V	19.9	11.6	31.5	82.2	-50.7
100.45 MHz	V	21.3	11.9	33.2	82.2	-49.0
102.09 MHz	V	21.0	12.2	33.1	82.2	-49.1
110.0 MHz	V	20.6	13.1	33.7	82.2	-48.5
<b>Tx Mode</b>						
30.208 MHz	H	14.6	20.4	35.0	82.2	-47.2
77.168 MHz	H	25.8	8.7	34.5	82.2	-47.8
113.13 MHz	H	16.6	13.4	29.9	82.2	-52.3
30.139 MHz	V	14.8	20.5	35.2	82.2	-47.0
57.845 MHz	V	21.0	8.1	29.1	82.2	-53.1
76.571 MHz	V	29.9	8.6	38.5	82.2	-43.7
110.0 MHz	V	20.8	13.1	34.0	82.2	-48.2
30.139 MHz	H	14.3	20.5	34.8	82.2	-47.5
78.064 MHz	H	22.4	8.8	31.1	82.2	-51.1
87.614 MHz	H	24.0	9.7	33.7	82.2	-48.5





TILE Instrument Control System EMI Measurement Software

**Radiated Emissions from 30MHz to 1GHz**

**Date:** 3/21/2008

**Company:** ADC Telecommunications  
**Model:** LGC WMAX Optical Repeater  
**Test Engineer:** Uri Spector/Simon Khazon  
**Special Info:** 2660MHz  
**Standard:** FCC Part 27  
**Test Site:** 3m Anechoic Chamber, 3m measurement distance  
**Note:** The table shows the worst case radiated emissions  
 Measurements were taken using a Peak detector

**Table # 2**

Frequency	Ant. Polarity	Peak Reading dBµV	Ant.Factor dB1/m	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
<b>Rx Mode</b>						
30.526 MHz	V	14.3	20.3	34.6	82.2	-47.6
78.354 MHz	V	30.4	8.8	39.1	82.2	-43.1
100.3 MHz	V	21.4	11.9	33.3	82.2	-49.0
110.0 MHz	V	21.0	13.1	34.2	82.2	-48.0
<b>Tx Mode</b>						
30.175 MHz	H	14.0	20.5	34.5	82.2	-47.7
77.737 MHz	H	26.2	8.7	35.0	82.2	-47.2
108.77 MHz	H	16.7	13.0	29.8	82.2	-52.4
32.632 MHz	V	22.2	19.2	41.3	82.2	-40.9
35.888 MHz	V	19.4	17.4	36.8	82.2	-45.4
77.168 MHz	V	31.4	8.7	40.0	82.2	-42.2
109.4 MHz	V	20.8	13.1	33.9	82.2	-48.3
32.701 MHz	H	19.0	19.1	38.1	82.2	-44.1
77.765 MHz	H	22.1	8.7	30.8	82.2	-51.4
87.614 MHz	H	22.6	9.7	32.3	82.2	-49.9



TILE Instrument Control System EMI Measurement Software

Radiated Emissions from 30MHz to 1GHz

Date: 3/21/2008

**Company:** ADC Telecommunications  
**Model:** LGC WMAX Optical Repeater  
**Test Engineer:** Uri Spector/Simon Khazon  
**Special Info:** 2690MHz  
**Standard:** FCC Part 27  
**Test Site:** 3m Anechoic Chamber, 3m measurement distance  
**Note:** The table shows the worst case radiated emissions  
 Measurements were taken using a Peak detector

Table # 3

Frequency	Ant. Polarity	Peak Reading dBµV	Ant.Factor dB1/m	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
<b>Rx Mode</b>						
30.632 MHz	V	15.2	20.2	35.4	82.2	-46.8
59.116 MHz	V	24.1	8.1	32.2	82.2	-50.0
78.354 MHz	V	30.4	8.8	39.2	82.2	-43.0
111.15 MHz	V	20.4	13.2	33.6	82.2	-48.6
<b>Tx Mode</b>						
30.737 MHz	H	14.3	20.2	34.5	82.2	-47.7
77.825 MHz	H	25.1	8.7	33.8	82.2	-48.4
112.38 MHz	H	17.0	13.3	30.3	82.2	-51.9
30.346 MHz	V	14.4	20.4	34.7	82.2	-47.5
62.209 MHz	V	24.6	7.9	32.5	82.2	-49.7
77.765 MHz	V	29.9	8.7	38.6	82.2	-43.6
108.66 MHz	V	20.8	13.0	33.8	82.2	-48.4
30.0 MHz	H	14.5	20.5	35.0	82.2	-47.2
77.765 MHz	H	23.8	8.7	32.5	82.2	-49.7
88.808 MHz	H	22.7	9.9	32.6	82.2	-49.6



TILE Instrument Control System EMI Measurement Software

**Radiated Emissions from 1GHz to 18GHz**

**Date:** 03-21-2008

**Company:** ADC Telecommunications  
**Model:** LGC WMAX Optical Repeater  
**Test Engineer:** Uri Spector/Simon Khazon  
**Special Info:** 2630MHz  
**Standard:** FCC Part 27  
**Test Site:** 3m Anechoic Chamber, 3m measurement distance  
**Note:** The table shows the worst case radiated emissions  
 All measurements were taken using a Peak detector

**Table # 4**

Frequency MHz	Antenna Polarity	Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
<b>Rx Mode</b>							
1.2176 GHz	V	36.9	28.1	39.6	25.3	82.2	-56.9
2.3056 GHz	V	39.2	32.1	38.1	33.2	82.2	-49.0
2.462 GHz	V	46.0	32.5	37.9	40.6	82.2	-41.6
2.5708 GHz	V	36.8	32.8	37.8	31.8	82.2	-50.4
6.5012 GHz	V	38.2	42.4	36.3	44.3	82.2	-37.9
7.3852 GHz	V	37.8	43.9	36.7	45.0	82.2	-37.2
9.8468 GHz	V	36.3	46.7	34.7	48.2	82.2	-34.0
<b>Tx Mode</b>							
2.3056 GHz	H	39.3	32.1	38.1	33.3	82.2	-48.9
2.462 GHz	H	41.9	32.5	37.9	36.5	82.2	-45.7
2.5708 GHz	H	35.6	32.8	37.8	30.5	82.2	-51.7
9.8468 GHz	H	36.8	46.7	34.7	48.7	82.2	-33.5
<b>Tx Mode</b>							
1.2176 GHz	V	37.9	28.1	39.6	26.3	82.2	-55.9
2.3056 GHz	V	42.1	32.1	38.1	36.2	82.2	-46.1
2.462 GHz	V	46.7	32.5	37.9	41.4	82.2	-40.9
2.5708 GHz	V	38.3	32.8	37.8	33.2	82.2	-49.0
2.632 GHz	V	37.8	32.9	37.9	32.9	82.2	-49.3
7.3852 GHz	V	40.3	43.9	36.7	47.5	82.2	-34.7
2.3056 GHz	H	39.3	32.1	38.1	33.3	82.2	-48.9
2.462 GHz	H	42.6	32.5	37.9	37.3	82.2	-44.9
2.5708 GHz	H	36.9	32.8	37.8	31.9	82.2	-50.3
2.632 GHz	H	35.4	32.9	37.9	30.5	82.2	-51.7
9.8468 GHz	H	37.5	46.7	34.7	49.4	82.2	-32.8



TILE Instrument Control System EMI Measurement Software

**Radiated Emissions from 1GHz to 18GHz**

**Date:** 03-21-2008

**Company:** ADC Telecommunications  
**Model:** LGC WMAX Optical Repeater  
**Test Engineer:** Uri Spector/Simon Khazon  
**Special Info:** 2660MHz  
**Standard:** FCC Part 27  
**Test Site:** 3m Anechoic Chamber, 3m measurement distance  
**Note:** The table shows the worst case radiated emissions  
 All measurements were taken using a Peak detector

**Table # 5**

Frequency MHz	Antenna Polarity	Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
<b>Rx Mode</b>							
1.2176 GHz	V	37.2	28.1	39.6	25.6	82.2	-56.6
2.3056 GHz	V	38.5	32.1	38.1	32.6	82.2	-49.6
2.462 GHz	V	45.6	32.5	37.9	40.2	82.2	-42.0
2.5708 GHz	V	36.7	32.8	37.8	31.7	82.2	-50.5
4.6108 GHz	V	36.0	38.9	37.5	37.3	82.2	-44.9
6.5012 GHz	V	37.7	42.4	36.3	43.8	82.2	-38.4
6.9228 GHz	V	36.7	43.0	37.1	42.7	82.2	-39.5
7.3852 GHz	V	37.3	43.9	36.7	44.5	82.2	-37.7
9.8468 GHz	V	35.4	46.7	34.7	47.4	82.2	-34.8
<b>Tx Mode</b>							
2.3056 GHz	H	39.2	32.1	38.1	33.3	82.2	-48.9
2.462 GHz	H	41.7	32.5	37.9	36.4	82.2	-45.8
2.5708 GHz	H	36.2	32.8	37.8	31.2	82.2	-51.0
9.8468 GHz	H	36.4	46.7	34.7	48.4	82.2	-33.9
<b>Tx Mode</b>							
1.2176 GHz	V	37.4	28.1	39.6	25.9	82.2	-56.3
2.1628 GHz	V	34.8	31.8	38.3	28.3	82.2	-53.9
2.3056 GHz	V	41.2	32.1	38.1	35.2	82.2	-47.0
2.462 GHz	V	46.3	32.5	37.9	40.9	82.2	-41.3
2.5708 GHz	V	38.7	32.8	37.8	33.7	82.2	-48.5
2.6592 GHz	V	35.8	33.0	37.9	31.0	82.2	-51.2
6.5012 GHz	V	38.0	42.4	36.3	44.1	82.2	-38.1
6.9228 GHz	V	36.8	43.0	37.1	42.8	82.2	-39.4
7.3852 GHz	V	37.9	43.9	36.7	45.1	82.2	-37.1
9.8468 GHz	V	36.9	46.7	34.7	48.9	82.2	-33.4
<b>Tx Mode</b>							
2.3056 GHz	H	40.1	32.1	38.1	34.1	82.2	-48.1
2.462 GHz	H	39.7	32.5	37.9	34.3	82.2	-47.9
2.5708 GHz	H	38.0	32.8	37.8	32.9	82.2	-49.3
2.6592 GHz	H	34.5	33.0	37.9	29.7	82.2	-52.5
9.8468 GHz	H	37.0	46.7	34.7	49.0	82.2	-33.2



TILE Instrument Control System EMI Measurement Software

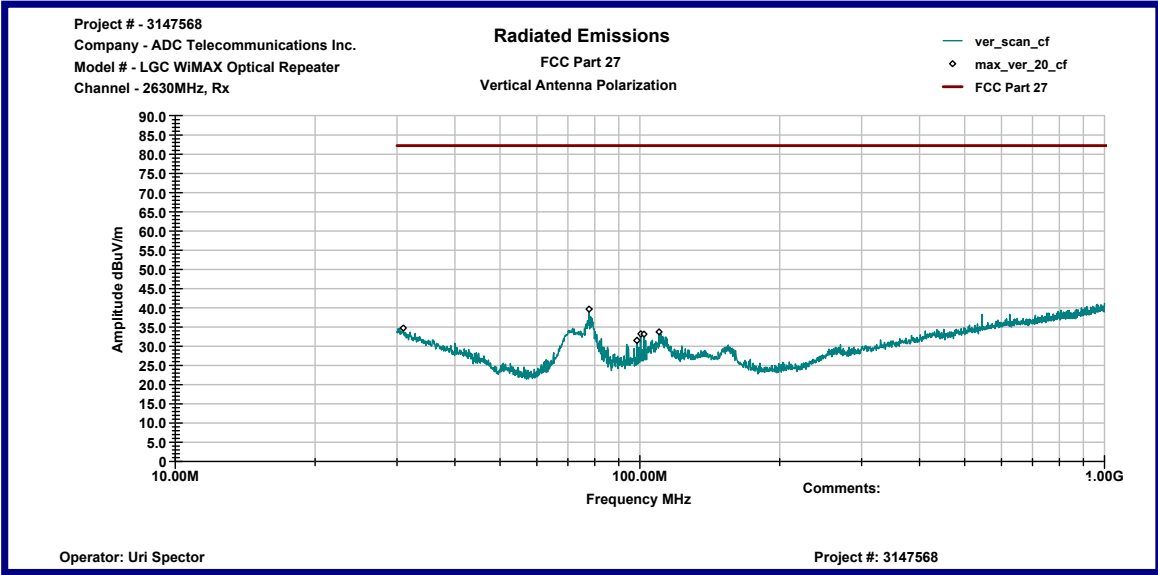
**Radiated Emissions from 1GHz to 18GHz**

**Date:** 03-21-2008

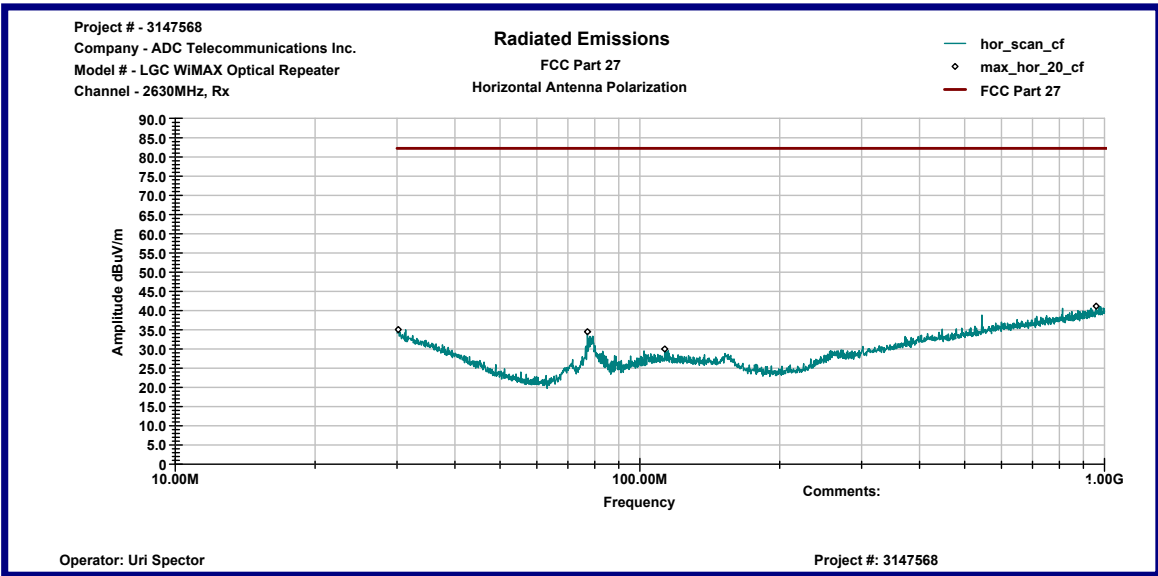
**Company:** ADC Telecommunications  
**Model:** LGC WMAX Optical Repeater  
**Test Engineer:** Uri Spector/Simon Khazon  
**Special Info:** 2690MHz  
**Standard:** FCC Part 27  
**Test Site:** 3m Anechoic Chamber, 3m measurement distance  
**Note:** The table shows the worst case radiated emissions  
 All measurements were taken using a Peak detector

**Table # 6**

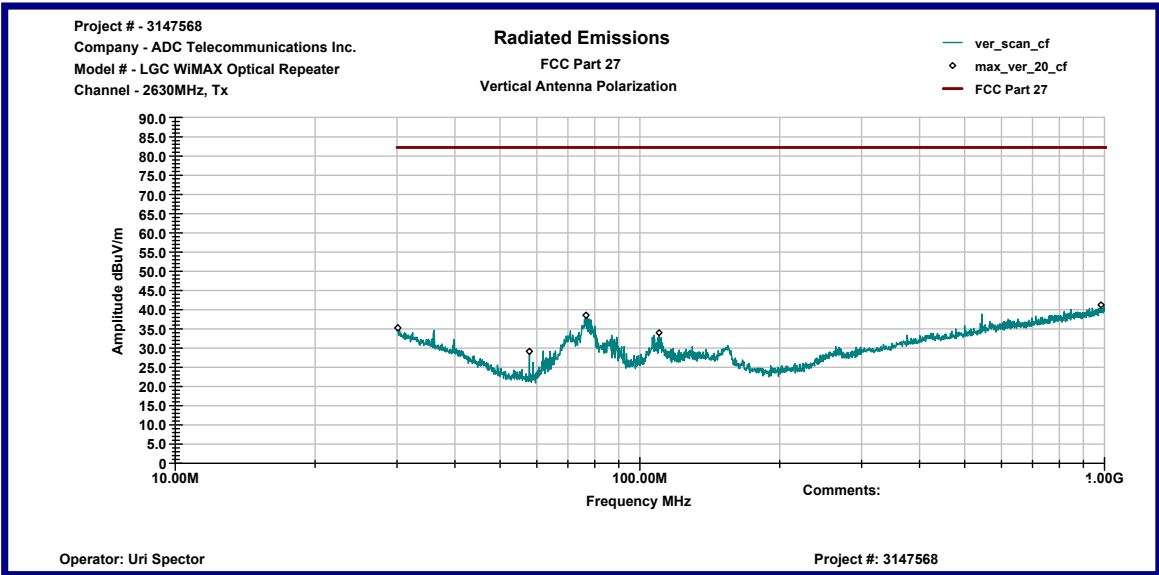
Frequency MHz	Antenna Polarity	Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
<b>Rx Mode</b>							
1.2176 GHz	V	36.4	28.1	39.6	24.8	82.2	-57.4
2.3056 GHz	V	39.0	32.1	38.1	33.0	82.2	-49.2
2.462 GHz	V	45.4	32.5	37.9	40.0	82.2	-42.2
2.5708 GHz	V	36.9	32.8	37.8	31.9	82.2	-50.3
6.5012 GHz	V	38.0	42.4	36.3	44.1	82.2	-38.1
7.3852 GHz	V	38.5	43.9	36.7	45.7	82.2	-36.5
<b>Tx Mode</b>							
2.3056 GHz	H	38.2	32.1	38.1	32.2	82.2	-50.0
2.462 GHz	H	40.2	32.5	37.9	34.9	82.2	-47.3
2.5708 GHz	H	34.6	32.8	37.8	29.5	82.2	-52.7
9.8468 GHz	H	35.8	46.7	34.7	47.7	82.2	-34.5
<b>Rx Mode</b>							
1.2176 GHz	V	37.19	28.05	39.63	25.61	82.2	-56.59
2.3056 GHz	V	40.28	32.13	38.11	34.3	82.2	-47.9
2.462 GHz	V	46.71	32.51	37.86	41.36	82.2	-40.84
2.5708 GHz	V	37.56	32.78	37.83	32.52	82.2	-49.68
2.6932 GHz	V	38.04	33.1	37.88	33.26	82.2	-48.94
6.5012 GHz	V	38.55	42.4	36.3	44.65	82.2	-37.55
7.3852 GHz	V	38.31	43.94	36.74	45.52	82.2	-36.68
9.8468 GHz	V	35.57	46.65	34.7	47.52	82.2	-34.68
<b>Tx Mode</b>							
2.1628 GHz	H	33.9	31.8	38.3	27.3	82.2	-54.9
2.3056 GHz	H	39.3	32.1	38.1	33.4	82.2	-48.8
2.462 GHz	H	42.6	32.5	37.9	37.3	82.2	-44.9
2.5708 GHz	H	37.4	32.8	37.8	32.4	82.2	-49.9
2.6932 GHz	H	36.2	33.1	37.9	31.4	82.2	-50.8
9.8468 GHz	H	36.0	46.7	34.7	47.9	82.2	-34.3



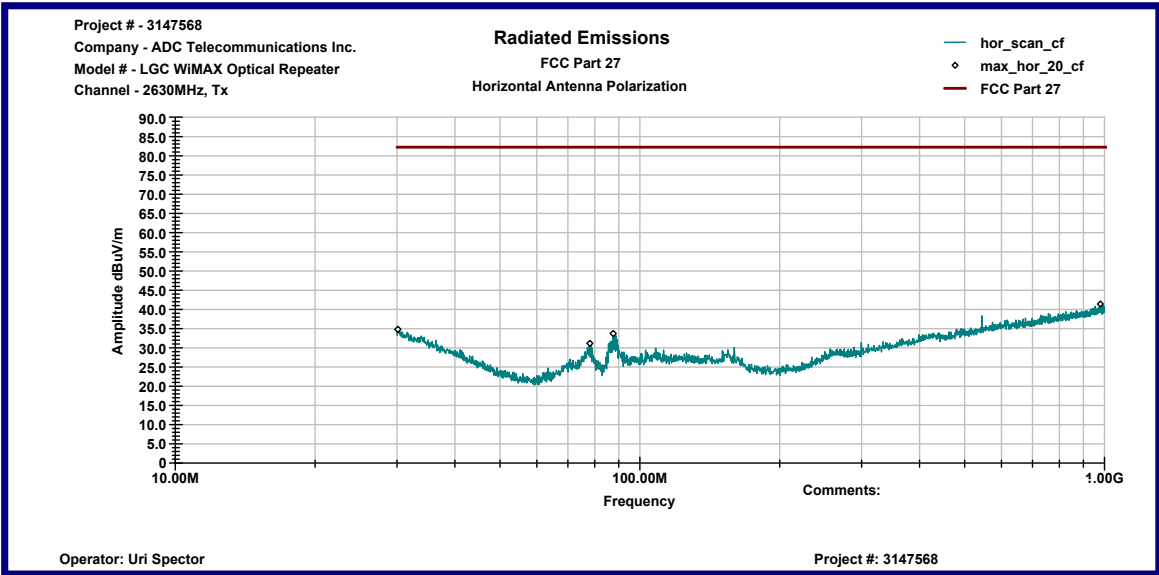
Graph 1



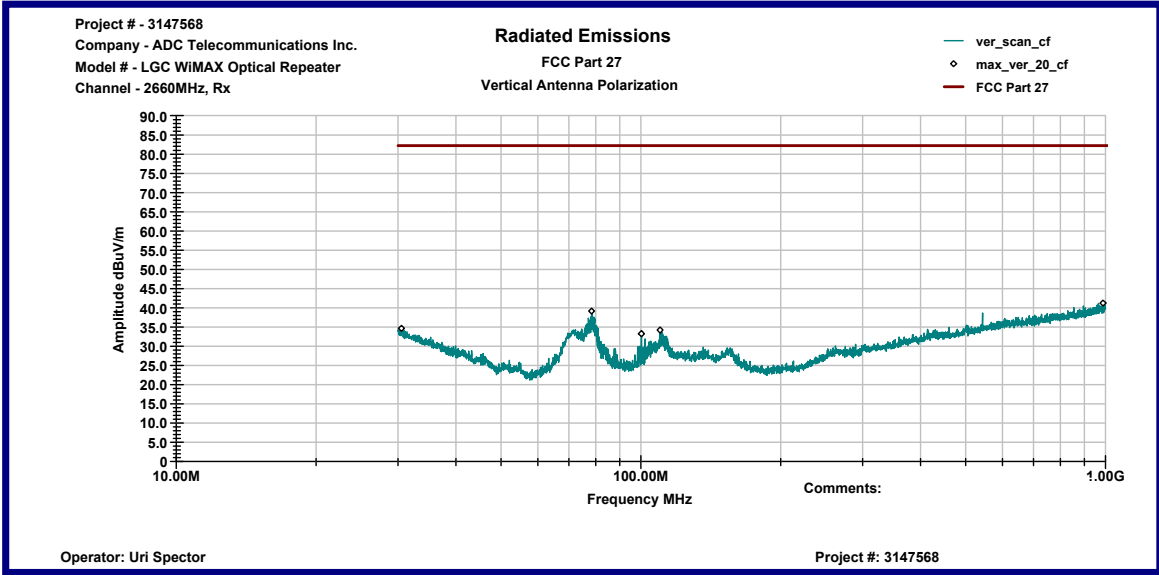
Graph 2



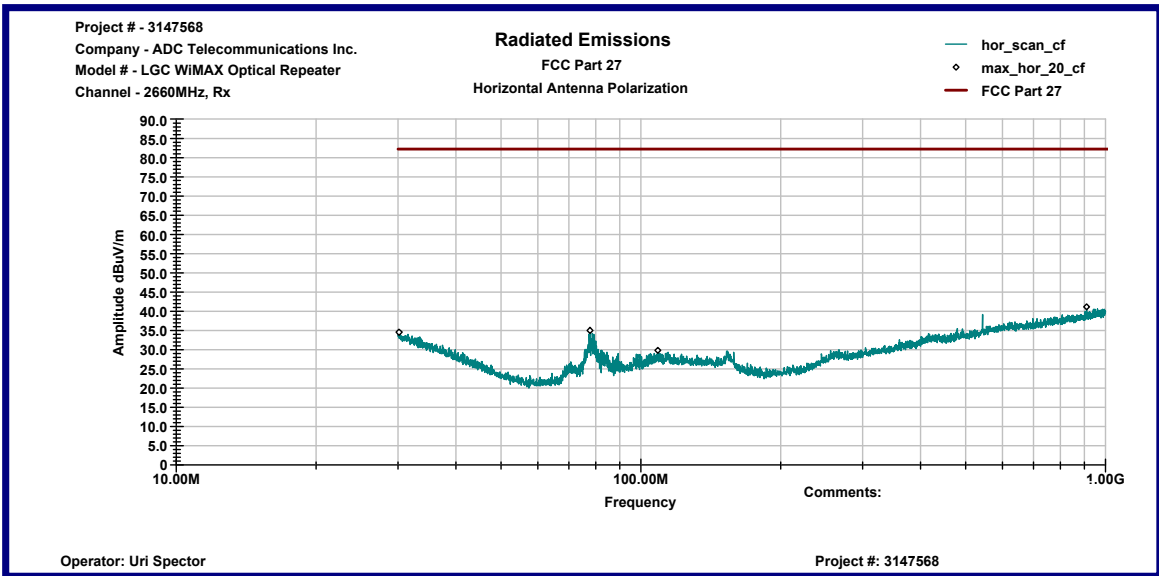
Graph 3



Graph 4

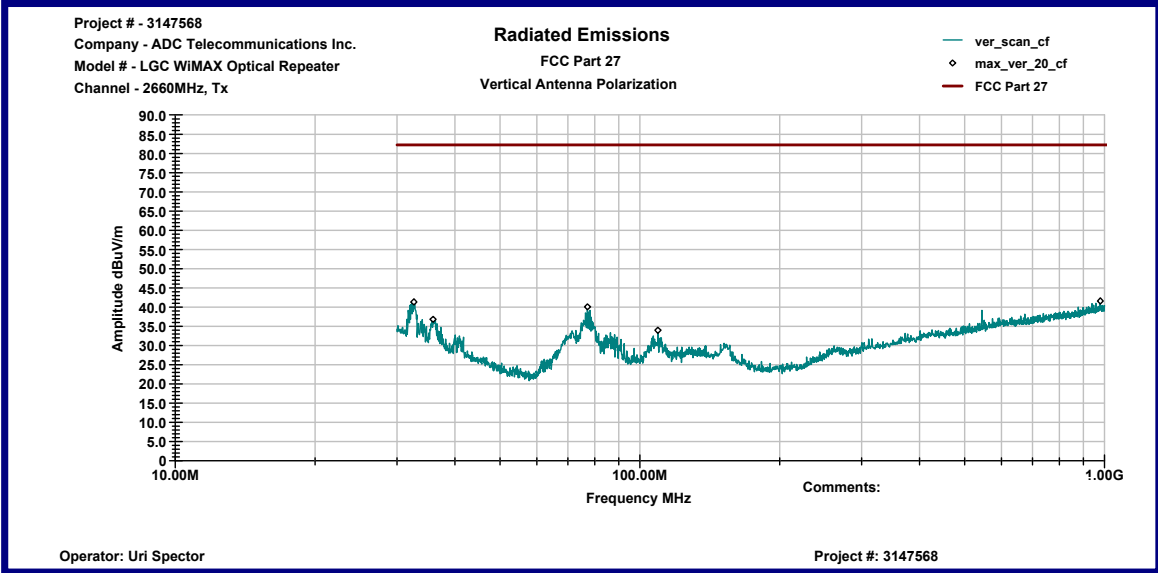


Graph 5

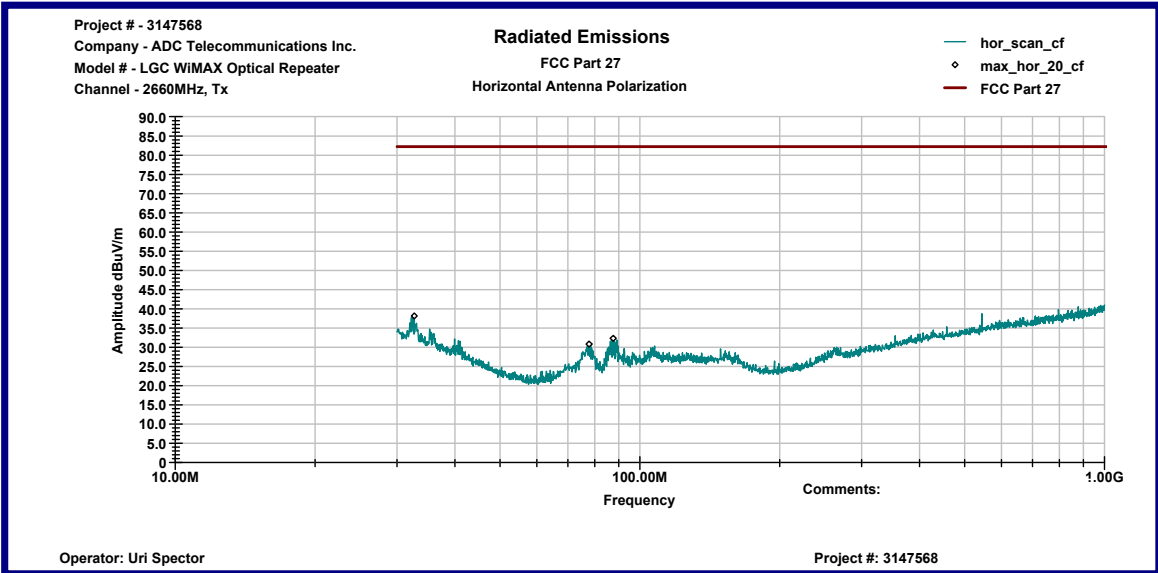


Graph 6

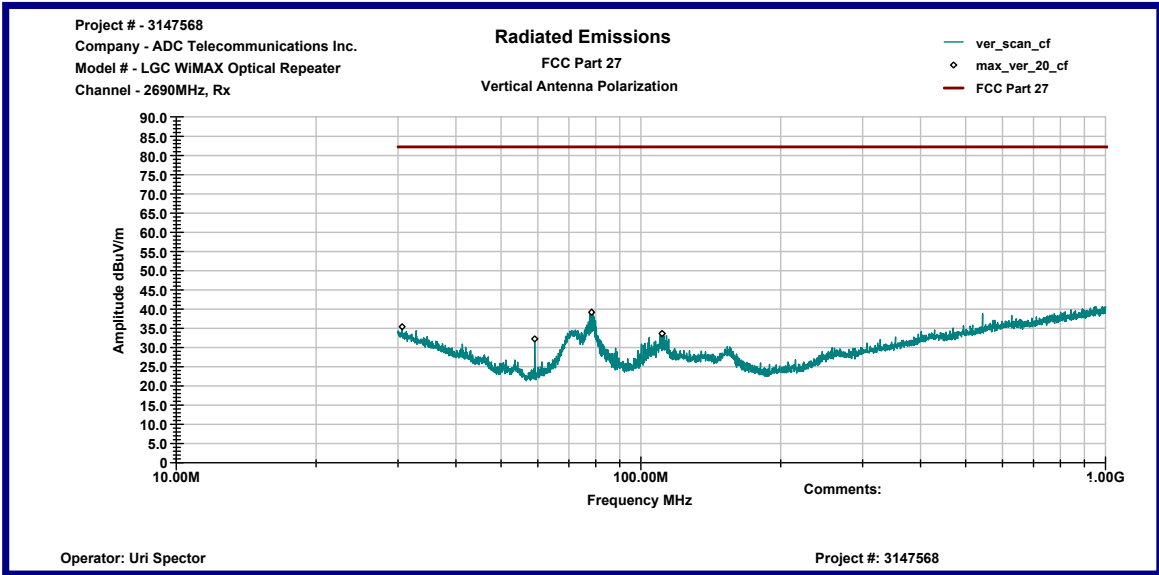




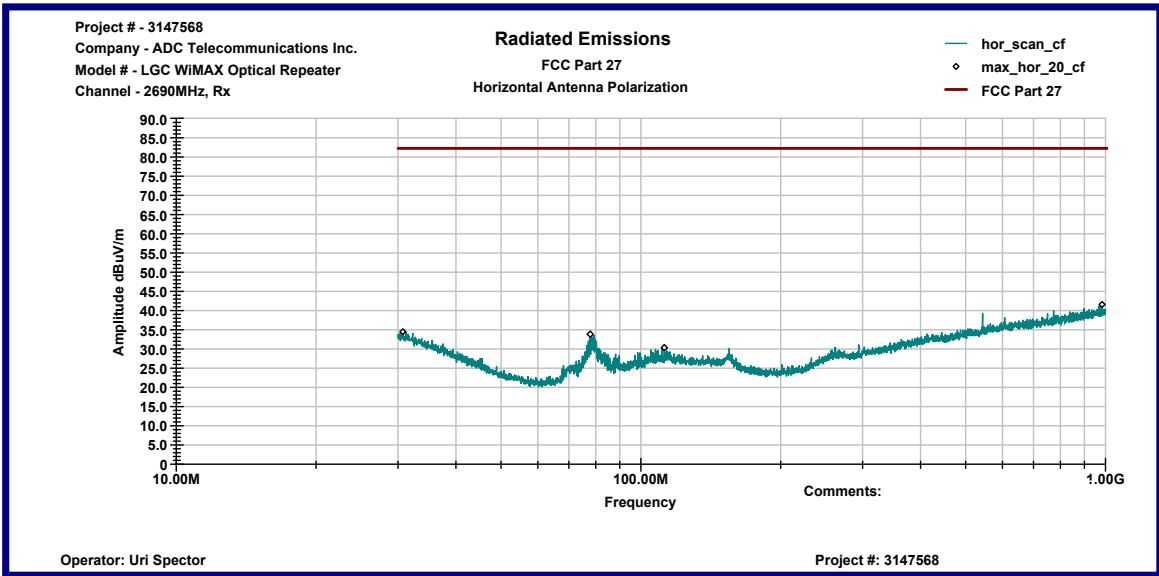
Graph 7



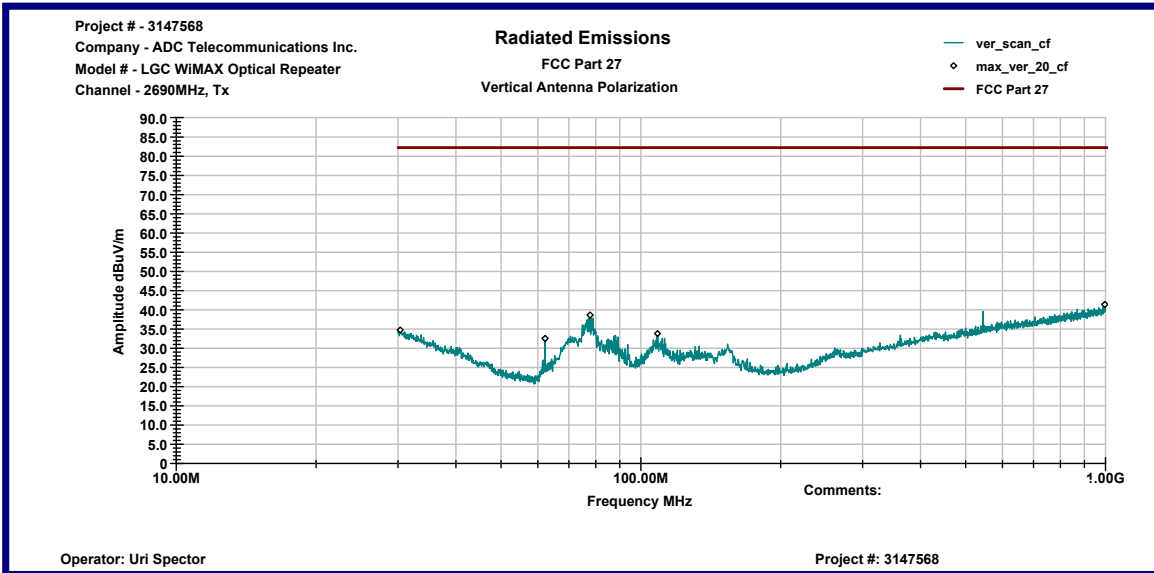
Graph 8



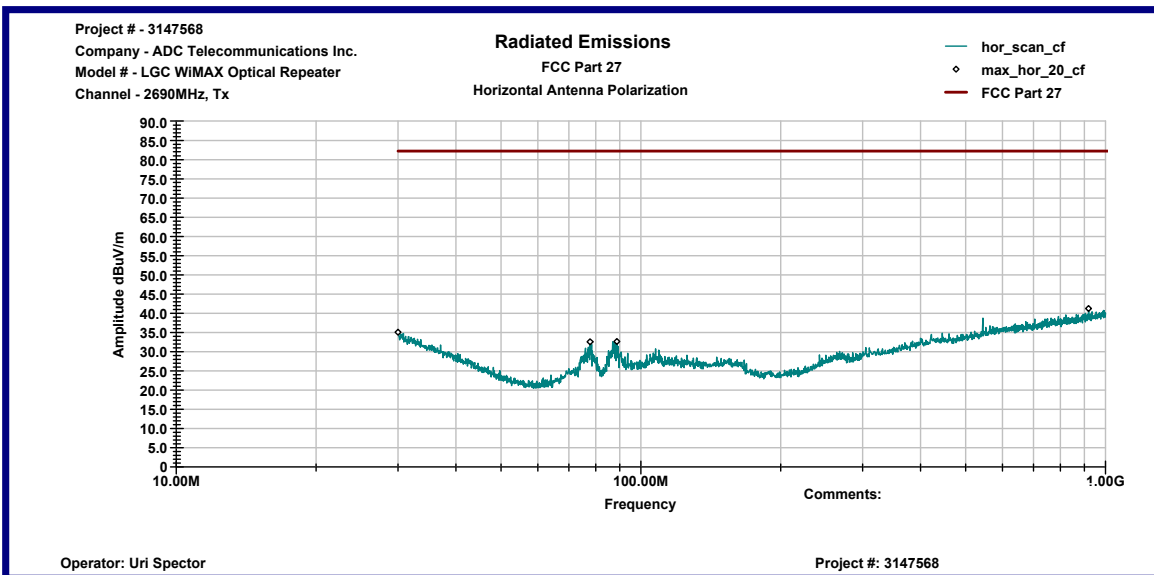
**Graph 9**



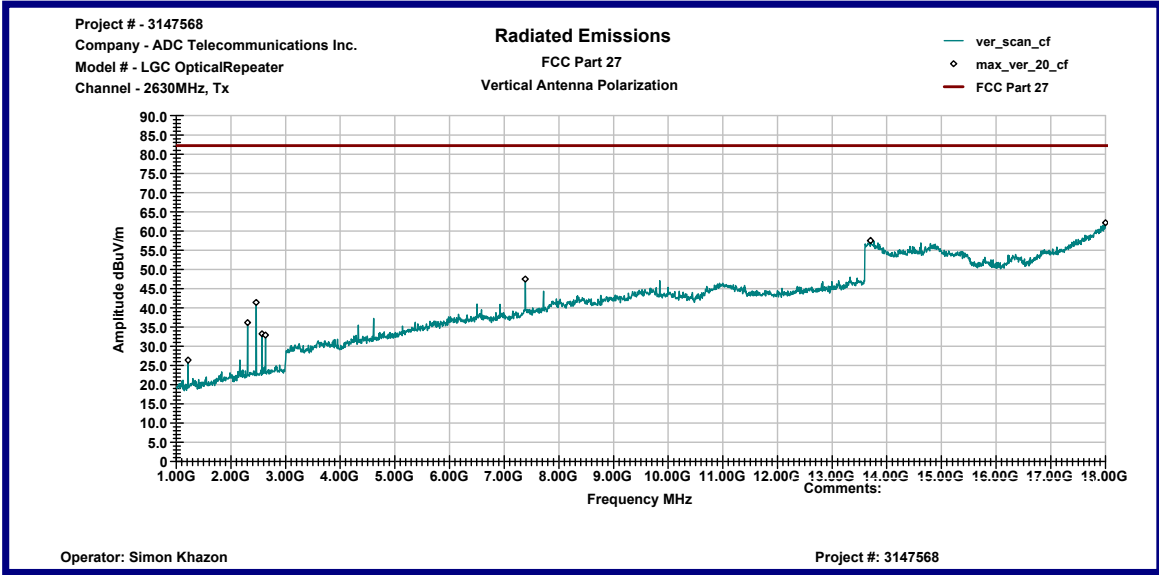
**Graph 10**



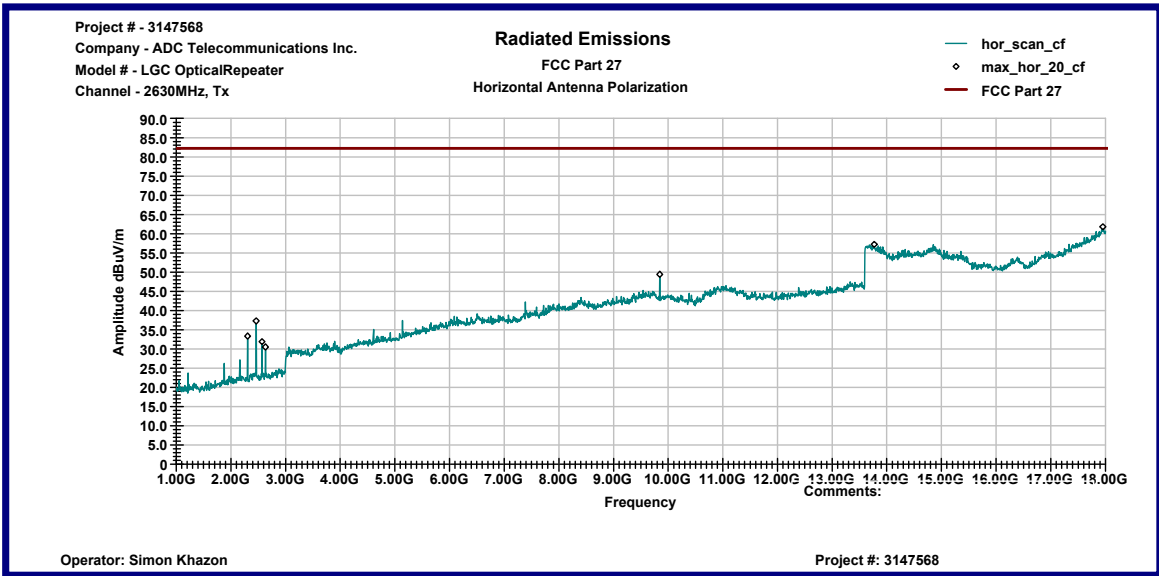
Graph 11



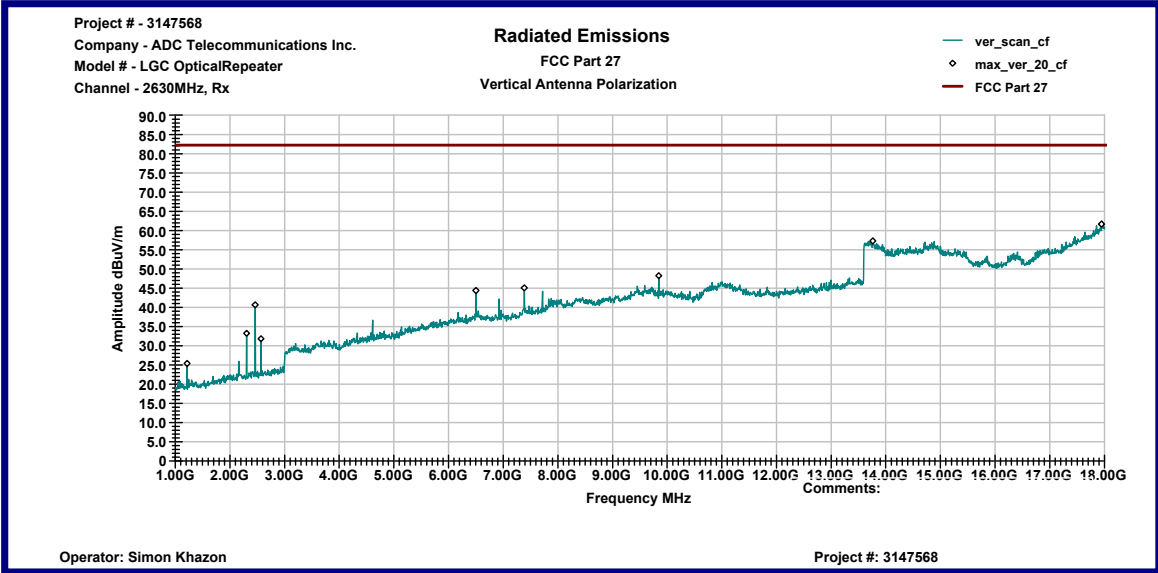
Graph 12



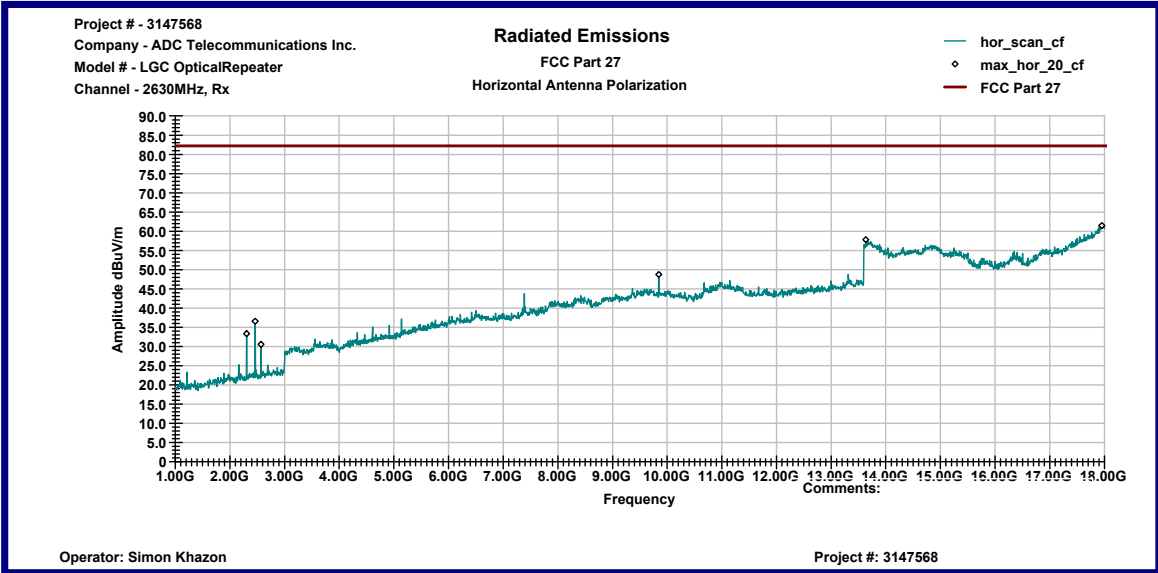
**Graph 13**



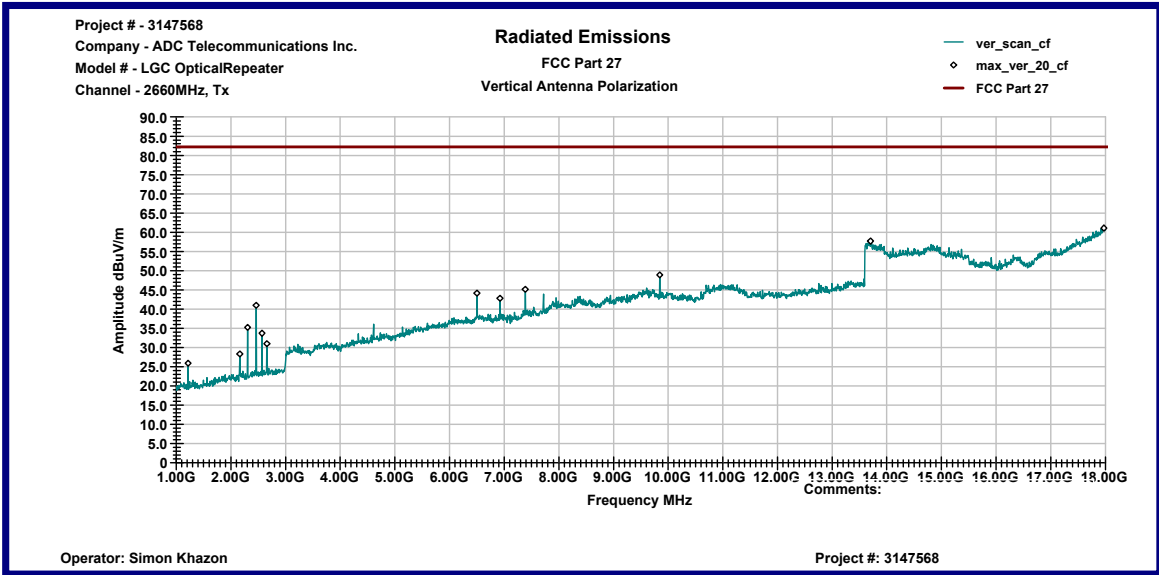
**Graph 14**



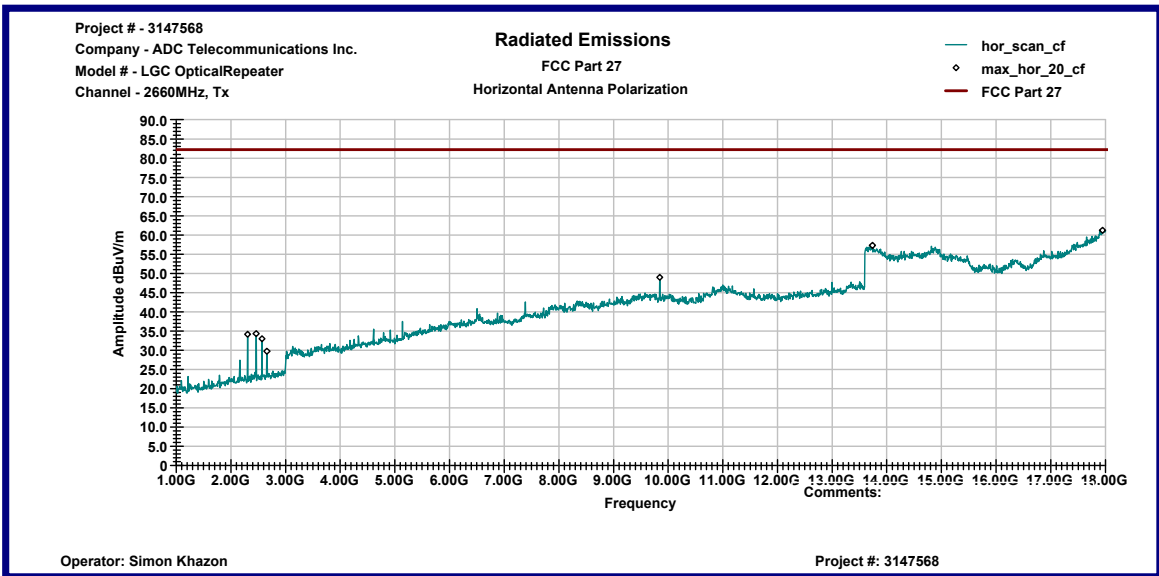
Graph 15



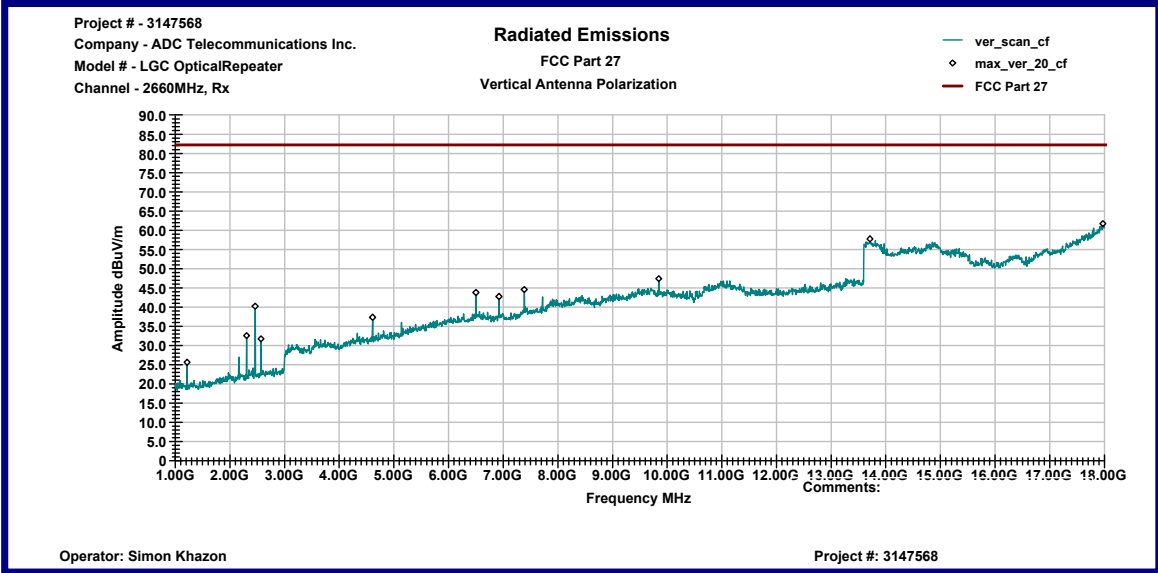
Graph 16



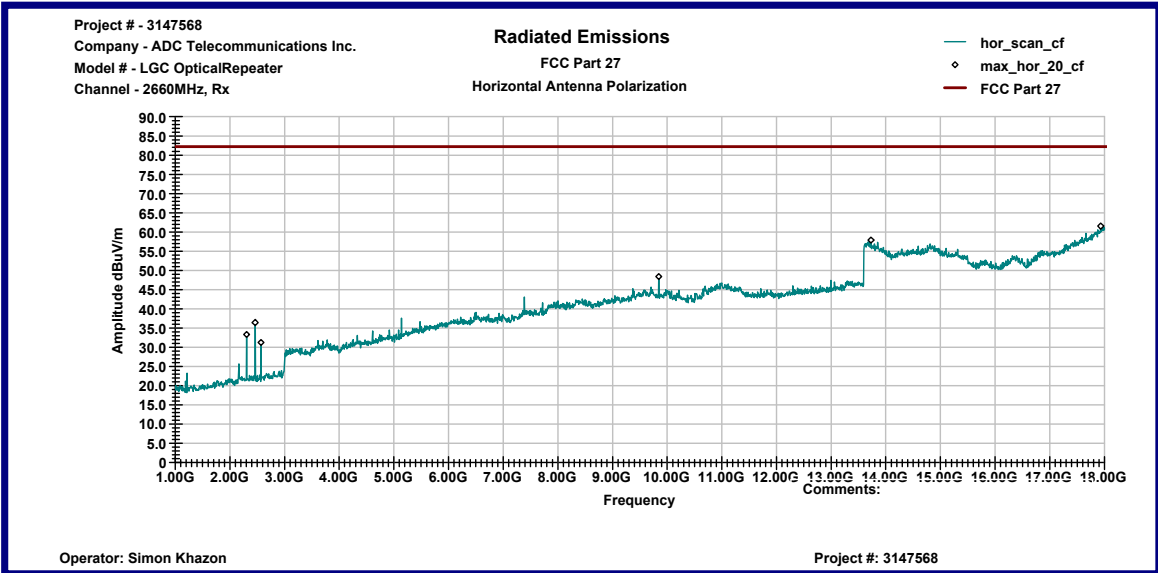
**Graph 17**



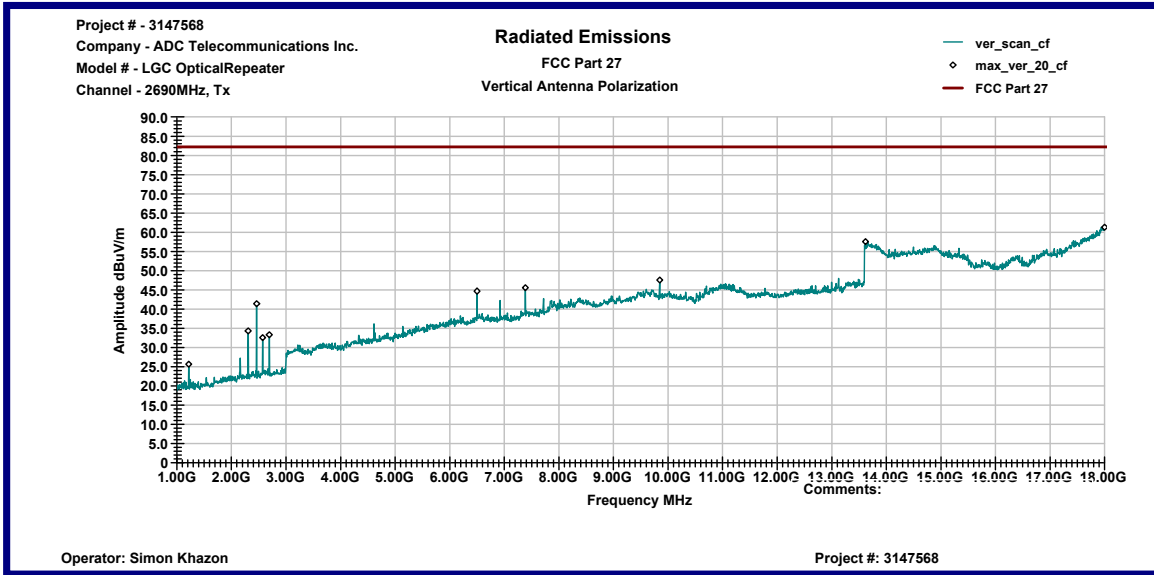
**Graph 18**



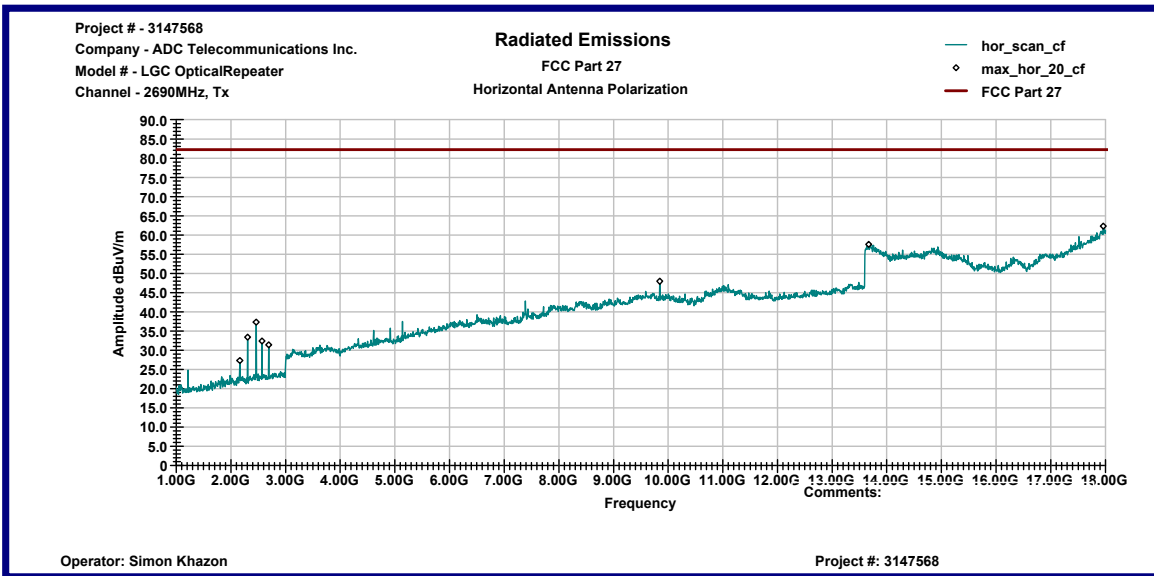
Graph 19



Graph 20

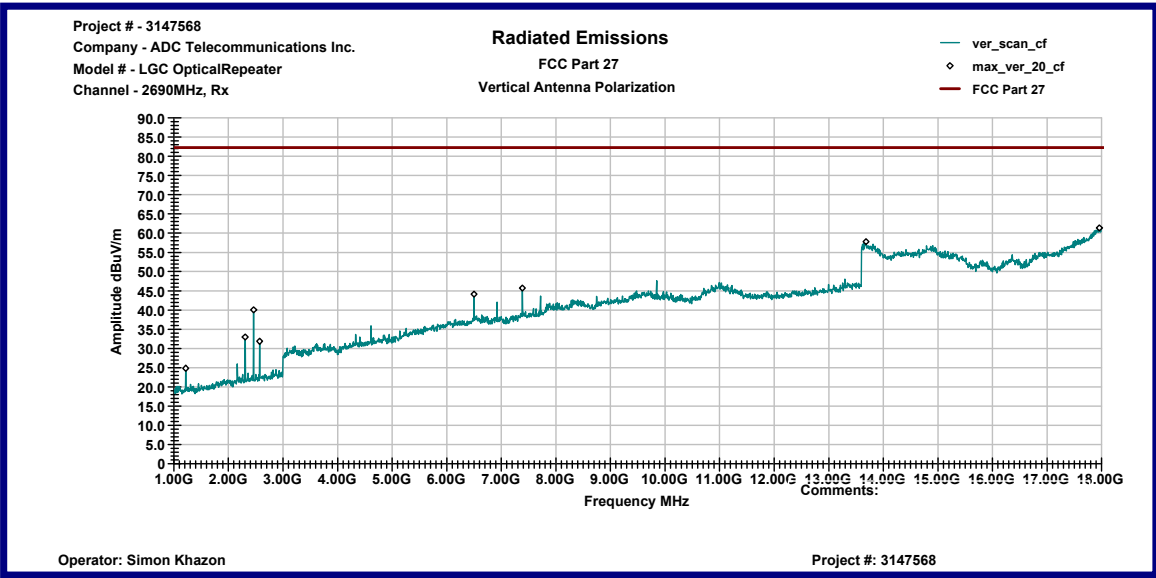


**Graph 21**

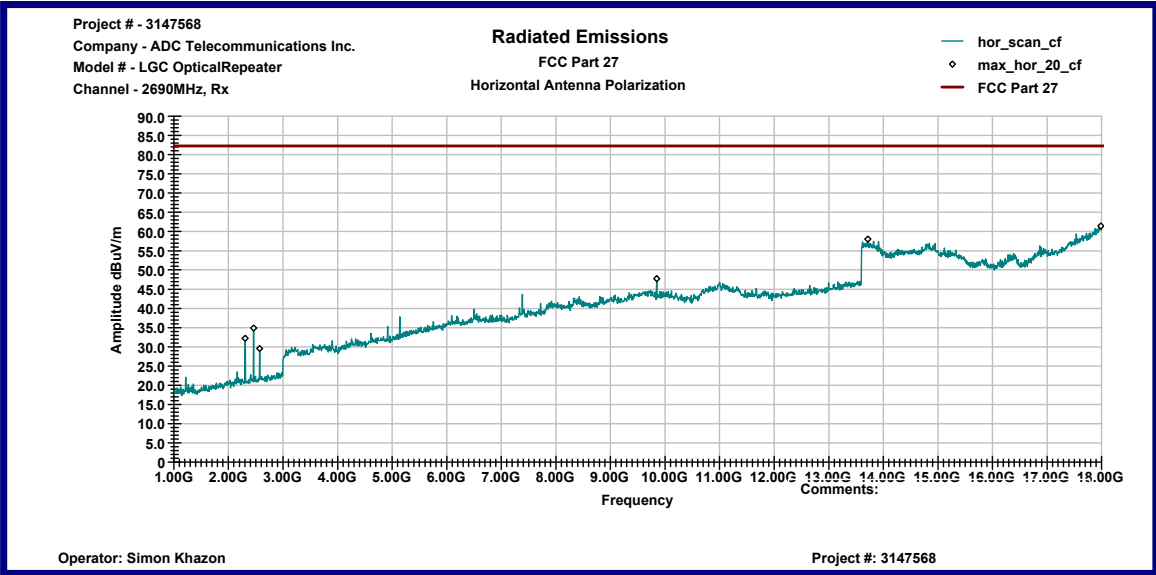


**Graph 22**

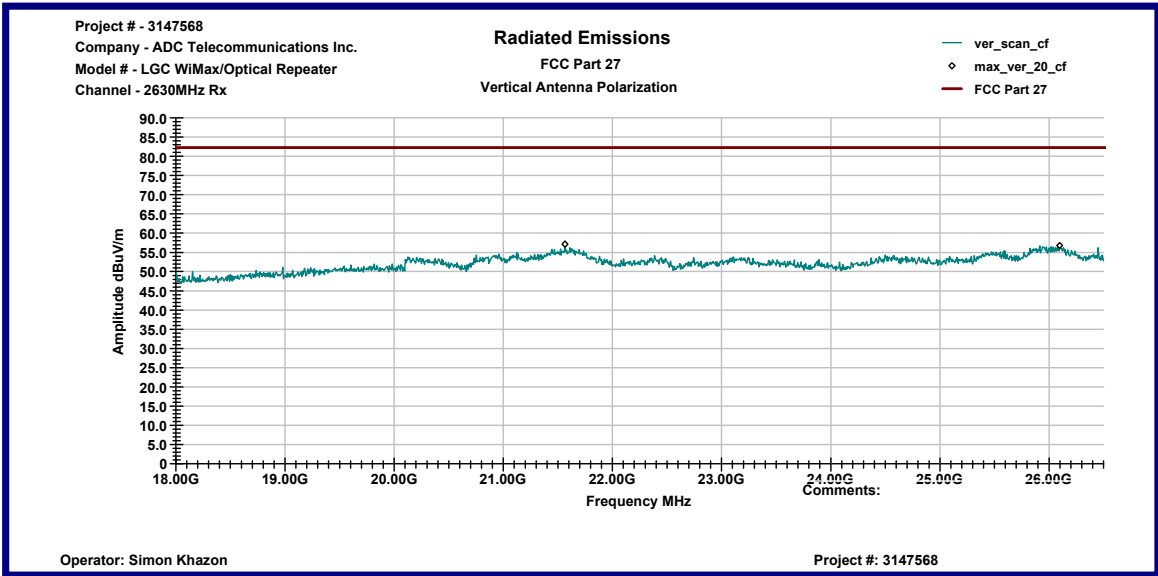




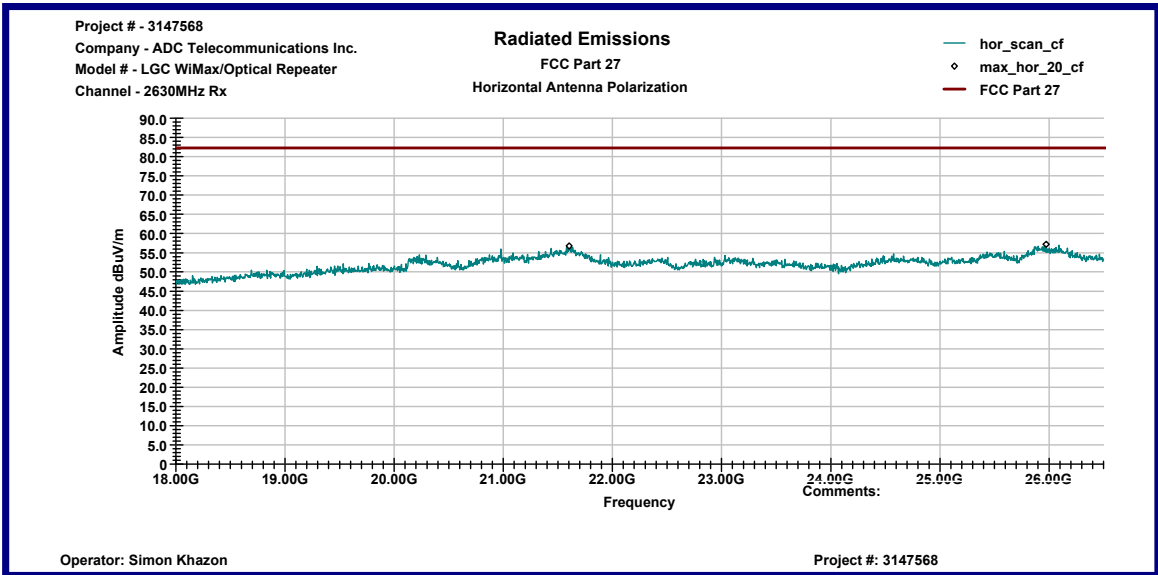
Graph 23



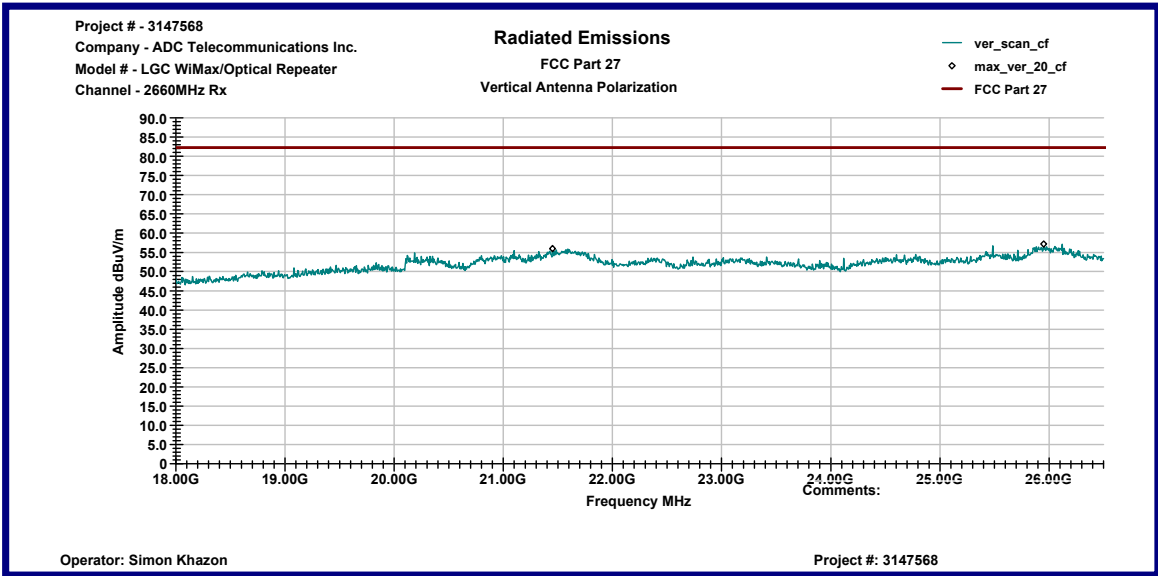
Graph 24



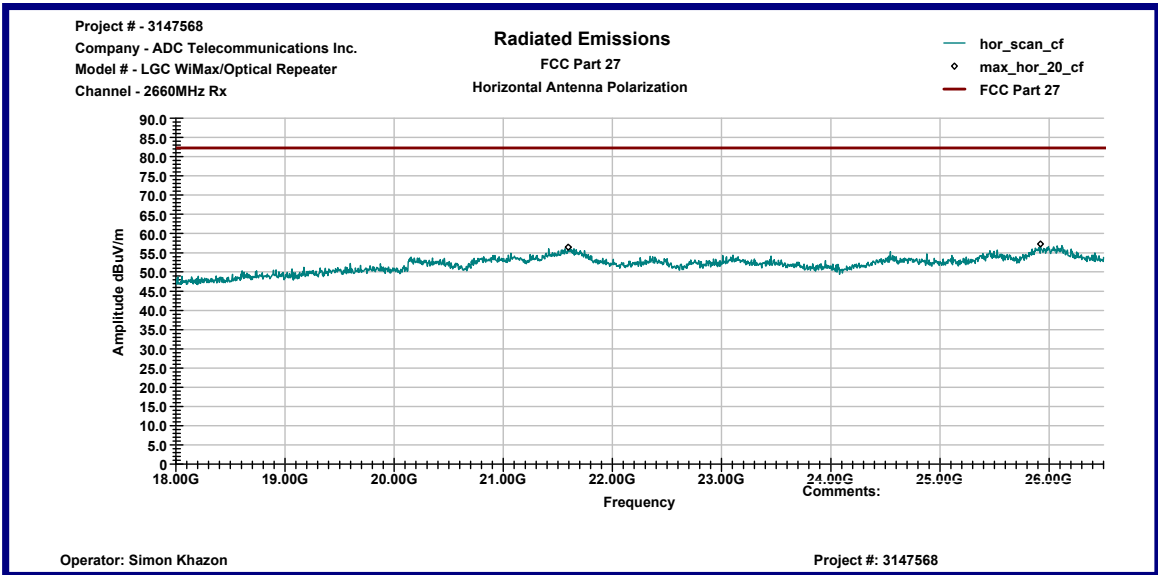
Graph 25



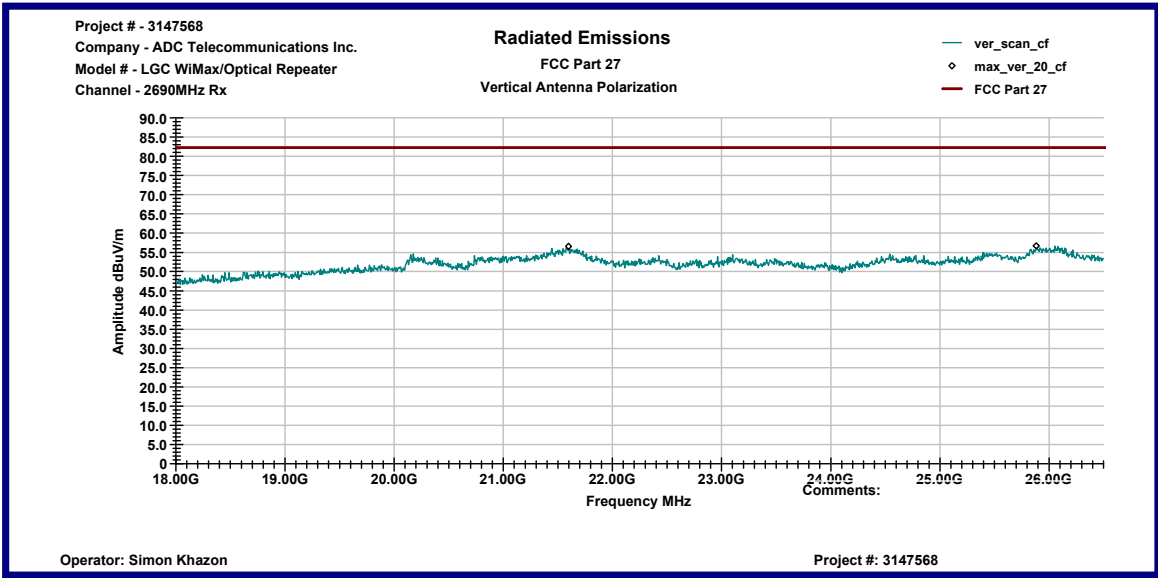
Graph 26



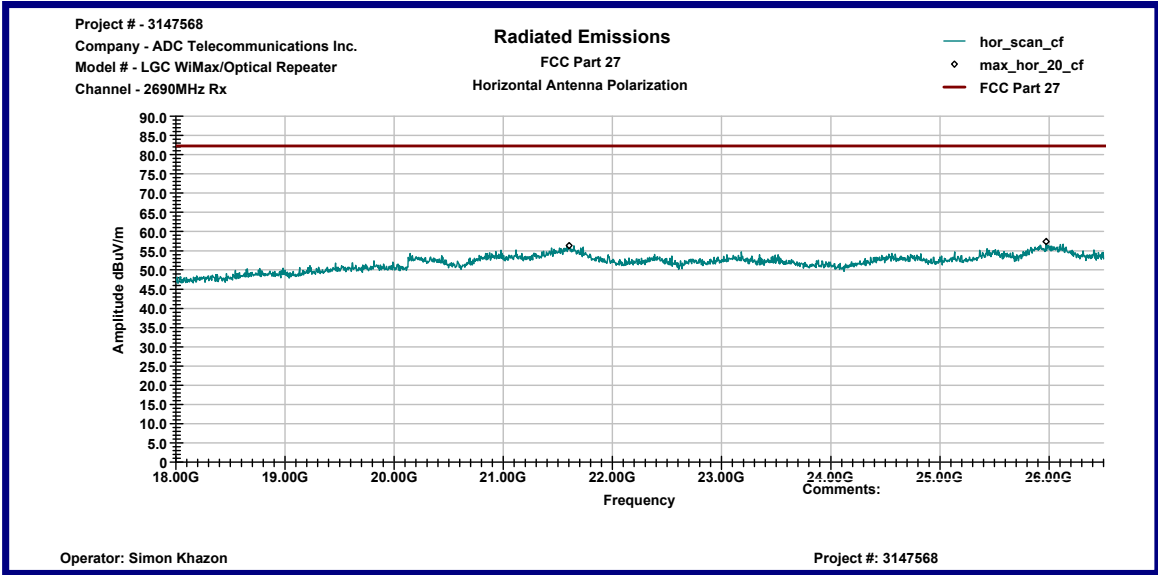
Graph 27



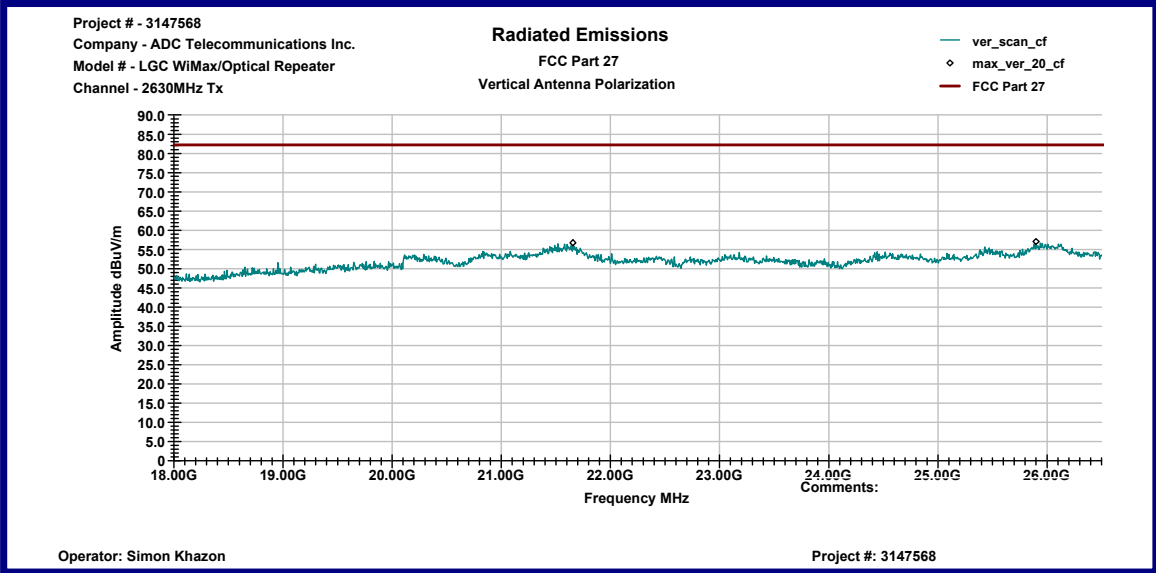
Graph 28



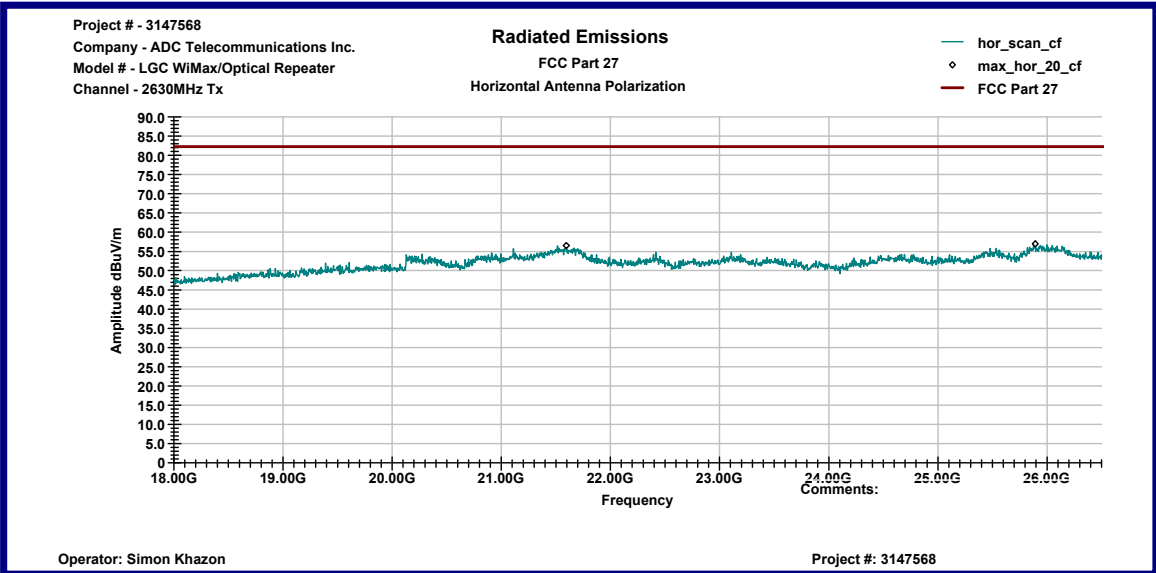
Graph 29



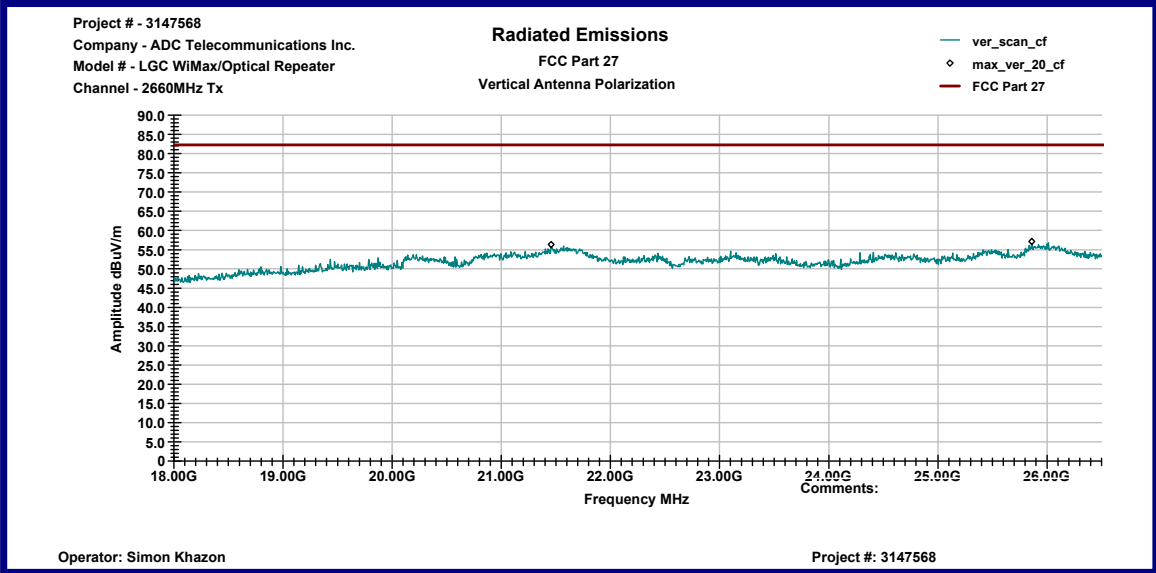
Graph 30



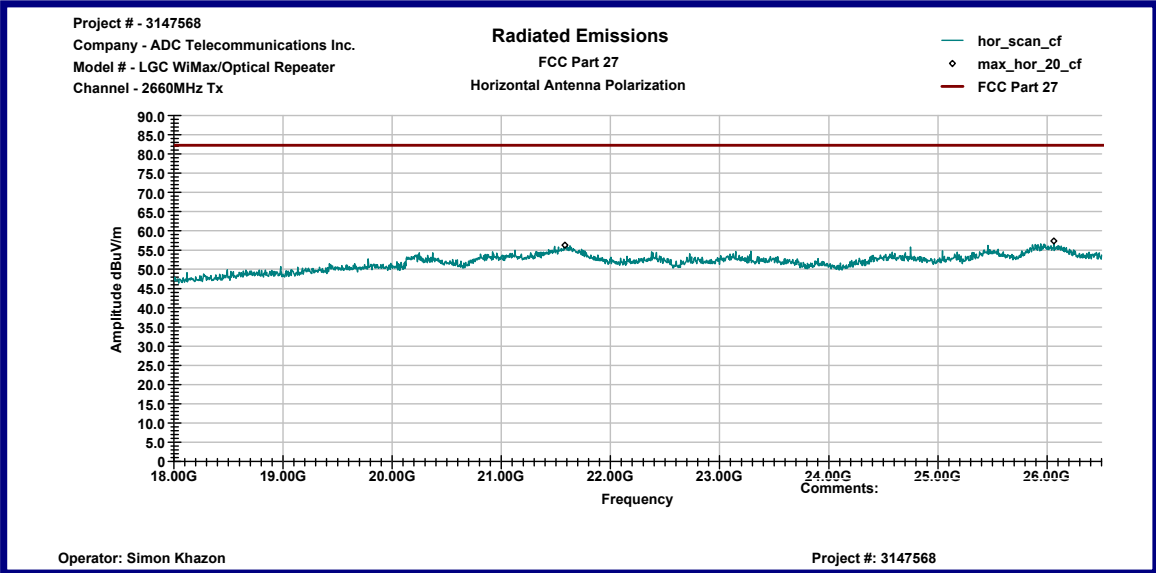
Graph 31



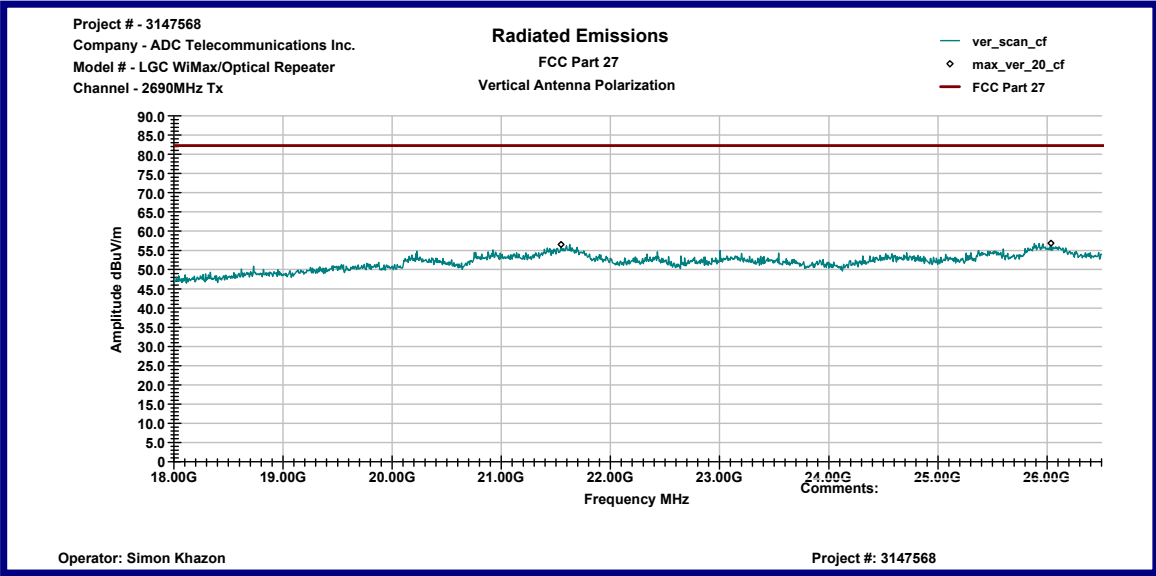
Graph 32



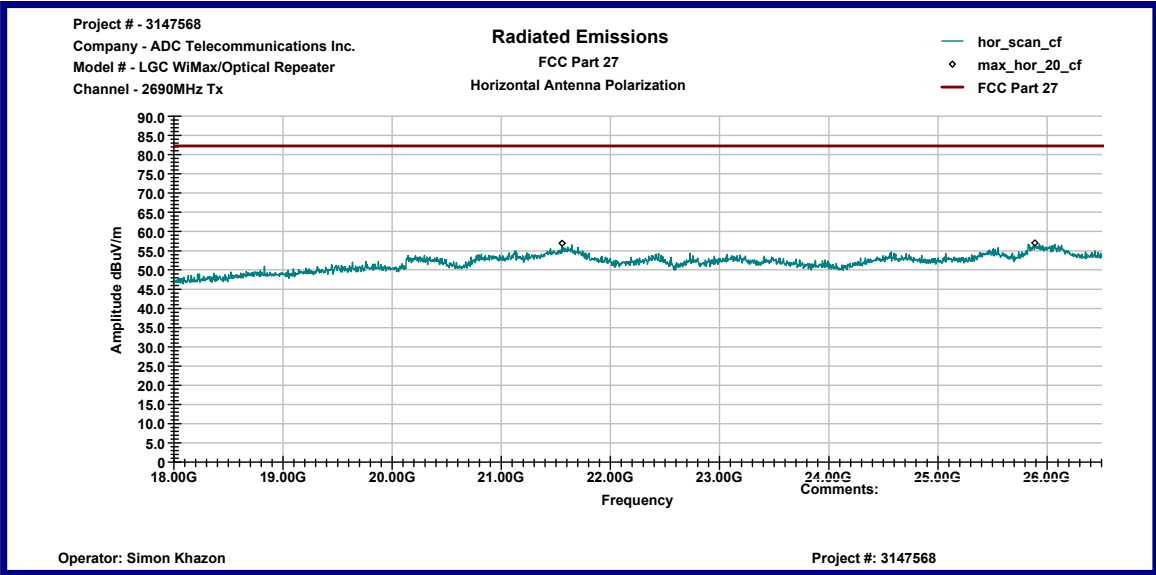
Graph 33



Graph 34



Graph 35



Graph 36



### 3.1 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

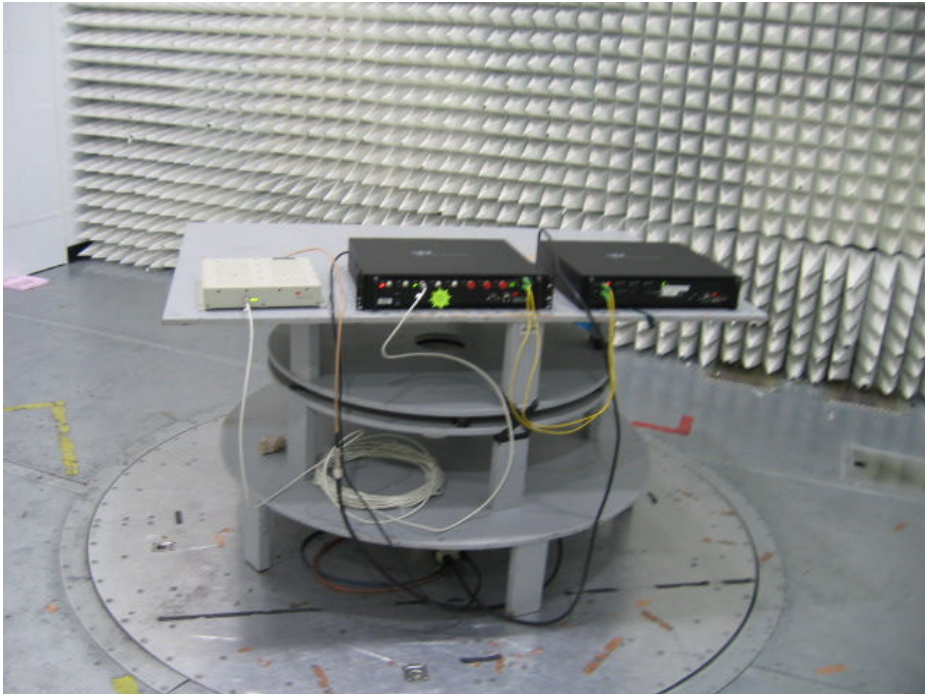
**Temperature:** 15-35 ° C

**Humidity:** 30-60 %

**Atmospheric pressure:** 86-106 kPa



4.0 PHOTOS



Test Setup Photos



## 5.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	08/23/2008	<input checked="" type="checkbox"/>
Spectrum Analyzer	R & S	ESCI	100358	04/27/2008	<input checked="" type="checkbox"/>
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	07/30/2008	<input checked="" type="checkbox"/>
Horn Antenna	EMCO	3115	9507-4513	02/13/2009	<input checked="" type="checkbox"/>
Waveguide Horn Antenna	EMCO	3116	9904-2423	07/20/2008	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	04/24/2008	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	11/05/2008	<input checked="" type="checkbox"/>
System	TILE! Instrument Control		Ver. 3.4.K.29	VBU	<input checked="" type="checkbox"/>



**8.0**

**APPENDIX C**

Measurement Protocol

[Back to Table of Contents:](#)

# Measurement Protocol

## Environmental conditions of the lab, (ADC)

Temperature: 21 - 26° C

Relative Humidity: 21 - 24 %

Atmospheric Pressure: 97.8 - 100.0 kPa

## **Test Methodology:**

Emission testing is performed according to the procedures in ANSI C63.4-2003.

## **Measurement Uncertainty**

The test system for conducted emissions is defined as the signal generator(s), the power meter, the spectrum analyzer and the coaxial cable. The equipment comprising the test systems is calibrated prior to testing the EUT.

## **Justification**

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left un-terminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

## **Radiated Emissions**

The final level, in dBuV/m, equals the reading from the spectrum analyzer (Level dBuV), adding the antenna correction factor and cable loss factor (Factor dB) to it, and subtracting the preamp gain (and duty cycle correction factor, if applicable). This result then has the limit subtracted from it to provide the Delta, which gives the tabular data as shown in the data sheets in Appendix B.

Example:

FREQ (MHz)	LEVEL (dBuV)	CABLE/ANT/PREAMP (dB) (dB/m) (dB)	FINAL (dBuV/m)	POL/HGT/AZ (m) (deg)	DELTA1
60.80	42.5Qp +	1.2 + 10.9 - 25.5 =	29.1	V 1.0 0.0	-10.9

## **Substitution Method**

A cabinet (or enclosure) radiated emission scan was also made, at Intertek, with the EUT's antenna replaced with a termination to demonstrate case radiation compliance to the -13 dBm requirement. Radiated emissions from the EUT are measured in the frequency range of 30 to 20,000 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. The field strength levels were measured per ANSI C63.4. The EUT is then replaced with a tuned dipole antenna (below 1GHz) or horn antenna (above 1 GHz). The substitute antenna was placed in the same polarization as the test antenna. A signal generator was used to generate a signal level that matched the highest level measured from the EUT. The signal generator level minus the cable loss from the signal generator to the substitute antenna plus the substitute antenna gain equals the spurious power level.

## **Test Equipment**

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure.