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RF Exposure / SAR Information – FCC KDB 447498

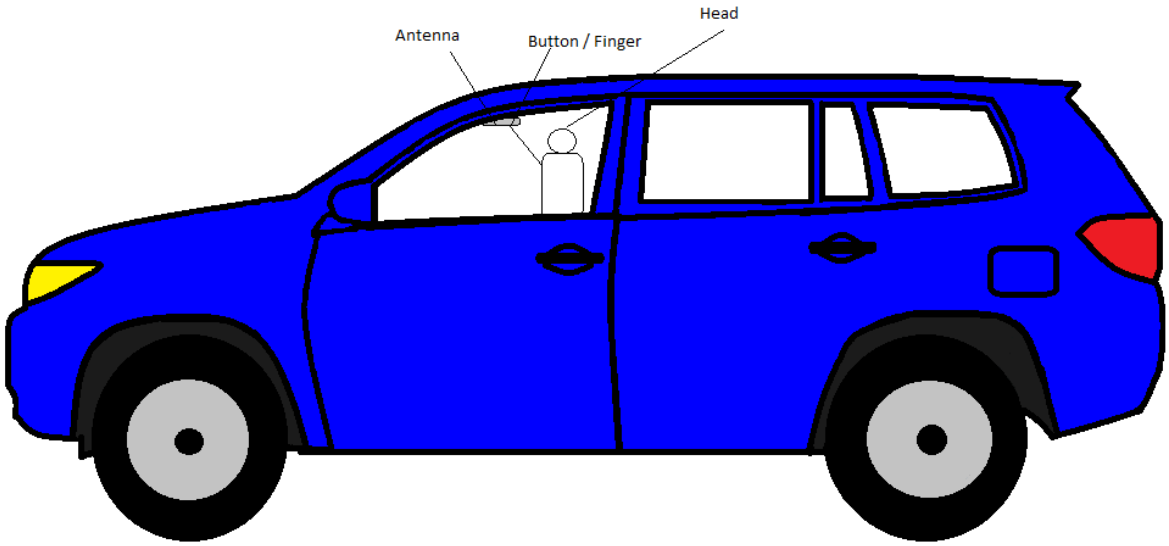
FCC ID: CB2440AHL5
Applicant: Johnson Controls, Inc.
Model: 440AHL5

The following describes the use case, user separation for the extremities and head, and conducted power of the 440AHL5 model. Per KDB 447498 section 4.3.1, the module was under the test exclusion thresholds for all bands.

This device is designed to be used while in a seated position inside of a vehicle. The operational condition is shown in the diagram below. It operates while a button is pressed, therefore the finger would be the closest part of the body to the antenna while it is transmitting. This distance is approximately 35mm due to the separation between the button surface and the antenna. The antenna to head distance would conservatively be 200mm away during the transmission.

Antenna - Button Separation: Approximately 35mm

Antenna - Head Separation: Conservatively 200mm



Calculations:

As the finger would be inside of the 50mm test separation distance, the following formula would be used for calculating the extremity exclusion threshold:

[(max power in mW) / (min test separation in mm)] * [(f(GHz))^1/2]

The head conservatively would not be closer than 200mm away, which would put it outside of the 50mm test separation distance. Thus the following formulas would be used for calculating the head exclusion threshold:

Step 1 threshold = {3 / [(f(GHz))^1/2]}*(50)

then the limit in mW is given by

[Step 1 threshold + (test separation distance – 50mm) * (f(MHz)/150]mW

Frequency – 288MHz

Measured Conducted Power – 15.39dBm

Converting to mW – 15.39dBm = 35mW

Extremity Test Separation – 35mm

Head Test Separation – 200mm

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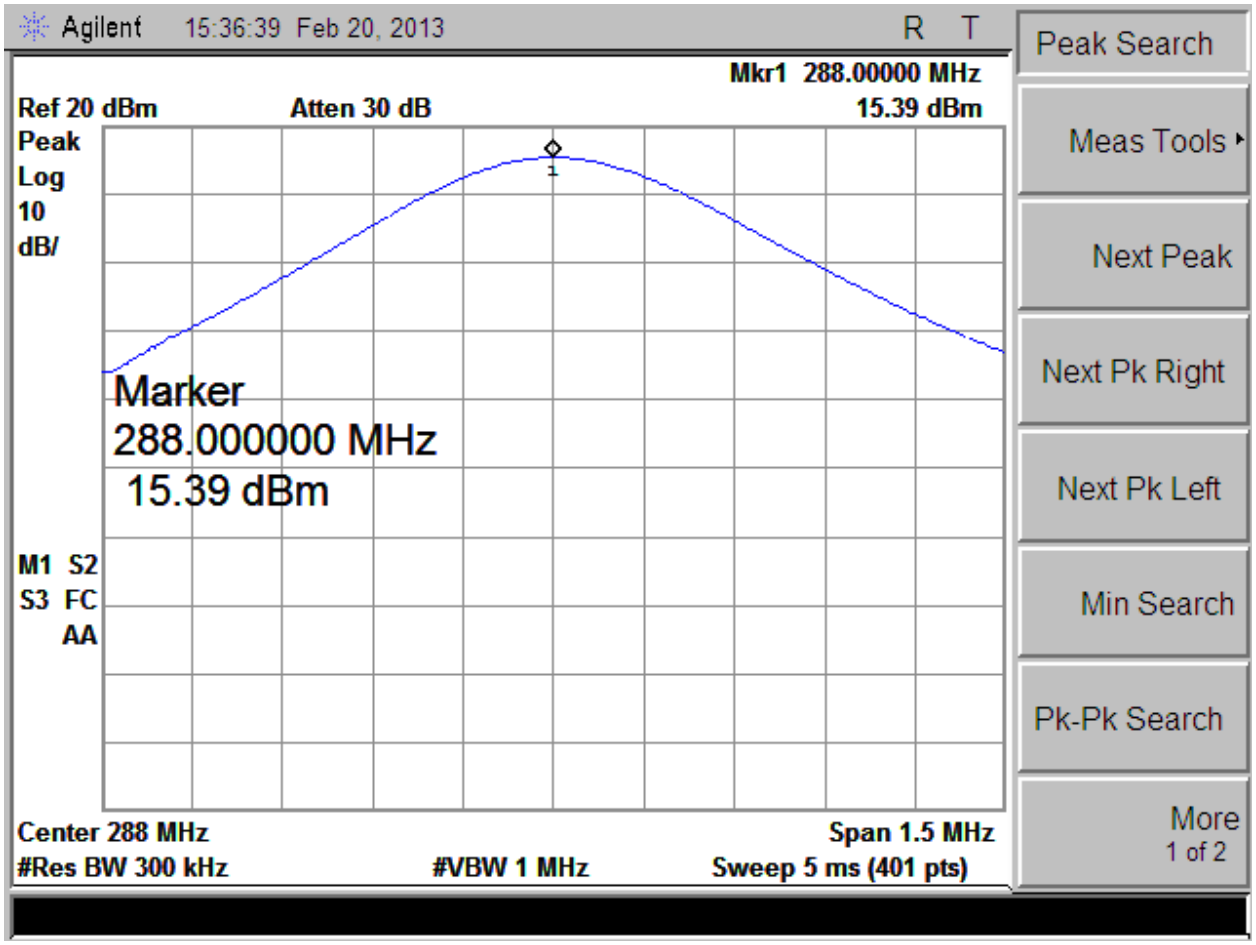
Conducted Measurement



10-g Extremity:

[(35mW) / (35mm)] * [(0.288(GHz))^1/2] = **0.537**

Which is less than the 7.5 for 10-g SAR

1-g Head:

{3 / [(0.288(GHz))^1/2]}*(50) = 280

[280 + (200mm – 50mm) * 288/150]mW = **568mW**

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35mW max output is less than the 568mW limit for test separation distances > 50mm

Frequency – 310MHz

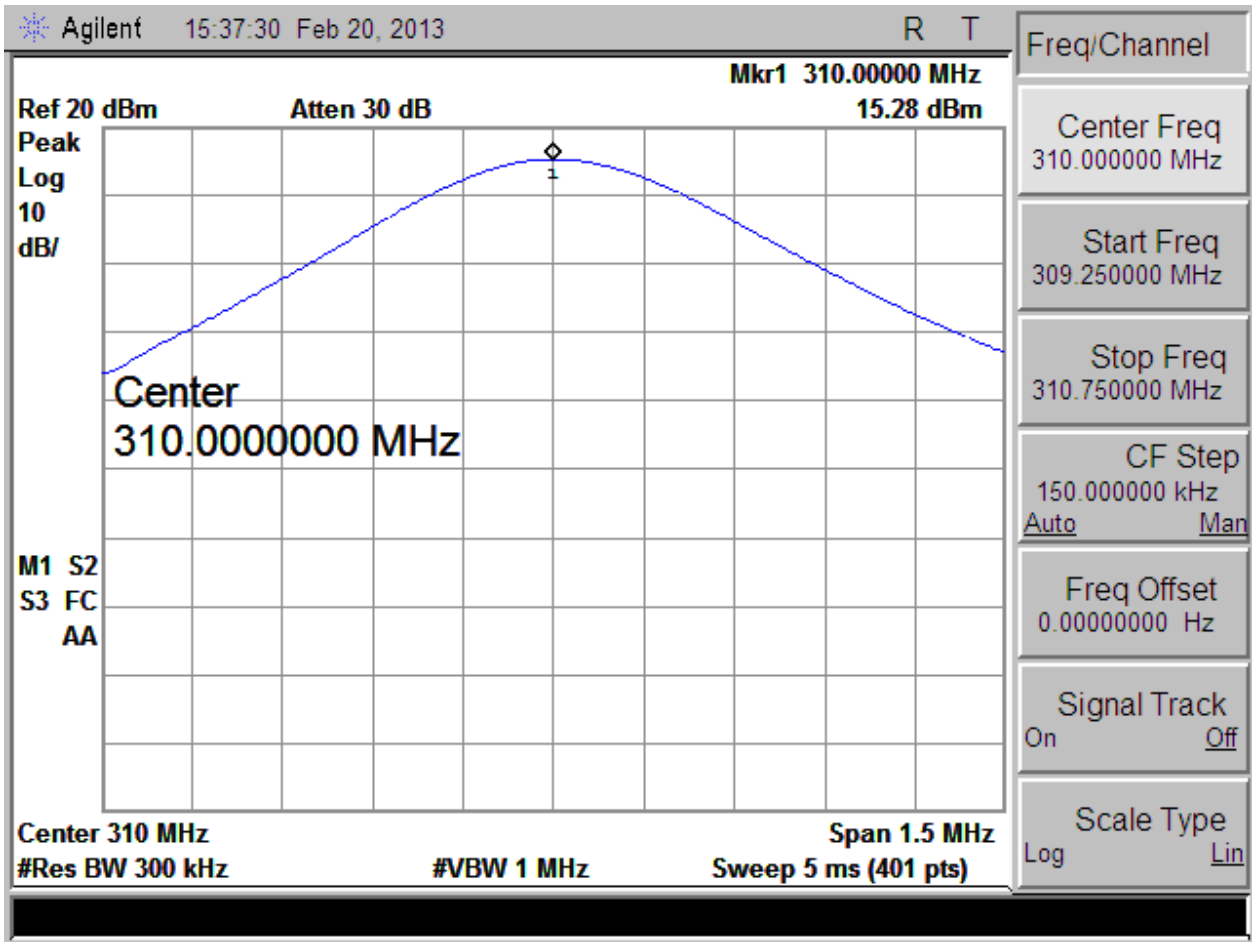
Measured Conducted Power – 15.28dBm

Converting to mW – 15.28dBm = 34mW

Extremity Test Separation – 35mm

Head Test Separation – 200mm

Conducted Measurement



10-g Extremity:

[(34mW) / (35mm)] * [(0.310(GHz))^1/2] = **0.541**

Which is less than the 7.5 for 10-g SAR

1-g Head:

{3 / [(0.310(GHz))^1/2]}*(50) = 269

[269 + (200mm – 50mm) * 310/150]mW = **579mW**

34mW max output is less than the 579mW limit for test separation distances > 50mm

Frequency – 365MHz

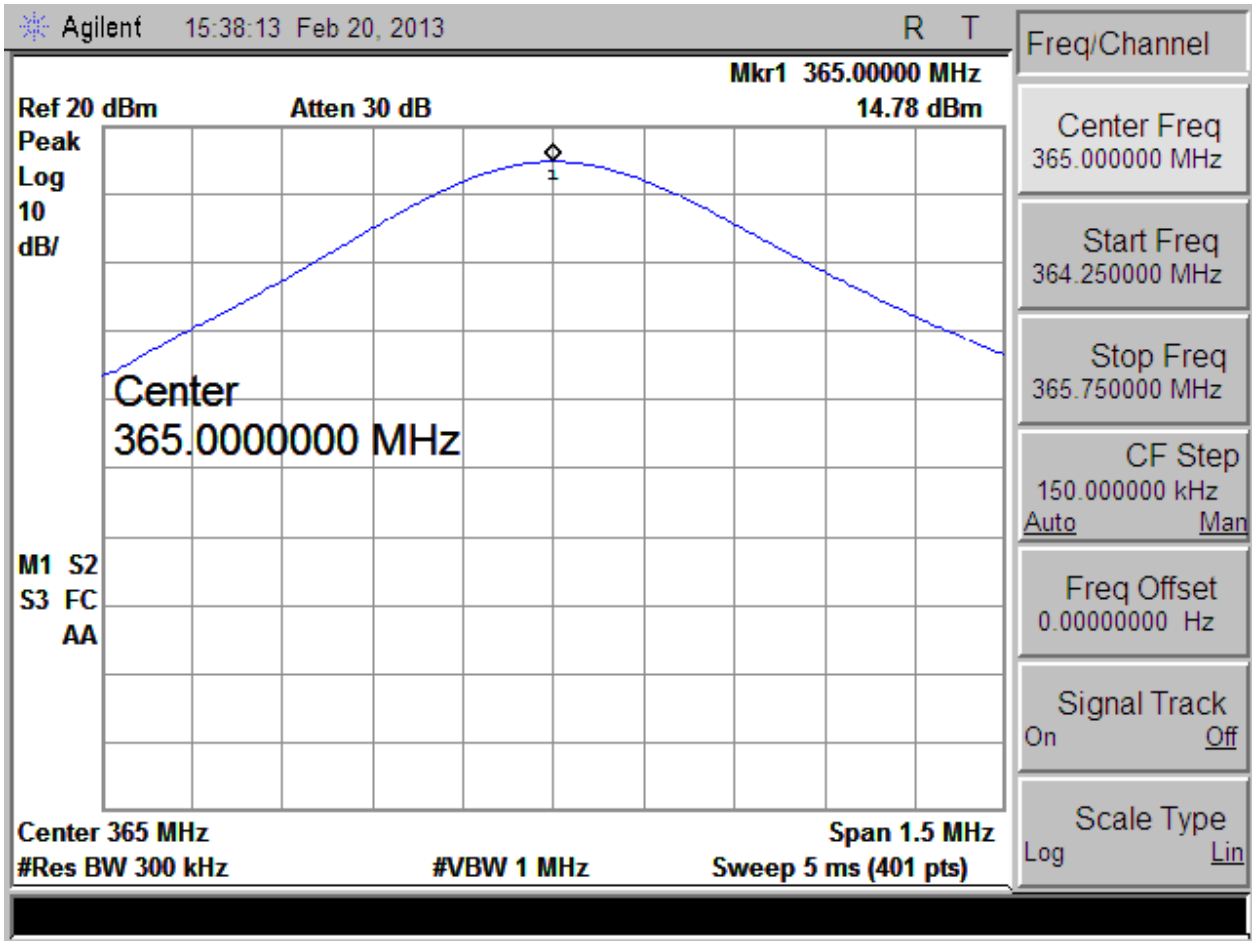
Measured Conducted Power – 14.78dBm

Converting to mW – 14.78dBm = 30mW

Extremity Test Separation – 35mm

Head Test Separation – 200mm

Conducted Measurement



10-g Extremity:

[(30mW) / (35mm)] * [(0.365(GHz))^1/2] = **.518**

Which is less than the 7.5 for 10-g SAR

1-g Head:

{3 / [(0.365(GHz))^1/2]}*(50) = 248

[248 + (200mm – 50mm) * 365/150]mW = **613mW**

30mW max output is less than the 613mW limit for test separation distances > 50mm

Frequency – 433MHz

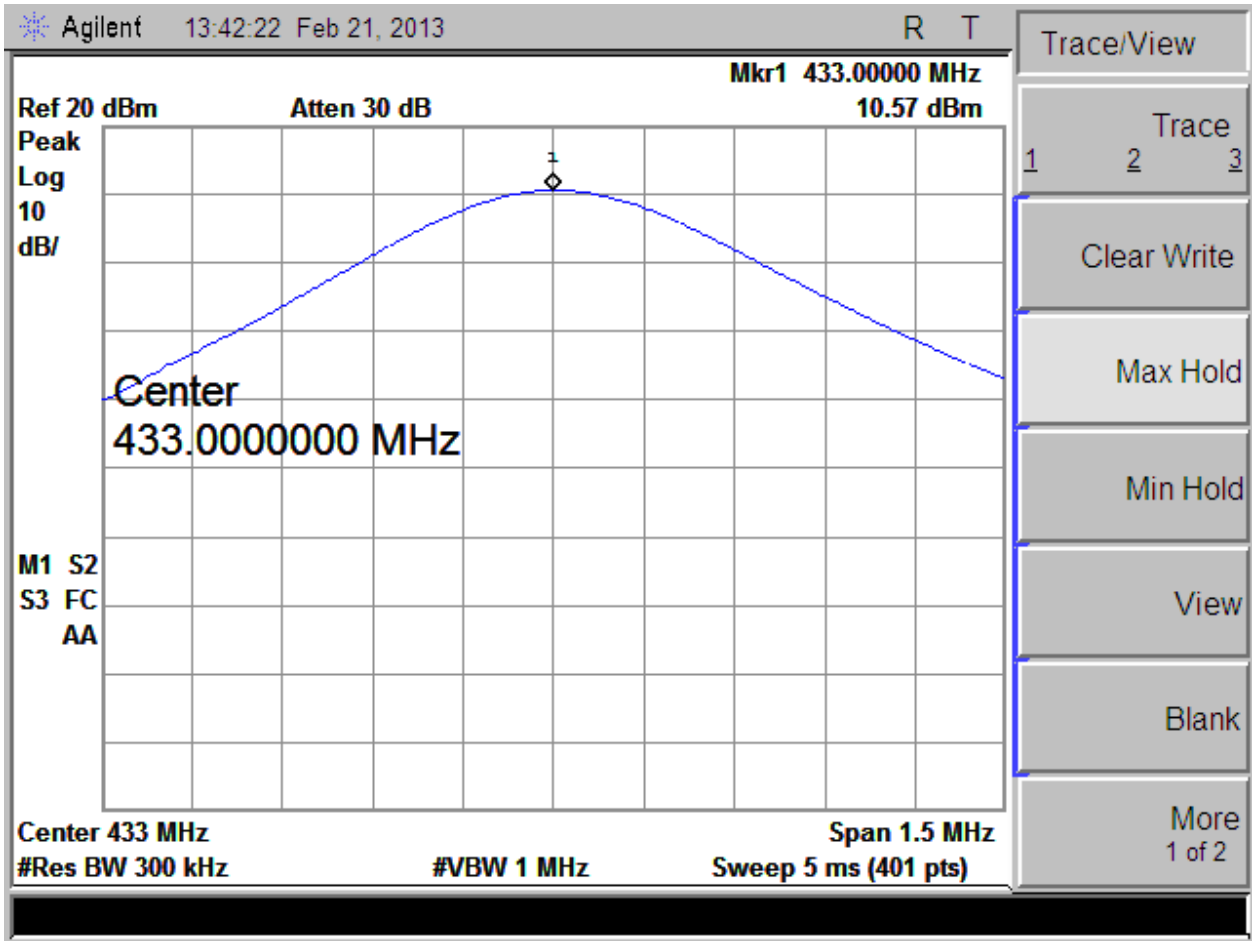
Measured Conducted Power – 10.57dBm

Converting to mW – 10.57dBm = 11mW

Extremity Test Separation – 35mm

Head Test Separation – 200mm

Conducted Measurement



10-g Extremity:

[(11mW) / (35mm)] * [(0.433(GHz))^1/2] = **0.207**

Which is less than the 7.5 for 10-g SAR

1-g Head:

{3 / [(0.433(GHz))^1/2]}*(50) = 228

[228 + (200mm – 50mm) * 433/150]mW = **661mW**

11mW max output is less than the 661mW limit for test separation distances > 50mm

Frequency – 902.25MHz

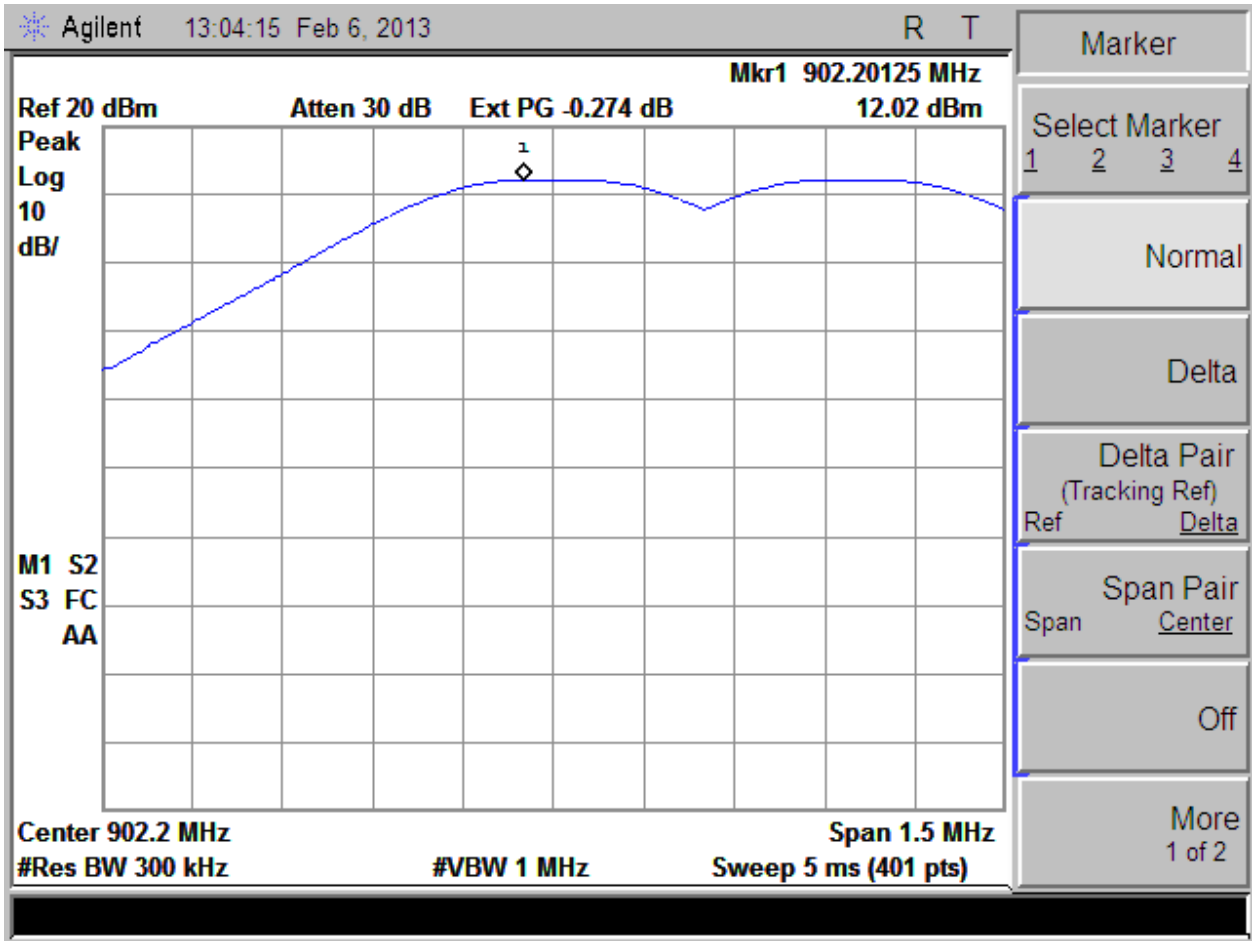
Measured Conducted Power – 12.02dBm

Converting to mW – 12.02dBm = 16mW

Extremity Test Separation – 35mm

Head Test Separation – 200mm

Conducted Measurement



10-g Extremity:

[(16mW) / (35mm)] * [(0.90225(GHz))^1/2] = **0.434**

Which is less than the 7.5 for 10-g SAR

1-g Head:

{3 / [(0.90225(GHz))^1/2]}*(50) = **158**

[158 + (200mm – 50mm) * 902.25/150]mW = **1060mW**

16mW max output is less than the 1060mW limit for test separation distances > 50mm

Frequency – 914.75MHz

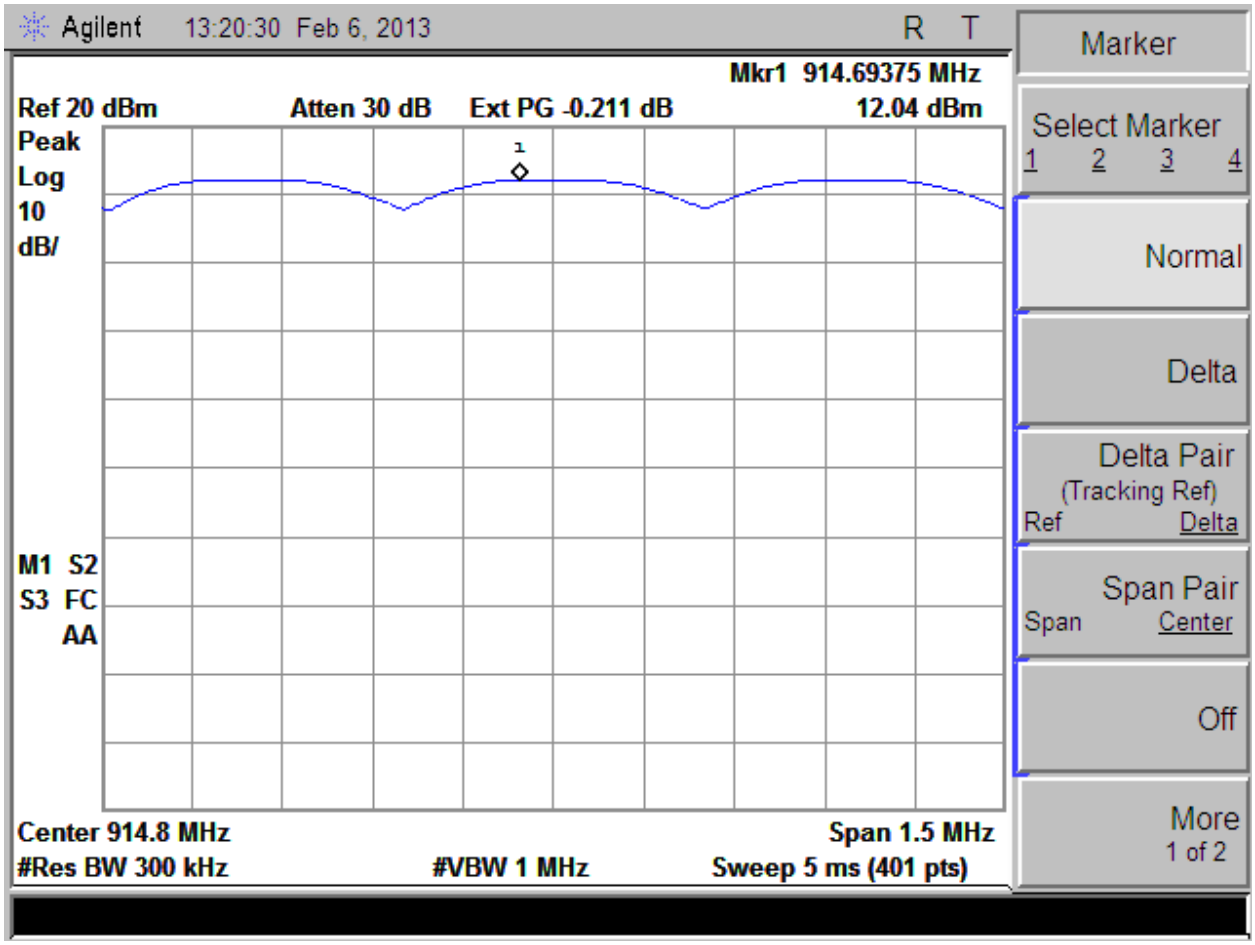
Measured Conducted Power – 12.04dBm

Converting to mW – 12.04dBm = 16mW

Extremity Test Separation – 35mm

Head Test Separation – 200mm

Conducted Measurement



10-g Extremity:

[(16mW) / (35mm)] * [(0.91475(GHz))^1/2] = **0.437**

Which is less than the 7.5 for 10-g SAR

1-g Head:

{3 / [(0.91475(GHz))^1/2]}*(50) = 157

[157 + (200mm – 50mm) * 914.75/150]mW = **1072mW**

16mW max output is less than the 1072mW limit for test separation distances > 50mm

Frequency – 926.75MHz

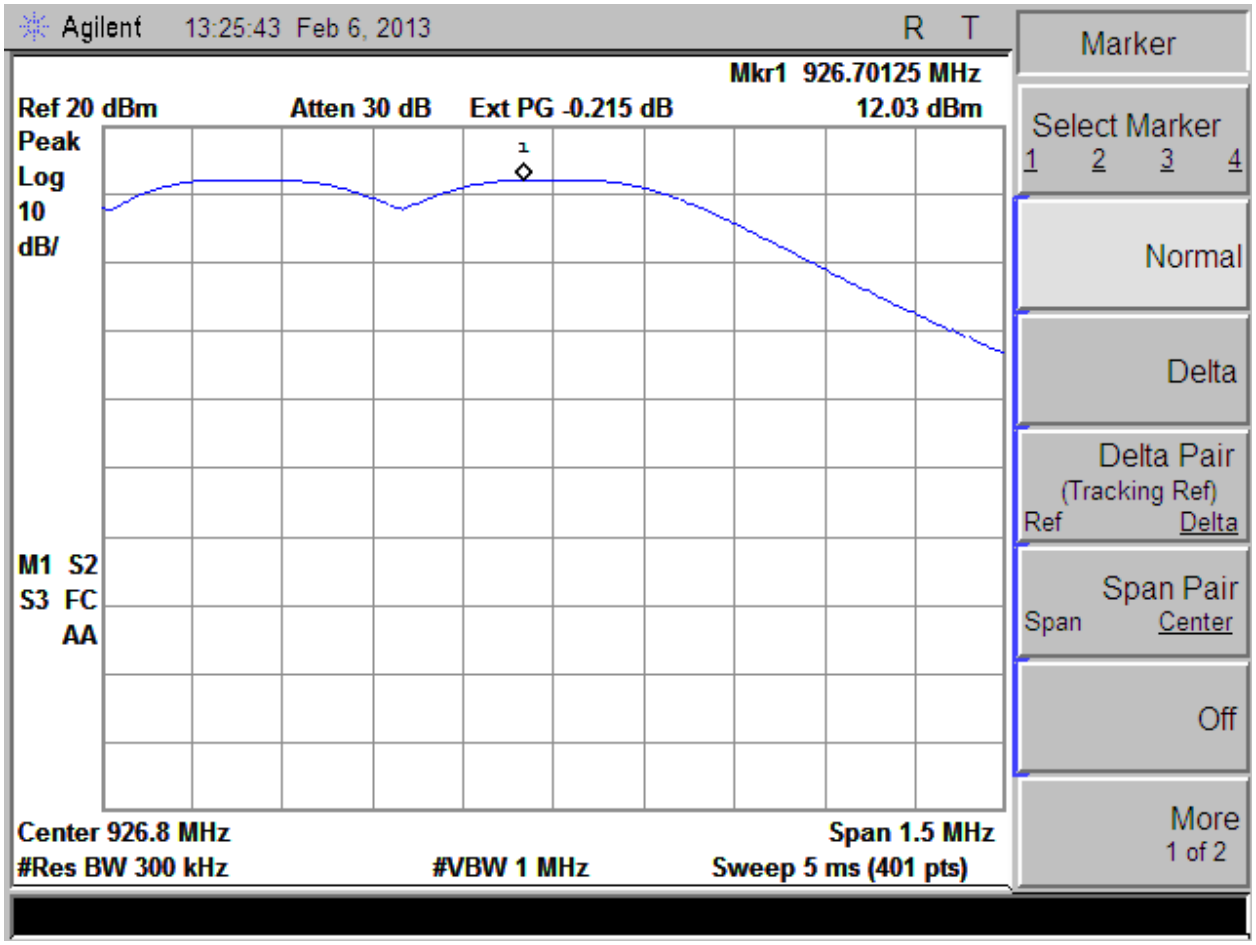
Measured Conducted Power – 12.03dBm

Converting to mW – 12.03dBm = 16mW

Extremity Test Separation – 35mm

Head Test Separation – 200mm

Conducted Measurement



10-g Extremity:

[(16mW) / (35mm)] * [(0.92675(GHz))^1/2] = **0.441**

Which is less than the 7.5 for 10-g SAR

1-g Head:

{3 / [(0.92675(GHz))^1/2]}*(50) = 156

[156 + (200mm – 50mm) * 926.75/150]mW = **1083mW**

16mW max output is less than the 1083mW limit for test separation distances > 50mm