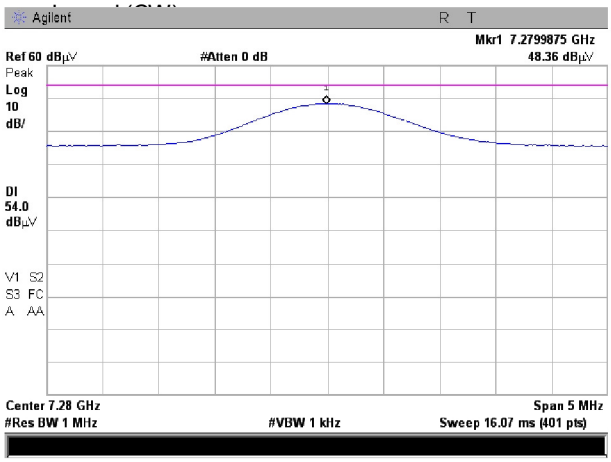
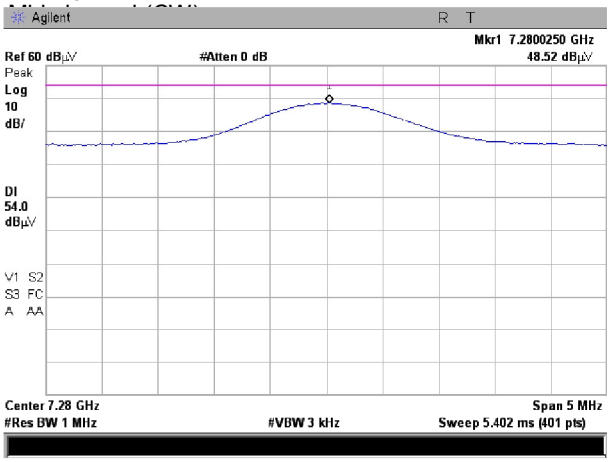
Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

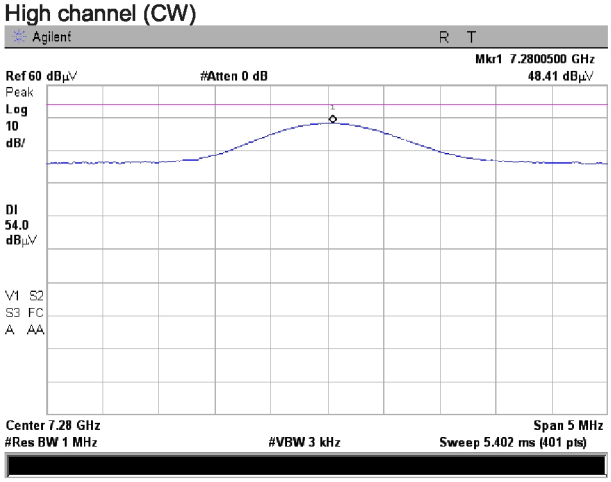
Plot 7.2.7 Radiated emission measurements at frequency 7280 MHz

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average

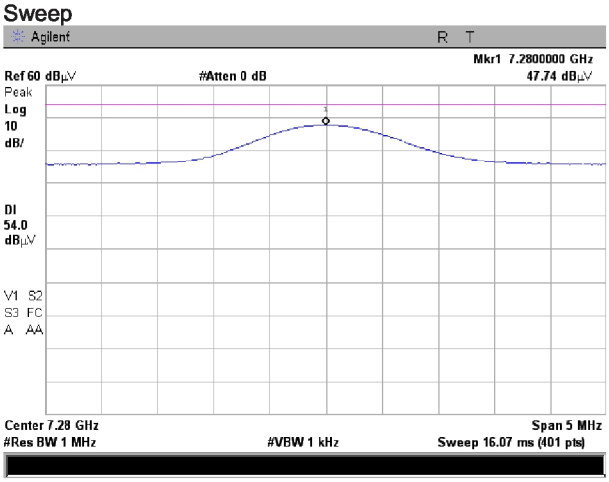




High channel (CW)



Sweep

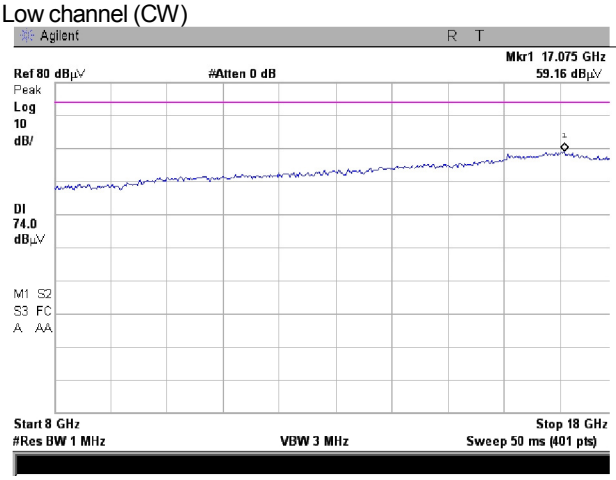


Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance		
Date:	1/16/2012	Verdict:	PASS
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

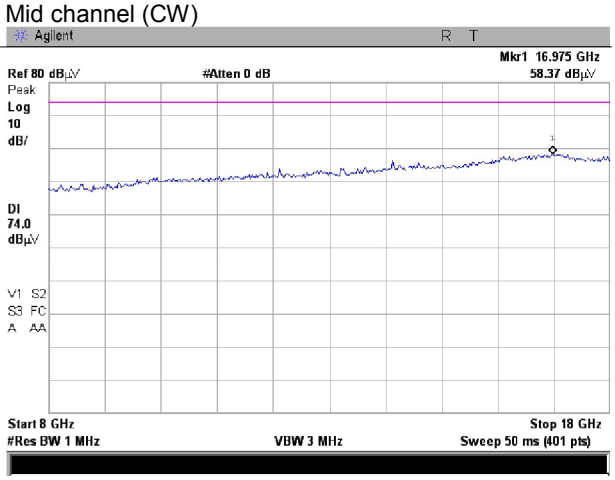
Plot 7.2.8 Radiated emission measurements from 8000 – 18000 MHz

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak hold

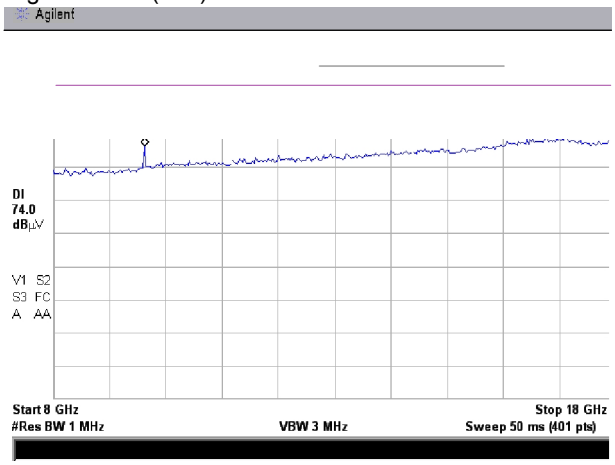
Low channel (CW)



Mid channel (CW)



High channel (CW)

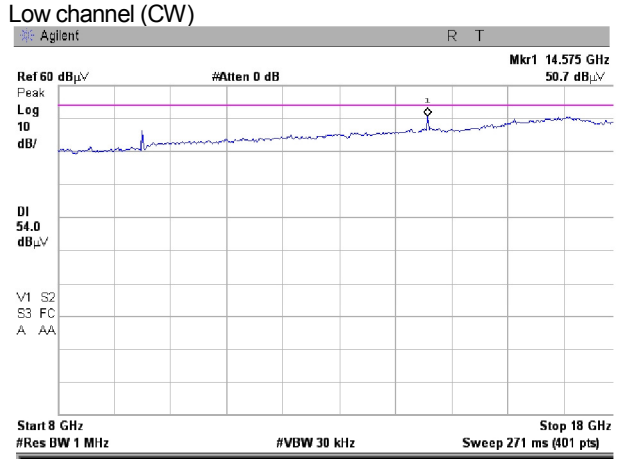


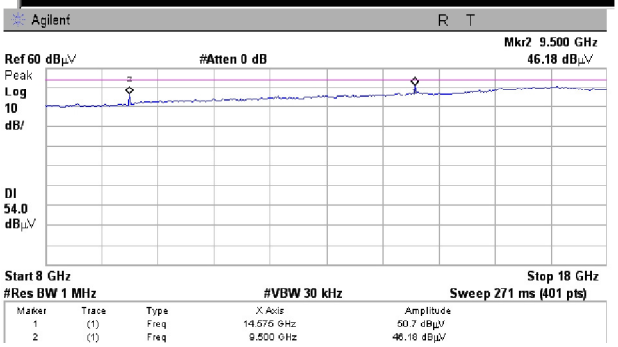
Test specification:	**Section 15.253(e)(1), Radiated emissions below 40 GHz**		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance		
Date:	1/16/2012	**Verdict:**	PASS
Temperature: 21.2 ˚C	**Air Pressure:** 1021 hPa	**Relative Humidity:** 43 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.2.9 Radiated emission measurements from 8000 – 18000 MHz

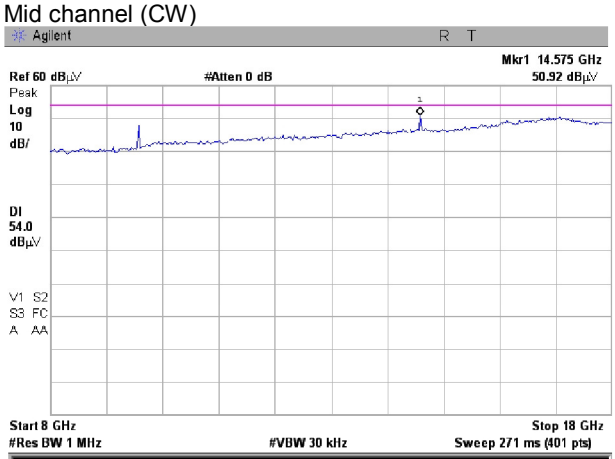
TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average

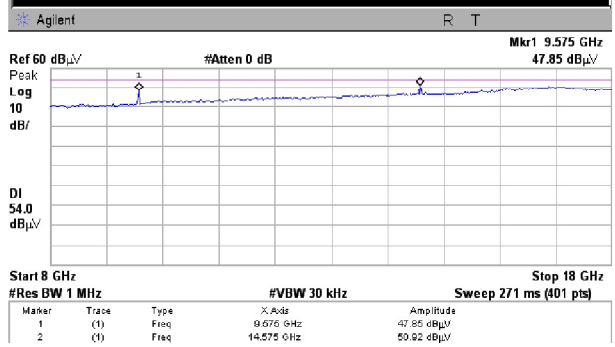
Low channel (CW)





Mid channel (CW)



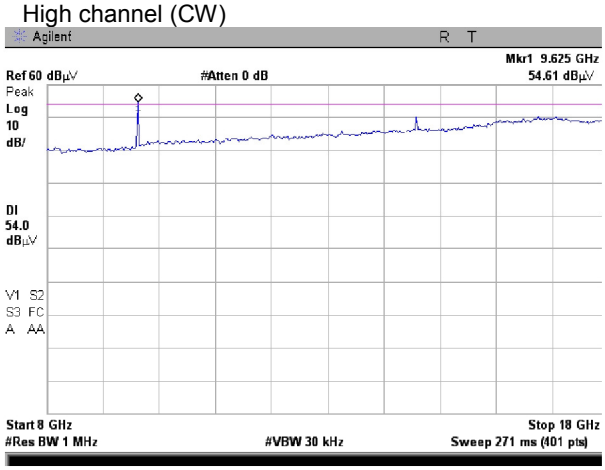


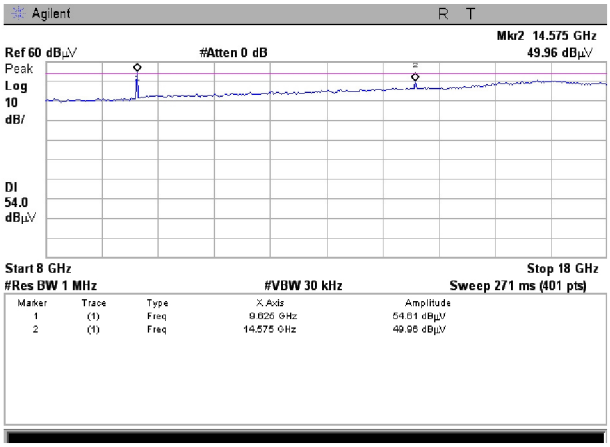
Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.10 Radiated emission measurements from 8000 – 18000 MHz

TEST SITE:	Semi-anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
DETECTOR:	Average

High channel (CW)



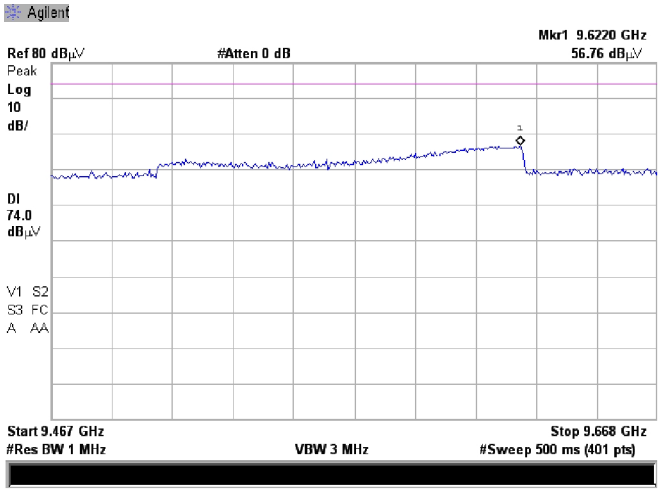


Note: Final measurement was done in chirp modulation mode, for test results refer to Plot 7.2.11, Plot 7.2.12.

Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

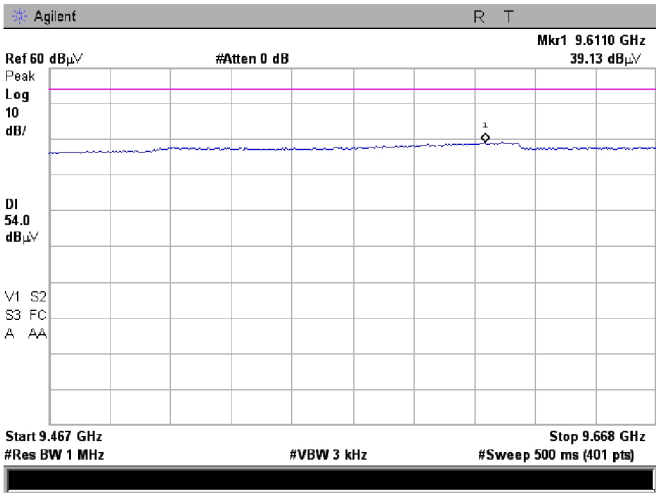
Plot 7.2.11 Radiated emission measurements in 9467 – 9668 MHz

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak hold



Plot 7.2.12 Radiated emission measurements in 9467 – 9668 MHz

TEST SITE: Semi-anechoic chamber 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average

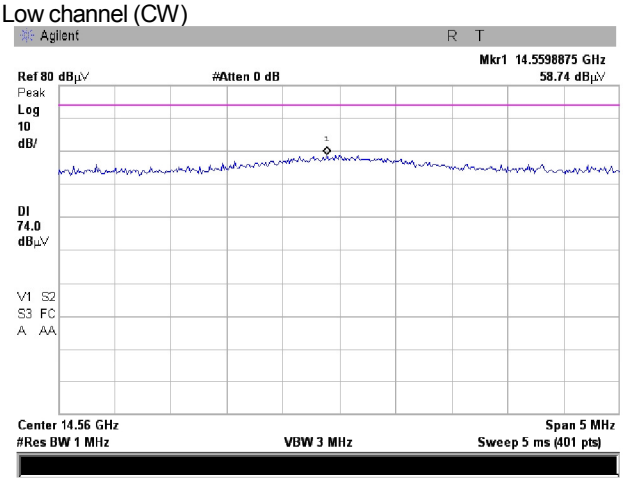


Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

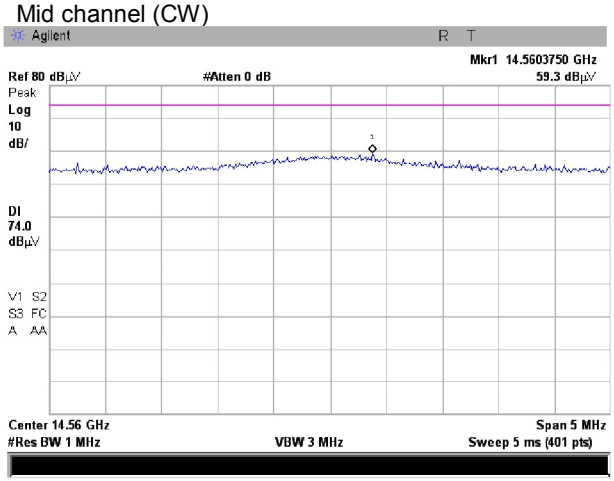
Plot 7.2.13 Radiated emission measurements at frequency 14560 MHz

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak hold

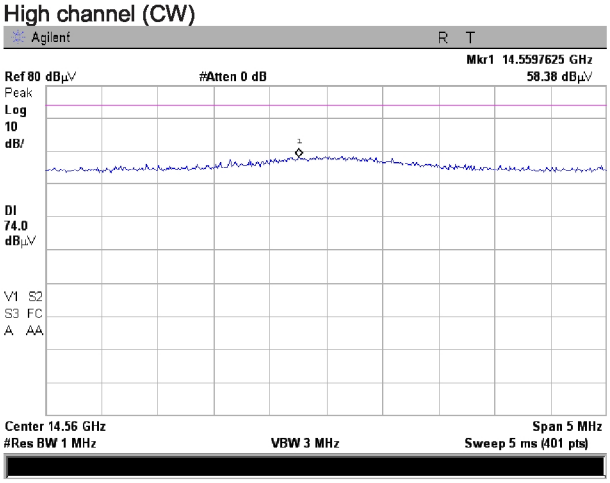
Low channel (CW)



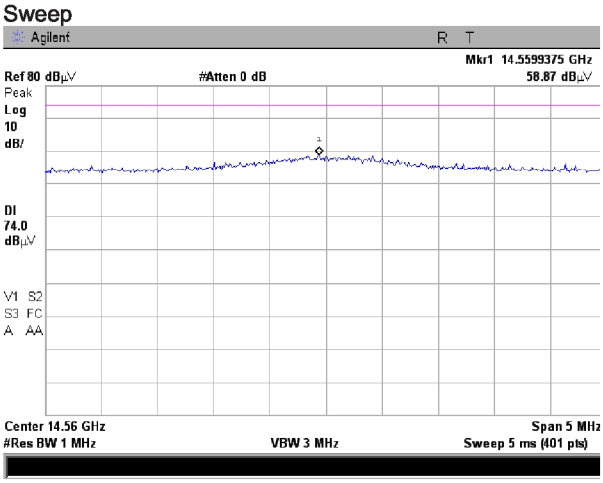
Mid channel (CW)



High channel (CW)



Sweep

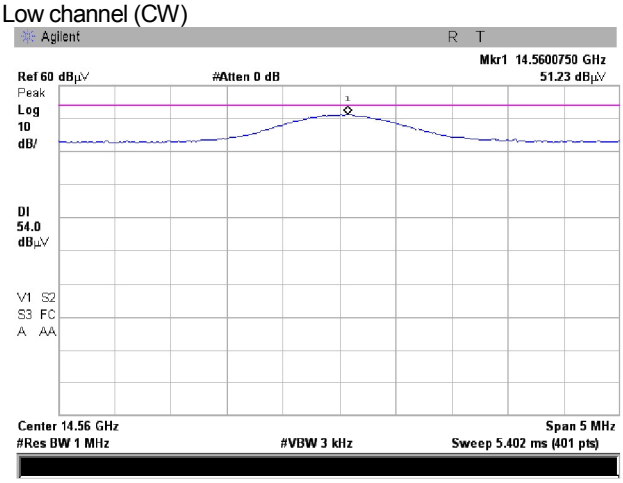


Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

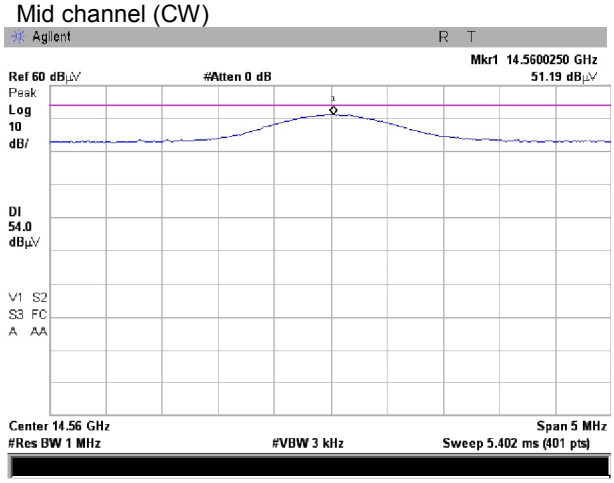
Plot 7.2.14 Radiated emission measurements at frequency 14560 MHz

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average

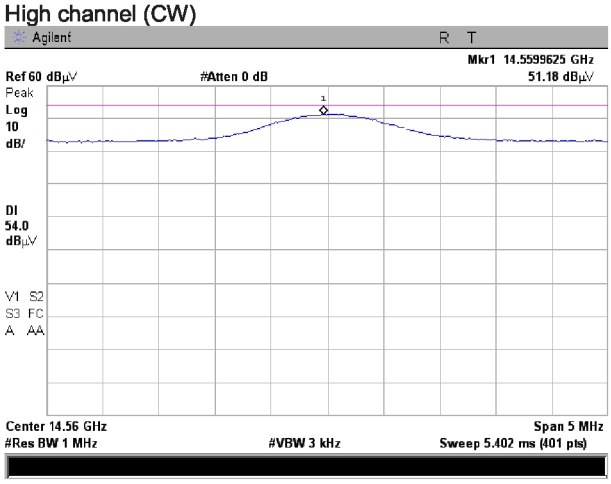
Low channel (CW)



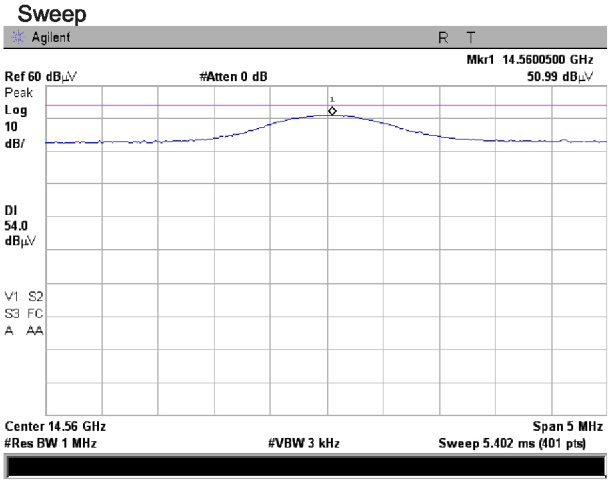
Mid channel (CW)



High channel (CW)



Sweep

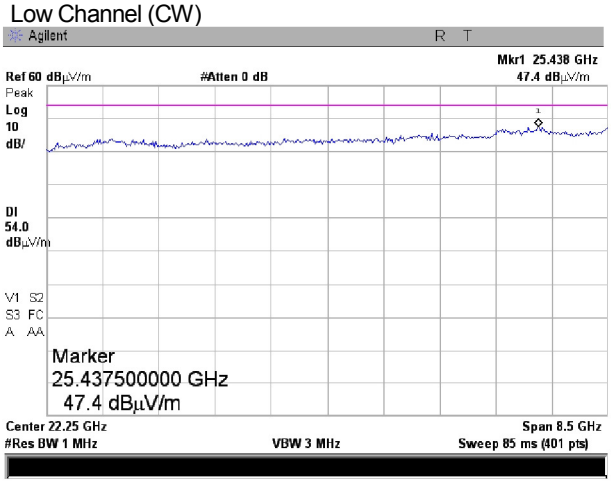


Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

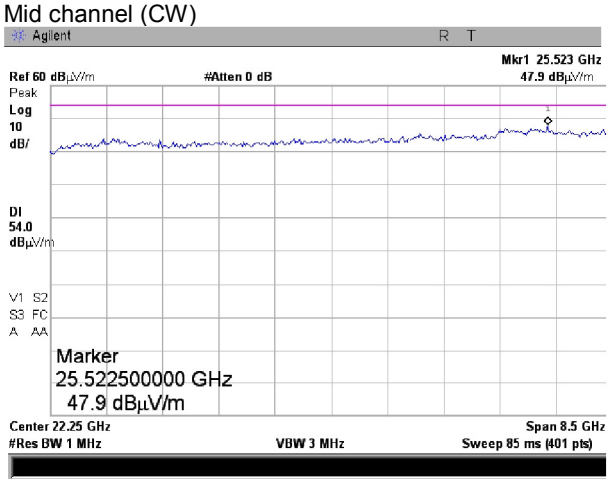
Plot 7.2.15 Radiated emission measurements from 18000 to 26500 MHz

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak

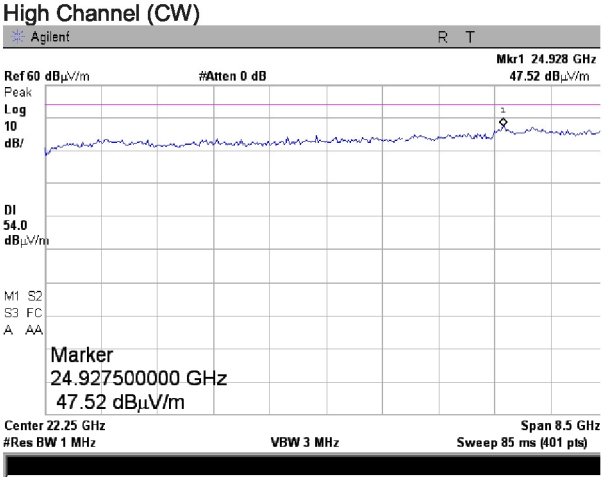
Low Channel (CW)



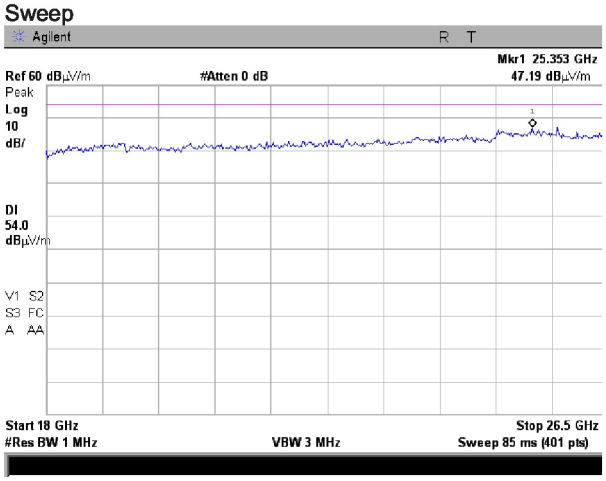
Mid channel (CW)



High Channel (CW)



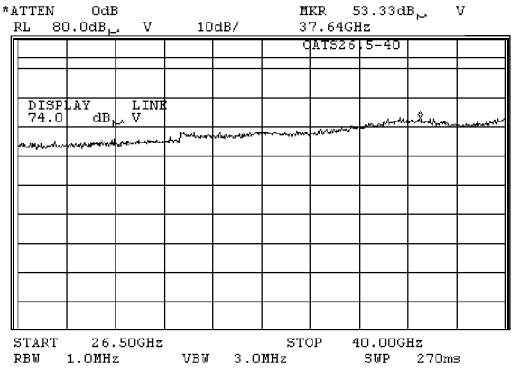
Sweep

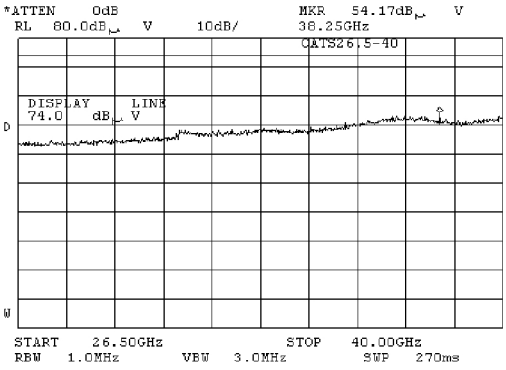


Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

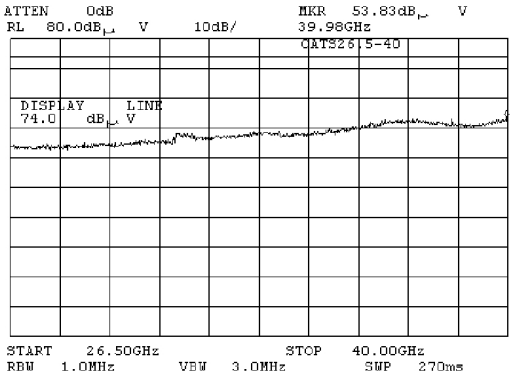
Plot 7.2.16 Radiated emission measurements from 26500 to 40000 MHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak hold

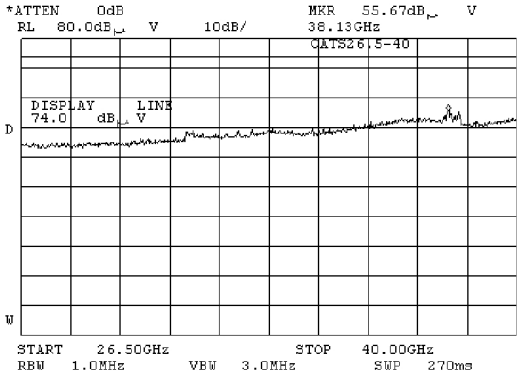




High channel (CW)



Sweep

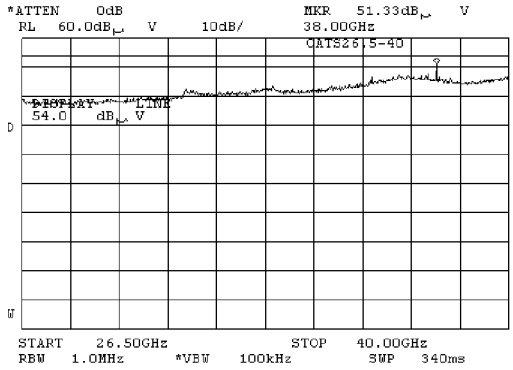


Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

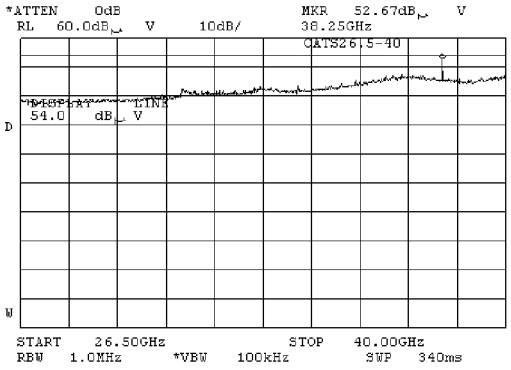
Plot 7.2.17 Radiated emission measurements from 26500 to 40000 MHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average (VBW = 30 kHz)

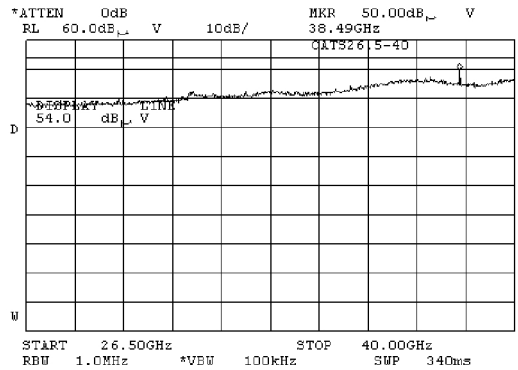
Low channel (CW)



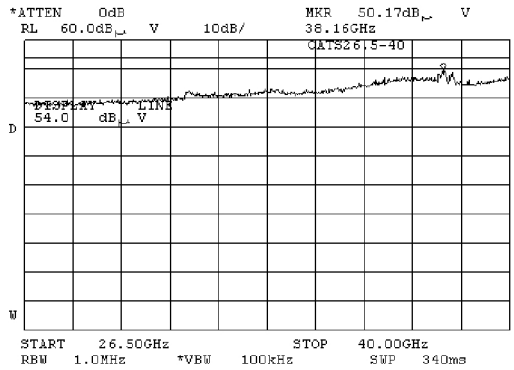
Mid channel (CW)



High channel (CW)



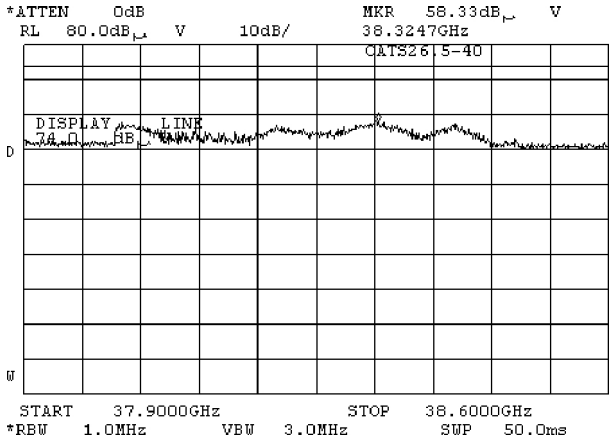
Sweep



Test specification:	Section 15.253(e)(1), Radiated emissions below 40 GHz		
Test procedure:	ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

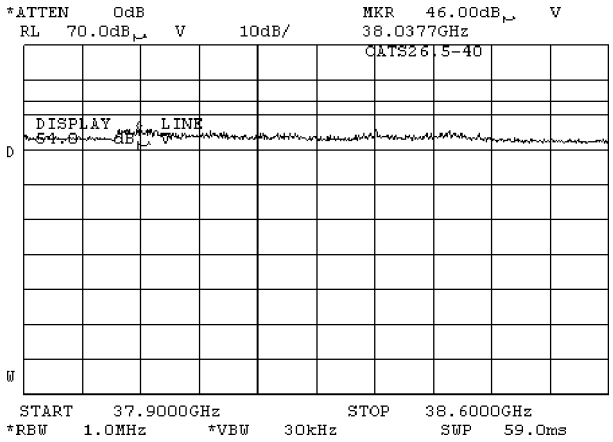
Plot 7.2.18 Radiated emission measurements at frequency 38 GHz

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak hold



Plot 7.2.19 Radiated emission measurements at frequency 38 GHz

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

7.3 Out of band radiated emissions above 40 GHz up to 220 GHz

7.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Power density emission limits

Frequency, GHz	Power density at 3 m distance pW/cm$_2$	Distance, m	Field strength dB(NV/m)*, peak	Field strength dB(NV/m)*, average
40 – 200	600	3	113.5**	93.5**
110 - 140	600	0.5	129.04***	109.04***
140 - 170	600	0.08	152.16****	132.16****
170 - 200	600	0.08	153.85****	133.85****
200 – 220	1000	3	115. 8**	95.8**
200 – 220	1000	0.08	157.56****	137.56****

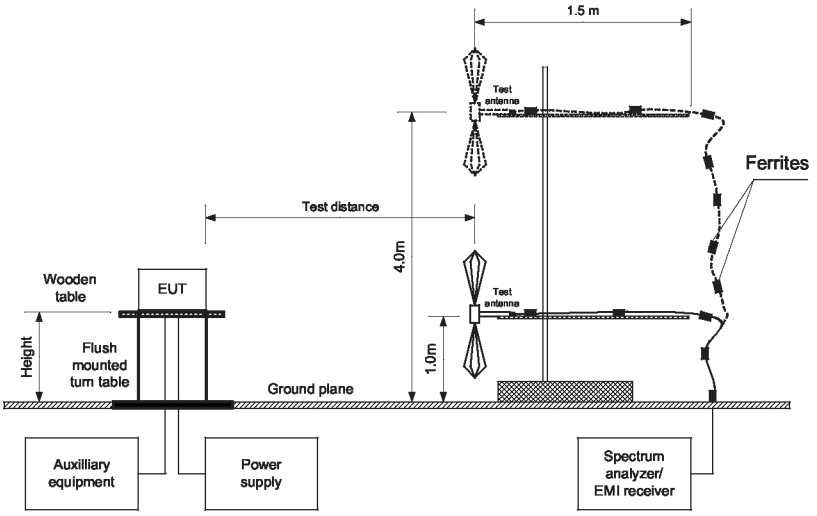
*- The limit is provided in average values.
**- The field strength was calculated as follows:
[20 log (10^2 x Px1207c) + 120] dB(μV/m)
***- The limit for 0.5 m test distance was calculated using the inverse square distance extrapolation factor as follows:
$Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters;
****- The limit for 0.08 m test distance was calculated using the inverse square distance extrapolation factor from the point of measurement to the edge of far field as follows:
$Lim_{S3} = Lim_{S2} + 40 \log (S_2/S_3)$,
where S_2 and S_3 – the edge of far field boundary and test distance respectively in meters.

7.3.2 Test procedure for spurious emission field strength measurements

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.
7.3.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.
7.3.2.3 The test results are shown in the associated plots.

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Figure 7.3.1 Radiated emissions above 40 GHz test set up



Photograph 7.3.1 Setup for radiated emissions measurements above 40 GHz

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Photograph 7.3.2 Setup for radiated emissions measurements above 40 GHz, EUT close view

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.2 Out of band radiated emissions test results

TEST DISTANCE: 0.25 - 3 m
EUT POSITION: Typical (Vertical)
MODULATION: FM
MODULATING SIGNAL: Linear Chirp
TRANSMITTER OUTPUT POWER: Maximum
INVESTIGATED FREQUENCY RANGE: 40 – 220 GHz
RESOLUTION BANDWIDTH: 1000 kHz
VIDEO BANDWIDTH: Z Resolution bandwidth
TEST ANTENNA TYPE: Standard Gain Horn 25dB (40-60 GHz)
Standard Gain Horn 25dB (50-75 GHz)
Standard Gain Horn 25dB (75-110 GHz)
Standard Gain Horn 24dB (90-140 GHz)
Standard Gain Horn 25dB (140-220 GHz

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=1 kHz)			Verdict
	Polariz.	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	
Low carrier frequency 76.02 GHz										
No spurious emissions were found										Pass
Mid carrier frequency 76.50 GHz										
No spurious emissions were found										Pass
High carrier frequency 76.98 GHz										
No spurious emissions were found										Pass

***-** EUT front panel refer to 0 degrees position of turntable.
****-** Margin = Measured emission - specification limit.

NOTE: Spurious investigation was performed with EUT set to produce unmodulated carrier at the lowest, middle and highest carrier frequency and the peak values were measured. Then the EUT was configured to produce the normally modulated sweep and average values were measured at the specific spurious frequencies.

Reference numbers of test equipment used

HL 0747	HL 0770	HL 0771	HL 0772	HL 1303	HL 1312	HL 209	HL 3235
HL 3295	HL 3305	HL 3306	HL 3433	HL 3434	HL 3536		

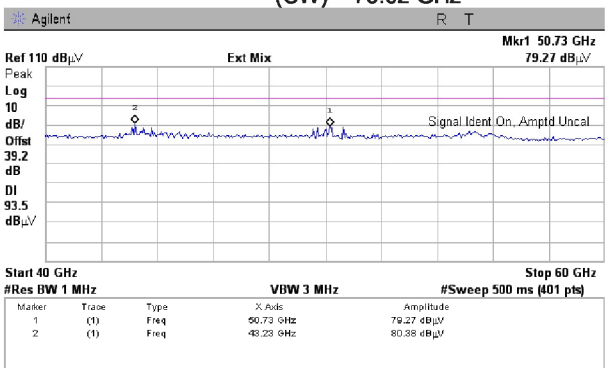
Full description is given in Appendix A

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

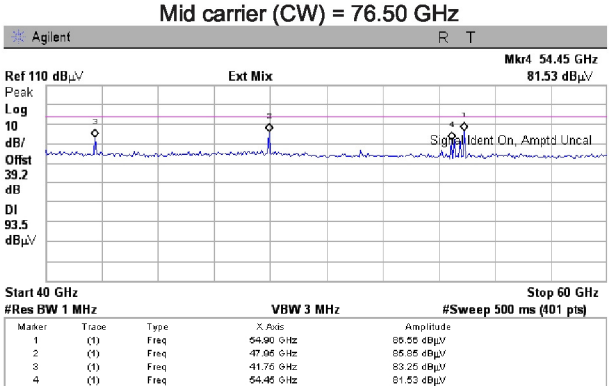
Plot 7.3.1 Radiated emission measurements from 40 to 60 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA Vertical and Horizontal
DETECTOR: Peak hold

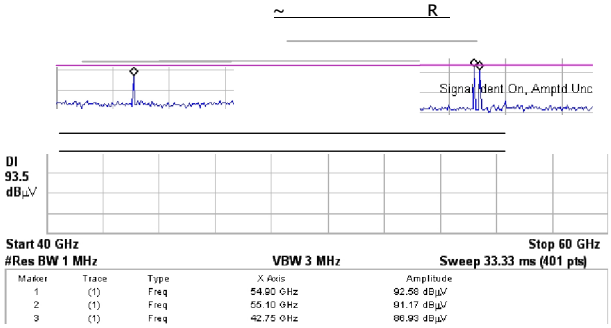
Low carrier (CW) = 76.02 GHz



Mid carrier (CW) = 76.50 GHz



High carrier (CW) = 76.98 GHz



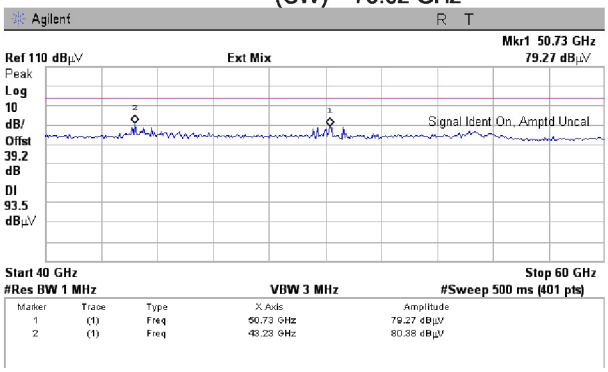
NOTE: All spurious emissions are imaginary products of the mixing process.

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

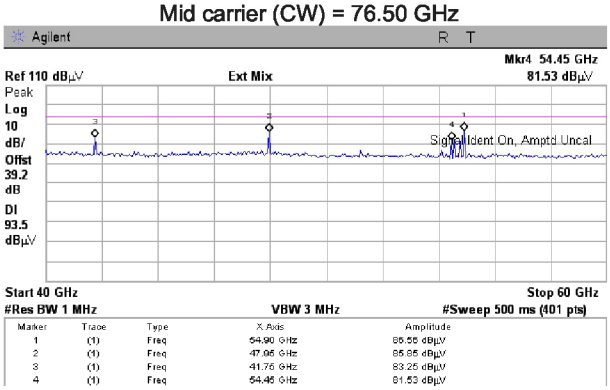
Plot 7.3.2 Radiated emission measurements from 40 to 60 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA Vertical and Horizontal
DETECTOR: Peak hold

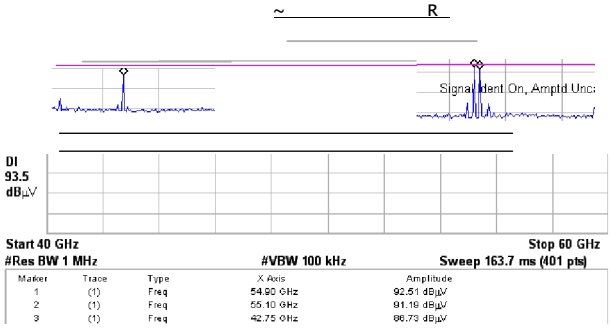
Low carrier (CW) = 76.02 GHz



Mid carrier (CW) = 76.50 GHz



High carrier (CW) = 76.98 GHz



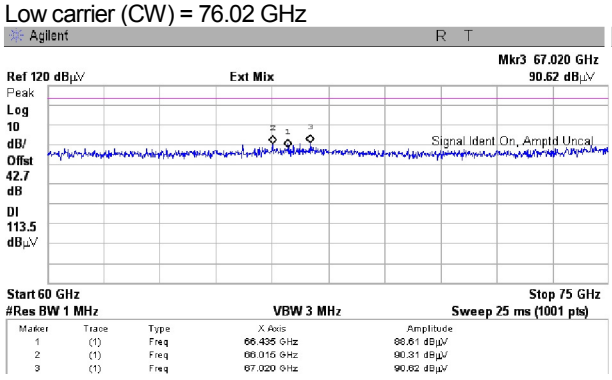
NOTE: All spurious emissions are imaginary products of the mixing process.

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

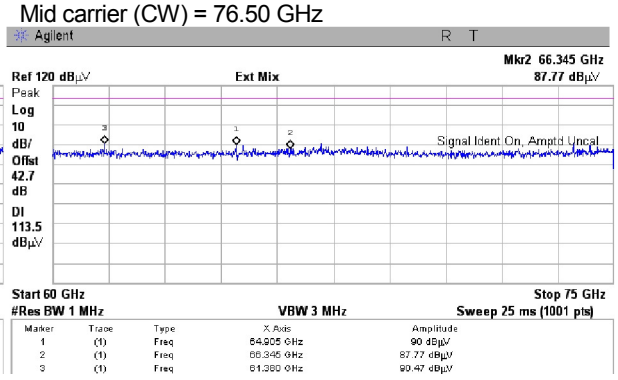
Plot 7.3.3 Radiated emission measurements from 60 to 75 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak hold

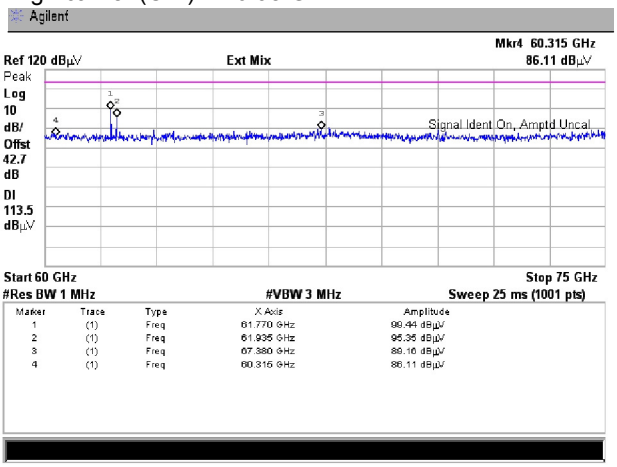
Low carrier (CW) = 76.02 GHz



Mid carrier (CW) = 76.50 GHz



High carrier (CW) = 76.98 GHz



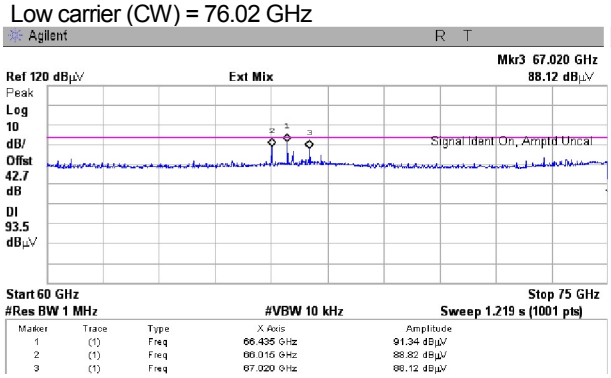
NOTE: All spurious emissions are imaginary products of the mixing process.

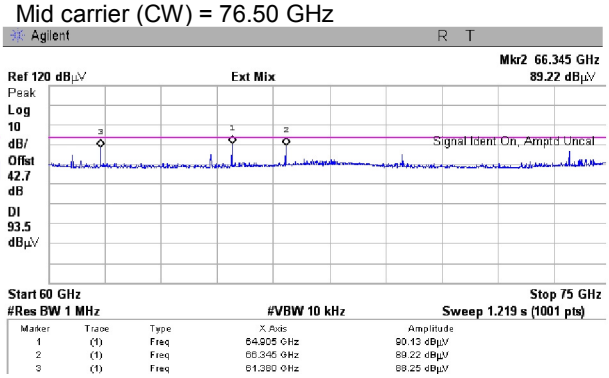
Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.4 Radiated emission measurements from 60 to 75 GHz

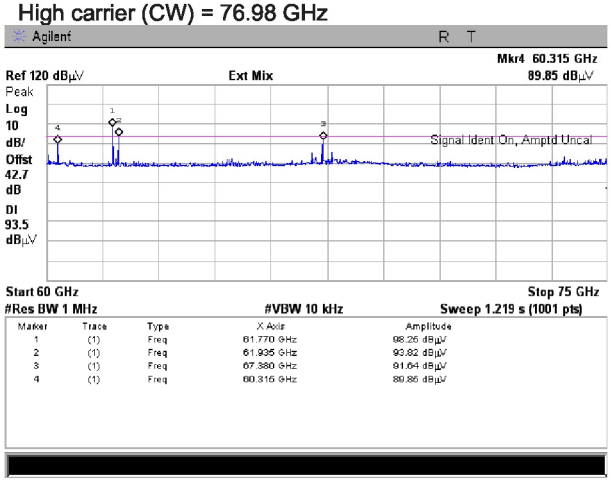
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: VBW = 30 kHz

Low carrier (CW) = 76.02 GHz





High carrier (CW) = 76.98 GHz



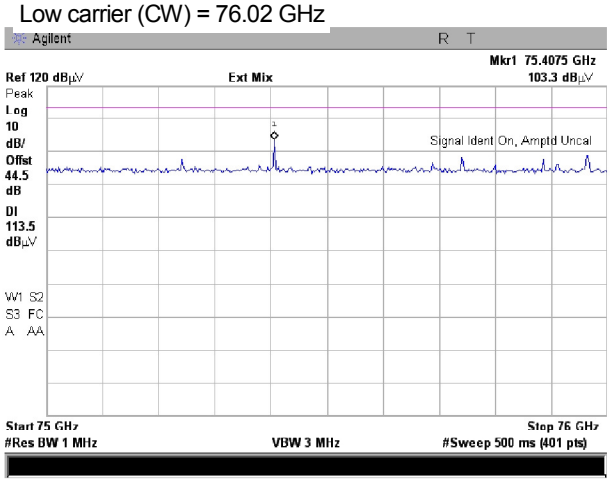
NOTE: All spurious emissions are imaginary products of the mixing process.

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

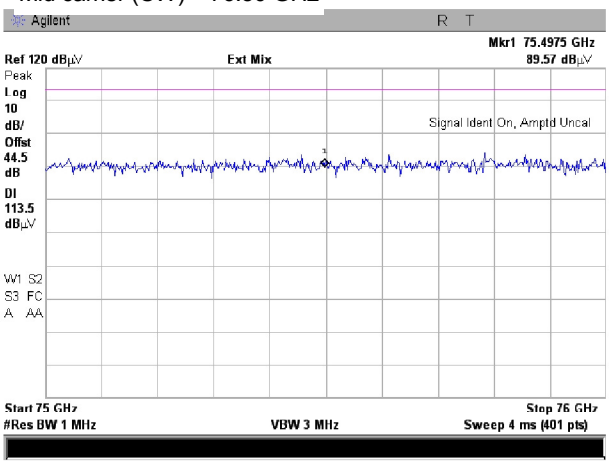
Plot 7.3.5 Radiated emission measurements from 75 to 76 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak hold

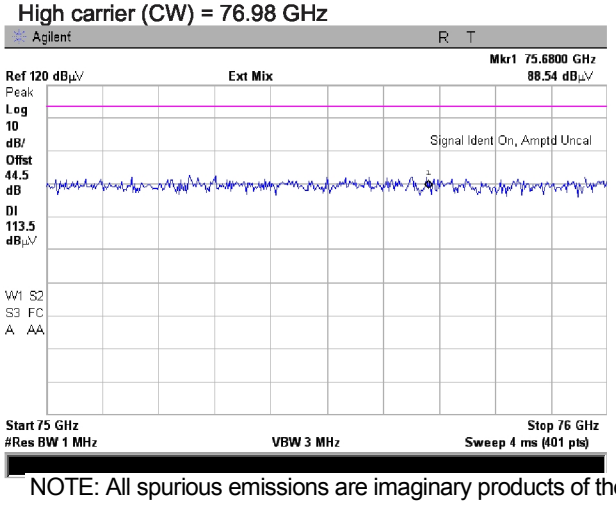
Low carrier (CW) = 76.02 GHz



Mid carrier (CW) = 76.50 GHz



High carrier (CW) = 76.98 GHz



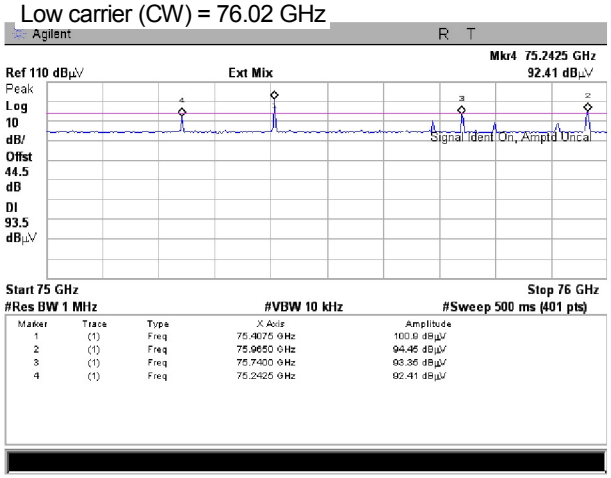
NOTE: All spurious emissions are imaginary products of the mixing process.

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

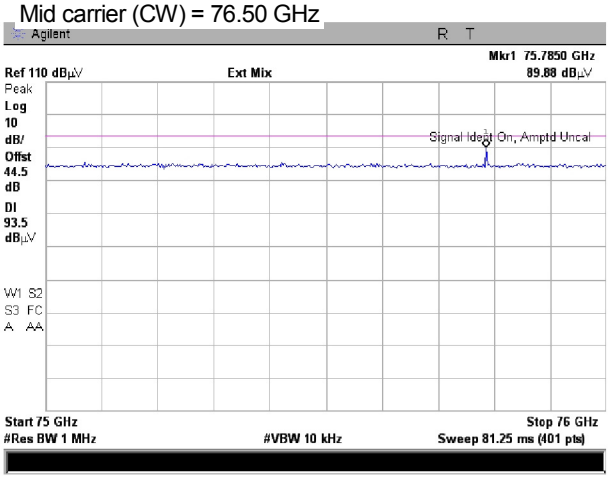
Plot 7.3.6 Radiated emission measurements from 75 to 76 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

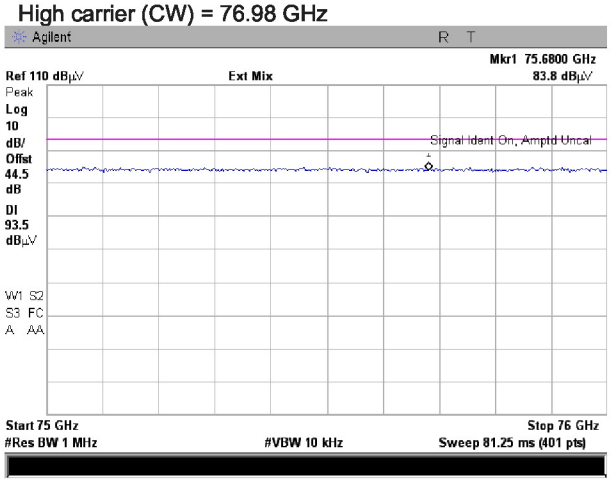
Low carrier (CW) = 76.02 GHz



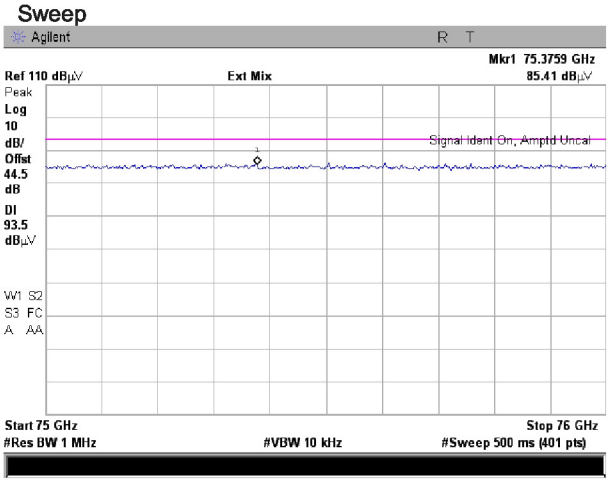
Mid carrier (CW) = 76.50 GHz



High carrier (CW) = 76.98 GHz



Sweep



DETECTOR: VBW = 10 kHz

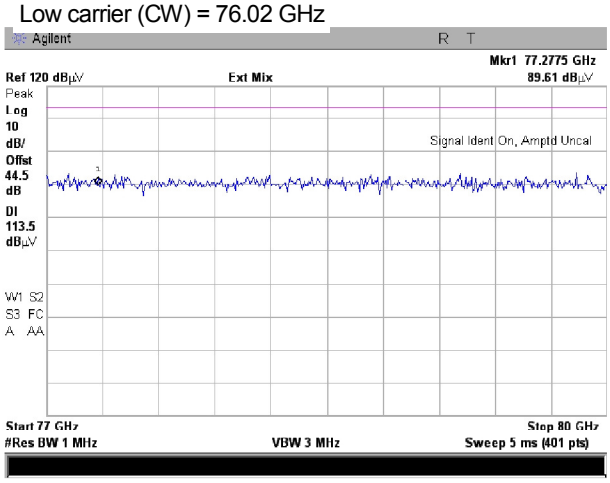
NOTE: All spurious emissions are imaginary products of the mixing process.

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

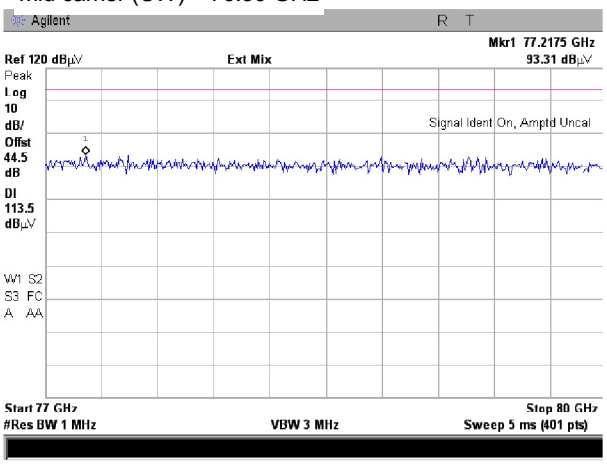
Plot 7.3.7 Radiated emission measurements from 77 to 80 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak

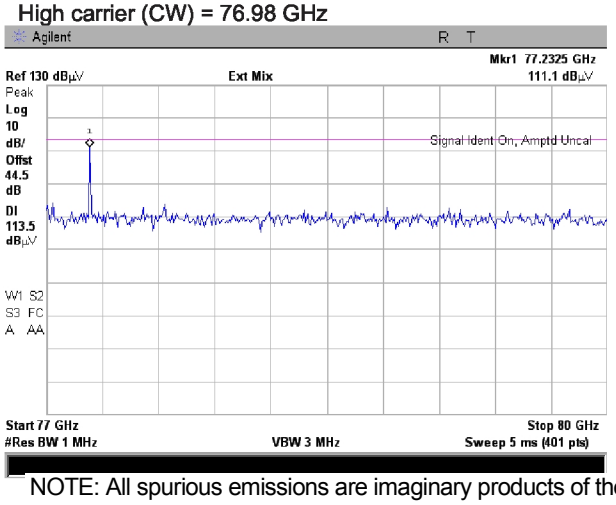
Low carrier (CW) = 76.02 GHz



Mid carrier (CW) = 76.50 GHz



High carrier (CW) = 76.98 GHz

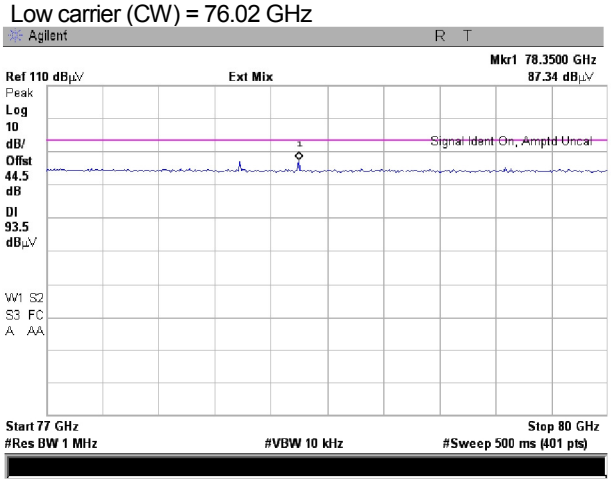


NOTE: All spurious emissions are imaginary products of the mixing process.

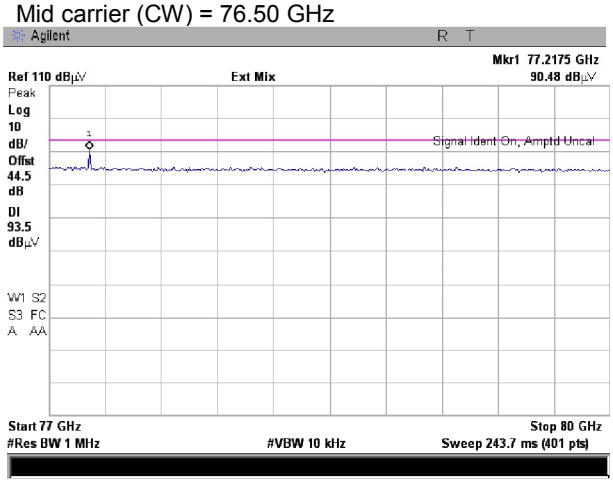
Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 ˚C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.8 Radiated emission measurements from 77 to 80 GHz

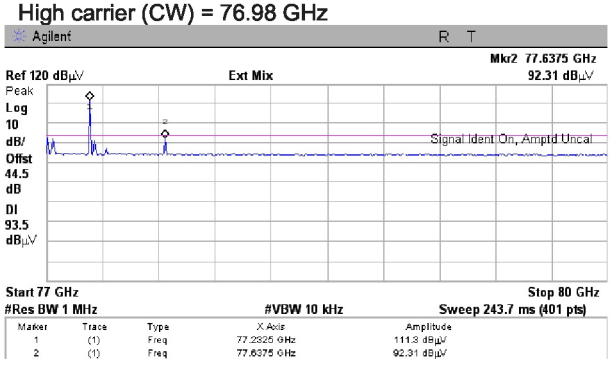
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: VBW = 10 kHz
Low carrier (CW) = 76.02 GHz



Mid carrier (CW) = 76.50 GHz



High carrier (CW) = 76.98 GHz



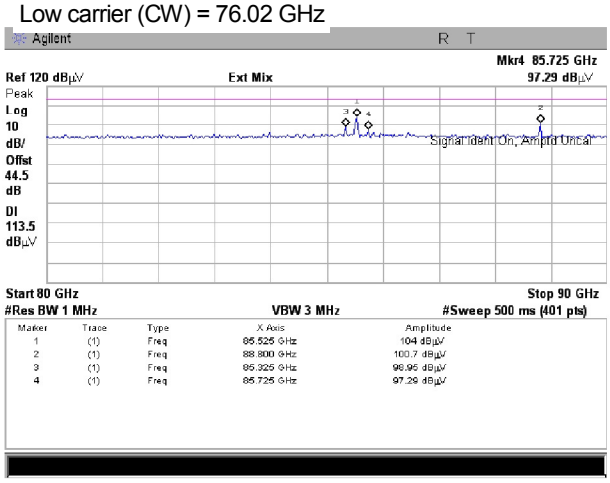
NOTE: All spurious emissions are imaginary products of the mixing process.

Test specification:	Section 15.253(e)(2)(ii), (3), Out of band radiated emissions above 40 GHz		
Test procedure:	Millimeter wave test procedure accepted by FCC Lab		
Test mode:	Compliance	Verdict:	PASS
Date:	1/16/2012		
Temperature: 21.2 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

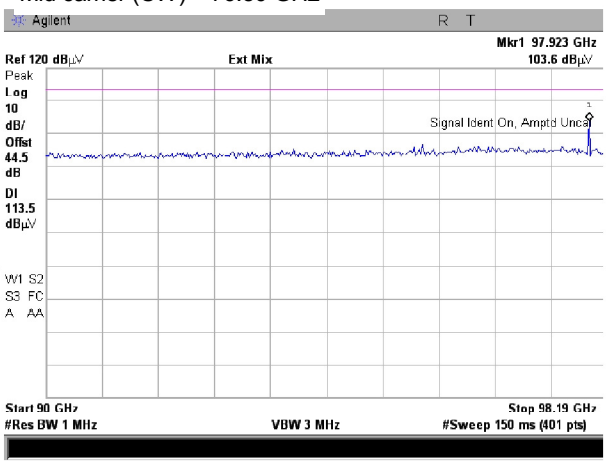
Plot 7.3.9 Radiated emission measurements from 80 to 90 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak

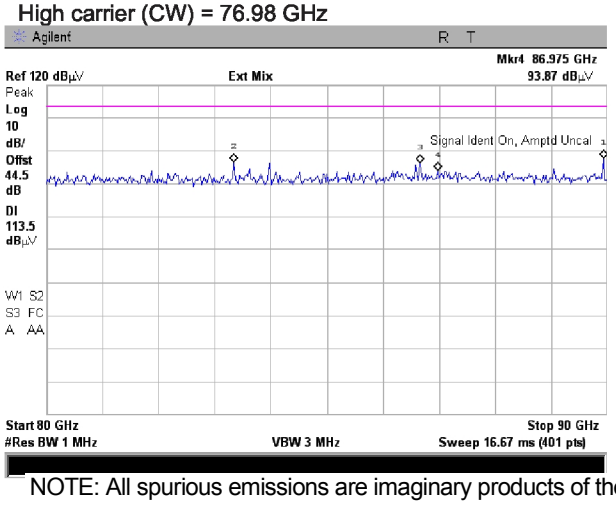
Low carrier (CW) = 76.02 GHz



Mid carrier (CW) = 76.50 GHz



High carrier (CW) = 76.98 GHz



NOTE: All spurious emissions are imaginary products of the mixing process.