PSD, 5560 MHz, HT/VHT20 Beam Forming, M16 to M23, M0.3 to M9.3



Antenna A

Antenna B

cisco

🔆 Agilent	Meas Setup
Ch Freq 5,56 GHz Trig Free Channel Power Averages: 100	Avg Number 100 <u>On</u> Off
Marker 5.562757000 GHz Mkr1 5.562 757 GHz	Avg Mode Exp Repeat
Ref 16 dBm Atten 20 dB 0.469 dBm €Avg Log	Integ BW 17.6400 MHz
dB/ Offst 13.1	Chan Pwr Span 40.0000000 MHz
dB Center 5.560 000 GHz Span 40 MHz	PSD Unit, dBm/MHz
Image: style in the s	Optimize Ref Level
11.02 dBm /17.6400 MHz -1.44 dBm/MHz	More 1 of 2
Copyright 2000–2008 Agilent Technologies	

Antenna C

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PSD, 5700 MHz, Non HT/VHT20 Beam Forming, 6 to 54 Mbps

Antenna A



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PSD, 5700 MHz, HT/VHT20, M8 to M15, M0.2 to M9.2



Antenna A

Antenna B

cisco

🔆 Agilent	Meas Setup
Ch Freq 5.7 GHz Trig Free Channel Power Averages: 100	Avg Number 100 <u>On</u> Off
Marker 5.697571000 GHz	Avg Mode Exp Repeat
Ref 16 dBm Atten 20 dB 2.074 dBm Hyg Log	Integ BW 17.5800 MHz
dB/ Offst 13.1	Chan Pwr Span 40.0000000 MHz
dB Center 5.700 000 GHz Span 40 MHz	PSDUnit , dBm/MHz
•Res BW 1 MHz •VBW 8 MHz Sweep 1.092 ms (8192 pts) Channel Power Power Spectral Density	Optimize RefLeve
11.73 dBm /17.5800 MHz -0.73 dBm/MHz	More 1 of 2
Copyright 2000–2008 Agilent Technologies	

Antenna C

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PSD, 5700 MHz, HT/VHT20, M16 to M23, M0.3 to M9.3



Antenna A

Antenna B

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Antenna C

Antenna D

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PSD, 5700 MHz, HT/VHT20 Beam Forming, M16 to M23, M0.3 to M9.3



Antenna A

Antenna B

cisco

* Agilent	Meas Setup
Ch Freq 5.7 GHz Trig Free Channel Power Averages: 100	Avg Number 100 <u>On</u> Off
Marker 5.697361000 GHz Mkr1 5.697 361 GHz	Avg Mode Exp Repeat
Ref 16 dBm Atten 20 dB -0.102 dBm #Avg 1 1 Log 1 1	Integ BW 17.6200 MHz
dB/ Offst 13.1	Chan Pwr Span 40.0000000 MHz
dB Center 5.700 000 GHz Span 40 MHz	PSDUnit dBm/MHz
*Res BN 1 MHz *VBN 8 MHz Sweep 1.092 ms (8192 pts) Channel Power Power Spectral Density	Optimize RefLevel
10.18 dBm /17.6200 MHz -2.28 dBm/MHz	More 1 of 2
Copyright 2000–2008 Agilent Technologies	

Antenna C

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PSD, 5700 MHz, HT/VHT20 Beam Forming, M16 to M23, M0.3 to M9.3



Antenna A

Antenna B



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Conducted Spurious Emissions

15.407: For transmitters operating in the 5.25-5.35 and 5.47-5.725 GHz band: all emissions outside of the 5.25-5.35 and 5.47-5.725 GHz bands shall not exceed an EIRP of -27dBm/MHz.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer).

Span:	30 MHz-40 GHz
Reference Level:	20 dBm
Attenuation:	10 dB
Sweep Time:	10 s
Resolution Bandwidth:	1 MHz
Video Bandwidth:	3 MHz
Detector:	Peak
Trace:	Single
Marker:	Peak

Record the marker waveform peak to spur difference

Please note that scans were performed to verify that duty cycle did not have a significant impact on the test results. Also, scans with reduced RBW and VBW settings were performed to verify that no significant emissions were present under the noise floor.

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Frequency (MHz)	Mode	Antenna Gain	Limit (dBm/MHz)	Adjusted Limit (dBm/MHz)	Margin (dBm)
EE00	Non HT/VHT20, 6 to 54 Mbps	7	-27	<u>-34</u>	>6dBm
5500	HT/VHT20, M0 to M23, M0.1 to M9.3	7	-27	<u>-34</u>	>6dBm
	Non HT/VHT40, 6 to 54 Mbps	7	-27	<u>-34</u>	>6dBm
5500/5520	HT/VHT40, M0 to M23, M0.1 to M9.3	7	-27	<u>-34</u>	>6dBm
	_		-		
5500/5520	Non HT/VHT80, 6 to 54 Mbps	7	-27	<u>-34</u>	>6dBm
5540/5560	HT/VHT80, M0 to M23, M0.1 to M9.3	7	-27	<u>-34</u>	>6dBm
	Non HT/VHT40, 6 to 54 Mbps	7	-27	<u>-34</u>	>6dBm
5540/5560	HT/VHT40, M0 to M23, M0.1 to M9.3	7	-27	<u>-34</u>	>6dBm
	_		-		
FF60	Non HT/VHT20, 6 to 54 Mbps	7	-27	<u>-34</u>	>6dBm
5500	HT/VHT20, M0 to M23, M0.1 to M9.3	7	-27	<u>-34</u>	>6dBm
E 700	Non HT/VHT20, 6 to 54 Mbps	7	-27	<u>-34</u>	>6dBm
5700	HT/VHT20, M0 to M23, M0.1 to M9.3	7	-27	<u>-34</u>	>6dBm

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🔆 Agilent Sweep Mkr4 22.00 GHz Sweep Time Ref 20 dBm -42.51 dBm #Atten 18 dB 10.00 s #Peak Auto Man ٥ Log 10 Sweep dB/ Single Cont Offst 13.1 dB Auto Sweep Time 4 Norm Accy W-R Gate 0n LgAv Off Start 30 MHz Stop 40.00 GHź **#Res BW** 1 MHz Gate Setup **#VBW** 3 MHz ***Sweep** 10 s (2000 pts) Type Freq X Axis 5.50 GHz Amplitude Marker Trace (1) (1) 10.38 dBm -47.95 dBm -43.74 dBm 11.00 GHz 16.50 GHz Freq 23 Points (1)(1)Freq 2000 4 Freq 22.00 GHz -42.51 dBm Copyright 2000–2004 Agilent Technologies

Conducted Spurs, 5500 MHz, Non HT/VHT20, 6 to 54 Mbps

🔆 Agilent Sweep Mkr4 22.00 GHz Sweep Time -42.01 dBm Ref 20 dBm #Atten 18 dB 10.00 s #Peak Auto <u>Man</u> ٥ Log 10 Sweep dB/ Single Cont Offst Auto Sweep 13.1 dB. Time 4 2-0 Norm Accy A. ale Gate 0n Off LgAv Stop 40.00 GHź Start 30 MHz *Res BW 1 MHz **#VBW** 3 MHz ***Sweep** 10 s (2000 pts) Gate Setup Type Freq Freq X Axis 5.50 GHz Amplitude Marker Trace (1) (1) (1) (1) 10.21 dBm -47.18 dBm 11.00 GHz Points 16.50 GHz -44.05 dBm -42.01 dBm Freq 2000 Freq 22.00 GHz 4

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Conducted Spurs, 5500 / 5520 MHz, Non HT/VHT40, 6 to 54 Mbps



Conducted Spurs, 5500 / 5520 MHz, HT/VHT40, M0 to M23, M0.1 to M9.3

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Conducted Spurs, 5500 / 5520 / 5540 / 5560 MHz, Non HT/VHT80, 6 to 54 Mbps





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🔆 Agilent Sweep Mkr4 22.20 GHz Sweep Time Ref 20 dBm -44.00 dBm #Atten 18 dB 10.00 s #Peak Auto Man 1 Log 10 Sweep dB/ Single Cont Offst 13.1 Auto Sweep dB Time 4 3 Norm Accy Gate 0n Off LgAv Start 30 MHz Stop 40.00 GHź **#VBW** 3 MHz *Res BW 1 MHz ***Sweep** 10 s (2000 pts) Gate Setup Amplitude 5.57 dBm -46.27 dBm -45.21 dBm Marker Trace Type Freq X Axis 5.55 GHz (1) (1) Freq 11.10 GHz Q Points (1) (1) 34 Freq 16.65 GHz 2000 Freq 22.20 GHz -44.00 dBm Copyright 2000–2004 Agilent Technologies

Conducted Spurs, 5540 / 5560 MHz, Non HT/VHT40, 6 to 54 Mbps

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Conducted Spurs, 5540 / 5560 MHz, HT/VHT40, M0 to M23, M0.1 to M9.3

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🔆 Agilent Sweep Mkr4 22.24 GHz Sweep Time -44.58 dBm Ref 20 dBm #Atten 18 dB 10.00 s #Peak Auto Man Log 10 Sweep dB/ Single Cont Offst 13.1 dB Auto Sweep Time 4 Norm Accy Mark Gate 0n Off LgAv Start 30 MHz Stop 40.00 GHź *Res BW 1 MHz **#VBW** 3 MHz ***Sweep** 10 s (2000 pts) Gate Setup⊦ Marker Type Freq X Axis 5.56 GHz Trace Amplitude (1) (1) (1) (1) (1) 9.51 dBm -46.62 dBm -45.09 dBm 11.12 GHz 16.68 GHz Freq 23 Points Freq 2000 Freq -44.58 dBm Δ 22.24 GHz Copyright 2000–2004 Agilent Technologies

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Conducted Spurs, 5560 MHz, Non HT/VHT20, 6 to 54 Mbps

Conducted Spurs, 5560 MHz, HT/VHT20, M0 to M23, M0.1 to M9.3



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Conducted Spurs, 5700 MHz, Non HT/VHT20, 6 to 54 Mbps 🔆 Agilent Sweep Mkr4 22.80 GHz Sweep Time Ref 20 dBm -44.68 dBm #Atten 18 dB 10.00 s #Peak Auto Man õ Log 10 Sweep dB/ Single Cont Offst 13.1 dB Auto Sweep Time 3 4 Norm Accy Gate 0n <u>0ff</u> LgAv Start 30 MHz Stop 40.00 GHź *Res BW 1 MHz **#VBW** 3 MHz ***Sweep** 10 s (2000 pts) Gate Setup⊦ X Axis 5.70 GHz 11.40 GHz 17.10 GHz 22.80 GHz Amplitude 9.69 dBm -47.38 dBm -42.29 dBm -44.68 dBm Trace Marker Type (1) (1) Freq Freq 2 Points 3 (1) (1) Freq Freq 2000 4 Copyright 2000–2004 Agilent Technologies

Conducted Spurs, 5700 MHz, HT/VHT20, M0 to M23, M0.1 to M9.3



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Conducted Bandedge

15.407: For transmitters operating in the 5.25-5.35 and 5.47-5.725 GHz band: all emissions outside of the 5.25-5.35 and 5.47-5.725 GHz bands shall not exceed an EIRP of -27dBm/MHz.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer).

Span:	30 MHz-40 GHz
Reference Level:	20 dBm
Attenuation:	10 dB
Sweep Time:	10 s
Resolution Bandwidth:	1 MHz
Video Bandwidth:	3 MHz
Detector:	Peak
Trace:	Single
Marker:	Peak

Record the marker waveform peak to spur difference

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Frequency (MHz)	Mode	Number of TX paths	Target Power Setting (dBm)	Correlated Antenna Gain (dBi)	Conducted Bandedge Level (dBm/MHz)	Total Bandedge Level (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
	Non HT/VHT20, 6 to 54 Mbps	1	16	7	<u>-42.15</u>	-35.15	-27	8.15
5500	HT/VHT20, M0 to M23, M0.1 to M9.3	1	16	7	<u>-38.7</u>	-31.7	-27	4.7
5500/	Non HT/VHT40, 6 to 54 Mbps	1	14	7	<u>-35.27</u>	-28.27	-27	1.27
5520	HT/VHT40, M0 to M23, M0.1 to M9.3	1	16	7	<u>-35.87</u>	-28.87	-27	1.87
	<u>.</u>	-			-		-	
5500/	Non HT/VHT80, 6 to 54 Mbps	1	14	7	<u>-34.41</u>	-27.4	-27	0.41
5540/ 5560	HT/VHT80, M0 to M23, M0.1 to M9.3	1	16	7	<u>-38.29</u>	-31.29	-27	4.29
	Non HT/VHT20, 6 to 54 Mbps	1	13	7	<u>-42.46</u>	-35.46	-27	8.46
5700	HT/VHT20, M0 to M23, M0.1 to M9.3	1	13	7	<u>-40.24</u>	-33.24	-27	6.24

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🔆 Agilent Sweep Mkr3 5.458 37 GHz Sweep Time 1.000 ms to Man Ref 20 dBm #Atten 20 dB -42.15 dBm #Peak <u>Auto</u> Log 10 Sweep dB/ <u>Single</u> Cont Offst 13.1 dB Auto Sweep Time ♦ <u>Norm</u> Accy alman dependance. Ny provinsi hanana a n din day that at (). Gate 0n <u> 0ff</u> #PAvg Start 5.350 00 GHz Stop 5.510 00 GHz *Res BW 1 MHz **#VBW** 3 MHz **Sweep** 1 ms (601 pts) Gate Setup Trace (1) (1) (1) Type Freq Freq Freq Marker X Axis 5.500 16 GHz Amplitude 2.18 dBm -47.33 dBm -42.15 dBm GHz Points 5.458 601 Copyright 2000–2008 Agilent Technologies

Conducted Bandedge, Peak, 5500 MHz, Non HT/VHT20, 6 to 54 Mbps

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Conducted Bandedge Peak, 5500 MHz, HT/VHT20, M0 to M23, M0.1 to M9.3

19 T. 19												
Ref 20	dBm		*Atten	20 dB				Mkr3	5.465 -38.7	57 GHz '0 dBm	Sele	ct Marker
#reaк										1	_	- <u> </u>
10 18/										y-MM.		Normal
Offst 121											-	
dB								3				Delta
								1 12 M	A PA			Donta
d.	Westerder	www.alu	niwe	montallow	andahayik	www.wh	UN THE	Y Y				Delta Pair
		. 1	ark of sort		יין ייןז		<u>r ' i '</u>				(Ti	racking Ref)
#PAvg											Ref	Δ
Start 5	5.350 0) 0 GHz						Stop	5.510	00 GHz		
*Res B	W 1 M	Hz		#V	BW 3 M	1Hz	S	меер 1	l ms (6	01 pts)	Conn	Span Pair
Marke	∍r T	race	Туре		Х	Axis			Amplit	ude	span	Center
1		(1)	Fred	1	5.500	16 GHz			7.20	dBm		
2		(1)	Fred	1	5.470	12 GHz			-50.13	dBm		044
3		(1)	Fred	1	5.465	57 GHZ			-38.70	dBm		UII
												More
												1 of 2
Copyri	ght 20	000-20	008 Ag	ilent T	echnol	ogies						
r												

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Conducted Bandedge Peak, 5500 / 5520 MHz, Non HT/VHT40, 6 to 54 Mbps

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Conducted Bandedge Peak, 5500 / 5520 MHz, HT/VHT40, M0 to M23, M0.1 to M9.3

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Conducted Bandedge Peak, 5500 / 5520 / 5540 / 5560 MHz, Non HT/VHT80, 6 to 54 Mbps

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Conducted Bandedge Peak, 5500 / 5520 / 5540 / 5560 MHz, HT/VHT80, M0 to M23, M0.1 to M9.3



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🔆 Agilent					Marker
Ref 20 dBm	#Atten 20 dB		Mkr3	5.735 7 GHz -45.81 dBm	Select Marker
#Feak 1 Log ↔ 10 dB/ Offst					Normal
13.1 dB	an ale and a state and a state and		nen etaboran negora ne	7.19-5-19-40-40-40-40-40-40	Delta
LgAv					Delta Pair (Tracking Ref) Ref <u>∆</u>
Start 5.690 0 GHz #Res BW 1 MHz	#VBW	3 MHz #	Stop Sweep 10	6.000 0 GHź s (601 pts)	Span Pair Span <u>Center</u>
1 (1) 2 (1) 3 (1)	Freq Freq Freq Freq	5.700 0 GHz 5.725 0 GHz 5.735 7 GHz	 	7.45 dBm 42.46 dBm 45.81 dBm	Off
					More 1 of 2

Conducted Bandedge Peak, 5700 MHz, Non HT/VHT20, 6 to 54 Mbps

Conducted Bandedge Peak, 5700 MHz, HT/VHT20, M0 to M23, M0.1 to M9.3



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Radiated Spurious Emissions

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

1GHz – 15 GHz
80 dBuV
10 dB
Coupled
1MHz
1 MHz for peak, 10 Hz for average
Peak

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots:1) Average Plot (Vertical and Horizontal), Limit= 54dBuV @3m2) Peak plot (Vertical and Horizontal), Limit = 74dBuV @3m

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands.

This report represents the worst case data for all supported operating modes.

Please note that for the 1-18GHz test results, the noise floor is close to the limit for the Average plots. Scans were performed with reduced RBW and VBW in order to verify that no significant emissions were hidden by the noise floor.

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Graphical Test Results: 30MHz – 1000MHz (Transmitter on)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

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Please note that the high emissions at 375MHz, 125MHz, and 625MHz are digital emissions. These will be covered in the EMC test report. A comparison measurement was made with the radio transmitter turned off. The emissions were still observed when the radio was off, so it can be concluded that the emissions are not caused by the radio.



Test Results Table

Fo	rmal Data												
No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1	375.007	43.0	1.8	15.1	60.0	Quasi Max	V	141	195	46.0	14.0	Fail	
2	125.006	39.3	1.1	14.0	54.4	Quasi Max	Н	199	192	43.5	10.9	Fail	
3	625.010	30.9	2.4	19.4	52.7	Quasi Max	V	104	294	46.0	6.7	Fail	
4	48.369	26.4	.6	8.6	35.6	Quasi Max	V	138	78	40.0	-4.4	Pass	wideband
5	38.187	18.2	.5	15.0	33.8	Quasi Max	V	114	334	40.0	-6.2	Pass	wideband
6	33.179	17.1	.5	18.7	36.3	Quasi Max	V	127	86	40.0	-3.7	Pass	wideband
7	875.024	18.3	2.8	22.1	43.2	Quasi Max	Н	107	315	46.0	-2.8	Pass	
8	650.007	22.9	2.4	19.9	45.2	Quasi Max	Н	140	313	46.0	8	Pass	
9	62.131	20.6	.7	7.7	29.0	Quasi Max	V	120	71	40.0	-11.0	Pass	wide band
10	550.006	21.2	2.2	18.3	41.7	Quasi Max	Н	177	125	46.0	-4.3	Pass	

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Graphical Test Results: 30MHz – 1000MHz (Transmitter Off – EMC emission for comparison) Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

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Please note that the high emissions at 375MHz, 125MHz, and 625MHz are digital emissions. These will be covered in the EMC test report. A comparison measurement was made with the radio transmitter turned off. The emissions were still observed when the radio was off, so it can be concluded that the emissions are not caused by the radio.



Test Results Table

Fo	Formal Data												
No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1	374.956	40.8	1.8	15.1	57.7	Peak [Scan]	V	100	0	46.0	11.7	Fail	
2	125.181	38.6	1.1	14.0	53.6	Peak [Scan]	Н	200	0	43.5	10.1	Fail	
3	624.731	34.4	2.4	19.4	56.1	Peak [Scan]	V	100	0	46.0	10.1	Fail	
4	48.794	30.9	.6	8.4	39.8	Peak [Scan]	V	100	0	40.0	2	Pass	
5	33.031	17.4	.5	18.9	36.8	Peak [Scan]	V	100	0	40.0	-3.2	Pass	
6	38.488	21.2	.5	14.8	36.5	Peak [Scan]	V	100	0	40.0	-3.5	Pass	
7	875.113	17.1	2.8	22.1	42.0	Peak [Scan]	Н	200	0	46.0	-4.0	Pass	
8	650.194	18.9	2.4	19.9	41.2	Peak [Scan]	Н	300	0	46.0	-4.8	Pass	
9	599.875	20.4	2.3	18.4	41.2	Peak [Scan]	V	100	0	46.0	-4.8	Pass	
10	97.294	28.0	.9	9.6	38.5	Peak [Scan]	Н	200	0	43.5	-5.0	Pass	

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Graphical Test Results 802.11a: 1 – 18GHz (5500MHz – Average)

Peak Search Marker 1 5.505000000000 GHz #Avg Type: RMS Trig: Free Run #Atten: 0 dB TYP 0: Fast ↔ ain:High PPPPP FGai Next Peak Mkr1 5.505 GHz 71.86 dBµV Ref 86.99 dBµV 0 dB/div Next Pk Right Next Pk Left Marker Delta Mkr→CF Mkr→Ref Lv More 1 of 2 Start 1.000 GHz #Res BW 1.0 MHz Stop 18.000 GHz 13.3 s (1601 pts) #VBW 1.0 kHz Sweep trum Analyzer - EMiSoft Vasona: EMi Emission Softwa Peak Search larker 1 5.505000000000 GHz #Avg Type: RMS Trig: Free Run #Atten: 0 dB DET PPPPP PNO: Fast Next Peak r1 5.505 GHz 69.68 dBµV Ref 86.99 dBµV 0 dB/div Next Pk Right ê Next Pk Left Marker Delta Mkr→CF Mkr→Ref Lvi More Start 1.000 GHz #Res BW 1.0 MHz 1 of 2 Stop 18.000 GHz 13.3 s (1601 pts) #VBW 1.0 kHz Sweep Title: 1 - 18GHz Test Results at 5500MHz (Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

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Graphical Test Results 802.11a: 1 – 18GHz (5500MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



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