Lab Code: 200167-0

FCC PART 15.407

INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007 MEASUREMENT AND TEST REPORT

For

Psion Teklogix Inc.

2100 Meadowvale Boulevard
Mississauga, Ontario, Canada L5N 7J9

FCC ID: GM37535G2BTRA2043
IC ID: 2739D-7535G2B3

Report Type: ☒ Original Report	**Product Type:** The Benchmark in Hand-Held Computing
Test Engineer(s):	Victor Zhang
Report Number:	R0804175-UNII
Testing Date(s):	2008-04-28, 2008-05-20
Report Date:	2008-05-23
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1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *Psion Teklogix Inc.* Product, *FCC ID: GM37535G2BTRA2043, IC: 2739D-7535G2B3, model: 7535 G2*or the "EUT" as referred to this report is a Benchmark in Hand-Held Computing. It was engineered to meet the performance and durability requirements for data collection in some of the harshest environments. It has been ergonomically crafted with the user in mind in order to combine usability with performance.

** Testing was preformed on a post production sample provided by Psion Teklogix Inc.*

1.2 Mechanical Description of EUT

The *Psion Teklogix Inc.* product, *model: 7535 G2 is* of plastic construction and measures approximately 248 mm **(L)** x 97 mm **(W)** x 71 mm **(H)**, weighing approximately 704.5 g.

1.3 Antenna Description

Item Number	Model/Type	
Antenna	Model number:	C802-510001-A
	Manufacturer:	Symbol
	Frequency Range:	2400-2500 MHz; 5150-5850 MHz
	Connector Type	RP-SMA MALE
	Antenna Type	Dual Band Antenna (4dBi for 2.4 GHz; 3 dBi for 5 GHz)

1.4 EUT Photo

Please refer to Exhibit C for addition EUT photographs.

1.5 Objective

This report is prepared on behalf of *Psion Teklogix Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, C and E of the Federal Communication Commissions rules and Industry Canada RSS-210 Issue 7, June 2007.

The objective is to determine compliance with FCC and IC standards, rules and limits for this device including:

- Output Power
- Power Spectral Density
- 26 dB (99%) Bandwidth
- Radiated Spurious Emission [Restricted bands, Harmonics & Spurious]
- Band Edge
- AC line Conducted Emission
- Unwanted Spurious Emission & Receiving Spurious Emission
- DFS

1.6 Related Submittal(s)/Grant(s)

No related submittals.

1.7 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.8 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from $\pm$2.0 for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.9 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and

December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-2463 and R-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The host system was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the testing mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The EUT is programmed with the following data rate settings that were used during testing:

Type	Frequency (MHz)		
	Low	Middle	High
WI-FI (802.11 a)	5180	5240	5320
WI-FI (802.11 a)	5500	5600	5700

2.3 Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

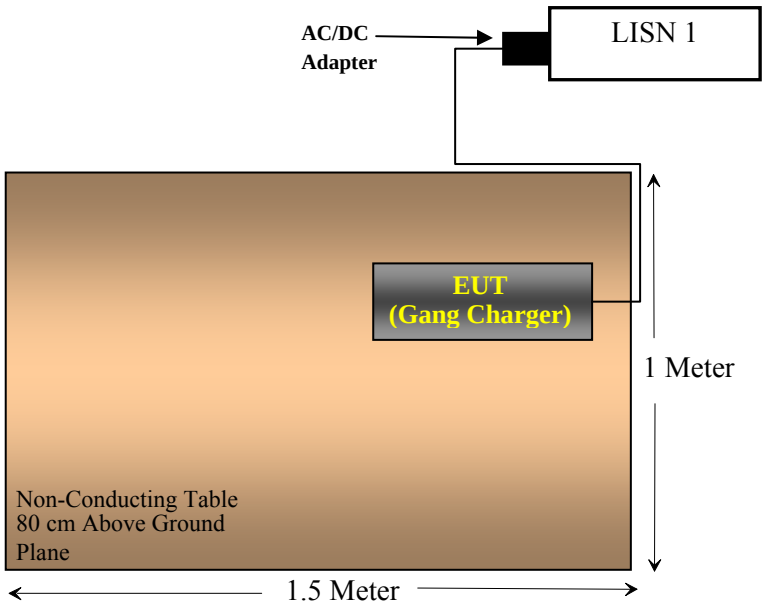
Manufacturer	Description	Model	Serial Number
TOSHIBA	Laptop	Satellite Pro 4200 Series	20016067J

2.6 Interface Ports and Cabling

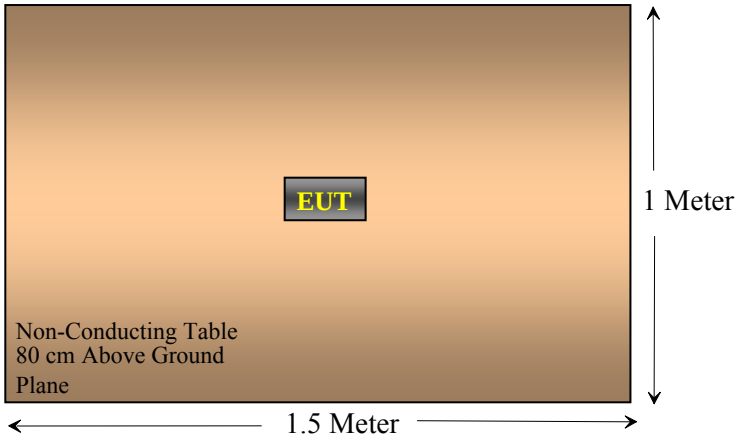
Cable Description	Length (m)	From	To
N/A	N/A	N/A	N/A

2.7 Test Setup Block Diagrams

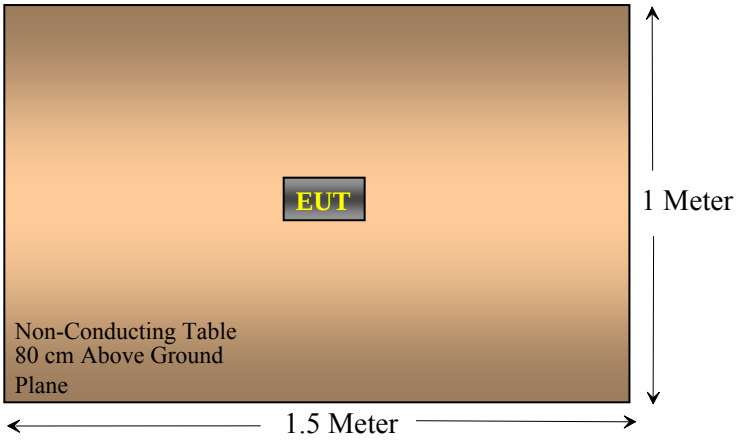
Conducted Emissions



Receiver Radiated Emissions



Transmitter Spurious Radiated Emissions



3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC & RSS-210 Rules	Description of Test	Result	Note
§ 15.407 (a); RSS-210	6 dB (99%) Bandwidth	N/A	Refer to FCC ID H9PLA5137A2/IC: 1549D-LA5137A2 reports
§ 15.407 (a); RSS-210	Output Power	N/A	Refer to FCC ID H9PLA5137A2/IC: 1549D-LA5137A2 reports
§ 15.407 (a); RSS-210	Power Spectral Density	N/A	Refer to FCC ID H9PLA5137A2/IC: 1549D-LA5137A2 reports
§ 15.407 (a); RSS-210	Peak Excursion	N/A	Refer to FCC ID H9PLA5137A2/IC: 1549D-LA5137A2 reports
§ 15.407 (b),§15.205,§15.209 RSS-210 A9.3	Radiated Spurious Emission [Restricted bands, Harmonics & Spurious]	Compliant	
§ 15.407 (a); RSS-210	Band Edge	N/A	Refer to FCC ID H9PLA5137A2/IC: 1549D-LA5137A2 reports
§ 15.407 (h); RSS-210 A9.4	DFS	Compliant	

4 FCC §15.203 & IC RSS-Gen §7.1.4- ANTENNA REQUIREMENT

4.1 Applicable Standard

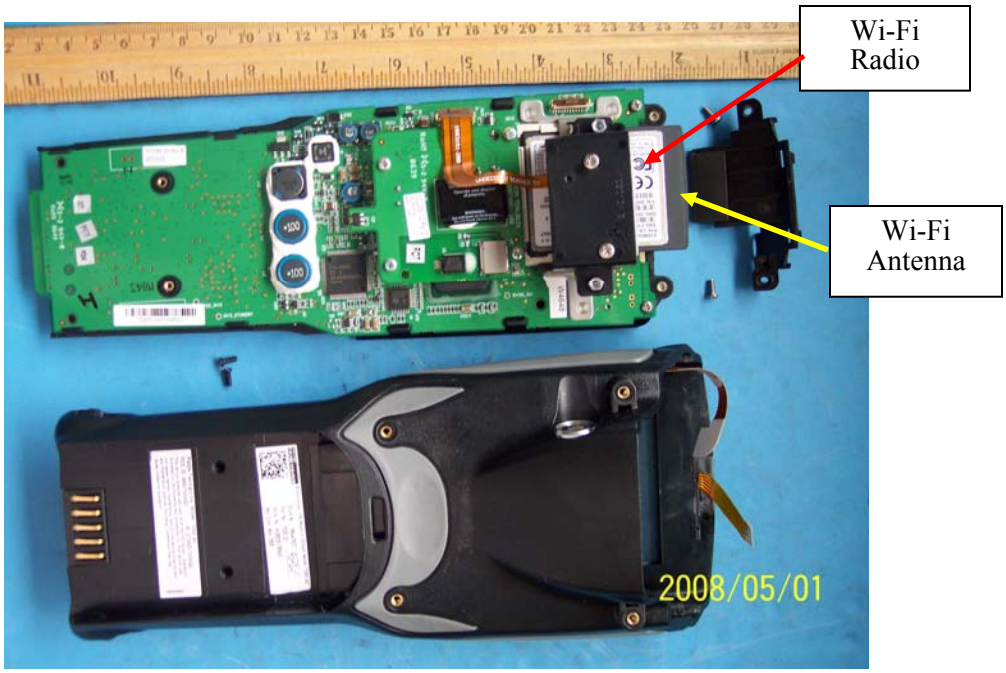
According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to § 15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to RSS-Gen§7.1.4, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

4.2 Antenna Connected Construction

The integral antenna is permanently mounted on the printed circuit board and located inside the enclosure, please refer to the EUT internal photos.



5 FCC §15.205, §15.209 & §15.407, IC RSS-210 RADIATED SPURIOUS EMISSIONS

5.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.407 (b) *Undesirable emission limits:* Exceptas shown in paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.
(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band.
(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of ¥27 dBm/MHz.
(4) For transmitters operating in then 5.725–5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.
(7) The provisions of § 15.205 apply to intentional radiators operating under this section.
(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

IC RSS-210 the measurement method shall be described in the test report. The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

5.2 Test Setup

The radiated emissions tests were performed in the 3-meter open area test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

5.3 EUT Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

5.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Mini-Circuits	Pre amplifier	ZKL-2	7786100643	2008-01-02
HP	Pre amplifier	8449B	3147A00400	2007-11-02
Sunol Science Corp	Combination Antenna	JB1 Antenna	A103105-3	2008-03-25
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2007-06-07
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

*** Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

5.5 Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meters away from the testing antenna, which is varied from 1-4 meters, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

5.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit.
The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

5.7 Environmental Conditions

Temperature:	16 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Victor Zhang from 2008-05-03*

5.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC and IC requirements, and had the worst margin readings of:

Wi-Fi 802.11a (5150MHz-5350MHz Band) Harmonics & Spurious

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-9.17	519.997	Vertical	Low, 30 MHz – 1GHz
-10.01	800.027	Vertical	Mid, 30 MHz – 1GHz
-10.15	800.037	Vertical	High, 30 MHz – 1GHz

Above 1GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-0.52	10360	Vertical	Low, 1GHz – 40GHz
-0.71	10480	Vertical	Mid, 1GHz – 40GHz
-1.2	10640	Vertical	High, 1GHz – 40GHz

Wi-Fi 802.11a (5470MHz-5725MHz Band) Harmonics & Spurious

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-7.78	800.037	Vertical	Low, 30 MHz – 1GHz
-8.63	520.006	Vertical	Mid, 30 MHz – 1GHz
-8.29	520.017	Vertical	High, 30 MHz – 1GHz

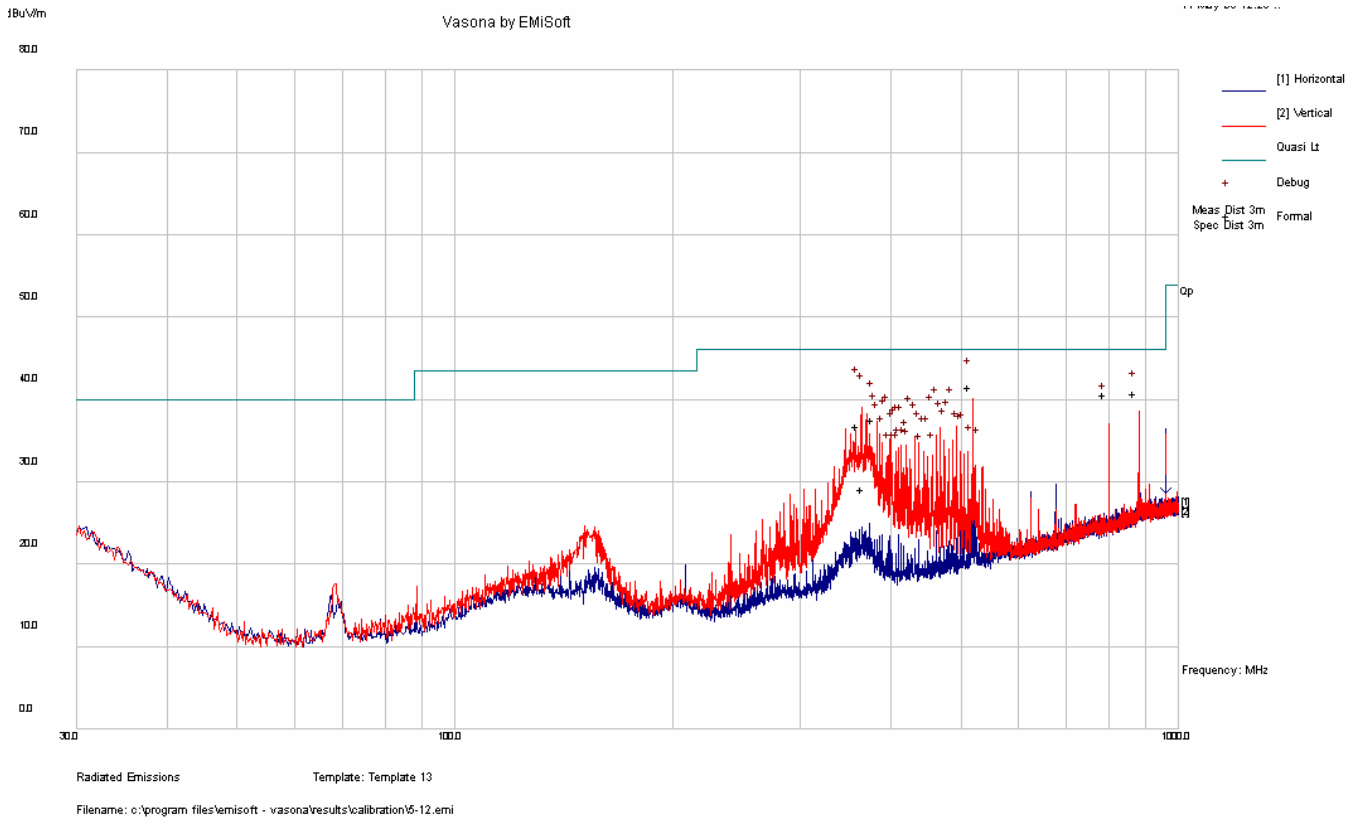
Above 1GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-1.03	11000	Vertical	Low, 1GHz – 40GHz
-0.19	11200	Vertical	Mid, 1GHz – 40GHz
-0.36	11400	Vertical	High, 1GHz – 40GHz

5.9 Radiated Emissions Test plot & data:

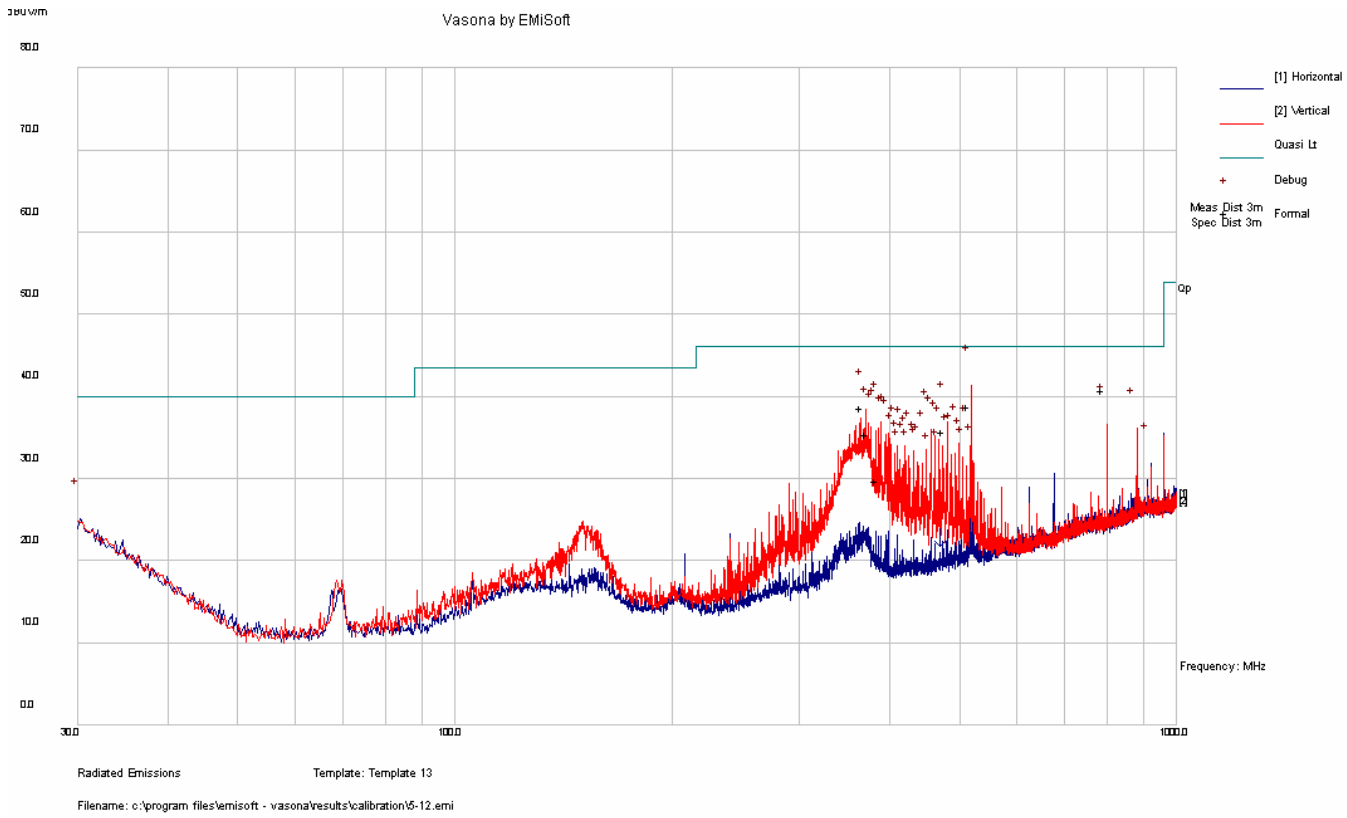
Wi-Fi 802.11a (5150MHz-5350MHz Band)

30MHz -1GHz



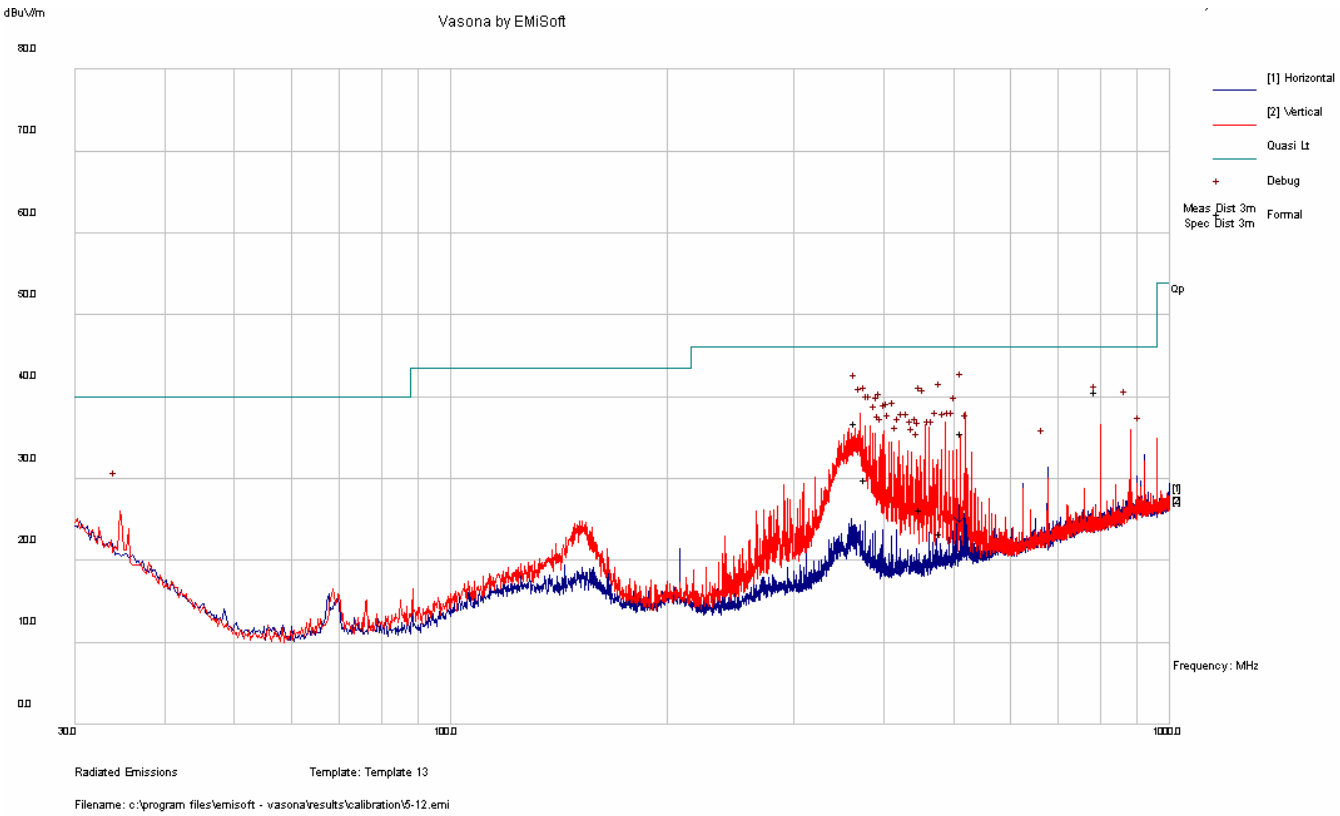
Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Correction Factor (dB)	Ant. Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
519.997	36.83	100	-12.3	V	114	46	-9.17
880.043	36.07	100	-7.38	V	164	46	-9.93
800.045	35.92	109	-8.48	V	5	46	-10.08
382.336	32.74	133	-13.44	V	350	46	-13.26
363.979	32.02	122	-13.69	V	115	46	-13.98
370.147	24.41	208	-13.52	V	94	46	-21.59

Middle channel 5240 MHz



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Correction Factor (dB)	Ant. Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
800.027	35.99	106	-8.48	V	2	46	-10.01
520	34.02	184	-12.3	V	133	46	-11.98
370.134	33.83	134	-13.52	V	13	46	-12.17
480.251	30.98	108	-12.44	V	4	46	-15.02
376.202	30.65	116	-13.42	V	288	46	-15.35
388.462	24.97	302	-13.42	V	12	46	-21.03

High channel 5320 MHz



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Correction Factor (dB)	Ant. Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
800.037	35.85	102	-8.48	V	5	46	-10.15
370.083	31.97	100	-13.52	V	290	46	-14.03
519.982	30.84	236	-12.3	V	114	46	-15.16
382.29	25.23	147	-13.44	V	7	46	-20.77
456.06	21.45	116	-12.9	V	43	46	-24.55
486.353	18.59	123	-12.35	V	340	46	-27.41

WI-FI 802.11a (5150MHz-5350MHz Band) Measured at 3 meters, 1 GHz – 40 GHz

Low channel 5180 MHz

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5180	67.71	260	1.6	V	34	8.41	0	110.12			Fund/Peak
5180	66.62	260	1.6	V	34	8.41	0	109.03			Fund/Ave.
5180	65.59	200	1	H	34	8.41	0	108			Fund/Peak
5180	64.42	200	1	H	34	8.41	0	106.83			Fund/Ave.
10360	41.31	226	2.1	V	40	7.61	35.44	53.48	54	-0.52	Ave
10360	39.92	37	1.95	H	40	7.61	35.44	52.09	54	-1.91	Ave
10360	46.19	226	2.1	V	40	7.61	35.44	58.36	74	-15.64	Peak
10360	44.87	37	1.95	H	40	7.61	35.44	57.04	74	-16.96	Peak

Middle channel 5240 MHz

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5240	65.34	265	1.59	V	34	8.48	0	107.4			Fund/Peak
5240	62.33	265	1.59	V	34	8.48	0	106.63			Fund/Ave.
5240	67.93	200	1.19	H	34	8.48	0	107.62			Fund/Peak
5240	65.66	200	1.19	H	34	8.48	0	106.88			Fund/Ave.
10480	40.83	68	2.02	V	40.2	7.68	35.42	53.29	54	-0.71	Ave
15720	36.78	6	1.28	V	39.1	9.86	35.51	50.23	54	-3.77	Ave
10480	43.16	68	2.02	V	40.2	7.68	35.42	55.62	74	-18.38	Peak
15720	40.08	6	1.28	V	39.1	9.86	35.51	53.53	74	-20.47	Peak

High channel 5320 MHz

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5320	66.86	260	1.7	V	34	8.52	0	109.38			Fund/Peak
5320	64.66	260	1.7	V	34	8.52	0	107.18			Fund/Ave.
5320	68.07	200	1.35	H	34	8.52	0	110.59			Fund/Peak
5320	65.84	200	1.35	H	34	8.52	0	108.36			Fund/Ave.
10640	40.41	205	1	V	40.1	7.89	35.6	52.8	54	-1.2	Ave
10640	35.04	242	1.65	H	40.1	7.89	35.6	47.43	54	-6.57	Ave
10640	42.44	205	1	V	40.1	7.89	35.6	54.83	74	-19.17	Peak
10640	41.85	242	1.65	H	40.1	7.89	35.6	54.24	74	-19.76	Peak

Restricted Band Edge (Near Band Edge): Low channel

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5020.413	36.59	259	1.75	V	33.6	4.94	38.23	36.9	54	-17.1	Ave
4978.032	35.08	203	1.74	H	33.6	4.94	38.23	35.39	54	-18.61	Ave
5020.413	40.19	259	1.75	V	33.6	4.94	38.23	40.5	74	-33.5	Peak
4978.032	39.61	203	1.74	H	33.6	4.94	38.23	39.92	74	-34.08	Peak

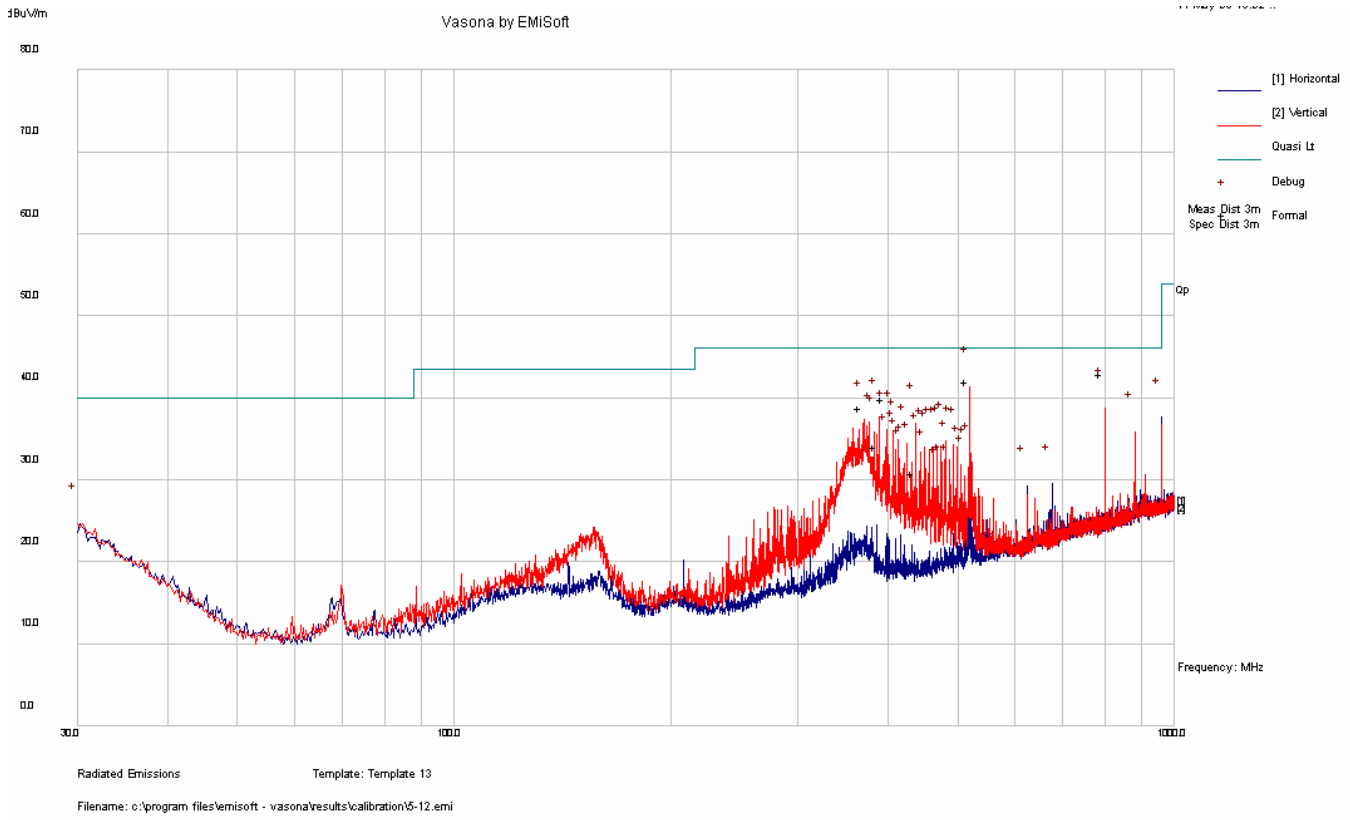
Restricted Band Edge (Near Band Edge): High channel

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5395.933	39.25	208	1	V	34.6	5.4	37.69	41.56	54	-12.44	Ave
5410.178	37.58	288	1.54	H	34.6	5.4	37.69	39.89	54	-14.11	Ave
5395.933	43.67	208	1	V	34.6	5.4	37.69	45.98	74	-28.02	Peak
5410.178	41.45	288	1.54	H	34.6	5.4	37.69	43.76	74	-30.24	Peak

Wi-Fi 802.11a (5470MHz-5725MHz Band)

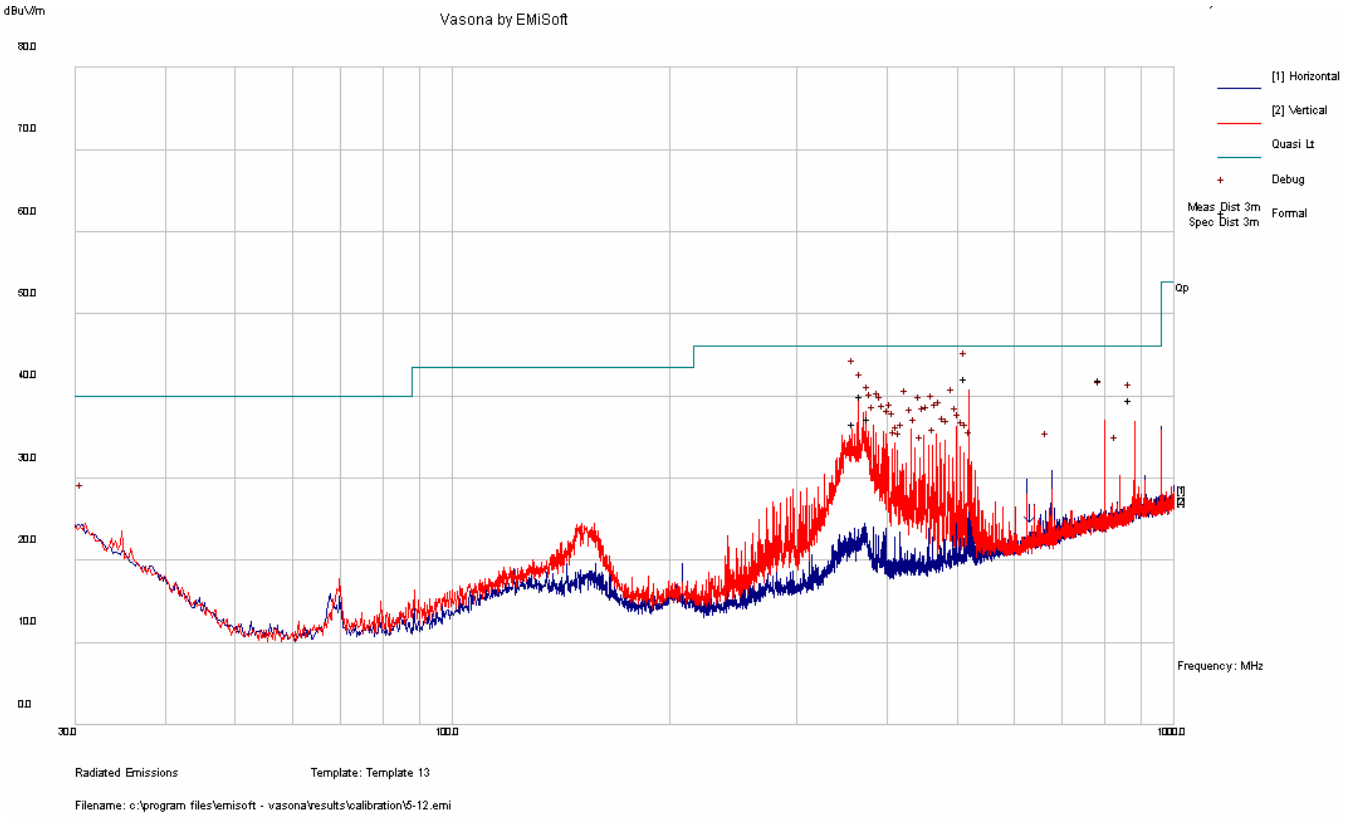
30MHz -1GHz

Low channel 5500 MHz



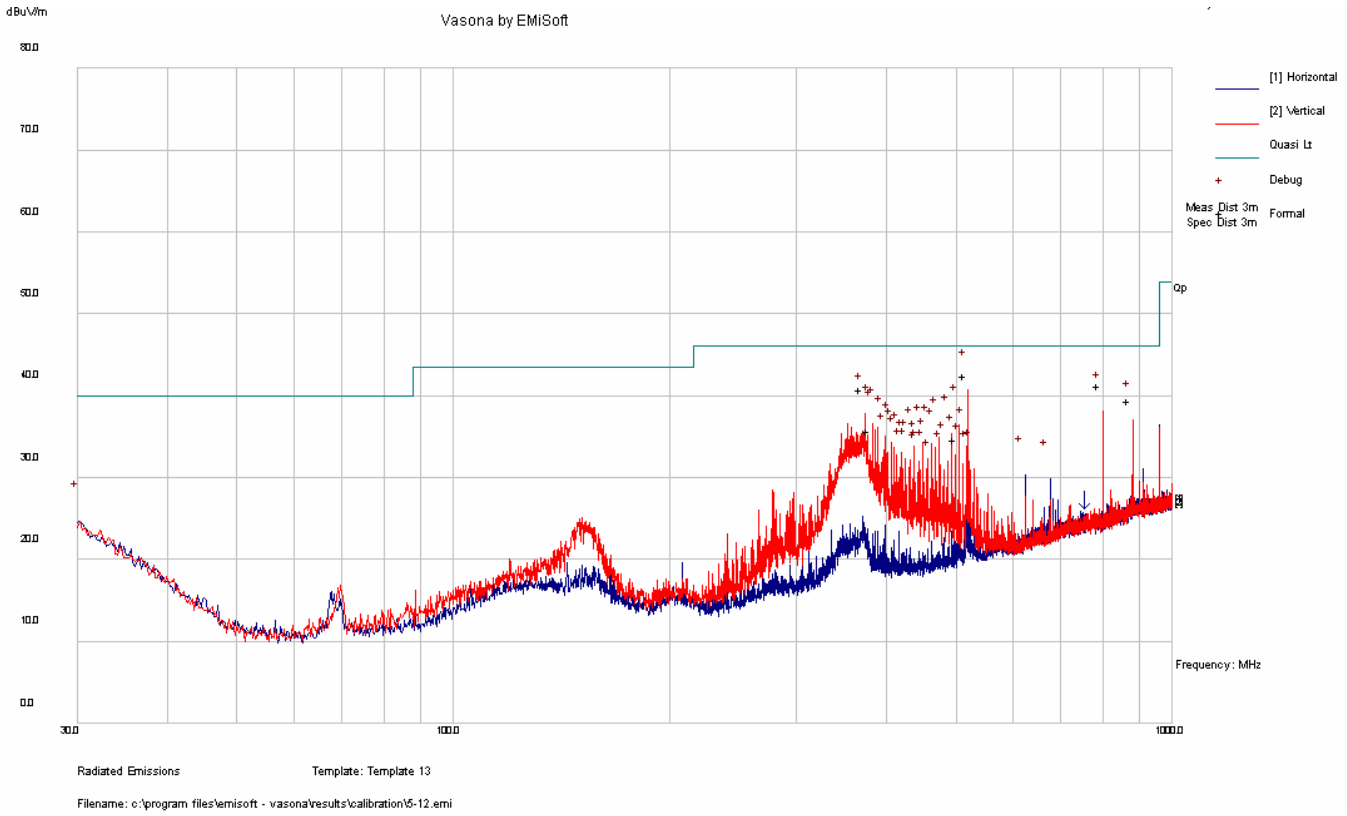
Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Correction Factor (dB)	Ant. Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
800.037	38.22	98	-8.48	V	2	46	-7.78
519.989	37.23	110	-12.3	V	184	46	-8.77
397.645	35.18	116	-13.49	V	339	46	-10.82
370.092	34.04	137	-13.52	V	329	46	-11.96
388.469	29.32	136	-13.42	V	213	46	-16.68
437.419	26.05	102	-13.07	V	190	46	-19.95

Middle channel 5600 MHz



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Correction Factor (dB)	Ant. Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
520.006	37.37	111	-12.3	V	128	46	-8.63
800.029	37.25	100	-8.48	V	6	46	-8.75
373.186	35.26	155	-13.45	V	24	40	-10.74
880.016	34.77	147	-7.38	V	184	46	-11.23
382.372	32.55	128	-13.44	V	11	46	-13.45
363.997	31.9	114	-13.68	V	229	46	-14.1

High channel 5700 MHz



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Correction Factor (dB)	Ant. Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
520.017	37.71	100	-12.3	V	182	46	-8.29
800.032	36.55	111	-8.48	V	6	46	-9.45
373.177	36.03	112	-13.45	V	26	40	-9.97
880.052	34.69	100	-7.38	V	178	46	-11.31
382.361	31.02	111	-13.44	V	273	46	-14.98
504.71	29.92	100	-12.22	V	4	46	-16.08

Wi-Fi 802.11a (5470MHz-5725MHz) Measured at 3 meters, 1 GHz – 25 GHz

Low channel 5500 MHz

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5500	64.72	270	1.3	V	34.6	8.56	0	107.88			Fund/Peak
5500	63.4	270	1.3	V	34.6	8.56	0	106.56			Fund/Ave.
5500	66.49	208	1.24	H	34.6	8.56	0	109.65			Fund/Peak
5500	65.2	208	1.24	H	34.6	8.56	0	108.36			Fund/Ave.
11000	40.22	162	1.7	V	40.1	8.16	35.51	52.97	54	-1.03	Ave.
16500	38.65	298	1.25	V	39	10.39	35.58	52.46	54	-1.54	Ave
16500	43.86	298	1.25	V	39	10.39	35.58	57.67	74	-16.33	Peak
11000	44.85	162	1.7	V	40.1	8.16	35.51	57.6	74	-16.4	Peak

Middle channel 5600 MHz

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5600	67.7	268	1.32	V	34.6	8.6	0	110.9			Fund/Peak
5600	66.07	268	1.32	V	34.6	8.6	0	109.27			Fund/Ave.
5600	68.1	200	1.24	H	34.6	8.6	0	111.3			Fund/Peak
5600	66.6	200	1.24	H	34.6	8.6	0	109.8			Fund/Ave.
11200	40.81	280	1.28	V	40.3	8.21	35.51	53.81	54	-0.19	Ave.
11200	36.1	196	1	H	40.3	8.21	35.51	49.1	54	-4.9	Ave
11200	43.57	280	1.28	V	40.3	8.21	35.51	56.57	74	-17.43	Peak
11200	41.9	196	1	H	40.3	8.21	35.51	54.9	74	-19.1	Peak

High channel 5700 MHz

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5700	66.45	265	1.3	V	34.6	8.65	0	109.7			Fund/Peak
5700	64.55	265	1.3	V	34.6	8.65	0	107.8			Fund/Ave.
5700	67.55	205	1.28	H	34.6	8.65	0	110.8			Fund/Peak
5700	65.63	205	1.28	H	34.6	8.65	0	108.88			Fund/Ave.
11400	39.66	194	1.3	V	41.2	8.37	35.59	53.64	54	-0.36	Ave.
11400	37.71	128	1.29	H	41.2	8.37	35.59	51.69	54	-2.31	Ave
11400	43.51	194	1.3	V	41.2	8.37	35.59	57.49	74	-16.51	Peak
11400	41.95	128	1.29	H	41.2	8.37	35.59	55.93	74	-18.07	Peak

Restricted Band Edge (Near Band Edge): Low channel

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5410.233	37.65	0	1.54	V	34.6	5.4	37.69	39.96	54	-14.04	Ave
5400.187	35.54	229	1.51	H	34.6	5.4	37.69	37.85	54	-16.15	Ave
5410.235	40.4	0	1.54	V	34.6	5.4	37.69	42.71	74	-31.29	Peak
5400.187	38.89	229	1.51	H	34.6	5.4	37.69	41.2	74	-32.8	Peak

6 FCC §15.109, RSS-GEN – UNWANTED SPURIOUS EMISSION AND RECEIVER SPURIOUS EMISSIONS

6.1 Applicable Standard

According to §15.247(a)(2), Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field strength (microvolt/meter)
30-88	100
88-216	150
216-960	200
Above 960	500

6.2 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Mini-Circuits	Pre amplifier	ZKL-2	7786100643	2008-01-02
HP	Pre amplifier	8449B	3147A00400	2007-11-02
Sunol Science Corp	Combination Antenna	JB1 Antenna	A103105-3	2008-03-25
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2007-06-07
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

6.3 Environmental Conditions

Temperature:	16 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Victor Zhang from 2008-05-03.*

6.4 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC and IC requirements, and had the worst margin readings of:

Wi-Fi 802.11a (5150MHz-5350MHz) Unwanted Emissions and Receiving Spurious Emission

30-1000 MHz:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-10.51	520.021	Vertical	30 to 1000 MHz

Above 1GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-11.49	5347.802	Vertical	1 – 40 GHz

Wi-Fi 802.11a (5470MHz-5725MHz) Unwanted Emissions and Receiving Spurious Emission

30-1000 MHz:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-7.19	519.987	Vertical	30 to 1000 MHz

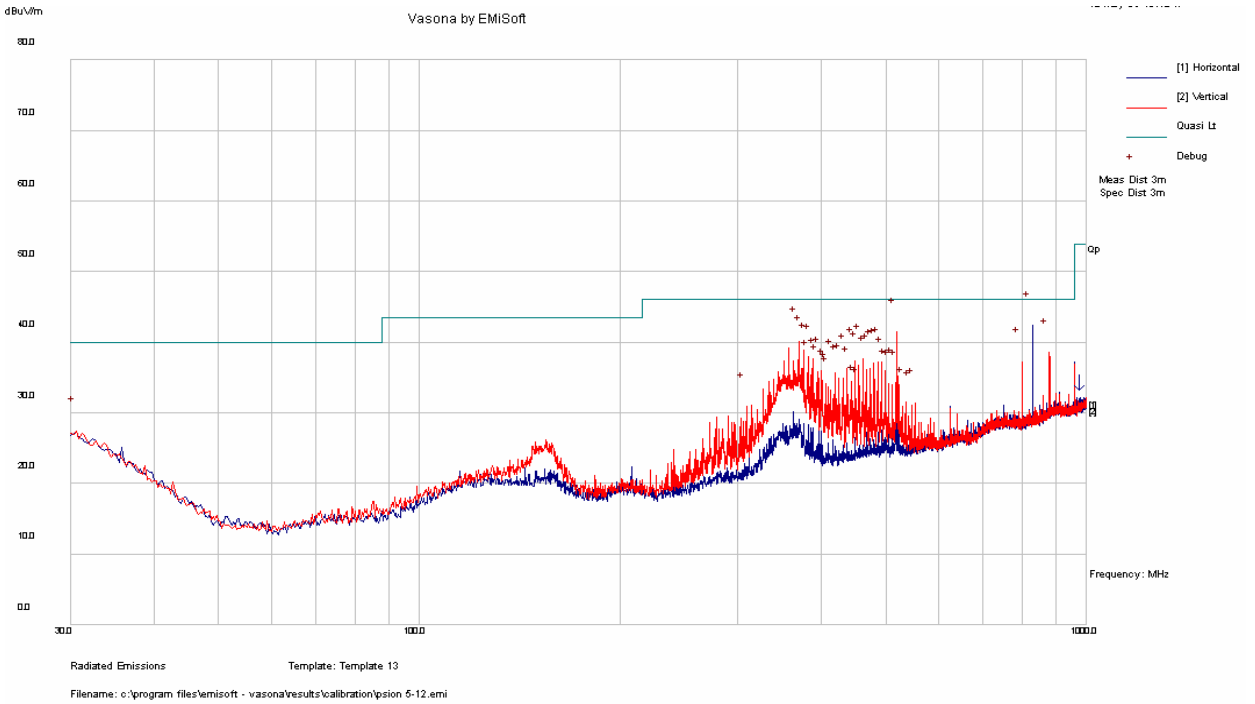
Above 1GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-11.05	5589	Vertical	1 – 40 GHz

6.5 Radiated Emissions Test plot & data:

Wi-Fi 802.11a (5150MHz-5350MHz)

30MHz -1GHz



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Correction Factor (dB)	Ant. Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
520.021	35.49	100	-12.3	V	125	46	-10.51
370.117	34.61	150	-13.52	V	26	46	-11.39
376.223	33.59	117	-13.42	V	54	46	-12.41
474.107	30.88	100	-12.55	V	340	46	-15.12
492.446	28.67	107	-12.27	V	116	46	-17.33
829.947	23.53	198	-8.06	V	248	46	-22.47

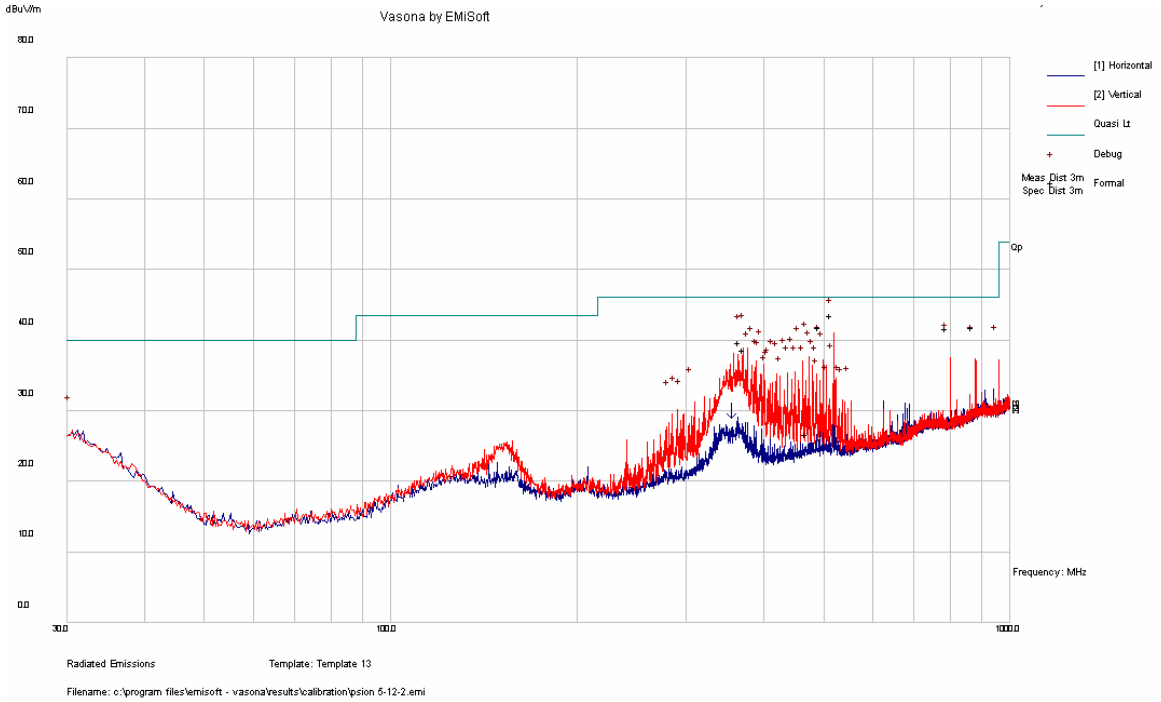
Wi-Fi 802.11a (5150MHz-5350MHz), Measured at 3 meters, above 1GHz

Receiving Mode (Middle Channel)

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5347.802	40.2	126	1	V	34.6	5.4	37.69	42.51	54	-11.49	Ave
5258.979	37.58	209	1	H	34.6	5.4	37.69	39.89	54	-14.11	Ave
5347.802	43.67	126	1	V	34.6	5.4	37.69	45.98	74	-28.02	Peak
5258.979	41.25	209	1	H	34.6	5.4	37.69	43.56	74	-30.44	Peak

Wi-Fi 802.11a (5470MHz-5725MHz)

30MHz -1GHz



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Correction Factor (dB)	Ant. Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
519.987	38.81	100	-12.3	V	166	46	-7.19
879.998	37.05	98	-7.38	V	190	46	-8.95
799.988	37.02	118	-8.48	V	361	46	-8.98
370.106	34.89	127	-13.52	V	311	46	-11.11
376.21	33.89	137	-13.42	V	26	46	-12.11
474.11	21.98	201	-12.54	V	122	46	-24.02

Wi-Fi 802.11a (5470MHz-5725MHz), Measured at 3 meters, above 1 GHz

Receiving Mode (Middle Channel)

Frequency (MHz)	Receiver Reading (dBµV)	Azimuth Degrees	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
5589	39.57	238	1.51	V	34.6	5.59	37.44	42.95	54	-11.05	Ave
5620.969	37.89	284	1.43	H	34.6	5.59	37.44	40.33	54	-13.67	Ave
5589	44.04	238	1.51	V	34.6	5.59	37.44	46.42	74	-27.58	Peak
5620.969	42.02	284	1.43	H	34.6	5.59	37.44	44	74	-30	Peak

7 FCC §15.407(h), IC RSS-210 A9.4 DYNAMIC FREQUENCY SELECTION

7.1 Applicable Standard

FCC §15407(h) & IC RSS-210 A9.4

Table 1: Applicability of DFS requirements prior to use of a channel

Requirement	Operational Mode		
	Master	**Client (Without radar detection)**	**Client (With radar detection)**
Non-Occupancy Period	Yes	Not Required	Yes
DFS Detection Threshold	Yes	Not Required	Yes
Channel Availability Check Time	Yes	Not Required	Not Required
Uniform Spreading	Yes	Not Required	Not Required
U-NII Detection Bandwidth	Yes	Not Required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	**Client** (Without DFS)	**Client** (With DFS)
DFS Detection Threshold	Yes	Not Required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes

Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (See Notes 1 and 2)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.
Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

Table 4: DFS Response requirement values

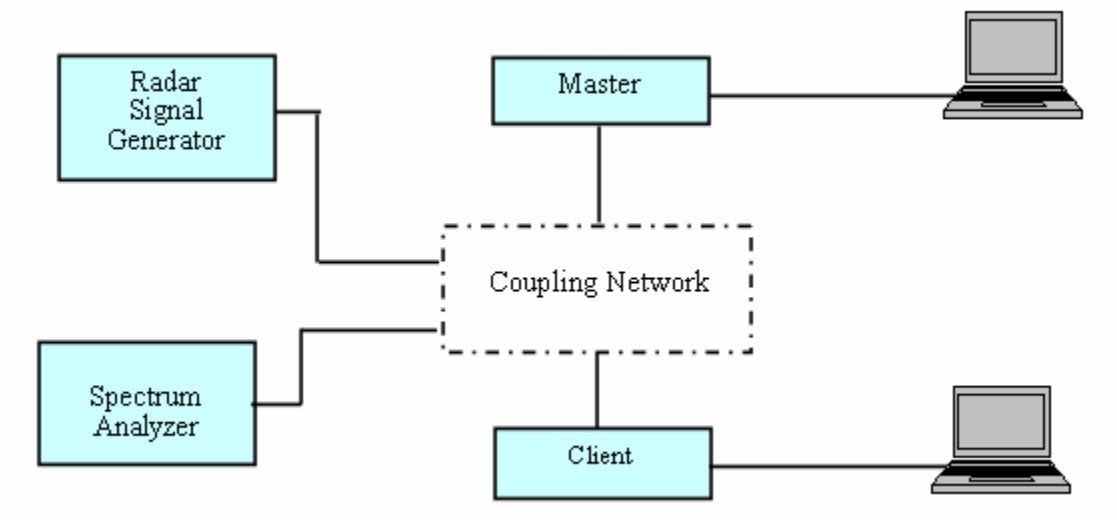
Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 80% of the UNII 99% transmission power bandwidth. See Note 3.

Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:
- For the Short Pulse Radar Test Signals this instant is the end of the *Burst*.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated.
- For the Long Pulse Radar Test Signal this instant is the end of the 12 second period defining the *Radar Waveform*.

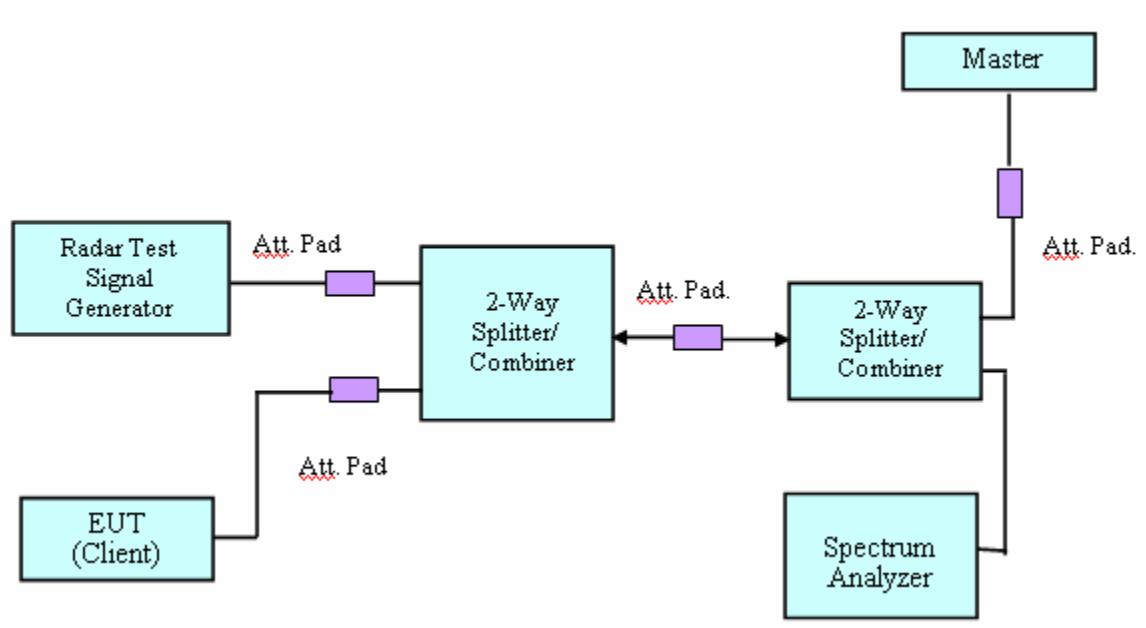
Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Note 3: During the *U-NII Detection Bandwidth* detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

7.2 Test Setup



System Block Diagram



Conducted Method Setup for Client with injection at the Master

7.3 EUT Setup

The EUT operates in 5150-5350 MHz and 5470-5725 MHz range.

The EUT is a Slave device without radar detection function.

The antenna of the EUT is tri-band Omni antenna, the gain is 2 dBi.

The rated output power of EUT is <23 dBm (EIRP).

WLAN traffic is generated by streaming the video file TestFile.mpg, this file is used by IP and Frame based systems for loading the test channel during the In-service compliance testing of the U-NII device. The file is streamed from the Access Point to the Client in full motion video mode using the media player with the V2.61 Codec package.

The Master device supported for testing is Cisco Aironet 1130AG Series IEEE 802.11 a/b/g Acess Point
FCC ID: LDK102054E
Model No.: AIR-AP1131AG-A-K9
S/N: FTX1109T0X8
Manufacturer: Cisco Systems, Inc.

7.4 Test Equipment List and Details

Equipment Description	Manufacturer	Model Number	S/N
NI PXI-1042 8-Slot chassis	National Instruments	PXI-1042	V08X01EE1
Arbitrary Waveform Generator	National Instruments	PXI-5421	N/A
RF Upconverter	National Instruments	PXI-5610	N/A
Upconverter	Ascor	AS-7206	N/A
Spectrum Analyzer	Agilent	E4440A	MY44303352
Pre-Amplifier	Avantek	2-8 GHz Lab AMP	218
Pre-Amplifier	Ducommun Technologies	ALN-09173030-01	990297-02
Splitter/Combiner	Mini-Circuits	2FSC-2-10G	0349
Splitter/Combiner	Narada	4326B-2	03514
Attenuator	MIDWest	290-30	N/A
Attenuator	Mini-Circuits	BW-S30W2	N/A

- **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

7.5 Environmental Conditions

Temperature:	20-23 °C
Relative Humidity:	48 % - 55 %
ATM Pressure:	1015 kPa

Testing performed by Victor Zhang on 2008-05-19 ~ 2008-05-21

7.6 Summary of Test Results

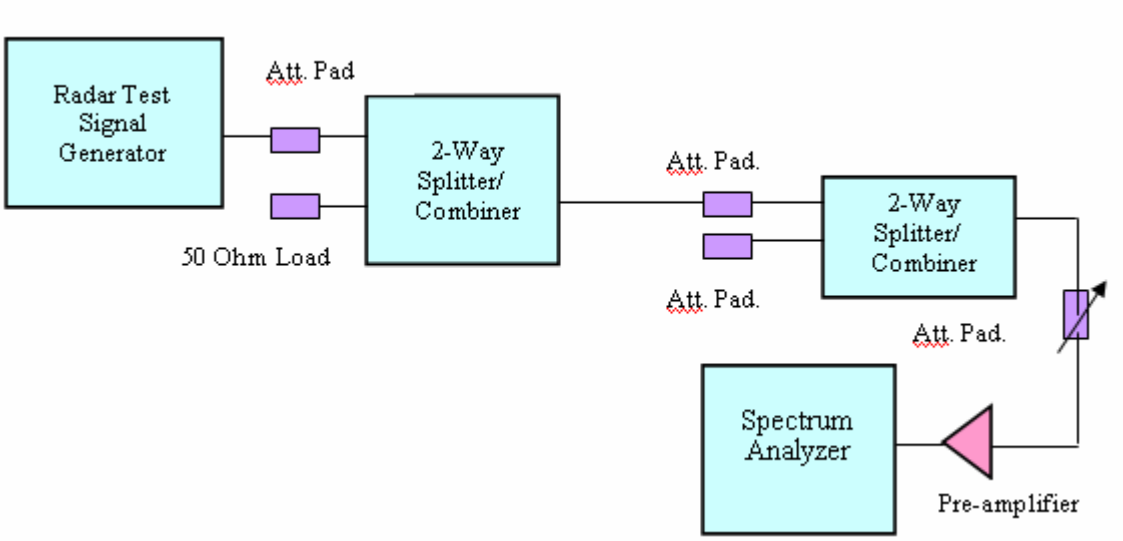
Items	Description of Test	Result
Detection Bandwidth	UNII Detection Bandwidth	NR
Performance Requirements Check	Initial Channel Availability Check Time (CAC)	NR
	Radar Burst at the Beginning of the CAC	NR
	Radar Burst at the End of the CAC	NR
In-Service Monitoring	Channel Move Time	Complies
	Channel Closing Transmission Time	Complies
	Non-Occupancy Period	NR
Radar Detection	Statistical Performance Check	NR

Note: *NR – Not Required.*

7.7 Test Procedure

A spectrum analyzer is used as a monitor verifies that the EUT status including Channel Closing Transmission Time and Channel Move Time, and does not transmit on a Channel during the Non-Occupancy Period after the diction and Channel move. It is also used to monitor EUT transmissions during the Channel Availability Check Time.

Radar Waveform Calibration

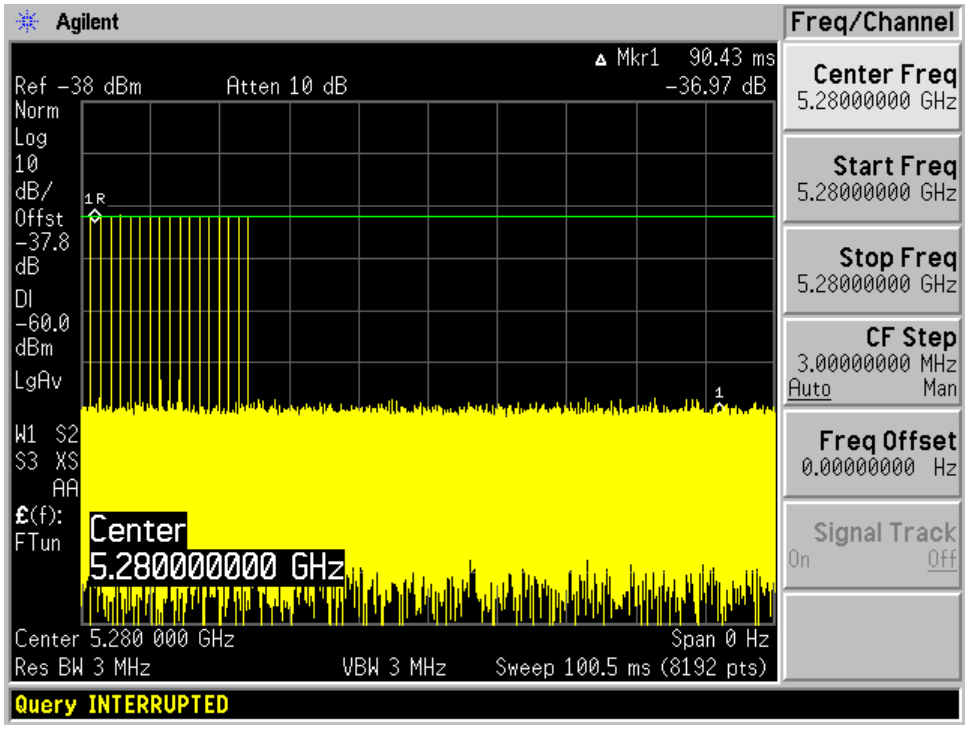


Conducted Calibration Setup Block Diagram

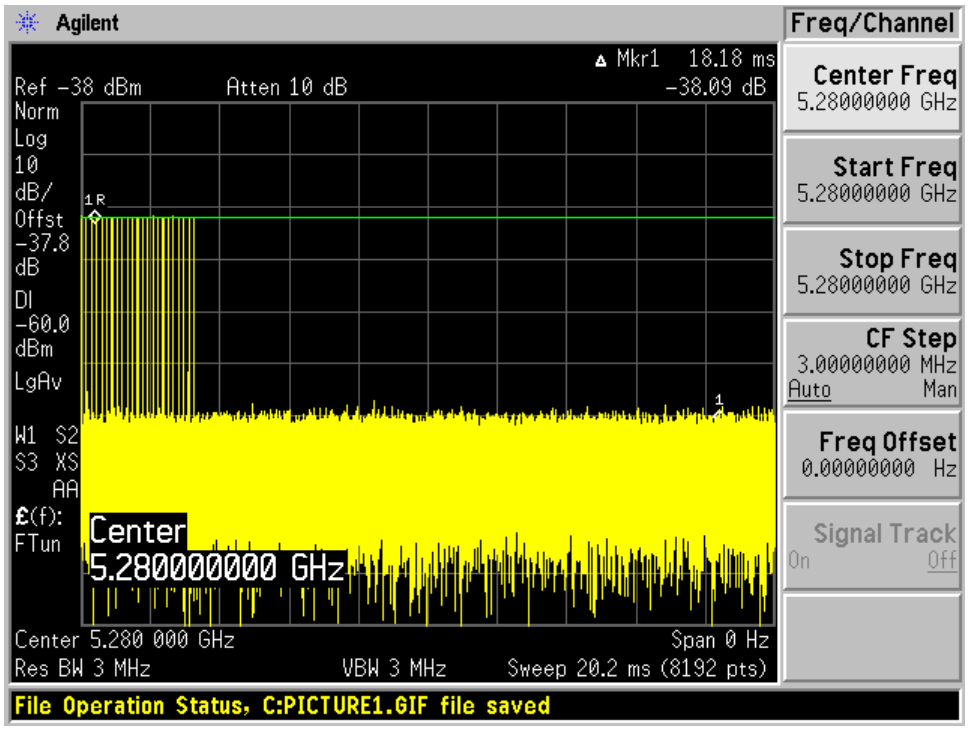
Plots of Radar Waveforms

5280 MHz

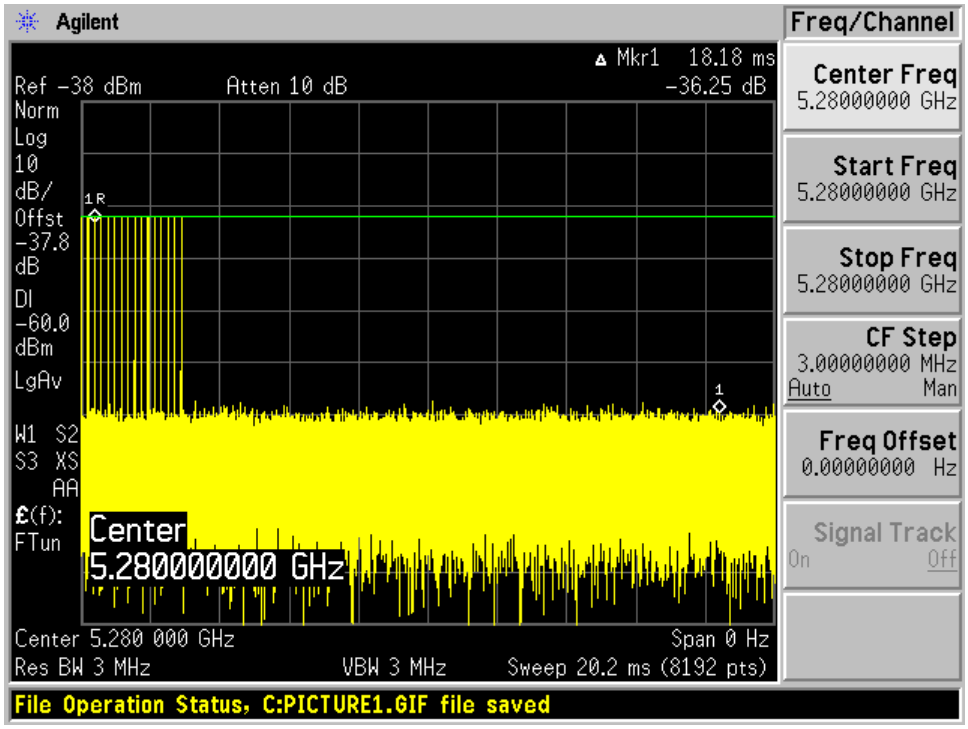
Radar Type 1



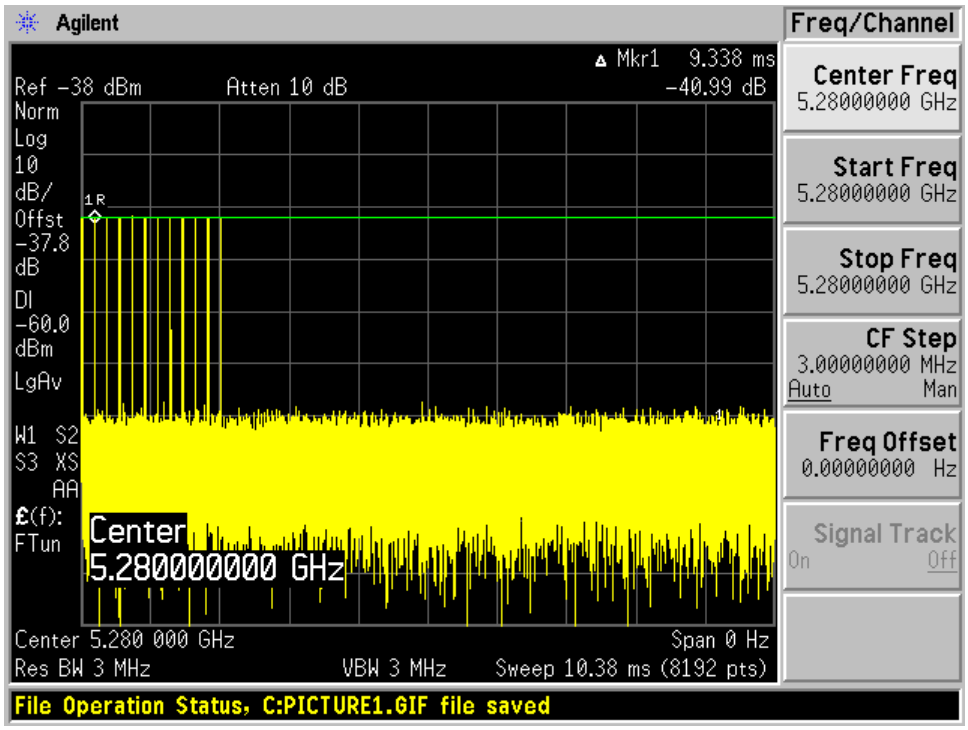
Radar Type 2



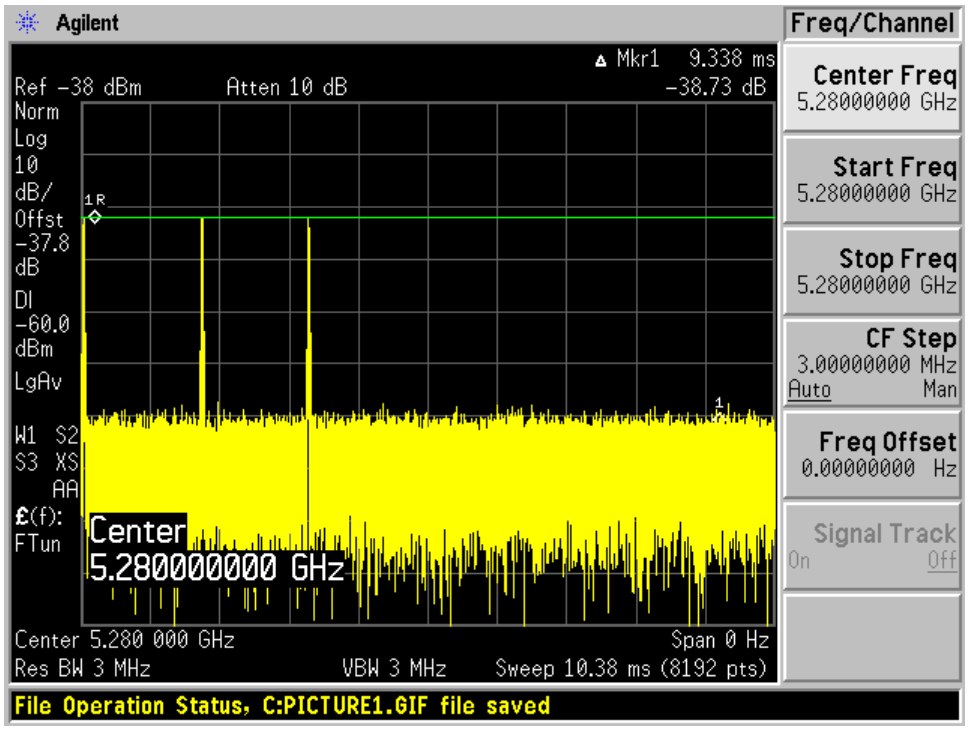
Radar Type 3



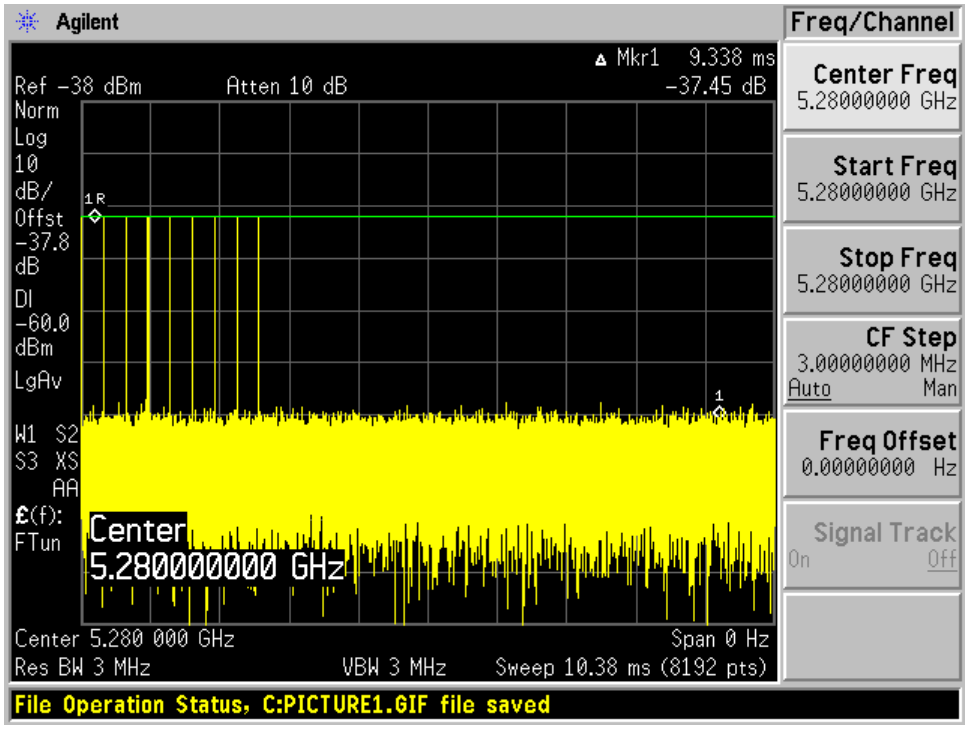
Radar Type 4



Radar Type 5

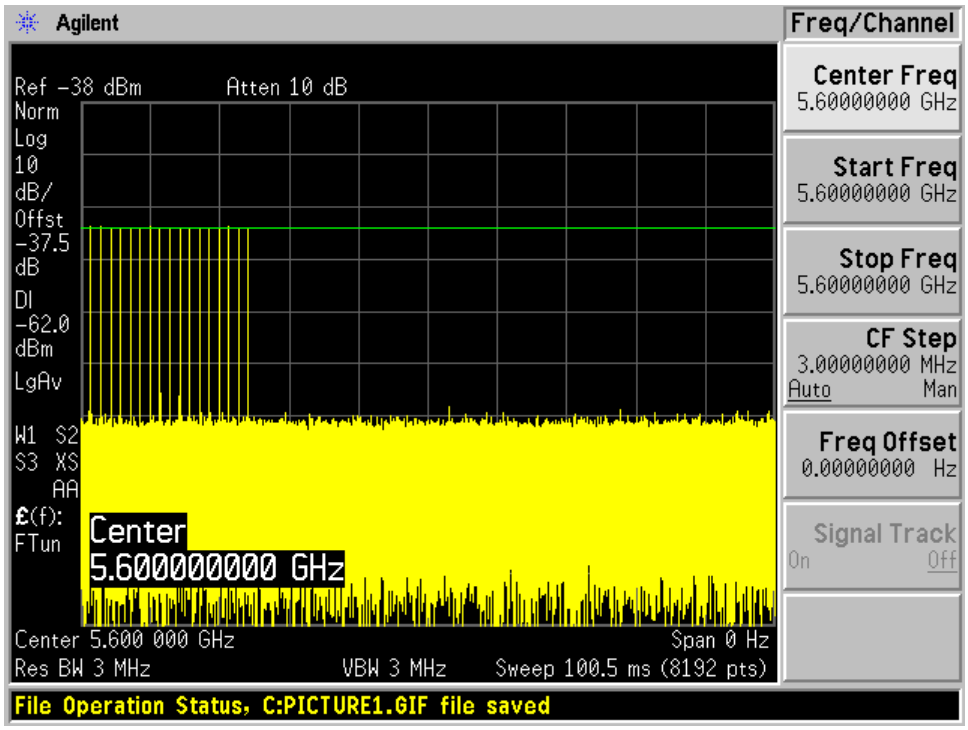


Radar Type 6

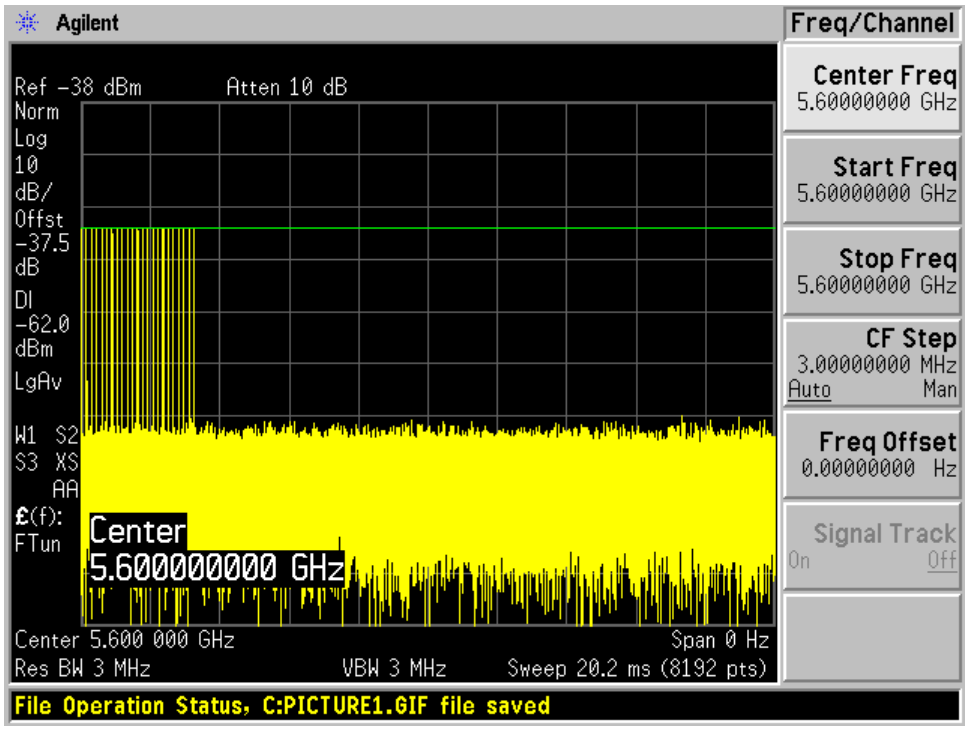


5600 MHz

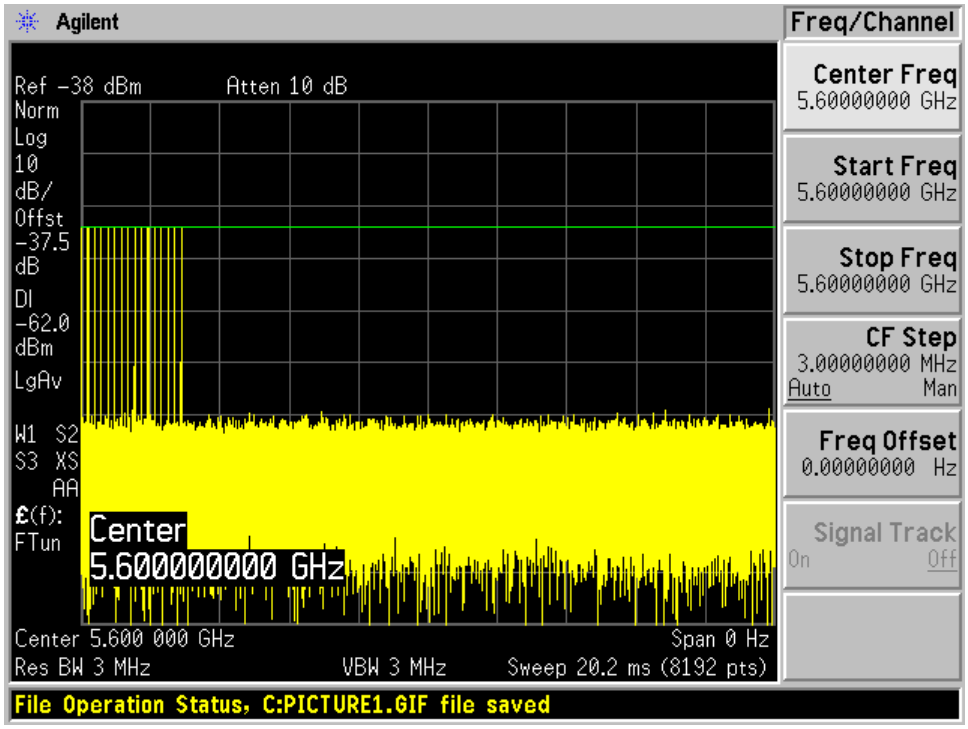
Radar Type 1



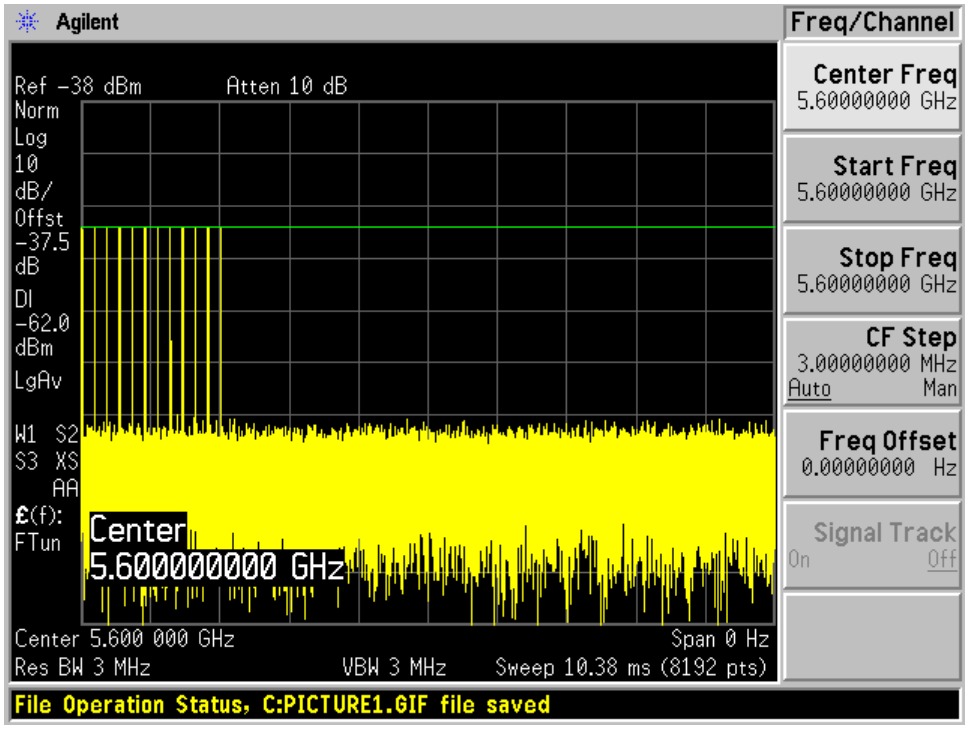
Radar Type 2



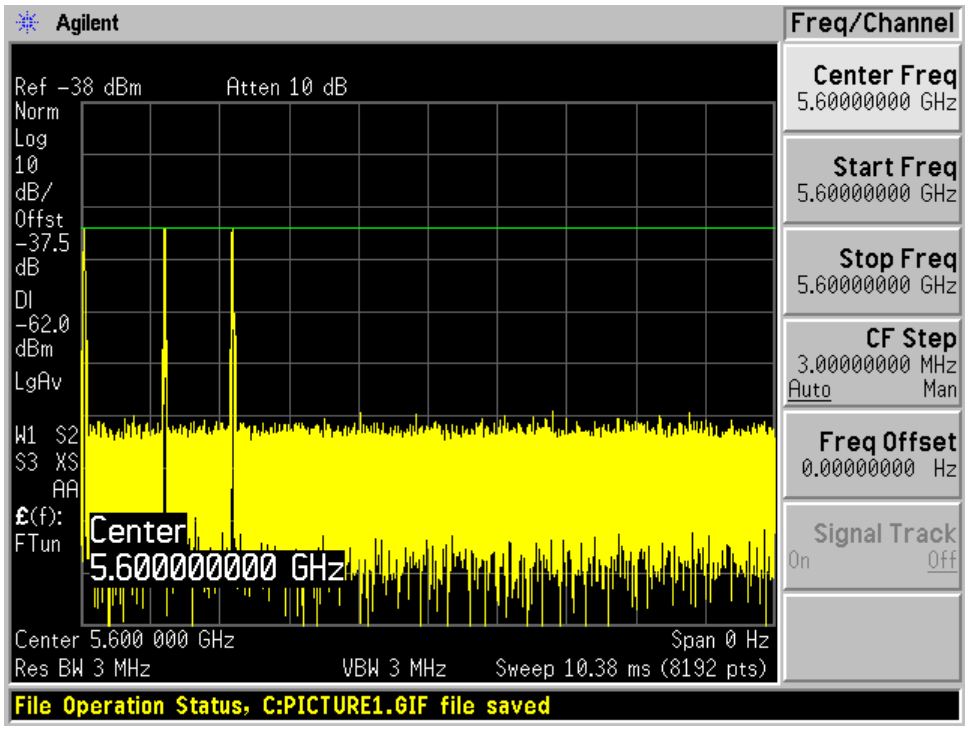
Radar Type 3



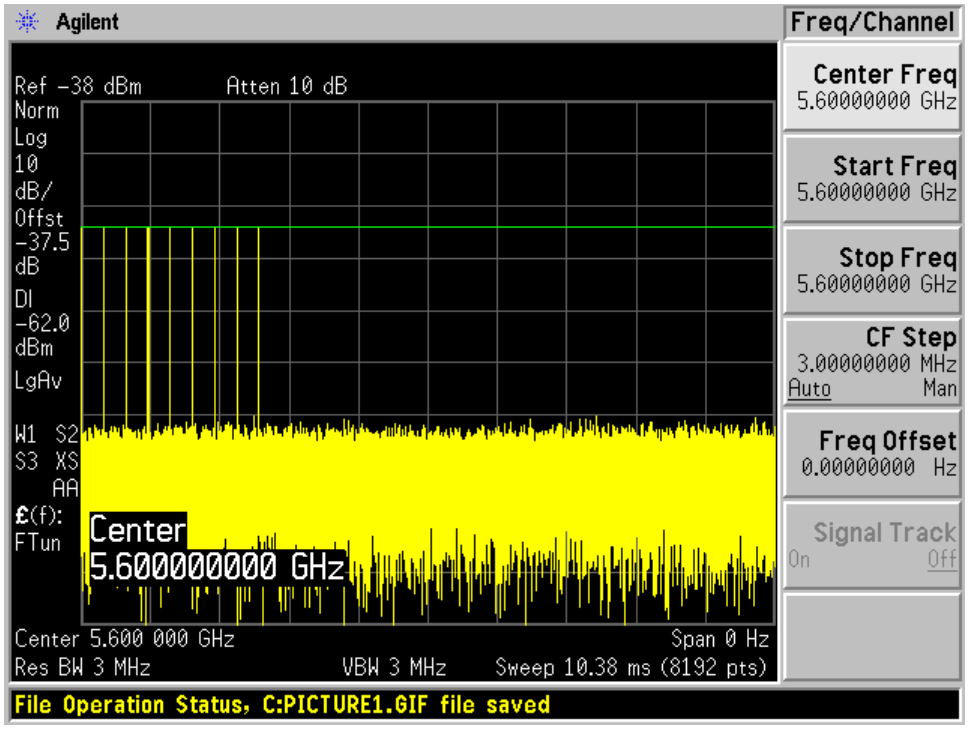
Radar Type 4



Radar Type 5



Radar Type 6



Channel Move time and channel closing transmission time

Test Procedure:

Perform one of the type1 to type 4 short pulse radar waveform, BACL use type 1 radar signal, repeat using a long pulse radar type5 waveform.

The aggregate channel closing transmission time is calculated as follows:

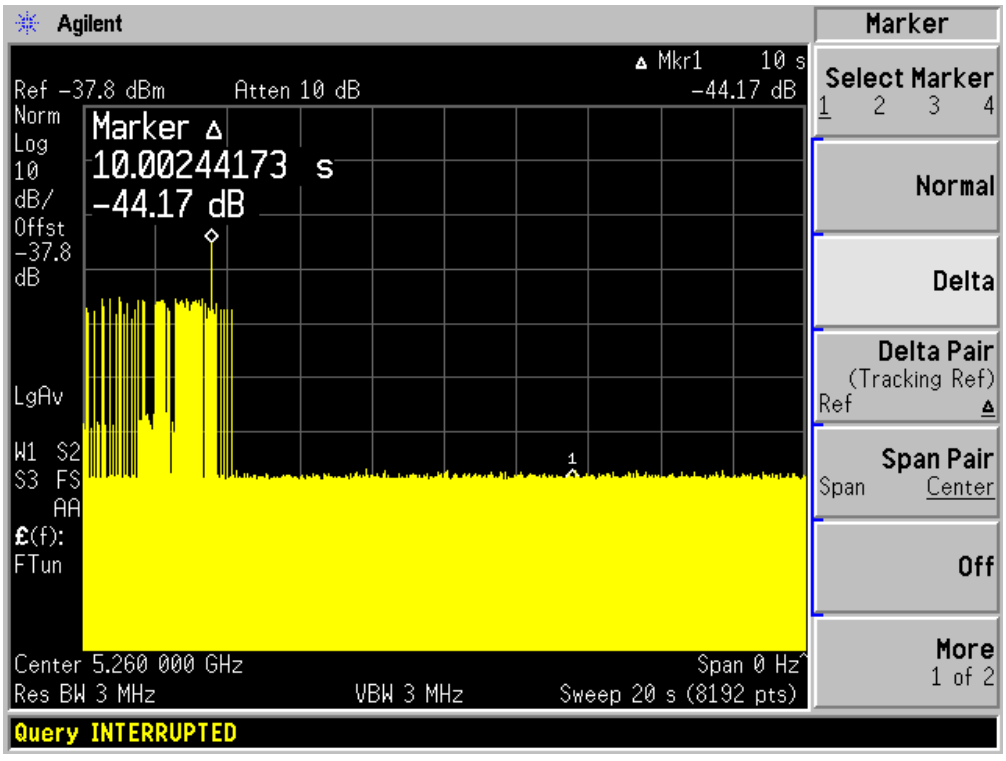
Aggregate Transmission Time = N * Dwell Time

N is the number of spectrum analyzer bins showing a device transmission
Dwell Time is the dwell time per bin (i.e. Dwell Time = S/B, S is the sweep time and B is the number of bin, i.e. 8192)

5260 MHz

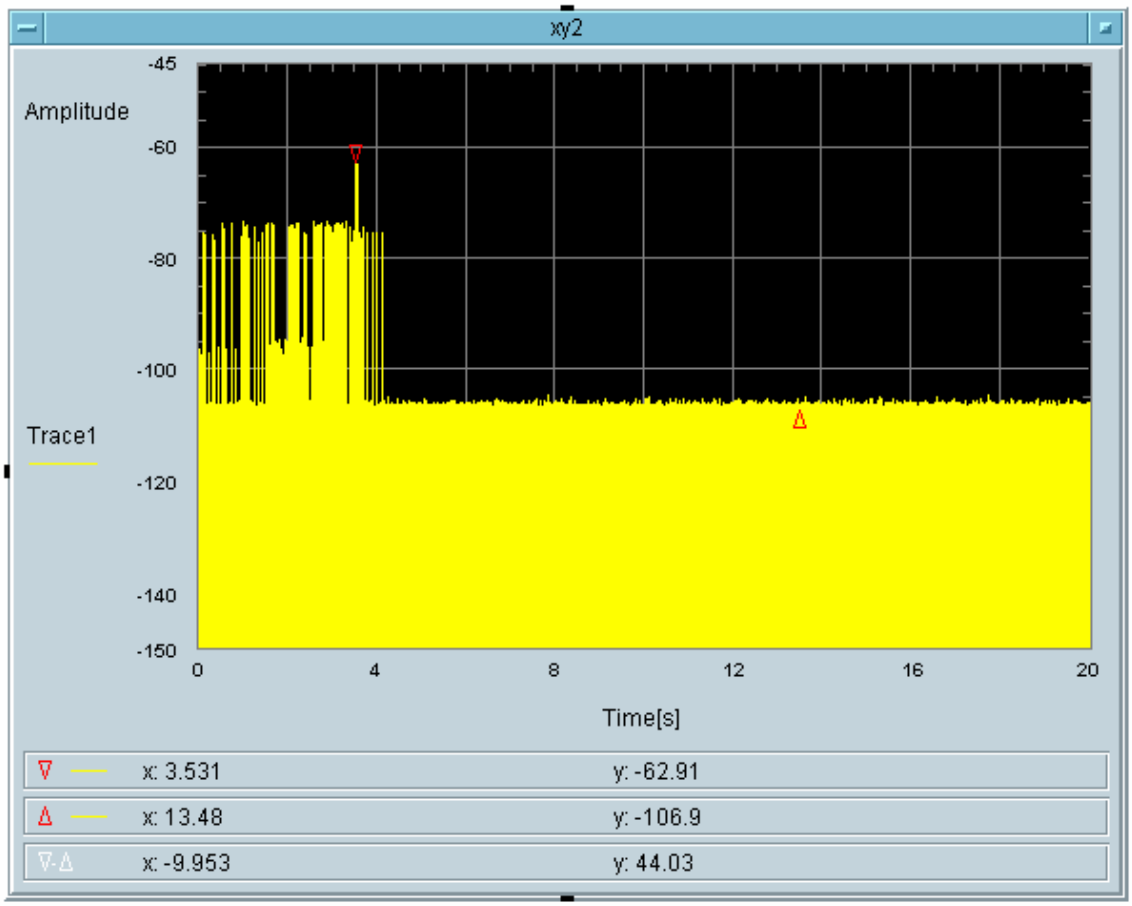
Type 1 radar channel move time result:

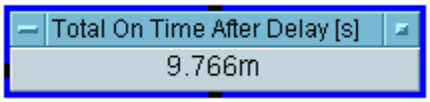
Channel Move Time (sec.)	Limit (sec.)
0.673	10



Type1 radar channel closing transmission time result:

Aggregate Transmission Time (ms)	Limit (ms)	Margin (ms)
9.766	60	50.234

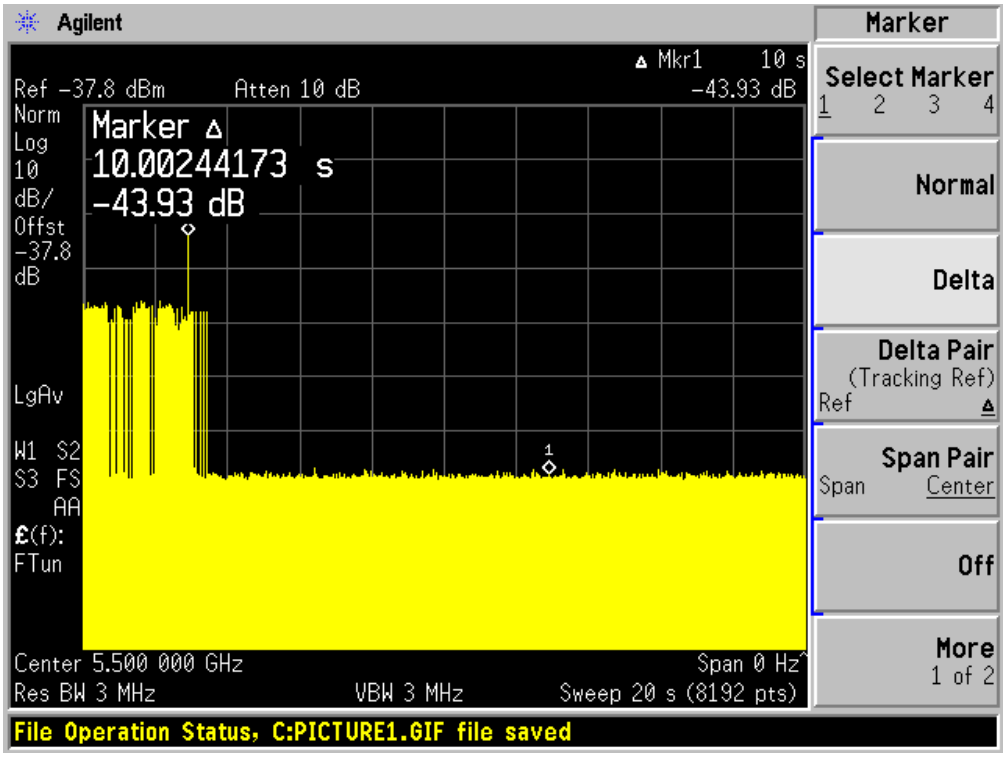




5500 MHz

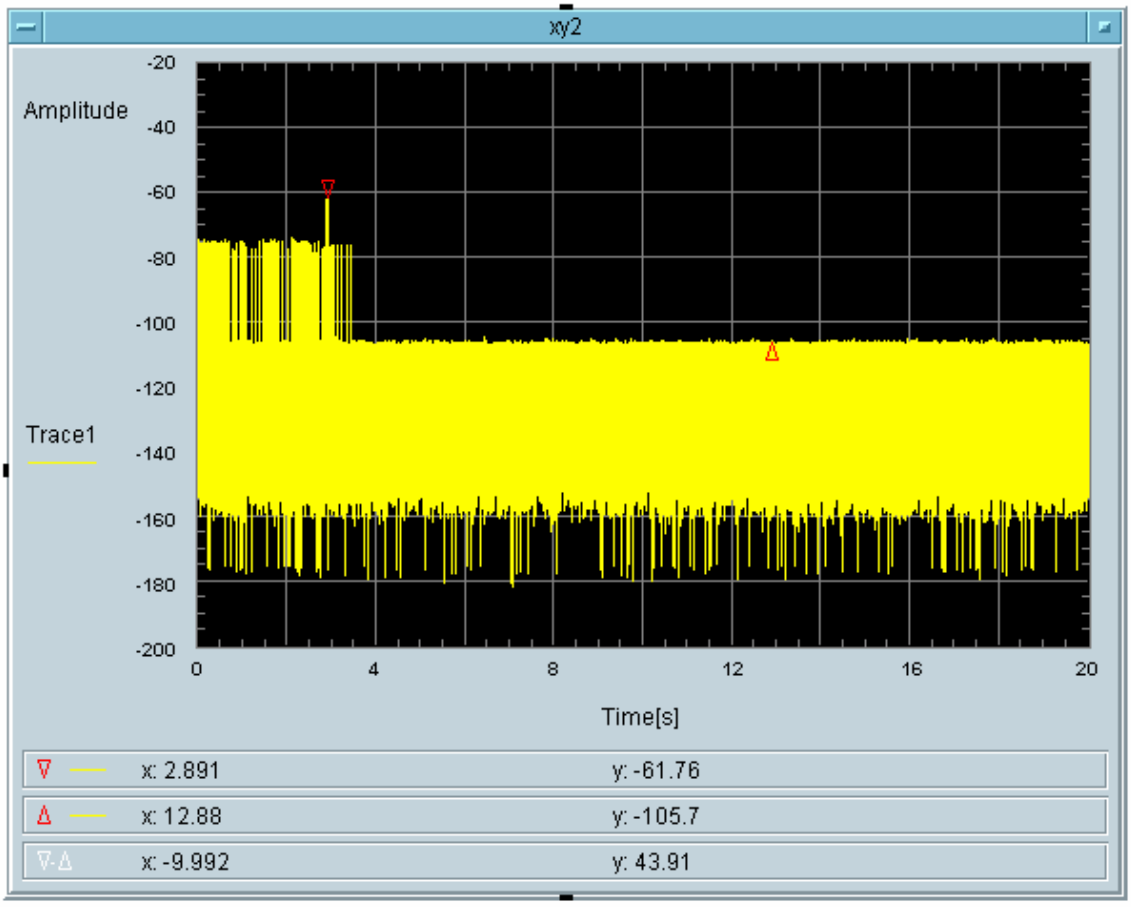
Type 1 radar channel move time result:

Channel Move Time (sec.)	Limit (sec.)
0.576	10



Type1 radar channel closing transmission time result:

Aggregate Transmission Time (ms)	Limit (ms)	Margin (ms)
7.324	60	52.676



Non-Occupancy Period

Test Procedure

Client device is not permitted to transmit beacons on DFS frequencies.

1) Non-associated test: The master has been off, monitor the analyzer on the test mode frequency that have been selected for testing, power up the client for 30 minutes to make sure no beacons have been transmitted.
2) Associated test: Associate the master and client and stream the movie as specified for non-occupancy test. Transmit Radar type 1, monitor the test frequency to make sure no beacons have been transmitted for 30 minutes.

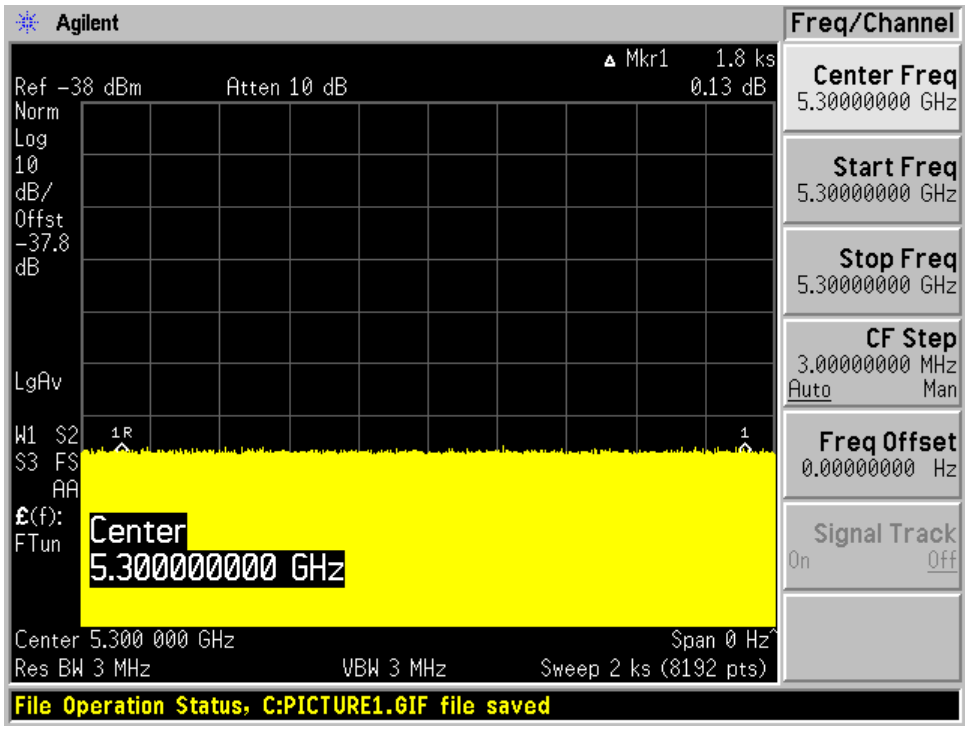
Result: Pass.

Mode	Results
Non-Associated	No Beacons transmit
Associated	No transmissions

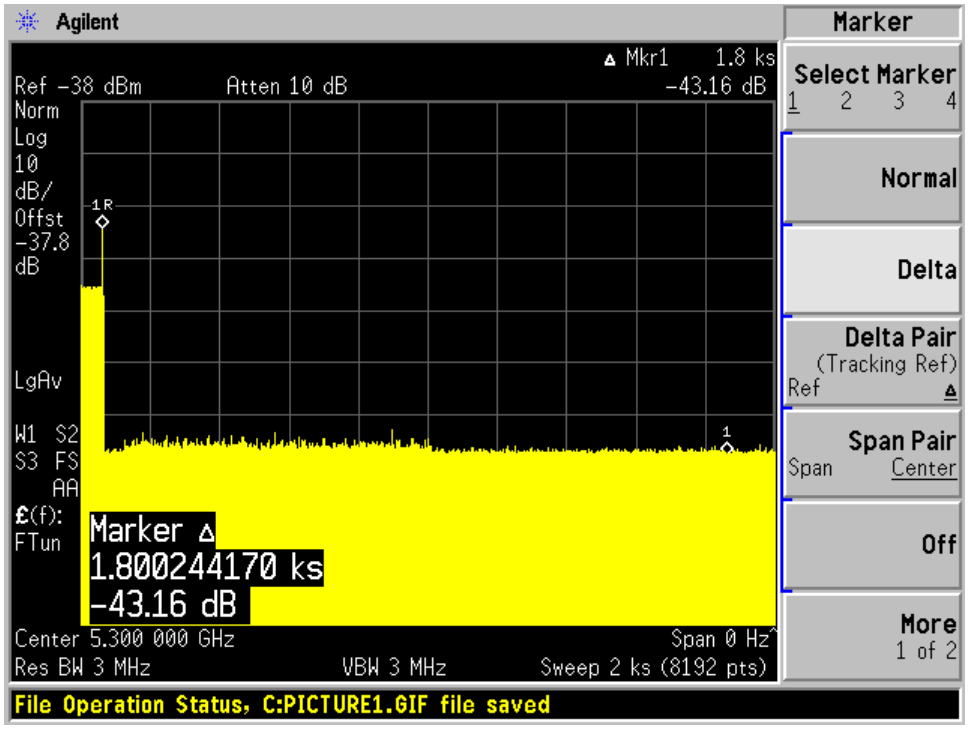
Please refer to the following plots.

5300 MHz:

1) Non-associated:

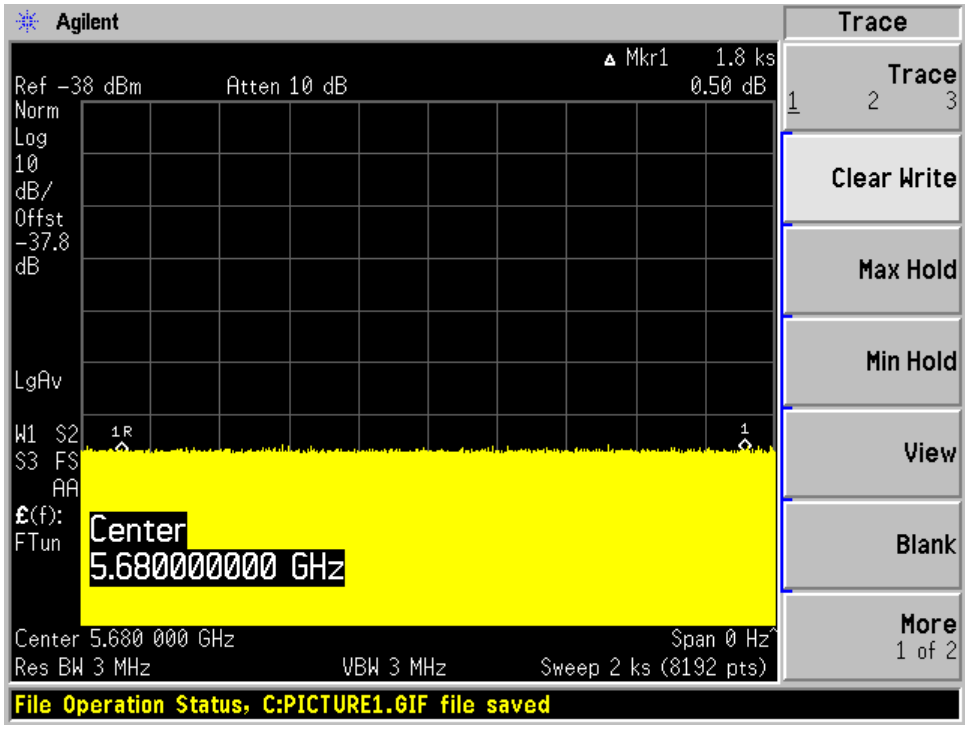


2) Associated:



5680 MHz:

1) Non-associated:



2) Associated: