FCC 47 CFR PART 15 SUBPART E

Product Type	:	Play-Fi Player
Applicant	:	Phorus, Inc.
Address	:	16255 Ventura Boulevard, Suite 310,Encino ,United States, 91436
Trade Name	:	Phorus
Model Number	:	PS2 Speaker
Test Specification	:	FCC 47 CFR PART 15 SUBPART E: Oct., 2012 Canada RSS-210 ISSUE 8: Dec., 2010 Canada RSS-Gen ISSUE 3: Dec., 2010 ANSI C63.10-2009 ANSI C63.4-2009
Application Purpose	:	Original
Receive Date	:	Apr. 18, 2013
Test Period	:	Apr. 23 ~ May 03, 2013
Issue Date	:	Sep. 03, 2013

Issue by

A Test Lab Techno Corp.
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Taiwan Accreditation Foundation accreditation number: 1330

Revision History

Rev.	Issue Date	Revisions	Revised By
00	Sep. 03, 2013	Initial Issue	

Verification of Compliance

Issued Date: 09/03/2013

Product Type	:	Play-Fi Player
Applicant	:	Phorus, Inc.
Address	:	16255 Ventura Boulevard, Suite 310,Encino ,United States, 91436
Trade Name	:	Phorus
Model Number	:	PS2 Speaker
FCC ID	:	2AAWQ-PS2SPEAKER
IC	:	11138A-PS2SPEAKER
EUT Rated Voltage	:	DC 12V, 2A
Test Voltage	:	120 Vac / 60 Hz
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART E: Oct., 2012 Canada RSS-210 ISSUE 8: Dec., 2010 Canada RSS-Gen ISSUE 3: Dec., 2010 ANSI C63.10-2009 ANSI C63.4-2009
Test Result	:	Complied
Application Purpose	:	Original
Performing Lab.	:	A Test Lab Techno Corp. No. 140-1, Changan Street, Bade City, Taoyuan County 334, Taiwan R.O.C. Tel：+86-3-2710188 / Fax：+86-3-2710190 Taiwan Accreditation Foundation accreditation number: 1330 http://www.atl-lab.com.tw/e-index.htm

A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By	:		Reviewed By	:	
(Manager)		(Murphy Wang)	(Testing Engineer)		(Fly Lu)

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1 EUT Description

Product Type	Play-Fi Player			
Trade Name	Phorus			
Model Number	PS2 Speaker			
Applicant	Phorus, Inc. 16255 Ventura Boulevard, Suite 310,Encino ,United States,91436			
Manufacturer	Wistron InfoComm (Zhongshan) Corporation Linhai Branch Xiyiwei, Ma'an Cun, Zhongshan Torch Development Zone, Zhongshan City, Guangdong, China			
FCC ID	2AAWQ-PS2SPEAKER			
IC	11138A-PS2SPEAKER			
Frequency Range	Band	Mode	Frequency Range (MHz)	Number of Channels
	UNII Band II	IEEE 802.11n Standard-20 MHz	5260 – 5320	4 Channels
		IEEE 802.11n Wide-40 MHz	5270 – 5310	2 Channels
	UNII Band III	IEEE 802.11n Standard-20 MHz	5500 – 5700	11 Channels
		IEEE 802.11n Wide-40 MHz	5510 – 5670	5 Channels
Type of Modulation	OFDM			
Equipment Type	Client (without DFS)			

2 Test Methodology

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, RSS-GEN Issue 3, and RSS-210 Issue 8.

3 Dynamic Frequency Selection

3.1. LIMITS

Industry Canada

IC RSS-210 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-210 Issue 8 A9.4 (b) (ii) Channel Availability Check Time:

Additional requirements for the band 5600-5650 MHz: Until further notice, devices subject to this Section shall not be capable of transmitting in the band 5600-5650 MHz, so that Environment Canada weather radars operating in this band are protected.

RSS-210 Issue 8 A9.4 (b) (iv) Channel closing time: the maximum channel closing time is 260 ms.

FCC

§15.407 (h) and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION.

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client (without DFS)	Client (with DFS)
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
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 3: DFS Detection Thresholds for Master or Client Devices Incorporating DFS	
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 U-NII 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.	

Table 5 –Short Pulse Radar Test Waveforms					
Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

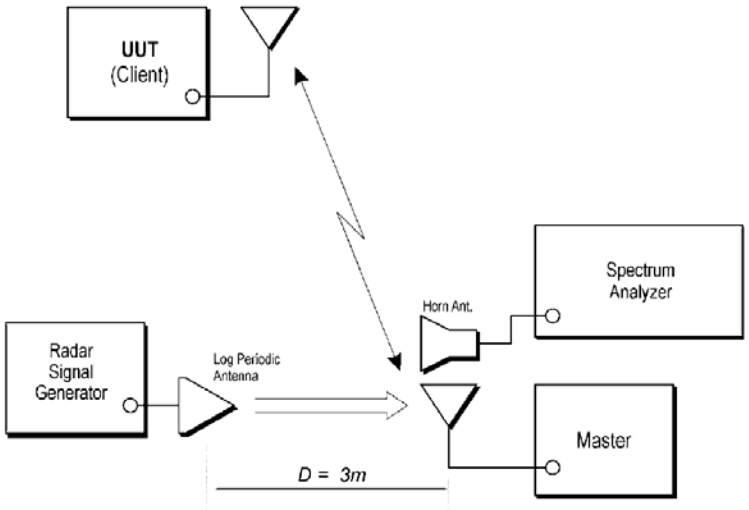
Table 6 –Long Pulse Radar Test Waveform							
Radar Waveform	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000 - 2000	1-3	8-20	80%	30

Table 7 – Frequency Hopping Radar Test Signal							
Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

3.2. Test and Measurement System

3.2.1. Setup for Master with injection at the Master

Example Conducted Setup where UUT is a Master and Radar Test Waveforms are injected into the Master



3.2.2. System Calibration

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the A Test Lab Techno Corp. simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time. The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem of FCC 06-96 APPENDIX. The frequency of the signal generator is incremented in 1 MHz steps from FL to FH for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

3.2.3. System Calibration

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of -64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is -64 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of -64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

3.2.4. Adjustment of Displayed Traffic Level

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. The video test file is streamed to generate WLAN traffic. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

3.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4408B	MY45107753	07/09/2012	(1)
Signal Generator	R&S	SMU200A	102598	01/30/2013	(1)
Test Site	ATL	TE02	TE02	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.

NOTE: N.C.R. = No Calibration Request.

4 Test Methodology

4.1. Mode of Operation

Decision of Test ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: IEEE 802.11n 20MHz U-NII Band II Link Mode
Mode 2: IEEE 802.11n 20MHz U-NII Band III Link Mode
Mode 3: IEEE 802.11n 40MHz U-NII Band II Link Mode
Mode 4: IEEE 802.11n 40MHz U-NII Band III Link Mode

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

IEEE 802.11n 20MHz U-NII Band II mode:
Unless otherwise noted, all tests were performed with the radar burst at the channel center frequency of 5300 MHz.

IEEE 802.11n 20MHz U-NII Band III mode:
Unless otherwise noted, all tests were performed with the radar burst at the channel center frequency of 5500 MHz.

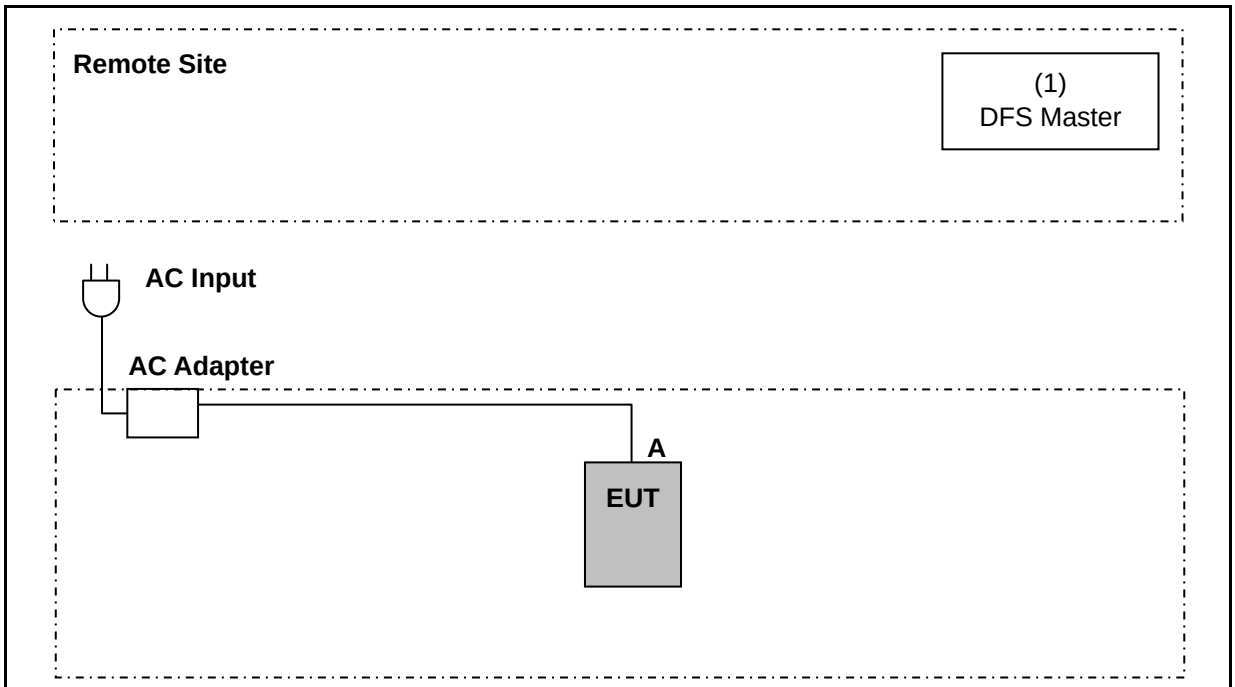
IEEE 802.11n 40MHz U-NII Band II mode:
Unless otherwise noted, all tests were performed with the radar burst at the channel center frequency of 5310 MHz.

IEEE 802.11n 40MHz U-NII Band III mode:
Unless otherwise noted, all tests were performed with the radar burst at the channel center frequency of 5510 MHz.

4.2. EUT Exercise Software

1.	Setup the EUT shown on 3.3.
2.	Turn on the power of all equipment.
3.	Turn on Wi-Fi function link to Notebook.
4.	EUT run test program.

4.3. Configuration of Test System Details



Signal Cable Type		Signal Cable Description
A	DC Power Cable	Non-Shielded, 1.5 m

Devices Description					
Product		Manufacturer	Model Number	FCC ID	IC
(1)	DFS Master	CISCO	AIR-AP1252AG-A-K9	LDK102061	24618-102061

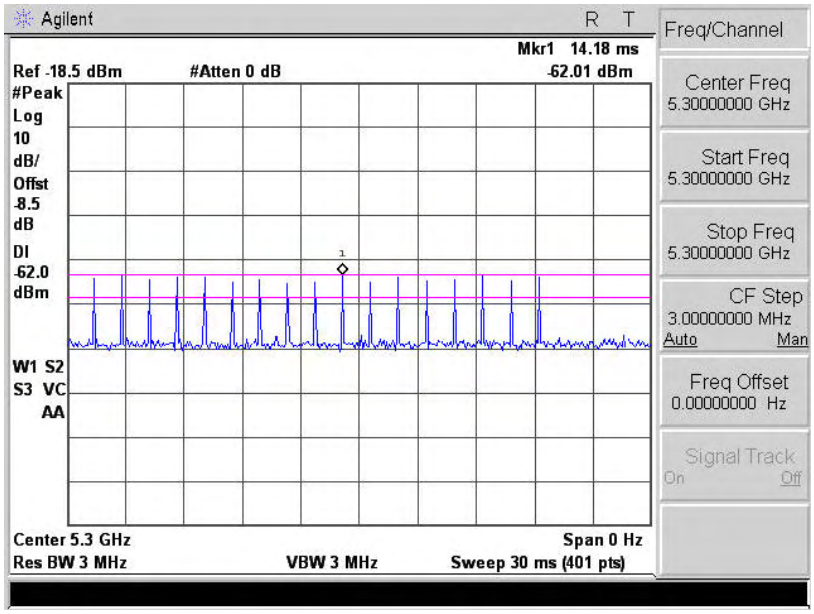
4.4. Test Site Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

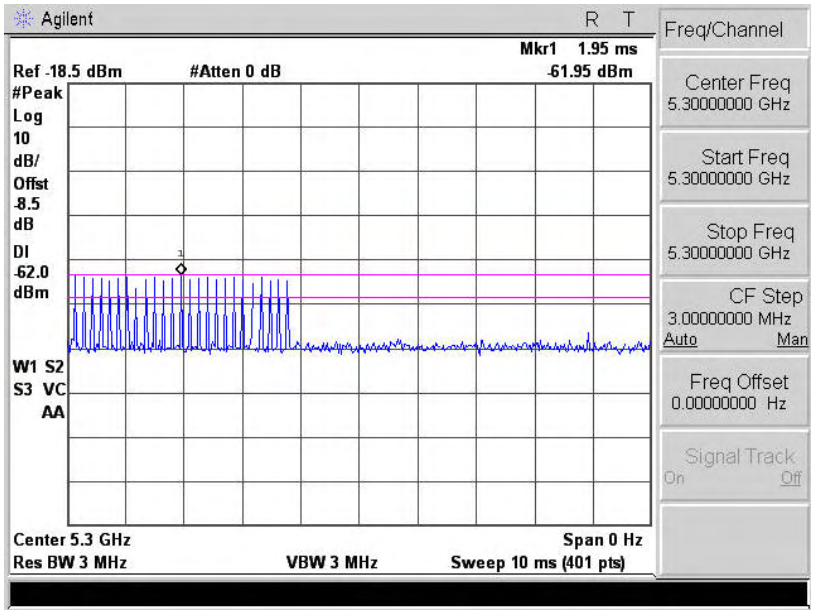
5 Results for 20 MHz Bandwidth

5.1. Radar Waveforms and Traffic

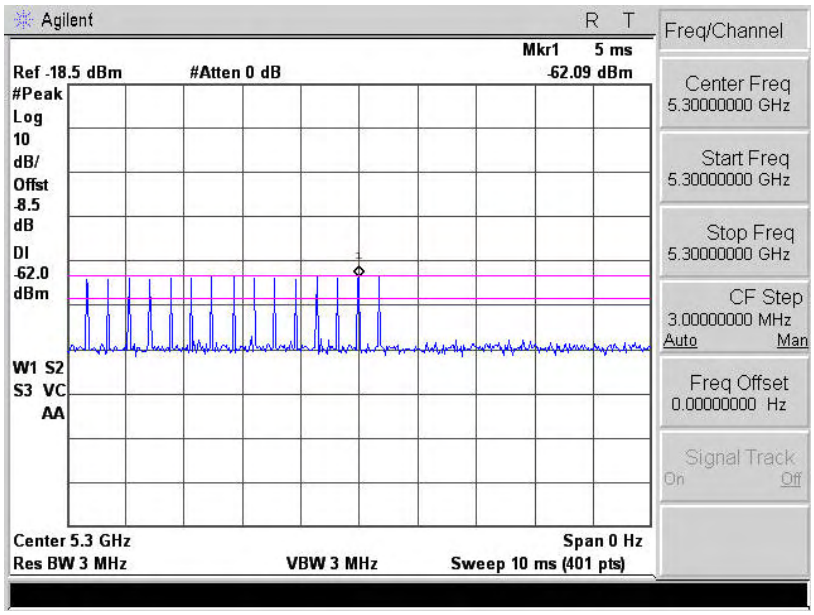
Mode 1: IEEE 802.11n 20MHz U-NII Band II Link Mode
Short Pulse Radar Type 1



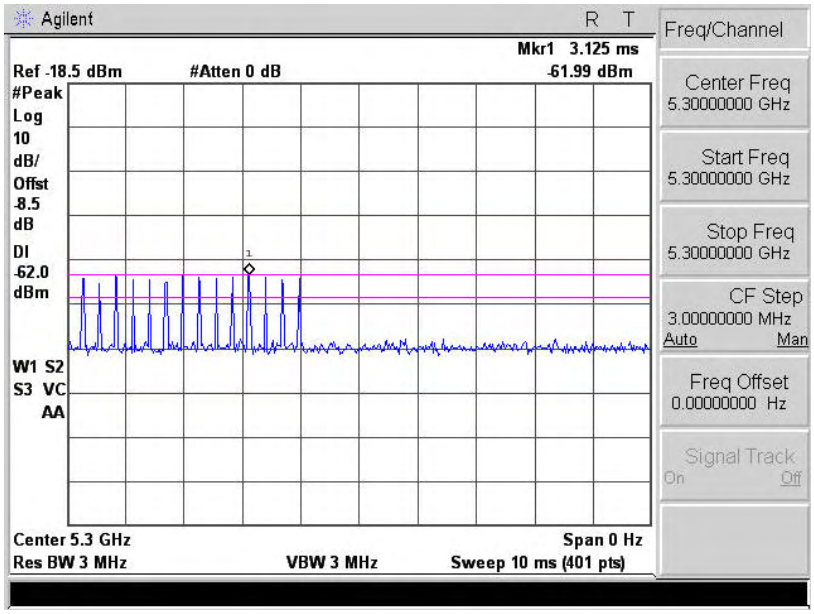
Sample of Radar Type 2



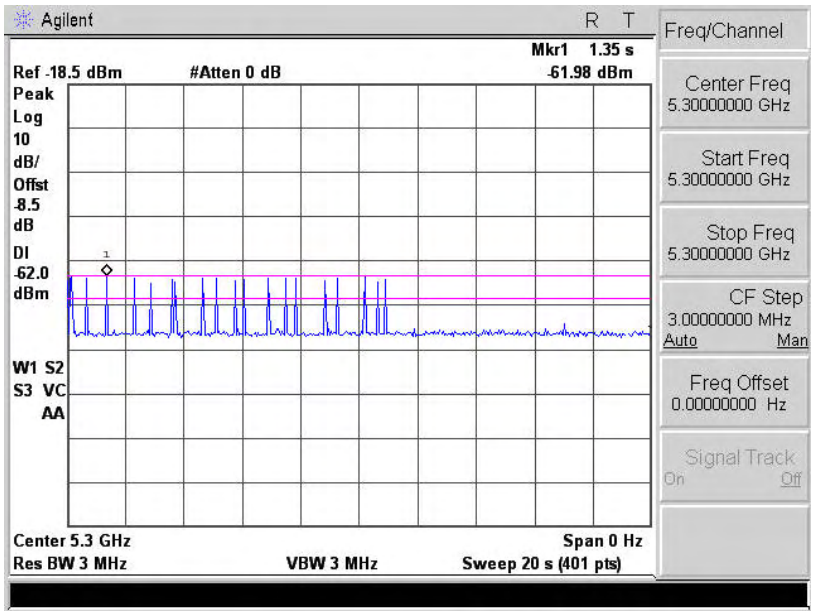
Mode 1: IEEE 802.11n 20MHz U-NII Band II Link Mode
Sample of Radar Type 3



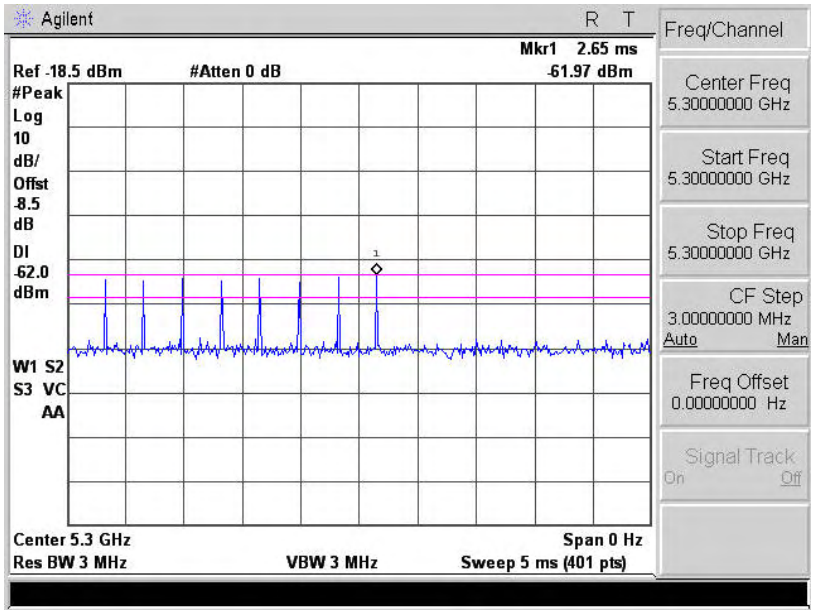
Sample of Radar Type 4



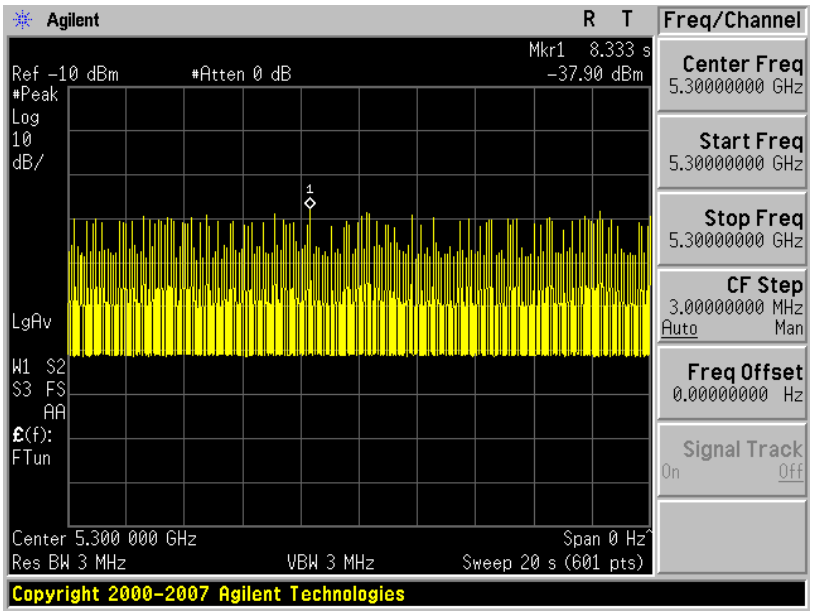
Mode 1: IEEE 802.11n 20MHz U-NII Band II Link Mode
Sample Of Single Burst of Radar Type 5



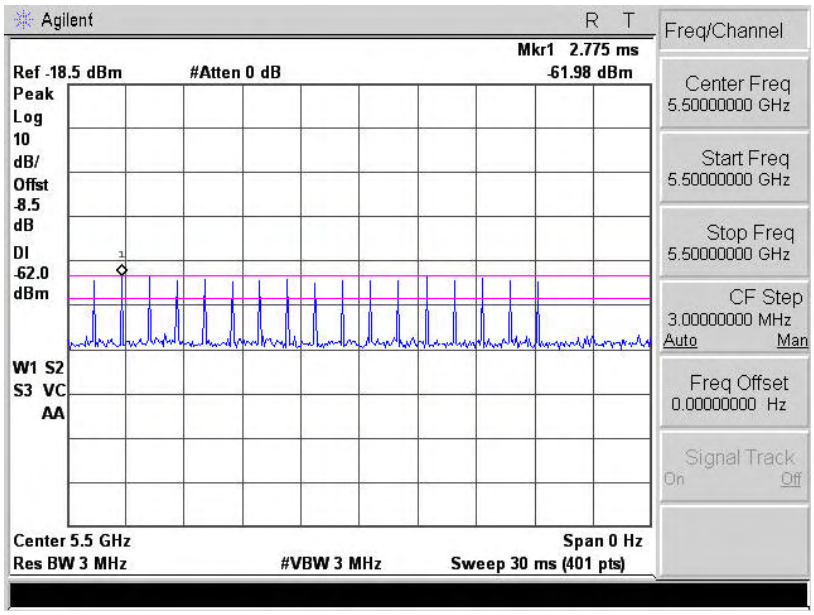
Single Burst of Radar Type 6



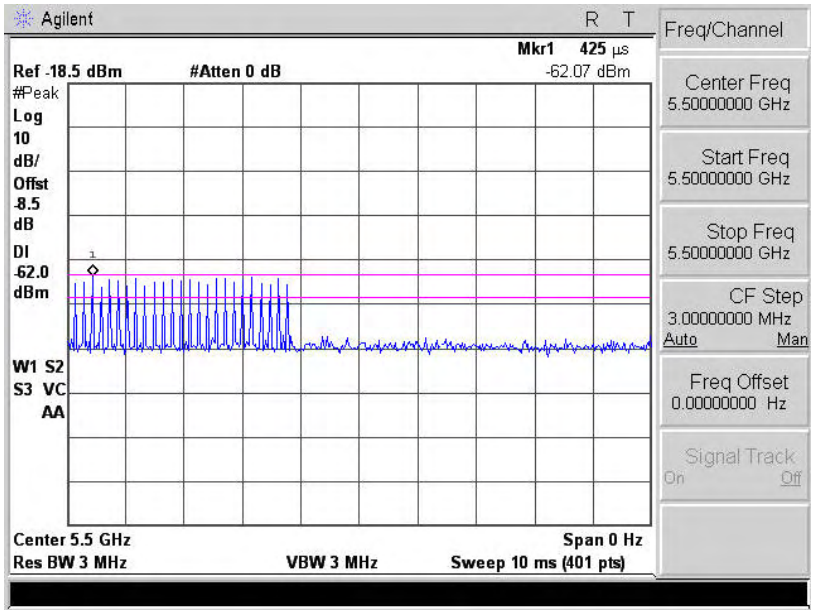
Mode 1: IEEE 802.11n 20MHz U-NII Band II Link Mode
Traffic



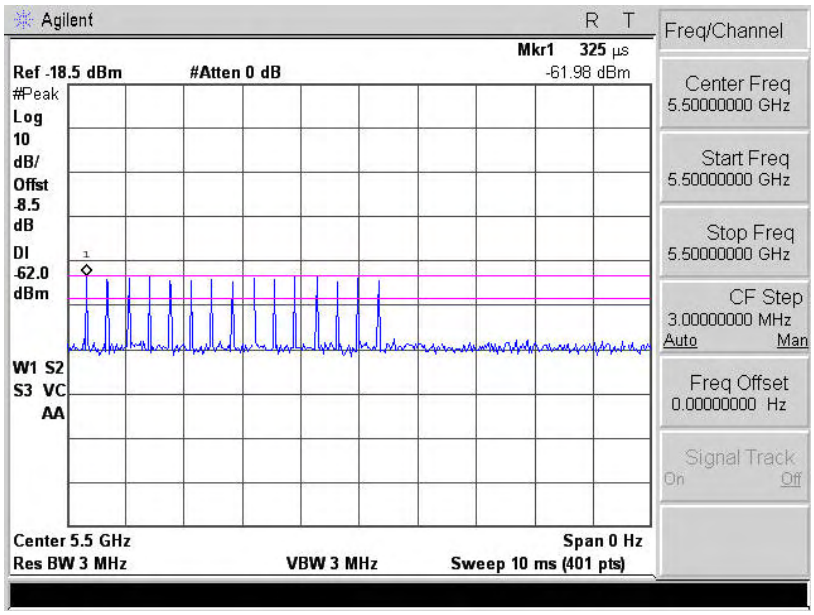
Mode 2: IEEE 802.11n 20MHz U-NII Band III Link Mode
Short Pulse Radar Type 1



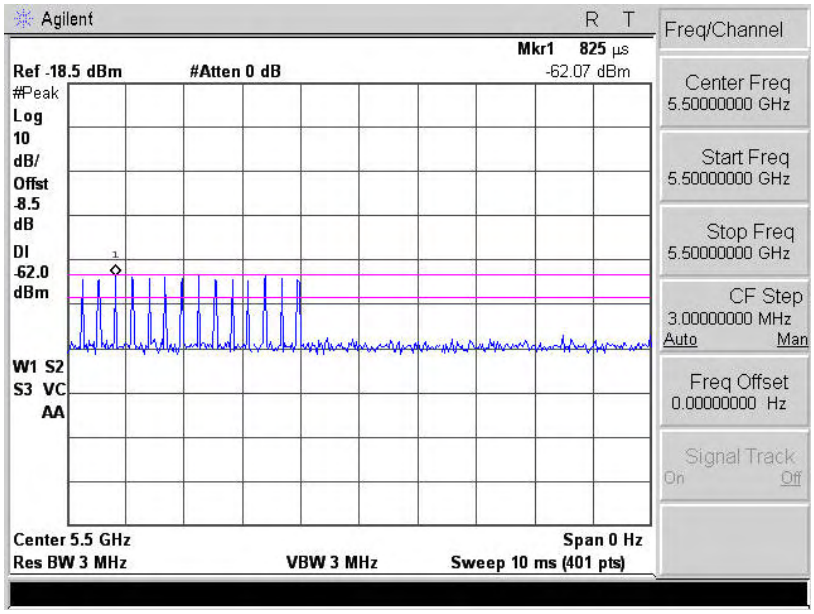
Sample of Radar Type 2



Mode 2: IEEE 802.11n 20MHz U-NII Band III Link Mode
Sample of Radar Type 3

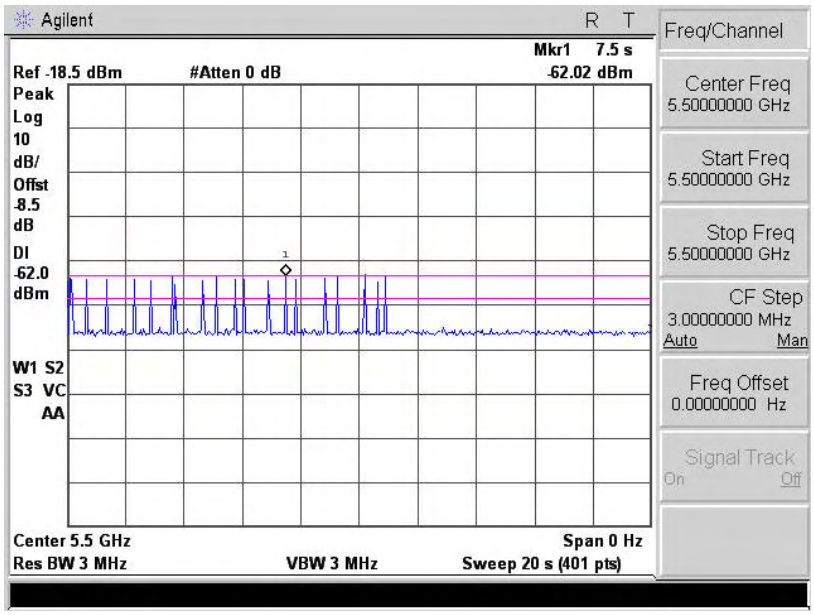


Sample of Radar Type 4

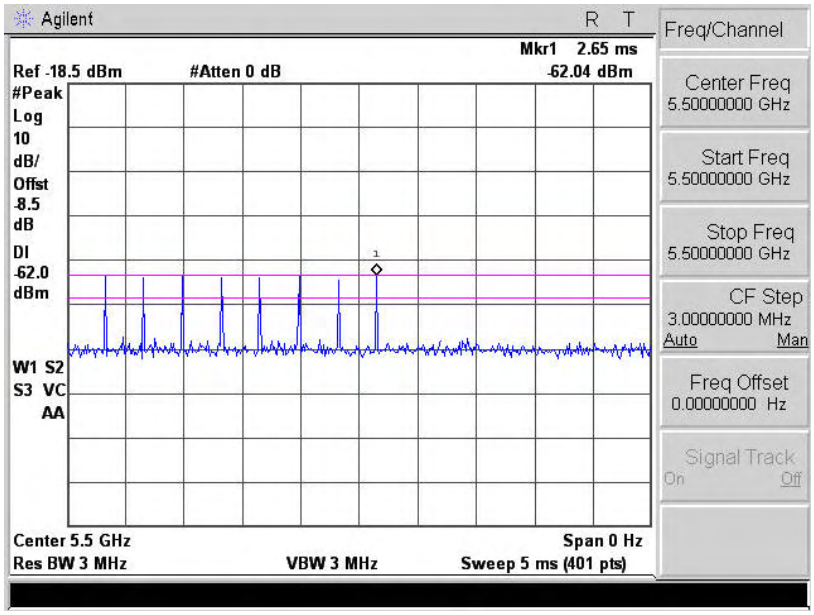


Mode 2: IEEE 802.11n 20MHz U-NII Band III Link Mode

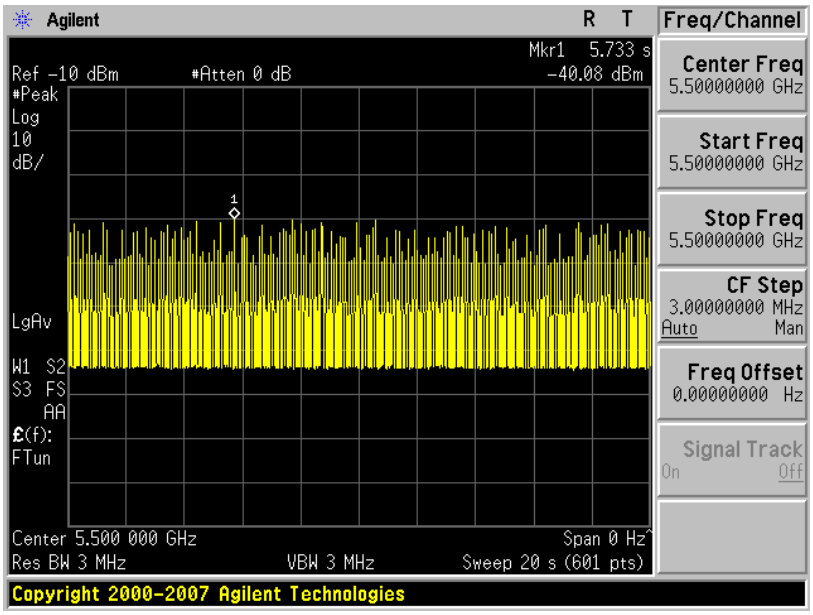
Sample Of Single Burst of Radar Type 5



Single Burst of Radar Type 6



Mode 2: IEEE 802.11n 20MHz U-NII Band III Link Mode
Traffic



5.2. Channel Availability Check Time

5.2.1. Procedure to Determine Initial Power-Up Cycle Time

A link was established on channel then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

5.2.2. Procedure for Timing Of Radar Burst

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

5.2.3. Quantitative Results

These tests are not applicable.

5.3. Overlapping Channel Tests

5.3.1. Results

These tests are not applicable.

6.4. Move and Closing Time

6.4.1. Reporting Notes

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse.
This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:
Aggregate Transmission Time = (Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

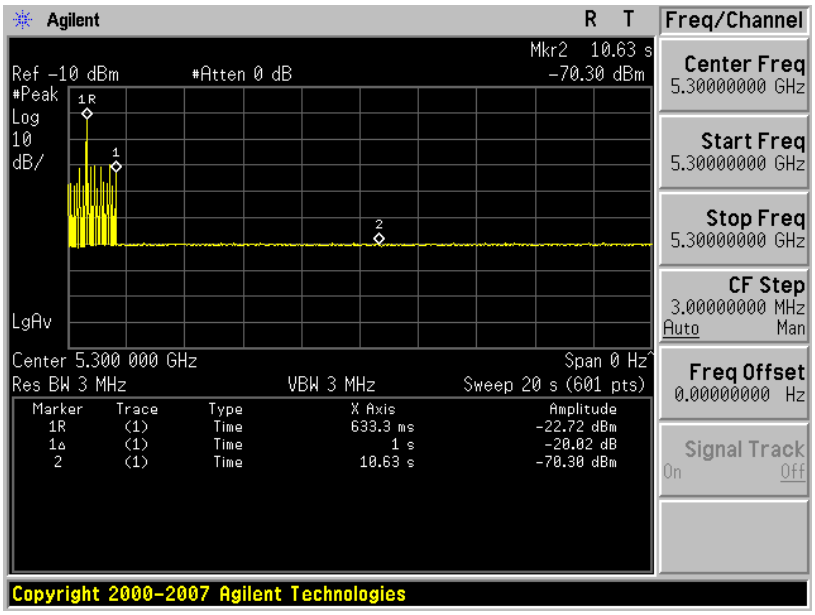
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

Results

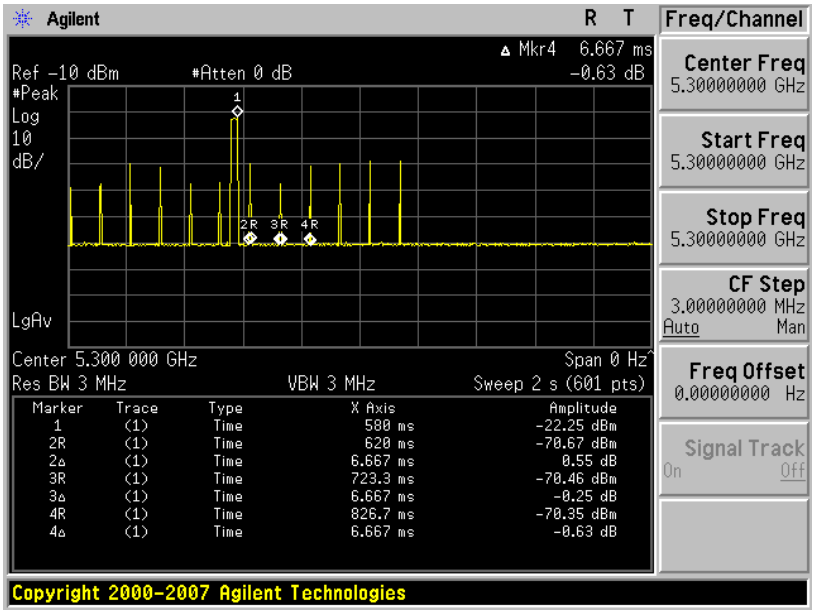
Agency	Frequency (MHz)	Channel Move Time (sec)	Limit (sec)
FCC / IC	5300	0.8667	10
	5510	0.9333	10

Agency	Frequency (MHz)	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	5300	40.002	260
	5510	40.002	260
IC	5300	40.002	260
	5510	40.002	260

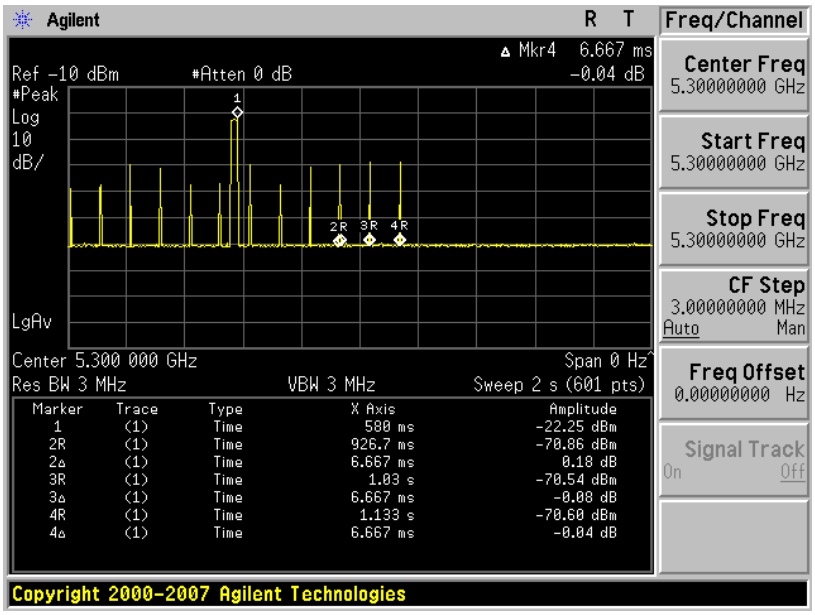
Mode 1: IEEE 802.11n 20MHz U-NII Band II Link Mode
Move Time



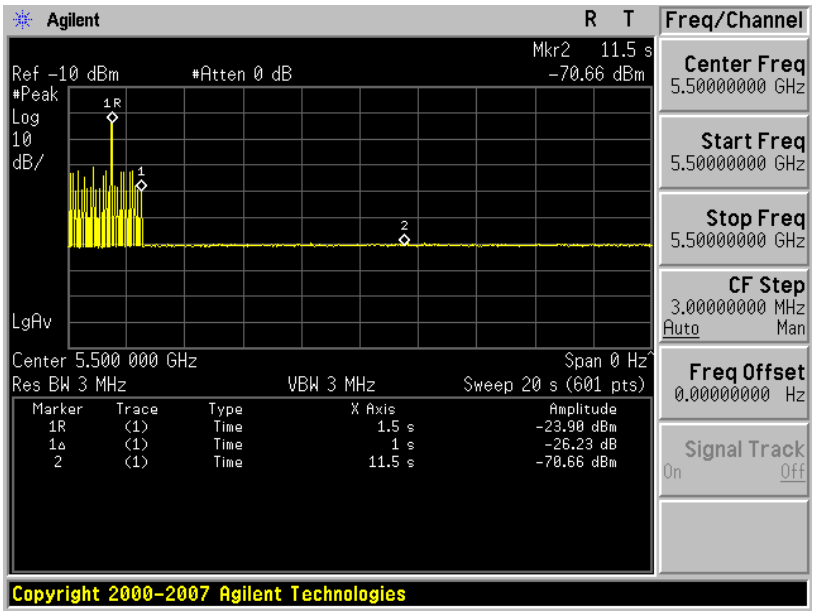
Channel Closing Time



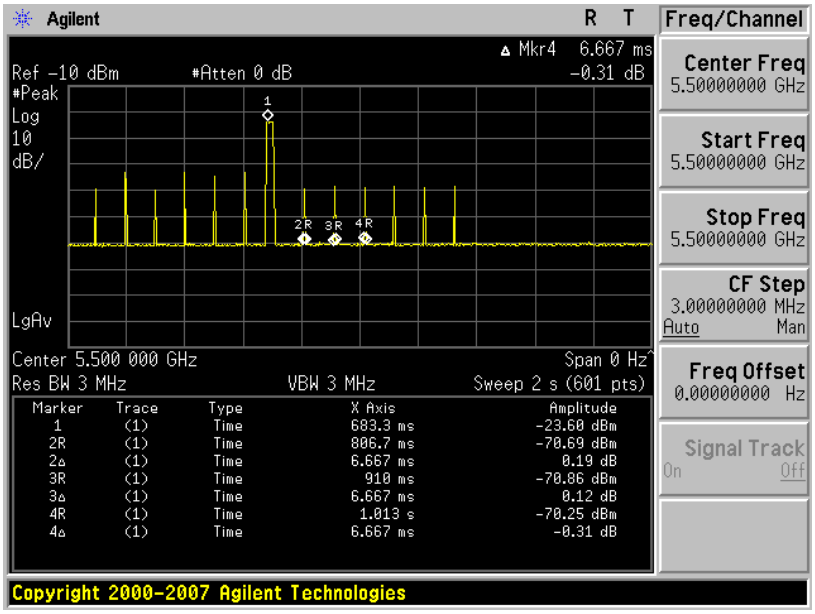
Mode 1: IEEE 802.11n 20MHz U-NII Band II Link Mode
Channel Closing Time



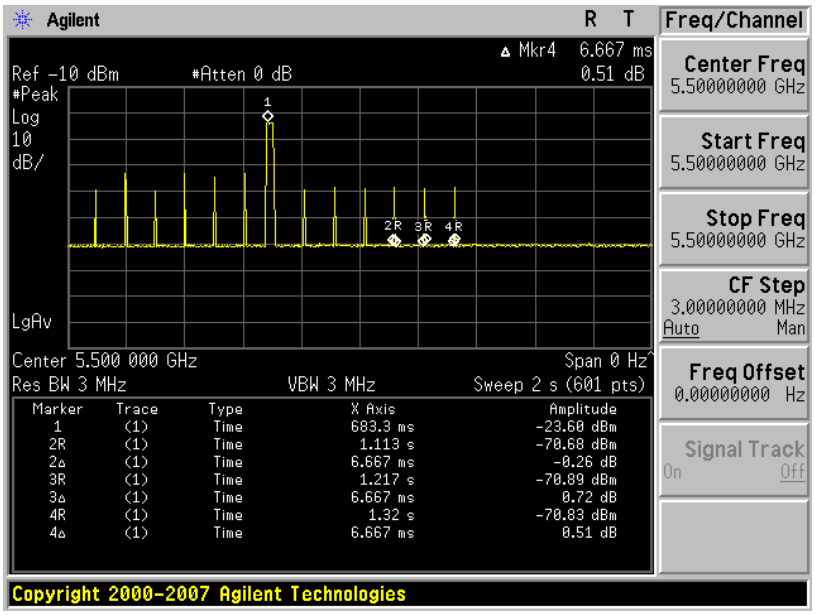
Mode 2: IEEE 802.11n 20MHz U-NII Band III Link Mode
Move Time



Channel Closing Time



Mode 2: IEEE 802.11n 20MHz U-NII Band III Link Mode
Channel Closing Time

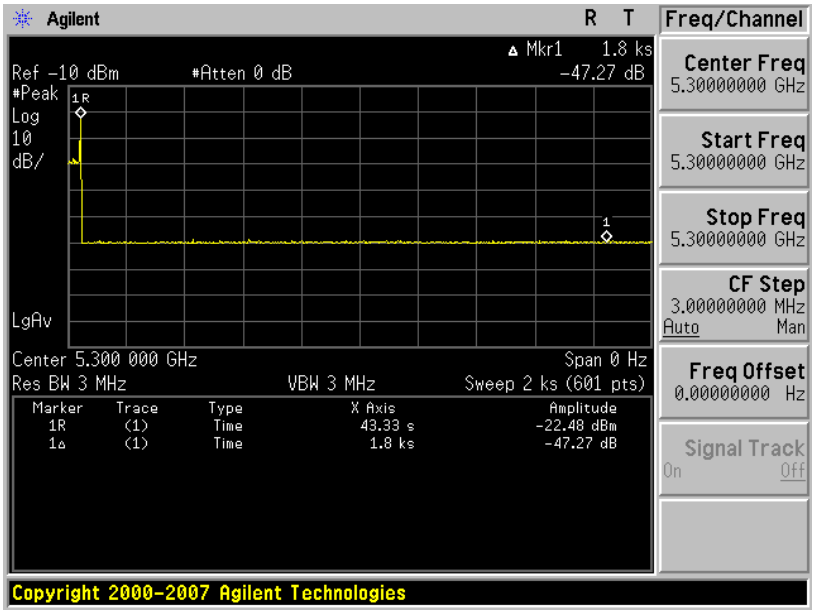


5.5. Non-Occupancy Period

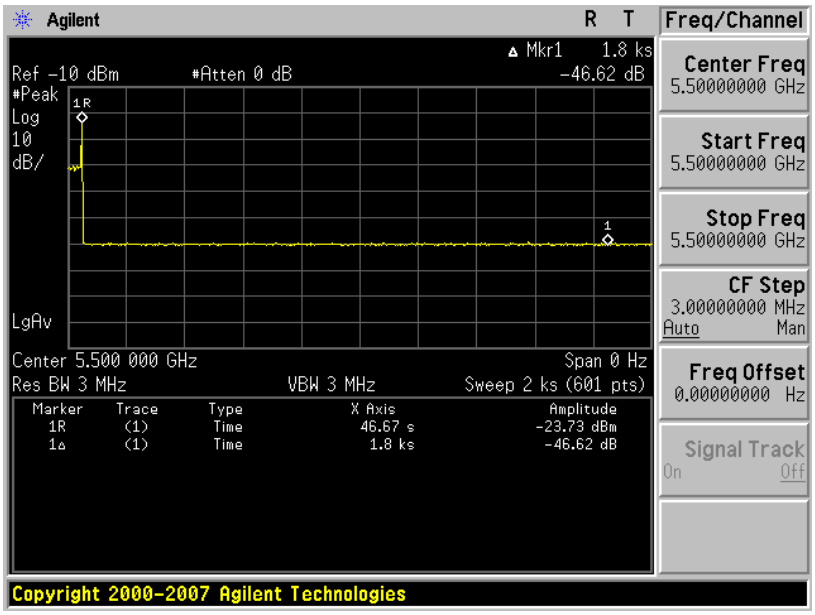
Results

No EUT transmissions were observed on the test channel during the 30-minute observation time.

Mode 1: IEEE 802.11n 20MHz U-NII Band II Link Mode
Reference Plot Of 99% Power Bandwidth



Mode 2: IEEE 802.11n 20MHz U-NII Band III Link Mode
Reference Plot Of 99% Power Bandwidth



5.6. Detection Bandwidth

These tests are not applicable.

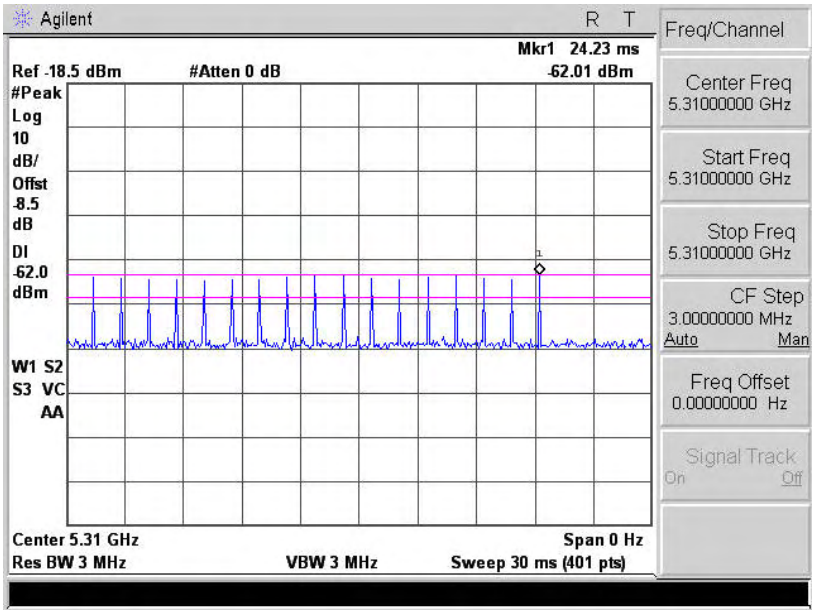
5.7. In-Service Monitoring

These tests are not applicable.

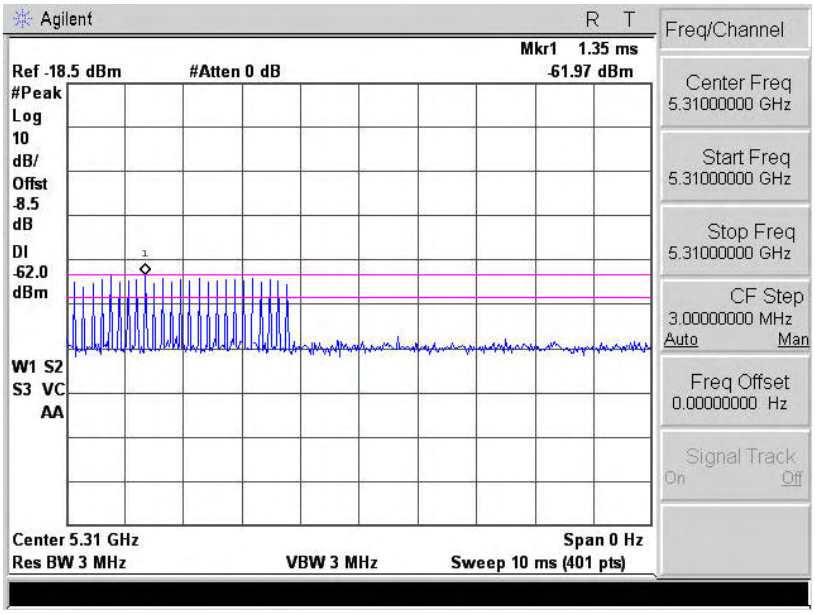
6 Results for 40 MHz Bandwidth

6.1. Radar Waveforms and Traffic

Mode 3: IEEE 802.11n 40MHz U-NII Band II Link Mode
Short Pulse Radar Type 1

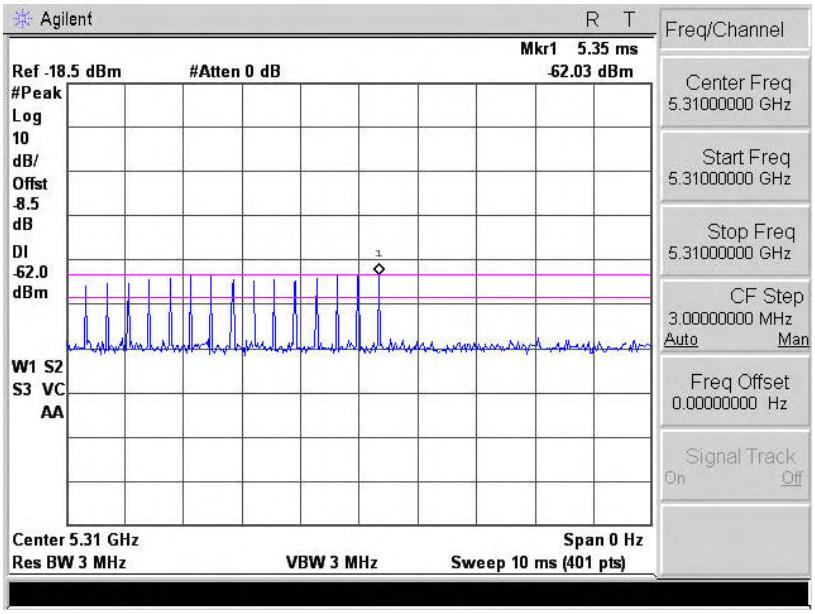


Sample of Radar Type 2

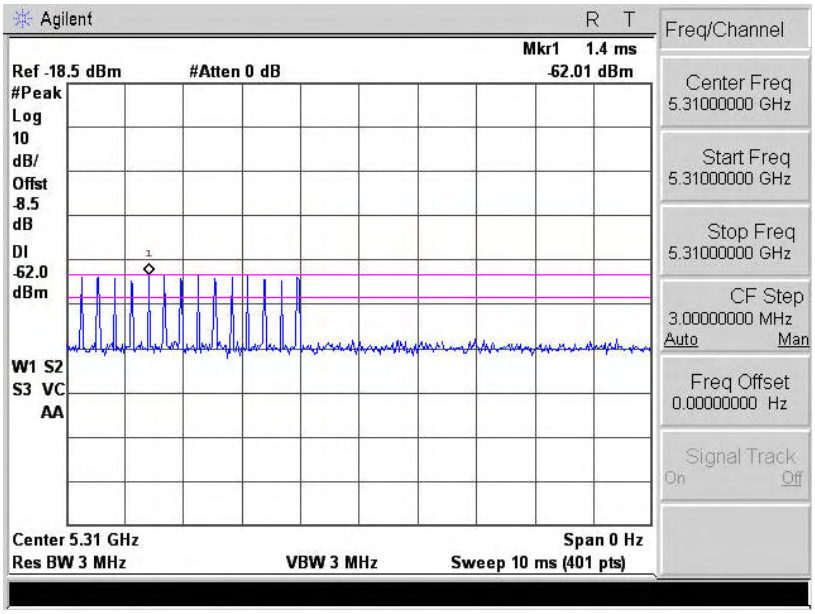


Mode 3: IEEE 802.11n 40MHz U-NII Band II Link Mode

Sample of Radar Type 3

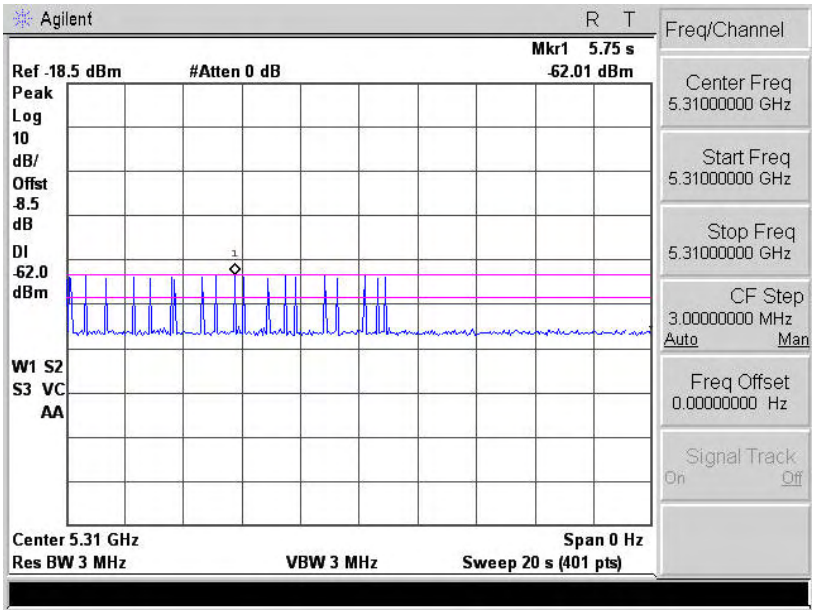


Sample of Radar Type 4

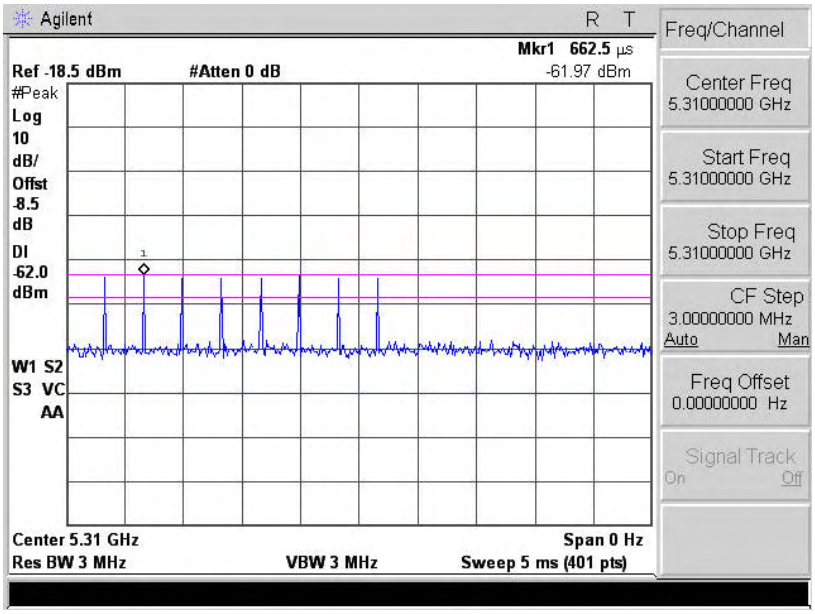


Mode 3: IEEE 802.11n 40MHz U-NII Band II Link Mode

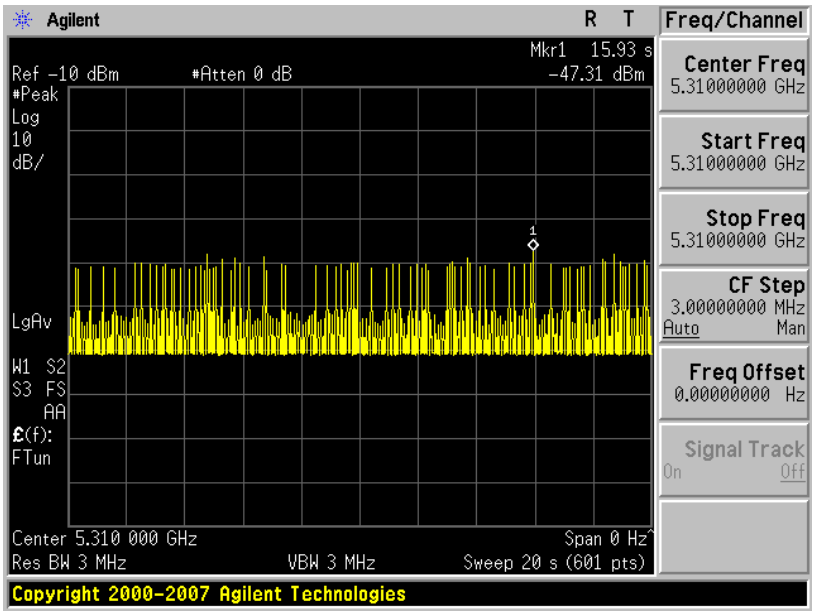
Sample Of Single Burst of Radar Type 5



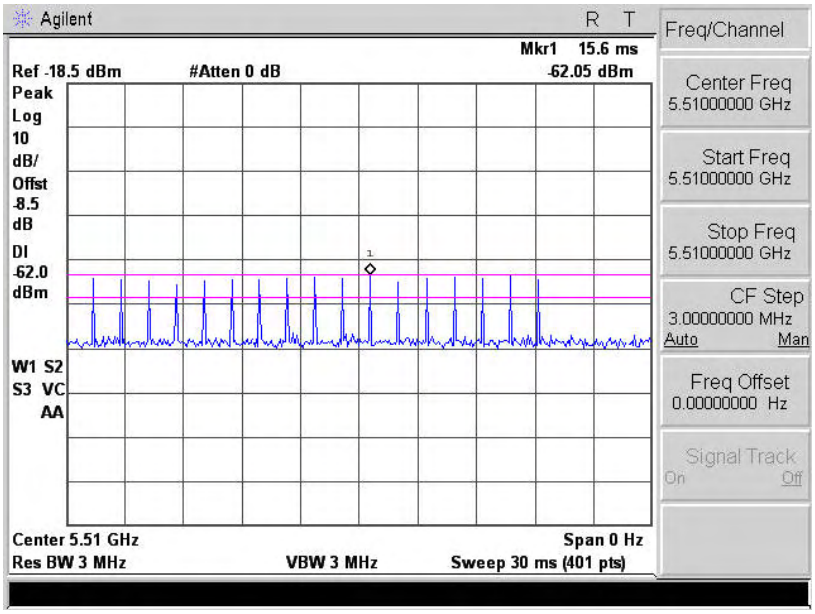
Single Burst of Radar Type 6



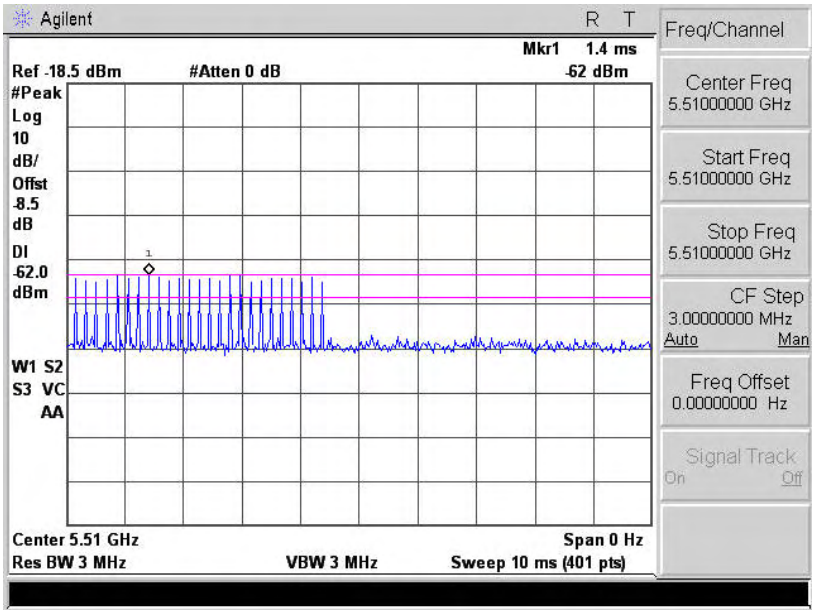
Mode 3: IEEE 802.11n 40MHz U-NII Band II Link Mode
Traffic



Mode 4: IEEE 802.11n 40MHz U-NII Band III Link Mode
Short Pulse Radar Type 1

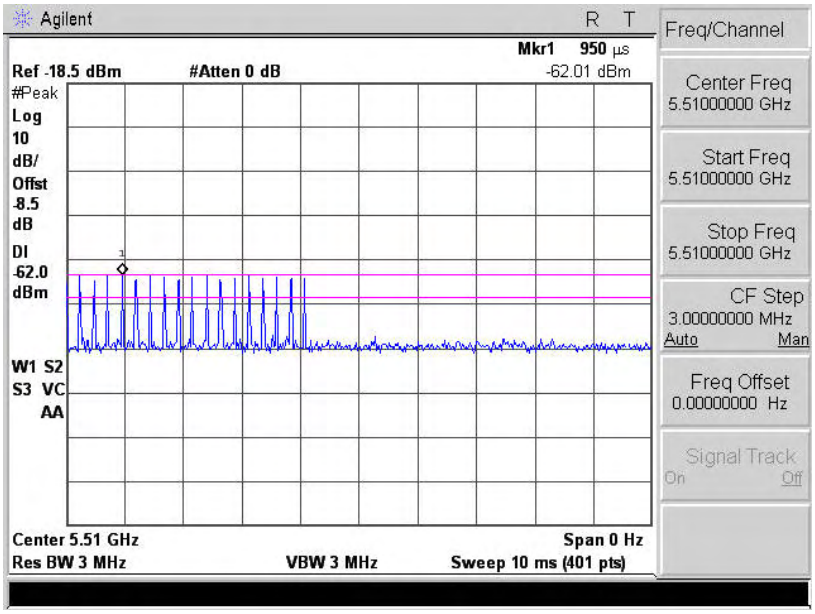


Sample of Radar Type 2

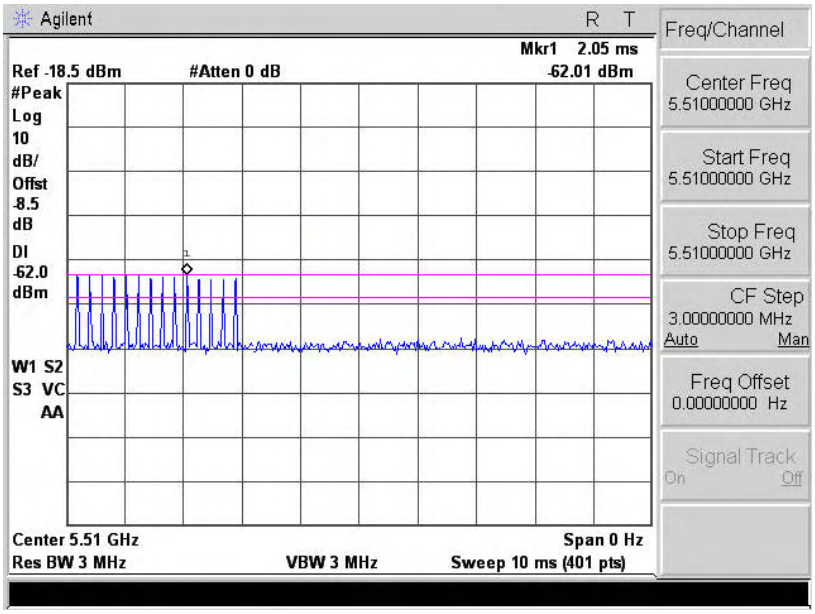


Mode 4: IEEE 802.11n 40MHz U-NII Band III Link Mode

Sample of Radar Type 3

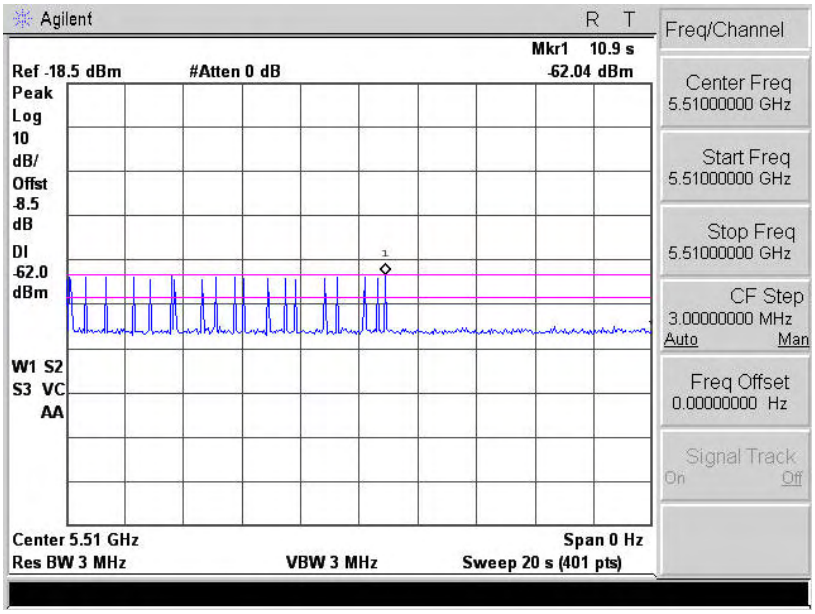


Sample of Radar Type 4

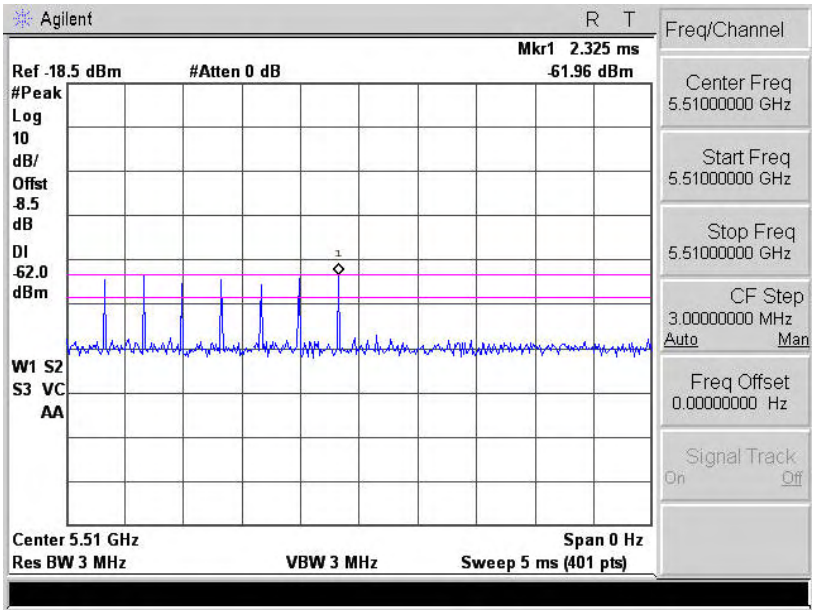


Mode 4: IEEE 802.11n 40MHz U-NII Band III Link Mode

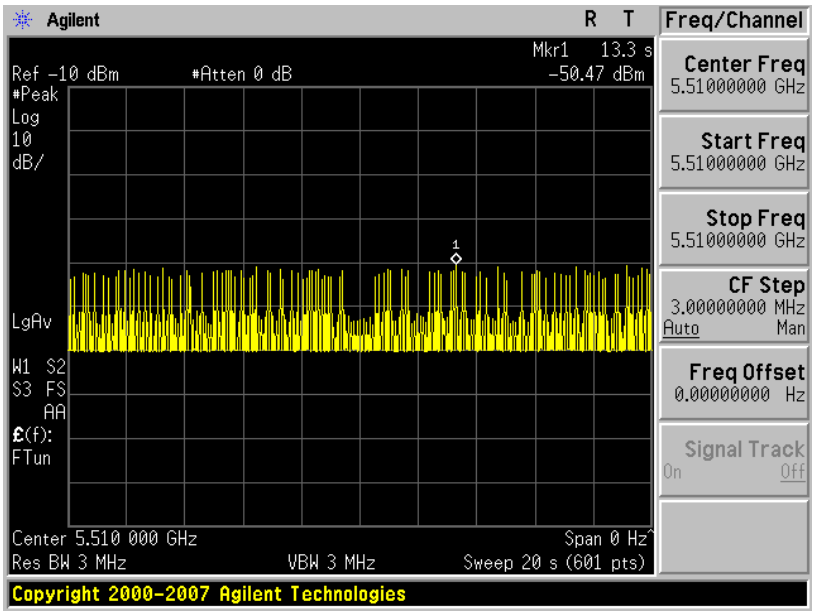
Sample Of Single Burst of Radar Type 5



Single Burst of Radar Type 6



Mode 4: IEEE 802.11n 40MHz U-NII Band III Link Mode
Traffic



6.2. Channel Availability Check Time

6.2.1. Procedure to Determine Initial Power-Up Cycle Time

A link was established on channel then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

6.2.2. Procedure for Timing Of Radar Burst

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

6.2.3. Quantitative Results

These tests are not applicable.

6.3. Overlapping Channel Tests

6.3.1. Results

These tests are not applicable.

6.4. Move and Closing Time

6.4.1. Reporting Notes

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse.
This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:
Aggregate Transmission Time = (Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

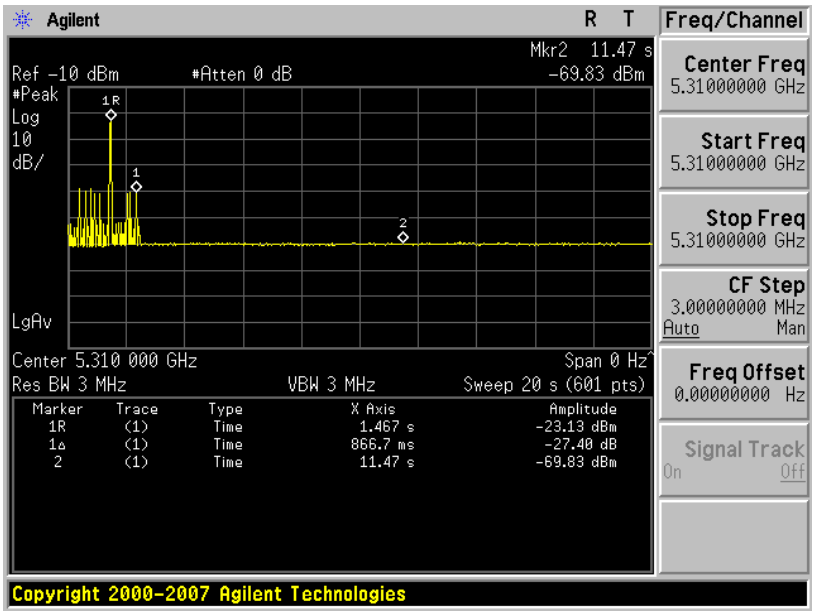
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

Results

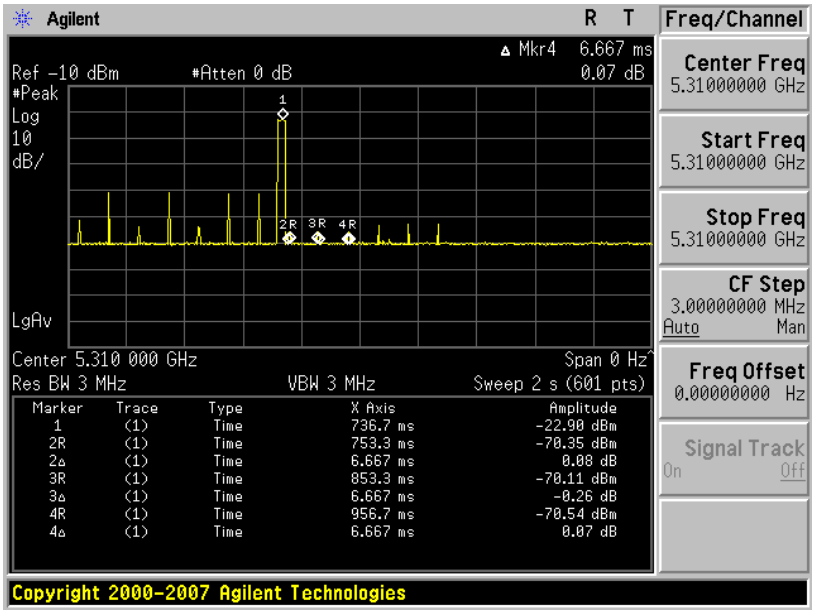
Agency	Frequency (MHz)	Channel Move Time (sec)	Limit (sec)
FCC / IC	5300	0.8667	10
	5510	0.9333	10

Agency	Frequency (MHz)	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	5300	40.002	60
	5510	40.002	60
IC	5300	40.002	260
	5510	40.002	260

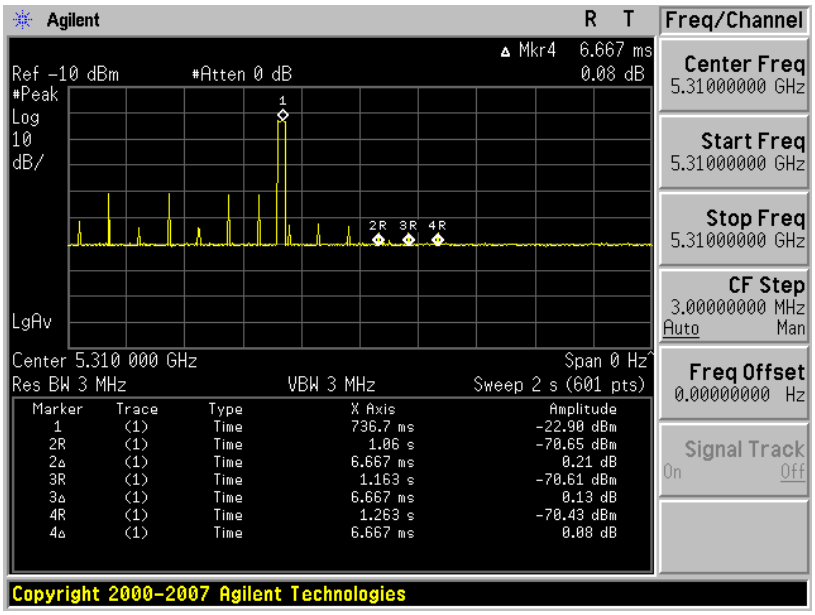
Mode 3: IEEE 802.11n 40MHz U-NII Band II Link Mode
Move Time



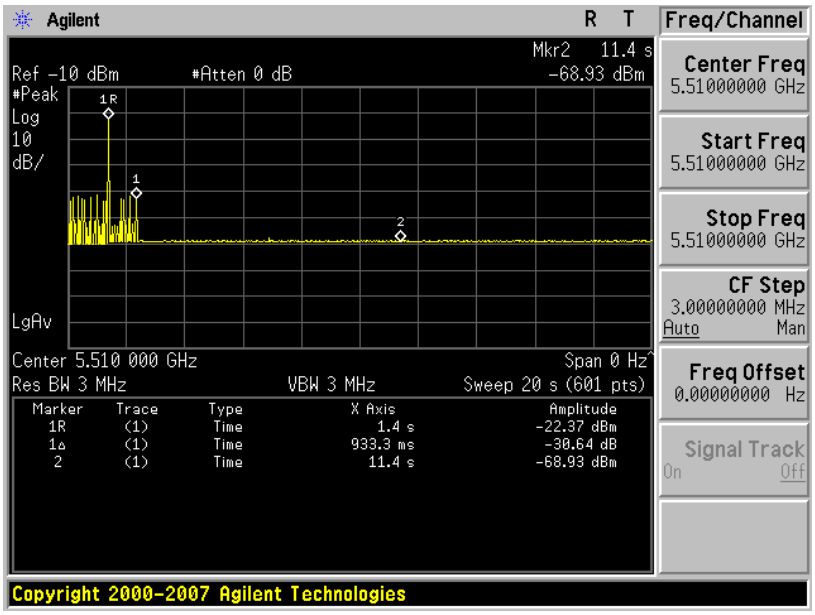
Channel Closing Time



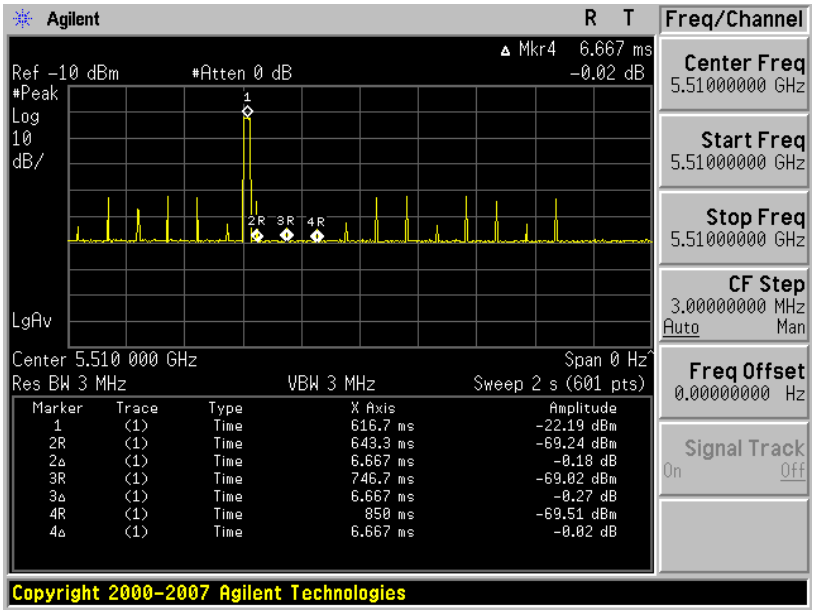
Mode 3: IEEE 802.11n 40MHz U-NII Band II Link Mode
Channel Closing Time



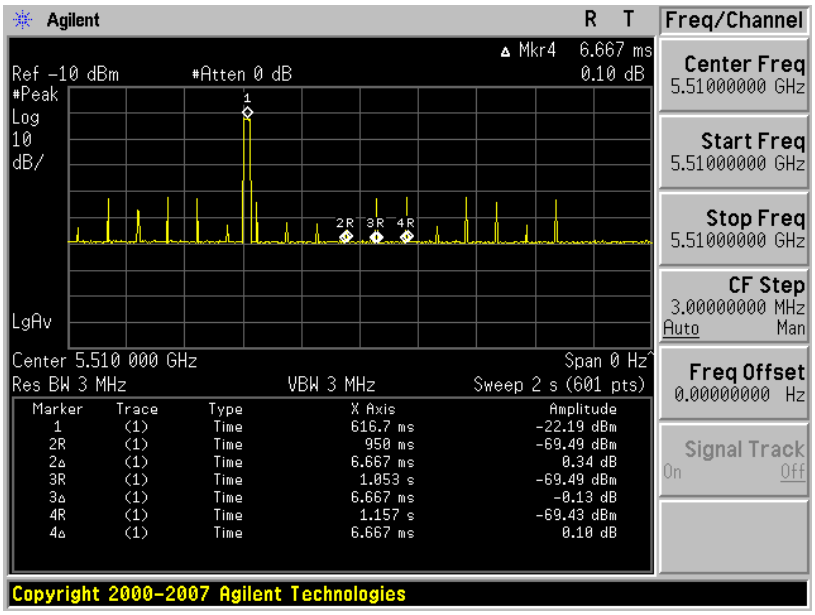
Mode 4: IEEE 802.11n 40MHz U-NII Band III Link Mode
Move Time



Channel Closing Time



Mode 4: IEEE 802.11n 40MHz U-NII Band III Link Mode
Channel Closing Time

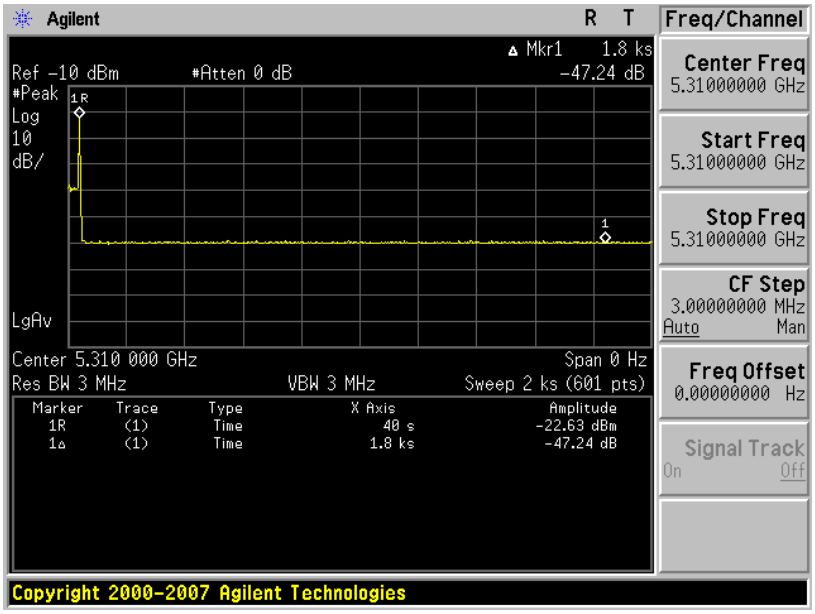


6.5. Non-Occupancy Period

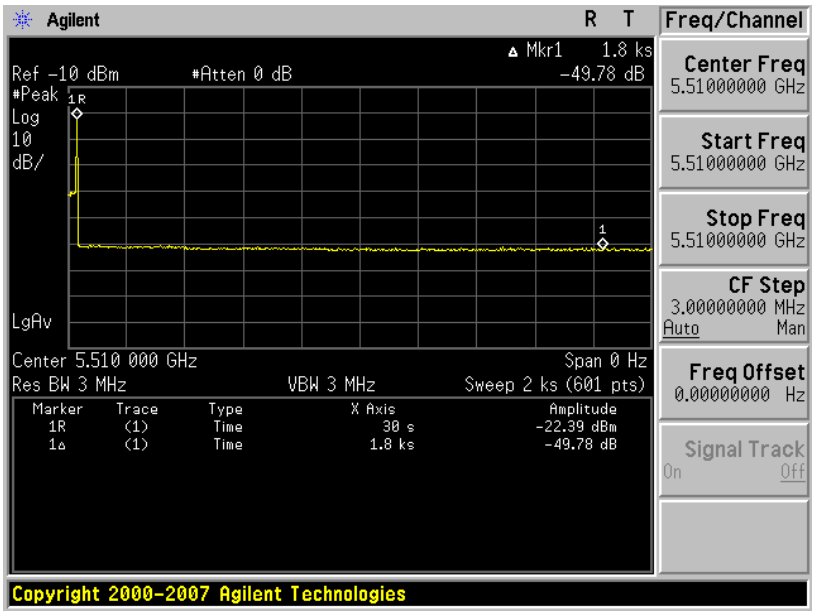
Results

No EUT transmissions were observed on the test channel during the 30-minute observation time.

Mode 3: IEEE 802.11n 40MHz U-NII Band II Link Mode
Reference Plot Of 99% Power Bandwidth



Mode 4: IEEE 802.11n 40MHz U-NII Band III Link Mode
Reference Plot Of 99% Power Bandwidth



6.6. Detection Bandwidth

These tests are not applicable.

6.7. In-Service Monitoring

These tests are not applicable.