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Report No.: 1612RSU02404
Report Version: V01
Issue Date: 07-11-2017

DFS MEASUREMENT REPORT

EN 301 893 V1.8.1

Applicant:	Compex Systems Pte Ltd
Address:	No:9 Harrison Road, Harrison Industrial Building, #05-01, Singapore 369651
Product:	802.11ac Dual Band Module
Model No.:	WLE600VX, WLE600VX-I
Brand Name:	COMPEX
Standards:	EN 301 893 V1.8.1 (2015-03) Clause 4.7
Type of Device:	☒ Master Device ☐ Client Device without radar detection ☐ Client Device with radar detection
Result:	Complies
Test Date:	Mar. 16 ~ Jun. 15, 2015

Reviewed By : Robin Wu
(Robin Wu)

Approved By : Marlinchen
(Marlin Chen)

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

Revision History

Report No.	Version	Description	Issue Date
1612RSU02404	Rev. 01	Initial report	07-11-2017

Note: This report was based on the original report no. 1503RSU02907 and add one type antenna 7#. The test rule EN 301 893 version upgrade from v1.7.1 to v1.8.1, there is no change for DFS testing.

CONTENTS

1. General Information

1.1. Applicant

Compex Systems Pte Ltd

No:9 Harrison Road, Harrison Industrial Building, #05-01, Singapore 369651

1.2. Manufacturer

Compex Systems Pte Ltd

No:9 Harrison Road, Harrison Industrial Building, #05-01, Singapore 369651

1.3. Testing Facility

Test Site

MRT Technology (Suzhou) Co., Ltd

Test Site Location

D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China

- **MRT facility is a FCC registered (MRT Reg. No. 809388) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.**
- **MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.**
- **MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.**
- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.**

1.4. Feature of Product

Product Name	802.11ac Dual Band Module
Model No.	WLE600VX, WLE600VX-I
Brand Name	COMPEX
Wi-Fi Specification	802.11a/b/g/n/ac

1.5. Product Specification Subjective to this Report

Frequency Range	802.11a/n-HT20/ac-VHT20: 5260 ~ 5320MHz; 5500 ~ 5700MHz 802.11n-HT40/ac-VHT40: 5270 ~ 5310MHz; 5510 ~ 5670MHz 802.11ac-VHT80: 5290MHz, 5530MHz, 5610MHz
Channel Number	802.11a/n-HT20/ac-VHT20: 15 802.11n-HT40/ac-VHT40: 7 802.11ac-VHT80: 3
Type of Modulation	802.11a/n/ac: OFDM
Data Rate	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.6Mbps
Power-on cycle	Requires 89.99 seconds to complete its power-on cycle
Uniform Spreading	The Uniform Spreading is a mechanism to be used by the RLAN to provide, on aggregate, a uniform loading of the spectrum across all devices. The Uniform Spreading is limited to the channels being declared as part of the channel plan.

Note: For other features of this EUT, test report will be issued separately.

1.6. Operation Frequency / Channel List

802.11a/n-HT20/ac-VHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
52	5260 MHz	56	5280 MHz	60	5300 MHz
64	5320 MHz	100	5500 MHz	104	5520 MHz
108	5540 MHz	112	5560 MHz	116	5580 MHz
120	5600 MHz	124	5620 MHz	128	5640 MHz
132	5660 MHz	136	5680 MHz	140	5700 MHz

802.11n-HT40/ac-VHT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz	102	5510 MHz
110	5550 MHz	118	5590 MHz	126	5630 MHz
134	5670 MHz	N/A	N/A	N/A	N/A

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
58	5290 MHz	106	5530 MHz	122	5610 MHz

1.7. Test Channel / Test Mode

Test Mode	5250 ~ 5350MHz		5470 ~ 5725MHz	
	Test Channel	Test Frequency	Test Channel	Test Frequency
802.11a	60	5300 MHz	100	5500 MHz
802.11ac-VHT80	58	5290 MHz	106	5530 MHz

1.8. Description of Available Antennas

Antenna Type	Frequency Band (GHz)	Manufacturer	Tx Paths	Max Directional Gain (dBi)
Antenna 1#	5.1 ~ 5.8	Kunshan Wavelink Electronic Co., Ltd.	2	2
Antenna 2#	5.1 ~ 5.8	Compex Systems Pte Ltd	2	5
Antenna 3#	5.1 ~ 5.8	Compex Systems Pte Ltd	2	5
Antenna 4#	5.1 ~ 5.8	TAOGLAS Inc	2	6.7
Antenna 5#	5.1 ~ 5.8	Smart Ant Inc	2	7
Antenna 6#	5.1 ~ 5.8	Kenbotong Communication LTD	2	10
Antenna 7#	5.1 ~ 5.8	Sensor Systems, Inc.	2	8

Note 1: The frequency bands (5150~5350MHz & 5470~5725MHz) support the max antenna gain 7dBi and another frequency band (5725~5850MHz) supports the max antenna gain 10dBi.

1.9. Standards Applicable for Testing

The EUT complies with the requirements of EN 301 893 V1.8.1 clause 4.7.

2. DFS Requirements and Radar Test Waveforms

2.1. Applicability

The following table lists the DFS related technical requirements and their applicability for every operational mode. If the RLAN device is capable of operating in more than one operational mode then every operating mode shall be assessed separately.

Table 2-1: Applicability of DFS requirements

Requirement	DFS Operational mode		
	Master	Slave without radar detection	Slave with radar detection
Channel Availability Check	√	Not required	√ (see note 2)
Off-Channel CAC (see note 1)	√	Not required	√ (see note 2)
In-Service Monitoring	√	Not required	√
Channel Shutdown	√	√	√
Non-Occupancy Period	√	Not required	√
Uniform Spreading	√	Not required	Not required
NOTE 1: Where implemented by the manufacturer. NOTE 2: A slave with radar detection is not required to perform a CAC or Off-Channel CAC at initial use of the channel but only after the slave has detected a radar signal on the Operating Channel by In-Service Monitoring.			

Table 2-2: DFS requirement values

Parameter	Value
Channel Availability Check Time	60 s (see note 1)
Minimum Off-Channel CAC Time	6 minutes (see note 2)
Maximum Off-Channel CAC Time	4 hours (see note 2)
Channel Move Time	10 s
Channel Closing Transmission Time	1 s
Non-Occupancy Period	30 minutes
NOTE 1: For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the Channel Availability Check Time shall be 10 minutes. NOTE 2: For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the Maximum Off-Channel CAC Time shall be 24 hours.	

2.2. DFS Devices Requirements

Per ETSI EN 301 893 V1.7.1 the following are the requirements for Master Devices:

a) The master device shall use a Radar Interference Detection function in order to detect radar signals. The master device may rely on another device, associated with the master, to implement the Radar Interference Detection function. In such a case, the combination shall comply with the requirements applicable to a master.

b) A master device shall only start operations on Available Channels. At installation (or reinstallation) of the equipment, the RLAN is assumed to have no Available Channels within the band 5 250 MHz to 5 350 MHz and/or 5 470 MHz to 5 725 MHz. In such a case, before starting operations on one or more of these channels, the master device shall perform either a Channel Availability Check or an Off-Channel CAC to ensure that there are no radars operating on any selected channel. If no radar has been detected, the channel(s) becomes an Available Channel(s) and remains as such until a radar signal is detected during the In-Service Monitoring. The Channel Availability Check or the Off-Channel CAC may be performed over a wider bandwidth such that all channels within the tested bandwidth become Available Channels.

c) Once the RLAN has started operations on an Available Channel, then that channel becomes an Operating Channel. During normal operation, the master device shall monitor all Operating Channels (In-Service Monitoring) to ensure that there is no radar operating within these channel(s). If no radar was detected on an Operating Channel but the RLAN stops operating on that channel, then the channel becomes an Available Channel.

d) If the master device has detected a radar signal on an Operating Channel during In-Service Monitoring, the master device shall instruct all its associated slave devices to stop transmitting on this channel which becomes an Unavailable Channel. For devices operating on multiple (adjacent or non-adjacent) Operating Channels simultaneously, only the Operating Channel containing the frequency on which radar was detected shall become an Unavailable Channel.

e) An Unavailable Channel can become a Usable Channel again after the Non-Occupancy Period. A new Channel Availability Check or an Off-Channel CAC is required to verify there is no radar operating on this channel before it becomes an Available Channel again.

f) In all cases, if radar detection has occurred, then the channel containing the frequency on which radar was detected becomes an Unavailable Channel. Alternatively the channel may be marked as an Unusable Channel.

2.3. DFS Detection Threshold Values

The DFS detection thresholds are defined for Master devices and Client Devices with In-service monitoring. These detection thresholds are listed in the following table.

Table 2-3: Interference threshold values

EIRP Spectral Density dBm/MHz	Value (see notes 1 and 2)
10	-62 dBm
NOTE 1: This is the level at the input of the receiver of a RLAN device with a maximum EIRP density of 10 dBm/MHz and assuming a 0 dBi receive antenna. For devices employing different EIRP spectral density and/or a different receive antenna gain G (dBi) the DFS threshold level at the receiver input follows the following relationship: DFS Detection Threshold (dBm) = -62 + 10 - EIRP Spectral Density (dBm/MHz) + G (dBi), however the DFS threshold level shall not be lower than -64 dBm assuming a 0 dBi receive antenna gain. NOTE 2: Slave devices with a maximum EIRP of less than 23 dBm do not have to implement radar detection.	

2.4. Radar Wave Parameters

Table 2-4: Parameters of the reference DFS test signal

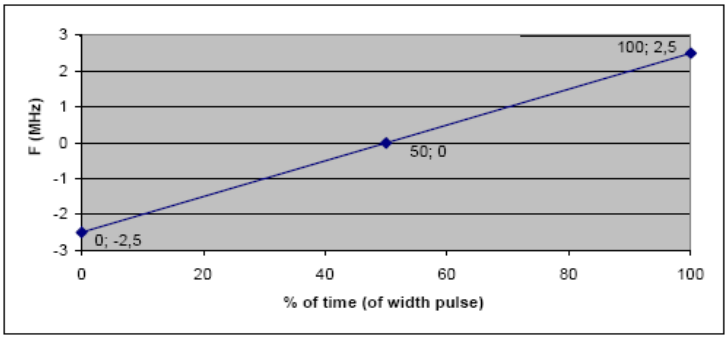
Pulse width W [µs]	Pulse repetition frequency PRF [pps]	Pulses per burst [PPB]
1	700	18

Table 2-5: Parameters of radar test signals

Radar test signal # (see notes 1 to 3)	Pulse width W [µs]		Pulse repetition frequency PRF (PPS)		Number of different PRFs	Pulses per burst for each PRF (PPB) (see note 5)
	Min	Max	Min	Max		
1	0.5	5	200	1000	1	10 (see note 6)
2	0.5	15	200	1600	1	15 (see note 6)
3	0.5	15	2300	4000	1	25
4	20	30	2000	4000	1	20
5	0.5	2	300	400	2/3	10 (see note 6)
6	0.5	2	400	1200	2/3	15 (see note 6)

NOTE 1: Radar test signals 1 to 4 are constant PRF based signals. See figure D.1. These radar test signals are intended to simulate also radars using a packet based Staggered PRF. See figure D.2.

NOTE 2: Radar test signal 4 is a modulated radar test signal. The modulation to be used is a chirp modulation with a ±2,5 MHz frequency deviation which is described below.



NOTE 3: Radar test signals 5 and 6 are single pulse based Staggered PRF radar test signals using 2 or 3 different PRF values. For radar test signal 5, the difference between the PRF values chosen shall be between 20 PPS and 50 PPS. For radar test signal 6, the difference between the PRF values chosen shall be between 80 PPS and 400 PPS. See figure D.3.

NOTE 4: Apart for the Off-Channel CAC testing, the radar test signals above shall only contain a single burst of pulses. See figures D.1, D.3 and D.4.

For the Off-Channel CAC testing, repetitive bursts shall be used for the total duration of the test. See figures D.2 and D.5. See also clauses 4.7.2.2, 5.3.8.2.1.3.1 and 5.3.8.2.1.3.2.

NOTE 5: The total number of pulses in a burst is equal to the number of pulses for a single PRF

multiplied by the number of different PRFs used.
NOTE 6: For the CAC and Off-Channel CAC requirement s, the minimum number of pulses (for each PRF) for any of the radar test signals to be detected in the band 5 600 MHz to 5 650 MHz shall be 18.

Table2-6: Detection probability

Parameter	Detection Probability (Pd)	
	Channels whose nominal bandwidth falls partly or completely within the 5 600 MHz to 5 650 MHz band	Other channels
CAC, Off-Channel CAC	99,99 %	60 %
In-Service Monitoring	60 %	60 %
NOTE: Pd gives the probability of detection per simulated radar burst and represents a minimum level of detection performance under defined conditions. Therefore Pd does not represent the overall detection probability for any particular radar under real life conditions.		

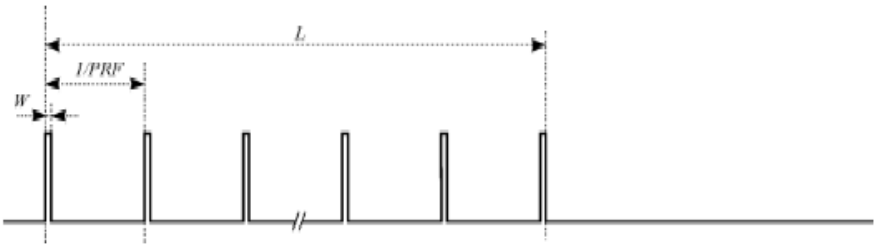


Figure 2.1: General structure of a single burst / constant PRF based radar test signal

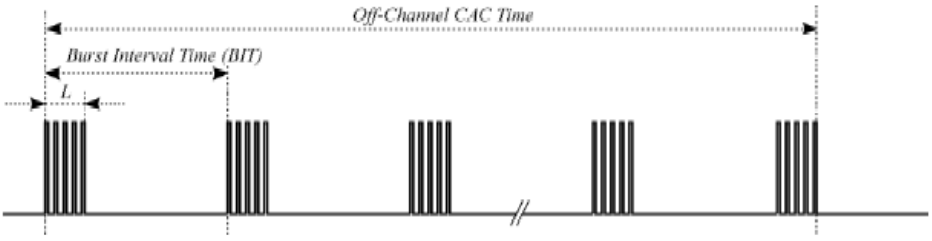


Figure 2.2: General structure of a multiple burst / constant PRF based radar test signal

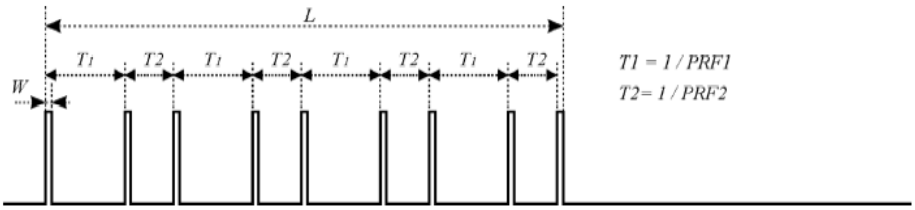


Figure 2.3: General structure of a single burst / single pulse based staggered PRF radar test signal

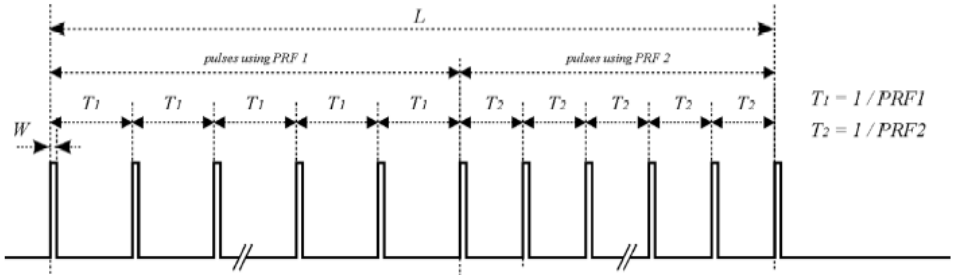


Figure 2.4: General structure of a single burst / packet based staggered PRF radar test signal

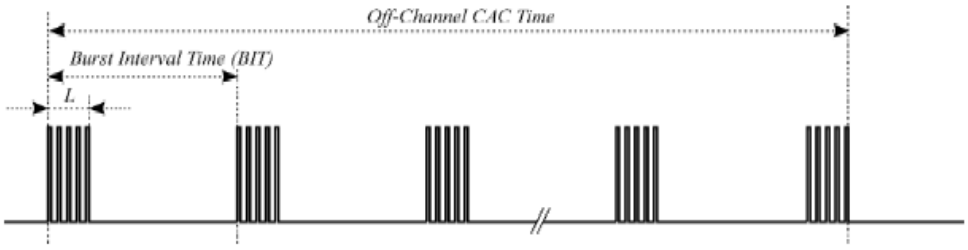
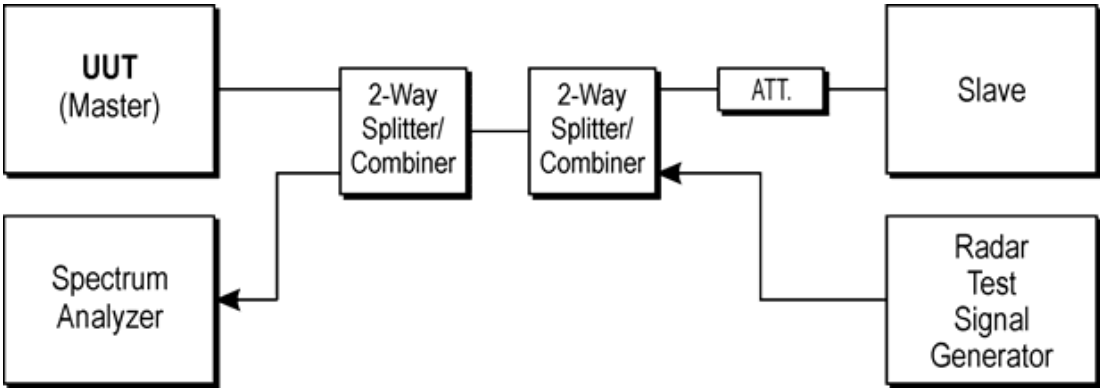


Figure 2.5: General structure of a multiple burst / packet based staggered PRF based radar test Signal

2.5. Conducted Test Setup

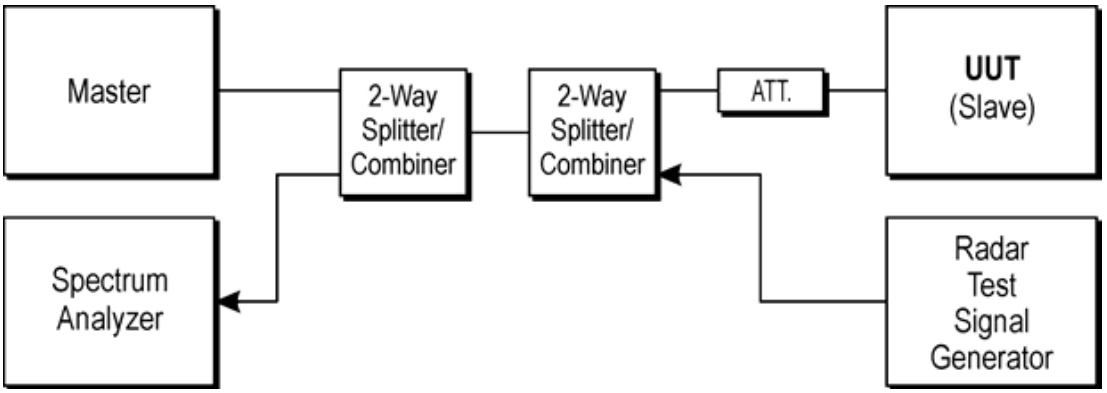
Set-up A

Set-up A is a set-up whereby the UUT is a RLAN device operating in master mode. Radar test signals are injected into the UUT. This set-up also contains a RLAN device operating in slave mode which is associated with the UUT.



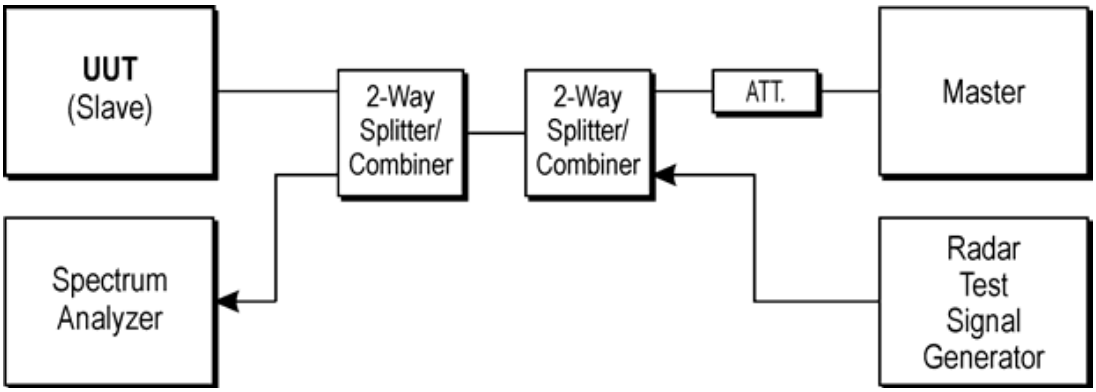
Set-up B

Set-up B is a set-up whereby the UUT is a RLAN device operating in slave mode, with or without Radar Interference Detection function. This set-up also contains a RLAN device operating in master mode. The radar test signals are injected into the master device. The UUT (slave device) is associated with the master device.

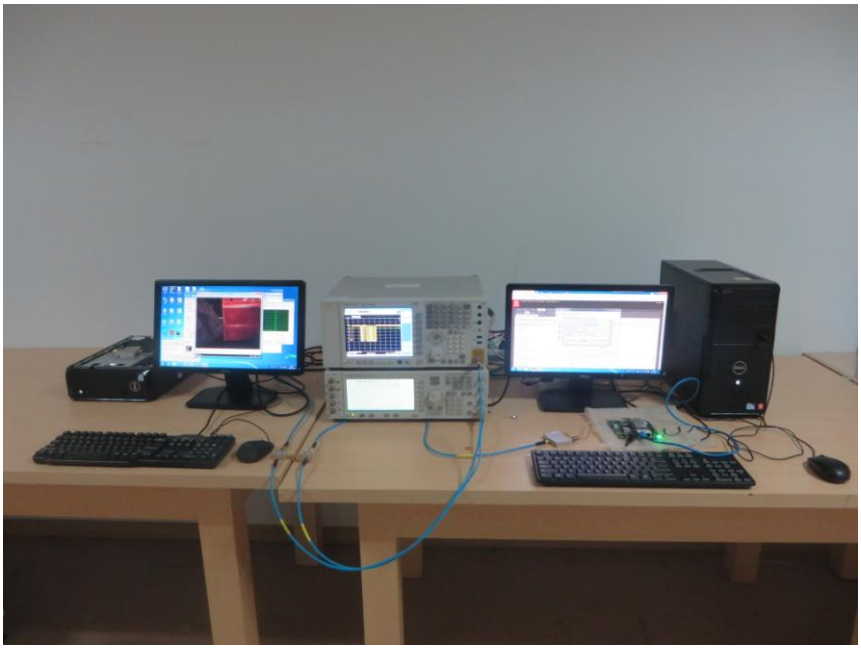


Set-up C

The UUT is a RLAN device operating in slave mode with Radar Interference Detection function. Radar test signals are injected into the slave device. This set-up also contains a RLAN device operating in master mode. The UUT (slave device) is associated with the master device.



DFS Test Set-up Photo for Master Device - Set-up A



3. Test Equipment Calibration Date

Dynamic Frequency Selection (DFS)

Instrument	Manufacturer	Type No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	1 year	2016/04/23
ESG Vector Signal Generator	Agilent	E4438C	1 year	2015/12/09

Software	Manufacturer	Function
Pulse Building	Agilent	Radar Signal Generation Software
DFS Tool	Agilent	DFS Test Software

4. Test Summary

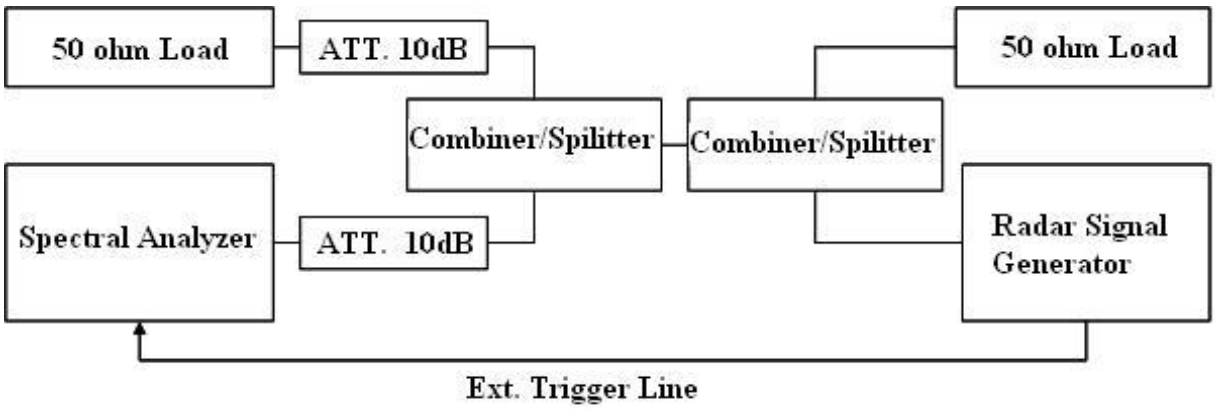
Parameter	Limit	Test Result	Reference
Radar Waveform Calibration	Refer Table 2-4, 2-5, 2-6	Pass	Section 5.1
Test Transmission Sequences	Activity Ratio ≥ 30%	Pass	Section 5.2
Initial Channel Availability Check Time	Refer Tablet 2-2	Pass	Section 5.3
Radar Burst at the Beginning of the Channel Availability Check Time	Refer Tablet 2-2	Pass	Section 5.4
Radar Burst at the End of the Channel Availability Check Time	Refer Tablet 2-2	Pass	Section 5.5
Off-Channel Channel Availability Check	Refer Tablet 2-2	Pass	Section 5.6
Radar Detection Threshold	Refer Tablet 2-2	Pass	Section 5.7
In-Service Monitoring	Refer Tablet 2-2	Pass	Section 5.8
Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	Refer Tablet 2-2	Pass	Section 5.9
Uniform Spreading	≥ 60%	Pass	Section 5.10

5. Test Result

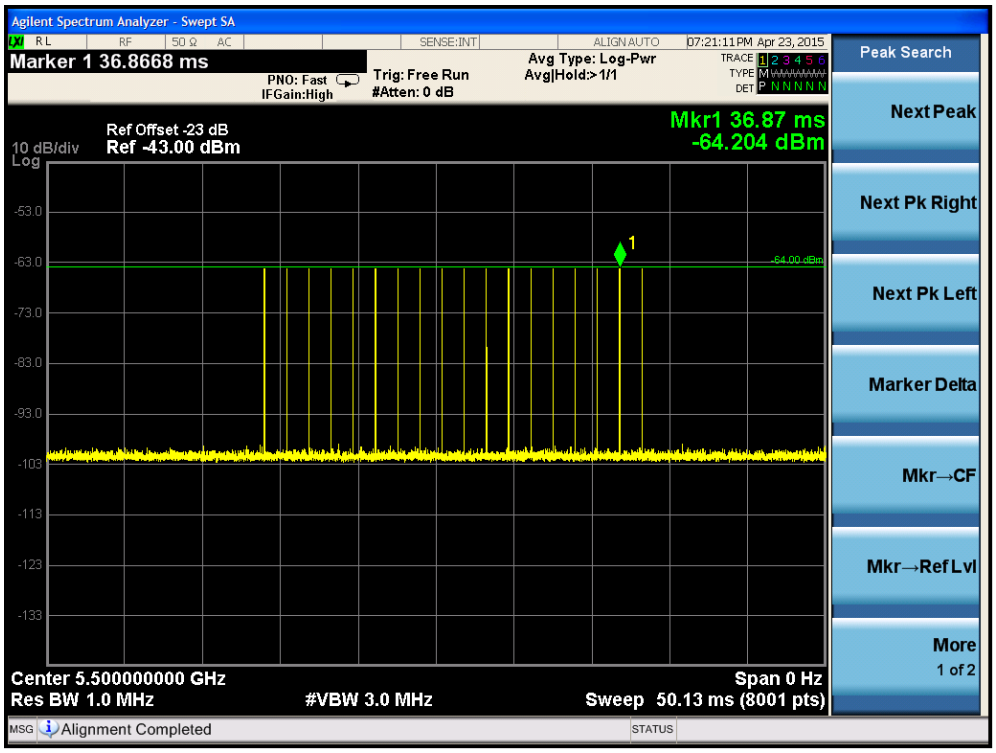
5.1. Radar Waveform Calibration

The following equipment setup was used to calibrate the conducted radar waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the master or client device. The spectrum analyzer was switched to the zero spans (time domain) at the frequency of the radar waveform generator. Peak detection was utilized. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to 1 MHz and 3 MHz.

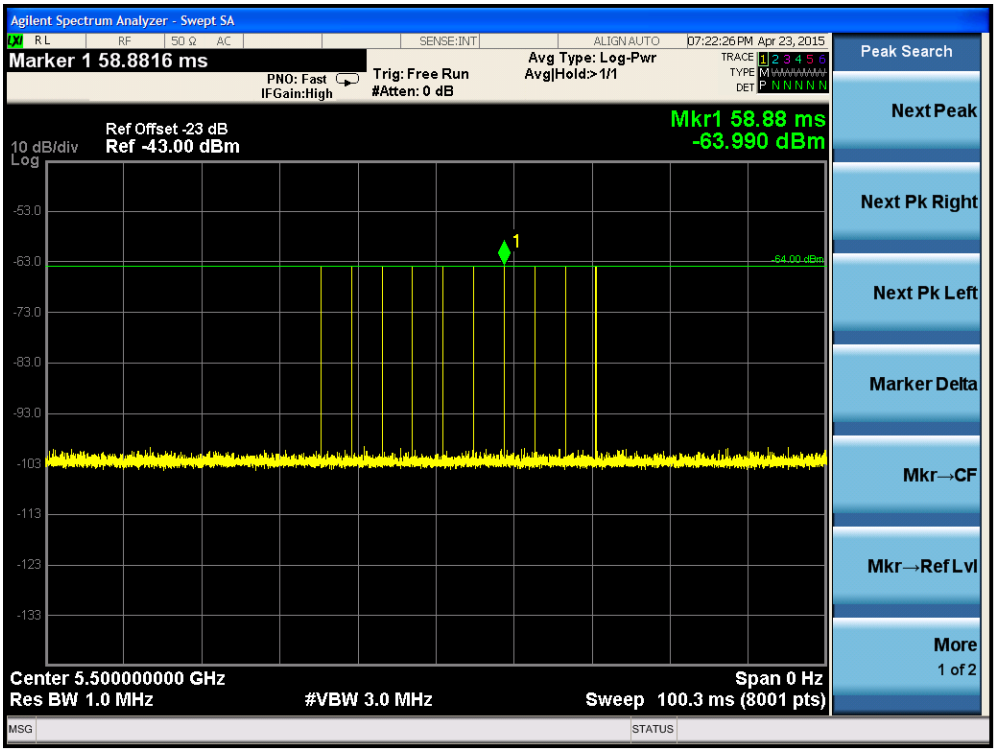
Conducted Calibration Setup



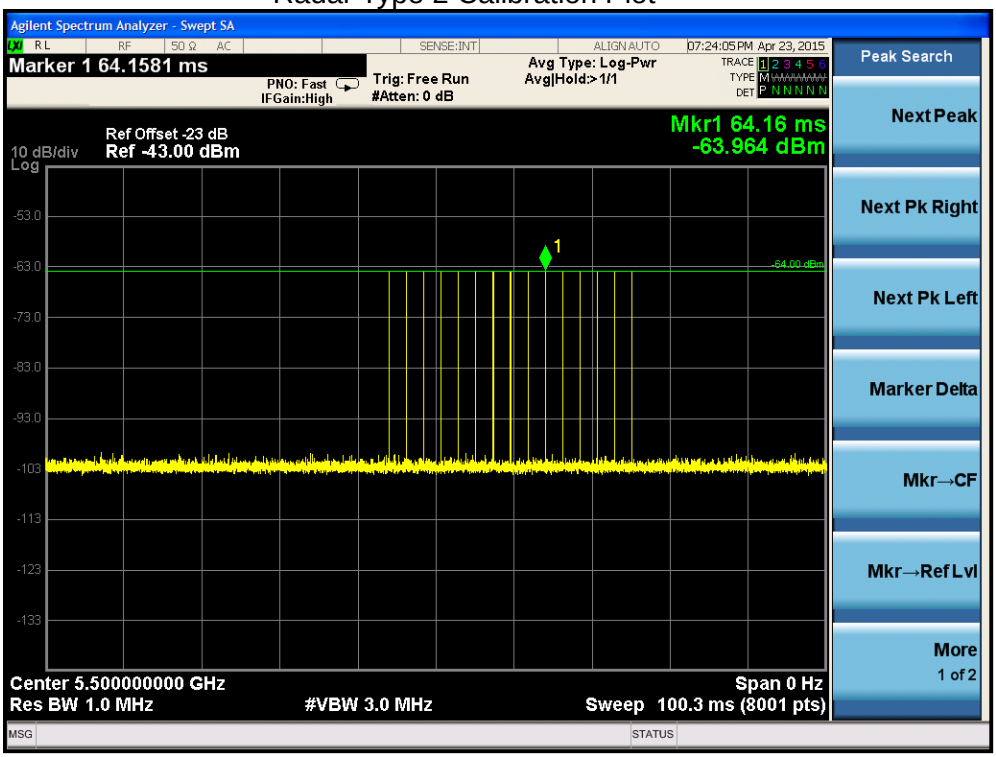
Radar Type 0 Calibration Plot



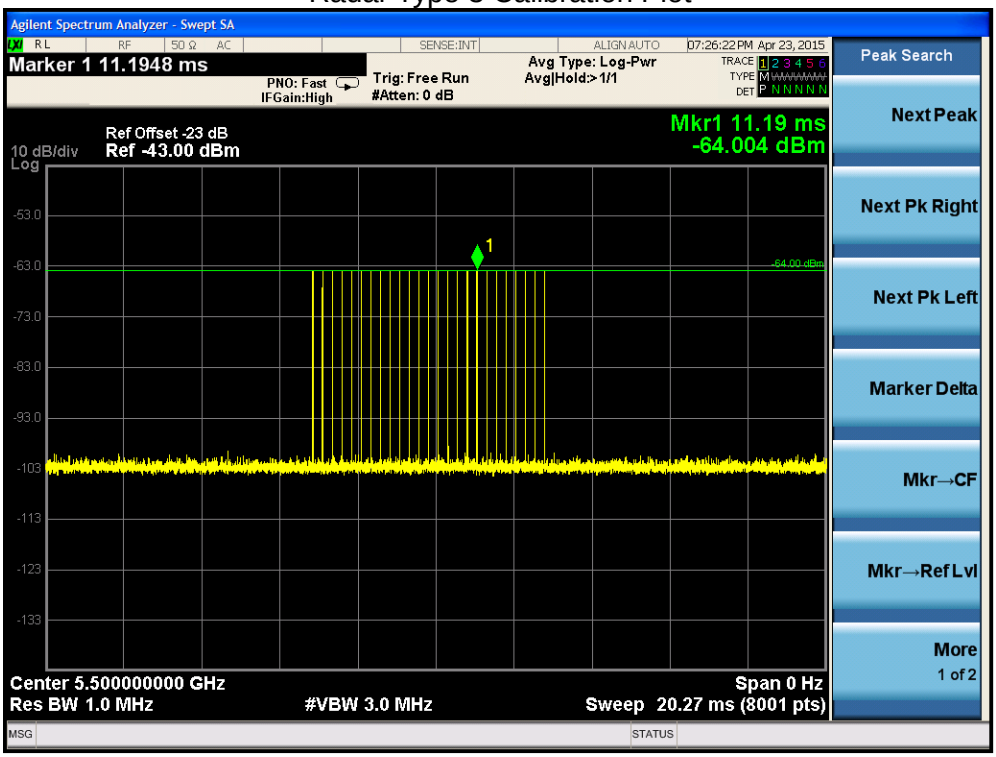
Radar Type 1 Calibration Plot



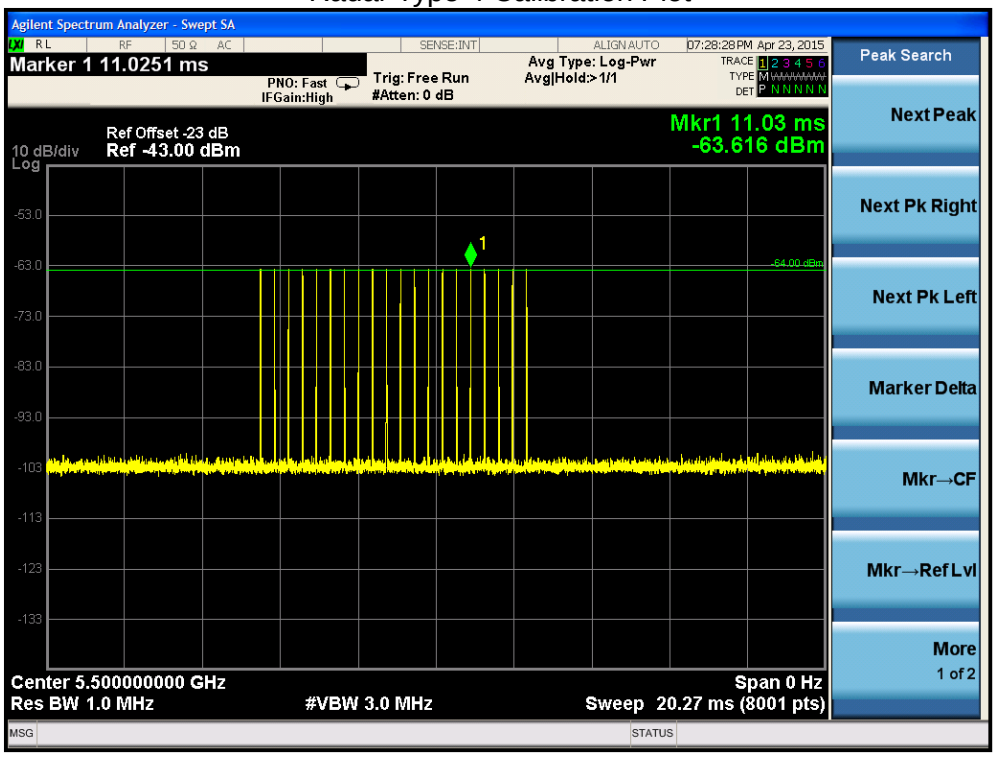
Radar Type 2 Calibration Plot



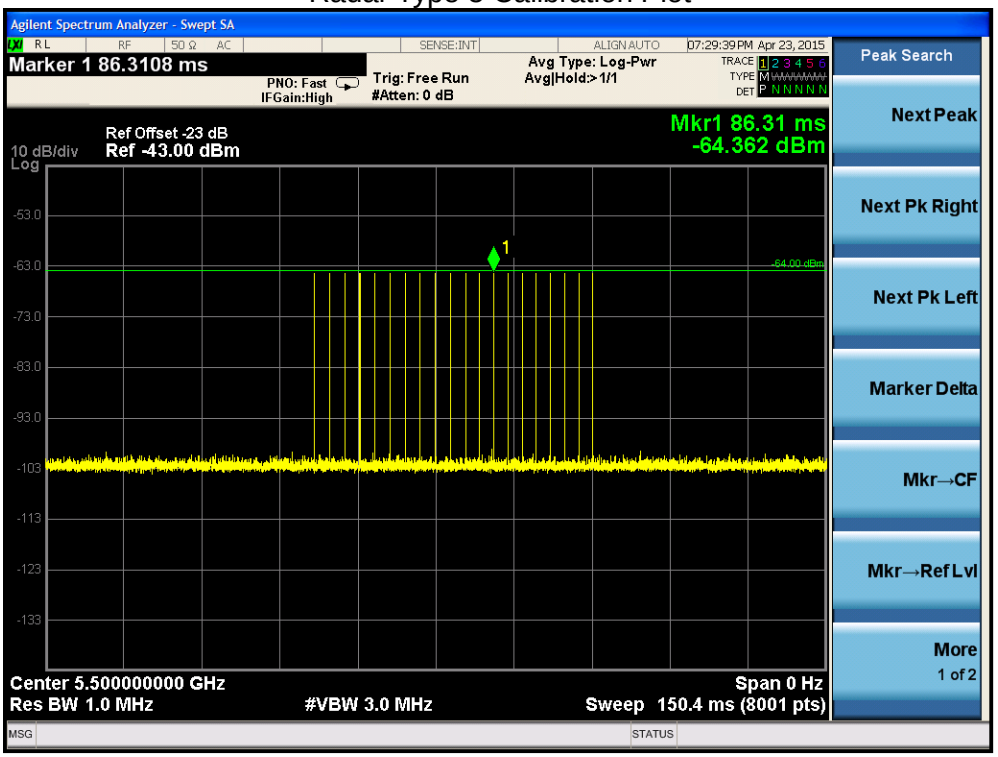
Radar Type 3 Calibration Plot



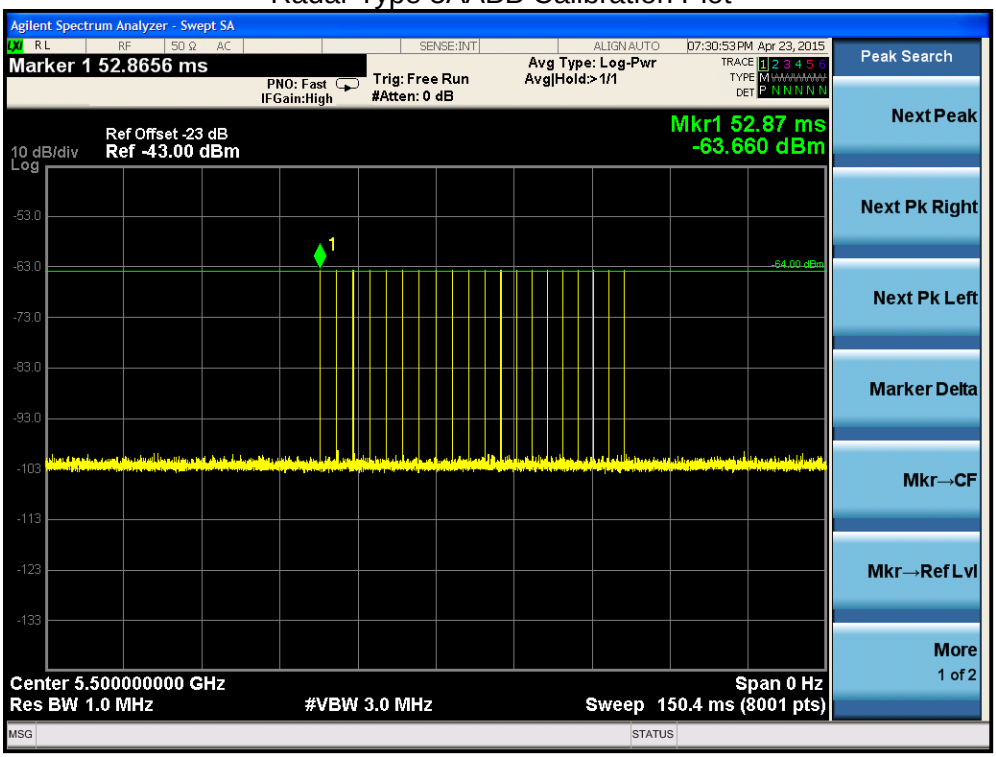
Radar Type 4 Calibration Plot



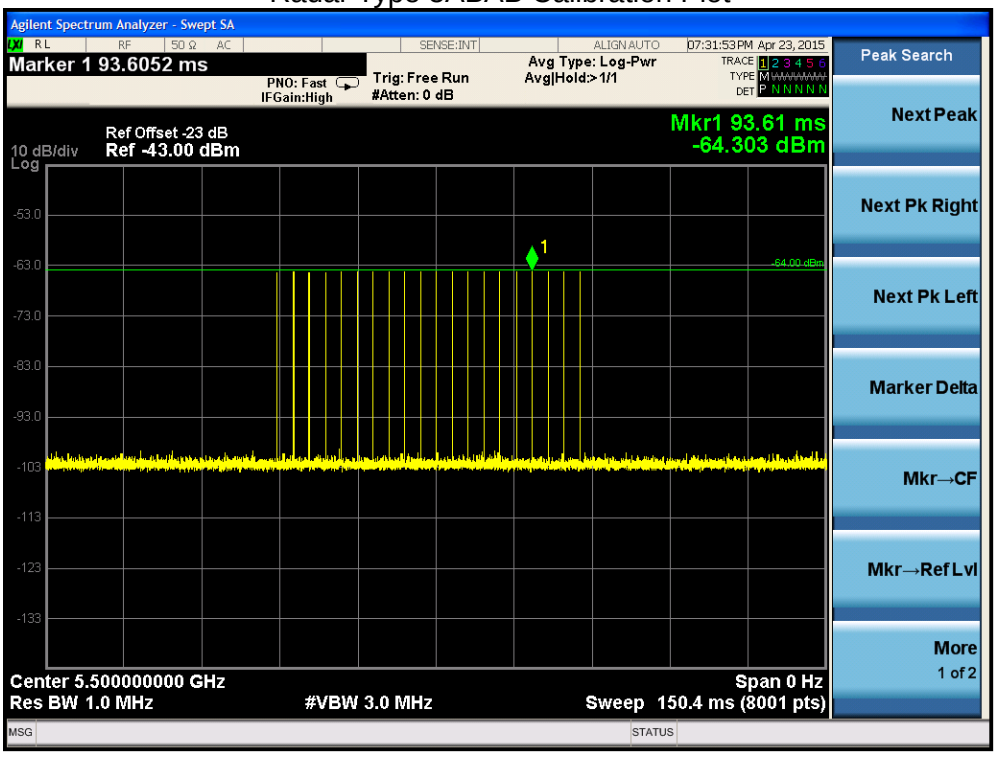
Radar Type 5 Calibration Plot



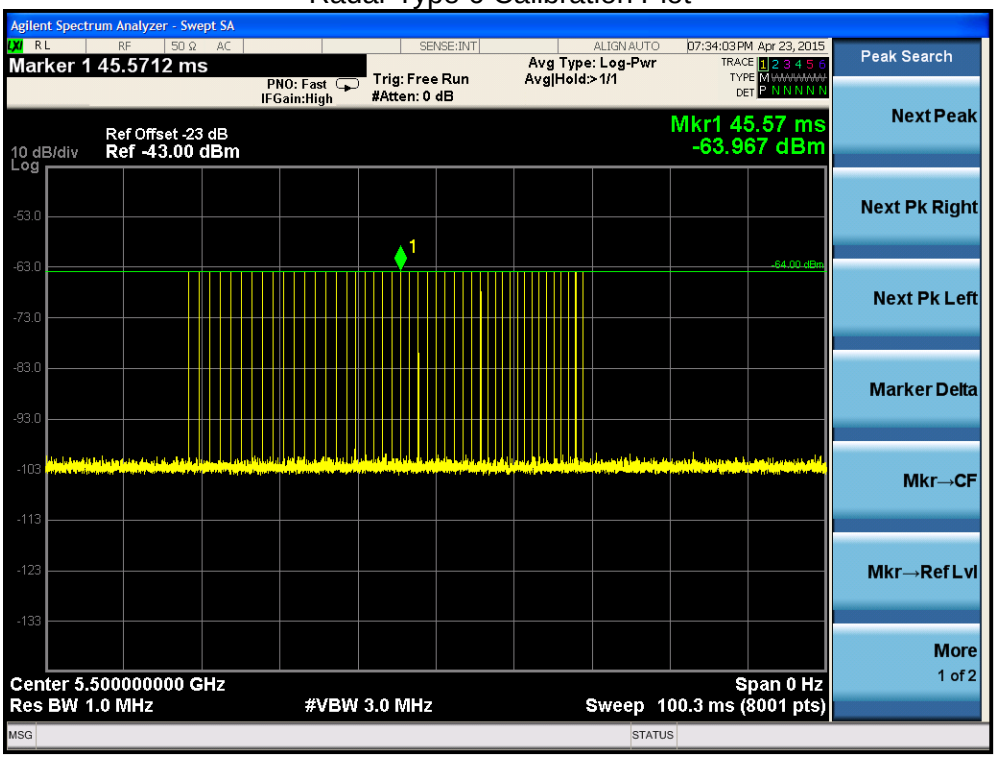
Radar Type 5AABB Calibration Plot



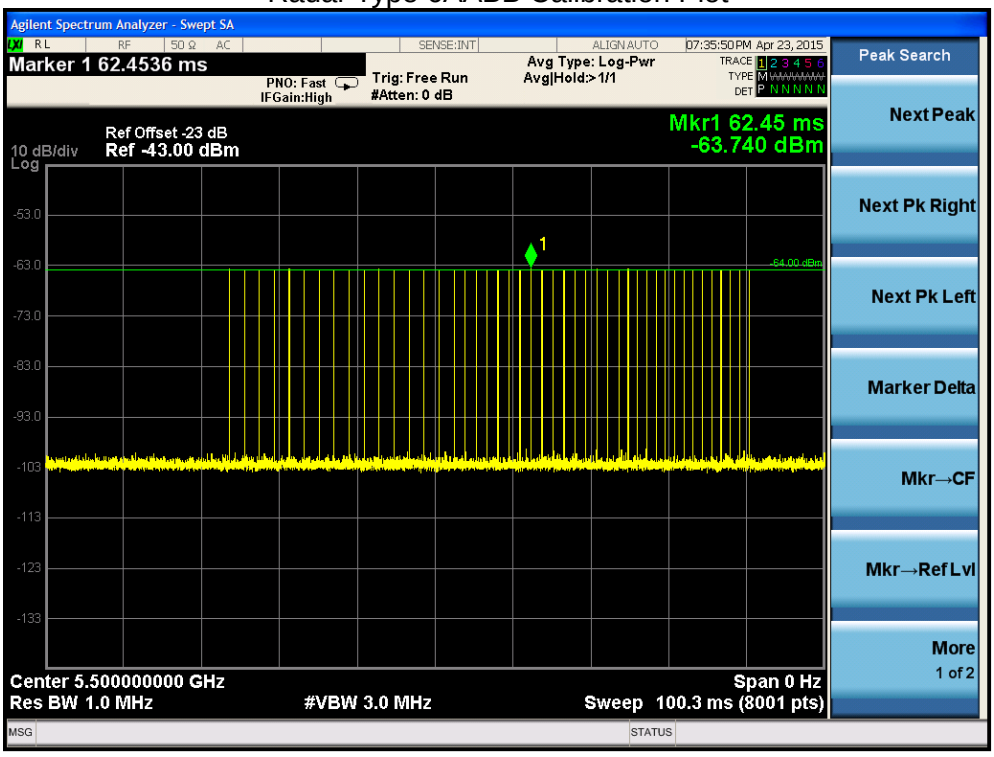
Radar Type 5ABAB Calibration Plot



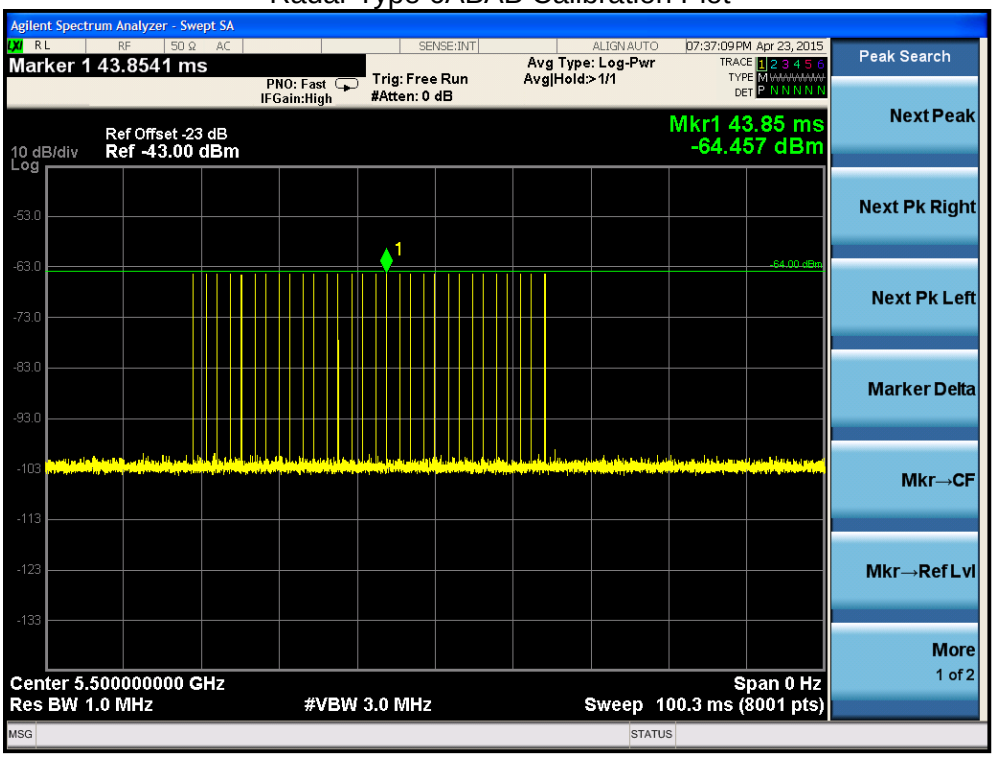
Radar Type 6 Calibration Plot



Radar Type 6AABB Calibration Plot



Radar Type 6ABAB Calibration Plot

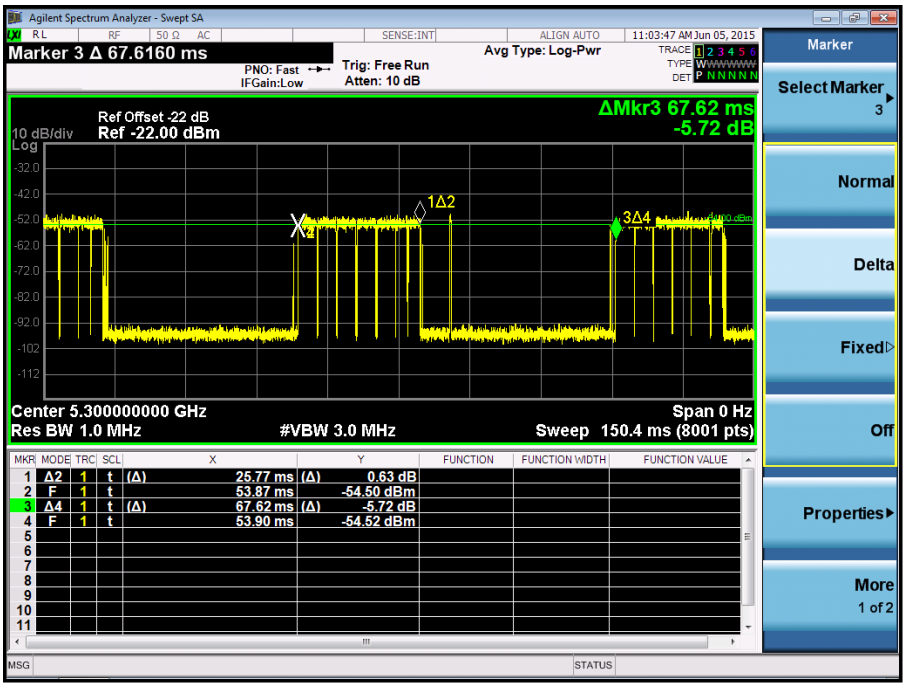


5.2. Test Transmission Sequences

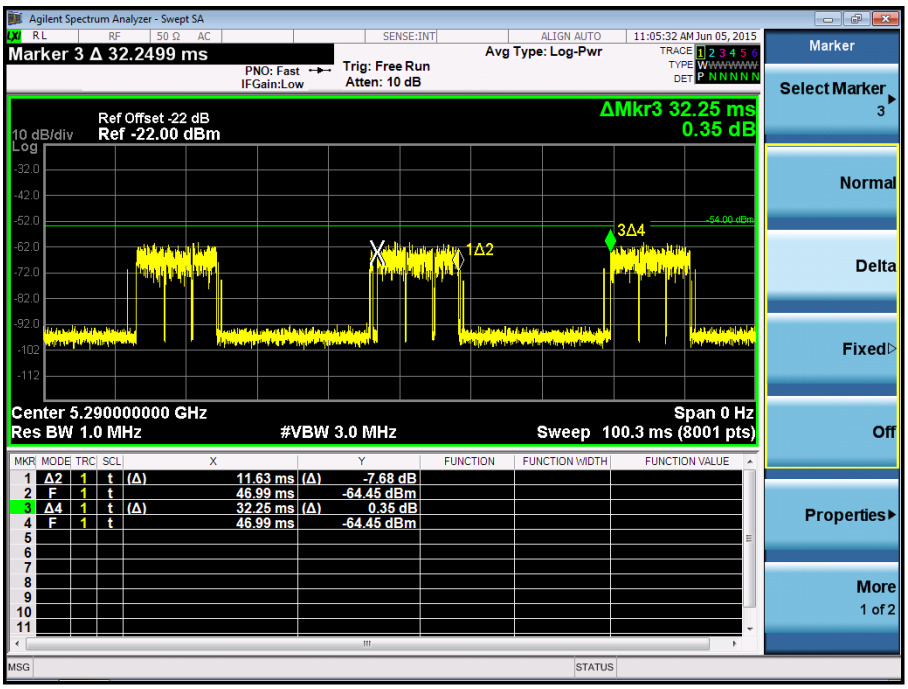
The DFS tests related to the Off-Channel CAC Check and the In-Service Monitoring shall be performed by using a test transmission sequence on the Operating Channel that shall consist of packet transmissions that together exceed the transmitter minimum activity ratio of 30 % measured over an interval of 100ms. The duration of the sequence shall be adequate for the DFS test purposes.

There shall be no transmissions on channels being checked during a Channel Availability Check.

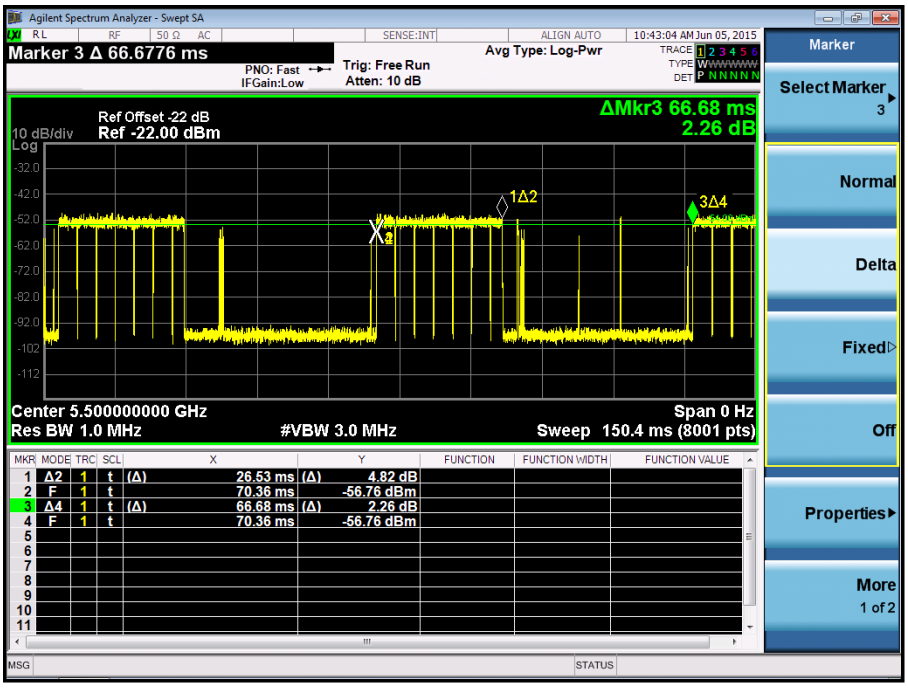
Transmission Sequences Plot - 802.11a-5300MHz



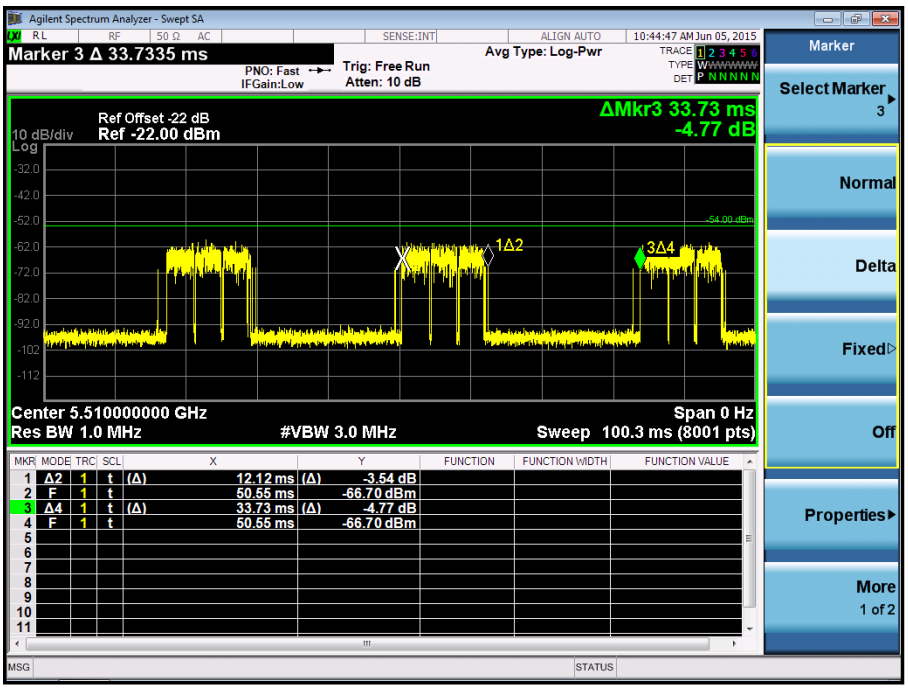
Transmission Sequences Plot - 802.11ac80 5290MHz



Transmission Sequences Plot - 802.11a-5500MHz



Transmission Sequences Plot - 802.11ac80 5530MHz



Test Mode	Test Frequency	Activity Ratio	Test Result
802.11a	5300	38.11%	Pass
802.11a	5500	39.79%	Pass
802.11ac-VHT80	5290	36.06%	Pass
802.11ac-VHT80	5530	35.93%	Pass

5.3. Initial Channel Availability Check Time Measurement

5.3.1 Test Limit

The Channel Availability Check shall be performed during a continuous period in time (Channel Availability Check Time) which shall not be less than the value defined in table 2-2.

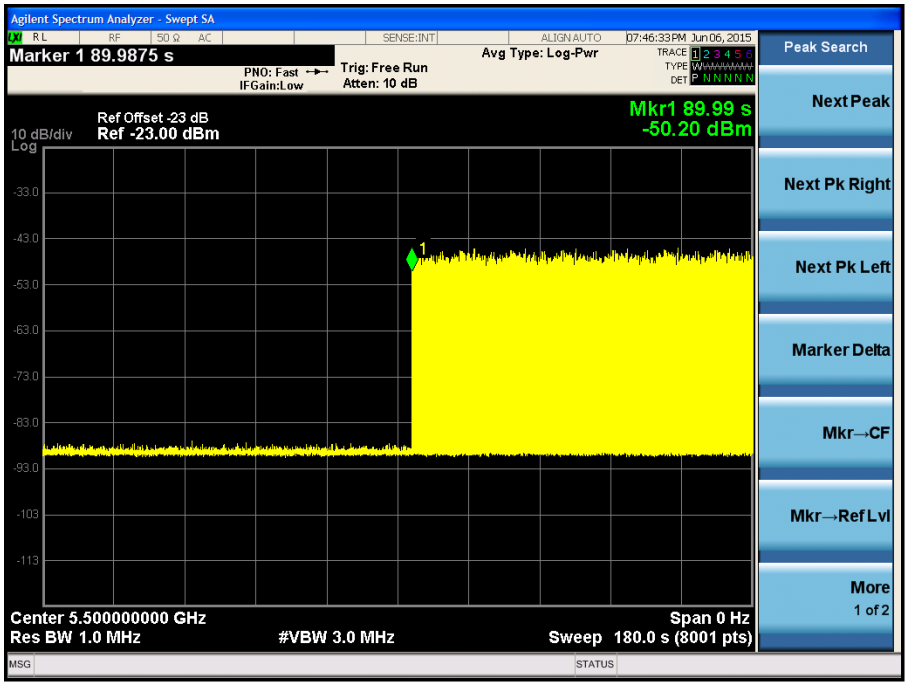
5.3.2 Test Procedure

1. The master devices will be powered on and be instructed to operate on the appropriate channel which falls within the frequency range 5250-5350MHz, 5470-5725MHz. At the same time the EUT is powered on, the spectrum analyzer will be set to zero span mode with a 3 MHz RBW and 3 MHz VBW on the Channel occupied by the radar (Ch_r) with a 2.5 minute sweep time. The spectrum analyzer's sweep will be started at the same time power is applied to the master device.
2. The EUT should not transmit any beacon or data transmissions until at least 1 minute after the completion of the power-on cycle.
3. Confirm that the EUT initiates transmission on the channel. Measurement system showing its nominal noise floor is marker1.

5.3.3 Test Result

The EUT does not transmit any beacon or data transmissions until at least 1 minute after the completion of the power-on cycle (89.99 sec). Initial beacons/data transmissions are indicated by marker 1 (29.99 sec).

Initial Channel Availability Check Time for 802.11a(5500MHz)



5.4. Radar Burst at the Beginning of the Channel Availability Check Time Measurement

5.4.1 Test Limit

During the Channel Availability Check, the RLAN shall be capable of detecting any of the radar test signals that fall within the ranges given by table 2-4, table 2-5 and table 2-6 with a level above the Radar Detection Threshold defined in table 2-3.

5.4.2 Test Procedure

a) The signal generator and UUT are connected using Set-up A. The power of the UUT is switched off.

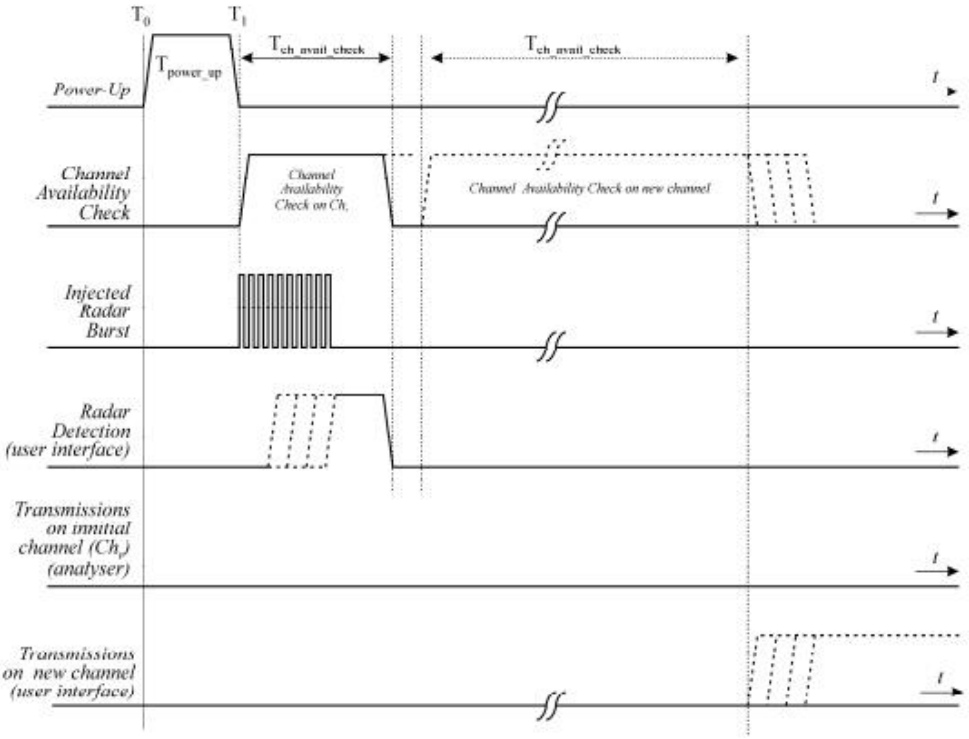
b) The UUT is powered on at T0. T1 denotes the instant when the UUT has completed its power-up sequence (T_{power_up}) and is ready to start the radar detection. The Channel Availability Check is expected to commence on Ch_r at instant T1 and is expected to end no sooner than T1 + $T_{ch\_avail\_check}$ unless a radar is detected sooner.

Note: Additional verification may be needed to define T1 in case it is not exactly known or indicated by the UUT.

c) A single radar burst is generated on Ch_r using the reference test signal defined in table D.3 at a level of up to 10 dB above the level defined in table 2-3. This single-burst radar test signal shall commence within 2 s after time T1.

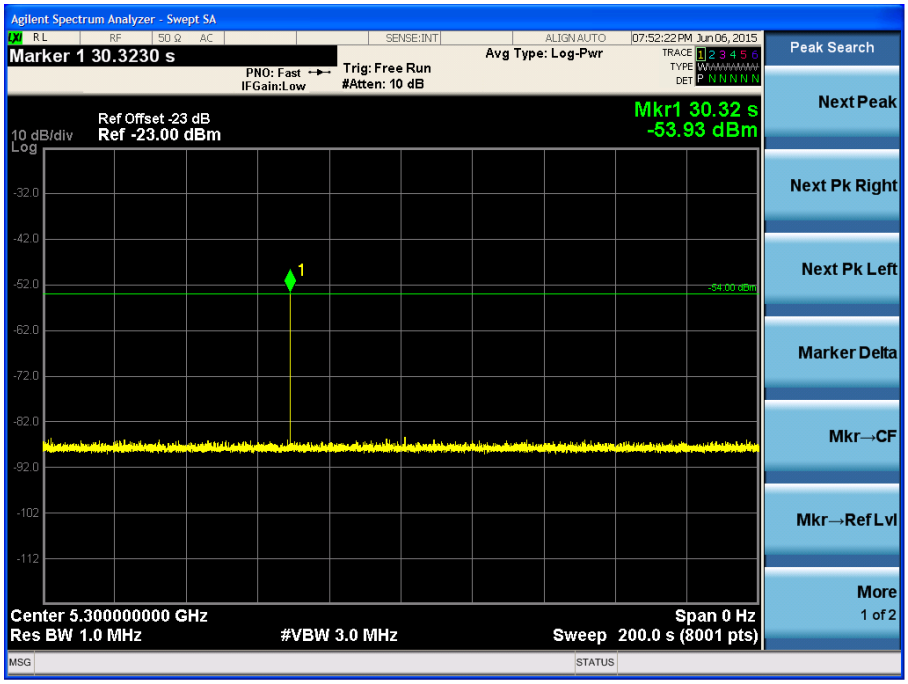
d) It shall be recorded if the radar test signal was detected.

e) A timing trace or description of the observed timing and behaviour of the UUT shall be recorded.

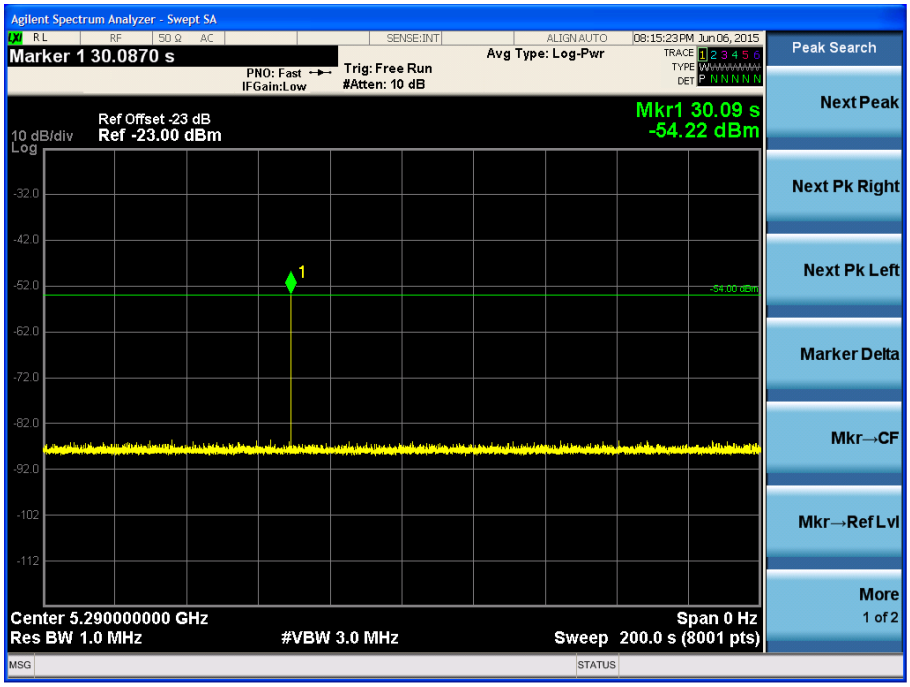


5.4.3 Test Result

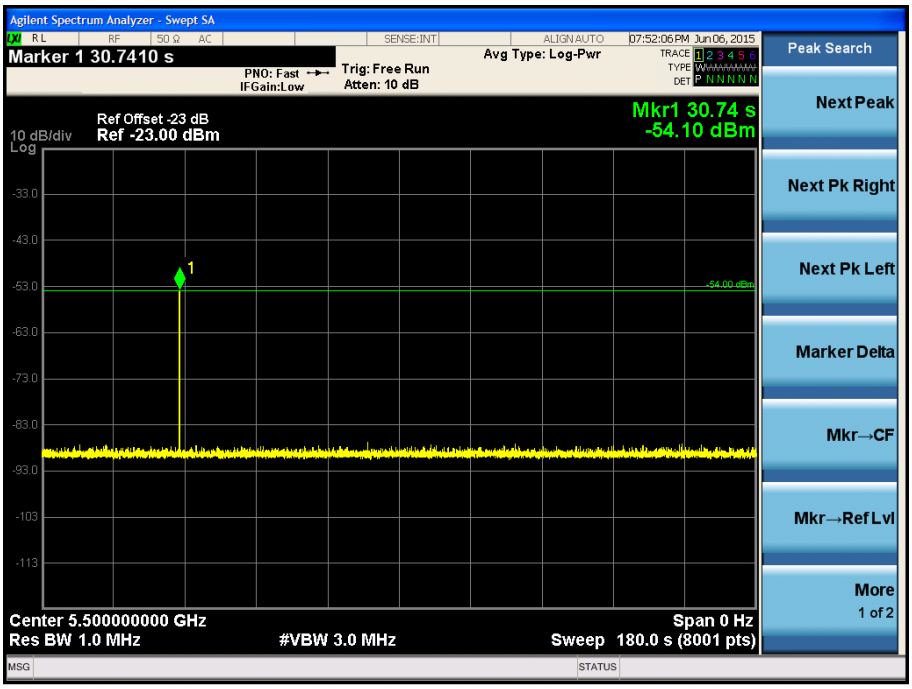
Radar Burst at the Beginning of the Channel Availability Check Time for 802.11a(5300MHz)



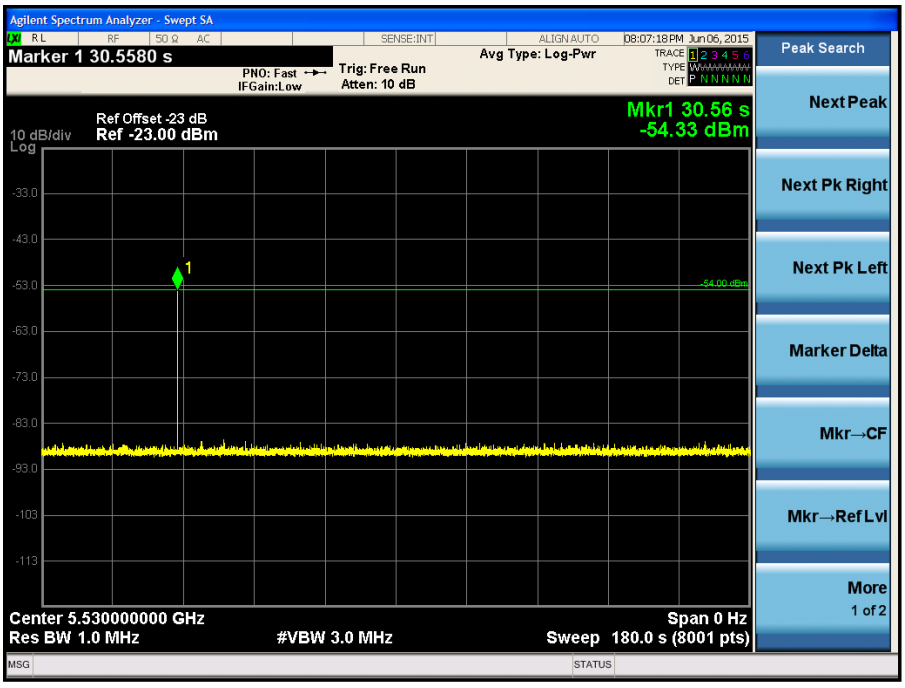
Radar Burst at the Beginning of the Channel Availability Check Time for 802.11ac-VHT80(5290MHz)



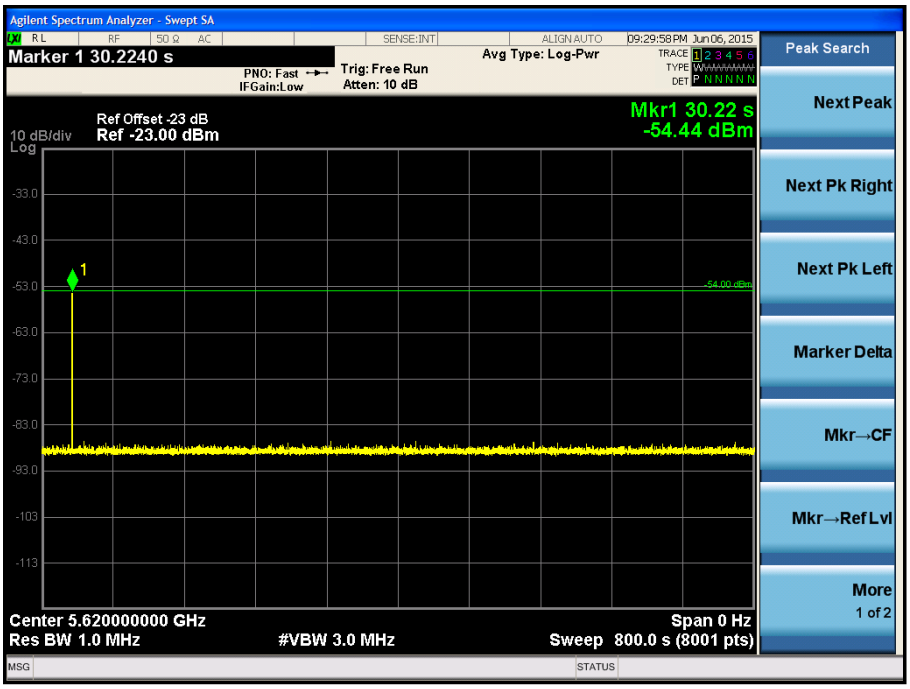
Radar Burst at the Beginning of the Channel Availability Check Time for 802.11a(5500MHz)



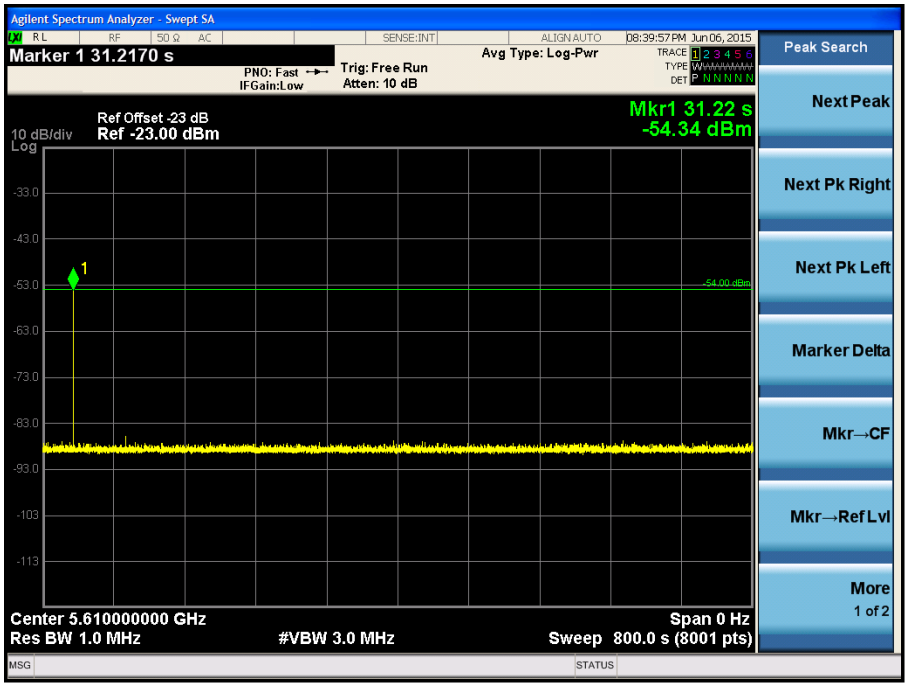
Radar Burst at the Beginning of the Channel Availability Check Time for 802.11ac-VHT80(5530MHz)



Radar Burst at the Beginning of the Channel Availability Check Time for 802.11a(5620MHz)



Radar Burst at the Beginning of the Channel Availability Check Time for 802.11ac-VHT80(5610MHz)



5.5. Radar Burst at the End of the Channel Availability Check Time Measurement

5.5.1 Test Limit

During the Channel Availability Check, the RLAN shall be capable of detecting any of the radar test signals that fall within the ranges given by table 2-4, table 2-5 and table 2-6 with a level above the Radar Detection Threshold defined in table 2-3.

5.5.2 Test Procedure

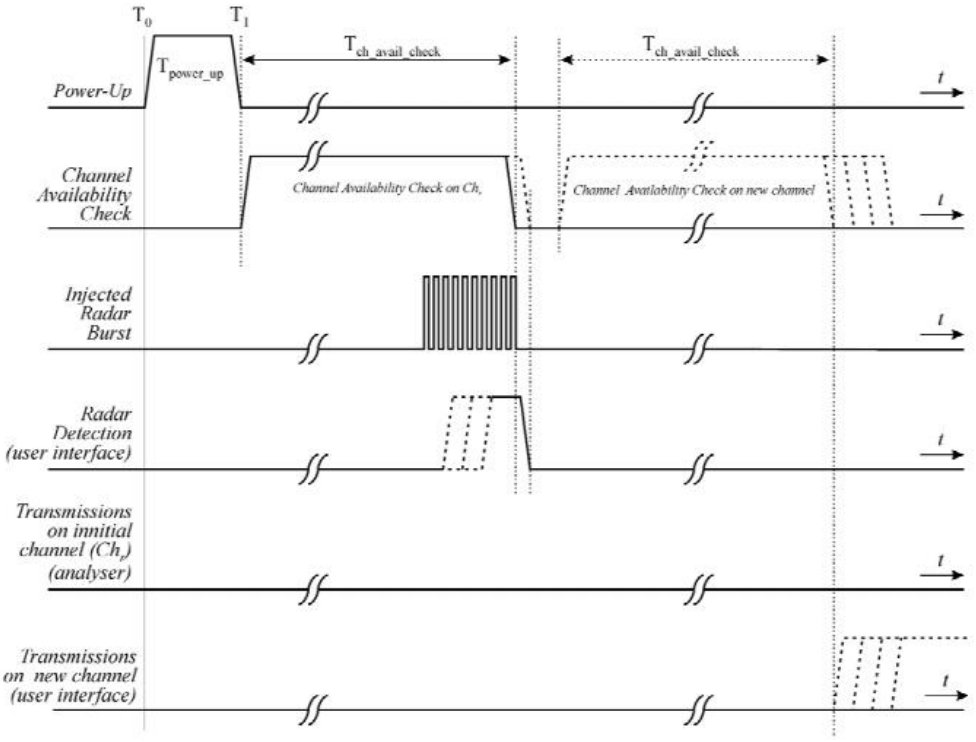
a) The signal generator and UUT are connected using Set-up A. The power of the UUT is switched off.

b) The UUT is powered up at T0. T1 denotes the instant when the UUT has completed its power-up sequence (T_{power_up}) and is ready to start the radar detection. The Channel Availability Check is expected to commence on Ch_r at instant T1 and is expected to end no sooner than T1 + $T_{ch\_avail\_check}$ unless a radar is detected sooner.

c) A single radar burst is generated on Ch_r using the reference test signal defined in table D.3 at a level of up to 10 dB above the level defined in clause 5.3.8.2.1. This single-burst radar test signal shall commence towards the end of the minimum required Channel Availability Check Time but not before time T1 + $T_{ch\_avail\_check}$ - 2 s.

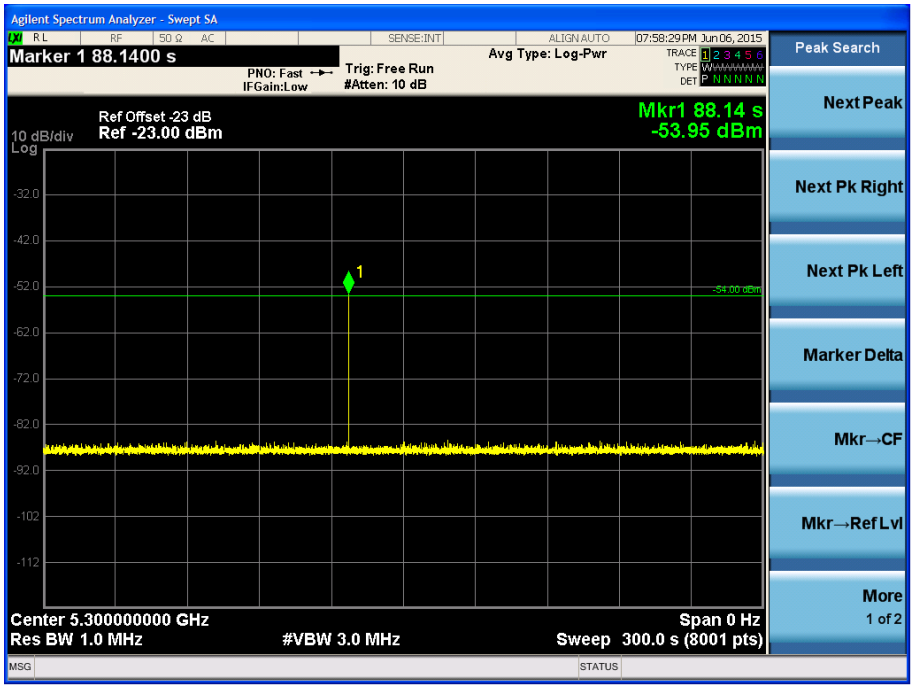
d) It shall be recorded if the radar test signal was detected.

e) A timing trace or description of the observed timing and behaviour of the UUT shall be recorded.

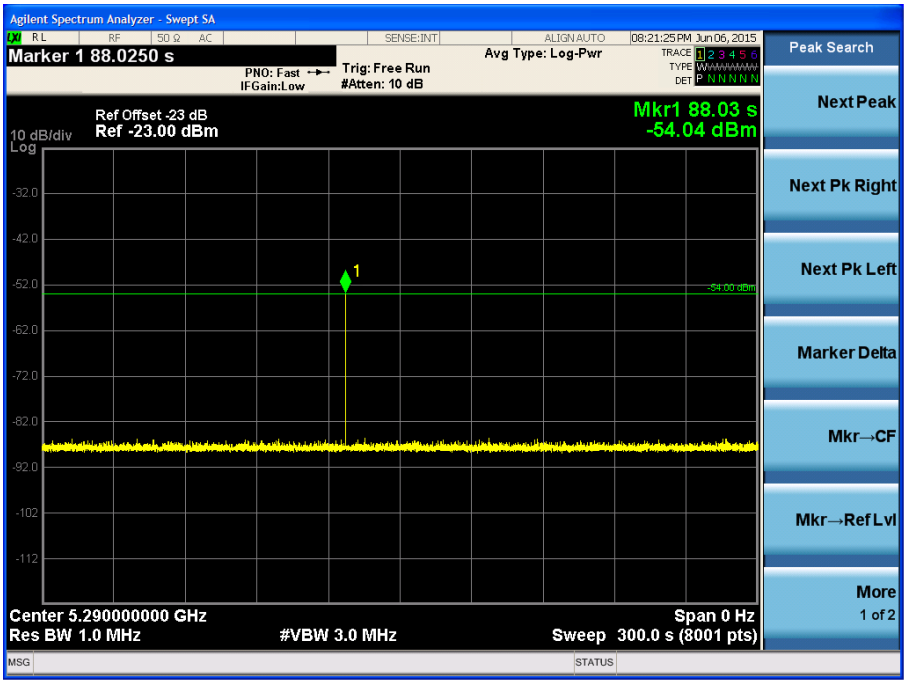


5.5.3 Test Result

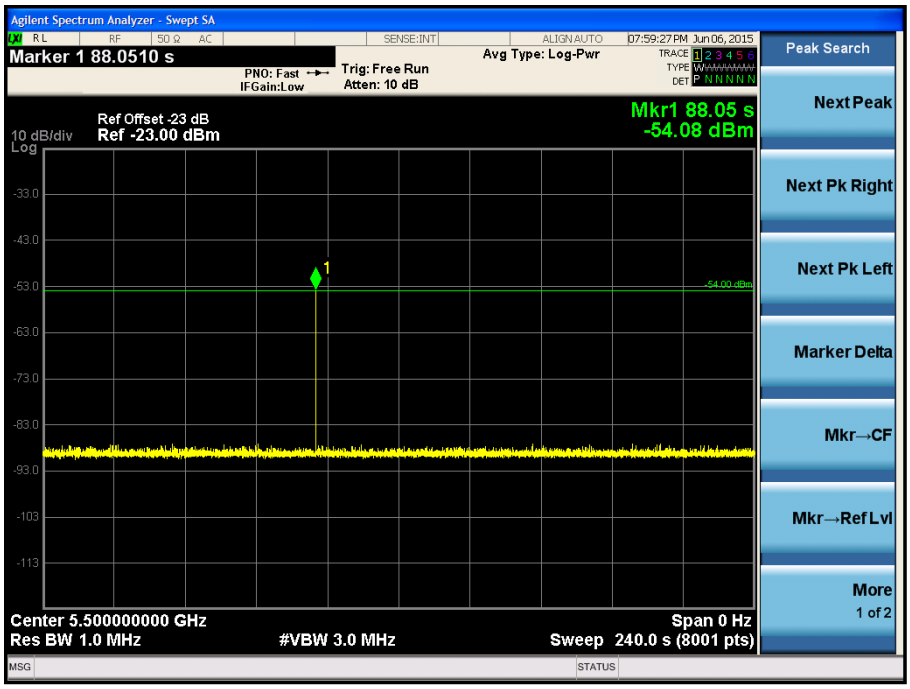
Radar Burst at the End of the Channel Availability Check Time for 802.11a(5300MHz)



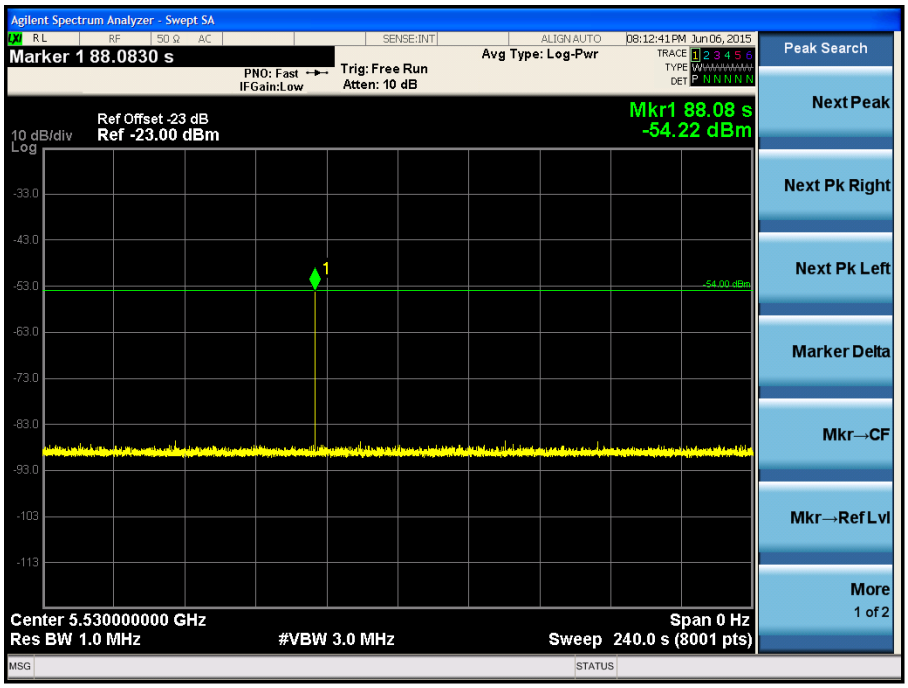
Radar Burst at the End of the Channel Availability Check Time for 802.11ac-VHT80(5290MHz)



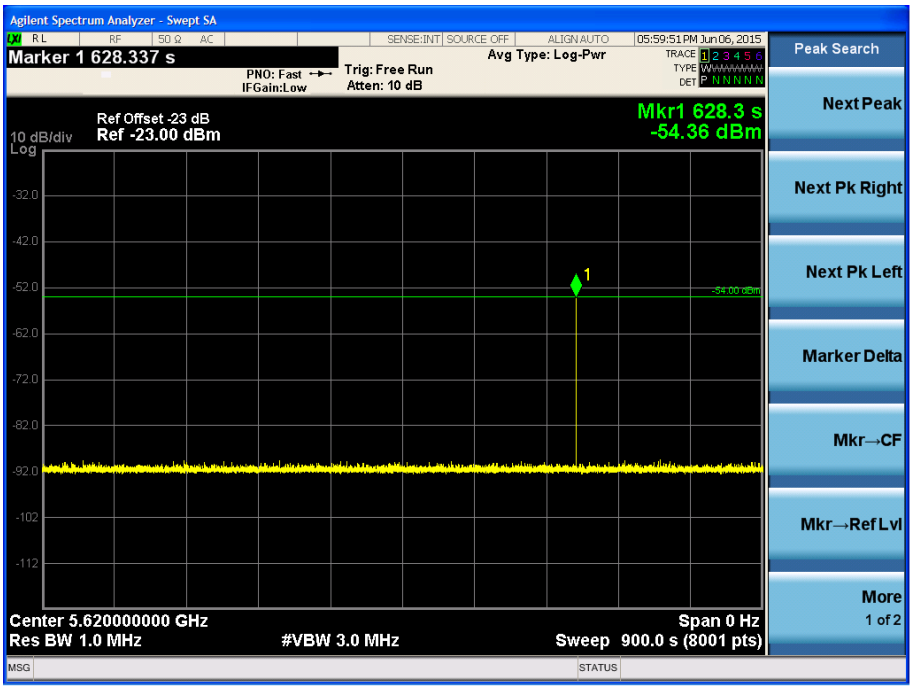
Radar Burst at the End of the Channel Availability Check Time for 802.11a(5500MHz)



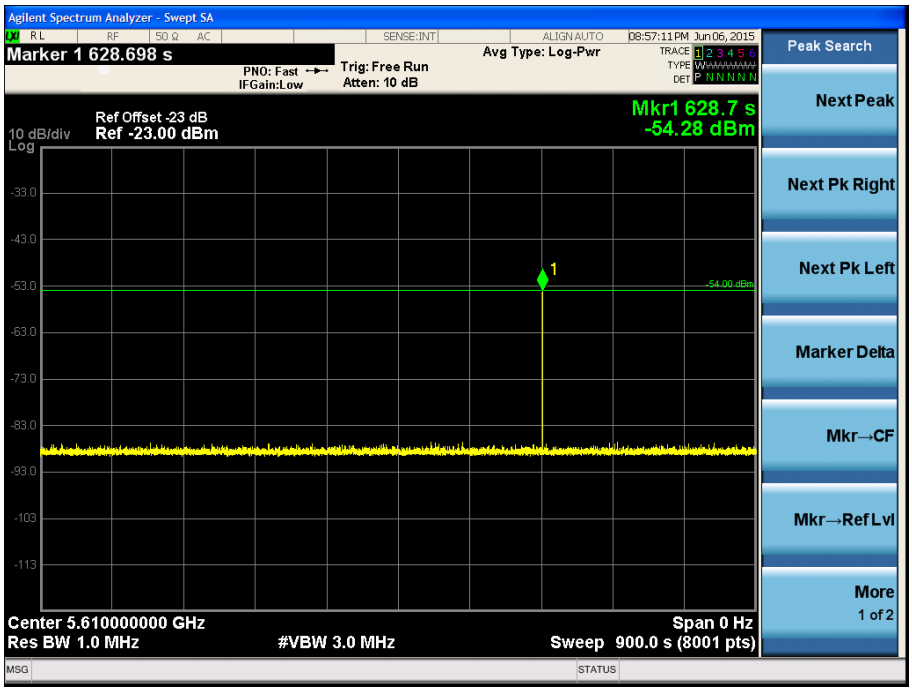
Radar Burst at the End of the Channel Availability Check Time for 802.11ac-VHT80(5530MHz)



Radar Burst at the End of the Channel Availability Check Time for 802.11a(5620MHz)



Radar Burst at the End of the Channel Availability Check Time for 802.11ac-VHT80(5610MHz)



5.6. Off-Channel Channel Availability Check

5.6.1 Test Limit

Where implemented, the Off-Channel CAC Time shall be declared by the manufacturer. However, the declared Off-Channel CAC Time shall be within the range specified in table 2-2.
During the Off-Channel CAC, the RLAN shall be capable of detecting any of the radar test signals that fall within the ranges given by table 2-4 & table 2-5 with a level above the Radar Detection Threshold defined in table 2-3.
The minimum required detection probability is defined in table 2-6.

5.6.2 Test Procedure

Radar Detection Threshold (during Off-Channel CAC)

The different steps below define the procedure to verify the Radar Detection Threshold during the Off-Channel CAC.
Where the declared channel plan includes channels whose nominal bandwidth falls completely or partly within the 5 600 MHz to 5 650 MHz band, the test shall be performed on one of these channels in addition to a channel outside this band.

a) The signal generator, the UUT (master device) and a slave device associated with the UUT, are connected using Set-up A.

b) The UUT shall transmit a test transmission sequence in accordance with clause 5.1.2.2 on (all) the Operating Channel(s).

c) A multi burst radar test signal is generated on Ch_r using any of the radar test signals defined in table D.4 at a level defined at table 2-3. The radar test signal used shall be recorded in the report. This multi burst radar test signal shall commence at T3 and shall continue for the total duration of the Off-Channel CAC Time ($T_{Off\text{-}Channel\_CAC}$) as declared by the manufacturer in accordance with table 2-2. For channels within the 5 600 MHz to 5 650 MHz band test signals #3 and #4 shall not be used and the Burst Interval Time (BIT) during the test shall be varied between 8 minutes and 10 minutes. For channels outside this band, the Burst Interval Time (BIT) during the test shall be varied between 45 s and 60 s.

d) The UUT shall detect the radar test signal before the end of the Off-Channel CAC Time and this shall be recorded.

Detection Probability (P_d)

For channels outside the 5 600 MHz to 5 650 MHz band, the test is sufficient to demonstrate that the UUT meets the Detection Probability (Pd) defined in table 2-6.
Where the declared channel plan includes channels whose nominal bandwidth falls completely or partly within the 5 600 MHz to 5 650 MHz band, the procedure in the steps below has to be performed on one of these channels.

a) A multi burst radar test signal is generated on Ch_r using any of the radar test signals defined in

table 2-4 and table 2-5 (except signals #3 and #4) at a level of 10 dB above the level defined at table 2-3. The radar test signal used shall be recorded in the report. This multi burst radar test signal shall commence at T3 and shall continue for the total duration of the Off-Channel CAC Time ($T_{Off\text{-}Channel\_CAC}$) as declared by the manufacturer in accordance with table 2-2. The Burst Interval Time (BIT) during the test shall be varied between 8 minutes and 10 minutes.

b) It shall be recorded how many bursts have been detected by the UUT at the end of the Off-Channel CAC Time.

The minimum number of bursts that the UUT shall detect in order to comply with the detection probability defined for this frequency range in table 2-6 is given by table as below.

Table: Minimum number of burst detections for channels within the 5 600 MHz to 5 650 MHz band

Off-Channel CAC Time (Minutes)	Number of Bursts generated assuming a BIT of 10 minutes	Minimum Number of burst detections
60	6	5
90	9	6
160	16	7
320	32	8
1440	144	9

5.6.3 Test Result

This device didn’t support Off-Channel CAC mechanism which was declared by the manufacturer, so Radar Detection Threshold and Detection Probability were not performed.

5.7. Radar Detection Threshold (during the Channel Availability Check)

5.7.1 Test Limit

The minimum required detection probability is defined in table as below.

Parameter	Detection Probability (Pd)	
	Channels whose nominal bandwidth falls partly or completely within the 5 600 MHz to 5 650 MHz band	Other channels
CAC, Off-Channel CAC	99,99 %	60 %
NOTE: Pd gives the probability of detection per simulated radar burst and represents a minimum level of detection performance under defined conditions. Therefore Pd does not represent the overall detection probability for any particular radar under real life conditions.		

5.7.2 Test Procedure

The different steps below define the procedure to verify the Radar Detection Threshold during the Channel Availability Check Time for channels outside the 5 600 MHz to 5 650 MHz band.

a) The signal generator and UUT are connected using Set-up A. The power of the UUT is switched off.

b) The UUT is powered on at T0. T1 denotes the instant when the UUT has completed its power-up sequence (T_{power_up}) and is ready to start the radar detection. The Channel Availability Check on Ch_r is expected to commence at instant T1 and is expected to end no sooner than T1 + $T_{ch\_avail\_check}$ unless a radar is detected sooner.

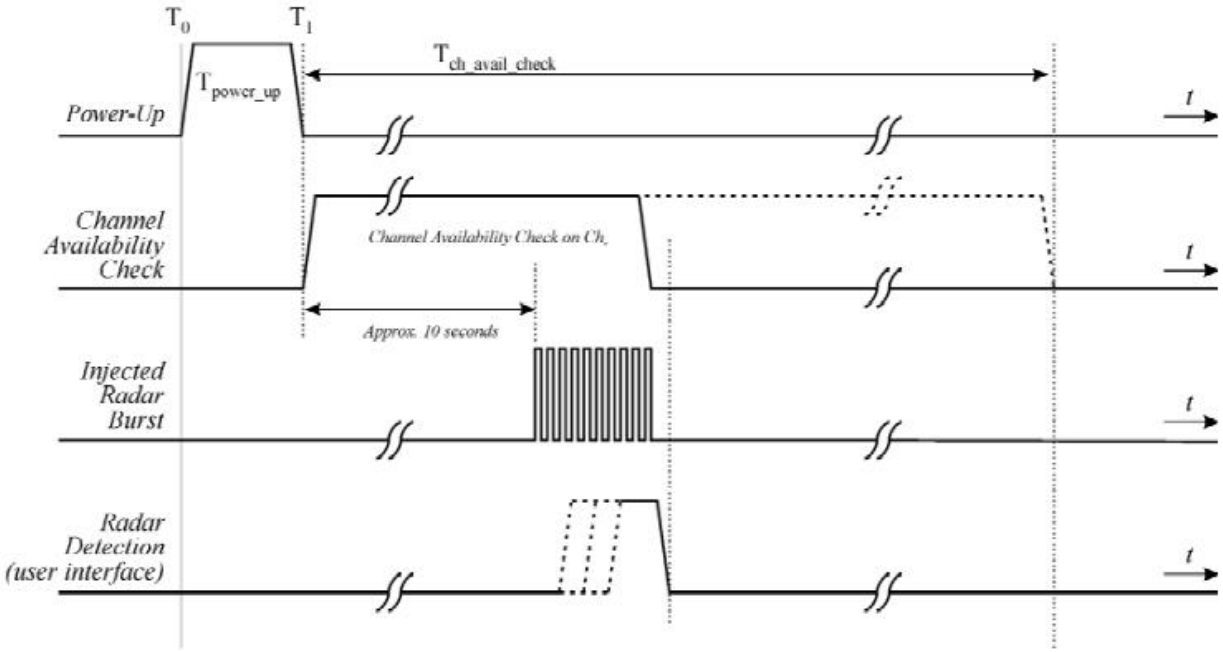
c) A single burst radar test signal is generated on Ch_r using any of the radar test signals defined in table 2-4 and table 2-5 at a level defined in table 2-3. This single-burst radar test signal may commence at any time within the applicable Channel Availability Check Time.

d) It shall be recorded if the radar test signal was detected.

e) The steps c) to d) shall be performed 20 times and each time a different radar test signal shall be generated from options provided in table 2-4, table 2-5 and table 2-6. The radar test signals used shall be recorded in the report. The radar test signal shall be detected at least 12 times out of the 20 trials in order to comply with the detection probability specified for this frequency range in table 2-6 Where the declared channel plan includes channels whose nominal bandwidth falls completely or partly within the 5 600 MHz to 5 650 MHz band, additional testing as described in the steps below shall be performed on a channel within this band.

f) A single burst radar test signal is generated on Ch_r using any of the radar test signals defined in table 2-4 and table 2-5 (except signals #3 and #4) at a level of 10 dB above the level defined in table 2-3. This single burst radar test signal may commence at any time within the applicable Channel Availability Check Time.

g) Step f) shall be performed 20 times, each time a different radar test signal shall be generated from options provided in table D.4 (except signals #3 and #4). The radar test signals used shall be recorded in the report. The radar test signal shall be detected during each of these trials and this shall be recorded.



5.7.3 Test Result

802.11a channel 60 - 5300MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-64dBm	20	100%	60%	Pass
Type 2	-64dBm	20	100%	60%	Pass
Type 3	-64dBm	20	100%	60%	Pass
Type 4	-64dBm	20	95%	60%	Pass
Type 5	-64dBm	20	100%	60%	Pass
Type 5AABB	-64dBm	20	100%	60%	Pass
Type 5ABAB	-64dBm	20	100%	60%	Pass
Type 6	-64dBm	20	100%	60%	Pass
Type 6AABB	-64dBm	20	100%	60%	Pass
Type 6ABAB	-64dBm	20	95%	60%	Pass

802.11 ac-VHT80 channel 58 - 5290MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-64dBm	20	100%	60%	Pass
Type 2	-64dBm	20	100%	60%	Pass
Type 3	-64dBm	20	100%	60%	Pass
Type 4	-64dBm	20	100%	60%	Pass
Type 5	-64dBm	20	100%	60%	Pass
Type 5AABB	-64dBm	20	100%	60%	Pass
Type 5ABAB	-64dBm	20	100%	60%	Pass
Type 6	-64dBm	20	100%	60%	Pass
Type 6AABB	-64dBm	20	100%	60%	Pass
Type 6ABAB	-64dBm	20	100%	60%	Pass

802.11a channel 100 - 5500MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-64dBm	20	100%	60%	Pass
Type 2	-64dBm	20	100%	60%	Pass
Type 3	-64dBm	20	90%	60%	Pass
Type 4	-64dBm	20	100%	60%	Pass
Type 5	-64dBm	20	100%	60%	Pass
Type 5AABB	-64dBm	20	100%	60%	Pass
Type 5ABAB	-64dBm	20	100%	60%	Pass
Type 6	-64dBm	20	100%	60%	Pass
Type 6AABB	-64dBm	20	100%	60%	Pass
Type 6ABAB	-64dBm	20	95%	60%	Pass

802.11 ac-VHT80 channel 106 - 5530MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-64dBm	20	100%	60%	Pass
Type 2	-64dBm	20	95%	60%	Pass
Type 3	-64dBm	20	100%	60%	Pass
Type 4	-64dBm	20	100%	60%	Pass
Type 5	-64dBm	20	100%	60%	Pass
Type 5AABB	-64dBm	20	100%	60%	Pass
Type 5ABAB	-64dBm	20	90%	60%	Pass
Type 6	-64dBm	20	100%	60%	Pass
Type 6AABB	-64dBm	20	100%	60%	Pass
Type 6ABAB	-64dBm	20	100%	60%	Pass

802.11a channel 124 5620MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-54dBm	20	100%	99.99%	Pass
Type 2	-54dBm	20	100%	99.99%	Pass
Type 5	-54dBm	20	100%	99.99%	Pass
Type 5AABB	-54dBm	20	100%	99.99%	Pass
Type 5ABAB	-54dBm	20	100%	99.99%	Pass
Type 6	-54dBm	20	100%	99.99%	Pass
Type 6AABB	-54dBm	20	100%	99.99%	Pass
Type 6ABAB	-54dBm	20	100%	99.99%	Pass

802.11ac-VHT80 channel 122 5610MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-54dBm	20	100%	99.99%	Pass
Type 2	-54dBm	20	100%	99.99%	Pass
Type 5	-54dBm	20	100%	99.99%	Pass
Type 5AABB	-54dBm	20	100%	99.99%	Pass
Type 5ABAB	-54dBm	20	100%	99.99%	Pass
Type 6	-54dBm	20	100%	99.99%	Pass
Type 6AABB	-54dBm	20	100%	99.99%	Pass
Type 6ABAB	-54dBm	20	100%	99.99%	Pass

5.8. In-Service Monitoring Measurement

5.8.1 Test Limit

The In-Service Monitoring shall be used to monitor each Operating Channel.
The In-Service-Monitoring shall start immediately after the RLAN has started transmissions on a channel.
During the In-Service Monitoring, the RLAN shall be capable of detecting any of the radar test signals that fall within the ranges 5250-5350MHz,5470-5725MHz with a level above the Radar Detection Threshold defined in table 2-3.
The minimum required detection probability associated with a given radar test signal is defined in table 2-4 and table 2-5.

5.8.2 Test Procedure Used

a) When the UUT is a master device, a slave device will be used that associates with the UUT. The signal generator and the UUT are connected using Set-up A.
b) The UUT shall transmit a test transmission sequence on the selected channel Ch_r While the testing is performed on Ch_r, the equipment is allowed to have simultaneous transmissions on other adjacent or non-adjacent operating channels.
c) At a certain time T0, a single burst radar test signal is generated on Ch_r using radar test signal #1 defined in table 2-5 and at a level defined in table 2-3. T1 denotes the end of the radar burst.
d) It shall be recorded if the radar test signal was detected.
e) The steps b) to d) shall be performed 20 times. The radar test signal shall be detected at least 12 times out of the 20 trials in order to comply with the detection probability specified in table 2-6.
f) The steps b) to e) shall be repeated for each of the radar test signals defined in table 2-5 and as described in table 2-3.

5.8.3 Test Result

In-Service Monitoring 802.11a channel 60 - 5300MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-64dBm	20	100%	60%	Pass
Type 2	-64dBm	20	95%	60%	Pass
Type 3	-64dBm	20	100%	60%	Pass
Type 4	-64dBm	20	100%	60%	Pass
Type 5	-64dBm	20	100%	60%	Pass
Type 5AABB	-64dBm	20	100%	60%	Pass
Type 5ABAB	-64dBm	20	100%	60%	Pass
Type 6	-64dBm	20	100%	60%	Pass
Type 6AABB	-64dBm	20	100%	60%	Pass
Type 6ABAB	-64dBm	20	95%	60%	Pass

In-Service Monitoring 802.11ac-VHT80 channel 58 - 5290MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-64dBm	20	100%	60%	Pass
Type 2	-64dBm	20	90%	60%	Pass
Type 3	-64dBm	20	100%	60%	Pass
Type 4	-64dBm	20	100%	60%	Pass
Type 5	-64dBm	20	100%	60%	Pass
Type 5AABB	-64dBm	20	100%	60%	Pass
Type 5ABAB	-64dBm	20	100%	60%	Pass
Type 6	-64dBm	20	90	60%	Pass
Type 6AABB	-64dBm	20	100%	60%	Pass
Type 6ABAB	-64dBm	20	100%	60%	Pass

In-Service Monitoring 802.11a channel 100 - 5500MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-64dBm	20	95%	60%	Pass
Type 2	-64dBm	20	90%	60%	Pass
Type 3	-64dBm	20	90%	60%	Pass
Type 4	-64dBm	20	100%	60%	Pass
Type 5	-64dBm	20	100%	60%	Pass
Type 5AABB	-64dBm	20	100%	60%	Pass
Type 5ABAB	-64dBm	20	95%	60%	Pass
Type 6	-64dBm	20	100%	60%	Pass
Type 6AABB	-64dBm	20	100%	60%	Pass
Type 6ABAB	-64dBm	20	100%	60%	Pass

In-Service Monitoring 802.11ac-VHT80 channel 106 - 5530MHz

Radar Wave Type	Detection Threshold	Trail Number	Detection Result	Limit	Note
Type 1	-64dBm	20	100%	60%	Pass
Type 2	-64dBm	20	85%	60%	Pass
Type 3	-64dBm	20	85%	60%	Pass
Type 4	-64dBm	20	90%	60%	Pass
Type 5	-64dBm	20	90%	60%	Pass
Type 5AABB	-64dBm	20	100%	60%	Pass
Type 5ABAB	-64dBm	20	95%	60%	Pass
Type 6	-64dBm	20	100%	60%	Pass
Type 6AABB	-64dBm	20	100%	60%	Pass
Type 6ABAB	-64dBm	20	100%	60%	Pass

5.9. Channel Shutdown and Non-Occupancy Period

5.9.1 Test Limit

Parameter	Value
Channel Move Time	< 10 s
Channel Closing Transmission Time	< 1 s

5.9.2 Test Procedure Used

a) When the UUT is a master device, a slave device will be used that associates with the UUT. The signal generator and the UUT shall be connected using Set-up A.

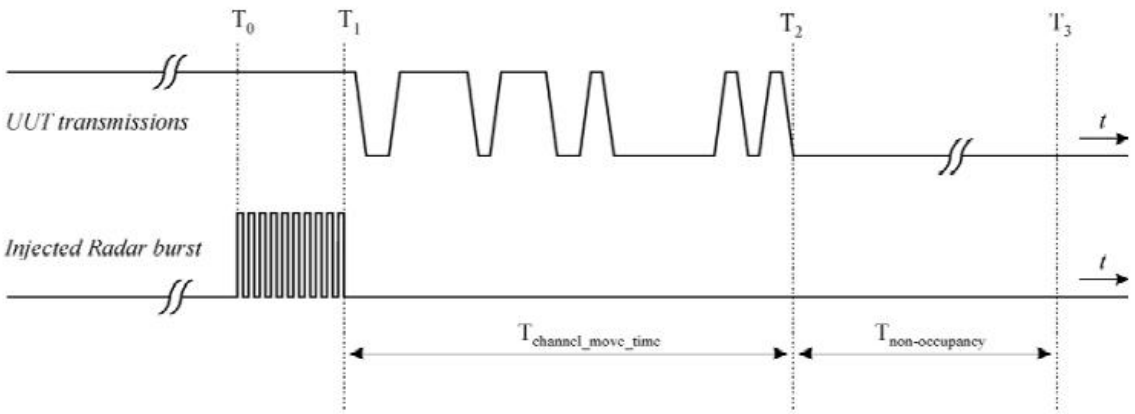
b) The UUT shall transmit a test transmission sequence on the selected channel Ch_r. While the testing is performed on Ch_r, the equipment is allowed to have simultaneous transmissions on other adjacent or non-adjacent operating channels.

c) At a certain time T0, a single burst test signal is generated on Ch_r using the reference DFS test signal defined in table 2-4 and at a level of up to 10 dB above the level defined in table 2-3 on the selected channel. T1 denotes the end of the radar burst.

d) The transmissions of the UUT following instant T1 on the selected channel Ch_r shall be observed for a period greater than or equal to the Channel Move Time defined in table 2-2. The aggregate duration (Channel Closing Transmission Time) of all transmissions from the UUT on Ch_r during the Channel Move Time shall be compared to the limit defined in table 2-2. For equipment capable of having simultaneous transmissions on multiple (adjacent or non-adjacent) operating channels, the equipment is allowed to continue transmissions on other Operating Channels (different from Ch_r).

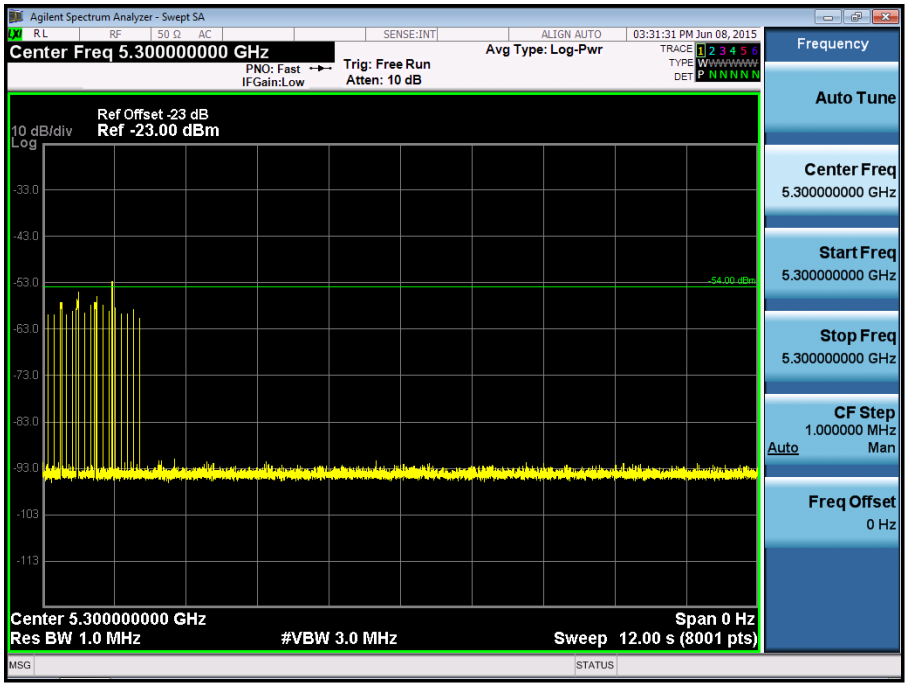
e) T2 denotes the instant when the UUT has ceased all transmissions on the channel Ch_r. The time difference between T1 and T2 shall be measured. This value (Channel Move Time) shall be noted and compared with the limit defined in table 2-2.

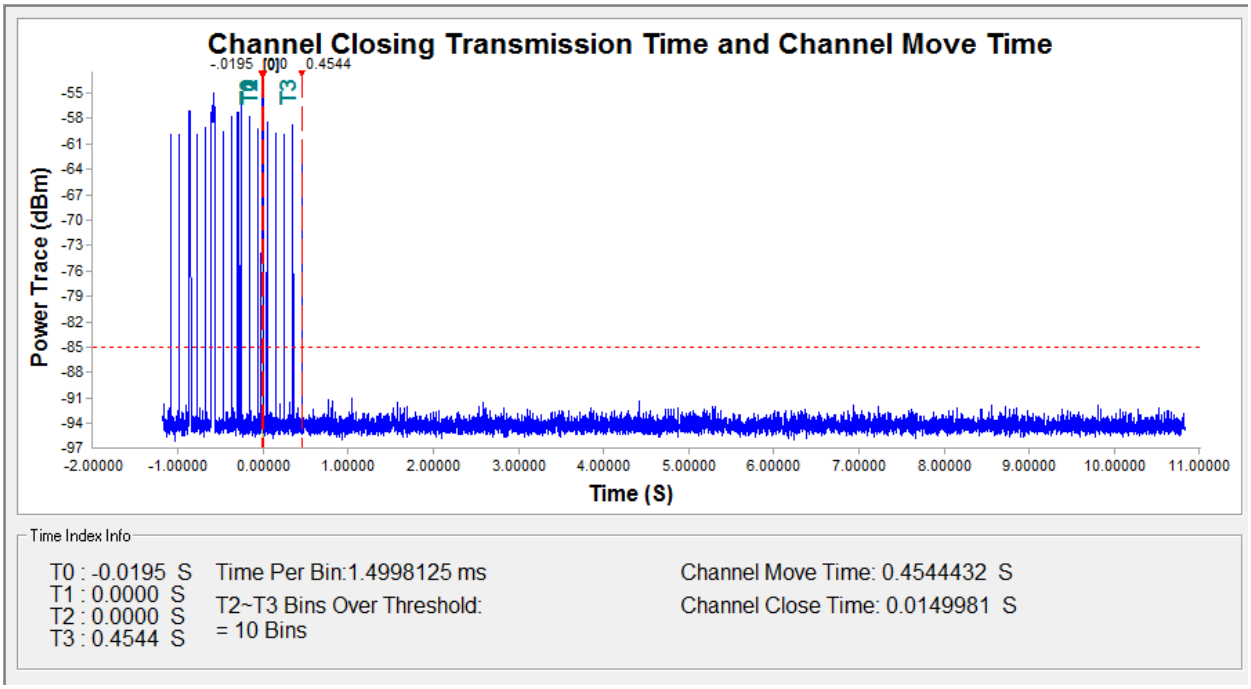
f) Following instant T2, the selected channel Ch_r shall be observed for a period equal to the Non-Occupancy Period (T3-T2) to verify that the UUT does not resume any transmissions on this channel.



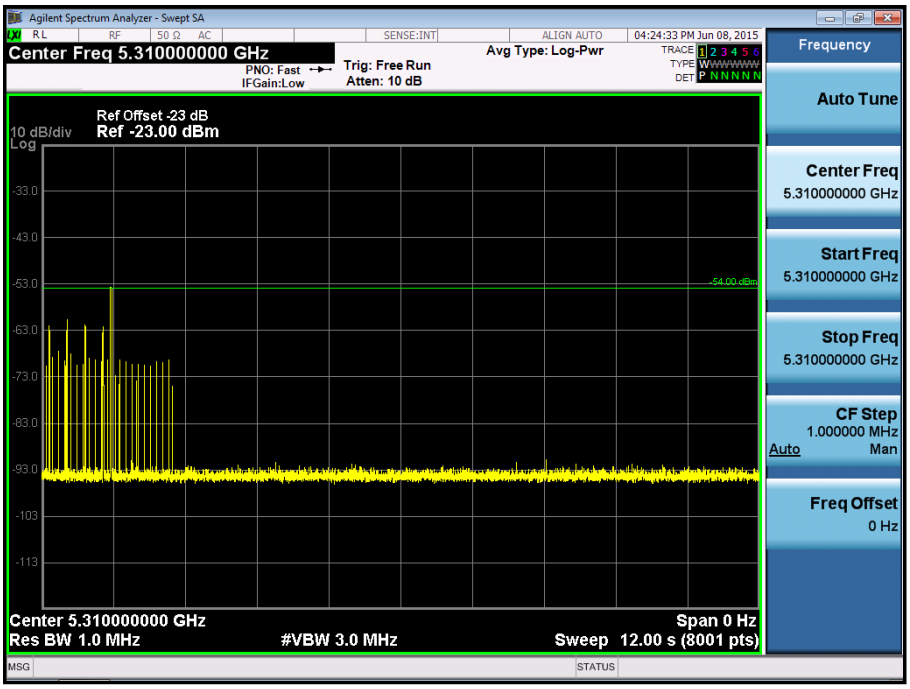
5.9.3 Test Result

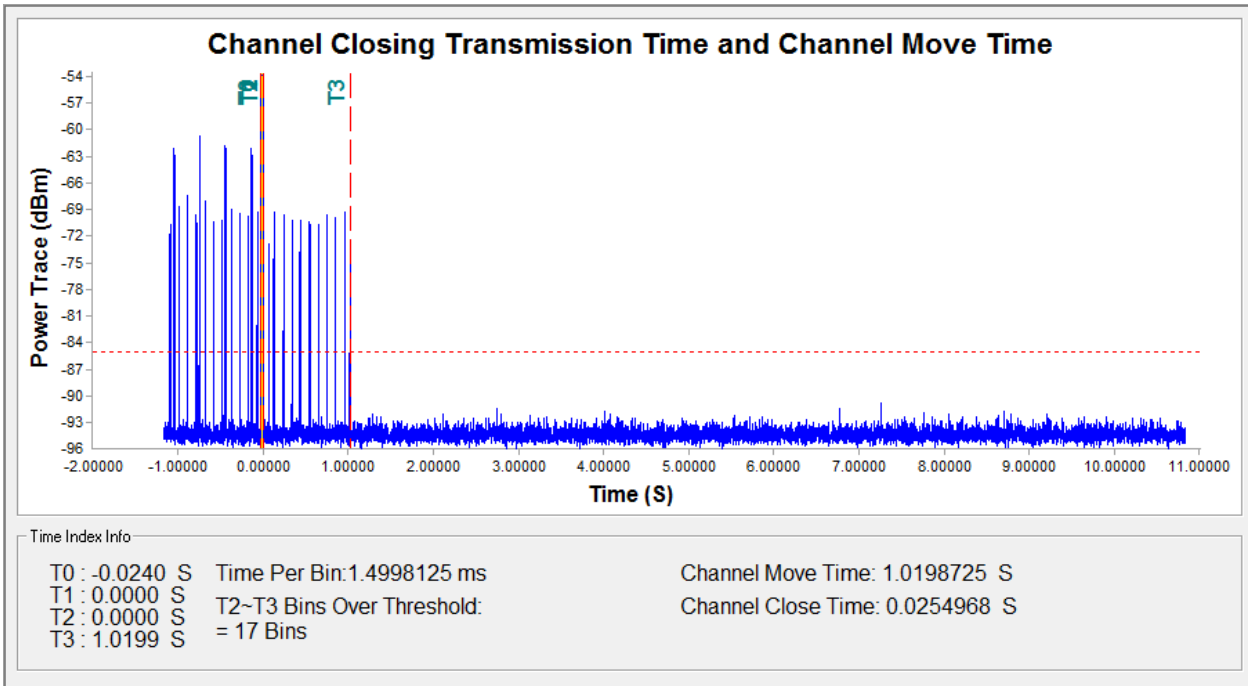
Channel Closing Transmission Time and Channel Move Time for 802.11a 5300MHz





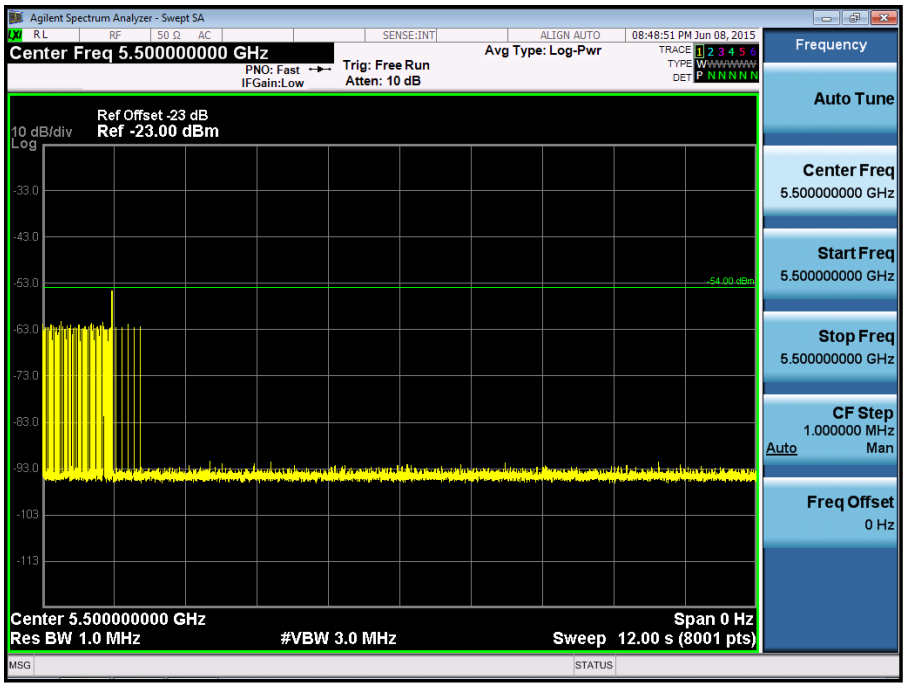
Channel Closing Transmission Time and Channel Move Time for 802.11n-HT40 5310MHz

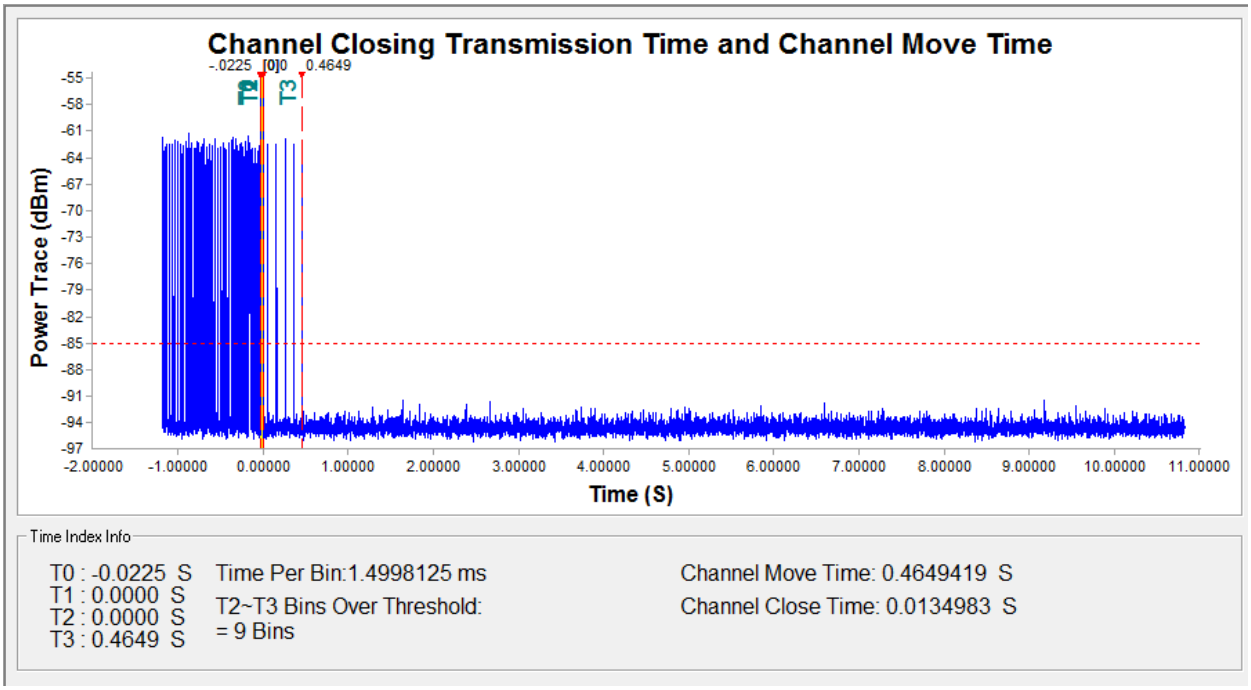




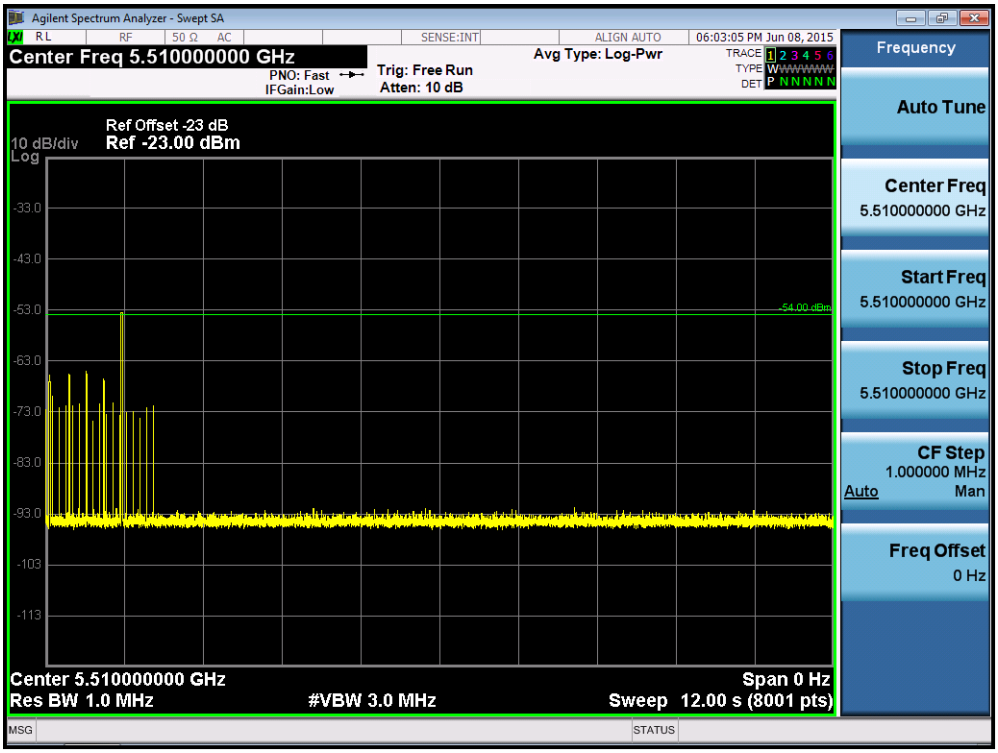
Test Item	Measured Time (s)		Limit	Results
	5300MHz	5310MHz		
Channel Move Time	0.454	1.020	< 10 s	Pass
Channel Closing Transmission Time	0.015	0.025	< 1 s	Pass

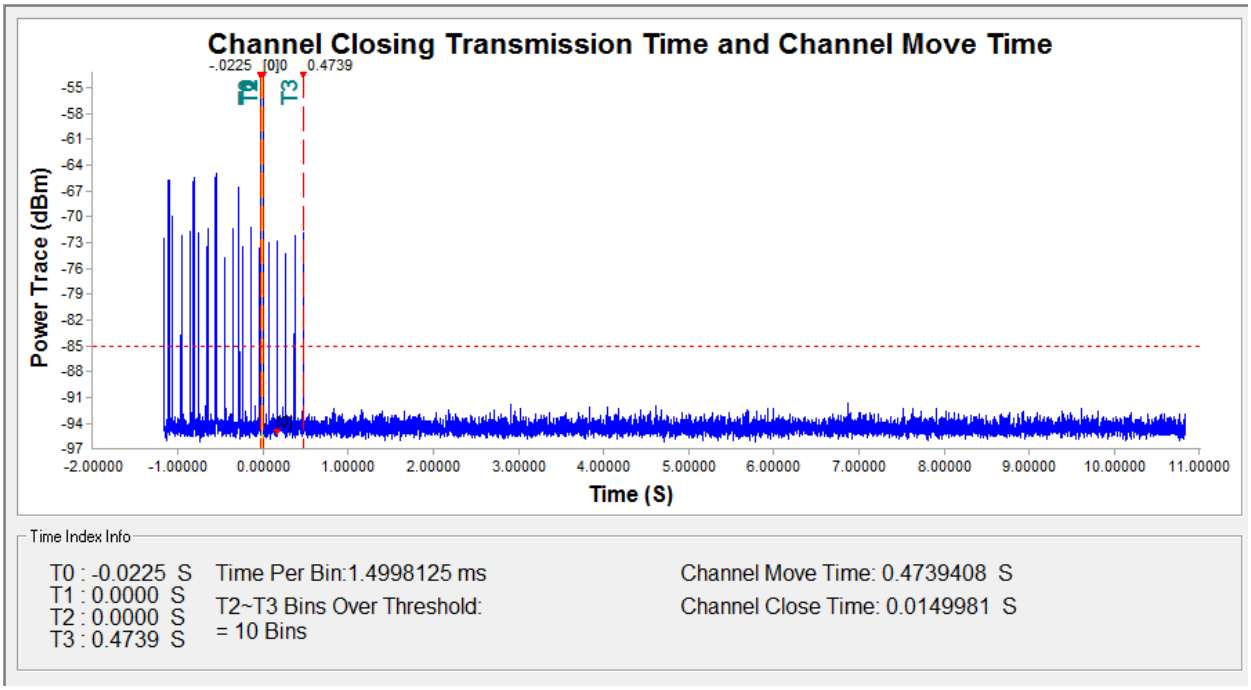
Channel Closing Transmission Time and Channel Move Time for 802.11a 5500MHz





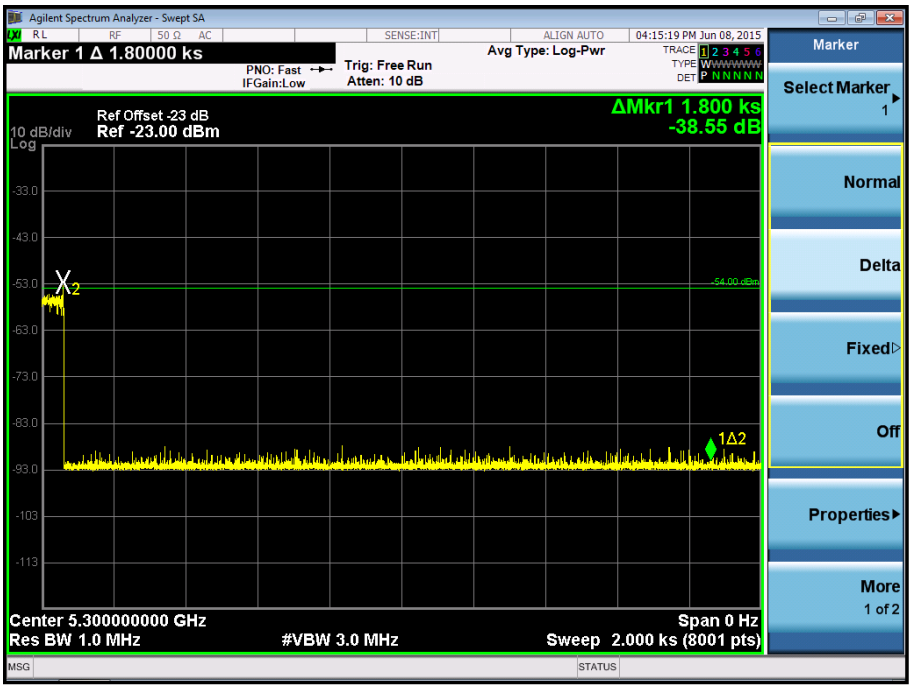
Channel Closing Transmission Time and Channel Move Time for 802.11n-HT40 5510MHz



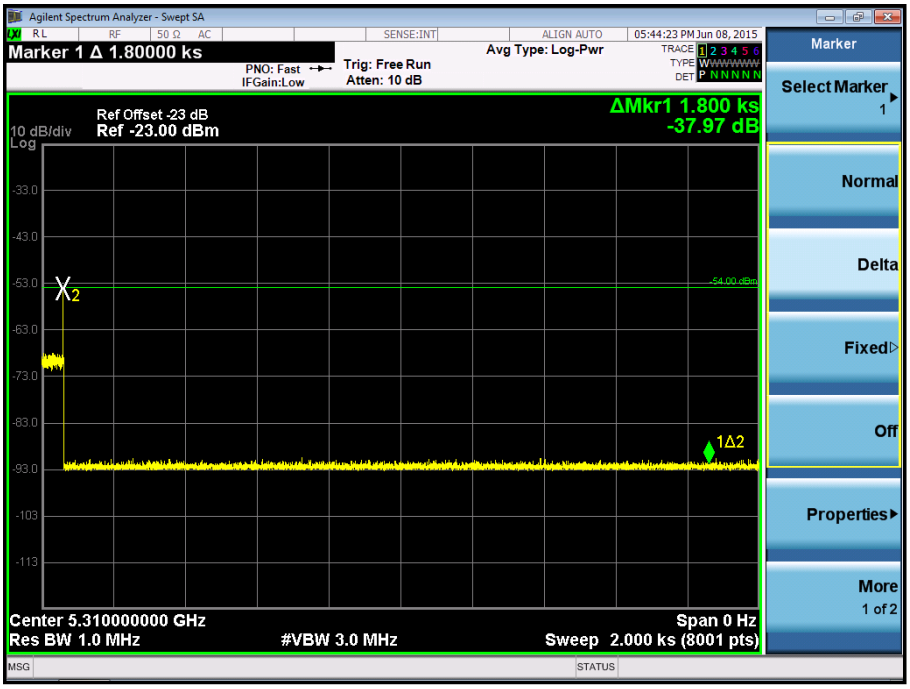


Test Item	Measured Time (s)		Limit	Results
	5500MHz	5510MHz		
Channel Move Time	0.465	0.474	< 10 s	Pass
Channel Closing Transmission Time	0.013	0.015	< 1 s	Pass

Non-Occupancy Period for 802.11a 5300MHz

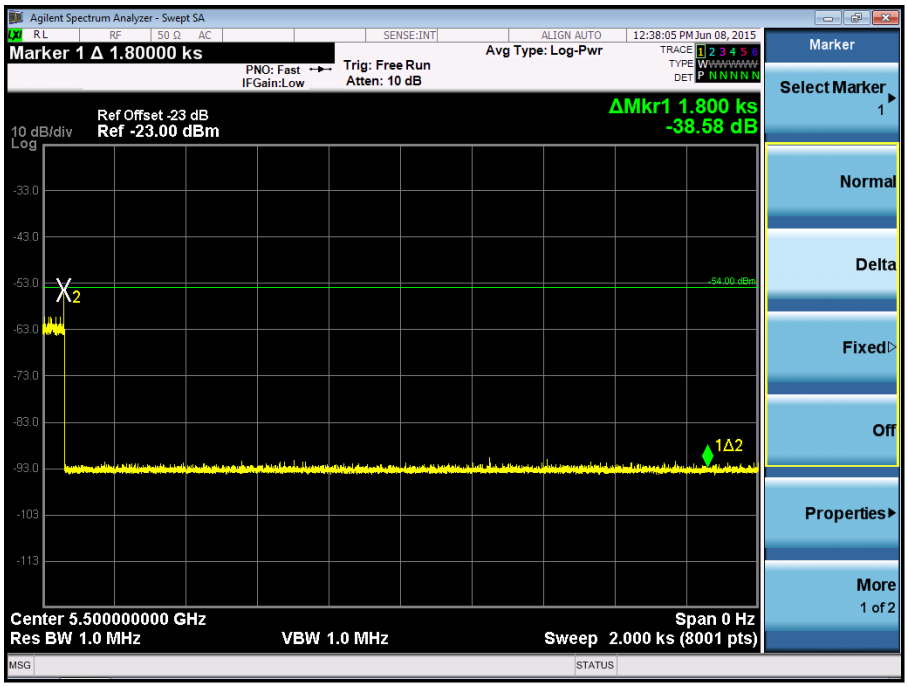


Non-Occupancy Period for 802.11n-HT40 5310MHz

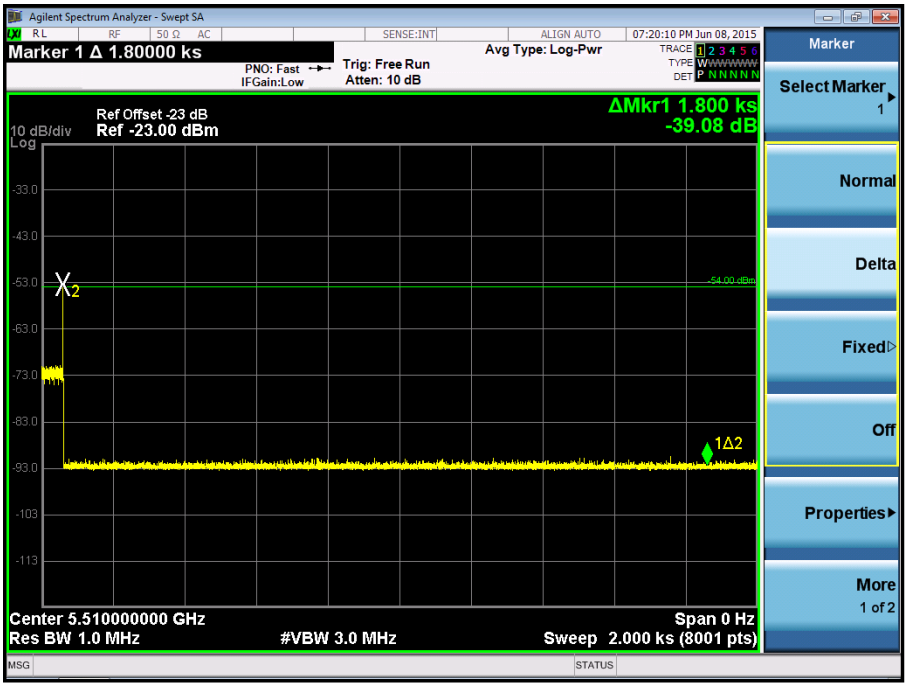


Test Item	Measured Time (Min)		Limit	Results
	5300MHz	5310MHz		
Non-Occupancy Period	> 30 Min	> 30 Min	> 30 Min	Pass

Non-Occupancy Period for 802.11a 5500MHz



Non-Occupancy Period for 802.11n-HT40 5510MHz



Test Item	Measured Time (Min)		Limit	Results
	5500MHz	5510MHz		
Non-Occupancy Period	> 30 Min	> 30 Min	> 30 Min	Pass

5.10. Uniform Spreading

5.10.1 Test Limit

Each of the declared Channel Plans shall make use of at least 60 % of the spectrum available in the applicable sub-band(s).

Each of the Usable Channels shall be used with approximately equal probability. RLAN equipment for which the declared channel plan includes channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz may omit these channels from the list of Usable Channels at initial power up or at initial installation. Channels being used by other RLAN equipment may be omitted from the list of Usable Channels.

5.10.2 Test Result

Uniform Spreading Mechanism			
Declared Channel Band (MHz)	Applicable sub-band (MHz)	Test Result (%)	Limit (%)
5240 - 5320	5250 - 5350	80	≥60
5500 - 5700	5470 - 5725	78.4	≥60

Note: Each of usable channels can be used with approximately equal probability which was declared by the manufacturer.

The End