TEST REPORT

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1. Client

- Name : KAON Media Co.,Ltd.
- Address : Kaonmedia Building, 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
- Date of Receipt : 2019-11-11

2. Use of Report : Certification

3. Name of Product and Model : AP Router / AR2146

4. Manufacturer and Country of Origin : KAON Media Co.,Ltd. / Korea

5. FCC ID : WQT-AP5000

6. Date of Test : 2019-12-04 to 2020-01-15

7. Test Standards : FCC Part 15 Subpart C, 15.407

8. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Euijung Kim (Signature)	Technical Manager Name : Bobae Lee (Signature)

2020-02-10

KCTL Inc.

Report revision history

Date	Revision	Page No
2020-02-03	Initial report	-
2020-02-10	Added plot of Detection threshold	10 ~ 11

Note. The report No. KR20-SRF0031 is superseded by the report No. KR20-SRF0031-A.

CONTENTS

1. General information

Client	:	KAON Media Co.,Ltd.
Address	:	Kaonmedia Building, 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
Manufacturer	:	KAON Media Co.,Ltd.
Address	:	Kaonmedia Building, 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
Laboratory	:	KCTL Inc.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 Industry Canada Registration No. : 8035A KOLAS No.: KT231

2. Device information

Equipment under test	:	AP Router
Model	:	AR2146
Derivative model	:	EVO5000AP
Frequency range	:	2 412 ㎒ ~ 2 462 ㎒ (802.11b/g/n_HT20) 2 422 ㎒ ~ 2 452 ㎒ (802.11n_HT40) UNII-1: 5 180 ㎒ ~ 5 240 ㎒ (11a/n_HT20/ac_VHT20) UNII-1: 5 190 ㎒ ~ 5 230 ㎒ (11n_HT40/ac_VHT40) UNII-1: 5 210 ㎒ (11ac_VHT80) UNII-2A: 5 260 ㎒ ~ 5 320 ㎒ (11a/n_HT20/ac_VHT20) UNII-2A: 5 270 ㎒ ~ 5 310 ㎒ (11n_HT40/ac_VHT40) UNII-2A: 5 290 ㎒ (11ac_VHT80) UNII-2C: 5 500 ㎒ ~ 5 720 ㎒ (11a/n_HT20/ac_VHT20) UNII-2C: 5 510 ㎒ ~ 5 710 ㎒ (11n_HT40/ac_VHT40) UNII-2C: 5 530 ㎒ ~ 5 690 ㎒ (11ac_VHT80) UNII-3: 5 745 ㎒ ~ 5 825 ㎒ (11a/n_HT20/ac_VHT20) UNII-3: 5 755 ㎒ ~ 5 795 ㎒ (11n_HT40/ac_VHT40) UNII-3: 5 775 ㎒ (11ac_VHT80)
Modulation technique	:	DSSS (802.11b) OFDM (802.11a/g/n_HT20/ HT40/ac_VHT20/ VHT40/ VHT80)
Number of channels	:	11 ch (802.11b/g/n_HT20)_2.4 ㎓ Band 9 ch (802.11n_HT40)_2.4 ㎓ Band UNII-1: 4 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒) UNII-2A: 4 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒) UNII-2C: 12 ch (20 ㎒), 6 ch (40 ㎒), 3 ch (80 ㎒) UNII-3: 5 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒)
Power source	:	DC 12 V
Antenna specification	:	PCB Antenna 2.4G 1.88 ㏈i UNII-1 1.98 ㏈i UNII-2A 1.97 ㏈i

	UNII-2C	1.94 dBi
	UNII-3	1.86 dBi
Software version	:	1.0.22
Hardware version	:	1.0
Operation temperature	:	22 ℃

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
AC Adapter	Chenzhou Frecom Electronics Co.,Ltd	F24L9-120200SPAU	N/A	N/A

2.2. Information about derivative model

The difference between basic model and derivative models is:

The basic and derivative model are electrically identical.
The derivative models is only for the simplified derivation based on buyer's model name.

2.3. Description of EUT

1. The EUT operates over the 5260 ㎒ - 5320 ㎒ and 5500 ㎒ - 5720 ㎒ ranges.
2. The EUT is a Master device with radar detection.
3. In case of MIMO operation, The highest power level within these bands in 23.18 dBm EIRP in the 5260 ㎒ - 5320 ㎒ band and 23.56 dBm EIRP in the 5500 ㎒ - 5720 ㎒ band.
4. The EUT one transmitter/receiver chain connected to a coaxial cable to perform conducted tests.
5. The EUT utilizes the 802.11a/n/ac architecture. Four nominal channel bandwidth is implemented: 20 ㎒, 40 ㎒, 80 ㎒

2.4. Frequency/channel operations

This device contains the following capabilities:
2.4 ㎓ WIFI: WLAN 802.11b/g/n(HT20,HT40)
5 ㎓ WIFI: WLAN 802.11a/g/n(HT20,HT40)/ac(VHT20,VHT40,VHT80)

UNII-2A		UNII-2C	
Ch.	Frequency (㎒)	Ch.	Frequency (㎒)
52	5 260	100	5 500
56	5 280	120	5 600
64	5 320	144	5 720

Table 2.4.1. 802.11a/n/ac_HT20/VHT20 mode

UNII-2A		UNII-2C	
Ch.	Frequency (㎒)	Ch.	Frequency (㎒)
54	5 270	102	5 510
62	5 310	118	5 590
		142	5 710

Table 2.4.2. 802.11n/ac_HT40/VHT40 mode

UNII-2A		UNII-2C	
Ch.	Frequency (㎒)	Ch.	Frequency (㎒)
58	5 290	106	5 530
		122	5 610
		138	5 690

Table 2.4.3 802.11ac_VHT80 mode

Notes:
1. The device supports DFS bands between UNII-2A and UNII-2C and operates as a master device.

3. Summary of tests

FCC Part section(s)	Parameter	Test results
15.407(h)	DFS -Non-occupied period -Channel Availability Check Time -Channel Move Time -Channel Closing Transmission Time -U-NII Detection Bandwidth	Pass

Notes:

1. The test procedure(s) in this report were performed in accordance as following.
   - KDB 905462 D02 UNII DFS compliance procedure new rules .

4 DFS (Dynamic Frequency Selection) TEST

4.1. Applicability

Table1: 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
U-NII Detection Bandwidth	Yes	Not required	Yes

Table2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required

Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 ㎒ channels and the channel center frequency.

4.2. DFS Detection Threshold

Table3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt power spectral density < 10 dBm / MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm

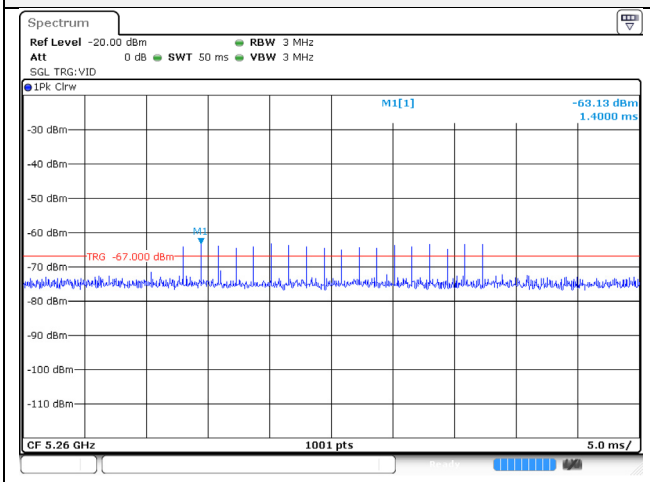
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna

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.

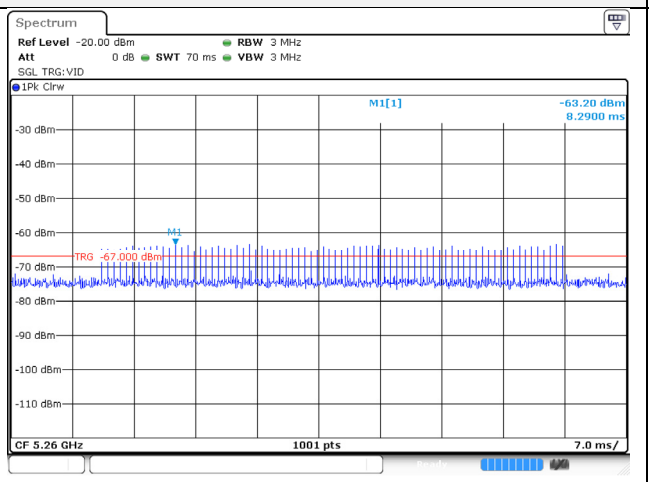
Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

Plot of Detection threshold

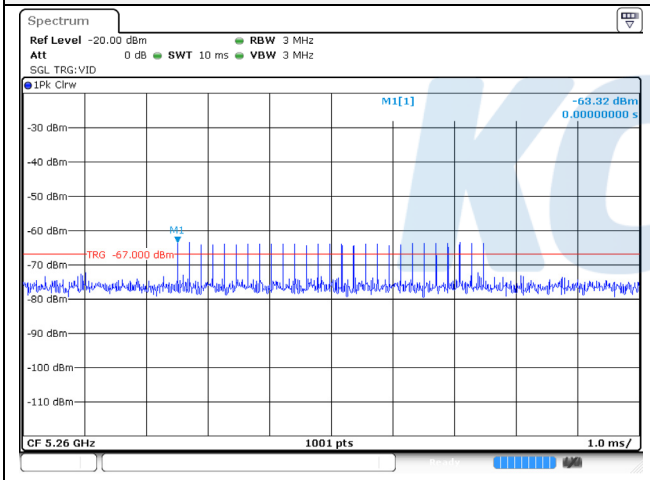
Short Pulse radar type 0



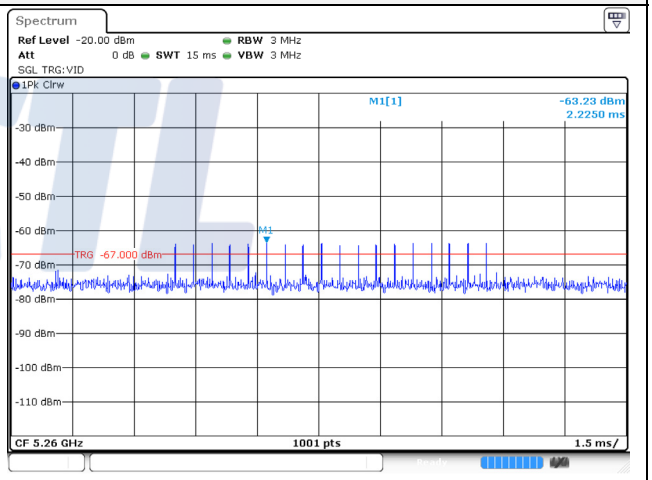
Short Pulse radar type 1



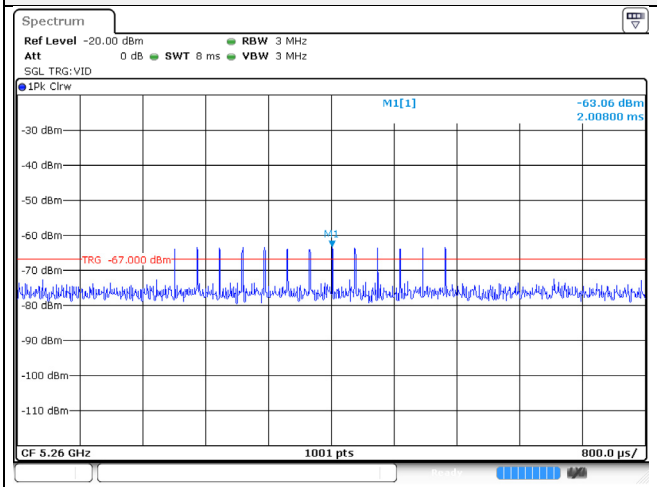
Short Pulse radar type 2



Short Pulse radar type 3



Short Pulse radar type 4



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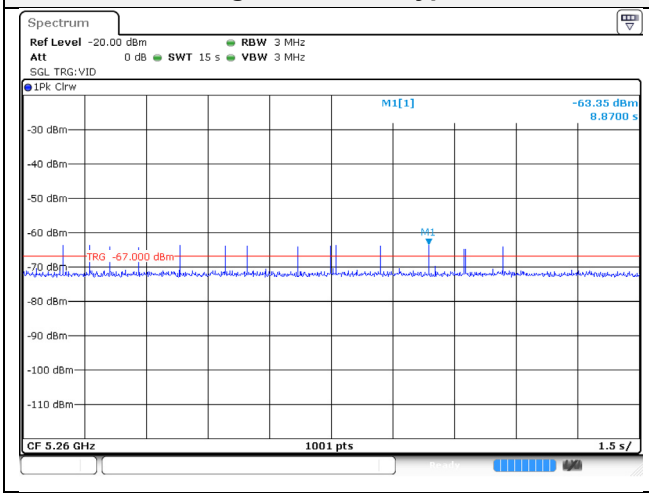
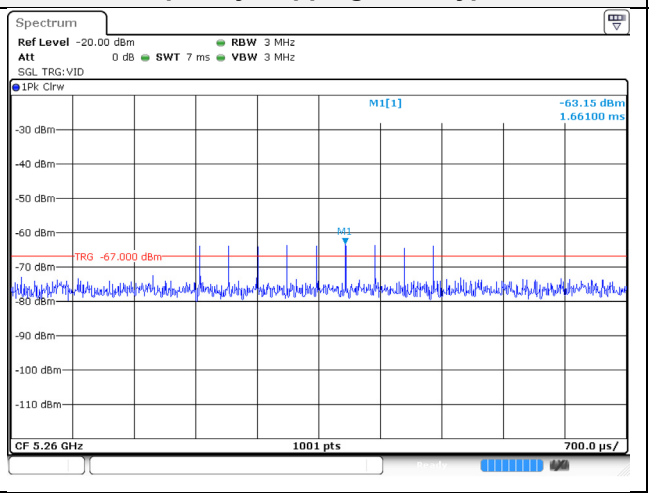
Long Pulse radar type 5	Frequency Hopping radar type 6
	

4.3. Requirements

- Requirements of Master devices

a) The Master Device will use DFS in order to detect Radar Waveforms with received signal strength above the DFS Detection Threshold in the 5250 - 5350 ㎒ and 5470 - 5725 ㎒ bands. DFS is not required in the 5150 - 5250 ㎒ or 5725 - 5825 ㎒ bands.

b) Before initiating a network on a Channel, the Master Device will perform a Channel Availability Check for a specified time duration (Channel Availability Check Time) to ensure that there is no radar system operating on the Channel, using DFS described under subsection a) above.

c) The Master Device initiates a U-NII network by transmitting control signals that will enable other U-NII devices to Associate with the Master Device.

d) During normal operation, the Master Device will monitor the Channel (In-Service Monitoring) to ensure that there is no radar system operating on the Channel, using DFS described under a).

e) If the Master Device has detected a Radar Waveform during In-Service Monitoring as described under d), the Operating Channel of the U-NII network is no longer an Available Channel. The Master Device will instruct all associated Client Device(s) to stop transmitting on this Channel within the Channel Move Time. The transmissions during the Channel Move Time will be limited to the Channel Closing Transmission Time.

f) Once the Master Device has detected a Radar Waveform it will not utilize the Channel for the duration of the Non-Occupancy Period.

g) If the Master Device delegates the In-Service Monitoring to a Client Device, then the combination will be tested to the requirements described under d) through f) above.

Table4: 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.
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. 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.	

4.4. Parameters of DFS test signals

Table5: Short Pulse Radar Test Waveforms

Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{PRI_{\mu sec}}\right)\right\}$	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A			
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
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

Table6: Long Pulse Radar Test Waveform

Radar Type	Pulse Width (μs)	Chirp Width (㎒)	PRI (μs)	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

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

Each waveform is defined as follows:

1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst Count.
3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.
4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.
5) Each pulse has a linear frequency modulated chirp between 5 and 20 ㎒, with the chirp width being randomly chosen. Each pulse within a transmission period will have the same chirp width. The chirp is centered on the pulse. For example, with a radar frequency of 5300 ㎒ and a 20 ㎒ chirped signal, the chirp starts at 5290 ㎒ and ends at 5310 ㎒
6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the random time interval between the first and second pulses is chosen independently of the random time interval between the second and third pulses.
7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst Count. Each interval is of length (12,000,000 / Burst Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen randomly.

A representative example of a Long Pulse Radar Type waveform:

1) The total test waveform length is 12 seconds.
2) Eight (8) Bursts are randomly generated for the Burst Count.
3) Burst 1 has 2 randomly generated pulses.
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
5) The PRI is randomly selected to be at 1213 microseconds.
6) Bursts 2 through 8 are generated using steps 3 – 5.
7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. *Bursts* 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. *Burst* 2 falls in the 1,500,001 – 3,000,000 microsecond range).

Figure 1 provides a graphical representation of the Long Pulse Radar Test Waveform.

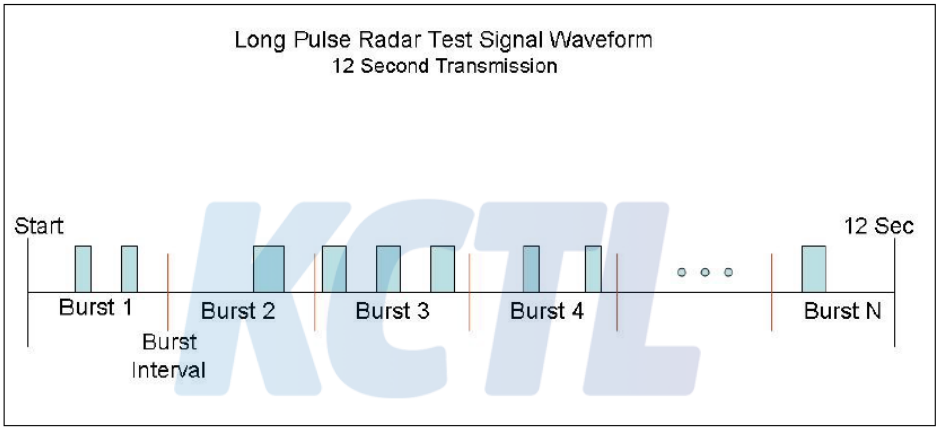


Figure 1: Graphical Representation of a Long Pulse Radar Type Waveform

Table7: Frequency Hopping Radar Test Waveform

Radar Waveform	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (㎑)	Hopping Sequence Length (μs)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	0.333	300	70%	30

For the Frequency Hopping Radar Type, the same *Burst* parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 ㎒. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

4.5. Test and measurement system

Procedure

The tests in this section are run sequentially and the UUT must pass all tests successfully. If the UUT fails any one of the tests it will count as a failure of compliance. To show compliance, all tests must be performed with waveforms randomly generated as specified with test results meeting the required percentage of successful detection criteria. All test results must be reported to the FCC. One frequency will be chosen from the operating Channels of the UUT within the 5250-5350 ㎒ or 5470-5725 ㎒ bands.

- Setup for Master with injection at the Master

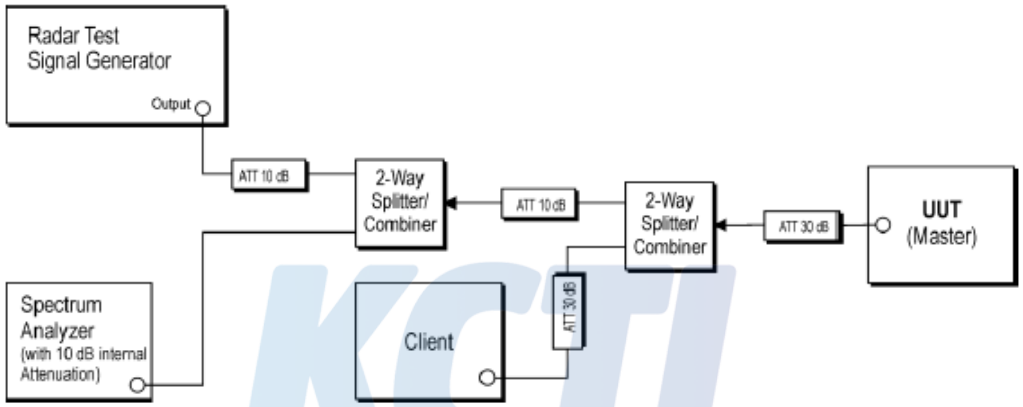


Figure 1. Conducted Test Setup for DFS

- Spectrum analyzer setting parameter

This setting parameter is shown below and it according to the 905462 D02 UNII DFS Compliance Procedures New Rules.

1) RBW/VBW ≥ 3 ㎒
2) Detector = peak
3) Span = zero span

4.6 Test result

4.6.1 U-NII Detection Bandwidth

Adjust the equipment to produce a single Burst of any one of the Short Pulse Radar Types 0 – 4 in **Table 5** at the center frequency of the UUT Operating Channel at the specified DFS Detection Threshold level found in **Table 3**.

Set the UUT up as a standalone device (no associated Client or Master, as appropriate) and no traffic. Frame based systems will be set to a talk/listen ratio reflecting the worst case (maximum) that is user configurable during this test.

Generate a single radar Burst, and note the response of the UUT. Repeat for a minimum of 10 trials. The UUT must detect the Radar Waveform within the DFS band using the specified U-NII Detection Bandwidth criterion shown in **Table 4**. In cases where the channel bandwidth may exceed past the DFS band edge on specific channels (i.e., 802.11ac or wideband frame based systems) select a channel that has the entire emission bandwidth within the DFS band. If this is not possible, test the detection BW to the DFS band edge.

Starting at the center frequency of the UUT operating Channel, increase the radar frequency in 5 ㎒ steps, repeating the above test sequence, until the detection rate falls below the U-NII Detection Bandwidth criterion specified in **Table 4**. Repeat this measurement in 1 ㎒ steps at frequencies 5 ㎒ below where the detection rate begins to fall. Record the highest frequency (denote as F_H) at which detection is greater than or equal to the U-NII Detection Bandwidth criterion. Recording the detection rate at frequencies above FH is not required to demonstrate compliance.

Starting at the center frequency of the UUT operating Channel, decrease the radar frequency in 5 ㎒ steps, repeating the above test sequence, until the detection rate falls below the U-NII Detection Bandwidth criterion specified in **Table 4**. Repeat this measurement in 1 ㎒ steps at frequencies 5 ㎒ above where the detection rate begins to fall. Record the lowest frequency (denote as F_L) at which detection is greater than or equal to the U-NII Detection Bandwidth criterion. Recording the detection rate at frequencies below F_L is not required to demonstrate compliance.

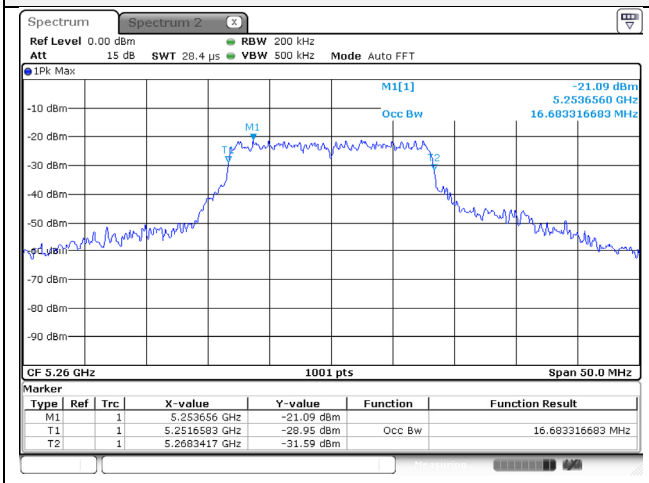
The U-NII Detection Bandwidth is calculated as follows:

U-NII Detection Bandwidth = $F_H – F_L$

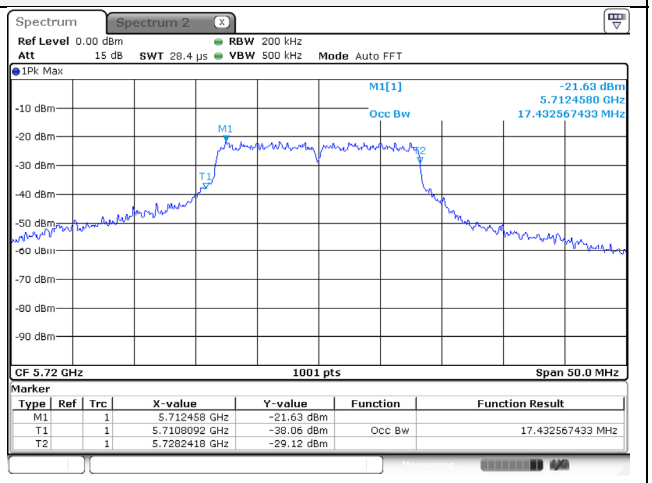
The U-NII Detection Bandwidth must meet the U-NII Detection Bandwidth criterion specified in **Table 4**. Otherwise, the UUT does not comply with DFS requirements. This is essential to ensure that the UUT is capable of detecting Radar Waveforms across the same frequency spectrum that contains the significant energy from the system. In the case that the U-NII Detection Bandwidth is greater than or equal to the 99 percent power bandwidth for the measured F_H and F_L, the test can be truncated and the U-NII Detection Bandwidth can be reported as the measured F_H and F_L.

Plot of 99% Bandwidth

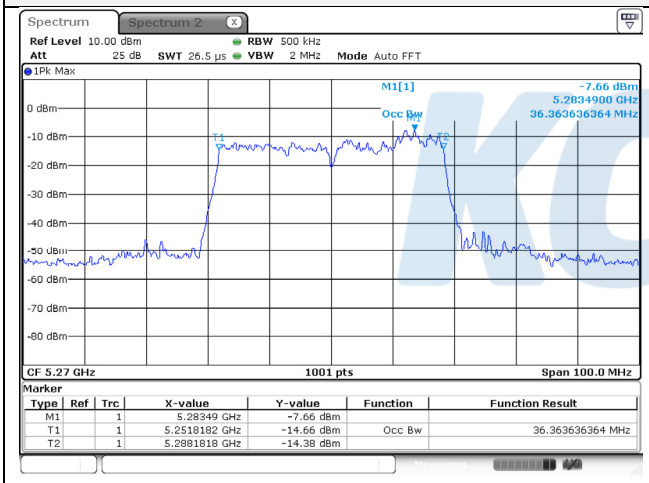
802.11a - 5 260 ㎒



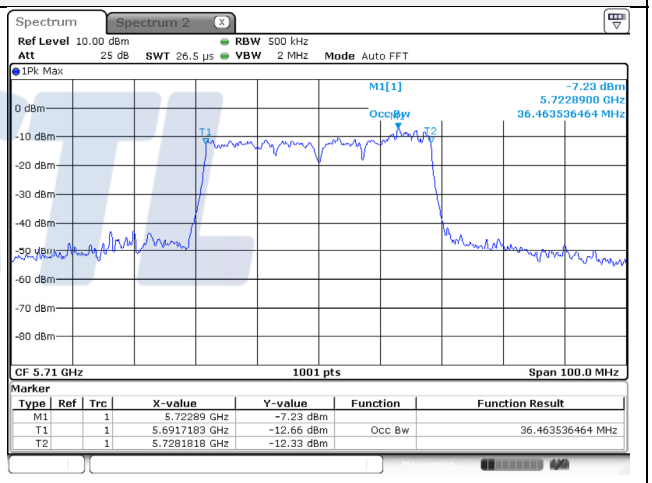
802.11a - 5 720 ㎒



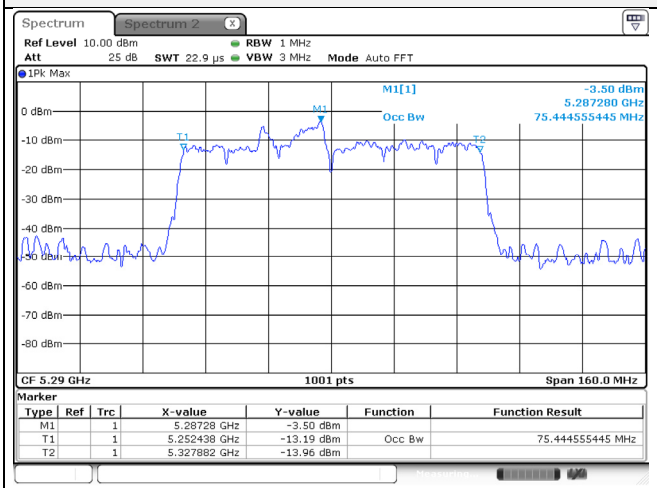
802.11n(HT40) - 5 270 ㎒



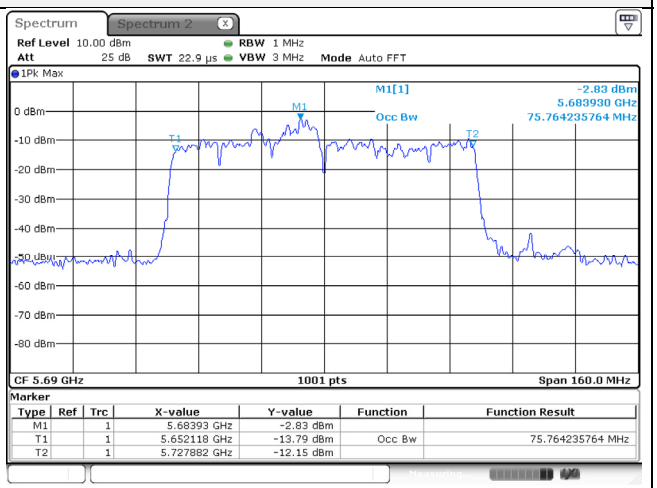
802.11n(HT40) - 5 710 ㎒



802.11ac(VHT80) - 5 290 ㎒



802.11ac(VHT80) - 5 690 ㎒



U-NII 2A / EUT Frequency = 5 260 ㎒ 802.11a (Detection = O, No Detection = X)											
Radar Frequency (㎒)	0	1	2	3	4	5	6	7	8	9	Detection Rate
-14											
-13											
-12											
-11	X	X	X	X							<90%
-10	O	O	O	O	O	O	O	O	O	O	100%
-9	O	O	O	O	O	O	O	O	O	O	100%
-8	O	O	O	O	O	O	O	O	O	O	100%
-7	O	O	O	O	O	O	O	O	O	O	100%
-6	O	O	O	O	O	O	O	O	O	O	100%
-5	O	O	O	O	O	O	O	O	O	O	100%
-4	O	O	O	O	O	O	O	O	O	O	100%
-3	O	O	O	O	O	O	O	O	O	O	100%
-2	O	O	O	O	O	O	O	O	O	O	100%
-1	O	O	O	O	O	O	O	O	O	O	100%
Frequency 5 260 (㎒)	O	O	O	O	O	O	O	O	O	O	100%
+1	O	O	O	O	O	O	O	O	O	O	100%
+2	O	O	O	O	O	O	O	O	O	O	100%
+3	O	O	O	O	O	O	O	O	O	O	100%
+4	O	O	O	O	O	O	O	O	O	O	100%
+5	O	O	O	O	O	O	O	O	O	O	100%
+6	O	O	O	O	O	O	O	O	O	O	100%
+7	O	O	O	O	O	O	O	O	O	O	100%
+8	O	O	O	O	O	O	O	O	O	O	100%
+9	O	O	O	O	O	O	O	O	O	O	100%
+10	O	O	O	O	O	O	O	O	O	O	100%
+11	X	X	X	X							<90%
+12											
+13											
+14											
Detection Bandwidth = $F_H - F_L$ = 5 270 - 5 250 = 20 ㎒											
EUT 99% Bandwidth = 16.68 ㎒ (ref. bandwidth channel 5 260 ㎒)											
For each frequency step the minimum percentage detection is 90%											

U-NII 2C / EUT Frequency = 5 720 ㎒ 802.11a (Detection = O, No Detection = X)											
Radar Frequency (㎒)	0	1	2	3	4	5	6	7	8	9	Detection Rate
-14											
-13											
-12											
-11	X	X	X	X							<90%
-10	O	O	O	O	O	O	O	O	O	O	100%
-9	O	O	O	O	O	O	O	O	O	O	100%
-8	O	O	O	O	O	O	O	O	O	O	100%
-7	O	O	O	O	O	O	O	O	O	O	100%
-6	O	O	O	O	O	O	O	O	O	O	100%
-5	O	O	O	O	O	O	O	O	O	O	100%
-4	O	O	O	O	O	O	O	O	O	O	100%
-3	O	O	O	O	O	O	O	O	O	O	100%
-2	O	O	O	O	O	O	O	O	O	O	100%
-1	O	O	O	O	O	O	O	O	O	O	100%
Frequency 5 720 (㎒)	O	O	O	O	O	O	O	O	O	O	100%
+1	O	O	O	O	O	O	O	O	O	O	100%
+2	O	O	O	O	O	O	O	O	O	O	100%
+3	O	O	O	O	O	O	O	O	O	O	100%
+4	O	O	O	O	O	O	O	O	O	O	100%
+5	O	O	O	O	O	O	O	O	O	O	100%
+6	O	O	O	O	O	O	O	O	O	O	100%
+7	O	O	O	O	O	O	O	O	O	O	100%
+8	O	O	O	O	O	O	O	O	O	O	100%
+9	O	O	O	O	O	O	O	O	O	O	100%
+10	O	O	O	O	O	O	O	O	O	O	100%
+11	X	X	X	X							<90%
+12											
+13											
+14											
Detection Bandwidth = F_H – F_L = 5 730 - 5 710 = 20 ㎒											
EUT 99% Bandwidth = 17.43 ㎒ (ref. bandwidth channel 5 720 ㎒)											
For each frequency step the minimum percentage detection is 90%											

U-NII 2A / EUT Frequency = 5 270 ㎒ 802.11n HT40 (Detection = O, No Detection = X)											
Radar Frequency (㎒)	0	1	2	3	4	5	6	7	8	9	Detection Rate
-24											
-23											
-22											
-21	X	X	X	X							<90%
-20	O	O	O	O	O	O	O	O	O	O	100%
-19	O	O	O	O	O	O	O	O	O	O	100%
-18	O	O	O	O	O	O	O	O	O	O	100%
-17	O	O	O	O	O	O	O	O	O	O	100%
-16	O	O	O	O	O	O	O	O	O	O	100%
-15	O	O	O	O	O	O	O	O	O	O	100%
-14	O	O	O	O	O	O	O	O	O	O	100%
-13	O	O	O	O	O	O	O	O	O	O	100%
-12	O	O	O	O	O	O	O	O	O	O	100%
-11	O	O	O	O	O	O	O	O	O	O	100%
-10	O	O	O	O	O	O	O	O	O	O	100%
-9	O	O	O	O	O	O	O	O	O	O	100%
-8	O	O	O	O	O	O	O	O	O	O	100%
-7	O	O	O	O	O	O	O	O	O	O	100%
-6	O	O	O	O	O	O	O	O	O	O	100%
-5	O	O	O	O	O	O	O	O	O	O	100%
-4	O	O	O	O	O	O	O	O	O	O	100%
-3	O	O	O	O	O	O	O	O	O	O	100%
-2	O	O	O	O	O	O	O	O	O	O	100%
-1	O	O	O	O	O	O	O	O	O	O	100%
Frequency 5 270 (㎒)	O	O	O	O	O	O	O	O	O	O	100%

U-NII 2A / EUT Frequency = 5 270 ㎒ 802.11n HT40 (Detection = O, No Detection = X)											
Radar Frequency (㎒)	0	1	2	3	4	5	6	7	8	9	Detection Rate
Frequency 5 270 (㎒)	O	O	O	O	O	O	O	O	O	O	
+1	O	O	O	O	O	O	O	O	O	O	100%
+2	O	O	O	O	O	O	O	O	O	O	100%
+3	O	O	O	O	O	O	O	O	O	O	100%
+4	O	O	O	O	O	O	O	O	O	O	100%
+5	O	O	O	O	O	O	O	O	O	O	100%
+6	O	O	O	O	O	O	O	O	O	O	100%
+7	O	O	O	O	O	O	O	O	O	O	100%
+8	O	O	O	O	O	O	O	O	O	O	100%
+9	O	O	O	O	O	O	O	O	O	O	100%
+10	O	O	O	O	O	O	O	O	O	O	100%
+11	O	O	O	O	O	O	O	O	O	O	100%
+12	O	O	O	O	O	O	O	O	O	O	100%
+13	O	O	O	O	O	O	O	O	O	O	100%
+14	O	O	O	O	O	O	O	O	O	O	100%
+15	O	O	O	O	O	O	O	O	O	O	100%
+16	O	O	O	O	O	O	O	O	O	O	100%
+17	O	O	O	O	O	O	O	O	O	O	100%
+18	O	O	O	O	O	O	O	O	O	O	100%
+19	O	O	O	O	O	O	O	O	O	O	100%
+20	O	O	O	O	O	O	O	O	O	O	100%
+21	X	X	X	X							<90%
+22											
+23											
+24											
Detection Bandwidth = F_H – F_L = 5 290 - 5 250 = 40 ㎒											
EUT 99% Bandwidth = 36.36 ㎒ (ref. bandwidth channel 5 270 ㎒)											
For each frequency step the minimum percentage detection is 90%											

U-NII 2C / EUT Frequency = 5 710 ㎒ 802.11n HT40 (Detection = O, No Detection = X)											
Radar Frequency (㎒)	0	1	2	3	4	5	6	7	8	9	Detection Rate
-24											
-23											
-22											
-21	X	X	X	X							<90%
-20	O	O	O	O	O	O	O	O	O	O	100%
-19	O	O	O	O	O	O	O	O	O	O	100%
-18	O	O	O	O	O	O	O	O	O	O	100%
-17	O	O	O	O	O	O	O	O	O	O	100%
-16	O	O	O	O	O	O	O	O	O	O	100%
-15	O	O	O	O	O	O	O	O	O	O	100%
-14	O	O	O	O	O	O	O	O	O	O	100%
-13	O	O	O	O	O	O	O	O	O	O	100%
-12	O	O	O	O	O	O	O	O	O	O	100%
-11	O	O	O	O	O	O	O	O	O	O	100%
-10	O	O	O	O	O	O	O	O	O	O	100%
-9	O	O	O	O	O	O	O	O	O	O	100%
-8	O	O	O	O	O	O	O	O	O	O	100%
-7	O	O	O	O	O	O	O	O	O	O	100%
-6	O	O	O	O	O	O	O	O	O	O	100%
-5	O	O	O	O	O	O	O	O	O	O	100%
-4	O	O	O	O	O	O	O	O	O	O	100%
-3	O	O	O	O	O	O	O	O	O	O	100%
-2	O	O	O	O	O	O	O	O	O	O	100%
-1	O	O	O	O	O	O	O	O	O	O	100%
Frequency 5 710 (㎒)	O	O	O	O	O	O	O	O	O	O	100%

U-NII 2C / EUT Frequency = 5 710 ㎒ 802.11n HT40 (Detection = O, No Detection = X)											
Radar Frequency (㎒)	0	1	2	3	4	5	6	7	8	9	Detection Rate
Frequency 5 710 (㎒)	O	O	O	O	O	O	O	O	O	O	
+1	O	O	O	O	O	O	O	O	O	O	100%
+2	O	O	O	O	O	O	O	O	O	O	100%
+3	O	O	O	O	O	O	O	O	O	O	100%
+4	O	O	O	O	O	O	O	O	O	O	100%
+5	O	O	O	O	O	O	O	O	O	O	100%
+6	O	O	O	O	O	O	O	O	O	O	100%
+7	O	O	O	O	O	O	O	O	O	O	100%
+8	O	O	O	O	O	O	O	O	O	O	100%
+9	O	O	O	O	O	O	O	O	O	O	100%
+10	O	O	O	O	O	O	O	O	O	O	100%
+11	O	O	O	O	O	O	O	O	O	O	100%
+12	O	O	O	O	O	O	O	O	O	O	100%
+13	O	O	O	O	O	O	O	O	O	O	100%
+14	O	O	O	O	O	O	O	O	O	O	100%
+15	O	O	O	O	O	O	O	O	O	O	100%
+16	O	O	O	O	O	O	O	O	O	O	100%
+17	O	O	O	O	O	O	O	O	O	O	100%
+18	O	O	O	O	O	O	O	O	O	O	100%
+19	O	O	O	O	O	O	O	O	O	O	100%
+20	O	O	O	O	O	O	O	O	O	O	100%
+21	X	X	X	X							<90%
+22											
+23											
+24											
Detection Bandwidth = F_H – F_L = 5 290 - 5 250 = 40 ㎒											
EUT 99% Bandwidth = 36.46 ㎒ (ref. bandwidth channel 5 710 ㎒)											
For each frequency step the minimum percentage detection is 90%											

U-NII 2A / EUT Frequency = 5 290 ㎒ 802.11ac VHT80 (Detection = O, No Detection = X)											
Radar Frequency (㎒)	0	1	2	3	4	5	6	7	8	9	Detection Rate
-42											
-41	X	X	X	X							<90%
-40	O	O	O	O	O	O	O	O	O	O	100%
-39	O	O	O	O	O	O	O	O	O	O	100%
-38	O	O	O	O	O	O	O	O	O	O	100%
-37	O	O	O	O	O	O	O	O	O	O	100%
-36	O	O	O	O	O	O	O	O	O	O	100%
-35	O	O	O	O	O	O	O	O	O	O	100%
-34	O	O	O	O	O	O	O	O	O	O	100%
-33	O	O	O	O	O	O	O	O	O	O	100%
-32	O	O	O	O	O	O	O	O	O	O	100%
-31	O	O	O	O	O	O	O	O	O	O	100%
-30	O	O	O	O	O	O	O	O	O	O	100%
-29	O	O	O	O	O	O	O	O	O	O	100%
-28	O	O	O	O	O	O	O	O	O	O	100%
-27	O	O	O	O	O	O	O	O	O	O	100%
-26	O	O	O	O	O	O	O	O	O	O	100%
-25	O	O	O	O	O	O	O	O	O	O	100%
-24	O	O	O	O	O	O	O	O	O	O	100%
-23	O	O	O	O	O	O	O	O	O	O	100%
-22	O	O	O	O	O	O	O	O	O	O	100%
-21	O	O	O	O	O	O	O	O	O	O	100%
-20	O	O	O	O	O	O	O	O	O	O	100%
-19	O	O	O	O	O	O	O	O	O	O	100%
-18	O	O	O	O	O	O	O	O	O	O	100%
-17	O	O	O	O	O	O	O	O	O	O	100%
-16	O	O	O	O	O	O	O	O	O	O	100%
-15	O	O	O	O	O	O	O	O	O	O	100%
-14	O	O	O	O	O	O	O	O	O	O	100%
-13	O	O	O	O	O	O	O	O	O	O	100%
-12	O	O	O	O	O	O	O	O	O	O	100%
-11	O	O	O	O	O	O	O	O	O	O	100%
-10	O	O	O	O	O	O	O	O	O	O	100%
-9	O	O	O	O	O	O	O	O	O	O	100%
-8	O	O	O	O	O	O	O	O	O	O	100%

-7	O	O	O	O	O	O	O	O	O	O	100%
-6	O	O	O	O	O	O	O	O	O	O	100%
-5	O	O	O	O	O	O	O	O	O	O	100%
-4	O	O	O	O	O	O	O	O	O	O	100%
-3	O	O	O	O	O	O	O	O	O	O	100%
-2	O	O	O	O	O	O	O	O	O	O	100%
-1	O	O	O	O	O	O	O	O	O	O	100%
Frequency 5 290 (㎒)	O	O	O	O	O	O	O	O	O	O	100%
+1	O	O	O	O	O	O	O	O	O	O	100%
+2	O	O	O	O	O	O	O	O	O	O	100%
+3	O	O	O	O	O	O	O	O	O	O	100%
+4	O	O	O	O	O	O	O	O	O	O	100%
+5	O	O	O	O	O	O	O	O	O	O	100%
+6	O	O	O	O	O	O	O	O	O	O	100%
+7	O	O	O	O	O	O	O	O	O	O	100%
+8	O	O	O	O	O	O	O	O	O	O	100%
+9	O	O	O	O	O	O	O	O	O	O	100%
+10	O	O	O	O	O	O	O	O	O	O	100%
+11	O	O	O	O	O	O	O	O	O	O	100%
+12	O	O	O	O	O	O	O	O	O	O	100%
+13	O	O	O	O	O	O	O	O	O	O	100%
+14	O	O	O	O	O	O	O	O	O	O	100%
+15	O	O	O	O	O	O	O	O	O	O	100%
+16	O	O	O	O	O	O	O	O	O	O	100%
+17	O	O	O	O	O	O	O	O	O	O	100%
+18	O	O	O	O	O	O	O	O	O	O	100%
+19	O	O	O	O	O	O	O	O	O	O	100%
+20	O	O	O	O	O	O	O	O	O	O	100%
+21	O	O	O	O	O	O	O	O	O	O	100%
+22	O	O	O	O	O	O	O	O	O	O	100%
+23	O	O	O	O	O	O	O	O	O	O	100%
+24	O	O	O	O	O	O	O	O	O	O	100%
+25	O	O	O	O	O	O	O	O	O	O	100%
+26	O	O	O	O	O	O	O	O	O	O	100%
+27	O	O	O	O	O	O	O	O	O	O	100%
+28	O	O	O	O	O	O	O	O	O	O	100%
+29	O	O	O	O	O	O	O	O	O	O	100%
+30	O	O	O	O	O	O	O	O	O	O	100%
+31	O	O	O	O	O	O	O	O	O	O	100%

+32	O	O	O	O	O	O	O	O	O	O	100%
+33	O	O	O	O	O	O	O	O	O	O	100%
+34	O	O	O	O	O	O	O	O	O	O	100%
+35	O	O	O	O	O	O	O	O	O	O	100%
+36	O	O	O	O	O	O	O	O	O	O	100%
+37	O	O	O	O	O	O	O	O	O	O	100%
+38	O	O	O	O	O	O	O	O	O	O	100%
+39	O	O	O	O	O	O	O	O	O	O	100%
+40	X	X	X	X							<90%
+41											
+42											
Detection Bandwidth = F_H – F_L = 5 329 - 5 250 = 79 ㎒											
EUT 99% Bandwidth = 75.44 ㎒ (ref. bandwidth channel 5 290 ㎒)											
For each frequency step the minimum percentage detection is 90%											

U-NII 2C / EUT Frequency = 5 690 ㎒ 802.11ac VHT80 (Detection = O, No Detection = X)											
Radar Frequency (㎒)	0	1	2	3	4	5	6	7	8	9	Detection Rate
-42											
-41	X	X	X	X							<90%
-40	O	O	O	O	O	O	O	O	O	O	100%
-39	O	O	O	O	O	O	O	O	O	O	100%
-38	O	O	O	O	O	O	O	O	O	O	100%
-37	O	O	O	O	O	O	O	O	O	O	100%
-36	O	O	O	O	O	O	O	O	O	O	100%
-35	O	O	O	O	O	O	O	O	O	O	100%
-34	O	O	O	O	O	O	O	O	O	O	100%
-33	O	O	O	O	O	O	O	O	O	O	100%
-32	O	O	O	O	O	O	O	O	O	O	100%
-31	O	O	O	O	O	O	O	O	O	O	100%
-30	O	O	O	O	O	O	O	O	O	O	100%
-29	O	O	O	O	O	O	O	O	O	O	100%
-28	O	O	O	O	O	O	O	O	O	O	100%
-27	O	O	O	O	O	O	O	O	O	O	100%
-26	O	O	O	O	O	O	O	O	O	O	100%
-25	O	O	O	O	O	O	O	O	O	O	100%
-24	O	O	O	O	O	O	O	O	O	O	100%
-23	O	O	O	O	O	O	O	O	O	O	100%
-22	O	O	O	O	O	O	O	O	O	O	100%
-21	O	O	O	O	O	O	O	O	O	O	100%
-20	O	O	O	O	O	O	O	O	O	O	100%
-19	O	O	O	O	O	O	O	O	O	O	100%
-18	O	O	O	O	O	O	O	O	O	O	100%
-17	O	O	O	O	O	O	O	O	O	O	100%
-16	O	O	O	O	O	O	O	O	O	O	100%
-15	O	O	O	O	O	O	O	O	O	O	100%
-14	O	O	O	O	O	O	O	O	O	O	100%
-13	O	O	O	O	O	O	O	O	O	O	100%
-12	O	O	O	O	O	O	O	O	O	O	100%
-11	O	O	O	O	O	O	O	O	O	O	100%
-10	O	O	O	O	O	O	O	O	O	O	100%
-9	O	O	O	O	O	O	O	O	O	O	100%
-8	O	O	O	O	O	O	O	O	O	O	100%

-7	O	O	O	O	O	O	O	O	O	O	100%
-6	O	O	O	O	O	O	O	O	O	O	100%
-5	O	O	O	O	O	O	O	O	O	O	100%
-4	O	O	O	O	O	O	O	O	O	O	100%
-3	O	O	O	O	O	O	O	O	O	O	100%
-2	O	O	O	O	O	O	O	O	O	O	100%
-1	O	O	O	O	O	O	O	O	O	O	100%
Frequency 5 690 (㎒)	O	O	O	O	O	O	O	O	O	O	100%
+1	O	O	O	O	O	O	O	O	O	O	100%
+2	O	O	O	O	O	O	O	O	O	O	100%
+3	O	O	O	O	O	O	O	O	O	O	100%
+4	O	O	O	O	O	O	O	O	O	O	100%
+5	O	O	O	O	O	O	O	O	O	O	100%
+6	O	O	O	O	O	O	O	O	O	O	100%
+7	O	O	O	O	O	O	O	O	O	O	100%
+8	O	O	O	O	O	O	O	O	O	O	100%
+9	O	O	O	O	O	O	O	O	O	O	100%
+10	O	O	O	O	O	O	O	O	O	O	100%
+11	O	O	O	O	O	O	O	O	O	O	100%
+12	O	O	O	O	O	O	O	O	O	O	100%
+13	O	O	O	O	O	O	O	O	O	O	100%
+14	O	O	O	O	O	O	O	O	O	O	100%
+15	O	O	O	O	O	O	O	O	O	O	100%
+16	O	O	O	O	O	O	O	O	O	O	100%
+17	O	O	O	O	O	O	O	O	O	O	100%
+18	O	O	O	O	O	O	O	O	O	O	100%
+19	O	O	O	O	O	O	O	O	O	O	100%
+20	O	O	O	O	O	O	O	O	O	O	100%
+21	O	O	O	O	O	O	O	O	O	O	100%
+22	O	O	O	O	O	O	O	O	O	O	100%
+23	O	O	O	O	O	O	O	O	O	O	100%
+24	O	O	O	O	O	O	O	O	O	O	100%
+25	O	O	O	O	O	O	O	O	O	O	100%
+26	O	O	O	O	O	O	O	O	O	O	100%
+27	O	O	O	O	O	O	O	O	O	O	100%
+28	O	O	O	O	O	O	O	O	O	O	100%
+29	O	O	O	O	O	O	O	O	O	O	100%
+30	O	O	O	O	O	O	O	O	O	O	100%
+31	O	O	O	O	O	O	O	O	O	O	100%

+32	O	O	O	O	O	O	O	O	O	O	100%
+33	O	O	O	O	O	O	O	O	O	O	100%
+34	O	O	O	O	O	O	O	O	O	O	100%
+35	O	O	O	O	O	O	O	O	O	O	100%
+36	O	O	O	O	O	O	O	O	O	O	100%
+37	O	O	O	O	O	O	O	O	O	O	100%
+38	O	O	O	O	O	O	O	O	O	O	100%
+39	O	O	O	O	O	O	O	O	O	O	100%
+40	X	X	X	X							<90%
+41											
+42											
Detection Bandwidth = F_H – F_L = 5 729 - 5 650 = 79 ㎒											
EUT 99% Bandwidth = 75.76 ㎒ (ref. bandwidth channel 5 690 ㎒)											
For each frequency step the minimum percentage detection is 90%											

4.6.2 Initial Channel Availability Check Time

The Initial Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test Channel until the power-up sequence has been completed and the U-NII device checks for Radar Waveforms for one minute on the test Channel. This test does not use any Radar Waveforms and only needs to be performed one time.

b) The U-NII devices will be powered on and be instructed to operate on the appropriate U-NII *Channel* that must incorporate DFS functions. At the same time the UUT is powered on, the spectrum analyzer will be set to zero span mode with a 3 ㎒ RBW and 3 ㎒ VBW on the *Channel* occupied by the radar (Chr) with a 2.5 minute sweep time. The spectrum analyzer's sweep will be started at the same time power is applied to the U-NII device.

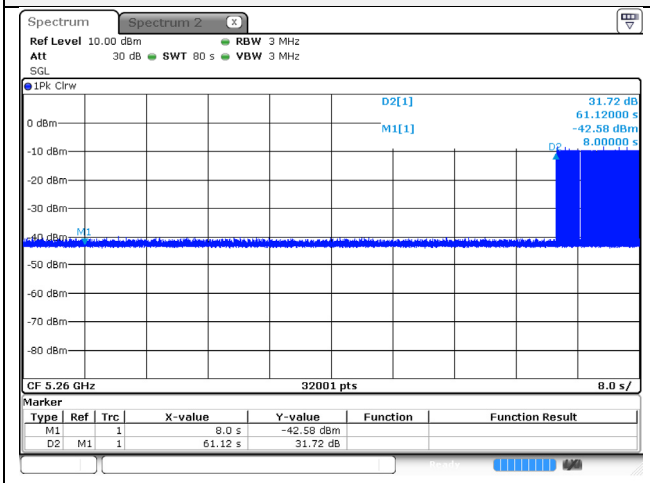
c) The UUT should not transmit any beacon or data transmissions until at least 1 minute after the completion of the power-on cycle.

d) Confirm that the UUT initiates transmission on the channel

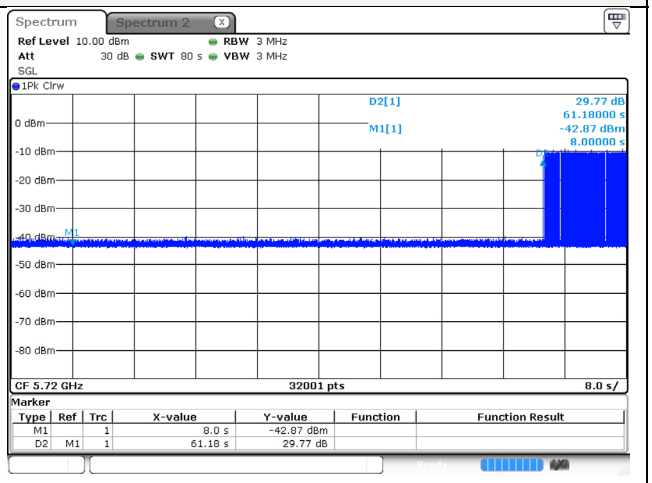
This measurement can be used to determine the length of the power-on cycle if it is not supplied by the manufacturer. If the spectrum analyzer sweep is started at the same time the UUT is powered on and the UUT does not begin transmissions until it has completed the cycle, the power-on time can be determined by comparing the two times.

Plot of Initial Channel Availability Check Time

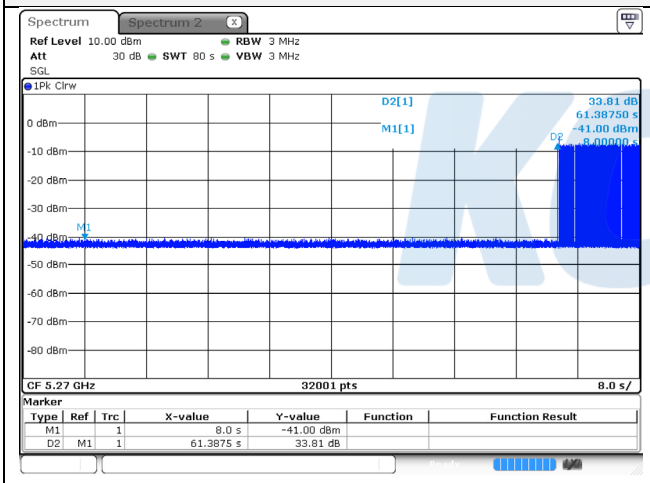
802.11a - 5 260 ㎒ = 61.12 s



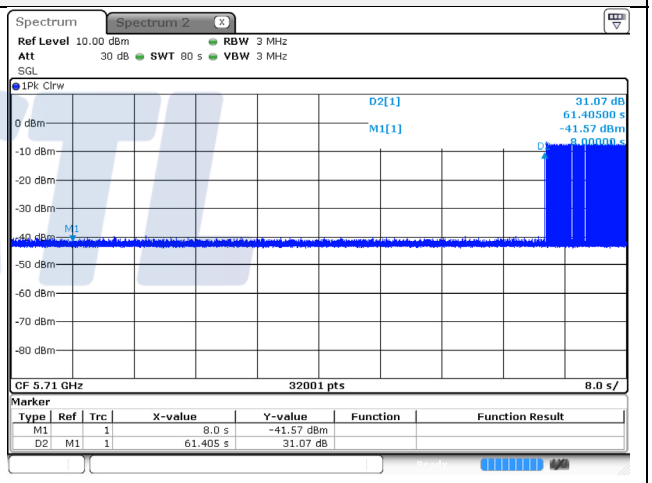
802.11a - 5 720 ㎒ = 61.18 s



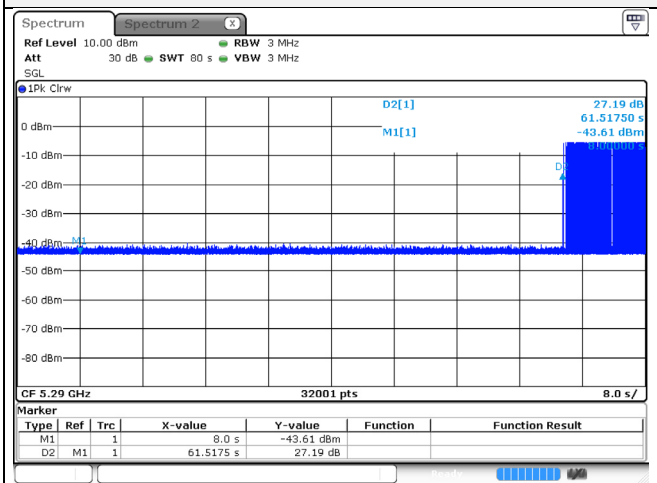
802.11n(HT40) - 5 270 ㎒ = 61.39 s



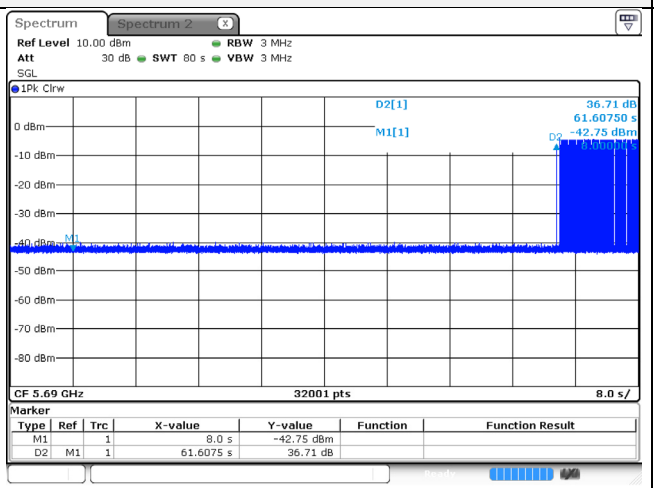
802.11n(HT40) - 5 710 ㎒ = 61.41 s



802.11ac(VHT80) - 5 290 ㎒ = 61.52 s



802.11ac(VHT80) - 5 690 ㎒ = 61.61 s



4.6.3 Radar Burst at the Beginning of the Channel Availability Check Time

The steps below define the procedure to verify successful radar detection on the test Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB occurs at the beginning of the Channel Availability Check Time. This is illustrated in **Figure 15**.

a) The Radar Waveform generator and UUT are connected using the applicable test setup described in the sections on configuration for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.

b) The UUT is powered on at T_0. T_1 denotes the instant when the UUT has completed its power-up sequence (T_{power_up}). The Channel Availability Check Time commences on Ch_r at instant T_1 and will end no sooner than $T_1 + T_{ch\_avail\_check}$.

c) A single Burst of one of the Short Pulse Radar Types 0-4 will commence within a 6 second window starting at T_1. An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors.

d) Visual indication or measured results on the UUT of successful detection of the radar Burst will be recorded and reported. Observation of Ch_r for UUT emissions will continue for 2.5 minutes after the radar Burst has been generated.

e) Verify that during the 2.5 minute measurement window no UUT transmissions occurred on Ch_r. The Channel Availability Check results will be recorded.

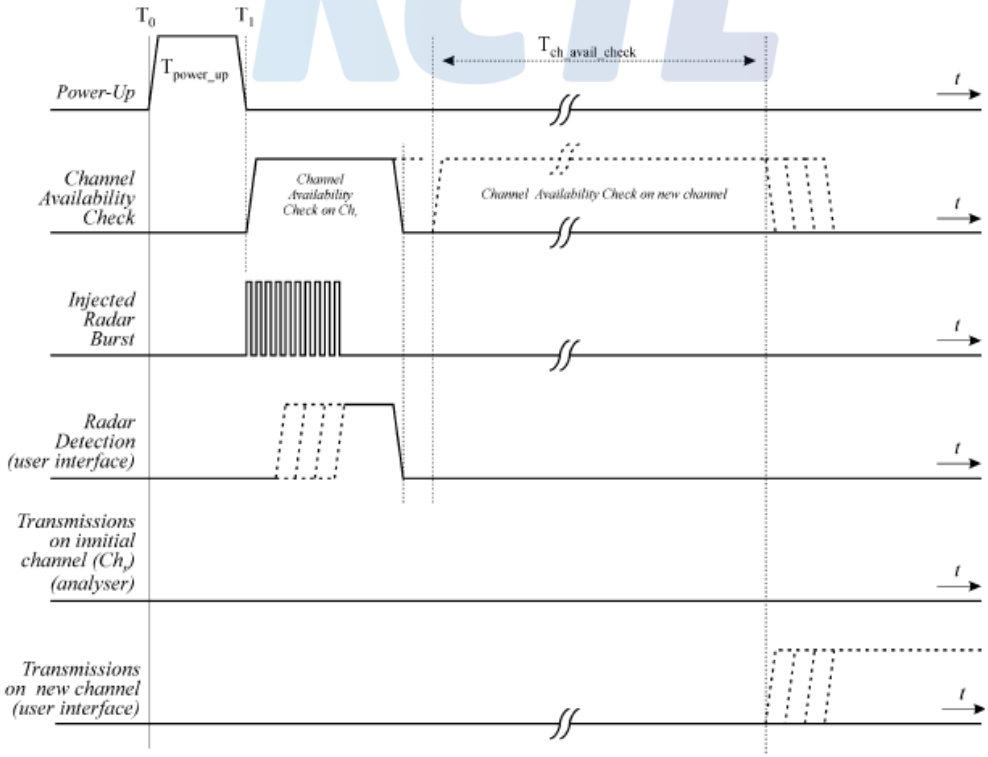
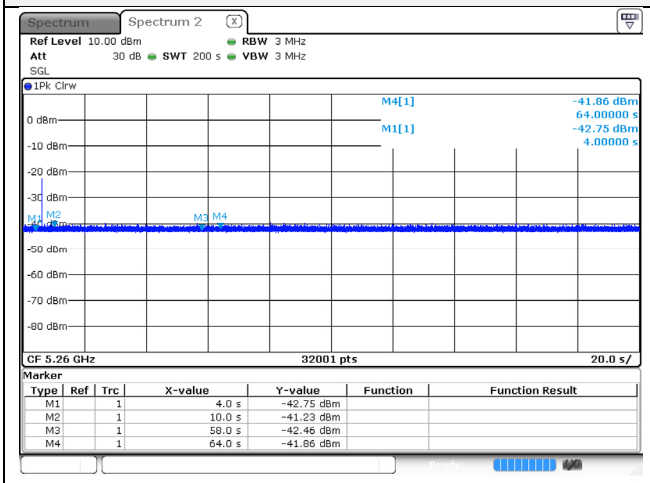


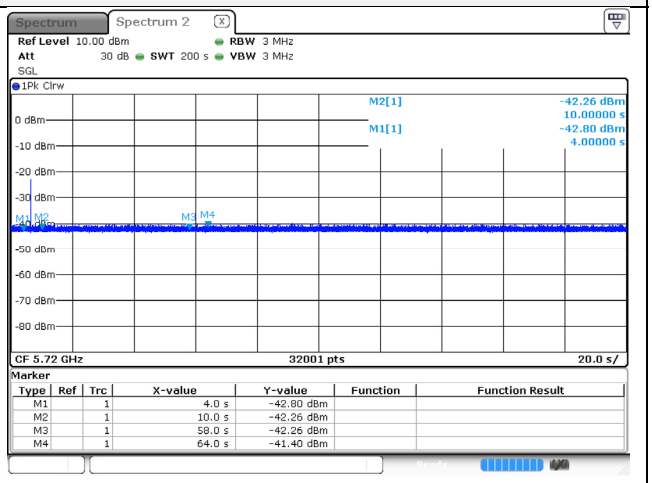
Figure 15: Example of timing for radar testing at the beginning of the Channel Availability Check Time

Plot of Radar Burst at the Beginning of the Channel Availability Check Time

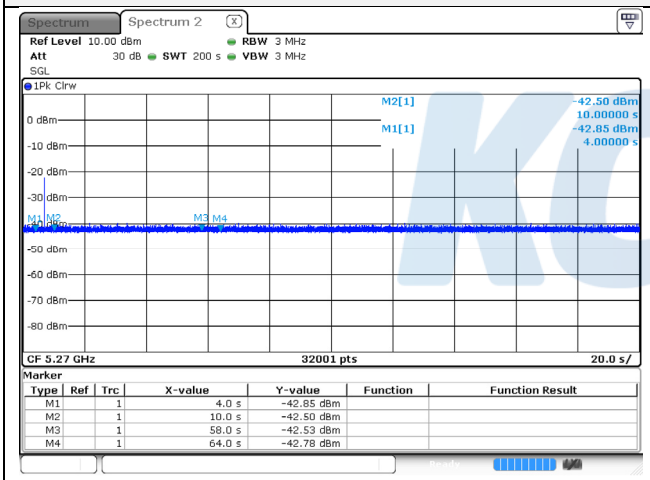
802.11a - 5 260 ㎒



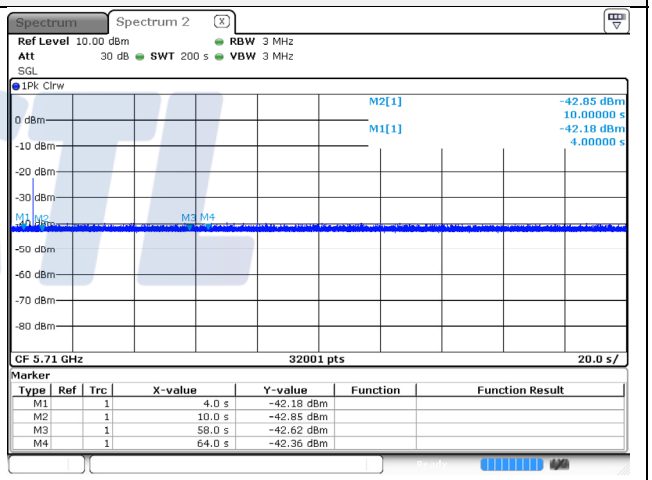
802.11a - 5 720 ㎒



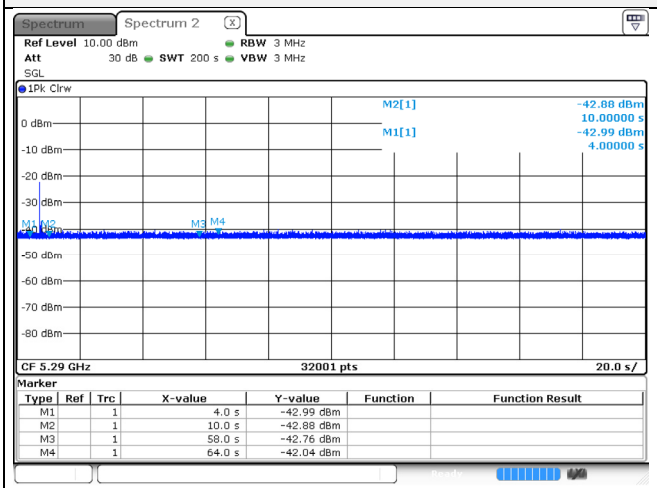
802.11n(HT40) - 5 270 ㎒



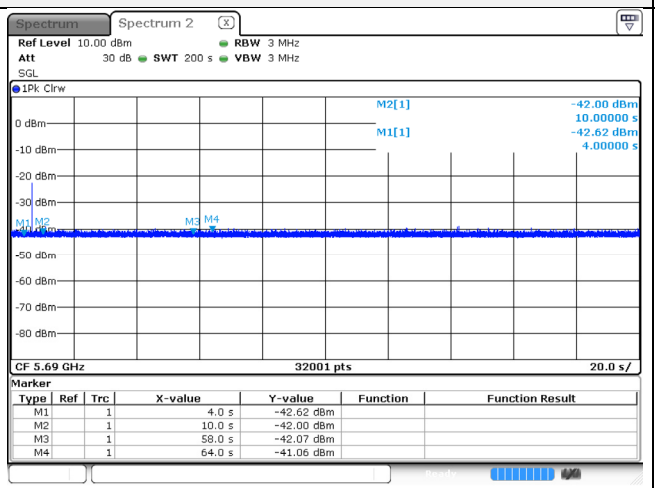
802.11n(HT40) - 5 710 ㎒



802.11ac(VHT80) - 5 290 ㎒



802.11ac(VHT80) - 5 690 ㎒



4.6.4 Radar Burst at the End of the Channel Availability Check Time

The steps below define the procedure to verify successful radar detection on the test Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1dB occurs at the end of the Channel Availability Check Time. This is illustrated in **Figure 16**.

a) The Radar Waveform generator and UUT are connected using the applicable test setup described in the sections for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.

b) The UUT is powered on at T_0. T_1 denotes the instant when the UUT has completed its power-up sequence (T_{power_up}). The Channel Availability Check Time commences on Ch_r at instant T_1 and will end no sooner than $T_1 + T_{ch\_avail\_check}$.

c) A single Burst of one of the Short Pulse Radar Types 0-4 will commence within a 6 second window starting at T_1 + 54 seconds. An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors.

d) Visual indication or measured results on the UUT of successful detection of the radar Burst will be recorded and reported. Observation of Ch_r for UUT emissions will continue for 2.5 minutes after the radar Burst has been generated.

e) Verify that during the 2.5 minute measurement window no UUT transmissions occurred on Ch_r. The Channel Availability Check results will be recorded.

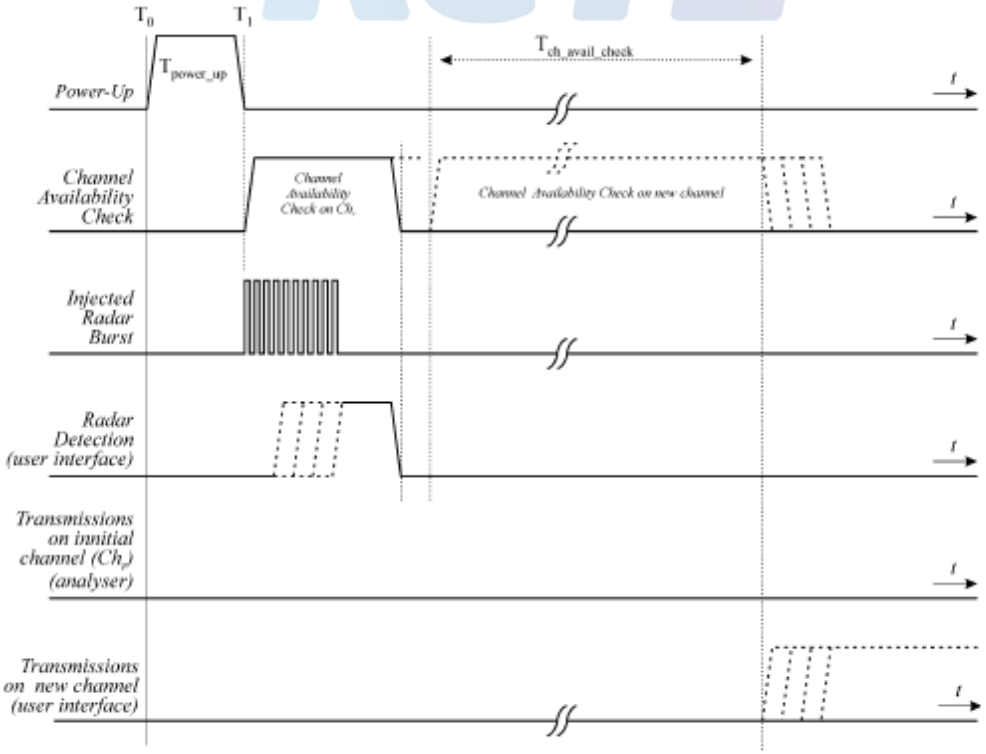


Figure 15: Example of timing for radar testing at the beginning of the Channel Availability Check Time