Haier US Appliance Solutions, Inc.

RF TEST REPORT

Report Type:
FCC Part 15.407 & ISED RSS-247 RF report (DFS Only)

Model:
UVH13012M1SS

Additional Model:
See Page 2

REPORT NUMBER:
190100007SHA-003

ISSUE DATE:
February 18, 2019

DOCUMENT CONTROL NUMBER:
TTRF15.407-02_V1 © 2018 Intertek

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TEST REPORT

Report no.: 190100007SHA-003

Applicant:	Haier US Appliance Solutions, Inc.
	Appliance Park AP2-226, Louisville, KY, 40225, United States
Manufacturer:	Haier US Appliance Solutions, Inc.
	Appliance Park AP2-226, Louisville, KY, 40225, United States
Product Name:	KITCHEN HUB
Type/Model:	UVH13012M1SS
Additional Model:	UVH13012M2SS, UVH13012M3SS, UVH13012M4SS, UVH13012M5SS, UVH13013M1DS, UVH13013M2DS, UVH13013M3DS, UVH13013M4DS, UVH13013M5DS, UVH13014M1WM, UVH13014M2WM, VH13014M3WM, UVH13014M4WM, UVH13014M5WM, UVH13013M1TS, UVH13013M2TS, UVH13013M3TS, UVH13013M4TS, UVH13013M5TS
FCC ID:	ZKJ-KITCHENHUB1
IC:	10229A-KITCHENHUB1

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:

47CFR Part 15 (2017): Radio Frequency Devices (Subpart C)

RSS-247 Issue 2 (February 2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02: Compliance Measurement Procedures for Unlicensed-National Information Infrastructure Devices Operating In The 5250-5350 MHz and 5470-5725 MHz Bands Incorporating Dynamic Frequency Selection

KDB 905462 D03 NII Clients Without Radar Detection New Rules v01r02: U-NII CLIENT DEVICES WITHOUT RADAR DETECTION CAPABILITY

PREPARED BY:	REVIEWED BY:
Wade zhang	Danny
Project Engineer	Reviewer
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Content

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Revision History

Report No.	Version	Description	Issued Date
190100007SHA-003	Rev. 01	Initial issue of report	February 18, 2019

TEST REPORT

Measurement result summary

TEST ITEM	FCC REFERANCE		RESULT
Initial Channel Availability Check Time	15.407(h)(2)	RSS-247 Clause 6.3	NA
Radar Burst at The Beginning of The Channel Availability Check & End of The Channel Availability Check Time	15.407(h)(2)	RSS-247 Clause 6.3	NA
Channel Move Time, Channel Closing Time	15.407(h)(2)	RSS-247 Clause 6.3	Pass
Non-Occupancy Period	15.407(h)(2)	RSS-247 Clause 6.3	Pass
UNII Detection Bandwidth Measurement	15.407(h)(2)	RSS-247 Clause 6.3	NA
Statistical Performance Check	15.407(h)(2)	RSS-247 Clause 6.3	NA

Notes: 1: NA =Not Applicable
2. Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.
3: Additions, Deviations and Exclusions from Standards: None.

TEST REPORT

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	KITCHEN HUB
Type/Model:	UVH13012M1SS
Additional Model:	UVH13012M2SS, UVH13012M3SS, UVH13012M4SS, UVH13012M5SS, UVH13013M1DS, UVH13013M2DS, UVH13013M3DS, UVH13013M4DS, UVH13013M5DS, UVH13014M1WM, UVH13014M2WM, VH13014M3WM, UVH13014M4WM, UVH13014M5WM, UVH13013M1TS, UVH13013M2TS, UVH13013M3TS, UVH13013M4TS, UVH13013M5TS
Description of EUT:	The EUT is a kitchen hood which was install wireless modules, there have 20 models, and they are electrically identical except different PCB silkscreen, different software version and the man-machine interface (not change the RF parameters), appearance skin and surface treatment process.
Rating:	120VAC 60Hz, 4A
Software Version:	/
Hardware Version:	/
Sample received date:	October 19, 2018
Date of test:	October 19, 2018 ~ November 2, 2018

1.2 Technical Specification

Frequency Range:	5250 ~ 5350MHz, 5470 ~ 5725MHz
Support Standards:	802.11a, 802.11n/ac(HT20), 802.11n/ac(HT40), 802.11ac(VHT80)
Type of Modulation:	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Channel Number:	Channel 52 – 64, Channel 100 - 144
Channel Bandwidth:	20, 40, 80MHz
Operating Mode:	☐ Master ☒ Client without Radar Detection ☐ Client with Radar Detection
Max. EIRP Power:	☒ < 200mW ☐ ≥ 200mW
Antenna:	Internal antenna, 2.7dBi Peak gain
Manufacturer Statement:	Manufacturer statement confirming that information regarding the parameters of the detected Radar Waveforms are not available to the end user.

1.3 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN1175
	IC Registration Lab Registration code No.: 2042B-1
	VCCI Registration Lab Registration No.: R-4243, G-845, C-4723, T-2252
	A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2017): Radio Frequency Devices

RSS-247 Issue 2 (February 2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02: Compliance Measurement Procedures for Unlicensed-National Information Infrastructure Devices Operating In The 5250-5350 MHz and 5470-5725 MHz Bands Incorporating Dynamic Frequency Selection

KDB 905462 D03 NII Clients Without Radar Detection New Rules v01r02: U-NII CLIENT DEVICES WITHOUT RADAR DETECTION CAPABILITY

2.2 Mode of operation during the test

Stream the channel loading test file from the Master Device to the Client Device on the test Channel for the entire period of the test if necessary.

The EUT was operating with the software for DFS test used the command which provided by applicant.

2.3 Test software list

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

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	Laptop computer	HP ProBook 6470b	100-240V AC, 50/60Hz FCC DOC
2	AC/DC adaptor	KA25	100-240VAC, DC5V1A FCC VOC
3	RF Board	NA	NA
4	WIFI AP (Master)	A-240Z-A	FCC ID: 2ADZRA240ZA

2.5 Test environment condition:

Test items	Temperature	Humidity
Channel Move Time, Channel Closing Time	22°C	53% RH
Non-Occupancy Period	22°C	55% RH

2.6 Instrument list

Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	Test Receiver	R&S	ESIB 26	EC 3045	2019-09-12
☑	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2019-06-10
☑	Horn antenna	R&S	HF 906	EC 3049	2019-11-17
☑	Horn antenna	ETS	3117	EC 4792-1	2020-01-09
☑	Horn antenna	TOYO	HAP18-26W	EC 4792-3	2020-07-09
☑	Pre-amplifier	R&S	Pre-amp 18	EC5262	2019-06-10
☑	Semi-anechoic chamber	Albatross project	-	EC 3048	2019-07-31
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2019-03-05
☑	PXA Signal Analyzer	Keysight	N9030B	EC 6078	2019-12-22
☑	Power sensor	Agilent	U2021XA	EC 5338-1	2019-03-05
☑	Vector Signal Generator	Agilent	N5182B	EC 5175	2019-03-05
☑	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2019-03-05
☑	Test Receiver	R&S	ESCI 7	EC 4501	2019-09-12
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3783	2019-02-28
☑	Pressure meter	YM3	Shanghai Mengde	EC 3320	2019-07-01

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Item No.	Test Items	Expanded Uncertainty (k=2)
1	Radio frequency	± 0.84 × 10-7
2	RF power, conducted	± 0.74 dB
3	RF power, radiated	± 5.92 dB
4	Maximum Frequency Deviation	± 2.77 %
5	Adjacent channel power	± 1.45 dB
6	Spurious emissions of transmitter, conducted	± 2.89 dB
7	Spurious emissions of receiver, conducted	± 2.80 dB
8	Spurious emissions, radiated	± 5.93 dB
9	Power Spectral Density, conducted	± 2.99 dB
10	Occupied Channel Bandwidth	± 0.88 %
11	Time	± 1.15 %
12	Temperature	± 1 °C
13	Humidity	± 5 %
14	DC and low frequency voltages	± 1.3 %

3 DFS Detection Thresholds and Radar Test Waveforms

3.1 Interference Threshold values

Maximum Transmit Power	Value (see note)
≥ 200 mW	-64 dBm
< 200 mW	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. *Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.*	

3.2 DFS Response requirement values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 80% of the 99% power bandwidth See Note 3.
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.* *Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.*	

3.3 Radar Test Waveforms Minimum Step

Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

3.4 Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (µs)	PRI (µs)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1a	1	15 unique PRI values randomly selected from the list of 23 PRI values in Note 2	Roundup $\{(1/360)*(19*10^6/PRI)\}$	60%	30
1b		15 unique PRI values randomly selected within the range of 518-3066µsec, with a minimum increment of 1 µsec, excluding PRI values selected in radar type 1a			
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.*

Note 2: *Pulse Repetition Intervals Values for Radar Type 1a*

Pulse Repetition Frequency No	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (us)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

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.

For example if in Short Pulse Radar Type 1 Test B a PRI of 3066us is selected, the number of pulses would be

$$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^{6}}{3066}\right)\right\} = \text{Roundup}\{17.2\} = 18.$$

3.5 Long Pulse Radar Test Waveform

Radar Type	Pulse Width (µs)	PRI (µs)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Burst	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 MHz, with the chirp width being randomly chosen. Each pulse within a *Burst* will have the same chirp width. Pulses in different *Bursts* may have different chirp widths. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.

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).

3.6 Frequency Hopping Radar Test Waveform

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

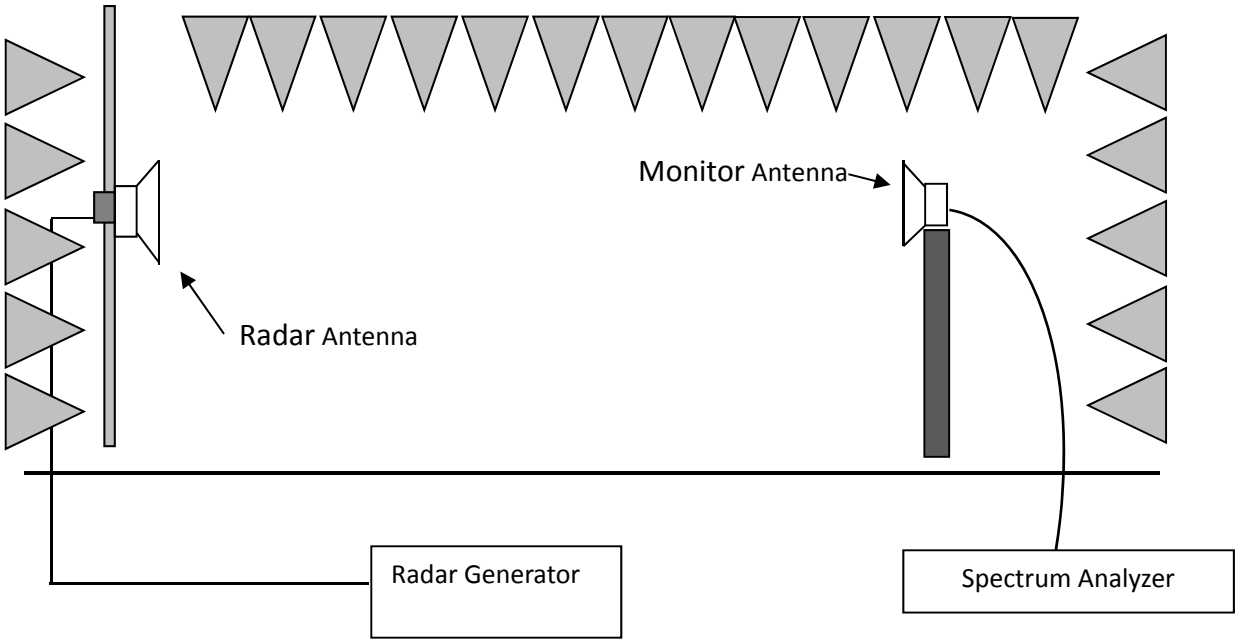
For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724MHz. 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.

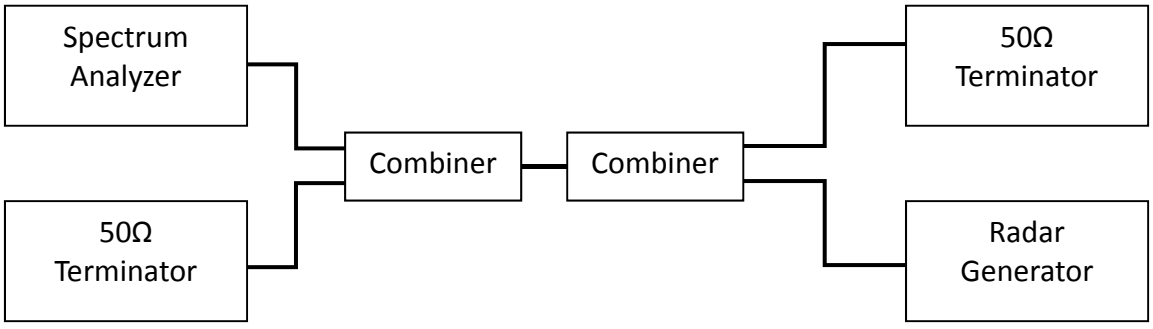
Note: If a segment does not contain at least 1 frequency within the U-NII Detection Bandwidth of the UUT, then that segment is not used.

3.7 Calibration Setup

☐ Radiated Method



☒ Conducted Method



3.8 Radar Waveform Calibration Procedure

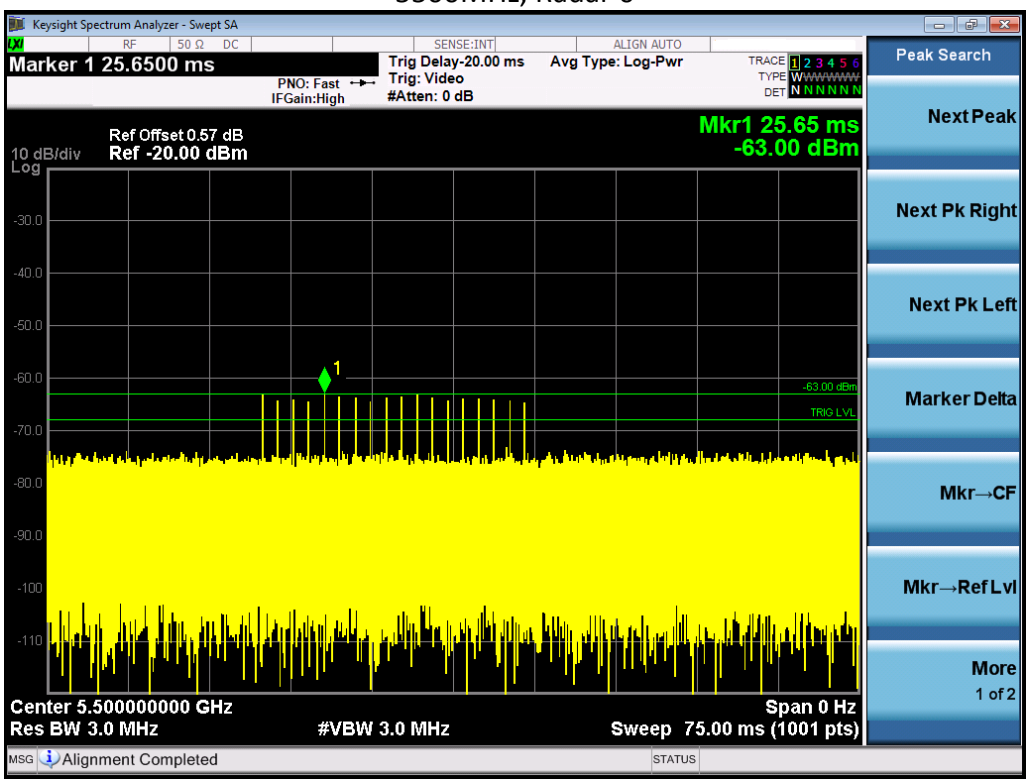
The Interference Radar Detection Threshold Level is -64dBm or -62dBm + 0 [dBi] + 1 dB that had been taken into account the output power range and antenna gain. The above equipment setup was used to calibrate the conducted Radar Waveform. A vector signal generator was utilized to establish the test signal level for each radar type. During this process there were replace 50ohm terminal form Master and Client device and no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) at the frequency of the Radar Waveform generator. Peak detection was used. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to at least 3MHz. The vector signal generator amplitude was set so that the power level measured at the spectrum analyzer was -64dBm or -62dBm + 0 [dBi] + 1 dB. Capture the spectrum analyzer plots on short pulse radar types, long pulse radar type and hopping radar waveform.

Central Frequency of Calibration:

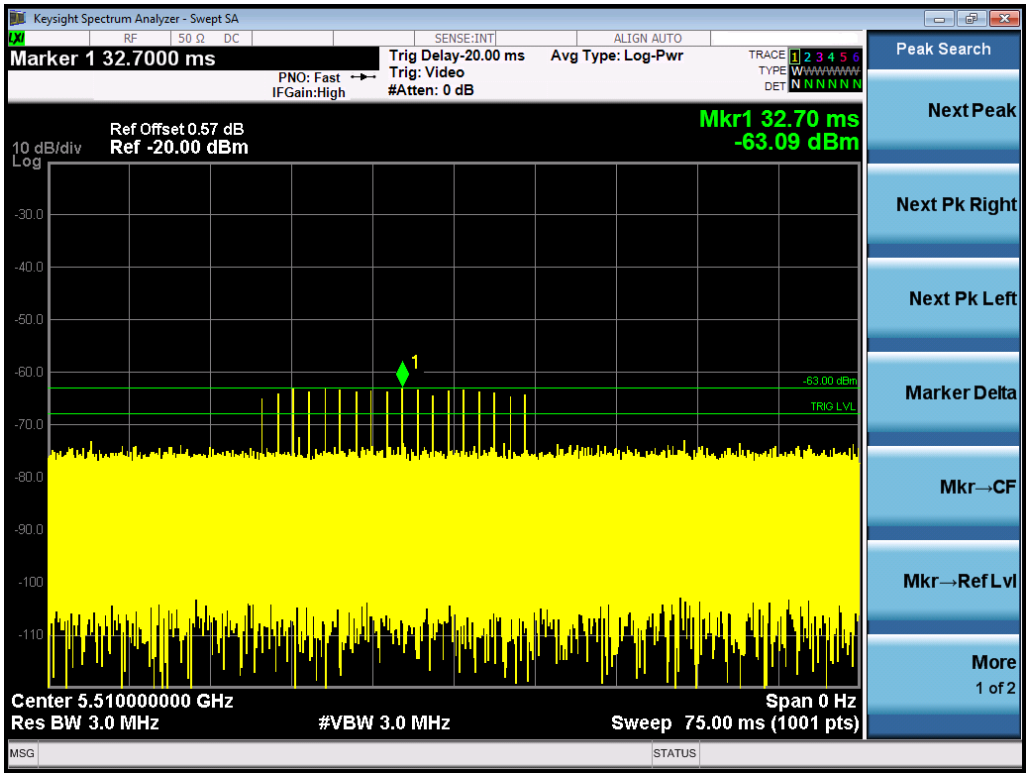
☒Bandwidth 20MHz: 5500MHz
☒Bandwidth 40MHz: 5510MHz
☒Bandwidth 80MHz: 5530MHz

3.9 Radar Waveform Calibration Result

5500MHz, Radar 0



5510MHz, Radar 0



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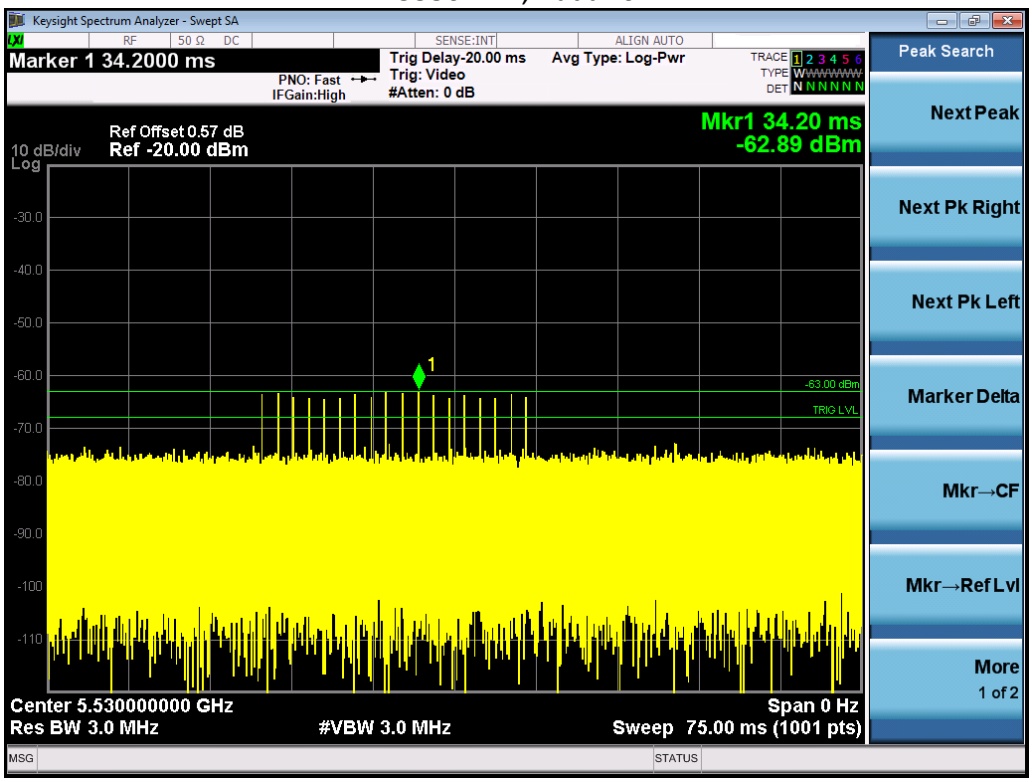
5530MHz, Radar 0



4 In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

These tests define how the following DFS parameters are verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time, and Non-Occupancy Period.

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB (-63dBm) is generated on the Operating Channel of the U-NII device.

A U-NII device operating as a Client Device will associate with the UUT (Master) at 5530MHz. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test.

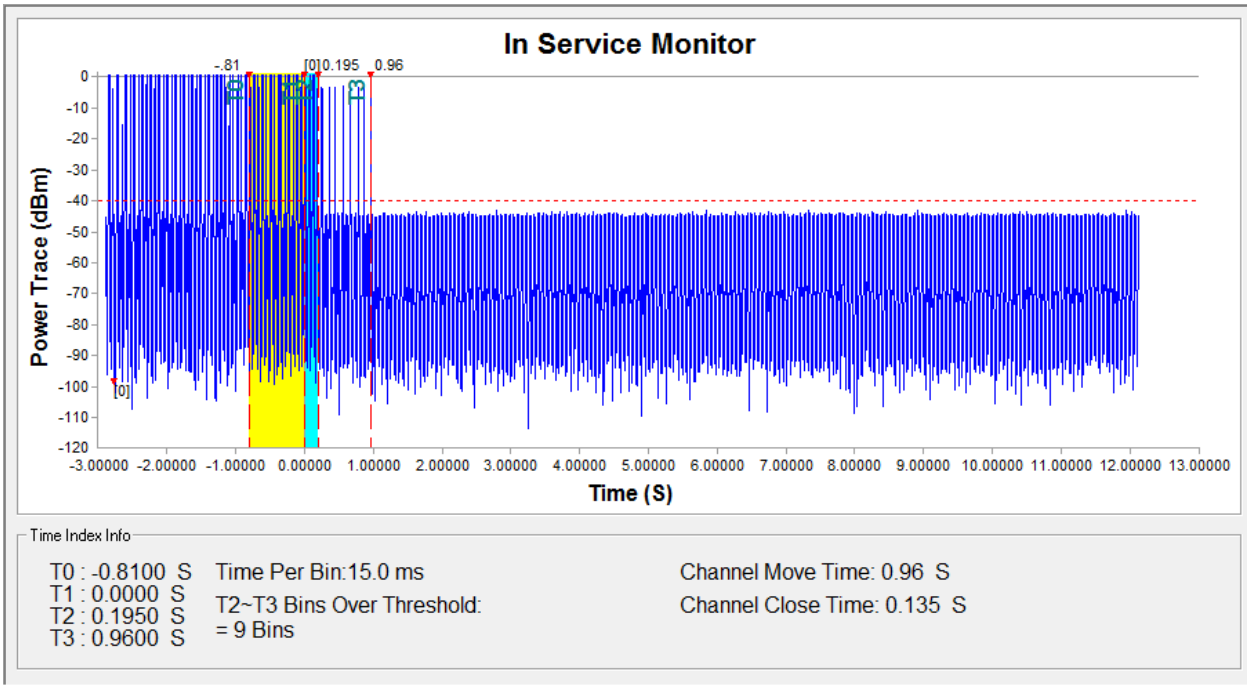
At time T0 the Radar Waveform generator sends a Burst of pulses for each of the radar types at -63dBm.

Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time results to the limits defined in the DFS Response requirement values table.

Type 0 radar was used for these tests.

4.1 Channel Move Time, Channel Closing Transmission Time

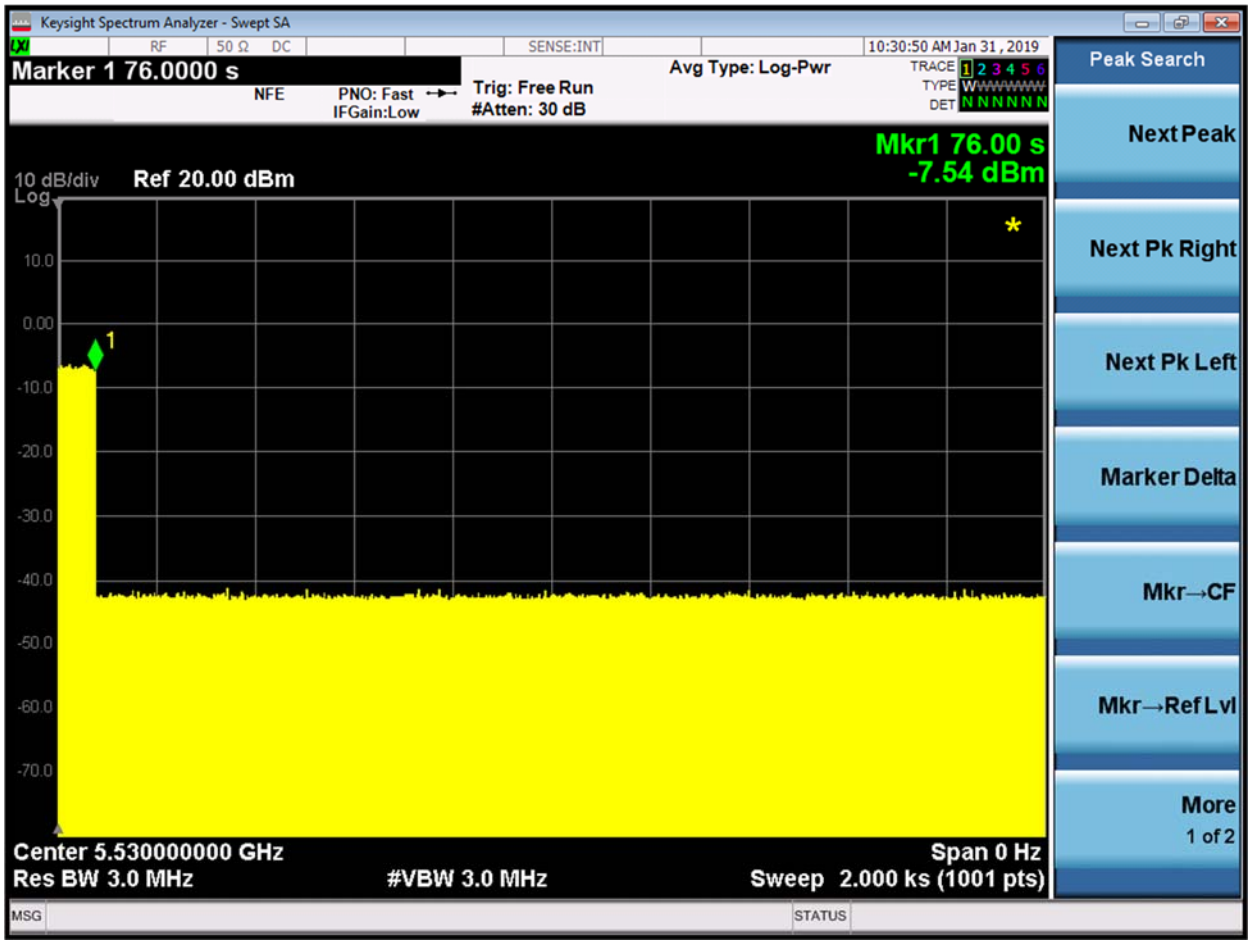
5530MHz



Test Item	Test value	Limit	Results
Channel Move Time	0.96 s	10 s	Pass
Channel Closing Transmission Time	0.135 s	200ms + an aggregate of 60ms over remaining 10 second period.	Pass

4.2 Non-Occupancy Period

5530MHz



Test Item	Limit	Results
Non-Occupancy Period	30 minutes	Pass

********** END **********