

Test report

367960-1TRFWL

Date of issue: February 6, 2019

Applicant:

Panasonic Corporation of North America

Product:

Home Monitoring Camera Indoor

Model(s):

KX-HNC850 / KX-HNC810

FCC ID:

ACJ96NKX-HNC850

ACJ96NKX-HNC810

ISED Registration Number:

216A-KXHNC855

216A-KXHNC815

Specifications:

◆ **FCC 47 CFR Part 15 Subpart E, §15.407(h)**

Unlicensed National Information Infrastructure Devices
(2) Dynamic Frequency Selection (DFS)

◆ **RSS-247 Issue 2, February 2017, Section 6.3**

Licence-Exempt Local Area Network (LE-LAN) Devices. Dynamic Frequency Selection (DFS)
for Devices Operating in the Bands 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz

Test location

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Site number	FCC: CA2040 (3 m semi anechoic chamber)

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Date	February 6, 2019
Signature of the reviewer	<i>Andrey Adelberg</i>

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Panasonic Corporation of North America
Address	2 Riverfront Plaza, 9 th floor
City	Newark
Province/State	NJ
Postal/Zip code	07102-5490
Country	USA

1.2 Test specifications

FCC 47 CFR Part 15, Subpart E, Clause 15.407	Unlicensed National Information Infrastructure Devices
RSS-247 Issue 2, February 2017, Section 6.3	Licence-Exempt Local Area Network (LE-LAN) Devices

1.3 Test methods

789033 D02 General UNII Test Procedures New Rules v01	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
905462 D02 Client Without DFS New Rules v01r01	U-NII client devices without radar detection capability
905462 D02 UNII DFS Compliance Procedures New Rules v01r01	Compliance measurement procedures for unlicensed – national information infrastructure devices operating in the 5250–5350 MHz and 5470–5725 MHz bands incorporating dynamic frequency selection

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued



Section 2. Summary of test results

2.1 FCC §15.407(h)(2), test results

KDB Section	Test description	Verdict
7.8.3	Channel move time	Pass
7.8.3	Channel closing transmission time	Pass
7.8.3	Non-occupancy period	Pass

Note: EUT is a Client device without radar detection.

2.2 RSS-247 Issue 2, test results

Section	Test description	Verdict
6.3.2(c)	Channel move time	Pass
6.3.2(d)	Channel closing transmission time	Pass
6.3.2(e)	Non-occupancy period	Pass

Note: EUT is a Client device without radar detection.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	January 1, 2019
Nemko sample ID number	1

3.2 EUT information

Product name	Home Monitoring Camera Indoor
Model	KX-HNC850 / KX-HNC810
Serial number	0001

3.3 Technical information

Operating band	5250–5350 MHz and 5470–5725 MHz
Operating frequencies	5260–5320 MHz; 5500–5700 MHz
Modulation type	802.11n
Channel bandwidth	20–80 MHz
Power requirements	120 V _{AC} 60 Hz
Antenna information	Mono-Pol Antenna The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

Wireless Camera (AC Powered) with 2.4 GHz / 5 GHz communication.

3.5 EUT exercise details

EUT (Client Device without DFS detection) was tested in a setup with Certified Master CISCO Access Point FCC ID: LDK102091.

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed.

5.3 Uncertainty of measurement

Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of $K=2$ with 95% certainty.

Section 6. Test equipment

6.1 Test equipment list

Table 6.1-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
DFS test box	Aeroflex	PXI	FA002628	–	VOU
Spectrum analyzer	Rohde & Schwarz	FSW43	FA002971	1 year	Mar. 16/19

Section 7. Test rules and requirements

7.1 FCC 15.407(h)(2) Radar Detection Function of Dynamic Frequency Selection (DFS)

(2) Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25–5.35 GHz and 5.47–5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. Operators shall only use equipment with a DFS mechanism that is turned on when operating in these bands. The device must sense for radar signals at 100 percent of its emission bandwidth. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200 mW to 1 W (23–30 dBm) is –64 dBm. For devices that operate with less than 200 mW (23 dBm) e.i.r.p. and a power spectral density of less than 10 dBm in a 1 MHz band, the minimum detection threshold is –62 dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. For the initial channel setting, the manufacturers shall be permitted to provide for either random channel selection or manual channel selection.

(i) Operational Modes. The DFS requirement applies to the following operational modes:

(A) The requirement for channel availability check time applies in the master operational mode.

(B) The requirement for channel move time applies in both the master and slave operational modes.

(ii) Channel Availability Check Time. A U-NII device shall check if there is a radar system already operating on the channel before it can initiate a transmission on a channel and when it has to move to a new channel. The U-NII device may start using the channel if no radar signal with a power level greater than the interference threshold values listed in paragraph (h)(2) of this section, is detected within 60 seconds.

(iii) Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

(iv) Non-occupancy Period. A channel that has been flagged as containing a radar system, either by a channel availability check or in-service monitoring, is subject to a non-occupancy period of at least 30 minutes. The non-occupancy period starts at the time when the radar system is detected.

Table 7.1-1: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds ¹
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period ^{1 and 2}
U-NII Detection Bandwidth	Minimum 100% of the 99% power bandwidth ³

Notes: ¹ The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:

- For the Short pulse radar Test Signals this instant is the end of the Burst.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar Burst generated.
- For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.

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 Channel changes (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.

³ During the *U-NII Detection Bandwidth* detection test, radar type 0 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.

Table 7.1-2: Short Pulse Radar Test Waveforms

Radar type	Pulse width, μs	Pulse Repetition Interval (PRI), μs	Number of pulses	Minimum percentage of successful detection	Minimum number of trials
0	1	1428	18	See note	See note
		Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in table below	$\text{Roundup}\{(1 \div 360) \times (19 \times 10^6 \div \text{PRI}_{\mu\text{s}})\}$		
1	1	Test B: 15 unique PRI values randomly selected within the range of 518–3066 μs , with a minimum increment of 1 μs , excluding PRI values selected in Test A		60%	30
2	1–5	150–230	23–29	60%	30
3	6–10	200–500	16–18	60%	30
4	11–20	200–500	12–16	60%	30
Aggregate (Radar types 1–4)				80%	120

Note: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.

Table 7.1-3: Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency number	Pulse Repetition Frequency, Pulses per second	Pulse Repetition Interval (PRI), μs
1	1930.5	518
2	1818.7	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	1355.0	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	1139.0	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

Table 7.1-4: Long Pulse Radar Test Waveforms

Radar type	Pulse width, μs	Chirp width, MHz	Pulse Repetition Interval (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

Table 7.1-5: Frequency Hopping Radar Test Waveforms

Radar type	Pulse width, μs	Pulse Repetition Interval (PRI), μs	Pulses per hop	Hopping rate, kHz	Hopping sequence length, ms	Minimum percentage of successful detection	Minimum number of trials
6	1	333	9	0.333	300	70%	30

Table 7.1-6: Summary of the requirements

Description	Radar type	Requirement	Notes
5.2 DFS Detection Threshold	Type 0	-64 dBm	Any BW
7.8.1 U-NII Detection Bandwidth	Type 0-4 (any)	100 % of 99 % BW	10 trials for each BW
7.8.2.1 Initial Channel Availability Check (CAC) Time	Type 0-4 (any)	≥60 s	Any BW
7.8.2.2 Radar Burst at the Beginning of the CAC	Type 0-4 (any)	No Tx	Any BW
7.8.2.3 Radar Burst at the End of the CAC	Type 0-4 (any)	No Tx	Any BW
7.8.3 Channel Move Time	Type 0	≤10 s	Widest BW
7.8.3 Channel Closing Transmission Time	Type 0	≤260 ms	Widest BW
7.8.3 Non-Occupancy Period	Type 0	>30 min	
7.8.4 Statistical Performance Check:	Type 1-6 (all)		Each BW; Each 20 MHz channels + center
7.8.4.1 Short Pulse Radar Test	Type 1-4 (all)	60% detection	30 trials (for each type)
7.8.4.2 Long Pulse Radar Test	Type 5	80% detection	30 trials
7.8.4.3 Frequency hopping Radar Test	Type 6	70% detection	30 trials

7.2 RSS-247 6.3 Radar Detection Function of Dynamic Frequency Selection (DFS)

Industry Canada requires the use of either the FCC KDB Procedure 905462 or the DFS test procedure in the ETSI EN 301 893 for demonstrating compliance with the DFS radar detection requirements set out in this section.

If any part of an operating device's emission bandwidth falls in the bands 5250–5350 MHz, 5470–5600 MHz or 5650–5725 MHz, the device shall comply with the following:

1) DFS radar signal detection threshold

Devices shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. The device must detect radar signals within its entire emission bandwidth. The minimum DFS radar signal detection threshold is described below in Table below.

Table 7.2-1: DFS Detection Threshold for Master Devices and Slave Devices with Radar Detection

Devices' e.i.r.p. information	DFS Threshold
Devices with an e.i.r.p. < 200 mW AND a Power Spectral Density < 10 dBm/MHz	–62 dBm
Devices with $200 \text{ mW} \leq \text{e.i.r.p.} \leq 1 \text{ W}$	–64 dBm

Note: The detection threshold power is the received power, averaged over a 1-microsecond reference to a 0 dBi antenna.

2) Operational requirements

The requirement for channel availability check time applies in the master operational mode. The requirement for channel move time applies in both the master and slave operational modes. The requirement for in-service monitoring does not apply to slave devices without radar detection.

- i. **In-service monitoring:** an LE-LAN device shall be able to monitor the operating channel to check that a co-channel radar has not moved or started operation within range of the LE-LAN device. During in-service monitoring, the LE-LAN radar detection function continuously searches for radar signals between normal LE-LAN transmissions.
- ii. **Channel availability check time:** the device shall check whether there is a radar system already operating on the channel before it initiates a transmission on a channel and when it moves to a channel. The device may start using the channel if no radar signal with a power level greater than the interference threshold value specified in Section 6.3(1) above is detected within 60 seconds.
- iii. **Channel move time:** after a radar signal is detected, the device shall cease all transmissions on the operating channel within 10 seconds.
- iv. **Channel closing transmission time:** is comprised of 200 ms 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 ms) over the remaining 10-second period of the channel move time.
- v. **Non-occupancy period:** a channel that has been flagged as containing a radar signal, either by a channel availability check or in-service monitoring, is subject to a 30-minute non-occupancy period where the channel cannot be used by the LE-LAN device. The non-occupancy period starts from the time that the radar signal is detected.

Section 8. Testing data

8.1 Channel closing transmission and move time

8.1.1 Definitions and limits

Maximum channel closing transmission time is 200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period.
Maximum channel move time is 10 seconds.

8.1.2 Test summary

Test date February 1, 2019

8.1.3 Observations, settings and special notes

The test was performed with the use of Radar type 0.

8.1.4 Test data

Table 8.1-1: Channel closing transmission time results

Channel	Measured closing transmission time, ms	Limit, ms	Margin, ms
60	1.864	260.00	198.136
100	1.636	260.00	198.364

Table 8.1-2: Channel move time results

Channel	Measured move time, s	Limit, s	Margin, s
60	0.00	10.00	10.00
100	0.00	10.00	10.00

Table 8.1-3: Channel closing transmission and move time measurement results

Channel	Region	Start, s	End, s	Measured, ms	Limit, ms
60	0	0	0.2	0.669	200
60	1	0.2	10	1.195	60
60	2	10	12	0	0
100	0	0	0.2	0.662	200
100	1	0.2	10	0.974	60
100	2	10	12	0	0

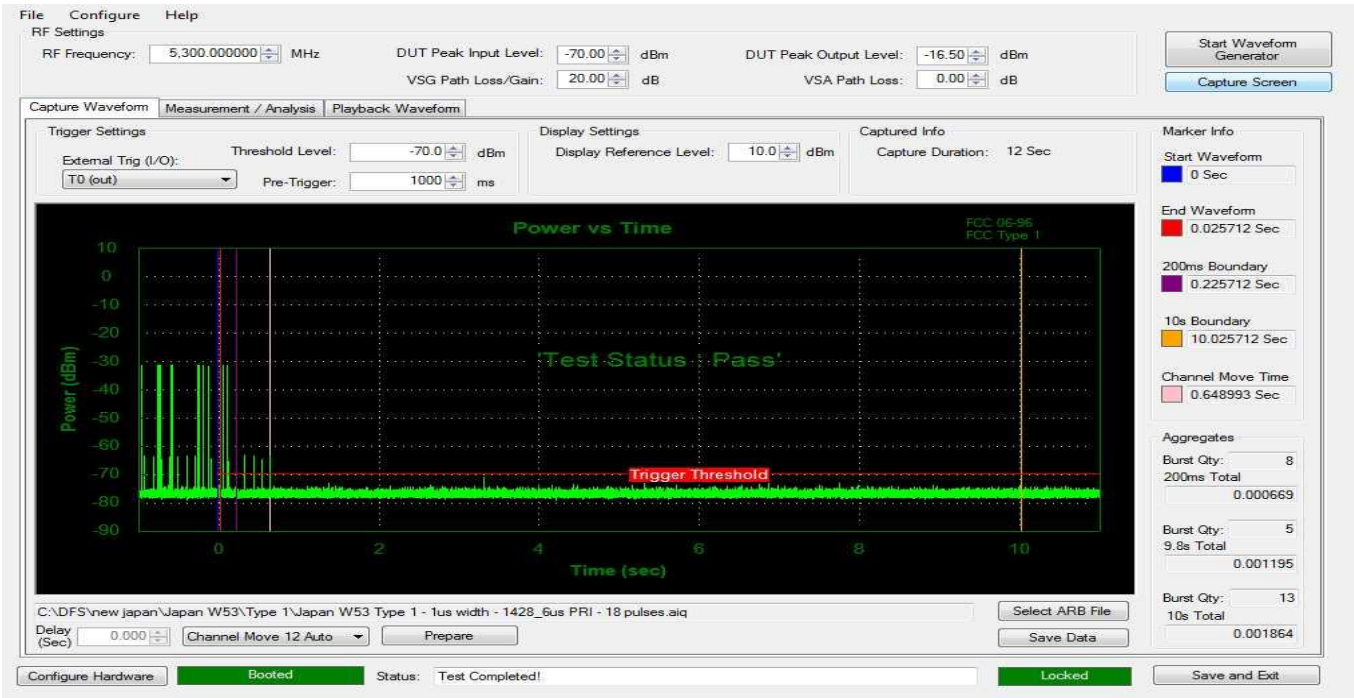


Figure 8.1-1: Channel closing transmission and move time, channel 60

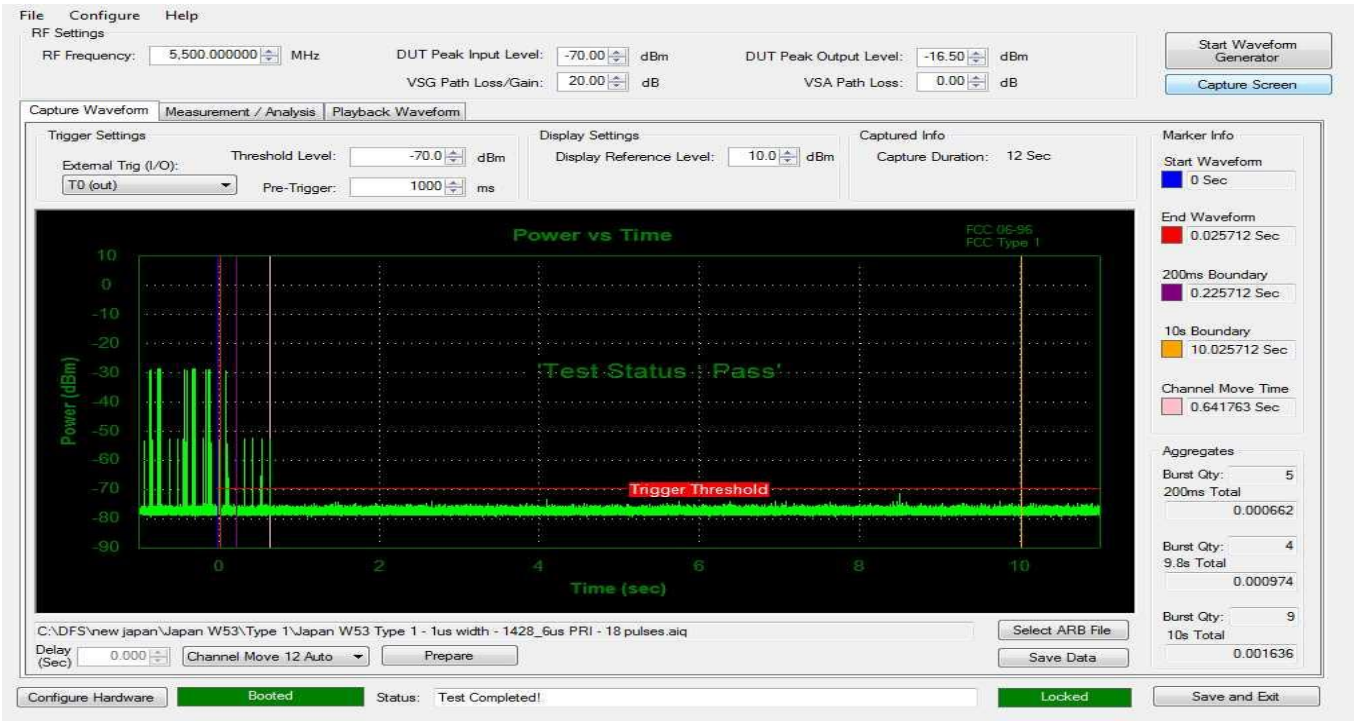


Figure 8.1-2: Channel closing transmission and move time, channel 60

8.2 Non-occupancy period

8.2.1 Definitions and limits

Non-occupancy period minimum is 30 minutes.

8.2.2 Test summary

Test date February 1, 2019

8.2.3 Observations, settings and special notes

The EUT was monitored for more than 30 minutes following instant T_2 (the end of Radar pulses) to verify that the EUT does not resume any transmissions on this Channel. This test was performed with the use of Radar type 0.

8.2.4 Test data

Table 8.2-1: Non-occupancy period results

Measured Non-occupancy period, min	Minimum limit, min	Margin, min
>30	30	>0

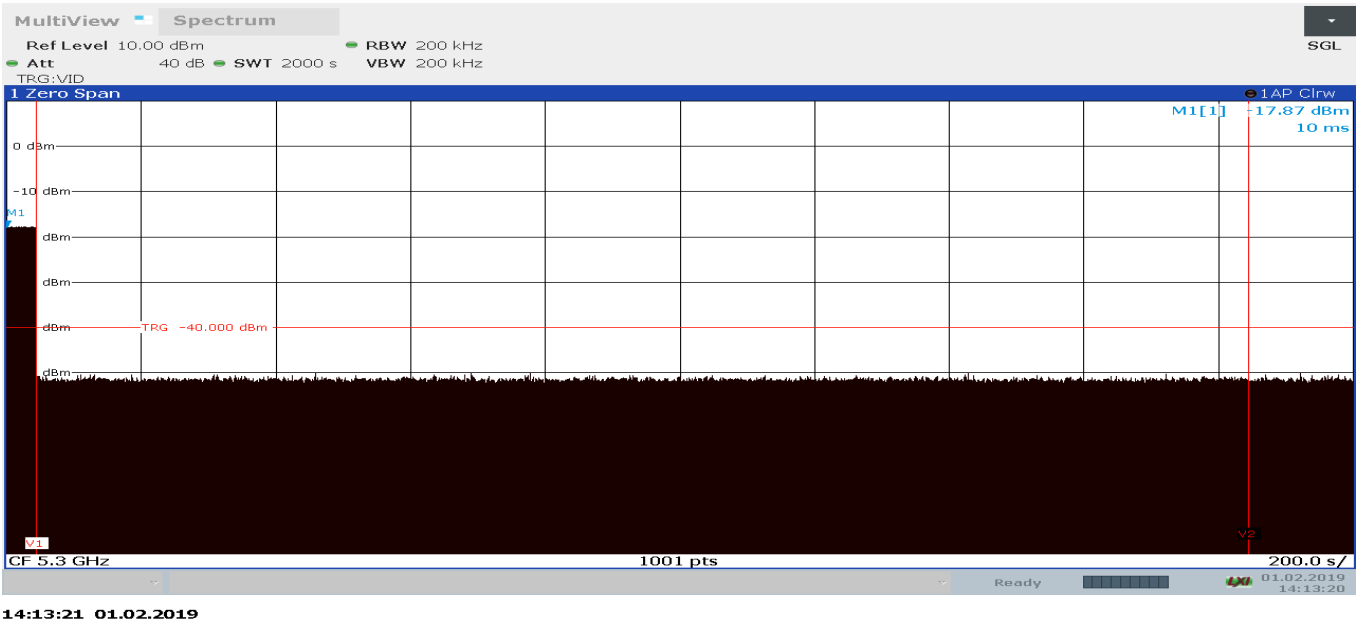


Figure 8.2-1: Non-occupancy period for 5.25–5.35 GHz band

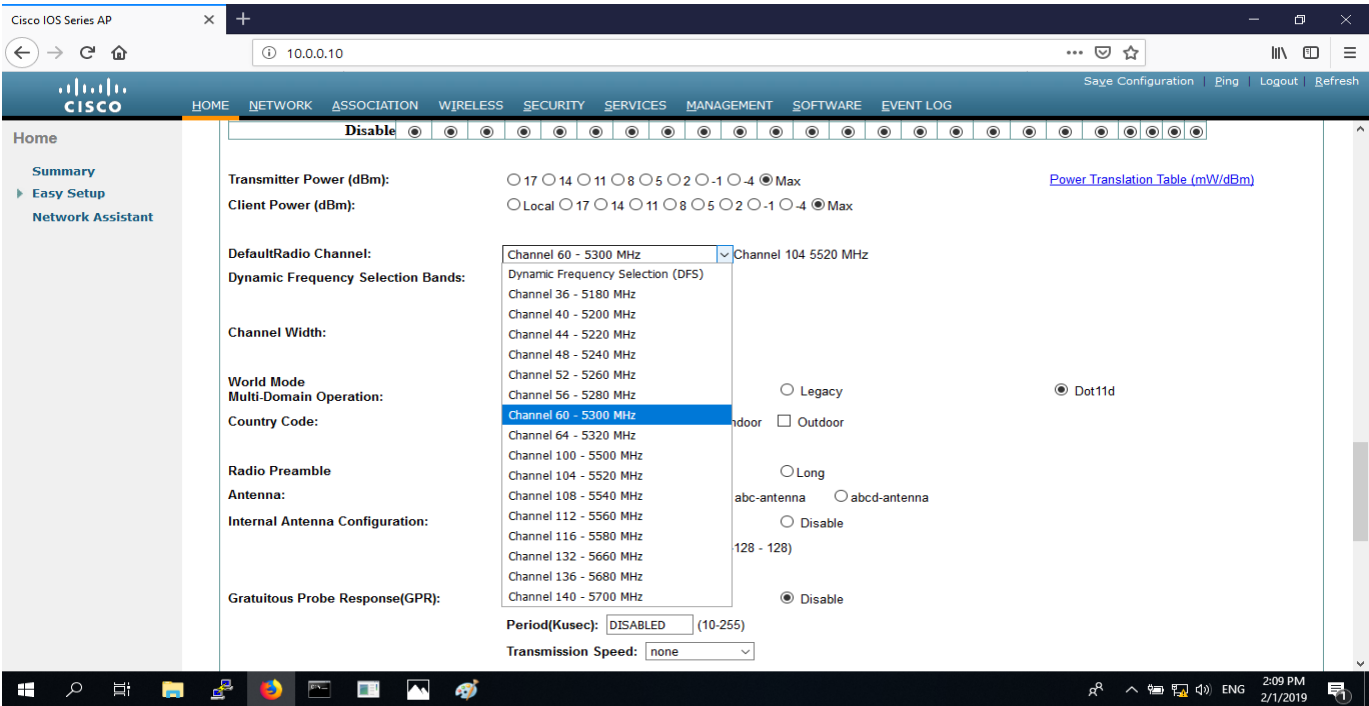


Figure 8.2-2: Screenshot showing the channel 60 is available prior to radar detection

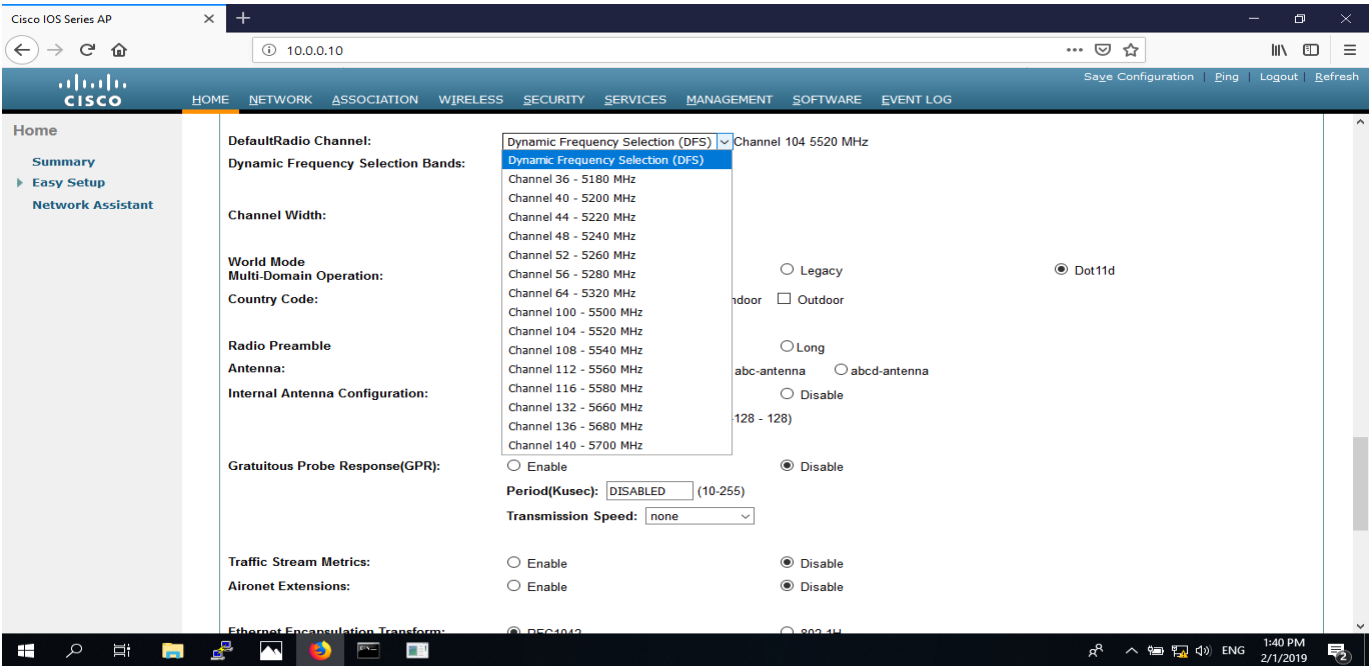
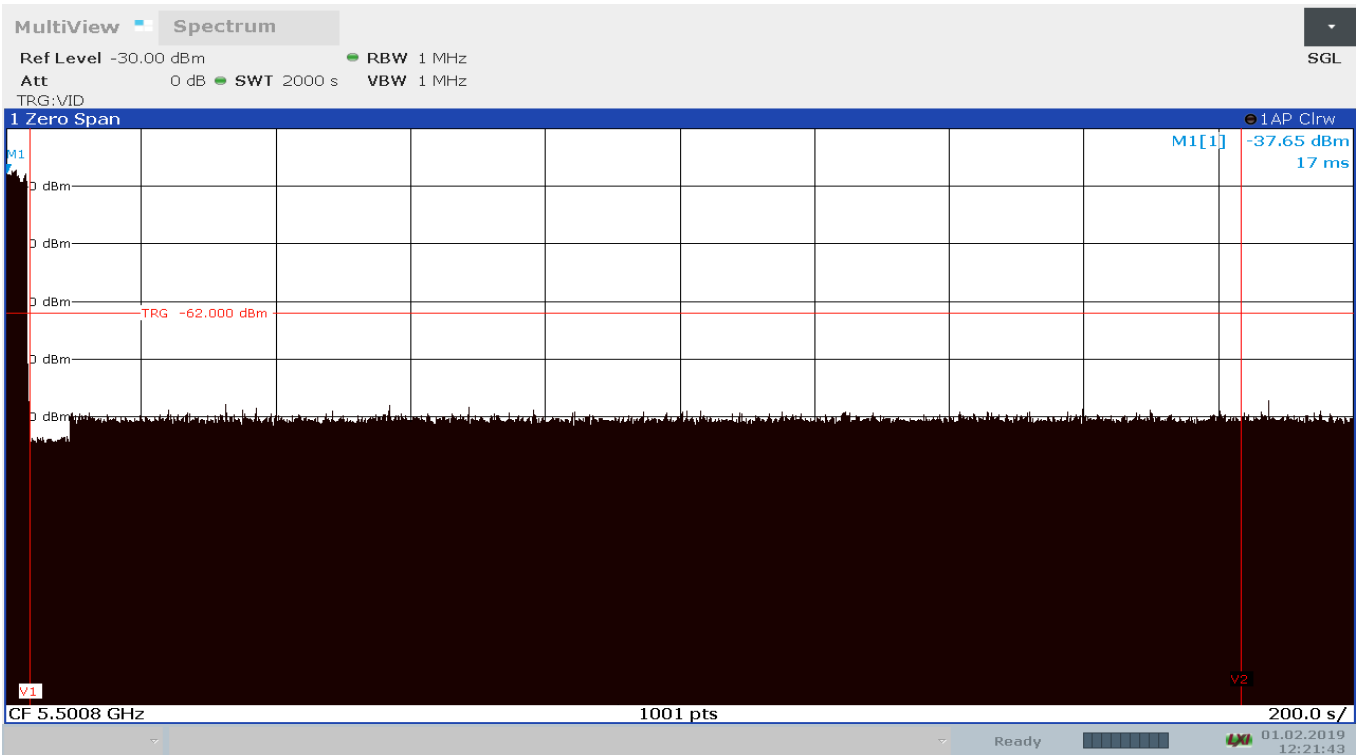


Figure 8.2-3: Screenshot showing the channel 60 is unavailable after radar detection



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Figure 8.2-4: Non-occupancy period for 5.47–5.725 GHz band

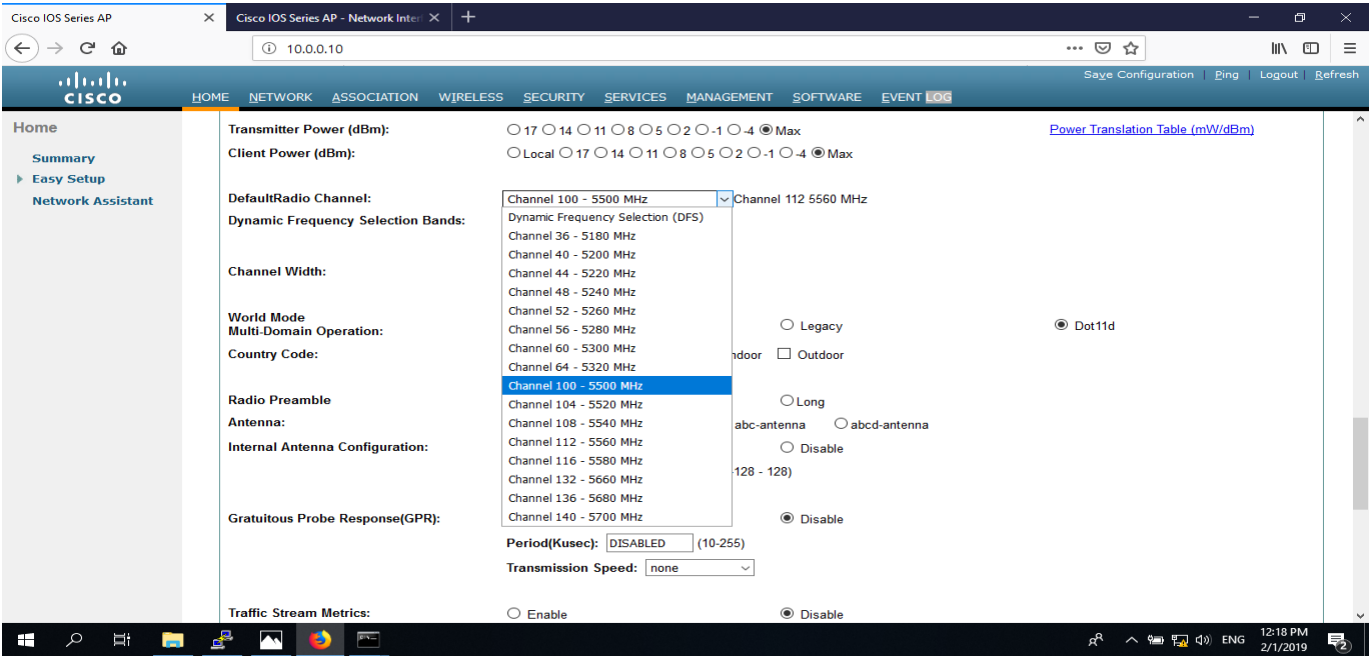


Figure 8.2-5: Screenshot showing the channel 100 is available prior to radar detection

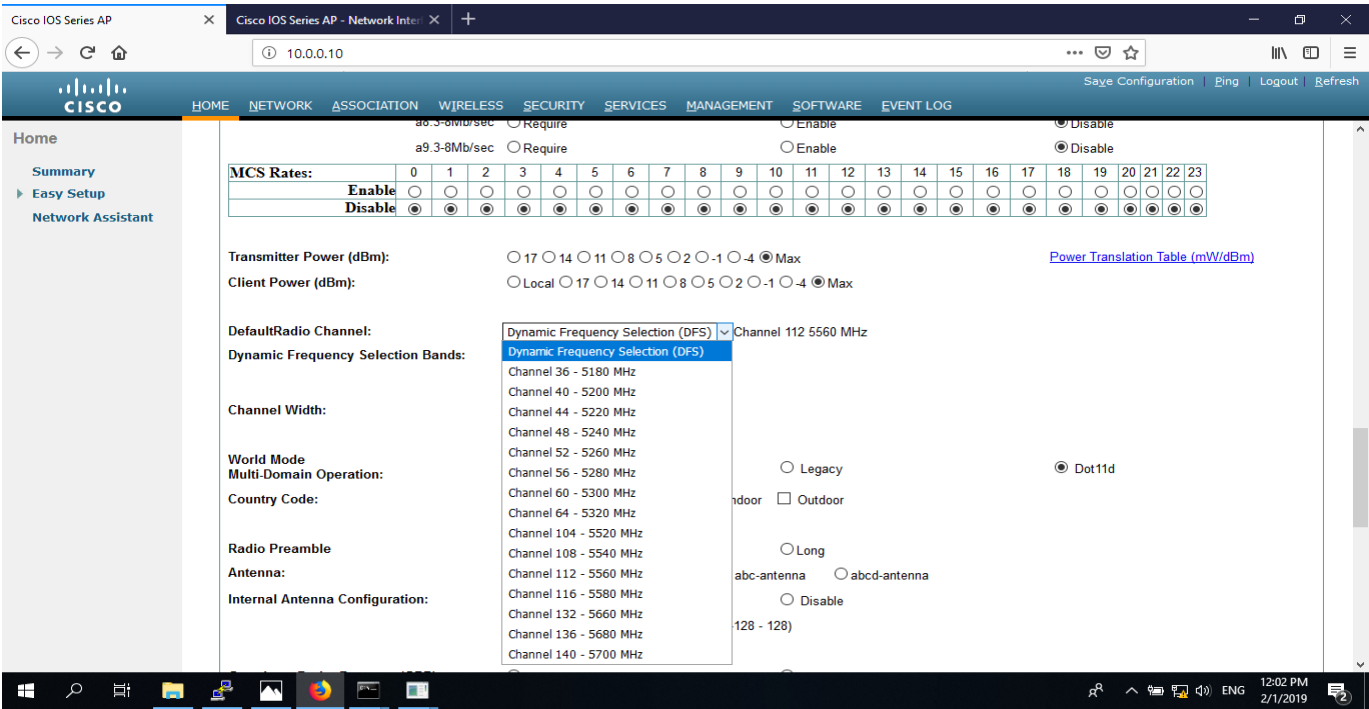
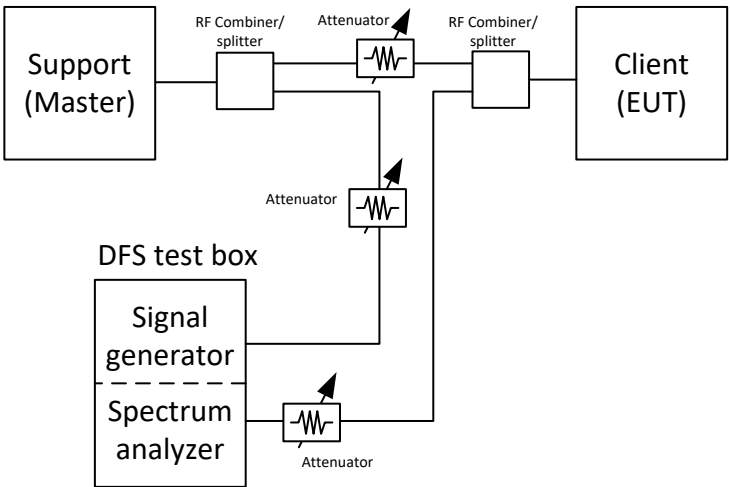


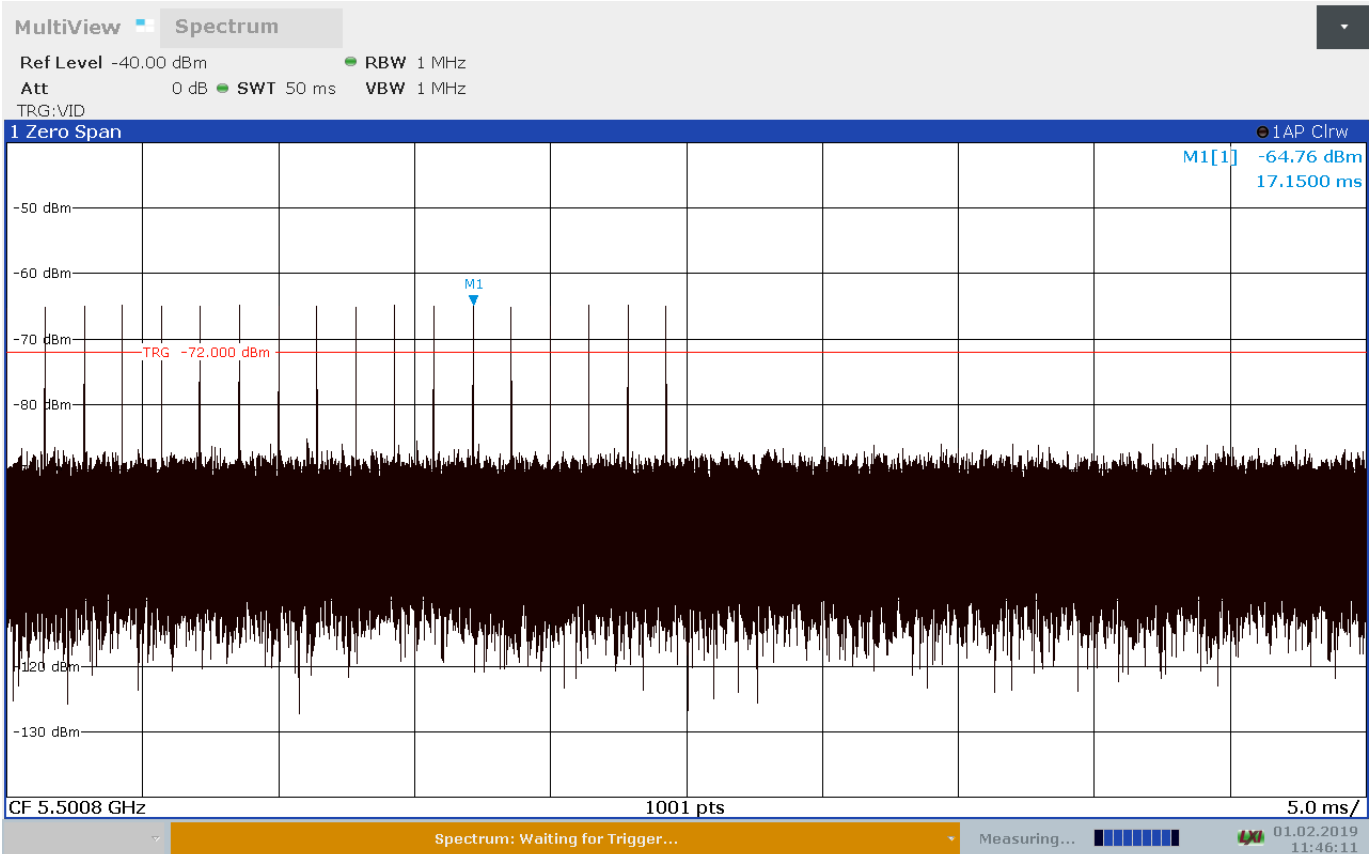
Figure 8.2-6: Screenshot showing the channel 100 is unavailable after radar detection

Section 9. Block diagrams of test set-ups

9.1 Test set-up diagram



Section 10. Radar pulse details



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Figure 9.1-1: Example of radar pulses of Type 0 for testing