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# Wireless test report – 392997-2TRFWL

Applicant:

**Panasonic Corporation of North America**

Product type:

**Window camera**

Model:

**KX-HNC500**

Model Variant:

**KX-HNC505C**

FCC ID:

**ACJ96NKX-HNC500**

IC Registration number:

**216A-KXHNC505**

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, Feb 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

Date of issue: **February 27, 2020**

**Mark Libbrecht, EMC Specialist**

Tested by

**Kevin Rose, Wireless/EMC Specialist**

Reviewed by

Signature

Signature

#### Test location

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|                       |                             |
|-----------------------|-----------------------------|
| Company name          | Nemko Canada Inc.           |
| Site name             | Cambridge                   |
| Address               | 130 Saltsman Drive, Unit #1 |
| City                  | Cambridge                   |
| Province              | Ontario                     |
| Postal code           | N3E 0B2                     |
| Country               | Canada                      |
| Telephone             | Tel: +1 519 680 4811        |
| Website               | www.nemko.com               |
| Site number (3 m SAC) | FCC/IC: CA0101              |

#### Limits of responsibility

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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         | Two Riverfront Plaza, 9th 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, Feb. 2017, Section 6.3      | Licence-Exempt Local Area Network (LE-LAN) Devices     |

### 1.3 Test methods

|                                                          |                                                                                                                                                                                                 |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 789033 D02 General UNII Test Procedures New Rules v02r01 | Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E                                                                          |
| 905462 D03 Client Without DFS New Rules v01r02           | U-NII client devices without radar detection capability                                                                                                                                         |
| 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 |

### 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 # | Date of issue     | Details of changes made to test report |
|------------|-------------------|----------------------------------------|
| TRF        | February 27, 2020 | Original report issued                 |

## Section 2. Summary of test results

### 2.1 FCC §15.407(h)(2), test results

| KDB Section | Test description                                               | Verdict        |
|-------------|----------------------------------------------------------------|----------------|
| 5.2         | DFS detection threshold                                        | Not applicable |
| 7.8.1       | U-NII detection bandwidth                                      | Not applicable |
| 7.8.2.1     | Initial Channel Availability Check (CAC) time                  | Not applicable |
| 7.8.2.2     | In-service monitoring, radar burst at the beginning of the CAC | Not applicable |
| 7.8.2.3     | In-service monitoring, radar burst at the end of the CAC       | Not applicable |
| 7.8.3       | Channel move time                                              | Pass           |
| 7.8.3       | Channel closing transmission time                              | Pass           |
| 7.8.3       | Non-occupancy period                                           | Pass           |
| 7.8.4.1     | Statistical performance with short pulse radar test            | Not applicable |
| 7.8.4.2     | Statistical performance with long pulse radar test             | Not applicable |
| 7.8.4.3     | Statistical performance with frequency hopping radar test      | Not applicable |

Note: EUT is a client without radar detection

### 2.2 RSS-247 Issue 2, test results

| Section             | Test description                                               | Verdict        |
|---------------------|----------------------------------------------------------------|----------------|
| RSS-247 6.3(1)      | DFS radar signal detection threshold                           | Not applicable |
| KDB Section 7.8.1   | U-NII detection bandwidth                                      | Not applicable |
| RSS-247 6.3(2)(ii)  | Initial Channel Availability Check (CAC) time                  | Not applicable |
| RSS-247 6.3(2)(i)   | In-service monitoring, radar burst at the beginning of the CAC | Not applicable |
| RSS-247 6.3(2)(i)   | In-service monitoring, radar burst at the end of the CAC       | Not applicable |
| RSS-247 6.3(2)(iii) | Channel move time                                              | Pass           |
| RSS-247 6.3(2)(iv)  | Channel closing transmission time                              | Pass           |
| RSS-247 6.3(2)(v)   | Non-occupancy period                                           | Pass           |
| KDB Section 7.8.4.1 | Statistical performance with short pulse radar test            | Not applicable |
| KDB Section 7.8.4.2 | Statistical performance with long pulse radar test             | Not applicable |
| KDB Section 7.8.4.3 | Statistical performance with frequency hopping radar test      | Not applicable |

Note: EUT is a client without radar detection

## Section 3. Equipment under test (EUT) details

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### 3.1 Sample information

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|                        |                   |
|------------------------|-------------------|
| Receipt date           | February 25, 2020 |
| Nemko sample ID number | 1                 |

### 3.2 EUT information

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|                  |               |
|------------------|---------------|
| Product name     | Window camera |
| Model            | KX-HNC500     |
| Model Variant    | KX-HNC505C    |
| Serial number    | 3896570006    |
| Hardware Version | 1.00          |
| Software Version | 00.40         |

### 3.3 Technical information

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|                       |                                                                                             |
|-----------------------|---------------------------------------------------------------------------------------------|
| Operating band        | FCC: 5470–5725 MHz; IC: 5470–5600 MHz and 5650–5725 MHz                                     |
| Operating frequencies | 5500–5700 MHz                                                                               |
| Modulation type       | 802.11n                                                                                     |
| Channel bandwidth     | 20 MHz                                                                                      |
| Power requirements    | 120 V <sub>AC</sub> 60 Hz                                                                   |
| Antenna information   | The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. |

### 3.4 Product description and theory of operation

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The window camera is used for security surveillance. The window camera attaches to a smart phone using Bluetooth to obtain the SSID shared key required to monitor the live video feed. The video feed is transmitted using 2.4 GHz, and 5 GHz WIFI but is limited to 20 MHz bandwidth maximum.

### 3.5 EUT exercise details

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The window camera tested is a mass production unit, not capable of peer to peer live video stream. The EUT was exercised by providing a ping from an external laptop, which created the traffic required for DFS testing.

## Section 4. Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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

### 4.2 Technical judgment

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Model variant is the same hardware but requires different production firmware for sale in Canada.

### 4.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

## Section 5. Test conditions

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### 5.1 Atmospheric conditions

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|                   |               |
|-------------------|---------------|
| 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

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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.

## Section 6. Test equipment

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### 6.1 Test equipment list

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*Table 6.1-1: Equipment list*

| Equipment         | Manufacturer    | Model no. | Asset no. | Cal cycle | Next cal.   |
|-------------------|-----------------|-----------|-----------|-----------|-------------|
| DFS test box      | Aeroflex        | PXI       | FA002628  | 1 year    | Sept. 19/20 |
| Spectrum analyzer | Rohde & Schwarz | FSW43     | FA001877  | 1 year    | June 21/20  |

### 6.2 EUT sub assemblies

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*Table 6.2-1: Support equipment*

| Description  | Brand name | Model/Part number | Serial number |
|--------------|------------|-------------------|---------------|
| Laptop       | Sony VAIO  | VJP132C11N        | NONE          |
| laptop       | Panasonic  | CF-SX2ADHCS       | 3BKSA73136    |
| Access point | Aruba      | APIN0335          | CNH7JOY421    |

## 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 <sup>1</sup>                                                                               |
| Channel Closing Transmission Time | 200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period <sup>1 and 2</sup> |
| U-NII Detection Bandwidth         | Minimum 100% of the 99% power bandwidth <sup>3</sup>                                                  |

Notes: <sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> 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, $\mu\text{s}$ | Pulse Repetition Interval (PRI), $\mu\text{s}$ | Number of pulses |
|------------|----------------------------|------------------------------------------------|------------------|
| 0          | 1                          | 1428                                           | 18               |

Note: Short Pulse Radar Type 0 used for the channel move time, channel closing time tests, and Non-Occupancy period tests.

**Table 7.1-3: Summary of the requirements**

| Description                             | Radar type | Requirement   |
|-----------------------------------------|------------|---------------|
| 7.8.3 Channel Move Time                 | Type 0     | $\leq 10$ s   |
| 7.8.3 Channel Closing Transmission Time | Type 0     | $\leq 260$ ms |
| 7.8.3 Non-Occupancy Period              | Type 0     | $> 30$ min    |

Note: EUT only supports 20 MHz BW

## 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 mW ≤ e.i.r.p. ≤ 1 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 25, 2020 |
| Test engineer | Mark Libbrecht    |
| Verdict       | Pass              |

#### 8.1.3 Observations, settings and special notes

The test was performed on the widest channel BW, which is 20 MHz with the use of Radar type 0.

#### 8.1.4 Test data

**Table 8.1-1:** Channel closing transmission time results

| Measured closing transmission time, ms | Limit, ms | Margin, ms |
|----------------------------------------|-----------|------------|
| 27.9                                   | 260.00    | 232.1      |

**Table 8.1-2:** Channel move time results

| Measured move time, s | Limit, s | Margin, s |
|-----------------------|----------|-----------|
| 7.88                  | 10.00    | 2.12      |

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

| Region | Start, s | End, s | Measured, ms | Limit, ms | Margin, ms |
|--------|----------|--------|--------------|-----------|------------|
| 0      | 0        | 0.2    | 0.3          | 200       | 199.7      |
| 1      | 0.2      | 10     | 27.6         | 60        | 32.4       |
| 2      | 10       | 12     | 0            | 0         | 0          |

8.1.1 Test data, plot

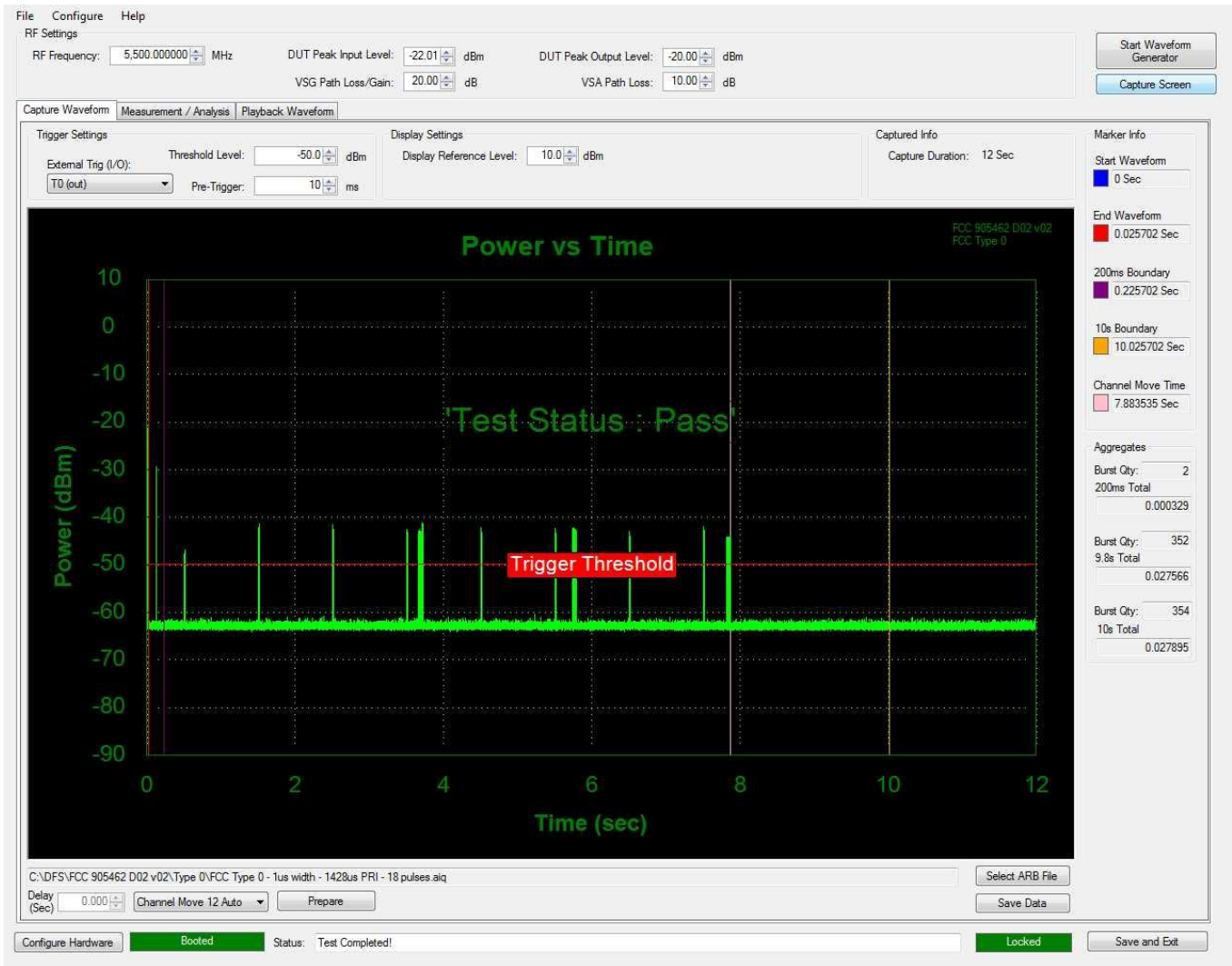


Figure 8.1-1: Channel closing transmission and move time

## 8.1.2 Test data, measurement data

```

Report Generated :25/02/2020
TestResult :Passed
Test Type :Channel Move Auto 12
Waveform : C:\DFS\FCC 905462 D02 v02\Type 0\FCC Type 0 - lus width - 1428us PRI - 18 pulses.aiq

Reported results are filtered. Any gaps in transmission less than 1E-05ms are assumed to be continuous tra
Aggregate time is calculated on filtered data

Timings Relative to Start of Capture
T1 : 25.702 (ms)

Transmission Duration by Region

Region      ,      Start,      End,      Power,      Power      Pass/Fail
            ,      (sec),      (sec),      Allowed,      Measured,
            ,              (ms),              (ms),              (ms),
0            ,      0,      0.2,      200,      0.329,      Pass
1            ,      0.2,      10,      60,      27.566,      Pass
2            ,      10,      12,      0,      0,      Pass

Pulses Detected
Start Time,      Stop Time,      Duration
(ms),      (ms),      (ms)
1.429,      1.431,      0.002
2.508,      2.836,      0.328
2.857,      2.858,      0.002
4.285,      4.287,      0.002
5.713,      5.715,      0.002
7.141,      7.143,      0.002
8.569,      8.570,      0.002
9.997,      9.999,      0.002
11.425,      11.426,      0.002
12.853,      12.854,      0.002
14.281,      14.282,      0.002
15.709,      15.710,      0.002
17.137,      17.138,      0.002
18.565,      18.567,      0.002
19.993,      19.995,      0.002
21.421,      21.423,      0.002
22.849,      22.851,      0.002
24.277,      24.279,      0.002
25.705,      25.707,      0.002
124.632,      124.961,      0.329
508.681,      508.681,      0.000
508.808,      508.808,      0.000
509.071,      509.071,      0.000
509.309,      509.309,      0.000
509.330,      509.330,      0.000
509.723,      509.723,      0.000
509.742,      509.742,      0.000
509.854,      509.858,      0.004
509.893,      509.894,      0.000

```

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

## 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 25, 2020 |
| Test engineer | Mark Libbrecht    |
| Verdict       | Pass              |

### 8.2.3 Observations, settings and special notes

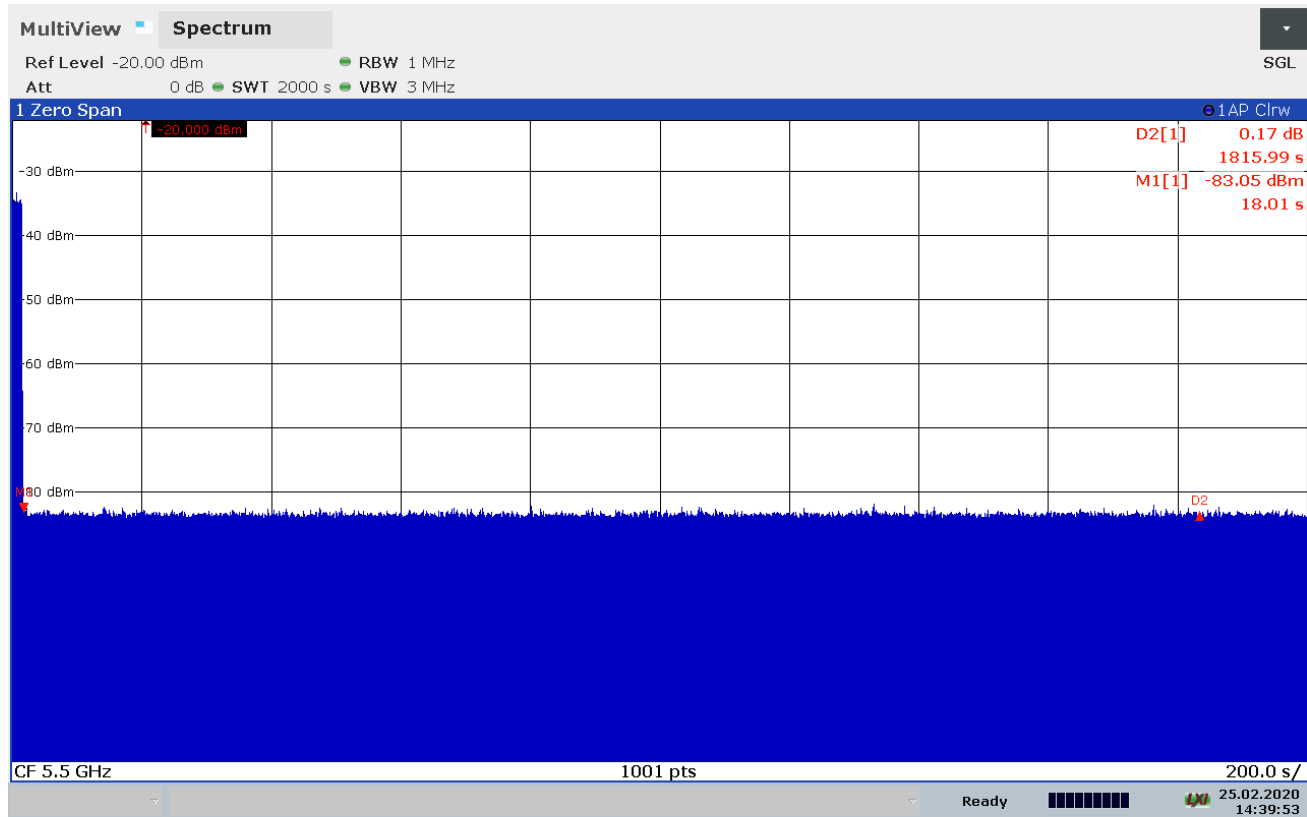
---

The EUT was monitored for more than 30 minutes following instant T<sub>2</sub> (the end of Radar pulses) to verify that the EUT does not resume any transmissions on this Channel. This test was performed once on the widest channel BW, which is 20 MHz 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 |
|------------------------------------|--------------------|-------------|
| 33                                 | 30                 | 3           |



14:39:54 25.02.2020

**Figure 8.2-1: Non-occupancy period**

## Section 9. Block diagrams of test set-ups

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### 9.1 Test set-up diagram

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