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Wireless test report – 392997-1TRFWL

Applicant:

Panasonic Corporation of North America

Product type:

Window camera

Model:	Model Variant:
KX-HNC500	KX-HNC505C
FCC ID:	IC Registration number:
ACJ96NKX-HNC500	216A-KXHNC505

Specifications:

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

  Unlicensed National Information Infrastructure Devises
  (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	Mark Libbrecht
Tested by	Signature
Kevin Rose, Wireless/EMC Specialist	
Reviewed by	Signature

Test location

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

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.

Copyright notification

Table of contents

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 Devises
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 Section7.8.4.1	Statistical performance with short pulse radar test	Not applicable
KDB Section7.8.4.2	Statistical performance with long pulse radar test	Not applicable
KDB Section7.8.4.3	Statistical performance with frequency hopping radar test	Not applicable

Note: EUT is a client without radar detection

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	February 25, 2020
Nemko sample ID number	1

3.2 EUT information

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

Operating band	5250–5350 MHz
Operating frequencies	5260–5320 MHz
Modulation type	802.11n
Channel bandwidth	20 MHz
Power requirements	120 V_{AC} 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

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

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

4.1 Modifications incorporated in the EUT

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

4.2 Technical judgment

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

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 ±5 %, for which the equipment was designed.

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	1 year	Sept. 19/20
Spectrum analyzer	Rohde & Schwarz	FSW43	FA002971	1 year	June 21/20

6.2 EUT sub assemblies

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[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
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	≤10 s
7.8.3 Channel Closing Transmission Time	Type 0	≤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
35.7	260.00	224.3

Table 8.1-2: *Channel move time results*

Measured move time, s	Limit, s	Margin, s
7.99	10.00	2.01

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	0.7	200	199.3
1	0.2	10	35	60	25
2	10	12	0	0	0

8.1.1 Test data, plot

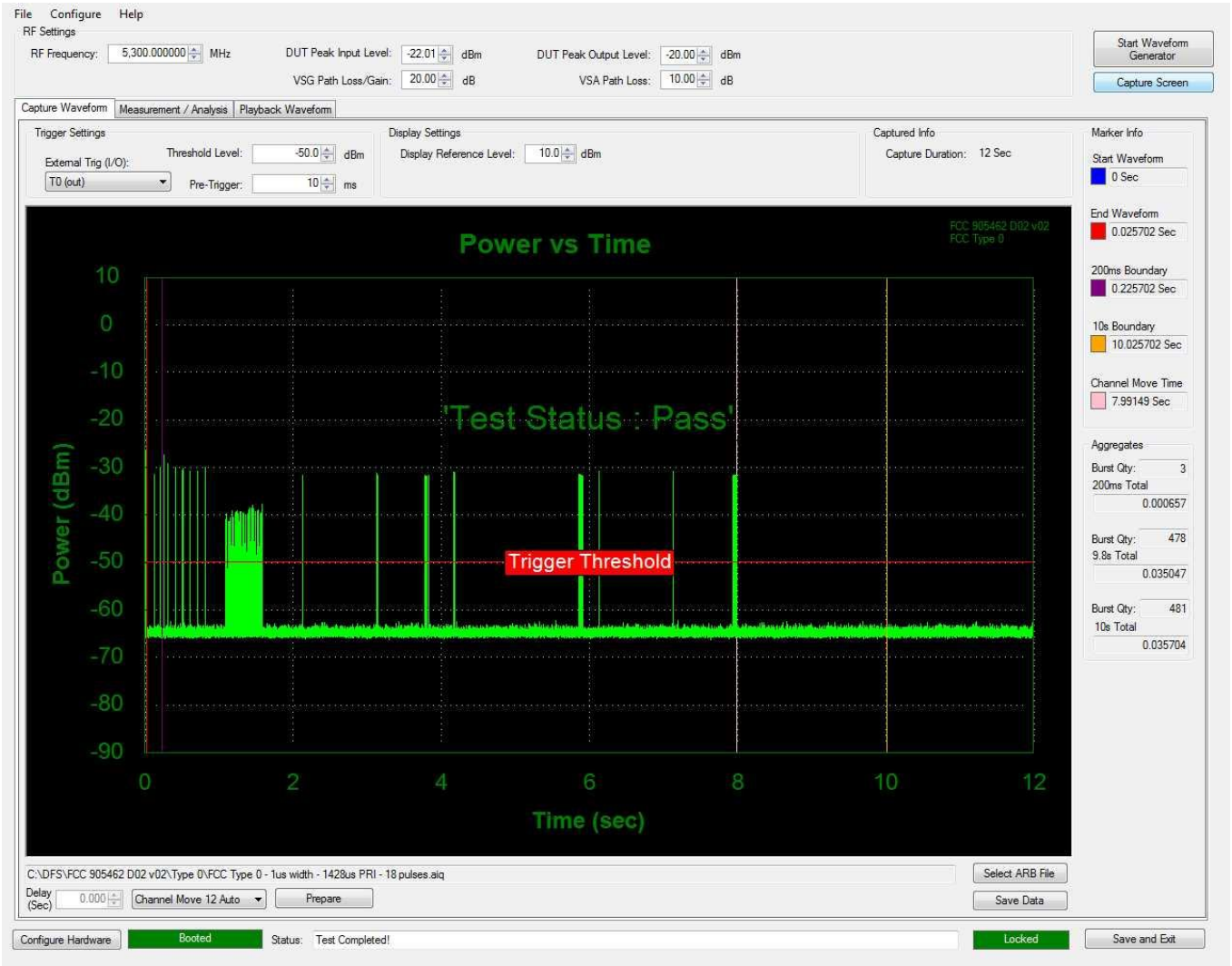

Figure 8.1-1: *Channel closing transmission and move time, plot*

8.1.1 Test data, measurement data

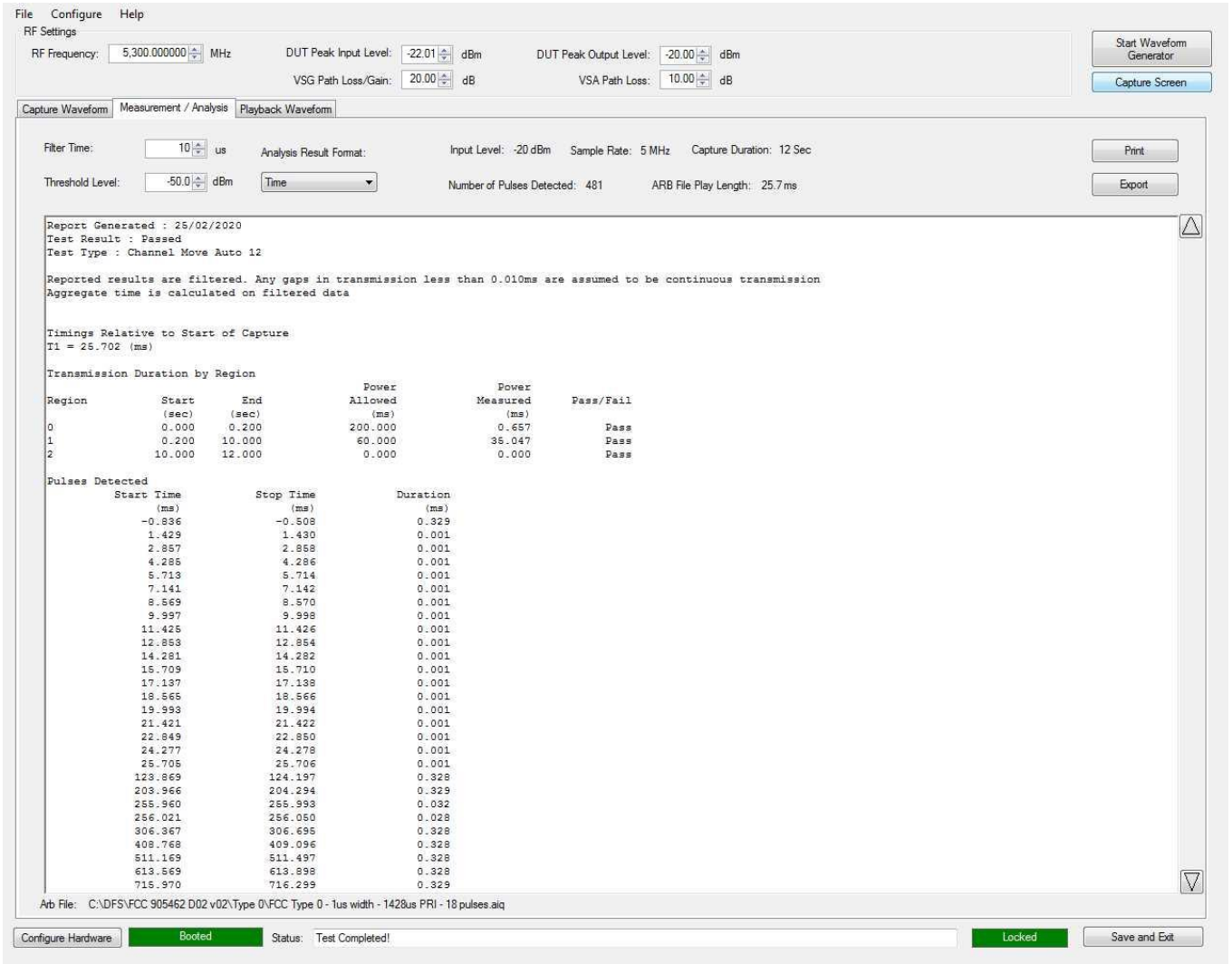

Figure 8.1-2: *Channel closing transmission and move time, measurement data*

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_2 (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
32	30	2

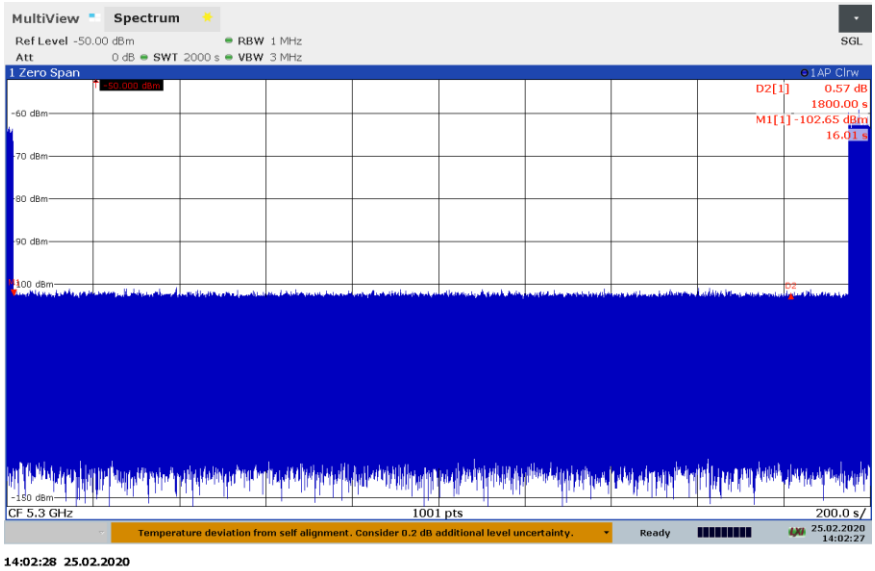

Figure 8.2-1: *Non-occupancy period*

Section 9. Block diagrams of test set-ups

9.1 Test set-up diagram