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Test report

311245-4TRFWL

Date of issue: May 10, 2017

Applicant:

Siemens Canada Ltd.

Product:

Multiprotocol Intelligent Node with LTE and Wi-Fi

Model:

RX1400

FCC ID:

VG5RX1400

IC Registration Number:

4997A-VG5RX1400

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, 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

Company name	Nemko Canada Inc.
Address	303 River Road
City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: 176392 (3 m semi anechoic chamber)

Tested by	Andrey Adelberg, Senior Wireless/EMC Specialist
Reviewed by	Kevin Rose, Wireless/EMC Specialist
Date	May 10, 2017
Signature of the reviewer	

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	Siemens Canada Ltd.
Address	300 Applewood Cres
City	Concord
Province/State	Ontario
Postal/Zip code	L4K 5C7
Country	Canada

1.2 Test specifications

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

1.3 Test methods

789033 D02 General U-NII Test Procedures New Rules v01r03	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 #	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
5.2	DFS detection threshold	Pass
7.8.1	U-NII detection bandwidth	Pass
7.8.2.1	Initial Channel Availability Check (CAC) time	Pass
7.8.2.2	In-service monitoring, radar burst at the beginning of the CAC	Pass
7.8.2.3	In-service monitoring, radar burst at the end of the CAC	Pass
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	Pass
7.8.4.2	Statistical performance with long pulse radar test	Pass
7.8.4.3	Statistical performance with frequency hopping radar test	Pass

Note: None

2.2 RSS-247 Issue 2, test results

Section	Test description	Verdict
RSS-247 6.3.1	DFS radar signal detection threshold	Pass
KDB Section 7.8.1	U-NII detection bandwidth	Pass
RSS-247 6.3.2 (b)	Initial Channel Availability Check (CAC) time	Pass
RSS-247 6.3.2 (a)	In-service monitoring, radar burst at the beginning of the CAC	Pass
RSS-247 6.3.2 (a)	In-service monitoring, radar burst at the end of the CAC	Pass
RSS-247 6.3.2 (c)	Channel move time	Pass
RSS-247 6.3.2 (d)	Channel closing transmission time	Pass
RSS-247 6.3.2 (e)	Non-occupancy period	Pass
KDB Section7.8.4.1	Statistical performance with short pulse radar test	Pass
KDB Section7.8.4.2	Statistical performance with long pulse radar test	Pass
KDB Section7.8.4.3	Statistical performance with frequency hopping radar test	Pass

Note: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	August 1, 2016
Nemko sample ID number	1 (48 V_{DC}), 2 (24 V_{DC}) and 3 (120 V_{AC})

3.2 EUT (Master) information

Product name	Multiprotocol Intelligent Node with LTE and Wi-Fi
Model	RX1400
Part number	6GK60140AM230AA0-ZA02+C00+D00+E00+F00+G02+V00 (120 V_{AC}) – EUT (Master)
Part number variants	6GK60140AM210AA0-ZA02+C00+D00+E00+F00+G02+V00 (24 V_{DC}) 6GK60140AM220AA0-ZA02+C00+D00+E00+F00+G02+V00 (48 V_{DC})
Serial number	RUM/H805061787 (48 V_{DC}), RUM/H805061785 (24 V_{DC}), RUM/H805061788 (120 V_{AC})
RF module information	Manufacturer: TI P/N: WL1807MODGIMOCT MAC FW version: 8.9.0.2.55 PHY version: 8.2.0.0.233

3.3 AUX (Client) information

Product name	Multiprotocol Intelligent Node with LTE and Wi-Fi
Model	RX1400
Part number	6GK60140AM210AA0-ZA02+C00+D00+E00+F00+G02+V00 (24 V_{DC})
Serial number	RUM/H805061785 (24 V_{DC})
RF module information	Manufacturer: TI P/N: WL1807MODGIMOCT MAC FW version: 8.9.0.2.55 PHY version: 8.2.0.0.233

3.4 Technical information

Operating band	5250–5350 MHz, 5470–5725 MHz
Operating frequencies	(U-NII-2A for 20 MHz channels): 5260–5230 MHz, (U-NII-2C for 20 MHz channels): 5500–5700 MHz, (U-NII-2A for 40 MHz channels): 5270–5310 MHz, (U-NII-2C for 40 MHz channels): 5510–5670 MHz
Modulation type	802.11a, 802.11n HT20, 802.11n HT40
Channel bandwidth	20 MHz, 40 MHz
Power requirements	120 V_{AC} 60 Hz
RF power Max (W), Conducted	(U-NII-2A for 20 MHz channels): 0.0139, (U-NII-2C for 20 MHz channels): 0.0187 (U-NII-2A for 40 MHz channels): 0.0069, (U-NII-2C for 40 MHz channels): 0.0090
Antenna information	See table below. The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.
DFS type	EUT was assessed as a Master device.

Table 3.4-1: *Antenna[1] information*

Model number	Directivity	Gain, dBi
ANT793-8DJ (FCC only)	Directional	18[2]
ANT793-8DP (FCC only)	Directional	13.5[3]
ANT795-6DC (FCC only)	Directional	9
ANT793-6DG (FCC only)	Directional	9
ANT795-6MN (FCC only)	Omni-directional	8
ANT793-6DT (FCC only)	Omni-directional	8
ANT795-6MT (FCC only)	Omni-directional	7
ANT793-4MN	Omni-directional	6
ANT795-4MA	Omni-directional	5
ANT795-4MC	Omni-directional	5
ANT795-4MD	Omni-directional	5
ANT793-6MN	Omni-directional	5
ANT795-4MX	Omni-directional	2.5

Notes: [1]The EUT is professionally installed

[2]Connected via 10 m cable, 6X1875-5CN10, 8.8 dB loss. Total gain 9.2 dBi

[3]Connected via 5 m cable, 6X1875-5CH50, 4.4 dB loss. Total gain 9.1 dBi

3.5 Product description and theory of operation

The RUGGEDCOM RX1400 is a multi-protocol intelligent node that combines Ethernet switch, routing and firewall functionality with various wide area connectivity options. The RX1400 switch, with its rugged metal housing, is designed for DIN rail, panel or rack mounting. The device has IP40 degree protection, does not use internal fans for cooling and supports a −40 to 85 °C (−40 to 185 °F) extended temperature range.

Wireless Interfaces

WWAN module (Contains FCC ID: N7NMC7355 / IC: 2417C-MC7355):

- LTE: 700- B13, B17, 800/900/1800/2100/2600 MHz
- UMTS/HSPA+: 850/900/1900/2100 MHz
- Quad-Band EDGE/GPRS/GSM

GNSS

WLAN Access Point and Client: WLAN Direct® (multi-channel, multi-role) dual band transceiver support of IEEE 802.11a/b/g/n for 2.4 GHz 2×2 MIMO and 5 GHz SISO, 20 MHz and 40 MHz channels

Ethernet Interfaces

- 4 × 10/100Base-T RJ45 ports Serial Interfaces with Isolation

Optical SFP Pluggable Transceivers

- 2 × 1000 Mbit/s ports

Serial Interface with isolation

- 2 × RS232/422/485 ports

Other Interfaces

- Isolated built-in power input
- RS232 console port for local management/ diagnostics on the device
- SMA connectors for RF interfaces

Power Supply

- 12 to 24 V_{DC}
- ±12 to 24 V_{DC}
- ±48 V_{DC}
- HI VAC/VDC

3.6 EUT exercise details

EUT was controlled from laptop using web GUI and CLI commands.
Channel loading of at least 17% was achieved by using *iperf* session between master and slave devices.

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 ±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	1 year	Jan. 14/18
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Apr. 15/17

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
1	1	**Test A:** 15 unique PRI values randomly selected from the list of 23 PRI values in table below **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	Roundup{(1 ÷ 360) × (19 × 10^6 ÷ $PRI_{\mu s}$)}	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 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 Dynamic Frequency Selection (DFS) detection threshold

8.1.1 Definitions and limits

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.

8.1.2 Test summary

Test date	April 21, 2017	Temperature	23 °C
Test engineer	Andrey Adelberg	Air pressure	1004 mbar
Verdict	Pass	Relative humidity	41 %

8.1.3 Observations, settings and special notes

This test was performed once on the widest channel BW, which is 40 MHz with the use of Radar type 0.
Maximum EIRP is less than 23 dBm, therefore detection threshold limit was −62 dBm. 1 dB was added to compensate for variations in measurement equipment. The testing was performed conducted at the antenna port (similar to 0 dBi antenna gain).

8.1.4 Test data

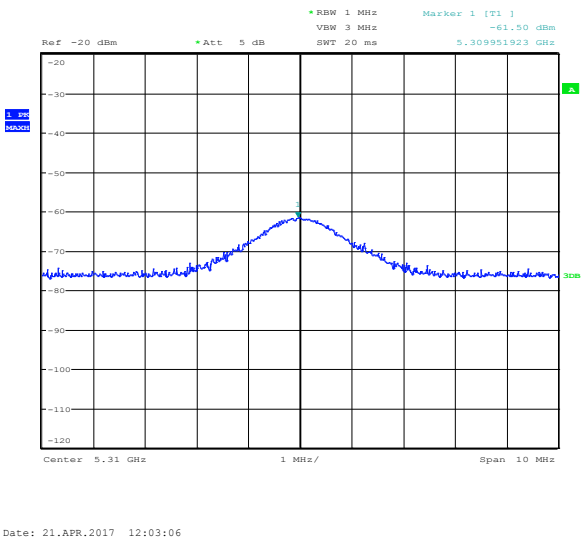

Figure 8.1-1: *Detection threshold measurements on U-NII-2A band, Type 0*

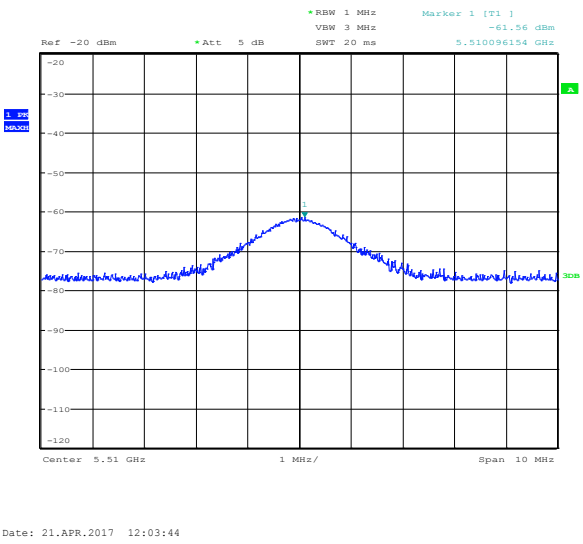

Figure 8.1-2: *Detection threshold measurements on U-NII-2C band, Type 0*

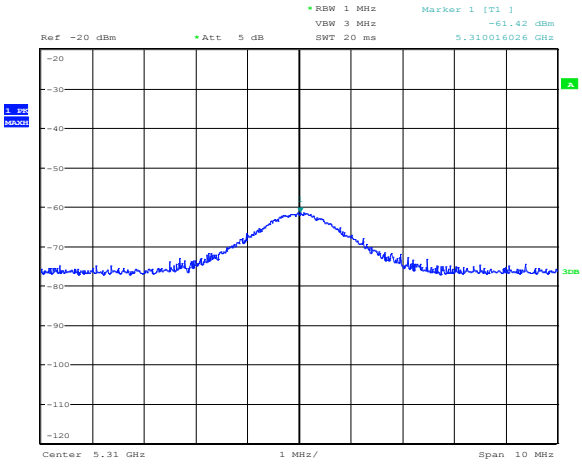

Figure 8.1-3: *Detection threshold measurements on U-NII-2A band, Type 1*

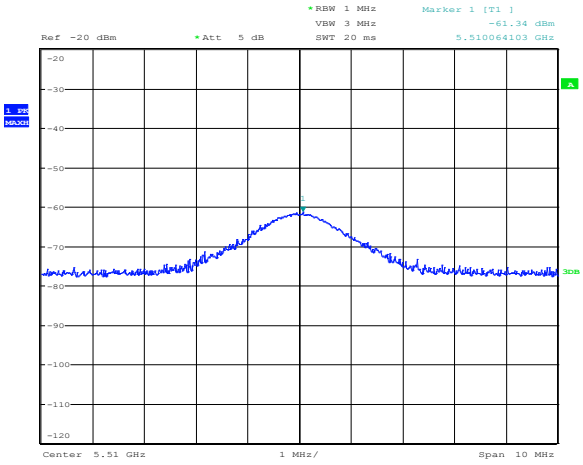

Figure 8.1-4: *Detection threshold measurements on U-NII-2C band, Type 1*

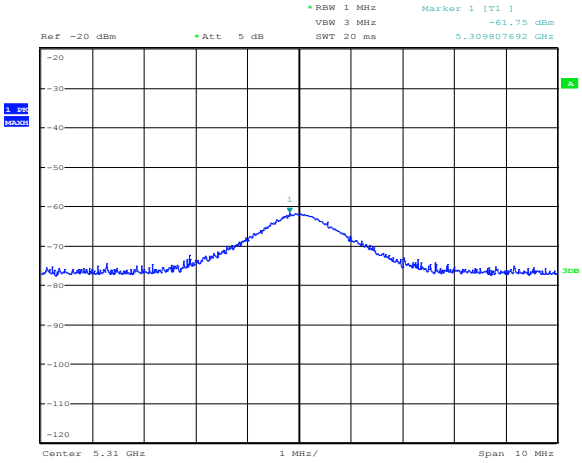

Figure 8.1-5: *Detection threshold measurements on U-NII-2A band, Type 2*

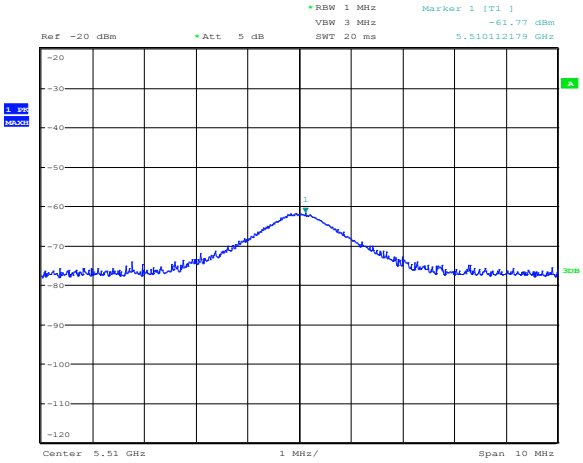

Figure 8.1-6: *Detection threshold measurements on U-NII-2C band, Type 2*

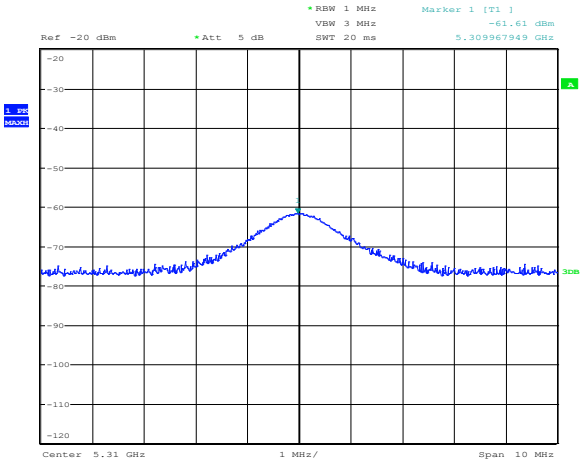

Figure 8.1-7: *Detection threshold measurements on U-NII-2A band, Type 3*

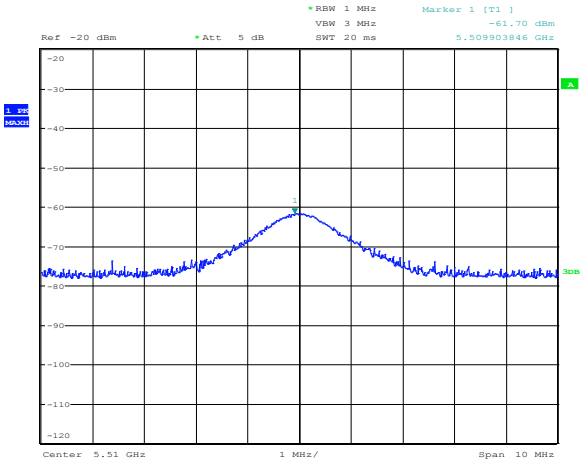

Figure 8.1-8: *Detection threshold measurements on U-NII-2C band, Type 3*

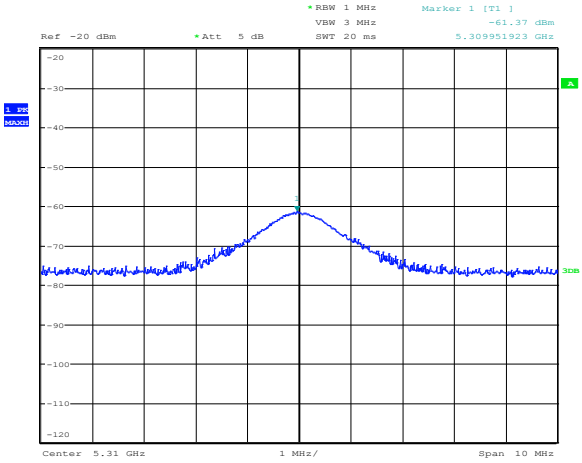

Figure 8.1-9: *Detection threshold measurements on U-NII-2A band, Type 4*

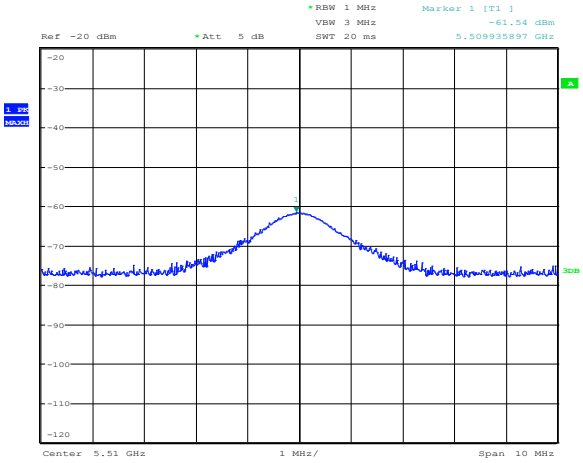

Figure 8.1-10: *Detection threshold measurements on U-NII-2C band, Type 4*

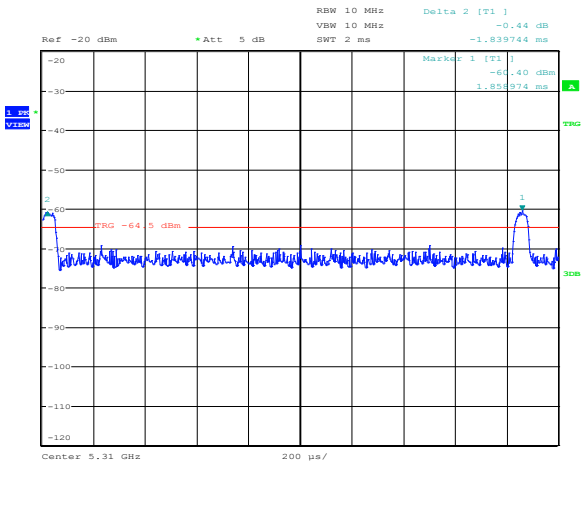

Figure 8.1-11: *Detection threshold measurements on U-NII-2A band, Type 3*

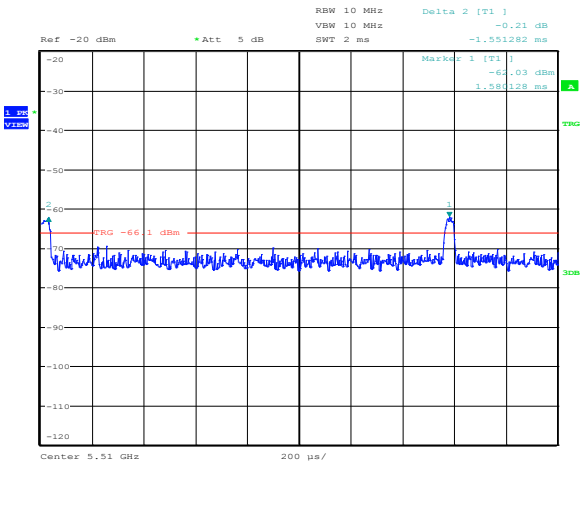

Figure 8.1-12: *Detection threshold measurements on U-NII-2C band, Type 3*

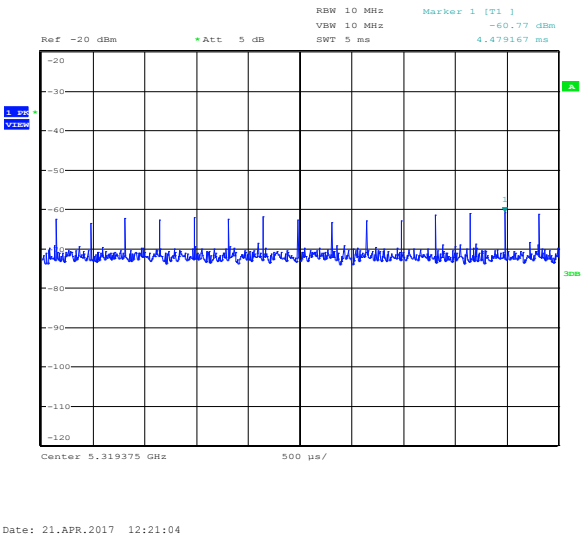

Figure 8.1-13: *Detection threshold measurements on U-NII-2A band, Type 4*

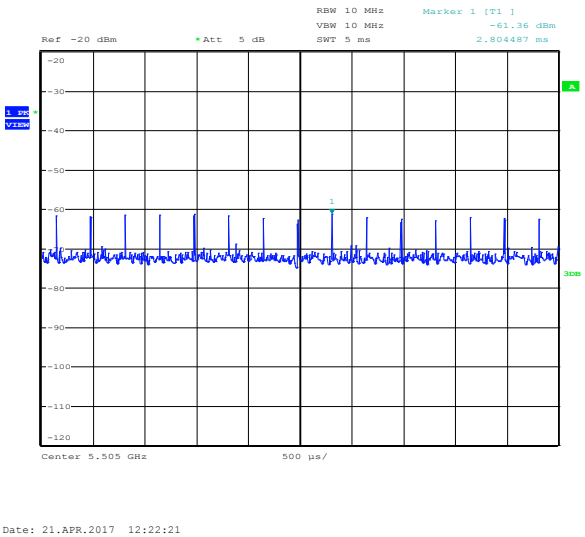

Figure 8.1-14: *Detection threshold measurements on U-NII-2C band, Type 4*

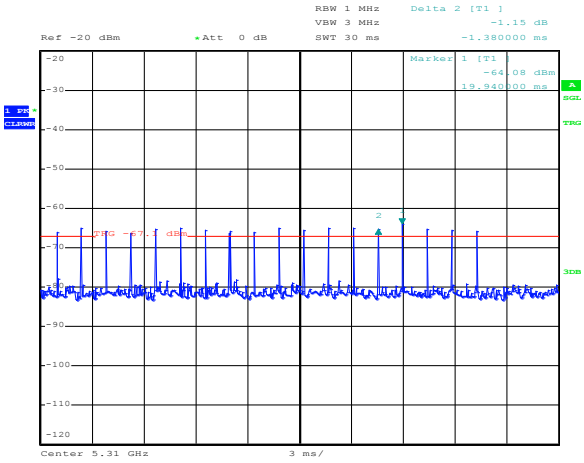

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Figure 8.1-15: *Radar waveform burst view on U-NII-2A band, Type 0*

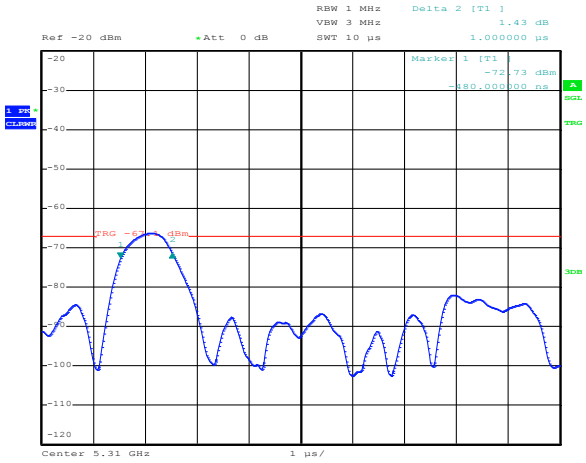

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Figure 8.1-16: *Pulse width on U-NII-2A band, Type 0*

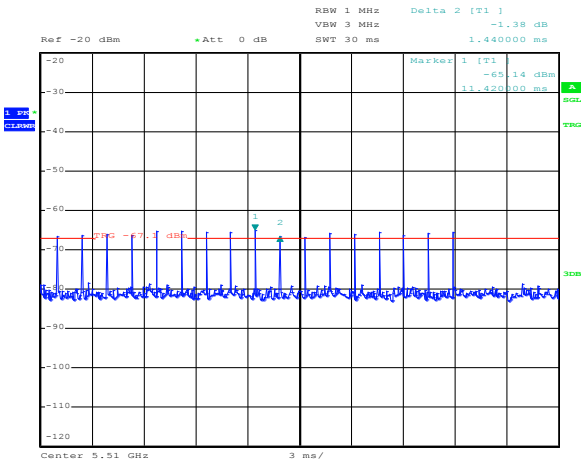

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Figure 8.1-17: *Radar waveform burst view on U-NII-2C band, Type 0*

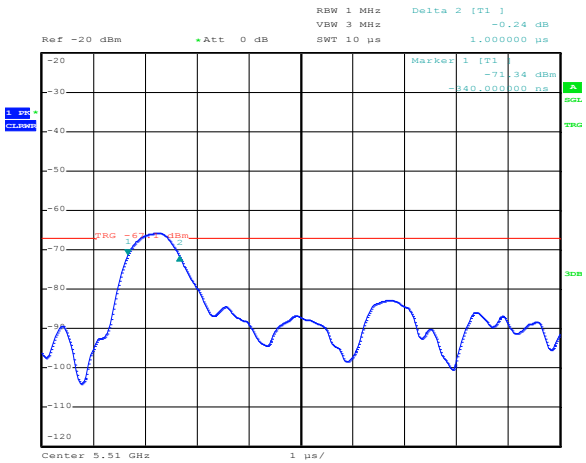

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Figure 8.1-18: *Pulse width on U-NII-2C band, Type 0*

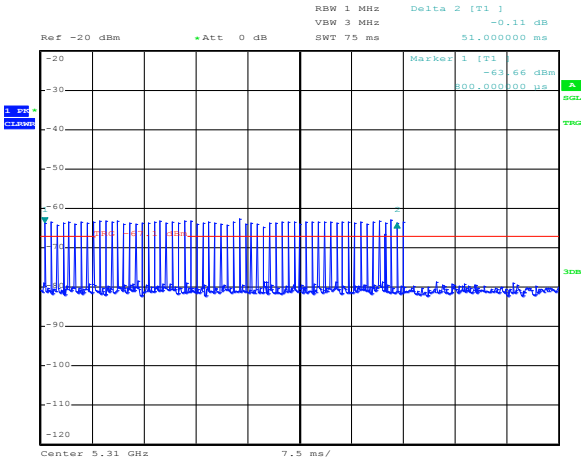

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Figure 8.1-19: *Radar waveform burst view on U-NII-2A band, sample Type 1 waveform*

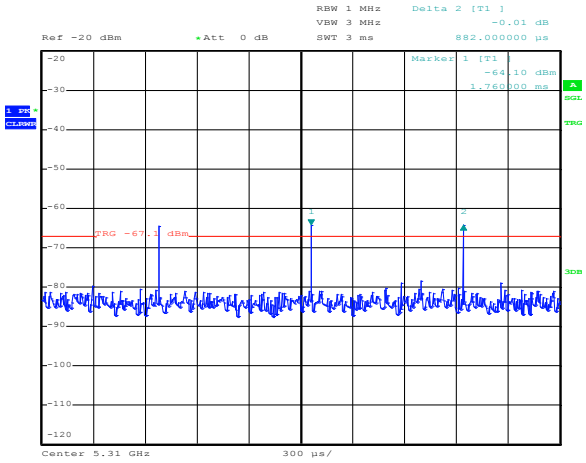

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Figure 8.1-20: *Pulse repetition view on U-NII-2A band, sample Type 1 waveform*

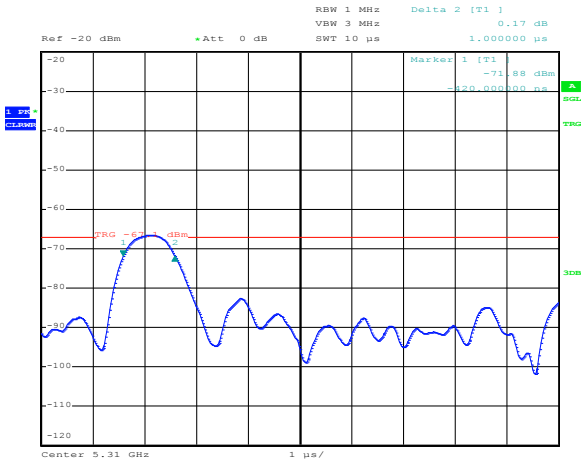

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Figure 8.1-21: *Pulse width view on U-NII-2A band, sample Type 1 waveform*

Table 8.1-1: *Sample waveform parameters*

Type	Pulse width, µs	PRI, µs	No. of pulses
1	1	878	61

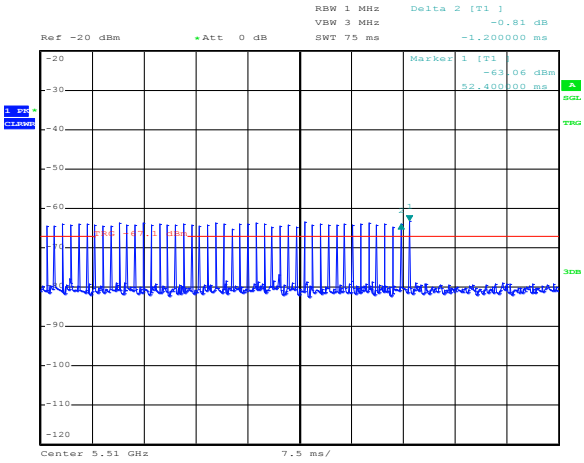

Figure 8.1-22: *Radar waveform burst view on U-NII-2C band, sample Type 1 waveform*

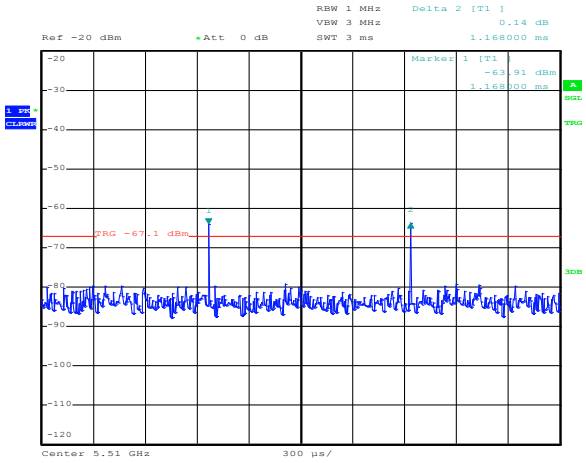

Figure 8.1-23: *Pulse repetition view on U-NII-2C band, sample Type 1 waveform*

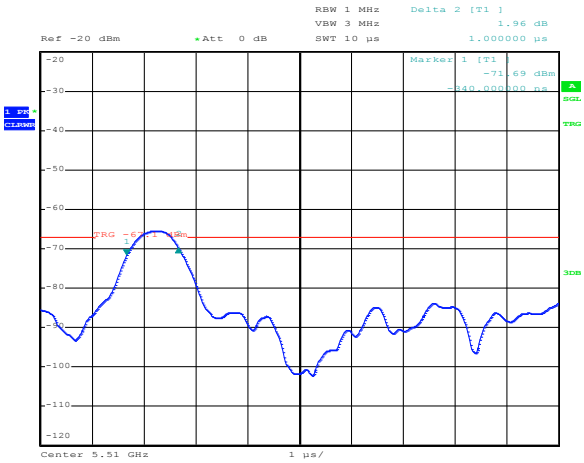

Figure 8.1-24: *Pulse width view on U-NII-2C band, sample Type 1 waveform*

Table 8.1-2: *Sample waveform parameters*

Type	Pulse width, µs	PRI, µs	No. of pulses
1	1	1164	46

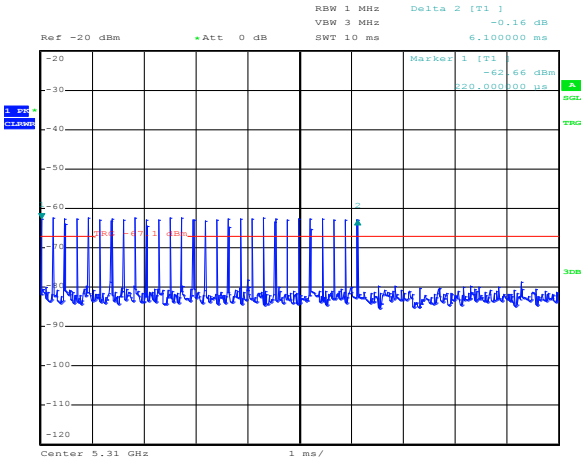

Figure 8.1-25: *Radar waveform burst view on U-NII-2A band, sample Type 2 waveform*

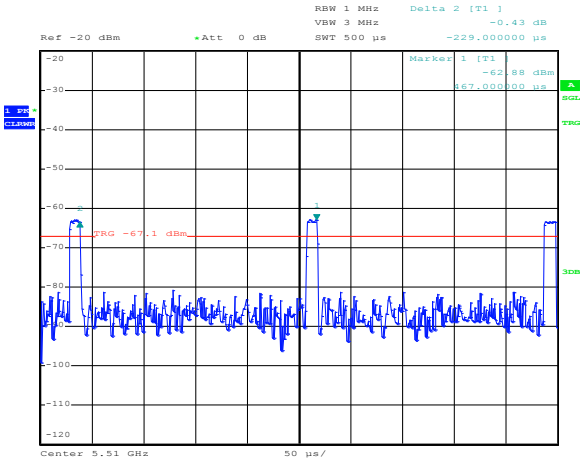

Figure 8.1-26: *Pulse repetition view on U-NII-2A band, sample Type 2 waveform*

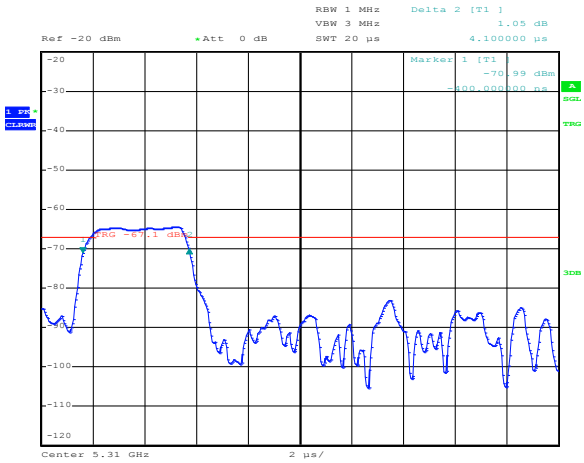

Figure 8.1-27: *Pulse width view on U-NII-2A band, sample Type 2 waveform*

Table 8.1-3: *Sample waveform parameters*

Type	Pulse width, µs	PRI, µs	No. of pulses
2	4.1	225	29

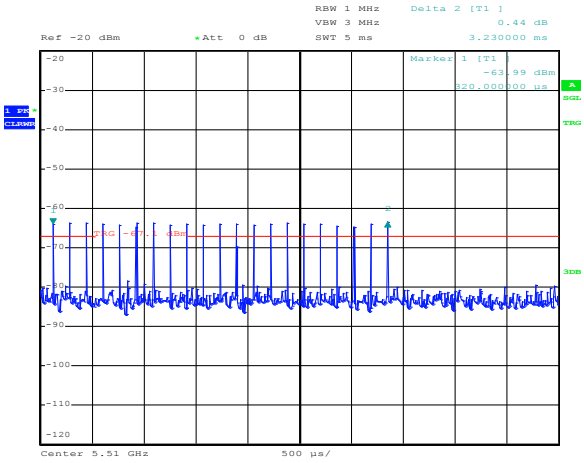

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Figure 8.1-28: *Radar waveform burst view on U-NII-2C band, sample Type 2 waveform*

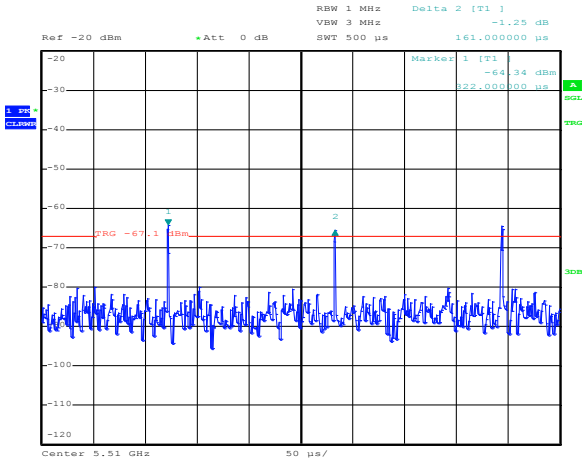

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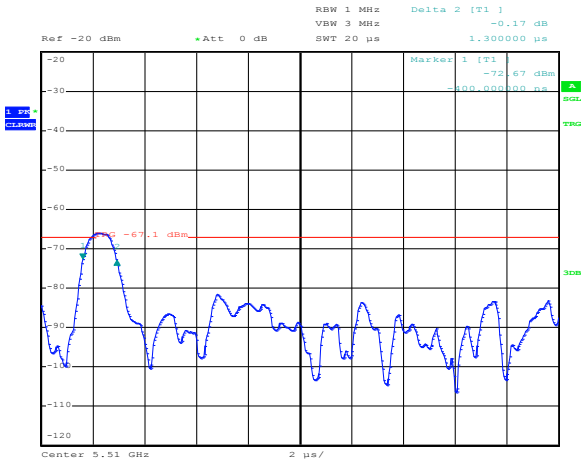
Figure 8.1-29: *Pulse repetition view on U-NII-2C band, sample Type 2 waveform*



Date: 25.APR.2017 11:09:43

Figure 8.1-30: *Pulse width view on U-NII-2C band, sample Type 2 waveform*

Table 8.1-4: *Sample waveform parameters*

Type	Pulse width, µs	PRI, µs	No. of pulses
2	1.3	161	23

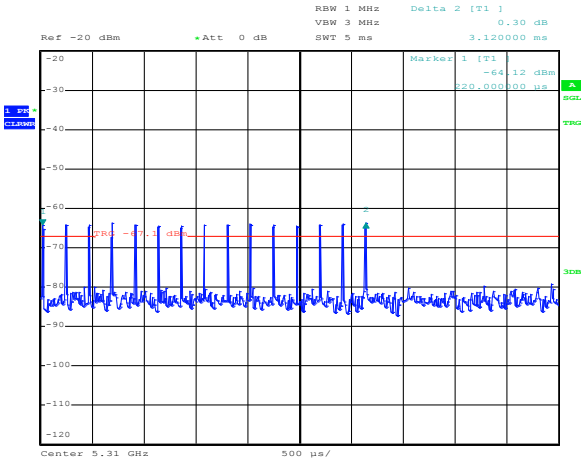


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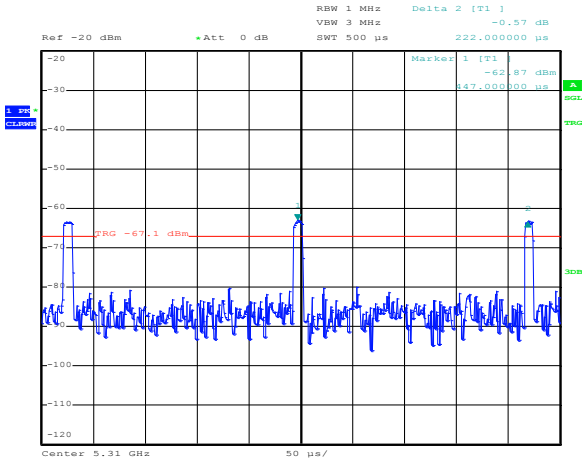
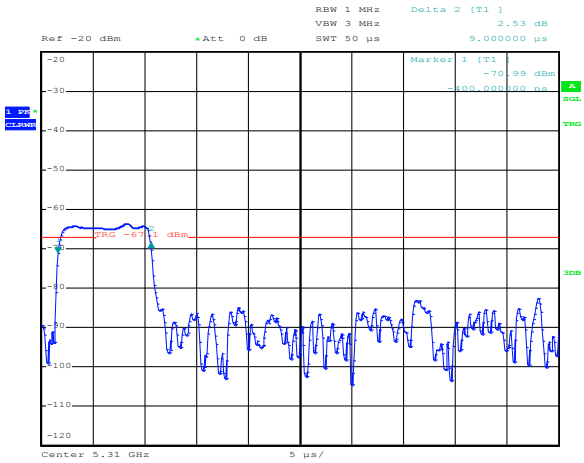
Figure 8.1-31: *Radar waveform burst view on U-NII-2A band, sample Type 3 waveform*



Date: 25.APR.2017 10:59:00

Figure 8.1-32: *Pulse repetition view on U-NII-2A band, sample Type 3 waveform*



Date: 25.APR.2017 11:08:23

Figure 8.1-33: *Pulse width view on U-NII-2A band, sample Type 3 waveform*

Table 8.1-5: *Sample waveform parameters*

Type	Pulse width, µs	PRI, µs	No. of pulses
3	9	222	16

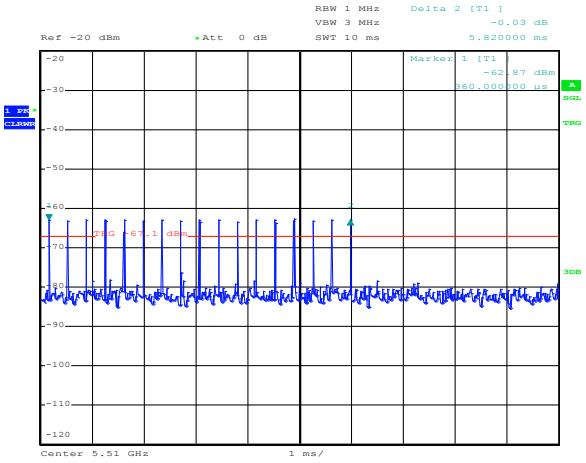


Figure 8.1-34: *Radar waveform burst view on U-NII-2C band, sample Type 3 waveform*

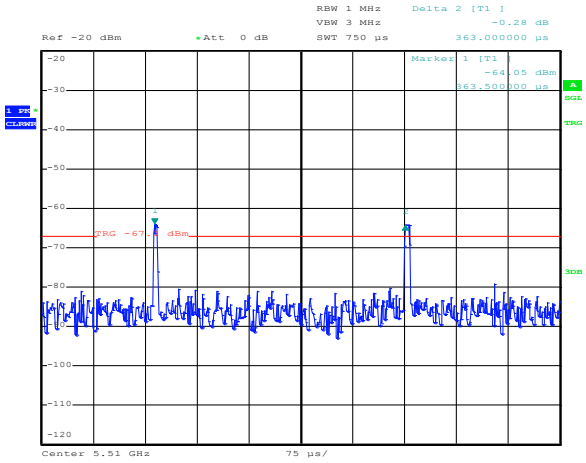


Figure 8.1-35: *Pulse repetition view on U-NII-2C band, sample Type 3 waveform*

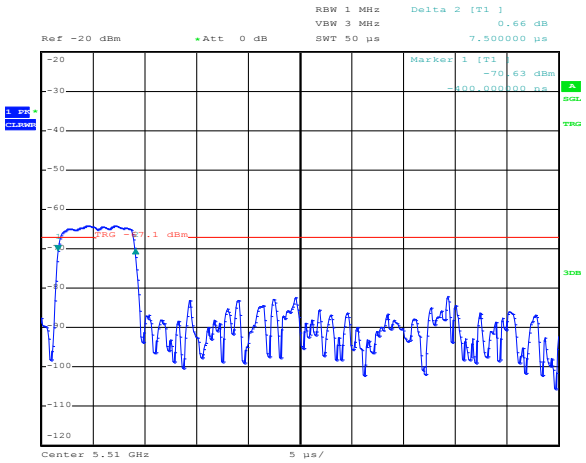


Figure 8.1-36: *Pulse width view on U-NII-2C band, sample Type 3 waveform*

Table 8.1-6: *Sample waveform parameters*

Type	Pulse width, µs	PRI, µs	No. of pulses
3	7.5	363	18

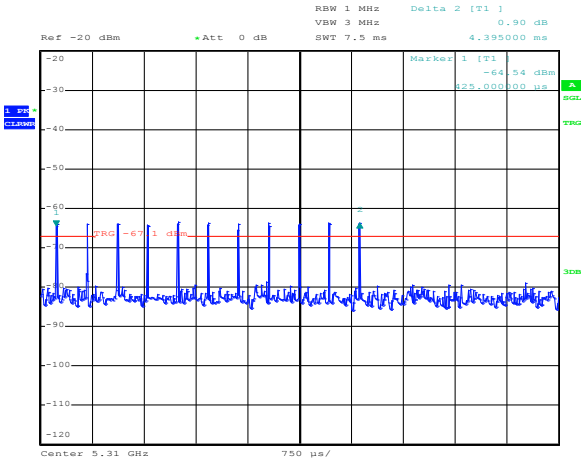


Figure 8.1-37: *Radar waveform burst view on U-NII-2A band, sample Type 4 waveform*

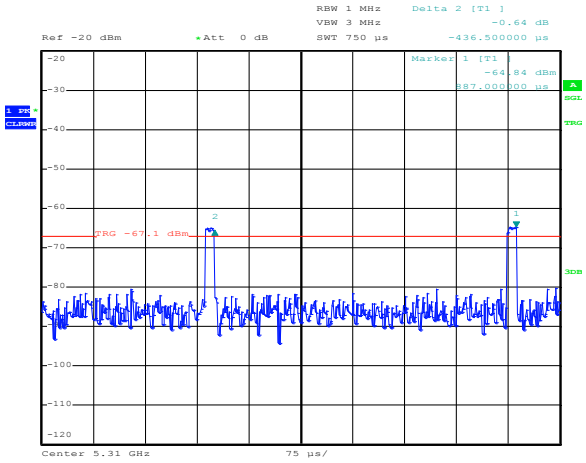


Figure 8.1-38: *Pulse repetition view on U-NII-2A band, sample Type 4 waveform*

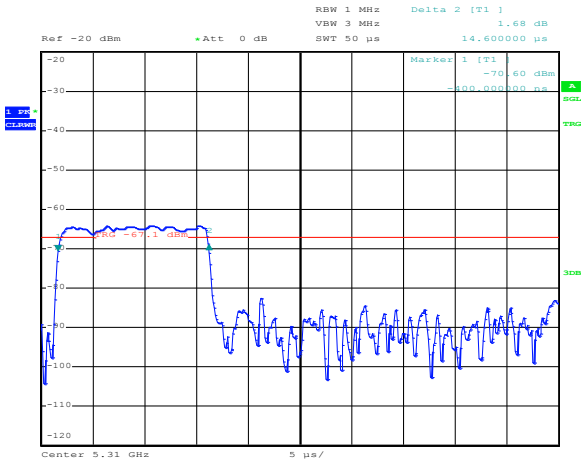


Figure 8.1-39: *Pulse width view on U-NII-2A band, sample Type 4 waveform*

Table 8.1-7: *Sample waveform parameters*

Type	Pulse width, µs	PRI, µs	No. of pulses
4	14.6	437	12

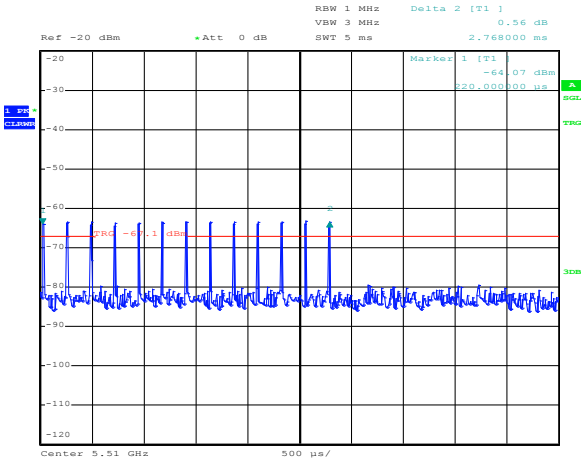


Figure 8.1-40: *Radar waveform burst view on U-NII-2C band, sample Type 4 waveform*

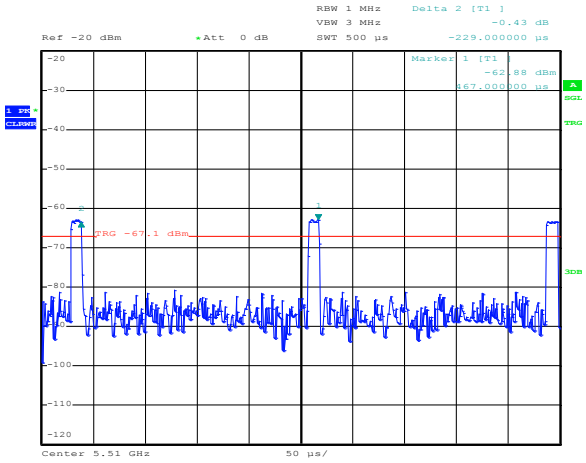


Figure 8.1-41: *Pulse repetition view on U-NII-2C band, sample Type 4 waveform*

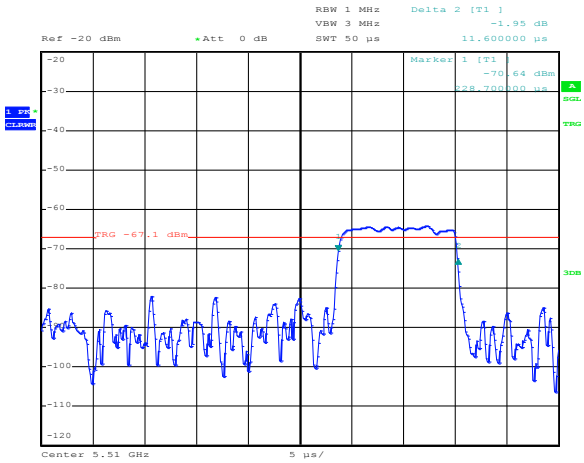


Figure 8.1-42: *Pulse width view on U-NII-2C band, sample Type 4 waveform*

Table 8.1-8: *Sample waveform parameters*

Type	Pulse width, µs	PRI, µs	No. of pulses
4	11.6	229	14

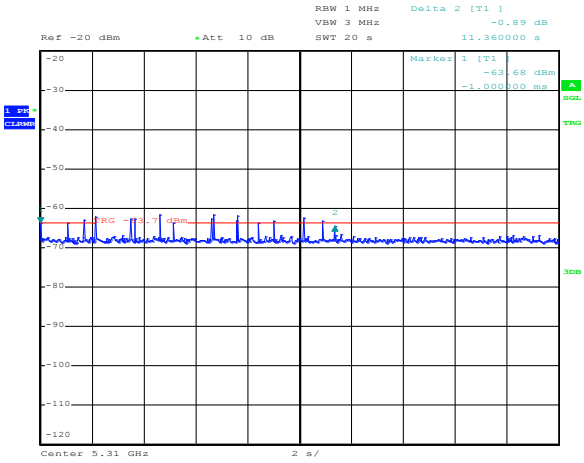


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Figure 8.1-43: *Radar waveform burst view on U-NII-2A band, sample Type 5 waveform*

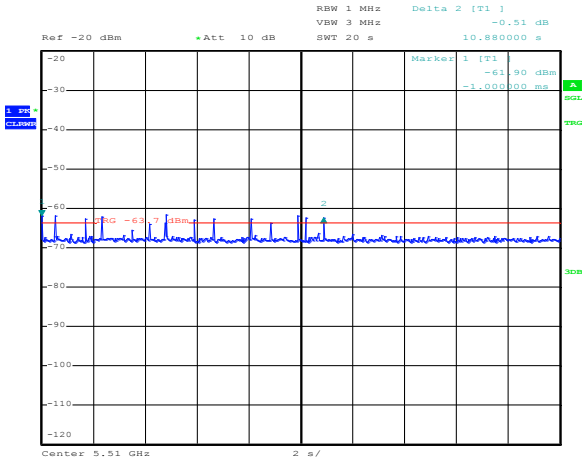

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Figure 8.1-44: *Radar waveform burst view on U-NII-2C band, sample Type 5 waveform*

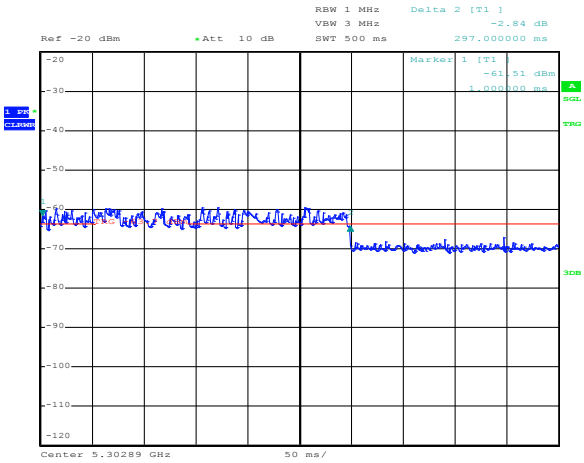

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Figure 8.1-45: *Radar waveform burst view on U-NII-2A band, sample Type 6 waveform*

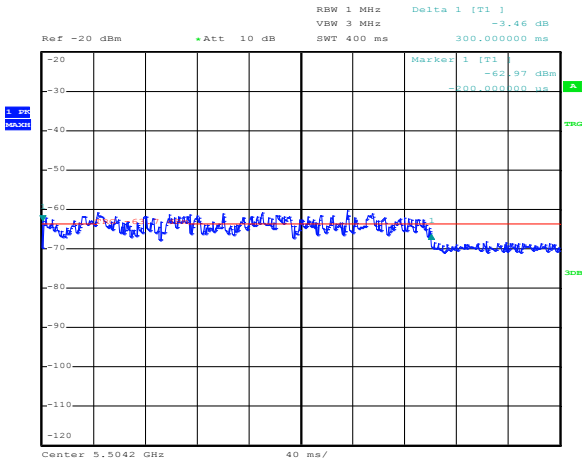

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Figure 8.1-46: *Radar waveform burst view on U-NII-2C band, sample Type 6 waveform*

8.2 U-NII detection bandwidth

8.2.1 Definitions and limits

Minimum U-NII detection bandwidth is 100% of the U-NII 99% transmission power bandwidth.

8.2.2 Test summary

Test date	April 10, 2015	Temperature	21 °C
Test engineer	Andrey Adelberg	Air pressure	1005 mbar
Verdict	Pass	Relative humidity	30 %

8.2.3 Observations, settings and special notes

Starting at the center frequency of the UUT operating Channel, the radar frequency was increased in 5 MHz steps, the test sequence was repeated until the detection rate fell below the U-NII Detection Bandwidth criterion.
This measurement was repeated than in 1 MHz steps at frequencies 5 MHz below where the detection rate began to fall. This highest frequency (denoted as F_H) at which detection is greater than or equal to the U-NII Detection Bandwidth criterion was recorded. Recording the detection rate at frequencies above F_H is not required to demonstrate compliance.
Also this measurement was repeated in 1 MHz steps at frequencies 5 MHz below where the detection rate began to fall. This lowest frequency (denoted as F_L) at which detection is greater than or equal to the U-NII Detection Bandwidth criterion was recorded. Recording the detection rate at frequencies below F_L is not required to demonstrate compliance.
Radar type 0 was applied. Measurements were performed with no data traffic.

8.2.4 Test data

Table 8.2-1: *Detection bandwidth verification summary for U-NII-2A band*

Modulation	F_L, MHz	F_H, MHz	Detection bandwidth, MHz	99% transmission power bandwidth, MHz
802.11n HT20	5290	5310	20	18.11
802.11n HT40	5292	5329	37	36.79

Table 8.2-2: *Detection bandwidth test results for 802.11n HT20, U-NII-2A band*

Frequency, MHz	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	Rate, %	F_L, F_H
5289	☐	☐	☒	☐	☐	☐	☒	☐	☐	☐	20	
5290	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	F_L
5291	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5292	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5293	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5294	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5295	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5300	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5305	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5306	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5307	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5308	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5309	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5310	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	F_H
5311	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	10	

Table 8.2-3: *Detection bandwidth test results for 802.11n HT40, U-NII-2A band*

Frequency, MHz	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	Rate, %	F_L, F_H
5291	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0	
5292	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	F_L
5290	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5295	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5300	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5305	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5310	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5315	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5320	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5325	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5326	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5327	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5328	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5329	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	F_H
5330	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0	

Table 8.2-4: *Detection bandwidth verification summary for U-NII-2C band*

Modulation	F_L, MHz	F_H, MHz	Detection bandwidth, MHz	99% transmission power bandwidth, MHz
802.11n HT20	5487	5513	26	18.19
802.11n HT40	5491	5530	39	36.79

Table 8.2-5: *Detection bandwidth test results for 802.11n HT20, U-NII-2C band*

Frequency, MHz	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	Rate, %	F_L, F_H
5486	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0	
5487	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	F_L
5488	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5489	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5490	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5495	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5500	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5510	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5511	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5512	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5513	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	F_H
5514	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	10	

Table 8.2-6: *Detection bandwidth test results for 802.11n HT40, U-NII-2C band*

Frequency, MHz	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	Rate, %	F_L, F_H
5490	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0	
5491	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	F_L
5492	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5493	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5494	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5495	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5500	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5505	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5510	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5515	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5520	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5525	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	
5530	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	100	F_H
5531	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	10	

8.3 Statistical performance for short pulse radars

8.3.1 Definitions and limits

For Radar types 1–4 (short pulse radars) minimum percentage of successful detection is 60 %. The aggregate limit is 80 %.

8.3.2 Test summary

Test date	April 10, 2015	Temperature	21 °C
Test engineer	Andrey Adelberg	Air pressure	1005 mbar
Verdict	Pass	Relative humidity	30 %

8.3.3 Observations, settings and special notes

The percentage of successful detection is calculated by:

$$\frac{Total\ waveform\ detections}{Total\ waveform\ trials} \times 100\% = Percentage\ of\ successful\ detection\ Radar\ waveform\ N = P_d N$$

In addition an aggregate minimum percentage of successful detection across all Short Pulse Radar Types 1–4 is required and is calculated as follows:

$$\frac{P_d 1 + P_d 2 + P_d 3 + P_d 4}{4}$$

For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.

Table 8.3-1: *Radar frequency applications*

Operational band	Frequency on Trials 1–10, MHz	Frequency on Trials 11–20 MHz	Frequency on Trials 21–30, MHz
U-NII-2A, 802.11n HT20	5292	5300	5308
U-NII-2A, 802.11n HT40	5297	5310	5324
U-NII-2C, 802.11n HT20	5490	5500	5510
U-NII-2C, 802.11n HT40	5496	5510	5525

8.3.4 Test data

Table 8.3-2: *Summary of the short radar detection probability results for 802.11n HT20 in U-NII-2A band*

Radar type	Detection probability (P_d), %	Minimum Limit, %	Margin, %
1	100	60	40
2	100	60	40
3	100	60	40
4	100	60	40
Aggregate	100	80	20

Table 8.3-3: *Summary of the short radar detection probability results for 802.11ac VHT40 in U-NII-2A band*

Radar type	Detection probability (P_d), %	Minimum Limit, %	Margin, %
1	100	60	40
2	100	60	40
3	100	60	40
4	100	60	40
Aggregate	100	80	20

Table 8.3-4: *Summary of the short radar detection probability results for 802.11n HT20 in U-NII-2C band*

Radar type	Detection probability (P_d), %	Minimum Limit, %	Margin, %
1	100	60	40
2	96.67	60	36.67
3	100	60	40
4	100	60	40
Aggregate	91.17	80	11.17

Table 8.3-5: *Summary of the short radar detection probability results for 802.11ac VHT40 in U-NII-2C band*

Radar type	Detection probability (P_d), %	Minimum Limit, %	Margin, %
1	100	60	40
2	100	60	40
3	100	60	40
4	100	60	40
Aggregate	100	80	20

Table 8.3-6: *Radar type 1 trials' details and detection results for 802.11n HT20 in U-NII-2A band, channel 60, 5300 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	102	1	518	☒
2	101	1	526	☒
3	95	1	558	☒
4	92	1	578	☒
5	89	1	598	☒
6	86	1	618	☒
7	83	1	638	☒
8	78	1	678	☒
9	74	1	718	☒
10	70	1	758	☒
11	68	1	778	☒
12	67	1	798	☒
13	62	1	858	☒
14	61	1	878	☒
15	58	1	910	☒
16	57	1	937	☒
17	57	1	938	☒
18	50	1	1061	☒
19	46	1	1164	☒
20	28	1	1904	☒
21	26	1	2076	☒
22	24	1	2265	☒
23	23	1	2311	☒
24	22	1	2430	☒
25	21	1	2575	☒
26	21	1	2610	☒
27	20	1	2727	☒
28	19	1	2850	☒
29	19	1	2890	☒
30	18	1	3066	☒

Table 8.3-7: *Radar type 1 trials' details and detection results for 802.11n HT40 in U-NII-2A band, channel 62, 5310 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	95	1	558	☒
2	92	1	578	☒
3	89	1	598	☒
4	86	1	618	☒
5	80	1	663	☒
6	78	1	678	☒
7	77	1	693	☒
8	76	1	698	☒
9	72	1	738	☒
10	70	1	758	☒
11	68	1	778	☒
12	68	1	782	☒
13	67	1	798	☒
14	63	1	838	☒
15	62	1	858	☒
16	61	1	878	☒
17	59	1	898	☒
18	45	1	1190	☒
19	44	1	1205	☒
20	36	1	1471	☒
21	35	1	1512	☒
22	30	1	1772	☒
23	30	1	1810	☒
24	26	1	2061	☒
25	23	1	2320	☒
26	23	1	2323	☒
27	22	1	2442	☒
28	22	1	2459	☒
29	19	1	2852	☒
30	18	1	3066	☒

Table 8.3-8: *Radar type 1 trials' details and detection results for 802.11n HT20 in U-NII-2C band, channel 100, 5500 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	99	1	538	☒
2	95	1	558	☒
3	92	1	578	☒
4	90	1	592	☒
5	89	1	598	☒
6	83	1	638	☒
7	78	1	678	☒
8	72	1	738	☒
9	70	1	758	☒
10	68	1	778	☒
11	68	1	784	☒
12	67	1	798	☒
13	65	1	822	☒
14	64	1	830	☒
15	63	1	842	☒
16	62	1	858	☒
17	59	1	898	☒
18	58	1	918	☒
19	57	1	938	☒
20	55	1	964	☒
21	53	1	1012	☒
22	45	1	1174	☒
23	45	1	1196	☒
24	43	1	1240	☒
25	35	1	1515	☒
26	32	1	1674	☒
27	21	1	2542	☒
28	20	1	2679	☒
29	20	1	2777	☒
30	18	1	3066	☒

Table 8.3-9: *Radar type 1 trials' details and detection results for 802.11n HT40 in U-NII-2C band, channel 102, 5510 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	102	1	518	☒
2	99	1	538	☒
3	95	1	558	☒
4	94	1	563	☒
5	92	1	578	☒
6	89	1	598	☒
7	86	1	618	☒
8	83	1	638	☒
9	79	1	675	☒
10	76	1	698	☒
11	70	1	758	☒
12	67	1	798	☒
13	65	1	818	☒
14	63	1	838	☒
15	62	1	858	☒
16	61	1	873	☒
17	61	1	878	☒
18	58	1	918	☒
19	51	1	1051	☒
20	47	1	1142	☒
21	34	1	1574	☒
22	28	1	1913	☒
23	26	1	2098	☒
24	24	1	2238	☒
25	24	1	2271	☒
26	19	1	2823	☒
27	19	1	2834	☒
28	18	1	2956	☒
29	18	1	3002	☒
30	18	1	3045	☒

Table 8.3-10: *Radar type 2 trials' details and detection results for 802.11n HT20 in U-NII-2A band, channel 60, 5300 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	28	1.1	187	☒
2	23	1.3	161	☒
3	24	1.5	171	☒
4	23	1.5	209	☒
5	26	1.5	214	☒
6	28	1.8	190	☒
7	29	1.9	167	☒
8	29	2.2	173	☒
9	25	2.5	150	☒
10	26	2.5	203	☒
11	23	2.6	208	☒
12	24	2.8	202	☒
13	29	2.8	218	☒
14	26	3.1	152	☒
15	28	3.1	177	☒
16	28	3.4	199	☒
17	24	3.7	191	☒
18	26	3.7	199	☒
19	23	3.9	153	☒
20	29	3.0	226	☒
21	23	4.1	162	☒
22	29	4.1	225	☒
23	26	4.2	226	☒
24	24	4.3	175	☒
25	26	4.3	211	☒
26	29	4.5	184	☒
27	27	4.8	189	☒
28	24	4.9	168	☒
29	26	4.9	179	☒
30	23	5.0	160	☒

Table 8.3-11: *Radar type 2 trials' details and detection results for 802.11n HT40 in U-NII-2A band, channel 62, 5310 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	24	1.6	157	☒
2	25	1.6	162	☒
3	24	1.6	169	☒
4	24	1.6	206	☒
5	24	1.0	225	☒
6	29	2.4	154	☒
7	29	2.6	192	☒
8	23	2.7	222	☒
9	26	2.8	184	☒
10	23	2.9	166	☒
11	24	3.2	157	☒
12	28	3.6	185	☒
13	27	3.6	212	☒
14	23	3.8	175	☒
15	27	3.8	178	☒
16	29	3.8	190	☒
17	23	3.9	208	☒
18	24	3.0	202	☒
19	27	4.1	218	☒
20	29	4.3	171	☒
21	28	4.3	188	☒
22	28	4.4	216	☒
23	29	4.4	222	☒
24	25	4.6	159	☒
25	24	4.6	161	☒
26	25	4.6	179	☒
27	27	4.9	158	☒
28	29	4.0	150	☒
29	27	4.0	179	☒
30	29	5.0	177	☒

Table 8.3-12: *Radar type 2 trials' details and detection results for 802.11n HT20 in U-NII-2C band, channel 100, 5500 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	24	1.6	157	☒
2	25	1.6	162	☒
3	24	1.6	169	☒
4	24	1.6	206	☒
5	24	1.0	225	☒
6	29	2.4	154	☒
7	29	2.6	192	☒
8	23	2.7	222	☒
9	26	2.8	184	☒
10	23	2.9	166	☒
11	24	3.2	157	☒
12	28	3.6	185	☒
13	27	3.6	212	☒
14	23	3.8	175	☒
15	27	3.8	178	☒
16	29	3.8	190	☒
17	23	3.9	208	☒
18	24	3.0	202	☒
19	27	4.1	218	☒
20	29	4.3	171	☒
21	28	4.3	188	☒
22	28	4.4	216	☒
23	29	4.4	222	☒
24	25	4.6	159	☒
25	24	4.6	161	☒
26	25	4.6	179	☐
27	27	4.9	158	☒
28	29	4.0	120	☒
29	27	4.0	179	☒
30	29	5.0	177	☒

Table 8.3-13: *Radar type 2 trials' details and detection results for 802.11n HT40 in U-NII-2C band, channel 102, 5510 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	26	1.1	215	☒
2	28	1.4	209	☒
3	24	1.5	164	☒
4	23	2.3	166	☒
5	23	2.3	168	☒
6	29	2.3	172	☒
7	28	2.5	163	☒
8	28	2.7	221	☒
9	29	2.8	165	☒
10	28	2.9	173	☒
11	27	3.1	163	☒
12	27	3.2	192	☒
13	23	3.4	181	☒
14	26	3.4	222	☒
15	29	3.6	153	☒
16	27	3.6	159	☒
17	23	3.7	196	☒
18	23	4.1	150	☒
19	23	4.1	173	☒
20	23	4.1	189	☒
21	24	4.2	190	☒
22	29	4.2	220	☒
23	28	4.4	220	☒
24	23	4.4	224	☒
25	27	4.4	224	☒
26	27	4.6	172	☒
27	24	4.6	184	☒
28	32	4.8	176	☒
29	27	4.9	158	☒
30	24	4.0	185	☒

Table 8.3-14: *Radar type 3 trial's details and detection results for 802.11n HT20 in U-NII-2A band, channel 60, 5300 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	17	6.1	345	☒
2	16	6.2	337	☒
3	18	6.3	268	☒
4	16	6.3	330	☒
5	16	6.3	334	☒
6	18	6.7	409	☒
7	17	6.8	263	☒
8	16	6.9	283	☒
9	17	6.9	431	☒
10	17	7.1	241	☒
11	17	7.1	451	☒
12	18	7.4	255	☒
13	16	7.5	286	☒
14	18	7.5	363	☒
15	17	7.8	484	☒
16	17	7.0	324	☒
17	18	8.1	333	☒
18	17	8.5	445	☒
19	17	8.6	431	☒
20	17	8.7	393	☒
21	17	9.1	248	☒
22	17	9.1	278	☒
23	18	9.1	467	☒
24	16	9.2	366	☒
25	16	9.3	323	☒
26	18	9.4	482	☒
27	18	9.0	200	☒
28	18	9.0	219	☒
29	16	9.0	222	☒
30	18	9.0	352	☒

Table 8.3-15: *Radar type 3 trial's details and detection results for 802.11n HT40 in U-NII-2A band, channel 62, 5310 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	17	6.3	424	☒
2	18	6.3	437	☒
3	18	6.7	246	☒
4	16	6.9	449	☒
5	18	6.0	448	☒
6	17	7.2	347	☒
7	18	7.3	220	☒
8	17	7.3	470	☒
9	16	7.8	385	☒
10	17	7.8	451	☒
11	17	8.2	378	☒
12	16	8.3	286	☒
13	18	8.3	332	☒
14	16	8.4	273	☒
15	17	8.4	355	☒
16	16	8.5	272	☒
17	17	8.7	214	☒
18	16	8.7	254	☒
19	16	8.9	474	☒
20	16	8.0	233	☒
21	17	8.0	265	☒
22	16	8.0	322	☒
23	17	9.1	404	☒
24	16	9.2	258	☒
25	18	9.4	370	☒
26	17	9.5	279	☒
27	16	9.7	263	☒
28	17	9.7	332	☒
29	17	9.9	260	☒
30	17	10.0	313	☒

Table 8.3-16: *Radar type 3 trial's details and detection results for 802.11n HT20 in U-NII-2C band, channel 100, 5500 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	18	6.1	352	☒
2	17	6.2	420	☒
3	17	6.3	239	☒
4	16	6.3	493	☒
5	18	6.4	261	☒
6	18	6.6	464	☒
7	18	6.8	283	☒
8	16	6.8	447	☒
9	18	6.9	219	☒
10	16	7.1	286	☒
11	17	7.1	446	☒
12	16	7.2	274	☒
13	18	7.3	211	☒
14	17	7.3	303	☒
15	18	7.3	432	☒
16	17	7.3	499	☒
17	18	7.4	488	☒
18	17	7.7	255	☒
19	18	7.7	295	☒
20	16	8.4	384	☒
21	18	8.4	465	☒
22	17	8.9	261	☒
23	18	8.0	225	☒
24	18	9.2	369	☒
25	18	9.2	432	☒
26	18	9.5	339	☒
27	17	9.6	327	☒
28	16	9.6	342	☒
29	18	9.7	218	☒
30	18	9.0	366	☒

Table 8.3-17: *Radar type 3 trial's details and detection results for 802.11n HT40 in U-NII-2C band, channel 102, 5510 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	17	6.1	247	☒
2	18	6.2	248	☒
3	17	6.2	367	☒
4	18	6.9	209	☒
5	18	6.0	278	☒
6	18	6.0	335	☒
7	18	7.4	279	☒
8	17	7.5	244	☒
9	17	7.5	300	☒
10	17	7.6	429	☒
11	16	7.0	358	☒
12	16	8.1	351	☒
13	18	8.7	210	☒
14	17	8.8	445	☒
15	16	8.9	307	☒
16	18	8.9	337	☒
17	18	8.9	368	☒
18	16	8.0	275	☒
19	17	8.0	485	☒
20	18	9.1	363	☒
21	18	9.2	444	☒
22	18	9.3	366	☒
23	16	9.1	210	☒
24	16	9.1	443	☒
25	16	9.7	253	☒
26	18	9.7	489	☒
27	17	9.9	233	☒
28	16	9.9	404	☒
29	17	9.0	259	☒
30	16	9.0	438	☒

Table 8.3-18: *Radar type 4 trial's details and detection results for 802.11n HT20 in U-NII-2A band, channel 60, 5300 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	14	11.6	229	☒
2	15	12.1	412	☒
3	13	12.4	397	☒
4	16	12.8	351	☒
5	15	12.9	367	☒
6	12	13.2	370	☒
7	13	13.8	433	☒
8	16	13.9	358	☒
9	15	14.4	303	☒
10	16	14.6	289	☒
11	12	14.6	437	☒
12	15	15.2	476	☒
13	12	15.6	480	☒
14	16	15.0	210	☒
15	13	16.5	486	☒
16	14	17.5	404	☒
17	14	17.6	461	☒
18	15	17.7	342	☒
19	15	17.8	402	☒
20	16	18.3	231	☒
21	15	18.5	466	☒
22	12	18.7	280	☒
23	12	18.7	459	☒
24	14	18.8	468	☒
25	14	19.1	432	☒
26	15	19.2	244	☒
27	16	19.4	424	☒
28	13	19.6	307	☒
29	12	19.6	448	☒
30	12	20.0	290	☒

Table 8.3-19: *Radar type 4 trial's details and detection results for 802.11n HT40 in U-NII-2A band, channel 62, 5310 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	12	11.1	292	☒
2	14	11.5	246	☒
3	16	11.5	477	☒
4	12	11.6	353	☒
5	13	11.8	304	☒
6	13	11.9	336	☒
7	12	12.5	207	☒
8	12	12.7	460	☒
9	16	14.2	242	☒
10	16	14.8	224	☒
11	14	15.2	345	☒
12	16	15.4	413	☒
13	13	15.5	291	☒
14	15	15.5	427	☒
15	16	15.6	302	☒
16	16	15.6	378	☒
17	15	15.7	267	☒
18	16	15.7	290	☒
19	14	15.8	317	☒
20	16	16.4	407	☒
21	15	16.5	369	☒
22	15	16.6	215	☒
23	13	16.6	467	☒
24	16	16.7	206	☒
25	14	17.6	494	☒
26	15	17.9	431	☒
27	15	17.0	253	☒
28	14	18.1	346	☒
29	15	18.9	360	☒
30	15	19.9	464	☒

Table 8.3-20: *Radar type 4 trial's details and detection results for 802.11n HT20 in U-NII-2C band, channel 100, 5500 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	14	11.3	344	☒
2	13	11.5	419	☒
3	13	11.6	439	☒
4	13	11.7	457	☒
5	14	11.7	484	☒
6	16	12.2	300	☒
7	12	12.4	277	☒
8	15	12.7	352	☒
9	16	12.0	257	☒
10	15	13.1	387	☒
11	15	13.9	468	☒
12	15	13.0	324	☒
13	15	14.1	253	☒
14	12	14.6	444	☒
15	14	16.4	290	☒
16	13	16.5	310	☒
17	14	16.8	280	☒
18	16	16.9	435	☒
19	16	16.0	399	☒
20	16	17.1	369	☒
21	13	17.2	327	☒
22	14	17.7	460	☒
23	12	17.0	467	☒
24	15	18.3	241	☒
25	16	18.3	449	☒
26	14	19.1	395	☒
27	15	19.2	241	☒
28	15	19.7	313	☒
29	12	19.9	476	☒
30	15	20.0	425	☒

Table 8.3-21: *Radar type 4 trial's details and detection results for 802.11n HT40 in U-NII-2C band, channel 102, 5510 MHz*

Trial number	Pulses/Bursts	Pulse width, µs	PRI, µs	Detected
1	13	11.1	416	☒
2	12	11.3	428	☒
3	13	11.6	409	☒
4	15	11.0	463	☒
5	16	12.1	369	☒
6	15	12.3	429	☒
7	14	12.7	291	☒
8	13	13.4	286	☒
9	13	13.5	200	☒
10	13	13.8	472	☒
11	14	13.9	231	☒
12	13	14.4	417	☒
13	13	14.4	451	☒
14	16	14.7	462	☒
15	14	14.9	390	☒
16	12	15.1	333	☒
17	15	15.1	496	☒
18	16	15.3	347	☒
19	16	15.9	286	☒
20	13	16.1	466	☒
21	14	16.9	416	☒
22	16	16.0	397	☒
23	15	17.1	310	☒
24	13	17.6	216	☒
25	14	17.6	272	☒
26	14	17.6	351	☒
27	14	18.3	435	☒
28	16	18.5	465	☒
29	12	19.6	219	☒
30	12	19.0	276	☒

8.4 Statistical performance for long pulse radars

8.4.1 Definitions and limits

For Radar type 5 (long pulse radars) minimum percentage of successful detection is 80 %.

8.4.2 Test summary

Test date	January 25, 2017	Temperature	23 °C
Test engineer	Andrey Adelberg	Air pressure	1007 mbar
Verdict	Pass	Relative humidity	40 %

8.4.3 Observations, settings and special notes

The percentage of successful detection is calculated by:

$$\frac{Total\ waveform\ detections}{Total\ waveform\ trials} \times 100\%$$

The minimum number of trails is 30.

8.4.4 Test data

Table 8.4-1: *Summary of the long radar detection probability results for 802.11n HT20 for U-NII-2A band*

Radar type	Detection probability (P_d), %	Minimum Limit, %	Margin, %
5	100	80	20

Table 8.4-2: *Summary of the long radar detection probability results for 802.11n HT20 for U-NII-2C band*

Radar type	Detection probability (P_d), %	Minimum Limit, %	Margin, %
5	100	80	20

Table 8.4-3: *Summary of the long radar detection probability results for 802.11n HT40 for U-NII-2A band*

Radar type	Detection probability (P_d), %	Minimum Limit, %	Margin, %
5	93.3	80.00	13.3

Table 8.4-4: *Summary of the long radar detection probability results for 802.11n HT40 for U-NII-2C band*

Radar type	Detection probability (P_d), %	Minimum Limit, %	Margin, %
5	100	80.00	20

Table 8.4-5: *Radar Type 5 detection probability test results for 802.11n HT20, U-NII-2A band*

Trial	Chirp width, MHz	F_L, MHz	F_H, MHz	Radar pulse offset, MHz	Radar frequency, MHz	Detection
0	5	5290	5310	Center of channel	5300.000	☒
1	18	5290	5310	Center of channel	5300.000	☒
2	5	5290	5310	Center of channel	5300.000	☒
3	20	5290	5310	Center of channel	5300.000	☒
4	11	5290	5310	Center of channel	5300.000	☒
5	6	5290	5310	Center of channel	5300.000	☒
6	14	5290	5310	Center of channel	5300.000	☒
7	9	5290	5310	Center of channel	5300.000	☒
8	17	5290	5310	Center of channel	5300.000	☒
9	11	5290	5310	Center of channel	5300.000	☒
10	9	5290	5310	3.6	5293.600	☒
11	8	5290	5310	3.2	5293.200	☒
12	13	5290	5310	5.2	5295.200	☒
13	6	5290	5310	2.4	5292.400	☒
14	8	5290	5310	3.2	5293.200	☒
15	8	5290	5310	3.2	5293.200	☒
16	16	5290	5310	6.4	5296.400	☒
17	15	5290	5310	6.0	5296.000	☒
18	19	5290	5310	7.6	5297.600	☒
19	16	5290	5310	6.4	5296.400	☒
20	20	5290	5310	8.0	5302.000	☒
21	10	5290	5310	4.0	5306.000	☒
22	13	5290	5310	5.2	5304.800	☒
23	14	5290	5310	5.6	5304.400	☒
24	19	5290	5310	7.6	5302.400	☒
25	13	5290	5310	5.2	5304.800	☒
26	18	5290	5310	7.2	5302.800	☒
27	6	5290	5310	2.4	5307.600	☒
28	19	5290	5310	7.6	5302.400	☒
29	10	5290	5310	4.0	5306.000	☒

Example of Radar frequencies calculation:
Chirp width of Radar signal is 13 MHz (Trial 12).
EUT F_L = 5290.000 MHz
$F_{C\_Radar\_L}$ = 5290.000 + (0.4 × 13.000) = 5290.000 + 5.2 = 5295.200 MHz
Chirp width of Radar signal is 18 MHz (Trial 26).
EUT F_H = 5310.000 MHz
$F_{C\_Radar\_H}$ = 5310.000 − (0.4 × 18.000) = 5310.000 − 7.200 = 5302.800 MHz

Table 8.4-6: *Radar Type 5 detection probability test results for 802.11n HT40, U-NII-2A band*

Trial	Chirp width, MHz	F_L, MHz	F_H, MHz	Radar pulse offset, MHz	Radar frequency, MHz	Detection
0	6	5292	5329	Center of channel	5310.000	☒
1	15	5292	5329	Center of channel	5310.000	☒
2	9	5292	5329	Center of channel	5310.000	☒
3	17	5292	5329	Center of channel	5310.000	☒
4	9	5292	5329	Center of channel	5310.000	☒
5	13	5292	5329	Center of channel	5310.000	☒
6	19	5292	5329	Center of channel	5310.000	☒
7	18	5292	5329	Center of channel	5310.000	☒
8	17	5292	5329	Center of channel	5310.000	☒
9	8	5292	5329	Center of channel	5310.000	☒
10	17	5292	5329	6.8	5298.800	☒
11	12	5292	5329	4.8	5296.800	☒
12	18	5292	5329	7.2	5299.200	☒
13	14	5292	5329	5.6	5297.600	☒
14	9	5292	5329	3.6	5295.600	☐
15	13	5292	5329	5.2	5297.200	☒
16	18	5292	5329	7.2	5299.200	☒
17	16	5292	5329	6.4	5298.400	☒
18	17	5292	5329	6.8	5298.800	☒
19	8	5292	5329	3.2	5295.200	☐
20	12	5292	5329	4.8	5324.200	☒
21	10	5292	5329	4.0	5325.000	☒
22	20	5292	5329	8.0	5321.000	☒
23	17	5292	5329	6.8	5322.200	☒
24	13	5292	5329	5.2	5323.800	☒
25	20	5292	5329	8.0	5321.000	☒
26	18	5292	5329	7.2	5321.800	☒
27	12	5292	5329	4.8	5324.200	☒
28	8	5292	5329	3.2	5325.800	☒
29	6	5292	5329	2.4	5326.600	☒

Example of Radar frequencies calculation:
Chirp width of Radar signal is 14 MHz (Trial 13).
EUT F_L = 5292.000 MHz
$F_{C\_Radar\_L}$ = 5292.000 + (0.4 × 14.000) = 5292.000 + 5.600 = 5297.600 MHz
Chirp width of Radar signal is 20 MHz (Trial 25).
EUT F_H = 5329.000 MHz
$F_{C\_Radar\_H}$ = 5329.000 − (0.4 × 20.000) = 5329.00 – 8.000 = 5321.000 MHz

Table 8.4-7: *Radar Type 5 detection probability test results for 802.11n HT20, U-NII-2C band*

Trial	Chirp width, MHz	F_L, MHz	F_H, MHz	Radar pulse offset, MHz	Radar frequency, MHz	Detection
0	20	5487	5513	Center of channel	5500.000	☒
1	18	5487	5513	Center of channel	5500.000	☒
2	12	5487	5513	Center of channel	5500.000	☒
3	13	5487	5513	Center of channel	5500.000	☒
4	7	5487	5513	Center of channel	5500.000	☒
5	9	5487	5513	Center of channel	5500.000	☒
6	17	5487	5513	Center of channel	5500.000	☒
7	8	5487	5513	Center of channel	5500.000	☒
8	12	5487	5513	Center of channel	5500.000	☒
9	5	5487	5513	Center of channel	5500.000	☒
10	19	5487	5513	7.6	5494.600	☒
11	15	5487	5513	6.0	5493.000	☒
12	20	5487	5513	8.0	5495.000	☒
13	19	5487	5513	7.6	5494.600	☒
14	5	5487	5513	2.0	5489.000	☒
15	19	5487	5513	7.6	5494.600	☒
16	5	5487	5513	2.0	5489.000	☒
17	18	5487	5513	7.2	5494.200	☒
18	10	5487	5513	4.0	5491.000	☒
19	7	5487	5513	2.8	5489.800	☒
20	8	5487	5513	3.2	5509.800	☒
21	13	5487	5513	5.2	5507.800	☒
22	12	5487	5513	4.8	5508.200	☒
23	19	5487	5513	7.6	5505.400	☒
24	13	5487	5513	5.2	5507.800	☒
25	18	5487	5513	7.2	5505.800	☒
26	9	5487	5513	3.6	5509.400	☒
27	14	5487	5513	5.6	5507.400	☒
28	14	5487	5513	5.6	5507.400	☒
29	10	5487	5513	4.0	5509.000	☒

Example of Radar frequencies calculation:
Chirp width of Radar signal is 5 MHz (Trial 14).
EUT F_L = 5487.000 MHz
$F_{C\_Radar\_L}$ = 5487.000 + (0.4 × 5.000) = 5487.000 + 2.000 = 5489.000 MHz
Chirp width of Radar signal is 9 MHz (Trial 26).
EUT F_H = 5513.000 MHz
$F_{C\_Radar\_H}$ = 5513.000 − (0.4 × 9.000) = 5513.000 − 3.600 = 5509.400 MHz

Table 8.4-8: *Radar Type 5 detection probability test results for 802.11n HT40, U-NII-2C band*

Trial	Chirp width, MHz	F_L, MHz	F_H, MHz	Radar pulse offset, MHz	Radar frequency, MHz	Detection
0	7	5491	5530	Center of channel	5510.000	☒
1	19	5491	5530	Center of channel	5510.000	☒
2	17	5491	5530	Center of channel	5510.000	☒
3	20	5491	5530	Center of channel	5510.000	☒
4	11	5491	5530	Center of channel	5510.000	☒
5	5	5491	5530	Center of channel	5510.000	☒
6	7	5491	5530	Center of channel	5510.000	☒
7	19	5491	5530	Center of channel	5510.000	☒
8	9	5491	5530	Center of channel	5510.000	☒
9	10	5491	5530	Center of channel	5510.000	☒
10	8	5491	5530	3.2	5494.200	☒
11	19	5491	5530	7.6	5498.600	☒
12	19	5491	5530	7.6	5498.600	☒
13	16	5491	5530	6.4	5497.400	☒
14	18	5491	5530	7.2	5498.200	☒
15	6	5491	5530	2.4	5493.400	☒
16	15	5491	5530	6.0	5497.000	☒
17	10	5491	5530	4.0	5495.000	☒
18	9	5491	5530	3.6	5494.600	☒
19	8	5491	5530	3.2	5494.200	☒
20	18	5491	5530	7.2	5522.800	☒
21	14	5491	5530	5.6	5524.400	☒
22	9	5491	5530	3.6	5526.400	☒
23	8	5491	5530	3.2	5526.800	☒
24	18	5491	5530	7.2	5522.800	☒
25	5	5491	5530	2.0	5528.000	☒
26	18	5491	5530	7.2	5522.800	☒
27	6	5491	5530	2.4	5527.600	☒
28	17	5491	5530	6.8	5523.200	☒
29	10	5491	5530	4.0	5526.000	☒

Example of Radar frequencies calculation:
Chirp width of Radar signal is 6 MHz (Trial 15).
EUT F_L = 5491.000 MHz
$F_{C\_Radar\_L}$ = 5491.000 + (0.4 × 6.000) = 5491.000 + 2.400 = 5493.400 MHz
Chirp width of Radar signal is 17 MHz (Trial 28).
EUT F_H = 5530.000 MHz
$F_{C\_Radar\_H}$ = 5530.000 − (0.4 × 17.000) = 5530.00 – 6.800 = 5523.200 MHz

8.5 Statistical performance for frequency hopping radars

8.5.1 Definitions and limits

For Radar type 6 (frequency hopping radars) minimum percentage of successful detection is 70 %.

8.5.2 Test summary

Test date	April 10, 2015	Temperature	21 °C
Test engineer	Andrey Adelberg	Air pressure	1005 mbar
Verdict	Pass	Relative humidity	30 %

8.5.3 Observations, settings and special notes

The percentage of successful detection is calculated by:

$$\frac{Total\ waveform\ detections}{Total\ waveform\ trials} \times 100\%$$

The minimum number of trails is 30.
Pulses per hop is 9; Pulse Repetition Interval (PRI) is 333 µs; Pulse width is 1 µs

8.5.4 Test data

Table 8.5-1: *Summary of the frequency hopping radar detection probability results for 802.11n HT20*

Radar type	Band	Detection probability (P_d), %	Minimum Limit, %	Margin, %
6	U-NII-2A	100.00	70.00	30.00
6	U-NII-2C	100.00	70.00	30.00

Table 8.5-2: *Summary of the frequency hopping radar detection probability results for 802.11n HT40*

Radar type	Band	Detection probability (P_d), %	Minimum Limit, %	Margin, %
6	U-NII-2A	100.00	70.00	30.00
6	U-NII-2C	100.00	70.00	30.00

Table 8.5-3: *Frequency hopping Radar type 6 results*

Trial	Detections for 802.11n HT20, U-NII-2A band, channel 60, 5300 MHz	Detections for 802.11n HT40, U-NII-2A band, channel 62, 5310 MHz	Detections for 802.11n HT20, U-NII-2C band, channel 100, 5500 MHz	Detections for 802.11n HT40, U-NII-2C band, channel 102, 5510 MHz
0	☒	☒	☒	☒
1	☒	☒	☒	☒
2	☒	☒	☒	☒
3	☒	☒	☒	☒
4	☒	☒	☒	☒
5	☒	☒	☒	☒
6	☒	☒	☒	☒
7	☒	☒	☒	☒
8	☒	☒	☒	☒
9	☒	☒	☒	☒
10	☒	☒	☒	☒
11	☒	☒	☒	☒
12	☒	☒	☒	☒
13	☒	☒	☒	☒
14	☒	☒	☒	☒
15	☒	☒	☒	☒
16	☒	☒	☒	☒
17	☒	☒	☒	☒
18	☒	☒	☒	☒
19	☒	☒	☒	☒
20	☒	☒	☒	☒
21	☒	☒	☒	☒
22	☒	☒	☒	☒
23	☒	☒	☒	☒
24	☒	☒	☒	☒
25	☒	☒	☒	☒
26	☒	☒	☒	☒
27	☒	☒	☒	☒
28	☒	☒	☒	☒
29	☒	☒	☒	☒

8.6 Channel closing transmission and move time

8.6.1 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.

8.6.2 Test summary

Test date	April 7, 2017	Temperature	23 °C
Test engineer	Andrey Adelberg	Air pressure	1010 mbar
Verdict	Pass	Relative humidity	37 %

8.6.3 Observations, settings and special notes

The test was performed on the widest channel BW, which is 40 MHz with the use of Radar type 0.

8.6.4 Test data

Table 8.6-1: *Channel closing transmission time results*

Band	Measured closing transmission time, ms	Limit, ms	Margin, ms
U-NII-2A	0.930	260.00	259.070
U-NII-2C	12.545	260.00	247.455

Table 8.6-2: *Channel move time results*

Band	Measured move time, s	Limit, s	Margin, s
U-NII-2A	0.336	10.00	9.664
U-NII-2C	0.481	10.00	9.519

Table 8.6-3: *Channel closing transmission and move time measurement results*

Band	Region	Start, s	End, s	Measured, ms	Limit, ms
U-NII-2A	0	0	0.2	0.448	200
U-NII-2A	1	0.2	10	0.482	60
U-NII-2A	2	10	12	0.000	0
U-NII-2C	0	0	0.2	11.661	200
U-NII-2C	1	0.2	10	0.884	60
U-NII-2C	2	10	12	0.000	0

Figure 8.6-1: *Channel closing transmission and move time, U-NII-2A band*

Figure 8.6-2: *Channel closing transmission and move time, U-NII-2C band*

8.7 Initial channel availability check time

8.7.1 Definitions and limits

The initial channel availability check (CAC) time tests that the EUT 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.

8.7.2 Test summary

Test date	April 7, 2017	Temperature	23 °C
Test engineer	Andrey Adelberg	Air pressure	1010 mbar
Verdict	Pass	Relative humidity	37 %

8.7.3 Observations, settings and special notes

None

8.7.4 Test data

Table 8.7-1: *Initial CAC results*

Band	Measured CAC, s	Minimum limit, s	Margin, s
U-NII-2A	60	60	0
U-NII-2C	60	60	0

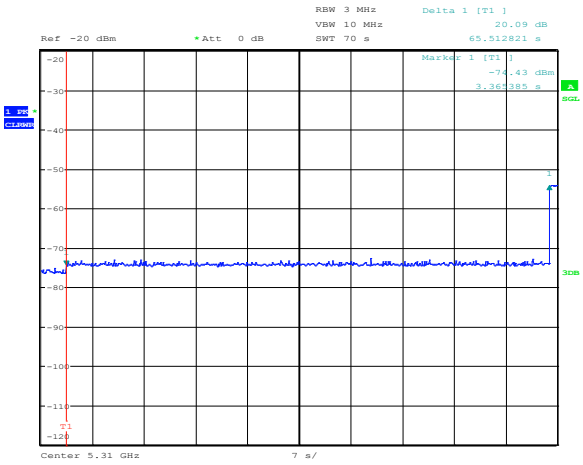


Figure 8.7-1: *Initial CAC for U-NII-2A band*

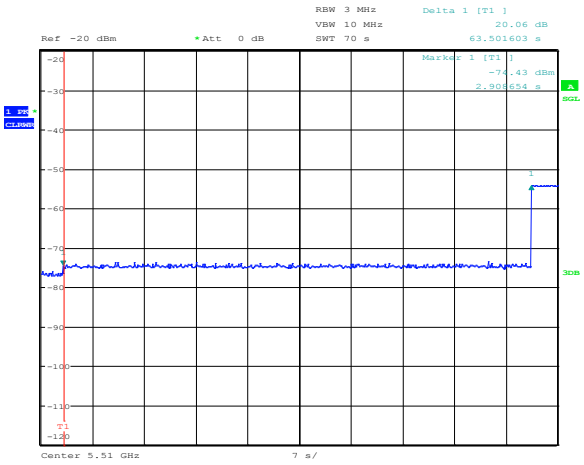


Figure 8.7-2: *Initial CAC for U-NII-2C band*

8.8 In-service monitoring radar burst at the beginning of the CAC

8.8.1 Definitions and limits

This procedure is 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 (within first 6 seconds) of the Channel Availability Check Time.

8.8.2 Test summary

Test date	April 21, 2017	Temperature	23 °C
Test engineer	Andrey Adelberg	Air pressure	1010 mbar
Verdict	Pass	Relative humidity	37 %

8.8.3 Observations, settings and special notes

This test was performed once on the widest channel BW, which is 40 MHz with the use of Radar type 0.

8.8.4 Test data

Table 8.8-1: *In-service monitoring radar burst at the beginning of the CAC*

Band	Radar pulses delay from the beginning of CAC, s	Successful Radar detection and channel vacation
U-NII-2A	5	☒
U-NII-2C	5	☒

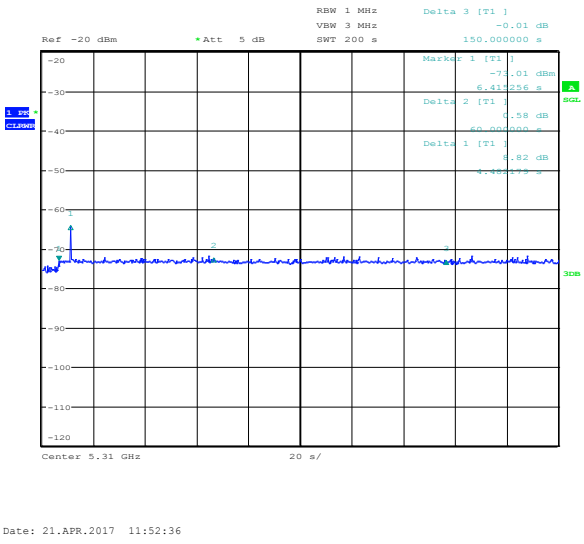


Figure 8.8-1: *In-service monitoring radar burst at the beginning of the CAC for U-NII-2A band*

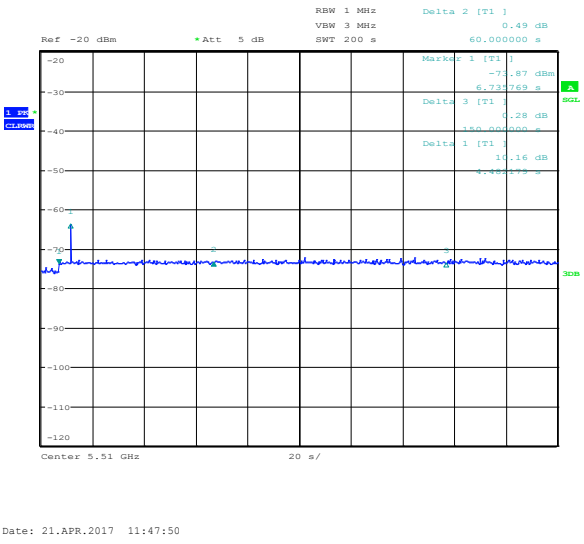


Figure 8.8-2: *In-service monitoring radar burst at the beginning of the CAC for U-NII-2C band*

8.9 In-service monitoring radar burst at the end of the CAC

8.9.1 Definitions and limits

This procedure is 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 end (within last 6 seconds) of the Channel Availability Check Time.

8.9.2 Test summary

Test date	April 21, 2017	Temperature	23 °C
Test engineer	Andrey Adelberg	Air pressure	1010 mbar
Verdict	Pass	Relative humidity	37 %

8.9.3 Observations, settings and special notes

This test was performed once on the widest channel BW, which is 40 MHz with the use of Radar type 0.

8.9.4 Test data

Table 8.9-1: *In-service monitoring radar burst at the end of the CAC*

Band	Radar pulses delay from the beginning of CAC, s	Successful Radar detection and channel vacation
U-NII-2A	55	☒
U-NII-2C	55	☒

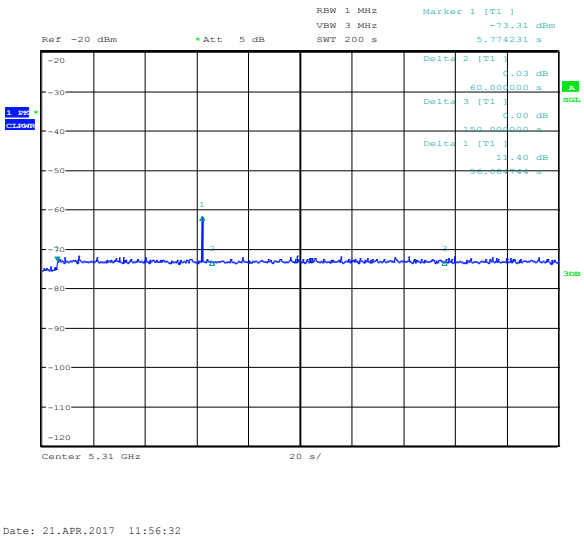


Figure 8.9-1: *In-service monitoring radar burst at the end of the CAC for U-NII-2A band*

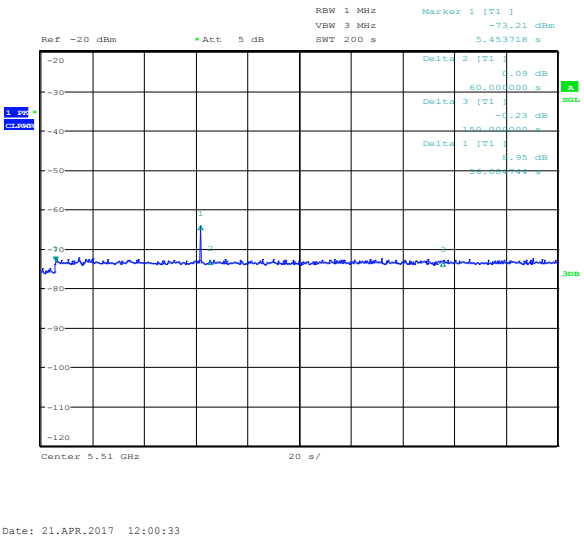


Figure 8.9-2: *In-service monitoring radar burst at the end of the CAC for U-NII-2C band*

8.10 Non-occupancy period

8.10.1 Definitions and limits

Non-occupancy period minimum is 30 minutes.

8.10.2 Test summary

Test date	April 10, 2017	Temperature	22 °C
Test engineer	Andrey Adelberg	Air pressure	1006 mbar
Verdict	Pass	Relative humidity	38 %

8.10.3 Observations, settings and special notes

The EUT was monitored for more than 30 minutes following instant indicated with Marker 1 on the plots below (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 40 MHz with the use of Radar type 0.

8.10.4 Test data

Table 8.10-1: *Non-occupancy period results*

Band	Measured Non-occupancy period, min	Minimum limit, min	Margin, min
U-NII-2A	31.8	30	At least 1.8
U-NII-2C	32.5	30	At least 2.5

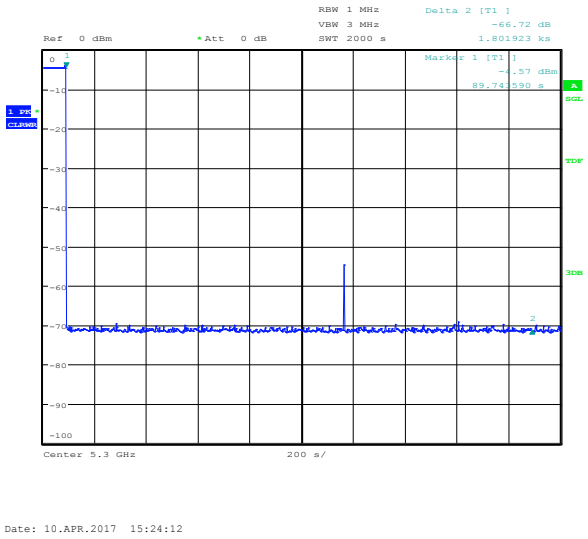


Figure 8.10-1: *Non-occupancy period for U-NII-2A band*

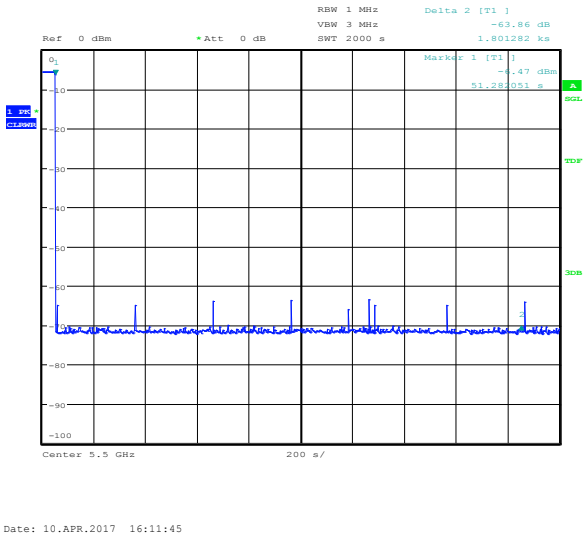
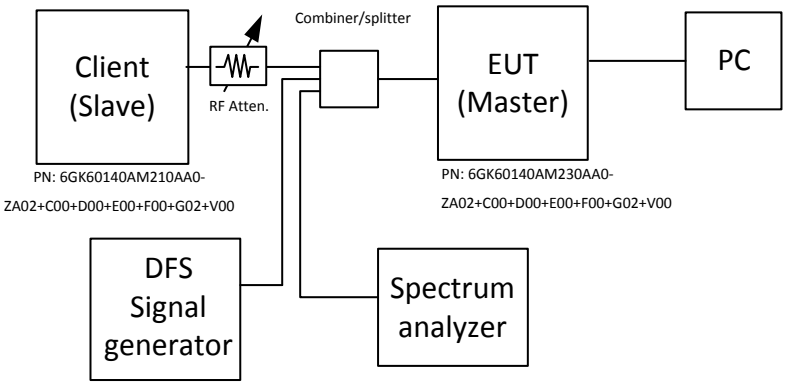


Figure 8.10-2: *Non-occupancy period for U-NII-2C band*

Section 9. Block diagram and photo of test set-up

9.1 Test set-up diagram



Master device was connected conducted via RF attenuator, through the combiner to the Client device. Path was calibrated so the receiving level at the EUT input port is as per standard requirement.
DFS test box was added to the RF chain system (Master/Client) using combiner. RF path loss was verified and the level of the Radar pulses at the EUT input was adjusted as per standard requirement.
EUT was connected to PC via Ethernet port. Channel selection, channel BW, iperf session were controlled from this PC.
EUT was configured to transmit on selected channel using iperf session with 17% load. Spectrum analyzer was connected to the link for observation purposes. Radar pulses were applied to the system. After successful detection PC Web interface GUI indication of the channel move was also verified visually on the screen of the spectrum analyzer.
Iperf was then stopped. EUT reset, verified completion of CAC. Transmission enabled.
System was ready for another round.

9.2 Test set-up photo