TEST REPORT

Test Report No. : UL-RPT-RP11200639JD01A

Manufacturer	:	Cambium Networks Ltd
Model No.	:	PTP 50650
FCC ID	:	QWP-50650
Test Standard(s)	:	FCC Part 15.407(h)(2)

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

Date of Issue: 31 March 2016

Checked by:

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UL VS LTD

0644

This laboratory is accredited by UKAS. The tests reported herein have been performed in accordance with its terms of accreditation.

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1. Customer Information

Company Name:	Cambium Networks Ltd
Address:	Unit B2/3, Linhay Business Park Eastern Road Ashburton Devon TQ13 7UP United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.407
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart E (Unlicensed National Information Infrastructure Devices) - Section 15.407
Site Registration:	FCC: 209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	15 March 2016 to 22 March 2016

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.407(h)(2)	U-NII Detection Bandwidth	✓
Part 15.407(h)(2)(ii)	Initial Channel Availability Check Time	✓
Part 15.407(h)(2)(ii)	Radar Burst at the Beginning of the Channel Availability Check Time	✓
Part 15.407(h)(2)(ii)	Radar Burst at the End of the Channel Availability Check Time	✓
Part 15.407(h)(2)(iii)	Channel Closing Transmission Time and Channel Move Time	✓
Part 15.407(h)(2)(iv)	Non-occupancy Period	✓
Part 15.407(h)(2)	Statistical Performance Check – Short Pulse Radar Types 1-4	✓
Part 15.407(h)(2)	Statistical Performance Check – Long Pulse Radar Type 5	✓
Part 15.407(h)(2)	Statistical Performance Check – Frequency Hopping Radar Type 6	✓
Key to Results ✓ = Complied ✗ = Did not comply		

Note(s):

1. The EUT operates in the 5250 to 5350 MHz and 5470 to 5725 MHz bands. It was tested operating on a representative channel in the 5470-5725 MHz band.
2. The manufacturer confirms that information regarding the parameters of the radar waveforms is not available to, or configurable by the end user.

2.3. Methods and Procedures

Reference:	FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v01r02, May 15 2015
Title:	Compliance Measurement Procedures for Unlicensed-National Information Infrastructure Devices Operating in the 5250-5350 MHz and 5470-5725 MHz Bands Incorporating Dynamic Frequency Selection

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Cambium Networks Ltd
Model Name or Number:	PTP 50650
Serial Number:	000456506174 (*Master*)
Hardware Version:	P5
Software Version:	650-01-42
FCC ID:	QWP-50650

Brand Name:	Cambium Networks Ltd
Model Name or Number:	PTP 50650
Serial Number:	000456506173 (*Client*)
Hardware Version:	P5
Software Version:	650-01-42
FCC ID:	QWP-50650

3.2. Description of EUT

The Equipment Under Test was a fixed radio transceiver operating in the 5250 to 5350 MHz and 5470-5725 MHz frequency bands.

Power is provided by a PoE supply.

Bridge modes and Mesh modes are not supported.

The EUT is available in two configurations:

1. Connectorised with two external antenna ports. Cambium Part No. C050065B002A.
2. Integrated flat plate antenna. Cambium Part No. C050065B001A.

Since tests were performed conducted and antenna gain compensated for, only the version with two external antenna ports was tested.

3.3. Modifications Incorporated in the EUT

No modifications were made to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	Unlicensed National Information Infrastructure Devices (U-NII)	
Type of Unit:	Microwave fixed radio link transceiver	
Modes/Modulation Type:	AQU, BPSK, QPSK, 16QAM, 64QAM & 256QAM	
Channel Spacing:	5, 10, 15, 20, 30, 40 & 45 MHz	
Radar Detection supported on Client?:	Yes	
Highest possible EIRP:	27.5 dBm (34.5 dBi parabolic antenna / 1.5 dB RF cable loss / power setting -5.5)	
Lowest possible EIRP:	-3.5 dBm (13 dBi omnidirectional antenna / 1.5 dB RF cable loss / power setting -15)	
Antenna Port Used For Testing (Master):	Port H	
Antenna Port Used For Testing (Client):	Port H	
Antenna Connector Impedance:	50 Ohms	
Power-on cycle time:	48.2 seconds	
Power Supply Requirement(s):	Nominal	PoE supply input 120 VAC 60 Hz. PoE output 48 VDC.
Operating Frequency Range:	5250 to 5350 MHz 5470 to 5725 MHz	

Transmit / Receive Channels Tested at each bandwidth setting:	**Bandwidth (MHz)**	**Channel Frequency (MHz)**
	5	5593
	10	5595
	15	5588
	20	5590
	30	5585
	40	5580
	45	5573

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	PoE Power supply
Brand Name:	Cambium Networks
Model Name or Number:	E100109B G
Part Number:	C000065L002B
Serial Number:	1421005533

Description:	PoE Power supply
Brand Name:	Cambium Networks
Model Name or Number:	E100109B G
Part Number:	C000065L002B
Serial Number:	1451008904

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	Latitude D5400
Serial Number:	JX19G4J

Description:	Laptop PC
Brand Name:	Toshiba
Model Name or Number:	Satellite C850
Serial Number:	YC255340R

3.6. Antenna

The table below lists the antennas that the manufacturer intends to use with this product when operating in the 5250-5350 & 5470-5725 MHz bands:

Type	Stated Gain (dBi)	Manufacturer	Antenna Name	Used for Testing	Note
Dual polarised plate	19.0	MARS	MA-EM56-DP-19CM	-	-
Dual polarised plate	23.0	MARS	MA-WS54-50R	-	-
4 ft Parabolic Dual Polarised	34.5	Andrews	PX4F-52-N7A/A	-	-
65° Sectorised	17.0	Laird	ANT, AP Sector	-	-
90° Sectorised	17.0	Laird	ANT, AP Sector	-	-
Omnidirectional	13.0	KP	KPPA-5.7-DPOMA	X	1, 2

X = This antenna was used for testing purposes

Note(s):

1. Used in conjunction with two, 1 metre RF cables having an individual insertion loss of 1.5 dB across the operating band.
2. This antenna has the lowest gain. The EUT is configured to produce the highest conducted output power when this antenna is used.

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating modes, unless otherwise stated:

- As a Master or Client device.
- The EUT has radar detection in both Master and Client modes.
- The EUT was transmitting with 64QAM modulation.
- The radar detection sensitivity is linked to the allowed maximum transmit power of the device in the GUI. This is also limited dependant on the operating bandwidth. These conducted powers were set in the GUI for each tested bandwidth:

Bandwidth / MHz	GUI Conducted Power / dBm
5	12
10	15
15	17
20 to 45	18

  This was designed to simulate the use of the antenna with the minimum specified gain.

- The EUT was set to maximum duty cycle. For 5 MHz this had a transmit/receive symmetry of 1:1, for 10 MHz to 45 MHz it was 2:1, giving its maximum duty cycle, as required by KDB 905462 D02 clause 7.7.2.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- All measurements were made using a conducted link. The antenna ports gave independent access to 'H' (Horizontal) and 'V' (Vertical) antenna connections.
- A laptop PC with a standard web browser was connected to the EUT via Ethernet. This was used to configure the EUT via its normal end-user web configuration utility. The EUT's web configuration console also featured a special engineering test-mode login, where additional set-up parameters, usually unavailable to the end user, could access specific DFS test modes and configuration options.
- The same laptop PC was also used to connect via a telnet client to receive debug messages on port 9999. DFS debug messages were enabled via the engineering test-mode of the web interface so radar detection events were reported to the telnet application.
- For tests requiring channel loading (Channel Closing Transmission Time, Channel Move Time and Statistical Performance Check), TCP test data was streamed at maximum rate from the master to the client device using iPerf bandwidth testing software. The EUT has fixed frame rates so this did not affect the EUTs duty cycle, only causing additional processor loading to the EUT. The frame symmetry setting was set to maximum Tx/Rx ratio, and therefore met the channel loading requirement of >17% in KDB 905462 D02 7.7 c).
- Further details of the conducted test network and set-up can be found in Appendix 2 of this test report.
- Calculation of the radar detection threshold:
    - The customer declared the lowest gain antenna to be 13 dBi, used in conjuction with a 0.9 dB the product 11.5 dBi (13.0 dBi – 1.5 dB cable) assembly (including cable loss) typically. However, they also stated the worst-case cable loss could be 1.5 dB, and therefore this figure was used as it would result in a lower antenna gain and hence more severe test when used to calculate the test radar amplitude. This additional incoming gain in signal would normally be present in a radiated link, but is not present in the conducted test. This minimum gain is therefore added to the radar test level amplitude.
    - The EUT transmitted with an EIRP >200 mW. Therefore the radar detection threshold was calculated for all bandwidths using the -64 dBm limit found in 15.407 h) (2) and KDB 905462 D02 Table 3.
    - This -64 dBm detection threshold was then compensated for antenna gain (including cable loss), and an additional 1 dB added as stated in KDB 905462 D02 Table 3, notes 1 and 2. This gave a radar test level of -64 dBm + 13 dBi – 1.5 dB + 1 dB = -51.5 dBm.

KDB 905462 D02 Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

Maximum Transmit Power	**Value (See Notes 1, 2, and 3)**
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note 3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section* 6 *Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. U-NII Detection Bandwidth

Test Summary:

Test Engineer:	Philip Harrison	**Test Dates:**	15 March 2016, 16 March 2016, 17 March 2016, 18 March 2016 & 21 March 2016
Test Sample Serial Numbers:	000456506174 *(Master)* 000456506173 *(Client)*		

FCC Reference:	Part 15.407(h)(2)
Test Method Used:	KDB 905462 D02 Section 7.8.1 and Notes below

Environmental Conditions:

Temperature (°C):	25 to 27
Relative Humidity (%):	26 to 28

Notes:

1. In accordance with KDB 905462 D02 Table 2, the U-NII Detection Bandwidth test was performed on all supported bandwidths on both Master and Client devices with radar detection modes.
2. The 99% bandwidth was measured in accordance with FCC KDB 789033 D02 General UNII Test Procedures New Rules v01, Section II D.
3. Tests were performed using a type 0 radar (as stated in KDB 905462D02 Table 4, Note 3) and the radar detection threshold used was as calculated in Section 4.2 of this test report.
4. KDB 905462 D02 Section 7.8.1 requests testing detection bandwidth at 1 MHz steps near the channel edges until the entire 99% bandwidth is covered. However, due to small channel bandwidths or 99% bandwidths of the EUT, smaller steps were used at the channel edge extremities when testing 5 MHz and 10 MHz channels.

U-NII Detection Bandwidth (continued)

Results: 5 MHz Master

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
5	4.444	≥4.5	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-2.25 (F_L)	10	100
-2.0	10	100
-1	10	100
0 (5593)	10	100
+1	10	100
+2	10	100
+2.25 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 10 MHz Master

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
10	8.946	≥9.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-4.5 (F_L)	10	100
-4	10	100
-3	10	100
-2	10	100
-1	10	100
0 (5595)	10	100
+1	10	100
+2	10	100
+3	10	100
+4	10	100
+4.5 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 15 MHz Master

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
15	13.367	≥14.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-7 (F_L)	10	100
-6	10	100
-5	10	100
0 (5588)	10	100
+5	10	100
+6	10	100
+7 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 20 MHz Master

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
20	17.863	≥18.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-9 (F_L)	10	100
-8	10	100
-7	10	100
-6	10	100
-5	10	100
0 (5590)	10	100
+5	10	100
+6	10	100
+7	10	100
+8	10	100
+9 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 30 MHz Master

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
30	26.956	≥28.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-14 (F_L)	10	100
-13	10	100
-12	10	100
-11	10	100
-10	10	100
-5	10	100
0 (5585)	10	100
+5	10	100
+10	10	100
+11	10	100
+12	10	100
+13	10	100
+14 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 40 MHz Master

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
40	37.099	≥38.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-19 (F_L)	10	100
-18	10	100
-17	10	100
-16	10	100
-15	10	100
-10	10	100
-5	10	100
0 (5580)	10	100
+5	10	100
+10	10	100
+15	10	100
+16	10	100
+17	10	100
+18	10	100
+19 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 45 MHz Master

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
45	40.649	≥42.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-21 (F_L)	10	100
-20	10	100
-15	10	100
-10	10	100
-5	10	100
0 (5573)	10	100
+5	10	100
+10	10	100
+15	10	100
+20	10	100
+21 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 5 MHz Client

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
5	4.444	≥4.5	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-2.25 (F_L)	10	100
-2.0	10	100
-1	10	100
0 (5593)	10	100
+1	10	100
+2	10	100
+2.25 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 10 MHz Client

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
10	8.946	≥9.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-4.5 (F_L)	10	100
-4	10	100
-3	10	100
-2	10	100
-1	10	100
0 (5595)	10	100
+1	10	100
+2	10	100
+3	10	100
+4	10	100
+4.5 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 15 MHz Client

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
15	13.367	≥14.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-7 (F_L)	10	100
-6	10	100
-5	10	100
0 (5588)	10	100
+5	10	100
+6	10	100
+7 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 20 MHz Client

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
20	17.863	≥18.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-9 (F_L)	10	100
-8	10	100
-7	10	100
-6	10	100
-5	10	100
0 (5590)	10	100
+5	10	100
+6	10	100
+7	10	100
+8	10	100
+9 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 30 MHz Client

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
30	26.956	≥28.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-14 (F_L)	10	100
-13	10	100
-12	10	100
-11	10	100
-10	10	100
-5	10	100
0 (5585)	10	100
+5	10	100
+10	10	100
+11	10	100
+12	10	100
+13	10	100
+14 (F_H)	10	100

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 40 MHz Client

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
40	37.099	≥38	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-19 (F_L)	9	90
-18	10	100
-17	10	100
-16	10	100
-15	9	90
-10	10	100
-5	10	100
0 (5580)	10	100
+5	10	100
+10	10	100
+15	10	100
+16	10	100
+17	10	100
+18	9	90
+19 (F_H)	9	90

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Results: 45 MHz Client

Channel Bandwidth (MHz)	99% Bandwidth (MHz)	U-NII Detection Bandwidth $F_H - F_L$ (MHz)	Result
45	40.649	≥42.0	Complied

Maximum Offsets from centre frequency as tested (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)
-21 (F_L)	9	90
-20	10	100
-15	9	90
-10	10	100
-5	10	100
0 (5573)	9	90
+5	10	100
+10	10	100
+15	10	100
+20	9	90
+21 (F_H)	9	90

The EUT exceeded the requirement of ≥90% detection probability over 100% of the measured 99% bandwidth.

U-NII Detection Bandwidth (continued)

Limits:

FCC 15.407 (h)(2)

The device must sense for radar signals at 100 percent of its emission bandwidth.

KDB 905462 D02 Table 4: DFS Response Requirement Values

Parameter	Value
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

5.2.2. Initial Channel Availability Check Time

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	17 March 2016
Test Sample Serial Numbers:	000456506174 *(Master)* 000456506173 *(Client)*		

FCC Reference:	Part 15.407(h)(2)(ii)
Test Method Used:	KDB 905462 D02 Section 7.8.2.1 and Notes below

Environmental Conditions:

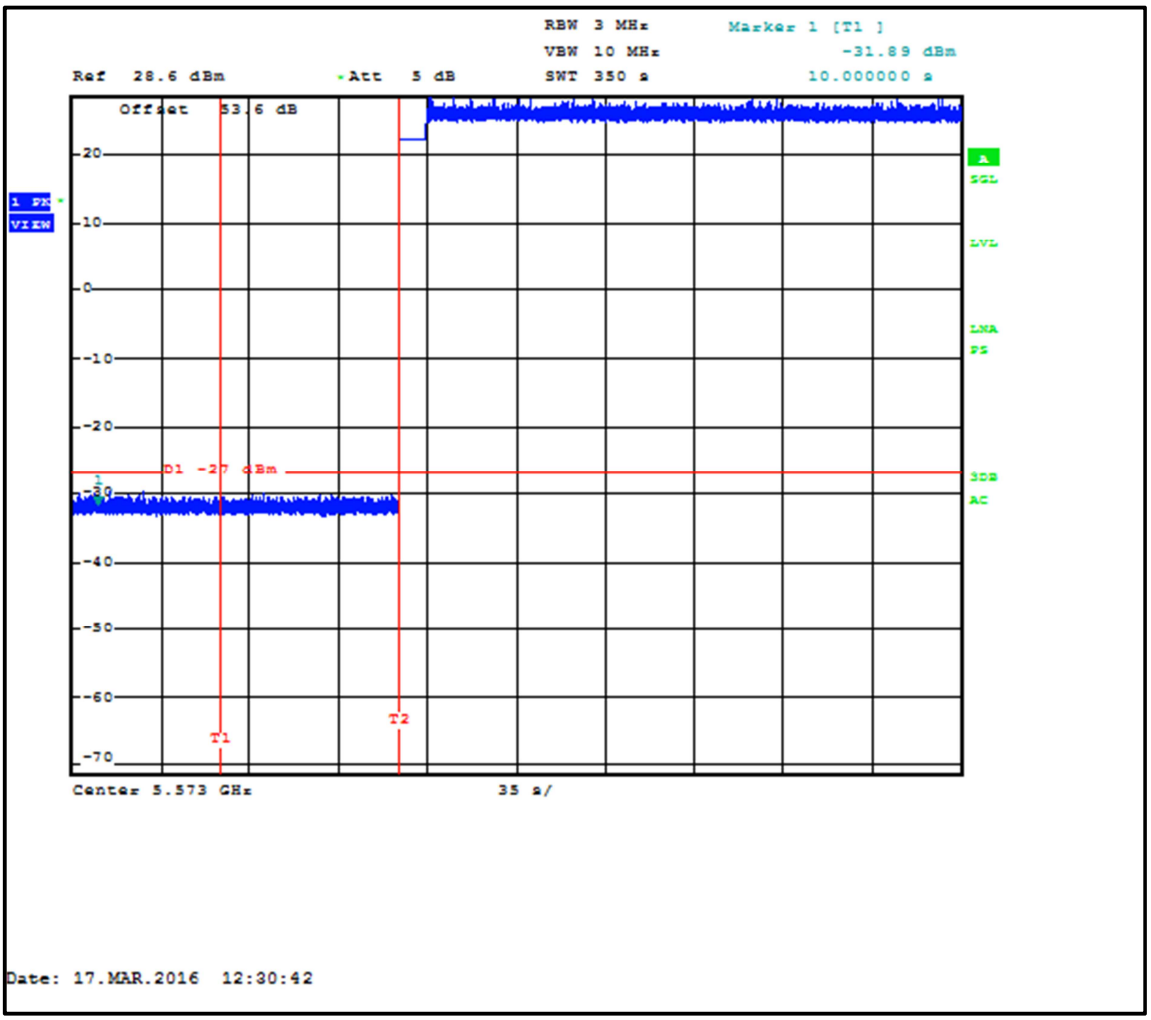
Temperature (°C):	25
Relative Humidity (%):	28

Notes:

1. In accordance with KDB 905462 D02 Table 2, the Initial Channel Availability Check test was performed on any single bandwidth. It was therefore tested only on a 45 MHz bandwidth.
2. The EUT master device was powered on at Marker 1 on the plot below. This gave improved accuracy over starting the sweep at the same time as power up as requested by KDB 905462 D02. During the test, 32,000 sweep points were used on the spectrum analyser.
3. A second PTP 50650, set as a Client device, was connected and powered up throughout the test.
4. No beacon or data transmission was seen from the master during channel availability check time. The master did not transmit for >60 seconds, only transmitting after 118.2 seconds. The EUT therefore complies, as shown on the plot in the results on the following page.
5. All emissions remained below the -27 dBm spurious limit. This was measured worst-case with a peak detector and 3 MHz RBW in accordance with KDB 905462 D02 Section 7.8.2.1(a).
6. A 53.6 dB level offset was entered on the spectrum analyser, which was calculated as *42.1 dB (attenuation from the signal analyser to the master) + 11.5 dBi (antenna gain – cable loss).*
7. The customer declared the CAC time to be 70 seconds, therefore the power up time until CAC start was calculated to be 118.2 - 70 = 48.2 seconds. The result plot on the following page shows from Marker 1 to Time Line T1 as the power on time (48.2 seconds) and time from Time Line T1 to Time Line T2 is the Channel Availability Check time (70 seconds).

Initial Channel Availability Check Time (continued)

Results: 45 MHz Master



Limits:

FCC 15.407(h)(2)(ii)

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 part, is detected within 60 seconds.

KDB 905462 D02 Table 4: DFS Response Requirement Values

Parameter	Value
Channel Availability Check Time	60 seconds

5.2.3. Radar Burst at the Beginning of the Channel Availability Check Time

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	17 March 2016
Test Sample Serial Numbers:	000456506174 *(Master)* 000456506173 *(Client)*		

FCC Reference:	Part 15.407(h)(2)(ii)
Test Method Used:	KDB 905462 D02 Section 7.8.2.2

Environmental Conditions:

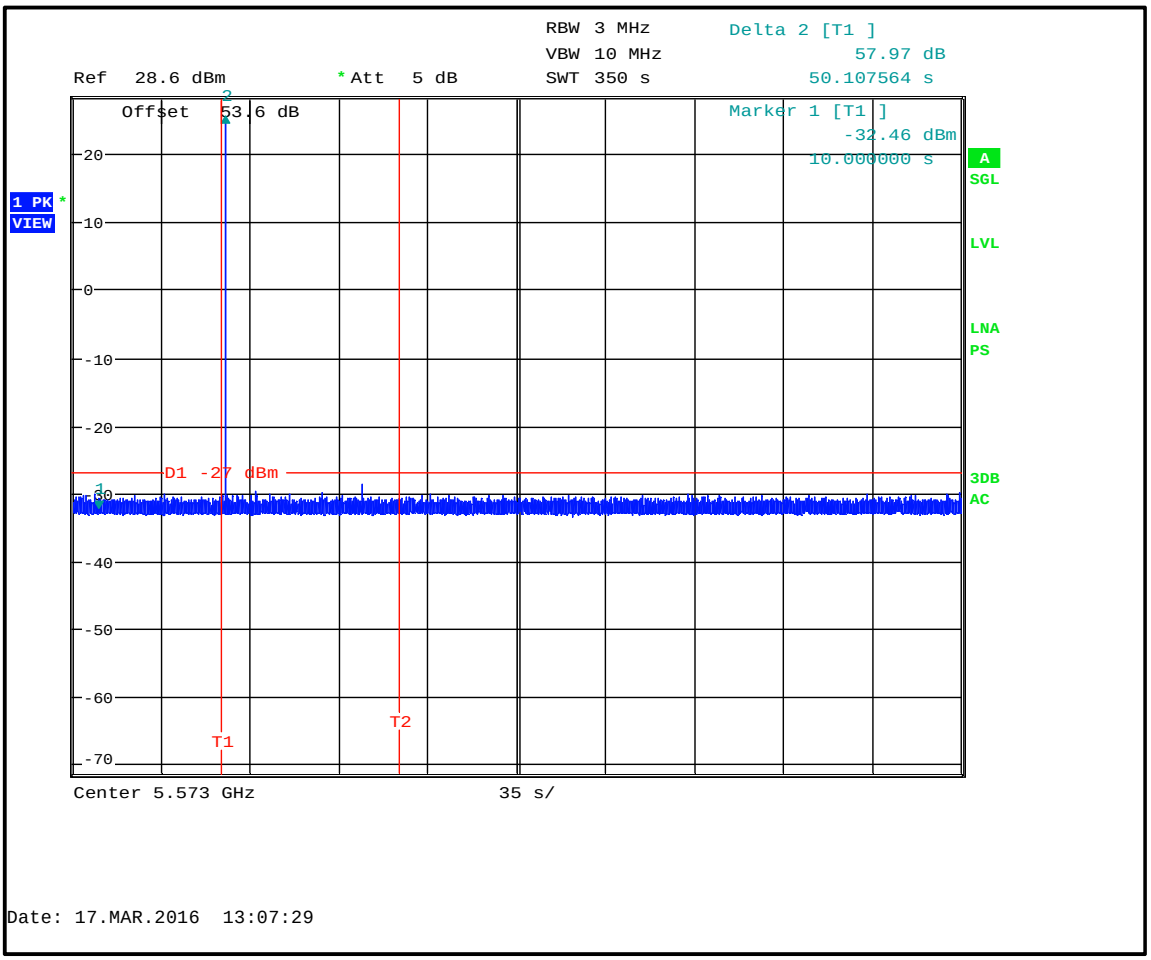
Temperature (°C):	25
Relative Humidity (%):	28

Notes:

1. In accordance with KDB 905462 D02 Table 2, the Initial Channel Availability Check test was performed on any single bandwidth. It was therefore tested only on a 45 MHz bandwidth.
2. The radar was fired 1.9 seconds into the allowed 6 second radar window at the beginning of CAC.
3. Observation of Ch_r continued for >2.5 minutes after the radar burst was generated.
4. Tests were performed using a type 0 radar and the radar detection threshold was as calculated in Section 4.2 of this test report.
5. The radar burst type 0, shown occurring just after the T1 line on the plot on the following page, was detected and no beacon or data transmission seen from the EUT after the end of CAC. Therefore the CAC starts at the time declared and, in conjunction with the *Radar Burst at the End of the Channel Availability Check Time* test, shows the CAC duration is greater than the 60 second minimum.
6. No transmissions occurred.
7. All emissions remained below the -27 dBm spurious limit. This was measured worst-case with a peak detector and 3 MHz RBW to give equivalent results to the *Initial* Channel Availability Check test method defined in KDB 905462 D02 7.8.2.1(a). Measured results were recorded and the EUT complies.

Radar Burst at the Beginning of the Channel Availability Check Time (continued)

Results: 45 MHz Master



Plot showing the radar at the beginning of CAC

Limits:

FCC 15.407(h)(2)(ii)

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 part, is detected within 60 seconds.

KDB 905462 D02 Table 4: DFS Response Requirement Values

Parameter	Value
Channel Availability Check Time	60 seconds

5.2.4. Radar Burst at the End of the Channel Availability Check Time

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	17 March 2016
Test Sample Serial Numbers:	000456506174 *(Master)* 000456506173 *(Client)*		

FCC Reference:	Part 15.407(h)(2)(ii)
Test Method Used:	KDB 905462 D02 Section 7.8.2.3

Environmental Conditions:

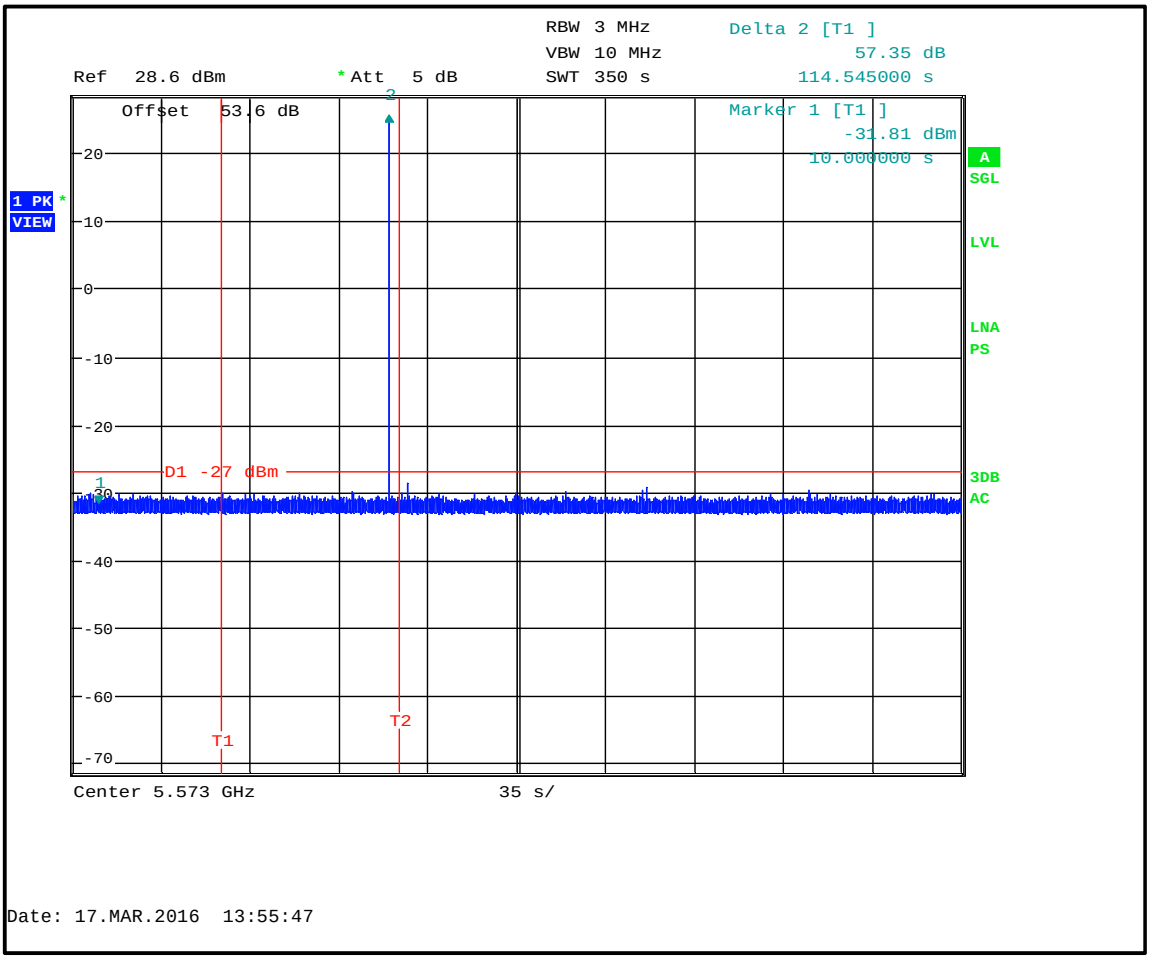
Temperature (°C):	25
Relative Humidity (%):	28

Notes:

1. In accordance with KDB 905462 D02 Table 2, the Initial Channel Availability Check test was performed on any single bandwidth. It was therefore tested only on 45 MHz bandwidth.
2. The radar was fired 4.3 seconds before the end of the allowed 6 second radar window at the end of CAC.
3. Observation of Ch_r continued for >2.5 minutes after the radar burst was generated.
4. Tests were performed using a type 0 radar and the radar detection threshold calculated in Section 4.2 of this test report.
5. No transmissions occurred. All emissions remained below the spurious limit.
6. The radar burst type 0, shown occurring just before the T2 line on the plot on the following page, was detected and no beacon or data transmission seen from the EUT after the end of CAC. Therefore the CAC ends at the point declared and, in conjunction with the *Radar Burst at the Beginning of the Channel Availability Check Time* test, shows the CAC duration is greater than the 60 second minimum. Measured results were recorded and the EUT complies.

Radar Burst at the End of the Channel Availability Check Time (continued)

Results: 45 MHz Master



Plot showing the radar fired at the end of CAC

Limits:

FCC 15.407(h)(2)(ii)

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 part, is detected within 60 seconds.

KDB 905462 D02 Table 4: DFS Response Requirement Values

Parameter	Value
Channel Availability Check Time	60 seconds

5.2.5. Channel Closing Transmission Time and Channel Move Time

Test Summary:

Test Engineer:	Philip Harrison	**Test Dates:**	17 March 2016 & 21 March 2016
Test Sample Serial Numbers:	000456506174 *(Master)* 000456506173 *(Client)*		

FCC Reference:	Part 15.407(h)(2)(iii)
Test Method Used:	KDB 905462 D02 Section 7.8.3

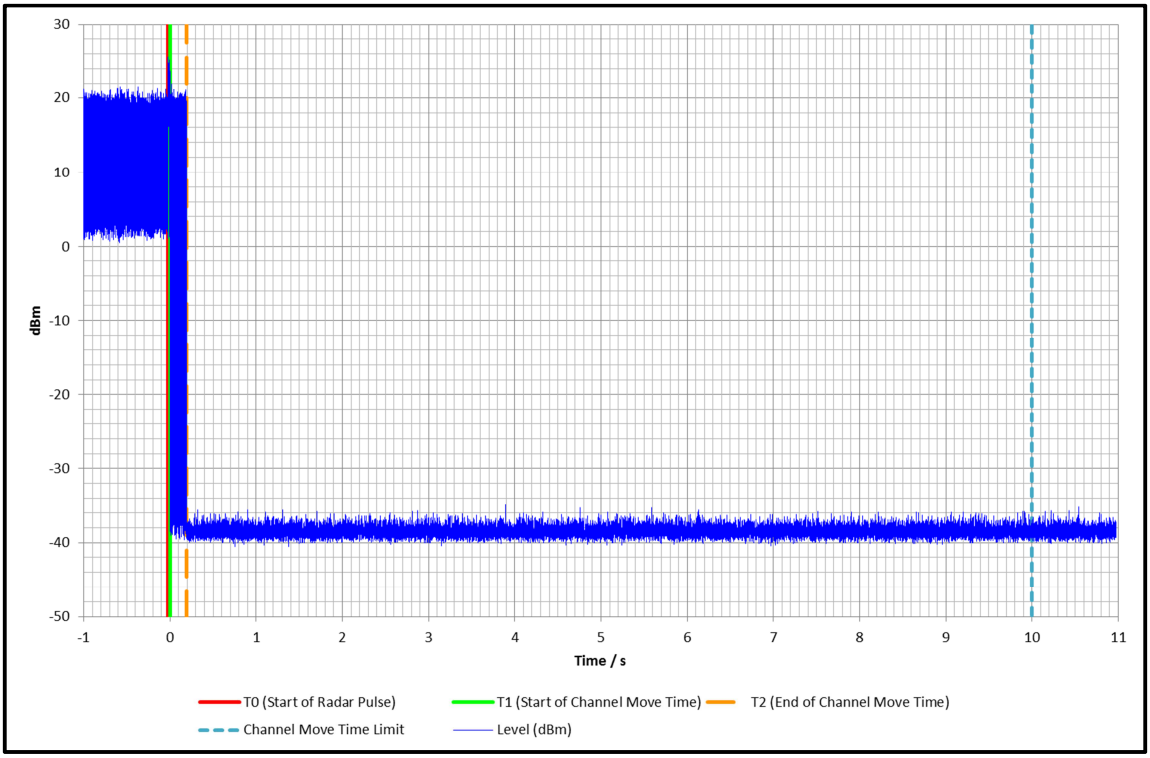
Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	26 to 28

Notes:

1. In accordance with KDB 905462 D02 Table 2, the Initial Channel Availability Check test was performed on the widest bandwidth. It was therefore tested only on 45 MHz bandwidth.
2. Tests were performed using a type 0 radar and the radar detection threshold calculated in Section 4.2 of this test report.
3. The total channel closing time limit was 200 ms + 60 ms = 260 ms (from KDB 905462 D02 Table 4).
4. Radar burst type 0 was detected and channel move occurred within the channel move and channel closing time limits, for both master and client modes. Therefore the EUT complied.

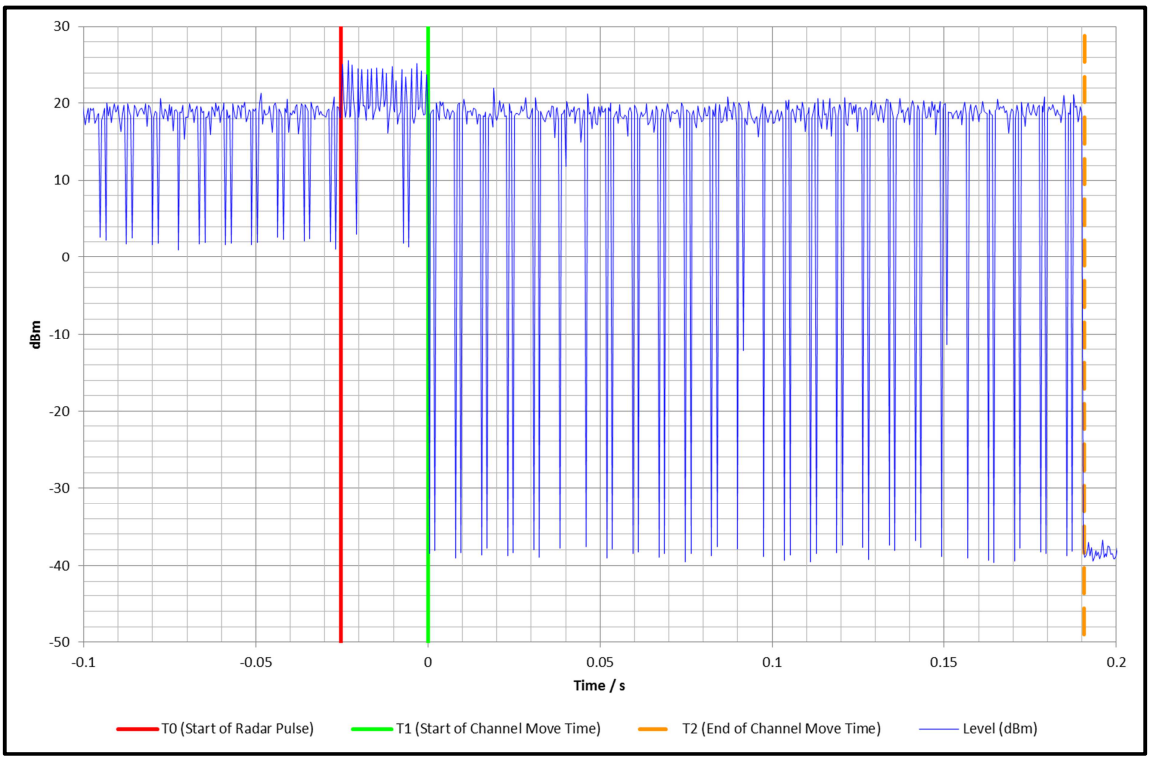
Results: 45 MHz Master – Channel Move Time



Plot showing the full 10 second shutdown limit

Channel Closing Transmission Time and Channel Move Time (continued)

Results: 45 MHz Master (continued)



Zoomed plot showing the first 200 ms after the end of the type 0 radar burst

Results: 45 MHz Master - Channel Move Time

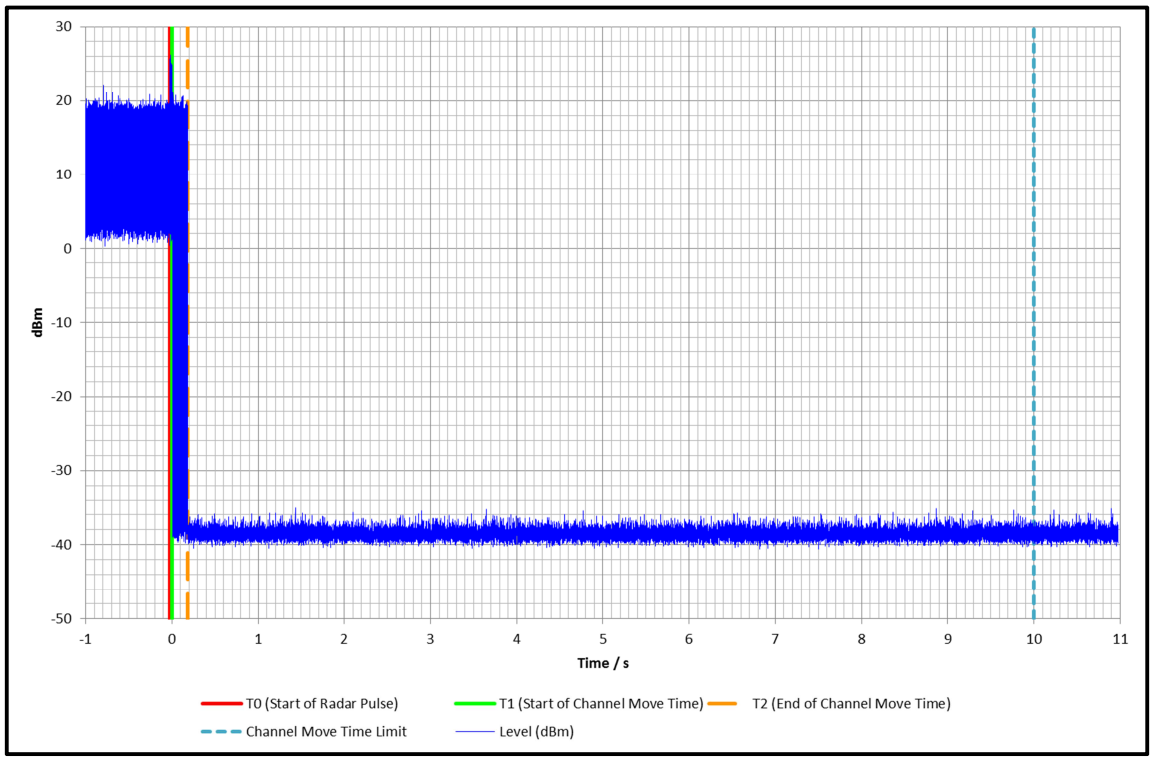
Channel (MHz)	BW (MHz)	Trial	Radar Type	PW (us)	PRF 1 (pps)	PPB	Move Time (ms)	Limit (ms)	Margin (ms)	Detected
5573	45	1	0	1	700	18	190.4	10000	9809.6	Yes

Results: 45 MHz Master - Channel Closing Transmission Time

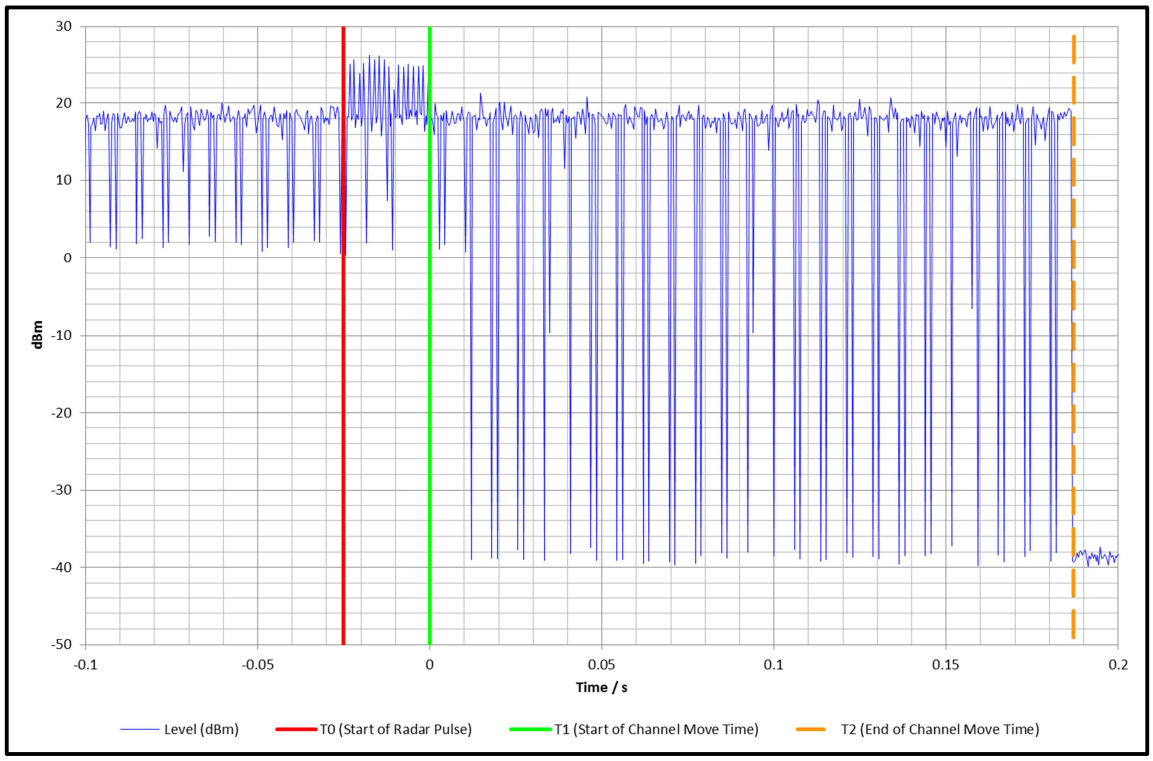
Channel (MHz)	BW (MHz)	Trial	Radar Type	PW (us)	PRF 1 (pps)	PPB	Total Aggre-gate Tx Time (ms)	Limit (ms)	Margin (ms)	Tx Time >200 ms after end of radar (ms)	Limit (ms)	Margin (ms)
5573	45	1	0	1	700	18	170.8	260	89.2	0	60	60

Channel Closing Transmission Time and Channel Move Time (continued)

Results: 45 MHz Client – Type 0 Radar Fired at Client



Plot showing the full 10 second shutdown limit



Zoomed in plot showing the first 200 ms after the end of the type 0 radar burst

Channel Closing Transmission Time and Channel Move Time (continued)

Results: 45 MHz Client, Radar fired at Client – Channel Move Time

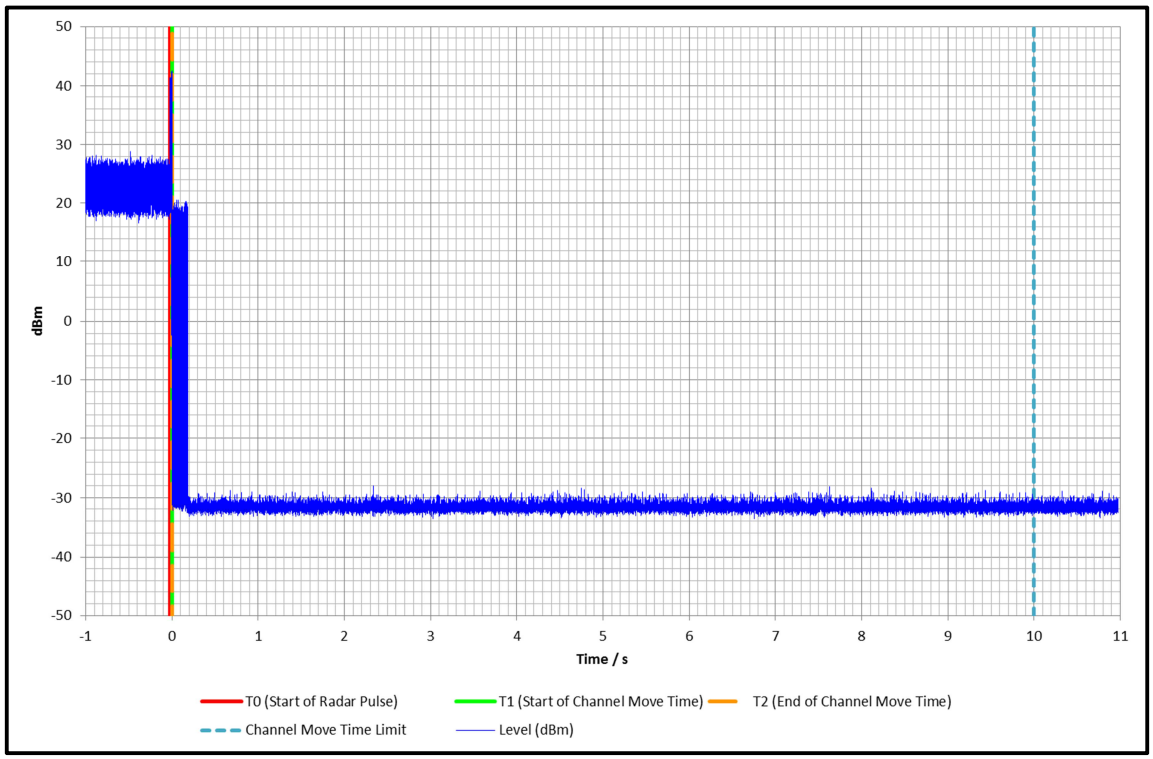
Channel (MHz)	BW (MHz)	Trial	Radar Type	PW (uS)	PRF 1 (pps)	PPB	Move Time (ms)	Limit (ms)	Margin (ms)	Detected
5573	45	1	0	1	700	18	186.8	10000	9813.2	Yes

Results: 45 MHz Client, Radar fired at Client – Channel Closing Transmission Time

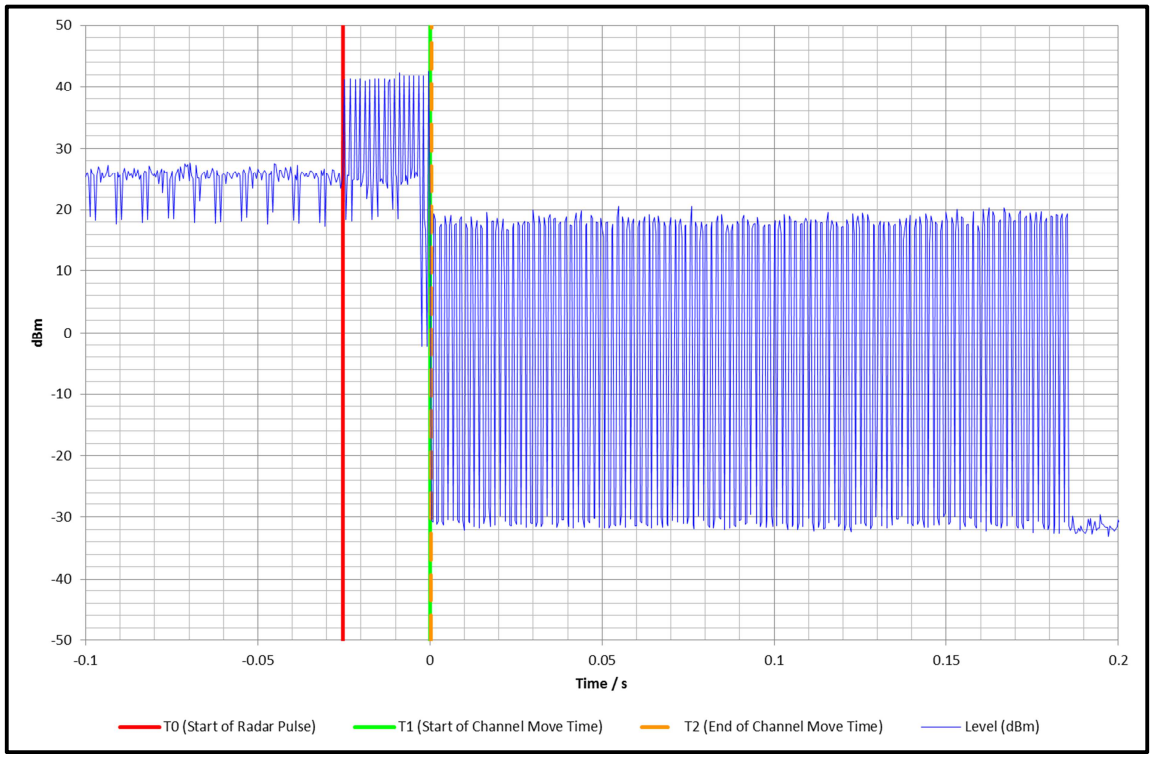
Channel (MHz)	BW (MHz)	Trial	Radar Type	PW (uS)	PRF 1 (pps)	PPB	Total Aggre-gate Tx Time (ms)	Limit (ms)	Margin (ms)	Tx Time >200 ms after end of radar (ms)	Limit (ms)	Margin (ms)
5573	45	1	0	1	700	18	167.6	260	92.4	0	60	60

Channel Closing Transmission Time and Channel Move Time (continued)

Results: 45 MHz Client – Type 0 Radar Fired at Master



Plot showing the full 10 second shutdown limit



Zoomed plot showing the first 200 ms after the end of the type 0 radar burst

Channel Closing Transmission Time and Channel Move Time (continued)

Results: 45 MHz Client – Type 0 Radar Fired at Master (continued)

Results: 45 MHz Client, Radar fired at Master - Channel Move Time

Channel (MHz)	BW (MHz)	Trial	Radar Type	PW (uS)	PRF 1 (pps)	PPB	Move Time (ms)	Limit (ms)	Margin (ms)	Detected
5583	45	1	0	1	700	18	0.0	10000	10000	Yes

Results: 45 MHz Client, Radar fired at Master - Channel Closing Transmission Time

Channel (MHz)	BW (MHz)	Trial	Radar Type	PW (uS)	PRF 1 (pps)	PPB	Total Aggre-gate Tx Time (ms)	Limit (ms)	Margin (ms)	Tx Time >200 ms after end of radar (ms)	Limit (ms)	Margin (ms)
5583	45	1	0	1	700	18	0.0	260	260	0	60	60

NOTE: A Channel move time of 0 occurs where the EUT has shut down before the final pulse of the radar.

Channel Closing Transmission Time and Channel Move Time (continued)

Limits:

FCC 15.407(h)(2)(iii)

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.

KDB 905462 D02 Table 4: DFS Response Requirement Values

Parameter	Value
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.

Note 1: *Channel Move Time* and the *Channel Closing Transmission Time* should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.

Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.