Product Service

Choose certainty.
Add value.

Report On

DFS Testing of the u-blox WiBear11n / ELLA-W1
In accordance with FCC 47 CFR Part 15E and
Industry Canada RSS-247

COMMERCIAL-IN-CONFIDENCE

FCC ID: PV7-WIBEAR11N-DF1, PV7-WIBEAR11N-DF2, XPYELLAW161, XPYELLAW163
IC: 7738A-WB11NDF1, 7738A-WB11NDF2, 8595A-ELLAW161, 8595A-ELLAW163

Document 75931213 Report 01 Issue 2 **December 2015**

Product Service

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuv-sud.co.uk

REPORT ON

DFS Testing of the
u-blox WiBear11n / ELLA-W1
In accordance with FCC 47 CFR Part 15E and
Industry Canada RSS-247

Document 75931213 Report 01 Issue 2

December 2015

PREPARED FOR

u-blox AG
Zürcherstrasse 68
CH-8800 Thalwil
Switzerland

PREPARED BY

Simon Bennett
Wireless Test Engineer

APPROVED BY

Nic Forsyth
Authorised Signatory

DATED 24 December 2015

This report has been up-issued to Issue 2 to remove references to CAC tests in the brief summary of results and test results sections for the '802.11n - 40 MHz Bandwidth' configuration.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate compliance with the FCC 47 CFR Part 15E and Industry Canada RSS-247. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s):

S Bennett

UKAS TESTING
0141

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

DFS Testing of the
u-blox WiBear11n / ELLA-W1
In accordance with FCC 47 CFR Part 15E and Industry Canada RSS-247

Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the DFS Testing of the U-Blox WiBear11n / ELLA-W1 to the requirements of FCC 47 CFR Part 15E and Industry Canada RSS-247.

Objective	To perform DFS Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	U-Blox
Model Number(s)	WiBear11n / ELLA-W1
Serial Number(s)	0489341
Number of Samples Tested	01
Test Specification/Issue/Date	FCC 47 CFR Part 15E (2014) Industry Canada RSS-247 (Issue 1, May 2015)
Incoming Release Date	Application Form 16 July 2015
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	LALB-201507081_Rev0 8 July 2015
Start of Test	8 July 2015
Finish of Test	30 July 2015
Name of Engineer(s)	S Bennett
Related Documents	KDB 905462 D02 v01r02 KDB 905462 D06 v01r02 KDB 905462 D04 v01 KDB 662911 D01 UKAS M3003: Edition 2 (2007) ETSI TR 100 028 (2001)

Product Service

1.2 TEST REQUIREMENTS

1.2.1 FCC 47 CFR Part 15E

1.2.1.1 DFS Overview

The requirements according to FCC 47 CFR Part 15, clause 15.407 (h)(2) are described below.

U-NII devices operating in the 5.25 GHz to 5.35 GHz and 5.47 GHz to 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. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200 mW to 1 W is -64 dBm. For devices that operate with less than 200 mW e.i.r.p. the minimum detection threshold is -62 dBm.

Master mode U-NII devices shall comply with Channel Availability Check Time, Channel Move Time and Non-occupancy Period DFS requirements.

Client mode U-NII devices shall comply with Channel Move Time DFS requirements.

1.2.1.2 Channel Availability Check Time

The requirements according to FCC 47 CFR Part 15, clause 15.407 (h)(2)(ii) are described below.

A master mode 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 DFS detection threshold, is detected within 60 seconds.

1.2.1.3 Channel Move Time

The requirements according to FCC 47 CFR Part 15, clause 15.407 (h)(2)(iii) are described below.

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.

1.2.1.4 Non-occupancy Period

The requirements according to FCC 47 CFR Part 15, clause 15.407 (h)(2)(iv) are described below.

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.

Product Service

1.2.2 KDB 905462

1.2.2.1 DFS Overview

The requirements according to KDB 905462, clause 5.1 are described below.

A U-NII network will employ a DFS function to detect signals from radar systems and to avoid co-channel operation with these systems. This applies to the 5250 to 5350 MHz and/or 5470 to 5725 MHz bands.

Within the context of the operation of the DFS function, a U-NII device will operate in either Master Mode or Client Mode. U-NII devices operating in Client Mode can only operate in a network controlled by a U-NII device operating in Master Mode.

Tables 1 and 2 summarise the information contained in sections 5.1.1 and 5.1.2 of the test specification.

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client without Radar Detection
DFS Detection Threshold	Yes	Not Required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not Required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

Product Service

Master Mode Devices

The specific master mode device requirements according to KDB 905462, clause 5.1.1 are described below.

a) The Master Device will use DFS in order to detect Radar Waveforms with received signal strength above the DFS Detection Threshold in the 5250 MHz to 5350 MHz and 5470 MHz to 5725 MHz bands. DFS is not required in the 5150 MHz to 5250 MHz or 5725 MHz to 5825 MHz bands.

b) Before initiating a network on a Channel, the Master Device will perform a Channel Availability Check for a specified time duration (Channel Availability Check Time) to ensure that there is no radar system operating on the Channel, using DFS described under subsection a) above.

c) The Master Device initiates a U-NII network by transmitting control signals that will enable other U-NII devices to Associate with the Master Device.

d) During normal operation, the Master Device will monitor the Channel (In-Service Monitoring) to ensure that there is no radar system operating on the Channel, using DFS described under a).

e) If the Master Device has detected a Radar Waveform during In-Service Monitoring as described under d), the Operating Channel of the U-NII network is no longer an Available Channel. The Master Device will instruct all associated Client Device(s) to stop transmitting on this Channel within the Channel Move Time. The transmissions during the Channel Move Time will be limited to the Channel Closing Transmission Time.

f) Once the Master Device has detected a Radar Waveform it will not utilise the Channel for the duration of the Non-Occupancy Period.

g) If the Master Device delegates the In-Service Monitoring to a Client Device, then the combination will be tested to the requirements described under d) through f) above.

Product Service

Client Devices

The specific client mode device requirements according to KDB 905462, clause 5.1.2 are described below.

a) A Client Device will not transmit before having received appropriate control signals from a Master Device.

b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.

c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.

d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.

e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shut down (rather than moving channels), no beacons should appear.

1.2.2.2 DFS Detection Thresholds

The requirements according to KDB 905462, clause 5.2 are described below.

Table 3 provides the DFS Detection Thresholds for Master Devices as well as Client Devices incorporating In-Service Monitoring.

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 mW	-64 dBm
EIRP < 200 mW and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 mW 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	

Product Service

1.2.2.3 Test Protocol

The test protocol requirements according to KDB 905462, clause 7.1 are described below.

The test transmission will always be from the Master Device to the Client Device, for all configurations irrespective of In-Service Monitoring capability.

Master Devices

The conformance requirements specified in KDB 905462, clause 7.8 will be verified utilising the Short Pulse Radar types defined in Table 5.

The Channel Move Time and Channel Closing Transmission Time requirements will be verified utilising the Short Pulse Radar Type 0 defined in Table 5.

The statistical performance check will be verified utilising all Radar Types (1-6).

Client Devices with In-Service Monitoring

Two configurations must be tested.

(1) Client with injection at the Client:
   (a) The client device detects the Radar Waveform.
   (b) The Channel Move Time and Channel Closing Transmission Time requirements will be verified utlising Short Pulse Radar Types (0-4), defined in Table 5 and the Long Pulse Radar Types (5) defined in Table 6.
   (c) The statistical performance check will be verified utilising all Radar Types (1-6). During this test it must be ensured that the Client Device is responding independantly based on the Client Device's sel-detection rather than responding to detection by the Master Device.
   (d) The signal level of the Radar Waveform as received by the Client Device must be set in accordance with the DFS Detection Threshold specified by the DFS technical requirements in Table 3.

(2) Client with injection at the Master:
   (a) The master device detects the Radar Waveform.
   (b) The Channel Move Time and Channel Closing Transmission Time will be verified utilising Short Pulse Radar Type defined in Table 5. During this test, it must be ensured that the Client Device is respoonding to detection by the Master Device rather than self-detection by the Client Device.
   (c) For all tests of Client Devices (with or without In-Service Monitoring), the Master device which the Client Device is associated must meet the DFS conformance requirements.

Client Devices without Radar Detection

The Channel Move Time and Channel Closing Transmission Time requirements will be verified with one Short Pulse Radar Type defined in table 5.

Product Service

1.2.2.4 Response Requirements

The requirements according to KDB 905462, clause 5.3 are described below.

Table 4 provides the response requirements for Master Devices incorporating DFS.

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
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.
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
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. 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.	

1.2.2.5 DFS Conformance Test Procedures

The requirements according to KDB 905462, clause 7.8 are described below.

If the UUT fails any one of the tests it will count as a failure of compliance. To show compliance, all tests must be performed with waveforms randomly generated as specified with test results meeting the required percentage of successful detection criteria. All test results must be reported to the FCC. One frequency will be chosen from the operating Channels of the UUT within the 5250 MHz to 5350 MHz or 5470 MHz to 5725 MHz bands.

Product Service

1.3 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15E and Industry Canada RSS-247 is shown below.

Section	Specification Clause		Test Description	Result	Comments
	Part 15	RSS-247			
802.11a					
2.1	15.407 (h)(2)	-	U-NII Detection Bandwidth	Pass	
2.2	15.407 (h)(2)(ii)	6.3 (2)(ii)	Initial Channel Availability Check Time	Pass	
2.3	15.407 (h)(2)(ii)	6.3 (2)(ii)	Radar Burst at the Beginning of the Channel Availability Check Time	Pass	
2.4	15.407 (h)(2)(ii)	6.3 (2)(ii)	Radar Burst at the End of the Channel Availability Check Time	Pass	
2.5	15.407 (h)(2)	6.3 (2)(i)(iii)(iv)	In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	Pass	
2.6	15.407 (h)(2)	-	Statistical Performance Check	Pass	
2.7	15.407 (h)(2)	-	Uniform Spreading	Declaration	

Product Service

Section	Specification Clause		Test Description	Result	Comments
	Part 15	RSS-247			
802.11n - 20 MHz Bandwidth					
2.1	15.407 (h)(2)	-	U-NII Detection Bandwidth	Pass	
2.2	15.407 (h)(2)(ii)	6.3 (2)(ii)	Initial Channel Availability Check Time	Pass	
2.3	15.407 (h)(2)(ii)	6.3 (2)(ii)	Radar Burst at the Beginning of the Channel Availability Check Time	Pass	
2.4	15.407 (h)(2)(ii)	6.3 (2)(ii)	Radar Burst at the End of the Channel Availability Check Time	Pass	
2.5	15.407 (h)(2)	6.3 (2)(i)(iii)(iv)	In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	Pass	
2.6	15.407 (h)(2)	-	Statistical Performance Check	Pass	
2.7	15.407 (h)(2)	-	Uniform Spreading	Declaration	

Product Service

Section	Specification Clause		Test Description	Result	Comments
	Part 15	RSS-247			
802.11n - 40 MHz Bandwidth					
2.1	15.407 (h)(2)	-	U-NII Detection Bandwidth	Pass	
2.5	15.407 (h)(2)	6.3 (2)(i)(iii)(iv)(v)	In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	Pass	
2.6	15.407 (h)(2)	-	Statistical Performance Check	Pass	
2.7	15.407 (h)(2)	-	Uniform Spreading	Declaration	

Product Service

1.4 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	WiBear11n-DF1/-DF2, ELLA-W161/-W163
Part Number	AN00J93172/AN00J94360, AN00J94362/AN00J93176, ELLA-W161-00B-00, ELLA-W163-00B-00, ELLA-W161-00A-00, ELLA-W163-00A-00
Hardware Version	WiBear11n: E6, ELLA-W1: G8
Software Version	14.44.35
FCC ID	PV7-WIBEAR11N-DF1, PV7-WIBEAR11N-DF2, XPYELLAW161, XPYELLAW163
IC	7738A-WB11NDF1, 7738A-WB11NDF2, 8595A-ELLAW161, 8595A-ELLAW163
Technical Description (Please provide a brief description of the intended use of the equipment)	Short-range radio module supporting IEEE 802.11a/b/g/n Wi-Fi, Bluetooth 3.0+HS

TYPE OF EQUIPMENT	
☒	Master
☐	Client with Radar Detection
☒	Client without Radar Detection
☒	Wi-Fi Direct Support

TRANSMITTER TECHNICAL CHARACTERISTICS	
FREQUENCY CHARACTERISTICS	
☒	5.150 GHz to 5.250 GHz
☒	5.250 GHz to 5.350 GHz
☒	5.470 GHz to 5.725 GHz
☒	5.725 GHz to 5.825 GHz
☒	Please confirm the EUT does not operate in the frequency band 5600 – 5650 MHz
☐	Off Channel CAC Implemented
	Off Channel CAC within 5600 – 5650 MHz band hours, (1 – 24)
	Off Channel CAC outside 5600 – 5650 MHz band minutes, (6 – 240)
Note: DFS is not required in the ranges 5.15 – 5.25 GHz and 5.725 – 5.825 GHz	

TRANSMITTER RF POWER CHARACTERISTICS		
Maximum rated transmitter output power as stated by manufacturer		
Conducted Power	15 dBm	
Maximum Antenna Gain	4.6 dBi	
EIRP	19.6 dBm	
Minimum rated transmitter output power as stated by manufacturer (if applicable)		
Conducted Power	6 dBm	
Maximum Antenna Gain	4.6 dBi	
EIRP	10.6 dBm	
Is TPC supported?	☒ Yes	☐ No
If Yes, provide a description of operation.		
Power depends on modulation scheme and distance to access point or client.		

Product Service

POWER SOURCE			
☐ AC mains supply		State voltage	
AC supply frequency	(Hz)	VAC	
☒ DC supply			
Nominal voltage	3.3		

SYSTEM ARCHITECTURE			
☐	Frame Based		
☒	IP Based		
☐	Other	If other please state	
☒	802.11(a)	Receiver Bandwidth:	20 MHz
☒	802.11(n) – 20 MHz	Receiver Bandwidth:	20 MHz
☒	802.11(n) – 40 MHz	Receiver Bandwidth:	40 MHz
☐	802.11(ac) – 20 MHz	Receiver Bandwidth:	MHz
☐	802.11(ac) – 40 MHz	Receiver Bandwidth:	MHz
☐	802.11(ac) – 80 MHz	Receiver Bandwidth:	MHz

DECLARATION			
No parameter or information relating to the detected radar waveforms is available or accessible to the end user.			
☒	True	☐	False

MISCELLANEOUS (Master Device Only)	
Power-on cycle time*	0 s
* Time from switching on the UUT to the point at which Channel Availability Check (CAC) commences	

UNIFORM SPREADING (Master Device Only)
Describe how the meter provides, on aggregate, uniform channel loading of the spectrum across all channels.
Channels are randomly selected by the access point.

Product Service

ANTENNA OPTIONS	
Antenna 1	
Antenna Description:	.On board SMT antenna
Antenna Model:	Antenova A10194
Antenna Maximum Gain:	4.1 dB
Antenna Frequency Range:	4.900 - 5.900 GHz
Antenna 2	
Antenna Description:	Dipole antenna
Antenna Model:	Linx ANT-DB1-RAF-RPS
Antenna Maximum Gain:	4.6 dB
Antenna Frequency Range:	5.150 - 5.850 GHz
Antenna 3	
Antenna Description:	Dipole antenna
Antenna Model:	Taoglas GW.40.2153
Antenna Maximum Gain:	2.5 dB
Antenna Frequency Range:	5.150 - 5.850 GHz
Antenna 4	
Antenna Description:	Dipole antenna
Antenna Model:	Taoglas GW.59.3153
Antenna Maximum Gain:	2.93 dB
Antenna Frequency Range:	5.150 - 5.850 GHz
Antenna 5	
Antenna Description:	
Antenna Model:	
Antenna Maximum Gain:	
Antenna Frequency Range:	

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature: Name: Matthias Mahlig

Position held: Manager HW-Engineering Date: 2015-07-16

Product Service

1.5 PRODUCT INFORMATION

1.5.1 Technical Description

The Equipment Under Test (EUT) was a u-blox WiBear11n / ELLA-W1. A full technical description can be found in the manufacturer's documentation.

The EUT is a master mode device employing a Radar Detection Device (RDD).

The following is provided by the applicant as part of the FCC filing:

- A complete User's Manual and/or Professional Installers Manual.
- A Statement of Conformity for the Client in Non-Associated mode is required. The Form 731 application must include a Cover Letter Attachment stating that the client software and associated drivers will not initiate any transmission on DFS frequencies without initiation by a master. This includes restriction on transmissions for beacons and support for ad-hoc peer-to- peer modes.
- A channel/frequency plan for the device showing the channels that have active scanning or passive scanning. Active scanning is where the device can transmit a probe (beacon) and passive scanning is where the device can listen only without probes.
- Software security description.

1.6 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. See individual test clauses.

The development board was powered from a 10.0 V DC supply, which in turn provided 3.3 V DC to the EUT.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

1.7 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard were made during testing.

1.8 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.

Product Service

1.9 TEST CONFIGURATION

1.9.1 DFS Measurement Instrumentation

The Aeroflex Dynamic Frequency Selection Radar Simulation and Analyser Test Suite was utilised. This test system consists of hardware and software; which comprises of a radar test signal generator and a test signal analyser.

The DFS test system utilises a PXI chassis with PXI instruments populating this chassis; which allows all instrumentation to communicate on a common bus. The following PXI instruments are populated in the PXI chassis; PC with a dual core processor, Frequency References, Vector Signal Generator and a Digitiser.

The test signal and analysis software is run on the PC and controls all of the instruments such that the required test signals are generated and analysed using test sequences in the test software application. The specific test utilisation of this system is described within applicable measurement procedures.

1.9.1.1 Test Signal Generator

The PXI Vector Signal Generator is capable of generating all test signals required by the relevant test specification and is driven using the Aeroflex DFS Simulation and Analyser Test Suite on the PXI PC. An external trigger is also provided at the SMB output of the signal generator which is employed when an external spectrum analyser is utilised for DFS measurements instead of the Aeroflex Digitiser.

1.9.1.2 Test Signal Analyser

The PXI Digitiser is used for channel monitoring during DFS testing and is capable of capturing measurement sweeps with sample rates of 5 Msamples/s and 2.5 Msamples/s with sweep times of 12 s and 24 s respectively.

Various markers are contained within the generated test signals. The markers are used to trigger the Signal Analyser at the correct points. Once a measurement sweep has completed, the signal analyser software evaluates the data according the relevant test requirement.

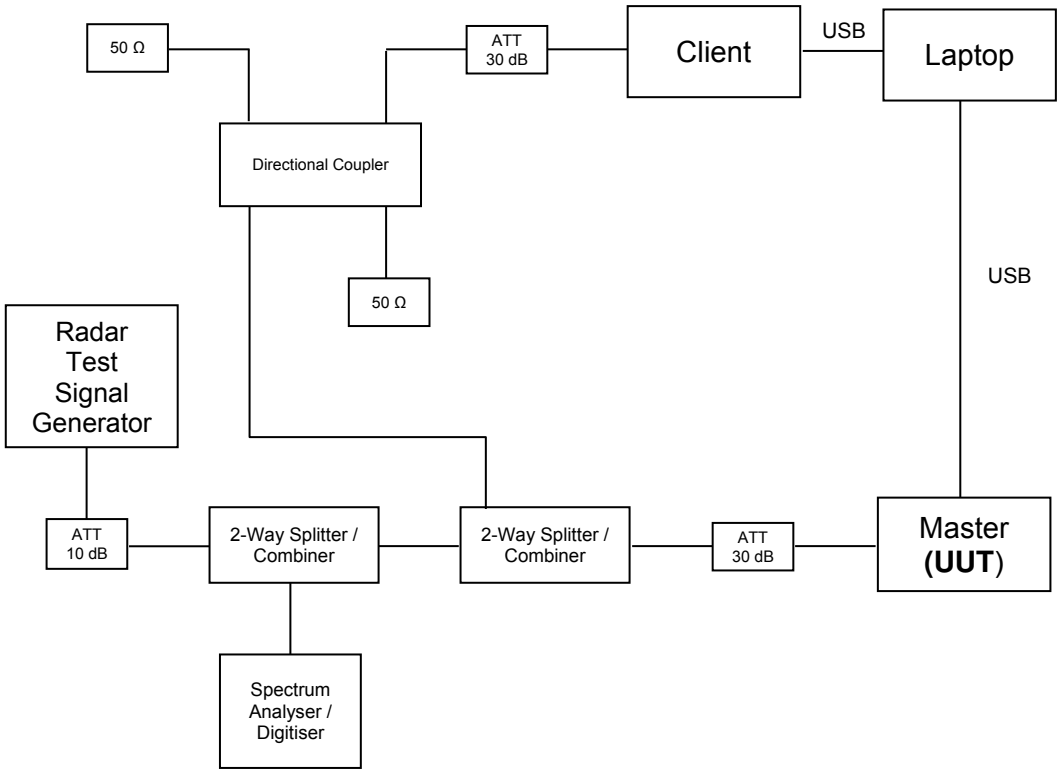
Product Service

1.9.2 DFS Setup

DFS testing was completed using the Conducted Test method as described in KDB 905462, clause 7.2. A frequency stable path was utilised between the Radar Test Signal Generator and the Radar Detection Device.

Conducted Setup for Master with injection at the Master

Setup for Master



Product Service

1.9.3 Test Channel, Channel Bandwidth and Data Rate Selection

This device is capable of operating within 5600 to 5650 MHz except when operating within the scope of Industry Canada RSS-247.

In cases where the fundamental emission channel bandwidth exceeds DFS band edges and where it is not possible to select a channel that has the entire emission bandwidth within the DFS band (e.g. 802.11ac 160 MHz), specific requirements and procedures are detailed further in the relevant test sections.

A single test channel was selected for each channel bandwidth of every mode. Where applicable, the control channels were identified. The following channels and data rates were utilised during testing:

Mode	Channel Bandwidth (MHz)	Data Rate (Mbps)	Fundamental Emission		Control Channel	
			Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
802.11a	20	6	56	5280	56	5280
802.11n	20	6.5	56	5280	56	5280
802.11n	40	13.5	52	5260	56	5280

1.9.4 Test Signal Selection and Calibration

The test signal calibration was completed using the calibration procedure as described in KDB 905462, clause 7.5.

The EUT is a master mode device employing a Radar Detection Device, with the following power and antenna assembly characteristics:

- The maximum declared antenna gain is 4.6 dBi. Testing was carried out in a worst case configuration using an antenna gain of 0 dBi.
- The maximum EIRP is 91.2 mW.
- The maximum power spectral density is <10 dBm/MHz.

Note that the maximum EIRP is based on the highest antenna gain. In the cases of MIMO devices, the maximum EIRP has been obtained according to KDB 662911.

A spectrum analyser was used to establish the test signal level for the radar types utilised during testing. During this process, there were no transmissions by the EUT or ancillary devices. The spectrum analyser was switched to the zero span (time domain) mode at the frequency of the radar waveform generator. The peak detector function of the spectrum analyser was utilised. The spectrum analyser resolution bandwidth and video bandwidth were set to 3 MHz.

According to KDB 905462, clause 5.2, Table 3, Note 2; throughout the test procedures an additional 1 dB should be added to the amplitude of the test transmission waveforms to account for variations in measurement equipment and thus ensuring that the test signal is at or above the detection threshold level to trigger a DFS response. As such, the radar test signal level was calibrated for each operating channel to a level of, the DFS Detection Threshold + 1dB; yielding a radar signal level of -61 dBm at the receiver.

Test waveforms conforming to KDB 905462, Clause 6 were utilised during testing. The parameters and calibration of the waveforms to be used for determining DFS compliance are detailed further.

Product Service

Step intervals of 0.1 μs for Pulse Width, 1 μs for PRI, 1 MHz for chirp width and 1 for the number of pulses were utilised for the random determination of specific test waveforms.

1.9.4.1 Short Pulse Radar Test Waveforms

An excerpt from KDB 905462, Clause 6.1 and Table 5 details the required parameters for short pulse radar test waveforms.

Table 5: Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μs)	PRI (μs)	Number of Pulses
0	1	1428	18
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	$RoundUp\left\{\frac{1}{360}\times\frac{19\times10^6}{PRI_{\mu sec}}\right\}$
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A	-
2	1-5	150-230	23-29
3	6-10	200-500	16-18
4	11-20	200-500	12-16
Note 1: Short Pulse Radar Type 0 shall only be used for the channel availability and detection bandwidth tests. It should be noted that any of the radar test waveforms 0 – 4 can be used for the channel availability and detection bandwidth tests.			

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

KDB 905462, Clause 6.1, Table 5a details 15 unique PRI values randomly selected from a list of 23 PRI values.

Table 5a: Pulse Repetition Intervals Values for Test A

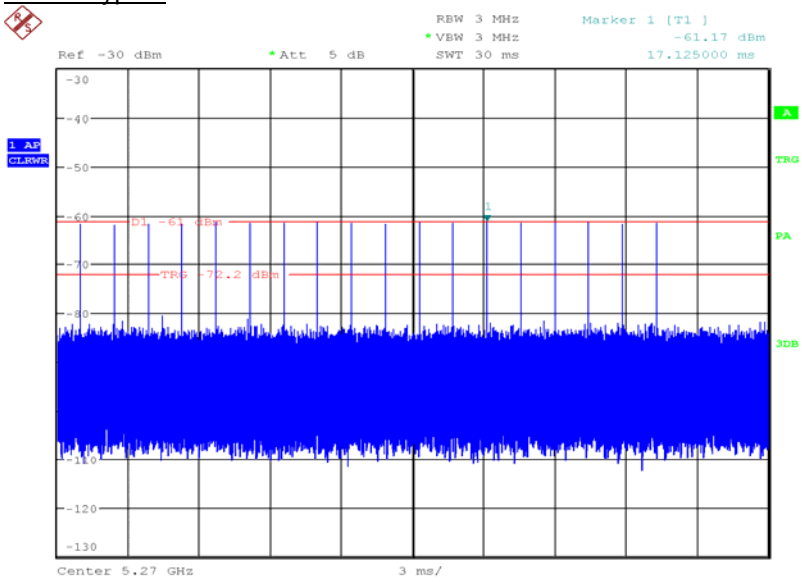
Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355.0	738
13	1319.3	758
14	1285.3	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

Spectrum analyser plots for the calibration of the burst of pulses on the Channel frequency were recorded. Test signal calibrations for each Short Pulse Radar Waveform Type utilised during testing are shown below.

Product Service

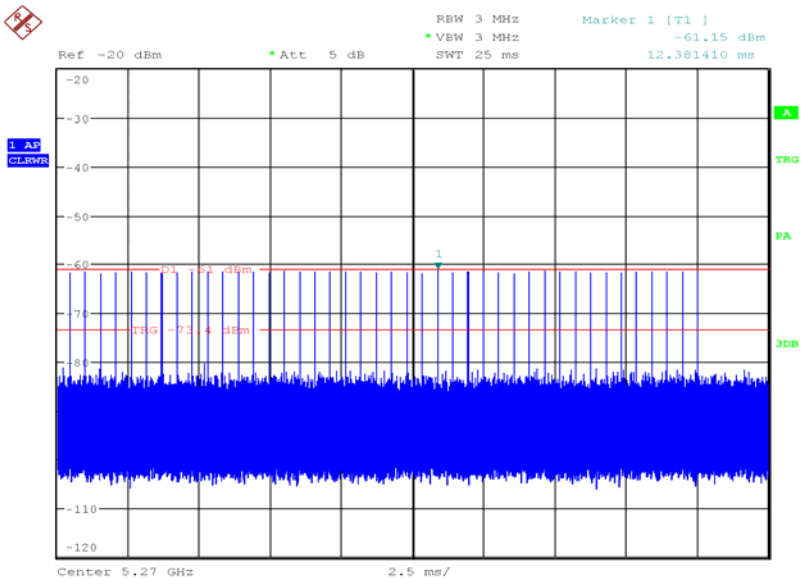
5270 MHz

Radar Type 0



Date: 8.JUL.2015 12:48:11

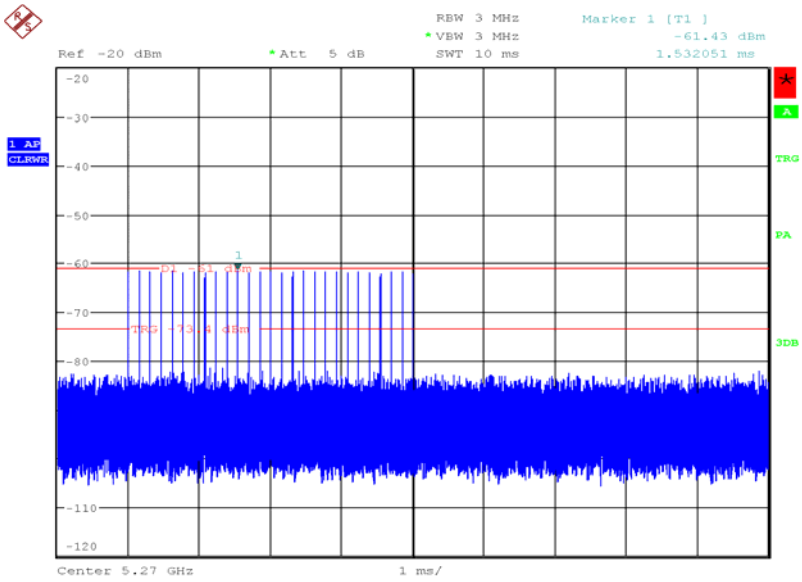
Radar Type 1



Date: 9.JUL.2015 08:31:28

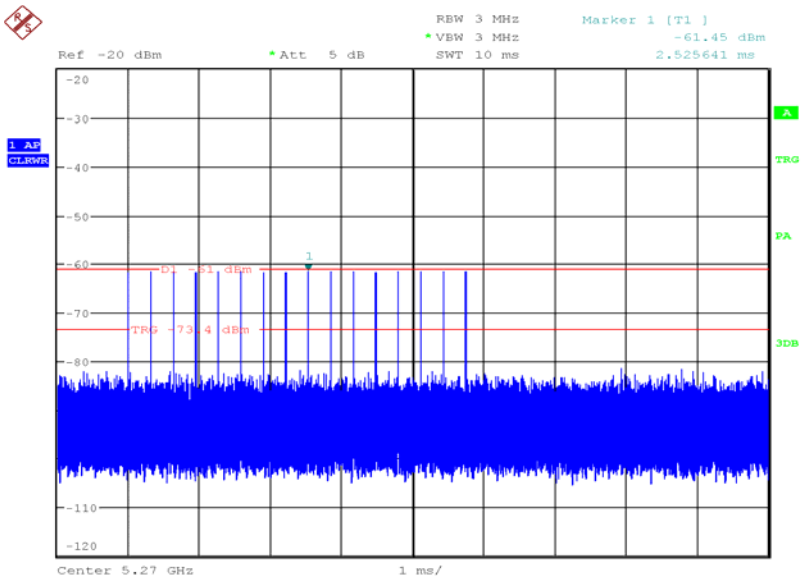
Product Service

Radar Type 2



Date: 9.JUL.2015 08:39:06

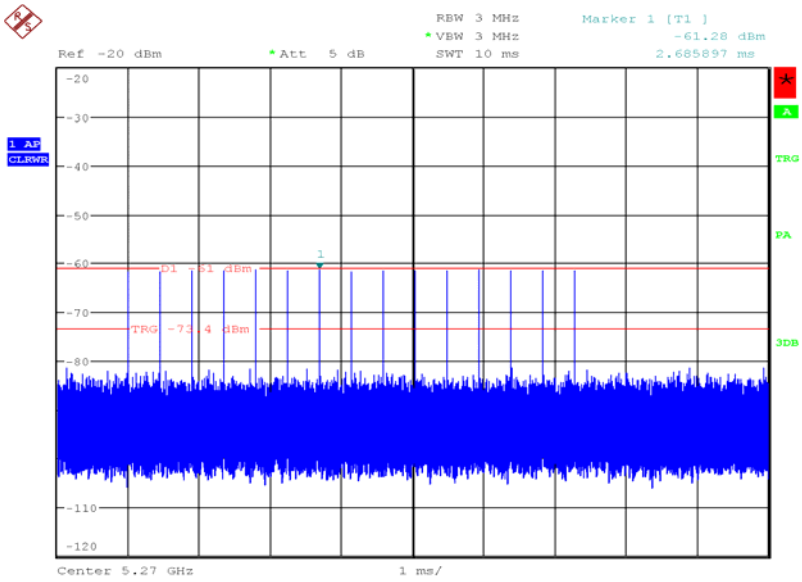
Radar Type 3



Date: 9.JUL.2015 08:42:37

Product Service

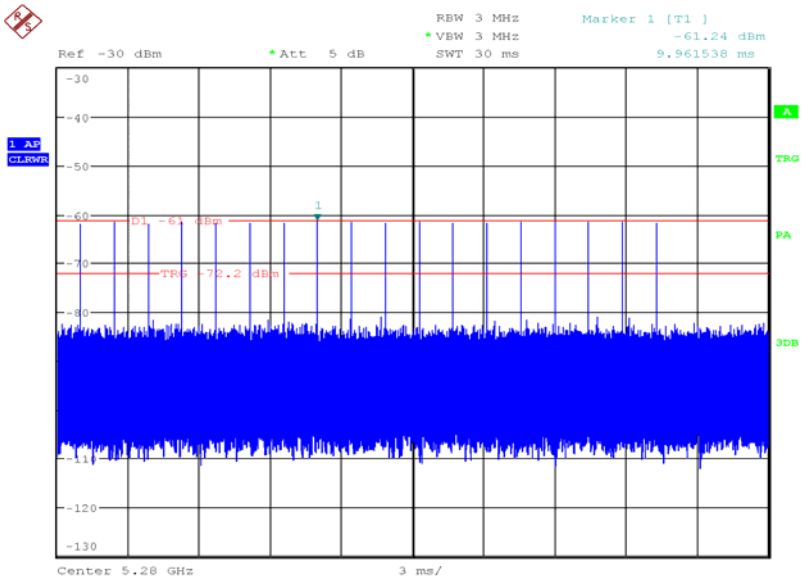
Radar Type 4



Date: 9.JUL.2015 08:45:36

5280 MHz

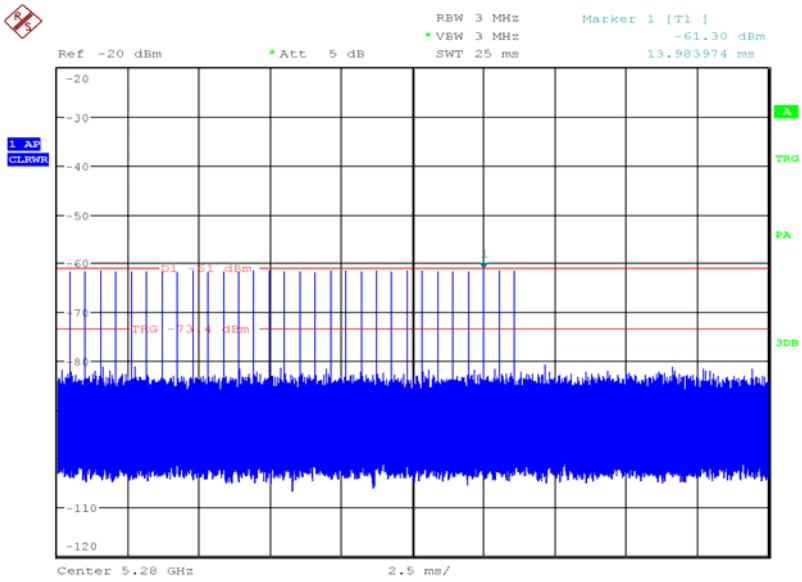
Radar Type 0



Date: 8.JUL.2015 12:49:28

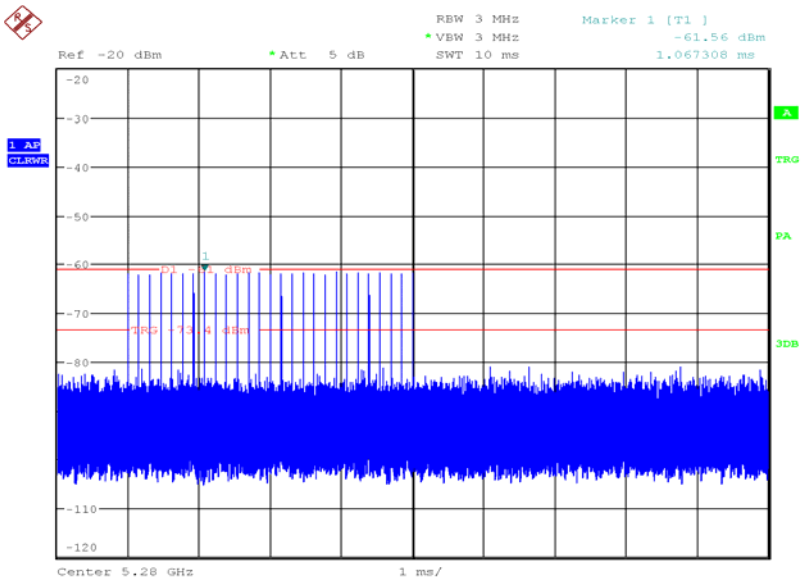
Product Service

Radar Type 1



Date: 9.JUL.2015 08:30:33

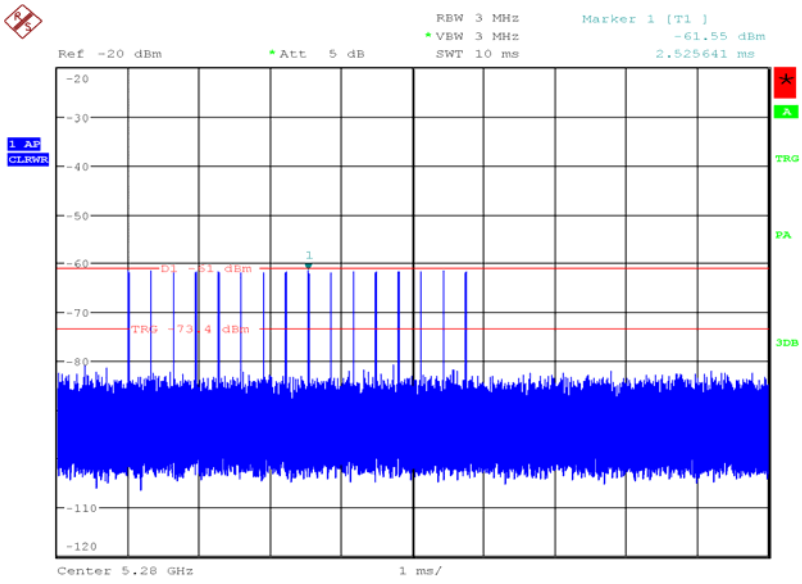
Radar Type 2



Date: 9.JUL.2015 08:40:04

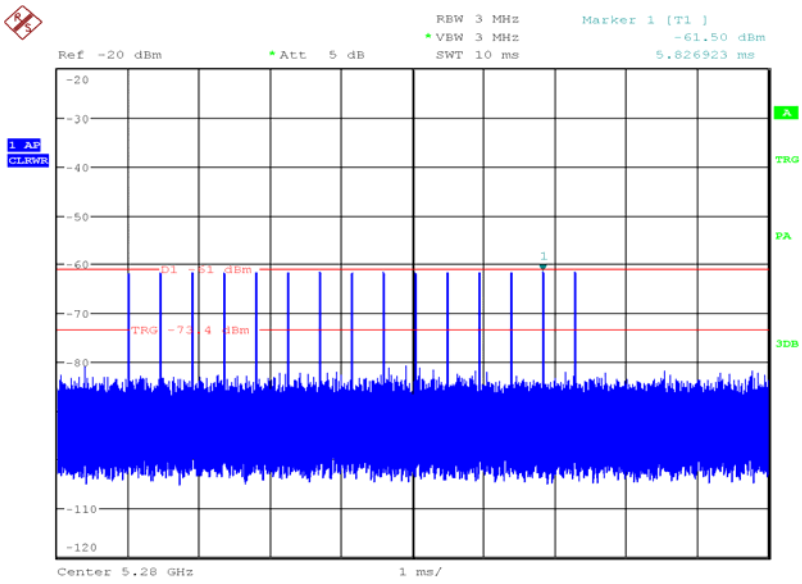
Product Service

Radar Type 3



Date: 9.JUL.2015 08:41:52

Radar Type 4



Date: 9.JUL.2015 08:46:26

Product Service

1.9.4.2 Long Pulse Radar Test Waveforms

An excerpt from KDB 905462, Clause 6.2 and Table 6 details the required parameters for long pulse radar test waveforms.

Table 6: Long Pulse Radar Test Waveforms

Radar Type	Pulse Width (µs)	Chirp Width (MHz)	PRI (µs)	Number of Pulses per Burst	Number of Bursts
5	50-100	5-20	1000-2000	1-3	8-20

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

Each waveform is defined as follows:

The transmission period for the Long Pulse Radar test signal is 12 seconds.

There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst_Count.

Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.

The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.

Each pulse has a linear frequency modulated chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.

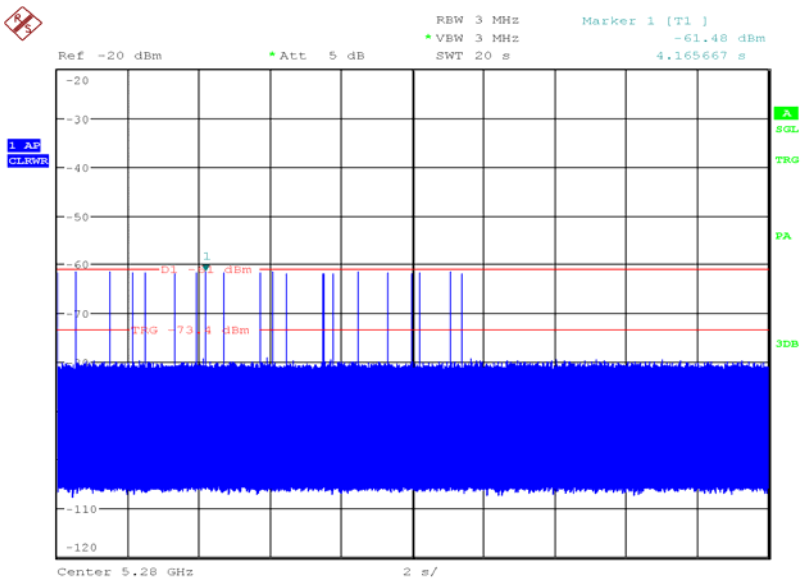
If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the random time interval between the first and second pulses is chosen independently of the random time interval between the second and third pulses.

A Spectrum analyser plot for the calibration of a single burst (1-3 pulses) on the channel frequency was recorded. Test signal calibration for the Long Pulse Radar Waveform Type utilised during testing is shown below.

Product Service

5270 MHz

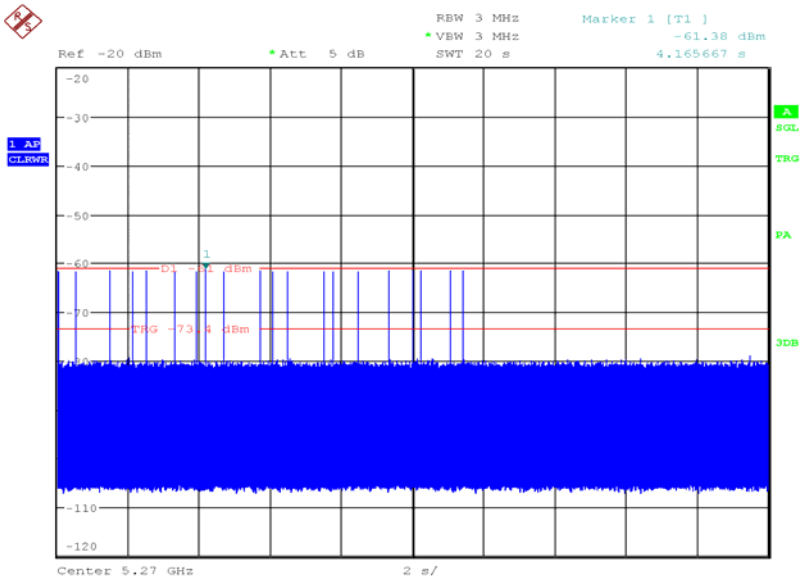
Radar Type 5



Date: 9.JUL.2015 08:57:38

5280 MHz

Radar Type 5



Date: 9.JUL.2015 08:56:31

Product Service

1.9.4.3 Frequency Hopping Radar Test Waveform

An excerpt from KDB 905462, Clause 6.3 and Table 7 details the required parameters for Frequency Hopping Radar test waveforms.

Table 7: Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µs)	PRI (µs)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)
6	1	333	9	0.333	300

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

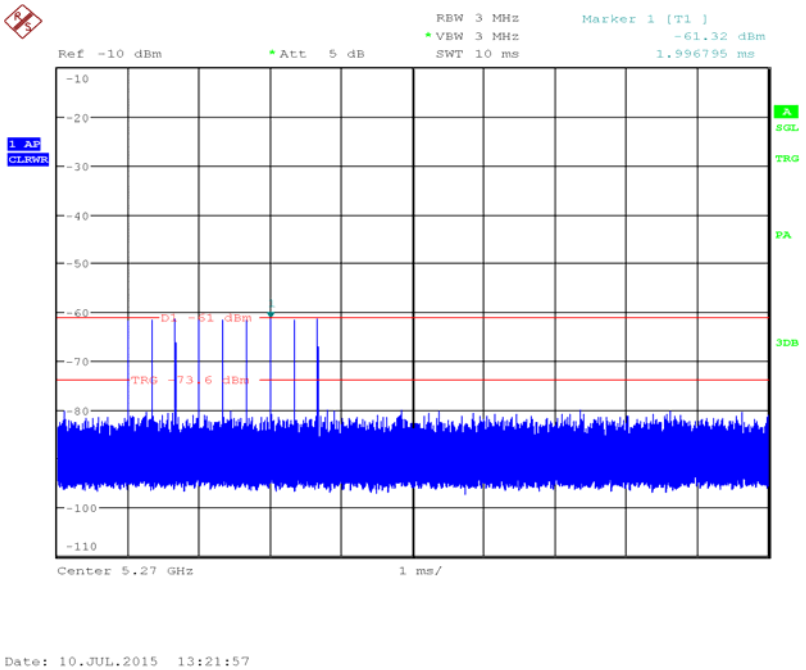
The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 MHz to 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

If a segment does not contain at least 1 frequency within the U-NII Detection Bandwidth of the EUT, then that segment is not used.

A spectrum analyser plot showing 9 pulses of a Frequency Hopping Radar Test Waveform on one frequency within the U-NII Detection Bandwidth was recorded and is shown below.

5270 MHz

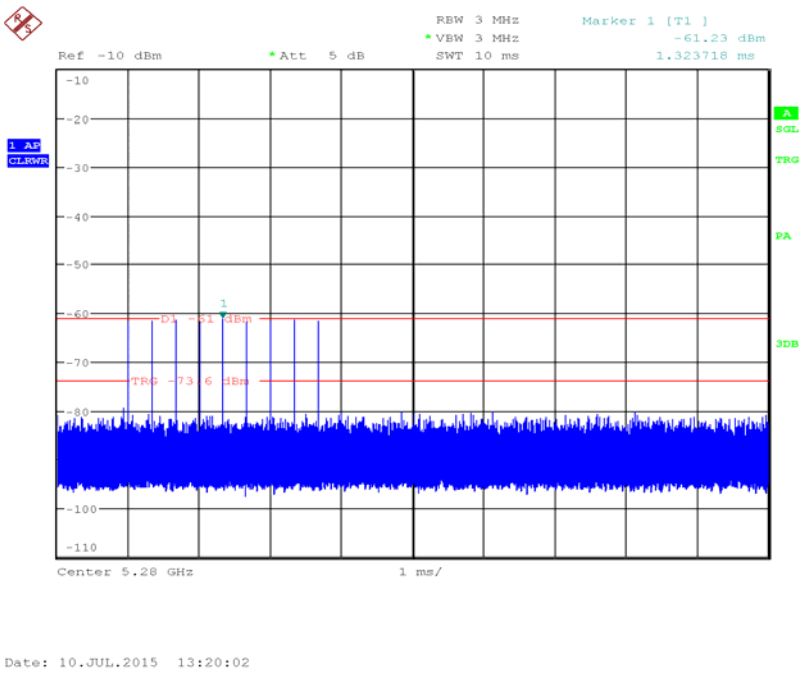
Radar Type 6



Product Service

5280 MHz

Radar Type 6



Date: 10.JUL.2015 13:20:02

1.9.5 Control Signal and Channel Loading Verification

Control Signal Verification

The presence of control signals were verified by disabling channel loading and monitoring with a spectrum analyser. A spectrum analyser utilising a peak detector was used to verify the control signals frequency.

Channel Loading

Initially, the Master was configured to a Client device. The system is an IP based system and data was transferred from the Master to the Client as per Clause 7.7.1.

Initial testing was carried out to determine which data rates/modulation schemes produced a duty cycle of >17 %. The EUT was configured to send equal length packets with a random ping interval as defined in Clause 7.7(b). A Unicast, (UDP), protocol was used as described in Clause 7.7(d).

The minimum channel loading requirement of 17 % was adhered to throughout all testing. Channel loading results for each operating mode and data rate under test has been recorded. These channel loading configurations were utilised throughout all testing unless otherwise stated.

The channel loading was determined using the methods described in KDB 789033 D02, Clause II.B. A spectrum analyser in zero-span mode was employed. A peak detector was utilised with resolution and video bandwidths that exceeded the fundamental emission bandwidth wherever possible. The measurement sweep trace showing transmissions on the channel frequency was exported to a data file and then analysed. An amplitude threshold was applied to the trace data in the file, such that all the total number of the sweep points that exceeded this threshold was determined. The duration of each sweep point was calculated by dividing the sweep time by the number of sweep points. The channel loading was calculated by multiplying this total number of sweep points by the time duration of each sweep point.

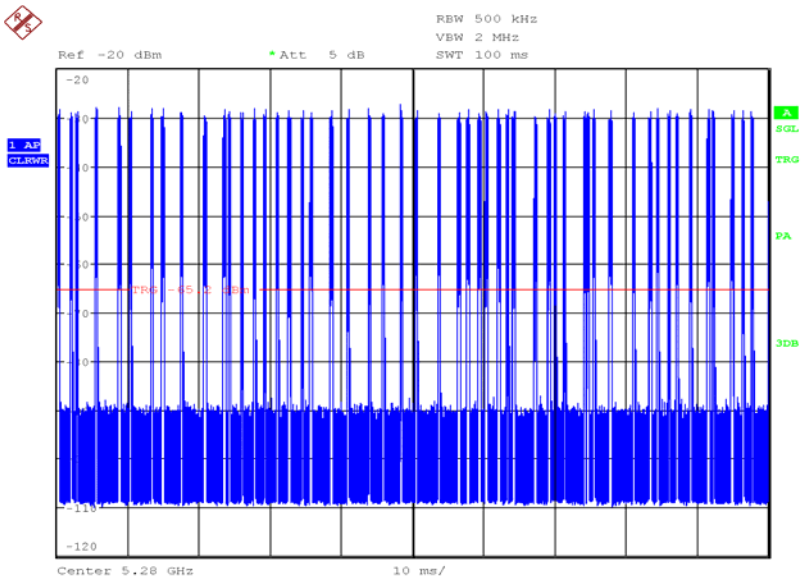
802.11a

Data Rate: 6 Mbps

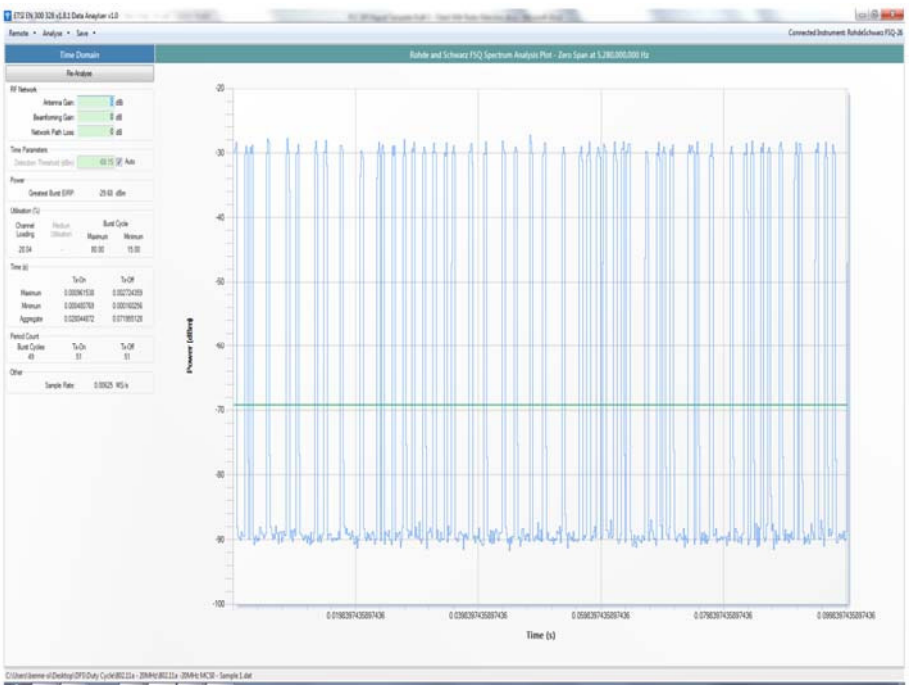
Channel Loading

5280 MHz

The channel loading was 28.04 %.



Date: 8.JUL.2015 10:56:59



Product Service

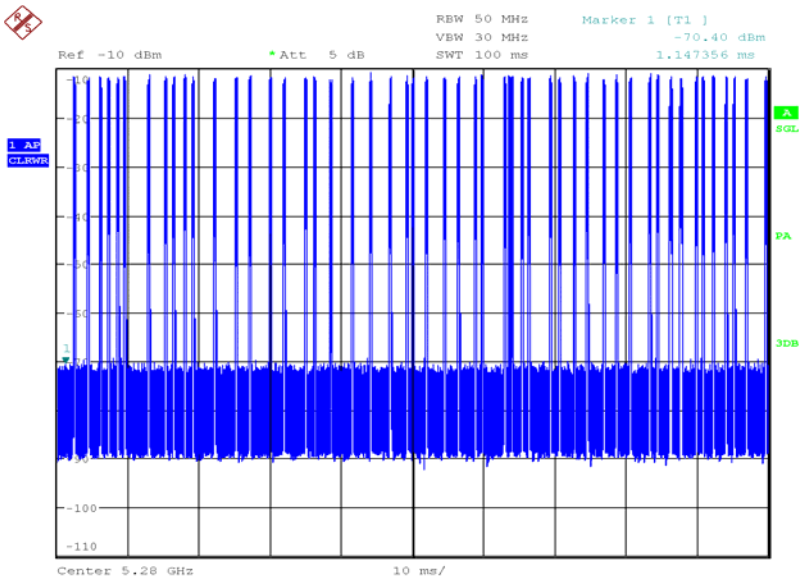
802.11n – 20 MHz Bandwidth

Data Rate: 6.5 Mbps

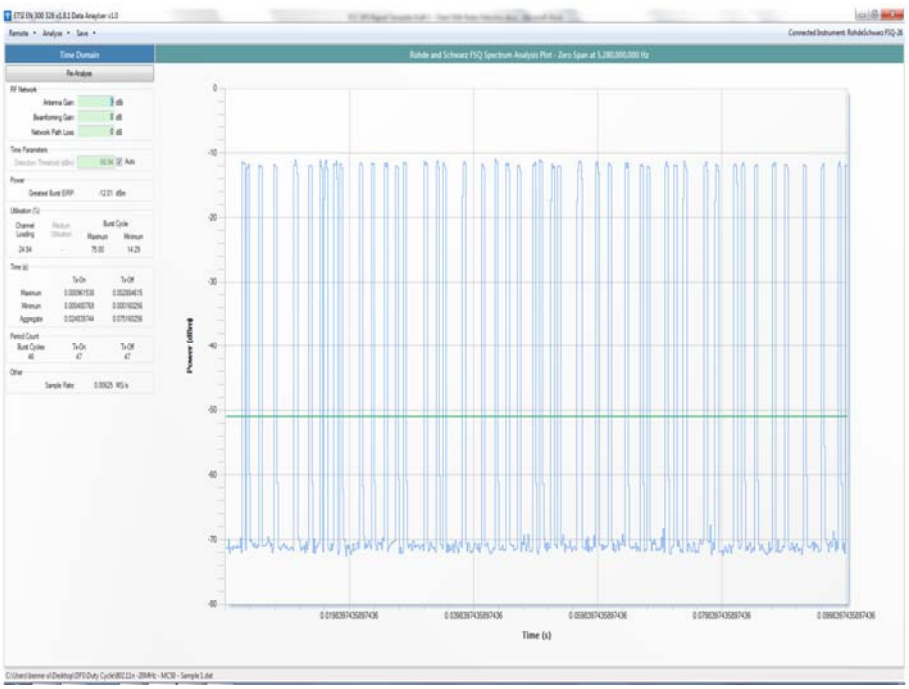
Channel Loading

5280 MHz

The channel loading was 24.84 %.



Date: 8.JUL.2015 10:10:23



802.11n – 40 MHz Bandwidth

Data Rate: 13 Mbps

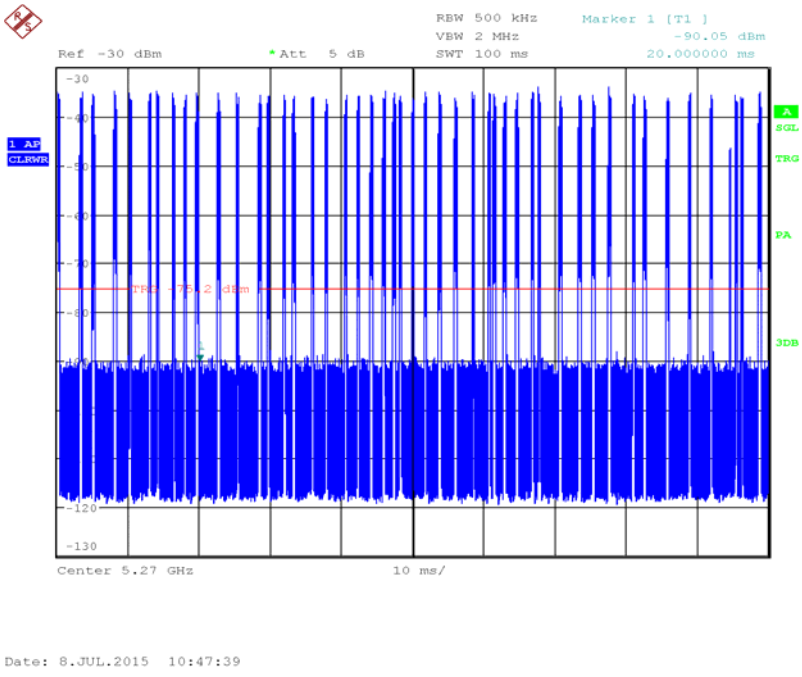
Control Channel Verification

Control signals were observed on test frequency 5260 MHz which was configured as the Primary Control Channel. 5280 MHz was configured as the supplementary channel. As the loading was reduced, it was observed that the Supplementary channel switched off to leave the Primary Channel.

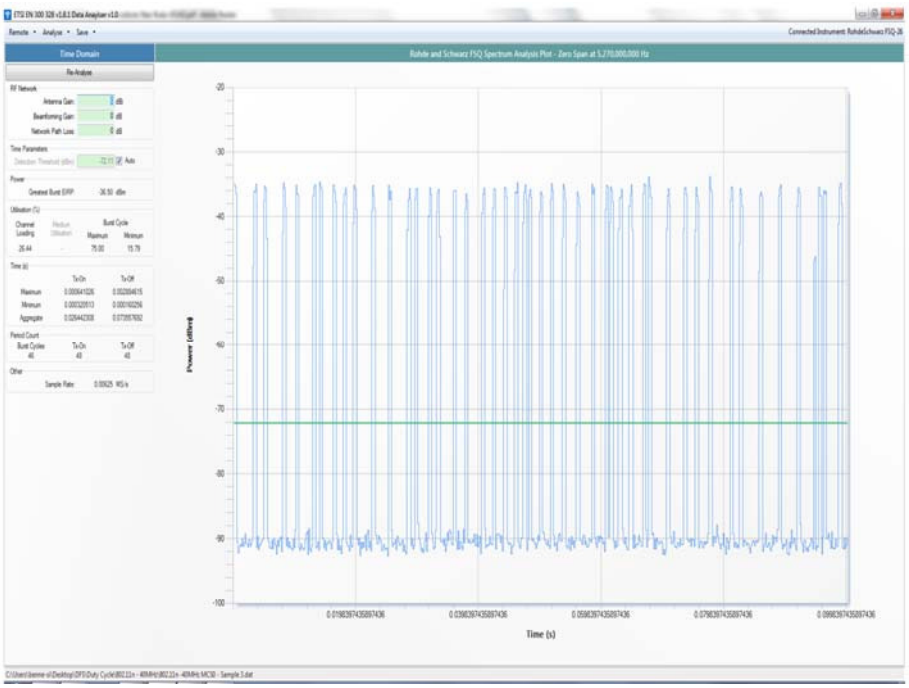
Channel Loading

5270 MHz

The channel loading was 26.44 %.



Product Service

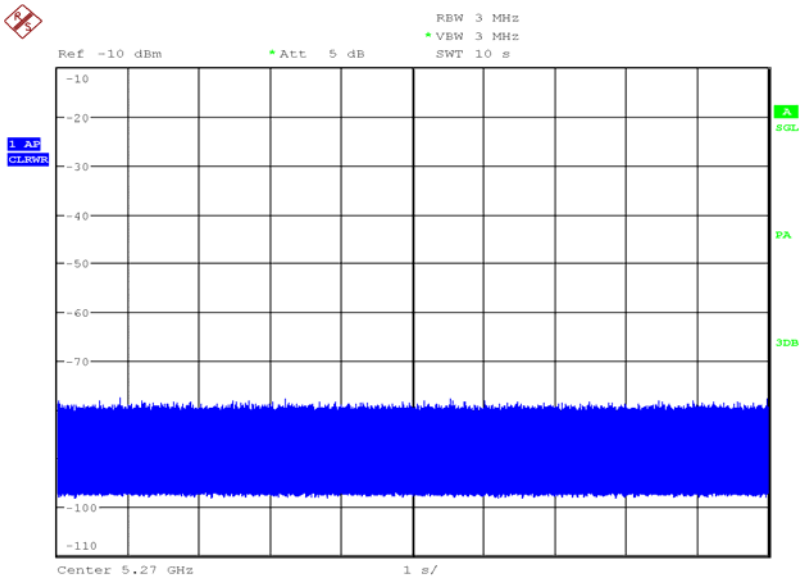


Product Service

1.9.6 Noise Floor Characterisation

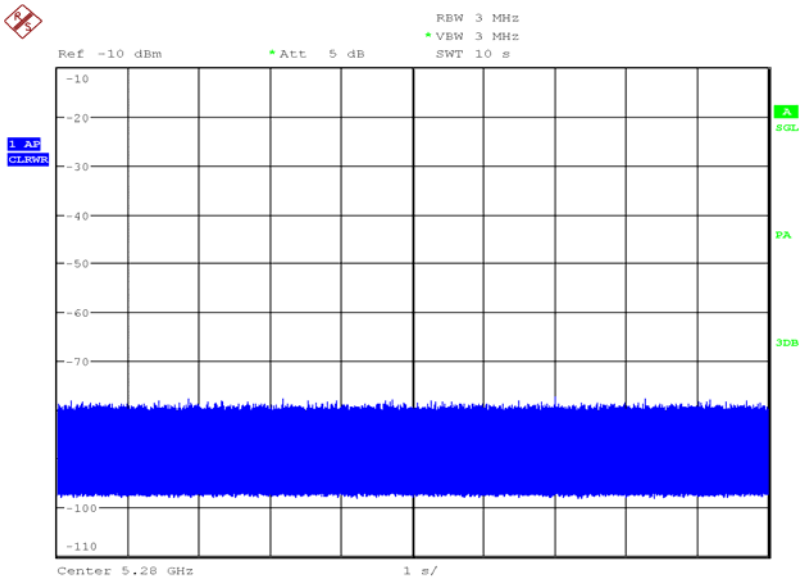
The noise floor of the spectrum analyser was characterised for each for comparative use with Availability Check, initial radar bursts, In-Service Monitoring, and 30 minute Non-Occupancy Period tests. The spectrum analyser centre frequency was set to each intended test frequency and utilised a peak detector with resolution and video bandwidths of 3 MHz

5270 MHz



Date: 8.JUL.2015 14:48:12

5280 MHz



Date: 8.JUL.2015 14:48:51

Product Service

SECTION 2

TEST DETAILS

DFS Testing of the
U-Blox WiBear11n-DF1
In accordance with FCC 47 CFR Part 15E and Industry Canada RSS-247

Product Service

2.1 U-NII DETECTION BANDWIDTH

2.1.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407 (h)(2)

2.1.2 Equipment Under Test and Modification State

WiBear11n-DF1 S/N: 0489341 - Modification State 0

2.1.3 Date of Test

8 July 2015

2.1.4 Environmental Conditions

Ambient Temperature	22.4 ºC
Relative Humidity	51.5 %

2.1.5 Test Requirements

The requirements according to KDB 905462, clause 5.3, Table 4:

The EUT must meet the minimum detection requirement within a minimum 100% of the U-NII 99% transmission power bandwidth.

During the U-NII Detection Bandwidth detection test, any one of radar types 0 - 4 can be used and for each frequency step the minimum percentage of detection is 90 %. Measurements are performed with no data traffic

The requirements according to KDB 905462, clause 7.8.1:

The U-NII Detection Bandwidth must meet the U-NII Detection Bandwidth criterion specified in Table 4. Otherwise, the EUT does not comply with DFS requirements. This is essential to ensure that the EUT is capable of detecting Radar Waveforms across the same frequency spectrum that contains the significant energy from the system. In the case that the U-NII Detection Bandwidth is greater than or equal to the 99 % power bandwidth for the measured F_H and F_L, the test can be truncated and the U-NII Detection Bandwidth can be reported as the measured F_H and F_L.

The U-NII Detection Bandwidth is calculated as follows:

U-NII Detection Bandwidth = $F_H - F_L$

Where F_H is highest frequency and F_L is the lowest frequency, at which detection is greater than or equal to the U-NII Detection Bandwidth criterion.

Product Service

2.1.6 Test Procedure

To determine the required detection bandwidth, the 99% occupied bandwidth was measured with the required resolution bandwidth of 200 kHz in conjunction with the occupied bandwidth measurement method described in KDB 789033 D02, Clause II.D.

The 99% occupied bandwidth of the fundamental emission was measured using a 99 % occupied bandwidth measurement function on a spectrum analyser. The spectrum analyser employed a peak detector utilising resolution and video bandwidths of 200 kHz and 1 MHz respectively.

The U-NII Detection Bandwidth was measured according to the method described in to KDB 905462, Clause 7.8.1.

The EUT was configured as a standalone device with no associations with any other devices and with no channel loading. Starting at the centre frequency of the EUT operating channel, a single radar burst of a short pulse radar test signal (types 0 to 4) was produced with a level of the required DFS Detection Threshold, at the antenna port of the EUT. The EUT response from this radar test signal was noted.

This procedure was repeated for a minimum of 10 trials, while adjusting the radar test signal frequency in ±5 MHz steps until the detection rate fell below the U-NII Detection Bandwidth criterion. At this point the previous procedure was repeated in 1 MHz steps until the highest and lowest frequencies were determined by the points at which detection was greater than or equal to the U-NII Detection Bandwidth criterion.

In cases where the fundamental emission channel bandwidth exceeds DFS band edges and where it is not possible to select a channel that has the entire emission bandwidth within the DFS band (e.g. 802.11ac 160 MHz); the detection bandwidth was tested up to the DFS band edges.

Product Service

2.1.7 Test Results

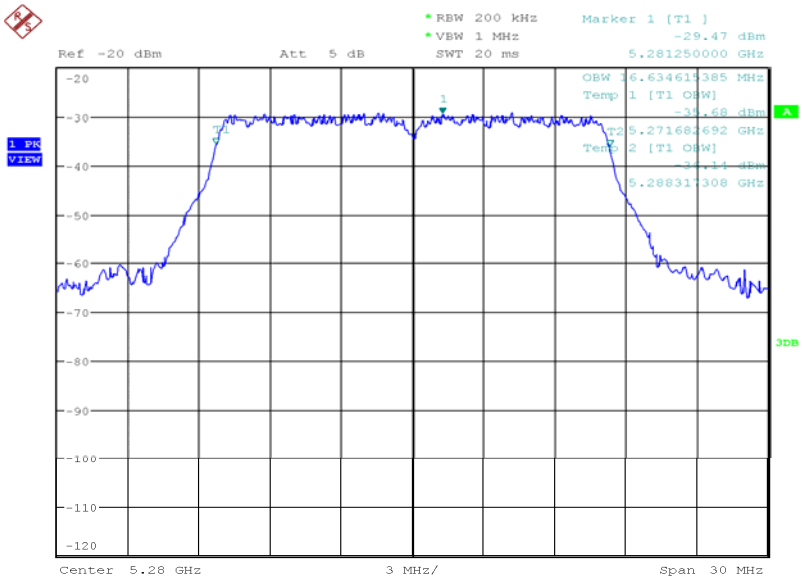
802.11a

Data Rate: 6 Mbps

5280 MHz

99 % Occupied Bandwidth

The measured occupied bandwidth was 16.634 MHz.



U-NII Detection Bandwidth

The specific parameters of the waveforms used during these measurements are detailed in Appendix A of this report.

The highest detection frequency is 5289 MHz and the lowest detection frequency is 5271 MHz, yielding a Detection Bandwidth of 18 MHz. The specific measurements are detailed below.

Radar Waveform	Radar Frequency Offset (MHz)	Number of Detections	Number of Non-detections	Detection Rate (%)
FCC Short Pulse Radar (Type 0)	-10	0	10	0
	-9	10	0	100
	-8	10	0	100
	-7	10	0	100
	-6	10	0	100
	-5	10	0	100
	0	10	0	100
	5	10	0	100
	6	10	0	100
	7	10	0	100
	8	10	0	100
	9	10	0	100
	10	0	10	0

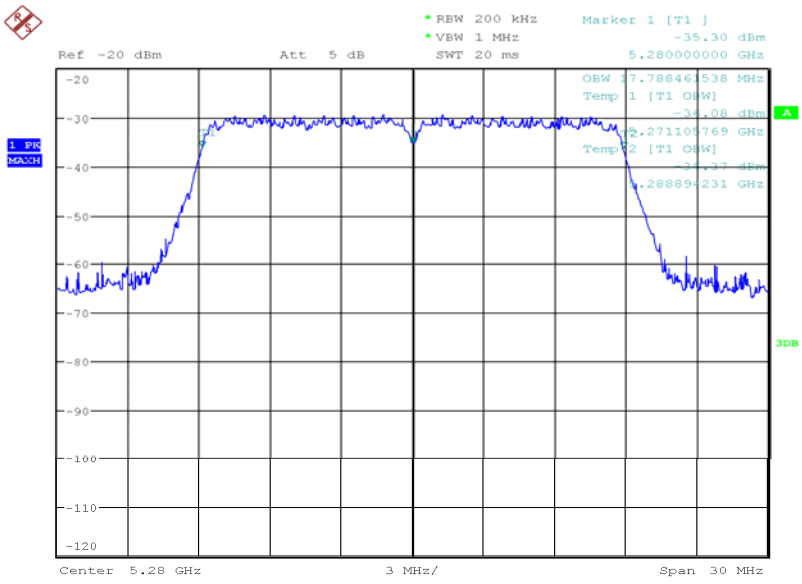
802.11n – 20 MHz Bandwidth

Data Rate: 6.5 Mbps

5280 MHz

99 % Occupied Bandwidth

The measured occupied bandwidth was 17.788 MHz.



Date: 8.JUL.2015 11:14:28

Product Service

U-NII Detection Bandwidth

The specific parameters of the waveforms used during these measurements are detailed in Appendix A of this report.

The highest detection frequency is 5289 MHz and the lowest detection frequency is 5271 MHz, yielding a Detection Bandwidth of 18 MHz. The specific measurements are detailed below.

Radar Waveform	Radar Frequency Offset (MHz)	Number of Detections	Number of Non-detections	Detection Rate (%)
FCC Short Pulse Radar (Type 0)	-10	0	10	0
	-9	10	0	100
	-8	10	0	100
	-7	10	0	100
	-6	10	0	100
	-5	10	0	100
	0	10	0	100
	5	10	0	100
	6	10	0	100
	7	10	0	100
	8	10	0	100
	9	10	0	100
	10	0	10	0

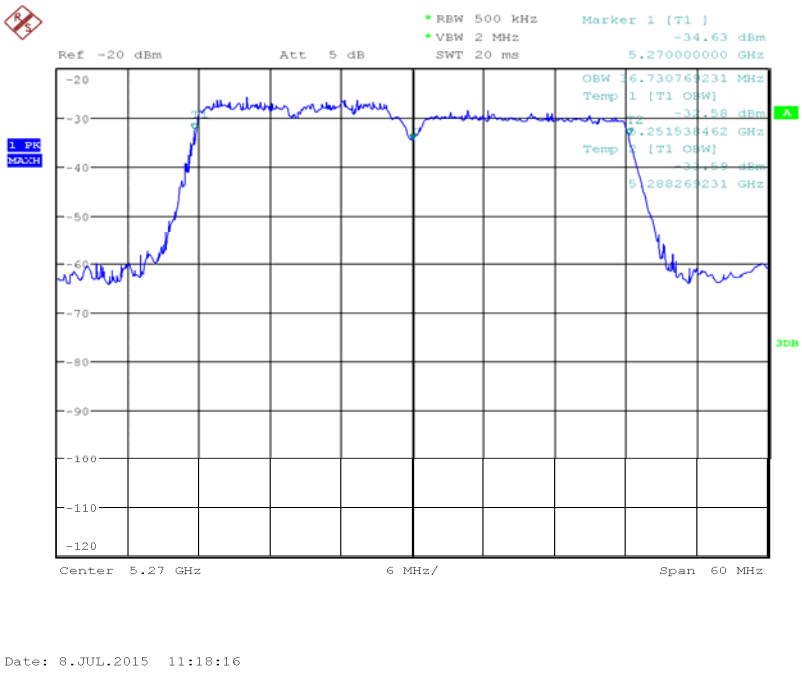
802.11n – 40 MHz Bandwidth

Data Rate: 13.5 Mbps

5270 MHz

99 % Occupied Bandwidth

The measured occupied bandwidth was 36.731 MHz.



Product Service

U-NII Detection Bandwidth

The specific parameters of the waveforms used during these measurements are detailed in Appendix A of this report.

The highest detection frequency is 5289 MHz and the lowest detection frequency is 5251 MHz, yielding a Detection Bandwidth of 38 MHz. The specific measurements are detailed below.

Radar Waveform	Radar Frequency Offset (MHz)	Number of Detections	Number of Non-detections	Detection Rate (%)
FCC Short Pulse Radar (Type 0)	-20	0	10	0
	-19	10	0	100
	-18	10	0	100
	-17	10	0	100
	-16	10	0	100
	-15	10	0	100
	-10	10	0	100
	-5	10	0	100
	0	10	0	100
	5	10	0	100
	10	10	0	100
	15	10	0	100
	16	10	0	100
	17	10	0	100
	18	10	0	100
	19	10	0	100
	20	0	10	0

Product Service

2.2 INITIAL CHANNEL AVAILABILITY CHECK TIME

2.2.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407 (h)(2)(ii)
Industry Canada RSS-247, Clause 6.3 (2)(ii)

2.2.2 Equipment Under Test and Modification State

WiBear11n-DF1 S/N: 0489341 - Modification State 0

2.2.3 Date of Test

8 July 2015

2.2.4 Environmental Conditions

Ambient Temperature	23.7 ºC
Relative Humidity	46.3 %

2.2.5 Test Requirements

The requirements according to FCC 47 CFR Part 15, clause 15.407 (h)(2)(ii) are described below.

A master mode 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 DFS detection threshold, is detected within 60 seconds.

In addition, according to KDB 905462, clause 5.3, Table 4; the channel availability check shall be performed for a minimum of 60 seconds by the U-NII device.

2.2.6 Test Procedure

The measurement was made in accordance with the method described in to KDB 905462, Clause 7.8.2.1.

The Initial Channel Availability Check 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, therefore this test does not use any Radar Waveforms and was only performed once for each mode and test frequency.

A spectrum analyser was used for measurements. The spectrum analyser centre frequency was set to the intended test frequency and utilised a peak detector with resolution and video bandwidths of 3 MHz. During the channel availability testing a measurement sweep duration no less than 2.5 minutes was observed. The spectrum analyser sweep was started at the same time that power was applied to the EUT.

The manufacturer declared that the power-cycle time is 0 seconds.

When performing channel availability check measurements, the EUT was pre-configured to operate in each mode and set to operate on the test frequency before commencing the Channel Availability Check. Upon the EUT CAC being started, the spectrum analyser sweep was triggered whereby the channel activity was monitored. Using delta markers on the measurement sweep, the channel availability check time was determined. The start of sweep, (0 seconds), was the start of the EUT's CAC period.

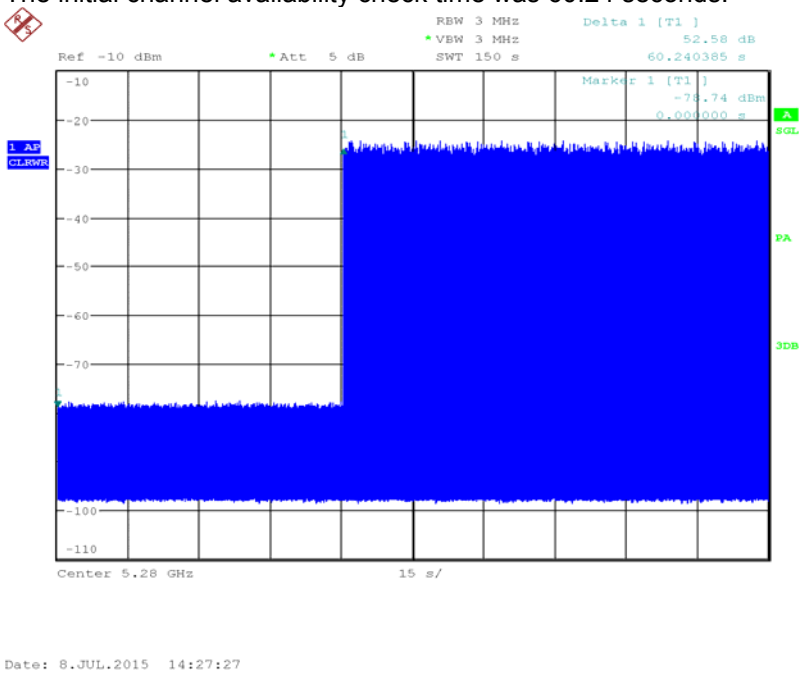
The spectrum analyser nominal noise floor was characterised with a 10 second sweep time before testing, using the same resolution and video bandwidths utilised during testing. During this process, there were no transmissions by the EUT or companion devices.

2.2.7 Test Results

802.11a

Data Rate: 6 Mbps

The initial channel availability check time was 60.24 seconds.

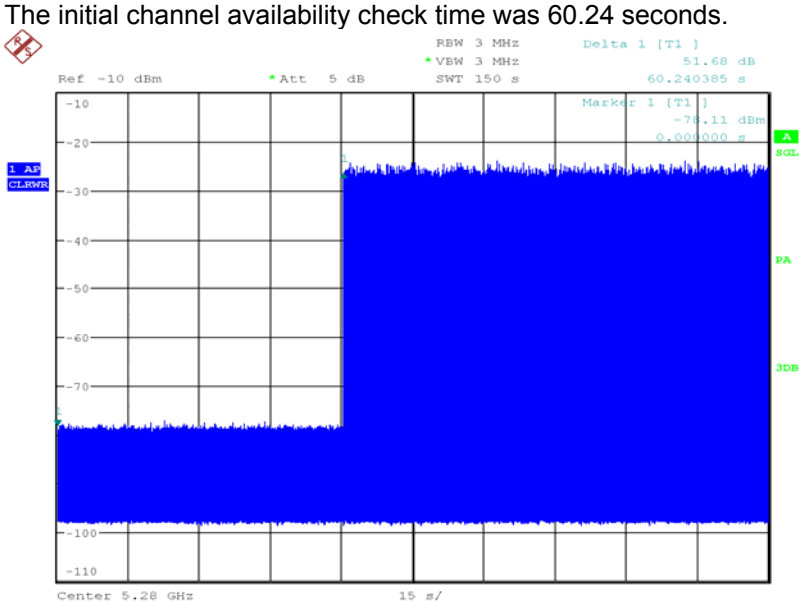


Product Service

802.11n – 20 MHz Bandwidth

Data Rate: 6.5 Mbps

The initial channel availability check time was 60.24 seconds.



Product Service

2.3 RADAR BURST AT THE BEGINNING OF THE CHANNEL AVAILABILITY CHECK TIME

2.3.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407 (h)(2)(ii)
Industry Canada RSS-247, Clause 6.3 (2)(ii)

2.3.2 Equipment Under Test and Modification State

WiBear11n-DF1 S/N: 0489341 - Modification State 0

2.3.3 Date of Test

8 July 2015

2.3.4 Environmental Conditions

Ambient Temperature	23.8 ºC
Relative Humidity	45.4 %

2.3.5 Test Requirements

The requirements according to FCC 47 CFR, clause 15.407 (h)(2)(ii) are described below.

A master mode 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 DFS detection threshold, is detected within 60 seconds.

In addition, according to KDB 905462, clause 5.3, Table 4; the channel availability check shall be performed for a minimum of 60 seconds by the U-NII device.

2.3.6 Test Procedure

The measurement was made in accordance with the method described in to KDB 905462, Clause 7.8.2.2.

The radar burst at the beginning of the channel availability check time verifies successful radar detection on the test channel during a period equal to the channel availability check time as well as 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 of the channel availability check time.

A spectrum analyser was used for measurements. The spectrum analyser centre frequency was set to the intended test frequency and utilised a peak detector with resolution and video bandwidths of 3 MHz.

When performing channel availability check measurements, the EUT was pre-configured to operate in each mode and set to operate on the test frequency before commencing the Channel Availability Check. Upon the EUT CAC being started, the spectrum analyser sweep was triggered whereby the channel activity was monitored. Using delta markers on the measurement sweep, the Radar signal injection time was indicated. The start of sweep, (0 seconds), was the start of the EUT's CAC period.

Product Service

A single short pulse radar type 0 was applied to the EUT receiver within 6 seconds of the beginning of the channel availability check time, at a level equal to the detection threshold level + 1 dB, accounting for equipment variation/errors.

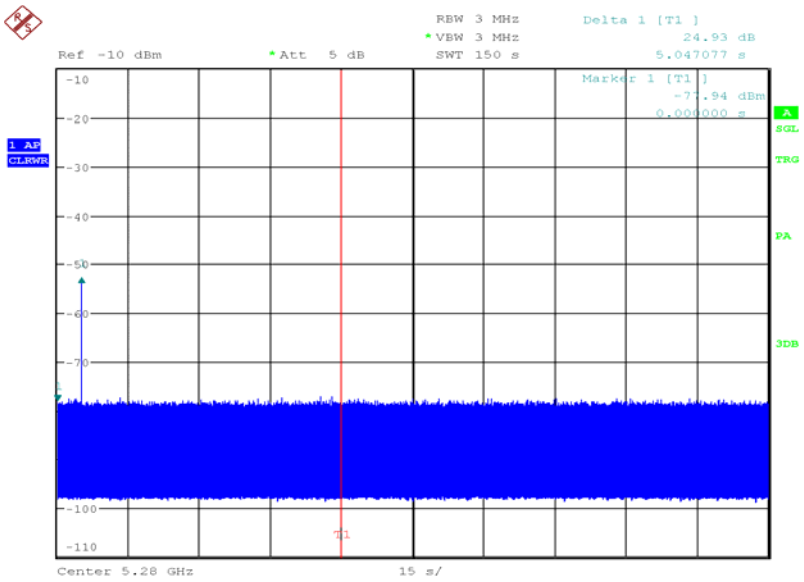
The measurement observation period was no less than 2.5 minutes proceeding the time at with the radar test signal was generated. It was verified that no EUT transmissions occurred on the test channel during this 2.5 minutes measurement period.

2.3.7 Test Results

802.11a

Data Rate: 6 Mbps

It was verified that no transmissions were produced from the EUT on the test channel during the channel availability check time.

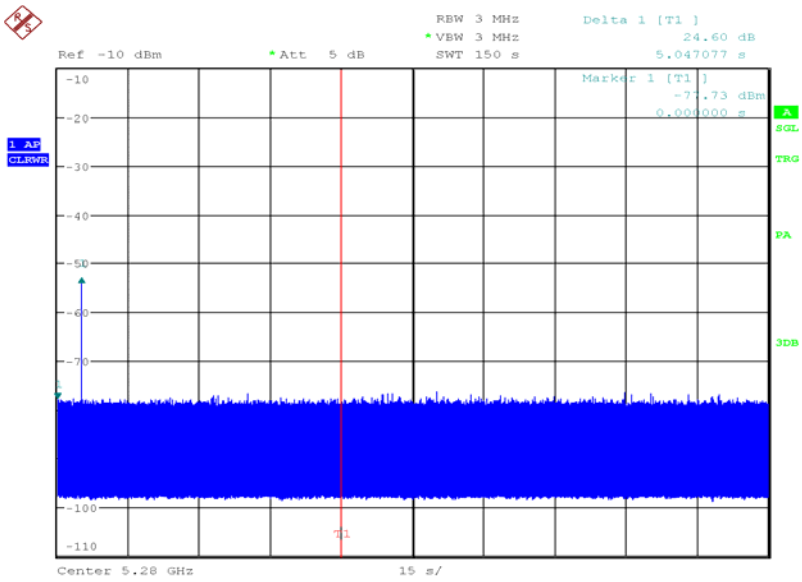


Note: T1 denotes 60 second CAC period. Marker delta denotes Radar injection time relative to CAC Start time.

802.11n – 20 MHz Bandwidth

Data Rate: 6.5 Mbps

It was verified that no transmissions were produced from the EUT on the test channel during the channel availability check time.



Note: T1 denotes 60 second CAC period. Marker delta denotes Radar injection time relative to CAC Start time.

Product Service

2.4 RADAR BURST AT THE END OF THE CHANNEL AVAILABILITY CHECK TIME

2.4.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407 (h)(2)(ii)
Industry Canada RSS-247, Clause 6.3 (2)(ii)

2.4.2 Equipment Under Test and Modification State

WiBear11n-DF1 S/N: 0489341 - Modification State 0

2.4.3 Date of Test

8 July 2015

2.4.4 Environmental Conditions

Ambient Temperature	24.1 ºC
Relative Humidity	44.0 %

2.4.5 Test Requirements

The measurement was made in accordance with the method described in to KDB 905462, Clause 7.8.2.1.

The requirements according to FCC 47 CFR Part 15, clause 15.407 (h)(2)(ii) are described below.

A master mode 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 DFS detection threshold, is detected within 60 seconds.

In addition, according to KDB 905462, clause 5.3, Table 4; the channel availability check shall be performed for a minimum of 60 seconds by the U-NII device.

2.4.6 Test Procedure

The radar burst at the end of the channel availability check time verifies successful radar detection on the test channel during a period equal to the channel availability check time as well as 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 of the channel availability check time.

A spectrum analyser was used for measurements. The spectrum analyser centre frequency was set to the intended test frequency and utilised a peak detector with resolution and video bandwidths of 3 MHz.

When performing channel availability check measurements, the EUT was pre-configured to operate in each mode and set to operate on the test frequency before commencing the Channel Availability Check. Upon the EUT CAC being started, the spectrum analyser sweep was triggered whereby the channel activity was monitored. Using delta markers on the measurement sweep, the Radar signal injection time was indicated. The start of sweep, (0 seconds), was the start of the EUT's CAC period.

A single short pulse radar type 0 was applied to the EUT receiver within 6 seconds of the end of the channel availability check time, at a level equal to the detection threshold level + 1 dB, accounting for equipment variation/errors.

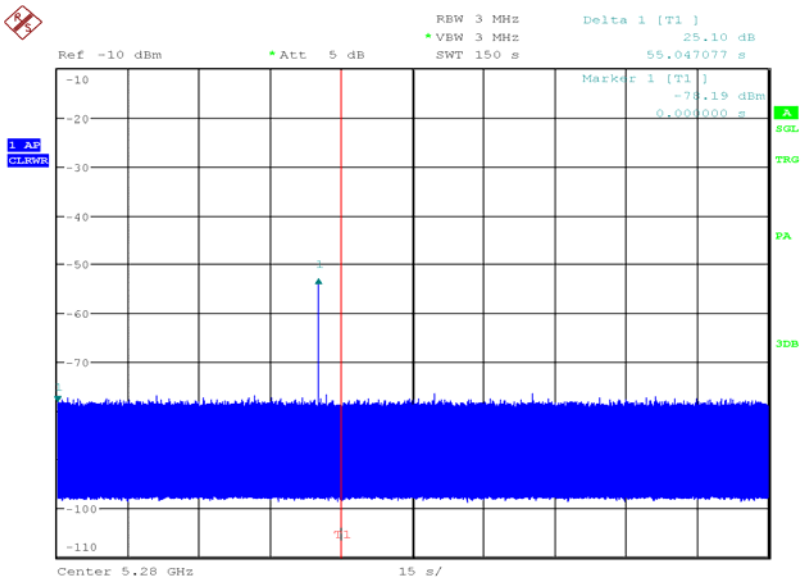
The measurement observation period was no less than 2.5 minutes proceeding the time at with the radar test signal was generated. It was verified that no EUT transmissions occurred on the test channel during this 2.5 minutes measurement period.

2.4.7 Test Results

802.11a

Data Rate: 6 Mbps

It was verified that no transmissions were produced from the EUT on the test channel during the channel availability check time.



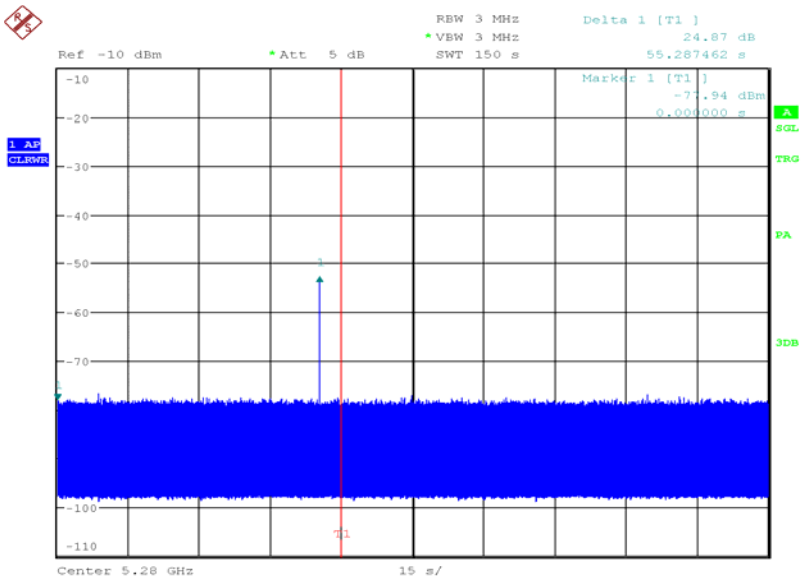
Date: 8.JUL.2015 16:13:44

Note: T1 denotes 60 second CAC period. Marker delta denotes Radar injection time relative to CAC Start time.

802.11n – 20 MHz Bandwidth

Data Rate: 6.5 Mbps

It was verified that no transmissions were produced from the EUT on the test channel during the channel availability check time.



Note: T1 denotes 60 second CAC period. Marker delta denotes Radar injection time relative to CAC Start time.

Product Service

2.5 IN-SERVICE MONITORING FOR CHANNEL MOVE TIME, CHANNEL CLOSING TRANSMISSION TIME AND NON-OCCUPANCY PERIOD

2.5.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407 (h)(2)(ii)
Industry Canada RSS-247, Clause 6.3 (2)(i)(iii)(iv)

2.5.2 Equipment Under Test and Modification State

WiBear11n-DF1 S/N: 0489341 - Modification State 0

2.5.3 Date of Test

8 July 2015

2.5.4 Environmental Conditions

Ambient Temperature	23.9 ºC
Relative Humidity	40.9 %

2.5.5 Test Requirements

The requirements according to FCC 47 CFR Part 15, clause 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.

The requirements according to FCC 47 CFR Part 15, clause 15.407 (h)(2)(iv). 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.

In addition, according to KDB 905462, clause 5.3, Table 4; the following requirements apply:

- The channel move time is 10 seconds. The channel move time begins at the end of the final pulse of the type 0 radar test signal.
- The channel closing transmission time, 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.
- The non-occupancy period is a minimum of 30 minutes.

Product Service

2.5.6 Test Procedure

The measurement was made in accordance with the method described in to KDB 905462, Clause 7.8.3.

Two test sequences were conducted to verify in-service monitoring:

1. Channel move time and channel closing transmission time.
2. Non-occupancy period.

Each test frequency was verified to contain control signals during the control signals and channel loading verification. The presence of control signals were verified by disabling channel loading and monitoring with a spectrum analyser.

The channel was loaded with data transmissions from the master mode device to the associated client device. A type 0 radar test signal was applied to the EUT/Master mode device, at a level equal to the detection threshold + 1 dB, accounting for equipment variation/errors.

Channel Move Time and Channel Closing Transmission Time

The transmissions of the EUT were observed for a duration greater than 10 seconds, after the final radar pulse. The transmissions from the EUT during the observation time were measured, such that the channel move time and channel closing transmission time were determined.

Non-occupancy Period

The test frequency was monitored for no less than 30 minutes after the channel move time to verify that the EUT did not resume transmissions during the non-occupancy period.

Product Service

2.5.7 Test Results

802.11a

Data Rate: 6 Mbps

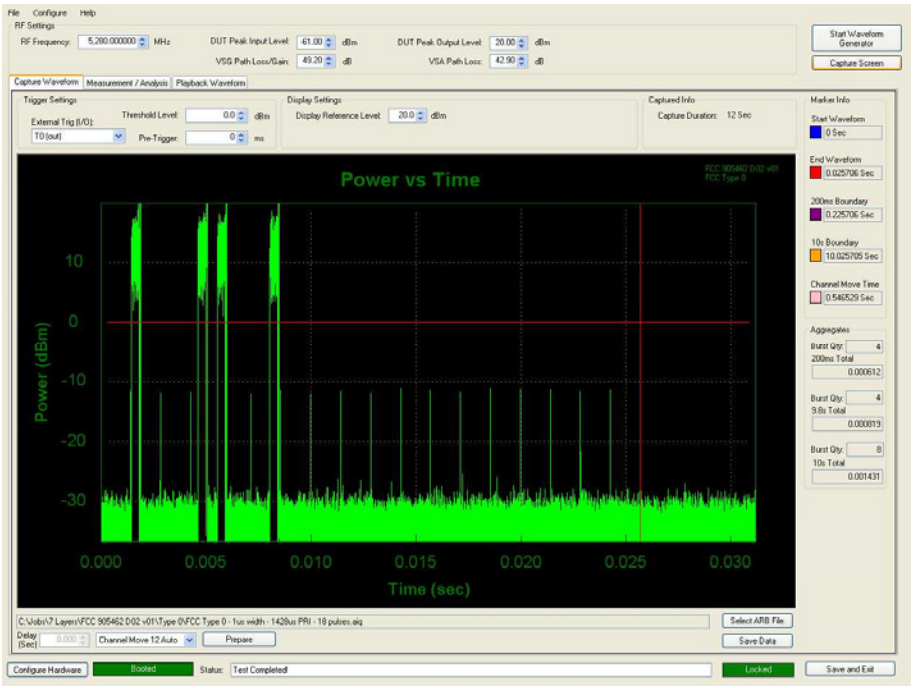
Channel Move Time	0.547 seconds
Channel Closing Transmission Time	1.431 ms

Channel Move and Close Time Summary

Radar Type	Channel Move Time (seconds)	Channel Closing Time (ms)
1	0.540	1.432
2	0.537	1.501
3	0.539	1.676
4	0.540	1.428
5	0.767	0
6	0.678	1.072

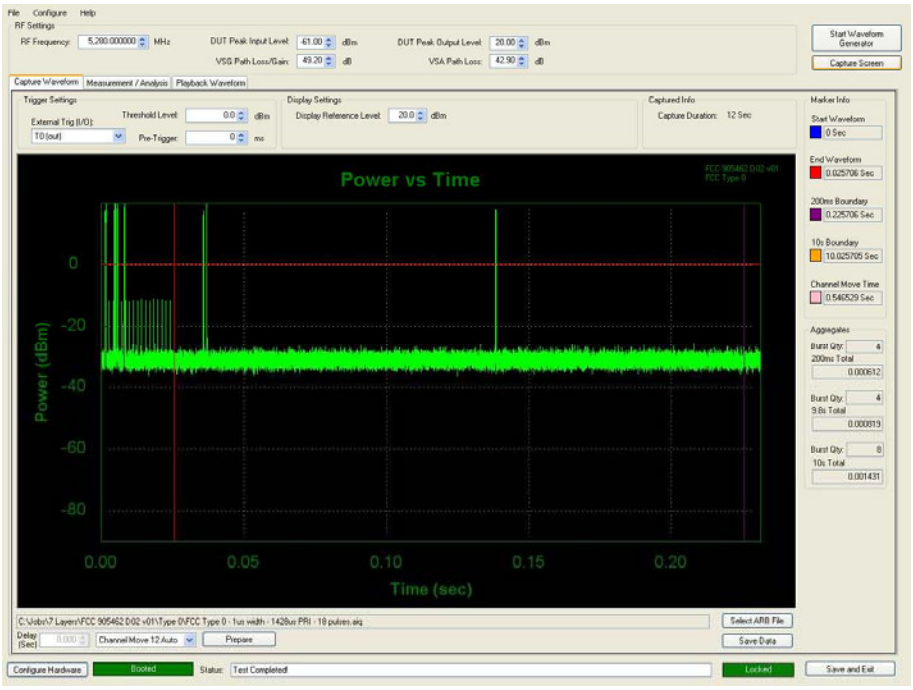
Channel Move Time and Channel Closing Transmission Time

Radar Test Signal Verification Plot

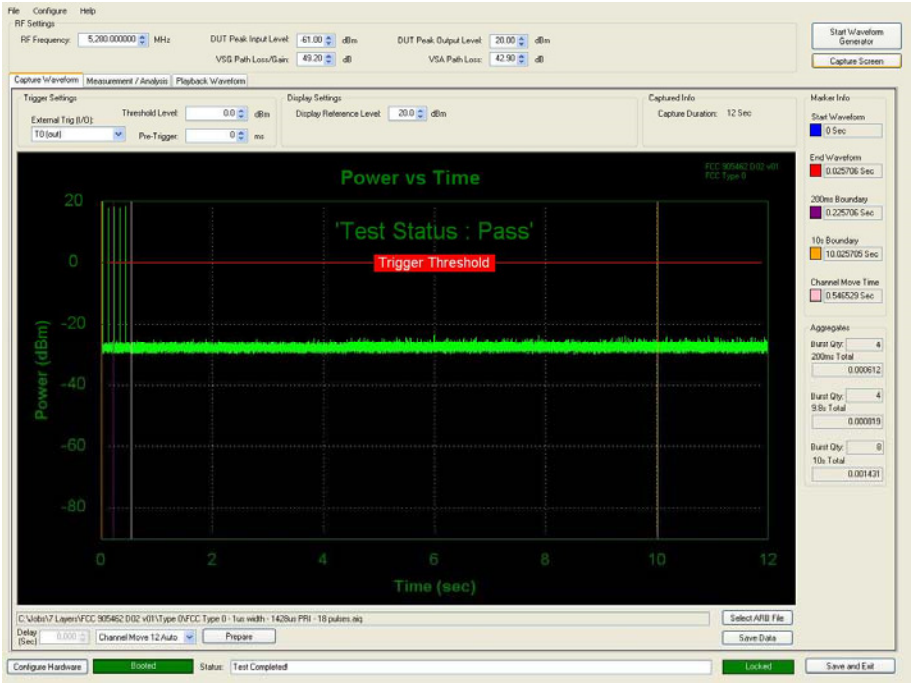


Product Service

250 ms Test Observation Period



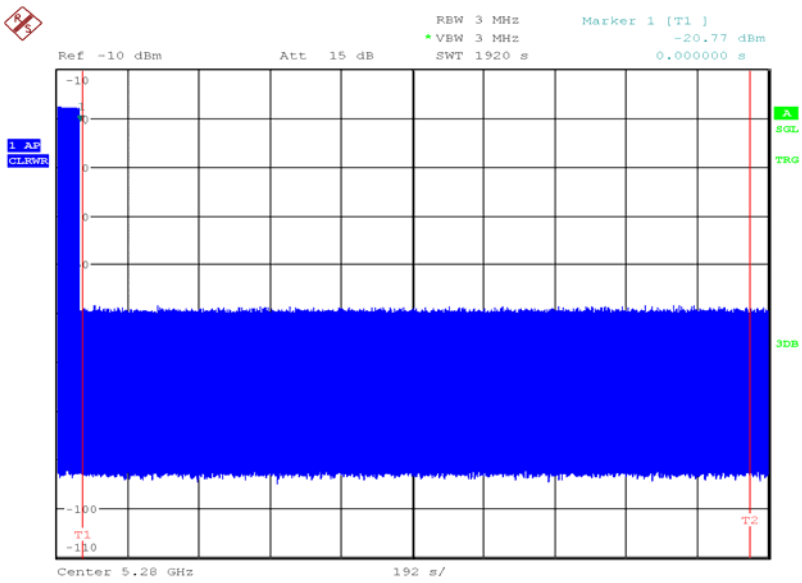
12 s Test Observation Period



Product Service

Non-occupancy Period

The EUT did not resume transmissions during the non-occupancy period.



Date: 9.JUL.2015 08:09:19

802.11n – 40 MHz Bandwidth

Data Rate: 13.5 Mbps

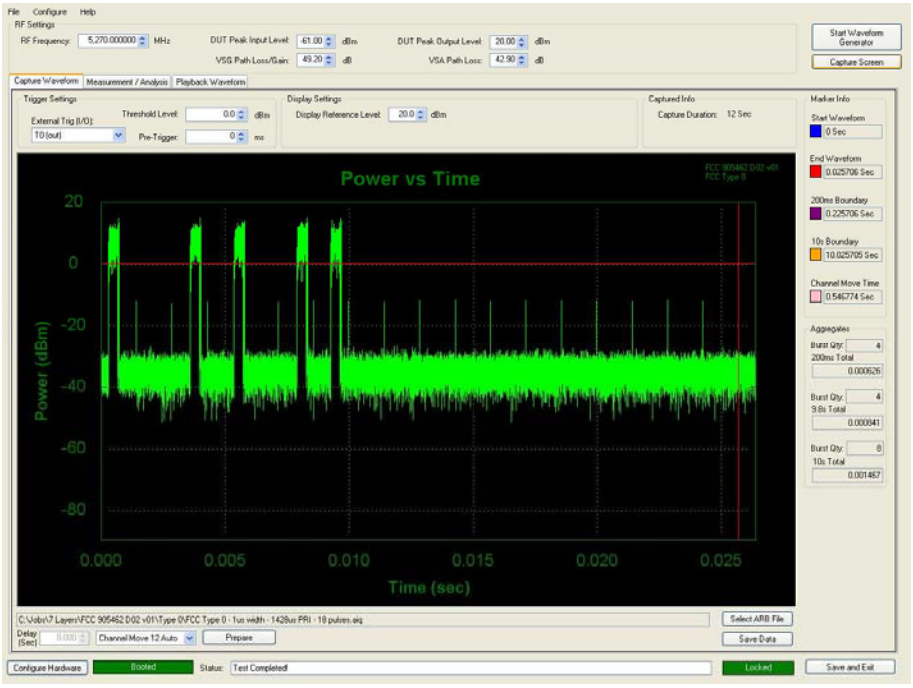
Channel Move Time	0.547 seconds
Channel Closing Transmission Time	1.467 ms

Channel Move and Close Time Summary

Radar Type	Channel Move Time (seconds)	Channel Closing Time (ms)
1	0.541	1.467
2	0.538	1.722
3	0.539	1.600
4	0.541	1.535
5	0.767	0
6	0.677	1.070

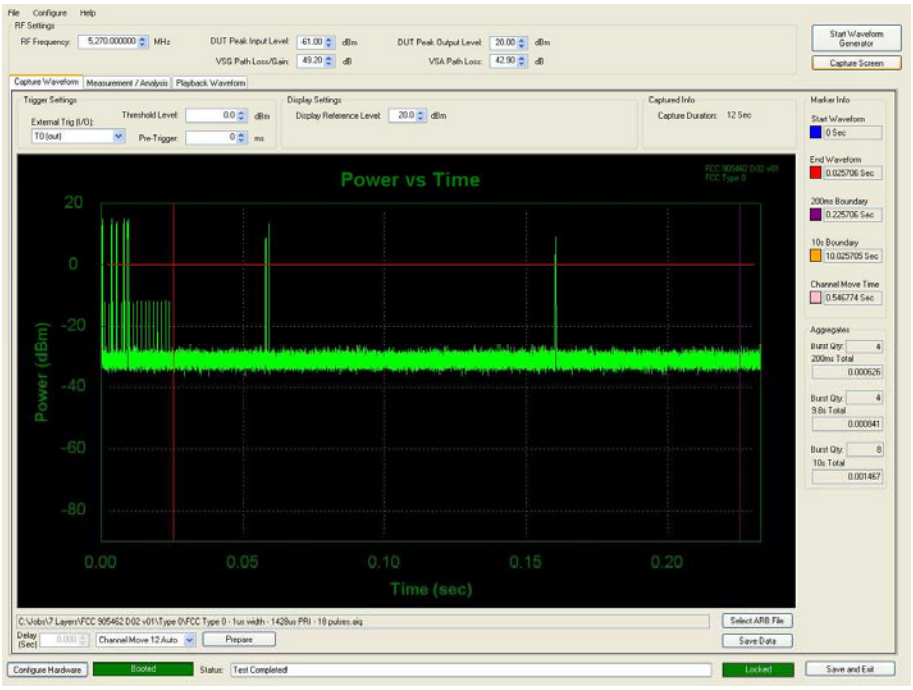
Channel Move Time and Channel Closing Transmission Time

Radar Test Signal Verification Plot

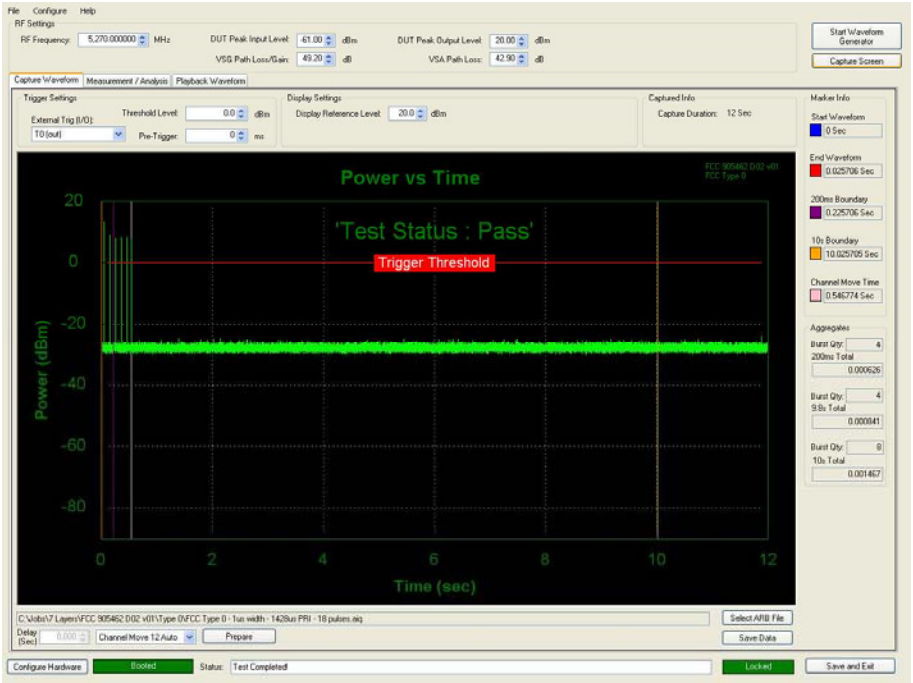


Product Service

250 ms Test Observation Period



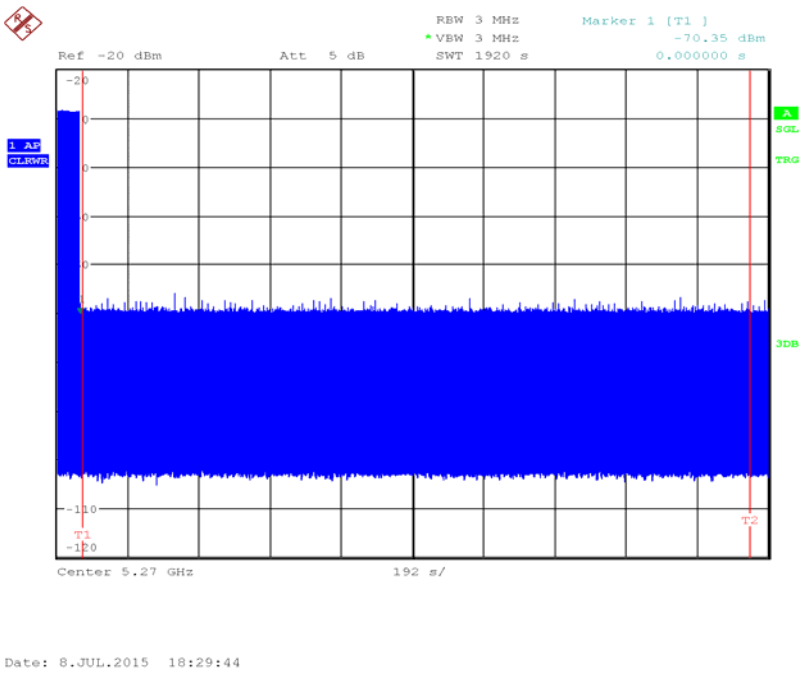
12 s Test Observation Period



Product Service

Non-occupancy Period

The EUT did not resume transmissions during the non-occupancy period.



Note: Marker 1 indicates the end of the Radar burst. T1 is situated 10 seconds after the end of the Radar Burst. T2 equates to T1 + 30 minutes.

Product Service

2.6 STATISTICAL PERFORMANCE CHECK

2.6.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407 (h)(2)

2.6.2 Equipment Under Test and Modification State

WiBear11n-DF1 S/N: 0489341 - Modification State 0

2.6.3 Date of Test

9 July & 10 July 2015 (Types 1, 2, 3, 4, 6)
30th July 2015 (Type 5)

2.6.4 Environmental Conditions

Ambient Temperature	21.5 - 23.7 ºC
Relative Humidity	37.9 – 44.7 %

2.6.5 Test Requirements

The requirements according to FCC 47 CFR Part 15, clause 15.407 (h)(2). U-NII devices operating in the 5250 MHz to 5350 MHz and 5470 MHz to 5725 MHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems.

In addition, according to KDB 905462, clause 6; Tables 5-7:

Radar Type	Pulse Length Type	Minimum Percentage of Successful Detection (%)	Minimum Number of Trials
0	Short Pulse	-	-
1	Short Pulse	60	30
2	Short Pulse	60	30
3	Short Pulse	60	30
4	Short Pulse	60	30
Aggregate (1-4)	Short Pulse	80	120
5	Long Pulse	80	30
6	Frequency Hopping	70	30

Product Service

2.6.6 Test Procedure

The measurement was made in accordance with the method described in to KDB 905462, Clause 7.8.4.

The EUT is a Master Device, a companion U-NII device operating as a Client Device was used and the Client was associated with the EUT (Master).

The channel was loaded with data transmissions from the master mode device to the associated client device.

Radar types 1-6 radar test signal were individually applied to the EUT/Master mode device, at a level equal to the detection threshold + 1 dB, accounting for equipment variation/errors.

The test frequency was observed for at least 10 seconds after generating each short pulse radar test signal to ensure detection had occurred. The test frequency was observed for at least 22 seconds after generating each long pulse radar test signal to ensure detection had occurred.

Once the performance requirements checks were completed, the statistical data for each radar type was calculated using the percentage of successful detection methods described in KDB 905462, clause 7.8.4.

2.6.7 Test Results

802.11a

Data Rate: 6 Mbps

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
1	1	5280	Y	16	5276	Y
	2	5280	Y	17	5276	Y
	3	5280	Y	18	5276	Y
	4	5280	Y	19	5276	Y
	5	5280	Y	20	5276	Y
	6	5280	Y	21	5284	Y
	7	5280	Y	22	5284	Y
	8	5280	Y	23	5284	Y
	9	5280	Y	24	5284	Y
	10	5280	Y	25	5284	Y
	11	5271	Y	26	5289	Y
	12	5271	Y	27	5289	Y
	13	5271	Y	28	5289	Y
	14	5271	Y	29	5289	Y
	15	5271	Y	30	5289	Y
EUT Test Frequency : 5280 MHz				Total Detected		30 (100 %)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
2	1	5280	Y	16	5276	Y
	2	5280	Y	17	5276	Y
	3	5280	Y	18	5276	Y
	4	5280	Y	19	5276	Y
	5	5280	Y	20	5276	Y
	6	5280	Y	21	5284	Y
	7	5280	Y	22	5284	Y
	8	5280	Y	23	5284	Y
	9	5280	Y	24	5284	Y
	10	5280	Y	25	5284	Y
	11	5271	Y	26	5289	Y
	12	5271	Y	27	5289	Y
	13	5271	Y	28	5289	Y
	14	5271	Y	29	5289	Y
	15	5271	Y	30	5289	Y
EUT Test Frequency : 5280 MHz				Total Detected		30 (100 %)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
3	1	5280	Y	16	5276	Y
	2	5280	Y	17	5276	Y
	3	5280	Y	18	5276	Y
	4	5280	Y	19	5276	Y
	5	5280	Y	20	5276	Y
	6	5280	Y	21	5284	Y
	7	5280	Y	22	5284	Y
	8	5280	Y	23	5284	Y
	9	5280	Y	24	5284	Y
	10	5280	Y	25	5284	Y
	11	5271	Y	26	5289	Y
	12	5271	Y	27	5289	N
	13	5271	Y	28	5289	Y
	14	5271	Y	29	5289	Y
	15	5271	Y	30	5289	Y
EUT Test Frequency : 5280 MHz				Total Detected		29 (96.7 %)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
4	1	5280	Y	16	5276	Y
	2	5280	Y	17	5276	Y
	3	5280	Y	18	5276	Y
	4	5280	Y	19	5276	Y
	5	5280	Y	20	5276	Y
	6	5280	Y	21	5284	Y
	7	5280	Y	22	5284	Y
	8	5280	Y	23	5284	Y
	9	5280	Y	24	5284	Y
	10	5280	Y	25	5284	Y
	11	5271	Y	26	5289	Y
	12	5271	N	27	5289	Y
	13	5271	Y	28	5289	Y
	14	5271	Y	29	5289	Y
	15	5271	Y	30	5289	Y
EUT Test Frequency : 5280 MHz				Total Detected		29 (96.7 %)

Radar Type	Number Of Trials	Number Of Successful Detections	Minimum Percentage Of Successful Detection
1	30	30	100 %
2	30	30	100 %
3	30	29	96.7 %
4	30	29	96.7 %
Aggregate (100 % + 100 % + 96.7 % + 96.7 %) / 4 = 98.4 %			

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
5	1	5285	Y	16	5277.1	Y
	2	5281.9	Y	17	5281.5	Y
	3	5282.2	Y	18	5278.1	Y
	4	5278.3	Y	19	5284.7	Y
	5	5274.4	Y	20	5276.2	Y
	6	5279.2	Y	21	5273.6	Y
	7	5275.1	Y	22	5283.7	Y
	8	5276	Y	23	5276.5	Y
	9	5286	Y	24	5279.5	Y
	10	5279.8	Y	25	5286.9	Y
	11	5286.5	Y	26	5282.4	Y
	12	5283	Y	27	5273.3	Y
	13	5281.6	Y	28	5285.8	Y
	14	5283.2	Y	29	5274.1	Y
	15	5283.4	Y	30	5286.2	Y
EUT Test Frequency : 5280 MHz				Total Detected		30 (100%)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
6	1	Frequency Hopping	Y	16	Frequency Hopping	Y
	2	Frequency Hopping	Y	17	Frequency Hopping	Y
	3	Frequency Hopping	Y	18	Frequency Hopping	Y
	4	Frequency Hopping	Y	19	Frequency Hopping	Y
	5	Frequency Hopping	Y	20	Frequency Hopping	Y
	6	Frequency Hopping	Y	21	Frequency Hopping	Y
	7	Frequency Hopping	Y	22	Frequency Hopping	Y
	8	Frequency Hopping	Y	23	Frequency Hopping	Y
	9	Frequency Hopping	Y	24	Frequency Hopping	Y
	10	Frequency Hopping	Y	25	Frequency Hopping	Y
	11	Frequency Hopping	Y	26	Frequency Hopping	Y
	12	Frequency Hopping	Y	27	Frequency Hopping	Y
	13	Frequency Hopping	Y	28	Frequency Hopping	Y
	14	Frequency Hopping	Y	29	Frequency Hopping	Y
	15	Frequency Hopping	Y	30	Frequency Hopping	Y
EUT Test Frequency : 5280 MHz				Total Detected		30 (100%)

802.11n – 20 MHz Bandwidth

Data Rate: 6.5 Mbps

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
1	1	5280	Y	16	5276	Y
	2	5280	Y	17	5276	Y
	3	5280	Y	18	5276	Y
	4	5280	Y	19	5276	Y
	5	5280	Y	20	5276	Y
	6	5280	Y	21	5284	Y
	7	5280	Y	22	5284	Y
	8	5280	Y	23	5284	Y
	9	5280	Y	24	5284	Y
	10	5280	Y	25	5284	Y
	11	5271	Y	26	5289	Y
	12	5271	Y	27	5289	Y
	13	5271	Y	28	5289	Y
	14	5271	Y	29	5289	Y
	15	5271	Y	30	5289	Y
EUT Test Frequency : 5280 MHz				Total Detected		30 (100%)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
2	1	5280	Y	16	5276	Y
	2	5280	Y	17	5276	Y
	3	5280	Y	18	5276	Y
	4	5280	Y	19	5276	Y
	5	5280	Y	20	5276	Y
	6	5280	Y	21	5284	Y
	7	5280	Y	22	5284	Y
	8	5280	Y	23	5284	Y
	9	5280	Y	24	5284	Y
	10	5280	Y	25	5284	Y
	11	5271	Y	26	5289	Y
	12	5271	Y	27	5289	Y
	13	5271	Y	28	5289	Y
	14	5271	Y	29	5289	Y
	15	5271	Y	30	5289	Y
EUT Test Frequency : 5280 MHz				Total Detected		30 (100%)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
3	1	5280	Y	16	5276	Y
	2	5280	Y	17	5276	Y
	3	5280	Y	18	5276	Y
	4	5280	Y	19	5276	Y
	5	5280	Y	20	5276	Y
	6	5280	Y	21	5284	Y
	7	5280	Y	22	5284	Y
	8	5280	Y	23	5284	Y
	9	5280	Y	24	5284	Y
	10	5280	Y	25	5284	Y
	11	5271	Y	26	5289	Y
	12	5271	Y	27	5289	Y
	13	5271	Y	28	5289	Y
	14	5271	Y	29	5289	Y
	15	5271	Y	30	5289	Y
EUT Test Frequency : 5280 MHz				Total Detected		30 (100%)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
4	1	5280	Y	16	5276	Y
	2	5280	Y	17	5276	Y
	3	5280	Y	18	5276	N
	4	5280	Y	19	5276	Y
	5	5280	Y	20	5276	Y
	6	5280	Y	21	5284	Y
	7	5280	Y	22	5284	Y
	8	5280	Y	23	5284	Y
	9	5280	Y	24	5284	Y
	10	5280	Y	25	5284	Y
	11	5271	Y	26	5289	Y
	12	5271	Y	27	5289	Y
	13	5271	Y	28	5289	Y
	14	5271	Y	29	5289	Y
	15	5271	Y	30	5289	Y
EUT Test Frequency : 5280 MHz				Total Detected		29 (96.7 %)

Radar Type	Number Of Trials	Number Of Successful Detections	Minimum Percentage Of Successful Detection
1	30	30	100 %
2	30	30	100 %
3	30	30	100 %
4	30	29	96.7 %
Aggregate (100 % + 100 % + 100 % + 96.7 %) / 4 = 99.2 %			

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
5	1	5277.4	Y	16	5287.1	Y
	2	5281.6	Y	17	5279.9	Y
	3	5282.2	Y	18	5275.8	Y
	4	5284.7	Y	19	5278.9	Y
	5	5287.9	Y	20	5283	Y
	6	5280.2	Y	21	5272.8	Y
	7	5283.6	Y	22	5275.5	Y
	8	5278.7	Y	23	5273.6	Y
	9	5274.3	Y	24	5279.8	Y
	10	5273.5	Y	25	5279	Y
	11	5279.7	Y	26	5283.2	Y
	12	5278.6	Y	27	5285.2	Y
	13	5283.9	Y	28	5277	Y
	14	5273.1	Y	29	5280.8	Y
	15	5273.8	Y	30	5275.3	Y
EUT Test Frequency : 5280 MHz				Total Detected		30 (100%)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
6	1	Frequency Hopping	Y	16	Y	Frequency Hopping
	2	Frequency Hopping	Y	17	Y	Frequency Hopping
	3	Frequency Hopping	Y	18	Y	Frequency Hopping
	4	Frequency Hopping	Y	19	Y	Frequency Hopping
	5	Frequency Hopping	Y	20	Y	Frequency Hopping
	6	Frequency Hopping	Y	21	Y	Frequency Hopping
	7	Frequency Hopping	Y	22	Y	Frequency Hopping
	8	Frequency Hopping	Y	23	Y	Frequency Hopping
	9	Frequency Hopping	Y	24	Y	Frequency Hopping
	10	Frequency Hopping	Y	25	Y	Frequency Hopping
	11	Frequency Hopping	Y	26	Y	Frequency Hopping
	12	Frequency Hopping	N	27	Y	Frequency Hopping
	13	Frequency Hopping	Y	28	Y	Frequency Hopping
	14	Frequency Hopping	Y	29	Y	Frequency Hopping
	15	Frequency Hopping	Y	30	Y	Frequency Hopping
EUT Test Frequency : 5280 MHz				Total Detected		29 (96.7 %)

802.11n – 40 MHz Bandwidth

Data Rate: 13.5 Mbps

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
1	1	5270	Y	16	5260	Y
	2	5270	Y	17	5260	Y
	3	5270	Y	18	5260	Y
	4	5270	Y	19	5260	Y
	5	5270	Y	20	5260	Y
	6	5270	Y	21	5280	Y
	7	5270	Y	22	5280	Y
	8	5270	Y	23	5280	Y
	9	5270	Y	24	5280	Y
	10	5270	Y	25	5280	Y
	11	5251	N	26	5289	Y
	12	5251	Y	27	5289	Y
	13	5251	Y	28	5289	Y
	14	5251	Y	29	5289	Y
	15	5251	Y	30	5289	Y
EUT Test Frequency : 5270 MHz (Primary : 5260 MHz, Secondary: 5280 MHz)				Total Detected		29 (96.7 %)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
2	1	5270	Y	16	5260	Y
	2	5270	Y	17	5260	Y
	3	5270	Y	18	5260	Y
	4	5270	Y	19	5260	Y
	5	5270	Y	20	5260	Y
	6	5270	Y	21	5280	Y
	7	5270	Y	22	5280	Y
	8	5270	Y	23	5280	Y
	9	5270	Y	24	5280	Y
	10	5270	Y	25	5280	Y
	11	5251	N	26	5289	Y
	12	5251	N	27	5289	Y
	13	5251	N	28	5289	Y
	14	5251	N	29	5289	Y
	15	5251	N	30	5289	Y
EUT Test Frequency : 5270 MHz (Primary : 5260 MHz, Secondary: 5280 MHz)				Total Detected		25 (83.3 %)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
3	1	5270	Y	16	5260	Y
	2	5270	Y	17	5260	Y
	3	5270	Y	18	5260	Y
	4	5270	Y	19	5260	Y
	5	5270	Y	20	5260	Y
	6	5270	Y	21	5280	Y
	7	5270	Y	22	5280	Y
	8	5270	Y	23	5280	Y
	9	5270	Y	24	5280	Y
	10	5270	Y	25	5280	Y
	11	5251.5	Y	26	5288.5	Y
	12	5251.5	Y	27	5288.5	Y
	13	5251.5	Y	28	5288.5	Y
	14	5251.5	N	29	5288.5	Y
	15	5251.5	Y	30	5288.5	Y
EUT Test Frequency : 5270 MHz (Primary : 5260 MHz, Secondary: 5280 MHz)				Total Detected		29 (96.7 %)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
4	1	5270	Y	16	5260	Y
	2	5270	Y	17	5260	Y
	3	5270	Y	18	5260	Y
	4	5270	Y	19	5260	Y
	5	5270	Y	20	5260	Y
	6	5270	Y	21	5280	Y
	7	5270	Y	22	5280	Y
	8	5270	Y	23	5280	Y
	9	5270	Y	24	5280	Y
	10	5270	Y	25	5280	Y
	11	5251.5	Y	26	5288.5	Y
	12	5251.5	Y	27	5288.5	Y
	13	5251.5	Y	28	5288.5	Y
	14	5251.5	Y	29	5288.5	Y
	15	5251.5	Y	30	5288.5	Y
EUT Test Frequency : 5270 MHz (Primary : 5260 MHz, Secondary: 5280 MHz)				Total Detected		29 (96.7 %)

Radar Type	Number Of Trials	Number Of Successful Detections	Minimum Percentage Of Successful Detection
1	30	29	96.7 %
2	30	25	83.3 %
3	30	29	96.7 %
4	30	29	96.7 %
Aggregate (96.7 % + 83.3 % + 96.7 % + 96.7 %) / 4 = 93.4 %			

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
5	1	5275.1	Y	16	5266.8	Y
	2	5280.4	Y	17	5273.8	Y
	3	5265.1	Y	18	5272	Y
	4	5285	Y	19	5280.1	Y
	5	5262.7	Y	20	5280.3	Y
	6	5266.5	Y	21	5281.4	Y
	7	5275.6	Y	22	5281.2	Y
	8	5267.4	Y	23	5255.3	Y
	9	5280.8	Y	24	5264.5	Y
	10	5279.2	Y	25	5283.9	Y
	11	5264.9	Y	26	5269.4	Y
	12	5276.8	Y	27	5282.4	Y
	13	5262.3	Y	28	5267.3	Y
	14	5259.8	Y	29	5270.4	Y
	15	5262.4	Y	30	5268.7	Y
EUT Test Frequency : 5270 MHz (Primary : 5260 MHz, Secondary: 5280 MHz)				Total Detected		30 (100%)

Radar Type	Trial No	Frequency (MHz)	Detection (Y/N)	Trial No	Frequency (MHz)	Detection (Y/N)
6	1	Frequency Hopping	Y	16	Frequency Hopping	Y
	2	Frequency Hopping	Y	17	Frequency Hopping	Y
	3	Frequency Hopping	Y	18	Frequency Hopping	Y
	4	Frequency Hopping	Y	19	Frequency Hopping	Y
	5	Frequency Hopping	Y	20	Frequency Hopping	Y
	6	Frequency Hopping	Y	21	Frequency Hopping	Y
	7	Frequency Hopping	Y	22	Frequency Hopping	Y
	8	Frequency Hopping	Y	23	Frequency Hopping	Y
	9	Frequency Hopping	Y	24	Frequency Hopping	Y
	10	Frequency Hopping	Y	25	Frequency Hopping	Y
	11	Frequency Hopping	Y	26	Frequency Hopping	Y
	12	Frequency Hopping	Y	27	Frequency Hopping	Y
	13	Frequency Hopping	Y	28	Frequency Hopping	Y
	14	Frequency Hopping	Y	29	Frequency Hopping	Y
	15	Frequency Hopping	Y	30	Frequency Hopping	Y
EUT Test Frequency : 5270 MHz (Primary : 5260 MHz, Secondary: 5280 MHz)				Total Detected		30 (100%)

2.7 UNIFORM SPREADING

2.7.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407 (h)(2)

2.7.2 Equipment Under Test

WiBear11n-DF1

2.7.3 Test Requirements

The requirements according to FCC 47 CFR Part 15, clause 15.407 (h)(2); The DFS process shall be required to provide a uniform spreading of the loading over all the available channels.

2.7.4 Test Results

Customer Declaration

Product Service

SECTION 3

TEST EQUIPMENT USED

Product Service

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 – In-Service Monitoring					
Directional Coupler	Hewlett Packard	11692D	451	12	2-Oct-2015
Multimeter	Fluke	75 Mk3	455	12	23-Jul-2015
30dB/2W Attenuator	Narda	4772-30	460	-	TU
30dB Attenuator	Narda	4772-30	463	-	TU
Hygrometer	Rotronic	I-1000	2891	12	16-Jul-2015
Termination (50ohm, 1W)	Suhner		3080	12	5-Mar-2016
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	6-Aug-2015
PXI Digital RF Signal Generator	Aeroflex	3025	4015	24	3-Oct-2015
1800-6000 MHz Power Splitter	Mini-Circuits	ZN2PD-63-S+	4055	-	O/P Mon
1800-6000 MHz Power Splitter	Mini-Circuits	ZN2PD-63-S+	4056	-	O/P Mon
Attenuator	Sealectro	SO-674-1010-89	N/S	-	TU
Hygrometer	Rotronic	A1	2677	12	11-Jun-2016
Spectrum Analyser	Rohde & Schwarz	FSU 26	2747	12	20-Jan-2016
PXI Digital RF Digitizer	Aeroflex	3035	4012	24	3-Oct-2015
PXI Digital RF Signal Generator	Aeroflex	3010	4013	24	3-Oct-2015
PXI Digital RF Signal Generator	Aeroflex	3011	4014	24	3-Oct-2015

TU – Traceability Unscheduled
O/P MON – Output Monitored with Calibrated Equipment

3.2 SUPPORT TEST EQUIPMENT

Instrument	Manufacturer	Type No.	Serial Number
Development Board	U-Blox	EVK-E05	Unknown
Client	U-Blox	DF1	0489369
Laptop	Fujitsu	Litebook S7220	YKKF052471

Product Service

3.3 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	MU
Channel Availability Check	Time Measurement Uncertainty: ± 0.47 % Amplitude Uncertainty: ± 1.29 dB
Channel Availability Check – Radar Burst at the Beginning	Time Measurement Uncertainty: ± 0.47 % Amplitude Uncertainty: ± 1.29 dB
Channel Availability Check – Radar Burst at the End	Time Measurement Uncertainty: ± 0.47 % Amplitude Uncertainty: ± 1.29 dB
Channel Shutdown	Time Measurement Uncertainty: ± 0.47 % Amplitude Uncertainty: ± 1.29 dB
Non-Occupancy Period	Time Measurement Uncertainty: ± 0.47 % Amplitude Uncertainty: ± 1.29 dB

Product Service

SECTION 4

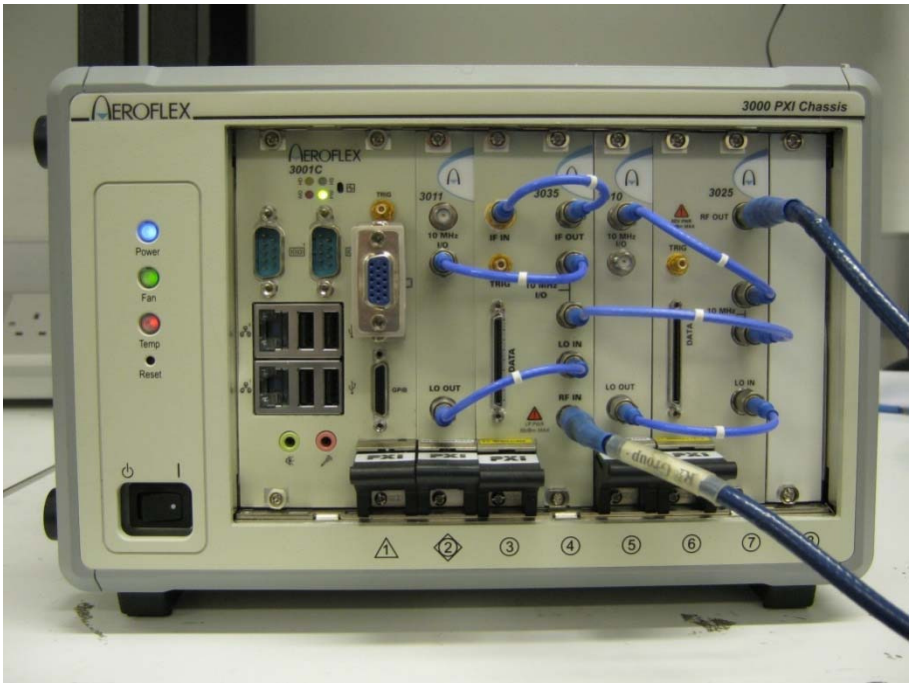
PHOTOGRAPHS

Product Service

4.1 TEST SET-UP PHOTOGRAPHS

See test set-up photographs exhibit “75931213 FCC Set Up Photos.pdf”.

4.2 DFS TEST EQUIPMENT



Test Set Up

Product Service

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

Product Service

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

ANNEX A

TEST WAVEFORMS USED

U-NII Detection Bandwidth

Type 0

Pulse Width (µs)	Number of Pulses	Pulse Repetition Interval (µs)
1	18	1428

Channel Availability Check – Radar Burst at the Beginning

Type 0

Pulse Width (µs)	Number of Pulses	Pulse Repetition Interval (µs)
1	18	1428

Channel Availability Check – Radar Burst at the End

Type 0

Pulse Width (µs)	Number of Pulses	Pulse Repetition Interval (µs)
1	18	1428

In-service Monitoring

Type 1

Pulse Width (µs)	Number of Pulses	Pulse Repetition Interval (µs)
2	99	538

Type 2

Pulse Width (µs)	Number of Pulses	Pulse Repetition Interval (µs)
27	1.1	154

Type 3

Pulse Width (µs)	Number of Pulses	Pulse Repetition Interval (µs)
16	6.4	316

Type 4

Pulse Width (µs)	Number of Pulses	Pulse Repetition Interval (µs)
11.1	15	448

Type 5

Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	64	19	1980	0	220036
2	3	98	16	1825	1974	119802
3	2	50	16	1599	0	488073
4	1	56	8	0	0	527511
5	2	96	18	1483	0	286745
6	1	52	7	0	0	494477
7	2	60	11	1233	0	504362
8	3	68	6	1848	1348	161387
9	2	54	15	1576	0	69078
10	2	55	11	1429	0	515077
11	2	88	13	1206	0	250181
12	2	71	11	1500	0	54394
13	3	89	19	1338	1770	482296
14	1	58	19	0	0	142735
15	3	68	17	1946	1357	259438
16	1	64	10	0	0	507385
17	1	84	17	0	0	578037
18	3	72	18	1027	1424	197262
19	3	85	10	1257	1600	447637
20	1	65	17	0	0	184228

Type 6

Hopping Frequency List (MHz)
5447,5361,5434,5556,5383,5401,5373,5503,5389,5482,5583,5646,5539,5412,5504,5312,5625,5615,5293,5397,5455,5551,5451,5478,5390,5411,5623,5316,5456,5354,5692,5723,5356,5631,5576,5672,5295,5457,5379,5308,5336,5502,5467,5366,5263,5518,5302,5639,5527,5593,5596,5299,5437,5408,5621,5635,5681,5444,5718,5714,5475,5657,5378,5616,5648,5433,5505,5652,5364,5579,5407,5638,5338,5368,5709,5348,5358,5708,5513,5587,5642,5535,5673,5260,5666,5716,5575,5464,5558,5624,5569,5339,5335,5522,5712,5264,5439,5385,5289,5572

Statistical Performance Check

RADAR TYPE 1			
Trial #	Pulse Repetition Frequency Number (1 to 23)	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	2	99	538
2	4	92	578
3	TEST B	90	590
4	6	86	618
5	7	83	638
6	TEST B	81	653
7	9	78	678
8	11	74	718
9	13	70	758
10	15	67	798
11	TEST B	67	799
12	16	65	818
13	17	63	838
14	18	62	858
15	19	61	878
16	20	59	898
17	21	58	918
18	22	58	921
19	TEST B	57	938
20	TEST B	40	1321
21	TEST B	37	1435
22	TEST B	36	1485
23	TEST B	36	1498
24	TEST B	33	1614
25	TEST B	30	1808
26	TEST B	28	1924
27	TEST B	23	2303
28	TEST B	22	2416
29	TEST B	21	2577
30	TEST B	19	2789

RADAR TYPE 2			
Trial #	Number Pulses per Burst	Pulse Width (μs)	PRI (μs)
1	27	1.1	154
2	23	1.1	155
3	26	1.1	224
4	23	1.4	153
5	27	1.6	187
6	29	1.6	190
7	26	1.8	152
8	28	1.0	197
9	25	2.1	158
10	25	2.3	180
11	25	2.4	185
12	29	2.5	196
13	29	2.6	181
14	24	2.6	198
15	28	2.7	165
16	27	2.8	201
17	27	2.9	163
18	26	2.9	216
19	25	2.0	169
20	26	2.0	202
21	27	3.1	212
22	25	3.6	181
23	25	3.9	161
24	29	3.9	182
25	27	3.9	187
26	24	4.1	207
27	26	4.1	227
28	25	4.3	176
29	27	4.7	174
30	25	4.9	224

RADAR TYPE 3			
Trial #	Number Pulses per Burst	Pulse Width (μs)	PRI (μs)
1	16	6.4	316
2	18	6.4	473
3	18	6.7	304
4	16	6.8	213
5	16	6.8	214
6	18	6.8	246
7	18	6.8	446
8	17	6.0	226
9	16	7.3	294
10	17	7.4	477
11	16	7.5	460
12	18	7.8	422
13	18	7.0	294
14	18	8.1	336
15	16	8.1	408
16	18	8.4	273
17	17	8.5	356
18	17	8.6	405
19	16	8.8	303
20	18	8.8	425
21	16	8.9	338
22	16	8.0	493
23	16	9.2	221
24	17	9.2	475
25	17	9.3	331
26	18	9.4	246
27	16	9.6	200
28	17	9.6	385
29	16	9.7	469
30	17	9.0	256

RADAR TYPE 4			
Trial #	Number Pulses per Burst	Pulse Width (μs)	PRI (μs)
1	11.1	15	448
2	11.2	12	436
3	11.2	16	403
4	11.5	15	311
5	411.8	13	250
6	11.0	12	231
7	11.0	16	253
8	12.4	12	428
9	12.5	12	274
10	12.9	13	307
11	12.9	13	350
12	13.4	14	259
13	13.6	16	340
14	14.5	15	325
15	15.2	13	365
16	15.2	16	425
17	15.4	12	315
18	15.6	15	460
19	16.5	15	406
20	16.8	15	225
21	18.1	15	257
22	18.1	13	476
23	18.5	16	221
24	18.0	15	413
25	19.8	15	309
26	19.9	13	332
27	19.0	13	209
28	19.0	12	433
29	20.0	16	332
30	20.0	16	343

RADAR TYPE 5						
Trial Number:1						
Number of Bursts in Trial:20						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	64	19	1980	0	220036
2	3	98	16	1825	1974	119802
3	2	50	16	1599	0	488073
4	1	56	8	0	0	527511
5	2	96	18	1483	0	286745
6	1	52	7	0	0	494477
7	2	60	11	1233	0	504362
8	3	68	6	1848	1348	161387
9	2	54	15	1576	0	69078
10	2	55	11	1429	0	515077
11	2	88	13	1206	0	250181
12	2	71	11	1500	0	54394
13	3	89	19	1338	1770	482296
14	1	58	19	0	0	142735
15	3	68	17	1946	1357	259438
16	1	64	10	0	0	507385
17	1	84	17	0	0	578037
18	3	72	18	1027	1424	197262
19	3	85	10	1257	1600	447637
20	1	65	17	0	0	184228

RADAR TYPE 5						
Trial Number:2						
Number of Bursts in Trial:14						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	3	73	8	1158	1252	832114
2	2	93	20	1196	0	111466
3	1	83	19	0	0	524
4	1	98	12	0	0	275877
5	3	55	16	1599	1299	8057
6	1	76	10	0	0	520366
7	1	99	12	0	0	51497
8	2	61	8	1561	0	688707
9	2	74	8	1178	0	377911
10	1	91	15	0	0	593983
11	2	80	16	1203	0	717783
12	2	66	11	1211	0	732627
13	3	57	8	1450	1269	206471
14	3	61	15	1994	1300	588514
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:3						
Number of Bursts in Trial:18						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	57	18	1848	0	504076
2	3	64	12	1491	1370	214095
3	1	88	19	0	0	45741
4	1	50	16	0	0	651363
5	1	68	15	0	0	437323
6	2	51	20	1937	0	485304
7	3	58	15	1393	1651	540046
8	1	52	20	0	0	424254
9	2	72	19	1392	0	266560
10	3	96	9	1523	1365	426472
11	1	82	9	0	0	215488
12	3	71	17	1499	1469	546297
13	3	100	13	1558	1327	480759
14	3	77	19	1604	1020	92926
15	2	57	13	1098	0	643849
16	1	94	12	0	0	505874
17	2	79	6	1807	0	347851
18	2	53	20	1388	0	321464
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:4						
Number of Bursts in Trial:15						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	91	17	1441	0	284235
2	3	53	5	1985	1732	469670
3	3	81	20	1275	1108	627318
4	2	73	13	1622	0	945
5	1	69	11	0	0	379933
6	3	90	10	1861	1555	433477
7	1	74	14	0	0	442295
8	2	54	16	1134	0	155262
9	3	74	5	1836	1811	370654
10	3	62	9	1282	1405	741280
11	3	97	13	1749	1379	9998
12	3	54	9	1711	1123	140876
13	1	82	7	0	0	271861
14	3	86	16	1831	1324	260012
15	3	76	5	1548	1618	7479
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:5						
Number of Bursts in Trial:19						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	53	14	1150	0	387280
2	1	77	6	0	0	507928
3	1	54	18	0	0	33118
4	3	55	10	1851	1791	107093
5	1	75	13	0	0	352195
6	2	79	14	1636	0	80424
7	1	86	18	0	0	249361
8	3	58	16	1640	1546	16795
9	2	74	14	1239	0	578517
10	3	80	20	1272	1402	431506
11	1	59	17	0	0	282342
12	3	70	5	1513	1987	361222
13	1	76	11	0	0	63039
14	1	59	16	0	0	625279
15	3	60	12	1815	1824	225592
16	3	86	9	1608	1857	617715
17	2	67	8	1441	0	531127
18	2	53	20	1178	0	489866
19	3	56	13	1451	1422	602908
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:6						
Number of Bursts in Trial:10						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	1	92	13	0	0	1103329
2	3	70	8	1214	1344	435440
3	2	88	20	1131	0	505737
4	2	50	20	1675	0	345947
5	3	63	14	1107	1741	971535
6	1	76	10	0	0	305770
7	2	97	16	1527	0	154099
8	3	67	6	1628	1939	47975
9	1	75	7	0	0	812336
10	1	60	15	0	0	316108
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:7						
Number of Bursts in Trial:14						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	74	16	1671	0	178185
2	3	63	11	1179	1167	253163
3	3	94	6	1992	1461	24112
4	2	50	15	1319	0	802710
5	2	87	8	1750	0	647869
6	2	71	13	1614	0	387589
7	1	94	16	0	0	762707
8	1	53	10	0	0	211056
9	2	97	19	1461	0	549333
10	2	68	11	1168	0	185082
11	1	87	15	0	0	535197
12	1	81	7	0	0	9293
13	2	73	6	1847	0	838694
14	2	78	18	1410	0	850225
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:8						
Number of Bursts in Trial:13						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	1	63	20	0	0	123613
2	3	55	11	1052	1881	86916
3	3	69	10	1240	1214	358313
4	3	91	15	1723	1078	689520
5	1	82	18	0	0	112090
6	3	98	9	1908	1799	882690
7	2	50	6	1945	0	177322
8	2	95	13	1760	0	521576
9	1	96	13	0	0	62818
10	3	80	17	1239	1684	30895
11	3	63	9	1352	1092	305182
12	1	82	11	0	0	412454
13	3	99	9	1918	1025	301984
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:9						
Number of Bursts in Trial:11						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	1	60	9	0	0	1106599
2	1	99	13	0	0	588046
3	1	54	17	0	0	412748
4	1	59	5	0	0	267914
5	3	59	6	1707	1715	1019888
6	3	67	9	1082	1312	922778
7	1	81	15	0	0	50910
8	2	72	12	1042	0	511130
9	1	83	9	0	0	959506
10	3	92	8	1481	1291	426379
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:10						
Number of Bursts in Trial:11						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	3	88	13	1732	1932	675625
2	2	71	10	1921	0	729214
3	1	83	16	0	0	222735
4	2	73	16	1895	0	699027
5	3	99	17	1654	1535	855720
6	3	93	5	1623	1856	1045460
7	3	52	20	1536	1090	972523
8	1	92	20	0	0	87602
9	3	75	12	1610	1657	62680
10	2	59	17	1732	0	431317
11	3	79	17	1954	1876	213603
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:11						
Number of Bursts in Trial:9						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	3	80	11	1713	1064	941946
2	1	80	16	0	0	891327
3	2	79	15	1067	0	890014
4	2	63	9	1212	0	1231883
5	1	93	8	0	0	1111002
6	3	56	14	1011	1459	255353
7	2	60	16	1967	0	150625
8	2	84	20	1441	0	976952
9	1	52	9	0	0	1319170
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:12						
Number of Bursts in Trial:16						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	1	54	10	0	0	34588
2	3	77	15	1664	1271	10420
3	3	70	13	1859	1940	106271
4	1	57	13	0	0	64651
5	2	94	15	1955	0	224746
6	3	64	18	1479	1630	59831
7	2	60	8	1660	0	24056
8	1	99	12	0	0	495101
9	3	78	11	1953	1248	713688
10	1	56	13	0	0	443325
11	3	96	17	1904	1303	236545
12	2	69	16	1068	0	191599
13	3	59	15	1934	1324	154131
14	2	60	19	1906	0	252984
15	3	95	7	1785	1452	537117
16	3	67	17	1140	1348	663352
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:13						
Number of Bursts in Trial:16						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	1	90	9	0	0	669096
2	2	81	18	1220	0	304684
3	2	55	10	1784	0	14093
4	3	88	17	1938	1594	511483
5	2	61	18	1737	0	387819
6	3	85	15	1401	1276	86456
7	2	65	5	1757	0	400920
8	3	74	18	1296	1043	88521
9	1	75	5	0	0	313347
10	3	85	17	1595	1033	151602
11	3	60	20	1946	1934	421388
12	2	74	19	1193	0	612966
13	1	64	15	0	0	52018
14	3	63	11	1845	1284	61070
15	1	82	13	0	0	724821
16	2	84	6	1196	0	115
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:14						
Number of Bursts in Trial:19						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	3	62	19	1711	1095	12022
2	3	80	10	1100	1377	242006
3	3	65	7	1203	1416	219108
4	3	72	11	1750	1750	76052
5	2	78	12	1979	0	358792
6	3	63	9	1911	1306	8015
7	3	69	19	1975	1761	282380
8	3	75	7	1705	1914	496567
9	1	92	7	0	0	165644
10	3	65	13	1492	1056	309850
11	3	63	13	1569	1833	20577
12	2	92	6	1474	0	342849
13	1	62	18	0	0	306051
14	2	56	20	1610	0	154028
15	2	71	13	1770	0	135171
16	1	70	14	0	0	329176
17	3	67	18	1957	1395	366845
18	3	72	8	1617	1753	32935
19	2	81	12	1247	0	597588
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:15						
Number of Bursts in Trial:15						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	1	89	11	0	0	143247
2	2	95	17	1927	0	299188
3	3	89	10	1687	1622	660071
4	1	56	6	0	0	584083
5	1	93	8	0	0	647391
6	3	97	10	1857	1192	167151
7	3	55	13	1266	1561	62956
8	3	57	17	1778	1932	115715
9	2	60	20	1675	0	667828
10	3	56	8	1050	1487	251244
11	2	81	16	1087	0	773469
12	2	62	8	1025	0	494756
13	3	78	14	1242	1088	100489
14	2	100	7	1326	0	277139
15	3	59	11	1034	1849	206459
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:16						
Number of Bursts in Trial:9						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	87	20	1159	0	427217
2	3	50	15	1826	1992	1167458
3	3	78	14	1906	1526	1000378
4	2	67	11	1749	0	1070741
5	2	62	19	1160	0	1289470
6	3	72	10	1053	1119	246084
7	1	88	9	0	0	867790
8	2	62	18	1236	0	586038
9	1	78	6	0	0	617573
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:17						
Number of Bursts in Trial:18						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	3	95	15	1630	1392	332478
2	3	67	15	1140	1727	179569
3	1	91	9	0	0	143215
4	2	97	17	1514	0	273881
5	3	80	19	1194	1396	346033
6	1	65	13	0	0	23196
7	1	71	11	0	0	132282
8	3	89	16	1661	1618	237738
9	3	56	7	1924	1287	57291
10	1	98	8	0	0	551406
11	2	67	20	1361	0	631904
12	1	89	11	0	0	664304
13	3	82	5	1134	1105	391639
14	3	89	14	1464	1440	497740
15	1	57	7	0	0	415032
16	3	72	20	1908	1309	340613
17	1	54	15	0	0	280402
18	3	74	5	1248	1538	657646
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:18						
Number of Bursts in Trial:11						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	82	16	1746	0	1073886
2	1	67	12	0	0	342651
3	2	74	17	1077	0	367293
4	1	90	16	0	0	273174
5	3	92	13	1687	1466	414783
6	3	73	15	1798	1369	811208
7	2	97	12	1462	0	667590
8	2	71	19	1714	0	430662
9	2	73	20	1126	0	833249
10	1	80	6	0	0	640182
11	3	64	20	1700	1158	827409
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:19						
Number of Bursts in Trial:20						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	1	67	17	0	0	317290
2	2	77	6	1568	0	9454
3	2	67	14	1724	0	420646
4	2	93	13	1443	0	128818
5	1	85	10	0	0	369976
6	2	93	14	1211	0	410479
7	2	69	8	1291	0	420057
8	2	66	6	1091	0	110511
9	1	54	11	0	0	256286
10	1	60	20	0	0	590897
11	2	95	10	1426	0	275875
12	1	98	16	0	0	171202
13	3	87	6	1671	1767	194234
14	2	55	15	1331	0	26809
15	3	54	10	1285	1771	210327
16	2	56	15	1264	0	137738
17	2	85	18	1242	0	195840
18	2	51	19	1970	0	207755
19	1	67	12	0	0	209809
20	3	76	9	1755	1007	189420

RADAR TYPE 5						
Trial Number:20						
Number of Bursts in Trial:14						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	3	96	6	1271	1510	27519
2	2	55	18	1809	0	27725
3	1	80	10	0	0	364266
4	3	76	20	1018	1077	623546
5	2	85	19	1738	0	748612
6	3	90	18	1155	1380	563922
7	3	88	13	1781	1801	828405
8	3	67	11	1804	1128	460208
9	3	66	19	1028	1543	610653
10	3	88	20	1240	1739	440259
11	1	58	13	0	0	544126
12	1	93	9	0	0	588240
13	2	68	6	1840	0	673798
14	2	100	13	1181	0	584413
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:21						
Number of Bursts in Trial:17						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	3	61	7	1941	1408	687490
2	3	63	6	1420	1624	471946
3	3	51	5	1560	1640	307589
4	1	62	13	0	0	377331
5	2	55	14	1256	0	40036
6	1	95	16	0	0	127662
7	2	65	13	1814	0	199263
8	1	61	6	0	0	463030
9	1	80	7	0	0	188033
10	3	85	10	1817	1771	59467
11	2	55	20	1444	0	124064
12	2	90	5	1343	0	107385
13	3	83	10	1407	1239	34390
14	2	58	8	1735	0	350146
15	2	65	13	1049	0	656510
16	2	58	9	1897	0	626325
17	1	73	18	0	0	253031
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:22						
Number of Bursts in Trial:8						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	93	10	1422	0	738059
2	1	94	20	0	0	1100931
3	2	61	16	1027	0	1133381
4	2	60	14	1036	0	880362
5	3	90	12	1394	1244	1881
6	2	87	12	1262	0	1021393
7	1	77	5	0	0	261973
8	2	75	17	1788	0	362233
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:23						
Number of Bursts in Trial:14						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	67	17	1527	0	599536
2	2	57	13	1562	0	591697
3	2	72	8	1419	0	223490
4	1	73	6	0	0	361050
5	3	63	11	1710	1052	279824
6	3	85	18	1282	1831	335922
7	3	90	6	1396	1462	581780
8	3	77	10	1467	1194	755720
9	2	52	17	1322	0	538785
10	3	68	5	1686	1366	310924
11	1	55	15	0	0	633981
12	1	50	20	0	0	253338
13	1	87	9	0	0	698531
14	2	56	5	1799	0	359769
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:24						
Number of Bursts in Trial:15						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	53	11	1076	0	435411
2	1	50	14	0	0	288135
3	1	97	19	0	0	635308
4	3	73	11	1892	1283	661442
5	3	84	13	1386	1171	739629
6	1	63	8	0	0	97174
7	1	80	6	0	0	760814
8	2	55	9	1954	0	108166
9	2	75	16	1633	0	525389
10	3	68	10	1938	1591	288450
11	1	61	16	0	0	775035
12	2	97	5	1686	0	191540
13	1	70	18	0	0	617796
14	2	58	12	1825	0	765813
15	2	80	7	1477	0	603812
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:25						
Number of Bursts in Trial:17						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	60	5	1867	0	338770
2	3	79	8	1682	1871	640088
3	3	94	7	1472	1502	43017
4	2	86	20	1175	0	442037
5	3	59	12	1452	1531	278380
6	2	100	8	1733	0	333546
7	1	82	9	0	0	633688
8	1	60	11	0	0	407166
9	1	59	19	0	0	376187
10	1	79	15	0	0	344159
11	3	77	13	1764	1770	379248
12	3	62	18	1369	1028	199297
13	1	82	16	0	0	470493
14	1	75	18	0	0	362545
15	1	80	19	0	0	284564
16	1	70	20	0	0	313153
17	1	83	9	0	0	612165
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:26						
Number of Bursts in Trial:19						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	3	86	12	1653	1969	441991
2	2	97	5	1050	0	512909
3	1	57	11	0	0	341588
4	2	62	10	1694	0	467023
5	1	64	9	0	0	414719
6	1	74	10	0	0	342356
7	1	59	8	0	0	38202
8	1	72	9	0	0	578338
9	1	50	8	0	0	500255
10	2	80	7	1553	0	40895
11	1	57	5	0	0	288684
12	3	92	9	1615	1125	431064
13	2	73	17	1506	0	310256
14	2	98	15	1845	0	540734
15	3	50	16	1133	1625	167737
16	1	57	19	0	0	241150
17	2	55	16	1592	0	579547
18	1	67	6	0	0	200971
19	2	95	12	1035	0	470144
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:27						
Number of Bursts in Trial:16						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	71	13	1718	0	335091
2	2	97	10	1694	0	233193
3	1	72	19	0	0	623966
4	3	80	7	1714	1744	83220
5	2	89	8	1586	0	121433
6	3	93	10	1486	1969	229502
7	3	99	12	1176	1840	533363
8	2	73	20	1639	0	591218
9	1	64	16	0	0	670866
10	2	62	15	1756	0	548421
11	3	64	15	1143	1682	161805
12	3	78	12	1562	1598	627582
13	3	50	8	1471	1388	489769
14	3	95	16	1260	1781	353129
15	3	88	19	1879	1267	386197
16	2	85	16	1235	0	430599
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:28						
Number of Bursts in Trial:16						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	1	67	12	0	0	467402
2	3	94	20	1402	1040	709608
3	1	64	12	0	0	317456
4	1	80	17	0	0	649898
5	1	74	13	0	0	121036
6	2	97	9	1043	0	215455
7	3	98	19	1110	1491	320483
8	2	57	5	1161	0	163129
9	1	93	9	0	0	283619
10	2	88	12	1655	0	303674
11	3	71	5	1905	1864	174438
12	1	58	7	0	0	685151
13	2	67	16	1583	0	45879
14	2	57	18	1790	0	633586
15	3	64	5	1436	1578	575151
16	1	60	7	0	0	546736
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:29						
Number of Bursts in Trial:16						
Chirp Center Frequency: See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	82	15	1443	0	379791
2	3	100	8	1257	1326	278893
3	3	56	14	1881	1347	207917
4	1	97	9	0	0	693107
5	3	91	12	1562	1388	425903
6	1	54	6	0	0	668361
7	1	72	8	0	0	98058
8	3	55	7	1554	1492	111940
9	2	77	13	1551	0	231727
10	3	93	16	1423	1862	8788
11	1	72	16	0	0	563569
12	3	57	19	1119	1381	498485
13	1	58	11	0	0	249059
14	2	95	12	1176	0	176715
15	1	82	12	0	0	104549
16	1	58	9	0	0	697366
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 5						
Trial Number:30 or 0 as per the file structure						
Number of Bursts in Trial: 11						
Chirp Center Frequency:See test page						
Burst	Number of Pulses	Pulse Width (µs)	Chirp Width (MHz)	Pulse 1-to-2 spacing (µs)	Pulse 2-to-3 spacing (µs)	Starting Location Within Interval (µs)
1	2	86	15	1671	0	252427
2	3	92	20	1506	1379	957631
3	3	63	11	1110	1483	480427
4	2	54	8	1777	0	28991
5	2	76	7	1723	0	398474
6	3	65	11	1594	1538	246196
7	2	82	15	1038	0	524109
8	3	78	12	1533	1378	85767
9	1	64	19	0	0	230819
10	1	83	19	0	0	859229
11	1	86	12	0	0	491740
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0

RADAR TYPE 6	
Trial #	Hopping Frequency List (MHz)
1	5447,5361,5434,5556,5383,5401,5373,5503,5389,5482,5583,5646,5539,5412,5504,5312, 5625,5615,5293,5397,5455,5551,5451,5478,5390,5411,5623,5316,5456,5354,5692,5723, 5356,5631,5576,5672,5295,5457,5379,5308,5336,5502,5467,5366,5263,5518,5302,5639, 5527,5593,5596,5299,5437,5408,5621,5635,5681,5444,5718,5714,5475,5657,5378,5616, 5648,5433,5505,5652,5364,5579,5407,5638,5338,5368,5709,5348,5358,5708,5513,5587, 5642,5535,5673,5260,5666,5716,5575,5464,5558,5624,5569,5339,5335,5522,5712,5264, 5439,5385,5289,5572
2	5650,5570,5346,5371,5605,5491,5649,5319,5621,5698,5363,5485,5495,5710,5373,5253, 5668,5498,5505,5469,5454,5620,5610,5258,5511,5561,5721,5350,5573,5293,5507,5436, 5634,5413,5266,5395,5478,5343,5509,5316,5700,5499,5443,5501,5701,5575,5276,5251, 5289,5260,5611,5568,5544,5367,5280,5684,5338,5585,5494,5548,5470,5578,5441,5651, 5576,5332,5693,5703,5500,5574,5714,5439,5679,5427,5359,5282,5661,5534,5719,5311, 5563,5522,5593,5339,5295,5435,5390,5483,5465,5546,5402,5279,5590,5310,5299,5723, 5669,5283,5646,5622
3	5378,5299,5413,5578,5575,5305,5648,5484,5499,5486,5632,5545,5308,5286,5708,5517, 5359,5341,5498,5617,5342,5650,5562,5662,5590,5686,5250,5328,5600,5723,5464,5290, 5607,5382,5585,5335,5559,5706,5296,5640,5371,5534,5489,5716,5487,5633,5300,5518, 5376,5554,5373,5681,5266,5526,5321,5711,5618,5538,5485,5429,5547,5568,5446,5404, 5657,5273,5506,5570,5427,5529,5277,5717,5425,5682,5636,5457,5677,5599,5703,5333, 5369,5366,5309,5263,5573,5337,5483,5405,5542,5354,5667,5397,5291,5478,5449,5586, 5352,5297,5581,5641
4	5504,5683,5713,5716,5329,5536,5661,5626,5277,5601,5383,5673,5590,5363,5284,5459, 5598,5259,5658,5429,5336,5271,5711,5648,5592,5569,5453,5436,5596,5574,5723,5267, 5312,5553,5411,5378,5317,5659,5287,5400,5582,5377,5665,5695,5718,5532,5652,5444, 5715,5342,5364,5402,5554,5483,5696,5314,5374,5485,5458,5439,5406,5276,5385,5655, 5528,5535,5597,5330,5530,5325,5620,5278,5479,5619,5295,5678,5286,5455,5446,5608, 5482,5319,5313,5667,5423,5610,5392,5638,5559,5254,5367,5571,5634,5432,5266,5468, 5373,5589,5651,5361
5	5501,5448,5671,5449,5718,5522,5519,5502,5314,5295,5465,5408,5267,5588,5627,5260, 5336,5647,5381,5368,5534,5281,5338,5412,5536,5426,5466,5389,5467,5407,5455,5513, 5677,5416,5699,5664,5399,5424,5369,5307,5723,5684,5413,5617,5569,5364,5458,5286, 5713,5666,5717,5691,5417,5582,5431,5346,5303,5362,5572,5613,5259,5619,5315,5421, 5652,5321,5594,5662,5473,5261,5310,5322,5435,5724,5644,5351,5655,5430,5418,5450, 5532,5331,5692,5327,5316,5669,5401,5320,5518,5552,5397,5436,5387,5300,5443,5507, 5656,5405,5344,5287
6	5512,5489,5676,5431,5391,5444,5470,5626,5355,5695,5369,5714,5412,5395,5670,5365, 5384,5251,5543,5455,5342,5434,5639,5518,5263,5368,5320,5460,5278,5295,5437,5659, 5393,5430,5563,5364,5488,5259,5600,5396,5617,5446,5426,5317,5397,5254,5330,5297, 5562,5540,5270,5578,5556,5419,5304,5286,5638,5378,5326,5400,5415,5327,5650,5657, 5305,5269,5515,5555,5602,5374,5376,5620,5257,5572,5370,5258,5288,5272,5623,5462, 5274,5344,5260,5509,5328,5575,5606,5523,5721,5452,5501,5385,5710,5466,5256,5663, 5691,5432,5718,5524
7	5297,5439,5517,5369,5288,5377,5516,5589,5625,5562,5700,5431,5504,5477,5277,5493, 5577,5399,5361,5500,5481,5437,5278,5273,5472,5531,5617,5524,5378,5622,5569,5460, 5462,5613,5307,5486,5485,5593,5660,5600,5547,5367,5528,5285,5419,5503,5635,5364, 5282,5606,5274,5540,5251,5488,5346,5571,5624,5315,5496,5434,5327,5587,5293,5560, 5588,5694,5256,5342,5530,5425,5720,5605,5614,5636,5469,5362,5363,5264,5687,5436, 5646,5612,5544,5389,5669,5272,5286,5353,5289,5666,5716,5583,5639,5370,5271,5476, 5430,5659,5576,5602

RADAR TYPE 6	
Trial #	Hopping Frequency List (MHz)
8	5353,5459,5510,5427,5495,5419,5462,5624,5582,5638,5701,5400,5592,5398,5508,5389, 5531,5502,5500,5597,5528,5445,5503,5449,5672,5605,5717,5362,5506,5408,5711,5692, 5512,5565,5537,5501,5261,5583,5668,5552,5291,5384,5670,5663,5515,5598,5693,5471, 5407,5586,5704,5323,5632,5681,5311,5479,5614,5349,5368,5423,5652,5451,5432,5329, 5557,5696,5613,5519,5644,5556,5294,5487,5558,5406,5352,5369,5394,5465,5662,5554, 5713,5439,5658,5581,5507,5491,5452,5648,5686,5267,5461,5333,5424,5290,5721,5403, 5676,5488,5280,5659
9	5561,5571,5373,5525,5323,5511,5308,5679,5627,5486,5348,5537,5444,5615,5624,5365, 5423,5262,5675,5315,5567,5564,5349,5540,5298,5322,5653,5328,5398,5311,5710,5608, 5303,5602,5336,5457,5639,5434,5432,5433,5498,5270,5449,5644,5649,5614,5533,5391, 5606,5705,5663,5538,5689,5342,5722,5471,5557,5476,5250,5583,5704,5531,5566,5500, 5282,5654,5390,5632,5508,5553,5493,5319,5543,5620,5374,5369,5661,5516,5331,5297, 5502,5643,5685,5605,5589,5625,5413,5573,5453,5691,5429,5674,5612,5719,5473,5520, 5579,5699,5446,5360
10	5295,5333,5273,5428,5571,5662,5351,5541,5463,5293,5265,5484,5453,5504,5260,5429, 5382,5672,5257,5345,5369,5644,5403,5352,5364,5675,5258,5379,5684,5573,5332,5610, 5457,5560,5427,5267,5688,5311,5617,5359,5410,5676,5669,5470,5357,5709,5388,5631, 5692,5715,5375,5654,5645,5313,5621,5653,5696,5581,5614,5685,5448,5598,5516,5297, 5425,5492,5680,5283,5477,5534,5717,5401,5420,5455,5626,5395,5641,5435,5426,5574, 5509,5671,5331,5630,5266,5363,5371,5284,5339,5285,5469,5449,5320,5679,5309,5526, 5432,5701,5648,5317
11	5487,5566,5662,5494,5618,5416,5276,5551,5665,5429,5509,5599,5339,5569,5690,5519, 5475,5533,5259,5669,5442,5314,5517,5648,5349,5500,5586,5364,5252,5449,5650,5441, 5433,5490,5693,5497,5470,5680,5258,5512,5344,5290,5603,5706,5359,5264,5300,5591, 5418,5639,5373,5295,5501,5394,5570,5640,5434,5427,5309,5674,5622,5386,5550,5702, 5346,5577,5250,5406,5347,5274,5368,5391,5472,5571,5313,5281,5260,5318,5387,5713, 5549,5652,5676,5548,5547,5518,5588,5605,5654,5333,5698,5619,5439,5323,5638,5691, 5673,5477,5541,5524
12	5401,5499,5687,5369,5487,5290,5278,5663,5554,5723,5461,5251,5300,5395,5537,5427, 5583,5553,5410,5697,5366,5284,5418,5577,5382,5715,5616,5439,5347,5352,5485,5258, 5377,5525,5516,5585,5428,5281,5547,5576,5716,5504,5699,5408,5438,5273,5349,5279, 5357,5317,5569,5330,5360,5711,5496,5398,5563,5565,5452,5533,5700,5717,5647,5594, 5270,5566,5405,5522,5587,5370,5375,5505,5443,5419,5669,5692,5517,5610,5719,5320, 5413,5694,5409,5435,5475,5441,5509,5399,5262,5400,5301,5416,5432,5445,5351,5479, 5619,5677,5571,5454
13	5449,5282,5585,5612,5666,5292,5529,5606,5402,5679,5457,5463,5532,5554,5677,5435, 5560,5341,5688,5263,5438,5357,5700,5453,5277,5711,5474,5590,5288,5716,5291,5473, 5689,5661,5548,5547,5534,5398,5704,5518,5445,5569,5625,5615,5293,5422,5528,5713, 5558,5265,5307,5381,5543,5664,5567,5250,5416,5715,5589,5262,5540,5283,5645,5497, 5504,5609,5324,5336,5583,5442,5719,5705,5303,5640,5674,5597,5604,5417,5686,5579, 5580,5290,5675,5584,5482,5403,5687,5276,5383,5406,5409,5720,5423,5524,5344,5496, 5511,5593,5685,5471
14	5573,5270,5499,5363,5324,5618,5716,5386,5444,5301,5677,5684,5718,5695,5637,5272, 5456,5362,5278,5557,5308,5562,5545,5442,5604,5366,5579,5326,5645,5425,5711,5619, 5543,5351,5564,5707,5289,5612,5414,5284,5721,5686,5358,5293,5463,5530,5373,5657, 5505,5398,5378,5413,5260,5449,5307,5483,5683,5288,5688,5310,5524,5600,5691,5314, 5424,5593,5322,5290,5416,5475,5589,5522,5312,5436,5399,5390,5560,5455,5346,5605, 5277,5396,5491,5380,5341,5365,5650,5531,5653,5375,5321,5661,5412,5327,5355,5504, 5584,5464,5598,5648

RADAR TYPE 6	
Trial #	Hopping Frequency List (MHz)
15	5700,5580,5351,5384,5263,5632,5343,5373,5558,5591,5489,5643,5573,5544,5548,5294, 5502,5682,5365,5610,5547,5464,5451,5375,5438,5678,5322,5716,5454,5675,5486,5330, 5257,5353,5420,5635,5279,5681,5267,5529,5541,5421,5494,5634,5507,5575,5311,5252, 5627,5349,5712,5350,5379,5671,5310,5560,5644,5607,5354,5408,5636,5469,5374,5637, 5265,5546,5347,5422,5647,5721,5679,5669,5293,5540,5391,5393,5673,5584,5706,5269, 5659,5506,5303,5260,5291,5432,5336,5262,5582,5415,5383,5662,5295,5431,5296,5251, 5333,5563,5382,5270
16	5252,5266,5269,5685,5501,5658,5495,5427,5616,5466,5439,5381,5686,5535,5539,5640, 5335,5382,5713,5622,5666,5336,5603,5407,5453,5347,5492,5538,5705,5454,5644,5345, 5373,5282,5258,5275,5412,5376,5358,5250,5579,5560,5691,5673,5668,5531,5333,5620, 5482,5675,5575,5485,5329,5388,5587,5481,5403,5416,5681,5446,5411,5547,5343,5653, 5527,5514,5478,5684,5273,5712,5292,5355,5369,5654,5463,5646,5263,5597,5306,5619, 5694,5612,5678,5342,5611,5549,5680,5559,5363,5529,5523,5405,5693,5582,5651,5588, 5442,5698,5521,5458
17	5374,5559,5389,5543,5625,5552,5411,5577,5573,5370,5700,5435,5627,5653,5314,5318, 5403,5394,5717,5564,5528,5613,5373,5583,5504,5338,5286,5479,5292,5632,5419,5705, 5546,5425,5309,5540,5265,5722,5536,5368,5523,5252,5429,5315,5654,5430,5582,5298, 5706,5681,5486,5436,5531,5289,5515,5656,5535,5666,5675,5720,5474,5477,5254,5503, 5387,5396,5431,5446,5255,5610,5695,5597,5272,5356,5299,5434,5371,5723,5589,5473, 5664,5598,5258,5701,5270,5712,5310,5452,5268,5566,5427,5329,5297,5626,5524,5484, 5648,5600,5465,5378
18	5417,5513,5409,5607,5350,5469,5553,5721,5274,5250,5538,5381,5494,5411,5685,5410, 5260,5267,5549,5492,5693,5578,5431,5654,5598,5355,5399,5470,5448,5354,5314,5382, 5605,5533,5647,5586,5612,5566,5623,5438,5719,5614,5294,5559,5610,5665,5363,5474, 5631,5300,5697,5563,5332,5479,5258,5320,5333,5522,5644,5425,5473,5723,5602,5288, 5380,5708,5594,5505,5584,5589,5290,5554,5520,5530,5334,5643,5263,5446,5695,5564, 5356,5545,5617,5496,5540,5641,5325,5390,5295,5670,5627,5539,5293,5501,5316,5353, 5629,5704,5467,5439
19	5429,5448,5531,5528,5437,5288,5507,5459,5563,5417,5632,5443,5611,5487,5461,5303, 5588,5509,5449,5625,5508,5575,5505,5627,5520,5562,5392,5671,5306,5541,5716,5346, 5642,5365,5418,5689,5262,5453,5286,5608,5655,5457,5502,5350,5428,5345,5407,5263, 5579,5300,5290,5445,5268,5538,5646,5598,5276,5641,5451,5364,5512,5600,5352,5525, 5495,5318,5497,5384,5472,5565,5694,5301,5322,5404,5425,5405,5378,5341,5255,5501, 5521,5328,5353,5444,5545,5662,5362,5537,5559,5494,5674,5626,5434,5326,5636,5669, 5332,5260,5630,5697
20	5427,5569,5594,5525,5597,5425,5466,5296,5710,5421,5502,5349,5369,5273,5422,5300, 5498,5560,5652,5572,5638,5321,5552,5351,5694,5372,5604,5493,5433,5259,5720,5595, 5548,5625,5509,5574,5269,5314,5661,5513,5508,5696,5527,5302,5373,5586,5497,5332, 5308,5309,5355,5267,5492,5354,5628,5303,5528,5526,5411,5506,5478,5546,5637,5450, 5495,5716,5501,5374,5538,5580,5654,5618,5629,5320,5481,5632,5262,5487,5537,5489, 5520,5639,5608,5459,5709,5707,5535,5640,5298,5655,5460,5385,5667,5251,5341,5532, 5659,5542,5562,5723
21	5708,5354,5621,5514,5649,5593,5665,5306,5577,5395,5368,5564,5334,5357,5291,5390, 5556,5295,5264,5570,5385,5389,5271,5496,5319,5485,5547,5255,5555,5702,5330,5494, 5428,5412,5625,5355,5338,5442,5610,5296,5358,5437,5327,5314,5266,5353,5642,5491, 5519,5711,5365,5548,5615,5588,5568,5332,5374,5444,5413,5660,5475,5599,5315,5647, 5456,5301,5363,5409,5692,5461,5673,5312,5681,5479,5690,5567,5563,5489,5286,5716, 5689,5670,5538,5307,5272,5723,5446,5250,5423,5686,5452,5724,5392,5693,5720,5501, 5468,5597,5580,5403

RADAR TYPE 6	
Trial #	Hopping Frequency List (MHz)
22	5640,5505,5375,5619,5478,5571,5457,5420,5439,5608,5350,5653,5348,5399,5637,5336, 5365,5688,5692,5288,5711,5584,5682,5337,5722,5572,5311,5659,5543,5368,5258,5339, 5384,5633,5526,5621,5319,5494,5600,5517,5252,5496,5569,5624,5464,5371,5622,5352, 5642,5381,5482,5717,5613,5364,5646,5418,5532,5481,5723,5395,5486,5489,5341,5563, 5437,5598,5266,5267,5595,5425,5286,5264,5307,5675,5684,5411,5610,5265,5451,5269, 5705,5604,5452,5512,5263,5601,5491,5330,5625,5432,5626,5363,5612,5630,5438,5328, 5632,5361,5605,5298
23	5435,5469,5459,5604,5325,5362,5417,5458,5718,5538,5480,5581,5460,5303,5519,5589, 5659,5500,5697,5666,5492,5455,5365,5297,5722,5360,5263,5516,5341,5577,5383,5553, 5660,5271,5390,5451,5456,5513,5699,5485,5338,5608,5280,5420,5384,5533,5574,5698, 5586,5686,5664,5531,5705,5354,5411,5606,5690,5348,5475,5667,5270,5446,5627,5448, 5632,5368,5497,5449,5293,5434,5423,5518,5695,5277,5414,5692,5665,5603,5382,5724, 5615,5444,5680,5642,5703,5570,5490,5266,5281,5464,5616,5706,5557,5512,5285,5374, 5542,5502,5259,5326
24	5722,5639,5275,5470,5343,5724,5271,5690,5261,5254,5611,5412,5580,5612,5527,5270, 5407,5486,5480,5385,5432,5384,5402,5587,5347,5542,5484,5662,5363,5678,5257,5670, 5566,5705,5655,5465,5668,5648,5281,5443,5650,5694,5553,5626,5578,5430,5628,5602, 5265,5481,5332,5502,5504,5665,5539,5598,5607,5720,5511,5278,5623,5300,5603,5467, 5263,5490,5682,5312,5326,5483,5454,5286,5460,5463,5556,5501,5259,5641,5638,5647, 5595,5416,5625,5415,5401,5592,5311,5652,5574,5656,5622,5321,5272,5360,5388,5644, 5404,5297,5455,5672
25	5346,5597,5329,5518,5629,5356,5266,5429,5373,5300,5363,5324,5530,5444,5265,5556, 5605,5355,5563,5392,5304,5478,5623,5474,5499,5687,5693,5452,5271,5432,5674,5420, 5339,5453,5495,5438,5573,5305,5277,5516,5322,5624,5310,5303,5314,5364,5483,5389, 5267,5417,5362,5617,5659,5618,5593,5699,5579,5268,5666,5387,5539,5408,5665,5351, 5668,5709,5327,5551,5708,5550,5328,5296,5336,5706,5578,5435,5459,5312,5253,5561, 5527,5404,5559,5626,5464,5718,5286,5335,5378,5491,5639,5683,5360,5287,5534,5562, 5284,5592,5570,5572
26	5637,5264,5385,5408,5558,5343,5653,5476,5404,5650,5514,5390,5555,5492,5297,5337, 5714,5513,5717,5643,5570,5317,5620,5605,5310,5356,5535,5475,5694,5398,5527,5682, 5557,5647,5612,5328,5559,5453,5716,5450,5485,5283,5418,5499,5519,5486,5474,5294, 5291,5651,5251,5369,5505,5348,5451,5533,5252,5434,5502,5711,5433,5722,5409,5259, 5405,5443,5556,5586,5436,5340,5582,5266,5413,5250,5649,5319,5280,5327,5493,5547, 5461,5447,5263,5300,5506,5431,5511,5501,5674,5464,5614,5268,5289,5458,5421,5507, 5318,5257,5594,5516
27	5564,5250,5510,5432,5475,5403,5417,5493,5641,5436,5668,5308,5543,5720,5542,5506, 5330,5255,5554,5316,5336,5284,5301,5446,5546,5384,5313,5710,5479,5453,5382,5608, 5262,5515,5323,5681,5357,5334,5431,5410,5277,5671,5684,5471,5462,5603,5482,5426, 5427,5514,5450,5478,5465,5381,5278,5582,5282,5429,5655,5682,5464,5651,5626,5362, 5529,5716,5257,5298,5447,5721,5610,5650,5338,5341,5700,5333,5505,5555,5534,5415, 5276,5592,5441,5379,5522,5289,5666,5653,5500,5251,5480,5320,5456,5283,5569,5349, 5491,5419,5264,5705
28	5518,5564,5552,5707,5387,5290,5302,5498,5501,5598,5371,5516,5438,5308,5435,5257, 5677,5315,5370,5671,5669,5608,5420,5412,5606,5307,5380,5708,5432,5314,5364,5401, 5295,5324,5601,5539,5626,5600,5252,5524,5377,5358,5528,5267,5699,5384,5367,5316, 5354,5618,5284,5573,5681,5381,5545,5505,5647,5514,5319,5534,5365,5393,5559,5405, 5442,5300,5413,5495,5394,5480,5312,5589,5333,5721,5591,5500,5259,5507,5261,5476, 5644,5421,5719,5462,5454,5568,5351,5599,5715,5550,5686,5488,5666,5373,5339,5428, 5450,5661,5641,5623

RADAR TYPE 6	
Trial #	Hopping Frequency List (MHz)
29	5651,5648,5678,5283,5723,5582,5382,5482,5639,5709,5447,5654,5493,5542,5457,5664, 5637,5686,5445,5714,5342,5420,5629,5492,5261,5317,5384,5646,5297,5444,5351,5308, 5454,5270,5276,5539,5501,5534,5352,5555,5467,5483,5636,5702,5401,5559,5422,5607, 5489,5538,5358,5465,5531,5480,5268,5436,5272,5655,5460,5435,5389,5450,5473,5516, 5642,5413,5583,5615,5497,5584,5509,5652,5340,5427,5620,5554,5288,5533,5631,5718, 5567,5527,5464,5521,5314,5512,5357,5256,5441,5345,5262,5674,5289,5689,5325,5499, 5575,5403,5671,5696
30	5341,5346,5570,5285,5618,5422,5627,5538,5613,5546,5647,5259,5720,5371,5349,5565, 5410,5507,5491,5536,5317,5556,5328,5318,5671,5515,5323,5457,5446,5469,5717,5373, 5517,5550,5429,5693,5667,5387,5464,5558,5395,5628,5440,5436,5664,5294,5567,5701, 5594,5339,5637,5384,5509,5267,5501,5353,5348,5420,5342,5394,5554,5523,5467,5666, 5380,5623,5273,5293,5657,5391,5414,5607,5256,5470,5480,5576,5379,5648,5461,5382, 5646,5645,5676,5415,5298,5360,5460,5700,5313,5611,5447,5599,5626,5696,5315,5274, 5705,5718,5463,5619