TEST REPORT

Test Report No. : UL-RPT-RP10266605JD01A

Manufacturer	:	Siemens AG
Model No.	:	ELN-W1-RJ-E1
FCC ID	:	LYHELN1V1
IC Certification No.	:	267AA-ELN1V1
Technology	:	WLAN (802.11 a/n)
Test Standard(s)	:	FCC Part 15.407(h)(2) & Industry Canada RSS-210 A9.3

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

Date of Issue: 12 May 2014

Checked by:

Sarah Williams
Engineer, Radio Laboratory

Issued by :

pp

John Newell
Group Quality Manager
Basingstoke,
UL VS LTD

0644

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

UL VS LTD

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG, UK
Telephone: +44 (0)1256 312000
Facsimile: +44 (0)1256 312001

This page has been left intentionally blank.

Table of Contents

1. Customer Information **4**

2. Summary of Testing **5**
2.1. General Information 5
2.2. Summary of Test Results 5
2.3. Methods and Procedures 6
2.4. Deviations from the Test Specification 6

3. Equipment Under Test (EUT) **7**
3.1. Identification of Equipment Under Test (EUT) 7
3.2. Description of EUT 7
3.3. Modifications Incorporated in the EUT 7
3.4. Additional Information Related to Testing 8
3.5. Support Equipment 8

4. Operation and Monitoring of the EUT during Testing **9**
4.1. Operating Modes 9
4.2. Configuration and Peripherals 9

5. Measurements, Examinations and Derived Results **10**
5.1. General Comments 10
5.2. Test Results 11
5.2.1. U-NII Detection Bandwidth 11
5.2.2. Initial Channel Availability Check Time 15
5.2.3. Radar Burst at the Beginning of the Channel Availability Check Time 16
5.2.4. Radar Burst at the End of the Channel Availability Check Time 17
5.2.5. Channel Closing Transmission Time and Channel Move Time 18
5.2.6. Non-Occupancy Period 23
5.2.7. Statistical Performance Check – Short Pulse Radar Types 1 - 4 24
5.2.8. Statistical Performance Check – Long Pulse Radar Type 5 29
5.2.9. Statistical Performance Check – Frequency Hopping Radar Type 6 31

6. Measurement Uncertainty **32**

Appendix 1. Test Equipment Used **33**

Appendix 2. Monitoring Methods Diagrams **34**

Appendix 3. Radar Type 1-6 Calibration and Verification Data **36**

Appendix 4. Test platform confirmation email **43**

Appendix 5. Statistical Performance Check– Radar Type 5 Trial Records **44**

Appendix 6. System Noise floor Reference Plots **60**

Appendix 7. Test Set-up Photograph **61**

1. Customer Information

Company Name:	Siemens AG
Address:	Sector Industry Automation Division, Oestliche Rheinbrueckenstr. 50, D-76181-Karlsruhe, Germany

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.407
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart E (Unlicensed National Information Infrastructure Devices) - Section 15.407
Specification Reference:	Industry Canada RSS-210 Issue 8 December 2010
Specification Title:	Low-power Licence-exempt Radio communication Devices (All Frequency Bands): Category I Equipment.
Site Registration:	FCC: 209735; Industry Canada: 3245B-2
Test Dates:	10 April 2014 to 29 April 2014

2.2. Summary of Test Results

FCC Reference (47CFR)	IC Reference	Measurement	Result
Part 15.407(h)(2)	RSS-210 A9.3(a)	U-NII Detection Bandwidth	✓
Part 15.407(h)(2)(ii)	RSS-210 A9.3(b)(ii)	Initial Channel Availability Check Time	✓
Part 15.407(h)(2)(ii)	RSS-210 A9.3(b)(ii)	Radar Burst at the Beginning of the Channel Availability Check Time	✓
Part 15.407(h)(2)(ii)	RSS-210 A9.3(b)(ii)	Radar Burst at the End of the Channel Availability Check Time	✓
Part 15.407(h)(2)(iii)	RSS-210 A9.3(b)(iii)(iv)	Channel Closing Transmission Time and Channel Move Time	✓
Part 15.407(h)(2)(iv)	RSS-210 A9.3(b)(v)	Non-occupancy Period	✓
Part 15.407(h)(2)	RSS-210 A9.3(a)	Statistical Performance Check – Short Pulse Radar Types 1-4	✓
Part 15.407(h)(2)	RSS-210 A9.3(a)	Statistical Performance Check – Long Pulse Radar Type 5	✓
Part 15.407(h)(2)	RSS-210 A9.3(a)	Statistical Performance Check – Frequency Hopping Radar Type 6	✓

Key to Results

✓ = Complied ✗ = Did not comply

Note(s):

1. Only DFS tests at the lowest EUT bandwidth (20 MHz) are required in accordance with clause 8.3)18) of FCC 06-96. Tests for detection bandwidth were additionally performed at 40 MHz to ensure the EUT also detected radars across the entire frequency range of the wider bandwidth setting.
2. The Manufacturer confirms that information regarding the parameters of the radar waveforms is not available to the end user.

2.3. Methods and Procedures

Reference:	FCC 06-96
Title:	Compliance Measurement Procedures for Unlicensed-National Information Infrastructure Devices Operating in the 5250-5350 MHz and 5470-5725 MHz Bands Incorporating Dynamic Frequency Selection

2.4. Deviations from the Test Specification

There were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Siemens
Model Name or Number:	ELN-W1-RJ-E1
Serial Number:	VPE1128901 *(Master)*
Hardware Version Number:	1
Software Version Number:	3.2
FCC ID:	LYHELN1V1
Industry Canada Certification Number:	267AA-ELN1V1

Brand Name:	Siemens
Model Name or Number:	ELN-W1-RJ-E1
Serial Number:	VPE1128902 *(Client)*
Hardware Version Number:	1
Software Version Number:	3.2
FCC ID:	LYHELN1V1
Industry Canada Certification Number:	267AA-ELN1V1

3.2. Description of EUT

The equipment under test was an 802.11a/b/g/n Wi-Fi Access Point.

The EUT can be operated in either Master or Client mode depending on the firmware configuration. Client mode does not feature radar detection.

The 802.11n mode supports both 20 MHz and 40 MHz bandwidths. It has a single antenna port and therefore only supports SISO data rates (MCS0-7).

3.3. Modifications Incorporated in the EUT

No modifications were made to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	Unlicensed National Information Infrastructure Devices (U-NII)		
Type of Unit:	Access Point		
Modulation:	802.11a, 802.11n (MCS0-7)		
Minimum Antenna Gain:	5 dBi		
Power Supply Requirement:	Nominal	24 VDC	
Transmit & Receive Frequency Range:	5150 MHz to 5850 MHz (excluded 5600 MHz to 5650 MHz)		
Channel Spacing:	20 MHz		
Transmit & Receive Channels Tested:	**Channel Frequency Master (MHz):**		5500
	Channel Frequency Client (MHz):		5680
Channel Spacing:	40 MHz		
Transmit & Receive Channels Tested:	**Channel Frequency (MHz):**		5510

3.5. Support Equipment

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

Description:	FCC Approved DFS Master (for Client Testing)
Brand Name:	Cisco
Model Name or Number:	Aironet IOS Access Point AIR-AP1252AG-A-K9
Serial Number:	FGL1547Z00U
FCC ID:	LDK102061
Industry Canada Certification Number:	2461B-102061

Description:	Laptop Computer (on Master Device)
Brand Name:	Dell
Model Name or Number:	Lattitude D610
Serial Number:	GN20Q1J

Description:	Laptop Computer (on Client Device)
Brand Name:	Dell
Model Name or Number:	Lattitude D610
Serial Number:	3SCJ02J

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- The EUT was tested as a Master or Client, transmitting on full power.
- The EUT was tested with 802.11n MCS7 modulation (65 Mbps data rate).
- The EUT has a single antenna port which normally connects to an external antenna. The radar signal was applied to this port, at the levels defined in FCC 06-96, compensated for the minimum antenna gain.
- The device was tested with a power level of 20 dBm (100 mW). This was designed to simulate the use of an antenna with the minimum specified gain of +5 dBi.
- The DFS detection threshold of -62 dBm was used throughout, as the maximum transmit power was <200 mW.
    - The customer declared the highest gain of the antennas used in the product to be 5 dBi. Since the test is performed conducted, this additional gain which would normally be present in the signal is added to the radar test level.
    - The radar level to be presented at the antenna ports was calculated as:
      -62 dBm +5 dBi antenna gain +1 dB to account for variations = -56.0 dBm radar level at antenna ports.

FCC 06-96 Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

Maximum Transmit Power	**Value (See Notes 1 and 2)**
< 200 milliwatt	-62 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.	

4.2. Configuration and Peripherals

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

- All measurements were made using a conducted link.
- A laptop PC was used to configure the EUT parameters during the testing using a standard web browser and via a terminal application. The laptop was connected to the EUT via Ethernet and serial connections to set EUT parameters.
- The EUT's serial interface was used to report radar detection events.
- When the system required channel loading, a MPEG video file that streamed full motion video at 30 frames per second was downloaded from http://ntiacsd.ntia.doc.gov/dfs/ and played between 2 laptops. The file was transferred from the master device to the client device during this testing.

5. Measurements, Examinations and Derived Results

5.1. General Comments

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

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

5.2. Test Results

5.2.1. U-NII Detection Bandwidth

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	11 April 2014
Test Sample Serial Number:	VPE1128901 (Master)		

FCC Reference:	Part 15.407(h)(2)
Industry Canada Reference:	RSS-210 A9.3(a)
Test Method Used:	FCC 06-96 Section 7.8.1

Environmental Conditions:

Temperature (℃):	25
Relative Humidity (%):	30

Note(s):

1. The device was not connected to a client and no data transfer was performed during the test (so the detection probability was not reduced due to data load of the channel) in accordance with FCC 06-96.
2. The EUT was tested at 1 MHz steps out from centre frequency of 5500 MHz (HT20) or 5510 MHz (HT40) until the entire 99% bandwidth was covered.
3. 99% bandwidth was measured using the OBW function of the Rohde & Schwarz FSV30 spectrum analyser.

U-NII Detection Bandwidth (continued)

Results: 20 MHz

Bandwidth setting (MHz)	Measured 99% Bandwidth (MHz)
20	18.8

Offset from centre frequency (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)	Result (>90% detection)
-10.0	10	100	Complied (<F_L)
-9.0	10	100	Complied
-8.0	10	100	Complied
-7.0	10	100	Complied
-6.0	10	100	Complied
-5.0	10	100	Complied
-4.0	10	100	Complied
-3.0	10	100	Complied
-2.0	10	100	Complied
-1.0	10	100	Complied
+1.0	10	100	Complied
+2.0	10	100	Complied
+3.0	10	100	Complied
+4.0	10	100	Complied
+5.0	10	100	Complied
+6.0	10	100	Complied
+7.0	10	100	Complied
+8.0	10	100	Complied
+9.0	10	100	Complied
+10.0	10	100	Complied (>F_H)

The detection bandwidth of 20 MHz covers the whole channel bandwidth, and is therefore greater than 80% of the 99% bandwidth of 18.8 MHz.

U-NII Detection Bandwidth (continued)

Results: 40 MHz

Bandwidth setting (MHz)	Measured 99% Bandwidth (MHz)
40	37.3

Offset from centre frequency (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)	Result (>90% detection)
-19.0	10	100	Complied (<F_L)
-18.0	10	100	Complied
-17.0	10	100	Complied
-16.0	10	100	Complied
-15.0	10	100	Complied
-14.0	10	100	Complied
-13.0	10	100	Complied
-12.0	10	100	Complied
-11.0	10	100	Complied
-10.0	10	100	Complied
-9.0	10	100	Complied
-8.0	10	100	Complied
-7.0	10	100	Complied
-6.0	10	100	Complied
-5.0	10	100	Complied
-4.0	10	100	Complied
-3.0	10	100	Complied
-2.0	10	100	Complied
-1.0	10	100	Complied
+1.0	10	100	Complied
+2.0	10	100	Complied
+3.0	10	100	Complied
+4.0	10	100	Complied
+5.0	10	100	Complied
+6.0	10	100	Complied
+7.0	10	100	Complied
+8.0	10	100	Complied
+9.0	10	100	Complied
+10.0	10	100	Complied
+11.0	10	100	Complied

U-NII Detection Bandwidth (continued)

Results: 40 MHz (continued)

Offset from centre frequency (MHz)	Detection attempts successful from 10 attempts at each frequency	Detection Rate (%)	Result (>90% detection)
+12.0	10	100	Complied
+13.0	10	100	Complied
+14.0	10	100	Complied
+15.0	10	100	Complied
+16.0	10	100	Complied
+17.0	10	100	Complied
+18.0	10	100	Complied
+19.0	10	100	Complied (>F_H)

The detection bandwidth of 38 MHz covers the whole channel bandwidth, and is therefore greater than 80% of the 99% bandwidth of 37.3 MHz.

Limits:

Table 4: DFS Response Requirement Values

Parameter	Value
U-NII Detection Bandwidth	Minimum 80% of the U-NII 99% transmission power bandwidth. See Note 3.
Note 3: During the U-NII Detection Bandwidth detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

5.2.2. Initial Channel Availability Check Time

Test Summary:

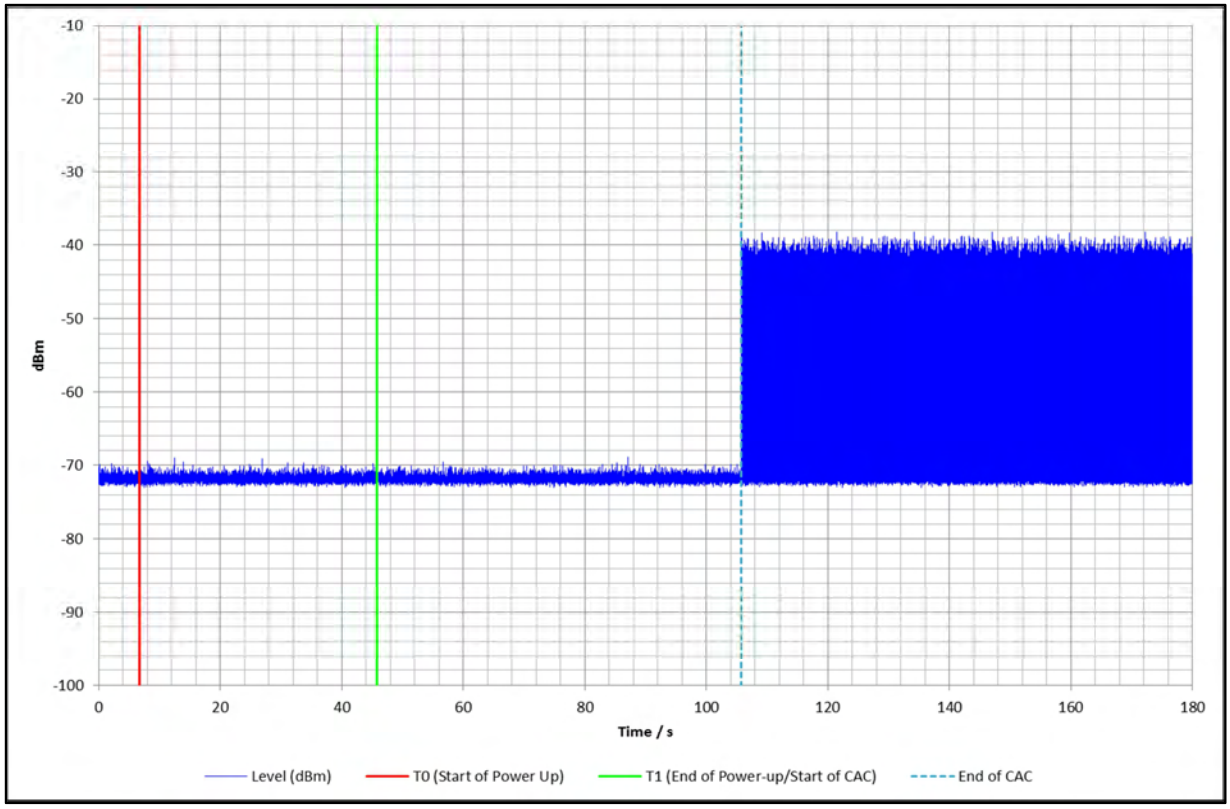
Test Engineer:	Philip Harrison	**Test Date:**	14 April 2014
Test Sample Serial Number:	VPE1128901 (Master)		

FCC Reference:	Part 15.407(h)(2)(ii)
Industry Canada Reference:	RSS-210 A9.3(b)(ii)
Test Method Used:	FCC 06-96 Section 7.8.2.1

Environmental Conditions:

Temperature (℃):	27
Relative Humidity (%):	30

Results: 20 MHz



Power up time is 39 s. CAC length is 60 s. Transmissions occurred 99 s after power on.

No beacon or data transmission seen during channel availability check time.

Limit:

Parameter	Value
Channel Availability Check Time	60 seconds

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

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	11 April 2014
Test Sample Serial Number:	VPE1128901 (Master)		

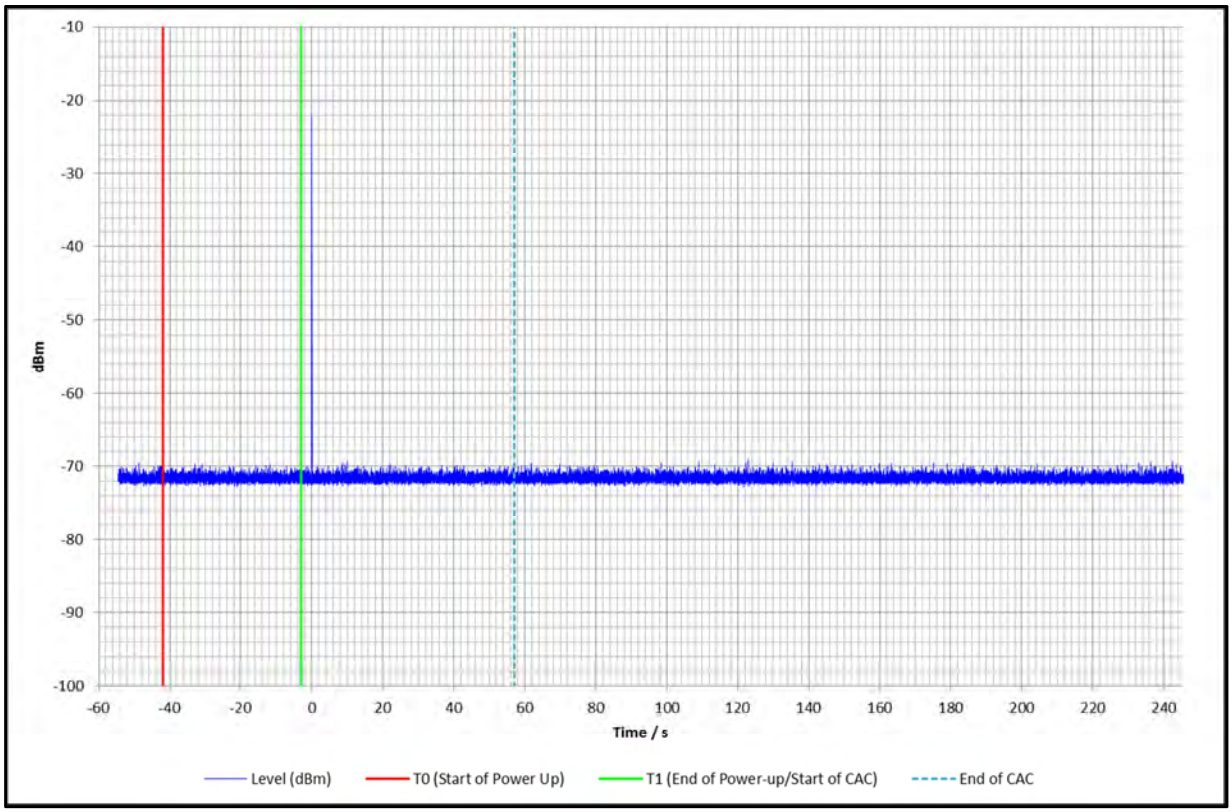
FCC Reference:	Part 15.407(h)(2)(ii)
Industry Canada Reference:	RSS-210 A9.3(b)(ii)
Test Method Used:	FCC 06-96 Section 7.8.2.2

Environmental Conditions:

Temperature (℃):	26
Relative Humidity (%):	28

Results: 20 MHz

Radar burst type 1 was detected and no beacon or data transmission seen.



Radar Pulse 3 s after the beginning of CAC

Limit:

Parameter	Value
Channel Availability Check Time	60 seconds

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

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	11 April 2014
Test Sample Serial Number:	VPE1128901 (Master)		

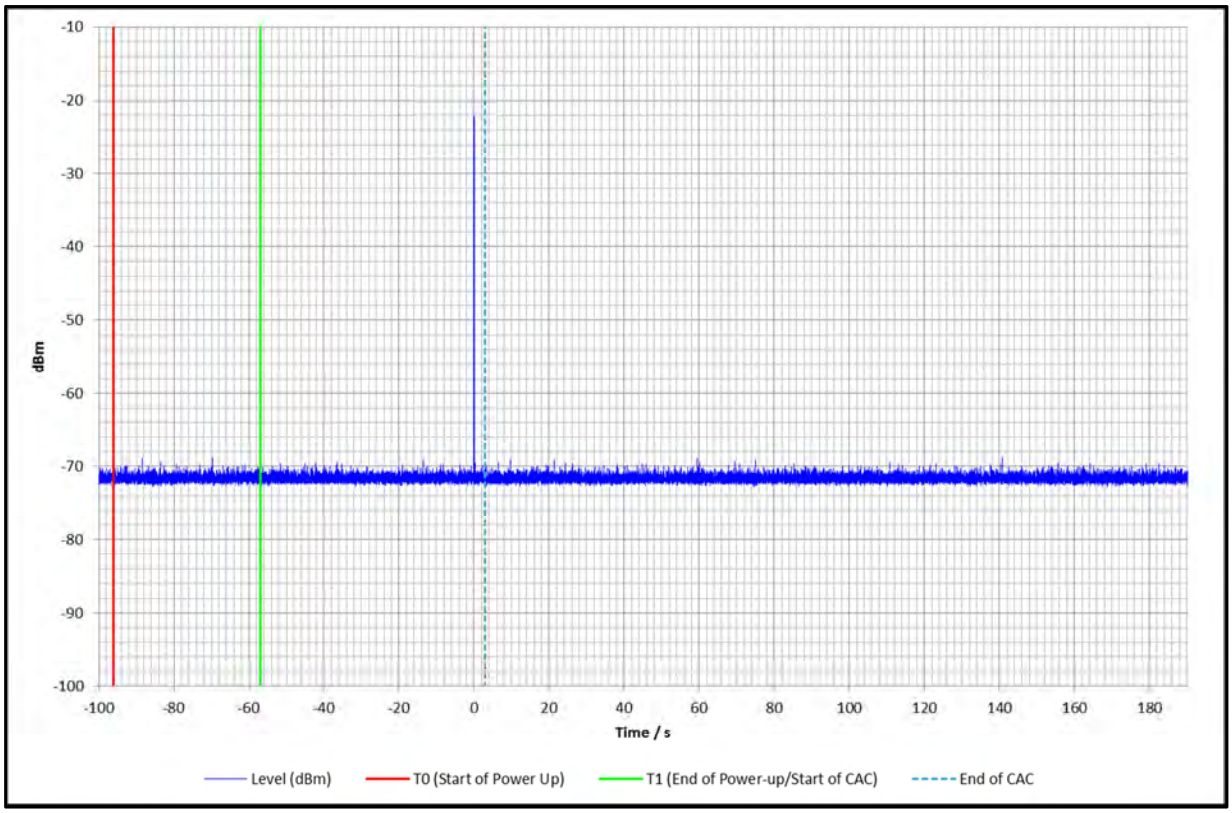
FCC Reference:	Part 15.407(h)(2)(ii)
Industry Canada Reference:	RSS-210 A9.3(b)(ii)
Test Method Used:	FCC 06-96 Section 7.8.2.3

Environmental Conditions:

Temperature (℃):	26
Relative Humidity (%):	28

Results: 20 MHz

Radar burst type 1 was detected and no beacon or data transmission seen.



Radar Pulse 3 s before end of CAC

Limit:

Parameter	Value
Channel Availability Check Time	60 seconds

5.2.5. Channel Closing Transmission Time and Channel Move Time

Test Summary:

Test Engineer:	Philip Harrison	**Test Dates:**	14 April 2014 & 29 April 2014
Test Sample Serial Numbers:	VPE1128901 (Master) VPE1128902 (Client)		

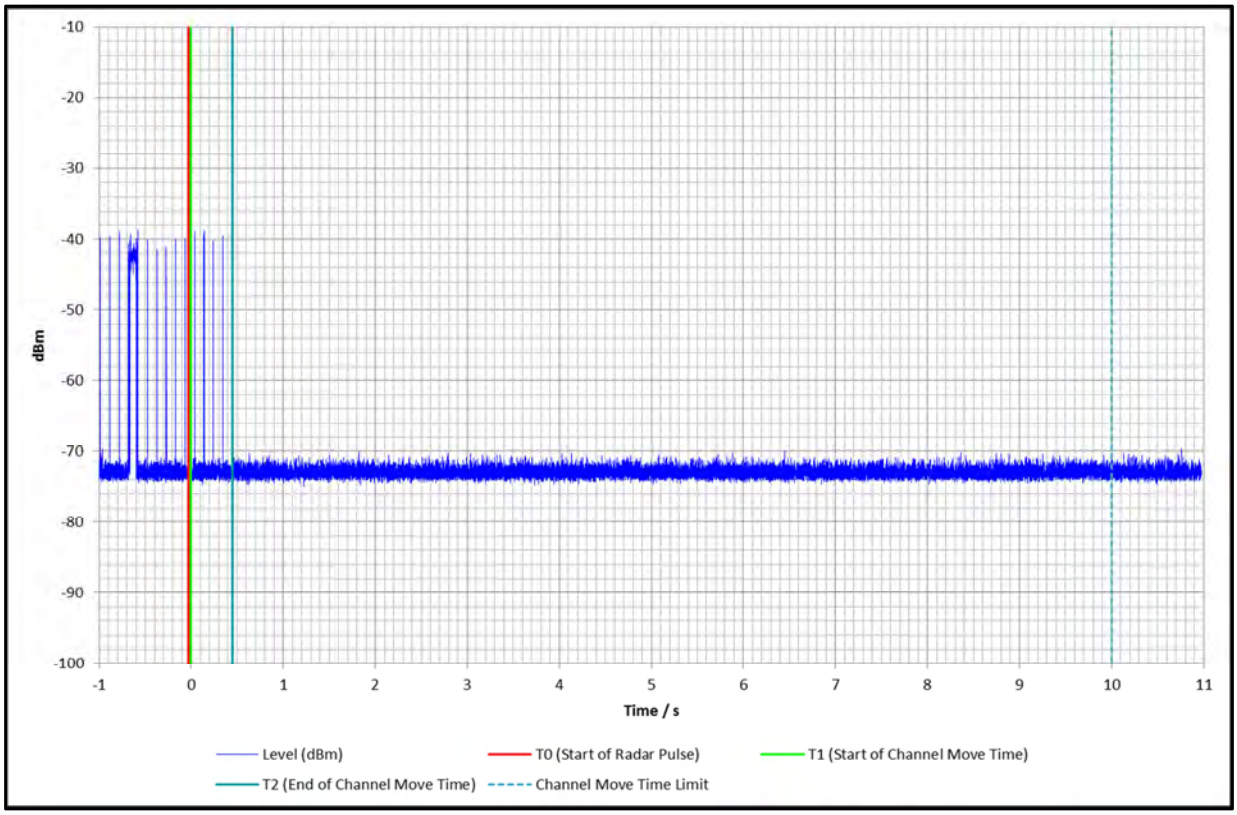
FCC Reference:	Part 15.407(h)(2)(iii)
Industry Canada Reference:	RSS-210 A9.3(b)(iii)(iv)
Test Method Used:	FCC 06-96 Section 7.8.3

Environmental Conditions:

Temperature (℃):	26 to 27
Relative Humidity (%):	30 to 31

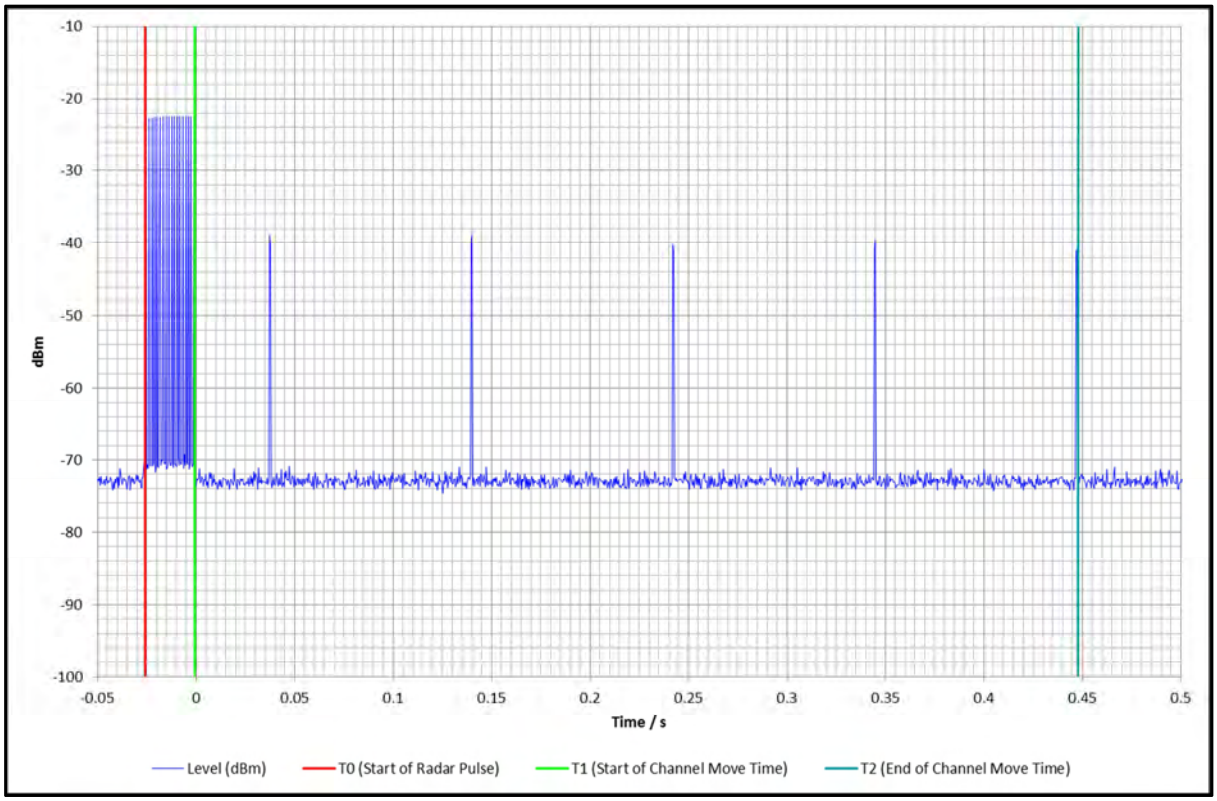
Results: 20 MHz Master – Short Radar Type

Radar burst type 1 was detected and channel move occurred.



Plot Showing 10 sec Move Time Limit

Channel Closing Transmission Time and Channel Move Time (continued)

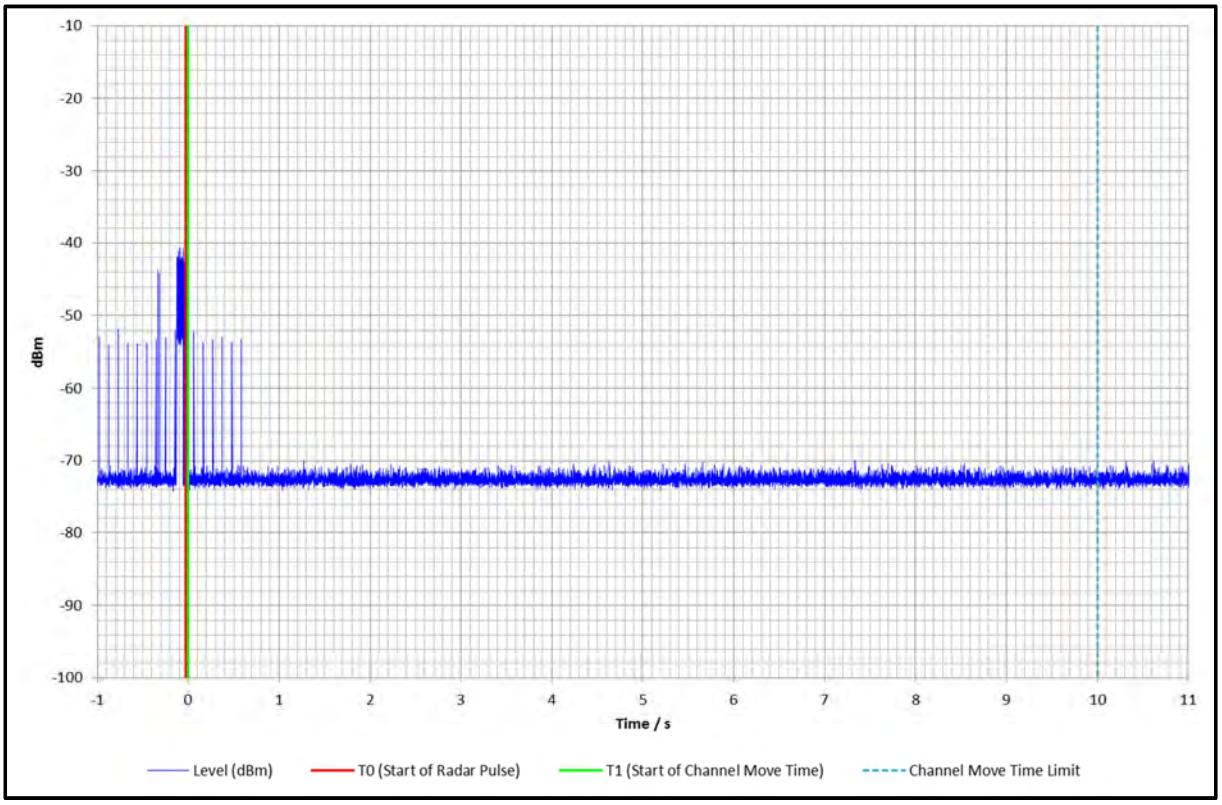


Zoomed Plot Showing Radar Pulse and end of Channel Move Time

Analysis of Response to Type 1 Radar	
Channel Move Time / ms	448.125
Total Transmit Time after end of radar / ms	3.75
Total Transmit time after 200 ms from the end of the radar / ms	2.25

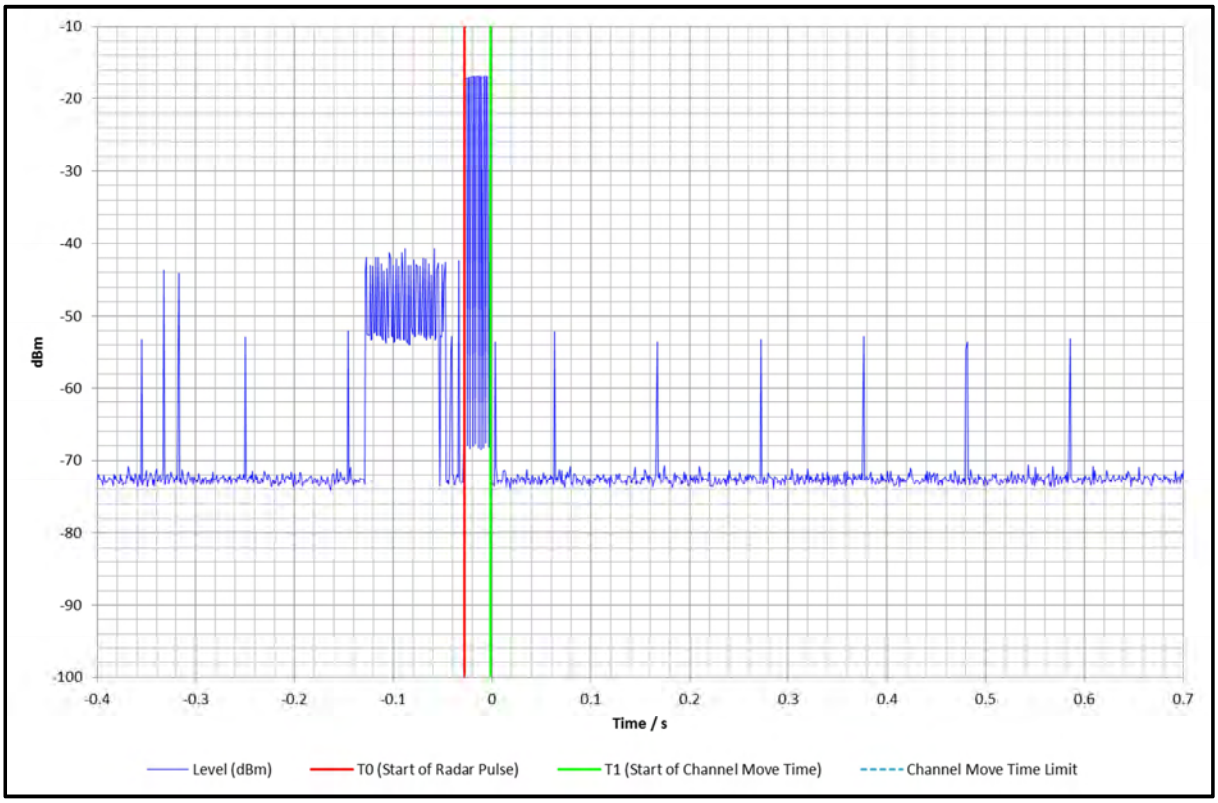
Channel Closing Transmission Time and Channel Move Time (continued)

Results: 20 MHz Client – Short Radar Type



Plot Showing 10 sec Move Time Limit

Channel Closing Transmission Time and Channel Move Time (continued)

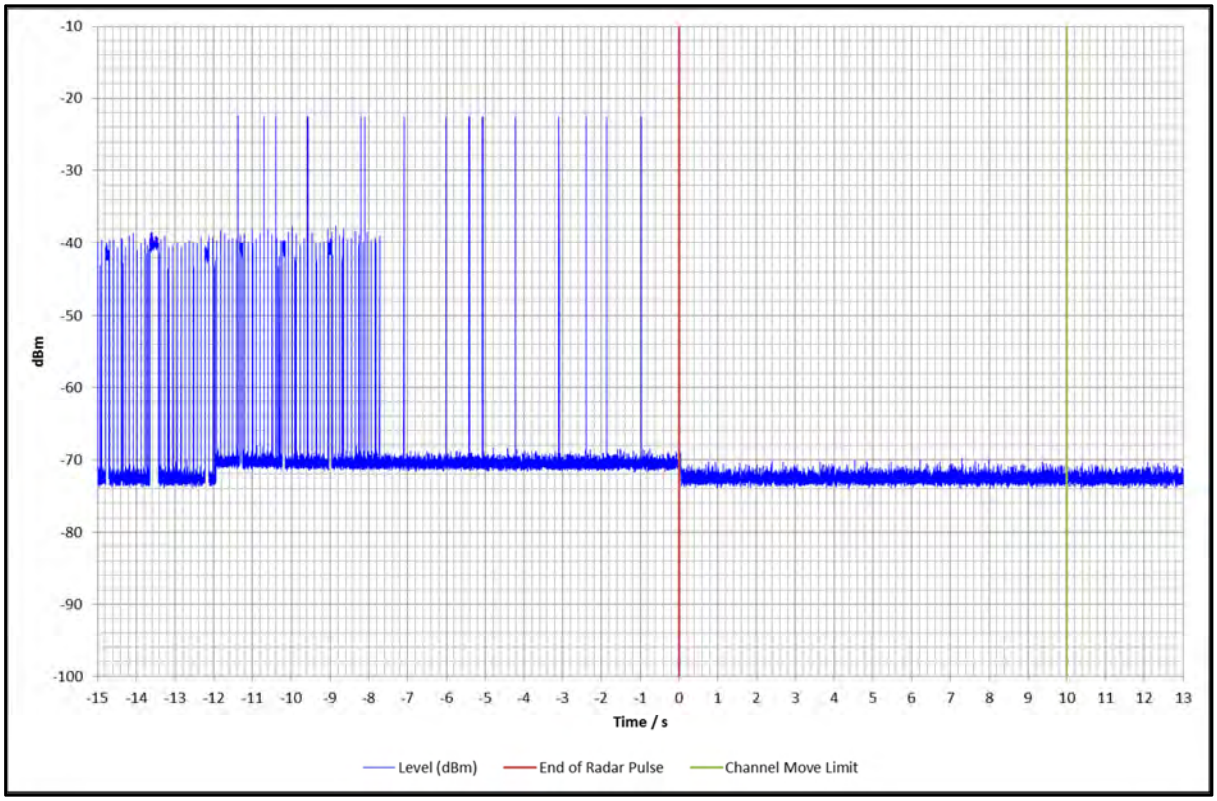


Zoomed Plot Showing Radar Pulse and end of Channel Move Time

Analysis of Response to Type 1 Radar	
Channel Move Time / ms	0 (EUT stop transmitting before end of radar burst)
Total Transmit Time after end of radar / ms	0 (EUT stop transmitting before end of radar burst)
Total Transmit time after 200 ms from the end of the radar / ms	0 (EUT stop transmitting before end of radar burst)

Channel Closing Transmission Time and Channel Move Time (continued)

Results: 20 MHz Client – Long Radar Type



Radar burst type 5 was detected and channel move occurred.

No time limits apply for the long radar type; this plot is included for reference only.

Limits:

Table 4: DFS Response Requirement Values

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

Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:

- For the Short Pulse Radar Test Signals this instant is the end of the *Burst*.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated.
- For the Long Pulse Radar Test Signal this instant is the end of the 12 second period defining the *Radar Waveform*.

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.

5.2.6. Non-Occupancy Period

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	11 April 2014
Test Sample Serial Numbers:	VPE1128901 (Master) VPE1128902 (Client)		

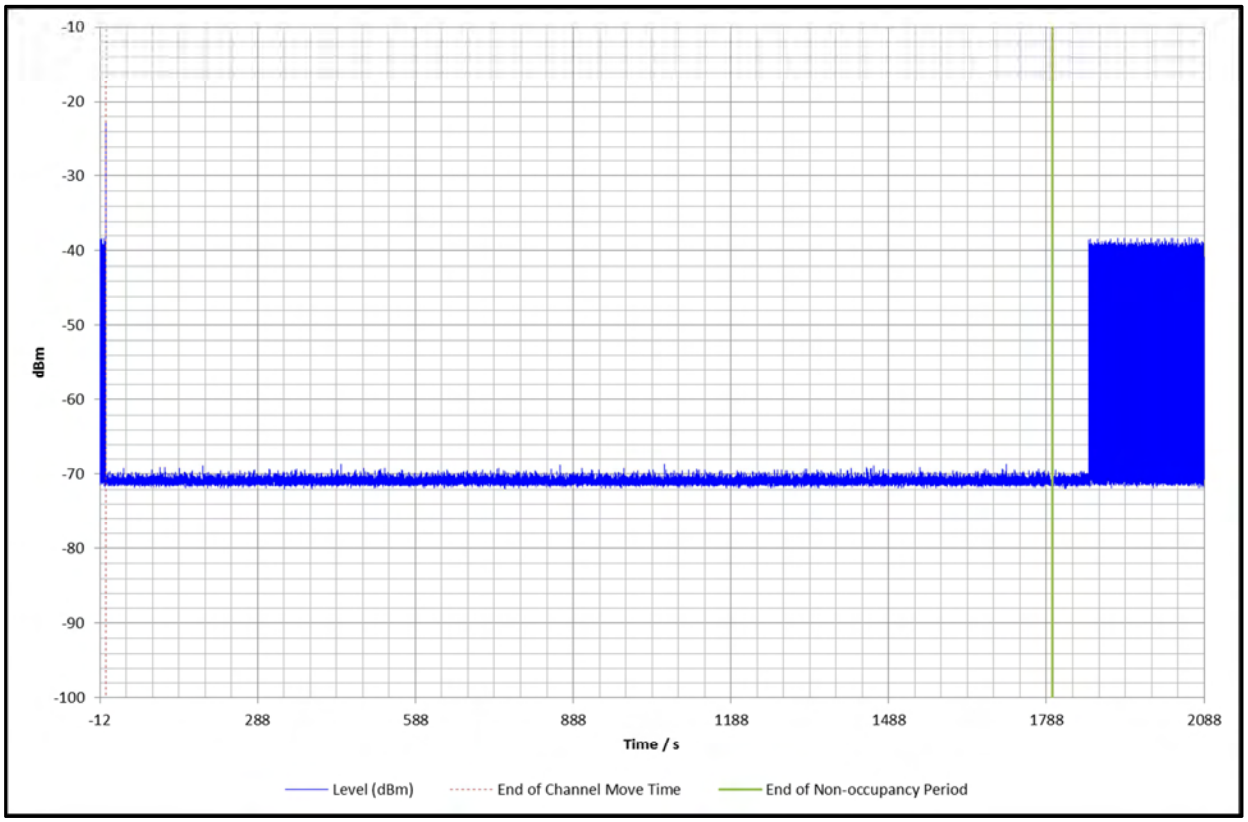
FCC Reference:	Part 15.407(h)(iv)
Industry Canada Reference:	RSS-210 A9.3(b)(v)
Test Method Used:	FCC 06-96 Section 7.8.3

Environmental Conditions:

Temperature (℃):	26
Relative Humidity (%):	28

Results: 20 MHz

Radar burst type 1 detected and channel was vacated for 31.1 minutes (>30 minutes).



Limit:

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes

5.2.7. Statistical Performance Check – Short Pulse Radar Types 1 - 4

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	10 April 2014
Test Sample Serial Number:	VPE1128901 (Master)		

FCC Reference:	Part 15.407(h)(2)
Industry Canada Reference:	RSS-210 A9.3(a)
Test Method Used:	FCC 06-96 Section 7.8.4.1

Environmental Conditions:

Temperature (℃):	27
Relative Humidity (%):	30

Note(s):

1. The aggregate detection probability was 113 detected of 120 trials, resulting in an aggregate detection of 94.2 %.

Results: 20 MHz / Radar Type 1 / Master Mode

Radar Type	Trial Number	Detected?	Trial Number	Detected?
1	1	Yes	16	Yes
	2	Yes	17	Yes
	3	Yes	18	Yes
	4	Yes	19	Yes
	5	No	20	Yes
	6	Yes	21	Yes
	7	Yes	22	Yes
	8	Yes	23	Yes
	9	Yes	24	Yes
	10	Yes	25	Yes
	11	Yes	26	Yes
	12	Yes	27	Yes
	13	Yes	28	Yes
	14	Yes	29	Yes
	15	Yes	30	Yes
	Detection level		96.7 %	

Statistical Performance Check – Short Pulse Radar Types 1 - 4 (continued)

Results: 20 MHz / Radar Type 2 / Master Mode

Radar Type	Trial Number	Number Pulses per Burst	Pulse Width (µs)	PRI (µs)	Detected?
2	1	23	1.1	172	Yes
	2	23	1.1	174	Yes
	3	24	1.1	181	Yes
	4	27	1.1	186	Yes
	5	28	1.3	164	Yes
	6	27	1.4	230	Yes
	7	26	1.5	168	Yes
	8	28	1.7	227	Yes
	9	29	1.8	221	Yes
	10	24	2.0	201	Yes
	11	26	2.2	209	No
	12	27	2.3	157	No
	13	29	2.3	218	Yes
	14	28	2.7	189	Yes
	15	23	2.7	218	Yes
	16	23	2.9	190	Yes
	17	28	3.1	164	Yes
	18	24	3.3	226	Yes
	19	24	3.5	229	No
	20	29	3.6	151	Yes
	21	28	3.6	152	Yes
	22	25	3.7	196	Yes
	23	24	4.0	185	Yes
	24	29	4.4	157	Yes
	25	27	4.6	161	Yes
	26	29	4.8	182	Yes
	27	26	4.9	163	Yes
	28	26	4.9	181	Yes
	29	27	4.9	185	Yes
	30	24	5.0	166	Yes
	Detection Level			90.0 %	

Statistical Performance Check – Short Pulse Radar Types 1 - 4 (continued)

Results: 20 MHz / Radar Type 3 / Master Mode

Radar Type	Trial Number	Number Pulses per Burst	Pulse Width (µs)	PRI (µs)	Detected?
3	1	17	6.0	397	Yes
	2	18	6.1	270	Yes
	3	18	6.2	308	Yes
	4	17	6.2	442	Yes
	5	17	6.9	346	Yes
	6	16	6.9	493	Yes
	7	16	7.1	269	Yes
	8	17	7.3	362	Yes
	9	18	7.4	415	Yes
	10	18	7.5	442	Yes
	11	17	7.7	237	Yes
	12	17	7.7	361	Yes
	13	18	7.7	417	Yes
	14	16	7.8	461	No
	15	16	8.0	210	Yes
	16	18	8.1	252	Yes
	17	18	8.2	459	Yes
	18	18	8.3	290	Yes
	19	16	8.5	342	Yes
	20	16	8.5	418	Yes
	21	18	8.7	258	Yes
	22	16	8.8	341	Yes
	23	18	9.2	444	Yes
	24	16	9.3	352	Yes
	25	18	9.5	362	No
	26	17	9.6	277	Yes
	27	16	9.6	330	No
	28	17	9.7	269	Yes
	29	18	9.7	328	Yes
	30	18	9.7	431	Yes
	Detection Level			90.0 %	

Statistical Performance Check – Short Pulse Radar Types 1 - 4 (continued)

Results: 20 MHz / Radar Type 4 / Master Mode

Radar Type	Trial Number	Number Pulses per Burst	Pulse Width (µs)	PRI (µs)	Detected?
4	1	16	11.3	460	Yes
	2	12	11.4	259	Yes
	3	16	11.5	314	Yes
	4	15	11.8	255	Yes
	5	12	12.0	327	Yes
	6	16	12.1	424	Yes
	7	15	12.2	432	Yes
	8	15	12.6	439	Yes
	9	14	13.0	425	Yes
	10	14	13.2	424	Yes
	11	13	13.4	233	Yes
	12	15	13.7	414	Yes
	13	13	13.9	337	Yes
	14	16	14.0	215	Yes
	15	14	14.0	322	Yes
	16	15	14.0	458	Yes
	17	13	15.1	222	Yes
	18	14	15.8	461	Yes
	19	15	16.2	430	Yes
	20	15	16.6	353	Yes
	21	15	16.7	386	Yes
	22	15	16.9	471	Yes
	23	13	17.1	317	Yes
	24	15	17.4	241	Yes
	25	12	17.5	262	Yes
	26	13	18.2	300	Yes
	27	13	18.3	494	Yes
	28	12	18.4	363	Yes
	29	12	18.8	204	Yes
	30	14	20.0	251	Yes
	Detection Level			100 %	

Statistical Performance Check – Short Pulse Radar Types 1 - 4 (continued)

Limits:

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

5.2.8. Statistical Performance Check – Long Pulse Radar Type 5

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	10 April 2014
Test Sample Serial Number:	VPE1128901 (Master)		

FCC Reference:	Part 15.407(h)(2)
Industry Canada Reference:	RSS-210 A9.3(a)
Test Method Used:	FCC 06-96 Section 7.8.4.2

Environmental Conditions:

Temperature (℃):	27
Relative Humidity (%):	30

Results: 20 MHz / Radar Type 5 / Master Mode

Radar Type	Trial Number	Detected?	Trial Number	Detected?
5	1	Yes	16	Yes
	2	Yes	17	Yes
	3	Yes	18	Yes
	4	Yes	19	Yes
	5	Yes	20	Yes
	6	Yes	21	Yes
	7	Yes	22	Yes
	8	Yes	23	Yes
	9	Yes	24	Yes
	10	Yes	25	Yes
	11	Yes	26	Yes
	12	Yes	27	Yes
	13	Yes	28	Yes
	14	Yes	29	Yes
	15	Yes	30	Yes
	Detection level		100 %	

Statistical Performance Check – Long Pulse Radar Type 5 (continued)

Notes:

Further details of all parameters on which the trials using Radar Type 5 were created and can be found in Appendix 5: Statistical Performance Check– Radar Type 5 Trial Records.

Limits:

Table 6 – Long Pulse Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per *Burst*	Number of *Bursts*	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

5.2.9. Statistical Performance Check – Frequency Hopping Radar Type 6

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	10 April 2014
Test Sample Serial Number:	VPE1128901 (Master)		

FCC Reference:	Part 15.407(h)(2)
Industry Canada Reference:	RSS-210 A9.3(a)
Test Method Used:	FCC 06-96 Section 7.8.4.3

Environmental Conditions:

Temperature (℃):	27
Relative Humidity (%):	30

Results: 20 MHz / Radar Type 6 / Master Mode

Radar Type	Trial Number	Detected?	Trial Number	Detected?
6	1	Yes	16	Yes
	2	Yes	17	Yes
	3	Yes	18	Yes
	4	Yes	19	Yes
	5	Yes	20	Yes
	6	Yes	21	Yes
	7	Yes	22	Yes
	8	Yes	23	Yes
	9	Yes	24	Yes
	10	Yes	25	Yes
	11	Yes	26	Yes
	12	Yes	27	Yes
	13	Yes	28	Yes
	14	Yes	29	Yes
	15	Yes	30	Yes
	Detection level		100 %	

Limits:

Table 7 – Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Confidence Level (%)	Calculated Uncertainty
Dynamic Frequency Selection (DFS) – Radar Amplitude	95%	2.17 dB
Dynamic Frequency Selection (DFS) – CAC Plot Timing	95%	± 918 ms
Dynamic Frequency Selection (DFS) – Channel Shutdown Timing	95%	± 450 µs
Dynamic Frequency Selection (DFS) – Non-Occupancy Timing	95%	± 79.25 ms

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

Appendix 1. Test Equipment Used

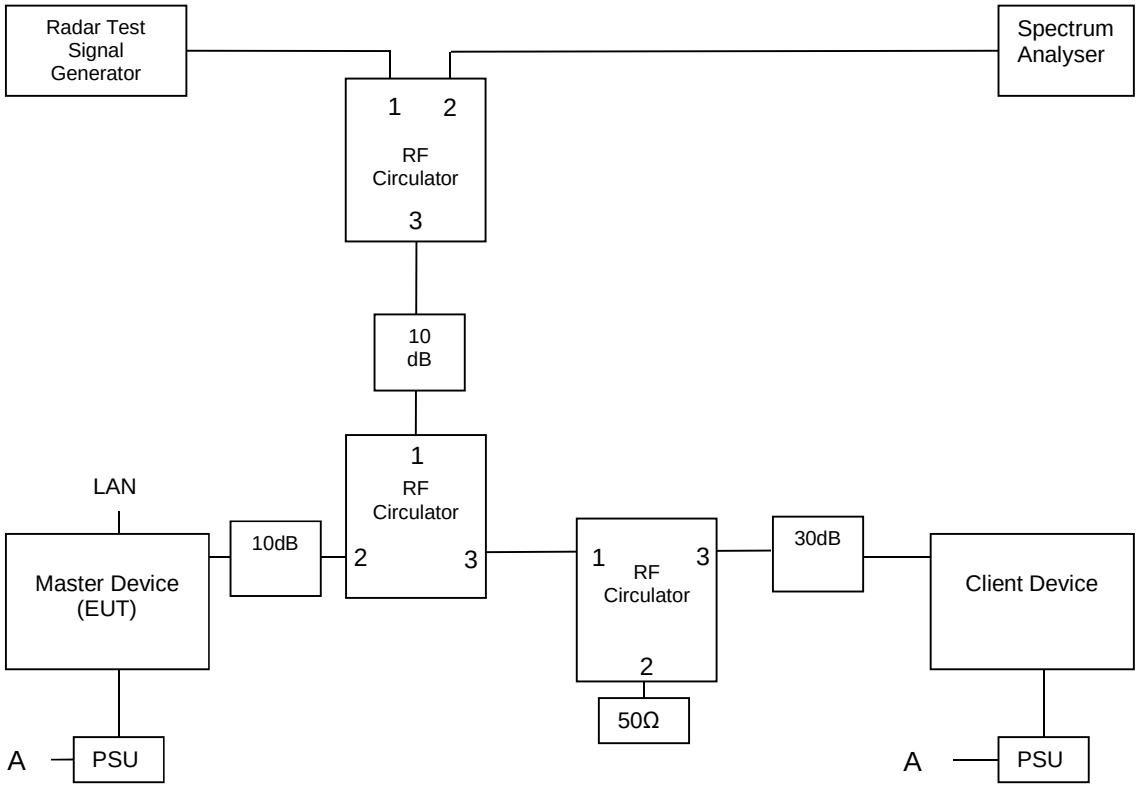
Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1631	DFS Test System	Aeroflex	PXI 3000	300110/291	11 Jun 2015	24
L1028	Spectrum Analyser	Rohde & Schwarz	FSV30	100233	23 May 2014	12
A2141	10 dB Attenuator	AtlanTecRF	AN18-10	090918-04	Calibrated before use	-
A030	Step Attenuator	Narda	445-69	01544	Calibrated before use	-
A090	Step Attenuator	Narda	743-80	01057	Calibrated before use	-
A2179	Coaxial Circulator 4-18GHz	AtlanTecRF	ACC-20130-SF-SF-SF	120409230	Calibrated before use	-
A2180	Coaxial Circulator 4-18GHz	AtlanTecRF	ACC-20130-SF-SF-SF	120409231	Calibrated before use	-
A2181	Coaxial Circulator 4-18GHz	AtlanTecRF	ACC-20130-SF-SF-SF	120409232	Calibrated before use	-
G0608	Signal Generator	Rohde & Schwarz	SMIQ 06B	838341/033	14 Feb 2015	12
M1590	Test Receiver	Rohde & Schwarz	ESU26	1000239	31 Jul 2014	12

NB In accordance with UKAS requirements all the measurement equipment is on a calibration schedule.

Appendix 2. Monitoring Methods Diagrams

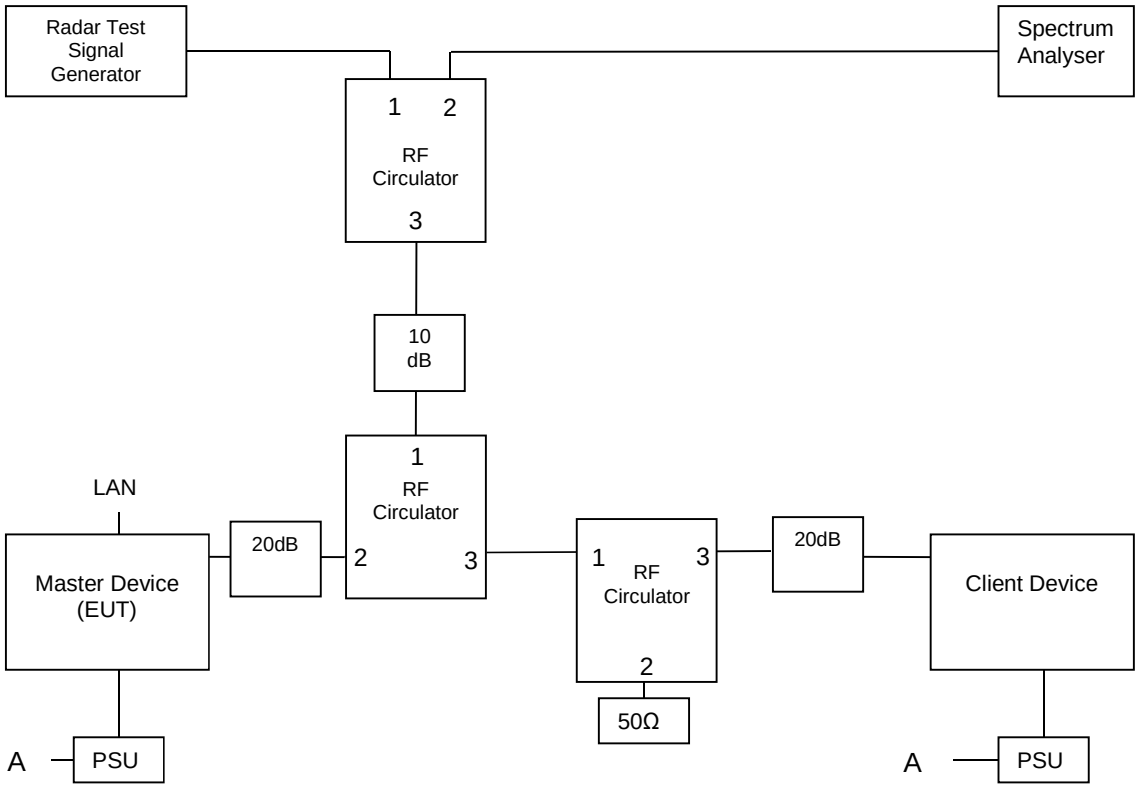
All tests were performed as conducted measurements using the setups as shown below

Setup Diagram – EUT – Master, Radar Injection at Master



Note: The circulators are stated to have approximately 18 dB loss in the reverse direction. The bottom right circulator is to provide the same path loss in both directions between the master and client device.

Setup Diagram – EUT – Client, Radar Injection at Master



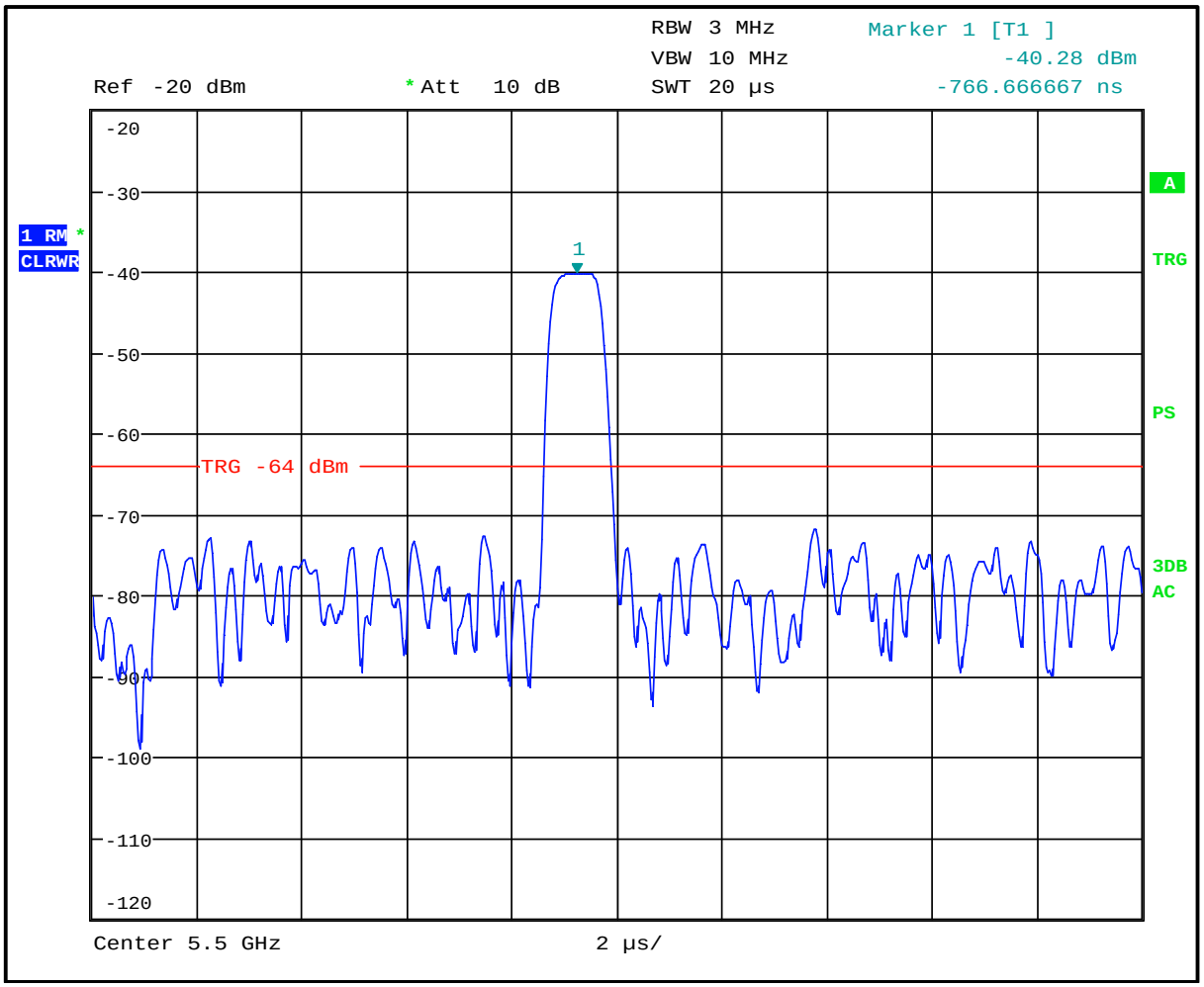
Note: The circulators are stated to have approximately 18 dB loss in the reverse direction. The bottom right circulator is to provide the same path loss in both directions between the master and client device.

Appendix 3. Radar Type 1-6 Calibration and Verification Data

All radars were generated and produced by a calibrated Aeroflex DFS test system. The radar pulse generation of this system has previously been verified by the FCC (see Appendix 4). However, an amplitude verification plot and example plots of each radar have been included.

Amplitude Verification

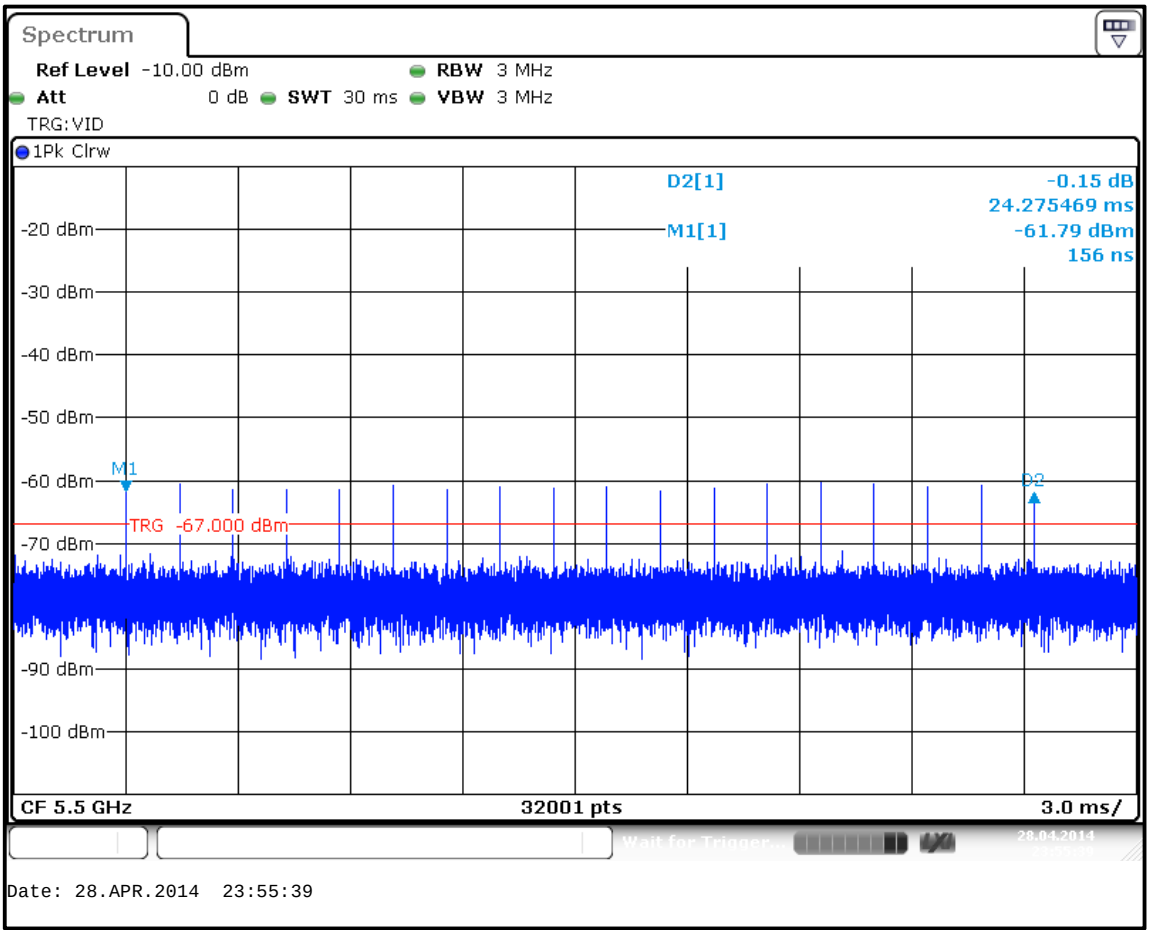
Plots were taken at the EUT port of the test network with spectrum analyser replaced with a 50 Ω load, and the EUT replaced with the spectrum analyser. Amplitude verification was done with an “output level” of -40 dBm to improve the distance from the noise floor. This is offset by the test network path loss compensation value of 39.8 dB which was calibrated with a CW signal. This should therefore result in a measured value of -40.0 dBm at the EUT. The amplitude requirement of *average power per 1 µs* was achieved by using an RMS detector and a sampling time of 66.6 ns (noticeably shorter than 1 µs) so the RMS averaging of the type 1 radar’s 1 µs pulse did not include large amounts of off-period dependant on the radar versus sampling synchronicity.



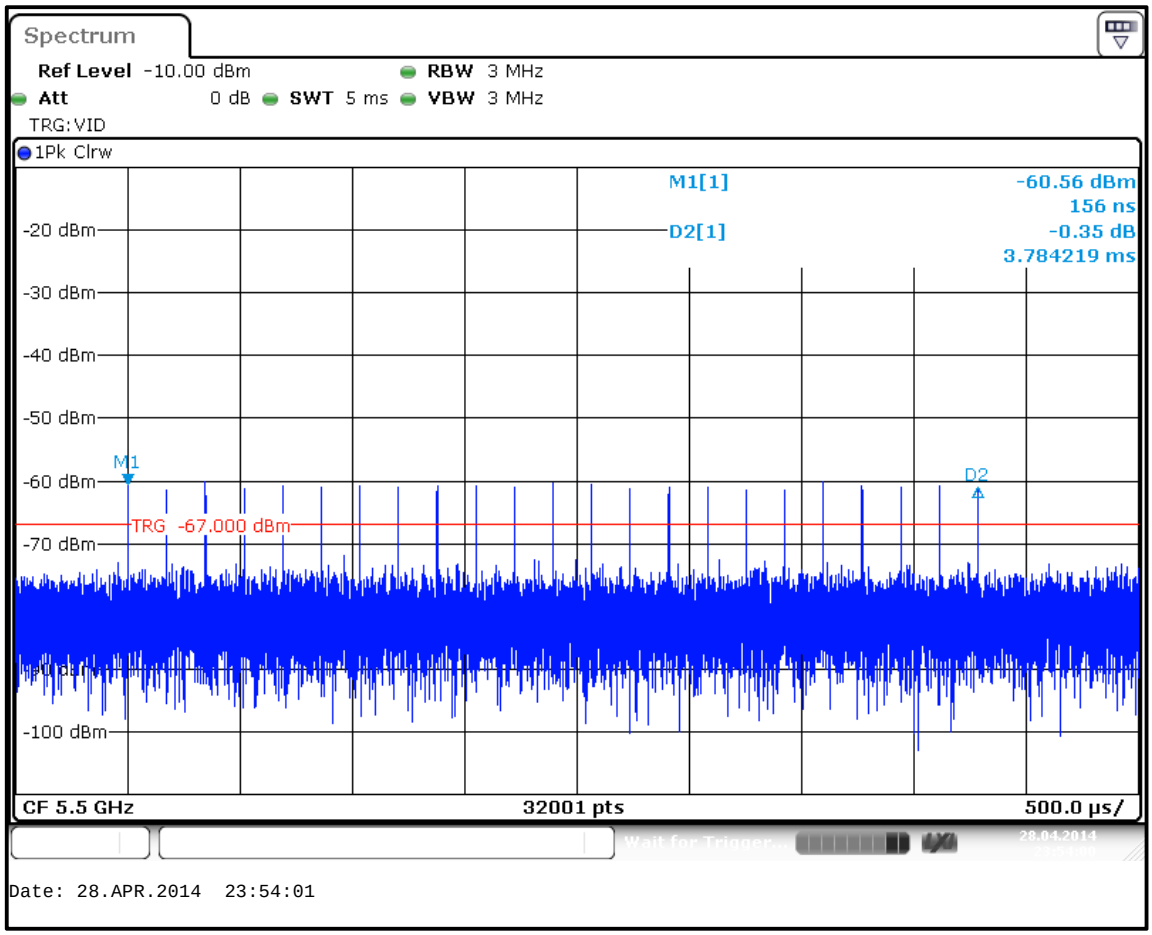
Radar Amplitude Verification

Radar Verification

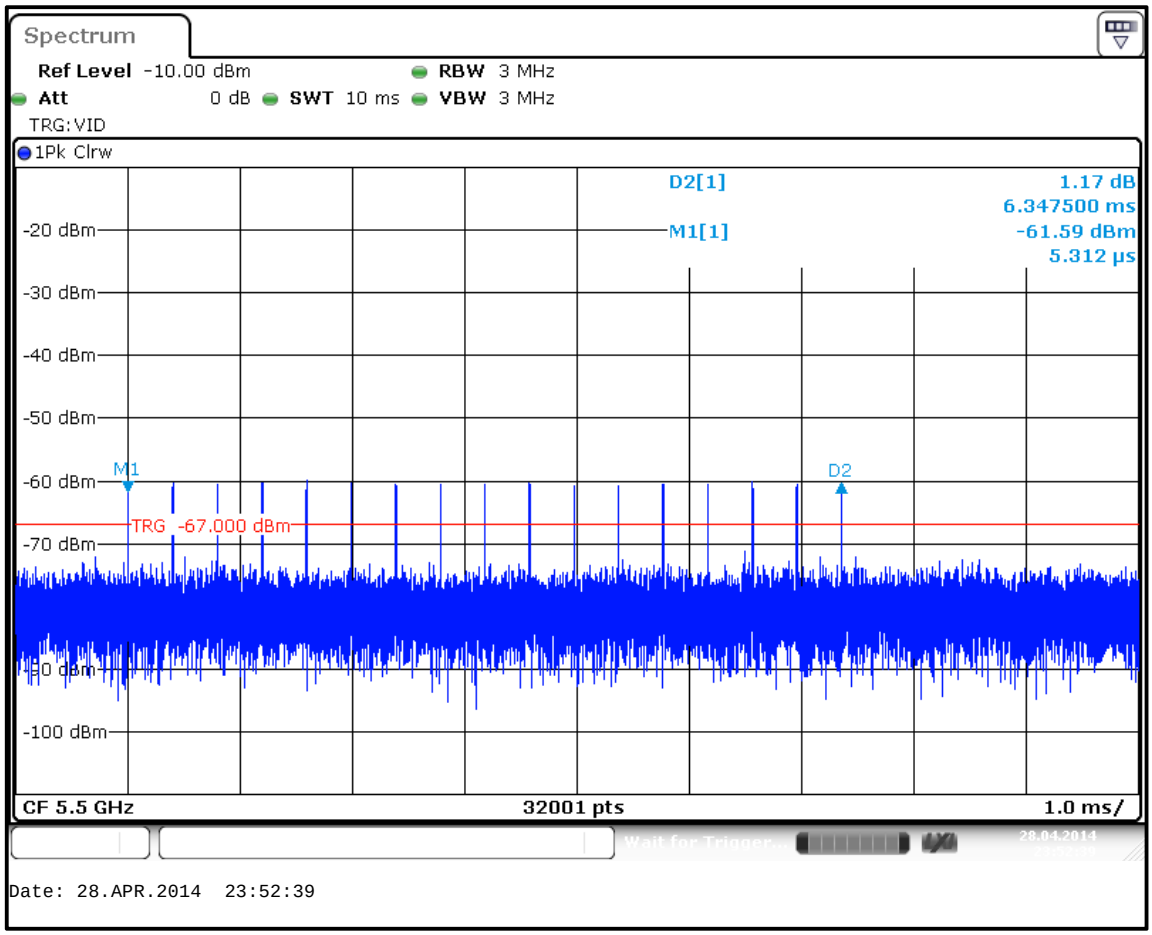
The following plots show examples of the radar timing and number of pulses. Due to the sampling limitations of a spectrum analyser plot over the duration of the radar capture, the amplitude of the pulses will not appear correct using an RMS detector and a sample size (averaging time) greater than a radar pulse. Therefore they were taken for timing validation only, using a peak detector.



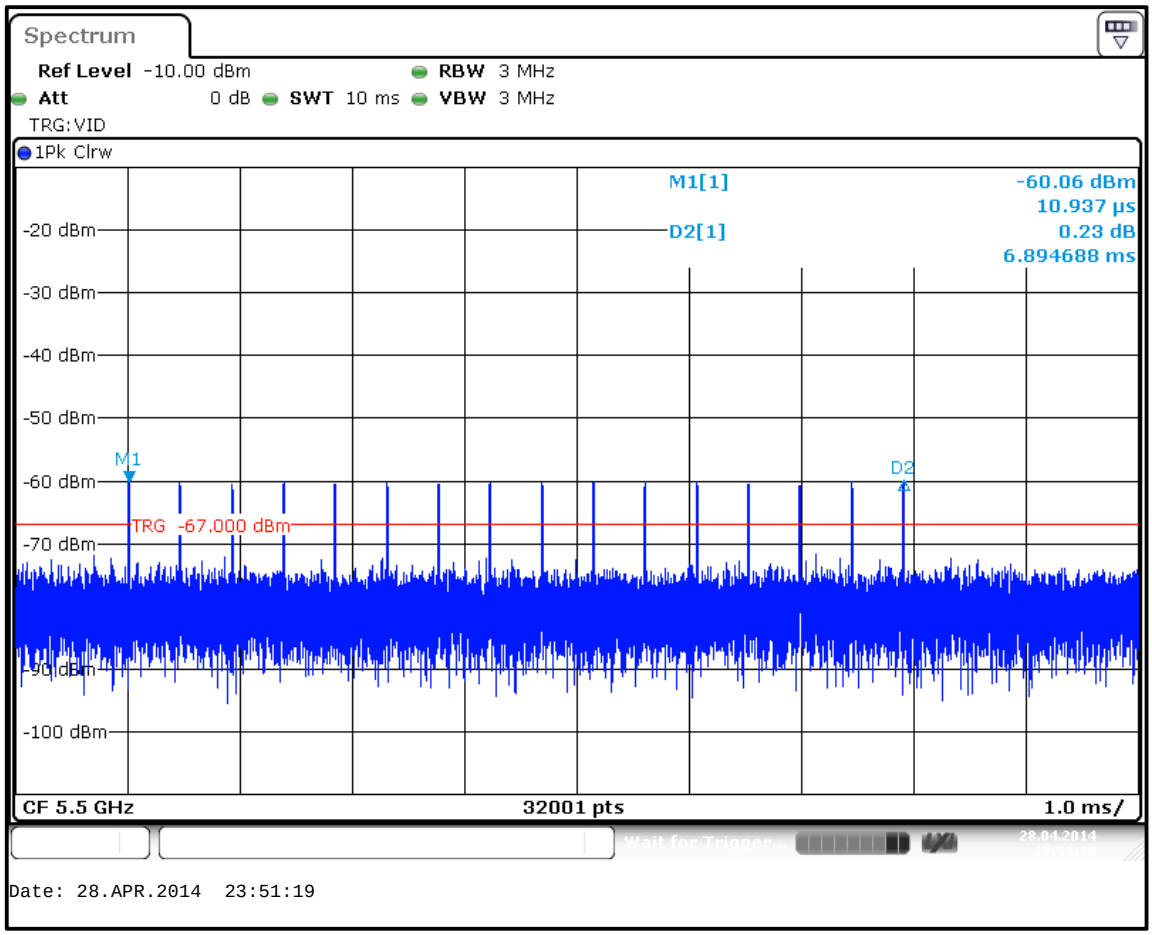
Radar Pulse 1



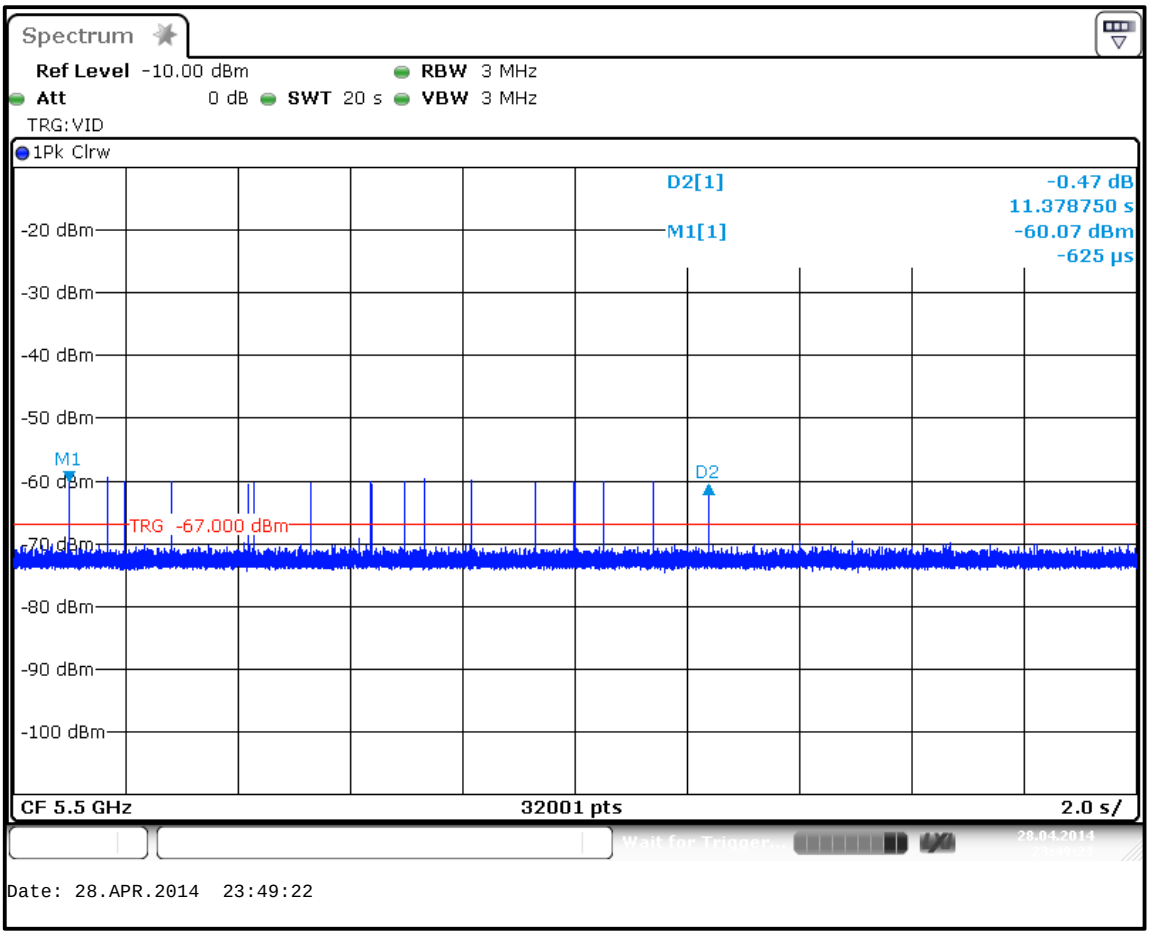
Radar Pulse 2



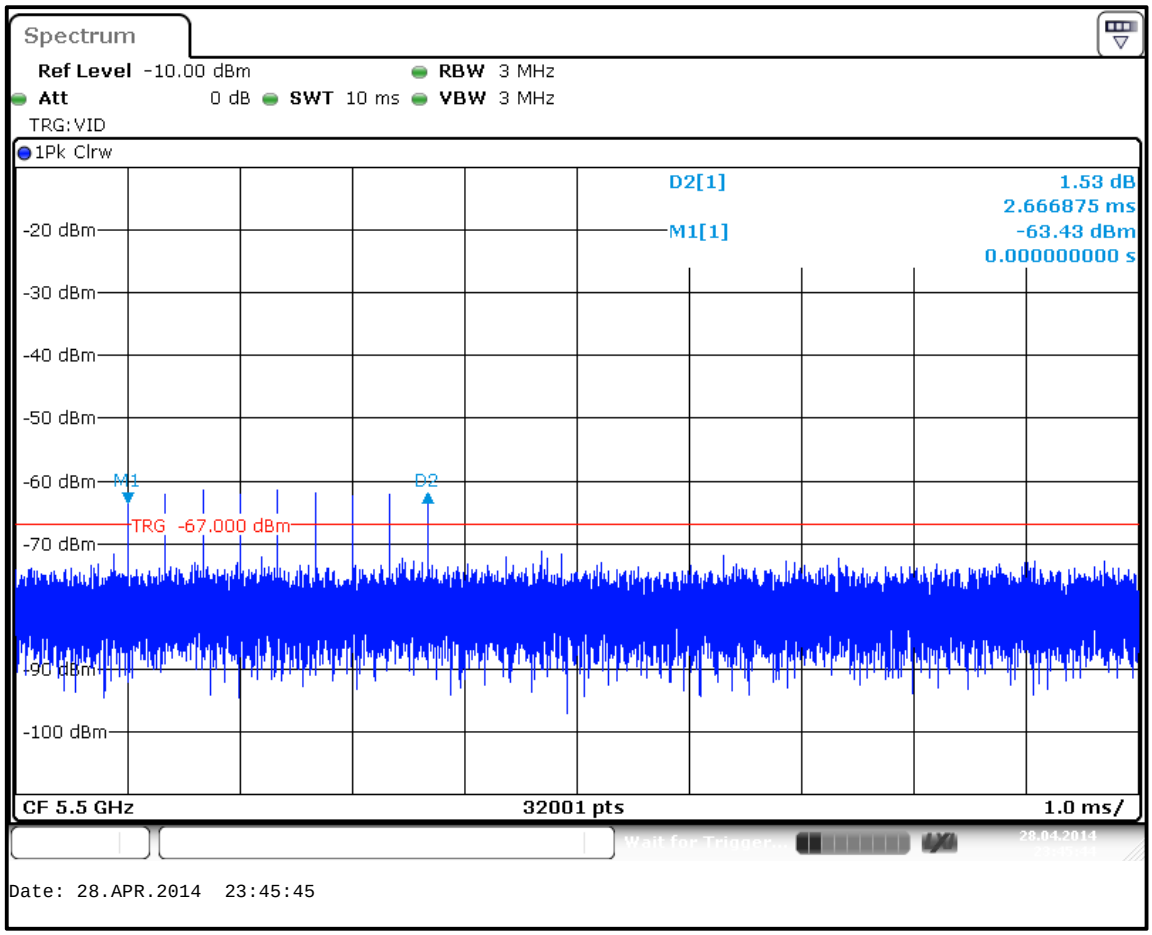
Radar Pulse 3



Radar Pulse 4



Long Radar Pulse 5



Hopping Radar Pulse 6

Appendix 4. Test platform confirmation email

From: Andrew Leimer [mailto:Andrew.Leimer@fcc.gov]
Sent: Friday, September 23, 2011 4:24 PM
To: Chisham, Steve
Cc: Carey, Tim; Hack, Barry; Rashmi Doshi; Joe Dichoso
Subject: RE: Certification for Aeroflex DFS solution

Hello Steve,
The Aeroflex "DXI based DFS test solution" system used for DFS alternative radar signal generation has been approved by the FCC and NTIA.
This approval permits the system to be used by labs in the testing of DFS devices for equipment authorization Certification. It is recommended that applicants that use your system for testing include a statement in the Test Report or a Letter Exhibit stating that the system has FCC and NTIA approval. This E-mail is your record of this approval.
Note that the appropriate term for your system is Approved as the term Certification is reserved for devices gaining equipment authorization through the FCC or a TCB.

Regards,
Andy Leimer

FCC/OET/EACB

Appendix 5. Statistical Performance Check– Radar Type 5 Trial Records

20 MHz – Master Mode – Trial 1

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	1	51	17	-	-	566527
2	2	71	5	1363	-	487515
3	3	69	10	1524	1326	38843
4	2	57	7	1535	-	118602
5	2	100	19	1584	-	741520
6	2	91	19	1344	-	88418
7	1	67	6	-	-	348401
8	3	80	12	1991	1069	681094
9	3	63	6	1433	1658	533151
10	3	86	9	1999	1326	127941
11	1	80	8	-	-	222155
12	1	60	17	-	-	600894
13	2	57	5	1533	-	553121
14	1	61	5	-	-	323126
15	2	97	7	1060	-	466058
16	2	56	19	1497	-	693464

20 MHz - Master Mode - Trial 2

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	3	55	14	1345	1792	940969
2	1	76	8	-	-	653624
3	2	63	8	1268	-	332023
4	3	62	13	1694	1622	530477
5	2	64	18	1058	-	176730
6	1	78	9	-	-	115724
7	2	80	9	1487	-	882205
8	2	77	15	1741	-	951737
9	3	86	18	1832	1975	733425
10	3	90	10	1671	1877	433620
11	3	65	17	1376	1830	846143

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 3

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	88	14	1263	-	137637
2	1	94	20	-	-	806034
3	2	90	6	1575	-	859803
4	3	88	17	1788	1444	924821
5	2	61	10	1236	-	632980
6	1	99	17	-	-	1057414
7	3	72	15	1770	1388	121084
8	1	63	12	-	-	764695
9	2	54	15	1198	-	363291
10	2	78	9	1610	-	1070759
11	2	50	14	1385	-	1010527

20 MHz - Master Mode - Trial 4

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	72	10	1682	-	564593
2	1	53	5	-	-	25794
3	1	56	10	-	-	118530
4	3	85	12	1326	1086	531594
5	3	85	5	1986	1722	20033
6	3	68	18	1414	1685	530890
7	1	92	12	-	-	445816
8	3	95	17	1805	1335	11901
9	2	58	9	1382	-	124168
10	1	97	9	-	-	43332
11	3	75	13	1171	1202	238791
12	2	83	15	1968	-	570368
13	1	80	10	-	-	113626
14	3	76	16	1973	1015	374258
15	2	64	13	1737	-	24918
16	3	84	10	1835	1816	268045
17	2	67	20	1343	-	470157
18	3	64	10	1235	1240	73979
19	3	71	17	1053	1802	80802

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 5

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	3	70	20	1268	1473	109187
2	1	51	11	-	-	139844
3	2	89	9	1815	-	129901
4	2	86	9	1358	-	716025
5	1	92	11	-	-	553462
6	3	68	12	1445	1082	830866
7	3	53	13	1803	1148	346421
8	2	63	18	1870	-	105488
9	3	62	6	1815	1463	792560
10	1	84	20	-	-	41523
11	3	72	9	1438	1848	844091
12	1	74	6	-	-	588301
13	3	98	12	1176	1446	191036
14	2	84	16	1011	-	381809

20 MHz - Master Mode - Trial 6

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	86	11	1604	-	278776
2	3	66	11	1138	1761	122027
3	3	59	14	1257	1364	276741
4	2	57	17	1756	-	169110
5	2	89	17	1943	-	339491
6	1	71	15	-	-	866408
7	3	80	11	1955	1578	50535
8	1	84	12	-	-	157848
9	3	77	5	1815	1538	902136
10	3	99	7	1366	1329	788554
11	2	82	9	1364	-	565321
12	3	68	12	1077	1008	463433
13	3	59	10	1794	1668	624026

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 7

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	1	87	15	-	-	611169
2	1	82	10	-	-	954397
3	1	99	13	-	-	272662
4	1	63	14	-	-	81048
5	3	89	15	1213	1441	412261
6	1	50	6	-	-	681801
7	1	59	14	-	-	216352
8	1	57	9	-	-	834910
9	1	80	7	-	-	52593
10	2	84	5	1659	-	592790
11	2	96	17	1734	-	233755
12	1	55	11	-	-	25064

20 MHz - Master Mode - Trial 8

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	94	15	1405	-	977842
2	2	69	14	1142	-	500929
3	1	89	11	-	-	1476908
4	2	98	5	1896	-	1327111
5	1	100	7	-	-	1173752
6	3	97	6	1289	1949	1212300
7	3	75	18	1162	1138	1232436
8	3	83	8	1532	1535	275534

20 MHz - Master Mode - Trial 9

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	3	66	14	1626	1528	1090770
2	1	63	8	-	-	289837
3	2	92	5	1281	-	113949
4	3	74	13	1229	1435	1039804
5	1	92	7	-	-	814341
6	1	58	12	-	-	393234
7	3	68	10	1016	1905	395590
8	2	62	9	1575	-	623984
9	2	77	17	1289	-	447884

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 10

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	1	77	19	-	-	840752
2	3	100	9	1749	1295	721423
3	2	69	5	1276	-	657554
4	3	99	11	1854	1146	805375
5	1	100	15	-	-	578901
6	1	99	17	-	-	780869
7	1	69	13	-	-	849967
8	1	57	14	-	-	591490
9	2	55	11	1045	-	267515
10	2	79	20	1858	-	283915
11	1	91	18	-	-	556711
12	2	72	8	1530	-	968932

20 MHz - Master Mode - Trial 11

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	1	63	13	-	-	5144
2	2	99	5	1338	-	765815
3	2	87	7	1039	-	183315
4	2	64	12	1100	-	431509
5	2	70	15	1722	-	713804
6	3	98	20	1689	1994	81529
7	2	87	7	1060	-	269957
8	1	78	11	-	-	399642
9	1	78	8	-	-	1175
10	1	77	7	-	-	616825
11	2	51	6	1964	-	71382
12	3	72	7	1586	1540	511520
13	1	80	5	-	-	288965
14	2	93	19	2000	-	756414
15	3	95	10	1720	1096	479124

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 12

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	3	58	15	1402	1352	549168
2	1	67	15	-	-	966605
3	1	79	17	-	-	797699
4	3	88	15	1923	1045	983633
5	1	60	19	-	-	157932
6	2	77	8	1793	-	775862
7	3	69	18	1488	1750	524921
8	3	96	7	1289	1825	452488
9	3	85	12	1718	1308	268580
10	1	53	7	-	-	742727
11	3	52	16	1961	1768	309929

20 MHz - Master Mode - Trial 13

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	3	91	9	1386	1631	818228
2	2	63	6	1003	-	212784
3	3	92	13	1633	1221	416985
4	2	75	11	1427	-	114134
5	1	50	16	-	-	490704
6	1	80	18	-	-	678220
7	3	86	16	1400	1177	409172
8	2	51	5	1746	-	821358
9	2	61	8	1969	-	109578
10	1	58	7	-	-	711539
11	1	68	9	-	-	732267
12	1	92	13	-	-	234606
13	2	52	20	1909	-	389306
14	1	60	13	-	-	213695

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 14

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	57	15	1458	-	513520
2	3	73	20	1908	1051	35730
3	2	63	18	1426	-	908639
4	2	72	12	1835	-	281489
5	2	99	9	1370	-	909876
6	3	52	20	1936	1029	400158
7	3	94	18	1010	1153	690607
8	3	76	11	1114	1920	427118
9	1	53	17	-	-	82579
10	2	73	16	1782	-	84955
11	2	56	20	1191	-	374630
12	1	79	20	-	-	386521
13	3	99	5	1604	1720	354357

20 MHz - Master Mode - Trial 15

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	92	18	1633	-	1369573
2	2	59	11	1499	-	53067
3	1	59	16	-	-	853217
4	2	61	8	1343	-	695144
5	3	93	18	1747	1662	344102
6	2	99	7	1948	-	663475
7	2	67	11	1069	-	100506
8	2	94	7	1178	-	1445467

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 16

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	85	10	1780	-	225784
2	1	93	12	-	-	447091
3	3	63	9	1633	1174	356095
4	1	58	11	-	-	197417
5	2	53	12	1056	-	242163
6	3	89	15	1502	1886	209718
7	1	58	12	-	-	491127
8	1	56	11	-	-	529389
9	3	68	6	1659	1202	399977
10	2	54	17	1895	-	281410
11	2	85	16	1849	-	286613
12	3	53	15	1967	1812	354540
13	2	67	14	1393	-	402926
14	1	88	18	-	-	531040
15	2	86	9	1550	-	580143
16	2	70	9	1386	-	20633
17	3	50	17	1031	1334	386563
18	2	66	5	1951	-	129742
19	2	70	6	1257	-	466940
20	3	53	17	1997	1273	196454

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 17

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	1	50	18	-	-	249769
2	1	94	6	-	-	276010
3	3	62	19	1931	1589	493655
4	1	62	16	-	-	191925
5	3	87	18	1668	1978	178897
6	1	64	8	-	-	361675
7	1	74	11	-	-	456547
8	2	52	16	1029	-	295037
9	1	58	11	-	-	546379
10	2	71	8	1477	-	83922
11	3	98	12	1831	1061	403977
12	2	80	6	1341	-	14399
13	2	60	19	1690	-	302975
14	1	66	18	-	-	102673
15	2	77	6	1287	-	451508
16	2	58	10	1826	-	222758
17	1	87	18	-	-	46594
18	2	62	7	1500	-	245582
19	3	63	20	1945	1400	3333
20	3	51	9	1747	1404	215416

20 MHz - Master Mode - Trial 18

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	65	17	1123	-	1153586
2	1	53	13	-	-	685528
3	1	89	16	-	-	131552
4	1	86	6	-	-	373223
5	2	68	15	1909	-	197689
6	3	71	14	1686	1282	1068343
7	2	96	14	1421	-	15255
8	1	68	13	-	-	420249
9	2	68	20	1424	-	1151232

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 19

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	1	59	8	-	-	361757
2	3	61	19	1974	1294	60388
3	3	60	8	1403	1344	624699
4	1	94	9	-	-	74752
5	2	78	10	1716	-	1152362
6	3	60	17	1780	1080	435524
7	1	52	20	-	-	939295
8	1	69	11	-	-	677207
9	2	79	19	1303	-	444588
10	1	97	6	-	-	136138

20 MHz - Master Mode - Trial 20

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	3	59	6	1151	1802	354026
2	2	93	13	1340	-	469258
3	1	55	8	-	-	128184
4	3	76	7	1282	1621	70461
5	1	90	10	-	-	421256
6	2	84	8	1975	-	260074
7	1	91	6	-	-	500621
8	3	95	9	1055	1242	213433
9	1	69	19	-	-	26920
10	3	77	12	1742	1089	408504
11	3	90	18	1493	1853	501495
12	2	90	12	1312	-	552898
13	1	94	6	-	-	190555
14	3	98	9	1393	1324	257651
15	2	96	19	1407	-	441758
16	1	88	13	-	-	97264
17	1	97	7	-	-	174343
18	3	61	20	1596	1982	572375
19	2	73	14	1931	-	259179
20	3	75	18	1727	1807	356501

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 21

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	89	9	1285	-	1050919
2	3	54	6	1585	1646	305978
3	1	64	20	-	-	198035
4	2	69	6	1003	-	415594
5	1	72	18	-	-	1162352
6	3	99	12	1517	1229	526873
7	1	87	14	-	-	995142
8	2	69	5	1394	-	429135
9	1	76	18	-	-	449460
10	3	60	10	1642	1437	868485

20 MHz - Master Mode - Trial 22

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	82	17	1251	-	541510
2	3	97	9	1421	1897	253190
3	2	95	7	1622	-	314765
4	3	73	11	1773	1543	592094
5	3	98	18	1423	1058	587313
6	3	77	10	1053	1791	180280
7	1	69	19	-	-	187755
8	3	83	12	1754	1974	274881
9	2	97	20	1229	-	135018
10	3	80	7	1021	1953	229694
11	2	96	18	1414	-	288065
12	3	98	13	1878	1559	221077
13	3	79	7	1243	1601	244438
14	2	88	10	1789	-	11720
15	1	66	19	-	-	264876
16	3	88	6	1948	1154	19480
17	3	96	14	1459	1070	536576
18	2	91	13	1231	-	57407
19	3	63	7	1399	1096	586696
20	1	59	15	-	-	161569

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 23

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	71	15	1536	-	387934
2	1	51	8	-	-	331542
3	3	70	10	1941	1666	415347
4	3	77	13	1090	1944	603301
5	2	97	10	1060	-	549220
6	1	87	17	-	-	749836
7	3	75	17	1200	1321	120074
8	3	77	11	1403	1782	234558
9	3	58	12	1921	1222	547244
10	2	60	13	1677	-	418304
11	1	92	5	-	-	369092
12	1	74	17	-	-	747779
13	1	71	12	-	-	127828
14	3	79	16	1344	1396	733351
15	3	56	15	1162	1494	574337
16	3	94	7	1511	1310	144645

20 MHz - Master Mode - Trial 24

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	54	20	1438	-	295870
2	1	84	13	-	-	47328
3	2	70	12	1897	-	276860
4	3	80	10	1483	1388	114424
5	1	78	13	-	-	697399
6	1	67	9	-	-	587456
7	2	67	9	1687	-	79900
8	3	100	6	1957	1137	294136
9	1	87	12	-	-	748133
10	2	64	15	1597	-	336647
11	3	63	17	1028	1922	39902
12	2	95	13	1073	-	218869
13	1	50	19	-	-	62411
14	3	66	16	1387	1057	281917
15	3	82	8	1113	1327	331802

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 25

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	50	14	1489	-	520591
2	3	99	7	1544	1245	538183
3	1	74	6	-	-	388399
4	3	94	10	1047	1794	278177
5	1	60	13	-	-	202708
6	2	53	18	1630	-	411159
7	3	80	15	1619	1270	370451
8	2	90	9	1166	-	677840
9	3	59	6	1954	1337	406865
10	1	68	17	-	-	244051
11	3	64	14	1346	1408	559464
12	1	60	8	-	-	550161
13	1	77	20	-	-	232908
14	1	71	18	-	-	586211
15	1	70	6	-	-	27829
16	3	92	12	1034	1138	428226
17	3	98	18	1497	1874	167226

20 MHz - Master Mode - Trial 26

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	1	50	9	-	-	1149673
2	3	73	14	1095	1387	1123754
3	2	61	16	1782	-	1226680
4	3	71	10	1356	1267	983473
5	2	90	18	1374	-	876320
6	2	62	8	1964	-	826426
7	2	86	8	1857	-	539201
8	2	99	9	1947	-	658483
9	3	75	20	1090	1817	520891

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 27

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	1	62	11	-	-	108188
2	2	99	11	1916	-	145843
3	2	74	6	1033	-	220585
4	3	71	8	1731	1496	366703
5	3	76	7	1453	1042	271787
6	3	90	19	1805	1778	369400
7	1	80	8	-	-	666040
8	2	73	7	1752	-	529139
9	3	59	7	1480	1218	606339
10	1	54	6	-	-	508589
11	2	66	18	1902	-	340377
12	1	97	6	-	-	72034
13	1	80	5	-	-	276308
14	2	97	17	1440	-	71795
15	3	93	17	1592	1745	501886
16	3	66	20	1974	1824	328621
17	2	86	18	1042	-	278704
18	1	71	16	-	-	474202

Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 28

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	67	5	1554	-	122258
2	3	89	13	1549	1412	297391
3	1	61	8	-	-	630068
4	3	79	6	1918	1181	96025
5	3	65	14	1588	1894	111340
6	2	60	16	1379	-	471658
7	2	99	8	1426	-	353552
8	1	78	5	-	-	353455
9	2	71	11	1022	-	349638
10	2	81	5	1652	-	416722
11	2	89	13	1741	-	416797
12	1	71	20	-	-	189942
13	3	70	10	1855	1032	455472
14	2	63	20	1571	-	129598
15	2	76	18	1622	-	475831
16	2	95	14	1032	-	261129
17	2	66	13	1032	-	20859
18	3	94	8	1563	1383	89496
19	1	63	9	-	-	101782

20 MHz - Master Mode - Trial 29

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	2	69	9	1896	-	319679
2	2	74	12	1277	-	1239453
3	3	96	20	1120	1159	1241759
4	3	95	8	1070	1792	1230638
5	3	88	17	1042	1429	281211
6	1	58	9	-	-	839269
7	2	86	20	1504	-	436982
8	1	60	19	-	-	1282699

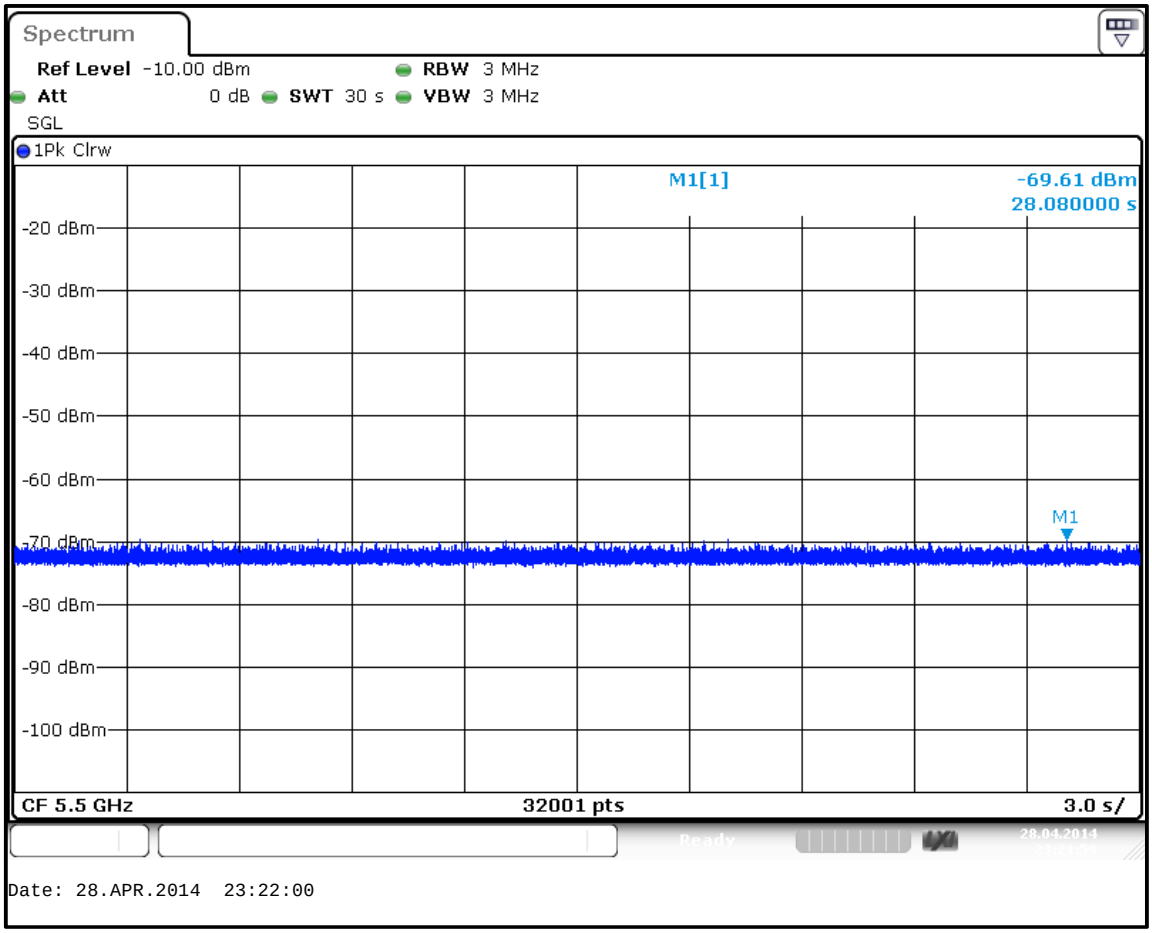
Statistical Performance Check– Radar Type 5 Trial Records (continued)

20 MHz - Master Mode - Trial 30

Burst Segment	Number of Pulses	Pulse Width (usec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (usec)	Pulse 2-to-3 Spacing (usec)	Starting Location Within Interval (usec)
1	3	60	5	1959	1238	588896
2	1	65	9	-	-	500703
3	1	54	9	-	-	998014
4	2	77	6	1170	-	260798
5	1	69	6	-	-	760290
6	2	72	9	1149	-	872408
7	2	90	15	1256	-	286570
8	3	53	17	1689	1834	1070125
9	3	99	17	1871	1882	596338

Appendix 6. System Noise floor Reference Plots

As required by section 8.3.18(iii) of FCC 06-96, the following plots show the reference noise floor of the system used during measurement.



Noise floor of test system