
# Report On

Limited FCC Testing of the
Frontier Silicon Ltd Venice 6.5
In accordance with FCC CFR 47 Part 15E

COMMERCIAL-IN-CONFIDENCE

FCC ID: YYX-HA-FS2026-F5

Document 75917143 Report 09 Issue 1 June 2012

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**REPORT ON**

Limited FCC Testing of the
Frontier Silicon Ltd Venice 6.5
In accordance with FCC CFR 47 Part 15E

Document 75917143 Report 09 Issue 1

June 2012

**PREPARED FOR**

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**PREPARED BY**

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**APPROVED BY**

**Ryan Henley**
Authorised Signatory

**DATED** 22 June 2012

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 limited compliance with FCC CFR 47 Part 15E. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s):

S Bennett

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**SECTION 1**

**REPORT SUMMARY**

Limited FCC Testing of the
Frontier Silicon Ltd Venice 6.5
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## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Limited FCC Testing of the Frontier Silicon Ltd Venice 6.5 to the requirements of FCC CFR 47 Part 15E.

| | |
|---|---|
| Objective | To perform Limited FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out. |
| Manufacturer | Frontier Silicon Ltd |
| Model Number(s) | Venice 6.5 |
| Serial Number(s) | RAD103022 |
| Hardware Version | PCB Rev5 (FS00152-5) PP Build |
| Software Version | V1.0.16 |
| Number of Samples Tested | 1 |
| Test Specification/Issue/Date | FCC CFR 47 Part 15E (2011) |
| Incoming Release<br>Date | Application Form<br>29 May 2012 |
| Disposal<br>Reference Number<br>Date | Held Pending Disposal<br>Not Applicable<br>Not Applicable |
| Order Number<br>Date | FS021247<br>17 February 2012 |
| Start of Test | 25 April 2012 |
| Finish of Test | 25 April 2012 |
| Name of Engineer(s) | S Bennett |
| Related Document(s) | FCC 06-96: 2006; FCC Public Notice DA 02-2138: 2002; UKAS M3003: Edition 2: 2007; ETSI TR 100 028: 2001 |

## 1.2 TEST REQUIREMENTS

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

| Requirement | Operational Mode | | |
|---|---|---|---|
| | Master | Client Without DFS | Client With DFS |
| Non-Occupancy Period | Yes | Not required | Yes |
| DFS Detection Threshold | Yes | Not required | Yes |
| Channel Availability Check Time | Yes | Not required | Not required |
| Uniform Spreading | 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 | Client Without DFS | Client With DFS |
| DFS Detection Threshold | Yes | Not required | Yes |
| Channel Closing Transmission Time | Yes | Yes | Yes |
| Channel Move Time | Yes | Yes | Yes |
| U-NII Detection Bandwidth | Yes | Not required | Yes |

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## 1.3 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 15E is shown below.

| Section | Spec Clause | Test Description | Result | Comments/Base Standard |
|---|---|---|---|---|
| DFS | | | | |
| 2.1 | NA | Calibration of Test Setup | - | |
| 2.2 | 15.407 (h)(2)(iii) | In-Service Monitoring | Pass | |

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## 1.4 APPLICATION FORM

| EQUIPMENT DESCRIPTION | |
|---|---|
| Model Name/Number | Venice 6.5 |
| Part Number | HA-FS2026-F5xxxx ('FCC variant , 'x' depends on customer variant e.g.HA-FS2026-F50008) and HA-FS2026-05xxxx ('ETSI variant , 'x' depends on customer variant e.g.HA-FS2026-050008) |
| Hardware Version | PCB Rev5 (FS0152-5) PP Build |
| Software Version | V1.0.16 |
| FCC ID | YYX-HA-FS2026-F5 |
| Technical Description (Please provide a brief description of the intended use of the equipment) | The Venice 6.5 is a radio module supporting Internet Radio (WiFi or Ethernet), Networked Audio Streaming (WiFi or Ethernet), iPod/iPhone/iPad control and DAB/DAB+/FM-RDS reception when installed in a consumer audio product. |

| TYPE OF EQUIPMENT | |
|---|---|
| ☐ | Master |
| ☐ | Client with Radar Detection |
| ☒ | Client without Radar Detection |

| 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 |
| 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 (if applicable) | | |
| Conducted Power | 11 dBm | |
| Maximum Antenna Gain | 5.5 dBi | |
| EIRP | dBm | |
| Minimum rated transmitter output power as stated by manufacturer (if applicable) | | |
| Conducted Power | 5 dBm | |
| Maximum Antenna Gain | 5.5 dBi | |
| EIRP | dBm | |
| Is TPC supported? | ☒ Yes | ☐ No |
| If Yes, provide a description of operation. | | |
| Implemented as per all TPC features mandated by 802.11-2007 for operation in the 5GHz DFS bands | | |

| POWER SOURCE | | |
|---|---|---|
| ☐ AC mains supply | | State voltage |
| AC supply frequency | (Hz) | VAC |
| ☒ DC supply | | |
| Nominal voltage | 4V, 3.3V, 1.2V +/-5% | |

| 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 |

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

| MISCELLANEOUS |
|---|
| Power-on cycle time* |
| * Time from switching on the UUT to the point at which Channel Availability Check (CAC) commences |

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| ANTENNA OPTIONS | |
|---|---|
| **Antenna 1** | |
| Antenna Description: | Onboard PIFA (part of PCB) |
| Antenna Model: | PIFA |
| Antenna Maximum Gain: | 5.5 dBi |
| Antenna Frequency Range: | |
| **Antenna 2** | |
| Antenna Description: | Integral External Antenna |
| Antenna Model: | Kinsun, 6604313035-200 |
| Antenna Maximum Gain: | 2.5 |
| Antenna Frequency Range: | |
| **Antenna 3** | |
| Antenna Description: | |
| Antenna Model: | |
| Antenna Maximum Gain: | |
| Antenna Frequency Range: | |
| **Antenna 4** | |
| Antenna Description: | |
| Antenna Model: | |
| Antenna Maximum Gain: | |
| Antenna Frequency Range: | |
| **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: Abdul Wahed Dewan

Position held: Principal RF Engineer Date: 29 May 2012

## 1.5 PRODUCT INFORMATION

### 1.5.1 Technical Description

The Equipment Under Test (EUT) was a Frontier Silicon Ltd Venice 6.5. A full technical description can be found in the manufacturer's documentation.

## 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. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 12V DC supply.

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## 1.7 DEVIATIONS FROM THE STANDARD

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

## 1.8 MODIFICATION RECORD

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

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## 1.9 DFS TEST SYSTEM

The DFS system consists of hardware and software. The Hardware uses a PXI chassis with PXI instruments populating the chassis. The instruments used are a Vector Signal Generator, a Digitiser, Frequency References and a Dual Core PC. The measurement and analysis software runs on the PC and controls the instruments within the mainframe via commands on the PXI bus. Various markers are contained within the generated waveforms. The markers are used to trigger the measurement system at the appropriate points. An external trigger is also provided at the SMB output on the Vector Signal Generator which is employed where a Spectrum Analyser is used in place of the Aeroflex Digitiser. These are described within the test procedure for the applicable test.

The Aeroflex DFS software generates the pulses in accordance with FCC 06-96.

Short Pulse Radar Test Waveform (Types 1-4)

The short pulse radar simulation is a conventional amplitude pulse with varying pulse widths, pulse rate intervals (PRI) and number of pulses. General characteristics for these types and number of repetitions required by the standard are as follows:

| Radar Type | Pulse Width (µsec) | PRI (µsec) | Number of Pulses |
|---|---|---|---|
| 1 | 1 | 1428 | 18 |
| 2 | 1-5 | 150-230 | 23-29 |
| 3 | 6-10 | 200-500 | 16-18 |
| 4 | 11-20 | 200-500 | 12-16 |

FCC 06-96 - Table 5 – Short Pulse Radar Test Waveforms

Long Pulse Radar Test Waveform (Type 5)

The long pulse radar simulation is a 12 second concatenated series of chirps, chosen randomly. The general characteristics for type 5 and number of repetitions required by the standard are as follows:

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

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FCC 06-96 - Table 6 – Long Pulse Radar Test Waveform

A Type 5 Radar sequence is constructed in the following way:

1) The user provides the required level based on the calibration and the test frequency.
2) The Burst_Count, (a number between 8 and 20 inclusive), is chosen representing the number of "bursts" (or waveform segments). Type 5 waveform length is 12 seconds, thus each "burst" length will be BL = 12/ Burst_Count.
3) Pulse_Count, a number between 1 and 3 inclusive is chosen for each burst segment (1 through Burst_Count) representing the number of chirped pulses for each burst segment.
4) For each burst segment, the following chirp parameters are randomly chosen (all chirped pulses within a given burst segment are the same, whether 1, 2, or 3 chirped pulses are chosen):
a) Frequency width (5 MHz to 20 MHz, a linear and symmetrical ramp)
b) Pulse period (50 µs to 100 µs)
c) Pulse Rate Interval (1 ms to 2 ms, in 1 µs increments)
d) The start of the first pulse in a given burst segment is randomly chosen (in 1 µs increments) between 1 µs and [(the total burst length - (total of all pulse periods within a burst) + (the total space between pulses within a burst)]. Or stated otherwise, 1 µs to [ (BL - (Pulse_Count * pulse period) + (Pulse_Count - 1)* randomly chosen PRI Interval)].

Frequency Hopping Test Waveform (Type 6)

The frequency hopping radar simulation emits 9 1 µs wide amplitude pulses with a 333 µs PRI spacing on a randomly chosen frequency, hops to another randomly chosen frequency, emits another 9 pulses and then continues this sequence for 100 different frequencies chosen using a pseudo random sequence. General characteristics for type 6 and number of repetitions required by the standard are as follows:

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

FCC 06-96 - Table 7 – Frequency Hopping Radar Test Waveform

The frequency hopping Radar is generated in the following way:

a) The user inputs the required level based on the calibration and a frequency within the EUT detection bandwidth.
b) A sequence of 100 numbers, (n = 1 to 100), are randomly chosen from between 1 to 475 and then removed from the sequence producing 100 unique random numbers.
c) Frequency assignments are 5250 MHz + n.
d) If the list generated from steps (b) and (c) does not include at least one frequency which is between 5250 to 5350 MHz or 5470 to 5725 MHz, the list is regenerated.
e) Secondly, in order to verify that at least one frequency in the list is at the EUT frequency plus or minus ½ the EUT detection bandwidth (i.e. at least one of the frequencies in the list must conflict with the EUT's operation such that the EUT will attempt to relocate when the sequence is played), the frequency supplied by the user is inserted into the list, replacing one selection.

Using the supplied Aeroflex software, the pulses are automatically generated and the required numbers of trials are created for each Radar Type – except in the case of Radar Type 1 which has no changeable attributes. The pulses are saved as Arbitrary Waveform files which are then selected by the user for use in the scenario being tested.

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**SECTION 2**

**TEST DETAILS**

Limited FCC Testing of the
Frontier Silicon Ltd Venice 6.5
In accordance with FCC CFR 47 Part 15E

## 2.1 CALIBRATION OF TEST SETUP

### 2.1.1 Specification Reference

FCC CFR 47 Part 15E

### 2.1.2 Equipment Under Test and Modification State

Venice 6.5 S/N: RAD103022 - Modification State 0

### 2.1.3 Date of Test

25 April 2012

### 2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.1.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 24.3°C |
| Relative Humidity | 27.4% |

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### 2.1.6 Test Results

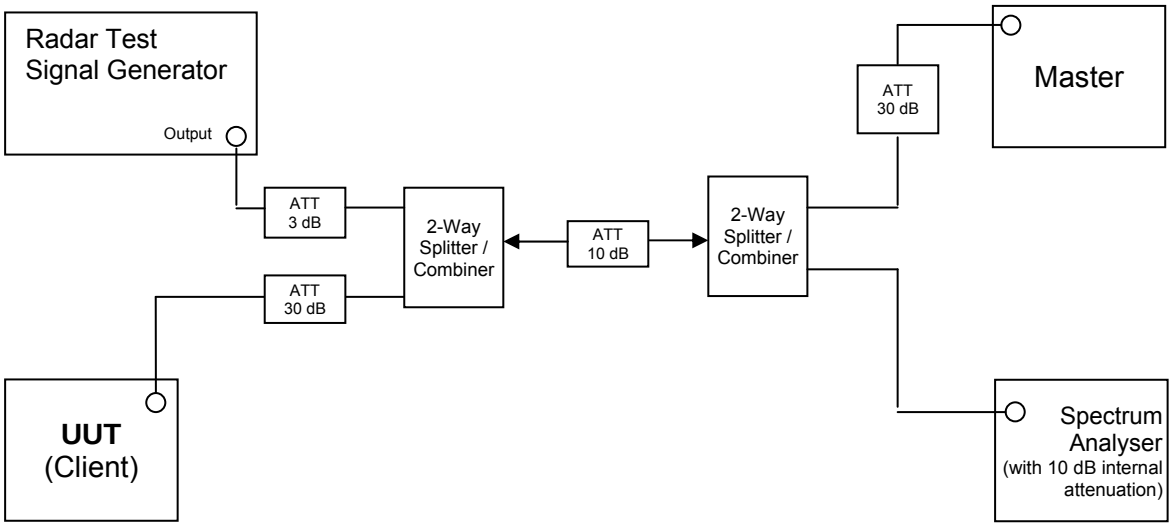
In this test equipment configuration, Radar signals are injected at the Master. The configuration ensures that the Radar pulses are received only by the Master device and not the Client. To calibrate the Radar pulses, the UUT was replaced by a Spectrum Analyser. The required Radar Waveform, (Type 1), was loaded into the Arbitrary Waveform Generator. The Spectrum Analyser was set to zero Span and the RBW and VBW set to 3MHz. The sweep time was set to display the entire burst and triggered on the Radar Burst. The output level of the Radar Signal Generator was adjusted to give the correct level as defined in the table below with the 1dB correction accounted for. Trace data showing the used Radar Pulses was recorded.

DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

| Maximum Transmit Power | Value (See Notes 1 and 2) |
|---|---|
| ≥ 200 milliwatt | -64 dBm |
| < 200 milliwatt | -62 dBm |
| Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.<br>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. | |

Test Equipment Setup

**Setup for Client with injection at the Master**



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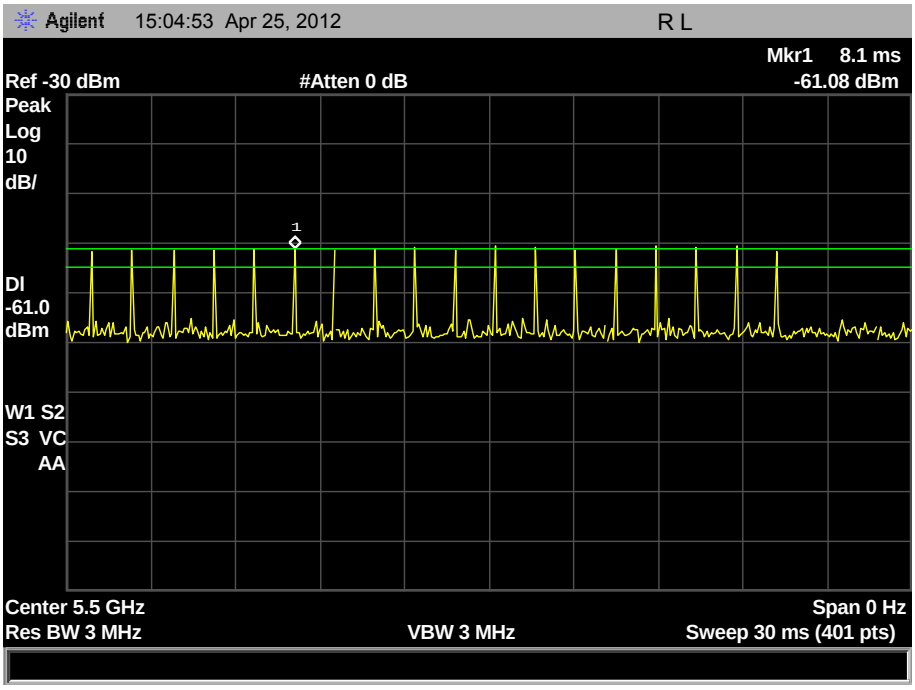
Radar Pulse Type 1

Short Radar Pulse Characteristics

| Radar Type | Pulse Width (µs) | PRI (µs) | Number Of Pulses |
|---|---|---|---|
| 1 | 1 | 1428 | 18 |

Client without DFS

Radar Type 1 Plot



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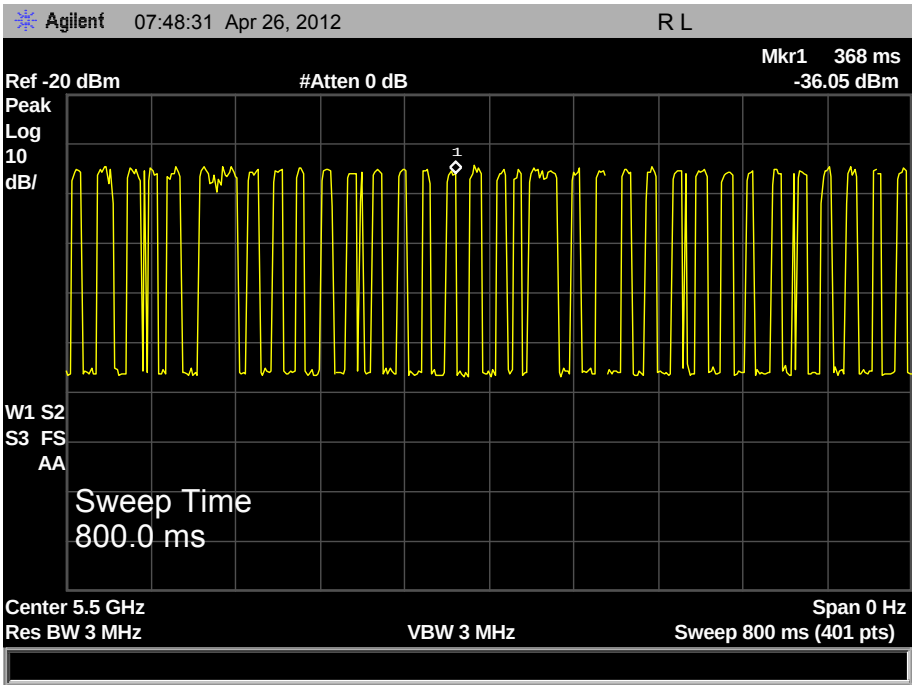
Channel Loading Plot



## 2.2 IN-SERVICE MONITORING

### 2.2.1 Specification Reference

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

### 2.2.2 Equipment Under Test and Modification State

Venice 6.5 S/N: RAD103022 - Modification State 0

### 2.2.3 Date of Test

25 April 2012

### 2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.2.5 Test Procedure

Client Without DFS

The EUT was associated with the FCC Approved Master device FCC ID: H9PAP5131D. A laptop was connected via an Ethernet cable to the Master device and the FCC defined audio/video file was streamed to the Client device using Windows Media Player.

Radar Pulse Type 1 was then transmitted and the Spectrum monitored. The transmissions from the UUT were observed for a period of 12 seconds after the final injected Radar Pulse. The Channel Move Time and the Channel Closing Time were measured and recorded.

The plot also shows 0.6 seconds prior to the radar pulses being applied to the UUT.

### 2.2.6 Environmental Conditions

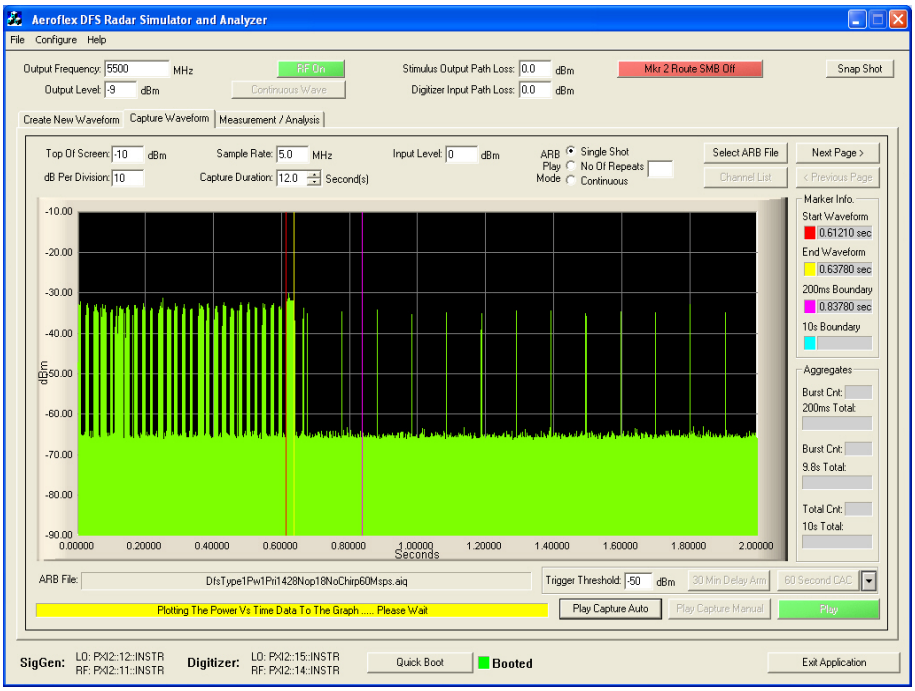
| | |
|---|---|
| Ambient Temperature | 24.3°C |
| Relative Humidity | 27.4% |

Product Service

### 2.2.7 Test Results

| | |
|---|---|
| Channel Move Time | 3.62 seconds |
| Channel Closing Time<br>(Aggregate Time During 200ms) | 1.212 ms |
| Channel Closing Time<br>(Aggregate Time During +200ms to 10s) | 3.197 ms |
| Channel Closing Time<br>(Aggregate Time During 10s) | 4.409 ms |

0 – 2 seconds



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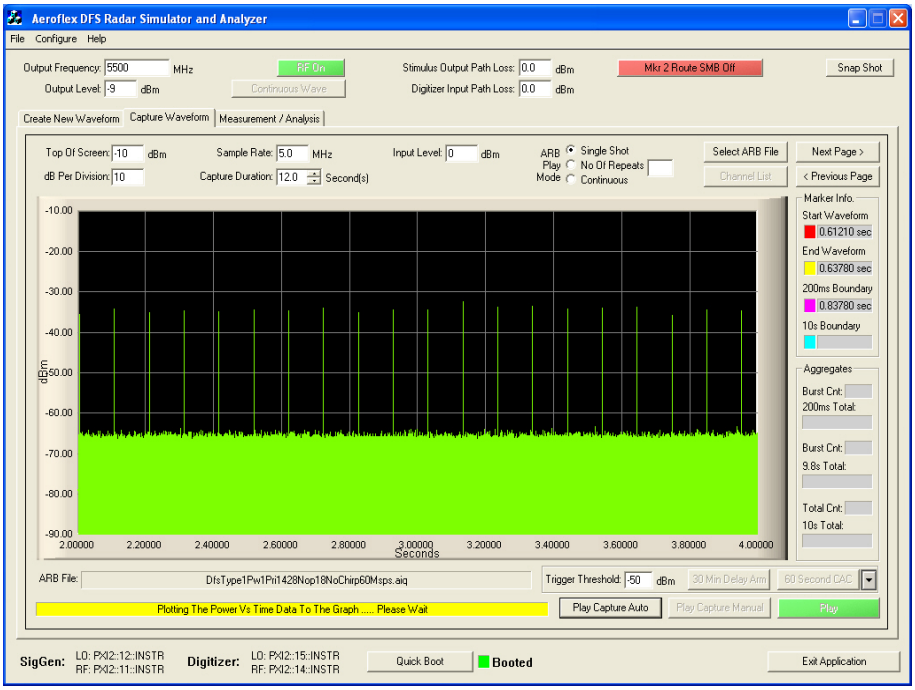
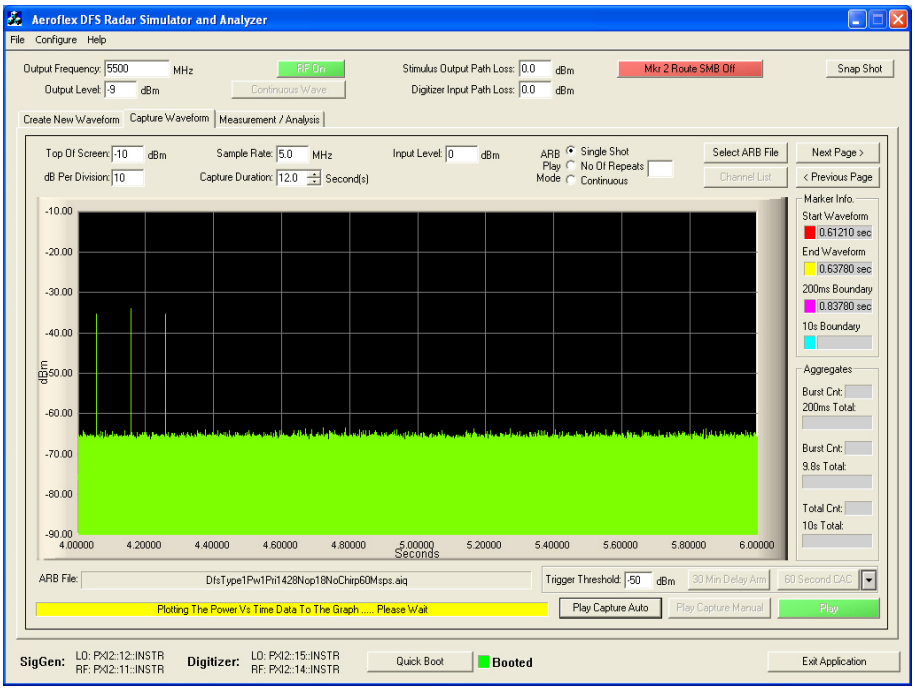
2 – 4 seconds




4 – 6 seconds



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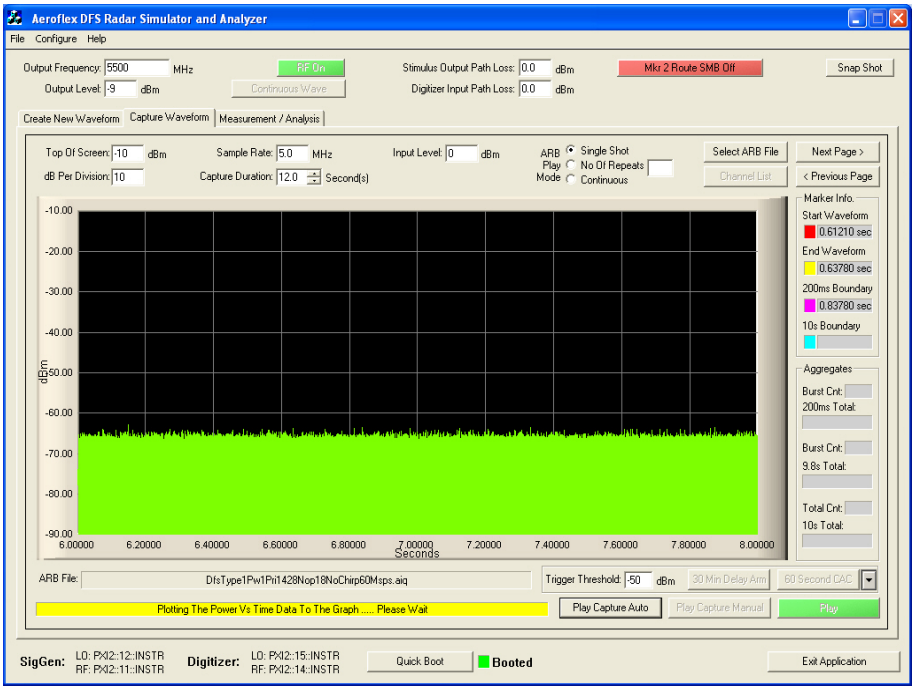
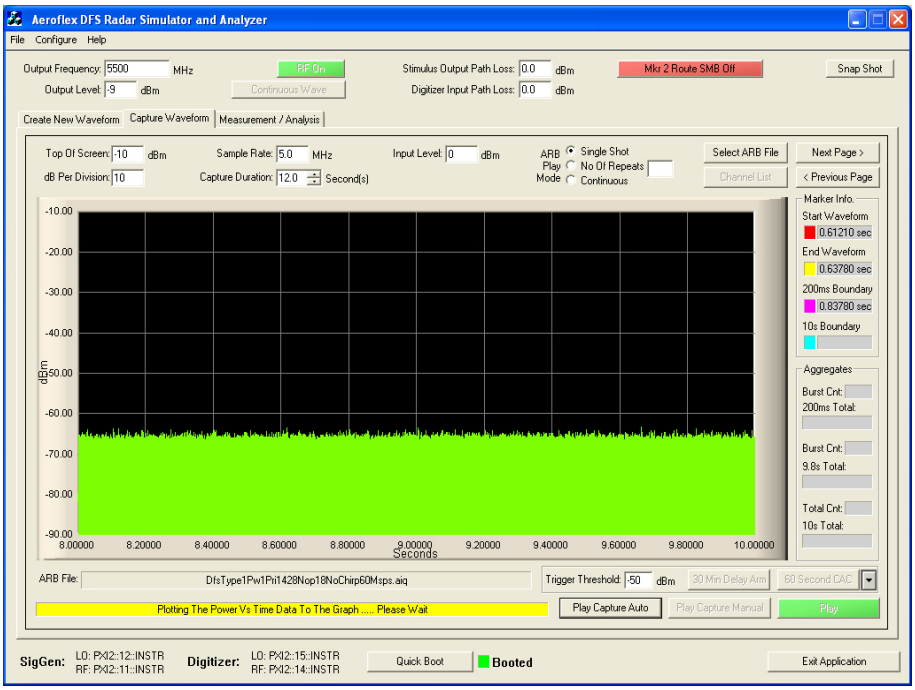
6 – 8 seconds




8 – 10 seconds



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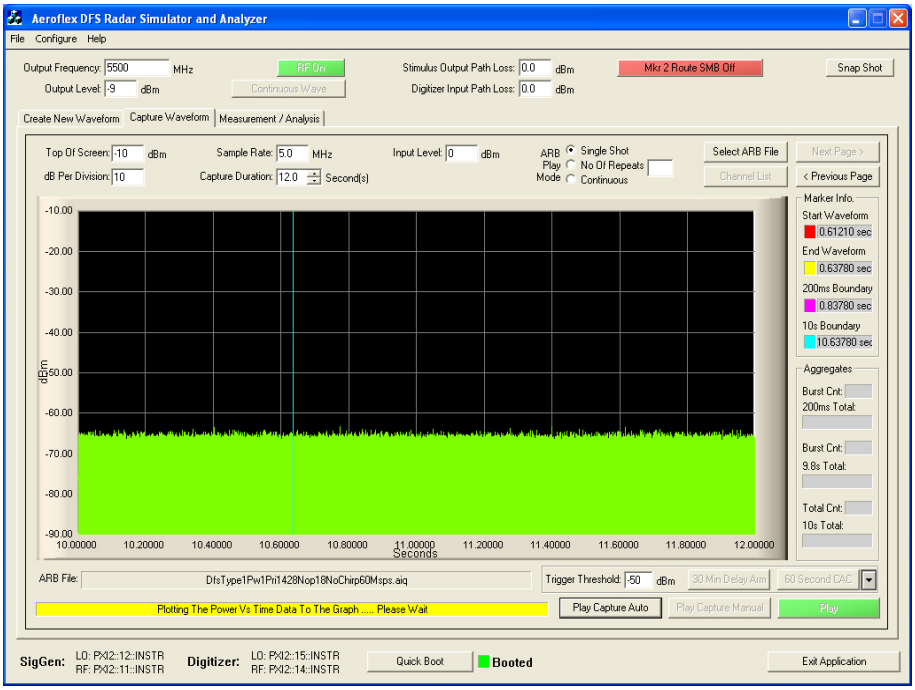
10 – 12 seconds




Limit Clause 4.07 (h)(2(iii)

| | |
|---|---|
| Channel Move Time | <10s |
| Channel Closing Time<br>(Aggregate Time During 200ms) | <200ms |
| Channel Closing Time<br>(Aggregate Time During +200ms to 10s) | <60ms |

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**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** | | | | | |
| 30dB/2W Attenuator | Narda | 4772-30 | 460 | - | TU |
| 30dB Attenuator | Narda | 4772-30 | 463 | - | TU |
| Multimeter | Iso-tech | IDM-101 | 466 | 12 | 5-Mar-2013 |
| 3dB/10W Attenuator | Texscan | HFP-50N | 475 | 12 | 27-Mar-2013 |
| Spectrum Analyser | Hewlett Packard | E4407B | 1154 | 12 | 28-Jun-2012 |
| Power Supply | Iso-tech | IPS 2010 | 2439 | - | O/P Mon |
| Attenuator (10dB, 50W) | Aeroflex / Weinschel | 47-10-34 | 3166 | 12 | 10-Jun-2012 |
| Hygrometer | Rotronic | I-1000 | 3220 | 12 | 3-May-2012 |
| PXI RF Digitizer | Aeroflex | 3025 | 4012 | 24 | 6-Dec-2013 |
| PXI RF Synthesizer | Aeroflex | 3010 | 4013 | 24 | 6-Dec-2013 |
| PXI RF Synthesizer | Aeroflex | 3010 | 4014 | 24 | 6-Dec-2013 |
| PXI Digital RF Signal Generator | Aeroflex | 3025 | 4015 | 24 | 6-Dec-2013 |
| 1800-6000 MHz Power Splitter | Mini-Circuits | ZN2PD-63-S+ | 4055 | 12 | 6-Mar-2013 |
| 1800-6000 MHz Power Splitter | Mini-Circuits | ZN2PD-63-S+ | 4056 | 12 | 6-Mar-2013 |

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

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## 3.2 SUPPORT TEST EQUIPMENT

| Instrument | Manufacturer | Type No. | Serial No. |
|---|---|---|---|
| Power Injector | Symbol | AP-PSBIAS-T-1P-AF | 105496049056326 |
| Laptop | Dell | Latitude D630 | CN-0KU184-12961-79B-B 0FC |
| Ethernet Cable | Net M | Cat 5E 1m | N/S |
| Ethernet Cable | Net M | Cat 5E 1m | N/S |
| Access Point | Symbol | AP-5131 | 05357520500184 |

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### 3.3 MEASUREMENT UNCERTAINTY

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

| Test Discipline | MU |
|---|---|
| In-Service Monitoring | Time: ± 4%<br>Power: ± 1.5 dB |

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**SECTION 4**

**PHOTOGRAPHS**

Product Service

## 4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)


Top View


Bottom View

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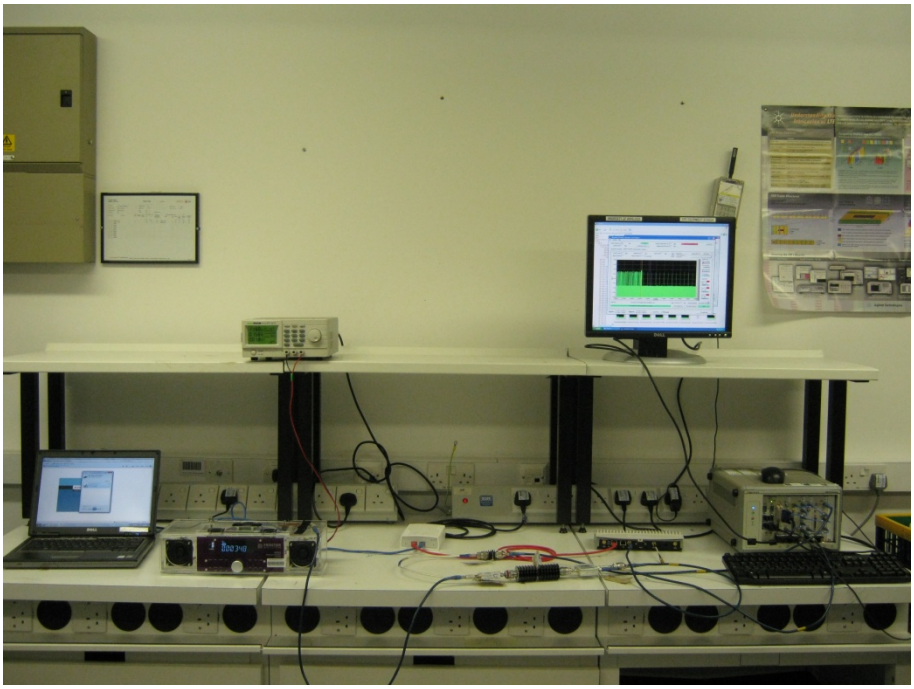
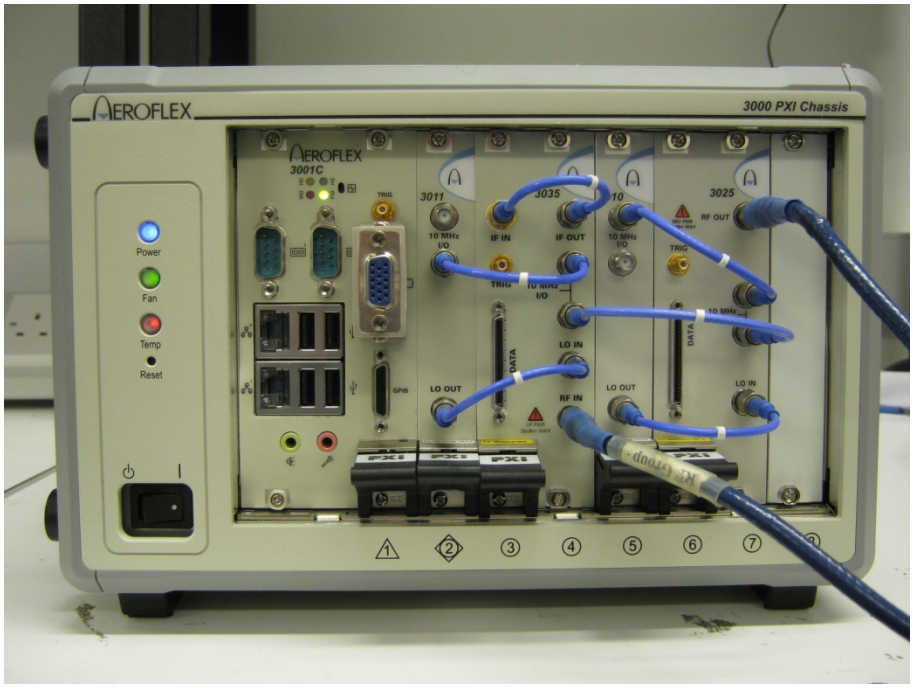
## 4.2 TEST SET-UP PHOTOGRAPHS



View 1

## 4.3 DFS TEST EQUIPMENT




Test Set Up

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## SECTION 5

## ACCREDITATION, DISCLAIMERS AND COPYRIGHT

## 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).