VIAVI Solutions

Data Sheet

VIAVI
DFS
Radar Simulator and Analyzer Test Suite

All-in-one Dynamic Frequency Selection (DFS) test system for compliance and pre-compliance testing

The DFS Radar Simulator and Analyzer Test Suite is a qualified solution for testing the compliance of commercial equipment operating in the 5 GHz to 6 GHz UNII frequency band in accordance with published Dynamic Frequency Selection (DFS) requirements. With an easy to use task orientated user interface, it is an ideal solution for pre-compliance work on new commercial devices. The test suite is also used in leading compliance laboratories around the world and compliant with USA, European and Japanese published standards for DFS radar simulation and response analysis.

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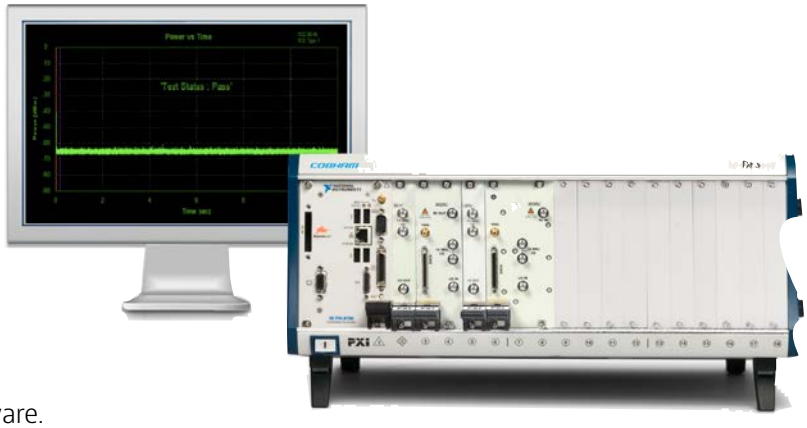
The DFS application provides an intuitive, user-friendly interface with the ability to easily generate and play compliant radar signature waveforms and then view and measure how the EUT responds.

DFS testing requirements are of particular importance for commercial products based on IEEE 802.11a, ac (WiFi), wireless telephones, unlicensed IEEE 802.16 (WIMAX) applications as well as other unlicensed devices operating in the UNII band.

The solution comprizes PXI 3000 Series modular hardware and software to simulate DFS radar signatures and synchronously analyze the Equipment Under Test (EUT) responses. PXI 3000 Series modules are supplied integrated into a choice of PXI chassis with a system controller hosting the DFS Radar Simulator and Analyzer application software.

Features

- DFS Radar Simulation compliant with USA, European, and Japanese standards controlled by easy-to-use graphical user interface
- DFS response analysis:
- Channel Availability Check (CAC)
  - 60 second non-transmit test
- Channel Move Time Check
  - Display of Power vs Time for up to 24 seconds
  - Aggregate transmission time measurement
  - Automated Play & Capture
- Portable hardware system consisting of:
  - General Purpose 6 GHz Signal Generator with dual channel AWG
  - General purpose 6 GHz RF Digitizer
  - Integrated system controller



Highlights

DFS Radar Simulator - Creating Waveforms

Users can select from a list of regional standards then generate either a specific single radar signature waveform or a whole test suite of waveforms compliant with that standard. The software arranges work activities by "Project", so that all associated files for each project can be archived as a complete folder with the ability to generate the entire set of waveforms for a given project with the single button push.

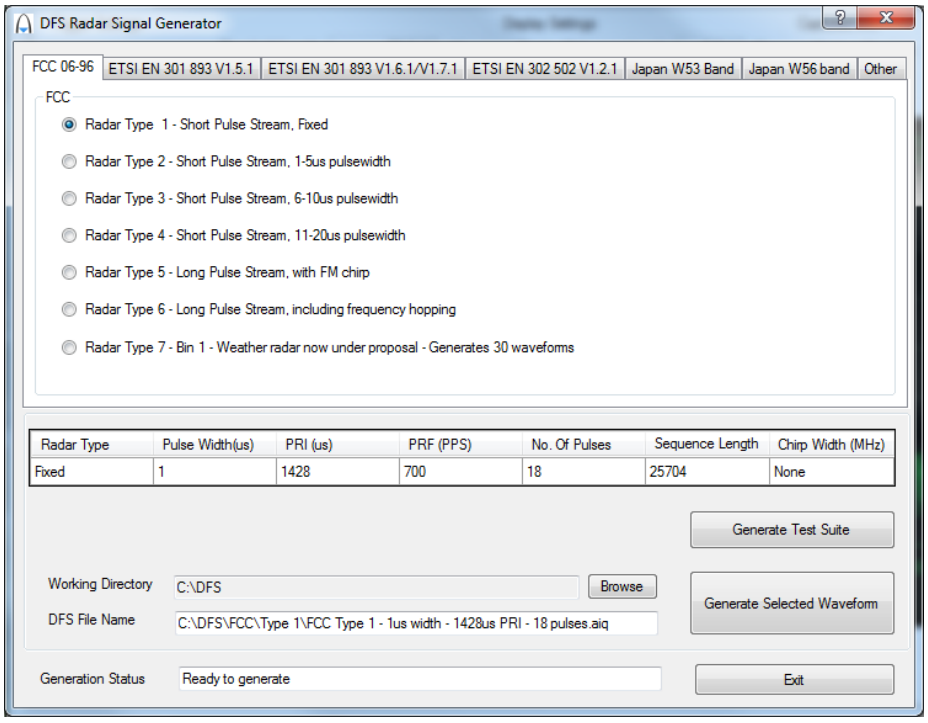


Figure 1. Create New Waveform

Simulation and Analysis - Play and Play/Capture

The application can be used to simply play radar simulation waveforms or play waveforms and analyze responses. Synchronization between analysis and signal generation ensures accurate measurement of channel move time and aggregate transmission time etc. Measurement values are displayed together with graphical trace of power vs. time which can be expanded to observe very narrow transient events in fine detail. Trace results are also available to output to file for use in documentation.

Stimulus Play Function - Radar Simulation

The play function supports single-shot, repeated, or continuous signal generation. Single-shot operation is ideal for compliance testing, whereas repeat and continuous operation is provided to help trouble shooting during the development process. Created waveforms can be identified and replayed as desired, allowing the user to archive and play back waveforms for activities such as initial verification, re-verification, firmware regression testing, as well as operational correlation between compliance test houses and their clients.

Play & Capture Function - Integrated Response Analysis

DFS performance analysis could never have been easier. Documentation required by regulatory agencies showing initial 60 second Channel Availability Checks, with and without radar bursts at the start or end of a Channel Availability Check, In-Service Monitoring Test power versus time plots, or 30 minute non-occupancy tests are easily

accomplished. Markers within each waveform are used internally to ensure accurate synchronization with response measurements. On-screen markers showing key events in the captured response are provided to identify important boundaries for different modes of operation.

Basic System Capture/Analysis Modes

- 60 second Channel Availability Check – EUT transmissions is prohibited during the initial 60 seconds following power on during which time it should monitor the channel. This test ensures EUT transmissions exceeding a user defined threshold during the initial 60 seconds arecaptured and time stamped.

  Secondly, the application verifies that in the event of a radar signal being detected during the initial 60 second monitoring period then transmission is prohibited for a further 30 minutes.

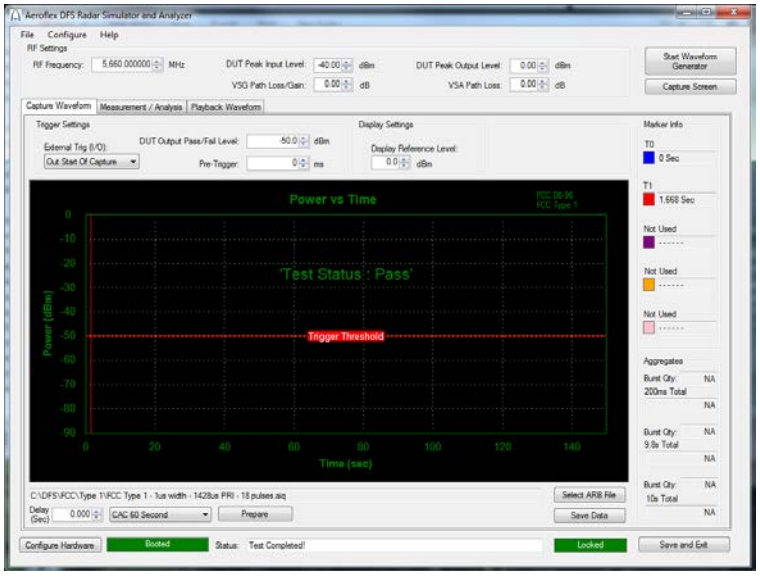


Figure 2. 60 Second Availability Check

- In-service Monitoring – Channel Close Time and Channel Move Time are measured in response to each waveform file. The results are displayed numerically and as a power versus time trace with colored markers indicating start, stop and intermediate time boundaries, making it easy to interpret the result display.

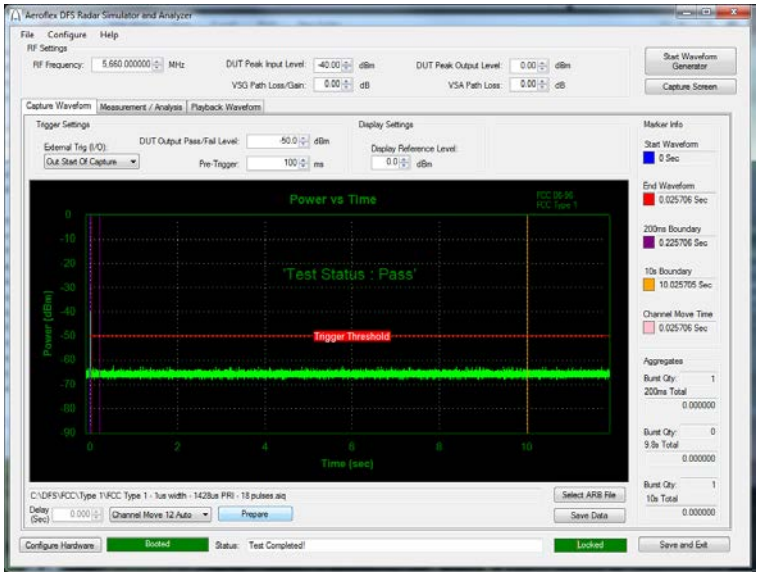


Figure 3. Channel Closing Time/Channel Move Time

Figure 4. Channel Closing Time/Channel Move Time (zoom)

DFS Response Analyzer - Measurement and Analysis

Post-analysis of signals captured by the Play and Capture function provides measurement of aggregate transmission times from the end of the waveform to the 10 second no-transmit boundary. This function provides three values, including the total aggregates over the full 10 second period (required for ETSI), as well as the number of pulses occurring in the first 200 ms and the subsequent 9.8 seconds (required by the FCC). The Play & Capture Auto function not only captures the waveform, it invokes the Measurement and Analysis function, as well as outputting the full set of plots to .JPEG screen capture files.

This feature also presents important information such as the Rising Edge and Falling Edge of any detected bursts from the EUT. The Pulse Width and Average Power for each detected pulse are also displayed for the user to view. This feature can be utilised as a verification of the Capture Waveform function. See Figure 5.

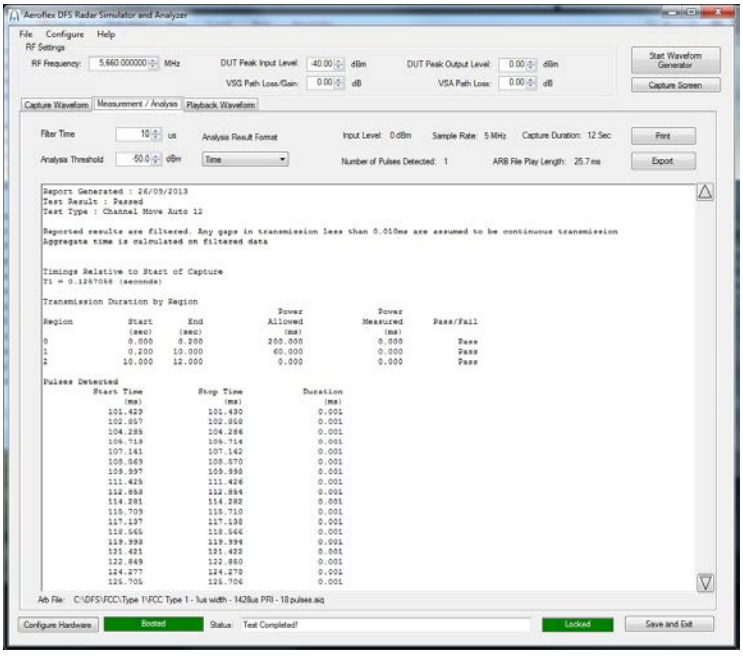


Figure 5. Measurement Analysis

Figure 6 displays the Playback Waveform window. This window enables the user to navigate to the appropriate sub-directory and select a folder of waveforms. These will appear on the left half of the display. The user can then add selected files to the right half of the display and play them in either single shot, repeat, continuous or CW only mode.

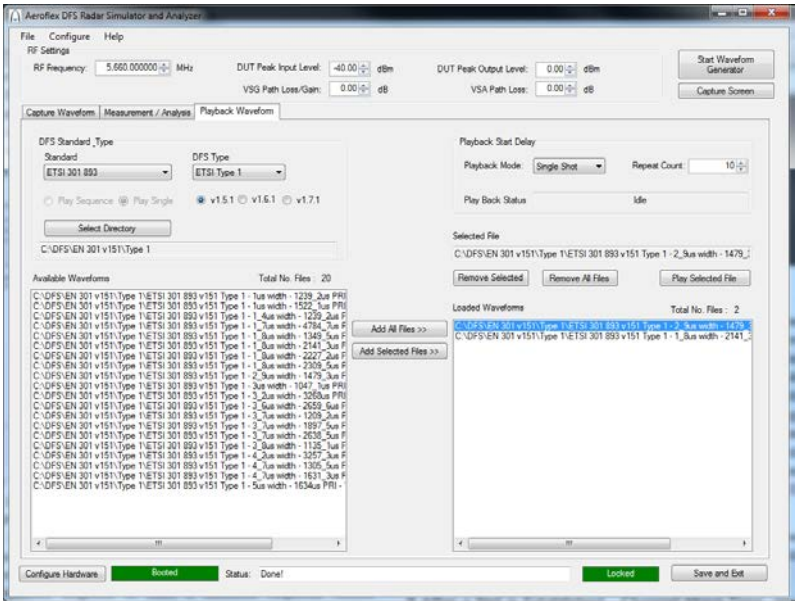


Figure 6. Measurement Analysis

Specification

The following specifications apply when the DFS Radar Simulator and Analyzer Test Suite is used in conjunction with specified PXI 3000 Series RF modules operated in the frequency range 5250 – 5350 MHz and 5470-5725 MHz.

For general purpose RF performance refer to product specifications for PXI 3000 Series modules.

Radar Waveform Simulation Modes	CAC 60 second
	CAC 60 second Begin
	CAC 60 second End
	Channel move 12 second auto
	Channel move 24 second auto
Air Play Modes	Single, Repeat(N), Continuous
Pulse Width Accuracy (50% points)	Typically ±16.67 ns ± reference accuracy
Marker Output	Selectable Marker outputs (TTL via SMB front panel connector) aligned with the start of the radar waveform)
Waveforms	
Arbitrary Waveform Files	
Arbitrary waveform files are stored in a hardware specific format with a file extension .AIQ. File names are automatically generated and provide a description of the file content, for example:	
"DfsType1Pw1Pri1428Nop18NoChirp60Msps.aiq"	
Sequenced Waveforms	
Sequenced waveforms, such as FCC Type 5 or Type 6 use 3025C List Mode functionality	

FCC

FCC Types 0-4 (ref. 905462 - D02)

Pulsed with the following characteristics:

Radar Type Pulse	Width (µsec)	PRI (µsec)	Number of Pulses
0	1	1428	18
1	1	518-3066	43-3066
2	1-5	150-230	23-29
3	6-10	200-500	16-18
4	11-20	200-500	12-16

FCC

FCC Type 5 Concatenated Chirps

8 to 20 bursts of 1 to 3 pulses with fixed chirp widths and pulse widths of 50 to 100 µs with the following characteristics:

Pulse Width (µs)	PRI (µs)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (ms)
1	333	9	0.333	300

Frequency Hopping

FCC Type 6

100 frequencies randomly chosen in 1 MHz increments from operation frequency range noted above, playing the following CW pulse waveform at each frequency:

European

ETSI Waveforms

Radar	Pulse Width (µs)		PRI (µs)	Pulses per Burst
	EN 301 893 version 1.5.1	EN 301 893 v1.6.1/1.7.1/1.8.1 EN 302 502 version 1.2.1		
Ref	1	1	1428	18
1	0.8 - 5	0.5 - 5	1000 - 5000	10
2	0.8 - 15	0.5 - 15	625 - 5000	15
3	0.8 - 15	0.5 - 15	250 - 435	25
4	20 - 30	20 - 30	250 - 500	20
5	0.8 - 2	0.5 - 2	2500 - 3333	10
6	0.8 - 2	0.5 - 2	833 - 2500	15

Japanese

W53 Waveforms (5.3 GHz band)

Radar	Pulse Width (µs)	PRI (µs)	Pulses per Burst	Number of Burssts
1	1	1428	18	1
2	2.5	3846	18	1

W56 Waveforms (fixed & variable) (5.5 - 5.7 GHz band)				
Radar	**Pulse Width (µs)**	**PRI (µs)**	**Pulses per Burst**	**Number of Burssts**
1	0.5	1389	18	
2	215	1428	18	
3	2	4000	18	
4*	1-5	150 - 230	23 - 29	
5*	6-10	200 - 500	16 - 18	
6*	11-20	200 - 500	12 - 16	

Analysis Measurements	
Channel closing time and channel move time	
Verifies EUT close time and channel move time upon detecting a radar signal.	
Indication	0 to 10s: Burst Count
	0 to 0.2s: Aggregate Time(s) and Burst Count
	0.2 to 10s: Aggregate Time(s) and Burst Count
	Channel Move Time (s)
	Power versus Time Trace (12 seconds or 24 seconds) with Markers displaying waveform start and end, 200 ms and 10 second time boundaries and trigger threshold
Channel Availability Check	
Modes	
60 Seconds Measurement	
Verifies no transmission occurs within 60 seconds of power up under conditions.	
	• With no radar signal • With radar signal applied towards the beginning and the end of the initial 60 seconds
Indication	Pass/Fail (with time stamps)
General	
PXI Hardware Minimum Requirements	
PXI modules to be located within a single trigger bus segment	
PXI chassis with 7 vacant PXI-1 peripheral slots	
PXI Module Driver Software	
Revision 8.8.0 or later	
Revision 8.8.0 or later when used with PXI 3050A, PXI 3320 or PXI	
3070A modules	
PC Minimum Requirements	
Operating System	Windows 7/32
National Instruments Visa	Version 4.3 or higher
Memory	2 GByte or greater

Versions, Options, and Accessories

When ordering please quote the full ordering number information.

Order As:	
Hardware	
Add line items for each of the required PXI hardware components as follows:	
Select one PXI chassis	• 82565 – 18 slot chassis
	• 82531 – 8 slot chassis (recommended)
Select one PXI controller	• 28541/192 "NI PXI-8119 2.3GHz Quad Core PXI Embedded Controller (Win7/64), 4 GB RAM
	• 46885/416 MXIexpress PXI-PCIe interface card external controller (recommended)
	• 46885/598 PXI-PCI Interface card external controller
Select sgnal generator	• 3025C, PXI 6 GHz signal generator with option 114 "DFS Radar Simulator" 3011, PXI RF Synthesizer with option 01 "High speed Frequency Switching"
	• 3050A, PXI Signal Generator with option 03 "Frequency Extended to 6 GHz" and " option 05 "IQ Modulation" 3320, PXI Dual AWG with option 114 "DFS Radar Simulator"
Select RF Digitizer	• 3035C, PXI 6 GHz RF Digitizer 3010, RF Synthesizer with option 01 "High Speed Frequency Switching"
	• 3070A, PXI RF Digitizer with option 01 "High Speed Frequency Switching" and option 03 "Frequency Extended to 6 GHz"
Supplied With	
	CD-ROMs
	PXI module drivers and PXI Studio application (pre-installed when purchased with PXI Embedded CPU)
	DFS Radar Simulator and Analyzer Application (pre-installed when purchased with PXI Embedded CPU)
	If 1-4 above is selected the order will be supplied as a configured system with PXI modules fitted and interconnected.
	If an embedded control is chosen all software is pre-installed.

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