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.

The system is compliant with USA, European and Japanese published standards for DFS radar simulation and response analysis.

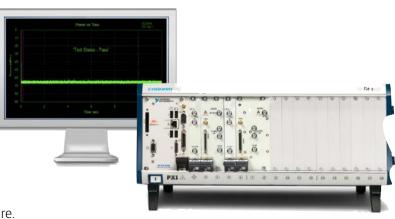
The DFS application provides an intuitive, user-friendly interface with the ability to easily generate and play compliant radar signature waveforms and then view and measure how the EUT responds.

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.

DFS Radar Signal	Generator			Dana latings		? ×
FCC 06-96 ETSI EN	301 893 V1.5.1	ETSI EN 301 893	V1.6.1/V1.7.1 ETS	EN 302 502 V1.2.1	Japan W53 Band Ja	apan W56 band Other
Radar Type	1 - Short Pulse Stre	eam, Fixed				
Radar Type	2 - Short Pulse Stre	am, 1-5us pulsewi	idth			
Radar Type	3 - Short Pulse Stre	am, 6-10us pulsev	width			
Radar Type	4 - Short Pulse Stre	am, 11-20us pulse	ewidth			
Radar Type	5 - Long Pulse Stre	am, with FM chirp				
Dadar Time	6 Long Pulso Stro	am, including frequ				
nauar Type	6 - Long Fuise Sile	am, including neq	dency hopping			
	-		proposal - Generates 3	0 waveforms		
	-			0 waveforms		
Radar Type	7 - Bin 1 - Weather	radar now under p	proposal - Generates 3		Sequence Length	
Radar Type	-	radar now under p	PRF (PPS)	No. Of Pulses	Sequence Length	
Radar Type	7 - Bin 1 - Weather Pulse Width(us)	radar now under p	proposal - Generates 3		Sequence Length	Chirp Width (MHz) None
Radar Type	7 - Bin 1 - Weather Pulse Width(us)	radar now under p	PRF (PPS)	No. Of Pulses	25704	
Radar Type Radar Type Radar Type Rixed	7 - Bin 1 - Weather Pulse Width(us) 1	radar now under p	PRF (PPS)	No. Of Pulses	25704	None
Radar Type Radar Type Fixed Working Directory	Pulse Width(us) 1 C:\DFS	PRI (us)	PRF (PPS) 700	No. Of Pulses 18 Brow	25704 Gen	None
Radar Type Radar Type Radar Type Rixed	Pulse Width(us) 1 C:\DFS	PRI (us)	PRF (PPS)	No. Of Pulses 18 Brow	25704 Gen	None

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.

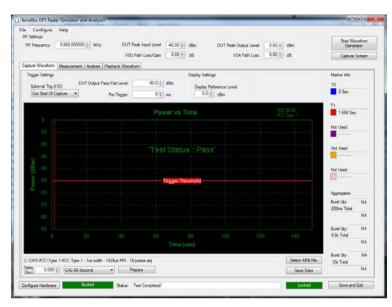


Figure 2. 60 Second Availability Check

• 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.

e Configure IF Settings	Help							
	5.660 000000 💿 MHz	DUT Peak Input	Level: 40.00	diam DU	T Peak Output Level:	0.00 ÷ d8		Stat Waveform Generator
		VSG Path Loss	/Gan: 0.00	dB	VSA Path Loss:	0.00 ÷ d8		Capture Screen
apture Waveform	Measurement / Analysis P	layback Waveform						
Trigger Settings				Daplay Settings				Marker Info
Edemai Trig (1/0)) DUT Output Par	iz/Fal Level:	60.0 🜩 dBm	Display Reference	ce Level			Start Waveform
Out Start Of Ca	sture •	Pre-Trigger:	100 0 ms	0.0 👘 dB	n			0 Sec
								End Waveform
							46 g 1	0.025706 Sec
								200ms Boundary
								0.225706 Sec
				us : Pass'				10s Boundary 10 025705 Sec
								Channel Move Time
-50			Trigger T	hreshold				0.025706 Sec
e .60								Aggregates
-70	and start all start of the second							Burst Oty 1
								200ms Total 0.000000
								0.00000
								Burst Oty: 0 9.8a Total
								9.5e Total 0.000000
DES\FCC\Type	IVFCC Type 1 - Tus width - 1	1428us PRI - 18 pulses aid				5	elect AR8 File	Burst Oty: 1 10s Total
Sec) 0.000	Channel Move 12 Auto	Prepare				-	Save Data	0.000000

Figure 3. Channel Closing Time/Channel Move Time

le Configure RF Settings	Help							
RF frequency:	5.650.000000 🔄 MHz	DUT Peak Input Level	40.00	dBm DUT Peak Ou	tput Level:	0.00 😳	dBm	Start Waveform Generator
		VSG Path Loss/Gain:	0.00 💠	dB VSA	Path Loss:	0.00 💠	dB	Capture Screen
Capture Waveform	Measurement / Analysis Ph	yback Waveform						
Trgger Settings				Display Settings				Marker Info
Edemal Trig (M	2): DUT Output Pase	/Fal Level: 50.0 🔆	dBm	Daplay Reference Level				Start Waveform
OLE STAR OF CA	pture •	Pre-Trigger: 100	-	0.0 0 dBm				0 Sec
								End Waveform
							de se Type 1	0.025706 Sec
								200ms Boundary
-30								0.225706 Sec
-40								10s Boundary
								10.025705 Sec
E -50 ···								Channel Move Time
rr (d								0.025706 Sec
-60								110
70	all the second	Villes, extended to the state	diam'r avit	ala an an de de strike a de se	1012 1.21	CONTRACTOR OF	and a state	Aggregates
Let	and the second secon	ten indunanti dan entre	(And and a second		a na	allough and	ACCOUNT OF LEVEL	Bunt City. 1
-80 0								200ms Total 0 000000
.90								Bunt City: 0 9.8s Total
.0								0.000000
							[Bunt Oby 1
	TVFCC Type 1 - Tus width - T-						Select ARB File	10s Total 0.000000
(Sec) 0.00014	Channel Move 12 Auto	Prepare					Save Data	0.000000

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.

le Configure H RF Settings	ыb							
and the second se	660 000000 😌	MHz DUT Peak	input Level 40.00	dBm DL	IT Peak Output Level	0.00 🕂 dBm	Start Wave Generate	form or
			h Loss/Gain: 0.00 1	dB	VSA Path Loss	0b + 000	Capture So	reen
Capture Waveform M	tasurement / Ana	ahsa Playback Waveform	0					
Fiber Time	10 0	us Analysis Result	Format	input Level: 0dBm	Sample Rate 5	MHz Capture Duration: 12 Sec	Print	2
Analysis Threshold	-50.0 💠	dBm Time	•	Number of Pulses Dete	ected: 1	ARB File Play Length: 25.7 ms	[Expot	
	: Passed Channel Move alte are fil	Auto 12		• shan 0.010mm •	tre assumed to 1	e continuous transmission		2
Timings Rela 71 = 0.12670	58 (seconds)							
Trensmission	Duration by	Region	Power	Power				
Region	Start (sec)	End (sec)	Allowed	Measured (ms)	Fass/Fail			
0	0.000	0.200	200.000	0.000	Pass			
1	0.200	10.000	60.000	0.000	Pass			
2	10.000	12.000	0.000	0.000	Pape			
Pulses Deter	Led							
81	art Time	Stop Time	Duratio					
10.00	(ma)	(808)	(ma)					
	101.429	101.430	0.000					
	104,285	104,286	0.00					
	104.205	105.714	0.00					
	107.141	107.142	0.00					
	108.569	108.570	0.001					
	109.997	109.990	0.001					
	111.425	111.426	0.00					
	112.853	112.884	0.00					
	115.709	114.282	0.00					
		117,100	0.001					
		110.546	0.001					
	117.137		0.00					
	110.565	119.994						
	110.665 119.993 121.421	121,422	0.001					
	110.565 119.993 121.421 122.849	121.422 122.650	0.001					
	118.565 119.993 121.421 122.849 124.277	121.423 122.850 124.270	0.000					100
	118.565 119.998 121.421 122.849 124.277 125.705	121.422 122.650	0.001 0.001 0.001					5

Figure 5. Measurement Analysis

Figure 6 displays the Playback Waveform window. This window enables the user to navigate to the appropriate subdirectory 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.

e Configure	Simulator and Analy Help							
F Settings							1	Start Waveform
RF Frequency:	5.660.000000 🔃 MH		-40.00 ÷		DUT Peak Output Level:	0.00 C dBm		Generator
		VSG Path Loss/Gain:	0.00	dB	VSA Path Loss:	0.00 🗇 d8		Capture Screen
apture Waveform	Measurement / Analysi	e Playback Waveform						
DFS Standard Ty	pe				Playback Start Dela	ry .		
Standard		DFS Type			Playback Mode		Repeat Court	10 -
ETSI 301 893	•]	ETSI Type 1 🔹			Playback Mode.	Single Shot	• Repeat Court	10 (*)
O Play Sequer	ce 🛞 Play Single	🔹 v1.5.1 🗇 v1.6.1 💮 v1.7.1			Play Back Status		lde	
Select	Directory				Selected File			
C:\DFS\EN 301	v151\Type 1				C:\DFS\EN 301 v15	T\Type T\ETSI 30	1 893 v 151 Type 1 - 2,	Sus width - 1479_1
Available Waveform		Total No. Files	20		Remove Selected	Bemove ALE		ty Selected File
		893 v151 Type 1 - Tus width - 1239 2			There're solorios	T Spingto Parts		g concentration
C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8	193 v 151 Type 1 - 1us width - 1522_1c 193 v 151 Type 1 - 1 4us width - 1239	a PRE		Loaded Waveforms		To	tal No. Files : 2
C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8	293 v151 Type 1 - 1_7us width - 4784 293 v151 Type 1 - 1_7us width - 1349	7.8 F	Add All Files >>	C\055\EN301v15	IVTgee IVETSE	1 693 v 151 Type 1 - 2	9.# with - 1479
C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8	193 v 151 Type 1 - 1 8us width - 2141	Jus F Cours	d Selected Files		intige inclator	/1 603 V 151 19De 1 - 1,	ous worn - 2141_2
C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8	293 v 151 Type 1 - 1_8us width - 2227 293 v 151 Type 1 - 1_8us width - 2309	Sus F					
C:\DFS\EN 301 v1 C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8 51\Type 1\ETSI 301 8	393 v151 Type 1 - 2_9us width - 1479 893 v151 Type 1 - 3us width - 1047_1.	3 n F					
C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8	193 v 151 Type 1 - 3_2us width - 3268 193 v 151 Type 1 - 3 Gus width - 2659	is PRI					
C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8	893 v 151 Type 1 - 3_7us width - 1209	2us F					_
C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8	893 v151 Type 1 - 3 Jus width - 1897 193 v151 Type 1 - 3 Jus width - 2638	5us P					
C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8	293 v 151 Type 1 - 2_8us width - 1135 293 v 151 Type 1 - 4_2us width - 3257	Tus F					
C:\DFS\EN 301 v1	51\Type 1\ETSI 301 8	393 v 151 Type 1 - 4_7us width - 1305 893 v 151 Type 1 - 4_7us width - 1631	Sus F					
		193 v151 Type 1 - 5us width - 1634us						
•			<u>)</u>		¥ []	111		+
	Rocted	Status: Done!				274	Locked	Save and Ext

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	CAC 60 second				
Simulation Modes	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 \pm 16.67 ns \pm 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:					
"DfsType1Pw1Pri1428Nop18	NoChirp60Msps.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	Radar Type Pulse	Width (µsec)	PRI (µsec)	Number of Pulses
0	1	1428	18	3	6-10	200-500	16-18
1	1	518-3066	43-3066	4	11-20	200-500	12-16
2	1-5	150-230	23-29				·

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

	Pulse	e Width (µs)			
Radar	EN 301 893 version 1.5.1	EN 301 893 v1.6.1/1.7.1/1.8.1EN 301 893 version 1.5.1EN 302 502 version 1.2.1		Pulses per Burst	
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 Waveform	ns (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 cha	nnel move time				
Verifies EUT close time and cha	annel 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	s 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 Requ					
PXI modules to be located wit	hin 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 us	ed 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 th	e 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.



To reach the VIAVI office nearest you, visit viavisolutions.com/contact

© 2018 VIAVI Solutions Inc. Product specifications and descriptions in this document are subject to change without notice. pxi-dfs-ds-wir-nse-ae 30186487 907 1018