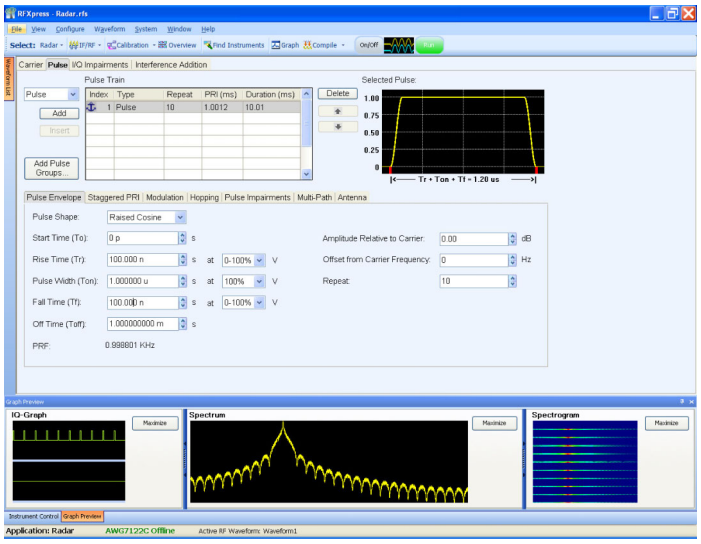
Advanced RF/IF/IQ Waveform Software

RFX100 RFXpress® Data Sheet



Features & Benefits

- Quickly and Simply Create Digitally Modulated IQ, IF, and RF Waveforms
- Great Flexibility to Customize Waveform to Meet Specific Requirements
- Define Baseband IQ, IF, and RF Signals using a Variety of Modulation Schemes
- Create Single and Multicarrier Signals where Each Carrier is Independently Defined
- Define and Create Hopping Patterns
- Apply Impairments such as Quadrature Error and Imbalance or Nonlinear Impairments
- Add Sinusoidal Interferences, Noise (SNR), and Multipaths during Waveform Creation
- Capture and Replay Waveforms from Oscilloscopes, Real-time Spectrum Analyzers, and MATLAB®*1 files as IQ or IF/RF
- Add Impairments or Interference and then Replay Captured Waveforms
- Support for Characterizing a DUT and S-parameter Emulation of RF Components
- Apply Calibration for Flat Frequency and Linear Phase Response out of AWG
- Support for Programmatic Interface in General-purpose and Radar Plug-ins enables Easy Integration of RFXpress into Test Automation Systems

Radar

- Create Single or Multiple Pulse Groups to form a Coherent or Noncoherent Pulse Train
- Define Each Pulse Group Independently or Add Different Pulse Groups to Simulate Simultaneous Multiple Target Returns
- Define Inter and Intra Pulse-hopping Patterns in both Frequency and Amplitude
- Define all Pulse Parameters including Start Time, Rise Time, Off Time, Fall Time, Pulse Width, Droop, Overshoot, and Ripple
- Define a Staggered PRI with Ramp, User-defined Profiles and Add up to 10 Different Multipaths
- Create a User-defined Pulse Sequence and use the AWG Sequence Mode to Optimize the Memory and to Create a Large Number of Pulses*3
- Support for a Variety of Intra-modulation Types including FM Chirp, QPSK, BPSK, FM Step, Barker/Frank/Polyphase Codes including P1/P2/P3/P4, User-defined Step FM/AM and Step PM/AM, and Custom Modulation
- Define Antenna Beam Profile and Simulate Target Returns

Generic OFDM

- Configure All Parts of Your OFDM Signal. Build Your Own OFDM Frame from Base Data to Packets to Frames
- Support for Reed Solomon, Convolution Coding, and Scrambling
- Add Impairments such as Phase Noise, Multipath, and Quantization
- Define Frequency Hopping and Gated Noise
- Support for a Variety of Subcarrier Modulation Formats including BPSK, QPSK, QAM (16, 32, 64, 256), and 8-PSK
- Support for Tone Nulling and Clipping
- Presets for WiFi and WiMAX Standards

Tektronix®

Environment Signal Generation

- Define up to 25 Signals that Add up to your Environment
- Support for WiMAX, WiFi, GSM, GSM-EDGE, EGPRS 2A, EGPRS2B, CDMA, W-CDMA, DVB-T, Noise, and CW Radar
- Seamlessly Import Signals from other RFXpress Plug-ins (including Radar, Generic Signal, etc.), Matlab®*1, Tektronix Spectrum Analyzers and Oscilloscopes into the Environment
- Configure PHY Parameters of your Standard-specific Signals
- Ability to Control Carrier Frequency, Power, Start Time, and Duration for all the Signals in the Environment

UWB-WiMedia

- Direct RF Generation of all the WiMedia Band Groups (BG1 to BG6) including Band Hopping*2
- Comprehensive WiMedia Signal Generation Support for MAC and PHY Layers
- Gated Noise Feature can be Used to Define Noise Profiles, which can be Defined Individually for Each Section of the UWB Packet (Preamble, PPDU HeadBer, and PSDU)
- Create Tone Nulling with Intermediate Values for both Amplitude (+20 dB to –40 dB) and Phase (–180° to +180°) for OFDM Carrier Mapping
- Apply Ready-to-Use "Real-world Interference" like WiFi (802.11a and MIMO), WiMAX, Radar, and Captured Baseband Waveforms as Interferer to the WiMedia Waveform
- Define Your Own TFC Pattern in Custom Mode

Applications

- Design, Characterize, and Debug Wideband Wireless Communications Receivers
- Generate General-purpose Digitally Modulated IQ, IF, and RF Signals
- Design, Debug, and Development of Radar Receivers and Radar Systems
- Radar Interference Testing and Environment Signal Creation
- Characterize WiMedia MB-OFDM Ultra Wideband (UWB) Radio Platform for Applications like Wireless USB (WUSB), FireWire, Bluetooth, and Others

*1 MATLAB® is a registered trademark of Math Works.

*2 Using Tektronix AWG7122 models with Option 06, BG5 requires calibration.

*3 Using a Tektronix AWG7000 or AWG5000 Series AWG with Option 08.

RF Signal Generation Made Easy

RF signals are becoming more and more complex, making it more difficult for RF engineers to accurately create the signals required for conformance and margin testing. To address this design challenge, RFXpress delivers advanced RF/IF/IQ creation and editing tools. RFXpress is a software package that digitally synthesizes modulated baseband, IF, and RF signals taking signal generation to the new levels by fully exploiting the wideband signal generation capabilities of Tektronix arbitrary waveform generators (AWGs).

Digitally Modulated signals are easily created with the base RFXpress package. Supporting a wide range of modulation schemes, the software allows users to create standard waveforms or customized waveforms with specific modulation and frequency-hopping criteria. In Auto mode, the software can automatically calculate the waveform length (in time (sec), samples, or symbols) and the sampling rate required to accurately create the desired output from the arbitrary waveform generator.

RFXpress also includes a calibration feature that can pre-distort the signals to provide flat frequency and linear phase response from the AWG output. RFXpress enables users to easily replicate waveforms from Tektronix oscilloscopes (*.wfm), and IQ waveforms of a real-time spectrum analyzer (*.iqt, *.tiq). Impairments, distortion, or interference can then be added to thoroughly stress test designs.

Radar Signal Creation is a software module for RFXpress that provides the ultimate in flexibility for creating Pulsed Radar waveforms. It gives users the ability to build custom Radar Pulse suites starting from pulse-to-pulse trains to pulse groups. It supports a variety of modulation schemes including LFM, Up-Down Chirp, QPSK, BPSK, Barker/Frank/Polyphase Codes including P1/P2/P3/P4, Step FM, Nonlinear FM, User-defined Step FM/AM and Step PM/AM, and Custom Modulation. It also has the ability to generate pulse trains with staggered PRI to resolve Range and Doppler ambiguity, frequency hopping for Electronic Counter-Counter Measures (ECCM), and pulse-to-pulse amplitude variation to simulate Swerling target models, including antenna scan patterns, clutter, and multipath effects.

Environment Signal Creation is a software module that allows you to emulate the interference between Radar and other communication standards to test Radar receivers under realistic and worst-case conditions. The users can configure the various standard-specific parameters of these interfering signals including power levels, start time, and duration. The time and frequency overview enables them to adjust the above parameters to quickly create worst-case scenarios. The standards that are supported in the environment module include WiMAX, WiFi, GSM, GSM-EDGE, EGPRS 2A, EGPRS2B, CDMA, W-CDMA, DVB-T, and CW Radar. It also allows seamless integration of signals created using other RFXpress plug-ins such as Generic, Radar, OFDM, and WiMedia.

Generic OFDM Creation is a software module for RFXpress that allows users to configure every part of the OFDM signal definition. It allows users to build the signal symbol-by-symbol to create a complete OFDM frame. RFXpress supports a variety of data coding formats that include Reed Solomon, Convolution, and Scrambling. Each subcarrier in the symbol can be configured independently for Type, Modulation, and Base Data. You could then add Zero Padding or Cyclic Prefix. Symbols can be modified by specifying the clipping ratio and tone nulling. A symbol table gives you a summary of all the carriers in the selected symbol. OFDM packets/frames can be built by specifying the spacing between the symbols/frames. Parts of the OFDM packets can be stressed by adding Gated Noise to it.

SPARA is a software module for RFXpress that provides emulation of RF components from touchstone files. You can cascade multiple touchstone files to emulate a RF chain. The effect of the RF component can also be de-embedded by selecting the Inversion option. This option also adds a provision to characterize a two-port device (DUT). A wizard guides you through a step-by-step process to obtain S21 characteristics (Insertion Loss) of the device in a text format.

UWB-WiMedia (UWBCF/UWBCT) is a software module for RFXpress that has the capability to digitally synthesize and generate signals in the UWB spectrum. As per the latest WiMedia specification, the software module can recreate signals that are required to band hop in real time over 1.5 GHz modulation bandwidth. UWBCF/UWBCT gives users complete control over the characteristics of the WiMedia signal including the preamble synchronization sequences, cover sequences, and TFCs in all band groups. All six band groups (BG1 to BG6) can be generated in either IQ, IF, or Direct RF signals giving users 3 different options for creating/up-converting the signals. The software operates in two modes, in the conformance mode (UWBCF) users can generate the standard waveforms that conform to the latest version of the WiMedia's specifications, in the custom mode (UWBCT) users can adjust any part of the signal header or payload to perform for stress and margin testing.

RFXpress runs on a PC or as an integral part of Tektronix AWG7000 and AWG5000 Series arbitrary waveform generators.

Characteristics*4

*4 All ranges mentioned in the data sheet are for AWG7122 models with Opt. 06 until and otherwise explicitly stated.

Software

Digital Modulation software creation package.

Compatibility for Import and Replication of Waveform Files

Product	Description
Oscilloscopes	Tektronix TDS6000, MSO70000, DSA70000, DPO70000, and DPO7000 Series (*.wfm)
Arbitrary Waveform Generators	Tektronix AWG400, AWG500, AWG600, and AWG700 Series (*.wfm)
Real-time Spectrum Analyzers	Tektronix RSA3000, RSA5000, and RSA6000 Series (*.iqt , *.tiq)
Others	MATLAB®*1 Binary Formats (*.mat), ADS®*5 (*.txt), VSA®*5 (*.csv)

*1 MATLAB® is a registered trademark of Math Works.

*5 PSG®, ADS®, VSA® are registered trademarks of Agilent Technologies.

Instrument Control

Characteristic	Description
Tektronix Arbitrary Waveform Generators	**RFXpress** runs on an external PC or an integral part of the AWG7000 and AWG5000 Series. When installed as an integral part of the instrument waveform transfer and control can be performed directly from RFXpress.
Controls	
Analog	Sampling Rate, Interleave and Zeroing On/Off, Amplitude, Offset, Run, Stop and Channel Output On/Off, Sequence Run Mode (For radar plug-in only)
Digital markers	Amplitude High, Low, and Delay
Tektronix Oscilloscopes	Remote-control Tektronix oscilloscope parameters from RFXpress
Controls	
General settings	Run, Stop, Single, and Autoset
Vertical settings	Channel, Scale
Horizontal settings	Scale, Record Length, Sampling Rate
Tektronix Spectrum Analyzers	Remote-control Tektronix real-time spectrum analyzer parameters from RFXpress
Controls	
Settings	Center, Start, Stop Frequency, Span, Step Size, Max Trace Points
Acquire	Bandwidth, Samples, and Length
Analysis	Offset, Length, Time Zero Ref, Amplitude Ref Levels
IQ Modulators	Remote-control PSG®*5 – E8267D modulator parameters from RFXpress
Controls	Frequency, Frequency Offset, Amplitude, Amplitude Offset, Output RF On/Off, Output Mod On/Off, Source Type, Frequency Mode, ALC On/Off, ALC Mode, ALC Bandwidth, ALC Levels, Attenuation Hold On/Off, ALC Power, Attenuation
Carrier leakage suppression	IQ State, IQ Adjustment, I Offset and Q Offset

*5 PSG®, ADS®, VSA® are registered trademarks of Agilent Technologies.

RFXpress for General Purpose IQ, IF, and RF Signal Creation

Characteristic	Description
Carrier Definition	Single Carrier, Multicarrier (1 to 1024)
Amplitude	IF/RF: –100 dBm to +30 dBm IQ: 0 V_{RMS} to 5 V_{RMS}
Base Data	All 0 (Zero), All 1 (One), PRBS (7, 9, 15, 16, 20, 21, 23, user defined), Pattern and File Input
Modulation Schemes	No Modulation, QPSK, π/4-QPSK, π/2-QPSK, BPSK, π/2-BPSK, n-DPSK, O-QPSK, 8PSK, O-8PSK, SD-PSK, QAM16, π/2-QAM16, QAM32, QAM64, QAM128, QAM256, QAM512, QAM1024, GMSK, 2-FSK, 4-FSK, 8-FSK, 16-FSK, 32-FSK, CPM, SBPSK, SOQPSK, ASK, OOK, AM, FM, PM, Guassian Noise, File1 (I and Q Samples), File2 (I and Q Symbols), File3 (Symbol Maps)
Symbol Map	
Total symbols	2 to 512
Modulation modes	Normal, Diff (Continuous), Diff (Alternate)
Rotation angle	–180° to +180°
Offset modulation	On/Off
Predefined map	None, BPSK, QPSK, QAM16, QAM32, QAM64, QAM128, QAM256
Filter	No Filter, Raised Cosine, Rectangular, Triangular, Square Root Raised Cosine, Gaussian (Dirac Delta), Gaussian (Rectangular), EDGE, Half Sine, User-defined Filter (from a file)
Window	No Window, Triangular, Hamming, Kaiser, Hanning, Chebyshev Ripple, Blackman, Blackman-Harris, Tapered Cosine, Exact Blackman, and Flat Top
Window Parameters	
Kaiser parameter	1 to 10
Chebyshev ripple	10 db to 80 dB
Coding	Gray, Differential, Gray Differential, NADC, TFTS, MSAT Differential
Hopping	
Pattern	Pseudo Random (Range, List, Avoid)
Hopping range	100 Hz to 12 GHz
Channel spacing	100 Hz to BW
PRBS	7, 9, 15, 16, 20, 21, 23, user defined
Hop time	Symbols per Hop / Hops per Second
Pattern	Custom
Hopping parameters	Hop, Start Symbol, End Symbol, Frequency Offset (±MHz), Relative Amplitude (±dB)
Power Ramp	
Ramp functions	None, Linear, and Cosine
Ramping time	0 to 1 second
Power level for the symbols	from –60 dB to +20 dB
IQ Impairments	
Carrier leakage	I: –50% to +50% Q: –50% to +50%
Quadrature error	–30° to +30°
IQ imbalance	–30% to +30%
AM/AM conversion	k2: –3 dB +3 dB k3: –3 dB to +3 dB
AM/PM conversion	k2: –30° to +30° k3: –30° to +30°
Hardware skew	–100 ps to +100 ps (AWG7000) –5 ns to +5 ns (AWG5000)
IQ Swap	On/Off
I Invert	On/Off
Q Invert	On/Off
Distortion Addition	
Amplifier distortion	Amplifier – Nonlinear, soft limiting, hard limiting
AM/AM conversion	k3: –3 dB to +3 dB k5: –3 dB to +3 dB
AM/PM conversion	k3: –30° to +30° k5: –30° to +30°
Interference Addition	
Frequency offset	–12 GHz to +12 GHz (AWG7000 Option 02/06) –6 GHz to +6 GHz (AWG7000 standard option) –600 MHz to +600 MHz (AWG5000)
Sinusoidal interference	
C/I	–40 dB to +40 dB
Frequency offset	–6 GHz to +6 GHz (AWG7000B Option 02/06) –3 GHz to +3 GHz (AWG7000B standard option) –185 MHz to +185 MHz (AWG5000B)
Signal addition	Software, Hardware, IQ, and RF/IF
Additive noise	
SNR	–40 dB to +40 dB
Eb/No	–40 dB to +40 dB
Bandwidth	1 Hz to 12 GHz
Multipath	
# of paths	0 to 10
Delay	–80 symbols to +80 symbols
Amplitude	–60 dB to 0 dB
Phase	–180° to +180°
Subcarrier Modulation	
Modulation	AM, FM, PM
Carrier frequency	1 Hz to 12 GHz
AM modulation index	0 to 200%
Graphs	In-phase i(t) and quadrature q(t) component vs. time
	Eye diagram I
	Eye diagram q
	Constellation (Vector q (t) vs. i (t))
	Spectrum for both RF/IF and I/Q signals (magnitude spectrum of the I/Q signal vs. frequency)
	Pulse Shape
	CCDF
	Spectrogram
	Correction Plot of Phase and Amplitude after calibration
	CPI Plot (only for radar plug-in)
Calibration*[6]	Calibrate the signal or calibrate the image IQ Direct, IQ with Modulator, IF with Mixer & RF
Average	1 to 100
Start frequency	10 MHz to 0.49 fs
End frequency	10 MHz to 0.49 fs
Frequency resolution	1 MHz to 10 MHz in increments of 1 MHz
Supported Instruments	Tektronix TDS6000, MSO70000, DSA70000, DPO70000, DPO7000 Series Oscilloscopes and RSA6000, RSA5000 Series Real Time Spectrum Analyzers

*[6] DUT characterization is supported only on AWG7000 Series instruments.

RFXpress Plug-in for Radar Signal Creation

Characteristic	Description
Number of Pulses	4096 max
Groups	Simulate Simultaneous Multiple Targets Returns using "Add Pulse Group" feature
Pulse Shape	Trapezoidal, Raised Cosine, Exponential, Rectangular, Saw Tooth, and Custom
Pulse Parameters	Start Time (To), Rise Time (Tr), Pulse Width (Ton), Fall Time (Tf), Off Time (Toff)
Amplitude Relative to Carrier	–80 dB to 0 dB
Offset from Carrier Frequency	–12 GHz to +12 GHz (AWG7000 Option 02/06) –6 GHz to +6 GHz (AWG7000 standard option) –600 MHz to +600 MHz (AWG5000)
Staggered PRI	
Ramp	–180° to +180°
User defined	
Modulation	
Linear Frequency Modulation (LFM)	
Sweep range	0 to 12 GHz
Frequency sweep	Low to High, High to Low
Bi-phase Coded Pulse – Barker	2, 3, 4, 5, 7, 11, 13
Polyphase Codes	
# of steps	200
Initial offset	–180° to +180°
Phase offset	–180° to +180°
User-defined Step PM/AM	
BPSK	1 to 200 Symbols/Pulse
QPSK	1 to 200 Symbols/Pulse
Polyphase Codes	P1, P2, P3, P4 1 to 10 code lengths
Frank Code	1 to 10 code lengths
Up-Down Chirp	1 to 12 Up-Downs with an option to Invert
Step Frequency Modulation	
# of steps	200
Initial step	–12 GHz to +12 GHz
Step size	–12 GHz to +12 GHz
Nonlinear FM	
User-defined Step FM/AM	
Custom Modulation	
Pulse-to-Pulse Hopping	Frequency Offset (±MHz), Relative Amplitude (±dB)
Pulse Impairments	
Edge jitter	Gaussian, Uniform
Width jitter	Gaussian, Uniform
Amplitude Deviation	
Droop	–50% to 50%
Overshoot	0% to 50%
Ripple	0% to 50%
Ripple frequency	1 Hz to 12 GHz
Multipath	
# of paths	0 to 10
Delay	0 to PRI (in µs)
Amplitude	–60 dB to 0 dB
Phase	–180° to +180°
Antenna	
Beam type	Sinc, Guassian, user defined
Beam width	0° to +180°
MRA (Max Radial Axis)	0° to +180°
Scan rate	0 to 180°/s
Clutter	
Signal to Clutter Ratio	–60 dB to +60 dB
Start Time Duration	0 s to PRI
Statistical Profile	Rayleigh
Power Spectral Density	None, Guassian
Clutter Frequency Offset	–12 GHz to +12 GHz (AWG7000 Option 02/06) –6 GHz to +6 GHz (AWG7000 standard option) –600 MHz to +600 MHz (AWG5000)
IQ Impairments	
Carrier leakage	I: –50% to +50% Q: –50% to +50%
Quadrature error	–30° to +30°
IQ imbalance	–30% to +30%
Hardware skew	–100 ps to +100 ps (AWG7000) –5 ns to +5 ns (AWG5000)
IQ swap	On/Off
Signal Addition	Software, Hardware, IQ, and RF/IF
Noise	
SNR	–60 dB to +60 dB
Bandwidth	0.01 fs to 0.50 fs

RFXpress Option for S-parameter and DUT Characterization

Characteristic	Description
S-parameter	
Mode	Noncascading, Cascading (6 max)
Filter bandwidth	Auto, Full Bandwidth, Manual (1 Hz to 12 GHz)
File formats	s1p, s2p, and s4p (single-ended and differential), *.txt created from DUT characterization
Apply inversion	On/Off
DUT Characterization*6	
Frequency	Start, Stop, and Resolution
# of Iterations	1 to 5
Mixer	On/Off – Low Frequency, LSB, USB
Plot	Amplitude, Phase
Output File	*.txt (containing S21 characteristics)

*6 DUT characterization is supported only on AWG7000 Series instruments.

RFXpress Plug-in for Environment Signal Generation

Characteristic	Description
Carrier Magnitude Peak	–2 dBm to 3.9 dBm
Standards Supported	WiFi (a/b/g), WiMAX, GSM, CDMA, W-CDMA, DVB-T
Common Parameters	Carrier frequency, power in dB, start time, and duration of the signal, option to periodically extend
Configuration Parameters for Individual Standards	
WiFi (802.11a)	
Data Rate	6, 9, 12, 18, 24, 36, 48, 54 Mb/s
Data Length	40, 1024 bytes
Off Time	1 µs to 1 s
WiFi (802.11b)	
Data Rate	1 Mb/s – Barker DPSK, 2 Mb/s – Barker DQPSK, 5.5 Mb/s – CCK DQPSK, 11 Mb/s – CCK DQPSK, 5.5 Mb/s – PBCC BPSK, 11 Mb/s – PBCC QPSK
Data Length	40, 1024 bytes
Off Time	1 µs to 1 s
WiFi (802.11g)	
Data Rate	1 Mb/s – Barker DPSK, 2 Mb/s – Barker DQPSK, 5.5 Mb/s – CCK DQPSK, 11 Mb/s – CCK DQPSK, 5.5 Mb/s – PBCC BPSK, 11 Mb/s – PBCC QPSK, 22 Mb/s – PBCC 8PSK, 6 Mb/s – OFDM, 9 Mb/s – OFDM, 12 Mb/s – OFDM, 18 Mb/s – OFDM, 24 Mb/s – OFDM, 36 Mb/s – OFDM, 48 Mb/s – OFDM, 54 Mb/s – OFDM
Data Length	40, 1024 bytes
Off Time	1 µs to 1 s
WiMAX (802.16e) Downlink Only	
Bandwidth	1.25, 2.5, 5, 7, 10, 15, 20, 28 MHz
Modulation	BPSK, QPSK, QAM16, QAM64
Payload	4, 10, 40
Off Time	1 µs to 1 s
Guard Interval	1/4

Characteristic	Description
GSM	
Frequency Band	900, 1800, 1900 MHz
Transmit	Base, Mobile
Radio Format	GSM, EDGE, EGPRS2A, EGPRS2B
Time Slot Burst Type	Normal, Frequency Correction, Synchronization, Access, Dummy
CDMA	
Link	Forward, Reverse
Number of Channels	9, 12, 15
Radio Configuration	RC1, RC2, RC3, RC4, RC5
Data Rate	1200,1500, 1800, 2400, 2700, 3600, 4800, 7200, 9600, 14400 bps
W-CDMA	
Link	Up, Down
Downlink Mode	DPCH, Test Mode 1 to 6
Number of DPCH Channels	1 to 6
Data Rate	15, 30, 60, 120, 240, 480, 960 Kb/s
DVB-T	
Transmission	Hierarchical, Non-hierarchical
Alpha	1
Mode	2K, 8K
Bandwidth	5, 6, 7, 8 MHz
Modulation	QPSK, 16QAM, 64QAM
Interleaver	Native, In-depth
Noise	
Bandwidth	White, Band Limited
Duration	0 to 1 s

RFXpress Plug-in for OFDM Signal Creation

Characteristic	Description
Carrier Magnitude	–2 dBm to 3.9 dBm
Base Data	Up to 8 max All 0 (Zero), All 1 (One), PRBS (7, 9, 15, 16, 20, 21, 23, user defined), pattern, and file input
Data Coding	Reed Solomon, Scrambling, and Convolution
Symbol	
Spacing between carriers	1 Hz to 12 GHz
# of subcarriers	2 to 65536
Subcarrier type	Data, Pilot, Null, and Guard
Subcarrier modulation	BPSK, QPSK, 16-QAM, 32-QAM, 64-QAM, 256-QAM, 8-PSK
Zero Padding / Cyclic Prefix	0 ns to 1 s or 0% to 1000%
Frequency offset	–12 GHz to +12 GHz (AWG7000 Option 02/06) –6 GHz to +6 GHz (AWG7000 standard option) –600 MHz to +600 MHz (AWG5000)
Packet	
Preamble/ Postamble	As file input
Spacing between symbols	0 ps to 1 s
Overlap between symbols	0% to 50%
Overlap window	None, Trapezoidal, Hanning, Hamming, Blackmann
Hopping	
Hopping parameters	Hop, Start Symbol, End Symbol, Frequency Offset (±MHz), Relative Amplitude (±dB)
Gated Noise	
Symbols S/N	–60 dB to +60 dB
Frames	
Spacing between packets	42 ps to 1 s
Multipath	
# of paths	0 to 10
Delay	84 to 1 frame (in µs)
Amplitude	–60 dB to 0 dB
Phase	–180° to +180°
Phase Noise	
Time model	
Profile	1/f0, 1/f1, 1/f2, 1/f4
VCO bandwidth	1 Hz to 6 GHz
Phase noise (RMS)	0.01° to 180°
Frequency profile model	
Frequency offset	1 Hz to 6 GHz (in 5 steps)
dBc/Hz	–40 to –180
Distortion Addition	
Quantization	1 to 10 bits
Presets	WiFi (802.11a 36 Mb/s), WiMAX (802.16-2004 Down Link 5 MHz, 10 MHz, and 20 MHz)

RFXpress Plug-in for UWB-WiMedia Signal Generation

Characteristic	Description
RFXpress Plug-in for UWB-WiMedia IQ, IF, and RF	Conformance Signal Creation (UWBCF) Custom Signal Creation (UWBCT)
Setup	In addition to user-defined setup using “My setup”, three example setups are provided: WiMedia Specs Example Packet 53.3, 80, and 106.7 Mb/s Packets 480 Mb/s Burst Mode Packets
Marker Mapping	Two markers can be mapped for each of the bands with a marker delay ranging from: –312.5 ns to +312.5 ns
Number of Packet Groups	1 to 100
Number of Packets in a Packet Group	1 to 30
Packet Group Repetition	1 to 100 times
Group Start Delay	0 to 200 symbols
Group End Delay	0 to 200 symbols
Spacing between Packets	
Standard mode	6 symbols to 200 symbols. (Can be defined in pSIFS and pMIFS)
Payload Source	WiMedia Spec Example
	ALL 0 (Zero), ALL 1 (One)
	PRBS7, 9, 15, 16, 20, 21, and 23
	User Defined (by file input)
Tone Nulling	–40 dB to +20 dB
MAC Header	10 byte MAC header data can be selected from WiMedia Spec Example
	ALL 0 (Zero), ALL 1 (One)
	PRBS7, 9, 15, 16, 20, 21, and 23
	User Defined: wherein user can enter the MAC header pattern and file input
Packet Mode	Standard, Burst
Preamble Type	Standard or Burst for data rates greater than 200 Mb/s
Packet Size	
Standard mode	0 to 4095
Burst mode	1 to 4095
BandGroup	BandGroup1 to BandGroup6
TF Code	TFC1 to TFC10
BandGroup Center Frequency	Can be defined by the user
Calibration	RF and IF
IQ Impairments	
Carrier leakage	I: –50% to +50% Q: –50% to +50%
Quadrature error	–30° to +30°
IQ imbalance	–30% to +30%
AM/AM conversion	k2: –3 dB to +3 dB k3: –3 dB to +3 dB
AM/PM conversion	k2: –30° to +30° k3: –30° to +30°
Hardware skew	–100 ps to +100 ps (AWG7000) –5 ns to +5 ns (AWG5000)
Distortion Addition	
Amplifier distortion amplifier	No linear, soft limiting, hard limiting
AM/AM conversion	k3: –3 dB to +3 dB k5: –3 dB to +3 dB
AM/PM conversion	k3: –30° to +30° k5: –30° to +30°
Interference Addition	
Frequency offset	–12 GHz to +12 GHz (AWG7000 Option 02/06) –6 GHz to +6 GHz (AWG7000 standard option) –600 MHz to +600 MHz (AWG5000)
Sinusoidal interference C/I	–60 dB to 60 dB
Real-world signal interference	WiMAX, WiFi (MIMO), WiFi (802.11a), Radar, IQ Interference Signal as file input
Frequency	1 Hz to 12 GHz
Amplitude	–60 dB to +60 dB
Signal Addition Software, Hardware IQ and RF/IF	
Gated Noise	
Packets	Preamble S/N, PLCP Header S/N, Payload S/N – "–40 dB to +20 dB"
Symbols S/N	–40 dB to +20 dB
Multipath	
# of paths	0 to 10
Delay	–2 symbols to +2 symbols
Amplitude	–60 dB to 0 dB
Phase	–180° to +180°
Conformance Mode	
Data rates	53.3, 80, 106.7, 160, 200, 320, 400, and 480 Mb/s
Custom Mode	
TF code	TFC1 to TFC10 and user defined. User can define his/her own hopping sequence and number the TFC code from 1 to 15. Select this option to generate signals for the selected TF code without hopping. However, markers still continue to hop based on the TFC pattern.
User-defined components in the PPDU structure	Preamble Time Domain Base Sequence, Cover Sequence, Reserved bits, Tail bits, HCS, Channel Estimation, Frame Payload, Sequence, Length, Scrambler Init, Hopping Pattern, Reed Solomon parity bits and FCS can either be calculated/taken from standard or can be defined by the user
Provision to switch off the PLCP header and the PSDU	

System Requirements

The following PC configuration is required to install the offline version.

Note: The hardware requirements detailed here are the minimum required. Additional processing power and memory will increase the performance of the generation software.

- PC with genuine Intel Pentium class >1.2 GHz processor recommended
- Intel or 100% compatible motherboard chipset
- Windows XP Operating System, Windows Vista Business Edition (English Language), or Windows 7
- 512 Megabytes (MB) RAM
- 2 GB of available hard disk space for the applications and documentation
- XVGA 1024×768 with 120 dpi font size recommended
- CD-ROM or DVD drive
- Keyboard and Microsoft mouse or other compatible pointing device

Ordering Information

RFX100

RFX100 can be ordered as follows:

RFXpress

Product	Option	Description
RFX100		Base Software: RFXpress for general purpose RF, IF, and IQ signal creation
RFXpress plug-in for:		
	Opt. UWBCF	UWB-WiMedia IQ, IF, and RF conformance signal creation (requires RFX100 as prerequisite)
	Opt. UWBCT	UWB-WiMedia IQ, IF, and RF custom and conformance signal creation (requires RFX100 as prerequisite and includes Opt. UWBCF)
	Opt. RDR	Radar Signal Creation (requires RFX100 as prerequisite)
	Opt. SPARA	S-parameter emulation and DUT characterization (requires RFX100 as prerequisite)
	Opt. OFDM	OFDM Signal Creation (requires RFX100 as prerequisite)
	Opt. ENV	Environment Signal Generation (requires RFX100 as prerequisite)
	Opt. ENV01	Bundling Option – Opt. ENV + Opt. RDR (requires RFX100 as prerequisite)
	Opt. ENV02	Bundling Option – Opt. ENV + Opt. RDR + Opt. OFDM (requires RFX100 as prerequisite)
	Opt. ENV03	Bundling Option – Opt. ENV + Opt. RDR + Opt. OFDM + Opt. SPARA (requires RFX100 as prerequisite)
	Opt. ENV04	Bundling Option – Opt. ENV + Opt. RDR + Opt. OFDM + Opt. SPARA + Opt. UWBCT (requires RFX100 as prerequisite)

Product Upgrades

Product	Option	Description
RFX100	Opt. RFXUP ENV	Upgrade option to add Environment Signal Generation to RFX100
	Opt. RFXUP RDR	Upgrade option to add Radar Signal Generation to RFX100
	Opt. RFXUP SPARA	Upgrade option to add S-parameter and DUT Characterization to RFX100
	Opt. RFXUP OFDM	Upgrade option to add Generic OFDM Signal Generation to RFX100
	Opt. RFXUP UWBCF	Upgrade option to add UWB-WiMedia Conformance Signal Generation for RFX100
	Opt. RFXUP UWBCFT	Upgrade option to add UWB-WiMedia Custom Signal Generation to RFX100 (requires Opt. UWBCF)
	Opt. RFXUP UWBCT	Upgrade option to add UWB-WiMedia Customer and Conformance Signal Generation to RFX (includes Opt. UWBCF)

CE

Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

Contact Tektronix:

ASEAN / Australasia (65) 6356 3900

Austria 00800 2255 4835*

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777

Belgium 00800 2255 4835*

Brazil +55 (11) 3759 7627

Canada 1 800 833 9200

Central East Europe and the Baltics +41 52 675 3777

Central Europe & Greece +41 52 675 3777

Denmark +45 80 88 1401

Finland +41 52 675 3777

France 00800 2255 4835*

Germany 00800 2255 4835*

Hong Kong 400 820 5835

India 000 800 650 1835

Italy 00800 2255 4835*

Japan 81 (3) 6714 3010

Luxembourg +41 52 675 3777

Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90

Middle East, Asia, and North Africa +41 52 675 3777

The Netherlands 00800 2255 4835*

Norway 800 16098

People's Republic of China 400 820 5835

Poland +41 52 675 3777

Portugal 80 08 12370

Republic of Korea 001 800 8255 2835

Russia & CIS +7 (495) 7484900

South Africa +41 52 675 3777

Spain 00800 2255 4835*

Sweden 00800 2255 4835*

Switzerland 00800 2255 4835*

Taiwan 886 (2) 2722 9622

United Kingdom & Ireland 00800 2255 4835*

USA 1 800 833 9200

* European toll-free number. If not accessible, call: +41 52 675 3777

Updated 10 February 2011

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit **www.tektronix.com**

Copyright © Tektronix, Inc. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks, or registered trademarks of their respective companies.

04 Jun 2012 76W-20817-8