



# RF Downconverter A-40-Series

## Wideband Frequency Coverage up to 40 GHz



### ABOUT US



DynamicSignals LLC is a customer oriented industry leader in high-performance, accurate, and reliable data acquisition solutions. Vertically integrated, our core competencies include engineering, manufacturing and integration of digitizers, signal conditioners, and arbitrary waveform generators into continuous signal recording, processing, and playback systems via our product brands of GaGe, Signatec, and KineticSystems.

### APPLICATIONS

- Wideband Signal Analysis
- Radar Design and Test
- Signals Intelligence (SIGINT)
- Electronic Warfare (EW)
- Ultrasonic Non-Destructive Testing
- LIDAR Systems
- Satellite & Cellular Communications
- Optical Coherence Tomography
- Spectroscopy
- High-Performance Imaging
- Time of Flight
- Life Sciences
- Particle Physics



### Spectrum Analysis Covering Wideband RF Frequencies up to 40 GHz with System Options for Real-Time Signal Recording Capabilities!



### FEATURES

- 24 GHz to 40 GHz RF Input Frequency Coverage
- Real-Time Instantaneous IF Bandwidth of 500 MHz
- Wireless mmWave 5G Frequency Range 2 (FR2) Testing:
  - Covers the 400 MHz Channel Bandwidth of mmWave 5G FR2
- Pre-Select Filtering Eliminates Out-of-Band Signals & Aids Spurious Mitigation
- Real-Time Signal Recordings for:
  - Wideband up to 40 GHz RF with External Digitizer via PCIe
- Windows Spectrum Analyzer with Real-Time Signal Recording & Monitoring
- Integrated Operational Control of Both RF Downconverter Receiver & Digitizer
- Analysis Displays Include: IQ Time Domain, I Spectrum, IQ Power Spectrum, Constellation Plot, Spectrogram Plot, Persistence Plot, and Histogram Plot
- Actively Monitor Displayed Snapshots During Real-Time Live Recordings
- Multi-Channel Systems with 10 MHz In/Out Reference Synchronization
- Programming-Free GUI Operation; No Programming Skills Required

### Overview

Today's high-band signal standards are using higher frequencies and wider bandwidths than ever before for applications such as next generation 5G wireless services, satellite communications, electronic warfare, and more.

The RF Downconverter A-40-Series model meets these new signal standards featuring breakthrough input frequency and bandwidth coverage for its size. Its width and length is less than a sheet of paper, weighing only 1.7 kg (3.7 lbs.) and consuming only 20 W of power.

The RF frequency input range of 24 GHz to 40 GHz with 500 MHz bandwidth covers the high range of radio spectrum bands for a variety of applications that can be captured for real-time analysis or signal recordings when combined with DynamicSignals high-speed GaGe or Signatec Digitizers.

The Downconverter combined with the GaGe EON Express Digitizer is an ideal solution for mmWave 5G Frequency Range 2 (FR2) Testing. The combination provides the capability to view the entire 400 MHz channel bandwidth in real-time and save it. The SpectraScopeRT based software will record that entire bandwidth in real-time for up to 11 hours.

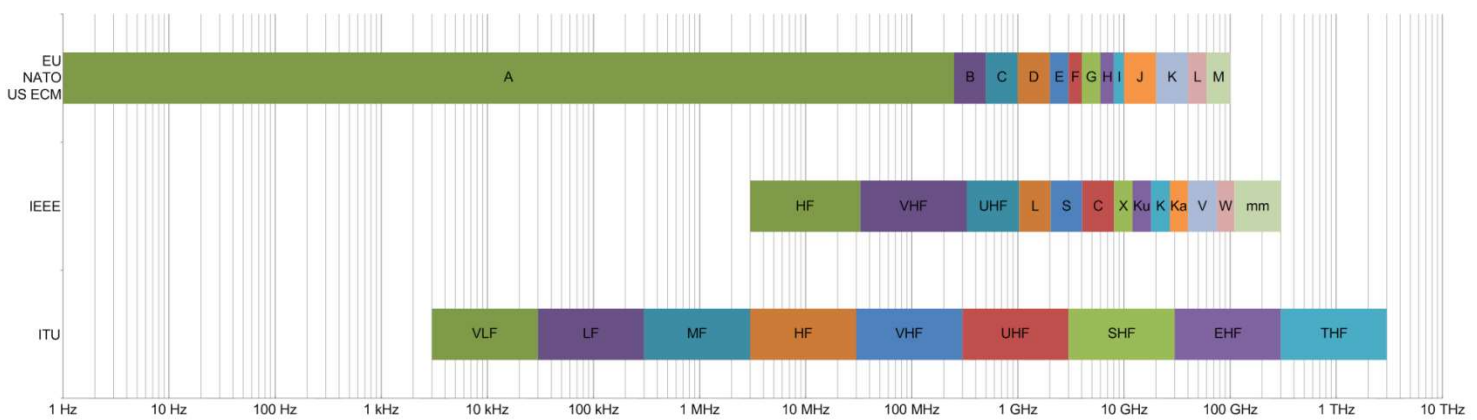
Multi-channel RF systems are constructed by distributing a common external 10 MHz reference clock source to the instruments, as well as a common supplied external trigger source, for synchronized operations.

SpectraScopeRT, a Windows based spectrum analyzer application, allows for integrated operational control of both the RF Downconverter receiver and the Digitizer for signal capture, analysis, and recordings with no programming required.

Analysis displays include IQ Time Domain, Frequency Domain, I Spectrum, IQ Power Spectrum, Constellation Plot, Spectrogram Plot, Persistence Plot, and Histogram Plot. Other capabilities include frequency domain triggering, and signal averaging, with many cursor and display options.

Complete integrated turnkey systems are available in ultra-portable, portable, desktop and rackmount form factors with scalable storage solutions up to 192 TB for hours of high-speed real-time signal recordings. As COTS-based open architecture systems, component items are also future upgradeable and compatible with other 3rd party items and software. Contact us to configure a custom system tailored for your application requirements.

### Radio Band Designation Standards & RF Downconverter Coverage



**Downconverter  
Radio Band  
Standards  
Coverage**



**DCA40G  
24 GHz to 40 GHz**

<b>EU, NATO, US ECM:</b>	K (from 24 GHz)
<b>IEEE:</b>	K (from 24 GHz), Ka
<b>ITU:</b>	SHF (from 24 GHz), EHF (up to 40 GHz)

## SpectraScopeRT & SpectraViewRT – Real-Time Spectrum Analyzer & Playback Viewer



SpectraScopeRT is a Windows based spectrum analyzer application that requires no programming and allows for integrated operational control of both the RF Downconverter receiver and the Digitizer for signal capture, analysis, recordings.

SpectraScopeRT provides the ability to save established settings to a configuration file that can later be opened and applied, thus saving time from manually re-applying settings for repetitive configurations.

Analysis displays include IQ Time Domain, Frequency Domain, I Spectrum, IQ Power Spectrum, Constellation Plot, Spectrogram Plot, Persistence Plot, and Histogram Plot. Multiple display type windows can be opened and shown simultaneously with auto tile and cascade options or manually sized and placed as desired.

Display windows include support for scope cursors to navigate through the display and obtain measurements. Cursor Track Mode can be enabled to lock the position of the two placed cursors. When locked, the spacing between cursors remains constant as they are moved through the display of data.

SpectraScopeRT supports both an On-Board Memory Mode and a Streaming Mode of operation.

Using the On-Board Memory mode supports all the full bandwidth modes of the receiver. The On-Board Memory mode takes snapshots of data during execution, not all the real-time data is collected. The rate at which the snapshots are taken depends on the number of active display plots, the number of acquisition samples for each snapshot, the performance of the graphics subsystem and the processing power of the local processor. Typical update rates are from 10 to 30 captures per second.

During On-Board Memory modes of operation the process starts by triggering an acquisition. The trigger options include forcing a trigger for each collection or to trigger when the RF input exceeds a predetermined level threshold.

Once triggered the selected number of samples are collected. The sample count is determined by the Resolution Bandwidth specified. After the samples are received from the RF Downconverter the required calculations are performed and the visible displays updated. This process is repeated until requested to cease. If recording to disk is enabled, the raw count data is written to the specified file after the displays are updated.



The primary advantage of SpectraScopeRT is the ability to conduct real-time streaming signal recordings to drive storage with provided monitoring capability to ensure the recording process is operating with expected signal data and without errors.

The non-proprietary file format of the raw binary data file allows for other 3rd party software applications to import and utilize the data easily, with associated separate XML-based header files that contain the context information on the data file.

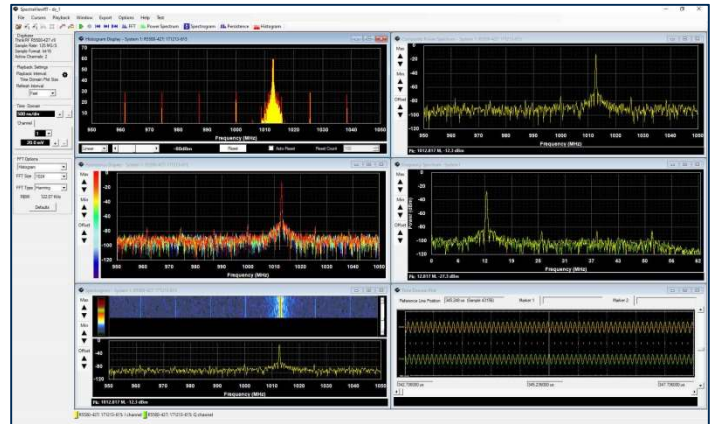
The lossless Streaming Mode collects all real-time data digitized from the RF Downconverter. Data is captured by using an external Digitizer connected to the single IF output of the downconverter. All of the full bandwidth mode of the receiver data can be captured in real-time due to the fast transfer rates that can be sustained for streaming data to the controller across a PCIe based connection on the external Digitizer.

The recording control section of the application is utilized to establish and conduct real-time signal recording operations with various option settings that include flexible output filename management parameters, custom user text information, file span recording that splits long recordings into multiple size-specified files, and recording duration by file size, elapsed time, or both.

The SpectraViewRT application allows an operator to open/view and conduct playback of previous signal recordings to the display monitor for analysis.

Viewing file details will display the details of the opened signal recording present in the header file associated with the recording data file for review. It includes basic information about the recording, applied Digitizer model information, applied receiver model information, and settings utilized for the recording with total elapsed time duration of the recording file.

The various display types for Time Domain, Frequency Domain, Spectrogram, Persistence, and Histogram can all be effectively utilized for playback operations.



Playback operations utilize familiar navigation toolbar buttons for starting playback, stopping playback, stepping backwards and forwards, and moving back to start.

Selecting Start will initiate the playback through the entire signal recording data file to the active displays on the monitor. The playback operation can be manually stopped at any time by selecting Stop.

Selecting Step Backward causes the time domain display to step one interval backward, while selecting Step Forward causes the time domain display to step one interval forward. The amount of interval movement is dependent on the setting in the Playback Interval setting in the Playback Settings group. The step backward and step forward can either be by number of samples, time or time domain plot size.

Selecting Move to Start rewinds the playback to the start of the recording. If the playback is not actively running when this selection is made, the file pointer is reset to the beginning of the file but the display is not updated. You must continue playback or perform a step operation for a display update.

When the Enable Playback Looping option is enabled, the time domain data will loop from the end of the file back to the beginning when the end of file is reached. If the option is disabled the playback ceases once the end of the file has been reached.

### A-40-Series: DCA40G

The DCA40G RF Downconverter supports an input frequency from 24 GHz to 40 GHz with 500 MHz bandwidth coverage in a small compact and light design weighing only 1.7 kg / .7 lbs. and consuming only 20 W of power.



The wideband DCA40G model feature a single fixed IF output at 1.536 GHz with a fixed bandwidth of 500 MHz. It has a tuning resolution of 100 kHz, a pre-amplifier, and 8 pre-select filters to eliminate out-of-band signals and enable spurious mitigation. The front-end software selectable attenuator control range is from 0 dB to 31.5 dB with a 0.5 dB step size.

The DCA40G is particularly well suited for mmWave based 5G applications as it covers the entire 5G Frequency Range 2 (FR2) specification from 24 to 40 GHz with maximum channel bandwidth of 400 MHz. The lower sub-6 based 5G that utilizes the Frequency Range 1 (FR1) specification from 600 MHz to 4.6 GHz with maximum channel bandwidth of 100 MHz can be covered with the alternative A-27-Series DCA08G model (see A-27-Series datasheet). Thus utilizing DCA08G and DAC40G together can cover the entire 5G space of both sub-6 and mmWave spectrums.

Multi-channel RF systems are constructed by distributing a common external 10 MHz reference clock source to the instruments, as well as a common supplied external trigger source, for synchronized operations.

The DCA40G RF Downconverter analog IF output can be connected to any external spectrum analyzer capable of accepting its 500 MHz bandwidth centered at 1.536 GHz IF output for spectrum monitoring. Alternatively, the DCA40G analog IF output can be connected to the RF input of any of the A-27-Series models (see A-27-Series datasheet) to effectively output a lower analog IF bandwidth of either 160 MHz / 80 MHz / 10 MHz or 100 MHz / 40 MHz / 10 MHz.

### External Digitizers

The DCA40G can also be utilized with an external high-speed Digitizer suitable for integration with ultra-portable, portable, desktop, or rackmount system form factors.



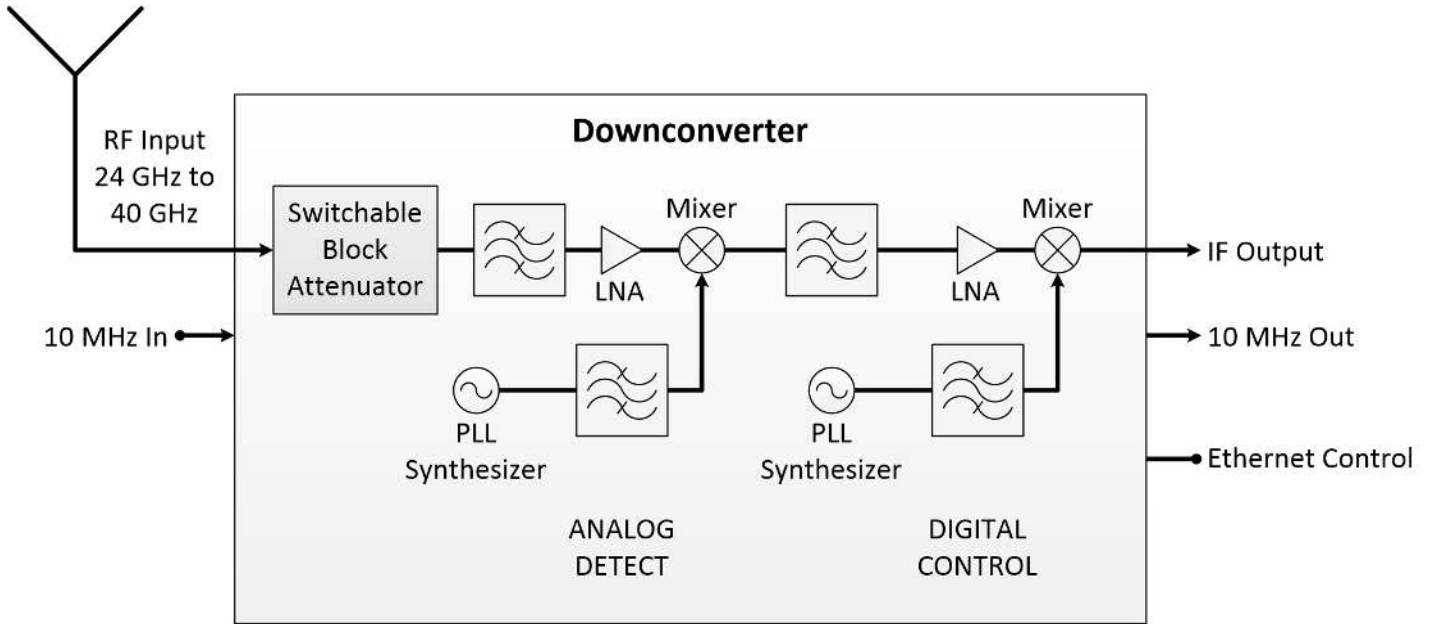
The use of an external high-speed Digitizer for capturing the large IF output at 1.536 GHz with wide 500 MHz bandwidth is typically more cost-effective than stand-alone box style spectrum analyzers, with the prime advantage that monitored signals can also be captured for real-time processing and real-time signal recordings.

The GaGe high-speed 12-bit EON Express Digitizer with A/D sampling rates up to 6 GS/s is available for use with the DCA40G Downconverter model. The EON Express Digitizer with its maximum 1.75 GHz input bandwidth allows for the capture of an effective usable bandwidth of 464 MHz, from 1.286 GHz to 1.75 GHz; from the DCA40G IF output.

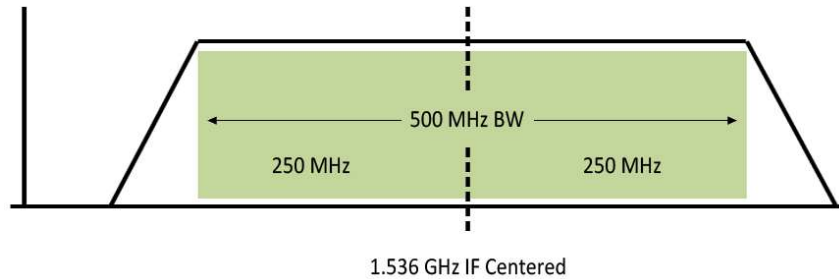
The large onboard FIFO memory of the EON Express Digitizer allows for real-time streaming of the capture data via PCI Express (PCIe) to the controller's memory for post processing, display, and storage.

For real-time streaming signal recordings, the EON Express Digitizer utilizes a maximum A/D sampling rate of 4.8 GS/s in an effective 8-bit mode to sustain the data streaming rate to host drive storage capacities that are configurable up to a maximum of 192 TB providing up to 11 hours of recording duration.

## Block Diagram and Bandwidth Mode Figure for A-40-Series: DCA40G

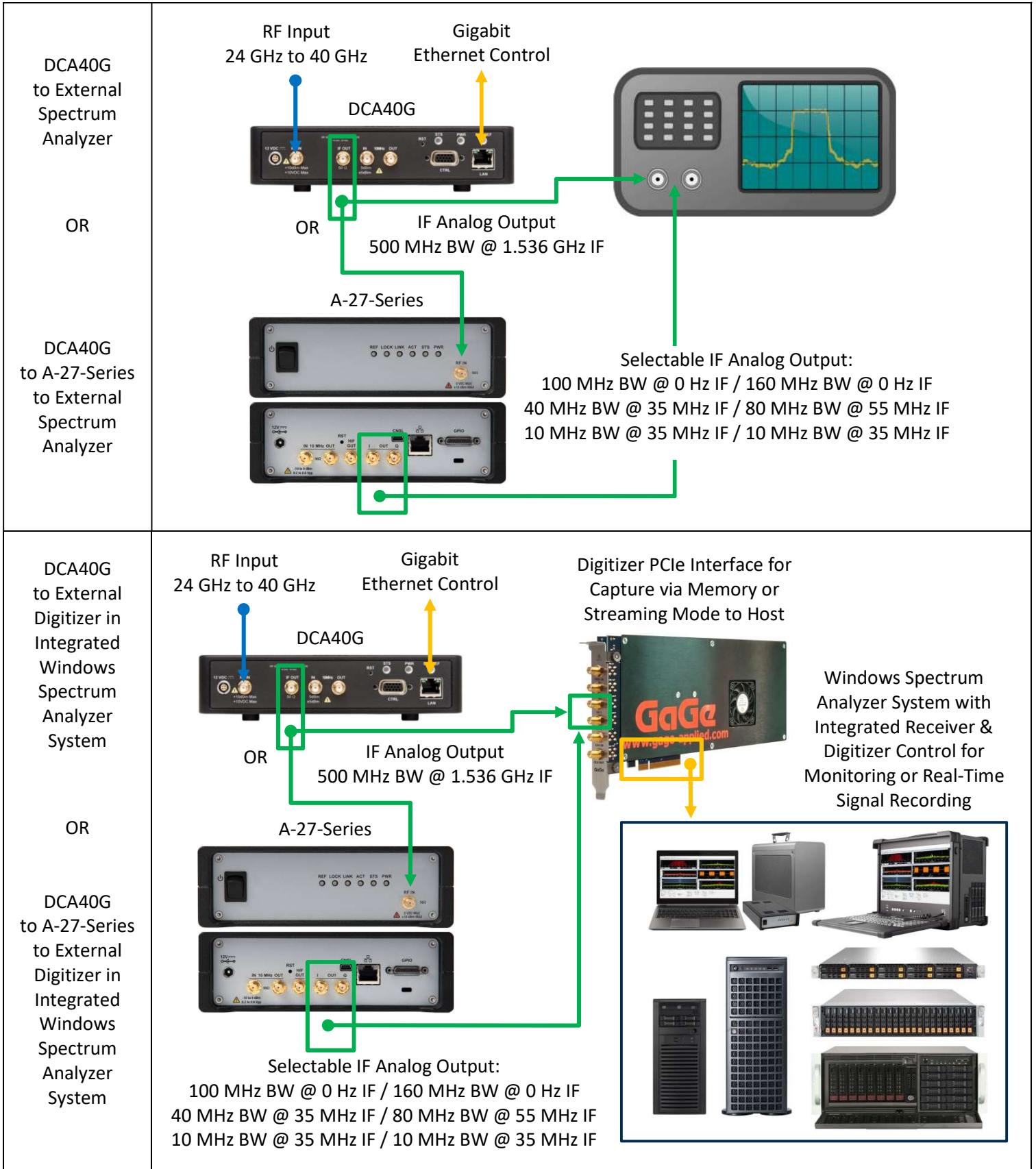


### Downconverter Bandwidth Mode



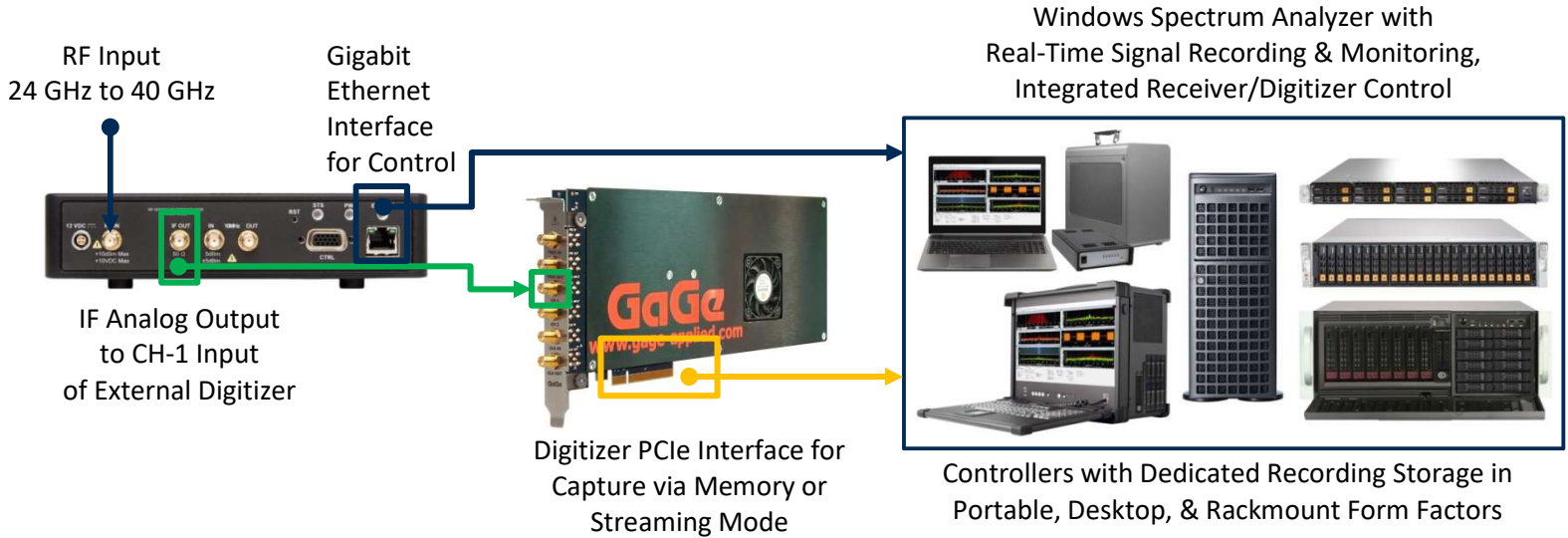
500 MHz @ 1.536 GHz IF

## DCA40G Connection Setup Options





### Overview for Wide Bandwidth Applications with DCA40G



Downconverter with External Digitizer ADC Operational Rates and Modes

Operating Receiver Bandwidth Mode	Operating Receiver Bandwidth (MHz)*	Operating Receiver Center IF (GHz)	Operating Receiver IF Analog Outputs	Operating Digitizer Analog Inputs	Operating Digitizer Sample Resolution	Operating Digitizer ADC Rate (GS/s)	Operating Transfer Modes Supported	Operating Transfer Data Rate (GB/s)	Streaming Mode Continuous Samples Recording Maximum Duration Time
Fixed	500	1.536	1	CH-1	12-Bit	6	Memory	9	N/A
Fixed	500	1.536	1	CH-1	8-Bit	4.8	Streaming	4.8	8 TB: 27 m, 47 s 16 TB: 55 m, 33 s 24 TB: 1 h, 23 m, 20 s 32 TB: 1 h, 51 m, 07 s 48 TB: 2 h, 46 m, 40 s 64 TB: 3 h, 42 m, 13 s 96 TB: 5 h, 33 m, 20 s 192 TB: 11 h, 06 m, 40 s

\* The effective usable bandwidth for capture from the DCA40G IF output is 464 MHz, from 1.286 GHz to 1.75 GHz; as the maximum input bandwidth for the external EON Express Digitizer is 1.75 GHz.



### DCA40G Downconverter Specifications



#### Tuning and Bandwidth

Input Frequency Range	24 GHz to 40 GHz
Tuning Resolution with Analog IF Output	100 kHz
Bandwidth Mode (Fixed)	500 MHz @ 1.536 GHz IF

#### Frequency Reference

Internal/External	10 MHz
Internal 10 MHz Oscillator Stability	±0.2 ppm

#### Amplitude

Accuracy @ IF Output	±1.2 dB
Measurement Range	DANL to max. safe input level
Attenuator Range	0 to 31.5 dB in 0.5 dB steps (at input)
Max. Safe RF Input Level	+10 dBm, 10 V DC

#### Noise Figure

40 GHz Model – DCA40G	< 12 dB (typical)
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#### Third Order Intercept (TOI)

At 1 GHz	> 15 dBm (typical)
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#### Pre-Selection Filter Bank

40 GHz Model – DCA40G	8-Channel Switched
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#### Panel Connectors

RF Input	SMA Female, 50 Ω
10 MHz Reference In & Out	SMA Female, 50 Ω
Analog IF Out	SMA Female, 50 Ω
10/100/1000 Ethernet	RJ-45
GPIO	15-pin Female D-Subminiature
Coaxial Power	+12V DC LEMO, 4-pin

#### Physical

Power Supply	Input AC 120V-240V / Output +12V
Power Consumption	20 W
Operating Temperature Range	-10°C to +55°C / 14° to 131° F
Storage Temperature Range	-51°C to +71°C / -60° to 160° F
Enclosure Dimensions	193 (L) x 193 (W) x 41 (H) mm 7.6 (L) x 7.6 (W) x 1.6 (H) inches
Weight	1.7 kg / 3.7 lb.

#### RF PLL Phase Noise at 35 GHz (using internal 10 MHz reference)

Frequency Offset	1 kHz	10 kHz	100 kHz	1 MHz
RF PLL Phase Noise Typical	-83 dBc/Hz	-88 dBc/Hz	-93 dBc/Hz	-99 dBc/Hz



### ORDERING INFORMATION

#### A-40-Series: DCA40G

Model #	RF Input	Bandwidth Modes	Filtering	Order Part #
DCA40G500	24 GHz to 40 GHz	500 MHz @ Center IF 1.536 GHz	8-Channel Switched & Pre-Amplifier	DCA-040-000

#### Software for all A-40-Series Models

Description	Order Part #
Downconverter Software APIs for C/C++, MATLAB, and LabVIEW	Included
SpectraScopeRT – Spectrum Analyzer and Signal Recording Application	DSD-SRT-A00
SpectraViewRT – Spectrum Analyzer and Playback Viewer Application	DSD-SVT-000

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[www.signatec.com](http://www.signatec.com)

#### WARRANTY

Standard two years parts and labor.

Unless otherwise specified, all dynamic performance specs have been qualified on engineering samples. All specifications are subject to change without notice.

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