

# thinkRF™ D5550

## Wideband RF Downconverter



50 MHz to 8 GHz / 18 GHz / 27 GHz



### COMPACT & LIGHT DESIGN

257.3 x 193.7 x 60 mm  
(10.13" x 7.63" x 2.36")  
2.54 kg (5.6 lbs)



### SILENT

Fanless design for quiet  
operation



### WIDEBAND DOWNCONVERTER

Designed to monitor  
wideband signals up to  
160 MHz bandwidth



## OVERVIEW

### D5550 Wideband RF Downconverter

Compact, fanless, networked,  
remote deployable and cost-  
effective downconverter for the  
next generation RF environment

1

50 MHz to 8, 18 or 27 GHz

2

0.1 / 10 / 40 / 100 / 160 MHz\*  
Real-time bandwidth (RTBW)

3

Up to 28 GHz/s @ 10 kHz RBW  
Sweep Rate

4

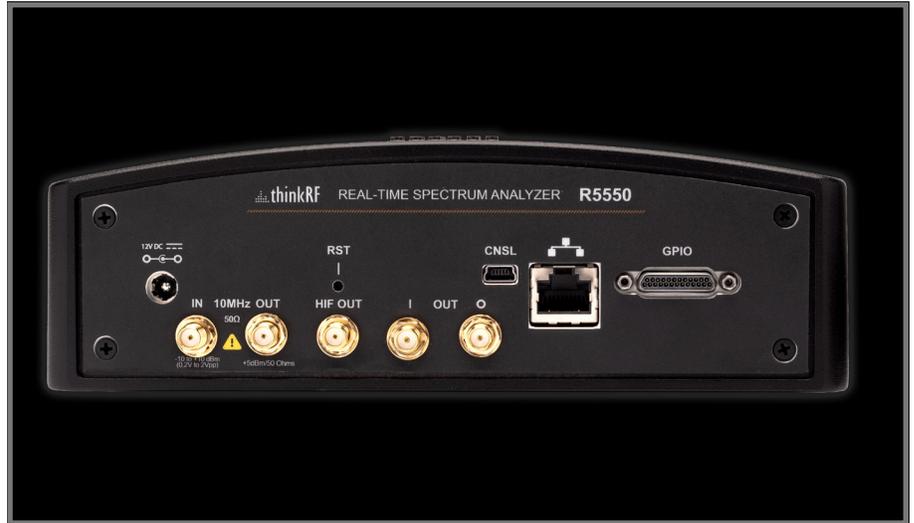
20 W @ 12V input power  
consumption

5

257.3 x 193.7 x 60 mm  
(10.13" x 7.63" x 2.36")  
Compact

6

2.54 kg (5.6 lbs)  
Light



## A cost-effective platform for tests, measurement and monitoring of wideband signals up to 160 MHz bandwidth.

The thinkRF D5550 offers a cost-effective platform for test, measurement and monitoring of wideband signals up to 160 MHz bandwidth through the new Wideband IQ (WBIQ) options.

thinkRF™ makes the cost-effective testing and monitoring of billions of wireless devices possible. Built on innovative software-defined radio technologies, the thinkRF D5550 Wideband Downconverter has the performance of a traditional lab-grade instruments at a fraction of the cost, size, weight and power consumption.

Designed for distributed deployment in the lab, in the field, or in a vehicle, the portable, fanless thinkRF D5550 provides the benefits of a high-performance software-defined RF receiver, digitizer and analyzer.

The thinkRF D5550 Wideband Downconverter is silent, lightweight, and offers improved spectral performance in a more rugged form factor.

# ARCHITECTURE

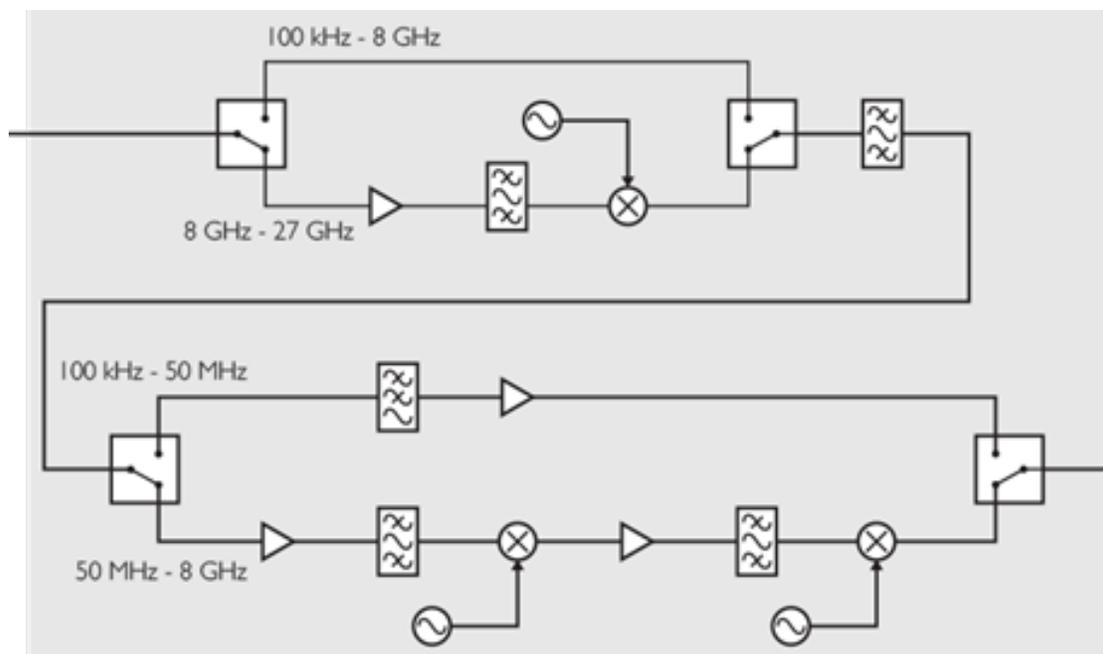
## D5550 Wideband RF Downconverter

The D5550 benefits:

- The D5500 has a hybrid receiver architecture that supports both super-heterodyne and direct-conversion modes of operation through software control.
- Direct-conversion receivers offer the advantage of providing the widest bandwidth in the simplest and most cost-effective way. However, they introduce artifacts such as DC and IQ-offsets that the user has to account and/or compensate for.
- Super-heterodyne receivers by comparison are more complex and have about half the bandwidth. The advantage however is that they do not introduce DC and IQ offsets.
- A key advantage of thinkRF's receivers is that they are based on a hybrid architecture that allows the user to software-reconfigure the receiver to either architecture depending on the application.

### The D5550 Front End

The front-end processing blocks of the D5550 utilize up to 20 pre-select filters to mitigate input-related spurs and image responses. There are three mixing stages and various IF filter banks to further condition the signal. The block diagram for the RF front end when operating in Super-heterodyne mode, is shown below.



# ARCHITECTURE

## D5550 Wideband RF Downconverter

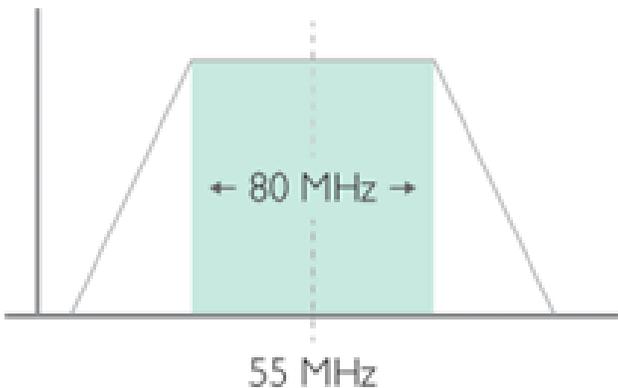
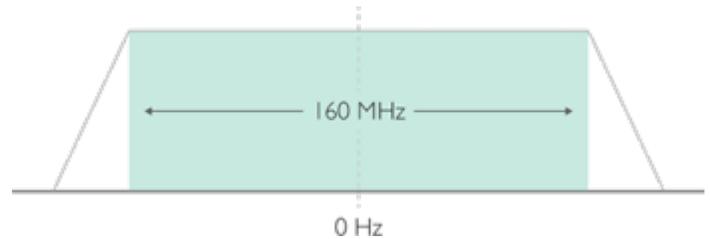
### IF Outputs

The D5550 has a single RF input and three software-selectable IF bandwidths of 160 MHz, 80 MHz and 10 MHz. When the receiver is in direct-conversion mode, the analog signal is present on both the I and Q outputs. In this case, each output is band-limited to 80 MHz, for a total of 160 MHz. When the receiver is in super-heterodyne mode, the analog output is present on the I output only and centered at either 55 MHz (80 MHz bandwidth) or 35 MHz (10 MHz bandwidth).

### 160 MHz Bandwidth

In the widest bandwidth mode of operation, the D5550 is configured as a direct-conversion receiver. This mode is well suited for applications such as ISM band signal detection/analysis and RF data acquisition.

The final IF signal is centered at DC (0 Hz) and available on both the I and Q output connectors. In order to process this signal, a dual-channel digitizer with a sampling rate of at least 250 MS/s is required.



### 80 MHz Bandwidth

The D5550 has a wideband super-heterodyne mode of operation that allows the processing of signals with a bandwidth of up to 80 MHz. This mode of operation is best suited for signal demodulation and spectrum analysis. The down converted signal is centered at 55 MHz. Depending on the roll-off that can be tolerated by the application, the user may choose to utilize 100 MHz of bandwidth. In this case, the band begins at 5 MHz and ends at 105 MHz. In order to process this signal, a single channel digitizer with a sampling rate of at least 250 MS/s is required.

# ARCHITECTURE

## D5550 Wideband RF Downconverter

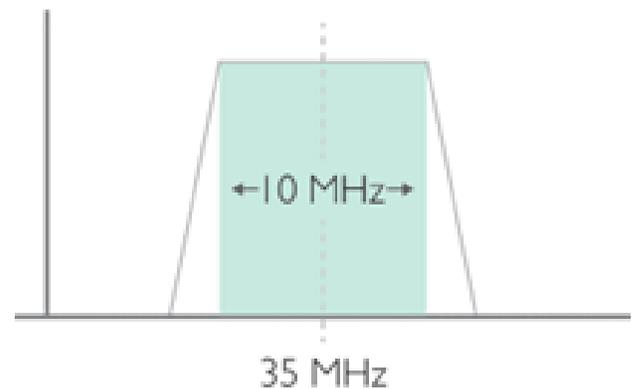
### D5550 Product Range

There are a few different models 8 / 18 / 27 either standard product with 40 MHz super het bandwidth and 100 MHz direct conversion or wide band version WBIQ.

The D5550 has a narrower 10 MHz Super-heterodyne mode of operation. The narrower bandwidth filter centered at 35 MHz offers best rejection of adjacent signals, best spurious performance and flattest noise floor of all available receiver modes. This signal, while present at the analog I output, can also be processed using the internal digitizer sampling at 125 MS/s

### 10 MHz Bandwidth

The D5550 has a narrower 10 MHz Super-heterodyne mode of operation. The narrower bandwidth filter centered at 35 MHz offers best rejection of adjacent signals, best spurious performance and flattest noise floor of all available receiver modes. This signal, while present at the analog I output, can also be processed using the internal digitizer sampling at 125 MS/s



### WBIQ Product Range

When bandwidths of greater than 100 Mhz are required the D5550 product variant of the D5550-xxx can extend the bandwidth range up to 160 MHz. The D5550 product is intended for use with external digitizers (via the analog IF output).

thinkRF's D5550 is a versatile RF tuner/downconverter that can either be used stand-alone or in conjunction with an external wideband digitizer to process signals that operate to 27 GHz and with bandwidths up to 160 MHz.

The ability to use external digitizers allows the systems integrator to provide a highly customizable COTS solution to a variety of radio frequency analysis challenges.

Many existing systems with embedded digitizers can benefit from the increased frequency coverage and bandwidth options provided by the D5550. This advantage can be readily applied in military spiral development program.

# APIS - PROGRAMMING ENVIRONMENTS

## D5550 Wideband RF Downconverter

By supporting a rich set of industry-leading standard protocols, the D5550 can easily integrate into your new or existing applications.



### Python™ and PyRF development framework

PyRF enables rapid development of powerful applications that leverage the new generation of measurement-grade software-defined radio technology. It is built on the Python Programming Language and includes feature-rich libraries, example applications and source code and is openly available, allowing commercialization of solutions through BSD open licensing.



### NI LabVIEW®

Easily and quickly integrate the D5550 into your existing or new NI LabVIEW® based acquisition, measurement, automated test and validation systems.



### MATLAB®

thinkRF provides MATLAB® APIs for connecting to thinkRF's D5550 Wideband RF Downconverter and MATLAB® program code examples to get you started towards developing your own.



### C/C++ APIs and DLL

Underneath our rich set of APIs and programming environments is the C/C++ API and DLL which abstracts the SCPI command and VITA VRT dataflow from the D5550.

## STANDARD PROTOCOLS

Compliance with standard protocols provides you both multi-vendor independence and device interoperability.

# SCPI



### SCPI and VITA VRT

The D5550 supports the Standard Commands for Programmable Instruments (SCPI) for control and the VITA-49 Radio Transport (VRT) protocol for data flow.

thinkRF provides extensive documentation and examples for programming and interfacing at the SCPI and VITA-49 VRT level.

# HiSLIP

### HiSLIP

The D5550, with firmware 1.6.1 or higher, supports HiSLIP, which is an industry standard TCP/IP-based protocol for remote instrument control of LAN-based test and measurement instruments.

# RF and Digitization Specifications

## Frequency

Frequency Ranges	50 MHz to 8 / 18 / 27 GHz	
Frequency Reference	±1.0 ppm ±1.0 ppm 0°C to 55°C ±1.0 ppm per year	Accuracy at room temperature Stability over temperature Aging
Real-Time Bandwidth (RTBW)	0.1 / 10 / 40 / 100 MHz	
Spurious Free Dynamic Range (SFDR)	60 dBc (typical*) 70 dBc (typical*) 100 dBc (typical*)	100 MHz RTBW 10 / 40 MHz RTBW 0.1 MHz RTBW

## Amplitude

Amplitude Accuracy (25 °C ± 5 °C)	± 2.00 dB typical*	50 MHz to 27 GHz
Attenuator Range	0 to 30 dB in 10 dB steps	
Maximum Safe RF Input Level	+10 dBm, Max DC: 10 V	

## Displayed Average Noise Level (DANL | at 25 °C ± 5 °C, typical\*)

Frequency (GHz)	8 GHz (typical*)	18 GHz (typical*)	27 GHz (typical*)
0.1 GHz	- 157 dBm/Hz	- 161 dBm/Hz	- 160 dBm/Hz
0.5 GHz	- 155 dBm/Hz	- 160 dBm/Hz	- 159 dBm/Hz
1 GHz	- 156 dBm/Hz	- 160 dBm/Hz	- 159 dBm/Hz
2 GHz	- 154 dBm/Hz	- 154 dBm/Hz	- 153 dBm/Hz
3 GHz	- 152 dBm/Hz	- 158 dBm/Hz	- 157 dBm/Hz
4 GHz	- 151 dBm/Hz	- 162 dBm/Hz	- 162 dBm/Hz
5 GHz	- 150 dBm/Hz	- 158 dBm/Hz	- 158 dBm/Hz
6 GHz	- 149 dBm/Hz	- 157 dBm/Hz	- 157 dBm/Hz
7 GHz	- 150 dBm/Hz	- 153 dBm/Hz	- 155 dBm/Hz
8 GHz	- 144 dBm/Hz	- 160 dBm/Hz	- 161 dBm/Hz
9 GHz		- 158 dBm/Hz	- 161 dBm/Hz
10 GHz		- 160 dBm/Hz	- 161 dBm/Hz
11 GHz		- 156 dBm/Hz	- 160 dBm/Hz
12 GHz		- 158 dBm/Hz	- 157 dBm/Hz
13 GHz		- 151 dBm/Hz	- 157 dBm/Hz
14 GHz		- 154 dBm/Hz	- 154 dBm/Hz
15 GHz		- 160 dBm/Hz	- 157 dBm/Hz
16 GHz		- 157 dBm/Hz	- 157 dBm/Hz
17 GHz		- 150 dBm/Hz	- 156 dBm/Hz
18 GHz		- 144 dBm/Hz	- 156 dBm/Hz
19 GHz			- 149 dBm/Hz
20 GHz			- 154 dBm/Hz

\* thinkRF expects this performance by design in 90% of the units produced. Variability is possible from unit to unit.

# RF and Digitization Specifications

## Displayed Average Noise Level (DANL | at 25 °C ± 5 °C, typical\*)

Frequency (GHz)	8 GHz (typical*)	18 GHz (typical*)	27 GHz (typical*)
21 GHz			- 153 dBm/Hz
22 GHz			- 152 dBm/Hz
23 GHz			- 153 dBm/Hz
24 GHz			- 155 dBm/Hz
25 GHz			- 153 dBm/Hz
26 GHz			- 150 dBm/Hz
27 GHz			- 148 dBm/Hz
Third Order Intercept (TOI) at max gain	+12 dBm, typical*	At 1 GHz (D5550-408 only)	

## Spectral Purity

SSB Phase Noise 25°C ± 5°C At 1GHz, measured with external oscillator not present	Offset	
	100 Hz	-90 dBc/Hz
	1 kHz	-93 dBc/Hz
	10 kHz	-98 dBc/Hz
	100 kHz	-106 dBc/Hz
	1 MHz	-120 dBc/Hz

## Digitization

Data Sampling Rate and Resolution	125 MS/s, 14 bit 300 kS/s, 24 bit	10 / 40 / 100 MHz RTBW 0.1 MHz RTBW
Sweep Rate	Up to 28 GHz/s @ 10 kHz RBW	40 MHz IBW
Stream Rate	Up to 360 Mbit/s	

# General Specifications

## Connectors

RF In	SMA female, 50 Ω
10 MHz Reference In and Out	SMA female, 50 Ω
Analog I and Q Out	SMA female, 50 Ω
HIF Out	SMA female, 50 Ω
10/100/1000 Ethernet	RJ45
USB Console	Type B mini
GPIO	25-pin male D-Subminiature
Power	Coaxial Type A: 5.5 mm OD, 2.5 mm ID

## Status Indicators

PLL Lock / 10 MHz reference clock status	Refer to the R5550 User Manual
Ethernet Link and Activity Status	
CPU and Power Status	

\* thinkRF expects this performance by design in 90% of the units produced. Variability is possible from unit to unit.

## General Specifications

### Power

Physical Power Supply	Use AC Wall Power Adaptor provided	Input AC 120V-240V / Output +12V
Power Consumption	23W with Power Adaptor provided (418, 427) 17W with Power Adaptor provided (408)	At room temperature

### Physical

Operating Temperature Range	0°C to +50°C	
Storage Temperature Range	-40°C to +85°C	
Warm up time	30 minutes	
Dimensions	257.3 x 193.7 x 66 mm (10.13" x 7.63" x 2.61")	With mounting feet
	257.3 x 193.7 x 60 mm (10.13" x 7.63" x 2.36")	Without mounting feet
Weight	2.54 kg (5.6 lbs)	408
	2.72 kg (6 lbs)	427
Security	Kensington Security Slot	Located on back end-plate

### Regulatory Compliance

RoHS Compliance	RoHS	
Marks	CE	European Union
EMC Directive 2014/30/EU	EN 61326-1:2013	Electromagnetic Compatibility
Low Voltage Directive 2006/95/EC	EN 61010-1:2010 Class 1	Safety
FCC		

### Environmental

Humidity & Temperature	MIL-STD-PRF-28800 Class 2	
Shock & Vibration	MIL-STD-PRF-28800 Class 2	
	MIL-STD-PRF-28800 Class 3	

### APIs and Protocols

Python™	PyRF RTSA	
LabVIEW	LabVIEW Base Development System for Windows (version 2014 and up)	
MATLAB®	MATLAB® Release 2014b - 2019b	
C/C++	ISO/IEC 14882:2011	
SCPI	IEEE 488.2 - Standard Commands for Programmable Instruments	
VRT	VITA-49 Radio Transport	
HiSLIP	IVI TCP/IP-based protocol v1.0	

# General Specifications

Recommended PC	
Operating System	Windows 10 (32 or 64)
Minimum RAM Size	4 GB
Minimum Free Hard Disk Space	2 GB
Ethernet Port	1 GigE
Display Resolution	1920 x 1080

# Ordering Information

Base Units	Part Number	Description
8 GHz RTSA	D5550-408-WBIQ	50 MHz to 8 GHz, RTBW up to 160 MHz, Wideband option
18 GHz RTSA	D5550-418-WBIQ	50 MHz to 18 GHz, RTBW up to 160 MHz, Wideband option
27 GHz RTSA	D5550-427-WBIQ	50 MHz to 27 GHz, RTBW up to 160 MHz, Wideband option

D5550 Power Plug Options	Description
0	North American power plug (115 V, 60 Hz)
1	Universal Euro power plug (220 V, 50 Hz)
2	United Kingdom power plug (240 V, 50 Hz)
3	Australia power plug (240 V, 50 Hz)
4	Switzerland power plug (220 V, 50 Hz)
5	Japan power plug (100 V, 50/60 Hz)
6	China power plug (50 Hz)
7	India power plug (50 Hz)

CONTACT US TODAY  
FOR A FREE DEMO!

# thinkRF™ D5550

## Wideband RF Downconverter



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#### Intellectual Property - Patents

The thinkRF D5550 product line is protected by patents, (US8,675,781, US9,197,260, US9,350,404, US8,886,794) in the United States. This information is provided to satisfy the patent marking provisions including, but not limited to, the patent marking provisions of the America Invents Act (AIA) and is intended to serve as notice under 35 U.S.C. § 287(a), as amended by Section 16 of the AIA. Additional patents may be pending in the United States and/or elsewhere.

  
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