R&S®FC330
FREQUENCY CONVERTERS

Frequency extension from 220 GHz to 330 GHz for wideband signal analysis and generation

R&S®FC330SR
R&S®FC330ST

Product Brochure
Version 01.00

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Make ideas real

AT A GLANCE

The R&S®FC330ST and R&S®FC330SR frequency converters are specifically designed for the upconversion and downconversion of intermediate frequency (IF) signals to and from the RF frequency range from 220 GHz to 330 GHz. Commonly referred to as the H band, this frequency range is gaining importance for various applications, not just for 6G research but also in radar technology and advanced imaging in the area of security and healthcare.

A high-performance mixer with low conversion loss ensures precise measurements, while the integrated IF amplifier enhances sensitivity and signal performance.

The R&S®FC330 frequency converters support a wide IF range up to 35 GHz, enabling the transmission and reception of ultra-wideband signals.

The optional R&S®FC330-Z50 external amplifier features a low noise figure and a typical gain of 15 dB. It can be used to boost transmitter output power or as a low-noise amplifier to improve receiver sensitivity.

To complete the solution, a range of accessories is available, including a variety of bandpass filters, tuneable attenuators and horn antennas.

Key facts

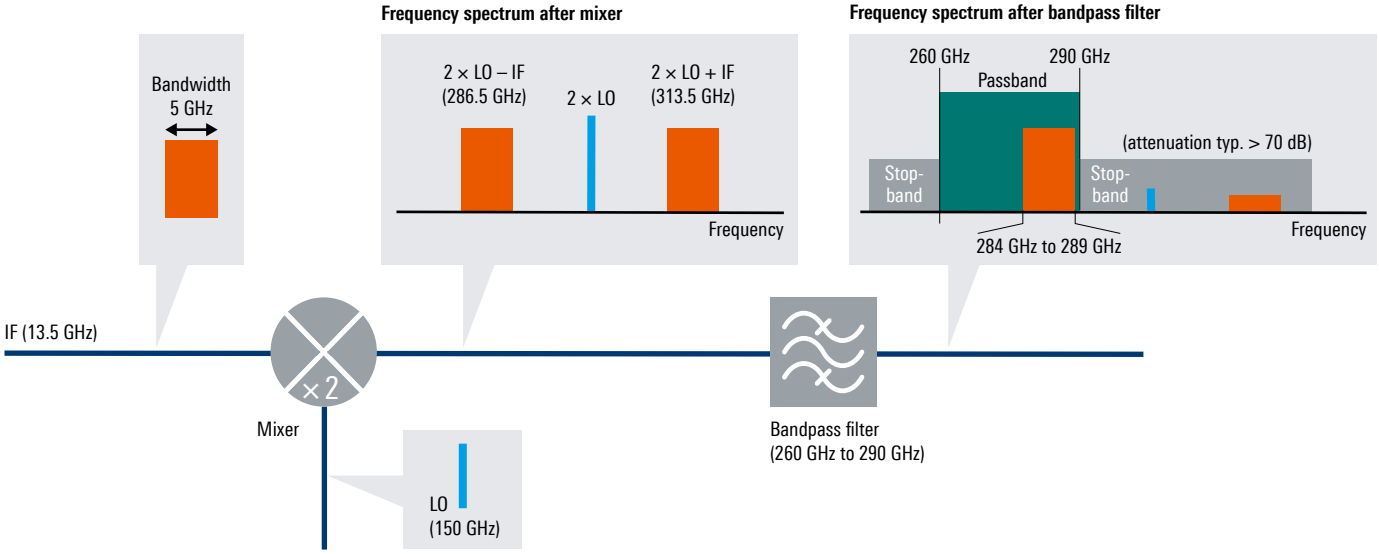
- Full H band support from 220 GHz to 330 GHz
- Ultra-wide IF bandwidth up to 35 GHz
- Low conversion loss due to integrated IF amplifier
- Superior signal quality
- High-performance external H band amplifier

R&S®FC330ST with connected R&S®FC330-Z50 external amplifier and R&S®FC330-Z20 WR3.4 waveguide-to-waveguide adapter.

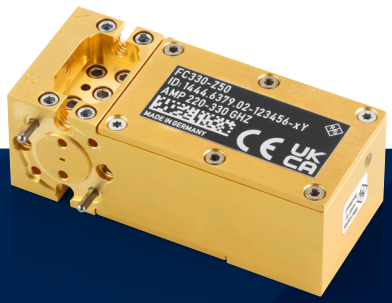
The main component of the R&S®FC330 frequency converters is a subharmonic mixer. In general, a mixer consists of two input ports and one output port. The two input signals are mixed so that the output signal frequency is either the sum or the difference of the source frequencies.

This implies that, in the upconversion case, both signals are present at the RF output port and, typically, one of the signals should be suppressed. The broad supported IF range and the large variety of available bandpass filters help eliminate the unwanted sideband and local oscillator (LO) signals.

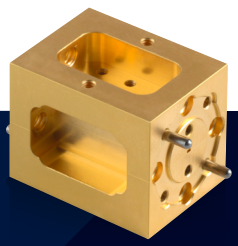
Concept of a subharmonic mixer and bandpass filter with example IF signal and LO frequency



R&S®FC330-Z50
External amplifier



R&S®FC330-Z0x
Waveguide filters
(30 GHz passband)



R&S®FC330-Z20
WR3.4 waveguide-to-waveguide
adapter (straight section)

R&S®SGH330Gxx
Horn antenna

BENEFITS AND KEY FEATURES

Full H band support from 220 GHz to 330 GHz

The R&S®FC330 frequency converters for upconversion and downconversion provide seamless frequency coverage from 220 GHz to 330 GHz, utilizing a WR3.4 waveguide RF connector that meets the WR3 EIA standard. To support flexible operation and minimize unwanted signals, a set of five external bandpass filters is available, each with a 30 GHz passband. These filters enable the selective elimination of sideband and local oscillator signals, ensuring optimal performance and signal quality across the entire frequency range.

Ultra-wide IF bandwidth up to 35 GHz

The IF frequency range of the R&S®FC330 from 1 GHz to 35 GHz enables the transmission of wideband signals and provides the user with a wide range of options to select the optimal IF/LO combination. Each frequency converter is characterized in the factory and supplied with measurement and alignment data on a USB flash drive. This flexibility in customization allows precise control of the system to achieve a specific RF frequency, making it an ideal solution for various applications.

Low conversion loss due to integrated IF amplifier

R&S®FC330ST as well as R&S®FC330SR incorporate an integrated IF amplifier, which serves to enhance sensitivity in receive mode and optimizes the mixer input levels in transmit mode. By amplifying the downconverted IF signal directly after the mixer, the amplifier improves overall system performance for the R&S®FC330SR. In transmit mode, the amplifier ensures that the mixer input level is optimized, resulting in improved signal quality.

Superior signal quality

The superior signal quality, even at sub-THz frequencies, can be achieved by the combination of high-performance IF generation and analysis together with the unique performance of the R&S®FC330 frequency converters.

High-performance external H band amplifier

The R&S®FC330-Z50 external amplifier operates within the frequency range from 220 GHz to 330 GHz. It can be supplied with power directly from the R&S®FC330 and provides a typical gain of 15 dB, delivering signals with up to +8 dBm output power (measured at saturation). Due to its low noise figure, the amplifier is suitable for transmit (TX) as well as receive (RX) direction.

EVM measurement of a single-carrier signal with 16QAM modulation and 4 GHz symbol rate at 286.5 GHz carrier frequency.
Used devices: R&S®SFI100A, R&S®SMA100B, R&S®FC330ST/SR and R&S®FSW43.

APPLICATION EXAMPLE

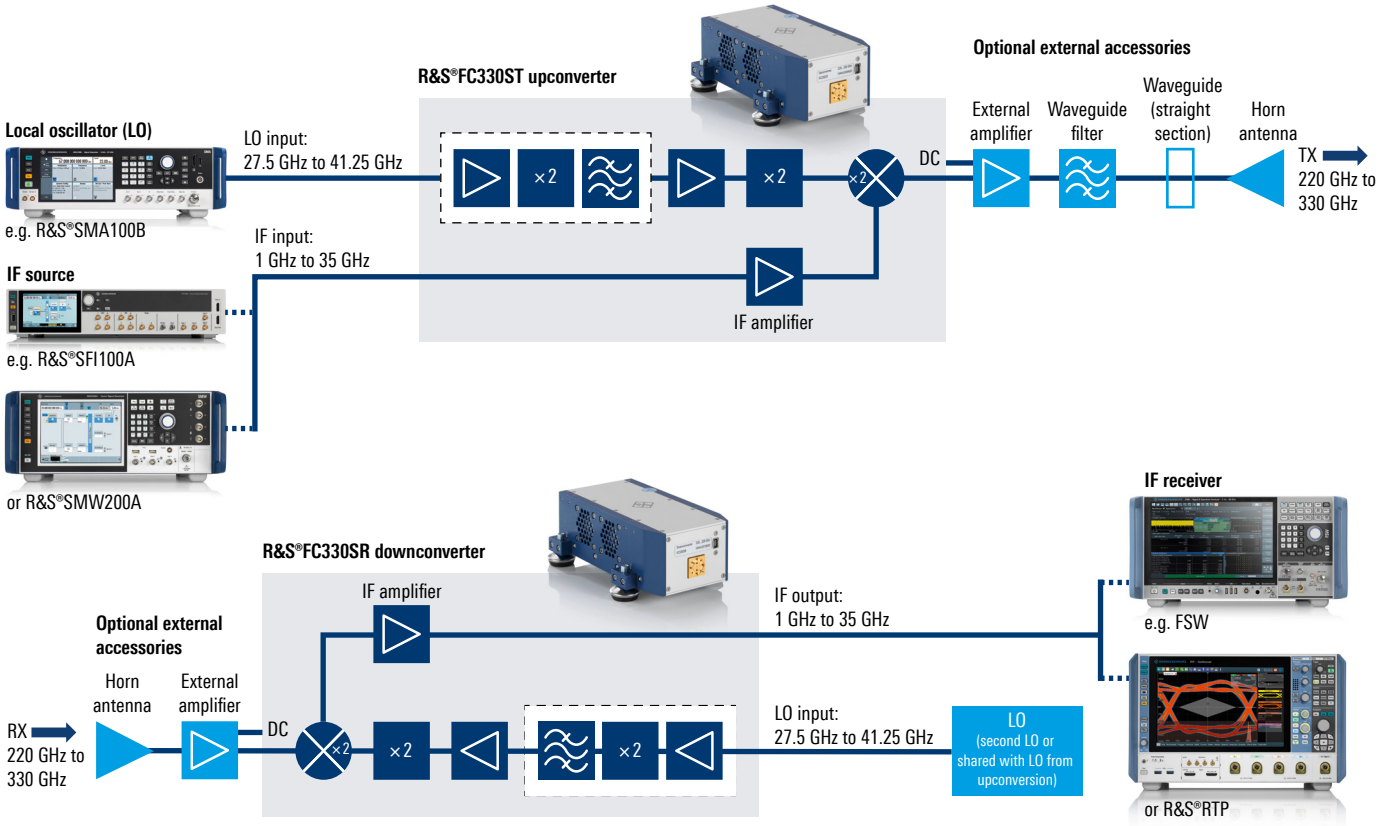
R&S®FC330ST and R&S®FC330SR require an external local oscillator. An ideal choice for this task is the R&S®SMA100B RF and microwave signal generator, which produces extremely clean CW signals with minimal phase noise.

In general, any signal source can be used to feed suitable IF signals to the R&S®FC330ST for upconversion. However, for demanding applications requiring very wide bandwidths, the R&S®SFI100A wideband IF vector signal generator is an ideal choice. This signal generator excels with an impressive RF modulation bandwidth of up to 10 GHz and delivers excellent modulation signal quality.

On the receive side, the FSW signal and spectrum analyzer or the R&S®RTP oscilloscope are ideal tools to analyze downconverted IF signals. The FSW, in particular, offers a wide internal analysis bandwidth of 8.3 GHz and exceptional accuracy, ensuring reliable and precise measurements.

A complete solution utilizing Rohde&Schwarz instruments is illustrated in the figure below.

R&S®FC330 setup with LO source, IF generation and signal analysis



SPECIFICATIONS IN BRIEF

Specifications in brief		
R&S®FC330SR downconverter		
RF frequency range	at RF waveguide input	220 GHz to 330 GHz
Connector		WR3.4 waveguide
LO frequency range	at LO input connector (harmonic factor × 8)	27.5 GHz to 41.25 GHz
Connector		RPC2.92, female
IF frequency range	at IF output connector	1 GHz to 35 GHz
Connector		RPC2.92, female
Conversion loss	raw mixer	+12 dB
Conversion gain	including internal IF amplifier	+4 dB
RF input level	without external amplifier	max. +5 dBm
	with R&S®FC330-Z50 external amplifier	max. –8 dBm
Dimensions (W × H × D)	without adjustable device feet	90 mm × 60 mm × 180 mm (3.54 in × 2.36 in × 7.09 in)
Net weight		1.23 kg (2.71 lb)
R&S®FC330ST upconverter		
RF frequency range	at RF waveguide output	220 GHz to 330 GHz
Connector		WR3.4 waveguide
LO frequency range	at LO input connector (harmonic factor × 8)	27.5 GHz to 41.25 GHz
Connector		RPC2.92, female
IF frequency range	at IF input connector	1 GHz to 35 GHz
Connector		RPC2.92, female
Conversion loss	raw mixer	+12 dB
Conversion gain	including internal IF amplifier	–5 dB
Maximum RF output power (CW)	without external amplifier	–5 dBm
	with R&S®FC330-Z50 external amplifier	+5 dBm
Dimensions (W × H × D)	without adjustable device feet	90 mm × 60 mm × 180 mm (3.54 in × 2.36 in × 7.09 in)
Net weight		1.23 kg (2.71 lb)

More information

For detailed specifications and ordering information, see R&S®FC330SR specifications (PD 3673.0263.22).
For detailed specifications and ordering information, see R&S®FC330ST specifications (PD 3673.0270.22).

ORDERING INFORMATION

Designation	Type	Order No.
Downconverter, 220 GHz to 330 GHz	R&S®FC330SR	1444.6310.02
Upconverter, 220 GHz to 330 GHz	R&S®FC330ST	1444.6304.02
Including +12 V power supply		
External accessories		
Waveguide filter, 220 GHz to 250 GHz	R&S®FC330-Z01	1444.6327.02
Waveguide filter, 240 GHz to 270 GHz	R&S®FC330-Z02	1444.6333.02
Waveguide filter, 260 GHz to 290 GHz	R&S®FC330-Z03	1444.6340.02
Waveguide filter, 280 GHz to 310 GHz	R&S®FC330-Z04	1444.6356.02
Waveguide filter, 300 GHz to 330 GHz	R&S®FC330-Z05	1444.6362.02
WR3.4 waveguide-to-waveguide adapter, 40 mm	R&S®FC330-Z20	1444.6385.02
External amplifier, 220 GHz to 330 GHz	R&S®FC330-Z50	1444.6379.02
Horn antenna, 220 GHz to 330 GHz	R&S®SGH330G25	1538.5875.03
Tunable attenuator, 230 GHz to 325 GHz	R&S®WTA325	3593.4005.02
Fixed attenuator (0 dB to 40 dB, due customer specification)	WFA 220-330 [1]	04710037 (RPG part number)
Recommended extras		
Torque wrench, for 3.5/2.92/2.4/1.85 mm connectors, 0.9 Nm coupling torque	R&S®ZN-ZTW	1328.8534.35
Torque wrench, for waveguide flanges, 0.58 Nm	R&S®ZCTW	1175.2014.02
Recommended LO generator		
RF and microwave signal generator	R&S®SMA100B	1419.8888.02
Frequency option, 8 kHz to 40 GHz	R&S®SMAB-B140	1420.8988.02
Ultra-low phase noise option	R&S®SMAB-B711	1420.8020.02

[1] This product was manufactured for Rohde&Schwarz by: RPG-Radiometer Physics GmbH, Werner-von-Siemens-Str. 4, 53340 Meckenheim, Germany

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Sustainable product design

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ISO 9001

Certified Environmental Management
ISO 14001

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R&S®FC330 Frequency Converters
Data without tolerance limits is not binding | Subject to change