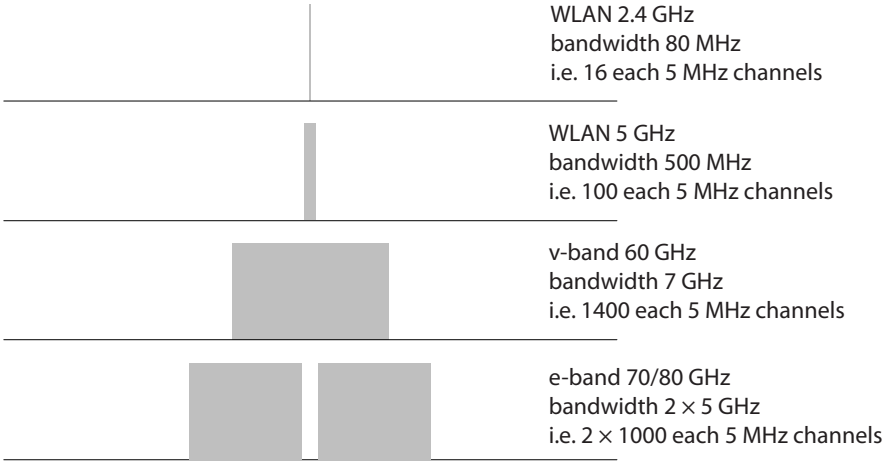
High capacity RF communication in mm-wave bands

Application report

The capacity of wireless RF communication is all about the bandwidth. Recently two new bands have become internationally available in the mm-wave area; 60 GHz and 70/80 GHz. Together with the 2.4 GHz and the 5 GHz these bands are license exempt or subject to light licensing.

A comparison of available bandwidth for these bands shows the vast bandwidth that has become available at the 60 GHz and 70/80 GHz band.



Wireless RF data communication in WLAN applications

Wireless RF communication is a competitive alternative to copper and fiber connectivity for many applications like data transmission, video surveillance, and high capacity backhaul.
A very common frequency band for wireless RF communication occurs at 2.4 GHz. This spectrum is internationally available as a license exempt free band for WLAN (Wireless Local Area Network) fig 1, with the most common applications using the WiFi or Bluetooth standards. The available bandwidth is however small, restricting capacity; additionally this spectrum is shared between many applications, resulting in channel competition.

Fig 1, WLAN at 2.4 GHz

Wireless RF data communication in Point-to-Point high-speed applications

Many applications require high capacity wireless RF links that are not subject to conflict with other radio signals as well as a bandwidth wide enough to accommodate RF communication of Gbps capacity.
By using a technique referred to as frequency conversion communication at very high frequencies can be performed. License exempt bands or bands requiring so called "light licensing" are now available worldwide at 60 and 70/80 GHz. These bands have several GHz of spectrum available and the physics of electromagnetic wave propagation at these high frequencies lent itself to creating high security and interference free communication links.

A logical diagram of this approach could appear as below, Fig 2.

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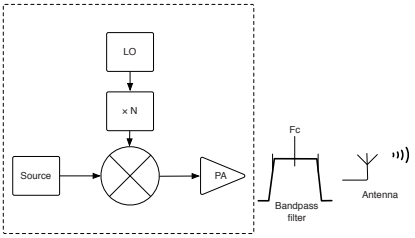
High capacity RF communication in mm-wave bands

Frequency up converter



Frequency down converter

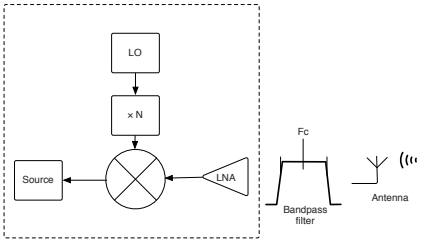
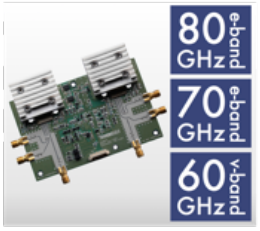


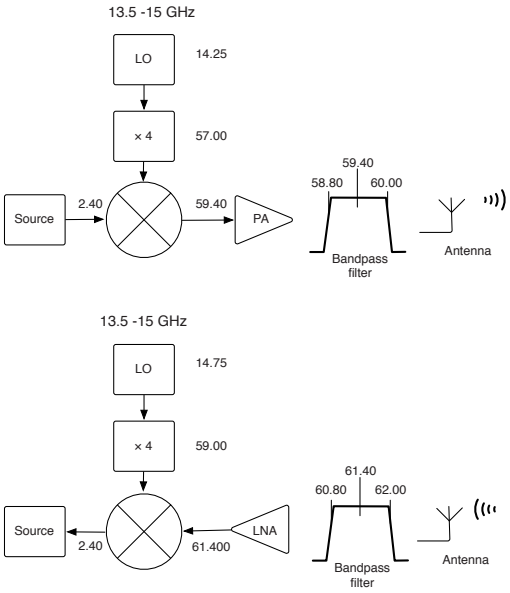
Fig 2. RF data communication using a frequency converter

The source can be any modulated digital information as data, video, telemetry etc.



Sivers IMA offers a 60 GHz and a 70/80 GHz converter, with variants based on the basic configuration illustrated in Fig 2.
This line of converters is modular in design and offers operation on the 60 GHz and the 70/80 GHz bands.

An example of a frequency conversion for the 60 GHz band is showed in Fig 3.



Transmitter (top) and Receiver (bottom) of a full duplex mm-wave link

Fig 3. Example frequency conversion for the 60 GHz band

In this example we are using the symbols and numbers, see next page

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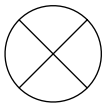
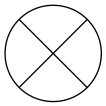
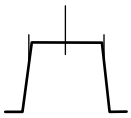
Symbol	Description	Transmitter (TX) GHz	Receiver (RX) GHz
	LO (Local Oscillator)	14.25	14.75
	Frequency multiplier will multiply the LO frequency 4 times	57.00	59.00
 Transmitter	The frequency mixer will add the two incoming frequencies from the multiplier and the source to the PA	See Frequency multiplier and Source; 57.00 + 2.40 = 59.40	-
 Receiver	The frequency mixer will subtract the two incoming frequencies from the LNA and the multiplier to the source	-	See LNA and Frequency multiplier; 61.40 – 59.00 = 2.40
	Source or destination modulated data	2.40	2.40
	PA (Power Amplifier) will amplify the signal fed to bandpass filter and the antenna		
	LNA (Low Noise Amplifier) will amplify the weak signal from the remote end and feed it to the frequency mixer		
	Bandpass filter will filter out unwanted mixer products		
	Antenna		
	Radiation		

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