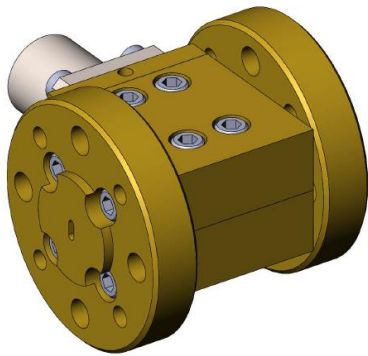
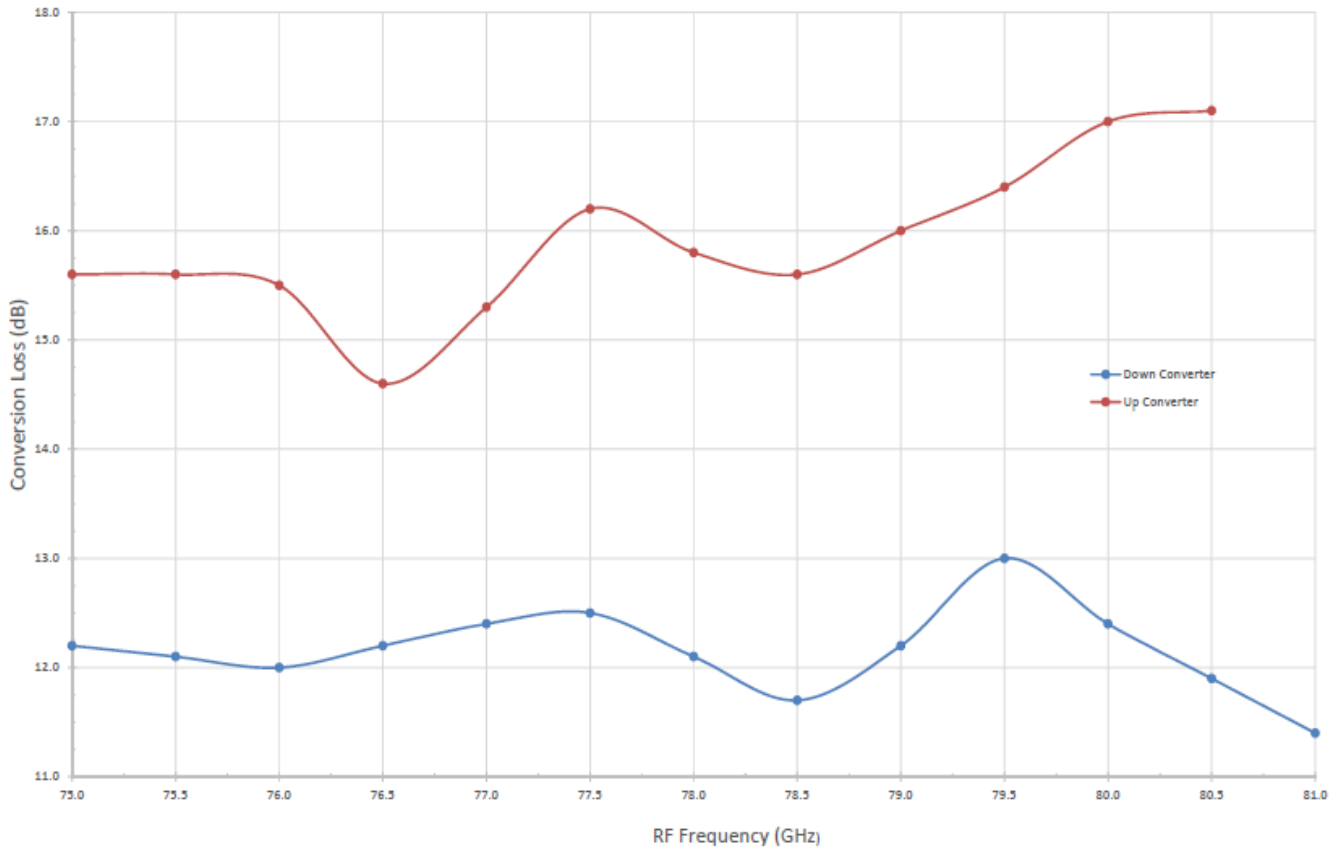


Spacek Labs is currently developing a G-Band sub-harmonic mixer. This mixer will utilize a W-band LO signal that is half of the expected RF frequency. These type of mixers leverage current technology to decrease the cost of cutting edge systems. RF power above 60 GHz is typically achieved in 2 steps. First, a lower frequency signal is multiplied up. Second, the signal is amplified to the desired level. The second part of this procedure is typically the cost driver. Cost of amplification and power increases with frequency. As an example an amplifier that delivers $\sim +17$ dBm at 60 GHz is $\sim \$4.5$ K while a similar amplifier at 90 GHz is $\sim \$9$ K. Just a 50% increase in frequency increases the cost by a factor of 2. Given this trend it behooves systems designers to utilize any techniques that reduce the need for moderate powers at high frequencies. A sub-harmonic mixer fits into these criteria well.

Mixers use a moderately high power signal to bias diodes into a non-linear regime. Once in the regime an intrinsic property of non-linear devices allows them to mix signals (add/subtract). When an additional signal (RF or IF) is impinged on the diodes they will add or subtract from the LO in frequency. In a sub-harmonic mixer, the diodes are arranged so that the RF and IF signal add or subtract on $2\times$ the LO signal. Spacek Labs is currently developing a line of sub-harmonic mixers. This line currently has both E and W band mixers. The typical constraints on making higher frequency units is test equipment. We plan on utilizing our extensive infrastructure from 1–110 GHz to mitigate capital equipment costs and reduce overhead on higher frequency mixers. For G-band we will produce 2 mixers. One will be utilized as an up converter (signals adding) and one as a down converter (signals subtracting).

The only issue that currently hinders our progress into making sub-harmonic mixers in G-Band is suitable diodes. Diodes are expected to become available over the next several weeks to a month. In the mean time we will utilize diodes optimized for W-band to create the designs and infrastructure to develop these higher frequency units. We expect that G-band sub-harmonic mixers with W-band diodes will have decreased performance, but with the ability to supply large IF signals and relatively high compression points for the diodes we expect obtain sufficient signal to noise.

W-Band Sub Harmonic Mixer 66 GHz Fixed LO



**Max dimension:
~15 mm**

