

V123b Wideband waveguide power combiner for ALMA Band 7+8 (275-500 GHz) Local Oscillator

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At NAOJ, we are developing SIS mixers based on high critical current density junctions to cover two sub-mm ALMA bands. In order to benefit from all equipment and know-how acquired during the design and production of ALMA band 8 receivers, we are aiming at covering ALMA band 7 (275-373 GHz) and band 8 (385-500 GHz) simultaneously. The fractional bandwidth of this target band is slightly over 60%. This is too wide for typical LO sources at these high frequencies, and therefore, it is necessary to combine the power of two different LO sources, one for each ALMA band. Such a power combiner has three different waveguide ports for each of the bands involved: WR-3.0 for band 7, WR-2.2 for band 8, and WR-2.3 for band 7+8, and it is therefore highly asymmetric, which represent an additional design challenge. The power combiner has been designed by using different waveguide filters, 90 hybrid couplers, and waveguide transitions. The design has been performed with the Mode-Matching software WaspNet, and the performance has been verified with HFSS Finite Element simulations. Two prototypes have been fabricated, and characterized by VNA measurements at NICT. Measurement results agree reasonably well with simulations, considering the difficulties in fabrication of such a complex waveguide component to be used at sub-mm frequencies. One of the prototypes has been integrated in the Band 7+8 (275-500 GHz) noise temperature measurement setup at NAOJ and successful measurements in the whole band have been achieved in a single cool down.