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Design study for the local oscillator injection scheme for the ALMA band 10 receiver

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Abstract— The ALMA band 10 receiver will cover the highest frequency range observable with ALMA covering the spectrum from 787 GHz to 950 GHz. The ALMA band 10 receiver front-end is currently under development. In this paper we introduce a novel concept of Local Oscillator (LO) injection scheme. Three solutions were studied for the band 10 receiver LO injection system. The first solution being investigated was a full waveguide scheme which main characteristic was to have the LO source (pair of triplers devices) connected to each other by an oversized waveguide. The first multiplier was located in the 110K thermal stage and the second tripler into the 4K thermal stage. The mixer then received the LO power from a waveguide 10 dB coupler connected to the 792-955GHz signal output. This scheme was tested and demonstrated to suffer of large standing waves, which eventually made the mixing process impossible due to lack of LO pumping power at some frequencies of band 10. The use of a double mirror coupling system together with a beam splitter for quasi-optical LO power injection was also investigated. However mechanical constrains made this design not practicable.

The current design implies the use of a double mirror coupling system which purpose is to couple two identical horns in a so called horn-to-horn scheme. The 10 dB power coupler is then used for power injection to the mixer chip. The design and software analysis of the total power coupling between the two horns will be presented in this paper. Some initial measurements of beam pattern and total power being transmitted from horn to horn will be shown aiming at the concept validation for the nominal design room temperature.