

Performance of the first six ALMA Band 10 receivers

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Abstract—We have developed and characterized the first six (preproduction) Atacama Large Millimeter/submillimeter Array (ALMA) Band 10 (787–950 GHz) receivers. The front-end optics comprises a pair of ellipsoidal mirrors, a wire grid, and two corrugated feed horns. A waveguide mixer block is attached to each feed horn in which a mixer chip employing Nb/AlOx/Nb junctions and NbTiN/SiO₂/Al microstrip tuning circuits is mounted to a WR-1.2 full-height waveguide. A local oscillator (LO) signal receiving horn and a waveguide 10-dB or 13-dB LO coupler are integrated in the block to provide the LO signal to the mixer chip. The LO signal is generated by a fixed-tuned x9 multiplier with an output diagonal horn located at the 110-K stage, and is then quasi-optically coupled to the mixer receiving horn. A quasi-optical attenuator is inserted in the LO optical path at the 15-K stage to adjust the output power of the individual multipliers down to a proper level for the SIS mixer. A very wide intermediate frequency (IF) system with a bandwidth of 4–12 GHz is employed. A set of detailed tests of the receiver in terms of the receiver sensitivity, beam, stability, and other many characteristics demonstrated that the first six receivers had excellent and almost the same performances as specified by ALMA. These results suggest that the subsequence full-production up to 73 receivers is achievable.