

Integration and verification of ALMA receiver front ends

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Abstract—We present the method and results of integration and verification of the receiver Front Ends (FEs) for the Atacama Large Millimeter/submillimeter Array (ALMA), an international partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. For installation in the 66 antenna elements of ALMA, 70 FEs including four spares are being integrated. The FEs will be initially equipped with 7 bands (84 – 116 GHz, 125 – 163 GHz, 211 – 275 GHz, 275 – 373 GHz, 385 – 500 GHz, 602 – 720 GHz and 787 – 950 GHz) for all antennas and another band (163 – 211 GHz) for selected antennas. The FE is designed to include up to 10 bands with the “band cartridge” concept, which enables us to replace a faulty band cartridge or install additional bands later.

For the purpose of the assembly, integration and verification of the FE assemblies, we have established three FE Integrations Centers (FEICs); at National Radio Astronomy Observatory in Charlottesville, USA, at Rutherford Appleton Lab., STFC in UK, and at the Aeronautical Research Laboratory, Chung Shan Institute of Science and Technology in Taiwan. Each FEIC is equipped with the FE test and measurement system including cold and ambient temperature loads for noise temperature measurements and near-field beam scanners for verification of the optical performance. Tilt tables enable us to test FEs at different angle of elevation between horizontal and vertical positions.

So far, 43 FEs have been delivered to Chile from the FEICs after passing a set of verification tests and measurements. They have been installed in the ALMA antenna elements on site, and have been in use in commissioning and science observations. We also present some statistics of the performances measured at FEICs that indicates a remarkable uniformity of these FEs.