

ASKAP Mk II Phased-Array Feed: from the Laboratory to the Observatory

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We present the integration, laboratory verification, and field testing of the first full-size Mk II Phased-Array Feed (PAF) built for the Australian Square Kilometre Array Pathfinder (ASKAP) radio telescope. The ASKAP PAFs are a 94 port $\times$ 2 polarisation version of a planar connected “chequerboard” array (Hay and O’Sullivan, Radio Science, 43, no. 6, 2008). They operate over 0.7 GHz to 1.8 GHz and enable each 12 m ASKAP dish to observe a 30 deg² field of view and survey the sky extremely rapidly.

The Mk II PAF (Hampson et al., ICEAA, 2012, pp. 807-9) is designed to deliver significant improvements to noise performance, operability, and maintainability over the Mk I PAF. The Mk II uses RF-over-fibre (RToF) to transport all signals back to the central building, vastly reducing the complexity of electronics and support systems located in the antenna pedestal.

We describe the program of laboratory and field tests performed to verify the Mk II design and prepare it for production. First, we installed the PAF in a shielded room where we characterised the operating level, bandpass, and stability of all 188 RF paths including the new RToF links. At this stage we also measured adjacent receiver chain isolation, tested electromagnetic shielding integrity, and checked for unwanted electromagnetic emissions. Second, we performed aperture-array Y-factor noise performance measurements with the PAF on the ground, alternately observing the “cold” sky and a “hot” microwave absorber load. Third, we installed the PAF on ASKAP antenna 29 and are now using astronomical measurements to determine full-system performance.



Fig. 1. The first Mk II PAF on ASKAP antenna 29 at the Murchison Radio-astronomy Observatory.

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