

A 650 – 1670 MHz Phased Array Feed Package for SKA1 Survey

M. Bowen* ⁽¹⁾, Y. Chung⁽¹⁾, A. Dunning⁽¹⁾, D. Hayman⁽¹⁾, K. Jeganathan⁽¹⁾, R. Shaw⁽¹⁾, P. Doherty⁽¹⁾, H. Kanoniuk⁽¹⁾, S. Mackay⁽¹⁾ and R. Gough⁽¹⁾

(1) CSIRO Astronomy and Space Science, Marsfield, Australia, 2122,

<http://www.csiro.au/Organisation-Structure/Divisions/Astronomy-and-Space-Science.aspx>

The Square Kilometre Array radio telescope (SKA) will be 100 to 1000 times more sensitive than any radio telescope currently available enabling it to probe key questions in cosmology and physics, including the early origins of the universe. The SKA will be built in two stages “SKA1” and SKA2”. SKA1 was originally envisioned as being the first 10% of the full SKA, with SKA2 completing the project. SKA1 has three distinct components SKA1_low, SKA1_mid and SKA1_survey.

SKA1_survey will be located on the Murchison Radio Observatory (MRO) in Western Australia and consist of the 36 12-m diameter dishes of the Australian SKA Pathfinder (ASKAP), and 60 new 15-m diameter SKA1 dishes. SKA1_survey will operate over the frequency range 350 MHz – 4.0 GHz in three frequency bands 350 – 900MHz (band 1), 650 – 1670 MHz (band 2) and 1.5 – 4.0 GHz (band 3). Initially the antennas will only be equipped with the PAF package for band 2 (650 – 1670 MHz), but the overall system must be designed to accommodate all three receiver bands.

The SKA1_survey band 2 feed packages will be third generation Phased Array Feed (PAF) systems and build on the first and second generation PAF systems developed for the Australian SKA Pathfinder (ASKAP). The feed packages include the receiving elements, RF signal chain and RF over optical fibre links used to transport signals to the digital receivers. Achieving the low noise performance and high dynamic range for the large number of channels required within the cost, size, weight, and RFI compliance constraints of the SKA will be very challenging; requiring high levels of integration and design for mass manufacture.

We outline the feed package development, present detail on the design of the key subsystems and experimental results from a proof-of-concept system.