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A Multiband Primary Focus Receiver for Noto Antenna

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Abstract

A new multiband receiver has been completed to be used in the primary focus of the 32m Noto parabola. The included frequency bands in double circular polarisation are: 3.6/13 coaxial, 21, 18, 2.5 cm. The range 250-1000 MHz is also covered with the addition of external dedicated antennas. Main features are described along with the architecture adopted to integrate in the entire new system also receivers placed in the secondary focus. Cooled front-end and feeds for both L and S/X bands allow to achieve interesting performance.

1. Description

The multiband receiver developed in Noto is in the final stages of mounting and testing before being installed in the primary focus of the 32 m Noto parabola. It will replace the old uncooled S/X and L band receivers, the former being placed in the primary, the latter in secondary focus. The system presents several improvements with respect to the old one and adds new functionality. Moreover a full range between 250 and 1000 MHz is added, that includes the 92 and 49 cm VLBI bands. An holographic set of receivers is mounted allowing to check with the phase reference method the surface accuracy.

Receivers for secondary focus are integrated in the new system, allowing the entire set of receivers to be seen as a unique multifunctional block. Indeed three blocks are present, defined as "primary", "vertex" and "VLBA" box. The first is included in the receiver box placed in the primary focus and contains all the electronics. Moreover the receiver box contains the great dewar, and the noise-cal module. The S/X coaxial feed and the L band one are cooled at 77 K to reduce the noise contribution, while the six LNAs are cooled at 20 K. Appropriate thermal gaps are placed between the orthomode transducer and the waveguide-coaxial conversion to properly take into account the temperature difference.

The "vertex" box is placed in the secondary focus room and is fed by the signals at sky frequency transferred through appropriate cables, as selected by the primary box switch matrix, remotely controlled. IFs produced by the other receivers placed even in the vertex room are selected along with the new receiver bands to be sent to the control room through two channels 1 GHz bandwidth analog fibre optic connection.

Finally the "VLBA" box is responsible for reconstructing from the fibres two IFs, to adjust the power levels with 0.5 dB of accuracy and to send to a double channel up-converter, from where is sent back again to this box and selected to feed the four IFD channels of the VLBA terminal.

The three sections are remotely controlled by a dedicated addressable serial/optical interface, and a Windows based program is used to set and control the entire functionality.

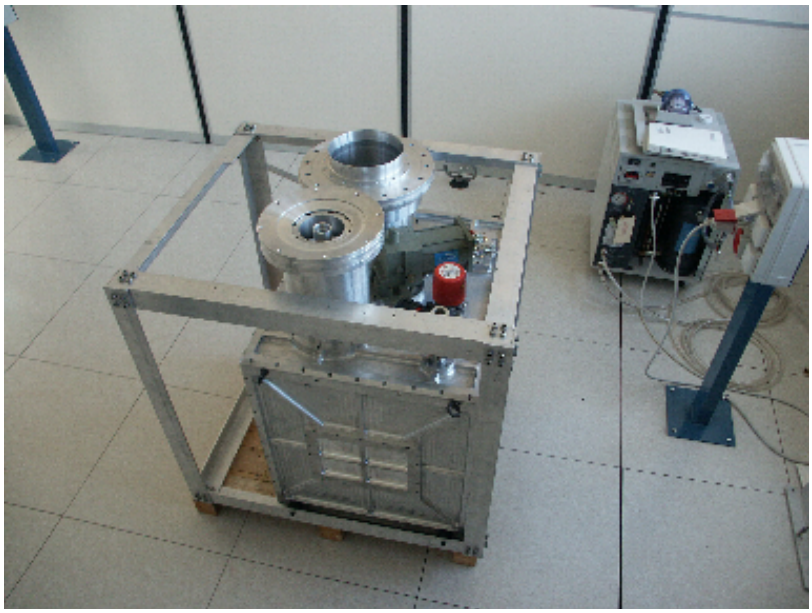

Figure 1. Receiver Box View with Dewar and Feeds

2. Main Receiver Features

In the following list, the main difference with respect to the old system are shown:

Wide X band for geodesy (8100-8900 MHz);
New design for the both cooled (77 K) feeds, the coaxial S/X and L band;
Cooled (20 K) low noise cryogenic front-end amplifiers;
Centralized synthesizer used as local oscillator for the full set of receiver (including the secondary focus receiver system);
Double Up-Converter for the VLBA terminal;
Four IFs usage with remote feeding selection;
Two IFs coarse-fine power level control;
Entire set of receivers controlled and checked by Windows based software (dialogue with FS in development).

Temperature performance showed in laboratory satisfactory values, with a total noise contribution including feed and amplifiers of about 15-20 K in L and S band, while 20-25 K in X band. The actual final system temperature will be determined when the receiver will be mounted on top of the antenna, during 2002.