22 GHZ RADIOMETER FOR VLBI STATION "SIMEIZ"

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The 22 GHz VLBI cooled radiometer was put into operation at 22-m radio telescope of the CrAO (station "Simeiz" of the European VLBI Network). The System Equivalent Flux Density was measured as 2300 Jy in zenith.

VLBI is a very powerful tool for study of the Active Galactic Nuclei (AGN), Star Formation Regions (SFR), and Stars: it gives a possibility to study their structures with angular resolution up to submilliarcsecond, which is not reached in other regions of the electromagnetic spectrum.

The radio telescope of the Crimean Astrophysical Observatory with a 22-m dish (RT-22) has taken part at VLBI observations in 1969 using Mark-I system and rubidium frequency standard. Then the RT-22 was included as an international station "Simeiz" into the global European VLBI network for astrophysical studies. The station was equipped with Mark-II system and hydrogen maser frequency standard with stability to be equal to 10^{-14}. These observations were carried out by CrAO and Institute of Space Research of RAS at 1.35, 2.8, 6, 18, 49 and 92 cm. In June 1994, the RT-22 was equipped with Mark-IIIA terminal supplied by GSFC NASA.

In August 1999, the 22 GHz VLBI cooled radiometer was put into operation at the RT-22. The low noise cryogenically cooled receiver was developed and manufactured by Joint-Stock Scientific Production Enterprise "Saturn" with assistance of the Crimean Astrophysical Observatory and the Institute of Radio Astronomy of NASU. Figure 1 shows the block scheme of the low noise 22 GHz receiver and Table 1 gives the receiver parameters. The cryostat with cooled pHEMT amplifier, the phase and the amplitude calibration units have been installed in the secondary focus of the antenna.

Table 1: The parameters of 22 GHz receiver

Parameter	*Range*
Input frequencies	22.0 – 22.5 GHz
Input noise temperature	45 K
IF output frequencies	100 – 600 MHz
Reference frequency	5 MHz

All measurements of the noise of radiotelescope-radiometer system were made by Mark-IIIA and Field System 8.2. System Equivalent Flux Density (SEFD) was measured by observing radio sources with known flux densities: DR21, Virgo-A, Cygnus-A, Taurus-A. The power pattern of antenna was equal to 170″. SEFD was measured as 2300 Jy in zenith, this value of SEFD corresponds to the effective area of 180 m^2 and system noise temperature of 150 K.

The installation of the new low noise receiver has to be considered as the first stage of the upgrading of receiver base of "Simeiz" station which will allow to continue astrophysical single dish and VLBI observations with a high sensitivity.

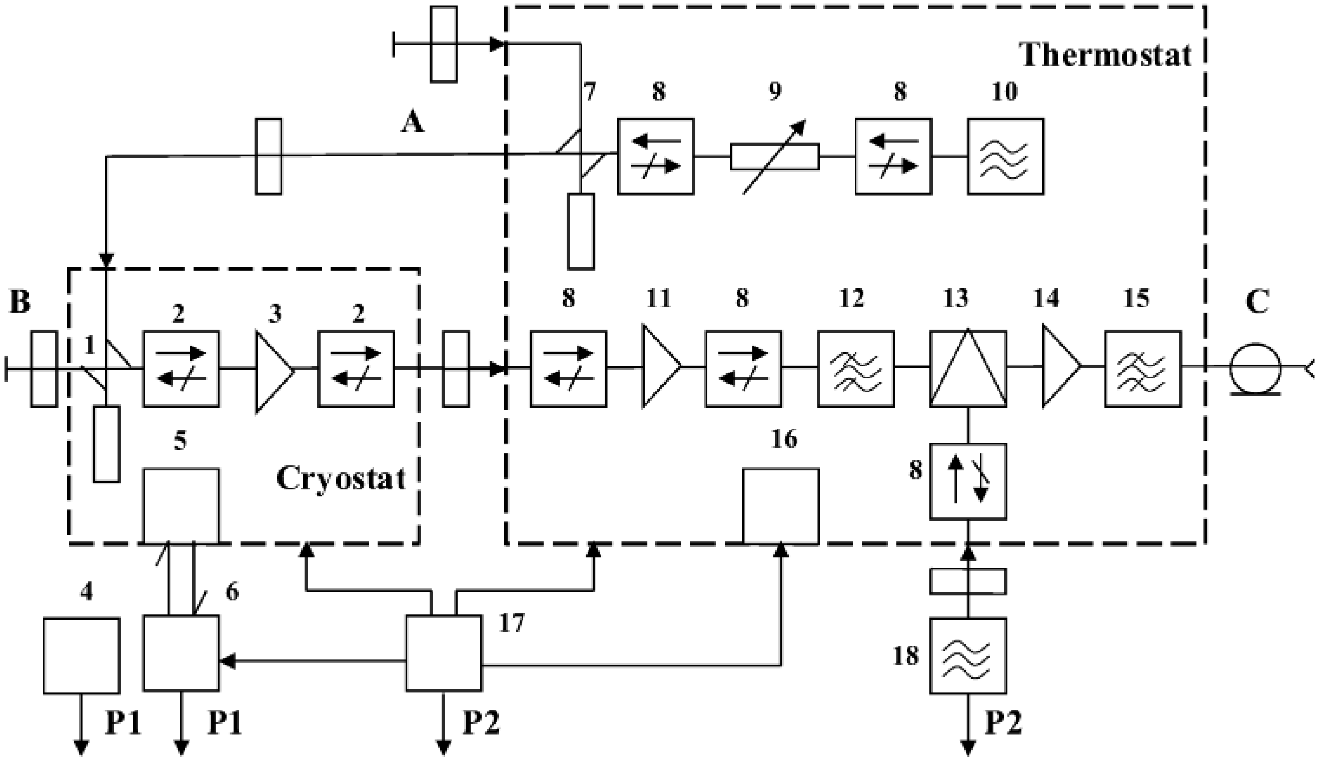

Figure 1: The block scheme of 22 GHz receiver:

1 – directional coupler,
2 – cooled isolator,
3 – cooled amplifier,
4 – vacuum system,
5 – cooled hit,
6 – compressor,
7 – directional coupler,
8 – isolator,
9 – attenuator,
10 – noise generator,
11 – amplifier,
12 – band-pass filter,
13 – balance mixer,
14 – IF amplifier,
15 – band-pass filter,
16 – thermostat system,
17 – power supply and control block,
18 – LO,
A – input phase calibration,
B – input 22.0 – 22.5 GHz,
C – output 100 – 600 MHz,
P1 – power 380 V,
P2 – power 220 V