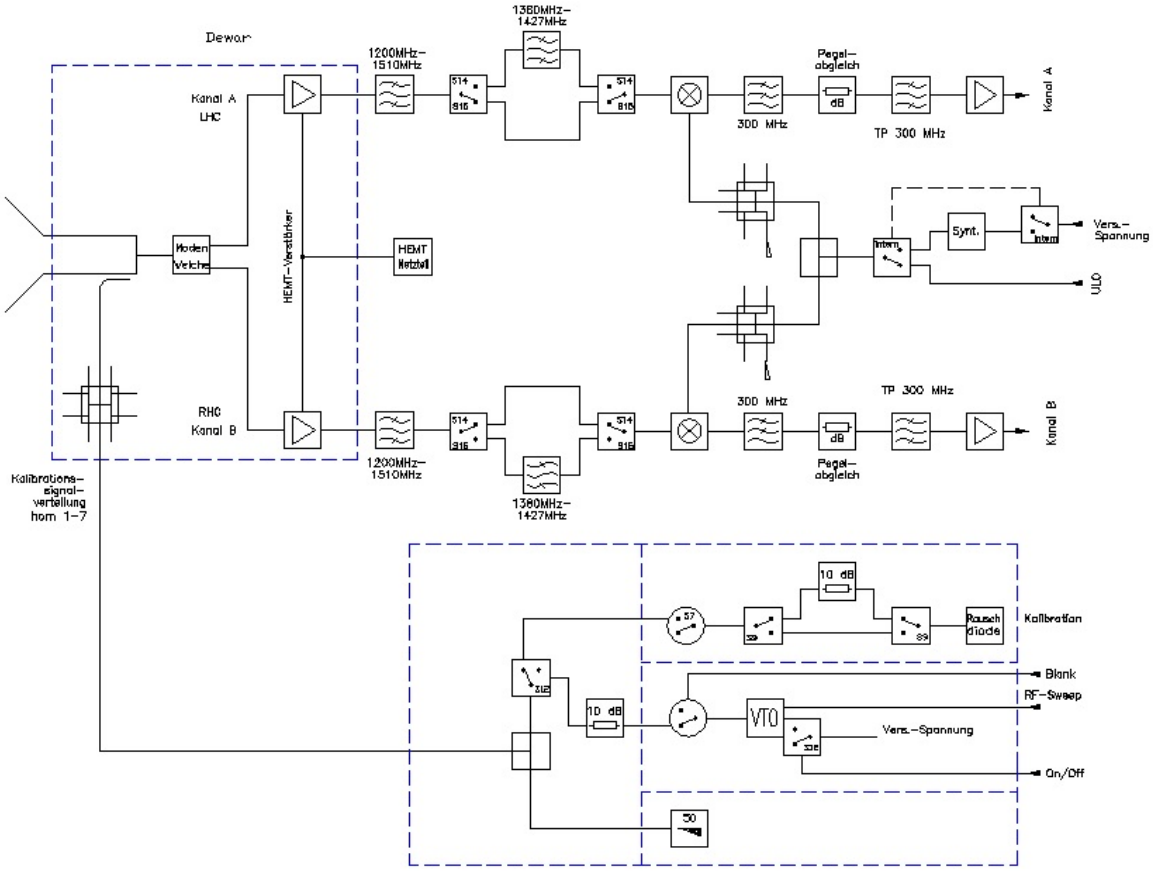
Technical Documentation of the 21cm 7 Beam Receiver 1290 - 1430GHz (P217mm)

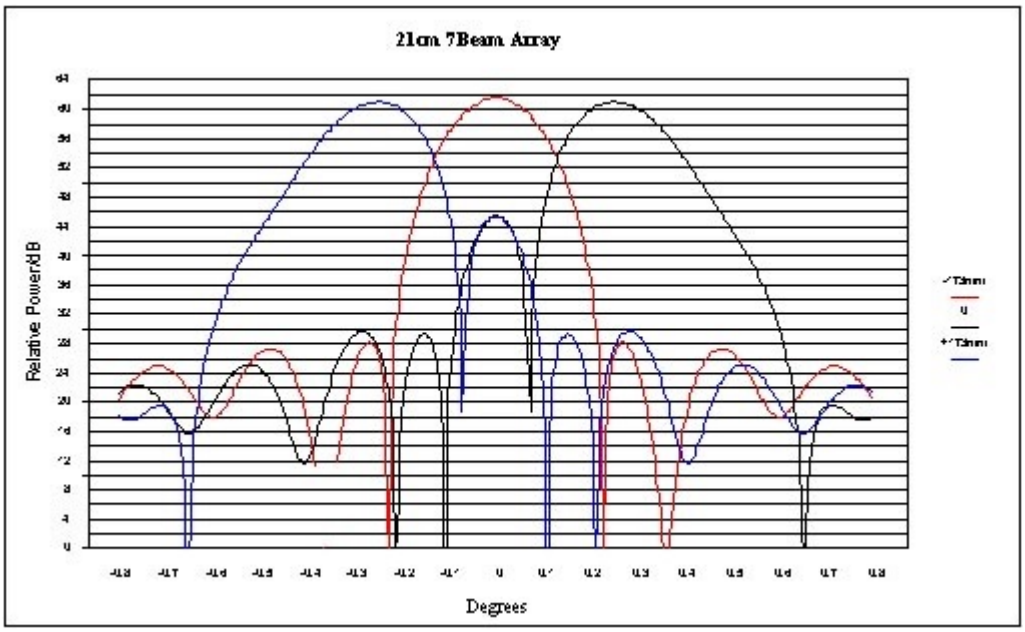
Type	HEMT ,Cooled
Channels	14 in 7 beams
Receiver Noise Temperature	10 K - 20 K (see below)
Frequency Range	1260 - 1510 MHz
Bandwidth RF-Filters	1260 – 1510 MHz
→	1380 – 1427 MHz
Calibration	Noise Diode,VTO: yes
Phaseshift	no
feed	Coaxial Horn
Beam separation	0.25° = 1,6 beam widths
1. Oscillator	ULO1 or LO, upper side band, 1230 MHz
1. IF	30 - 280 MHz

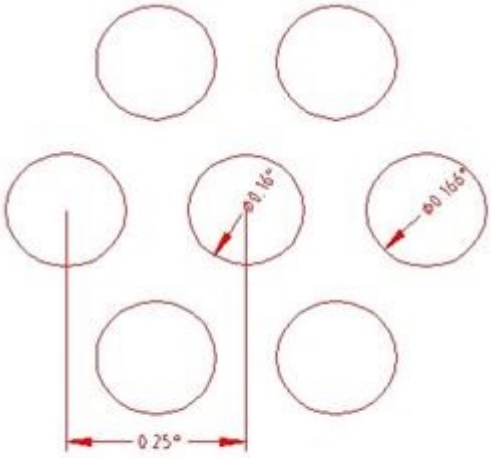
====== Block Diagram ======electronics:rx:techinfo



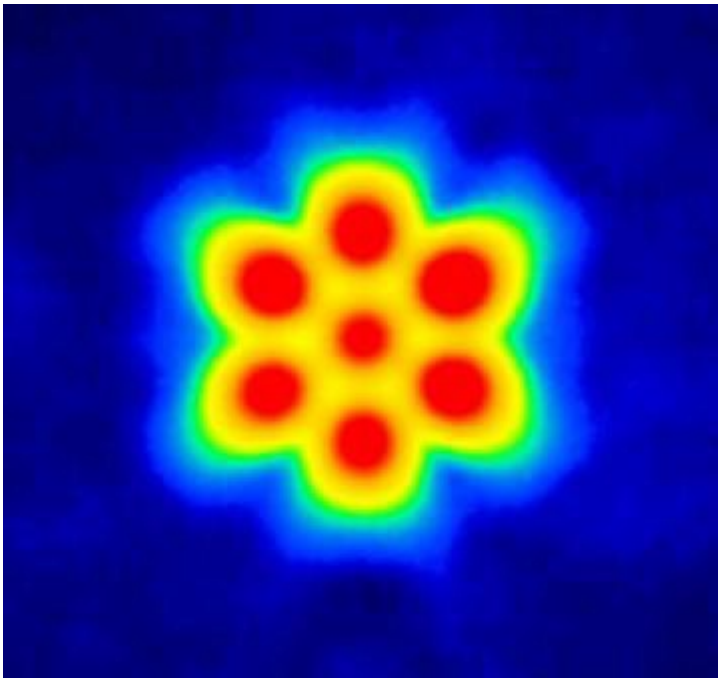
Charts

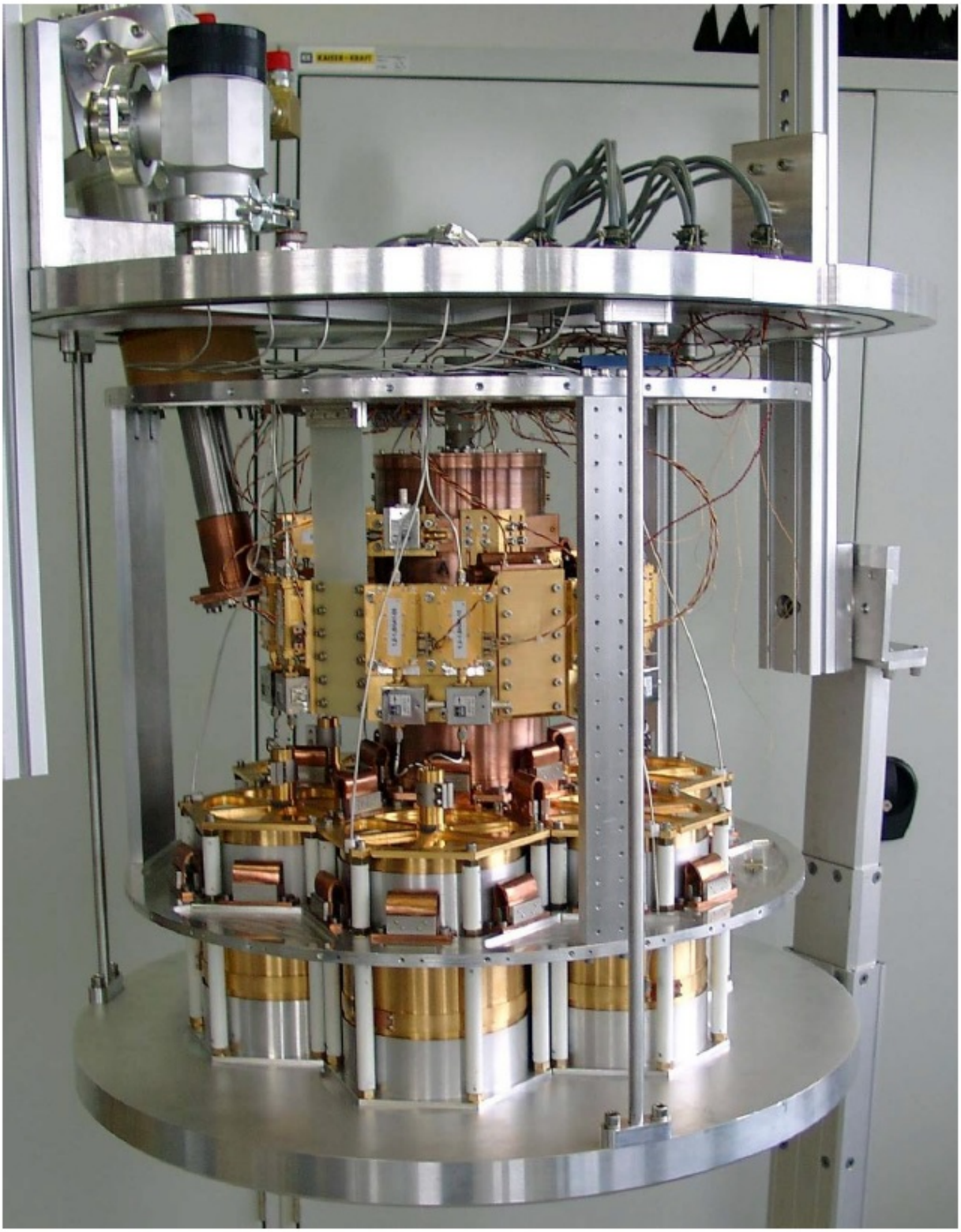
> Antenna Diagram and Beam Distribution:

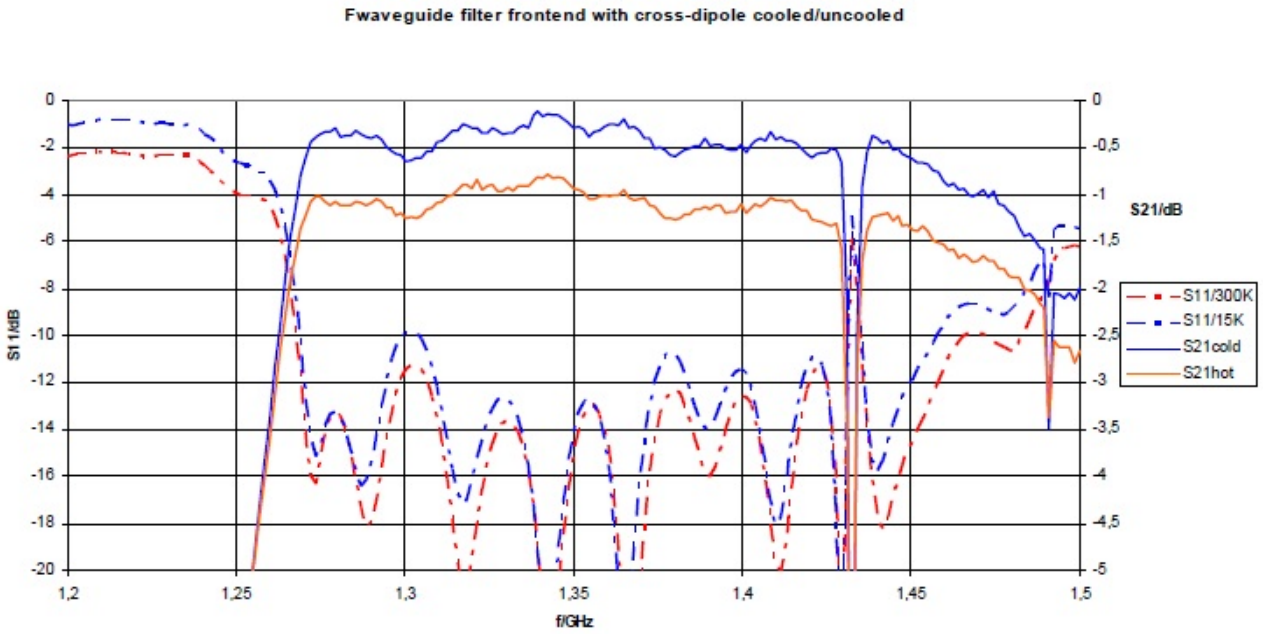




Beam distribution







Measurements of one of the outer front-ends at 15 K and 300 K.

Channel	Polarization (sky)	S14, S15 = 0: 140 MHz bandwidth			S14, S15 = 1: 47 MHz bandwidth		
		T_E /K	$T_{cal\ I}$/K	$T_{cal\ II}$/K	T_E /K	$T_{cal\ I}$/K	$T_{cal\ II}$/K
0A	LHC	20,9	12,6	1,3	20,9	4,5	0,5
0B	RHC	20,5	16,8	1,7	20,5	5,5	0,6
1A	V	13,9	10,2	1,0	13,9	4,0	0,4
1B	H	10,9	13,2	1,3	10,9	4,1	0,4
2A	V	16,8	17,2	1,7	16,8	4,8	0,5
2B	H	9,9	10,6	1,1	9,9	4,7	0,5
3A	V	20,6	10,4	1,0	20,6	4,2	0,4
3B	H	14,2	13,3	1,3	14,2	4,0	0,4
4A	V	17,6	13,6	1,4	17,6	3,9	0,4
4B	H	13,5	12,5	1,3	13,5	4,0	0,4
5A	V	19,3	11,7	1,2	19,3	3,6	0,4
5B	H	14,3	10,5	1,1	14,3	4,0	0,4
6A	V	11,4	9,6	1,0	11,4	4,4	0,4
6B	H	14,1	8,9	9,0	14,1	5,1	0,5

> Measured Noise Figure of the 14 receiver channels.

comments

> **Beam - Park Experiments**

This is a receiver for the 21 cm Radioastronomy band. It is primarily built for the European Space Operation Centre (ESOC) for space debris measurements in Beam-Park Experiments (BPE). The Project is entitled „Multi-Beam Receiver for Beam-Park Experiments“, Contract No. 16173/02/D/HK, and pays all the material cost of the receiver while manpower is provided by MPIfR. Beam Park Experiments for space debris measurements are performed by a bistatic radar arrangement with the antenna beams parked at one certain point at the sky. The transmitting station is the TIRA antenna of FGAN in Wachtberg – Werthofen near Bonn, which is 21 km line of sight apart of the receiving Effelsberg telescope. In this configuration debris particles down to 9 mm diameter at 800 km to 1000

km height can be detected. This could be demonstrated in a first joint measurement in 1996: COBEAM.

A new backend was also developed for this receiver. It consists of seven commercially of the shelf dual channel sampling cards. The data is digitized with a sample rate up to 100 MHz and can be processed by a powerful FPGA. For BPE the sampled data is filed through the FPGA to a PCI system together with an accurate time stamp. BPE are now performed on a regular basis since June 2006.

Radio Astronomy

The 21 cm seven beam receiver is operated in Effelsberg and can be used for radio astronomy purpose most of the time. Two filter bandwidths are available: the protected radio astronomy band 1380 MHz to 1427 MHz and the full receiver bandwidth 1260 MHz to 1510 MHz. The centre horn has circular polarization, the outer horns are linear polarized. The horns are arranged in an hexagonal package close together. The beam footprint at the sky is shown below.