

Linearity Measurements
of Mark-4 rack IF
Total Power Detectors

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1 Introduction

This report shows a set of measurements to verify the linearity of the four total power/continuum detectors of the Mark-4 VLBI rack installed in the backend room of the 40m radiotelescope in Yebes Observatory (Guadalajara, Spain).

The origin of these measurements comes from the need to have several power detectors simultaneously for radioastronomy observations. Currently, there is only one continuum detector, the OAY-14 unit, operating from 50 MHz to 1500 MHz whose detected voltage is read by a Keithley 2701 digital multimeter. The remote control and communications with this multimeter are performed through its Ethernet port.

First, the measurement setup will be described together with the instrumentation use for this purpose in section 2. After this, the results will be shown in section 3.

2 Measurement setup

The measurements were performed the 11th of November, 2009. The equipment used for these measurements was placed in the backend room of the 40m radiotelescope, as shown in figure 1.

The instrumentation used for these measurements consists of the following elements:

- Additive-white-gaussian-noise (AWGN) generator (100 MHz - 1100 MHz) with manual 1dB step output power control, developed in Yebes laboratories.
- Band-pass filter (500 MHz - 1000 MHz), model Lorch Microwave 7BP7-750/600A-SM/S, sn. AJ1.
- 2-way power splitter (10 MHz - 2000 MHz) model Mini-Circuits ZFSC-2-11-S.
- Rohde-Schwarz NRVS power meter with NRV-Z15 power detector.
- Fluke 77 IV voltmeter.
- Low loss coaxial cables.

The power of the AWGN generator was modified at 5dB steps and measured with the Rohde NRVS power meter, to have an indication of the input

power to the Mark-4 IF continuum detector. The detected voltage was measured with the Fluke voltmeter at the monitoring front-panel outputs, as shown in figure 1.

3 Results

The measured values of input power and detected voltages for each one of the four Mark-4 IF detectors (A, B, C and D) are shown in table 1 and plotted in figure 2 for better visualization.

It can be concluded, from figure 2, that the Mark-4 IF total power detectors are linear in the input power range from **-32 dBm** to **-22 dBm**.

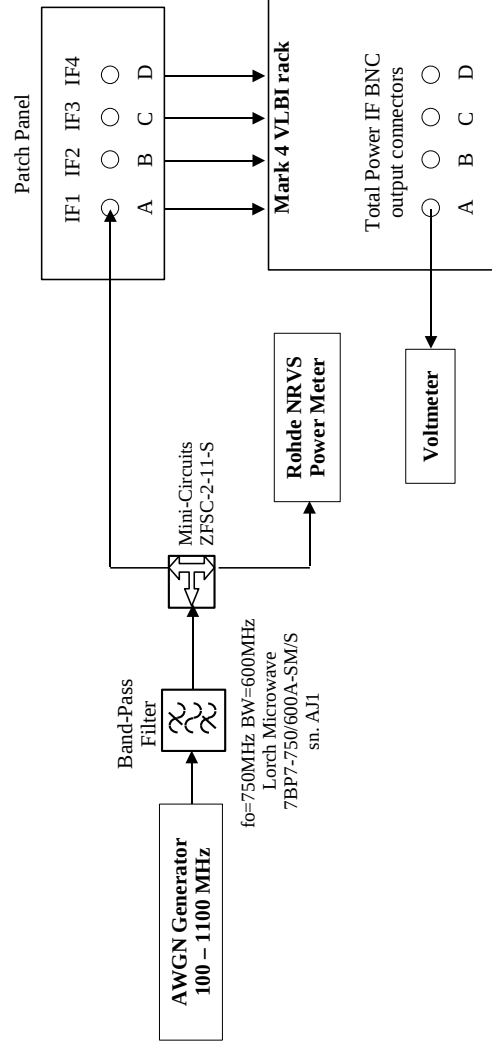
Acknowledgments

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Table 1: Mark-4 IF continuum detector linearity measurements.

AWGN Aten. (dB)	P_i IF-A (dBm)	V_o IF-A (V)	P_i IF-B (dBm)	V_o IF-B (V)	P_i IF-C (dBm)	V_o IF-C (V)	P_i IF-D (dBm)	V_o IF-D (V)
40	-46.82	0.03	-46.97	0.05	-47	0.04	-47.12	0.03
35	-41.82	0.09	-41.88	0.12	-41.9	0.1	-41.92	0.08
30	-36.75	0.29	-36.82	0.36	-36.83	0.29	-36.84	0.25
25	-31.63	0.93	-31.69	1.15	-31.7	0.93	-31.71	0.79
20	-26.54	3.07	-26.59	3.79	-26.6	3.11	-26.62	2.61
15	-21.59	5.54	-21.64	5.66	-21.66	5.62	-21.67	5.72
10	-16.34	5.69	-16.38	5.76	-16.4	5.73	-16.41	5.83
5	-11.01	5.77	-11.05	5.84	-11.06	5.8	-11.07	5.93
0	-5.44	5.78	-5.47	5.84	-6.6	5.81	-6.6	5.95

Figure 1: Measurement setup.



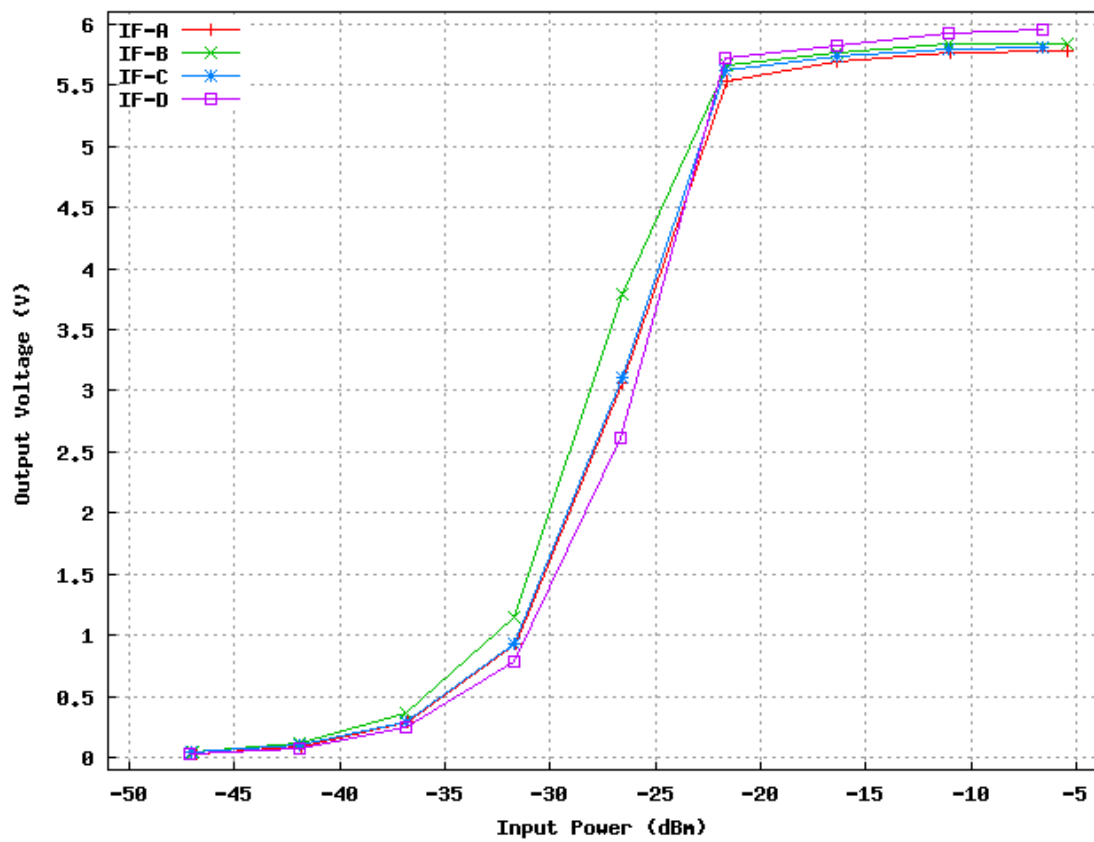


Figure 2: Mark-4 IF total power detector linearity.