

UNIVERSITY OF SOUTH AFRICA

ELECTRICAL ENGINEERING DEPARTMENT

B-TECH: INDUSTRIAL PROJECT IV

**L-Band microwave receiver for the initial testing of
the KAT-XDM Telescope**

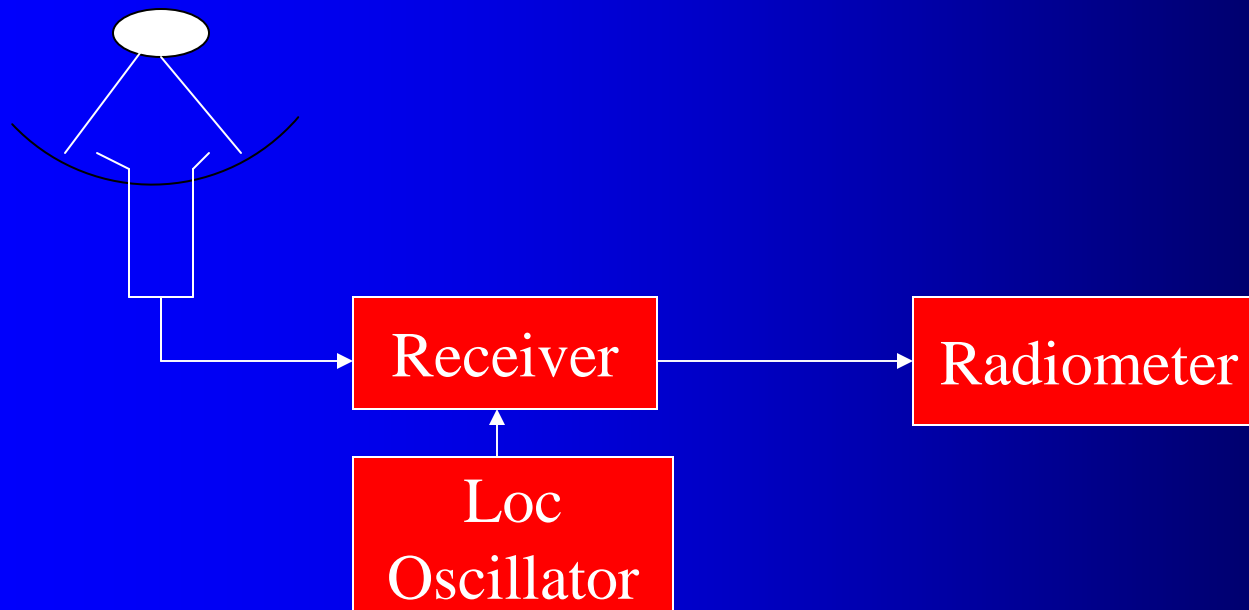
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TOPICS

- Introduction
- Project objectives
- Theoretical analysis
- L-Band receiver design
- System performance test
- Conclusion

Introduction

- Radio Astronomy
- Radio Telescope
- Radio Astronomy in Africa



Introduction



Project objectives

- Design, development, testing and calibration of an L-Band, radio astronomy microwave receivers that will used to perform the initial testing of the KAT-XDM telescope

Theoretical analysis

Important Requirements

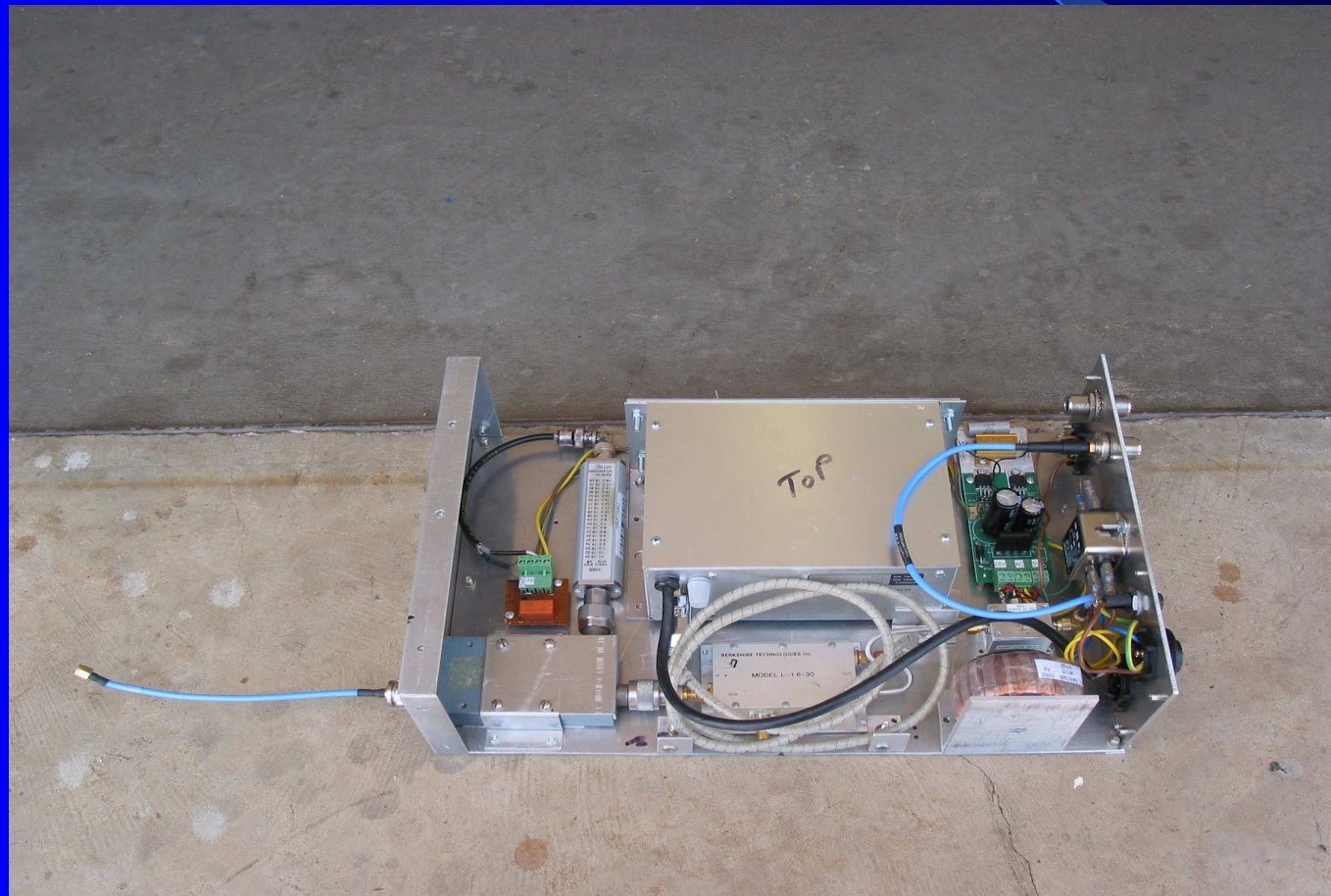
- ⑩ High gain
- ⑩ High sensitivity
 - ⑩ Low noise temperature
 - ⑩ Good stability
- ⑩ Radio Frequency interference (RFI) rejection
- ⑩ Availability of a calibration noise source

Theoretical analysis

Important Requirements

$$\Delta T_{\text{min}} = \frac{K_s T_{\text{sys}}}{\sqrt{\Delta v t n}}$$

Built L-Band receiver



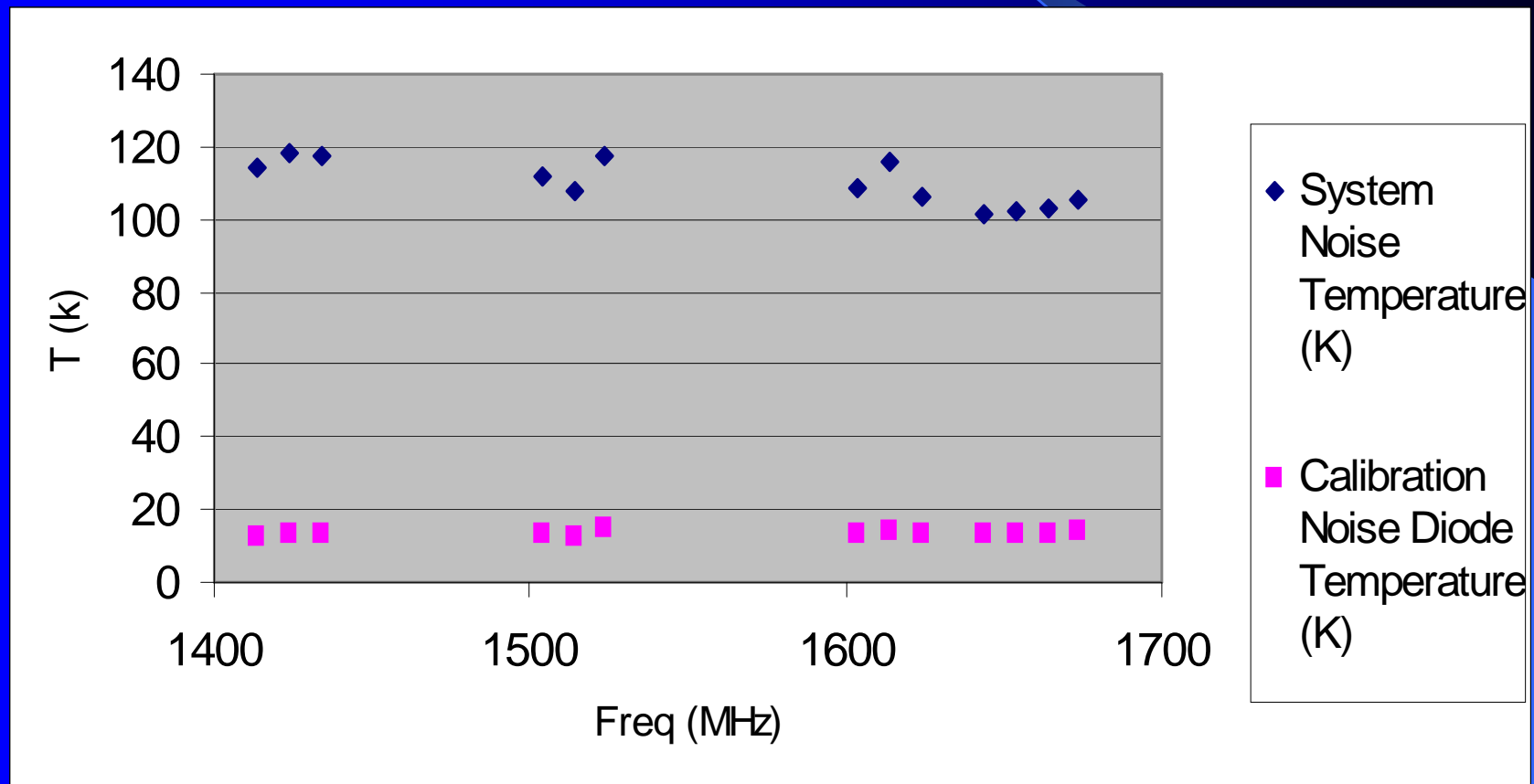
System performance test



L-Band receiver measured gain

Freq (MHz)	Gain (dB)
1414	45
1424	45
1434	45
1604	43
1614	43
1624	43
1654	42
1664	42
1674	42

L-Band receiver Measured Equivalent Noise Temperature



Calculated Results

Friiss' formula

$$T_e = T_{e1} + \frac{T_{e2}}{G_1} + \frac{T_{e3}}{G_2} + \dots$$

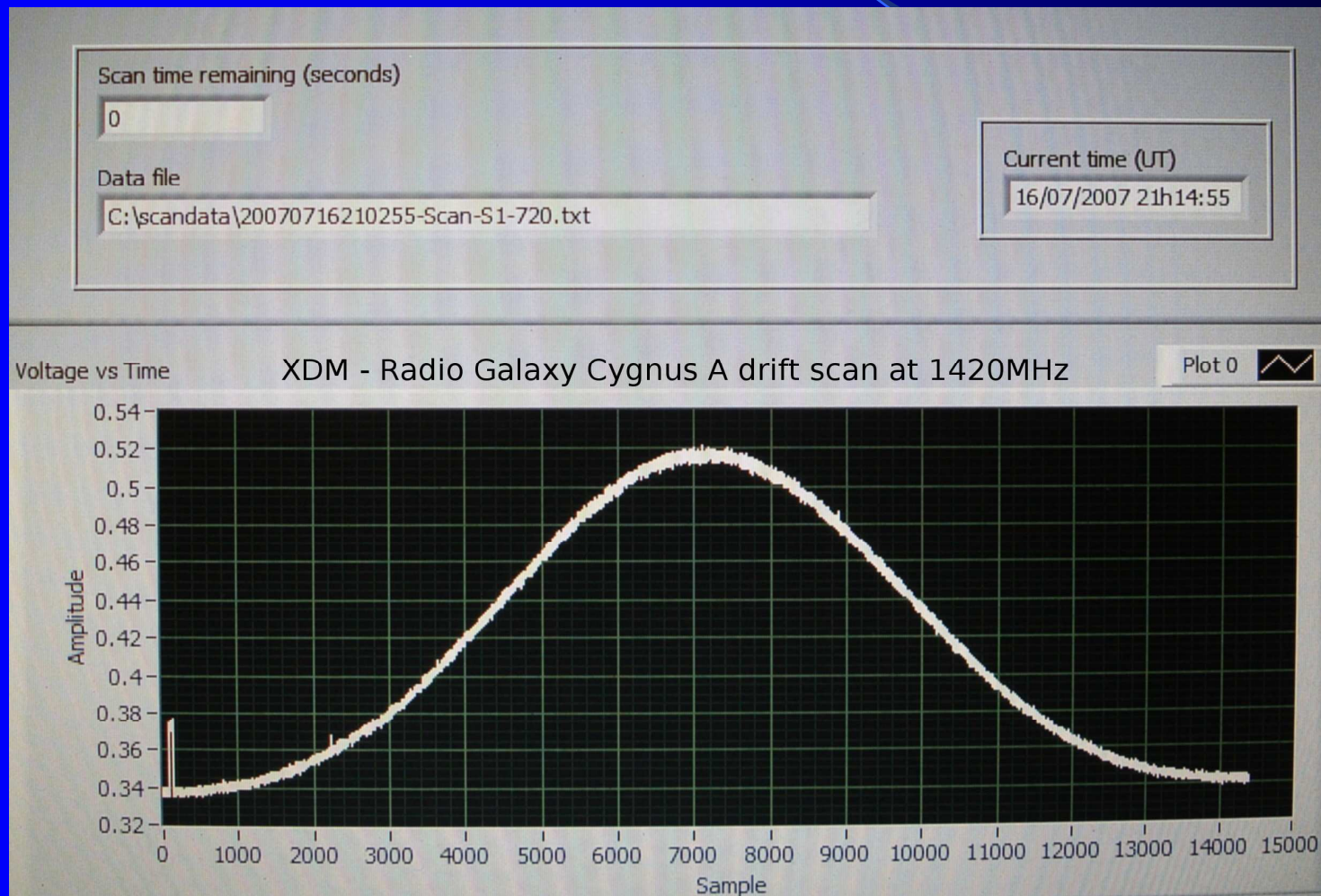
Installed L-Band receiver on the KAT-XDM Telescope



Installed L-Band receiver on the KAT-XDM Telescope



Galaxy Cygnus A drift scan at 1420 MHz



Conclusion

- The microwave receiver's measured system noise temperature and gain meet the required design specifications.