Effect of swapping the first two amplifiers on operation of a 2.3 GHz radio astronomy receiver

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Abstract

This paper investigates the effect of swapping the first 2 amplifiers in a radio astronomy receiver.

1 Introduction

The interaction between the various units that comprise the radio receiver is fairly complex and some seemingly minor rearrangements of the hardware can catch the uninitiated unaware.

2 Theory

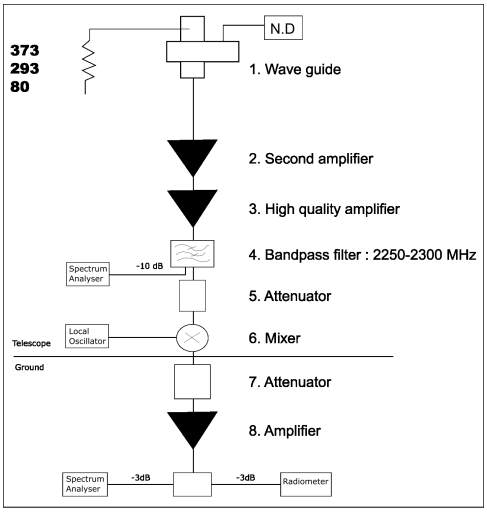

Figure 1: Receiver with first two amplifiers swapped

3 Procedure

The amplifiers in the existing receiver must be physically interchanged as shown in figure 1. The experimental procedure is identical to that taken in Carr (2005).

4 Results

	measured	uncertainty		measured	uncertainty							
Cold temp	0.314	0.001	Y factor	3.65	0.02	dB					dTn	don
Hot temp	0.729	0.001		2.317395	0.010672		Tn	142.4087	4.024881	K	dTh	0.576193
			Rough Y	2.321656	0.0105785			141.6916			dTc	3.094341
											dY	28501.76
heated	373	1	K									
normal	293	1	K	B	50000000	hz						
cooled	80	2	K	k	1.381E-23	J/K						

Figure 2: Table of results for system temperature with amps swapped

temperature	calculated	uncertainty	units
T_N	85.2	3.4	K
$T_{N_{swapped}}$	142.4	4.0	K

Table 1: Comparison of original and swapped noise temperatures

5 Discussion

The swapping of the amplifiers increases the noise temperature of the system by 57.18 K. Any noise initially introduced into the system dominates the rest of the noise contributions throughout the rest of the receiver. It is therefore desirable to set the noise injected at the first stage of the receiver as low as financially possible. Even seemingly small deviations in noise characteristics result in pronounced differences following the amplification of the first amplifier.

6 Conclusion

The further up the circuit noise is introduced, the more important it is. It is therefore of the utmost importance to utilise the highest quality amplifier available in the first stage of the receiver.

References

Carr, D. (2005), *Determination of the noise temperature of a 2.3 GHz radio astronomy receiver system and noise diode.*