Investigation of the introduction of lossy cable prior to the first amplifier of a 2.3 GHz radio astronomy receiver

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Abstract

This paper explores the effect of a lossy cable in the system preceding the first amplifier.

1 Introduction

At frequencies in the gigahertz range, the normally negligible impedance offered by conducting wire become appreciable. This is circumvented by using waveguides to transmit the high frequency signals received from the source, and mixing the signal down before it is transmitted via cabling. The extent to which high frequency loss in wire warrants consideration is best shown experimentally.

2 Theory

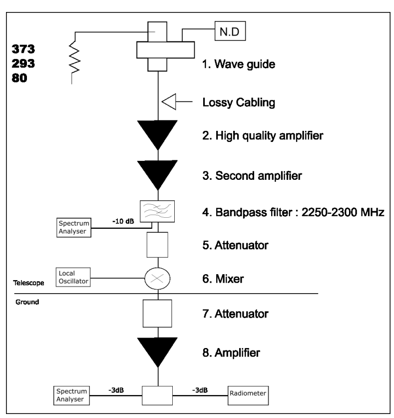

Figure 1: Radio astronomy receiver fitted with lossy cable

3 Procedure

The lossy cable must be introduced between the source resistors and the first amplifier in the existing receiver, as shown in figure 1. The experimental procedure is identical to that taken in Carr (2005).

4 Results

	measured	uncertainty		measured	uncertainty			measured	uncertainty		
Cold temp	0.344	0.001	Y factor	3.82	0.02	dB					dTn
Hot temp	0.819	0.001		2.409905	0.011098		Tn	127.815357	3.8555572	K	dTh
			Rough Y	2.380814	0.0098279			132.1936842			dTc
											dY
heated	373	1	K								
normal	293	1	K	B	50000000	hz			L		1.1
cooled	80	2	K	k	1.381E-23	J/K					

Figure 2: Table of temperatures with the lossy cable

temperature	calculated	uncertainty	units
T_N	85.2	3.4	K
$T_{N_{wire}}$	127.8	3.9	K

Table 1: Comparison of original and wired noise temperatures

5 Conclusion

The losses introduced by the cable are appreciable. This reinforces the importance of waveguide design in the initial sections of the circuit which deal with the signal as received from the source.

References

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