Report

Analysis of air coaxial cable 5m-dish/shack at Bleien observatory in view of Phoenix-3

Author(s):
Monstein, Christian

Publication Date:
2007

Permanent Link:
https://doi.org/10.3929/ethz-a-005385235

Rights / License:
In Copyright - Non-Commercial Use Permitted
Analysis of air coaxial cable 5m-dish/shack at Bleien observatory in view of Phoenix-3.

Christian A. Monstein, Hansueli Meyer

ETH Zurich, Institute of Astronomy, CH-8092 Zurich, Switzerland

Draft 27.05.2007 / Updated 28.05.2007

Abstract. The coaxial cable between antenna and receiver needed to be tested and qualified in view of the new planned solar FFT radio spectrometer Phoenix-3. The cable should be as broad in frequency as possible to keep the dynamic range of the spectrometer. Cable loss should be as low as possible to not increase the noise figure of the whole instrument.

Key words. TDR, attenuation, cable loss, dB.

1. Introduction

On Thursday, 24th and Friday, 25th of May 2007 we made several qualification tests on the antenna and the existing cabling to get information about different high frequency aspects of the present system. The results are presented and discussed below. This coaxial cable issue needs to be discussed and a solution has to be defined. The decision has direct impact on the design of the receiver and also direct impact to additional costs because no budget has been assigned to this aspect. Different acronyms used in labels and text are described in Table 1.

2. Measurements and Results

Two different measurements have been made to qualify the old, long and thick air coaxial cable between 5m dish and the observatory. The first measurement of the attenuation using a rf signal generator and a broad power meter lead to the attenuation plot shown in figure 1. The second measurement was done with a hp time domain reflectometer hp1415A. Several configurations were tested to identify any discontinuity in the coaxial cable. So far, all tests were acceptable. In the zoomed picture (figure 5) one can recognize two small steps. The first one is due to N-connection between the air cable and a RG-213 extension cable 6m long. The second discontinuity can not be identified because it’s below the ground about 10m away from the shack. Its amplitude is too small to conclude a complete malfunction of the cable.

3. Conclusions

Although the cable is quite old, it seems to be in good order. But its highest frequency is roughly 5GHz. Presumably the cable was originally specified up to 3GHz about 25 Years ago. So there are about four solutions to this problem which shall be discussed internally.
3.1. Pull in an additional cable

Pulling in an additional cable seems to be simplest solution but, it may not succeed due to the fact that the existing cable were tight together. Thus, we have a high risk of destroying the new and also the existing cables while pulling the new one through the underground tube. The expected cost are in the order of 2000SFr plus 2 days x 3 people of work.

3.2. Complete replacement of all the old cables

This solution is even more expensive because all the old cables have first to be pulled off of the underground tube. This takes some time and a powerful tractor and some additional tooling are needed. Pulling in new cables takes some time because all connections have to renewed. There are two control cables having 37 pins each. Expected cost in the order of 3200SFr and 3 days x 3 people of work.

3.3. Stay with old cable but reduce frequency range to 5GHz

This alternative costs nothing, we stay as we are now but have to reduce the highest observable frequency to less than 5.4GHz (5GHz).

3.4. Stay with old cable and use it for base band only

This is not a real alternative because we then need to put the receivers into the 5m tower. This is a thermal issue because of the high temperature differences between day and night as well as between summer and winter in the of range from $-20^\circ$ up to $+50^\circ$. We needed an air conditioning system for temperature and a humidity conditioning system which are quite a cost factor. Also maintenance is not easy due to the fact that space in the tower is occupied by existing motion control, humidity conditioner and cabling.

Acknowledgements. We thank specialists from Huber&Suhner company for discussions about old fashioned air cable and some possible solutions.