LINEARITY CHARACTERIZATION OF DETECTORS FOR INTERFEROMETRIC RADIOMETERS

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1. INTRODUCTION

The performance of the power detectors used to denormalize the digital correlations in interferometric radiometers may be degraded due to the non-linear behavior of the diode response. This work presents the comparison of two methods used to characterize and correct the non-linear response of the detectors. The results are illustrated by presenting the characterization of the MIRAS (Microwave Imaging Radiometer with Aperture Synthesis) instrument [1], which is the single payload of the ESA-SMOS mission [2]. The MIRAS instrument is compounded of 63 receivers (LICEF) equally distributed in the arms of a "Y" shape array. Other 9 receivers are also used as reference real aperture radiometers and/or redundancy. In order to denormalize the 1 bit-2 level digital correlations each LICEF includes a PMS (Power Measurement System) to measure the system temperature. This set of 72 PMS has been thoroughly characterized on-ground by Mier Comunicaciones, La Garriga, Spain. The presentation will summarize the main results of this work, organized as follows:

- Measurement set-up
- Comparison of measurement errors
- Linearity correction comparison
- Conclusions

2. MEASUREMENT SET-UP

In order to characterize the non-linear behaviour of the PMS detectors two methods are taken into account, the so-called

a) Constant deflection method [3]
b) Slope method [4]

Both methods have the major advantage that the detector response is characterized using the PMS in an operating condition close to nominal. In addition, the set-up makes use of the radiometer circuitry providing an end-to-end characterization. This section will provide a brief description of the main features of both measurement methods

3. COMPARISON OF MEASUREMENT ERRORS

The impact on system performance of non-linearity errors has been found moderate (around 1% error) [5]. However, some kind of correction is required in order to guarantee a residual linearity error well below the 1% system requirement. Since the non-linearity is moderate, an accurate characterization is mandatory. This section analyzes the major error contributions in the detector characterization with relation to both methods. The work takes benefit of the fact that the same measurement set-up can be used to implement both characterization methods, since the main difference comes from the data processing procedure.

4. LINEARITY CORRECTION PROCEDURE

Since the magnitudes used to characterize the detector non-linear response in both methods are different, the linearity correction that follows also differs. This section is devoted to evaluate its impact in the correction procedure in relation to the in-orbit calibration of the PMS.

5. CONCLUSIONS

Finally, this section is devoted to summarize the main conclusions of the study, providing a tradeoff assessment on both methods.

11. REFERENCES

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