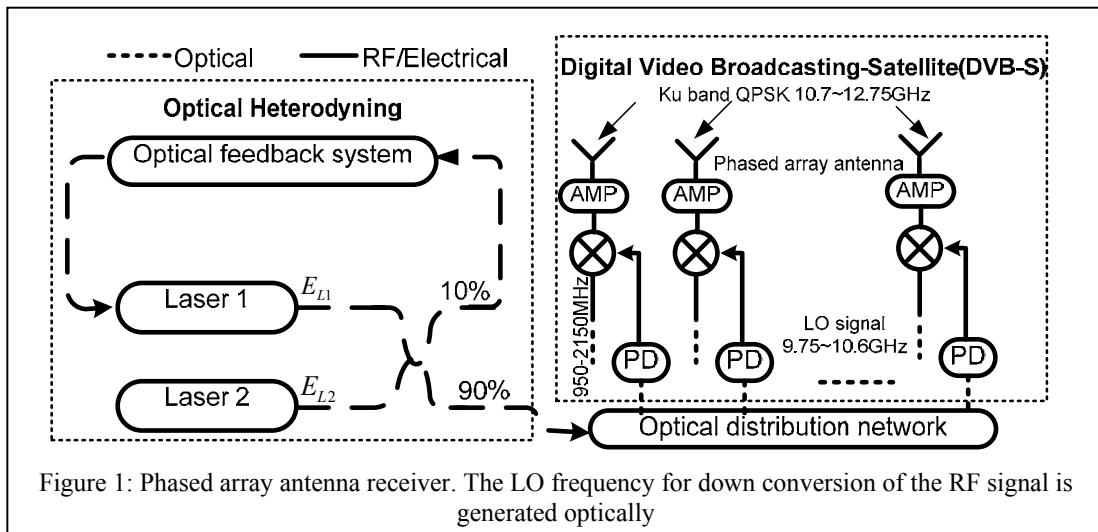


Analysis of Phase Noise and CNR Degradation of Externally Generated LO signal in LNB for Ku-Band DVB-S Systems by Heterodyning Two Lasers

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Abstract—We investigate the externally generation of an LO signal by optical heterodyning, which is then distributed to each of the mixers at every antenna element of a phased array antenna used for standard DVB-S (digital Video Broadcasting-Satellite) reception system. The system¹ is presented in Figure 1. The Ku-Band (10.7 GHz ~12.75 GHz) RF signal from the antenna array is amplified and then down-converted to IF (950 MHz to 2150 MHz) at the mixer by a 9.75 GHz LO signal generated by optical heterodyning.

An optical heterodyning system using two lasers (one tunable and one fixed) oscillating at different frequencies (i.e. 200 THz and approx. 200.01 THz) will be used. An optical distribution network (ODN) will distribute the optical power from the optical heterodyning to a series of photo-detectors. The output signals of the detectors will be the difference frequency of the lasers. We investigate the stability (phase noise) of the optically generated LO in order to comply with LO stability of -105dBc/Hz in a commercially available LNB. The LO can be further stabilized by implementing a feedback loop in the



optical heterodyning system.

The effect of total phase noise contribution from all the possible noise sources (thermal, shot, lasers phase and RIN) from the optical heterodyning is analyzed. In this analysis we will investigate the degradation of the carrier-to-noise ratio (CNR) of DVB-S reception system due to the instability in the LO signal.

The critical parameters of the LO signal (i.e. power and phase stability, drift) will be calculated from optical heterodyning system and the properties of its components (i.e. lasers, ODN, photo-detectors, feedback loop). The results will then be compared with the performance of a standard LO in a LNB.

¹ This work is in the framework of the MEMPHIS project. The authors gratefully acknowledge the support of the Smart Mix Programme of the Netherlands Ministry of Economic Affairs and the Netherlands Ministry of Education, Culture and Science.