Design of Wideband Quadruple-Ridged Flared Horn Feeds for Future Radio Telescopes

Marianna V. Ivashina[1], Theunis S. Beukman[2], Carlo Bencivenni[1], Oleg Iupikov[1], Rob Maaskant[1], Petrie Meyer[2], Miroslav Pantaleev[3]

[1]*Department of Signals and Systems,* [3]*Onsala Space Observatory, Chalmers, Gothenburg, Sweden*
Email: marianna.ivashina@chalmers.se; carlo.bencivenni@chalmers.se, oleg.iupikov@chalmers.se, rob.maaskant@chalmers.se; miroslav.pantaleev@chalmers.se

[2]*Department of Electrical and Electronic Engineering, Stellenbosch University, Stellenbosch, South Africa*
Email: theunis.beukman@gmail.com; pmeyer@sun.ac.za

I. INTRODUCTION

Balanced excitations are required to achieve ultra wideband performance with the novel reflector-antenna feeds consisting of pair(s) of interleaved spiral, log-periodical or other travelling-wave structures, which are currently being developed for radio astronomic instruments [1]–[3]. This excitation is commonly realized by using a balun interfacing the balanced antenna to single-ended amplifiers. However, practical designs of such passive networks are often bulky and lead to power dissipation losses. Power dissipation reduces the antenna radiation efficiency and increases the system thermal noise temperature. Another limiting factor is that the ultra wideband balun design restricts the reference impedance for the optimum noise matching between the antennas and low-noise amplifiers (LNAs). To obviate these disadvantages, differential low-noise amplifiers (dLNA), which can be directly integrated at the antenna terminals, represent an interesting alternative solution.

II. RESULTS

In this paper two designs of the quadruple-ridged flared horn (QRFH) antennas are presented: one design in [4] that is based on conventional excitation using the ridge-to-coax balun transition [1] and another one with a new type of differential feed that allows for the integration of dLNAs [5]. The latter is excited by two orthogonal differential modes and herein referred to as 'quadraxial feed'. We will show that in this configuration the fundamental TE11 mode is most strongly excited over the entire frequency band, while the even-order modes are significantly suppressed, as compared to the conventional excitation. These properties lead to several advantages for QRFH antenna applications which require frequency-invariant beam characteristics, high port isolation and low cross-polarisation level, such as e.g. reflector antenna feeds for future radio telescopes.

III. ACKNOWLEDGMENT

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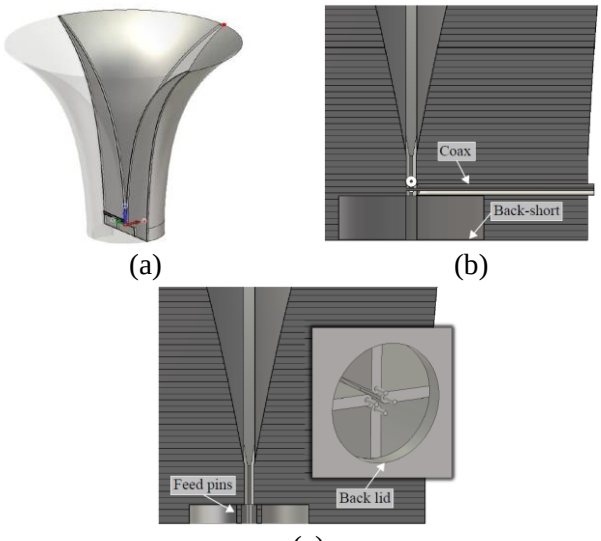

Fig. 1 (a) EM-model of the QRFH antenna with the conventional feed consisting of a back-short section and ridge-to-coax transition, as detailed on fig. (b); and (c) the quadraxial feed with centre conductors connected to the ridges.