Breaking Barriers in Space Observation: High-Power Vacuum Tube Amplifiers for TIRA

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ABSTRACT

Since the 1970s, Fraunhofer FHR's space observation radar TIRA [1] has established itself as the leading research instrument for near-Earth space observation in Europe. As an experimental system, TIRA is used for the development, investigation, and demonstration of radar procedures and algorithms, particularly in the field of imaging and tracking space objects [2]. TIRA is equipped with a 34-meter parabolic antenna, an imaging radar in Ku-band, and a tracking radar in L-band, enabling the detection, imaging, and tracking of orbiting objects such as satellites and space debris.
In the context of the miniaturization of satellites and satellite attachments, the development of the latest scientific methods is necessary to enable the imaging of these objects sufficiently well and to examine them in detail. For this reason, the actual research aims to develop a new imaging radar system in the Ka-band, which enables a significantly higher spatial resolution of space objects and also a detailed analysis of the scattering matrix using a new fully polarimetric concept. The use of the Ka-band enables larger bandwidths for a higher spatial resolution than in the Ku-band currently in use.

Both the L-band and Ku-band, as well as the future Ka-band system currently under development, rely on the most powerful vacuum tube amplifiers available to generate the radar signals. Therefore, FHR has built up a unique wealth of experience in the successful operation of various vacuum tube amplifiers.
The fact that TIRA is a unique experimental system means that the vacuum tube amplifiers must also fulfill unique requirements. In the presentation, we will provide an overview of the special requirements for vacuum tube amplifiers from the user's perspective. Additionally, we will present insights into the challenges in the development of the new quasi-optical transmission system for the new Ka-band system.

References

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