Planar Satellite on the Move Antenna

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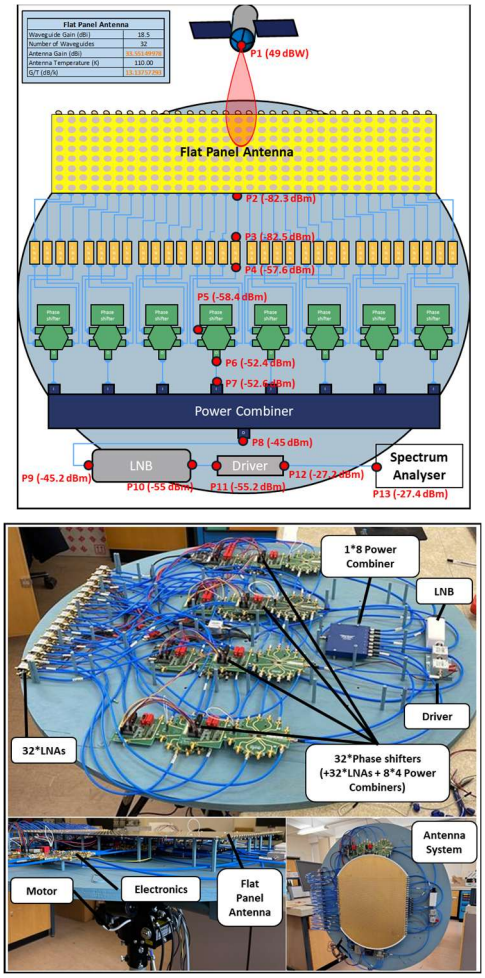
***Abstract*— Emerging satellite communication services increasingly rely on dynamic, multi-orbit architectures to deliver high-capacity, low-latency connectivity. As these networks expand to support 5G and upcoming 6G applications, particularly in remote or underserved regions where terrestrial deployment is challenging, there is a growing need for advanced on-the-move terminals equipped with reliable tracking antennas. These antennas enable continuous alignment with rapidly changing satellite links, ensuring stable performance across diverse orbital regimes and enhancing the overall viability of next-generation satcom infrastructures. Traditional solutions relied on mechanically steered parabolic reflectors, which offer excellent performance characteristics but suffer from increased profile that can be problematic for deployment on mobile platforms. Instead flat panel antennas (FPAs) emerge as a desired solution for mobile and LEO/MEO satellite connectivity. FPAs with beam tracking capability are essential for maintaining LEO satellite tracking and vary from fully mechanical solutions to electronically steered architectures. For achieving high scanning speed and efficiency, phased array antennas represent a compact option that delivers excellent scanning capability, high gain, cleaner radiation patterns, and multibeam operation [2]. However, such benefits come with increased power consumption and cost due to a high number of RF components like beamformers, low-noise amplifiers and power amplifiers. Hybrid solutions combining electronic and mechanical technologies offer a practical compromise, maintaining performance while lowering RF hardware costs. In this work, we introduce an integrated and economical SCOM on-the-move platform (Fig. 1), combining electronic elevation scanning achieved through a flat-panel leaky-wave antenna (LWA) array—adapted from an optimized substrate integrated waveguide (SIW) structure previously reported in [3]—with mechanical azimuth scanning. A breadboard of this antenna fitting within a 60cm diameter and meeting satellite communication requirements in the Ku-band has been developed and tested both in the anechoic chamber as well as in the field. The performance indicates favourable measured characteristics including gain in excess of 32 dBi, instantaneous bandwidth of 300MHz as well as measured G/T in excess of 13 dB/K. Future developments will focus on component-level integration rather than off-the-shelf assemblies to minimise insertion losses and improve overall compactness. These enhancements are expected to further advance performance, highlighting strong potential for next-generation satellite communication systems.**



Schematic layout and photo of breadboard

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