Internal Pattern-Steerable High-Gain 1.0 Wavelength Loop Antenna Array Capable of 360 Degrees Sagittal Plane Coverage for Satellite Smartphone Applications

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National Institute of Information and Communications Technology (NICT) in Japan has conducted the research on Satellite/Terrestrial Integrated Mobile Communications System (STICS). In STICS, a single mobile phone can has dual-communication functions for being connected to either terrestrial or satellite link, and it shares the same 2 GHz band between satellite and terrestrial systems to improve spectrum efficiencies. Therefore, satellite/terrestrial link integrated smartphones have opportunities to become popular consumer products in the future. However, it is different compared to the terrestrial phone antennas. For the satellite phones, it needs to integrate antennas with relatively high gain. Hence, it would be a challenge to achieve antenna design with high-gain, wide-coverage and compact size at the same time.

In our prior studies, it showed that by designing two sets of two-element folded loop antenna array at orthogonal top and side edge of a handset PCB respectively, four switchable fan-shape radiating beams are formed to cover 360 degrees of coronal plane (W. Y. Li, W. Chung, A. Miura and H. Tsuji etc., AP-S/URSI 2017). In this paper, a novel internal pattern-steerable high-gain loop antenna array capable of 360 degree sagittal plane coverage for STICS mobile phone applications is presented. Figure 1 shows geometry of the proposed STICS handset antenna array and the measured different directional 3D radiation patterns. The proposed antenna is constructed by designing a 4-element optimized 1.0 λ loop antenna array (Antennas 1, 2, 3, 4) at both top and bottom short-side edges of the handset PCB. And there are eight different directional radiating beams can be generated successfully to cover the sagittal plane of the handset by controlling different on and off combinations of the antenna feeding switch circuit. The measured radiation performances can fulfill STICS satellite-link requirements. More detail analysis will be presented in the conference.

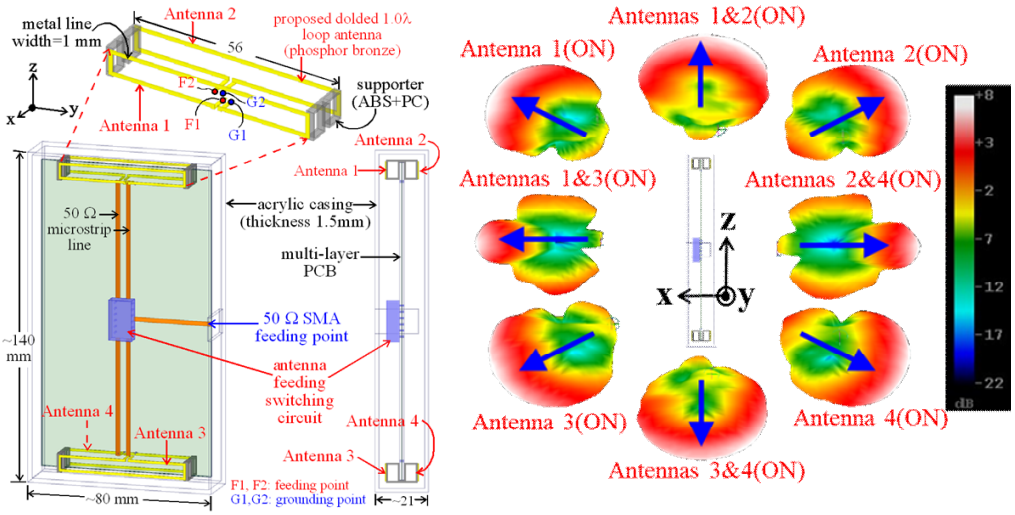

Figure 1. Geometry of the proposed STICS handset antenna array and measured eight different 3D radiation patterns.