Phased array angular imaging technique has recently been paid attention in the weather radar engineering field, which realized several-times higher refresh rates. The angular imaging technique was originally proposed in [1] for researching spatiotemporally complicated structures of tornadoes. In [1], precipitation at several elevational angles are simultaneously observed by using a delay-line arrayed antenna and multiple-frequency transmission. In contrast, a group of Osaka university, Toshiba Corp., and National Institute of Information and Communications Technology developed a phased array weather radar (PAWR) which accomplished an elevational angular imaging by using a single frequency and by sampling received signals individually on each element of the arrayed antenna. The use of a single frequency is practically important for its operational use from a standpoint of frequency allocation [2].

The PAWR radiates a broad transmission beam and resolves the broad angle by multiple narrow reception beams [3]. The broad transmission beam is formed by feeding power to elements in a limited part of the arrayed antenna, which is equivalent to a use of a small-sized antenna. Compared to the broad-beam transmission, an idea of a comb-beam transmission arises. A comb transmission beam consists of several sharp beams which direct separated angles. In [4], the authors introduced a concept of the comb-beam transmission, and showed via numerical simulations that sidelobe levels superior to the broad-beam transmission can be achieved in two-way antenna patterns. The comb-beam transmission concept allows to adjust peak powers of each sharp beam. Thereby, it weakens sharp beams directing higher angles, instead, strengthens lower angles so as to make it be adaptive to troposphere which has a thin layer 0—10 or 0—15 km above ground. Therefore, the concept of the comb-beam transmission is effective for long-range (tens or hundreds of kilometers) radar observation that is typically performed by current weather radars.

In the presentation, the comb-beam transmission concept will be reviewed comparatively to the broad-beam transmission, and a configuration of its radar hardware, which would be reasonable for manufacturing, will be newly introduced.


Keywords: Phased array weather radar, Angular imaging, Comb beam