3.13 ENHANCING WEATHER SURVEILLANCE WITH EECS 3.5GHZ HIGH FREQUENCY DUAL-POL S-BAND WEATHER RADAR SYSTEMS

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Weather radar systems typically operate in one of three frequency bands: S-band, C-band, or X-band. In general, S-band weather radars have the longest surveillance range, the least Doppler velocity ambiguity, and the best performance in observing severe weather (hail, tornado, hurricane, etc.). Therefore, the National Weather Service (NWS) in the United States (US) has chosen the S-band frequency range (2.7-3.0 GHz) for its nationwide Next-Generation Weather Radar (NEXRAD) network. A major disadvantage for S-band radars is the large antenna required to achieve a comparable angular resolution as compared with C-band/X-band radar. The NEXRAD systems typically use a ˜8.5m (28-foot) dish, achieving a beam width of 0.96°@2.7 GHz and 0.88°@3.0 GHz. Given such a large antenna, the system complexity and cost, both up-front and life-cycle, are considerably higher than comparable C-band and X-band systems.

Recently, Enterprise Electronics Corporation (EEC) in Alabama, United States, developed a new type of "high-frequency" (3.5-3.6 GHz) S-band weather radarthe Defender SK1000H series. Compared to NEXRAD systems, EEC's "high-frequency" system applies a much smaller antenna (6.096m or 20-feet), while maintain a similar beam width (0.95°) to that of more traditions S-band radars with a 8.5m dish. Therefore, its size, cost, and complexity are effectively reduced. In addition, due to the frequency increase (from 2.7-3GHz to 3.5-3.6GHz), the radar performance is improved for radar sensitivity, measurement accuracy, and clutter filtering. It is noted that the attenuation @3.5 GHz is only slightly increased and does not affect data quality.

EEC's "high-frequency" Defender SK1000H systems have been delivered to several television (TV) station customers across the US to provide local weather analysis. These systems are generally operated with a very high spatial-temporal resolution configurations (0.25 degree and 125 meters azimuth-range resolution, updating every 0.5-1 minute). Compared to NEXRAD data (0.5-1 degree, 250-1000 meters, updating roughly every 5 minutes), the high-resolution Defender SK1000H data presents surprisingly in-depth details of storm features and evolution. With EEC's advanced radar analysis software, EDGE, the local TV stations can provide high quality weather services, such as quantitative precipitation estimation, flash flood forecasts & warning, and severe weather detection, nowcasting, & alerts. This study presents several cases of high-quality weather surveillance taken from operational EEC Defender SK1000H "high-frequency" S-band radar systems, including several tornadoes and hailstorms in the southern plains of US.