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Polarization upgrade of operational weather radars - a cost-effective realization

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The weather radar community throughout the world has witnessed an ever accelerating development over the past three decades, evolving radar technology from wire-wrapped DVIPs in intensity-only radars over two-channel Doppler analog receivers to single channel Doppler digital receivers that are the current operational state of the art. DWD's research radar at Hohenpeissenberg has taken a major part in all of these developments. However, keeping abreast with the latest developments is a cost factor that can prevent useful new techniques to become operational, especially in a network. On the other hand, a constantly growing users group is now looking for new techniques to discriminate between rain, hail, snow, or ground clutter and to improve precipitation measurement. Dual polarization is considered the most promising technique to achieve this.

Existing polarization setups often require heavy pedestals due to large and expensive dual rotary joints. This may even necessitate modifications in the static structure of existing radar towers. Besides, dual rotary joints as well as non-identical waveguide losses for both transmit and receive may introduce unknown asymmetries between the polarization channels. The design developed and realized at Hohenpeissenberg eliminates these drawbacks and offers several additional advantages. It may be used to simultaneously dopplerize and polarize ageing radars or upgrade modern ones at a moderate cost. The new design is even applicable to the specification of next gene-ration weather radars (as in DWD's RADSYS$_E project) without buying hardware options for a later polarization upgrade.$

The main feature is to bring up but one wave guide from the transmitter to the antenna and split up polarizations above the elevation rotary joint only. This leaves pedestal, antenna statics, rotary joints and most part of the wave guide unchanged, avoids the

asymmetries mentioned above, and saves 3/4 of waveguide losses (once up, twice down). As a trade-off, the receiver has to be mounted on the antenna as well. Since modern radar and IT components are ethernet devices, the signal processor is also put up the antenna, connecting to the radar host by 54 Mbit/s wireless LAN (2.4 GHz for DWD C-band radars) instead of conventional slip rings. An environmentally protected box houses the sensitive components and can be manufactured completely in the factory. This modular concept facilitates testing and repair and minimizes installation cost.