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小功率便携式电离层斜向返回探测雷达设计

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摘要: 采用伪随机编码、脉冲压缩和相干频谱积累技术, 获得27 dB的相位编码脉冲压缩增益和21 dB的相干频谱积累增益, 从而在小功率下实现远距离探测。采用等间隔收发新型探测体制, 实现2 000 km范围内的无距离盲区探测和获得所用伪随机序列的最大增益性能。依据软件化雷达思想, 通过可编程数字信号处理技术来实现雷达的大部分功能, 从而使雷达具有良好的可编程、可配置和易升级性能。在整体结构上, 采用PXI(外围部件互联总线面向仪器的扩展)总线技术, 该雷达设计成为一个模块化、小体积的PXI系统。实际探测结果表明: 在发射功率为100 W的情况下, 该雷达清晰地获得了2 000 km内的返回散射扫频电离图和返回散射扫频多普勒电离图。

关键字: 电离层斜向返回探测雷达; 伪随机编码; 脉冲压缩; 相干频谱积累; 等间隔收发

A low-power portable ionospheric oblique backscattering sounding radar design

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Abstract: A new kind of ionospheric oblique backscattering sounding radar was developed. With the new system design, the radar can usually obtain 27 dB gain from phase coded pulse compression and 21 dB gain from coherent spectral integration using pseudo-random code, pulse compression and coherent spectral integration techniques. Furthermore, due to the adoption of a new kind of sounding system of alternate transmission and reception in equal interval, this radar can detect the ionospheric state in 2 000 km with no dead zone and can achieve the largest gain of applied pseudo-random sequences. In addition, a large portion of the functionality was implemented using programmable signal processing techniques for the sake of programmable, reconfigurable and upgradeable ability. This radar also exploited merits of PXI (Peripheral component interconnect extensions for Instruments) bus technology and was designed as a modular, compact PXI-based system. The results show that the backscatter ionogram and Doppler ionogram can be clearly obtained over 2 000 km for 100 W power.

Key words: ionosphere oblique backscattering sounding radar; pseudo-random code; pulse compression; coherent spectral integration; transmission and reception in equal interval

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