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THEORETICAL ANALYSIS AND ENGINEERING SOLUTION OF PARASITICAL SPECTRUM IN THE CINRAD TRANSMITTER

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INTRODUCTION

To deal with the parasitical frequency spectrum in the CINRAD transmitter, this paper establishes mathematical models for the parasitical signals existing in radar transmitter and analyzes their effect on weather radar performance.

Based on an engineering analysis of their possible sources, a step-by-step method to eliminate parasitical spectrum is presented, which is applied in troubleshooting an experimental weather radar.

MATHEMATICAL MODELS FOR PARASITICAL SIGNALS AND THEIR EFFECT ON RADAR PERFORMANCE

$$s(t) = A(1 + m \cdot f(t)) \cdot \cos(2\pi f_c t)$$

$$s(t) = A\cos\left[2\pi f_c t + \beta \cdot g(t)\right]$$

- Reduced spectrum purity→False target detection
- Reduced power for carrier frequency →SNR loss →Degraded power estimate
- Biased signal phase→Biased Doppler velocity estimate
- Increased phase noise→ Degraded system coherency and clutter suppression ability

ENGINEERING ANALYSIS AND METHODS TO ELIMINATE PARASITICAL SIGNALS

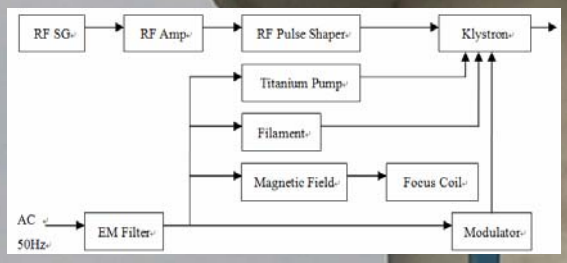

Fig.1. Simplified block diagram for CINRAD transmitter

- RF input signal
- Klystron chamber
- Cathode modulator
- Power supply
- Mechanical vibration
- Cable layout

EXPERIMENT RESULTS

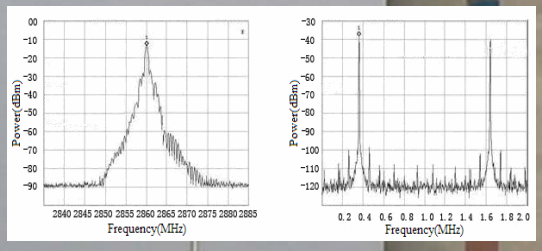

Fig.2. Frequency spectrum before debugging

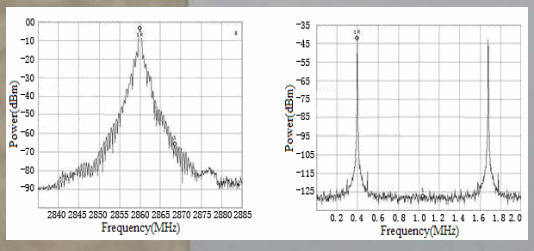

Fig.3. Frequency spectrum after debugging

CONCLUSIONS

Parasitical spectrum is basically eliminated. In addition, improved spectrum purity and reduced phase noise is achieved. Moreover, accuracy for velocity estimate as well as ground clutter suppression ability of the radar system is enhanced.