

WIDEBAND INTERFERENCE REJECTING ANTENNA SUBSYSTEM (WIRAS)

Technology in Development:

- Army Phase I SBIR awarded November 2006
- Army Phase II SBIR award selected June 2007
- Real-time demo 18 months into Phase II



General Description:

GIRD Systems, in collaboration with Pole/Zero Corporation, a subsidiary of Dover Corporation, is developing a novel antenna array subsystem for mitigation of strong interference while allowing a sensitive receiver to receive very weak signals.

By using an antenna array and GIRD Systems' proprietary signal processing methods, the subsystem is capable of rejecting strong multiple interference while allowing very weak signals to pass through to a subsequent sensitive receiver simultaneously, provided that the directions of the interferers are different from that of the weak signal source.



Figure 1 – A possible application scenario of WIRAS for an Army convoy. However, WIRAS is also equally applicable to other application scenarios in an interference rich environment or in electronic warfare.

Example Application:

Figure 1 illustrates one potential application – an Army convoy. Strong intentional or unintentional interference, which could be wideband, hampers a sensitive receiver to receive very weak signals of interest. Application of WIRAS mitigates such strong interference and allows the sensitive receiver to receive the very weak signals of interest. Other applications include communications in interference-rich environments, and air, land, or sea based electronic warfare.

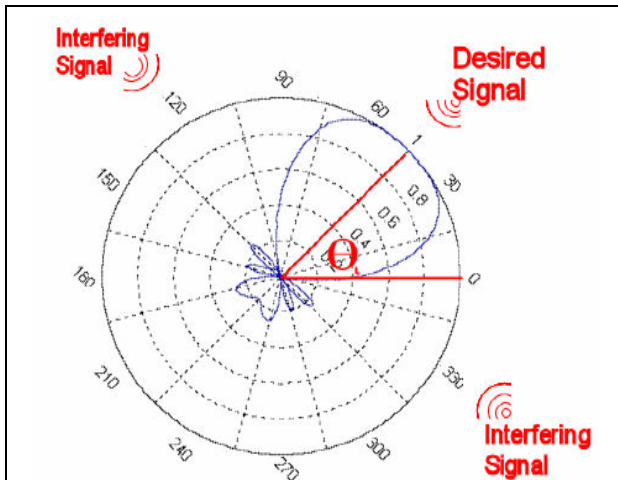


Figure 2 – An antenna array subsystem can maintain receiver gain in a desired direction while rejecting multiple strong interference from other directions.

Principle of Operation:

Figure 2 illustrates the antenna array subsystem's general principle of operation. The multiple antennas and their subsequent signal processing place multiple notches towards the strong interferers, whereas maintains a desired gain in a "look" direction, allowing very weak signals of interest to pass through.

Simulation Example:

Figures 3 to 5 illustrate an example of Phase I simulation results. Shown in Figure 3 is a very weak signal of interest (SOI) that is

completely submerged in very strong wideband interference without processing. A sensitive receiver is unable to receive the weak SOI. After processing by WIRAS, the weak signal of interest is recovered (Figure 4) so a subsequent receiver can now receive the weak SOI.

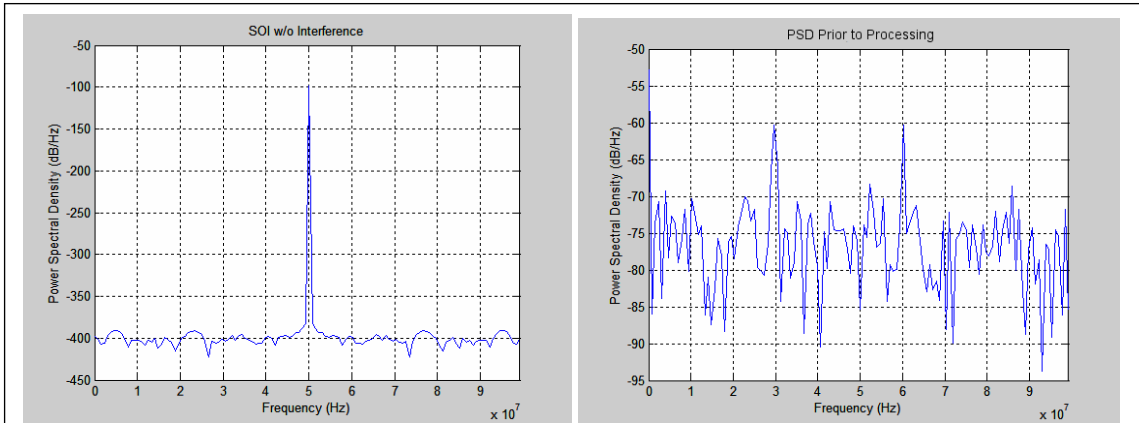


Figure 3 – A simulation example: SOI alone (left) and SOI plus interference (right) before processing. Note the different scales of the two plots – the SOI is completely submerged in the strong interference.

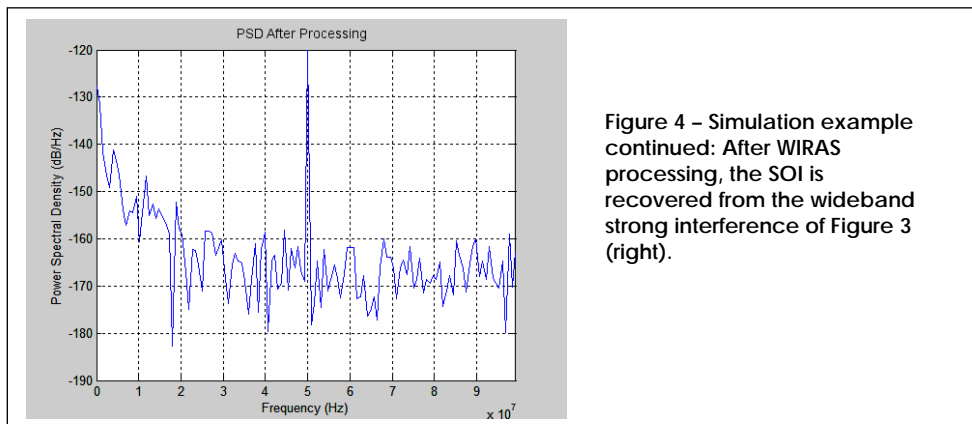


Figure 4 – Simulation example continued: After WIRAS processing, the SOI is recovered from the wideband strong interference of Figure 3 (right).

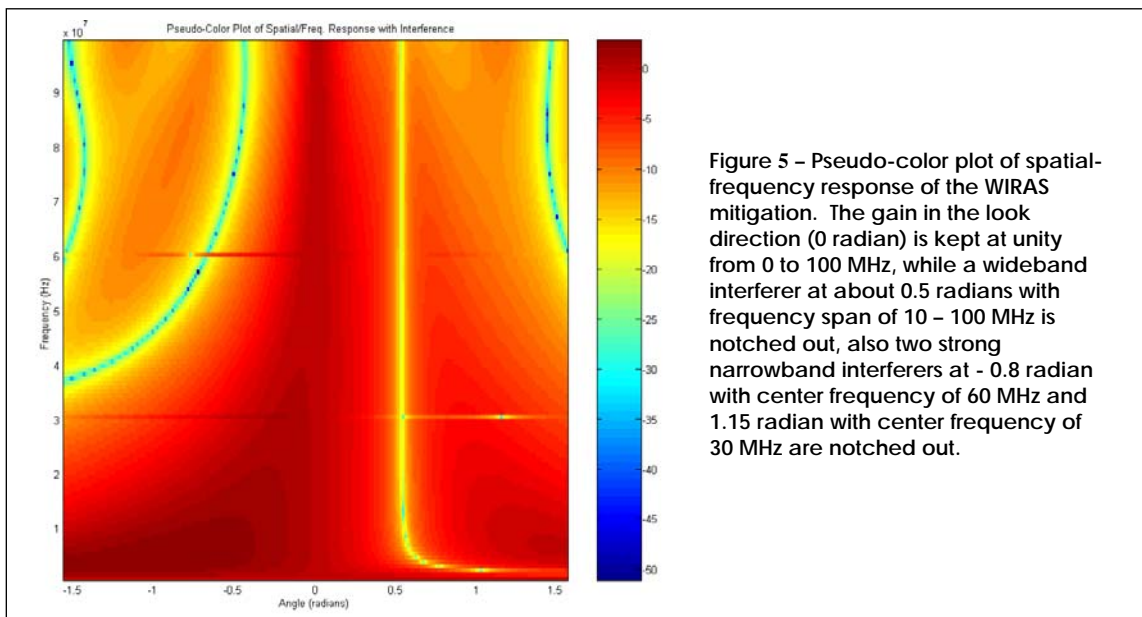


Figure 5 – Pseudo-color plot of spatial-frequency response of the WIRAS mitigation. The gain in the look direction (0 radian) is kept at unity from 0 to 100 MHz, while a wideband interferer at about 0.5 radians with frequency span of 10 – 100 MHz is notched out, also two strong narrowband interferers at - 0.8 radian with center frequency of 60 MHz and 1.15 radian with center frequency of 30 MHz are notched out.