

Electromagnetic Band Gap (EBG) Surfaces for Antenna Applications

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MSR

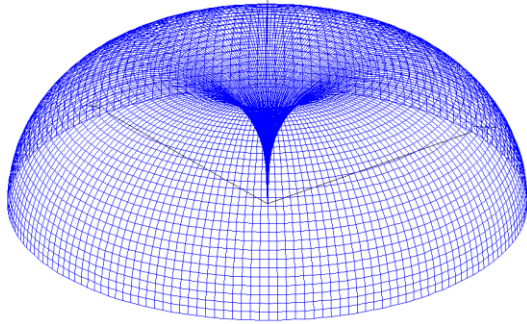


Problem

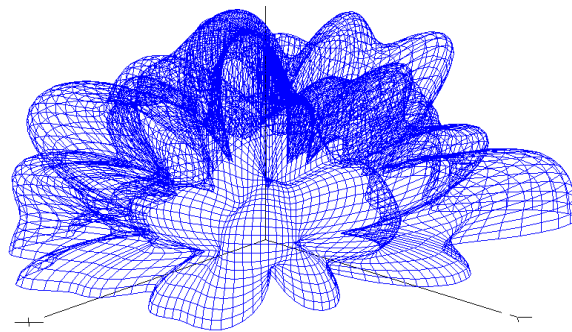


- **The performance of antenna systems mounted on platforms (soldiers, vehicles, ships, aircraft) is limited and/or degraded by the electromagnetic interaction between the antenna and the platform.**
- **Electromagnetic Band Gap (EBG) surfaces can be used to mitigate or alter the electromagnetic interaction between an antenna and the platform.**
- **EBG surfaces offer a mechanism to improve antenna performance, reduce antenna size and reduce antenna to antenna coupling on platforms.**
- **EBG surfaces may provide a mechanism for the reduction of SAR (Specific Absorption Rate) for soldier (body) worn antenna systems.**

Background



Ideal Radiation Pattern of Omnidirectional Antenna



Radiation Pattern of Omnidirectional Antenna on Platform

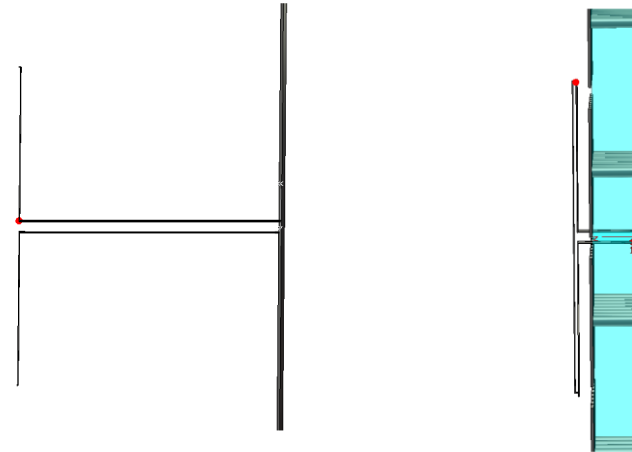


Illustration of Profile Reduction that can be Achieved with an EBG Surface

Antennas on platforms typically exhibit pattern degradation or they have undesirable size. EBG surfaces in conjunction with the antenna can aid in mitigating these issues.

Objective



- **Develop wideband, efficient electromagnetic surfaces in conjunction with omnidirectional and directional antennas to offer platform independent antenna performance.**
- **Integrate electromagnetic surfaces with existing antennas to improve performance on various platforms.**
- **Develop design techniques and methodology for incorporating electromagnetic surfaces within the antenna design process with the goal of achieving optimum performance regardless of platform configuration.**
- **Work with the programs offices, platforms and industry to ensure a successful technology transition.**

Activities

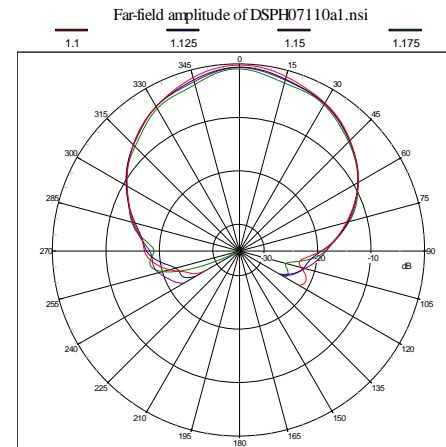
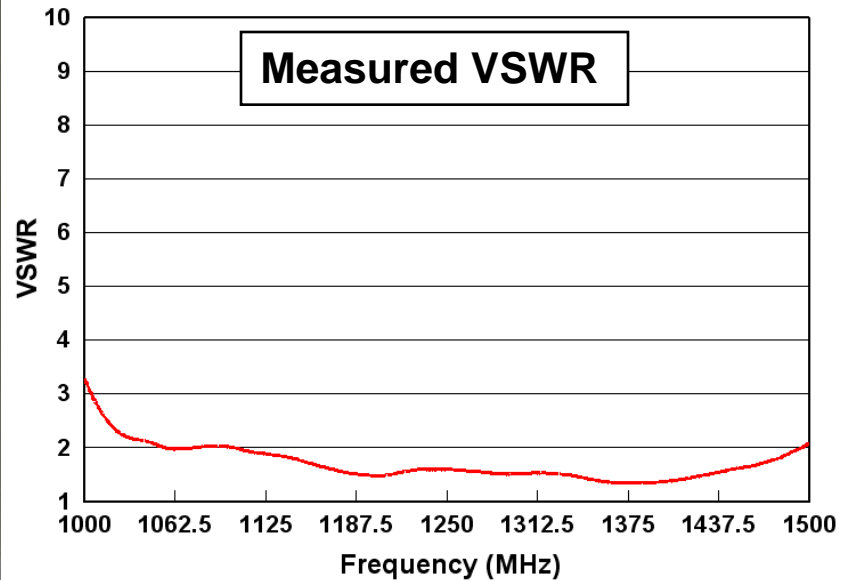


- **Complete literature search to investigate current state-of-the-art in the design of electromagnetic surfaces.**
- **Design, fabricate and test electromagnetic surfaces and antennas to optimize antenna pattern and bandwidth performance.**
- **Incorporate electromagnetic surfaces within the design process of omnidirectional and directional antennas.**
- **Investigate the extent to which platform independence can be achieved with antenna/electromagnetic surface optimization.**
- **Investigate physical limitations of electromagnetic surfaces (size and weight) and how they can be incorporated within a platform.**

Highlight

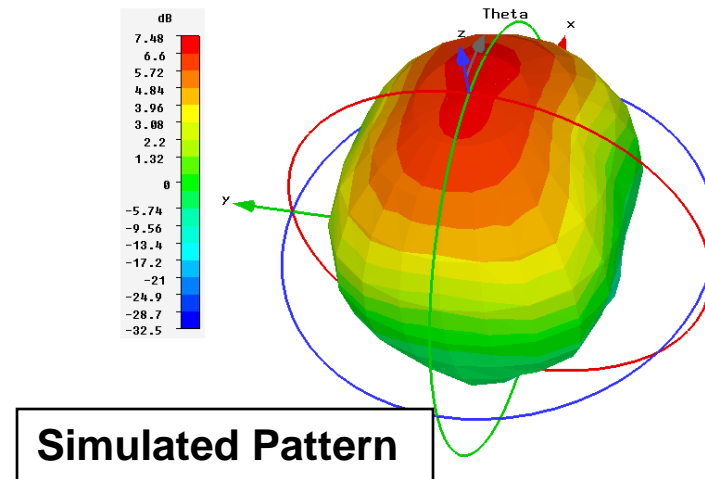
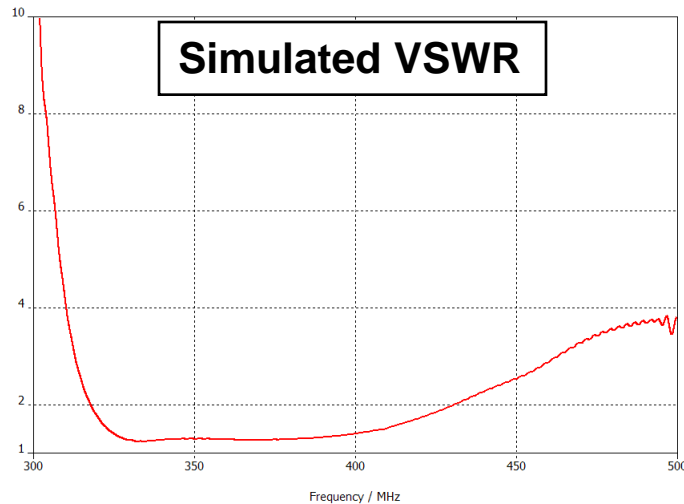
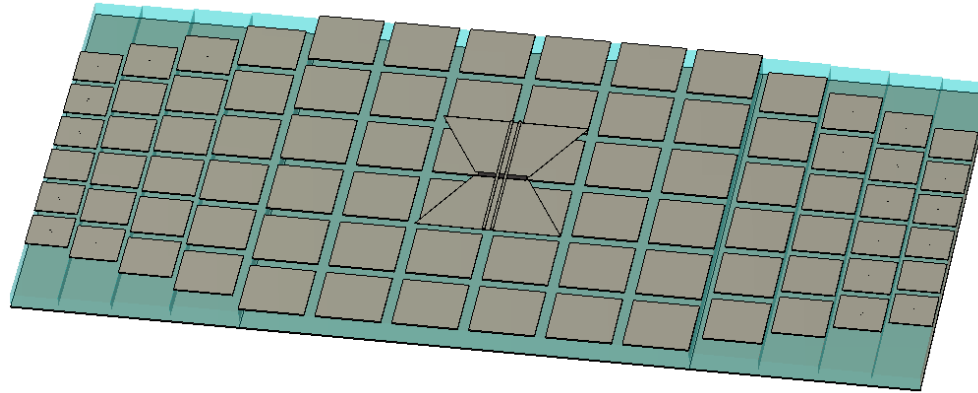


**Fabricated Prototype: 1000 – 1500
MHz Antenna/Electromagnetic Band
Gap Surface**



**Measured
Patterns**

Highlight



Numerical Simulation of Modified Antenna/EBG Surface

Impacts



- **Identify the operating bandwidth limits that can be achieved as a function of electromagnetic surface size and volume.**
- **Provide a definitive understanding of the extent to which new antenna/electromagnetic surfaces can be used to optimize antenna performance on platforms.**
- **Provide the basic building blocks and design processes for developing wideband antenna systems that can provide optimum performance independent of installation on platform.**
- **Provide antenna/electromagnetic surface design descriptions to DOD and appropriate contractors to allow for development of production antenna/electromagnetic surfaces for a variety of communication systems.**

Future Plans



- **Continue the optimization process of integrating antennas with EBG surfaces.**
- **Investigate the profile reduction and achievable bandwidth for directional antennas used in conjunction with EBG surfaces.**
- **Investigate the achievable pattern improvement and achievable bandwidth for omnidirectional antennas used in conjunction with EBG surfaces.**
- **Publish and patent research results.**
- **Transition technology to industry and appropriate government programs.**