

National Institute of Justice Grant 2009-SQ-B9-K012

(“Antenna Systems for Multiband Mobile & Portable Radio”)

## Phase I Summary Technical Report

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This report summarizes findings from Phase I of the project “Antenna Systems for Multiband Mobile & Portable Radio,” performed under Grant No. 2009-SQ-B9-K012 from the National Institute of Justice of the U.S. Dept. of Justice. The overall goal of this project is to develop and demonstrate land mobile radio (LMR) antenna systems which can operate in many frequency bands relevant to public safety operations in the U.S. This project is documented via the project web site [1] which includes a recent overview presentation [2]. Please refer to the latter (in particular, slides 1 and 2) for background on the motivation and specific goals of this project.

In Phase I of the project, we investigated the problem, tested some commercial antennas to establish a performance baseline, developed a prototype to enable a preliminary evaluation of our ideas, and demonstrated the prototype. Our emphasis in this phase of the project was on a solution using a simple monopole-type antenna augmented with an electronic antenna tuner. Major outcomes from Phase I, and the reports in which they are documented, are summarized below:

- Documentation of the Phase I prototype design, including results of laboratory evaluation, appear in “Description and Laboratory Evaluation of a Prototype LMR Multiband Antenna System” (S. Ellingson, Project Report No. 11, September 20, 2010).
- A preliminary design was documented in “Candidate Design for a Multiband LMR Antenna System Using a Rudimentary Antenna Tuner” (S. Ellingson, Project Report No. 4, June 30, 2010). This report addresses reasons for key design choices and includes predictions of performance over a wider range of frequencies than the above report.
- Documentation of theory and analysis methods employed this work appear in the reports “Fundamental Limits of Cylindrical Antennas” (M. Manteghi, Project Report No. 1, July 10, 2010), “Methodology for Analysis of LMR Antenna Systems,” (S. Ellingson, Project Report No. 3, June 30, 2010), and “An Alternative Approach to Specifying Test Electric Field Magnitude for Evaluation of Broadband LMR Antennas” (S. Ellingson, Project Report No. 6, August 19, 2010).

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- We evaluated 6 commercially-available LMR antennas in field conditions, as documented in “Measurement and Analysis of Multiband Mobile Antennas for Portable Radio Applications” (M. Manteghi, Project Report No. 2, July 10, 2010). The antennas included in this study cover frequency bands from VHF-Low through 800 MHz, including the Sti-Co Inc. “Interoperable Mobile Antenna” which is designed for use in the VHF-High, UHF, and 800 MHz public safety bands.
- We developed new methodology for evaluation of LMR antennas in receive-mode operation, which is described in Slides 33–37 of [2]. A key element of this evaluation is the use of in-band but subaudible LMR signals to obtain a “bottom-line” receive sensitivity metric for antenna systems in terms of audio signal-to-noise ratio.

## Acknowledgments

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## References

- [1] Virginia Tech project web site, <http://www.ece.vt.edu/swe/asmr>.
- [2] S. Ellingson, “Antenna Systems for Multiband Mobile & Portable Radio (NIJ Grant 2009-SQ-B9-K012) Site Visit / Project Review” (presentation slides), Blacksburg, VA, September 21, 2010. Available on-line [1].