



FM Boosters Topic at NAB Radio Show Session

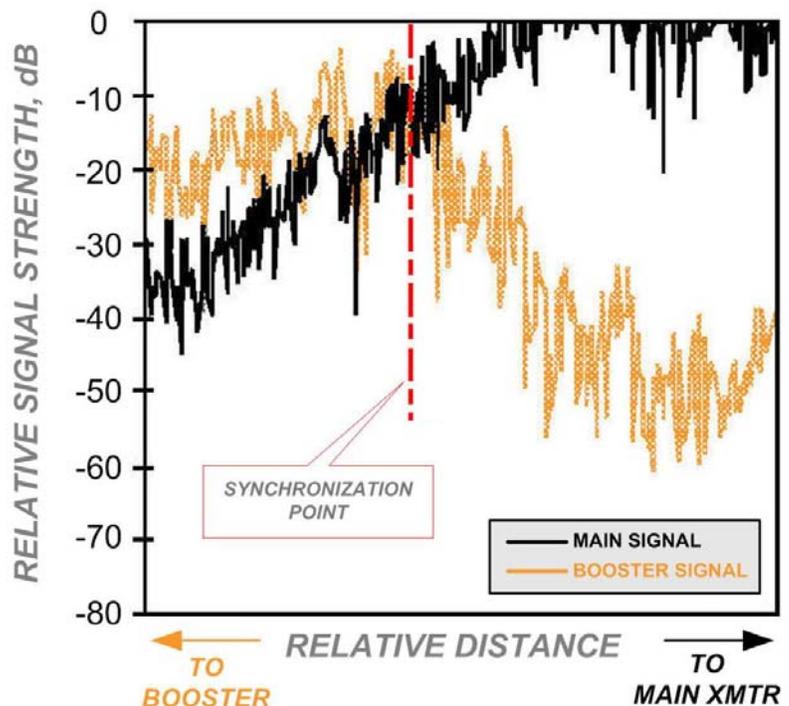
Boosters have been in use since the 1980s to provide same-frequency "fill-in" service for FM stations. A session at the upcoming NAB Radio Show (September 17-19, 2008, Austin, TX, www.nabradioshow.com) called "FM Boosters—Opportunities and Challenges" will explore the theory behind booster usage and provide practical information on when and how broadcasters can use boosters to provide better coverage within their service area. Stan Salek, a registered Professional Engineer with the engineering consulting firm of Hammett & Edison (San Francisco, CA, www.h-e.com) will be conducting this session, and has provided some introductory material on this topic for this week's *Radio TechCheck*.

The concept of FM boosters is quite simple: extend coverage into areas that are not served or well-served by the main transmitter. The FCC does not permit boosters to exist outside of an FM station's projected service contour, so from a regulatory standpoint, there is no service gain. In the real world, however, FCC contours, which only take an average of terrain conditions out to 16 kilometers from the main transmitter site, do not always provide a realistic assurance of coverage, potentially leaving areas without adequate service.

Mountainous regions of the U.S. provide excellent sites for FM transmitting facilities without the need for tall towers. Those same mountains, though, can create a great deal of blockage to FM signal propagation, and hence blockage to communities potentially located on the other side of neighboring ridgelines. The opportunity to serve such communities is sometimes offset by considerable challenge. Establishing a booster in a signal-shadowed area involves (1) locating an optimum booster site, (2) delivering a clean program signal to the booster, and (3) controlling areas of potential self-interference where main and booster signals are both receivable.

Over the years, finding a suitable site for an FM booster has been subject to much experimentation, but more recent terrain-sensitive propagation analysis has been applied to add a degree of science to the process. Delivering a program signal to a booster is often a challenge in itself, because the same terrain that blocks the FM signal also blocks direct microwave STL signals. Creative ways often need to be developed to provide programming to a booster. Finally, and often most challenging, controlling the overlap between main and booster signals is paramount in determining whether a booster implementation is a success. Arguably the most common reason that a booster fails in implementation is when it causes greater lost service than the new service it creates.

Methods of signal synchronization have improved over the years to the point where it is possible to provide a nearly seamless transition between main and booster service on FM receivers moving between the service areas. However, because the main and booster transmitters are located at separate sites, perfect synchronization occurs only in an elliptical band between the sites. The time delay of one



transmitted signal can be adjusted to steer the "seam" to a populated area, but self-interference still occurs as the receiver moves farther away from the seam. The goal is to place the inevitable self-interference zones to unpopulated areas, and to make sure that the booster service area is well contained outside the main service area.

The figure above illustrates a real example of successful main/booster synchronization. In this case, a large east-west mountainous ridge exists with the main FM transmitter on the north face and the booster transmitter on the south face. Just to the west of the ridge is a major north-south roadway. The figure shows actual measured relative signal levels of the main and booster facilities, taken separately, when traveling on the roadway. As can be seen, the main transmitter signal is dramatically stronger to the north (i.e. towards the transmitter), but begins to fade as the ridge creates blockage in the south. At one point, the main and booster signals are essentially equal (the "synchronization point" in the figure), with the booster signal more dominant in the south (i.e. towards the booster). The timing synchronization point was adjusted to place it on the roadway at the equal signal strength point. As a further result, the interference areas were placed on the unpopulated mountain ridge and in other lesser populated areas.

FM booster implementation is further complicated by the new need to preserve in-band, on-channel (IBOC) digital signals that could exist on main and booster signals of a station. Due to the nature of the analog and digital decoders used in receivers, synchronization of digital signals is a much more mathematical process. Recent studies have been conducted to quantify the behavior of networked IBOC transmitters, called Single Frequency Networks (SFNs). The predicted performance of these networks can be directly applied to IBOC booster implementations.

The FM boosters engineering session will be held Wednesday, September 17, 2008 from 10AM-11AM in room 17A (on level 4) of the Austin Convention Center. Additional information about The NAB Radio Show engineering sessions is available online at <http://www.nabradioshow.com/2008/conferences/EngineeringProgram.asp>.



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AM antenna experts Ron Rackley and Ben Dawson, along with antenna modeling software specialist Jerry Westberg, will lead the seminar demonstrating how moment method modeling makes analysis of actual tower current distributions possible and how a model can be used to proof an array provided the proper criteria are considered. All instructors are well known in the radio industry as experts in the field of directional antenna design and maintenance. Their decades of experience offer station engineers an opportunity to learn techniques, tips and tricks that can be immediately useful.

Seminar fee: \$395.00 (NAB members) and \$495.00 (non-members). For more information on the curriculum, how to register or housing go to [AM DA Seminar](#) on the NAB Web site or call Sharon Devine at (202)-429-5338. Register now for the NAB AM Antenna Computer Modeling Seminar!

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