

July 24, 2003

Marlene H. Dortch  
Secretary  
Federal Communications Commission  
445 12<sup>th</sup> Street, SW  
Washington, DC 20554

Re: MM Docket No 99-325

Dear Ms. Dortch:

The National Association of Broadcasters (“NAB”) hereby submits this report on recent tests conducted and recommendations for use of separate antennas for implementation of FM In-Band On-Channel (“IBOC”) transmissions. This report was prepared by an ad hoc technical group of broadcast engineers convened by NAB to consider antenna implementations for IBOC. Based on the following discussion and the attached technical report, the NAB recommends that the FCC authorize FM broadcasters to implement IBOC using a separate antenna approach consistent with the parameters we discuss herein. Further, we recommend that the Commission extend this authorization to all FM broadcasters meeting the established criteria without the need for those broadcasters to seek additional authorization from the FCC.

#### A. Introduction

The Commission’s *Report and Order* authorizing AM and FM stations to commence IBOC broadcasts mandated that stations use a common antenna implementation for both the analog and digital component of the IBOC transmission.<sup>1</sup> The Commission imposed this requirement to ensure that stations implementing IBOC would conform their operations to the system parameters used in the tests conducted under the auspices of and endorsed by the National Radio Systems Committee (“NRSC”). In the absence of information about separate antenna transmissions, the Commission concluded it could best safeguard against interference by mandating common antenna implementations for IBOC.<sup>2</sup>

---

<sup>1</sup> *Digital Audio Broadcasting Systems and Their Impact on the Terrestrial Radio Broadcast Service*, MM Docket No. 99-325, *Report and Order* (Oct. 11, 2002) at ¶41.

<sup>2</sup> *Id.*

Most FM IBOC tests evaluated by the NRSC were conducted using a high level power combiner to deliver the analog and digital signals into a common antenna. In the “high level combined” method, the station adds a digital transmitter and RF power combiner to the existing analog transmission system. The use of a high level combiner results in a 90% loss of the digital energy; thus it requires the use of a higher power (and higher cost) digital transmitter and results in great power inefficiencies. An alternate approach, for stations with analog transmitter power outputs (“TPO”) of less than 10 kW, is the use of the “low power combined” method. This method was used during FM IBOC tests at a Class A FM facility. In this method, a broadcaster purchases a new transmitter or upgrades an existing transmitter to linear amplification of the combined analog and digital signals. Typically when a transmitter is upgraded for linear operation the maximum output is de-rated to 65% resulting in the purchase of a larger transmitter in many cases. Although the low power combined method avoids the inefficiencies of the 90% combiner loss, this method requires installation of a large (and potentially costly) transmitter with sufficient power to amplify both the analog and digital signals.

Subsequent to the completion of the NRSC evaluation program, equipment manufacturers began development of less expensive implementation options designed to facilitate more rapid introduction of IBOC. Manufacturers have developed several approaches that minimize implementation costs by allowing broadcasters to use separate antennas for transmission of the analog and digital signals. In these separate antenna approaches, smaller digital transmitters are used to transmit the digital signals through an antenna or portions of an antenna dedicated to transmission of the digital portion of the IBOC signal only. The transmitter required in the separate antenna configuration is one tenth the power of the transmitter needed for the high level combined method. The broadcaster can avoid the cost associated with a high power digital transmitter and the inefficiencies of a 90% loss from the high level combining methodology by the use of a separate antenna for the digital transmission.<sup>3</sup> The use of a separate antenna results in smaller transmitters, lower cost of equipment acquisition and operation, and reduced floor space requirements in the transmitter room. These reduced implementation costs should provide an incentive for broadcaster adoption of IBOC.

#### B. The Ad Hoc Technical Group

Because a separate antenna implementation involves broadcast of the analog and digital signals from independent antennas located at different locations, this approach presents different coverage and compatibility issues than a combined implementation approach. In November 2002, the NAB established this ad hoc technical group (“Technical Group”) to develop a test program to explore the feasibility of a separate antenna approach.<sup>4</sup> The Technical Group focused on two issues. First, would the separate antenna approach provide digital coverage comparable

---

<sup>3</sup> The higher the power level of the station, the greater is the potential cost savings from a separate antenna approach. The cost savings for all classes of stations is significant and based upon each station’s individual transmission facilities.

<sup>4</sup> A list of Technical Group participants is attached as Appendix A.

to that available with a combined antenna approach? Second, would the separate antenna approach increase interference from the digital signal into the host analog signal?

The Technical Group concluded it could expedite Commission consideration of separate antenna implementations if it developed a set of criteria for determining a station's eligibility to use this approach without seeking separate Commission authorization. The Technical Group determined that Commission adoption of the following eligibility criteria would ensure the maximum applicability of the separate antenna approach while minimizing the risk of increased interference or impaired digital service.<sup>5</sup>

### C. Eligibility Criteria and Test Program

The Technical Group selected the following criteria for routine eligibility to use a separate antenna approach:

1. The digital transmission must use a licensed auxiliary antenna to minimize administrative burdens on the Commission.
2. The auxiliary antenna must be located within three seconds of latitude and longitude of the main antenna.
3. The vertical separation of the antennas must be limited such that the auxiliary antenna is between 70 and 100 percent of the height above average terrain of the main analog antenna.

The Technical Group identified three FM stations to use for tests to provide some real world evidence that adherence to these criteria would ensure continued digital performance without significantly increasing host compatibility concerns. These three stations provided a variety of horizontal and vertical separations that had the potential to affect both digital coverage and host compatibility.<sup>6</sup> For each station, measurements were made using both a combined and a separate antenna implementation. This approach allowed the Technical Group to make a direct comparison of the coverage and compatibility of each mode of operation<sup>7</sup>.

### D. Test Results

The test program confirmed the viability of the separate antenna approach and the feasibility of a blanket authorization for stations to implement IBOC in this manner. In the majority of cases the coverage from the separate antenna approach approximated the coverage

---

<sup>5</sup> The Technical Group recommends that separate antenna operations outside of the criteria listed be considered by the FCC on a case by case basis.

<sup>6</sup> Additional details about the test stations can be found in the technical report attached as Appendix B. A copy of the Technical Group's test procedures is included in Appendix B (see Appendix A1).

<sup>7</sup> Additionally, the ad hoc technical group agreed that, for the majority of cases, interleaved antennas and multi-layer/multi-fed antennas may be licensed by the FCC as auxiliary antennas and as such would meet the criteria detailed herein.

Ms. Marlene H. Dortch

July 24, 2003

Page 4

from the combined antenna approach. Moreover, the impact to the analog signal tracked closely for both the combined and separate antenna implementations.

The tests conducted using WMGC-FM highlight the potential for different results in certain circumstances. In this case, the side mounted auxiliary antenna, although nondirectional, experienced some shielding from the tower structure. This resulted in limited digital coverage in one direction behind the tower structure. The Technical Group concluded, however, that this loss of coverage was insignificant when compared to the benefits of the separate antenna implementation.

Based on the test results, the Technical Group endorsed blanket authorization of separate antenna implementations for stations conforming to the eligibility requirements described herein. The tests indicate the separate antenna implementations offer a negligible potential for increased host interference. Although there may be a limited number of situations where the separate antenna creates some limitation on potential digital coverage, the benefits of the lower cost implementation outweigh any concerns of this kind.

#### E. Conclusions

For the foregoing reasons, NAB encourages the Commission to allow broadcasters to implement IBOC using the separate antenna approach as discussed herein. Moreover, NAB recommends that the Commission apply this authorization to all broadcasters without requiring any new station licensing as long as the implementation satisfies the eligibility criteria the Technical Group has developed.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Henry L. Bauman". The signature is fluid and cursive, with a long horizontal stroke at the end.

Henry L. Bauman

## Appendix A

### NAB ad-hoc technical group on FM IBOC separate antennas

NAME	TITLE	COMPANY/ORGANIZATION
Talmage Ball	Vice President Engineering	Bonneville International Corporation
Jeff Littlejohn	Senior Vice President, Engineering	Clear Channel Broadcasting, Inc.
Rozwell Clark	Director of Technical Operations	Cox Radio, Inc.
Sterling Davis	Vice President, Engineering	Cox Broadcasting
Alan Rosner	Senior Engineer	Denny & Associates
Matt Leland	Radio Product Line Manager	Dielectric Corporation
Marty Hadfield	Vice President, Engineering	Entercom Communications Corporation
Tom Silliman	President	ERI, Inc.
Eric Wandel	Director of Product Development	ERI, Inc.
Edward DeLaHunt	Associate Division Chief	FCC
Milford Smith	Vice President, Radio Engineering	Greater-Media, Inc.
Greg Nease	Manager, Systems Integration & Test	iBiquity Digital Corporation
Albert Shuldiner	Vice President and General Counsel	iBiquity Digital Corporation
E. Glynn Walden	Vice President, Broadcast Engineering	iBiquity Digital Corporation
Tom Giglio	Vice President, Engineering	Jefferson-Pilot Communications Company
David Layer	Director, Advanced Engineering	NAB
John Marino	Vice President, Science & Technology	NAB
Valerie Schulte	Deputy General Counsel	NAB
Bud Aiello	Director of Engineering Technology	NPR
Jan Andrews	Senior Engineer	NPR
David Allen	Sales Manager	Shively Labs
Peter Matthews	Senior RF Engineer	Shively Labs
Bob Surette	Manager, RF Engineering	Shively Labs
Charlie Morgan	Vice President	Susquehanna Radio
Norman Philips	Director of Technical Operations	Susquehanna Radio

## **Appendix B**

### **NAB ad-hoc technical group on FM IBOC separate antennas Test Data Report**