Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of:	)	
	)	
Digital Audio Broadcasting Systems	)	MM Docket No. 99-325
And Their Impact on the Terrestrial	)	
Radio Broadcast Service	)	

Reply Comments of Barry D. McLarnon

In my previous comments[1] related to the IBOC FNPRM/NOI, I pointed out that the hybrid AM IBOC system has an occupied bandwidth (per the Commission's definition) of approximately 28 kHz. I claimed that this was an increase of 100% over the occupied bandwidth of a typical AM station today, which I estimated to be no more than 14 kHz. Since that time, I have had the opportunity to make some measurements, and it turns out that my estimate was well off the mark.

The measurements were done on three local AM stations using an HP 8560E spectrum analyzer, which has the capability of measuring occupied bandwidth directly. All three are 50,000 Watt stations, and the measurement location was in the main lobe of each station's daytime antenna pattern. Groundwave field strengths at the measurement location were such that each of the stations produced received carrier powers at least 80 dB above the noise floor of the spectrum analyzer when it was connected to a suitable broadband antenna. Two of the stations have talk formats, and the other has an oldies music format. Given that the technical standards existing in Canada are essentially the same as in the

1 Comments of Barry D. McLarnon, filed 14 June 2004

United States, there is no reason to believe that the signals from these stations would not be representative of AM stations in the US.

Initial measurements were done using the usual settings for NRSC mask compliance (i.e., 300 Hz resolution bandwidth and the "peak hold" function on). The "occupied bandwidths" measured with these settings were 13.0, 14.1, and 15.8 kHz, the latter being for the music format station. These are close to my previous estimate, but this measurement in fact does *not* represent occupied bandwidth, as defined by the Commission in 47 CFR § 2.202. The true occupied bandwidth depends upon the spectral distribution of *average* power, not peak power. Repeating the measurement, but this time using averaging instead of peak hold, I got a very different answer: the occupied bandwidth was only 1 kHz for the two talk stations, and 1.25 kHz for the music station. In retrospect, this perhaps should not be very surprising, since two-thirds of the AM signal's power is in the carrier even when it is fully modulated, which it obviously is not most of the time. The occupied bandwidth of the hybrid IBOC signal remains unchanged, however, at about 28 kHz. The occupied bandwidth of the AM signal therefore increases dramatically when the digital signal is added, by a factor of approximately **twenty-five.**

As stated in my previous comments, a more direct and revealing approach to the question of adjacent channel interference is to determine how much power is deposited by the signal into those channels. Here again, the potential for interference is more closely related to the *average* power we put into those channels, not the peak power. In the case of hybrid AM IBOC, the primary digital sidebands deposit an average power of -16 dBc into each first adjacent channel (i.e., from 5 to 15 kHz from the carrier frequency). There are also smaller contributions from the secondary digital sidebands and from the analog signal,

but they can be disregarded since they will raise the total average power in that frequency range by less than 1 dB. I previously estimated that for the analog signal alone, the average power deposited into a first adjacent channel would be at least 10 dB less than for the hybrid IBOC signal (i.e., less than -26 dBc). My recent measurements have shown that this was a very conservative estimate.

In order to arrive at the total power in an adjacent channel, I recorded the average power spectral density of each station in the range of 5 to 15 kHz from its carrier, using 300 Hz resolution bandwidth. I then approximated the power spectral density using line segments and obtained an average power value for each 300 Hz "bin" in the 5-15 kHz range. Finally, I summed the contributions of the bins and converted the sum back to logarithmic units to obtain the total power in dBc. The measured total average power in the first adjacent channel was found to be -40 dBc and -55 dBc for the two talk format stations, and -34 dBc for the station with the music format. **Adding hybrid IBOC to these stations would therefore increase the first adjacent interference power by about 24, 39, or 18 dB, respectively** – far more than I had previously estimated.

This drastic increase in interference power deposited into the first adjacent channels, when hybrid IBOC is activated, clearly illustrates that current allocation rules will be completely dysfunctional with regard to protection of stations on adjacent channels. This fact would have been more readily apparent in the laboratory tests conducted by iBiquity if the analog interfering signal used in those tests had actually reflected current practices in AM broadcasting.

As stated in my previous comments, since current allocation rules are no longer adequate to prevent objectionable interference when hybrid AM IBOC is transmitted, this

emission is not permissible under the terms of the US-Canada bilateral agreement on AM broadcasting. Moreover, it is in clear contravention of the article in that agreement which states: "Classes of emission other than A3E, for instance to accommodate stereophonic systems, could also be used on condition that the energy level outside the necessary bandwidth does not exceed that normally expected in A3E...". The "necessary bandwidth" in this case is defined as 10 kHz. Identical wording is used in the agreement between the US and Mexico, so that agreement is also violated by any usage of the hybrid AM IBOC system.

Several commenters, notably including the management of clear channel stations WGN and KRVN, have urged the Commission not to implement blanket authorization of nighttime AM IBOC, due to concerns about damage to their existing areas, with no offsetting benefit. Their concerns are well-founded. Several commenters have urged that nighttime authorization be granted only if it can be shown through standard RSS calculations that other stations will continue to be protected. This approach is laudable, but as I pointed out in my previous comments, it will be futile unless the primary digital sidebands are treated as separate entities in the calculations. To do otherwise is to ignore the IBAC nature of this emission.

If, on the other hand, the Commission acquiesces to the desires of the IBOC proponents for a blanket authorization of nighttime AM IBOC operation, it is setting itself up for a "world of hurt" in dealing with numerous interference complaints. When the dust settles, no one will have benefited from this fiasco. Instead, the commission should recognize that the interference problems have been consistently understated by the IBOC proponents, and undertake a serious review of the decision to endorse this technology as the

means of transitioning to digital transmission in the AM band. The push to deploy this technology is driven by corporate greed, not the public interest.

The AM band offers only 1.17 MHz of spectrum, less than 6% of the bandwidth afforded by the FM band. It also has some unique properties: extensive groundwave coverage that is relatively unaffected by physical obstacles, and the possibility of greatly augmented coverage from skywave propagation at night. Receivers for AM broadcast are inexpensive, and ubiquitous. Any change in usage of this band should recognize its limitations, and play to its strengths. Clearly, the band can only support narrowband emissions, and with well over 5000 stations in North America, it is very crowded. To provide the maximum benefit to the public, every effort should be made to minimize interference between the services, which means that emissions should be confined as much as possible within the nominal 10 kHz bandwidths of the channels. This is insufficient to support high quality music programming using analog modulation techniques, but that is not a serious shortcoming. There are numerous alternatives for obtaining such programming. Given the narrowband nature of the medium, the appropriate usage for it is obviously the spoken word: news, talk, sports and other information programming, with an emphasis on localism. Indeed, this describes the most viable operations that exist on the band today, so why not let this trend continue? Why hinder these services by forcing an extreme makeover for which there is no public demand?

The most compelling reason for introducing digital transmission in the AM band, as it is for FM, is improved reception quality. A properly-designed digital system will help beat back the rising noise levels that currently impair AM reception in some locales, and it will provide improved immunity from co-channel and adjacent channel interference. Given

similar power levels, a digital system could provide coverage that is superior to that of the current analog system, with uniform audio quality throughout the coverage area. It may also provide some useful supplementary data services. The hybrid AM IBOC system, however, is not what the doctor ordered for the AM band. In order to coexist with an analog host, it puts most of its power into the adjacent channels, where its performance is crippled, particularly at night, by analog interference. Its coverage is more limited than that of the analog host, generally extending over areas where analog reception is already very good. At the same time, it impacts on the coverage of adjacent channel stations. Viable AM operations consequently become less so. This is not the way to improve AM broadcasting.

The only reasonable way for the AM band to evolve into the digital era is to introduce an all-digital emission as a replacement for analog, when there is a sufficient installed base of digital (i.e., software-defined) receivers to support it. This might be the iBiquity all-digital system, DRM, or perhaps something that is not even on the drawing boards as yet. The most important attribute of such a system is that it can coexist with analog services without increasing interference levels, which means that the emission should be largely confined to a 10 kHz bandwidth. This eventuality is obviously some years away. In the meantime, AM radio broadcasting will not die, despite what we're being told by the hybrid IBOC components, providing that the broadcasters provide the kind of news/talk/sports/information programming that people want to hear. AM will continue to have the far-reaching coverage, unhampered by digital noise, that is so valuable in emergency situations. The huge installed base of AM receivers will continue to provide useful functionality, and not be consigned to landfills. Some marginal AM operations will

go silent, but that is just natural selection in action – at least it will not be hastened by the impact of unwanted digital interference.

Respectfully submitted,

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