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

In the Matter of:	)	
	)	
Revitalization of the AM Radio Service	)	MB Docket No. 13-249

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Introduction

The Notice of Proposed Rulemaking for AM service revitalization is somewhat of a mixed bag. Some of the proposals (such as use of FM translators) are quite promising, while others may actually increase interference as unintended consequences. Except for the use of FM translators, none of the proposals will have an "oh, wow" improvement for AM.

The main problem with AM radio is that it only works in cars anymore. It is mostly unusable in residences. Speaking from my own experience, I am 6.4 miles from my local 5 kW AM station (KNCO, Grass Valley, California). My daytime signal strength is predicted to be 47 mV/M. This is a good strong signal. Yet on common radios in my house the signal is unlistenable. There are too many switching power supplies, wall-wart chargers, compact fluorescent lamps, LED lamps, and EPA "Energy Star" electronic polluters in my house. Switching power supplies offer many advantages, but they are also severe electronic polluters of the electromagnetic spectrum. Radio listeners suffer from this interference in the medium-wave AM Broadcast Band.

Internet streaming is not a viable option because there is no broadband internet here in my rural location other than satellite, which is limited in both speed and cumulative data caps.

I need to be able to hear KNCO in my house in the winter months for news on school closings, road closings, blizzard conditions, power outages, and other emergencies. So recently I surveyed AM radio reception with a portable receiver and found that I had to get at least 100 feet away from my house to receive AM radio stations without interference. I bought a Pixel Technologies active broadband loop antenna, poured concrete for a mounting post, and trenched in coax in conduit. The Pixel loop antenna is 130 feet from my house. At last, I can receive AM radio in my house again – but only on whatever receiver is connected to the Pixel loop antenna. A photograph of my completed Pixel loop antenna installation with my house in the background follows below.

Figure 1 – Outdoor Antenna Required for Residential AM Radio Reception

As I was doing the manual labor to install my outdoor AM radio antenna, I was struck by the irony of what I was doing. About 90 years ago, if you wanted to receive AM radio stations, you had to put up an outdoor antenna. Fifty years ago when I was a kid, AM radios with simple loopstick antennas worked just fine in houses. Those days are gone and they are not coming back. There are just too many EPA “Energy Star” devices jamming the AM (and HF) bands. Now, we are back to where we were 90 years ago. AM reception in houses requires an outdoor antenna.

I made a short recording of KNCO on its nighttime pattern using a Sangean HDT-1 tuner. The first 5 seconds are recorded with the Sangean's original loop antenna indoors, oriented for maximum signal strength. KNCO is buried in interference from domestic devices. The last 5 seconds are recorded with the same tuner, but driven from the outdoor Pixel loop antenna. This file may be obtained here:

http://www.w9gr.com/clips/KNCO-loop-test.mp3

For these reasons most of the revitalization proposals are “too little, too late.” They do not fix the basic problem – interference. I would estimate that AM radio transmitted power would need to increase by 20 to 30 dB to make AM work in houses again. A one kilowatt station becomes 100 kW to 1 MW. A 50 kilowatt station becomes 5 to 50 megawatts. Obviously this is not practical.

That being said, there are still several major advantages of AM radio. These characteristics are determined by physics. With decent power (50 kW or more and/or a

low dial position) AM radio covers a large area in the daytime and a huge area at night, at least to vehicles. Rulemaking should not try to legislate or oppose physics. The AM band is what it is. Signals travel a long distance, well beyond line of sight. Because of the large nighttime coverage, it is best suited for use by a relatively small number of high power stations. The audience will still be mostly in vehicles. The band is not well-suited to digital transmission, at least not with good audio quality and high reliability. It is a narrow bandwidth medium with selective fading. Analog broadcasting degrades gracefully during fading. A robust digital system would require too much bandwidth. (However, if a new medium wave allocation structure were created with perhaps 50 kHz per channel, then robust, high quality digital AM becomes possible.)

As long as analog AM exists, any all-digital system should be restricted to just one channel – not three as is the case with hybrid AM IBOC, which occupies ±15 kHz. In other words, the signal must be limited to ±5 kHz. The all-digital version of the current AM IBOC system occupies ±10 kHz, which still spans three channels. This is not acceptable. Increasing AM interference is not the way to revitalize AM. (If a digital AM signal occupies 20 kHz of bandwidth, it occupies that bandwidth continuously. Analog signals occupying 20 kHz only occupy the full bandwidth on a fleeting transient basis.) DRM offers options which fit within a ±5 kHz channel.

Any all-digital system must also be upgradeable. Both the modulation system and more importantly, the audio coding algorithm should be upgradeable. As new technologies enable more efficient use of a 10 kHz channel, they should be deployed to existing receivers, hopefully without any intervention required by the listener. AM digital receivers should be made to accept over-the-air upgrades. In other words, any rulemaking for digital AM should specify the receiver, and not the specific transmission system.

Section (G), paragraph 45 of the NPRM solicits additional ideas and proposals for AM improvement. My comments are mostly in response to paragraph 45.

The Larger Question

The real question should be, “How do we preserve local broadcasting” rather than revitalizing AM radio specifically. If we do this right, we can preserve local broadcasting and revitalize AM at the same time.

How to Preserve Local Broadcasting

In many areas the allocations for effective FM translators are highly limited or unavailable. For this reason, new allocations are needed. Spectrum is available on VHF television channels no longer being used.

The basic approach I propose is to migrate most AM stations away from AM and onto at least two alternative transmission modes:

1. New VHF broadcast allocations using TV channels 5 and 6, and/or possibly channels 7-13 where available. DRM+ appears to be the best choice among existing systems for a new digital VHF allocation. Rather than specifying a transmission mode, we should instead specify the receiver as a flexible software-defined platform. At first the transmission mode might be DRM+ but it could be changed or upgraded with over-the-air transmission of new receiver software.

2. Allocate M/H packets on existing digital TV stations to AM broadcasters.

The analog AM broadcasts could continue for years during a transition period – or as long as the licensee wishes.

M/H is an encoding method which is backwards-compatible with ATSC digital television. M/H allows mobile reception and is more robust than ATSC DTV itself. Although intended for mobile video reception, the same coding can be used for audio-only programming (radio). In any given market, it is conceivable that all of the local AM broadcasts could be simulcast using M/H on just one television transmitter, without major degradation of video quality. Perhaps AM stations on M/H could be deployed initially on PBS stations.

M/H transmission on UHF television channels would allow small receiving antennas on portable devices.

The transition to alternative transmission modes should be done invisibly to the listener. Future radios capable of receiving AM, analog or digital broadcasts on new VHF allocations, and M/H packets broadcast over TV channels, would automatically select the best receiving mode. The AM analog transmissions could include low speed metadata transmitted either as an audio "watermark" or in the Q (quadrature) channel. Such metadeta would tell the receiver where the station is being simulcast – the VHF frequency and/or the TV channel and M/H packet ID.

For local broadcasting, VHF and M/H should adequately cover large metropolitan areas with immunity to medium wave interference. M/H and DRM+ can be enhanced with synchronous transmission or distributed transmission techniques. Both will work mobile and in residences.

If most AM broadcasters eventually transition to VHF and M/H, then the AM band can be filled with a small number of high power stations which can cover the rural and unpopulated areas where VHF and UHF broadcasts cannot be received. Long distance truckers, for example, still rely heavily on the AM band. And the wide-area coverage of medium wave nighttime signals is invaluable to rural and small-town listeners not served by local stations of any sort.

AM would be revitalized by using it more efficiently, matching the allocation structure to the physics of the medium. It is most effectively utilized as a wide area, narrow bandwidth medium. Unfortunately it will be limited to vehicular reception until electronic

noisemakers can be silenced or made obsolete. That will not happen anytime soon. In the meantime, outdoor AM antennas for houses are an option.

There are some other transmission modes which could successfully deliver AM signals to residences. These include:

1. Internet streaming
2. Audio-only channels on DirecTV, Dish Network, and cable TV.

These options would be less painful than erecting outdoor antennas for AM reception. And these options could also be broadcast in an AM station's metadata to inform receivers of the additional options.

Conclusion

Because of intense interference, AM radio for the most part is unusable in residences. Yet local programming on AM stations is still needed. Now is the time to migrate most of the “AM” service to new transmission modes and spectrum, leaving some high power stations on AM to provide wide nighttime coverage. A new VHF digital service would be a good match for local programming, with additional coverage provided by audio-only M/H service on DTV stations, internet streaming, DirecTV and Dish Network.

Any new digital service should be planned to be upgradeable. Both the modulation system and more importantly, the audio coding should be upgradeable so that new technology can be quickly deployed. Such upgrades should not require consumer or user intervention.