

**Before the
Federal Communications Commission**

**In the Matter of)
Revitalization of the)
AM Radio Service)**

MB Docket No. 13-249

The following comments were written by Burt I. Weiner who has been actively involved in broadcast engineering since 1957 and for the past 25 years has specialized in the measurement and mitigation of radio signal interference.

The AM Broadcast Band is one of the most vital resources we have when it comes to communicating information to the general public. It's simple and very robust, receivers are plentiful and in virtually every home and car, it does not depend on fragile or vulnerable infrastructure to work, and it's free to the listener.

In order to know which direction revitalization of the AM Broadcast band should go, it's first necessary to know the history of how the AM Broadcast Band evolved into such low technical standards and regards. Many of today's broadcast engineers do not recall the time when AM radio sounded very good and was virtually noise free.

Broadcast AM radio used to have sufficient audio bandwidth to deliver enjoyable musical programming. The physics of AM have not changed; only the man-made environment has changed with disregard to audio quality and interference.

There are two major problems with Broadcast AM that need to be given serious attention before it has any hope of regaining its place as an acceptable media. The first problem is recovered audio bandwidth, and the second problem is the myriad sources of noise that have been allowed to permeate the AM broadcast band.

Recovered audio bandwidth is more a problem of receiver bandwidth limitations and audio design than it is a transmission problem. In the mid to late 1950's radio manufacturers were concerned about complaints of a "whistle". This "whistle", mostly heard only at night, was actually the 10 kHz beat-note between first adjacency stations spaced 10 KHz apart. The typical bandwidth of receivers from those days was sufficient to pass that 10 kHz beat note. Radio manufacturers responded by making receivers that became increasingly narrow in response - much narrower than necessary. There were other simpler ways to solve the problem. What manufacturers seemed to forget, or at least ignore, was the fact that the high frequency component of the audio was a function of the sidebands that are located farther out from the AM carrier. Manufacturers began using ceramic filters in their receivers that were so narrow that they limited AM reception audio bandwidth to about 3 kHz, or less, making audio from these receivers sound muffled. Because of this, AM developed a reputation of being a low quality, muffled sounding media. Currently, the AM section of most radios is still crippled in this way and the resultant audio quality is objectionable to most listeners.

Man-made noise is a major issue plaguing AM reception that discourages listenership. Computers, televisions, light dimmers, Compact Fluorescent Light as well as many microprocessor controlled devices generate a high level of steady noise pollution. Many digital radios generate noises that self-interfere with the very radios they are intended to enhance. Power line noise is a major polluter. With the increase in population and its geographical spread, as well as urban development, power companies have, almost by necessity, gone to higher voltage transmission systems. Higher voltage systems are more prone to arcing insulators and corona discharge. A very common problem is loose hardware on power poles that often arcs and generates severe electrical noise. Sodium Vapor street lights generate considerable wideband noise interference when the bulbs start to fail. All of these can be devastating not only to AM Broadcast radio, but FM and digital television reception. The over-head trolley lines used in some light-rail transportation systems radiate broadband noise not only from arcing trolley contacts, but also from their switching type power sources that can completely destroy AM reception. This is clearly demonstrated by the Metro Gold Line Lite Rail system that runs along the center of the 210 Freeway through Pasadena and Sierra Madre in Southern California. All of these electrical noises mentioned are not only radiated, but conducted along the wires that act like large transmitting antennas next to well-traveled highways and often conducted into homes. Depending on the source, sometimes the interference is conducted for miles and radiated along the way.

Broadband over Power Lines, (BPL), has proven to be a major source of noise where it has been tested or implemented. Power transmission lines are designed to transport D.C. or very low frequency A.C. utility power, not higher Radio Frequency (RF) signals. At the higher RF frequencies these same power lines also act as a large antenna that has been shown to efficiently radiate BPL signals, not contain them on the way to their destination.

In-Band On-Channel (IBOC) digital radio for AM has cluttered up the AM Broadcast band with even more noise that buries many otherwise listenable signals. The IBOC digital sidebands are a continuous signal that goes right up to the carrier of first adjacent channels and to the edge of second adjacent channels. These digital signals are more disruptive than the typical dynamic analog sidebands. There is a well-documented problem called "regrowth", the name given to intermodulation products between the digital sidebands and the host carrier. It's been shown that in many cases there are also intermodulation product issues between the host's analog sidebands and the digital sidebands. It's not unusual to see the resultant intermodulation products themselves produce even more intermodulation products, which in some cases extend for several channels either side of the host signal. These signals often greatly exceed the limits set by 73.44 of the Commission's rules as described below. Directional AM antenna arrays are typically adjusted at the carrier frequency; at the sidebands they may behave very differently. The end result is that the IBOC digital sidebands may not be contained within the pattern limits and can propagate over greater distances than the carrier, which can harm other licensees, particularly at night.

Digital radio is not immune from electrical noise problems; it does not eliminate or reduce the problem, it only hides the problem until it's too late. Once the noise exceeds a signal level that allows for proper decoding, the digital signal is completely lost.

In about 1989 the FCC instituted new rules requiring annual measurements of an AM station's emissions. These rules are covered under sections 73.1590 and 73.44, and are part of the AM Self Inspection Check List. They are the most meaningful rules to date to discover and resolve AM transmission caused interference. Stations must have the current year's measurement available for Commission inspection. Unfortunately, compliance with these rules are seldom confirmed or enforced during Commission field inspections. As a result some stations simply do not make these measurements believing they will never be cited. As components in station transmission equipment age and begin to fail, adjacent channel interference as well as spurious signals can and often appear without station personnel being aware of it. Without these periodic measurements, licensees have no way to demonstrate to the Commission (as they must), and more importantly, positively know whether or not their transmission systems may be causing interference. These rules must be maintained into the future and vigorously enforced for all AM broadcast stations, both analog and digital.

In the many years that I have been performing the required annual Occupied Bandwidth measurements covered under sections 73.1590 and 73.44 of the Commission's rules, I often find overhead power lines not only generating excessive noise, but also generating very erratic harmonic signals as well as intermodulation products between stations. Using standard direction finding techniques, these signals have proven in many cases to clearly be the fault of loose hardware associated with the overhead power transmission lines and not the fault of nearby radio stations.

I make the following recommendations:

The FCC, under Congress, must enforce the rules they already have. The laws of physics cannot be repealed and must not be ignored. The FCC's rules that rightfully bind licensees to comply with the laws of physics should not be changed, and must be enforced.

Random FCC inspections of all transmission aspects of broadcast transmitter facilities should be re-instituted. It is well known to most of the engineers in my profession that the FCC's failure to make such inspections has led to an attitude that the FCC no longer cares. This has resulted in stations that no longer pay attention to facilities or emissions until they experience a complete failure. Minimal necessary repairs are often made to merely get the station back on the air. Transmission equipment that is not properly maintained, tested and adjusted can impact other stations as well as other services. Responsible engineers still believe that the Commission is supposed to take an active role in preventing this apparent neglect. Competent broadcast engineers should be able to depend on FCC support (enforcement) to help them guide their employers and clients on the path to good engineering and compliance.

The FCC rules covered by 47 CFR Part 15 clearly spell out limits for both intentional and unintentional radiators. Generally speaking, it's the unintentional radiators described above that create the most damaging interference to AM reception. The FCC must reinstitute a policy of strictly enforcing these rules.

The mandatory annual measurements specified in 73.1590 and 73.44 must be maintained as written. There are groups that have a pecuniary interest in having the requirement for these measurements as well as 73.44 deleted from the rules. This must not be allowed to happen.

The rules regarding AM modulation levels that allow negative peaks to 100 percent should be re-written. Negative modulation amplitude of 100 percent results in carrier cutoff that more often than not produces buckshot and/or splatter. The rules should clearly specify a maximum negative peak modulation of 96 percent, which is only a fraction of a Decibel lower and would not be discernable to any listeners. This would allow for transmission system response and instrumentation errors.

All Broadcast FM receivers must have a Broadcast AM receiver section with a minimum standard of performance, not limited to just acceptable bandwidth, but overall sound fidelity. Precedence has already been established by the Commission's regulations for minimum receiver performance standards in other services.

FM translators for AM stations do nothing to improve or revitalize the AM broadcast band, and in fact pull listeners away from AM broadcast. We should learn from the many FM to FM "translators" which have a history of abuse in that many operate very differently from the intended purpose of the translator rules. If we are to have FM translators for AM then the FCC must take steps to prevent this same abuse from happening now and in the future for the AM translator service.

The AM translator rules should be written to strictly enforce the following:

1. Pair all AM-to-FM translators to its parent AM station by license.
2. To be non-transferable except by way of transfer of ownership with its parent AM.
3. To prohibit an AM translator to LMA with any station within or outside of its ownership.
4. Prohibit an AM translator from carrying separate programming for any reason.
5. Prohibit a translator from operating for more than 14 hours after the parent AM station is off the air for any reason, and require the parent AM station to operate continuously and at licensed values during normal Daytime hours.
6. AM to FM translators may not be used to extend the parent AM station's coverage beyond its primary signal coverage.

This will allow a Daytime only station to provide community service during Nighttime hours, and at the same time prevent abuse of the translator rules where an AM station with a FM translator could allow the AM facilities to fall into disrepair or claim hardship and continue to operate as a FM station. Vaguely written rules leave loopholes for abuse.

Authorizing higher power for existing AM stations with the expectation of overriding man-made noise will do nothing more than create more man-made noise in the form of station to station interference.

The current form of AM digital transmission known as IBOC should be revisited. Close examination will clearly show that in its relatively brief history it has been more destructive than beneficial to the AM Broadcast band as a direct result of the severe interference it causes to adjacent channel signals. Due to the nature of propagation in the AM Broadcast band IBOC has proven itself to not be a reliable method of digital transmission at these frequencies and only adds to the list of interference sources to other licensees.

Respectfully submitted by:

A handwritten signature in blue ink, appearing to read "Burt I. Weiner". The signature is fluid and cursive, with the first name "Burt" being more prominent.

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