Before the
Federal Communications Commission
Washington, D.C.

In the matter of:

	)	
Revitalization of the AM Radio Service	)	**MB Docket No. 13-249**
	)	

REPLY COMMENTS OF DU TREIL, LUNDIN & RACKLEY, INC.

The engineering consulting firm of du Treil, Lundin & Rackley, Inc. ("dLR") hereby replies to certain comments filed in response to the Commission's October 31, 2013 Notice of Proposed Rulemaking in the above-captioned proceeding. In that Notice, the Commission solicited comments on its various specific proposals and also invited submission of further proposals. Interested parties responded with approximately 150 comment submissions in addition to those of our firm during the open period for filing them with the Commission.

We have reviewed the comments and are very pleased to see the interest in AM band revitalization they represent. We submit these reply comments to provide our positions on several issues that were raised by others but not considered in our original comments.

Comments of Eng. Wifredo G. Blanco-Pi – Authorizing Synchronous Boosters

We strongly agree with the position of Eng. Wifredo G. Blanco-Pi on synchronous transmission by AM stations. It is a very odd situation where existing synchronous transmission facilities continue to exist because they are authorized for experimental operation over and over again, even though no experimentation is needed to know that the technology works and can be useful for providing improved service. This

results, frankly, from the FCC "dropping the ball" and never following through with a rulemaking to authorize synchronous transmission long ago. The time has come to rectify this situation.

The history of synchronous transmission dates back to the 1920s when the legendary radio engineering figure Dr. Frank Conrad led a team of Westinghouse engineers in experiments to synchronize transmitters to provide WBZ service over an area plagued with very low ground conductivity in Massachusetts. The technology was very primitive, involving ultrasonic tones that could be sent, but not with 100% reliability, over telephone lines to synchronize transmitter oscillators of novel design.

By the mid-1930s, further experiments had been conducted by others at various other stations. Improved methods for synchronizing carrier frequencies had been developed. Equipment for synchronizing audio signals to correct for delay had been tested and found beneficial for minimizing interference zone signal distortion.[1] The technology, while falling far short of what is possible today, was sufficient to allow reliable operation by the nascent synchronous transmitter facilities of that time.

By the 1940s, methods for synchronous transmission had been perfected to the point where it was coming into routine use. Two well known synchronous facilities that used the technology to provide directional antenna null fill were WBZ in Boston (with WBZA) and WBT in Charlotte (with WBTA), but there were many other synchronous systems in operation. We believe that the practice would have continued to expand but for one thing, the FCC's decision to count synchronous transmitters against the limited number of stations a company could own under the rules of that time. Synchronous operation eventually ceased for the stations that had been using it except for, to our knowledge, one facility – that of WLLH in Lowell, Massachusetts with its synchronous transmitter on 1400 kHz in nearby Lawrence, Massachusetts.

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[1] L. McC. Young, "Present Practice in the Synchronous Operation of Broadcast Stations as Exemplified by WBBM and KFAB." Proceedings of the I.R.E., vol. 24, pp. 433 – 446; March, 1936

When AM improvement was being pursued by the industry and the FCC in the mid 1980s, the idea of synchronous AM transmission resurfaced. Ideas about how new technology might make good quality synchronous operation more readily achievable than had been the case in the past were openly discussed. The FCC decided to authorize experiments with the new technology by allowing the first new synchronous transmitters to be built in decades.

The latest technologies for synchronizing carrier frequencies were evaluated by the newly authorized experimental stations starting in the 1980s and tests were run to explore the improvement in avoiding undesired audio artifacts available with modern audio delay equipment for synchronizing program circuits. It became clear that synchronization was not only possible, but very practical. Two schools of thought developed on synchronization: the absolute synchronization of carrier frequencies such as through use of satellite GPS technology and precision offset of frequencies using very high stability frequency generators. The advantage of the former being to completely eliminate any time varying signal beat product and the advantage of the latter being to replace a constant groundwave standing wave pattern with one where signal outphasing occurs at a more acceptable interval at any given point in the interference zone. General agreement was reached that digital delay equipment of modest cost can be used to synchronize program audio and minimize delay distortion effects where the signals from two transmitters are close together in amplitude.

While it is impossible to completely eliminate fading zones between synchronized transmitters, it has proven to be practical to use existing, well known technology to minimize their undesirable effects and make it possible to design systems around them to optimize coverage of desired service areas with synchronous transmission.[2] We believe the system in Puerto Rico cited as an example by Eng. Wifredo G. Blanco-Pi to be a good example of the beneficial application of synchronization technology, and that there are a number of others.

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[2] George Whitaker, “Case History: Synchronous Broadcasting.” Proceedings of the 1991 SBE Broadcast Engineering Conference, pp. 101-107; September, 1991

It clearly is time to recognize the usefulness of modern synchronous transmitter technology to improve service to the public in the AM band and for the experiments to end. We believe that FCC regulation of synchronous transmitters should focus on protecting other stations from interference, while giving broadcasters who want to use them maximum flexibility in locating transmitter sites and designing transmitter/antenna combinations to optimize interference zone performance with regard to the audiences they serve. Normal business forces can be trusted to motivate station licensees to strive for good coverage by synchronous transmitters.

We urge the FCC to make rules that will allow the existing experimental AM synchronous stations to become permanently licensed and new systems to be built. We believe that the rules should include the following provisions:

1. A synchronous system will be defined as multiple transmitters carrying identical (synchronized) audio signals.
2. Synchronous operation shall allow either absolutely synchronized carrier frequencies or precision offset operation with equipment sufficiently stable in frequency to maintain them within a tolerance of 0.1 Hz or less if precision offset is desired to minimize standing wave fading zone effects.
3. Synchronous systems shall consist of multiple transmitters with normally protected daytime signal level contours that overlap or are contiguous with nighttime operation authorized even if higher nighttime interference levels might result in no joining of interference-free contours. [Nighttime-only synchronous transmitters at locations meeting the daytime criteria shall be authorized, if desired.]
4. Synchronous systems should be studied for allocations with each transmitter considered individually.
5. A system of synchronous transmitters, each of which meets all applicable allocations criteria with regard to protecting other stations from interference when considered alone, shall be licensed without regard to extension of the

coverage area of the primary station. If overall coverage is expanded without interference being produced to any other station, that will be a good thing.

6. As synchronous transmitters may have intentionally limited coverage areas, no minimum antenna efficiency, height or ground system requirements shall apply to them.
7. A synchronous system of transmitters shall count as one station insofar as the ownership requirements FCC rules are concerned.

Comments of Cavell, Mertz & Associates – Making Permanent Foreign Interference STAs

We strongly agree with Further Proposal 5 of the Cavell, Mertz & Associates comments that steps should be taken to license AM stations operating on STAs that were originally approved to overcome foreign interference with higher power than their presently licensed levels. Generally, such stations were on "regional" channels and, therefore, limited by the FCC rules in effect at the time their STAs were first requested to a maximum power of 5.0 kilowatts, even though they had to employ directional antenna patterns that provided full protection to other domestic and recognized foreign stations at their higher authorized power levels. Although the rules eventually changed to allow the stations to become licensed at higher powers, they thereafter found it impossible to use them because of conflicts with foreign notifications that were made subsequent to their STA authorizations. This happened because the FCC never notified the increased power levels for the stations internationally – treating them as private domestic matters – and other countries made conflicting notifications in the mean time. Many of the conflicting notifications are just that – notifications that were originally added to the list for bargaining position for which actual stations have never been built. We believe that the FCC should work proactively to eliminate any international conflicts that prevent licensing of the stations with their STA power levels and that any domestic conflicts that might have arisen during the intervening years should be grandfathered as if the STA facilities were licensed all along.

Comments of Sellmeyer Engineering – Eliminating Short Form Applications

We strongly agree with the statement in Further Proposal 1 of the Sellmeyer Engineering comments "…Issue No More Filing Windows for Short Form Applications." The short form application process that the FCC adopted at the time of the transition from FCC hearings to spectrum auctions has been pitifully inefficient, when you compare the very small number of AM stations that have been licensed to the hundreds of facilities that were originally proposed in filing window applications. It also has harmed existing stations by preventing them from being able to make signal improvements.

The short form application process has been absolutely toxic for existing AM stations wishing to improve their facilities, because, in many cases, legitimate applications for improved service from facilities engineered to fully protect other stations from interference could not be processed and granted by the FCC due to conflicts with short form applications for speculative facilities. Making matters worse is that in many cases the proposals were for facilities that could never be built because of violations of the FCC's technical rules with regard to existing stations that went unknown because of the lack of sufficient detail required for short form technical proposals.

We have existing AM station clients that have had grants of applications for very useful improvements held up as long as several years because of the "daisy chains" of speculative applications that formed in the filing window process. Great harm has been done to the AM radio service by the FCC's acceptance of short form applications. We believe that the practice must stop to allow AM stations wishing to make investments in providing improved service in compliance with the FCC rules to do so without being blocked by speculative proposals that do not consider protection to other stations and probably will never turn into real facilities.

Comments of Clear Channel Communications, Inc. – Short Antennas and Interference Protection

Section V of the Clear Channel Communications, Inc. comments states that "any modification of AM antenna efficiency standards must be carefully designed to prevent additional signal from entering the nighttime skywave." We agree that nighttime allocations should be based on the high angle radiation characteristics of all antennas, no matter what their height or horizontal plane radiation efficiency. High angle radiation will not present any particular problem with short antennas, however, as can be seen on the following tabulation:

1.0 kW Theoretical No-Loss Radiated Field Strength at 1.0 kM						
	Height = 1/4 λ		Height = 1/8 λ		Height = 0*	
Vertical Angle (Deg.)	mV/m at 1.0 kM	dB Relative	mV/m at 1.0 kM	dB Relative	mV/m at 1.0 kM	dB Relative
0	313.7	0.0	303.1	0.0	299.9	0.0
10	306.7	-0.2	298.0	-0.1	295.3	-0.1
20	286.8	-0.8	283.0	-0.6	281.8	-0.5
30	256.1	-1.8	259.0	-1.4	259.7	-1.3
40	217.9	-3.2	227.1	-2.5	229.7	-2.3
50	175.3	-5.1	188.8	-4.1	192.8	-3.8
60	131.0	-7.6	145.6	-6.4	149.9	-6.0
70	86.8	-11.2	98.9	-9.7	102.6	-9.3
80	43.1	-17.2	50.0	-15.7	52.1	-15.2
90	0.0	- ∞	0.0	- ∞	0.0	- ∞
* Theoretical for an elemental dipole in half-space.						

Although very short antennas do not provide high angle skywave suppression like antennas on the order of one-half wavelength do, the fact is that as height approaches zero the vertical radiation pattern approaches that of an elemental dipole in half space – the cosine function for the angle above the horizontal plane. Far from "blowing up" at high vertical angles, the vertical radiation pattern of a short vertical antenna conforms closely to that of a quarterwave tower as its height is decreased even to zero, although the practical limit of having useful radiation efficiency will be the limiting factor for height. Using the calculated vertical radiation pattern for the actual antenna height in allocations will ensure protection of other stations from interference, even with short antennas.

Comments of MMTC – Relaxing Urbanized Area Relocation Restrictions

With regard to section VI-B of the comments of the Minority Media Telecommunications Council, we wish to contribute our opinion that it is very unfortunate that AM radio stations have been "caught in the net" of the *Rural Radio* proceeding that was created to deal primarily with the issue of commercial FM station relocation from more rural to more urban communities. In our experience, AM stations that propose city of license changes generally do so out of necessity to deal with coverage requirement issues of the FCC rules when transmitter site changes are made and not out of any other motivation to change the communities with which they identify.

The differences in how station allocations are considered by the FCC for AM and commercial FM radio are striking. Commercial FM stations are licensed to the communities where their channels are assigned, based on distance spacings toward other assignments, and hold classifications specifying discreet height and power combinations that result in relatively few different coverage area sizes that are pretty much standard for each class of station. AM stations are licensed to communities that were chosen at the time their applications were filed based on the FCC's coverage requirements, once their power levels were selected and their antenna patterns were designed to avoid interference with other stations.

AM coverage areas vary from station to station in ways that commercial FM coverage areas do not, with essentially every one having a unique shape and size. AM station coverage areas are very different at night from what they are in the daytime, while FM coverage areas remain constant day and night. AM stations, in general, are up against the coverage areas of other stations located around them with which protection contours touch, or even overlap, service contours – making even small changes in location often impossible without significant alteration of the antenna pattern and, hence, coverage area. Commercial FM stations are situated according to a table of assignments based on spacing between transmitter sites and changes in location are possible by amending the table of assignments.

If there were a board game called "Radio Allocations," the commercial FM coverage area pieces would for the most part be circular and of only a few sizes to move around on the board with spaces around them while the AM pieces would look more like interlocking puzzle pieces that change shape every time they are moved or the sun sets or rises. AM stations, because of how they are packed into the spectrum, do not lend themselves to moving around between cities of license as easily as is possible for commercial FM stations. They should not be treated the same as FM stations in that regard. AM radio stations need flexibility to be able to make transmitter site location changes based on need, with the objective of optimizing coverage of the populations they serve, and should not be saddled with regulations designed to limit city of license changes by FM stations.

Comments of Cohen, Dippell & Everist, P.C. – Adopting 50 Percent RSS Exclusion for Nighttime Allocation Studies

We agree with Cohen, Dippell & Everist that the "…current rules tend to overprotect [nighttime] groundwave contours or, conversely, over-estimate the potential for interference" and believe that the statistical analysis provided to support their argument for 50 percent RSS exclusion very conclusively demonstrates why that is

appropriate. We believe that the 25 percent exclusion of the present rules should expire with the ratchet clause.

Comments of Cohen, Dippell & Everist, P.C. – Adopting 50 Percent of Time Propagation Model for Nighttime Allocation Studies

We agree with Cohen, Dippell & Everist that skywave field strength values calculated for 50 percent of the time at two hours after sunset should be used in nighttime allocation studies. We note that this will make the FCC rules conform to the standards that are used elsewhere internationally, such as are specified in the Region Two agreement for use by neighboring countries.

Conclusion

We believe that strong support for many possible changes to the FCC rules that could help revitalize the AM radio service has been expressed in the comments of this rulemaking. We urge the FCC to act on them, without delay.

Respectfully Submitted, March 4, 2014

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