ASSOCIATION OF

FEDERAL COMMUNICATIONS CONSULTING ENGINEERS

WASHINGTON, D.C.

Before The
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	RM No. 11779
Amendment of Part 73 to permit Permanent Licensing	)	
of AM Synchronous Booster Stations	)	

Comments of AFCCE

Established in 1948, the Association of Federal Communications Consulting Engineers ("AFCCE") is an organization that includes approximately 60 full members who are Registered Professional Engineers engaged in the practice of consulting engineering and over 100 members in allied fields of endeavor before the Federal Communications Commission. AFCCE members were involved in the engineering of many of the Standard Broadcast ("AM") stations operating in the United States and also designed many of the present and former AM Synchronous operations in the U.S.

In a recent Petition for Rulemaking,[1] the petitioner asked the Commission to routinely authorize AM Synchronous Booster stations as a part of FCC rules and specified certain rules that would be necessary to achieve that result. AFCCE generally supports the proposals set forth in the Petition with regard to authorization of such systems on a permanent basis and believes that based on known technical data[2, 3] the application to such systems of certain of the Part 73 interference protection requirements will be adequate to prevent interference with other stations.

AFCCE notes that in 1987, the Commission adopted a Notice of Inquiry to authorize "multiple synchronous transmitters by AM stations." AFCCE (among some 22 commenters)

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[1] Eng. Wifredo G. Blanco-Pi, Petition for Rulemaking, November 21, 2016.

stated that the technology was promising but noted that there remained challenges and that test data showed inconsistent benefits. So, in a 1989 Memorandum Opinion and Order the FCC declined to proceed to a Notice of Proposed Rulemaking. The FCC indicated it would "revisit this matter when the circumstances appear appropriate." AFCCE believes that the circumstances are now appropriate for the FCC to revisit this matter.

Background and Summary of Petition

Synchronous AM transmitter systems have been tested in various configurations for decades but they are not currently permitted under Part 73 or Part 74 of the FCC rules. Since 1989, the FCC has issued at least 16 authorizations for Synchronous AM facilities under Part 5 of the FCC's Rules.[2] To our knowledge, none of these operations has resulted in objectionable interference to any other station, so-called "self-interference" notwithstanding. A technical description of AM Synchronous operation, references to its historical antecedents, and a summary of some of the challenges and benefits can be found in a paper by King, Smith, *et al*.[3] Notably, one of the authors of the paper is the petitioner and the paper includes technical data on his existing AM Synchronous operations.

AFCCE notes that the Petition may be somewhat difficult to follow and so offers the following as a compact summary of the technical proposals it believes are contained therein:

1. Allow AM synchronous boosters without limit within the primary station's 2 mV/m contour. (*i.e.,* these would be "fill-in" boosters)
2. Allow synchronous boosters to expand coverage beyond the primary station's contour, so long as there is some overlap of 2 mV/m contours.
3. Each synchronous booster station must afford the same protection of other stations as the primary station.

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[2] A December 15, 2016, search of the FCC's CDBS for File Number Prefix "BLEX" resulted in 16 records of AM Synchronous operation: KHNU, 620 kHz, Hilo, HI; KK2XDA, 730 kHz, Forest Hill, TX; KR2XVA, 1600 kHz, Fort Worth, TX; KZ2XTU, 660 kHz, Eugene, OR; KCOH, 1230 kHz, Houston, TX; KDTD, 1340 kHz, Kansas City, KS; KKOB, 770 kHz, Santa Fe, NM; KLSQ, 870 kHz, East Las Vegas, NV; KM2XVL, 680 kHz, Arecibo, PR; KM2XVL, 1220 kHz, Crockett, TX; WBZT, 1230 kHz, Pompano Beach, FL; WI2XAC, 740 kHz, Ponce, PR; W12XSO, 1260 kHz, Mayagüez, PR; WI3XSO, 1260 kHz, Aguadillo, PR; and WR2XJR, 670 kHz, Portsmouth, VA. This may not be a complete list.

[3] King, T. F., Smith, S. F., Blanco-Pi, W. G., and Blanco-Galdo, J. G., "Field Trial Results of AM Transmitter Carrier Synchronization." (in Proc. 2015 NAB Broadcast Engineering Conference). http://www.kintronic.com/wp-content/uploads/2016/01/NAB-AM-Synchronization-Paper-TK-SFS.pdf

4. Allow synchronous boosters to operate non-directionally or directionally.
5. Allow synchronous boosters to operate with lesser or greater power than the main station.
6. Require all stations in network to maintain carrier frequency within ±0.2 Hz.
7. Require all stations in network to rebroadcast the primary station's content including maintaining proper audio phasing.

AFCCE respectfully submits comments on the proposals listed above.

Fill-in Booster Operation

"Fill-in" operation of synchronous boosters can help alleviate interference from RF noise sources, such as power lines, computers, video displays, and LED and fluorescent lighting systems. Such interference has been well documented to the Commission[4] and, as SBE and others have noted in comments to the Noise Floor Inquiry, the AM service is particularly susceptible to interference from electronic devices of all types.[5] AM broadcasters should have an expectation of being able to provide interference-free service within their service contour. Ubiquitous and increasing RF noise interference has frustrated this expectation and AM boosters can help restore that service.

Expansion of Coverage

Local synchronous boosters can effectively increase the coverage of a primary station in much the same way as a complex directional array can, but without the costly requirements of additional acreage and the complex matching and antenna systems that are associated with multi-tower AM arrays. With proper engineering design, increased coverage afforded by synchronous boosters need not come at the expense of increased interference to other stations. The question of whether to allow AM licensees to use synchronous boosters to increase coverage beyond the service contour of the primary station is largely a non-technical policy matter, to which AFCCE takes no position but urges the FCC to seek comment. AFCCE believes that in an AM synchronous network that has been properly designed to protect other stations there should be no technical reason why additional interference should result.

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4 See generally comments to ET Docket No. 16-191, the FCC TAC Noise Floor Technical Inquiry, released June 15, 2016.

5 Comments of the Society of Broadcast Engineers to ET Docket No. 16-191, August 11, 2016.

Protection of Other Stations

Increased interference in the AM band is not limited to RF noise sources. Interference also results from co-channel and adjacent-channel emissions from other stations, which can travel great distances especially at night. A key provision in allowing AM synchronous booster operation must be to require all stations in the network to comply with the Commission's existing allocation rules, including not increasing the RSS interference level to any other station.

Non-Directional or Directional Operation

While AFCCE believes that many Synchronous boosters will be simple non-directional operations, interference protection of other stations may necessitate directional operation. AFCCE supports this option and believes that AM booster stations will construct the minimal design that their economical situation permits.

Power Levels

As with the question of expanded coverage, there appears to be no technical reason why booster power levels should be limited so long as full protection is afforded to other stations. As a domestic and international regulatory matter, however, AFCCE recommends that booster power levels should be limited to the maximum power level for the class of operation of the primary station.

Carrier Frequency Tolerance

Operation of two proximate stations with a difference of 0.2 Hertz – the Petitioner's proposed carrier frequency tolerance – is likely to result in a very low-frequency beat that would make the station annoying to listen to. With GPS frequency locking as proposed by the petitioner, AFCCE sees no reason why a much more precise tolerance cannot be achieved that would reduce or eliminate the objectionable beat. AFCCE suggests a frequency tolerance not to exceed 0.01 Hz between stations in a synchronous network. Practical GPS-based synchronization systems can typically achieve 0.001 Hz frequency accuracies using standard commercial hardware.

However, it is also AFCCE's understanding that intentional frequency offsetting by stations in the network may be desired to avoid a standing wave pattern and, instead, have

cancellation outphasing occur at a given location every few seconds instead of all the time. AFCCE therefore suggests that intentional frequency offsetting be permitted on a case-by-case basis.

Modulation Synchrony

The whole point of synchronous operation is for the stations in the network to provide seamless coverage over some area. Precise control of modulation index and audio phase parameters is key to maintaining seamless coverage without objectionable artifacts. However, AFCCE believes that the licensee should be responsible for deciding how to maintain synchrony. Only the quality of the station's program will be affected by improper modulation alignment, not the interference potential (except for self-interference). Accordingly, AFCCE does not believe that the Commission needs to specify technical parameters for maintaining program synchrony beyond a requirement that all stations in the network must carry the same (identical) programming.

Other Issues – Boosters should be secondary

In keeping with current booster requirements for FM and TV, AFCCE recommends that AM Synchronous Boosters be authorized as a secondary service under Part 74 of the rules. Doing so would help ensure that licensees have no expectation that their booster operations would be protected by new or changed operations by primary stations authorized under Part 73 and helps assure that ongoing operation will be on an unprotected, non-interference basis.

Other Issues – IBOC and AM Stereo should not be routinely authorized at this time

AFCCE is not aware of any field testing of digital (IBOC) or AM stereo operations in an synchronous AM network. Such operations may have different and unexpected requirements than those proposed by the petitioner and may require further study before they can be routinely authorized. As such, experimental or special temporary authorizations are suggested for those seeking to incorporate digital or stereo operations.

Other Issues – Relaxed minimum antenna efficiency and ground radial requirements

Because AM Synchronous booster stations would be secondary and generally have limited coverage goals, AFCCE believes that there would be some benefit to not applying Part

73 requirements that only tend to increase the cost of such facilities. These include the minimum antenna efficiency requirement and the general license requirement to use 120 ground radials. AFCCE believes that short radiators should be permitted with lesser ground systems as long as the radiation efficiency can be determined and the vertical radiation characteristics can each be established with reasonable accuracy.

The current standard ground system, consisting of 120, equally-spaced quarter-wavelength, buried radials was derived from testing conducted at 3,000 kilohertz and is in fact conservative for frequencies in the AM broadcast band (530 kHz to 1710 kHz). Studies conducted reveal that the ground system for frequencies in the AM band, unlike higher frequencies, can be significantly reduced without being detrimental to the facility's performance.[6] AFCCE urges the Commission to permit non-standard antennas so long as their radiation characteristics can be reasonably established.

Summary

The Commission recently sought comment on a number of proposals to help revitalize the AM service. A specific proposal to authorized AM synchronous booster operations was not part of the AM revitalization docket,[7] but several commenters[8] noted that AM boosters could also benefit AM stations. Unlike the AM revitalization proposal, this petition to authorize AM synchronous boosters does not propose to change interference protections, nor does it change the protected service contour. Neither does it propose to shift AM listeners to frequencies in the FM band. In fact, the proposal seeks to make more efficient use of the AM radio spectrum.

The petitioner's AM booster operations in Puerto Rico have been operating successfully and apparently without interference for well over 10 years. Over a dozen other AM booster operations have been authorized by the FCC and to AFCCE's knowledge have not resulted in objectionable interference. A number of those operations are currently in operation.

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6 Benjamin F. Dawson III and Stephen S. Lockwood, "Revisiting Medium-Wave Ground-System Requirements", IEEE Antennas and Propagation Magazine, Vol. 50, No. 4, (August 2008)

7 MB Docket No. 13-249, "Revitalization of the AM Radio Service," First Report and Order, Further Notice of Proposed Rulemaking and Notice of Inquiry, released October 23, 2015

8 Reply comments in support of authorizations for AM synchronous boosters were noted from at least 10 commenters in MB Docket No. 13-249..

Synchronous AM operation can reinforce coverage without raising the primary station's transmitter power and thereby avoids further increasing interference to other stations

AM Synchronous networks can offer coverage equivalent to complex directional antenna arrays, but without the drawbacks of such arrays. Such drawbacks include reduced bandwidth, increased acreage requirements, and cost. AM synchronous boosters can help provide high quality AM service to locations where low local ground conductivity prevents service or where high local noise levels make service difficult. The use of synchronous boosters can also restore or augment nighttime service in areas where daytime service is provided by adding simple non-directional facilities. Finally, synchronous boosters can economically restore or augment service in the "null zones" of the primary station that otherwise would require station relocation or a highly complex directional array of considerable acreage.

Accordingly, AFCCE finds no technical reason not to routinely authorize AM Synchronous booster stations and urges the Commission to take the requisite actions necessary to move this petition forward to the rule-making stage.

Respectfully submitted,

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by

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