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

In the Matter of:	)	
	)	
The Amendment of Part 97 of the Commission's Amateur Radio Service Rules to Permit Greater Flexibility in Digital Data Communications	)	RM-11708
	)	
By: W. Lee McVey W6EM PG-12-19879	)	
	)	
To: The Chief, Wireless Telecommunications Bureau	)	
	)	

COMMENTS

Pursuant to 47 CFR §1.41 and §1.405, I respectfully offer my Comments in the above captioned Proceeding.

Introduction

1. The American Radio Relay League (ARRL) asks that the Commission remove what it terms to be an antiquated means of determining the permissible bandwidth for data transmissions on the high frequency (HF) amateur radio bands.[1] It justifies its request based on the current use of the symbol rate to determine the bandwidth for digital communications. Criteria that are a hold-over from the days when single carrier, frequency-shift keying was the method employed in digital and radio teletype (RTTY) communications. Frequency-shift keying was widely employed for digital and RTTY

[1] From 160M through 10M, all inclusive.

communications in earlier times before the advent of the various modems that are now widely used along with suppressed-carrier single-sideband (SSB) transmitters for amateur radio digital and RTTY transmission. It stands to reason that a different method is sorely needed to limit bandwidth that will properly limit the bandwidth of former, current and future digital communications emission types and modulation techniques equitably. In any case, one should use great care with regard to digital time domain modulation schemes when it comes to radio. If for nothing else, by definition, the bandwidth of a Unit Impulse signal in the frequency domain is only the *entire spectrum*.

Discussion

2. The Commission defines two types of bandwidth for regulatory purposes. The ***Occupied Bandwith*** (OB) in Part 2, Subpart C, of Commission regulations as *the frequency bandwidth such that, below its lower and above its upper frequency the bandwidth limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.....*[2] ***The Necessary Bandwidth*** (NB), on the other hand: *For a given class of emission, the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed, under specified conditions.....* [3] OB is always greater than NB. In its argument against the present standards, ARRL errantly claims that there is no correlation between symbol rate and bandwidth.[4] And, it further muddies the water by stating that there is a precedent that already exists in regulations at Part 97, Section 307(f)(14)(i) for limiting Pactor III maximum bandwidth in the 60M band.[5] As stated *infra,* historically, frequency-shift keying, akin to on-off keying of carriers, has an NB that is a *direct function of baud rate and carrier frequency shift*.[6] When shifting or on-off

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[2] 47 CFR § 2.202(a)

[3] 47 CFR § 2.202(b)

[4] ARRL at 3, Footnotes 2 and 3.

[5] For the 60M Band, digital modes are given the mode description 2K80J2D. Which, by convention, includes an NB of 2.8kHz, not an OB of that value. The OB for such a mode description would be somewhat greater. Likely, about 3.1kHz. ARRL at 9 advises [that] Pactor III has an OB of 2.4kHz. As such, its mode description should be something more like 2K20J2D, if its OB is indeed truly 2.4kHz.

[6] 47 CFR § 2.202(g) Table of Necessary Bandwidths: III-A Frequency Modulation, Telegraphy. B_n (or NB) is calculated by the following formula: 2M+2DK. Where M is equal to one half of the Baud Rate, D is one half the frequency shift in Hz, and K is a constant, typically 1.2. Using amateur service values of 170Hz frequency shift and 300 Baud, the result is an NB of 564Hz. For 1200Baud, an NB of 1644Hz. As is demonstrated, NB is a function of Baud rate when Frequency Modulation is employed.

keying of a carrier occurs, there definitely *is* a correlation between rate and bandwidth.

3. The above Part 2 definitions remind us that NB is the *minimum* bandwidth needed to effectively communicate; whereas OB is of greater interest as it is essentially the *maximum* permitted bandwidth in order to prevent adjacent channel interference and efficient use of spectrum. ARRL has confused the two in its earlier 60M example.

4. The International Telecommunications Union (ITU) system of mode definitions is contained at Part 2, Section 2.201. Tables exist for amplitude, frequency and phase modulation and the various types of modulations employed in accord with ITU standards. One need only briefly peruse the Table at Part 2, Section 2.202(g) to get an idea as to the many possibilities there are for mode and modulation combinations. And, to quickly see how specifically determining an NB based upon symbol rate, frequency shift, modulation frequency and other factors can be quite complicated. However, the example given for calculating the NB of 2K80J3E SSB is somewhat of an exception since the NB is determined quite simply by the modulation audio frequency response limits.[7] After reading its Petition in its entirety, it appears that ARRL proposes what amounts to an overall OB of 2.8kHz.[8] Regulations meant to constrain bandwidth should contain *maximum permissible bandwidths* as ARRL proposes, not mode descriptions with NB designators. And, the transmitting apparatus in widespread use today to effect digital communications on the HF amateur bands itself does not constrain OB to 2.8kHz.[9]

5. The specified digital modes identified at 47CFR § 97.309(a) require various NBs and all now appear to use SSB equipment for their transmission and reception on the HF bands. Therefore, it is important to recognize and incorporate the maximum permissible bandwidth or OB capabilities of such equipment in any default-bandwidth regulations.

6. The OB of SSB equipment is determined primarily by the shape factor of passband filtering; and, passband filter response upon the transfer-function of the specific types of

[7] For SSB, the NB is simply the net difference in modulation frequency. With 3000Hz as a maximum audio modulation frequency and 200Hz as a minimum, the resulting NB is simply the difference. (2.8kHz)
[8] ARRL at 13.
[9] The NB of SSB transmitters used in the Amateur Service is 2.8kHz, with an OB of approximately 3.1kHz.

filters employed.[10] By its very nature, it is the filtering of the SSB transmitter that offers a "constraint of last resort." That is to say, it determines the minimum number of simultaneous communications that can occur in any given band segment at the same time. Of course, modems can be adjusted to vary the actual OB to values less than a regulated maximum, but multiple subcarrier modes like Pactor III can and do vary operating bandwidth often times dramatically during operation.[11]

Summary and Conclusions

7. In order to permit the greatest amateur service flexibility in use of spectrum by present and future modes, OB should be defined as a constraint. Mode efficiency will control the NB as old modes are improved and new ones discovered to convey more information more rapidly using less overall spectrum. However, in the interest of protection of all digital communications, a default constraint should remain so as to ensure that whatever hardware and software means are employed to transmit digital signals, protocols and modes from this point forward, they will all have sufficient spectral constraint to remain totally within a reasonable OB. An OB that will permit the use of both older and newer technologies.

8. In the interest of brevity and simplicity I would ask that the Commission specify a maximum OB for HF digital communications in Part 97 Section 307(f) of not more than 3.1 kHz. Essentially the same OB as a present-day communications-quality, SSB voice channel (2K80J3E) employing a 2.8kHz NB. Again, this would reasonably protect and preserve HF spectrum, yet provide the maximum flexibility in how specified HF digital modes could be transmitted. Most importantly, it would encourage continuing employment of the extremely-steep, highly-desirable shape factor characteristics of bandpass filtering in SSB equipment so as to ensure minimal spurious emissions outside the OB; irrespective of the type of digital communications. It would also be consistent with the mode specification for digital communication in the 60M Amateur Band in the

[10] Modern SSB equipment utilizes either digital signal processors, multi-section quartz crystal or mechanical filter sections (or in combination) to create very steep rolloff of filter stop-band characteristics.
[11] PacTOR III, for example, may utilize as many as 18 separate subcarriers to avoid exceeding the symbol rate limit.

Table at Part 97, Section 307(f)(14)(i).[12]

9. ARRL has introduced "STANAG" as an example in its Petition of perhaps yet another specified digital mode that would be permitted if symbol rate regulation were to be dropped. Moreover, it appears there are several STANAG digital modes used by NATO military organizations, both fast and slow.[13] Also, there are other popular open-source, low-cost narrow-NB digital modes such as JT-65 and PSK-31 that should be added to 47 CFR § 97.309(a). They are now used to a greater extent by amateurs than some of the other specified modes now included in the regulation as examples. As such, I ask that the Commission revise and update § 97.309(a) as part of this Proceeding to add two popular, relevant, specified digital modes and also STANAG, if appropriate.

I have included an Appendix to my Comments that reflects recommended changes to pertinent sections of Part 97 based upon the above.

Respectfully Submitted this 13th Day of December, 2013,

/s/

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Attachments: Appendix A

[12] 47 CFR § 307 (f)(14)(i) specifies 2K80J2D for digital data, with an NB of 2.8kHz and its greater OB of perhaps as much as 3.1kHz.
[13] STANAG 4285, 4529 and 5066 define modem operating characteristics.

Appendix A

The following revisions incorporate changes that reflect my Comments:

47 CFR § 97.305(f) The following standards and limitations apply to transmissions on the frequencies specified in § 97 .305(c) of this part.

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(3)~~Only a~~ A RTTY or data emission using a specified digital code listed in § 97.309(a) of this part may be transmitted. ~~The symbol rate must not exceed 300 bauds, or for frequency shift keying, the frequency shift between mark and space must not exceed 1kHz.~~ The authorized Occupied Bandwidth, as defined by § 2.202(a), is 3.1 kHz.

(4) Only a RTTY or data emission using a specified digital code listed in § 97.309(a) of this part may be transmitted. ~~The symbol rate must not exceed 1200 bauds, or for frequency shift keying, the frequency shift between mark and space must not exceed 1kHz. .~~ The authorized Occupied Bandwidth, as defined by § 2.202(a), is 3.1 kHz.

(5) A RTTY, data or multiplexed emission using a specified digital code listed in § 97.309(a) of this part may be transmitted. ~~The symbol rate must not exceed 19.6 kilobauds.~~ A RTTY, data or multiplexed emission using an unspecified digital code under the limitations listed in§ 97.309(b) of this part also may be transmitted. The authorized Occupied Bandwidth, ~~bandwidth~~ as defined by § 2.202(a), is 20 kHz.

(6) A RTTY, data or multiplexed emission using a specified digital code listed in § 97.309(a) of this part may be transmitted. ~~The symbol rate must not exceed 56 kilobauds.~~ A RTTY, data or multiplexed emission using an unspecified digital code under the limitations listed in § 97.309(b) of this part also may be transmitted. The authorized Occupied Bandwidth, ~~bandwidth~~ as defined by § 2.202(a), is 100 kHz.

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47 CFR § 97.309(a) Where authorized by §§ 97.305(c) and 97.307(f) of the part, an amateur station may transmit a RTTY or data emission using the following specified digital codes:

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(4) An amateur station transmitting a RTTY or data emission using a digital code specified in this paragraph may use any technique whose technical characteristics have been documented publicly, such as CLOVER, G-TOR, JT-65, ~~or~~ PacTOR, PSK-31 or a version of STANAG for the purpose of facilitating communications.

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W.L.M. 12/13/13