

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

In the Matter of)
)
Amendment of Part 97 of the Commission’s) **WT Docket No. 16-239**
Amateur Radio Service Rules to Permit Greater)
Flexibility in Digital Data Communications) **RM-11708**

To: The Commission
Via: Office of the Secretary

COMMENTS OF ARRL, THE NATIONAL ASSOCIATION FOR AMATEUR RADIO

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to Section 1.415 of the Commission’s Rules (47 C.F.R. §1.415), hereby respectfully submits its comments in response to the Commission’s *Notice of Proposed Rule Making*, FCC 16-96, 31 FCC Rcd. 8485, released July 28, 2016 (the Notice).¹ The Notice was issued in response to ARRL’s November 13, 2013 Petition for Rule Making² proposing to modify Sections 97.305 and 97.307 of the Commission’s rules as specified in an *Appendix* attached to the Petition. The instant Notice proposes - per ARRL’s Petition - to remove limitations on the symbol rate³ applicable to data emissions in certain amateur bands. Notably, however, and most problematically, the Notice does *not* propose to implement the very necessary, additional rule change proposed by ARRL, which is the establishment of a bandwidth limit on the order of 2.8 kilohertz for Amateur data emissions in the RTTY/data subbands below 29.7 MHz. In the vital interest of the Amateur Radio Service in

¹ The Notice was published in the Federal Register on August 12, 2016; See, 81 Fed. Reg. 53388, establishing a comment date of October 11, 2016. Therefore these comments are timely filed.

² ARRL’s Petition was placed on public notice on November 21, 2013. (*Public Notice*, Report No. 2993).

³ The symbol rate in a digital system is the number of times per second that a change of state occurs. It should not be confused with the data rate (bit rate), though in a binary system the values will be the same. The Notice describes the symbol rate as the rate at which the carrier waveform amplitude, frequency, and/or phase is varied to transmit information. Symbol rate is also defined at 47 C.F.R. § 101.3 as “Modulation rate in bauds. This rate may be higher than the transmitted bit rate as in the case of coded pulses or lower as in the case of multilevel transmission.” The Notice text equates the symbol rate with the baud rate.

compatible, intensive use of shared bands with dissimilar emission types, ARRL states as follows:

I. Introduction and Background.

1. ARRL's intention in seeking the deletion of the symbol rate limit for data emissions in the RTTY/data subbands in the High Frequency (HF) Amateur allocations is clearly deregulatory: to relieve the Amateur Radio Service of outdated, 1980s-era restrictions that presently hamper or preclude Amateur Radio experimentation with modern HF and other data transmission protocols. The elimination of the symbol rate limit would undeniably permit greater flexibility in the choice of data emissions.

2. The current Section 97.307(f) of the Commission's Rules limits the digital data emissions of Amateur stations operating below 28 MHz to a symbol rate not to exceed 300 bauds, and in the 10-meter band (28.0-28.3 MHz) to a symbol rate not to exceed 1200 bauds. The current restrictions on symbol rate for data emissions in Section 97.307(f) are summarized in the following table:

Amateur Band(s)	Maximum Symbol Rate	Authorized Bandwidth	Rule Reference
160-12 meters (excluding the channels around 5.4 MHz)	300 bauds	N/A	97.307(f)(3)
10 meters	1200 bauds	N/A	97.307(f)(4)
50 and 144 MHz	19.6 kilobauds	20 kHz	97.307(f)(5)
219 MHz	N/A	100 kHz	97.307(f)(13)
222 and 420 MHz	56 kilobauds	100 kHz	97.307(f)(6)
902 MHz and above	N/A	N/A	97.307(f)(7)

3. The state of the art in HF digital communications has advanced overwhelmingly since the present rules establishing the referenced symbol rate limitations were first written. Indeed, transmission protocols are available (and are in active use in other radio services) in which the

symbol rate exceeds the present limitations set forth in Section 97.307(f) of the Commission's Rules, but the necessary bandwidths of those protocols are within the bandwidth of a typical HF single sideband channel (3 kHz), or the authorized bandwidths set forth in Section 97.307(f) where such limits exist.⁴ The symbol rate limit at HF, reflective of 1980s technology, has no place in an essentially experimental radio service where modern protocols can be efficiently used in the very crowded RTTY/data subbands. The symbol rate limit was created in order to maximize the efficient use and reuse of that crowded, shared spectrum, but the assumptions made at the time are no longer valid⁵ and the rules now prohibit radio amateurs from utilizing state-of-the-art technology, thus precluding or substantially inhibiting any meaningful contribution to the advancement of the radio art in this area.

4. In fact, the present symbol rate limits applicable to the HF Amateur bands permit, if not actually encourage inefficient spectrum utilization, in that they allow data transmissions of *essentially unlimited bandwidth*⁶ as long as the symbol rate is sufficiently slow. Eliminating the symbol rate limitations for data emissions, *and substituting or retaining a reasonable maximum authorized bandwidth for those same emissions* would permit the utilization of *all* HF data transmission protocols presently legal in the Amateur Radio Service, and as well a number of state-of-the-art protocols that are spectrum-efficient but prohibited solely due to the symbol rate limit, *without* enabling usurpation of the limited spectrum by overly wide bandwidth data stations.

⁴ Section 97.307(f) does not set forth a bandwidth limitation at HF, except that Subsections (3) and (4), for frequency-shift keying *only*, limit the frequency shift between mark and space to 1 kilohertz or less. This limitation of frequency shift between mark and space is *not* a bandwidth limitation, as occupied bandwidth will be dependent upon a number of other factors. Further, multiplexed data transmission modes could utilize multiple mark and multiple space signals within the necessary bandwidth, each pair of which may comply with the 1 kilohertz spacing limitation while accumulating on aggregate to a greater bandwidth.

⁵ This is principally because there is no correlation between the data rate and the occupied bandwidth in the rules now.

⁶ *i.e.* the only bandwidth limitation currently in place is that the emission must be contained within the RTTY/data subband.

5. It is important and incumbent on the Commission in the fundamentally experimental Amateur Radio Service to reduce or eliminate by deregulation whenever possible those impediments to experimentation with data emissions.⁷ However, it is also critically important, given the intensive and extensive use of the crowded, shared HF bands (including the RTTY/data subbands), to: (1) standardize the criteria used to determine the permissibility of data transmissions, and (2) to establish some reasonable ground rules, flexibly tailored to protect incumbent, well-established RTTY, narrow-bandwidth data and Morse telegraphy users from interference. A reasonable bandwidth limitation was deemed critical by ARRL in order to facilitate compatible sharing in the bands in which data transmissions are made under local or remote control.⁸

6. Therefore, because the symbol rate restrictions presently in Section 97.307(f) of the Commission's Rules no longer reflect the state of the art of digital telecommunications technology, and because it is clearly in the interests of all radio Amateurs to encourage both flexibility and efficiency in the employment of digital emissions by Amateur stations while protecting dissimilar emission types and incumbent users from interference from wide-bandwidth data emissions that simply cannot be accommodated in the RTTY/data subbands,

⁷ Commission policy has consistently supported deregulation so as to permit increased experimentation with data emissions. In 2008, the Commission dismissed a Petition for Rule Making that would have had the practical effect of precluding data emissions permitted now. The Commission stated: "Additionally, we believe that amending the amateur service rules to limit the ability of amateur stations to experiment with various communications technologies or otherwise impeding their ability to advance the radio art would be inconsistent with the definition and purpose of the amateur service. Moreover, we do not believe that changing the rules to prohibit a communications technology currently in use is in the public interest." *Mark Miller*, DA 08-1082, 23 FCC Rcd. 7449 at 7455 (2008).

⁸ ARRL's Petition argued that there is precedent for such an approach in the present Amateur Radio Service regulations: the 60-meter channels near 5.4 MHz have a maximum authorized bandwidth of 2.8 kHz. Data may be transmitted on those channels, but there is no maximum symbol rate specified. That maximum bandwidth was not initially specified in the Commission's rules for the 60-meter channels in order to accommodate data transmissions. It was established because initially, the only emission permitted on those channels was Single-Sideband voice, which has a bandwidth of 2.8 kilohertz. However, now that a substantial number of digital codes are permitted on those channels, the 2.8 kilohertz maximum occupied bandwidth has proven suitable because it does not prohibit current data emissions typically used by radio Amateurs.

ARRL's Petition requested (1) that the Commission modify Section 97.307(f) to delete all references to symbol rate and (2) to apply to all locally or remotely controlled amateur data emissions below 29.7 MHz a maximum occupied bandwidth limit of 2.8 kHz.

7. A very large number⁹ of comments were filed in response to the ARRL Petition, almost exclusively by individual radio Amateurs. Many supported the Petition's dual, complimentary proposals. However, a large number of comments were filed by RTTY, narrow-bandwidth data emission users and users of Morse telegraphy who expressed concern about the effect on their operations in the RTTY/data subbands of a plethora of data emissions with bandwidths up to 2.8 kilohertz. Those that did not support the ARRL Petition did not, in general, challenge the removal of the symbol rate limitation for data emissions in the band segments where RTTY and data emissions are now permitted. Many did, however, erroneously view the ARRL proposal to establish a maximum occupied bandwidth of 2.8 kHz for data emissions [in the medium-frequency (MF) and HF bands where data emissions are permitted now] as an enabling provision. Instead, it would impose a *limitation* on the maximum bandwidth of data emissions, because none exists now.

8. The reasons that ARRL proposed a 2.8 kilohertz bandwidth limitation as an incident of its proposal to eliminate the symbol rate limitation were several: (1) There is now no bandwidth limitation for data emissions in the band segments¹⁰ where data emissions are permitted (with the exception of rules which limit unattended operations which were not affected whatsoever by ARRL's Petition); (2) The symbol rate limit *does not now act as a bandwidth limitation* for HF

⁹ The Notice, at footnote 1, indicates that there were more than 1550 comments filed on ARRL's Petition.

¹⁰ i.e. 1.8-2.0 MHz; 3.5-3.6 MHz; 7.000-7.125 MHz; 30 meters; 14.00-14.15 MHz; 18.068-18.110 MHz; 21.0-21.2 MHz; 24.89-24.93 MHz; and 28.0-28.3 MHz.

data emissions.¹¹ (4) An occupied bandwidth limit of 2.8 kilohertz is wide enough that it will permit to continue those data emissions currently permitted by the existing rules, and it will permit additional data emissions that are now prohibited because the symbol rate limit of 300 baud applicable to the HF bands below 28 MHz precludes them. At the same time, a 2.8 kilohertz bandwidth limit is sufficiently narrow that it limits the ability of any given Amateur station using data emissions of that bandwidth or less to usurp overly large portions of the limited, crowded and shared RTTY/data subbands. Some opponents of the ARRL Petition argued that their non-data operations would suffer if the proposed rule changes were adopted. However, they offered no evidence that the relief proposed in the ARRL Petition would create a situation in which data transmissions will overwhelm the subband, precluding narrow bandwidth emission communications. In any case, ARRL argued, a bandwidth limit much lower than 2.8 kilohertz would have the effect of precluding those data emissions that are already in constructive use in the RTTY/data subbands now. To those few who argued that it is necessary to continue a completely outdated regulatory restriction that has no relevance to modern data communications as a primary means of avoiding interference to CW, RTTY or narrower-bandwidth data emissions such as PSK-31, ARRL simply disagreed. The Commission has properly chastised the Amateur Service for resisting deregulatory proposals that are designed to enable Amateur experimenters to refine and adapt technologies.¹² ARRL is of the view that

¹¹ See, the ARRL Petition, at paragraph 9. Given modern data technologies, there is no necessary correlation between the symbol rate and the bandwidth of a data emission. The symbol rate limit does not limit data emissions to bandwidths less than 2.8 kilohertz, or 3 kilohertz, or any other wider bandwidth in the HF RTTY and data subbands. Instead, it acts only as a limit on the efficiency of data emissions in the HF bands as a practical matter, and as an artificial and arbitrary filter on the types of emissions that can be utilized by radio Amateurs.

¹² The Commission in 1978 decided not to adopt a proposed table of maximum bandwidths, stating that:

The comments indicated that for the sizeable portion of the amateur community who do not experiment, the present emissions table is preferable. Accordingly, the Commission will not adopt the proposed maximum bandwidth table. We are disappointed that the comments on our proposal were unfavorable, because we continue to believe deregulation is a sound idea. This proposed new

outdated Commission regulations that needlessly preclude experimentation with data technologies should not be preserved as an alternative to cooperative sharing arrangements in the HF bands through voluntary band plans, coupled with some minimal “traffic laws” that are necessary to ensure equitable and compatible sharing in very limited spectrum. Indeed, the high degree of responsibility that cooperative sharing at HF has always required has been standard procedure since the beginning of Amateur Radio and it has worked well to date. Indeed, due to growth of the Amateur Service and the static bandwidths of the RTTY/data subbands, the ability of radio Amateurs to compatibly share that spectrum is being constantly tested.

9. Notwithstanding any of the foregoing, those who either opposed deletion of the symbol rate limit or supported that deletion but opposed the ARRL’s proposed 2.8 kilohertz maximum bandwidth for locally and remotely controlled data emissions in the MF and HF bands ***have a very valid concern that absolutely must be addressed***. They collectively express a predictive, unquantified fear that an increase in the number of data emissions in the RTTY/data subbands will create new incompatibility¹³ between data emissions and ongoing CW, RTTY and narrow bandwidth data modes (such as PSK-31) that are and have long been popular in the low ends of MF and HF bands. This concern must be addressed. Had the Commission proposed to enact both

bandwidth table would have given the Amateur Radio Service a new opportunity to fulfill one of its bases and purposes, “advancement of the radio art,” by allowing the amateur the freedom to experiment with new emissions. However, many commenters disagreed with the bandwidth concept because of the added cost and responsibility they said it would place on amateurs. This loses sight of the concept that amateurs should be on the forefront of technical advancement, and that any attempt by the Commission to spur amateur experimentation will necessarily increase amateur responsibility. The Commission will continue to consider ways of introducing further deregulation and simplification in the Amateur Radio Service.

Second Report and Order in Docket 20777, FCC 78-588, 43 Pike & Fischer Radio Regulation 2d 1622, 1623 (1978).

¹³ They argue that mixing of “wide bandwidth” data emissions where narrow bandwidth emissions such as CW and PSK 31 operate now will result in interference to those narrower emission types because licensees using HF data emissions may disregard ongoing communications before commencing transmissions. A corollary argument is that the benefits to a few operators who choose to experiment with and use HF data emissions which necessitate higher symbol rates than are now permitted should not come at the expense of many thousands of licensees who regularly operate narrowband data, RTTY and CW in the lower segments of the HF bands. ARRL is sensitive to this concern.

of the proposals in ARRL's Petition rather than just one, the fears expressed by these commenters would be overstated. As it is, those fears might well be realized.

II. The Notice Proposal is Necessary But Not Sufficient.

10. The Notice states that the Commission "tentatively" agrees with ARRL that the symbol rate limits should be eliminated, and proposes to amend the rules to delete them in Section 97.307(f) of the Rules. The Commission affirmed that digital emissions were "in their early stages and experimentation with them was limited" at the time the symbol rate limits were adopted and that the state of the art in HF digital communications has advanced substantially since then. The Commission anticipated the need to delete the limits as early as 1993, holding that "as technology progresses the rules may become unnecessarily restrictive, particularly with regard to the permissible baud rate."¹⁴ The Notice also states that the Commission "tentatively" agrees that a symbol rate restriction has become unnecessary due to advances in modulation techniques, and no longer serves a useful purpose. Eliminating the symbol rate restriction could, the Notice states, "encourage individuals to more fully utilize the amateur service in experimentation and could promote innovation, more efficient use of the radio spectrum currently allocated to the amateur service, and the ability of the amateur service to support public safety efforts in the event of an emergency." However, the Commission asks for comment¹⁵ on whether eliminating the symbol rate limit would improve amateur communications, or instead increase "congestion." To the extent that elimination of the symbol rate limit is likely to increase congestion, the Commission asks for comment "on whether the costs of such an increase are

¹⁴ See Allocation of the 219-220 MHz Band for Use by the Amateur Radio Service, *Notice of Proposed Rule Making*, ET Docket No. 93-40, 8 FCC Rcd 2352, 2356 ¶ 30 (1993). The Notice cites ARRL's example; that PACTOR 3, which has a data rate of up to 3600 bits per second and a symbol rate of 100 bauds, is permitted in the HF bands; but PACTOR 4, which is capable of a data rate of 5800 bits per second without occupying any more spectrum, is prohibited at HF by the current rules because it has a symbol rate of 1800 bauds.

¹⁵ See the Notice, at ¶ 8.

outweighed by the benefits that are likely to flow from the elimination of the limits, and whether there are ways to mitigate these costs without losing the benefits of the proposed initiative.”¹⁶ Additionally, it is asked whether there are other costs and benefits and whether the benefits outweigh the costs.

11. There is no doubt whatsoever that the elimination of the symbol rate limit will improve Amateur communications. If the symbol rate for data communications is allowed to increase as technology develops and the Amateur Service utilizes new data emission types, the efficiency of Amateur data communications will of necessity increase. This is because, with increased data throughput, the duration of transmissions is reduced for a given message, and the efficiency in the use of a given frequency therefore increases. Conversely, the artificial limitation of symbol rate precludes the use of newer, more efficient data communications modes which utilize lower bandwidths than those which meet the symbol rate limitations. ARRL noted in its Petition that there are emissions which are utilized by the United States government, such as STANAG, which has a 2400-baud symbol rate and emissions can fit within a channel bandwidth of 2.8 kHz. That emission is not now permitted in the Amateur Service at HF, despite its efficiency¹⁷ and utility in emergency and disaster relief communications due to the symbol rate. The Amateur Service could utilize this and other similar emission types for improved interoperable communications with United States government agencies; thus to better contribute to emergency communications efforts than it is able to now with the symbol rate limitation in place.

12. The state of the art in digital communications now allows transmission protocols in which the symbol rate exceeds the present limitations of Section 97.307(f) of the FCC Rules. At

¹⁶ *Id.*

¹⁷ STANAG has a data speed of between 2400 and 9600 bits per second.

the same time, the necessary bandwidth of these protocols is within the bandwidth of a typical HF single sideband channel (3 kHz); roughly the same occupied bandwidth of digital emissions now permitted by that rule section. The symbol rate “speed limit” therefore prohibits radio amateurs from utilizing state of the art technology, but at the same time offers no efficiencies over those emissions now permitted with similar occupied bandwidths. In fact, the present rules in the data subbands at HF allow data transmissions of unlimited bandwidth as long as the symbol rate is sufficiently slow. Eliminating the symbol rate limitations for data emissions would permit the utilization of all HF data transmission protocols presently legal in the Amateur Radio Service, as well as state of the art protocols that are now precluded. This is an absolutely positive, deregulatory action that is overdue in the Amateur Service.

13. Nor would the Notice proposal have *any effect whatsoever* on automatically controlled stations using data emissions at MF or HF. Any automatically controlled data communications at MF or HF are limited as follows: (1) they must operate within nine very narrow specific HF subbands;¹⁸ **or** (2) they may operate on any other frequency within the RTTY/data subband,¹⁹ if (and only if) they transmit only in response to interrogation by a station under local or remote control, and if they utilize an occupied bandwidth no greater than 500 hertz.²⁰ The fear of interference from automatically controlled stations noted in some of the comments filed in response to the ARRL Petition is not a valid one.

14. However, it cannot fairly be said that the elimination of the symbol rate limit, unless coupled with imposition of a maximum bandwidth limitation as proposed by ARRL, would not unnecessarily and problematically increase “congestion” in the MF and HF RTTY/data subbands. The Commission absolutely should *not* have attempted, as the Notice proposal does, to

¹⁸ See 47 C.F.R. § 97.221(b).

¹⁹ See 47 C.F.R. § 97.305(c).

²⁰ See 47 C.F.R. § 97.221(c).

“cherry pick” the proposal. ARRL attempted, in proposing *both* the deletion of the symbol rate limit *and* the adoption of a 2.8 kHz maximum bandwidth for data emissions at HF, to balance the two objectives of facilitating use of new and future data emissions, *and protecting against potential usurpation of the entire subband by a few data stations*. Some bandwidth limit is necessary, regardless of whether the outdated symbol rate limit is eliminated (which it should be). As noted above, it would not be possible to reduce the permitted maximum bandwidth for data emissions at HF much below 2.8 kHz without prohibiting data modes that are in legal use now. At the same time, it is clearly not desirable to have a few data stations using large swaths of spectrum for a single emission to the detriment of simultaneous use by other stations using other, narrower bandwidth emission modes. So it would be reasonable to respond to the inquiry at paragraph 8 of the Notice by saying that the benefits of elimination of the symbol rate limit (without more) outweigh the congestion that should be anticipated. However, it could also be said fairly that the drawbacks of the same action outweigh the benefits. The answer depends *entirely* on a licensee’s point of view. ARRL’s view, however, is that there is a “win-win” situation, in which the benefits of elimination of the symbol rate limits can be achieved *without* suffering the drawbacks of “increased congestion” in the RTTY/data subbands by simply adopting ARRL’s 2.8 kilohertz maximum bandwidth limitation along with deleting the symbol rate limit.

15. At paragraph 9 of the Notice, the Commission states that it declines to propose to add a 2.8 kilohertz bandwidth limitation for RTTY and data emissions in the MF/HF bands as requested by ARRL. The Notice claims that ARRL “concedes that the question of whether a bandwidth limitation is necessary is ‘reasonably debatable’”²¹ but notes ARRL’s support for the limitation because it would constitute a balancing of the laudable goal of minimal regulation in

²¹ *Citing* ARRL’s Petition at page 11.

this instance and of the need for equitable access to limited spectrum by hundreds of thousands of Amateur licensees (using different emission modes with different occupied bandwidths). Furthermore, the Notice cited ARRL's argument that a 2.8 kilohertz bandwidth limitation on data emissions would accommodate the HF data emissions that are in common use today. The Notice claimed that those commenters who supported eliminating the symbol rate restriction also generally supported the 2.8 kilohertz bandwidth limitation, but others who supported eliminating the baud rate restriction favored a narrower bandwidth limitation in order to protect what the Notice termed "low-bandwidth modes of communication."

16. Notwithstanding the record fairly summarized in the Notice, the Commission tentatively concluded that a specific bandwidth limitation for RTTY and data emissions in the MF/HF bands is not necessary *at all*. It noted that only the digital codes specified in Section 97.309(a) may be used for MF/HF data emissions,²² and that the Part 97 rules do not impose any specific bandwidth limitation on use of the specified digital codes in any frequency band other than the 60 meter band. The Notice described the 60 meter band as a "special case," however, inasmuch as it is channelized and data emissions are limited. The Notice also cited Section 97.307(a) of the Rules, requiring that no amateur station transmission "shall occupy more bandwidth than necessary for the information rate and emission type being transmitted, in accordance with good amateur practice" and Section 97.307(c) which prohibits interference from spurious emissions. Based only on the citation of these inapposite rules, the Notice "tentatively" concludes that there are sufficient limits in place to help protect against "inefficient use or other abuse of the spectrum identified by commenters". The conclusion was thus that these rules,

²² It is unclear why this point is relevant. The fact is that pursuant to Section 97.309(a), a data emission using a digital code specified in that section can use "any technique whose technical characteristics have been documented publicly... (examples omitted) for the purpose of facilitating communications. This is a very flexible enabling provision and not a limiting one. It does not preclude one or a few stations from usurping the entire HF subband with one emission or a few emissions.

separately or in the aggregate, are sufficient to negate ARRL's reason for proposing a bandwidth limitation: to facilitate compatible sharing among amateur licensees. The Notice also expressed a reluctance to impose a 2.8 kilohertz bandwidth limitation because, though such would accommodate HF data emissions that are in common use today, a bandwidth limit could preclude Amateur use of future technologies or result in a loss of flexibility to develop and improve technologies. The Notice calls for comment on these conclusions, however, and the Commission *does* ask whether it should establish emission bandwidth standards for amateur service MF/HF RTTY and data emissions, and if so what the maximum bandwidth should be, the basis for the particular limitation, and whether the limit should apply across the bands or only in particular subbands.

17. As noted hereinabove, the Commission's rules do not specifically limit the permissible bandwidth for RTTY and data emissions in the amateur HF bands. Instead, Section 97.307(f) limits specified RTTY or data emissions to the symbol rates discussed above, or for frequency-shift keying (FSK), to a maximum frequency shift of 1 kilohertz between mark and space. Additionally, the present rules allow amateur stations to transmit data emissions subject to the conditions that the station transmission shall occupy no more bandwidth than necessary for the information rate and emission type being transmitted,²³ and that emissions resulting from modulation must be confined to the band or segment available to the control operator.²⁴ ARRL proposed a maximum bandwidth limitation at HF, where none exists now. The Commission's findings in the Notice are that: (1) it is best to permit flexible experimentation with digital emissions to the greatest extent possible; and (2) the substitution of an overly restrictive maximum bandwidth limitation for an overly restrictive symbol rate limitation would not

²³ See 47 C.F.R. § 97.307(a).

²⁴ See 47 C.F.R. § 97.307(b).

constitute progress and might potentially limit future experimentation. In ARRL's view, both of these conclusions are spot-on. However, because it is critical in ARRL's view that the overly restrictive symbol rate restrictions be eliminated, there must at the same time be some maximum occupied bandwidth limitation for locally or remotely controlled data emissions in the existing HF and MF RTTY/data subbands. ARRL is of the firm view that 2.8 kilohertz is a reasonable balance for that maximum.

18. Nothing in the existing rules cited at paragraphs 10 and 11 of the Notice (nor any provision in any other existing rule) would in any way preclude a single data station operating in any of the HF bands from utilizing the entire RTTY/data subband at one time, either now or if the symbol rate limit is deleted. The specification of digital codes at Subsection 97.309(a) does not do that. Nor does Subsection 97.307(a) of the Rules protect against usurpation of the subband. That Subsection, which requires the use of only that amount of bandwidth necessary for the information rate and emission type being transmitted, in accordance with good amateur practice.²⁵ Nor does Section 97.307(c) help at all. It merely prohibits interference from spurious emissions. Each of those rules cited in the Notice is important and useful in context, but separately or in the aggregate, they are largely irrelevant to the issue, and absolutely insufficient to preclude usurpation of the very small RTTY/data subbands by a few Amateur stations using data emissions, to the great detriment of those using other emission types in the same crowded subbands. The Commission, in tentatively declining to adopt a maximum bandwidth limitation, effectively admonishes radio Amateurs to self-regulate, stating that empowerment through deregulation calls for increased licensee responsibility. In the specific context of the admixture of data and other modes in the HF and MF bands, reliance solely on voluntary band planning is

²⁵ Furthermore, this rule section is very difficult, if not impossible, to enforce quantitatively and therefore it is not sufficient alone to limit occupied bandwidth in a given situation.

expecting quite a lot. ARRL is in complete agreement that voluntary band plans - the tried-and-true manifestation of the exercise of responsible self-regulation in Amateur spectrum management (especially at HF) is critical to compatible shared use of the small, intensely used HF and MF bands and subbands. The Amateur Service in the United States does an admirable job of adherence to voluntary band plans overall. But just as increased automobile traffic in urbanized areas necessitates not only driver courtesy but also some traffic signals, increased use of data emissions in the HF and MF data and RTTY subbands necessitates adherence by licensees not only to voluntary band plans but also adherence to some fixed limits that (1) prevent a few individuals from usurping the entire band and (2) ensure basic access by all.

19. ARRL seeks to balance the laudable goal of minimal regulation in this instance against the need for equitable access to limited spectrum by hundreds of thousands of Amateur licensees, each of whom has earned the same right to operate using a very wide variety of emission types in these limited, shared allocations. ARRL, after careful deliberation, proposed a maximum bandwidth for locally and remotely controlled data emissions in the HF bands of 2.8 kilohertz. The reason for that selection is that it would accommodate the HF data emissions that are in common use today such as PACTOR 3, which is now permitted and which has an occupied bandwidth of 2.4 kilohertz; and at the same time, it does not exceed the normal bandwidth of a single-sideband voice emission. Specification of a 2.8 kilohertz bandwidth maximum would not prohibit any emissions that are now being commonly conducted, and at the same time accommodate most digital emissions that are anticipated for the foreseeable future. ARRL shares the Commission's very reasonable reluctance to establish a bandwidth limit for data communications that might foreclose future communications technologies. That is to be avoided to the extent possible. However, it is absolutely necessary to balance against that

concern the equally critical goal of not disenfranchising any incumbent licensees using technologies that they favor and that enable them to serve the public just as effectively as do the cutting-edge digital technology experimenters.

20. As to what the specific maximum bandwidth should be precisely, there is a limited range of options that achieve the balance that ARRL is looking for. ARRL's Petition noted that one precedent for the proposed 2.8 kilohertz bandwidth maximum for HF data emissions and for elimination of the symbol rate limit was the fact that each of the 60-meter channel bandwidths are 2.8 kilohertz wide, and that there was no symbol rate limit for data emissions on those channels. The Commission's Notice asserts, absolutely correctly, that the 60-meter channels are unique because the channelization scheme there, necessitated by the need for compatible sharing of the band with primary government users, is not found in any other MF or HF band. The Notice concludes therefore that the bandwidth of the 60-meter channels cannot serve as a model for determination of an appropriate maximum data bandwidth in the other HF bands. While the fact of the 2.8 kilohertz bandwidths of each of the current five, 60-meter channels is not a stand-alone justification for the proposed maximum occupied bandwidth for data emissions in other, non-channelized MF and HF bands, the point ARRL was making in its Petition was quite different: Because there is no symbol rate limit for data emissions in the 60-meter channels, but instead only a bandwidth limit (i.e. the channel bandwidth in the 60-meter case) that regulatory scheme serves as a precedent for the concept of elimination of the symbol rate limit and for the reliance only on a bandwidth maximum for data emissions instead. ARRL was not arguing that the 2.8 kilohertz bandwidth maximum was, by itself, justified by the channel bandwidths of the five 60-meter channels. Instead, the selection of a particular proposed maximum bandwidth was premised on an effort to accommodate three, equally important requirements simultaneously: (1)

continuing to permit all data emissions that are permitted and in constructive use now; (2) encouraging additional experimentation with data emissions that are prohibited now because of the symbol rate limitation and those foreseeably available in the future; and (3) precluding the use of data emissions in the HF RTTY/data subbands that would utilize too large an occupied bandwidth and thus usurp the limited spectrum available for sharing with incumbents and future users of dissimilar emissions. Because of this last goal, ARRL strongly disagrees with the Commission's tentative conclusion that elimination of the symbol rate limit should be accomplished *without* adding *any* maximum bandwidth limitation. *There must be some limit on occupied bandwidth for data emissions at MF and HF.*

21. ARRL's proposed 2.8 kilohertz proposal is a balanced approach. Accomplishing the above goals simultaneously does not allow much flexibility in the specification of a maximum bandwidth: The range of reasonable alternatives extends from about 2.5 kilohertz to about 3 kilohertz. The suggestion of a 1 kilohertz or a 2.2 kilohertz limit found in some comments on ARRL's Petition were either intended to or would effectively preclude most data emissions at MF and HF. They are therefore unreasonable on their face, assuming that the Commission intends to act consistently with its prior holdings that it is undesirable to prohibit emissions that are currently permitted. Nor is it necessary to specify a larger bandwidth to accommodate foreseeable new technologies, and a larger maximum bandwidth for data emissions in the HF spectrum would reduce the number of stations that can simultaneously share the small, intensely utilized subbands at MF and HF compatibly. ARRL believes that the maximum bandwidth should therefore be 2.8 kilohertz.

III. Conclusions.

22. The state of the art in digital communications now allows transmission protocols in which the symbol rate exceeds the present limitations of Section 97.307(f) of the FCC Rules, but the necessary bandwidth of the protocol is within the bandwidth of a typical HF single sideband channel (3 kHz). The symbol rate “speed limit” therefore prohibits radio amateurs from utilizing state of the art technology. The present rules in the data subbands at HF permit spectrum inefficiency, allowing data transmissions of unlimited bandwidth as long as the symbol rate is sufficiently slow. Eliminating the symbol rate limitations for data emissions and substituting a maximum authorized bandwidth would permit the utilization of all HF data transmission protocols presently legal in the Amateur Radio Service, as well as state of the art protocols that fall within the authorized bandwidth.

23. The Commission should remove the symbol rate limitation for data emissions in the band segments where RTTY and data emissions are now permitted. It should also establish a maximum bandwidth for data emissions of 2.8 kHz on MF and HF bands (where none currently exists, except for some unattended operations). The Commission should also leave intact the requirement now in the rules for the RTTY and data subbands listed above that data emissions must be a specified digital code listed in § 97.309(a) of the FCC rules. Nor should the Commission change the restrictions on automatically controlled digital stations. The Section 97.221 rule should remain unchanged. That rule now prohibits automatically controlled RTTY or data emissions below 6 meters unless: (1) the automatically controlled station is responding to an interrogation and the occupied bandwidth is less than 500 Hz; or (2) the station is transmitting in one of nine very small HF subbands listed in the rule. The result of these actions in the aggregate

would be to permit the utilization of existing and future data protocols which allow greater throughput, while limiting data emissions to those which are reasonably spectrum efficient.

24. It can be fairly debated whether or not 2.8 kHz is the proper maximum bandwidth for data emissions. Greater bandwidth for data emissions would permit a wider array of data emissions now and in the future. However, even 2.8 kHz could arguably permit usurpation of the subbands to the detriment of CW and other narrow bandwidth emissions. ARRL views the 2.8 kHz maximum bandwidth proposal for data emissions at HF to be a necessary component of the proposal in the Notice, and it fairly balances the objectives of facilitating use of new and future data emissions and protecting against usurpation of the band by a few data stations. Some bandwidth limit is necessary if the outdated symbol rate limit is eliminated, which it should be. It would not be possible to reduce the permitted maximum bandwidth for data emissions at HF much below 2.8 kHz without prohibiting data modes that are in legal use now. At the same time, it would not be desirable to have a few data stations using large swaths of spectrum to the detriment of other modes.

Therefore, the foregoing considered, ARRL, the national association for Amateur Radio, respectfully requests that the Commission modify Sections 97.305 and 97.307 of the Commission's rules so as to delete all references to symbol rate from Section 97.307(f) of the Commission's rules; to create any necessary conforming amendments to other sections of

the rules; and to establish a bandwidth limit of 2.8 kilohertz for Amateur data emissions below 29.7 MHz within the RTTY/data subbands.

Respectfully submitted,

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