

Accepted/Filed

NOV 15 2013

FCC Office of the Secretary

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

In the Matter of)
)
Amendment of Part 97 of the Commission's)
Amateur Radio Service Rules to Permit Greater)
Flexibility in Digital Data Communications)

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NOV 15 2013
Federal Communications Commission
Bureau Office

To: The Chief, Wireless Telecommunications Bureau
Via: Office of the Secretary

PETITION FOR RULEMAKING

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to Section 1.405 of the Commission's Rules (47 C.F.R. §1.405), hereby respectfully requests that the Commission issue a *Notice of Proposed Rule Making* at an early date, proposing to modify Sections 97.305 and 97.307 of the Commission's rules as specified in the *Appendix* attached hereto. The changes proposed would, in the aggregate, relieve the Amateur Radio Service of outdated, 1980s-era restrictions that presently hamper or preclude Amateur Radio experimentation with modern High Frequency (HF) and other data transmission protocols. The proposed rule changes would also permit greater flexibility in the choice of data emissions. Specifically, ARRL proposes to delete all references to symbol rate from Section 97.307(f) of the Commission's rules; to create a conforming amendment to Section 97.305(c) of the rules; and to establish a bandwidth limit of 2.8 kilohertz for Amateur data emissions below 29.7 MHz. In support of its Petition, ARRL states as follows:

I. Introduction.

1. 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

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10-meter band (28.0-28.3 MHz) to a symbol rate not to exceed 1200 bauds. In a digital system the symbol rate is the number of times per second that a change of state occurs. It should not be confused with data rate (bit rate), though in a binary system the values will be the same. 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)

2. As is discussed *infra*, the state of the art in HF digital communications has advanced substantially since the present rules establishing the above symbol rate limitations were first written. Transmission protocols are available and 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.¹

3. An authorized bandwidth limitation is reasonable and may be necessary in order to ensure equitable and efficient sharing among Amateur licensees of very limited and heavily used Amateur Radio spectrum (especially at HF). However, the symbol rate "speed limit" reflective of

¹ 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.

1980s technology, albeit created in order to maximize the efficient use and reuse of that spectrum using assumptions made at the time, now prohibits radio amateurs from utilizing state-of-the-art technology, and precludes or substantially inhibits any meaningful contributions to the advancement of the radio art in this area. In fact, the present symbol rate limits applicable to the HF Amateur bands permit, if not actually encourage inefficient² spectrum utilization, in that they allow data transmissions of essentially unlimited bandwidth³ 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 fall within the authorized bandwidth. Such an approach would also standardize the criterion used to determine the permissibility of data transmissions, and it would eliminate the confusion that often exists between symbol rate and baud rate. A reasonable bandwidth limitation would facilitate sharing in the bands in which data transmissions are made under local or remote control. Furthermore, there is precedent for such an approach in the present Amateur Radio regulations: the 60 meter channels near 5.4 MHz have a maximum authorized bandwidth (2.8 kHz)⁴, and data may be transmitted on the channels, but there is no maximum symbol rate specified.

4. 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

² Though wide bandwidth emissions can of course be efficient depending on the data rate, there is no correlation between the data rate and the occupied bandwidth in the rules now.

³ *i.e.* the only bandwidth limitation is that the emission must be contained within the RTTY/data subband.

⁴ 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 is suitable because it does not prohibit current data emissions typically used by radio Amateurs.

flexibility and efficiency in the employment of digital emissions by amateur stations, ARRL requests that the Commission modify Section 97.307(f) to delete all references to symbol rate and to apply to all locally or remotely controlled amateur data emissions below 29.7 MHz a maximum bandwidth limit of 2.8 kHz.

II. Background.

5. The symbol rate limit in Section 97.307(f) was enacted in 1980 by the *Third Report and Order* in Docket 20777 (FCC 80-35, 45 Fed. Reg. 8990, released February 7, 1980); See, 46 *Pike & Fischer Radio Regulation 2d* 1435. However, in the same docket, four years earlier, the Commission proposed⁵ to adopt a maximum bandwidth table for emissions in the Amateur Service, instead of addressing permitted emission types on a case-by-case basis. A table of maximum bandwidths would, said the Commission, permit any type of mode or emission as long as the occupied bandwidth of that emission did not exceed the bandwidth limit for that frequency. Digital emissions were in 1976 in their early stages and experimentation with them was limited. The comments filed in response to the Commission's proposal, filed for the most part by those who did not conduct data transmission experiments at the time, suggested that the continued specification of permitted emission types on a case-by-case basis was preferable to a maximum bandwidth table. The Commission in 1978 reluctantly relented and decided not to adopt the proposed table of maximum bandwidths, stating⁶ 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 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

⁵ *Notice of Proposed Rule Making*, Docket 20777, released April 22, 1976, 41 Fed. Reg. 17789.

⁶ See the *Second Report and Order* in Docket 20777, FCC 78-588, 43 *Pike & Fischer Radio Regulation 2d* 1622, 1623 (1978).

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.

6. Shortly after this *Second Report and Order* was issued in Docket 20777 on August 11, 1978, the Commission released in the same proceeding a *Further Notice of Inquiry and Further Notice of Proposed Rule Making*, 43 Fed. Reg. 36984, in which it proposed to deregulate the emissions authorized in the Amateur Service by providing for the use of the American Standard Code for Information Interchange (ASCII) for teleprinter transmissions. Theretofore, the only teleprinter transmissions permitted in the Amateur Service was the International Telegraphic Alphabet No. 2, commonly known as the Baudot Code. Because ASCII had already largely replaced Baudot in *commercial* teleprinter applications in the United States, it was proposed to be allowed for Amateur Radio experimentation as well. The Commission asked what technical limitations should be applied to ASCII, including maximum permissible bandwidth, sending speed, frequency deviation and modulating frequency, etc.

7. The *Further Notice of Inquiry and Further Notice of Proposed Rule Making* triggered the filing of only 55 comments and 2 reply comments. The vast majority of those comments urged the Commission to adopt few, if any, restrictions or standards relating to radioteleprinter operation, consistent with the spirit of Section 97.1 of the Commission's rules which obligates Amateur Radio licensees to continue and extend "the amateur's proven ability to contribute to the advancement of the radio art" and to advance "skills in both the communications and technical phases of the art." The comments reflected the view that any standards should be as

broad as possible, (such as the “specification of maximum permissible bandwidth”)⁷ and there was concern expressed that overregulation of ASCII in the Amateur Service would constitute “reregulation” rather than “deregulation.” As to the technical limits, the Commission held as follows:

There was virtually unanimous agreement that the Commission should not concern itself with (or adopt rules relating to) the use of a parity bit, the order of bits (in terms of most or least significant), or the use of synchronous or asynchronous transmission. There was also general agreement that the permissible bandwidths of ASCII or other radio teleprinter signals should be similar to the traditional bandwidths associated with the use of the Baudot Code in the various frequency bands. In most cases, these traditional radioteleprinter bandwidths were taken as the basis for calculating maximum permissible sending speeds (but not “standard” sending speeds), inasmuch as operation within such maximum specified limits is very easily ascertained (thus facilitating compliance); and provides amateur teleprinter operators with some latitude in sending speed which would be lost with little, if any advantage, if we were to specify or require the use of “standard” speeds within certain tolerances. Thus, there appeared to be a general consensus of opinion (sic) that the speed between 3.5 and 29.7 MHz should be limited to 300 bauds where the use of F1 emission is authorized, 1200 bauds between 50.1 and 225 MHz where the use of F1, F2 and A2 emissions are authorized, and no limit above 420 MHz. Several of those filing comments, however, pointed out the dual “wideband” and “narrowband” nature of the 10 meter band (28.0-29.7 MHz) and argued that the use of up to 1200 bauds would appear to be appropriate. There were also some comments suggesting that 19.6 kilobauds would be an appropriate limit in the higher (i.e. above 420 MHz) amateur frequency bands. There were many indications in the comments that while amateur operators, in general, favored flexible rules which fostered experimentation; many would none the less use conventional codes and sending speeds in conjunction with traditional or generally accepted frequency shifts or modulating frequencies, or with technical parameters chosen with more of a view toward more efficient, spectrum conserving operation.⁸

Thus the Commission, based on this discussion, decided to permit ASCII in the Amateur Service, the only limitation being “a sending speed limit applicable to each band.” The fundamental assumption at the time was that there was a direct correlation between sending speed and emission bandwidth. As justification for the sending speed limitations, the Commission stated only that “(r)ecognizing that the use of slower speeds is likely to be the norm,

⁷ *Third Report and Order*, Docket 20777, FCC 80-35, 46 Pike & Fischer Radio Regulation 2d 1435 (1980).

⁸ *Id.*, 46 Pike & Fischer Radio Regulation 2d at 1436 (1980).

we have, in order to provide maximum flexibility, decided to permit speeds up to 300 bauds between 3.5 and 28 MHz, 1200 bauds between 28 and 225 MHz, and 19.6 kilobauds above 420 MHz.”⁹ This Order, released 33 years ago, was literally the first and last time that the symbol rate restrictions on Amateur stations were evaluated as a regulatory matter.

8. The Commission created a different regulatory paradigm for automatically controlled digital stations, permitted in small portions¹⁰ of the HF bands and generally in the bands above 50.0 MHz.¹¹ Section 97.221 permits automatic control¹² of amateur stations transmitting a RTTY or data emission on very high frequency (VHF) and higher amateur bands; on nine specific HF subbands¹³; and on any other amateur frequency authorized for RTTY or data emissions¹⁴ if the station is responding to interrogation by a station under local or remote control and provided that no transmission from the automatically controlled station occupies a bandwidth of more than 500 hertz.¹⁵

III. The Justification for the Symbol Rate Restriction No Longer Appertains.

9. As the history of the symbol rate restriction clearly shows, the limits were established in 1980 when data emission experimentation was in its infancy. The adoption of the rule was prompted by assumptions that are no longer valid. The Commission at the time evaluated a

⁹ *Id.*

¹⁰ Section 97.221(b) permits an Amateur station to be automatically controlled while transmitting a RTTY or data emission on the 6 m or shorter wavelength bands, and on the 28.120-28.189 MHz, 24.925-24.930 MHz, 21.090-21.100 MHz, 18.105-18.110 MHz, 14.0950-14.0995 MHz, 14.1005-14.112 MHz, 10.140-10.150 MHz, 7.100-7.105 MHz, or 3.585-3.600 MHz segments.

¹¹ There is no proposal herein to change that nominal bandwidth limitation for automatically controlled stations transmitting data emissions. The bandwidth limitation, and the subband limitation for automatically controlled stations at HF are both necessary in order to preclude a plethora of automatically controlled stations usurping the limited spectrum available.

¹² Automatic control requires that the station licensee use devices and procedures for control when the station is transmitting so that compliance with the FCC Rules is achieved without the control operator being present at a control point. See 47 C.F.R. § 97.3(a)(6). Only stations specifically designated in Part 97 may be automatically controlled. See 47 C.F.R. § 97.109(d).

¹³ See 47 C.F.R. § 97.221(b).

¹⁴ See 47 C.F.R. § 97.305(c).

¹⁵ See 47 C.F.R. § 97.221(c).

relatively few comments stating that the permissible bandwidths of ASCII or other teleprinter signals should be similar to the traditional bandwidths associated with the use of the Baudot Code in the various frequency bands. By limiting the symbol rate, the Commission thought it was achieving that objective, because it equated the symbol rate with the bandwidth of the data emission. Now, 33 years later, that very limited rationale for a regulatory limit on symbol rate that may have been accepted in 1980 has been thoroughly eroded by advances in modulation techniques¹⁶ that have effectively divorced the bandwidth of a digital signal from the symbol rate. The symbol rate restrictions were created to suit digital modes that are no longer in favor. Continuation of those restrictions as the metric for the legality of digital emissions leads to anomalies that actually limit efficient spectrum use.¹⁷ Today the modern digital emissions are capable of much more accurate and reliable transmissions at greater speeds with much less bandwidth than in 1980. For example, PACTOR 4, which has a symbol rate of 1800 bauds, a mark-space frequency shift separation of less than 1 kHz, and a bandwidth of 2.4 kHz, is not permitted by the current rules at HF. However, it is capable of a data rate of 5800 bits per second. By contrast, PACTOR 3, which has a symbol rate of 100 bauds, a mark-space frequency shift of less than 1 kHz, *and the same 2.4 kHz bandwidth, is* permitted by the current rules at HF, and it is capable of a data rate of 3600 bits per second. These protocols are each able to operate in a bandwidth no greater than that of a typical single-sideband (SSB) voice emission.

10. If the symbol rate is allowed to increase as technology develops and the Amateur Service utilizes new data emission types, the efficiency of Amateur data communications will

¹⁶ For example, by using multiple carriers, each with multiple-bit-per-symbol modulation it is possible to obtain relatively high data rates while maintaining the low symbol rates that are required to combat the effects of multi-path propagation on the HF bands. The problem with this, however, is that multiple carriers necessitate greater occupied bandwidth, which is quite limited at HF.

¹⁷ For example, PACTOR 1 has a 200 baud symbol rate, but it has a maximum data speed of 200 bits per second maximum. PACTOR 3 has a symbol rate half that of PACTOR 1, but it has a data speed of 3600 bits per second. PACTOR 1 is not as useful in emergency communications efforts due to the low data speed.

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 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. There are emissions which are utilized by the United States Government, such as STANAG, which has a 2400 baud symbol rate and can fit within a bandwidth of 2.8 kHz. That emission is not permitted in the Amateur Service at HF, despite its efficiency¹⁸ 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.

IV. A Maximum Bandwidth of 2.8 kHz Should be Applied to Locally or Remotely Controlled Digital Data Stations at HF.

11. As noted above, 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,¹⁹ and that emissions resulting from modulation must be confined to the band or segment available to the control operator.²⁰ ARRL proposes a maximum bandwidth limitation at HF, where none exists now. It is best to permit

¹⁸ STANAG has a data speed of between 2400 and 9600 bits per second.

¹⁹ See 47 C.F.R. § 97.307(a).

²⁰ See 47 C.F.R. § 97.307(b).

flexible experimentation with digital emissions to the greatest extent possible, and the substitution of an overly restrictive maximum bandwidth limitation for an overly restrictive symbol rate limitation would not constitute progress. Because it is critical in ARRL's view that the overly restrictive symbol rate restrictions be eliminated there should be some maximum occupied bandwidth limitation.

12. In May of 2008, the Commission dismissed²¹ a Petition for Rule Making, RM-11392, which proposed to make several changes in the rules regarding data emissions. Among these proposed changes was the establishment of maximum necessary bandwidths for radioteletype and data emissions in the amateur HF bands. The Commission declined to do this due to the insufficient justification set forth in the Petition for the relief requested at the time. However, in dismissing the Petition, the Commission cited the adverse effect of limitations on the ability of radio Amateurs to experiment with communications technologies:

We also believe that imposing a maximum bandwidth limitation on data emissions would result in a loss of flexibility to develop and improve technologies as licensees' operating interests change, new technologies are incorporated, and frequency bands are reallocated. 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.²²

For this proposition the Commission cited a Notice of Proposed Rule Making, *Amendment of the Amateur Service Rules to Provide for Greater Use of Spread Spectrum Communication Technologies*, WT Docket No. 97-12, 12 FCC Rcd 2591, 2595 ¶ 8 (1997).

13. Notwithstanding the ideals of allowing higher HF data rates and facilitating experimentation with data emissions, and notwithstanding the fact that there are commercial and military interests in use of data emissions at HF that would allow higher HF data rates absent any

²¹ See the Order, *Mark Miller*, DA 08-1082, 23 FCC Rcd. 7449 (2008).

²² *Id.*, 23 FCC Rcd. at 7455.

bandwidth limitation, 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 in these limited, shared allocations. ARRL has, 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 this 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. 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,²³ and the limit would apply only to data modes in the subbands where RTTY and data are authorized emission types and not to either analog or digital telephony emissions. While specification of any maximum bandwidth for HF data emissions, and if there is to be one, what it should be are both reasonably debatable topics, ARRL suggests that on balance, a maximum bandwidth for data emissions in the HF spectrum should be 2.8 kilohertz.

Therefore, the foregoing considered, ARRL, the national association for Amateur Radio, respectfully requests that the Commission issue a Notice of Proposed Rule Making at an early date, proposing to modify Sections 97.305 and 97.307 of the Commission's rules as specified in the *Appendix* attached hereto, so as to delete all references to symbol rate from Section 97.307(f) of the Commission's rules; to create a conforming amendment to Section 97.305(c) of the rules;

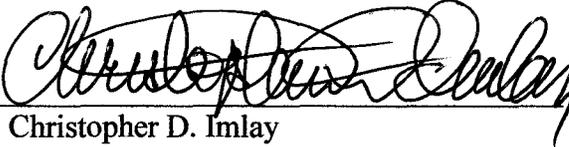
²³ As the Commission noted in *Mark Miller, supra*, changing the rules to prohibit a communications technology that is currently in use is not in the public interest.

and to establish a bandwidth limit of 2.8 kilohertz for Amateur data emissions below 29.7 MHz.

Respectfully submitted,

ARRL, the national association for Amateur Radio

225 Main Street
Newington, CT 06111-1494

By: 
Christopher D. Imlay
Its General Counsel

Booth, Freret, Imlay & Tepper, P.C.
14356 Cape May Road
Silver Spring, MD 20904-6011
(301) 384-5525

November 14, 2013

APPENDIX

Part 97, Subpart D of the Amateur Service Rules is amended at Section 97.305(c), as indicated below:

97.305 - Authorized emission types.

* * *

(c) A station may transmit the following emission types on the frequencies indicated, as authorized to the control operator, subject to the standards specified in § 97.307(f) of this part.

Wavelength band	Frequencies	Emission types authorized	Standards see § 97.307(f), paragraph:
MF:			
160 m	Entire band	RTTY, data	(3).
160 m	Entire band	Phone, image	(1), (2).
HF:			
80 m	Entire band	RTTY, data	(3), (9).
75 m	Entire band	Phone, image	(1), (2).
40 m	7.000-7.100 MHz	RTTY, data	(3), (9)
40 m	7.075-7.100 MHz	Phone, image	(1), (2), (9), (11)
40 m	7.100-7.125 MHz	RTTY, data	(3), (9)
40 m	7.125-7.300 MHz	Phone, image	(1), (2)
30 m	Entire band	RTTY, data	(3).
20 m	14.00-14.15 MHz	RTTY, data	(3).
20 m	14.15-14.35 MHz	Phone, image	(1), (2).
17 m	18.068-18.110	RTTY, data	(3).

	MHz		
17 m	18.110-18.168 MHz	Phone, image	(1), (2).
15 m	21.0-21.2 MHz	RTTY, data	(3), (9).
15 m	21.20-21.45 MHz	Phone, image	(1), (2).
12 m	24.89-24.93 MHz	RTTY, data	(3).
12 m	24.93-24.99 MHz	Phone, image	(1), (2).
10 m	28.0-28.3 MHz	RTTY, data	(43).
10 m	28.3-28.5 MHz	Phone, image	(1), (2), (10).
10 m	28.5-29.0 MHz	Phone, image	(1), (2).
10 m	29.0-29.7 MHz	Phone, image	(2).
VHF:			
6 m	50.1-51.0 MHz	MCW, phone, image, RTTY, data	(2), (5).
Do	51.0-54.0 MHz	MCW, phone, image, RTTY, data, test	(2), (5), (8).
2 m	144.1-148.0 MHz	MCW, phone, image, RTTY, data, test	(2), (5), (8).
1.25 m	219-220 MHz	Data	(13)
Do	222-225 MHz	RTTY, data, test MCW, phone, SS, image	(2), (6), (8)
UHF:			
70 cm	Entire band	MCW, phone, image, RTTY, data, SS, test	(6), (8).
33 cm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
23 cm	Entire band	MCW, phone, image, RTTY, data, SS, test	(7), (8), and (12).

13 cm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
SHF:			
9 cm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
5 cm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
3 cm	Entire band	MCW, phone, image, RTTY, data, SS, test	(7), (8), and (12).
1.2 cm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
EHF:			
6 mm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
4 mm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
2.5 mm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
2 mm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
1mm	Entire band	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).
	Above 275 GHz	MCW, phone, image, RTTY, data, SS, test, pulse	(7), (8), and (12).

Part 97, Subpart D of the Amateur Service Rules is amended at Subsection 97.307(f) dealing with technical standards as indicated below.

97.307 - Emission standards.

* * *

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

* * *

~~(3) Only a~~ A RTTY or data emission using a specified digital code listed in § 97.309(a) of this part may be transmitted. 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 symbol rate must not exceed 300 bauds, or for frequency shift keying, the frequency shift between mark and space must not exceed 1 kHz.~~ The authorized bandwidth is 2.8 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 1 kHz.~~ [Reserved.]

(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 bandwidth 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 bandwidth is 100 kHz.

* * *