

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

**In the Matter of** )  
 )  
**Amendment of Part 97 of the Commission’s** )  
**Rules Governing the Amateur Radio Service** ) **RM-\_\_\_\_\_**  
**Concerning Permitted Emissions and** )  
**Control Requirements** )

**To: The Chief, Wireless Telecommunications Bureau  
VIA OFFICE OF THE SECRETARY**

**PETITION FOR RULE MAKING**

ARRL, the National Association for Amateur Radio, also known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to Section 1.401 of the Commission’s Rules, 47 C.F.R. §1.401, hereby respectfully requests that the Commission issue at an early date a Notice of Proposed Rule Making, proposing changes requested herein in the rules governing the Amateur Radio Service. The rule changes proposed in this Petition would comprehensively modify the means by which the extremely varied emission modes in the Amateur Radio Service are developed, experimented with, implemented, and regularly utilized in the course of normal Amateur Radio communications. In short, the Petition proposes Amateur band segmentation not by emission types, but by bandwidth maxima. This petition seeks for the Amateur Radio Service the flexibility to experiment with new digital transmission methods and types to be developed in the future, while permitting present operating modes to continue to be used for as long as there are radio amateurs who wish to use them. The changes proposed in the attached Appendix will also update the Commission’s rules, and eliminate much of the currently

cumbersome procedures for determining whether a new digital communications technology is or is not permitted under the Part 97 regulations. As good cause for the rule changes proposed in the attached Appendix, ARRL states as follows:

### **I. Introduction and Background**

1. The Amateur Radio Service rules limit emission types that can be deployed in the Amateur Service. The reason for this is largely historical, rather than practical. In this Petition, ARRL suggests a shift in regulatory philosophy, which is the Amateur Radio version of a change from a “command and control” model for Amateur Radio regulation to one based on facilitating research, development, experimentation and refinement of Amateur Radio digital communications techniques and advanced technologies.<sup>1</sup> In order to encourage the implementation of new technologies in the Amateur Radio Service, the rules must be modified to more flexibly accommodate use of such technologies.<sup>2</sup> The philosophy espoused herein is to regulate bands by maximum bandwidth rather than specific or defined emission modes. This is to make it easier for new types of emissions to be introduced compatibly among incumbent emission types, while reducing or eliminating the regulatory burden of interpreting or applying rules to new technologies in the context of a presently cumbersome regulatory matrix. This can be done, and ARRL believes that the attached Appendix does that, without prohibiting or significantly restricting use of current Amateur radio technologies and emission modes. Care has

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<sup>1</sup> Indeed, in WT Docket No. 98-143, The Commission encouraged the Amateur community to complete discussions and seek consensus regarding implementation of new and more modern communications technologies within the Amateur Service. This Petition is a necessary component of that effort. See, the *Report and Order*, FCC 99-412, 65 Fed. Reg. 6548 *et seq.*, 15 FCC Rcd. 315 (1999) at ¶ 17.

<sup>2</sup> The Commission has consistently expressed its intention to offer amateur radio operators the opportunity to experiment with various types of emissions and operating modes. See, e.g. *Amendment of the Amateur Service Rules to Revise Transmitter Power Standards and Authorized Emissions*, 5 FCC Rcd. 6374 (1990) (Order) and 6 FCC Rcd. 4433 (1991) (Memorandum Opinion and Order).

been exercised to avoid any reduction of choices of emissions which could be used by existing licensees.

2. There is a pronounced trend in the Amateur Service toward digital communications, without necessarily replacing analog modes. It is apparent therefore that both analog and digital modes will be used in the same bands at the same times for the foreseeable future. For regulatory purposes, the most important parameter is the bandwidth of the transmitted signal. Generally, established Amateur practice, current rules and accepted national, regional and local band plans provide narrow-bandwidth signals at the lower frequency range of each band with wider bandwidth emission types in the upper portions. In order to implement digital technologies, there appears to be a need for an intermediate bandwidth in the middle of certain bands. ARRL has developed this plan based on the following key principles:

(a) The rule changes to be implemented must withstand the test of time over the next ten years, if not longer. The impetus for the changes is to permit greater flexibility for Amateur Radio operators to develop, experiment with, and implement technologies that are not yet envisioned, while permitting present operating modes to continue to be used as long as there are licensees who wish to use them.

(b) We are in the early stages of a dramatic shift in Amateur operating patterns, especially in the High Frequency (HF) bands. It is impossible to determine now where this shift may lead. The Commission's Rules should not stand in the way of where technology takes Amateur Radio in its fulfillment of the bases and purposes of the Amateur Radio Service (47 C.F.R. §97.1).

(c) The Commission's rules alone cannot, and should not be expected to effectively prevent conflicts in HF spectrum usage between Amateurs pursuing different operating interests on-air. Responsibility for resolving conflicts in shared spectrum must be shouldered by the Amateur community itself. Voluntary band planning must be adequate and must gain broad acceptance by amateurs as the best means of protecting their individual interests. Traditionally, these cooperative methods have worked satisfactorily.

3. As noted above, the history of Amateur Radio regulation by emission mode is the principal determining factor in the unnecessarily restrictive Part 97 regulatory environment now.

The Commission recently<sup>3</sup> stated the circumstances succinctly:

In the early days of radio, communication by radiotelegraphy was the primary means used to exchange messages between radio operators at all radio stations, including amateur radio stations. Proficiency in telegraphy using the Morse code was mandated to ensure that operators of amateur radio stations would not cause interference to Government and commercial stations and that amateur radio stations would be able to stay clear of maritime distress messages.

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We are persuaded that because the amateur service is fundamentally a technical service, the emphasis on Morse code proficiency as a licensing requirement does not comport with the basis and purpose of the service. We note, moreover, that the design of modern communications systems, including personal communication services, satellite, fiber optic, and high definition television systems, are based on digital communication technologies...[M]odern communication systems are designed to be automated systems.

Just as the Commission properly intended in the Docket 98-143 proceeding to update the licensing process to facilitate the implementation and use of new digital technology, this Petition seeks to facilitate and encourage the development, refinement and use of new digital technologies without the regulatory remnants developed at a time when the principal emissions used in the Amateur Radio Service were Morse telegraphy and single- or double-sideband amplitude-modulated telephony.

4. Prior to the 1979 World Administrative Radio Conference (WARC-79), the International Radio Consultative Committee (CCIR) recognized that the then-familiar emission designators were obsolete. Examples of the old emission designators were:

A1 for on-off keyed CW,  
A3 for double-sideband amplitude modulated (AM) telephony

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<sup>3</sup> See, WT Docket No. 98-143 *Report and Order*, FCC 99-412, 15 FCC Rcd. 315 (1999), and Errata released April 19, 2000; *Affirmed as modified by Memorandum Opinion and Order*, FCC 01-108, released April 6, 2001.

A3J for single-sideband AM telephony

CCIR proposed a more descriptive and complex system of emission designators to take into account the many new systems in use then and in the future. The 1979 World Administrative Radio Conference (WARC-79) incorporated a new set of emission designators into the international Radio Regulations.

5. Given that the Radio Regulations specifying emission designators constituted treaty text, the United States was obliged to implement them in domestic regulations. The *Third Report and Order* in General Docket No. 80-739, released November 1984, implemented the new designators in Part 2 of the Commission's Rules.<sup>4</sup> Service rules for the Amateur Radio Service were implemented in FCC 84-510. In April 1985, the Commission changed the format of frequency and emission tables in Part 97 of its Rules.<sup>5</sup> This was a complex list of amateur frequency bands versus new emission designators for permitted emission modes. Unfortunately, it was incomplete and contained difficulties in implementation. Subsequently, individual radio amateurs asked the then-Private Radio Bureau (PRB) for interpretations and petitioned the Commission to add emission designators thought to have been missing from the list. The updating process was cumbersome and not conducive to experimentation with technologies that did not fit into the regulatory framework. The new emission designators became effective in the Part 97 rules January 1, 1985. The earlier Part 97 rules designated only 14 types of emission and there was some reluctance to incorporate all 1296 of the possible combinations into the Part 97 rules. So, the Commission did a one-for-one substitution of new for old designators, which met

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<sup>4</sup> See the Third Report and Order, General Docket No. 80-739, *In the Matter of Amendment of Part 2 of the Commission's Rules Regarding Implementation of the Final Acts of the World Administrative Radio Conference, Geneva, 1979*, released November 27, 1984.

<sup>5</sup> See the Order, *Change in Format of Frequency and Emission Tables in the Amateur Radio Service Rules*, released March 29, 1985.

the treaty requirement for implementing post-WARC-79 Radio Regulations, but provided only limited flexibility for Amateur experimenters and delayed new technology in the Amateur Service. Radio Amateurs cannot be expected to experiment with emissions not authorized for use in their Service.

6. Subsequently, there occurred meetings between ARRL representatives and Private Radio Bureau representatives, including exchanges of drafts to simplify the designation of emissions in Part 97, but there was no resolution. In April of 1987, the discussions commenced again.<sup>6</sup> ARRL completed a paper on the subject in August 1987, in response to a request from Private Radio Bureau staff. The philosophy used in developing the emission designator system was to satisfy the Commission's intent to implement the WARC-79 treaty in all radio services, yet to introduce as little change as possible in the variety of emissions amateurs were permitted. The basic concept then, which has continued to the present time, is that there are traditional "CW" (i.e., Morse telegraphy) and "phone" (i.e., analog telephony, most often single-sideband) bands, and these terms should be preserved while mapping them within the context of the then-new ITU emission designators. Conceptually, this is a limited view.

7. The key recommendation in the ARRL paper was to specify emissions by key words and abbreviations, namely "CW," "data," "image," "phone," "pulse," "RTTY," "SS," and "test." Each of these words and abbreviations was defined as encompassing a group of the new ITU emission designators. Alternative concepts were also considered. Mr. Phil Karn, the licensee of Amateur Station KA9Q, and a notable technical innovator, was a proponent of regulation solely by bandwidth. The basic idea was simply to segment the Amateur allocations by bandwidth; e.g., the lower part of a band could have a bandwidth limitation of (for example) 500 Hz for CW and

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<sup>6</sup> Private Radio Bureau staff was concerned about the constant flow of requests to add other emission designators on an *ad hoc* basis, and urged the adoption of a general solution. That problem continues to the present time.

digital data/RTTY modes and approximately 3 kHz for telephony. The segmentation by bandwidth approach was not adopted at the time. A more recent article by Peter Martinez, G3PLX, revisited the issue in a thoughtful manner.<sup>7</sup>

8. On March 24, 1988, the Commission released a *Notice of Proposed Rule Making* in PR Docket 88-139, a proceeding intended to modernize the rules governing the Amateur Radio Service in the United States. This was the most extensive reorganization of Amateur rules since 1951.<sup>8</sup> This “rules rewrite,” as it came to be called, incorporated the concept of using words and abbreviations to designate a group of emissions, such as the variations of “phone.” The rules incorporated bandwidth and symbol-rate limits. This double-regulation (limitation to specified emissions with specific bandwidth maxima, and limitation of those emissions to specific symbol-rate limits) has undoubtedly handicapped Amateur digital data communication development and use. It is now necessary to permit higher data rates, in order to permit the development of digital multimedia technology, which is now coming into use in the Amateur Radio Service, and which has great promise for improving and fostering more effective emergency and disaster relief communications.

## **II. There is a Need for Change in Authorized Amateur Radio Emissions**

9. There have indeed been created accommodations in the current rules for new digital technologies, notwithstanding the need to revamp the existing system of designating specific permitted emissions and transmission characteristics. Specific “designer” digital data modes were accommodated through a modification of §97.309(a)(4):

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<sup>7</sup> Martinez, Peter, G3PLX, “Wide or Narrow? The Digital Dilemma,” *RADCOM*, July 1999, p38.

<sup>8</sup> See, the *Report and Order*, In the Matter of Reorganization and Deregulation of Part 97 of the Rules Governing the Amateur Radio Service, 4 FCC Rcd. 4719 (1989).

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, or PacTOR, for the purpose of facilitating communications.

Digital voice is also accommodated under the definition of *Phone* in §97.3(c)(5)<sup>9</sup>, though the accommodation requires some interpretation, and the matter is not clear to many radio amateurs, leading to burdensome interpretational questions to ARRL and Commission staff, and generally inhibiting experimentation. The fact is that Amateur Radio operators have both scientific curiosity and a healthy self-regulatory attitude. As such, they tend to avoid use of experimental technologies if there is a question about its legality under the Part 97 rules. The rules are typically strictly, rather than liberally, interpreted.

10. The real catalyst for change, however, is the need to permit higher speed data in the Amateur bands from 1.8 MHz to 450 MHz, above which there are no limits except to contain the transmitted signal within the allocation edges. A recent example of the concern was an inquiry received by ARRL from a technical experimenter, Mr. Steve Waterman, licensee of Amateur Station K4CJX, concerning the symbol rate restrictions of HF amateur communications:

...[A]bout the potential to test a new mode with a symbol rate of nearly 5600 baud and a bandwidth of 2.4 kHz. The amateur rules currently restrict symbol rates to 1200 baud on 10 meters and 300 baud on all other HF bands. [ARRL staff] suggested that an experimental license might be a possibility.

In addition, given the current interest in and expectations for use of digital multimedia, the lines between data, image and voice have blurred. As an example, amateurs are now sending pictures using MFSK 16<sup>10</sup> in the segments of the bands where data (not image) emission is permitted. A reasonable interpretation of the current Part 97 rules would indicate that this is permitted, but the

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<sup>9</sup> Rinaldo, Paul L., W4RI, "Is Digital Voice Permissible under Part 97?" sidebar, *QEX*, May/June 2000.

<sup>10</sup> MFSK 16 is a frequency shift keyed system using 16 tones.

legality of it is not readily apparent to all who would otherwise experiment with digital multimedia.

11. In summary, there is a need to permit higher speed digital data communications in the bands between 1.8 and 450 MHz, but to do so in a manner that does not create interference with current analog or other digital modes in regular use in these crowded allocations. The simplest means of streamlining the Commission's rules, while at the same time providing maximum flexibility for the incorporation of new digital communications looking forward to the next decade, and to protect ongoing Amateur communications, is to provide for band segmentation by bandwidth rather than by emission mode in the Part 97 Rules. Regulation of emissions by limiting bandwidth is not the only option. Many countries do not segment their amateur bands by bandwidth *or* mode in their domestic regulations. Rather, band planning is done either on a regional basis through the International Amateur Radio Union band plans, or through voluntary band plans developed by the national Amateur Radio society in that country. In those cases, the rules simply require that Amateur signals be kept within the allocated band. Because there is a strong tradition in the United States of restricting subbands by rule rather than purely through voluntary band plans, complete elimination of regulatory band segments and complete reliance on informal band planning does not appear to be a suitable option in the United States.

### **III. Bandwidth Segmentation by Regulation**

12. Having a narrow bandwidth segment and a wide bandwidth segment in a given allocation would tend to keep signals of roughly the same bandwidth in their own spectrum. The specific bandwidth limits, once incorporated in the Rules, would allow a more natural development of new digital technologies. It would also satisfactorily protect incumbent analog

services to a reasonable extent, just as Amateurs do now, using dynamic frequency selection methods.

13. The principal change to the Commission's rules proposed herein is to eliminate, to the maximum extent possible, the specific protocols or modes of emissions from the rules. The difficulty in doing this is the determination of the proper maximum bandwidth in a given band. ARRL was guided in the preparation of the attached Appendix by advice from an Ad Hoc Digital Committee formed to advise the ARRL on issues that arise from the development of new high-frequency digital data modes of operation, and by extensive input from ARRL members. The proposed Appendix constitutes a balance, in ARRL's view, between the need to encourage wider bandwidth, faster digital communications and the need to reasonably accommodate all users in crowded bands. The HF allocations offer the least opportunity for frequency re-use, and the higher UHF and microwave bands offer the most flexibility in this respect. The higher frequency bands, therefore, properly offer the widest available bandwidths. These premises, and the proposed Appendix which implements them, promote the most efficient use of spectrum shared among Amateur licensees. The recommendations of ARRL's Ad Hoc Digital Committee were to delete the symbol rate limitations in Sections 97.307(f)(3) and (4); to segment the bands below 28.0 MHz by nominal bandwidths of 200, 500 and 2700 Hz as upper limits; and to require that digital data protocols be published, so that they can be duplicated and monitored to protect against intruders. The Committee was aware of the bandwidths and frequency segments under consideration by Region 1 of the International Amateur Radio Union. A bandwidth of 200 Hz was chosen to accommodate Morse telegraphy and the narrowest RTTY/data emissions. A bandwidth of 500 Hz would permit the foregoing modes and a wide range of RTTY/data modes and some image modes yet to be designed. IARU Region 1 studies chose a bandwidth of 2700

Hz for SSB telephony and to accommodate digital voice and higher speed data. The Rules already specify a bandwidth of 2800 Hz for SSB voice in the 60-meter band. As the issue is a maximum regulatory bandwidth, not current practice, which varies from approximately 2400 to 2800 Hz, a bandwidth of 3500 Hz is recommended in the proposed Appendix for the wide bandwidth segments in order to encourage maximum flexibility. The proposed rules also specify that “bandwidth” will be defined in terms of *necessary bandwidth* rather than *occupied bandwidth*, to reduce undue concern by operators about determinations by measurement of occupied bandwidth.<sup>11</sup> Some radio amateurs who have discussed this issue with ARRL representatives have expressed concern that permitting bandwidths up to 3.5 kHz for HF digital communications is an overly generous accommodation for digital communications users at HF. However, it is no expansion of present operating authority whatsoever: there is presently *no effective bandwidth limit* on HF digital operations. The existing bandwidth limit of 500 Hz applies only to automatically controlled stations where the station is responding to interrogation by a station under local or remote control. See, 47 C.F.R. §97.221(c). In fact, in the band segments proposed in the attached Appendix to be limited to 200 or 500 kHz, there is greater protection proposed for narrowband emission modes than exists today.<sup>12</sup>

14. There are certain incumbent Amateur operations that should be allowed to continue, though they may not comply with the above-referenced bandwidth limitations. Principal among these is double-sideband AM, which has a significant following in the Amateur community. The

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<sup>11</sup> With respect to the 60-meter band, which under current rules (47 C.F.R. § 97.303(s)) atypically specifies 2.8 kHz maximum bandwidth on specific channelized segments as a matter of specific, coordinated protection for Federal systems operating in the same band segment, no change to that maximum bandwidth is proposed herein.

<sup>12</sup> Nor is the proposal a means of expanding telephony subbands. The specification of bandwidth only will have the regulatory effect of permitting telephony operation in, for example, the 14.100-14.150 MHz segment and the 10.135-10.150 MHz segment, where presently, it is not permitted by rule. However, it is not the ARRL’s intent to encourage telephony operation in those segments. Rather, such matters should be regulated by voluntary band planning.

proposed rules accommodate continued DSB-AM operation in the high-frequency bands without additional restriction, as is the case now.<sup>13</sup> Again, this is based on the principle that accommodation of new technologies should not be at the expense of currently used operating modes. On the other hand, the current provision in the Amateur Rules generally permitting Independent Sideband [See, Section 97.307(f)(2)] is removed, since that emission mode is not in current use in the Amateur Service, and has not been for more than ten years. ISB operation would, however, be permitted in the segments in which a 6 kHz or greater bandwidth is permitted.

#### **IV. Specific Rule Change Proposals to Implement Bandwidth Regulation**

15. The current rules<sup>14</sup> permit what is informally referred to within the Amateur Radio community as “fully automatic control” of HF data communications in small segments of the bands below 28.0 MHz. The concept is that automatically controlled stations can be programmed to initiate transmissions to other locally, remotely or automatically controlled stations. This was initiated in the mid-1980s in order to provide for the automatic forwarding of messages using the AX.25 packet protocol. Automatic control of data communications at HF presents technical problems that make sharing with other modes and uses challenging. Fully automatic control, in a network or station configuration where both stations in communication can be under automatic control, unless limited to certain band segments where automatically initiated transmissions can be expected, complicates efficient sharing of crowded HF spectrum. While it is not ARRL’s intention whatsoever to segregate HF data communications by rule, it is necessary to do so where the station or network configuration is such that stations under automatic control can initiate transmissions. To do otherwise would be to create an environment where such stations might

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<sup>13</sup> See, 47 C.F.R. §§ 97.3(c)(1) and 97.307.

<sup>14</sup> See, 47 C.F.R. §§ 97.31(b).

initiate transmissions that would interfere with ongoing communications on the same frequency using incompatible emission types. Therefore, the existing provisions of § 97.109(e) and §97.221(b), which permit automatic control of HF data operation in certain narrow segments of the HF bands below 28.0 MHz, are proposed to be retained.<sup>15</sup> There are proposed changes to the specific segments that would be available for fully automatic control of RTTY or data communications. Specifically, it is proposed to eliminate some of the narrow segments that are presently included in Section 97.221(b), and to move another, so as to fit better the graduated bandwidth segmentation plan set forth in the Appendix.<sup>16</sup> The title of § 97.221, “Automatically controlled digital station” is misleading and is proposed to be modified to read, “Automatically controlled stations transmitting RTTY or data emissions.” The term “digital” is too broad, as, for example, Morse telegraphy is a digital emission. This change is especially timely, given the recent introduction of digital voice and digital image emissions.

16. An additional and more practical concept for HF data and RTTY communications is what is commonly referred to as “semi-automatic control,” where a station which is automatically controlled cannot initiate transmissions; all communication must be initiated by a station under local or remote control by a control operator. This configuration is permitted by the present Section 97.221(c), but only under the significant constraint of a limitation of 500 Hz bandwidth. It appears to be practical as a generalized operating practice. It should suffice for interference avoidance purposes generally to require, as does the current Section 97.221(c)(1),

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<sup>15</sup> Section 97.109(e) was deleted, ARRL believes inadvertently, in the Order portion of the Notice of Proposed Rule Making and Order in WT Docket No. 04-140 (See, FCC 04-79, released April 15, 2004). The language formerly included in that rule section is included in a *proposed* change to Section 97.115 contained in the NPRM portion of that proceeding, but it is unclear whether the revised language properly preserves the entirety of the original requirement of Section 97.109(e). In any event, because the proposed rules in the NPRM in WT Docket No. 04-140 have not yet been adopted, there is a temporary vacuum in connection with the requirements formerly set forth in Section 97.109(e).

<sup>16</sup> Specifically, the 14.095-14.0995 MHz, 18.105-18.110 MHz, and 24.925-24.930 MHz segments are proposed to be eliminated, and the 15-meter segment at 21.090-21.100 MHz is proposed to be moved to 21.150-21.160 MHz.

that stations under automatic control (outside the specific segments where automatically controlled stations can operate without this limitation) not initiate communications without interrogation by a station under local or remote control. Therefore, it is proposed to modify Section 97.221(c) to delete the limitations on semi-automatic control and to permit the same throughout the amateur HF bands. Residual risk of interference from this station (or network) configuration can best be managed by the Amateur community through a combination of technology (including further development of listen-before-transmit protocols) and respectful operating practices (which are already necessitated and practiced by radio amateurs).

17. Section 97.119 (b)(1) is proposed to be modified by adding MCW for the purposes of identification in addition to CW, as the former is in common use for repeater identification. Phone emission in the English language is proposed to remain but with the limitation that it be done on frequency segments where there is sufficient bandwidth authorized. Identification in the emission used for communication is also proposed, which will cover new emissions not originally specified. Accordingly, there is no longer a need to specify identification in accordance with § 73.682(a) and it is proposed that § 97.119(b)(4) be deleted.

18. The current § 97.305(b) mixes the subjects of test transmissions, pulse emissions and spread spectrum. For ease of understanding, it should be amended to deal only with test emissions. The existing § 97.305(c) table is proposed for deletion as it segments bands by mode of emission. It would be replaced with a table segmenting bands by bandwidth, with the new paragraph (e) including some consequential renumbering of § 97.305. The bandwidths 200 Hz, 500 Hz, 2.8 kHz, 3.5 kHz, 9 kHz, 16 kHz and 100 kHz appear in the proposed Appendix.

► **200 Hz** is intended to be the narrowest bandwidth to permit Morse telegraphy at all speeds that human operators can decode. The necessary bandwidth depends on speed and whether the

circuit is fading or non-fading. An analysis by ARRL in the 1980s showed that 150 Hz is adequate and is based on rise and fall times of 5 ms. A bandwidth of 200 Hz will permit data modes such as PSK31 as well.

▶ **500 Hz** is meant to provide for RTTY and data modes, and possibly new image modes, but the bandwidth is not adequate for conventional telephony. This is not, however, to exclude experimentation with highly compressed or synthesized telephony designed to fit in a 500-Hz bandwidth at sacrifice of natural sounding voice.

▶ **2.8 kHz** is required by NTIA for Amateur operation on the designated 60-meter channels.

▶ **3.5 kHz** would accommodate SSB and digital telephony, image, high-speed data and multi-media (that is, a combination of these modes). ARRL recommends 3.5 kHz as a general rule rather than 2.7 kHz as is specified in the band plan in ITU Region 1, or 2.8 kHz as required by NTIA for Amateur use on the 60-meter channels. However, 3.5 kHz is not wide enough for DSB-AM, so a separate sub-paragraph is proposed to accommodate such operation as a specific exception to the general 3.5 kHz bandwidth standard.

▶ **9 kHz:** Though the necessary bandwidth of a DSB AM emission is often stated as 6K00A3E, ARRL recommends 9 kHz in order to leave no doubt that transmitters now in use for DSB AM emissions can continue to be operated.

▶ **16 kHz** also is a reasonable compromise bandwidth to continue to permit analog FM voice, data, digital voice and multimedia in the 29.0-29.7 MHz segment.

As a matter of interest, the following is a table from ITU-R document 8A/248 (Report of the Thirteenth Meeting of ITU-R Working Party 8A, 17-23 September 2002). It was the result of a Canadian input paper to define characteristics of land mobile systems. It has not been fully studied or agreed upon. However, it is a good summary of bandwidths needed for various analog and digital systems in use or planned for the immediate future in the land mobile services, and can offer some direction in bandwidth regulation for the Amateur Service, which from time to time utilizes converted land mobile radio equipment in Amateur systems. It can be seen from this table that there is no international consensus on land mobile bandwidth generally, and it is understood that in the United States, VHF and UHF bandwidth for land mobile radio is currently settling on a 12.5 kHz standard, but something on the order of 16 kHz would be realistic for bands above 29 MHz in the Amateur Service for the near term.

TABLE

**IF filter specifications for terrestrial land mobile receivers**

Modulation Type	Bandwidth (kHz) <sup>1</sup>	ENBW (kHz)	IF Filter Simulation
Analogue FM (25 kHz) ±5 kHz	±7.5	12.6	*

Analogue FM (25 kHz) $\pm 4$ kHz NPSPAC	$\pm 6$ .	10.1	*
Analogue FM (12.5 kHz) $\pm 2.5$ kHz	$\pm 4.6$	7.8	*
C4FM	$\pm 3.4$	5.7	*
CQPSK	$\pm 3.65$	5.7	12-pole Inverse Cheby <sup>†</sup>
GMSK BT=0.25 (12.5 kHz)	$\pm 4.6$	7.8	*
CVSD (25 kHz) $\pm 4$ kHz	$\pm 7.5$	12.6	*
CVSD (25 kHz) $\pm 3$ kHz NPSPAC	$\pm 6.0$	10.1	*
$\pi/4$ DQPSK (IMBE) TDMA (12.5 kHz)	$\pm 5.6$	9.5	*
EDACS® (IMBE) (25 kHz)	$\pm 5.8$	9.8	*
EDACS® (IMBE) (12.5 kHz)	$\pm 5.4$	9.1	*
DIMRS	$\pm 8.75$	16.0	RRC, $\alpha=0.2$
<sup>1</sup> Parameters for use with filter design formulas. * Cascade of three 4-pole Butterworth stages, each 4-pole stage having a 3 dB bandwidth as given in the "Bandwidth" column. <sup>†</sup> = 0.0003 [NOTE - A symbol is missing]. C4FM = Compatible 4-level FM. CQPSK = Compatible quadrature phase-shift keying. GMSK = Gaussian Minimum Shift Keying. CVSD = Continuously-variable slope delta modulation. DIMRS = Digital integrated mobile radio system. EDACS® = Enhanced digital access communication system [(Trademark of Ericsson)]. NPSPAC = National Public Safety Planning and Advisory Committee. RRC = Root Raised Cosine filter. ENBW = Equivalent Necessary Bandwidth			

► **100 kHz** is presently permitted (for RTTY and data) in bands above 420 MHz. It is reasonable to extend this maximum bandwidth starting at 50 MHz (avoiding 50-50.3 MHz and 144-144.3 MHz), so as to allow both digital multimedia and high-speed meteor scatter (burst) communications.

## V. Band-By-Band Summary of Proposed Bandwidth Regulation

19. The following is a band-by-band summary of the changes proposed in the table at § 97.305(e). The proposed changes are intended and are believed to be generally consistent with the Commission's proposal for "refarming" the Novice Class subbands proposed in WT Docket No. 04-140, which is now pending.

► **160 m band:** This petition does not propose segmenting the 160-meter band but would allow maximum bandwidths of 3.5 kHz throughout (while continuing to permit DSB-AM). ARRL's band plan recommends that the band be segmented informally by mode. ARRL does not suggest band segmentation in this band by regulation, because generally, the use of voluntary band plans in lieu of mandated segmentation has, in this band in particular, been historically sufficient. However, should the Commission nevertheless determine at some time in the future that segmentation by regulation is in the public interest, it is recommended that the segmentation be accomplished by bandwidth limits and not by emission mode, in accordance with the recommendations in this Petition.

► **80 m and 75 m bands:** The three tiers of bandwidth are as recommended by ARRL's *ad hoc* HF Digital Committee, with slight modifications to accommodate the narrow fully automatic control segments in Section 97.221(b).

► **60 m band:** The five channels and the Alaska Emergency calling channel are added here because they have specific bandwidth limitations inherent in the Amateur allocation, which should be specified as are other bands in the table, especially because of the unique maximum bandwidths specified elsewhere in the rules.

► **40 m band:** This is as recommended by the ARRL *ad hoc* HF Digital Committee.

► **30 m band:** This proposes 200 Hz, 500Hz and 3.5 kHz bandwidths. While telephony is not encouraged in this band due to the relatively narrow, secondary allocation status of the Amateur Service, this can best be regulated by voluntary band planning.

► **20 m band:** The three tiers of bandwidth in this segment would for the first time permit telephony in the 14.100-14.150 MHz segment. This, again, is not encouraged due to extensive international use of the segment, but this can be best regulated through voluntary band planning.

► **17, 15 and 12 m bands:** These would include the three-tier bandwidth standard.

► **10 m band:** This would permit a 16-kHz bandwidth in the upper part of the band, 29.0-29.7 MHz, but otherwise includes the three-tier bandwidth standard.

► **6 and 2 m bands:** This preserves the lower 300 kHz in each band for narrowband, weak-signal modes reflecting established practice, but opens the rest of these bands for bandwidths up to 100 kHz. This is intended to permit new modes, particularly multimedia.

► **1.25 m band(s):** Both of the segments of this band already permit up to 100 kHz bandwidth for data.

► **70 cm through 1 mm bands:** Present rules permit 100 kHz for data but allow wider bandwidth for TV, generally regarded as up to 6 MHz for vestigial sideband AM in bands below

1240 MHz, noting that FM TV is used in bands above 1240 MHz. In these bands, the rules should minimize bandwidth limits to permit maximum flexibility in Amateur operation. The only limitation should be to keep the necessary bandwidth of the emission in the allocated band, and to employ normal band-sharing protocols (i.e. good “amateur practice”).

20. Rather than the current language in § 97.309 concerning RTTY and data emission codes which specify some codes specifically and then permit others that are published, the Appendix proposes simply that the digital codes be published, and that all other applicable rules are observed.

## **VI. Conclusions**

21. The regulation of emission modes in Amateur Radio Service allocations is a limiting factor with respect to Amateur Radio experimentation. It leads to attempts to put new technology into a regulatory framework that was designed to deal not with digital emissions, but rather with older, analog technologies. The conversion to segmentation by bandwidth provides a regulatory environment which is conducive to the transition to newer technologies. The regulation of emissions by bandwidth is the most flexible means of encouraging experimentation with new communications techniques in the Amateur Service. There are emission types that are in use today which do not necessarily fall neatly into a sub-band division by maximum bandwidth, such as DSB AM, but those emissions can continue to be accommodated for those who wish to use them, without detracting from the use of the bands by others and without diverging substantially from the paradigmatic change suggested herein.

22. The Commission’s rules cannot efficiently prevent conflicts in HF spectrum usage between or among amateurs pursuing different interests. Of course, there must be mechanisms to minimize interference between analog and digital operation, since they cannot compatibly share the same “channel” or frequency range. However, using the Commission’s rules to subdivide the

HF bands should be minimized. Reflected in the attached Appendix is a nearly pure regime of regulation of the bands by bandwidth only. This is both necessary and sufficient in order to preclude usurpation of the narrow and crowded bands by any one type of emission or user, and yet flexible enough to permit accommodation of new modes in an “overlay” fashion. This petition does not favor one mode at the expense of another. It merely allows expansion of the repertoire of options that Amateurs may pursue, compatibly. The plan places increased responsibility on the Amateur community to establish workable, accepted band plans for these bands, but ARRL is confident that the ongoing effort to do that will be successful. ARRL is firmly committed to completing a competent and acceptable band plan to accompany the rule changes proposed herein.

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, looking toward adoption of the rule changes set forth in the attached Appendix, and adopt the proposed regulatory scheme herein as a blueprint for the future of Amateur Radio regulation.

**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

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**APPENDIX A**

**PROPOSED RULE CHANGES**

Part 97 of Chapter I of Title 47 of the Code of Federal Regulation is proposed to be amended as follows:

**Section 97.3(a)(8) is amended to read as follows:**

(8) *Bandwidth*. For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions (*See the definition of Necessary Bandwidth in Section 2.1 of this Chapter and Section 97.101(a) of this Part*).

**Section 97.3(a)(42) is amended to read as follows:**

(42) Spurious Emission. For the purposes of this Part, emission on a frequency or frequencies which are outside the allocated frequency band and which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products.

**Section 97.109(e) is amended to read as follows:**

§97.109 Station control.

(a)...

\*\*\*\*\*

(e) No station may be automatically controlled while transmitting third party communications, except a station transmitting a RTTY or data emission. All messages that are retransmitted must originate at a station that is being locally or remotely controlled.

**Section 97.119 is amended to read as follows:**

§ 97.119 Station identification.

\*\*\*\*\*

(b)...

(1) By a CW or MCW emission. When keyed by an automatic device used only for identification, the speed must not exceed 20 words per minute;

(2) By a phone emission in the English language where a bandwidth of at least 3.5 kHz is authorized. Use of a standard phonetic alphabet as an aid for correct station identification is encouraged;

(3) By the same emission as used for the communication.

(4) (Deleted)

**Section 97.221 is amended to read as follows:**

§ 97.221 Automatically controlled stations transmitting RTTY or data emissions.

\*\*\*\*\*

(b) A station may 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, 21.150-21.160 MHz, 14.100-14.112 MHz, 10.140-10.150 MHz, 7.100-7.105 MHz, or 3.620-3.635 MHz segments.

(c) A station transmitting a RTTY or data emission may be automatically controlled on any other frequency authorized for such emission types provided that the station is responding to interrogation by a station under local or remote control.

(1) (Deleted)

(2) (Deleted)

**Section 97.305 is amended to read as follows:**

§ 97.305 Authorized emission types.

(a) An amateur station may transmit a CW emission on any frequency authorized to the control operator except for the frequencies in the 60 m band.

(b) A station may transmit a test emission on any frequency authorized to the control operator for brief periods for experimental purposes. Test transmissions are authorized in the segments 51-54 MHz, 144.1-148.0 MHz and on all bands above 222 MHz.

(c) Pulse emissions are permitted on all bands authorized to the control operator above 902 MHz except in the 23 cm and 3 cm bands.

(d) SS emissions are permitted on all bands authorized to the control operator above 420 MHz.

(e) Except as otherwise provided in this Section, a station may transmit any emission on any frequency authorized to the control operator subject to the following bandwidth limitations:

Wavelength band	Frequencies authorized	Maximum bandwidth	Standards See §97.307(f) paragraph:
160 m	Entire band	3.5 kHz	(1)
80 m	3.500-3.580 MHz	200 Hz	
80m	3.580-3.620 MHz	500 Hz	
75 m	3.620-4.000 MHz	3.5 kHz	(1)
60 m	5.1675 MHz	2.8 kHz	See §97.401(c)
-do-	5.332, 5.348, 5.368, 5.373 and 5.405 MHz	2.8 kHz	See §97.301(s)
40 m	7.000-7.035 MHz	200 Hz	
-do-	7.035-7.075 MHz	500 Hz	
-do-	7.075-7.100 MHz	500 Hz	(2)
-do-	7.100-7.300 MHz	3.5 kHz	(1)
30 m	10.100-10.120 MHz	200 Hz	
-do-	10.120-10.135 MHz	500 Hz	
-do-	10.135-10.150 MHz	3.5 kHz	
20 m	14.000-14.065 MHz	200 Hz	
-do-	14.065-14.100 MHz	500 Hz	
-do-	14.100-14.350 MHz	3.5 kHz	(1)
17 m	18.068-18.100 MHz	200 Hz	
-do-	18.100-18.110 MHz	500 Hz	
-do-	18.110-18.168 MHz	3.5 kHz	(1)
15 m	21.000-21.080 MHz	200 Hz	
-do-	21.080-21.150 MHz	500 Hz	
-do-	21.150-21.450 MHz	3.5 kHz	(1)
12 m	24.890-24.920 MHz	200 Hz	
-do-	24.920-24.930 MHz	500 Hz	
-do-	24.930-24.990 MHz	3.5 kHz	(1)
10 m	28.000-28.050 MHz	200 Hz	
-do-	28.050-28.120 MHz	500 Hz	
-do-	28.120-29.000 MHz	3.5 kHz	(1)
-do-	29.000-29.700 MHz	16 kHz	
6 m	50.000-50.100 MHz	200 Hz	
-do-	50.100-50.300 MHz	3.5 kHz	
-do-	50.300-54 MHz	100 kHz	
2 m	144.0-144.1 MHz	200 Hz	
-do-	144.1-144.3 MHz	3.5 kHz	
-do-	144.3-148.0 MHz	100 kHz	
1.25 m	219-220 MHz	100 kHz	
-do-	222-225 MHz	-	(3)
70 cm	Entire band	-	(3)
33 cm	Entire band	-	(3)
23 cm	Entire band	-	(3)

13 cm	Entire band	-	(3)
9 cm	Entire band	-	(3)
5 cm	Entire band	-	(3)
3 cm	Entire band	-	(3)
1.2 cm	Entire band	-	(3)
6 mm	Entire band	-	(3)
4 mm	Entire band	-	(3)
2.5 mm	Entire band	-	(3)
1 mm	Entire band	-	(3)
-	Above 300 GHz	-	

**Section 97.307(f) is amended to read as follows:**

§ 97.307 Emission standards.

\*\*\*\*\*

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

(1) The 3.5 kHz maximum bandwidth does not apply to double-sideband amplitude-modulated phone A3E emissions which are limited to bandwidths of up to 9 kHz.

(2) Phone and image emissions with a maximum bandwidth of 3.5 kHz may be transmitted only by stations located in ITU Regions 1 and 3, and by stations located within ITU Region 2 that are west of 130° West longitude or south of 20° North latitude.

(3) No specific bandwidth limitations apply except that the entire emission must be within the allocated band to meet the requirements of §97.307(d).

(4) through (13) (Deleted)

**Section 97.309 is amended to read as follows:**

§ 97.309 RTTY and data emission codes.

(a) Where authorized by §97.305(e) and §97.307(f) of this Part, an amateur station may transmit a RTTY or data emission using published digital codes for the purpose of facilitating communications.

(b) When deemed necessary by the FCC's Enforcement Bureau to assure compliance with the FCC Rules, a station must:

- (1) Cease the transmission using the unspecified digital code;
- (2) Restrict transmissions of any digital code to the extent instructed; and
- (3) Maintain a record, convertible to the original information, of all digital communications transmitted.