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

Amendment of Part 97 of the	)
Commissions Amateur Radio	)
Service Rules to Permit Greater	) RM-11708
Flexibility in Digital Data	)
Communications	)

To: The Chief, Wireless Telecommunication Bureau
Via: The ECFS

Comments of Robert Montague Wilson, NT0A

The undersigned, Robert Montague Wilson, pursuant to Sections 1.41 and 1.405 of the Commission's rules (47 CFR Sections 1.41, 1.405) respectfully offers these comments in support of the above-captioned Petition for Rule Making.

COMMENTS:

1. It is impossible for me to overstate how strongly I support adoption of the ARRL petition, including the erratum, to replace the antiquated 300 baud symbol rate limitation with a limitation based upon bandwidth. Adopting the metric of a digital bandwidth of at least 2.8 kHz will allow an accelerated development of more efficient digital waveforms for the **A**mateur **R**adio **S**ervice (**ARS**), development that has been stymied by the artificial 300 baud limitation.

2. In its deliberations, I recommend that the Commission consider adopting a maximum digital bandwidth of 3.0 kHz rather than the proposed 2.8 kHz. A bandwidth of 3.0 kHz will bring MF/HF digital operations of the amateur radio service (ARS) in line with commercial and military MF/HF digital operations. This will allow the ARS to better fulfill its obligation under CFR 97 Subpart E (§97.401 through §97.407).

3. The first part of these comments will be directed towards justification for embracing the change from a 300 baud limitation to a limitation based on bandwidth. The second part will address general and specific objections to changing the metric for digital signals, and the final part will be a

summary of the justification for the change of the metric and the reason why all of the filed objections are specious.

4. Special notice should be taken to the use of the word “specious.” Specious is a precise word that applies to the logic of the objections adopting a bandwidth rule for digital signals. It does not describe the individuals who filed the objections. Specious is a pejorative adjective for the comments, not the commenters.

5. There are parallel threads to the history of ham radio. One thread is replete with ground breaking, watershed advancements of the radio art by amateur radio operators such as:

a. Long range radio transmission by frequency rather than spark.

b. Modulation of radio signals.

c. Discovery that 200 meters and above were the best frequencies for long range communications.

d. Single Side Band.

e. The first radio broadcasting of music and news.

f. The first communications satellite.

6. The second thread is chocked full of doom and gloom projections that each new technological development would spell the end of amateur radio. The passage of time proved that the objections were unfounded as amateur radio thrived with the new changes. The approval of RM-11708 will be another of the many watershed events in amateur radio history from which amateurs around the world will benefit.

7. It should be intuitively obvious that the dual needs for more efficient use of the frequency bands available to the ARS and faster, more reliable communications for CERT, ARES, and RACES communication are more than sufficient to justify adopting the ARRL petition for changing to a

bandwidth metric. Unfortunately there is a basic misunderstanding of the meaning of "efficiency" that distorts objectors understanding of the issues and muddies their arguments.

a. Practically all of the comments filed in objection to the ARRL petition either unknowingly or deliberately confuse population/numbers with efficiency. The simplest definition of efficiency is to complete a task in the minimum possible time. Merriam-Webster defines efficiency as:[1]

> the ability to do something or produce something without wasting materials, time, or energy

Efficiency is not the measure of how many 50 Hz wide signals a 100 kHz bandwidth can contain compared with the number of 3.0 kHz wide signals that can be contained in the same 100 kHz bandwidth.

b. The most egregious comments filed in objection to the proposed change confuse the number of discrete signals in a given bandwidth with the efficiency of a specific signal in terms of data rate or throughput. By any performance metric, a 31.5 Hz wide PSK31 signal that results in roughly a 50 word per minute CTR/monitor printout speed is far less efficient than an open definition, 2.8 kHz, MIL-STD-188-110A waveform that results in characters printed out in 1/100th of the time.

8. Simply put, the adoption of RM-11708 is a needed modernization of FCC Part 97. RM-11708 will allow maximizing the efficient use of the RF spectrum by the ARS for digital messaging below 29.7 MHz. It will allow use of open standard MIL-STD, STANAG, and commercial waveforms that operate at symbol rates in excess of the current limits that fit within the 2.8 kHz bandwidth metric. This will provide high speed digital communication with humanitarian, local, state and U.S. government as well as military stations in times of emergencies.

9. The objections to replacing the antiquated 300 baud restriction with a 2.8 kHz limitation are remarkably consistent in that they are heartfelt, but they all exhibit either a limited understanding or a deliberate exclusion of what current regulations allow and how advocates of RM-11708 use digital

[1] http://www.merriam-webster.com/dictionary/efficiency

modes in non-emergency routine hamming in the ARS. The objections to RM-11708 are based either on faulty data and/or contain faulty logic evidenced as disjunctive syllogisms, contradiction of known facts, and/or self-contradictions.

10. The remainder of the comments in support of RM-11708 will be rebuttals of the above list using specific comments filed in objection to changing the digital signal metric from baud rate to band width. To improve readability, filed objections will be formatted using single spacing, boldface headings, and indented margins

. Rebuttal arguments will conform to the standard double space, indented paragraph format.

11. The primary objection to RM-11708 is that it will interfere with narrow band modes of communications such as CW, RTTY, and PSK31. Secondary objections include:

a. Will interfere with existing ARS modes.

b. Narrow band emissions are more efficient.

c. Increasing data rate is not a valid reason for the change.

d. Wideband waveforms will Require a higher S/N ratio or more power.

e. Change will not enhance experimentation.

f. Will benefit only a few hams.

g. Will not make efficient use of the spectrum.

h. Will authorize encryption on the amateur bands.

i. Reliable high data rate transmission on HF are a either an unattainable pipe dream or a stalking horse for a hidden agenda such as commercialization fo the ham bands.

12. No one would dispute the fact that if all the PSK31 devotees switched to a digital signal that was 2.8 kHz wide, narrow band communications would not be possible. It should be intuitively obvious that those fears are baseless. Specifically:

a. Most amateurs are interested in making contact for a new state or country, for a contest, or to rag chew. As such, they are going to use the digital modes that are most commonly used by other amateurs, CW, RTTY, and PSK31. This can be shown empirically by tuning up in on 20 meters and transmitting an extended CQ with one of the wideband digital signals allowed by FCC regulations. No one will answer the CQ.

b. The only real interest in wideband, i.e., 2.8 kHz, digital waveforms are amateurs with an interest in traffic handling, emergency communications, or experimentation.

c. Traffic or message handling nets are regularly scheduled and conducted at times and on a portion of the band designed to cause minimal interference to other signals.

d. The impact of 2.8 kHz, long haul communications out of a disaster area would be minimal and limited to the time that regular methods of long haul communications are inoperative. Additionally, the FCC regulations are crystal clear that emergency communications take precedence over all other communications on the frequencies allowed on the ARS bands.

13. Objections because of potential interference:

Objection 1
We need technologies that make more efficient usage of our spectrum, not those that hog our limited resource. Furthermore, this proposal is a slap in the face to those pioneering individuals who have developed and use narrowband modes, the most efficient means of utilizing our limited spectrum.

Objection 2
The ARRL proposed bandwidth limit of 2.8 kHz bandwidth for digital emissions in the RTTY, data, and CW segments of amateur HF bands below 29.7 MHz would greatly increase interference to existing stations using traditional RTTY, data and CW modes of 500 Hz or less in these segments of the bands. Mixing wide-band signals (emissions greater than 500 Hz) and narrow-band signals (emissions of 500 Hz or less) in the same segments of the amateur HF bands is problematic due to a greater potential of interference to narrow bandwidth modes. The valid technical reasons for not mixing wide-band and narrow-band modes have been well documented by Charles Rauch, Jr. Adding additional wide-band signals where traditional narrow-band modes are in use is a recipe for disaster and would cause irreparable damage to the Amateur Radio Service. For a simple example of what a 2.8 kHz digital signal could do in regard to interference, refer to the screenshot below which shows a bandwidth of approximately 2.6 kHz (300- 2900 Hz) in the 12-meter amateur band

(24 MHz) taken by me on November 24, 2013. Within this 2.6 kHz section of the band, there are six narrow-band mode signals. There is one JT94 signal, four PSK315 signals and one CW signal. They are sharing the same 2.6 kHz of bandwidth and not interfering with each other. Now imagine one 2.8 kHz digital signal overlapping this same 2.6 kHz segment of the band, either by accident or hidden transmitter effect6. It would take up all of the width of the spectrum shown and interfere with all six of these signals. This is only a small example of what could happen. There could actually be well over a hundred narrow-band signals in this same 2.6 kHz segment. If that were the case, all of them could be interfered by one 2.8 kHz signal. Approval of RM-11708 would expand the already harmful mixing of wide-band and narrow-band emissions.

Objection 3
Specifically, I cannot recommend that 2.8 kHz emissions be allowed in our CW and data HF sub-bands.

Mixing wider 2.8 kHz bandwidth emissions with narrower CW and data emissions potentially allows one operator to interfere with many other stations, sometimes completely unaware of the occurrence.

Many of the narrower bandwidth emissions operate efficiently under weak signal conditions (PSK31, MT63, etc), provided interference from other stations is abated.

Encouraging wider bandwidth signals with unfettered access in our traditionally narrower and weak signal emission sub-bands will create more interference.

Anti-interference protocols for existing WinLink2000 systems have proven ineffective, as they cannot properly detect an on-going weak signal conversation using our narrower bandwidth emissions.

Instances of WinLink2000 PACTOR 3 stations starting up on top of ongoing narrow bandwidth PSK31 or CW conversation are observed daily on our HF bands.

Increasing the data rate of the WinLink2000 by using PACTOR 4 will not abate interference by increasing faster data transfers, but will instead encourage its' users to send larger data files.

An example of what will happen on our other prized HF bands is to observe what happens on our unrestricted 160-meter band during the CQWW phone contest. Despite a gentlemen's agreement, operating CW or PSK31 is useless until the contest is over.

14. These interference objections to changing the metric for digital signals from the antiquated baud rate standard to a 2.8 kHz bandwidth standard are both specious and misdirected. Changing the metric will allow the effective data rate for textual material, i.e., messages, to increase by a minimum of

10:1, and in some cases much higher. This means that it would take 1/10 of the time to send a message than the current 300 baud restriction allows. In the simplest terms, changing the metric will reduce rather than increase the potential for interference.

15. Perhaps the most fractured and unsupportable objections deal with the fear that narrow band digital signals will be driven off the air by the proliferation of 2.8 kHz digital signals. In considering these objections, it is instructive to examine the current digital operations of amateurs. Digital signals in amateur radio range in bandwidth from a very narrow CW Morse code signal to a 2.5 kHz WSPR signal.

16. Many of the objectors to the proposed change cite an instance where a strong wideband signal covered a weaker narrow band signal the ham was working. The rationale often given is that wideband digital operators do not listen before they start transmitting. The objectors scale up such interference to an unsupportable conclusion that hams will not be able to use narrow band modes because of PACTOR4 and other wideband (2.8 kHz) transmissions. Interestingly, the objections completely disregard the reality and impact of one-way propagation on common amateur operations.

17. There can be multiple reasons why a station may not detect a QSO or conversation between two stations one of which has a weak signal.

a. While a path exists between the objecting ham and the weak signal station, there may not be a path between the weak signal station and station transmitting a wide band digital signal.

b. There may also be the complication of one-way propagation. The objecting station may be able to hear the digital station, but the digital station may not be able to hear the objecting station.

c. When one-way propagation exists, either the objecting or weak station will not be detected by the digital station regardless of the sensitivity of an amateur's HF receiver, the amount of time that an amateur radio operator listens prior to transmitting, or the performance of the **L**isten **B**efore **T**ransmit (**LBT**) algorithms in the software.

18. Studiously ignored are the normal digital practices of hams that support the adoption of RM-11708. As permitted by one-way propagation, I and all of the hams of whom I am aware are careful not to block any QSO in progress digital or not. Likewise, when we want to ham it up digitally, we turn to the popular narrow band modes such as CW, RTTY, PSK31, etc. We do not waste time calling CQ with a wideband digital signal that no one is going to answer. My/our interest in high speed digital data rates is for the increase in efficiency they offer for traffic handling on established networks and emergency communications

19. While it is possible that there are some malicious amateur radios operators supporting the proposed change plan who intend to flood the ham bands with PACTOR4 transmissions, just as there are malicious hams who deliberately cause interference with other hams, those individual would certainly be in the minority. Most amateurs who support the change in the digital metric do so because of the significantly higher data rates for reliable and rapid emergency communications that RM-11708 offers.

20. Objections to premise that wider signals offers higher data rates:

> **Objection 4**
> Increasing symbol rates carries with it a need to increase signal-to-noise ratio as well so the constellation points in the protocol can be reliably separated. This typically means a higher power transmitter is required which, again, increases interference significantly and allows fewer stations to use a HF frequency based on geographical separation, especially on the HF bands where the ionosphere has such an impact on propagation. Again, this lowers the usefulness of the HF spectrum for the vast majority of amateur operators.

21. Almost as egregious as some of the interference objections are comments that the promise of higher data rates offered by a 2.8 kHz bandwidth are artificial because of the characteristics of HF radio. This position completely ignores the ability of **A**utomatic **L**ink **E**stablishment (**ALE**) equipment and software to establish a high quality HF link in a few seconds time with a distant station that enables error free communication at very high data rates. It also overlooks software tools that can provide frequency or channel specific predictions for success in digital communications with a key station that scans a set of known frequencies for a call.

22. Objections to wideband signals and request for protection of narrow band signals.

Objection 5
If any changes were made to the existing rules, I would encourage regulations that separate or segment areas of bands by signal bandwidths, wide and narrow, using our existing sub-band frequency alignment.

This requires establishing a narrower bandwidth specification to be compatible with our current CW and lower data rate emissions, possibly in the 500 Hz range.

Objection 6
This proposal does not, in any way, address the interference created by unattended digital stations that occurs today. Increasing the bandwidth of these unattended stations and allowing wider spectrum boundaries for these unattended stations would increase their interference significantly. This lowers the usefulness of the HF spectrum for the vast majority of amateur operators and is most definitely not a desired outcome.

23. While both of the objections above have been partially addressed in the discussion of propagation in paragraphs 16 through 18 above, the concept of regulatory limits on emissions allowed in certain segments of the spectrum may not be without merit. Perhaps there should be some prohibitions against wideband (2.0 to 3.0 kHz) emission in some portion of an ARS band. If that is a route chosen by the commission to explore, I implore the commission to retain the incentives for amateur radio operators to upgrade. For example, if the decision is to protect 50 kHz or 100 kHz segment of the 80 meter band for narrow band digital signals, including CW, this band segment must retain the upgrade incentive sub-segments for Extra class, Advanced class and above, and General class ARS licensees and above.

24. Objections to the unstated premise that there is a valid reason for RM-11708

Objection 7
"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." The Amateur Service is not an extension of or a replacement for US government agency communications. This is *NOT* a valid or legitimate reason to make any changes in the current rules governing the Amateur Radio Service. In addition, most high capacity/high data rate communications done by amateur radio during emergencies is accomplished over a small geographic footprint, a footprint that can typically be covered using VHF spectrum which provides consistent propagation over the period of a day and which

is, therefore, far more effective.

25. This objection displays an utter lack of knowledge of the changes to the relationship between the amateur radio service and governmental agencies that has occurred since September 11, 2001. The objector is correct that the ARS is not an extension of or a replacement for a governmental agency, but it ignores the mandated role that ARES and RACES play in the disaster plans at every level of government. The objection also displays a disregard or ignorance of the need for the amateur radio service to possess the ability to communicate reliably with these governmental entities using the same high speed, digital waveforms for interoperability.

26. Objection that reliable wideband digital waveforms require higher signal to noise ratio which can be achieved only by increasing power.

> **Objection 8**
> Increasing symbol rates carries with it a need to increase signal-to-noise ratio as well so the constellation points in the protocol can be reliably separated. This typically means a higher power transmitter is required which, again, increases interference significantly and allows fewer stations to use a HF frequency based on geographical separation, especially on the HF bands where the ionosphere has such an impact on propagation. Again, this lowers the usefulness of the HF spectrum for the vast majority of amateur operators.

27. This objection confuses average power output across a bandwidth over a period of time with the power output at any instant of time. If the power output from a transmitter producing a digital signal across a 10 kHz band width is 25 watts, it is 25 watts. It is not a multiple of 25 watts and some coefficient of the bandwidth. The power of the 25 watt 10 kHz digital signal is the same as a 25 watt CW signal. Perhaps the confusion rests in trying to equate the area under a curve with instantaneous power. The fallacy of this approach is that at any instant the total power in a 25 watt CW and a 25 watt 10 kHz wide digital signal are identical. That is not to say that the power in a digital signal does not vary as the waveform changes, but if the power output of a transmitter is limited 25 watts, the maximum power it can put out is 25 watts regardless of how much the transmitting frequency varies across the digital

waveform's bandwidth.

28. Objection that RM-11708 will not enhance or increase amateur experimentation with digital waveforms on the HF bands.

> **Objection 9**
> I urge the Commission to reject this change of the the Amateur Radio Service rules. The change will *not* enhance Amateur experimentation with higher symbol rate signals since such experimentation can be done at frequencies above the HF spectrum. The change *will*, however, increase interference on the Amateur HF bands as wider signals with much higher power are implemented, especially by unattended stations which simply ignore ongoing communications on the frequencies which they use.

29**.** This objection flies in the face of the history of amateur radio. In every era of amateur radio, hams have experimented with different modes and equipment. The digital era is no different. Amateurs have made significant advancements in narrow band **D**igital **S**ignal **P**rocessing (**DSP**), and it is inconceivable that they will ignore the potential for experimentation and advancement of the radio arts that a 2.8 kHz bandwidth metric would provide. While successful experimentation in this area will require significant knowledge in waveform standards and DSP as well as considerable skill in computer programing and/or hardware design, there are ham radio operators in the United States of America with those abilities and an abiding interest in digital communications who will assure that RM-11708 results in advancements in the radio arts.

30. Objection that RM-11708 will only benefit a few hams.

> **Objection 10**
> This proposal will benefit a very small portion of the amateur community at the expense of the vast majority. Accordingly, it should not be adopted.

31. To the contrary, this will benefit every section of the amateur community. First, and foremost, it will provide an quantum leap for emergency communications by increasing the data rate. Whether a ham is involved with ARES, RACES, or CERT activities or not, amateur radio participation in manmade and natural disasters keeps the importance and usefulness of amateur radio more clearly in the public eye than any other activity. RM-11708 will increase the efficiency and effectiveness of

communications out of the disaster area which will further enhance the value of the amature radio service in the view of the public and regulatory agencies.

32. Second, it expands and increases the relevance of ham radio in terms of computers and digital communications both of which will help attract younger students of engineering and the hard sciences into our increasingly grey, geriatric amateur radio community. The future of amateur radio lies in attracting youth into the hobby. It does not lie with grey beards with their hands on a CW key. The last sentence is not an anti-CW comment. I enjoy CW especially using a straight key.

33. Objection that RM-11708 will not make efficient use of the spectrum.

> **Objection 11**
> Experimentation and the advancement of the radio art have always been extremely important aspects of amateur radio and they should continue to be encouraged. No one questions this premise. However, this proposal is backward-looking, not forward looking. We should be seeking to do more with less, not more with more. Allowing digital signals up to 2.8 khz wide anywhere in the current authorized band segments would be a major step backward and would produce even more interference and disruption of the activities of current users than we already have today. We need technologies that make more efficient usage of our spectrum, not those that hog our limited resource. Furthermore, this proposal is a slap in the face to those pioneering individuals who have developed and use narrowband modes, the most efficient means of utilizing our limited spectrum.

34. This is both a specious and misdirected objection to RM-11708. Changing the metric will allow the effective data rate for textual material, i.e., messages, to increase by a factor of at least 10. This means that it would take 1/10 of the time to send a message than the current restrictions allow. In the simplest terms, changing the metric would reduce rather than increase the potential for interference.

35. Objection that approval of RM-1170 would be a defacto approval of encryption.

> **Objection 12**
> Furthermore, as I have come to understand, this proposal would also allow the use of proprietary, non-open-source protocols, which is effectively the same as allowing a form of encryption. It would prevent identification of interfering or unlawfully operating stations unless one has purchased a licensed modem capable of decoding the signals. This seems to be not only illegal under current regulations but also is certainly counter to all traditions of amateur radio! I submit that this proposal

> should be either retracted by ARRL or denied by the FCC. Should the ARRL wish to pursue these efforts at rule change, they should then first open the discussion to ALL of their membership, clearly explain all issues and objectives, and obtain a consensus among members prior to re-submitting another proposal.

36. This is yet another specious objection to RM-11708. The claim that it would be a defacto authorization for use of encryption on the amateur frequencies because it would authorize the use of PACTOR4 commercial modems fails under the light of close observation. The objection is based on the premise that PACTOR4 is a proprietary waveform that cannot be read by either the average amateur or government monitors. This is patently false. All that is required to read the signal is either to purchase a PACTOR4 modem or decoding software that will allow any amateur to read the PACTOR4 waveform. The comments that use the encryption argument clearly do not know the difference between encryption and the technology/algorithms for various techniques of data compression, **F**orward **E**rror **C**orrection (**FEC**), etc.

37. Objection that RM-11708 is a stalking horse for commercialization of the ham bands.

> **Objection 13**
> Once again the FCC is being asked whether to allow a change that will benefit a few to the detriment of many. This proposed change is being put forward to allow a private company to commercialize the AR bands. It is being disguised in the terms of, "Radio Advancement" and EMCOMM, but make no mistake. This is a private company trying to expand their sales of a proprietary protocol and using the free AR bands in their business model. This is against the rules and the spirit of Amateur Radio. There is nothing this proprietary protocol can accomplish that can't already be done and done accurately and well within the limits already in place. This is a change where no change is needed. I fear once Pandora's Box has been opened. The Amateur Radio bands will be relegated to a glorified Wi-FI system for remote location computer access for those who buy a Pactor 4 modem. I fear this will not help advance radio, but will eventually stifle it. True innovations come from doing more with less, so to speak. We see new protocols like JT65 which can do amazing things with less bandwidth and less power. That is the true spirit and intent of Amateur Radio.

38. Objections that RM-11708 would result in commercialization of the bands or turning the HF bands into an inappropriate pipeline for email traffic fail because they ignore the minimal impact of the existing WinLink network, the existing FCC band restriction on automatic operation on the HF bands,

and the state of emerging LBT technology. Those restrictions that will not be changed if the ARRL proposal is adopted, but the performance of listen before transmit hardware and software will grow by leaps and bounds.

Summary and Conclusions

39. At the outset, it should be noted that the comments filed supporting the change outnumber the number of comments filed in objection to the proposed change by more than 10:1. This is quite significant. The ratio of supporting to opposing comments is significantly higher than in past proceedings on the metric for digital operations in the amateur radio service.

40. All of the objections filed to the adoption of RM-11708 are flawed, and most of those flaws are errors of logic such as disjunctive syllogisms, contradiction of known facts, and/or internal self-contradictions. In some cases there appears to be a rampant disregard for the reality of current digital practices in amateur radio, the basics of HF propagation, and the state of digital and LBT software and hardware systems.

41. There appears to be an inexplicable lack of recognition by a great many hams that ham radio exists only through the forbearance of the federal government due to its understanding of the value of the amateur radio service, and that most of the perceived value has roots in amateur radio's support of governmental agencies during disasters.

42. Development of reliable, high speed, digital waveforms has reached its practical limit with the current 300 baud metric. Further advancement of the radio arts in the digital realm of the amateur radio service will only be possible by the adoption of RM-11708. If RM-11708 is not approved, development of more efficient digital modes in amateur radio will continue to drift sideways.

43. Approval of RM-11708 is the single most significant action the FCC could do to bring the amateur radio service fully into the 21st century.

Respectfully submitted,

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