Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of Parts 2 and 97 of	)	
the Commission's Rules Regarding	)	**RM-__________**
an Allocation of a Band near 5 MHz	)	
for the Amateur Radio Service	)	

To: The Commission

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 1.405 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, looking toward amendment of Parts 2 and 97 of the Commission's Rules (in accordance with the attached Appendix) in order to create a narrow (150 kHz), secondary domestic allocation for the Amateur Radio Service at 5 MHz (herein referred to as the "60-meter band"). Such an allocation is urgently needed to fill the ionospheric propagation gap between the propagation paths provided by the current amateur allocations in the bands 3500-4000 kHz (known as the 80-meter band) and 7000-7300 kHz (known as the 40-meter band). As good cause for this Petition and for the requested Notice of Proposed Rule Making, ARRL states as follows:

I. Introduction

1. The Amateur Service currently operates in relatively narrow segments of the High-Frequency (HF) bands between 3 and 30 MHz. These include 3,500-4,000 kHz, 7,000-7,300 kHz, 10,100-10,150 kHz, 14,000-14,350 kHz, 18,068-18,168 kHz, 21,000-21,450 kHz, 24,890-24,990 kHz, and 28,000-29,700 kHz. These bands are popularly referred to in terms of their approximate wavelengths, i.e. 80 meters, 40 meters, 30 meters, 20 meters, 17 meters, 15 meters, 12 meters, and 10 meters, respectively. These narrow segments, which are extremely heavily used by radio amateurs at all times of the day and night are, with one major exception, spaced such that propagation paths are likely to be available to all parts of the world during all parts of the day. The exception is the segment between the 80-meter band and the 40-meter band. The propagation characteristics of the Amateur HF bands were not

the principal basis for the establishment of the allocations. Rather, they were harmonically related so as to preclude harmonic interference to other radio services from early amateur transmitters. That the bands are for the most part spaced adequately for propagation purposes was thus more accident than intent, and that explains the propagation gap between 80 and 40 meters.[1]

2. There are times on certain paths when a frequency in the 80-meter band is too low, and a frequency in the 40-meter band is too high for reliable ionospheric propagation. Because amateur stations use relatively low power and increasingly use digital modulation requiring low multipath delay, operating frequencies should be chosen near the maximum usable frequency (MUF) for the desired path and time. On those occasions when 5 MHz provides optimum propagation characteristics (especially during the summer months) for communications between two given locations, frequencies in the 80-meter band may exhibit excessive atmospheric or manmade noise for the transmitter power used and/or produce intersymbol interference (ISI), or pulse blurring, resulting from multipath distortion. ISI limits the symbol rate and reliability of digital signals. Multipath distortion also degrades analog modulated signals such as single-sideband radiotelephony. This is especially a problem on paths between the United States and the Caribbean, and the propagation "gap" between the 80- and 40-meter bands occasionally disrupts emergency communications during hurricanes and severe weather disasters. As well, due the size of the 80-meter and 40-meter allocations, an additional band between them would relieve what is periodically substantial overcrowding.

3. Because Amateur stations use relatively low power, and because of the radical differences in skywave propagation of frequencies throughout the HF spectrum, it is necessary for the Amateur Service to have bands logarithmically spaced throughout the MF and HF bands for reliable ionospheric propagation. An interval of 1.4:1 or less is desirable and has been achieved in bands between 40 meters and 10 meters. The ratio of the 80-meter band to the 40-meter band is 1.75. An intermediate band around 5.2 MHz would result in two

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[1] NTIA explained, however, the need for an even distribution of HF bands in *U.S. National Spectrum Requirements, Projections and Trends,* NTIA Special Publication 94-31, March, 1995, at 164:

> …A good selection of frequencies spread throughout the HF bands is critical to maintaining reliable communications. Amateurs use voice and data communications in the HF bands, operating from base and mobile stations.

smaller intervals of approximately 1.25 (the ratio of 5 to 4 MHz) and 1.4 (the ratio of 5 to 7 MHz).

4. As will be more fully discussed below, the current occupancy of frequencies in the fixed and mobile service bands around 5 MHz is sufficiently low as to permit amateur stations to dynamically select operating frequencies in most segments any time of the day or night, so as to avoid interference. The viability of amateur operation on a secondary basis to the Fixed service using dynamic frequency selection inherent in Amateur Radio has been proven in the band 10,100-10,150 kHz where Amateur and Fixed stations continue to co-exist without harmful interference.[2]

5. Amateur operators can assess the conditions on the various frequencies available and select one that does not penetrate the ionosphere for the path, does not exhibit excessive atmospheric or manmade noise, and does not have unacceptable ISI. While it is difficult to predict with certainty which of three bands (3.5, 5 or 7 MHz) will be optimum on any given day, operators can easily find the optimum propagation in real time simply by monitoring and attempting communications on the available frequencies. The best frequency is chosen for sufficient signal-to-noise ratio and minimum fading along the desired path, and occasionally on the basis of band loading, given heavy occupancy at any given time of day.[3]

II. Propagation Considerations

6. Long-term propagation differences between the 3.5, 5 and 7 MHz bands can be assessed using computer simulation. **Annex 1** hereto shows a number of situations in which a 5-MHz frequency would provide distinctly better reliability than either 3.5 or 7 MHz. Since reliability of a target HF path is critical during weather-related and other emergency communications conducted over fairly long periods of time, ample justification exists for the proposed allocation.

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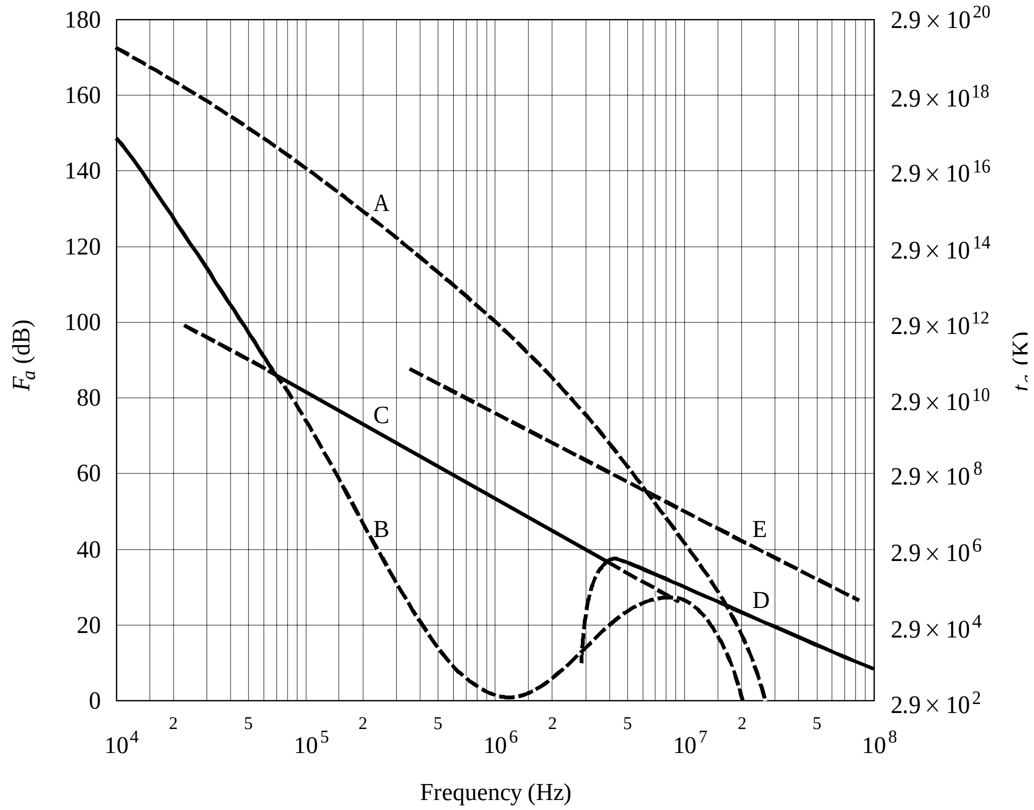
[2] See, *Amateur Radio Service*, (FCC 82-469), 52 RR 2d 727 (1982); *Table of Frequency Allocations (WARC Conformance)*, 54 RR 2d 1500, 1505 (1983).

[3] As NTIA put it, "Amateur allocations have been based, in part, on the desirability of having a choice of relatively narrow frequency bands with different propagation properties distributed throughout the spectrum. As propagation conditions change in the medium and high-frequency bands, amateur operators can follow the changing maximum usable frequency (MUF) and still be able to communicate. Higher frequency bands have other propagation properties useful for different amateur activities, such as amateur-satellite and short-range land mobile applications. Current amateur allocations start at 1800 kHz and, in narrow bands, extend to 250 GHz. *Id.*, *U.S. National Spectrum Requirements: Projections and Trends*, NTIA, at 164.

7. Atmospheric noise varies according to weather, time of day, season, latitude and frequency. Atmospheric noise decreases with increasing frequency. Figure 2 from Recommendation ITU-R P.372 illustrates the differences in noise levels.

FIGURE 2

F_a versus frequency (10^4 to 10^8 Hz)



A : atmospheric noise, value exceeded 0.5% of time
B : atmospheric noise, value exceeded 99.5% of time
C : man-made noise, quiet receiving site
D : galactic noise
E : median business area man-made noise
——— minimum noise level expected

D02

8. Atmospheric noise generally decreases with increasing latitude and increases in equatorial areas. During summer months and particularly at night, the noise levels in the southern United States and in the Caribbean and Central America make it difficult to use the 80-meter band. However, for shorter distances, 7 MHz may penetrate the ionosphere rather than be reflected, and the shorter path transmissions would not, therefore, be successful. At

those times, on southern propagation paths, a frequency band around 5 MHz would be reliable.

III. Spectrum Requirement

9. The Amateur Service's requirement presently is an allocation of 150 kHz of usable bandwidth near 5 MHz. The request for a 5 MHz allocation was included in a compilation of the U.S. National Spectrum Requirements issued by the U.S. Department of Commerce in March of 1995.[4] Subsequently, in November 1996, the Department of Commerce stated "The additional allocation near 5 MHz will require technical studies to determine the availability of these bands to support amateur use."[5] The 1996 document stated further:

> **4945-4995 kHz**. A new amateur service requirement for 500 kHz of shared use around 5000 kHz appears possible at 4945-4995 kHz. This band is allocated to the fixed and mobile services. In this 50 kHz, there are approximately 150 Federal and 50 non-Federal assignments.

NTIA's specification of the band 4945-4995 kHz was illustrative only; it was intended to establish that spectrum could be allocated to the Amateur Service in a band around 5 MHz. It was not intended to be determinative of an optimum segment, or that a full 500 kHz of bandwidth near 5 MHz is a current requirement of the Amateur Service.

10. The International Amateur Radio Union has established a spectrum requirement for a narrow allocation in the vicinity of 5 MHz, for the same reasons set forth herein.[6]

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[4] Id.

[5] Department of Commerce, *High Frequency Spectrum Planning Options*, NTIA Special Publication 96-332, November 1996.

[6] The IARU spectrum requirements document states: Based on the recommendation of the 1978 CCIR Special Preparatory Meeting, the 1979 World Administrative Radio Conference accepted the principle that, like other high-frequency radio services, the amateur service should have access to a family of frequency bands so communications can be maintained as propagation conditions change. New exclusive allocations were added in the vicinity of 25 and 18 MHz, and a new allocation secondary to the fixed service was added in the vicinity of 10 MHz, to bridge gaps between the bands then in existence. Particularly in the higher latitudes, there are many times when the MUF is below 7 MHz but is too far above the next lowest amateur frequency band (3.8 or 4.0 MHz, depending upon the Region) for communication to be supported in that band using typical amateur antennas and power levels. Also, as amateur communication increasingly uses digital rather than analogue modes of emission, inter-symbol distortion caused by multipath propagation becomes a more important factor and requires choice of an operating frequency as near as possible to the MUF.

11. There are currently pending proposals for a band around 5 MHz in Europe. In the United Kingdom the band 5245-5445 kHz is being studied as a possible candidate for the Amateur Service.[7] The rationale for the Great Britain proposal is similar to the foregoing: that the peak absorption in the D-region of the ionosphere occurs during the hours of daylight around 1.5 MHz, and vertically directed radio waves only begin to be returned to Earth by the E-layer above 1.6 MHz. As the transmission frequency is increased, the strength of the returned signal increases (the D-layer attenuation decreases) until the so-called Critical Frequency for the highest ionospheric layer is reached. In practice, the Critical Frequency occurs in the range from 3 MHz to 11 MHz for much of the 11-year sunspot cycle. For communications inter-UK, therefore, the best HF band lies in this range, depending on ionospheric conditions and the status of the sunspot cycle. There is a trade-off between the power required to combat severe D-layer attenuation, and the need not to exceed the Critical Frequency by very much; otherwise, a near vertically radiated signal will not be returned to Earth. For more than 6 years of each sunspot cycle, the 40-meter band cannot support inter-UK amateur communications, and the 80-meter band during the daytime suffers from too much D-layer absorption to allow skywave communications at power levels permitted radio amateurs. The solution, as proposed in Great Britain, is a proposal for a band in the vicinity of 5 MHz. Efforts are underway to obtain authority for experimental operations there now.

IV. Experimental Operations on 5 MHz

12. Since early 1999, ARRL has conducted experimental operations on 5 MHz under a Part 5 experimental license grant, WA2XSY. Details of the tests are included as **Annex # 2.** Results show that amateur stations can co-exist with incumbent services, and that the propagation paths between the United States and Caribbean countries, where much hurricane disaster relief communications are conducted, are well-served by operation at 5 MHz.

V. Band Occupancy and Allocation Status

13. There has been a trend for the fixed service to migrate from HF to alternative technologies, such as terrestrial microwaves, satellites and fiber. Over the past two decades,

[7] Recent E-mail correspondence received from the Spectrum Director of the Radio Society of Great Britain (RSGB) stated that the inter-governmental PT40 committee met on February 8, 2001and considered an RSGB proposal for Amateur access to the band 5245-5445 kHz. There were no objections to this proposal in principle. The Ministry of Defence did not see a band allocation as an option at this time but was prepared to consider spot frequencies in this band.

this evolution has been reflected in NTIA studies. NTIA's 1989 Spectrum Resource Assessment of Government Use of the HF (3-30 MHz) Band provided a snapshot of the importance of HF at that time:[8]

> Today the HF spectrum still accounts for about one-quarter of the number of frequency assignments world wide. The use of the HF band is currently growing despite the large expenditures for satellite-dependent communications systems.

14. By 1995, however, NTIA had concluded that although HF continued to be useful, alternative technologies would contribute to a decrease in the use of HF:[9]

> Spectrum Requirements for the HF Fixed Services
>
> The HF bands have been very crowded, because HF has been the only technology that could provide very long range coverage with a minimum investment in infrastructure. In the past, HF circuits operated by government, industry, and private and common carriers provided the great majority of long ranged fixed circuits, including most of the transoceanic circuits. All HF services remain extremely crowded today, with strong competition between services for spectrum and a substantial backlog of demand to absorb any frequencies that become available.
>
> However, the availability of alternative technologies may bring a decrease in HF crowding. Communication satellites and greatly improved optical fiber undersea cables have taken over the majority of overseas circuits. Inexpensive VSAT terminals[209] and improved wired telecommunications infrastructure in many foreign countries are also reducing the past heavy dependency on HF circuits. Although HF fixed use may decrease, it will remain very important for emergency use within the United States and for backup communications between the United States and foreign countries. [Automatic Link Establishment] ALE techniques have recently made HF communications more reliable and useful.
>
> ———
>
> [209] *See (National Spectrum Requirements)* p.87 for a discussion of very small aperture terminal (VSAT) technology.

15. In the intervening period, the fixed service has continued its exodus from HF. This is easily observed by monitoring, and from a review of the Government Master File and the Commission's databases. Many of the assignments, at one time active, have become back-up circuits. As time progresses, reliance on newer technologies becomes stronger

[8] Department of Commerce, *Spectrum Resource Assessment of Government Use of the HF (3-30 MHz) Band*, NTIA Technical Memorandum 89-141, June 1989.

[9] Department of Commerce, *U.S. National Spectrum Requirements: Projections and Trends*, NTIA Special Publication 94-31, March 1995.

because of the need for higher data rates, increased volume and greater quality of service requirements.

16. The International Table of Allocations allocates the band 4995-5003 kHz to Standard Frequency and Time signals centered at 5000 kHz in all three ITU Regions. 5003-5005 kHz is allocated as well to Standard Frequency and Time signals on a primary basis, and on a secondary basis to Space Research in all three regions. The band 5005-5060 kHz is allocated on a co-primary basis to the Fixed and Broadcasting Services. The band 5060-5250 kHz is allocated to the Fixed service on a primary basis, and secondarily to the Mobile (except Aeronautical Mobile) services. The 5250-5450 kHz band is allocated to the Fixed and Mobile (except Aeronautical Mobile) services on a co-primary basis in all three regions. In Region 2, the band 5450-5480 kHz is allocated to the Aeronautical Mobile service, and in all three regions, the 5480-5730 kHz band is allocated to Aeronautical Mobile as well.

17. Domestically, the 4995-5005 kHz band is allocated for Standard Frequency and Time Signals. The 5005-5060 kHz segment is allocated to Government and non-government fixed services. 5060-5450 kHz is allocated on a primary basis to the Fixed service, and on a secondary basis to the mobile, except aeronautical mobile, service. The 5450-5730 kHz segment is allocated to the Aeronautical Mobile service.

18. Non-Federal government use of the bands around 5 MHz is minimal and is largely restricted to emergency uses. Part 90 of the Commission’s rules permits operation in the band 2000-10,000 kHz in the Local Government Radio Service for fixed, base or mobile use limited to disaster communications purposes only. Use of the band 2000-25,000 kHz by the Power Radio Service, Petroleum Radio Service and the Telephone Radio Service is authorized. Section 90.264 authorizes the use of the band 2000-10,000 kHz (by assignment) for disaster communications in the bands allocated to fixed and land mobile services. Section 90.253 authorizes the use of the frequency 5167.5 kHz in and within 92.6 km of the State of Alaska for emergency purposes.

VI. Selection of a Candidate Band for Allocation to the Amateur Radio Service

19. The bands 4750-4995 kHz, 5050-5100 kHz and 5900-6000 kHz are used by the broadcasting service and should be avoided for amateur use because of the relatively low power of amateur stations compared to broadcasting stations and the resultant sharing incompatibility. The band 4995-5000 kHz is not considered suitable candidate for amateur service use as it is allocated for standard frequency and time signal use. The band 5450-5730 kHz is allocated to the aeronautical mobile service and should not be considered. This leaves the band 5100-5450 kHz for consideration as a candidate band for the selection of a 150 kHz Amateur domestic allocation.

20. ARRL has obtained a search of the Government Master File (GMF) from the Office of Spectrum Management of NTIA (current as of May 1, 2001)[10], and has searched the Commission's database to determine the number of authorizations, assignments or licenses for each 50 kHz segment within 5100-5450 kHz. The results are as shown in the table below:

Table 1
U.S. Assignments

Band (kHz)	FCC	GMF	Total
5100-5150	15	297	312
*5150-5200	1297	161	1458
5200-5250	259	505	764
5250-5300	20	117	137
5300-5350	55	352	407
5350-5400	28	290	318
5400-5450	1	499	500
Totals	1675	2221	3896

* The frequency 5167.5 kHz is authorized for limited use in Alaska by the Amateur Radio Service.

21. From the above Table, the band 5250-5400 kHz shows the fewest assignments in the United States and is therefore proposed for domestic allocation on a secondary basis to the Amateur Radio Service. The requested bandwidth, 150 kHz, is necessary and desirable to

[10] It is noteworthy that the number of GMF assignments in May of 2001 was distinctly lower than the number of such assignments in the same frequency segments in July of 1997. The total number of such assignments in the 5100-5450 kHz band then was 2844, a difference of 623 assignments from the present time.

allow Amateurs the flexibility to dynamically, in real time, determine an operating frequency over a sufficiently wide range as to avoid interference to fixed and mobile services.

VII. Conclusions

22. ARRL has determined, both through research facilitated by its experimental license, and by virtue of its technical analysis, that the allocation of a 150 kHz-wide segment at 5250-5400 kHz is both necessary and feasible. It is proposed that a domestic, secondary allocation for the Amateur Service in that band, with adequate protection incorporated in the Part 97 rules for protection of the Fixed service, be proposed immediately. There is ample precedent for Amateur operation in a band occupied (in this instance relatively minimally) by Fixed Service licensees, since the Amateur Service has done so successfully in the 10.100-10.150 MHz band for many years now. An Amateur Allocation in this band would improve the Amateur Service's already exemplary record of providing emergency communications during natural disasters when even modern communications systems typically fail. HF Amateur stations are a necessary backbone in international disaster relief involving, for example, Caribbean countries, and the proposed allocation would provide seamless propagation path coverage between the United States and Caribbean nations, and the United States' own possessions and commonwealths there.

23. There are not proposed any special operating restrictions for this band, though it is clear in the proposed Part 97 rules in the attached Appendix that amateur operation in this band will have to be conducted so as to protect the Fixed and Mobile Service stations operating in that same band.

Therefore, the foregoing considered, ARRL hereby respectfully requests that the proposed allocation, being amply justified, be proposed by the Commission without delay, and that rules for Amateur operation in that band be adopted in order to facilitate operation there.

Respectfully submitted,

ARRL, the National Assocation
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ANNEX # 1

ICEPAC Examples

The following are specific examples showing times, seasons and sunspot numbers when 5.2 MHz provides better reliability (REL) than either 3.8 or 7.1 MHz using ICEPAC[11] Method 16 (system performance) for the path Washington, DC to Dallas, TX, 0 and 120 sunspot numbers, January and July:

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          CCIR Coefficients        METHOD 16     ICEPAC          Version 001204W
JAN    2001                SSN =   0.      Qeff= 0.0     Minimum Angle  5.00 deg
Washington, DC            Dallas, TX              AZIMUTHS        N. MI.     KM
38.54 N   77.01 W - 32.46 N   96.47 W         254.89   63.50     1016.3   1882.0
XMTR  2-30 IONCAP #23[samples\SAMPLE.23    ] Az=295.5 OFFaz=319.4   0.100kW
RCVR  2-30 IONCAP #23[samples\SAMPLE.23    ] Az= 56.5 OFFaz=  7.0
3 MHZ NOISE = -145.0 DBW       REQ. REL = .90     REQ. SNR = 34.0 DB
MULTIPATH POWER TOLERANCE =  3.0 DB   MULTIPATH DELAY TOLERANCE =  1.670 MS

  8.0  9.3    3.8   5.2    7.1                          FREQ
       1F2  2F2  2F2  1F2  -  -  -  -  -  -  -  -  -  MODE
       14.7 25.9 27.8 11.3  -  -  -  -  -  -  -  -  -  ANGLE
        6.8  7.3   7.4   6.6  -  -  -  -  -  -  -  -  -  DELAY
        333  255  277  267  -  -  -  -  -  -  -  -  -  V HITE
       0.50 0.98 0.76 0.92  -  -  -  -  -  -  -  -  -  MUFday
        137  128  128  133  -  -  -  -  -  -  -  -  -  LOSS
          9     9    12    13  -  -  -  -  -  -  -  -  -  DBU
       -117 -106 -107 -113  -  -  -  -  -  -  -  -  -  S DBW
       -158 -144 -149 -154  -  -  -  -  -  -  -  -  -  N DBW
         40   38    41    40  -  -  -  -  -  -  -  -  -  SNR
         18    5     4     4  -  -  -  -  -  -  -  -  -  RPWRG
       0.63 0.72 0.81 0.79  -  -  -  -  -  -  -  -  -  REL
       0.00 0.00 0.00 0.00  -  -  -  -  -  -  -  -  -  MPROB

 12.0  9.5    3.8   5.2   7.1                          FREQ
       1F2  2F2  2F2  1F2  -  -  -  -  -  -  -  -  -  MODE
       13.4 25.2 26.2 10.5  -  -  -  -  -  -  -  -  -  ANGLE
        6.7   7.2   7.3   6.6  -  -  -  -  -  -  -  -  -  DELAY
        307  248  259  253  -  -  -  -  -  -  -  -  -  V HITE
       0.50 1.00 0.87 0.98  -  -  -  -  -  -  -  -  -  MUFday
        140  129  128  134  -  -  -  -  -  -  -  -  -  LOSS
          8    10    13    12  -  -  -  -  -  -  -  -  -  DBU
       -120 -106 -107 -114  -  -  -  -  -  -  -  -  -  S DBW
       -158 -144 -148 -153  -  -  -  -  -  -  -  -  -  N DBW
         38    38    41    39  -  -  -  -  -  -  -  -  -  SNR
         23     5     2     4  -  -  -  -  -  -  -  -  -  RPWRG
       0.58 0.71 0.83 0.75  -  -  -  -  -  -  -  -  -  REL
       0.00 0.00 0.00 0.00  -  -  -  -  -  -  -  -  -  MPROB
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[11] ICEPAC High Frequency (HF) Planning software developed by: U.S. Department of Commerce, National Telecommunications and Information Administration, Institute for Telecommunication Sciences (NTIA/ITS), 325 Broadway, Boulder, Colorado 80305.

24.0	11.4	3.8	5.2	7.1									FREQ
	1F2	2F2	2F2	1F2	-	-	-	-	-	-	-	-	MODE
	12.3	23.6	24.2	9.5	-	-	-	-	-	-	-	-	ANGLE
	6.7	7.1	7.1	6.6	-	-	-	-	-	-	-	-	DELAY
	286	231	237	234	-	-	-	-	-	-	-	-	V HITE
	0.50	1.00	0.94	0.98	-	-	-	-	-	-	-	-	MUFday
	144	132	131	138	-	-	-	-	-	-	-	-	LOSS
	5	7	10	10	-	-	-	-	-	-	-	-	DBU
	-124	-110	-110	-115	-	-	-	-	-	-	-	-	S DBW
	-159	-147	-150	-154	-	-	-	-	-	-	-	-	N DBW
	35	37	40	39	-	-	-	-	-	-	-	-	SNR
	23	7	4	5	-	-	-	-	-	-	-	-	RPWRG
	0.51	0.65	0.79	0.73	-	-	-	-	-	-	-	-	REL
	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	MPROB

JAN 2001 SSN = 120

4.0	10.7	3.8	5.2	7.1									FREQ
	1F2	2F2	2F2	1F2	-	-	-	-	-	-	-	-	MODE
	17.7	28.0	29.5	12.4	-	-	-	-	-	-	-	-	ANGLE
	7.0	7.4	7.5	6.7	-	-	-	-	-	-	-	-	DELAY
	391	279	297	289	-	-	-	-	-	-	-	-	V HITE
	0.50	1.00	0.99	1.00	-	-	-	-	-	-	-	-	MUFday
	136	129	128	133	-	-	-	-	-	-	-	-	LOSS
	13	7	13	13	-	-	-	-	-	-	-	-	DBU
	-113	-107	-106	-113	-	-	-	-	-	-	-	-	S DBW
	-159	-144	-148	-152	-	-	-	-	-	-	-	-	N DBW
	45	37	41	39	-	-	-	-	-	-	-	-	SNR
	7	6	1	3	-	-	-	-	-	-	-	-	RPWRG
	0.78	0.65	0.87	0.79	-	-	-	-	-	-	-	-	REL
	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	MPROB

12.0	10.3	3.8	5.2	7.1									FREQ
	1F2	2F2	2F2	1F2	-	-	-	-	-	-	-	-	MODE
	15.9	28.1	28.8	12.2	-	-	-	-	-	-	-	-	ANGLE
	6.9	7.4	7.5	6.7	-	-	-	-	-	-	-	-	DELAY
	356	280	288	284	-	-	-	-	-	-	-	-	V HITE
	0.50	1.00	0.98	1.00	-	-	-	-	-	-	-	-	MUFday
	137	130	129	133	-	-	-	-	-	-	-	-	LOSS
	13	6	12	12	-	-	-	-	-	-	-	-	DBU
	-114	-108	-107	-113	-	-	-	-	-	-	-	-	S DBW
	-159	-144	-148	-153	-	-	-	-	-	-	-	-	N DBW
	45	36	41	39	-	-	-	-	-	-	-	-	SNR
	12	7	3	4	-	-	-	-	-	-	-	-	RPWRG
	0.73	0.61	0.82	0.76	-	-	-	-	-	-	-	-	REL
	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	MPROB

JUL 2001 SSN = 0. Qeff= 0.0 Minimum Angle 5.00 deg

4.0	10.4	3.8	5.2	7.1									FREQ
	1F2	2F2	2F2	1F2	-	-	-	-	-	-	-	-	MODE
	14.8	25.6	27.1	11.0	-	-	-	-	-	-	-	-	ANGLE
	6.8	7.2	7.3	6.6	-	-	-	-	-	-	-	-	DELAY
	333	252	268	262	-	-	-	-	-	-	-	-	V HITE
	0.50	1.00	0.90	0.97	-	-	-	-	-	-	-	-	MUFday
	139	138	132	138	-	-	-	-	-	-	-	-	LOSS
	8	3	8	9	-	-	-	-	-	-	-	-	DBU
	-119	-113	-111	-118	-	-	-	-	-	-	-	-	S DBW
	-156	-138	-143	-149	-	-	-	-	-	-	-	-	N DBW
	37	25	32	31	-	-	-	-	-	-	-	-	SNR
	23	16	8	10	-	-	-	-	-	-	-	-	RPWRG
	0.56	0.13	0.40	0.33	-	-	-	-	-	-	-	-	REL
	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	MPROB

ANNEX #2

ARRL 5 MHz Tests under Part 5 Experimental License Call Sign WA2XSY

On July 8, 1998, ARRL applied for a Part 5 experimental license to operate in the band 5100-5450 kHz on behalf of 15 stations located in the states California, Florida, Indiana, Maryland, Mississippi, New Hampshire, New York, Ohio, Tennessee, Texas, Utah and Wisconsin, and the U.S. Virgin Islands.

On January 8, 1999, the Commission granted experimental license (File Number 6206-EX-PL-1998) and assigned the call sign WA2XSY. ARRL requested modification of that license, so as to delete certain stations and add others, which was granted October 6, 2000 (File Number 0058-EX-ML-2000) and December 6, 2000 (File Number 0264-EX-RR-2000).

The objective of the experiments was to compare communications reliability between the bands at 3.8 MHz, 5.2 MHz and 7 MHz.

The ARRL experimental license application stated the following:

> Operation would be by RTTY and data emission modes authorized pursuant to Section 97.309(a) of the Commission's rules governing the Amateur Service, and by single-sideband voice, under the same technical limitations applied to such operation in Section 97.307 of the Commission's rules. Power would be limited to 100 watts TPO. Antennas would be similar at each participant station. These would consist of multiband trap wire dipole or similar antennas for each participant. The antennas would be in horizontal or inverted-vee configuration at heights of up to 50 feet AGL, and operate in the amateur 40 and 80-meter bands, and as well in the proposed 5 MHz segment.
>
> Operation by the participants will consist of short duration transmissions to determine propagation characteristics. Any interference to or from another service on a given frequency will cause immediate termination of operation on that frequency and the contact will move to a predetermined alternative frequency, or to an amateur frequency or Internet IRC location. Monthly reports of propagation findings and any instances of interference will be assembled by each participant during the test period and forwarded to the American Radio Relay League, Inc.; such reports will be available to the Commission upon request at any time.

Normal operation was to establish communication on 5.2 MHz and quickly change to frequencies in the 3500-4000 kHz and 7000-7300 kHz bands, and exchange readability and signal strength reports. Finally stations would return to 5.2 MHz to discuss the findings. Most operation was with SSB.

The IONCAP propagation model was used extensively in planning the operating schedule of the WA2XSY tests. An IONCAP method was used that produced the complete system performance (a full page of information for each hour) for a given circuit. A computer program developed for the project extracted the needed information from the IONCAP results and compressed it into one page for each 24-hour circuit.

The information shown below in Table A is the signal level in dB expected at the operators' earphones relative to residential background noise excluding atmospheric noise. The first column is the time in UTC, the second column is the MUF (a median value) and then the following six columns list the dB above local noise (excluding atmospheric) that the signal is predicted at the receiver audio output. Within the variation of the real world relative to the model, without atmospheric noise, higher positive numbers indicate higher probability of communications while negative numbers indicate communications is not likely. However, as previously discussed, atmospheric noise may degrade reliability in all three bands with more severe atmospheric noise and associated degradation in the lower frequency bands.

Table A

Received Signal Level in Decibels (dB)
Relative to Residential Manmade Noise

Noise floor= 35 dB-Hz in a 3 kHz BW. 3 MHz noise = -148 dBW.
28-18N 81-22W to 26-14-47N 80-10-29W Florida Test
160 mi 257 km Isotropic radiator. 100 watts SSN=116 Jan'01

Time UTC	MUF MHz	Received Signal Level (dB)					
		3.5 MHz	4 MHz	5.1 MHz	5.4 MHz	7 MHz	7.3 MHz
0100	7.0	27	27	27	27	21	20
0200	5.9	26	26	25	24	8	3
0300	5.2	25	24	20	17	-	-
0400	4.9	24	24	18	16	1	-3
0500	4.7	24	23	17	14	-3	-8
0600	4.5	23	22	15	13	-7	-
0700	4.7	23	23	16	14	-4	-9
0800	4.9	23	23	18	16	6	2
0900	4.7	23	22	16	15	2	-2
1000	4.1	21	18	11	8	-	-
1100	4.3	21	19	13	10	-8	-
1200	6.1	23	24	25	24	10	5
1300	8.8	21	23	25	26	27	27
1400	10.8	17	18	22	23	26	26
1500	11.5	6	12	17	18	23	24
1600	11.6	-2	2	12	11	20	21
1700	11.6	-7	-2	10	9	18	19
1800	11.7	-7	-2	10	10	17	18
1900	11.7	-2	2	11	11	19	20
2000	11.7	9	13	17	18	22	23
2100	11.5	18	18	22	23	26	26
2200	10.9	22	24	26	27	28	28
2300	9.7	25	26	28	28	29	29
2400	8.3	27	27	28	28	28	27

The circuit shown in Table A was over a 160-mile path in Florida, which may be representative of communications between Caribbean islands. Note that there are two times that a band was predicted not to support communications, i.e., 7.2 MHz during local night and 3.8 MHz during local daytime. The 5.2 MHz band is predicted to be more stable and an important band during propagation transitions near the sunrise (1200 UTC) and sunset (0100 UTC) periods. Note also that 3.5 MHz noise is often higher which will degrade the indicated signal level by several dB.

To date, no incidents of interference to the incumbent users of the band have been noted by the participants or reported to ARRL. As the stations are largely scattered throughout the country, most of the operations have been over long distances at night.

The WA2XSY experimental operations confirmed that there was usually a difference in communications reliability among the three bands with the 5.2 MHz band frequently the most reliable. The test showed that though the signal strength may be similar on 3.8 and 5.2 MHz, the higher atmospheric noise at 3.8 MHz would leave 5.2 MHz as the more reliable band of the two.

APPENDIX

Amendment of Parts 2 and 97 of the FCC Rules

PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

§2.106 Table of Frequency Allocations

MOD

<table>
<tr><th colspan="3">International table</th><th colspan="2">United States table</th><th colspan="2">FCC use designators</th></tr>
<tr><th>Region 1-allocation kHz
(1)</th><th>Region 2-allocation kHz
(2)</th><th>Region 3-allocation kHz
(3)</th><th>Government
Allocation kHz
(4)</th><th>Non-Government
Allocation kHz
(5)</th><th>Rule Part(s)
(6)</th><th>Special-use frequencies
(7)</th></tr>
<tr><td colspan="3">5060-5250
FIXED
Mobile except aeronautical mobile
S5.133</td><td rowspan="2">5060-5450
FIXED
MOBILE
except
aeronautical
mobile

US212</td><td rowspan="2">5060-5450
FIXED
MOBILE
except
aeronautical
mobile
Amateur
US212 NG[ ]</td><td rowspan="2">AVIATION (87)
INTERNATIONAL
FIXED PUBLIC (23)
MARITIME (80)
PRIVATE LAND
MOBILE (90)
AMATEUR (97)</td><td rowspan="2"></td></tr>
<tr><td colspan="3">5250-5450
FIXED
MOBILE except aeronautical
mobile</td></tr>
</table>

ADD

NG[ ] The band 5250-5400 kHz is also allocated to the amateur service on a secondary basis. No amateur station shall cause harmful interference to, nor is protected from interference stations authorized in the mobile and fixed services.

PART 97 – AMATEUR RADIO SERVICE

Section 97.13(c)(1) is amended to read as follows:

Wavelength Band		Evaluation Required if Power* (watts) Exceeds:
*****		
HF	60m	500

*****

Section 97.301(b), (c), and (d):

Wavelength band	ITU Region 1	ITU Region 2	ITU Region 3	Sharing requirements See §97.303, Paragraph:
HF	MHz	MHz	MHz	
ADD				
60 m	—	5.250-5.400	—	(r)

Section 97.303 Frequency sharing requirements.

ADD

(r) No amateur station transmitting in the 5.250-5.400 MHz band shall cause harmful interference to, nor is protected from interference due to the operation of, stations authorized in the mobile and fixed services.

Section 97.305 Authorized emission types.

Wavelength band	Frequencies	Emission Types Authorized	Standards See §97.307(f), paragraph
ADD			
60 m	Entire band	RTTY, data	(3) (9)
		Phone, image	(1) (2)