中華民國業餘無線電促進會

會址：(33060) 桃園市中平路 102 號 22 樓
電話：(03) 220-9207 轉 112 ．傳真：(03) 220-2245
立案證書字號：內政部台內社字第九二０七一六號核准立案

[附件1]

有關472-479Khz依WRC12決議分配給業餘無線電業務

國際使用狀況與本會運用計畫

[附件 1]

有關 472-479Khz 依 WRC12 決議分配給業餘無線電業務」,國際使用狀況與本會運用計畫：

依交通部 101 年 8 月 27 日交郵字第 1010031564 號函,說明第二項第 1 款辦理「有關 472-479Khz 依 WRC12 決議分配給業餘無線電業務」,CTARL 回覆之運用計劃等資料。

一、背景

1、73Khz 和 136Khz

業餘無線電低頻(LF, i.e. 30-300Khz)的操作在 1996 年由英國所開啟,當年該國的電信管理機構 Ofcom 以特別核准的方案准許英國的業餘無線電人員操作 73Khz 低頻頻段,總共有 250 個業餘無線電臺參與此項的實驗測試,實驗的結果如以功率 100 瓦,可以到達 100 公里的可靠通信。目前該頻段已停止操作,ITU 國際電聯會世界無線電會議 WRC 也未分配這個頻率給業餘無線電業務使用。

隨後在 1998 年 1 月 30 日,英國電信單位再核准 135.7-137.8Khz 以實驗電臺方式開放操作,美國、CEPT、紐西蘭及澳大利亞隨後跟進,並擴大了通信範圍,這個 2200 米波在 WRC07 年時被大會決議以次要條件下分配給予各區的業餘無線電人員使用,並要求業餘無線電臺操作這個頻段時,功率不得超出 1 瓦特 e.i.r.p.,也不得干擾到主要

業務; 固定、航海移動及無線電定位等。另外蒙古、卡基斯坦共和國及土庫曼共和國在 130-148.5Khz 以次要業務分配給予無線電定位使用，同時享有平等的權利。我國交通部業於 100 年 2 月 9 日公告以次要業務條件下供業餘業務使用。

2、472-479 千赫(600 米波長)

交通部 101 年 7 月 16 日交郵字第 1015010373 號函請各會提出 WRC12 新增頻段之建言，CTARL 在回覆交通部的建議事項及意見中，新增 472-479 千赫分配給予業務依次要條件下使用。其中有關 500 千赫原先作為航海移動通信中所扮演的背景， 貴部郵電司鄧 司長是這方面的長材，知之甚詳，不再贅述。

二、國際間運作的情形

美國是 500 千赫最早核准以實試驗電臺方式給予業餘無線電業務的國家，並試圖在 WRC 會議上聯合其它國家作成議案，經由數年的努力後，於今年 3 月的 WRC 會議中通過本項決議案。

73 千赫及 136 千赫在歐洲經過多年的操作經驗後，業餘無線電人員發現 73Khz 在天線及地網的架設方面遭遇到許多的困難，又 136 千赫其波長為 2200 公尺，同樣也遇到上述的情況，最主要是天線的效率無法發揮。因此在國家或是社會遭到自然災害時，野外架設無法實用，但 136 千赫可以在接收方面獲取低頻傳播的經驗，如果有一合適

的場所架設天線或是地網線，136 千赫不失為地波傳播非常良好的頻段，因此 WRC07 年指配給予業餘業務使用。

業餘無線電社會及電波領域的科學家們提出 500 千赫最主要的考量為;

*這個頻段在航海業務已經操作過約一個世紀的時間(1912 年鐵達尼號求救呼叫即已使用 500 千赫)，因此累積相當多的硬體設計經驗及傳播理論，只可惜這些航海通信人員在 GMDSS 系統啟用後，已大部份改行在陸地上工作。

*有感於特高頻及超高頻(VHF & UHF) 為直線波通信最佳的通信頻段，但這兩頻段除非利用中繼或是衛星的方式方能作為中長程通信，以一部 50W 的功率架在 10 公尺以下的高度，通常可靠的通信只在 20-30 公里間。一個國家受到例如颱風或是戰爭、地震之侵擾時，受災範圍會達到數百公里或是更大。又晚近特高頻及超高頻頻段內充斥著眾多的業務使用。

業餘無線電業務在 1.8 兆赫/3.5 兆赫/7.0 兆赫等雖然可以作為緊急通信之作業平臺，但由於輻射角度大部份都很大的情況下，在做為一無死角通信的頻段有所缺失，因此尋找可傳播直線波又不受電離層變動影響的中長距離通信頻段，科學家們認為中頻 500 千赫是合適的。(請見附件 1-1、A 600-meter amateur band by Frederich H. Raab

Ph D, W1FR)

美國的操作經驗

*在 2004 年提出這樣的理念後，FCC 於 2005 開始以「實試驗電臺方式---FCC Rule Part 15」核准 ARRL 以呼號「WD2XSHxx」操作，其電臺(請見附件 1-2)及地理位置圖(請見附件 1-3)。

*操作的經驗:由於美國核准 20 瓦特的輻射功率，通信模式以莫爾斯電碼為主(Morse code , A1A), 並使用電腦的極慢速電碼方式(QRSS, 10s 及 20 秒)，通信距離在 81 哩至 884 哩間。白晝以地波傳送會在百公里至數百公里，夜間由於天波的作用可達到數百公里至千公里。如果依 WRC12 的規定，發射功率限制在 1w e.i.r.p.，我認為在數十公里至數百公里間可以操作穩定的通信(達數百公里的要件需有很好的天線效率、絕佳的地網鋪設環境，而且在夜間利用天波通信)。請見附件 1-4(ARRL 在 2006 年 9 月 30 日至 12 月 1 日間的操作報告。)及最後的報告(附件 1-5. 2008 年 9 月 1 日至 11 月 30 日)。國際間的操作，請見附件 1-6。

DK----德國

OK----捷克

SM----瑞典

G-----英國

ON----比利時

YO----羅馬尼亞

VE----加拿大

LA----挪威

三、我的經驗

我國在這個頻段分配給水上行動作為主要業務，航空定位為次，又我國的各海岸電已不守值 500 千赫 (410Khz -520Khz)。目前在此頻段者有航空 NDB 兩個電臺，一在恒春的 415Khz KW(-87.5dBm), 另外在嘉義的 525 千赫 KU(-76dBm)，信號強度接收地點在台中潭子。

世界上在航海海事信息傳送以 518 千赫作為專用頻率(NAVTEX)，這也是目前在這個頻段最重要的頻率。我國的基隆海岸電臺也在此發送海事相關的信息，其距離可達到 400 浬，發射站臺有二座，分別在東北角及屏東林園。可能是高山阻隔的因素，在台中接收東北角的信號有時比泰國發來的信號微弱(真正的原因不詳，也曾經向基隆海岸電台反應過)。這個頻段各國依海事委員會(IMO)的規劃，分時發送信息，從最北的俄羅斯至最南端的印尼，測試你的接收機及天線是否有效率，可以利用這個頻道。尚有其它的國家使用 490 千赫，以其國家的語言傳送海事信息。

由於我對於低頻信號研究有數十年的經驗，這個頻段白晝以 Navtex

1Kw 的功率，可以到達約 400 哩的距離，由於航海 Navtex 接收機是以一約 1 至 2 公尺內建置強波器之天線(active whip ant)，因此其接收效率並不是很理想。如果利用良好的地網及有效率的長型天線，應可收到更遠的電臺。夜間由於天波的作用，而且這個頻段的天波比較穩定，因此可收到很遠的電台。

四、CTARL 對於 472-479 千赫的運用計劃

1、頻譜計劃(Band Plan)

在國際業餘無線電聯盟(IARU)尚未作出 600 米波段之頻譜計劃前，CTARL 將先行參照美國 ARRL 的 500Khz 頻譜計劃，國際間先前在 500Khz 試驗操作時之 Band Plan，移往 472-479Khz 進行試驗操作。

2、以我國現行電信法及業餘無線電管理辦法之規定操作本頻段，發射模式以莫爾斯電碼(Morse code , A1A)為主，相位移送 PSK31 及極慢速電腦傳送莫爾斯電碼(QRSS)等操作，不允許語音通信操作。

3、嚴格要求業餘無線電人員操作本頻段時依次要業務下運作，亦即操作前先行接收，遇到有示標臺(Beacon station)或是航海移動通信進行時，不得操作或是停作操作或更改頻率。本會秘書處在 貴部分配本頻段給予操作前，先行教育我國業餘無線電人員知悉本頻段的相關規定，並知會其它業餘無線電團體。

4、嚴格要求各業餘無線電人員，操作本頻段其天線輸出功率不得超

出 1 瓦特 e.i.r.p. 。在干擾到其它業務或有其它單位提出干擾報告時，應即停止操作。如有諧波發射「Spurious Emission」 或是混調變發生後，需進一步改善以符合技術規範之規定。

5、嚴格遵守不得在「頻帶外發射—Out-of-band emission」，各類別通信應嚴守技術規範及 ITU RR 所律定的「指配頻帶寬度—Assing Frequency Band」及「佔用頻帶寬度—Occupied Bandwidth」等之規定。

中華民國業餘無線電促進會法規委員會主任委員
歐錦昌/BX4AA 101 0901

中華民國業餘無線電促進會
會址：(33060) 桃園市中平路 102 號 22 樓
電話：(03) 220-9207 轉 112 ・傳真：(03) 220-2245
立案證書字號：內政部台內社字第九二0七一六號核准立案

［附件1-1］

A 600-meter amateur band

by Frederich H. Raab Ph D, W1FR

GREEN MOUNTAIN
RADIO RESEARCH COMPANY

77 Vermont Avenue, Fort Ethan Allen, Colchester, Vermont 05446 U.S.A. Tel./Fax. (802) 655-9670

RN04-5

A 600-meter amateur band

by

Frederick H. Raab, Ph.D., W1FR

March 11, 2004
Revision A: April 18, 2004

Abstract

A 600-meter (500-kHz) band will give the amateur service a unique capability for ultra-reliable regional ground-wave communication. Such communications are based upon ground-wave propagation and therefore not subject to interruption by solar storms or other events that disrupt the ionosphere. This frequency range also offers unique opportunities for experimentation with antennas, propagation, modulation, and signal processing. The frequency band from 495 - 510 kHz is recommended, as it is no longer used for maritime telegraphy in the western hemisphere, has not yet been claimed by another service, and is not used for power-line communications. A group of experimenters is applying for part-5 experimental licenses for these frequencies. The ARRL is encouraged to begin work toward obtaining an amateur allocation in this frequency range before another entity lays claim to the unused frequencies.

Indexing Terms

Radio, amateur
Communication, MF

1. INTRODUCTION

This note provides an overview of a new 600-meter (500-kHz) amateur band. Included here are:

- Characteristics and advantages,
- Frequencies and interference,
- Experimental licenses,
- ARRL involvement, and
- Historical perspective.

2. CHARACTERISTICS, ADVANTAGES, AND USES

A frequency allocation at 600 meters (500 kHz) will offer a number of unique opportunities and capabilities to the amateur service, including both

- Ultra-reliable regional ground-wave communication, and
- Experimentation with antennas, propagation, modulation, and signal processing for MF.

Ultra-Reliable Emergency Communications via Ground Wave

Ground-wave (also called "surface-wave") propagation at low and medium frequencies can provide reliable communication over medium and large ranges. The ground-wave signal propagates along the surface of the earth. Such communication is omni-directional and continuous and is therefore well-suited for "party-line" communication among all terminals in a network. Since the ground-wave signal is not dependent upon the ionosphere, communications based upon ground waves are not interruptable by solar events (sunspots, solar storms, coronal mass ejection) or a high-altitude nuclear detonation that disturb the ionosphere. A recent burst of solar activity (November 2003) produced significant aurora and disrupted HF ionospheric communication for several days.

The optimum frequency for ground-wave communication depends upon antenna efficiency, ground-wave propagation loss, and atmospheric noise. Vertical antennas with heights of 40 to 50 ft are readily constructed from aluminum tubing. For communication with such an antenna over average ground to distances of 100 - 300 km (60 - 200 mi), the best signal-to-noise ratio (SNR) per watt of transmitter output (see appendix) occurs in the range of 400 to 600 kHz, as shown in Figure 1. The 600-m amateur band is therefore ideal for amateur ground-wave emergency communications.

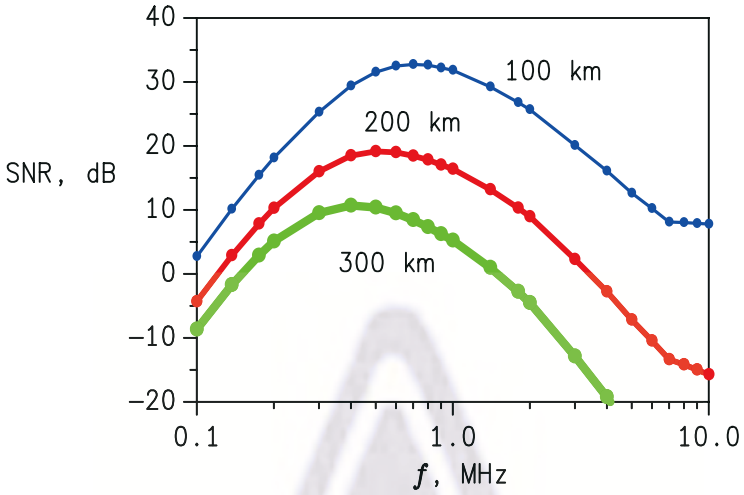


Figure 1. Ground-wave SNR as a function of frequency for typical amateur use.

An "Amateur Ground-Wave Emergency Net" operating in the 600-m band will provide uninterruptable emergency/disaster/homeland-security communication across a midwestern-sized state (e.g., Iowa). Fixed nodes will be established in major cities (e.g., Waterloo, Des Moines, Souix City) and will interface with local VHF/UHF amateur networks. Transportable units can be deployed to the site of an emergency (e.g., a tornado). Such units can be transported by pick-up truck or van and will consist of 100-500-W transmitters, laptop computer, and a 40-50-ft vertical antenna that is assembled from aluminum tubing.

No current amateur frequency allocations provide this kind of coverage. The 160, 80, 60, and 40-meter bands provide regional coverage through near-vertical-incidence skywave (NVIS). However, different frequencies are required to communicate over different distances and communication is subject to ionospheric disturbances. Troposcatter at VHF and UHF can also provide coverage over distances. However, directional antennas are required, hence coverage is point-to-point rather than regional. The proposed 137-kHz band is not suitable as it has a very limited frequency allocation and the efficiency of realistic amateur antennas is very low for 137 kHz.

Experimentation

The 600-meter band will also give amateurs several unique opportunities for experimentation, including:

- Electrically short antennas,
- Propagation,
- Modulation techniques, and
- Signal processing.

Operation on this band will motivate experiments to produce electrically short antennas that are efficient and transportable. It will afford a chance to experiment with both long-range

ground-wave propagation as well as D-layer propagation effects, neither of which is possible on higher-frequency amateur bands.

The need for reliable digital communication on this band is expected to motivate experimentation not only with existing digital modes, but also modulation techniques such as minimum-shift keying (MSK), which is efficient both in the use of bandwidth and power. Development of protocols for adaptation of data rates to the SNR will also be needed so that the emergency-communication systems can move data faster when noise levels are lower. The 600-meter band will also present new challenges for signal processing, including optimum nonlinear processing of atmospheric noise and adaptive cancellation of man-made noise and interference.

3. FREQUENCIES

The uses in Region 2 of the LF and MF spectrum immediately below the BC band are summarized in Table 1. The specific allocations are given in [1]

BAND	FREQUENCY, kHz	USE	USER
A	190 - 285	Aeronautical NDBs	FAA
B	285 - 325	Marine DGPS	USCG
C	325 - 435	Aeronautical NDBs	FAA
D	435 - 495	High-accuracy DGPS	USCG
E	495 - 505	Maritime calling and distress	None
F	505 - 510	Maritime Mobile	None
G	510 - 535	Aeronautical NDBs	FAA

Table 1. Simplified LF/MF allocations in Region 2.

Differential Global Positioning System (DGPS)

The marine nondirectional beacons in Band B have been phased out and replaced by DGPS beacons. These transmissions relay information from a GPS monitoring station to allow significant improvement in the accuracy of a GPS position fix of a nearby receiver.

The U.S. Coast Guard (USCG) in cooperation with six other federal agencies such as highways (FHWA) and railroads (FRA) is undertaking a significant expansion of the differential GPS (DGPS) system [2]. This includes a faster data rate (500 or 1000 b/s, vs. the 200 b/s for the DGPS beacons at 300 kHz). The plan is to have coverage from at least two beacons everywhere in CONUS. The higher data rate allows the use of more monitors and the use of carrier phase. This gives them centimeter accuracy and accurate velocity for "real-time kinematics" (RTK). There is a wide variety of applications ranging from tracking vehicles to guiding crop dusters. Many of the applications are for terrestrial navigation such as tracking cars and trains and knowing which lane or track they are on. The MF transmissions are well suited for this because they can be received at all altitudes beyond line of sight. Two such transmitters (Maryland and Virginia, 454 and 456 kHz) have recently been put on the air.

The chief of the Navigation Technology Branch at the U.S. Coast Guard Navigation Center (NAVCEN) advises that they plan to use the entire Band D from 435 to 495 kHz for these new high-accuracy DGPS beacons. This frequency allocation was obtained through NTIA and it is unlikely that any attempts for either new experimental licenses or an amateur allocation in this frequency band would be successful.

Aeronautical NonDirectional Beacons

Nondirectional Beacons (NDBs) in Bands A, C, and G act as nonprecision approach aids and compass-type locators. The FAA currently operates over 700 NDBs. approximately 200 are operated by the DoD and another 800 are privately operated. Some NDBs are "stand-alone" types, while others are associated with an Instrument Landing System (ILS).

The Federal Radionavigation Plan (FRP, Section 3.1.9) [3] calls for phasing-out the stand-alone NDBs. This is scheduled to begin in 2010 and will take about five years. Those NDBs associated with an ILS will continue to be operated until the ILS is retired.

At present, any attempt for experimental licenses or secondary amateur use of these bands will immediately run into flight-safety issues. If the NDBs are phased out by 2005 as planned, some parts of these bands may become available. However, ILS-associated NDBs will continue to operate and the phase-out of other NDBs may be delayed.

Maritime Telegraphy Bands

The frequencies from 435 to 525 kHz were once widely used for maritime telegraphy. The band from 495 to 505 kHz was reserved for calling and distress communication. These frequencies were monitored by both ships and shore stations.

Maritime communication is now handled by HF, VHF, and satellite communication. The Global Maritime Distress and Safety System (GMDSS) [4] has supplanted MF marine telegraphy for both routine and distress communication. Marine telegraphy is no longer used in the Western hemisphere except for occasional special-event transmissions. The USCG no longer monitors 500 kHz, nor do most nations.

A number of shore stations retain their licenses. However, the only signal reported in the remaining marine telegraphy band (Bands E and F) by the 600MRG (see next section) in the past three months is a special-event transmission by marine shore station KPH in Bolinas, CA. Another special-event transmission is scheduled for late May-June 2004 in connection with the cruise of the LST Memorial Ship *LST 325*. Loggings in the *Lowdown* for the past year report no other activity in Region 2.

The USCG has stated that it has no interest in these bands, nor any objection to their use for experimental or amateur service. The FAA does not appear to have an immediate interest in these bands, nor does the current allocation fit their use.

It is possible that some 500-kHz systems remain in use in Regions 1 and 3. However, use of 500 kHz in those regions is certainly declining and will eventually cease. For example, the

Italian government ceased monitoring of 500 kHz at the end of 2003. Thus this band has the potential to become an international allocation.

NAVTEX

NAVTEX [4] provides automated distribution of weather and navigation-system information to mariners. Worldwide, transmissions are authorized on 490 and 518 kHz, but only 518 kHz is used in the United states. A dozen transmitters provide coverage of most of the coast to a distance of 400 nmi (740 km). NAVTEX uses AMTOR protocol (100-baud FSK 170-Hz shift). NAVTEX broadcasting was implemented between 1983 - 1993 and appears to be mature and stable. Since NAVTEX is part of the GMDSS, it is likely to remain in operation for the forseeable future. Use of this band would require protection of NAVTEX transmissions at 518 kHz. This could be done by regional power/operating restrictions in the band from 517 to 519 kHz.

Recommendation

The marine-telegraphy bands from 495 to 510 kHz are currently unused and the obvious choice for experimental licenses and a new amateur band. There should be no objection to the use of Band F (505 to 510 kHz). While Band E (495 - 505) is similarly unused, there may be some objection to its use because of the possibility that legacy 500-kHz equipment could be used for an emergency transmission. This objection should fade rapidly over the next few years. A reasonable approach may be to ask for the band edges first and the band center later.

Experimental and amateur use of these frequencies will ensure that they are monitored regularly. Since government agencies are no longer monitoring this band, experimental and amateur use would actually improve the odds of reception of an emergency transmission on 500-kHz. Interference to those systems is expected to be minimal to nonexistant because of (a) the relatively high power of those stations and (b) the distance.

Perhaps a decade or so in the future, it may be possible to expand into Band G (510 to 535 kHz) as NDBs in that band are decommissioned.

4. EXPERIMENTAL LICENSES

The Six-Hundred-Meter Research Group (600MRG) was organized by Ken Gordon W7EKB in 2001. It initially included 35 members at various locations across the USA. In December 2001, the 600MRG was granted experimental license WC2XSR and authorized to use 440, 470, 480, 495, and 166.5 kHz. Several members began experimental transmissions almost immediately. However, within a week or two, the USCG complained to the FCC and the authorization for 440 - 495 kHz was withdrawn. One 480-kHz experimental beacon, WA2XRM (operated by W0RW) continues to operate, but that authorization expires at the end of the year. A few members operate experimental transmitters on 166.5 kHz, but many others were primarily interested in 600 meters. The 600MRG is now preparing a modification to its license to use the 505-510-kHz band and the edges of the 495-505-kHz band. A dozen more members will be added to the license at a later date. About half a dozen members have 500-kHz equipment ready to go as soon as a license is granted. Another dozen should be on the air within a short

period thereafter. Experimental use by this group should establish positively that there is no interference problem with other services.

5. OBTAINING A NEW AMATEUR BAND

The preceding discussion has shown that

- A 600-meter amateur band will offer unique opportunities for emergency communication and experimentation,
- The maritime-telegraphy band from 495 to 510 kHz is virtually unused, and neither the US Coast Guard nor FAA currently are interested in it, and
- There is interest in such a band, as a group of experimenters is ready to put transmitters on the air under part 5.

In addition,

- An amateur allocation is the only way to ensure access to the 600-meter band on a permanent basis.
- Access by US amateurs to the amateur band at 137 kHz is not likely to be granted for a number of years until experimental licensees prove that they do not disrupt power-line communication (PLC), and
- Interference with power-line communication is not an issue for the 600-meter band, as the highest frequency used in PLC is 490 kHz.

The ARRL is therefore strongly encouraged to begin work to obtain an amateur 600-meter band. ARRL involvement is essential to this quest for two reasons:

- ARRL personnel have experience in dealing with the FCC, WRC, and other administrative bodies and procedures, and
- A petition from ARRL will carry far more weight than petitions from the 600MRG, AMRAD, and individuals.

Frequencies

The band from 495 to 510 kHz is currently allocated on a primary basis to maritime telegraphy. The author recommends seeking secondary status (no harmful interference to existing marine telegraphy) for amateurs in the entire 495-to-510-kHz band. The petition should divide the band into three segments:

- 505 - 510 kHz,
- 495 - 497.5 and 502.5 - 505 kHz, and
- 497.5 - 502.5 kHz.

Little if any concern is expected for the 505 - 510 kHz band. Since the band from 495 to 505 kHz was once used for distress communication, there may be some concerns about legacy operators using these frequencies. The division into three subbands will allow setting different lower power levels and/or phasing-in access to protect any possible legacy users in the 495 to 505 kHz band.

At a later date, we will need to track the FAA's plans for decommissioning the NDBs. Sometime after 2010, we may be able to add 510 – 525 kHz to the 600-meter amateur band.

Modulation Modes

The anticipated modulation modes are CW and narrow-band digital. Voice transmission does not seem appropriate given the limited size of the band.

Uses

Given the limited frequency range available, consideration should be given to limiting the uses of the band (at least initially) to experimental and emergency communication. The exchange of signal reports, locations, and equipment characteristics should be considered a legitimate part of experimentation. However, rag-chewing and contesting should be avoided.

Prompt Action Imperative

When the author first began monitoring these bands in 2000, the band from 435 to 495 kHz was essentially unused. It has since been acquired by the US Coast Guard for their HA DGPS service. The unconfirmed report of an MSK transmission on 504.5 kHz is a reminder that some one else will find a use for these frequencies if they are not acquired for amateur use.

Now is the ideal time for the ARRL to take action to convert these frequencies into an amateur band. The US Coast Guard has yet to fill the 435 - 495-kHz band with DGPS beacons and is not yet looking for more spectrum. The FAA is not currently planning any other use for its LF/MF bands. The demise of maritime telegraphy has left the band from 495 to 510 kHz virtually unused. Thus we have a brief window of opportunity to try to acquire these frequencies for the amateur service before someone else does so.

International Interest

In response to a suggestion by the RSGB at the 2003 IARU Region 1 conference, the IARU formed a working to study the issues relating to an amateur band near 500 kHz.

6. HISTORICAL PERSPECTIVE

Maritime telegraphy in the 500-kHz band has been used almost since inception of radio communication. A transition to amateur service would allow it to become a working monument

that preserves the traditions of telegraphy and emergency communication. Amateurs using a new 600-meter band will welcome special-event transmissions from stations such as KPH. It may even be possible on special occasions to arrange for cross-service communication between amateurs and legacy maritime stations such as KPH (much as is done with DoD stations on Armed Forces Day).

7. REFERENCES

[1] 47CFR2.106, available at http://www.fcc.gov.

[2] Meetings of the Civil Global Positioning System Service Interface Committee (CGSIC). http://www.navcen.uscg.gov/cgsic/meetings.

[3] "2001 Federal Radionavigation Plan," U.S. Department of Transportation and U. S. Department of Defense, document DOT-VNTSC-RSPA-01-3/DOD-4650.5, Dec. 2001. Available from http://www.navcen.uscg.gov/pubs/frp2001/.

[4] "Global Maritime Distress and Safety System," U.S. Coast Guard, http://www.navcen.uscg.gov/marcomms/gmdss.

[5] *The Numerical Electromagnetics Engineering Design System*. Monterey, CA: The Applied Computational Electromagnetics Society, 1989.

[6] L. Boithias, *Radiowave Propagation*. New York: Wiley, 1987.

[7] A. D. Spaulding and J. S. Washburn, "Atmospheric radio noise: World- wide levels and other characteristics," Report 85-173 (PB85-212 942), National Telecommunications and Information Administration, Boulder, CO, April 1985.

APPENDIX. SNR PREDICTIONS

The SNR prediction (Figure 1) is based upon a combination of three factors. Antenna gain is predicted by simulation with the Numerical Electromagnetics Code NEC2 [5]. The amplitude of the surface wave is then predicted by a combination of standard Sommerfeld and spherical-earth theory [6]. Noise levels are based upon standard tables [7].

The specific parameters for this plot are:

- 15-m (50-ft) monopole with sixteen 30-m radials,
- Ground with σ = 0.01 S/m and ε_r = 10,
- 1 W delivered to the antenna,
- Median atmospheric-noise factor for fall and spring (50 dB), and
- Median atmospheric-noise level (50-percent).

The predicted antenna gain at 500 kHz is -15 dBi.

中華民國業餘無線電促進會
會址：(33060) 桃園市中平路 102 號 22 樓
電話：(03) 220-9207 轉 112 ．傳真：(03) 220-2245
立案證書字號：內政部台內社字第九二０七一六號核准立案

[附件1-2]
2009_0728 WD2XSH
FCC License Grant

Christopher D. Imlay, 225 Main Street, Newington, CT 06111,

United States of America
FEDERAL COMMUNICATIONS COMMISSION
EXPERIMENTAL
RADIO STATION CONSTRUCTION PERMIT
AND LICENSE

EXPERIMENTAL	WD2XSH
(Nature of Service)	(Call Sign)
XR FX MO	0099-EX-ML-2008
(Class of Station)	(File Number)

NAME American Radio Relay League, Inc.

Subject to the provisions of the Communications Act of 1934, subsequent acts, and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this license, the licensee hereof is hereby authorized to use and operate the radio transmitting facilities hereinafter described for radio communications in accordance with the program of experimentation described by the licensee in its application for license.

Operation: In accordance with Sec. 5.3(i) of the Commission's Rules

Station Locations

(1) Jamestown, RI - NL 41-27-30; WL 71-23-45; MOBILE: within 50 km of specified fixed station location, within 50 km
(2) Hammond, LA - NL 30-27-00; WL 90-31-00; MOBILE: , within 50 km
(3) Bow, NH - NL 43-07-30; WL 71-30-59; MOBILE: within 50 km of specified fixed station location, within 50 km
(4) Long Beach, MS - NL 30-21-42; WL 89-08-10; MOBILE: within 50 km of specified fixed station location, within 50 km
(5) Natchitoches, LA - NL 31-46-37; WL 93-11-01; MOBILE: within 50 km of specified fixed station location, within 50 km
(6) McLean, VA - NL 38-55-58; WL 77-10-17; MOBILE: within 50 km of specified fixed station location, within 50 km
(7) Jamestown, RI - NL 41-29-47; WL 71-22-50; MOBILE: within 50 km of specified fixed station location, within 50 km
(8) Stanfield, NC - NL 35-15-21; WL 80-23-00; MOBILE: within 50 km of specified fixed station location, within 50 km
(9) Cookeville, TN - NL 36-13-37; WL 85-33-00; MOBILE: within 50 km of specified fixed station location, within 50 km
(10) Nederland, CO - NL 39-58-27; WL 105-29-10; MOBILE: within 50 km of specified fixed station location, within 50 km
(11) Verndale, MN - NL 46-36-42; WL 94-48-16; MOBILE: within 50 km of fixed station location, within 50 km
(12) Colchester, VT - NL 44-30-20; WL 73-08-40; MOBILE: within 50 km of specified fixed station location, within 50 km
(13) Roland, AR - NL 34-49-51; WL 92-31-43; MOBILE: within 50 km of fixed station location, within 50 km

This authorization effective July 28, 2009 and
will expire 3:00 A.M. EST August 01, 2010

FEDERAL COMMUNICATIONS COMMISSION

Station Locations

(14) St. Francis, MN - NL 45-22-54; WL 93-21-41; MOBILE: within 50 km of specified fixed station location, within 50 km

(15) Marshfield, MA - NL 42-04-46; WL 70-42-21; MOBILE: within 50 km of specified fixed station location, within 50 km

(16) Green Harbor, MA - NL 42-04-18; WL 70-39-16; MOBILE: within 50 km of specified fixed station location, within 50 km

(17) Batavia, IL - NL 41-50-48; WL 88-19-08; MOBILE: within 50 km of specified fixed station location, within 50 km

(18) Cottage Grove, OR - NL 43-42-14; WL 123-02-19; MOBILE: within 50 km of specified fixed station location, within 50 km

(19) Buffalo, NY - NL 43-00-03; WL 78-47-34; MOBILE: within 50 km of specified fixed station location, within 50 km

(20) Wayland, MA - NL 42-21-55; WL 71-20-08; MOBILE: within 50 km of specified fixed station location, within 50 km

(21) Hilo, HI - NL 19-38-58; WL 155-07-26; MOBILE: within 50 km of specified fixed station location, within 50 km

(22) El Cerrito, CA - NL 37-54-02; WL 122-18-22; MOBILE: within 50 km of specified fixed station location, within 50 km

(23) Nikiski, AK - NL 60-40-05; WL 151-18-51; MOBILE: within 50 km of specified fixed station location, within 50 km

(24) Moscow, ID - NL 46-44-09; WL 116-59-55; MOBILE: within 50 km of fixed station location, within 50 km

(25) Elbe, WA - NL 46-45-45; WL 122-10-18; MOBILE: within 50 km of specified fixed station location, within 50 km

(26) Stehekin, WA - NL 48-21-23; WL 120-44-01; MOBILE: within 50 kilometers of specified fixed station location, within 50 km

(27) North Pole, AK - NL 64-46-52; WL 147-22-06; MOBILE: within 50 km of specified fixed station location, within 50 km

(28) Wasilla, AK - NL 61-35-43; WL 149-24-32; MOBILE: within 50 km of specified fixed station location, within 50 km

(29) Conneaut, OH - NL 41-50-45; WL 80-36-41; MOBILE: within 50 km of specified fixed station location, within 50 km

(30) Eden Prairie, MN - NL 44-52-33; WL 93-28-04; MOBILE: within 50 km of specified fixed station location, within 50 km

(31) Forest, VA - NL 37-23-39; WL 79-14-16; MOBILE: within 50 km of specified fixed station location, within 50 km

(32) Gays Mills, WI - NL 43-17-40; WL 90-52-01; MOBILE: within 50 km of specified fixed station location, within 50 km

(33) Boone, IA - NL 42-02-25; WL 93-58-21; MOBILE: within 50 km of specified fixed station location, within 50 km

(34) Indianola, IA - NL 41-26-16; WL 93-34-06; MOBILE: within 50 km of specified fixed station location, within 50 km

(35) Elk Point, SD - NL 42-45-51; WL 96-41-55; MOBILE: withiin 50 km of specified fixed station location, within 50 km

(36) Bethany, OK - NL 35-30-41; WL 97-39-45; MOBILE: within 50 km of specified fixed station location, within 50 km

(37) Groton, MA - NL 42-36-14; WL 71-32-31; MOBILE: within 50 km of specified fixed station location, within 50 km

Station Locations

(38) Charlestown, NH - NL 43-14-19; WL 72-25-30; MOBILE: within 50 km of specified fixed station location, within 50 km

(39) Pelham, NH - NL 42-44-58; WL 71-21-47; MOBILE: witihin 50 km of specified fixed station location, within 50 km

(40) New Bedford, MA - NL 41-40-16; WL 70-56-39; MOBILE: within 50 km of specified fixed station location, within 50 km

(41) Stow, MA - NL 42-24-24; WL 71-29-50; MOBILE: within 50 km of specified fixed station location, within 50 km

(42) Caldwell, NJ - NL 40-50-43; WL 74-16-48; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency Information

Jamestown, RI - NL 41-27-30; WL 71-23-45; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Hammond, LA - NL 30-27-00; WL 90-31-00; MOBILE: , within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Bow, NH - NL 43-07-30; WL 71-30-59; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B	20 W (ERP)	

Frequency Information

Bow, NH - NL 43-07-30; WL 71-30-59; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	62H0G1D	20 W (ERP)	

Long Beach, MS - NL 30-21-42; WL 89-08-10; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Natchitoches, LA - NL 31-46-37; WL 93-11-01; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

McLean, VA - NL 38-55-58; WL 77-10-17; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	FX	150HA1A 62H0J2B 62H0F1B	20 W (ERP)	

Frequency Information

McLean, VA - NL 38-55-58; WL 77-10-17; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	FX		20 W (ERP)	
		62H0G1D		

Jamestown, RI - NL 41-29-47; WL 71-22-50; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		
		62H0G1D		

Stanfield, NC - NL 35-15-21; WL 80-23-00; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		
		62H0G1D		

Cookeville, TN - NL 36-13-37; WL 85-33-00; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		

Frequency Information

Cookeville, TN - NL 36-13-37; WL 85-33-00; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	62H0G1D	20 W (ERP)	

Nederland, CO - NL 39-58-27; WL 105-29-10; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Verndale, MN - NL 46-36-42; WL 94-48-16; MOBILE: within 50 km of fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Colchester, VT - NL 44-30-20; WL 73-08-40; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B	20 W (ERP)	

Frequency Information

Colchester, VT - NL 44-30-20; WL 73-08-40; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	62H0G1D	20 W (ERP)	

Roland, AR - NL 34-49-51; WL 92-31-43; MOBILE: within 50 km of fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

St. Francis, MN - NL 45-22-54; WL 93-21-41; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Marshfield, MA - NL 42-04-46; WL 70-42-21; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B	20 W (ERP)	

Frequency Information

Marshfield, MA - NL 42-04-46; WL 70-42-21; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		62H0G1D		

Green Harbor, MA - NL 42-04-18; WL 70-39-16; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		
		62H0G1D		

Batavia, IL - NL 41-50-48; WL 88-19-08; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		
		62H0G1D		

Cottage Grove, OR - NL 43-42-14; WL 123-02-19; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		

Frequency Information

Cottage Grove, OR - NL 43-42-14; WL 123-02-19; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	62H0G1D	20 W (ERP)	

Buffalo, NY - NL 43-00-03; WL 78-47-34; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Wayland, MA - NL 42-21-55; WL 71-20-08; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Hilo, HI - NL 19-38-58; WL 155-07-26; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B	20 W (ERP)	

Frequency Information

Hilo, HI - NL 19-38-58; WL 155-07-26; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	62H0G1D	20 W (ERP)	

El Cerrito, CA - NL 37-54-02; WL 122-18-22; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Nikiski, AK - NL 60-40-05; WL 151-18-51; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Moscow, ID - NL 46-44-09; WL 116-59-55; MOBILE: within 50 km of fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B	20 W (ERP)	

Frequency Information

Moscow, ID - NL 46-44-09; WL 116-59-55; MOBILE: within 50 km of fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		62H0G1D		

Elbe, WA - NL 46-45-45; WL 122-10-18; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		
		62H0G1D		

Stehekin, WA - NL 48-21-23; WL 120-44-01; MOBILE: within 50 kilometers of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		
		62H0G1D		

North Pole, AK - NL 64-46-52; WL 147-22-06; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		

Frequency Information

North Pole, AK - NL 64-46-52; WL 147-22-06; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		62H0G1D		

Wasilla, AK - NL 61-35-43; WL 149-24-32; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0F1B		
		62H0J2B		
		62H0G1D		

Conneaut, OH - NL 41-50-45; WL 80-36-41; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		
		62H0G1D		

Eden Prairie, MN - NL 44-52-33; WL 93-28-04; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		

Frequency Information

Eden Prairie, MN - NL 44-52-33; WL 93-28-04; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	62H0G1D	20 W (ERP)	

Forest, VA - NL 37-23-39; WL 79-14-16; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Gays Mills, WI - NL 43-17-40; WL 90-52-01; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Boone, IA - NL 42-02-25; WL 93-58-21; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B	20 W (ERP)	

Frequency Information

Boone, IA - NL 42-02-25; WL 93-58-21; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		62H0G1D		

Indianola, IA - NL 41-26-16; WL 93-34-06; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		
		62H0G1D		

Elk Point, SD - NL 42-45-51; WL 96-41-55; MOBILE: withiin 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		
		62H0G1D		

Bethany, OK - NL 35-30-41; WL 97-39-45; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO		20 W (ERP)	
		150HA1A		
		62H0J2B		
		62H0F1B		

Frequency Information

Bethany, OK - NL 35-30-41; WL 97-39-45; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	62H0G1D	20 W (ERP)	

Groton, MA - NL 42-36-14; WL 71-32-31; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Charlestown, NH - NL 43-14-19; WL 72-25-30; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Pelham, NH - NL 42-44-58; WL 71-21-47; MOBILE: witihin 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B	20 W (ERP)	

Frequency Information

Pelham, NH - NL 42-44-58; WL 71-21-47; MOBILE: witihin 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	62H0G1D	20 W (ERP)	

New Bedford, MA - NL 41-40-16; WL 70-56-39; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Stow, MA - NL 42-24-24; WL 71-29-50; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0J2B 62H0F1B 62H0G1D	20 W (ERP)	

Caldwell, NJ - NL 40-50-43; WL 74-16-48; MOBILE: within 50 km of specified fixed station location, within 50 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	150HA1A 62H0F1B 62H0G1D	20 W (ERP)	

Frequency Information

Caldwell, NJ - NL 40-50-43; WL 74-16-48; MOBILE: within 50 km of specified fixed station location, within 50 km

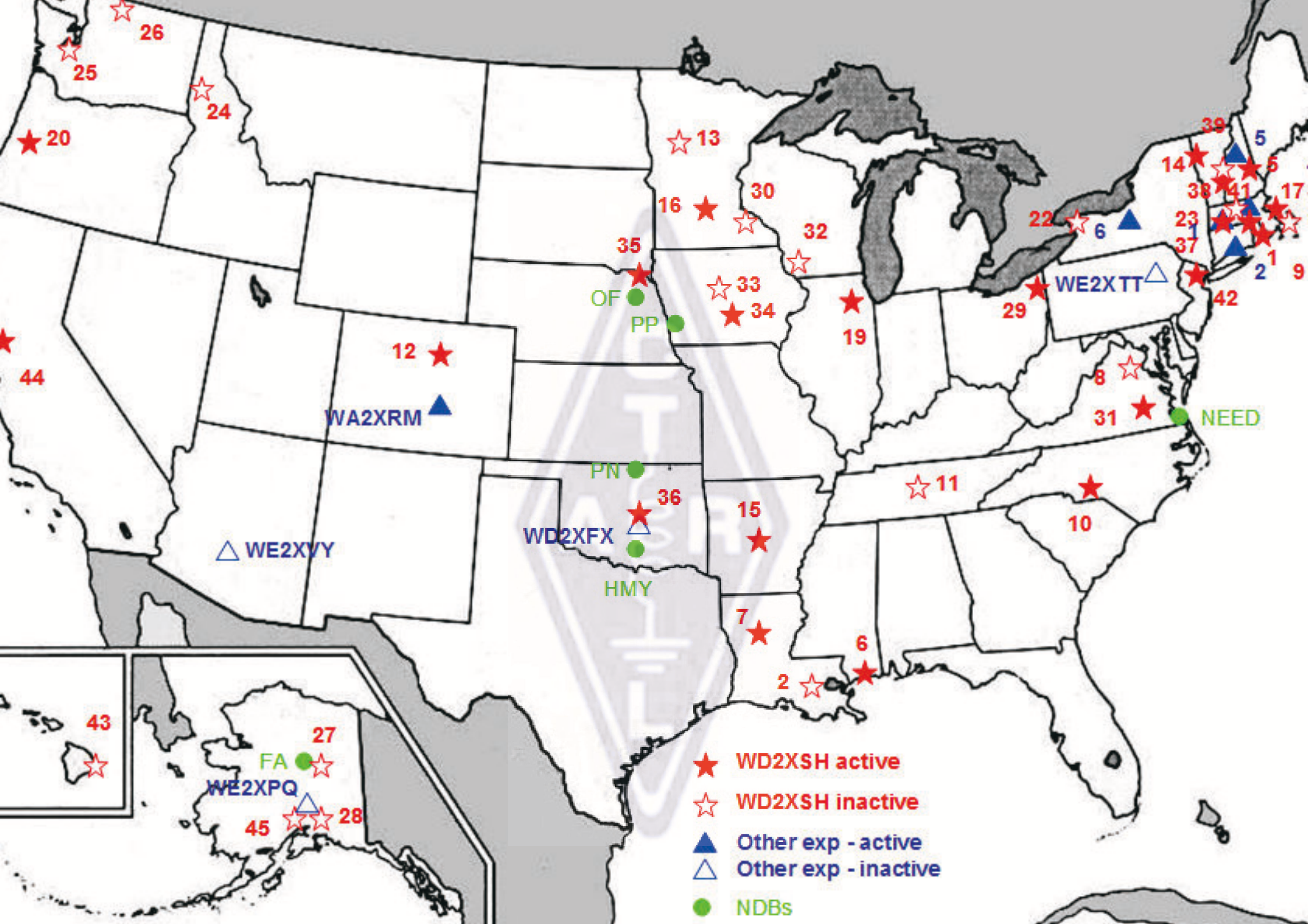
Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
495-510 kHz	MO	62H0J2B	20 W (ERP)	

Special Conditions:

(1) In lieu of frequency tolerance, the occupied bandwidth of the emission shall not extend beyond the band limits set forth above.

中華民國業餘無線電促進會
會址：(33060) 桃園市中平路 102 號 22 樓
電話：(03) 220-9207 轉 112 ・傳真：(03) 220-2245
立案證書字號：內政部台內社字第九二０七一六號核准立案

［附件1-3］
600 Meter Stations


26
25
24
20
13
16
30
32
35
33
34
OF
PP
12
44
WA2XRM
19
39
5
14
5
38
41
17
22
6
23
37
1
2
9
WE2XTT
29
42
8
31
NEED
PN
36
11
15
10
WE2XVY
WD2XFX
HMY
7
6
2
43
27
FA
WE2XPQ
45
28
WD2XSH active
WD2XSH inactive
Other exp - active
Other exp - inactive
NDBs

中華民國業餘無線電促進會
會址：(33060) 桃園市中平路 102 號 22 樓
電話：(03) 220-9207 轉 112 ・傳真：(03) 220-2245
立案證書字號：內政部台內社字第九二０七一六號核准立案

[附件1-4]

ARRL操作報告

GMRR M06-8

WD2XSH status report: September 13 - December 1, 2006

Prepared by Fritz Raab, W1FR, Experiment Coordinator

December 5, 2006

1. ADMINISTRATIVE ISSUES

The grant was issued on September 13. It permits CW transmission with up to 20 W ERP from 505 to 510 kHz. No explanation has been offered about why PSK-31 was not included; we assume that the FCC wants to be able to identify the stations easily.

The locations of the 21 stations are shown in Figure 1. Two of the original 23 dropped out for personal reasons, and one of the original participants has relocated because of Katrina. Fifteen have gotten on the air, although winds have taken down the antenna of one of these. The experiment coordinator has restricted the midwest stations to 505 - 508 kHz to ensure no interference to the NDB in Nebraska. He has also assigned frequencies for QRSS, CW beacons, rotating beacon, and calling.

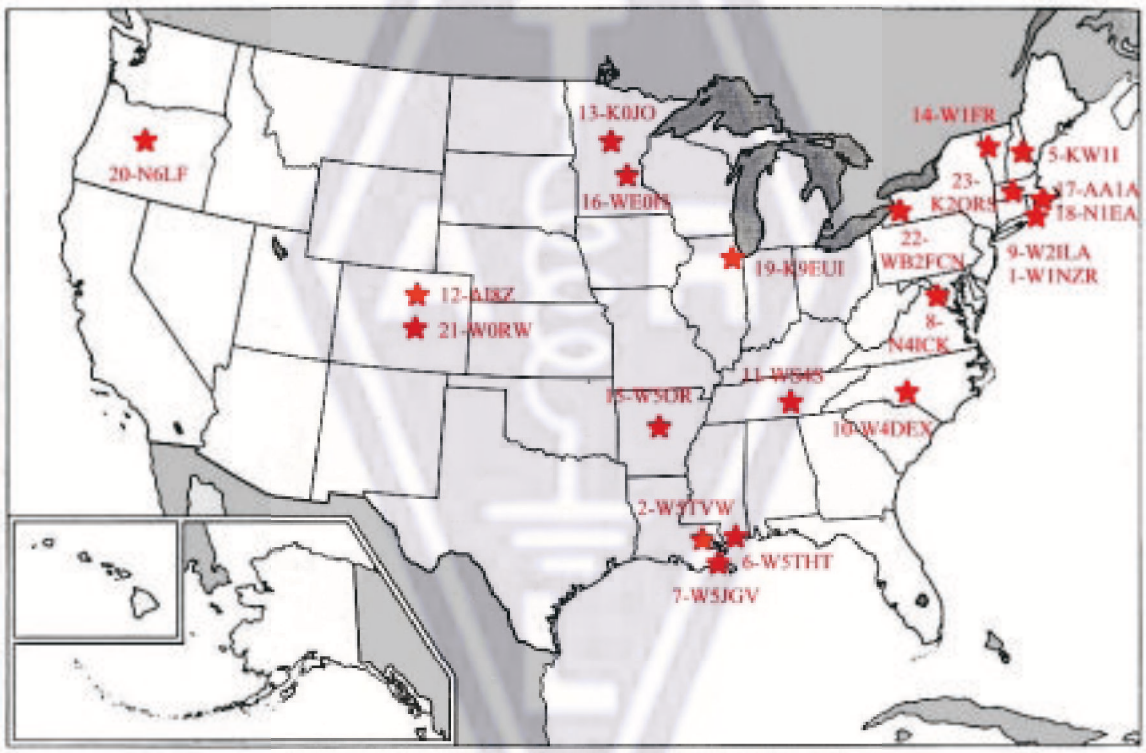


Figure 1. WD2XSH stations.

All participants must submit logs in Excel format. We have just begun processing the logs to extract statistics about our operations. There have been a number of glitches, but we are beginning to be able to extract useable information.

Our web site www.500kc.com is operational. It provides information on the project as well as a way for outsiders to file reception reports. The reports go into a data base which will later be sorted to produce statistics.

2. INTERFERENCE ISSUES

None.

3. COMMUNICATIONS

Most communications to date have been night-time sky-wave. Transmissions have included both CW and QRSS. Twenty-seven CW QSOs have been reported at distances ranging from 81 to 884 mi. Our web site has over 900 reception reports. Distances of 500 mi are readily achieved, and 1000-mi distances are not uncommon. Three stations have been received in Europe and one has been received in Hawaii.

Fast fading (possibly due to multipath) has been observed. It spreads the bandwidth of the signal beyond the 0.25-Hz spacing in the current QRSS assignments. A slower fading has been observed that makes it difficult to copy complete callsigns in the QRSS10 and QRSS30 modes.

4. PLANS

In the short term, we hope to get most of the remaining 21 stations on the air. We also plan to expand processing the logs and begin processing the web-site reports. A little later we will begin day-time tests to determine ground-wave capabilities. A technical note has been drafted for use on our web site and as an article for *QEX*.

We will also continue coordination with the RSGB and IARU committees who are interested in 500-kHz operations. In the long term, we hope to add stations in the southwest, Hawaii, Alaska, and perhaps Puerto Rico.

APPENDIX. STATISTICS

STATION	CALL	STATUS	HOURS	QSOs NUMBER	QSOs WITH
WD2XSH/1	W1NZR	ON		1	17
WD2XSH/2	W5TVW	ON		2	6, 11
WD2XSH/3	WD5CVG	DROPPED			
WD2XSH/4	WD4PLI	DROPPED			
WD2XSH/5	KW1I	ON	4	9	11, 14, 17
WD2XSH/6	W5THT	ON	178	8	2, 10, 11
WD2XSH/7	W5JGV	MOVED			
WD2XSH/8	N4ICK	-			
WD2XSH/9	W2ILA	ON		1	17
WD2XSH/10	W4DEX	ON	247	9	5, 6, 11, 14, 17
WD2XSH/11	WS4S	ON	433	2	2, 5, 6, 10
WD2XSH/12	AI8Z	ON	14		
WD2XSH/13	KOJO	ON			
WD2XSH/14	W1FR	ON	8	3	5, 10, 17
WD2XSH/15	W5OR	ON	2		
WD2XSH/16	WEOH	-			
WD2XSH/17	AA1A	ON	23	9	1, 5, 9, 10, 14
WD2XSH/18	N1EA	-			
WD2XSH/19	K9EUI	ON	446		
WD2XSH/20	N6LF	OFF	372		
WD2XSH/21	W0RW	ON	652		
WD2XSH/22	WB2FCN	-			
WD2XSH/23	K2ORS	-			
TOTAL		14 ON	2379	27	

Note:
Operating hours are derived from logs.
QSOs are derived from W0RPK's weekly summary.

中華民國業餘無線電促進會
會址：(33060) 桃園市中平路 102 號 22 樓
電話：(03) 220-9207 轉 112 ・傳真：(03) 220-2245
立案證書字號：內政部台內社字第九二０七一六號核准立案

[附件1-5]

ARRL最後報告

GMRR M08-8

WD2XSH status report: September 1 - November 30, 2008

Prepared by Fritz Raab, W1FR, Experiment Coordinator

December 28, 2008

1. SUMMARY OF OPERATIONS

This report provides a summary of WD2XSH activity during the fall of 2008. The QRN has decreased and propagation has improved considerably from summer, and activity is accordingly up as well. The key statistics of our operations to date are:

- Number of QSOs: 18 additional, total 296;
- Number of reports via web site: 390 additional, total 7132;
- Operating hours: 6,605 additional, total 31,127; and
- Number of interference complaints: 0.

All statistics are based upon the end of the reporting period (11/30/08).

2. ADMINISTRATIVE

We identified two corrections to be made in the August 22 filing for expansion. ARRL attorney Chris Imlay W3KD made the corrections on October 16.

I have asked the FCC whether we could be granted permission to communicate with foreign amateur-experimental stations (e.g., the Canadians) by a post-grant communication. While this should be simple as it does not involve any new stations or frequencies, it appears that they have no procedure for dealing with such a request other than our filing a formal request for modification.

3. COMMUNICATIONS

Activity has increased considerably this fall. A number of trans-continental and trans-Atlantic receptions have been reported.

The ground-wave tests concluded at the end of the summer. Logs have been received from all but the New England cluster. I am working on software for processing the data.

On Nov. 30, WE2XGR/6 and GI4DPE has a hybrid SSB-CW QSO. WE2XGR was transmitting LSB on 510 kHz and running about 50 W ERP (vs. his usual 200 W ERP) because of ice on his antenna. GI4DPE (Northern Ireland) responded in CW. This is the first transatlantic reception of SSB voice on 500 kHz .

4. INTERFERENCE

There have been no reports of interference, however, we are continuing to monitor three potential interference problems.

NDB OF

K0HW is again making signal-level comparisons, and will continue through the end of February. This year's tests use a single omni-directional antenna and a single receiver so that the results will be completely consistent. Two stations in Oklahoma (KD5UWL and W5GHZ) plan to conduct similar tests involving our signals and the two 500-kHz NDBs near them.

NEED

We continue to hear NEED on 505 kHz from time to time.

SBQ

A mystery signal identifying itself as SBQ has been observed several times in Nachitoches, Louisianna by W5JGV, starting on November 5. This appears to be an FSK signal, as the Morse ID "SBQ" has been observed on 507.2 kHz, and an inverse-keyed signal has been observed simultaneously on 507.5 kHz. This is an over-the-air signal and has been heard only at night, suggesting it is sky-wave. Unidentifiable signals on 507.5 kHz have been reported in Texas and South Dakota, but they could not be identified positively. We are making an effort to ascertain who can hear this signal as the first step in localizing it.

5. OTHER EXPERIMENTAL/AMATEUR OPERATIONS

On September 16, experimental license WE2XTT was issued to Phil Galasso K2PT. He is located in Shickshinny, PA, and has permission to operate from 505 to 510 kHz with 1 kW RF in CW and 1.5 kW in SSB mode.

On December 9, Michael Gray KD7LDO was issued experimental license WE2XVY. He is located in Fountain Hills, Arizona (near Phoenix). He is authorized to transmit on frequencies between 500 and 510 kHz using CW, FSK, and PSK with 200 W ERP. He has an ambitious plan for ground-wave tests that includes automated remore receivers. Two points about this license are of particular interest. While the requested access to 510 - 515 kHz was dropped, no objections were raised about access to the former distress/calling band from 500 to 505 kHz. His application was filed on October 25 and thus issued in only five weeks. Our request for expansion (while more complex) was filed earlier and remains pending.

Currently, this makes a total of six U.S. experimental licenses with access to 500 kHz:

- WD2XSH,
- WE2XGR,

- WD2XFF,
- WE2XPQ,
- WE2XTT, and
- WE2XVY.

In addition, WA2XRM is authorized to operate on 480 kHz.

On December 16, Mike Reid WE0H (WD2XSH/16) requested modification of his own experimental license WD2XGI to include 501 - 509 kHz. This modes include CW and voice transmissions.

On December 17, Brian Ford KF4TAP from Boaz, Alabama filed a new application WE2XXH. He has requested the use of 495 - 510 kHz with CW signals and 1 W ERP, plus a 500-km mobile operating radius.

On December 23, Charles Vest from South Coffeyville, Oklahoma filed a new application for access to 495 - 510 kHz. He has asked for 1-W ERP with narrowband FSK, CW, and general modulation modes for propagation testing.

In preparation for WRC-11, Industry Canada has decided on November 10 to permit Canadian amateurs to operate from 504 to 509 kHz with an ERP up to 20 W and a bandwidth up to 1 kHz. These will officially be special development licenses and will have distinctive call signs.

On September 28, NTTH (*USS Cassin Young*) operated on 512 kHz from the Charleston, MA Navy Yard. The equipment is being restored by Steve Russell, who hopes for more operations in the future.

On November 21 and 22, the Maritime Radio Historical Society arranged for a special event involving KPH/KSM and ships KXCH (*SS Jerimiah O'Brien*) and KYVM (*SS Red Oak Victory*). The KPH transmitter was keyed remotely from its pre-World-War-II site in Marshall and operations were conducted on both MF and HF.

On October 3, LBA, Inc. filed an application for an experimental license (WE2XVO) for testing mine communication on 435 - 495 kHz with 10-W ERP and voice modulation. It will be interesting to see whether this application is opposed by the USCG because of plans for their HA DGPS system.

6. REGULATORY AND WRC-11

The German Seefunker organization is continuing efforts to get UNESCO to declare 500 kHz a world heritage and thereby to prevent other uses. They cite a relatively new UNESCO convention for safeguarding intangible cultural assets. It is unclear whether they could be successful and if so what effect this would have on other uses of the band.

6. PORTABLE STATION

Fred Temple, KN8AZN, continues to refine his Small Wonder Labs PSK20/30/40 digital transceiver and Communications Concepts EB63 linear amplifier modifications for 600m. Both modified units, known as the PSK600 and EB63-600 with an LPF-600, are working on Fred's bench and ready to go on-the-air with 120W output when licensing allows.

Ralph Wallio, W0RPK, with considerable support from Fred, has a PSK600 working on his bench and is now duplicating Fred's EB63-600 and LPF-600. The only differences in modification parts for PSK20 vs. PSK30 and PSK40 are LO crystal frequencies. Modification documentation and parts lists are available.

Design and fabrication work for a portable transmit antenna continue with the goal being a reasonable balance between radiating efficiency and portability. Dimensions of radial field and vertical radiator are limited to allow quick deployment in far less than ideal surroundings.

7. PLANS

Plans for winter quarter include:

- General operations,
- Monitoring to compare signal levels to those of NDBs, and
- Reduction of ground-wave data from this summer.

APPENDIX A. STATISTICS

STATION	CALL	STATUS	08/31/08		11/30/08		COMMENT
			HOURS	QSOs	HOURS	QSOs	
WD2XSH/1	W1NZR	ON	11:37	5	13:36	7	
WD2XSH/2	W5TVW	OFF	12:31	22	12:31	22	QRT Order
WD2XSH/3	WD5CVG	DROPPED	-	-	-	-	Dropped
WD2XSH/4	WD4PLI	DROPPED	-	-	-	-	Dropped
WD2XSH/5	KW1I	ON	19:47	42	21:37	46	
WD2XSH/6	W5THT	ON	3577:22	81	4022:51	90	
WD2XSH/7	W5JGV	MOVED	-	-	-	-	Moved
WD2XSH/8	N4ICK	OFF	0	0	0	0	Inactive
WD2XSH/9	W2ILA	ON	9:37	26	9:37	26	Inactive
WD2XSH/10	W4DEX	ON	856:00	22	1070:58	22	
WD2XSH/11	WS4S	OFF	809:42	12	809:42	12	QRT Order
WD2XSH/12	AI8Z	ON	8670:53	21	10355:53	21	
WD2XSH/13	K0JO	OFF	897:30	7	997:00	7	Illness
WD2XSH/14	W1FR	ON	118:05	5	151:02	5	
WD2XSH/15	W5OR	ON	3345:05	2	3557:18	2	
WD2XSH/16	WE0H	ON	332:04	0	470:44	3	

WD2XSH/17	AA1A	ON	713:38	23	772:49	23	
WD2XSH/18	N1EA	OFF	3935:00	0	3935:00	0	QRT Order
WD2XSH/19	K9EUI	ON	1310:21	3	1310:21	3	QRT Order
WD2XSH/20	N6LF	OFF	1963:12	7	1963:12	7	Inactive
WD2XSH/21	W0RW	DROPPED	652:42	0	652:42	0	Dropped
WD2XSH/22	WB2FCN	MOVED	-	-	-	-	Ready
WD2XSH/23	K2ORS	OFF	110:11	0	110:11	0	QRT Order
TOTAL 08/31/08		12 ON	27,445	278			
TOTAL 11/30/08		8 ON	31,127	293			

Note:
Operating hours and QSOs are derived from logs through November 30, 2008.
Total number of QSOs is half the total shown for individual stations.
The statistics in this appendix were compiled by Rudy Severns N6LF using the Excel logs submitted by the stations.
Several stations are subject to a QRT order for not being current in submitting their logs. These stations are required to remain QRT until they have rectified the situation.

中華民國業餘無線電促進會
會址：(33060) 桃園市中平路 102 號 22 樓
電話：(03) 220-9207 轉 112 ・傳真：(03) 220-2245
立案證書字號：內政部台內社字第九二0七一六號核准立案

[附件1-6]

國際間的操作狀況

WD2XSH status report: December 1, 2008 - February 28, 2009

Prepared by Fritz Raab, W1FR, Experiment Coordinator

March 21, 2009

1. SUMMARY OF OPERATIONS

This report provides a summary of WD2XSH activity during the winter of 2008-2009. The key statistics of our operations to date are:

- Number of QSOs: 42 additional, total 335;
- Number of reports via web site: 1186 additional, total 8138;
- Operating hours: 2,349 additional, total 33,476; and
- Number of interference complaints: 0.

All statistics are based upon the end of the reporting period (02/28/09).

2. ADMINISTRATIVE

We are still waiting for action on our request for modification to add stations, frequencies, and portable operation. I have been told that our application will be subject to a "high-level review" at the FCC to determine whether or not we are really an experimental operation. I have recommended that someone from the ARRL visit the FCC to clarify this.

I visited the ARRL office in Fairfax, VA on February 11. In attendance were Paul Rinaldo, Brendan Price, and Jonathan Siverling. We discussed the WRC process and various issues related to a 600-meter amateur band. In the evening, I gave a presentation on the 500-kHz experiment to AMRAD.

John Oehlenschlager K0JO - WD2XSH/13 passed away on February 2. Participants in the the experiment made a total of $400 in memorial contributions to the Tri-County Home Hospice that helped to care for John during his final months.

3. COMMUNICATIONS

As expected, conditions improved during the winter months. Consequently, both activity and reception reports are up. A number of trans-Atlantic receptions have been reported in both directoins.

Processing of the ground-wave data from last summer is still pending.

4. INTERFERENCE

There have been no reports of interference, however, we are continuing to monitor three potential interference problems.

NDB OF

K0HW has collected a good deal of data on the relative signal strengths of our signals compared to those of NDB OF. These tests are now concluded and I plan to process the data during the next month.

NEED

We continue to hear NEED on 505 kHz from time to time.

SBQ

SBQ was heard several times in December, but only on the Louisianna grabber (W5JGV). It has not been heard since. There have been several reports (by K0HW, AA5AM, WE0H, and KN8AZN) of weak unidentified carriers near 506.7 kHz. One signal (heard by K0HW in South Dakota) was the second harmonic of the audio tone from NDB OF in Norfolk, Nebraska.

5. OTHER US EXPERIMENTAL LICENSES

The frequency ranges of current US amateur experimental licenses as well as international licenses for the 500-kHz band are shown in Figure 1. Parameters are given in the Table 1.

Application WE2XXH by Brian Keith Ford was dismissed on January 22, 2009, for failure to respond. On December 17, the FCC asked for a description of the experiment and justification for the five-year term.

Experimental license WE2XVY (Michael Gray, KD7LMO, Fountain Hills, AZ) was granted on 01/05/09. It runs through 01/01/11 and allows operation on 500 - 510 kHz with 200 W ERP and CW or 1-kHz FSK or general phase/frequency modulation. It runs from 12/09/2008 to 12/01/2010.

Experimental license WE2XVO was granted to LBA Technology, Inc. It allows operation on 435 to 495 kHz with 10 W ERP within a 24-km radius of Portolus, NC. The specified modulation (30K0N0N) is basically steady carrier. This license is said to be for mine communication in support of contract 240-BPA-08-EH-0172. While this is not an amateur activity, it is of interest because the US Coast Guard previously objected to amateur experimentation in this band.

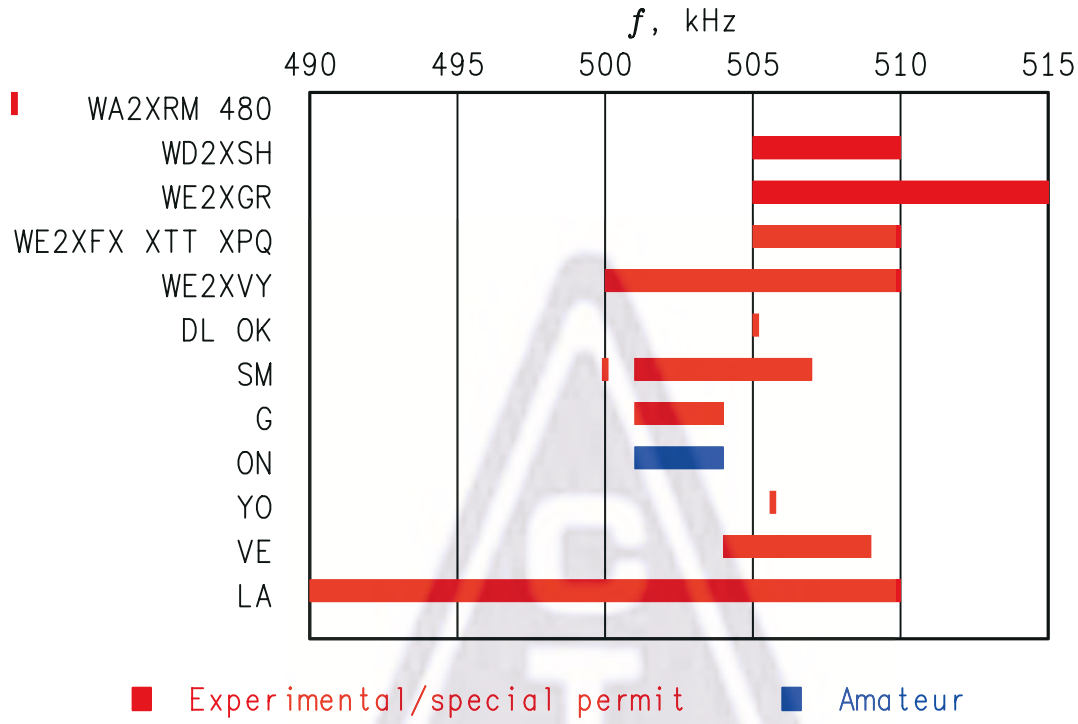


Figure 1. Worldwide amateur activity at 500 kHz.

CALL	NUMBER	QTH	f, kHz	ERP, W	DATES
WA2XRM	1	CO	480	100	01/01/09 - 01/01/14
WD2XSH	20	CONUS	505 - 510	20	09/13/06 - 08/01/10
WE2XGR	5	New England	505 - 515	200	09/05/07 - 09/01/12
WE2XFX	1	OK	505 - 510	20	07/27/07 - 10/21/08
WE2XTT	1	PA	505 - 510	1500*	09/08/08 - 09/01/13
WE2XPQ	1	AK	505 - 510	50	06/05/08 - 06/01/13
WE2XVY	1	AZ	500 - 510	200	12/09/08 - 12/01/10

* RF output to antenna

Table 1. Active US experimental licenses.

Charles Vest W5COV was granted experimental license WE2XXO on February 23. He had requested 136-137 kHz, 160 160 - 185 kHz, and 495 - 510 kHz, but was granted only 160 - 185 kHz. not 495 - 510 originally requested. Possible interference to aircraft beacons was cited in refusing the 500-kHz band. He is located in Oklahoma, which has NDBs at 512 kHz (HMY) and 515 kHz (PN).

On February 11, Roy Croston AB4OM applied for an experimental license for operation on 135-136 and 505-510 kHz. He has requested 10 W ERP and 30-Hz on-off keying (30H0A1A, 30H0A1D).

6. INTERNATIONAL AMATEUR ACTIVITIES

The Canadians are not yet active on 500 kHz. They are still working-out procedures for qualifying applicants.

On January 17, the NRRL announced that Norwegian amateurs will be able to operate from 490 to 510 kHz, CW only. The NRRL and a historical-preservation group have been working together toward this. [Author's note: The use of 490 kHz seems unlikely given the use of this frequency for NAVTEX in Europe.]

On February 18, Ofcom announced that the NoV's for UK amateur operation on 500 kHz will be extended one more year (until February 28, 2010). They also increased the power from 1 to 10 W ERP. Statistics from our experiment were used by the RSGB in their request for the increase in power.

The February 2009 issue of the Lowdown reports that the European prankster PAT again sent a "Happy New Year" message on 499 kHz. He was heard in Europe and Canada.

DI2AT has gone QRT due to lack of listening reports. Only ten reports were received in the past 6 months.

7. HERITAGE (MUSEUM) OPERATIONS

KSM participated in Straight Key Night on January 1 on 426 and 500 kHz.

The Seefunker organization signed a memorandum of understanding with the German DARC on January 26. This agreement for cooperation between amateur and heritage organizations proposes that the amateur service will become the curator of the maritime historical frequencies (e.g., 500 kHz). WNE license OM The New England Historical Radio Society, Inc. in Stoneham, MA has been granted a new coastal-station license with the callsign WNE. WNE is authorized to operate with 5 kW of RF output on 500 and 472 kHz. The principal member of the NEHRS is Steve Russell, and his plans are to build the station from the ground up. It will probably be located at his house. The web page for the NEHRS is http://nehrs.net.

KL1X is in the PRC on business. He reports receiving XSV from Tianjins and hearing their transmitting a gale warning (with "TTT") on 500.0 kHz on February 24.

8. REGULATORY AND WRC-11

The 2008 update to the "Federal Radionavigation Plan" (FRP) was released in January. It has two points of interest, but neither represents a change in policy.

The High-Accuracy National Differential GPS (HA-NDGPS) is discussed in Section 5.1.3.1.2. Currently, the Coast Guard is working to improve the accuracy to something better than the accuracy of 10 to 15 cm that is currently being achieved. When the improvements are complete, a standard is to be developed for this system. (U.S. Coast Guard interest in developing this system has kept experimental licenses out of the band from 435 to 495 kHz).

Non-Directional Beacons (NDBs) are addressed in Section Section 5.1.8 addresses nondirectional aircraft beacons (NDBs). It states that there are currently 1300 NDBs in the national airspace, 300 of which are operated by the FAA. Decommissioning has begun, although NDBs will be retained in certain areas (Alaska, Gulf of Mexico off shore) where no equivalent service is available. Appendix B.2.7 states that there are 1575 NDBs in the NAS, 728 of which are operated by the FAA. Subsection K further states that except in Alaskan airspace, no future civil aeronautical uses are envisioned for these [frequency] bands after the aeronautical NDB system has been decommissioned throughout the rest of the NAS.

9. PORTABLE STATION

Fred Temple KN8AZN has successfully modified digital transceiver and amplifier kits for operation on 600 m. Ralph Wallio W0RPK has a simple base-loaded vertical radiator with deployable radials ready to go on-the-air. Other antennas will be tested as the experiment progresses. The AMRAD LF antenna design has been modified for use on 600 m.

Little progress has been made in selecting an operating prototol that includes both FEC and error detection/correction. Local testing into a dummy load finds PSK31FEC significantly outperforms BPSK31. However, PSK31FEC requires more bandwidth than we are permitted.

10. PLANS

Plans for winter quarter include:

- General operations,
- Processing of the NDB signal-level comparisons, and
- Reduction of ground-wave data from this summer.

APPENDIX A. STATISTICS

STATION	CALL	STATUS	08/31/08 HOURS	08/31/08 QSOs	11/30/08 HOURS	11/30/08 QSOs	COMMENT
WD2XSH/1	W1NZR	ON	13:36	7	13:36	7	Inactive
WD2XSH/2	W5TVW	OFF	12:31	22	12:31	22	QRT Order
WD2XSH/3	WD5CVG	DROPPED	-	-	-	-	Dropped
WD2XSH/4	WD4PLI	DROPPED	-	-	-	-	Dropped
WD2XSH/5	KW1I	ON	21:37	46	24:07	48	
WD2XSH/6	W5THT	ON	4022:51	90	4590:20	111	
WD2XSH/7	W5JGV	MOVED	-	-	-	-	Moved
WD2XSH/8	N4ICK	OFF	0	0	0	0	Inactive
WD2XSH/9	W2ILA	ON	9:37	26	9:37	26	Inactive
WD2XSH/10	W4DEX	ON	1070:58	22	1233:46	28	
WD2XSH/11	WS4S	OFF	809:42	12	809:42	12	QRT Order
WD2XSH/12	AI8Z	ON	10355:53	21	11814:19	22	
WD2XSH/13	KOJO	OFF	997:00	7	997:00	7	SK
WD2XSH/14	W1FR	ON	151:02	5	224:21	5	
WD2XSH/15	W5OR	ON	3557:18	2	4131:33	2	
WD2XSH/16	WEOH	ON	470:44	3	871:45	12	
WD2XSH/17	AA1A	ON	772:49	23	722:49	23	Inactive
WD2XSH/18	N1EA	OFF	3935:00	0	3935:00	0	QRT Order
WD2XSH/19	K9EUI	ON	1310:21	3	1313:51	3	
WD2XSH/20	N6LF	OFF	1963:12	7	1963:12	7	Inactive
WD2XSH/21	WORW	DROPPED	652:42	0	652:42	0	Dropped
WD2XSH/22	WB2FCN	MOVED	-	-	-	-	Ready
WD2XSH/23	K2ORS	OFF	110:11	0	110:11	0	QRT Order
TOTAL 11/30/08		8 ON	31,127	293			
TOTAL 02/28/09		8 ON	33,476	335			

Note:
Operating hours and QSOs are derived from logs through February 28, 2009.
The statistics in this appendix were compiled by Rudy Severns N6LF using the Excel logs submitted by the stations.
Several stations are subject to a QRT order for not being current in submitting their logs. These stations are required to remain QRT until they have rectified the situation. Generally, these stations have an equipment problem or some other problem that keeps them from operating.
Two stations moved from the location specified on our original license. They are ready to go on the air as soon as the modification is approved.

中華民國業餘無線電促進會

會址：(33060) 桃園市中平路 102 號 22 樓
電話：(03) 220-9207 轉 112 ．傳真：(03) 220-2245
立案證書字號：內政部台內社字第九二０七一六號核准立案

[附件2]

關於WRC12 8.3-9.0kHZ本會所提之補充說明

[附件 2]關於 WRC12 8.3-9.0kHZ 本會所提之補充說明：

有關交通部對於 8.3-9.0Khz 約詢之議題，再作下列的補充說明:

BX4AA 得到此議題的所有背景性資料，此議題在於人類由公元 1939 年起,就已經開啟對於「閃(雷)電偵測---Lighting dection system 」的研究，由於閃電發生時可以產生很寬的頻譜(由數十赫芝至數百萬兆赫)，其傳播距離可達到半個地球或是到達全球。但是其中功率最大部份載於 5 千赫至 20 千赫間，這也代表著利用頻譜 5-20Khz 是研究這個議題最佳的頻段。

多年來大氣物理的科學家們有感於閃電對於預測下列威脅有很大的功效;雷擊、洪水、嚴重的降冰、風剪、風的騷亂以及陣風等。

長期來在科學家們的努力下，於 1987 年發展出一種準確的位置計算系統，稱「Arrival Time Difference system , ATD」，該系統利用 13.733Khz 作為接收頻率，頻寬在 3 千赫。由於特低頻不受太陽黑子活動的影響，又其不論在白晝或是夜間均可傳播至數千公里的的特性，如果在世界不同的地理位置設立十幾座特低頻 ATD 系統，由於由全球地理位置所得到的資料有著時間差，利用網路連線的情況下，科學家很快就可以撐握全球的閃(雷)電情資，對於閃電發生劇烈地區所產生威脅予以提早預防。

美國在 1990 年代，NASA 提出一個對於閃電研究的計劃，稱

「INSPIRE」。該計劃針對高中以上的學校及學生鼓勵他們參與，他們利用「特低頻接收機---VLF receiver」在不同的地理位置及時間利用錄音機錄下接收的情況，這個系統接收者尚包含在太空飛行的太空梭、軍中的飛行器、海上航行的船艦等，將所錄下的錄音帶寄返 NASA 即可(我 BX4AA 也參與)。其目的在於 NASA 希望得到全世界閃電發生的地理位置及強度與頻率等相關的信息，以作為全球氣候預測的資訊。

就在此種背景下，WRC 在公元 2007 年的會議中，作成第 671 號決議案，並邀請 ITU-R 研究出適當的對策，在 20 千赫以下選擇一適當的頻段，可以有效的運作而不受其它業務的干擾。

但就如本人在上封有關本頻段所作的評論中提及，在 9-14 千赫主要業務為「航海定位」，14-19.95 千赫主要業務要「固定」及「航海行動」，在注腳 5.55 中俄羅斯等國將「無線電定位」列為主要業務。因此，9-14Khz 似乎無法作為 ATD 系統的工作頻段。ITU 為了找出不受干擾的頻譜，最後在 WRC-12 決議以 8.3Khz-9.0Khz 為「氣象輔助---Meteorological aids service」閃電偵測系統的頻段並列為「主要業務」，並期盼其它業務者或想在 9Khz 新增運作者(國)可以避開這個新增的頻段。由於該系統為接收系統，因此是屬於「被動式系統---passive system」。

建議我國也將此列為「氣象輔助」，並列為「主要業務」，或是參與此項國際間的「閃電偵測系統」合作計劃。

中華民國業餘無線電促進會法規委員會主任委員
歐錦昌/BX4AA　101 0828