

WAC Informal Working Group (IWG)-1

UNITED STATES OF AMERICA

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 1.15: *to consider possible allocations in the range 3-50 MHz to the radiolocation service for oceanographic radar applications, taking into account the results of ITUR studies, in accordance with Resolution 612 (WRC07);*

Resolution 612 (WRC07): *Use of the radiolocation service between 3 and 50 MHz to support high-frequency oceanographic radar operations*

Background Information: WRC-12 Agenda item 1.15 calls for the consideration of the creation of radiolocation allocations in the 3 to 50 MHz range. These allocations will be used for the operation of oceanographic radars that map ocean surface currents, monitor the sea state and wave heights, and track large objects. These radars will have an operational range which will not be greater than 300 km.

Oceanographic radars have been operating in the 3 to 50 MHz range since the 1970s under Radio Regulations No. 4.4 in the United States, Germany, France, Australia, Korea, India, Japan, China, and the United Kingdom. Experimental use has allowed development of radar technology to identify suitable spectrum in terms of both compatibility with other users and effectiveness for ocean measurements. The need for data to mitigate the effects of disasters, including tsunamis, to understand climate change, and to ensure safe maritime travel has led to the consideration of operational use of oceanographic radar networks on a global basis. Increased reliance on the data from these systems for maritime safety, search and rescue, oil spill disaster response, oceanographic, climatological, meteorological research has driven the need to improve the regulatory status of the spectrum which is used by oceanographic radars while taking into account the protection of existing allocated services.

Summary of technical and operational studies and relevant ITU-R Recommendations:

Existing relevant ITU-R Recommendations and Reports: :

Recommendation ITU-R P.368 Ground-wave curves for frequencies between 10 kHz and 30 MHz Recommendation ITU-R P.372 Radio noise

Recommendation ITU-R P.533 Method for the prediction of the performance of HF circuits Recommendation ITU-R P.1546 Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 3 000 MHz

New relevant ITU-R Recommendations and Reports:

Draft new Recommendation ITU-R M.1874

Preliminary Draft New Report ITUR M.[RLS 3-50 MHz Sharing].

Multiple sub-bands are required within the range of 3 to 50 MHz for providing long range data as well as high resolution data. Manufacturers and researchers have settled on frequencies for experimental licenses near 4.5 MHz \pm 1 MHz, 8.5 MHz \pm 1 MHz, 13 MHz \pm 1 MHz, 26 MHz \pm 4 MHz and 43 MHz \pm 4 MHz to meet scientific and operational requirements. This does not imply that 2 to 6 MHz are required in each range; actual spectrum requirements are much lower, as discussed below.

Sharing studies have focused on compatibility in the bands used by fixed service and/or land mobile service only for the following reasons:

- Sharing with Amateur, Broadcasting Services, and Radio Astronomy seems to be difficult due to their protection criteria requirements.
- Sharing with Maritime Mobile, Aeronautical Mobile (R) and Standard Time and Frequency Services should be avoided due to the safety aspects of their operations.

The bands, considered most suitable fall in the Fixed and Land Mobile bands. Based on prior experience, Table 1 below lists bands that have been utilized most frequently in the past, and are therefore proposing for primary radiolocation licensing.

Table 1

Band	Operational Needs Proposed for Oceanographic Radars (resolution)	Most Suitable Band	Services
4.5 \pm 1 MHz	2 * 25 + 10 kHz [60 kHz total] (25 kHz for 6 km)	4 440 – 4 500 kHz	FIXED, MOBILE exc. AM(R)
8.5 \pm 1 MHz	2 * 30 + 15 kHz [75 kHz total] (30 kHz for 5 km)	7 725 – 7 800 kHz	FIXED, MOBILE exc AM(R)
13 \pm 1 MHz	1 * 100 + 10 kHz [2*110 kHz total] (100 kHz for 1.5 km)	13 410-13 530 kHz 13 870-13 990 kHz	FIXED, Mobile exc AM(R) FIXED, Mobile exc AM(R)
26 \pm 4 MHz	2 * 200 + 30 kHz [430 kHz total] (200 kHz for 750 m)	25 330-25 550 kHz 26 200-26 420 kHz	FIXED, MOBILE exc AM
43 \pm 4 MHz	2 * 375 + 50 kHz [800 kHz total] (375 kHz for 400 m)	41 600-42 400 kHz	FIXED, MOBILE

An oceanographic radar installation may use one or more of the frequency bands listed in Table 1, and it is possible to share the same bandwidth by oceanographic radar systems.

Analysis of the Results of Sharing Studies

PDN Report M.[RLS 3-50 MHz Sharing] contains sharing studies between oceanographic radiolocation systems and the fixed service and the land mobile service in the bands listed in Table 1. Refer to that Report for results.

HF Oceanographic Radars for 40 Years Operating Under Experimental Licenses

Starting with one or two HF radars in 1970 that first measured current and waves, and increasing in number to over 300 worldwide today (most operating continuously in real time), this evolving experience under experimental licenses has produced much information about impacts regarding interference to others. All of these radars have radiated on fixed frequencies. In the U.S. alone, there are approximately 25 approved HF radar frequencies licensed for experimental use. The signals employ bandwidths from 18 kHz to 500 kHz, depending on the band of operation (from 4 to 45 MHz). At frequencies above 10 MHz, there have never been any complaints of interference to other users over a 30-year period, except when an operator set a wrong frequency by mistake. At lower frequencies, there have been complaints from one or two primary license holders who heard the signals in a skywave mode; as a remedy, the HF radar ceased operating on that frequency. In those cases, the licensing agency assigned the experimental licenses unaware of another active primary license holder on that channel. At two or three of the lower HF frequencies, operation has continued for years with no interference complaints. Under a future proposed primary licensing arrangement, the number of these 25 HF frequencies could be reduced (rather than increased), even as the number of radars grows, so that there might be two channels per each of the four/five bands. Each channel, with adequate bandwidth for the signal's required range resolution, could accommodate many HF radars, using newly developed and proven modulation synchronization and sharing methods.

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Four decades' experience has also shown that distances at which the HF radar interference is received are always significantly less than those predicted in modeling studies. This is attributed primarily to two factors:

1. External noise seen in practice is always higher than that predicted from surveys, such as C.C.I.R. Often reality is 25 dB higher than predictions, and always at least 5 dB higher. This means that the noise into a receiver will mask any interfering signal below that level.
2. The assumption of flat ground behind the HF radar antenna used in studies is never the situation seen in practice. Trees and other foliage, terrain and hills higher than the coastal radar's elevation, and buildings attenuate the potentially interfering signal significantly, beyond that of the idealized flat or smooth spherical earth models that have formed the basis of sharing studies.

Proposal:

Article 5
Section IV – Table of Frequency Allocations
 (See No. 2.1)

MOD USA/AI 1.15/1

3 230 – 5 003 kHz

Allocation to services		
Region 1	Region 2	Region 3
4 438-4 400 FIXED MOBILE except aeronautical mobile (R)		4 438-4 400 FIXED MOBILE except aeronautical mobile
4 440-4 500 FIXED MOBILE except aeronautical mobile (R) <u>RADIOLOCATION 5.XXX</u>		4 440-4 500 FIXED MOBILE except aeronautical mobile <u>RADIOLOCATION 5.XXX</u>
4 500-4 650 FIXED MOBILE except aeronautical mobile (R)		4 500-4 650 FIXED MOBILE except aeronautical mobile

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ADD USA/AI 1.15/2

~~5.XXX~~ Stations shall not claim protection from existing stations in other primary services and RESOLUTION 612 (REV. WRC 07-12) shall apply.

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Reason: Allocations to the Radiolocation (oceanographic radars) service are proposed because previous experience under experimental licenses (No. 4.4) has demonstrated compatibility with other services.

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13 360-18 030 kHz

Allocation to services		
Region 1	Region 2	Region 3
13 360-13 410	FIXED RADIO ASTRONOMY 5.149	
13 410- <u>13 530</u>	FIXED RADIO ASTRONOMY 5.149 <u>RADIOLOCATION 5.XXX</u>	
<u>13 530-13 570</u>	FIXED Mobile except aeronautical mobile (R) 5.150	
13 570-13 600	BROADCASTING 5.134 5.151	
13 600-13 800	BROADCASTING	
13 800-13 870	BROADCASTING 5.134 5.151	
13 870-13 990	FIXED Mobile except aeronautical mobile (R) <u>RADIOLOCATION 5.XXX</u>	
13 990-13 990	FIXED Mobile except aeronautical mobile (R)	

ADD USA/AI 1.15/2
5.XXX Stations shall not claim protection from existing stations in other primary services and RESOLUTION 612 (REV. WRC 07-12) shall apply.

Reason: Allocations to the Radiolocation (oceanographic radars) service are proposed because previous experience under experimental licenses (No. 4.4) has demonstrated compatibility with other services.

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MOD USA/AI 1.15/4

23 350-27 500 kHz

Allocation to services		
Region 1	Region 2	Region 3
25 210- 25 330	FIXED MOBILE except aeronautical mobile	
25 330-25 550	FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.XXX	
25 550-25 670	RADIO ASTRONOMY 5.149	
25 670-26 100	BROADCASTING	
26 100-26 175	MARITIME MOBILE 5.132	
26 175- 26 200	FIXED MOBILE except aeronautical mobile 5.150	
26 200-26 420	FIXED MOBILE except aeronautical mobile, 5.150 RADIOLOCATION 5.XXX	
26 420-27 500	FIXED MOBILE except aeronautical mobile 5.150	

ADD [USA/AI 1.15/2](#)
5.XXX Stations shall not claim protection from existing stations in other primary services and RESOLUTION 612 (REV. WRC 07-12) shall apply.

Reason: Allocations to the Radiolocation (oceanographic radars) service are proposed because previous experience under experimental licenses (No. **4.4**) has demonstrated compatibility with other services.

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MOD USA/AI 1.15/5

27.5-47 MHz

ADD [USA/AI 1.15/2](#)

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41.015-41.6	FIXED MOBILE 5.160 5.161	
41.6-42.4	FIXED MOBILE 5.160 5.161 RADIOLOCATION 5.XXX	
42.4-44	FIXED MOBILE 5.160 5.161	6

5.XXX Stations shall not claim protection from existing stations in other primary services and RESOLUTION 612 (REV. WRC 07-12) shall apply.

Reason: Allocations to the Radiolocation (oceanographic radars) service are proposed because previous experience under experimental licenses (No. 4.4) has demonstrated compatibility with other services.

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MOD USA/AI 1.15/6

RESOLUTION 612 (REV. WRC-12)

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Use of the radiolocation service between 3 and 50 MHz to support high-frequency oceanographic radar operations

The World Radiocommunication Conference (Geneva, 2012),

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considering

a) that there is increasing interest, on a global basis, in the operation of oceanographic radars for measurement of coastal sea surface conditions to support environmental, oceanographic, meteorological, climatological, maritime and disaster mitigation operations;

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b) that oceanographic radars are also known in parts of the world as HF ocean radars, HF wave height sensing radars or HF surface wave radars;

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c) that oceanographic radars operate through the use of ground-wave propagation;

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d) that oceanographic radar technology has applications in global maritime domain awareness by allowing the long-range sensing of surface vessels, which provides a benefit to the global safety and security of shipping and ports;

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e) that operation of oceanographic radars provides benefits to society through environmental protection, disaster preparedness, public health protection, improved meteorological operations, increased coastal and maritime safety and enhancement of national economies;

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f) that oceanographic radars have been operated on an experimental basis around the world over several decades, providing understanding of spectrum needs and spectrum sharing considerations, as well as an understanding of the benefits these systems provide;

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h) that

g) that experience, performance, and data requirements dictate the regions of spectrum that can be used by oceanographic radar systems for ocean observations,

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recognizing

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a) that oceanographic radars have been operated on an experimental basis since the 1970s by several administrations;

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b) that developers of the experimental systems have implemented techniques to make the most efficient use of the spectrum and mitigate interference to other radio services;

Deleted: c) . that the objective of Question ITU-R 240/8 is to study the most appropriate frequency bands for operation of high-frequency oceanographic radars considering both radar system requirements and the protection of existing services;¶
d) that high-frequency oceanographic radars operate with peak power levels on the order of 50 W.¶

c) that for the purpose of protecting existing services from interference.

oceanographic radars shall not exceed a power flux-density at interfering points with an I/N ratio of -6 dB when referred to Recommendation ITU-R P.372-9 radio noise for quiet rural and rural;

d) that for the purpose of protecting existing services from interference, oceanographic radars' impact via ground-wave propagation can be checked by Report ITU-R M.[RLS 3-50MHz SHARING] based on Recommendation ITU-R P.368-9 and P.1546-3,

resolves

1 that oceanographic radars shall be notified to the Bureau in accordance with No 11.2 of the Radio Regulations and that each station requires transmission of the station identification (call sign);

2 that oceanographic radars shall not operate with a peak EIRP of more than 25 dBW;

3 that oceanographic radars shall operate at the distances from the international borders as specified in the Table 1 below;

Table 1: Distances from International Borders for Placement of Oceanographic Radars

<u>Frequency band</u>	<u>Land path</u>	<u>Sea path or mixed</u>
<u>4 – 16 MHz</u>	<u>120 km</u>	<u>300 km</u>
<u>22 – 29 MHz</u>	<u>100 km</u>	<u>160 km</u>
<u>40 – 50 MHz</u>	<u>60 km</u>	<u>110 km</u>

instructs the Secretary-General

to bring this Resolution to the attention of the International Maritime Organization (IMO), World Meteorological Organization (WMO) and other international and regional organizations concerned.

Reason: The Resolution was revised to reflect completion of ITU-R studies and to establish regulatory reference for the operation of the oceanographic radar between 3 and 50 MHz.

Deleted: 1 to invite ITU-R to identify high-frequency oceanographic radar system applications between 3 and 50 MHz, including bandwidth requirements, appropriate portions of this band for these applications, and other characteristics necessary to conduct sharing studies;¶
 2 to invite ITU-R to conduct sharing analyses between the radiolocation service applications identified under *resolves* 1 and incumbent services in the bands identified to be suitable for the operation of high-frequency oceanographic radar systems;¶
 3 that, if compatibility with existing services is confirmed under *resolves* 2, to recommend that WRC-11 consider allocations to the radiolocation service in several suitable bands between 3 and 50 MHz, as determined in the ITU-R studies, each band not exceeding 600 kHz, for the operation of oceanographic radars,¶
 invites

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Deleted: agreements between administrations to contribute to the sharing studies between the radiolocation service and incumbent services in portions may reduce distances between an oceanographic radar and the border of the 3 to 50 MHz band identified as suitable for high-frequency oceanographic radar operations,

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