PUBLIC NOTICE

Federal Communications Commission
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DA 10-2060
October 28, 2010

FCC SEEKS COMMENT ON RECOMMENDATIONS APPROVED BY THE ADVISORY COMMITTEE FOR THE 2012 WORLD RADIOCOMMUNICATION CONFERENCE

IB Docket No. 04-286

Comment Date: November 12, 2010

On October 26, 2010, the Advisory Committee for the 2012 World Radiocommunication Conference (WRC-12 Advisory Committee) approved and provided for Commission consideration its recommendations on a number of issues that will be considered by the 2012 World Radiocommunication Conference (WRC-12). These recommendations are attached to this Public Notice (Attachment 1).

Based upon an initial review of the recommendations forwarded to the Commission, the International Bureau, in coordination with other Commission Bureaus and Offices, tentatively concludes that we can generally support most of the attached WRC-12 Advisory Committee recommendations. We do, however, have some reservations concerning recommendations provided in document WAC/105. We also take note of differing views expressed by the WRC-12 Advisory Committee in documents WAC/101 and WAC/102. We seek comment on the recommendations provided by the WRC-12 Advisory Committee (Attachment 1).

The FCC also seeks comment on the attached draft proposals that have been provided to the FCC by the National Telecommunications and Information Administration (NTIA) (Attachment 2). Finally, the FCC seeks comment on the International Bureau's initial conclusions with regard to the WRC-12 Advisory Committee recommendations.

The comments provided by interested parties will assist the FCC in its upcoming consultations with the U.S. Department of State and NTIA in the development of U.S. positions for WRC-12. The recommendations that are attached to this Public Notice may evolve in the course of interagency discussions as we approach WRC-12 and, therefore, do not constitute a final U.S. Government position on any issue.

The complete text of these preliminary views and proposals is also available in the FCC's Reference Information Center, Room CY-A257, 445 12th Street, SW, Washington, DC 20554 or by accessing the FCC's WRC-12 web site at: http://www.fcc.gov/ib/wrc-12/.

The deadline for comments on the proposed preliminary views is November 12, 2010. It is necessary that all comments be received by November 12, 2010 in order to allow sufficient time to finalize the U.S. position before commencement of regional WRC-12 preparatory meetings.

All comments should refer to IB Docket No. 04-286 and to specific recommendations by WAC document number. Comments may be filed using (1) the Commission's Electronic Comment Filing System (ECFS), (2)

by email to wrc-12@fcc.gov, or (3) by filing paper copies.[1] Generally, only one copy of an electronic submission must be filed.

Comments filed through the ECFS can be sent as an electronic file via the Internet to http://www.fcc.gov/cgb/ecfs/. In completing the transmittal screen, commenters should include their full name, U.S. Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form." A sample form and directions will be sent in reply.

Parties who choose to file by paper must file an original and four copies of each filing.

Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

The Commission's contractor will receive hand-delivered or messenger-delivered paper filings for the Commission's Secretary at 445 12th Street, SW, Room TW-A325, Washington, DC 20554. The filing hours at this location are Monday through Friday, 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes must be disposed of before entering the building.

Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743.

U.S. Postal Service first-class mail, Express Mail, and Priority Mail should be addressed to FCC Headquarters at 445 12th Street, SW, Washington, DC 20554.

Additionally, filers must deliver courtesy copies by email to the following Commission staff: Alexander Roytblat, at Alexander.Roytblat@fcc.gov

People with Disabilities: To request materials in accessible formats for people with disabilities (Braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer and Governmental Affairs Bureau at (202) 418-0530, (202) 418-0432 (TTY).

- FCC -

[1] *See* Electronic Filing of Documents in Rulemaking Proceedings, 63 Fed. Reg. 24121 (1998).

ATTACHMENT 1
to FCC Public Notice DA 10-2060

Recommendations presented at 26 October 2010 Meeting of the Advisory Committee for the 2012 World Radiocommunication Conference

Maritime Aeronautical and Radar Services

DOCUMENT WAC/094(26.10.10)

UNITED STATES OF AMERICA

Draft Proposals for the Work of the conference

Agenda Item 1.3: *To consider spectrum requirements and possible regulatory actions, including allocations, in order to support the safe operation of unmanned aircraft systems (UAS), based on the results of ITU-R studies, in accordance with Resolution **421 (WRC-07)***

Background Information: Unmanned aircraft systems (UASs) enable the remote piloting of aircraft over short or long range distances within or out-of-sight of the remote pilot. These flight operations currently take place in segregated airspace to ensure the safety of the air vehicle and other airspace users.

Some administrations expect deployment of UASs throughout the airspace structure, i.e. within both segregated and non-segregated airspace. As UAS deployment increases, it will be impractical for some users to deploy in segregated airspace. Some UASs will need to integrate with the current non-segregated airspace users in a safe and seamless manner. To accomplish integration into non-segregated airspace, UASs will require high integrity communication links between the unmanned aircraft (UA) and remote control centers capable of relaying the necessary air traffic control (ATC) messages and flight critical aircraft information. The UAS pilot will need sense and avoid functions for situational awareness.

The International Civil Aviation Organization (ICAO) future communications study may be able to identify technologies with some capability to meet the requirements for command and control, including the relaying of ATC communications. The ITU-R is currently examining existing aeronautical allocations to satisfy UAS spectrum requirements prior to studying new allocations. Additionally, the ITU-R is investigating the addition of a new AMS(R)S allocations within portions of the 22.50 – 22.55 GHz or 23.55-23.60 GHz bands to satisfy the UAS beyond line-of-sight communication requirements. However, sharing studies need to be conducted to ascertain whether these bands can be allocated to the AMS(R)S.

Command & Control

In non-segregated airspace, the remote pilot must reliably monitor the status of the UA, pass control instructions to the UA, and interact with the appropriate air traffic controllers monitoring the airspace within which the UA is flying. A line-of-sight link might provide these capabilities for UA flying and maneuvering in a localized area. A combination of a terrestrial radio and satellite network could provide these capabilities to UA flying trans-horizon.

Relay of Air Traffic Control (ATC) Communications

Safe operation of manned or unmanned aircraft depends on ATC communications. Pilots act based on ATC instructions. When the aircraft is piloted remotely, the pilot and ATC must maintain a communication channel to relay information from a radio in the aircraft to the pilot on the ground. Early concepts assume that this function, if digitized, could be part of the command and control links.

Sense and Avoid

The safe flight operation of UA necessitates advanced techniques to detect and track nearby aircraft, terrain, and obstacles to navigation. Unmanned aircraft must avoid these objects in a manner equivalent to that of a manned aircraft. The remote pilot will need to be aware of the environment within which the aircraft is operating, be able to identify the potential threats to the continued safe operation of the aircraft, and take the appropriate action. The radiodetermination service allocations could potentially accommodate the sense and avoid function. The ITU-R is examining existing aeronautical radionavigation service (ARNS) allocations for suitable bandwidth prior to studying new ARNS allocations. The UAS industry is studying the suitability of various technologies for sense and avoid.

Payload

Resolution **421 (WRC-07)** *Resolves 1* specifically excludes the allocation of spectrum at WRC-11 for payload applications. However, *invites ITU-R 3* does call for the development of an ITU-R report or recommendation on how to accommodate the radiocommunication requirements for UAS payloads. The purpose of this agenda item is not to seek new spectrum allocations to meet payload requirements.

UAS control link communication could potentially be accommodated by the FSS through the use of portions of the existing 11/12/14 GHz and 20/30 GHz FSS allocations. Specifically through the addition of an appropriate footnote to the Table of Frequency Allocations that would in turn incorporate by reference a WRC-12 Resolution which would contain the necessary technical and regulatory provisions for support of a UAS type of service. The use of the aforementioned FSS bands can contribute to satisfying the UAS beyond line-of-sight communications requirements.

Proposal*:

MOD USA/1.3/1

ARTICLE 5

Frequency Allocations
10-11.7 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
10-10.45 FIXED MOBILE RADIOLOCATION Amateur 5.479	**10-10.45** RADIOLOCATION Amateur 5.479 5.480	**10-10.45** FIXED MOBILE RADIOLOCATION Amateur 5.479
10.45-10.5	RADIOLOCATION Amateur Amateur-satellite 5.481	
10.5-10.55 FIXED MOBILE Radiolocation	**10.5-10.55** FIXED MOBILE RADIOLOCATION	
10.55-10.6	FIXED MOBILE except aeronautical mobile Radiolocation	
10.6-10.68	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) Radiolocation 5.149 5.482 5.482A	
10.68-10.7	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.483	
10.7-11.7 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 5.484A 5.YYY (Earth-to-space) 5.484 MOBILE except aeronautical mobile	**10.7-11.7** FIXED FIXED-SATELLITE (space-to-Earth) 5.441 5.484A 5.YYY MOBILE except aeronautical mobile	

11.7-14 GHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">11.7-12.5
FIXED
MOBILE except aeronautical mobile
BROADCASTING
BROADCASTING-SATELLITE 5.492

5.487 5.487A</td><td>11.7-12.1
FIXED 5.486
FIXED-SATELLITE (space-to-Earth) 5.484A 5.488 5.YYY
Mobile except aeronautical mobile 5.485</td><td rowspan="2">11.7-12.2
FIXED
MOBILE except aeronautical mobile
BROADCASTING
BROADCASTING-SATELLITE 5.492

5.487 5.487A</td></tr>
<tr><td>12.1-12.2
FIXED-SATELLITE (space-to-Earth) 5.484A 5.488 5.YYY
5.485 5.489</td></tr>
<tr><td>12.2-12.7
FIXED
MOBILE except aeronautical mobile
BROADCASTING
BROADCASTING-SATELLITE 5.492

5.487A 5.488 5.490</td><td>12.2-12.5
FIXED
FIXED-SATELLITE (space-to-Earth) 5.YYY
MOBILE except aeronautical mobile
BROADCASTING
5.484A 5.487</td></tr>
<tr><td>12.5-12.75
FIXED-SATELLITE (space-to-Earth) 5.484A 5.YYY (Earth-to-space)

5.494 5.495 5.496</td><td>12.7-12.75
FIXED
FIXED-SATELLITE (Earth-to-space)
MOBILE except aeronautical mobile</td><td>12.5-12.75
FIXED
FIXED-SATELLITE (space-to-Earth) 5.484A 5.YYY
MOBILE except aeronautical mobile
BROADCASTING-SATELLITE 5.493</td></tr>
<tr><td>12.75-13.25</td><td colspan="2">FIXED
FIXED-SATELLITE (Earth-to-space) 5.441
MOBILE
Space research (deep space) (space-to-Earth)</td></tr>
<tr><td>13.25-13.4</td><td colspan="2">EARTH EXPLORATION-SATELLITE (active)
AERONAUTICAL RADIONAVIGATION 5.497
SPACE RESEARCH (active)
5.498A 5.499</td></tr>
<tr><td>13.4-13.75</td><td colspan="2">EARTH EXPLORATION-SATELLITE (active)
RADIOLOCATION
SPACE RESEARCH 5.501A
Standard frequency and time signal-satellite (Earth-to-space)
5.499 5.500 5.501 5.501B</td></tr>
<tr><td>13.75-14</td><td colspan="2">FIXED-SATELLITE (Earth-to-space) 5.484A 5.ZZZ
RADIOLOCATION
Earth exploration-satellite
Standard frequency and time signal-satellite (Earth-to-space)
Space research
5.499 5.500 5.501 5.502 5.503</td></tr>
</table>

14-15.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14-14.25	FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ RADIONAVIGATION 5.504 Mobile-satellite (Earth-to-space) 5.504B 5.504C 5.506A Space research 5.504A 5.505	
14.25-14.3	FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ RADIONAVIGATION 5.504 Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.508A Space research 5.504A 5.505 5.508	
14.3-14.4 FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radionavigation-satellite 5.504A	**14.3-14.4** FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 5.506 5.506B 5.ZZZ Mobile-satellite (Earth-to-space) 5.506A Radionavigation-satellite 5.504A	**14.3-14.4** FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 5.506 5.506B 5.ZZZ MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radionavigation-satellite 5.504A
14.4-14.47	FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Space research (space-to-Earth) 5.504A	
14.47-14.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radio astronomy 5.149 5.504A	
14.5-14.8	FIXED FIXED-SATELLITE (Earth-to-space) 5.510 MOBILE Space research	
14.8-15.35	FIXED MOBILE Space research 5.339	
15.35-15.4	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.511	

15.4-18.4 GHz

<table>
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<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>15.4-15.43</td><td colspan="2">AERONAUTICAL RADIONAVIGATION
5.511D</td></tr>
<tr><td>15.43-15.63</td><td colspan="2">FIXED-SATELLITE (Earth-to-space) 5.511A
AERONAUTICAL RADIONAVIGATION
5.511C</td></tr>
<tr><td>15.63-15.7</td><td colspan="2">AERONAUTICAL RADIONAVIGATION
5.511D</td></tr>
<tr><td>15.7-16.6</td><td colspan="2">RADIOLOCATION
5.512 5.513</td></tr>
<tr><td>16.6-17.1</td><td colspan="2">RADIOLOCATION
Space research (deep space) (Earth-to-space)
5.512 5.513</td></tr>
<tr><td>17.1-17.2</td><td colspan="2">RADIOLOCATION
5.512 5.513</td></tr>
<tr><td>17.2-17.3</td><td colspan="2">EARTH EXPLORATION-SATELLITE (active)
RADIOLOCATION
SPACE RESEARCH (active)
5.512 5.513 5.513A</td></tr>
<tr><td>17.3-17.7
FIXED-SATELLITE
(Earth-to-space) 5.516
(space-to-Earth) 5.516A 5.516B 5.YYY
Radiolocation
5.514</td><td>17.3-17.7
FIXED-SATELLITE
(Earth-to-space) 5.516
BROADCASTING-SATELLITE
Radiolocation
5.514 5.515</td><td>17.3-17.7
FIXED-SATELLITE
(Earth-to-space) 5.516
Radiolocation
5.514</td></tr>
<tr><td rowspan="2">17.7-18.1
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.YYY
(Earth-to-space) 5.516
MOBILE</td><td>17.7-17.8
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.517 5.YYY
(Earth-to-space) 5.516
BROADCASTING-SATELLITE
Mobile
5.515</td><td rowspan="2">17.7-18.1
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.YYY
(Earth-to-space) 5.516
MOBILE</td></tr>
<tr><td>17.8-18.1
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.YYY
(Earth-to-space) 5.516
MOBILE
5.519</td></tr>
<tr><td>18.1-18.4</td><td colspan="2">FIXED
FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY
(Earth-to-space) 5.520
MOBILE
5.519 5.521</td></tr>
</table>

18.4-22 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
18.4-18.6	FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY MOBILE	
18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B 5.YYY MOBILE except aeronautical mobile Space research (passive) 5.522A 5.522C	**18.6-18.8** EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.522B 5.YYY MOBILE except aeronautical mobile SPACE RESEARCH (passive) 5.522A	**18.6-18.8** EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B 5.YYY MOBILE except aeronautical mobile Space research (passive) 5.522A
18.8-19.3	FIXED FIXED-SATELLITE (space-to-Earth) 5.516.B 5.523A MOBILE	
19.3-19.7	FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.523B 5.523C 5.523D 5.523E MOBILE	
19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY Mobile-satellite (space-to-Earth) 5.524	**19.7-20.1** FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528 5.529	**19.7-20.1** FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY Mobile-satellite (space-to-Earth) 5.524
20.1-20.2	FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528	
20.2-21.2	FIXED-SATELLITE (space-to-Earth) 5.YYY MOBILE-SATELLITE (space-to-Earth) Standard frequency and time signal-satellite (space-to-Earth) 5.524	
21.2-21.4	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive)	
21.4-22 FIXED MOBILE BROADCASTING-SATELLITE 5.208B 5.530	**21.4-22** FIXED MOBILE	**21.4-22** FIXED MOBILE BROADCASTING-SATELLITE 5.208B 5.530 5.531

22-24.75 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
22-22.21	FIXED MOBILE except aeronautical mobile 5.149	
22.21-22.5	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) 5.149 5.532	
22.5-22.55	FIXED MOBILE	
22.55-23.55	FIXED INTER-SATELLITE 5.338A MOBILE 5.149	
23.55-23.6	FIXED MOBILE	
23.6-24	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340	
24-24.05	AMATEUR AMATEUR-SATELLITE 5.150	
24.05-24.25	RADIOLOCATION Amateur Earth exploration-satellite (active) 5.150	
24.25-24.45 FIXED	**24.25-24.45** RADIONAVIGATION	**24.25-24.45** RADIONAVIGATION FIXED MOBILE
24.45-24.65 FIXED INTER-SATELLITE	**24.45-24.65** INTER-SATELLITE RADIONAVIGATION 5.533	**24.45-24.65** FIXED INTER-SATELLITE MOBILE RADIONAVIGATION 5.533
24.65-24.75 FIXED INTER-SATELLITE	**24.65-24.75** INTER-SATELLITE RADIOLOCATION-SATELLITE (Earth-to-space)	**24.65-24.75** FIXED INTER-SATELLITE MOBILE 5.533

24.75-29.9 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
24.75-25.25 FIXED	**24.75-25.25** FIXED-SATELLITE (Earth-to-space) 5.535	**24.75-25.25** FIXED FIXED-SATELLITE (Earth-to-space) 5.535 MOBILE
25.25-25.5	FIXED INTER-SATELLITE 5.536 MOBILE Standard frequency and time signal-satellite (Earth-to-space)	
25.5-27	EARTH EXPLORATION-SATELLITE (space-to Earth) 5.536B FIXED INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space-to-Earth) 5.536C Standard frequency and time signal-satellite (Earth-to-space) 5.536A	
27-27.5 FIXED INTER-SATELLITE 5.536 MOBILE	**27-27.5** FIXED FIXED-SATELLITE (Earth-to-space) INTER-SATELLITE 5.536 5.537 MOBILE	
27.5-28.5	FIXED 5.537A FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ MOBILE 5.538 5.540	
28.5-~~29.1~~ 28.6	FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.523A 5.539 5.ZZZ MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540	
28.~~5~~6 -29.1	FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.523A 5.539 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540	
29.1-29.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.516B 5.523C 5.523E 5.535A 5.539 5.541A MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540	
29.5-29.9 FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space)	**29.5-29.9** FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.525 5.526 5.527 5.529 5.540	**29.5-29.9** FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space)

29.9-34.2 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
29.9-30	FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543 5.525 5.526 5.527 5.538 5.540 5.542	
30-31	FIXED-SATELLITE (Earth-to-space) 5.338A 5.ZZZ MOBILE-SATELLITE (Earth-to-space) Standard frequency and time signal-satellite (space-to-Earth) 5.542	
31-31.3	FIXED 5.338A 5.543A MOBILE Standard frequency and time signal-satellite (space-to-Earth) Space research 5.544 5.545 5.149	
31.3-31.5	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340	
31.5-31.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile 5.149 5.546	**31.5-31.8** EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340	**31.5-31.8** EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile 5.149
31.8-32	FIXED 5.547A RADIONAVIGATION SPACE RESEARCH (deep space) (space-to-Earth) 5.547 5.547B 5.548	
32-32.3	FIXED 5.547A RADIONAVIGATION SPACE RESEARCH (deep space) (space-to-Earth) 5.547 5.547C 5.548	
32.3-33	FIXED 5.547A INTER-SATELLITE RADIONAVIGATION 5.547 5.547D 5.548	
33-33.4	FIXED 5.547A RADIONAVIGATION 5.547 5.547E	
33.4-34.2	RADIOLOCATION 5.549	

ADD USA/1.3/2

5.YYY Earth stations on board unmanned aircraft and their associated control stations (CSs) that operate as part of an Unmanned Aircraft System (UAS) may receive from geostationary satellite networks in primary allocations of the fixed- satellite service (space-to-Earth) in the following frequency bands: 10.95 – 11.20 GHz, 11.45 – 11.70 GHz, 11.70 – 12.20 GHz (in Region 2 only), 12.20 – 12.50 GHz (in Region 3 only), 12.50 – 12.75 GHz (in Regions 1 and 3 only), 17.30 – 17.70 GHz (in Region 1 only), 17.70 – 18.80 GHz and 19.70 – 21.20 GHz. Such operations shall be in accordance with the provisions of Resolution [SAT-UAS-FSS] (WRC-12). The use of these frequency bands by the aforementioned (UAS and CS) stations is limited to UAS control link communications in the space-to-Earth direction. Moreover, the operation of UAS control links in any of the above specified frequency bands does not establish priority in the Radio Regulations over any station operating in a primary service allocated to these bands, including stations operating in the fixed-satellite service, nor does it establish priority in relation to other communication links within the fixed satellite service. The UAS control link is comprised of any radio link used for the transmission of UA command and telemetry data, transmission of sense and avoid data from the UA to the associated control station, and relay of voice communication between the Air Traffic Control ("ATC") and the UA control station.

ADD USA/1.3/3

5.ZZZ Earth stations on board unmanned aircraft and their associated control stations (CSs) that operate as part of an Unmanned Aircraft System (UAS) may transmit to geostationary satellite systems on a primary basis in the fixed- satellite service (Earth-to-space) in the following frequency bands: 13.75 – 14.00 GHz, 14.00 – 14.50 GHz and 27.50 – 28.6 GHz and 29.50 – 31.00 GHz. Such operations shall be in accordance with the provisions of Resolution [SAT-UAS-FSS] (WRC-12). The use of these frequency bands by the aforementioned (UAS and CS) stations is limited to UAS control link communications in the Earth-to-space direction. Moreover, the operation of UAS control links in any of the above specified frequency bands does not establish priority in the Radio Regulations over any station operating in a primary service allocated to these bands, including stations operating in the fixed-satellite service, nor does it establish priority in relation to other communication links within the fixed satellite service. The UAS control link is comprised of any radio link used for the transmission of UA command and telemetry data, transmission of sense and avoid data from the UA to the associated control station, and relay of voice communication between the Air Traffic Control ("ATC") and the UA control station.

*These proposals supplement those already agreed for the 5GHz band related to agenda item 1.3

ADD USA/1.3/4

RESOLUTION [SAT-UAS-FSS] (WRC-12)

Use of FSS frequency bands not subject to Appendix 30A/30B for the control communications of unmanned aircraft systems in non-segregated airspaces with geostationary satellites operating in the fixed-satellite service

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that worldwide use of unmanned aircraft systems (UAS) is expected to increase significantly in the near future;

b) that unmanned aircraft (UA) need to operate seamlessly with piloted aircraft in non-segregated airspace and that there is a need to provide spectrum for that purpose;

c) that the operation of UAS in non-segregated airspace requires reliable communication links, in particular to relay the air traffic control communications and for the remote pilot to control the flight;

d) that the operation of UAS in non-segregated airspace on a worldwide basis requires the development by the civil aviation community (e.g. ICAO) of international aeronautical standards and recommended practices (SARPs) for the airworthiness certification of supporting terrestrial and satellite systems;

e) that satellite radiocommunications are an essential part of UAS operations, in particular to relay transmissions beyond the horizon and include links between the unmanned aircraft and the satellite, and links between the UA Control Station (CS) and the satellite;

f) that satellite systems operating in the fixed satellite service (FSS) bands have the capability to provide the communication links mentioned in *considering* e);

g) that Annex 10 of the Convention of the ICAO contains SARPs for aeronautical radionavigation and radiocommunication systems used by international civil aviation,

further considering

a) that there is a need to limit the number of communication equipments onboard an UA;

b) that, as a dedicated satellite system for UAS is not likely, it is necessary to have use of existing and future satellite systems to accommodate the growth of the use of UAS;

c) that there are various technical methods that may be used to increase the reliability of digital communication links, e.g. modulation, coding, redundancy, etc.;

d) that for UAS communications used for the control of UA, relay of Air Traffic Control (ATC) voice communications, and sense and avoid have certain technical, operational, and regulatory requirements;

e) that the requirements in *further considering d)* can be specified for UAS use of FSS networks,

resolves

1 that for the communications for control of the unmanned aircraft (UA), Air Traffic Control (ATC) voice communications, and sense and avoid data transmission between an UA and the UA control station (CS) via geostationary satellites in the FSS, the frequency bands in Nos. 5.YYY and 5.ZZZ may be used, provided that these FSS satellite systems and the Earth Station on board the UA and the associated control stations meet the technical requirements contained in Annex 1 of this Resolution;

2 that the use of such links will be guided by the relevant SARPs established by the ICAO;

3 that the administration that issues the license for the use of UAS in these bands (licensing administration) shall ensure that such stations follow the provisions of this Resolution;

4 that UAS shall operate within the established coordination agreements of FSS operators in accordance with the provisions of Article 9 of the Radio Regulations.

requests the Secretary-General

to bring this Resolution to the attention of the ICAO.

Annex 1

Technical characteristics of fixed-satellite service systems to support control communication links of unmanned aircraft systems (UAS)

1 Introduction

UAS that fly beyond-line-of-sight (BLOS) need satellite communications to maintain aircraft control, relay Air Traffic Control (ATC) voice communications through the UA, and pass sense and avoid data between the UA and the UA Control Station (UA CS). It is likely that UA will utilize terrestrial radio communications for critical low-altitude operations, such as takeoff and landing, but switch over to satellite communications for the majority of their flight. These satellite links need to achieve high availability to meet national and international aviation requirements when flying in non-segregated airspace.

This annex contains the performance criteria that must be met and the technical characteristics of UAS control links necessary to meet them. Meeting these technical criteria will allow UAS to use FSS allocations.

The UA CS Earth Station and UA Earth Station are operated to the same regulatory limits as a conventional FSS Earth Station.

The technical characteristics of UAS to be used in assessing the forward and return (UAS) link performance via a FSS network is provided in Section 2.

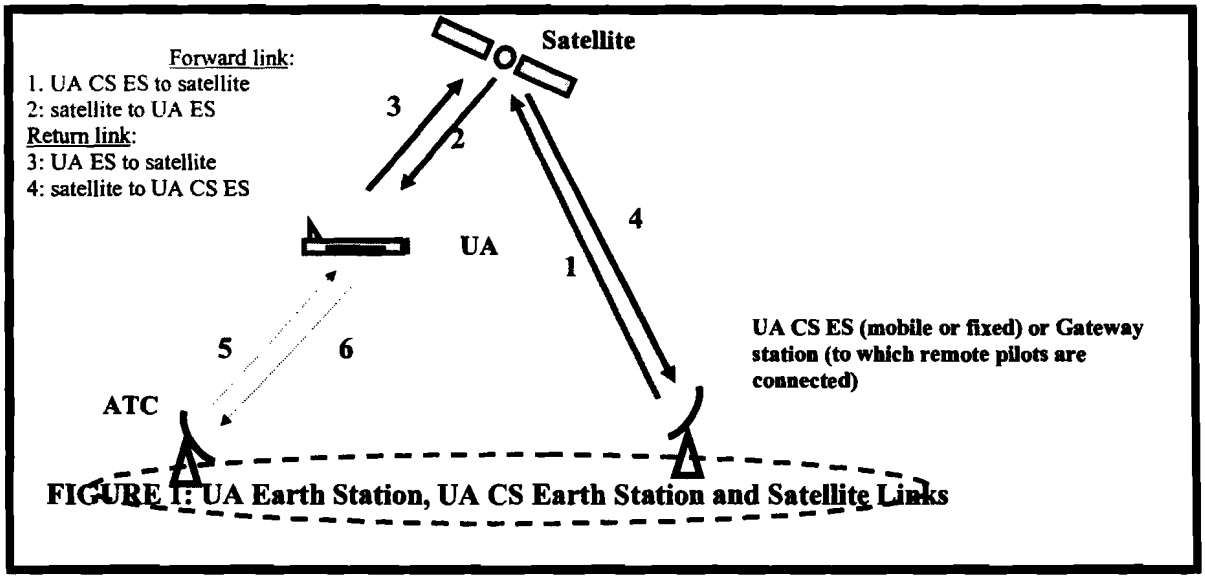

FIGURE 1: UA Earth Station, UA CS Earth Station and Satellite Links

2 Technical requirements

The technical characteristics of UAS to be used in assessing the forward and return (UAS) link performance via a FSS network is provided below. It is emphasized that an administration may implement an UAS with characteristics different than those listed below within its national airspace.

a) Frequency bands.

Space-to-Earth
10.95 – 11.20 GHz
11.45 – 11.70 GHz
11.70 – 12.20 GHz [Region 2 only]
12.20 – 12.50 GHz [Region 3 only]
12.50 – 12.75 GHz [Regions 1 and 3 only]
17.30 – 17.70 GHz in Region 1
17.70 – 18.8 GHz
19.70 – 21.20 GHz

Earth-to-Space
13.75 – 14.00 GHz
14.00 – 14.50 GHz
27.50 – 28.60 GHz
29.50 – 31.0 GHz

b) Minimum required availability for the end-to-end Forward (up 1 and down 2) Link and end-to-end Return (up 3 and down 4) Link – refer to figure 1.

End-to-end Forward (UA CS ES to UA ES) Link Availability: exceed 99.8% under the conditions contained in this Annex.

End-to-end Return (UA ES to UA CS ES) Link Availability: exceed 99.8% under the conditions contained in this Annex.

In practice, the allocation of availability to the up and down portions of each end-to-end link will not be the same; however, the combined availability of the up and down links should meet the end-to-end availability cited herein.

c) Geographic coverage area where the UAS requirements will have to be met.

Using appropriately located satellites, the availability referenced in b) should be met with the UA or UA CS at any longitude and less than +/-75 degrees latitude. The availability referenced in b) should be met with the satellite equivalent isotropically radiated power (e.i.r.p.), G/T and saturated flux density (s.f.d) at the locations of the UA CS Earth Station and UA Earth Station.

Global operations are expected covering all longitudes and latitudes to +/-75 degrees. Ranges of operation can extend to transcontinental and transoceanic distances. Flight times can extend to many days of either loitering over a specific area or flying point to point paths.

d) **The rain conditions (i.e. rain rates) in which the links must operate.**

UA CS Earth Stations should be designed to achieve the availability referenced in b) while accommodating the rain rates experienced in their location. Recommendation ITU-R P-837 should be used to determine the maximum UA CS Earth Station rain rates (links 1 and 4 in Figure 1) for 0.01 % of the average year and any other rain related information.

UA Earth Stations should be designed to achieve the availability referenced in b) while accommodating rain rates up to and including 20 mm/hr for 0.01% of the average year (links 2 and 3 in Figure 1). For safety reasons aircraft will be operated to mitigate very high rain rates either by flying at altitudes above the rain or by changing their flight plan to fly where rain rates are lower. Recommendation ITU-R P-837 should be used to determine any other rain related information.

e) **Carrier characteristics:**

It is noted that other carrier characteristics may also be suitable to achieve the required performance in b).

Information rate. Forward Link 10 kbit/s. Return Link 320 kbit/s.
Occupied bandwidth. Forward Link 9 kHz. Return Link 290 kHz.
Modulation type. QPSK
Forward error correction rate. Rate ¾ concatenated with Reed Solomon (212,236).
Minimum required C/(N+I). 3.8 dB.

f) **Minimum and maximum antenna sizes and corresponding gains of the UA CS Earth Station and UA Earth Station antennas.**

UA CS Earth station antennas should be sized to achieve the availability defined in b) for the rain rates experienced at their location d), as well as the other technical requirements cited in this Annex.

The minimum UA Earth Station antenna diameter should be 0.5 meters (20/30GHz) and 0.8 meters (12/14GHz). Maximum UA Earth Station antenna diameters are limited by the size and weight constraint of the UA airframe, so maximum diameters of 1.2m are anticipated The peak antenna gain values to be used in UAS Control Link performance calculations using the aforementioned antenna diameters and frequencies are provided below:

14GHz UA antenna transmit gain 38 dBi (0.8 meter) – 42 dBi (1.2 meter).
12GHz UA antenna receive gain 36 dBi (0.8 meter) – 40 dBi (1.2 meter).
30GHz UA antenna transmit gain 40 Bi (0.5 meter) – 48 dBi (1.2 meter).
20GHz UA antenna receive gain 37 dBi (0.5 meter) – 44dBi (1.2 meter).

g) **Pointing accuracy of the UA Earth Station antenna.**

The 12/14GHz UA Earth Station antenna tracking error not exceed +/- 0.40 degrees peak[1].

The 20/30GHz UA Earth Station antenna tracking error not exceed +/- 0.40 degrees peak.[2]

h) **Maximum and minimum e.i.r.p density of the UA CS Earth Station and UA Earth Station.**

14 GHz UA CS Earth Station and UA Earth Station should meet the following off-axis e.i.r.p. density levels under clear sky conditions in the plane of the geostationary satellite orbit location:

Angle off-axis	***Maximum e.i.r.p. per 4 kHz***
$1.5° \leq \theta \leq 7°$	$15 - 10 \log (N) - 25 \log\theta$ dBW/4 kHz
$7° < \theta \leq 9.2°$	$-6 - 10 \log (N)$ dBW/4 kHz
$9.2° < \theta \leq 48°$	$18 - 10 \log (N) - 25 \log\theta$ dBW/4 kHz
$48° < \theta \leq 85°$	$-24 - 10 \log (N)$ dBW/4 kHz
$85° < \theta \leq 180°$	$-14 - 10 \log (N)$ dBW/4 kHz

where θ is the angle in degrees from the line connecting the antenna to the target satellite. The e.i.r.p density should be met with the maximum antenna pointing error referenced in g). For digital SCPC using frequency division multiplex access (FDMA) or time division multiple access (TDMA) technique, N is equal to one. For digital SCPC using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

30 GHz UA CS Earth Station and UA Earth Station should meet the following off-axis e.i.r.p. density levels under clear sky conditions in the plane of the geostationary satellite orbit location:

Angle off-axis	***Maximum e.i.r.p. per 40 kHz***
$2.0° \leq \theta \leq 7°$	$(18.5 - 25 \log \theta) - 10 \log (N)$ dB (W/40 kHz)
$7° < \theta \leq 9.23°$	$-2.63 - 10 \log (N)$ dB (W/40 kHz)
$9.23° < \theta \leq 48°$	$(21.5 - 25 \log \theta) - 10 \log (N)$ dB (W/40 kHz)
$48° < \theta \leq 180°$	-10.5 dB $- 10 \log (N)$ (W/40 kHz).

where θ is the angle in degrees from the line connecting the antenna to the target satellite. The e.i.r.p. density should be met with the maximum antenna pointing error referenced in g). For digital SCPC using frequency division multiplex access (FDMA) or time division multiple access (TDMA) technique, N is equal to one. For digital SCPC using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

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[1] Additional study is required to verify the correct antenna tracking/pointing error.

[2] Id.

i) Minimum G/T of the receiving UA CS Earth Station and UA Earth Station.

The UA Earth Station system noise temperature should not exceed 270° Kelvin at the antenna feed flange. G/Ts will depend on the antenna size used. UA CS Earth station G/Ts are the same as conventional FSS systems.

DOCUMENT WAC/095(26.10.10)

WAC Informal Working Group (IWG)-1

Modifications to NTIA's Proposal on
Agenda Item 1.9

Preparation for ITU Radiocommunication Conferences

UNITED STATES OF AMERICA
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 1.9: to revise frequencies and channeling arrangements of Appendix **17** to the Radio Regulations, in accordance with Resolution **351 (Rev.WRC-07)**, in order to implement new digital technologies for the maritime mobile service

Background Information: The introduction of new data exchange technologies[1] in the HF maritime mobile service is providing an alternative to narrow-band direct printing (NBDP) technology. According to the International Maritime Organization, current NBDP applications include maritime safety information (MSI) broadcasts, ship reporting, weather forecasts and business communications (e.g. fishing fleets). Since alternative data communication technologies for these functions are available, NBDP equipment use is in rapid decline. However, NBDP telegraphy remains essential for distress communications in the polar regions (sea area A4) where geostationary satellites cannot provide coverage and other terrestrial means of communication are unreliable.

The global maritime community intends to improve efficiency and flexibility in the HF maritime mobile service spectrum by designating certain assignable frequencies in Appendix **17** to data transmissions using new data exchange technologies. This proposal would:

1) significantly reduce the number of NBDP frequencies to those actually used for NBDP telegraphy and the GMDSS/NBDP core frequencies (Appendix **15**);

2) allow for the use of the current NBDP bands for digital data transmissions, subject to not claiming protection from nor causing harmful interference to other stations in the maritime mobile service using NBDP technology until December 31, 2014;

~~3) make new digital data transmissions primary in the current NBDP bands effective January 1, 2015, though stations could use NBDP technology subject to not claiming protection from nor causing harmful interference to stations in the maritime mobile service using digital data transmissions;~~

3) re-designate the frequencies currently assignable to stations using facsimile, wide-band telegraphy and Morse telegraphy A1A/A1B to stations using data transmission without a transition period;

[redacted]

[1] See Recommendation ITU-R M.1798 *Characteristics of HF radio equipment for the exchange of digital data and electronic mail in the maritime mobile service*

4) allow stations using wide-band telegraphy or Morse telegraphy A1A/A1B to continue on their currently assigned frequencies subject to not claiming protection from nor causing harmful interference to stations in the maritime mobile service using digital data transmissions;

5) not modify Appendix **25** radiotelephony bands, but would allow for the use of digitally modulated emissions in the radiotelephony bands in accordance with the Appendix **25** allotment plan; and

6) provide some flexibility to administrations in portions of the bands 4 MHz, 6 MHz and 8 MHz to assign new simplex radiotelephony frequencies in accordance with No. **52.177**, subject to not claiming protection from stations **in** the maritime mobile service using digital data transmissions.

Proposal:

MOD USA/AI 1.9/1

APPENDIX 17 (REV.WRC-12)

Frequencies and channelling arrangements in the high-frequency bands for the maritime mobile service

(See Article **52**)

PART A – Table of subdivided bands (WRC-12)

In the Table, where appropriate[1], the assignable frequencies in a given band for each usage are:

– indicated by the lowest and highest frequency, in heavy type, assigned in that band;

– regularly spaced, the number of assignable frequencies (*f.*) and the spacing in kHz being indicated in italics.

1 Within the non-shaded boxes.

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service

Band (MHz)	4	6	8	12	16	18/19	22	25/26
Limits (kHz)	4 063	6 200	8 195	12 230	16 360	18 780	22 000	25 070
Frequencies assignable to ship stations for oceanographic data transmission *c)*	**4 063.3** to **4 064.8** *6 f. 0.3 kHz*							
Limits (kHz)	4 065	6 200	8 195	12 230	16 360	18 780	22 000	25 070
Frequencies assignable to ship stations for telephony, duplex operation *a) i) hh)*	**4 066.4** to **4 144.4** *27 f. 3 kHz*	**6 201.4** to **6 222.4** *8 f. 3 kHz*	**8 196.4** to **8 292.4** *33 f. 3 kHz*	**12 231.4** to **12 351.4** *41 f. 3 kHz*	**16 361.4** to **16 526.4** *56 f. 3 kHz*	**18 781.4** to **18 823.4** *15 f. 3 kHz*	**22 001.4** to **22 157.4** *53 f. 3 kHz*	**25 071.4** to **25 098.4** *10 f. 3 kHz*
Limits (kHz)	4 146	6 224	8 294	12 353	16 528	18 825	22 159	25 100

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service (*continued*)

Band (MHz)	4	6	8	12	16	18/19	22	25/26
Limits (kHz)	4 146	6 224	8 294	12 353	16 528	18 825	22 159	25 100
Frequencies assignable to ship stations and coast stations for telephony, simplex operation *a) hh)*	**4 147.4** to **4 150.4** *2 f. 3 kHz*	**6 225.4** to **6 231.4** *3 f. 3 kHz*	**8 295.4** to **8 298.4** *2 f. 3 kHz*	**12 354.4** to **12 366.4** *5 f. 3 kHz*	**16 529.4** to **16 547.4** *7 f. 3 kHz*	**18 826.4** to **18 844.4** *7 f. 3 kHz*	**22 160.4** to **22 178.4** *7 f. 3 kHz*	**25 101.4** to **25 119.4** *7 f. 3 kHz*
Limits (kHz)	4 152	6 233	8 300	12 368	16 549	18 846	22 180	25 121
Frequencies assignable to ship stations for data transmission *p) ee)*								*z*
Limits (kHz)	4 172	6 261	8 340	12 420	16 617	18 870	22 240	25 161.25
Frequencies assignable to ship stations for oceanographic data transmission *c) p)*								
Limits (kHz)	4 172	6 262.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *d) p)* [redacted] *cc)*								
Limits (kHz)	4 175.25	6 266.25	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25

Frequencies (paired) assignable to ship stations for narrow-band direct-printing (NBDP) telegraphy and data transmission systems at speeds not exceeding 100 Bd for FSK and 200 Bd for PSK *d) j)*	**4 176** to **4 178** *5 f. 0.5 kHz*	**6 266.5** to **6 268.5** *5 f. 0.5 kHz*						
Limits (kHz)	4 178.25	6 268.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *d) p)* [redacted] *cc)*								
Limits (kHz)	4 181.75	6 275.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service (*continued*)

Band (MHz)	**4**	**6**	**8**	**12**	**16**	**18/19**	**22**	**25/26**
Limits (kHz)	4 181.75	6 275.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *p) m)*								
Limits (kHz)	4 186.75	6 280.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *d) p)* [redacted] *cc)*								
Limits (kHz)	4 186.75	6 284.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *m) p)*								
Limits (kHz)	4 202.25	6 300.25	8 365.75	12 476.75	16 683.25	18 870	22 279.25	25 171.25
Frequencies assignable to ship stations for data transmission *p) m)*								
Limits (kHz)	4 202.25	6 300.25	8 370.75	12 476.75	16 683.25	18 870	22 284.25	25 172.75
Frequencies assignable to ship stations for data transmission *) p) m)*								
Limits (kHz)	4 202.25	6 300.25	8 376.25	12 476.75	16 683.25	18 870	22 284.25	25 172.75