

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

In the Matter of)	
)	
Revision of Parts 2 and 15 of the Commission's)	ET Docket No. 03-122
Rules to Permit Unlicensed National)	RM-10371
Information Infrastructure (U-NII) Devices in)	
the 5 GHz Band)	

To: The Commission

**COMMENTS OF ARRL, THE NATIONAL ASSOCIATION
FOR AMATEUR RADIO**

ARRL, the National Association for Amateur Radio, also known as the American Radio Relay League, Incorporated (ARRL), by counsel, hereby respectfully submits its comments in response to the *Notice of Proposed Rule Making*, FCC 03-110, 68 Fed. Reg. 44011, released June 4, 2003 (the Notice). The Notice was published in the Federal Register on July 25, 2003, and therefore these comments are timely filed, pursuant to the *Erratum*, DA 03-2323, released July 15, 2003. The Notice proposes to Amend Part 15 of the Commission's Rules governing the operation of unlicensed National Information Infrastructure (U-NII) devices, including radio local area networks (RLANs) to make available an additional 255 MHz of spectrum in the 5.470-5.725 GHz band. This would increase the total amount of spectrum in this frequency range for U-NII devices¹ from 300 MHz to 555 MHz. In the interests of the Amateur Radio Service and the Amateur-Satellite Service in the allocation 5.650-5.725 GHz, ARRL states as follows:

¹ Presently, U-NII devices are permitted to operate at 5.15-5.35 GHz and 5.725-5.825 GHz, per Section 15.403 of the Commission's rules.

I. Introduction

1. This proceeding is based on a petition for rule making, RM-10371, filed by the Wireless Compatibility Alliance (WECA), which sought to permit U-NII operation at 5470-5725 MHz (in addition to the 5150-5350 MHz and 5725-5825 MHz bands). ARRL opposed the petition in comments filed February 28, 2002, principally on the basis that the petition asked the Commission to assume the outcome of studies to be concluded and presented at the 2003 WRC and the following 2006 WRC concerning RLAN operation and allocations. ARRL suggested that such "jumping the gun" was inappropriate policy. ARRL also argued that the 300 MHz made available for U-NII operation earlier had not been shown to be insufficient for the purpose or for encouraging RLAN development in the United States. WECA had merely argued that RLAN operation was beneficial; that it was being used in Europe; that international harmonization of allocations was right and proper policy; and that more spectrum is better for RLAN facilities. WECA's argument relied heavily on the European HIPERLAN system, which uses all of the 5150-5350 MHz and 5450-5725 MHz bands.

2. There have been several significant events involving the 5 GHz band since the January, 2002 filing of the WECA petition for rulemaking. The ARRL's concerns which were expressed in its comments on the WECA petition have been ameliorated to some extent, leaving one principal issue unresolved, to-wit: potential aggregate interference from RLAN or other U-NII devices to Amateur Radio space stations in the band 5.65-5.67 GHz. To a lesser extent, ARRL is concerned that aggregate RLAN operation will preclude other terrestrial Amateur operations in this band. ARRL has no interest in the 5.470-5.650 GHz segment.

3. During 2002 and thus far in 2003, wireless devices and systems using IEEE 802.11 protocols have become increasingly popular. The use of the 2.4 GHz band has expanded significantly, to the point that Amateur radio operation in the band is substantially compromised in many urbanized and suburban environments. Use of the 5 GHz band for IEEE 802.11a operation is underway and inexpensive dual-band devices are available. The aggregate interference to Amateur stations in many configurations in the 2.4 GHz band is substantial, and periodically preclusive. While it is anyone's guess whether an additional 255 MHz of spectrum to be made available for U-NII device deployment at 5 GHz is either necessary or the right amount, the debate has, from a regulatory perspective, essentially been settled at the 2003 World Radiocommunication Conference (WRC-03), which allocated the band 5.47-5.725 GHz to the mobile service for implementation of wireless access systems (WAS) including RLANs, subject to the provisions of Resolution 229 [temporarily designated COM5/16] (WRC-03). A summary of the changes in the 5 GHz range made at WRC-03 is attached hereto as *Exhibit A*, for reference.

4. WRC-03 Resolution 229 notes the need to protect the existing primary services in the 5 GHz band.² In relevant part, it resolves:

6 that in the band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW³ with a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band;

² See, Resolution [COM5/16]: "*considering h*) that there is the need to protect the existing primary services in the 5 150-5 250 and 5 470-5 725 MHz bands".... A copy of that Resolution is attached hereto as **Exhibit B** for reference.

³ Administrations with existing regulations prior to this Conference may exercise some flexibility in determining transmitter power limits.

7 that in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

8 that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures found in Annex 1 to Recommendation ITU-R M.1652 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems...

5. While the above mitigation measures were not specifically intended to protect the Amateur Services' secondary allocation in the band 5.65-5.725 GHz or the Amateur-Satellite Service Earth-to-space allocation pursuant to Footnote 5.282 in the band 5.65-5.67 GHz, the Amateur Services derive some benefit from them. The e.i.r.p. limits set forth in that Recommendation are intended to, and would, provide a certain level of protection. The dynamic frequency selection (DFS) listen-before-transmit technique specified in Recommendation ITU-R M.1652, which had not been approved by the ITU at the time ET Docket 03-122 was initiated, should also help to protect Amateur operations. ARRL notes, however, that this Recommendation was based on technical studies of potential interference from RLANs to radars, not to amateur station receivers, which have different characteristics.

6. However, Recommendation ITU-R M.1652 offers virtually no benefit to Amateur space station receivers in the band 5.65-5.67 GHz, as this is only an Earth-to-space band in which Amateur space stations are not allowed to transmit. Thus, DFS would inhibit transmission by a U-NII device only if it is within close proximity of an Amateur earth station making a transmission to a satellite. Preliminary studies by ARRL indicate that light use of IEEE 802.11 transmissions on channel 132 (5.66 GHz center

frequency) would not pose a significant problem, but the cumulative effects of ubiquitous operation in this band could render this uplink band unreliable. ARRL recognizes that this U-NII authorization is likely, given the outcome of WRC-03. Therefore, ARRL will work with the RLAN industry to (1) assess the potential aggregate interference from 802.11a devices to an amateur space station receiver and (2) if necessary, explore mitigation techniques for the band 5.65-5.67 GHz. ARRL would, however, urge the Commission to caution RLAN equipment manufacturers to avoid the 5.650-5.670 GHz segment in product development, or otherwise take precautionary steps to avoid interference to this Amateur Satellite Service band.

7. As the Commission has not issued any amendments to the Notice subsequent to WRC-03, it is not clear to what extent, if any, the decisions of the Conference will modify the Commission's proposals in this proceeding. Of particular interest, there is a difference between the ITU allocations to the mobile service and the Notice proposal to add 5.470-5.725 GHz to the U-NII band at 5.725-5.825 GHz regulated by the Part 15 Rules. ARRL would suggest that the latter approach is preferable for the United States.

II. The Amateur Allocation at 5.650-5.925 GHz Has Been Subject to "Death by a Thousand Cuts"

8. The Amateur allocation at 5650-5925 MHz in the United States is a secondary allocation. Domestically, the entire band is allocated to the Government Radiolocation service (limited to military services) and to the Amateur Service on a secondary basis. By footnote, Amateur-Satellite Service Earth-to-space operations are permitted in the band 5650-5670 MHz subject to not causing harmful interference to other services operating in

accordance with the Radio Regulations. Space-to-Earth applications in the Amateur-Satellite Service are permitted in the segment 5830-5850 MHz, secondary as well to the Government Radiolocation service. Thus, there are important paired uplink and downlink segments in the Amateur-Satellite Service at 5.65-5.85 GHz, which are in the planning stages of deployment now. The upper portion of the overall Amateur allocation at 5 GHz, 5850-5925 MHz, is allocated to the Fixed-Satellite Service for uplinks on a primary basis with the radiolocation service. Further complicating matters, the frequency 5800 MHz, plus and minus 75 MHz, is designated for industrial, scientific and medical (ISM) devices.

9. The Department of Defense is the major government user of the band. They use the band for radiolocation for rocket tracking, aircraft guidance, anti-surveillance radar, transponder tracking, telemetry, and ground facilities for development and testing of associated radio and radar systems. Department of Energy and NASA also have radiolocation activities in this band.

10. Amateur Radio has been disaccommodated on a continuing basis in the 5.650-5.925 GHz band domestically in the past six years. The deterioration of the status of Amateur Radio in this band began with the first U-NII provision in 1997.⁴ The purpose of this rather vaguely defined authority was to encourage wireless LANs and to further enable mobile internet access, premised on the European Hiperlan system. The 1997 *Report and Order* made available under Part 15 a total of 300 MHz at 5150-5350 MHz and 5725-5825 MHz. The lower (non-Amateur) segment is available for higher-power

⁴ See the *Report and Order, Amendment of the Commission's Rules to Provide for Operation of Unlicensed U-NII Devices in the 5 GHz Frequency Range*, FCC 97-5, released January 9, 1997 in ET Docket No. 96-102.

devices. In making this band available for U-NII purposes (over ARRL's objection), the Commission suggested:

With regard to sharing this band with Amateur operations, we believe that U-NII devices will cause little interference to amateur operations because of the relatively low power with which U-NII devices will operate. Further, we note that the amateur service has access to all spectrum within the 5.65-5.925 GHz range. We therefore believe that amateur operation will be able to avoid using frequencies within the 5.725-5.825 GHz band that are available to U-NII devices, in those rare cases where such avoidance may be necessary.

11. This was an error for two reasons. First, it presumed that fixed stations in allocated services might have to move in order to avoid interference from unallocated, unlicensed devices. ARRL suggests that such was bad spectrum management policy. Second, it failed to acknowledge the aggregate interference potential of these devices. In any event, however, of the 5650-5925 MHz available to the Amateur Service on a secondary basis (a total of 275 MHz), 100 MHz was to become less useful than it would be absent the U-NII provisions. The instant proceeding would continue that process, compromising the use of an additional 75 MHz of spectrum for the same purposes.

12. The second major event in this band occurred in 1999, when the Commission allocated the 5850-5925 MHz segment to Part 90 Intelligent Transportation Services (ITS) Direct vehicle to roadside, or "Dedicated Short Range Communications" (DSRC).⁵ This allocation was made, again, over ARRL's strong objection. The Commission justified that allocation on the basis that the Amateur Service has available to it "275 megahertz of spectrum in the 5.650- 5.925 GHz band." Given the mobile characteristics of DSRC operations the sharing opportunities for Amateurs are minimal. The

Commission was clear in its instructions to Amateurs in the 1999 *Report and Order* authorizing DSRC: Amateurs could continue to operate in the band, but only to the extent that they do not interfere with DSRC operations. Furthermore, there are certain safety characteristics of DSRC applications, at least in the future, which makes future Amateur operation in that segment somewhat risky. It is apparent, therefore, that the Commission has largely disaccommodated the Amateur Service in the 5.650-5.925 GHz band. After the DSRC allocation, Amateurs were left essentially with relatively uncompromised access to the 5650-5725 MHz segment (75 MHz) and the 5825-5850 MHz segment (25 MHz), a total of 100 MHz. The instant proceeding would compromise the lower of those two remaining segments.

III. Amateur Earth Station Operation at 5.650-5.670 GHz

13. As discussed above, the Amateur-Satellite segment at 5.650-5.670 GHz (Earth-to-space) is paired, both internationally and domestically, with the Amateur Satellite Service allocation at 5.830-5.850 GHz (space-to-Earth). ARRL would request that the 5.650-5.670 GHz segment in particular be protected against interference from U-NII devices. While Amateur weak-signal terrestrial communications are subject to increasing disruption in the existing U-NII and Amateur band around 5.760 GHz, the proposed rules for U-NII use of the lower 5.650-5.725 GHz segment are in some respects more reasonable than those which govern the existing (upper) segment. For example, the proposed Power Spectral Density (PSD) in Section 15.407(a)(2) of Appendix B to the Notice is better than that in the band 5.725-5.825 GHz (Section 15.407(a)(3) of Appendix B). The PSD in the lower segment would not exceed 11 dBm in any 1 MHz. The rules for

⁵ See, the *Report and Order*, FCC 99-305, 14 FCC Rcd. 18221 (released October 22, 1999 in ET Docket No. 98-95).

the upper band permit a PSD of 17 dBm. So, there is some reason to hope that the interference levels to the Amateur-Satellite service in this segment caused by U-NII devices will not approach the levels of harmful interference now being experienced by Amateurs around 5760 MHz from existing Part 15 (presumably U-NII) devices. ARRL would also support the Commission's proposal to limit e.i.r.p. for U-NII devices in the lower segment to 1 watt.

14. ARRL would urge U-NII equipment manufacturers to avoid use of the 5.650-5.670 GHz segment, as the only practical means of avoiding interference to the Amateur-Satellite service in that band. The Commission should also expand the Dynamic Frequency Selection (DFS) provisions in the proposed rules to take into account more than just radar devices. For example, in Section 15.403, the definition of "Available Channel" which now refers only to dynamic channel selection to avoid interference to government radars, should be modified to read as follows: "A radio channel on which a *Channel Availability Check* has not identified the presence of a signal above the DFS detection threshold." This would be consistent with some other definitions in that same section, including "Channel Move Time" and subsequent provisions. Other references to "radar" in connection with the DFS provisions should instead make reference to "signals above the DFS detection threshold." Since U-NII devices are to be subject, as the Commission states at paragraph 19 of the Notice, to the standard non-interference obligations attendant to the operation of any Part 15 device⁶ relative to authorized radio services generally, it makes little sense to implement a DFS requirement for radiolocation

⁶ In this proceeding, as in prior proceedings, the Commission takes great comfort in the non-interference provisions of Part 15 (47 C.F.R. §15.5). Make no mistake, however: this regulatory requirement is pure illusion. Once the Commission authorizes a technically incompatible unlicensed device or system, the

stations and not require the same thing for other types of signals, such as Amateur and Amateur-Satellite station transmissions, which are not subject to any less protection against interference. Paragraph 19 of the Notice gives short shrift to incumbent Amateur uses of the 5.650-5.725 GHz band, but the importance of that segment, given the difficulties created for Amateur use of the 5.725-5.825 GHz and 5.850-5.925 GHz segments will increase in the near term. Furthermore, there is Amateur-Satellite operation in the band 5.650-5.670 GHz, for which there is planned future operation.

15. Finally, ARRL would support the use of transmit power control (TPC) for U-NII devices in the 5 GHz band, to cause a 6 dB reduction in transmit power for U-NII devices when triggered. The same should be required for all new U-NII devices operating in the 5.650-5.825 GHz segment. The combination of a conservative e.i.r.p. limit not to exceed one watt, plus DFC and TPC, should minimize instances of interference between U-NII devices and Amateur stations in this band. However, it is recommended nevertheless that U-NII device manufacturers be requested to avoid the segment 5.650-5.670 GHz completely.

Now, therefore, the foregoing considered, ARRL, the National Association for Amateur Radio, respectfully requests that the Commission implement U-NII, including

device is going to be operated by the consumer or other purchaser, and neither radio amateurs, nor the Commission, are in a position as a practical matter to remedy the interference.

RLAN operation in the 5.650-5.725 GHz segment, in accordance with the recommendations contained herein, and not otherwise.

Respectfully submitted,

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EXHIBIT A

WRC-03 MODIFICATIONS AT 5 GHz

4 800-5 830 MHz

Allocation to services		
Region 1	Region 2	Region 3
5 150-5 250	AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE (Earth-to-space) 5.447A MOBILE except aeronautical mobile 5.446A 5.446B 5.446 5.447 5.447B 5.447C	
5 250-5 255	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH 5.447D MOBILE except aeronautical mobile 5.446A 5.447F 5.448 5.448A 5.447E	
5 255- 5 350	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) MOBILE except aeronautical mobile 5.446A 5.447F 5.448 5.448A 5.447E	
5 350-5 460	EARTH EXPLORATION-SATELLITE (active) SPACE RESEARCH (active) 5.448C AERONAUTICAL RADIONAVIGATION 5.449 RADIOLOCATION 5.448D 5.448B	
5 460-5 470	RADIONAVIGATION 5.449 EARTH EXPLORATION-SATELLITE (active) SPACE RESEARCH (active) RADIOLOCATION 5.448D 5.448B	
5 470-5 570	MARITIME RADIONAVIGATION MOBILE except aeronautical mobile 5.446A 5.450A EARTH EXPLORATION-SATELLITE (active) SPACE RESEARCH (active) RADIOLOCATION 5.450B 5.450 5.451 5.452 5.448B	
5 570-5 650	MARITIME RADIONAVIGATION MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B 5.450 5.451 5.452	

5 650-5 725

RADIOLOCATION

MOBILE except aeronautical mobile 5.446A 5.450A

Amateur

Space research (deep space)

5.282 5.451 5.453 5.454 5.455

5.446A The use of the bands 5 150-5 350 MHz and 5 470-5 725 MHz by the stations in the mobile service shall be in accordance with Resolution **229 (WRC-03)**. (WRC-03)

5.446B In the band 5 150-5 250 MHz, stations in the mobile service shall not claim protection from earth stations in the fixed-satellite service. Number **5.43A** does not apply to the mobile service with respect to FSS earth stations. (WRC-03)

5.447F In the band 5 250-5 350 MHz, stations in the mobile service shall not claim protection from the radiolocation service, the Earth exploration-satellite service (active) and the space research service (active). These services shall not impose on the mobile service more stringent protection criteria, based on system characteristics and interference criteria, than those stated in Recommendations ITU-R M.1638 and ITU-R SA.1632. (WRC-03)

5.448D In the frequency band 5 350-5 470 MHz, stations in the radiolocation service shall not cause harmful interference to, nor claim protection from, radar systems in the aeronautical radionavigation service operating in accordance with No. **5.449**. (WRC-03)

5.450B In the frequency band 5 470-5 650 MHz, stations in the radiolocation service, except ground-based radars used for meteorological purposes in the band 5 600-5 650 MHz, shall not cause harmful interference to, nor claim protection from, radar systems in the maritime radionavigation service. (WRC-03)

5.450A In the band 5 470-5 725 MHz, stations in the mobile service shall not claim protection from radiodetermination services. Radiodetermination services shall not impose on the mobile service more stringent protection criteria, based on system characteristics and interference criteria, than those stated in Recommendation ITU-R M.1638. (WRC-03)

5.447E *Additional allocation:* The band 5 250-5 350 MHz is also allocated to the fixed service on a primary basis in the following countries in Region 3: Australia, Korea (Rep. of), India, Indonesia, Iran (Islamic Republic of), Japan, Malaysia, Papua New Guinea, Philippines, Sri Lanka, Thailand and Viet Nam. The use of this band by the fixed service is intended for the implementation of fixed wireless access (FWA) systems and shall comply with Recommendation ITU-R F.1613. In addition, the fixed service shall not claim protection from the radiodetermination, Earth exploration-satellite (active) and space research (active) services, but the provisions of No. **5.43A** do not apply to the fixed service with respect to the Earth exploration-satellite (active) and space research (active) services. After implementation of FWA systems in the fixed service with protection for the existing radiodetermination systems, no more stringent constraints should be imposed on the FWA systems by future radiodetermination implementations. (WRC-03)

5.448C The space research service (active) operating in the band 5 350-5 460 MHz shall not cause harmful interference to nor claim protection from other services to which this band is allocated. (WRC-03)

SUP 5.443A

5.443B In order not to cause harmful interference to the microwave landing system operating above 5 030 MHz, the aggregate power flux-density produced at the Earth's surface in the band 5 030-5 150 MHz by all the space stations within any radionavigation-satellite service system (space-to-Earth) operating in the band 5 010-5 030 MHz shall not exceed -124.5 dB(W/m²) in a 150 kHz band. In order not to cause harmful interference to the radio astronomy service in the band 4 990-5 000 MHz, radionavigation-satellite service systems operating in the band 5 010-5 030 MHz shall comply with the limits in the band 4 990-5 000 MHz defined in Resolution [COM5/1] (WRC-03). (WRC-03)

5.444 The band 5 030-5 150 MHz is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing. The requirements of this system shall take precedence over other uses of this band. For the use of this band, No. **5.444A** and Resolution **114 (Rev.WRC-03)** apply. (WRC-03)

5.444A *Additional allocation:* the band 5 091-5 150 MHz is also allocated to the fixed-satellite service (Earth-to-space) on a primary basis. This allocation is limited to feeder links of non-geostationary mobile-satellite systems in the mobile-satellite service and is subject to coordination under No. **9.11A**.

In the band 5 091-5 150 MHz, the following conditions also apply:

- prior to 1 January 2018, the use of the band 5 091-5 150 MHz by feeder links of non-geostationary-satellite systems in the mobile-satellite service shall be made in accordance with Resolution **114 (Rev.WRC-03)**;
- prior to 1 January 2018, the requirements of existing and planned international standard systems for the aeronautical radionavigation service which cannot be met in the 5 000-5 091 MHz band, shall take precedence over other uses of this band;
- after 1 January 2012, no new assignments shall be made to earth stations providing feeder links of non-geostationary mobile-satellite systems;
- after 1 January 2018, the fixed-satellite service will become secondary to the aeronautical radionavigation service. (WRC-03)

5.447 *Additional allocation:* in Israel, Lebanon, Pakistan, the Syrian Arab Republic and Tunisia, the band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, subject to agreement obtained under No. **9.21**. In this case, the provisions of Resolution [COM5/16] (WRC-03) do not apply. (WRC-03)

5.448 *Additional allocation:* in Azerbaijan, Libyan Arab Jamahiriya, Mongolia, Kyrgyzstan, Slovakia, Romania and Turkmenistan, the band 5 250-5 350 MHz is also allocated to the radionavigation service on a primary basis. (WRC-03)

5.448A The Earth exploration-satellite (active) and space research (active) services in the frequency band 5 250-5 350 MHz shall not claim protection from the radiolocation service. Number **5.43A** does not apply. (WRC-03)

5.448B The Earth exploration-satellite service (active) operating in the band 5 350-5 570 MHz and space research service (active) operating in the band 5 460-5 570 MHz shall not cause harmful interference to the aeronautical radionavigation service in the band 5 350-5 460 MHz, the radionavigation service in the band 5 460-5 470 MHz and the maritime radionavigation service in the band 5 470-5 570 MHz. (WRC-03)

5.450 *Additional allocation:* in Austria, Azerbaijan, Iran (Islamic Republic of), Mongolia, Kyrgyzstan, Romania, Turkmenistan and Ukraine, the band 5 470-5 650 MHz is also allocated to the aeronautical radionavigation service on a primary basis. (WRC-03)

5.453 *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, China, Congo, Côte d’Ivoire, Korea (Rep. of), Egypt, the United Arab Emirates, Gabon, Guinea, Equatorial Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kenya, Kuwait, Lebanon, the Libyan Arab Jamahiriya, Madagascar, Malaysia, Nigeria, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. People’s Rep. of Korea, Singapore, Sri Lanka, Swaziland, Tanzania, Chad, Thailand, Togo, Viet Nam and Yemen, the band 5 650-5 850 MHz is also allocated to the fixed and mobile services on a primary basis. In this case, the provisions of Resolution **229 (WRC-03)** do not apply. (WRC-03)

5.454 *Different category of service:* in Azerbaijan, Georgia, Mongolia, Uzbekistan, Kyrgyzstan, the Russian Federation, Tajikistan and Turkmenistan, the allocation of the band 5 670-5 725 MHz to the space research service is on a primary basis (see No. **5.33**). (WRC-03)

5.455 *Additional allocation:* in Armenia, Azerbaijan, Belarus, Cuba, Georgia, Hungary, Kazakhstan, Latvia, Moldova, Mongolia, Uzbekistan, Kyrgyzstan, the Russian Federation, Tajikistan, Turkmenistan and Ukraine, the band 5 670-5 850 MHz is also allocated to the fixed service on a primary basis. (WRC-03)

5.456 *Additional allocation:* in Cameroon, the band 5 755-5 850 MHz is also allocated to the fixed service on a primary basis. (WRC-03)

5 830-7 550 MHz

Allocation to services		
Region 1	Region 2	Region 3
5 925-6 700	FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.149 5.440 5.458	

5.457B In the bands 5 925-6 425 MHz and 14-14.5 GHz, earth stations on board vessels may operate with the characteristics and under the conditions contained in Resolution **902** in Algeria, Saudi Arabia, Bahrain, Comoros, Djibouti, Egypt, United Arab Emirates, Jordan, Kuwait, Libyan Arab Jamahiriya, Morocco, Mauritania, Oman, Qatar, Syrian Arab Republic, Sudan, Tunisia and Yemen, in the maritime mobile-satellite service on a secondary basis. Such use shall be in accordance with Resolution **902**. (WRC-03)

EXHIBIT B

RESOLUTION 229 (WRC-03)

Use of the bands 5 150-5 250, 5 250-5 350 MHz and 5 470-5 725 MHz by the mobile service for the implementation of wireless access systems including radio local area networks

The World Radiocommunication Conference (Geneva, 2003),

considering

- a)* that this Conference has allocated the bands 5 150-5 350 MHz and 5 470-5 725 MHz on a primary basis to the mobile service for the implementation of wireless access systems (WAS), including radio local area networks (RLANs);
- b)* that this Conference has decided to make an additional primary allocation for the Earth exploration-satellite service (EESS) (active) in the band 5 460-5 570 MHz and space research service (SRS) (active) in the band 5 350-5 570 MHz;
- c)* that this Conference has decided to upgrade the radiolocation service to a primary status in the 5 350-5 650 MHz band;
- d)* that the band 5 150-5 250 MHz is allocated worldwide on a primary basis to the fixed-satellite service (FSS) (Earth-to-space), this allocation being limited to feeder links of non-geostationary-satellite systems in the mobile-satellite service (No. **5.447A**);
- e)* that the band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, in some countries (No. **5.447**) subject to agreement obtained under No. **9.21**;
- f)* that the band 5 250-5 460 MHz is allocated to the Earth exploration-satellite service (EESS) (active) and the band 5 250-5 350 MHz to the space research service (active) on a primary basis;
- g)* that the band 5 250-5 725 MHz is allocated on a primary basis to the radiodetermination service;
- h)* that there is a need to protect the existing primary services in the 5 150-5 350 and 5 470-5 725 MHz bands;
- i)* that results of studies in ITU-R indicate that sharing in the band 5 150-5 250 MHz between WAS, including RLANs, and the FSS is feasible under specified conditions;
- j)* that studies have shown that sharing between the radiodetermination and mobile services in the bands 5 250-5 350 and 5 470-5 725 MHz is only possible with the application of mitigation techniques such as dynamic frequency selection;
- k)* that there is a need to specify an appropriate e.i.r.p. limit and, where necessary, operational restrictions for WAS, including RLANs, in the mobile service in the bands 5 250-5 350 MHz and 5 470-5 570 MHz in order to protect systems in the Earth exploration-satellite service (active) and space research service (active);
- l)* that the deployment density of WAS, including RLANs, will depend on a number of factors including intrasystem interference and the availability of other competing technologies and services,

further considering

- a) that the interference from a single WAS, including RLANs, complying with the operational restrictions under *resolves 2* will not on its own cause any unacceptable interference to FSS receivers on board satellites in the band 5 150-5 250 MHz;
- b) that such FSS satellite receivers may experience an unacceptable effect due to the aggregate interference from these WAS, including RLANs, especially in the case of a prolific growth in the number of these systems;
- c) that the aggregate effect on FSS satellite receivers will be due to the global deployment of WAS, including RLANs, and it may not be possible for administrations to determine the location of the source of the interference and the number of WAS, including RLANs, in operation simultaneously,

noting

that, prior to WRC-03, a number of administrations have developed regulations to permit indoor and outdoor WAS, including RLANs, to operate in the various bands under consideration in this Resolution,

recognizing

- a) that in the band 5 600-5 650 MHz, ground-based meteorological radars are extensively deployed and support critical national weather services, according to footnote No. **5.452**;
- b) that the means to measure or calculate the aggregate pfd level at FSS satellite receivers specified in Recommendation ITU-R S.1426 are currently under study;
- c) that certain parameters contained in Recommendation ITU-R M.1454 related to the calculation of the number of RLANs tolerable by FSS satellite receivers operating in the band 5 150-5 250 MHz require further study;
- d) that the performance and interference criteria of spaceborne active sensors in the Earth exploration-satellite service (EESS) (active) are given in Recommendation ITU-R SA.1166;
- e) that a mitigation technique to protect radiodetermination systems is given in Recommendation ITU-R M.1652;
- f) that an aggregate pfd level has been developed in Recommendation ITU-R S.1426 for the protection of FSS satellite receivers in the 5 150-5 250 MHz band;
- g) that Recommendation ITU-R SA.1632 identifies a suitable set of constraints for WAS, including RLANs, in order to protect the EESS (active) in the 5 250-5 350 MHz band;
- h) that Recommendation ITU-R M.1653 identifies the conditions for sharing between WAS, including RLANs, and the EESS (active) in the 5 470-5 570 MHz band;
- i) that the stations in the mobile service should also be designed to provide, on average, a near-uniform spread of the loading of the spectrum used by stations across the band or bands in use to improve sharing with satellite services;
- j) that WAS, including RLANs, provide effective broadband solutions;
- k) that there is a need for administrations to ensure that WAS, including RLANs, meet the required mitigation techniques, for example, through equipment or standards compliance procedures,

resolves

1 that the use of these bands by the mobile service will be for the implementation of WAS, including RLANs, as described in Recommendation ITU-R M.1450;

2 that in the band 5 150-5 250 MHz, stations in the mobile service shall be restricted to indoor use with a maximum mean e.i.r.p.¹ of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band or equivalently 0.25 mW/25 kHz in any 25 kHz band;

3 that administrations may monitor whether the aggregate pfd levels given in Recommendation ITU-R S.1426² have been, or will be exceeded in the future, in order to enable a future competent conference to take appropriate action;

4 that in the band 5 250-5 350 MHz, stations in the mobile service shall be limited to a maximum mean e.i.r.p. of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band. Administrations are requested to take appropriate measures that will result in the predominant number of stations in the mobile service being operated in an indoor environment. Furthermore, stations in the mobile service that are permitted to be used either indoors or outdoors may operate up to a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band, and, when operating above a mean e.i.r.p. of 200 mW, these stations shall comply with the following e.i.r.p. elevation angle mask where θ is the angle above the local horizontal plane (of the Earth):

-13	dB(W/MHz)	for $0^\circ \leq \theta < 8^\circ$
$-13 - 0.716(\theta - 8)$	dB(W/MHz)	for $8^\circ \leq \theta < 40^\circ$
$-35.9 - 1.22(\theta - 40)$	dB(W/MHz)	for $40^\circ \leq \theta \leq 45^\circ$
-42	dB(W/MHz)	for $45^\circ < \theta$;

5 that administrations may exercise some flexibility in adopting other mitigation techniques, provided that they develop national regulations to meet their obligations to achieve an equivalent level of protection to the EESS (active) and the SRS (active) based on their system characteristics and interference criteria as stated in Recommendation ITU-R SA.1632;

6 that in the band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW³ with a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band;

7 that in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if

¹ In the context of this Resolution, “mean e.i.r.p.” refers to the e.i.r.p. during the transmission burst which corresponds to the highest power, if power control is implemented.

² $-124 - 20 \log_{10} (h_{SAT}/1\,414)$ dB(W/(m² · 1 MHz)), or equivalently, $-140 - 20 \log_{10} (h_{SAT}/1\,414)$ dB(W/(m² · 25 kHz)), at the FSS satellite orbit,

where h_{SAT} is the altitude of the satellite (km).

³ Administrations with existing regulations prior to this Conference may exercise some flexibility in determining transmitter power limits.

transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

8 that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures found in Annex 1 to Recommendation ITU-R M.1652 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems,

invites administrations

to adopt appropriate regulation if they intend to permit the operation of stations in the mobile service using the e.i.r.p. elevation angle mask in *resolves* 4, to ensure the equipment is operated in compliance with this mask,

invites ITU-R

1 to continue work on regulatory mechanisms and further mitigation techniques to avoid incompatibilities which may result from aggregate interference into the FSS in the band 5 150-5 250 MHz from a possible prolific growth in the number of WAS, including RLANs;

2 to continue studies on mitigation techniques to provide protection of EESS from stations in the mobile service,

3 to continue studies on suitable test methods and procedures for the implementation of dynamic frequency selection, taking into account practical experience.
