FCC 94-273

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

In the Matter of	)	
	)	
Amendment of Parts 2 and 15	)	
of the Commission's Rules to Permit	)	ET Docket No. 94-124
Use of Radio Frequencies Above 40 GHz	)	RM-8308
for New Radio Applications	)	

NOTICE OF PROPOSED RULE MAKING

Adopted: October 20, 1994 ; Released: November 8, 1994

Comment Date: January 30 , 1995
Reply Comment Date: March 1, 1995
By the Commission:

INTRODUCTION

1. By this action, the Commission proposes to open for commercial development and use a portion of the "millimeter wave" frequency bands above 40 GHz.[1] To date, millimeter wave technology has been limited to military and scientific applications. The proposals set forth herein will encourage use of this technology in commercial products and services.

2. In particular, the Commission proposes to make available a total of 16 GHz of spectrum in the frequency range between 47.2 and 153 GHz on a shared basis with existing and future government users. The Commission also proposes to make available 2 GHz of spectrum in the 40.5-42.5 GHz band for non-government users for a total of 18 GHz. These new frequency bands will permit the development of short-range wireless radio systems with communications capacities approaching that now achievable only with coaxial and optical fiber cable. Such systems could support many short-range applications that require very high bandwidth or data transfer rates. Uses could include applications involving the National Information Infrastructure (NII); educational or medical applications such as remote wireless access to libraries or other informational databases; and non-communications uses such as automobile radar systems to avoid collisions. The proposed rules provide for the operation of such systems on both a licensed and an unlicensed basis. The Commission is also proposing

[1] The term millimeter wave frequency bands is take from the fact that the wavelength of radio signals on frequencies between 30 GHz and 300 GHz ranges between 1 and 10 millimeters.

technical standards for millimeter wave band equipment and operation.

3. The Commission believes that the proposals set forth herein will provide the American public with access to new products and communications services; provide new opportunities for American business and industry; and, promote new jobs and economic growth in the United States.

BACKGROUND

4. The radio spectrum above 40 GHz is generally unused at the present time[2] and until recently the technology to operate in this portion of the spectrum has been prohibitively expensive. In recent years, however, the U.S. Government has funded projects in millimeter wave technology for a number of military and scientific applications.[3] For example, such technology is used for guidance systems on "smart" munitions, for advanced radar systems, and for remote sensing applications. Given these advances, it now appears that millimeter wave technology can be used for more general radio communications applications.

5. Interest has also been shown in developing millimeter wave technology for vehicular radar systems. In this regard, we have received a petition for rule making from General Motors Research Corporation (GM) requesting that we permit the use of automotive radar systems in the 76-77 GHz band.[4] In its petition, GM indicates that its radar system would alert a driver to potentially hazardous situations in the path of the vehicle. It states that its proposed product would not cause harmful interference to existing or future communications users and would have a low susceptibility to receiving interference due to the type of modulation employed, the use of low transmit power and the use of a narrow beam antenna.[5]

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[2] While the Commission has allocated spectrum up to 275 GHz, it has not previously adopted service rules to permit general use of millimeter wave spectrum above 40 GHz. See 47 CFR Section 2.106.

[3] The U.S. Department of Defense's Advanced Research Projects Agency (ARPA) has invested over $550 million in the Monolithic Microwave Integrated Circuit Program (MIMIC) in order to decrease the production cost of this technology.

[4] See Petition for Rule Making filed by General Motors Research Corporation (RM-8308) on July 13, 1993.

[5] The frequency band 76-81 GHz is allocated primarily for radiolocation services. It is also allocated to the Amateur Radio Service on a secondary basis. See 47 CFR Section 2.106. GM states that, based upon discussions with a representative of the American Radio Relay League, this band is not currently used by amateur operators. GM indicates that only two operators currently use the 76-81 GHz band: an antenna test range used by the Georgia Institute of Technology, and a U.S. Government system, operated by Bell Labs in New York

GM also indicates that the 76-77 GHz band has been proposed for radar and future road guidance systems within Europe. GM states that allocation of the same spectrum in the U.S. would enable it to produce a single product for both the U.S. and Europe, permitting GM and other U.S. auto makers to control costs and enhance productivity.

6. Ford Motor Company (Ford), Chrysler Corporation (Chrysler), VORAD Safety Systems, Inc. (VORAD) and the American Automobile Manufacturers Association (AAMA) submitted comments responding to GM's petition. These parties request that we expand GM's proposal to include other frequency bands. For example, AAMA, which is composed of Ford, Chrysler and GM, indicates that its members desire to use spectrum in the bands 24.75-25.25 GHz, 37.5-38.5 GHz, 76-77 GHz, 92-95 GHz, 139-141 GHz and 152-154 GHz. VORAD requests that we allow operation of vehicular radar transmitters in 200 MHz of spectrum somewhere within the 46-50 GHz band. Reply comments supporting the positions of the commenting parties were filed by GM, VORAD, AAMA and Rockwell International Corporation (Rockwell).[6]

DISCUSSION

7. The millimeter wave region of the spectrum is a major resource that is essentially undeveloped and is unavailable today for commercial use. It has been our experience that opening regions of the spectrum to commercial applications and technologies fosters the development and growth of new industries and jobs. For example, opening spectrum in the 2 GHz range for commercial development on both a licensed and unlicensed basis for personal communications services (PCS) has stimulated investment and technological development in that spectrum that promise to bring tremendous benefits to consumers and the economy in the form of new communications services, lower costs and a more competitive industry.[7] Opening certain unlicensed bands to spread spectrum technology only a few years ago has similarly stimulated rapid commercial development of that technology so that today millions of spread spectrum devices are used by numerous businesses and other users for such diverse applications as remote meter reading, utility load management, voice-secure cordless

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and New Jersey for research.

[6] While we are including GM's petition and the comments filed thereon in this general proceeding on use of the millimeter wave spectrum, we may later choose to act on these issues separately if doing so would expedite the implementation of vehicular radar systems.

[7] See Amendment of the Commission's Rules to Establish New Personal Communications Services, GEN Docket No. 90-314, Second Report and Order, 8 FCC Rcd 7700 (1993), Memorandum Opinion and Order, 9 FCC Rcd 5947 (1994)

telephones, and radio local area networks.[8] We believe that opening portions of the millimeter wave spectrum will similarly stimulate new applications of radio technology for the American public, facilitate technology transfer from the military sector, and create opportunities for economic growth and jobs. This action will also promote United States competitiveness internationally by enabling development of technology for potential use in other parts of the world.[9]

8. The propagation of millimeter wave radio signals is more limited than that of radio signals at lower frequencies. Signals in the millimeter wave bands are significantly affected by the presence of oxygen and water vapor within the atmosphere. Absorption and scattering caused by oxygen and water vapor limit the range of millimeter wave transmissions to a few kilometers almost regardless of the power used.[10] While the limited range of such transmissions might appear to be a major disadvantage, the ability to reuse frequencies within very short distances will allow a higher concentration of transmitters to be located in a geographical area than is possible with lower-frequency transmitters.[11] In addition, the wide bandwidth that is possible in the millimeter wave spectrum can support the operation of

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[8] See First Report and Order in GEN Docket No. 81-413, 101 FCC 2d 419 (1985), adopting rules in Part 15 for low power spread spectrum devices. The Part 15 spread spectrum rules were recodified and clarified in the First Report and Order in GEN Docket No. 87-389, 4 FCC Rcd 3493 (1989). See also Report and Order in GEN Docket No. 89-354, 5 FCC Rcd 4123 (1990), amending Parts 2 and 15 of the rules with regard to operation of spread spectrum systems. See 47 CFR Section 15.247.

[9] We note that other parts of the world, such as Europe and Japan, are also considering commercial uses of millimeter wave technology.

[10] The amount of signal attenuation due to absorption and scattering varies with frequency and other factors. Attenuation caused by oxygen is significant throughout the millimeter wave spectrum, but increases dramatically at frequencies around 60 GHz and 120 GHz. Attenuation caused by water vapor varies based on temperature and relative humidity, but generally increases with frequency. Rain, snow, hail, and fog can all affect the range of millimeter wave transmissions. For a more detailed discussion of atmospheric attenuation in the millimeter wave spectrum, see ITU CCIR Report 719-3.

[11] See The Use of the Radio Frequency Spectrum Above 30 GHz: A Consultative Document, Department of Trade and Industry, Radiocommunications Division, London, September 1988. This document quantifies the relationship of frequency reuse to useful communications working range for various frequencies. In the millimeter wave spectrum, especially near 60 GHz, there is a tremendous frequency reuse potential which differs dramatically from lower bands.

wireless communications links with capacity approaching that of coaxial cable and fiber-optic systems.[12]

9. Millimeter wave spectrum is suitable for many types of short-range communications systems. The large amount of spectrum available at these frequencies can accommodate the wide channel bandwidth that is needed for rapid transmission of large volumes of data. For example, millimeter wave technology applications could include transmission of high resolution video images, access to large data bases, and communication system backbones. Such systems could also provide short-range wireless access to the NII with wider bandwidth, and therefore greater capacity, than is available from systems operating in lower frequency bands. While spectrum to accommodate wide bandwidth applications is becoming scarce below 40 GHz, the millimeter wave region of the spectrum is largely unused and can accommodate those bandwidths. In addition, as indicated by GM and other automotive vehicle manufacturers, these frequencies can be used for many types of vehicular applications, such as collision avoidance radars and highway guidance systems.

10. Section 303(g) of the Communications Act (Act) directs the Commission to "generally encourage the larger and more effective use of radio in the public interest."[13] In addition, Section 7 of the Act states that "[i]t shall be the policy of the United States to encourage the provision of new technologies and services to the public."[14] One of the ways we accomplish these statutory goals is to continually seek opportunities to encourage new product development in the telecommunications industry. New products result in economic development and job growth in the United States, and provide the American public with access to new and innovative communications technologies. The proposals set forth herein are intended to further these goals.

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[12] Bandwidth limitations, modulation techniques used, and signal-to-noise ratios restrict the ability of existing radio communications systems to transmit data at high rates. For example, early Personal Communications Service (PCS) systems are expected to accommodate data rates of approximately 64,000 bits/second, although PCS systems may ultimately be able to support data rates of 1,000,000 bits/second (1 Megabit/second) or more by using different modulation or channeling schemes. Today's optical fiber cable systems are capable of carrying data at rates of 1,000 Megabits/second or more. Because of the large amount of bandwidth available in the millimeter wave spectrum, transmission of data rates ranging from 50 Megabits/second up to 5,000 Megabits/second, or more, are possible depending upon the frequency band.

[13] See 47 U.S.C. Section 303(g).

[14] See 47 U.S.C. Section 157.

Proposed Frequency Bands

11. We are proposing to open a total of 18 GHz of spectrum between 40.5 and 153 GHz for commercial development. All of the spectrum above 40 GHz, with the exception of the 40.5-42.5 GHz band, several Amateur Radio Service allocations, and a Government satellite allocation[15], is allocated on a shared basis to government and non-government use, and most of the bands we are proposing to open for commercial use will continue to be available for existing and future government use. Thus, in cooperation with the Department of Commerce's National Telecommunications Information Administration (NTIA),[16] we are proposing twelve frequency bands in the region of the spectrum from 47 GHz to 153 GHz for potential use by new millimeter wave technologies. These frequency bands are:

47.2 - 48.2 GHz
59.0 - 64.0 GHz
71.0 - 72.0 GHz
76.0 - 77.0 GHz
84.0 - 85.0 GHz
94.7 - 95.7 GHz
103.0 - 104.0 GHz
116.0 - 117.0 GHz
122.0 - 123.0 GHz
126.0 - 127.0 GHz
139.0 - 140.0 GHz
152.0 - 153.0 GHz.

We are also proposing to permit commercial use in the 40.5-42.5 GHz band which is already allocated entirely to non-government use.

12. In developing this proposal, we have attempted to identify frequencies where it is unlikely that interference would occur to government and non-government communications services that already exist or are planned.[17] Further, we have attempted to provide large,

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[15] 43.5 - 45.5 GHz.

[16] NTIA has responsibility for managing use of the radio spectrum by the federal government and its agencies.

[17] In general, we have tried to propose frequency bands that are not currently being used. However, in some cases we have proposed bands in which government or other non-government services may eventually operate. For example, the Federal Aviation Administration is conducting research into new flight safety systems that might operate in millimeter wave spectrum. The National Oceanic and Atmospheric Administration ("NOAA") indicates that it plans to use the 60.4-61.2 GHz band for weather satellites beginning in late 1995. We do not believe that our proposals would preclude these possible future uses or

contiguous blocks of spectrum in order to accommodate the high data rate and wide bandwidth requirements anticipated for millimeter wave operations and technologies. We request comment on our proposed list of bands to be made available for use by millimeter wave technologies. In particular, we invite interested parties to address the suitability of the specific bands identified for use by millimeter wave technologies and, if appropriate, to suggest alternative bands that might be desirable to make available for use at this time.[18] We also invite suggestions for rules that would enhance the use of specific bands for particular services.[19]

13. We are tentatively proposing an approximately even division of available millimeter spectrum between licensed services and unlicensed uses, with unlicensed spectrum further divided between general unlicensed devices and unlicensed vehicular radar systems. We recognize potential benefits in licensing exclusive access to millimeter wave spectrum for the provision of certain kinds of communications services. Certain applications, particularly those covering wide areas or requiring large investment in infrastructure, may not be able to accept the restrictions that accompany unlicensed use or, may require the additional protection from interference that can be afforded under a licensed service. The interference management capability provided by a licensing system would permit higher output power levels and more flexible technical standards than for unlicensed, non-coordinated users. In addition, a significant demand for licensed services on frequencies below 40 GHz[20] indicates that there would be demand for licensed spectrum in nearby millimeter wave regions with similar propagation and technology.

14. In general, unlicensed use may be justified for a limited amount of spectrum because of high transactions cost associated with charging for spectrum used by the envisioned low power devices and the limited interference among users, given restrictions on power and imposition of spectrum sharing etiquettes. That is, some services that would be provided in

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prejudice any future decisions that may be taken with regard to authorizing such services.

[18] With regard to NOAA's plan to use the 60.4-61.2 GHz band, we note that the unique properties of this band will enable satellite sensors looking down into the atmosphere to determine the temperature at different heights above the earth. Parties are requested to provide detailed analysis and comment on whether terrestrial use of the 60.4-61.2 GHz band would interfere with NOAA's planned operations in that band and, in particular, whether this portion of the band should be excluded from the frequency bands that may be authorized for millimeter wave technology under this proceeding.

[19] The specific frequency bands we are proposing, along with their technical standards, may be altered in the final rules based on comments from both government and non-government parties.

[20] For example, many parties have expressed interest in obtaining licenses near 38 GHz in order to provide PCS backhaul services.

unlicensed bands may not be optimally provided in licensed bands because they have the characteristics of a public good. Once the power limits and etiquettes have been set, it may not be efficient for a licensee to charge for entry, because one person's use is not likely to interfere with another person's use. But a licensee would wish to charge for entry to maximize profits. Thus allocating all spectrum to licensed use would result in under-provision of such services. Our experience with the Part 15 spread spectrum rules[21] and with unlicensed 2 GHz PCS has shown us that there is a potentially significant demand for unlicensed devices, some of which involve the application of military technology to novel commercial uses. Restricting power and permitting unlicensed use are not costless, however, since they foreclose uses of that spectrum that require higher power. Ideally, a cost-benefit analysis would be used to determine an efficient allocation of spectrum for such low power devices. A decision to allocate additional spectrum to unlicensed use would require a showing that the value of the increase in net benefits in unlicensed use exceeds the market value of comparable spectrum (i.e., the opportunity cost of the spectrum in licensed use).

15. Although a full cost-benefit analysis may not be feasible, such an analysis would likely conclude that a greater proportion of the millimeter spectrum should be allocated to unlicensed use than has been the norm in lower frequency ranges. In the millimeter spectrum, interference potential and scarcity are less of a concern because the physical characteristics (wide bandwidth and limited range) greatly reduce the potential for interference and the demand is - or at least has been - light. Thus, it would appear that a larger portion of the expected uses of millimeter spectrum (particularly those that can operate satisfactorily with short range, reduced bandwidth and/or highly directional antennas) can coexist on an unlicensed basis without mutually interfering with each other or reducing the amount of spectrum available to each other. For this reason, we are proposing to allocate approximately half of the spectrum available for commercial development for use on an unlicensed basis.

16. At this time, we believe that it is appropriate for vehicular radar systems to operate on an unlicensed basis. It appears that such systems pose little risk of mutual interference in this spectrum due to the low power and directional nature of transmissions. We seek comment on whether we should include the provisions for vehicular radar systems in specific bands allocated exclusively for unlicensed use under Part 15 of our rules. Due to the safety nature of vehicular radar systems and the lack of experience of such systems sharing with totally different technologies, we tentatively find that they should have exclusive bands until we can develop sharing criteria that would allow other users to share these bands.

17. In order to decide which bands should be proposed for each of the three categories described above, we considered the nature of propagation, the proximity to existing bands, and the specific requests we have received for vehicular radars. Thus, we are proposing that the lowest bands, 40.5-42.5 GHz and 47.2-48.2 GHz, be used mostly for licensed applications since they are less than 10 GHz away from an existing band that has similar propagation

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[21] See 47 CFR 15.247.

characteristics and similar equipment technology. However, since we had a request for vehicular radars in this region, 47.2-47.4 GHz be designated for unlicensed vehicular radars. Since 59-64 GHz has the most severe propagation losses we find that there is minimal chance of interference and propose that the whole band be used for unlicensed devices. For the higher frequency bands in which propagation is poor compared to the 47 GHz band but not as limiting as in the 59-64 GHz band, we are proposing a mixture of uses. We propose that some bands be used only for vehicular radars in response to requests we have received. For the remaining bands, we are proposing that each band be evenly split between licensed and unlicensed uses in order to enable both types of applications. These proposals are described in more detail in the following sections. We seek comment on whether this is the appropriate split between licensed and unlicensed uses.

18. General Unlicensed Device Bands. The extremely limited propagation range of the 59-64 GHz band, as well as higher millimeter wave frequency bands, suggests that major portions of those bands be designated for general use by unlicensed devices.[22] Therefore, we are proposing to provide the following frequency bands for unlicensed operations under Part 15 of our rules: 59-64 GHz, 71.5-72.0 GHz, 84.5-85.0 GHz, 103.5-104.0 GHz, 116.5-117.0 GHz, 122.5-123.0 GHz, 126.5-127.0 GHz, and 152.5-153.0 GHz. This would provide 3.5 GHz in seven of the frequency bands and 5 GHz in an eighth band, for a total of 8.5 GHz for general unlicensed operations.

19. Part 15 devices generally operate on a non-interference basis in spectrum assigned for licensed services. However, it is our intention at this time that non-government licensed and unlicensed uses generally not be permitted in the same bands. Given the large number of unlicensed devices that are likely to be operating in these bands, the difficulty of resolving interference problems involving such unlicensed devices, and the current availability of other millimeter wave spectrum, we believe sharing of spectrum by unlicensed and licensed operators would not be workable.

20. Licensed Service Bands. Based on the demand for licensed services below 40 GHz, we are proposing to designate all of the 40.5-42.5 GHz band and virtually all of the 47.2-48.2 GHz band for licensed use (except for a small portion that would be designated for vehicular radar use, as indicated below). Similarly, we are proposing that portions of the bands above 64 GHz that are not designated for vehicular radar use be designated for licensed use.[23] In particular, we are proposing to provide spectrum for licensed services in each of the

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[22] See note 9.

[23] We are not proposing any licensed use in the 59-64 GHz band because its propagation range is extremely limited.

following bands: 40.5-42.5 GHz[24], 47.4-48.2 GHz, 71.0-71.5 GHz, 84.0-84.5 GHz, 103.0-103.5 GHz, 116.0-116.5 GHz, 122.0-122.5 GHz, 126.0-126.5 GHz and 152.0-152.5 GHz. Comments are requested on whether the proposed total of 6.3 GHz of spectrum for licensed operations will be sufficient to meet the needs of those operations where licensing is appropriate.

21. Despite range limitations and the current high cost of technology, there may be many potentially valuable uses of licensed spectrum above 40 GHz. The current allocations for these bands in the ITU and the U.S. domestic allocation tables include a wide diversity of terrestrial and satellite services of a fixed, mobile or broadcasting nature. Furthermore, the 1992 World Administrative Radio Conference (WARC-92) adopted several changes to the International Table of Frequency Allocations that may need to be reflected in changes to our Table of Frequency Allocations, contained in Section 2.106 of our rules. In particular, Space Research (space-to-earth) use was added as a secondary allocation for the 76-81 GHz band. We are proposing to adopt this WARC-92 related allocation change in this proceeding.[25] At present, there is little information as to which of these potential services represent the highest valued use of this spectrum. We therefore propose to retain the full range of services presently allowed under the allocation table; in other words, any of the services currently listed in the allocation table will be permissible. For convenience, we will refer to these uses collectively as "Licensed Millimeter Wave Service", or LMWS. We propose to incorporate this service into Part 21 of our rules.

22. While we are retaining the broad flexibility in the current allocation table, we must also prescribe rules for the licensing of this spectrum. Normally, licensing issues are determined in the context of a specific service. However, because of the wide range of services that we propose to permit in this spectrum, a different approach is required. In this case, we will define licensing rules based on our best judgement of what the dominant use of this spectrum is likely to be rather than designing them around a prescribed use. We believe that in this instance precision is less important because of the broad degree of flexibility that is being provided and the ability of the market to adjust. The important objective is to open this spectrum for commercial development and to eliminate the current regulatory barriers and uncertainties that now prevent this spectrum from being used.

23. We believe that many of the uses of millimeter spectrum are likely to be technically and operationally similar to those contemplated in the 28 GHz band for the Local Multipoint

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[24] This band is subject to footnote US211 in our Table of Allocations, 47 C.F.R. 2.106, which deals with protecting radio astronomy users in adjacent bands. We are excluding air-to-ground uses from the present proposals as it may be impractical to protect these users. Any space-to-earth use would have to demonstrate protection of radio astronomy users.

[25] In addition, the 84-86 GHz band is allocated on a world-wide basis for broadcasting and satellite broadcasting, although the U.S. has not yet implemented this allocation domestically.

Distribution Service (LMDS), e.g., fixed point-to-point and point-to-multipoint services for video, voice and data transmission to subscribers throughout an area. We therefore propose to model our licensing rules for the millimeter bands after the rules and procedures proposed for LMDS.[26] Comments are invited as to any modifications to the proposed LMDS rules that may be appropriate in the licensing of millimeter spectrum. In the 28 GHz band, we proposed to divide the available spectrum (in that case a total of 2 GHz) into two license blocks of 1000 MHz for exclusive assignment in each area. We propose a similar division of spectrum in the millimeter bands. Thus, for example, the 47.4-48.2 GHz licensed band would be divided into two 400 MHz contiguous blocks. Comments are requested on whether this is an appropriate division of spectrum in these bands and on whether the licensed blocks should be contiguous or further subdivided into paired blocks to facilitate duplex (two-way) transmission.

24. In the 28 GHz band, we proposed to use Rand McNally "Basic Trading Areas" as the service areas for LMDS licenses.[27] However, in that proceeding, the particular type of service was more narrowly prescribed and specific technologies had been proposed which suggested BTA service areas. In the millimeter wave bands, however, we are proposing to allow a much broader range of uses and technologies, some of which may require larger service areas. Also, larger service areas will facilitate the setting of technical standards, reduce coordination requirements between adjoining licensees, and produce larger economies of scale, which could be especially important during the initiation of new services. For these reasons, we are proposing to use Rand McNally Major Trading Areas (MTAs) in the licensing of LMWS rather than the BTAs used in the 28 GHz band.[28] We also propose, as we did in the 28 GHz

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[26] See, Notice of Proposed Rulemaking, Order, Tentative Decision and Order on Reconsideration, CC Docket No. 92-297, 8 FCC Rcd 557 (1993). We are not including in Appendix B specific proposed Part 21 rules for the Licensed Millimeter Wave Service since we are proposing that those rules be very similar to the rules proposed in the LMDS proceeding.

[27] id, at para. 30.

[28] Major Trading Areas (MTAs) are defined in the Rand McNally 1992 Commercial Atlas & Marketing Guide, 123rd Edition, pages 36-39. There are 47 MTAs as defined by Rand McNally. As we have done in other services in which we have used MTA license areas, we propose to separate Alaska from the Seattle MTA and license it as a separate MTA-like area. We also propose to separately license the following three additional MTA-like areas: (1) Guam and the Northern Mariana Islands; (2) Puerto Rico and the United States Virgin Islands; and (3) American Samoa. Thus we will license a total of 51 MTA or MTA-like areas on each spectrum block. We note that Rand McNally & Company owns the copyright to MTA/BTA Listings, which list the BTAs contained in each MTA and the counties within each BTA, as embodied in Rand McNally's Trading Area System MTA/BTA Diskette, and geographically represented in the map contained in Rand McNally's Commercial Atlas & Marketing Guide. Rand McNally has licensed the use of its

band, to limit each LMWS licensee to a single spectrum block in each band in the same area. Thus, a given entity would be allowed to own one LMWS license in each band in the same area but would not be permitted to own both licenses in the same band in any area.

25. In the 28 GHz proceeding, we proposed a number of regulations (e.g., mandatory buildout requirements, financial qualifications and transfer restrictions) aimed at deterring speculation, on the assumption that lotteries would be used as the licensing procedure. However, we propose to use auctions to award LMWS licenses, and thus licensees would have much less incentive to engage in uneconomic warehousing or other forms of speculation. We tentatively conclude that mandatory buildout requirements and transfer restrictions for LMWS would reduce licensee flexibility and reduce the ability of licensees to put this spectrum to its highest valued use. We also tentatively conclude that the use of auctions to award LMWS licenses will ensure that applicants are financially qualified. Thus, we do not propose to adopt additional financial qualifications for LMWS applicants. We seek comment on these tentative conclusions. In the LMDS proceeding, we proposed a five- year license term. However, in the millimeter spectrum, development and implementation times are likely to be significantly longer than at 28 GHz. Thus, to encourage the longer term investment that will be required to develop and market commercial applications in the millimeter spectrum, we propose a ten-year license term. We also propose to adopt renewal expectancy rules for LMWS licenses and request comment on the details of such rules.

26. Section 309(j)(1) of the Communications Act, as amended, 47 U.S.C. § 309(j)(1), permits auctions only where mutually exclusive applications for initial licenses or construction permits are accepted for filing by the Commission and where the principal use of the spectrum will involve or is reasonably likely to involve the receipt by the licensee of compensation from subscribers in return for enabling those subscribers to receive or transmit communications signals. We conclude that the principal use of millimeter wave spectrum as licensed in the manner we are proposing is likely to be of a commercial nature and involve the receipt by the licensee of compensation from subscribers in return for enabling those subscribers to receive or transmit communications signals and would thus meet the statutory requirements for the use of auctions. We also conclude that the use of competitive bidding in licensing millimeter spectrum will serve the public interest by recovering for the public a portion of the value of the spectrum, as envisioned in Section 309(j)(3)(C), id, and by awarding licenses to those who value them the most and thus are most likely to introduce service most rapidly to the public. Thus, we propose to use auctions to award LMWS licenses in the case of mutually exclusive applications. Comments are requested on these conclusions and on any special provisions that may be needed to meet the objectives of Section 309(j)(3)(B), id, of "promoting economic opportunity" and "avoiding excessive

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copyrighted MTA/BTA Listings and maps for certain services such as PCS and 800 MHz SMR. At present, however, services in millimeter wave spectrum above 40 GHz are not covered by this agreement. We encourage interested parties and Rand McNally to explore the extension of the current agreement to cover the proposed LMWS as well.

concentration of licenses" by disseminating licenses "among a wide variety of applicants." In the Second Report and Order in PP Docket No. 93-253, 9 FCC Rcd 2348 (released April 20, 1994), (Second Report and Order), we adopted rules which provide the Commission with a menu of options to choose to promote these objectives with respect to particular spectrum serves to be auctioned.

27. In the Second Report and Order, id, we also adopted criteria that we would use in determining the method of auction in particular services. Based on these criteria, we propose that LMWS licenses be auctioned using a simultaneous multiple round bidding procedure. The use of this method is indicated where the expected value of licenses is high compared to the cost of conducting the auction and the values of licenses are interdependent. See Second Report and Order at ¶ 177. We believe these licenses will be highly valued because of the wide range of services and technologies that are permitted and because of indications of high demand for spectrum in the 28 GHz band, which has similar technical and operational characteristics to millimeter bands. We also conclude that LMWS licenses in one area are likely to be of greater value when combined with licenses in other areas and are therefore interdependent. Also, because of technical and operational similarities across the several bands to be licensed, licenses in one band may be close substitutes for those in other bands, thus indicating the need for a simultaneous auction. Comments are requested on these conclusions.

28. We seek to ensure that spectrum is used in the way that brings most value to the public. Therefore, we invite response to several questions we have about area-wide licensing and the use of competitive bidding. First, is there a significant commercial or other interest in obtaining exclusive, area-wide use of millimeter wave spectrum? If so, what size spectrum blocks and licensing areas should be used? Second, should the spectrum be free of U.S. government operations or the requirement for coordination with the Government in order for commercial use thereof to be viable? As mentioned previously, the millimeter wave spectrum is currently shared between U.S. government and non-government users. It would take additional time for us to negotiate such non-government exclusivity with NTIA, potentially resulting in a significant delay in the implementation of millimeter wave technology.[29]

29. Unlicensed Vehicular Radar System Bands. As noted previously, the automobile industry is actively developing vehicular radar systems for use in various millimeter wave bands. We note that such technology is envisioned as a key feature of the Intelligent Vehicle Highway System, which is intended to offer significant benefits to the American public by

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[29] We are proposing to require that all non-government uses of shared millimeter wave frequency bands be coordinated with NTIA unless we are able to negotiate non-government exclusivity. Information on U.S. Government assignments would be made available to the public except when necessary to meet national security concerns. Comments are invited regarding the information that non-government licensees may need on existing or planned government operations to affect coordination.

improving highway safety. In view of the promise and importance of this technology, and its intended use for public safety purposes, we believe it merits special consideration. We tentatively conclude that it is appropriate to take steps to minimize the likelihood of interference to such systems, notwithstanding the assertions of the automobile manufacturers that this technology would have a low susceptibility to receiving interference. Accordingly, we are proposing to designate three of the twelve millimeter wave bands, as well as part of a fourth band, for use by vehicular radar systems and we are not proposing any other new uses for them at this time. These bands are: 47.2-47.4 GHz, 76.0-77.0 GHz[30], 94.7-95.7 GHz, and 139.0-140.0 GHz. This would provide 3.2 GHz of spectrum for vehicular radar systems.

30. In developing this proposal we have attempted to satisfy the automobile manufacturers' requests for spectrum for vehicular radar systems. Three of the bands we are proposing for vehicular radar systems are within the bands suggested by the automobile manufacturers. We are also proposing 200 MHz of spectrum in the 46-50 GHz band, as requested by VORAD. With regard to the 37.5-38.5 GHz band, we note that parties seeking to future provide PCS services are planning to use this band to connect PCS base stations.[31] We believe that new users operating in the 37.5-38.5 GHz band could cause interference to future PCS operations, and thus have not proposed use of this band for vehicular radar systems. We have not proposed to allow operation in the 24.75-25.25 GHz band because of possible interference to aviation radionavigation systems operating under Part 87 of our rules. We also have not proposed to allow unlicensed operation in the 92.0-94.7 GHz band due to concerns expressed by NTIA about possible interference to government operations. However, we are proposing to allow vehicular radar systems in the nearby 94.7-95.7 GHz band. With regard to AAMA's request for spectrum in the region of 152-154 GHz, we have elected to instead make spectrum available in this region for licensed fixed services and unlicensed devices. The information received to date from the vehicular radar proponents has contained few details on the justification for the amount of bandwidth required in each band and how the bandwidth affects equipment cost and performance. While we do not want to prejudge which bands might ultimately be most effective for various vehicular radar applications, we are also concerned about the number of bands which have been proposed. More specific information on the number of bands needed and the amount of spectrum required in each band would be very helpful in our deliberations on these questions.

Alternative Approaches

31. Although we are proposing one approach for dividing the millimeter wave frequency bands between licensed services, general unlicensed devices, and vehicular radar systems, we

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[30] This band is also allocated to the Amateur Radio Service and is available for use under Part 97 of our Rules. This allocation and its service rules are not affected by this proceeding.

[31] See Second Report and Order, GEN Docket 90-314, 8 FCC Rcd 7700 at 7741, para. 95 (1993).

invite discussion on alternative approaches. For example, could (or should) unlicensed devices and licensed services be permitted to operate in the same frequency bands? Could vehicular radar systems operate safely (i.e., without causing or receiving harmful interference) in frequency bands that also are assigned for other unlicensed devices or for licensed use? If not, are there any compatible highway information or safety services that could operate safely in the bands set aside for vehicular radar systems? Should we change the proportion of spectrum for unlicensed devices, licensed services, and vehicular radar systems? The final rules that are adopted in this proceeding may change significantly from those proposed herein based on the comments and recommendations that are received.

32. The spectrum involved in this proposal, except for the 40.5-42.5 GHz band, is all shared with government users at this time. The LMWS concept outlined above would either involve government users sharing the same spectrum as the licensee[32] or require coordinating each LMWS license before issuance with NTIA. We request comment on the feasibility of these two possible approaches or alternatives to them. If neither of these approaches are possible we may have to request that NTIA agree to an exclusive non government allocation in the licensed bands or use a more traditional approach of licensing individual systems on a first-come-first-served basis, e.g., as we now do for point-to-point systems under Parts 21, 74, 78 and 94 of our Rules, rather than issuing flexible, wide area licenses. We request comments on these alternatives.

Proposed Technical Standards and Equipment Authorization Requirements

33. Licensed Services. Consistent with our assessment that the millimeter wave bands offer the potential to support a large variety of new radio technologies and services, we are proposing to allow licensees broad flexibility to choose the technologies and bandwidth of fixed applications that they operate in these bands, subject only to technical rules intended to minimize interference to other licensed users of these bands. In particular, we are proposing to limit the power of licensed transmitters in the proposed frequency bands to 16 dBW equivalent isotropically radiated power (EIRP). This is based on: 1) an assumed limit of -20 dBW of transmitter power, which is likely to be typical of commercially-affordable microwave integrated circuits in the near future; and, 2) an antenna gain of 36 dB, which we believe will be typical of economical antennas and transmission systems in the near future. We propose to permit either direct EIRP measurements or indirect calculations based on transmitter power and antenna gain measurements. Because of the broad flexibility we are proposing in the use of licensed bands, we will consider higher power limits on a case-by-case basis subject to coordination with affected licensees. Comments are requested on the need for field strength limits at the boundaries of licensed service areas and on the need for rules requiring interference coordination between licensees in adjoining service areas.

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[32] Thus both the Government and the licensee could expand their existing systems or add new systems within the service area. Each new Government or licensed transmitter would be prohibited from interfering with previously-authorized and installed uses.

34. We are proposing the same spurious emissions and frequency stability requirements for licensed devices as unlicensed devices. For licensed devices, these limits would apply to emissions outside the assigned spectrum block in which the transmitter is operating. We invite comment as to whether licensed devices should be subject to somewhat different requirements. For example, we note that the spurious emission standard may be more difficult to meet for licensed equipment due to the higher power permitted for the transmitter. With regard to frequency stability, we note that we normally require compliance over a temperature range of -20 to +50 degrees Celsius for products operating under Part 15 and -30 to +50 degrees Celsius for products operating under many licensed services. We invite comment as to whether it is appropriate to establish different temperature range requirements for frequency stability for unlicensed and licensed equipment. We also request comments as to whether susceptibility standards may be appropriate or necessary for licensed equipment.

35. We are proposing that transmitters operating in the licensed millimeter wave bands be subject to type acceptance by the Commission prior to marketing. The type acceptance procedure, which is generally similar to the certification procedure used with unlicensed devices, is described in 47 CFR Section 2.981, et seq. It requires that tests be performed to measure the levels of radio frequency (RF) energy that are radiated by the device into the open air or conducted by the device onto the power lines. After these tests have been performed, a report must be produced showing the test procedure, the test results, and some additional information about the device including design drawings.

36. Our rules do not provide any relevant guidance on type acceptance measurement procedures for the millimeter wave spectrum. Nor are we aware of any measurement procedures developed in the private sector that may be appropriate. Accordingly, we are proposing only that measurements for type acceptance purposes be in accordance with good engineering practice. We are, however, generally proposing the same requirements on measurement frequency range and instrumentation as we are proposing for unlicensed devices. We invite comment on this proposal and alternatives.

37. We are considering in a separate proceeding the appropriate RF safety exposure standard for radio transmissions, including millimeter wave band operations, to be incorporated into our rules.[33] It is our intention to ultimately adopt millimeter wave band

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[33] See Notice of Proposed Rule Making, ET Docket No. 93-62, 8 FCC Rcd 2849 (1993). Our current rules specify the use of the American National Standard ANSI C95.1-1982, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz" for evaluating the environmental effects of RF radiation. See 47 CFR Section 1.1301, et seq. The Notice of Proposed Rule Making proposes to use a newly-developed standard, IEEE C95.1-1991 (ANSI/IEEE C95.1-1992), "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz." For frequencies above 15 GHz, ANSI C95.1-1982 is generally more restrictive than IEEE C95.1-1991. We are proposing to defer any decisions about relevant RF safety exposure

rules that will ensure millimeter wave equipment meets the relevant RF exposure standards. Since we are limiting our proposal for licensed operation to fixed services, we believe it is appropriate to apply the relevant RF exposure standards for controlled environments.[34]

38. Unlicensed Devices. We are proposing Part 15 rules that would allow the use of millimeter wave technology for virtually any short-range communications application, with only minimal technical restrictions intended to minimize interference and to avoid potential safety concerns. Specifically, we propose to limit the peak power density of unlicensed Part 15 millimeter wave transmitters, except those used in vehicular radar systems, to 200 nanowatts/square centimeter at a distance of 3 meters from the antenna.[35] We believe that this limit will accommodate the needs of low-power, unlicensed users. It will also help ensure that unlicensed millimeter wave devices, which could be located virtually anywhere at distances potentially very close to users, comply with the relevant RF safety standards.

39. As noted above, we currently have a proceeding pending to consider new standards for RF exposure from radio frequency equipment. The power levels we have proposed for unlicensed millimeter wave transmitters comply with the IEEE C95.1-1991 standard for uncontrolled environments at distances in excess of 2 cm from the antenna. However, we note that comments filed in ET Docket No. 93-62 suggest that a more stringent RF exposure guideline may be appropriate.

40. We invite comment on whether our proposed power limit is appropriate and whether we should require compliance with the IEEE standard at a distance other than 2 cm from the antenna.[36] In addition, we request comments on alternative approaches that could be implemented to assure that Part 15 millimeter wave technology devices are used safely. One approach could be to permit the approval of devices with higher power levels provided they have design features that preclude excessive human exposure to RF signals.[37]

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standards pending completion of that proceeding. However, should this proceeding be completed prior to completion of ET Docket No. 93-62, any millimeter wave band rules that do not conform with the new RF exposure guidelines would be modified accordingly.

[34] See Notice of Proposed Rule Making, ET Docket No. 93-62, supra, at 12, for discussion about the definition of a controlled environment.

[35] This is comparable to 0.25 watts EIRP.

[36] The power of unlicensed millimeter wave devices could be increased if we permitted compliance with the IEEE standard at a greater distance.

[37] Such design features could include circuitry to automatically turn off the transmitter if a person comes too near to the antenna, or physical protective enclosures to keep people at least a certain distance from the antenna.

41. In order to protect other radio services from harmful interference, we propose to limit spurious emissions from unlicensed transmitters operating above 40 GHz to 2 picowatts/square centimeter measured 3 meters from the radiating source. This limit would apply to emissions outside the allocated band in which the transmitter is operating. With regard to frequency stability, we propose to require that fundamental emissions remain confined within the operating band under all conditions of operation, including changes due to frequency tolerance of the stabilizing circuitry and frequency drift over the product's operating temperature range. The temperature range over which compliance must be maintained would be -20 to +50 degrees Celsius, with an input voltage variation of 85 percent to 115 percent of rated input voltage. This is consistent with the current temperature range and voltage variation requirement for other products operating under Part 15. We solicit comment as to whether we should adopt a more specific requirement, such as a frequency tolerance specified in parts-per-million.

42. In discussions with NTIA, concern has been expressed about the susceptibility of non-government operations to interference from government operations. We note that under Part 15, unlicensed devices must accept any interference received.[38] We also note that, although we have specific legal authority to set mandatory standards regarding the ability of home electronic equipment to be unaffected by interference received from other devices, we have never implemented such requirements.[39] Finally, we recognize that industry often develops voluntary standards to address potential susceptibility problems.[40] Nevertheless, we appreciate the general concerns of government interests and invite comments as to whether we should rely on voluntary standards to address potential susceptibility problems associated with millimeter wave devices, or whether it may be advisable to establish mandatory standards governing the susceptibility of unlicensed equipment operating in the millimeter wave bands.[41]

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[38] See 47 CFR Section 15.5.

[39] See 47 U.S.C. Section 302(a).

[40] The Electronic Industries Association has developed RF susceptibility standards for TV receivers. See, for example, ANSI/EIA 544-1989, "Immunity of TV and VCR Tuners to Internally Generated Harmonic Interference from Signals in the Band 535 kHz to 30 MHz." The International Electrotechnical Commission and the Special International Committee on Radio Interference (CISPR) have also developed, and are developing, a number of susceptibility standards that can be applied to a variety of electrical and electronic products. See, for example, IEC Publication 801-3 (1984), "Electromagnetic Compatibility for industrial-process measurement and control equipment; Part 3: Radiated electromagnetic field requirements".

[41] Typically, we have refrained from adopting standards regarding the level of interference that home electronic equipment must be able to withstand because we have felt such requirements could pose an excessive and unneeded regulatory burden. Instead, we have generally relied on the manufacturers and users of Part 15 devices to correct any problems

If mandatory standards are deemed necessary, we request comment on appropriate susceptibility requirements to adopt. If mandatory standards are deemed not necessary, we invite comments as to the information that unlicensed device manufacturers may require about government operations to enable design of equipment that will be less susceptible to interference from such systems.

43. Part 15 transmitters are subject to the equipment authorization procedure of certification, as specified in Section 2.1031, et seq., of our rules.[42] The certification procedure requires that tests be performed to measure the levels of RF energy that are radiated by the device into the open air or conducted by the device onto the electrical power lines. After these tests have been performed, a report must be produced showing the test procedure, the test results, and some additional information about the device, including design drawings. We propose to subject unlicensed millimeter wave transmitters to the certification requirements.

44. The current Part 15 rules do not include a specific measurement procedure for devices operating above 40 GHz. However, several general requirements which are pertinent for devices operating above 40 GHz are contained in Sections 15.31 of the rules , as well as the requirements in Sections 15.33 and 15.35 on the frequency range over which tests must be performed and the measurement instrument detector function and bandwidth. We expect that, at least initially, we may certify equipment under the general guidance provided in these sections and in accordance with good engineering practice. However, comments are invited on whether more specific guidance is needed for measurements performed on devices operating above 40 GHz and, if so, what measurement procedures are appropriate.[43]

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they encounter or for industry to develop voluntary standards for susceptibility. However, we recognize a lack of such standards can cause interference problems that may be difficult to resolve. Furthermore, we recognize that many other countries, including Canada and countries in Europe, adopt mandatory receiver and antennas standards as part of their overall interference protection plan.

[42] 47 CFR Section 2.1031, et seq.

[43] For unlicensed Part 15 transmitters operating on frequencies below 40 GHz, we apply the measurement procedures contained in "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz", ANSI C63.4-1992, which was jointly developed by industry and FCC staff. This document is available as specified in 47 CFR Section 15.31(a)(6). We invite comment on the desirability of applying this standard, in whole or in part, to unlicensed or possibly licensed millimeter wave equipment.

45. The current Part 15 rules do not require spurious emission measurements above 40 GHz.[44] If we do not raise this upper limit for the radiated emission measurements of all Part 15 devices, there will be an increased potential for harmful interference to new operations above 40 GHz. Consequently, we propose to require that all Part 15 transmitters operating above 30 GHz be measured to the fifth harmonic of the fundamental frequency or to 200 GHz, whichever is lower. We also propose that all Part 15 transmitters operating between 10 GHz and 30 GHz be measured to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower. Comments are requested on the costs of such tests and their effectiveness at reducing the potential for interference. Comments are also requested on the impact these proposed new testing requirements would have on existing lines of Part 15 equipment.

46. The measurement detector function used to test emissions from radio equipment has a significant impact on the amount of radiation that can be emitted by a device. An average detector function measures the average field intensity emitted by a device, and a peak detector measures the peak field intensity emitted by a device. The difference between an average detector reading and a peak detector reading is relatively small for a constant, amplitude-modulated signal, and quite large for a pulse-modulated signal. The current Part 15 rules specify use of instrumentation employing an average detector function for measurements above 1000 MHz.[45] We solicit comment as to whether such instrumentation is appropriate and generally available in the proposed millimeter wave bands. Also, as a matter of policy we have generally required that measurements of emissions above 1000 MHz be made with a minimum 1 MHz resolution bandwidth.[46] We are proposing to codify this requirement for all Part 15 devices.

47. Vehicular Radar Systems. We are generally proposing to apply the same technical and administrative requirements to vehicular radar systems as would be applied to unlicensed devices, with the exception of the power requirement. We propose to limit the peak power density of millimeter wave vehicular radar systems operated under Part 15 to 30 microwatts/square centimeter measured 3 meters from the radiating source and in the

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[44] See 47 CFR Section 15.33 for unlicensed Part 15 transmitters. See, also, 47 CFR Section 2.997 for licensed transmitters. The latter section does not place a limit on the upper frequency range over which emissions shall be measured. However, it states that emissions shall be measured "to the highest frequency practicable in the present state of the art of measurement techniques." The Commission has normally interpreted this upper limit to be 40 GHz. This results in no measurements of harmonics for any transmitter with a highest fundamental frequency above 20 GHz.

[45] The resolution bandwidth of the measuring instrument to be used above 1 GHz is not specified in the regulations, although ANSI C63.4-1992 does discuss the appropriate minimum resolution bandwidth for measurements above 1000 MHz. See 47 CFR Section 15.35(b).

[46] See note following Section 13.1.4.2 in ANSI C63.4-1992.

center of the main lobe of the radiation pattern. In addition, we propose a peak power density limit outside the main lobe of 200 nanowatts/square centimeter. We note that industry has been performing RF emissions tests on experimental vehicular radar equipment designed to operate in the millimeter wave bands.[47] These tests have indicated that our proposed power limits would allow development of effective radar equipment and, at the same time, minimize the potential for harmful interference. We believe that these limits, which are higher than those proposed for other unlicensed millimeter wave transmitters, are appropriate for automotive radar systems because their narrow beam widths and concentrated use on the nation's roadways will make them less of an interference threat.

CONCLUSION

48. Millimeter wave technology is expected to break new ground in opening up vast, largely untapped regions of the radio spectrum. The proposals we are making are based on limited information and preliminary analyses. Accordingly, we fully expect that adjustments in these proposals may be necessary. Nevertheless, the potential benefits compel us to move forward based on the best available knowledge so that we can create opportunities that will bring new products and services to American businesses and consumers. We invite comment on the proposed frequency bands, and the spectrum requirements for unlicensed services, licensed services, and vehicular radar systems. We also solicit the broadest possible information on the appropriate regulatory and technical requirements for such services.

PROCEDURAL MATTERS

49. This is a non-restricted notice and comment rule making proceeding. Ex parte presentations are permitted, except during the Sunshine Agenda period, provided they are disclosed as provided in the Commission's Rules. See generally 47 CFR Sections 1.1202, 1.1203, and 1.1206(a).

50. Initial Regulatory Flexibility Analysis. As required by Section 603 of the Regulatory Flexibility Act, the Commission has prepared an Initial Regulatory Flexibility Analysis (IFRA) of the expected impact on small entities of the proposals suggested in this document. The IFRA is set forth in Appendix A. Written public comments are requested on the IFRA. These comments must be filed in accordance with the same filing deadlines as comments on the rest of the Notice, but they must have a separate and distinct heading designating them as responses to the Initial Regulatory Flexibility Analysis. The Secretary shall send a copy of this Notice of Proposed Rule Making, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration in accordance with

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[47] See letter dated March 21, 1994, from General Motors Research Corporation (RM-8308).

paragraph 603(a) of the Regulatory Flexibility Act. Pub. L. No. 96-354, 94 Stat. 1164, 5 U.S.C. Section 601 et seq. (1981).

51. Comment dates. Pursuant to applicable procedures set forth in Sections 1.415 and 1.419 of the Commission's Rules, 47 CFR Sections 1.415 and 1.419, interested parties may file comments on or before January 30, 1995 and reply comments on or before March 1, 1995. To file formally in this proceeding, you must file an original and four copies of all comments, reply comments, and supporting comments. If you want each Commissioner to receive a personal copy of your comments, you must file an original plus nine copies. You should send comments and reply comments to Office of the Secretary, Federal Communications Commission, Washington, D.C. 20554. Comments and reply comments will be available for public inspection during regular business hours in the FCC Reference Center, Room 239, 1919 M Street, N.W., Washington, D.C. 20554.

52. The proposed action is authorized under Sections 4(i), 302, 303(e), 303(f), and 303(r) of the Communications Act of 1934, as amended 47 U.S.C. Sections 154(i), 302, 303(e), 303(f), and 303(r).

53. For further information regarding this Notice of Proposed Rule Making, please send an electronic mail message via the internet to mmwaves@fcc.gov, or contact either Dr. Michael J. Marcus, Office of Engineering and Technology, (202) 653-8110 or Richard Engelman, Office of Engineering and Technology, at (202) 653-6289.

FEDERAL COMMUNICATIONS COMMISSION

William F. Caton
Acting Secretary

APPENDIX A

Initial Regulatory Flexibility Analysis

I. Reason for Action: The proposals in this Notice of Proposed Rule Making are put forth on our own initiative with the intention of allocating several frequency bands above 40 GHz for general consumer and commercial applications. This action is also taken, in part, to respond to the petition submitted by General Motors Research Corporation to amend Part 15 of our rules to permit the operation of a vehicular radar systems in the band 76-77 GHz.

II. Objectives: The objective of this proposal is to encourage commercial development of equipment that can operate in the frequency bands above 40 GHz. Such development would improve access to the National Information Infrastructure by making commercial use of technology developed for the U.S. Military.

III. Legal Basis: The proposed action is authorized under Sections 4(i), 302, 303(e), 303(f), and 303(r) of the Communications Act of 1934, as amended 47 U.S.C. Sections 154(i), 302, 303(e), 303(f), and 303(r).

IV. Reporting, Record Keeping and Other Compliance Requirements: Licensed transmitters are subject to the authorization procedure of type acceptance. Unlicensed transmitters are subject to the authorization procedure of certification. Operators of licensed transmitters must also file license applications. Applicants for equipment authorization of products operating above 30 GHz will now be required to test for radiated emissions to the fifth harmonic of the highest fundamental frequency generated or 200 GHz, whichever is higher. They are now required to test only up to 40 GHz. Applicants for equipment authorization of products operating above 10 GHz and at or below 30 GHz will now be required to test for radiated emissions to the fifth harmonic of the highest fundamental frequency generated or 100 GHz, whichever is higher. They are now required to test only up to 40 GHz.

V. Federal Rules Which Overlap, Duplicate or Conflict With These Rules: None.

VI. Description, Potential Impact and Number of Small Entities Involved: It is unknown how many small entities may be affected. Fewer than ten small entities will now be required to test radiated emissions from transmitters operating above 30 GHz to the fifth harmonic of the highest fundamental frequency generated or 200 GHz, whichever is higher. They are now required to test only up to 40 GHz. Fewer than ten small entities will now be required to test radiated emissions from transmitters operating above 10 GHz and at or below 30 GHz to the fifth harmonic of the highest fundamental frequency generated or 100 GHz, whichever is higher. They are now required to test only up to 40 GHz.

VII. Any Significant Alternatives Minimizing the Impact on Small Entities Consistent with Stated Objectives: None.

APPENDIX B

I. Part 2 of Title 47 of the Code of Federal Regulations is revised to read as follows:

1. The authority citation for Part 2 continues to read as follows:

AUTHORITY: Sec. 4, 302, 303, and 307 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154, 154(i), 302, 303, 303(r), and 307, unless otherwise noted.

2. Section 2.106 is amended by revising column 4 for the frequency band 76-81 GHz and column 6 for the frequency bands 40.5-42.5 GHz, 47.2-50.2 GHz, 59-64 GHz, 71-74 GHz, 76-81 GHz, 84-86 GHz, 92-95 GHz, 95-100 GHz, 102-105 GHz, 116-126 GHz, 126-134 GHz, 134-142 GHz, and 151-164 GHz to read as follows:

Section 2.106 Table of frequency allocations.

* * * * *

United States table		FCC use designators	
Government	Non-government	Rule part(s)	Special-use frequencies
Allocation GHz (4)	Allocation GHz (5)	(6)	(7)
* * * * *			
40.5-42.5 US211	40.5-42.5 BROADCASTING-SAT ELLITE. /BROADCASTING/. Fixed. Mobile. US211	DOMESTIC PUBLIC FIXED (21).	
* * * * *			
47.2-50.2 FIXED. FIXED-SATELLITE (Earth-to-space). MOBILE. 904 US264 US297	47.2-50.2 FIXED. FIXED-SATELLITE (Earth-to-space). MOBILE. 904 US264 US297	RADIO FREQUENCY DEVICES (15). DOMESTIC PUBLIC FIXED(21).	
* * * * *			

59-64 FIXED. INTER-SATELLITE. MOBILE. 909 RADIOLOCATION 910 911	59-64 FIXED. INTER-SATELLITE. MOBILE. 909 RADIOLOCATION 910 911	RADIO FREQUENCY DEVICES (15).	

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71-74 FIXED. FIXED-SATELLITE (Earth-to-space). MOBILE. MOBILE-SATELLITE (Earth-to-space). US270	71-74 FIXED. FIXED-SATELLITE (Earth-to-space). MOBILE. MOBILE-SATELLITE (Earth-to-space). US270	DOMESTIC PUBLIC FIXED (21). RADIO FREQUENCY DEVICES (15).	

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76-81 RADIOLOCATION. Space Research (space-to-Earth) 912	76-81 RADIOLOCATION. Amateur. Amateur-Satellite. 912	RADIO FREQUENCY DEVICES (15). Amateur (97).	

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84-86 FIXED. MOBILE. 913 US211	84-86 FIXED. MOBILE. BROADCASTING. BROADCASTING- SATELLITE. 913 US211	DOMESTIC PUBLIC FIXED (21). RADIO FREQUENCY DEVICES (15).	

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92-95 FIXED. FIXED-SATELLITE (Earth-to-space). MOBILE. RADIOLOCATION. 914	92-95 FIXED. FIXED-SATELLITE (Earth-to-space). MOBILE RADIOLOCATION. 914	RADIO FREQUENCY DEVICES (15).	

95-100 MOBILE 902. MOBILE-SATELLITE. RADIONAVIGATION. RADIONAVIGATION-SATELLITE. Radiolocation. 903 904	95-100 MOBILE 902. MOBILE-SATELLITE. RADIONAVIGATION. RADIONAVIGATION-SATELLITE. Radiolocation. 903 904	RADIO FREQUENCY DEVICES (15).	

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102-105 FIXED. FIXED-SATELLITE (space-to-Earth). 722 US211	102-105 FIXED. FIXED-SATELLITE (space-to-Earth). 722 US211	DOMESTIC PUBLIC FIXED (21). RADIO FREQUENCY DEVICES (15).	

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116-126 EARTH EXPLORATION-SATELLITE (passive). FIXED. INTER-SATELLITE. MOBILE. 909 SPACE RESEARCH (passive). 722 915 916 US211 US263	116-126 EARTH EXPLORATION-SATELLITE (passive). FIXED. INTER-SATELLITE. MOBILE. 909 SPACE RESEARCH (passive). 722 915 916 US211 US263	DOMESTIC PUBLIC FIXED (21). RADIO FREQUENCY DEVICES (15).	122.5 GHz ± 500 MHz: Industrial, scientific and medical frequency.
126-134 FIXED. INTER-SATELLITE. MOBILE. 909 RADIOLOCATION. 910	126-134 FIXED. INTER-SATELLITE. MOBILE. 909 RADIOLOCATION. 910	DOMESTIC PUBLIC FIXED (21). RADIO FREQUENCY DEVICES (15).	
134-142 MOBILE 902 MOBILE-SATELLITE. RADIONAVIGATION. RADIONAVIGATION-SATELLITE. Radiolocation. 903 917 918	134-142 MOBILE 902 MOBILE-SATELLITE. RADIONAVIGATION. RADIONAVIGATION-SATELLITE. Radiolocation. 903 917 918	RADIO FREQUENCY DEVICES (15).	

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151-164 FIXED. FIXED-SATELLITE. 211	151-164 FIXED. FIXED-SATELLITE. 211	DOMESTIC PUBLIC FIXED (21). RADIO FREQUENCY DEVICES (15).	

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3. Section 2.997 is amended to read as follows:

Section 2.997 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Sections 2.991 and 2.993 of this Part, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

(d) Unless otherwise specified, measurements above 40.5 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

II. Part 15 of Title 47 of the Code of Federal Regulations is revised to read as follows:

1. The authority citation for Part 15 continues to read as follows:

AUTHORITY: Sec. 4, 302, 303, 304, and 307 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154, 302, 303, 304, and 307.

2. Section 15.33 is amended by revising paragraph (a) to read as follows:

Section 15.33 Frequency range of radiated measurements.

(a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown below:

(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.

(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1)-(a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this Section, whichever is the higher frequency range of investigation.

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3. Section 15.35 is amended by revising paragraph (b) to read as follows:

Section 15.35 Measurement detector functions and bandwidth.

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(b) On any frequency or frequencies above 1000 MHz, unless otherwise stated, the radiated limits shown are based on the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in the regulations, including emission measurements below 1000 MHz, there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. Measurements of AC power line conducted emissions are performed using a CISPR quasi-peak detector, even for devices for which average radiated emission measurements are specified.

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4. Section 15.205 is amended by adding a new paragraph (d)(4) to read as follows:

Section 15.205 Restricted bands of operation.

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(d) * * *

(4) Any equipment operated under the provisions of Section 15.253.

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5. A new Section 15.253 is added to read as follows:

Section 15.253 Operation within the bands 47.2-47.4 GHz, 59.0-64.0 GHz, 71.5-72.0 GHz, 76.0-77.0 GHz, 84.5-85.0 GHz, 94.7-95.7 GHz, 103.5-104.0 GHz, 116.5-117.0 GHz, 122.5-123.0 GHz, 126.5-127.0 GHz, 139.0-140.0 GHz and 152.5-153.0 GHz.

(a) Operation under the provisions of this section is not permitted on aircraft.

(b) Operation within the bands 47.2-47.4 GHz, 76.0-77.0 GHz, 94.7-95.7 GHz and 139.0-140.0 GHz is restricted to devices whose primary mode of operation is as a vehicular-mounted field disturbance sensor. The transmission of additional information, such as data, is permitted provided the primary mode of operation is as a vehicular-mounted field disturbance sensor.

(c) The radiated emission limits above 47.2 GHz are as follows:

(1) The power density of any emission within the bands specified in this section shall not exceed 200 nanowatts/square centimeter at 3 meters, except that the power density of any transmitter used as a field disturbance sensor pursuant to paragraph (b) shall not exceed 30 microwatts/square centimeter at 3 meters when the vehicle is moving at a minimum rate of one kilometer/hour.

(2) The power density of any emissions outside the bands specified in this section shall not exceed 2 picowatts/square centimeter at 3 meters.

(3) Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to +50 degrees celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

(4) The limits in this paragraph are based on instrumentation employing an average detector.

(d) Radiated emissions below 47.2 GHz shall not exceed the general limits in Section 15.209 of this Part. The provisions in Section 15.35 of this Part for averaging pulsed emissions and for limiting peak emissions apply. Further, the provisions in Section 15.205 of this Part that limit spurious emissions appearing in the restricted bands below 40 GHz also apply.