OVERVIEW OF APPLE COMPUTER's PETITION FOR RECONSIDERATION

Apple Computer (Apple) filed a Petition for Reconsideration of the R&O for the U-NII devices on March 3, 1997. In its petition, Apple requested three modifications.

ITEM 1 — The Commission Should Expedite Its Consideration of Whether to Permit U-NII Devices Operating in the 5725-5825 MHz Band to Use More Highly Directional Transmit Antennas

Discussion

In its petition, Apple states that the Commission should consider simultaneously the permissible use of higher gain directional antennas for spread spectrum Part 15 devices and U-NII devices operating in the 5725-5825 MHz band. In the R&O, the Commission indicated that it would first decide whether to increase antenna gain for spread spectrum systems, and only then decide whether to increase antenna gain for U-NII devices. Apple believes that the question of whether the use of more highly directional antennas will increase or decrease interference to others operating in the 5725-5825 MHz band can best be addressed if all relevant attributes of both spread spectrum and U-NII systems are examined at the same time. Apple also maintains that the record in this proceeding already contains an extensive discussion of the interference potential between U-NII systems that employ directional antennas and other users of the 5725-5825 MHz band.

Impact to Federal Operations

NTIA is concerned about the compatibility of high-power radar systems with U-NII devices employing high gain antennas in the 5725-5825 MHz band.[4] NTIA believes that robust receiver design is essential to successful operation of these devices in this band. Receiver design techniques that have proven effective against high-power, pulsed signals include: spread spectrum techniques, peak signal limiters, high efficiency error correction, bit interleaving, and error detection with retransmission protocols. NTIA also believes that protocols employing dynamic channel selection can be very effective in minimizing interference, both to and from radars, if implemented in such a way as to adequately detect radar signals with characteristics (e.g., pulse width, pulse repetition frequency) typical to this band.

The Commission has recently completed a rulemaking that will eliminate the limit on

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[4]See Reply Comments of NTIA, Amendment of the Commission's Rules to Provide for Unlicensed NII SUPERNet Operations in the 5 GHz Frequency Range, Notice of Proposed Rulemaking, ET Docket No. 96-102, 11 FCC Rcd 7205 (1996).

directional gain antennas for spread spectrum transmitters operating in the 5725-5850 MHz band.[5] The Spread Spectrum R&O permits spread spectrum systems to use a maximum output power of 1 W and transmitting antennas with directional gains greater than 6 dBi without any corresponding reduction in the transmitter peak output power. The R&O also requires these systems to be used exclusively for fixed point-to-point operations; no point-to-multipoint systems are permitted.

In the Spread Spectrum R&O, the Commission discusses how the signal spreading technique enables spread spectrum systems to tolerate strong undesired signals (e.g., pulsed radar signals), resulting in a reduced likelihood of receiving interference. The direct sequence spread spectrum systems are required to have a processing gain of at least 10 dB. The processing gain is the ability of spread spectrum receivers to detect the desired signal in the presence of an interfering signal. For example, a processing gain of 10 dB means that the spread spectrum receiver can detect the desired signal when the interference is 10 dB greater than the desired signal, making them more immune to interference from Government radar systems operating in the band. In contrast, the U-NII devices, for the most part, will be employing digital modulation techniques that are more susceptible to interference from Government radar systems unless robust receiver design techniques as discussed above are employed, or there exist adequate distance separation between the radar and the U-NII device.

NTIA agrees with the Commission that directional gain antennas can reduce interference in some instances because the narrow mainbeam and the lower sidelobes of the antenna focus most of the energy in one direction, thus reducing the interference in the other directions. In a situation where the interfering transmitter is within the mainbeam of the directional gain antenna, however, the range at which interference occurs, and the levels of interference seen by the U-NII receiver will increase significantly. This is of particular concern to NTIA because of the high-powered Government radar systems operating in the 5725-5825 MHz band. Therefore, NTIA does not believe that U-NII devices employing directional gain antennas with unlimited antenna gain should be permitted in the 5725-5825 MHz band. Based on the recent rulemaking for spread spectrum systems, however, NTIA is proposing the following modifications to the rules in the U-NII R&O for the 5725-5825 MHz band:

> (1) U-NII devices operating in the 5725-5825 MHz may employ transmitting antennas with directional gain greater than 6 dBi and less than 23 dBi without any corresponding reduction in the transmitter peak output power. For transmitting antennas with directional gain greater than 23 dBi, a 1 dB reduction in power for each 1 dB of antenna gain in excess of 23 dBi would be required;
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> (2) U-NII devices operating in the 5725-5825 MHz band that employ transmitting antennas with directional gains greater than 6 dBi are to be used exclusively for fixed, point-to-point

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[5] See Amendment of Parts 2 and 15 of the Commission's Rules Regarding Spread Spectrum Transmitters, Report and Order, ET Docket No. 96-8, FCC 97-114 (rel. April 10, 1997) [hereinafter Spread Spectrum R&O].

operations. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omni directional applications, and multiple collocated transmitters transmitting the same information;

(3) The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

The Administration has established as a national goal to connect all of the nation's classrooms, libraries, hospitals, and clinics to the NII by the year 2000. NTIA believes that high gain directional antennas on U-NII devices would promote this end, and that 5725-5825 MHz is the band best suited for this application. NTIA, therefore, supports Apple's proposed modifications.

To emphasize the potential interference problems that can be caused by high-powered Government radars to U-NII devices employing high gain directional antennas, NTIA suggests adding a second sentence to Section 2 (a) of the U-NII Part 15 Rules in the R&O:

The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.

ITEM 2 **The Commission Should Also Promptly Consider Whether to Permit the Use of More Highly Directional Transmit Antennas in the 5250-5350 MHz Band**

Discussion

Apple is recommending that the Commission amend the antenna directionality rules for U-NII devices operating in the 5250-5350 MHz band at the same time that it amends the antenna directionality rules for U-NII devices and spread spectrum devices operating in the 5725-5825 MHz band.

In both the 5250-5350 MHz and 5725-5825 MHz bands, the R&O requires a dB for dB reduction in transmit power for antennas with gain greater than 6 dBi. Apple recommends that, in the 5250-5350 MHz band, rule this be replaced with a rule requiring a reduction of 1 dB in transmit power for each 3 dB increase in antenna gain in excess of 6 dBi, with no upper limit. Alternatively, Apple suggests that the same directionality rules for the 5250-5350 MHz band could be adopted that are adopted for the 5725-5825 MHz band.

Impact to Federal Operations

The 5250-5350 MHz band has a worldwide allocation for use by radiolocation stations

installed on spacecraft employed for the earth exploration satellite service (EESS). Several such systems are being, or will be, flown on U.S. spacecraft, as well as those of foreign nations that have established joint research partnerships. Examples of these systems include synthetic aperture radars (SARs) flown by the European Space Agency on their Earth Resources Satellite-2 (ERS-2) and their upcoming ENVISAT, by the Canadian Space Agency on their RADARSAT-1 and planned RADARSAT-2, and by the National Aeronautics and Space Administration (NASA) on the Shuttle Radar Laboratory (SRL) and the upcoming Shuttle Radar Topographic Mission (SRTM). Also, radar altimeters are being flown on joint French-U.S. missions (TOPEX-POSEIDON) and the upcoming JASON-1. The 5250-5350 MHz band is the most widely used band for SARs.

As stated above, many of the systems employed for EESS are joint research partnerships with foreign countries. An example of one such partnership is the RADARSAT-1, which is a cooperative program led by the Canadian Space Agency (CSA), with the support of NASA and the National Oceanic and Atmospheric Administration (NOAA). Using state-of-the-art SAR technology, RADARSAT-1 satisfies the requirements of a broad spectrum of global users for timely and economically valuable Earth imagery. The 5.3 GHz SAR carried by RADARSAT-1 was specifically designed to maximize the utility of the resulting imagery for a wide variety of applications. These applications include: geology, agriculture, urban planning, cartography, disaster monitoring, oil spills, navigation through ice, hydrology, and many others. The capability to image in any weather condition makes the use of SAR a necessary element for any future commercial exploitation of satellite imagery.

A recently completed ITU-R study shows that U-NII devices meeting the emission limits proposed in the R&O for the 5250-5350 MHz band should not cause interference with spaceborne sensors. The study,[6] which shows compatibility between the U-NII devices and spaceborne sensors, assumes that only one percent of the U-NII devices are operating outdoors and the U-NII devices operating indoors would be afforded 20 dB of building attenuation. Apple's community network proposal in the 5250-5350 MHz band would greatly increase the amount of outdoor usage, thereby substantially increasing the interfering signal level at the spaceborne sensor receiver.

Apple's proposal to increase the effective isotropic radiated power (EIRP) above 1 W when more directional antennas are used for community networks in the 5250-5350 MHz will also result in a significant increase in the received interfering signal level at the spaceborne sensor receiver. It should be realized that, although these directional antennas for the most part will not be directed at the spaceborne sensors, scattered and reflected signals will be major sources of interference to the sensitive spaceborne sensors. The resulting interference from community networks with increased EIRP in the 5250-5350 MHz could corrupt spaceborne sensor images potentially rendering the image data sets invalid for specific applications. Apple fails to provide any technical analysis of the impact of its proposal on spaceborne sensors.

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[6] USWP 7C 121 (Rev 1), Analysis of Potential Interference to Spaceborne SARs from Wireless High Speed Local Area Networks Around 5.3 GHz, February 21, 1997.

In discussions with NTIA, NASA has stated that interference to spaceborne sensors will occur if either the power limits for the U-NII devices in the 5250-5350 MHz band are increased or if long distance outdoor links with unlimited antenna gain are implemented in the 5250-5350 MHz band. NTIA supports the concerns raised by NASA and, thus, opposes Apple's request in the 5250-5350 MHz band. NTIA supports the power level and antenna gain limits proposed by the Commission in the R&O.

ITEM 3 **The Commission Should Amend the Power Spectral Density Limits Applicable to the 5250-5350 MHz and 5725-5825 MHz Bands by Basing the Power Spectral Density Limits on a 2 MHz Rather than a 20 MHz Bandwidth**

Discussion

Apple believes that the rules governing the U-NII bands should not be so strict that they make impossible U-NII devices to satisfy lower bandwidth applications. Apple is recommending that the Commission amend the power spectral density rules in the 5250-5350 MHz and the 5725-5825 MHz bands to support lower bandwidth communications over distances of several kilometers. Apple maintains that, while they are allowed for spread spectrum systems, trade-offs between distance and bandwidth are not permitted for U-NII devices.

Impact to Federal Operations

An examination of the public record in this proceeding indicates that the purpose of making this Federal spectrum available for unlicensed devices was to satisfy a specific requirement for high speed, broadband multimedia applications requiring broad channels with bandwidths of up to 20 MHz each. This would support the decision made in the R&O that the power spectral density be defined using a 20 MHz bandwidth.

The public record also supports the need for low cost T-1 type connections (1.544 Mbps). Contrary to Apple's claim, however, there are other applications that can satisfy this requirement. For example, there are currently unlicensed spread spectrum systems available that support T-1 type connections at affordable costs in the 2.45 GHz band. In addition, the unlicensed PCS (U-PCS) band has a maximum bandwidth of 2.5 MHz and could support T-1 type connections as described in Apple's proposal. Moreover, the Commission's recent rulemaking permitting unlicensed spread spectrum devices to employ directional gain antennas extending their communications range can also be used to support many of the narrowband (T-1) applications discussed in Apple's petition.

Apple's proposal to specify the power spectral density limits in terms of a 2 MHz bandwidth instead of 20 MHz would result in a higher output power. A power increase of this magnitude represents a directly proportional increase in the level of interference created by the U-NII devices, thereby increasing the probability of causing interference to Federal systems operating in the 5250-5350 MHz and 5725-5825 MHz bands. As a result of the Commission's recent rulemaking in the

5725-5850 MHz band there are already applications that are available to support the lower data rate applications over longer distances identified in Apple's petition. Therefore, the potential increase in interference resulting from Apple's proposal does not seem necessary and should be denied.

OVERVIEW OF HEWLETT-PACKARD PETITION FOR RECONSIDERATION

On March 3, 1997, Hewlett-Packard (HP) filed a Petition for Reconsideration of the R&O for U-NII devices. In its petition, HP seeks clarification or modification of two items.

ITEM 1 The Commission Should Reconsider the Power Limit Adopted for the 5150-5250 MHz Band

Discussion

Tthe R&O allows U-NII devices operating in the 5150-5250 MHz band to employ a peak output power of 50 mW with up to 6 dBi of antenna gain. In addition, U-NII devices in this band are prohibited from outdoor operation. HP argues that this power limit was adopted to protect Mobile Satellite Service (MSS) systems from harmful interference, and will limit U-NII devices to providing short-range communications within a very local area. HP believes that the increase in transmitter power to 1 W will not subject MSS systems to unacceptable levels of interference. HP maintains that there is no reason to defer authorizing U-NII devices at up to 1 W of power. HP adds that HIPERLAN devices using 1W of power could be approved and implemented in twenty European countries. In addition, under the ETSI standard, HIPERLAN devices may operate within three classes of power levels, the highest of which is 1W. HP also adds that increasing the transmitter power to 1 W will also promote international harmonization of the technical standards for unlicensed 5 GHz devices.

HP does not request that the Commission reconsider the aspect of the rules governing indoor operation of the U-NII devices in the 5150-5250 MHz band.

Impact to Federal Operations

The band 5150-5250 MHz is a portion of the larger band 5000-5250 MHz, which is allocated to Federal aeronautical radionavigation operations. In particular, this band is adjacent to the band identified by the International Civil Aviation Organization (ICAO) as an extension band for MLS (5091-5150 MHz). In addition, the ICAO Global Navigation Satellite Systems Panel (GNSSP) has proposed the 5090-5150 MHz band for the Local Differential GPS (DGPS) data link. Any proposal to increase the transmitter power of U-NII devices would have to consider the potential of interference to these safety-of-life operations.

The present ETSI HIPERLAN standard (ETS-300-652) defines three classes of terminals: Class A (10 mW EIRP), Class B (100 mW EIRP), and Class C (1 W EIRP). In its petition, HP requests a transmit power of 1 W not an EIRP of 1 W. Under the R&O, power is limited to 50 mW and a 6 dBi antenna gain resulting in an EIRP of 200 mW. HP's proposal is to allow a transmit power of 1 W and the 6 dBi antenna gain which would result in an EIRP of 4W. This is clearly not consistent with any of the classes of terminal specified in the HIPERLAN standard. The ETSI

standard does specify a limit of 1 W EIRP for HIPERLAN Class C terminals; however, at this point in time there are no countries manufacturing 1 W systems. The R&O is consistent with the Class B terminals and would allow for harmonization with the HIPERLAN standard. Therefore, NTIA opposes HP's proposal for higher power levels in the 5150-5250 MHz band, and supports the power level proposed by the Commission in the R&O.

ITEM 2 HP Supports the Petition for Reconsideration filed by WINForum

Discussion

HP supports WINForum's request for reconsideration and clarification of several aspects of the R&O in order to prevent overly restrictive interpretations of the technical rules governing U-NII devices.

Impact on Federal Operations

These issues are discussed in the comments on the WINForum petition for reconsideration.