NASA Procedural Requirements

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Subject: NASA Radio Frequency (RF) Spectrum Management Manual

Responsible Office: Space Operations Mission Directorate

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Chapter 3: RF Allocations and Assignments

3.1 General

3.1.1 In order to effectively implement the national and international spectrum management policy, NASA has adopted procedures for requesting frequency assignments and for obtaining new frequency allocations. These procedures allow for a coordinated process starting with identification of agency program/project needs and ending with national and international recognition of actual band usage.

3.1.2 For the purpose of this NPG, the following definitions are adopted from the ITU Radio Regulations (RR).

a. Frequency Allotment: Entry of a designated frequency channel in an agreed-upon plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specific conditions.

b. Frequency Allocation: Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more (terrestrial or space) radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned.

c. Frequency Assignment: Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions.

3.1.3 In general, the frequency assignment process takes the form outlined in Figure 3-1 and is initiated at the user NASA Center and ends with issuance of a Radio Frequency Authorization (RFA). If the use is not for a major terrestrial program or not for frequencies to be used for transmissions to and from space, the frequency assignment process is fairly simple as described in paragraph 3.3.2.2.

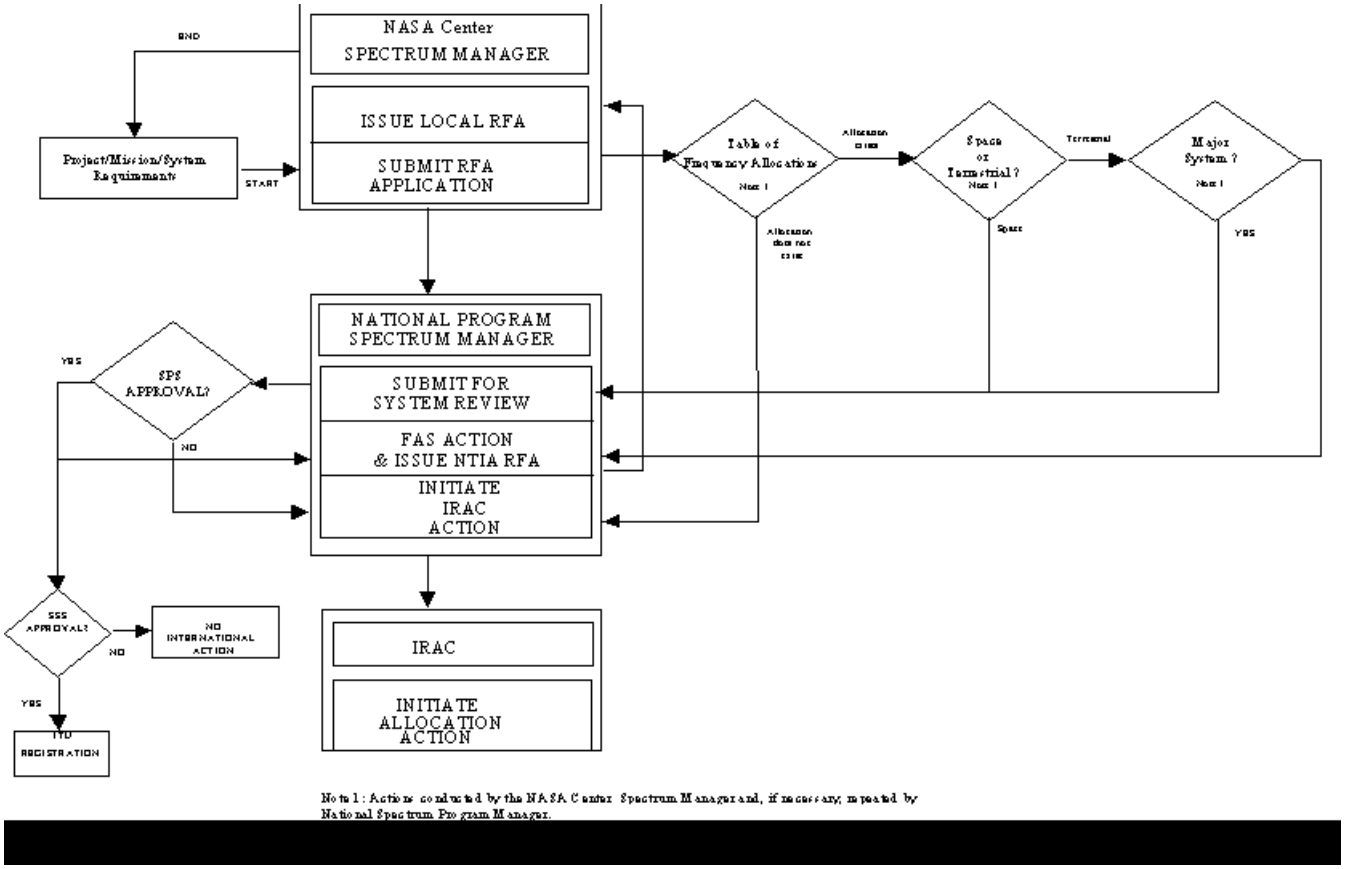
3.1.4 However, for major new programs or for programs involving spacecraft, NTIA has established a systems review process by which the use is coordinated within the United States and internationally. This process is described in Appendix F.

3.2 Frequency Allocations

3.2.1 In most cases, identification of RF spectrum support for Agency needs is focused on frequency bands currently allocated nationally and internationally for the particular radio service for which the Agency requires support. This includes both terrestrial use (in fixed and mobile allocations) and space use (in space services that support the U.S. space programs). However, in some cases, particularly as new scientific, technological, and commercial requirements emerge and bands lower in the RF spectrum become congested, it may be necessary to move Agency communication operations elsewhere in the RF spectrum where appropriate allocations do not currently exist within which to operate. As shown in Figure 3-1, the identification of the need for a new allocation may be made by reference to the Table of Frequency Allocations or as a result of the systems review process which includes a study of current frequency band occupancy.

3.2.2 In cases where new frequency allocations are deemed necessary, it is imperative that long-lead times be allowed for the national and international processes which are required for new allocations to be made. While ITU conferences, which are competent to reallocate portions of the RF spectrum occur on a periodic basis, NASA must be prepared to identify new requirements well in advance of these conferences so that supporting technical and regulatory arguments can be prepared and presented.

Figure 3-1 Frequency Authorization Process



3.3 Frequency Assignments

3.3.1 General

Specific procedures by which Agency users may be authorized to operate on a particular frequency depend upon the following factors:

a. Whether a frequency allocation exists or not;

b. Whether the system is terrestrial or spaceborne; and

c. Whether the system is considered a major telecommunications system, e.g., high investment.

3.3.2 Process for frequency selection prior to design commitment (See Figure 3.2)

3.3.2.1 Project Commitment (Funding Approved)

The dissemination of information of project commitment made at NASA Headquarters or within NASA Programs and Projects is key to the successful coordination of design decisions involving the selection of frequencies for systems requiring RF communications.

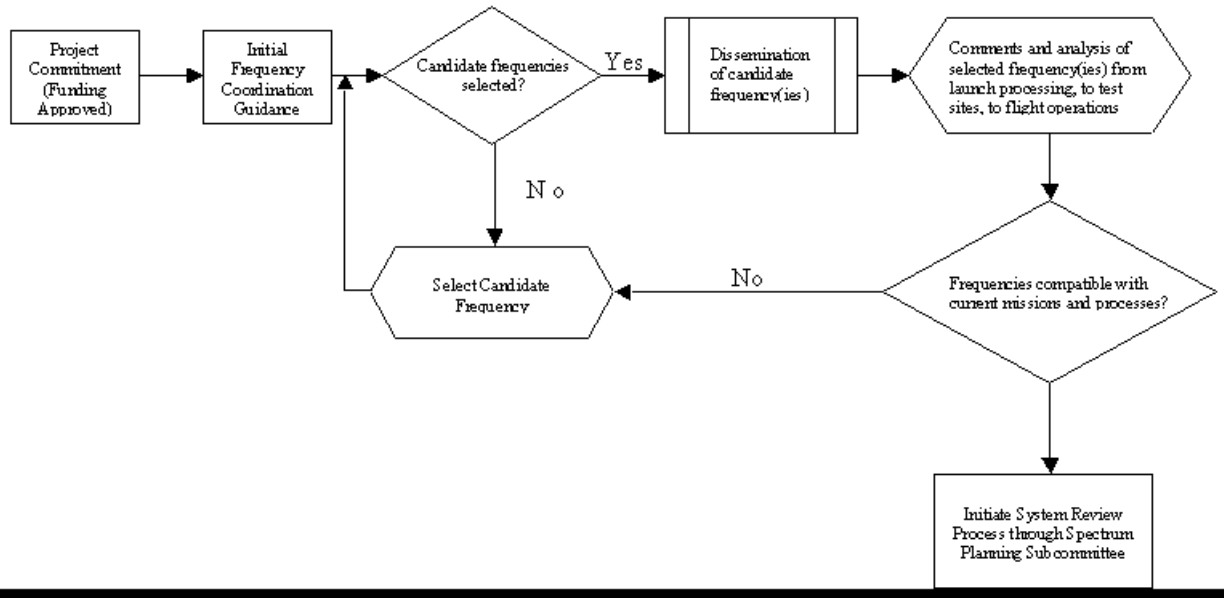
3.3.2.2 Initial Frequency Coordination Guidance

Due to the increasing complexity and usage of the RF spectrum, the availability of spectrum may actually drive the design requirements for future NASA missions. Each Center has a designated Radio Frequency Spectrum Manager who is responsible for obtaining, maintaining, and retiring the RFA for programs and projects at the Center, and for preventing or mitigating radio frequency interference at the Center or to the Center's programs to enable mission execution. The Center Radio Frequency Spectrum Manager, or Spectrum Manager, provides guidance on the selection of properly allocated frequency bands to fulfill mission requirements. Once candidate frequency bands and center frequencies are selected, the dissemination of the information is necessary to ensure that appropriate feedback is obtained to ensure timely resolution of problems from within NASA, as well as with other users of the spectrum.

3.2.3.3 Dissemination of Candidate Frequencies

The dissemination of candidate frequencies should include the relevant NASA Spectrum Managers at the Center level and the candidate Government or commercial launch sites that NASA may use in the future. In addition, the NASA National Spectrum Program Manager must be included on distribution to ensure that the NTIA's Spectrum Planning Subcommittee (SPS) concerns are addressed before the submission of a Systems Review. Spectrum Managers may also provide additional insight into scheduling issues for frequencies in highly congested bands requiring ground station support.

Figure 3-2 Process for Frequency Selection



3.3.2.4 Comments and Analysis of Frequencies

Projects should employ an approach similar to the RF analysis of the candidate frequencies (see Figure 3-2). Therefore, projects should be prepared to fund an RF analysis that may need to be conducted to ensure electromagnetic compatibility with other users of the proposed frequency band(s) of operation. The results of such an analysis should provide better information for the selection of the best frequency for a particular mission and should be included in a submission to the NTIA for a Systems Review.

3.3.2.5 Initiate Spectrum Planning Subcommittee Process

The conceptual phase of a mission ends when the necessary analysis has determined the best frequency candidate for a particular mission. The planning phase then begins with an initial submission of a Systems Review (Stage 1 or 2) to the NTIA. The NTIA may provide further guidance or raise concerns regarding existing systems that may be incompatible with the particular mission. {See Appendix F of this NPG and chapter 10 of the NTIA Manual.}

3.3.3 Terrestrial Assignments

3.3.3.1 Some terrestrial systems may be classified as major telecommunications systems. These would be expected to include systems which, even though spectrum allocations currently exist, may be required to submit to NTIA for a systems review, for example, high bandwidth requirements, new modulation techniques, and novel applications. This systems review procedure is referred to in Appendix F of this NPG.

3.3.3.2 NASA users requiring assignments for radio frequencies for nonmajor terrestrial use should provide the specific technical information via electronic means for submission to NTIA via the Frequency Assignment Subcommittee (FAS) electronic agenda. This information should be submitted for all frequency assignment actions (new, renewal, and modifications) to the appropriate NASA Center Spectrum Manager for review and submission to the National Spectrum Program Manager in the proper NTIA computer mnemonic format, as described in Chapter 9 of the NTIA Manual.

3.3.3.3 The following procedures and notes will aid NASA spectrum users in the preparation of applications for frequency assignments, and facilitate the processing of the applications:

Step 1: From the operational requirements, determine the specific frequency or band of frequencies, together with alternate frequencies that would be acceptable if the desired frequencies are not available. Allow a lead-time of at least 30 work days for processing of typical land mobile radio operations and up to 180 work days for complex systems requiring pre-coordination with other Federal agencies. The time process commences when the application appears on the FAS electronic agenda.

Step 2: The Center Spectrum Manager will ensure that the frequencies are available and are in accordance with the National Table of Frequency Allocations. (Do not request "out-of-band" frequency assignments or allocations unless absolutely necessary and with writtenjustification). In cases where out-of-band frequencies must be used, allow the maximum lead-time possible.

Step 3: Refer to paragraph 3.4 to determine if coordination with other users of the spectrum is required. The type and amount of coordination that might be required varies with the specific frequencies involved. When such coordination is extensive, the user (applicant) must provide funds for such coordination, including the preparation of coordination contour charts.

Step 4: For each frequency assignment action required, submit the information to the NASA Center Spectrum Manager together with any other information that will aid in expediting the application. If necessary, refer to Appendices G and H for procedures to determine bandwidth and emissions designations and call signs.

3.3.3.4 NASA Center Spectrum Managers are responsible for processing the information into the proper NTIA computer mnemonic format. Submit this data directly to the National Spectrum Program Manager.

3.3.3.5 Submission of data or acknowledged receipt does not constitute an assignment or authorization regardless of any verbal agreements or understandings between the applicant and NASA spectrum management personnel. Do not attempt to operate on the frequency requested or to purchase equipment requiring such frequency support until authorized by formal RFA issued through the Center Spectrum Manager.

3.3.4 Space Assignments

3.3.4.1 Chapter 10 of the NTIA Manual entitled, "Procedures for the Review of Telecommunication Systems for Frequency Availability and Electromagnetic Compatibility (EMC)" states that for Government agencies the systems review process is applicable to certain systems and subsystems. The systems review is intended for:

a. New telecommunication systems or subsystems, and major modifications to existing systems or subsystems, involving the use of satellites or spacecraft.

b. New major terrestrial systems or subsystems, and major modifications to existing systems or subsystems.

c. Such systems or facilities as may be referred to the Spectrum Planning Subcommittee (SPS) on a case-by-case basis.

3.3.4.2 The systems review is a procedure used by the SPS to develop recommendations on behalf of the IRAC for the Deputy Associate Administrator, Office of Spectrum Management of NTIA, regarding certification of spectrum support for telecommunication systems or subsystems. This review provides an early awareness in the regulatory community and allows for either early support or early identification of potential problems in the future. A system can be reviewed at four stages as it matures into an operational status. These are:

Stage 1 Conceptual

Stage 2 Experimental

Stage 3 Developmental

Stage 4 Operational

3.3.4.3 This review process is mandatory for space systems except those that operate under Annex K of the NTIA Manual regarding low power nonlicensed devices. For those systems so designated, the Center Spectrum Manager will be required to coordinate with the NASA SPS representative throughout the review process.

3.3.4.4 Details of the systems review procedure can be found in Appendix F.

3.4 U.S. Coordination Requirements

3.4.1 NASA Components as Tenants at Other Government Agencies

The Centers having joint tenant status at other Government agencies will coordinate frequency requirements with the host Government agency as required. Applications are then forwarded to the NASA National Spectrum Program Manager reflecting the recommendations of the host Agency under whose jurisdiction the operation is proposed.

3.4.2 Joint Radio Frequency Coordination for National Test Ranges

3.4.2.1 The Department of Defense (DOD) has established a system of military interservice frequency coordination to minimize interference and to avoid conflict with or among radio and electronic operations at the DOD National Test Ranges. This system requires that certain frequencies must be coordinated with DOD Area Frequency Coordinators (AFC) prior to the issuance of assignments. In the interest of economy and compatibility of operations, this system of coordination is used by NASA, in accordance with the joint DOD-NASA Agreement of July 28, 1980.

3.4.2.2 The areas in which Military Interservice Frequency Coordination is required are shown in Figure 3-3 and further defined in Table 3-1. Table 3-1 also lists the DOD AFC responsible for coordination within each area.

3.4.2.3 DOD AFC maintain current records of frequencies that have been coordinated with them for use in their area of cognizance. Upon request for frequency coordination, they supply technical comments on the probability of harmful interference being caused or received by the proposed operations.

3.4.2.4 All frequencies intended for use within the National Test Ranges (or within those areas delineated in Table 3-1) which are considered capable of causing harmful interference to operations at the specified test ranges, including any extended established "down-range" areas, are coordinated with the responsible DOD AFC. Area frequency coordination is accomplished by the Spectrum Manager of the NASA Center in accordance with the following procedures:

Step 1: When NASA operations require DOD range support and are to be conducted at sites under military cognizance, select the use of the frequencies required in coordination with the AFC of the range concerned. In the case of those military test facilities where there is no resident AFC, coordinate NASA frequency usage with the local Military Frequency Manager who will, in turn, effect the necessary coordination with the cognizant AFC.

Step 2: If the frequencies required are already assigned for use at the range concerned, the AFC (or local Military Frequency Manager) will effect local authorization and interference protection as necessary. When the frequencies required are not assigned to the range, the AFC will request assignment from the military department having cognizance of that range.

Step 3: Where NASA operations are to be conducted at sites not under military cognizance, but within the area defined in Table 3-1, coordinate the use with the AFC of the range concerned by providing system/emission characteristics for this purpose. The AFC will comment with due regard to all military frequency usage within the area involved.

Step 4: Forward system/emission characteristics in accordance with chapter 9 of the NTIA Manual to NASA GRC for coordination with other users and IRAC, as appropriate. Include a memorandum stating that coordination has been effected with the AFC involved. The National Spectrum Program Manager will apply for the assignments to cover these operations.

Step 5: Should a frequency conflict arise between DOD AFC and NASA Center Spectrum Managers that cannot be resolved satisfactorily through measures acceptable to the Center involved, forward a complete and detailed report to the National Spectrum Program Manager who will attempt to resolve the conflict at the national level.

Figure 3-3 Geographic Locations of National Ranges and National Radio Quiet Zone

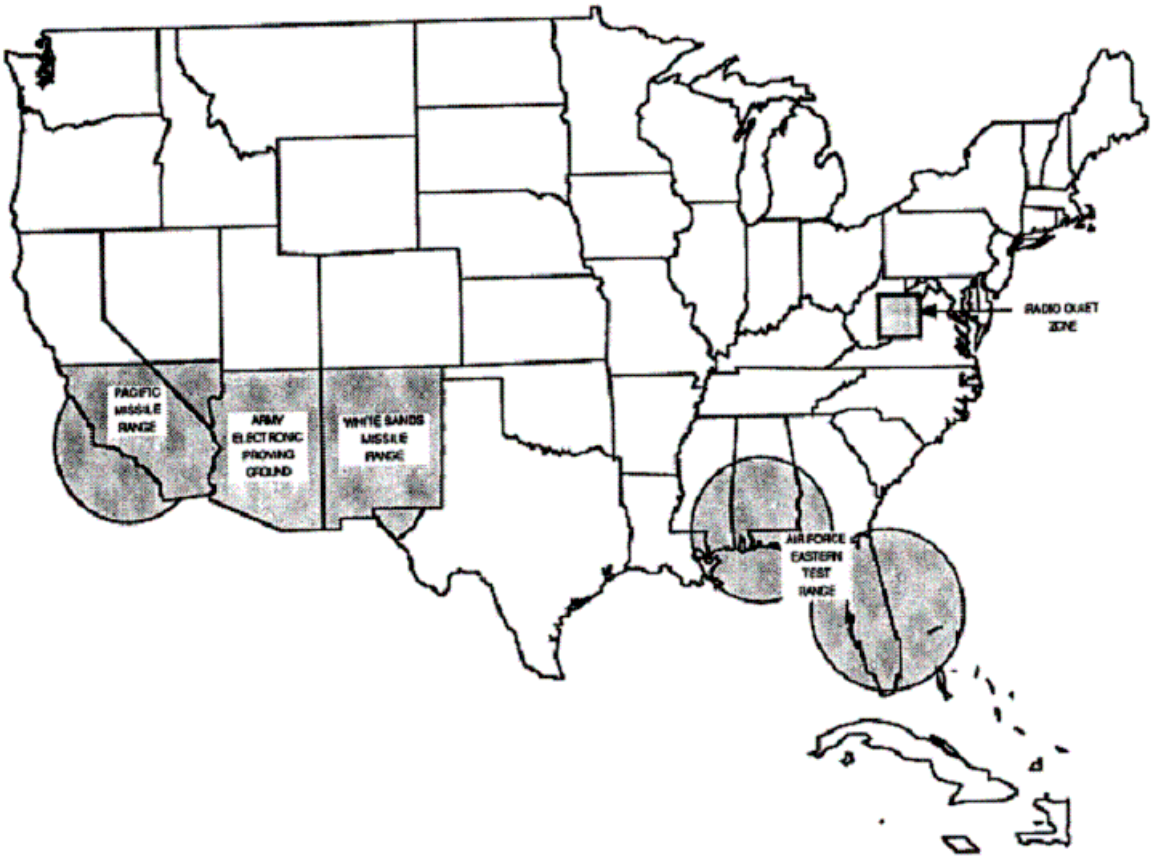


Table 3-1. Coordination Areas for National Test Ranges

Area	Responsibility
The entire State of Florida including Key West Area, as well as the area enclosed within a 200 mile radius of the Headquarters Building, Patrick Air Force Base, Florida; and the area enclosed within a 200-mile radius of Eglin Air Force Base, Florida.	Area Frequency Coordinator, Air Force Eastern Range (ER) Patrick Air Force Base, Florida.
The entire State of Arizona.	Area Frequency Coordinator, U.S. Army Electronic Proving Ground, Fort Huachuca, Arizona
The entire State of New Mexico and other U.S. Territories within a 150-mile radius of the Headquarters Building, White Sands Missile Range, Las Cruces, New Mexico.	Area Frequency Coordinator, White Sands Missile Range, Las Cruces, New Mexico.
The area enclosed within a 200-mile radius of the Headquarters Building, Pacific Missile Range, Point Mugu, California, plus the areas of Nevada and California that lie south of latitude 37° 30'N. This Area Frequency Coordinator will provide frequency coordination for the Naval Weapons Center, China Lake, California; and Edwards Air Force Base, California.	Area Frequency Coordinator, Pacific Missile Range, Point Mugu, California.

3.4.3 Coordination Procedures for the National Radio Quiet Zone (NRQZ)

3.4.3.1 The NRQZ is an area approximately 100 miles square set aside for radioastronomy observations. This area is bounded by 39°15'N on the North, 78°30'W on the East, 37°30'N on the South and 80°30'W on the West (Figure 3-3).

3.4.3.2 To protect the NRQZ from interference, the following criteria have been established for the maximum field strength limits:

a. 50 MHz to 1 GHz Less than 0.1 microvolt per meter

b. 1 GHz to 10 GHz Less than 1.0 microvolt per meter

c. 10 GHz to 100 GHz Less than 10.0 microvolts per meter

(Measured at 38°31' 16" N, 79°16' 36" W at 2,292 feet above mean sea level.)

3.4.3.3 All proposed frequency assignments to NASA radio stations within the NRQZ must be coordinated per the NTIA Manual Part 8.3.9, prior to authorization.

3.4.4 Coordination Procedures with the Aerospace and Flight Test Radio Coordinating Council (AFTRCC)

3.4.4.1 Coordination procedures are applicable for all frequency assignment actions for use of frequencies in the bands 1435-1535 MHz and 2310-2390[1] MHz by U.S. Government radio stations within the conterminous United States, and are implemented to minimize, through local selection of frequencies and effective coordination, the possibility of interference.

3.4.4.2 All frequency applications (proposed and renewal) for NASA radio stations must be accompanied by an AFTRCC concurrence letter submitted in accordance with the NTIA Manual Chapter 8.3.17 and Annex D of the NTIA Manual.

3.5 NASA Contractors (NASA FAR Supplement, Subpart 1823.71 and Section 1852.223-71)

3.5.1 Center Spectrum Manager

3.5.1.1The Center Spectrum Manager shall request the contracting officer to insert the clause from NASA FAR Supplement Section 1852.223-71 Frequency Authorization, in any contract which calls for the development, construction, or operation of a device for which an RFA is required.

3.5.1.2The Center Spectrum Manager shall provide to the contracting officer such technical assistance as may be required to enable the issuance of a radio frequency assignment.

3.5.2 NASA Contracting Officers

Commercial contractors, providing or operating RF equipment for NASA use, shall obtain RF spectrum authorization in accordance with the terms of the contract, through the NASA Contracting Officer.

3.6 Foreign Frequency Assignments

Foreign frequency assignments shall be obtained by the Senior NASA Official available at, or convenient to, the site of operations. Reports of all such actions will be made to the AA for OSF, National Aeronautics and Space Administration, Washington, DC 20546.

3.7 Conditions of Assignment

3.7.1 All Center activities will be assigned frequencies by NTIA through the National Spectrum Program Manager and will reflect full particulars of the assignment. The National Spectrum Program Manager will forward these assignments, using NTIA supplied RFA forms, to the appropriate Center Spectrum Manager upon completion of the frequency coordination process. Based on this authorization, Center Spectrum Managers may issue Center RFA's.

3.7.2 Annually, the National Spectrum Program Manager will provide, upon request, each Center Spectrum Manager with a current list of all NASA frequency assignments that have been approved by NTIA. Additionally, a copy of the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management will also be supplied to all Spectrum Managers. Supplements to the NTIA Manual will be furnished by GRC Spectrum Management Office, when published by NTIA.

3.7.3 All NASA frequency assignments are issued subject to the following conditions:

a. All frequencies assigned to NASA are issued subject to the conditions stated on the authorization.

b. Radio transmitters must be operated by adequately trained and designated personnel, and in a manner conforming to established and accepted procedures.

c. Transmitter operations must be conducted only on authorized frequencies.

d. Approved power, emissions, and conditions of assignments must be adhered to at all times.

e. All land mobile radio transmissions must be identified by the use of the authorized radio call signs, pursuant to Appendix H of this NPG.

f. Transmitter operations must be held within the prescribed tolerances outlined in chapter 5 of the NTIA Manual, unless otherwise authorized.

g. A copy of the current RFA for each fixed radio station should be posted or retained in some manner at the principal control point of each station.

h. An RF evaluation should be conducted to determine the effects on human health, including interference with personnel operations such as maintenance procedures. Evaluations must be handled at a local level and must be coordinated with the Center Spectrum Manager. Local procedures will vary at each site and as a minimum, follow ANSI C95.1, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields."

i. Chapter 7 paragraph 11 of the NTIA Manual outlines conditions under which specific frequency usage may be authorized without prior coordination with other Government agencies. The Center Spectrum Managers may issue local RFA's without referral to the National Spectrum Program Manager, to cover those operations that meet the criteria established in this chapter of the NTIA Manual for the particular frequency usage involved.

3.8 Emergency and Wartime Procedures

3.8.1 Emergency Procedures

3.8.1.1 Under a declared emergency condition, Center Spectrum Managers may use or assign to an operation under their direction, frequencies not otherwise authorized, provided that:

3.8.1.2 The nature and duration of the requirement is such that the normal frequency assignment procedures are impractical.

3.8.1.3 All reasonable measures are taken before such frequencies are used to ensure that harmful interference will not be caused to other users.

3.8.2 Wartime Procedures

3.8.2.1 In wartime, all radio frequencies, both Government and non-Government, will be under the centralized authority of NTIA. Normally, under such conditions, military operations will take precedence over nonmilitary operation. However, all priorities established by NTIA take into account all aspects of the President's communications requirements for the national defense in time of war.

3.8.2.2 NASA's role in providing support for these wartime procedures is established through NTIA by the Agency's Spectrum Policy and Planning Director, and will be implemented as required. The specific procedures are beyond the scope or intent of this NPG.

[1] The bands 2305-2320 MHz and 2345-2360 MHz are allocated as Primary for Wireless Communication Services. The bands 2320-2345 MHz are allocated as Primary for Digital Audio Services via satellite and terrestrial means. Use of the whole band 2310-2390 MHz currently is allocated to Aeronautical Telemetry Service on a primary basis until the Wireless Communication Service and Digital Audio Radio begin service.

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