

## Chapter 10

# Procedures for the Review of Telecommunication Systems for Frequency Availability, Electromagnetic Compatibility (EMC), and Telecommunications Service Priority for Radiocommunications (TSP-R)

## 10.1 GENERAL

### 10.1.1 Avoiding Interference

Federal agencies planning the use of, conducting experiments relating to, or developing and procuring telecommunication systems requiring the use of radio frequencies shall take all reasonable measures to ensure that such systems will neither cause nor receive harmful interference to or from other authorized users when placed in their intended operational environments. In planning telecommunication systems within the scope of this procedure, federal agencies shall develop systems for operational use in accordance with the applicable portions of the National Tables of Frequency Allocations and the provisions of this Manual, unless an exception is recommended by the Spectrum Planning Subcommittee (SPS) and approved by NTIA.

### 10.1.2 Satisfying OMB Circular A-11

OMB Circular No. A-11 specifies in Section 33.4: “You must obtain a certification by the National Telecommunications and Information Administration, Department of Commerce that the radio frequency required can be made available before you submit estimates for the development or procurement of major radio spectrum-dependent communications-electronics systems (including all systems employing space satellite techniques)”. NTIA certification of spectrum support can be obtained using the procedures in this chapter. The matter of preparation and submission to OMB of budget estimates for federal systems is covered in Section 8.2.5.

### 10.1.3 SPS Review of New Systems

To assist federal agencies in meeting the above responsibilities and to support the NTIA and the IRAC in the management of radio spectrum resources for the satisfaction of federal requirements, and in the national interest, these procedures provide for the review of certain new federal telecommunication systems and subsystems by the SPS, at a number of the stages of their evolution, prior to the assignment of frequencies. Such review will, as appropriate, require an examination of the existing systems in the frequency band(s) being considered.

### 10.1.4 Administering the Telecommunications Service Priority for Radiocommunications (TSP-R) System

Executive Order 13618, July 17, 2012, specifies in Section 5.3 (f) that: The Department of Commerce shall: (f) administer a system of radio spectrum priorities for those spectrum-dependent telecommunications resources belonging to and operated by the Federal Government and certify or approve such radio spectrum priorities, including the resolution of conflicts in or among such radio spectrum priorities during a crisis or emergency. NTIA, with advice from the Emergency Planning Subcommittee (EPS), will certify or approve National Security and Emergency Preparedness (NSEP) spectrum dependent systems and assign the appropriate TSP-R (spectrum use priority), resolve conflicts in or among TSP-Rs during a crisis or emergency, and report their use to the Director of the Office of Science and Technology Policy (OSTP).

### 10.1.5 FCC Participation

Full participation of the FCC in these procedures, for the review of federal systems intended for operation in bands of mutual federal/non-federal interest, occurs through the normal FCC liaison representation on the IRAC and its subcommittees.

## **10.2 DEFINITIONS**

### **10.2.1 Telecommunication System**

A telecommunication system, for the purpose of this procedure, is a combination of facilities, stations, or circuits intended to perform an information transfer function by the use of the radio spectrum, e.g.:

- a. a space station and its associated earth stations for provision of meteorological information;
- b. a combination of aeronautical stations for communication support of air traffic control;
- c. an interconnected network of fixed stations;
- d. a combination of fixed and land mobile stations intended to provide communication support for law enforcement or protection activities on a local or area-wide basis;
- e. a combination of facilities intended to provide a radionavigation service; or
- f. a combination of facilities intended to provide a radiolocation (radar) service.

### **10.2.2 Telecommunication Subsystem**

A telecommunication subsystem, for the purpose of this procedure, is a combination of facilities, stations, or circuits intended to provide telecommunication support to a broader functional telecommunication entity (e.g., the surveillance portion of an air defense system or an avionics package of a nomenclatures aircraft).

### **10.2.3 Major Terrestrial System or Subsystem**

A major terrestrial system or subsystem is a telecommunication system or subsystem that does not involve the use of satellites or spacecraft, and which may have significant impact on existing or potential future use of the portion of the radio frequency spectrum in which it is intended to operate, taking into account systems of the same radio service and those of any other radio service with which the spectrum in question is shared.

### **10.2.4 Major Modification**

A major modification is any change of the technical or operational characteristics of an existing telecommunication system or subsystem which may have significant impact on existing or potential future use of the portion of the radio frequency spectrum in which it is intended to operate, taking into account systems of the same radio service and those of other radio services with which the spectrum in question is shared.

### **10.2.5 System Review**

The system 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 coming within the scope of this chapter (see Section 10.2). A system can be reviewed at four stages as it matures into an operational status. These are:

- a. Stage 1, Conceptual: The initial planning effort has been completed, including proposed frequency bands and other available characteristics;
- b. Stage 2, Experimental: The preliminary design has been completed, and radiation, using such things as test equipment or preliminary models, may be required;
- c. Stage 3, Developmental: The major design has been completed, and radiation may be required during testing; and
- d. Stage 4, Operational: Development has been essentially completed, and final operating constraints or restrictions required to assure compatibility need to be identified.

(NOTE: The stages of review are discussed in greater detail in Section 10.4.1.)

## **10.2.6 Telecommunications Service Priority for Radio (TSP-R) Conflict**

A TSP-R conflict occurs when two or more NSEP systems having the same level of TSP-R request spectrum support for the same location and operate in the same or overlapping frequency bands.

## **10.2.7 Notification of Transportable AWS, Cell and PCS Systems in Selected Bands**

Agencies planning to procure transportable Advanced Wireless Service (AWS), Cellular, and Personal Communications Services (PCS) Systems, including Cell-On-Wheels (COW) and Cell-On-Light Truck (Colt) systems, which operate in the bands 698-758, 775-788, 805-806, 824-849 MHz, 901-902 MHz, 930-931 MHz, 940-941 MHz, 1710-1755 MHz, 1850-1990 MHz, and 2110-2155 MHz are required to obtain certification of spectrum support from NTIA, in accordance with Section 8.2.5 of the NTIA Manual. Requests for spectrum certification of such systems shall be submitted for review by the Spectrum Planning Subcommittee (SPS) and shall contain the following information:

- a. Stage of Review: Indicate the stage of review requested.
- b. Responsible Organization Entity and Point-of-Contact: Provide the name of the bureau, program office, or other organization entity responsible for the field-level deployment and management of the system, including a telephone point-of-contact.
- c. Equipment Identification: Name of the manufacturer of the equipment and the name or model number of the specific equipment.
- d. FCC Certification Identification Number(s): Provide the FCC ID Number(s) of all transmitters in the system.
- e. Number of Units: Number of individually deployable transportable units that will be operating cooperatively and simultaneously within the deployed system.
- f. Frequency Band(s): Identify the frequency band(s) in which the subject system is to operate.
- g. Power: Transmitter power of each unit in the deployable system, in watts.
- h. Emission Designator(s): Specify the emission designator(s) for transmitters within the system.
- i. Rationale for the Procurement of the System: Submit justification for procurement of the system and an explanation of the plans and conditions under which the system would be deployed, including projected arrangements or constraints related to sharing of the system among other federal agencies.
- j. Federal agency agreement with non-federal entity: Provide a summation of agreements established to facilitate the operation of the system.

## **10.3 SCOPE OF PROCEDURE**

### **10.3.1 Applicability and Limitations**

This procedure is applicable to systems and subsystems as defined in Section 10.2. It shall be limited to:

- 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 SPS on a case-by-case basis by the NTIA, the IRAC, the FAS, or a cognizant federal agency. Such referral may result from factors of system cost or importance, or follow from estimates of unusual potential impact on other spectrum uses.

### **10.3.2 Experimental Projects**

Experimental projects are included in this procedure.

### **10.3.3 EW/ECM Threat Simulators**

EW/ECM threat simulators are specialized RF systems which operate in many parts of the frequency spectrum. These systems are used for testing, training, and evaluation of electronic warfare systems and procedures. They usually operate at military installations and ranges as specified in Sections 7.11 and 7.17. Threat simulators operate in accordance with Section 7.14, but their frequency assignments are exempt from the

provisions of Chapter 10. This does not preclude the review of EW/ECM threat simulators by the IRAC. All threat simulator assignments will use the 'XT' station class and bear the special note 371.

#### **10.3.4 Individual Stations, Links, or Networks**

An individual radio station, an individual point-to-point radio link, or an individual network in the mobile radio service, any of which is to become a part of an existing identified telecommunication system or subsystem, for example, will normally not be considered for the purpose of this review procedure. Application and plans for such individual stations, radio links, and services will be reviewed by the SPS only upon direct referral for cogent reasons such as given in Subsection 10.3.1.c.

#### **10.3.5 Individual Components**

An individual component of a system or subsystem, as defined in Section 10.2, will normally not be considered for the purpose of this review procedure.

#### **10.3.6 Federal Use of the Band 220-222 MHz**

Nationwide systems using the 2 designated, exclusive federal nationwide 5-channel blocks and local systems operating on the channels shared with non-federal users in the band 220-222 MHz are included in this procedure. Detailed equipment characteristics of systems that have been type-accepted by the FCC or already received by the SPS will normally not be considered for the purpose of this review procedure. However, a list of all base stations (geographic coordinates when known and site names), with antenna heights, effective radiated power, and dates of construction and bringing into use for each nationwide and non-nationwide system shall be provided to the Spectrum Planning Subcommittee for review. Justification of any implementation dates more than 1 year after the requested date of Stage 4 Certification of Spectrum Support should be included for non-nationwide systems.

#### **10.3.7 Non-Licensed Devices**

Federal policy for non-licensed devices is covered in Parts 7.8 and 7.9 and such devices will normally not be considered for the purpose of this review procedure. Plans or proposals to operate non-licensed devices in space, however, shall be submitted to the SPS for record (this information should be submitted via a short memorandum and include the frequency bands, Part 15 FCC ID number if applicable, and how the equipment will be used). Agencies can request that information on a non-licensed device, regardless of whether it is to be used in a terrestrial application or in space, shall include a justification for SPS consideration of such a device.

#### **10.3.8 Spectrum Support for Use of Federal Fixed Ultrawideband Systems Not Intended for Operation under Sections 7.8 or 7.9**

Federal agencies desiring to deploy fixed UWB systems that do not conform to Sections 7.8 or 7.9 shall request spectrum support in accordance with Chapter 10. In response to spectrum support requests for such systems, NTIA, with the assistance of the SPS, will, considering the frequency range of operation, develop a list ("List") of federal systems that must be considered when evaluating the compatibility of the proposed UWB use. NTIA will use the analysis method provided in NTIA Special Publication 01- 43, *Assessment of Compatibility between Ultrawideband Devices and Selected Federal Systems*, as the basis to develop coordination trigger distances for each of the federal systems on the List. In developing the coordination trigger distances, NTIA may, as necessary, also take into consideration other UWB application-specific factors (e.g., aggregate interference). NTIA will evaluate the intended location of the proposed UWB system in terms of these coordination trigger distances with respect to any federal operations related to systems on the List. If the proposed UWB location falls outside of the established distances, then the application will receive spectrum support. If its location falls within the established distances, then the requesting agency will have to work with the affected agency or agencies. As part of this effort, measurements or more detailed analyses, performed in cooperation with the affected agency or agencies, may be required. Such measurements or analyses may demonstrate, through consideration of additional technical factors or system characteristics, that the proposed UWB system is compatible with authorized systems on the List or may be operated at a distance less than the coordination trigger distance. Such measurements or analyses may require the support of the potentially impacted agency or agencies, including making the potentially

impacted system or systems available for measurements. Where the measurements or analyses show compatibility, NTIA will grant spectrum support. Furthermore, any measurements or analyses used to establish compatibility will become a resource to be considered in future spectrum support assessments for the supported UWB system at other locations.

## **10.4 STAGES OF REVIEW AND SCHEDULING**

### **10.4.1 Stages of Review**

1. *Stage 1, Conceptual*: Certification of spectrum support for telecommunication systems or subsystems at Stage 1 provides guidance on the feasibility of obtaining certification of spectrum support at subsequent stages. Those systems or subsystems that have a major impact on spectrum usage as defined by the user agencies, IRAC, or NTIA, especially those that use new technological concepts or use existing technology in significant new ways, should be submitted. The guidance provided will indicate any modifications, including more suitable frequency bands, necessary to assure conformance with the National Table of Frequency Allocations and the provisions of Chapter 5.

2. *Stage 2, Experimental*: Certification of spectrum support for telecommunication systems or subsystems at Stage 2 is a prerequisite for NTIA authorization of radiation in support of experimentation for systems that are subject to these procedures (see Section 10.2). It also provides guidance for assuring certification of spectrum support at subsequent stages. Certification at Stage 2 may be requested for test equipment, modified operational equipment, or initial design models that can be used to determine which of several frequency bands or which of several proposed equipment configurations should be selected for continued investigation.

3. *Stage 3, Developmental*: Certification of spectrum support for telecommunication systems or subsystems at Stage 3 is a prerequisite for NTIA authorization of radiation in support of developmental testing for systems that are subject to these procedures. It also provides guidelines for assuring certification of spectrum support at Stage 4. At this point, the intended frequency band will normally have been determined and certification at Stage 3 will be required for testing of proposed operational hardware and potential equipment configurations.

4. *Stage 4, Operational*: Certification of spectrum support for telecommunication systems or subsystems at Stage 4 is a prerequisite for NTIA authorization of radiation from a station with an operational station class (i.e., other than experimental) for systems that are subject to these procedures. Tracking, telemetry, and telecommand operations for satellite networks shall have NTIA Stage 4 certification of spectrum support before the launch of the spacecraft (see Section 8.2.53). Stage 4 certification provides restrictions on the operation of the system or subsystem as may be necessary to prevent harmful interference.

### **10.4.2 Scheduling of Reviews**

Systems or subsystems falling within the scope of this chapter shall be referred to the SPS in sufficient time to permit guidance to be developed by SPS and NTIA and applied by the agency. Routine system reviews can be typically completed and spectrum support guidance can be provided within two to six months from the date of submission to SPS. The submitter shall consider this time period and the provision of Subsection 10.5.3.1 requiring the FAS to withhold frequency assignments until the assignment particulars conform to the spectrum support guidance. For space systems, the submitter shall also consider the time requirements for international processing of advance publication, coordination, notification, and agreement documents.

## **10.5 RESPONSIBILITIES**

### **10.5.1 Spectrum Planning Subcommittee (SPS)**

1. In its system reviews, the SPS shall give consideration to:
  - a. system compliance with prevailing spectrum management policy, allocations, regulations, and technical standards (Federal, National, and International);
  - b. the predicted degree of EMC between the proposed system and the electromagnetic environment; and,
  - c. the possible need for and evaluation of the results of prototype EMC testing.
2. Upon assessment of a proposed system or subsystem, considering these criteria and any other pertinent factors, the SPS will make recommendations with supporting documentation to NTIA with an information copy to

the IRAC, for:

- a. approval of spectrum support for the system at its proposed stage of development, without qualification; or
  - b. approval of spectrum support subject to stated limitations or to modification of the proposed system; or
  - c. approval of spectrum support subject to limitations or modifications to systems already in the band; or
  - d. approval of spectrum support subject to submission of information for advance publication, agreement of affected foreign administrations, notices for coordination, and notification of frequency assignments for unclassified space systems, as appropriate, under the provisions of Articles **5**, **9** and **11** of the ITU Radio Regulations; or
  - e. disapproval of spectrum support.
3. The SPS will refer cases when the affected agencies are unable to reconcile specific points of potential EMC conflict to the IRAC for resolution.

### **10.5.2 Space Systems Subcommittee (SSS)**

1. The SSS shall review the data furnished by federal agencies regarding the advance publication, agreement with affected administrations, and coordination and notification of frequency assignments for space telecommunication systems under the provisions of Articles **5**, **9** and **11** of the ITU Radio Regulations. The SSS shall give consideration to:

- a. the conformance of the system to the provisions of the ITU Radio Regulations and applicable Radiocommunication Bureau (BR) Circular Letters;
- b. the identification of those countries from whom agreement must be obtained under the provisions of the ITU Radio Regulations; and
- c. the identification of those countries with whom the system must be coordinated under the provisions of the ITU Radio Regulations.

2. The SSS shall also review the correspondence furnished by the Radiocommunication Bureau (BR) and by other countries regarding proposed space telecommunication systems in accordance with the ITU Radio Regulations. The SSS will estimate the impact of foreign space systems on existing and planned federal space and terrestrial telecommunication systems and will develop appropriate replies. Information regarding foreign space systems that operate in bands shared with U.S. terrestrial stations will be furnished to the SPS for comment when it is appropriate.

3. Documents which have been approved by the SSS shall be coordinated with the Deputy Associate Administrator, Office of Spectrum Management, and provided to the FCC Liaison Representative for transmittal to the Radiocommunication Bureau (BR) and any concerned foreign countries.

### **10.5.3 Frequency Assignment Subcommittee (FAS)**

1. The FAS shall not recommend the assignment of frequencies to stations in systems that are subject to these procedures until notice is received that frequency support for the system has been certified. The particulars of the assignments shall conform to the terms of the system approval. Assignment applications for such stations received in the FAS prior to system review shall be tabled until the appropriate stage of the system review procedure has been completed. The FAS shall inform the SPS of this action.

2. The FAS may recommend frequency assignment action for (a) additional stations and (b) the modification of assignments to stations in existing systems or systems approved under this procedure, provided the operations resulting from the assignment action will have only minor local effect upon the electromagnetic environment.

3. The FAS shall place emphasis on the careful review of applications involving sharing of the same frequency bands by terrestrial and space services. When necessary, the FAS may recommend to IRAC that further EMC analysis by NTIA, or other cognizant agency, be completed prior to assignment action. Any matters that cannot be resolved, and those applications for which approval could result in major effects on the future use of the frequency band concerned, shall be referred to the IRAC.

#### **10.5.4 Technical Subcommittee (TSC)**

The TSC and its working groups shall provide information from the ongoing programs in standards, criteria for spectrum sharing, propagation, trade-offs among telecommunication techniques, radio noise and interference environments, side effects of spectrum use, and federal-wide EMC capability. In addition, the TSC shall be guided in its work, scope, and priority by requirements identified by the IRAC for support of EMC reviews underway and expected in accordance with these procedures.

#### **10.5.5 Emergency Planning Subcommittee (EPS)**

The EPS shall:

1. Take note of the Telecommunications Service Priority for Radiocommunications (TSP-R) as determined by a department or agency for each of its systems supporting national security emergency preparedness (NSEP) functions approved under the provisions of this chapter.

2. Consider the NSEP function, the telecommunication system or systems which is or are to support the function, and the priority designated by the agency in relation to the function. Consideration of an agency-designated TSP-R is intended only to ensure consistency of TSP-R criteria interpretation. An assessment of the designated TSP-R in relation to other systems or functions of the submitting agency or those of other departments or agencies is not appropriate.

3. Incorporate the approved NSEP systems and their spectrum requirements and TSP-Rs into its recommendations to NTIA with an information copy to the IRAC. Upon receipt, NTIA shall annotate the NTIA Emergency Readiness Plan for Use of the Radio Spectrum (ERP).

4. Forward any disputed NSEP spectrum requirements and TSP-Rs to NTIA for resolution.

#### **10.5.6 Federal Agencies**

1. Agencies will participate in the application of these procedures in the IRAC and its Subcommittees and shall provide information needed for the system review as specified in Parts 10.7 and 10.8.

2. IRAC representatives shall be responsible for determining within their agencies which systems come within the scope of this procedure (see Section 10.3) and should, therefore, be submitted to the SPS for system reviews. In making this determination, IRAC representatives should give serious consideration to the spectrum-related concerns of other member agencies. A system review under Chapter 10 entails consideration of a more detailed EMC analysis than is appropriate within the FAS.

3. Agencies will take into account recommendations provided as a result of the system review in the modification and resubmission of proposals to improve system EMC characteristics and facilitate frequency support. Agencies may recommend and will consider modifications to existing facilities and will facilitate the accommodation of new systems. Agencies may participate in EMC studies specified in Section 10.6 as an active associate to the degree required to assure responsiveness to their requirements and responsibilities and shall be consulted to assure development of realistic assignment criteria and other technical system considerations.

#### **10.5.7 National Telecommunications and Information Administration (NTIA)**

NTIA will review any disputed NSEP spectrum requirements and TSP-Rs and inform the EPS of its decision.

### **10.6 EMC ANALYSIS SUPPORT**

#### **10.6.1 General**

1. In reviewing and assessing the EMC and frequency availability aspects of proposed telecommunication systems, as defined herein, the SPS shall depend upon system and equipment characteristics data submitted by the proposing agency and upon available environmental information.

2. The SPS shall make use of the results of any available technical studies and any pertinent EMC analysis capabilities within federal agencies when assessing proposed systems. More specifically, the SPS shall arrange for and make use of existing EMC analysis capabilities and procedures of the DoD, NASA, and other federal agencies where they may expedite or enhance its assessment of a proposed system. Arrangement for such support will be

obtained through NTIA. Moreover, the SPS shall promote the cooperative exchange of views and information among the agencies that may provide EMC analysis support to the subcommittee.

3. The SPS will be supported by NTIA and may refer to NTIA, as appropriate, system proposals for evaluation and recommendations regarding:

- a. compliance with prevailing standards and sharing criteria;
- b. predicted degree of EMC with the environment;
- c. relative efficiency in the use of the radio spectrum by the proposed system;
- d. system modification or alternatives, including modifications to stations already operating in the band(s) in question, where appropriate; and
- e. technical solutions for systems having conflicting spectrum requirements within the US&P.

4. The SSS will be supported by NTIA and may refer to NTIA, as appropriate, U.S. and foreign space system proposals for evaluation and recommendations regarding:

- a. conformance to applicable national and international rules and regulations;
- b. predicted degree of EMC with the environment; and
- c. system modifications or alternatives, including modifications to stations already operating in the band(s) in question, where appropriate.

## **10.6.2 Types of Analysis**

1. Types of analysis will vary from a determination of gross impact on the spectrum to detailed EMC analysis. The level and complexity of analysis must depend on the quality of the data available at the various stages of system development.

2. In analyses leading to certification of spectrum support at Stage 1, Conceptual, much of the system data will be estimated, only gross calculations may be achievable for a general evaluation of spectrum impact that will be subject to adjustment during later stages. The system will be reviewed in conformance to International and National Allocation Tables. In addition, checks will be made against existing standards and sharing criteria, comparison will be made with known similar systems, and spectrum efficiency will be considered.

3. In analyses leading to certification of spectrum support at Stage 2, Experimental, the foregoing types of analysis will be applied where appropriate with more specific EMC analysis against a typical environment being added where experimental testing of technically defined equipment is involved. Recommendations for changes to equipment characteristics and contemplated operational employment/deployment will be provided, where appropriate. Calculations required in connection with national and international space coordination procedures in accordance with the methods of Appendices 7 and 8 of the ITU Radio Regulations will be performed to the extent practicable.

4. In analyses leading to certification of spectrum support at Stage 3, Developmental, more detailed EMC analyses will be performed, using measured data from experimentation when available. Appropriate recommendations as to equipment characteristics and/or operational employment/deployment will be developed. Calculations in connection with national and international space system coordination procedures will be performed or updated as appropriate.

5. In analyses leading to certification of spectrum support at Stage 4, Operational, detailed EMC analyses will be updated, as required, to include consideration of frequency assignments for specific system deployment. Appropriate recommendations as to equipment characteristics and/or operational limitations will be provided.

## **10.6.3 Prototype EMC Testing**

When the results of EMC analyses so indicate, prototype EMC tests may be required as an input to the determination of spectrum availability and electromagnetic compatibility.

## **10.7 GENERAL DATA REQUIREMENTS**

### **10.7.1 Minimum Data Required**

Federal agencies shall provide data, as appropriate and categorized below, to the SPS for review at the various stages as systems mature, in accordance with the provisions of this chapter. All of the specified categories of data that are appropriate to the system under review are required for Stages 2, 3, and 4. While no specific minimums of data are specified for a Stage 1 review, beyond the guidance provided under the various categories below, agencies



should provide sufficient data to allow determination of conformance with allocation tables and, for space systems, conformance with power flux density limitations.

### **10.7.2 Submission of Additional Data**

The SPS may request the submission of additional data or data estimates during the course of its system review, or may endorse direct contact between the EMC analysis support agency (NTIA or other) and the requesting agency for development of data estimates.

### **10.7.3 Upgrading of Data Previously Provided**

Agencies proposing new systems shall be responsible for the upgrading of data provided to the SPS for the earlier stages, as more valid information becomes available and as the system progresses through the various review stages to its final operational configurations.

### **10.7.4 Changes to Submissions**

1. In between the time an agency submits a system to the SPS for review and prior to its NTIA approval, changes or additions to the system characteristics may occur. If these changes are easily correctable, they will be inserted by NTIA in the agency's original submission document. If the changes are more extensive, the submitting agency will revise the affected forms and submit them to NTIA for incorporation in the original submission document. The purpose of this procedure is to ensure that the latest available data is included in the final NTIA system review package. All changes will be reviewed by the SPS before its recommendations to NTIA are finalized.

2. Changes or additions to an NTIA approved Certification of Spectrum Support may occur after a system has been certified. Changes submitted will include the Certification of Spectrum Support to be modified. The purpose of this procedure is to ensure that the members of the SPS may see the salient spectrum management issues in their present state, including those of a classified nature; and, this inclusion may permit the SPS provide a ruling at the table. All changes will be reviewed by the SPS before its recommendations to NTIA are finalized.

### **10.7.5 Selective Upgrading of Data**

The SPS may request the selective upgrading of electromagnetic environmental data for specific areas and radio services, where necessary to support realistic EMC analyses of new systems.

## **10.8 SPECIFIC DATA REQUIREMENTS**

1. Certification requests shall contain information sufficient to enable NTIA and the SPS to evaluate systems for spectrum supportability. The information necessary to support the system review process is summarized in Sections 10.8.1 through 10.8.8. Additional information required for review of trunked land mobile radio systems is summarized in Section 10.9. Effective November 1, 2009, requests are to be prepared and submitted electronically in a format that is compatible with the Office of Spectrum Management Data Dictionary (OSMDD). NTIA has developed the Equipment Location – Certification Information Database (EL-CID) tool to facilitate preparation and submission of certification requests.

2. EL-CID is a suite of automated capabilities that provides a graphical, icon-based user interface that is supported by logic that captures relationships among and between groupings of data that characterize components of the system and modes in which the system operates. The tool facilitates entry of system parameters required to complete applications for certification of spectrum support. The EL-CID tool prompts users with displays and instructions for entering the specific data into a properly formatted file that can be used to conduct a system review. Help files are available through the EL-CID user interface to assist in clarifying data requirements and ensuring that it is formatted correctly.

3. The EL-CID tool is available to federal agencies and supporting contractors at: <http://www.ntia.doc.gov/osmhome/elcid>.

## 10.8.1 Information Required for all Systems

1. *Stage of Review Requested*: Indicate the stage of review requested.
2. *Purpose of the System*: Submit for all stages a summary description of the function of the system or subsystem (e.g., collect and disseminate meteorological data using satellite techniques; transmission of radar data for air traffic control; remote control of ATC radars).
3. *Information Transfer Requirement*: Submit for all stages the required character, quantities, data rates, and circuit quality/reliability.
4. *Estimated Termination Date (where applicable)*.
5. *Estimated Initial Cost of the System*: Provide the estimated cost of the radiocommunication system, subsystem, or equipment for which certification is requested. If multiple units of the system are to be procured, the cost per unit and estimated number of units included in the procurement are to be specified. This item is for information to assist NTIA in monitoring the investment by federal agencies in spectrum-dependent systems and technology. It is not intended to be a determining factor in system reviews.
6. *Target Date*: Submit dates on which spectrum-related decisions must be made relative to system planning, development, procurement, and employment.
7. *System Relationship and Essentiality*: Submit for all stages a statement of the relationship between the proposed system and the function or operation it is intended to support. Include a brief statement of the essentiality to the supported function or operation.
8. *Replacement Information*: Identify the existing system(s) to be replaced by the proposed system, where applicable.
9. *Non-Conforming Operations*: Submit a justification for any telecommunication system or subsystem for which the proposed operations are not in accordance with the National Table of Frequency Allocations as directed in Section 10.1.1 of this Chapter. The justification should be accompanied by details of how it is feasible to conduct such non-conforming operations on a non-interference basis. This information is required for systems or subsystems that will operate in the United States, its possessions, or in space in a manner that is not in complete conformance with the National Table of Frequency Allocations.
10. *National Security Emergency and Preparedness Function*: A statement as to whether the proposed system, if it becomes operational, will support a NSEP function and require review in accordance with Section 10.1.4 of this Chapter.

## 10.8.2 Required Data for Space Systems

1. Stage 1 and 2 Requirements:
  - a. Satellite orbital characteristics (longitude for geostationary satellites, and apogee, perigee, and inclination for non-geostationary satellites).
  - b. Satellite transmitter maximum spectral power density for each transponder.
  - c. Earth station locations (city and state) within the US&P, and frequencies or frequency bands used at each.
2. Stage 3 Requirements; In addition to satisfying all Stage 1 and 2 requirements the following data items are required for each Earth station transmitter and receiver site:
  - a. Frequencies or frequency bands and satellites accessed.
  - b. Coordinates.
  - c. Emission designator for each frequency or frequency band.
  - d. Maximum spectral power density and output power for each frequency or frequency band.
  - e. Antenna gain and beamwidth.
  - f. Minimum elevation angle of antenna main beam.
  - g. Range of azimuth angles.
  - h. Lowest total receiver noise temperature.
3. Stage 3 Requirements; In addition to satisfying all Stage 1 and 2 requirements for each space station transmitter and receiver:
  - a. Frequency or frequency bands and interoperating earth stations.
  - b. Satellite orbital information.
  - c. Emission designator for each frequency or frequency band.
  - d. Peak power and spectral power density for each frequency or frequency band for transmitters.
  - e. Receiver noise temperature.

- f. Transmitter antenna pattern (only if PFD limits are exceeded).
4. Stage 4 Requirements; In addition to satisfying all Stage 3 requirements, the following data items are required for each earth station:
  - a. Horizon elevation angle diagram.
  - b. Antenna altitude above ground.
5. Unclassified space systems which have not been waived from the requirements of international registration as described in Section 3.3, similar information must be prepared in specific formats and submitted to the SSS in accordance with instructions in Section 3.3. The data required by the SSS to satisfy the specifications in Appendix 4 of the ITU Radio Regulations for:
  - a. Advance Publication shall be submitted at the same time as the Stage 2 system review request;
  - b. Coordination and Notification data shall be submitted at the same time as Stage 3 system review requests.
6. If any of the frequency bands proposed for the satellite network or system are subject to coordination under the ITU Radio Regulations, the simplified advance publication information for those bands, as set forth in Sub-Section IB of Article 9 of the Radio Regulations, cannot be used in lieu of 10.8.2 data. In those cases where the simplified advance publication information is required by the ITU, the simplified information as well as the 10.8.2 data must be submitted.

### **10.8.2.A Supplemental Information for Space Systems Using Necessary Bandwidths Greater Than 5 MHz for Transmissions from Space in the Band 2200-2290 MHz**

For space station transmitters that operate in the band 2200-2290 MHz and require use of necessary bandwidths that exceed 5 MHz, requests for certification shall include a justification explaining why such bandwidth is required. Additionally, the sponsoring agency must explain why the radio communications requirement cannot be satisfied using less bandwidth. Spread spectrum missions (e.g., space-to-Tracking and Data Relay Satellite communications, lunar downlinks, and lunar data relay satellite communications) that enable multiple users on the same channel and require a necessary bandwidth of approximately 6.16 MHz, are exempt from this policy.

### **10.8.3 Required Data for Terrestrial Systems (all stages)**

Required Data For Terrestrial Systems:

- a. Station class(es),
- b. Number of units (for mobile systems),
- c. Station locations and/or areas of operation, as appropriate (geographical coordinates required for Stages 2, 3, and 4),
- d. Frequency requirements (i.e., band(s) or discrete frequencies required, bandwidth and emission designators, and netting information, where appropriate),
- e. Proposed date of activation.

### **10.8.4 Related Analysis Data**

1. For all stages, submit reports of any previous EMC studies, predictions, analyses, and prototype EMC testing that are relevant to the assessment of the system under review, or references thereto if previously provided to the IRAC/SPS, including references to previous system reviews of the same system or its predecessors.
2. For military requests for Stage 3 spectrum certification of 1030/1090 MHz systems, attach a copy of the Department of Defense (DoD) International AIMS Program Office (PO) box-level certification letter, and for Stage 4 reviews, attach a copy of the DoD AIMS Program Office platform certification letter.

### **10.8.5 Describe Equipment Characteristics**

Technical characteristics of the system need to be provided to enable evaluation of compliance with applicable NTIA spectrum standards. Additionally, the equipment data needs to characterize operating modes by association of specific data elements on a mode-by-mode basis. The EL-CID tool has been designed to facilitate the collection of the required information in a manner that associates data elements with specific operational modes.

## 10.8.6 Required Transmitter Characteristics Data

Required Transmitter Characteristics Data:

- a. The transmitter nomenclature/name model number and manufacturer.
- b. The frequency stability.
- c. The spurious emission level.
- d. The harmonic emission levels.
- e. The transmitter power delivered to the antenna terminals.
- f. The frequency range through which the transmitter is capable of being tuned.
- g. The emission designators for the types of emission capable of being used by the transmitter.
- h. For each emission designator the emission bandwidth at the -3, -20, -40, -60 dB levels.
- i. For each emission designator based on the modulation symbols and the description of the modulation methods the EL-CID tool will request the technical data required to describe the modulation.
- j. Identify the availability of an automatic transmit power control system for fixed microwave systems in the bands 1780-1850 MHz, 2200-2290 MHz, 4400-4940 MHz, and 7125-8500 MHz.

## 10.8.7 Required Receiver Characteristics Data

Receiver Characteristics Data:

- a. The receiver nomenclature/name model number and manufacturer.
- b. The frequency stability.
- c. The spurious rejection level.
- d. The image rejection level.
- e. The frequency range through which the receiver is capable of being tuned.
- f. The emission designators identifying the types of emission for which this receiver is designed.
- g. For each frequency band the RF bandwidths at the -3, -20, -60 dB levels.
- h. For each emission designator the IF bandwidths at the -3, -20, -60 dB levels for the narrowest IF amplifier.
- i. For each emission designator specify the receiver sensitivity and specify the criteria used.

## 10.8.8 Required Antenna Characteristics Data

Required Antenna Characteristics Data:

- a. The antenna nomenclature/name model number and manufacturer.
- b. The range of frequencies for which it is designed.
- c. The polarization.
- d. The maximum gain and beamwidth.
- e. The maximum gain of the first side lobe and the angular displacement from the main beam.
- f. The generic name and description of the antenna. The EL-CID tool will prompt for specific technical characteristics based on the antenna description.

## 10.8.9 Required Data for Wideband and Narrowband Emission Level and Temporal Measurements in the Navstar Global Positioning System Frequency Bands

When Stage 4 certification is requested for systems (excluding passive systems) operating in the bands 390-413 MHz, and 960-1710 MHz, measured data is to be submitted as specified in Section 8.2.55.

- a. The measured emission levels are to be provided as shown in the example below:

*GPS Wideband emission level: 1164-1240 MHz band is -XX dBW/MHz; 1559-1610 MHz band is -XX dBW/MHz*

*GPS Narrowband emission level: 1164-1240 MHz band is -YY dBW; 1559-1610 MHz band is -YY dBW*

The EL-CID tool will prompt the user to provide the data when appropriate.

- b. For pulsed systems a plot of the relative power level in the 1164.45-1188.45 MHz, 1215.6-1239.6 MHz,

and 1563.42-1587.42 MHz bands as a function of time can also be submitted as an attachment to the EL-CID tool.

c. The guidelines for making the emission level and temporal measurements are provided in Annex M, Sub-Section M.2.1.F.

## **10.9 TRUNKED LAND MOBILE DATA REQUIREMENTS**

Trunked system review is based on the need to consider the system as a whole, which is not possible with the unconnected and separate frequency proposals made to the FAS.

### **10.9.1 Requests for New Trunked Systems**

Requests for spectrum certification of new trunked land mobile systems shall contain the following information:

- a. **Operating Location:** Provide the city (or other geographic subdivision) and state.
- b. **Equipment Identification:** Provide the manufacturer and model number/name of the equipment.
- c. **Docket Number of Previous Certification:** Provide the SPS docket number of the NTIA Certification of Spectrum Support for the equipment. (Agencies may obtain this information from the SPS Secretary, who maintains a list of approved trunking systems and associated docket numbers.) If the equipment has not received NTIA Certification of Spectrum Support, provide the equipment characteristics identified in Section 10.8.6 using the EL-CID tool.
- d. **System Overview:** Provide a line diagram representing the system configuration and method of connecting multiple sites. Specify if dispatcher uses phone lines or RF to connect to the base/repeater stations.
- e. **Coverage Information.** Provide the following for each repeater site:
  - (1) Geographical Coordinates: (in degrees, minutes, and seconds)
  - (2) Site Elevation: (in meters above mean sea level)
  - (3) Antenna Height: (in meters above site elevation)
  - (4) Antenna Gain: (in dBi)
  - (5) Transmitter Power: (in watts)
  - (6) Radius of Operation: (in kilometers); or Geographical Plot of Required Coverage Area
- f. **Frequency Requirements:**
  - (1) Frequency Band
  - (2) Number of Frequencies Required
- g. **Total Number of Users**
- h. **Target Date for System Activation**
- i. **Frequency Assignments to Be Replaced by this System:**
  - (1) **Assignments to Be Relinquished:** Provide the existing Assigned Frequencies, Agency Serial Numbers, and Expected Relinquishment Date.
  - (2) **Assignments to Be Used by the Trunked System:** For each existing frequency assignment that will be incorporated into the trunked system, provide the existing Assigned Frequencies and Agency Serial Numbers.
- j. **Estimated Initial Cost of the System**
- k. **Separate System Justification:** For trunked land mobile systems that are within 30 km of an existing or planned trunked land mobile system authorized by NTIA, provide the information required under Section 8.2.48A.
  1. *National Security Emergency and Preparedness Function:* A statement as to whether the proposed system, if it becomes operational, will support a NSEP function and require review in accordance with Section 10.1.4 of this Chapter.

### **10.9.2 Requests for Expansion/Additional Channels**

Requests for expansion or additional channels for previously certified trunked land mobile systems shall contain the following information:

- a. *Docket Number of Previous Certification:* Provide the SPS docket number of the NTIA Certification of Spectrum Support for the existing trunked system.
- b. *Additional Frequency Requirements*
  - (1) *Number of Additional Frequencies Required*
  - (2) *Rationale for Additional Frequencies:* (e.g., channel loading, queuing times, new users).

c. *Details of Expansion*

(1) *Additional Repeater Sites*: Provide the information listed in Section 10.9.1, paragraphs 5a-5f, for each additional repeater site.

(2) *Additional Users*: Provide the information listed in Section 10.9.1, paragraph 7 for additional users.

d. *Equipment Identification*

e. *Target Date for Expansion/Additional Channels Activation*:

f. *Estimated Cost of this Expansion*

g. *National Security Emergency and Preparedness Function*: A statement as to whether the proposed system, if it becomes operational, will support a NSEP function and require review in accordance with Section 10.1.4 of this Chapter.

### 10.9.3 Guidelines Regarding Certification of Spectrum Support for Trunked Systems

1. Certifications of spectrum support for trunked systems with a date of activation exceeding one year from the date of certification will include a recommendation that record note S321 be applied to the corresponding requests for frequency assignment.

2. The SPS, will consider whether record note S321 should be applied to existing frequency assignments for systems not activated within one year from the date of certification.

3. The SPS will review the certification of spectrum support for each trunked system not activated within five years from the date of certification. Unless the responsible agency submits adequate justification for an extension of the activation time limit, the SPS will recommend to NTIA that the certification and all associated frequency assignment be revoked.

4. Unless otherwise approved by the SPS, telephone interconnects will be limited to one for each five channels, but no more than three for any size system. A trunked system with telephone interconnect must have the capability to:

a. “time-out” the length of telephone messages, and

b. control and reduce the number of channels available for telephone interconnect as demand for dispatch calls increases. For planned expansions of trunked systems, the dedicated use and/or blockage caused by telephone interconnect will not be considered as the justification for a request of additional channels.

5. The SPS, when recommending to NTIA that spectrum support be certified for a new trunked system, includes in its recommendation the maximum number of channels (frequency pairs) which may be used by the system. In arriving at this figure, the SPS uses a basis of 100 subscriber stations per channel. For the purposes of determining compliance with trunked system loading requirements, the term “subscriber stations” includes control (or land) stations as well as vehicular and portable units.

a. *New Systems*. A federal agency requesting spectrum support for a new trunked system shall verify that a minimum of 70 subscriber stations for each channel authorized will be placed in operation within five years of the date of the certification of spectrum support.

b. *Expansion of Existing Systems*. The SPS will not recommend approval of any request for expansion of an existing trunked system unless the existing system has a loading level of at least 70 subscriber stations per channel.

c. *Exceptions*. Exceptions to the above loading criteria will be considered by the SPS on a case-by-case basis. Other factors (for example, the number of required failsoft channels) may be considered in addition to the criteria described above.

## 10.10 LAND MOBILE SYSTEM DATA REQUIREMENTS

An agency choosing to submit a conventional land mobile system for spectrum certification shall, for land mobile systems that are within 30 km of an existing or planning trunked land mobile system authorized by NTIA, provide the information required under Subparagraph 8.2.48A.

## 10.11 ULTRA-WIDEBAND RADARS

### 10.11.1 Frequency Availability

1. There are provisions in Parts 7.8 and 7.9 and Annex K of the NTIA Manual for federal agencies to operate

systems that conform to either the Federal Communications Commission's rules in 47 CFR Part 15 or those in NTIA Manual Annex K on a non-licensed, non-interference basis. Both 47 CFR, Part 15 and Annex K include provisions for non-licensed operation of UWB devices that can be mass-marketed and operated largely without coordination with existing authorized stations.

2. This section provides guidance for agencies seeking to operate UWB systems that cannot conform to the 47 CFR Part 15 or Annex K rules for non-licensed operations. Such devices, like the non-licensed UWB systems, may only operate on a non-interference basis to stations operating in accordance with the allocation tables. Since UWB systems that do not conform to Part 15 or Annex K provisions will require certification of spectrum support, authorization for these UWB systems will be provided only when the requesting agency provides a suitable analysis and operating restrictions can be made to ensure compatible operation with existing authorized stations.

3. The requirements of this section do not apply to systems such as radars, fixed, or fixed-satellite systems with bandwidths greater than 500 MHz that are operated in bands that have been allocated sufficient bandwidth for such intended operations (e.g. 71-76 GHz, 92-95 GHz).

### **10.11.2 Electromagnetic Compatibility**

In order to assure electromagnetic compatibility (EMC), agencies responsible for UWB operations shall:

- a. at a minimum, ensure protection of safety-of-life, radionavigation satellite, search and rescue, satellite uplink, satellite downlink, passive sensing, radio astronomy, and aeronautical radionavigation operations.
- b. in a timely manner, coordinate with other agencies that may be affected and may include provisions for real-time coordination during the period the UWB system is in operation.
- c. immediately suspend such operations upon the request of an affected agency or non-federal entity in the event that the UWB system causes harmful interference to authorized stations.

### **10.11.3 Requests for Spectrum Support**

1. All requests for spectrum support of ultra-wideband radars must be accompanied by a satisfactory justification for such operations.

2. Requests involving ultra-wideband radars developed by federal agencies, or those commercially available but without an FCC type-acceptance number, must initially be submitted at Stage 1, 2, or 3.

3. To simplify the system review process, requests involving ultra-wideband radars which have been type-accepted by the FCC can initially be submitted at Stage 4.

4. All requests must contain EMC/EMI test measurements, spectrum signature, or EMC analyses demonstrating the system's degree of electromagnetic compatibility with authorized services in the intended operating bands, adjacent bands, and possible harmonic frequency bands.

5. Requests involving ultra-wideband operations in frequency bands subject to footnote US246 must contain one of the following as justification for waiving the provisions of this footnote:

- a. An EMC analysis showing that there will be no impact upon radio astronomy observations.
- b. Evidence that the selection of operating locations will ensure a minimum potential for interference to radio astronomy observations.
- c. Methods for protecting radio astronomy observations, such as attenuating emissions through filtering, thus meeting or exceeding the harmful interference levels specified by ITU-R Recommendation RA.769-2.

### **10.11.4 EMC Analysis**

1. All Stage 1, 2, or 3 requests shall include an analysis demonstrating the system's degree of EMC with authorized services in the intended operating bands, adjacent bands, and possible harmonic frequency bands as per Section 10.8.1.9 (Non-Conforming Operations) and shall specifically include "details of how operations on a non-interference basis are feasible."

2. In frequency bands subject to footnote US246, the EMC analysis must show that there will be no impact upon radio astronomy observations and passive sensing operations. Various EMC methods may include:

- a. an analysis showing evidence that the selection of operating locations will ensure protection of radio astronomy observations and Earth Exploration-Satellite Service passive sensing operations;
- b. descriptions of design techniques incorporated in the UWB system for protecting radio astronomy observations and Earth Exploration-Satellite Service sensor operations, such as attenuating emissions through filtering; or

c. the use of interference levels specified by ITU-R Recommendation RA.769-2 or RS.1029-2 as a coordination trigger with the radio astronomy and Earth Exploration-Satellite Service passive sensor operations (If the UWB system emission levels are below the interference levels specified in ITU-R Recommendation RA.769-2 or RS.1029-21, coordination is not required).

3. The analysis shall clearly indicate the equivalent isotropically radiated power (e.i.r.p.) of the system expressed as average power per MHz based on the r.m.s. voltage as a function of frequency and victim receiver bandwidth, antenna gains, losses, propagation path losses, and the interference criteria of the victim receiver used in the analysis. For additional information on the details of performing EMC analyses, see ECAC-TN-78-005 EMC Analysis Handbook, NTIA Special Publication 01-43, and NTIA Technical Memorandum 04-408.

4. Additional power losses due to “terrain, foliage, or building shielding” or other phenomenon included in the analysis shall only be applied where it can be clearly demonstrated that such losses will occur consistently in all plausible operational scenarios. Polarization mismatch losses shall not be considered in the analysis. Such mismatches are only applicable where both the transmitter and receiver are fixed, and are within each-others mainbeam.

### **10.11.5 Measurements**

1. All Stage 3 requests must contain a measured spectrum signature to a level at least 20 dB below the maximum value of the emission level of the system when measured as described herein. Depending on the magnitude of the emission level, measurement data might be required at even lower levels. (This level is 10 dB below the necessary bandwidth. Measurement to this level is not required for non-licensed devices since the power levels are generally low enough to be practicably unmeasurable at levels 20 dB below the maximum emission without specialized measurement equipment with very low noise figures.) The spectrum analyzer (SA) (or other suitable measurement instrument) used for the measurements shall have an r.m.s. detector function. The r.m.s. average field strength of the emission spectrum shall be measured over the entire -20 dB emission bandwidth with a 1 MHz resolution bandwidth and a video bandwidth greater than or equal to 1 MHz. Although a video bandwidth setting of 10 times the resolution bandwidth is generally recommended for this type of measurement, it is recognized that most SAs will typically have a maximum video bandwidth of 3 MHz and if available should be used. Where practicable, the SA should have sufficient dynamic range. The averaging time for the r.m.s. measurement is to be 1 millisecond or less. If the UWB system employs pulse gating, in which the transmitter is quiescent for intervals that are long compared to the pulse repetition interval, all measurements are to be made while the pulse train is gated on. Peak radiated emission measurements shall be made using a spectrum analyzer with a 3 MHz RBW and no less than a 3 MHz VBW. The SA should be used in a maximum-hold trace mode. Additional measurements shall be made in the frequency bands 1164-1240 MHz and 1559-1610 MHz with a resolution bandwidth of no less than 1 kHz.

2. To the maximum extent possible, the field strength measurements should be performed with the UWB system under test as it is intended to be used in actual operating conditions. The radiated field strength measurements must be made using the antenna to be employed with the UWB system under test. The measurement antenna must be sufficiently broad-band to cover the frequency range of the measurements, and the use of multiple measurement antennas may be required. All measurement antennas must be accurately calibrated and must demonstrate low phase dispersion over the frequency range of the measurement. The orientation of the measurement antenna shall be varied horizontally and vertically to determine the point that maximizes the measured field strength.

a. The spectrum to be measured should include at least the fundamental emission and the secondary lobe regardless of the center frequency. The frequency spectrum shall be measured from the lowest frequency generated within the UWB system, without going below 9 kHz, up to an upper frequency defined by adding three divided by the pulse width in seconds to the center frequency in Hz.

b. A measurement showing the SA noise floor level shall also be included so that it may be clearly distinguished from the emission spectrum of the UWB system under test.

c. The resultant field strength plots shall indicate the measurement distance.

d. The resultant graphs shall be corrected to account for amplifiers, attenuators, cables, and antennas used in the measurements before the information is submitted.



e. The measured data presented shall be a composite of the maximum measurements of field strength of both horizontal and vertical polarization at each frequency and indicate the measurement distance.

f. The measured field strength levels should then be converted to e.i.r.p. (i.e. dBm or dBW) that may be used directly in EMC analyses without further conversion using the following equations:

$$\text{e.i.r.p.} = E_o + 20 \text{ Log (D) } - 104.8 \text{ (dBm)}$$

$$\text{e.i.r.p.} = E_o + 20 \text{ Log (D) } - 134.8 \text{ (dBW)}$$

where

$E_o$  is the field strength in dB

D is the measurement distance in meters.

g. The measured data shall be presented in graphical form with sufficient resolution for analytical purposes and be properly labeled.

**(Last Page in Chapter 10)**