ATP 6-02.70

Techniques for Spectrum Management Operations

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Contents

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Preface

ATP 6-02.70, *Techniques for Spectrum Management Operations*, establishes Army doctrine for Army spectrum management operations. This publication provides doctrinal guidance to Army spectrum users and describes how spectrum managers support commanders through the warfighting functions, the military decision making process, and the common operational picture (COP). This ATP provides technical descriptions of the spectrum management tools; including capabilities and compatibilities This ATP discusses ways to use the various spectrum management tools while performing spectrum management operations in support of unified land operations.

The principal audience for ATP 6-02.70 is Army commanders, leaders and staffs at all levels, members of the Army profession whose duties involve spectrum management operations. Commanders and staffs of Army headquarters serving as joint task force or multinational headquarters should also refer to applicable joint or multinational doctrine concerning the range of military operations and joint or multinational forces. Trainers and educators throughout the Army may also use this publication.

Commanders, staffs, and subordinates ensure their decisions and actions comply with applicable U.S., international, and, in some cases, host-nation laws and regulations. Commanders at all levels ensure their Soldiers operate in accordance with the law of war and the rules of engagement (See FM 6-27).

ATP 6-02.70 uses joint terms where applicable. Selected joint and Army terms and definitions appear in both the glossary and the text. Terms for which this publication is the proponent are marked with an asterisk (*) in the glossary. Definitions for which ATP 6-02.70 is the proponent publication are boldfaced in the text. For other definitions shown in the text, the term is italicized and the number of the proponent publication follows the definition.

This publication applies to the Active Army, Army National Guard/Army National Guard of the United States, and United States Army Reserve unless otherwise stated.

The proponent of ATP 6-02.70 is the U.S. Army Cyber Center of Excellence. The preparing agency is the Cyber Center of Excellence Doctrine Branch, United States Army Cyber Center of Excellence. Send comments and recommendations on a DA Form 2028 (*Recommended Changes to Publications and Blank Forms*) to Commander, U.S. Army Cyber Center of Excellence and Fort Gordon, ATTN: ATZH-OP (ATP 6-02.70), 506 Chamberlain Avenue, Fort Gordon, Georgia 30905-5735, or by e-mail to usarmy.gordon.cybercoe.mbx.gord-fg-doctrine@mail.mil.

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Introduction

ATP 6-02.70, Techniques for Spectrum Management Operations, is the Army's doctrine for SMO in support of unified land operations. This publication aligns with FM 6-02, Signal Support to Operations and FM 3-12, Cyberspace and Electronic Warfare Operations.

SMO enables and supports the Army warfighting functions and is essential to commanders' ability to project command and control (C2) throughout their area of operations (AO). SMO encompasses the development and dissemination of the policies governing the use of the electromagnetic spectrum throughout a unit's AO.

SMO is an integral part of electronic warfare, providing awareness of potential spectrum conflict between spectrum dependent device[s] (SDD) that may result in electromagnetic interference (EMI). Through SMO, spectrum managers mitigate EMI by deconflicting frequencies, identifying protected frequencies, and managing allotted frequencies. Spectrum managers coordinate with host nations for use of the spectrum when conducting SMO outside the continental United States.

Spectrum managers use various spectrum management tools to conduct SMO. These tools allow the spectrum manager the capability to create products and input during the military decision making process (MDMP) and cyberspace electromagnetic activities (CEMA) working groups.

Spectrum managers encounter numerous challenges throughout the electromagnetic environment (EME) when conducting SMO. These challenges come from competing SDDs that are either friendly, enemy, neutral, or civil.

This publication contains four chapters and six appendixes—

Chapter 1 provides an overview of spectrum management operations, states the objectives, and describes spectrum management operations core functions.

Chapter 2 discusses spectrum management operations support and input to the military decision making process and briefly describes the common operational picture. Spectrum managers provide support at every step of the military decision making process.

Chapter 3 links Army spectrum management operations to the warfighting functions, describes how spectrum management operations support, and enables commander's efforts as they exercise command and control.

Appendix A describes the electromagnetic spectrum manager task list and each supporting sub-tasks. This appendix also contains flow charts that show the collaboration process between electromagnetic spectrum managers and the CEMA element.

Appendix B provides basic electromagnetic physics and underlying principles of the electromagnetic spectrum.

Appendix C provides spectrum management tools, to include their compatibilities and capabilities to meet spectrum management operations critical tasks. These network centric systems are in many cases linked and accessible through Non-classified Internet Protocol Router Network (NIPRNET) and SECRET Internet Protocol Router Network (SIPRNET).

Appendix D introduces the 12-step spectrum management lifecycle. This process serves as a guide to follow in establishing a functional and efficient spectrum management program. The lifecycle encompasses the complete process of providing spectrum management operations support to the commander and is applicable to all spectrum managers regardless of duty location. The Army spectrum management lifecycle utilizes the joint task force lifecycle adapted for the Army spectrum manager.

Appendix E provides the reader with an overview of the military time zone designators. This appendix describes time zones for civilian and military uses. The chart, included in this appendix, provides a valuable tool to reference time zones in all parts of the world.

Appendix F describes spectrum information and products necessary at the corps and joint task force levels. Spectrum managers are located within three organizations in a joint task force: the joint frequency management office, the joint electromagnetic spectrum operations cell, and joint spectrum management element. These agencies have a wide variety of inputs, collaboration, and products. This chapter shows input and products from different joint agencies displayed in table format.

Chapter 1

Overview

This chapter provides an overview of spectrum management operations and provides an overview of spectrum management operations process. This chapter describes the core functions related to spectrum management operations within the context of unified land operations. This chapter discusses spectrum management operations in an operational environment. This chapter includes a description of various challenges that spectrum management personnel encounter while operating in a congested and contested environment.

SECTION I – SPECTRUM MANAGEMENT OPERATIONS

1-1. *Spectrum Management Operations (SMO)* consists of the interrelated functions of spectrum management, frequency assignment, host nation coordination, and policy that together enable the planning, management, and execution of operations within the electromagnetic operational environment (EMOE), during all phases of military operations (FM 6-02). SMO includes all activities in military operations to manage the electromagnetic spectrum. SMO is the management function of electromagnetic spectrum operations (EMSO). SMO aim to manage resources within the EMOE while resolving electromagnetic interference (EMI) by conducting EMI analysis and resolution activities. Figure 1-1 depicts the various responsibilities related to spectrum management operations as they pertain to the EMOE.
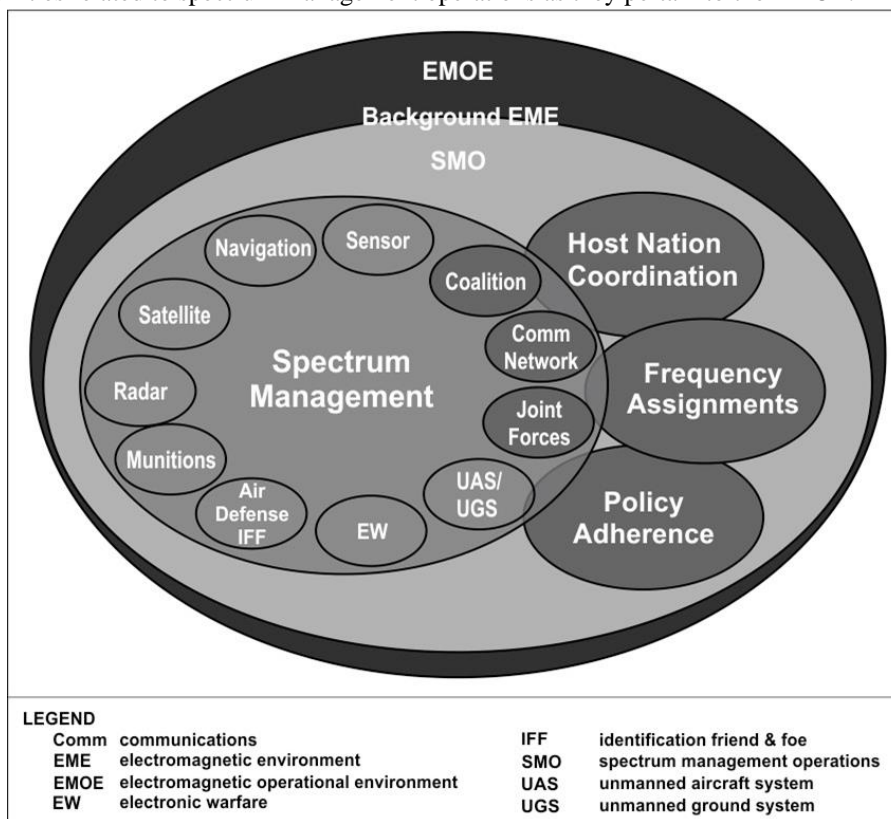

Figure 1-1. Spectrum management operations within the EMOE

1-2. Spectrum managers coordinate and collaborate with spectrum managers working in joint environments. Collaboration with joint personnel and coalition partners is common practice necessary for the Army spectrum manager while using the highly saturated and limited spectrum available. In the joint environment, joint electromagnetic spectrum operations encompass joint electromagnetic spectrum management operations and electronic warfare with the same intent as the Army's electromagnetic spectrum operations (see JP 6-01).

OBJECTIVE OF SPECTRUM MANAGEMENT OPERATIONS

1-3. SMO aims to ensure access to the electromagnetic spectrum in support of the Army's operational missions. SMO is a supporting function or enabler for unified land operations. SMO is an enabler for cyberspace electromagnetic activities (CEMA). Spectrum management is the operational, engineering, and administrative procedures to plan, coordinate, and manage use of the EMS and enables cyberspace, signal and electronic warfare (EW) operations.

1-4. SMO enables management of allotted and limited frequencies directly supporting operational forces throughout the world. The Army is dependent upon the use of the electromagnetic spectrum at all levels of unified land operations. An effective SMO program enables electronic systems to perform their functions in the intended environment without causing EMI.

1-5. Commanders must have the ability to see the use of their assigned spectrum resources so they can apply precise command and control (C2). The electromagnetic spectrum is a vital warfighting resource that requires the same planning and management as other critical resources such as fuel, water, and ammunition. Spectrum managers, with the appropriate expertise and tools, ensure that commanders have adequate knowledge of the utilization of the frequency spectrum to make decisions that positively influence the accomplishment of their missions.

SPECTRUM MANAGEMENT OPERATIONS CORE FUNCTIONS

1-6. SMO core functions determine the tasks and requirements of the spectrum manager. These four functions are—
- Spectrum management.
- Frequency assignment.
- Host nation coordination.
- Policy adherence.

SPECTRUM MANAGEMENT

1-7. Spectrum management includes the planning, coordinating, and managing use of the electromagnetic spectrum through operational, engineering, and administrative procedures. Spectrum management consists of evaluating and mitigating electromagnetic environmental effects, managing frequency records, and databases, deconflicting frequencies, frequency interference mitigation, allotting frequencies, spectrum supportability assessments, and electronic warfare coordination to ensure SDDs operate without causing EMI. Spectrum management includes conducting effective EMI management of enemy, neutral, friendly, natural, or manmade sources. EMI is resolved on a case-by-case basis and users report all suspicious activity, regardless of the severity.

1-8. EMI from natural sources, called natural EMI and include geographic electromagnetic phenomena originating from the earth, atmospheric noise (thunderstorms), and galactic noise (stars). When conducting spectrum management, spectrum managers inform users that natural interference can sometimes be reduced by using directional antennas to prevent receiving interference from all directions. However, this technique typically will not eliminate the interference coming from the direction of a received antenna. The use of higher frequencies may also mitigate natural interference. When using higher frequencies, spectrum managers must take caution not to select frequencies that could create EMI with critical frequencies using Sky wave circuits (critical frequencies). The Air Force Space Forecaster Center and National Oceanic and Atmospheric Administration transmits a daily automatic digital network messages that summarizes solar and geophysical activity (see CJCSM 3320.01C). Refer to ATP 3-12.3 for electronic protection considerations.

1-9. EMI from manmade sources are called manmade EMI and include power lines, power generators, alarm systems, electrified railroads, and fluorescent lights. When conducting spectrum management, spectrum managers inform users that it is important to isolate SDDs from manmade interference sources.

FREQUENCY ASSIGNMENT

1-10. Frequency assignment includes the planning necessary for combat net radio, Army common user systems, and associated systems. The request and issuance of authorizations to use frequencies for specific equipment, such as combat net radio and Army common user systems is a task of frequency assignment. Examples of frequency assignment are assigning the frequencies required to generate single-channel ground and airborne radio system (SINCGARS) hop sets, frequencies for remotely operated aerial systems and line of sight networks, or assigning frequencies for the Warfighter Information Network-Tactical (WIN-T) network.

HOST NATION COORDINATION

1-11. Each nation has sovereignty over its electromagnetic spectrum within its geographic area and negotiates the use of the spectrum on a case-by-case basis. A representative of the sovereign country evaluates each Department of Defense (DOD) request for the use of spectrum based on the perceived potential for EMI to local receivers. Use of military or commercial spectrum systems in host nations requires coordination and negotiation that results in formal approvals and certifications.

ENFORCING POLICY

1-12. Policies are authoritative instruments from the national strategy through the tactical level that nest and shape the spectrum management, frequency assignment, and host nation coordination process. The commander's ability to access and maneuver within the electromagnetic spectrum is dependent on policy. Countries coordinate global international spectrum use through the International Telecommunications Union and the World Radio Communication Conference. At the U.S. national level under U.S. Code Title 47, the division of spectrum management responsibility rests with the National Telecommunications and Information Administration (NTIA) for federal frequencies and the Federal Communications Commission for non-federal frequencies. The Military Command, Control, Communications and Computers Executive Board (MC4EB) is the central coordinating body for spectrum matters among DOD components. Overseas, the U.S. mission, working with DOD strategic partners, is to negotiate treaties and agreements when stationed or training U.S. forces are within a host nation. These agreements establish lines of communications between the host-nation and senior military commands to negotiate spectrum usage in support of training and operations. Examples of policy instruments include International Telecommunications Union and World Radio Communication Conference agreements, the status of forces agreements, host-nation agreements, operational orders, U.S. Code Title 47, and operations plans.

SPECTRUM MANAGEMENT OPERATIONS PROCESS

1-13. The SMO process comprises of three interacting and continuous activities: planning, coordinating and managing (see figure 1-2, page 1-4). The SMO process continues throughout the four strategic roles of the Army's mission—shape, prevent, conduct large-scale ground combat, and consolidate gains (for more information on the Army's strategic roles see FM 3-0). During the execution of unified land operations, SMO processes occur concurrently.
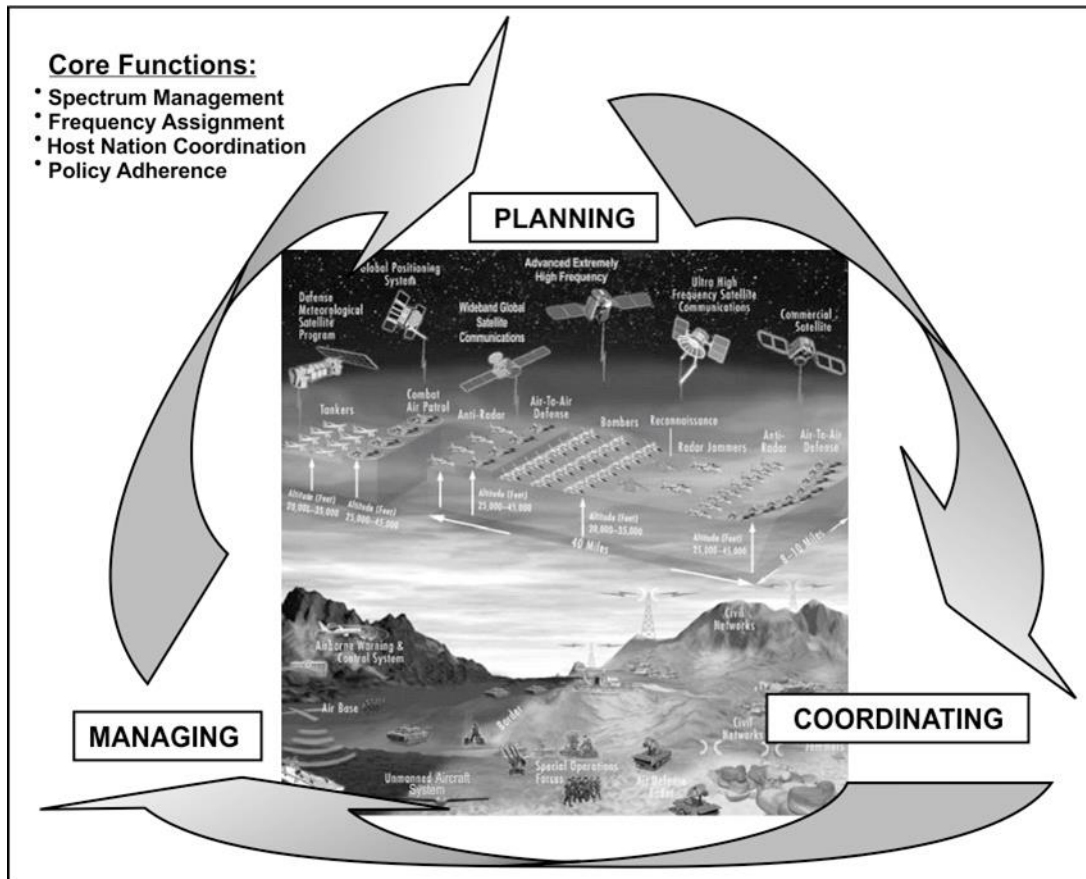
Figure 1-2. Army spectrum management operations process

PLANNING SPECTRUM MANAGEMENT OPERATIONS

1-14. SMO planning includes the identification of spectrum requirements for training, pre-deployment, deployment, and reconstitution of Army forces, both in and outside the continental United States. SMO planning is an on-going process that must be deliberate as well as dynamic to support unified land operations. It requires the collection, storage, and protection of critical spectrum data, and assured access to this data by spectrum planners on a global scale. Additionally, planning for the establishment of lines of communications and coordinating for spectrum use with national and international government and non-government agencies is critical to the spectrum planning process.

1-15. The CEMA section have an assigned spectrum manager (CEMA spectrum manager) that provides expertise in planning and coordinating horizontally and vertically to support unified land operations. The primary role of the spectrum manager is to assist with deconflicting detection and delivery assets through the planning and targeting processes.

COORDINATING SPECTRUM MANAGEMENT OPERATIONS

1-16. Coordination ensures initial spectrum availability and supportability for operations. Lines of communication for coordinating spectrum allocation at the national and international level are primarily a matter of policy established in the planning process. Enemy nations or their military do not receive United States host nation coordination.

1-17. Spectrum managers coordinate spectrum with friendly or neutral countries adjacent to the enemy, particularly if U.S. Forces stage, train, or operate within these countries. Coordination includes airspace, sovereign waters, terrestrial frequencies, and frequencies for satellites. Coordination at the operational Army

level requires prior coordination as well as the use of dynamic, instantaneous collaboration tools. Staff coordination, communications security coordination, satellite coordination, frequency deconfliction, frequency interference resolution, joint restricted frequency list (JRFL), and integration and synchronization of spectrum to support cyberspace and EW operations are SMO tasks that support spectrum functions.

Staff Coordination

1-18. Spectrum managers coordinate with various staff sections to ensure effective SMO. Commanders engage spectrum managers early in the planning process when forecasting for the use of SDDs. Spectrum managers work with many systems that are not exclusively communications systems. They must interact with other staff members to provide guidance, assistance, and advice to the commander regarding the use and prioritization of the spectrum. Systems such as remotely operated aerial systems, common user jammers, radars, navigational aids, and sensors all use the spectrum for operation. Their extensive use and unique operating characteristics necessitate special planning and coordination to mitigate frequency fratricide.

Unified Action Partners

1-19. *Unified action partners* are those military forces, governmental and nongovernmental organizations, and elements of the private sector with which Army forces plan, coordinate, synchronize, and integrate with during the conduct of operations (ADP 3-0). Coordinating spectrum use involves collaborating with unified action partners. This function ensures initial spectrum availability and supportability for operations. Lines of communication for coordinating spectrum allocation at the national and international levels are primarily a matter of policy established in the planning process.

Host Nation Coordination

1-20. Use of military or commercial spectrum systems in host nations requires coordination and negotiation resulting in formal approvals and certifications. Coordination for the use of the spectrum in host nations is required if forces stage, train, or operate within these countries to include airspace, sovereign waters, and frequencies for satellites. Prior coordination, as well as dynamic, immediate collaboration tools, results in a seamless use of the spectrum. Failure to request frequency usage promptly results in the inability to operate communications equipment in the host nation. Each nation has sovereignty over its spectrum within its geographic area and negotiates the use of spectrum on a case-by-case basis. A representative of the sovereign country evaluates each DOD request for spectrum usage based on the perceived potential for EMI to local receivers.

1-21. Military spectrum management offices use the host nation spectrum worldwide database online (HNSWDO) to track DOD host nation spectrum supportability requests to determine equipment supportability. The sponsoring service spectrum management agency adds the host nation access request to HNSWDO. The sponsoring service spectrum management agency additionally forwards the host nation's access request to the respective combatant command's joint frequency management office (JFMO) for situational awareness. The JFMO assures to annotate comments regarding the host nation's access request in HNSWDO for visibility. Tactical spectrum managers coordinate frequency assignments through established spectrum coordination channels. The JFMO may delegate the role of the joint spectrum management element (JSME) to the spectrum management offices to perform person-to-person host nation coordination in support of joint task force operations.

Electronic Warfare Coordination

1-22. Spectrum managers should be an integral part of all EW planning to provide awareness of spectrum conflicts initiated by friendly systems for personnel protection, enemy exploitation, or enemy denial. The advent of common user "jammers" has made this awareness and planning critical for the spectrum manager. In addition to jammers, commanders and staffs must consider non-lethal weapons that use electromagnetic radiation. EW coordination usually takes place in the CEMA working group. It may take place in the EW cell if it is operating under a joint construct or operating at a special echelon.

Communications Security Coordination

1-23. Spectrum managers work closely with communications security personnel to ensure the proper keying material for the appropriate frequency resource of single channel ground and air radio system (SINCGARS) loadsets. Spectrum managers only manage and process communications security for SINCGARS by way of loadsets. They do not manage communications security for other emitters.

Satellite Coordination

1-24. Spectrum managers coordinate with satellite managers to maintain awareness of channels (frequencies) used by satellite communications systems. The satellite manager generates and processes satellite access authorization (SAA). Spectrum managers receive and verify the information provided in the satellite access request for all satellite communications. Once approved, the spectrum manager enters the frequencies into the Spectrum XXI database as a space record for frequency deconfliction with all other emitters in the area of operations.

Frequency Deconfliction

1-25. Frequency deconfliction is a systematic management procedure to coordinate the use of the electromagnetic spectrum for operations, communications, and intelligence functions. Frequency deconfliction is one element of electromagnetic spectrum management and applies practices to minimize or prevent SDDs from causing EMI. It is easy to confuse EMI mitigation with frequency deconfliction. The main difference is that frequency deconfliction occurs during the planning phase of a mission while EMI mitigation occurs during mission execution.

Joint Restricted Frequency List

1-26. Commanders and planners prohibit jamming or attacking frequencies listed on the JRFL. The JRFL is a J-3 product and includes command channels of senior commanders, coalition forces, and frequencies used by local civilian noncombatants. The JSME, with collaborative input from the J-2, J-3, and J-6, develop the JRFL. Upon approval by the J-3, the JSME, in concert with the EW planners, publishes the JRFL. Three types of protection status codes apply to frequency assets identified for inclusion in a JRFL: taboo frequencies, protected frequencies, and guarded frequencies (see Appendix D).

1-27. Use of the JRFL is to protect high priority nets, bands, and frequencies from friendly electronic attack when possible; however, the concern of the spectrum manager is to ensure that all friendly systems can operate unimpaired. Accomplish this by adding the offending jammer to a database and using spectrum management techniques such as changing frequencies, changing assignments, or moving to an unaffected area. The spectrum manager has tools that can identify potential frequency fratricide. Refer to Appendices A and F for further information on the JRFL.

> *Note*. The use of the JRFL does not deconflict all frequency issues. The JRFL does not provide communications planners with frequencies electronic attack (EA) systems transmit or the technical information needed to deconflict EA from friendly operations including lower echelon maneuver forces. Efficient utilization of spectrum management tools identifies potential interference and frequency conflicts during mission planning reducing frequency fratricide. See CJCSM 3320.01C for more information on the JRFL development process.

Interference Resolution

1-28. Spectrum managers perform interference resolution at the echelon receiving the interference. Interference is the radiation, emission, or indication of electromagnetic energy; either intentionally or unintentionally causing degradation, disruption, or complete obstruction of the designated function of the electronic equipment affected. The spectrum manager should use available near-real time monitoring and analysis capabilities to aid in the interference resolution. The reporting end user is responsible for assisting the spectrum manager in tracking, evaluating, and resolving interference. Appendix D contains further information on frequency interference resolution and reporting.

Frequency Fratricide

1-29. Frequency fratricide is the unintentional interruption of friendly frequencies. The CEMA section spectrum manager deconflicts the spectrum, identifies conflicts, and advises the cyber electronic warfare officer (CEWO) about mitigating possible frequency fratricide. The CEMA spectrum manager works to mitigate frequency fratricide and potential EMI during the planning phase of all forms of fire. If the CEMA section spectrum manager is not available, one of the other spectrum managers assumes the responsibility that is necessary during the CEMA working group. Frequency fratricide can cause many problems for operations and prevention is the key to mission success. Spectrum managers provide the CEMA working group with frequency options and advice that follows internal and external policies that minimize frequency fratricide.

MANAGING SPECTRUM MANAGEMENT OPERATIONS

1-30. The managing function of SMO enables and sustains the functions of planning and coordinating. It includes the process to plan, conduct, coordinate, and support SMO. SMO ensures the efficient use of allocated spectrum and associated frequencies in a given area of operations.

1-31. Spectrum managers use the managing function to enable dynamic frequency assignment, re-assignment, interference mitigation, and frequency deconfliction across all users in an area of operations. The architecture provides for interoperability with United States national and local government agencies, non-government agencies, and unified action partners

SECTION II – ENVIRONMENT AND CHALLENGES WHEN CONDUCTING SPECTRUM MANAGEMENT OPERATIONS

1-32. This section describes the electromagnetic spectrum followed by defining the EMOE in which spectrum managers conduct SMO. This section discusses SDDs operating throughout the EMOE and describe their continuing competition for resources in the EMS. This section discusses SMO challenges in a congested and contested environment.

ELECTROMAGNETIC SPECTRUM

1-33. The electromagnetic spectrum is a continuum of all electromagnetic waves arranged according to frequency and wavelength. Multiple radiated signals coexist in the same physical space. Use of appropriate equipment and channels allows selective detection of emitted signals. The spectrum extends from below the frequencies used for radio (at the long-wavelength end) through gamma radiation (at the short-wavelength end).

1-34. The spectrum encompasses wavelengths, from thousands of kilometers to a fraction of an atom, divided into alphabetically designated bands for specific wavelengths and frequency ranges. Radio signals can coexist in the same physical space. The radio frequency spectrum is the continuum of frequencies of electromagnetic radiation from 3 hertz to 3.000 gigahertz or 3 terahertz. The type of SDD used, users are isolated to specific frequency bands of the continuum. For example, users of the single channel ground to airborne radio systems have isolated use of the very high frequency band within the frequency continuum.

1-35. Dependency of the electromagnetic spectrum by both friendly, neutral, and enemy actors results in congestion. Figure 1-3, page 1-8, displays the different frequency bands of the electromagnetic spectrum and just some of the commercial and military SDDs competing in each of those bands.
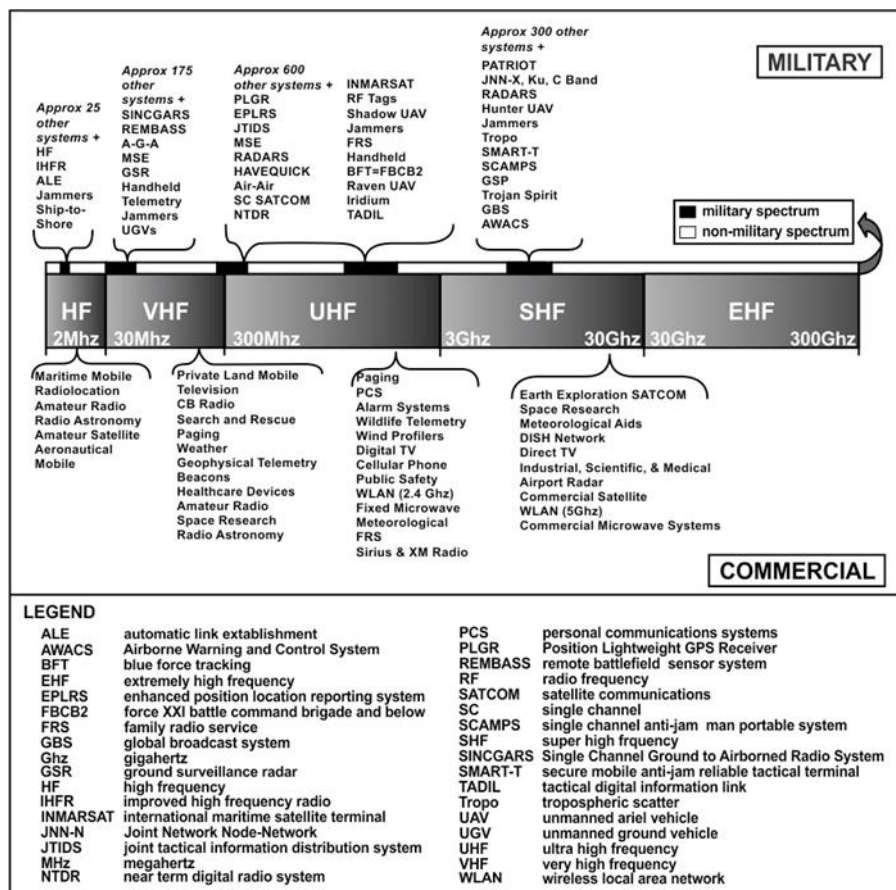
Figure 1-3. Electromagnetic spectrum competition

THE ELECTROMAGNETIC OPERATIONAL ENVIRONMENT

1-36. The EMOE is the portion of the electromagnetic environment (EME) within which the spectrum manager conducts SMO and is the authoritative source of spectrum-use information. The EMOE includes the background EME and all friendly, enemy (to the extent available), neutral, and civil SDDs within that AO. Electromagnetic order of battle is the assessment of those SDDs encountered throughout the EMOE.

1-37. The EME is the resulting product of power and time distribution in various frequency ranges of the radiated or conducted electromagnetic emission levels encountered by military forces, systems, or platforms while performing an assigned mission within its intended operational environment (JP 3-13.1). The EME consists of all spectrum emission within an AO, while the EMOE encompasses both the EME and SDDs that are emitting and receiving spectrum emissions within an AO.

1-38. In addition to spectrum-use information, EMOE includes environmental parameters (ground and atmospheric) and terrain elevation data. During Army operations, the spectrum management chief is responsible for building and managing the EMOE. If a corps or division assumes the role of JTF headquarters, the assigned spectrum management chief may assume the roles and responsibilities of the JSME. The JSME is responsible for developing and managing the EMOE for joint operations (see JP 3-12 for conducting cyberspace operations in a joint environment). Figure 1-4, page 1-9, depicts the EMOE.
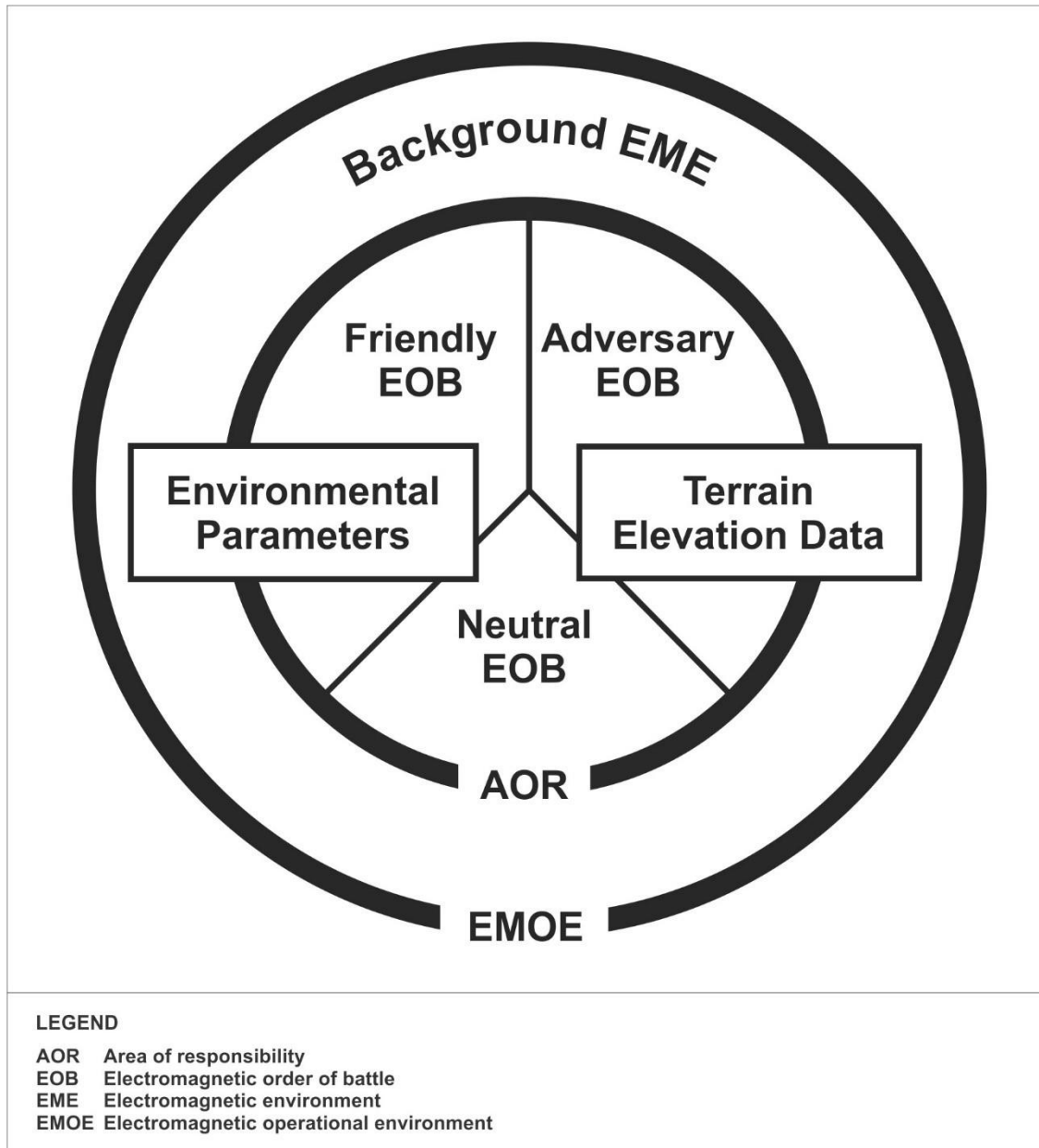
Figure 1-4. The electromagnetic operational environment

SPECTRUM DEPENDENT DEVICES

1-39. An SDD is a device that uses the electromagnetic spectrum to emit, receive, or monitor frequencies. SDDs include any conceptual, experimental, developmental, operational transmitter, receiver, or device that uses any portion or part of the electromagnetic spectrum. SDDs include such equipment and systems as transmitters, receivers, command and control systems, and platforms, electronic warfare assets, sensors, beacons, navigational aids, radios and radio systems, radar systems, radio-controlled robotic equipment, and manually or remotely operated aircraft systems.

1-40. Electromagnetic interference (EMI) is an electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the performance of electronics or electrical equipment (JP 3-13.1). It can be injected intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious

emissions and responses and intermodulation products. The spectrum manager is vital to ensuring all Army SDDs operate as intended without EMI. The spectrum manager is the commander's resident expert who provides courses of action based on software modeling and simulations to mitigate EMI.

1-41. Commanders and spectrum users should understand that the electromagnetic spectrum is not a replaceable resource like fuel or ammunition. Once the allotted spectrum is in use, it is no longer available for use depending upon system and environmental variables. Operationally, the commander may need to assess the impact of sacrificing other potentially critical capabilities to ensure the use of more important SDDs. The goal is to protect systems from harmful interference while allowing the optimum use of the spectrum.

> *Note.* SMO is bottom driven for requirements while top fed for resources. The brigade combat teams represent the tactical edge, and it is critical that the staff at each echelon captures all requirements to ensure commanders receive the proper resources. Maximizing the use of the electromagnetic spectrum requires the spectrum manager to coordinate with EW, network operations, intelligence staffs, and other known users.

CONGESTED AND CONTESTED ENVIRONMENT

1-42. Gaining and maintaining control of the electromagnetic spectrum is a critical requirement for the commander. From communications to intelligence collection, to electronic warfare, all forces and supporting agencies depend on the electromagnetic spectrum to execute operations in the air, land, maritime, space, and cyberspace domains. Within the electromagnetic spectrum, joint forces contend with civil agencies, commercial entities, allied forces, and adversaries for the use of a common electromagnetic spectrum resource. This demand for electromagnetic spectrum use results in a congested and contested environment that affects operations across all domains and functions.

CONGESTED ENVIRONMENT

1-43. The electromagnetic spectrum congestion results from multiple SDDs attempting to use the same portions of the spectrum simultaneously. Congestion can potentially lead to the operational failure of systems during critical missions due to EMI. The Army shares spectrum-related resources with other Services, civilian counterparts, friendly forces, enemies, and adversaries. Due to a large number of SDDs using the electromagnetic spectrum, portions may be unavailable.

1-44. In the past, the bulk of spectrum management only consisted of networked communications emitters and combat net radio networks. Today, the tactical environment includes a vast number of systems comprised of SDDs operating throughout the electromagnetic spectrum across the battlefield. The key to sound spectrum management is having an understanding of all systems in the area of operations (AO) for deconfliction.

1-45. Figure 1-5 on page 1-11, illustrates some of the competing systems that cause challenges throughout the electromagnetic spectrum. The assistant chief of staff for communications, signal staff officer (G-6) or the battalion or brigade signal staff officer (S-6) is responsible for coordination with all electromagnetic spectrum users within a given AO, to identify all requirements for spectrum access. The spectrum manager uses this information to conduct frequency deconfliction. The G-6/S-6 also maintains a database of all known emitters and receivers in the AO. Use of this database is to identify and prioritize competing systems for frequency assignments.
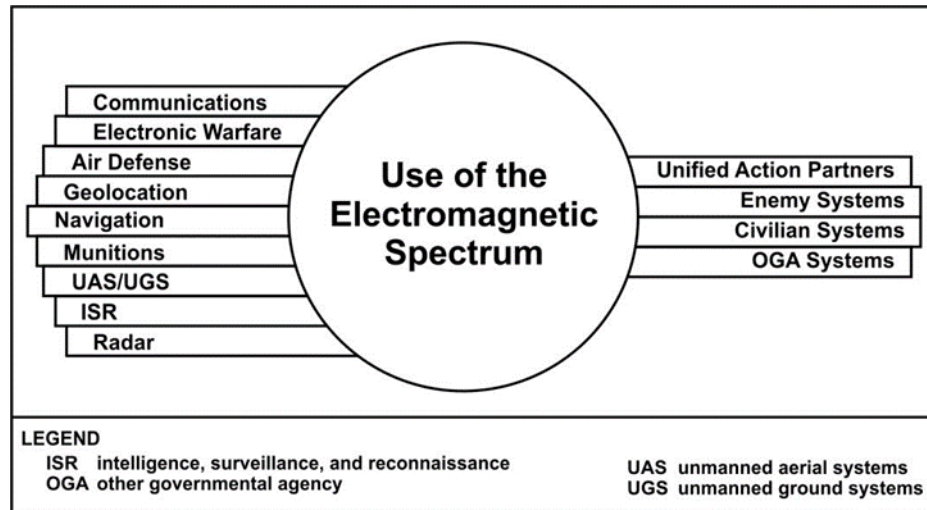
Figure 1-5. Competition in the electromagnetic spectrum

1-46. The spectrum manager is responsible for maintaining a library, both paper and electronic, of spectrum-related manuals, for including national, international, and governmental regulations and policies. The library consists of the manuals listed in the reference section of this publication. It is essential as a spectrum manager to become familiar with the unit's AO. In particular, know both national and international agencies regulating spectrum use and obtain their contact information.

1-47. All SDDs should have a current and completed Stage 4 Operational DD Form 1494 (*Application for Equipment Frequency Allocation*), to operate in the unit's AO. Completion of the DD Form 1494 is the responsibility of the material developer. The material developer must provide a collection of technical data about the device to begin the planning process by placing the technical data in spectrum management tool databases. Material developers report the characteristics of SDDs to higher echelon spectrum management agencies to receive authorization for using the device in the AO.

1-48. Unauthorized SDDs used in the AO create the potential for severe mutual interference among other spectrum users or can squander resources and inhibit warfighting capabilities. An approval number, documented on the SDDs' DD Form 1494, indicates approval to coordinate for spectrum resources. The joint spectrum center database stores approved DD Form 1494s. The sponsoring military department submits an SDD's DD Form 1494. Further coordination is the responsibility of the material developer.

Note. For more information on the Army spectrum management program, see AR 5-12.

1-49. Spectrum managers should understand the types and number of SDDs in their unit. This information leads to a firm understanding of SDD's used during a mission to provide accurate information when requesting spectrum resources. Incoming spectrum managers should obtain a detailed in briefing from the outgoing spectrum manager. The incoming spectrum manager also meets with and establishes a rapport with other staff members.

1-50. Spectrum managers identify all SDDs used by the organization using the modified table of organization and equipment. By understanding SDDs in the organization, the spectrum manager can pre-plan for future missions. With pre-planning the spectrum manager can identify unauthorized frequencies that if used, may result in EMI with restricted or friendly frequencies, resulting in a potential for suspension or minimization of the unit's use of the spectrum. A combination of understanding the organization's SDDs and pre-planning allows the spectrum manager the ability to develop well thought courses of actions to the commander to mitigate foreseen EMI prior to initiation of the mission.

1-51. The spectrum manager should visit all subordinate units in the organization to identify any SDDs that may not be in the database. During visits, the spectrum manager may consider meeting with the unit

commanders to discuss spectrum management options. Such meetings provide the commander with valuable information used during the MDMP and provide points of contact for spectrum concerns.

1-52. It is essential that the spectrum manager becomes familiar with the unit's spectrum management tools and develop databases for them. Part of developing databases include building force templates that include SDDs and spectrum requirements to aid in mission planning. Some spectrum management tools (see Appendix C) require obtaining map files, such as digital terrain elevation data for the unit's AO.

1-53. The spectrum manager should develop a spectrum management checklist (see Table C-4) relating to spectrum management functions specific to the unit. The goal of the checklist is to serve as a reminder for completing the same tasks in the future. The checklist provides an excellent start for briefing incoming spectrum managers.

1-54. Home station operations present unique challenges and opportunities for spectrum managers. SDDs returning from theaters outside continental United States sometimes do not have spectrum supportability within U.S. territories. Collaborating with civilian counterparts supporting home station operations also present challenges because of their limited exposure to tactical spectrum operations.

CONTESTED ENVIRONMENT

1-55. FM 6-02 details how adversaries are increasingly contesting friendly use of the EMS. Enemies and adversaries may deliberately attempt to deny friendly use of SDDs in all operational domains. Due to heavy joint reliance on advanced communications systems, such an attack may be a central element of any enemy or adversaries' anti-access and area denial strategy, requiring a higher degree of protection for friendly C2 systems and planning for operations in a denied or degraded environment (JP 6-0).

1-56. Enemies and adversaries have demonstrated an increased technological capability that has become a continuous threat to U.S. dominance throughout the electromagnetic spectrum. U.S. military communications and information networks have become high value targets by an enemy or adversary with the intention of disrupting C2 communications, a key enabler to unified land operations. Technologically sophisticated enemies and adversaries understand the extent of U.S. forces' reliance of the electromagnetic spectrum. These peer and near-peer enemies and adversaries have demonstrated the ability to cause an immediate threat. We should expect that in future conflicts, enemies and adversaries would contest the information environment to deny operational access and diminish the effectiveness of United States and allied forces.

1-57. Successfully integrating signal support with cyberspace, electronic warfare, and intelligence operations is the key to obtaining and maintaining freedom of action in the electromagnetic spectrum. These capabilities also provide the ability to degrade or deny the enemies and adversaries' ability to conduct successful operations. Synchronizing capabilities across multiple domains and warfighting functions maximizes their inherently complementary effects in and through the electromagnetic spectrum.

1-58. Hostile threat actions can result in degraded capabilities of U.S. forces and joint allies information systems. An example of degraded capability from hostile threat can be inadequate communications capability due to intentional EMI (jamming).

Chapter 2

Spectrum Management Operations at Corps and Below

SMO is dynamic and requires continuous coordination among all echelons and warfighting functions both vertically and horizontally to mitigate harmful interference. This chapter describes SMO roles and responsibilities for staff organizations at corps and below, and provides an overview of division, brigade, and battalion spectrum management operations.

SECTION – I SPECTRUM MANAGEMENT PERSONNEL AT CORPS AND BELOW

2-1.   Spectrum management personnel includes spectrum management chiefs (master sergeants), spectrum managers (sergeants first class), and spectrum management noncommissioned officers (staff sergeants). All spectrum management personnel are responsible for uploading all EMI identified in their perspective unit's AO to the joint spectrum interference resolution (JSIR).

2-2.   The spectrum management chief is the principal advisor to the commander for spectrum management related matters. It is essential that subordinate spectrum managers receive training on spectrum management operations, including spectrum managers at lower echelons that lack exposure to the critical tasks performed at echelons above brigade. Mentorship to subordinate spectrum managers is the responsibility of the spectrum management chief. The spectrum management chief provides advice and assistance to subordinate units on SMO for mission accomplishment and career progression. The spectrum management chief is responsible for preparing spectrum specific briefings to the commander and staff during the planning process and throughout operations.

2-3.   The spectrum manager, assigned to the G-6 section, advises the network planners in all SMO related matters. The spectrum manager assists the spectrum management chief and the CEWO with developing the COP that provides the commander and staff knowledge of the EMOE. The spectrum manager is also a member of the CEMA working group.

2-4.   The spectrum management noncommissioned officer (NCO) is a member of the network management element. The spectrum management NCO assists the spectrum manager with requesting frequencies used to employ SDDs throughout the corps AO. At brigade and higher, the spectrum management NCO helps the CEMA spectrum manager with identifying and resolving EMI, including EMI unresolved by subordinate units.

2-5.   The CEMA spectrum manager is responsible for reviewing the electronic attack request format (EARF) for potential conflicts prior to EW operations. The CEMA spectrum manager assists the CEMA section in the planning, coordination, assessment, and implementation of EW electronic attacks, protection, and support requirements.

SECTION II – SPECTRUM MANAGEMENT PERSONNEL AT CORPS AND DIVISION

2-6.   This section discusses spectrum management personnel at corps and division. This section also discusses some of the key roles and responsibilities of spectrum management personnel at each echelon.

SPECTRUM MANAGEMENT PERSONNEL—CORPS

2-7.   Spectrum management personnel at the corps focus on host nation coordination, establishing policy and procedure to assure the necessary spectrum resources are available for operations. Spectrum management personnel at the corps ensure that subordinate units use the allotted spectrum resources efficiently while conducting SMO. Spectrum management personnel develop standard operating procedures based on joint and service regulations, instructions, policies, and doctrine. At the corps, there are four spectrum management personnel—one spectrum management NCO, two spectrum managers, and one spectrum management chief.

SPECTRUM MANAGEMENT CHIEF—CORPS

2-8.   At corps, the spectrum management chief—
- Oversees the development of spectrum-related policies for the corps that describes corps and below SMO activities for achieving theater and joint training and operational objectives.
- Integrates the corps EMOE into joint and coalition operational environments.
- Ensures that subordinate spectrum managers maintain a SIPRNET account and are accounting for assigned spectrum management tools and applications.
- Ensures the synchronization of SMO and CEMA objectives in support of the commander's mission requirements.
- Is the liaison between the corps and other Army, joint, coalition, and host nations regarding all corps SMO related activities.
- On order, assumes the roles and responsibilities of the JSME.
- Serves on national strategic panels, committees, and working groups while advising international, domestic, military, and civil organizations on SMO.
- With assistance from subordinate spectrum management personnel, is responsible for the development of the corps COP. The COP includes frequency charts, diagrams, reports, and databases of frequency interference incidents, providing EMOE situational awareness to the commander and staff.
- Is responsible for developing communications-electronics operation instructions (CEOI) and loadsets for the corps.
- In a joint environment, develops the joint communications-electronics operation instructions (JCEOI) in conjunction with the necessary loadsets.
- Uploads all identified EMI to the JSIR. The JSIR is accessed using joint spectrum interference resolution online (JSIRO).

CORPS SPECTRUM MANAGER—CORPS

2-9.   At corps, the spectrum manager—
- Serves as the lead coordinator in the development and promulgation of the JRFL.
- Obtains spectrum resources from spectrum management authority of the host nation and defines spectrum management policy for the corps and subordinate units.
- Prepares and forwards the frequency requests for coordinating frequency allotment, assignment, and use and forwards frequencies to subordinate divisions upon receiving approval.
- Prepares frequency requests to the appropriate U.S. military, U.S. civilian agency, or host nation agency for frequency allocation to meet corps requirements, using appropriate spectrum management tools.
- Upon approval of the frequency request, receives frequencies, and then submits frequencies assignments to the frequency database for distribution to subordinate units.
- Participates in all CEMA working groups to assist the CEMA spectrum manager with ensuring EW planning meets requirements.
- Serves as the principal spectrum manager in support of all activities supporting the spectrum management lifecycle (see Appendix D).

- In coordination with spectrum management chief and CEMA section spectrum manager, performs situational awareness analysis using a spectrum analyzer or monitoring receiver and spectrum link reliability modeling using appropriate spectrum modeling tools.
- With oversight from the spectrum management chief, develops and disseminates the corps' SMO standard operating procedures.
- Creates and sends data call messages to staff elements, subordinate units, and supporting agencies that specifies how to request spectrum support for SDDs operating within the corps AO.
- Determines if the unit's SDDs have spectrum supportability and coordinates with host nations' spectrum organizations for spectrum access when the corps conducts operations OCONUS.
- Provides frequency-engineering support to the G-6 for communications network design and services.
- Assists the spectrum management chief with developing the communications annexes and appendices for corps operations orders.
- Uploads all identified EMI to the JSIR.
- Is responsible for maintaining SIPRNET access and accounting for assigned spectrum management tools and applications.

CYBERSPACE ELECTROMAGNETIC ACTIVITIES SECTION SPECTRUM MANAGER—CORPS

2-10. At corps, the CEMA spectrum manager—
- Defines the EMOE for the CEMA section.
- Forwards all reported EMI identified by CEMA assets to the to the corps spectrum manager for resolution.
- Maintains frequency charts, diagrams, and reports of EMI incidents identified during EW missions.
- Assists the plans spectrum manager by providing input for the JRFL and serves as the subordinate spectrum manager in support of all activities supporting the spectrum management lifecycle.
- Is the primary spectrum manager during the CEMA and information operations (IO) working groups.
- Determines if SDDs that are part of EW systems have spectrum supportability and provides frequency-engineering support for EW operations.
- Advises the CEWO on potential spectrum conflicts and issues.
- Assists the spectrum management chief with developing the communications annexes and appendices for the corps operations orders.
- Distributes CEOI, or JCEOI, and loadsets created by the spectrum manager or spectrum management NCO to authorized personnel in the CEMA section.
- Handles any issues that arise with the CEOI, JCEOI, and loadsets within the CEMA section. The CEMA spectrum manager then collaborates with either the spectrum management chief or spectrum manager for resolution.
- Uploads all identified EMI to the JSIR.
- Maintains SIPRNET access and accountability for assigned spectrum management tools and applications.

SPECTRUM MANAGEMENT NONCOMMISSIONED OFFICER—CORPS

2-11. At corps, the spectrum management NCO—
- Assists the spectrum management chief in developing a COP that displays the EMOE throughout the corps' AO.
- Is responsible for overseeing the distribution of frequencies, to subordinate units.
- Assists in validating spectrum link reliability of assigned frequencies using appropriate modeling tools.

- Assists the corps spectrum manager with establishing the corps' guidance for managing, requesting, coordinating, and assigning spectrum use, JRFL, CEOI, EMI, and related SMO functions.

Note. All established guidance adheres to policies and guidelines established by the corps spectrum management chief per the commander's guidance.

- Maintains an accurate listing of all SDDs in the corps AO.
- Develops the CEOI and loadsets.
- Is responsible for the distribution of CEOI and loadsets to subordinate units.
- Conducts radio frequency engineering and analysis and evaluates regulatory policy to determine supportability of SDDs used in the corps' AO.
- Assists the network operation section with generating satellite access requests and submitting to the proper controlling authority.
- Once the controlling authority grants satellite access authorization, informs users of the authorized frequencies.
- Performs regular frequency database reviews and submits requests for updates when necessary.
- Uploads all identified EMI to the JSIR.
- Is responsible for maintaining SIPRNET access and accounting for assigned spectrum management tools and applications.

SPECTRUM MANAGEMENT PERSONNEL—DIVISION

2-12. A division has one spectrum management chief in the G-6 network management element, one spectrum manager in the CEMA element of the CEMA section, and one spectrum manager in the G-6 plans element. The spectrum management chief is responsible for the network frequency assignments to include satellite access authorization and deconfliction. Network planners work closely with the spectrum manager while designing the communications network. The spectrum manager assists the network planners by determining spectrum requirements and requesting the necessary frequencies to support the communications network.

SPECTRUM MANAGEMENT CHIEF—DIVISION

2-13. At division, the spectrum management chief—
- Develops command spectrum management policy and procedures for approval by the division commander. Subordinate spectrum management personnel use these policies and procedures are the basis for policies and procedures at lower echelons.
- Writes the spectrum-related portions of the division's operation orders.
- Assesses and recommends changes to Army and joint spectrum management policies.
- Manages the division's spectrum databases and assists users in obtaining spectrum supportability through appropriate federal and host nation agencies.
- Assists in resolving EMI incidents and reports unresolved EMI to corps spectrum management chief.
- Reviews EMI databases and recognizes trends and repeated incidents that occur in the EMOE.
- On order, assumes the roles and responsibilities of the JSME.
- Serves on national strategic panels, committees, and work groups while advising international, domestic, military, and civil organizations.
- Is responsible for developing the communications-electronics operation instructions (CEOI) and loadsets for the corps.
- In a joint environment, may also be responsible for developing the joint communications-electronics operation instructions (JCEOI) in conjunction with the necessary loadsets.
- Uploads all identified EMI to the JSIR.

- Ensures that subordinate spectrum managers maintain a SIPRNET account and are accounting for assigned spectrum management tools and applications.

DIVISION SPECTRUM MANAGER—DIVISION

2-14. At division, the spectrum manager—
- Is responsible for attaining spectrum resources from spectrum management authority of the host nation during operations independent of the corps.
- Serves as the lead coordinator in the development and promulgation of the JRFL, when the division is conducting operations autonomous of the corps headquarters.
- Prepares and forwards the frequency requests for coordinating frequency allotment, assignment, and use to higher headquarters or appropriate U.S. military, U.S. civilian agency, or host nation agency.
- In coordination with the spectrum management chief and the CEMA section spectrum manager, performs situational awareness analysis by using spectrum modeling tools.
- Participates in all CEMA working groups to assist the CEMA spectrum manager with meeting EW planning requirements.
- Serves as the principal spectrum manager in support of all activities supporting the spectrum management lifecycle.
- Prepares frequency requests for the division using appropriate spectrum management tools.
- Forwards frequency requests to higher headquarters or the appropriate civilian or military agency for authorization.
- After approval of the frequency requests, issues frequency assignments to subordinate units.
- Uploads all identified EMI to the JSIR.
- Is responsible for maintaining SIPRNET access and accounting for assigned spectrum management tools and applications.

CYBER ELECTROMAGNETIC ACTIVITIES SECTION SPECTRUM MANAGER—DIVISION

2-15. At division, the CEMA spectrum manager—
- Defines the EMOE for the CEMA section.
- Forwards EMI reported from the CEMA section to the spectrum manager for resolution.
- Maintains frequency charts, diagrams, and reports of EMI incidents identified by the CEMA section.
- Assists the spectrum manager by providing input for the JRFL and serves as the subordinate spectrum manager in support of all activities supporting the spectrum management lifecycle.
- Is the primary spectrum manager during the CEMA and IO working groups.
- Distributes COEI (or JCOEI) and loadsets created by the spectrum management chief to authorized personnel in the CEMA section.
- Handles any issues that arise with the CEOI, JCEOI, and loadsets within the CEMA section. The CEMA spectrum manager then collaborates with either the spectrum management chief or spectrum manager for resolution.
- Uploads all identified EMI to the JSIR.
- Maintains SIPRNET access and accounting for assigned spectrum management tools and applications.

SECTION III – SPECTRUM MANAGEMENT PERSONNEL AT BRIGADE AND BELOW

2-16. This section discusses spectrum management personnel at BCTs, maneuver brigades, TTSBs, maneuver battalions, and expeditionary signal battalions. This section also discusses some of the key roles and responsibilities of spectrum management personnel at each echelon.

SPECTRUM MANAGEMENT PERSONNEL—BRIGADE COMBAT TEAM

2-17. BCTs have two spectrum management personnel: one spectrum manager and one CEMA spectrum manager. The spectrum manager is a member of the S-6 section. The CEMA spectrum manager is a member of the CEMA section.

SPECTRUM MANAGER–BRIGADE COMBAT TEAM

2-18. At the BCT, the spectrum manager—

- Prepares and forwards the frequency requests for coordinating frequency allotment, assignment, and use to higher headquarters or appropriate U.S. military, U.S. civilian agency, or host nation agency.
- Coordinates with the spectrum management NCO from the fire support/EW cell to perform situational awareness analysis using spectrum-modeling tools.
- Ensures restricted frequencies are not distributed to subordinate units.
- Serves as the lead coordinator in the compiling and distribution of the JRFL when the BCT is conducting operations autonomous of the division headquarters.
- Attain the resources from spectrum management authority of the host nation and defining spectrum management policy when the BCT is conducting independent operations.
- Participates in all CEMA working groups conducted at higher headquarters to assist the CEMA spectrum manager with meeting EW mission planning.
- Serves as the principal spectrum manager in support of all activities supporting the spectrum management lifecycle.
- Makes all CEOI and loadset requests for the BCT when operating independently of division through the spectrum management personnel at higher headquarters.
- Prepares frequency requests for the BCT using appropriate spectrum management tools.
- Forwards frequency requests to higher headquarters or the appropriate civilian or military agency.
- Issues approved frequency assignments to subordinate units.
- Uploads all identified EMI to the JSIR.
- Maintains SIPRNET access and accounting for assigned spectrum management tools and applications.

CYBERSPACE ELECTROMAGNETIC ACTIVITIES SPECTRUM MANAGER—BRIGADE COMBAT TEAM

2-19. At the BCT, the CEMA spectrum manager—

- Assists the CEMA section in the planning, coordination, assessment, and implementation of EW electronic attacks, protection, and support requirements.
- Defines the EMOE for the CEMA section.
- Forwards EMI reported from the CEMA section to the spectrum manager for resolution.
- Maintains frequency charts, diagrams, and reports of EMI incidents identified by the CEMA section.
- Assists the spectrum manager by providing input for the JRFL and serves as the subordinate spectrum manager in support of all activities supporting the spectrum management lifecycle.
- Participates in CEMA and IO working groups conducted by higher headquarters as the BCT's primary spectrum manager.
- Distributes CEOI, or JCEOI, and loadsets created by higher headquarters to authorized personnel in the CEMA section.
- Collaborates with either the BCT spectrum manager or spectrum management personnel at higher headquarters for resolution of the issues that arises with CEOI (or JCEOI) and loadsets within the CEMA section.

- Uploads all identified EMI to the JSIR.
- Maintains SIPRNET access and accounting for assigned spectrum management tools and applications.

SPECTRUM MANAGEMENT NONCOMMISSIONED OFFICER— MANEUVER BRIGADE

2-20. Maneuver brigades have one spectrum management NCO located in the S-6 section. The spectrum management NCO—

- Employs appropriate spectrum tools to request frequencies used for SDDs throughout the brigade.
- Assists the S-6 section by requesting and disseminating frequencies for SDDs employed by the headquarters, its subordinate battalions, and any attached units.
- Attempts to resolve EMI reported by victim units.
- Forwards all EMI reported by victim units, both resolved and unresolved to the higher headquarters spectrum manager.
- Uploads all EMI identified in the AO to the JSIR.
- Develops the COP to provide situational awareness to the commander and staff.
- Is responsible for overseeing the distribution of frequencies to organic and attached subordinate units collocated in the brigade's AO.
- Validates spectrum link reliability of assigned frequencies using a spectrum analyzer or monitoring receiver.
- Establishes the brigade's guidance for managing, requesting, coordinating, and assigning spectrum use CEOI, EMI, and related SMO functions. Ensures the brigade's guidance aligns with higher headquarters policies and guidance.
- Attains the JRFL from higher headquarters and disseminates the JRFL to assigned or attached subordinate units.
- Maintains an accurate listing of the brigade's SDDs in the supported unit's AO.
- Conducts radio frequency engineering and analysis and evaluates regulatory policy to determine supportability of the brigade's SDDs.
- Prepares frequency requests using appropriate spectrum management tools, followed by forwarding the request to higher headquarters for processing.
- Once higher headquarters authorizes the request for frequency, nominates frequencies from the database established by higher headquarters, make assignments in the database, and notifies the requestors of the assignments.
- Maintains SIPRNET access and accounting for assigned spectrum management tools and applications.

Note. An aviation brigade has two spectrum management personnel: a spectrum manager and a CEMA spectrum manager, similar to the structure of a BCT. Refer to the BCT spectrum management section for roles and responsibilities of spectrum management personnel for aviation brigades.

SPECTRUM MANAGEMENT PERSONNEL—THEATER TACTICAL SIGNAL BRIGADE

2-21. A theater tactical signal brigade (TTSB) has three spectrum management personnel in its headquarters. The spectrum management chief and a spectrum management NCO are part of the engineering branch and the spectrum manager is part of the network operations section.

SPECTRUM MANAGEMENT CHIEF—THEATER TACTICAL SIGNAL BRIGADE

2-22. At the TTSB, The spectrum management chief
- Serves as the senior SMO advisor to the commander
- Maintains supervisory responsibility and oversight of the spectrum management NCO and the spectrum manager located in the network operations section.
- Ensures spectrum management personnel at the expeditionary signal battalions are proficient in performing critical spectrum management tasks.
- Provides advice and assistance to the expeditionary signal battalions on SMO for mission accomplishment and career progression.
- Prepares spectrum specific briefings to the commander and staff during the planning process and throughout operations.
- Develops operational spectrum management policy and procedures, which upon approval by the commander, is distributed to subordinate ESBs to establish policies and procedures.
- Writes the spectrum-related portions of the TTSB's operation orders.
- Assesses and recommends changes to Army and joint spectrum management policies.
- Ensures that all subordinate spectrum managers maintain a SIPRNET account and are accounting for assigned spectrum management tools and applications.
- Manages all spectrum databases maintained at the TTSB and assists users in obtaining spectrum supportability through appropriate federal and host nation agencies.
- Assists in resolving EMI incidents and reports unresolved EMI to higher headquarters of the supported organization when deployed.
- Reviews EMI databases and recognizes trends and repeated incidents that occur in the EMOE.
- When deployed and supporting a corps or division, the TTSB spectrum management chief may participate in CEMA working groups.
- If the supported corps or division spectrum management chief assumes the roles and responsibilities of the JSME, the supported corps or division may task the TTSB to provide their spectrum management chief to fulfill the corps or division's spectrum management chief responsibilities.

SPECTRUM MANAGER—THEATER TACTICAL SIGNAL BRIGADE

2-23. At the TTSB, the spectrum manager is assigned to the network operations branch and—
- Is responsible for requesting, allocating, and deconflicting frequencies for systems used for establishing the TTSB's portion of the Department of Defense Information Network-Army (DODIN-A).
- Assists the network operations section in the planning, coordination, assessment, and implementation of Warfighter Information Network-Tactical systems and mission command systems for establishing DODIN-A connectivity for supported units.
- Defines the EMOE in garrison, uses the supported unit's EMOE during deployments, and produces a spectrum management plan for the network operations section.
- Resolves all EMI throughout the TTSBs AO assigned by the supported unit when deployed, and in garrison when not deployed. When deployed, reports all EMI to the supported unit's higher headquarters.
- Validates spectrum link reliability of assigned frequencies using a spectrum analyzer or monitoring receiver.
- Establishes the TTSB's guidance for managing, requesting, coordinating, and assigning spectrum use CEOI, EMI, and related SMO functions in alignment with higher headquarters' policies and guidelines.
- Attains the JRFL from its higher headquarters—garrison, or from the supported unit's spectrum management personnel—deployed.
- Disseminates the JRFL to assigned or attached subordinate units.

- Maintains an accurate listing of all of the TTSB's SDDs in the supported unit's AO.
- Uploads EMI incidents to the JSIR.
- Maintains SIPRNET access and accounting for assigned spectrum management tools and applications.
- Maintains the TTSB's frequency charts, diagrams, reports, and databases of EMI incidents.
- Conducts EW deconfliction throughout the TTSB's AO assigned by the supported unit when deployed, and in garrison when not deployed.
- When deployed and supporting a corps or division, the spectrum manager may participate in CEMA working groups.

SPECTRUM MANAGEMENT NONCOMMISSIONED OFFICER—THEATER TACTICAL SIGNAL BRIGADE

2-24. At the TTSB, the spectrum management NCO—
- Employs appropriate spectrum tools to request frequencies used to operate SDDs for its expeditionary signal battalions and attached units.
- Assists the engineering branch by requesting and disseminating frequencies for SDDs employed by the headquarters, its expeditionary signal battalions, and any attached units.
- Identifies EMI, takes appropriate steps to resolve EMI, and forwards EMI reports to the higher headquarters spectrum manager on both resolved and unresolved EMI.
- Is responsible for overseeing the distribution of frequencies, to expeditionary signal battalions collocated in the supported unit's AO and any attached units.
- Requests all CEOI and loadsets from higher headquarters and distributes them to subordinate units.
- Conducts radio frequency engineering and analysis and evaluates regulatory policy to determine supportability of the assigned SDDs operating the TTSB's AO—garrison and the TTSB's SDDs used in a support unit's AO—deployed.
- Prepares frequency requests using appropriate spectrum management tools, followed by forwarding the request to higher headquarters for processing.
- Once higher headquarters authorizes the request for frequency, nominates frequencies from the database established by higher headquarters, make assignments in the database, and notifies the requestors of the assignments.
- Receives communications network input from higher headquarters and upon interpreting the information, creates frequency requirements and plans, logically organizes the data provided, and forwards the CEOI and loadsets to spectrum management NCO.
- Maintains SIPRNET access and accounting for assigned spectrum management tools and applications.
- Uploads all EMI identified in the AO to the JSIR.

SPECTRUM MANAGEMENT NONCOMMISSIONED OFFICER— MANEUVER BATTALION

2-25. The maneuver battalion has one spectrum management NCO. The battalion spectrum management NCO—
- Employs appropriate spectrum tools to request frequencies used to operate SDDs throughout the battalion's AO.
- Develops a COP that displays the EMOE throughout the battalion's AO. The COP includes frequency charts, diagrams, reports, and databases of frequency interference incidents, providing EMOE situational awareness to the commander and staff.
- Oversees the distribution of frequencies, to subordinate units.
- Validates spectrum link reliability of assigned frequencies using a spectrum analyzer or monitoring receiver.

- Establishes the battalion guidance for managing, requesting, coordinating, and assigning spectrum use, JRFL, CEOI, EMI, and related SMO functions in alignment with higher headquarters policies and guidelines.
- Maintains an accurate listing of all SDDs in the battalion.
- Requests all CEOI and loadsets from higher headquarters and distributes them to subordinate units.
- Receives communications network input from higher headquarters and upon interpreting the information, creates frequency requirements and plans, logically organizes the data provided, and distributes CEOI and loadsets to required users.
- Conducts radio frequency engineering and analysis and evaluates regulatory policy to determine supportability of SDDs used in the battalion's AO.
- Prepares frequency requests using appropriate spectrum management tools, followed by forwarding the request to higher headquarters for processing.
- Once higher headquarters authorizes the request for frequency, nominates frequencies from the database established by higher headquarters, make assignments in the database, and notifies the requestors of the assignments.
- Generates satellite access request and submits to the proper controlling authority. Once the controlling authority grants authorization for satellite access, the battalion spectrum management NCO informs and provides users of the authorized frequencies.
- Performs regular frequency database reviews and submits requests for updates when necessary.
- Maintains SIPRNET access and accounting for assigned spectrum management tools and applications.
- Uploads all EMI identified in the AO to the JSIR.

SPECTRUM MANAGEMENT PERSONNEL—EXPEDITIONARY SIGNAL BATTALION

2-26. An expeditionary signal battalion (ESB) has two spectrum management personnel. The spectrum manager and the spectrum management NCO are members of the S-2/S-3 section. The spectrum manager is responsible for the supervision of the spectrum management NCO and in collaboration are responsible for conducting SMO for the ESB and subordinate units. The ESB's spectrum management personnel—

- Requests, allocates, and deconflicts frequencies for systems used for establishing the TTSB's portion of the Department of Defense Information Network-Army (DODIN-A).
- Establishes the ESB's guidance for managing, requesting, coordinating, and assigning spectrum use, JRFL, CEOI, EMI, and related SMO functions in alignment with higher command's policies and guidelines.
- Requests frequencies for SDDs needed to establish DODIN-A connectivity for the TTSB or another support unit.
- Prepares frequency requests using appropriate spectrum management tools, followed by forwarding the request to higher headquarters for processing. Once higher headquarters authorizes the request for frequency, the spectrum management personnel at the ESB nominate frequencies from the database established by higher headquarters, make assignments in the database, and notifies the requestors of the assignments.
- Request all CEOI and loadsets from higher headquarters and distributes them to subordinate units. The spectrum management personnel receive communications network input from the S-3 and upon interpreting the information, create frequency requirements and plans, logically organize the data provided, and distribute CEOI and loadsets to required users.
- Contributes to higher headquarters EMOE by providing data regarding all SDDs employed by the ESB.
- Receives the completed EMOE from higher headquarters to develop the ESB's COP. The COP includes frequency charts, diagrams, reports, and databases of frequency interference incidents, providing EMOE situational awareness to the commander and staff.

- Resolve EMI reported by the expeditionary signal companies and forwards all EMI incidents, both resolved and unresolved, to higher headquarters.
- Upload all EMI to the JSIR.
- Maintains SIPRNET access and accounting for assigned spectrum management tools and applications.

SECTION IV – SPECTRUM MANAGEMENT INPUT DURING THE MILITARY DECISION MAKING PROCESS

2-27. This section discusses the inputs and outputs provided by spectrum management personnel throughout the MDMP. Spectrum managers are responsible for providing specific information (inputs) at the beginning of each of the seven MDMP steps, resulting in products (outputs) that commanders require towards the end of each MDMP step.

2-28. The MDMP is an iterative planning methodology to understand the situation and mission, develop a course of action, and produce an operation plan or order. The MDMP is the Army's analytical approach to problem solving. The MDMP is a tool that assists the commander and staff in developing estimates and a plan.

2-29. Spectrum management personnel provide input throughout the MDMP. The MDMP is essential to the operations process and minimizes the risk of overlooking a critical aspect of the operation. The complete MDMP results in a detailed operation order or operation plan. The complete MDMP is a time-consuming process; however, if implemented correctly, it alleviates many unexpected issues and result in preplanned contingencies for possible changes that may occur during an operation. For further information concerning the MDMP, see FM 6-0.

2-30. Key inputs for the MDMP are actions, processes or information spectrum managers provide to the MDMP. SMO key outputs for MDMP are the completed CEOI, reports, frequency proposals or data call messages. Table 2-1, page 2-12, depicts the key SMO inputs and outputs for each step of the MDMP.

Table 2-1. Key SMO inputs and outputs during MDMP

Key SMO inputs	*Steps*	*Key SMO outputs*
- Updated EMS database - Unit electronic order of battle - Library of EMS documents - HN allocation tables - Gather spectrum management tools	**Step 1:** Receive Mission	- Defined EMOE - Data call message - Identify EMS constraints - JFRL guidance
- Identified EMS capabilities pertaining to combat power - List of unit's SSDs - Frequency requests - JRFL requests	**Step 2:** Mission Analysis	- Prioritized EMS use - Completed JRFL - Frequency reuse plans - Initial EMS risk assessment
- Commander's intent - Frequency allotments - Initial frequency assignments - DD-1494 for unit's SDDs	**Step 3:** Develop COA	- M&S of EMS to develop multiple COAs - EMI/EW deconfliction - Initial Spectrum Plan - EMS COP
- Initial Spectrum Plan - Mitigating factors to decrease EMS risk	**Step 4:** COA Analysis (War Game)	- M&S shows EMS advantages/ disadvantages for each COA - Continues analysis of EMS risk assessment - Recommend modifications
- Optional unit movement routes for planning COTM - Refines EMS COAs	**Step 5:** COA Comparison	- M&S depicts EMS use to compare COAs - Recommended EMS COAs
- Recommended EMS COA - Coordinated frequency conflicts - Frequency proposals	**Step 6:** COA Approval	- Commander selected EMS COA and any modifications - Frequency assignments
- Frequency assignments/allotments from higher echelon ESM - HN frequency clearance - CREW loadsets	**Step 7:** Orders Production, Dissemination and Transition	- The Spectrum Plan - CEOI/JCEOI - Annex H of OPORD - Distribute frequency assignments to requestors - CNR loadsets

Legend

CEOI	communications-electronics operation instructions		EW	electronic warfare
CNR	combat net radio		HN	host nation
COA	course of action		JCOEI	joint communications electronic operation instructions
COP	common operational picture		JRFL	joint restricted frequency list
COTM	communications on-the-move		M&S	modeling and simulation
CREW	counter radio-controlled improvised explosive device electronic warfare		OPORD	operations order
EMI	electromagnetic interference		SMO	spectrum management operations
EMOE	electromagnetic operating environment		SDD	spectrum dependent device
EMS	electromagnetic spectrum			
SM	spectrum manager			

SUPPORT TO MDMP STEPS

2-32. SMO supports the commander's SMO objectives during each step of the MDMP. The following are some responsibilities expected of the spectrum manager for each step of the MDMP—

- **Step 1: Receipt of Mission—**
  - The spectrum manager conducts data calls to attain a list of SDDs and their spectrum requirements.
  - Using spectrum management tools, the spectrum manager models the operational area with digital topography and electromagnetic environmental effects information to analyze spectrum supportability.

- Using governmental and host nation spectrum allocation tables, the spectrum manager determines frequencies used in an AO.
- The spectrum manager compiles restrictions or constraints of spectrum use that may prevent planning and use of protected, taboo, and guarded frequencies in the AO. For a listing of the worldwide-restricted frequency list, see CJCSM 3320-01C.
- The spectrum manager should understand the EMOE for awareness of the spectrum occupancy in the AO. Colors representing users of the spectrum are—blue (friendly), red (enemy), and gray (neutral and civil).

2-33. **Step 2: Mission Analysis—**
- The spectrum manager analyzes the EMOE, highlighting unified action partners' spectrum users, and aid the commander in determining spectrum priorities.
- The spectrum manager conducts an initial spectrum risk assessment identifying the spectrum impact mission on unified action partners in the operational area. This process also identifies frequency usage conflicts such as EMI and frequency fratricide.
- The spectrum manager generates a frequency reuse plan for spectrum optimization and increased spectrum capabilities.
- The spectrum manager identifies spectrum constraints where certain frequencies are either taboo, protected, or guarded. Constraints include those frequencies not allocated for use by the host nation.
- The spectrum manager, with guidance from the CEWO, determines spectrum capabilities of combat power, such as EW and counter radio-controlled improvised explosive device electronic warfare (CREW) systems.

- **Step 3: Course of Action Development—**
  - Using spectrum management tools, the spectrum manager models the unit's boundaries and movement formations. The use of these models is for developing COA recommendations.
  - Using spectrum management tools, the spectrum manager performs EMI and EW frequency deconfliction for both COA development and spectrum supportability.
  - The spectrum manager generates frequency allotment and allocation tables for subordinate units.
  - The spectrum manager identifies spectrum impact on civilian spectrum users in the AO.
  - The spectrum manager evaluates primary, alternate, contingency, and emergency communications for each COA based on unit capabilities, software simulation, and spectrum supportability.

- **Step 4: Course of Action Analysis (War Game) —**
  - The spectrum manager identifies the spectrum advantages and disadvantages throughout the AO for each COA.
  - The spectrum manager identifies mitigating factors for the spectrum risk assessment to reduce or eliminate risks.
  - The spectrum manager recommends modifications to the COA based on newly identified spectrum requirements and supportability during the wargame.

- **Step 5: Course of Action Comparison—**
  - Using spectrum management tools, the spectrum manager develops multiple COAs. The commander determines the COA best suited for the mission.
  - The spectrum manager analyzes routes used for movement of forces and advises the commander on routes with the least likelihood of spectrum interference or loss of spectrum coverage.

- **Step 6: Course of Action Approval—**
  - The spectrum manager consolidates units' submission of frequency proposals and provides the units with frequency assignments.

- ▪ The spectrum manager modifies the spectrum management portion of COAs according to the commander's guidance.
- ▪ The spectrum manager coordinates frequency conflicts through higher echelons for mitigation assistance.
- ● **Step 7: Orders Production Dissemination and Transition—**
  - ▪ The spectrum manager produces the CEOI and disseminate to units.

Note. Spectrum managers operating in a joint environment produce and disseminate the JCEOI instead of the CEOI.

- ▪ The spectrum manager provides input to Annex H (Signal) of the operations order (OPORD) that addresses all signal concerns, to include spectrum use information.

Note. Refer to FM 6-0 for additional information on Annex H of the OPORD.

THE COMMON OPERATIONAL PICTURE

2-34. The COP is a single display of relevant information within a commander's AO tailored to user requirements and based on shared data and information shared by more than one command. The spectrum manager assists with the information collection efforts by providing detailed data of the EMOE for the commander's COP.

2-35. SMO planning tools, used in conjunction with Intelligence and EW information, allow the spectrum manager to collect spectrum-related details tailored to the commander's AO. These tools provide a visual depiction of force structure and geographical locations in a three-dimensional picture that personnel can understand quickly and easily. The following are some examples of SMO supports to the COP—

- ● **Live spectrum analysis.** The spectrum manager uses SMO planning tools to analyze spectrum emissions within the commander's AO. Use of information attained from the spectrum analysis is to perform EMI mitigation. SMO planning tools include—spectrum analyzers or monitoring receivers, direction-finding antennas, and analysis software. SMO planning tools can be used to show or model persistent unplanned signals that interfere with assigned frequencies during detection of EMI. SMO planning tools provide a three-dimensional picture of the EME to the commander and includes a graphical depiction of the spectrum footprint, along with recommendations for frequency reassignment to maintain communications in the AO. Using information provided by SMO planning tools and mission priorities, the commander may deem it necessary to obtain new frequencies for mission accomplishment.
- ● **Movement of forces to a new location.** When the commander orders movement of forces to a new area, the spectrum manager creates the proposed movement route with the SMO planning tools. The spectrum manager collaborates with adjacent units to minimize EMI with friendly forces' communications systems, sensors, and receivers throughout the movement. The SMO planning tools perform a simulation and provide COAs to determine if communication systems remain operational during movement. The SMO planning tools determine if a specific movement route with active EW systems can cause interference of friendly communications along that route. The SMO planning tools produce a report with actionable information such as sources, victims, levels, and duration of interference. This information provides the commander with supplementary information to make knowledgeable decisions.

Chapter 3

Support to the Warfighting Functions

SMO enables and supports the Army's warfighting functions described in ADP 3-0, Unified Land Operations. A warfighting function is a group of tasks and systems (people, organizations, information, and processes) united by a common purpose that commanders use to accomplish missions and training objectives. The Army's warfighting functions are—movement and maneuver, intelligence, fires, sustainment, command and control, and protection. This chapter links Army SMO to the warfighting functions, also describes how SMO supports and enables the commander's efforts as they exercise command and control.

MOVEMENT AND MANEUVER

3-1.   SMO enables movement and maneuver by maintaining freedom of action within the electromagnetic spectrum. Commanders can leverage information derived from SMO to provide lethal and non-lethal effects against enemy combat capabilities while ensuring protection from adversary's use of the spectrum. SMO supports movement and maneuver by—

- Spectrum resource planning, analysis, and simulation to determine spectrum supportability over a projected movement of forces.
- Analysis, location, and direction finding of unknown and unplanned signals.
- Planning and simulating spectrum within the AO.
- Frequency deconfliction planning during movement of forces.

INTELLIGENCE

3-2.   SMO supports intelligence through the provision of spectrum situational understanding and the ability to gain a greater understanding of the EMOE. Understanding the EMOE results in successful frequency deconfliction of SDD, greater fidelity in threat recognition, and provision in support to the denial and destruction of enemies' counter-intelligence, counter-surveillance, and counter-reconnaissance systems. SMO supports intelligence by—

- Spectrum situational awareness using measurement, analysis, and assessment of signals in the AO.
- Providing a detailed caption of the EMOE for situational awareness.
- Production and promulgation of JRFL identifying protected frequencies used by friendly forces that are of critical importance, to include intelligence operations, including guarded frequencies on the JRFL to exploit an adversary's intelligence.
- Centralized databases facilitate collection management through subordinate and adjacent units.
- Deconflicting frequencies that create EMI with unmanned aircraft systems that may be conducting intelligence operations in the AO.

FIRES

3-3.   SMO provides crucial support to the fires warfighting function through spectrum awareness and direct support to EW. Electromagnetic environmental effects influence the operational capability of military forces, equipment, systems, and platforms. Spectrum management operations support the fires warfighting function through mitigation of EMI amongst fires systems.

3-4. SMO supports fires by—

- Coordination throughout the EMOE to prevent EMI to and from firing devices, sensors, and data links that use the spectrum.
- Coordination with the CEMA element that allows effective use of spectrum resources for EW operations.
- Integration and synchronization of CEMA by assignment and allocation of spectrum use in joint environments.

> *Note.* Coordinated execution of joint electromagnetic spectrum operations with other lethal and nonlethal operations that enable freedom of action in the electromagnetic operational environment comprises electromagnetic spectrum control. (JP 3-13.1)

SUSTAINMENT

3-5. The sustainment warfighting function is the related tasks and systems that provide support and services to ensure freedom of action, extend operational reach, and prolong endurance. SMO ensures that all SDDs used for sustainment have necessary frequencies and minimal EMI.

3-6. Through coordination with EW, SMO contributes to overall sustainment in a hostile EMOE. SMO supports sustainment by—

- Providing the necessary frequencies for logistics SDDs within the EMOE conducting sustainment operations.
- Obtaining frequency clearance for logistics SDDs to conduct sustainment operations for the duration of the mission.
- Frequency deconfliction and emissions control procedures in support of sustainment operations.

COMMAND AND CONTROL

3-7. The command and control (C2) warfighting function develops and integrates those activities, enabling a commander to balance the art of command and the science of control. C2 emphasizes the centrality of the commander. Commanders exercise C2 by driving the operations process, knowledge management and information management, synchronization of information-related capabilities, and conducting CEMA. SMO enables C2 through the mitigation of EMI resulting from both frequency fratricide and enemy attack actions. In a contested, congested, and competitive EMOE, the C2 function must remain effective. SMO plays a vital part in the planning and management process that results in situational awareness of the EMOE.

3-8. Figure 3-1 on page 3-3 shows the relationship between two types of spectrum management tools. The spectrum situational awareness system (S2AS) and the electronic warfare planning management tool (EWPMT) or coalition joint spectrum management planning tool (CJSMPT), used to support C2 using the command post of the future as the SDD. Spectrum managers can substitute the S2AS and EWPMT with other spectrum management tools as necessary.

> *Note.* EWPMT is the Army program of record for SMO. CJSMPT is still widely used by spectrum managers in the Army and remains as an optional spectrum management tool under the global electromagnetic spectrum information system (GEMSIS).
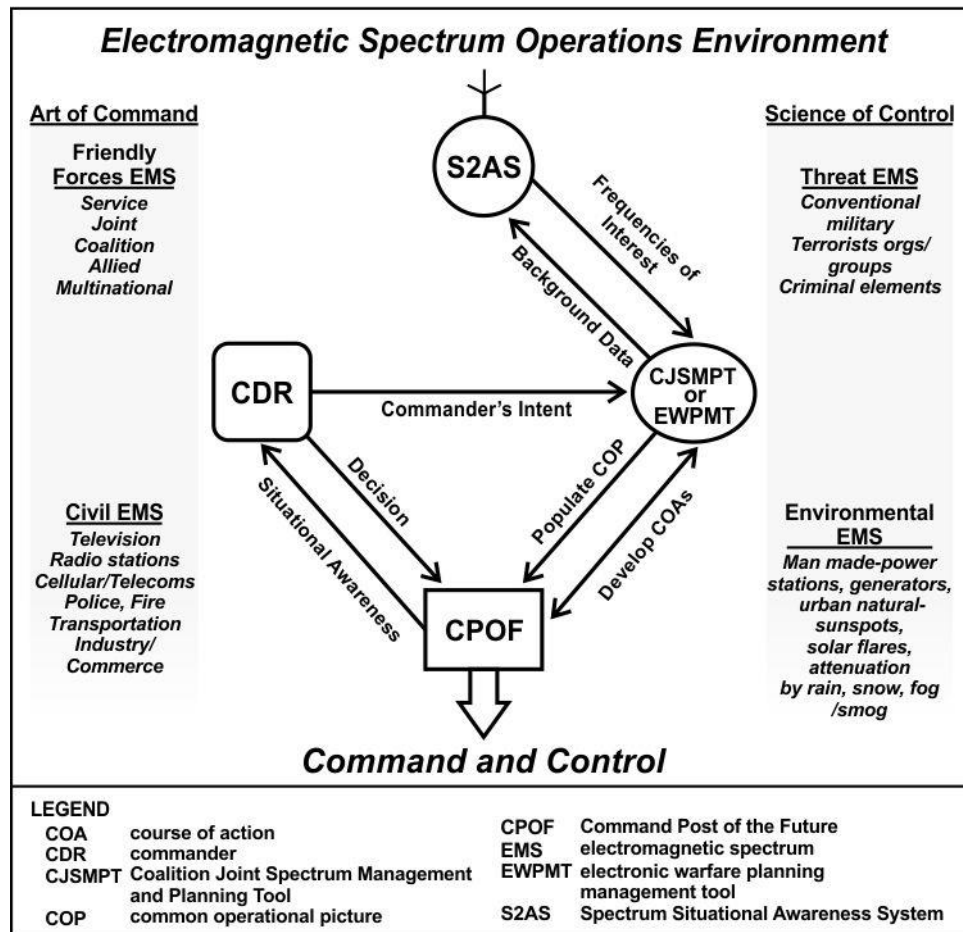
Figure 3-1. S2A2 using EWPMT or CJSMPT support to command and control

3-9. SMO supports C2 by—
- Planning and preparing the spectrum in response to a mission.
- Assessment of the EMOE in response to the commander's intent.
- Preparation and maintenance of the EMOE database.
- Understanding the impact of a mission on friendly, neutral, adversary, enemy, joint, interagency, intergovernmental, and multinational entities.
- Collecting spectrum information and visualizing this information in quick and easy to understand formats for completion of the COP.
- Control of the spectrum through force tracking and visualization, frequency deconfliction, reprogramming, registration of SDDs.
- Development of SMO planning and management tools that support the network-centric environment (NCE) and become interoperable with Army and joint task force spectrum users.

PROTECTION

3-10. The protection warfighting function is the related tasks and systems that preserve the force so the commander can apply maximum combat power. SMO supports the protection warfighting function through the conduct of frequency deconfliction, interference mitigation, and support to EW defensive actions.

3-11. SMO supports protection by—

- Network and frequency fratricide avoidance, detection, and mitigation.
- Developing of the JRFL to prevent frequency fratricide and mission degradation.
- Coordinating with CEMA Element to protect against blue force EMI during EW operations, such as counter radio-controlled improvised explosive device EW use.

3-12. The spectrum manager also protects the force by recognizing the potential of electromagnetic environmental effects. Electromagnetic environmental effects (E3) is the impact of the electromagnetic environment upon the operational capability of military forces, equipment, systems, and platforms. E3 encompasses all electromagnetic disciplines, including electromagnetic compatibility and electromagnetic interference, electromagnetic vulnerability, electromagnetic pulse (EMP). The three types of E3 are—

- **Electronic protection, hazard of electromagnetic radiation to personnel (HERP)**. HERP is the hazard that exists due to the exposure of personnel to an electromagnetic field with sufficient intensity to heat the human body. Radar, communication systems, and EW systems that use high-power transmitters and high-gain antennas represent a hazard to personnel working on, or near these systems. Leaders should ensure areas are marked off to avoid injury to personnel.
- **Hazard of electromagnetic radiation to ordnance (HERO)**. HERO is the danger of accidental actuation of electro-explosive devices or otherwise electrically activating ordnance because of the radio frequency electromagnetic fields. This unintended actuation could cause premature firing of ordnance.
- **Hazard of electromagnetic radiation to fuels (HERF).** HERF is the potential hazard that exists when volatile combustibles, such as fuel, exposed to electromagnetic fields of sufficient energy to cause ignition. The hazard is likely to occur when refueling operations are taking place. Leaders must adhere to proper grounding and static discharge procedures. Cease or minimize transmissions during refueling operations to prevent the potential hazard and exposure to radiation fields.

Appendix A
Spectrum Management Task List

This appendix describes the current spectrum manager task list to include each task and their supporting sub-tasks. This appendix also contains flow charts that illustrate the collaboration process between spectrum managers and the EW Cell.

TASKS

A-1. Tasks assigned or associated with spectrum management are unit specified. Spectrum management encompasses a wide range of military activities and missions. Each unit has standard operating procedures establishing spectrum management operations.

A-2. Each unit provides the spectrum manager with a unique set of circumstances. As an example, assignments to aviation units differ from Special Operations units in the deployment and use of SDD and related systems.

PLAN THE USE OF THE ELECTROMAGNETIC SPECTRUM FOR ALL SPECTRUM DEPENDENT DEVICES

A-3. Planning for spectrum use requires information from a variety of sources. The spectrum manager uses force structure templates to plan missions. Forces submit spectrum requirements for all devices used for the mission to the spectrum manager. The spectrum manager submits frequency proposals to appropriate agencies in the correct format (standard frequency action format [SFAF] or standard spectrum resource format [SSRF]). Frequency record creation in the proper database prevents other units from using the same spectrum resources in locations that would cause EMI. Supporting sub-tasks for planning the use of the electromagnetic spectrum for all spectrum dependent devices include—
- Conduct a data call.
- Generate frequency proposal.
- Process frequency proposal from subordinate units.
- Analyze spectrum resource allocations and partition them into allotment plans and assignments.
- Nominate assignments against allotments (spectrum resources).
- Create and edit a frequency record.
- Provide input to the production of Annex H (OPORD).

CONDUCT ELECTROMAGNETIC INTERFERENCE ANALYSIS

A-4. The spectrum manager analyzes the spectrum's impact on the mission. Identification of possible EMI that could result during an upcoming mission occurs during the initial planning process using spectrum management tools. Identifying possible EMI allows a course of action (COA) development to eliminate or mitigate the interference. Spectrum users and spectrum managers identify EMI during mission execution in various ways, such as reports of degraded communications, inoperable sensors, or malfunctioning equipment.

A-5. The spectrum manager analyzes the EMI to identify the cause of the EMI. EMI happens for various reasons, such as operator programming errors, or blue, gray, red force jamming (intentional or otherwise), or improper equipment deployment. The primary resources that the spectrum manager has for EMI mitigation is spectrum monitoring and direction finding devices used in conjunction with the JSIR process and interagency collaboration. As outlined in the JSIR procedures, the spectrum manager mitigates EMI at

the lowest echelon possible. EMI reporting, to higher echelons, occurs for all EMI occurrences. Reporting EMI occurs regardless of a resolution for the interference.

Note. See CJCSM 3320.02D for more information on JSIR.

A-6.   The following sub-tasks support the task conduct electromagnetic interference analysis—
   ● Identify EMI.
   ● Provide recommendation to eliminate or mitigate interference.
   ● Prevent frequency substitution by locking nets, and assignments.
   ● Provide recommended frequency modification or replacement by user-assigned priority.
   ● Import and validate JSIR input from subordinates.
   ● Export JSIR to higher headquarters.

Note. The joint spectrum center (JSC) serves as the center for EMI mitigation and monitors the JSIRO collaboration portal. JSIRO is accessible through the SIPRNET link provided in the reference portion of CJCSM 3320.02D. JSIRO is currently the preferred method of reporting EMI occurrences.

ASSIGN FREQUENCIES WITHIN THE OPERATIONAL PARAMETERS OF SPECTRUM DEPENDENT DEVICES AND AVAILABLE RESOURCES

A-7.   The use of spectrum management tools provides the spectrum manager with operational characteristics of all SDDs validated by the DD Form 1494 process. The spectrum manager performs an analysis of the operational requirements of a mission based on the characteristics of each device. Host nation comments and agreement allows the spectrum manager to construct allocation tables for the operational area. The spectrum manager assigns frequencies based on these allocations to requesting units for use during the mission. The following sub-tasks support this task—
   ● Conduct data call.
   ● Determine if SDD is supportable in the area of interest.
   ● Coordinate for spectrum usage with the host nation.
   ● Create and edit a frequency record.

OBTAIN REQUESTS AND PROVIDE ELECTROMAGNETIC SPECTRUM RESOURCES TO REQUESTING UNIT

A-8.   Subordinate units submit frequency requests, in the correct format (SFAF or SSRF), to the spectrum manager after a unit receives a mission and determines spectrum requirements to support that mission. The following sub-tasks support this task—
   ● Conduct data call.
   ● Determine if SDD is supportable in the area of interest.
   ● Coordinate for spectrum usage with host nation using HNSWDO.
   ● Create and edit a frequency record.

PROVIDE ELECTROMAGNETIC OPERATIONAL ENVIRONMENT INFORMATION IN EITHER A NETWORKED OR STAND-ALONE MODE

A-9.   Sharing of information within and between agencies is critical for accurate and efficient spectrum management. As spectrum management tools become more NCE compliant, sharing of critical information among agencies becomes easier. As the spectrum manager may not always have access to the network, spectrum management tools must remain functional in a stand-alone mode. The following sub-tasks support this task—

- Derive specific mission requirements from the operation plan.
- Maintain situational awareness of the EMOE.
- Conduct EMOE information data exchange with peer-to-peer, subordinate to higher and higher to subordinate users.
- Delete, modify, and export user selected background data.
- Conduct analysis.

PERFORM MODELING AND SIMULATION OF THE EMOE USING USER SELECTED DATA FIELDS OF THE IMPACT OF THE EMOE ON PROJECTED SPECTRUM PLANS

A-10. Modeling and simulation of the EMOE using spectrum management tools allow for mitigating the effects of SDD on unintended bystanders. It also provides for the development of various COAs during the MDMP upon receipt of an OPORD or fragmentary order. It is critical for the spectrum manager to monitor the spectrum continually to detect EMI or EW during mission performance. The following sub-tasks support this task—

- Conduct data call.
- Maintain situational awareness of the EMOE.
- Derive specific mission requirements from the operation plan (OPLAN) or OPORD.
- Conduct analysis.

MONITOR AND USE SPECTRUM COMMON OPERATIONAL PICTURE INFORMATION IN SUPPORT OF UNIFIED LAND OPERATIONS

A-11. The COP provides commanders with an easy to understand picture of all relevant information that pertains to a mission. Development of the COP requires an accurate and up-to-date depiction of spectrum use within the AO. For instance, the spectrum manager uses a spectrum analyzer or monitoring receiver to identify signals in the AO and overlay the results with a color-coded display on a two or three-dimensional picture of the area. The following sub-tasks support this task—

- Maintain situational awareness of the EMOE.
- Export the Spectrum Plan in a format compatible for import by mission command systems.
- Provide spectrum situational awareness to the common operational picture.

PRIORITIZE SPECTRUM USE BASED ON COMMANDERS GUIDANCE

A-12. When the requirement for spectrum exceeds the supply, spectrum use priority becomes established. The commander, usually with input from the G-6 or S-6 spectrum manager, institutes prioritization. Priorities placed into various spectrum management tools for planning missions make prioritization very efficient. Prioritization of spectrum users allows interference mitigation per the commander's intent. The following sub-tasks support this task—

- Maintain situational awareness of the EMOE.
- Identify conflicts.
- Perform spectrum course of action analysis.

USE ELECTRONIC WARFARE REPROGRAMMING DURING THE NOMINATION, ASSIGNMENT, AND DECONFLICTION PROCESSES

A-13. Blue force electronic warfare can easily disturb other spectrum users within the EMOE. Coordination between the CEMA element spectrum manager and the G-6 or S-6 spectrum manager can mitigate many of these disturbances. Spectrum management tools allow the spectrum manager to analyze the effects of EW and provide frequency deconfliction recommendations to return spectrum users to operational status (if possible). There are no sub-tasks associated with this task.

IMPORT SATELLITE ACCESS AUTHORIZATION

A-14. The Defense Information Systems Agency regional satellite support center is responsible for disseminating satellite access authorizations and satellite frequencies to agencies within a prescribed AO. Spectrum managers import the satellite authorizations provided for satellite users within the unit and transfer it to the proper MC4EB format. The spectrum manager uses the satellite authorizations data to refine the COP that all authorized spectrum management agencies can use. The supporting task is to modify satellite access authorization record to ensure required data fields comply with the MC4EB standard for assignment.

> *Note.* SAA authorizes user access to specific satellites authorizes satellite access to users and provides frequencies for use on satellite communications systems. The satellite access authorization does not provide area frequency clearance in the operational area. Spectrum managers must obtain frequency clearance from the host nation using guidelines for the respective geographic commander before allowing units to transmit on the assigned uplink frequency. Deconflict these frequencies from other ground-based emitters to prevent interference during mission execution.

CREATE, IMPORT, EXPORT, EDIT, DELETE, DISPLAY, AND DISTRIBUTE THE JOINT RESTRICTED FREQUENCY LIST

A-15. The JRFL is a management tool used by various operational, intelligence, and support elements to identify the level of protection desired for a critical function within the electromagnetic spectrum. EW planners use the JRFL to conduct mission planning and to mitigate the effects of friendly offensive and defensive electronic attack when possible. Planners limit JRFL entries to the minimum number of radio frequencies and intelligence equities necessary for friendly forces to accomplish mission objectives. The JRFL entry contains at a minimum—

- Tactical/operational point of contact for frequency usage.
- Center channel of the frequency assignment.
- Emission designator.
- Name of receiver location.
- Geolocation of receiver.
- Protection radius of the receiver.
- Justification for protection.
- JRFL code (protected, taboo, guarded).
- Serial number of Spectrum XXI frequency record for transmitters only. Receivers or sensors incapable of transmitting do not have frequency records.

A-16. The spectrum manager receives requests from subordinate units to place friendly force spectrum users into the JRFL. Spectrum managers validate organizational and subordinate JRFL requests and forwards them to higher echelons for approval. The command with responsibility for developing and promulgating the JRFL validates subordinate unit input. Upon completion of the JRFL, the spectrum manager disseminates the JRFL to subordinate users. The following sub-tasks support this task—

- Gather and compile JRFL input.
- Validate JRFL input (codes: taboo, guarded, and protected).
- Export JRFL input to higher headquarters.
- Import completed JRFL from higher headquarters.
- Export completed JRFL to subordinates.

ACCESS AND USE SPECTRUM MANAGEMENT OPERATIONS TECHNICAL DATA

A-17. Every SDD has operational characteristics that allow it to perform the intended functions. The spectrum manager accesses these characteristics through various spectrum databases and uses them during

the frequency assignment process to ensure that spectrum resources support the proper operation of the device. Some of these characteristics include waveforms, number of frequencies used, transmit and receive power, and frequency bands. The following sub-tasks support this task—

- Delete, modify, and export user selected background data.
- Determine if an SDD is supportable in the operational area.

MANAGE, STORE, AND ARCHIVE SPECTRUM USE DATA (FREQUENCY MANAGEMENT WORK HISTORY) AND HOST NATION COMMENTS IN THE SPECTRUM NOMINATION AND ASSIGNMENT PROCESS

A-18. The spectrum manager uses spectrum management tools to file spectrum use data and use host nation comments during the spectrum nomination and assignment process. This process not only aids current mission planning, but also planning for future missions. The following sub-tasks support this task —

- File data according to regulatory records.
- Coordinate for spectrum usage with host nation using HNSWDO.

SUB-TASK LIST

A-19. The following list describes the sub-tasks as they pertain to the functions of the Army spectrum manager—

- **Conduct Data Call:** The spectrum requirements data call message guides staff elements, components, and supporting agencies on how to request spectrum support for SDD systems that operate under their control within the area of operations. This multipart message can be sent in an operations or fragmentary order at the division and below echelons and should cover the following subjects—
    - Spectrum management policy and guidance.
    - Security classification guidance.
    - Frequency and communications-electronics operating instructions.
    - Master netlist request procedures.
    - Guidance for identifying nets and frequencies to be included on the JRFL.

Note. For a sample of the data call format, see CJCSM 3320.01C.

- **Process frequency proposals from subordinate units:** The spectrum manager receives frequency requests from subordinate units in the format described in the data call message. Receiving frequency requests allows the spectrum manager to place the required information into the planning software and analyze the impact of the request on the spectrum. Also of concern is receipt of agency approval, host nation supportability operations using host nation comments, receiving and updating spectrum related databases, and input from the area frequency coordinator. Once the spectrum requirements exist within databases, the spectrum manager determines the spectrum supportability of the request.
- **Generate frequency proposal:** Once the frequency proposal processing is complete, the spectrum manager submits the proposal in the correct format (SFAF or SSRF) to obtain frequency assignment. Use of spectrum management tools allows the manager to generate and submit frequency proposals to the appropriate agencies accurately.
- **Analyze spectrum resource allocations and partitions them into allotment plans and assignments:** Spectrum managers receive a range of frequency allocations in a given area for SDDs. The spectrum manager can use spectrum management tools to analyze force spectrum requirements and submit frequency proposals based on the analysis.
- **Nominate assignments against allotments (spectrum resources):** If provided allotments for use within given bands of the spectrum, the spectrum manager assigns frequencies to spectrum users. The spectrum management tool in use during the planning process determines possible frequency assignments and if they are supportable.

- **Create and edit a frequency record:** A frequency record includes all information about spectrum use of a specific unit or force (blue, red, or gray). Frequency records include characteristics, capabilities, frequency proposal and assignment, frequency clearance, and the force structure supporting the frequency use. Frequency records consolidation occurs during the normal procedures for obtaining frequency assignment with spectrum management tools. Location of the frequency records is in various databases.

- **Provide input to the production of Annex H (OPORD):** Annex H of the OPORD concerns signals. The spectrum manager places key spectrum information in Annex H of the OPORD. Information in Annex H allows the commander and subordinate units to have a clear picture of the operational environment.

- **Identify EMI:** EMI can present itself in various ways. For instance, a communications terminal may contact the brigade or battalion headquarters concerning difficulty receiving a signal from another communications terminal. The primary tool used to identify immediate EMI is S2AS. TheS2AS can scan the specific frequency range that the terminal is operating within for jamming, intermodulation, and noise, and eventually locate (through direction finding) and assist the spectrum manager in determining the cause of the EMI (frequency fratricide or enemy EW).

- **Provide recommendation to eliminate and or mitigate interference:** Various spectrum management tools can perform mitigation or frequency deconfliction of EMI occurrences. Recommendations provided to the commander from the spectrum manager enhance decision making. The commander may decide to continue with limited spectrum use or obtain frequency reassignment.

- **Prevent frequency substitution by locking nets and assignments:** Based on mission priority and commander's discretion, the JRFL lists frequencies, and networks that require protection from friendly force spectrum users. A variety of spectrum management tools allow for automatically locking nets and assignments during the mission planning process.

- **Provide recommended frequency modification or substitution by user:** Frequency modification or substitution occurs to obtain new frequencies for users that experience unresolved EMI. The commander may deem frequency modification necessary based on user priority during EW operations.

- **Conduct analysis:** The spectrum manager conducts an analysis when using spectrum management tools to plan spectrum use. Tools determine the impact of spectrum use in the operational area by calculated EMI, spectrum requirements, and force structure. The analysis results determine if the spectrum can support a given COA.

- **Export Spectrum Plan in a format compatible for import by mission command systems:** Spectrum management tools currently in use are capable of exporting the correct format for use by various command systems. The spectrum manager verifies the accuracy and completeness of the spectrum plan before exporting it in the correct format to various mission command systems.

- **Provide spectrum situational awareness to the COP:** This occurs during mission performance by using spectrum analyzers or receivers. The spectrum manager can use these tools while stationary to detect unknown or unplanned signals. Mobile packages or antennas allow for direction finding and locating these signals to conduct EME.

- **Identify conflicts:** Spectrum awareness identifies when spectrum conflicts occur. These conflicts may be blue, gray, or red forces. Use the JSIR procedures and spectrum awareness tools to locate, characterize, and determine critical information concerning the signal(s) in question.

- **Perform spectrum COA analysis:** Differing spectrum management tools develop COAs during the planning phase of a mission. During mission execution, EMI occurrence requires the development of COAs. The nature of the EMI (blue, red or gray force caused EMI) determines the development of COAs. The spectrum manager may require new frequencies for users. Another COA, based on the impact of the EMI and mission priority, may be to do nothing. The JSIR procedures include directions and reporting procedures to mitigate EMI.

- **Satellite Access Authorization:** To create Satellite Access Authorization records to ensure required data fields comply with the MC4EB and Military Communications Executive Board (MCEB) standards for assignment. Spectrum users that depend on satellite resources require a satellite access authorization from the regional satellite communications support center

responsible for the location of the user. Once the regional satellite communications support center disseminates satellite access authorizations to the requesting unit the spectrum manager must receive the authorization and transfers the information into the correct SFAF or SSRF (MC4EB Publication 7 or MCEB Publication 8) format before obtaining frequency clearance in the area.

Note. The regional satellite communications support center generally interfaces with brigade satellite operations. In some cases, the brigade spectrum manager is also the satellite operations NCO.

- **Import and validate JSIR input from subordinates:** Report EMI at the lowest level recognized. The spectrum manager attempts to mitigate the EMI at the lowest level possible using the JSIR procedures (CJCSM 3320.02D). If that level cannot rectify the situation, it escalates to the next higher level until EMI resolution. Spectrum users and managers of all levels report EMI occurrences to the next higher echelon, regardless of severity or cause. Some spectrum management tools allow the spectrum manager to generate a JSIR report. Spectrum managers can then use the JSIR report to determine the validity of the information injected into the JSIR by subordinate units. If SIPRNET access is available, use the JSIRO collaboration portal for EMI reporting.

- **Export JSIR to higher headquarters:** Once imported and validated the next higher headquarter stakes action. If SIPRNET access is available, use the JSIRO collaboration portal for EMI reporting. If not, various spectrum management tools allow for exporting the JSIR to higher headquarters.

- **Derive specific mission requirements from OPLAN or OPORD:** The OPLAN or OPORD contains a variety of information that spectrum managers may use to perform critical tasks, such as generating the CEOI or performing a data call.

- **Maintain Spectrum Analysis of the EMOE:** This task is an ongoing task for the duration of a mission. Ideally, the spectrum manager performs live spectrum analysis even before the mission becomes active to determine whether the planned frequencies have interference once active. Live spectrum monitoring plays a critical role in identifying, analyzing, and mitigating EMI.

- **Conduct EMOE information data exchange with peer-to-peer, subordinate to higher and higher to subordinate users:** Spectrum managers update a variety of databases, especially in a joint environment, to remain effective in spectrum use. Spectrum management tools currently in use allow for data exchange through common formats and central databases.

- **Delete, modify, and export user selected background data:** User selected background data involves obtaining detailed SDD data and characteristics. Location of background data characteristics are in spectrum-related databases. The spectrum manager must update the selected background data periodically to ensure that the databases reflect accurate information.

- **Build and test base CEOI or JCEOI:** The spectrum manager uses spectrum management tools to develop the CEOI or JCEOI based on mission requirements and the commander's intent. The CEOI or JCEOI gives the spectrum user guidelines for operating within the spectrum and instructions for reporting spectrum issues.

- **Determine if SDD is supportable:** Completion of the DD Form 1494 is critical in determining the area of interest supportability. Also of use are the various spectrum databases provided under the Global Electromagnetic Spectrum Information System (GEMSIS), such as the EWPMT, the Joint Spectrum Data Repository (JSDR), Spectrum XXI, and HNSWDO.

Note. The program manager of the SDD is responsible for DD Form 1494 processing and completion. The user is responsible for ensuring the SDD has a completed DD Form 1494.

- **File data in accordance with regulatory records:** Data compliance with SFAF or SSRF, Federal Communications Commission, NTIA, International Telecommunications Union, and host nation formatting to file data correctly. Use of various spectrum management tools automates the process of formatting during the frequency acquisition process.

- **Gather and compile JRFL input:** Placing some spectrum users on the JRFL is dependent on mission priorities and the commander's discretion.
- **Validate JRFL input (codes: taboo, guarded, and protected):** Many users request placement on the JRFL. However, JRFL code selection requires validation of mission priority and commander's discretion.
- **Export JRFL input to higher headquarters:** Once the JRFL validation is complete, the spectrum manager exports it to higher headquarters to place the user's SDD frequency on the central JRFL spectrum management tools allow the user to export JRFL information in the correct format.
- **Import completed JRFL from higher headquarters:** The higher headquarters completes and compiles the JRFL based on subordinate unit's inputs. The spectrum manager then imports the JRFL from the higher echelon and prepares to disseminate it to subordinate units.
- **Export completed JRFL to subordinates:** The spectrum manager disseminates the approved JRFL to subordinate units to place the JRFL into effect. Various spectrum management tools allow for the distribution of the completed JRFL.
- **Coordinate for spectrum usage with host nation using HNSWDO:** When operating outside the U.S. and its possessions, it is critical to coordinate spectrum use within the area of operations with the host nations. Use of the spectrum within a host nation without authorization from that nation causes international consequences, such as fines, imprisonment, or loss of life. HNSWDO is the primary means for the spectrum manager to determine host nation spectrum supportability for SDD.
- **Perform person-to-person host nation coordination:** When delegated under combatant command authority the JSME may be required to conduct host nation coordination in support of Joint Task Force spectrum access within the joint operational area.
- **Distribute JRFL electronically or by printed text:** The spectrum manager disseminates the completed JRFL to the units that require it. Spectrum management tools currently in use allow for disseminating the JRFL to required agencies electronically or by printed text.

SPECTRUM MANAGEMENT OPERATIONS TO ELECTRONIC WARFARE FLOW CHARTS

A-20. The following flow charts describe the collaboration process between the G-6 or S-6 spectrum manager and the EW Cell. Figure A-1 on page A-9 shows an overview of the entire process. In these figures, descriptions of spectrum managers' tasks are beneath the chart. For more information concerning EW tasks, review FM 3-12 and JP 3-13.1.
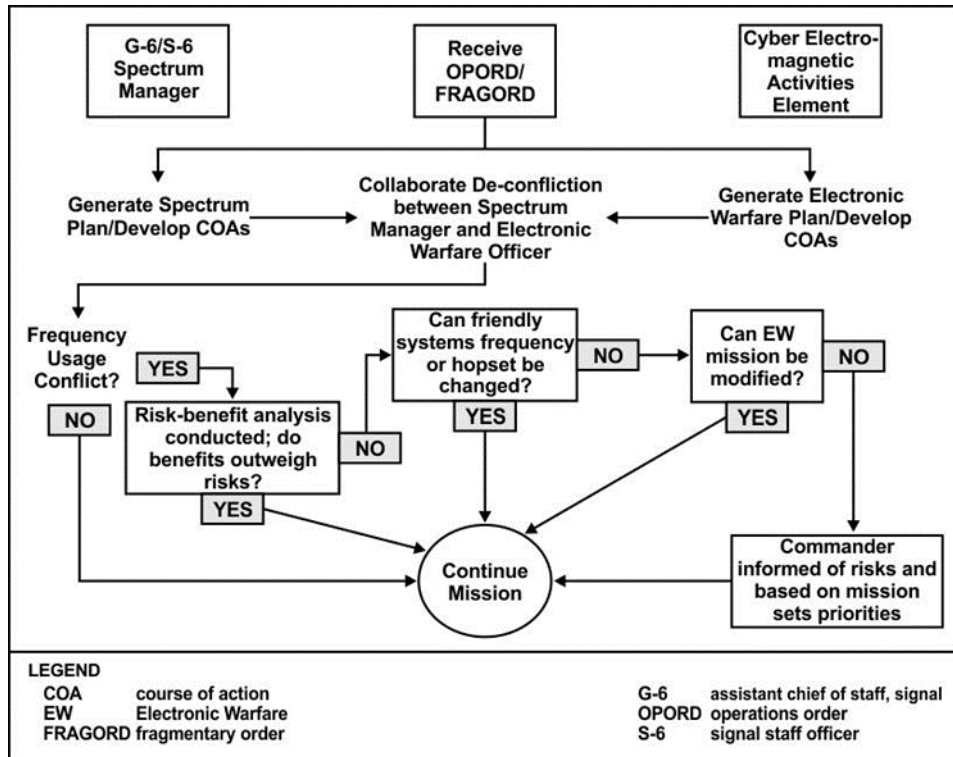
Figure A-1. The SMO to EW collaboration process

A-21. Figure A-2 shows a detailed description of the SMO tasks that support the collaboration process.
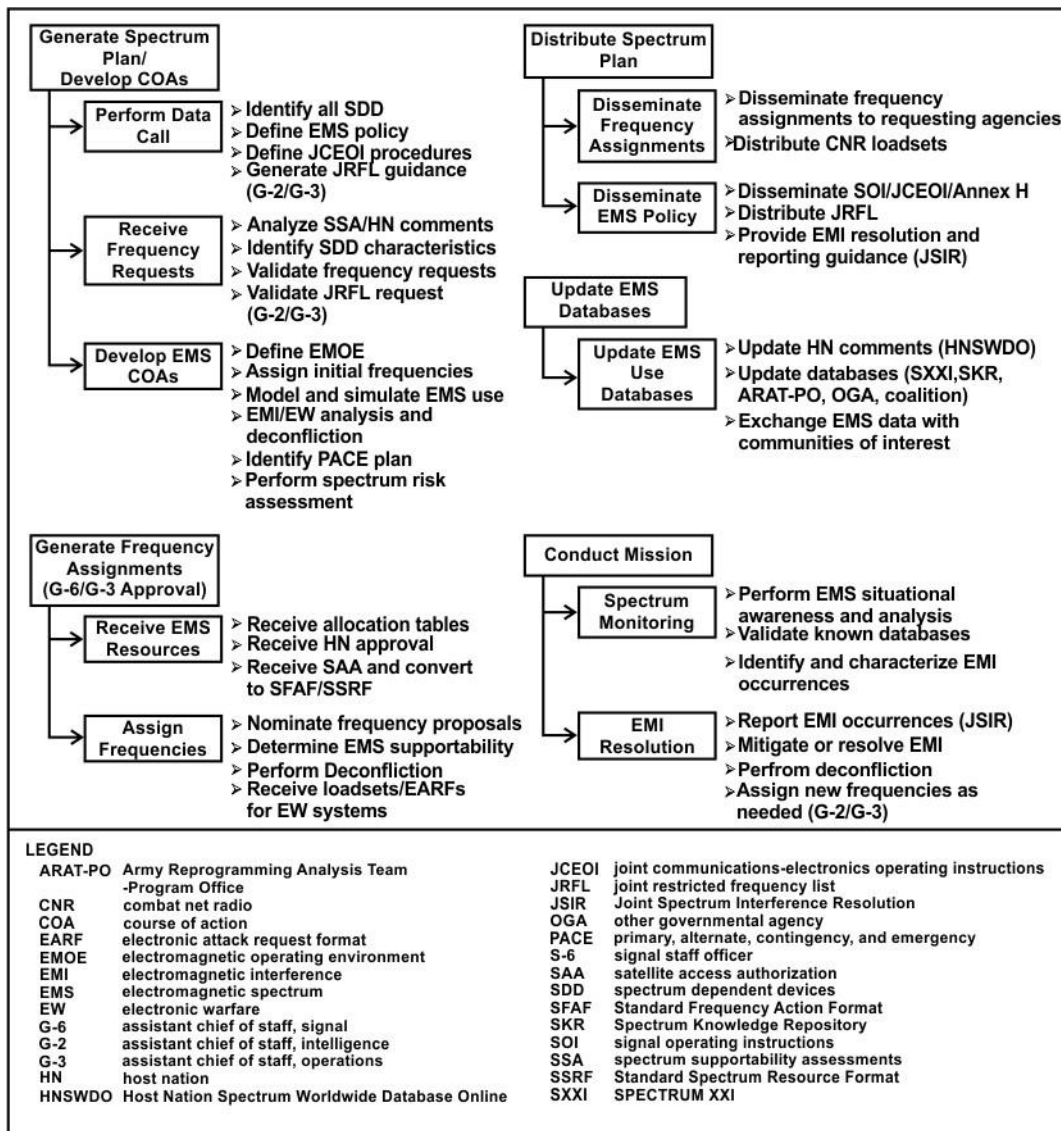
Figure A-2. The G-6 or S-6 spectrum manager's tasks

A-22. **Generate tactical spectrum plan and develop COAs:** Spectrum managers use various spectrum management tools to plan a mission (ACES/JACS, EWPMT, Spectrum XXI, and systems planning, engineering, and evaluation device [SPEED]). The spectrum manager generates a data call message to all subordinate units. The data call message—

- Directs the units to identify all SDDs.
- Define spectrum policy.
- Defines the procedures included on the JCEOI and defines JRFL Guidance.

A-23. **Receive frequency request:** As the units answer the message, the spectrum manager receives frequency requests according to mandatory formats (SFAF, SSRF, NTIA or International Telecommunications Union required items). Spectrum managers review the SDD characteristics and determine if each has passed the spectrum certification process (DD Form 1494), and is supportable in the operational area by reviewing host nation comments (HNSWDO). The spectrum manager validates frequency requests by checking for inflated requests (such as the unit requests more frequency than

needed). The spectrum manager validates JRFL requests with the G-2 and G-3; this ensures warranted protection requests. The spectrum manager also prioritizes spectrum users, with the G-3, to aid in planning and to prioritize frequency requests.

A-24. **Develop COA**—spectrum managers develop COAs for the mission and issue initial frequency assignments to perform modeling and simulation for the spectrum. Various spectrum management tools identify EMI caused by multiple sources and provide deconfliction recommendations. Spectrum managers also perform a spectrum risk assessment to determine the effects of the SDD in the area of responsibility. The commander may choose the COA according to all of the identified spectrum issues and risks.

A-25. **Generate frequency assignments**—the spectrum manager receives spectrum resources, in the form of allotments or frequency assignments from higher echelon (such as the Army Frequency Management Office, the network enterprise center, JFMO, and host nation coordination). The spectrum manager uses spectrum management tools to request resources in SFAF format.

A-26. **Assign frequencies and nominate frequency proposals**—spectrum managers nominate frequency proposals to the approving authority. Upon receiving approved frequency assignments, the spectrum manager determines the spectrum supportability of any new or revised frequencies and then assign frequencies using spectrum management tools.

A-27. **Distribute tactical spectrum plans**—the spectrum manager disseminates the tactical spectrum plan to all required agencies (JFMO, JSME, and CEMA element) and provides spectrum data to communities of interest such as unified action partners. The spectrum manager generates and distributes combat network radio loadsets. The spectrum manager disseminates approved policies for spectrum use, to include the CEOI or JCEOI Annex H (OPORD), the completed JRFL, and EMI resolution guidance (CJCSM 3320.02D).

A-28. **Update spectrum databases**—the spectrum manager deliberately and continuously updates database repositories in addition to keeping spectrum management tools filled with accurate data.

A-29. **Conduct mission**—spectrum managers conduct spectrum monitoring before conducting the mission to validate spectrum databases and identify differences between planned, authorized frequencies and spurious or unauthorized frequencies in use. Spectrum managers use spectrum analyzers and spectrum analysis software to monitor frequencies. Spectrum managers can aid in spurious frequency detection, EMI detection, and geolocation utilizing spectrum management tools. When required, spectrum managers can conduct site surveys and fact-finding missions for direction finding of frequencies, characterize the EMOE, and conduct or advise EMI resolution COAs. Spectrum monitoring during the mission identifies and characterizes EMI occurrences. Upon EMI occurrence, the spectrum manager performs EMI resolution mitigation and reporting procedures. The spectrum manager uses the data to submit a JSIR report. The spectrum manager then follows the steps in the CJCSM 3320.02D, to attempt to resolve and mitigate the EMI at the lowest echelon possible. If a resolution is not possible, the spectrum manager provides spectrum users with new frequency assignments.

A-30. Figure A-3 provides a graphic depiction of EW tasks conducted in the CEMA element in collaboration with the SMO process.
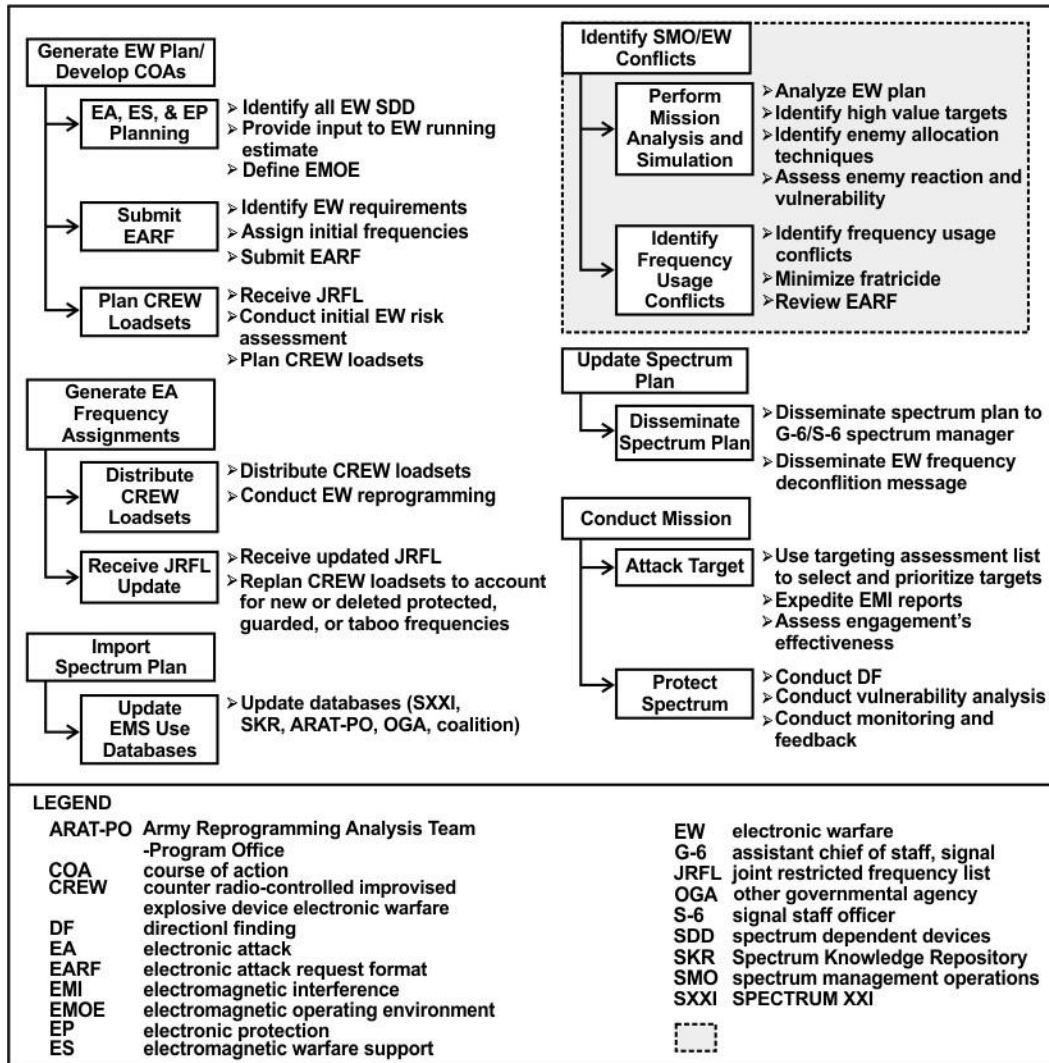
Figure A-3. CEMA element in collaboration with the SMO process.

A-31. The CEMA element, with guidance from the CEWO, and in coordination with the G-6 (S-6), G-2 (S-2), and G-3 (S-3), plan EW operations that includes EA, electronic warfare support, and electronic protection planning. This plan results in the development of the electronic attack request format and includes spectrum use requirements.

A-32. The CEMA element receives the tactical spectrum plan from the G-6(S-6) spectrum manager. The CEMA spectrum manager analyzes the frequencies for EMI conflicts that may result from implementing the EW mission. The CEMA element also identifies conflicts with the JRFL.

A-33. The CEMA spectrum manager is responsible for deconflicting EW missions against JRFL requirements. The CEMA spectrum manager may request alternate frequencies in the event that the EW mission affects the DODIN or other friendly systems or networks. The G-6 (S-6) may also assign additional frequencies to the CEMA element specific to a unique EW mission.

A-34. Figure A-4 shows the collaboration between the spectrum manager, the G-6/S-6, and the G-3/S-3.
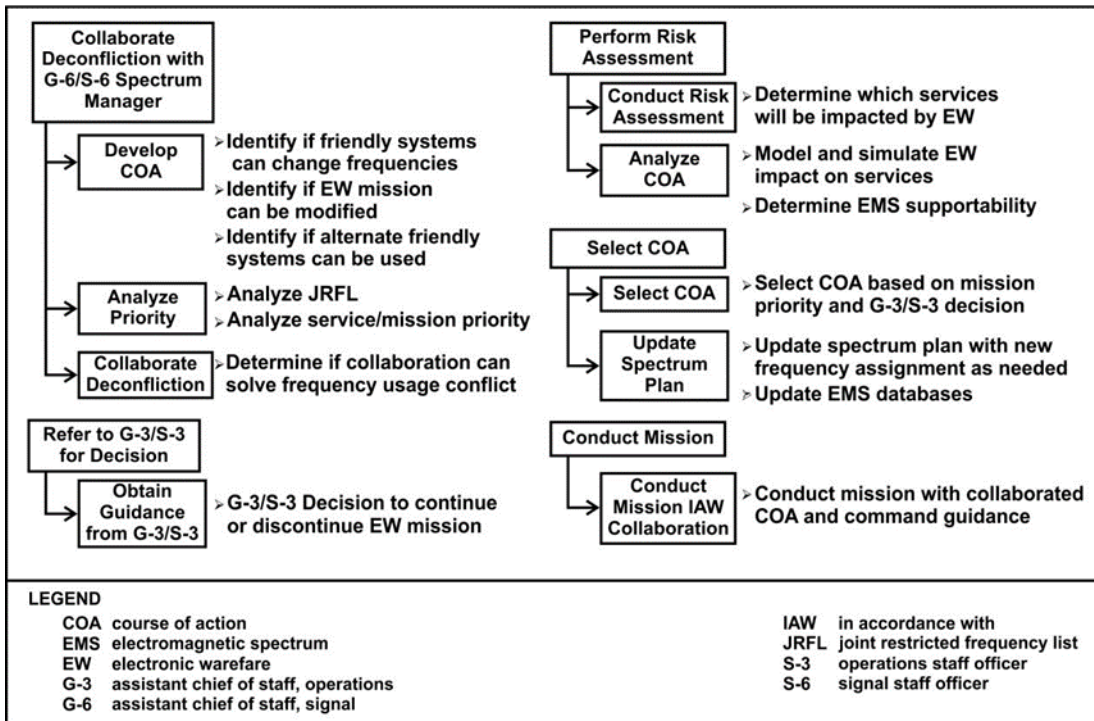
Figure A-4. G-6/S-6 and G-3/S-3 collaboration with the SMO process.

A-35. Collaboration and deconfliction with spectrum manager occur when the CEMA element identifies frequency conflicts. The collaboration determines if friendly systems can change frequencies, if not, consider possible modification of EW mission and decide if friendly forces can use a different system. If these steps resolve the conflict, continue to conduct the mission. The G-3 determines which services or missions to end or alter. The G-3 prioritizes service or mission terminations. Based on the G-3s guidance, the spectrum manager assesses the new or altered mission. Determine the spectrum supportability for the mission. Develop COAs for the mission change. With direction from the G-3, select and enact the appropriate COA. Refer to G-6 or S-6 spectrum manager and CEMA element to conduct mission blocks.

A-36. Upon mission completion, each agency conducts after mission actions. These include submitting frequency assignments for deletion, updating spectrum databases, and updating host nation comments to aid in future mission planning.

Note. For more information on spectrum management tools used to accomplish SMO critical tasks see Appendix C.

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Appendix B

Spectrum Physics

This appendix describes the physics of radio frequency spectrum. A basic understanding of the underlying principles of radio frequency energy is necessary for the execution of spectrum management operations.

RADIO FREQUENCY

B-1.   Radio frequency (RF) communications, based on the laws of physics, describes the behavior of electromagnetic energy waves. RF communication works by creating electromagnetic waves at a source and being able to receive those electromagnetic waves at a particular destination. These electromagnetic waves travel through the air at the speed of light. The wavelength of an electromagnetic signal is inversely proportional to the frequency and the higher the frequency, the shorter the wavelength.

B-2.   Frequency measurements are in Hz (hertz or cycles per second), and typically radio frequency measurements are in kilohertz or thousands of cycles per second (kHz), megahertz or millions of cycles per second (MHz) and gigahertz or billions of cycles per second (GHz). The wavelength for a device utilizing a frequency in the MHz range is longer than a frequency in a GHz range. In general, signals with longer wavelengths travel a greater distance and penetrate through, and around objects better than signals with shorter wavelengths.

B-3.   Waveforms are patterns of electrical energy over time. A Sine wave is the fundamental building block of electricity and other energy types. A Sine wave mathematically defines a natural action describing a harmonic alternating event.

B-4.   Figure B-1 provides a graphic depiction of a simple waveform. Displacement is the crest (high point) and trough (low point) of a wave. The wavelength is the distance from one crest or trough on a wave to the same point on the preceding crest or trough. Amplitude is the displacement of a crest or trough from the centerline or "rest position."
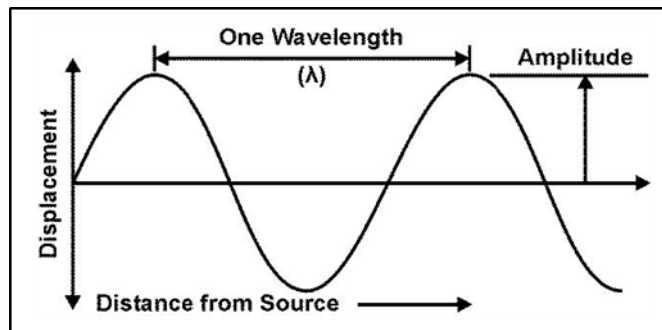
Figure B-1. Waveform characteristics

HARMONICS AND INTERMODULATION PRODUCTS

B-5.   Frequencies are associated with different standing wave patterns that produce wave patterns known as harmonics. Figure B-2 on page B-2 displays the relationship between the wave that generates the pattern and the length of the medium in relations to the generated pattern. The pattern for the first harmonic reveals a half wavelength where each point on the line represents nodes, and the arching middle represents antinodes. The second harmonic displays a complete wavelength; this pattern described as starting at the

rest position, rising upward to peak displacement, returning down to a rest position, then descending to a peak downward displacement and finally returning to the rest position.

B-6.   One complete wave in a standing wave pattern consists of two loops. Thus, one loop is equivalent to one-half of a wavelength. The third harmonic pattern consists of three anti-nodes. There are three loops within the length of the wave. Since each loop is equivalent to one-half a wavelength, the length of the wave is equal to three-halves of a wavelength. The table has a pattern when inspecting standing wave patterns and the length-wavelength relationships for the first three harmonics. The number of antinodes in the pattern is equal to the harmonic number of that pattern. The first harmonic has one antinode; the second harmonic has two antinodes, and the third harmonic has three antinodes. The mathematical relationship emerges from the pattern and the understanding that each loop in the pattern is equivalent to one-half of a wavelength. The general equation that describes this length-wavelength relationship for any harmonic is on the right side column of Figure B-2.
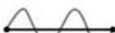
Harmonic	# of Nodes	# of Antinodes	Pattern	Length-Wavelength(λ) Relationship
1st	2	1		$L = 1 / 2 \cdot \lambda$
2nd	3	2		$L = 2 / 2 \cdot \lambda$
3rd	4	3		$L = 3 / 2 \cdot \lambda$
4th	5	4		$L = 4 / 2 \cdot \lambda$
5th	6	5		$L = 5 / 2 \cdot \lambda$
6th	7	6		$L = 6 / 2 \cdot \lambda$

Figure B-2. Wavelength relationship

B-7.   Harmonics develop into currents and voltages with frequencies that are multiples of the fundamental frequency. Harmonic signals that fall within the passband of a nearby receiver with a signal level of sufficient amplitude can degrade the performance of the receiver. Receivers live under constant bombardment of signals that enter through the antenna port. Some of these signals quickly attenuate due to front-end filtering, also called pre-selection.

B-8.   Intermodulation generation occurs when multiple signals reach a non-linear element, such as a detector, mixer, or amplifier, and are mixed. Whenever two signals mix, introduction of two additional signals result as the sum and difference of the original frequencies. This process is often intentional as in the case of mixing a frequency with the intermediate frequency in a system to produce the desired operating signal. Harmonics of the original two frequencies are still present, but most occur well outside the passband of the RF and intermediate frequency filters and cause no problems. The harmonics that tend to create the most problems are the odd-order products. For example, if a 50 MHz mixing frequency combines with a 98 MHz intermediate frequency to produce the desired transmission signal of 148 MHz, this is very close to the 3rd order harmonic of 50 MHz (150 MHz) and may cause interference at the desired frequency. Channelized communications systems tend to suffer more from these issues due to the uniform spacing of the channels.

TRANSMISSION, PROPAGATION, AND RECEPTION

B-9.   A radio transmits a signal by driving current on an antenna where the current amplitude is the changing quantity of the signal. This changing current, in turn, induces an electromagnetic field about itself, with a field strength that corresponds to the current amplitude. This electromagnetic field propagates

away from the antenna as a wave at the speed of light. As the signal propagates, it attenuates. At a remote receiver, the electromagnetic wave passes across the receiver's antenna and induces a current. Figure B-3 shows transmit waves and propagation.
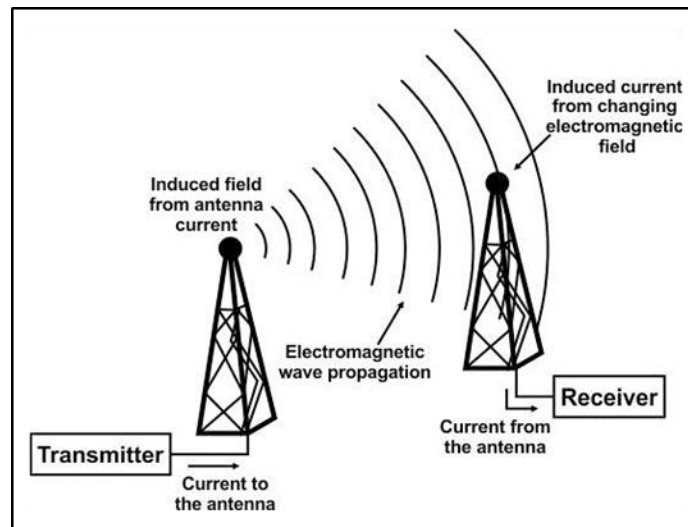
Figure B-3. Transmission and propagation of electromagnetic waves

B-10. Electromagnetic radiation in the area passes across the receiving antenna. The receiving antenna must be able to isolate the desired signal from all others to detect and receive the correct signal. If the receiver is in range of two transmitters using the same frequency band it is attempting to obtain; then the receiver may not correctly capture the desired signal for demodulation. The received signal captured may be unintelligible. The spectrum management process tries to prevent this situation from occurring. The goal is not to deter transmitters from using the same frequencies, but to ensure that receivers are capable of receiving and distinguishing the desired signals. There may be more than one transmitter using the same carrier frequency as long as the receivers can distinguish the desired signal over the others.

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Appendix C

Spectrum Management Tools, Compatibilities, and Capabilities

Spectrum managers have access to a wide variety of tools to aid in effective and efficient spectrum planning and management. This chapter provides a technical description of several of the more popular tools used to facilitate spectrum management operations. Included in this chapter are hardware and infrastructure requirements, software used, and capabilities of spectrum management tools. This appendix additionally provides an overview of the capabilities and compatibilities of various spectrum management tools. Because of the wide variety of spectrum management tools, compatibility understanding is of great importance.

SECTION I – SPECTRUM MANAGEMENT TOOLS

C-1.   There are a variety of spectrum management tools used to plan, manage, and distribute frequencies for communications networks and SDDs throughout the Army and joint operational environments. Spectrum management tools should be interoperable with other tools used by the spectrum manager. For example, EW personnel should use the same spectrum management tool that the spectrum manager uses, allowing the spectrum manager to mitigate harmful interference to friendly systems possibly caused by EW systems.

C-2.   Gathering and managing spectrum data requires considerable time to ensure accuracy. Tools that support the automation of spectrum management functions can drastically reduce this time constraint. Spectrum management tools that promote the flow of information between spectrum stakeholders reduce the planning cycle, resulting in quicker decisionmaking. Spectrum managers can perform the core SMO functions efficiently when tools comply with the NCE environment.

C-3.   The NCE is a common shared virtual space used within and among differing authenticated units and organizations, has facilitated numerous advantages for spectrum managers of all levels. Central access to multiple databases reduces or eliminates the need to visit agencies to obtain a list of devices used in the area of operations. Having central databases requires spectrum management tools to have interoperable and compatible formats to function. The NCE is very effective in joint task force operations.

C-4.   There exist many data file standards regarding frequency proposals. SFAF is a line-oriented text format used by DOD, and by U.S. allies and unified action partners who use Spectrum XXI. SFAF is the standard format for frequency proposals, assignments, modifications, renewals, reviews, and deletions.

> *Note.* Spectrum managers at all echelons are required to maintain SIPRNET access. This requirement is necessary to access GEMSIS, CJSMPT, JIST, HNSWDO, Spectrum XXI, and other spectrum management tools. Additionally, for Spectrum XXI, spectrum managers must also have Oracle and JOB accounts.

GLOBAL ELECTROMAGNETIC SPECTRUM INFORMATION SYSTEM TOOLS

C-5.   GEMSIS is a joint program of record that provides access to several spectrum management tools. Spectrum managers access GEMSIS on the internet using NIPRNET and SIPRNET access. GEMSIS increases the effectiveness of the COP, accelerates spectrum access, increases interoperability, and support

to NCE. GEMSIS increment 2 incorporates other spectrum management tools, such as CJSMPT, Spectrum XXI, and Stepstone as an effort to further transition spectrum management to an NCE compliant and provide all the needed capabilities to the spectrum manager in one central tool.

C-6.   GEMSIS provides worldwide visibility of host nation supportability of SDD equipment. The system automates the distribution of host nation coordination requests and combatant command submission of host nation supportability comments. GEMSIS enables spectrum managers to determine the historical supportability of other systems in the same frequency band. GEMSIS provides the following spectrum services and tools—

- Integrated spectrum desktop (ISD).
- Coalition Joint Spectrum Management Planning Tool (CJSMPT).
- JSDR.
- Spectrum XXI.
- End-to-end supportability system (E2ESS).
- HNSWDO.
- Stepstone.

Note. SPEED is another spectrum management tool commonly used, developed for the Marine Corps and is not a program of record in the U.S. Army. SPEED is compatible with GEMSIS tools.

INTEGRATED SPECTRUM DESKTOP

C-7.   The ISD provides a common desktop for accessing web-based spectrum management capabilities. The ISD facilitates the integration and interoperability of the GEMSIS spectrum tools. The ISD provides web links to various sites and abilities used to support the spectrum community.

C-8.   The ISD facilitates the integration of web-based capabilities within GEMSIS and provides a single web site to access those capabilities. Access to all spectrum tools through the ISD requires a single login, and users attain access to spectrum tools by clicking authorized widgets.

COALITION JOINT SPECTRUM MANAGEMENT PLANNING TOOL

C-9.   CJSMPT is a capability delivered by GEMSIS. Developed as a joint capability technology, CJSMPT enables spectrum managers at the joint task force level down to a brigade in accomplishing their duties. Using CJSMPT, spectrum managers conduct spectrum planning and frequency deconfliction for mission planning and combat operations. CJSMPT provides the following capabilities:

- Defines the EMOE.
- Gathers spectrum requirements and defines spectrum requirements for networks, SDDs, users, and location within an EMOE.
- Defines spectrum requirements for movement within an AO.
- Defines the area of interest, maps, and terrain.
- Aggregates requirements through data collaboration with other spectrum management systems.
- Provides spectrum summaries.
- Recommends frequency allotments based on modeling and simulation of the EMOE.
- Nominates and assigns frequencies, suggesting specific frequencies for account restraints.
- Employs the communications effects simulator.
- Predicts potential interference prior to the assignment of frequencies.
- Predicts EMI prior to implementation of a mission within the EMOE.
- Mitigates and reports (internally) EMI through the spectrum plan advisor.
- Suggests modifications to the spectrum plan to mitigate or minimize EMI.
- Generates formatted reports (internally).
- Capability to create a model the EMOE.

- Conduct simulations of the EMOE using a created model.
- Spectrum planning tools.

C-10. CJSMPT provides the capability to predict interference as units move across a simulated EMOE. CJSMPT uses this simulation to perform deconfliction analysis that is compatible with EW operations and future rapid maneuvering forces. Using CJSMPT, the spectrum manager can simulate and visualize a unit's movement, perform spectrum interference analysis and frequency deconfliction, and provide recommendations to the commander for complete spectrum use during the unit's movement.

C-11. The CJSMPT database is the spectrum data repository. CJSMPT is compatible with S2AS and Spectrum XXI using common data formats. The map manager functional area of the software allows the user to import any national geospatial-intelligence agency map resource. The spectrum data repository provides users with a single authoritative data source of known databases, such as joint, equipment, tactical, and space.

C-12. CJSMPT performs spectrum optimization and conflict mitigation using environmental factors, operational priorities, frequency allocation and assignments, and international spectrum management policies and regulations. The main visualizer panel within CJSMPT displays spectrum use in a color-coded two and three-dimensional picture that is available throughout the mission's duration. CJSMPT can import an SAA for situational awareness and deconfliction purposes.

C-13. CJSMPT allows the operator to submit frequency proposals to the Spectrum XXI system using the SFAF. Upon approval by Spectrum XXI, CJSMPT can import frequency assignments into the spectrum data repository. CJSMPT can automatically create a SFAF from an imported satellite access authorization.

C-14. The spectrum plan advisor utility within CJSMPT automatically generates spectrum reuse plans and calculates the minimum spectrum requirements for an interference-free operation over a given movement of forces. The spectrum plan advisor utility allows for rapid force movement while minimizing the spectral impact of a mission. CJSMPT can generate formatted reports, such as the JSIR report, based on the communications effects simulator utility. The operator can save detailed reports in extensible markup language (XML), HTML, or comma-separated values formats. Spectrum planning within CJSMPT can account for bandwidth, frequency locking, guard bands, and frequency allocation tables.

C-15. Using CJSMPT, spectrum managers can manually build a force structure that includes SDDs and networks in support of a mission. Once created, the mission can be saved for future use and edited to support future missions. When building a force structure, spectrum managers must manually put networks and SDD characteristics into a variety of locations, such as XML spreadsheets. It is important that when building a force structure to ensure the data entry is correct. Incorrect input of data may result in data format inconsistencies, possible human error, and time delays.

C-16. CJSMPT functions in an NCE by granting network access through SIPRNET. Users perform peer-to-peer collaboration and retrieve information from the master spectrum data repository while connected to the SIPRNET. CJSMPT also provides support to joint task force environments by providing features targeted to key joint task force agencies. Spectrum managers at all echelons control and update the local spectrum data repository. The CJSMPT administrator gathers data from different sources to create the spectrum data repository. CJSMPT functions in a standalone environment to operate while not connected to the SIPRNET.

JOINT SPECTRUM DATA REPOSITORY

C-17. The Defense Spectrum Organization collects, standardizes, and distributes spectrum-related data. The Defense Spectrum Organization provides direct on-line data access to the joint spectrum data repository (JSDR) and provides customized reports. The JSDR contains DOD, national, and international spectrum-related information up to the secret level. Spectrum managers access the JSDR at the joint spectrum center data access web server (JDAWS) tool. JDAWS provides user access to the database components of JSDR.

C-18. The JSDR allows access to a collection of over 100 area studies. Area studies are the Defense Spectrum Organization produced country-specific telecommunication profiles hosted on Intelink. Area studies found within the JDAWS provide hyperlink access to the Intelink site.

C-19. The JSDR contains various resources in a variety of formats. The following are the primary features of the JSDR—

- **Joint Equipment, Tactical, and Space (JETS) Database.** The JETS segment of JSDR is a Defense Spectrum Organization created and maintained resource that includes: Parametric data for DOD; commercial and multinational equipment; platform data, including equipment complements; U.S. military unit names, locations, and hierarchy; U.S. military unit equipment and platform complements; and space satellite parametric and orbital data.
- **HNSWDO** is a web-based application for processing DOD Host Nation Coordination Requests and responses.
- **Spectrum certification system database** is the central archive repository for all DOD spectrum certification system data, including information from the joint force 12 (known as the J/F-12), Application for Equipment Frequency Allocation. J/F-12 is the unique tracking number assigned by the Army Spectrum Management Office.
- **Background environmental information database.** Represents the electromagnetic environment, the Defense Spectrum Organization collects additional non-U.S. Federal and international frequency assignments, stored in the BEI database. The BEI currently includes International Telecommunication Union, Federal Communications Commission, Canadian, and Radio Astronomy assignments.
- **Government master file database.** The GMF is a data source containing records of the frequency assigned to all U.S. Federal Government agencies in the U.S. and its possessions. NTIA provides the data.
- **Frequency resource record system database (FRRS).** FRRS contains information on DOD frequency assignments used worldwide, that the Commanders of the Unified Commands and the Military Departments controls.
- **Electronic order of battle (EOB) database.** The JSDR contains nearly 25,000 Defense Intelligence Agency EOB foreign equipment locations.

SPECTRUM XXI

C-20. Commanders have several configuration options within Spectrum XXI. Spectrum XXI is a client and server, Windows-based software system that provides spectrum managers with a single information system that addresses spectrum management automation requirements. The JSC manages Spectrum XXI. Spectrum XXI supports operational planning as well as management of the electromagnetic spectrum with an emphasis on assigning compatible frequencies and performing spectrum-engineering tasks. Spectrum XXI client version is a software package that requires a unit funded computer.

C-21. The joint spectrum center central repository for Spectrum XXI provides the DOD with a central database that contains spectrum certification for compliant systems, topography and electromagnetic environmental effects data, and all DOD spectrum proposals and assignments. The repository also serves as the mechanism to transfer data between the DOD and NTIA for permanent frequency assignments in the U.S. and its possessions. Spectrum XXI users may access the government master file through the central repository as needed.

SPECTRUM XXI USERS

C-22. Spectrum XXI users can connect to one of the three regional servers through local area network access, SIPRNET access, or secure telephone for dial-up access. The Spectrum XXI database uses the Oracle database management system based on structured query language that requires licenses and training for the regional servers. The client version that Army spectrum managers use does not require an Oracle license or training. The client can function in standalone mode using the local database with limited functionality when network connectivity is unavailable. Spectrum XXI contains a table of International Telecommunications Union allocations by region to aid the spectrum manager in international spectrum planning compliance. The Spectrum XXI database also includes geographical boundaries and utilities. The system can plot SDD based on frequency records.

C-23. Spectrum XXI allows the user to create and maintain permanent, temporary, proposed assignments, including background on frequency assignments. Spectrum XXI analyzes frequency assignments for operating conditions, interference, intermodulation, allocation and allotment tables, and compliance with technical and administration standards. A simulated spectrum analyzer displays current spectrum occupancy and projected spectrum use at user-defined sites. The system also creates and manages input to the JRFL. Spectrum XXI can analyze the impact of EW on spectrum users. Spectrum XXI is compliant with the SFAF as outlined in the MC4EB Publication 7 format.

Spectrum XXI Key Components

C-24. Spectrum XXI includes numerous spectrum management capabilities using various software component modules. For a complete list of Spectrum XXI capabilities relating to a spectrum manager's critical task, see Appendix A. Such modules include the—

- **Interference analysis module** analyzes existing frequency assignments for potential interference. Perform this analysis when the holder of a frequency assignment reports interference from an unknown station. An interference analysis can determine whether a transmitter on a single frequency would potentially cause interference to an existing environmental receiver represented by a frequency record in the database. The interference analysis module performs analysis to determine if a receiver potentially receives interference from an existing environmental transmitter represented by a frequency record in the database.

- **Interference report module** generates interference reports that describe interference problems and provides information to resolve the problem. Interference reports can also document a history of problems, and thus identify possible causes for subsequent interference. If interference problems exist, the first step as a spectrum manager is to verify that the person reporting the interference has the authorization to use that frequency. Spectrum managers attempt to resolve interference problems at the lowest level possible. If this is not possible, the spectrum manager creates a report for distribution to higher authorities. The spectrum manager reports the interference information to the unified or specified command (usually the combatant commander or the service representative) who then may call upon the JSIR team (as part of the JSIR program located at the JSC) to investigate.

- **EW deconfliction module** assesses the impact of a planned electronic attack and jamming on existing receivers during contingency operations and exercises. The joint staff, operations must know the operational situation to make intelligent decisions when using this module. The EW Deconfliction Module, used in conjunction with the JRFL Module, documents a list of frequencies protected from jamming. In addition, the module analyzes the impact a frequency jammer has on environmental receivers using a range of azimuths. Analysis results comprise three types of conflicts—
  - Frequency assignment conflicts.
  - JRFL conflicts.
  - Communications electronics operating instructions conflicts.

- **Joint Restricted Frequency List Module** is a management tool used by various operational and support elements to identify the level of protection they desire, applied to specific spectrum, to preclude these assets from being "jammed" by friendly forces conducting electronic warfare activities. The JRFL identification and building process begins at the unit level, works upward through the military services' chain of command, then consolidated within the combatant command or joint task force staff. The module allows users to select a frequency assignment from Spectrum XXI or JCEOI nets. Select these frequency assignments by importing the generated CEOI in the JRFL module.

- **Engineering tools module** is a collection of utilities used to perform several types of analyses—

- **Coordinate Conversion**—provides a graphical representation of the conversion between latitude, longitude, and military grid coordinates.

- **Co-site Analysis**—performs co-site analysis on a list of frequencies and emissions.

- **Coverage Plots**—creates terrain elevation plots, line-of-sight plots, and signal strength plots. This function provides the commander analytics to help determine the best placement of sensors.

- **Geomagnetic conversion**—converts magnetic azimuths to true azimuths.
- **High frequency skywave analysis**—calculates the high frequency skywave, propagation prediction values for the maximum usable frequency, the frequency of optimum transmission, and the lowest usable frequency based on the time of day between a transmitting and receiving location.
- **Point-to-point link analysis** displays the terrain profile and aids in the determination of the viability of radio links between transmitting and receiving locations.
- **Satellite look angles for multiple earth stations and multiple satellites** calculate the azimuth and take-off (elevation) angle from earth stations to geostationary satellites.
- **Spectrum occupancy** displays a graphical representation of the calculated received signal power at a specified location indicated in the frequency records of the assignment database (this is similar to the view seen on a spectrum analyzer).
- **Topographic manager module** an automated capability that reformats the level-1and level-2 digital terrain elevation data obtained directly from the National Geospatial-Intelligence Agency on compact disk-read only memory disks. The Topographic Manager can register and manage reformatted topographical data files.
- **Frequency assignment module** automates the processing of requests for the use of frequency resources from spectrum managers in support of authorized users. The process includes the preparation of frequency assignment proposals, validation of those proposals, determination of possible interference with the background environment, distribution and status tracking of proposals. The frequency assignment module also provides processes for frequency assignment database updates and retrievals.
- **Allotment plan generator module** creates a list of frequencies commonly referred to as Allotment Plans, Channelization Plans, Spectrum Use Plans, or Radio Frequency Authorizations. These plans are a frequency resource for nominating proposals using the Frequency Assignment module. In some cases, allotment plans disseminate authorized temporary frequencies used for training or tactical exercises.
- **Compliance module** checks the format and content of frequency records saved to a file and are not in the proposal editor. There are three types of compliance checks performed—allocation table checks, Canadian and Mexican coordination checks, or field validation checks. You also have the option to perform all checks. The record source determines which validation checks to perform depending on the records provided. International users should use the Validation option only.
- **Spectrum certification system** an automated system used to prepare a DD Form 1494, Application for Equipment Frequency Allocation, at frequency management offices that support materiel acquisition.
- **Data exchange module** electronically exchanges data between servers and client computers. The Data Exchange Module manages the server accounts, job accounts, and domains used for data exchanges. A stand-alone client (not network connected) cannot use the functions of Data Exchange. When first installed, Spectrum XXI is a stand-alone client until the initial connection to a server. When connected, it becomes a data-exchanging client.

END-TO-END SUPPORTABILITY SYSTEM

C-25. E2ESS provides a data collection tool and database for spectrum supportability business processes. E2ESS provides worldwide visibility of host nation SDD supportability. E2ESS integrates and evolves both Stepstone and HNSWDO capabilities to meet GEMSIS end-to-end supportability requirements.

HOST NATION SPECTRUM WORLDWIDE DATABASE ONLINE

C-26. HNSWDO is a web-based application providing worldwide visibility of host nation SDD supportability. The HNSWDO automates the distribution of host nation coordination requests allowing combatant command submission for host nation supportability, reducing time requirements for managing the host nation spectrum authorization process. The design of the database provides informed decision making concerning frequency bands. HNSWDO mitigates the risk of acquiring potentially unsupportable systems. HNSWDO provides the user with near instantaneous updates and dramatic reductions in process

lag (from years to months). HNSWDO requires an approved account and NIPRNET access using a unit provided laptop computer. The Defense Spectrum Organization processes account requests.

Note. Host nation allocation tables and SDD certification does not constitute the authority to assign frequencies within the host nation. Send all formal frequency requests to the host nation to obtain frequency authorization. See JP 6-01 for more information on host nation coordination.

STEPSTONE

C-27. Stepstone is an online resource for data capture of parametric information for SDDs supporting the spectrum certification and spectrum supportability processes. Stepstone provides a mechanism to complete an application for equipment frequency allocation (DD Form 1494). Stepstone also can conduct compliance checks to assure data quality, collaboration and workflow capabilities, and certification process metrics of SDDs.

OTHER AVAILABLE SPECTRUM MANAGEMENT TOOLS AND SERVICES

C-28. In addition to GEMSIS, there are other spectrum management tools and services available to a spectrum manager. Some tools and services may have similar capabilities as GEMSIS, but are more user-friendly, or they may have additional capabilities necessary for interoperability with emerging and evolving technologies.

ELECTRONIC WARFARE PLANNING MANAGEMENT TOOL

C-29. The EWPMT is a software, web-based system that provides the CEWO and spectrum manager the capability to plan, coordinate, and synchronize spectrum management operations and electronic warfare throughout the operations process. EWPMT integrates electronic warfare battlefield information and management of electronic warfare systems into mission command systems and facilitates efficient electronic capabilities management. From battalion to theater level, EWPMT provides a tailorable, user-defined display of the EMOE. EWPMT leverages available organic and non-organic EW resources to synergize EW effects.

C-30. EWPMT is a suite of software tools that provide the ability to control and manage units designated portion of the electromagnetic spectrum. EWPMT provides a common operational picture of the EMOE that integrates data elements from C2, intelligence, and fires. Using EWPMT, a CEWO can plan, coordinate, and manage electronic warfare activities and can employ assets to conduct offensive electronic warfare targeting. The spectrum manager can conduct near real-time spectrum deconfliction of SDDs in the AO during cyberspace and EW operations while synchronizing spectrum management operations within the CEMA section.

C-31. EWPMT allows spectrum managers the ability to send, receive, store, display, and develop situational awareness regarding the friendly, enemy, neutral, and unknown SDDs within an area of operations. This capability allows commanders to seize, retain, and exploit advantages within the EMS.

C-32. EWPMT synchronizes current and emerging spectrum management and EW capabilities to provide commanders a COP of the EMOE and illustrate the effects of organic SDDs, including EW systems. For emerging technologies, EWPMT utilizes an information technology box strategy that allows software upgrades to meet the requirements of rapidly evolving technology.

SYSTEMS PLANNING, ENGINEERING, AND EVALUATION DEVICE

C-33. The SPEED developed as the United States Marine Corps government off the shelf software. SPEED is a modular software application that provides modules that target user-specific needs. SPEED allows the spectrum manager to complete and edit SFAF forms while using an equipment database that includes tactical platforms, equipment, and antennas. The Asset Manager module within SPEED provides the capability to import, export, build vehicle manifests, personnel rosters, and equipment deployment lists.

SPEED is free to all federal agencies but primarily used by the United States Marine Corps communications and spectrum managers. Army spectrum managers may interface with SPEED in joint operations.

C-34. SPEED provides both two and three-dimensional views of the operational area to support the COP. The Advanced Prophet and Terrain Integrated Rough Earth Model and National Geospatial-Intelligence Agency provide map data to the system. SPEED offers the user with a color-coded display of spectrum use over the operational area. SPEED can generate JRFL input in the correct format to the next higher echelon. The system allows the user to manually input, store, and view information for a tactical satellite network defined in a satellite access authorization, but cannot automatically format the authorization into the SFAF or SSRF. SPEED is a software package distributed with the automated communications engineering software or joint automated CEOI system image on the unit provided AN/GYK-33 computer.

AFLOAT ELECTROMAGNETIC SPECTRUM OPERATIONS PROGRAM

C-35. Afloat electromagnetic spectrum operations program (AESOP) is an integrated operational radar, combat system, and communications frequency-planning tool primarily used by U.S. Navy and U.S. Coast Guard spectrum managers. This tool calculates optimal frequency use and distance separation that considers all strike group SDDs. AESOP minimizes electromagnetic interference according to national and international frequency regulations. The strike group staff or designated frequency coordinator can select frequencies and separation distances for the group's ships to ensure that the radars operate with a minimum of electromagnetic interference.

C-36. In addition to the vessels of the U.S. Navy, AESOP contains data from fleets of over 60 countries. AESOP supports radar and communication analysis and spectrum planning for joint warfare operations on platforms for the following—
- Ships.
- Submarines.
- Aircraft.
- Military and civilian ground sites.

C-37. AESOP periodic updates have improved the performance of communications networks in the presence of counter radio-controlled improvised explosive device electronic warfare and other EW. The AESOP master database is shore-based and is only available using connection to the SIPRNET. For users with no access to SIPRNET or having limited bandwidth, AESOP is available in a standalone mode with a local database.

C-38. AESOP is compliant with the SFAF and SSRF. Measurements taken by AESOP provide input and development of the DD Form 1494. AESOP provides spectrum visualization after analysis of spectrum use. AESOP can import and export XML files. The system can provide input from the Navy to the JRFL during joint task force operations. Army spectrum managers may interface with AESOP when coordinating spectrum use in operational areas collocated with Navy missions.

AUTOMATED COMMUNICATIONS ENGINEERING SOFTWARE AND JOINT AUTOMATED COMMUNICATIONS ENGINEERING SOFTWARE

C-39. Automated Communications Engineering Software (ACES) and Joint Automated Communications Engineering Software (JACS) are part of the Army key management system that automates the management of communications security (COMSEC) keys, electronic protection (EP) data, and CEOI. These multipurpose programs reside on a laptop computer. Key features of the software for SMO purposes are CEOI generation, viewing and printing, EP identifiers, transmission security keys, data generation, creating loadsets for SINCGARS and SINCGARS compatible radios and electronic distribution of the joint automated communications-electronics operation instructions system.

C-40. ACES and JACS integrate secure network planning, EP distribution, and CEOI generation and management. The workstation functions in conjunction with the data transfer device, hosting tier 3 software to automate cryptographic control operation for networks with electronically keyed COMSEC equipment.

C-41. The resident software components on the ACES or JACS workstation include the following—

- General-purpose module.
- Core module.
- Area common user system module.
- Resource manager module.
- Master net list module.
- SOI (signal operating instructions) module.
- Combat net radio module.
- ARC-220 module.
- Satellite Communications module.

Note. SOI module is the name of the module used for ACES/JACS. The term SOI also known as the CEOI. CEOI is the term used throughout this publication.

General Purpose Module

C-42. The general-purpose module provides the information and operations necessary to satisfy the planning requirements for cryptonets that operate independently of area common user systems and combat net radio networks. It allows the planning capability for manual key assignments for compatible COMSEC equipment in an operator-designed cryptonet configuration. It allows for the importing of the Black Key packages from the local COMSEC management system.

Area Common User System Module

C-43. The area common user system module lists the information that encompasses both Joint Network Node equipment and echelons above corps networks. The module contains procedures for creating and drawing an area common user system backbone network and creating and drawing network extensions. It also describes the processes required to validate and generate area common user system networks, and modify area common user system member properties.

Resource Manager Module

C-44. The resource manager module contains the list of available frequency resources and allows the creation, editing, merging, deleting, and printing of these resources. Each frequency resource has attributes that specify the authorized use and location of all the frequencies contained within the resource manager module. The resource manager module also provides planners the capability to import and export resources in JACS, Integrated System Control, and SFAF formats.

Master Net List Module

C-45. The master netlist module provides a communications list containing the net name or description, net identification, organizational code, restrictions, frequency type, power, reuse class, reuse zone, and call word or color word requirements. Spectrum managers develop the master netlist for an operations plan. The master netlist module provides the capability to create, edit, merge, delete, and print nets. The master netlist module incorporates many SFAF-compatible fields to facilitate the transfer of data to and from other frequency management systems such as Spectrum XXI, as well as unique service systems. The database capabilities of the workstation allow the data in the master netlist to create the initial SFAF frequency proposal and the CEOI.

SOI Module

C-46. The SOI module contains call signs, call words, frequency assignments, signs, and countersigns necessary in making a CEOI. The SOI module also includes pyrotechnic and smoke signals, dictionaries, groups, a quick reference, and title pages. Generation of pyrotechnics and smoke signal components may be separate or randomly selected. The SOI module also provides the capability to create the Master Call

Sign packets, as well as different extract packets, while maintaining a database link to nets in the master netlist.

Combat Net Radio Module

C-47. The combat net radio module provides the necessary functions to create, modify, and generate hopsets or loadsets for SINCGARS transmission security keys. It also provides the capability to plan combat net radio nets in all bands. Combat net radio network planning offers integration with the master netlist module. Loadsets are packages of frequency hopping data and COMSEC keys required to load up to six channels of the SINCGARS radios. One loadset consists of COMSEC keys tags, hopsets, lockouts, transmission security keys, and net identifiers. Hopsets consists of a set or sets of resources converted into SINCGARS useable frequency hopping data. The complexity of the hopset may relate directly to the amount of memory needed in the receiver-transmitter. Construction of hopset resources have minimal pattern interruption, as the radio is frequency hopping at a rate of 100 channels per second. Lockouts are digitized hopset data generated and stored in the combat net radio. Lockouts electronically map all available frequencies by relaying to the radio's memory frequencies it cannot use. Lockouts deliberately disable unused frequency channels, avoiding interference with another service.

ARC-220 Module

C-48. The ARC–220 module allows platforms and equipment assignment to ARC–220 nets. ARC-220 is a radio network that supports long-range communications between military aircraft and ground stations. This network type provides support for the AN/ARC-220 (aircraft version) and AN/VRC-100 (ground version) radios. These radios operate in three different modes: single channel (Basic Preset or Manual), automatic link establishment, and electronic counter-countermeasure. The net validating function ensures that the platforms intended to communicate with each other can do so. The net generated function automatically creates COMSEC key tag assignments to secure the network.

Satellite Communications Module

C-49. The satellite communications module allows the operator the capability to support the crypto planning for two of the Army's satellite communications terminals. These terminals are the Single Channel Anti-Jam Man-Portable Terminal and the Secure Mobile Anti-Jam Reliable Tactical Terminal. These satellite systems operate at radio frequencies in the extremely high frequency range.

C-50. The network planning functionality of ACES or JACS incorporates cryptonet planning, key management, and key tag generation. The planning concept relates to the development of network structures supporting missions and plans. The data for a given plan includes individual nets and assigned individual net members. Net members are associated with a specific platform and equipment. Once designation of all variable information (net members, platforms, and equipment), specific equipment fill locations defined, and keys are associated with the equipment locations. The equipment records, which include platform data, net data, and key tags, is downloadable to the data terminal device, and subsequently associated with the required key. Similarly, the EP data and CEOI generated by the JACS workstation operator downloads to the data terminal device if necessary.

SPECTRUM SITUATIONAL AWARENESS SYSTEM

C-51. The S2AS is theater provided equipment used to assist in maintaining effective use of the spectrum. The S2AS provides a fixed site and portable spectrum-monitoring receiver that performs instantaneous analysis of captured spectrum data. The S2AS consists of government off-the-shelf software referred to as multispectral ambient noise collection and analysis tool (MANCAT) and commercial off-the-shelf hardware Rohde & Schwarz PR100 monitoring receiver and ancillary antennas. The S2AS requires the unit to provide a computer to run the software and a global position location device. The system comes with a ruggedized carrying case that protects the PR100 and HE-300 antenna while in transit. Figure C-1, on page C-11, shows the components that comprise S2AS.

Note. An upgrade to the HE-300 antenna is available that includes a built-in global positioning system location device and electronic compass. This capability, in conjunction with an available software update for the PR100, allows for basic direction finding of signals and triangulation between multiple S2AS users and measurements. The S2AS provides direction-finding antenna and triangulation capability intended for a post, camp, or forward operations base locations. System use of S2AS is for a relatively small area. This upgrade also eliminates the need for a global positioning system receiver. S2AS also has an upgrade that interfaces with maps and conducts automatic triangulation and geolocation on a map overlay in real-time.

Figure C-1. S2AS and supporting equipment

C-52. The advantages of a monitoring receiver over a traditional spectrum analyzer are its rapid precision measurements and analysis of spectrum over a wide bandwidth. The monitoring receiver provides the measured spectrum to the MANCAT software for automated analysis. The PR100 can operate on 100 to 240 volts alternating current and comes with a wide variety of connectors to allow for connecting to different voltage sources around the world. The PR100 also has an easily removable and rechargeable battery with an approximate lifespan of 3.5 hours.

C-53. When used with a location device, S2AS allows for mobile measurements of the spectrum. For example, the spectrum manager can take S2AS on a convoy route to measure persistent signals that are in use in the area. The location device senses the grid coordinates of the route for mapping captured signals by other tools (Global Electromagnetic Spectrum Information System [GEMSIS] and MANCAT). When imported, Google maps provide the software overlays with a color-coded spectrum map over a three-dimensional digitally mapped terrain to support the COP. Figure C-2 on page C-12, depicts Soldiers operating the direction-finding antenna and the PR-100 handheld receiver.

Figure C-2. S2AS in use by Soldiers

C-54. The S2AS provides a fast panoramic scan across the frequency range of 9 kHz to 7.5 GHz. Panoramic scanning enables Soldiers to quickly access the spectrum and begin to incorporate data into the required database. The display on the device provides a spectrum and spectrogram display which users of the spectrum analyzer may be familiar with on a portable 6.5" color screen. S2AS provides storage of measurement data to the receiver's built-in storage card. The PR-100 design is ergonomic and rugged for portable use and low weight. The device has a setting for the manual location of spectrum emissions using the active directional antenna or automatic location of spectrum emissions with direction-finding algorithms.

C-55. The operator of the S2AS can save spectrum measurements in comma-separated value format and spectrum screenshots in a portable network graphics format. MANCAT software exports reports in PDF, HTML, JPEG, or TIFF formats.

C-56. The S2AS includes a continuous band antenna that is vehicle-mounted or fixed to a tripod stand for measurements of the spectrum from 30 to 6000 MHz. The system comprises a handheld HE-300 antenna with three interchangeable modules for the 20 MHz to 7.5 GHz ranges, and the HE-300HF module for high frequency ranges from 9 kHz to 20 MHz. Antenna HE-300 provides the capability to perform direction finding of unplanned signals in specific frequency ranges. S2AS is compatible with some antennas that units may already have, including the SINCGARS vehicle whip and the OE-254 antenna.

C-57. The S2AS standard package can measure and analyze signals from 20 MHz to 7.5 GHz with the included continuous band antenna and HE-300 antennas. This range encompasses the majority of spectrum conflicts the spectrum manager encounters. An upgrade package, that expands the range to 18 GHz, is available for users that need to analyze higher frequencies.

C-58. S2AS uses standard data formats compatible with EWPMT, GEMSIS, and Spectrum XXI. Once the captured signals are available in the EMPMT or Spectrum XXI tools, the spectrum manager can update known databases. The MANCAT software allows the user to import frequencies of interest from planned databases, such as Spectrum XXI, and provide a visual display to the operator of planned or known signals.

C-59. S2AS provides a visual representation of locally detected frequencies so that the spectrum manager can determine unauthorized frequencies and further investigate the source of the signal. Figure C-3, page C-13, shows the functional relationship between the S2AS vital capabilities. The figure provides a graphical depiction of the sensing characteristic. Sensing and monitoring frequencies that are available to the user is an initial operational function of the S2AS. The system then analyzes the information captured and shares the data with the listed database.
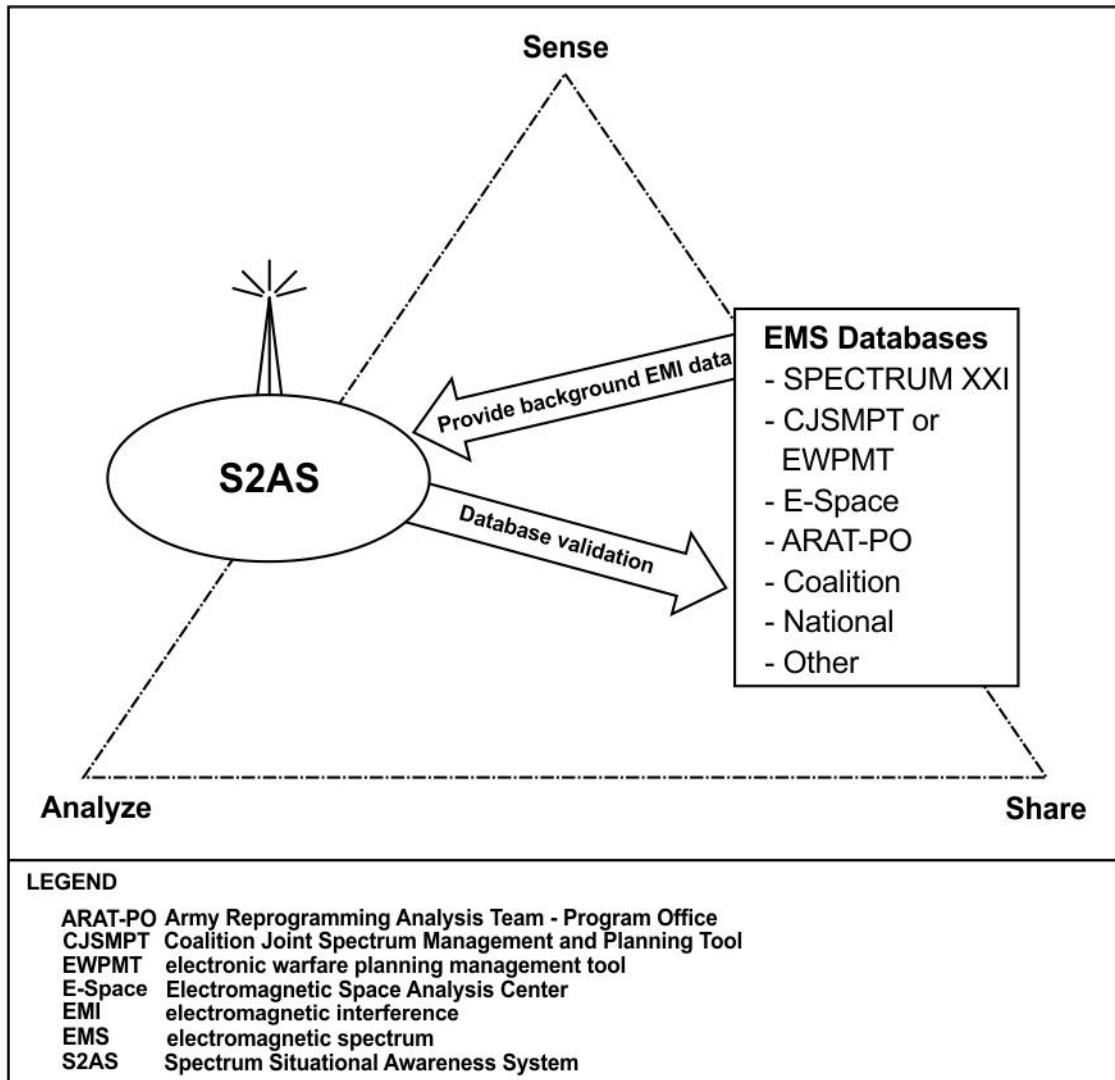
Figure C-3. S2A2 functional relationships

JOINT SPECTRUM INTERFERENCE RESOLUTION ONLINE

C-60. JSIRO collaboration portal is the preferred tool for reporting EMI occurrences. JSIRO is a Web-based, centralized application containing data and correspondence for reported EMI, intrusion, and jamming incidents dating back to 1970. JSIRO is the repository for the results of analyses, collected data, and supporting documentation for EMI resolution to support both trend and future interference resolution analysis.

C-61. To access the JSIRO tool, use a SIPRNET link. JSC provides management and control of the JSIRO. Intelink and the joint worldwide intelligence communication system host the JSIRO tool. The spectrum manager may access the tool through a SIPRNET connected computer without the need for loading software onto the computer. JSIRO allows the user to upload files that may be instrumental in mitigating the EMI, such as spectrum analyzer traces, recorded-audio, or comma-separated values files. Use the manual JSIR report format when SIPRNET access is not available.

C-62. When reporting online, JSIRO prompts the user for required information using a fill-in-the-blank form. Checkboxes and dropdown menus supply choices where possible. The JSIRO provides free text input space for input of directly into the report. Spectrum managers can copy and include text from e-mail and

other documents in the JSIRO report or add as attachments. Updates to the reports happen as more information becomes available.

SECTION II – SPECTRUM MANAGEMENT TOOLS COMPATIBILITIES AND CAPABILITIES

C-63. This section discusses spectrum management tools compatibilities considerations. It is important that spectrum managers are aware of the interoperability between spectrum management tools to determine which tools are best suited for the mission. This section also discusses the capabilities of various spectrum management tools currently used by spectrum managers. Spectrum managers' awareness of spectrum management tools capabilities assists in determining which spectrum management tool provides the necessary capabilities to enable completion of SMO critical tasks.

TOOLS COMPATIBILITIES

C-64. The spectrum manager should have an understanding of spectrum management tool compatibilities to ensure interoperability between spectrum management tools and services. Table C-1 shows the compatibilities among spectrum management tools with a description of known compatibility fixes.

Table C-1. Compatibility between spectrum management tools

TOOL	Spectrum XXI	EWPMT	S2AS	AESOP	SPEED	ACES/JACS	HNSWDO
Spectrum XXI		X	X	X	X	X	
EWPMT	X		X		X	X	X
S2AS	X	X					
AESOP	X						X
SPEED	X	X					X
ACES/ JACS	X	X					X
HNSWDO		X		X	X	X	

Legend: **X** = formatting compatible ***** = limited format compatibility   blank = not currently compatible
ACES   automated communications engineering software
AESOP   Afloat Electromagnetic Spectrum Operations Program
EWPMT   electronic warfare planning management tool
HNSWDO Host Nation Spectrum Worldwide Database Online
JACS   joint automated communications-electronics operation instructions system
S2AS   Spectrum Situational Awareness System
SPEED   systems planning, engineering, and evaluation device

C-65. Format compatibility is a spectrum management tool can imports and exports spectrum-related files from another spectrum management tool without the need to modify the original format. Format compatibility between tools complies with the NCE concept and reduces time constraints for spectrum managers in a joint environment. Limited format compatibility means that the tool has the capability of importing or exporting spectrum-related files between other tools, but requires the spectrum manager to manipulate format inconsistencies. For instance, legacy Spectrum XXI records modify or delete records in Spectrum XXI Online, but cannot create new records.

C-66. Table C-2 on page C-15, shows the capabilities of spectrum management tools.

TOOLS CAPABILITIES

C-67. Spectrum managers should be knowledgeable of the capabilities provided by the various available spectrum management tools. Table C-2 compares spectrum management tools and shows the capability of each tool. A description of each capability follows the table.

Table C-2. Spectrum management tool capabilities

SMO Capability	Spectrum Management Tools						
	Spectrum XXI	EWPMT	HNSWDO	S2AS	AESOP	SPEED	ACES/JACS
Spectrum measurement and direction finding				X			
Live Spectrum Analysis				X			
EW/EMI analysis and frequency deconfliction (fixed location)	*	X			X	X	
EW/EMI analysis and frequency deconfliction (on-the - move)		X			X	X	
2D/3D Simulation and Modeling of EMOE	*	X		X	*	X	
Plan spectrum reuse and minimize requirements		*				*	X
Import satellite access authorization and convert to SFAF/SSRF		X				X	
"Drag and Drop" Force structure templates		X			X	X	
Assign Frequencies	X	*			*	*	*
Access JETS database		X					
Access 2D/3D Digital Terrain databases	*	X		X	X	X	
Access CREW loadsets		X			X		
Access HN comments			X				
XML Format		X		X	X	X	
HTML Format		X		X			
CSV Format		X		X		X	
Generate CEOI/JCEOI					X		X
Provide input to CEOI/JCEOI		X					

Table C-2. Spectrum management tool capabilities (continued)

SMO Capability	*Spectrum Management Tools*						
Generate JSIR report	x	x					
Provide JRFL input to higher echelon	x	x			x	x	
SFAF Format	x	x		x	x	x	x
SSRF Format		*			x	x	
Provide input to COP						x	
COA Development		x			x	*	
NCE Compliant	x	x			*	*	
Standalone operations	x	x	x	x	x	x	x

Legend: **X** = formatting compatible ***** = limited format compatibility   blank = not currently compatible

SMO - spectrum management operations ACES - automated communications engineering software AESOP - Afloat Electromagnetic Spectrum Operations Program EWPMT –electronic warfare planning management tool CEOI communications electronics operations instructions COA - course of action COP - common operational picture CSV - comma separated values EMI - electromagnetic interference EMOE - electromagnetic operational environment	EW - electronic warfare HN - host nation HNSWDO - Host Nation Spectrum Worldwide Database Online HTML - hypertext markup language JACS - joint automated communications-electronics operation instructions system JCEOI - joint communications-electronics operation instructions JRFL- joint restricted frequency list JSIR - joint spectrum interference resolution NCE – network centric environment	S2AS - Spectrum Situational Awareness System SFAF - standard frequency action format SPEED - systems planning, engineering, and evaluation device SSRF - standard spectrum resource format XML - extensible markup language

C-68. Spectrum management tool capabilities are the attributes of a system or tool used to perform spectrum management operations. The following list is not comprehensive and many of the spectrum management tools change with technology improvements.

- **Spectrum measurement and direction finding:** This tool takes measurements (live) of the spectrum and provides direction finding of unknown, unplanned, EW, or EMI signals.
- **Live spectrum analysis:** This tool receives spectrum measurements and provides analysis of the measured signals over time for frequency records, trend analysis, and EW interference detection.
- **EW and EMI analysis and frequency deconfliction (fixed location):** This tool analyses EW and EMI effects (actual or planned) on spectrum use and provides recommendations and COAs for deconfliction of the EW and EMI for stationary SDD. This tool also includes the analysis of second or third order harmonics, intermodulation, and electromagnetic environmental effects in the areas impacted by spectrum use.
- **EW and EMI analysis and frequency deconfliction (on-the-move):** Same as above, with the exception that the tool analyzes and deconflicts SDDs while conducting communications on-the-move.
- **Two or three-dimensional simulation and modeling of EMOE:** This tool provides both a two and a three-dimensional model of the EMOE to include topography, electromagnetic environmental effects, and color-coded spectrum footprints.
- **Plan spectrum reuses and minimize requirements:** This tool reduces the impact of a mission on the spectrum through the reuse of frequencies in different locations and planning for the minimum requirements for spectrum users and provides for more flexible and available spectrum resources for all users.
- **Import Satellite Access Authorization and convert to SFAF or SSRF:** This tool imports an authorization and automatically converts it to the SFAF or SSRF approved format. This capability

provides a complete spectrum database and aids in the mitigation of EMI caused by or affecting space-based SDD.

- **Force structure templates:** This tool has the capability of creating or accessing force structures and placing them quickly and easily on the three-dimensional map of the battlefield using drag and drop, with associated SDD and the general spectrum requirements for those devices.

- **Assign frequencies:** The tool can assign frequencies to users that have submitted a frequency proposal in the correct format (SFAF or SSRF). A check mark means that the tool is capable and authorized to assign frequencies. An asterisk indicates that the tool may allocate and plan for projected frequencies approved by another tool before use of the projected spectrum.

- **Access joint spectrum center equipment, tactical, and space (JETS) database:** This tool may query the JETS database for information and receive updates (refreshes) from the database.

- **Access three-dimensional Digital Terrain databases:** This tool imports detailed three-dimensional digital terrain data from a variety of sources, such as the terrain integrated rough earth model, or Google Maps for planning, managing, and visualizing the EMOE. If marked with an asterisk, the tool has limited capabilities, such as two-dimensional maps only.

- **Access counter radio-controlled improvised explosive device EW load sets:** This tool can access counter radio-controlled improvised explosive device EW load sets for frequency deconfliction planning.

- **Access Host Nation comments:** This tool has access to host nation allocation tables that aid in planning spectrum use in various host nation locations. If marked with an asterisk, the tool has limited access, such as relying on importing data from another tool.

- **XML Format-Extensible Markup Language (XML)** is a file format that is rapidly becoming the standard for compatibility between software packages. If selected, the tool may import or export various files (records, reports, and data) in XML format.

- **HTML Format: Hypertext Markup Language (HTML)** is the primary markup language for creating web pages and other information displayed in a web browser. HTML elements form the building blocks of all websites. HTML allows embedding images and objects within web pages to create interactive forms. It provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items.

- **Comma-separated values (CSV) Format:** CSV is a common, relatively simple file format that is widely supported by consumer, business, and scientific applications. Among its most common uses is moving tabular data between programs that natively operate on incompatible (often proprietary or undocumented) formats. Moving tabular data in this fashion works because so many programs support some variation of CSV at least as an alternative import or export format. If checked, the tool can import or export various files in CSV format.

- **Generate CEOI or JCEOI:** CEOI or JCEOI provide for policies and regulations to subordinate units. If selected, the tool may generate and disseminate CEOI or JCEOI in the correct format to subordinate units.

- **Provide input to CEOI or JCEOI:** This tool provides input to the CEOI or JCEOI with+ compatible formats, but cannot generate the CEOI or JCEOI.

- **Generate JSIR report:** Use the JSIR report format to report EMI occurrence to the next higher echelon in a joint task force operating environment. This tool has the capability of generating the JSIR report in the correct format and exporting the report to the next higher echelon.

- **Provide JRFL input to higher echelon:** The JRFL is a time and geographically oriented listing of functions, nets, and frequencies requiring protection from friendly EW. This tool allows the operator to process JRFL input from subordinate forces, provide the data to higher echelons in the correct format, and distribute the JRFL to concerned units upon approval from higher echelon.

- **SFAF Format:** This tool can propose, assign, modify, renew, review, and delete radio frequencies in the SFAF (MC4EB Pub 7) approved format. If marked with an asterisk, the tool has limited capabilities, such as it can only import and read an SFAF frequency record.

- **SSRF Format:** This tool can propose, assign, modify, renew, review, and delete radio frequencies in the SSRF (MCEB Pub 8) approved format. If marked with an asterisk, the tool has limited

capabilities, such as the tool requires manual workarounds to generate proposals in the SSRF approved format.

- **Provide input to COP:** The COP is a single identical display of relevant information shared by more than one command. This tool can interface and provide relevant spectrum information to the COP.

- **COA Development:** This tool can analyze spectrum resources impacted by a mission and develop many COAs to determine how to best support the mission and mitigate spectrum conflicts.

- **NCE Compliant:** This tool is compliant with the NCE concept by providing central locations for access of information (through SIPRNET or NIPRNET) to authorized users both within an agency (vertically) and between agencies (horizontally) in joint environments. If marked with an asterisk, the tool is only partially NCE compliant, such as not providing information between agencies.

- **Operate in a standalone environment:** This tool can operate while disconnected from outside agencies or central databases.

SECTION III – SPECTRUM MANAGEMENT TOOLS TO CRITICAL TASKS

C-69. Spectrum managers have many Army, joint, and multi-service spectrum management tools available that assist in completing critical tasks. Spectrum managers should consider interoperability when choosing spectrum management tools used to complete critical tasks. Such considerations as the operational environment, including other services, coalition forces, and host nation determines the appropriate spectrum management tools necessary for specific tasks.

C-70. Table C-3, page C-19 thru C-21, shows the various spectrum management tools available to spectrum managers and the critical tasks that they can accomplish. The table also identifies if the spectrum management tool is an Army, joint, or other services spectrum management tools.

Table C-3. Spectrum management tools to critical task list

Critical Tasks	ACES/JACS	Spectrum XXI	HNSWD-O	SPEED	CJSMPT	NPT	J-TNT (WIN-T)	JIST	ACAS	AMHS	BUILDER	STEPSTONE	S2AS	AESOP	SKL	SDB TOOLKIT	SPINS	PR-100
	J	J	J	M	A	A	A	J	A	A	N	A	A	N	J	J	AF	J
Process Spectrum Requirements		X			X			X	X			X				X	X	
Produce CEOI/JCEOI and loadsets	X														X			
Perform electronic warfare deconfliction					X						X			X				X
Define the EMOE		X	X		X	X								X			X	X
Produce spectrum management plan	X	X	X		X	X					X			X			X	
Resolve EMI		X			X						X		X	X				X
Conduct five year review		X								X							X	
Predict spectrum link reliability		X		X	X	X	X											
Develop a JRFL	X	X															X	
Define spectrum management policy	X		X							X		X					X	
Produce allotment plan		X	X		X												X	
Obtain spectrum resources from the spectrum management host nation		X	X							X		X					X	

Legend:

ACAS	Army centralized access satellite request system	JRFL	joint restricted frequency list
ACES	automated communications engineering software	NIPR	Non-classified Internet Protocol Routing
AEHF	advanced extremely high frequency	NPT	network planning terminal
AESOP	afloat electromagnetic spectrum operations program	PR-100	portable receiver-100
AMHS	automated message handling system	RHN	regional hub node
ATO	authorization to operate	SATCOM	satellite communications
CEOI	communications electronics operations instructions		
CJSMPT	coalition joint spectrum management planning terminal	S2AS	spectrum situational awareness system
CoN	certificate of networthiness	SDB	symbolic debugger
EMI	electromagnetic interference	SHF	super high frequency
EMOE	electromagnetic operational environment	SIPR	SECURE Internet Protocol Routing
FH	frequency hopping	SKL	simple key loader
HNSWD-O	host nation spectrum worldwide database online	SPEED	system planning engineering evaluation device
IATO	interim authorization to operate	SPINS	airspace special instructions
J-TNT	joint tactical networking environment network operations toolkit	STEP	standardized tactical entry point
JCEOI	joint communications electronics operation instructions	UHF	ultra-high frequency
JIST	joint integrated satellite communications tool	WIN-T	Warfighter Information Network-Tactical

Table C-3. Spectrum management tools to critical task list (continued)

	ACES/JACS	Spectrum XXI	HNSWD-O	SPEED	CJSMPT	NPT	J-TNT (WIN-T)	JIST	ACAS	AMHS	BUILDER	STEPSTONE	S2AS	AESOP	SKL	SDB TOOLKIT	SPINS	PR-100
Implied Tasks	J	J	J	M	A	A	J	J	A	A	N	A	A	N	J	J	AF	J
Process/UHF/SHF/AEHF SATCOM requests		x						x										
Create FH loadsets for aviation assets	X																	
Publish and distribute spectrum data cells										x								
RHN/STEP/teleport SATCOM planning capability								x	x									
Connectivity Capability																		
NIPR			X					X	X				X					X
SIPR	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
WEB based			X					X	X	X	X	X				X	X	X
CoN	X	X			X	X	X	X	X	X	X							X
ATO/IATO	X				X		X							X				X

Legend:
ACAS — Army centralized access satellite request system
ACES — automated communications engineering software
AEHF — advanced extremely high frequency
AESOP — afloat electromagnetic spectrum operations program
AMHS — automated message handling system
ATO — authorization to operate
CJSMPT — coalition joint spectrum management planning terminal
CoN — certificate of networthiness
EMI — electromagnetic interference
EMOE — electromagnetic operational environment
FH — frequency hopping
HNSWD-O — host nation spectrum worldwide database online
IATO — interim authorization to operate
J-TNT — joint tactical networking environment network operations toolkit
JCEOI — joint communications electronics operation instructions
JIST — joint integrated satellite communications tool

JRFL — joint restricted frequency list
NIPR — Non-classified Internet Protocol Routing
NPT — network planning terminal
PR-100 — portable receiver-100
RHN — regional hub node
SATCOM — satellite communications
S2AS — spectrum situational awareness system
SDB — symbolic debugger
SHF — super high frequency
SIPR — SECURE Internet Protocol Routing
SKL — simple key loader
SPEED — system planning engineering evaluation device
SPINS — airspace special instructions
STEP — standardized tactical entry point
UHF — ultra-high frequency
WIN-T — Warfighter Information Network-Tactical

C-72. The spectrum management chief is responsible for ensuring that both the headquarters and subordinate units have established internal controls to ensure acquisition and employment of SDDs. Table C-4 is an example of a SMO checklist provides the spectrum management chief and subordinate spectrum management personnel with questions to consider for mission success. Units can use this SMO checklist as a foundation to develop a unit's standard operating procedures for spectrum management personnel. See AR 5-12 for regulatory guidance regarding the use of the electromagnetic spectrum.

Table C-4. Spectrum management checklist

Item Number	Frequency Assignment Policies and Procedures	Reference Source	Validation	
1	Spectrum manager successfully completed 25E MOS training and has a top secret security clearance.	AR 5-12 (Ch. 2-12f, E-5c; CJCSM 3320.01C)	Validate graduation date from 25E course at Fort Gordon; TS is current (EWO) only.	☐
2	Dedicated NIPRNET Workstation, SIPRNET Workstation/ACES AN/GYK-33F?	PBO/IMO/Unit SOP	Verify operational workstation in field environment	☐
3	Spectrum management Tools (SXXI, ACES, CJSMPT) are updated to latest build?	AR 5-12 Ch 2 2-17b	Verify operational dedicated workstation	☐
4	Spectrum management SOP or spectrum management annex to unit Annex H?	Unit Annex H / Higher HQ SOP	SOP reviewed for completeness with the approving authorities signature	☐
5	Spectrum manager has awareness of unit overall mission and spectrum operations conducted according to the SOP and in support of all aspects of unit mission (signal, intelligence, electronic warfare)	Unit Annex H	spectrum manager awareness of unit overall mission and spectrum operations conducted IAW SOP and in support of all aspects of unit mission i.e. (Signal/Intel/EW)	☐
6	Spectrum manager works collectively with higher headquarters to develop frequency request plan?	Unit SOP/ AR 5-12	BDE spectrum manager works collectively with DIV spectrum manager to develop frequency request plan	☐
7	Spectrum manager is aware of subordinate unit relationships, coordinates with subordinates in support of unit missions?	AR 5-12 Ch. 2-17d / Unit Annex H / Unit SOP	Spectrum manager is aware of subordinate unit relationships, coordinates with subordinates in support of unit missions	☐
8	NIPR accounts (GEMSIS) required for spectrum management are active?	IMO	Verify connectivity and active account	☐
9	SIPR accounts (SXXI, GEMSIS, E2ESS, CJSMPT, JIST, SDB, and JSIRO) required for spectrum management are active?	IMO	Verify connectivity and active account	☐
10	Unit has active job account on SXXI and is able to data exchange?	Joint Spectrum Center	Data exchange with Spectrum XXI server	☐
11	Spectrum manager maintains unit emitter list and it is current?	ACES Help File	Display current unit emitter list (contains all unit receiver and/or transmitter equipment in use)	☐

Table C-4. Spectrum management checklist (continued)

Item Number	*Frequency Assignment Policies and Procedures*	*Reference Source*	*Validation*	
12	Master net list is inclusive to all emitters on unit emitter list?	ACES Help File	Display current unit MNL.	☐
13	Spectrum manager is capable of tier 3 download to simple key loaders?	ACES Help File	Transfer loadset from ACES/JACS to SKL	☐
14	Spectrum manager is familiar with JIST request process and active in mission submissions?	JIST Homepage / ACAS	SAR submitted for Satellite Access Approval	☐
15	Spectrum manager is familiar with SATCOM database and has access for read only access?	CJCSI 6250.01F/SI 714-4	Spectrum manager is able to validate SDBs contained in SATCOM requests on JIST. Request access through: usarmy.bragg.forscom.list.g6-spectrum-manager@mail.mil	☐
16	Spectrum manager is able to produce a standard frequency action format report?	AR 5-12	Display a current / valid SFAF	☐
17	Spectrum manager participates in JRFL development and publishes JRFL?	CJCSM 3320.01C/ Unit SOP	Maintain a copy of current JRFL	☐
18	Spectrum manager is familiar with JSIRO website and able to logon and check previous JSIR's?	AR 5-12/ CJCSM 3320.02C/ Unit SOP	Report and track interference (JSIR online preferred) Operator or user experiencing the interference is responsible for submitting the initial interference report. (https://intelshare.intelink.sgov.gov/sites/jsir/default.asp)	☐

Table C-4. Spectrum management checklist (continued)

Item Number	Frequency Assignment Policies and Procedures	Reference Source	Validation	
19	Spectrum manager participates in CEMA working group?	Unit SOP/ AR 5-12	Spectrum manager is a member of CEMA working groups	☐
20	Internal coordination (EW, Fires, Intel, Engineers)	AR 5-12 Ch. 2-17d / Unit Annex H	Establish working relationships among staff sections and internal coordination conducted routinely, Spectrum manager included in working groups	☐
21	AKO-S	AKO help desk	Access AKO SIPRNET account	☐

Legend

ACES	automated communications engineering software
AKO	Army Knowledge Online
AKO-S	Army Knowledge Online-Secure
AR	Army regulation
CEMA	cyber electromagnetic activities
CJSMPT	coalition joint spectrum management planning tool
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
CJCSM	Chairman of the Joint Chiefs of Staff Manual
E2ESS	end-to-end supportability system
GEMSIS	global electromagnetic spectrum information system tools
IMO	information management officer
JIST	joint integrated satellite communications tool
JRFL	joint restricted frequency list
JSIR	joint spectrum interference resolution
JSIRO	joint spectrum interference resolution online
MOS	military occupational skill
NIPRNET	Non-classified Internet Protocol Router Network
PBO	property book officer
SATCOM	satellite communications
SDB	satellite communications database
SIPRNET	SECRET Internet Protocol Router Network
SOP	standard operating procedures
SXXI	Spectrum XXI

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Appendix D
Spectrum Management Lifecycle

The Army spectrum management lifecycle serves as a guide to follow in establishing a functional and efficient spectrum management program. The lifecycle encompasses the complete process of providing spectrum management support to the commander and applies to all spectrum managers regardless of duty location. The Army spectrum management lifecycle mirrors the joint task force lifecycle.

ACTIVITIES OF THE SPECTRUM MANAGEMENT LIFECYCLE

D-1. The spectrum management lifecycle consists of 12 activities that enhance SMO. It is not imperative to conduct lifecycle activities as presented. Some spectrum management lifecycle activities happen simultaneously while others happen only in succession. Listed below are the 12 activities of the spectrum management lifecycle—

- Activity 1. Define command-specific policy and guidance.
- Activity 2. Gather requirements.
- Activity 3. Develop an electromagnetic spectrum requirements summary.
- Activity 4. Define the EMOE.
- Activity 5. Obtain spectrum resource.
- Activity 6. Develop a spectrum management plan.
- Activity 7. Nominate and assign frequencies.
- Activity 8. Generate the joint communication-electronic operating instructions.
- Activity 9. Develop JRFL.
- Activity 10. Perform electronic warfare deconfliction.
- Activity 11. Resolve interference.
- Activity 12. Report interference.

ACTIVITY 1. DEFINE COMMAND-SPECIFIC POLICY AND GUIDANCE

D-2. Unit standard operating procedures establish specific guidance for managing, requesting, coordinating, and assigning spectrum use, the JRFL process, communications electronic operating instructions, and other operations. Policy and guidance information should be available in the commander's spectrum guidance, spectrum management manual, command regulations, instructions, or existing plans.

D-3. Spectrum managers require many resources. The unit standard operating procedures would establish the basic spectrum management resources needed to establish a spectrum management element in support of operations anywhere within the commander's operational area. Such resources should include digitized terrain data, background electromagnetic environment records, country area studies, copies of agreements for spectrum use or sharing with involved or adjacent host nations, and historical spectrum use records involving the operational area. This step generates two deliverable products: the spectrum concept and the spectrum requirements data call message.

D-4. The spectrum management concept is the vision of spectrum management operations best practices performed to support the mission. The spectrum management concept comprises assumptions, considerations, and restrictions that, when analyzed together, can illustrate the best approach to managing the EMOE.

D-5.   The EMS requirements data call message guides staff elements, subordinate units, and supporting agencies on how to request spectrum support for spectrum-dependent systems that operate under their control within an area of influence. This multipart message should cover the following subjects: spectrum management policy and guidance, security classification guidance, frequency, and communications electronic operating instructions master netlist request procedures, as well as a guide for identifying nets and frequencies to be included on the JRFL. There are two deliverable products generated with this activity:

- **Spectrum management concept.** The spectrum management concept is the vision of the best way to perform SMO in support of the mission. It includes assumptions, considerations, and restrictions that, when analyzed together, illustrate the best approach to managing the EMOE.
- **Data call message.** The EMS requirements data call message guides staff elements, components, and supporting agencies on how to request spectrum support for SDDs that operate under their control within the EMOE.

ACTIVITY 2. GATHER REQUIREMENTS

D-6.   Gathering requirements begins as soon as spectrum management receives guidance and defined coordination channels. Spectrum managers must also obtain the requirements of spectrum users, primarily the staff elements. These requirements must address both communications and non-communications such as radar and weapons systems and stated in terms of spectrum requirements to support the command. This step involves undocumented requirements from sources external to the spectrum management coordination chain.

D-7.   Spectrum managers identify all requirements for their SDDs. The best practices to identify SDD requirements is by attending operational briefings, meetings, and planning sessions to mitigate the chance of SDDs being missed or overlooked in coordinating spectrum use. It is essential to identify all receive-only SDDs (SDDs designed to receive and do not radiate or transmit a signal) since these systems are vulnerable to interference from licensed emitters. Recognizing many of these receive-only SDDs results from collaboration with staff sections and ensuring to request information on known receive-only SDDs currently activated or planned for activation. Once identified, the spectrum manager can document known receive-only SDDs by creating a SFAF record within the SPECTRUM XXI database as the best way to protect these devices.

D-8.   Satellite systems operators receive authorization for the use of satellites from the satellite controlling authority. Satellite access authorizations stating local frequency clearance is the responsibility of the user. The spectrum manager ensures the EMS requirement data call message includes instructions to users, including procedures for submitting satellite access request and authorizations. The spectrum manager creates SFAF records for these authorizations. The spectrum manager should consider making a separate frequency assignment record for single channel satellite systems located at higher headquarters. These frequencies are protected frequencies. Having a different frequency assignment record for these protected frequencies aids in reducing and identifying EMI. The spectrum manager also requests approval from the commander to place these protected frequencies on the unit's JRFL.

D-9.   The spectrum manager is always aware of incoming units and organizations that operate in the EMOE. Incoming units and organizations should coordinate with the spectrum manager for spectrum use and support, reducing the likeliness of EMI issues.

D-10. Gathering requirements involves capturing and documenting potential JTF spectrum use by other service components and JTF staff, as well as undocumented external sources to the spectrum management coordination chain. Spectrum managers ensure that the EMS requirements data call message requires units to submit their EMS requests accordingly. Gathering requirements is an ongoing activity until the mission dissolves and requires flexible planning. The product generated by the gathering requirements activity is a SPECTRUM XXI database that contains known spectrum requirements and SDDs already in use in the AO.

ACTIVITY 3. DEVELOP THE ELECTROMAGNETIC SPECTRUM REQUIREMENTS SUMMARY

D-11. This summary quantifies the amount of spectrum necessary to support the command, determine the necessity of using frequency sharing and reuse plans, and help in the development of allotment or channeling plans. This process requires compiling and analyzing the data generated. The spectrum manager analyzes the summary and determines the amount of spectrum needed. The spectrum requirements summary identifies the number of different radio services competing for spectrum in the same frequency band, determines the different emissions utilizing a particular band, and supports the development of a plan for frequency sharing.

D-12. The spectrum requirements summary generated is a compilation of the requirements identified in response to the spectrum requirements data call message. This product is for the sole use of the spectrum manager and provides a tool to base future decisions about efficient spectrum-use and initial requirements definition. This product may assist the spectrum manager with requesting spectrum authorization from a host nation. The product may also assist the spectrum manager with allocating portions of the spectrum better, with supporting emitters utilizing varying bandwidths.

ACTIVITY 4. DEFINE THE ELECTROMAGNETIC OPERATIONAL ENVIRONMENT

D-13. Military operations require a common, single, authoritative source for spectrum use information for all friendly, enemy (to the extent available), neutral, and civil emitters and receivers to achieve and manage joint spectrum use successfully. This common source of spectrum use information found within the EMOE must be current, accurate, and accessible to authorized users. The spectrum manager is responsible for building and managing this common source of information.

D-14. The EMOE database contains spectrum use information on all friendly military and civilian, available enemy, and neutral forces. Defining the EMOE creates not only a database of frequency assignments but also identifies factors that affect signal propagation, such as environmental characteristics and terrain. This activity starts with defining your operational area and its environmental aspects, locating necessary terrain data and then locating the data for and creating a database of the known spectrum use information. Defining EMOE is an ongoing activity. The information produced by this activity provides a baseline database digitally depicting the EMOE and the basis for all spectrum interaction analyses.

ACTIVITY 5. OBTAIN SPECTRUM RESOURCES

D-15. Obtain spectrum resources needed to support the command. The spectrum manager coordinates military spectrum use with the spectrum management authority of the host nation or coalition forces involved. The host nation can request spectrum resources for exercises or most military operations other than war. Operations that preclude prior coordination with a host nation, such as forced entry, require the spectrum manager to determine the spectrum resource; evaluation of the background and history of the electromagnetic environment provides support to the spectrum manager. If needed, an assessment of the background environment is essential to establish well-defined spectrum requirements and for the EMOE to remain as up-to-date as possible.

D-16. It is essential to establish well-defined EMS requirements and for the EMOE to be defined and up-to-date as possible. Spectrum requirements generated in previous activities assist in determining the amount of EMS needed to support the mission. The EMS requirements summary can help quantify the amount of spectrum required and identify the different radio services and emissions that may be operating within each frequency band.

ACTIVITY 6. DEVELOP THE SPECTRUM MANAGEMENT PLAN

D-17. Unit standard operating procedures establish specific guidance for managing, requesting, coordinating, and assigning spectrum use and procedures for JRFL and JCEOI processing. Additionally, the spectrum manager is the focal point for the inclusion of spectrum use considerations in the Annex H development and provides administrative and technical support for military spectrum use. This process uses

the spectrum management concept, developed in the first activity, along with existing policy and guidance. Other sources of information are lessons learned from previous operations and exercises, the JSC, and other spectrum managers.

D-18. The spectrum manager devises a plan to use available spectrum resources that depends upon the products resulting from the previous activities. Spectrum managers evaluate spectrum management plans for possible improvement regularly. The spectrum management plan is typically included as an appendix to Annex H of an OPLAN or OPORD and evolves from guidance as to the operation or exercise transitions from the planning to the execution phase.

D-19. The spectrum management plan guides all spectrum management functions, including information exchange, expected coordination channels, format for deliverable products, interference and reporting resolution procedures, and suggested resolution steps. Evaluation for possible improvement of the spectrum management plan is continuous.

ACTIVITY 7. NOMINATE AND ASSIGN FREQUENCIES

D-20. Nominate and assign frequencies is the actual implementation of the spectrum management plan. Authority, delegated to components, to issue frequency assignments or allotments provides the maximum latitude and flexibility in support of combat operations. This activity involves the initial assigning of frequencies. The spectrum manager may assign frequencies or delegate (decentralize) assignment authority using frequency pools (allotment plans) provided to functional and service component spectrum managers allowing them to assign frequencies. Decentralized assignment authority requires that all temporary frequency assignments be data exchanged with the SPECTRUM XXI regional server so they can be included in other spectrum managers' nomination and assign frequencies activity. Conducting a data exchange for all temporary frequency assignments also requires updating the EMOE continuously as part of Activity 4 and depends upon the available EMS resources and restrictions established in Activity 6.

D-21. The frequency assignment database, which conforms to and is created based on the table of frequency allocations, radio regulations, and channel plans, is the most critical resource the spectrum manager has available and forms the basis for nominating interference-free assignments, providing impact analyses of EW operations, and identifying and resolving interference issues.

ACTIVITY 8. GENERATE COMMUNICATIONS-ELECTRONICS OPERATING INSTRUCTIONS

D-22. The CEOI is a two-part document. Part 1 is a directory of radio nets or units and their associated frequencies, call signs, call words, and network identification listed by time. Part 2 contains supplemental procedures for electronic, visual, and verbal interactions, such as sign or countersigns, obscurants or pyrotechnics, and suffix or expanders. CEOI development and distribution is an S-6 or G-6 responsibility and delegated to the spectrum manager.

D-23. The CEOI provides communications details and information to include—
- Daily changing and non-changing frequency assignments.
- SINCGARS cue, manual, and net identification assignments.
- Call sign assignments.
- Call words assignments.
- Daily changing code words.
- Running passwords.

D-24. Information found in the CEOI includes document-handling instructions, controlling authority data, effective dates, and reproduction instructions. Due to the sensitive information contained in the CEOI, classification should be at the same level.

Note. The CEOI the same as the joint communications-electronic operating instructions (JCEOI). A JCEOI is a CEOI when generated in a joint environment. The JCEOI is the most widely used communication control document in any given AO.

D-25. Overarching regulatory guidance for CEOI management, to include call signs and call words, is contained within the CJCSI 3320.03D, JCEOI publication. Additional guidance may apply based on command relationships with other unified action partners.

D-26. During operations in a joint environment, the combatant commander is the authority for the JCEOI. The combatant commander may delegate this authority, to the ground component commander or the respective joint task force commander. There is a distinction between the air and ground component JCEOI. The relevant air component issues a Special Instructions document that is the air operations equivalent of the JCEOI.

D-27. Within garrison, the Army Command, Army Service component command, or direct reporting unit commander has responsibility for CEOI production and distribution in support of training requirements. U.S. Forces Command may delegate authority to a corps, division or remain centralized to meet installation-training objectives. Regardless of echelon, the commander is responsible for the JCEOI. The J-6 or G-6 develops and promulgates the JCEOI or delegates responsibilities to the JSMI. The J-3 or G-3 validates master netlist requirements and resolves conflicts.

Distribution and Development

D-28. The COMSEC facility provides distribution of the final ACES or JACS produced JCEOI product. Doing so ensures all units receive the latest JCEOI with the dissemination of COMSEC. Communications cards are derivative products of the JCEOI and are METT-TC driven. Document and protect communications cards in the manner appropriate for their security classification level. These products inherit the classification level of the source JCEOI material.

D-29. Both ACES and JACS can generate a SINCGARS loadset. When required to maintain administrative tempo with the pace of operations it may be necessary to operate without management of the SINCGARS compatible loadset generated by ACES or JACS, keeping the list of SINCGARS networks using a spreadsheet.

Call Words, Call Signs, Suffixes, and Expanders

D-30. Call signs and call words to establish and maintain communications. They identify the radio stations of command authorities, activities, facilities, units, elements, or individual positions. Call signs do not identify people. Tactical call sign systems meet specific military requirements under an exemption to the International Telecommunications Union radio regulations. Table D-1 on page D-6, shows examples and explanations of call signs.

- **Call signs** are a combination of alphanumeric or phonetically pronounceable characters that identifies a communication facility, command, authority, activity, or unit; used primarily for establishing and maintaining communications.
- **Call words** identify units when communicating within a secured communications net. The generation of call words differ based on service component command guidance or directed based on command authority.
- **Suffixes and expanders** further assist in identifying a radio station's position or function. Care in the management of call words ensures that each station sounds phonetically different over voice transport (for example, MAD DAWG 6 or MAD DOG 6). Call word usage is for secure networks only.

Table D-1 Call sign, call word, suffix and expander

Item Name	Example	Explanation
Call Sign	X6Y24E B9K60H	The term "call sign" refers to the letter-number-letter combination that typically designates a unit element in the CEOI or JCEOI. CJCSI 3320.03D specifies that changes to call signs, call words, and frequencies occur daily, weekly, monthly, or quarterly based on threat, security of radio communications, and commander's guidance. Examples: X6Y= 1/A/1-25 INF (1st Platoon, A Co., 1-25 INF Bn)
Call Word	Bulldog24E Fury60H	Pronounceable words that identify a communications facility, command, authority, activity or unit; serves the same functionality as the call sign. The Army does not have set call words per unit. Call word deconfliction is typically handled by the highest level spectrum manager. EXAMPLES: Bulldog = 1/a/1-25 INF (1st Platoon, A Co., 1-125 INF Bn)
Suffix	X6Y24E B9K60H Bulldog24E Fury60H	The term "suffix" refers to the two digits assigned to a particular position, mission or function within a unit or element. EXAMPLES: 24 = AVN Officer/NCO 60 = G-6 or S-6
Expander	X6Y24E B9K60H Bulldog24E Fury60H	A single letter code (A through Z) used in conjunction with a suffix and call sign to identify a sub-element of the position, mission, or function. EXAMPLES: E = NCOIC H = Officer in charge

Legend
ACES   automated communications engineering software
AVN   aviation
Bn   battalion
CEOI   communications-electronics operating instruction
CJCSI   Chairman of the Joint Chiefs of Staff Instruction
Co   company
INF   infantry
JACS   joint automated communications-electronics operation instructions system
JANAP   joint Army, Navy, Air Force publication
JCEOI   joint communications-electronics operation instructions
NCO   noncommissioned officer
NCOIC   noncommissioned officer in charge

Security Classification

D-31. The content of the JCEOI, master netlist, and communications card extracts determine the classification levels. The level of COMSEC key tag information entered into the system for ACES terminal and corresponding generated loadsets determine the classification. Similar to a classified presentation, the overall classification of a specific product would be the highest level of classification it contains.

Note. See AR 380-5 for security classification markings.

ACTIVITY 9. DEVELOP JOINT RESTRICTED FREQUENCY LIST

D-32. The JRFL is a time and geographically oriented listing of functions, nets, and frequencies requiring protection from friendly spectrum users. Developing the JRFL requires the spectrum manager to prepare and combine G-2, G-3, G-6, and component inputs to build a JRFL for approval by the G-3, and when needed, periodically update and distribute the JRFL.

D-33. The JRFL is a G-3 product; it protects communications nets, including friendly communications for command and control, enemy communications for exploitation purposes, and safety of life frequencies used by the command and local civil noncombatants. The development, distribution, and maintenance of the JRFL is a task of the S-6 or G-6 and generally accomplished by the spectrum manager. Creation of the

JRFL is for the CEMA element and based on guidelines established by the commander, CEWO and the CEMA working group.

D-34. Leaders should become familiar with the types of protection status codes that exist for the JRFL. Knowing these status codes allows the CEWO to plan jamming operations on the unrestricted frequencies for training and during operations. Three types of protection status codes apply to frequency assets identified for inclusion in a JRFL: Taboo frequencies, protected frequencies, and guarded frequencies (see Appendix D). Sample JRFL restriction status codes include—

- **Taboo frequencies:** Taboo frequencies are any friendly frequencies of such importance that they must never be deliberately jammed, interfered with by friendly forces. These include international distress, safety, stop buzzer, and controller frequencies. They are generally long-standing as well as time-oriented (JP 3-13.1).
- **Protected frequencies:** Those friendly frequencies used for a particular operation, identified to prevent them from inadvertent friendly force jamming while engaged in active EW operations against hostile forces. These frequencies are of such critical importance that jamming should be restricted unless necessary or until coordination with the user unit. These frequencies are generally time-oriented, may change with the tactical situation, and updated periodically. Protected frequencies are friendly frequencies used for a particular operation. An example of a protected frequency would be the command net of a maneuver force engaged in the fight (JP 3-13.1).
- **Guarded frequencies:** Guarded frequencies are those enemy frequencies exploited for combat information and intelligence. Guarded frequencies are time-oriented in that the list changes as the enemy assumes different combat postures. Jamming these frequencies are possible after the commander has weighed the potential operational gains against the loss of the technical information gained (JP 3-13.1).

ACTIVITY 10. PERFORM ELECTRONIC WARFARE DECONFLICTION

D-35. The S-3 or G-3 EW spectrum manager is a member of the CEMA element and performs spectrum management duties, including EW deconfliction analysis. The CEWO identifies planned EA missions and requests the spectrum manager perform an analysis on the impact of these missions on operations. This process requires information from the JRFL, communications electronics operating instructions, and EMOE. The analysis determines what impact the EA mission has on communication nets, systems, enemy communications nets exploitation, and possible safety of life situations.

D-36. This product provides the CEMA element with an analysis of the potential impact of friendly EW operations on friendly forces. The CEMA element then decides if the benefits of the jamming mission outweigh the dangers of the possible fratricide. This product is time-sensitive and produced on an as-needed basis.

ACTIVITY 11. RESOLVE INTERFERENCE

D-37. Resolving interference is a daily activity once forces have deployed and are part of the planning process. This activity encompasses reporting and attempting to resolve EMI. Various factors such as unauthorized users, faulty nomination criteria, lack of timely data exchanges, or equipment problems can create interference.

D-38. Victim units should make every effort to resolve frequency interference locally. Multiple interference problems may indicate the unintentional impact of blue or gray EW operations, errors in the spectrum management plan, or adversary EW operations. The spectrum manager should define and analyze the EMOE to help determine the cause of an EMI problem.

ACTIVITY 12. REPORT INTERFERENCE

D-39. Spectrum congestion and the nature of military operations make some level of EMI likely. Interference reporting and tracking provide the spectrum manager with a valuable historical reference for

resolving future EMI problems. After performing interference analysis, always create an interference report to document the results.

D-40. Keep these reports in a database used as a history of interference problems. The purpose of the interference report database is to provide the spectrum manager with a repository for previous interference incidents and steps taken to resolve them. This database provides a wealth of information on unit discipline, training deficiencies, and a starting place for the spectrum manager to begin resolving interference issues. Spectrum managers share this database with all. To the extent, unexplained interference persists or recurs coincident with either red, blue or gray operations, notification to the CEMA element occurs.

D-41. Involvement of the spectrum manager begins at the onset of interference. Spectrum managers are responsible for resolving and reporting interference within the unit's AO and sets alerts in JSIRO for interference affecting the unit's operations. They receive notifications by secure email of interference reports submitted for action and situational understanding of the interference. Spectrum managers assist and mitigate spectrum interference at the lowest level possible and should be knowledgeable of all forms of jamming, deception, and interference. Users experiencing EMI may change frequencies only when the spectrum manager coordinates authorized replacement frequencies. Guidance for the JSIR program can be found in CJCSI 3320.02F. Additional procedural guidance in support of the JSIR program may apply based off command relationships such as military departments, Army commands, and combatant commands.

JOINT SPECTRUM INTERFERENCE REPORT

D-42. Victims of interference report EMI using JSIRO. JSIRO is a web-based, centralized application containing data and correspondence for reported EMI, intrusion, and jamming incidents. It is the repository for the results of analyses, collected data, and supporting documentation for EMI resolution to support both trend and future interference resolution analysis. JSIRO and CJCSI 3320.02F provide an operator checklist for local investigations.

D-43. EMI is any electromagnetic disturbance that interrupts, obstructs, degrades, or limits the effective performance of electronics and electrical equipment. EMI can be induced intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious emissions, responses or intermodulation products.

D-44. EMI mitigation begins with operator-level troubleshooting and reporting. It is imperative that affected users attempt to resolve EMI incidents at the lowest possible level. Troubleshooting may identify the source of the interference as truly EMI or, as in most cases, an equipment or operator failure. Reporting facilitates situational understanding and supports the development of solutions. Report and investigate all prohibitive EMI through the JSIR program. Not all EMI incidents are restrictive; however; prohibitive EMI has an operational impact. Trained equipment operators should identify the difference between prohibitive EMI, equipment failure, and purposeful interference by the adversary. The JSIRO report is submitted through intelligence channels by the appropriate authority if the interfering signal is determined to be from a hostile source,

D-45. The spectrum manager or the victim of interference is responsible for reporting interference using the JSIR format with the information described in table D-2 on page D-9.

Table D-2. Data input for JSIR offline reporting

Item Number	Data Input
1	When electromagnetic interference started (Zulu time).
2	The affected system name, nomenclature, manufacturer (with model number), or other system description. If available, include the equipment characteristics of the victim receiver, such as bandwidth, antenna type, and antenna size.
3	The affected frequency (Format must be numerical).
4	The channel selected on the affected system.
5	The characteristics of the interference (noise, pulsed, continuous, intermittent, frequency, or bandwidth).
6	The geographical location of the affected system.
7	The name of the country that the affected system is in.
8	The description of the EMI (include what it sounds like, reduced range, false targets, reduced intelligibility, data errors, actions taken thus far, and any other descriptive comments).
9	Victim point of contact (include name, phone number, email, unit, combatant command, service, or agency).

D-46. The spectrum manager or victim of interference, reports the types of interference signals, the actions used to overcome the interference, the suspected cause, and other comments related to the interference signal. Send this report online or forward offline as soon as feasible, based on the situation.

TYPES OF JAMMING SIGNALS

D-47. Jamming is an effective way for the adversary to disrupt C2. An adversary can jam by broadcasting a signal tuned to friendly frequencies with enough power to override friendly signals at the receivers. There are two modes of jamming. Spot jamming is power concentrated toward one channel or frequency. Barrage jamming is power spread over several frequencies or channels at the same time.

D-48. Jamming can be difficult, and sometimes impossible to detect. Users of spectrum devices have the potential of being jammed and should be trained to recognize jamming. The two types of jamming most commonly encountered are obvious and subtle jamming. Obvious jamming usually is very simple to detect. When experiencing a jamming incident, it is more important to recognize and overcome the incident than to identify it formally. The spectrum manager or victim reports the jamming signal during the JSIR process. The more commonly used jamming signals of this type are—

- **Random noise or synthetic radio noise.** It is random in amplitude and frequency. It is similar to normal background noise and can degrade all types of signals. Operators often mistake it for a receiver or atmospheric noise and fail to take appropriate actions.
- **Stepped tones.** These are tones transmitted in increasing and decreasing pitch and resemble the sound of bagpipes. Single-channel voice circuits are usually the victims of stepped tones.
- **Spark.** The spark signal is one of the easiest and effective types of jamming. Bursts are of short duration and high intensity. Spark jamming signals, repeated at a rapid rate, is useful in disrupting all kinds of radio communications.
- **Gulls.** The gull signal is a quick rise and slow fall of a variable radio frequency and is similar to the cry of a seagull. It produces a nuisance effect and is very effective against voice radio communications.
- **Random pulse.** In this type of interference, pulses of varying amplitude, duration, and rate are generated and transmitted. They disrupt teletypewriter, radar, and various types of data transmission systems.
- **Wobbler.** The wobbler signal is a single frequency modulated by a low and slowly varying tone. The result is a howling sound that causes a nuisance effect on voice radio communications.
- **Recorded sounds.** Recorded sounds are any audible sound, especially of a variable nature, to distract radio operators and disrupt communications. Music, screams, applause, whistles, machinery noise, and laughter are examples of recorded sounds jamming.

- **Preamble jamming.** This type of jamming occurs when a broadcast resembling the synchronization preamble speech of security equipment over the operating frequency of secure radio sets. With preamble jamming, all radios become locked in receive mode. It is especially effective when employed against radio nets using speech security devices.
- **Subtle jamming.** Subtle jamming is not obvious and has no sound from the receiver radio. The radio cannot receive the intended incoming signal, even though everything appears normal to the radio operator. In effect, the threat jammers block out these radios' ability to receive a friendly transmission without the operator being aware it is happening. Squelch capture is a subtle and effective jamming technique. The radio operator can readily detect jamming in all other function control modes. Often, the operator assumes that the radios are malfunctioning instead of recognizing subtle jamming for what it is.

RECOGNIZING JAMMING

D-49. Equipment operators must be able to recognize jamming. Threat jammers may employ obvious or subtle jamming techniques. In addition, interference caused by sources having nothing to do with adversary jamming may be the source. Jammers affect receivers and do not affect transmitters.

D-50. The following may cause prohibitive EMI—
- Unintentionally by other radios (friendly and enemy).
- Other electronic, electric, or electromechanical equipment.
- Atmospheric conditions.
- Malfunction of the radio.
- Improper operation of the radio.
- Combination of any of the above.

D-51. **Internal or external interference.** The two sources of interference are internal and external. If the interference or suspected jamming remains after grounding or disconnecting the antenna, the disturbance is most likely internal and caused by a malfunction of the radio—contact maintenance personnel to assist in troubleshooting. Further examinations could reveal external interference from adversary jamming or unintentional interference.

D-52. **Jamming or unintentional interference.** Causes of unintentional interference include other radios, some other type of electronic or electromechanical equipment, or atmospheric conditions. The battlefield is so crowded with radios and other electronic equipment that some unintentional interference is virtually unavoidable. Static electricity produced by atmospheric conditions can negatively affect radio communications. Unintentional interference travels typically only a short distance, and a search of the immediate area may reveal the source of this type of interference. Moving the receiving antenna for short distances may cause noticeable variations in the strength of the interfering signal. These variations usually indicate unintentional interference. Conversely, little or no variation may indicate inadvertent friendly or adversarial jamming. Regardless of the source, take actions to reduce the effect of interference on our communications.

D-53. In all cases, report suspected adversary jamming and any unidentified or unintentional interference that disrupts our ability to communicate. Reporting applies even if the radio operator can overcome the effects of the jamming or interference. Information provided to higher headquarters in the JSIR report mitigates the adversary jamming efforts.

D-54. The adversary can use two types of jamming signals: powerful un-modulated or noise-modulated signals. Un-modulated jamming signals lack any noise and noise modulated jamming signals have noticeable interference noises.

OVERCOMING JAMMING

D-55. The adversary continually strives to perfect and use new and more confusing forms of jamming. Our equipment operators must be increasingly alert to the possibility of jamming. Training and experience are the essential tools operators have to determine when a particular signal is a jamming signal. Exposure to the

effects of jamming during training events or actual situations is invaluable. The ability to recognize jamming is essential because jamming is a problem that requires action.

D-56. Continue to operate if jamming does occur. Usually, adversarial jamming involves a period of jamming followed by a brief listening period. The adversary is attempting to determine how effective jamming has been. What the victim is doing during this short period when listening, tells the jammer how effective jamming has been. If the operation is continuing in a usual manner, as it was before the jamming began, the enemy assumes that jamming has not been particularly effective. If the adversary finds users discussing the jamming over the radio or shut down our operation entirely, the adversary may very well assume that jamming has been effective. Because the enemy jammer is monitoring operations, unless otherwise ordered, never shut down operations or in any other way disclose to the enemy that you may be adversely affected. Normal operations should continue even when degraded by jamming.

IMPROVE THE SIGNAL-TO-JAMMING RATIO

D-57. The signal-to-jamming ratio is the relative strength of the desired signal to the jamming signal at the receiver. Signal refers to the frequency users are attempting to receive. Jamming refers to the hostile or unidentified interference received. A signal-to-jamming ratio in which the desired signal is stronger than the jamming signal cannot significantly degrade the desired signal.

D-58. Users experiencing jamming may take a variety of steps to improve the signal-to-jamming ratio. Adjust the receiver and ensure frequency tuning is as precise as possible to the desired incoming signal to improve the signal-to-jamming ratio. Additional techniques to improve signal-to-jamming ratio include—

- Adjusting the radio frequency bandwidth if possible.
- Adjusting the gain or volume control.
- Fine-tuning the frequency.
- Increasing the transmitter power output.

D-59. Increasing the power output of the transmitter emitting the desired signal improves the signal-to-jamming ratio. The transmitter must be set on something less than full power when jamming begins to increase the power output at the time of jamming. Using low power as a preventive technique depends on the adversary not being able to detect radio transmissions. Once the adversary begins jamming radios, the threat of exposure increases.

D-60. Users experiencing jamming should ensure antennas are in the best position to receive the desired incoming signal. Additional techniques to improve incoming signal strength regarding antenna include—

- Reorienting the antenna.
- Changing the antenna polarization. (Perform this action at all stations.)
- Installing an antenna with a more extended range (higher gain).

D-61. **Relocate the antenna.** Frequently, relocating the antenna and its associated radio set affected by the jamming or interference improves the signal-to-jamming ratio. Improving the signal-to-jamming ratio may require moving the antenna a few meters or several hundred meters. It is best to relocate the antenna and associated radio set to an area that has a terrain feature between the user and any suspected enemy jamming location.

D-62. **Establish a retransmission station.** A retransmission station can increase the range and power of a signal between two or more radio stations. Depending on the available resources and the situation, this may be a viable method to improve the signal-to-jamming ratio.

D-63. **Use an alternate route for communications.** If radio communications have degraded between two radio stations that must communicate, there may be another radio station or route of communications that can communicate with both of the radio stations. Use the alternate radio station or route as a relay between the two other radio stations.

D-64. **Change frequencies.** If a communications net cannot overcome adversarial jamming using the above measures, the commander (or designated representative) may direct the net to switch to an alternate or spare frequency coordinated through your spectrum manager. If practical, dummy stations can continue to operate on the frequency being jammed to mask the change to an alternate frequency. Preplanned

frequency changes result in minimal communications loss. During adversarial jamming, it is challenging to coordinate a change of frequency.

Appendix E

Military Time Zone Designators

Spectrum managers provide support for the EMOE in support of unified action partners. Spectrum managers communicate with users across different time zones and provide commanders with operational times established during missions. Support for airborne operations provides the most extensive use of military time zones during flight missions. Knowledge of global military time zone differences for spectrum managers is a vital skill. Spectrum managers can prepare briefings, conduct and assist planning, or provide input to critical documents, accurate time zone information is essential.

MILTARY TIME

E-1.   Military time uses the 24-hour clock beginning at midnight (0000 hours) and ending at 2359 hours. Military time format eliminates the need for using A.M. and P.M. designations as regular time uses numbers 1 to 12 to identify the hours in a day. In Military time 12 P.M. is 1200 hours, 1 P.M. is 1300 hours 2 P.M. is 1400hours, continuing up until 11 P.M., which is 2300 hours. The military uses this standard as it leaves less room for confusion than standard time. Through military time, the earth has 24 equally divided time zones with each zone having a letter designation and the military phonetic alphabet word.

E-2.   The time zone for Greenwich, England is the letter "Z," and the military phonetic word is "Zulu." Since many U.S. military operations coordinate across times zones, the military uses Coordinated Universal Time (formerly Greenwich Mean Time) as the standard time. The U.S. military refers to this as Zulu (Z) time and attaches the suffix to ensure the related time zone is clear.

E-3.   When referring to specific military time zones, speak the letter or word attached. As an example, if a military exercise began at 3:00 P.M. Zulu time; or "fifteen hundred hours Zulu time" and written as 1500Z.

E-4.   The time zones from the U.S. are Romeo, Sierra, Tango, Uniform, Victor, Whiskey, and X-Ray. Local time uses the letter J or Juliet. The written format for 9 A.M. local time is 0900J and spoken as "Zero 900 hours Juliet time." The Lima time zone designator does not equate to local time. See Time Zone chart, Figure E-1 on page E-2, for the location of Lima time zone.

E-5.   Some countries have a 15, 30, or 45-minute offset from the designated time zone designator. Although located in the Delta time zone, Juliet time in Afghanistan is Coordinated Universal Time +4 hours 30 minutes. An asterisk behind the affected time zone designator denotes that a Juliet offset is in effect. See Time Zone Chart for affected regions. Record as 0430D* or 190430RDEC13* within a Date Time Group.

MILITARY TIME ZONE CONSIDERATIONS

E-6.   While conducting military operations, spectrum managers must consider all rules for determining a specific time. The following are some consideration to be aware of—
- The military observes daylight savings time when recognized by the state or country.
- The 12 time zones west of the Zulu time zone (coordinated universal time), starting from the International Date Line and ending in the Pacific Ocean are November through Yankee.
- The 12 time zones east of the Zulu time zone (coordinated universal time), starting at the International Date Line and ending in the Pacific Ocean are Alpha through Mike.
- 12 A.M. can be both 0000 and 2400 hours. However, clocks that display military time always display it as 0000.

E-7. Many countries use military time as their primary time format. European, African, Asian, and Latin American countries commonly use military time as their prime time format. Some countries use both the 12 and 24-hour clock. Figure E-1 shows the world map and military zone designators for each zone.
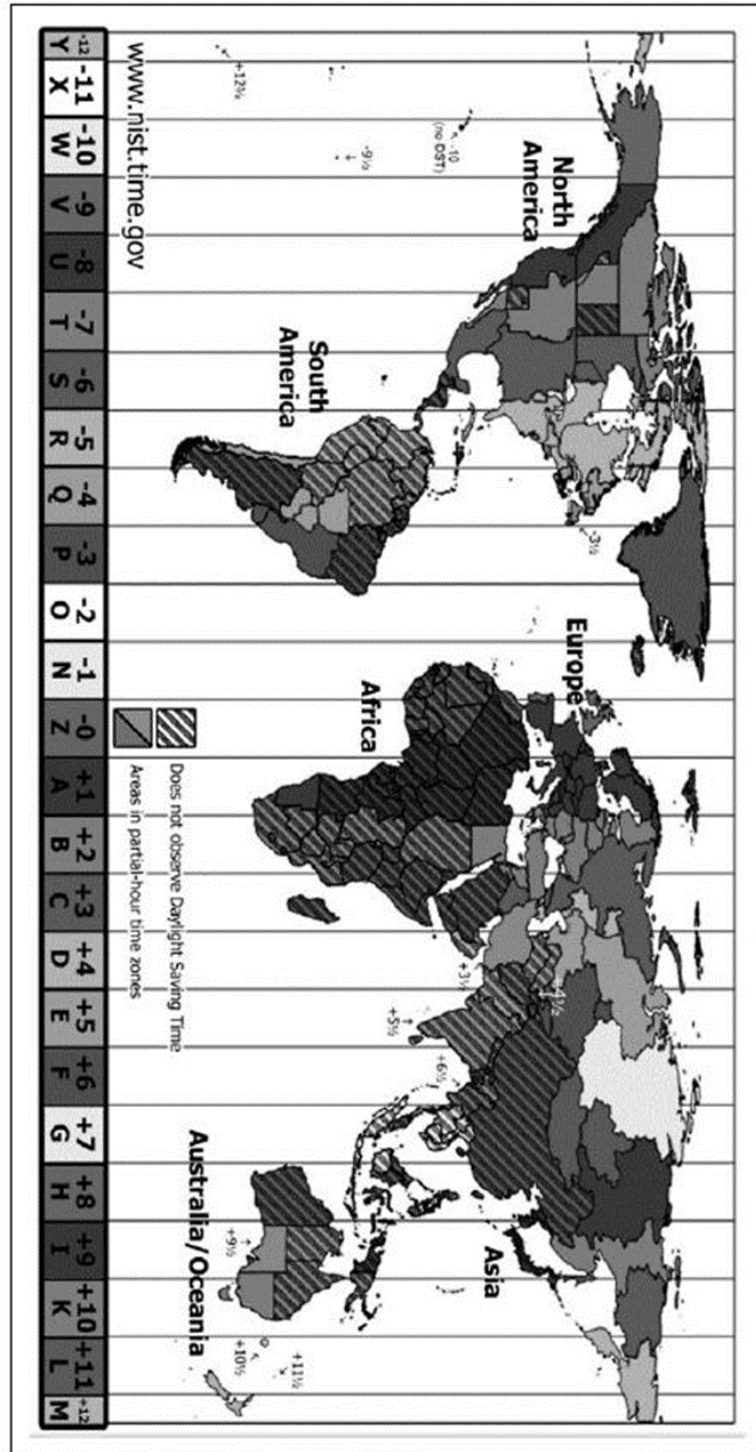

Figure E-1. World military time zone designator chart

E-8.   Table E-1 outlines each time zone around the world and provides its relationship to Zulu time.

Table E-1. Example of world time zone conversion (standard time)

Military Time Zone Designators																								
Y	X	W	V	U	T	S	R	Q	P	O	N	Z	A	B	C	D	E	F	G	H	I	K	L	M
Civilian Time Zones																								
IDLW	NT	HST	ASDT	PST	MST	CST	EST	AST	NST	AT	WAT	UTC	CET	EET	BT	ZP4	ZP5	ZP6	WAST	CCT	JST	GST	SBT	IDLE
1200	1300	1400	1500	1600	1700	1800	1900**	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200*

Standard Time=Universal Time + Value from Table								
Z	0	E	+5	K	+10	P	-3	U	-8
A	+1	F	+6	L	+11	Q	-4	V	-9
B	+2	G	+7	M	+12	R	-5	W	-10
C	+3	H	+8	N	-1	S	-6	X	-11
D	+4	I	+9	O	-2	T	-7	Y	-12

* =Today   ** =Yesterday

Legend
ASDT-Alaska Standard Time
AST-Atlantic Standard Time
AT-Azores Time
AWST-Australian Western Standard Time
BT-Baghdad
CCT-China Coast Time
CET-Central European Time
CST-Central Standard Time
EET-Eastern European Time

EST-Eastern Standard time
GST-Guam Standard Time
HST-Hawaii Standard Time
IDLE-International Date Line East
IDLW-International Date Line West
JST-Japan Standard Time
MST-Mountain Standard Time
NST-Newfoundland Standard Time
NT-Nome Time

PST-Pacific Standard Time
SBT-Solomon Island Time
UTC-Coordinated Universal Time
WAST-West Africa Time Zone
WAT-West Africa Time
ZP-4 Azerbaijan, Oman, Mauritius
ZP-5 Maldives, Pakistan, Tajikistan
ZP-6 Bangladesh, Kazakhstan

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Appendix F

Joint Task Force Considerations

Modern warfare is inherently a joint operation. Joint operations require precise coordination and establishment of procedures for effective spectrum use. This chapter describes the information and products for planning, coordination, and control of the spectrum at the joint task force level.

SPECTRUM MANAGERS WITHIN A JOINT TASK FORCE

F-1.   Spectrum manager assignments within a joint task force include the JFMO and the JSME. These agencies have a wide variety of inputs, collaboration, and products. Figure F-1 describes the spectrum management workflow between organizations in a joint task force environment. The following paragraphs contain an in-depth look at the workflow between organizations in a joint task force environment.
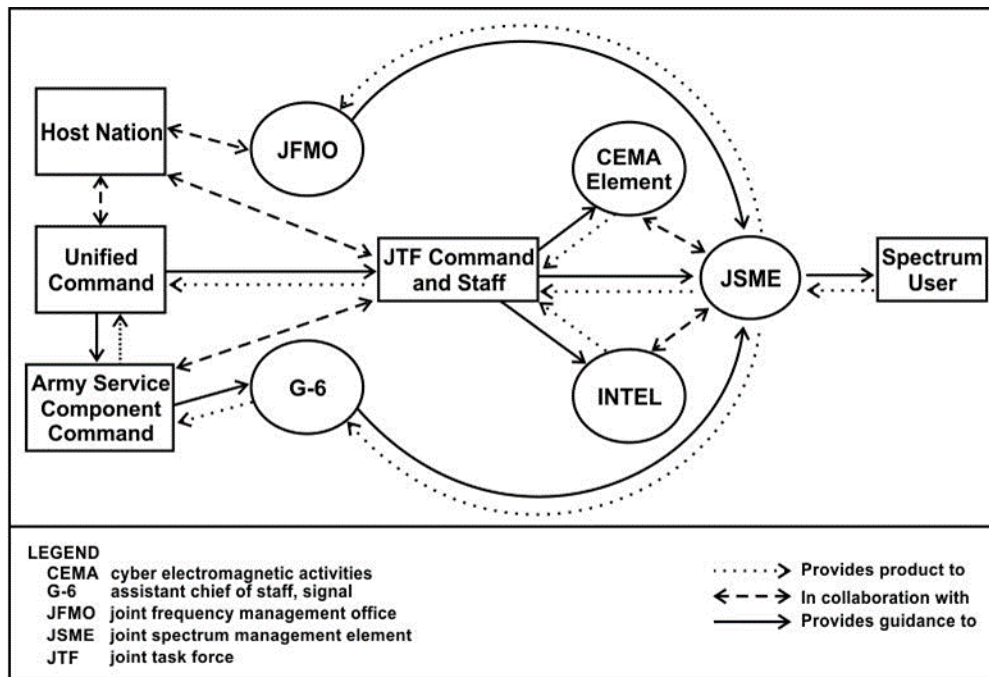

Figure F-1. Interagency workflow in a joint task force environment

JOINT FREQUENCY MANAGEMENT OFFICE

F-2.   The JFMO is a permanent organization within the area of responsibility of a combatant command. The JFMO Chief is a Department of the Army Civilian. Action officers staff the JFMO and are responsible for exercising the core functions of joint electromagnetic spectrum management operations (JEMSMO)— spectrum management, frequency management, joint spectrum interference resolution, and host-nation coordination. The JFMO staff size varies and is dependent on regional requirements. Figure F-2, on page F-2, shows a basic structure of the JFMO.
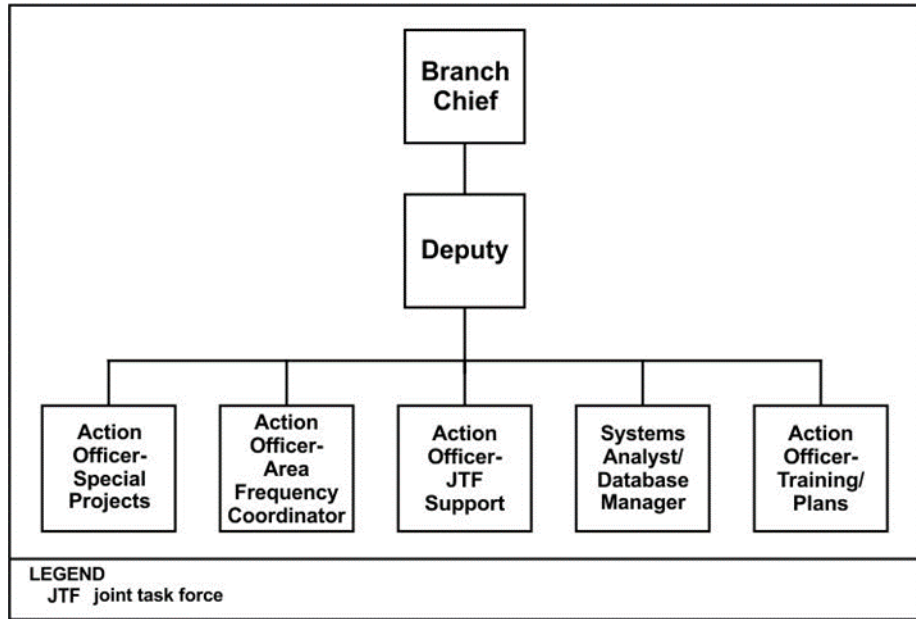
Figure F-2. JFMO structure

F-3.   Table F-1 shows the inputs to the JFMO by the agency. The table provides the agency, the action conducted, and the input the agency provides.

Table F-1. Agency inputs to the JFMO

Agency	*Action*	*JFMO Inputs*
Combatant Command	Provides guidance and direction	JCEOI
JTF staff, JSME	Provides	Inputs to develop a JTF JRFL
JSME	Receives	Frequency proposals
Joint staff, civil-military operations (J-9), host nation	Provide input and responsible for	Host nation frequency authorizations
Spectrum users experiencing EMI	Submit	JSIR report
Legend EMI electromagnetic interference JCEOI joint communications-electronics operation instructions JFMO joint frequency management office JRFL joint restricted frequency list JSIR joint spectrum interference resolution JSME joint spectrum management element JTF joint task force		

F-4.   Table F-2 shows a sample of the products of the JFMO and includes the agency and action taken.

Table F-2. Products of the JFMO

Agency	*Action*	*JFMO Products*
Spectrum users	Provides guidance and direction	Administrative and technical support for spectrum use
JTF staff, JSME, spectrum users	Provides guidance and direction	JCEOI
JTF staff, JSME	Provides guidance and direction	The Spectrum Plan, to include frequency use, reuse, and sharing schemes
JFMO	Provides guidance and direction	• Frequency assignments and allotments • Production and management of common spectrum use databases • The JRFL, upon approval from Joint Staff, Operations (J-3) • Mitigation assistance for EMI suffered
Legend EMI electromagnetic interference JCEOI joint communications-electronics operation instructions JFMO joint frequency management office JRFL joint restricted frequency list JSIR joint spectrum interference resolution JSME joint spectrum management element JTF joint task force		

Note. For more information on the JFMO, see JP 6-01.

JOINT SPECTRUM MANAGEMENT ELEMENT

F-5.   The JSME is a temporary organization that activates only for the duration of a specific joint task force mission. Members of the JSME, assigned to the joint communications control center of the JTF, can come from the J-6 staff, the ASCC staff, or from an external corps or division G-6. The service designated as having operational control of a JTF may task its senior spectrum manager as the JSME lead. Upon designation, that service's spectrum management office assumes the roles and responsibilities of the JSME.

F-6.   Spectrum management personnel from coalition forces and the other services augment organizations designated as a JSME during deliberate planning using the global force management process. Initial augmentation during the crisis action-planning phase of operations may come from joint enablers such as the JSC, the Joint Electronic Warfare Center, or directly from the combatant command, J-6 JFMO. Depending on the size of the force structure supported, JSME end strength ranges from three to ten military service members.

F-7.   The JSME establishes JTF specific guidance for the JEMSMO functions and the JCEOI. The JSME develops the JRFL by gathering requirements from J-2, J-3, and J-6 for approval by the J-3. The JSME has the authority to either issue frequency assignments or allotments, or delegate this authority. However, the JSME must ensure that components overlapping geographic areas do not assign multiple frequencies on the same radio frequency band.

F-8.   The JSME maintains the common spectrum-use database required for planning and coordinating access to the EMOE. This database includes spectrum-use information of friendly, military and civilian, enemy, and neutral forces.

F-9.   The JSME ensures that assigned joint task forces receive sufficient access to the spectrum to execute their designated missions. The JSME satisfies spectrum needs and provides frequency deconfliction, before assignment or allotment, of all SDDs, including systems used by the joint task force and component forces,

such as the United Nations, the North Atlantic Treaty Organization, and coalition forces. The JSME provides additional support based on strategic agreements between DOD, the U.S. mission, and the host nation. Table F-3, shows the agency inputs to the JSME. See JP 6-01 for more information on the JSME.

Table F-3. Agency inputs to the JSME

Agency	*Action*	*JSME Inputs*
JTF commander, JFMO	Provide guidance/ direction	JCEOI Guidance
JTF STAFF	Responsible for	Inter service considerations, such as data formats, tools in use, frequency request procedures.
J-6	Provide Guidance / Direction	Nets to be included on the JCEOI
Component Commanders	Receive Guidance / Direction from	Friendly Force Spectrum use requirements and call words for inclusion on the JCEOI
Joint Staff, Intelligence (J-2)	Responsible for	Priority of intelligence gathering requirements
Spectrum Users	Provide Input	JRFL requirements
Spectrum Users Experiencing EMI	Provide Input	JSIR report
JTF Staff and various databases	Provide Guidance / Direction for	Spectrum use information on all friendly military and civilian, available enemy, and neutral forces
Spectrum Users	Responsible for	Requests for frequency authorization, modification, and deletion
JFMO	Provide Guidance / Direction for	Frequency allocations
CEMA ELEMENT	Responsible for	Instances of hostile EW
J-3	Provide Guidance / Direction for	Spectrum user priority
Joint staff, civil-military operations (J-9), Host Nation	Provide	Host Nation spectrum authorization
Legend CEMA cyberspace electromagnetic activities EMI electromagnetic interference EW electronic warfare J-2 intelligence directorate of a joint staff; intelligence staff section J-3 operations directorate of a joint staff J-6 communications system directorate of a joint staff JCEOI joint communications-electronics operation instructions JFMO joint frequency management office JRFL joint restricted frequency list JSIR joint spectrum interference resolution JSME joint spectrum management element JTF joint task force		

Note. Collaboration and coordination with varying agencies, especially host nations, occurs through a variety of processes. These processes are generally very formal and setup through the fostering of mutual trust and rapport between the JFMO and the host nation. The spectrum manager must keep in mind customs and cultures, tact and courtesy, and the concerns of other agencies while still attempting to obtain the spectrum resources necessary for the mission. The spectrum manager must also maintain accurate records of all dialogue and agreements made with the host nation.

F-10. Table F-4 shows some of the products produced by or for the JSME. These products include the data call message, JCEOI, and the spectrum plan.

Table F-4. Products of the JSME

JSME Products	Action	Agency
The JRFL, upon approval from J-3 and JFMO	Develop and disseminate product	Spectrum users
Spectrum requirements data call message	Provides guidance and direction	Spectrum users
JSIR assistance	Provides guidance and direction	Spectrum users
Annex K of the OPORD, upon JTF commander approval	Provides guidance and direction	Spectrum users
JSIR report	Disseminates product	JFMO
Frequency proposals	Disseminates product	JFMO
Frequency assignments and allotments for stationary units and those on-the-move or at-the-quick- halt	Provides guidance and direction	Spectrum Users
The Spectrum Plan, to include frequency use and reuse and sharing schemes	In collaboration with	JTF Staff, Spectrum Users
JCEOI	Provides guidance and direction	Spectrum Users
Frequency usage conflict identification, risk assessment, COA recommendations, and deconfliction	Identified in collaboration with	CEMA Element
Definition of EMOE	Identified in collaboration with	Joint Staff
Live spectrum monitoring	Disseminated product	JTF Commander

Legend
CEMA   cyberspace electromagnetic activities   COA   course of action   EMOE   electromagnetic operational environment   J-3   operations directorate of a joint staff   JCEOI   joint communications-electronics operation instructions   JFMO   joint frequency management office   JRFL   joint restricted frequency list   JSIR   joint spectrum interference resolution   JSME   joint spectrum management element   JTF   joint task force   OPORD operation order

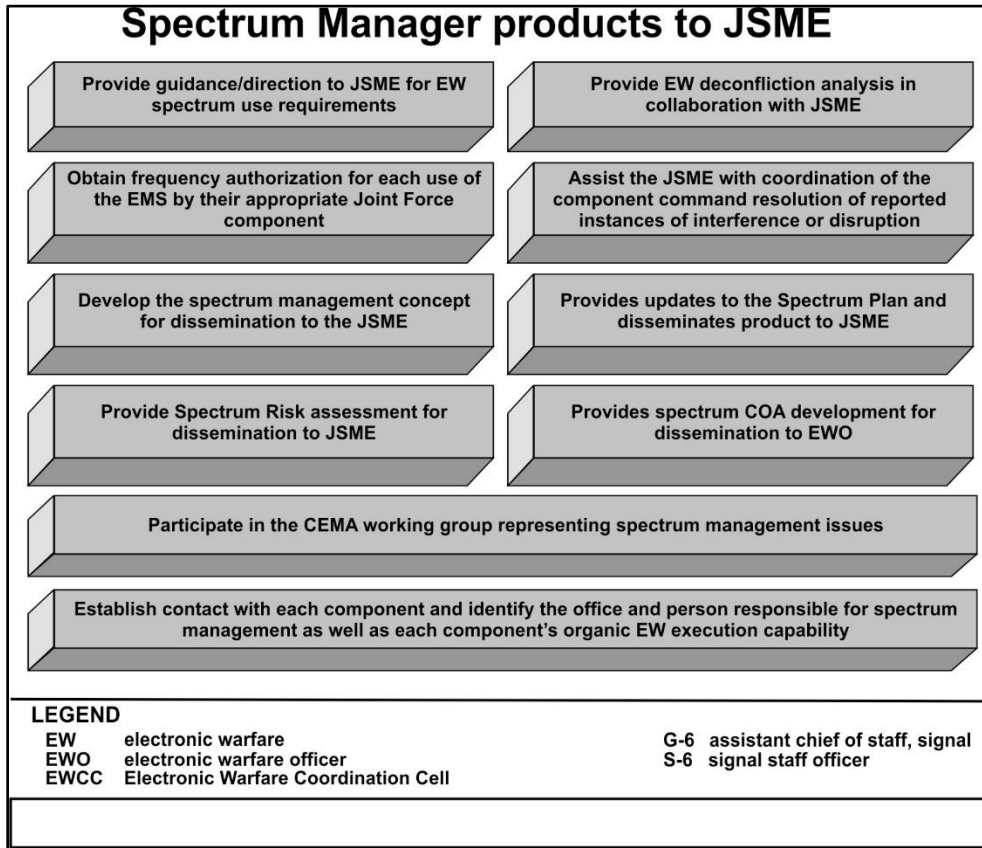F-11. Figure F-3 shows the spectrum manager input to the JSME.

Spectrum Manager products to JSME

Provide guidance/direction to JSME for EW spectrum use requirements

Provide EW deconfliction analysis in collaboration with JSME

Obtain frequency authorization for each use of the EMS by their appropriate Joint Force component

Assist the JSME with coordination of the component command resolution of reported instances of interference or disruption

Develop the spectrum management concept for dissemination to the JSME

Provides updates to the Spectrum Plan and disseminates product to JSME

Provide Spectrum Risk assessment for dissemination to JSME

Provides spectrum COA development for dissemination to EWO

Participate in the CEMA working group representing spectrum management issues

Establish contact with each component and identify the office and person responsible for spectrum management as well as each component's organic EW execution capability

LEGEND
EW   electronic warfare   G-6   assistant chief of staff, signal
EWO   electronic warfare officer   S-6   signal staff officer
EWCC Electronic Warfare Coordination Cell

Figure F-3. Spectrum manager inputs for a JSME

SPECTRUM MANAGEMENT SUPPORT TO DEFENSE SUPPORT OF CIVIL AUTHORITIES

F-12. Army Defense Support of Civil Authorities (DSCA) encompasses all support provided by the components of the Army to civil authorities within the U.S. and its possessions and territories. DSCA includes support provided by the Regular Army, Army Reserve, and Army National Guard when in Title 10 or Title 32 status. United States Code Title 10, Armed Forces, enables the Army to organize lawfully, train, equip, and conduct operations in coordination with other military services, federal departments, and agencies. United States Code Title 32, National Guard, consist of National Guard forces conducting DSCA while under the authority of the specific State. Army forces conduct DSCA in response to requests from federal, state, local, and tribal jurisdictions for domestic incidents, emergencies, disasters, designated law enforcement support, and other domestic activities (ADP 3-28).

F-13. Spectrum management in support of domestic operations requires liaison with state, municipal, local, and tribal authorities as well as first responders. Spectrum management for domestic operations within the U.S. must comply with a complex legal, regulatory, and policy environment. United States Northern Command (USNORTHCOM) and United States Indo-Pacific Command (USINDOPACOM) are the principal planning agents for DSCA and have the responsibility to provide joint planning and execution directives for peacetime assistance rendered by DOD within their assigned areas of responsibility. The other combatant commands provide capabilities to USNORTHCOM and USINDOPACOM for DSCA as directed by the Secretary of Defense.

F-14. Various resources may provide spectrum management support when Army forces are operating within the homeland. The separate joint forces headquarters for each state retains responsibility for forces

operating within that state or territory. The National Guard (NG) J-6 spectrum management branch is the office responsible for coordinating and planning spectrum management for NG forces and provides support to the state's spectrum managers for domestic operations. The NG J-6 spectrum management branch provides coordination between the State's spectrum managers and all federal agencies. NG J-6 authorizes state spectrum managers direct liaison with the Army frequency management office or the Army spectrum management office. Spectrum managers from a joint task force headquarters form a JSME in support of operational task forces under state active duty, dual status (Title 32 or Title 10) domestic operations.

F-15. Activated forces, after acquiring frequency assignments, may operate both civil and military systems within an AO to achieve interoperability with other Federal agencies and civil authorities. NG forces may request frequency assignments through the NG, or through Title 10 military channels depending on their duty status for a given operation. The National Telecommunications and Information Administration controls the spectrum within the homeland. They certify and license civilian usage of the electromagnetic spectrum. Similar to numerous states, local agencies, and federal agencies, NG forces and U.S. Coast Guard may operate both civil and military systems within a domestic area of operations.

F-16. After receiving orders to conduct movement for a domestic operation, each operational element initially contacts their local state spectrum manager or JSME for a JCEOI extract detailing the frequencies and procedures to use for communications. The regional spectrum manager or the JSME submits a SFAF request for frequencies on behalf of the end user. A state's qualified spectrum manager provides spectrum management for a given geographical state to the greatest extent possible. Spectrum managers coordinate for regional operations, and spectrum deconfliction for operations adjacent to another spectrum manager's area of responsibility. Local spectrum managers form the JSME and work directly for the incident commander (or the regional state joint force headquarters before the appointment of an incident commander).

F-17. Domestic operations lessons learned have demonstrated that both unity of effort and coordinated spectrum management are critical to the success of the operation. Congress and the DOD, through the implementation of a dual-status commander (commander of both Title 32 NG forces, and Title 10 NG and active Army forces for a domestic operation) have addressed unity of effort. Unity of command is not applicable between Federal military forces and the state NG, but the achievement of unity of effort is possible if the President and the Governor formally agree to appoint a dual-status commander. Established federal authorities allow a designated dual-status commander to serve in a hybrid Federal and state status. A dual-status commander is usually a National Guard officer who given simultaneous, but separate authorities over Federal and state military forces. Spectrum management for a domestic operation requires consolidation under one JSME, (or at a minimum coordinated Title 10 and Title 32 JSMEs led by the same commander) to minimize confusion and provide seamless support to tactical communications.

F-18. The JSME initially assigned to an incident continues to work for the incident commander as the operation transitions to a different duty status or legal authority, to ensure continuity of spectrum management. Typically, a state Governor or Adjutant General creates a standing joint task force including a JSME or establishes a joint task force with a JSME in response to an incident. Optionally, each state builds its JSME from qualified spectrum managers and equipment from within the state National Guard's tables of distribution and allowance allotment. If a state does not have qualified spectrum managers, the Adjutant General and Governor may request that trained spectrum managers deploy from other states, forming a JSME under a formalized emergency management assistance compact. The JSME may require a spectrum flyaway team from the NG Bureau J-6 and USNORTHCOM to supplement the element.

F-19. Figure F-4, on page F-8, provides a graphic of the collaboration process during domestic operations.

Note. See JP 3-28 and JP 6-01 for more information regarding domestic operations.
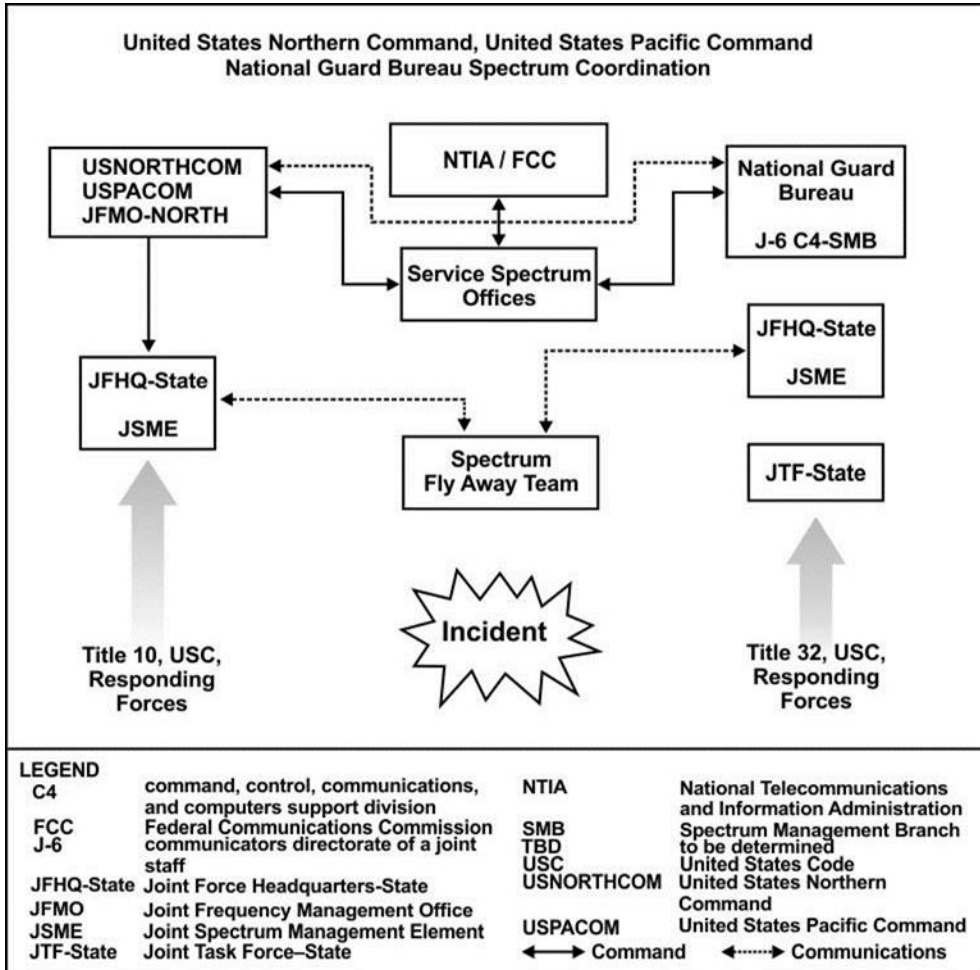
Figure F-4. Spectrum management support during domestic operations

Glossary

The glossary lists acronyms and terms with Army or joint definitions. Where Army and joint definitions differ, (Army) precedes the definition. The proponent publication for terms is listed in parentheses after the definition. This publication is not the proponent for any terms.

SECTION I – ACRONYMS AND ABBREVIATIONS

ACES	automated communications engineering software
AESOP	Afloat Electromagnetic Spectrum Operations Program
AO	area of operations
C2	command and control
CEMA	cyberspace electromagnetic activities
CEOI	communications-electronics operation instructions
CEWO	cyber electronic warfare officer
CJSMPT	coalition joint spectrum management planning tool
COA	course of action
COP	common operational picture
CSV	comma separated values
DOD	Department of Defense
EA	electronic attack
EMI	electromagnetic interference
EMOE	electromagnetic operational environment
EP	electronic protection
EW	electronic warfare
EWPMT	electronic warfare planning management tool
G-2	assistant chief of staff for intelligence
G-3	assistant chief of staff for operations
G-6	assistant chief of staff for signal
G-39	information operations element
GEMSIS	Global Electromagnetic Spectrum Information System
GHz	gigahertz
HERF	hazards of electromagnetic radiation to fuels
HERO	hazards of electromagnetic radiation to ordinance
HERP	hazards of electromagnetic radiation to personnel
HN	host nation
HNSWDO	Host Nation Spectrum Worldwide Database Online
Hz	hertz
IO	information operations

IOWG	information operations working group
IRC	information-related capability
J-3	operations directorate of a joint staff
J-6	communications systems directorate of a joint staff
JACS	joint automated communications electronics operation instruction system
JCEOI	joint communications electronics operation instructions
JFMO	joint frequency management office
JEMSMO	joint electromagnetic spectrum management operations
JRFL	joint restricted frequency list
JSC	joint spectrum center
JSIR	joint spectrum interference resolution
JSIRO	joint spectrum interference resolution online
JSME	joint spectrum management element
kHz	kilohertz
MANCAT	multi spectral ambient noise collection and analysis tool
MC4EB	Military Command, Control, Communications & Computers Executive Board
MCEB	Military Communications Executive Board
MDMP	military decision making process
MHz	megahertz
NCE	network centric environment
NCO	noncommissioned officer
NG	National Guard
NIPRNET	Non-classified Internet Protocol Router Network
NTIA	National Telecommunications and Information Administration
OPLAN	operation plan
OPORD	operation order
RF	radio frequency
S-2	battalion or brigade intelligence staff officer
S-3	battalion or brigade operations staff officer
S-6	battalion or brigade signal staff officer
S2AS	Spectrum Situational Awareness System
SDD	spectrum dependent device
SFAF	standard frequency action format
SINCGARS	single-channel ground and airborne radio system
SIPRNET	SECRET Internet Protocol Router Network
SMO	spectrum management operations
SOI	signal operating instructions
SPEED	systems planning, engineering, and evaluation device
SSRF	standard spectrum resource format
XML	extensible markup language

SECTION II – TERMS

cyber electromagnetic activities

The process of planning, integrating, and synchronizing cyberspace and electronic warfare operations in support of unified land operations (ADP 3-0)

direction finding

A procedure for obtaining bearings of radio frequency emitters by using a highly directional antenna and a display unit on an intercept receiver or ancillary equipment. (JP 3-13.1)

electromagnetic environmental effects

The impact of the electromagnetic environment upon the operational capability of military forces, equipment, systems, and platforms. Also called E3. (JP 3-13.1)

electromagnetic interference

Any electromagnetic disturbance, induced intentionally or unintentionally, that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics and electrical equipment. Also called EMI (JP 3-13.1)

electromagnetic operational environment

The background electromagnetic environment and the friendly, neutral, and adversarial electromagnetic order of battle within the electromagnetic area of influence associated with a given operational area. Also called EMOE. (JP 6-01)

electromagnetic spectrum

The range of frequencies of electromagnetic radiation from zero to infinity. It is divided into 26 alphabetically designated bands. Also called EMS. (JP 3-13.1)

electromagnetic spectrum control

Coordinated execution of joint electromagnetic spectrum operations with other lethal and nonlethal operations that enable freedom of action in the electromagnetic operational environment. (JP 3-13.1)

electromagnetic spectrum management

Planning, coordinating, and managing joint use of the electromagnetic spectrum through operational, engineering, and administrative procedures. (JP 6-01)

electronic attack

Division of electronic warfare involving the use of electromagnetic energy, directed energy, or antiradiation weapons to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability and is considered a form of fires. Also called EA. (JP 3-13.1)

electronic protection

Division of electronic warfare involving actions taken to protect personnel, facilities, and equipment from any effects of friendly or enemy use of the electromagnetic spectrum that degrade, neutralize, or destroy friendly combat capability. Also called electronic protection. (JP 3-13.1)

electronic warfare

Military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. Also called EW. (JP 3-13.1)

electronic warfare support

Division of electronic warfare involving actions tasked by, or under the direct control of, an operational commander to search for, intercept, identify, and locate or localize sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition, targeting, planning, and conduct of future operations. Also called ES. (JP 3-13.1)

frequency allocation

An 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 radio communication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned. (NTIA Redbook)

frequency allotment

An entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radio communication service in one or more identified countries or geographical areas and under specified conditions. (NTIA Redbook)

frequency assignment

The authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions. (NTIA Redbook)

frequency deconfliction

A systematic management procedure to coordinate the use of the electromagnetic spectrum for operations, communications, and intelligence functions. Frequency deconfliction is one element of electromagnetic spectrum management. (JP 3-13.1)

frequency proposal

A proposed frequency assignment which is in the approval process (upon approval it becomes a frequency assignment). (MCEB Pub 8)

guarded frequencies

A list of time-oriented, enemy frequencies that are currently being exploited for combat information and intelligence or jammed after the commander has weighed the potential operational gain against the loss of the technical information. (JP 3-13.1)

host nation

A nation which receives the forces, supplies of allied nations or North Atlantic Treaty Organization organizations to be located on, to operate in, or to transit through its territory. Also called HN. (JP 3-57)

joint electromagnetic spectrum management operations

Those interrelated functions of frequency management, host nation coordination, and joint spectrum inteference resolution that together enable the planning, management, and execution of operations within the electromagnetic operational environment during all phases of military operations. Also called JEMSMO. (JP 6-01)

joint electromagnetic spectrum operations

Those activities consisting of electronic warfare and joint electromagnetic spectrum management operations used to exploit, attack, protect, and manage the electromagnetic operational environment to achieve the commander's objectives. Also called JEMSO. (JP 6-01)

joint restricted frequency list

A time and geographically oriented listing of TABOO, PROTECTED, and GUARDED functions, nets, and frequencies and limited to the minimum number of frequencies necessary for friendly forces to accomplish objectives. Also called JRFL. (JP 3-13.1)

joint spectrum interference resolution

A process designed to mitigate or define the procedures to mitigate Electromagnetic interference (EMI) that regularly hampers the mission command of military or non-military operations by degrading essential systems that use the electromagnetic spectrum. Since EMI can be caused by enemy, neutral, friendly, or natural sources, it generally must be resolved on a case-by-case basis. The intent of the JSIR procedures (CJCSM 3320.02D) is to mitigate EMI incidents at the lowest possible level within the command structure. However, when the cause and recipient of the interference are not within the same component force or supporting element, resolution may require assistance from the combatant command, joint task force (JTF), Service Spectrum Management Headquarters or higher levels of authority. Also called JSIR. (MCEB Pub 8)

military decision making process

An interactive planning methodology to understand the situation and mission, develop a courses of action, and produce an operation plan or order. (ADP 5-0)

protected frequencies

Friendly, generally time-oriented, frequencies used for a particular operation, identified and protected to prevent them from being inadvertently jammed by friendly forces while active electronic warfare operations are directed against hostile forces. (JP 3-13.1)

spectrum management operations

(Army) The interrelated functions of spectrum management, frequency assignment, host nation coordination, and policy that together enable the planning, management, and execution of operations within the electromagnetic operational environment during all phases of military operations. Also called SMO. (FM 6-02)

standard frequency action format

Used for DOD radio frequency proposals, assignments, modifications, renewals, reviews, and deletions. Will be replaced by the standard spectrum resource format. Also called SFAF. (MC4EB Pub 7)

standard spectrum resource format

A format for exchanging data related to spectrum management within the DOD. Will replace the Standard Frequency Action Format. Also called SSRF. (MCEB Pub 8)

TABOO frequencies

Any friendly frequency of such importance that it must never be deliberately jammed or interfered with by friendly forces including international distress, safety, and controller frequencies. (JP 3-13.1)

unified action partners

Those military forces, governmental and nongovernmental organizations, and elements of the private sector with whom Army forces plan, coordinate, synchronize, and integrate during the conduct of operations. (ADP 3-0)

warfighting function

A group of tasks and systems (people, organizations, information, and processes) united by a common purpose that commanders use to accomplish missions and training objectives. (ADP 3-0)

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WEBSITES

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