LINK 16 ELECTROMAGNETIC COMPATIBILITY FEATURES CERTIFICATION MANUAL

Volume 1: Processes and Requirements

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VERSION 2

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DEPARTMENT OF WAR
6000 Defense Pentagon
Washington, D.C. 20301-6000

CHIEF INFORMATION OFFICER

FOREWARD

This Link 16 Electromagnetic Compatibility Features Certification Manual, Volumes 1 and 2, is issued under the authority of DoD Directive 5144.02, "DoD Chief Information Officer (DoD CIO)," November 21, 2014, Incorporating Change 1, September 19, 2017. It delineates the process, specifies the requirements, and promulgates procedures for the certification and acceptance testing of the Electromagnetic Compatibility (EMC) Features of Link 16 Terminals.

This manual applies to the Office of the Secretary of War, the Military Departments, the Chairman of the Joint Chiefs of Staff, the Combatant Commands, the Office of the Inspector General of the Department of War, the Defense Agencies, the DoW Field Activities, and all other organizational entities in the DoW (hereafter referred to collectively as the "DoW Components").

This manual is effective immediately and is mandatory for use by all the DoW Components involved in the certification of Link 16 Terminal EMC features and their integration into host platforms.

The DoW Components, other Federal Agencies, and the public may download the manual from (https://dodcio.defense.gov/Library/)

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SECTION 1: GENERAL INFORMATION

1.1. APPLICABILITY.

This volume applies to the Office of the Secretary of War, the Military Departments, the Chairman of the Joint Chiefs of Staff, the Combatant Commands, the Office of the Inspector General of the Department of War, the Defense Agencies, the DoW Field Activities, and all other organizational entities in the DoW (hereafter referred to collectively as the "DoW Components").

1.2. PURPOSE.

It is DoW policy according to DoD Instruction 4650.01 to implement spectrum management for Link 16 Terminals, with specific focus on EMC Features certification as stipulated in the Memorandum of Agreement between the DoD and the Department of Transportation. The Link 16 EMC Features certification requirement of Interdepartment Radio Advisory Committee Document (IRAC) 33583 is a prerequisite for uncoordinated operation of Link 16 equipment in the United States and possessions.

This Link 16 Electromagnetic Compatibility (EMC) Features Certification Manual, Volume 1 and Volume 2, serve as a uniform source of procedures for the certification and acceptance testing of Link 16 Terminals pursuant to DoD Instruction 4650.01.

This manual delineates the process, specifies the requirements, and promulgates procedures for the certification and acceptance testing of the Electromagnetic Compatibility (EMC) Features of Link 16 Terminals.

This volume provides the processes and requirements for Link 16 EMC Features certification.

SECTION 2: RESPONSIBILITIES

2.1. DOW CHIEF INFORMATION OFFICER (DOW CIO).

The DoW CIO oversees the Link 16 EMC Features Certification Program.

Establishes and maintains the Link 16 EMC Features Certification Manual Volumes 1 and 2.

2.2. CHIEF OF NAVAL OPERATIONS (CNO).

The CNO provides funding resources to the Navy Marine Corps Spectrum Center (NMSC) for Joint Link 16 spectrum certification. The CNO provides funding resources to the Naval Information Warfare Systems Command (NAVWAR) as the Certification Authority (CA) and Technical Authority (TA) for Joint Link 16 EMC Features certification responsibilities.

2.3. DOW RESOURCE SPONSORS.

The DoW Resource Sponsors plans, programs, and budgets for incorporation and testing of Link 16 EMC Features in Link 16 Terminals and platforms.

2.4. NMSC.

The NMSC:

a. Under the oversight of the DoW CIO and the Joint Staff, NMSC serves as the DoW Spectrum Management single point of contact with the National Telecommunications and Information Administration (NTIA) and the Federal Aviation Administration (FAA) for Link 16 operations; to include the processing of Temporary Frequency Authorizations (TFAs) for non-Stage 4 systems and oversight of spectrum certification submissions. Service Spectrum Management Offices (SMOs) shall keep NMSC informed of their Link 16 Spectrum Planning Subcommittee (SPS) certification requests, EMC Features Certification packages and any approved written deviation requests by providing copies for awareness prior to submission to the NTIA SPS WG-1. All TFAs and test requests will be processed through NMSC in accordance with established procedures documented in the Chairman of the Joint Chiefs of Staff Instruction 6232.01F and Chairman of the Joint Chiefs of Staff Manual 6235.01.

b. Assists the Programmatic Authority (PA) to implement requirements for emitted radio frequency (RF) signal provisions into Link 16 Terminals and platforms as outlined in EL-CID application guidance in the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, Sections 10.8.1 through 10.8.8.

2.5. CA.

The CA:

a. CA is the authority to independently verify products meet established standards and comply with applicable certification requirements and policy, as well as documenting potential operational impacts for each identified EMC Features related deviations.

b. NAVWAR Office of the Chief Engineer (5.0) functions as the CA and serves as the DoW authority regarding Link 16 EMC Features self-certification.

c. Relies on inputs, review, and recommendations from PA/CA to determine the level of testing required in accordance with Appendix 3B: Link 16 EMC Features System Test Boundary Plan and ensure Link 16 systems meet standards/specifications and waveform compliance in support of DoW self-certification of Link 16 EMC Features.

d. Assists the PA to implement requirements for EMC Features during Link 16 Terminal development, integration, and operations.

e. Issues EMC Features certification letters to the PA upon satisfactory completion of certification requirements in accordance with this DoW CIO Link 16 EMC Features Certification Manual Volume 1 and Volume 2.

2.6. TA.

The TA:

a. TA is the authority, responsibility, and accountability to establish and monitor technical standards, tools, and processes in conformance with applicable policy, requirements, architectures and standards as outlined in the References section.

b. NAVWAR TA is embedded within the NAVWAR CA Certification team. TA also resides within the various Program Offices in the role of embedded NAVWAR 5.0 Assistant Project Managers for Engineering (APM-Es) and/or lead engineers.

c. Provides relevant and independent technical assessments throughout the systems engineering lifecycle to support the PA and CA.

d. Provides expert technical review, observation and adjudication of applicable objective quality evidence (OQE) (certification test plans, test results, technical supporting documentation, etc.) to support the CA's ability to make a certification decision.

2.7. PA.

The PA:

a. PA is the authority to manage programs and projects from concept to disposal, including oversight of cost, schedule and performance. PA is exercised by Program Executive Officers (PEO) and Program Manager (PM).

b. The PA is the responsible organization for Link 16 Terminal development, procurement, or integration; the PA can be government or industry.

c. Submits the Equipment Location - Certification Information Database (EL-CID) through the Service chain of command to the respective service Spectrum Management Office (SMO) through the spectrum management process for processing and review. All Stage 4 Applications must be submitted with the CA EMC Features Certification letter, data package, and applicable deviation documentation.

d. Coordinate with the TA regarding technical specifications to apply to contractual documentation related to Link 16 EMC Features development (for new equipment), changes (for existing equipment), or platform integration.

e. Generate and submit all requests for deviation from specification (DFS) of EMC Features or RF emissions requirements and related documentation to NAVWAR TA for review and consideration towards the EMC Features certification of the Terminal.

f. Ensure coordination with TA/CA in requirements reviews and technical interchange meetings (TIMs) where Link 16 EMC Features will be discussed, and all certification or regression testing and platform verifications of Link 16 EMC Features or RF emissions.

2.8. SERVICE SMOS.

The SMOs:

a. Review and coordinate PA submissions of the EL-CID record, the CA EMC Features certification letter, EMC Features data package, and applicable deviation documentation through their service chain of command, and the NTIA SPS for processing and approval in accordance with established procedures documented in the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management.

b. Generate a draft Certification of Spectrum Support document to provide with the Link 16 system EL-CID for submission to the NTIA SPS. As part of the Link 16 Terminal spectrum certification SMO shall review any applicable antenna and platform co-site information to verify compliance with NTIA policy and FAA requirements for operations within the National Airspace System (NAS).

SECTION 3: PROCEDURES

3.1. LINK 16 EMC FEATURES CERTIFICATION PROCESS.

a. Introduction.

Link 16 EMC Features certification and subsequent Stage 4 Spectrum certification are required for all Link 16 systems to be operationally fielded in accordance with the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management. This section outlines the required actions and steps to obtain Link 16 EMC Features certification for new, updated (enhanced), or redesigned equipment, and to obtain frequency assignments to operate the equipment in its intended facilities and platforms. These steps include the procedures for requesting and obtaining approval for DFS.

b. New Link 16 Equipment.

(1) This section illustrates the actions and responsibilities for Link 16 EMC Features certification of new or redesigned Link 16 equipment that are not covered by the engineering change process described in Paragraph 3.1.c., Engineering Changes to Link 16 Equipment.

(2) After a new Link 16 program or system is defined, the PA responsible for a Link 16 Terminal development/procurement program or the integration PA (if a new Link 16 capability is being designed and integrated into a platform acquisition program) shall incorporate the EMC Features description, performance, and testing requirements listed in Sections 3.2 and 3.3, and Link 16 EMC Features Certification Manual Volume 2 into the acquisition documentation for the Link 16 Terminal. These performance and test requirements shall form the basis for Link 16 EMC Features certification.

(3) The PA responsible for the Link 16 procurement or integration contract shall include the requirements for EMC Features development and certification in their contractual documentation. The statement of work (SOW) for the proposed Link 16 procurement shall include the requirement to comply with EMC Features requirements in the Link 16 EMC Features Certification Manual Volumes 1 and 2. EMC Features performance requirements defined in Sections 3.2 and 3.3 shall be incorporated into procurement specifications. Contract Data Requirements List (CDRL) items or equivalent shall include the following:

(a) Appendix 3A: Link 16 EMC Features Whitepaper Template. A technical document developed by the vendor/PA containing the software (SW), firmware (FW), and hardware (HW) configuration including features or changes introduced in the configuration to be certified. Continuing revisions to this document shall include the EMC Features design and implementation.

(b) Link 16 EMC Features Certification Test Plan. A general EMC Features Test Plan is provided in Volume 2 and could be tailored as necessary and used as the basis for a program EMC Features Certification Test Plan. Alternative PA proposed test approaches may be used upon CA approval.

(c) Link 16 EMC Features Test Procedures. The CA shall approve the test methodology and observe required witness certification testing. To improve and expedite certification testing, industry is encouraged to develop their test procedures and data in collaboration with the TA/CA.

(d) Link 16 EMC Features Test Report. This is an annotated version of the test procedure with detailed descriptions of the test methodologies, completed data entries, and attached test data.

(e) Acceptance Test Procedures (ATPs) and Acceptance Test Reports (ATRs) (EMC Features and emitted RF signal provisions only).

(f) As necessary, technical reports addressing unforeseen EMC Features design deviation or performance concerns.

(4) The frequency assignment process begins with the submission of the EL-CID through the service chain of command in accordance with DoD Instruction 4650.01, and applicable service directives/instructions. All applications for Link 16 equipment shall be initiated by the acquisition PA as soon as there is a service approved requirement and then be submitted to its respective Service SMO.

(5) The PA responsible for the procurement or integration contract shall ensure coordination of TA participation in EMC Features design and test planning reviews (e.g., preliminary design review (PDR)). NAVWAR TA shall have access to applicable design specifications via a Whitepaper and test plans/objectives.

(6) The PA responsible for the certification test of EMC Features shall provide the NAVWAR TA/CA with the Link 16 EMC Features certification test procedures and data package at least 60 days before the certification test of Link 16 Terminal EMC Features and emitted RF signals. EMC Features certification test setups and methods will form the basis of ATP test setups and methods. The EMC Features certification test report and ATP shall be provided to NAVWAR TA for review and coordination within 60 days of test completion.

(7) The CA shall certify that Link 16 Terminals meet the EMC Features certification requirements upon satisfactory completion and documentation of all requirements in Sections 3.2 and 3.3. The test and measurement results of the ATP shall be consistent with the results from the EMC Features certification test. The CA shall provide an EMC Features Terminal certification letter to the acquisition PA for submission per Paragraph 3.1.b.(8) below. This letter shall address the configuration that is being certified (to include HW, FW and SW versions/serial numbers (SNs)), and if applicable, identify any deviations from specification associated with the Link 16 Terminal.

(8) After completion of the EMC Features certification process, the acquisition PA shall submit the Stage 4 EL-CID with the CA EMC Features certification letter, the data package and applicable DFS to its respective Service SMO for processing with NTIA. The PA shall maintain all Terminal EMC Features certification documentation and upon request, provide copies to its respective Service SMO for submission to NTIA.

c. Engineering Changes to Link 16 Equipment.

(1) This section illustrates the actions and responsibilities for Link 16 EMC Features certification of enhancements or upgrades to Link 16 equipment. Enhancements include equipment HW, FW, or SW upgrades/modifications affecting RF emissions or impacting EMC Features performance and functionality. If such enhancement/upgrade results in a condition where the Terminal cannot meet any portion of the requirements of Sections 3.2 and 3.3, an application must be made for a DFS in accordance with Paragraph 3.1.e., before the EMC Features can be certified and to obtain subsequent Stage 4 approval.

(2) When HW, FW, or SW engineering changes are proposed for a Link 16 Terminal/platform with a prior EMC Features certification, the acquisition PA responsible for a Link 16 Terminal development/procurement, or the integration PA, shall leverage embedded engineering TA to evaluate changes for impact on emitted RF signals or EMC Features. Such changes would include the following but are not limited to:

- HW changes in the transmit chain that can affect the transmitted signal or spectrum,
- SW changes that can affect or be interrelated to code that performs any of the EMC Features algorithms,
- EMC Feature monitor threshold determination,
- EMC SW controls,
- EMC Features fault counts or EMC Features Fault Report timing, and
- HW that has any association with the EMC Features related HW or that hosts FW/SW.

Appendix 3B: Link 16 EMC Features System Test Boundary Plan (STBP) provides guidance on determining whether engineering changes to the Terminal have the potential to impact EMC Features along with proposed testing guidelines on impacted area. If the engineering changes have no potential to affect EMC Features, the PA shall notify CA of this determination. If CA determines that further evaluation is needed, a TIM will be conducted to determine the appropriate level of testing. The CA will schedule the TIM within 10 working days of making the further evaluation of the associated engineering change.

(3) If it is determined that the engineering change has the potential to affect Terminal/platform EMC Features or emitted RF signals, the PA shall provide analysis and/or regression test plans for EMC Features or emitted RF signal impacts. The TA/CA will review the documentation and prescribe the required certification level of effort in accordance with STBP. This level of effort will be sent back to the requesting PA for consideration.

(a) The PA responsible for the procurement or integration contract once the engineering change impacting EMC Features is mature and ready for government level input, shall ensure the TA participates in EMC Features requirements reviews, EMC Features design reviews, and TIMs where the engineering change will be discussed, and that the scope and approach for the certification is coordinated with the TA.

(b) The PA responsible for the procurement or integration contract shall submit EMC Features documentation related to the engineering change to the NAVWAR TA for review and comment. This documentation shall include the following items: Whitepaper, regression test plan as determined by the application of the System Test Boundary Plan, test procedures, and test report.

(c) At least 60 days before regression testing of the Terminal EMC Features, the responsible PA shall provide the NAVWAR TA the regression Test Plan. At least 30 days before the regression testing, the responsible PA shall provide the NAVWAR TA with the test schedule and regression test procedures for review and coordination. The CA shall approve the test methodology and observe required witness certification testing. To improve and expedite certification testing, industry is encouraged to develop their test procedures and data in collaboration with the TA/CA. The NAVWAR TA typically provides feedback within 30 days after receipt of the documentation.

(4) Upon satisfactory completion and documentation of all development and test requirements above, the CA shall provide to the acquisition PA a certification letter verifying continued compliance with the requirements of Section 3.2. The acquisition PA shall forward the CA certification letter and any relevant data package to their Service SMO through their service chain of command for submittal to the NTIA SPS. Upon receipt of the CA certification letter, the Service SMO shall generate a draft update to the current Stage 4 EL-CID to identify the configuration change.

(5) If a prior DFS has been corrected or implemented, the CA shall generate a certification letter verifying compliance with Section 3.2 to the PA. The acquisition PA office shall forward the CA certification letter and data package to their Service SMO through their service chain of command for submittal to the NTIA SPS. Upon receipt of the CA certification letter, the Service SMO shall generate a draft update to the current Stage 4 EL-CID to identify the configuration change. If the DFS had resulted in operational restrictions and was certified to be corrected by the CA, the Service SMO shall notify user activities to resubmit frequency assignment requests to remove the restrictions.

d. Platform Integration of Link 16 Equipment.

(1) This section illustrates the actions and responsibilities for platform integration of Link 16 equipment.

(2) After a new Link 16 platform integration requirement is identified, the PA responsible for the platform integration shall incorporate the following NTIA platform integration requirements from the SPS Working Group One (WG-1) TR-03-001, SPS 14216, EMC Certification Guidance and Requirements for JTIDS/MIDS TDMA Equipment into the platform acquisition documentation and specifications:

(a) Multiple operator actions required for selection of a mode other than Full EMC Protection mode during a mission.

(b) Multiple operator actions required for selection of high power mode (if applicable).

(c) Provisions for operator EMC Features Reset of Transmit inhibits per the operator action requirements.

(d) Provisions for extraction of the EMC Features Log (stored in Terminal memory) of transmit inhibits, the identity of EMC Features faults and EMC Features Built-in Test (BIT) failures, occasions when the Terminal is switched from a Full EMC Protection mode to Exercise EMC Features mode or Combat mode, and instances when the Terminal is placed in the high power mode (if applicable).

(e) Provisions for notch filters and low-level detector (LLD) blanking interfaces, where required.

(f) Verification documents for Link 16 Terminal platform co-site compatibility with navigation and Air Traffic Control (ATC)/surveillance equipment.

(3) The platform integration PA responsible for the integration contract shall submit documentation related to the platform integration requirements of Paragraph 3.1.d.(2) to NMSC and their Service SMO.

(4) The PA responsible for the platform integration, with their Service SMO oversight, shall review the applicable description of platform characteristics in EL-CID and notify the responsible PA to update the application with any changes to the pertinent platform information/type. At a minimum, this information shall include the platform name, certified Link 16 waveform SW version number (i.e., integrated build (IB) or equivalent nomenclature), antenna cable loss, antenna gain characteristics for all platform antennas that radiate the Link 16 RF waveform, and a description of all of the applicable platform provisions in Paragraph 3.1.d.(2) and the information required as outlined in the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management Section 10.8. Notch filter attenuation and insertion loss information shall be included, if applicable.

(5) The Service SMOs shall verify that the platform integration documentation incorporates the requirements of Paragraph 3.1.d.(2) and shall forward the platform integration data to NTIA as part of the certification of Spectrum Support package (see Paragraph 3.1.h.)

(6) DFS to platform integration requirements shall be handled in accordance with Paragraph 3.1.e., DFS.

e. DFS.

(1) Specifications are engineered requirements such as performance, capability, type of materials, dimensional clearances, vibration levels, and physical arrangement to which Link 16 components are purchased, installed, tested, and maintained. All Terminals are designed and constructed to specific technical and physical requirements. It is imperative that every effort be made to maintain all Terminal systems and components to their designed specifications. There are occasions where the applicable specification cannot be met. In these cases, the nonconformance to specifications is controlled with a DFS. DFSs are discouraged because they may result in a frequency assignment that further restricts equipment operations from the levels specified in the NTIA Joint Tactical Information Distribution System/Multifunctional

Information Distribution System (JTIDS/MIDS) Time Division Multiple Access (TDMA) Architecture and Waveform Spectrum Support Certification, Interdepartment Radio Advisory Committee Document (IRAC) 33583/6 (e.g., restricted functionality, operating hours, and/or operating areas.) Therefore, it is incumbent upon the acquisition/integration PA and vendors to discuss potential DFS as early as possible (prior to the work close out or component assembly) to determine direction of actions and alternatives to the DFS. Every effort must be made to correct each deficiency prior to equipment or system shipment and subsequent operation to prevent additional restrictions from being placed on the use of the equipment. This section describes the process for handling all nonconforming conditions to Link 16 EMC Features and emitted RF signal requirements.

(2) When a conflict exists between specifications, the governing requirement shall be determined by the CA on a case-by-case basis. This manual, along with the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, are provided to assist in determining the governing specification. The PA or vendor submits a DFS to report, requesting approval and clearance of the nonconformance to specification conditions with supporting documentation to enable a technical evaluation of the DFS request and final adjudication from the TA/CA (reference Appendix 3C).

(3) The PA or vendor shall be responsible for tracking the DFS until it is approved or disapproved.

(4) The PA or vendor shall be responsible for tracking and/or updating all approved DFS relating to its systems or components until cleared or cancelled. DFSs shall be cleared as soon as possible based on

- Condition has been corrected.
- Condition is no longer applicable as a result of an alteration
- Condition is no longer applicable as a result of a change in the specification that originally resulted in the DFS request

(5) All DFSs shall be reported and controlled. The DFS shall be retained and tracked by a unique SN in an auditable fashion by CA to reflect the specific non-compliance issue impacting EMC Features.

(6) The CA shall include all identified EMC Features related DFS in the EMC Features certification letter with an associated impact assessment for each identified EMC Features related deviation.

(7) CA will submit approved DFS in support of Stage 4 request as outlined in the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management.

f. Frequency Assignments.

The NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management describes the procedures for user activities to request frequency assignments. It should be noted that requests for temporary frequency authorizations (TFAs), submitted prior to completion of

the NTIA Stage 4 certification process, will be considered for coordinated operations under potentially restricted conditions.

g. EMC Features Audit.

(1) CA may perform an EMC Features audit. This audit will ensure that no unauthorized changes have been made to the equipment or platform that could adversely affect the equipment EMC Features or emitted RF waveform and will verify the continuing accuracy and completeness of the equipment ATP. If the CA finds there are unauthorized changes, those changes shall be subject to the requirements identified in Paragraph 3.1.e.

(2) The CA shall afford the applicable PA and contractor at least four weeks advance notice of each EMC Features audit. The PA shall also ensure contracts contain appropriate language authorizing audits at the contractor's facility.

h. Information Requirements.

Table 1 summarizes the information required by the CA to perform Link 16 Terminal and platform EMC Features and RF emissions certification. Items in bold italics are submitted to the Service SMO as part of the DoW spectrum certification package. The Service SMO will then forward the package containing these items to NTIA for Stage 4 approval.

Table 1. Information Requirements for Link 16 EMC Features and RF Emissions

New Link 16 Terminals (Paragraph 3.1.b.) • EMC Features performance requirements in procurement specifications o Link 16 EMC Features Whitepaper o Link 16 EMC Features Qualification Test Plan o ***Link 16 EMC Features Qualification Test Procedures*** o ***Link16 EMC Features Qualification Test Report*** o ***Link 16 Terminal ATP (EMC Features and emitted RF signal provisions only)*** o ***Electromagnetic Interference (EMI) Test Report*** o SPS Stage 4 Submission Package o ***CA EMC Features Certification Letter*** o Draft Certification of Spectrum Support Document
Link 16 Terminal Engineering Changes (Paragraph 3.1.c.) o Link 16 EMC Features Whitepaper o Regression Test Plan o ***Qualification Test Procedures/Regression Test Procedures*** o ***Regression Test/Qualification Retest Report*** o ***CA EMC Features Certification Letter*** o (Updated) SPS Stage 4 Submission Package o Draft Certification of Spectrum Support Document
Link 16 Terminal Integration (Paragraph 3.1.d.)

- Platform Acquisition Documentation and Specifications for:
  - Selection of a mode other than Full EMC Protection mode during a mission
  - Selection of high power mode (if applicable)
  - Provisions for operator reset of Transmit inhibits
  - Provisions for extraction of records (stored in Terminal memory) of Transmit inhibits, EMC Features faults, EMC Features BIT failures, occasions when the Terminal is switched from a Full EMC Protection mode to Exercise EMC Features mode or Combat mode, and instances when the Terminal is placed in the high power mode (if applicable)
  - Provisions for notch filters and LLD suppression (blanking) interfaces (where required)

DFS (Paragraph 3.1.e.)

- ***CA Approved DFS*** (if applicable)

Operations and Maintenance Procedures

EMC Features BIT Procedures (for platforms operating 24/7)

- *Records of:
  - Transmit inhibits
  - EMC Features faults and EMC Features BIT failures
  - Occasions when the Terminal is switched from Full EMC Protection mode to Exercise EMC Features mode or Combat mode
  - Enabling of high power mode operations (if applicable)

* Records must be kept for a period no less than one year as outlined in the System Planning Subcommittee Working Group One (SPS WG-1) TR-03-001, SPS 14216, EMC Certification Guidance and Requirements for JTIDS/MIDS TDMA Equipment. For Terminals that have a data log built into its non-volatile memory, written records of these occurrences are not required. If not, written copies must be maintained at the end-user level.

3.2. LINK 16 EMC PROTECTION FEATURES (EPF) CERTIFICATION PERFORMANCE SPECIFICATION.

a. Scope.

(1) This document provides Link 16 time division multiple access (TDMA) spectrum, equipment design, and verification requirements to ensure that transmissions are electromagnetically compatible to operate with military and civil systems in the 960 megahertz (MHz) to 1215 MHz band. The requirements defined herein describe the minimum waveform characteristics and equipment features that must be incorporated into Link 16 equipment and be operational when Link 16 is instantiated[1] for certification to operate in the 960 to 1215 MHz band. In cases where these requirements are not incorporated or cannot be met, DFS shall be submitted in accordance with Paragraph 3.1.e.

(2) This document is intended for use directly in, or as guidance for preparation of Link 16 Terminal procurement documents (e.g., SOW and specifications). A Link 16 Terminal is any configuration of HW and SW/FW that is capable of producing the Link 16 waveform. A Terminal configuration can include an external power amplifier (EPA). This EPA shall meet all the applicable requirements prescribed in this manual.

(3) These specifications pertain to Link 16 systems designed after the initial Multifunctional Information Distribution System (MIDS) Low Volume Terminal (LVT) production procurement, including applications of the Link 16 RF waveform in multi-waveform capable equipment. The conditions and requirements for the transmission of Link 16 signals are established by the NTIA Joint Tactical Information Distribution System/Multifunctional Information Distribution System (JTIDS/MIDS) Time Division Multiple Access (TDMA) Architecture and Waveform Spectrum Support Certification, Interdepartment Radio Advisory Committee Document (IRAC) 33583/6, System Planning Subcommittee Working Group One (SPS WG-1) TR-03-001, SPS 14216, EMC Certification Guidance and Requirements for JTIDS/MIDS TDMA Equipment, and the Chairman of the Joint Chiefs of Staff Instruction 6232.01F.

(4) This document shall be used to facilitate the EMC Features certification process. Before each new Terminal model from each Terminal manufacturer can be approved for operation in the 960 to 1215 MHz band (unless otherwise authorized in the specific frequency assignment), the EMC Features, both SW and HW shall be certified by the designated DoW EMC Features CA. The EMC Features data shall be collected during EMC Features certification testing, which shall be in accordance with the Link 16 EMC Features Certification Manual Volume 2.

(5) This document defines the Link 16 RF signal output, which includes spectral characteristics of the Link 16 waveform (Paragraph 3.2.b.), and the functional requirements for the EMC Features (Paragraphs 3.2.c. through 3.2.g.) The EMC Features includes built-in

[1] There is an exception. The operation of the EMC Features can be suspended after power on and before start net entry or coarse synchronization as long as the Link 16 isolation is applied.

functions that monitor certain RF characteristics of the pulsed Link 16 waveform and cause the Terminal to inhibit transmissions via an EMC Features failure when out-of-tolerance conditions are detected. This document also includes requirements for the testing of the EMC Features and spectral characteristics to verify the EMC compliance of the Terminal (DoW CIO Link 16 EMC Features Certification Manual Volume 2). A Test Plan is provided in Section 2.2 in Volume 2. This Test Plan will be used to facilitate the generation of test procedures required for the EMC Features certification process.

(6) This document provides the algorithm for the frequency remapping (FR) capability (Section 3.3). FR is a mandated requirement per the Memorandum of Agreement between Department of Defense and Department of Transportation regarding the 960-1215 MHz Frequency Band and the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management.

(7) The requirements specified herein apply to all operating environments (OEs) of the Terminal.

b. RF Signal Output Capability.

(1) Frequency Hopping.

(a) Link 16 operates normally in a frequency hopping mode (Communication Mode 1).

(b) When initialized to operate in the frequency hopping mode, the successive Link 16 pulses of the transmitted RF signals shall be hopped pseudo-randomly among 51 carrier frequencies or a minimum of 37 carrier frequencies under FR conditions.

(c) The Terminal shall process an adaptable parameter (AP) that allows or disallows carrier FR. The Terminal shall process an AP that identifies the frequencies to be remapped. The setting of these APs shall be independent of the selected EMC Protection mode AP. The Terminal shall transmit carrier frequencies using the DoW specified frequency selection algorithms.

(2) Output Power Modes No Greater Than 200 Watts (W) + Decibel (dB).

(a) The Terminal may transmit RF output power at one or more output power levels. The transmitted power level shall be limited to the selected power level. If the Terminal has the capability to operate in a mixed power mode, the transmitted power level shall be limited to the output power mode selected on a time slot by time slot basis. The Terminal shall have the capability to provide the host platform with the selected power mode information.

1. The Terminal shall provide an output power mode such that the peak output power summed from all Link 16 RF outputs of the Terminal shall not exceed 200 W + 1 dB.

2. For all Link 16 power modes, the Terminal peak output power summed from all the Link 16 RF outputs of the Terminal, which includes an EPA[2], shall be no more than the selected power + 1 dB. This peak output power level shall be defined as the instantaneous peak level across the top of a normally transmitted pulse. A minimum of 5.4 µs interval centered on the top of the pulses shall be used to measure the peak output power.

3. EPAs used to generate power levels less than 200 W + 1 dB shall, in conjunction with the Terminal, meet all EMC Features requirements as specified in this document.

(b) The Terminal shall transmit at the output power level identified by the output power mode AP. The Terminal shall have a capability allowing the host to change the output power mode as applicable. The Terminal shall have the capability to restrict the peak output power to 200 W + 1 dB or less.

(3) Output Power Greater Than 200 W + 1 dB.

Terminal implementations utilizing internal power amplifiers or EPAs that generate Link 16 power levels greater than 200 W + 1 dB shall meet all EMC Features requirements as specified in this document.

(4) Antenna Interface Signal Output.

(a) The Link 16 implementation shall use a single antenna mode, multiple antenna mode, or both. For the single transmit antenna mode, if two or more antenna ports are implemented, the Terminal shall provide Link 16 signals for transmission to the antenna port selected. For the multiple antenna mode, the Terminal may provide output power to both or all antenna ports in any specified proportion. If sets of antennas from an EPA are utilized in addition to antennas on the Main Terminal, then the peak output power level summed at the non-selected set of antennas shall be included in the overall calculated and measured peak power when assessing compliance with power and spectrum requirements in this manual. Multiple antenna modes refer to potential transmission on two antennas.

(b) For each selected power mode, as shown in Figure 1, during at least a 2.5 microsecond (µs) interval between pulses in each 13 µs period of a Link 16 message, the Link 16 peak output power summed from the Terminal antenna ports and EPA antenna ports shall be at least -80 dB relative to the peak output power of the transmitted Link 16 message pulses. The power of the Link 16 pulses shall be measured in a 3 MHz bandwidth (BW) centered on the carrier frequency. The power between the Link 16 pulses shall be measured in a 3 MHz BW across the 960 MHz to 1215 MHz band. In the case where pulse transmissions are suppressed, the interval becomes at least 15.5 µs and increases by multiples of 13 µs depending on the number of transmitted pulses between the last pulse transmitted before the suppression and the next pulse transmitted after the suppression.

[2] The term "EPA" is used to indicate a separate power amplifier from a Terminal that is capable of transmitting Link-16. This EPA shall meet all the requirements prescribed in this manual.

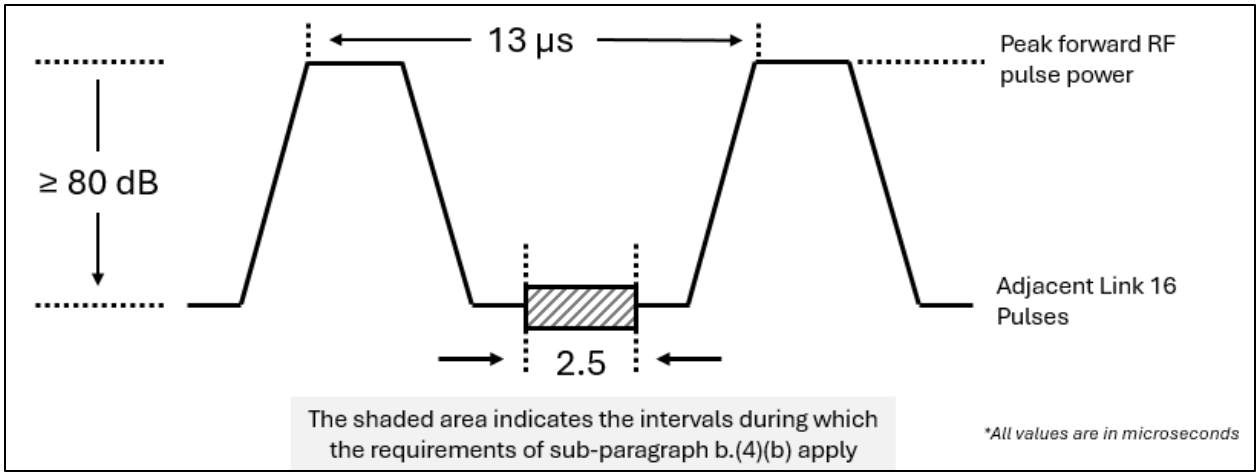


Figure 1. Link 16 Inter-Pulse Power Level Requirement

(c) As shown in Figure 2, after power is applied, the peak RF output power summed at the Terminal and EPA antenna ports shall not exceed -57 dB relative to one milliwatt (dBm), as measured in a 1 MHz resolution BW (RBW), exclusive of the following intervals. (This requirement shall not be construed as a waiver of Military Standard 461G.

1. The interval from five µs before the 50% voltage level of the leading edge of the first pulse to five µs after the 50% voltage level of the trailing edge of the last pulse of a Terminal commanded Link 16 message transmitted through the Terminal or EPA antenna ports.

2. The interval from five µs before the 10% voltage level of the earliest leading edge to five µs after the 10% level of the latest trailing edge of a Terminal commanded non-Link 16 waveform transmission through the Terminal or EPA antenna ports. For example, with tactical air navigation (TACAN) X-mode interrogations, this interval should be no more than 29 µs.

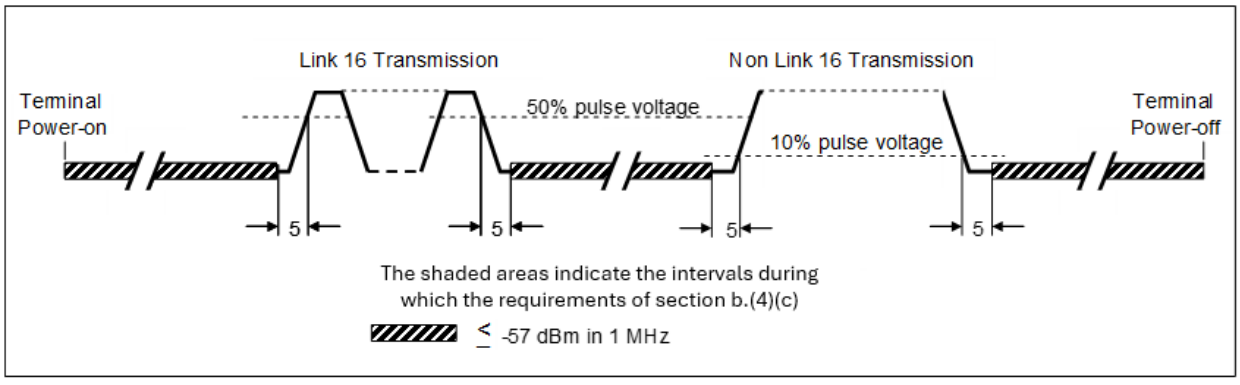


Figure 2. Inter-Message Structure Power Level Requirements

(5) RF Spectrum.

(a) When the Terminal is operating in each of its power modes, the Link 16 spectrum of any authorized Link 16 carrier frequency shall meet the requirements specified in Paragraph 3.2.b.(5)(b) and as illustrated in Figure 3. Spectrum levels shall be measured in 300 kilohertz (kHz) BW segments for a continuous phase shift modulation (CPSM) carrier output signal using random message content.

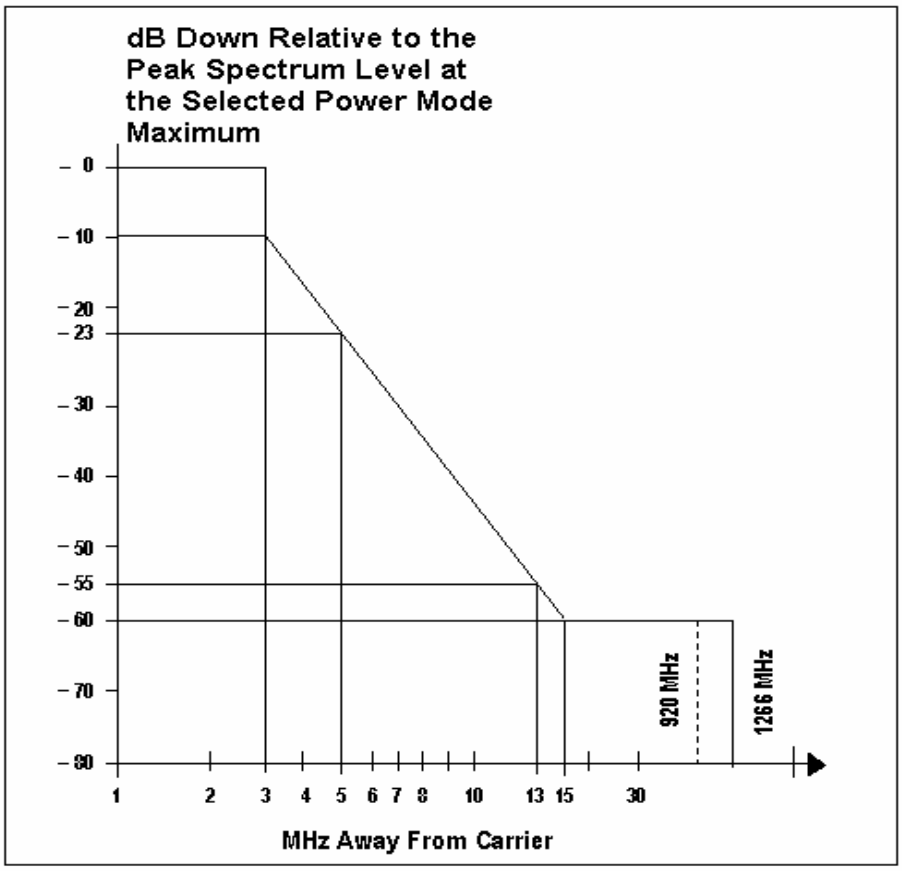


Figure 3. Link 16 Power Spectral Mask Within 920 to 1266 MHz

(b) The Link 16 single channel spectral characteristics shall be unrestricted from the carrier center frequency to ± 3 MHz exclusive. Relative to the peak power within ± 3 MHz of dB relative to the carrier (dBc), the spectral characteristics shall be at least -10 dBc at ± 3 MHz, at least -23 dBc at ± 5 MHz, at least -55 dBc at ± 13 MHz, and at least -60 dBc at and beyond ± 15 MHz from the carrier frequency. The spectrum requirements shall apply between 920 MHz and 1266 MHz.

(c) To enable verification of the spectral characteristics for each carrier center frequency, the Terminal, when controlled by test maintenance equipment, shall be capable of transmitting Link 16 messages at any single frequency (Communication Mode 2), which shall be any one of the 51 carrier frequencies.

(6) Out of Band (OOB) Emission Characteristics.

Except for the second and the third harmonics, the OOB harmonics and all other spurious emission below 920 MHz and above 1266 MHz shall be at least -80 dB relative to the level at the fundamental. The second and third harmonics shall be suppressed 50 + 10 log p (where p = peak power output in W at the fundamental) or 80 dB, whichever requires less suppression. These OOB emission requirements shall apply for each selected power level.

c. EPF Requirements - General.

The Terminal shall include independent, built-in monitoring called EMC Features, which has the ability to inhibit the transmission of Link 16 RF signals from the Terminal if the Link 16 signal characteristics are outside the tolerances given in this specification. The purpose of the EMC Features is to ensure that the Terminal complies with the appropriate National Frequency Authority requirements for spread spectrum Link 16 transmissions in the 960 to 1215 MHz band.

(1) The Terminal shall monitor all emissions, whether the single antenna mode or multiple antenna mode is selected for transmission, regardless of which output power mode is selected for transmission. The 1030/1090 MHz LLD, pulse width (PW), frequency, and power monitors shall measure the TDMA RF transmissions at a pickoff point located along the RF transmit path after all active components and all other components that could affect the pulse shape, frequency, or spectral characteristics, including all final combiners used to increase transmitter power. The pickoff point may be placed before a hybrid splitter, output filters, and devices used for antenna selection, providing it can be demonstrated, and that the Terminal incorporates provisions to ensure those components will not alter the RF characteristics of the TDMA waveform as measured at the pickoff point. The Terminal shall incorporate provisions such as an external monitor port in the pickoff point monitor line to verify this requirement and the (frequency dependent) path loss to the antenna ports should be ascertained.

(2) Out-of-specification conditions in the Link 16 transmission characteristics shall result in an EPF Fault Report. Except for operation in Combat mode, EMC Features faults shall result in a transmission inhibit as defined herein. Each EMC Features fault condition shall be identified by the specific EMC Feature monitor designed to detect that fault condition. Each EMC Feature fault and transmit inhibit shall be reported to the host/operator. EMC Features failure shall result in a transmit inhibit of Link 16 prior to the next time slot when operating in any EMC Features mode that is not Combat mode.

(3) The Terminal shall have special EMC Features signal input ports and special EMC Features monitor output ports (or equivalent input/output functionalities) so that verifications of the EMC Features monitors, and their corresponding BIT circuitry can be accomplished. Verifying that the Link 16 EMC Features capabilities operate as specified herein shall be possible with minimal disassembly of the Terminal. The disassembly of the Terminal shall be accomplished in a manner such that the integrity of the Terminal shielding does not affect the transmitted waveform so that the EMC test data is not compromised. The Terminal shall also have provisions to facilitate verification that RF characteristics are not altered between the pickoff point and antenna port.

(4) Calibration of the EMC Features monitors, and their corresponding BIT circuitry shall be possible with minimal disassembly of the Terminal. This calibration shall only be

performed by Depot or intermediate maintenance personnel. The Terminal design shall facilitate Depot-level calibration and checkout to assure conformance with the requirements in this document. Conducting ATP shall be possible without disassembly of the Terminal except where acceptance testing is performed at the shop replaceable unit (SRU) level.

(5) The EMC Features performance capabilities shall not be affected by any failure of the Terminal to perform Link 16 signal transmissions in accordance with system specification requirements. Failures in components that cause complete cessation of Link 16 transmissions are exempt from this requirement. Failure of an EMC Features component or function shall not affect the RF transmissions of the Terminal.

(6) If the Terminal supports one or more non-Link 16 waveforms, only the Link 16 waveform transmissions shall be affected by the Link 16 EMC Features functions.

(7) If the Terminal has integral ATC functions, the EMC Features shall not interfere with their performance requirements to operate in the NAS when exposed to their total intended signal environment. The embedded ATC functions shall not interfere with the proper operation of EMC Features.

(8) If the Terminal has integral non-TDMA or ATC equipment functions, the Terminal does not have to include special EMC Features that monitor the transmission of non-TDMA or ATC equipment pulses.

(9) If the Terminal includes an EPA used for Link 16 transmissions, it shall be considered an integral part of the Terminal and all the requirements in this document shall apply. The Terminal shall process and combine the EMC Features monitoring activities of both the EPA and the Terminal (if applicable) on a time slot by time slot basis. If a transmit inhibit results from EMC Features faults arising from either the Terminal and/or the EPA, transmission shall be inhibited from both the Terminal and the EPA until manually reset. However, if a transmit inhibit occurs from faults arising only from the EPA, it is acceptable to reinitialize to transmit through the Terminal if it has been demonstrated that the EPA cannot transmit or accept transmit commands from the Terminal. The converse is also true, if a transmit inhibit occurs from EMC Features faults arising only from the Terminal, it is acceptable to reinitialize to transmit through the EPA if the Terminal EMC Features fault condition does not pertain to the EPA Exciter transmission path and if it has been demonstrated that the Terminal cannot be commanded to transmit.

d. EMC Features Monitors and Monitoring Functions.

The EMC Features monitors or monitoring functions consist of capability to transmit (CTT), 1030/1090 MHz LLD, PW, frequency, uniform use of authorized carriers (UUAC), time slot duty factor (TSDF), output power restrictions, message structure restrictions, net number restriction, access restrictions, and relay restrictions.

(1) CTT Monitor.

(a) The CTT monitoring requirement is defined in terms of time intervals when the Terminal is capable to transmit Link 16 pulses within each 13 μs interval of a Link 16 message

transmission. The CTT monitor shall be active during all intervals in which the Terminal has not scheduled a Link 16 pulse transmit command to the power amplifier (i.e., between pulses and during all other time intervals when the Terminal is not capable to transmit Link 16 pulses as depicted in the shaded areas of Figures 1 and 2). It is acceptable to ignore (i.e., shall not increment the CTT event count specified in Paragraph 3.2.d.(1)(b) the outputs of the CTT monitors after power on and before start network entry (SNE) as long as the Link 16 waveform is isolated from the power amplifier. The intent of this function is to detect all unscheduled Link 16 transmissions that could result in non-compliance with Paragraphs 3.2.b.(4)(b) and 3.2.b.(4)(c). For the period between pulses, the CTT monitors shall indicate that the Terminal is not CTT during a period of at least 2.5 µs as specified in Paragraph 3.2.b.(4)(b). During periods where the pulses are suppressed, it is acceptable for the monitors to verify there is no CTT during the 2.5 µs intervals when the CTT monitor Operational BIT (OBIT) and the non-transmit time would normally be evaluated (i.e., the previous on-pulse CTT high-level verification) (see Figure 1). The Terminal shall perform CTT monitoring for CTT fault and transmit inhibit determination at intervals equal to 7.8125 millisecond (ms). All time periods within that 7.8125 ms interval shall be monitored and shall count toward a single CTT EMC Features fault determination. Upon EMC Features failure, transmit inhibit shall occur prior to the next time slot after the end of the CTT processing period.

(b) The Terminal shall include component monitors that measure the voltages, bias currents, or other signal characteristics of each stage of the RF power amplifier, including stages that may be bypassed because of the selected power mode. Each CTT monitor shall be capable of detecting whenever the status of these characteristics exceeds a level that is -10 dB relative to the normal level[3] at that monitoring point during a Link 16 transmission. The intent is to establish a stable threshold sufficiently below the normal transmission pulse level at the monitored point to ensure proper and reliable operation of each component CTT monitor. Monitoring of RF amplification stages must occur during each 13 µs interval. If one or more CTT monitors detect(s) CTT in a 13 µs period, a CTT EMC Features event shall be incurred.

(c) If the Terminal incorporates non-Link 16 capabilities (e.g., an integrated TACAN/Distance Measuring Equipment (DME) interrogator function), then when transmitting non-Link 16 waveforms, a CTT monitor(s) specific only to the Link 16 function shall be implemented. The output of other CTT monitors common to both the Link 16 and non-Link 16 functions can be ignored for the duration of the scheduled non-Link 16 transmissions, provided the output of the CTT monitor(s) specific to the Link 16 function is (are) not ignored. If the Terminal is initialized to operate only the Link 16 waveform, CTT monitor outputs shall not be ignored.

[3] For a current monitor or voltage monitor, the 10 dB calculation would be equal to 20*Log (Vtr/Vth) or 20*Log (Itr/Ith). For a power level monitor, this would equate to 10*Log (Ptr/Pth). (See definitions in Appendix 3). When utilizing a Log detector for power measurements, the 10 dB is defined as the CTT monitor level during normal transmissions minus the threshold level if the log response ratio is one to one. Otherwise, the slope needs to be taken into account. The analysis needs to take into account the worst-case frequency response of the RF detector.

(d) The Terminal shall incur a CTT EMC Features fault (and increment the CTT EMC Features fault count) if, at the end of a Link 16 time slot, the CTT EMC Features event count is two or more. If a transmit inhibit is incurred and at least one EMC Features fault is due to CTT, the supply voltage to the final stage of the power amplifier shall be removed or the Link 16 waveform generation shall be isolated in addition to a transmit inhibit. The removal of supply voltage or the application of Link 16 isolation to the power amplifier is not required during an identification friend or foe (IFF) emergency so that only precise participant location and identification (PPLI) messages can be transmitted (i.e., these messages are exempt from the EMC Features transmit inhibit requirement during an IFF emergency)[4]. If a CTT EMC Features fault requires that the voltage supply that is connected to the power amplifier be shut down, it is not necessary that the voltage on the capacitors be removed immediately as long as the Terminal inhibits transmission before the start of the next time slot. However, the voltage supply shall remain off or the isolation shall be applied until an Interference Protection Feature (IPF) Reset is manually initiated. It is acceptable that isolation of the Link 16 waveform generation from the Terminal power amplifier does not prevent transmission through the EPA as long as the fault that was generated by the Terminal was unrelated to the generation of the EPA exciter output signal and the Terminal output is no stronger than -57 dBm. Similarly, it is also acceptable that isolation of an EPA from the waveform generate function does not prevent transmission through the Terminal power amplifier as long as the fault generated in the EPA was unrelated to generation of the RF Amplifier (RFA) output signal. These capabilities shall be demonstrated to verify proper operation.

(e) The Terminal shall perform Start-Up BIT (SBIT) to verify that in the Link 16 "isolated" state, the Link 16 waveform is effectively isolated from RF amplification stages that are common to the Link 16 and the non-Link 16 waveform. With the isolator in the "not-isolated" position, the Terminal shall provide a Link 16 signal, or equivalent, into the isolator. The signal level shall not be less than that of a Link 16 signal during normal transmission. If the CTT monitor(s) that is/are specific only to the Link 16 signal generation indicate(s) that the signal is not within -2 dB relative to the minimum Exciter level, the Terminal shall report a failure of the BIT and incur a transmit inhibit. The isolator shall then be switched from "not isolated" to "isolated." With the isolator in the "isolated" position, the Terminal shall provide a Link 16 signal, or equivalent, into the isolator. If any CTT monitor following the isolator indicates CTT, the Terminal shall report a failure of the BIT and incur a transmit inhibit. Any CTT monitor can be used, including the Link 16 specific CTT monitor used to verify the test signal as long as it follows the isolator. This shall also be performed during operator manually Initiated BIT (IBIT).

(2) 1030/1090 MHz LLD Monitor.

[4] An IFF emergency is the result of any event which causes a pilot to either switch the IFF transponder to transmit an emergency code of 7700 or when a pilot ejects from the aircraft. On Link 16 equipped aircraft, PPLI messages are to be sent to assist in resolving the emergency. Under these conditions, the IFF transponder and the Link 16 PPLI transmissions shall not be inhibited.

(a) When operating in any of the power modes, the Terminal shall measure energy radiated within ±7 MHz of 1030 MHz and energy radiated within ±7 MHz of 1090 MHz during each 13 μs interval in which the Terminal commands transmission of a Link 16 pulse.

(b) The Link 16 RF measurements shall be made at a point along the RF transmit signal path that is after all active components and after all other components that could affect the pulse shape, frequency, or spectral characteristics, including all final combiners used to increase transmitter power. The pickoff point may be placed before a hybrid splitter, output filters, and devices used for antenna selection, providing those components cannot cause the RF characteristics of the Link 16 emission at the antenna port from being different than those at the pickoff point. However, the pickoff point shall not be placed after filters that reduce the signal level in the 1030 MHz and/or the 1090 MHz exclusion bands whether or not the filters are permanently installed.

(c) The threshold power shall be the radiated power of a pulse whose power level is -7 dBm as measured in a 3 MHz BW, and the PW rise and fall times of which are equivalent to that of a normally transmitted pulse. The threshold requirement can also be interpreted as being the output power level in a 300 kHz BW in the bands of 1030 ± 7 MHz or 1090 ± 7 MHz that exceeds -60 dB relative to the peak Link 16 pulse power based on a 200 W mode. For Terminals using a nominal level that is stronger than 200 W, the threshold requirement shall be the equivalent of -60 dBc with respect to the nominal power level (i.e., for the 1000 W power mode, the threshold requirement shall be 0 dBm or -60 dBc with respect to 1000 W). If during each 13 μs interval, the measured radiated power of a pulse within 7 MHz of 1030 or 1090 MHz summed through all antenna ports connected to the power amplifier utilized for message transmission exceeds this power threshold, the Terminal shall increment a 1030/1090 MHz EMC Features event count. The -7 dBm, 0 dBm, or the -60 dBc level is exclusive of the attenuation provided at 1030 MHz or 1090 MHz in notch filters incorporated within the Terminal.[5]

(d) If necessary, to ensure that Link 16 transmissions are not inhibited due to interference from co-located ATC transmitters, a pulse with excessive 1030/1090 MHz power does not have to be counted toward the 1030/1090 MHz fault count (i.e., the output of the LLD detector may be ignored) if at any point during the 13 μs interval, a 1030/1090 MHz LLD suppression signal[6] becomes active. This signal must not affect proper operation of any EMC Feature functions outside of LLD EMC Features event declaration during the applicable 13 μs interval. The LLD suppression signal, which is used to prevent false LLD EMC Features faults, is permissible for use only with ATC equipment operating in the 1030/1090 MHz bands and only while those systems are transmitting. When operating in the Full EMC protection mode, each transmitted Link 16 pulse that occurs when the LLD suppression signal is present shall increment a counter by one for each 13 μs interval. The counter shall not exceed 55,385 in any 12-second frame. The cumulative time of 55,385 13 μs intervals is equal to 6% of 12 seconds. If the limit is exceeded, and the Terminal is not operating under IFF emergency conditions, the Terminal

[5] During the 1030 MHz testing with 444 pulses, the droop test will be conducted to see if it is within 1 dB across the band. This was the most convenient place to insert the testing without impact. This test is a confirmation of the most conservative level for dynamic range testing, but there is not a pass or fail criteria for this test.

[6] This signal is typically referred to as an LLD or IPF suppression signal. In this manual, it will be referred to as the LLD suppression signal.

shall ignore LLD suppression for the remainder of the 12-second frame. The Terminal shall report such action to the host.

(e) The Terminal shall incur an LLD EMC Features Fault Report (and increment the LLD EMC Features fault count) if five or more 1030/1090 MHz LLD EMC Features event counts occur during a transmit time slot.

(3) PW Monitor.

(a) In each 13 μs interval in which the Terminal commands transmission of a Link 16 pulse, the Terminal shall measure the PW of the envelope of each transmitted pulse.

(b) The Terminal shall measure the PW of each pulse whose 100% power level is between at least +2 dB and -8 dB of the nominal power selected for transmission for each Link 16 message. PW monitor measurements shall be accurate over this range. The measurement shall be made at a point along the RF transmit path that is after all active components and all other components that could affect the pulse shape, frequency, or spectral characteristics, including all final combiners used to increase transmitter power and all circuits used for antenna selection. The pickoff point can be placed before a hybrid splitter and devices used for antenna selection providing those components cannot cause the RF characteristics of the Link 16 emission at the antenna port to be different than those at the pickoff point.

(c) The Terminal shall incur a PW EMC Features event whenever the PW is not within the range of 6.08 to 6.72 μs when measured at the 95% amplitude (90% power).

(d) If the amplitude of the pulse is weaker or stronger than the capability of the Terminal to accurately measure PW, or too narrow for the Terminal to accurately measure the 100% power level, it shall report a zero PW and incur a PW event count. The 100% power level shall be the average level of a pulse whose leading and trailing edges are equivalent to the transmitted pulse. In determining the 100% level, the Terminal shall use the average level measured over an interval of at least 3.2 μs. The Terminal shall determine the average level using at least 64 samples measured over this interval.

(e) If the Terminal fails to measure the PW of a Link 16 pulse it has commanded for transmission, it shall report a zero PW and increment the PW event count. Suppressed pulses[7] shall be treated as if they were never commanded.

(f) The Terminal shall incur a PW EMC Features fault (and increment the PW EMC Features fault count) if more than 32 PW EMC Features events are incurred in any group of 64 contiguous Link 16 pulses of a Link 16 message transmission. Suppressed pulses shall not be included in the 64 contiguous pulse train. It is not necessary that the 64 contiguous pulses used for this evaluation be carried over to a following time slot, although it is acceptable to do so.

[7] Suppressed pulses can be a fully suppressed pulse or a partially suppressed pulse to accommodate a priority ATC system transmission that occurs from the same power amplifier.

(4) UUAC.

(a) In each 13 µs interval in which the Terminal commands transmission of a Link 16 pulse, the Terminal shall measure the frequency of each transmitted pulse. The authorized carriers shall be the 51 frequencies unless fewer than 51 authorized carriers are specified by initialization. If fewer are specified, the authorized carriers shall be those determined by initialization in accordance with the methods specified in Section 3.3.

(b) The Terminal shall measure the frequency of each pulse whose 100% power level is between at least +2 dB and -8 dB of the nominal power selected for transmission for each Link 16 message. The measurements shall be accurate over this range. The measurement shall be made at a point along the RF transmit path that is after all active components and all other components that could affect the pulse shape, frequency, or spectral characteristics, including all final combiners used to increase transmitter power and all circuits used for antenna selection. The pickoff point can be placed before a hybrid splitter and devices used for antenna selection providing those components cannot cause the RF characteristics of the Link 16 emission at the antenna port to be different than those at the pickoff point.

(c) After the Terminal measures the frequency of each Link 16 pulse, it shall increment the count of one of at least 53 distinct bins. 51 of these bins correspond to the maximum of 51 authorized carrier frequencies. If the measured frequency is within one of the following ranges, the Terminal shall increment the bin count associated with that carrier by one-fourth if the pulse is from the first 32 pulses of any Link 16 message and by one for all other pulses. The term "adjacent authorized carrier" refers to a carrier that is 3 MHz above or below a specific carrier.

1. -2.0 MHz and +2.0 MHz of an authorized carrier for which there is no adjacent authorized carrier.

2. -1.5 MHz and +2.0 MHz of an authorized carrier for which there is an adjacent authorized carrier lower in frequency and no adjacent authorized carrier higher in frequency.

3. -2.0 MHz and +1.5 MHz of an authorized carrier for which there is an adjacent authorized carrier higher in frequency and no adjacent authorized carrier lower in frequency.

4. -1.5 MHz and +1.5 MHz of any of the remaining authorized carrier frequencies.

(d) The Terminal shall determine the end of an authorized carrier frequency measurement block when the sum of the bin counts of the authorized carrier frequency measurements is at least equal to 1020 but not more than 1440. The Terminal shall make this determination at the end of each time slot. The Terminal shall reset the bin counts to zero when a new block begins but not before the completion of Paragraphs 3.2.d.(4)(d)1. through 3.2.d.(4)(d)3.

1. At the end of each block, the Terminal shall perform the UUAC Histogram evaluation and ascertain for each authorized carrier if the carrier count is less than 0.1 times the expected value of the count or greater than 1.9 times the expected value of the count. The

expected value of the count for each authorized carrier is equal to the sum of the bin counts in the block divided by the number of authorized carriers.

2. At the end of each block, the Terminal shall determine if the counts associated with four or more authorized carriers are outside either limit specified in Paragraph 3.2.d.(4)(d)1. If the Terminal is operating in the frequency hopping mode and counts are outside these limits, the Terminal shall incur a Short-Term Frequency Histogram EMC Features fault (and increment the UUAC EMC Features fault count).

3. At the end of four consecutive blocks, the Terminal shall determine if there is at least one authorized carrier for which counts in all four blocks are outside either limit specified in Paragraph 3.2.d.(4)(d)1. The current and three previous blocks shall be used for this determination. If the Terminal is operating in the frequency hopping mode and counts are outside these limits, the Terminal shall incur a Long-Term Frequency Histogram EMC Features fault (and increment the UUAC EMC Features fault count).

(e) If the measured frequency of the pulse is within 7 MHz of either 1030 or 1090 MHz, the Terminal shall increment by one in the 52nd bin, which is referred to as the high-level 1030/1090 MHz frequency bin. The Terminal shall incur a 1030/1090 MHz high-level detector (HLD) EMC Features fault (and increment the HLD EMC Features fault count) if, at the end of a time slot, the 1030/1090 MHz HLD Frequency bin has two or more counts. The Terminal shall set the 1030/1090 HLD MHz Frequency bin to zero before the beginning of the next time slot.

(f) The frequency monitor shall increment by one in the 53rd bin (or one of the bins designated for any OOB frequency range or for non-measured pulses), which is referred to as the OOB Frequency bin and no other bin if:

1. The measured frequency is not an authorized carrier and is not within 7 MHz of either 1030 MHz or 1090 MHz, or

2. The frequency monitor fails to measure the frequency of the pulse that the Terminal has commanded for transmission[8] for any reason, including but not limited to cases where the pulse amplitude is too low or the pulse is too narrow for frequency measurement or the frequency measurement process is not functioning properly, or

3. The measured frequency reported by the EPA is an unauthorized carrier frequency or an OOB measured pulse frequency, or

4. The Terminal does not receive an EPA measured frequency for any pulse the Terminal commands the EPA to transmit. EPA suppressed pulses shall be treated as if they were never commanded.

(g) The Terminal shall incur an OOB EMC Features fault (and increment the OOB EMC Features fault count) if at the end of a time slot, the sum of the OOB Frequency designated

[8] Suppressed pulses shall be treated as if they were never commanded.

bins has a count of two or more. The Terminal shall set the OOB Frequency bin to zero before the beginning of the next time slot.

(5) Overpower (OP) Monitor Function.

(a) In each 13 µs interval in which the Terminal commands transmission of a Link 16 pulse, the Terminal or EPA shall measure the total output power of the transmitted Link 16 pulses from all antenna ports in each selected power mode. The measurement shall be made at a point along the RF transmit path that is after all active components and all other components that could affect the pulse shape, frequency, or spectral characteristics, including all final combiners used to increase transmitter power and all circuits used for antenna selection. The pickoff point can be placed before a hybrid splitter and devices used for antenna selection providing those components cannot cause the RF characteristics of the TDMA emissions at the antenna port to differ from those emissions at the pickoff point.

(b) The Terminal with high power capability shall process a variable parameter (VP) that instructs it to either allow or disallow power levels greater than 200 W + 1 dB by an internal power amplifier or EPA. The setting of this VP shall be platform dependent.

(c) Power levels of transmissions by an internal power amplifier or EPA shall be measured using a peak power monitor. If the selected power mode is nominally 200 W or less, the Terminal shall incur an OP EMC Features Fault Report (and increment the OP EMC Features fault count) if the peak pulse power of five or more Link 16 pulses in a time slot is more than 200 W + 2 dB. The threshold power shall be defined as the average of the peak levels using 64 or more samples measured over at least the center 3.2 µs interval of a pulse whose leading and trailing edges are equivalent to the transmitted pulse.

(d) If the VP is instructed to disallow high power transmission of greater than 200 W + 1 dB, and the Terminal receives an initialization instruction to transmit high power, the Terminal shall limit the transmissions to 200 W + 1 dB out of the Terminal or EPA. The Terminal shall report its action to the host.

(6) TSDF Monitoring Function.

(a) 100% TSDF is defined as 396,288 pulses per 12-second frame. During each 12-second frame, the Terminal shall maintain a count of the number of Link 16 pulses commanded for transmission by either the Terminal or the EPA in any EMC Features mode. All Link 16 pulses commanded for transmission shall be counted. In the Full EMC Protection mode, the Terminal shall incur an EMC Features failure and inhibit further Link 16 transmission through its antenna interface or an EPA interface during the remainder of the 12-second frame in which the count exceeds the value of the maximum TSDF VP. The value of the maximum TSDF VP shall be dependent on the TSDF limit(s) imposed in the applicable Full EMC Protection mode for the platform in which the Terminal is installed. As an example, in Full EMC Protection mode on a platform with a 20% TSDF limit, the VP is [79257.6 (3962.88-198144, 3962.88)].[9] The

[9] This shorthand notation means that in the 20% mode (79257.6), the VP should be adjustable from 1% (3962.88) to 20% (79257.6) in 1% (3962.88) steps. For the 50% mode, the maximum number of pulses allowed is 50 times 3962.88 equals 198144.

Terminal may exceed the limit but shall inhibit after the end of the time slot in which the limit was exceeded. The transmission inhibit shall be cleared automatically and the TSDF pulse count is reset to zero at the end of the 12-second frame. The specified range of values for this VP corresponds to limitations on the TSDF between one and 50%.

(b) The Terminal shall prevent the operator from resetting the transmission inhibit prior to the end of the 12-second frame. The Terminal shall automatically reset the EMC Features failure due to excessive TSDF at the end of the 12-second frame.

(c) The Terminal shall allow time slot assignments (TSAs) that result in transmission during adjacent time slots.

(7) Message Structure Controls.

(a) The Terminal shall process a VP or an AP that instructs it to accept any selectable limit of Link 16 message structure pulses per time slot. This limit shall not exceed 444 pulses per time slot.

(b) The Terminal shall process a VP or an AP that instructs it to transmit no more than zero to eight messages in a 12-second frame in the round-trip timing (RTT)-broadcast (RTT-B) Network Participation Group (NPG 3) in random access mode. The number of assigned time slots in a block is determined by the block's recurrence rate number. If, in an initialization data load or stored set, the number of RTT-B transmit TSAs exceeds this limit, the Link 16 Waveform shall either reject the load or accept it with a change in the assignment that results in compliance with the limits of the VP. For example, to reduce the number of RTT-B TSAs in the initialization load, delete assignments beginning with the last in the order received until compliance with the VP limit is achieved. During time slots of the deleted assignment, the Link 16 Waveform may be allowed to perform default reception.

(c) The Terminal shall process an AP to either disallow or allow RTT-B transmissions. If the AP is set to allow RTT-B transmissions, then the limit shall be in accordance with the value of the VP or AP in Paragraph 3.2.d.(7)(b).

(8) Net Usage Control.

The Terminal shall process a VP or AP in the range 0 to 126 that determines the range of valid net numbers for transmit TSAs and paired slot relay (PSR) assignments. If the net number in the assignment is outside the valid range, the Terminal shall reject the assignment. If Terminal initialization allows the operator to select the net number, transmission shall not occur on net numbers that are not within the range of allowed net numbers.

(9) Relay Mode Controls.

(a) Conditional PSR (CPSR) Controls.

The Terminal shall process a VP or an AP that accepts or rejects CPSR assignments.

(b) Repromulgation and Enhanced Repromulgation Relay Controls.

1. The Terminal shall process a VP or AP to allow or disallow repromulgation relay transmissions. If the VP or AP is set to disallow, the Terminal shall not repromulgation relay any message it receives. The Terminal may transmit messages it originates.

2. The Terminal shall transmit all repromulgation relay messages with a random jitter delay having a minimum step size of 10 µs with at least eight randomly selectable delays. A BIT function shall be implemented to verify the random jitter delay for relaying messages and inhibit repromulgation relay transmissions if the random jitter delays are not operating as intended. The Terminal shall have an OBIT function that keeps a running check of the jitter values generated for each relayed message. If the same jitter value is used more than eight times in a row, the repromulgation relay of the message shall be inhibited. If inhibited, the Terminal shall select a random jitter delay for the next message that is different from the previous eight delays, and then the transmission of repromulgation relay messages can resume. In addition, the Terminal shall have a "loopback" OBIT to verify that the commanded jitter delay value is the same value that is transmitted. If the commanded jitter delay value differs by more than one µs from the value that is transmitted three times in a 12-second frame, repromulgation relay messages shall be inhibited for the remainder of the 12-second frame.

(10) Access Mode Controls.

(a) Machine-Controlled Contention Controls.

The Terminal shall process a VP or AP that instructs it either to accept or reject transmit TSAs that result in machine-controlled contention access mode transmissions. The use of this AP or VP shall not apply to RTT-B or initial network entry (INE) TSAs.

(b) Time Slot Reallocation (TSR) Controls.

The Terminal shall process a VP or AP that allows or disallows non-centralized TSR TSAs. If non-centralized TSR is disallowed, the TSAs can be maintained in the receive only mode for their assigned participation groups (PGs) or they can operate in a centralized mode. The TSR control does not apply to centralized TSR.

e. EMC Features BIT.

The CTT, 1030/1090 MHz LLD, PW, frequency, and OP monitors shall be periodically verified for proper operation using BIT. The premise is that each monitor shall have a BIT that operates continuously or periodically during normal Link 16 transmissions. If a BIT for a particular monitor cannot operate continuously or periodically (i.e., OBIT), then the monitor shall be checked during Terminal start-up (i.e., SBIT) and an operator shall have the capability to manually initiate its BIT (i.e., IBIT). EMC Features IBIT can be implemented separately, or it can be incorporated into the Terminal's manual IBIT function. A failure of an operational or periodic BIT shall inhibit Link 16 transmissions in accordance with the inhibit criteria. A failure of an SBIT or an IBIT shall cause Link 16 transmissions to be inhibited. If a transmission inhibit due to an SBIT or an IBIT check is reset or cleared, then the BIT check of the failed EMC Feature monitor shall be repeated. If an EMC Feature in the EPA fails SBIT or IBIT and all EMC Features in the Terminal pass SBIT and IBIT, transmission through the Terminal (if initialized) should not be inhibited. If an EMC Feature in the Terminal fails SBIT or IBIT and

all EMC Features in the EPA pass SBIT and IBIT, transmission through the EPA should not be inhibited as long as the failed SBIT or IBIT cannot be related to the EPA exciter signal from the Terminal. The BIT implementations described in Paragraphs 3.2.e.(1) through 3.2.e.(5) can be modified if approved by CA.

(1) CTT Monitor BIT.

The CTT monitor OBIT shall verify proper operation of the monitors of each stage during each 13 µs interval of the normal Link 16 pulse transmissions. In order to pass OBIT, each CTT monitor shall indicate the state of CTT during an interval of at least 2.5 µs when each Link 16 pulse is commanded and indicate the state of not CTT during the intervals defined in paragraphs 3.2.b.(4)(b), 3.2.b.(4)(c), and 3.2.d.(1)(a). Suppressed pulses shall be treated as if they were never commanded. If any CTT monitor OBIT fails in a 13 µs interval, the Terminal shall increment the CTT EMC Features event count. It shall only be possible for the Terminal to incur one CTT EMC Features event per 13 µs interval.

(2) 1030/1090 MHz LLD Monitor BIT.

(a) During the 1030/1090 MHz LLD monitor SBIT/IBIT, the Terminal shall perform two tests that independently verify the proper operation of the 1030 MHz and 1090 MHz LLD circuits.

1. The first test shall provide to the 1030 MHz LLD monitor, a Terminal generated pulsed signal with power no more than +2 dB relative to the power stated in Paragraph 3.2.d.(2)(c). Excessive power in the 1090 MHz LLD circuitry shall not affect independent verification of the 1030 MHz LLD monitor.

2. The second test shall provide to the 1090 MHz LLD monitor, a Terminal generated pulsed signal with power no more than +2 dB relative to the level stated in Paragraph 3.2.d.(2)(c). Excessive power in the 1030 MHz LLD circuitry shall not affect independent verification of the 1090 MHz LLD monitor.

(b) If either of these two BITs are not successful, the Terminal shall inhibit transmissions. Each BIT shall be considered successful if the Terminal incurs an LLD EMC Features event for each pulsed signal that is used as part of the BIT, or if the Terminal generates the report after no more than five pulsed signals that would have incremented the LLD EMC Features fault count if the Terminal were fully operational. If the transmission inhibit is reset, the two BITs shall be performed again and pass in order to successfully clear the EMC Features failure.

(c) LLD monitor BIT shall be performed without regard to the state of any LLD suppression signal or any AP that restricts or inhibits transmission.

(3) PW Monitor BIT.

(a) SBIT and IBIT shall be implemented to verify proper operation of the PW monitor. The test shall be performed by providing the PW monitor with Terminal-generated RF pulse waveforms having pulse shape similar to that of normally transmitted pulses and at a peak

power level no greater than -6 dB relative to the lowest power level into the PW monitor. The Terminal-generated waveform shall include narrow PW no less than 5.98 µs, normal PW, and wide PW no greater than 6.82 µs as defined in Paragraph 3.2.d.(3)(c) at the 95% amplitude. The quantity of narrow and wide pulses shall equal the quantity of PW EMC Features events to be incurred. A minimum of eight wide and eight narrow pulses shall be generated. Pulses with normal width shall not cause PW EMC Features event to be incurred. It is acceptable to utilize pulses with constant data modulation (i.e., pulsed continuous wave (CW)) for PW monitor BIT.

(b) If the PW monitor BIT is not successful, the Terminal shall inhibit transmissions. The PW monitor BIT shall be considered successful only if:

1. The 100% amplitude determined by the PW monitor is within the dynamic range of the PW monitor, and

2. The conditions defined in Paragraph 3.2.e.(3)(a) are met.

(c) The PW monitor BIT shall be performed without regard to the state of any LLD suppression signal or any AP that restricts or inhibits transmission.

(4) Frequency Monitor BIT.

During each scheduled Link 16 pulse transmission, the Terminal shall verify proper operation of the UUAC function. The Terminal shall incur a Frequency Monitor OBIT (FMO) EMC Features Fault Report (and increment the EMC Features Fault Report count) if the frequency bin measured is different from the carrier frequency commanded for transmission five or more times in a transmit time slot. Suppressed pulses shall be treated as if they were never commanded.

(5) OP Monitor BIT.

When operating in a power mode that is nominally 200 W + 1 dB or less, the Terminal shall have a BIT to check the accuracy of the +2.0 dB (peak power) tolerance limits of the output power monitors. During the last five pulses of a message in one time slot within a 12-second frame, verify that the Terminal would declare a peak OP fault (for BIT purposes only) when the OP monitor threshold is modified to -2 dB relative to the selected nominal power level. The BIT is successful if a peak OP fault (for BIT purposes only) is incurred. If a peak OP fault is not incurred, then the Terminal shall incur a Peak OP EMC Features Fault Report (and increment the EMC Features fault count). If the OBIT is performed in only one time slot per frame, then it is not necessary to trigger the OP monitor event/fault condition for the last five pulses that have been altered to perform the peak OP monitor OBIT. The threshold for at least nine frequencies across the frequency band shall vary by no more than 0.75 dB to avoid the need to test additional frequencies. If the variation across all nine of the frequencies selected is greater than 0.75 dB, then all 51 frequencies threshold values from tuning will need to be checked.

f. EPF Modes.

The Terminal shall have the capability to operate in each EMC Feature mode. These modes include the Full EMC Protection mode, the Exercise EMC Protection mode, and the Combat

mode. The Terminal shall operate in accordance with the EMC Protection mode identified by the EMC Protection mode AP. In each of the EMC Protection modes, the Terminal shall detect and store EMC Features data in accordance with Paragraph 3.2.g., EMC Features Data Storage.

(1) Full EMC Protection Mode.

(a) The Terminal shall operate in a Full EMC Protection mode unless Exercise EMC Features or Combat mode is explicitly selected during initialization. The Terminal shall perform every function stated in Paragraphs 3.2.d. and 3.2.e. when it is in the Full EMC protection mode. If the VP that restricts the output power mode to 200 W or less is set to allow high power transmissions, the Terminal shall continue to perform the output power monitoring functions stated in Paragraph 3.2.d.(5)(c), unless high power operations are authorized and a power mode nominally greater than 200 W + 1 dB is assigned for message transmission.

(b) By default, the Terminal shall start-up in the Full EMC protection mode and not change from that mode except by specific operator actions to modify the initialization. The EMC Features mode used during previous operation (i.e., prior to the last time the Terminal was powered down) can be used only if that operator took positive action (e.g., placed the Terminal in a standby mode), prior to removing power, to retain the EMC Features mode when the Terminal is next powered up. It is acceptable for the EMC Features mode to be automatically retained for power interrupts less than two minutes.

(c) Figure 4 summarizes the EMC Features fault conditions for the functions detailed in Paragraphs 3.2.d.(1) through 3.2.d.(6). Each declared EMC Features fault shall be counted by a separate SW algorithm for each EMC Features monitor, and the Terminal shall incur an EMC Features fault no later than the end of each time slot if the number of EMC Features faults exceeds the limit specified for that function. As shown in Figure 4, if more than one function induces an EMC Features Fault Report, the EMC Features fault count (up to two) is incremented by only one in any time slot. If the EMC Features fault count reaches two, the Terminal shall incur an EMC Features failure and inhibit Link 16 transmissions[10] before the next time slot. This EMC Features failure and transmit inhibit requirement also applies to an EPA configuration if present. The Terminal shall include provisions that allow the Terminal operator to manually reset a transmission inhibit which zeroizes the EMC Features fault count. A single EMC Features fault shall not be zeroized if an operator commands an IPF reset in the absence of a transmission inhibit. Except for the EMC Features failure due to excessive TSDF specifically identified for automatic EMC Features Reset (see Paragraph 3.2.d.(6)), automatic EMC Features Reset shall be strictly prohibited. The EMC Features fault count can be reset after the Terminal is placed in standby for longer than two minutes, the power has been turned off, or 24 hours have elapsed since the first EMC Features fault. With the exception of the 24-hour condition, the EMC Features fault count shall only be cleared if the Terminal automatically runs SBIT prior to reenabling transmission. The EMC Features fault count shall not be cleared when changing the EMC Features mode or if the Link 16 waveform is de-instantiated without removing power unless SBIT is performed. A transmit inhibit can be cleared after the Terminal has been placed in the Off state or in standby mode for two minutes or more as long as SBIT is performed.

[10] PPLI messages to be transmitted during an IFF emergency are exempt from the EMC Features transmit inhibit requirement.

Performing SBIT is not necessary after a manual IPF Reset, unless the EMC Features failure was due to failed SBIT or IBIT which requires that specific BIT to be repeated.

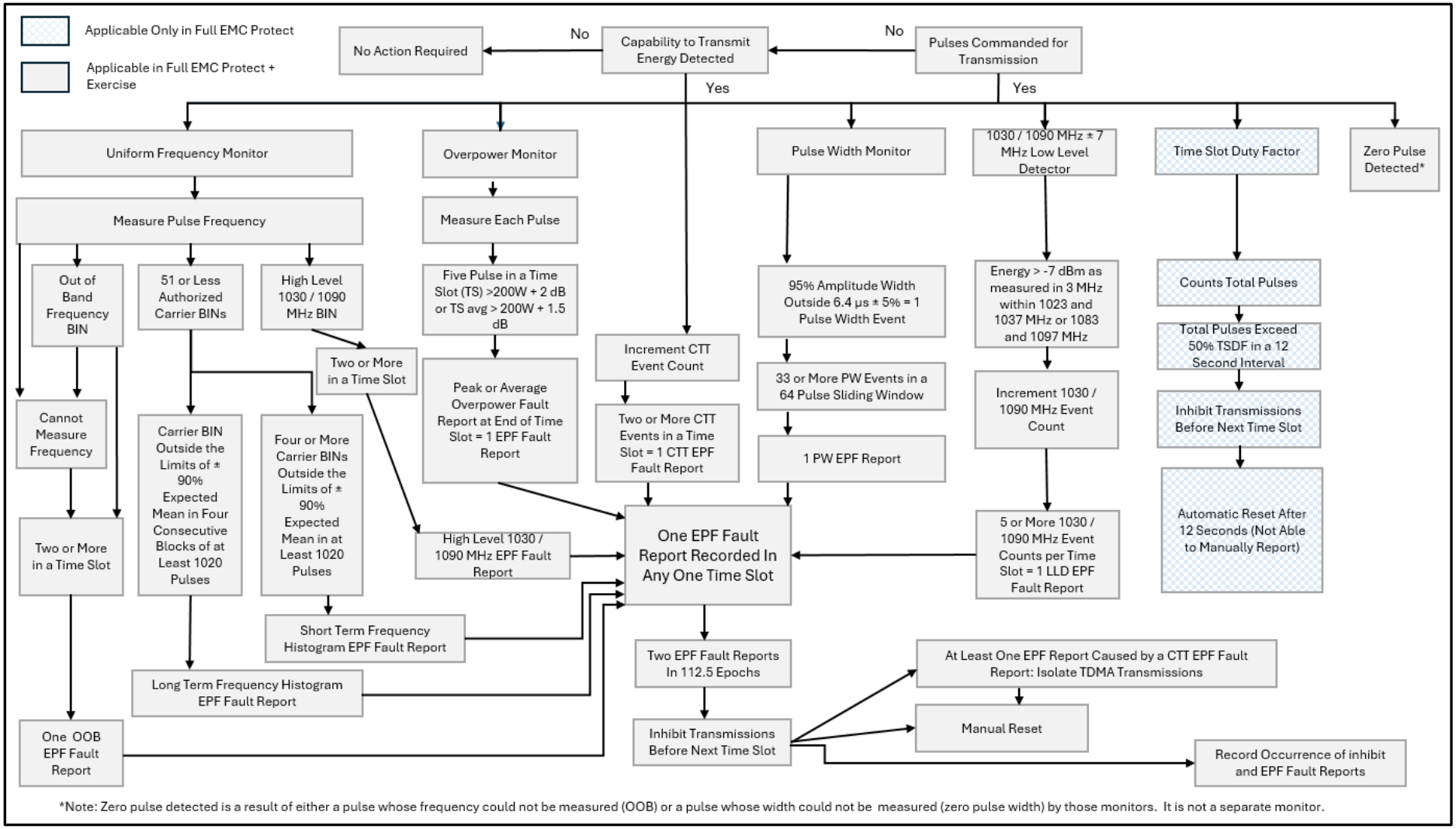
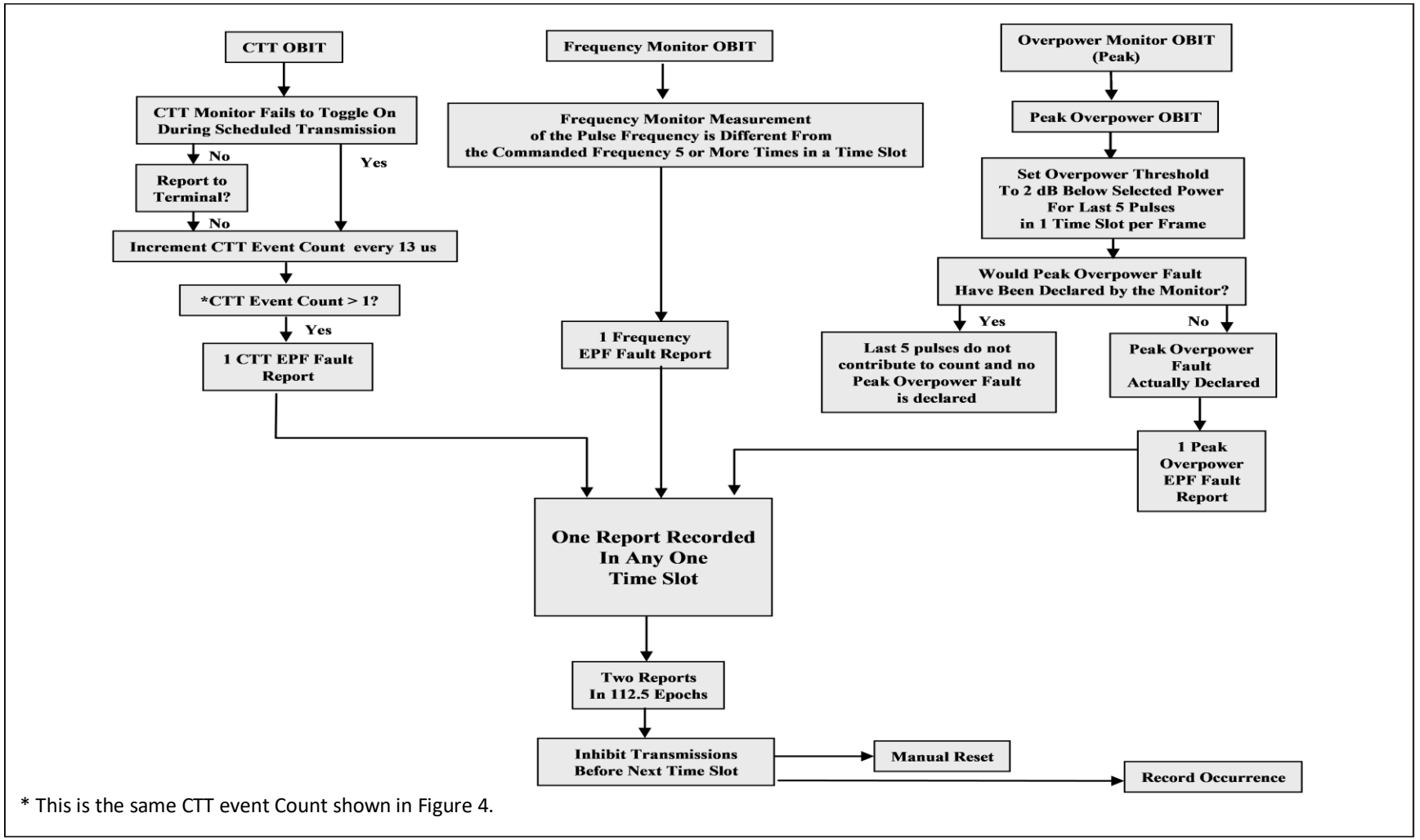


Figure 4. EMC Features Transmit Inhibit Criteria

(d) Depending on the TSDF limit imposed by the applicable Full EMC Protection mode, the Terminal shall inhibit further Link 16 transmissions through its antenna interface during the remainder of any 12-second frame in accordance with Paragraph 3.2.d.(6). The specified range of values for this VP corresponds to limitations on the TSDF between integers 1 and 50%.

(e) The Terminal shall perform every function stated in Paragraphs 3.2.d.(7). through 3.2.d.(10). and report all EMC Features faults and failures. The Terminal shall inhibit Link 16 repromulgation relay message transmissions before the next time slot after the time slot in which the OBIT failure occurred and those messages shall not resume until the criteria in Paragraph 3.2.d.(9)(b)2. is met.

(f) Figure 5 summarizes the EMC Features fault conditions in the OBIT implementations described in Paragraphs 3.2.e.(1), 3.2.e.(4), and 3.2.e.(5). Each incurred EMC Features event shall be counted by a separate SW algorithm for each of the OBITs and the Terminal shall incur an EMC Features Fault Report no later than the end of each time slot if the number of EMC Features events exceeds the limit specified for that function. (An EMC Features OBIT Fault Report is treated like any EMC Features Fault Report shown in Figure 4.)



* This is the same CTT event Count shown in Figure 4.

Figure 5. OBIT Implementation

(g) Figure 6 summarizes the pass/fail conditions for SBIT and IBIT implementations. These implementations are described in Paragraphs 3.2.e.(2) and 3.2.e.(3).

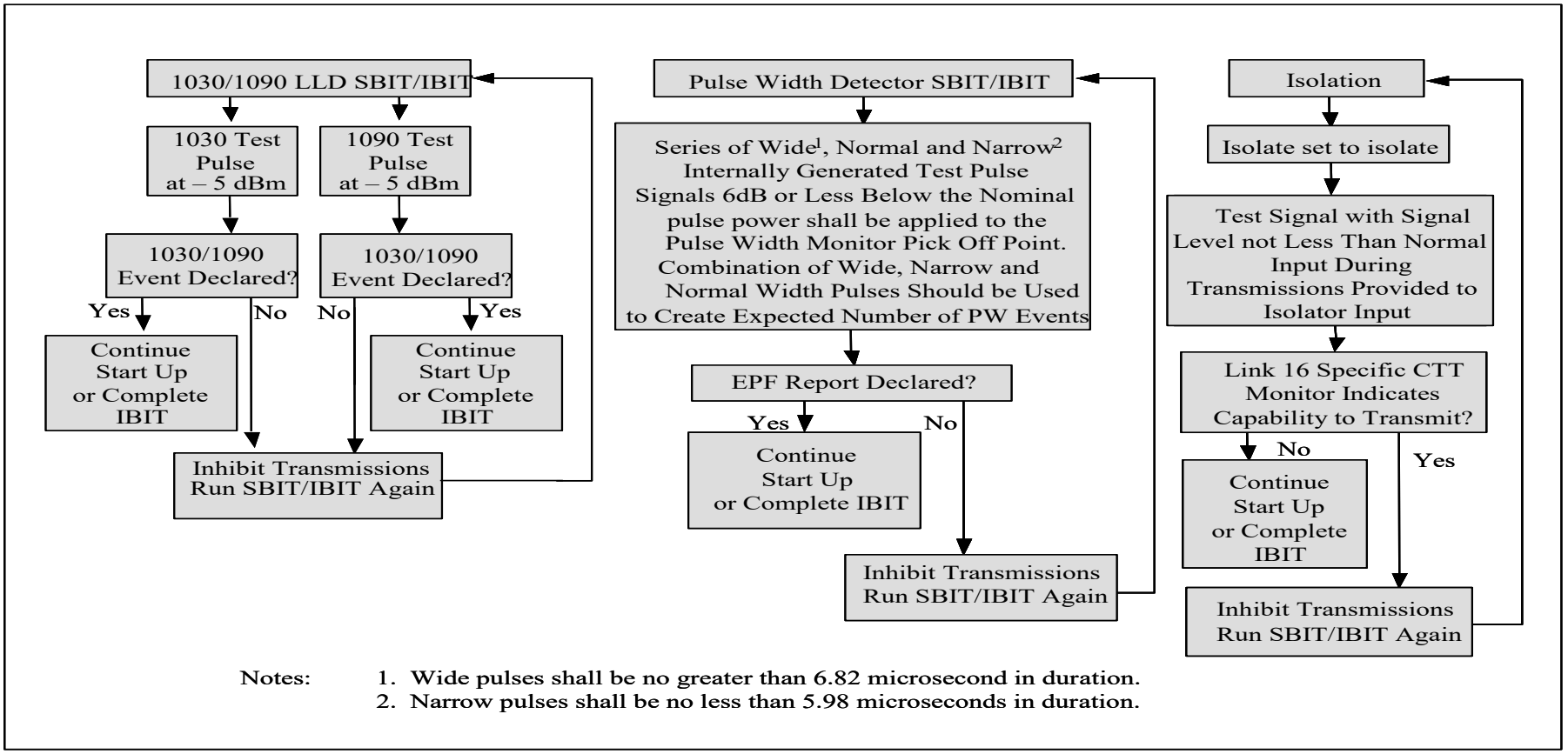


Figure 6. SBIT/IBIT Implementation

(h) The Terminal shall record EMC Features faults while in the Full EMC Protection mode in accordance with Paragraph 3.2.g. so they can be accessed by maintenance personnel and appropriate repair actions can be accomplished.

(2) Exercise EMC Protection Mode.

(a) The Terminal shall perform every function stated in Paragraphs 3.2.d.(1) through d.(4). (exclusive of incrementing the counter in Paragraph 3.2.d.(2)(d) and the BIT functions as defined in Paragraph 3.2.e. when it is in the Exercise EMC Features mode). These functions, under the stated fault conditions and as shown in Figures 4, 5, and 6 shall cause the Terminal to inhibit further transmissions. The handling of EMC Features Fault Reports, the EMC Features Fault Report counts, transmission inhibits, and transmit inhibit resets shall be in accordance with the requirements in Paragraph 3.2.f.(1)(c).

(b) The VP that restricts the output power mode to 200 W shall be overridden. The Terminal shall perform the output power monitoring functions stated in Paragraph 3.2.d.(5)(c), unless high power operations are authorized and a power mode that is nominally greater than 200 W + 1 dB is assigned for message transmission.

(c) When the Terminal is in the Exercise EMC Protection mode, it shall not perform the transmission inhibit function stated in Paragraph 3.2.d.(6).

(d) The Terminal shall not perform (override) the functions stated in Paragraphs 3.2.d.(7), 3.2.d.(8), 3.2.d.(9)(a), 3.2.d.(9)(b)1., and 3.2.d.(10). However, the Terminal shall perform the repromulgation relay control functions defined in Paragraph 3.2.d.(9)(b)2.

(e) The Terminal shall record EMC Features faults while in the Exercise mode in accordance with Paragraph 3.2.g. so they can be accessed by maintenance personnel and appropriate repair actions can be accomplished.

(3) Combat Mode.

(a) When in the Combat mode, the Terminal shall perform the functions stated in Paragraphs 3.2.d.(1) through 3.2.d.(4) (exclusive of incrementing the counter in Paragraph 3.2.d.(2)(d)) and the BIT functions as defined in Paragraph 3.2.e. These functions, under the stated EMC Features fault conditions and as shown in Figures 4, 5, and 6 shall cause the Terminal to incur EMC Features faults from waveform characteristic failures detected by the EMC Features or from failures of EMC Feature monitor BIT.

(b) The Terminal shall not inhibit transmissions due to any EMC Features Fault Report or EMC Feature monitor BIT failures.

(c) The Terminal shall not perform the output power restriction in Paragraph 3.2.d.(5). The Terminal output power restrictions shall be overridden, and the Terminal shall be allowed to transmit high power.

(d) When the Terminal is in Combat mode, it shall not perform the transmission inhibit stated in Paragraph 3.2.d.(6). In Combat mode, the Terminal shall not perform (override) the functions stated in Paragraphs 3.2.d.(7) through 3.2.d.(10).

(e) The Terminal shall record EMC Features faults while in Combat mode in accordance with Paragraph 3.2.g. so they can be accessed by maintenance personnel and appropriate repair actions can be accomplished. The EMC Features faults shall not be cleared when changing the Full EMC Features Protection mode.

g. EMC Features Data Storage.

(1) The Terminal shall maintain in non-volatile memory, data that shall include the following:

(a) Each transmit inhibit, including those due to EMC Features SBIT or IBIT failure,

(b) The identity of all EMC Features faults detected independent of the EMC Protection mode,

(c) When the Terminal EMC Protection mode AP was set to Exercise or Combat EMC Protection mode, and

(d) When the Terminal is set to enable RF output power at a nominal level exceeding 200 W.

(2) The date, the beginning time, and ending times of the events listed in Paragraph 3.2.g.(1). shall also be stored. A capability shall be established to store the data for one year and shall be made available as outlined in the System Planning Subcommittee Working Group One (SPS WG-1) TR-03-001, SPS 14216, EMC Certification Guidance and Requirements for JTIDS/MIDS TDMA Equipment.

3.3. FR ALGORITHM.

a. FR Requirement.

The transmitted RF signals shall be hopped pseudorandomly among 51 carrier frequencies, or among a subset of these 51 frequencies resulting from FR up to 14 of these frequencies if FR is enabled. Two carrier frequency selection and remapping algorithms shall be used, one for time refinement and data pulses, and the other for the synchronization preamble pulses. These algorithms are defined in Paragraphs 3.3.b. through 3.3.h.

b. Carrier Frequency Selection.

(1) The Terminal shall have the capability to enable or disable carrier FR. When FR is disabled, the Terminal shall select carrier frequencies in accordance with the 51 carrier frequency hop set algorithm[11]. When FR is enabled, the Terminal shall identify the frequency numbers required to be remapped. If the number of frequencies is less than or equal to 14 and greater than or equal to one, the Terminal shall select carrier frequencies in accordance with the FR algorithm described in this enclosure. If the indicated number is 0 or more than 14, the Terminal shall provide an alert to the host and inhibit TDMA transmission until a valid assignment is received. The FR capability shall be independent of the EMC Protection mode.

(2) When FR is disabled, the Terminal shall select the carrier frequency using (for transmission or reception) the 51 carrier frequency hop set algorithms for the preamble and for the time refinement and data pulses. When FR is enabled, the Terminal shall also use these algorithms, but only to generate an initial set of carrier frequency numbers, which shall then be modified to replace each unauthorized frequency with an authorized frequency in accordance with Paragraphs 3.3.c. through 3.3.h.

c. Carrier FR.

(1) When FR is enabled, the carrier frequencies shall exclude the carrier frequencies defined by the remapped frequency number list, which indicates for each of the 51 frequency numbers whether or not that frequency number is to be remapped. The carrier frequencies required to be remapped shall be referred to as the "unauthorized carrier frequencies." All other carrier frequencies shall be referred to as the "authorized carrier frequencies." When FR is enabled, the Terminal shall select frequencies such that:

(a) Every pulse in a message that would have used an authorized frequency if FR were disabled shall use the same frequency when FR is enabled,

[11] The 51 carrier frequency hop set algorithms for the synchronization preamble and for the time refinement and data pulses are not described in this DoW CIO Manual. The algorithms can be located in the applicable Link 16 System Specification.

(b) Every pulse that would have used an unauthorized frequency if FR were disabled shall use an authorized frequency when FR is enabled, and

(c) Every Terminal that replaces an unauthorized frequency with an authorized frequency, on any particular pulse, shall make the same frequency replacement decision for that pulse, and this shall be the same whether the Terminal is transmitting or receiving. The replacement frequency selections shall depend only on the set of frequencies initially selected for the entire message by the 51 carrier frequency hop set algorithms.

(2) One goal in selecting authorized frequencies to replace unauthorized frequencies is to do this in such a way as to make the overall distribution of frequency usage, among all of the authorized carrier frequencies, as uniform as possible over time. A specific method for doing this is specified herein so that all Terminals using this method, whether they are transmitting or receiving, will make exactly the same frequency replacement decisions for each pulse in a message if they are operating on the same net number in the same time slot and using the same transmission security (TRANSEC) cryptovariable for carrier frequency selection. The remapping method to be described herein refers to certain specific entities (e.g., the "sorted frequency list," the "frequency selection counters," the "candidate list," etc.) and to specific algorithms. These are used merely for the purpose of defining precisely what the results of the Terminal's remapping must be. It is not required that the Terminal implement the specific entities and algorithms described here, but the method implemented in the Terminal shall be functionally equivalent to the method described herein, in the sense that it must always produce the exact same remapping decisions as the method described herein. This is necessary for interoperability among all Terminals that will implement FR.

(3) For the purposes of the frequency replacement method, the Terminal shall maintain a set of frequency selection counters, Cf, for f=0 through 50, indicating how many pulses have been selected to use each of the authorized carrier frequencies, and for transmission or reception within the current message. These counters shall be separate from the carrier frequency bins used in Paragraph d.(4) of Section 3.2. The Terminal shall also maintain a sorted list of frequency numbers which will be referred to here as the "sorted frequency list." The number of items in this list shall always be equal to the number of authorized carrier frequencies, although the ordering of these items will change as unauthorized frequencies are replaced by authorized frequencies. Each authorized carrier frequency number shall appear exactly once in this list.

d. Frequency Replacement for All Messages Except RTT-Replies (RTT-Rs).

(1) When FR is enabled, the Terminal shall first generate all of the frequency numbers needed for a 444 pulse message (the longest possible case), using the 51 carrier frequency hop set algorithms for the preamble frequency numbers and for the time refinement and data pulse frequency numbers (these algorithms use the full set of 51 frequency numbers). Some of these frequency numbers will correspond to authorized carrier frequencies, and some will correspond to unauthorized carrier frequencies. The generated frequency numbers shall be denoted by f_k, where k = 1 to 8 for the preamble, and k = 9 to 420 for the time refinement and data pulses. (The first eight frequency numbers are each used on four preamble pulses, so a message with N total pulses will use a total of N-24 frequency numbers). All of these frequency numbers shall be generated before any pulses in the message are transmitted or received, because they are needed

to determine which replacement frequency numbers will be used for each frequency number that corresponds to an unauthorized carrier frequency. The set of frequency numbers f_k is the same set that would actually be used for transmission if FR were not enabled. Whenever an unauthorized frequency number f_k is replaced by an authorized frequency number, the replacement frequency number will be denoted by f^*_k. Whenever the originally generated frequency number was authorized and did not need replacement, then $f^*_k = f_k$.

(2) Prior to making any frequency replacement decisions, the Terminal shall first pre-compute the number of pulses that use each of the authorized carriers, based on the f_k values generated by the original frequency selection logic (the hop set algorithms that use the full set of 51 frequency numbers). For the purpose of specifying the frequency replacement algorithm, the following notation shall be used. Let NA_f denote the number of pulses among the first 258 pulses in the time slot for which the frequency number f (ranging from 0 to 50) was generated. A pulse count of four shall be contributed by each of the eight selected preamble frequencies. Let NB_f denote the number of pulses among pulses 259 through 444 in the time slot for which the frequency number f (ranging from 0 to 50) was generated. Prior to making any frequency replacement decisions among the first 258 pulses of a message, the frequency selection counter C_f shall be set equal to NA_f for each frequency number f that is an authorized carrier. For each f that is an unauthorized carrier, C_f is undefined and shall not be used. After the frequency selection counters C_f have been determined, and before the first frequency replacement decisions are made, the sorted list of frequencies shall be initialized by sorting all of the authorized carrier frequency numbers in order of increasing values of C_f and such that, within each subgroup of frequency numbers having the same value of C_f, the frequency numbers are in ascending order. For example, suppose that the smallest value of C_f was one and that frequency numbers 11, 24, and 47 were the only frequencies with this value, and suppose that the next smallest value of C_f was two and that frequency numbers 1, 9, 36, and 40 were the only frequencies with this value. Then, the first seven entries in the initial sorted frequency list would be 11, 24, 47, 1, 9, 36, and 40. This would be followed by the frequencies whose C_f value is greater than two, etc. The sorted frequency list only contains those frequencies that have been authorized. Thus, it will contain fewer than 51 frequencies when remapping is enabled.

(3) After the sorted list has been initialized, the Terminal shall process each frequency number, f_k that corresponds to an unauthorized carrier frequency, to determine which authorized carrier frequency to use as a replacement. This shall be done in sequential order, starting with k=1. Each time that an unauthorized carrier frequency is to be replaced by an authorized carrier frequency, the Terminal shall first determine a candidate list of frequencies (a subset of the authorized carrier frequencies), using the logic for preamble pulses in Section 6 if this is a preamble frequency (k=1 to 8) or using the logic for time refinement or data pulses in Section 7, if this is a time refinement or data pulse frequency (k>=9). After the candidate list has been determined, the Terminal shall use the logic in Section 8 to determine the specific carrier frequency number from the candidate list that will replace the unauthorized carrier number.

(4) After all frequency replacement decisions have been made for the first 258 pulses of a message, but before any frequency replacement decisions are made for pulses 259 through 444, NB_f shall be added to the frequency selection counter C_f for each frequency number f that is an authorized carrier. Next, the sorted list of frequencies shall be re-initialized by sorting all of the authorized carrier frequency numbers in order of increasing values of C_f and such that, within

each subgroup of frequency numbers having the same value of C_f, the frequency numbers are in ascending order (this is the same manner in which the sorted list was initialized at the beginning of the message). After the sorted list has been re-initialized, the frequency replacement process shall continue for the remaining pulses in the message using the logic in Paragraphs 3.3.g. and 3.3.h. to determine the specific carrier frequency number to be used in each case.

(5) The above algorithm defined the frequency replacement decisions for a 444 pulse message, the longest possible. For any message shorter than 444 pulses (e.g., a 258 pulse message or a 72 pulse RTT-interrogation (RTT-I) message), the frequency replacement decisions among those pulses shall be the same as they would be for the corresponding pulse in a 444 pulse message. This shall be the same whether the Terminal is transmitting or receiving. When the Terminal is receiving, it will not know in advance the total number of pulses in the message being received. Thus, it must make frequency replacement decisions for a 444 pulse message, the longest possible case. However, the use of the preceding logic will ensure that, in any of these cases, the receiving Terminal will make the same frequency replacement decisions as the transmitting Terminal for every pulse in the message, so that every pulse may be received correctly.

e. Frequency Replacement for RTT-R Messages.

(1) When FR is enabled, the Terminal shall first generate all of the frequency numbers needed for the entire RTT-R message, using the 51 carrier frequency hop set algorithms for the preamble and for the time refinement and data pulses (these algorithms use the full set of 51 frequency numbers). Some of these frequency numbers will correspond to authorized carrier frequencies, and some will correspond to unauthorized carrier frequencies. The generated frequency numbers shall be denoted by f_k, where k = 1 to 8 for the preamble, and k = 9 to 48 for the time refinement and data pulses. (The first eight frequency numbers are each used on four preamble pulses, so a message with 72 total pulses will use a total of 72-24 = 48 frequency numbers). For an RTT-R message, both the transmitting and receiving Terminal will know that the message is an RTT-R, so only enough frequency numbers for a 72 pulse RTT-R message shall be generated. It should be noted that an RTT-R message is always the second message within a time slot, and that the set of f_k generated for the RTT-R message is different from the set of f_k that was generated for the first message in the time slot. This is always true, even when FR is not enabled. All these frequency numbers shall be generated before any pulses in the RTT-R message are transmitted or received, because they are needed to determine which replacement frequency numbers will be used for each frequency number that corresponds to an unauthorized carrier frequency. In the case of a type 2(1) RTT-R message, the frequency numbers (f_1 to f_{48}) cannot be determined until the modified secure data unit (SDU) SN of the RTT-I is known, so the receiver will not be able to generate f_1 through f_{48} for the RTT-R until after the RTT-I has been received. In any case, the set of frequency numbers f_k for the RTT-R shall be the same set that would actually be used for transmission of the RTT-R message if FR were not enabled. Whenever an unauthorized frequency number f_k is replaced by an authorized frequency number, the replacement frequency number will be denoted by f^*_k. Whenever the originally generated frequency number was authorized and did not need replacement, then $f^*_k = f_k$.

(2) Prior to making any frequency replacement decisions for the RTT-R message, the Terminal shall first pre-compute the number of pulses that use each of the authorized carriers,

based on the f_k values generated by the original frequency selection logic (the hop set algorithms that use the full set of 51 frequency numbers). In the case of a type 2(1) RTT-R message, these shall be the f_k values after the frequency shift (based on the modified SDU SN of the RTT-I) has been made. Let NR_f denote the number of pulses among the 72 pulses in the RTT-R message for which the frequency number f (ranging from 0 to 50) was generated. A pulse count of four shall be contributed by each of the eight selected preamble frequencies for the RTT-R message. Prior to making any frequency replacement decisions among the 72 pulses of the RTT-R message, the frequency selection counter C_f shall be set equal to NR_f for each frequency number f that is an authorized carrier. For each f that is an unauthorized carrier, C_f is undefined and shall not be used. After the frequency selection counters C_f have been determined, and before the first frequency replacement decisions are made, the sorted list of frequencies shall be initialized by sorting all the authorized carrier frequency numbers in order of increasing values of C_f and such that, within each subgroup of frequency numbers having the same value of C_f, the frequency numbers are in ascending order.

(3) After the sorted list has been initialized, the Terminal shall process each frequency number, f_k that corresponds to an unauthorized carrier frequency, to determine which authorized carrier frequency to use as a replacement. This shall be done in sequential order starting with k=1. Each time that an unauthorized carrier frequency is to be replaced by an authorized carrier frequency, the Terminal shall first determine a candidate list of frequencies (a subset of the authorized carrier frequencies), using the logic for preamble pulses if this is a preamble pulses in Section 6 if this is a preamble frequency (k=1 to 8) or using the logic for time refinement or data pulses in Section 3.3.g. if this is a time refinement or data pulse frequency (k>=9). After the candidate list has been determined, the Terminal shall use the logic in Section 8 to determine the specific carrier frequency number from the candidate list that will replace the unauthorized carrier number.

(4) The use of the preceding logic will ensure that the receiving Terminal will make exactly the same frequency replacement decisions as the transmitting Terminal for every pulse in the RTT-R message, so that every pulse may be received correctly.

f. Synchronization Preamble Candidate Frequencies.

(1) When FR is enabled, all eight preamble frequency numbers shall be unique. In the following, the notation f^*_k (k = 1 to 8) is used to denote the preamble frequency numbers after frequency replacement has been applied, while the notation f_k (k = 1 to 8) is used to denote the original preamble frequency numbers that were generated by the 51 carrier frequency hop set algorithm. Each of these eight frequency numbers, f_k (k= 1 to 8), shall be examined, in order. If f_k is an authorized frequency number, it shall not be altered, i.e., f^*_k shall equal f_k. If f_k is an unauthorized frequency number, then the replacement frequency number f^*_k shall be determined by the processing specified in steps identified in Paragraphs 3.3.f.(1)(a) through 3.3.(1)(k):

(a) The Terminal shall start with the lowest value of k among the frequency numbers f_k (k = 1 to 8) that are unauthorized.

(b) The Terminal shall generate a list of candidate frequency numbers (from which f^*_k will eventually be chosen). This is a 51-element array, with one element for each of the

carrier frequency numbers from 0 to 50. Each element in this array is a flag indicating whether that frequency number is or is not a candidate frequency. Initially, all the authorized frequency numbers are marked as candidate frequencies.

(c) If $1<=k<=7$, and if f_{k+1} is an authorized frequency number, then the Terminal shall remove from the candidate list f_{k+1} and the frequency numbers of up to seven consecutive frequencies above and up to seven consecutive frequencies below that are adjacent to f_{k+1}. (This will ensure at least a 24 MHz separation between f^*_k and f_{k+1}.)

(d) If $2<=k<=8$, then the Terminal shall remove from the candidate list f^*_{k-1} and the frequency numbers of up to seven consecutive frequencies above and up to seven consecutive frequencies below that are adjacent to f^*_{k-1}. (This will ensure at least a 24 MHz separation between f^*_k and f^*_{k-1}.)

(e) If $k=1$, and if f_8 is an authorized frequency, then the Terminal shall remove from the candidate list f_8 and the frequency numbers of up to five consecutive frequencies above and up to five consecutive frequencies below that are adjacent to f_8. (This will ensure at least an 18 MHz separation between f^*_1 and f_8.)

(f) If $k=8$, then the Terminal shall remove from the candidate list f^*_1 and the frequency numbers of up to five consecutive frequencies above and up to five consecutive frequencies below that are adjacent to f^*_1. (This will ensure at least an 18 MHz separation between f^*_1 and f^*_8.)

(g) If $k=6$, and if f_9 is an authorized frequency, then the Terminal shall remove f_9 from the candidate list, where f_9 denotes the frequency number selected for the first time refinement pulse. (This will ensure that f^*_6 and f_9 are not identical.)

(h) The Terminal shall remove from the candidate list each of the frequency numbers f_1 through f_8 that is an authorized frequency, and which has not already been removed from the candidate list in a previous step. (This will ensure that f^*_k is unique from each of the other preamble frequencies that are not being replaced.)

(i) The Terminal shall remove from the candidate list each of the replacement frequency numbers f^*_n (n = 1 to k-2) that has already been selected and which has not already been removed from the candidate list in a previous step. (This will ensure that f^*_k is unique from each of the other preamble frequencies that have already been selected for replacement of an unauthorized frequency.)

(j) The remaining list of candidate frequency numbers contains all the possible frequency numbers that are allowed for the replacement frequency f^*_k. The Terminal shall choose f^*_k from this candidate list, using the logic specified in Paragraph 3.3.h.

(k) The Terminal shall select the next higher value of k among the frequency numbers f_k (k = 1 to 8) that are unauthorized and shall repeat the processing in steps identified in Paragraphs 3.3.f.(1)(b) through 3.3.f.(1)(k). The processing in the step identified in Paragraph 3.3.f.(1)(b) shall be repeated to re-initialize the candidate list for each new value of k.

(2) In the steps identified in Paragraphs 3.3.f.(1)(c), 3.3.4.(1)(d), and 3.3.f.(1)(g), when the frequency numbers of up to seven consecutive frequencies that are adjacent to the referenced frequency, on both sides of it, and are being removed from the candidate list, this shall mean frequencies that are 3, 6, 9,…, 21 MHz higher and lower than the referenced frequency. Similarly, in steps shown in Paragraphs 3.3.f.(1)(e) and 3.3.f.(1)(f), when the frequency numbers of up to five consecutive frequencies that are adjacent to the referenced frequency, on both sides of it, and are being removed from the candidate list, this shall mean frequencies that are 3, 6, 9,…, 15 MHz higher and lower than the referenced frequency. Depending on the referenced frequency, fewer than seven or five frequencies might end up being removed on either side of the referenced frequency. For example, if the frequency number of the referenced frequency is 13, corresponding to 1008 MHz, then there are no adjacent frequencies above 1008 MHz (because the next frequency is at 1053 MHz, which is more than 21 MHz above 1008 MHz). For the requirement to remove up to seven frequencies, then, in addition to frequency number 13, frequency numbers six through 12 would be removed. Similarly, if the frequency number of the referenced frequency were 6, corresponding to 987 MHz, the frequency number six would be removed. There are seven consecutive adjacent frequencies above it, so frequency numbers seven to 13 would be removed. There are six consecutive adjacent frequencies below it, so frequency numbers 0 through five would also be removed. The group of consecutive frequency numbers being removed at any step shall never extend across the guard bands centered at 1030 MHz or 1090 MHz.

(3) After frequency replacement has been accomplished for each of the preamble frequencies that required it, the resulting frequency number set f^*_1 through f^*_8 shall be used for the transmission or reception of the preamble pulses in place of the set f_1 through f_8.

g. Time Refinement and Data Symbol Candidate Frequencies.

(1) When FR is enabled, a minimum frequency separation of 24 MHz between adjacent pulses will be satisfied. In the following, the notation f^*_k is used to denote the frequency number for a pulse after frequency replacement has been applied, while the notation f_k is used to denote the original value of the frequency number that was generated by the 51 carrier frequency hop set algorithm. The terms f^*_{k-1} and f_{k-1} refer to the corresponding values for the previous pulse, while f^*_{k+1} and f_{k+1} refer to the following pulse. (f_k is always determined from f_{k-1} in the 51 carrier frequency logic algorithm, never from f^*_{k-1}.) The first-time refinement pulse is indicated by k=9. The selected frequency number f_k shall be examined to see if it is an authorized frequency. If f_k is an authorized frequency number, it shall not be altered, i.e., f^*_k shall equal f_k. If f_k is an unauthorized frequency number, then the replacement frequency number f^*_k shall be determined as follows. The Terminal shall generate a list of candidate frequency numbers (from which f^*_k will eventually be chosen). This is a 51-element array, with one element for each of the carrier frequency numbers from 0 to 50. Each element in this array is a flag indicating whether that frequency number is or is not a candidate frequency. Initially, all the authorized frequency numbers are marked as candidate frequencies. Next, additional frequency numbers shall be removed from this candidate list in accordance with the following rules:

(a) If f_{k+1} is an authorized frequency number, then the Terminal shall remove from the candidate list f_{k+1} and the frequency numbers of up to seven consecutive frequencies above and up to seven consecutive frequencies below that are adjacent to f_{k+1}. (This will ensure at least

a 24 MHz separation between f^*_k and f_{k+1}.) If k indicates the last pulse in the message, then f_{k+1} does not exist, so this rule shall not apply. For RTT-R messages, the last pulse in the message is indicated by k=48 (pulse number 72). For all other message types, the last pulse in the message (for the purpose of this rule) is indicated by k=420. The reason for this is that, if the message type is not an RTT-R, the receiver will not know in advance whether a 444, 258, or 72 pulse message is being received, so all remapping decisions among the first 258 pulses must be exactly the same as they would be if a 444 pulse message were being received. For example, if the message being received has only 258 pulses, and the frequency of the 258th pulse must be remapped, this rule will still remove (from the candidate list) the frequency that would have been used on the 259th pulse (if it is an authorized frequency) and the seven frequencies adjacent to it on each side.

(b) The Terminal shall remove from the candidate list f^*_{k-1} and the frequency numbers of up to seven consecutive frequencies above and up to seven consecutive frequencies below that are adjacent to f^*_{k-1}. (This will ensure at least a 24 MHz separation between f^*_k and f^*_{k-1}.)

(c) If f_{k+2} is an authorized frequency number, then the Terminal shall remove f_{k+2} from the candidate list. (This will ensure that f^*_k and f_{k+2} are not identical). If k indicates the last pulse or second-to-last pulse in the message, then f_{k+2} does not exist, so this rule shall not apply. For RTT-R messages, the last pulse in the message is indicated by k=48 (pulse number 72). For all other message types, the last pulse in the message (for the purpose of this rule) is indicated by k=420.

(d) The Terminal shall remove f^*_{k-2} from the candidate list. (This will ensure that f^*_k and f^*_{k-2} are not identical).

(e) The remaining list of candidate frequency numbers contains all the possible frequency numbers that are allowed for the replacement frequency f^*_k. The Terminal shall choose f^*_k from this candidate list, using the logic specified in Paragraph 3.3.h. For the time refinement and data pulses, the candidate list will never be empty, it will always contain at least five frequency numbers.

(2) The above logic requires the final frequency numbers selected for the two preceding pulses (f^*_{k-2} and f^*_{k-1}) to be examined in determining candidate frequencies for replacing the frequency number for the current pulse (f_k). If f_k refers to the frequency number of the first-time refinement pulse (k=9), then f^*_{k-2} and f^*_{k-1} refer to the frequency numbers used for the last two transmitted pulses in the synchronization preamble (f^*_5 and f^*_6). If f_k refers to the frequency number of the second time refinement pulse (k=10), then f^*_{k-2} refers to the frequency number used for the last transmitted pulse in the synchronization preamble (f^*_6), and f^*_{k-1} refers to the frequency number actually used for the first time refinement pulse (f^*_9).

(3) After frequency replacement has been accomplished for a pulse that required it, the resulting frequency number f^*_k (which represents an authorized carrier) shall be used for the transmission or reception of the pulse, instead of the frequency number f_k (which represents an unauthorized carrier).

h. Selection of the Replacement Frequency.

For any frequency f_k that must be replaced for a particular pulse, the Terminal shall scan through the sorted frequency list which was defined in Paragraph 3.3.c.(3), and shall select the first frequency number in the sorted frequency list that is also in the list of candidate frequencies that was determined for this pulse (according to the logic in Paragraphs 3.3.f. or 3.3.g.) Let this frequency number be denoted by f*. Next, the frequency selection counter C_{f*} shall be incremented by one (for a time refinement or data symbol pulse) or four (for a preamble pulse) for the selected frequency number f^*. Finally, the position of f* in the sorted frequency list shall be moved down to a location after all frequencies whose C_f value is less than the new value of C_{f*}, but before any other frequencies whose C_f value is greater than or equal to the new value of C_{f*}.

APPENDIX 3A: LINK 16 EMC FEATURES WHITEPAPER TEMPLATE

3A.1. LINK 16 EMC FEATURES WHITEPAPER.

Technical documentation developed by the vendor/PA containing the configuration of the Terminal to be certified, the SW, FW, and HW changes introduced in the configuration along with technical description of EMC Features design, implementation, and impacts (as applicable). Design-specific SW/FW/HW implementations that are not specifically covered by the Link 16 EMC Features Certification Manual but are associated with EMC Features functionality need to be articulated in the Whitepaper. The Whitepaper should be developed at the start of the Link 16 EMC Features certification process as illustrated in Figure 7.

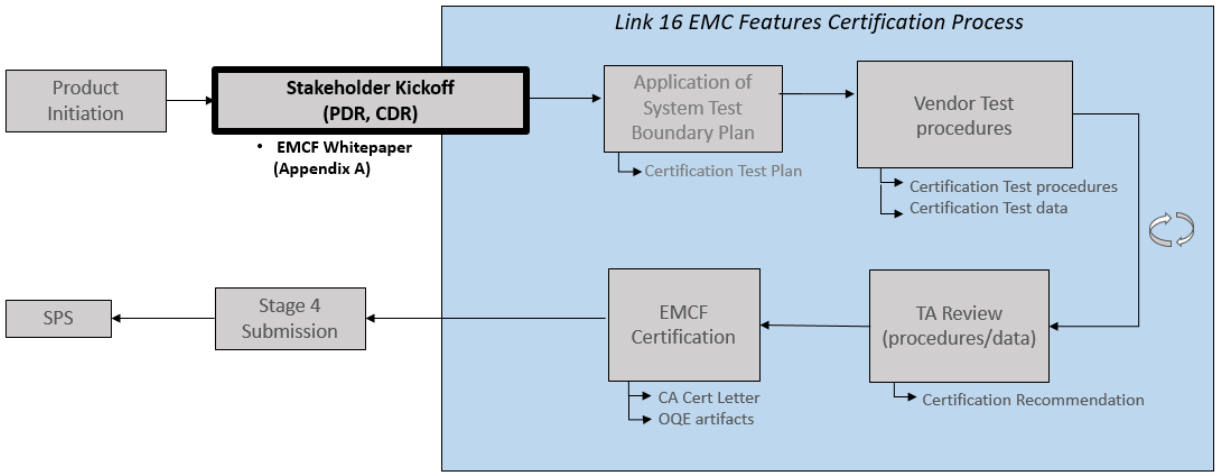


Figure 7. Link 16 EMC Features Certification Process (High-Level)

a. System Overview.

An overview/functional block diagram of the Terminal configuration (Terminal HW Line Replaceable Unit (LRU)/SRU) to include all relevant connections, signals, monitor ports, injection ports, antenna outputs, and description of host interfaces.

Summary of proposed changes.

b. EMC Features Monitors and Functions.

A description of the EMC Features design and implementation location:

(1) Description of HW monitors (CTT, UUAC, LLD, PW, and OP)

(a) Threshold setting levels, EMC Features fault, and transmit inhibit algorithms for each EMC Features monitor

(b) Number and description of the amplifier stages and measurement parameters (i.e., voltage, power, or current)

(c) Isolation technique (if applicable) if other waveform uses the same PA

(d) CTT insertion and pick off

(2) Description of BIT capabilities and algorithms

(3) Description of SW controls

(4) Description of power and antenna modes

(5) EMC Features Log Description and Process

(6) IPF mode startup, IPF fault retention, and SBIT (e.g., standby mode)

(7) Description of other waveforms using the PA or a portion of the Terminal (e.g., TACAN, IFF, and tactical targeting network technology (TTNT))

(8) SW/FW update Terminal field loading capabilities

(9) Acceptance test approach

(10) Functions not used by the Terminals (e.g., repromulgation relay, TSR, and OP for low power Terminals)

c. HW Configuration.

An overview of the projected HW configuration of the Terminal configuration to include (as applicable):

(1) Assembly description

(2) Part number/configuration information

(3) Revision version

d. HW Engineering Change Proposal (ECP).

A list of projected HW changes to the configuration to include:

(1) Description of change: component description or new/enhanced functionality

(a) ECP/problem report (PR) listing with explanation of change

(2) Component affected (e.g., RFA, Link 16 Transceiver, or Crypto)

(a) Redesign vs. part obsolescence/replacements

(3) Impact of change: PR/ECP listing with EMC Features evaluation/assessment of the HW change

If required or supporting information/technical documentation exists in another format, please include these documents as attachments.

e. SW/FW Configuration.

An overview of the projected SW and FW configuration of the Terminal configuration to include (as applicable):

(1) IB

(2) Block Cycle

(a) Version of CORE and signal message processor (SMP)

f. SW/FW Engineering Change Proposal.

A list of projected SW/FW changes to the configuration to include:

(1) Nature of change: problem or enhancement description (e.g., PR or ECP)

(2) Detailed summary of fix or SW implementation (e.g., list of modules)

(3) Component affected (e.g., OE, waveform (red/black side), field programmable gate array (FPGA), and modem hardware abstraction layer (MHAL))

(4) Impact of change: PR/ECP listing with EMC Features evaluation/assessment of the SW change

If required or supporting information/technical documentation exists in another format, please include these documents as attachments.

g. Certification Test Plan.

A list of proposed tests to certify the Terminal configuration by utilizing Appendix 3B: Link 16 EMC Features System Test Boundary Plan:

(1) SW Flowchart Output Matrix (reference Appendix 3B, Figure 9)

PR/ECP	Description	SW Decision Block (Y=Yes, N=No, NA=Not Applicable)						
		S1	S1.a	S1.a.1	S1.a.2	S1.b.	S1.b.1	S1.b.2

(2) HW Flowchart Output Matrix (reference Appendix 3B, Figure 10)

PR/ECP	Description	HW Decision Block (Y=Yes, N=No, NA=Not Applicable)						
		H1	H1.a	H1.b	H1.b.1	H1.b.2		

(3) Proposed Test Plan: Listing of suggested test cases to certify the terminal configuration (reference Appendix 3B, Table 2)

APPENDIX 3B: LINK 16 EMC FEATURES SYSTEM TEST BOUNDARY PLAN

3B.1. INTRODUCTION.

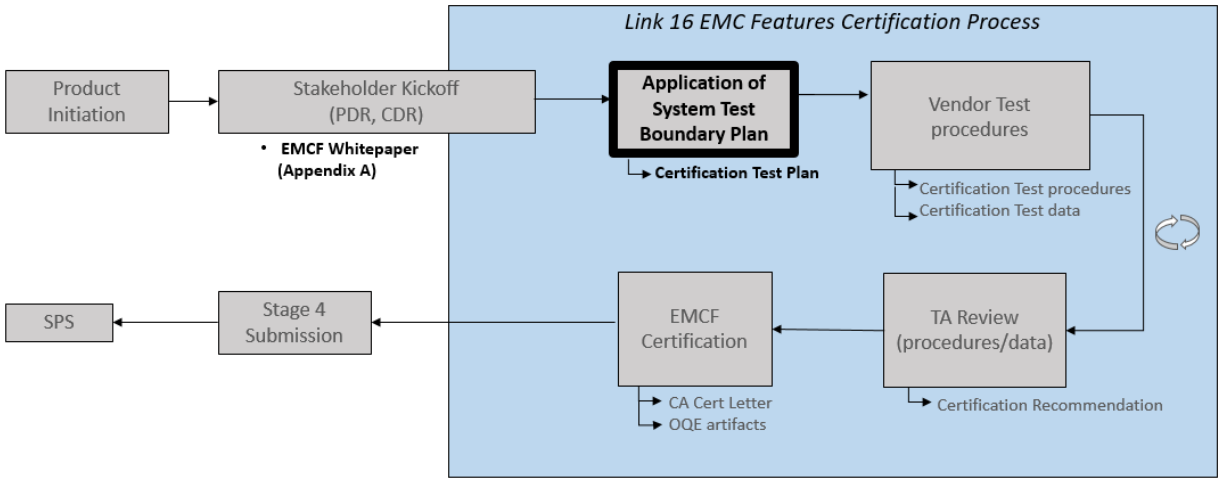
a. Overview.

The entirety of Link 16 EMC Features certification testing may span upwards of 200 test cases depending on the Terminal design and configuration. By utilizing this Link 16 EMC Features System Test Boundary Plan, a PA or vendor can assess and plan if proposed changes to a certified Terminal have the potential to impact EMC Features certification. The intent of the Link 16 EMC Features System Test Boundary Plan is to determine the appropriate level of testing required to certify changes to a previously certified Terminal and to reduce unnecessary testing. Final testing and certification determinations are made by CA through design evaluation, Terminal configuration changes, and impacts to EMC Features. This determination will be formally codified and provided to PA/vendor as an official Test Memorandum.

b. Scope.

The application of the System Test Boundary Plan applies to certified Link 16 Terminal HW, SW, or FW updates. The PA or vendor shall submit a Whitepaper articulating the EMC Features design, SW, FW, and HW changes to the Terminal configuration (see Appendix 3A), identifying potential impacts to EMC Features. The CA and the designated TA shall review and assess the projected impacts to EMC Features and make the initial determination for test scope and accomplishment by applying the System Test Boundary Plan. Any test scope changes will be formally communicated from CA to PA/vendor. Figure 8 illustrates where the application of the System Test Boundary Plan fits in the overall EMC Features certification process.

Figure 8. Link 16 EMC Features Certification Process (High-Level)



3B.2. SW OR FW CHANGES.

a. SW and/or FW changes may impact EMC Features. Use the guide in Figure 9 to evaluate SW and FW changes to determine if there is a need for additional EMC Features certification testing. This approach evaluates whether any of the SW/FW changes are made in EMC Features code modules (algorithm, controls, or the inhibit modules) or whether changes are made in the EMC Features control/message data flow/buffer. Examples provided in this section are not a comprehensive list of all possible changes.

b. Table 2 identifies potential EMC Features testing based on specific areas of change. Use this table to evaluate initial/appropriate level of testing. Any changes in test scope will be coordinated during NAVWAR TIM. EMC Features CA will provide formal feedback on final test scope determination.

c. Below are examples of SW and/or FW changes that may impact EMC Features:

- Changes or updates to EMC Features algorithms [Figure 9. Block S1.b.1]
- Changes or updates to EMC Features related SW controls [Figure 9. Block S1.b]
- Changes or updates to modules associated with EMC Features - processing the event/fault status, assessing the EMC Features algorithms, updating EMC Features thresholds for the power amplifier or making inhibit decisions (e.g., Link 16 Red/Black SW, OE (e.g., MHAL, Link 16 transceiver FPGA FW, and modem) [Figure 9. Blocks S1.b, S1.b.1, S1.b.2]
- Changes or updates to modules that share resources with Link 16 (e.g., message processing for events/faults/inhibit reporting) [Figure 9. Block S1.a]
- Changes or updates to modules that invoke/call EMC functions [Figure 9. S1.a.1]
- Changes or updates to the VP defaults (platform specific defaults) [Figure 9. S1.a.2]

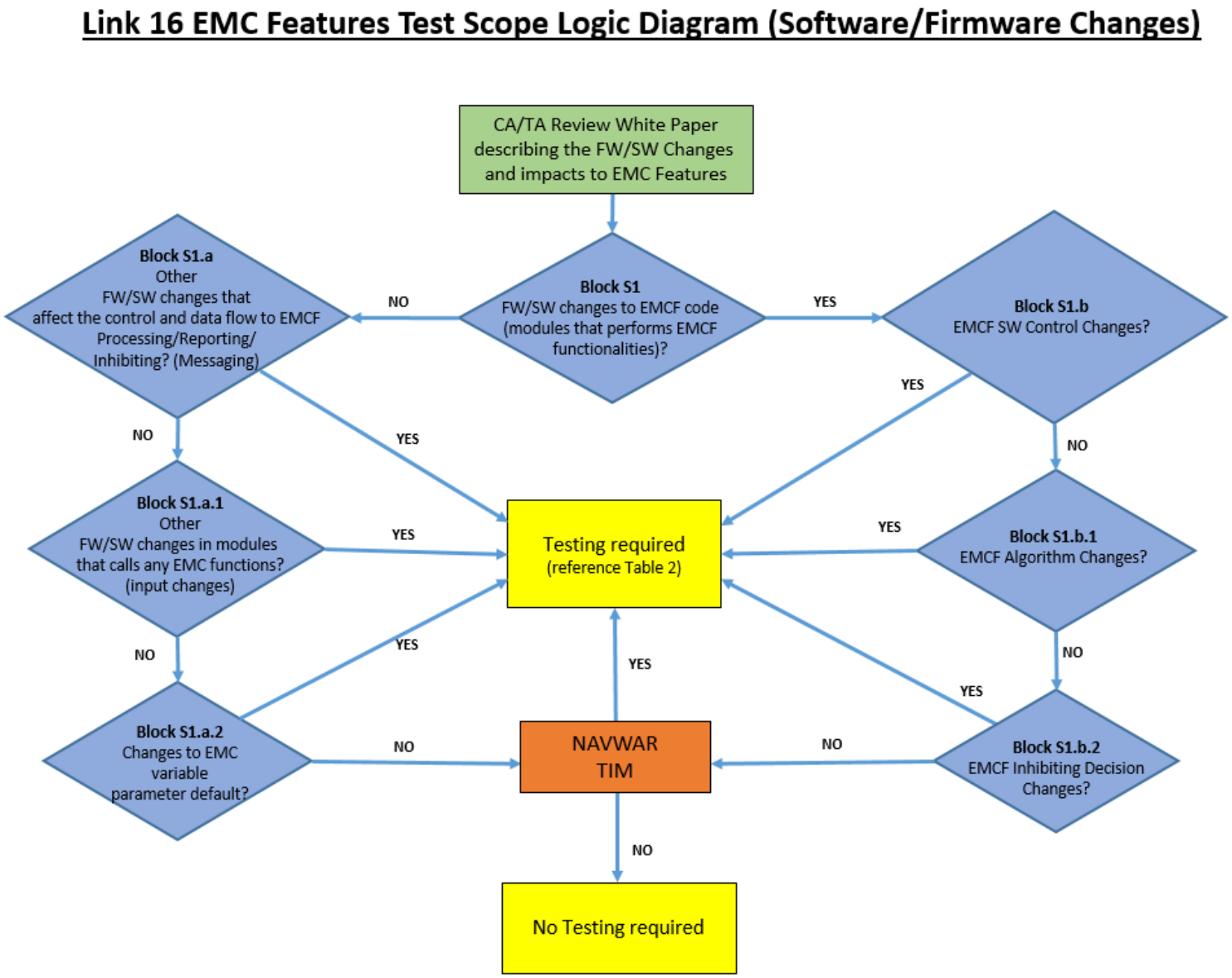


Figure 9. Link 16 EMC Features Test Scope Logic Flowchart (SW/FW Changes)

3B.3. HW CHANGES.

a. HW changes may impact EMC Features. Use the guide in Figure 10 to evaluate HW changes to determine if there is a need for additional EMC Features certification testing. EMC Features functions may be shared across multiple sub-components. HW changes or modifications of these components will require evaluation and a determination if testing is required. Examples provided in this section are not a comprehensive list of all possible changes.

b. Table 2 identifies potential EMC Features testing based on specific areas of change. Use this table to evaluate initial/appropriate level of testing. Any changes in test scope will be coordinated during the NAVWAR TIM. EMC Features CA will provide formal feedback on final test scope determination.

c. Below are examples of HW changes that may impact EMC Features:

- HW ECPs associated with the Link 16 transceiver, exciter, modulator, back panel, modems, antenna interface unit, amplifiers, or EMC Features monitor circuitry [Figure 10. Blocks H1.b, H1.b.2]
    - Changing or adding components in the Link 16 power amplifier (high power and/or external amplifier). The impact to EMC Features functionality will be dependent on the component and its location in the amplifier design
    - Changing or adding RF amplifiers and/or transistors in the Link 16 transmit path or in EMC Features monitor circuitry
    - Changes to RF detectors in EMC Features monitor circuitry
    - Changing or adding a component in the transmit path, BIT signal path, the data busses, or in EMC Features monitor circuitry
    - Changing or adding filters in the transmit path
    - Changing or adding attenuators in transmit path, BIT signal path, or in EMC Features monitor circuitry
    - Printed wiring board (PWB) re-spins that contain EMC Features monitor circuitry

d. Changes to EMC Features ATP test methods or tuning targets [Figure 10. Block H1.a] are not considered HW changes. However, scope of retest will need to be evaluated.

e. Part obsolescence will be identified and addressed via the ECP process and may be elevated to the NAVWAR TIM. Changes to screws, name plates, backshells, connectors, brackets, mounts, coatings, solder joints, and non-volatile memory are not considered impacts to EMC Features.

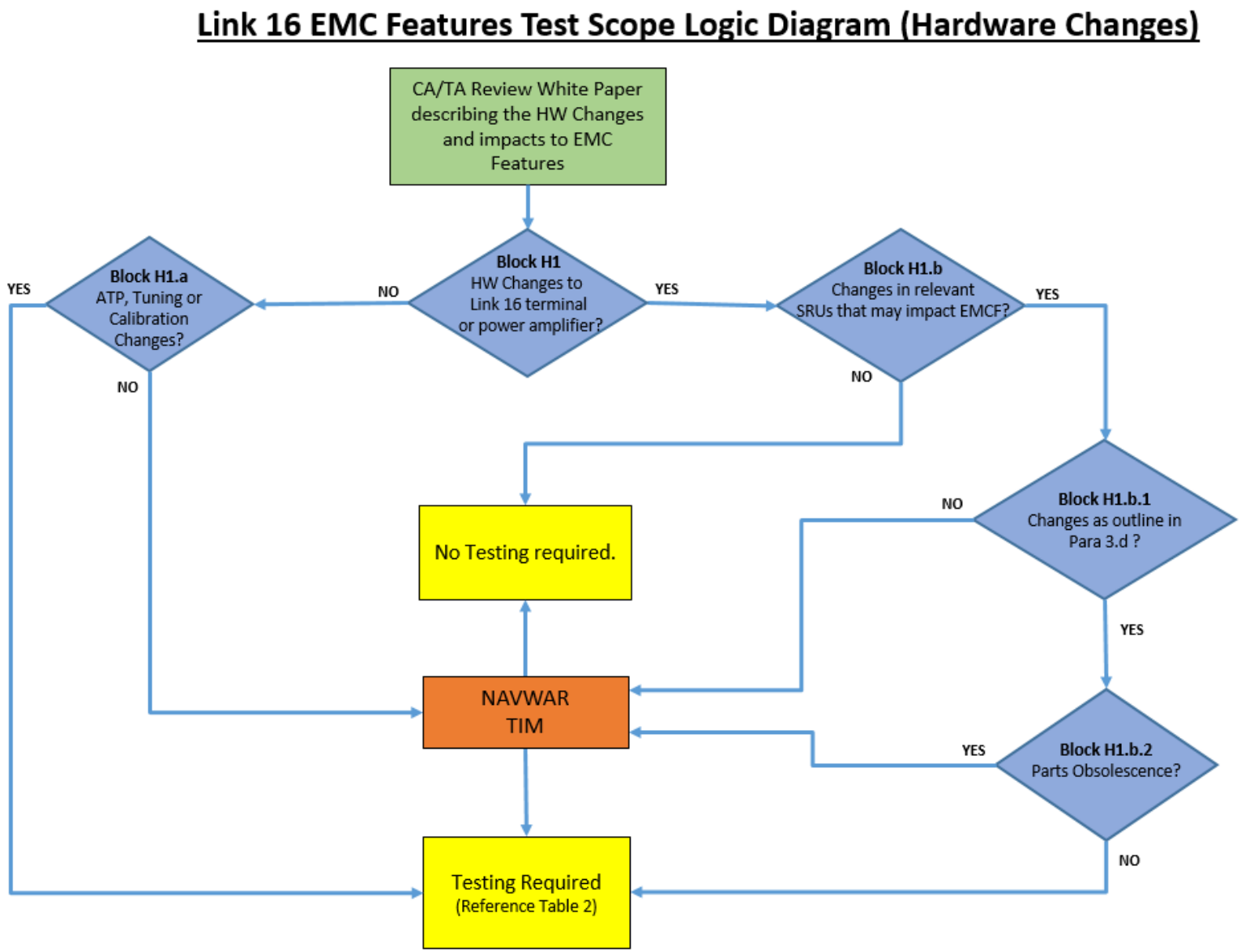


Figure 10. Link 16 EMC Features Test Scope Logic Flowchart (HW Changes)

a. Proposed Testing Guidelines.

Table 2 outlines suggested testing guidelines based on changes to the Link 16 Terminal and ancillary equipment.

Table 2. Proposed Testing Guideline

App	Test	DoD Manual 4650.01-M, Volume 2, Section 2.2 Test Objective	Shielding/ Chassis	Calibration	Transmit Path Hardware	EPF Path HW	EPF FW	Power Amp FW	Signal Message Processor FW	Signal Message Processor SW (Black Side-WF)	Link 16 Core Software (Red Side - WF)	OE-Platform SW
A	Power Between Link 16 Pulses and Between Messages	Objective 1 - Output Power between Pulses	●	●	●			●	●	●		
A		Objective 2 - Output Power between Messages	●	●	●			●	●	●		
A	RF Pulse and Full Band Spectrum	Objective 1 - Pulse Power Spectrum.	●	●	●			●	●	●		
A		Objective 2 - Exclusion Band, Band Edges, Broadband Spectral Characteristics	●	●	●			●	●	●		
A		Objective 3 - Multi-waveform	●	●	●			●	●	●		
A	Out of Band Emissions	Objective - Out of Band Emissions	●	●	●			●	●	●		
F	CTT Function Assessment	Objective 1- CTT Event Detection						●	●	●		
F		Objective 2 - CTT Monitor Levels	●	●	●							
F		Objective 3 - Mixed Link 16 and non-Link 16 CTT Fault Conditions						●	●	●		
F		Objective 4 - EPF Fault Assessment						●	●	●		
I		Objective 5 - Isolation SBIT/IBIT	●	●	●			●	●	●		
F		Objective 6 - EPA	●	●	●			●	●	●		
D	1030/1090 MHz LLD Function Assessment	Objective 1 - 1030/1090 Fault Detection					●		●	●		
D		Objective 2 - Verify Transmission Inhibit after Second EPF Fault					●		●	●		
D		Objective 3 - Combat Mode								●		
D		Objective 4 - LLD Thresholds using the -7 dBm Test Approach	●	●	●	●						
D		Objective 5 - LLD Suppression					●		●	●		
C	Pulse Width Monitor Function Verification	Objectives 1, 2, and 3 - Pulse Width Algorithm					●		●	●		
C		Objective 4 - Combat Mode								●		
C		Objective 5 - Pulse Width Monitor Detection Thresholds	●	●	●	●				●		
C		Objective 6 - PW Measurement Dynamic Range	●	●	●	●						
J	Uniform Use of Authorized Carriers	Objective 1 - Long-Term and Short-Term Histogram Fault Detection					●		●	●		
E		Objective 2 - High Level 1030/1090 MHz Fault Detection					●		●	●		
E		Objective 3 - Out of Band Fault Detection,					●		●	●		
E		Objective 4 - Band Edges, and 1030 MHz and 1090 MHz Transition Frequency	●	●	●	●				●		
E		Objective 5 - Frequency Detection Dynamic Range	●	●	●	●						
	● = Potential Impact											

App	Test	DoD Manual 4650.01-M, Volume 2, Section 2.2 Test Objective	Shielding/ Chassis	Calibration	Transmit Path Hardware	EPF Path HW	EPF FW	Power Amp FW	Signal Message Processor FW	Signal Message Processor SW (Black Side-WF)	Link 16 Core Software (Red Side - WF)	OE-Platform SW
B	Overpower Monitoring Function Assessment	Objective 1 - Output Power Level Measurements	●	●	●			●				
B		Objective 2 - High Power Transmissions Variable Parameter									●	
B		Objective 3 - Overpower Monitor Threshold and Algorithm	●	●	●	●	●		●	●		
G	TSDF Monitoring Function Assessment	Objectives 1 and 2 - TSDF Count and Inhibit							●			
G		Objective 3 - Zero Pulse Detection							●			
G		Objective 4 - Exercise EMC Feature Protection and Combat Modes.							●			
G	Message Structure Control Verification	Objective 1 - Message Structure Pulses per Time Slot Control									●	
G		Objective 2 - RTT-B Control									●	
G		Objective 3 - Allow or Disallow RTT-B Messages									●	
G		Objective 4 - Exercise EMC Protection and Combat Modes									●	
G	Net Usage Control Assessment	Objective 1 - Net Number Control									●	
G		Objective 2 - Exercise EMC Protection and Combat Modes									●	
G	CPSR and Repromulgation Relay Controls	Objective 1 - CPSR Time Slot Control									●	
G		Objective 2 - Suspended and Unconditional Paired Slot Relay Time Slots									●	
G		Objective 3 - Repromulgation Relay Time Slot Control									●	
G		Objective 4 - Exercise EMC Protection and Combat Modes									●	
G		Objective 5 - Repromulgation Relay Jitter Delay and Jitter Delay OBIT									●	
G		Objective 6-Repromulgation Relay Loopback OBIT								●	●	
G	Access Mode Controls Verification	Objective 1 - Machine-Controlled Contention Access Control Verification									●	
G		Objective 2 - TSR Control Verification									●	
G		Objective 3 - Centralized TSR Control Verification									●	
G		Objective 4 - Exercise EMC Protection and Combat Modes									●	
F	CTT Operational BIT	Objective 1 - CTT OBIT.						●	●	●		
F		Objective 2 - CTT Event Declaration						●	●	●		
F		Objective 3 - EPF Fault Declaration						●	●	●		
I	1030/1090 MHz LLD SBIT and IBIT Verifications	Objectives 1 through 3 and 6 - 1030/1090 LLD SBIT and IBIT	●	●		●						
I		Objectives 4 and 5 - 1030/1090 LLD SBIT and IBIT Simulated Failure					●		●	●		
	● = Potential Impact											

App	Test	DoD Manual 4650.01-M, Volume 2, Section 2.2 Test Objective	Shielding/ Chassis	Calibration	Transmit Path Hardware	EPF Path HW	EPF FW	Power Amp FW	Signal Message Processor FW	Signal Message Processor SW (Black Side-WF)	Link 16 Core Software (Red Side - WF)	OE-Platform SW
I	Pulse Width Monitor BIT Verification	Objectives 1 and 2 - PW Monitor SBIT and IBIT	●	●		●						
I		Objective 3 - The Terminal Inhibits Transmissions if the Test is not Successful					●		●	●		
J	Frequency Monitor OBIT	Objective - OBIT Frequency Fault Detection	●	●		●	●		●	●		
B	Overpower Monitor OBIT	Objectives 1, 2, and 3 - Peak Overpower Monitor OBIT Fault Detection	●	●	●	●	●		●	●		
H	Default to Full EMC Protection Mode after Terminal Power-On	Objective 1 - Default to Full EMC Protection Mode								●	●	
H		Objective 2 - Retaining the Current Use Set.								●	●	
H	Fault Report Retention after Combat Mode	Objective 1								●	●	
H		Objective 2								●	●	
H		Objective 3								●	●	
H		Objective 4								●	●	
H	EMC Features Data Storage Verification	Objective 1								●	●	●
H		Objective 2									●	
H		Objective 3									●	
H	SBIT Check after 2 Minutes in Standby	Objective - SBIT Check after 2 Minutes in Standby and clearance of the EPF Fault count.								●	●	
H	Transmit Inhibit Reset Shall Not Clear a Single EPF Fault Report	Objective - Single EPF Fault Report not cleared								●	●	
	● = Potential Impact											

APPENDIX 3C: DEVIATION FROM SPECIFICATION REQUEST

Guidance for DFS is outlined in DoW CIO Link 16 EMC Features Certification Manual Volume 1, Paragraph 3.1.e.

1. DEVIATION SERIAL NUMBER Click to enter text. (COMPLETED BY NAVWAR 5.0)	**2. DATE OF REQUEST** Click to select date.	
3A. TERMINAL TYPE Click to enter text.	**3B. TERMINAL HARDWARE NOMENCLATURE** Click to enter text.	**3C. OTHER IDENTIFIER / ALIAS** Click to enter text.
4A. TERMINAL SOFTWARE / FIRMWARE Click to enter text.	**4B. SOFTWARE ALIAS** Click to enter text.	**5. ADDITIONAL IDENTIFIER** Click to enter text.
6A. VENDOR NAME Click to enter text.	**6B. GOVERNMENT REPRESENTATIVE** Click to enter text.	
7A. DEVIATION TYPE: DESIGN ☐ PERFORMANCE ☐	**7B. EXPECTED CLEARANCE DATE** Click to enter text.	
8. APPLICABLE REFERENCES / IMPACTED REQUIREMENTS (Link 16 EMC Features Certification Manual) Click to enter text.		
9. DEVIATION SUMMARY (TO INCLUDE EMCF MONITOR IMPACTS AND PLANS FOR RESOLUTION (AS REQUIRED)) Click to enter text.		
10. TERMINAL / COMPONENT / LOCATION AND SHORT DESCRIPTION Click to enter text.		
11. APPLICABLE TEST REPORT(S) / SUPPORTING DOCUMENTATION Click to enter text.		
12. SUBMITTING ACTIVITY (WITH POC INFO) Click to enter text.		

13. ATTACHMENTS		
	NAME	**DESCRIPTION**
1	Click to enter text.	Click to enter text.
2	Click to enter text.	Click to enter text.
3	Click to enter text.	Click to enter text.

PROGRAM OFFICE / SPONSOR TECHNICAL AUTHORITY	○ Not Required
14A. CONCURRENCE: ○ YES ○ NO	**14B. DFS TYPE:** ○ TEMPORARY ○ PERMANENT
14C. ACTION: ○ FORWARD TO NAVWAR TWH FOR REVIEW ○ FORWARD TO NAVWAR 5.0 TECH AUTH FOR REVIEW	
14D. PROGRAM OFFICE / SPONSOR TA COMMENTS (ENDORSEMENTS): Click to enter text.	
14E. Program Office / Sponsor TA Name: Click to enter text.	**Date:** Click to select date.
NAVWAR TECHNICAL WARRANT HOLDER	○ Not Required
15A. CONCURRENCE: ○ YES ○ NO	**15B. DFS TYPE:** ○ TEMPORARY ○ PERMANENT
15C. ACTION: ○ FORWARD TO NAVWAR 5.0 TECH AUTH FOR REVIEW ○ FORWARD TO NAVWAR 5.0 CA FOR DETERMINATION	
15D. NAVWAR TWH COMMENTS (ENDORSEMENTS) Click to enter text.	
15E. NAVWAR TWH Name: Click to enter text.	**Date:** Click to select date.
NAVWAR 5.0 TECHNICAL AUTHORITY	
16A. CONCURRENCE: ○ YES ○ NO	**16B. DFS TYPE:** ○ TEMPORARY ○ PERMANENT
16C. ACTION: ○ FORWARD TO NAVWAR CA FOR DETERMINATION	
16D. NAVWAR 5.0 TA COMMENTS (ENDORSEMENTS) Click to enter text.	
16E. NAVWAR 5.0 TA Name: Click to enter text.	**Date:** Click to select date.
NAVWAR 5.0 CERTIFICATION AUTHORITY	
17A. APPROVAL: ○ YES ○ NO	**17B. DFS TYPE:** ○ TEMPORARY ○ PERMANENT
17C. ACTION: ○ RETURN TO PO TECH AUTH/VENDOR ○ FORWARD TO EXTERNAL AGENCY FOR REVIEW	
17D. NAVWAR CA COMMENTS (ENDORSEMENTS) ☐ PRECEDENT SETTING	Click to enter text.
17E. NAVWAR 5.0 CA Name: Click to enter text.	**Date:** Click to select date.
NTIA SPS WG-1	
18A. SPS NUMBER: Click to enter text.	**18B. APPROVAL:** ○ YES ○ NO
18C. NTIA SPS WG-1 COMMENTS (ENDORSEMENTS)	Click to enter text.
18D. NTIA SPS WG-1 Chair Name: Click to enter text.	**Date:** Click to select date.

This form must be completed electronically or typed.

REQUEST FOR DEVIATION FROM SPECIFICATION

INSTRUCTIONS

VENDOR:

2. Date of Request. e.g. "October 1, 2024"
3A. Terminal Type. Link 16 Terminal Type (e.g. JTIDS, MIDS-JTRS, BATS, TTR)
3B. Terminal Nomenclature. Link 16 Hardware Type (e.g. AN/URC-107(V)7)
3C. Other Identifier / Alias. Other HW Aliases.
4A. Terminal Software / Firmware. Link 16 Terminal Software Version (e.g. IB 3.6.5)
4B. Software Alias. e.g. "ER0H"
5. Additional Identifier. Problem Report or Engineering Change Proposal Identifier associated with DFS.
6A. Vendor Name. Terminal Manufacturer
6B. Government Representative. Government POC as applicable.
7A. Deviation Type. Check the appropriate box (Design: Terminal Design, Performance: Known Defect/Issue)
7B. Expected Clearance Date. Estimated date when DFS is scheduled to be resolved.
8. Applicable References / Impacted Requirements. Link 16 EMC Features Certification Manual Requirement Traceability
9. Deviation Summary. Brief summary of the impacted requirement, DFS, its impacts (operational and EMC Features) and plans to address the deviation.
10. Terminal / Component / Location & Short Description. Detailed description of the DFS.
11. Applicable Test Reports / Supporting Documentation. OQE artifacts associated with DFS.
12. Submitting Activity. Person submitting DFS.
13. Attachments. Additional artifacts to support DFS.

PROGRAM OFFICE / SPONSOR TECHNICAL AUTHORITY (IF REQUIRED):

14A. Concurrence. Check the appropriate button whether the reviewer/official concurs or not concurs with DFS.
14B. DFS Type. Check the appropriate button for DFS Type. Permanent DFS categorization is for deviations that are not planned to be resolved in this config
14C. Action. Check the appropriate button for Routing/Next Action.
14D. Program Office / Sponsor TA Comments. Indicate comments and feedback here.
14E. Program Office / Sponsor TA Name/Date. Program Office TA Reviewer Name conducting review and Date of Review.

NAVWAR TECHNICAL WARRANT HOLDER (IF REQUIRED):

15A. Concurrence. Check the appropriate button whether the reviewer/official concurs or not concurs with DFS.
15B. DFS Type. Check the appropriate button for DFS Type. Permanent DFS categorization is for deviations that are not planned to be resolved in this config
15C. Action. Check the appropriate button for Routing/Next Action.
15D. NAVWAR TWH Comments. Indicate comments and feedback here.
15E. NAVWAR TWH Name/Date. NAVWAR TWH Reviewer Name conducting review and Date of Review.

NAVWAR 5.0 TECHNICAL AUTHORITY:

16A. Concurrence. Check the appropriate button whether the reviewer/official concurs or not concurs with DFS.
16B. DFS Type. Check the appropriate button for DFS Type. Permanent DFS categorization is for deviations that are not planned to be resolved in this config
16C. Action. Check the appropriate button for Routing/Next Action.
16D. NAVWAR 5.0 Technical Authority Comments. Indicate comments and feedback here.
16E. NAVWAR 5.0 TA Name/Date. NAVWAR 5.0 TA Reviewer Name conducting review and Date of Review.

NAVWAR 5.0 CERTIFICATION AUTHORITY:

17A. Approval. Check the appropriate button whether the reviewer/official approves or disproves with DFS.
17B. DFS Type. Check the appropriate button for DFS Type. Permanent DFS categorization is for deviations that are not planned to be resolved in this config.
17C. Action. Check the appropriate button for Routing/Next Action.
17D. NAVWAR 5.0 Certification Authority Comments. Indicate comments and feedback here.
17E. NAVWAR 5.0 CA Name/Date. NAVWAR 5.0 CA Reviewer Name conducting review and Date of Review.

NTIA SPS WG-1:

18A. SPS NUMBER. Enter the SPS tracking number for this DFS.
18B. Approval. Check the appropriate button whether the reviewer/official approves or disproves with DFS.
18C. NTIA SPS WG-1 Comments. Indicate comments and feedback here.
18D. NTIA SPS WG-1 Chair Name/Date. NTIA SPS WG-1 Chairperson Name and Date of Signature.

GLOSSARY

G.1. ACRONYMS.

ACRONYM	MEANING
AP	Adaptable Parameter
APM-E	Assistant Project Manager for Engineering
ARNS	Aeronautical Radio-Navigation Service
ATC	Air Traffic Control
ATP	Acceptance Test Procedure
ATR	Acceptance Test Reports
BIT	Built-in Test
BW	bandwidth
C2	command and control
CA	Certification Authority
CDRL	Contract Data Requirements List
CIO	Chief Information Officer
CNO	Chief of Naval Operations
CPSM	continuous phase shift modulation
CPSR	conditional PSR
CTT	capability to transmit
CW	continuous wave
dB	decibel
dBc	dB relative to the carrier
dBm	dB relative to one milliwatt
DFS	deviation from specification
DME	distance measuring equipment
DoDI	DoD instruction
DoDM	DoD manual
DoW	Department of War

E3	Electromagnetic Environmental Effects
ECP	Engineering Change Proposal
EL-CID	Equipment Location - Certification Information Database
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EPA	external power amplifier
EPF	EMC Protection Feature(s)
FAA	Federal Aviation Administration
FMO	Frequency Monitor OBIT
FPGA	field programmable gate array
FR	frequency remap
FW	firmware
HLD	High-Level Detector
HPA	high power amplifier
HPAG	High Power Amplifier Group
HW	hardware
IB	integrated build
IBIT	Initiated BIT
ICD	interface control document
IFF	identification friend or foe
IJMS	Interim JTIDS Message Specification
INE	initial network entry
IPF	Interference Protection Feature
IRAC	Interdepartment Radio Advisory Committee
Ith	current level threshold
Itr	current level
JTIDS	Joint Tactical Information Distribution System
kHz	kilohertz
LLD	low-level detector
LOS	line of sight

LRU	line replaceable unit
LTTI	long-term transmit inhibit
LVT	Low Volume Terminal
µs	microsecond
ms	millisecond
MHAL	modem hardware abstraction layer
MHz	megahertz
MIDS	Multifunctional Information Distribution System
NAS	National Airspace System
NAVWAR	Naval Information Warfare Systems Command
NMSC	Navy Marine Corps Spectrum Center
NPG	Network Participation Group
NTIA	National Telecommunications and Information Administration
NTR	network time reference
OBIT	Operational BIT
OE	operating environment
OOB	out of band
OP	overpower
OQE	objective quality evidence
PA	Programmatic Authority
PDR	preliminary design review
PG	participation group
PPF	platform parameter file
PPLI	precise participant location and identification
PR	problem report
PSR	paired slot relay
Pth	power level threshold
Ptr	power level
PW	pulse width
PWB	printed wiring boards
RBW	resolution BW

RF	radio frequency
RTT	round-trip timing
RTT-B	RTT-broadcast
RTT-I	RTT-interrogation
RTT-R	RTT-reply
SBIT	Start-Up BIT
SCA	SW Communications Architecture
SDU	secure data unit
SMO	Spectrum Management Office
SMP	signal message processor
SN	serial number
SNE	start network entry
SOW	statement of work
SPS	Spectrum Planning Subcommittee
SPS WG-1	SPS WG One
SRU	shop replaceable unit
SSS	system segment specification
SW	software
TA	Technical Authority
TACAN	tactical air navigation
TADIL J	Tactical Digital Information Link J
TDMA	time division multiple access
TFA	temporary frequency assignment
TIM	technical interchange meeting
TRANSEC	transmission security
TSA	time slot assignment
TSDF	time slot duty factor
TSR	time slot reallocation
TTNT	tactical targeting network technology
UUAC	uniform use of authorized carriers
VP	variable parameter
Vth	Vtr threshold

Vtr	voltage level
W	watt
WG	working group

G.2. DEFINITIONS.

TERM	DEFINITION
AP	APs are the control parameters that are implemented in SW in a prescribed format to facilitate adjustment of parameter values at initialization or by operator entries without requiring reassembly of the computer program database.
ATC system	The national system used for providing information to aircraft and to air traffic controllers to enable the controllers to provide safe separation distances between aircraft that are enroute or within the Terminal areas.
Class 2H Terminal	A JTIDS Class 2 Terminal equipped with a High Power Amplifier Group (HPAG) for use in large airborne and surface command and control (C2) elements. The Class 2H Terminal uses J-series messages and has nominal output powers of 200 W or 1000 W. Some Class 2H Terminals will also have the capability to use Interim JTIDS Message Specification (IJMS) messages.
Communication Mode 1	Normal mode of operation which includes frequency hopping.
Communication Mode 2	No frequency hopping. All pulses are transmitted on a single frequency.
contention	A term used to denote multiple Link 16 transmissions that use the same frequency hopping pattern in the same time slot.
contention access	A Link 16 transmit access mode in which a group of Link 16 Terminals is assigned a pool of time slots to satisfy their transmission requirements. Time is divided into access intervals (e.g., once every three seconds). A user may transmit only up to the prescribed quantity of messages per access interval. Users randomly select their transmit time slots from the pool at the access rate they have been assigned regardless of the potential for two or more Terminals in the network to select the same time slot for transmission. Also referred as “random access.”

TERM	DEFINITION
coordinated Link 16 operations	Operations that: Desire to operate outside of peacetime spectrum certification limits. Do not have a valid frequency assignment for the geographic area desired. Do not meet all the EMC conditions required for Terminal operations to include co-site and collocation requirements or contain a platform that is not identified in the approved EL-CID. These operations are requested through NMSC and individually coordinated on a case-by-case basis with the FAA.
CTT	The Terminal operational state when the Link 16 message generation capability is not isolated (either through SW/FW or HW) from the power amplifiers or associated circuitry such that the transmitter has the ability to transmit Link 16 pulses. In the context of the CTT monitors, this is the period when the monitor indicates that a condition exists where a pulse is being transmitted.
EMC	The ability of systems, equipment, and devices that utilize the electromagnetic spectrum to operate in their intended operational environments without suffering unacceptable degradation or causing unintentional degradation because of electromagnetic radiation or response. It involves the application of sound electromagnetic spectrum management; system, equipment, and device design configuration that ensures interference-free operation; and clear concepts and doctrines that maximize operational effectiveness.
EMC Feature(s)	The HW, FW, and SW controls in a Link 16 Terminal that are used to detect Terminal faults which affect the Link 16 time/frequency waveform. FW/SW operational controls may also be used to lockout Terminal capabilities and control pulse transmission limits to ensure compliance with the frequency certification/clearance.
EPF	An alternate term for EMC Feature(s).
EPF event	The result of an EPF monitor detecting a condition that exceeds its threshold during a 13 µs period in which the monitor is active. EPF events may be purged from memory at the conclusion of the time slot.

TERM	DEFINITION
EPF event/fault condition	The signal or circumstance which results in an EPF event/fault.
EPF failure	The result of two EPF faults incurred during two distinct time slots, EPF SBIT or IBIT failure, or excessive TSDF. EPF failure results in the inhibition of further transmission prior to the subsequent time slot. EPF failure is not possible in Combat mode and not permitted to be cleared automatically except in the case of excessive TSDF at the conclusion of the 12-second frame. EPF failure may be cleared via EPF reset.
EPF fault	The result of sufficient quantity of EPF events during normal operation or OBIT in a 7.8125 ms time slot. EPF faults may be purged from memory after 24 hours or upon Terminal reboot so long as SBIT is performed upon reboot.
EPF mode	The mode of the Terminal where either all EMC Feature HW and SW controls are invoked (i.e., Full EMC Protection mode), only the HW controls are invoked (Exercise EMC Protection mode), or only the HW controls are invoked without the requirement to inhibit Link 16 transmissions (Combat mode).
EPF monitor port	Used to measure the RF characteristics of the injected signals that were used to simulate the various faults. There cannot be any RF devices between the last amplifier and the monitor port that can affect the RF characteristics of the injected signals such as the frequency and the PW.
epoch	A 12.8-minute interval consisting of 98,304 time slots. A 12-second subdivision of this epoch (sometimes referred to as a “frame”) is used in the Link 16 network designs.
high power output mode	A Terminal peak output power of stronger than 200 W + 1 dB, which does not exceed the selected high power mode by more than 1 dB summed for all the RF outputs of the Terminal.

TERM	DEFINITION
initial net entry process	The process the Terminal uses for achieving coarse synchronization with the network time. Coarse synchronization is usually achieved through successful reception of the Tactical Digital Information Link J (TADIL J) initial entry message or the IJMS net entry message. The network time reference (NTR) Terminal automatically transmits the initial entry message. Any Terminal may be initialized to transmit the initial entry message to facilitate network entry for Terminals that are not within line of sight (LOS) of the NTR. A Class 1 Terminal equipped NTR must be specifically initialized to transmit the net entry message.
initial net entry time slot	A specified time slot used for the Network synchronization process that all Terminals are inherently capable of receiving. Each Terminal must be specifically initialized to transmit in this specific net entry time slot. The INE time slot is the first time slot in each frame (epoch subdivision). The NTR automatically transmits the INE message in every such time slot. Other Terminals may be initialized to transmit in the initial entry time slot; they do so at an average rate of once per 24 seconds.
input nets	The exclusive use of time slot blocks by Link 16 users on one identified net which is part of the same network. There are 127 individual nets numbered from 0 to 126.
input ports	There are two input ports, one to inject the LLD faults prior to the antenna and one to inject the faults into the remaining monitors (not needed if the transmitted signal can be modified to simulate the various fault conditions).

TERM	DEFINITION
instantiation	In object-oriented programming, instantiation refers to the process for constructing an object instance from its parent object class. The JTRS SW Communications Architecture (SCA) extends this definition to include the process of launching the execution of installed application SW programs.[12] Waveforms are considered a type of application. The Application Factory interface class, defined in the SCA, provides an interface to request the creation of a specific type of application in the host radio domain. The Application Factory's create function allocates the resources required to run the application, loads the SW components comprising the application, connects the components to create transmission and/or reception channels, and initializes the application to a known state.[13]
IPF	An alternate term for EPF.
IRAC	A committee that assists in the assignment of frequencies to U.S. Government radio stations and in the development and execution of policies, programs, procedures, and technical criteria relevant to spectrum allocation, management, and use.
isolation	The state whereby the JTIDS/MIDS TDMA waveform capability is prevented (either through SW/FW or HW techniques) from sending messages or causing JTIDS/MIDS pulses from being transmitted through the Terminal antenna output ports or the EPA ports.
JTIDS	An advanced information distribution system that provides secure integrated, navigation, identification, and communications capabilities for application to military tactical operations. The system is designed to distribute information at high rates, encrypted, and in such a way as to provide secure, jam resistant and reliable navigation, identification, and communication capabilities in hostile electromagnetic environments.

[12] *Support and Rationale Document for the Software Communications Architecture Specification*, MSRC-5000SRD V1.2, Modular Software-Programmable Radio Consortium, December 21, 2000 pp. 3-15 - 3-16.
[13] *Software Communications Architecture Specification*, MSRC-5000SCA V2.2, Modular Software-Programmable Radio Consortium, November 17, 2001, pp. 3-38 - 3-44.

TERM	DEFINITION
Link 16 EMC Features	Those features implemented in Link 16 Terminals to prevent harmful EMI to Aeronautical Radio-Navigation Service (ARNS) systems operating in the same frequency band. The SPS WG-1, which reports to the NTIA IRAC, has established EMC Features requirements in NTIA Joint Tactical Information Distribution System/Multifunctional Information Distribution System (JTIDS/MIDS) Time Division Multiple Access (TDMA) Architecture and Waveform Spectrum Support Certification, Interdepartment Radio Advisory Committee Document (IRAC) 33583/6.
Link 16 EMC Features certification	Validation that Link 16 Terminal design, platform integration, operations, and maintenance meet requirements of NTIA Joint Tactical Information Distribution System/Multifunctional Information Distribution System (JTIDS/MIDS) Time Division Multiple Access (TDMA) Architecture and Waveform Spectrum Support Certification, Interdepartment Radio Advisory Committee Document (IRAC) 33583/6 and Section 3.2 of Volume 1.
Link 16 pulse	A 6.4 μs wide burst of energy at a carrier frequency. The carrier is continuously phase shift modulated by a 32-chip binary pseudorandom sequence at a five megabit per second rate. The 32-chip sequence represents a five-bit data symbol. The pulse also contains up to five additional chips in the leading edge and trailing edge for control of soft Turn-ON and Turn-OFF. The inter-pulse period for consecutive Link 16 pulses is 6.6 μs.
Link 16 Terminal	Any configuration of HW and SW/FW that is capable of producing the Link 16 TDMA waveform and includes all Terminal elements up to the antenna as defined in NTIA Joint Tactical Information Distribution System/Multifunctional Information Distribution System (JTIDS/MIDS) Time Division Multiple Access (TDMA) Architecture and Waveform Spectrum Support Certification, Interdepartment Radio Advisory Committee Document (IRAC) 33583/6.
message structure	The organization of Link 16 pulses within a time slot to provide for different information capacities and performance levels. The Class 1 Terminal can transmit 72, 129, or 258 Link 16 pulses in a time slot. The JTIDS Class 2 Terminal family and the MIDS LVT and MIDS Fighter Data Link Terminal can transmit 72, 258, or 444 Link 16 pulses in a time slot.

TERM	DEFINITION
MIDS	An advanced information distribution system, using the Link 16 waveform that provides navigation, identification and communication capabilities in an integrated form for application in air, land, and maritime tactical operations.
multinet (multiple nets)	A term used to denote multiple Link 16 transmissions in a time slot by different Terminals within the same operations area, each transmission using a different frequency hopping pattern.
net	A time division structure consisting of a single continuous sequence of time slots with a unique pseudorandom frequency hopping pattern. Any one of the unique pseudorandom frequency hopping patterns that may be generated by a Link 16 Terminal is a complex function of several elements that include net number, crypto-variable, and time. Link 16 Terminals that employ all the same elements on a time slot by time slot basis are participants on the same JTIDS/MIDS net.
network	A community of Link 16 users synchronized to a common NTR to exchange information.
network management	The process used to select appropriate Terminal parameters (such as APs) for member Terminals, assign time slots to provide for the transmission and reception requirements of each Terminal, and assure that all Terminals are initialized in a compatible manner so that a Link 16 communication network is established and maintained within the National Frequency Clearance Authorization Limits.
not having the CTT	A Terminal State in which any of the following items are true: The transmitter is not powered ON. The Link 16 waveform capability is isolated from the transmission circuitry that could produce Link 16 pulses or energy. The transmitter is sufficiently supervised and/or monitored to establish that its output is 80 dB or more below the selected output power mode.
packed 2 double pulse message	A JTIDS/MIDS message structure comprised of 444 pulses. This message structure contains the same amount of information as the packed 2 single pulse message, but information transfer reliability is enhanced by retransmitting each bit of information on the adjacent pulse.

TERM	DEFINITION
packed 2 single pulse message	A standard message structure comprised of 258 pulses. This message structure transmits twice as much information as the standard double pulse message because each bit of information is transmitted only once.
packed 4 single pulse message	A message structure comprised of 444 pulses. This message structure holds twice as much information as the packed two double pulse message and four times as much as the standard double pulse message because each bit of information is transmitted only once.
PSR	Retransmission of a message in a time slot block of the same size as the block of time slots designated for receiving the message to be relayed.
pulse density	See TSDF and equivalent TSDF definitions.
qualification test of Link 16 Terminal EMC Features and emitted RF signals	EMC Features and RF emissions data collection that will be used as final data in the EMC Features Qualification Test Report (or any interim reports) to certify the EMC Features compliance with NTIA Joint Tactical Information Distribution System/Multifunctional Information Distribution System (JTIDS/MIDS) Time Division Multiple Access (TDMA) Architecture and Waveform Spectrum Support Certification, Interdepartment Radio Advisory Committee Document (IRAC) 33583/6 and Section 3.3 of Volume 1.
random access mode	An alternative term for the contention access mode.
relay	Retransmission of a message at a fixed number of time slots after its initial reception.
repromulgation relay	A Link 16 relay technique that includes random jitter and is used to extend information transfer beyond LOS distances. A Terminal receiving a repromulgation relay message retransmits it in a later time slot donated by the originating Terminal, unless the Terminal received the identical message earlier or unless the specified number of retransmissions has been satisfied.
RF ports	Input ports and monitor port used to test LLD, LLD SBIT/IBIT, PW, PW SBIT/IBIT, OP, OP OBIT, UUAC, and FMO.
RTT-B	A type of RTT-I. Supports active fine synchronization of all Link 16 Terminals in the Network through broadcast RTT-Is.

TERM	DEFINITION
RTT message	Messages required for Terminal synchronization. An RTT message is either an interrogation that requests time-of-arrival information or a reply. RTT-Is and replies each contain 72 pulses. A reply message is transmitted in the same time slot as the requesting interrogation.
spectrum support certification	The certification by the National Regulatory Administrations that a given type of electronic equipment can be operated in a given frequency band to provide a specified class of service. (Synonymous with Frequency Clearance.)
SPS	A subcommittee of the IRAC that is responsible for planning for the use of the electromagnetic spectrum in the national interest. SPS responsibilities include apportionment of spectrum space for the support of established or anticipated radio services, as well as the apportionment of spectrum space between or among government and non-government activities.
SPS WG-1	A WG of the United States SPS established by the NTIA to evaluate all systems that operate in the 960 to 1215 MHz band. The NTIA reviews Federal Systems for frequency supportability and EMC.
TDMA	The architectural principle for which Link 16 networks are structured and periods of transmission are assigned to every participating unit. TDMA is a technology that allows many units to share the same frequency band by dividing it into different time slots. The users transmit in rapid succession, one after the other, each using their own assigned time slots. For this manual, the TDMA waveform refers to the waveform tested in the SPS WG-1 JTIDS EMC Test Program.
Terminal	Link 16 TDMA signals are transmitted using equipment referred to in this specification as a Terminal. A Terminal is any configuration of HW and SW that is instantiated to provide the Link 16 waveform. The Terminal may have one or multiple RF output ports. It also may have an interface to an EPA.
time slot	A 7.8125 millisecond time interval during which Link 16 messages may be transmitted or received.

TERM	DEFINITION
transmission inhibit	An action taken by the Terminal to prevent the transmission of any TDMA RF signals from its antenna ports as a result of EMC Feature failures. Re-evaluate the Fault Logging section to determine if additional clarity/words are needed to distinguish between transmission inhibit caused by EMC Features failures and other settings such as long-term transmit inhibit (LTTI).
TSDF	A two-term parameter that specifies the number of pulse transmissions allowed for a community of Link 16 Terminals during each 12-second frame. The first term is a percentage indicator of the number of transmissions allowed for the total community. The second percentage term indicates the limit for a single Terminal. The 100/50 TSDF notation specifies that the total community is limited to a pulse density of 396,288 (258 x 1536) transmitted Link 16 pulses in a 12-second frame and a single Terminal is limited to 198,144 (50% x 396,288) pulses. The TSDF is always stated in terms of a standard time slot containing 258 pulses. Therefore, the total number of pulses can be derived for a 100/50 TSDF by considering the 100% for the total community as: $100\%\ \text{TSDF} = \frac{258\ \text{pulses}}{\text{time slot}} \times \frac{128\ \text{time slots}}{\text{second}} \times \frac{12\ \text{seconds}}{\text{frame}}$ $= 396{,}288\ \text{pulses/frame}$ Using this total, the maximum percentage of time slots that is available to the Link 16 community for a 100/50 TSDF if all Terminals are programmed for Packed 4 single pulse messages can be derived by: $\text{Packed 4 time slot limitation} = \frac{396{,}288\ \text{pulses/frame}}{\frac{444\ \text{pulses}}{\text{time slot}} \times \frac{128\ \text{time slots}}{\text{second}} \times \frac{12\ \text{seconds}}{\text{frame}}}$ $= 58\%$
TSR	An access mode in which users share a predefined pool of time slots that are allocated to them dynamically, according to their current demands. The TSR protocol attempts to assure that Terminals have dedicated access to their allocated time slots. After the network is designed and the pool of TSR time slots is determined, entry to and exit from the TSR community is automatic.

TERM	DEFINITION
uncoordinated Link 16 operations	Operations that occur within the peacetime spectrum certification limits, have a valid frequency assignment for the desired geographic area, and all participating platforms are identified in the approved EL-CID.
VP	Parameters implemented in SW in a prescribed format to facilitate adjustment of values that may be required as the result of deployment or spectrum certification limits. These parameters may only be changed by recompiling the computer program or approved platform parameter file (PPF) loads. The notation [3 (1 - 5, 1)] means that the parameter is set at three, but may be changed from one to five in steps of one unit.
Vth, Ith, Pth	The voltage level (Vtr) threshold (Vth), current level (Itr) threshold (Ith), or power level (Ptr) threshold (Pth) of a CTT monitor whereby the monitor would declare during transmission of a Link 16 pulse.
Vtr, Itr, Ptr	The Vtr, Itr, or Ptr at a CTT monitor during transmission of a Link 16 pulse.

REFERENCES

Chairman of the Joint Chiefs of Staff Instruction 6232.01F, "Link 16 Spectrum Deconfliction" January 12, 2023

Chairman of the Joint Chiefs of Staff Manual CJCSM 6235.01, "Link 16 Spectrum Operations for Test and Evaluation," April 21 2025

DoD Instruction 3222.03, "Electromagnetic Environmental Effects (E3) Program," October 10, 2017

DoD Instruction 5025.01, "DoD Issuances Program," June 7, 2023

DoD Instruction 4650.01, "Policy and Procedures for Management and Use of the Electromagnetic Spectrum," October 17, 2017

Memorandum of Agreement between Department of Defense and Department of Transportation regarding the 960-1215 MHz Frequency Band, 31 December 2002

Military Standard 461G DoD Interface Standard entitled "Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment," December 11, 2015

NTIA Joint Tactical Information Distribution System/Multifunctional Information Distribution System (JTIDS/MIDS) Time Division Multiple Access (TDMA) Architecture and Waveform Spectrum Support Certification, Interdepartment Radio Advisory Committee Document (IRAC) 33583/6 Feb 17, 2023[14]

NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, January 2023 Revision of the January 2021 edition[15]

System Planning Subcommittee Working Group One (SPS WG-1) TR-03-001, SPS 14216, EMC Certification Guidance and Requirements for JTIDS/MIDS TDMA Equipment, February 3, 2004[16]

[14] To obtain a copy of this document, contact the NTIA Office of Spectrum Management, 1401 Constitution Ave NW, Washington DC, 20230.

[15] To obtain a copy of this Manual refer to the ordering instructions at the following website address: http://www.ntia.doc.gov/osmhome/redbook/redbook.html.

[16] To obtain a copy of this document, contact the NTIA Office of Spectrum Management, 1401 Constitution Ave NW, Washington DC, 20230.