DoD 4650.1-R1

LINK 16 ELECTROMAGNETIC COMPATIBILITY (EMC) FEATURES CERTIFICATION PROCESS AND REQUIREMENTS

April 26, 2005

Assistant Secretary of Defense for
Networks and Information Integration

ASSISTANT SECRETARY OF DEFENSE
6000 DEFENSE PENTAGON
WASHINGTON, DC 20301-6000

APR 26 2005

NETWORKS AND INFORMATION
INTEGRATION

FOREWORD

This Regulation is issued under the authority of DoD Directive 4650.1, "Policy for Management and Use of the Electromagnetic Spectrum", June 8, 2004 (reference (a)). It implements the policy, delineates the process, identifies responsibilities, specifies the requirements, and promulgates procedures for the certification testing of the electromagnetic compatibility (EMC) features of Link 16 Terminals.

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

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

Send recommended changes to this Regulation to the following address:

Office of the Assistant Secretary of Defense for
Networks and Information Integration/DoD Information Officer
6000 Defense Pentagon
Washington, DC 20301-6000

The DoD Components, other Federal Agencies, and the public may download this Regulation from the Washington Headquarters Services web page at
http://www.dtic.mil/whs/directives/corres/pub1.html

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REFERENCES

(a) DoD Directive 4650.1, "Management and Use of the Radio Frequency Spectrum," June 8, 2004

(b) Memorandum of Agreement between Department of Defense and Department of Transportation, 31 December 2002

(c) National Telecommunications and Information Administration (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 33583/1 March 25, 2004[1]

(d) DoD 5025.1-M. "DoD Directives Systems Procedures." March 2003

(e) DoD 8910.1-M, "DoD Procedures for Management of Information Requirements," June 30, 1998

(f) System Planning Subcommittee Working Group One (SPS WG-1) TR-03-001, Electromagnetic Compatibility (EMC) Certification Guidance and Requirements for JTIDS/MIDS TDMA Equipment, February 3, 2004[2]

(g) NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, May 2003[3]

(h) DoD Directive 5000.1, The Defense Acquisition System", May 12, 2003

(i) Chairman of the Joint Chiefs of Staff Instruction 6232.01C, "Link 16 Spectrum Deconfliction" April 2004

(j) Interface Control Document for JTIDS Class 2H Terminal Interface with MCE, Y207A114, Revision B, February 28, 1990[4]

(k) Military Standard 461E Department of Defense Interface Standard entitled "Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment," August 20, 1999

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[1] To obtain a copy of this document, contact The National Telecommunications and Information Administration (NTIA) Office of Spectrum Management, 1401 Constitution Ave NW, Washington DC, 20230

[2] ibid

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

[4] To obtain a copy of this document, contact Program Executive Officer, Command, Control, Communications, Computers, Intelligence and Space (PEO-C4I and Space), Air Integration Program Office (PMW 780), 4301 Pacific Highway, San Diego, 92110-3127

C1. CHAPTER 1
GENERAL INFORMATION

C1.1. INTRODUCTION

C1.1.1. The Department of Defense uses the 960 – 1215 MHz band for the Joint Tactical Information Distribution System (JTIDS), the Multifunctional Information Distribution System (MIDS), and other functionally similar Tactical Link systems (termed collectively, "Link 16 Terminals"). Based on its importance for aeronautical radio-navigation and supporting systems, the Department of Transportation (DoT) also has interests in this frequency band. Rapid growth in commercial and civil aviation during the 21st century shall increase the importance of ensuring spectrum supportability for existing and new systems that enhance air traffic safety.

C1.1.2. The Department of Defense and the DoT shall work cooperatively to support National Telecommunications and Information Administration (NTIA) action to protect both Link 16 and civil/commercial aeronautical systems sharing this portion of the radio frequency (RF) spectrum. Ensuring Electromagnetic Compatibility (EMC) is the cornerstone to spectrum management and supportability, and optimal system operation. Thus, the EMC features of Link 16 systems used throughout the Department of Defense shall be certified to ensure compliance with applicable requirements and specifications.

C1.2. PURPOSE

C1.2.1. Pursuant to reference (a), this Regulation implements spectrum management for Link 16 Terminals. With specific focus on EMC Features certification as stipulated in reference (b), this Regulation:

C1.2.1.1. implements the policy established in reference (b),

C1.2.1.2. identifies responsibility,

C1.2.1.3. delineates the process, and

C1.2.1.4. promulgates step-by-step procedures and associated timelines.

C1.2.2. This Regulation also implements the Link 16 EMC Features certification requirement of reference (c) as a prerequisite for uncoordinated operation of Link 16 equipment in the United States and possessions.

C1.2.3. The Link 16 EMC Features Certification Performance Specification has been incorporated as Appendix 1 to this Regulation, with the Link 16 EMC Features Certification Test Plan as Attachment 1 to Appendix 1. Both were initially drafted as separate documents. This incorporation is in full compliance with the structure and format requirements for DoD Issuances as specified in chapter 4 of DoD 5025.1-M (reference (d)).

C2. CHAPTER 2
LINK 16 TERMINAL EMC FEATURES CERTIFICATION POLICY AND RESPONSIBILITIES

C2.1. POLICY

C2.1.1. Within the Department of Defense, Link 16 Terminal EMC Features shall be certified by the Program Executive Officer - Command, Control, Communications, Computers, Intelligence and Space (PEO C4I&S), who shall then submit the EMC Features certification package to the Navy-Marine Corps Spectrum Center (NMSC). The NMSC shall forward this package and an updated DD Form 1494, Application for Equipment Frequency Allocation, to the NTIA for approval in accordance with established spectrum certification procedures. The DD Form 1494 has been assigned OMB Control Number 0704-0188 in accordance with DoD 8910.1-M (reference (e)).

C2.1.2. Exceptions to the certification requirements cited in reference (f) and Appendix 1, or failure to complete the certification process shall require processing of a request for deviation/waiver (See section C3.5.) prior to funding commitments for implementation and/or any production contract actions. Any deviation/waiver may result in a frequency assignment that further restricts equipment operations from the levels specified in reference (c) (for example, restricted functionality, operating hours, and/or operating areas). (See section C3.6.)

C2.2. RESPONSIBILITIES

C2.2.1. The Assistant Secretary of Defense for Networks and Information Integration (ASD(NII)) Communications Program Directorate shall oversee the EMC Features certification program and provide funding resources to the PEO C4I&S for Joint certification activities.

C2.2.2. The ASD(NII) Spectrum Management Directorate shall provide oversight of the Link 16 Frequency Allocation process (See paragraph C2.2.5.2.) and the Deviation/Waiver process (See subparagraph C2.2.5.4. and section C3.5.).

C2.2.3. The Service Resource Sponsors shall plan, program, and budget for incorporation and testing of Link 16 EMC Features in Link 16 Terminals and platforms.

C2.2.4. The Program Executive Officer Command, Control, Communications, Computers Intelligence and Space, Department of the Navy shall:

C2.2.4.1. Serve as the Link 16 Lead Service representative responsible for implementing the Joint Link 16 EMC Features certification program.

C2.2.4.2. Coordinate with the Service Resource Sponsors to ensure that EMC Features certification requirements are implemented during Link 16 Terminal development, integration, and operations.

C2.2.4.3. Assist the Service Link 16 program managers in implementing required EMC Features and emitted RF signal provisions into Link 16 Terminals and platforms.

C2.2.4.4. Certify Link 16 EMC Features and emitted RF signal provisions in Link 16 Terminals and platforms for initial compliance and audit continued compliance with certification requirements.

C2.2.5. <u>The Government Acquisition Program Managers</u> responsible for Link 16 Terminal development, procurement, or integration shall:

C2.2.5.1. Incorporate Link 16 capability, EMC Features performance and testing requirements into Link 16 Terminal acquisition documents, and specify Link 16 integration into all platforms.

C2.2.5.2. Submit Stage 3 and Stage 4 Application for Equipment Frequency Allocation (DD Form 1494) through the Service chain of command to the Office of the Chief of Naval Operations (CNO N61F) and to the NMSC for processing and review prior to funding commitments for implementation and/or any contract actions.

C2.2.5.3. Submit all contractual documentation related to Link 16 EMC Features development (for new equipment), changes (for existing equipment), or platform integration to the PEO C4I&S for review.

C2.2.5.4. Submit all requests for deviation/waiver of EMC Features or RF emissions requirements and related documentation to the PEO C4I&S, (with copy to the ASD (NII) Spectrum Management Directorate for oversight) and to the NMSC for forwarding to the NTIA/FAA in accordance with section C.3.5. prior to funding commitments for implementation and/or any contract actions.

C2.2.5.5. Ensure that the PEO C4I&S is invited to attend all requirements reviews and technical interchange meetings 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.

C2.2.6. <u>The Director, Navy Marine Corps Spectrum Center</u> shall:

C2.2.6.1. Review and coordinate program office submission of the DD Form 1494 with the office of the CNO N61F, the Military Communication Electronics Board Frequency Panel Equipment Spectrum Guidance Permanent Working Group, the Combatant Command Frequency Management Offices, and the NTIA Spectrum Planning Subcommittee (SPS) for processing and approval in accordance with established procedures documented in NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management (reference (g)). Also provide a copy of the final approved DD Form 1494 to the PEO C4I&S for information.

C2.2.6.2. Under the oversight of the ASD (NII) Spectrum Management Directorate, act as the DoD Spectrum Management single point of contact with the NTIA and the Federal

Aviation Administration (FAA) regarding coordinated Link 16 frequency assignments. Such coordination follows the normal Service spectrum management coordination.

C3. CHAPTER 3
CERTIFICATION PROCEDURES

C3.1. DISCUSSION

C3.1.1. Final EMC Features certification and approval will be required for all Link 16 systems (whether EMD or production) to be operationally fielded. The sections and paragraphs that follow lay out 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 getting approval for deviations/waivers.

C3.1.2. Sections C3.2. and C3.3. define the methodology for certification of new Terminals and Engineering Changes to existing Terminals. Section C3.4. defines the methodology for compliance review of Terminal integration into host platforms. Section C3.5. establishes the methodology for reviewing and coordinating requests for deviation/waivers. Section C3.6 describes required Link 16 user actions. Section C3.7. addresses audits of the Link 16 Terminal development and integration process. (See Chapter 2, section C2.2., which assigns responsibilities for these actions.)

C3.1.3. Technology refreshment is a part of normal Terminal evolution and is not covered by this procedure. However, any technology refreshment must be validated by the acquisition program manager to ensure it will not impact established EMC Features performance requirements.

C3.2. NEW LINK 16 EQUIPMENT

Figure C3.F1. illustrates the actions and responsibilities for Link 16 EMC Features certification of new Link 16 equipment or major redesigns of existing equipment that are not covered by the Engineering Change process. Procurement or integration program offices shall initiate these actions at the beginning of the Engineering Manufacturing Development (EMD) phase of development to ensure that all EMC Features requirements are addressed during the EMD phase. (See DoD Directive 5000.1 reference (h)).

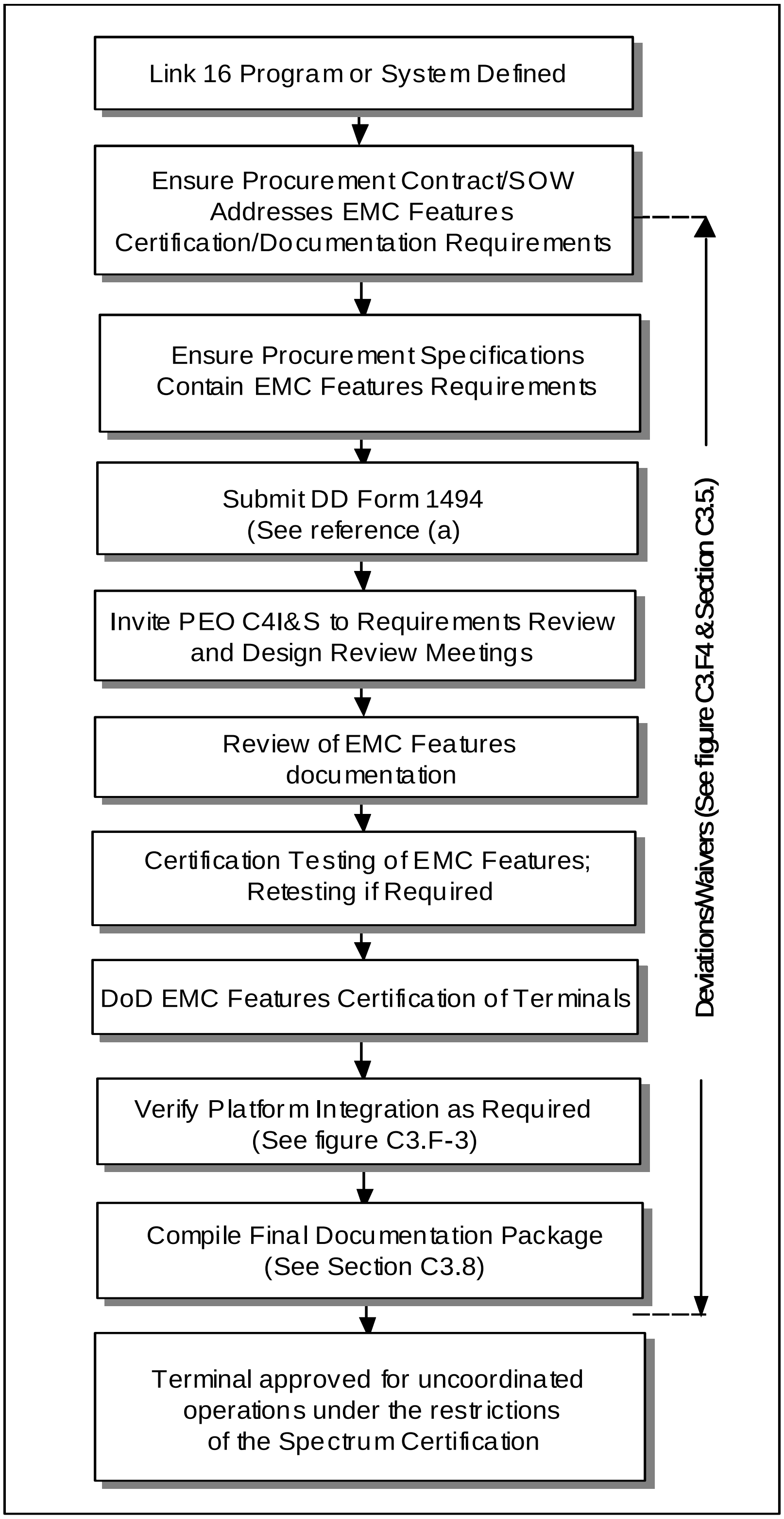

Figure C3.F1. <u>DoD New Link 16 Equipment EMC Features Certification Methodology</u>

C3.2.1. After a new Link 16 program or system is defined, the Resource Sponsor and/or program manager responsible for a Link 16 Terminal development/procurement program or the integration program manager (if a new Link 16 capability is being designed and integrated into a platform acquisition program) shall incorporate the performance and testing requirements listed in Appendix 1 and the remapping algorithm requirements in Appendix 2 into the acquisition documentation for the Link 16 Terminal. These performance and test requirements will form the basis for Link 16 EMC Features certification. (See section C3.5. for deviations/waivers to performance and test requirements.)

C3.2.2. The program office responsible for the Link 16 procurement or integration contract shall submit all contractual documentation related to EMC Features development and certification to the PEO C4I&S for review and comment at least 60 days prior to release of the Request for Proposal/Request for Quote (RFP/RFQ) for the proposed contract (or as soon as practical if awarding under unusual and compelling urgency). As a minimum, the documentation shall include the following:

C3.2.2.1. The Statement of Work for the proposed Link 16 procurement, which shall include testing and maintenance requirements defined in Appendix 1.

C3.2.2.2. Contract Data Requirements List items or equivalent, which shall include the following: Link 16 EMC Features Certification Test Plan, Test Procedure, and Test Report; Link 16 Terminal Acceptance Test Procedures (EMC Features and emitted RF signal provisions only); and Maintenance/Periodic Verification Test Procedures. A Government EMC Features Test Plan is provided as Attachment 1 to Appendix 1, and shall be used as the EMC Features Certification Test Plan.

C3.2.2.3. EMC Features performance requirements, defined in Appendix 1, and incorporated into procurement specifications.

C3.2.3. The frequency allocation process begins with the submission of a DD Form 1494 through the Service chain of command in accordance with reference (a) and applicable Service directives/instructions.

C3.2.3.1. All DD Forms 1494 for Link 16 equipment shall be initiated by the developer or procuring organization as soon as the requirement is identified, and submitted to the designated Service frequency management organization with a copy to the PEO C4I&S, CNO N61F, and the NMSC.

C3.2.3.2. The PEO C4I&S shall review and comment on the accuracy and completeness of the DD Form 1494, and forward comments to the developer/procuring organization, CNO N61F, and the NMSC.

C3.2.4. The program office responsible for the procurement or integration contract shall invite the PEO C4I&S to participate in EMC Features design reviews. The PEO C4I&S shall have access to applicable design specifications.

C3.2.5. The program manager responsible for the certification test of EMC Features shall provide the PEO C4I&S with the Link 16 EMC Features Certification Test Procedures at least 60 days before the certification test of Link 16 Terminal EMC Features and emitted RF signals. The PEO C4I&S shall witness the certification test and any retesting required to the extent necessary to verify compliance with EMC Features performance requirements. The Link 16 EMC Features certification testing will form the basis of Acceptance Test Procedures and Maintenance/Periodic Verification Test Procedures. The EMC Features Certification Test Report, Acceptance Test Procedures, and Maintenance/Periodic Verification Test Procedures shall be provided to the PEO C4I&S for review and coordination within 60 days after the certification test of Link 16 Terminal EMC Features and emitted RF signals.

C3.2.6. The PEO C4I&S shall certify that Link 16 Terminals meet the EMC Features certification requirements upon satisfactory completion and documentation of all development and test requirements in Appendix 1.

C3.2.7. After completion of the EMC Features certification process, the PEO C4I&S and the NMSC shall compile the certification package and provide it to NTIA for approval. Section C3.8. lists the documents required to support the final Spectrum Certification. Once the NTIA approves the Spectrum Certification, the equipment will be eligible for a frequency assignment allowing uncoordinated operation. (See section C3.6.)

C3.3. <u>ENGINEERING CHANGES TO LINK 16 EQUIPMENT</u>

Figure C3.F2. illustrates the actions and responsibilities for Link 16 EMC Features certification of enhancements or upgrades to Link 16 equipment covered under the Engineering Change process. Enhancements include equipment upgrades or changes to EMC Features performance. If such enhancement/upgrade results in a condition where the Terminal cannot meet any of the requirements of reference (f) and Appendix 1, an application must be made for a deviation or waiver, in accordance with section C3.5., prior to funding commitments for implementation and/or any production contract actions.

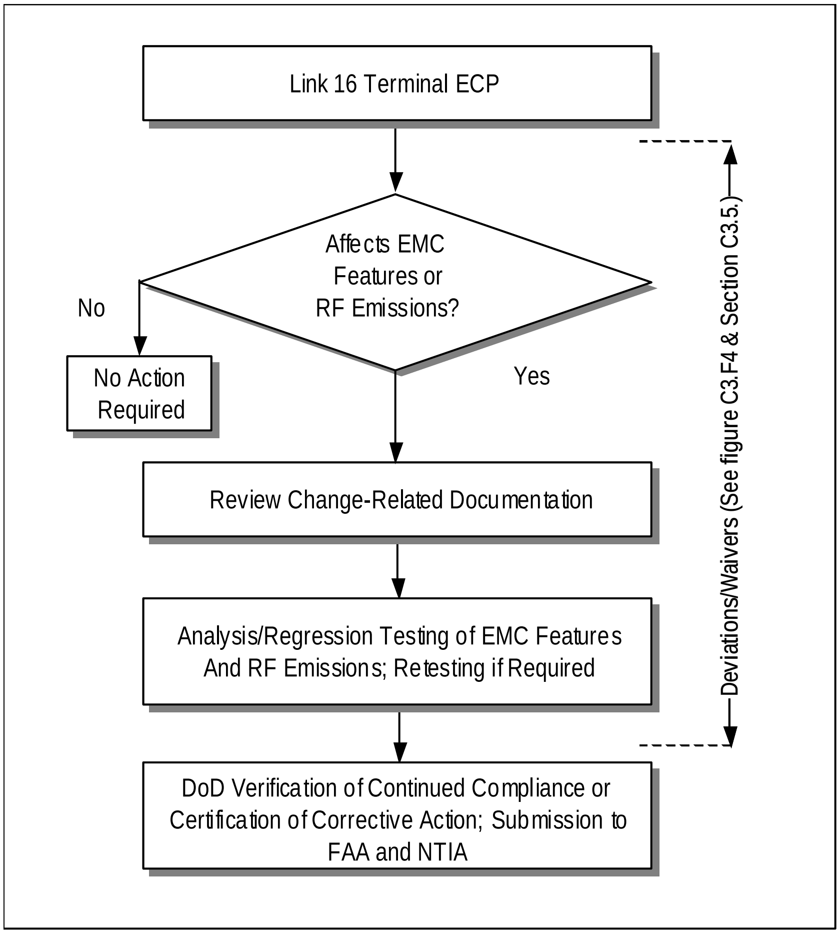

Figure C3.F2. DoD Link 16 EMC Features ECP Certification Compliance Methodology.

C3.3.1. After an Engineering Change Proposal (ECP) is defined for a Link 16 Terminal/platform that has had its EMC Features certified, the program manager responsible for a Link 16 Terminal development/procurement program, or the integration program manager, shall evaluate the ECP for impact on emitted RF signals or EMC Features defined by reference (f). If the program manager determines that the ECP has no potential to affect Terminal or platform emitted RF signals or EMC Features, no action will be required.

C3.3.2. If the program manager determines that the ECP has the potential to affect Terminal/platform EMC Features or emitted RF signals, the program manager shall notify the PEO C4I&S, and provide analysis and/or regression test plans for EMC Features or emitted RF signal impacts. The PEO C4I&S shall forward the ECP and related documentation to the NMSC and NTIA/FAA for review. The NTIA/FAA comments and recommendations will be sent back to the requesting program office for consideration during Configuration Control Board (CCB) deliberations. The approved engineering change will be described in a requested amendment to the approved DD Form 1494 and forwarded to the NMSC for appropriate coordination.

C3.3.2.1. The program manager responsible for the procurement or integration contract shall submit all contractual documentation related to the ECP to the PEO C4I&S for review and comment at least 30 days prior to submission of the ECP to a CCB for approval. This documentation shall include the following items: ECP, Regression Test Plan (if necessary), Test Procedures, and Test Report.

C3.3.2.2. The program manager responsible for the procurement or integration contract shall invite the PEO C4I&S to participate in requirements reviews, design reviews, and technical interchange meetings where the engineering change will be discussed.

C3.3.2.3. At least 60 days before regression testing of the Terminal EMC Features, the responsible program manager shall provide the PEO C4I&S the regression test plan. At least 30 days before the regression testing, the responsible program manager shall provide the PEO C4I&S with the test schedule and regression test procedures for review and coordination.

C3.3.3. The PEO C4I&S or their designated representative shall witness the regression testing, and any retesting required to verify compliance with EMC Features performance requirements. The Regression Test/Retest Report and changes to other related documentation shall be provided to the PEO C4I&S within 60 days after the regression test/retest.

C3.3.4. Upon satisfactory completion and documentation of all development and test requirements above, the PEO C4I&S shall verify continued compliance with the requirements of reference (d) and Appendix 1, and provide the documentation to NMSC. NMSC shall forward the updated DD Form 1494 to NTIA for approval.

C3.3.5. <u>NOTE</u>: If a prior deviation/waiver, which had resulted in operational restrictions, has been corrected, the PEO C4I&S shall certify the correction to NTIA for approval. If NTIA approves the DoD certification, the PEO C4I&S shall request that the NMSC notify user activities to resubmit frequency assignment requests to allow uncoordinated operations that exclude the previously invoked operational restrictions.

C3.4. <u>PLATFORM INTEGRATION OF LINK 16 EQUIPMENT</u>

Figure C3.F3. illustrates the actions and responsibilities for platform integration of Link 16 equipment.

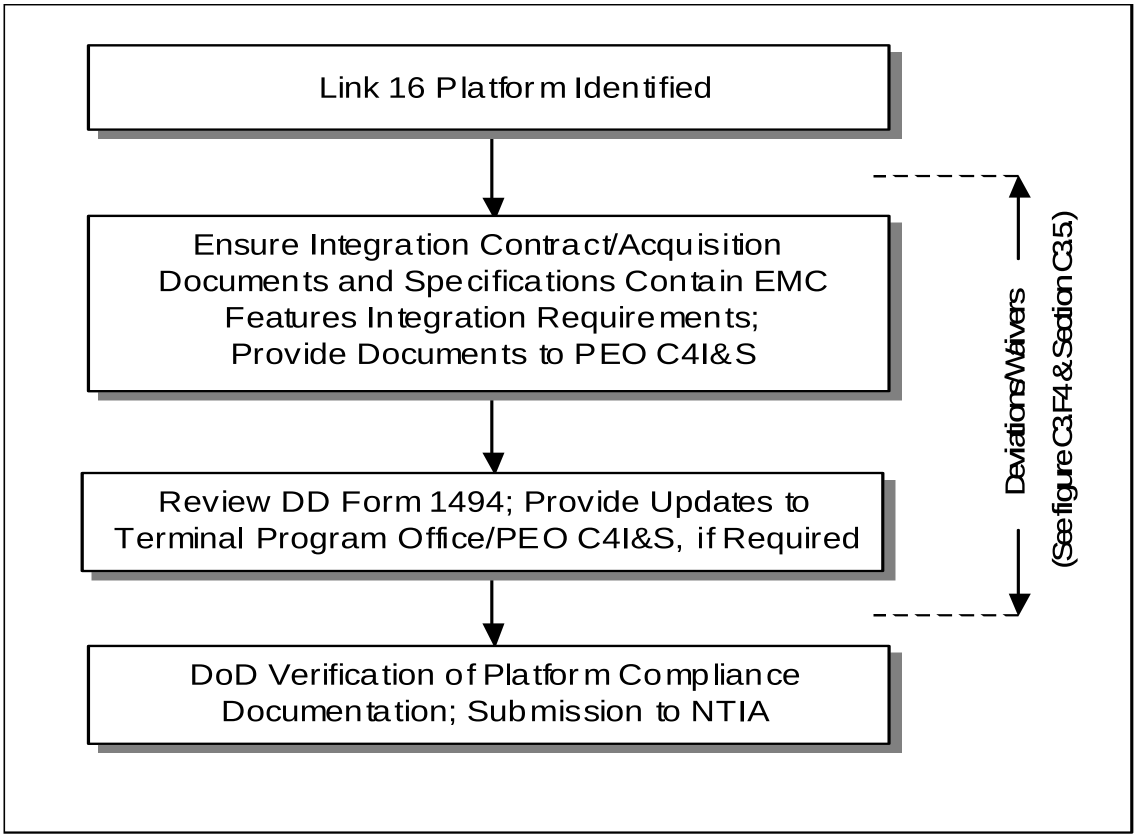

Figure C3.F3. DoD Link 16 Platform Integration Compliance Review Methodology.

C3.4.1. After a new Link 16 platform integration requirement is identified, the Resource Sponsor and/or program manager responsible for the platform integration shall incorporate the following NTIA platform integration requirements from reference (f) into the platform acquisition documentation and specifications:

C3.4.1.1. Multiple operator actions required for selection of a mode other than full EMC protection during a mission.

C3.4.1.2. Multiple operator actions required for selection of High Power Mode (if applicable).

C3.4.1.3. Provisions for operator reset of transmission inhibits per the operator action requirements of reference (c).

C3.4.1.4. Provisions for extraction of records (stored in Terminal memory) of transmit inhibits, the identity of EMC Features faults and its related built-in test (BIT) results, occasions when the Terminal is switched from a full EMC protection mode to exercise or combat mode, and instances when the Terminal is placed in the High Power mode (if applicable).

C3.4.1.5. Provisions for notch filters and Low Level Detector (LLD) blanking interfaces, where required.

C3.4.2. The program office responsible for the integration contract shall submit contractual documentation related to the platform integration requirements of paragraph C3.4.1. to the PEO C4I&S and NMSC for information at least 30 days prior to release of the RFP/RFQ for the proposed integration contract.

C3.4.3. The Resource Sponsor and/or program manager responsible for the platform integration, with the PEO C4I&S and the NMSC oversight, shall review the applicable DD Form 1494 description of platform characteristics and notify the responsible Terminal program office to update the DD Form 1494 with any changes to the pertinent platform information. As a minimum, this information shall include 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 subparagraphs C3.4.1.1. through C3.4.1.5.

C3.4.4. The PEO C4I&S shall verify that the platform integration documentation incorporates the requirements of paragraph C3.4.1. and provide this verification to the NMSC. The NMSC shall forward the revised DD Form 1494 to the NTIA as part of the certification package. (See section C3.8.)

C3.4.5. Deviations or waivers to platform integration requirements shall be handled in accordance with the procedures of section C3.5.

C3.5. DEVIATIONS AND WAIVERS

Figure C3.F4. illustrates the process for handling deviations and waivers to Link 16 EMC features and emitted RF signal requirements. Deviations and waivers are discouraged because they may result in a frequency assignment that further restricts equipment operations from the levels specified in reference (c). (For example, restricted functionality, operating hours, and/or operating areas.) Therefore, the procuring or integration program office shall strongly consider the validity of the deviation and waiver requests and should coordinate these requests with user activities before determining whether to submit the request for deviation/waiver for further action.

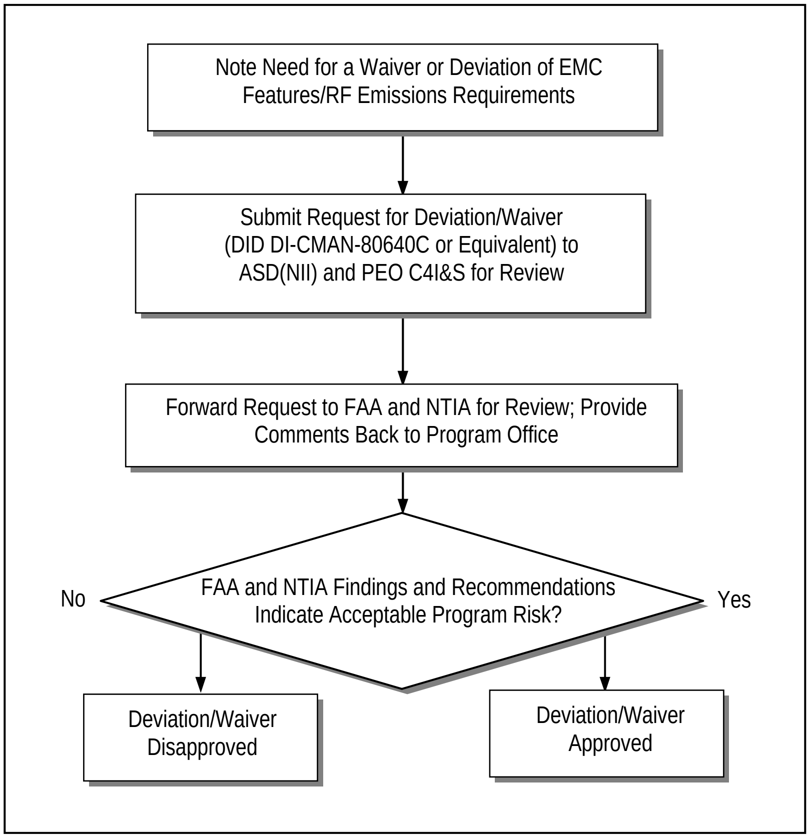

Figure C3.F4. DoD Link 16 EMC Features/RF Emissions Deviation/Waiver Process.

C3.5.1. When exception is taken to the requirements of reference (f) or Appendix 1, or when requirements are not met, the procurement or integration program office shall submit a request for deviation or waiver to the Office of the ASD (NII) (OASD(NII)) and the PEO C4I&S with supporting documentation at least 60 days before submitting the request for CCB action. No Broad Agency Announcements , RFIs, RFPs will be released with waivers or deviations to requirements unless the OASD(NII) grants approval. The appropriate Service Command or Agency Acquisition Executive will submit any requests for exceptions through the PEO C4I&S.

C3.5.2. The PEO C4I&S shall forward the request to the NMSC for submission to the NTIA/FAA for consideration. The NTIA/FAA findings and recommendations will be sent back to the requesting program office for consideration during CCB deliberations.

C3.5.3. The procuring or integration program office shall evaluate the NTIA/FAA recommendations for acceptable program risk and provide their findings to the Terminal and/or CCB integration program office. The CCB shall base their approval, in part, on whether the NTIA/FAA findings indicate acceptable program risks to obtaining platform frequency assignments. (See section C2.1)

C3.6. FREQUENCY ASSIGNMENTS

Reference (a) describes the procedures for user activities to request frequency assignments using the Frequency Resource Record System. It should be noted that requests for temporary frequency assignments, submitted prior to completion of the certification process, will be considered for coordinated operations under potentially restricted conditions. (See section C2.1.)

C3.7. EMC FEATURES AUDIT

The PEO C4I&S may perform an EMC Features audit at the Terminal or integration contractor's facility.

C3.7.1. 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 Acceptance Test and Maintenance/Periodic Verification processes. If the PEO C4I&S finds that there are unauthorized changes, those changes shall be subject to the requirements identified in section C3.5. The OASD NII shall be notified of the unauthorized changes.

C3.7.2. The PEO C4I&S shall afford the applicable Government Program Manager and contractor at least 2 weeks' advance notice of each EMC Features audit. The Government Program Manager shall also ensure that contracts contain appropriate language authorizing audits at the contractor's facility.

C3.8. INFORMATION REQUIREMENTS

Table C3.T1. summarizes the information required by the PEO C4I&S to perform Link 16 Terminal and platform EMC Features and RF emissions certification. Items in bold italics are submitted to NMSC as part of the initial DoD Terminal EMC Features certification package. The NMSC will then forward the package to NTIA for approval.

New or Redesigned Link 16 Terminals (section C3.2.)

- EMC Features performance requirements in procurement specifications
    - Link16 EMC Features Qualification Test Plan
    - ***Link16 EMC Features Qualification Test Procedures***
    - ***Link16 EMC Features Qualification Test Report***
    - ***Link 16 Terminal Acceptance Test Procedures (EMC Features and emitted RF signal provisions only)***
    - ***Maintenance/Periodic Verification Test Procedures (EMC Features and emitted RF signal provisions only)***
    - ***Submitted text of DD Form 1494***

Link 16 Terminal Engineering Changes (section C3.3.)

- Engineering Change Proposal (ECP)
- Regression Test Plan
- Qualification Test Procedures/Regression Test Procedures
- Regression Test/Qualification Retest Report

Link 16 Terminal Integration (section C3.4.)

- Platform Acquisition Documentation and Specifications for:
    - Selection of a mode other than full EMC protection during a mission
    - Selection of High Power mode (if applicable)
    - Provisions for operator reset of transmission inhibits
    - Provisions for extraction of records (stored in Terminal memory) of transmit inhibits, EMC Features faults and related built-in test (BIT) results, occasions when the Terminal is switched from a full EMC protection mode to exercise or combat mode, and instances when the Terminal is placed in the High Power mode (if applicable)
    - Provisions for notch filters and Low Level Detector (LLD) blanking interfaces (where required)
- Revisions to DD Form 1494

Deviations/Waivers (section C3.5.)

- ***Request for Deviation/Waiver (if applicable)***

Operations and Maintenance Procedures (see section 4.e of the Chairman Joint Chiefs of Staff Instruction CJCSI 6232.01C of 30 June 2004)

- EMC Features BIT Procedures (for platforms operating 24/7)
- Records of:
    - Transmission inhibits
    - EMC Features monitor faults and BIT results
    - Occasions when the Terminal is switched from a full EMC protection mode to exercise or combat mode
    - Enabling of High Power mode operations (if applicable)

Table C3.T1. <u>Information Requirements for Link 16 EMC Features and RF Emissions</u>

AP1. APPENDIX 1
LINK 16 ELECTROMAGNETIC COMPATIBILITY FEATURES CERTIFICATION PERFORMANCE SPECIFICATION

AP1.1. SCOPE

AP1.1.1. 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, for certification to operate in the 960 to 1215 MHz band. In cases where these requirements are not incorporated or cannot be met, waivers must be obtained. Request for waivers must be submitted in accordance with section C3.5. of this regulation.

AP1.1.2. This document is intended for use directly in, or as guidance for preparation of Link 16 Terminal[5] procurement documents (e.g. Statement of Work, specifications).

AP1.1.3. These specifications pertain to MIDS production Terminals and future Link 16 systems, including future applications of then Link 16 RF waveform in multi-waveform capable equipment. This document also pertains to any upgrades or redesign of legacy JTIDS and/or MIDS Terminals that affect EMC or EMC Features characteristics. The conditions and requirements for the transmission of JTIDS and MIDS signals are established by references (c) and (f).

AP1.1.4. It is not the intent of this specification to include requirements on the human interface between the operator and platform or the required performance of platform collocated systems in the presence of Link 16 system transmissions. These requirements are included in reference (f) and applicable platform integration documentation.

AP1.1.5. 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 software and hardware shall be certified by the designated DoD EMC Features certification activity (PEO C4I&S) and approved by NTIA. The EMC Features data shall be collected during a formal EMC Features certification test, which shall be in accordance with the DoD EMC Features Test Plan (Attachment 1 to Appendix 1). Terminals that have not been certified by the certification activity will result in restricted operations and will require a special Frequency Assignment for each operation.

AP1.1.6. This document defines the Link 16 RF signal output, which includes spectral characteristics of the JTIDS/MIDS Link 16 waveform (Appendix 1, Section AP1.3.), and the

[5] A Terminal is any configuration of hardware and software/firmware that is capable of producing the Link 16 waveform.

functional requirements for the EMC Features (Appendix 1, Section AP1.4.). The EMC Features include built-in functions that monitor certain RF characteristics of the pulsed Link 16 waveform and cause the Terminal to inhibit transmissions 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 (Appendix 1, Section AP1.5.). A test plan is provided in Attachment 1 to Appendix 1. This test plan shall be used to facilitate the generation of test procedures required for the EMC Features certification process.

AP1.1.7. The requirements specified herein apply to all operating environments of the Terminal.

AP1.2. APPLICABLE DOCUMENTS

AP1.2.1. General. The following documents form a part of this specification to the extent specified herein:

AP1.2.1.1. The main body of this document.

AP1.2.1.2. Reference (f)

AP1.2.1.3. Reference (c).

AP1.2.1.4. Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6232.01C (reference (i)).

AP1.3. RF SIGNAL OUTPUT CAPABILITY

AP1.3.1. Frequency Hopping. Link 16 operates normally in a frequency hopping mode.

AP1.3.1.1. 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 with up to 14 of the 51 carrier frequencies remapped.

AP1.3.1.2. The Terminal shall process an adaptable parameter that allows or disallows carrier frequency remapping. The Terminal shall process an adaptable parameter that identifies the frequencies to be remapped. The setting of these adaptable parameters shall be independent of the selected EMC protection mode adaptable parameter. The Terminal shall transmit carrier frequencies using the DoD specified frequency selection algorithms.

AP1.3.2. Output Power Modes.

AP1.3.2.1. The Terminal may have the capability to transmit (CTT) 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 level information.

AP1.3.2.1.1. The Terminal shall provide an output power mode such that the nominal peak output power summed from all Link 16 RF outputs of the Terminal shall not exceed 200 watts (W) + 1 decibel (dB).

AP1.3.2.1.2. For all Link 16 power modes, the Terminal peak output power summed from all the Link 16 RF outputs of the Terminal shall be no more than the selected power + 1 dB.

AP1.3.2.1.3. External power amplifiers 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.

AP1.3.2.2. The Terminal shall transmit at the output power level identified by the output power mode adaptable parameter. The Terminal may have a capability allowing the host to change the output power mode. The Terminal shall have the capability to restrict the peak forward output power to 200 W + 1 dB or less.

AP1.3.3. <u>Output Power Greater Than 200 W + 1 dB</u>.

AP1.3.3.1. If the Class 2H High Power Amplifier (HPA) is used, the Terminal shall be in compliance with the EMC Features data exchange requirements specified in the *Interface Control Document for JTIDS Class 2H Terminal Interface with MCE*, Y207A114, Revision B, (reference (j)). When using this power configuration, all Link 16 signals shall be transmitted by the HPA. The Terminal shall not implement an output power mode that allows some messages to be transmitted through the Terminal antenna ports and some through the HPA antenna ports.

AP1.3.3.2. Other Terminal implementations utilizing internal or external power amplifiers that generate Link 16 power levels greater than 200 W + 1 dB shall meet all EMC Features requirements as specified in this document.

AP1.3.4. <u>Antenna Interface Signal Output</u>.

AP1.3.4.1. The Link 16 implementation shall use a single antenna mode or dual[6] 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 dual antenna mode, the Terminal may provide output power to both or all antenna ports in any specified proportion.

AP1.3.4.2. For each selected power mode, as shown in Figure AP1.F1A., during at least a 2.5-microsecond interval between pulses in each 13-microsecond period of a Link 16 message structure, the Link 16 peak forward output power at the terminal antenna ports shall be at least 80 dB below the peak forward output power of the transmitted Link 16 message pulses. Peak forward pulse power shall be considered as the steady state power level of a pulse whose energy,

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[6] Dual antenna mode refers to potential transmission on two or more antennas.

and leading and trailing edges are equivalent to the transmitted pulse. The power of the Link 16 pulses shall be measured in a 3 MHz band centered on the carrier frequency. The power between the Link 16 pulses shall be measured in 3 MHz bands across the 960 MHz to 1215 MHz band.

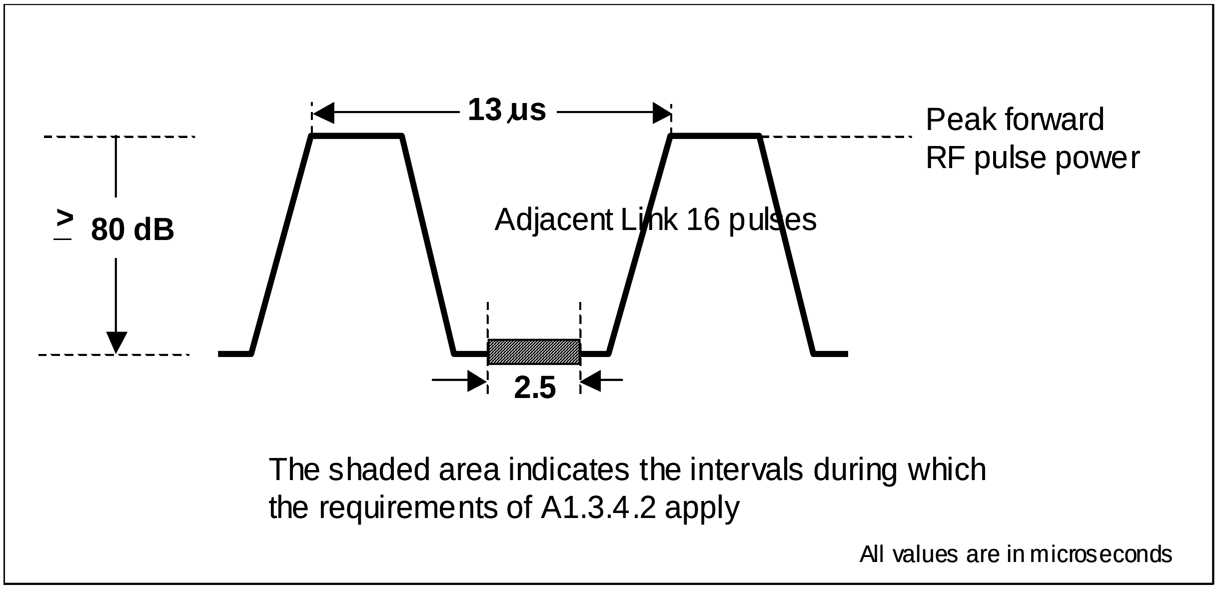


Figure AP1.F1A. Link 16 Inter-Pulse Power Level Requirement.

AP1.3.4.3. As shown in Figure AP1.F1B. , after power is applied, the peak forward RF output power at the terminal antenna ports shall not exceed –57 dBm, as measured in a 1 MHz bandwidth, exclusive of the following intervals. [This requirement shall not be construed as a waiver of Military Standard 461 (reference (k))].

AP1.3.4.3.1. The interval from 5-microseconds before the 50 percent voltage level of the leading edge of the first pulse to 5-microseconds after the 50 percent voltage level of the trailing edge of the last pulse of a Terminal commanded Link 16 message transmitted through the Terminal antenna ports.

AP1.3.4.3.2. The interval from 5-microseconds before the 10 percent voltage level of the earliest leading edge to 5-microseconds after the 10 percent level of the latest trailing edge of a Terminal commanded non-Link 16 waveform transmission. For example, with Tactical Air Navigation (TACAN) X-Mode interrogations, this interval should be no more than 29 usec.

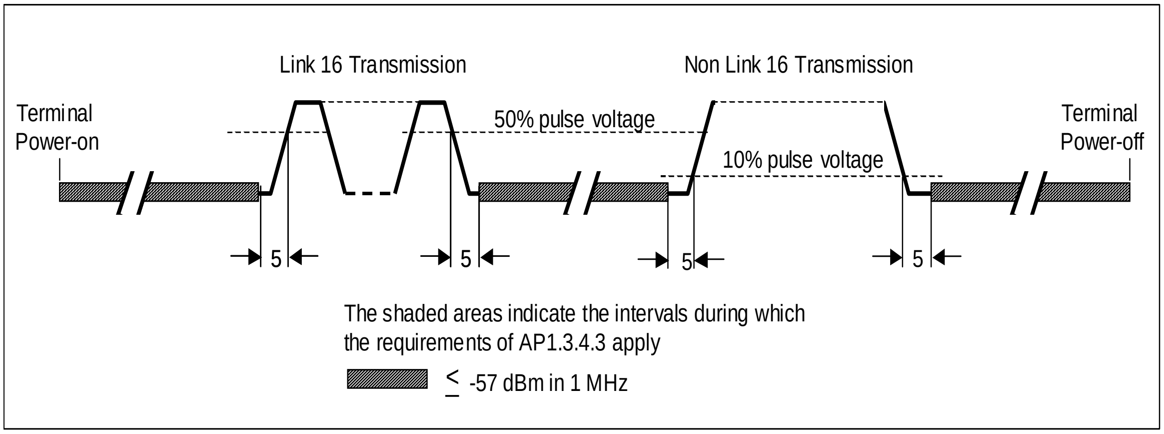


Figure AP1.F1B. Inter Message Structure Power Level Requirements

AP1.3.5. RF Pulse Spectrum.

AP1.3.5.1. When the Terminal is operating in each of its power modes, the Link 16 pulse spectral characteristics about any authorized Link 16 carrier frequency shall meet the requirements specified in subparagraph AP1.3.5.2. and as illustrated in Figure AP1.F2. Spectrum power levels shall be measured in 300 kilohertz (kHz) bandwidth segments for a Continuous Phase Shift Modulated (CPSM) carrier output power signal with random message content.

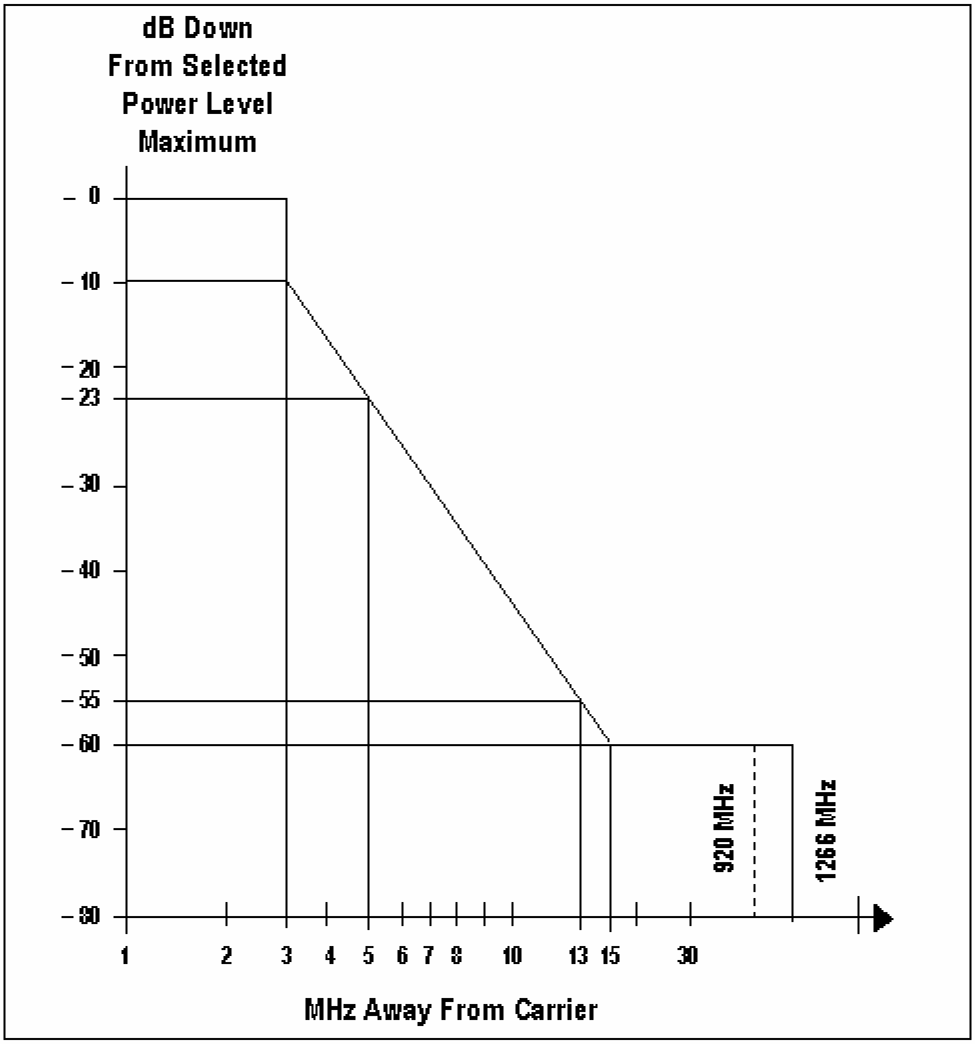


Figure AP1.F2. JTIDS/MIDS Pulse Power Spectral Mask within 920 to 1266 MHz.

AP1.3.5.2. The Link 16 pulse spectral characteristics shall be unrestricted from the carrier center frequency out to but not including ± 3 MHz. Relative to the peak spectrum level that is within ± 3 MHz of the carrier, the spectral characteristics shall be down at least 10 dB at ± 3 MHz, down at least 23 dB at ± 5 MHz, down at least 55 dB at ± 13 MHz, and down at least 60 dB at and beyond ± 15 MHz from the carrier frequency. The spectrum requirements shall apply between 920 MHz and 1266 MHz.

AP1.3.5.3. To enable verification of the pulse spectral characteristics for each carrier center frequency, the Terminal, when controlled by test maintenance equipment, shall be capable of transmitting Link 16 message package structures at any single frequency, which shall be any one of the 51 carrier frequencies.

AP1.3.6. 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 down from the level at the fundamental. The second and third harmonics shall be suppressed 50 + 10 log p (where p = peak power output in watts at the fundamental) or 80 dB, whichever requires less suppression. These out-of-band emission requirements shall apply for each selected power level.

AP1.4. EMC PROTECTION FEATURES REQUIREMENTS

AP1.4.1. The Terminal shall include independent, built-in monitoring equipment called EMC Features, which have 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.

AP1.4.1.1. The Terminal shall monitor all emissions, whether the single antenna mode or multiple antenna mode is selected for message transmission, and no matter which output power mode has been selected for transmission. The EMC 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 providing that the Terminal incorporates provisions to ensure that 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.

AP1.4.1.2. Out-of-specification conditions in the Link 16 transmission characteristics shall result in an EMC Protection Features Fault Report and a transmission inhibit as defined herein. The EMC Features fault condition shall be identified by the specific EMC Feature designed to detect that fault condition and each EMC Feature fault shall be reported to the host/operator.

AP1.4.1.3. 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 and their corresponding BIT circuitry can be accomplished. Verifying that the Link 16 EMC Features capability operates 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.

AP1.4.1.4. Calibration of the EMC Features 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 acceptance testing shall be possible without disassembly of the terminal except where acceptance testing is performed at the Shop Replaceable Unit (SRU) level.

AP1.4.1.5. The EMC Features performance capability 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.

AP1.4.1.6. If the Terminal supports multiple non-Link 16 waveforms, only the Link 16 waveform transmissions will be affected by the Link 16 EMC Features functions.

AP1.4.1.7. If the Terminal has integral Air Traffic Control (ATC) functions, the EMC Features shall not interfere with their performance requirements to operate in the National Airspace System when exposed to their total intended signal environment. The embedded ATC functions shall not interfere with the proper operation of the EMC Features.

AP1.4.1.8. 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.

AP1.4.1.9. If the Terminal includes an external power amplifier used for Link 16 transmissions, it shall be considered an integral part of the Terminal and all of the requirements in this document shall apply to the use of the external power amplifier. The Terminal shall process and combine the EMC Features monitoring activities of both the external power amplifier and the Terminal on a time slot by time slot basis. If a transmission inhibit condition results from fault reports arising from either the Terminal and/or the external power amplifier, transmission shall be inhibited from both the Terminal and the external power amplifier until manually reset. If the Class 2H High Power Amplifier (HPA) is connected to the Terminal, the Terminal shall be initialized so that all Link 16 messages are transmitted by either the Terminal or the HPA (not both). However, if an inhibit condition occurs from fault reports arising only from the HPA, it may be acceptable to reinitialize so that transmission can continue through the Terminal if it has been demonstrated that the HPA cannot transmit or accept transmit commands from the Terminal.

AP1.4.2. <u>EMC Features Monitors and Monitoring Functions</u>.

AP1.4.2.1. The EMC Features monitors or monitoring functions consist of CTT detection, 1030/1090 MHz Emissions, Pulse Width, Uniform Use of Authorized Carriers, Time Slot Duty Factor, Output Power Restrictions, Message Structure Restrictions, Net Number Restriction, Access Restrictions, and Relay Restrictions. Net Number Restrictions may be handled through network design.

AP1.4.2.1.1. CTT Detection Function.

AP1.4.2.1.1.1. The CTT monitoring requirement is defined in terms of time intervals when the Terminal is capable of transmitting Link 16 pulses (with a nominal duration of 6.4- microseconds) within each 13-microsecond interval of a Link 16 message transmission. Thus, the CTT function shall be active during all intervals in which the Terminal has not scheduled a Link 16 transmit command (pulse) to the power amplifier (i.e. between pulses and during all other time intervals when the Terminal is not capable of transmitting Link 16 pulses as depicted in the shaded areas of Figures AP1.F1A. and AP1.F1B.). Exceptions to this requirement are noted in subparagraph AP1.4.2.1.1.3. The intent of this function is to detect all unscheduled Link 16 transmissions that could result in non-compliance with subparagraphs AP1.3.4.2. and AP1.3.4.3. For the period between pulses, the CTT monitors should indicate that the Terminal is not capable of transmitting during a period of at least 2.5 microseconds as specified in subparagraph AP1.3.4.2.

AP1.4.2.1.1.2. The Terminal shall include component monitors that measure at a minimum, the voltages, bias currents, or other signal characteristics of each stage of the RF output 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 below the normal level at that monitoring point during a Link 16 transmission. For example, if the CTT function includes a current sensing monitor, it is acceptable for the threshold to be slightly greater than any leakage current that may exist when the amplifier is not transmitting a Link 16 pulse. 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 amplifier stages must occur during each 13-microsecond interval. If one or more component CTT monitors detect an unscheduled Link 16 transmission in a 13-microsecond period, a CTT Event count shall be incremented by one.

AP1.4.2.1.1.3. If the Terminal incorporates non-Link 16 capabilities (e.g. an integrated TACAN/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 suppressed (i.e. shall not increment the CTT Event count specified in subparagraph AP1.4.2.1.1.2.) 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 suppressed. If the terminal is initialized to operate only the Link 16 waveform, no CTT monitor outputs shall be suppressed.

AP1.4.2.1.1.4. The Terminal shall generate a CTT EMC Protection Feature (EPF) Fault Report (and increment the EPF Fault Report count) if, at the end of a Link 16 time slot interval, the CTT Event count is two or more. If the Terminal inhibits Link 16 transmission where at least one of the two EPF Fault Reports is caused by a CTT fault, the power supply voltage to the power amplifier shall be removed or the Link 16 waveform generation shall be isolated. If a CTT fault requires that the power supply that is connected to the power amplifier be shut down, it is not necessary that the voltage on the power supply capacitors be removed immediately as long as the Terminal inhibits transmission before the start of the next time slot.

However, the power supply shall remain off or the isolation shall be applied until an IPF reset is manually initiated.

AP1.4.2.1.1.5. The Terminal shall perform start-up BIT to verify that when Link 16 is isolated, 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 specific only to the Link 16 signal generation indicates that the test signal has not attained its nominal level, the terminal shall inhibit Link 16 transmissions. 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 a CTT monitor(s) following the isolator indicates CTT, the Terminal shall inhibit Link 16 transmissions. (Note 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). These tests shall also be performed during operator manually initiated BIT.

AP1.4.2.1.1.6. If the Terminal includes an external power amplifier other than the JTIDS Class 2H HPA, the external power amplifier shall meet all the requirements of AP1.4.2.1.1.

AP1.4.2.1.2. <u>1030/1090 MHz LLD Function</u>.

AP1.4.2.1.2.1. 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-microsecond interval in which the Terminal commands transmission of a Link 16 system pulse.

AP1.4.2.1.2.2. 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.

AP1.4.2.1.2.3. The threshold or reference energy level shall be the radiated energy of a pulse whose peak steady state power level is –7 dBm as measured in a 3 MHz bandwidth, and whose width, and rise and fall times are equivalent to that of a normally transmitted pulse. If during each 13-microsecond interval, the measured radiated energy of a pulse within 7 MHz of 1030 or 1090 MHz summed through all antenna ports exceeds this reference energy level, the Terminal shall increment a 1030/1090 MHz Event count. The - 7 dBm level is exclusive of the attenuation provided at 1030 MHz or 1090 MHz in notch filters incorporated within the Terminal.

AP1.4.2.1.2.4. If necessary to ensure that JTIDS/MIDS transmissions are not inhibited due to interference from collocated ATC transmitters, a pulse with excessive 1030/1090 MHz energy does not have to be counted towards the 1030/1090 MHz fault count (i.e., the output of the LLD detector may be ignored) if during the 13-microsecond interval, a 1030/1090 MHz suppression signal becomes active. The suppression signal, which is used to prevent false LLD Fault Reports, is limited to only 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 TDMA pulse that occurs when the suppression signal is present shall increment a counter by one for each 13-microsecond interval. The counter shall not exceed 55,385 in any 12-second interval. The cumulative time of 55,385 13-microsecond intervals is equal to 6 percent of 12 seconds. If the limit is exceeded, and the Terminal is not operating under Identification Friend or Foe (IFF) Emergency conditions, the Terminal shall ignore suppression signals for the remainder of the 12-second interval. The Terminal shall report such action to the host.

AP1.4.2.1.2.5. The Terminal shall generate an LLD EPF Fault Report (and increment the EPF Fault Report count) if five or more 1030/1090 MHz Event counts occur during a time slot.

AP1.4.2.1.3. <u>Pulse Width Monitor Function</u>.

AP1.4.2.1.3.1. In each 13-microsecond interval in which the Terminal commands transmission of a Link 16 pulse, the Terminal shall measure the width of the envelope of each transmitted pulse.

AP1.4.2.1.3.2. The Terminal shall measure the pulse width of each pulse whose 100 percent power level is between at least +2 dB and –8 dB of the nominal power selected for transmission of the 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.

AP1.4.2.1.3.3. The Terminal shall increment the Pulse Width Event count whenever the pulse width is not within the range of 6.08 to 6.72-microseconds between the 95 percent voltage levels (90 percent power levels).

AP1.4.2.1.3.3.1. If the pulse widths are measured at a level other than the 95 percent voltage level, the fault reporting criteria must be demonstrated to verify that the fault reporting satisfies the 6.08 to 6.72-microsecond limits at the 95 percent amplitude voltage level. In complying with the requirement in AP1.4.2.1.3.3., it is acceptable to assume that the width of normally transmitted pulses at the measurement level minus the width of the pulse at the 95 percent voltage level is constant at other pulse widths.

AP1.4.2.1.3.4. If the power of the pulse is weaker or stronger than the capability of the Terminal to accurately measure pulse width, or too narrow for the Terminal to accurately measure the 100 percent power level, it shall report a zero pulse width and increment the Pulse Width Event count. The 100 percent power level shall be the steady state level of a pulse whose energy and leading and trailing edges are equivalent to the transmitted pulse. In determining the 100 percent level, the Terminal shall use the average level measured over an interval of at least 3.2-microseconds. The Terminal shall determine the average level using at least 64 samples measured over this interval.

AP1.4.2.1.3.5. If the Terminal fails to measure the width of a Link 16 pulse it has commanded for transmission, it shall report a zero pulse width and increment the Pulse Width Event count.

AP1.4.2.1.3.6. The Terminal shall generate a Pulse Width EPF Fault Report (and increment the EPF Fault Report count) if more than 32 Pulse Width Event counts are detected in any group of 64 contiguous pulses of a Link 16 message transmission.

AP1.4.2.1.4. <u>Uniform Use of Authorized Carriers</u>

AP1.4.2.1.4.1. In each 13-microsecond 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 allowed by initialization. If fewer are allowed, the authorized carriers shall be those determined by initialization in accordance with the methods specified in Appendix 2.

AP1.4.2.1.4.2. The Terminal shall measure the frequency of each pulse whose 100 percent power level is between at least +2 dB and –8 dB of the nominal power selected for transmission of the 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 pick off 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.

AP1.4.2.1.4.3. After the Terminal measures the frequency of each Link 16 pulse, it shall increment the count of one of 53 distinct bins. Fifty-one 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 package structure and by one for all other pulses. (The term “adjacent carrier” refers to a carrier that is 3 MHz above or below a specific carrier).

AP1.4.2.1.4.3.1. –2.0 MHz and +2.0 MHz of an authorized carrier for which there is no adjacent (3 MHz away) authorized carrier.

AP1.4.2.1.4.3.2. –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.

AP1.4.2.1.4.3.3. –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.

AP1.4.2.1.4.3.4. –1.5 MHz and +1.5 MHz of any of the remaining authorized carrier frequencies.

AP1.4.2.1.4.4. 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 subparagraphs AP1.4.2.1.4.4.1. through AP1.4.2.1.4.4.3.

AP1.4.2.1.4.4.1. At the end of each block, the Terminal shall 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.

AP1.4.2.1.4.4.2. 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 subparagraph AP1.4.2.1.4.4.1. If the Terminal is operating in the frequency hopping mode and counts are outside these limits, the Terminal shall generate a Short-Term Frequency Histogram EPF Fault Report (and increment the EPF Fault Report count). .

AP1.4.2.1.4.4.3. 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 subparagraph AP1.4.2.1.4.4.1. 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 generate a Long-Term Frequency Histogram EPF Fault Report (and increment the EPF Fault Report count).

AP1.4.2.1.4.5. If the measured frequency of the pulse is within 7 MHz of either 1030 or 1090 MHz, the Terminal shall increment by one the fifty-second bin, which is referred to as the High Level 1030/1090 MHz Frequency bin.

AP1.4.2.1.4.5.1. The Terminal shall generate a High Level 1030/1090 MHz EPF Fault Report (and increment the EPF Fault Report count) if, at the end of a time slot, the High Level 1030/1090 MHz Frequency bin has two or more counts. The Terminal shall set the High Level 1030/1090 MHz Frequency bin to zero before the beginning of the next time slot.

AP1.4.2.1.4.6. The frequency monitor shall increment by one the fifty-third bin, which is referred to as the OOB Frequency bin and no other bin if:

AP1.4.2.1.4.6.1. The measured frequency is not an authorized carrier and is not within 7 MHz of either 1030 MHz or 1090 MHz, or

AP1.4.2.1.4.6.2. The frequency monitor fails to measure the frequency of the pulse that the Terminal has commanded for transmission for any reason, including (but not limited to) cases where the pulse level is too weak or the pulse width is too narrow for frequency measurement or the frequency measurement process is not functioning properly, or

AP1.4.2.1.4.6.3. The measured frequency reported by the high power amplifier is an unauthorized carrier frequency or an out of band measured pulse frequency, or

AP1.4.2.1.4.6.4. The Terminal does not receive a high power amplifier measured frequency for any pulse the terminal commands the high power amplifier for transmission.

AP1.4.2.1.4.6.5. The Terminal shall generate an OOB EPF Fault Report (and increment the EPF Fault Report count) if at the end of a time slot, the OOB Frequency bin has two or more counts. The Terminal shall set the OOB Frequency bin to zero before the beginning of the next time slot.

AP1.4.2.1.5. <u>Overpower Monitor Function</u>.

AP1.4.2.1.5.1. In each 13-microsecond interval in which the Terminal commands transmission of a Link 16 pulse, the Terminal or external amplifier 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 pick off 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.

AP1.4.2.1.5.2. The Terminal with high power capability shall process a variable parameter that instructs it to either allow or disallow power levels greater than 200 W + 1 dB transmissions by an internal or external power amplifier. The setting of this variable parameter shall be platform dependent.

AP1.4.2.1.5.3. Power levels of transmissions by an internal or external power amplifier shall be measured using a peak power monitor or an average power monitor.

AP1.4.2.1.5.3.1. If the selected power mode is nominally 200 W + 1dB or less, and a peak power monitor is used, the Terminal shall generate a Peak Overpower EPF Fault Report (and increment the EPF Fault Report count) if the peak forward pulse power of five or more Link 16 pulses in a time slot is more than 200 W + 2 dB. Peak forward pulse power shall be the steady state power level of a pulse whose energy and leading and trailing edges are equivalent to the transmitted pulse.

AP1.4.2.1.5.3.2. If the selected power mode is nominally 200 W + 1dB or less, and an average power monitor is used, the Terminal shall generate an Average Overpower EPF Fault Report (and increment the EPF Fault Report count) if the average of the peak power values (in watts) of the Link 16 transmitted pulses in a time slot is more than 200 W + 1.5 dB.

AP1.4.2.1.5.4. If the variable parameter is instructed to disallow high power transmission of greater than 200 W + 1 dB signals, 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 external power amplifier. The Terminal shall report its action to the host.

AP1.4.2.1.6. Time Slot Duty Factor Monitoring Function. During each 12 second interval, the Terminal shall maintain a count of the number of Link 16 pulses commanded for transmission by either the Terminal or by the external power amplifier (if used). All Link 16 pulses commanded for transmission shall be accounted for. The Terminal shall inhibit further Link 16 transmission through its antenna interface during the remainder of the 12 second frame in which the count exceeds a variable parameter [X (3962-198140, 3962)]. The value of X shall be dependent on the TSDF limits imposed in the applicable full EMC protection mode. For example, when in the full EMC protection mode where the platform TSDF limit is established as 20 percent, the variable parameter is [79256 (3962-198140, 3962)].[7] The transmission inhibit shall be cleared automatically and the time slot duty factor pulse count is reset to zero at the end of the 12 second interval. The specified range of values for this variable parameter corresponds to limitations on the time slot duty factor between 1 and 50 percent.

AP1.4.2.1.6.1. The Terminal shall prevent the operator from resetting the transmission inhibit prior to the end of the 12 second interval. The terminal shall resume normal operation at the end of the 12 second interval.

AP1.4.2.1.6.2. The Terminal shall allow time slot assignments that result in transmission during adjacent time slots.

AP1.4.2.1.7. Message Structure Controls.

AP1.4.2.1.7.1. The Terminal shall process a variable or an adaptable parameter 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.

AP1.4.2.1.7.2. The Terminal shall process a variable or an adaptable parameter that instructs it to accept assignments from zero to eight time slots in a 12 second frame that results in Round Trip Timing – Broadcast (RTT-B) transmission.

[7] This shorthand notation means that in the 20 percent mode (79240), the Variable Parameter should be adjustable from 1 percent (3962) to 20 percent (79240) in 1 percent (3962) steps.

AP1.4.2.1.7.3. The Terminal shall process an adaptable parameter to either disallow or allow RTT-B transmissions. If the adaptable parameter is set to allow RTT-B transmissions, then the limit shall be in accordance with the setting of the variable or adaptable parameter in subparagraph AP1.4.2.1.7.2.

AP1.4.2.1.8. Net Usage Control. The Terminal shall process a variable or an adaptable parameter that determines which transmit time slot assignments shall be rejected on the basis of the net number included in the assignment. The Terminal should only accept assignment with a net number less than or equal to the value of the variable or adaptable parameter. The maximum number of net assignments shall be 127.

AP1.4.2.1.9. Relay Mode Controls.

AP1.4.2.1.9.1. Conditional Paired Slot Relay (CPSR) Controls. The Terminal shall process a variable or an adaptable parameter that accepts or rejects CPSR assignments.

AP1.4.2.1.9.2. Re-Promulgation and Enhanced Re-Promulgation Relay Controls.

AP1.4.2.1.9.2.1. The Terminal shall process a variable or an adaptable parameter that accepts or rejects time slot assignments that result in re-promulgation or enhanced re-promulgation relay Link 16 message transmissions.

AP1.4.2.1.9.2.2. The Terminal shall transmit all re-promulgation relay messages with a random jitter delay having a minimum step size of 10-microseconds with at least 8 randomly selectable delays. A BIT function shall be implemented to verify the random jitter delay requirements for relaying messages and inhibit transmission of the relayed message if the random jitter delay requirements are not operating as intended. Incorporating an operational BIT function that keeps a running check of the jitter values generated for each relayed message can satisfy this requirement. If the same jitter value is used more than eight times in a row, the re-promulgation relay of the message shall be inhibited. If the re-promulgation relay message is inhibited, the terminal shall select a random jitter delay for the next message. If a different delay is chosen, then the transmission of re-promulgation relay messages can resume. In addition, a "loopback" operational BIT check shall be implemented to verify that the calculated jitter delay value is the same value that is transmitted. If the calculated jitter delay value differs by more than 1-microsecond from the value that is transmitted, three times in a 12 second interval, the re-promulgation relay of the message shall be inhibited for the remainder of the 12 second interval.

AP1.4.2.1.10. Access Mode Controls.

AP1.4.2.1.10.1. Machine Controlled Contention Controls. The Terminal shall process a variable or an adaptable parameter that instructs it either to accept or reject transmit time slot assignments that result in machine controlled contention access mode transmissions. These types of contention access transmissions include CPSR, Round Trip Timing Broadcast Mode (RTT-B), Precise Participant Location and Identification (PPLI), Initial Network Entry (INE) and Fighter to Fighter message transmissions.

AP1.4.2.1.10.2. Time Slot Reallocation (TSR) Controls.

AP1.4.2.1.10.2.1. The Terminal shall process a variable or an adaptable parameter that accepts or rejects TSR time slot assignments that can result in contention conditions.

AP1.4.2.1.10.2.2. The TSR controls do not apply to centralized mode time slot reallocation access transmissions.

AP1.4.3. EMC Features BIT.

AP1.4.3.1. The CTT, 1030/1090 MHz LLD, pulse width, frequency, and overpower 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 (e.g. operational built-in-test (OBIT)). If a BIT for a particular monitor cannot operate continuously or periodically, then the monitor shall be checked during Terminal start-up (e.g. startup built-in-test (SBIT)) and an operator shall have the capability to manually initiate its BIT. This can be implemented separately from the Terminal's manually initiated built-in-test (IBIT) function. All EMC Feature BITs shall be verified for proper operation and the BIT threshold and signal levels shall be measured for proper calibration when the Terminal or LRU/SRU/module that contains the EMC Feature(s) is returned to the depot for maintenance. (See paragraph AP1.5.3.)

AP1.4.3.2. A failure of an operational or periodic BIT shall inhibit Link 16 transmissions in accordance with its 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.

AP1.4.3.2.1. CTT BIT. The CTT OBIT shall verify proper operation of the monitors of each stage during each 13-microsecond interval of normal Link 16 pulse transmissions. Proper operation means that each component monitor shall indicate the state of "Capable-of-Transmitting" during an interval of at least 2.5-microseconds when a Link 16 pulse is commanded and indicate the state of "Not-Capable-of-Transmitting" during the intervals defined in subparagraphs AP1.3.4.2. and AP1.3.4.3. The OBIT shall be considered successful if the Terminal reports that the monitors are operating properly. If the Terminal indicates that one or more of the monitors are not operating properly in a 13 microsecond interval, the Terminal shall increment the CTT Event count.

AP1.4.3.2.2. 1030/1090 MHz LLD BIT.

AP1.4.3.2.2.1. During the 1030/1090 MHz LLD SBIT and IBIT, the Terminal shall perform two tests that independently verify the proper operation of the 1030 MHz and 1090 MHz LLD circuits.

AP1.4.3.2.2.2. The first test shall be accomplished by providing to the 1030 MHz LLD monitor, a Terminal generated pulsed signal whose energy supplied to the 1030 MHz monitor is no more than 2 dB stronger than the level stated in AP1.4.2.1.2.3. Excessive energy in the 1090 MHz LLD circuitry shall not affect independent verification of the 1030 MHz LLD circuit.

AP1.4.3.2.2.3. The second test shall be accomplished by providing to the 1090 MHz LLD monitor, a Terminal generated pulsed signal whose energy supplied to the 1090 MHz monitor is no more than 2 dB stronger than the level stated in subparagraph AP1.4.2.1.2.3. Excessive energy in the 1030 MHz LLD circuitry shall not affect independent verification of the 1090 MHz LLD circuit.

AP1.4.3.2.2.4. If either of these two tests is not successful, the Terminal shall inhibit transmissions. Each test shall be considered successful if the Terminal generates the command that would have incremented the LLD fault count if the Terminal were fully operational. If the transmission inhibit is reset, the two tests shall be performed again.

AP1.4.3.2.2.5. The test shall be performed without regard to the state of any LLD suppression signal or any adaptable parameter that restricts or inhibits transmission.

AP1.4.3.2.3. <u>Pulse Width Monitor BIT</u>. SBIT and IBIT checks shall be implemented to verify proper operation of all components of the pulse width measurement process.

AP1.4.3.2.3.1. The test shall be performed by providing the pulse width capability with terminal-generated RF pulse waveforms having pulse shape similar to that of normally transmitted pulses and at a peak power level that is not stronger than 6 dB below the nominal level of the lowest output power mode. The terminal-generated waveform shall include pulse widths less than (narrow pulse width equivalent to no less than 5.98 microseconds), pulse widths within (normal pulse width) and pulse widths wider than (wide pulse width equivalent to no wider than 6.82 microseconds) the acceptable range, as defined in subparagraph AP1.4.2.1.3.3., at the 95 percent voltage level. The number of narrow and wide, or combination of narrow and wide pulses shall equal the number of pulse width event counts to be incremented. Pulses with normal widths shall not cause the pulse width event count to be incremented.

AP1.4.3.2.3.2. If the test is not successful, the Terminal shall inhibit transmissions. The test shall be considered successful only if:

AP1.4.3.2.3.2.1. The 100 percent voltage level determined by the pulse width monitor is at or above the nominal level at which the pulse width capability would be capable of measuring pulse width, and

AP1.4.3.2.3.2.2. The conditions defined in subparagraph AP1.4.3.2.3.1. are met.

AP1.4.3.2.3.3. The test shall be performed without regard to the state of any LLD suppression signal or any adaptable parameter that restricts or inhibits transmission.

AP1.4.3.2.4. Frequency Monitor BIT. During each scheduled Link 16 pulse transmission, the Terminal shall verify proper operation of the uniform use of authorized carriers function. The Terminal shall generate a Frequency EPF Fault Report (and increment the EPF Fault Report count) if the frequency bin count incremented is different from the Link 16 pulse carrier frequency commanded for transmission five or more times in a transmit time slot.

AP1.4.3.2.5. Overpower Monitor BIT. When operating in a power mode that is nominally 200 w + 1 dB or less, a BIT shall be provided to check the accuracy of the +1.5 dB (average power) or +2.0 dB (peak power) tolerance limits of the output power monitors and the inhibit software. If a peak power monitor is utilized, then during the last 5 pulses of a message in one time slot within a 12 second frame, verify that the terminal would declare a peak overpower fault (for test purposes only) when the overpower monitor threshold is attenuated by a level 2 dB below the selected nominal power level. The test is successful if a peak overpower fault (for test purposes only) is declared as a result of the 5 pulses. If a peak overpower fault is not declared, then the Terminal shall generate a Peak Overpower EPF Fault Report (and increment the EPF Fault Report count). If an average power monitor is utilized, verify that the terminal would declare an average overpower fault (for test purposes only) when the overpower monitor threshold is attenuated by a level 2 dB below the selected nominal power level during the transmission period of all the pulses in a single time slot within a 12 second frame. The test is successful if an average overpower fault is declared (for test purposes only) by the end of the time slot in which the OBIT was performed. If a test EPF fault is not declared, then the Terminal shall generate an Average Overpower EPF Fault Report (and increment the EPF Fault Report count).

AP1.4.3.3. The BIT implementations described in subparagraphs AP1.4.3.2.1. through AP1.4.3.2.5. can be modified. All proposed modifications shall be documented and approved by the PEO C4I&S prior to incorporation in the Terminal.

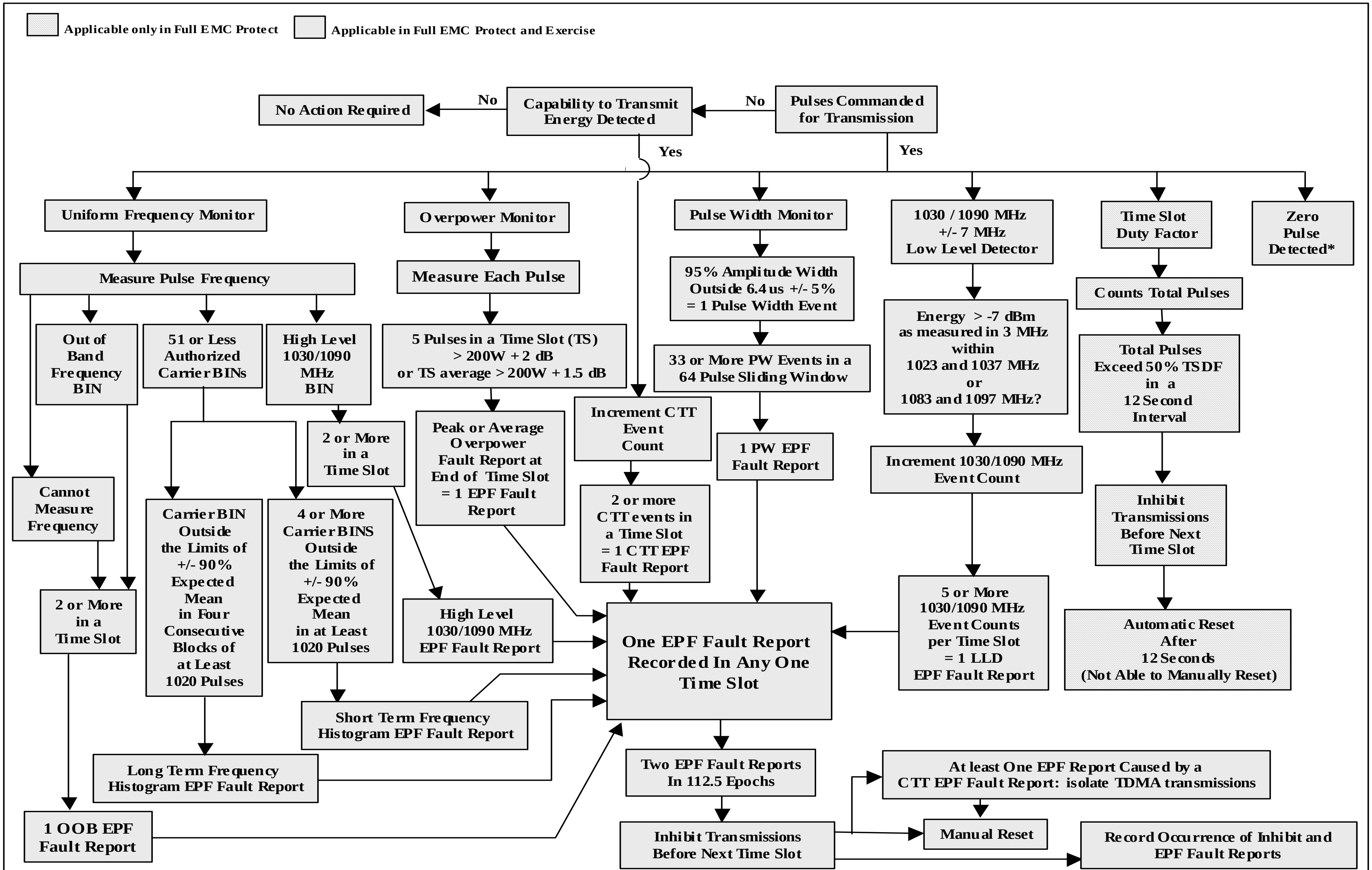
AP1.4.4. EMC Protection Modes. The Terminal shall have the capability to operate in each EMC Feature mode. These modes include the full EMC protection mode, the exercise EMC protection mode, and the combat mode. The Terminal shall operate in accordance with the EMC protection mode identified by the EMC protection mode adaptable parameter. In each of the EMC protection modes, the Terminal shall detect and store EMC Features data in accordance with paragraph AP1.4.5 (EMC Features Data Storage).

AP1.4.4.1. Full EMC Protection Mode.

AP1.4.4.1.1. The Terminal shall operate in the full EMC protection mode (e.g., 100/20, 100/50 TDSF) unless one of the other modes is authorized and is explicitly selected during initialization. The Terminal shall perform every function stated in paragraphs AP1.4.2.1. and the BIT functions as defined in paragraph AP1.4.3 when it is in the full EMC protection mode.

AP1.4.4.1.2. The Terminal shall automatically start up in the full EMC protection mode and not change from that mode except by specific operator actions to install a different initialization load that conforms to all requirements for uncoordinated Link 16 operation. The initialization load installed during the previous mission can be used only if that operator took positive action, prior to removing power, to retain the current initialization data when the Terminal is next powered up.

AP1.4.4.1.3. Figure AP1.F3. summarizes the fault conditions for the functions detailed in subparagraphs AP1.4.2.1.1. through AP1.4.2.1.6. Each declared fault shall be counted by a separate software algorithm for each of these RF EMC Features and the Terminal shall generate an EPF Fault Report no later than the end of each TDMA time slot if the number of faults exceeds the limit specified for that function. As shown in Figure AP1.F3., if more than one function generates an EPF Fault Report, the EPF Fault Report count is incremented by only one in any time slot. If the EPF Fault Report count reaches two or more the Terminal shall inhibit Link 16 transmissions. The Terminal shall inhibit Link 16 transmissions before the next time slot after the time slot in which the second EPF fault report occurred. This transmit inhibit requirement also applies to an external power amplifier configuration if present. The Terminal shall include provisions that allow the Terminal operator to manually reset a transmission inhibit which clears the EPF Fault Report count. A single EPF Fault Report shall not be cleared if an operator initiates a reset action without a transmission inhibit. Except for the EMC Features specifically identified for automatic reset in this document (e.g., the 12 second TSDF limits given in subparagraph AP1.4.2.1.6.), automatic reset of inhibits shall be strictly prohibited. The EPF Fault Report count can be reset after the Terminal is placed in Standby for longer than 2 minutes, the power has been Turned OFF, or 112.5 epochs (24 hours) have elapsed since the first EPF Fault Report. With the exception of the 112.5 epoch condition, the EPF Fault Report count shall only be cleared if the Terminal automatically goes through its Start-Up BIT Procedures prior to reactivating transmissions. The EPF Fault Report count shall not be cleared when changing the EMC Features protection mode.



* Note: Zero pulse detected is a result of either a pulse whose frequency could not be measured (OOB) or a pulse whose width could not be measured (zero pulse width) by those monitors. It is not a separate monitor.

Figure AP1.F3. TDMA Terminal EMC Features Transmit Inhibit Criteria.

AP1.4.4.1.4. 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 AP1.4.2.1.6. The specified range of values for this variable parameter corresponds to limitations on the TSDF between 1 and 50 percent.

AP1.4.4.1.5. The Terminal shall perform the message structure control and time slot assignment rejection functions in accordance with subparagraphs AP1.4.2.1.7. through AP1.4.2.1.10. and report all unacceptable conditions. The Terminal shall inhibit Link 16 transmissions before the next time slot after the time slot in which the unacceptable condition occurred.

AP1.4.4.1.6. Figure AP1.F4. summarizes the fault conditions in the OBIT implementations described in subparagraphs AP1.4.3.2.1., AP1.4.3.2.4., and AP1.4.3.2.5. Each declared fault shall be counted by a separate software algorithm for each of the OBITs and the Terminal shall generate an EPF Fault Report no later than the end of each TDMA time slot if the number of faults exceeds the limit specified for that function. (An OBIT Fault Report is treated like any RF EPF Fault Report shown in Figure AP1.F3.)

AP1.4.4.1.7 Figure AP1.F5. summarizes the fault conditions for Start-up and Manually Initiated BIT implementations.

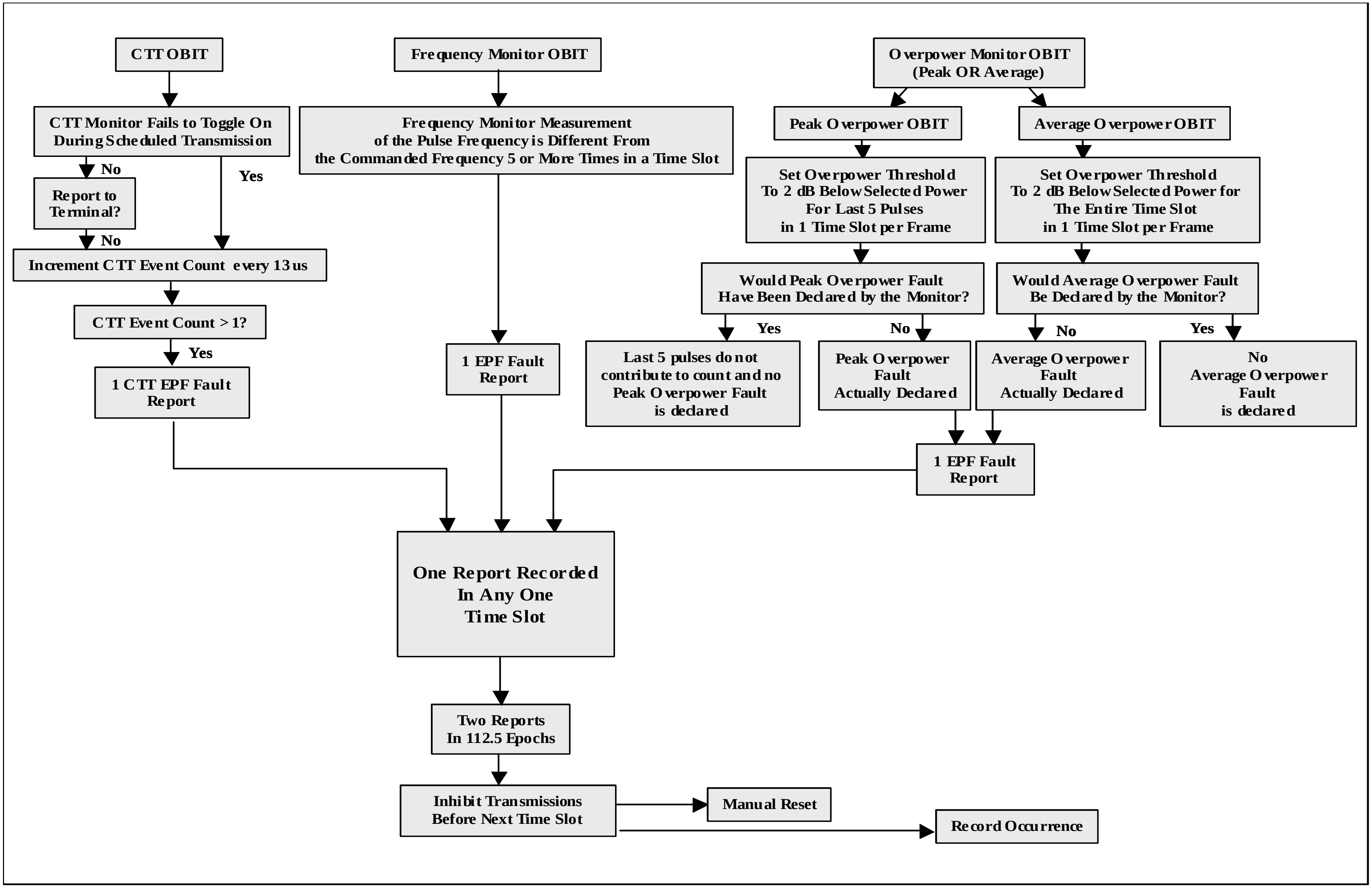
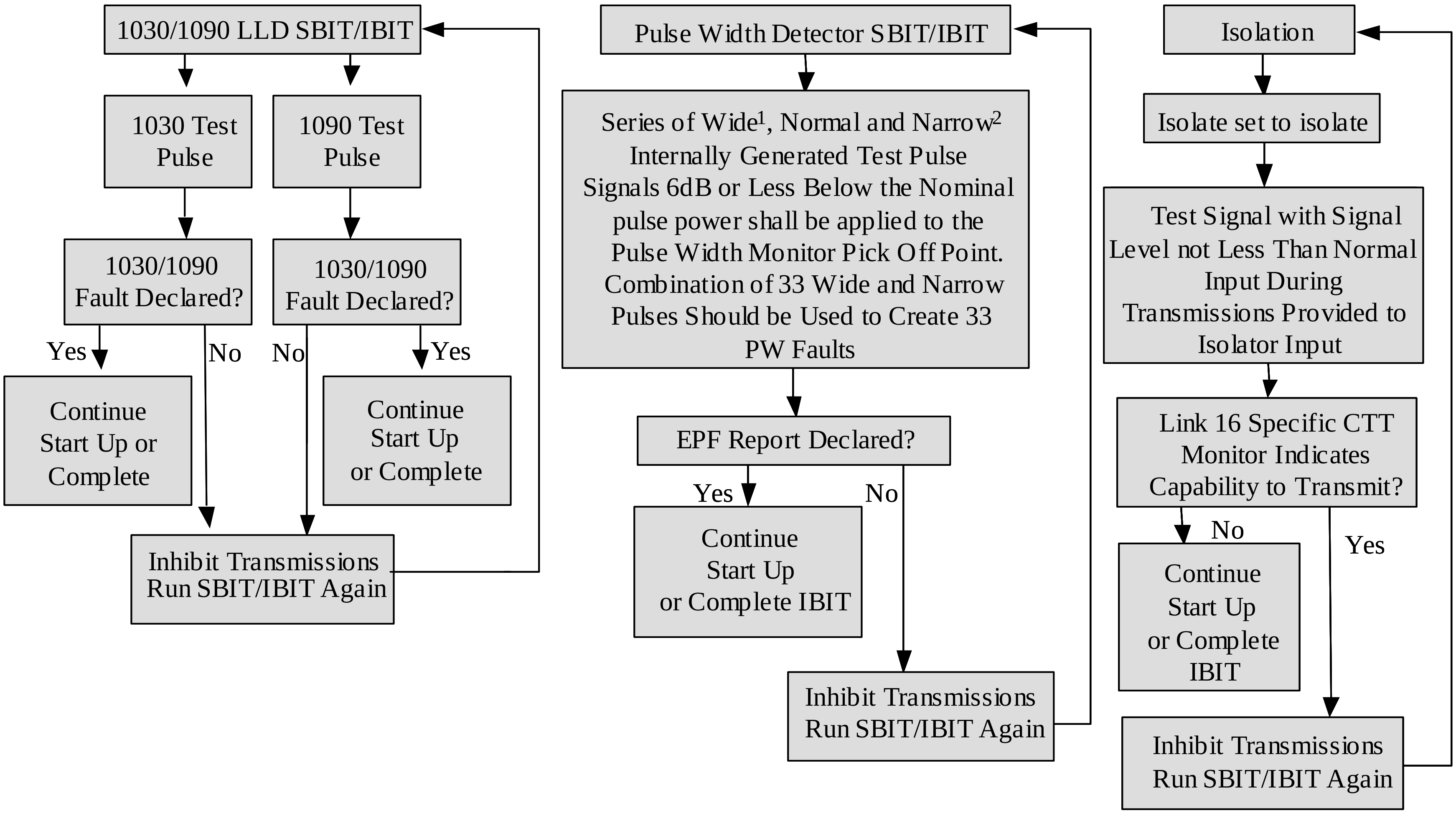


Figure AP1.F4. OBIT Implementation



Notes:
1. Wide pulses shall be no greater than 6.82 microseconds in duration.
2. Narrow pulses shall be no less than 5.98 microseconds in duration.

Figure AP1.F5. SBIT/IBIT Implementation

AP1.4.4.2. Exercise EMC Protection Mode.

AP1.4.4.2.1. The Terminal shall perform every function stated in subparagraphs AP1.4.2.1.1. through AP1.4.2.1.4. and the BIT functions as defined in paragraph AP1.4.3. when it is in the exercise mode. These functions, under the stated fault conditions and as shown in Figures AP1.F3 and AP1.F4, shall cause the Terminal to inhibit further transmissions. The handling of EPF Fault Reports, the EPF Fault Report count, transmission inhibits and transmit inhibit resets shall be in accordance with the requirements in subparagraph AP1.4.4.1.3.

AP1.4.4.2.2. The variable parameter that restricts the output power mode to 200 watts shall be overridden. The Terminal shall perform the output power monitoring functions stated in subparagraph AP1.4.2.1.5.3, unless high power operations are authorized and a power mode with a power level that is nominally greater than 200 watts + 1 dB is assigned for message transmission.

AP1.4.4.2.3. When the Terminal is in the exercise EMC protection mode, it should not perform the transmission inhibit function stated in subparagraph AP1.4.2.1.6.

AP1.4.4.2.4. The Terminal shall not perform the message structure control functions stated in subparagraph AP1.4.2.1.7.

AP1.4.4.2.5. The Terminal shall not perform the time slot assignment rejection functions identified in subparagraphs AP1.4.2.1.8., AP1.4.2.1.9.1., AP1.4.2.1.9.2.1., AP1.4.2.1.10.1., and AP1.4.2.1.10.2.1. However, the Terminal shall perform the re-promulgation relay control functions defined in subparagraph AP1.4.2.1.9.2.2.

AP1.4.4.3. Combat Mode.

AP1.4.4.3.1. When in the combat mode, the Terminal shall perform the functions stated in subparagraphs AP1.4.2.1.1. through AP1.4.2.1.4.

AP1.4.4.3.2. The Terminal shall not inhibit transmissions due to any EPF Fault Reports or EMC Feature Monitor BIT failures.

AP1.4.4.3.3. The Terminal shall not perform the output power restriction in subparagraph AP1.4.2.1.5. The Terminal output power restrictions shall be overridden and the Terminal shall be allowed to transmit high power.

AP1.4.4.3.4. In the combat mode, the Terminal shall not perform the time slot assignment rejection and the message structure disallowance functions stated in subparagraphs AP1.4.2.1.6. through AP1.4.2.1.10.

AP1.4.4.3.5. The Terminal shall record all EPF faults while in combat mode so they can be accessed by maintenance personnel and appropriate repair actions can be accomplished. The EPF faults shall not be cleared when changing the EMC Features protection mode.

AP1.4.5. <u>EMC Features Data Storage</u>.

AP1.4.5.1. The Terminal shall maintain in non-volatile memory, data that shall include the following:

AP1.4.5.1.1. Each Link 16 transmission inhibit, including when transmission was inhibited as a result of start-up or an operator initiated BIT;

AP1.4.5.1.2. The identity of all EPF Faults detected independent of the EMC protection mode,

AP1.4.5.1.3. When the Terminal EMC protection mode adaptable parameter was set to the exercise or combat EMC protection mode, and,

AP1.4.5.1.4. When the Terminal is set to enable RF output power at a nominal level exceeding 200W.

AP1.4.5.2. The date, the beginning time and ending times of the events listed in subparagraph AP1.4.5.1. shall also be stored. A capability shall be established to store the data for 1-year and shall be made available upon request.

AP1.5. <u>EMC FEATURES COMPLIANCE AND VERIFICATION</u>

AP1.5.1. <u>Formal EMC Features Certification Tests</u>.

AP1.5.1.1. The DoD Certification Authority shall certify compliance of the EMC spectral characteristics and EMC Features with all requirements in this document. This formal test shall be performed on each Terminal design in accordance with test procedures and results shall be properly documented. The test plan provided in Attachment 1 shall be utilized and tailored as appropriate to generate the test procedures. Both the tailored test plan and test procedures must be approved by the DoD Certification Authority prior to the formal certification testing.

AP1.5.1.2. The formal EMC Features certification tests shall be performed in a laboratory ambient temperature environment with a completely assembled Terminal with its antenna port terminated in its specified nominal load valued (e.g. value of 50 ohms), when practical (unless specific tests at the SRU level are required). Test equipment shall be used to provide external signals and to monitor the Terminal response to these signals. The system design shall provide easy access to inject test signals into the RF transmit path prior to the EMC Features monitor point(s).

AP1.5.2. <u>Acceptance Test Procedures</u>.

AP1.5.2.1. Prior to delivery, acceptance tests shall be performed on each Terminal and each LRU/SRU produced as spares that contain or affect the EMC Features or EMC characteristics. The acceptance test procedures shall be generated in accordance with the following tests using the approach described in the test plan provided in Attachment 1. The results of the following tests on each Terminal shall be recorded and maintained over the life of the Terminal.

AP1.5.2.1.1. Output Power. At nine carrier frequencies: 969, 990, 1008, 1053, 1065, 1113, 1146, 1176 and 1206 MHz, record the peak forward output power at each antenna port when the terminal is operated in the highest output power mode (200 watts or less) for each antenna selection mode. Verify that the sum of the output powers from all antennas does not exceed the nominal power level +1 dB.

AP1.5.2.1.2. Pulse Spectrum. While operating in each of the output power modes record plots of the individual pulse power spectrum at nine carrier frequencies: 969, 990, 1008, 1053, 1065, 1113, 1146, 1176 and 1206 MHz at each antenna when operating in the single antenna mode. Measure the spectrum in 300 kHz bandwidth segments. Set the spectrum analyzer to 50 MHz span centered on the carrier. Verify that the pulse spectra comply with the specified spectrum requirement.

AP1.5.2.1.3. Full Band Spectrum. While operating in each of the output power modes, in communication mode 1, record spectrum plots over the following frequency bands at each antenna when operating in the single antenna mode. Measure the spectrum in 300 kHz bandwidth segments. Record the plots at 100 MHz span centered on 925 MHz; 60 MHz span centered on 1030 MHz; 60 MHz span centered on 1090 MHz; 100 MHz span centered on 1250 MHz; and 960 to 1215 MHz. Verify that between 920 MHz and 1266 MHz the spectra comply with the specified spectrum requirement.

AP1.5.2.1.4. CTT Detection. For each Terminal power mode, at each component element that the terminal monitors to detect when it is capable of transmitting, including any monitor that verifies Link 16 isolation, measure and record the level into the monitor when not transmitting or isolated; the threshold level into the monitor where the monitor reports the terminal is capable of transmitting; and the level into the monitor during normal pulse transmissions. This test may be performed at the SRU acceptance test station. Verify that the recorded values are within 10 percent of their design values.

AP1.5.2.1.5. 1030/1090 MHz LLD. Measure and record the peak power level of the lowest power pulse continuous wave (CW) signal emitted at 1030 MHz that causes a 1030/1090 MHz Emissions Fault Report and the peak power level of the lowest power pulse CW signal emitted at 1090 MHz that causes a 1030/1090 MHz Emissions Fault Report. Measure the peak power level using a spectrum analyzer in 3 MHz bandwidth segments. The pulse shape of the injected CW signals shall be as close as possible to the shape of normally transmitted pulses. Verify that the peak CW power level is no greater than -7 dBm at the Terminal output port(s).

AP1.5.2.1.6. 1030/1090 MHz LLD BIT. Inject a test signal that results in an output at the 1030 MHz and 1090 MHz monitor that is the same as the level of the monitor self test signal at those monitor outputs. The width and shape of the injected signal should be the same as the Terminal self test signal. Measure and record the peak power of the injected test signal at the antenna port using a spectrum analyzer in 3 MHz bandwidth segments. Verify that the injected signal is no greater than -5 dBm at the antenna output.

AP1.5.2.1.7. Pulse Width Detection. Measure and record the pulse widths in accordance with subparagraphs AP1.5.2.1.7.1., AP1.5.2.1.7.2., and AP1.5.2.1.7.3. at nine carrier frequencies: 969, 990, 1008, 1053, 1065, 1113, 1146, 1176 and 1206 MHz, while operating in the highest output power mode (200 watts or less).

AP1.5.2.1.7.1. Measure and record the average pulse width at the 95 percent voltage level; the average pulse width at the level at which the Terminal measures pulse width; and the difference between a and b for the nine carrier frequencies. Denote this average as Δ. This part of acceptance testing may be performed at the SRU level.

AP1.5.2.1.7.2. Measure and record the narrowest width for which the Terminal identifies pulses as being an acceptable width. Record the average value of these for the nine frequencies. Denote this average by the variable name NA.

AP1.5.2.1.7.3. Measure and record the widest width for which the Terminal will identify the pulses as being an acceptable width. Record the average value of these for the nine frequencies. Denote this average by the variable name WA.

AP1.5.2.1.7.4. Verify that $NA - \Delta \geq 6080$ ns – 50 ns and $WA - \Delta \leq 6720$ ns + 50 ns.

AP1.5.2.1.8. Frequency Monitor Function. During these tests the Terminal shall operate in the multiple antenna mode (if available) and at the highest power mode (200 watts or less). Measure and record the frequency of an injected pulsed CW signal in the vicinity of 1023 MHz above which the Terminal declares a 1030/1090 MHz fault and below which the Terminal declares an OOB fault; the frequency of an injected pulsed CW signal in the vicinity of 1097 MHz below which the Terminal declares a 1030/1090 MHz fault and above which the Terminal declares an OOB fault; the frequency of an injected pulsed CW signal below the 969 MHz carrier at which the Terminal declares an OOB fault in order to verify that the measured boundary is within 200 kHz of 967 MHz, and the frequency of an injected pulsed CW signal above the 1206 MHz carrier at which the Terminal declares an OOB fault in order to verify that the measured boundary is within 200 kHz of 1208 MHz. Verify that the measured frequency boundaries are within 200 kHz of 1023 MHz, 1097 MHz, 967 MHz and 1208 MHz.

AP1.5.2.1.9. Overpower Monitor. For terminals that utilize a peak overpower monitor, verify that the Terminal indicates excess power when the peak pulse output power exceeds 200 watts +2 dB at any pulse carrier frequency. If the Terminal utilizes an average overpower monitor, verify that the Terminal indicates excess power when the average of all the peak pulse output power levels in a time slot exceeds 200 watts + 1.5 dB. This test may be performed at the SRU acceptance test station.

AP1.5.3. Maintenance Test Procedures.The Terminal shall have verification tests performed after maintenance, whenever the Terminal is returned to the Depot.

AP1.5.3.1. The BIT checks of the EMC Features that are implemented to satisfy the requirements in paragraph AP1.4.3 shall be verified for proper operation and the BIT threshold and signal levels shall be measured for proper calibration when the Terminal or LRU/SRU/module that contains the EMC Feature(s) is returned to the depot for maintenance. Proper operation of the BIT checks shall be accomplished using the same procedures generated for the EMC Features certification test that verifies proper BIT operations. Operation shall be verified in the full EMC protection mode, single antenna configuration and at the maximum nominal power level mode that is 200 watts or less.

AP1.5.3.2. In addition to the BIT tests identified in subparagraph AP1.5.3.1., the spectral characteristics at the standard nine fixed frequencies and for the composite of all authorized frequencies while in the frequency hopping mode at the highest nominal power mode 200 W or less shall be measured and recorded.

AP1.5.3.3. After maintenance on an inoperative SRU/LRU containing EMC Features, any EMC Features monitors that were repaired shall be tested in accordance with the applicable procedures described in paragraph AP1.5.2 and their associated BIT functions in accordance with subparagraph AP1.5.3.1.

AP1.5.3.4. The results of the tests in subparagraphs AP1.5.3.1. and AP1.5.3.2. shall be recorded and maintained over the life of the terminal.

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AP1.A1. ATTACHMENT 1 TO APPENDIX 1, LINK 16 ELECTROMAGNETIC COMPATIBILITY FEATURES CERTIFICATION PERFORMANCE SPECIFICATION

LINK 16 EMC FEATURES CERTIFICATION TEST PLAN

AP1.A1.1. INTRODUCTION.

AP1.A1.1.1. Scope. Certification of EMC Features and spectral characteristics is required to ensure that transmissions are electromagnetically compatible to operate with military and civil systems in the 960 MHz to 1215 MHz band. This test plan 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 software and hardware shall be certified within the Department of Defense by the PEO C4I&S and approved by the NTIA. The EMC Features data shall be collected during a formal EMC Features certification test, which shall be in accordance with this DoD EMC Features Test Plan. Terminals that have not been certified by the certification activity shall result in restricted operations and will require a FAA coordinated frequency assignment for each operation.

AP1.A1.1.2. Affected Equipment. This test plan pertains to Link 16 systems, including future applications of this RF waveform in multi-waveform capable equipment. This document also pertains to upgrades or redesign of any Link 16 Systems and Subsystems (including legacy Link 16 Systems and Subsystems) that may affect EMC or EMC Features characteristics. The conditions and requirements for the transmission of Link 16 signals are established by references (b), (c) and (f).

AP1.A1.1.3. Link 16 Terminal. The unit to be assessed should be the final representative hardware and software design of the Terminal procurement phase to be certified. Terminals that include external power amplifiers such as an HPA, shall be tested in each planned Terminal configuration or model (i.e. with and without the external HPA as applicable) for each test objective. Unless otherwise noted, the objectives are not applicable to Terminal configurations including the Class 2 HPA.

AP1.A1.1.4. Supporting Equipment. Calibrated test equipment shall be used to provide external signals and to monitor the Terminal response to these signals. The system design shall provide easy access to inject test signals into the RF transmit path prior to the EMC Features monitor point(s).

AP1.A1.1.5. Test Conditions. Unless otherwise specified in the objective or approach for each test requirement, the Terminal shall be operating in the full EMC protection mode, in one antenna configuration and in the highest power mode that is nominally 200 watts or less.

AP1.A1.2. RF SPECTRAL CHARACTERISTICS TESTING.

AP1.A1.2.1. Power Between Link 16 Pulses and Between Messages. Power levels between pulses and before and after messages shall be in accordance with the power level requirements identified in the performance specification section AP1.3.4., "Antenna Interface Signal Output."

AP1.A1.2.1.1. Objectives. Tests shall verify the following:

AP1.A1.2.1.1.1. Objective 1. That during at least a 2.5-microsecond interval between pulses in each 13-microsecond period of a Link 16 message structure, the Link 16 peak forward output power at the Terminal antenna ports is at least 80 dB below the peak forward output power of the transmitted Link 16 message pulses. Figure AP1.A1.F1. illustrates the between Link 16 pulse power level requirement.

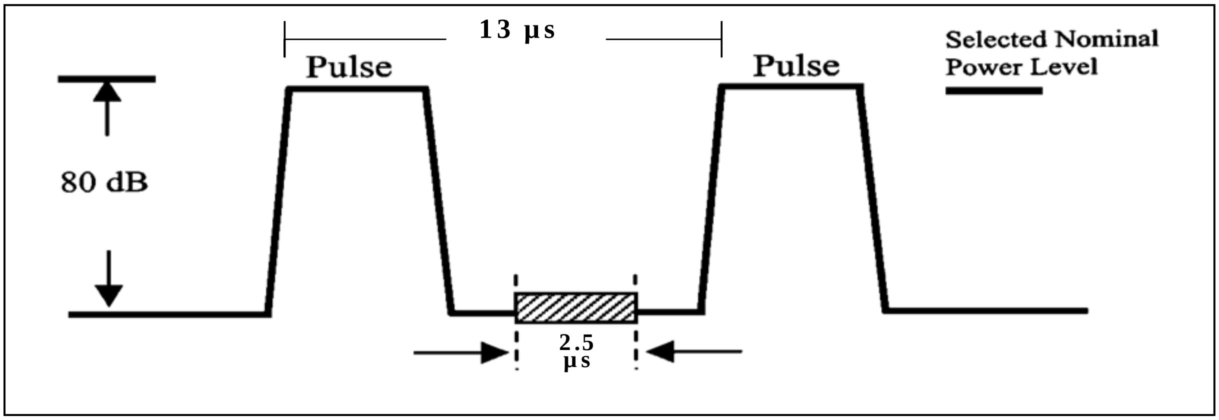

Figure AP1.A1.F1. Link 16 Inter-Pulse Power Level Requirement.

AP1.A1.2.1.1.2. Objective 2. That the peak forward RF output power at the Terminal antenna ports does not exceed –57 dBm, as measured in a 1 MHz bandwidth, exclusive of the following intervals described in subparagraphs a) and b) below. Figure AP1.A1.F2. illustrates the between Link 16 and non-Link 16 waveform power level requirement.

AP1.A1.2.1.1.2.1. Objective 2a. The interval from 5-microseconds before the 50 percent voltage level of the leading edge of the first pulse to 5-microseconds after the 50 percent voltage level of the trailing edge of the last pulse of a Terminal commanded Link 16 message transmitted through the Terminal antenna ports.

AP1.A1.2.1.1.2.2. Objective 2b. The interval from 5-microseconds before the 10 percent voltage level of the earliest leading edge to 5-microseconds after the 10 percent level of the latest trailing edge of a Terminal commanded non-Link 16 waveform transmission.

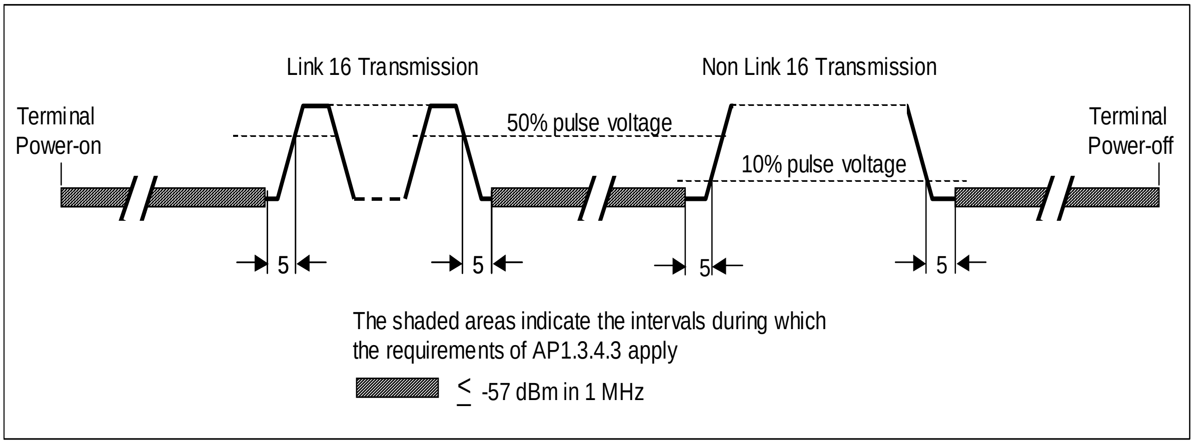

Figure AP1.A1.F2. Link 16 Inter-Message Structure Power Level Requirement.

AP1.A1.2.1.2. Approach.

AP1.A1.2.1.2.1. Objective 1 - Output Power between Pulses.

AP1.A1.2.1.2.1.1. Step 1. In a single antenna mode, measure the power level of the signal between pulses using a spectrum analyzer set for a 3 MHz video bandwidth, a 3 MHz resolution bandwidth, and a sweep rate that will allow resolution of the intervals between pulses. The amplitude of the pulses should be reduced during the "On Periods" to achieve the required spectrum analyzer sensitivity. With the Terminal operating in the frequency hopping mode and transmitting Link 16 messages, the analyzer should be set on zero span and tuned to the appropriate frequency. Measure the output level of the Terminal at each of the 51 carrier frequencies. Record the noise level and verify that the noise level between pulses is at least 80 dB weaker than the selected nominal pulse power level for a period of at least 2.5 microseconds.

AP1.A1.2.1.2.1.2. Step 2. The test performed in step 1 above shall be done in each power mode.

AP1.A1.2.1.2.1.3. Step 3. In the other antenna modes, the test performed in step 1 shall be measured at 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz in each power mode.

AP1.A1.2.1.2.2. Objective 2 - Output Power between Messages[8].

AP1.A1.2.1.2.2.1. Step 1. In a single antenna mode, measure the power level of the signal between time slot transmit periods using a spectrum analyzer set for a 1 MHz video bandwidth, a 1 MHz resolution bandwidth, and a sweep rate that will allow resolution of the intervals between time slot transmission periods. With the Terminal operating in the frequency hopping mode and transmitting Link 16 messages, the analyzer should be set on zero span and

[8] The term "message" is synonymous to the actual transmission time within a time slot.

tuned to the appropriate frequency. Measure the output level of the Terminal at each of the 51 carrier frequencies. Record the noise level and verify that the noise level between the interval from 5-microseconds before the 50 percent voltage level of the leading edge of the first pulse to 5-microseconds after the 50 percent voltage level of the trailing edge of the last pulse of a Terminal commanded Link 16 message is weaker than -57 dBm.

AP1.A1.2.1.2.2.2. Step 2. The test performed in step1 above shall be done in each power mode.

AP1.A1.2.1.2.2.3. Step 3. In the other antenna configurations, the test performed in step 1 shall be measured at 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz in each power mode.

AP1.A1.2.1.2.2.4. Step 4. If the Terminal has the capability to transmit non-Link 16 messages using the same antenna ports for Link 16 transmission, repeat step 1 while transmitting non-Link messages. Record the noise level and verify that the noise level between the interval from 5-microseconds before the 10 percent voltage level of the earliest leading edge to 5-microseconds after the 10 percent level of the latest trailing edge of a Terminal commanded non-Link 16 waveform transmission is weaker than -57 dBm.

AP1.A1.2.1.2.2.5. Step 5. The test performed in step 4 above shall be done in each power mode.

AP1.A1.2.1.2.2.6. Step 6. In the other antenna configurations, repeat the test performed in step 4 at 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz in each power mode.

AP1.A1.2.2. RF Pulse Spectrum. The Link 16 transmitted power spectrum, in each of its power modes, about any authorized carrier frequency in the 960 to 1215 MHz frequency band shall be in accordance with the requirements defined in the performance specification, (Appendix 1) paragraph AP1.3.5. "RF Pulse Spectrum".

AP1.A1.2.2.1. Objectives.

AP1.A1.2.2.1.1. Objective 1. Tests shall verify that the RF power level is down at least 10 dB at ± 3 MHz, down at least 23 dB at ± 5 MHz, down at least 55 dB at ± 13 MHz, and down at least 60 dB at and beyond ± 15 MHz from the nominal power level for each of the 51 carrier frequencies as illustrated in Figure AP1.A1.F3.

AP1.A1.2.2.1.2. Objective 2. The output spectral characteristics shall be measured on each exclusion band (1030 MHz and 1090 MHz) and on the band edges (925 MHz and 1215 MHz). Additionally, a broadband measurement from 960 to 1215 MHz shall be recorded.

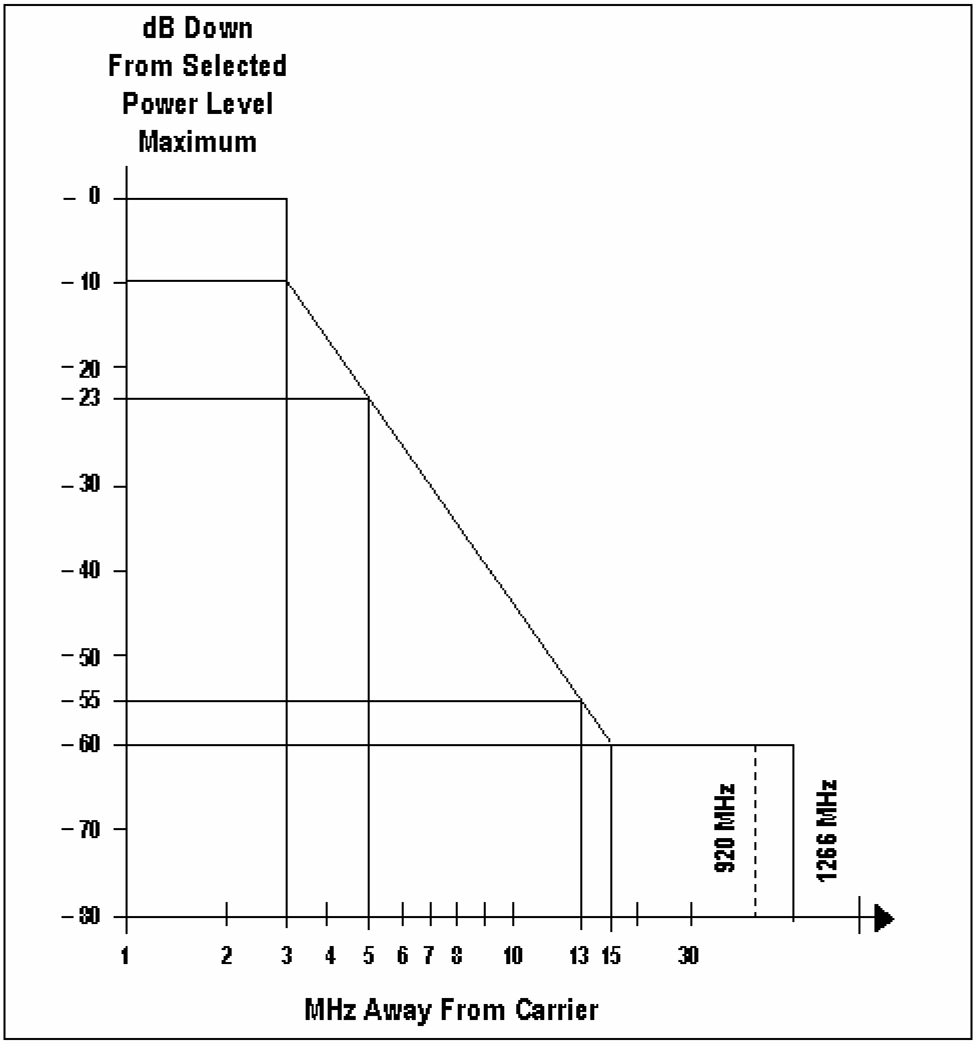

Figure AP1.A1.F3. Link 16 Pulse Power Spectral Mask within 920 to 1266 MHz**.**

AP1.A1.2.2.2. Approach.

AP1.A1.2.2.2.1. Objective 1 - Pulse Power Spectrum.

AP1.A1.2.2.2.1.1. Step 1. In a single antenna mode transmitting in the single fixed frequency test mode at a rate of at least 50 percent TSDF (198,144 pulses per 12 seconds), measure the output spectrum using a spectrum analyzer set to a 300 kHz video bandwidth, a 300 kHz resolution bandwidth, and a maximum hold display. Spectrum capture must be at least 60 seconds in duration. Using a 50 MHz and 200 MHz span, the continuous phase shift modulation (CPSM) pulse spectrum for each of the 51 frequencies shall be measured and recorded. Verify that the pulse spectrum for each of the 51 frequencies complies with Figure AP1.A1.F3.

AP1.A1.2.2.2.1.2. Step 2. The test performed in step 1 above shall be done in all power modes.

AP1.A1.2.2.2.1.3. Step 3. In the other antenna configurations, repeat the test performed in step 1 at 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz in each power mode.

AP1.A1.2.2.2.2. Objective 2 - Exclusion Band, Band Edges, Broadband Spectral Characteristics.

AP1.A1.2.2.2.2.1. Step 1. In a single antenna mode transmitting in the frequency hopping mode at a rate of at least 50 percent TSDF (198,144 pulses per 12 seconds), measure the output spectrum using a spectrum analyzer set to a 300 kHz video bandwidth, a 300 kHz resolution bandwidth, and a maximum hold display. Spectrum capture must be at least 60 seconds in duration. Using a 60 MHz span centered on each exclusion band (1030 MHz and 1090 MHz), record the spectrum analyzer data. Verify that the RF output is at least minus 60 dBc in the 14 MHz wide frequency bands centered on 1030 MHz and 1090 MHz.

AP1.A1.2.2.2.2.2. Step 2. Using a 100 MHz span centered on each of the band edges (925 MHz and 1250 MHz), record the spectrum analyzer data. Spectrum capture must be at least 60 seconds in duration. Verify that the RF output is at least minus 60 dBc in the frequency ranges below 954 MHz and above 1221 MHz.

AP1.A1.2.2.2.2.3. Step 3. Set the spectrum analyzer start frequency to 954 MHz and stop frequency to 1221 MHz, and record the data. Spectrum capture must be at least 60 seconds in duration. Verify that the levels at the 14 MHz wide exclusion bands centered on 1030 MHz and 1090 MHz and at the band edges are at least minus 60 dBc.

AP1.A1.2.2.2.2.4. Step 4. The tests performed in steps 1, 2, and 3 above shall be done in all power modes and in all antenna configurations.

AP1.A1.2.3. Out of Band Emissions. The OOB emissions below 920 MHz and above 1266 MHz band should be in compliance with the requirement stated in the performance specification paragraph AP1.3.6.

AP1.A1.2.3.1. Objective. Verify the output power spectrum outside the 920 to 1266 MHz band.

AP1.A1.2.3.2. Approach. The requirements can be verified during Electromagnetic Interference (EMI) testing and shall be made available at the EMC Features Certification test and included in the final EMC Features Certification Test Report.

AP1.A1.3. EMC FEATURES CERTIFICATION TESTING.

AP1.A1.3.1. EMC Features Monitoring Verification. The EMC Features monitors or monitoring functions to be assessed, consist of CTT detection, 1030/1090 MHz Emissions, Pulse Width, Uniform Use of Authorized Carriers, Output Power Restrictions, Time Slot Duty Factor, Message Structure Restrictions, Net Number Restriction, Relay Restrictions, and Access

Restrictions. EMC Feature Monitoring requirements are specified in the performance specification paragraph AP1.4.2.

AP1.A1.3.1.1. CTT Function Assessment. The CTT function monitors the period between Link 16 pulses and messages to ensure the Terminal is not radiating unscheduled or spurious Link 16 RF signals in the frequency band.

AP1.A1.3.1.1.1. Objectives. Tests shall verify:

AP1.A1.3.1.1.1.1. Objective 1. That in the Link 16 only mode, CTT monitoring is active during all intervals in which the Terminal has not scheduled a Link 16 transmit command (pulse) to the power amplifier.

AP1.A1.3.1.1.1.2. Objective 2. That CTT monitors measure the voltage, bias currents or RF signal characteristics at each stage of RF output power, including the RF output provided to an external power amplifier.

AP1.A1.3.1.1.1.3. Objective 3. That in a mixed Link 16 and non-Link 16 mode:

AP1.A1.3.1.1.1.3.1. Objective 3a. A minimum of one CTT monitor exclusive to Link 16 is active during non-Link 16 transmissions and all other CTT monitor outputs are suppressed.

AP1.A1.3.1.1.1.3.2. Objective 3b. CTT monitor outputs are not suppressed during all intervals which the Terminal has not scheduled either Link 16 or non-Link 16 transmissions.

AP1.A1.3.1.1.1.4. Objective 4. That the Terminal increments the EPF Fault Report count if the CTT Event count is two or more, at the end of a Link 16 time slot interval.

AP1.A13.1.1.1.4.1. Objective 4a. That the power supply voltage to the power amplifier has been removed until an IPF reset is initiated, or;

AP1.A.1.3.1.1.1.4.2. Objective 4b. That Link 16 waveform generation is isolated until an IPF reset is initiated, when the Terminal inhibits Link 16 transmissions due to a CTT fault. When Link 16 is isolated, and no other waveform is transmitting, the forward output power at the antenna is – 57 dBm/MHz or less when the Link 16 function is attempting to operate into the isolation at its normal input power.

AP1.A1.3.1.1.1.5. Objective 5. That the isolation, if implemented as stated in objective 4.b, is verified during SBIT and IBIT.

AP1.A1.3.1.1.1.6. Objective 6. If the Terminal has an external HPA configuration, repeat objectives 1 through 5 with the HPA

AP1.A1.3.1.1.2. Approach.

AP1.A1.3.1.1.2.1. Objective 1 - CTT Event Detection.

AP1.A1.3.1.1.2.1.1. Step 1. Ensuring the Terminal is in Link 16 Only mode of operation, inject/simulate a CTT fault condition for each CTT Monitor, between pulses. Record the injected fault condition.

AP1.A1.3.1.1.2.1.2. Step 2. Verify a CTT Event count is incremented for each injected fault.

AP1.A1.3.1.1.2.1.3. Step 3. Verify that the Terminal generates an EPF Fault Report when there are two or more CTT Events in a Link 16 time slot by the end of the time slot.

AP1.A1.3.1.1.2.1.4. Step 4. After two EPF Fault Reports, verify that the Terminal inhibits transmissions and

AP1.A1.3.1.1.2.1.4.1. Step 4a. The Link 16 Terminal removes the power supply voltages to the RF amplifier, or;

AP1.A1.3.1.1.2.1.4.2. Step 4b. The Link 16 Terminal waveform generation has been isolated.

AP1.A1.3.1.1.2.1.5. Step 5. Repeat steps 1 through 4 for a CTT fault condition between Link 16 messages.

AP1.A1.3.1.1.2.1.6. Step 6. Repeat steps 1 through 5 in the exercise EMC protection mode and combat mode. Verify that in the combat mode, the Terminal generates EPF Fault Reports, but does not inhibit transmissions.

AP1.A1.3.1.1.2.2. Objective 2 - CTT Monitor Levels.

AP1.A1.3.1.1.2.2.1 Step 1. Measure and record the signal levels at each CTT monitoring point when Link 16 pulses are not being transmitted.

AP1.A1.3.1.1.2.2.2. Step 2. Measure and record the signal levels at each CTT monitoring point in the RF Amplifier during scheduled Link 16 pulse transmissions ("active low").

AP1.A1.3.1.1.2.2.3. Step 3. Inject and record an RF signal capable of causing a CTT fault. Measure and record the threshold levels at each CTT monitoring point when the monitor starts detecting unscheduled emissions ("active-high"). Verify that the measured threshold level is at least 10 dB below the measured level during scheduled Link 16 transmissions recorded in step 2 above.

AP1.A1.3.1.1.2.2.4. Step 4. Repeat steps 1 through 3 in all power modes.

AP1.A1.3.1.1.2.3. Objective 3 - Mixed Link 16 and non-Link 16 CTT Fault Conditions.

AP1.A1.3.1.1.2.3.1 Step 1. For Terminals with both Link 16 and non-Link 16 capabilities, initialize the Terminal to include a non-Link 16 waveform.

AP1.A1.3.1.1.2.3.1.1. Step 1a. While transmitting a non-Link 16 waveform, demonstrate that there is at least one CTT monitor exclusive to Link 16 that does not indicate CTT while the non-Link 16 waveforms are transmitting. Verify that the CTT monitors that are not exclusive to Link 16 indicate CTT during the non-Link 16 transmissions, but that the CTT Event count is not incremented. For each exclusive CTT monitor, inject/simulate a CTT fault condition into that monitor. Verify that the CTT Event count is incremented by one.

AP1.A1.3.1.1.2.3.1.2. Step 1b. Remove the fault condition and verify CTT fault count is not incremented during non-Link 16 transmission.

AP1.A1.3.1.1.2.3.1.3. Step 1c. When no waveforms are commanded for transmissions, for each CTT monitor, inject/simulate a CTT fault into that monitor. Verify that the CTT Event count is incremented by one.

AP1.A1.3.1.1.2.4. Objective 4 - EPF Fault Assessment. For convenience Objective 4 tests may be included in tests identified in Objective 1 and/or 3 Methods.

AP1.A1.3.1.1.2.4.1. Step 1. Simulate a non-CTT EPF Fault in one time slot and 2 CTT Events (1 EPF Fault) in a second time slot. Verify that 2 EPF Fault Reports are generated.

AP1.A1.3.1.1.2.4.2. Step 2. After the two EPF faults, verify that after a transmission inhibit:

AP1.A1.3.1.1.2.4.2.1. Step 2a. The Link 16 Terminal removes the power supply voltages to the RF amplifier, or;

AP1.A1.3.1.1.2.4.2.2. Step 2b. The Link 16 Terminal waveform generation has been isolated. For a Terminal implementing a Link 16 isolation capability as defined in subparagraph AP1.4.2.1.1.3 of the performance specification, enable the isolation and attempt to operate Link 16 into the isolation. Measure and record the power level going into the isolation. Verify that this level is no less than that of a Link 16 signal during normal transmissions. Verify that the forward output power summed at all antenna ports is -57 dBm/MHz or weaker when the isolation is enabled. Measure and record this level. Remove the isolation and record the level that would have gone into the isolation and record the forward output power at the antenna.

AP1.A1.3.1.1.2.5. Objective 5 - Isolation SBIT/IBIT.

AP1.A1.3.1.1.2.5.1. Step 1. During normal transmissions, record the power level that is incident at the point in the transmission circuitry just prior to the isolation technique.

AP1.A1.3.1.1.2.5.2. Step 2. Upon start up of the Terminal, when the SBIT has set the isolation technique from the state of "non-isolated" to "isolated", record the internal test signal that is applied to the isolation technique. Verify that this level is no less than the level measured in step 1. Verify that the exclusive CTT monitor indicates its normal operating level as determined in Step 2 of objective 2. Verify that the CTT monitor used to detect whether emissions are occurring when the isolation is in place (referred to as the Isolation SBIT CTT Monitor), indicates no emissions.

AP1.A1.3.1.1.2.5.3. Step 3. Inject a fault into the exclusive CTT monitor such that it does not detect CTT during the Isolation SBIT. Verify that the Terminal fails SBIT and inhibits transmissions.

AP1.A1.3.1.1.2.5.4. Step 4. Inject/simulate a fault that indicates a CTT Event for the Isolation SBIT CTT monitor during the SBIT. Verify that the Terminal fails the SBIT and inhibits transmissions.

AP1.A1.3.1.1.2.5.5. Step 5. Repeat steps 1 through 4 for each power mode of the Terminal.

AP1.A1.3.1.1.2.6. Objective 6 - External HPA. If the Terminal has an external HPA configuration, all tests identified in subparagraphs AP1.A1.3.1.1.2.1. through AP1.A1.3.1.1.2.4. shall be performed.

AP1.A1.3.1.2. 1030/1090 MHz LLD Function Assessment. 1030/1090 MHz LLD monitors the RF signal levels at the 1030 and 1090 MHz notch frequencies, during each 13-microsecond Link 16 transmission interval and reports when the LLD threshold levels have been exceeded.

AP1.A1.3.1.2.1. Objectives.

AP1.A1.3.1.2.1.1. Objective 1. 1030/1090 LLD detection tests shall verify that an EPF Fault Report occurs if in five or more 13-microsecond intervals in a time slot, the output power level in the bands of 1030 ± 7 MHz or 1090 ± 7 MHz exceeds the energy of a pulse whose peak steady state power level is –7 dBm as measured in a 3 MHz bandwidth and whose width, rise and fall times are equivalent to that of a normally transmitted pulse. Or as an alternative test approach, verify that an EPF fault occurs if in five or more 13-microsecond intervals in a time slot, the output power level in a 300 kHz bandwidth in the bands of 1030 ± 7 MHz or 1090 ± 7 MHz exceeds a level greater than 60 dB below the peak Link 16 pulse power based on the standard 200 watt mode even when transmitting in a power mode less than 200 watts.

AP1.A1.3.1.2.1.2. Objective 2. Verify that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.2.1.3. Objective 3. Verify that no EPF fault transmit inhibits occur when in the combat mode.

AP1.A1.3.1.2.1.4. Objective 4. Measure the LLD threshold settings and record the values.

AP1.A1.3.1.2.1.5. Objective 5. During a 13-microsecond interval where a Suppression Signal input is active, verify:

AP1.A1.3.1.2.1.5.1. Objective 5a. Emissions exceeding the levels in objective 1 or 2 above do not increment the 1030/1090 MHz Event count.

AP1.A1.3.1.2.1.5.2. Objective 5b. That for every 13-microsecond interval when a suppression signal is active, a LLD suppression counter is incremented when the Terminal is in full EMC protection mode.

AP1.A1.3.1.2.1.5.3. Objective 5c. After the LLD suppression counter reaches 55,385 in any 12 second interval, and the Terminal is not operating under IFF Emergency conditions, the Terminal no longer ignores the LLD monitor outputs during the suppression signals for the remainder of the 12 second interval.

AP1.A1.3.1.2.2. Approach.

AP1.A1.3.1.2.2.1. Objective 1 - 1030/1090 Fault Detection.

AP1.A1.3.1.2.2.1.1. Step 1. Inject four CPSM pulses per time slot using a signal generator at 1030 MHz having a level above –7 dBm or –60 dBc at the antenna output. Using a spectrum analyzer, observe the presence of signals in the 1030 MHz band. Verify that no LLD EPF Faults are generated.

AP1.A1.3.1.2.2.1.2. Step 2. Inject five CPSM pulses per time slot using a signal generator at 1030 MHz having a level above –7 dBm or –60 dBc at the antenna output and observe that the Terminal generates an EPF Fault Report. Record and verify that the Terminal stopped transmitting before the time slot that followed the second EPF Fault Report.

AP1.A1.3.1.2.2.1.3. Step 3. Repeat steps 1 and 2 above with the insertion of pulses at 1090 MHz.

AP1.A1.3.1.2.2.1.4. Step 4. The tests performed in steps 1, 2, and 3 shall be done in the full EMC protection and exercise EMC protection modes, in all power modes, and in one antenna configuration.

AP1.A1.3.1.2.2.2. Objective 2 - Combat Mode.

AP1.A1.3.1.2.2.2.1. Step 1. In the combat mode, inject five CPSM pulses per time slot using a signal generator at 1030 MHz having a level above –7 dBm or –60 dBc at the antenna output and observe that the 1030/1090 MHz Event count is incremented. Verify that LLD EPF Reports are generated, but that the Terminal does not stop transmitting.

AP1.A1.3.1.2.2.2.2. Step 2. Repeat step 1 above using 1090 MHz injected pulses.

AP1.A1.3.1.2.2.3. Objective 3 - LLD Thresholds using the –7 dBm Test Approach.

AP1.A1.3.1.2.2.3.1 Step 1. The output spectrum should be measured using a spectrum analyzer with a 3 MHz video bandwidth, a 3 MHz resolution bandwidth, a maximum hold display, and a sweep rate of 15 MHz per second or less. The spectrum analysis should be at least 60 seconds in duration. The Terminal should be transmitting in the combat mode and in the frequency hopping mode at a rate of at least 198,144 pulses per 12 seconds (50 percent TSDF).

AP1.A1.3.1.2.2.3.2. Step 2. Inject at least five 6.4-microsecond randomly modulated CPSM test signals per time slot having approximately a 3 MHz bandwidth, at 1030 MHz. The strongest spectrum level of the weakest test signal that results in an LLD EPF Fault Report shall be determined using spectrum analyzer bandwidths of 3 MHz centered on 1030 MHz. Record this level and verify that the strongest level of the test signal does not exceed an absolute level of –7 dBm. This test shall be repeated with CPSM test signals injected at 1024.5 MHz and at 1035.5 MHz.

AP1.A1.3.1.2.2.3.3. Step 3. The test in step 2 above shall be repeated using test signals injected at 1090 MHz, and then at 1084.5 MHz and 1095.5 MHz. The spectrum analyzer shall be centered on 1090 MHz for these tests.

AP1.A1.3.1.2.2.3.4. Step 4. Inject 6.4-microsecond noise signals having a 14 MHz bandwidth centered on 1030 MHz. The strongest spectrum level of the weakest test signal that results in a LLD EPF Fault Report shall be determined using spectrum analyzer bandwidths of 3 MHz centered on 1030 MHz. Record this level and verify that the strongest level of the test signal does not exceed an absolute level of –7 dBm.

AP1.A1.3.1.2.2.3.5. Step 5. The test in step 4 above shall be repeated using noise signals having a 14 MHz bandwidth centered on 1090 MHz. The spectrum analyzer shall be centered on 1090 MHz for this test.

AP1.A1.3.1.2.2.3.6. Step 6. Inject at least five 6.4-microsecond pulsed CW test signals per time slot having a bandwidth less than 300 kHz, at 1030 MHz. The strongest spectrum level of the weakest test signal that results in a LLD EPF Fault Report shall be determined using spectrum analyzer bandwidths of 3 MHz centered on 1030 MHz. Record this level and verify that the strongest level of the test signal does not exceed an absolute level of –7 dBm. This test shall be repeated with pulsed CW test signals injected at 1023.5 MHz and at 1036.5 MHz.

AP1.A1.3.1.2.2.3.7. Step 7. The test in step 6 above shall be repeated using pulsed CW test signals injected at 1090 MHz, and then at 1083.5 MHz and at 1096.5 MHz. The spectrum analyzer shall be centered on 1090 MHz for these tests.

AP1.A1.3.1.2.2.3.8. Step 8. The tests performed in steps 1 through 7 shall be performed in all antenna configurations and in all power modes.

AP1.A1.3.1.2.2.4. Objective 3 - LLD Thresholds using the –60 dBc Test Approach.

AP1.A1.3.1.2.2.4.1. Step 1. The output spectrum should be measured using a spectrum analyzer with a 300 kHz video bandwidth, a 300 kHz resolution bandwidth, a maximum hold display, and a sweep rate of 15 MHz per second or less. The spectrum analysis should be at least 60 seconds in duration. The Terminal should be transmitting in the combat mode and in the frequency hopping mode at a rate of at least 198,144 pulses per 12 seconds (50 percent TSDF), or if less, the Terminal's maximum specified TSDF. Determine the strongest carrier power level in the selected power mode using a spectrum analyzer with a start frequency of 960 MHz and a stop frequency of 1215 MHz, adjusted to the selected power mode (e.g., if in a 20 watt power mode and the maximum pulse power measured at the antenna port(s) is 43 dBm, an adjustment of +10 dB would be added to the measured peak value to determine compliance with the –60 dBc requirement). Record this level.

AP1.A1.3.1.2.2.4.2. Step 2. Inject at least five 6.4-microsecond randomly modulated CPSM test signals per time slot having approximately a 3 MHz bandwidth, at 1030 MHz. The strongest spectrum level of the weakest test signal, (measured in a 300 kHz bandwidth) that results in a LLD EPF Fault Report shall be determined using a spectrum analyzer with a frequency span no wider than 60 MHz centered on 1030 MHz. Record this level and verify that the strongest level of the test signal does not exceed a level of 60 dB weaker than the level determined in step 1 above. This test shall be repeated with CPSM test signals injected at 1024.5 MHz and at 1035.5 MHz.

AP1.A1.3.1.2.2.4.3. Step 3. The test in step 2 above shall be repeated using test signals injected at 1090 MHz, and then at 1084.5 MHz and 1095.5 MHz. The spectrum analyzer shall be centered on 1090 MHz for these tests.

AP1.A1.3.1.2.2.4.4. Step 4. Inject at least five 6.4-microsecond noise signals per time slot having a 14 MHz bandwidth centered on 1030 MHz. The strongest spectrum level of the weakest test signal (measured in a 300 kHz bandwidth) that results in a LLD EPF Fault Report shall be determined using a spectrum analyzer with a frequency span no wider than 60 MHz centered on 1030 MHz. Record this level and verify that the strongest level of the test signal does not exceed a level of 63 dB weaker than the level determined in step 1.

AP1.A1.3.1.2.2.4.5. Step 5. - The test in step 4 above shall be repeated using noise signals having a 14 MHz bandwidth centered on 1090 MHz. The spectrum analyzer shall be centered on 1090 MHz for this test.

AP1.A1.3.1.2.2.4.6. Step 6. Inject at least five 6.4-microsecond CW test signals per time slot having a bandwidth less than 300 kHz, at 1030 MHz. The strongest spectrum level of the weakest test signal (measured in a 300 kHz bandwidth) that results in a LLD EPF Fault Report shall be determined using a spectrum analyzer with a frequency span no wider than 60 MHz centered on 1030 MHz. Record this level and verify that the strongest level of the test signal does not exceed a level of 57 dB weaker than the level determined in step 1. This test shall be repeated with pulsed CW test signals injected at 1023.5 MHz and at 1036.5 MHz.

AP1.A1.3.1.2.2.4.7. Step 7. The test in step 6 above shall be repeated using pulsed CW test signals injected at 1090 MHz, and then at 1083.5 MHz and at 1096.5 MHz. The spectrum analyzer shall be centered on 1090 MHz for these tests.

AP1.A1.3.1.2.2.4.8. Step 8. The tests performed in steps 1 through 7 shall be performed in all antenna configurations and in all power modes.

AP1.A1.3.1.2.2.5. Objective 4 - LLD Suppression.

AP1.A1.3.1.2.2.5.1. Step 1. In the full EMC protection mode, inject five 1030 MHz or 1090 MHz pulses per time slot having a level above –7 dBm or –60 dBc during an active LLD Suppression signal. Verify that the Terminal increments the LLD Suppression count every 13-microsecond interval where the suppression signal is present during a Link 16 transmission, and that the 1030/1090 MHz Event count is not incremented.

AP1.A1.3.1.2.2.5.2. Step 2. Inject ten 1030 MHz or 1090 MHz pulses per time slot having a level above –7 dBm or –60 dBc while the LLD suppression signal is active over five of the ten pulses. Verify that the LLD suppression count was increased by five and that the Terminal reports a LLD EPF Fault Report at the end of the time slot.

AP1.A1.3.1.2.2.5.3. Step 3. Continuously inject 1030 MHz or 1090 MHz pulses during an active high suppression signal. Verify that the Terminal does not increment the 1030/1090 MHz Event count until the LLD Suppression count reaches 55,385 in a 12 second period. After that time, verify that the Terminal increments the 1030/1090 MHz Event count, increments the LLD EPF Fault Report count, and that a transmission inhibit occurs.

AP1.A1.3.1.2.2.5.4. Step 4. Repeat step 3 above in the exercise EMC protection mode. Verify that transmission is not inhibited.

AP1.A1.3.1.3. Pulse Width Monitor Function Verification. Pulse Width Monitor measures the width of Link 16 pulses and determines when the pulse is outside the limits of 6.08 to 6.72- microseconds, between the 95 percent voltage levels (90 percent power levels).

AP1.A1.3.1.3.1. Objectives. Tests shall verify:

AP1.A1.3.1.3.1.1. Objective 1. That the Terminal measures Link 16 message pulse widths and increments the Pulse Width Event count when minimum and/or maximum pulse width parameters are exceeded.

AP1.A1.3.1.3.1.2. Objective 2. That the Terminal reports a zero pulse width and increments the Pulse Width Event count when the pulse width monitor fails to measure the width of a pulse.

AP1.A1.3.1.3.1.3. Objective 3. That the Terminal generates an EPF Fault Report if more than 32 Pulse Width Events occur in a contiguous 64 pulse group. Verify that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.3.1.4. Objective 4. That no EPF fault transmit inhibits occur when in the combat mode.

AP1.A1.3.1.3.1.5. Objective 5. That the settings for the lower and upper pulse width limits are set correctly to be equivalent to the 6.08 to 6.72-microseconds at 95 percent amplitude (voltage) level criteria. If the pulse widths are measured at a level other than the 95 percent amplitude level, verify that the fault reporting criteria satisfies the 6.08 to 6.72-microsecond limits at the 95 percent amplitude level.

AP1.A1.3.1.3.1.6. Objective 6. That the pulse width monitor accurately reports pulse width throughout the dynamic range of the monitor.

AP1.A1.3.1.3.2. Approach.

AP1.A1.3.1.3.2.1. Objectives 1, 2, and 3 - Pulse Width Algorithm.

AP1.A1.3.1.3.2.1.1. Step 1. Within three consecutive time slots, into the pulse width monitor, replace 32 contiguous pulses with pulses of width less than 6.08 microseconds (narrow). Record the width/number of the substituted narrow transmitted pulses; Verify that the EPF Fault Report count is not incremented and that all three time slots are transmitted. Record the display of all three time slots. Repeat again using 33 contiguous narrow pulses. Record the width/number of the substituted narrow transmitted pulses, that the EPF Fault Report count is incremented by two, and that the Terminal transmits in only two time slots. Record the display of the two time slots.

AP1.A1.3.1.3.2.1.2. Step 2. Within three consecutive time slots, into the pulse width monitor, replace 32 contiguous pulses with pulses of width more than 6.72 microseconds (wide). Record the width/number of the substituted wide transmitted pulses; Verify that the EPF Fault Report count is not incremented and that all three time slots are transmitted. Record the display of all three time slots. Repeat again using 33 contiguous wide pulses. Record the width/number of the substituted wide transmitted pulses, that the EPF Fault

Report count is incremented by two and that the Terminal transmits only two time slots. Record the display of the two time slots.

AP1.A1.3.1.3.2.1.3. Step 3. Within three consecutive time slots, into the pulse width monitor, replace 32 contiguous pulses with a combination of pulses with a width of less than 6.08 microseconds (narrow) and wider than 6.72 microseconds (wide) and one blanked pulse (zero) (as part of the 32 contiguous pulses). Record the width/number of the substituted narrow transmitted pulses. Verify that the EPF Fault Report count is not incremented and that all three time slots are transmitted. Record the display of all three time slots. Repeat again using one blanked pulse and a combination of 32 contiguous narrow and wide pulses. Record the width/number of the substituted transmitted pulses and that the EPF Fault Report count is incremented by two and that the Terminal transmits in only two time slots. Record the display of the two time slots.

AP1.A1.3.1.3.2.1.4. Step 4. The tests performed in steps 1 and 2 shall be performed in all power modes, in the full EMC protection and exercise EMC protection modes, and in all antenna configurations.

AP1.A1.3.1.3.2.2. Objective 4 - Combat Mode.

AP1.A1.3.1.3.2.2.1. Step 1. Within three consecutive time slots, into the pulse width monitor, replace 32 contiguous pulses with a combination of pulses with a width of less than 6.08 microseconds (narrow) and wider than 6.72 microseconds (wide) and one blanked pulse (zero) (as part of the 32 contiguous pulses). Record the width/number of the substituted narrow transmitted pulses; Verify that the EPF Fault Report count is not incremented and that all three time slots are transmitted. Record the display of all three time slots. Repeat again using 33 contiguous narrow pulses. Record the width/number of the substituted transmitted pulses and that the EPF Fault Report count is incremented by two and that the Terminal transmits all three time slots (i.e. the Terminal does not inhibit transmissions). Record the display of the three time slots.

AP1.A1.3.1.3.2.3. Objective 5 - Pulse Width Monitor Detection Thresholds.

AP1.A1.3.1.3.2.3.1. Step 1. In full EMC protection mode and in the single fixed frequency mode transmitting on 969 MHz, channel 0, measure and record the output pulse width at the 95 percent voltage amplitude points. Verify that the pulse width is within 6.4-microseconds ± 0.32-microseconds. Additionally, if the Terminal measures pulse widths at a level other than the 95 percent voltage amplitude point, measure and record the output pulse width at that level. Repeat these measurements for the remaining 50 carrier frequencies.

AP1.A1.3.1.3.2.3.2. Step 2. Perform the measurements described in step 1 above in all power modes using one antenna configuration.

AP1.A1.3.1.3.2.3.3. Step 3. Perform the measurement described in step 1 in the other antenna configurations in all power modes for at least nine individual fixed frequencies (969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz).

AP1.A1.3.1.3.2.3.4. Step 4. Calculate the average pulse widths taken at the 95 percent amplitude point. Denote this as AVG_{95}. If the Terminal measures pulse width at a level other than the 95 percent voltage amplitude point, calculate the average pulse widths taken at the measured level. Denote this as AVG_{ML}. The average width of the nominal pulse at the measured level (P_{ML}) equals AVG_{ML} - AVG_{95} + 6.4-microseconds. If the Terminal measures pulse width at the 95 percent voltage amplitude point, P_{ML} equal $AVG_{95.}$ The criteria for the narrow measurement level threshold (NML_C) equals P_{ML} – 0.32-microseconds. The criteria for the wide measurement level threshold (WML_C) equals P_{ML} + 0.32-microseconds. Record these values.

AP1.A1.3.1.3.2.3.5. Step 5. To determine the test pulse envelope that shall be used to shape injected pulses, use the average 100 percent amplitude of normally transmitted pulses over all 51 frequencies, as well as the average 95 percent amplitude measurements (AVG_{95}). If the Terminal measures the pulse width at a level other than the 95 percent voltage amplitude point, also use AVG_{ML}.

AP1.A1.3.1.3.2.3.6. Step 6. In the combat mode, into the pulse width monitor, replace a series of 33 contiguous pulses with pulses having the equivalent test pulse envelope established in step 5. Increase the width until the Terminal reports an EPF fault, maintaining the test pulse shape established in step 5 (i.e.. same rise and fall time as a normally transmitted pulse). At the voltage amplitude level for which the Terminal measures pulse width, measure the narrowest pulse within the injected pulse group. For each channel, record the narrowest pulse and verify that the width is no more than $WML_{C.}$. A 50 nanosecond (ns) tolerance is allowed for these measurements.

AP1.A1.3.1.3.2.3.7. Step 7. Perform the measurements described in step 6 in all power modes using one antenna configuration.

AP1.A1.3.1.3.2.3.8. Step 8. Perform the measurements described in step 6 in the other antenna configurations in all power modes for at least nine individual fixed frequencies (969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz).

AP1.A1.3.1.3.2.3.9. Step 9. In the combat mode, into the pulse width monitor, replace a series of 33 contiguous pulses with pulses having the equivalent test pulse envelope established in step 5. Decrease the width until the Terminal reports an EPF fault, maintaining the test pulse shape established in step 5 (i.e.. same rise and fall time as a normally transmitted pulse). At the voltage amplitude level for which the Terminal measures pulse width, measure the widest pulse within the injected pulse group. For each channel, record the widest pulse and verify that the width is no less than NML_C. A 50 ns tolerance is allowed for these measurements.

AP1.A1.3.1.3.2.3.10. Step 10. Perform the measurements described in step 9 above in all power modes using one antenna configuration.

AP1.A1.3.1.3.2.3.11. Step 11. Perform the measurements described in step 9 in the other antenna configurations in all power modes for at least nine individual fixed frequencies (969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz).

AP1.A1.3.1.3.2.4. Objective 6 - PW Measurement Dynamic Range.

AP1.A1.3.1.3.2.4.1. Step 1. Initialize the Terminal to operate on a single fixed frequency of 969 MHz (Channel 0). In the combat mode, into the pulse width monitor replace a series of 33 contiguous pulses with pulses having the equivalent test pulse envelope and width established in step 5 of subparagraph AP1.A1.3.1.3.2.3 above. Decrease the level of the externally generated pulses until the pulse width monitor reports a Pulse Width Event and record the value. Verify that the difference between the original signal level and that at which a zero pulse width is reported is at least 8 dB.

AP1.A1.3.1.3.2.4.2. Step 2. Increase the power by one dB (decrease the attenuator by one dB). Measure narrow and wide pulse width limits using the same methodology in steps 6 and 9 respectively in objective 5 above for at least nine individual fixed frequencies (969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz) in one antenna configuration. Ensure that the narrow and wide pulse width limits are no less than NML_C and no more than WML_C respectively. A 50 ns tolerance is allowed for these measurements.

AP1.A1.3.1.3.2.4.3. Step 3. Perform the tests described in steps 1 through 2 in all power modes.

AP1.A1.3.1.4. Uniform Use of Authorized Carriers. The Uniform Use of Authorized Carriers function monitors the transmission of authorized and unauthorized Link 16 carrier frequencies and ensures that the authorized frequencies are hopping uniformly.

AP1.A1.3.1.4.1. Objectives. The tests shall verify:

AP1.A1.3.1.4.1.1. Objective 1. That the Terminal generates an EPF Fault Report when the long-term and short-term frequency histogram criteria are exceeded. Verify that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.4.1.2. Objective 2. That the Terminal generates an EPF Fault Report when two or more pulses in a time slot are detected to be within 7 MHz of either 1030 or 1090 MHz. Verify that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.4.1.3. Objective 3. That the Terminal generates an EPF Fault Report when two or more pulses in a time slot are detected to be out of band. Verify that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.4.1.4. Objective 4. That the band edge and 1030 MHz and 1090 MHz transition frequencies are within the required frequency limits.

AP1.A1.3.1.4.1.5. Objective 5. That the frequency detection monitor accurately detects pulses throughout the dynamic range and acceptable pulse width of the monitor.

AP1.A1.3.1.4.2. Approach.

AP1.A1.3.1.4.2.1. Objective 1 - Long-Term and Short-Term Histogram Fault Detection.

AP1.A1.3.1.4.2.1.1. Step 1. Transmit pulse sequences with a uniform frequency pattern using all 51 frequency channels that will demonstrate at least one frequency measurement block. Verify that the sum of the bin counts of the authorized carrier frequency measurements in a frequency measurement block is greater than or equal to 1020 but not more than 1440. Verify this requirement using a message format with 258 and 444 pulses per time slot. Verify that the bin counts are reset to zero after each frequency measurement block.

AP1.A1.3.1.4.2.1.2. Step 2. Transmit pulse sequences with one authorized carrier frequency not used. In the combat mode, verify that long-term frequency histogram faults are reported after four frequency measurement blocks. Select the full EMC protection mode. Verify that a long-term frequency histogram fault is reported after four frequency measurement blocks, an EPF fault is reported, and the Terminal ceases transmission before the next time slot after the second long-term frequency histogram fault.

AP1.A1.3.1.4.2.1.3. Step 3. Repeat step 2 above using the following pulse sequences:

AP1.A1.3.1.4.2.1.3.1. Step 3a. Pulse sequences with one authorized carrier frequency used once in the message preamble.

AP1.A1.3.1.4.2.1.3.2. Step 3b. Pulse sequences having too many occurrences of one authorized carrier frequency.

AP1.A1.3.1.4.2.1.3.3. Step 3c. Pulse sequences having too many occurrences of three authorized carrier frequencies.

AP1.A1.3.1.4.2.1.4. Step 4. Transmit pulse sequences having too many occurrences of one authorized carrier frequency and too few occurrences of three authorized carrier frequencies. In the combat mode, verify that short-term frequency histogram faults are reported after one frequency measurement block. Select the full EMC protection mode. Verify that a short-term frequency histogram fault is reported after one frequency measurement block, an EPF fault is reported, and the Terminal ceases transmission before the next time slot after the second short-term frequency histogram fault.

AP1.A1.3.1.4.2.1.5. Step 5. Repeat step 4 above using pulse sequences having too many occurrences of four authorized carrier frequencies.

AP1.A1.3.1.4.2.1.6. Step 6. Repeat step 4 above using pulse sequences having too few occurrences of four authorized carrier frequencies.

AP1.A1.3.1.4.2.1.7. <u>Step 7</u>. Perform the tests in steps 2 through 6 in all power modes.

AP1.A1.3.1.4.2.1.8. <u>Step 8</u>. Perform the tests in steps 2 through 6 with frequencies remapped. Use combinations of one, seven, and fourteen frequencies remapped.

AP1.A1.3.1.4.2.2. <u>Objective 2 - High Level 1030/1090 MHz Fault Detection</u>.

AP1.A1.3.1.4.2.2.1. <u>Step 1</u>. Initialize the Terminal in a full EMC protection mode. Substitute any two normally transmitted pulses with two pulsed CW pulses at 1030 MHz per time slot in the frequency detection monitor. Verify that a high level 1030/1090 MHz frequency fault is reported. Verify that the Terminal generates an EPF Fault Report, and that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.4.2.2.2. <u>Step 2</u>. Substitute any two normally transmitted pulses with two pulsed CW pulses at 1090 MHz per time slot in the frequency detection monitor. Verify that a high level 1030/1090 MHz frequency fault is reported. Verify that the Terminal generates an EPF Fault Report, and that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.4.2.2.3. <u>Step 3</u>. Repeat steps 1 and 2 in all power modes, and in the exercise EMC protection and combat modes. Verify that when the Terminal is in the combat mode that it reports EPF faults resulting from the high level 1030/1090 MHz frequency faults, but that it does not inhibit transmissions.

AP1.A1.3.1.4.2.3. <u>Objective 3 - Out of Band Fault Detection</u>.

AP1.A1.3.1.4.2.3.1. <u>Step 1</u>. Initialize the Terminal in a full EMC protection mode. Substitute any two normally transmitted pulses with two pulsed CW pulses at 966.6 MHz per time slot in the frequency detection monitor. Verify that an out of band fault is reported. Verify that the Terminal generates an EPF Fault Report, and that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.4.2.3.2. <u>Step 2</u>. Repeat step 1 above substituting any two normally transmitted pulses with two pulsed CW pulses at 1022.6 MHz per time slot in the frequency detection monitor.

AP1.A1.3.1.4.2.3.3. <u>Step 3</u>. Repeat step 1 substituting any two normally transmitted pulses with one pulsed CW pulse at 966.6 MHz and blanking the presence of one other pulse per time slot in the frequency detection monitor.

AP1.A1.3.1.4.2.3.4. <u>Step 4</u>. Initialize the Terminal to re-map one frequency. Substitute any two normally transmitted pulses with two pulsed CW pulses at the frequency required to be remapped per time slot in the frequency detection monitor. Verify that the unauthorized frequency was reported as an out of band fault. Verify that the Terminal generates an EPF Fault Report, and that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.4.2.3.5. Step 5. Repeat steps 1 through 4 in all power modes and in the exercise EMC protection and combat modes. Verify that when the Terminal is in the combat mode that it reports EPF faults resulting from the out of band fault reports, but that it does not inhibit transmissions.

AP1.A1.3.1.4.2.4. Objective 4 - Band Edges, and 1030 MHz and 1090 MHz Transition Frequency.

AP1.A1.3.1.4.2.4.1. Step 1. In the combat mode, substitute any two normally transmitted pulses with 2 pulses (CPSM) at 969 MHz per time slot with an amplitude at nominal power level. Decrease the frequency of the substituted pulses until an out of band fault occurs. Record the transition frequency and verify that the value is not less than 967 MHz – 200 kHz.

AP1.A1.3.1.4.2.4.2. Step 2. In the combat mode, substitute any two normally transmitted pulses with 2 pulses (pulsed CW) at 1008 MHz per time slot with an amplitude at nominal power level. Increase the frequency of the injected pulses until an out of band fault occurs. Record the transition frequency and verify that the value is not more than 1010 MHz + 200 kHz.

AP1.A1.3.1.4.2.4.3. Step 3. In the combat mode, inject 2 pulses (pulsed CW) at 1053 MHz per time slot with an amplitude at nominal power level. Decrease the frequency of the injected pulses until an out of band fault occurs. Record the transition frequency and verify that the value is not less than 1051 MHz – 200 kHz.

AP1.A1.3.1.4.2.4.4. Step 4. In the combat mode, inject 2 pulses (pulsed CW) at 1065 MHz per time slot with an amplitude at nominal power level. Increase the frequency of the injected pulses until an out of band fault occurs. Record the transition frequency and verify that the value is not more than 1067 MHz + 200 kHz.

AP1.A1.3.1.4.2.4.5. Step 5. In the combat mode, inject 2 pulses (pulsed CW) at 1113 MHz per time slot with an amplitude at nominal power level. Decrease the frequency of the injected pulses until an out of band fault occurs. Record the transition frequency and verify that the value is not less than 1111 MHz – 200 kHz.

AP1.A1.3.1.4.2.4.6. Step 6. In the combat mode, inject 2 pulses (CPSM at 1206 MHz per time slot with an amplitude at nominal power level. Increase the frequency of the injected pulses until an out of band fault occurs. Record the transition frequency and verify that the value is not more than 1208 MHz + 200 kHz.

AP1.A1.3.1.4.2.4.7. Step 7. In the combat mode, inject 2 pulses (pulsed CW) at 1030 MHz per time slot with an amplitude at nominal power level. Verify the indications of high level 1030/1090 MHz frequency faults. Decrease the frequency of the injected pulses until the high level 1030/1090 MHz frequency faults changes to out of band faults. Record the transition frequency and verify that the value is not less than 1023 MHz – 200 kHz.

AP1.A1.3.1.4.2.4.8. Step 8. Repeat step 7 but slowly increase the frequency of the pulses. Record and verify that the transition frequency is not more than 1037 MHz + 200 kHz.

AP1.A1.3.1.4.2.4.9. Step 9. Repeat steps 7 and 8 injecting 2 pulses at 1090 MHz. Record and verify that the transition frequencies are not less than 1083 MHz – 200 kHz and not more than 1097 MHz + 200 kHz.

AP1.A1.3.1.4.2.5. Objective 5 - Frequency Detection Dynamic Range.

AP1.A1.3.1.4.2.5.1. Step 1. In the combat mode, substitute any two normally transmitted pulses with two pulsed CW pulses at 1030 MHz per time slot with an amplitude of nominal power level and nominal width. Verify the indications of high level 1030/1090 MHz frequency faults. Decrease the amplitude of the injected pulses until the high level 1030/1090 MHz frequency fault changes to an out of band frequency fault. Record the difference between the nominal power level and the level at which the high level 1030/1090 MHz frequency fault becomes an out of band fault. Verify that the difference is at least 8 dB. Increase the power level 1 dB, and repeat objective 4, steps 7 - 9. Verify that the transition frequencies are within the required frequency limits.

AP1.A1.3.1.4.2.5.2. Step 2. In the combat mode, substitute any two normally transmitted pulses with two pulsed CW pulses at 1030 MHz per time slot with an amplitude of nominal power level and nominal width. Verify the indications of High Level 1030/1090 MHz EPF Fault Reports. Reduce the width of the injected pulses until an out of band fault is indicated. Verify that the high level 1030/1090 MHz frequency fault does not disappear until the out of band fault is indicated.

AP1.A1.3.1.4.2.5.3. Step 3. In the combat mode, inject/simulate two CPSM pulses at 1176 MHz and notice that no frequency faults are indicated. Reduce the power of the injected pulses until an out of band fault is indicated. Record the difference between the nominal power level and the level at which an out of band fault is declared. Verify that the difference is at least 8 dB.

AP1.A1.3.1.4.2.5.4. Step 4. Perform steps 1-3 in all power modes.

AP1.A1.3.1.4.2.5.5. Step 5. Initialize the Terminal to re-map one frequency. In the combat mode, inject two pulses at the frequency required to be remapped per time slot with amplitude of nominal level and nominal width. Verify the indication of out of band faults.

AP1.A1.3.1.5. Overpower Monitoring Function Assessment. Link 16 Terminals measure the output RF signal strength for every commanded power level and report when signal limits are exceeded.

AP1.A1.3.1.5.1. Objectives. Tests shall verify:

AP1.A1.3.1.5.1.1. Objective 1. That the Terminal or external amplifier output power of the transmitted Link 16 pulses summed from all antenna ports will be the selected power ± 1 dB.

AP1.A1.3.1.5.1.2. Objective 2. That the Terminal with high power capability processes a platform dependent variable parameter that instructs it to either allow or disallow modes with nominal power levels greater than 200 W + 1 dB transmissions by an internal or external power amplifier. Verify that in the full EMC protection mode, if the variable parameter is set to not allow power levels greater than 200 W + 1 dB, the Terminal will not allow high power transmissions. Verify that in the exercise and combat modes, the Terminal disregards the variable parameter.

AP1.A1.3.1.5.1.3. Objective 3. That the Terminal incorporates a peak power monitor or an average power monitor.

AP1.A1.3.1.5.1.3.1. Objective 3a. If the Terminal has a peak power monitor and the Terminal is not selected to operate in the high power mode or is instructed to disallow high power transmissions, the Terminal will generate an EPF fault report (and increment the EPF Fault Report count) if the peak power values (in watts) of 5 or more Link 16 transmitted pulses in a time slot is more than 200 W + 2.0 dB.

AP1.A1.3.1.5.1.3.2. Objective 3b. If the Terminal has an average power monitor and the Terminal is not selected to operate in the high power mode or is instructed to disallow high power transmissions, the Terminal will generate an EPF fault report (and increment the EPF fault report count) if the average of the peak power values (in watts) of the Link 16 transmitted pulses in a time slot is more than 200 W + 1.5 dB.

AP1.A1.3.1.5.2. Approach.

AP1.A1.3.1.5.2.1. Objective 1 - Output Power Level Measurements.

AP1.A1.3.1.5.2.1.1. Step 1. With the Terminal in transmitting on a single frequency, measure and record the Terminal output power level at each antenna port. Verify that the sum of the measured power levels from all antenna ports is within ± 1 dB of the selected power level.

AP1.A1.3.1.5.2.1.2. Step 2. Perform step 1 above on each of the 51 frequency channels, for each power mode and in all antenna configurations.

AP1.A1.3.1.5.2.2. Objective 2 - High Power Transmissions Variable Parameter.

AP1.A1.3.1.5.2.2.1. Step 1. Initialize the Terminal in the full EMC protection mode and with the variable parameter set to disallow high power transmissions. Initialize the Terminal to transmit time slots in the high power mode. Verify that the Terminal does not transmit time slots in the high power mode. Inject/simulate and record high power conditions into the overpower monitor. Verify that the Terminal generates EPF Fault Reports and inhibits Link 16 transmissions. Switch the EMC protection mode to operate in the exercise EMC protection mode. Inject/simulate high power conditions into the overpower monitor and verify that no EPF Fault Reports are generated and that the Terminal does not inhibit Link 16 transmissions. Switch the EMC protection mode to the combat mode and to transmit time slots in the high power mode. Inject/simulate high power conditions into the overpower monitor and verify that no EPF Fault Reports are generated and that the Terminal does not inhibit Link 16 transmissions.

AP1.A1.3.1.5.2.2.2. Step 2. Initialize the Terminal in the full EMC protection mode and with the variable parameter set to allow high power transmissions. Initialize the Terminal to transmit time slots in the high power mode. Verify that the Terminal transmits in the high power mode and that the Terminal does not generate EPF faults. Initialize the Terminal to not transmit in the high power mode. Inject/simulate high power conditions into the overpower monitor that will produce overpower faults. Verify that the Terminal generates EPF faults and inhibits Link 16 transmissions.

AP1.A1.3.1.5.2.2.3. Step 3. If an overpower monitor is also incorporated in an external HPA, repeat the tests in steps 1 and 2 with the Link 16 HPA configuration.

AP1.A1.3.1.5.2.3. Objective 3 - Overpower Monitor Threshold and Algorithm.

AP1.A1.3.1.5.2.3.1. Objective 3a - Peak Power Detection.

AP1.A1.3.1.5.2.3.1.1. Step 1. Initialize the Terminal to operate in the combat mode with a software load that disallows high power transmissions. Increase the power level of five injected pulses into the overpower monitor until an EPF Fault Report is generated. Record the peak output power level of the five injected pulses and verify that the level summed at all antenna ports does not exceed 200 Watts + 2 dB. If the overpower monitor threshold was adjusted to simulate the overpower condition, show that the adjusted threshold is detecting pulses equivalent to 200 Watts + 2 dB or less. Initialize the Terminal to operate in the exercise EMC protection mode. Verify that transmissions are inhibited. After a transmission inhibit reset, continue to inject the five pulses. Verify and record that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.5.2.3.1.2. Step 2. Perform step 1 above in all antenna configurations.

AP1.A1.3.1.5.2.3.2. Objective 3b - Average Power Detection.

AP1.A1.3.1.5.2.3.2.1. Step 1. Initialize the Terminal to operate in the combat mode with a software load that disallows high power transmissions. Increase the power level of injected pulses into the overpower monitor until an EPF Fault Report is generated. Record the average output power level of the pulses in one time slot and verify that the level summed at all antenna ports does not exceed 200 Watts + 1.5 dB. If the overpower monitor threshold is adjusted to simulate the overpower condition, show that the adjusted threshold is detecting the average power level of pulses in a time slot equivalent to 200 Watts + 1.5 dB or less. Initialize the Terminal to operate in the exercise EMC protection mode. Verify that transmissions are inhibited. After a transmission inhibit reset, continue to inject the pulses. Verify and record that following the second EPF fault, the Terminal stops transmitting before the next time slot.

AP1.A1.3.1.5.2.3.2.2. Step 2. Perform step 1 above in all antenna configurations using message formats with 258 pulses per time slot and 444 pulses per time slot.

AP1.A1.3.1.6. TSDF Monitoring Function Assessment. The Terminal counts the number of commanded Link 16 pulses in a 12 second interval.

AP1.A1.3.1.6.1. Objectives. Tests shall verify:

AP1.A1.3.1.6.1.1. Objective 1. That the Terminal processes a variable parameter that sets the maximum number of pulses it can transmit in a 12 second interval. Verify that the Terminal counts all commanded Link 16 pulses (on a pulse by pulse basis) and inhibits further Link 16 transmission through its antenna interface during the remainder of the 12 second frame in which the count exceeds the variable parameter.

AP1.A1.3.1.6.1.2. Objective 2. That the transmission inhibit is cleared automatically at the end of the 12 second interval. Verify the Terminal prevents the operator from resetting transmission inhibit prior to the end of the 12 second interval.

AP1.A1.3.1.6.1.3. Objective 3. That the Terminal will increment the TSDF count by one if a pulse is not detected and not increment the count in the case where a pulse transmission command is suppressed.

AP1.A1.3.1.6.1.4. Objective 4. That the Terminal does not inhibit transmissions when in the exercise EMC protection and combat modes.

AP1.A1.3.1.6.2. Approach.

AP1.A1.3.1.6.2.1. Objectives 1 and 2 - TSDF Count and Inhibit.

AP1.A1.3.1.6.2.1.1. Step 1. With the Terminal operating in normal output power and in the full EMC protection mode, and the variable parameter set for a TSDF limit of 20 percent, initialize the Terminal to transmit in 20 percent of the time slots distributed evenly within 12 seconds. Use a message format that will produce 258 pulses per time slot. Record the number of pulses transmitted and verify that the Terminal counts all the pulses during each 12 second time interval.

AP1.A1.3.1.6.2.1.2. Step 2. With the Terminal operating in Normal output power and in the full EMC Feature protection mode and the variable parameter set for a TSDF limit of 20 percent, initialize the Terminal to transmit in 40 percent of the time slots distributed uniformly over a 12 second period using a message format that contains 258 pulses per time slot.

AP1.A1.3.1.6.2.1.3. Step 3. Verify that transmissions are inhibited 6 seconds into the 12 second period.

AP1.A1.3.1.6.2.1.4. Step 4. Verify that the transmissions resume at the end of the 12 seconds.

AP1.A1.3.1.6.2.1.5. Step 5. Attempt to perform a transmit inhibit reset before the end of the 12 seconds and verify that it is unsuccessful.

AP1.A1.3.1.6.2.1.6. Step 6. Repeat steps 2 – 5 using a message format with 444 pulses per time slot. Verify that transmissions are inhibited 3.5 seconds into the 12 second period.

AP1.A1.3.1.6.2.1.7. Step 7. With the Terminal operating in normal output power and in the full EMC protection mode, and the variable parameter set for a TSDF limit of 50 percent, initialize the Terminal to transmit in 50 percent of the time slots distributed evenly within 12 seconds. Use a message format that will produce 258 pulses per time slot. Record the number of pulses transmitted and verify that the Terminal counts all the pulses during each 12 second time interval.

AP1.A1.3.1.6.2.1.8. Step 8. With the Terminal operating in Normal output power and in the full EMC Feature protection mode and the variable parameter set for a TSDF limit of 50 percent, initialize the Terminal to transmit in 100 percent of the time slots over a 12 second period using a message format that contains 258 pulses per time slot.

AP1.A1.3.1.6.2.1.9. Step 9. Verify that transmissions are inhibited 6 seconds into the 12 second period.

AP1.A1.3.1.6.2.1.10. Step 10. Verify that the transmissions resume at the end of the 12 seconds.

AP1.A1.3.1.6.2.1.11. Step 11. Attempt to perform a transmit inhibit reset before the end of the 12 seconds and verify that it is unsuccessful.

AP1.A1.3.1.6.2.1.12. Step 12. Repeat steps 8 – 11 using a message format with 444 pulses per time slot. Verify that transmissions are inhibited 3.5 seconds into the 12 second period.

AP1.A1.3.1.6.2.2. Objective 3 - Zero Pulse Detection.

AP1.A1.3.1.6.2.2.1. Step 1. With the Terminal operating in normal power and in the full EMC protection mode, initialize the Terminal to transmit in a message structure resulting in 258 pulses per time slot. Blank the first pulse and suppress the next 10 pulse transmission commands in the transmission message. Verify that the Terminal increments the total pulse count to equal 248.

AP1.A1.3.1.6.2.3. Objective 4 - Exercise EMC Feature Protection and Combat Modes.

AP1.A1.3.1.6.2.3.1. Step 1. With the Terminal operating in the exercise EMC feature protection mode with the variable parameter set to 50 percent, initialize the Terminal to transmit in 100 percent of the time slots distributed uniformly over a 12 second period using a message format that contains 258 pulses per time slot.

AP1.A1.3.1.6.2.3.2. Step 2. Verify that the Terminal does not inhibit transmissions.

AP1.A1.3.1.6.2.3.3. Step 3. With the Terminal operating in the combat mode, initialize the Terminal to transmit in 100 percent of the time slots distributed uniformly over a 12 second period using a message format that contains 258 pulses per time slot.

AP1.A1.3.1.6.2.3.4. Step 4. Verify that the Terminal does not inhibit transmissions.

AP1.A1.3.1.7. Message Structure Control Verification. Link 16 Terminal are commanded to allow or disallow selectable Link 16 message structures.

AP1.A1.3.1.7.1. Objectives. Tests shall verify:

AP1.A1.3.1.7.1.1. Objective 1. That the Terminal, when operating in a full EMC protection mode, processes a variable or adaptable parameter instructing it to allow or disallow any selectable limit for Link 16 message structure up to a limit of 444 pulses per time slot.

AP1.A1.3.1.7.1.2. Objective 2. That the Terminal, when operating in a full EMC protection mode, processes a variable or adaptable parameter instructing it to accept time slot assignments from zero to eight time slots in a 12 second frame that results in Round Trip Timing – Broadcast (RTT-B) transmission.

AP1.A1.3.1.7.1.3. Objective 3. That the Terminal, when operating in a full EMC protection mode, processes an adaptable parameter to either disallow or allow RTT-B transmissions.

AP1.A1.3.1.7.1.4. Objective 4. That the Terminal, when operating in the exercise full EMC protection and combat modes, allows any message structure up to 444 pulses per time slot and that the use of RTT-B messages is unrestricted.

AP1.A1.3.1.7.2. Approach.

AP1.A1.3.1.7.2.1. Objective 1 - Message Structure Pulses per Time Slot Control.

AP1.A1.3.1.7.2.1.1. Step 1. Initialize the Terminal in a full EMC protection mode at normal power. Set the message structure variable or adaptable parameter to a 258 message structure, and initialize the Terminal to use a message structure with 258 pulses per time slot. Verify that the Terminal accepts the time slots that use this message structure.

AP1.A1.3.1.7.2.1.2. Step 2. - Initialize the Terminal to transmit time slots with a message format containing 444 pulses per time slot. Verify that the Terminal rejects these time slots and prohibits their use.

AP1.A1.3.1.7.2.1.3. Step 3. Set the message structure variable or adaptable parameter to 444, and initialize the Terminal to transmit time slots with a message format containing 444 pulses per time slot. Verify that the Terminal accepts and allows the use of these messages.

AP1.A1.3.1.7.2.2. Objective 2 - RTT-B Control.

AP1.A1.3.1.7.2.2.1. Step 1. Set the RTT-B variable or adaptable parameter to 3, and initialize the Terminal with three RTT-B transmit and receive time slot assignments. Verify that three RTT-B time slots are accepted and that three RTT-B transmissions in 12 seconds are allowed.

AP1.A1.3.1.7.2.2.2. Step 2. Initialize the Terminal with 6 RTT-B transmit and receive time slot assignments. Verify that the Terminal will not accept or transmit more than 3 RTT-B message time slots.

AP1.A1.3.1.7.2.2.3. Step 3. Set the RTT-B variable or adaptable parameter to 6, and initialize the Terminal with six RTT-B transmit and receive time slot assignments. Verify that six RTT-B time slots are accepted and that six RTT-B message transmissions in 12 seconds are allowed.

AP1.A1.3.1.7.2.3. Objective 3 - Allow or Disallow RTT-B Messages.

AP1.A1.3.1.7.2.3.1. Step 1. Initialize the Terminal with the "Allow" or "Disallow" RTT-B adaptable parameter set to allow RTT-B transmission time slots. Transmit three RTT-B transmit and receive assignments. Verify that three RTT-B transmissions in 12 seconds are allowed and are transmitted.

AP1.A1.3.1.7.2.3.2. Step 2. Initialize the Terminal with the "Allow" or "Disallow" RTT-B adaptable parameter set to disallow RTT-B transmissions. The same initialization shall have three RTT-B transmit and receive time slot assignments. Verify that these time slot assignments are rejected and that there are no RTT-B transmissions allowed.

AP1.A1.3.1.7.2.4. Objective 4 - Exercise EMC Protection and Combat Modes.

AP1.A1.3.1.7.2.4.1. Step 1. Initialize the Terminal in exercise EMC protection mode at normal power. Repeat the steps contained in subparagraphs AP1.A1.3.1.7.2.1 through AP1.A1.3.1.7.2.3. Verify that the Terminal accepts time slots with a message structure up to 444 pulses per time slot and that time slots with RTT-B messages are allowed and the number is not limited.

AP1.A1.3.1.7.2.4.2. Step 2. Initialize the Terminal in combat mode at normal power. Repeat the steps contained in subparagraphs AP1.A1.3.1.7.2.1 through AP1.A1.3.1.7.2.3. Verify that the Terminal accepts time slots with a message structure up to 444 pulses per time slot and that time slots with RTT-B messages are allowed and the number is not limited.

AP1.A1.3.1.8. Net Usage Control Assessment. Link 16 Terminals determine which time slot assignments are to be rejected.

AP1.A1.3.1.8.1. Objectives. Tests shall verify:

AP1.A1.3.1.8.1.1. Objective 1. That the Terminal, while operating in a full EMC protection mode, processes a variable or an adaptable parameter that determines which transmit time slot assignments are rejected on the basis of the net number included in the assignment. The maximum number of net assignments is 127.

AP1.A1.3.1.8.1.2. Objective 2. That the Terminal, while operating in the exercise EMC protection and combat modes, does not reject any time slot assignments based on net number.

AP1.A1.3.1.8.2. Approach.

AP1.A1.3.1.8.2.1. Objective 1 - Net Number Control.

AP1.A1.3.1.8.2.1.1. Step 1. Initialize the Terminal in a full EMC protection mode at normal power with the variable or adaptable parameter set to 1 and all time slot assignments set to either net 0 or net 1. Verify that all time slot assignments are allowed and transmitted.

AP1.A1.3.1.8.2.1.2. Step 2. Reinitialize the Terminal with some time slot assignments set to net 2, net 3 and net 126. Verify that these time slot assignments are rejected.

AP1.A1.3.1.8.2.1.3. Step 3. Initialize the Terminal in the full EMC protection mode at Normal power with the variable or adaptable parameter set to 127 and time slot assignments set to either net 0, net 1, net 2, net 3 and net 126. Verify that all time slot assignments are allowed and transmitted.

AP1.A1.3.1.8.2.2. Objective 2 - Exercise EMC Protection and Combat Modes.

AP1.A1.3.1.8.2.2.1. Step 1. Repeat the tests in subparagraph AP1.A1.3.1.8.2.1. with the Terminal initialized in the exercise EMC protection mode. Verify that time slot assignments are not rejected on the basis of net number and that all of the messages in these time slots are transmitted.

AP1.A1.3.1.8.2.2.2. Step 2. Repeat the tests in subparagraph AP1.A1.3.1.8.2.1. with the Terminal initialized in the combat mode. Verify that time slot assignments are not rejected on the basis of net number and that all of the messages in these time slots are transmitted.

AP1.A1.3.1.9. Relay Mode Controls Verification.

AP1.A1.3.1.9.1. CPSR and Repromulgation Relay Controls. Link 16 Terminals are commanded to accept or reject CPSR, repromulgation relay, and enhanced repromulgation relay time slot assignments.

AP1.A1.3.1.9.1.1. Objectives. Tests shall verify:

AP1.A1.3.1.9.1.1.1. Objective 1. That the Terminal, while operating in the full EMC protection mode, processes a variable or an adaptable parameter that either allows or rejects CPSR time slot assignments.

AP1.A1.3.1.9.1.1.2. Objective 2. That the Terminal, while operating in the full EMC protection mode, will accept suspended and unconditional paired slot relay assignments and that it will not inhibit unconditional paired slot relay assignments.

AP1.A1.3.1.9.1.1.3. Objective 3. That the Terminal, while operating in the full EMC protection mode, processes a variable or an adaptable parameter that allows or rejects repromulgation relay time slot assignments.

AP1.A1.3.1.9.1.1.4. Objective 4. That the Terminal, while operating in the exercise EMC protection and combat modes, does not reject any CPSR or repromulgation relay time slot assignments.

AP1.A1.3.1.9.1.1.5. Objective 5. That the Terminal assesses proper operation of the repromulgation relay jitter generation delay by monitoring the jitter delay and determining when the same delay has been selected more than 8 times in a row.

AP1.A1.3.1.9.1.1.6. Objective 6. That the Terminal performs a “loopback” operational BIT check that compares the actual jitter delay of the transmitted message with the calculated jitter delay value.

AP1.A1.3.1.9.1.2. Approach.

AP1.A1.3.1.9.1.2.1. Objective 1 - CPSR Time Slot Control.

AP1.A1.3.1.9.1.2.1.1. Step 1. Initialize the Terminal in a full EMC protection mode at normal power with the CPSR variable or adaptable parameter set to allow and with CPSR transmission time slot assignments as part of the initialization load. Verify that the Terminal accepts and transmits the CPSR messages as directed. This is usually performed with a second Terminal in order to provide a request for the relay of time slot messages.

AP1.A1.3.1.9.1.2.1.2. Step 2. Initialize the Terminal with the CPSR variable or adaptable parameter set to disallow and with CPSR transmission time slot assignments as part of the initialization load. Verify that the CPSR time slots are rejected and that messages are not transmitted during these time slots when the Terminal is instructed to relay. This is usually performed with a second Terminal in order to provide a request for the relay of time slot messages.

AP1.A1.3.1.9.1.2.2. Objective 2 - Suspended and Unconditional Paired Slot Relay Time Slots.

AP1.A1.3.1.9.1.2.2.1. Step 1. Initialize the Terminal in a full EMC protection mode at normal power with the CPSR variable or adaptable parameter set to disallow and with both suspended and unconditional paired slot relay transmission time slot assignments as part of the initialization load. Verify that the Terminal accepts suspended paired slot relay assignments and that it accepts and allows transmissions of unconditional paired slot relay time slot messages. Attempt to change the suspended or unconditional paired slot relay time slot assignment to CPSR. Verify that the Terminal rejects these assignments and does not transmit the messages in these relay time slots.

AP1.A1.3.1.9.1.2.3. Objective 3 - Repromulgation Relay Time Slot Control.

AP1.A1.3.1.9.1.2.3.1. Step 1. Initialize the Terminal in a full EMC protection mode at normal power with the re-promulgation relay variable or adaptable parameter set to disallow and with re-promulgation relay time slot assignments as part of the initialization load. Verify that the Terminal rejects these time slot assignments and that it does not relay re-promulgation relay message transmissions initiated from another Terminal, nor does it initiate re-promulgation relay messages. This test is usually performed with another Terminal that initiates or relays transmissions to or from the Terminal being tested.

AP1.A1.3.1.9.1.2.3.2. Step 2. Initialize the Terminal in a full EMC protection mode at normal power with the re-promulgation relay variable or adaptable parameter set to allow and with re-promulgation relay assignments as part of the initialization load. Verify that the Terminal accepts these time slot assignments and that it relays re-promulgation relay message transmissions initiated from another Terminal. Verify that it is capable of initiating re-promulgation relay messages. This test is usually performed with another Terminal that initiates or relays transmissions to or from the Terminal being tested.

AP1.A1.3.1.9.1.2.4. Objective 4 - Exercise EMC Protection and Combat Modes.

AP1.A1.3.1.9.1.2.4.1. Step 1. Repeat the tests in subparagraphs AP1.A1.3.1.9.1.2.1. through AP1.A1.3.1.9.1.2.3. with the Terminal initialized in the exercise

EMC protection mode. Verify that the Terminal accepts the time slot assignments and does not inhibit the transmissions of CPSR and relays re-promulgation relay messages.

AP1.A1.3.1.9.1.2.4.2. Step 2. Repeat the tests in subparagraphs AP1.A1.3.1.9.1.2.1. through AP1.A1.3.1.9.1.2.3. with the Terminal initialized in the combat mode. Verify that the Terminal accepts the time slot assignments and does not inhibit the transmissions of CPSR and relays re-promulgation relay messages.

AP1.A1.3.1.9.1.2.5. Objective 5 - Repromulgation Relay Jitter Delay OBIT.

AP1.A1.3.1.9.1.2.5.1. Step 1. Use a software load that holds the calculated re-promulgation relay jitter delay constant.

AP1.A1.3.1.9.1.2.5.2. Step 2. Apply power to the Terminal and initialize it in the full EMC protection mode with at least 24 re-promulgation relay time slot assignments that are assigned to another Terminal which initiates re-promulgation messages.

AP1.A1.3.1.9.1.2.5.3. Step 3. Using an outside source as a re-promulgation message initiator (usually a second Terminal), command the Terminal to repromulgation relay in every other time slot during the 24 time slot assignment set.

AP1.A1.3.1.9.1.2.5.4. Step 4. Verify that the Terminal does not repromulgation relay after the 16th time slot assignment (i.e. it inhibits repromulgation relay transmissions when the 9th repromulgation relay message that has the same calculated jitter delay).

AP1.A1.3.1.9.1.2.5.5. Step 5. Use a software load that holds the jitter delay constant for only the first 11 repromulgation relay transmissions.

AP1.A1.3.1.9.1.2.5.6. Step 6. Using the outside source in step 3, command the Terminal to repromulgation relay in every other time slot during the 24 time slot assignment set.

AP1.A1.3.1.9.1.2.5.7. Step 7. Verify that the Terminal does not repromulgation relay after the 16th time slot assignment, but that it starts repromulgation relay message transmissions again during the 24th repromulgation relay time slot assignment.

AP1.A1.3.1.9.1.2.5.8. Step 8. Repeat steps 1 through 7 with the Terminal in the exercise EMC protection mode.

AP1.A1.3.1.9.1.2.5.9. Step 9. Repeat steps 1 through 7 with the Terminal in the combat mode. Verify that while the Terminal reports the failed repromulgation relay OBIT, that it does not inhibit repromulgation relay transmissions.

AP1.A1.3.1.9.1.2.6. Objective 6 - Repromulgation Relay Loopback OBIT.

AP1.A1.3.1.9.1.2.6.1. Step 1. Use a software load with a known progression of calculated repromulgation relay jitter delays.

AP1.A1.3.1.9.1.2.6.2. Step 2. Apply power to the Terminal and initialize it in a full EMC protection mode with at least 24 repromulgation relay time slot assignments that are assigned to another Terminal which initiates repromulgation messages.

AP1.A1.3.1.9.1.2.6.3. Step 3. Using an outside source as a repromulgation message initiator (usually a second Terminal), command the Terminal to repromulgation relay in every other time slot during the 24 time slot assignment set.

AP1.A1.3.1.9.1.2.6.4. Step 4. Replace the first 3 repromulgation relay messages transmitted by the Terminal with messages that have repromulgation relay jitter delays that are offset from the known calculated relay jitter delays by more than 1microsecond. Measure and record the replacement jitter delays and the resulting pulse train (showing the jitter delay).

AP1.A1.3.1.9.1.2.6.5. Step 5. Verify that the Terminal inhibits repromulgation relay transmissions for the remainder of the 12 second frame and that the operator cannot reset the transmit inhibit.

AP1.A1.3.1.9.1.2.6.6. Step 6. Repeat steps 1 through 5 in the exercise EMC protection mode.

AP1.A1.3.1.9.1.2.6.7. Step 7. Repeat steps 1 through 5 in the combat mode. Verify that while the Terminal reports the repromulgation relay loopback OBIT failure, that transmissions of repromulgation relay messages are not inhibited.

AP1.A1.3.1.10. Access Mode Controls Verification. Link 16 Terminals are commanded to accept or reject transmit time slot assignments that result in machine controlled contention access mode and non-centralized TSR transmissions.

AP1.A1.3.1.10.1. Objectives. Tests shall verify:

AP1.A1.3.1.10.1.1. Objective 1. That the Terminal, while operating in a full EMC protection mode, processes a variable or an adaptable parameter that instructs it either to accept or reject transmit time slot assignments that result in machine-controlled contention access mode transmissions.

AP1.A1.3.1.10.1.2. Objective 2. That the Terminal, while operating in a full EMC protection mode, processes a variable or adaptable parameter that instructs it either to accept or reject transmit non-centralized TSR time slot assignments.

AP1.A1.3.1.10.1.3. Objective 3. That the Terminal accepts centralized time slot assignments and that messages in these time slots are transmitted.

AP1.A1.3.1.10.1.4. Objective 4. That the Terminal, while operating in the exercise EMC protection and combat modes, accepts machine-controlled contention time slot assignments and non-centralized contention time slot assignments, and that messages in these time slot assignments are transmitted.

AP1.A1.3.1.10.2. Approach.

AP1.A1.3.1.10.2.1. Objective 1 - Machine-controlled Contention Access Control Verification.

AP1.A1.3.1.10.2.1.1. Step 1. Set the machine-controlled contention access variable or adaptable parameter to disallow contention. Initialize the Terminal in a full EMC protection mode with Precise Participant Location and Identification – Broadcast (PPLI-B) time slot assignments set in the contention access mode. Verify that the Terminal processes the variable or adaptable parameter, rejects these time slot assignments and that PPLI-B messages in these assignments are not transmitted.

AP1.A1.3.1.10.2.1.2. Step 2. Initialize the Terminal in a full EMC protection mode with INE time slot assignments. Verify that the Terminal rejects these time slot assignments and that messages in these time slots are not transmitted.

AP1.A1.3.1.10.2.1.3. Step 3. Initialize the Terminal in a full EMC protection mode with Fighter to Fighter message time slot assignments. Verify that the Terminal rejects these time slot assignments and that messages in these time slots are not transmitted.

AP1.A1.3.1.10.2.1.4. Step 4. Set the machine-controlled contention access variable or adaptable parameter to allow contention. Initialize the Terminal in a full EMC protection mode with PPLI-B, INE and Fighter to Fighter time slot assignments set in the contention access mode. Verify that the Terminal processes this variable or adaptable parameter, accepts the time slot assignments and that the messages in these time slots are transmitted.

AP1.A1.3.1.10.2.2. Objective 2 - TSR Control Verification.

AP1.A1.3.1.10.2.2.1. Step 1. Set the non-centralized TSR variable or adaptable parameter to disallow non-centralized TSR transmissions. Initialize the Terminal in a full EMC protection mode to operate in a non-centralized TSR pool. Verify that the Terminal processes this variable or adaptable parameter, rejects these time slot assignments and that TSR messages in these assignments are not transmitted.

AP1.A1.3.1.10.2.2.2. Step 2. Set the non-centralized TSR variable or adaptable parameter to allow non-centralized TSR transmissions. Initialize the Terminal in a full EMC protection mode with non-centralized TSR time slot assignments. Verify that the Terminal processes this variable or adaptable parameter, accepts the time slot assignments, and the messages in these time slots are transmitted.

AP1.A1.3.1.10.2.3. Objective 3 - Centralized TSR Control Verification.

AP1.A1.3.1.10.2.3.1. Step 1. Initialize the Terminal in a full EMC protection mode with Centralized TSR time slot assignments. Set the non-centralized TSR variable or adaptable parameter to disallow non-centralized TSR transmissions. Verify that the Terminal accepts the centralized TSR time slot assignments and the messages in these time slots are transmitted.

AP1.A1.3.1.10.2.4. Objective 4 - Exercise EMC Protection and Combat Modes.

AP1.A1.3.1.10.2.4.1. Step 1. Repeat the tests in subparagraph AP1.A1.3.1.10.2.1. with the Terminal initialized in the exercise EMC protection mode. Verify that machine-controlled contention access time assignments are accepted and that messages in these time slots are transmitted.

AP1.A1.3.1.10.2.4.2. Step 2. Repeat the tests in subparagraph AP1.A1.3.1.10.2.1. with the Terminal initialized in the combat mode. Verify that machine-controlled contention access time assignments are accepted and that messages in these time slots are transmitted.

AP1.A1.3.1.10.2.4.3. Step 3. Repeat the tests in subparagraph AP1.A1.3.1.10.2.2. with the Terminal initialized in the exercise EMC protection mode. Verify that TSR time assignments are accepted and that messages in these time slots are transmitted.

AP1.A1.3.1.10.2.4.4. Step 4. Repeat the tests in subparagraph AP1.A1.3.1.10.2.2. with the Terminal initialized in the combat mode. Verify that TSR time assignments are accepted and that messages in these time slots are transmitted.

AP1.A1.3.2. EMC Features BIT Verification.

AP1.A1.3.2.1. CTT Operational BIT. Link 16 Terminals have an Operational BIT that continually verifies CTT Monitor functionality.

AP1.A1.3.2.1.1. Objective. Tests shall verify:

AP1.A1.3.2.1.1.1. Objective 1. That the CTT OBIT verifies proper operation of the CTT monitors of each stage during each 13-microsecond interval of normal Link 16 pulse transmissions. Proper operation means that each component monitor shall indicate the state of "Capable-of-Transmitting" during an interval of at least 2.5-microseconds when a Link 16 pulse is commanded and indicate the state of "Not-Capable-of-Transmitting" during the intervals between pulses and messages.

AP1.A1.3.2.1.1.2. Objective 2. That the Terminal shall increment the CTT Event count if these conditions are not met by any of the component monitors.

AP1.A1.3.2.1.1.3. Objective 3. That the Terminal generates an EPF Fault Report if, at the end of a Link 16 time slot interval, the CTT Event count is two or more.

AP1.A1.3.2.1.2. Approach.

AP1.A1.3.2.1.2.1. Objective 1 - CTT OBIT.

AP1.A1.3.2.1.2.1.1. Step 1. Initialize the Terminal to transmit in normal power in a full EMC protection mode.

AP1.A1.3.2.1.2.1.2. Step 2. During normal pulse transmissions, measure and record the output of each component CTT monitor.

AP1.A1.3.2.1.2.1.3. Step 3. Verify that each monitor indicates "capable of transmitting" (i.e., a parameter level greater than the monitor threshold) for at least a period of 2.5-microseconds during commanded pulse transmissions. An exception to this requirement would be for monitors of amplifier stages that are bypassed in certain power modes of the Terminal. Verify that the Terminal reports that the monitors are operating properly when the OBIT is successful.

AP1.A1.3.2.1.2.1.4. Step 4. Repeat steps 1 through 3 in each power mode of the Terminal.

AP1.A1.3.2.1.2.2. Objective 2 - CTT Event Declaration.

AP1.A1.3.2.1.2.2.1. Step 1. Induce a condition where during a normal pulse transmission, the output of the CTT monitor does not indicate "capable of transmitting." Verify that a CTT Event is declared.

AP1.A1.3.2.1.2.2.2. Step 2. Repeat step 1 for each CTT monitor.

AP1.A1.3.2.1.2.2.3. Step 3. Repeat steps 1 and 2 for each power mode of the Terminal.

AP1.A1.3.2.1.2.2.4. Step 4. Repeat steps 1 through 3 in the exercise EMC protection mode.

AP1.A1.3.2.1.2.2.5. Step 5. Repeat steps 1 and 2 in the combat mode.

AP1.A1.3.2.1.2.3. Objective 3 - EPF Fault Declaration.

AP1.A1.3.2.1.2.3.1. Step 1. Verify that after 2 CTT Events in a time slot resulting from the failed OBIT, the Terminal generates an EPF Fault Report.

AP1.A1.3.2.1.2.3.2. Step 2. Verify that after two EPF Fault Reports induced from the failed OBIT, the Terminal inhibits transmissions. Verify that after the transmission inhibit, the Terminal either removes the power supply voltages to the RF amplifier, or the Terminal Link 16 waveform generation is isolated.

AP1.A1.3.2.1.2.3.3. Step 3. Repeat steps 1 and 2 for each CTT monitor.

AP1.A1.3.2.1.2.3.4. Step 4. Repeat steps 1 through 3 for each power mode of the Terminal.

AP1.A1.3.2.1.2.3.5. Step 5. Repeat steps 1 through 4 for the exercise EMC protection mode.

AP1.A1.3.2.1.2.3.6. Step 6. Repeat steps 1 through 3 in the combat mode. Verify the occurrence of an EPF Fault Report, but not inhibited transmissions. Verify that the Terminal reports the EPF Fault to the host.

AP1.A1.3.2.2. 1030/1090 MHz LLD SBIT and IBIT Verifications. Link 16 Terminals have a Built In Test function that verifies 1030/1090 MHz LLD monitor functionality during startup and during manually initiated BIT.

AP1.A1.3.2.2.1. Objectives. Tests shall verify:

AP1.A1.3.2.2.1.1. Objective 1. That the Terminal performs two tests that independently verify the proper operation of the 1030 MHz and 1090 MHz LLD circuits during SBIT and IBIT.

AP1.A1.3.2.2.1.2. Objective 2. That the Terminal provides the 1030/1090 MHz LLD monitor with an internally generated 1030 MHz pulsed signal whose energy is no more than 2 dB stronger than – 7dBm.

AP1.A1.3.2.2.1.3. Objective 3. That the Terminal provides the 1030/1090 MHz LLD monitor with an internally generated 1090 MHz pulsed signal whose energy is no more than 2 dB stronger than – 7dBm.

AP1.A1.3.2.2.1.4. Objective 4. That the Terminal inhibits transmissions if either of these two tests is not successful.

AP1.A1.3.2.2.1.5. Objective 5. That upon a commanded transmission inhibit reset, the Terminal runs the failed SBIT or IBIT again and inhibits transmissions should the test fail again.

AP1.A1.3.2.2.1.6. Objective 6. That the 1030/1090 LLD SBIT and IBIT are unaffected by any LLD suppression signals or adaptable parameters that restricts or inhibits transmission.

AP1.A1.3.2.2.2. Approach.

AP1.A1.3.2.2.2.1. Objectives 1 through 3 and 6 - 1030/1090 LLD SBIT and IBIT.

AP1.A1.3.2.2.2.1.1. Step 1. With the Terminal in a full EMC protection mode and in the Link 16 only mode of operation, apply power and commence Terminal initialization. Measure and record the internally generated 1030 MHz test signal that is injected into the respective LLD circuits as part of SBIT. Verify that the test signal is no stronger than -5 dBm and that the Terminal passes the test.

AP1.A1.3.2.2.2.1.2. Step 2. Simulate an IPF suppression pulse during SBIT and verify that the Terminal passes the test. Verify that the Terminal passes the SBIT regardless of any adaptable parameter that would restrict or inhibit transmissions.

AP1.A1.3.2.2.2.1.3. Step 3. Repeat steps 1 through 2 for the 1090 MHz LLD monitor.

AP1.A1.3.2.2.2.1.4. Step 4. Repeat steps 1 through 3 with the Terminal set in the exercise EMC protection mode.

AP1.A1.3.2.2.2.1.5. Step 5. - Repeat steps 1 through 3 with the Terminal set in the combat mode. Verify that while the Terminal reports an SBIT failure, it does not inhibit transmissions.

AP1.A1.3.2.2.2.1.6. Step 6. Repeat steps 1 through 5 to verify the LLD monitor as part of an IBIT.

AP1.A1.3.2.2.2.2. Objectives 4 and 5 - 1030/1090 LLD SBIT and IBIT Simulated Failure.

AP1.A1.3.2.2.2.2.1. Step 1. Insert/simulate a “stuck good” condition into the 1030 LLD Monitor circuitry. This is usually performed with a modified LLD monitor that has a threshold above -5 dBm. With the Terminal in a full EMC protection mode and in the Link 16 only mode of operation, apply power and commence Terminal initialization. During startup, verify that the Terminal fails the 1030 MHz LLD SBIT and inhibits transmissions. Record the period between Terminal startup, fault insertion and fault detection, and reporting.

AP1.A1.3.2.2.2.2.2. Step 2. Perform a transmission inhibit reset. Verify that the Terminal performs the LLD SBIT again and that transmissions are still inhibited.

AP1.A1.3.2.2.2.2.3. Step 3. Repeat steps 1 and 2 for the 1090 MHz LLD monitor circuitry.

AP1.A1.3.2.2.2.2.4. Step 4. Repeat steps 1 through 3 in each power mode.

AP1.A1.3.2.2.2.2.5. Step 5. Repeat steps 1 through 4 in the exercise EMC protection mode.

AP1.A1.3.2.2.2.2.6. Step 6. Repeat steps 1 through 3 in the combat mode. Verify that the Terminal fails SBIT but does not inhibit transmissions.

AP1.A1.3.2.2.2.2.7. Step 7. Repeat steps 1 through 6 to verify the LLD monitor as part of IBIT.

AP1.A1.3.2.3. Pulse Width Monitor BIT Verification. Link 16 Terminal SBIT and IBIT is used to assess the performance of the Pulse Width Monitor.

AP1.A1.3.2.3.1. Objectives. Test shall verify:

AP1.A1.3.2.3.1.1. Objective 1. The Terminal provides the Pulse Width Monitor with a Terminal-generated RF pulse waveform with a pulse shape similar to that of a normally transmitted pulse and at a peak power level that is not stronger than 6 dB below the nominal level of the lowest output power mode. Also, test shall verify that the Terminal generates waveforms with pulse widths less than the narrow pulse width setting (narrow pulse widths no more than 100 ns less than the lower alarm limit), pulse widths within pulse width setting limits (normal pulse width) and pulse widths wider than (wide pulse width no more than 100 ns above the upper alarm limit) the acceptable range at the 95 percent voltage level.

AP1.A1.3.2.3.1.2. Objective 2. The Terminal passes the SBIT and IBIT tests.

AP1.A1.3.2.3.1.3. Objective 3. The Terminal inhibits transmissions if the test is not successful.

AP1.A1.3.2.3.2. Approach.

AP1.A1.3.2.3.2.1. Objectives 1 and 2 - PW Monitor SBIT and IBIT.

AP1.A1.3.2.3.2.1.1. Step 1. With the Terminal in a full EMC protection mode and in the Link 16 only mode of operation, apply power and commence Terminal initialization. Measure and record the internal Terminal generated waveform pulses that are injected into the Pulse Width Monitor. Verify that there are narrow (no more than 100 ns less than the lower alarm limit), normal and wide no more than 100 ns more than the upper alarm limit) pulses injected that are not stronger than 6 dB below the nominal level of the lowest output power mode.

AP1.A1.3.2.3.2.1.2. Step 2. Verify that the Terminal passes the SBIT test by noting that 1) the number of narrow and wide, or combination of narrow and wide, pulses shall cause the EPF Fault count to be incremented. 2) The number of normal pulses shall not cause the EPF Fault Count to be incremented and 3) the 100 percent voltage level determined by the pulse width monitor is at or above the nominal level at which the pulse width capability would be capable of measuring pulse width.

AP1.A1.3.2.3.2.1.3. Step 3. Perform an IBIT. Measure and record the internal Terminal generated waveform pulses that are injected into the Pulse Width Monitor.

Verify that there are narrow, normal and wide pulses injected that are not stronger than 6 dB below the nominal level of the lowest output power mode.

AP1.A1.3.2.3.2.1.4. Step 4. Verify that the Terminal passes the IBIT test by noting that 1) the number of narrow and wide, or combination of narrow and wide, pulses shall cause the EPF Fault count to be incremented. 2) The number of normal pulses shall not cause the EPF Fault Count to be incremented and 3) the 100 percent voltage level determined by the pulse width monitor is at or above the nominal level at which the pulse width capability would be capable of measuring pulse width.

AP1.A1.3.2.3.2.1.5. Step 5. Repeat Steps 1 through 4 for each power mode of the Terminal

AP1.A1.3.2.3.2.2. Objective 3 - PW Monitor Simulated SBIT and IBIT Failure.

AP1.A1.3.2.3.2.2.1. Step 1. With the Terminal in a full EMC protection mode and in the Link 16 only mode of operation, apply power and commence Terminal initialization.

AP1.A1.3.2.3.2.2.2. Step 2. Insert/simulate a "stuck good" condition into the Pulse Width monitor circuitry. This is usually performed by injecting normal width pulses when narrow or wide pulses are expected. Measure and record the injected pulses. Verify that the Terminal fails the SBIT and that it inhibits transmissions.

AP1.A1.3.2.3.2.2.3. Step 3. Perform a transmission inhibit reset. Verify that the SBIT is passed before transmissions occur.

AP1.A1.3.2.3.2.2.4. Step 4. Disable the injected pulses. Apply power and commence Terminal initialization.

AP1.A1.3.2.3.2.2.5. Step 5. With the Terminal transmitting, command an IBIT. Insert/simulate a "stuck good" condition into the Pulse Width monitor circuitry. This is usually performed by injecting normal width pulses when narrow or wide pulses are expected. Measure and record the injected pulses. Verify that the Terminal fails the IBIT and that it inhibits transmissions.

AP1.A1.3.2.3.2.2.6. Step 6. Perform a transmission inhibit reset. Verify that the Pulse Width IBIT is passed before transmissions occur.

AP1.A1.3.2.3.2.2.7. Step 7. Repeat steps 1 through 6 for each output power mode.

AP1.A1.3.2.3.2.2.8. Step 8. Repeat steps 1 through 7 in the exercise EMC protection mode.

AP1.A1.3.2.3.2.2.9. Step 9. Repeat steps 1 through 6 in the combat mode in one power mode. Verify that the transmissions are not inhibited in the combat mode.

AP1.A1.3.2.4. Frequency Monitor OBIT. The Terminal assesses performance of the frequency monitoring components during scheduled Link 16 transmissions.

AP1.A1.3.2.4.1. Objectives. Tests shall verify the Terminal accesses proper operation of the frequency monitor during each scheduled Link 16 pulse transmission and generates an EPF Fault Report if the measurement of the pulse frequency is not within the specified range of the Link 16 pulse carrier frequency commanded for transmission five or more times in a transmit time slot.

AP1.A1.3.2.4.2. Approach.

AP1.A1.3.2.4.2.1. Objective - OBIT Frequency Fault Detection.

AP1.A1.3.2.4.2.1.1. Step 1. With the Terminal in a full EMC protection mode and in the Link 16 only mode of operation, initialize the Terminal with a known frequency hopping pattern using carrier frequencies that are not at the band edges for the first 5 pulses in two consecutive transmit time slots. Measure and record the five pulses.

AP1.A1.3.2.4.2.1.2. Step 2. Inject/simulate the first five pulses of the two time slots with a hopping pattern similar to that used in step 1 with the frequency offset by 1.5 MHz + 200 kHz above the respective Link 16 carrier frequencies. Verify the Terminal detects the injected frequency faults, increments the Frequency Fault Count and generates an EPF Fault Report after the fifth pulse in the time slot.

AP1.A1.3.2.4.2.1.3. Step 3. Verify that transmissions are inhibited after the second time slot. Record the period between fault insertion and fault detection and reporting.

AP1.A1.3.2.4.2.1.4. Step 4. Repeat steps 1 through 3 in the exercise EMC protection mode.

AP1.A1.3.2.4.2.1.5. Step 5. Repeat steps 1 through 3 in the combat mode. Verify that the Terminal reports EPF Faults but does not inhibit transmissions.

AP1.A1.3.2.4.2.1.6. Step 6. Repeat steps 1 through 5 in each power mode of the Terminal.

AP1.A1.3.2.5. Overpower Monitor OBIT. Link 16 Terminal assesses the performance of the Overpower Monitor components during scheduled Link 16 transmissions using either a peak Overpower Monitor or an average Overpower Monitor.

AP1.A1.3.2.5.1. Objectives. Tests shall verify:

AP1.A1.3.2.5.1.1. Objective 1. For a Terminal implementing a peak Overpower Monitor, that the operational BIT simulates and detects a condition where the output power at the Overpower Monitor is greater than 200W + 2 dB. This applies for power modes with a nominal peak power less than or equal to 200 W. The simulation shall be accomplished by reducing the overpower monitor threshold 2 dB below the selected nominal power during the transmission of the last five pulses in one time slot in a 12 second frame. Verify that if the Terminal does not detect the overpower condition the Terminal generates an EPF Fault Report.

AP1.A1.3.2.5.1.2. Objective 2. For a Terminal implementing an average Overpower Monitor, that the operational BIT simulates and detects a condition where the output power at the Overpower Monitor is greater than 200W + 1.5 dB. This applies for power modes with a nominal peak power less than or equal to 200 W. The simulation shall be accomplished by reducing the overpower monitor threshold 2 dB below the selected nominal power during the transmission of all pulses over one transmit time slot in a 12 second frame. Verify that if the Terminal does not detect the overpower condition the Terminal generates an EPF Fault Report.

AP1.A1.3.2.5.1.3. Objective 3. That the Terminal will inhibit transmissions if there are two EPF Fault Reports due to the Overpower Monitor OBIT failures.

AP1.A1.3.2.5.1.4. Objective 4. That in the combat mode, the Terminal will report an EPF Fault, but will not inhibit transmissions after the second EPF Fault report due to a failed Overpower Monitor OBIT.

AP1.A1.3.2.5.2. Approach.

AP1.A1.3.2.5.2.1. Objectives 1, 3, and 4 - Peak Overpower Monitor OBIT Fault Detection.

AP1.A1.3.2.5.2.1.1. Step 1. With the Terminal operating in the full EMC protection mode and in the Link 16 only mode of operation, apply power and allow the Terminal to commence transmissions. Observe that during one time slot in a 12 second frame, the Terminal performs a test that reduces the overpower monitor threshold 2 dB less than the selected nominal power and that the overpower monitor indicates an overpower condition. Verify that the overpower monitor threshold is reduced no less than 2 dB below the selected power level.

AP1.A1.3.2.5.2.1.2. Step 2. Simulate a failure condition during the OBIT. When operating in the maximum power mode with a nominal power less than or equal to 200 W, replace the OBIT simulated condition with a condition that does not reduce the overpower monitor threshold. Observe that the Terminal fails the OBIT and that the Terminal increments the EPF Fault Report count.

AP1.A1.3.2.5.2.1.3. Step 3. Verify that the Terminal inhibits transmissions after 2 EPF Fault Reports within 24 hours that are the result of the failed Overpower monitor OBIT.

AP1.A1.3.2.5.2.1.4. Step 4. Repeat steps 1 through 3 with the Terminal in the exercise EMC protection mode.

AP1.A1.3.2.5.2.1.5. Step 5. Repeat steps 1 and 2 with the Terminal in combat mode. Verify that the Terminal reports the OBIT failure and increments the EPF Fault Report count, but does not inhibit transmissions after 2 EPF Fault Reports.

AP1.A1.3.2.5.2.1.6. Step 6. Repeat steps 1 through 5 in each power mode.

AP1.A1.3.2.5.2.2. Objectives 2, 3, and 4 - Average Overpower Monitor OBIT Fault Detection.

AP1.A1.3.2.5.2.2.1. Step 1. With the Terminal operating in the full EMC protection mode and in the Link 16 only mode of operation, apply power and allow the Terminal to commence transmissions. Observe that during one time slot in a 12 second frame, the Terminal performs a test that reduces the overpower monitor threshold by 2 dB below the selected power level during the transmission of all the pulses in the time slot and that the Terminal declares an overpower condition.

AP1.A1.3.2.5.2.2.2. Step 2. Simulate a “stuck low” condition during the OBIT. When operating in the maximum power mode with a nominal power less than or equal to 200 W, replace the OBIT simulated condition with a condition that does not reduce the overpower monitor threshold. Observe that the Terminal fails the OBIT and that the Terminal increments the EPF Fault Report count.

AP1.A1.3.2.5.2.2.3. Step 3. - Verify that the Terminal inhibits transmissions after 2 EPF Fault Reports within 24 hours that are the result of the failed Overpower monitor OBIT.

AP1.A1.3.2.5.2.2.4. Step 4. Repeat steps 1 through 3 with the Terminal in the exercise EMC protection mode.

AP1.A1.3.2.5.2.2.5. Step 5. Repeat steps 1 and 2 with the Terminal in combat mode in one power mode. Verify that the Terminal reports the OBIT failure and increments the EPF Fault Report count, but does not inhibit transmissions after 2 EPF Fault Reports.

AP1.A1.3.2.5.2.2.6. Step 6. Repeat steps 1 through 4 in each power mode.

AP1.A1.3.3. Other Tests.

AP1.A1.3.3.1. Default to Full EMC Protection Mode after Terminal Power-On.

AP1.A1.3.3.1.1. Objectives. Test shall verify:

AP1.A1.3.3.1.1.1. Objective 1. That the Terminal starts up in the full EMC protection mode after the Terminal is switched from the Terminal off state.

AP1.A1.3.3.1.1.2. Objective 2. That the Terminal retains its current use set of adaptable parameters after the Terminal starts up if the standby interface had been set to on.

AP1.A1.3.3.1.2. Approach.

AP1.A1.3.3.1.2.1. Objective 1 - Default to Full EMC Protection Mode.

AP1.A1.3.3.1.2.1.1. Step 1. Determine the default EMC protection mode installed in the Terminal.

AP1.A1.3.3.1.2.1.2. Step 2. - Turn on the Terminal (cold start) and command the Terminal to transmit. Display the transmission profile on an oscilloscope.

AP1.A1.3.3.1.2.1.3. Step 3. - Initialize the Terminal in combat mode with an appropriate set of time slot assignments for easy recognition on the oscilloscope. After the Terminal has been transmitting for at least two minutes, set the Terminal in the off state (remove prime power) and then turn the Terminal back on after an appropriate time interval. Verify that the Terminal comes up in the default mode.

AP1.A1.3.3.1.2.2. Objective 2 - Retaining the Current Use Set.

AP1.A1.3.3.1.2.2.1. Step 1. Initialize the Terminal with the same load used in step 3 of the objective 1 approach. After transmitting for two minutes, demonstrate the steps needed to be taken by the operator/host to retain the load prior to removing Terminal power. Turn the Terminal power back on to verify the prior load has been retained.

AP1.A1.3.3.2. Fault Report Retention after Combat Mode.

AP1.A1.3.3.2.1. Objectives. Tests shall verify:

AP1.A1.3.3.2.1.1. Objective 1. That a single Fault Report that occurs while in the full EMC protection mode is retained when the Terminal is reinitialized or turned to the combat mode and then back to the full EMC protection mode.

AP1.A1.3.3.2.1.2. Objective 2. That a single Fault Report that occurs while in the exercise protection mode is retained when the Terminal is reinitialized or turned to the combat mode and then back to the full EMC protection mode.

AP1.A1.3.3.2.1.3. Objective 3. That a transmit inhibit that occurs while in the full EMC protection mode is retained when the Terminal is reinitialized or turned to the combat mode and then back to the full EMC protection mode.

AP1.A1.3.3.2.1.4. Objective 4. That two EPF Faults that occur while in the combat mode are retained such that when the Terminal is reinitialized to the full EMC protection or exercise mode, that transmissions are inhibited.

AP1.A1.3.3.2.2. Approach.

AP1.A1.3.3.2.2.1. Objective 1.

AP1.A1.3.3.2.2.1.1. Step 1. Initialize the Terminal to operate in the full EMC protection mode. Simulate an EPF Fault and note that the EPF Fault Report count is equal to 1.

AP1.A1.3.3.2.2.1.2. Step 2. Change the Terminal to operate in the combat EMC protection mode. Verify that the EPF Fault Report count is one.

AP1.A1.3.3.2.2.1.3. Step 3. Change the Terminal to operate in the full EMC protection mode. Verify that the EPF Fault Report count is one. Simulate another EPF Fault report. Note that the EPF Fault Report count is two and that the Terminal has inhibited transmissions.

AP1.A1.3.3.2.2.2. Objective 2.

AP1.A1.3.3.2.2.2.1. Step 1. Initialize the Terminal to operate in the exercise EMC protection mode. Simulate an LLD EPF Fault and note that the EPF Fault Report count is equal to 1.

AP1.A1.3.3.2.2.2.2. Step 2. Change the Terminal to operate in the combat EMC protection mode. Verify that the EPF Fault Report count is one.

AP1.A1.3.3.2.2.2.3. Step 3. Change the Terminal to operate in the exercise EMC protection mode. Verify that the EPF Fault Report count is one. Simulate another LLD EPF Fault Report. Note that the EPF Fault Report count is two and that the Terminal has inhibited transmissions.

AP1.A1.3.3.2.2.3. Objective 3.

AP1.A1.3.3.2.2.3.1. Step 1. Initialize the Terminal to operate in the full EMC protection mode. Simulate two LLD EPF Faults in two consecutive time slots and note that the EPF Fault Report count is equal to 2 and that the Terminal inhibits transmissions.

AP1.A1.3.3.2.2.3.2. Step 2. Change the Terminal to operate in the combat EMC protection mode. Verify that while the EPF Fault Report count is two, the Terminal resumes transmissions.

AP1.A1.3.3.2.2.3.3. Step 3. Change the Terminal to operate in the full EMC protection mode. Verify that the Terminal inhibits transmissions.

AP1.A1.3.3.2.2.4. Objective 4.

AP1.A1.3.3.2.2.4.1. Step 1. Initialize the Terminal to operate in the combat mode. Simulate two LLD EPF Faults in two consecutive time slots and note that the EPF Fault Report count is equal to 2 and that transmissions are not inhibited.

AP1.A1.3.3.2.2.4.2. Step 2. Change the Terminal to operate in the full EMC protection mode. Verify that the Terminal inhibits transmissions.

AP1.A1.3.3.2.2.4.3. Step 3. Change the Terminal to operate in the exercise EMC protection mode. Verify that the Terminal continues to inhibit transmissions.

AP1.A1.3.3.3. EMC Features Data Storage Verification. Link 16 Terminals have non-volatile memory for data storage.

AP1.A1.3.3.3.1. Objective. Tests shall verify:

AP1.A1.3.3.3.1.1. Objective 1. That the Terminal maintains the date, the beginning time and ending times of the folowing events in non-volatile memory:

AP1.A1.3.3.3.1.1.1. Objective 1a. Each Link 16 transmission inhibit, including when transmission was inhibited as a result of start-up or an operator initiated BIT,

AP1.A1.3.3.3.1.1.2. Objective 1b. The identity of the failure that was detected that resulted in the Link 16 transmission inhibit,

AP1.A1.3.3.3.1.1.3. Objective 1c. When the Terminal EMC protection mode adaptable parameter was set to the exercise EMC protection or combat mode, and

AP1.A1.3.3.3.1.1.4. Objective 1d. When the Terminal is set to enable RF output power at a nominal level exceeding 200 W.

AP1.A1.3.3.3.1.2. Objective 2. That the date, the beginning time and ending times of the events listed in objective 1 above are available to the host upon request.

AP1.A1.3.3.3.2. Approach.

AP1.A1.3.3.3.2.1. Objective 1 - EMC Features Data Storage.

AP1.A1.3.3.3.2.1.1. Step 1. Initialize the Terminal in the full EMC protection mode. Induce two EPF Faults resulting in Link 16 transmission inhibit. Verify that transmissions are inhibited and that the date, beginning and ending times of the transmission inhibit and the identity of the EPF Fault are stored into non-volatile memory.

AP1.A1.3.3.3.2.1.2. Step 2. Initialize the Terminal in the full EMC protection mode. Induce an EMC Features monitor SBIT failure. Verify that transmissions are inhibited and that the date, beginning and ending times of the transmission inhibit and the identity of the BIT failure is stored into non-volatile memory.

AP1.A1.3.3.3.2.1.3. Step 3. Initialize the Terminal in the full EMC protection mode. Induce an EMC Features monitor manually IBIT failure. Verify that transmissions are inhibited and that the date, beginning and ending times of the transmission inhibit and the identity of the BIT failure is stored into non-volatile memory.

AP1.A1.3.3.3.2.1.4. Step 4. Initialize the Terminal in the full EMC protection mode. Induce two EMC Features monitor OBIT failures. Verify that transmissions are inhibited and that the date, beginning and ending times of the transmission inhibit and the identity of the BIT failure is stored into non-volatile memory.

AP1.A1.3.3.3.2.1.5. Step 5. Repeat steps 1 through 4 with the Terminal initialized in the exercise EMC protection mode.

AP1.A1.3.3.3.2.1.6. Step 6. Repeat steps 1 through 4 with the Terminal initialized in the combat mode. Verify that while transmissions are not inhibited, the events in those steps are stored in non-volatile memory.

AP1.A1.3.3.3.2.1.7. Step 7. Initialize the Terminal in the full EMC protection mode. Change the EMC protection mode adaptable parameter to the exercise EMC protection mode. Verify that the date, beginning and ending times of the switch from the full EMC protection mode to the exercise EMC protection mode is stored into non-volatile memory.

AP1.A1.3.3.3.2.1.8. Step 8. Initialize the Terminal in the full EMC protection mode. Change the EMC protection mode adaptable parameter to the combat mode. Verify that the date, beginning and ending times of the switch from the full EMC protection mode to the combat mode is stored into non-volatile memory.

AP1.A1.3.3.3.2.1.9. Step 9. Initialize the Terminal to operate in the exercise EMC protection mode. Command the Terminal to transmit high power above 200 watts. Verify that the date, beginning and ending times of the switch to the high power above 200 watts is stored into non-volatile memory.

AP1.A1.3.3.3.2.1.10. Step 10. Initialize the Terminal to operate in the combat mode. Command the Terminal to transmit high power above 200 watts. Verify that the date, beginning and ending times of the switch to the high power above 200 watts is stored into non-volatile memory.

AP1.A1.3.3.3.2.2. Objective 2 - EMC Features Data Access.

AP1.A1.3.3.3.2.2.1. Step 1. Download the data stored in non-volatile memory. Verify that the data retrieved matches data required to be stored in subparagraph AP1.A1.3.3.3.2.1. steps 1 through 10.

AP1.A1.3.3.4. SBIT Check after 2 Minutes in Standby.

AP1.A1.3.3.4.1. Objective. Tests shall verify that the Terminal performs SBIT after being in the Standby mode for at least two minutes.

AP1.A1.3.3.4.2. Approach.

AP1.A1.3.3.4.2.1. Objective - SBIT Check after 2 Minutes in Standby.

AP1.A1.3.3.4.2.1.1. Step 1. Initialize the Terminal in the full EMC protection mode and begin transmissions.

AP1.A1.3.3.4.2.1.2. Step 2. Place the Terminal in the Standby mode. After two minutes, place the Terminal in the On position. Verify that the Terminal performs SBIT before resuming transmissions.

AP1.A1.3.3.5. Transmit Inhibit Reset Shall Not Clear a Single EPF Fault Report[9].

AP1.A1.3.3.5.1. Objective. Tests shall verify that a single EPF Fault Report shall not be cleared if an operator initiates a reset action without a transmission inhibit.

AP1.A1.3.3.5.2. Approach. Objective - Single EPF Fault Report not cleared.

AP1.A1.3.3.5.2.1. Step 1. Initialize the Terminal in the full EMC protection mode.

AP1.A1.3.3.5.2.2. Step 2. Induce a single EPF Fault Report in a single time slot. Verify that the EPF Fault Report count is equal to one.

AP1.A1.3.3.5.2.3. Step 3. Verify that transmissions are not inhibited.

AP1.A1.3.3.5.2.4. Step 4. Attempt to perform a transmit inhibit reset.

AP1.A1.3.3.5.2.5. Step 5. Verify that the EPF Fault Report count is equal to one.

[9] This test can be performed as part of another test.

AP2. APPENDIX 2
FREQUENCY REMAPPING ALGORITHM

AP2.1. FREQUENCY REMAPPING REQUIREMENT

AP2.1.1. The transmitted RF signals shall be hopped pseudorandomly among 51 carrier frequencies, or among a subset of these 51 frequencies resulting from remapping up to 14 of these frequencies, if frequency remapping 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 section AP2.2 through paragraph AP2.8.1.

AP2.2. CARRIER FREQUENCY SELECTION

AP2.2.1. The Terminal shall have the capability to enable or disable carrier frequency remapping. When frequency remapping is disabled, the Terminal shall select carrier frequencies in accordance with the 51 carrier frequency hopset algorithm[10]. When frequency remapping is enabled, the Terminal shall identify the frequency numbers required to be re-mapped. If the number of frequencies is less than or equal to 14 and greater than or equal to 1, the Terminal shall select carrier frequencies in accordance with the frequency remapping algorithm described in this appendix. 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 frequency remapping capability shall be independent of the EMC protection mode. The Terminal shall enable the frequency remapping function only when it is not operating in the net and has not started the net entry process. If the host provides frequency remapping changes to the Terminal while operating in the net or has commenced the net entry process, the Terminal shall reject the change and shall provide an alert to the host.

AP2.2.2. When frequency remapping is disabled, the Terminal shall select the carrier frequency using (for transmission or reception) the 51 carrier frequency hopset algorithms for the preamble and for the time refinement and data pulses. When frequency remapping 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 section AP2.3 through paragraph AP2.8.1.

[10] The 51 carrier frequency hopset algorithms for the synchronization preamble and for the time refinement and data pulses are not described in this DoD Regulation. The algorithms can be located in the applicable Link 16 System Segment Specification.

AP2.3. CARRIER FREQUENCY REMAPPING

AP2.3.1. When frequency remapping is enabled, the carrier frequencies shall exclude the carrier frequencies defined by the re-mapped frequency number list, which indicates for each of the 51 frequency numbers whether or not that frequency number is to be re-mapped. The carrier frequencies required to be re-mapped shall be referred to as the "unauthorized carrier frequencies". All other carrier frequencies shall be referred to as the "authorized carrier frequencies". When frequency remapping is enabled, the Terminal shall select frequencies such that:

AP2.3.1.1. Every pulse in a message that would have used an authorized frequency if frequency remapping were disabled shall use the same frequency when frequency remapping is enabled,

AP2.3.1.2. Every pulse that would have used an unauthorized frequency if frequency remapping were disabled shall use an authorized frequency when frequency remapping is enabled, and

AP2.3.1.3. 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 hopset algorithms.

AP2.3.2. 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 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 frequency remapping.

AP2.3.3. For the purposes of the frequency replacement method, the Terminal shall maintain a set of frequency selection counters, C_f, for f=0 through 50, indicating how many pulses have been selected to use each of the authorized carrier frequencies, for transmission or reception, within the current message. These counters shall be separate from the carrier frequency bins used in subparagraph AP1.4.2.1.4. 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.

AP2.4. <u>FREQUENCY REPLACEMENT FOR ALL MESSAGES EXCEPT RTT REPLIES</u>

AP2.4.1. When frequency remapping 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 hopset 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 8 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 frequency remapping 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 $f^*_k = f_k$.

AP2.4.2. Prior to making any frequency replacement decisions, the Terminal shall first precompute 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 hopset 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 1 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 2 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 2, 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.

AP2.4.3. 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 AP2.6 if this is a preamble frequency (k=1 to 8) or using the logic for time refinement or data pulses in AP2.7, 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 AP2.8. to determine the specific carrier frequency number from the candidate list that will replace the unauthorized carrier number.

AP2.4.4. 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 sections AP2.7. and AP2.8. to determine the specific carrier frequency number to be used in each case.

AP2.4.5. 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 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 exactly the same frequency replacement decisions as the transmitting terminal for every pulse in the message, so that every pulse may be received correctly.

AP2.5 FREQUENCY REPLACEMENT FOR RTT REPLY MESSAGES

AP2.5.1. When frequency remapping is enabled, the Terminal shall first generate all of the frequency numbers needed for the entire RTT reply message, using the 51 carrier frequency hopset 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 8 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 reply message, both the transmitting and receiving terminal will know that the message is an RTT reply, so only enough frequency numbers for a 72 pulse RTT reply message shall be generated. It should be noted that an RTT reply message is always the second message within a time slot, and that the set of f_k generated for the RTT reply 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 frequency remapping is not enabled. All of these frequency numbers shall be generated before any pulses in the RTT reply 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 reply message, the frequency numbers (f_1 to f_{48}) cannot be determined until the modified SDU serial number of the RTT interrogation is known, so the receiver will not be able to generate f_1 through f_{48} for the RTT reply until after the RTT interrogation has been received. In any case, the set of frequency numbers f_k for the RTT reply shall be the same set that would actually be used for transmission of the RTT reply message if frequency remapping 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 $f^*_k = f_k$.

AP2.5.2. Prior to making any frequency replacement decisions for the RTT reply 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 hopset algorithms that use the full set of 51 frequency numbers). In the case of a type 2(1) RTT reply message, these shall be the f_k values after the frequency shift (based on the modified SDU serial number of the RTT interrogation) has been made. Let NR_f denote the number of pulses among the 72 pulses in the RTT reply 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 reply message. Prior to making any frequency replacement decisions among the 72 pulses of the RTT reply 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 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.

AP2.5.3. 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 AP2.6 if this is a preamble frequency (k=1 to 8) or using the logic for time refinement or data pulses in section AP2.7 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 AP2.8 to determine the specific carrier frequency number from the candidate list that will replace the unauthorized carrier number.

AP2.5.4. 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 reply message, so that every pulse may be received correctly.

AP2.6. SYNCHRONIZATION PREAMBLE CANDIDATE FREQUENCIES

AP2.6.1. When frequency remapping 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 hopset 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 subparagraphs AP2.6.1.1 through AP2.6.1.11 below:

AP2.6.1.1. The Terminal shall start with the lowest value of k among the frequency numbers f_k (k = 1 to 8) that are unauthorized.

AP2.6.1.2. 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 of the authorized frequency numbers are marked as candidate frequencies.

AP2.6.1.3. 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}).

AP2.6.1.4. 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}).

AP2.6.1.5. 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).

AP2.6.1.6. 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).

AP2.6.1.7. 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).

AP2.6.1.8. 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).

AP2.6.1.9. 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).

AP2.6.1.10. The remaining list of candidate frequency numbers contains all of 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 section AP2.8.

AP2.6.1.11. 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 subparagraphs AP2.6.1.2 through AP2.6.1.11. The processing in the step identified in subparagraph AP2.6.1.2 shall be repeated to re-initialize the candidate list for each new value of k.

AP2.6.2. In steps identified in subparagraphs AP2.6.1.3, AP2.6.1.4, and AP2.6.1.7 above, when the frequency numbers of up to seven consecutive frequencies that are adjacent to the referenced frequency, on both sides of it, 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 subparagraphs AP2.6.1.5 and AP2.6.1.6 above, when the frequency numbers of up to five consecutive frequencies that are adjacent to the referenced frequency, on both sides of it, 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 actually 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 6 through 12 would be removed. Similarly if the frequency number of the referenced frequency were 6, corresponding to 987 MHz, the frequency number 6 would be removed. There are seven consecutive adjacent frequencies above it, so frequency numbers 7 to 13 would be removed. There are six consecutive adjacent frequencies below it, so frequency numbers 0 through 5 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.

AP2.6.3. 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.

AP2.7. TIME REFINEMENT AND DATA SYMBOL CANDIDATE FREQUENCIES

AP2.7.1. When frequency remapping 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 hopset 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 of 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:

AP2.7.1.1. 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 reply 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 reply, 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 258^{th} 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.

AP2.7.1.2 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}).

AP2.7.1.3. 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 reply 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.

AP2.7.1.4. The Terminal shall remove f^*_{k-2} from the candidate list. (This will ensure that f^*_k and f^*_{k-2} are not identical).

AP2.7.1.5. The remaining list of candidate frequency numbers contains all of 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 AP2.8.0. For the time refinement and data pulses, the candidate list will never be empty - it will always contain at least five frequency numbers.

AP2.7.2. 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 actually 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 actually 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).

AP2.7.3. 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).

AP2.8. <u>SELECTION OF THE REPLACEMENT FREQUENCY</u>

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 AP2.3.3., 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 section AP2.6. or section AP2.7. Let this frequency number be denoted by f*. Next, the frequency selection counter C_{f*} shall be incremented by 1 (for a time refinement or data symbol pulse) or 4 (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*}.

AP3. APPENDIX 3
DEFINITIONS

AP3.1. Adaptable Parameter. Adaptable Parameters are those control parameters that are implemented in software, firmware, or hardware in a prescribed format to facilitate adjustment of parameter values at initialization or by operator entries without requiring reassembly of the computer program database.

AP3.2. Air Traffic Control (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 en route or within the Terminal areas.

AP3.3. Capability to Transmit (CTT). The Terminal operational state when the JTIDS/MIDS message generation capability is not isolated (either through software/firmware or hardware) from the power amplifiers or associated circuitry such that the transmitter has the ability to transmit JTIDS/MIDS pulses.

AP3.4. 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 elements. The Class 2H Terminal uses J-series messages and has nominal output powers of 200 watts or 1000 watts. Some Class 2H Terminals will also have the capability to use IJMS messages.

AP3.5. Contention. A term used to denote multiple JTIDS / MIDS transmissions that use the same frequency hopping pattern in the same time slot.

AP3.6. Contention Access. A JTIDS/MIDS transmit access mode in which a group of JTIDS/ MIDS users is assigned a pool of time slots to satisfy their transmission requirements. Time is divided into access intervals (e.g., once every 3 seconds). A user may transmit only once per access interval. Users randomly select their transmit time slots from the pool at the access rate they have been assigned. Also referred to as "Random Access."

AP3.7. Coordinated Link 16 Operations. Operations that:

AP3.7.1 Desire to operate outside of peacetime spectrum certification limits.

AP3.7.2 Do not have a valid frequency assignment for the geographic area desired.

AP3.7.3 Do not meet all of the electromagnetic compatibility (EMC) conditions required for Terminal operations to include co-site and collocation requirements or contain a platform that is not identified in the approved DD Form 1494. These operations must be individually coordinated on a case-by-case basis with the FAA. Requesting agencies must submit their request through NMSC and written approval from FAA is required prior to operations commencing.

AP3.8. Electromagnetic Compatibility (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.

AP3.9. EMC Feature. The hardware, firmware and software controls in a JTIDS/MIDS or future generation Terminal that are used to detect Terminal faults which affect the JTIDS/MIDS time/frequency waveform. Firmware/software operational controls may also be used to lockout Terminal capabilities and control pulse transmission limits to ensure compliance with the Frequency Certification/Clearance.

AP3.10. Enhanced Repromulgation Relay. A JTIDS/MIDS relay technique identical to re-promulgation relay except that an additional time delay is used on subsequent retransmissions. Use of the additional time delay enables the originating Terminal to donate fewer (compared to re-promulgation relay) assigned time slots for retransmission of the message thus increasing the message throughput from the originating Terminal.

AP3.11. EMC Protection Feature (EPF). An alternate term for EMC Feature.

AP3.12. Epoch. A 12.8 minute interval consisting of 98,304 time slots.

AP3.13. High Power Output Mode. A Terminal peak output power of stronger than 200 watts + 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.

AP3.14. Individual Nets. The exclusive use of time slot blocks by JTIDS/MIDS users on separate nets, which are part of the same network.

AP3.15. 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 Interim JTIDS Message Specification (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.

AP3.16. 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.

AP3.17. Instantiation. In object oriented programming, instantiation refers to the process for constructing an object instance from its parent object class. The JTRS Software Communications Architecture (SCA) extends this definition to include the process of launching the execution of installed application software programs.[11] 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 software components comprising the application, connects the components to create transmission and/or reception channels, and initializes the application to a known state.[12]

AP3.18. Interference Protection Feature (IPF). An alternate term for EMC Feature.

AP3.19. Inter-department Radio Advisory Committee (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.

AP3.20. Isolation. The state whereby the JTIDS/MIDS TDMA waveform capability is prevented (either through software/firmware or hardware techniques) from sending messages or causing JTIDS/MIDS pulses or energy from being transmitted through the Terminal antenna output ports or the external power amplifier ports.

AP3.21. Joint Tactical Information Distribution System (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.

AP3.22. Joint Tactical Information Distribution System/Multifunctional InformationDistribution System (JTIDS/MIDS) Net. One of the 128 unique pseudorandom sequences used to determine the time, phase and frequency parameters for JTIDS/MIDS transmissions.

AP3.23. JTIDS/MIDS Pulse. A 6.4-microsecond 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 5 bit data symbol. The pulse also contains up to 5 additional chips in the leading edge and trailing edge for control of soft Turn-ON and Turn-OFF. The inter-pulse period for consecutive JTIDS/MIDS pulses is 6.6-microseconds.

AP3.24. Link 16 EMC Features. Those features implemented in Link 16 Terminals to prevent harmful electromagnetic interference to Aeronautical Radio-navigation Service (ARNS) systems operating in the same frequency band. The Spectrum Planning Subcommittee Working Group 1 (SPS WG-1), which reports to the NTIA IRAC, has established EMC Features requirements in reference (f) and Appendix 1.

[11] *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.

[12] *Software Communications Architecture Specification*, MSRC-5000SCA V2.2, Modular Software-Programmable Radio Consortium, November 17, 2001, pp. 3-38 - 3-44.

AP3.25. Link 16 EMC Features Certification. Validation that Link 16 Terminal design, platform integration, operations and maintenance meet requirements of reference (f) and Appendix 1.

AP3.26. Link 16 Terminal. Any configuration of hardware and software/firmware that is capable of producing the Joint Tactical Information Distribution System/Multifunctional Information Distribution System (JTIDS/MIDS) time-division multiple access (TDMA) waveform, and includes all Terminal elements up to the antenna as defined in reference (f).

AP3.27. Low Output Power Mode. A Terminal peak output power of 1 watt or less summed for all the RF outputs of the Terminal.

AP3.28. Medium Output Power Mode. A Terminal peak output power of 25 watts or less summed for all the RF outputs of the Terminal.

AP3.29. Message Structure. The organization of JTIDS/MIDS pulses within a time slot to provide for different information capacities and performance levels. The Class 1 Terminal can transmit 72, 129 or 258 JTIDS pulses in a time slot. The JTIDS Class 2 Terminal family and the MIDS Low Volume Terminal and MIDS Fighter Data Link Terminal can transmit 72, 258 or 444 JTIDS/MIDS pulses in a time slot.

AP3.30. Multifunctional Information Distribution System (MIDS). An advanced information distribution system, using the JTIDS waveform that provides navigation, identification and communication capabilities in an integrated form for application in air, land and maritime tactical operations.

AP3.31. Multinet (Multiple Nets). A term used to denote multiple JTIDS/MIDS transmissions in a time slot within the same Operations Area, each transmission using a different frequency hopping pattern.

AP3.32. 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 JTIDS/MIDS Terminal is a complex function of several elements that include Net Number, crypto-variable and time. JTIDS/MIDS Terminals that employ all of the same elements on a time slot by time slot basis are participants on the same JTIDS/MIDS Net.

AP3.33. Network. A community of JTIDS/MIDS users synchronized to a common network time reference to exchange information.

AP3.34. Network Management. The process used to select appropriate Terminal parameters (such as adaptable parameters) for member Terminals, assign time slots to provide for the transmission and reception requirements of each Terminal, and to assure that all Terminals are initialized in a compatible manner so that a JTIDS/MIDS communication network is established and maintained within the National Frequency Clearance Authorization Limits.

AP3.35. Not Having The Capability To Transmit. A Terminal State in which any of the following items are true:

AP3.35.1. The transmitter is not powered ON.

AP3.35.2. The JTIDS/MIDS TDMA waveform capability is isolated from the transmission circuitry that could produce JTIDS/MIDS pulses or energy.

AP3.35.3 The transmitter is sufficiently supervised and/or monitored to establish that its output is 80 dB or more below the Selected Output Power Mode.

AP3.36. Pack 2 Double Pulse Message. A JTIDS/MIDS message structure comprised of 444 pulses. This message structure contains the same amount of information as the Pack 2 single pulse message, but information transfer reliability is enhanced by retransmitting each bit of information on the adjacent pulse.

AP3.37. Pack 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.

AP3.38. Pack 4 Single Pulse Message. A message structure comprised of 444 pulses. This message structure holds twice as much information as the Pack 2 double pulse message and four times as much as the standard double pulse message because each bit of information is transmitted only once.

AP3.39. Paired Slot Relay. 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.

AP3.40. Pulse Density. See Time Slot Duty Factor (TSDF) and Equivalent TSDF definitions.

AP3.41. 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 reference (f) and Appendix 1.

AP3.42. Random Access Mode. An alternative term for the Contention Access Mode.

AP3.43. Relay. Retransmission of a message at a fixed number of time slots after its initial reception.

AP3.44. Repromulgation Relay. A JTIDS/MIDS relay technique that includes random jitter and is used to extend information transfer beyond line-of-sight distances. A Terminal receiving a re-promulgation 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.

AP3.45. Round Trip Timing (RTT) Message. Messages required for Terminal synchronization. An RTT message is either an interrogation that requests time-of-arrival information or a reply. RTT interrogations and replies each contain 72 pulses. A reply message is transmitted in the same time slot as the requesting interrogation.

AP3.46. Round Trip Timing - Broadcast Mode (RTT-B). Supports active fine synchronization of all JTIDS/MIDS users in the Network through broadcast round trip timing interrogations.

AP3.47. Spectrum Planning Subcommittee (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.

AP3.48. Spectrum Planning Subcommittee Working Group - One (SPS WG-1). A working group of the United States SPS established by the National Telecommunications and Information Administration (NTIA) to evaluate all systems that operate in the 960 to 1215 MHz band. The NTIA reviews Federal Systems for frequency supportability and electromagnetic compatibility.

AP3.49. 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.)

AP3.50. Terminal. Link 16 TDMA signals are transmitted using equipment referred to in this specification as a Terminal. A Terminal is any configuration of hardware and software 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 external power amplifier.

AP3.51. Time Division Multiple Access (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 timeslots. For the purpose of this regulation, the TDMA waveform refers to the waveform tested in the SPS WG-1 JTIDS EMC Test Program.

AP3.52. Time Slot. A 7.8125 millisecond time interval during which JTIDS/MIDS messages may be transmitted or received.

AP3.53. Transmission Inhibit. An action taken by the Terminal to prevent the transmission of any TDMA RF signals from its antenna ports.

AP3.54. Time Slot Duty Factor (TSDF). A two term parameter that specifies the number of pulse transmissions allowed for a community of JTIDS/MIDS 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 JTIDS/MIDS pulses in a 12 second frame and a single Terminal is limited to 198,144 (50 percent 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 percent for the total community as:

AP3.54.1.

$$\text{100 percent TSDF} = \frac{258 \text{ pulses}}{\text{time slot}} \times \frac{128 \text{ time slots}}{\text{second}} \times \frac{12 \text{ seconds}}{\text{frame}}$$

$$= 396{,}288 \text{ pulses/frame}$$

AP3.54.2. Using this total, the maximum percentage of time slots that is available to the JTIDS/ MIDS community for a 100/50 TSDF if all Terminals are programmed for Pack 4 single pulse messages can be derived by:

$$\text{Pack 4 time slot limitation} = \frac{396{,}288 \text{ pulses/frame}}{\frac{444 \text{ pulses}}{\text{time slot}} \times \frac{128 \text{ time slots}}{\text{second}} \times \frac{12 \text{ seconds}}{\text{frame}}}$$

$$= 58 \text{ percent}$$

AP3.55. Time Slot Reallocation (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 users 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.

AP3.56. 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 DD Form 1494.

AP3.57. Variable Parameter. Parameters implemented in software in a prescribed format to facilitate adjustment of the adaptable parameter 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. The notation [3 (1 - 5, 1)] means that the parameter is set at 3, but may be changed from 1 to 5 in steps of 1 unit.