LINK 16 ELECTROMAGNETIC COMPATIBILITY FEATURES CERTIFICATION MANUAL

Volume 2: Certification and ATP Guidance

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VERSION 2

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SECTION 1: GENERAL INFORMATION

1.1. APPLICABILITY.

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

1.2. PURPOSE.

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

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

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

This volume provides guidance on generating EMC Features certification test procedures and Acceptance Test Procedures (ATPs) for Link 16 EMC Features.

SECTION 2: PROCEDURES

2.1. LINK 16 EMC FEATURES COMPLIANCE AND VERIFICATION.

a. EMC Features Certification Tests.

(1) The DoW Certification Authority (CA), Naval Information Warfare Systems Command (NAVWAR), shall certify compliance of the EMC spectral characteristics and EMC Features with all requirements in this document. This test shall be performed on each Terminal design in accordance with test procedures and results shall be properly documented. The test plan provided in Section 2.2. shall be utilized and tailored as appropriate to generate the test procedures. Both the tailored test plan and test procedures shall be approved by NAVWAR prior to the certification testing.

(2) 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 shop replaceable unit (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 and monitor test signals into the radio frequency (RF) transmit path prior to the EMC Features monitor point(s). Upon approval of the CA, normally transmitted signals may be modified by the Terminal rather than externally injected as long as the necessary EMC Protection Feature (EPF) event/fault conditions can be reliably induced, and the applicable modified signals are recorded.

b. ATPs.

Prior to delivery, acceptance tests shall be performed on each Terminal and each line replaceable unit (LRU)/SRU produced as spares that contain or affect the EMC Features or EMC characteristics. The ATPs shall be generated using an approach equivalent to the Terminal EMC Features Certification Test Plan provided in Section 2.2. The test and measurement results of the ATP shall be consistent with the results from the EMC Features certification tests and be maintained over the life of the Terminal. Tests shall be performed at the Terminal level unless it can be shown that all necessary parameters and validity of the data can be demonstrated at the SRU test station level. Actual time division multiple access (TDMA) continuous phase shift modulation (CPSM) exciter signals shall be used in the performance of these test procedures unless it can be demonstrated that the simulated signals provide equivalent results using the most conservative exciter signal level. The measurement of a CPSM pulse signal level is typically measured using a spectrum analyzer or a power meter. If a spectrum analyzer is used and a frequency span greater than 10 megahertz (MHz) is employed, measurement bandwidths (BW) of 3 MHz resolution and 3 MHz video are adequate to determine the peak power level. However, if a zero span is used the measurement BW needs to be increased to 10 MHz. All measurements of pulse shape and pulse width (PW) that are identified in this manual shall be performed with a measurement BW of at least 20 MHz to minimize the error. If the CA determines that additional ATP tests are required, a request that identifies the specific ATP test(s) with rationale will be submitted to the Programmatic Authority (PA).

(1) Output Power.

At nine carrier frequencies: 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz, record the peak output power (i.e., instantaneous peak power over middle 5.4 microseconds (µs) (of the transmitted pulses of a time slot) at each antenna port in all output power modes for each antenna mode. Verify that the sum of the output powers from all antennas including Terminal and external power amplifier (EPA) does not exceed the nominal power level +1 decibel (dB). If a spectrum analyzer is used to perform the power measurements, then BW settings of at least 3 MHz resolution BW (RBW) and at least 3 MHz video BW (VBW) shall be utilized.

(2) Pulse Spectrum.

(a) 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 kilohertz (kHz) RBW, 300 kHz VBW segments and a maximum hold display. Set the spectrum analyzer to 50 MHz span centered on the carrier and a 400 MHz span centered at 1090 MHz. The sweep rate should be (7.8125 millisecond (ms) * Number of Spectrum Analyzer Data Points)/time slot duty factor (TSDF[1]). Verify that the pulse spectra comply with the specified spectrum requirement in Volume 1, Figure 3.

(b) Additional pulse spectrum plots are needed if the Link 16 transmitted pulse can be suddenly interrupted by another waveform. During the collection of the additional pulse spectrum plots, the interrupt will be placed in various locations throughout the Link 16 pulse while the spectrum is being captured. The interrupt shall be placed every 250 ns through the rising edge (starting at 10%) of the pulse, with an emphasis on the top left corner where there is typically overshoot. The interrupt shall also be placed every 1µs along the top of the pulse. These captures should be taken while operating in the single fixed frequency test mode at a rate of the highest TSDF possible for the terminal, in each of the output power modes, record plots of the individual pulse power spectrum at four carrier frequencies: 969, 990, 1176, and 1206 MHz at each antenna when operating in the single antenna mode. Measure the output spectrum using a spectrum analyzer set to a 300 kHz VBW, a 300 kHz RBW, and a maximum hold display. Set the spectrum analyzer to 50 MHz span centered on the carrier and a 400 MHz span centered at 1090 MHz. Choose a sweep rate and the time for allowing the spectrum measurement to fill in to ensure that full spectrum is captured. The sweep rate should be (7.8125 ms * Number of Spectrum Analyzer Data Points)/TSDF. (Note: Unless CA approved, the minimum number of spectrum analyzer data points shall be no less than 1000.) Verify that the pulse spectra comply with the specified spectrum requirement in Volume 1, Figure 3.

(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 using a 300 kHz RBW and a 300 kHz VBW. The sweep

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[1] TSDF is a percentage (50% = "0.50").

rate should be (7.8125 ms * Number of Spectrum Analyzer Data Points)/TSDF using four sweeps. 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 in Volume 1, Figure 3.

(4) Capability to Transmit (CTT) Detection.

For each Terminal power mode and each single antenna mode[2], at each component element that the Terminal monitors to detect when it is CTT, including any monitor that verifies Link 16 isolation, measure and record the threshold into the monitor where the monitor reports the Terminal is CTT; and the level into the monitor during normal pulse transmissions. This test may be performed with an injection signal no stronger than the specified minimum exciter signal strength. Verify that the 10 dB requirement from Volume 1, Paragraph 3.2.d.(1)(b) is met.

(5) 1030/1090 MHz Low-Level Detector (LLD).

Measure and record the peak power level of the lowest power normally shaped pulse continuous wave (CW) signal emitted at 1023.5 MHz, 1030 MHz, and 1036.5 MHz that causes a 1030/1090 MHz LLD EPF Fault Report and the peak power level of the lowest power pulse CW signal emitted at 1083.5 MHz, 1090 MHz, and 1096.5 MHz that causes a 1030/1090 MHz LLD EPF Fault Report. Measurements shall be taken while operating in the highest power mode that is nominally 200 watts (W) or less and in all antenna modes. Measure the peak power level of this CW signal using a spectrum analyzer with a BW that minimizes the amount of noise that could affect the measurement (e.g., 500 kHz). 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 dB referenced to one milliwatt (dBm) at the Terminal output port(s). The LLD threshold shall be measured by injecting LLD event signals that have a shape similar to the normally transmitted pulses. The transmitted Mode 1 or Mode 2 Link 16 signal shall also be present at the antenna out port when the LLD threshold is determined. Verify that events are occurring while the injected level is measured on the spectrum analyzer.

(6) 1030/1090 MHz LLD Built-in Test (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 BIT signal at those monitor outputs. The width and shape of the injected signal should be the same as the Terminal BIT signal. Measure and record the peak power of the injected test signal at the antenna port using a spectrum analyzer with setting of 3 MHz RBW and 3 MHz VBW. If a CW test signal is used, ensure that the 3 MHz BW does not result in noise levels that could affect the accuracy of the measurement. If so, use an alternate BW (e.g., 500 kHz RBW, 500 kHz VBW). Measurements shall be taken while operating in the highest power mode that is nominally 200 W or less and in all antenna modes. Verify that the injected signal is no greater than -5 dBm at the antenna output.

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[2] If it can be demonstrated that there is no less than 3 dB margin from the 10 dB requirement in Volume 1, Paragraph 3.2.d.(1)(b) on one single antenna mode, then test can be limited to that single antenna only. All CTT monitors shall meet the additional 3 dB for the one antenna test to apply.

(7) PW Detection.

Measure and record the PWs at the 95% pulse amplitude at fifty-one carrier frequencies while operating in the highest output power mode that is nominally[3] 200 W or less in all single antenna modes. The pulse amplitude is defined as the average of the samples measured at least 3.2 µs of the center of the pulse. The number of samples shall be at least 64. As an alternative, it is acceptable to measure and record the pulse widths at the 95 percent pulse amplitude at nine carrier frequencies: 969, 990, 1008, 1053, 1065, 1113, 1146, 1176 and 1206 MHz, while operating in highest output power mode that is nominally 200 watts or less in all single antenna modes, if a separate test is conducted while operating the Terminal in the frequency hopping mode for no less than two minutes and verifying that there are no pulse width events reported.

(a) Verify that the PW of the pulses at these carriers are within the narrow and wide limits. The narrow limit shall be no less than 6.08 µs, and the wide limit shall be no more than 6.72 µs. Record and calculate these values.

(b) In the single frequency mode, verify the PW monitor thresholds in accordance with Paragraphs 2.1.b.(7)(b)1. and 2.(7)(b)2 at nine carrier frequencies: 969, 990, 1008, 1053, 1065, 1113, 1146, 1176 and 1206 MHz.

1. For each of the nine carrier frequencies, replace a series of 33 contiguous pulses with CW pulses having the normal pulse shape (i.e., same rise and fall time as a normally transmitted pulse) into the PW monitor in Combat mode. Increase the width until the Terminal reports a PW EPF fault, maintaining the normal pulse shape. At the 95% RF voltage amplitude for each frequency, measure and record the narrowest pulse within the modified pulse group and verify that the width is no more than 6.72 µs. A +50 nanosecond (ns) tolerance is allowed for these measurements.

2. For each of the nine carrier frequencies, replace a series of 33 contiguous pulses with CW pulses having the normal pulse shape (i.e., same rise and fall time as a normally transmitted pulse) into the PW monitor in Combat mode. Decrease the width until the Terminal reports an EPF fault, maintaining the normal pulse shape. At the 95% RF voltage amplitude for each frequency, measure and record the widest pulse within the modified pulse group and verify that the width is no less than 6.08 µs. A -50 ns tolerance is allowed for these measurements.

(8) Frequency Monitor Function.

During these tests, the Terminal shall operate in the multiple antenna mode (e.g., "dual antenna" mode) if available or in one single antenna mode if a multiple antenna mode is not available and at the highest power mode (200 W or less). Measure and record the frequency of an injected normally shaped 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 out of band (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 not less than

[3] Nominally refers to the power level(s) that will be certified for operation.

966.8 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 not greater than 1208.2 MHz. Verify that the measured frequency boundaries within the notches are no less than 1022.8 MHz and no more than 1097.2 MHz.

(9) Overpower (OP) Monitor.

Verify that the Terminal reports excess power when the peak pulse output power is at a level no stronger than 200 W + 2 dB (i.e., threshold verification) at the nine carrier frequencies: 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz. Measurements shall be taken while operating in all output power modes and in all single antenna modes.

c. Maintenance Test Procedures.

The Terminal shall have verification tests performed after maintenance, whenever the Terminal is returned to the Depot. These tests shall be equivalent to the measurements performed in Section 2.1.b, ATPs.

2.2. LINK 16 EMC FEATURES CERTIFICATION TEST PLAN.

a. Introduction.

(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 as a guidance for developing test procedures to facilitate the EMC Features certification process. If the CA determines that additional certification tests are required, a request that identifies the specific test(s) with rationale will be submitted to the PA. 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 (SW) and hardware (HW), shall be certified within the DoW by the EMC Features CA and approved by the National Telecommunications and Information Administration (NTIA). The EMC Features data shall be collected during an EMC Features certification test, which shall be in accordance with this DoW EMC Features Test Plan. Terminals that have not been certified by the CA could result in restricted operations and shall require a coordinated frequency assignment via the originator's spectrum management chain of command to the Navy Marine Corps Spectrum Center (NMSC) for approval with the Federal Aviation Administration (FAA) for each operation.

(2) Affected Equipment.

This test plan pertains to Link 16 systems, including future applications of this RF waveform in multi-waveform capable equipment. If the Terminal includes an EPA used for Link 16 transmissions, it shall be considered an integral part of the Terminal and all the test requirements in this document shall apply to both. This document also pertains to upgrades or redesign of any Link 16 systems or subsystems (including legacy Link 16 systems or subsystems) that may affect EMC or EMC Features characteristics. The conditions and requirements for the transmission of Link 16 signals are established by DoD Instruction 5025.01, DoD Instruction 4650.01 and the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management

(3) Link 16 Terminal.

The unit to be assessed should be the final representative HW and SW design of the Terminal procurement phase to be certified. Terminals that include EPAs shall be tested in each planned Terminal configuration or model (i.e., with and without the EPA as applicable) for each test objective.

(4) Supporting Equipment.

Test equipment with current calibration 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). Upon approval of CA, simulated events or faults may be generated by the Terminal rather than inserted from external source as long as the faults and their applicable generated test signals are recorded and verified.

(5) Test Conditions.

Unless otherwise specified in the objective or approach for each test requirement, the Terminal shall be operating in Full EMC Protection mode, in one antenna configuration, and in the highest power mode that is nominally 200 W or less.

The measurement of a CPSM pulse signal level is typically measured using a spectrum analyzer or a power meter. If a spectrum analyzer is used and a frequency span greater than 10 MHz is employed, measurement BWs of 3 MHz resolution and 3 MHz video are adequate to determine peak power level. However, if a zero span is used, the measurement BW needs to be increased to 10 MHz. All measurements of pulse shape and PW that are identified in the manual must be performed with a measurement BW of at least 20 MHz to minimize the error.

b. RF Spectral Characteristics Testing.

(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 Paragraph 3.2.b.(4) of Volume 1 of this manual.

(a) Objectives.

Tests shall verify the following:

1. Objective 1. That during at least a 2.5 µs interval between pulses in each 13 µs period of a Link 16 message, the Link 16 peak output power at the Terminal antenna ports is at least 80 dB below the peak output power of the transmitted Link 16 message pulses or -57 dBm whichever is greater. Figure 1 of Section 3.2 of Volume 1 illustrates the between Link 16 pulse power level requirement.

2. Objective 2. That the peak RF output power at the Terminal antenna ports does not exceed -57 dBm, as measured in a 1 MHz BW, exclusive of the following intervals described in Paragraphs 2.2.b.(1)(a)2.a. and 2.2.b.(1)(a)2.b. Figure 2 of Section 3.2 of Volume 1 illustrates the between Link 16 and non-Link 16 waveform power level requirement.

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

b. The interval from 5 µs before the 10% voltage level of the earliest leading edge to 5 µs after the 10% level of the latest trailing edge of a Terminal commanded non-Link 16 waveform transmission.

(b) Approach to Objective 1: Output Power between Pulses.

1. In a single antenna mode, measure the power level of the signal between pulses using a spectrum analyzer set for a 3 MHz VBW, a 3 MHz RBW, 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 transmitted pulses peak power level at the selected power mode for a period of at least 2.5 µs. Alternatively, the measurement can be taken once with a 960-1215 MHz span provided that sufficient attenuation is enabled during the pulse transmission. Sufficient attenuation shall be applied during the pulse and result in all emissions being weaker than -80 dB relative to the carrier (dBc). There shall be at least a 2.5 µs interval when there is no attenuation applied.

2. The test performed in Paragraph 2.2.b.(1)(b)1. shall be done in each power mode.

3. In the other antenna modes, the test performed in Paragraph 2.2.b.(1)(b)1. shall be measured at 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz in each power mode.

(c) Approach to Objective 2: Output Power between Messages[4].

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 VBW, a 1 MHz RBW, 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 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 µs after the 50% voltage level of the trailing edge of the last pulse in a message to 5 µs before the 50% voltage level of the leading edge of the first pulse of the following Terminal commanded Link 16 message is weaker than -57 dBm. Alternatively, the measurement can be taken once with a 960-1215 MHz span provided that sufficient attenuation is enabled during the pulse. Sufficient attenuation applied during the pulse would result in all emissions being weaker than -57 dBm. The interval from 5 µs after the 50% voltage level of the trailing edge of the last pulse in a message to 5 µs before the 50% voltage level of the leading edge of the first pulse of the following Terminal commanded Link 16 message shall be unattenuated.

2. The test performed in Paragraph 2.2.b.(1)(c)1. shall be done in each power mode.

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

3. In the other antenna configurations, the test performed in Paragraph 2.2.b.(1)(c)1. shall be measured at 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz in each power mode.

4. If the Terminal has the CTT non-Link 16 messages using the same antenna ports or common transmission circuits for Link 16 transmission, repeat Paragraph 2.2.b.(1)(c)1. while transmitting non-Link 16 messages[5]. Record the noise level and verify that the noise level exclusive of the interval from 5 µs before the 10% voltage level of the earliest leading edge to 5 µs after the 10% level of the latest trailing edge of a Terminal commanded non-Link 16 waveform transmission is weaker than -57 dBm.

5. The test performed in Paragraph 2.2.b.(1)(c)4. shall be done in each Link 16 power mode.

6. In the other antenna configurations, repeat the test performed in Paragraph 2.2.b.(1)(c)4. at 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz in each power mode.

7. Paragraphs 2.2.b.(1)(c)4. through 2.2.b.(1)(c)6. can be replaced with an alternative simplified test method when the non-Link 16 waveform is tactical air navigation (TACAN). In this alternative, the output power between Link 16 messages and non-Link 16 messages is accomplished using the Link 16 Communication Mode 1 (frequency hopping mode) instead of repeating the test for each of the 51 fixed Communication Mode 2 Link 16 frequencies. The setup is dependent on the use of attenuation, such as an RF switch, for both the TACAN pulses and the Link 16 pulses. This would allow for the use of a spectrum analyzer with a lower reference level to allow for measurements below -57 dBm/MHz.

a. The areas required to be measured are the durations where the TACAN and Link 16 transmissions are not attenuated. This is the interval from 5 µs after the 10% voltage level of the latest trailing edge to 5 µs before the 10% level of the earliest leading edge of a Terminal commanded non-Link 16 waveform transmission. Oscilloscope pictures must be captured to prove that the attenuation covers only required portions of the TACAN and Link 16 pulse and leaves the other portions which include the above-mentioned interval untouched.

b. Using a spectrum analyzer in a zero span mode centered on the TACAN frequencies and on nine Link 16 carrier frequencies (i.e., 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz), the maximum hold image shall be used to verify that there are no signals above -57 dBm/MHz. The spectrum analyzer sweep time can be set to a large value such as 1 ms with 1 MHz RBW and VBW. This eliminates the need to set specific time intervals between the TACAN pulses and the Link 16 pulses. The spectrum analyzer needs to be compensated for external attenuation and cable losses to accurately reflect absolute power at the antenna port.

[5] All non-Link 16 waveforms should be tested unless it can be ascertained in a review of the design that the multiple waveforms under consideration have sufficiently similar characteristics.

c. Paragraph 2.2.b.(1)(c)7.b. shall be repeated for three TACAN frequencies equally distributed over the TACAN interrogator frequency band.

(2) RF Pulse and Full Band Spectrum.

The Link 16 transmitted power spectrum, in each of its power modes, about any authorized carrier frequency or at the band edges in the 960 to 1215 MHz frequency band shall be in accordance with the requirements defined in Volume 1, Paragraph 3.2.b.(5), RF Spectrum.

(a) Objectives.

1. Objective 1. Tests shall verify that the RF power 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 for each of the 51 carrier frequencies as illustrated in Figure 3 of Section 3.2 of Volume 1.

2. Objective 2. The output spectral characteristics shall be measured on each exclusion band (centered on 1030 MHz and 1090 MHz) and on the band edges (centered on 925 MHz and 1250 MHz). Additionally, a broadband measurement from 954 to 1221 MHz shall be recorded.

(b) Approach to Objective 1: Pulse Power Spectrum.

1. In a single antenna mode transmitting in the single frequency mode (Communication Mode 2) at a rate of at least 50% TSDF (198,144 pulses per 12 seconds) or the maximum TSDF level the terminal is capable of transmitting, measure the output spectrum using a spectrum analyzer set to 300 kHz RBW and VBW, and a maximum hold display. Using a 50 MHz span centered on the carrier frequency and a 400 MHz span centered on 1090 MHz, the CPSM spectrum for each of the 51 frequencies shall be measured and recorded. Spectrum analyzer attenuation should be adjusted to maximize the signal to noise ratio. Choose a sweep rate that allows for the spectrum measurement to fill in efficiently to ensure that full spectrum is captured. The sweep rate should be (7.8125 ms * Number of Spectrum Analyzer Data Points)/TSDF. Verify that the spectrum for each of the 51 frequencies complies with Figure 3 of Section 3.2 of Volume 1.

2. The test performed in Paragraph 2.2.b.(2)(b)1. shall be done in all power modes.

3. In the other antenna configurations, repeat the test performed in Paragraph 2.2.b.(2)(a) at 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz in each power mode.

4. Additional pulse spectrum plots are needed if the Link 16 transmitted pulse can be suddenly interrupted by another waveform. During the collection of the additional pulse spectrum plots, the interrupt will be placed in various locations throughout the Link 16 pulse while the spectrum is being captured. The interrupt shall be placed every 250 ns through the rising edge (starting at 10%) and falling edge (ending at 10%) of the pulse, with an emphasis on the top left corner where there is typically overshoot. The interrupt shall also be placed every 1

µs along the top of the pulse. These captures should be taken while operating in the single fixed frequency test mode at a rate of the highest TSDF possible for the terminal, in each of the output power modes, record plots of the individual pulse power spectrum at four carrier frequencies: 969, 990, 1176, and 1206 MHz at each antenna when operating in the single antenna mode. Measure the output spectrum using a spectrum analyzer set to a 300 kHz VBW, a 300 kHz RBW, and a maximum hold display. Set the spectrum analyzer to 50 MHz span centered on the carrier and a 400 MHz span centered at 1090 MHz. Choose a sweep rate and the time for allowing the spectrum measurement to fill in to ensure that full spectrum is captured. The sweep rate should be (7.8125 ms * Number of Spectrum Analyzer Data Points)/TSDF. (Note: Unless CA approved, the minimum number of spectrum analyzer data points shall be no less than 1000.) Verify that the pulse spectra comply with the specified spectrum requirement in Volume 1, Figure 3.

(c) Approach to Objective 2: Exclusion Band, Band Edges, and Broadband Spectral Characteristics.

1. In a single antenna mode transmitting in the frequency hopping mode at the sweep rate of (7.8125 ms * Number of Spectrum Analyzer Data Points)/TSDF, measure the output spectrum using a spectrum analyzer set to a 300 kHz VBW, a 300 kHz RBW, and a maximum hold display. 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 -60 dBc in the 14 MHz wide frequency bands centered on 1030 MHz and 1090 MHz. The reference signal for the dBc determination shall be within the 60 MHz span.

2. Using a 100 MHz span centered on each of the band edges (925 MHz and 1250 MHz), record the spectrum analyzer data. The sweep rate should be (7.8125 ms * Number of Spectrum Analyzer Data Points)/TSDF using four sweeps. Verify that the RF output is at least -60 dBc in the frequency ranges below 954 MHz and above 1221 MHz. The reference signal for the dBc determination shall be within the 100 MHz span[6].

3. Set the spectrum analyzer start frequency to 954 MHz and stop frequency to 1221 MHz and record the data. The sweep rate should be (7.8125 ms * Number of Spectrum Analyzer Data Points)/TSDF using four sweeps. 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 -60 dBc. The reference signal for the dBc determination shall be within the 954 MHz to 1221 MHz span.

4. Repeat the tests performed in Paragraphs 2.2.b.(2)(c)1. through 2.2.b.(2)(c)3. with these remapping configurations: single remapped frequency at 972 MHz; seven remapped frequencies centered around 1176 MHz (GPS L5 center frequency); and 14 remapped frequencies at the first 14 frequencies (lower end of the band remapped).

5. The tests performed in Paragraphs 2.2.b.(2)(c)1. through b.(2)(c)4. shall be done in all power modes and in all antenna configurations.

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[6] For the test case in which Channels 0-13 is remapped, reference the peak level from the test where channels 0-13 were not remapped.

(3) OOB Emissions.

The OOB emissions below 920 MHz and above 1266 MHz band should be in compliance with the requirement stated in Volume 1, Paragraph 3.2.b.(6) Out of Band (OOB) Emission Characteristics.

(a) Objective.

Verify the output power spectrum outside the 920 to 1266 MHz band.

(b) 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 EMC Features certification package.

c. EMC Features Monitoring Functions.

The EMC Features monitors or monitoring functions to be assessed, consist of CTT detection, 1030/1090 MHz Emissions, PW, uniform use of authorized carriers (UUAC), output power restrictions, TSDF, message structure restrictions, net number restriction, relay restrictions, and access restrictions. EMC Feature monitoring requirements are specified in Paragraph 3.2.d. of Volume 1 of this manual. For the purposes of verifying EMC Features thresholds, compliance shall be determined at the antenna port(s). When relying on measurements at a point other than the antenna port(s), verification that the levels determined at this point are equivalent and not distorted from the levels measured at the antenna port(s) shall be provided.

(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.

(a) Objectives.

Tests shall verify:

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. If the Terminal suppresses the outputs of the CTT monitors after power on and before start net entry, then verify in the Link 16 only mode after initial start net entry, that CTT monitoring is active during all intervals in which the Terminal has not scheduled a Link 16 transmit command (pulse) to the power amplifier. Also, verify before initial start net entry that the Link 16 waveform is isolated from the power amplifier.

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 EPA.

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

a. A minimum of one CTT monitor exclusive to Link 16 is active during non-Link 16 transmissions and all other CTT monitor outputs are ignored.

b. CTT monitor outputs are not ignored during all intervals which the Terminal has not scheduled either Link 16 or non-Link 16 transmissions.

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, performs a transmit inhibit after two CTT EPF faults before the next time slot, and:

a. That the power supply voltage to the power amplifier has been removed until an Interference Protection Feature (IPF) reset is initiated, or

b. 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 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.

5. Objective 5. That the isolation, if implemented as stated in Paragraph 2.2.c.(1)(a)4.b., is verified during Start-Up BIT (SBIT) and Initiated BIT (IBIT).

6. Objective 6. If the Terminal has an EPA configuration, repeat objectives 1 through 5 with the EPA.

(b) Approach to Objective 1: CTT Event Detection.

1. Ensuring the Terminal is in Link 16 only mode of operation while operating in Full EMC Protection mode and the highest nominal power level that is nominally 200 W or less, induce a CTT EPF fault condition between pulses for each CTT monitor. Record evidence of the injected fault condition. Verify a CTT EPF event is incurred for each injected CTT EPF fault condition. Verify that the Terminal generates a CTT EPF fault when there are two or more CTT EPF events in a Link 16 time slot by the end of the time slot. After two CTT EPF faults, verify that the Terminal inhibits transmission, and:

a. The Link 16 Terminal removes the supply voltages to the RF amplifier (RFA), or

b. The Link 16 Terminal waveform generation is isolated.

2. Repeat Paragraph 2.2.c.(1)(b)1. for a CTT EPF fault condition between Link 16 messages in adjacent transmit time slots and during receive time slots.

3. Repeat Paragraphs 2.2.c.(1)(b)1. through 2.2.c.(1)(b)2. in Exercise EMC Protection mode and Combat mode. Verify that in Combat mode, the Terminal incurs CTT EPF faults but does not inhibit transmissions.

4. Verify the performance of the CTT monitor in the presence of suppressed Link 16 transmitted pulses in Full EMC Protection mode and the highest power mode that is nominally 200 W or less.

a. Inject CTT faults during suppression intervals. During the transmit suppression period, identify the CTT monitoring periods by injecting CTT EPF events and inducing CTT EPF faults. Confirm if the EPF faults can be detected throughout the transmit suppression period or if they are limited to the on-pulse and between pulse regions. Verify that the terminal inhibits when faults are detected.

b. Inject CTT faults before suppression intervals and verify that the faults can be detected and terminal inhibits.

c. Inject CTT faults immediately after the suppression signal ends and verify that the faults can be detected and terminal inhibits.

5. Repeat Paragraph 3.2.c.(1)(b)4. using LLD suppression instead of transmit suppression.

6. Repeat Paragraph 2.2.c.(1)(b)4.a. with a different CTT monitor.

7. If the Terminal ignores the outputs of the CTT monitors after power on and before start network entry (SNE), then verify that before initial SNE that the Link 16 waveform is isolated from the power amplifier.

8. Verify the performance of the Terminal using one CTT monitor in Full EMC Protection mode with the highest power mode that is nominally 200 W or less under these conditions:

a. Inject a non-CTT EPF fault in one time slot and then a CTT EPF fault and non-CTT fault in a second time slot and verify that transmissions are inhibited and that there is either a Link 16 isolation or the removal of supply voltage from the power amplifier.

b. Inject two non-CTT EPF faults and verify a transmit inhibit. After the transmit inhibit, induce two CTT events and verify that the Terminal isolates the Link 16 waveform or removes supply voltage from the power amplifier.

c. Inject CTT EPF events in order to determine the CTT processing boundary[7] (i.e., EPF event count accumulation, and fault and transmit inhibit determination) within a time slot. Verify that the boundary intervals are 7.8125 ms. Perform the test with standard messages. Repeat the test using Packed 2 double pulse messages. Repeat the test using

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[7] The boundary test needs to find the leading edge and the trailing edge of the time slot reporting boundary. That is, when does the location of the fault change with respect to which time slot it is associated with or disappear. Either of these occurrences would indicate that the current location of the injected event crossed a time slot reporting boundary. By fixing one event and sliding another event left and right of the first event, it should be observed when a fault that was being produced either disappears or when a fault appears. Either of these events is indicating that a boundary was crossed. The method should work for all three message types. Need to confirm that the delta between the boundary limits is approximately 7.8125 ms.

a mixture of standard and Packed 2 double pulse messages. Repeat the test using a mixture of standard and round-trip timing (RTT)-broadcast (RTT-B) reply messages.

(c) Approach to Objective 2: CTT Monitor Levels.

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

2. Measure and record the signal levels at each CTT monitoring point in the RFA during scheduled Link 16 pulse transmissions ("active low").

3. Inject and record a signal capable of causing a CTT fault. Measure and record the thresholds at each CTT monitoring point when the monitor starts detecting unscheduled emissions ("active-high"). Verify that the measured threshold is at least 10 dB below the measured level during scheduled Link 16 transmissions recorded in Paragraph 2.2.c.(1)(c)2. This shall be performed between pulses and between the messages of transmit time slots. For the Isolation CTT monitor, verify that the measured threshold is at least 10 dB below the minimum exciter level.

4. Repeat Paragraphs 2.2.c.(1)(c)1. through 2.2.c.(1)(c)3. in all power and in each single antenna mode. If the design is such that the levels for each of these Paragraphs is the same for each antenna, then the test can be limited to a single antenna mode only as long as the measured threshold is at least 13 dB below the measured level on that antenna during scheduled Link 16 transmissions recorded in Paragraph 2.2.c.(1)(c)2. If the CTT thresholds vary with power mode, the most sensitive threshold shall be applied during receive time slots.

(d) Approach to Objective 3: Mixed Link 16 and non-Link 16 CTT Fault Conditions.

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

2. Remove the fault condition and verify that the CTT fault count is not incremented during non-Link 16 transmission.

3. When only the non-Link 16 waveform is transmitting, inject a fault just outside the 5 µs boundary and verify that the event count is incremented by one. Perform this test for the exclusive monitor and one non-exclusive monitor.

(e) Approach to Objective 4: EPF Fault Assessment.

For convenience Objective 4 tests may be included in tests identified in Objective 1 and/or 3 Methods. Verify the performance of the Terminal using one of the CTT monitors in Full EMC Protection mode with the highest power mode (200 W or less).

1. Simulate a non-CTT EPF fault in one time slot and two CTT events (one EPF fault) in a second time slot. Verify that two EPF Fault Reports are generated.

2. After the two EPF faults, verify that after a transmission inhibit:

a. The Link 16 Terminal removes the power supply voltages to the RFA, or

b. The Link 16 Terminal waveform generation has been isolated. For a Terminal implementing a Link 16 isolation capability as defined in Volume 1, Paragraph 3.2.d.(1)(c), 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 output power summed at all antenna ports is -57 dBm/MHz or weaker when the isolation is enabled. Measure and record this level.

(f) Approach to Objective 5: Isolation SBIT/IBIT.

1. During normal transmissions, record the power level that is incident at the point in the transmission circuitry just prior to the isolation technique. Record the level at the exclusive CTT monitor during the non-isolated portion of the CTT Isolation SBIT/IBIT.

2. Upon startup 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 prior to the isolation technique measured in Paragraph 2.2.c.(1)(f)1. Verify that the exclusive CTT monitor indicates the level as determined in Paragraph 2.2.c.(1)(c)1. during non-transmissions, and that it does not detect CTT.

3. During the non-isolated portion of the Isolation SBIT test, reduce the level of the exciter signal level until the Terminal fails SBIT and inhibits transmissions. Verify that the level is not less than 2 dB lower than the minimum exciter level.

4. Inject/simulate a fault that indicates a CTT event for the exclusive CTT monitor during the isolated portion of the Isolation SBIT. Verify that the Terminal fails the SBIT and inhibits transmissions.

5. Repeat Paragraphs 2.2.c.(1)(f)1. through 2.2.c.(1)(f)4. for each power mode of the Terminal.

6. Repeat tests in Paragraphs 2.2.c.(1)(f)1. through 2.2.c.(1)(f)5. for IBIT.

(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 μs Link 16 transmission interval and reports when the LLD thresholds have been exceeded. Note two different approaches are provided for verifying compliance with the 1030/1090 MHz LLD requirement. One complete approach should be utilized to show that the Terminal complies with all the tests under that approach (i.e., compliance with some steps under one approach and then other steps under the other approach is not acceptable).

(a) Objectives.

1. Objective 1. 1030/1090 LLD detection tests shall verify that an EPF Fault Report occurs if in five or more 13 μs 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 RBW and a 1 MHz VBW 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 μs intervals in a time slot, the output power level in a 300 kHz BW 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 W mode even when transmitting in a power mode less than 200 W. For Terminals using a nominal level that is stronger than 200 W, this level shall be the equivalent of -60 dBc with respect to the nominal power level (i.e. for the 1000 W power mode, the threshold requirement shall be 0 dBm or -60 dBc with respect to 1000 W).

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

3. Objective 3. Verify that no EPF fault transmit inhibits occur when in Combat mode.

4. Objective 4. Measure the LLD threshold settings and record the values.

5. Objective 5. During a 13 μs interval when an LLD suppression signal input is active, verify:

   a. Emissions exceeding the levels in Objective 1 or 2 above do not increment the 1030/1090 MHz event count.

   b. That for every 13 μs interval when an LLD suppression signal is active, an LLD suppression counter is incremented when the Terminal is in Full EMC Protection mode.

   c. After the LLD suppression counter reaches 55,385 in any 12-second frame, and the Terminal is not operating under identification friend or foe (IFF) emergency conditions, the Terminal no longer ignores the LLD monitor outputs during the suppression signals for the remainder of the 12-second frame when operating in Full EMC Protection mode.

(b) Approaches to Objective 1: 1030/1090 Fault Detection and Objective 2: Verify Transmission Inhibit after Second EPF Fault.

1. Inject four CPSM pulses per time slot in three consecutive time slots using a signal generator at 1030 MHz having a level above -7 dBm or -60 dBc at the antenna output. Using a spectrum analyzer with at least a 3 MHz RBW and at least a 1 MHz VBW, observe the

presence of signals in the 1030 MHz band. Verify that no LLD EPF faults are generated and that all three time slots transmit.

2. Inject five CPSM pulses per time slot in three consecutive time slots 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 (i.e., only two time slots transmit).

3. Repeat Paragraphs 2.2.c.(2)(b)1. and 2.2.c.(2)(b)2. with the insertion of pulses at 1090 MHz.

4. The tests performed in Paragraphs 2.2.c.(2)(b)1. through 2.2.c.(2)(b)3. shall be done in Full EMC Protection and Exercise EMC Protection modes and in one antenna configuration.

5. Inject five 6.4 µs 1030 MHz CW or CPSM pulses per time slot at the same level and set the Link 16 transmission pulse suppression signal high at some point in the remaining transmission time frame of each time slot. Observe two LLD EPF faults and the cessation of transmissions. Capture data images that indicate the timing of the injected pulses and the suppression signal and superimpose the detected transmitted pulses. Repeat for 1090 MHz pulses. Repeat using LLD suppression signals instead of pulse suppression signal.

6. After an IPF reset, set the Link 16 transmission pulse suppression signal high during the time period of the first three pulses of each time slot followed by the injection (starting in the next 13 µs pulse transmission interval of those time slots) of five 6.4 µs 1030 MHz pulses. Observe two LLD EPF faults and the cessation of transmissions. Capture data images that indicate the timing of the injected pulses and the suppression signal and superimpose the detected transmitted pulses. Repeat for 1090 MHz pulses. Repeat using LLD suppression signals instead of pulse suppression signals.

7. Paragraphs 2.2.c.(2)(b)5. and 2.2.c.(2)(b)6. shall be performed in the highest power mode not to exceed 200 W and in a single antenna mode in Full EMC Protection and Exercise EMC Protection modes. Also, perform in Combat mode and verify that the Terminal reports EPF faults, but does not inhibit transmissions.

(c) Approach to Objective 3: Combat Mode.

1. In Combat mode, inject five CPSM pulses per time slot in three consecutive 444 pulse time slots 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 (i.e., all three time slots transmit). For the 1030 MHz test only, observe the Link 16 signal levels of the three consecutive time slots and verify that they do not contain a droop level in the 100% pulse power level for the pulses across the time slots of more than 1 dB from the nominal level.

2. Repeat Paragraph 2.2.c.(2)(c)1. using 1090 MHz injected pulses.

(d) Approach to Objective 4: LLD Thresholds using the -7 dBm Test Approach.

(Note: If this approach is utilized, then the Terminal shall comply with all the tests under this approach (i.e., compliance with some steps under this approach and the other steps under the approach defined in Paragraph 2.2.c.(2)(e) is not acceptable).

1. The output spectrum should be measured using a spectrum analyzer with a 3 MHz VBW, a 3 MHz RBW, a maximum hold display, and a sweep rate of 15 MHz per second or less using four sweeps. The spectrum analysis should be at least 60 seconds in duration. The Terminal should transmit in Combat mode and in the frequency hopping mode at a rate of at least 198,144 pulses per 12 seconds (50% TSDF). Verify that faults are occurring at a rate of at least one fault per 64 transmit time slots while the injected level is measured on the spectrum analyzer.

2. Inject at least five normally shaped (as defined in Paragraph 2.2.d.(2)(c)) 6.4 µs randomly modulated CPSM test signals per time slot having approximately a 3 MHz BW, 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 BWs 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.

3. The test in Paragraph 2.2.c.(2)(d)2. 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.

4. Inject 6.4 µs noise signals having a 14 MHz BW centered on 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 BWs 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.

5. The test in Paragraph 2.2.c.(2)(d)4. shall be repeated using noise signals having a 14 MHz BW centered on 1090 MHz. The spectrum analyzer shall be centered on 1090 MHz for this test.

6. Inject at least five 6.4 µs pulsed CW test signals per time slot having a BW less than 300 kHz, 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 BWs 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.

7. The test in Paragraph 2.2.c.(2)(d)6. 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.

8. The tests performed in Paragraphs 2.2.c.(2)(d)1. through 2.2.c.(2)(d)7. shall be performed in all antenna configurations and in all power modes.

9. The LLD threshold verification tests shall be performed with the injected pulses between consecutive Link 16 pulses. Inject at least five 6.4 µs pulsed CW test signals between consecutive pulses (during the 6.6 µs off time) per time slot having a BW less than 300 kHz, 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 BWs of 3 MHz centered on 1030 MHz. This test will verify that the threshold does not change and that the entire 13 µs pulse period is processed. Repeat the test at 1090 MHz.

10. For guidance on procedures in Paragraphs 2.2.c.(2)(d)2. through 2.2.c.(2)(d)9. for measuring the 1030 MHz LLD trip point for Terminals that utilize a 1030 MHz notch filter prior to its antenna ports, this example is provided for the -7 dBm test approach.

a. The proposed example employs the use of an external port that can be used to inject a test signal into the IPF monitors and an additional port for monitoring the injection signal level. Use the external injection port to inject a 1030 MHz test signal and increase the signal level until an LLD fault occurs. Use the external monitor port to measure the amplitude of the 1030 MHz signal level that produced the LLD trip. This measurement will serve as a baseline reference for the remaining measurements. Change the injected signal level to 1008 MHz. Verify that the amplitude at the monitor port is the same as the baseline reference level. It may be necessary to increase or decrease the injected signal level to match the baseline reference level. After achieving the same reference signal level, measure the amplitude of the 1008 MHz signal at the antenna output port(s). Change the injected signal level to 1053 MHz and repeat the same steps above to measure the 1053 MHz signal level at the antenna output port(s). The LLD measurement should be determined from the greatest of the 1008 and the 1053 MHz signal level measurements.

b. All the tests identified in Paragraph 2.2.c.(2)(d) shall be performed.

c. Similar procedures can be developed in the case where there is a 1090 MHz internal notch filter.

(e) Approach to Objective 4: LLD Thresholds Using the -60 dBc from the Nominal 200 W Power Mode Signal Level.

(Note: If this approach is utilized, then the Terminal shall comply with all the tests under this approach (i.e., compliance with some steps under this approach and the other steps under the approach defined in Paragraph 2.2.c.(2)(d) is not acceptable).

1. The output spectrum should be measured using a spectrum analyzer with a 300 kHz VBW, a 300 kHz RBW, 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 transmit in Combat mode and in the frequency hopping mode at a rate of at least 198,144 pulses per 12 seconds (50% 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 W 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.

2. Inject at least five 6.4 µs randomly modulated CPSM test signals per time slot having approximately a 3 MHz BW, at 1030 MHz. The strongest spectrum level of the weakest test signal, (measured in a 300 kHz BW) that results in an 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 Paragraph 2.2.c.(2)(e)1. This test shall be repeated with CPSM test signals injected at 1024.5 MHz and at 1035.5 MHz.

3. The test in Paragraph 2.2.c.(2)(e)2. 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.

4. Inject at least five 6.4 µs noise signals per time slot having a 14 MHz BW centered on 1030 MHz. The strongest spectrum level of the weakest test signal (measured in a 300 kHz BW) that results in an 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 Paragraph 2.2.c.(2)(e)1.

5. The test in Paragraph 2.2.c.(2)(e)4. shall be repeated using noise signals having a 14 MHz BW centered on 1090 MHz. The spectrum analyzer shall be centered on 1090 MHz for this test.

6. Inject at least five 6.4 µs CW test signals per time slot having a BW less than 300 kHz, at 1030 MHz. The strongest spectrum level of the weakest test signal (measured in a 300 kHz BW) that results in an 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 Paragraph 2.2.c.(2)(e)1. This test shall be repeated with pulsed CW test signals injected at 1023.5 MHz and at 1036.5 MHz.

7. The test in Paragraph 2.2.c.(2)(e)6. 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.

8. The tests performed in Paragraphs 2.2.c.(2)(e)1. through 2.2.c.(2)(e)7. shall be performed in all antenna configurations and in all power modes.

9. The LLD threshold verification tests shall be performed with the injected pulses between consecutive Link 16 pulses. Inject at least five 6.4 µs pulsed CW test signals between consecutive pulses (during the 6.6 µs off time) per time slot having a BW less than 300 kHz, 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 BWs of 3 MHz centered on

1030 MHz. This test will verify that the threshold does not change and that the entire 13 µs pulse period is processed. Repeat the test at 1090 MHz.

10. For guidance on procedures to use for measuring the 1030 MHz LLD trip point for Terminals that utilize a 1030 MHz notch filter prior to its antenna ports, the following acceptable example is provided for the -60 dBc from the nominal 200 W power mode signal level.

a. The proposed example employs the use of an external port that can be used to inject a test signal into the IPF monitors and an additional port for monitoring the injection signal level. Use the external injection port to inject a 1030 MHz test signal and increase the signal level until an LLD fault occurs. Use the external monitor port to measure the dBc value.

b. All the tests identified in Paragraph 2.2.c.(2)(e) shall be performed.

c. Similar procedures can be developed in the case where there is a 1090 MHz internal notch filter.

(f) Approach to Objective 5: LLD Suppression.

1. In 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 µs interval when the suppression signal is present during a Link 16 transmission, and that the 1030/1090 MHz event count is not incremented.

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 an LLD EPF Fault Report at the end of the time slot.

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. Verify that the terminal increments the 1030/1090 MHz event count and the LLD EPF Fault Report count, and that a transmission inhibit occurs.

4. Repeat Paragraph 2.2.c.(2)(f)3. in the Exercise EMC Protection mode. Verify that transmission is not inhibited.

(3) PW Monitor Function Verification.

PW monitor measures the width of Link 16 pulses and determines when the pulse is outside the limits of 6.08 to 6.72 µs, at the 95% voltage levels (90% power levels).

(a) Objectives.

Tests shall verify:

1. Objective 1. That the Terminal measures Link 16 message PWs and increments the PW event count when minimum and/or maximum PW parameters are exceeded.

2. Objective 2. That the Terminal reports a zero PW, increments the PW event count, and declares the pulse to be in the OOB frequency bin when the PW monitor fails to measure the width of a pulse.

3. Objective 3. That the Terminal generates an EPF Fault Report if more than 32 PW 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.

4. Objective 4. That no EPF fault transmit inhibits occur when in Combat mode.

5. Objective 5. That the settings for the lower and upper PW limits are set correctly within or equivalent to the 6.08 to 6.72 µs at 95% amplitude (voltage) level criteria. If the PWs are measured at a level other than the 95% amplitude, verify that the fault criteria satisfy the 6.08 to 6.72 µs limits at the 95% amplitude.

6. Objective 6. That the PW monitor accurately reports PW throughout the dynamic range of the monitor.

(b) Approaches for Objectives 1, 2, and 3: PW Algorithm.

1. Within three consecutive time slots, into the PW monitor, replace 32 contiguous pulses with pulses of width less than 6.08 µs (narrow). Record the width/number of the substituted narrow transmitted pulses and verify that the EPF Fault Report count is not incremented and that all three time slots transmit. Record the display of all three time slots. Repeat 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.

2. Within three consecutive time slots, into the PW monitor, replace 32 contiguous pulses with pulses of width more than 6.72 µs (wide). Record the width/number of the substituted wide transmitted pulses and verify that the EPF Fault Report count is not incremented and that all three time slots transmit. Record the display of all three time slots. Repeat 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.

3. Within three consecutive time slots, into the PW monitor, replace 32 contiguous pulses with a combination of pulses with a width of less than 6.08 µs (narrow) and wider than 6.72 µs (wide) and one blanked pulse (zero) (as part of the 32 contiguous pulses). Record the width/number of the substituted narrow and wide transmitted pulses. Verify that the EPF Fault Report count is not incremented and that all three time slots transmit. Record the display of all three time slots. Repeat using 30 contiguous pulses with a combination of pulses with a width of less than 6.08 µs (narrow) and wider than 6.72 µs (wide) and two blank pulses (zero) (as part of the 32 contiguous pulses). Record the width/number of the substituted narrow and wide transmitted pulses. Verify 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. Verify that two OOB EPF faults were declared during the two transmitted time slots.

4. The tests performed in Paragraphs 2.2.c.(3)(b)1. through 2.2.c.(3)(b)3. shall be performed in the highest nominal power mode, in Full EMC Protection and Exercise EMC Protection modes, and in one single antenna configuration.

5. Using Channel 0, inject into the IPF monitor, time slots having synchronized RF pulse groups containing 33 wide pulses having a width of 7 µs at the 95% amplitude point of the pulse and set the Link 16 transmission pulse suppression signal high for three pulses following the injected pulses. Observe two PW EPF faults and the cessation of transmissions. Capture data images that indicate the timing of the injected pulses and the suppression signal and superimpose the detected transmitted pulses. Repeat using LLD suppression signals instead of pulse suppression signals.

6. Perform an IPF reset. Set the Link 16 pulse suppression signal high during the time period of the second to fourth pulses of each time slot followed by the injection (starting in the next 13 µs pulse transmission interval of those time slots) of synchronized RF pulse groups containing 33 wide pulses having a width of 7 µs at the 95% amplitude point of the pulse. Observe two PW EPF faults and the cessation of transmissions. Capture data images that indicate the timing of the injected pulses and the suppression signal and superimpose the detected transmitted pulses. Repeat using LLD suppression signals instead of pulse suppression signals.

7. Paragraphs 2.2.c.(3)(b)5. and 2.2.c.(3)(b)6. shall be performed in the highest power mode not to exceed 200 W and in a single antenna mode in Full EMC Protection and Exercise EMC Protection modes. Also, perform in Combat mode and verify that the Terminal reports EPF faults, but does not inhibit transmissions.

(c) Approach to Objective 4: Combat Mode.

Within three consecutive time slots, into the PW monitor, replace 32 contiguous pulses with a combination of pulses with a width of less than 6.08 µs (narrow) and wider than 6.72 µs (wide) and one blanked pulse (zero) (as part of the 32 contiguous pulses). Record the width/number of the substituted narrow and wide transmitted pulses and verify that the EPF Fault Report count is not incremented and that all three time slots transmit. Record the display of all three time slots. Repeat using a combination of 33 contiguous narrow and wide pulses and two blanked pulses (as part of the 33). Record the width/number of the substituted narrow and wide transmitted pulses and that the EPF Fault Report count is incremented by three, continuously incrementing or that the total EPF Fault Report count is at least 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.

(d) Approach to Objective 5: PW Monitor Detection Thresholds.

1. In Full EMC Protection mode and in the single fixed frequency mode transmitting multiple pulses on 969 MHz, Channel 0, measure and record the output PW at the

95% voltage amplitude points and the 100% amplitude. Verify that the PW is within 6.4 µs ± 0.32 µs. Record the minimum, maximum, and average PW and the average 100% amplitude of all the pulses measured. Repeat these measurements for the remaining 50 carrier frequencies.

2. Perform the measurements described in Paragraph 2.2.c.(3)(d)1. in all power modes using one antenna configuration.

3. Perform the measurement described in Paragraph 2.2.c.(3)(d)1. in the other antenna configurations in each power mode for at least nine individual fixed frequencies (969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz).

4. Determine the test pulse envelope that shall be used to shape injected pulses using the average PW at the 95% amplitude and average 100% amplitude of normally transmitted pulses over all 51 frequencies calculated from the recorded values in Paragraph 3.2.c.(3)(d)1. There shall be a different test pulse envelope determined for each power mode.

5. In Combat mode, into the PW monitor, replace a series of 33 contiguous pulses with CPSM pulses having the equivalent test pulse envelope established in Paragraph 2.2.c.(3)(d)4. Increase the width until the Terminal reports an EPF fault, maintaining the test pulse shape established in Paragraph 2.2.c.(3)(d)4. (i.e., same rise and fall time as a normally transmitted pulse). At the voltage amplitude for which the Terminal measures PW, 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 6.72 µs at the 95% amplitude PW. A 50 ns tolerance is allowed for these measurements.

6. Perform the measurements described in Paragraph 2.2.c.(3)(d)5. in all power modes using one antenna configuration.

7. Perform the measurements described in Paragraph 2.2.c.(3)(d)5. in the other antenna configurations in each power mode for at least nine individual fixed frequencies (i.e., 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz).

8. In Combat mode, into the PW monitor, replace a series of 33 contiguous pulses with pulses having the equivalent test pulse envelope established in Paragraph 2.2.c.(3)(d)4. Decrease the width until the Terminal reports an EPF fault, maintaining the test pulse shape established in Paragraph 2.2.c.(3)(d)4. (i.e., same rise and fall time as a normally transmitted pulse). At the voltage amplitude for which the Terminal measures PW, 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 6.08 µs. A 50 ns tolerance is allowed for these measurements.

9. Perform the measurements described in Paragraph 2.2.c.(3)(d)8. in all power modes using one antenna configuration.

10. Perform the measurements described in Paragraph 2.2.c.(3)(d)8. in the other antenna configurations in each power mode for at least nine individual fixed frequencies (i.e., 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz).

(e) Approach to Objective 6: PW Measurement Dynamic Range.

1. Initialize the Terminal to operate on a single fixed frequency of 969 MHz (Channel 0). In Combat mode, into the PW monitor, replace a series of 33 contiguous pulses with pulses having the equivalent test pulse envelope and width established in Paragraphs 2.2.c.(3)(d)4. and 2.2.c.(3)(d)8. Decrease the level of the externally generated pulses until the PW monitor reports an OOB event and record the value. Verify that the difference between the original signal level and that at which a zero PW is reported is at least 8 dB. Repeat for at least eight other frequencies (e.g., 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz). The measured levels will be used as the baseline for the test in Paragraph 2.2.c.(3)(e)2.

2. Increase the power by 1 dB (decrease the attenuator by 1 dB) from the levels determined in 2.2.c.(3)(e)1. Measure narrow and wide PW limits using the same methodology described in Paragraphs 2.2.c.(3)(d)5. and 2.2.c.(3)(d)8. in one antenna configuration. Ensure that the narrow PW limits are no less than 6.08 µs and the wide PW limits are no more than 6.72 µs. A 50 ns tolerance is allowed for these measurements. Perform the test for at least nine individual fixed frequencies (i.e., 969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz) using the respective baseline levels established for those channels in Paragraph 2.2.c.(3)(e)1.

3. Perform the tests described in Paragraphs 2.2.c.(3)(e)1. and 2.2.c.(3)(e)2. in all power modes.

(4) UUAC.

The UUAC function monitors the transmission of authorized and unauthorized Link 16 carrier frequencies and ensures that the authorized frequencies are hopping uniformly.

(a) Objectives.

The tests shall verify:

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 when operating in Full EMC Protection and Exercise modes. Verify that transmissions are not inhibited in Combat mode. Verify that the data storage log non-volatile memory is not filled up as a result of the histogram faults.

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 when operating in Full EMC Protection and Exercise modes. Verify that transmissions are not inhibited in Combat mode.

3. Objective 3. That the Terminal generates an EPF Fault Report when two or more pulses in a time slot are detected to be OOB. Verify that following the second EPF Fault Report, the Terminal stops transmitting before the next time slot when operating in Full EMC Protection and Exercise modes. Verify that transmissions are not inhibited in Combat mode.

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

5. Objective 5. That the frequency detection monitor accurately detects pulses throughout the dynamic range and acceptable PW of the monitor.

(b) Approach to Objective 1: Long-Term and Short-Term Histogram Fault Detection.

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. Perform the test with frequencies remapped. Use combinations of one, seven, and fourteen frequencies remapped.

2. Transmit pulse sequences with one authorized carrier frequency not used. Select Full EMC Protection mode. Verify that a long-term frequency histogram fault is reported after four frequency measurement blocks occur, an EPF fault is reported, and the Terminal ceases transmission before the next time slot after the second long-term frequency histogram fault.

3. Repeat Paragraph 2.2.c.(4)(b)2. using these pulse sequences:

a. Pulse sequences with one authorized carrier frequency used once in the message preamble.

b. Pulse sequences having too many occurrences of one authorized carrier frequency.

c. Pulse sequences having too many occurrences of three authorized carrier frequencies.

4. Transmit pulse sequences having too many occurrences of one authorized carrier frequency and too few occurrences of three authorized carrier frequencies. Select 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.

5. Repeat Paragraph 2.2.c.(4)(b)4. using pulse sequences having too many occurrences of four authorized carrier frequencies.

6. Repeat Paragraph 2.2.c.(4)(b)4. using pulse sequences having too few occurrences of four authorized carrier frequencies.

7. Repeat the tests in Paragraphs 2.2.c.(4)(b)2. through 2.2.c.(4)(b)6. using Exercise mode. Repeat the tests in in Paragraphs 2.2.c.(4)(b)2. through 2.2.c.(4)(b)6. in Combat

mode. Verify that when in Combat mode, that while EPF faults are reported, transmissions are not inhibited.

8. Perform the tests in Paragraphs 2.2.c.(4)(b)2. through 2.2.c.(4)(b)6. with frequencies remapped using Full EMC Protection mode. Use combinations of one, seven, and 14 frequencies remapped.

9. Repeat Paragraph 2.2.c.(4)(b)2. by setting the Link 16 suppression signal high during the time period of the second thru fourth pulses of each time slot. Observe no change in the result (i.e., observe long-term histogram fault).

10. Paragraphs 2.2.c.(4)(b)9. shall be performed in the highest power mode not to exceed 200 W and in a single antenna mode in Full EMC Protection and Exercise EMC Protection modes. Also, perform in Combat mode and verify that the Terminal reports EPF faults, but does not inhibit transmissions.

11. Repeat Paragraph 2.2.c.(4)(b)4. by setting the Link 16 suppression signal high during the time period of the second thru fourth pulses of each time slot. Observe no change in the result (i.e. observe short term histogram fault).

12. After completion of one of Combat mode tests in 2.2.c.(4)(b)7., inspect the long-term histogram faults logged into the non-volatile memory. Verify that the data storage memory is not filled up as a result of the long-term histogram faults.

13. After completion of one of Combat mode tests in 2.2.c.(4)(b)7., inspect the short-term histogram faults logged into the non-volatile memory. Verify that the data storage memory is not filled up as a result of the short-term histogram faults.

(c) Approach to Objective 2: High-Level 1030/1090 MHz Fault Detection.

1. 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.

2. 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.

3. Repeat Paragraphs 2.2.c.(4)(c)1. and 2.2.c.(4)(c)2. in Exercise EMC Protection and Combat modes. Verify that when the Terminal is in Combat mode that it reports EPF faults resulting from the high-level 1030/1090 MHz frequency faults, but that it does not inhibit transmissions.

4. Repeat Paragraph 2.2.c.(4)(c)3. while setting the Link 16 transmission pulse suppression signal high after the substitution of the two 1030 MHz CW pulses. Observe two EPF faults and the cessation of transmissions. Capture data images that indicate the timing of the injected pulses and the suppression signal and superimpose the detected transmitted pulses. Repeat using LLD suppression signals instead of pulse suppression signals.

(d) Approach to Objective 3: OOB Fault Detection.

1. 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 OOB 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.

2. Repeat Paragraph 2.2.c.(4)(d)1. substituting any two normally transmitted pulses with two pulsed CW pulses at 1022.6 MHz per time slot in the frequency detection monitor.

3. Repeat Paragraph 2.2.c.(4)(d)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.

4. Initialize the Terminal to remap 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 OOB 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.

5. Repeat Paragraphs 2.2.c.(4)(d)1. through 2.2.c.(4)(d)4. in Exercise EMC Protection and Combat modes. Verify that when the Terminal is in Combat mode that it reports EPF faults resulting from the OOB faults, but that it does not inhibit transmissions.

6. Repeat Paragraph 2.2.c.(4)(d)1. while setting the Link 16 transmission pulse suppression signal high after the substitution of the two 966.6 MHz CW pulses. Observe two OOB EPF faults and the cessation of transmissions. Capture data images that indicate the timing of the injected pulses and the suppression signal and superimpose the detected transmitted pulses. Repeat using LLD suppression signals instead of pulse suppression signals.

7. Repeat Paragraph 2.2.c.(4)(d)1. while setting the Link 16 transmission pulse suppression signal high before the substitution of the two 966.6 MHz CW pulses. Observe two OOB EPF faults and the cessation of transmissions. Capture data images that indicate the timing of the injected pulses and the suppression signal and superimpose the detected transmitted pulses. Repeat using LLD suppression signals instead of pulse suppression signals.

8. Paragraphs 2.2.c.(4)(d)1. through 2.2.c.(4)(d)5. shall be performed in the highest power mode not to exceed 200 W and in a single antenna mode. Paragraphs 2.2.c.(4)(d)6. and 2.2.c.(4)(d)7. shall be performed in the highest power mode not to exceed 200 W and in a single antenna mode in Full EMC Protection and Exercise EMC Protection modes.

Also, perform in Combat mode and verify that the Terminal reports EPF faults, but does not inhibit transmissions. Repeat using LLD suppression signals instead of pulse suppression signals.

(e) Approach to Objective 4: Band Edges and 1030 MHz and 1090 MHz Transition Frequency.

1. In Combat mode, substitute any two normally transmitted pulses with two pulses (CPSM) at 969 MHz per time slot with an amplitude at nominal power level. Decrease the frequency of the substituted pulses until an OOB fault occurs. Record the transition frequency and verify that the value is not less than 967 MHz -200 kHz.

2. In Combat mode, substitute any two normally transmitted pulses with two 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 OOB fault occurs. Record the transition frequency and verify that the value is not more than 1010 MHz + 200 kHz.

3. In Combat mode, inject two 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 OOB fault occurs. Record the transition frequency and verify that the value is not less than 1051 MHz – 200 kHz.

4. In Combat mode, inject two 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 OOB fault occurs. Record the transition frequency and verify that the value is not more than 1067 MHz + 200 kHz.

5. In Combat mode, inject two 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 OOB fault occurs. Record the transition frequency and verify that the value is not less than 1111 MHz – 200 kHz.

6. In Combat mode, inject two pulses (CPSM at 1206 MHz per time slot with an amplitude at nominal power level. Increase the frequency of the injected pulses until an OOB fault occurs. Record the transition frequency and verify that the value is not more than 1208 MHz + 200 kHz.

7. In Combat mode, inject two 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 OOB faults. Record the transition frequency and verify that the value is not less than 1023 MHz – 200 kHz.

8. Repeat Paragraph 2.2.c.(4)(e)7. but slowly increase the frequency of the pulses. Record and verify that the transition frequency is not more than 1037 MHz + 200 kHz.

9. Repeat Paragraphs 2.2.c.(4)(e)7. and 2.2.c.(4)(e)8. injecting two 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.

10. Repeat Paragraphs 2.2.c.(4)(e)1. through 2.2.c.(4)(e)9. in all power modes.

(f) Approach to Objective 5: Frequency Detection Dynamic Range.

1. In 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 OOB 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 OOB fault. Verify that the difference is at least 8 dB. Increase the power level 1 dB, and repeat tests in Paragraphs 2.2.c.(4)(e)7. through 2.2.c.(4)(e)9. Verify that the transition frequencies are within the required frequency limits.

2. In Combat mode, substitute any two normally transmitted pulses with two pulsed CW pulses at 969 MHz per time slot with an amplitude of nominal power level and nominal width. Verify no indications of frequency faults. Decrease the amplitude of the injected pulses until there are indications of an OOB frequency fault. Increase the power level 1 dB and verify that the 969 MHz transition frequency is within the required frequency limits (no less than 966.8 MHz and no greater than 967.2 MHz). Reduce the PW until there is an indication of an OOB frequency fault. Increase the PW by 50 ns and verify that the 969 MHz transition frequencies are within the required frequency limits. Repeat by injecting 1030 MHz, 1090 MHz, and 1206 MHz CW pulses.

3. In 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 width. Verify the indications of high-level 1030/1090 MHz EPF Fault Reports. Reduce the width of the injected pulses until an OOB fault is indicated. Verify that the high-level 1030/1090 MHz frequency fault does not disappear until the OOB fault is indicated. Continue to reduce the width of the injected pulses and verify that the OOB faults continue to be reported without ever indicating authorized carriers.

4. In Combat mode, inject/simulate two CPSM pulses at 1176 MHz at the nominal level and notice that no frequency faults are indicated. Reduce the power of the injected pulses until an OOB fault is indicated. Record the difference between the nominal power level and the level at which an OOB fault is declared. Verify that the difference is at least 8 dB.

5. Perform Paragraphs 2.2.c.(4)(f)1. through 2.2.c.(4)(f)4. in all power modes and in one antenna mode.

6. Initialize the Terminal to remap one frequency. In the combat mode, inject two pulses at the frequency required to be remapped per time slot with amplitude set at the same level as determined in Paragraph 2.2.c.4(f)1. and nominal width. Verify the indication of out of band faults.

(5) OP Monitoring Function Assessment.

Link 16 Terminals measure the output RF signal strength for every commanded power level and report when signal limits are exceeded.

(a) Objectives.

Tests shall verify:

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.

2. Objective 2. That the Terminal with high power capability processes a platform dependent variable parameter (VP) that instructs it to either allow or disallow modes with nominal power levels greater than 200 W + 1 dB transmissions by an internal amplifier or EPA. Verify that in Full EMC Protection mode, if the VP is set to not allow power levels greater than 200 W + 1 dB, the Terminal will not allow high power transmissions. Verify that in Exercise and Combat modes, the Terminal disregards the VP.

3. Objective 3. That the Terminal incorporates a peak power monitor. If 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 W) of five or more Link 16 transmitted pulses in a time slot is more than 200 W + 2.0 dB.

(b) Approach to Objective 1: Output Power Level Measurements.

1. With the Terminal transmitting on a single frequency, measure and record the Terminal output power level at each antenna port. The measured output power level is defined as the instantaneous peak power across the top of the pulse[8]. Verify that the sum of the measured power levels from all antenna ports is no greater than + 1 dB of the selected power level.

2. Perform Paragraph 2.2.c.(5)(b)1. on each of the 51 frequency channels for each power mode and in all antenna configurations.

(c) Approach to Objective 2: High Power Transmissions VP.

1. Initialize the Terminal in Full EMC Protection mode and with the VP 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 OP monitor. Verify that the Terminal generates EPF Fault Reports and inhibits Link 16 transmissions. Switch the EMC Protection mode to operate in Exercise EMC Protection mode. Initialize the Terminal to transmit time slots in a power mode with a nominal power level stronger than 200 W + 1 dB. Verify that no EPF

[8] The recommended sample rate would be one sample per 200 ns, which is the chip rate. That would require 32 over 6.4 µs and 27 for a 5.4 µs period.

Fault Reports are generated and that the Terminal does not inhibit Link 16 transmissions. Switch the EMC Protection mode to Combat mode and to transmit time slots in the high power mode. Verify that no EPF Fault Reports are generated and that the Terminal does not inhibit Link 16 transmissions.

2. Initialize the Terminal in Full EMC Protection mode and with the VP set to allow high power transmissions. Initialize the Terminal to transmit time slots in a power mode with a nominal power level stronger than 200 W + 1 dB. Verify that the Terminal transmits in this 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 OP monitor that will produce OP faults. Verify that the Terminal generates EPF faults and inhibits Link 16 transmissions. Initialize the Terminal in Exercise EMC Protection mode and with the VP set to allow high power transmissions. Initialize the Terminal to transmit time slots in a power mode with a nominal power level stronger than 200 W + 1 dB. Verify that the Terminal transmits in this 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 OP monitor that will produce OP faults. Verify that the Terminal generates EPF faults and inhibits Link 16 transmissions.

3. If an OP monitor is also incorporated in an EPA, repeat the tests in Paragraphs 2.2.c.(5)(c)1. and 2.2.c.(5)(c)2. with the Link 16 EPA configuration.

(d) Approach to Objective 3: OP Monitor Threshold and Algorithm.

1. Initialize the Terminal to transmit time slots in a power mode nominally no stronger than 200 W in Combat mode with a SW load that allows high power transmissions. Increase the power level of five injected CPSM pulses per time slot into the OP 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 W + 2 dB. If the OP monitor threshold was adjusted to simulate the OP condition, show that the adjusted threshold is detecting pulses equivalent to 200 W + 2 dB or less.[9] Initialize the Terminal to operate in 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. Initialize the Terminal to operate in Full 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.

2. Perform Paragraph 2.2.c.(5)(d)1. in all antenna configurations and in all power modes. If there are additional OP monitor thresholds, then the tests in Paragraph 2.2.c.(5)(d)1. shall be repeated with those thresholds in all antenna configurations and in all power modes.

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[9] If Mode 1 is utilized, use a method that ensures that all 51 frequencies contribute sufficiently to the measurement (e.g., take the measurement using five injected pulses within more than 50 time slots). If Mode 2 is utilized, then for each power mode in one antenna mode, all 51 frequencies shall be tested. For the other antenna modes in each power mode, at least nine individual fixed frequencies (969, 990, 1008, 1053, 1065, 1113, 1146, 1176, and 1206 MHz) shall be tested.

3. Inject five CPSM pulses above the adjusted threshold found in Paragraph 2.2. c.(5)(d)1. and in Full EMC Protection mode, set the Link 16 pulse suppression signal high at some point in the remaining transmission time frame of each time slot. Observe two OP monitor EPF faults and the cessation of transmissions. Repeat using LLD suppression signals instead of pulse suppression signals.

4. In Full EMC Protection mode, set the Link 16 suppression signal high during the time period of the first three pulses of each time slot immediately followed by the injection (starting in the next 13 µs pulse transmission interval of those time slots) of five CPSM pulses above the adjusted threshold found in Paragraph 2.2.c.(5)(d)1. Observe two OP monitor EPF faults and the cessation of transmissions. Repeat using LLD suppression signals instead of pulse suppression signals.

5. Paragraphs 2.2.c.(5)(d)3. and 2.2.c.(5)(d)4. shall be performed in the highest power mode not to exceed 200 W and in a single antenna mode in Full EMC Protection and Exercise EMC Protection modes. Also, perform in Combat mode and verify that the Terminal reports EPF faults, but does not inhibit transmissions.

(6) TSDF Monitoring Function Assessment.

The Terminal counts the number of commanded Link 16 pulses in a 12-second frame. At least one of the TSDF algorithm tests shall be performed with the operational SW load.

(a) Objectives.

Tests shall verify:

1. Objective 1. That the Terminal processes a platform dependent VP that sets the maximum number of pulses it can transmit in a 12-second frame. 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 platform dependent VP.

2. Objective 2. That the transmission inhibit is cleared automatically at the end of the 12-second frame. Verify the Terminal prevents the operator from resetting transmission inhibit prior to the end of the 12-second frame.

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

4. Objective 4. That the Terminal does not inhibit transmissions when in Exercise EMC Protection and Combat modes.

(b) Approaches to Objectives 1 and 2: TSDF Count and Inhibit.

1. With the Terminal operating in normal output power and in Full EMC Protection mode, and the platform dependent VP set to the default operational TSDF limit,

initialize the Terminal to transmit with slots distributed over 12-second frame. Use a message format that will produce 258 pulses per time slot. Record the number of pulses (or time slots with 258 pulses) transmitted and verify that the Terminal counts all the pulses during each 12-second frame.

2. With the Terminal operating in normal output power and in Full EMC Protection mode, and the VP set to the default operational TSDF limit, initialize the Terminal to transmit above the operational default TSDF limit over a 12-second frame that contains 258 pulses per time slot. A distribution of slots should be used that allows the IPF reset in Paragraph 2.2.c.(6)(b)5. to be performed more easily and has a set of three to five consecutive slots at the limit to show that the Terminal inhibits immediately after the slot where the TSDF limit is reached.

3. Verify that transmissions are inhibited after the correct number of pulses or slots (TSDF limit) is reached. Ensure that the Terminal does not transmit beyond that. It is permissible for the Terminal to finish transmitting the slot in which the TSDF limit is reached.

4. Verify that the transmissions resume at the end of the 12-second frame.

5. Attempt to perform an IPF reset before the end of the 12-second frame and verify that it is unsuccessful.

6. Repeat Paragraphs 2.2.c.(6)(b)2. through 2.2.c.(6)(b)5. using a message format with 444 pulses per time slot. Verify that transmissions are inhibited after the TSDF limit is reached in the 12-second frame.

7. With the Terminal operating in normal output power and in Full EMC Protection mode, and the VP set for a TSDF limit that is different than the default operational TSDF limit, initialize the Terminal to transmit the time slots distributed over a 12-second frame. Use a message format that will produce 258 pulses per time slot. Record the number of pulses or slots transmitted and verify that the Terminal counts all the pulses during each 12-second frame. It is permissible for the rest of the slot to be transmitted in which the TSDF limit is reached.

8. With the Terminal operating in normal output power and in Full EMC Feature Protection mode, and the VP set for a TSDF limit used in Paragraph 2.2.c.(6)(b)7., initialize the Terminal to transmit above the TSDF limit used in Paragraph 2.2.c.(6)(b)7. over a 12-second frame using a message format that contains 258 pulses per time slot. A distribution of slots should be used that allows the IPF reset in Paragraph 2.2.c.(6)(b)11. to be performed more easily and has a set of three to five consecutive slots at the limit to show that the Terminal inhibits immediately after the slot where the TSDF limit is reached. It is permissible for the rest of the slot to be transmitted in which the TSDF limit is reached.

9. Verify that transmissions are inhibited when the correct number of pulses or slots (TSDF limit) is reached in the 12-second frame. It is permissible to finish transmitting the slot in which the TSDF limit is reached but shall inhibit transmissions immediately after that slot completes.

10. Verify that the transmissions resume after the end of the 12-second frame.

11. Attempt to perform an IPF reset before the end of the 12-second frame and verify that it is unsuccessful.

12. Repeat Paragraphs 2.2.c.(6)(b)8. through 2.2.c.(6)(b)11. using a message format with 444 pulses per time slot. Verify that transmissions are inhibited when the TSDF limit is reached in the 12-second frame. It is permissible to finish transmitting the slot in which the TSDF limit is reached but should inhibit transmissions immediately after that slot completes.

(c) Approach to Objective 3: Zero Pulse Detection.

With the Terminal operating at normal power and in Full EMC Protection mode, initialize the Terminal to transmit in a message structure resulting in 258 pulses per time slot. Blank a pulse and suppress 10 pulse transmission commands in the transmission message. Verify that the Terminal increments the total pulse count to equal 248. Repeat in Exercise and Combat modes.

(d) Approach to Objective 4: Exercise EMC Feature Protection and Combat Modes.

1. With the Terminal operating at normal power and in Exercise EMC Feature Protection mode, with the VP set to the same TSDF used in Paragraph 2.2.c.6.(b)7., initialize the Terminal to transmit with the initialization load used in Paragraph 2.2.c.6.(b)8. with slots distributed over a 12-second frame using a message format that contains 258 pulses per time slot.

2. Verify that the Terminal does not inhibit transmissions.

3. With the Terminal operating in Combat mode, initialize the Terminal to transmit with the TSDF chosen in Paragraph 2.2.c.6.(b)8. with the time slots distributed over a 12-second frame using a message format that contains 258 pulses per time slot.

4. Verify that the Terminal does not inhibit transmissions.

(7) Message Structure Control Verification.

Link 16 Terminals are commanded to allow or disallow selectable Link 16 message structures. A second Test Terminal (TT) shall be required for the RTT-B testing.

(a) Objectives.

Tests shall verify:

1. Objective 1. That the Terminal, when operating in a Full EMC Protection mode, processes a variable or adaptable parameter (AP) instructing it to allow or disallow any selectable limit for Link 16 message structure up to a limit of 444 pulses per time slot.

2. Objective 2. That the Terminal, when operating in Full EMC Protection mode, processes a VP or AP instructing it to allow RTT-B transmission from zero to eight time slots in a 12-second frame.

3. Objective 3. That the Terminal, when operating in Full EMC Protection mode, processes an AP to either disallow or allow RTT-B transmissions.

4. Objective 4. That the Terminal, when operating in Exercise 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.

(b) Approach to Objective 1: Message Structure Pulses per Time Slot Control.

1. Initialize the Terminal in a Full EMC Protection mode at normal power. Set the message structure variable or AP 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 and transmits 258 pulse time slots.

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 transmits 258 pulses per time slot instead of the 444 pulse time slot assignments (TSAs).

3. Set the message structure variable or AP 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 the use of these messages and transmits time slots with 444 pulses.

(c) Approach to Objective 2: RTT-B Control.

At least one of the RTT algorithm tests shall be performed with the operational SW load.

1. Set the RTT-B VP or AP to three. Initialize the Terminal in Full EMC Protection mode and normal power mode with TSA(s) specifying a recurrence rate and contention access rate that results in three RTT-B transmissions per 12-second frame. Verify that three RTT-B transmissions per 12-second frame are allowed.

2. Initialize the Terminal with TSA(s) specifying a recurrence rate and contention access rate that would result in six RTT-B transmissions per 12-second frame if not for the VP setting of three. Verify that the Terminal does not transmit more than three RTT-B messages per 12-second frame.

3. Set the RTT-B VP or AP to 6. Initialize the Terminal with TSA(s) specifying a recurrence rate and contention access rate that results in six RTT-B transmissions per 12-second frame. Verify that six RTT-B transmissions per 12-second frame are allowed.

(d) Approach to Objective 3: Allow or Disallow RTT-B Messages.

1. Set the RTT-B variable or AP to 3 and initialize the Terminal at normal power mode in Full EMC Protection mode with the “Allow” or “Disallow” RTT-B AP set to allow RTT-B transmission time slots. Initialize the Terminal with a load specifying a recurrence rate and TSAs that will result in three RTT-B transmit TSAs in 12 seconds. Verify that three RTT-B transmissions in 12 seconds are allowed and transmit.

2. Set the RTT-B variable or AP to three and initialize the Terminal with the “Allow” or “Disallow” RTT-B AP set to disallow RTT-B transmissions. Initialize the Terminal with a load specifying a recurrence rate and TSAs that will result in three RTT-B transmit TSAs in 12 seconds. Verify that these TSAs are rejected and that there are no RTT-B transmissions allowed.

(e) Approach to Objective 4: Exercise EMC Protection and Combat Modes.

1. Initialize the Terminal in Exercise EMC Protection mode at normal power. Repeat the steps contained in Paragraphs 2.2.c.(7)(b) through 2.2.c.(7)(d). 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.

2. Initialize the Terminal in Combat mode at normal power. Repeat the steps contained in Paragraphs 2.2.c.(7)(b) through 2.2.c.(7)(d). 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.

(8) Net Usage Control Assessment.

Link 16 Terminals determine which TSAs are to be rejected. A second TT shall be used for verifying the proper net number of the Terminal Under Test (TUT) message transmissions.

(a) Objectives.

Tests shall verify:

1. Objective 1. That the Terminal, while operating in a Full EMC Protection mode, processes a variable or an AP that determines which transmit TSAs are rejected on the basis of the net number included in the assignment.

2. Objective 2. That the Terminal, while operating in Exercise EMC Protection and Combat modes, does not reject any TSAs based on net number.

(b) Approach to Objective 1: Net Number Control.

1. Initialize the Terminal in a Full EMC Protection mode at normal power with the variable or AP set to one and all TSAs set to either net 0 or net 1. Verify that all TSAs are allowed and transmitted.

2. Reinitialize the Terminal with some TSAs set to net 2, net 3, and net 126. Verify that these TSAs are rejected.

3. Initialize the Terminal in Full EMC Protection mode at Normal power with the variable or AP set to three and with a voice, control or non-command and control (C2) participation group (PG) TSA set to 127. Verify that when the operator selected net number is between 0 and 3 the PG transmits messages on the net number. Verify that when the operator chooses a net between 4 and 126, that the change is rejected and the Terminal continues to transmit on the existing valid net number and TSAs set to either net 0, net 1, net 2, and net 3. Verify that all TSAs are allowed and transmitted.

(c) Approach to Objective 2: Exercise EMC Protection and Combat Modes.

1. Repeat the tests in Paragraph 2.2.c.(8)(b) with the Terminal initialized in Exercise EMC Protection mode. Verify that TSAs are not rejected on the basis of net number and that all of the messages in these time slots transmit.

2. Repeat the tests in Paragraph 2.2.c.(8)(b) with the Terminal initialized in Combat mode. Verify that TSAs are not rejected on the basis of net number and that all of the messages in these time slots transmit.

(9) Conditional Paired Slot Relay (CPSR) and Repromulgation Relay Controls Verification.

Link 16 Terminals are commanded to accept or reject CPSR, repromulgation relay, and enhanced repromulgation relay TSAs. A second TT shall be used for test performance and the verification of the proper actions of the TUT.

(a) Objectives.

Tests shall verify:

1. Objective 1. That the Terminal, while operating in Full EMC Protection mode, processes a variable or an AP that either allows or rejects CPSR TSAs.

2. Objective 2. That the Terminal, while operating in Full EMC Protection mode, will accept suspended and unconditional paired slot relay (PSR) assignments and that it will not inhibit unconditional PSR assignments.

3. Objective 3. That the Terminal, while operating in Full EMC Protection mode, processes a variable or an AP that allows or disallows repromulgation relay time slot transmissions. If the VP or AP is set to disallow, the only time slots that could result in repromulgation relay transmissions will either be restricted to only originate messages or be inactive.

4. Objective 4. That the Terminal, while operating in Exercise EMC Protection and Combat modes, does not reject any CPSR or repromulgation relay TSAs.

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 eight times in a row.

6. Objective 6. That the Terminal performs a "loopback" Operational BIT (OBIT) check that compares the actual jitter delay of the transmitted message with the calculated jitter delay value.

(b) Approach to Objective 1: CPSR Time Slot Control.

1. Initialize the Terminal in a Full EMC Protection mode at normal power with the CPSR variable or AP set to allow and with CPSR transmission TSAs 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 to provide a request for the relay of time slot messages.

2. Initialize the Terminal with the CPSR variable or AP set to disallow and with CPSR transmission TSAs 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.

(c) Approach to Objective 2: Suspended and Unconditional PSR Time Slots.

Initialize the Terminal in a Full EMC Protection mode at normal power with the CPSR variable or AP set to disallow and with both suspended and unconditional PSR transmission TSAs as part of the initialization load. Verify that the Terminal accepts suspended PSR assignments and that it accepts and allows transmissions of unconditional PSR time slot messages. Attempt to change the suspended or unconditional PSR TSA to CPSR. Verify that the Terminal rejects these assignments and does not transmit the messages in these relay time slots.

(d) Approach to Objective 3: Repromulgation Relay Time Slot Control.

1. Initialize the Terminal in a Full EMC Protection mode at normal power with the repromulgation relay variable or AP set to disallow and with repromulgation relay TSAs set to relay only as part of the initialization load. Verify that the Terminal does not transmit these TSAs and that it does not relay repromulgation relay message transmissions initiated from another Terminal. Repeat the test with the repromulgation relay TSA set to originate and relay. Verify that the Terminal does not relay repromulgation relay message transmissions initiated from another Terminal. Verify that the Terminal transmits repromulgation relay messages that it originates. These tests are usually performed with another Terminal that initiates or relays transmissions to or from the Terminal being tested.

2. Initialize the Terminal in a Full EMC Protection mode at normal power with the repromulgation relay variable or AP set to allow and with repromulgation relay assignments set to relay only as part of the initialization load. Verify that the Terminal accepts these TSAs and that it transmits repromulgation relay message transmissions initiated from another Terminal. Repeat this test with the repromulgation relay assignments set to originate and relay. Verify that the Terminal accepts these TSAs and that it transmits repromulgation relay message transmissions initiated from another Terminal. Verify that the Terminal transmits

repromulgation relay messages that it originates repromulgation. This test is usually performed with another Terminal that initiates or relays transmissions to or from the Terminal being tested.

(e) Approach to Objective 4: Exercise EMC Protection and Combat Modes.

1. Repeat the tests in Paragraphs 2.2.c.(9)(b) through 2.2.c.(9)(d) with the Terminal initialized in Exercise EMC Protection mode. Verify that the Terminal accepts the TSAs and does not inhibit the transmissions of CPSR and relays repromulgation relay messages.

2. Repeat the tests in Paragraphs 2.2.c.(9)(b) through 2.2.c.(9)(d) with the Terminal initialized in Combat mode. Verify that the Terminal accepts the TSAs and does not inhibit the transmissions of CPSR and relays repromulgation relay messages.

(f) Approach to Objective 5: Repromulgation Relay Jitter Delay and Jitter Delay OBIT.

1. Initialize the Terminal in a Full EMC Protection mode at normal power with the repromulgation relay variable or AP set to allow and with repromulgation relay assignments set to originate or relay as part of the initialization load. Record for sufficient duration of time the jitter delay interval during both Terminal originated repromulgation relay message transmissions and those that it relays from another Terminal. Ensure that the interval between random jitter delays for the time slot messages are a minimum of 10 µs with at least 8 different intervals chosen. A +/- 450 ns tolerance is allowed.

2. Use a SW load that holds the calculated repromulgation relay jitter delay constant.

3. Apply power to the Terminal and initialize it and another TT in Full EMC Protection mode. Initialize the TT with at least 24 originate message repromulgation relay TSAs in 12 seconds that will initiate a corresponding number of repromulgation relay messages from the TUT in 12 seconds.

4. Using the TT as the repromulgation message originator, command the Terminal to repromulgation relay in every other time slot during the 24 TSA set. Do this by assigning 48 time slots per 12 seconds to a PG to the TT. Instruct the TUT to relay the messages it receives from the TT in that PG.

5. Verify that the Terminal does not repromulgation relay after the 16^{th} TSA (i.e., it repromulgates eight consecutive messages and inhibits repromulgation relay transmissions when the 9^{th} repromulgation relay message that has the same calculated jitter delay).

6. Use a SW load that holds the jitter delay constant for only the first 11 repromulgation relay transmissions.

7. Using the TT, command the Terminal to repromulgation relay in every other time slot during the 24 TSA set.

8. Verify that the Terminal does not repromulgation relay after the 16th TSA, but that it starts repromulgation relay message transmissions again during the 24th repromulgation relay TSA.

9. Repeat Paragraphs 2.2.c.(9)(f)1. through 2.2.c.(9)(f)8. with the Terminal in Exercise EMC Protection mode.

(g) Approach to Objective 6: Repromulgation Relay Loopback OBIT.

1. Use a SW load with a known progression of calculated repromulgation relay jitter delays.

2. Apply power to the Terminal and initialize it in a Full EMC Protection mode at normal power with at least 24 repromulgation relay TSAs that are assigned to the TT which initiates repromulgation messages.

3. Using the TT as a repromulgation message initiator (usually a second Terminal), command the Terminal to repromulgation relay in every other time slot during the 24 TSA set.

4. Replace the first three 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 1 µs. Measure and record the replacement jitter delays and the resulting pulse train (showing the jitter delay).

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.

6. Repeat Paragraphs 2.2.c.(9)(g)1. through 2.2.c.(9)(g)5. in Exercise EMC Protection mode.

(10) Access Mode Controls Verification.

Link 16 Terminals are commanded to accept or reject transmit TSAs that result in machine-controlled contention access mode and non-centralized time slot reallocation (TSR) transmissions. A second TT may be required for test performance.

(a) Objectives.

Tests shall verify:

1. Objective 1. That the Terminal, while operating in a Full EMC Protection mode, processes a variable or an AP that instructs it either to accept or reject transmit TSAs that result in machine-controlled contention access mode transmissions.

2. Objective 2. That the Terminal, while operating in a Full EMC Protection mode, processes a variable or AP that instructs it either to accept or reject transmit non-centralized TSR TSAs.

3. Objective 3. That the Terminal accepts centralized TSR TSAs and that messages in these time slots transmit.

4. Objective 4. That the Terminal, while operating in Exercise EMC Protection and Combat modes, accepts machine-controlled contention TSAs and non-centralized TSR TSAs, and that messages in these TSAs transmit.

(b) Approach to Objective 1: Machine-Controlled Contention Access Control Verification.

1. Set the machine-controlled contention access variable or AP to disallow contention. Initialize the Terminal in a Full EMC Protection mode at normal power with precise participant location and identification – broadcast (PPLI-B) TSAs set in the contention access mode. Verify that the Terminal processes the variable or AP, rejects these TSAs and that PPLI-B messages in these assignments are not transmitted.

2. Initialize the Terminal in a Full EMC Protection mode at normal power with initial network entry (INE) TSAs. Verify that the Terminal accepts these TSAs and that messages in these time slots transmit.

3. Initialize the Terminal in a Full EMC Protection mode at normal power with Fighter-to-Fighter message TSAs. Verify that the Terminal rejects these TSAs and that messages in these time slots are not transmitted.

4. Set the machine-controlled contention access variable or AP to allow contention. Initialize the Terminal in a Full EMC Protection mode at normal power with PPLI-B, INE, and Fighter-to-Fighter TSAs set in the contention access mode. Verify that the Terminal processes this variable or AP, accepts the TSAs, and that the messages in these time slots transmit.

(c) Approach to Objective 2: TSR Control Verification.

1. Set the non-centralized TSR variable or AP to disallow non-centralized TSR transmissions. Initialize the Terminal in a Full EMC Protection mode at normal power to operate in a non-centralized TSR pool. Verify that the Terminal processes this variable or AP, rejects these TSAs, and that non-centralized TSR messages in these assignments are not transmitted.

2. Set the non-centralized TSR variable or AP to allow non-centralized TSR transmissions. Initialize the Terminal in a Full EMC Protection mode at normal power with non-centralized TSR TSAs. Verify that the Terminal processes this variable or AP, accepts the TSAs, and the messages in these time slots transmit.

(d) Approach to Objective 3: Centralized TSR Control Verification.

Initialize the Terminal in a Full EMC Protection mode at normal power with centralized TSR TSAs. Set the non-centralized TSR variable or AP to disallow non-centralized TSR transmissions. Verify that the Terminal accepts the centralized TSR TSAs and the messages in these time slots transmit.

(e) Approach to Objective 4: Exercise EMC Protection and Combat Modes.

1. Repeat the tests in Paragraph 2.2.c.(10)(b) with the Terminal initialized in Exercise EMC Protection mode at normal power. Verify that machine-controlled contention access TSAs are accepted and that messages in these time slots transmit.

2. Repeat the tests in Paragraph 2.2.c.(10)(b) with the Terminal initialized at normal power in Combat mode. Verify that machine-controlled contention access TSAs are accepted and that messages in these time slots transmit.

3. Repeat the tests in Paragraph 2.2.c.(10)(c) with the Terminal initialized in Exercise EMC Protection mode at normal power. Verify that TSR TSAs are accepted and that messages in these time slots transmit.

4. Repeat the tests in Paragraph 2.2.c.(10)(c) with the Terminal initialized in Combat mode at normal power. Verify that TSR TSAs are accepted and that messages in these time slots transmit.

d. EMC Features BIT Verification.

(1) CTT OBIT.

Link 16 Terminals have an OBIT that continually verifies CTT monitor functionality.

(a) Objectives.

Tests shall verify:

1. Objective 1. That the CTT OBIT verifies proper operation of the CTT monitors of each stage during each 13 µs 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 µs when a Link 16 pulse is commanded and indicate the state of "Not-Capable-of-Transmitting" during the intervals between pulses and messages.

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

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 and inhibits transmissions after two EPF Fault Reports.

(b) Approach to Objective 1: CTT OBIT.

1. Initialize the Terminal to transmit at normal power and in a Full EMC Protection mode. During normal pulse transmissions, measure and record the output of each component CTT monitor.

2. Initialize the Terminal to transmit at normal power in Combat mode. Verify that each monitor indicates "CTT" (i.e., a parameter level greater than the monitor threshold) for at least a period of 2.5 µs during commanded pulse transmissions. Measure the threshold where the monitor indicates CTT during the pulse transmission. Compare this threshold with the CTT monitor threshold for non-transmission intervals. The CTT OBIT threshold should be the same as the CTT threshold. An exception to this requirement would be for monitors of amplifier stages that are bypassed in certain power modes of the Terminal. Suppressed pulses shall be treated as if they were not commanded. During the suppression interval, the CTT monitors shall indicate not CTT in at least the 2.5 µs during the period when a pulse was originally to transmit and during at least the 2.5 µs period when the pulse was not to transmit (i.e., between pulses). Verify that the Terminal reports that the monitors are operating properly when the OBIT is successful.

3. Repeat Paragraphs 2.2.d.(1)(b)1. through 2.2.d.(1)(b)2. in each power mode of the Terminal.

(c) Approach to Objective 2: CTT Event Declaration.

1. Induce a condition where during a single normal pulse transmission in Full EMC Protection mode at normal power, the output of the CTT monitor does not indicate "CTT." Verify that a CTT event is declared.

2. Repeat Paragraph 2.2.d.(1)(c)1. for each CTT monitor.

3. Repeat Paragraphs 2.2.d.(1)(c)1. and 2.2.d.(1)(c)2. in Exercise EMC Protection mode.

4. Repeat Paragraphs 2.2.d.(1)(c)1. and 2.2.d.(1)(c)2. in Combat mode.

(d) Approach to Objective 3: EPF Fault Declaration.

1. Verify that in Full EMC Protection mode at normal power after two CTT events (in two different 13 µs pulse periods only) in a time slot resulting from the failed OBIT, the Terminal generates an EPF Fault Report.

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 RFA, or the Terminal Link 16 waveform generation is isolated.

3. Repeat Paragraphs 2.2.d.(1)(d)1. and 2.2.d.(1)(d)2. for each CTT monitor.

4. Repeat Paragraphs 2.2.d.(1)(d)1. through 2.2.d.(1)(d)3. in Exercise EMC Protection mode.

5. Repeat Paragraphs 2.2.d.(1)(d)1. through 2.2.d.(1)(d)3. in 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.

6. Ensuring the Terminal is in Link 16 only mode of operation in Full EMC Protection mode, during one time slot, inject/simulate a CTT fault condition for one CTT monitor between pulses in one 13 µs pulse period and inject/simulate a CTT OBIT fault condition during a transmitted pulse in a different 13 µs pulse period. Record the injected fault conditions and verify that the CTT event count increases by two and that a CTT EPF fault is declared.

7. Repeat Paragraph 2.2.d.(1)(d)6. in Exercise EMC Protection mode.

8. Repeat Paragraph 2.2.d.(1)(d)6. in Combat mode.

9. Ensuring the Terminal is in Link 16 only mode of operation in Full EMC Protection mode, during one time slot in the same 13 µs pulse period, inject/simulate a CTT OBIT fault condition during a transmitted pulse and inject/simulate a CTT fault condition for one CTT monitor between pulses. Record the injected fault conditions and verify that the CTT event count increases by one and that a CTT EPF fault is not declared.

10. Repeat Paragraph 2.2.d.(1)(d)9. in Exercise EMC Protection mode.

11. Repeat Paragraph 2.2.d.(1)(d)9. in Combat mode.

12. Repeat Paragraph 2.2.d.(1)(d)6. by adding a Link 16 pulse suppression after the injected fault condition. Record the injected fault conditions and verify that the CTT event count increases by two and that a CTT EPF fault is declared. Repeat using LLD suppression instead of the Link 16 pulse suppression.

(2) 1030/1090 MHz LLD SBIT and IBIT Verifications.

Link 16 Terminals have a BIT function that verifies 1030/1090 MHz LLD monitor functionality during startup and during manually IBIT.

(a) Objectives.

Tests shall verify:

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.

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 -7 dBm.

3. Objective 3. That the Terminal provides the 1030/1090 MHz LLD monitor with an internally generated 1090 MHz pulsed signal whose peak power level is no more than 2 dB stronger than -7 dBm.

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

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.

6. Objective 6. That the 1030/1090 LLD SBIT and IBIT are unaffected by any LLD suppression signals or APs that restricts or inhibits transmission.

(b) Approach to Objectives 1 through 3 and 6: 1030/1090 LLD SBIT and IBIT.

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 summed at the antenna outputs and that the Terminal passes the test. Also, measure the leakage signal at the antenna outputs during the SBIT and IBIT tests to verify no signal present (i.e., no stronger than -57 dBm/MHz).

2. Simulate an LLD IPF suppression pulse during SBIT. Verify that the SBIT is capable of detecting a faulty condition in the LLD monitor and that the SBIT is capable of indicating proper LLD monitor operation whenever suppression signals are present and regardless of any AP that would restrict or inhibit transmissions.

3. Repeat Paragraphs 2.2.d.(2)(b)1. and 2.2.d.(2)(b)2. for the 1090 MHz LLD monitor.

4. Repeat Paragraphs 2.2.d.(2)(b)1. through 2.2.d.(2)(b)3. with the Terminal set in Exercise EMC Protection mode at normal power.

5. Repeat Paragraphs 2.2.d.(2)(b)1. through 2.2.d.(2)(b)3. with the Terminal set in Combat mode at normal power.

6. Repeat Paragraphs 2.2.d.(2)(b)1. through 2.2.d.(2)(b)5. to verify the LLD monitor as part of an IBIT.

7. Repeat Paragraphs 2.2.d.(2)(b)1. through 2.2.d.(2)(b)3. for SBIT and IBIT at 1030 MHz and 1090 MHz in all power modes. For Paragraphs 2.2.d.(2)(b)6. IBIT tests, perform repeat of Paragraphs 2.2.d.(2)(b)1. through 2.2.d.(2)(b)3. in all power modes.

(c) Approach to Objectives 4 and 5: 1030/1090 LLD SBIT and IBIT Simulated Failure.

1. Insert/simulate an SBIT/IBIT failure 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. The number of LLD SBIT and IBIT failure events to be simulated shall be chosen to verify the actual BIT algorithm design.

2. Perform an IPF reset and verify that the failed tests are rerun, and that BIT fails. Next, remove the fault condition, then perform an IPF reset, and verify that the failed tests are rerun and that BIT passes.

3. Repeat Paragraphs 2.2.d.(2)(c)1. and 2.2.d.(2)(c)2. for the 1090 MHz LLD monitor circuitry.

4. Disable the injected pulses. Apply power and commence Terminal initialization.

5. Repeat Paragraphs 2.2.d.(2)(c)1. through 2.2.d.(2)(c)4. in Exercise EMC Protection mode.

6. Repeat Paragraphs 2.2.d.(2)(c)1. through 2.2.d.(2)(c)4. in Combat mode. Verify that the Terminal fails SBIT but does not inhibit transmissions.

7. Repeat Paragraphs 2.2.d.(2)(c)1. through 2.2.d.(2)(c)6. to verify the LLD monitor as part of IBIT.

(3) PW Monitor BIT Verification.

Link 16 Terminal SBIT and IBIT is used to assess the performance of the PW monitor.

(a) Objectives.

Test shall verify:

1. Objective 1. The Terminal provides the PW 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 selected power mode. Also, test shall verify that the Terminal generates waveforms with PWs less than the narrow PW setting (narrow PWs no more than 100 ns less than the lower alarm limit), PWs within PW setting limits (normal PW), and PWs wider than (wide PW no more than 100 ns above the upper alarm limit) the acceptable range at the 95% voltage level.

2. Objective 2. The Terminal passes the SBIT and IBIT tests.

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

(b) Approaches to Objectives 1 and 2: PW Monitor SBIT and IBIT.

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 PW monitor. Verify that there are narrow (no more than 100 ns less than the lower alarm limit), and 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.

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 appropriate increase in the PW event count or the EPF fault count to be incremented; 2) the number of normal pulses shall not cause an increase in the PW event count or the EPF fault count to be incremented; and 3) the 100% voltage level determined by the PW monitor is at or above the nominal level at which the PW capability would be capable of measuring PW.

3. Perform an IBIT. Measure and record the internal Terminal generated waveform pulses that are injected into the PW 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.

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 appropriate increase in the PW event count or the EPF fault count to be incremented; 2) the number of normal pulses shall not cause an increase in the PW event count or the EPF fault count to be incremented; and 3) the 100% voltage level determined by the PW monitor is at or above the nominal level at which the PW capability would be capable of measuring PW.

5. Repeat Paragraphs 2.2.d.(3)(b)1. through 2.2.d.(3)(b)4. for each power mode of the Terminal.

(c) Approach to Objective 3: The Terminal Inhibits Transmissions if the Test is Not Successful (i.e., PW Monitor Simulated SBIT and IBIT Failure).

1. With the Terminal in a Full EMC Protection mode at normal power and in the Link 16 only mode of operation, apply power and commence Terminal initialization.

2. Insert/simulate an SBIT/IBIT failure condition into the PW monitor circuitry. This is usually performed by injecting normal width pulses when narrow or wide pulses are expected. Measure and record the injected pulses. The number of injected pulses with incorrect PW shall be chosen to verify the actual BIT algorithm design. Verify that the Terminal fails the SBIT and that it inhibits transmissions.

3. Perform an IPF reset and verify that the failed tests are rerun, and that BIT fails. Next, remove the fault condition and then perform an IPF reset and verify that the failed tests are rerun and that BIT passes.

4. Disable the injected pulses. Apply power and commence Terminal initialization.

5. With the Terminal transmitting, command an IBIT. Insert/simulate an SBIT/IBIT failure condition into the PW 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.

6. Perform an IPF reset and verify that the failed tests are rerun, and that BIT fails. Next, remove the fault condition and then perform an IPF reset and verify that the failed tests are rerun and that BIT passes.

7. Repeat Paragraphs 2.2.d.(3)(c)1. through 2.2.d.(3)(c)6. in Exercise EMC Protection mode.

8. Repeat Paragraphs 2.2.d.(3)(c)1. through 2.2.d.(3)(c)6. in Combat mode. Verify that the transmissions are not inhibited.

(4) Frequency Monitor OBIT (FMO).

The Terminal assesses performance of the frequency monitoring components during scheduled Link 16 transmissions.

(a) Objective.

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.

(b) Approach to Objective: OBIT Frequency Fault Detection.

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 five pulses in two consecutive transmit time slots. Measure and record the five pulses.

2. Inject/simulate the first five pulses of the two time slots with a hopping pattern similar to that used in step 1 using CPSM pulses with a frequency offset of 2.75 MHz (i.e., 1.5 MHz + 1.25 MHz) above the respective Link 16 carrier frequencies as long as the test is also performed successfully showing proper operation with CW pulse injections. Such CW pulse injections shall have a frequency offset of 1.5 MHz + 200 kHz above the respective Link 16 carrier frequencies.

3. Verify that transmissions are inhibited after the second time slot.

4. Repeat Paragraphs 2.2.d.(4)(b)1. through 2.2.d.(4)(b)3. in Exercise EMC Protection mode with the addition of a Link 16 transmission suppression pulse in each time slot. Verify that 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 and that the Link 16 suppression pulse does not affect the reporting of the fault.

5. Repeat Paragraphs 2.2.d.(4)(b)1. through 2.2.d.(4)(b)3. in Combat mode. Verify that the Terminal reports EPF faults but does not inhibit transmissions.

6. Repeat Paragraphs 2.2.d.(4)(b)1. through 2.2.d.(4)(b)5. in each power mode of the Terminal.

(5) OP Monitor OBIT.

Link 16 Terminal assesses the performance of the OP monitor components during scheduled Link 16 transmissions using a peak OP monitor. The threshold for at least nine frequencies across the frequency band shall vary by no more than 0.75 dB to avoid the need to test additional frequencies. If the variation across all nine of the frequencies selected is greater than 0.75 dB, then all 51 frequencies threshold values from tuning will need to be checked.

(a) Objectives.

Tests shall verify:

1. Objective 1. That the OBIT simulates and detects a condition where the output power at the Peak OP monitor is greater than 200 W + 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 OP 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 OP condition, the Terminal generates an EPF Fault Report.

2. Objective 2. That the Terminal will inhibit transmissions if there are two EPF Fault Reports due to the peak OP monitor OBIT failures.

3. Objective 3. That in Combat mode, the Terminal will report an EPF fault but will not inhibit transmissions after the second EPF Fault Report due to a failed peak OP monitor OBIT.

(b) Approaches to Objectives 1, 2, and 3: Peak OP Monitor OBIT Fault Detection.

1. With the Terminal operating in 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 OP monitor threshold 2 dB less than the selected nominal power and that the OP monitor indicates an OP condition. Verify that the OP monitor threshold is reduced no more than 2 dB below the selected power level.

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 OP monitor threshold. Observe that the Terminal fails the OBIT and that the Terminal increments the EPF Fault Report count.

3. Verify that the Terminal inhibits transmissions after two EPF Fault Reports within 24 hours that are the result of the failed OP monitor OBIT.

4. Repeat Paragraphs 2.2.d.(5)(b)1. through 2.2.d.(5)(b)3. with the Terminal in Exercise EMC Protection mode.

5. Repeat Paragraphs 2.2.d.(5)(b)1. and 2.2.d.(5)(b)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 two EPF Fault Reports.

6. Repeat Paragraphs 2.2.d.(5)(b)1. through 2.2.d.(5)(b)5. in each power mode.

e. Other Tests.

(1) Default to Full EMC Protection Mode After Terminal Power On.

(a) Objectives.

Test shall verify:

1. Objective 1. That the Terminal starts up in Full EMC Protection mode after the Terminal is switched from the Terminal off state.

2. Objective 2. That the Terminal retains its current use set of APs after the operator takes positive action (e.g., placed the Terminal in a standby mode), prior to removing power.

(b) Approach to Objective 1: Default to Full EMC Protection Mode.

1. Determine the default EMC Protection mode installed in the Terminal.

2. Turn on the Terminal (cold start) and command the Terminal to transmit. Display the transmission profile showing time slots transmitted over a 12-second frame on an oscilloscope.

3. Initialize the Terminal in Combat mode at normal power with an appropriate set of TSAs for easy recognition on the oscilloscope. Ensure that the EMC Feature AP is set to Combat mode. 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. Verify that the Terminal comes up in the default EMC Protection mode by observing that the AP now indicates Full EMC Protection mode. Repeat this test using Exercise mode instead of Combat mode. Verify that the Terminal comes up in the default EMC Protection mode by observing that the AP now indicates Full EMC Protection mode.

(c) Approach to Objective 2: Retaining the Current Use Set.

Initialize the Terminal with the same load used in Paragraph 2.2.e.(1)(b)3. After transmitting for two minutes, demonstrate the steps needed to retain the load prior to removing Terminal power. Turn the Terminal power back on to verify the prior load has been retained.

(2) Fault Report Retention After Combat Mode.

(a) Objectives.

Tests shall verify:

1. Objective 1. That a single Fault Report that occurs while in Full EMC Protection mode is retained when the Terminal is reinitialized or turned to Combat mode and then back to Full EMC Protection mode.

2. Objective 2. That a single Fault Report that occurs while in Exercise Protection mode is retained when the Terminal is reinitialized or turned to Combat mode and then back to Exercise mode.

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 Combat mode and then back to Full EMC Protection mode.

4. Objective 4. That two EPF faults that occur while in Combat mode are retained such that when the Terminal is reinitialized to Full EMC Protection or Exercise mode, and that transmissions are inhibited.

(b) Approach to Objective 1.

1. Initialize the Terminal to operate in Full EMC Protection mode at normal power. Simulate an EPF fault and note that the EPF Fault Report count is equal to one.

2. Change the Terminal to operate in Combat EMC Protection mode. Verify that the EPF Fault Report count is one.

3. Change the Terminal to operate in 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.

(c) Approach to Objective 2.

1. Initialize the Terminal to operate in Exercise EMC Protection mode at normal power. Simulate an LLD EPF fault and note that the EPF Fault Report count is equal to one.

2. Change the Terminal to operate in Combat EMC Protection mode. Verify that the EPF Fault Report count is one.

3. Change the Terminal to operate in 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.

(d) Approach to Objective 3.

1. Initialize the Terminal to operate in Full EMC Protection mode at normal power. Simulate two LLD EPF faults in two consecutive time slots and note that the EPF Fault Report count is equal to two and that the Terminal inhibits transmissions.

2. Change the Terminal to operate in Combat EMC Protection mode. Verify that while the EPF Fault Report count is two, the Terminal resumes transmissions.

3. Change the Terminal to operate in Full EMC Protection mode. Verify that the Terminal inhibits transmissions.

(e) Approach to Objective 4.

1. Initialize the Terminal to operate in Combat mode at normal power. Simulate two LLD EPF faults in two consecutive time slots and note that the EPF Fault Report count is equal to two and that transmissions are not inhibited.

2. Change the Terminal to operate in Full EMC Protection mode. Verify that the Terminal inhibits transmissions.

3. Change the Terminal to operate in Exercise EMC Protection mode. Verify that the Terminal continues to inhibit transmissions.

4. Change the Terminal to operate in Combat mode. Verify that transmissions are no longer inhibited. Change the Terminal to operate in Full EMC Protection mode and verify that the Terminal inhibits transmissions.

(3) EMC Features Data Storage Verification.

Link 16 Terminals have non-volatile memory for data storage.

(a) Objective.

Tests shall verify:

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

   a. Each Link 16 transmission inhibit, including when transmission was inhibited as a result of start-up or an operator-IBIT,

   b. The identity of the failure that was detected that resulted in the Link 16 transmission inhibit,

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

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

2. Objective 2. That the date, the beginning time, and ending times of the events listed in Paragraph 2.2.e.(3)(a)1. are available to the host upon request.

3. Objective 3. That the Terminal has a methodology for informing the host that the memory log is full.

(b) Approach to Objective 1: EMC Features Data Storage.

1. Initialize the Terminal in 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.

2. Initialize the Terminal in 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.

3. Initialize the Terminal in 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.

4. Initialize the Terminal in 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.

5. Repeat Paragraphs 2.2.e.(3)(b)1. through 2.2.e.(3)(b)4. with the Terminal initialized in Exercise EMC Protection mode.

6. Repeat Paragraphs 2.2.e.(3)(b)1. through 2.2.e.(3)(b)4. with the Terminal initialized in Combat mode. Verify that while transmissions are not inhibited, the events in those steps are stored in non-volatile memory. Ensure that methods are in place to prevent the continued recording of faults and the filling up of the non-volatile memory for all types of EMC faults (including UUAC histogram) and BIT types.

7. Initialize the Terminal in Full EMC Protection mode. Change the EMC Protection mode AP to Exercise EMC Protection mode. Verify that the date and beginning and ending times of the switch from Full EMC Protection mode to Exercise EMC Protection mode is stored into non-volatile memory.

8. Initialize the Terminal in Full EMC Protection mode. Change the EMC Protection mode AP to Combat mode. Verify that the date and beginning and ending times of the switch from Full EMC Protection mode to Combat mode is stored into non-volatile memory.

9. Initialize the Terminal to operate in Exercise EMC Protection mode. Command the Terminal to transmit high power above 200 W. Verify that the date and beginning

and ending times of the switch to the high power above 200 W is stored into non-volatile memory.

10. Initialize the Terminal to operate in Combat mode. Command the Terminal to transmit high power above 200 W. Verify that the date and beginning and ending times of the switch to the high power above 200 W is stored into non-volatile memory.

11. Initialize the Terminal in Full EMC Protection mode. Induce CTT EPF faults. Verify that transmissions are inhibited and that the date, beginning and ending times of the transmission inhibit, and the identity of the EPF fault is stored into non-volatile memory. Continue to induce CTT EPF faults and verify that the faults are still being stored in non-volatile memory whether the Terminal Link 16 waveform is isolated or not [subject to the limit of the number of repeated faults to be recorded in that memory; see Paragraph 6].

(c) Approach to Objective 2: EMC Features Data Access.

Download the data stored in non-volatile memory. Verify that the data retrieved matches data required to be stored in Paragraphs 2.2.e.(3)(b)1. through 2.2.e.(3)(b)11. Remove power from the Terminal for two minutes. Turn on the Terminal and verify that the data in the memory log is retained.

(d) Approach to Objective 3: Informing the Host.

Simulate events that will fill the memory log. Verify that the Terminal has a methodology for informing the host when the memory log is full, and that the notification continues after the Terminal is turned off and then on.

(4) SBIT Check After Two Minutes in Standby.

(a) Objective.

Tests shall verify that the Terminal performs SBIT after being in the Standby mode for at least two minutes and that the EPF fault count is cleared.

(b) Approach to Objective: SBIT Check After Two Minutes in Standby and Clearance of the EPF Fault Count.

1. Initialize the Terminal in Full EMC Protection mode and begin transmissions. Simulate an EPF fault such that the EPF fault count is incremented by one (i.e., that the count is one).

2. Place the Terminal in the Standby mode. After two minutes, place the Terminal in the on position. Verify that the EPF fault count has been cleared and that the Terminal performs SBIT before resuming transmissions.

3. Repeat Paragraph 2.2.e.(4)(b)1. Place the Terminal in the Standby mode. Before two minutes, place the Terminal in the on position. Verify that the EPF fault count has not been cleared.

(5) Transmit Inhibit Reset Shall Not Clear a Single EPF Fault Report[10].

(a) 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.

(b) Approach to Objective: Single EPF Fault Report Not Cleared.

1. Initialize the Terminal in Full EMC Protection mode.

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

3. Verify that transmissions are not inhibited.

4. Attempt to perform a transmit inhibit reset.

5. Verify that the EPF Fault Report count is equal to one.

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

GLOSSARY

G.1. ACRONYMS.

ACRONYM	MEANING
AP	adaptable parameter
ARNS	Aeronautical Radio-Navigation Service
ATC	Air Traffic Control
ATP	Acceptance Test Procedure
BIT	Built-in Test
BW	bandwidth
C2	command and control
CA	Certification Authority
CIO	Chief Information Officer
CPSM	continuous phase shift modulation
CPSR	conditional PSR
CTT	capability to transmit
CW	continuous wave
dB	decibel
dBc	dB relative to the carrier
dBm	dB referenced to one milliwatt
DoDM	DoD manual
DoW	Department of War
E3	Electromagnetic Environmental Effects
EL-CID	Equipment Location - Certification Information Database
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EPA	external power amplifier
EPF	EMC Protection Feature(s)
FAA	Federal Aviation Administration

FMO	Frequency Monitor OBIT
FW	firmware
GPS	Global Positioning System
HPAG	High Power Amplifier Group
HW	hardware
IBIT	Initiated BIT
IFF	identification friend or foe
IJMS	Interim JTIDS Message Specification
INE	initial network entry
IPF	Interference Protection Feature
IRAC	Interdepartment Radio Advisory Committee
Ith	current level threshold
Itr	current level
JTIDS	Joint Tactical Information Distribution System
kHz	kilohertz
LLD	low-level detector
LOS	line of sight
LRU	line replaceable unit
LTTI	long-term transmit inhibit
LVT	Low Volume Terminal
µs	Microsecond
ms	millisecond
MHz	megahertz
MIDS	Multifunctional Information Distribution System
NAVWAR	Naval Information Warfare Systems Command
NMSC	Navy Marine Corps Spectrum Center
ns	nanosecond
NTIA	National Telecommunications and Information Administration

NTR	Network Time Reference
OBIT	Operational BIT
OOB	out of band
OP	overpower
PA	Programmatic Authority
PG	participation group
PPLI-B	precise participant location and identification – broadcast
PSR	paired slot relay
Pth	power level threshold
Ptr	power level
PW	pulse width
RBW	resolution BW
RF	radio frequency
RFA	RF amplifier
RTT	round-trip timing
RTT-B	RTT-broadcast
RTT-I	RTT-interrogation
SBIT	Start-Up BIT
SCA	SW Communications Architecture
SNE	start network entry
SPS	Spectrum Planning Subcommittee
SPS WG-1	SPS WG One
SRU	shop replaceable unit
SW	software
TACAN	tactical air navigation
TADIL J	Tactical Digital Information Link J
TDMA	time division multiple access
TSA	time slot assignment
TSDF	time slot duty factor
TSR	time slot reallocation
TT	Test Terminal

TUT	Terminal Under Test
UUAC	uniform use of authorized carriers
VBW	video BW
Vth	voltage level threshold
Vtr	voltage level
VP	variable parameter
W	watt
WG	working group

G.2. DEFINITIONS.

Term	**Definition**
AP	APs are those control parameters that are implemented in SW in a prescribed format to facilitate adjustment of parameter values at initialization or by operator entries without requiring reassembly of the computer program database.
ATC system	The national system used for providing information to aircraft and to air traffic controllers to enable the controllers to provide safe separation distances between aircraft that are enroute or within the Terminal areas.
Class 2H Terminal	A Joint Tactical Information Distribution System (JTIDS) Class 2 Terminal equipped with a High Power Amplifier Group (HPAG) for use in large airborne and surface C2 elements. The Class 2H Terminal uses J-series messages and has nominal output powers of 200 W or 1000 W. Some Class 2H Terminals will also have the capability to use Interim JTIDS Message Specification (IJMS) messages.
Communication Mode 1	Normal mode of operation which includes frequency hopping.
Communication Mode 2	No frequency hopping. All pulses are transmitted on a single frequency.
contention	A term used to denote multiple Link 16 transmissions that use the same frequency hopping pattern in the same time slot.

TERM	DEFINITION
contention access	A Link 16 transmit access mode in which a group of Link 16 Terminals is assigned a pool of time slots to satisfy their transmission requirements. Time is divided into access intervals (e.g., once every three seconds). A user may transmit only up to the prescribed quantity of messages per access interval. Users randomly select their transmit time slots from the pool at the access rate they have been assigned regardless of the potential for two or more Terminals in the network to select the same time slot for transmission. Also referred to as "random access."
coordinated Link 16 operations	Operations that: Desire to operate outside of peacetime spectrum certification limits. Do not have a valid frequency assignment for the geographic area desired. Do not meet all the EMC conditions required for Terminal operations to include co-site and collocation requirements or contain a platform that is not identified in the approved EL-CID. These operations are requested through NMSC and individually coordinated on a case-by-case basis with the FAA.
CTT	The Terminal operational state when the Link 16 message generation capability is not isolated (either through SW/firmware (FW) or HW) from the power amplifiers or associated circuitry such that the transmitter has the ability to transmit Link 16 pulses. In the context of the CTT monitors, this is the period when the monitor indicates that a condition exists where a pulse is being transmitted.
EMC	The ability of systems, equipment, and devices that utilize the electromagnetic spectrum to operate in their intended operational environments without suffering unacceptable degradation or causing unintentional degradation because of electromagnetic radiation or response. It involves the application of sound electromagnetic spectrum management; system, equipment, and device design configuration that ensures interference-free operation; and clear concepts and doctrines that maximize operational effectiveness.

TERM	DEFINITION
EMC Feature(s)	The HW, FW, and SW controls in a Link 16 Terminal that are used to detect Terminal faults which affect the Link 16 time/frequency waveform. FW/SW operational controls may also be used to lockout Terminal capabilities and control pulse transmission limits to ensure compliance with the frequency certification/clearance.
EPF	An alternate term for EMC Feature(s).
EPF event	The result of an EPF monitor detecting a condition that exceeds its threshold during a 13 µs period in which the monitor is active. EPF events may be purged from memory at the conclusion of the time slot.
EPF event/fault condition	The signal or circumstance which results in an EPF event/fault.
EPF failure	The result of two EPF faults incurred during two distinct time slots, EPF SBIT or IBIT failure, or excessive TSDF. EPF failure results in the inhibition of further transmission prior to the subsequent time slot. EPF failure is not possible in Combat mode. EPF failure is not permitted to be cleared automatically except in the case of excessive TSDF at the conclusion of the 12-second frame. EPF failure may be cleared via EPF reset.
EPF fault	The result of sufficient quantity of EPF events during normal operation or OBIT in a 7.8125 ms time slot. EPF faults may be purged from memory after 24 hours or upon Terminal reboot so long as SBIT is performed upon reboot.
EPF mode	The mode of the Terminal where either all EMC Feature HW and SW controls are invoked (i.e., Full EMC Protection mode), only the HW controls are invoked (Exercise EMC Protection mode), or only the HW controls are invoked without the requirement to inhibit Link 16 transmissions (Combat mode).
EPF monitor port	Used to measure the RF characteristics of the injected signals that were used to simulate the various faults. There cannot be any RF devices between the last amplifier and the monitor port that can affect the RF characteristics of the injected signals such as the frequency and the PW.

TERM	**DEFINITION**
epoch	A 12.8-minute interval consisting of 98,304 time slots. A 12-second subdivision of this epoch (sometimes referred to as a “frame”) is used in the Link 16 network designs.
high power output mode	A Terminal peak output power of stronger than 200 W + 1 dB, which does not exceed the selected high power mode by more than 1 dB summed for all the RF outputs of the Terminal.
initial net entry process	The process the Terminal uses for achieving coarse synchronization with the network time. Coarse synchronization is usually achieved through successful reception of the Tactical Digital Information Link J (TADIL J) initial entry message or the IJMS net entry message. The Network Time Reference (NTR) Terminal automatically transmits the initial entry message. Any Terminal may be initialized to transmit the initial entry message to facilitate network entry for Terminals that are not within line of sight (LOS) of the NTR. A Class 1 Terminal equipped NTR shall be specifically initialized to transmit the net entry message.
initial net entry time slot	A specified time slot used for the network synchronization process that all Terminals are inherently capable of receiving. Each Terminal shall be specifically initialized to transmit in this specific net entry time slot. The INE time slot is the first time slot in each frame (epoch subdivision). The NTR automatically transmits the INE message in every such time slot. Other Terminals may be initialized to transmit in the initial entry time slot. They do so at an average rate of once per 24 seconds.
input nets	The exclusive use of time slot blocks by Link 16 users on one identified net, which is part of the same network. There are 127 individual nets numbered from 0 to 126.
input ports	There are two input ports, one to inject the LLD faults prior to the antenna, and one to inject the faults into the remaining monitors (not needed if the transmitted signal can be modified to simulate the various fault conditions).

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

[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.

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

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

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

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

TERM — **DEFINITION**

transmission inhibit

An action taken by the Terminal to prevent the transmission of any TDMA RF signals from its antenna ports as a result of EMC Feature failures. Re-evaluate the Fault Logging section to determine if additional clarity/words are needed to distinguish between transmission inhibit caused by EMC Features failures and other settings such as long-term transmit inhibit (LTTI).

TSDF

A two-term parameter that specifies the number of pulse transmissions allowed for a community of Link 16 Terminals during each 12-second frame. The first term is a percentage indicator of the number of transmissions allowed for the total community. The second percentage term indicates the limit for a single Terminal. The 100/50 TSDF notation specifies that the total community is limited to a pulse density of 396,288 (258 x 1536) transmitted Link 16 pulses in a 12-second frame and a single Terminal is limited to 198,144 (50% x 396,288) pulses. The TSDF is always stated in terms of a standard time slot containing 258 pulses. Therefore, the total number of pulses can be derived for a 100/50 TSDF by considering the 100% for the total community as:

$$100\ \%\ \text{TSDF} = \frac{258\ \text{pulses}}{\text{time slot}} \times \frac{128\ \text{time slots}}{\text{second}} \times \frac{12\ \text{seconds}}{\text{frame}}$$

$$= 396{,}288\ \text{pulses/frame}$$

Using this total, the maximum percentage of time slots that is available to the Link 16 community for a 100/50 TSDF if all Terminals are programmed for Packed 4 single pulse messages can be derived by:

$$\text{Packed 4 time slot limitation} = \frac{396{,}288\ \text{pulses/frame}}{\frac{444\ \text{pulses}}{\text{time slot}} \times \frac{128\ \text{time slots}}{\text{second}} \times \frac{12\ \text{seconds}}{\text{frame}}}$$

$$= 58\%$$

TSR

An access mode in which users share a predefined pool of time slots that are allocated to them dynamically, according to their current demands. The TSR protocol attempts to assure that Terminals have dedicated access to their allocated time slots. After the network is designed and the pool of TSR time slots is determined, entry to and exit from the TSR community is automatic.

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

REFERENCES

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

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

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

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

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

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

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

NTIA Joint Tactical Information Distribution System/Multifunctional Information Distribution System (JTIDS/MIDS) Time Division Multiple Access (TDMA) Architecture and Waveform Spectrum Support Certification, Interdepartment Radio Advisory Committee Document (IRAC) 33583/6 Feb 17, 2023[13]

NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, January 2023 Revision of the January 2021 edition[14]

System Planning Subcommittee Working Group One (SPS WG-1) TR-03-001, SPS 14216, EMC Certification Guidance and Requirements for JTIDS/MIDS TDMA Equipment, February 3, 2004[15]

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

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

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