3.2.10.2.2.1 Category I Siting. MMLS in a split-site configuration shall provide Category I performance with the MMLS equipment placed on surfaces specified in table I of DM 7.2, on bedrock and/or on concrete surfaces. azimuth equipment shall be sited up to 15,000 ft from runway threshold along the runway centerline and the elevation equipment shall be sited within 450 ft of runway centerline.

3.2.10.2.2.2 Category II Siting. MMLS in a split-site configuration shall provide Category II operational performance when the equipment is installed and anchored to a surface capable of bearing a minimum of 80 tons per square foot. The azimuth equipment shall be sited up to 12,000 ft from runway threshold along the runway centerline and the elevation equipment shall be sited within 450 ft of runway centerline.

3.2.10.2.3 Nondegradation Conditions. MMLS shall not degrade beyond specified performance limits under any of the following siting conditions.

a. Placement of any MMLS element within 10 ft of any other MMLS element or obstruction, natural and/or fabricated, that lies 1 ft below the horizontal plane that is tangent to the lowest physical component of the radiating elements of the unit in question.

b. Placement of MMLS equipment and field sensors adjacent to a body of water with transmitting element(s) located 10 ft or higher above the surface of the water.

c. Placement of sandbags or equivalent protection stacked to the full equipment height, 10° or more outside the sector of transmission.

d. Placement in the vicinity of natural formations of hills, with and without foliage, and with and without snow cover, under and on one or both sides of the approach path, such hills not constituting obstructions within the definitions of TM 5-803-4 and AFM 55-9.

e. Placement in the vicinity of fabricated structures and equipment that do not constitute an obstruction within the definitions of AFR 86-14, AFR 86-5, TM 5-803-4, and AFM 55-9.

f. Placement of MMLS equipment on terrain inclinations of up to 10° in any direction. The antenna phase centers shall be higher than the height of the runway centerline.

g. Placement of MMLS ground equipment in up to 2 ft of snow.

3.2.10.3 Organizational Deployment Requirements.

3.2.10.3.1 CCG. The CCGs will deploy MMLS to support quick-reaction precision approach needs.

3.2.10.3.2 QWROTES. MMLS will be deployed as QWROTES to assure that sufficient MLS equipment is available at selected overseas bases to restore precision approach and guidance service that has been incapacitated. Those QWROTES assets will also be used to establish a precision approach capability for alternate landing surfaces.

3.2.10.3.3 U.S. Army. MMLS will be assigned to the Air Traffic Control Company (Forward) and Air Traffic Control Company (Communications Zone) to provide precision approach service into combat support areas.

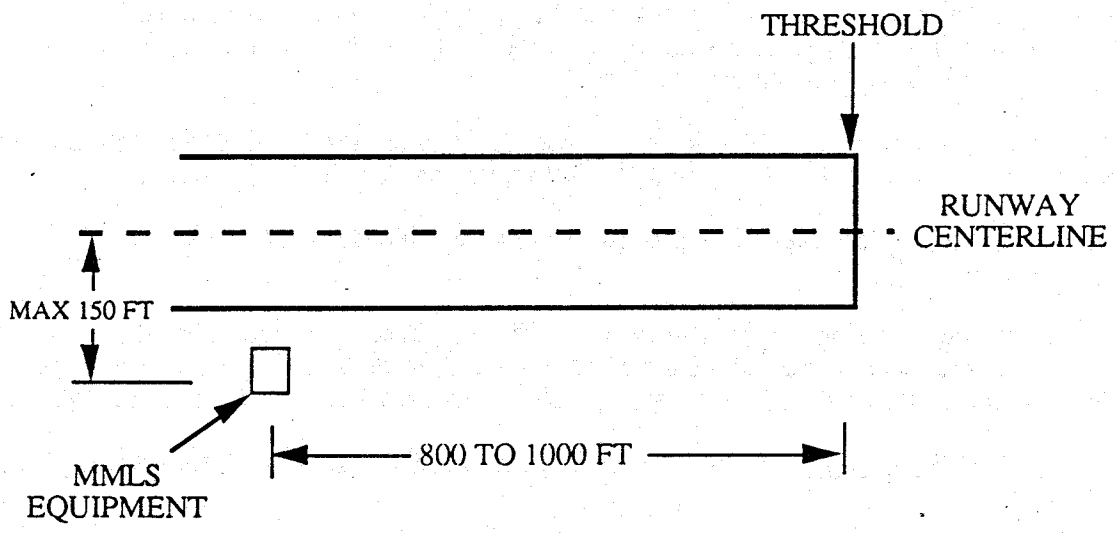


Figure 8. Siting Limits for MMLS Equipment in Collocated Configuration

3.2.11 System Effectiveness Models. System effectiveness models shall be developed to predict the operational performance of MMLS under varying conditions. The models shall be of sufficient detail to project system accuracy when MMLS is used:

a. To service aircraft equipped with varying grades of MLS avionics and at varying approach speeds and glide angles;

b. Under varying siting conditions including runway lengths, setup times, and multipath conditions;

c. Under varying environmental conditions including temperature, wind and rain. The modeling methodology shall be presented at the preliminary design review. The Government will specify up to 30 specific scenarios for examination and results shall be presented at the critical design review (CDR).

3.2.12 Nameplates and Product Marking. Identification and marking shall be in accordance with requirements specified in MIL-E-4158 with the following additions and exceptions:

3.2.12.1 Nameplates. Nameplates shall be in accordance with MIL-STD-130. Foil nameplates shall not be used.

3.2.12.2 Cable Identification. In addition to the cable identification required by MIL-E-4158, all cables with connectors shall bear a unique identification number that signifies the two chassis they interconnect. The identifier shall be permanently affixed to the cable, near each connector.

3.2.12.3 Crystal Identification. Crystals shall conform to MIL-STD-454, Requirement 38.

3.3 Processing Resources.

3.3.1 MMLS Processing Resources. MMLS processing resource requirements shall be completed by the contractor in accordance with Appendix I of MIL-STD-490 and subject to Government approval. All MMLS system functions shall be addressed both individually and collectively in determining the requirements. Processing resources shall satisfy the following general requirements.

3.3.1.1 Computer-Hardware Requirements.

3.3.1.1.1 Memory. Under worst case loading, each processor shall utilize no more than 80 percent of the total available memory at the time of delivery. Each processor shall have a growth capacity of at least 50 percent of the total available memory at the time of delivery.

3.3.1.1.2 Processing Speed. Under worst case loading, each processor, at the time of delivery, shall complete all its required processing utilizing no more than 50 percent of the total available processing time.

3.3.1.1.3 Port Requirements. At the time of delivery, each I/0 port shall be used at less than 50 percent of its capacity under worst-case loading. The system design shall allow for the addition of external devices without hardware redesign.

3.3.1.2 Programming Requirements. All MMLS software shall comply with the requirements of DOD-STD-2167 as tailored by the MMLS Statement of Work (SOW). Firmware shall be subject to the same requirements as software.

3.3.1.2.1 Programming Languages. All newly developed software shall be written in Ada as defined by MIL-STD-1815. A waiver from the contracting agency shall be required for the use of either an HOL other than Ada or an assembly language.

3.3.1.2.2 Compilers and Assemblers. All compilers and assemblers shall be off-the-shelf, vendor supported.

3.3.1.2.3 Operating System. All operating system software shall be off-the-shelf, vendor-supported.

3.3.1.2.3.1 Operating System Augmentations. Operating system augmentations shall be allowed provided they are treated as newly developed software and do not compromise the capability of the operating system vendor to provide maintenance or updates.

3.3.1.3 Design and Coding Constraints. Newly developed support software shall be allowed except for compilers, assemblers, debuggers, linking loaders, and editors which shall be off-the-shelf vendor-supported.

3.3.1.3.1 Design Requirements. Newly developed MMLS software shall be designed using a top-down methodology as specified in DOD-STD-2167.

3.3.1.3.2 Coding Requirements. Newly developed MMLS software shall be coded in accordance with DOD-STD-2167, Appendix C or with a government-approved Software Development Plan.

3.4 Quality Factors.

3.4.1 Reliability.

3.4.1.1 Mean Time Between Critical Failures (MTBCF). The specified MTBCF, considering both hardware and software, shall be greater than 5,000 hrs. The contractor shall predict and design the system to 7,200 hrs. Critical performance requirements are those that, due to failure or degradation, contribute to an out of tolerance condition defined in 3.1.4.3.2.1 and 3.1.4.3.3. Each active LRU with the exception of phase shifters, batteries, and field monitors shall have an elapsed time counter.

3.4.1.2 Mean Time Between Corrective Maintenance Actions (MTBCMA). The specified MTBCMA, with the exception of replacing batteries, shall be greater than 1,400 hrs. The contractor shall predict and design the system to twice the specified value.

3.4.1.3 Independence of Failures. Failure, damage, or removal of one unit or assembly shall not cause failure or damage in any other unit or assembly, and shall not cause a critical failure if there is a properly functioning unit or assembly that is redundant to the failed unit or assembly.

3.4.1.4 Reliability Modeling and Allocations. The contractor shall develop mathematical models, block diagrams, and allocate the specified system reliability values to lower item levels. Allocated values shall be used as baseline requirements in lower level specifications, including contractor and subcontractor procurement specifications and any GFE. All models and allocations shall consider the contribution of hardware and software to reliability. Allocations are subject to Government review and concurrence.

3.4.1.5 Reliability Predictions. The contractor shall predict the reliabilities to meet the maintenance needs (MTBCMA) as specified in 3.4.1.2 and mission needs (MTBCF) as specified in 3.4.1.1 of the system. Predictions will include any GFE and modified/ unmodified off-the-shelf items. All predictions shall include the contribution of both software and hardware. (DI-R-7095/T)

3.4.2 Modifiability.

3.4.2.1 Maintainability.

3.4.2.1.1 Equipment Checkout.

3.4.2.1.1.1 Fraction of Failures Detected (FFD). The FFD shall be at least 98 percent using BIT.

3.4.2.1.1.2 Mean Time Between False Alarms (MTBFA). The mean time between BIT false alarms shall exceed 50,000 hrs.

3.4.2.1.2 Corrective Maintenance-Organizational Level.

3.4.2.1.2.1 Fraction of Failures Isolated (FFI). The FFI to a single LRU shall be at least 90 percent using BIT.

3.4.2.1.2.2 Mean Time to Repair (MTTR). The MTTR, including time to isolate, remove, replace, align, and checkout hardware and reboot software, shall be less than 0.5 hr. At least 95 percent of all hardware repairs shall be completed within 1.5 hrs.

3.4.2.1.3 Corrective Maintenance-Intermediate Level. This paragraph is not applicable to this specification.

3.4.2.1.4 Corrective Maintenance-Depot Level.

3.4.2.1.4.1 FFI. The FFI to a discardable component within one hour shall be greater than 50 percent using BIT, external peculiar test equipment, external common test equipment, and/or external automatic test equipment.

3.4.2.1.5 Preventive Maintenance (PM). PM tasks shall take less than 60 minutes and shall be required no more often than once every 90 days. At any time during PM, the prime mission equipment (PME) shall be capable of being restored to full mission capability (FMC) status within 10 minutes. PM of redundant items shall not interrupt operational performance.

3.4.2.2 Flexibility and Expansion. This paragraph is not applicable to this specification.

3.4.3 Availability. This paragraph is not applicable to this specification.

3.4.4 Portability. Portability requirements shall be as specified in paragraphs 3.2.1.3 and 3.2.1.3.4.

3.5 Logistics. Interface requirements of logistics disciplines of DOD 5000.39 shall be integrated into the design and engineering constraints cited in this specification.

3.5.1 Support Concept.

3.5.1.1 Support Equipment. System BIT capability shall be designed to minimize support equipment requirements at all levels of maintenance.

3.5.1.1.1 Common Support Equipment. Common support equipment shall be restricted to standard test equipment listed in both MIL-HDBK-300 and DA 700-21-1.

3.5.1.1.2 Peculiar Support Equipment. Peculiar support equipment shall include all other test equipment necessary for depot-level maintenance.

3.5.1.2 Maintenance. Two levels of maintenance, organizational and depot, will be established in accordance with the provisions of AFR 66-1 and AFR 66-14.

3.5.1.2.1 Organizational-Level Maintenance. Organizational-level maintenance will consist of maintenance at the deployed site. At the deployed site, deployed personnel or maintenance personnel will have the capability to verify proper system operation and isolate faults to an LRU. System restoral capability at the deployed site will be limited to replacement of LRUs.

3.5.1.2.2 Depot-Level Maintenance. Depot-level maintenance will consist of repair, reclamation, condemnation, or overhaul of assemblies and subassemblies, manufacture of parts, depot-level modification, test, and other maintenance not possible at the organizational maintenance level. In addition, major structural overhaul and refurbishment will be accomplished at the depot facility. Depot maintenance may utilize approved common support equipment and approved peculiar support equipment.

3.5.2 Support Facilities. The maintenance facilities shall be capable of detecting, isolating, and correcting failures in hardware, firm–ware, and software. A software support facility will be determined by HQ AFLC. Specific requirements will be addressed in the Computer Resources Life Cycle Management Plan.

3.5.2.1 Hardware Support. The BIT function will be used at the organizational level to isolate problems down to the LRU level. BIT function and support equipment shall be provided at the depot to diagnose LRU faults, identify and verify shop-replaceable unit (SRU) faults, and identify and verify SRU component faults.

3.5.2.2 CSCI. The capability shall be provided to revise, test, and maintain MMLS software. Software support facility requirements are to be determined by HQ AFLC.

3.5.3 Supply. The system design shall make maximum use of standard, approved electrical, electronic, and technical parts and items. Spares shall be consistent with the maintenance design and cost-effectiveness of the MMLS.

3.5.4 Personnel.

3.5.4.1 Support Personnel.

3.5.4.1.1 Organizational-Level Maintenance Personnel. Organizational level maintenance shall be capable of being accomplished by Air Force (AF) skill Level 5 (AFSC 30452), U.S. Army military occupational specialty code (MOSC) 93D maintenance specialists, or equivalently trained personnel.

3.5.4.1.2 Depot-Level Maintenance Personnel. Depot-level maintenance shall be capable of being accomplished by AF skill levels 5 and 7 (AFSC 30452/72) or U.S. Army MOSC 28D maintenance specialists.

3.5.5 Training. Training requirements are to be determined.

3.6 Precedence. The following is the order of precedence of this specification and related specifications:

a. Quality factors defined in 3.4 through 3.4.4.

b. System functions defined in 3.1.4 through 3.1.4.4.4.

c. Physical requirements specified in 3.2.1 through 3.2.1.5 and system siting requirements in 3.2.10.1.

d. All other requirements in this specification.

e. Standards and specifications referenced in this specification.

4 QUALIFICATION REQUIREMENTS

4.1 General. This section specifies the requirements for formal verification of the design, construction, and performance of MMLS.

4.1.1 Philosophy of Testing. The basic objective of the MMLS test program described herein is to verify that all requirements of section 3 have been met. Requirement verification shall include contractor conducted development test and evaluation (DT&E) and Government conducted operational test and evaluation (OT&E). DT&E shall demonstrate that the system engineering design and development are complete, that design risks have been minimized, and that the system will perform as specified. Flight tests shall be performed during DT&E to verify system performance under various setup, deployment, and environmental conditions. Specific procedures for verification shall be defined by the contractor in test plans and procedures as approved by the Government. Verification of multiple requirements within a single test procedure shall be allowed, but the adequacy and completeness of the test procedure shall be approved by the Government.

4.1.2 Location of Testing. DT&E shall be conducted by the contractor at the contractor's facilities, any other suitable facility or at a Government-approved field site. DT&E flight tests shall be conducted at four sites to be designated by the Government.

4.1.3 Responsibility for Tests. The contractor is responsible for all inspections, analyses, demonstrations, and tests as specified herein. The Government reserves the right to perform all flight inspections and any of the verifications.

4.1.4 Qualification Methods. All requirements of section 3 shall be verified by one or more of the following methods: inspection (I); analysis (A); demonstration (D); and test (T). The qualification method(s) to be used for each of the MMLS performance requirements are specified in 4.4. The following definitions of I, A, D, and T shall apply.

a. Inspection. Verification shall be performed by visually examining the item, reviewing descriptive documentation, and comparing the appropriate characteristics with a referenced standard to determine conformance to requirements.

b. Analysis. Verification shall be performed by evaluation or simulation using mathematical representations, charts, graphs, circuit diagrams, and data reduction.

c. Demonstration. Verification shall be performed by operation, movement or adjustment of the item under a specific condition to perform the desired function without recording quantitative data except for check sheets.

d. Test. The verification shall be performed through systematic exercising of the applicable item under all appropriate conditions with instrumentation and collection, analysis, and evaluation of quantitative data.

4.1.5 Test Levels. The requirements of section 3 shall be verified on one or more of the following qualification levels as defined below: configuration item (CI), subsystem, system, and system deployment. The qualification level(s) to be used for each of the qualification methods are specified in 4.4.

a. CI Level. CI level verifications are performed on configuration items identified by the contractor. This level is identified by a (1) in the Qualification Cross Reference Table.

b. Subsystem Level. Subsystem level verifications are independently performed on the azimuth, elevation, or DME/P equipment. This level is identified by a (2) in the Qualification Cross Reference Table.

c. System Level. System level verifications are performed to verify proper operation of all CIs interacting as the entire MMLS. These verifications are exclusive of flight tests. This level is identified by a (3) in the Qualification Cross Reference Table.

d. System Deployment Level. System deployment level verifications are performed when it is necessary to verify the required system operation in a deployed state by flight tests. This level is identified by a (4) in the Qualification Cross Reference Table.

4.2 Formal Tests. The following verification requirements shall be performed during DT&E and production acceptance testing.

4.2.1 Design and Development Verification.

4.2.1.1 Software Qualification. The contractor shall establish by analysis, subject to Government approval, the worst case condition under which sufficient spare processing capacities shall be verified. At a minimum, the equipment shall be tested in the ON mode under conditions when the DME/P is processing the maximum interrogation rate specified in 3.1.4.2.1.3.

4.2.1.2 Environmental Stress Screening (ESS). The contractor shall verify ESS in accordance with 3.2.4.10. The contractor shall identify any failure that occurs during ESS that suggests design deficiencies and ensure that all failures are processed in accordance with the failure recording, analysis, and corrective action system (FRACAS). (DI-RELI-80253)

4.2.1.3 Parts Derating. Parts derating shall be verified by "analysis."

4.2.1.4 Parts Selection. Prior to DT&E verifications, the system shall be inspected to verify that the parts used are in the approved parts list.

4.2.2 Formal Equipment Performance Tests.

4.2.2.1 Radiated Signal Characteristics Verification.

4.2.2.1.1 Angle and Data. Channeling and frequency tolerance shall be demonstrated on all 200 frequencies specified in 3.1.4.1.1. Tests to verify the angle guidance encoding, function timing, accuracy, and scanning beam shape requirements shall be performed at a minimum of six different frequencies, as selected by the Government, spaced over the range of the frequency band. These measurements shall be performed on an antenna range and in deployment scenarios as specified in 4.2.5. All other verifications shall be performed at one frequency selected by the Government.

4.2.2.1.2 DME/P. Channeling and frequency stability shall be demonstrated on all 200 frequencies specified in 3.1.4.2.1.2. Tests to verify the pulse shape, pulse spacing, time delay, and accuracy requirements shall be performed at a minimum of 6 different frequencies,

as selected by the Government, spaced over the range of the frequency band. These measurements shall be performed on an antenna range and in deployment scenarios as specified in 4.2.5. All other verifications shall be performed at one frequency selected by the Government.

4.2.2.2 Performance Stability. The capability of the system to stay within operational performance limits for the specified time without realignment shall be verified by an instrumented test. The equipment shall be set up and aligned, and the performance verified, in both the split-site and collocated configurations. The equipment shall be subjected to a range of operational service conditions that emulate severe deployed conditions, including operational extremes of temperature, high and low humidity, rain, and winds. The total accumulated test time shall be at least 240 hrs. This test may be conducted simultaneously with other antenna range, deployment, environmental, or reliability tests. In addition, at least one stability evaluation shall be performed in a deployed environment, as specified in 4.2.5. The MMLS shall remain assembled and operational for at least 72 hrs. Flight inspections shall be conducted, in accordance with 4.2.5, after initial setup and after the 72-hr minimum operational period. Continuous performance monitoring and recording, at no less than two fixed points within the angle guidance coverage, shall be conducted during the operational period.

4.2.2.3 Deployment Verification. The MMLS shall be setup in split-site and collocated configurations at locations to be determined by the Government. The MMLS shall be operated as a total system for a minimum of two hours after each setup. Setup and teardown shall be performed in the operating environmental conditions specified herein wearing restrictive clothing. Thirty setup and teardown operations of one MMLS unit shall be performed by the contractor as part of qualification testing. The durability requirement shall be verified by analysis of any degradation or wear of mechanical or electronic parts during these setup/teardown tests. The setup and teardown shall be performed by completely packing the equipment on the packing containers, rolling up all wires, placing the equipment in the transportable configuration and transporting the equipment between each setup and teardown. These tests may be conducted simultaneously with other stability or reliability tests. At least the first 2 and last 3 of the 30 setup/teardown operations shall be conducted in conjunction with the Category I performance capability evaluations specified in 4.2.5.

4.2.2.4 Electromagnetic Compatibility (EMC). Electromagnetic interference EMI and susceptibility shall be tested by the methods and criteria of tables 1-1 and 1-1A of FAA-E-2721/11.

4.2.2.5 Internal and External Power. Tolerance of voltage transients shall be verified by applying the specified transient conditions of MIL-E-4158 to the MMLS equipment. Automatic switch-over to battery power shall be tested by removing external power to ensure no loss of MMLS operation.

4.2.3 Reliability Verification. The reliability of the system shall be verified in accordance with 10.2 as follows:

a. The contractor shall develop reliability test plans and procedures (DI-RELI-80251).

b. The system shall be operated as prescribed in figure 9. A contractor standard test environment, approved by the Government, may be used as an alternate.

c. The MTBCMA test shall continue until an accept or reject decision is reached, in accordance with figure 10. If the RVT has progressed beyond the "1000 hour accept" line as shown in figure 10, the government will take delivery of systems for IOT&E if all other DT&E testing has been successfully completed.

d. The MTBCF shall be verified in accordance with table III.

e. False alarms shall be verified as specified in 10.2.4.

f. The contractor shall analyze and summarize the test data and provide test report(s).

4.2.3.1 Failure Modes Effects and Criticality Analysis (FMECA). The contractor shall carry out a failure modes and effects prediction analysis and a criticality analysis in accordance with tasks 101 and 102, respectively, of MIL-STD-1629, and in accordance with the approved FMECA program plan. The criticality analysis shall be carried out using the quantitative approach. The purpose of this analysis is to ensure that the integrity requirements are designed into, and actually achieved by, the equipment. Each failure effect shall be shown to result in one or more of the following categories:

a. A monitor or control failure that would permit potentially hazardous MLS guidance or data signals to be radiated.

b. A transmitter failure that would cause potentially hazardous angle guidance or data signals to be radiated in the absence of correct monitor control system operation.

c. A failure that will cause an interruption of the MMLS guidance signals.

d. A failure that will have no effect on integrity.

4.2.3.2 Maintainability Demonstration (MD). Verification that items have met the maintainability requirements in 3.4.2.1 shall be accomplished by a MD for each specified level of maintenance. The contractor shall develop a MD plan (DI-T-3702A/T) and analyze the demonstration data and report on the results for each maintenance level demonstrated (DI-R-7113/T). The demonstration shall be in accordance with 10.3. Each demonstration shall use technical manuals (draft or final form), support test equipment, and trained Government personnel meeting the requirements of 3.5.4 and that are approved by the Government for the demonstration.

4.2.3.2.1 Organizational-Level Demonstration. Selected failures shall be induced into the equipment to verify that FFD, FFI, and MTTR meet the requirements of 3.4.2.1.1.1, 3.4.2.1.2.1, and 3.4.2.1.2.2, respectively. Inserted failures shall not cause damage and shall include opens, shorts, and adjustments that appear as total failures or degraded failures.

4.2.3.2.2 Intermediate-Level Demonstrations. This paragraph is not applicable to this specification.

4.2.3.2.3 Depot-Level Demonstration. Compliance with 3.4.2.1.4.1 shall be verified by demonstrating that the maintenance procedures and test equipment identified for use at the depot level are capable of isolating failures to a discardable item. Inserted failures will be selected from the failures inserted for organizational-level demonstrations and from other nondestructively inserted opens, shorts, and adjustments that appear as total, degraded, or intermittent failures. The depot-level demonstration shall be conducted when the Government depot is established.

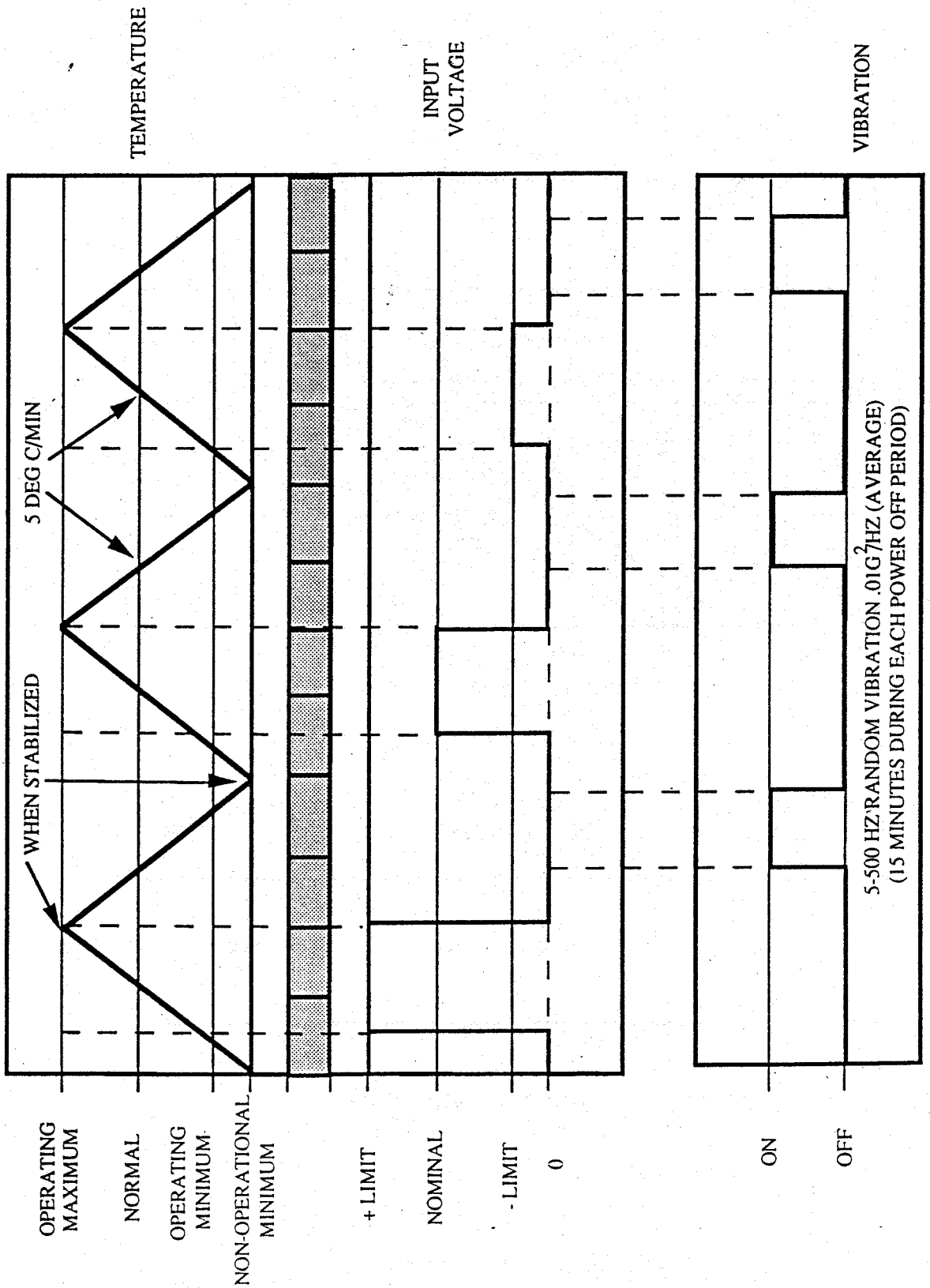
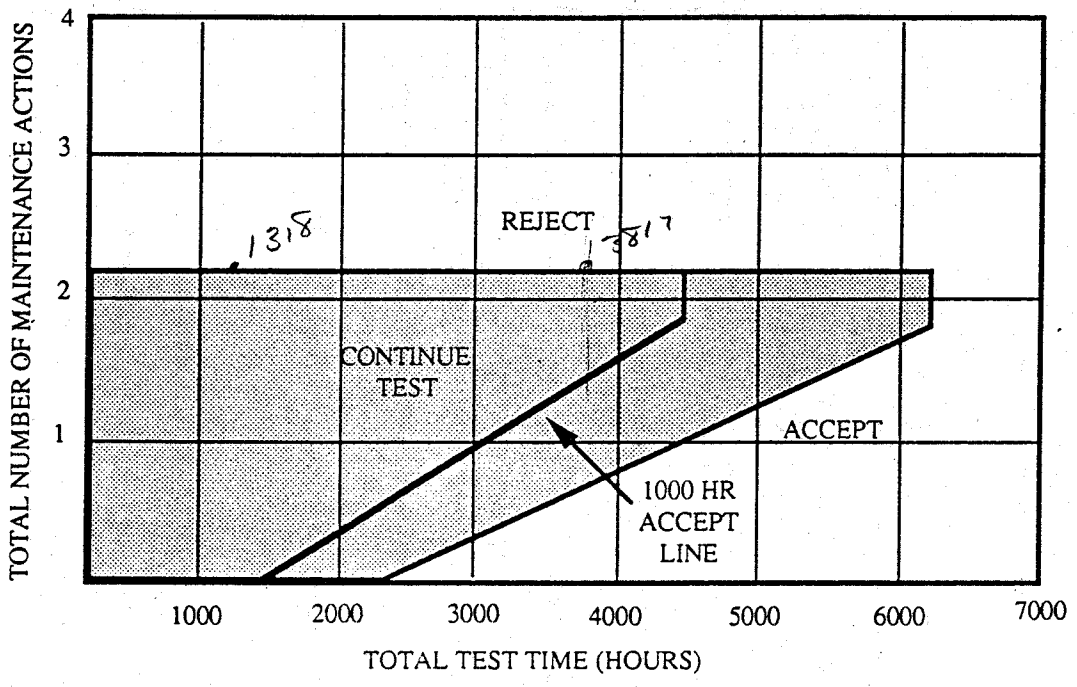


Figure 9. Ground Fixed Test Environment



TOTAL TEST TIME (HOURS)

NUMBER OF MAINTENANCE ACTIONS	REJECT (EQUAL OR LESS)	ACCEPT (EQUAL OR MORE)
0	N/A	2408
1	N/A	4340
2	N/A	6300
3	6300	N/A

Figure 10. MTBCF Accept/Reject Criteria

Table III. MTBCF Accept/Reject Criteria

1. If the MTBCF specification exceeds the MTBCMA actual test time, the verification is acceptable if two criteria are met:

   a. The MTBCMA is accepted in accordance with figure 10.

   b. The reliability prediction of both MTBCMA and MTBCF is accepted.

2. If the MTBCF specification is less than the MTBCMA test time, verification of the MTBCF shall be determined by the point estimate calculated by dividing the total MTBCF test time by the total count of critical failures. The verification is if the point estimate equals or exceeds the specified MTBCF.

4.2.3.3 Preventive Maintenance. Compliance with 3.4.2.1.5 shall be verified by demonstrating that the required PM can be accomplished within the specified time.

4.2.4 Environmental Tests. The following environmental tests shall be performed at one MLS/DME-paired frequency channel selected by the Government.

4.2.4.1 Temperature. The MMLS shall be tested in accordance with MIL-STD-810, Method 501.2, Procedure I and II, and Method 502.2, Procedures I and II. During the Procedure II, measurements of mean course error, mean glidepath error, and time delay of DME, as a minimum, shall be continuously recorded to determine compliance with the specified performance. In addition, the external temperature for each equipment (critical item configuration item or equivalent) shall be measured when the system temperature has stabilized during the maximum operating temperature tests. The measured temperatures shall be within specification for that equipment. Temperature sensors shall be placed at the hottest locations determined during parts derating tests for developed equipment, or by best engineering judgment for off-the-shelf equipment. As applicable to each equipment, the temperatures shall be verified for convection (air) and conduction (heat sink), and the plenum fluid for interior forced convection.

4.2.4.2 Relative Humidity. The MMLS shall be tested in accordance with MIL-STD-810, Method 507.2, Procedure III. During operation, measurements of mean course error, mean glidepath error, and time delay of DME, as a minimum, shall be continuously recorded to determine compliance with the specified performance.

4.2.4.3 Altitude. The MMLS shall be tested in accordance with MIL-STD-810, Method 500.2, Procedures I and II for the operating and non-operating requirements listed in 3.2.2.1.3. During Procedure II, measurements of MCE, mean glide path error, and time delay of DME, as a minimum, shall be continuously recorded to determine compliance with the specified performance.

4.2.4.4 Sand and Dust. The MMLS shall be tested in accordance with MIL-STD-810, Method 510.2, Procedures I and II with a sand concentration of 2.2 g/m^3 and wind velocities of 40 knots for a period of 120 minutes per side of test article. During operation, measurements of MCE, mean glidepath error, and time delay of DME, as a minimum, shall be continuously recorded to determine compliance with the specified performance.

4.2.4.5 Salt Fog. MMLS shall be tested in accordance with MIL-STD-810, Method 509.2, Procedure I with a minimum of 48-hours exposure and a 48-hour drying period.

4.2.4.6 Fungus. The MMLS shall be tested in accordance with MIL-STD-810, Method 508.3. Selected samples, chosen by the Government, shall be tested for a minimum period of 28 days.

4.2.4.7 Rain. The MMLS shall be tested in accordance with MIL-STD-810, Method 506.2, Procedure I with a rainfall rate of 4 in/hr and a wind speed of 50 knots and Procedure III with a water pressure of 40 psig. In addition, a demonstration showing the ease of clean-up of the MMLS shall be performed, including analysis to extrapolate to the use of decontamination agents.

4.2.4.8 Sunshine. The MMLS shall be tested in accordance with MIL-STD-810, Method 505.2, Procedure II.

4.2.4.9 Wind. The MMLS, including field sensor shall be subjected to a wind tunnel test in which the MMLS is exposed to the wind loads specified in 3.2.2.1.9. The MMLS shall be instrumented for continuous real-time monitoring of equipment dynamics, and video recordings of the tests shall be provided. As a minimum, stress and deflection of the equipment shall be recorded for analysis after the test.

4.2.4.10 Ice and Hail. The MMLS radome deicing capability shall be tested after coating the MMLS with 1/2-in of ice. The mean course and mean glidepath error shall be verified after completion of the deicing procedure. Prevention of ice formation on the antenna and field sensor radomes shall also be verified. The mean course and mean glidepath errors shall be measured during an icing procedure.

4.2.4.11 Shock and Vibration. The MMLS shall be tested for shock in accordance with MIL-STD-810, Method 516.3, Procedures IV, VI, and VIII, and for vibration in accordance with Method 514.3, for category 1 and category 3 equipment, with operation verified upon completion of each procedure.

4.2.5 Performance Capability Evaluation. Flight inspection/tests to verify system accuracy, power density, residual radiation, and coverage shall be conducted at four sites incorporating the test configurations defined in 4.2.5.1. At a minimum, the following conditions shall apply:

a. MLS receivers used will meet the requirements of S.N. 404L-50464-S-109.

b. The DME airborne interrogator used shall be the AN/ARN-118 or equivalent.

c. Flight test of the MMLS function shall be conducted as specified by FAA Order 8240.50 except coverage and accuracy requirements shall comply with MMLS performance specified herein. Additional flight check maneuvers to evaluate approaches at four additional glidepaths and one additional approach speed will be used. For collocated configurations up to four computed offset azimuth approaches shall be designated by the Government.

d. The performance of aircraft tracking equipment shall comply with standards established in sections 103.4 and 304 of AFM 55-8 and in paragraph 6.1 and associated subparagraphs for Category II measurement accuracies of ICAO Doc. 8071, Volume II.

e. Accuracy measurements and data reduction methodology for angle guidance functions shall be in accordance with paragraph 2.5.2, including figures and subparagraphs of Attachment G to Part I of ICAO SARPS Annex 10 and FAA Order 8240.50. For those portions of the flight tests not requiring the unique features of the MMLS receiver specified in S.N. 404L-50464-S-109, a standard FAA certified MLS receiver may be used.

f. Flight test of the DME transponder shall be conducted in accordance with section 203 of AFM 55-8, as modified by the performance requirements specified herein. Accuracy measurements for DME/P functions shall be made in accordance with paragraph 7.3.6, including figures and subparagraphs, of Attachment C to Part I of ICAO SARPS Annex 10.

4.2.5.1 Test Configurations. The test configurations chosen shall be representative of expected bare base, main operating base, and restored landing area scenarios as defined below. Flight tests shall include variations in approach elevation angles and azimuth angles representative of expected tactical precision approach flight paths.

4.2.5.1.1 Category I, Collocated System Deployment. The MMLS shall be set up in a collocated configuration, aligned, and readied for flight test for Category I operations as specified in 3.2.10.1.1 and 3.2.10.2.1

4.2.5.1.2 Category I, Split-Site System Deployment. The MMLS shall be set up in a split-site configuration and readied for flight test for Category I operations as specified in 3.2.10.1.2.1 and 3.2.10.2.2.1.

4.2.5.1.3 Category II, Split-Site System Deployment. The MMLS shall be set up in a split-site configuration and readied for flight test for Category II operations as specified in 3.2.10.1.2.2 and 3.2.10.2.2.2.

4.2.6 Production Acceptance Tests. A series of inspections, demonstrations and tests shall be conducted on each MMLS to assure that each operates and performs in accordance with the requirements of this specification. Acceptance test procedures shall include, as a minimum those verification tests marked with (1) in table IV. In addition, the first production system shall undergo the initial increment of the PRAT. (Tests marked (2)) The next initial (maximum of 3) production systems shall be subjected to the production qualification tests specified in 4.2.6.4. (Tests marked (3)).

4.2.6.1 Range Tests. The acceptance tests shall verify, as a minimum the following parameters by measurements with a MLS receiver, as specified in 4.2.5a, on a measurement range:

a. Verification of system MCE and mean glidepath error at a minimum of 3 points in space.

b. Verification of monitor functions.

c. Verification of the effective radiated power (ERP) of the angle guidance signal.

d. Verification of the angular guidance coverage.

4.2.6.2 Production Reliability Acceptance Test (PRAT). The reliability of the production system shall be verified in accordance with 10.2. The test shall be conducted on a sample from each production lot in accordance with the following:

Production Quantity	Number Involved in PRAT
1	1
1 - 5	lst
6 - 20	2
21 - 50	3
51 - 100	4
101 or greater	5

It is intended that the contractor shall perform a single PRAT for each production lot and may use multiple systems to reduce the test time as allowed by the table above.

4.2.6.3 Flight Inspections. Flight inspections shall be conducted on a sample system from each production lot to assure that the designed performance has not been degraded as a result of changes in tooling, processes, work flow, design, parts quality, or other contractor manufacturing method. The performance evaluation shall be conducted in accordance with 4.2.5, for the deployment scenario specified in 4.2.5.1.1. Production flight inspections shall be conducted at a location approved by the Government.

4.2.6.4 Production Qualification Test. In addition to the acceptance tests specified in 4.2.6.1 and 4.2.6.3, the initial production articles shall be subjected to the operating temperature, relative humidity, blowing rain, wind, basic transportation vibration, and EMC tests specified in paragraphs 4.2.4.1, 4.2.4.2, 4.2.4.7, 4.2.4.9, 4.2.4.11, and 4.2.2.4 respectively.

4.3 Formal Test Constraints. Formal test constraints shall be as specified herein.

4.4 Qualification Cross Reference. Table IV specifies the qualification method(s) and test level(s) to be used for each of the MMLS requirements. Any formal tests specified in 4.2 required to verify selected requirements are also identified in table IV. The qualification method shown in the table shall apply to all requirements of the referenced paragraphs unless specified otherwise.

Table IV. Qualification Cross Reference

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.1.3	Modes and states	D	2(1)	
3.1.3.1.1	OFF mode	D	2	
3.1.3.1.2	STANDBY mode	D	2(1)	
3.1.3.1.3	MAINTENANCE mode	D	2(1)	
3.1.3.1.4	SERVICE-DEMAND mode	D	2(1)	
3.1.3.1.5	ON mode	D	2(1)	
3.1.3.2.1	Deployed state	I	3	
3.1.3.2.2	Stored state	I	3	
3.1.4	System functions	D	3	
3.1.4.1.1	Channeling	D	2(1)	4.2.2.1.1
3.1.4.1.1.1	Frequency tolerance	D	2(1)	4.2.2.1.1
3.1.4.1.1.2	RF signal spectrum	T	2(1)	
3.1.4.1.2	Polarization	D	2	
3.1.4.1.3	Signal organization	D	2	
3.1.4.1.3.1	Function rates	T	2	
3.1.4.1.3.2	Function timing	T	2(1)	4.2.2.1.1
3.1.4.1.3.3	Function sequence	T	2	
3.1.4.1.3.4	Synchronization	T	2(1)	
3.1.4.1.4	Preamble	T	2(1)	
3.1.4.1.4.1	Carrier acquisition	T	2	
3.1.4.1.4.2	Modulation	T	2	
3.1.4.1.4.3	Receiver reference time code	T	2	
3.1.4.1.4.4	Function identification	T	2	

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.1.4.1.5	Angle guidance encoding	T	2(1)	4.2.2.1.1
3.1.4.1.5.1	Angle guidance parameters	T	2	
3.1.4.1.5.2	Angle guidance parameter tolerance	T	2	
3.1.4.1.5.3	Scan transmission symmetry	T	2	
3.1.4.1.6.1	Scanning convention	D	2	
3.1.4.1.6.2	Sector signals	T	2(1)	
3.1.4.1.6.2.1	Morse Code equipment identification	T	2	
3.1.4.1.6.2.2	Airborne antenna selection signal	D	2	
3.1.7.1.7.1	Scanning conventions	D	2	
3.1.4.1.7.2	Sector signals	T	2(1)	
3.1.4.1.8	Data functions	T	2(1)	
3.1.4.1.8.1	Basic data	T	2(1)	
3.1.4.1.8.2	Auxiliary data	T	2(1)	
3.1.4.1.9	System accuracy	T	4	4.2.5
3.1.4.1.9.1.1	MCE	T	2,(1)	4.2.5, 4.2.6.1, 4.2.6.3
3.1.4.1.9.1.2	Azimuth PFN	T	2,4(1)	4.2.5, 4.2.6.3
3.1.4.1.9.1.3	Azimuth degradation allowance	T	2,4	4.2.5, 4.2.6.3
3.1.4.1.9.1.4	Azimuth CMN	T	4(1)	4.2.5, 4.2.6.3
3.1.4.1.9.1.5	Azimuth CMN degradation	T	4	4.2.5, 4.2.6.3

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.1.4.1.9.2.1	Mean glidepath error	T	2,4(1)	4.2.5, 4.2.6.1, 4.2.6.3
3.1.4.1.9.2.2	Elevation PFN	T	2,4(1)	4.2.5, 4.2.6.3
3.1.4.1.9.2.3	Elevation degradation allowance	T	2,4	4.2.5, 4.2.6.3
3.1.4.1.9.2.4	Elevation CMN	T	4(1)	4.2.5, 4.2.6.3
3.1.4.1.9.2.5	Elevation CMN degradation allowance	T	4	4.2.5, 4.2.6.3
3.1.4.1.10	Power density	T	2,4(1)	4.2.5, 4.2.6.1, 4.2.6.3
3.1.4.1.11	Residual radiation	D	4(1)	4.2.5,
3.1.4.1.12	Coverage	T	4(1)	4.2.5, 4.2.6.1, 4.2.6.3
3.1.4.1.12.1	Azimuth scan adjustment	T	4	4.2.5 4.2.6.3
3.1.4.1.12.2	Elevation scan adjustment	D	2	
3.1.4.1.13	Azimuth scanning beam characteristics	D	2	4.2.2.1.1
3.1.4.1.13.1	Beamwidth	T	2(1)	
3.1.4.1.13.2	Scanning beam shape	T	2	
3.1.4.1.13.3	Dynamic sidelobes	T	2	
3.1.4.1.14	Elevation scanning beam characteristics	D	2	4.2.2.1.1
3.1.4.1.14.1	Beamwidth	T	2(1)	
3.1.4.1.14.2	Scanning beam shape	T	2	

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.1.4.1.14.3	Dynamic sidelobes	T	2	
3.1.4.2.1.1	DME/P Coverage	T	4(1)	4.2.5, 4.2.6.1, 4.2.6.3
3.1.4.2.1.2	Channeling	D	2(1)	4.2.2.1.2
3.1.4.2.1.3	Capacity	T	2	
3.1.4.2.1.4	DME/P transponder identification Reply pulses Identification code characteristics Identification implementation	T T T T	2 2 2 2	
3.1.4.2.1.5	DME/P modes	T	4	4.2.2.1.2
3.1.4.2.2.1	Frequency of operation	D	2(1)	
3.1.4.2.2.2	Frequency stability	T	2(1)	4.2.2.1.2
3.1.4.2.2.3	Pulse shape and spectrum	T	2(1)	4.2.2.1.2
3.1.4.2.2.4	Pulse spacing	T	2(1)	4.2.2.1.2
3.1.4.2.2.5	Power density Minimum transmission rate	T T	2,4(1) 2	4.2.2.1.2 4.2.5, 4.2.6.1, 4.2.6.3
3.1.4.2.2.6	Spurious radiation Out-of-band spurious radiation	T T	2(1) 2	
3.1.4.2.2.7	Squitter	T	2(1)	
3.1.4.2.2.8	Priority of transmission	T	2	
3.1.4.2.3.1	Frequency of operation	D	2(1)	
3.1.4.2.3.2	Frequency stability	T	2(1)	4.2.2.1.2
3.1.4.2.3.3	Sensitivity Minimum interrogation power density	T	2(1)	

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.1.4.2.3.3 (cont.)	Reply efficiencies	T	2(1)	
	Dynamic range	T	2(1)	
	Pulse pair spacing variations	T	2(1)	
3.1.4.2.3.4	Sensitivity reduction	T	2(1)	
3.1.4.2.3.5	Bandwidth	T	2	
	Minimum bandwidth	T	2	
	Out-of-band signals	T	2	
3.1.4.2.3.6	Recovery time	T	2(1)	
3.1.4.2.3.7	Spurious radiations	T	2(1)	
3.1.4.2.3.8	Echo suppression	T	2	4.2.2.1.2
3.1.4.2.3.9	CW interference	T	2	4.2.2.1.2
3.1.4.2.4	Decoding			
	Transponder triggering	T	2(1)	
	Decoder rejection	T	2(1)	
3.1.4.2.5	Time delay	T	2(1)	4.2.2.1.2
3.1.4.2.6	Accuracy	T	2,4(1)	4.2.2.1.2 4.2.6.1
3.1.4.2.7	Efficiency			
	Reply efficiency	T	2	
	Receiver dead time	T	2	
3.1.4.3	Monitor functions	T	3	
3.1.4.3.1	Integrity requirement	A	3	4.2.3.1
3.1.4.3.1.1	End-to-end integrity check capability	D	3(1)	
3.1.4.3.2.1	Angle and data monitor parameters	D	3(1)	4.2.6.1
3.1.4.3.2.2.a	Monitor parameter adjustability	D	3	
3.1.4.3.2.2.b	Monitor stabilization	D	3	

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.1.4.3.2.2.c	Mean angle error	D	3	
3.1.4.3.2.2.d	Data transmissions	D	3	
3.1.4.3.2.2.e	Multiple sensors	D	3	
3.1.4.3.2.2.f	MAINTENANCE	D	3	
3.1.4.3.2.2.g	Mean angle shift	D	3	
3.1.4.3.2.3	Responses to angle and data monitor alarms	D	3(1)	4.2.6.1
3.1.4.3.2.3.a	Automatic restart	D	3	
3.1.4.3.2.3.b	Alarm indications	D	3(1)	4.2.6.1
3.1.4.3.2.3.c	Field sensor disabled	D	3	
3.1.4.3.3	DME/P monitoring	T	3(1)	4.2.6.1
3.1.4.3.3.a	Multiple sensors	D	3	
3.1.4.3.3.b	Monitor parameter adjustability	D	3	
3.1.4.3.3.1	Responses to DME/P monitor alarms	D	3(1)	
3.1.4.4	Control and display functions	D	3	
3.1.4.4.1	Local control	D	2(1)	
3.1.4.4.1.1	Channel selection	D	3(1)	
3.1.4.4.1.2	Equipment alignment and antenna scan limit adjustment	D	2	
3.1.4.4.1.2.1	Azimuth alignment control	D	2	
3.1.4.4.1.2.2	Elevation alignment control	D	2	
3.1.4.4.1.3	Modes	D	2(1)	
3.1.4.4.1.4	Data entry	T	2(1)	
3.1.4.4.1.5	PRESET control	D	2	
3.1.4.4.1.6	Landing performance selection	D	3	

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.1.4.4.3	Remote control	D	3(1)	
3.1.4.4.4	Remote display	D	3(1)	
3.1.7.1.1.3	Power	D	3	4.2.2.5
3.1.7.1.3	Hardware-to-hardware external interfaces	T	3	4.2.2.5
3.1.7.1.4.1	MLS avionics interface	T	4	4.2.5
3.1.7.1.4.2	DME interface	T	4	4.2.5
3.2.1.1	Weight	D	3	
3.2.1.2	Dimensions	D	3	
3.2.1.3	Transportability	D	3	
3.2.1.3.1.1	Air transport: fixed wing	A	3	
3.2.1.3.1.2	Air transport: rotary wing	A	3	
3.2.1.3.2.1	Truck transport	A	3	
3.2.1.3.2.2	Trailer transport	A	3	
3.2.1.3.2.3	Rail transport	A	3	
3.2.1.3.3	Ship transport	A	3	
3.2.1.3.4	Man transport	D	3	
3.2.1.4	Durability	T	3	4.2.2.3
3.2.1.5	Stability	T	3,4	4.2.2.2
3.2.2	Environmental conditions	D	3	
3.2.2.1.1	Temperature	T	2(3)	4.2.4.1
3.2.2.1.2	Relative humidity	T	2(3)	4.2.4.2
3.2.2.1.3	Altitude	T	2	4.2.4.3
3.2.2.1.4	Sand and dust	T	2	4.2.4.4

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.2.2.1.5	Salt fog	T	2	4.2.4.5
3.2.2.1.6	Fungus	T	2	4.2.4.6
3.2.2.1.7	Rain	T,D	2(3)	4.2.4.7
3.2.2.1.8	Sunshine	T	2	4.2.4.8
3.2.2.1.9	Wind	T	2(3)	4.2.4.9
3.2.2.1.10	Ice and hail			
	Deicing	T	2	4.2.4.10
	Hail	A	2	
3.2.2.1.11	Snow	A	2	
3.2.2.1.12	Lightning	A	2	
3.2.2.2.1	Shock and vibrations	T	2(3)	4.2.4.11
3.2.2.2.2	Storage	A	3	
	Stackability	D	3	
	Accessibility (batteries)	D	3	
3.2.4.1	Design and construction	I	1(1)	
3.2.4.2	Obstruction lights	D	2	
3.2.4.3	Internal power	D	2(1)	
	Charging	D	2(1)	
	Standby battery switchover	D	3(1)	4.2.2.5
	Battery type	I	1	
	Low temperature operation	D	3	
3.2.4.4	Fastener hardware	I	1(1)	
3.2.4.5	Cables and connectors	I	1(1)	
3.2.4.6	Encapsulation and embedment material	I	1(1)	
3.2.4.7	Finish	I	1(1)	
3.2.4.8	Chemical decontamination	A	2	

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.2.4.9.1	Derated application of parts	A	1	4.2.1.3
3.2.4.9.2	Parts selection and screening	I	1	4.2.1.4
3.2.4.10	ESS	T	1	4.2.1.2
3.2.5	Electromagnetic radiation	T	3	4.2.2.4
3.2.6	Workmanship	I	1(1)	
3.2.7	Interchangeability	I	1	
3.2.8	Safety	A	1	
3.2.8.1	Safety criteria Applied Hazards	 A I	 1 1(1)	
3.2.8.2	Grounding, bonding, and shielding	I	1(1)	
3.2.8.3	Electrical overload protection	D	1	
3.2.8.4	Corona and electrical breakdown prevention	D	1	
3.2.9	Human performance/human engineering	D	3	
3.2.10.1	Setup and teardown	T	3,4	4.2.2.3 and 4.2.5
3.2.10.1.1	Collocated setup	T	3,4	4.2.5.1.1
3.2.10.1.2.1	Split-site setup (Category I)	T	3,4	4.2.5.1.2
3.2.10.1.2.2	Split-site setup (Category II)	T	3,4	4.2.5.1.3
3.2.10.2.1	Collocated siting	T	3,4	4.2.5.1.1
3.2.10.2.2.1	Split-site siting (Category I)	T	3,4	4.2.5.1.2
3.2.10.2.2.2	Split-site siting (Category II)	T	3,4	4.2.5.1.3
3.2.10.2.2.2.1	Category II design	T	3	

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.2.10.2.3	Nondegradation conditions	A	3	
3.2.12	Nameplates and product marking	I	1(1)	
3.2.12.1	Nameplates	I	1(1)	
3.2.12.2	Cable identification	I	1(1)	
3.2.12.3	Crystal Identification	I	1(1)	
3.3.1.1	Computer hardware requirements	I	1	
3.3.1.1.1	Memory	D	2	4.2.1.1
3.3.1.1.2	Processing speed	T	2	4.2.1.1
3.3.1.1.3	Port requirements	D	2	4.2.1.1
3.3.1.2	Programming requirements	I	1	
3.3.1.2.1	Programming languages	I	1	
3.3.1.2.2	Compilers and assemblers	I	1	
3.3.1.2.3	Operating system	I	1	
3.3.1.2.3.1	Operating system augmentations	A	1	
3.3.1.3	Design and coding constraints	I	1	
3.3.1.3.1	Design requirements	I	1	
3.3.1.3.2	Coding requirements	I	1	
3.4.1.1	MTBCF	T	3(2)	4.2.3, 4.2.6.2
3.4.1.2	MTBCMA	T	3(2)	4.2.3, 4.2.6.2
3.4.1.3	Independence of failures	D	3	

Table IV (continued)

Section 3 Paragraph	Qualification Requirement	Section 4 Method	Level	Formal Test
3.4.1.4	Reliability modeling and allocations	A	3	
3.4.1.5	Reliability predictions	A	3	
3.4.2.1.1.1	FFD	D	3	4.2.3.2.1
3.4.2.1.1.2	MTBFA	A	3	4.2.3
3.4.2.1.2.1	FFI: organizational-level	D	3	4.2.3.2.1
3.4.2.1.2.2	MTTR: organizational-level	D	3	4.2.3.2.1
3.4.2.1.4.1	FFI: depot-level	D	3	4.2.3.2.3
3.4.2.1.5	Preventive maintenance			4.2.3.3
	60 minute requirement	D	3	
	90 day requirement	A	3	
	10 minute restoral requirement	D	3	
3.4.4	Portability	D	3	4.2.2.3
3.5.1.1.1	Common Support equipment	I	3	
3.5.1.2.1	Organizational-level maintenance	D	3	4.2.3.2.1
3.5.1.2.2	Depot-level maintenance	D	3	4.2.3.2.3
3.5.3	Supply	A	3	

5 PREPARATION FOR DELIVERY

Preservation, packaging, and packing of the MMLS shall ensure that no damage shall be incurred during handling and shipment from the source of supply to the Government-designated destination. Level A preservation and packaging and Level A packing shall be provided in accordance with MIL-STD-2073. Design criteria of MIL-STD-2073 and MIL-P-9024 shall be applicable. Markings shall be in accordance with MIL-STD-129.