

## **SECTION 17000**

### **BASIC COMMUNICATIONS TECHNICAL REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.01 DESCRIPTION**

- A. Section provides an overview of technical requirements, engineering guidelines, technical constraints, and general conditions to be followed throughout the design of the Station Communications System.
- B. Technical requirements specific to each communications subsystem are in each of the subsystem Specification Sections within Division 17, Station Communications.

##### **1.02 GENERAL**

- A. The provisions of this Section apply to all sections within the Division 17, Station Communications, except as otherwise specified. This and all other Specification Sections are collectively referred to Specifications.

##### **1.03 REFERENCE STANDARDS**

- A. Building Industry Consulting Service International (BICSI):
  - 1. Registration as Communications Distribution Designer (RCDD)
- B. Institute of Electrical and Electronic Engineers (IEEE):
  - 1. 200 Reference Designations for Electrical and Electronics Part and Equipment
- C. Military Standard (MIL-STD):
  - 1. 472F Human Engineering

##### **1.04 SUBMITTALS**

- A. Design Review Submittals - General Requirements
  - 1. Submit Design Review Submittals consisting of a complete design description, including detailed drawings, specifications, and submittals of all subsystems and elements within the subsystem. If not governed by codes and regulations, as a minimum, calculation, test procedure, final drawing, and submittal shall be reviewed, signed and sealed by a BICSI Registered Communications Distribution Designer (RCDD). For submittals involving engineering design services required by governing codes and regulations; system design, load and design calculations shall be sealed and signed by a professional engineer, currently registered in the State of California, for the corresponding discipline. The final design document shall contain sufficient details for construction.

2. Include in each submittal phase all materials, equipment, assembly and installation required to carry out the functions and purposes indicated in the Specifications, and to make the system suitable for the purpose for which it is intended, whether or not such materials, equipment, assembly and installation are specifically indicated in the requirements of these Specifications.
3. The Engineer will not approve the proposed design that fails to achieve the result intended by the requirements of this Section or is not in accordance with sound engineering principles. Revise the design until it meets with Engineer approval in accordance with the requirements of these Specifications.
4. Approval or disapproval by the Engineer, or failure to approve or disapprove shall not relieve the Contractor of any responsibilities including the responsibility to provide a sound and practicable system design, suited for the intended purpose outlined in the Specifications and responsibility for accuracy and agreement of dimensions and details.
5. Coordinate each submittal with the requirements of the Work, placing particular emphasis upon assuring that each submittal of one trade is compatible with other submittals of related work. Ensure submittal is complete with all relevant data required for review, including, as a minimum the following:
  - a. The correctness of the drawings, for shop fits and field connections, and for the results obtained by the use of such drawings
  - b. Verification of catalog numbers, and similar data
  - c. Determination and verification of field measurements and field construction criteria
  - d. Checking and coordinating information in the submittal with requirements of the Work and of the Contract Documents
  - e. Determination of accuracy and completeness of dimensions and quantities
  - f. Confirmation and coordination of dimensions and field conditions at the site
  - g. Safety precautions
  - h. Errors or omissions on submittals
  - i. Coordination and performance of work of all trades
  - j. Identification of deviation(s) from Contract requirements
6. Approval of drawings and associated calculations by the Engineer shall not relieve the Contractor from the responsibility for errors or omissions

in the drawings and associated calculations, or from deviations from the Contract Documents, unless submittals containing such deviations were submitted to the Engineer and the deviations were specifically called to the attention of the Engineer in the letter of transmittal and within the submittal, and approved specifically by the Engineer as a Contract change.

7. Where requirements posed by individual subsystems, as defined in other Sections of these Specifications, are different or greater than those specified in this Section, those other requirements shall be deemed to augment the requirements specified herein. All requests for design variations and exceptions from specified standards must be submitted to the Engineer for review and approval.
8. Design Review requirements for each submittal: Preliminary and Final are defined within the individual subsystem Sections. Preliminary Design packages shall be individual submittals for each subsystem, where the Final Design package is one complete submittal sufficient to provide all the required details for construction, overall system integration, and operation. Requests for design variations and exceptions must be submitted not later than the Final Design review and approved by the Owner in writing before the affected Design Units could be released for construction.
9. Order the designated equipment and material only after Engineer's approval of the individual subsystem Preliminary Design submittal, which includes design, calculations, operation as well as the entire product data for that subsystem.

B. Preliminary Design Technical Requirements

1. Submit Preliminary Design packages to satisfy the requirement outlined herein and the subject subsystem section of these Specifications. Communications Preliminary Design shall be required for the following subsystems, except for those subsystems which are not included in the Contract:
  - a. Communications Facilities
  - b. Communications Cabinets
  - c. Conduit / Raceway / Ductbank Subsystem
  - d. Communications Cable
  - e. Power Cable
  - f. Fiber Optics Cable Subsystem
  - g. Public Address (PA) Subsystem
  - h. Visual Message Sign (VMS) Subsystem

- i. CCTV (Security Cameras)
  - j. Ticket Vending Machines (TVMs)
  - k. Clipper Network Card Interface Devices (CIDs)
  - l. Station Network Subsystem
  - m. Power Supplies and Distribution
  - n. Grounding and Protection
  - o. Miscellaneous Items
2. Each Preliminary Design package shall be organized to include the following headings and information:
- a. Preliminary Design Package Purpose and Scope: A brief description and introduction of the package.
  - b. Reference Material: List of relevant references and standards.
  - c. Specification compliance matrix table acknowledging and referencing the Contractor's conformance to each technical requirement clause of every subsystem specifications Section.
  - d. Design Description: As a minimum shall include the subsystem description, detailed design and interface information, all performance, functionality and operational description, as well as details such as the cable and equipment identification.
  - e. Interface Requirements: Identify all required interfaces with other communications and non-communications systems and subsystems. The Preliminary Design shall include the following:
    - 1) Interfaces between Work performed under this Contract and any other Communications contracts, such as, Rail Operations Control System (ROCS) and Passenger Information System located at the Central Control Facility (CCF), Alarm Points and any other required interfaces.
    - 2) Interfaces between the subsystems defined under this Contract. Examples are PAS and LAN; WAN and LAN, TVM and LAN; all the other required interfaces defined in these Specifications.
    - 3) Identification and description of any inquired hardware and software modifications or additions to existing subsystems equipment.
    - 4) Identification of all external interfaces, including those to facilities and equipment provided by others. Interface

examples include power, cable facilities, discreet signals, voice, and data; and the format/coding of the exchanged data.

- 5) Interfaces between the systems. This includes both Communications and Signals.
  - 6) Interfaces between existing systems and Work performed under this contract, between subsystems and all other interfaces which include media converters and/or protocol converters shall be identified and described in detail.
- f. Equipment List: Submit a table or list of model and part numbers for all proposed equipment and materials to be used for individual subsystems. Include the expected lead-time for each item while identifying in boldface type the ones with greater than 30 days. The table or list shall be grouped for each subsystem with functional descriptions of equipment or material included. Quantities and locations shall be included.
  - g. Product Data Sheet: Submit product information in sufficient detail to determine if the component meets these Specifications. The models to be used in the contract shall be explicitly identified in the product data sheet.
  - h. Calculations: Provide all the required signed and sealed calculations as outlined in the subject subsystem section.
  - i. Phasing and Cutovers: Identification and description of all major system cutover events or integration activities describing techniques, methods, duration and procedures.
  - j. Certifications, Registration, and Resumes: Provide a copy of all the required certifications, registrations and resumes as outlined in the subject subsystem section.
  - k. Drawings: Electrical, mechanical, block and functional diagrams with corresponding parts list.

C. Final Design Technical Requirements

1. Submit one complete Final Design package no later than 60 days after Engineer's approval of all the Preliminary Design submittals. Obtain Engineer's approval of all individual Preliminary Design submittals prior to submitting the Final Design submittal package.
2. The Final Design Submittal Package shall be organized to include the following final design information:
  - a. Engineer approved and updated versions of all previously submitted design review materials. Updated material shall represent complete design, final calculations; detailed product

and component level parts list, drawings, phasing and interface details required for construction, intended network, software and configuration settings. All the new and revised sections of the subsystem Preliminary Design shall be marked with revision bars to reflect the changes.

- b. Updated product submittals for all, materials and components for which product submittals were not previously submitted and Engineer approved.
  - c. Complete Drawing index
  - d. Complete cable identification and equipment labels
  - e. Complete wiring diagrams for all equipment to be installed, modified, upgraded, or interfaced
  - f. Top level mechanical drawings, if applicable
  - g. Grounding and protection details
  - h. Power panel schedule and distribution
- D. Installation Work Plans and Detailed Documentation
- 1. Submit complete installation Work Plan and detailed documentation and drawings no later than 60 days prior to the scheduled installation date for each location and each subsystem.
  - 2. Obtain Engineer's approval of the Final Design submittal prior to submitting installation detailed documentation applicable to a subsystem.
  - 3. Organize the Installation Work Plan package to include the following headings and information:
    - a. Scope and description of Work
    - b. Prerequisites
    - c. Tools
    - d. Installation personnel and their roles
    - e. Safety rules, regulations, procedures, and requirements
    - f. Permits, licenses, training including confined space, and certifications
    - g. Planned access dates and times for each location, the Engineer's resources required for each location, and Operational Impact
    - h. Daily Preparation Procedures and Clean-up

- i. Storage, staging facilities, security, and the overall job-site security
  - j. Installation procedures shall include each subsystem hardware and software components including any software and configuration settings and changes.
  - k. Installation drawings:
    - i. Corresponding subsystem design review drawings with updates and details. Include detailed physical layout drawings with material list keyed to the layouts.
    - ii. Cable and conduit schedules that show exactly where each cable is to be installed. Include and identify raceways, cable trays, conduit, junction boxes, pull boxes, manholes, hand-holes, and floor boxes. The cable and conduit schedules shall be accompanied with the corresponding voltage drop, cable gauge and conduit fill calculations, which shall be approved by the Engineer.
    - iii. Cable and wiring connectors and terminal assignments.
    - iv. Wiring diagrams to include terminal blocks, power panel details, Local Distribution Frames (LDF), Main Distribution Frame (MDF), and any additional wiring required for a complete design.
    - v. Names and labels for all equipment including every wire, cable, connector, terminal and rack.
    - vi. Electrical power diagrams and panel and power strip schedules.
    - vii. Mounting, securing, seismic protection and installation details for all equipment and materials.
    - viii. For racks in which equipment will be installed, rack-face elevations with all intra-rack and inter-rack wiring and cabling to be installed.
    - ix. Power connections, panel schedules and grounding/protection connections.
    - x. Location of all safety and hazard warning signs and labels.
    - xi. Site Survey information.
- E. Product Samples as required in individual subsystem Sections or where requested by Engineer.

F. Testing and Inspection

1. Submit Test Program no later than 60 days after Engineer's Final Design approval, outlining Contractor's overall testing strategy and schedule.
  - a. The program shall include a list of all tests to be performed for all subsystems and integral equipment and materials to meet the requirements of these Specifications.
  - b. The program shall include individual subsystem test plans.
  - c. At a minimum, the test program shall cover the following testing activities:
    - i. Factory Testing
    - ii. Inspection
    - iii. Field Equipment and Subsystem Testing
    - iv. End-to-End Acceptance Test
    - v. System Integration Test
  - d. The test program shall include a list all the required tests per subsystem, to be performed in order to meet the requirements of these Specifications. This list shall be organized to include:
    - i. Type of test
    - ii. Tools and Test Equipment
    - iii. Prerequisites
    - iv. Pass and fail criteria
    - v. Personnel and laboratory requirements
    - vi. Required Cutover and Phasing: The cutover sequences shall be accompanied with the corresponding fallback procedures (should something go wrong).
    - vii. Expected Impacts (Outages, Operational, Environmental, and Traffic, Revenue) and recovery Plan when required.
    - viii. Engineer's resources
    - ix. Scheduled date and expected duration
    - x. Additional Comments and notes
2. Submit test and inspection procedures no later than 60 days prior to the scheduled activity. All the required test and inspection procedure

submittals shall be detailed and organized to be consistent and include, but not be limited to the following heading and information:

- a. Scope and Purpose: Clearly state the scope, case, and conditions the procedure tests.
  - b. Prerequisites: Describe test environment and the prerequisites, including access, availability, and equipment configuration for each group of functions.
  - c. References
  - d. Tools: List test equipment and tools, with calibration data for each item.
  - e. Personnel: List test participants and their roles.
  - f. Procedure: Contain enumerated step-by- step procedures. This shall include regression test and Pass and Fail Criteria.
  - g. Drawings: Include detailed drawings depicting test setup. This shall include list of equipment, parts and material used and tested.
  - h. A Test Data Form that includes space to record the tools with calibration date, environmental condition during the test, i.e., rainy, cloudy, and temperature, test measurement, pass and fail criteria and space to record the pass and fail outcome and the signature of the test engineer and a test witness.
3. The Test Exception Form shall be used to record the identifier of the defect report and problem report generated as a result of faults or problems detected during the test. All the troubleshooting techniques and corrective actions shall be documented on this sheet. All found defects and problems, occurred as a result of the Contractor's deficient design or implementation, shall be rectified and retested to the satisfaction of the Owner representative.

G. Test and Inspection Records and Reports

1. Submit all test and inspection records and reports within one week of completion of the corresponding test.
2. Test and inspection records shall be reviewed, signed and sealed to certify adherence to design requirements and standards.
3. Organize test and inspection report submittal to include the following headings and information:
  - a. Purpose/Introduction: Defines the submittal scope.

- b. Test/Inspection Results Summary: Include measurements, results, problem areas, workarounds, troubleshooting, and exceptions.
  - c. Open Items: Identify any open items requiring resolution. Include the corrective action to resolve the open items.
  - d. Conclusion: This section shall document the Contractor's review and how the test and inspection meets the system design and performance requirements outlined in the Specifications.
  - e. Completed Test and Inspection Records: A completed, signed, and dated test/inspection procedure sheets, as well as a defect/problem report for each fault/problem found during the testing.
- H. As-built Documentation: In addition to the requirements of Section 01720, Contract Record Documents, submit the following documentation. Submit as-built versions of the following documentation sealed, as a minimum by a Registered Communications Distribution Designer (RCDD). Documentation with engineering design governed by codes and regulations shall be sealed and signed in blue ink by a professional engineer, currently registered in the State of California, for the discipline involved. Submit as outlined herein for the communications system:
- 1. Equipment inventory, with serial numbers including delivered, installed and spares.
  - 2. Drawings as a minimum shall include those submitted under Final Design, installation and test procedure documents. The As Built drawings shall be numbered and grouped in accordance with Caltrain AutoCAD standards.
  - 3. Final customized software data and source codes.
  - 4. Final alarm, hardware, network and software configurations including required configurations of any operating systems to allow the system to properly function.
  - 5. Final equipment configuration, provisioning, programming and settings.
  - 6. Technical Specification to reflect the final system design implemented in the field.

**PART 2 – PRODUCTS**

Not Used. See individual Specification Sections under Division 17.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION AND GENERAL DESIGN REQUIREMENTS**

- A. Refer to the Contract Drawings for information regarding Caltrain facilities and space in Caltrain facilities.
- B. Environmental condition to which equipment shall be designed is defined in these Specifications.
- C. Comply with IEEE 200.
- D. Operation and Maintenance
  - 1. Operating and maintenance safety shall be the highest consideration in equipment and subsystem design, construction, and installation.
  - 2. Human Factors for operations and maintenance of equipment configuration and positioning shall:
    - a. Comply with MIL-STD-1472.
    - b. User interface equipment and characteristics such as display devices, preferred viewing angles, lettering, control devices and their tactile characteristics, indicators, use of colors, and use of audible indicators shall be consistent with MIL-STD- 1472.
  - 3. Where applicable, equipment and design shall comply with ADA requirements.
- E. Continued Operation of Rail System
  - 1. The Caltrain Rail System conducts Revenue Operations seven days a week. The existing Communications systems and the CCF (Central Control Facility) are in use 24 hours, seven days a week.
  - 2. Installation, replacement, testing or modification of equipment or software during implementation of any new Communications System shall not disrupt continued operation of the Rail System, including operation of the CCF and Fare Collection system.
  - 3. During revenue or non-revenue hours, any disruption to the existing Communications systems and CCF shall be minimized. To the extent possible, no more than a single node shall be unavailable through the existing Communications systems and CCF at any point in time with prior to the Engineer's approval.
  - 4. Coordinate with and obtain necessary approvals from authorities having jurisdiction for shutdowns, temporary diversions, utility relocations, temporary sidewalk closures, and pedestrian detours.
  - 5. Refer to Sections 01011, Work Planning, and 01040, Work Hours and Track Access. Track access time is limited. Coordinate and comply with

requirements specified in Division 1, General Requirements, regarding track access and any work that could potentially interfere with the operating systems.

6. Follow Caltrain's rules for access to and working in any rail operating territory.

F. Design Review Meetings

1. Preliminary Design Review

- a. Conduct a formal meeting for review of the Preliminary Design Submittal with the Engineer.
- b. The review shall be conducted no less than 21 days but no more than 45 days following an Engineer "approved" or "approved as noted" status of all the Preliminary Design submittals.
- c. Submit meeting minutes to the Engineer for concurrence no later than seven days after the Preliminary Design meeting.

2. Final Design Review

- a. Conduct a formal Final Design Submittal review meeting with the Engineer after the approval of all Preliminary Design submittals.
- b. The review meeting shall be conducted no less than 21 days but no more than 45 days following an Engineer "approved" or "approved as noted" status of the Final Design.
- c. Submit meeting minutes to the Engineer for concurrence no later than seven days after the Final Design meeting.

G. First Article Inspections

1. Perform First Article Inspection (FAI) for each subsystem and component that is custom built, custom assembled, or generally not accepted as a commercial off-the-shelf item or assembly. Examples of items for which an FAI should be performed include Communication Facilities and pre-wired Communications Cabinets.
2. The Engineer will determine the format in which the Contractor shall certify FAI performance based on the custom equipment or facility purchased. Examples include:
  - a. Operational checklists of electrical system to include service outlets, lights, housekeeping alarms, and fire suppression.
  - b. Operational checklists to show the functionality of custom made equipment which may include standby power systems, automatic signal switching, and alarm reporting.
  - c. Cable run lists and equipment inventory records.

- d. Cable (copper or fiber) test results.
3. The purpose of each FAI shall be to determine the following:
- a. Based on inspection, measurement, and basic operation, whether the layout and mechanical aspects of the unit under inspection, e.g., Communications Facility, are consistent with Engineer approved drawings, requirements of these Specifications, and other design documentation. If not, the subject unit shall be re-assembled and the FAI repeated. Where maintainability, e.g., accessibility, safety, status indicators, power indicators and control, and exposure to power connector, are present in the unit, assessment of those maintainability aspects shall be included in the FAI.
  - b. Whether an acceptable level of workmanship that is consistent with approved workmanship standards and practices, is present in the initial copy of the unit under inspection. Where wiring, wiring connections, cabling, cable management, labels, tags or grounding connections are present in the unit under inspection, the workmanship standards, practices and procedures associated with the respective element shall be included as part of the FAI.
  - c. Whether an acceptable level of operating and maintenance safety is provided in the initial product submittal. If not, the unit shall be re-designed and re-assembled.
4. For each subsystem and component, the FAI shall be conducted at the earliest possible time in the manufacturing stage.
5. Notify the Engineer at least 21 days prior to each FAI.
6. The Engineer may request an FAI on any subsystem or component. For those subsystems or components where the Engineer requires a FAI:
- a. Obtain the Engineer's approval of the level of workmanship deemed to be acceptable.
  - b. The following, applicable to the subject subsystem or component, shall be available at the time of the FAI:
    - i. Engineer approved drawings and other design documentation
    - ii. Subsystem or Component Parts List
    - iii. Manufacturing and Quality Assurance Inspection Records
    - iv. Test Plan and Procedures
    - v. Tools and staff to make measurements

- vi. Tools and staff to remove covers and perform limited disassembly

### 3.02 TESTING AND INSPECTION

A. This includes basic testing requirements. Where requirements for these activities are present elsewhere, the requirements specified in this Section shall be augmented by those additional requirements

B. General

1. The Contractor shall:

- a. Be responsible for successfully completing all tests required by these Specifications.
- b. Provide all test instruments and any other materials, equipment and personnel needed to perform the tests.
- c. Provide qualified personnel throughout all the required troubleshooting activities that may involve Communications System equipment.
- d. Be fully responsible for the replacement of all equipment damaged as a result of the tests, and shall bear all associated costs.
- e. Maintain comprehensive records of all tests.
- f. Notify the Engineer in writing, no less than 21 days prior to each test activity including factory testing.
- g. Provide test plans, procedures, records and reports for Engineer's approval.

2. Engineer's testing shall not be considered as a replacement for any Contractor required testing or manufacturer producing materials for the Contract required testing. The Engineer reserves the right to:

- a. Inspect test records at any time.
- b. Require the Contractor to perform additional testing, beyond that specified herein, of any equipment or material at any time to determine conformance with these Specifications.
- c. Observe the on-site testing at any time at the Engineers discretion and without prior notification of the Contractor.

C. Factory Testing

1. Factory testing shall be conducted for:

- a. All equipment provided for installed.

- b. All components installed, integrated, and operated as a subsystem (to be tested as a subsystem).
2. Subsystem factory testing shall occur only after Final Design submittal package approval for that subsystem.
3. Factory testing for a subsystem shall be successfully completed prior to shipping any equipment for that subsystem
4. If the equipment for a location is assembled at the factory, factory conduct testing for that equipment after all the racks and other subassemblies are integrated and rack interconnections are in place.
5. In order to show proper operation of all aspects, behavior, and characteristics, minimum requirements for equipment testing include the following:
  - a. Manufacturer's Recommended Testing
  - b. Environmental Testing for Custom Equipment
  - c. Power-up Testing
  - d. Equipment burn-in of 72 hours, with concurrent operation of the equipment, for the full burn-in period
  - e. After burn-in, comprehensive functional testing, including testing of all controls and indicators
  - f. After burn-in, comprehensive diagnostic testing
  - g. After burn-in, comprehensive performance testing
  - h. After burn-in, comprehensive external interface testing, including verification of the following:
    - i. Electrical Interface
    - ii. Functional Interface
    - iii. Mechanical Interface
6. Minimum requirements for subsystem testing include the following:
  - a. Comprehensive Functional Testing
  - b. Comprehensive Performance Testing
  - c. Comprehensive External Interface Testing, including verification of the following:
    - i. Electrical Interface

- ii. Functional Interface
- iii. Mechanical Interface
- iv. Rack-to-rack Interconnects

D. Installation Inspection and Test

- 1. Pre-installation inspection shall include inspection for the following:
  - a. Missing components and parts
  - b. Correct serial numbers
  - c. Damage to equipment
- 2. Inspect installed equipment, as a minimum, for the following:
  - a. Conformance to standards, methods, and quality
  - b. Correct location, positioning, mounting, and orientation
  - c. Damage to equipment
  - d. Correct and secure external connections
  - e. Correct and secure routing of cable and wires
  - f. Correct and secure internal connections
  - g. Proper Grounding and Protection
  - h. Verification of all configuration data and setting
  - i. Correct labeling

E. Field Equipment and Subsystem Testing

- 1. Perform the following equipment field tests for all installed equipment. Additional field tests for each subsystem, listed in the subsequent paragraphs, shall not be construed to limit or otherwise relieve the Contractor of the responsibility for performing comprehensive field testing of the following:
  - a. Basic equipment operation
  - b. Functional and performance testing
  - c. All external interfaces such as mechanical, electrical, and functional
  - d. Operation in the presence of equipment and software failures
  - e. Operation in the presence of power failure and restart

2. Subsystem testing shall include the following:
  - a. Tests for proper local operation
  - b. Tests to confirm the installed equipment or subsystem meets performance requirements
  - c. Validation of all data used to configure or operate the subsystem
- F. End-to-End Acceptance Testing
  1. Refer to each Specification Section within Division 17, Station Communications.
- G. Engineer's Systems Integration Testing
  1. Conduct System Integration Testing (SIT) in accordance with Engineer's requirements.
  2. Upon activation, interface, and integration of all required individual subsystems required for each line section cutover, provide SIT including technical support. Technical support shall include providing engineer, technician, and installation staff as well as tools, appliances, fixtures, expendable materials, supplies, and test equipment as needed to perform the SIT procedures or to develop and implement required corrective actions on the Contractor's elements.
  3. This testing shall involve the interaction of the Communications System operating with one or more other sub-systems and shall be required through System Final Acceptance.
  4. SIT shall include testing of all communications subsystems added to, modified, or integrated as a result of work performed under this Contract and integrated or interfaced to existing systems and subsystems. Subsystem integration testing shall include:
    - a. Rail Operations Control System (ROCS) and Passenger Information System indications and controls between intended field and control locations
    - b. Station node integration
    - c. Proper local and remote operation of Station PA and VMS messaging
    - d. Proper operation of all voice circuits
    - e. Proper transport and operation of TVM data and indications

H. Site Burn-In Testing

1. Where applicable, certain subsystems shall undergo a Site Burn-In Testing where the tested subsystem's equipment and software shall maintain normal functioning in a fully operational mode during a predetermined approved period of time (i.e. 15-day, 31-day, etc.). The goal is to ensure the subsystem's performance in accordance with the Contract requirements while avoiding pre-defined number of occurrences of major and minor subsystem malfunctions (caused by the issues in the Contractor design and/or implementation). Contractor shall identify such major and minor malfunctions in the corresponding subsystem Test Plan and Procedures, which shall be approved by the Engineer.
2. If during the burn-in period of time, the subsystem exceeds the approved number/types of such malfunctions, the burn-in testing shall be stopped and considered failed. The Contractor shall review the subsystem's performance, submit for the Engineer's approval the list of found issues with their explanation and proposed methods for rectifying the found issues. Upon correcting all such issues and as per approval by the Engineer, the burn-In testing shall restart again.

I. Inspections and Tests for Final Acceptance

1. Perform Final Acceptance inspections and tests for each portion of the Communications System following successful completion of System Integration Testing (SIT) for that portion. At this stage all the defects and other open items relevant to the system and identified up to that time, shall have been closed and system shall be ready for final inspection and acceptance test.
2. Inspection and tests as outlined in these Specifications shall demonstrate to the Engineer that, the System is operating in accordance with the requirements of these Specifications.
3. Perform "Complete Testing" for all equipment that exhibited faults during the SIT. "Complete Testing" shall be testing that is equivalent to the field and functional testing performed on the equipment when first installed are required by these Specifications and Engineer approved test procedures including submission of test results and test reports.
4. Perform "Complete Testing" for all equipment that was replaced under warranty. For all subsystems and equipment that have been changed after initial testing after installation, perform complete testing of such subsystem and equipment.
5. Verify the accuracy of the as-built documentation for each equipment location.

**END OF SECTION**