DESIGN SPECIFICATIONS FOR

Trunk Carrier Systems

REA
TELECOMMUNICATIONS
FORM 397b
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RURAL ELECTRIFICATION ADMINISTRATION • U.S. DEPARTMENT OF AGRICULTURE
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PART I

TRUNK CARRIER EQUIPMENT PERFORMANCE SPECIFICATIONS

1. SCOPE

1.1 These specifications apply to trunk carrier equipment designed for use with paired cable. The specifications may also be used for trunk carrier designed for coaxial cable, radio, optical fibers or other facilities. Part I of Form 397b specifies the system performance of the installed equipment. Part II of Form 397b specifies requirements for installation, alignment, inspection and acceptance tests when such service is included as part of the contract. Part IIIA of Form 397b lists the equipment requirements and technical data for application engineering. Parts I and IIIA are completed by the Purchaser or its Engineer. Part IIIB is to be completed by the Seller.

NOTE: REA TE&CM Section 904 is an application guide for this specification.

1.2 Trunk carrier equipment is required for: (Company & REA Project No.)

_____

_____

1.3 The Seller will supply the equipment under one of the following conditions: (check one)

☐ Form 397: Furnish, deliver, install, align and test equipment and materials. Parts I, II and III of REA Form 397b comprise the specifications.

☐ Form 398: Furnish and deliver the equipment. Parts I and III of REA Form 397b comprise the specifications.

1.4 Specific equipment quantities and detailed application information are outlined in the Purchasers Narrative, C. O. Trunking Plan, Carrier System Layout(s), other Addenda, and one or more Part IIIA of the Form 397b. The Purchaser completes Parts I, II (when applicable) and IIIA along with attached addenda.

1.4.1 Purchaser's Narrative: The Purchaser's narrative describes the initial and ultimate equipment, system and route requirements and a tentative schedule for implementing each phase of growth. The narrative is supported by the Form 397b and addenda. The purpose of the narrative is to outline the Purchaser's plans so that the initial equipment furnished under this contract can be later expanded to ultimate service needs with minimal impact. (System may be expanded by Purchaser with the same type of equipment, or with other compatible equipment.)

1.4.2 Purchaser's Specifications: The Purchaser's specifications include the Form 397b, attached addenda and specifically referenced specifications (i. e., REA PE Specifications). All items specified in the Form 397b and attached addenda are to be included in the Seller's basic proposal

unless stated otherwise. Where the overall system is divided into separate contracts for component parts of the system, specific separation of Seller responsibilities are outlined in the Form 397b and addenda (i. e., separate contracts for PCM carrier terminals, span line and/or APS equipment.)

1.4.3 Seller's Proposal: Part IIIB of Form 397b and attached addenda contain the information from the equipment Seller which is considered essential in evaluating the proposal. The Seller's equipment and proposal shall meet all of the Purchaser's specifications except where specifically noted by the Seller. All items included in the Purchaser's specifications are included in the basic proposal unless stated otherwise. The Seller is to separate equipment and installation costs of the basic proposal, each alternate proposal and optional equipment. The equipment Seller completes Part IIIB and attached addenda as required.

1.4.4 Seller's Responsibility: It is the Seller's responsibility to furnish equipment under this contract that will provide all initial equipment requirements; and will provide for growth to the system ultimate requirements by adding new modules to partially equipped units and by adding new systems. Modification of existing equipment or wiring to accommodate future growth shall not be required unless specifically outlined by the Seller in Part IIIB. (Note: Items such as repeater housings shall be wired for full capacity. Additional systems are accommodated by inserting repeaters and protectors without altering the wiring within the housing.)

1.4.5 Seller's Narrative: The Seller shall provide a short descriptive narrative describing in quantities the proposed systems and component parts, accessories, options and necessary test equipment. The Seller shall also provide a plan for orderly growth from the initial quantities of channels and systems to the ultimate specified quantities. The equipment is expected to meet all requirements during each phase of growth.

2. SYSTEM PERFORMANCE

2.1 The installed trunk carrier equipment and accessories shall meet the requirements set forth in Part I and Part III, Form 397b.

2.2 Equipment furnished under this contract shall meet the following specification requirements. The performance requirements cited in these specifications are extended to include the applications and other specific criteria noted in Parts I and III, Form 397b.

☐ Analog Trunk Carrier Systems

- ☐ PE-60a
- ☐ PE-60f
- ☐ Other (Specify) _____

PART IIIB

1. SELLER'S PROPOSAL FOR TRUNK CARRIER EQUIPMENT

1.1 The Seller proposes to supply the following types of trunk carrier equipment:

_____

_____

_____

_____

_____

1.2 The proposed trunk carrier equipment and materials including repeaters, line treatment and associated equipment meets all requirements of Form 397b, Parts I, II (when included) and IIIA:

☐ Yes

☐ No (Exceptions noted in Paragraph 2.8)

1.3 Equipment lists and other descriptive material do not supercede the requirement to specifically outline exceptions to the requirements of Form 397b, Parts I, II and IIIA.

2. SELLER'S ADDENDA TO THIS SPECIFICATION

2.1 ☐ Published description of Seller's proposed equipment, including specifications. (Proposed equipment must meet Seller's specifications as well as Purchaser's specifications.)

2.2 ☐ Narrative describing the proposed system and its component parts, accessories, options and necessary test equipment.

2.3 ☐ Plan for orderly growth from the proposed initial quantities to the required ultimate quantities of equipment.

2.4 ☐ List of materials and cost of equipment comprising the Basic Proposal.

2.5 ☐ List of spare parts recommended by the Seller and costs as Options.

2.6 ☐ List of special test equipment recommended by the Seller and costs as Options.

2.7 ☐ Alternate Proposals, including costs.

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2.8 ☐ Exceptions to the requirements of any part or parts of this specification.

2.9 ☐ Calculated maximum current from central office batteries. (Briefly note partial and full system requirements based on normal busy hour conditions.) Seller will supply necessary battery filtering.

2.10 ☐ Discussion of training available for Purchaser.

2.11 ☐ A description showing the vertical rack space and rack width required. Also shows proposed locations and layout of equipment in the central office.

2.12 ☐ A description of the racks supplied by the Seller (quantities, height, width, and top supported or self-supported).

2.13 ☐ System layout including proposed repeater spacing necessary to meet transmission objectives of this specification. (Also included are locations of line treatment or other proposed equipment necessary for proper operation of equipment.)

(NOTE: Add to this list as necessary.)

REA Form 397b
October 1980

REA Design Specifications for

TRUNK CARRIER SYSTEMS

CONTENTS

☐ Digital Trunk Carrier Systems

- ☐ PE-60a - Terminal Equipment
- ☐ PE-60b - Span Line Equipment
- ☐ PE-60c - APS Equipment
- ☐ Other (Specify) _____

2.3 The physical and electrical characteristics of the outside plant over which the carrier system furnished under this contract shall operate and other information necessary for proper carrier system operation are specified under Part IIIA, Form 397b. The specifications are for paired cable facilities unless noted otherwise.

2.4 Frequency and level coordination among carrier systems shall be practiced so that transmission and signaling performance of any carrier circuits already installed and properly aligned on other wire pairs (and which meet normal transmission losses along all or a portion of the same routes) shall not be impaired by the installation and operation of carrier channels furnished under terms of this contract.

2.5 Where the same wire facility is used for voice, signaling and/or carrier, or other multipurpose use, the transmission, signaling and other functions shall not be appreciably degraded by the filters, interface equipment and accessory devices required. Where carrier channels are used for voice, signaling and/or alarms, or other multipurpose use, the transmission, signaling and other functions shall not be appreciably degraded. Multipurpose use of facilities and channels are described in Part III, Form 397b.

2.6 The carrier equipment must signal satisfactorily over the trunking network, including tandem offices, as shown in the Form 397b and addenda.

2.7 The documentation required includes at least one complete set of equipment manuals and other instructions including installation, troubleshooting techniques and maintenance recommendations for each central office in which the equipment is located and associated trunk routes. State any additional requirements.

_____

_____

2.7.1 Electrical protection procedures (maintenance procedures, options, etc.) for the terminal equipment, repeaters and accessory equipment installed on the outside plant shall be part of the manual required in 2.7 above.

2.7.2 The Seller shall provide installation procedures for Purchaser installed housings and equipment.

2.7.3 To the extent that the equipment is factory wired, the Seller shall provide office records showing wiring options used in the terminals, channels, filters, repeaters, jackfields and terminal blocks.

2.8 ☐ The Purchaser requires training for ___ employees. A description of this training is to be proposed by the Seller.

2.9 If this contract provides for installation, alignment and testing by the Seller, this work may be done during normal working hours unless otherwise specified here: _____

_____.

3. TECHNICAL DATA AND REQUIREMENTS

3.1 Technical data and detailed requirements may be outlined in one Part IIIA and attached addenda; or the technical data and detailed requirements may be outlined in a Part IIIA for each central office and/or trunk route and supported by attached addenda.

☐ The requirements are outlined in one Part IIIA and addenda.

☐ The requirements are separated into the following central offices, trunk routes and other equipment groups. Addenda applies to all groups unless indicated to apply to a specific group(s). (Identify specific Part IIIA groups included. Note if trunk route is separated into a central office to central office grouping, or a central office to specified boundary grouping.)

_____

_____

_____

_____

_____

_____

3.2 To the extent that each apply, the following is a summary of the Purchaser's technical data and system operation requirements. Additional data and requirements are specified in detail in addenda.

3.3 Central Office

3.3.1 A central office floor plan is attached for each central office in which carrier equipment will be located. Carrier equipment should not be located closer than six feet to rectifiers, voltage regulators and rotating equipment. The floor plan includes a detailed description and location of all existing and proposed equipment relative to the Seller's responsibilities. If installation is a part of the contract, the information includes rack profiles, locations and descriptions of alarm, traffic, power, ground and other similar connections, structural alterations (including masonry drilling), and other related information. Special considerations such as central office ground window are also included in the descriptive information.

3.3.2 Central office equipment information is attached for each central office. It includes the COE manufacturing and type of existing and proposed equipment. Central office circuit characteristics, and/or circuit numbers are included for trunk circuits, selector circuits, ANI, CCIS, and other interface requirements.

3.3.3 A central office trunking plan showing trunk groups between central offices is attached. The trunking plan includes detailed quantities of DDD, Operator, ANI, EAS, tandem trunk switching, and other trunking or special requirements.

3.4 Transmission and Special Requirements

3.4.1 A voice frequency transmission level diagram is attached showing all required 2 wire and 4 wire transmit and receive levels, alignment test points and jacks. The 1000 hertz (1000-1020 hertz) and channel noise requirements for standard voice circuits are:

☐ _____ dB loss (2 wire)

☐ _____ dBrncO maximum noise

☐ Loss and noise requirements vary and are outlined in detail in addenda.

3.4.2 Where carrier channels are required for special applications such as foreign exchange, full period, data, telementry, facsimile, control, order wire, etc., these special application and transmission requirements are outlined in addenda.

3.4.3 Where digital carrier channel banks provide trunks to a distant central office on a direct digital basis, special requirements may apply such as synchronization and transmission.

☐ Some or all of the digital carrier channel banks interface at the distant office on a direct digital basis.

☐ The channel bank transmit bit rate shall be synchronized by the bit rate of the receive signal as outlined in addenda.

☐ Special transmission requirements apply for direct digital interface circuits as outlined in addenda.

☐ Other special requirements are outlined in addenda.

3.4.4 Where carrier systems proposed under this contract must coordinate with other existing or future carrier systems sharing the same cable route or path, detailed information and requirements are outlined in addenda.

3.5 Outside Plant Information

3.5.1 The outside plant facilities over which the trunk carrier equipment is to operate are detailed in the Carrier System Layout or other attached addenda. The information should include accurate footage, housing or other access locations, cable gauge, cable pairs, cable type and manufacturer, year of installation, and REA cable specification (and data) purchased under. The information should also show the extent of rearranging necessary where cable pairs are currently in use.

3.5.2 The outside plant facilities are composed of:

☐ Buried PIC filled cable

☐ Buried PIC air core cable

☐ Aerial PIC air core cable

☐ Paper insulated cable

☐ Screened cable

☐ Unshielded or other facilities

☐ Joint use with power facility poles

3.5.3 PE Cable Specifications: _____

Installation Dates: Oldest: _____

Latest: _____

3.5.4 Cable sizes range from:

Smallest: _____ pairs

Largest: _____ pairs

3.5.5 Cable splices are mechanical connector type unless stated otherwise. Also state if splicing is other than normal color to color and unit to unit splicing.

3.5.6 Insertion loss, shield continuity, and other transmission measurements are to be made on outside plant facilities by the Purchaser and provided to the Seller:

☐ As a part of this contract

☐ Before installation of equipment

3.5.7 Interference from other cable pairs or from sources outside the cable facilities such as radio, power line carrier, power line influence or nearby substations that are known to exist are outlined (approximate distances) in attached addenda.

PART II

TRUNK CARRIER EQUIPMENT

Installation, Alignment, Inspection and Acceptance Tests

NOTE: Part II applies to the Seller when installation is included as a part of the contract (Form 397). When installation is not a part of the contract (Form 398), the Purchaser becomes the installer and should carry out the provisions of Part II including measurements and data required for approval of closeout documents.

1. INSTALLATION

1.1 The equipment and materials specified herein shall be installed to high quality workmanship standards by competent personnel.

1.2 The Seller is allowed reasonable access to Purchaser's facilities, equipment and materials necessary for the installation of the carrier equipment. It is the Purchaser's responsibility to be sure that these facilities are in good and accessible condition for the Seller.

1.3 Equipment and accessory plant devices mounted external to the central office building and external to the repeater and other outside housings will be installed by the Purchaser. These include filters, repeater housings, splicing of repeater cable stubs, externally mounted protective devices and other such accessory devices. The Seller will provide instructions for the Purchaser to properly install the accessory and plant equipment. The instructions will be in written form.

1.3.1 The Purchaser will provide the necessary voice loaded pairs for order wire, interrogation, etc.

1.4 All leads brought out to terminal blocks on the MDF (or IDF if stated in Part IIIA) and the blocks shall be identified and permanently labeled by the Seller.

1.4.1 Separate shielded type leads or TIP cables meeting REA cable crosstalk requirements shall be used for carrier frequencies inside the central office. The shields shall be grounded at one end only unless specified otherwise by the Purchaser or Seller.

1.4.2 The cables shall be grouped to separate carrier frequency, voice frequency, signaling and power leads.

1.4.3 The Seller will make the necessary power and ground connections to the Purchaser's power terminals and ground bus unless stated otherwise in Part IIIA. The location of these connections are shown in Part IIIA. The ground wire shall be 6 AWG unless stated otherwise.

1.4.4 The Purchaser shall make all cross connections (at the MDF or IDF) between the carrier equipment and the central office equipment unless otherwise specified in Part IIIA.

1.4.5 The wiring between the carrier channels and the central office equipment shall be such that two wire E and M, four wire E and M, loop dial and FX type signaling units can be easily exchanged without wiring changes or cabling being added.

2. ALIGNMENT

2.1 The equipment shall be adjusted and aligned to meet the requirements and conditions set forth in Parts I and III, Form 397b.

3. ACCEPTANCE TESTS AND DATA REQUIRED

3.1 Data shall be supplied to the Purchaser by the Seller in writing as a part of the final documents in closing out the contract as follows:

3.1.1 A detailed cross connect drawing of alarm to power board, central office battery to carrier system, wiring options used in terminals, channels, filters, repeaters, etc., shall be marked in the Purchaser's copy of the equipment manual or supplied separately.

3.1.2 The measured central office supply voltages applied to the equipment terminals or repeaters at the time the jack and test point readings are made and ac supply voltages where equipment is powered from commercial ac sources.

3.1.3 A list of all instruments, including accessories, by manufacturers and type number, used to obtain the data.

3.1.4 The measurements at all jack or test points recommended by the manufacturer, including carrier frequency level measurements at all carrier terminals and repeaters where utilized. Special note should be taken of the receive carrier levels to see that they are within prescribed limits.

3.1.5 Measurements on all channels for 1000 hertz (1000-1020 hertz) net loss, idle channel noise, and measurements on auxiliary test circuit such as interrogation pairs. The channels other than the one under test shall be transmitting signaling or other tones at the normal idle level.

3.2 Data in the form of a checklist or other notations shall be supplied showing the results of the operational tests. The operational tests shall include:

3.2.1 Dialing, talking, listening, and other operational tests (where applicable) on each channel supplied under this contract.

3.2.2 Performance and listening tests shall be made on equipment supplied under this contract and existing equipment to determine that any channel or system does not cause interference with other channels or system. A chosen sample of channels representing the highest probabilities of interference shall be tested.

3.2.3 Local and remote alarm indications shall be checked, including fuse failure and other alarm conditions.

4. JOINT INSPECTION REQUIREMENTS

4.1 The Seller shall notify the Purchaser in writing at least one week before the date equipment will be ready for inspection and tests. A joint inspection shall be made by the Seller and Purchaser (or Purchaser's Engineer) to determine that the equipment installation is acceptable. The inspection shall include physical inspection, a review of acceptance test data, operational tests and sample measurements.

4.2 The Purchaser shall review the acceptance test data and compare it to the requirements of this specification.

4.3 Sample Measurements shall be made on all systems installed under this contract. REA TE&CM Section 925 or other commonly accepted measurement methods will be used to determine compliance. The measurements shall consist of the following:

4.3.1 A check of measured test point and jack readings for compliance with the manufacturer's specifications. This applies also to channels, terminals, carrier frequency repeaters and fault locating circuits.

4.3.2 A measurement of voice frequency net loss at 1000 hertz (1000-1020 hertz) and a comparison to the requirements of Part III.

4.3.3 A measurement of idle channel noise in dBrn, "C" message weighted, and a comparison to the requirements in Part III.

4.3.4 A measurement of receive pulses in percent break and comparison to the requirements of PE-60.

4.4 Statements: In the event that the measured data or operational tests show that equipment fails to meet the requirements of this specification, the deficiencies are to be resolved as set forth in Article II of this contract. The reports of the Seller and Purchaser should be detailed as to deficiencies, causes, corrective action necessary, corrective action to be taken, completion time, etc.

PART IIIA

TRUNK CARRIER EQUIPMENT

Detailed Equipment Requirements and Technical
Data for Application Engineering

1. GENERAL

1.1 Part IIIA is to be completed by the Purchaser or its Engineer. Trunk carrier equipment is required for (Telco, REA Project No.):

_____

1.2 This equipment is to be located (Identify the central offices and routes included in this group):

_____

_____

_____

_____

2. PURCHASER'S EQUIPMENT REQUIREMENTS

2.1 Office Equipment: The office equipment requirements include but are not limited to (itemize quantities in blanks and check blocks as required with details in addenda):

2.1.1 _____ System Ends

(_____ Channels per fully equipped system)

2.1.2 _____ Channel Ends (900 ohms unless stated otherwise)

These channel ends include:

_____ E&M 2 Wire - With A&B Leads

_____ E&M 2 Wire - Without A&B Leads

_____ E&M 4 Wire (600 ohms)

_____ 4 Wire - Without Signaling (600 ohms)

_____ Dial Pulse Originating (One Way)

_____ Dial Pulse Terminating (One Way)

_____ Other Special Channels

Part IIIA

2.1.9.1 ☐ Prewired Bays

2.1.9.2 ☐ Connectorized Equipment

2.1.9.3 ☐ Fuses and Fuse Panels

2.1.9.4 ☐ Terminating Blocks

2.1.9.5 ☐ Racks

2.1.9.6 ☐ Wire and Cable

2.1.9.7 ☐ Cable Runways and Supports

2.1.9.8 ☐ Other _____

2.2 Outside Equipment: The outside equipment requirements include but are not limited to (details are outlined in addenda):

2.2.1 _____ Total Main plus Spare Span Lines

These include:

_____ Total Repeater Locations

_____ Repeater Housings Required

_____ Total Repeaters Required

2.2.2 Repeater Housings Requirements

☐ Bypass Type

☐ Grounded Only Type

☐ Pressure Type

☐ Vented Type

☐ Cable Stubs Required

☐ Other Requirements _____

2.2.3 Repeaters and repeater housings are one cable, two way operation unless stated otherwise. _____

2.2.4 Protection shall be provided for all equipment furnished under this contract (initial systems) unless stated otherwise. This includes repeaters, interrogation, order wire and other exposed components of the system. Other requirements: _____

_____

Part IIIA

2.2.5 ☐ Interrogation System Required

2.2.6 ☐ Order Wire Required

2.2.7 ☐ Field Power Supplies and Batteries Required

2.2.8 ☐ Other (Specify) _____

2.3 Special Equipment: The special equipment and facilities to be furnished by the Seller include but are not limited to (details are outlined in addenda).

2.3.1 ☐ Analog Multiplex Equipment

2.3.2 ☐ Digital Multiplex Equipment

2.3.3 ☐ Special Automatic Protection Switch Systems

2.3.4 ☐ Special Alarm Systems

2.3.5 ☐ Special Remote Maintenance Systems

2.3.6 ☐ Coaxial Cables

2.3.7 ☐ Optical Fiber Cables

2.3.8 ☐ Other (Specify) _____

3. PURCHASER'S ADDENDA TO THIS SPECIFICATION

NOTE: Check the blocks below indicating that Addenda is attached and is a part of this specification. Add other Addenda to this checklist as necessary to provide the Seller with complete requirements and engineering information.

3.1 ☐ Narrative (describing proposed trunk service, specific system requirements, and a tentative timetable for present and future requirements.)

3.2 ☐ Trunking Plan (showing trunk groups and quantities of equipment for present and future requirements.)

3.3 ☐ Carrier System Layout (showing trunk groups, quantities & location of equipment, and cable information.)

3.4 ☐ Separate Contracts cover component parts of the transmission system; separation of Seller responsibilities are outlined in addenda.

Part IIIA

3.5 ☐ Office Equipment (For each office, show detailed requirements for channels, systems, span terminations, APS, terminal and span power, office protectors, jacks, special features, hardware, etc.)

3.6 ☐ Outside Equipment (For each route, show detailed requirements for repeater housings, repeaters, interrogation systems, protectors, order wire, outside structures, field power, etc.

3.7 ☐ Special Equipment and Facilities (multiplex equipment, coaxial cables, optical fibers, etc., furnished by Seller).

3.8 ☐ Special Application Considerations (for Purchaser furnished multiplex, coaxial cables, optical fibers, etc.)

3.9 ☐ Alternate proposals or options to the Basic proposal are requested as outlined in the Addenda.

(NOTE: Add to this list as necessary)