

APPLICATION GUIDE FOR SUBSCRIBER CARRIER SPECIFICATION
REA FORM 397c

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1. GENERAL

1.1 This section provides REA borrowers, consulting engineers, carrier equipment manufacturers and sellers with information concerning the use of REA Form 397c, REA Design Specifications for Subscriber Carrier Systems.

1.2 The 397c (revised October 1980) is arranged to accommodate both small carrier systems and larger, more complex systems. An attempt was made to cover the necessary carrier system requirements with minimal duplication. This was done by including items that generally apply to the overall system in Part I, with specific details covered in Part IIIA. A Part IIIA is recommended for each central office exchange area.

1.3 Addenda such as the Purchaser's Narrative, Carrier System Layout, and other detailed requirements and technical data are necessary to outline the Purchaser's specific carrier system requirements. Attached addenda applies to all groups of proposed equipment unless specifically indicated to apply to a specific group or groups of equipment. (See Form 397c, Part I, Paragraph 3.1.)

1.4 The 397c is primarily intended to be used for complete carrier systems. However, it can be used for parts of a complete system furnished under separate transmission and/or switching contracts. Digital transmission and switching systems are modular in concept. A high degree of system integration is now possible. Recognizing this, the REA List of Materials now separates the listing of digital transmission equipment into categories of trunk terminal equipment, subscriber terminal equipment, span line equipment and automatic protection switch (APS) equipment. The

397c (or 397b) might be used for the purchase of span line equipment for use with separately purchased digital subscriber systems such as carrier, concentrators, or remotes from digital central offices.

1.5 The 397c (and 397b) basically conform to formal REA specifications and equipment in volume use in rural areas at the time of issue. The accelerating evolution of technology and/or the special circumstances surrounding a specific application may warrant deviations from these standard practices and equipment. The 397c provides for those deviations. For example, the T1 type span line as covered under PE-60b is the predominant transmission link between rural exchanges today, and is expected to remain the predominant link in the near future. Thus, the PE-60b Specification addresses T1 type span lines and is one of the specific blocks noted in Item 2.2 of Part I. If the Purchaser needs a higher bit rate transmission link over conventional paired cables, coaxial cables or optical fiber cables, this can be outlined in addenda. Since the 397c (and PE-60b) does not specifically address these higher bit rate systems, the Purchaser should reference other formal specifications or include detailed specifications in addenda.

2. PLANNING CARRIER PURCHASE

2.1 The use of trunk and subscriber carrier equipment has grown rapidly during the last decade. What was once a small and somewhat steady market has grown into a large and sometimes volatile market. On occasion, the transmission equipment costs exceed the switching equipment costs in a service area. The carrier industry attempts to provide immediate "off-the-shelf" delivery of products. This is not always possible, and extended lead times for certain items may occur. Planning and lead time may be especially necessary for larger purchases or to schedule equipment installation by the Seller.

2.2 Adequate planning should precede any large purchase of equipment. This planning should begin at the area coverage design (ACD) stage. Planning should include an outline of what is needed, when it will be needed, what is available, compatibility with other equipment (existing and future), and the projected impact of future technology and economics. All reasonable alternatives should at least be considered. The final determination should be made on the basis of the best overall service for the subscribers at the lowest overall cost to those subscribers.

2.3 Standardization and volume production often result in cost and reliability improvements. For digital subscriber systems, rural telephone companies have essentially standardized on systems such as D3 and D4 type channel banks and T1 type span lines covered under PE-64a and PE-60b specifications. These systems are economical, reliable, and conform to a hierarchy of digital transmission and switching systems to minimize obsolescence. Digital automatic protection switches (APS) are

partially but not completely standardized (end-to-end compatibility not completely specified). However, the PE-60c specification does cover many APS parameters that are considered to be essential to reliable service.

2.4 Analog subscriber carrier (station carrier) was designed to address rural telephone company needs (low subscriber density). For many applications station carrier is expected to remain a viable subscriber service tool for some time. Digital subscriber carrier is growing as an economical method of serving subscribers. With the explosive growth in digital switching and the use of integrated switching and transmission systems, future economics favor digital systems even more. Current D3-T1 digital trunk and subscriber carrier are generally compatible in the same cable with low density analog trunk and subscriber carrier covered under REA Specifications PE-60f and PE-64b.

2.5 All reasonable alternatives should be considered in selecting the most economical means of serving subscribers. The Purchaser's economic choice of equipment may be strongly influenced by circumstances within the telephone company and the ability of specific equipment features to address those circumstances. The following is a brief checklist of carrier system features and other factors that might influence the economic selection of subscriber carrier systems.

- a. Existing cables (quantity, condition, necessary reinforcement)
- b. Equipment compatibility in cables
- c. Existing equipment (additional spares and training; satisfaction with Seller or equipment)
- d. Obsolescence (age of existing equipment technology; how equipment fits into future telco plans and system arrangements)
- e. Remote testing capability
- f. CO battery requirements (power efficiency)
- g. AC power requirements (field locations)
- h. Voice frequency drop limits (review and specify)
- i. Service continuity (alarms; alternative power and/or transmission path where failures affect a large quantity of subscribers)
- j. Compatibility with concentrators (where separate concentrators use subscriber carrier for trunks, assure that the systems are compatible in terms of power requirements, traffic handling, loop limits, etc.)
- k. Special services (PABX, key systems, data, etc.)

2.6 Major changes planned for the Purchaser's operations, new services, and plant and equipment retirements should be considered. A major planned change such as outside plant or switching equipment retirement provides an excellent opportunity to review and consider major changes in the carrier equipment in service.

3. FORM 397c, PART I

3.1 Item 1.3 identifies the type of contract; check either the block for Form 397 (furnish and install) or Form 398 (furnish only). Adequate notification to the Seller is required so that the installation can be scheduled and completed on a timely basis. If the installation cannot begin immediately, it is necessary to notify the Seller when the installation can begin. This should be done in writing, and well in advance of the scheduled completion date.

3.1.1 Item 1.4: For most subscriber carrier purchases, a single narrative is recommended with a separate carrier system layout and Part IIIA for each central office exchange. Clearly identify the boundaries of each separate group of equipment.

3.1.2 Item 1.4.1: A narrative should always be included by the Purchaser. A brief narrative should be adequate for small contracts. Larger, more complex contracts may require more explanation; a good narrative can help simplify these more complex contracts.

3.1.3 Item 1.4.2: The 397c is arranged to cover many basic items on a general basis. The Purchaser should clarify and amplify these general specifications with addenda covering the Purchaser's specific requirements and circumstances. More complex contracts will require more detailed explanations to avoid confusion.

3.1.4 Item 1.4.3: The 397c is incomplete without a Part IIIB by the Seller. The Seller must respond to all Purchaser requirements as outlined in the 397c and addenda.

3.2 Item 2.2: Check the blocks for the basic equipment specifications covering the type of carrier equipment to be purchased. It is not necessary to attach a copy of the formal REA specification cited. If no appropriate REA specification exists, or if REA specifications must be clarified or amplified for the specific purpose intended, check Other and cite specific requirements (i.e., addenda, other formal specifications, etc).

3.2.1 Items 2.3 through 2.8 are self-explanatory. In addenda, cite any deviations to these generalized specifications.

3.3 Item 3.1: Identify each Part IIIA and specify the boundary of each equipment group.

3.3.1 Item 3.3.1: Accurate and descriptive information on floor plans, equipment locations, structural considerations and installation requirements are necessary for the Seller to provide a thorough proposal.

Special attention should be given to protection and grounding within the central office building. Some telephone company practices emphasize carrier protection by utilizing special protection panels or intermediate distribution frames (IDF) located within the central office building. Some manufacturers incorporate high voltage protection on the carrier equipment backplanes or on circuit cards. Because of the large scale use of sensitive electronic equipment within central office buildings, it is suggested that all high voltage protection (gas tubes, carbon blocks, etc.) be located at the point where the cables enter the building. Special protection panels can be utilized separate from the MDF protection. Special grounding considerations (i.e., ground window) should also be outlined.

3.3.2 Item 3.3.2: The Purchaser should adequately identify the equipment (types, characteristics, etc.) that will interface carrier equipment to be furnished by the Seller. If the proposed carrier equipment is to be reused in another application at a future date, include this information (i.e., relocation, changeout of COE, etc.).

3.4 Item 3.4.1: Voice frequency loss and noise requirements can be noted here, or can be summarized separately in addenda.

3.4.1 Item 3.4.2: Describe special application requirements in detail.

3.4.2 Item 3.4.3: In this era of technological advances, good planning can extend the useful life of cable and electronic systems in service. Newer digital systems are generally designed to be compatible in cables with existing digital systems. Some digital and analog systems can coexist in the same cable with minimal interference. To maximize the life of these cables and electronic systems, details should be included in addenda and cited as compatibility requirements or objectives.

3.5 Item 3.5 covers outside plant information. Outside plant information is often very inadequate in carrier contracts. To properly engineer digital carrier systems, the Seller must know the cable construction (materials, layup, etc.), splicing information, and be assured that the cable is in satisfactory condition. Splicing information becomes more important as cable sizes change along the route. Lacking detailed information, the Seller may recommend short repeater spacings resulting in higher costs.

4. FORM 397c, PART II

4.1 Part II of the 397c covers carrier installation on a rather detailed, but generalized basis. The Purchaser should outline additional or special requirements relating to installation, alignment, inspection and acceptance tests in addenda.

4.2 When the carrier equipment is purchased under an REA Form 398 (furnish only) contract, Part II of the 397c is not included. In this case, the Purchaser becomes the installer and should carry out the provisions of Part II including measurements and data required for approval of closeout documents.

5. FORM 397c, PART IIIA

5.1 Item 1.2: Identify the central office exchange and other locations to be included in this Part IIIA equipment group.

5.1.1 Items 1.3.1 and 1.3.2 identifies if the Seller must provide a proposal only as described in the Engineer's plan; or, if the Seller is invited to offer alternatives that can accomplish the same subscriber service, but in a different manner.

5.1.2 Item 1.3.3: If the subscriber carrier is to be used in conjunction with concentrators, provide enough information to assure compatibility of the carrier and concentrator equipment.

5.1.3 Item 1.3.4: Direct digital interface of subscriber carrier into a host digital central office or a remote switching terminal is considered an evolving technology at the time of this writing. Industry compatibility standards do not exist. It is recommended that the subscriber terminal of the digital subscriber carrier be treated the same as a digital remote switching terminal in terms of direct digital interface, transmission, etc. Outline all special requirements in addenda.

5.2 Item 2 covers the Purchaser's Equipment Requirements to be furnished by the Seller under this contract. Summarize equipment and quantities required under this contract in Items 2.1, 2.2, 2.3, and 2.4. Where special interface, application, or system requirements apply because of equipment furnished by the Purchaser (existing equipment, or equipment furnished under separate contracts), these special requirements should be clearly noted including manufacturer and equipment type if known in advance. These should be noted as special interface, application, or system requirements, and not requirements for equipment to be furnished under this contract.

5.2.1 Item 2.1: Summarize the initial equipment quantities required in this equipment group. Check the blocks to more specifically identify the Purchaser's requirements. In most cases, it will be necessary to more fully describe the Purchaser's specific initial and ultimate requirements in addenda. It is important to outline the Purchaser's ultimate requirements in addenda so that the system(s) can grow to their ultimate intended capacity. This is especially important in span

line design for digital systems. Span line repeater spacing and housing sizes are based on the ultimate system quantities even through initial equipment quantities are actually furnished under this contract. The Purchaser should also review Item 1.4.4 of Part I to assure that it is adequate for this specific contract and system growth.

5.2.2 Items 2.1.1 and 2.1.2 are to summarize the system and channel requirements in quantity totals. (Note: Subscriber carrier requirements are generally stated for both ends of the system. Direct digital interface with digital central offices will require only the subscriber terminal end.)

5.2.3 Item 2.1.4: Summarize the total main and spare span line terminating equipment required in this equipment group (includes both CO and subscriber ends unless noted otherwise).

5.2.4 Item 2.1.5: Summarize the total main and spare span lines to be protected by automatic protection switch equipment (APS) in this equipment group (includes both CO and subscriber ends unless noted otherwise). If the APS is arranged on a sectionalized basis or other special considerations, specific requirements must be outlined in addenda.

5.3. Item 2.2.1: The most common powering arrangement is to utilize individual power supplies for each terminal, span line, or other equipment powered from the 50 volts dc office battery.

5.3.1 Item 2.2.2 is checked only if the Seller is required to furnish equipment protection such as gas tubes within the office. Carrier equipment mounted within the central office building is often protected by Purchaser furnished protectors. See Paragraph 3.3.1 for additional discussion on protection.

5.3.2 Item 2.2.3: Illustrate all jack requirements.

5.3.3 Item 2.2.4 covers requirements related to special equipment features or ancillary equipment. Examples are alarms, disconnect, order wire, interrogation, etc. Include enough information in addenda to establish what is required and the extent of the requirements. For interrogation systems, cover specific requirements such as loop around interrogation, interrogation testing locations, details on APS utilized in system, and other variations required of a basic interrogation system.

5.3.4 Item 2.2.5: Note and provide details on hardware requirements such as connectorized bays of equipment, racks, supports, etc. When the carrier equipment is purchased under an REA Form 398 (furnish only), miscellaneous hardware normally furnished by the installer may not be included by the Seller. If equipment installation is not included in this contract, the Purchaser should specify the required installation

materials by checking the necessary blocks and outlining the details in addenda.

5.4 Item 2.3 covers outside equipment requirements in this equipment group.

5.4.1 Item 2.3.1 is to summarize the total (main plus spare) span lines, total repeater locations, repeater housings required and total repeaters required in this group. These are summary notations that must be covered in much more detail in the carrier system layout and other addenda.

5.4.2 Item 2.3.2: A variety of repeater housings are offered by carrier manufacturers. In the past, REA required that all repeater housings be capable of bypass protection. These housings could be arranged by bypass or grounded protection by removing or adding a strap between the inner repeater chassis and the outer repeater housing. If the Purchaser plans to use only grounded type protection, this requirement or preference should be stated. Cable stubs are another common item of discussion. State requirements for one or two cables, screens to separate directions of transmission, filled core, air core, etc. (Note: Housing cable stubs are generally standard cables furnished under REA Specifications PE-22, PE-39, etc. To be more appropriate for a specific housing or application, some cable stubs may vary slightly from these standard REA cable specifications in areas such as pair counts, unit identification, etc.)

5.4.3 Item 2.3.3: PCM repeaters furnished to small telephone companies are generally for one cable, two way operation.

5.4.4 Item 2.3.4: State the number of subscriber terminal locations and other special requirements related to the subscriber end of the system. It is not necessary to restate the number of channels, systems and other requirements previously outlined (i.e., Item 2.1, etc.).

5.4.5 Item 2.3.5: The Purchaser's operating procedures and the operating environment of the equipment should guide the specification of equipment protection. Item 2.3.5 and carrier equipment specifications provide for an adequate level of protection for most circumstances. In high lightning, high ground resistance areas, the Purchaser may wish to specify a higher level of protection. Because of company operating practices, the Purchaser may want more pairs protected than those required for the initial equipment. To readily accommodate growth in the near future, the Purchaser may specify that a large number of the "future" system pairs also be protected (perhaps all pairs). Protection of unused pairs can be a large percentage of total system costs; therefore, judgement should be used. In any case, the Purchaser should specify how the unused pairs should be handled. They might be loaded or shorted through the repeater housing, but should not be grounded at these intermediate locations.

5.4.6 Items 2.3.6 and 2.3.7 should agree with central office located equipment specified in Item 2.2.4. Note any special Purchaser requirements relating to field power supplies and batteries in Item 2.3.8. (Note: Field power supplies and batteries may be required for proper operation of the Seller's equipment, even though they are not a specific requirement of the Purchaser.)

5.5 Item 2.4 covers special equipment and facilities to be furnished by the Seller as a part of this contract. This special equipment may be a standard or a special multiplex system in the analog or digital hierarchy, higher order automatic protection switches, special alarms, etc. Where equipment furnished under this contract must coordinate with special equipment furnished by the Purchaser (or another Seller), check the Purchaser's Addenda Item 3.7 and note these special application considerations in addenda.

5.6 Item 3 is a checklist of major Purchaser's Addenda items. Check these items and provide details in addenda as appropriate. Add to this list as necessary so that the Purchaser's equipment requirements are clear and complete.

6. FORM 397c, PART IIIIB

6.1 Part IIIIB of the REA Form 397c is the Seller's Proposal for Subscriber Carrier Equipment. The contract is incomplete without a completed Part IIIIB and appropriate Seller's Addenda.

6.1.1 Item 1.1 identifies the specific equipment the Seller proposes to furnish.

6.1.2 Item 1.2 is checked to note if the proposed equipment meets all of the Purchaser's requirements outlined in Parts I, II and IIIA. If the Seller's equipment does not meet the Purchaser's requirements, specific exceptions are required. As noted in Item 1.3, equipment lists and other descriptive material do not supersede this requirement to specifically outline exceptions to the requirements of Form 397c, Parts I, II and IIIA.

6.1.3 Item 2 is a checklist of major Seller's Addenda items. Check these items and add to the list as appropriate. The Seller's detailed support data and information is contained in the Seller's addenda.