

REPUBLIC OF PARAGUAY

**CONSTRUCTION PROJECT  
OF  
MICROWAVE NETWORK**

Vol. III  
TENDER DOCUMENT  
&  
TECHNICAL SPECIFICATION

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This report is one of the following three volumes:

- |            |  |
|------------|--|
| Volume I   | Planning Report  |
| Volume II  | Detailed Design  |
| Volume III | Tender Document and<br>Technical Specification   |
| Part I     | General Instructions for Tender  |
| Part II    | Contractual Terms and Conditions   |
| Part III   | Technical Specifications for Supply<br>and Installations of Communication<br>Equipment |
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国際協力事業団

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## GENERAL CONTENTS

- Part I General Instructions for Tender
- Part II Contractual Terms and Conditions
- Part III Technical Specifications for Supply  
and Installations of Communication Equipment
- Part IV Annex ..... Separately Bound

ANTELCO shall decide a General Contract Condition and make a partial amendment of this document, PART I and PART II for Tender and Contract Documents.

**TENDER AND CONTRACT DOCUMENTS  
FOR  
PARAGUAY MICROWAVE NETWORK  
(TENDER NO.        )**

**PART 1  
GENERAL INSTRUCTIONS  
FOR  
TENDER**

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## 1. Object

The object of this Tender is to construct the microwave network between Asuncion-Pto. Pte. Stroessner and Asuncion - Paso de Patria in the Republic of Paraguay, to be connected with Brazil and Argentina and which forms a part of Interamerican Telecommunications Network. Upon completion of this network, Paraguay will be able to remarkably expand her international and domestic telecommunication system.

## 2. Funds

Loan funds from the Japanese government to the Republic of Paraguay has been provided for the implementation of this telecommunications project and a loan agreement dated \_\_\_\_\_ 1972 and concluded between \_\_\_\_\_ and the Republic of Paraguay restricts and limits the participants of this Public Tender to firms, suppliers and/or consortiums in Japan.

## 3. Scope of Work

3.1 The implementation of the project is based on the concept of a "Turn Key" contract, which shall include engineering, supply and installation of the telecommunication equipments and any other related works and services necessary for putting into service and operation of the microwave network, which may further be classified as follows:

- (1) System design and engineering.
- (2) Manufacture, supply and installation and commissioning of the microwave communication and its associated equipments.
- (3) Supply of measuring equipments, tools necessary for operation and maintenance, manuals and spare parts for 2 (two) years.
- (4) Training of personnel necessary for operation and maintenance.
- (5) Installation of towers.
- (6) Technical supervision for operation and maintenance of the system for 1 (one) year.

3.2 Notwithstanding the above, the following works shall be excluded from the Tender, and shall fall on the scope of work of ANTELCO.

- (1) All civil work for radio stations including access roads.
- (2) Construction of radio station buildings.
- (3) All facilities related to the buildings.
- (4) Installation of fuel-tanks for engine-generator.
- (5) Construction of tower bases.
- (6) Supply of commercial power.

3.3 Equipments and services for the international connecting sections are excluded from this Tender, and shall be incorporated into the Contract to be concluded with the successful Tenderer.

#### **4. Tenderer**

4.1 The offers must be presented by suppliers or manufacturers of communication equipments with well recognized prestige and international fame plus experience in providing and installing microwave systems and be guaranteed for technical competence and economic solvency and sufficient organization for executing the works of this Tender.

4.2 The Tenderer must have a permanent business address in Paraguay whose address should be stated clearly in the offer. All correspondence and notices dispatched to the said address shall be considered as delivered to the Tenderer in the proper manner. The Tenderer must also notify ANTELCO, in writing, any change in his address or that of his representative's, both before and after awarding the Tender.

#### **5. Legal Aspects**

It should be understood that the Tenderers are subject to all laws, regulations, ordinances, and other rules or Paraguayan Government or political subdivisions thereof, or any constituted public authority, applicable to the type of work to be performed under this project.



It should be also noted that this Tender is subject to the provisions of Government Exchange Note and Loan Agreement referred to in the Item 2 above.

## 6. Information

For any information or clarification concerning this Tender, address all correspondence to:

Administracion Nacional de Telecomunicaciones  
Edificio Ministerio de Obras Publicas  
y Comunicaciones, 4<sup>o</sup> Piso, Calle Oliva  
y Alberdi, Asuncion, Paraguay.

Any explanation requested by a Tenderer concerning the meaning or interpretation on the stipulations of Tender Documents must be made in writing to the above address and with sufficient time allowed for a reply to reach Tenderers before submission of their offers.

Any information given to such request will be provided to all prospective Tenderers as an amendment to or clarification on the Tender Documents.

## 7. Tender Documents

The Tender Documents shall be composed of the following parts:

- PART I General Instructions for Tender
- PART II Contractual Terms and Conditions
- PART III Technical Specifications for Supply and  
Installations of Communication Equipment
- PART IV Annex

and any amendment or clarification to be added and incorporated in accordance with the procedures is stated in the above Item 6.

## 8. Preparation and Submission of Offer

8.1 Offer shall be prepared in accordance with the documents of this Tender which comprises PART I, PART II, PART III & PART IV.

The Tenderer is required to make one complete offer based on the scope described in the above Item 3. Any offer having incomplete portion or not in compliance with the specifications shall not be considered. Furthermore, any offer having defective or incomplete data of documents required to be submitted by the tender specifications or technical data not based on the actual field experience, is liable to be excluded from consideration.

8.2 The Tenderer shall be considered as having understood the meaning and scope of the tender documents precisely and clearly and having considered them as one individual whole and the various conditions and clauses as mutually complementary and explanatory when he has submitted his offer documents to the Tender Committee.

8.3 Any offer reaching the ANTELCO's Tender Committee after the hour and date fixed for receipt of offers shall not be considered, and no counter-offers, modifications or corrections shall be permitted after the Tender deadline. Notwithstanding the above, ANTELCO reserves the right to request Tenderers to clarify their offers or to request any additional information at any time during the evaluation period.

8.4 Offers shall contain, at least, the followings;

- (1) General conditions.
- (2) Technical proposal stating detailed system design, technical data for equipments and materials as are required in the technical specifications or any additional literature relating to the technical aspects.
- (3) Resume of prices (FORM A in PART III in the Tender and Contract Documents)
- (4) Price schedule with detailed break-down of prices (FORM B in PART

III in the Tender and Contract Documents).

- (5) Work schedule.
- (6) Management chart.
- (7) Documents stating other similar or larger works of similar nature which the Tenderer or Supplier has executed and completed prior to the tender including those which are in the process of execution. Effective evidence or certificate from the respective authority must be attached.
- (8) Documents stating the financial status of the Tenderer and the Supplier, outline of business and products, address of head office and factories, number of employees.
- (9) Bid band.

8.5 All documents submitted concerning this Tender must be written in English. As for the unit of the weights and measures to be applied in preparing offer documents, the metric system must be used.

8.6 The Tenderer must submit his offer in 6 (six) copies.

8.7 Offer documents shall be enclosed in the envelope sealed with red wax and addressed to the ANTELCO's Tender Committee, with name and address of the Tenderer.

8.8 The offer documents of the successful Tenderer shall be incorporated as a part of the contract.

#### **9. Evaluation of Offer**

ANTELCO shall evaluate the received offers, taking into consideration the following points:

economical merits, technical merits, delivery terms, field experience, and ability in performing the similar projects, etc.

The contract shall be awarded to that responsible Tenderer whose

offer, conforming to the tender documents, shall be most advantageous to ANTELCO.

ANTELCO shall not be bound to accept the lowest offer when other factors like field experience and managerial capacity are as such which may compensate the price.

**10. Offer Validity**

The offer shall remain valid and may not be withdrawn, for a period of 90 (ninety) days from the tender closing date. For an offer of successful Tenderer, it shall remain valid until a formal contract is concluded.

**11. Bid Bond**

The Tenderer is required to submit with his offer a bid bond for an amount of not less than 2% of the total value of his basic offer.

The bid bond must be either in the form of a letter of guarantee or check certified by Banco Central del Paraguay. Cash guarantee or un-certified check will not be accepted. This bond must be valid for 90 (ninety) days from the closing date of the Tender. Offers received without this bond shall not be considered.

This bond constitutes a guarantee by which the Tenderer promises not to modify any one of the terms of his offer during the period of validity of his quotations and to insure that, in case he should be granted with the award, the Tenderer shall establish the corresponding contract. If the successful Tenderer fails to fulfil these obligations without any justifiable reason, ANTELCO reserves the right to forfeit the bond immediately.

The bond will be returned to the unsuccessful Tenderers after the official notice of award has been made and to the successful Tenderer after his submittal of the performance bond as provided in the Article 5 of PART II.

## **12. Prices**

12.1 All the prices, as well as the unit prices, must be quoted CIF Asunción according to the INCOTERMS 1953. Expenses after CIF up to the work site must be quoted separately. The total price must include the supply, installation of the equipments and materials, transportation, insurance and any other expenses necessary for putting into service the total system within the concept and scope of this Tender.

12.2 Quotation must be divided into two categories, "Foreign Portion" to be quoted in Japanese Yen and the "Local Portion" to be quoted in Paraguayan Guarani. It should be understood that the Foreign Portion refers to the expenses for the equipments, materials and services to be provided from Japan and other countries, and that the local Portion refers to the expenses for the materials and services to be procured and originated in Paraguay.

12.3 The Tenderer shall offer a "Price Variation Formula" for future orders.

## **13. Delivery**

The Tenderer shall specify in his offer the period required for the delivery of all the equipments and materials, installed, tested, and ready for operation in accordance with the stipulations in Item 1.4 of CHAPTER I, PART III in the Tender and Contract Documents.

## **14. Contractual Terms and Conditions**

The successful Tenderer is expected to negotiate and sign a contract providing assurance to ANTELCO that all obligations stipulated in the Contractual Terms and Conditions of PART II in the Tender and Contract Documents shall be met.

**TENDER AND CONTRACT DOCUMENTS**

**FOR**

**PARAGUAY MICROWAVE NETWORK**

**(TENDER NO.        )**

**PART II**

**CONTRACTUAL TERMS**

**AND**

**CONDITIONS**

## INTRODUCTION

The following Contractual Terms and Conditions shall apply in the resulting contract.

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## **Article 1. Definitions**

For the purpose of this Contract, the following terms and definitions shall be applied:

ANTELCO: (Contracting Party)	Administracion Nacional de Telecomunicaciones for whom the equipments, materials and work are to be supplied. It may be referred to as the "Contracting Party".
Contractor:	The successful Tenderer who enters into Contract with ANTELCO for the supply of equipment, materials and services covered by this Contract.
Sub-contractor:	Any contractor who carries out a local supply of materials and/or services for the Contractor.
The Contract:	The written agreement concluded between ANTELCO and the Contractor for the supply of the equipment and materials and the execution of the work, in accordance with the Contractual Terms and Conditions and the Technical Specifications of this Tender.

## **Article 2. Laws and Regulations**

The Contractor shall be subject to all laws, regulations, ordinances, and other rules of the Paraguayan Government or political subdivision thereof, or of any constituted public authority applicable to the type of work to be performed by the Contractor and/or its Sub-contractors.

This Contract is also subject to the provisions of Governmental Exchange Note and/or Loan Agreement.

## **Article 3. Tax and Customs Exemptions**

The procurement under this Contract shall be free from any and all customs duties, taxes, stamp duties and any other taxes or liabilities. Re-export of all equipments, instruments, vehicles, supplies or any other materials imported specifically for the execution of work under this Contract, shall be also subject to the privileges specified in the foregoing paragraph.

The Government of Paraguay shall exempt non-Paraguayan Contractor and his non-Paraguayan personnel from local taxes.

**Article 4. Contract Documents**

The Contractual Terms and Conditions and the Technical Specifications and any details given in any document annexed hereto, together with the signed and accepted offer documents submitted by the Contractor shall constitute the Contract Documents.

**Article 5. Performance Bond**

The Contractor must submit, at the time of signing the Contract, a performance bond equivalent to 10% (ten percent) of the total value of the contracted amount in the form described in the item 11 of PART I, in order to guarantee the fulfilment of the Contract requirements.

The bond shall remain valid until 12 (twelve) months after the provisional acceptance of the work. ANTELCO shall have the right to deduct from the performance bond any amount which may arise in settlement of a fine or penalty to be paid by the Contractor under the provisions of the Contract.

**Article 6. Guarantee**

6.1 The Contractor shall guarantee that the equipments, materials and services to be provided under this Contract shall be free from defects in both materials and workmanship and that they shall comply with the specifications stipulated in the Contract Documents.

6.2 The Contracting Party shall reserve the right, at any time during the term of validity of this guarantee, to reject any materials or services which should evidently be in disaccord with the above mentioned specifications and to require the Contractor to rectify and/or replace, at his own expense, such materials or services.

6.3 If the Contractor fails to fulfil his obligations specified in the preceding paragraph without any justifiable reasons, the Contracting Party may proceed to have such rectification or replacement made at the expense of the Contractor.

Expenses so incurred may be deducted from the performance bond.

6.4 The Contractor shall guarantee that, for a period of 1 (one) year after the date of provisional acceptance of the work, the performance and reliability of the total system shall be in accordance with the specifications of the Contract Documents.

The guarantee is applicable to the defects in manufacturing and/or designing the equipments which may be imputable to the Contractor and which may appear under normal operating conditions and adequate use. This guarantee does not cover defects due to the reasons of force majeure, or due to the defective maintenance, modification or reparation on the part of the Contracting Party, or due to lack of spare parts which are subject to normal wear.

#### **Article 7. Contractor's Organizations**

The Contractor shall, upon the execution of this Contract, submit to the Contracting Party a chart showing the administrative organizations and personnel to be employed in performing the work provided in the Contract, and their duties.

The Contractor shall submit, in writing, of a resident key personnel who shall be designated as a "Project Manager", and any instructions given to him by the Contracting Party shall be deemed to be given to the Contractor.

The Contractor shall provide sufficient technical, supervisory and administrative personnel to secure the proper execution of the work in accordance with the work schedule to be incorporated in the Contract Documents.

The Contracting Party reserves the right to require the Contractor to remove any personnel whose continued employment is deemed to be undesirable.

#### **Article 8. Permits and Licenses**

It shall be the duty of the Contractor to obtain all necessary permits and licenses required for the execution of the work under this Contract, unless otherwise provided in other articles in the contractual terms and conditions.

The Contractor shall be responsible for any damage, foreign and/or domestic, of any nature which the Contracting Party may suffer as a result of the Contractor's failure to comply with the provisions of this Article. However, the Contracting Party shall fully cooperate with the Contractor in an expeditious manner to obtain all required licenses and permits.

**Article 9. Changes and Modifications**

The Contracting Party may, by written notice, ask the Contractor to make changes and/or modifications within the general scope of this Contract. If any such change causes an increase or decrease in the cost of, time required for, or the execution of the Contract, an equitable adjustment shall be made in the price, or delivery date or schedule, or both, and the Contract shall be modified in writing, accordingly by mutual agreement.

**Article 10. Acceptance Test**

The delivery referred to in this Contract shall be carried out on a "Turn-Key" basis after the corresponding acceptance test has verified the compliance with the contractual technical specifications. For this purpose, the Contractor shall give a written notice to the Contracting Party, at least 2 (two) weeks prior to the date when the system shall be ready for commencement of the said test. The acceptance test shall be carried out in the presence of the Contracting Party and/or Inspectors and be completed within 45 (forty five) days after the commencement of the test. The Contractor shall remedy all defects which may not comply with the contractual technical specifications, immediately after they are discovered during the test. The testing period shall not be counted as part of the installation period. However, if the Contractor fails to remedy such defects without any justifiable reason, the period from the notification as such until the completion of remedy shall be counted as part of the installation period.

**Article 11. Provisional Acceptance**

Upon completion of the acceptance test in a satisfactory way, the Contracting Party shall issue a certificate of the provisional acceptance within one

week after the completion of the said test. The date of said certificate shall be considered as effective date of putting the system into service. The Contracting Party reserves the right, if he deems it to be in his interests, to put into operation any partially completed portions or sections of the system even before the Provisional Acceptance of the total system, subject to the consent of the Contractor. If such prior use increases the cost of, or delays the work, the Contractor shall be entitled to such additional compensation or extension of delivery time or both, as the both parties may agree. Those portions or sections shall be deemed as provisionally accepted when they are put into operation in the way mentioned above, and the corresponding certificate shall be issued.

#### **Article 12. Final Acceptance**

If, during the lapse of 12 (twelve) months from the date of the provisional acceptance of the system, a satisfactory performance and reliability have been proved, the Contracting Party shall issue a certificate of final acceptance. When serious defects are found to be existing in the system due to errors or negligence on the part of the Contractor, the final acceptance of the system shall not be carried out until they are remedied in accordance with the contractual technical specifications.

#### **Article 13. Penalty**

If the Contractor fails to complete the work or any part of the work within the time periods specified in the contract or any extension thereof, he shall be liable to a penalty for each calendar day, following the date specified for delivery at a rate equal to 0.5 (half) per thousand up to the maximum limit of 10% (ten percent) of the value of the unexecuted portion. Should the said period exceeds 200 (two hundreds) calendar days, the Contracting Party shall have the right to proceed to the termination of the Contract, in whole or part. If the delay arises out of causes beyond the control and without the fault or negligence of the Contractor, as specified in the Article 15, the delivery time shall be extended accordingly.

**Article 14. Delays**

The Contractor shall not be in default by reason of any failure in his performance under this Contract in accordance with its terms (including any failure by the Contractor to make progress in the prosecution of the work hereunder which endangers such performance) if such failure arises out of causes beyond the reasonable control and without the fault or negligence on the part of the Contractor. Such causes include, but are not restricted to: Acts of God or of the public enemy, acts of the Government in their sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather.

**Article 15. Title and Assumption of Responsibility**

Title for all equipments, materials and structures to be incorporated in the system covered by this Contract shall be transferred from the Contractor to the Contracting Party at the time of shipment from the Japan Port. Notwithstanding the above, the Contractor assumes all the responsibility inherent to the execution of the work in accordance with the Contract requirements and the responsibility lasts until the provisional acceptance of the system.

**Article 16. Transportation and Insurance**

16.1 Transportation, storage and insurance of all the equipments and materials from the factories up to the work site and during the installation shall be at the responsibility of the Contractor.

16.2 The Contractor shall carry adequate liability and compensation insurance in order to assume the responsibility stipulated in the foregoing Article.

16.3 The method of transportation of any property or personnel under this Contract shall be at the Contractor's option, giving, however, the first preference to the Paraguayan flag vessel.

**Article 17. Sub-contract**

17.1 The Contractor shall, as soon as practicable after the signing of the Contract, notify the Contracting Party in writing of the name(s) of Sub-contractor(s) proposed for the work.

17.2 The Contractor shall be responsible to the Contracting Party for all acts and omissions of his Sub-contractors and of all persons directly or indirectly used by him or such Sub-contractors in connection with the work required by this Contract and shall insure cooperation among all such persons and Sub-contractors.

**Article 18. Assignment**

Any assignment of this Contract in whole or in part or of any interest herein without the Contracting Party's written consent shall be invalid.

**Article 19. Patents**

The Contractor shall be responsible for the consequences which may derive from the use of patents, registered marks, intellectual and/or scientific property rights of equipments or any part thereof to be provided by the Contractor under this Contract.

**Article 20. Protection of Property**

20.1 The Contractor shall preserve and protect all existing facilities that he may be required to work in or around.

The Contractor shall repair or restore any damage to facilities resulting from his failure to exercise reasonable care in the execution of the work.

20.2 The Contractor shall take all safety measures that are required by law or may be requested by the Contracting Party, or that would be taken by a prudent contractor in the circumstances.

Article 21. Obligations of the Contracting Party

The Contracting Party shall:

- 21.1 Execute the following works in accordance with the work schedule and the requirements of the Contractor.
- (1) All civil work for radio stations including access road.
  - (2) Construction of radio station buildings.
  - (3) All facilities related to the buildings.
  - (4) Installation of fuel-tank for engine-generator.
  - (5) Construction of bases for towers.
  - (6) Supply of commercial power.
- 21.2 Provide necessary information regarding the existing facilities or any other matter which the Contractor may require for the proper execution of his duties.
- 21.3 Provide land for all sites and give permissions to the Contractor for free access to the existing buildings and the work sites.
- 21.4 Provide authorization for use of the required radio frequencies including those that may be needed for temporary purposes during the execution of the work.
- 21.5 Assume the responsibility to obtain the following releases, exemptions and exonerations from the Government of Paraguay.
- (1) Release from customs duties and taxes, including sales taxes, on the importation or re-exportation of equipment, instruments, and materials which the Contractor requires in strict and direct relation with the work assigned, and which are brought into the country for that purpose.
  - (2) Exemption from income taxes for the Contractor's personnel contracted outside Paraguay.
  - (3) Exoneration from obligations, rates or taxes related to entry and



stay of personnel in Paraguay.

- (4) Exemption from all kind of taxes, fees, or contributions which exist or will be created, whether national, departmental, or municipal.

21.6 Obtain the corresponding licenses for the importation and re-exportation as referred to in the Sub-item 21.5.

21.7 The Contractor is liable to claim for the compensation of any loss or damage to be incurred by the non-fulfillment of any of the above mentioned obligations on the part of the Contracting Party.

#### **Article 22. Arbitration**

22.1 Any disagreement or dispute concerning an interpretation and execution of this Contract which is not disposed of by agreement shall be submitted to the Arbitration Committee consisting of three people, one which is to be appointed by the Contracting Party, another to be appointed by a consulting group and the third to be appointed by the Contractor.

#### **Article 23. Termination of Contract**

The Contracting Party shall be able to terminate the Contract with 30 (thirty) days advance notice in writing to the Contractor in the following cases:

- (1) When the Contractor goes bankrupt or insolvent.
- (2) If the quality of the equipment, materials and services do not comply with the contract requirements.
- (3) If the delivery delays for more than 200 (two hundred) days from the specified date of delivery or the Contractor fails to replace or repair the rejected parts or materials by the mutually agreed date.

The conditions referred to in items (2) and (3) shall not be applied to the causes of force majeure and/or non-fulfillment of any of the Contracting Party's obligations stipulated in the Article 21.

Article 24. Payment

24.1 The payment of "Foreign Portion" shall be made in Japanese Yen in the following manner:

- (1) Equipments and Materials
  - \_\_\_ % at the time of signing the Contract
  - \_\_\_ % against shipping documents
  - \_\_\_ % at the time of Provisional Acceptance
- (2) Services
  - \_\_\_ % at the time of signing the Contract
  - \_\_\_ % against monthly progress
  - \_\_\_ % at the time of Provisional Acceptance
- (3) Technical Service for Operation and Maintenance
  - \_\_\_ % at the time of starting services
  - \_\_\_ % against monthly progress

24.2 The payment of "Local Portion" shall be made in Paraguayan Guarani in the following manner:

- (1) Materials and Services
  - \_\_\_ % at the time of signing the Contract
  - \_\_\_ % against monthly progress for services and/or against invoice for materials
  - \_\_\_ % at the time of provisional acceptance
- (2) Operation and Maintenance
  - \_\_\_ % at the time of starting services
  - \_\_\_ % against monthly progress

**TENDER AND CONTRACT DOCUMENTS**

**FOR**

**PARAGUAY MICROWAVE NETWORK**

**(TENDER NO.           )**

**PART III**

**TECHNICAL SPECIFICATIONS FOR SUPPLY**

**AND**

**INSTALLATIONS OF COMMUNICATION EQUIPMENT**

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## CHAPTER 1 GENERAL

### 1.1 Purpose

This PART of the Specifications hereby presented pertains to design, manufacture, supply and installation of the microwave radio links in Paraguay at the request of ANTELCO.

PART I, PART II, PART III and PART IV of this Tender and Contract Documents shall be considered minimum conditions.

### 1.2 Project Outline

The links shall be established as a part of the international wide-band signal transmission network between Paraguay and Argentina, and between Paraguay and Brazil.

The link between Asuncion and Paso de Patria shall be connected to the link in Argentina at Paso de Patria in Paraguay and Resistencia in Argentina.

Another link between Asuncion and Pto. Pte. Stroessner shall be connected to the link in Brazil at Pto. Pte. Stroessner in Paraguay and Foz do Iguacu in Brazil.

These links shall be used not only as international transmission network, but as national transmission network between Asuncion and Paso de Patria, and between Asuncion and Pto. Pte. Stroessner. Asuncion, Paraguari, San Juan Bautista, Pilar, Cnel. Oviedo and Pto. Pte. Stroessner shall be connected by these links, respectively. Caacupe, Villarrica and Encarnacion will be connected to those links after the establishment of each entrance circuits by the other project in the future.

A route map of these links is shown in Fig. 1-1.

A microwave link shall be established between Asuncion radio terminal station and Paso de Patria radio repeating station excluding the equipments for the direction to Resistencia. Another microwave link shall be established between Asuncion radio terminal station and Pto. Pte.



Stroessner radio terminal station excluding the equipments for the direction to Foz do Iguacu.

Loaded cable systems shall be established between Paraguari radio terminal station and Paraguari telephone office and between San Juan Bautista radio terminal station and San Juan Bautista telephone office.

Non-loaded cable system shall be established between Cnel. Oviedo radio terminal station and Cnel. Oviedo telephone office, and between Pto. Pte. Stroessner radio terminal station and Pto. Pte. Stroessner telephone office.

Above mentioned microwave links is planned to be used for television transmission, too. Initially, only international television transmission shall be considered, but, in the future, national television transmission will be added.

The network plan under this project is shown in Fig. 1-2.

### 1.3 Scope of Contract

The scope of contract shall include all work requisite to the completion of the link. Such work shall include design, manufacturing of equipment, supply of goods, installation and testing, as well as attending thereto. The work is classified into following major systems to be established:

- (1) Microwave System
- (2) Multiplex System
- (3) Toll Cable System
- (4) Voice Frequency Telegraph System
- (5) Power System
- (6) Tower
- (7) Associated Facilities

The following works shall be excluded from this contract, and will be established by the other contract.

- (1) Establishment of the international connecting sections of the

microwave systems, including:

All radio equipments to/from Resistencia at Paso de Patria station,

All radio equipments to/from Foz do Iguacu at Pto. Pte. Stroessner station.

- (2) Establishment of super group translating equipments and associated facilities to/from Resistencia at Pilar station.
- (3) Establishment of super group translating equipments and associated facilities to/from Foz do Iguacu at Pto. Pte. Stroessner station.
- (4) Establishment of group translating equipments, channel translating equipments, signaling equipments, program transmission equipments, voice frequency telegraph equipments and associated facilities for the international circuits at Asuncion station and Asuncion telephone office.
- (5) Notwithstanding above mentioned, the telephone circuits between Asuncion and Foz do Iguacu shall be included in this contract.

#### **1.4 Completion**

All work governed by this contract except the technical supervision for maintenance shall be completed and delivered within two years after the contract. However, earlier completion is preferable.

#### **1.5 Sharing Use of Equipment Room**

It shall be noted that, in several stations concerned, the installation of the equipment under separate projects are planned. Accordingly, the required space for the equipment under this project shall be minimized.

#### **1.6 Fundamental Requirement**

Equipment and materials to be supplied and work to be executed shall, besides being compatible with the description given in the Contractual Terms and Conditions and the related statement that appears later, shall also satisfy the following general requirement.

- (1) General

- (a) All facilities for this project shall be offered on the turn-key basis.
- (b) The most advanced, up-to-date techniques shall be employed.
- (c) Costs of construction, operation, and maintenance shall be the minimum possible.
- (d) Sufficient consideration shall be made for the durability as well as the prevention of damage, loss, false operations, and instability under all conceivable conditions.
- (e) Safety shall be secured for all personnels involved.
- (f) Characteristics of the system shall, except when clearly indicated in the Specifications, conform to the C.C.I.T.T. and C.C.I.R. Recommendations and I.T.U. Radio Regulations.
- (g) Should any C.C.I.T.T., C.C.I.R. Recommendations and I.T.U. Radio Regulations be revised, after the issue of the Specifications, modifications of the Specifications will be established by ANTELCO before the closing date of this Tender, and the Tenderer should undertake to incorporate such modifications as may be necessary.
- (h) The Tenderer shall submit an offer conforming with this Specifications, he can, however, propose a proper alternative offer, except the case clearly prohibited in this Specifications, performances of which shall satisfy the Specifications, if he should so desire.  
 In such a case, however, any deviation from the Specifications shall be clearly stated in the offer with comprehensible reasons so that due consideration may be given to the Tenderer in the ANTELCO's assessment.
- (i) The Tender shall submit item-by-item statement for every item of the Specification.

(2) Environmental Conditions

- (a) Equipment and materials to be supplied shall be so treated that they will thoroughly withstand the environmental conditions in

Paraguay.

- (b) Outdoor facilities shall satisfy the requirements in the Specifications under the following environmental conditions;

Ambient temperature	-5°C to 45°C
Ambient relative humidity	Up to 100%
Wind velocity	Up to 120 km/Hour

- (c) Indoor facilities shall satisfy the requirements in the Specification under the following environmental conditions;

	Radio equipments	Carrier equipment etc.
Ambient temperature	5 to 40°C	5 to 40°C
Ambient relative humidity	Up to 95%	Up to 95%

- (d) Those facilities shall be such that, even in case the ambient temperature exceed  $\pm 10^\circ\text{C}$  from the limits mentioned above and such conditions last for long time, the characteristics of facilities will not be seriously affected.

When the ambient temperature returns to within the limits mentioned above, the facilities shall once again be able to satisfy the requirements in the Specifications.

- (e) The highest station has an altitude of about 430 meters.

(3) Requirement for Equipment

- (a) Equipment shall be the minimum possible in size and weight.
- (b) Equipment shall be such that it can be accommodated in a metallic, sturdy bay or casing without distortion and can be neatly arranged. Moreover, those bays shall be capable of back-to-back arrangement.
- (c) Solid-state techniques shall be used.
- (d) Equipment shall be composed, as far as possible, of plug-in units featuring interchangeability.
- (e) All maintenance work shall, in principle, be able to be performed through the front of the equipment.
- (f) Adjustment units shall be such that they operate accurately and smoothly and that adjustment points do not easily change.

- (g) The high voltage units shall be such that there will be no danger to human life at the time of adjustment. The danger shall also be indicated by appropriate warning labels or signs.
- (h) Portions that require dust-proofing, such as relays, shall be protected with covers.
- (i) Equipment shall be provided with lamps that indicate the state of operation. Equipment operational status shall be indicated by visible alarms, which are centralized on the supervisory and control equipment.
- (j) All equipment, except power supply equipment, shall be wired above the bays. Wiring for connection of neighbouring equipment may be installed on the side of the bays.
- (k) The color of the basic communication equipments shall be light gray or similar color.
- (l) Panels and analogous assemblies, as well as detachable input and output terminals of each equipment, shall be given the same notations as in the circuit diagram.  
Adjustments shall be given the proper scaling when necessary.
- (m) A name plate showing appellation, date and number of manufacture and name of manufacturer shall be attached to each equipment in a place where it is easy to notice.  
For power equipment, the ratings shall also be indicated.
- (n) The power source for all equipment, except power equipment, dehydrator and measuring equipment, shall be DC-24V with ripple voltage of 20mV r.m.s. or less.  
Equipment shall be capable of satisfactory operation within voltage variations of  $\pm 10\%$ .

(4) Miscellaneous

- (a) The Contractor shall take measures in cooperation with ANTELCO to eliminate harmful radio interference which may arise between this system and any other existing radio system.
- (b) Work shall be executed in full coordination, and without causing

confusion, with other work under execution in about the same period.

(5) Data to be presented

- (a) For each station, the power consumption at initial stage and in 1990 shall be furnished with detailed breakdown such as microwave equipments, multiplex equipments and voice frequency telegraph equipments, etc. including all equipments which will be constructed in the future at concerned stations as shown in 6.2 (3).
- (b) For this project, over all reliability, each system reliability and the basis of calculation shall be described systematically.

## CHAPTER 2 MICROWAVE WYSTEM

### 2.1 General

This Chapter specifies the domestic section of the line-of-sight wide band microwave systems included in this project. The international connecting sections of these microwave systems are not included in this tender, as mentioned in Section 1.3.

### 2.2 Route

A route map appears in Fig. 1-1, and a profile of each hop is found in Figs. 2-1 to 2-12. These drawings are based on the field surveys.

The future plan is shown in Fig. 1-2.

### 2.3 Radio Frequency Plan

The basic frequency plan for the microwave systems under this project preferably uses the upper 6 GHz band in C.C.I.R. Recommendation 384-1.

The Tenderer shall propose the concrete frequency plan for each radio carrier frequency including the future plan conforming to the basic plan described above.

### 2.4 System Configuration

- (1) The system configuration of the microwave radio network is shown in Fig. 1-2.
- (2) In the proposed microwave radio system, there are thirteen microwave radio stations in total. Carrier terminal equipment will be installed at six of these stations, and the rest are repeater stations.
- (3) With regard to the number of systems, initially one each of telephone radio channel and stand-by radio channel should be established. TV transmission will be made over this stand-by radio channel at the initial stage. Design consideration should be given for possible provi-

sion of an independent television system in the future.

However, in the link between Asuncion and Paraguari, two telephone radio channels and one common stand-by radio channel for them should be installed at initial stage because two routes, i.e., routes for Brasil and for Argentina, are installed parallelly in this link.

- (4) The transmission capacity should be 960 telephone channels per microwave radio channel, and furthermore, the stand-by channel should be able to transmit a color television signal with one sound.
- (5) The configuration of each station should be as shown in Figs. 2-13 to 2-20.
- (6) Modem equipment for TV should be installed at Asuncion Station. Also, this modem equipment for TV should be installed at Pto. Pte. Stroessner and Pilar. Consideration has also been given to permit the dropping and insertion of a television program at each station for direction to Asuncion Station in the future when the national TV relay service is initiated.

The TV modem for this purpose in future should be duplicated.

- (7) The circuit change-over system employed at Asuncion should be the video switching system for both telephone radio channel and television channel; the video switching for telephone radio channel and IF switching for TV channel will be used as a rule at other switching stations.
- (8) The final channel capacity is three normal radio channels + one stand-by radio channel in a link between Asuncion and Paraguari and two normal radio channel + one stand-by radio channel between other links.
- (9) Configuration of television transmission line

When the stand-by channel is used for television transmission, the stand-by channel from Asuncion to Paraguari station shall be connected

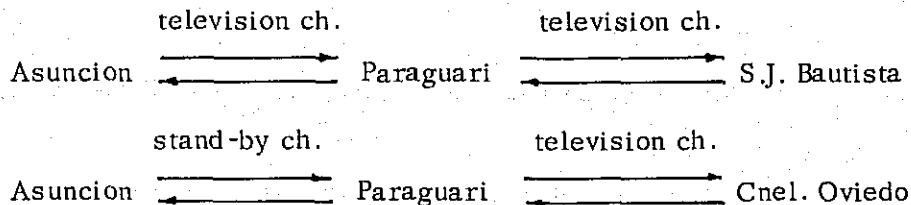


at Paraguari station with both stand-by channels from Paraguari to San Juan Bautista Station and from Paraguari to Cnel. Oviedo Station without any control.

The stand-by channel from Paraguari to Asuncion station shall be connected with one of the stand-by channels from San Juan Bautista to Paraguari Station and from Cnel. Oviedo to Paraguari Station with manual operation at Paraguari Station or remote operation from Asuncion Station.

The configuration of the television transmission channel established in the future, will be the same as that of the stand-by channel mentioned above.

After the television transmission channel is established in the future, using this channel and stand-by channel, it will be possible to send two television programs and to receive two television programs at Asuncion station simultaneously. In this case, at Paraguari Station, the connection or switching between television transmission and stand-by channels will be as follows:



(10) In the international border connection section, a 8.5 MHz pilot signal should be sent out on the TV channel for monitoring purposes at the time the television channel is not in operation in the future when the television channel is provided.

(11) Space diversity may be established by the other contract in the hops of S. J. Bautista – Estro Camba – Pilar – Paso de Patria – Resistencia because there are some swamps over these paths, if ANTELCO considers to need it after the system operation.

## 2.5 Transmission Capacity

The signal to be transmitted is either of:

- (1) An FDM telephone signal of whose limits of band occupied by 960 telephone channels is the 60 KHz ~ 4,028 KHz band (Refer to C.C.I.R. Recommendation 380-2).
- (2) A television video signal of System M in C.C.I.R. Report 308-2 (525 lines, Nominal video bandwidth 4.2 MHz). Further, simultaneous transmission of the television sound signal with the video signal shall be available through one circuit. Facilities shall be so designed that, in future, colour television signal can be also transmitted.

## 2.6 Overall Characteristics

The characteristics of the signals at the interconnection terminals of the link shall be as follows:

- (1) Telephone Baseband:
  - (a) Nominal input and output impedance shall be 75 ohms unbalanced, and return loss within the baseband shall be not less than 24 dB. (Refer to C.C.I.R. Recommendation 380-2)
  - (b) Nominal signal level in terms of channel test tone shall be:

Input level:	-45 dBr
Output level:	-20 dBr

(Refer to C.C.I.R. Recommendation 380-2)
  - (c) The noise power of each section between Asuncion and Pilar, between Asuncion and Stroessner and Pilar-Paso de Patria-Pilar section with IF loop connection at Paso de Patria, of length L km, at a point of zero relative level in a telephone channel, shall not exceed the values given in the section-2 of the C.C.I.R. Recommendation 395-1 as follows:  
for  $50 \text{ km} \leq L \leq 840 \text{ km}$ :
    - (i)  $3LpW + 200 \text{ pW}$  mean power in any hour,

- (ii)  $3L\text{pW} + 200\text{ pW}$  one-minute mean power for more than 20% of any month,
  - (iii)  $47500\text{ pW}$  one-minute mean power for more than  $(280/2500) \times 0.1\%$  of any month when  $L$  is less than 280 km, or more than  $(L/2500) \times 0.1\%$  of any month when  $L$  is greater than 280 km.
- (d) Attenuation/frequency characteristics in one baseband shall be kept within  $\pm 1.0\text{ dB}$  relative to 100 kHz.
- (e) Signal outside the baseband range at the output inter connection terminals of the microwave systems shall satisfy the conditions below: (Refer to C.C.I.R. Recommendation 381-2)
- (i) The level of any signal outside the baseband shall be suppressed below  $-50\text{ dBmO}$ .
  - (ii) The level of the total power of all the signals outside the baseband range, including noise, shall be less than  $-17\text{ dBmO}$ .

(2) Television Video Signal

- (a) Nominal input and output impedance shall be 74 ohms unbalanced, and return loss within the video band shall not be less than 24 dB. (Refer to C.C.I.R. Recommendation 421-2).
- (b) Nominal input and output signal level, picture signal level and synchronous signal level shall be 1 V, 0.7 V and 0.3 V peak-to-peak respectively. The variations of insertions gain shall not exceed  $\pm 0.3\text{ dB/sec}$  and  $\pm 1.0\text{ dB/hour}$ .  
(Refer to C.C.I.R. Recommendation 421-2)
- (c) Signal to-noise ratio shall be as follows:  
(Refer to C.C.I.R. Recommendations 289-1 & 421-2)
- (i) The ratio of signal (peak-to-peak), excluding synchronizing pulses, to the r.m.s. value of continuous random noise between 10 KHz and 4 MHz read on an instrument having an effective time constant in term of power of one second, using weighting network, shall not be less than the values given below:
    - X (=56)  $+4\text{ dB}$  for more than 20% of any month.
    - X (=56)  $-8\text{ dB}$  for more than 0.1% of any month.
  - (ii) Signal (peak-to-peak)-to-noise (peak-to-peak) ratio for

periodic noise shall not be less than the values given below:

Power supply hum including the fundamental frequency and lower order harmonics	35 dB
Single-frequency noise between 1 KHz and 1 MHz	59 dB
Single-frequency noise may decrease linearly between 1 MHz and 4 MHz	43 dB

(d) Linear waveform distortion shall be as follows:

(Refer to C.C.I.R. Recommendation 421-2)

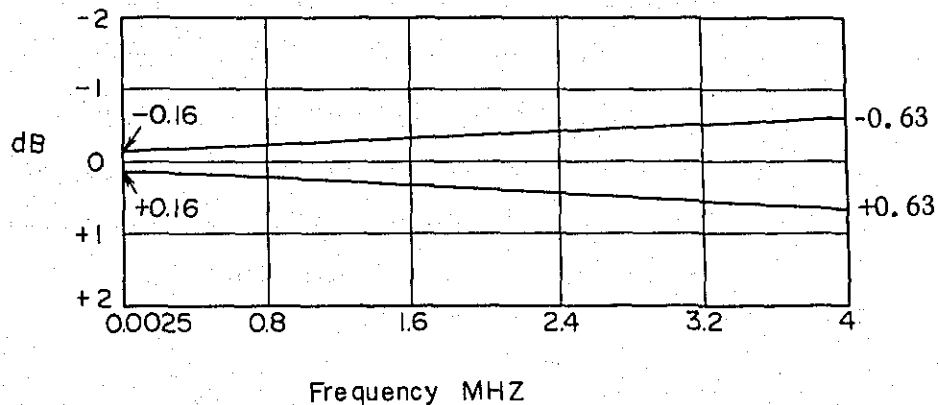
- (i) Field-time distortion shall not exceed  $\pm 5\%$  when the signal is unclamped or  $\pm 1\%$  when the signal is clamped, measured with the Test Signal No. 1 in C.C.I.R. Recommendation 421-2.
- (ii) Line-time waveform distortion shall not exceed  $\pm 1\%$  measured with the Test Signal No. 2 in C.C.I.R. Recommendation 421-2.
- (iii) Short-time waveform distortion, measured with the Test Signal No. 2 in C.C.I.R. Recommendation 421-2, shall not exceed the values given below:

Overshoot	$\pm 13\%$
Rise-time	$0.125 \mu s$

(e) Steady-state characteristics shall be as follows:

(Refer to C.C.I.R. Recommendation 421-2)

Attenuation/frequency characteristics shall lie within the following mask:

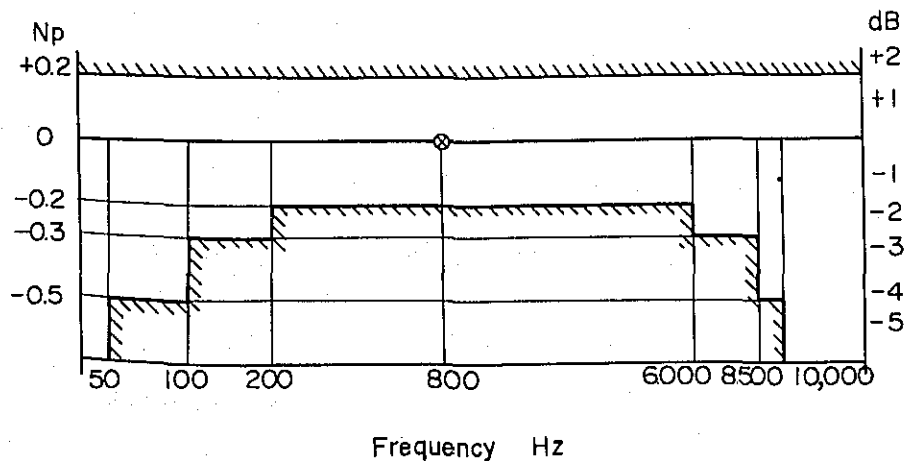


- (f) Non-linearity distortion shall be as follows:
- (i) The non-linearity distortion expressed as a percentage, in the form  $(1-m/M) \times 100$ , and measured with Test Signal No. 3, using a superimposed sine-wave at 3.6 MHz in C.C.I.R. Recommendation 421-2, shall not be more than 13%.
  - (ii) Quality of color television signal transmitted through the stand-by circuit shall be sufficient.  
The contractor shall submit a reasonable value to transmit NTSC system color television signal, expressed differential phase and differential gain characteristics, measured with a test signal using superimposed sine-wave at 3.58 MHz in C.C.I.R. Recommendation 421-2.
  - (iii) The amplitude of line-synchronizing signal, measured with Rest Signal No. 3 in C.C.I.R. Recommendation 421-2, shall lie between 0.26 V and 0.31 V.
- (g) The specification in respect to system performance mentioned above, shall be applied for the sections between Asuncion and Stroessner radio terminal stations, between Asuncion and Pilar radio terminal stations and for the section Pilar-Paso de Patria-Pilar with IF loop connection at Paso de Patria.  
The Tenderer shall submit expected system performance for those sections.

(3) Sound Channel

This specification deals with the over-all performance for a single sound program channel to be transmitted by means of frequency modulated sub-carrier inserted in the baseband above the video band and below the continuity pilot. (Refer to CCITT Recommendation J.21)

- (a) Audio bandwidth shall be from 50 to 10,000 Hz.
- (b) Attenuation/frequency characteristics shall lie within the following mask (relative to the value measured at 800 Hz, measured at the end of the circuit).



- (c) Signal to noise ratio shall be as follows, at the output of the radio system where nominal level is 0 dB (rel. 0.775 V) measured with the program circuit-sophometer as defined by CCITT:

No loading condition of video signal,  
not less than 48 dB

- (d) As for non-linear distortion, total harmonic distortion shall not exceed the following values, under the condition that sinusoidal signal of +9 dB (rel. 0.775 V) is sent to the radio system input where nominal level is 0 dB (rel. 0.775 V).

30 dB at fundamental frequencies below 100 Hz.

34 dB at fundamental frequencies above 100 Hz.

- (e) The specification in respect to system performance mentioned above shall be applied for the same sections mentioned in the paragraph 2.6-(2)-(g).

- (f) The overall performance for television signal mentioned in (2) before, shall be satisfied, even if the sound signal is transmitted simultaneously.

(4) Data to be Presented

- (a) The Tenderer shall submit calculation data for the system

design, allotment of thermal, distortion and interference noise, quoting the characteristics of equipment to be used such as transmitting power, antenna gain, receiver noise figure and feeder loss. Moreover, block diagram of overall microwave systems shall also be submitted.

- (b) The Tenderer shall submit his delivery experience, preferably supported by a certificate from an authoritative telecommunication organization, for microwave systems of 300 channels or more and of television relay already put into operation. Names and sections of links as well as route-km and channel-km shall be described classifying into the frequency bands and transmission capacities.

## 2.7 Radio Repeater

### (1) General

- (a) Radio repeater shall consist of microwave transmitter, receiver, modulator, demodulator, etc.
- (b) Those may be accommodated in the bay in a suitable combination.

### (2) Radio Frequency

- (a) Carrier frequency based on the description in 2.3 shall be used.
- (b) Accuracy of carrier frequency shall be kept within  $\pm 1 \times 10^{-4}$ .
- (c) Spurious radiation at the output of the branching filter shall be less than -65 dB relative to the non modulated carrier level. Measures shall be taken to prevent the occurrence of spurious radiation which may exert an adverse influence.
- (d) Suppression of image frequency shall be not less than 65 dB, including the branching filter, relative to nominal wanted signal level.

### (3) Modulation

(a) Telephone Baseband Signal:

- (i) Type of modulation shall be frequency modulation (FM).
- (ii) Frequency deviation shall be 200 kHz r.m.s. per channel test tone.  
(Refer to CCIR Recommendation 404-2)
- (iii) When using pre-emphasis, the characteristics shall conform to CCIR Recommendation 275-2.

(b) Television Video Signal

- (i) Type of modulation shall be FM.
- (ii) Frequency deviation shall be 8 MHz p-p for 1 V p-p video signal.  
(Refer to CCIR Recommendation 276-1)
- (iii) When using emphasis, the characteristics shall conform to CCIR Recommendation 405-1.

(4) Intermediate Frequency (IF)

(Refer to CCIR Recommendation 403-2)

- (a) Nominal center frequency shall be 70 MHz.
- (b) Nominal signal voltage shall be:

Input:	0.3 V r.m.s.
Output:	0.5 V r.m.s.

However, they may be modified in order to suit such arrangement as direct through connection at the IF stage.

- (c) Nominal input and output impedance shall be 75 ohms unbalanced, and return loss within a band covering the base band and the continuity pilot frequency on both sides of the center frequency shall be not less than 26 dB.

(5) Continuity Pilot

(Refer to CCIR Recommendation 401-2)

- (a) Continuity pilot shall be transmitted through microwave circuit in order to indicate the continuity of radio channel.
- (b) Frequency of the continuity pilot shall be 4,715 kHz for telephone signal 8,500 kHz for television signal and 9,023 kHz for stand-by radio channel.



- (c) Frequency stability of the continuity pilot shall be better than  $\pm 5 \times 10^{-5}$ .
- (d) Frequency deviation shall be 140 kHz r.m.s.
- (e) The level of the continuity pilot at the output interconnection terminal of the microwave system shall be suppressed below -50 dBmO. (Refer to CCIR Recommendation 381-2)

(6) Automatic Gain Control (AGC)

Automatic gain control function to cope with input receiving signal variations shall be provided in the receiver. By this function, the IF output level variation shall be maintained within 2.0 dB for 40 dB fading range.

(7) Squelching and Restoring Devices

- (a) Squelching function shall be provided in the receiver in order not to send a noise burst to the next stage in case the input signal of the receiver fades out.
- (b) IF restoring oscillator shall be provided in the transmitter and will function normally with the output of the restorer when the IF input signal fails.

(8) Sound Channel

(Refer to CCIR Recommendation 402 and CCITT Recommendations J21, J13)

- (a) Sound vision combiner and separator shall have working and stand-by units.  
In case the working sound vision combiner or separator fails, it shall be switched over automatically to stand-by one.
- (b) Frequency of sub-carrier shall be 7.5 MHz.
- (c) Deviation of sub-carrier shall be 140 kHz r.m.s. for a sinusoidal signal of +9 dB rel. 0.775 V at the input of the radio

system input.

(d) Deviation of IF and RF carrier

The amplitude of the unmodulated sub-carrier shall be such as to produce a deviation of the IF and RF carrier of 300 kHz r.m.s.

(e) Nominal input and output impedance of audio channel shall be 600 ohm balanced, and return loss at input terminal of sound vision combiner shall not be less than 15 dB at the frequencies of 100, 800 and 7,500 Hz.

(f) Maximum audio signal at the input and the output of the radio system shall be +9 dB rel. 0.775 V respectively.

The level at the input and the output of audio channel shall be adjustable  $\pm 2$  dB.

(9) Data to be Presented

The Tenderer shall submit explanatory data on the following

- (a) Outline of operation.
- (b) Block diagram of each equipment.
- (c) Level diagram.

## 2.8 Space Diversity System

(1) General

At the initial stage, space diversity is not adopted in the hope of S.J. Bautista - Esto Camba - Pilar - Paso de Patria - Resistencia where are some swamps over the propagation path.

However, from the result of operation data, ANTELCO may consider the adoption of space diversity in other contract.

(2) Space Diversity System

The "individual control space diversity system due to inphase linear adder" is preferable.

- (3) Data to be presented
  - (a) The Tenderer shall submit the schematic diagram and detailed explanation of space diversity system to be proposed.
  - (b) The Tenderer shall submit his delivery experience for the space diversity system already set into operation.
  - (c) The Tenderer shall submit the power consumption for space diversity equipment at initial stage and final stage (1990) in each concerned station.

## 2.9 Antenna System

### (1) General

- (a) Antenna system shall consist of antenna, feeder, branching filter, etc.
- (b) The antenna shall be installed on the towers to be constructed by the Contractor at all stations, except Asuncion station where the already constructed tower shall be used. (Refer to Chapter 9).
- (c) Near zone type reflector is not permitted to be used at all stations.

### (2) Characteristics and Necessary Conditions

- (a) Antenna system characteristics shall be such that overall characteristics can satisfy the requirements in 2.6.
- (b) Parabolic antenna shall be used. The front-to-back coupling loss shall not be less than 65 dB.
- (c) Feeder shall be waveguide type.
- (d) Antenna mounting structure shall be such that the antenna direction can be adjusted within a certain range necessary for installation.
- (e) Feeder mounting structure shall be such as to allow heat expansion of feeders without causing adverse influence mechanically or electrically.

- (f) The single polarized common transmit-receive antenna should be utilized. The branching circuit should be designed with consideration for ease of addition of television system in the future.
- (g) The outdoor portion of the feeder system shall be air-tight and shall be filled with pressurized dry air in order to prevent the penetration of moisture, dust, etc. Sufficient measures shall be taken to keep the dry air pressure unaffected by temperature variations.

(3) Data to be Presented

The Tenderer shall submit the explanatory data on the following items:

- (a) Envelope pattern drawings of horizontal and vertical antenna directivity.

## 2.10 Switching System

(1) General

A switching system shall be provided, which enables automatic switch over of the faulty normal radio channel to a stand-by radio channel whether television signal is transmitted or not.

The Tenderer shall refer to Fig. 2-21 which specifies the switching system.

Regarding the preferential sequence of the automatic switching, the first originating fault system should be given priority and consequently the subsequent fault system cannot be switched to the stand-by.

When more than two systems should simultaneously fail, preferential sequence is the telephone A, telephone B, and television in that order.

When a normal system should fail during the TV operation by stand-by, the stand-by operation will be released and the normal system

will be switched to the stand-by.

Incidentally, each normal system is provided with a lock function of an automatic switching.

The control capacity should be designed with consideration for ease of television system addition in the future, just as in the case of the branching filter.

The RF channel switching control system to be employed should be the receiving end control system.

This switching should be made automatically, and, in case of necessity, the manual operation of this switching should be possible.

In this case, besides manual operation at the local station, remote control can be made from Asuncion.

The status of RF channel switching should be displayed on the supervisory and control equipment in a local station.

In addition to indication in the local station, this display can be made at also Asuncion by remote supervisory and control system.

The stand-by system and future television system from Asuncion to Paraguari should be branched at all times at Paraguari to Coronel Oviedo and to S.J. Bautista.

Selection of the two TV signals from Coronel Oviedo and S.J. Bautista should be made at Paraguari. This selection should be possible to be made not only by manual operation, in the local station, but also by remote control from Asuncion.

The status of this selection should be displayed in Paraguari locally.

In addition to this local display, this display can be made at Asuncion by remote supervisory and control system. In the stand-by channel and the future television channel, the program will be cut off at all times in Pto. Pte. Stroessner and Pilar and extension of connection will be made according to the need of the international TV relay service

and the like.

This connection operation can be made not only by manual operation at the local station, but also by remote control from Asuncion.

This display can be made not only at the local station, but also remotely at Asuncion by the remote supervisory and control system.

(2) Switching Section

Switching section shall be Asuncion - Paraguari, Paraguari - Coronel Oviedo, Coronel Oviedo - Pto. Pte. Stroessner, Paraguari - San Juan Bautista, San Juan Bautista - Pilar and Pilar - Paso de Patria radio switching stations.

(3) Switching Capacity

The switching capacity shall be so designed that it can finally accommodate the radio channel included in the final scheme described in Fig. 1-2. When one television transmission channel described in the Figure are installed in the future, the switching system accommodating that channel shall be easily established by addition of panels, etc.

(4) Switching Function

(a) Switching Time

(i) Operation time required from start to completion of switching action shall not exceed 10 ms.

(ii) Transfer time shall not exceed 2 ms.

(b) Automatic Switching-over

(i) The switching action to the stand-by channel shall be started:

when the normal channel comes into the following state;  
the continuity pilot level drops by more than 10 dB from the normal level;

noise power in the band surrounding the continuity pilot becomes below 35 dB in terms of signal-to-unweighted noise ratio of the top channel in telephone baseband, a similar condition shall also be applied to the television

transmission channel established in the future.

- (ii) The stand-by channel shall be returned to the ordinary state when normal channel restores to the normal condition.
- (iii) For switching-over, the telephone transmission channel shall have priority over the television transmission channel.
- (iv) When a television signal is transmitted through the stand-by channel, switching shall be normally conducted even if telephone transmission channel become faulty simultaneously in both direction.

(c) Manual Switching-over

- (i) The switching system shall be so designed that, by manual operation at the switching station on the receiving side, any normal channel can be switched over to the stand-by channel, and also this switching shall be controlled from Asuncion station through the Supervisory and control system.
- (ii) Automatic operation shall have priority over manual operation.
- (iii) Automatic operation shall be locked out manually whenever necessary.

(d) Protection from False Operation

Switching devices shall be designed to protect sufficiently from false operation. Further, during failure of the service channel, present state shall be maintained.

(5) Display

At the switching stations, at least the following items shall be indicated.

- (a) The state of switching of transmission channels.
- (b) Normal or abnormal state of control signal transmission line.
- (c) Normal or abnormal state of each channel.
- (d) Audible alarm in case of abnormality.

Those items shall be indicated on the switch-over control equipment. In case of an unattended switching station, those items shall be remotely indicated with supervisory system to the Asuncion supervising

station.

(6) Data to be Presented

The Tenderer shall submit explanatory data on the following items:

- (a) Outline of operation including failure of service channel.

**2.11 Supervisory and Control System**

(1) Local Supervisory and Control System

(a) Failure of important equipment shall be indicated concentratedly on display panel of supervisory equipment in each station. Alarms shall be indicated visibly and audibly. It shall be possible to turn off indications of those alarms in an unattended station.

(b) Control shall be available for the main equipment in each station.

(2) Remote Supervisory and Control System

All the stations shall be remotely supervised and controlled by Asuncion. Signals for such a system shall be transmitted through the service channel described in 2.12.

The system design shall be so made that the remote supervisory and control can be made at Asuncion. Therefore, Asuncion must be designed as a center station for supervision and control of all the stations covered under the proposed project.

The schematic of the supervisory and control system is shown in Fig. 2-21. In addition to the local supervisory function, Asuncion should have a station selection function of each supervised station, and be able to remote-supervise and to remote-control these stations.

No simultaneous supervision and control of all the supervised stations are not required.

(a) Remote Alarm



- (i) Alarms of supervised stations shall be indicated visibly and audibly at the supervising station. The system shall be so designed that the subject of alarm and the name of station concerned can be definitely discerned.
- (ii) Regarding the preferential sequence of automatic supervision display, the display of the station originated first fault should be given top priority and the display of subsequent fault stations are held. In the event a fault should develop at more than two stations simultaneously, priority could be given to the station closest to Asuncion. In both cases, the display of subsequent fault stations should be possible by resetting the display of first faulty station.
- (iii) The remote display of the remote supervisory equipment should include the following as minimum.

However, the remote and local supervisory equipment should have the capacity for displaying 128 items.

- Station fault (by station)
- Microwave radio equipment fault
- Carrier equipment fault
- Power supply equipment fault
- Door open alarm
- First alarm
- Under-Maintenance
- RF channel switching control status display
- Non-Emergency alarm
- Response of the remote control
- Others (spares)

- (iv) The display of the RF channel switching control equipment mentioned in (iii) should include the following:
  - Normal system fault (by system, by direction)
  - Operating by stand-by system (by system, by direction)
  - Normal system recovered (by system, by direction)
  - TV system connection status of TV system and stand-by system at Paraguari.

The above remote supervisory and control system should be designed in consideration of possible future addition of television system, and the resulting switching of TV modem equipments and switching of dropping and inserting the TV program at each station.

(b) Remote Control

- (i) Control shall be protected from false operation to be caused by accidental touch on the part of maintenance personnel and by deterioration of signal transmission line.

(ii) The state of operation of controlled equipment shall be confirmed at the control station.

(iii) The subjects of control shall be as follows (as minimum requirement):

- Engine start, switch-over and stop
  - TV demodulator switching (from normal to stand-by, and vice versa)
  - TV modulator switching (from normal to stand-by, and vice versa)
  - TV program insertion switching (by normal system, by stand-by system)
  - Remote control of RF channel switching control equipment (by control item, by RF channel)
  - Others (spares)
- The remote control equipment should have the capacity for controlling 64 items.

(c) Interface

(i) Conditions at the interface shall be unified in following status, respectively between the supervisory and the supervised equipment, and between the control and the controlled equipment, in principle, for example:

Alarm input	Normal state .....	Open
	Abnormal .....	Earth

(3) Data to be Presented

The Tenderer shall submit the explanatory data on the following items:

- (a) Outline of operation including such cases as failure of service channel.
- (b) Time required from the initiation of operation to completion of display or control.

**2.12 Service Channel**

(1) General

Service channel shall be provided over the lower part of the base-band of the main radio-relay system, the signal of the service channel shall be transmitted simultaneously over the telephone transmission channel the stand-by channel.

Even in case of failure of either of the two bearers, the service channel signal shall be transmitted normally without manual operation.

When a television signal is transmitted by the stand-by channel, the service channel signal in the stand-by channel shall be stopped automatically.

Moreover, immediately after television signal transmission is stopped in the stand-by channel because of failure of the telephone transmission channel, etc., the transmission of the service channel signal by stand-by channel shall be started automatically.

The service channel shall be established for the transmission of switching, remote alarm and remote control signals and for the order wire.

(2) Service Channel

Service channel characteristics shall satisfy the requirements of the above mentioned signals to be transmitted.

(3) Order Wire

- (a) An omnibus speaker order wire shall be set up to connect all the stations together.
- (b) An express speaker order wire shall be set up to connect among Asuncion, Paraguari, Coronel Oviedo, Pto. Pte. Stroessner, San Juan Bautista and Pilar stations.
- (c) The telephone set shall be so arranged that it can be used conveniently by the maintenance personnel. Terminal or jacks for further extension of order wires shall be also provided.
- (d) Characteristics of the order wire shall be as follows:  
(Refer to CCIR Recommendation 400-2.)
  - (i) The order wire shall be a four-wire circuit.
  - (ii) Bandwidth of the order shall be 300 Hz – 3400 Hz
  - (iii) Nominal input and output impedance shall be 600 ohms balanced.

(iv) Psophometrically weighted mean noise power at a point of zero relative level shall not exceed 20,000 pW for every switching section.

(e) Although information on the order-wire telephone line between the international border connecting sections is not available, the system has been undertaken just as in the case of that between the national connection sections.

(4) Data to be Presented

The Tenderer shall submit explanatory data on the following items:

- (a) Block diagram and frequency allotment of service channel, including the switch-over control signal, supervisory and control signal and order wires.
- (b) Composition of switch-over control signal and remote supervisory and control signal.
- (c) Required characteristics of service channel.

## CHAPTER 3 CARRIER MULTIPLEX SYSTEM

### 3.1 General

This chapter specifies the requirements of the carrier multiplex system to be installed at:

- (i) ASUNCION
- (ii) PARAGUARI
- (iii) SAN JUAN BAUTISTA
- (iv) PILAR
- (v) CORONEL OVIEDO
- (vi) PUERTO PTE. STROESSNER

As described in Chapter 2, there are two microwave routes for this tender, one if the southern route which is composed of Asuncion, Paraguari, S. J. Bautista and Pilar. The other is the eastern route of Asuncion, Coronel Oviedo and Pto. Pte. Stroessner. Those circuits accommodated in the carrier multiplex system are also used for international communications to Argentina, Brazil and Uruguay.

- (1) The carrier multiplex system shall be used for establishing telephone circuits, telegraph circuits and programme circuits, together with the microwave system mentioned in Chapter 2.
- (2) The telephone circuits in this project shall be provided with dial pulse signaling system and ring down signaling system facilities, i.e. out band signaling method with 3,825 Hz relative frequency are adopted.
- (3) The carrier multiplex system is composed of each translating equipment of channel, group and supergroup, and other equipment required for this project.

The channel layouts in this project are shown in Fig. 3-1 and Fig. 3-2. Alternative channel layouts shall not be acceptable. The Contractor shall provide all facilities necessary for establishment of the carrier multiplex system in accordance with requirements specified

hereunder.

- (4) Those circuits accommodated in the carrier multiplex system are also used for international circuits.

The telephone circuits will be used for the various types of circuits such as junction lines, local lines and order-wires. Therefore, the signalling system to be applied to the carrier multiplex system shall be designed to be applicable to 3.4 (1) (c).

- (5) The bidder shall supply and install all the required equipments and materials up to main distribution frame (MDF) and MDF itself for the carrier multiplex system. And all wiring and cabling between the equipments covered in this chapter, and the equipments covered in other chapters shall be also included.

- (6) Following parts of carrier multiplex equipments for the international telecommunication network shall not be included in this tender.

- (a) Supergroup translating equipment and its associated equipments for Resistencia at Pilar.
- (b) Same equipments described above for Foz do Iguacu at Pto. Pte. Stroessner.
- (c) Carrier multiplex equipments (Group translating equipment, channel translating equipment and signalling equipment), programme channel equipments and voice frequency telegraph equipments for international telecommunication network at Asuncion.
- (d) Notwithstanding above mentioned as shown in Fig. 3-2, the telephone circuits between Asuncion and Foz do Iguacu will be inter-connected in real message channels between Pto. Pte. Stroessner and Foz do Iguacu at Pto. Pte. Stroessner with another project. Therefore, the bidder shall supply and install the required equipments for establishing these circuits at

Asuncion and Pto. Pte. Stroessner stations respectively.

### 3.2 Requirement for Carrier Terminal Equipment

(1) Make-up

The make-up shall conform to CCITT Recommendation G211.

(2) Transmission Capacity

The channel capacity of the carrier multiplex system of which facilities shall be provided is shown in Table 3-1. The arrangement of the baseband shall conform to CCITT Recommendation G423, Fig. 5.

The bidder shall offer the equipments which are designed to provide the facilities of the channel requirement of 1990. But initially those equipments shall be equipped with the facilities for 1980, and expansion for 1990 should be done easily to make good use of the facilities installed in 1980.

The transmission systems of S. J. Bautista-Encarnacion, Paraguari-Caacupe, Coronel Oviedo-Villarrica and Pto. Pte. Stroessner - Foz do Iguacu are not included in this tender, but some parts of the carrier multiplex equipment should be offered at this tender.

In other word all equipments for those routes shall be offered for Asuncion and the supergroup through filter equipments for S. J. Bautista and the group through filter equipment for Paraguari and Coronel Oviedo and the channel translating equipment for Pto. Pte. Stroessner shall be included.

Detailed diagram of interface points for S. J. Bautista, Paraguari Coronel Oviedo and Pto. Pte. Stroessner Terminal Stations are shown in Fig. 3-1 and Fig. 3-2 channel layout.

(3) Block Diagram of the System

A typical block diagram of the carrier multiplex system is shown in Fig. 3-3. In addition to the equipment shown in the block diagram, miscellaneous equipment such as intermediate power distribution equip-

ment and other equipment required for the maintenance work shall be provided.

(4) Arrangement of the Equipment

All the multiplex and programme transmission equipments shall be installed at the same floor of microwave equipments.

The arrangement of the equipment shall satisfy the conditions of CCITT Recommendation G231. However, the racks to be installed at small stations shall not always be obliged to CCITT Recommendation G231.

The suitable arrangement may be acceptable.

(5) Other Requirements

(a) Mechanical stackable equipment type such as subrack or sub-shelf may be acceptable, because of economy.

(b) All stations except Asuncion are unattended-stations.

Therefore, at least, following items should be considered for the multiplex system.

(i) Alarm indication at Asuncion

Failures of multiplex equipments such as line pilot, carrier supply circuits and power supply should be visibly indicated respectively at the unattended station, concentrated as a single code and transferred to the supervisory system.

(ii) Carrier amplifiers of the carrier supply equipment should be duplicated with automatic changeover.

(c) Dial pulse signalling system and ring down signalling system is adopted for the time being, but in near future automatic exchange system will be introduced in Paraguay, with R2 signalling system recommended by CCITT (Recommendation Q350-380 in Vol. 6). Accordingly channel translating equipments shall be designed to meet the requirement for R2 signalling system.

Furthermore, discontinuous signalling system with high level



(-5 dBmO) shall also be available by changing of strap, for example.

Bidder shall state the method of the changing the above mentioned signalling system in detail.

- (d) The equipments shall preferably be installed in back-to-back arrangement.
- (e) Power supply voltage for the multiplex equipment shall be DC -34V.
- (f) Adequate test points shall be provided for the equipment, and the points shall be of easy access.
- (g) Terminal blocks for communication, power and miscellaneous cables shall be provided on the top of the equipment bay.  
Necessary alarm indications shall be provided.

### 3.3 Equipment to be Installed

All the equipment to be initially installed at each station shall be designed to correspond to the channel layout shown in Fig. 3-1 and Fig. 3-2.

The connections of each equipment are as follows:

- (1) Frequency generating equipment (Called "FG" hereafter)

Wiring from the frequency generating equipment shall be directly conducted to each equipment.

- (2) Supergroup Translating Equipment (Called "SG TR" hereafter)

Each basic supergroup signal shall be sent to/from the group translating equipment via the supergroup distribution frame (SGDF), and the baseband signal combined in the SG TR, shall be conducted to/from the microwave equipment.

- (3) Group Translating Equipment (Called "G TR" hereafter)

Each basic group signal shall be sent to/from the channel transla-

ting equipment via the group distribution frame (GDF), and supergroup signal shall be sent from/to the SG TR via the SGDF.

(4) Channel Translating Equipment (Called "CH TR" hereafter)

Each voice signal shall be sent from CH TR to the voice frequency distribution frame (VDF), and vice versa. Each basic group signal shall be sent from/to the G TR via the GDF.

(5) 2-Wire/4-Wire Terminating Equipment (Called "HYB" hereafter)

Both 2-wire side and 4-wire side shall be connected to the VDF.

(6) Supergroup Automatic Gain Regulating Equipment (SG AGR)

Both input and output terminals of the SG AGR shall be connected to the SGDF.

(7) Supergroup Through Filter

The filter shall be wired to SGDF.

(8) Programme Transmission Equipment

The equipment shall be wired to GDF and VDF.

(9) VDF, GDF and SGDF

The VDF, GDF and SGDF shall be provided corresponding to respective capacities.

### 3.4 Performance of Translating Equipment

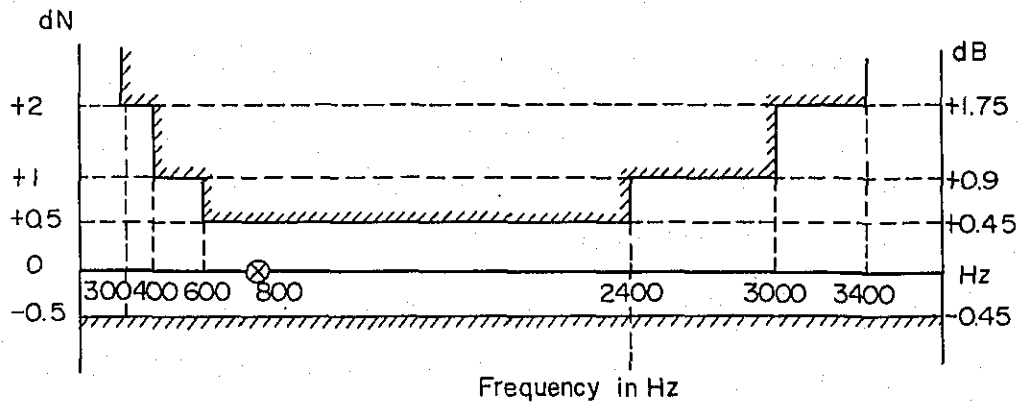
(1) Channel Translating Equipment

(a) Function

The equipment shall be capable of translating 12 voice frequency channels occupying 300 to 3,400 Hz into a B type basic group frequency band specified in CCITT Recommendation G211, and vice versa.

(b) Transmission Characteristics

(i) The overall loss of each pair of channel transmitting and receiving equipments of one terminal equipment shall not exceed the following limits.



- (ii) The carrier leak of each channel measured at the GDF shall be less than -30 dBmO, and the carrier leak measured at 4-wire transmitting and receiving points (VDF) shall be less than -20 dBmO, respectively.
- (iii) For equipment linearity, the variation of over-all loss per channel of a combination of transmitting and receiving terminal equipment shall be within  $\pm 0.3$  dB, when the input level is increased from 0 dBmO to +3.5 dBmO. (Refer to CCITT Recommendation G232.)
- (iv) For transmitting equipment amplitude limiting of an individual channel, the level of high frequency output signal shall not exceed 12 dBmO, when any level not exceeding 20 dBmO, at any frequency between 300 to 3,400 Hz, is applied at the input. (Refer to CCITT Recommendation G232.)
- (v) The intelligible cross-talk ratio between two channels of the same group, measured on a combination of transmitting and receiving terminal equipment, shall not be less than 65 dB.

The unintelligible cross talk produced in an adjacent channel shall not be less than 60 dB, measured on the same condition as above.

(Refer to CCITT Recommendation G232.)

- (vi) The total psophometrically weighted noise for one pair of channel modulators shall be less than 330 pW.

(c) Signalling

- (i) The out-band signalling (3825 Hz) system shall be adopted on the carrier multiplex system. However, multiple frequency code (MFC) signalling shall be adopted for register signal in case R2 signalling system (Refer to CCITT Recommendation Q350-380 in Vol. 6)

will be introduced in the future.

The equipment shall be designed to be used for both continuous and discontinuous type signalling.

The nominal value of the signalling frequency and its level, and dial distortion shall be met as follows:

Signalling frequency: 3825 Hz  $\pm$  4 Hz

Sending level

High level : -5 dBmO  $\pm$  1 dB

Low level : -20 dBmO  $\pm$  1 dB

Dial distortion : within  $\pm$  5 %

for 33% make ratio 10 - 20 PPS impulse.

This shall be satisfied even with  $\pm$  4 dB level variation.

(ii) The signalling relay shall be maintenance-free type.

(d) Voice Connection

The conditions at a voice frequency band shall satisfy the following requirements:

(i) The input and output impedance shall be 600 ohms, balanced, and the return loss shall not be less than 15 dB.

(ii) The level at 4-wire points (VDF) shall meet the followings:

Transmitting: Adjustable -1 to -16 dBr by 1 dB steps

Receiving: Adjustable -7 dBr to +8 dBr by 1 dB steps

(In addition to this facility continuous level adjuster, about  $\pm$  3 dB shall be provided)

(e) Basic Group Connection

The connection at the GDF shall satisfy the following conditions:

(i) The input impedance shall be 75 ohms, balanced, and the return loss shall not be less than 15 dB, except for the 84.08 KHz  $\pm$  60 Hz.

(ii) The nominal signal level in terms of channel test tone shall be as follows:

Transmitting: -36 dBr

Receiving: -18 dBr

- (f) Group Pilot
  - (i) The equipment shall be capable of injecting the group pilot of 84.08 KHz specified in CCITT Recommendation G241.
  - (ii) The output level of the pilot frequency shall be -20 dBmO as specified in CCITT Recommendation G241. The level of the pilot shall be adjustable within  $\pm 0.1$  dB to the nominal pilot level.

(2) Group Translating Equipment

(a) General

The equipment shall be capable of translating 5 basic groups into a basic supergroup occupying a band of 312 to 552 kHz specified in CCITT Recommendation G211, and vice versa.

(b) Transmission Characteristics

- (i) The deviation of frequency/attenuation distortion in the transmitting or the receiving equipment shall not exceed 0.5 dB within the basic group frequency band of 60 to 108 kHz, and 0.25 dB within the channel frequency band of 4 kHz.
- (ii) The transmitting equipment carrier leak shall be less than -30 dBmO on a group measured at the SGDF, and the receiving equipment carrier leak shall be less than -20 dBmO measured at the output terminal on a basic group side.
- (iii) The total psophometrically weighted noise of one pair of group modulators shall be less than 90 pW at a zero relative level point. (Refer to CCITT Recommendation G222.)
- (iv) The intelligible crosstalk ratio between two groups of the same supergroup measured on a combination of transmitting and receiving equipment shall not be less than 70 dB. (Refer to CCITT Recommendation G242.)

(c) Basic Group Connection

The conditions of the basic group connection are specified 3.4 (1) (e).

(d) Basic Supergroup Connection

The connection at the SGDF shall be in accordance with the following conditions:

(i) The input and output impedance shall be 75 ohms, unbalanced, and the return loss of the output shall not be less than 15 dB.

(ii) The nominal signal level in term of channel test tone shall be as follows;

Transmitting:	-29 dBr
Receiving:	-29 dBr

(e) Supergroup Pilot

(i) The equipment shall be capable of injecting and extracting the supergroup pilot of 411.92 KHz specified in CCITT Recommendation G241.

(ii) The output level of the pilot frequency shall be -20 dBmO as specified in CCITT Recommendation G241. The output level of the pilot shall be adjustable with  $\pm 0.1$  dB to the nominal pilot level.

(3) Supergroup Translating Equipment

(a) General

The equipment shall be capable of translating the basic Supergroup corresponding to the system capacities into a base-band for the microwave links, conforming to CCITT Recommendation G343 Plan 1, and vice versa.

(b) Transmission Characteristics

(i) The deviation of frequency/attenuation distortion in transmitting or receiving equipment shall not exceed 1.0 dB within the basic supergroup frequency band of 312 to 552 kHz, and 0.5 dB within the basic group frequency band of 60 to 108 kHz respectively.

(ii) The transmitting equipment carrier leak shall be less than -30 dBmO on a supergroup measured at the base-band output terminal, and the receiving equipment carrier leak shall be less than -20 dBmO measured at the basic supergroup output terminal.

(iii) The total weighted noise of one pair of supergroup modulators shall be less than 80 pW at a zero relative level point.

(iv) The intelligible crosstalk ratio between two supergroups in the system measured on a combination of transmitting and receiving equipment shall not be less than 70 dB. (Refer to CCITT Recommendation G242.)

(c) Basic Supergroup Connection

The conditions of the basic supergroup connection are specified in 3.4 (2) (d).

(d) Baseband Connection

(i) The input and output impedance shall be 75 ohms, unbalanced.

(ii) The nominal signal level in terms of channel test tone shall be as follows:

Transmitting:	-45 dBr
Receiving:	-20 dBr

(e) Stand-by Amplifier

One stand-by transmitting amplifier shall be provided on supergroup translating equipment together with a ready means (not involving soldering) of substituting it for a working amplifier which has failed.

### 3.5 Performance of Frequency Generating Equipment

(1) General

The equipment shall provide all carrier, pilot and signalling frequencies required for each translating equipment and system.

The characteristics of supplied frequencies shall be such that each translating equipment and system will function with specified performance.

The equipment shall conform to relevant CCITT Recommendation.

(2) Frequency Synchronization

The means shall be provided to ensure that the overall frequency synchronization of each channel does not exceed 2 Hz at any time.

The synchronizing pilot to ensure the above prescribed stability shall be employed at 60 kHz.

(3) Carrier Frequency.

All of the carrier frequencies shall be originated by one master oscillator except pilots and signalling currents.

- (a) The carrier frequency accuracy shall be better than  $\pm 10^{-7}$ .
- (b) The frequency stability required for one master oscillator shall be less than 1 Hz of deviation from the nominal value of the highest frequency of the baseband for a period of at least one month.

(4) Pilot Frequency

- (a) The pilot frequency accuracy shall be within the following limits, conforming to CCITT Recommendations G241 and G352.  
Group and supergroup pilot:  $\pm 1$  Hz relative to the nominal value
- (b) The level stability of those pilots shall be within  $\pm 0.3$  dB, conforming to CCITT Recommendations G241 and G332.

(5) Purity

(n x fundamental) kHz impure components accompanied with the carrier and pilot currents shall be suppressed by not less than the following limits, except for harmonic components.

Channel carriers .....	50 dB
Pregroup carriers (when used) .....	75 dB
Group carriers .....	80 dB
Supergroup carriers .....	80 dB
60 kHz pilot current .....	30 dB

Moreover, the harmonic component attenuation of these frequencies, group and supergroup pilots, and signal currents shall not be less than 20 dB.

(6) Duplication

- (a) The equipment shall be fully duplicated in each individual frequency generating equipment.
- (b) Automatic switch-over of the working equipment to the standby shall be applied. Restoring may be conducted manually. This



switch-over shall be made in the event of level degradation by 1 to 3.5 dB; and in case level stabilizer circuit is included, by 3.5 to 5 dB at the input of the stabilizer.

- (c) The switching time shall not exceed 4 ms for carrier and signal currents, and shall not exceed 25 ms for pilot currents.

### 3.6 2-Wire/4-Wire Terminating Equipment

#### (1) Function

The equipment shall have the following functions.

- (a) The equipment shall be capable of connecting a 2-wire circuit to a 4-wire circuit.
- (b) U-link shall be provided for 2-wire and 4-wire points, respectively, and they shall have high impedance measuring point.
- (c) The equipment shall provide a 600 ohm balancing network, if necessary.
- (d) The equipment shall be capable of providing with a signalling circuit for ring-down of 25 Hz. Moreover, 25 Hz ringing tone generator shall be provided.

#### (2) Transmission Characteristics

- (a) The transmission loss between 2-wire and 4-wire terminals shall be less than 4 dB at 800 Hz and shall be less than  $\pm 0.5$  dB within the frequency band of 300 to 3,400 Hz, excluding the blocking condenser.
- (b) The composite attenuation shall be greater than 40 dB when the blocking condenser is included. Measuring frequency shall be 300 to 3,400 Hz.
- (c) A high input impedance of a 2-wire circuit shall be provided against ringing current.

#### (3) Connection Conditions

The impedance of 2-wire and 4-wire terminals of the equipment shall be 600 ohm, balanced, respectively. Moreover, those return loss shall be more than 20 dB excluding the blocking condenser.

(4) Characteristics of Ring Down Converter

- (a) The circuit shall be capable of sending 25 Hz ringing tone to a 2-wire telephone circuit according to earth potential received on the E-wire.
- (b) The circuit shall be capable of sending earth potential to the M-wire, when 25 Hz ringing tone is received from 2-wire telephone circuit.

**3.7 Automatic Gain Regulating Equipment**

(1) Function

The equipment shall be capable of automatically regulating the level variation with time relative to nominal level at supergroup frequency band by detecting pilot level.

(2) Characteristics

- (a) The equipment shall satisfy the following conditions:

Pilot frequency : 411.92 kHz

Regulating range: At least  $\pm 4$  dB or more

- (b) The level deviation shall be less than 0.5 dB relative to nominal level after the automatic regulation.
- (c) Transmissible frequency band of the equipment shall be 312 to 552 kHz, and deviation of attenuation distortion in the said band shall be less than 0.5 dB.
- (d) The input and output impedance in terms of return loss against 75 ohm shall be less than 20 dB in the said transmission frequency band.
- (e) The total weighted noise of the equipment shall be less than 10

pW at a zero relative level point.

(3) Indication

Indication for operating conditions and alarms shall be provided on the equipment.

**3.8 Supergroup Through Filter**

(1) Function

The filter shall be used for through supergroup at the basic supergroup frequency band.

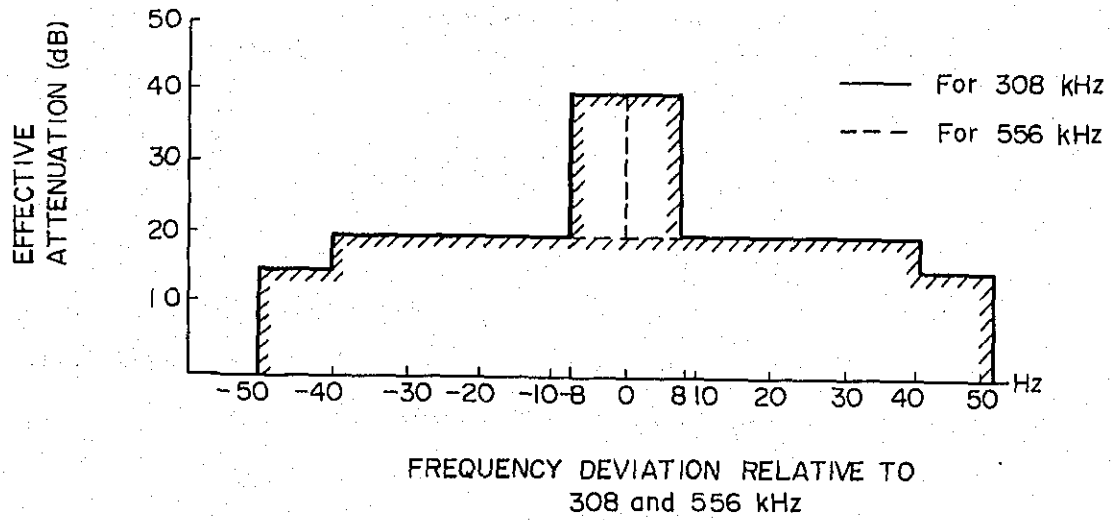
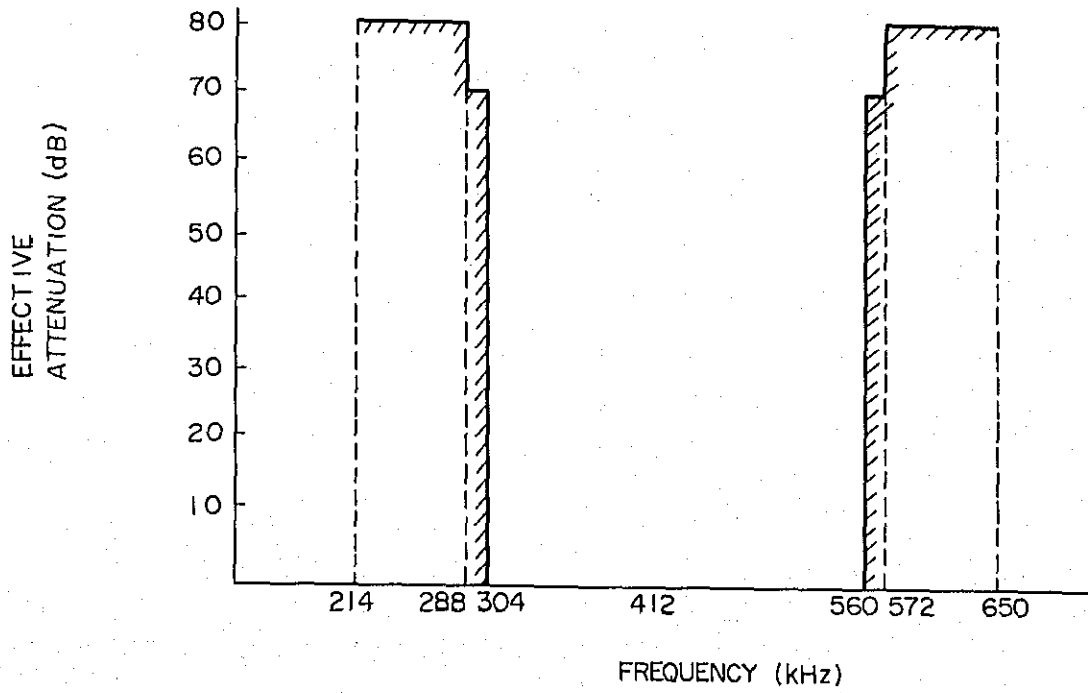
(2) Transmission Characteristics

(Refer to CCITT Recommendations G242 and G243)

- (a) The deviation of frequency/attenuation distortion of the filter shall be within 1.0 dB at the transmission frequency bandwidth.
- (b) The attenuation for out-band of transmission frequency bandwidth of the filter shall be as follows:
- (c) Connection

The conditions for basic supergroup connection is specified in 3.4. (2) (d).

Attenuation characteristics of the supergroup through filter



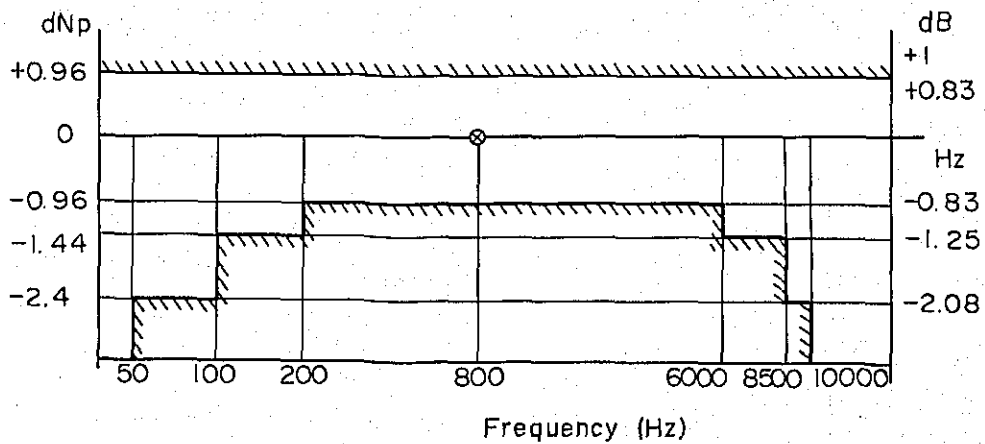
### 3.9 Program Transmission Equipment

#### (a) General

- (i) The equipment shall be utilized for transmission of broadcasting programme signal in accordance with Table 3-1 through the microwave systems.
- (ii) The equipment shall be capable of translating broad-casting programme signal of 50 to 10,000 Hz band to a band of 84 to 96 kHz corresponding to 3 telephone channels in the basic group frequency band, specified in CCITT Recommendation J22, and vice versa.

#### (b) Transmission Characteristics

- (i) The frequency/attenuation distortion of the equipment, measured on a combination of transmitting and receiving equipment, shall lie within the following limits, compared with the value for 800 Hz. (Refer to CCITT Recommendation J. 21).



- (ii) The signal-to-noise ratio (idle noise) of the equipment, measured on a combination of transmitting and receiving equipment, shall be more than 63 dB unweighted.

- (iii) The variation of overall loss of a combination of transmitting and receiving equipment shall be within  $\pm 0.3$  dB at the output level of +15 dB rel. 0.775 V.
  - (iv) For non-linear distortion, the total harmonic distortion attenuation shall not exceed the following values, measured on a combination of transmitting and receiving equipment under the condition that a sinusoidal signal of +9 dB (rel. 0.775 V) be sent to the input where the nominal level is +0 dB (rel. 0.775 V);
    - +35 dB at fundamental frequency above 100 Hz;
    - +39 dB at fundamental frequency below 100 Hz.(Refer to CCITT Recommendation J. 21)
  - (v) The crosstalk ratio between transmitting and receiving equipment shall be more than 80 dB.
- (c) Connection to the Line from the Origin

(i) Impedance

The nominal input and output impedance of the equipment for connection to the line from a programme origin shall be 600 ohms, balanced, and the return loss shall be not less than 15 dB.

(ii) Level

The nominal level at the transmitting equipment input terminal shall be 0 dB/(rel. 0.775 V). At the receiving equipment output terminal, the nominal level shall be 6 dB (rel. 0.775 V). The system shall be capable of handling a peak power corresponding to a sinusoidal signal of +15 dB (rel. 0.775 V) at the receiving equipment output terminal. The level at the transmitting equipment input terminal and the receiving equipment output terminal shall be adjustable  $\pm 2$  dB.

(d) Connection at the GDF

The connection of the equipment at the GDF shall be the same as that of basic group connections as described in 3.4 (1) (e).

### 3.10 Distribution Frame

#### (1) General

- (a) The distribution frame shall be provided at each station so as to facilitate the terminating and joining of cables.
- (b) The terminal blocks shall be provided with the capacity in accordance with channel layout requirement 1980.
- (c) The frame shall be constructed in such a manner as to be easily maintained, facilitating daily checks without deteriorating the transmission quality.
- (d) Each distribution frame shall be provided with holder for supporting jumper.
- (e) Composite frame of VDF, GDF and/or SGDF as well as wall mount type can be considered from the economical viewpoint.

#### (2) Voice Distribution Frame (VDF)

- (a) The VDF shall provide audio connection among necessary equipment concerned.
- (b) The crosstalk attenuation of the terminal block shall be greater than 100 dB.

#### (3) Group Distribution Frame (GDF)

- (a) The GDF shall provide basic group connection among channel translating equipment, group translating equipment, and through group filter equipment.
- (b) Adequate test points shall be provided as a form of U-link jack.
- (c) The crosstalk attenuation of the terminal block shall be greater than 100 dB.

#### (4) Supergroup Distribution Frame (SGDF)

- (a) The SGDF shall provide basic supergroup connection among

group translating equipment, supergroup translating equipment, supergroup level regulating equipment.

- (b) Adequate test points shall be provided similarly to GDF.
- (c) The crosstalk attenuation of the terminal block shall be greater than 100 dB.

### **3.11 Tie Cable**

Tie cable of Asuncion and Pilar shall be included in this tender. Steel armored cables of buried type shall be offered 1400 pairs or more for Asuncion, and 100 pairs or more for Pilar.

In these telephone offices, the VDF shall be supplied and installed corresponding to full pairs of the cable excluding the phantom circuits.

### **3.12 Data to be Presented**

The explanatory data shall be presented in the other on the following items:

- (1) Schematic diagram of each equipment.
- (2) Explanation of each equipment.
- (3) Power consumption for the carrier multiplex system at each station.



## CHAPTER 4 TOLL CABLE SYSTEM

### 4.1 General

This Chapter specifies the loaded cable systems between Paraguari radio terminal station and Paraguari telephone office, between San Juan Bautista radio terminal station and San Juan Bautista telephone office, the non-loaded cable systems between Cnel. Oviedo radio terminal station and new Cnel. Oviedo telephone office, between Pto. Pte. Stroessner radio terminal station and new Pto. Pte. Stroessner telephone office. These are entrance cables from radio station to telephone office.

The loaded cable systems and the non-loaded cable systems shall be used for establishing telephone circuits and telegraph circuits together with the microwave system and the carrier multiplex system mentioned in Chapter 2 and 3, respectively.

The kinds of the loaded cables and non-loaded cables to be installed are shown in Table 4-1.

The contractor shall supply and install all facilities necessary for establishment of the loaded cable systems and the non-loaded cable systems.

### 4.2 Loaded Cable System

#### (1) Requirement for Loaded Cable System

##### (a) Transmission loss (measuring frequency 1 kHz)

Overall transmission loss of each loaded cable system is hoped to be within  $0.17 \pm 0.02$  dB/km and  $0.23 \pm 0.02$  dB/km for the side circuits and phantom circuits, respectively, except the loss of repeating coils.

##### (b) Signal-to-crosstalk ratio shall be 67 dB or more at 1 kHz.

##### (c) Nominal impedance of the loaded cable systems shall be 600 ohms with matching transformer.

(2) Equipment to be Installed

(a) Cable line:

150 and 100 pairs of foamed polyethylene insulated cable with conductors 0.9 mm in diameter shall be installed in each section as shown in Table 4-1.

(b) Loading coil:

Loading coil shall be installed about every 1 km, and corresponding to full pairs of the cable including the phantom circuits.

(c) VDF:

In each telephone office, the VDF shall be installed, but in each radio terminal station, the loaded cable system use the VDF in common installed for the carrier multiplex system mentioned in Chapter 3.

The VDF installed shall be provided corresponding to full pairs of the cable, including the phantom circuits.

(d) Lightning protectors shall be supplied at both ends of the aerial cable.

(3) Cable Line

(a) Loaded cable system using side and phantom circuits shall be established.

(b) Cable whose copper conductors are insulated by foamed polyethylene and whose sheath material is polyethylene, shall be established.

The cable shall be composed of layers like the following example:

	Number of Quads	
	150 pairs	100 pairs
Center Layer	3	3
First Layer	9	9
Second Layer	15	16
Third Layer	21	22
Fourth Layer	27	

All quads in the cable shall differ in their twist.

The colours of the insulation of all quads shall be able to be identified with at least three colours. The cable core shall be wrapped with rubber or plastic tape and shielded with an aluminium tape having a thickness of 0.2 mm.

Such formed cable shall be covered with black polyethylene sheath. The nominal thickness of the polyethylene sheath shall be 2.1 mm (in the case of 150 pairs) and 2.0 mm (in the case of 100 pairs) and the minimum thickness shall not be less than 75% from the nominal thickness.

(c) One pair of alarm line in order to detect the water-leaked place, shall be included in the cable, and the alarm shall be indicated visibly and audibly in the concerned telephone office.

(d) Required performance

(i) The nominal resistance of any conductor, measured with direct current at 20°C, shall be 27.4  $\Omega$ /km. Additionally the maximum resistance of all conductors shall not exceed 8% from the nominal value. The resistance unbalance of two conductors of the same pair, measured with direct current, shall not exceed the loop resistance of this pair by more than 1%.

(ii) The nominal mutual capacitance, measured with an alternating current having a frequency of 800 Hz, shall be 38.5 nF/km for the side circuit and 109 nF/km for the phantom.

The average value of mutual capacitance shall not differ from nominal value by more than 8% for the side circuit and 12% for the phantom circuit.

The maximum and minimum value of mutual capacitance

shall not differ from the average value of all side circuits and phantom circuits by more than 10%.

- (iii) The capacitance unbalance measured with an alternating current having a frequency of 800 Hz at 20°C on manufactured length of L meters, shall not exceed the value shown below:

$$\text{Maximum value in all quads: } 70 \times \sqrt{\frac{L}{250}} \text{ pF}$$

$$\text{Average value of all quads: } 20 \times \sqrt{\frac{L}{250}} \text{ pF}$$

- (iv) Any conductor shall withstand 500 volts DC applied for at least one minute between the conductor and the earthed metallic sheath connected to all other conductors.
- (v) The insulation resistance between any conductor except alarm line and the sheath shall not be less than 10,000 MΩ/km.
- (c) The wooden poles to support the cable shall be installed along the road, in principle.

#### (4) Loading Coil

The loading coil shall be suitable for loading two side circuit and the phantom circuit.

The coil shall be assembled in suitable protective cases hermetically sealed. The protective case shall be installed on the pole.

#### (5) Data to be Presented.

The Tenderer shall submit the explanatory data on the following items:

- (a) Structure of the cable.
- (b) Explanation of each equipment.

### 4.3 Non-Loaded Cable System

#### (1) Requirement for Non-loaded Cable System

- (a) Transmission loss (measuring frequency 1 kHz)

Overall transmission loss of each non-loaded cable system is hoped to be within 0.94 dB/km and 1.05 dB/km for the side circuits and phantom circuits, respectively, except the loss of the repeating coils.

- (b) Signal-to-crosstalk ratio shall be 67 dB or more at 1 kHz.
- (c) Nominal impedance of the non-loaded cable systems shall be 600 ohms with matching transformer.

(2) Equipment to be Installed

(a) Cable line:

150 pairs of foamed polyethylene insulated cable with conductors 0.65 mm in diameter shall be installed in each section as shown in Table 4-1.

(b) VDF:

In each telephone office, the VDF shall be installed, but in each radio terminal station, the non-loaded cable system use the VDF in common installed for the carrier multiplex system mentioned in Chapter 3.

The VDF installed shall be provided corresponding to full pairs of the cable, including the phantom circuits.

(c) Lightning Protector

Lightning protectors shall be supplied at both ends of the aerial cable.

(3) Cable Line

(a) Non-loaded cable system using side and phantom circuits shall be established.

(b) Cable whose copper conductors are insulated by Foamed Polyethylene and whose sheath material is Polyethylene, shall be established.

The cable shall be composed of layers like the following

example:

	Number of Quads
	150 pairs
Center Layer	3
First Layer	9
Second Layer	15
Third Layer	21
Fourth Layer	27

All quads in the cable shall differ in their twist.

The colours of the insulation of all quads shall be able to be identified with at least three colours. The cable core shall be wrapped with rubber or plastic tape and shielded with an aluminium tape having a thickness of 0.2 mm.

Such formed cable shall be covered with black polyethylene sheath. The nominal thickness of the polyethylene sheath shall be 2.1 mm and the minimum thickness shall not be less than 75% from the nominal thickness.

(c) One pair of alarm in order to detect the water-leaked place, shall be included in the cable, and the alarm shall be indicated visibly and audibly in the concerned telephone office.

(d) Required performance

(i) The nominal resistance of any conductor, measured with direct current at 20°C, shall be 52.5  $\Omega$ /km.

Additionally the maximum resistance of all conductors shall not exceed 8% from the nominal value.

The resistance unbalance of two conductors of the same pair, measured with direct current, shall not exceed the loop resistance of this pair by more than 1.5%.

(ii) The nominal mutual capacitance, measured with an alternating current having a frequency of 800 Hz, shall be about 38.5 nF/km for the side circuit and 109 nF/km for the phantom.

The average value of mutual capacitance shall not differ from nominal value by more than 8% for the side circuit and 12% for the phantom circuit.

The maximum and minimum value of mutual capacitance shall not differ from the average value of all side circuits and phantom circuits by more than 10%.

- (iii) The capacitance unbalance measured with an alternating current having a frequency of 800 Hz at 20°C on manufactured length of L meters, shall not exceed the value shown below:

$$\text{Maximum value in all quads: } 105 \times \sqrt{\frac{L}{250}} \text{ pF}$$

$$\text{Average value of all quads: } 30 \times \sqrt{\frac{L}{250}} \text{ pF}$$

- (iv) Any conductor shall withstand 500 volts DC applied for at least one minute between the conductor and the earthed metallic sheath connected to all other conductors.
- (v) The insulation resistance between any conductor and the sheath shall not be less than 10,000 M  $\Omega$ /km.
- (e) The wooden poles to support the cable shall be installed along the road, in principle.
- (f) Data to be Presented

The Tenderer shall submit the explanatory data on the following items:

- (a) Structure of the cable
- (b) Explanation of each equipment

#### 4.4 Concideration for Safety

The facilities for the Toll Cable System shall be so designed and established that these facilities do not cause the damage of human and/or domestic animals in ordinary conditions.

The contractor shall also take it into consideration to keep safety during the installation period of these facilities.

## CHAPTER 5 VOICE FREQUENCY TELEGRAPH SYSTEM

### 5.1 General

- (1) This Chapter specifies frequency-shift voice-frequency telegraph (VFT) system of 50 bands for providing 24 channels on a four wire telephone circuit.
- (2) VFT equipment shall be installed at the telephone office of Asuncion, Paraguari, S. J. Bautista, Pilar, Cnel. Oviedo and Pto. Pte. Stroessner.
- (3) VFT equipments for international networks to Argentina, Brazil and Uruguay are not included in this tender. These equipments will be provided by the other contract in the future.
- (4) The Bidder shall supply and install all the required equipments and materials up to Main Distribution Frame (MDF) and MDF itself for VFT to be installed at a telephone office. Terminating equipments for VFT, for example, teleprinter, sender etc. are not included in this tender.

### 5.2 Requirements for VFT System

- (1) The capacity of VFT equipments to be installed at each station is required channel for 1980 as shown in Table 3-1. But the bidder shall offer the equipment to be designed to make use of for the future expansion for 1990. At Asuncion, those channels for Encarnacion, Villarrica and Caacupe shall be included in the present offer.
- (2) Mechanical stackable equipment type such as subrack or subshelf may be acceptable, because of economy and future expansion for the station having low channel capacity.
- (3) The power supply voltage of VFT equipment shall be DC-60V.



- (4) The VFT System shall be designed to operate on a 4-wire audio channel of  $600\ \Omega$  nominal impedance with a bandwidth of 300 - 3400 kHz.
- (5) The VFT System shall employ frequency shift modulation. The equipment shall be designed for double current full duplex telegraph operation.

### 5.3 VFT Equipment

(Refer to CCITT Recommendations R35 and R36)

#### (1) Performance of Equipment

##### (a) Number of channels

Equipment with a channel separation of 120 Hz between the mean frequencies shall be able to accommodate 24 channels.

##### (b) Modulation Rate

The nominal modulation rate of the equipment shall be standardized at 50 bands.

##### (c) Frequency

(i) The nominal mean frequencies shall be  $420 + (n-1) \times 120$  Hz,  $n$  being the channel serial number.

(ii) The mean frequencies at the sending end shall not deviate by more than  $\pm 2$  Hz from their nominal value.

(iii) The difference between the two characteristic frequencies (corresponding to the start and the stop conditions) in the same channel shall be fixed at 60 Hz.

The tolerance permitted in this difference shall be, at most,  $\pm 3$  Hz.

(iv) The frequency for the corresponding transmitted condition to the start polarity shall be the higher of the two characteristic frequencies and that corresponding to the stop polarity shall be the lower.

##### (d) Levels

(i) The total average power transmitted to the bearer channel by all the channels of a system shall be normally limited to 135 microwatts at relative zero level.

(ii) The mean power per channel at relative zero level shall be 5.6 microwatts at most.

- (iii) The signal power shall be adjustable.
- (iv) In operation, the levels of the signals corresponding to continuous stop polarity and continuous start polarity shall not differ by more than 1.7 dB in the same channel. Both of these levels shall lie between +1.7 dB and -1.7 dB with reference to the level of (ii).
- (v) The Tenderer shall give details of the equipment offered concerning the send and receive level diagram (dBm) with range of adjustment (including per channel).

(e) Parking Bias

In the absence of telegraph current controlling the channel modulator, a frequency shall be transmitted, within  $\pm 5$  Hz of the frequency normally transmitted for the start polarity.

This frequency need not be sent immediately after interruption of the control current.

(f) Level Variation

The receiving equipment shall operate satisfactorily when the receiving level falls to 17.4 dB below the nominal level. The receiving equipment shall have been restored to start polarity when the receiving level has fallen to 23.5 dB below the nominal level.

(g) Distortion

The following value shall not be exceeded for the degree of distortion on a telegraph channel, measured with text SQ9 defined in CCITT Recommendation R51.

Before the measurement, the levels shall be adjusted to their normal value and the frequencies shall be checked to see whether they are normal value. Bias distortion shall be eliminated by adjustment in the channel receivers.

When a channel under test is operating, the other channels of the system shall be modulated with unrelated signals when the effect of interchannel interference is to be included in the measurement.

- (i) The levels being normal, no frequency drift in bearer channel (artificial line), but the measured channel being subject to fortuitous distortion due to interchannel interference;

5% for degree of inherent isochronous distortion.

- (ii) As in (i) above, but at a value different from the normal level, for all constant levels between 8.7 dB above and 17.4 dB below the normal reception levels;

7% for degree of inherent isochronous distortion.

- (iii) In the presence of interference by a signal sine-wave frequency, equal first to one and then to the other characteristic frequency, with a level of 20 dB below the signal level, the other conditions for the start of measurements being maintained;

12% for degree of inherent isochronous distortion.

- (iv) By introducing a frequency drift of the signal, during transmission through the bearer channel, the initial conditions of the test otherwise being preserved;

$(5 + 2.5 \Delta f \text{ Hz}) \%$  for the degree of inherent isochronous distortion,  $\Delta f$  being not more than 5.

## (2) Connection to Telegraph Apparatus

- (a) The DC extensions to and from the telegraph apparatus shall be available for working of double current of 20 mA.

Further, the equipment shall satisfy the following conditions:

- (i) The DC connections shall be earth return circuits.
- (ii) Adjustable resistance shall be provided in the DC extensions for restricting the currents suitably.

- (b) The Tenderer shall state the conditions and limitations necessary for connection to DC extensions.

## (3) Telegraph Supplies

- (a) The telegraph supplies provided shall be  $\pm 60$  V, capable of supplying necessary current for all the circuits simultaneously at the rate of 20 mA per channel.

- (b) Telegraph supply voltage variations shall be maintained within  $\pm 3$  V and the difference between two supplies shall not exceed

3 V under conditions of full or partial load.

(4) Alarms

Alarms indicated by lamp and extension bell shall be provided for the following conditions:

- (a) Failure of power supply.
- (b) Failure of telegraph supplies.
- (c) Failure of common carrier supply (if used).
- (d) Failure of receive tone.

(5) Test and Monitor Facilities

Test and monitoring facilities shall be provided for the following in each VFT equipment rack:

- (i) Measurement of supply voltage.
- (ii) Measurement of telegraph supplies.
- (iii) Measurement of current in the DC extensions.
- (iv) The meter for indicating reversals is to be capable bias distortion check.
- (v) 1 : 1, 50 bauds reversal generator.

(6) Auxiliary Facilities

For ease and efficiency of maintenance testing of VFT systems and channels, the following facilities shall be provided.

(a) Jack Board

- (i) Jack board shall accommodate the following:

Test point for VFT system line.

Test point for send and receive side of telegraph channel.

Miscellaneous circuits.

Trunk jacks.

Facility for patching a faulty channel to a good channel.

- (ii) Jack board shall have max. capacity of the system.

(b) Test Facilities

Test and monitoring facilities shall be able to provide the following functions:

- (i) Measurement of DC extension.
- (ii) Measurement of teleprinter signal distortion and teleprinter speed in cooperation with the telegraph distortion measuring set (TDMS).
- (iii) Transmission of test signals in cooperation with a TDMS or a teleprinter.
- (iv) Communication with the distant terminal over any telegraph channel and local end teleprinter in cooperation with a teleprinter.
- (v) VF Loop back test through an external amplifier and variable attenuator.
- (vi) Measurement of signal levels and noise levels of the voice frequency line in cooperation with the level meter.
- (vii) Test and adjusting of telegraph relay (if used).

(7) All necessary test and patching cords shall be supplied.

**5.4 Data to be presented**

The explanatory data shall be presented in the offer on the following items:

- (1) Schematic diagram of each equipment.
- (2) Explanation of each equipment.
- (3) Power consumption for the VFT system at each station.

## CHAPTER 6 POWER SYSTEM

### 6.1 General

- (1) This chapter deals with the power system which supplies continuous power to the radio equipment, multiplex equipment, etc. of all the radio terminal and the repeater stations.
- (2) The power system design and performance shall be consistent with the overall system performance, with requirements fulfilling permanent operation of the telecommunications networks in the following conditions and characteristics.
- (3) The Contractor shall provide all necessary equipment and goods for establishing the power system, including engine generators, battery chargers, storage batteries, emergency power vehicles, but excluding the lighting, its wiring, and main fuel storage tanks and the foundations of engine generators.
- (4) The power supply system can broadly be classified into the commercial power available station, commercial power unavailable station, located near the all weather road and commercial power unavailable station located in swamp area.
  - (a) The power system of the commercial power available station shall be hereinafter called the power system-I. The power system-I shall principally comprise one stand-by engine generator, a battery charger, and storage batteries. The stations which fall into this category are Asuncion, Paraguari, Caapucu, San Juan Bautista, Coronel Oviedo, Caaguazu and Pto. Pte. Stroessner.
  - (b) The power system of the commercial power unavailable station located near the all weather road shall be hereinafter called the power system-II. The power system-II shall principally comprise a dual prime engine generator consisting of two

engine generators, control equipment, and fuel system, a battery charger and storage batteries.

The stations which fall into this category are Valle Apua, Guyraungua, and Colonia Yguazu.

- (c) The power system of the commercial power unavailable station located in swamp area shall be hereinafter called the power System -III. The power system -III shall principally comprise a triple prime engine generator consisting of three engine generators, control equipment, and fuel system, a battery charger and storage batteries.

The stations which fall into this category are Estero Camba, Pilar, and Paso de Patria.

- (5) The Tenderer shall submit the electrical and mechanical details of each equipment based on this specifications.

(6) Building Interfacing

The Contractor shall perform all the wiring and piping work, except for:

- (a) AC wiring of commercial power source input:

This wiring, up to the power room (but including the receiving equipment) shall be undertaken by ANTELCO.

- (b) Piping from main fuel tank:

The piping from the main fuel tank to the daily service tank and return piping from there to the main fuel tank shall be undertaken by ANTELCO.

- (c) Lighting of the inside of the station buildings and wiring for power outlet:

All the wirings assigned to the building such as room light, power outlet (for power system I, including the AC outlet for measuring equipments), etc. are provided by ANTELCO

including power distribution board.

## 6.2 Basic Conditions and Characteristics of Power System

This paragraph prescribes the required characteristics and capacity of the power system.

The power system shall operate under the worst ambient conditions.

(1) The power equipment supplying power to communication loads shall be of non-break type (no momentary interruption is allowed), and fluctuation of the supplied voltage shall be within the limits allowable for radio and multiplex equipments, and for other facilities.

(2) Composition and Function of the Power System

(a) System-I

The power system shall consist of stand-by engine generator, composed of one engine generator, an automatic starter, automatic switchover equipment (switching the input of battery charger to the commercial power source or the output of engine generator), battery charger composed of two rectifiers and batteries of full floating alignment and static type automatic voltage Regulator as shown in Fig. 6-1 Power Supply System-I.

Under normal conditions, AC power is supplied from the commercial AC power sources, however, in case the commercial AC power fails, the AC power shall be switched to and supplied from the engine generator automatically without any interruption of the DC power supply to the communication load, maintaining the change of the voltage within the limit allowable for the load.

Even when both commercial AC power and operation of the engine generator fail, the batteries shall continue to supply the DC power required to the communication load during the period specified in 6.2 (3) of this Chapter.



(b) System-II

The power system shall consist of Dual prime engine generators composed of two engine generators with automatic starter, an automatic switchover equipment, battery charger composed of two rectifiers and batteries of full floating alignment as shown in Fig. 6-2 Power Supply System-II.

Two engine generators shall be operated to supply the AC power to the charger alternately at a certain period.

Any time when the AC power output of one working engine generator is interrupted, switchover to stand-by engine generator shall take place automatically, so that no interruption of DC output may occur and the voltage shall be maintained within the limit allowable for the communication load.

Even when both of the engine generators fail to operate in sequence, the batteries shall continue to supply the DC power required to the communication load during the period specified in 6.2 (3) of this Chapter.

(c) System-III

As shown in Fig. 6-3 "Power Supply System III", the power system shall consist of a triple prime engine generator composed of three engine generators with automatic starter, an automatic switchover equipment, a full floating type battery charger composed of two rectifier, and storage batteries.

Each of the three engine generators are sequentially operated for a certain period of time to supply AC power to the station. In the working engine generator fails, an automatic changeover is made to the next engine generator. In this case, the two engines are alternately operated to supply AC power to the station.

If two engine-generators fail, AC power is supplied by the remaining one engine generator. While AC power may be interrupted momentarily when an automatic switchover is

effected, no-break power will be supplied to DC loads from the battery with its voltage within the allowable limit of the communications load.

Even when three engine generators should fail to operate, the battery shall continue to supply required DC power to communications load during the period specified in 6.2 (3) of this chapter.

- (d) Facilities for receiving the output of emergency power equipment.

Facilities such as a pair of terminals and a switch shall be supplied at each station to receive the output of emergency power equipment. The wiring between the facilities and the above mentioned Power system shall also be furnished.

The structure of this facilities shall be such that makes possible to receive the output of emergency power equipment even in a downpour.

- (e) Power outlet for pen recorder

A set of power outlet and non-fuse breaker, etc. for the power source (DC -24V) of pen recorder shall be provided.

The wiring shall also be furnished.

### (3) Capacity of Equipment

The power system capacity shall be calculated in accordance with (c) - (f) below. The initial and final capacity, used for calculation of each equipment, refers to the power consumption of the following communication equipments.

- (a) Equipments at initial stage

For the estimation of power consumption at initial stage (by 1980), following equipments, besides the microwave system involved in this tender, shall be taken into consideration.

Space diversity equipments at San Juan Bautista, Estero

Camba, Pilar and Paso de Patria Station.

Radio equipments for the international connecting section at Paso de Patria and Pto. Pte. Stroessner Station.

Multiplex equipments and programme transmission equipments for the international circuits at Asuncion, Pilar and Pto. Pte. Stroessner Station.

Radio and multiplex equipments of the microwave system between San Juan Bautista and Encarnacion at San Juan Bautista Station.

(This microwave system will be consisted of one telephone, one television and one stand-by RF channel, regarded as same type with the microwave systems in this tender. The number of circuits is shown in Table 3-1, Fig. 3-1 and Fig. 3-2.)

Radio and multiplex equipments for the microwave link between Earth Station and Central office (Central-2) at Asuncion Station. (the power consumption of these equipment is DC -24V, 100 A and AC 220V 3 $\phi$  4kVA).

Microwave equipments for television RF channel in each station as shown in Fig. 2-13 - 2-20.

(b) Equipments at final stage

For the estimation of power consumption at final stage (1990), following equipments, besides the equipment mentioned in above (a), shall be taken into consideration.

Multiplex equipments for the increased circuits as shown in Table 3-1, Fig. 3-1 and Fig. 3-2.

(c) Storage battery

The capacity of the battery shall determined as capable of reserve the initial capacity of communication loads for 2 hours or more at Asuncion Station, for 8 hours or more at the other stations.

The term "Reserve time" refers to the time in which the load voltage at the time of discharge reaches the allowable limit input voltage of communication equipment, and this holding time should be assured even at 10°C.

Notwithstanding above paragraph (a), regarding to the capacity of storage battery at San Juan Bautista Station, the capacity of communication loads for the equipments of the microwave system between San Juan Bautista and Encarnacion shall not be taken into consideration.

(d) Battery Charger

The battery charger shall consists of two rectifiers, but each rectifier shall be capable of supplying power up to 125% load of the initial capacity. It shall also be able to make a recovery charge of the storage battery mentioned in (i) above at 20-hour rate.

Notwithstanding above paragraph (a), regarding to the capacity of battery charger at San Juan Bautista, the capacity of communication loads for the equipment of the microwave system between San Juan Bautista and Encarnacion shall not be taken into consideration.

(e) Engine Generator

Engine generator should have the capacity to supply enough power to the battery charger corresponding to the final capacity, and in addition to this, the following non-essential load should be included for the capacity of Engine-generator.

- (i) Lighting, etc.: 3 kVA (Asuncion)  
2 kVA (Other Stations)

- (ii) Measuring equipment:  
For System-I: The input power of AVR mentioned in paragraph 6.8 of this tender documents.  
For System-II and III: 1 kVA

Note: The non-essential load is the sum of (i) and (ii) above.

(f) Emergency Power Equipment

The emergency power equipment shall have the same capacity as the maximum engine generator capacity of each station.

**6.3 Engine Generator**

(1) Composition

Equipment and the associated complements to be included in the offer are as follows:

(a) Main equipment

Diesel engine and three phase AC Generator mounted on engine bed.

(b) Control Equipment

Generator output control unit (automatic voltage regulator), meter (voltmeter, ammeter and frequency meter), and relays (automatic starting and stopping, output transfer) alarm and indicator power switchboard.

(c) Accessories

Starting battery and charging device, fuel service system, lubricating system, exhaust system, cooling air ducting tools etc.

(2) Generator Output Performance

The output of the engine generator shall have the following output performance characteristics:

Phase:	Three phase, 4 wire
Rated Voltage:	220/380 V
Voltage Regulation:	Within $\pm 5\%$ at steady state, no load to full load.
Rated Frequency:	50 Hz
Frequency Regulation:	Within $\pm 3\%$ at steady state, no load to full load.
Power Factor:	80% lagging

Revolution Speed: 1,500 r.p.m. or below.

(3) Mechanical Requirement

(a) Engine

The engine shall be an air cooled diesel engine, with 4-stroke cycle multi-cylinders.

(b) Generator

The AC generator shall be of single bearing, self-regulating screen protected type.

(c) Engine Bed

Anti-vibration cushion shall be fixed to the engine bed of the engine generator to prevent vibrations.

(d) Exhaust System

Engine exhaust gas shall be exhausted to outside via flexible pipe, silencer, and exhaust pipe. This exhaust system shall be designed with consideration for freedom from vibrations and heat resistance.

For the outdoor exhaust pipe, secure work shall be done so as to protect them against wind pressure and rain penetration.

(e) Exhaust Air Ducting

Air used for cooling the engine shall be exhausted from the power room via duct. This duct shall be so designed as to withstand engine vibrations.

(f) Fuel System

A daily service tank with capacity for full-load engine operation for a period of twenty-four hours shall be installed at each station. Each daily fuel tank shall be provided with a motor driven fuel transfer pump. On the daily fuel tank, a float switch shall be provided for automatic control of the fuel transfer pump, thereby keeping the fuel level in the fuel tank

somewhere from 1/2 to full mark. Also, the fuel system shall be so designed that it issues an alarm when the fuel level falls below 1/3 of the capacity.

(g) Starting System

One set or more of starting batteries shall be provided for each station. Also, the static charger with constant voltage shall be equipped to charge this starting battery. This charger shall also be provided with a selector switch to permit for boost-charging of the starting battery.

(h) Maintenance Interval

The engine generator shall be designed with the following considerations in mind.

Routing maintenance interval including any check  
..... once every three months.

Altitude ..... refer to the attached Fig. 1-1.

Ambient condition ..... refer to Chapter 1.

The engine generator shall efficiently and stably operate for more than the period indicated below, without making any maintenance services, and either on a continuous or interrupted duty basis.

Standby Engine Generator:	120 hours per engine
Dual Prime Engine Generator:	1,200 hours per engine
Triple Prime Engine Generator:	800 hours per engine

To ensure the above-mentioned performance, the following consideration must be given. (This remark does not apply to standby engine generator)

- (i) The lubricating system shall be provided with more than two oil filters, oil sub tanks, and pumps, and lube oil shall be circulated between the sub tank and engine oil pan.
- (ii) The air cleaner of the air intake system shall be of heavy-duty dry type.

(i) Interchangeability

When designing equipment, their interchangeability shall be taken into account as much as possible.

- (j) The type and the capacity of power system for each station shall be determined considering the altitude and ambient conditions.
- (k) A cooling or heating system is not furnished in the power room, therefore, those systems shall be provided for the normal operation of the power system, if necessary.

(4) Control Function

- (a) This engine generator shall be capable of operations mentioned in paragraph 6.2 and at the same time satisfy the following requirements.
- (b) Each engine generator shall be started and stopped by manual operation, and the transfer of a load and switch-on and off of the load shall also be done by manual operation.
- (c) In case of unattended maintenance of engine generators at stations where commercial power is unavailable, it shall be possible to alternately operate engine generator at interval of 48 hours by means of timer and remote controller from supervision station.

In case of unattended maintenance of an engine generator at stations where commercial power is available; it shall be possible to operate an engine generator for maintenance operation by means of remote control from supervision station.

- (d) When commercial power or working engine generator fails, the standby engine generator shall be started immediately and automatically, and the AC power shall be switched over to it automatically.

When commercial power returns to normal condition, the AC power of the engine generator shall be switched over to it after



ten minutes.

- (e) When any trouble as shown below occurs in the engine generator and further running is presumed to cause danger, the engine generator shall be stopped automatically,

Abnormal generator output voltage.

Excessive generator output current.

High temperature of the engine.

Excessive revolution speed.

Drop of oil pressure.

Fail to start.

- (f) The condition of commercial power failure shall be as follows.

When the voltage of commercial power varies more than +10 and -15% of nominal value, or when the even of open circuit in any phase is detected by either 3-phase sensing system or other proper technique.

#### 6.4 Emergency Power Equipment

The contractor shall provide two emergency power equipments.

- (1) Type

The type of emergency power equipments shall be vehicle mounted type (van type).

- (2) Engine Generator

The engine generator used for the emergency power equipment shall be in accordance with the performance requirements specified in paragraph 6.3. (2). It shall also be designed with the following points in mind.

- (a) Interchangeability with the engine generator mentioned in paragraph 6.3.

- (b) Minimum operational condition on which the engine generator provided for the emergency power equipment shall be designed are as follows:

Maintenance Interval: 120 hours operating time excluding fuel supply.

Altitude: about 430 meters above sea level

(c) The engine generator shall have mechanical strength sufficient to assure their rated operation. The engine shall be capable operating continuously for more than 120 hours.

(d) When any trouble, as shown below, occurs in the engine generator and further running is presumed to cause danger, the engine generator shall be stopped automatically, and audible and visible alarms which inform of the trouble shall be activated at the control equipment.

Abnormal generator output voltage,

Excessive generator output current,

High temperature of the engine,

Excessive revolution speed,

Drop of oil pressure

(e) A starting battery of lead acid type shall be mounted as starting equipment. Also, a constant voltage charger shall mounted to permit trickle charge of the starting battery when the emergency power equipment is not in use.

This charger shall be operated on 220 V power and be provided with 10-meter 2-core cable. A 2-pin socket shall be fitted to this cable for connection to the 2-pin general purpose power outlet.

During engine operation, the starting battery shall be charged by this charger or by a charging dynamo.

(f) As a fuel system, a fuel tank capable of 24-hour full-load operation by engine generator shall be provided.

(g) The 4-core power cable of 10 m length shall be attached for connecting the output of emergency power equipment with the receiving terminals mentioned in 6.2 (2) (d) to each emergency power equipment.

## 6.5 Emergency Power Vehicle (Except the engine generator)

### (1) General Condition Performance

- (a) Safety of the vehicle with the engine generator loaded thereon shall be sufficient and the vehicle shall be capable of traveling over rough terrain without hindrance even in a downpour.
- (b) Operation and maintenance of the engine generator shall be possible even at night and during a downpour.
- (c) Two or more persons shall be able to ride in the vehicle.

### (2) Mechanical Requirement

Vehicle Type:	not trailer type
Drive Type:	four wheel drive
Grade Ability:	15 degree or more
Minimum Road Clearance:	18 cm or more
Minimum Turning Radius:	8.0 m or less

## 6.6 Battery Charger and Battery

### (1) General

A full floating system using battery charger and batteries shall be adopted for supplying power to the radio and the multiplex equipment and to the other facilities with no momentary interruption, while maintaining the allowable voltage limit of the load even at the worst physical and electrical conditions prescribed in this Specification.

### (2) Battery Charger

- (a) The battery charger shall be of stationary type and consist of two rectifiers and a control device. One set of these rectifiers may be operated as a working set and the other as a standby set. These two sets of rectifiers may be operated in parallel if so desired.

Each rectifier shall be sufficient to carry out the designed

operation in any case.

- (b) The battery charger receives commercial power or engine generator output, and charges the installed batteries aligned in floating charge system, as well as supplying power to the load.
- (c) In case the working rectifier fails, the load shall be switched over to the standby rectifier automatically (in case of standby system). In case the one of both rectifier fails, the faulty rectifier shall be disconnected automatically. (In case of parallel operation system).
- (d) Each rectifier shall be provided with an automatic voltage control device to keep the output voltage always within a limited value. Also, the rectifier shall have dropping characteristics.
- (e) A load voltage regulator shall be comprised in the battery charger to control the load voltage automatically, if necessary.
- (f) The offered battery charger shall be high quality, assuring stable service.
- (g) The performance of the rectifier shall meet the requirement for the radio and the multiplex equipment and for the other facilities provided.
- (h) The output ripple (unweighted) of the battery charger shall be 20 mV rms or less when the battery is connected.
- (i) The battery charger shall be provided with a switch to permit a change-over from the floating charge to boost charge (equalizing charge), or vice versa.
- (j) If a thyristor is used for voltage control of each rectifier, a proper step shall be taken to reduce the input current distortion to a minimum.

### (3) Storage Battery

- (a) The storage battery shall consist of one set per station of

enclosed lead acid type.

- (b) The storage battery shall be explosion proof in structure.

### 6.7 Alarm and Indication

Audible and visible alarms shall be indicated on the control equipment to inform of the operating conditions of the aforementioned power equipment. Moreover, those alarms shall be extended to supervising equipment according to the item 2.11.

### 6.8 Automatic Voltage Regulator

A static type automatic voltage regulator shall be supplied to ensure regulated AC power to the measuring equipment in the power system I. This automatic voltage regulator (AVR) shall have the following performance characteristics.

- (a) Type: Static type
- (b) Input
  - Phase: Single phase
  - Voltage: 220 V
  - Voltage Fluctuation Range: +10, -15%
  - Frequency: 50 Hz
  - Frequency Fluctuation Range:  $\pm 3\%$
- (c) Output
  - Phase: Single phase
  - Voltage: 220 V
  - Voltage Accuracy: Within  $\pm 7\%$
  - Capacity: 1 kVA

- (d) Meter

A voltmeter shall be attached to this AVR for measurement of input and output voltages.

- (e) A circuit breaker shall be provided at the input of the AVR for protection as well as power ON-OFF purposes.

## 6.9 Earthing

The earth required for equipment, DC power line, arrester etc. shall be connected to the earthing terminal, which is prepared at the power room by ANTELCO.

## 6.10 Data to be Presented

The Tenderer shall submit explanatory data on the following items, including emergency power vehicle:

- (a) Block diagram of power supply system.
- (b) Explanation of each power equipment.
- (c) Characteristics of each power equipment.
- (d) Outline of operation and maintenance, and routine maintenance program.
- (e) Calculative basis of capacity of engine generator, batteries, rectifiers and fuel storage tank.
- (f) Measures for long maintenance interval.

## CHAPTER 7 MEASURING EQUIPMENT AND TOOL

### 7.1 General

This chapter deals with measuring equipment and tools.

### 7.2 Measuring Equipment

#### (1) General

(a) All measuring equipment necessary for maintenance only shall be supplied. Those to be used during installation and at the time of big repair shall not be included, but at least, measuring equipment specified in the following paragraphs shall be provided.

In addition, those items the Contractor recognizes as necessary shall also be provided as options.

(b) Measuring equipment required for construction work only shall be offered as options.

(c) Measuring equipment shall be provided with all necessary accessories for measuring, such as attenuators, auxiliary amplifiers and filters as well as plugs and cords.

(d) Power source for measuring equipment shall be AC 220 V, except for power source built-in type, and DC-24V for stationary type.

Equipments shall be capable of satisfactory operation within voltage variations of  $\pm 10\%$ .

(e) Solid state type is preferable.

(f) Measuring equipment except the stationary type shall be easy to transport. Carrying case shall also be provided as options, if necessary.

(g) Measuring equipment shall have sufficient measuring range compatible with the system subject to measuring.

- (h) Preference will be given for direct visual measuring by such method as sweeper.
- (i) Measuring accuracy of equipment shall be sufficiently high to bear comparison with the standards of objects to be measured, and shall be such as can be calibrated as required.
- (j) It shall be permissible to assort by functions the measuring equipment mentioned in the following paragraphs and rearrange them into one unit.
- (k) In case a single equipment cannot measure the required range, it will be permissible to use two or more equipments.
- (l) The types of measuring equipment are the following
  - Common measuring equipment.
  - Measuring equipment for microwave system.
  - Measuring equipment for multiplex system.
  - Measuring equipment for VFT system.
  - Measuring equipment for power system.

## (2) Common Measuring Equipment

At least the following shall be supplied as fundamental measuring equipments to be used commonly for the systems involved. Such equipments shall be provided in quantities shown in Table 7.1.

### (a) Multi-range volt-ammeter (MULT M)

This shall be the precision type volt-ammeter to measure DC and AC source voltage and current.

### (b) Circuit tester (TESTER)

Being the conventional type universal volt-ammeter, this shall be qualified for use for simple checking.

### (c) Megger (MEG)

This shall be used for measuring insulation resistance of a circuit. Impressed voltage shall be both 500 V and 100 V.

### (d) High impedance voltmeter (HV)



This shall be capable of voltage measuring with sufficiently high impedance in the band ranging from DC to the maximum modulation frequency of the microwave system, including the continuity pilot.

(e) Oscilloscope (OSCILLO)

This shall be capable of measuring in the band specified in (4) below.

(f) Pen recorder (REC)

This shall be a multiple pen recorder for recording characteristics continuously by connecting various kinds of equipment as required. The number of pens per unit shall be two or more.

Notwithstanding above mentioned, the power source of the pen recorder shall be DC -24 V.

The tenderer shall propose the type of recorders.

(3) Measuring Equipment for Microwave System

At least the following measuring equipments shall be supplied. Such equipments shall be provided in quantities shown in Table 7.1. The items indicated by mark \* at least, shall be capable of direct visual measuring with the sweeper method.

(a) Baseband signal generator (BSG)

This shall be capable of generating a sinusoidal test signal. The frequency range shall cover 20 Hz to 10 MHz.

(b) Baseband level meter (BLM)

This shall be capable of measuring signal level in the band mentioned in (a) above.

(c) Noise measuring equipment (NM)

This shall be capable of measuring noise performance on the telephone circuit according to the method using the uniform spectrum signal based on CCIR Recommendation 399-1.

The sending signal level shall be variable. Further, this shall be applicable for 960 channel systems.

(d) Television test signal generator (TVSG)

This shall be capable of generating the television test signal based on CCIR Recommendation 421-2. Further, superposition of a 3.58 MHz signal shall be available on Test Signal No. 3 of the said Recommendation.

(e) Television circuit performance measuring equipment (TVM)

This shall be capable of measuring performance of items based on CCIR Recommendation 421-2, in cooperation with the television test signal generator in (d) above.

(f) Linearity measuring equipment (LIN)\*

This shall be capable of measuring linearity of modulator and demodulator.

(g) Delay measuring equipment (DELAY)\*

This shall be capable of measuring IF-IF group delay in overall system and repeater.

(h) Amplitude characteristics measuring equipment (AMP)\*

This shall be capable of measuring RF-IF and RF-RF amplitude characteristics in a repeater.

(i) Deviation measuring equipment (DEV)

This shall be capable of measuring frequency deviation of FM signal in the IF stage and of measuring the IF frequency also.

(j) Radio frequency meter (RFM)

This shall be capable of measuring radio frequency.

(k) Radio frequency power meter (RFPM)

This shall be capable of measuring signal power in the RF band.

(l) IF test signal generator (IFSG)

This shall be capable of generating test signal required

for test and adjustment in the IF band.

(m) IF level meter (IFLM)

This shall be capable of measuring signal level in the IF band.

(n) Measuring equipment for repeater (REP)

This shall be capable of measurements necessary for test and adjustment of a repeater. Measuring shall be conducted, as far as possible, by the direct visual method using the sweeper.

(o) Measuring equipment for service channel (SC)

This shall be capable of measurements necessary for test and adjustment of service channel transmission line and equipment.

(p) Master monitor (MM)

This shall be capable of monitoring television signal picture and wave form. Equipment shall be suited for cutover connection to the necessary monitor points.

(4) Measuring Equipment for Multiplex System

At least the following measuring equipments shall be supplied. Such equipments shall be provided in quantities shown in Table 7.1.

(a) Signal generator for carrier system (CSG)

This shall be capable of generating a sinusoidal test signal in the frequency range covering the carrier system.

(b) Signal generator for audio system (ASG)

This shall be capable of generating a sinusoidal test signal in the audio frequency range covering the frequency band between 50 - 10,000 Hz.

(c) Level meter for carrier system (CLM)

This shall be capable of measuring signal level in the band mentioned in (a) above.

(d) Level meter for audio system (ALM)

This shall be capable of measuring signal level in the band mentioned in (b) above.

(e) Selective level meter (SLM)

This shall be capable of measuring signal frequency level such as carrier leak, crosstalk and distortion attenuation in a carrier system, selectively.

(f) Psophometer (PSO)

This shall be capable of measuring psophometric noise voltage on the telephone circuits and the programme circuits.

(g) Impulse sender (IS)

This shall be capable of sending dialing pulses and measuring their distortion.

(5) Measuring Equipment for VFT System

At least the following measuring sets shall be supplied. Such sets shall be provided in quantities shown in Table 7.1.

(a) VFT Transmission Measuring Set (VTM)

(i) The set shall be capable of measuring characteristics of VFT system such as level, frequency, loss and gain.

(ii) The set shall be composed of audio frequency signal generator, level meter, attenuator, amplifier, control keys, etc.

(b) Telegraph Distortion Measuring Set (TDM)

(i) This shall be portable in type and shall consist of a transmitter and receiver for measuring the start-stop distortion of a continuous train of a double current signal at 50 bauds.

(ii) The transmitter shall be able to generate signals of 1:1, 2:2, 1:6, 6:1 and SQ9 for testing VFT circuits in accordance with CCITT Recommendation R51. These signals shall be distorted by accurately predetermined amounts, as required.

(iii) The receiver shall be designed by a display on a cathode ray tube. The measuring range shall be 0 to 50% dis-

tortion and the measuring accuracy shall be within  $\pm 0.25\%$ .

The receiver shall be capable of measuring transmission speed in bauds.

**(6) Measuring Equipment for Power System**

At least the following measuring equipments shall be supplied, in quantities shown in Table 7.1.

- (a) Portable 3V voltmeter for battery checking.
- (b) Syringe hydrometer.
- (c) Battery thermometer.
- (d) Tachometer.

**7.3 Tools**

One complete set of tools shall be provided for each station. Tools for engine generator, including a nozzle tester, shall also be quoted. Two sets of these engine-generator servicing tools shall be provided only for Asuncion Station.

**7.4 Data to be Presented**

The tenderer shall submit data on the following items:

- (1) Explanatory data on the performance for each measuring equipment.
- (2) Kind and quantity of each measuring equipment and necessary maintenance tools.

## CHAPTER 8 SPARE

In this Chapter, spares to be supplied for the facilities under this contract are specified.

- (1) All spares necessary for stable and reliable operation of the systems involved shall be supplied.
- (2) Spares shall be supplied prior to the provisional handing-over of the system involved.
- (3) Spares shall be supplied at least in accordance with such standards as are specified in the following paragraphs. Necessary items of other than such specified standards if any, shall also be supplied as options.
- (4) One set of spare panels of radio equipment, voice frequency telegraph equipment including power supply panel of each equipment shall be provided for all the terminal stations.
- (5) One set of spare panels for one group in the channel translating equipments including power supply panel shall be provided for all the terminal stations.
- (6) Toll cables for repair purposes for those listed in Table 4-1 shall be provided for Paraguari, S. J. Bautista, Cnel. Oviedo and Pto. Pte. Stroessner in length of 250 meters each.
- (7) Connection cords, connectors, U-links, and telephone handsets including those for test equipment shall be supplied to Asuncion. The quantity of these cords, connectors, U-links, handsets, etc. shall be 30 percent of the total numbers required for operation.
- (8) With the exception of power cables and earth wires, inter-office communications cables shall be supplied to Asuncion as spares.  
  
The quantity of the cables supplied as spares shall be 10 percent of the overall length of the cables installed at all stations and minimum length of each such spare cable shall be 10 meters.
- (9) Computing of items of which the required quantity is given in the

percentage of working complement shall be made for the whole of the constantly running system, including the working equipment and the stand-by equipment.

- (10) Consumable parts such as lamps and fuses needed at each station shall be supplied in quantities corresponding to the requirements for two years after provisional handing-over.
- (11) Spare parts necessary for operation of engine generator shall be supplied in quantities corresponding to the requirements for two years after provisional handing-over including the spare parts for over-haul, if necessary.

## CHAPTER 9 TOWER

### 9.1 General

This Chapter deals with the tower to be constructed for the micro-wave system in PARAGUAY.

All the towers shall be self supporting type, the structure shall be square type and the steel members for their structure shall be angular.

### 9.2 Documentation

- (1) The Tenderer shall submit a tower strength calculation sheet of Guyraungua station along with an offer.

The calculation sheet shall include the following:

- Material standard.
- Calculation of wind load.
- Calculation of stress.
- Calculation of tower sway.
- Stress diagram.
- Other necessary data.

- (2) After contract, the Contractor shall submit a detailed calculation sheet of the antenna tower strength, and assembly and construction drawing pertaining to Guyraungua station for approval.

- (3) Certified copies of mill reports for steel materials shall accompany the delivery of the tower elements.

- (4) Because ANTELCO is to prepare the tower foundation, the Contractor shall submit to ANTELCO the data necessary for preparation of this tower foundation.

### 9.3 Conditions of Design, Material Standard and Manufacture

- (1) Steel structures and bolts and nuts



- (a) In the tower strength calculation, the following shall conform to the EIA standard in U.S.A. RS-222-A, November of 1966 (Structural Standards for Steel Antenna Towers and Antenna Supporting Structure).
  - (i) Calculation of wind load.
  - (ii) Specification and calculation of the stress tolerance for structural steels and bolts nuts.
- (b) All the antenna towers shall be designed to sufficiently withstand the wind velocity of 120 km/h.
- (c) The deflection of the antenna secured to the tower top shall be  $\pm 0.7^\circ$ , provided that wind velocity is 120 km/h. Therefore, in the design of antenna towers, these requirements shall be fully met.
- (d) The antenna towers shall be designed with sufficient strength under the condition indicated in Fig. 9-1 and 9-2. However, the quantity and the mounting height of the antennas are used only for towers strength design.

Incidentally, the antennas marked \* in Fig. 9-1 & 9-2 represent those to be constructed under possible future expansion project, the quotation for the antenna mount for these antennas in the future needs not to be made.

- (e) Since, the Asuncion Station, the existing antenna tower will be used, no antenna tower has to be quoted. However, it is necessary to quote on, and supply, a suitable antenna mounting base for proper antenna installation for this project. The existing tower is 60 meters high and 2 GHz antenna and feeder in existence.
- (f) All the towers shall be constructed on the ground.
- (g) No strength allowance for earthquake needs be taking into consideration in this case.
- (h) Fabrication and erection of steel structures shall be in accord-

ance with the American Institute of Steel Construction "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" adopted in 1963, "Code of standard Practice for Steel Buildings and Bridges" revised March 15, 1959 or the British Standards Institution "The Use of Structural Steel in Building", or equivalent national standard.

- (i) Field connections shall be fastened with steel bolts using such methods of prevent loosening as double nuts.
- (j) Structural steel for all work shall conform to ASTM A-283-67, A-306-64, A-36-67, BS 15, or equivalent.
- (k) All bolts used in connection with structural steel shall conform to ASTM A-307-68, BS 15, or equivalent.
- (l) Where structural joints are made by welding, the details of all joints, the welding technique employed, the appearance and quality of welds made, and the methods used in correcting defective work shall conform to requirements of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, or equivalent, and the "Code for Arc and Gas Welding in Building Construction" of the American Welding Society, or equivalent.
- (m) All steel parts and their attachments, except for portions to be encased in concrete, shall be given a protective zinc coating on all surfaces by dipping in a bath of molten zinc in compliance with the following specifications.
  - (i) For parts other than nuts, bolts and similar threaded fasteners, the zinc coating shall be carried out to the requirements of ASTM A-123-68 or equivalent.
  - (ii) For nuts, bolts and similar threaded fasteners the zinc coating shall be carried out to the requirements of ASTM A-153-67, or equivalent.
  - (iii) All parts shall be galvanized after fabrication, i.e. after holes, bands and welds have been made.
  - (iv) The uniformity of the coating shall normally be determined by visual means. However, submit certified

reports of the Preece copper sulphate test as specified in BS. 729, ASTM A-239-41 (65) or equivalent.

#### 9.4 Obstruction Lighting and Painting

##### (1) Obstruction Lighting

- (a) Obstruction lights for preventing night air navigation hazard shall be provided on all the towers except for Asuncion and Caapucu station. Red lights shall be used for them.
- (b) All the towers shall be provided with top light. Moreover, when the tower height exceeds 45 meters, intermediate lights shall be provided for each additional 45 meters or fraction thereof. These intermediate lights shall be spaced as equally as practicable between the top light and ground level.
- (c) Number and arrangement of lights at each level shall be such that the obstruction is indicated from every angle, clearly in azimuth.
- (d) Intensity of the top light shall be not less than 60 candelas with two 100 Watt lamps, and that of the intermediate light shall be not less than 30 candelas with 100 watt lamp.
- (e) On-off of these lights shall be automatically controlled by such device as photo cell switch (day and night switch).
- (f) AC 220 V single phase source shall be used for these lights.

##### (2) Painting

- (a) All the towers except for Asuncion and Caapucu station shall be painted in red and white in appropriate vertical intervals for marking the obstruction clearly in order to prevent air navigation.
- (b) Painting shall be alternately white and red. The top portion shall be in red. The white or red colored vertical width of tower shall be 3 to 5 meters.

## 9.5 Associated Work

(1) Adequate access to the Antenna system by authorized personnel shall be provided in the form of ladders for new towers. On each ladder, rest platforms with necessary personnel safety means shall be installed at intervals of less than 15 meters for new tower. Working platforms for antennas shall be provided.

(2) The only vertical feeder racks, which are made of structural steel, shall be provided with the towers.

The width of feeder rack shall be minimum 60 cm for new towers.

(3) The lightning rod on the tower top and the 38 mm<sup>2</sup> copper wire along the tower shall be provided with all the towers for new tower.

## CHAPTER 10 INSTALLATION

### 10.1 General

This chapter describes the installation of all facilities involved in this contract such as radio, multiplex and power equipment. All the installation work covered by this contract shall be implemented in accordance with the specifications given in this chapter.

### 10.2 Condition of Installation

#### (1) Scope of Contractor Responsibility

(a) The Contractor shall supply the installation materials mentioned below and be responsible for proper installation of equipment, including:

(i) Supply of installation materials and the installation of the equipment (such as radio, multiplex and power equipments, antenna, feeder, tower and toll cable) and inland transportation.

(ii) Testings (refer to Chapter 11) of the equipment supplied by the Contractor.

(iii) All the materials such as oil, water, electric power and others necessary during installation and testing.

(iv) Horizontal feeder rack;

The distance of the rack, which is made of structural steel, from the building to the tower is 7 meters and the width of the rack is minimum 60 cm.

(b) The installation shall cover all necessary work, such as unpacking and handling of materials from storage, as well as transportation, levelling, marking, fixing, mounting, assembling and full performance tests thereof.

(c) The Contractor shall bear expenses for all necessary materials and tools, as well as transportation of equipment, and for living and travelling of his workers.

#### (2) Responsibility of ANTELCO

ANTELCO supplies by himself all the below-mentioned materials and undertake all incidental works:

- (a) Tower foundation.
- (b) Access road.
- (c) Buildings.
- (d) Engine generator foundation.
- (e) Site selection and site work.
- (f) Outdoor storage fuel tank on the ground and piping from the storage tank to the day-tank in power equipment room.
- (h) Commercial power receiving line.
- (i) Outdoor earthing work (including underground earthing work of the tower).
- (j) All other civil and building works.

(3) Utilization of Lands and Buildings

The Contractor will be allowed to utilize sites and buildings for the purpose of completing the installation work effectively. However, all temporary structures which the Contractor will build for the purpose of installation shall be withdrawn prior to the provisional handing-over of completed work. For the use of lands other than the sites, the Contractor shall assume all responsibilities.

- (4) Throughout the installation period, the Contractor shall assume responsibilities to keep the related sites, buildings and equipment, as well as parts and materials in good conditions and, at the end of installation work, to put all such facilities in good order and perfect trim.

- (5) ANTELCO's personnel will be allowed to cooperate in the actual installation work for the purpose of receiving training.

The Contractor shall exercise caution for safety operations during the installation period.

### 10.3 Conditions of Workmanship

#### (a) Basic Conditions:

- (i) Workmanship shall be such as will provide convenience for maintenance work;
- (ii) Installation materials of optimum quality shall be selected and used;
- (iii) Fixing and mounting shall be done in such way that they will be sufficiently stable and rigid. For the parts required to be flexible, appropriate devices shall be rendered;
- (iv) Work shall be finished presentably;
- (v) When working additionally on station buildings, the Contractor shall get in touch with ANTELCO's Engineer to obtain his approval. The workmanship shall be such as will not impair water-proofing and other functions of station buildings;
- (vi) Material to be used for steel work shall be high in quality and anti-corrosive in nature;
- (vii) For mounting of structure, etc., it is permissible to utilize fixing rails attached on beams of buildings.
- (viii) Sufficient marking and levelling shall be conducted for installing equipment.

#### (b) Wiring:

- (i) For bay-type equipment except for power supply equipment, wiring shall be performed from the upper section, using cable rack or similar means;
- (ii) For cable and wire termination, utmost care shall be exercised in order that the fixed terminals can be used for a long period;
- (iii) For cabling, care shall be exercised in order that no undesirable stress will be exerted or no damage inflicted on the cable;
- (iv) Each equipment shall be effectively earthed;
- (v) For power lines, AC line and DC line shall be laid in separate groups;
- (vi) Cable racks, ducts, holes, etc. for wiring shall be such as will allow expansion for the final scheme.

### 10.4 Documentation

- (1) The Tenderer or Contractor shall submit the information and data

given below:

- (a) The Tenderer shall submit, at the time of making an offer, the information on the storage fuel tank capacity and the equipment layout drawing for each station covered under the proposed project.
- (b) The Contractor shall submit the data on tower foundation needed by ANTELCO for preparation of the tower foundation within three (3) months after the signing of the contract.
- (c) The Contractor shall submit, within six (6) months after the signing of the contract, the installation drawings and installation schedule for approval.
- (d) The Contractor shall submit the monthly reports on installation.
- (e) The Contractor shall submit, within three (3) months after the signing of the contract, all the detailed requirements in connection with station building.
- (f) Regarding the installation the Tenderer shall submit the detailed items which be quoted in the proposal prices.  
  
After contract, if a change in the conditions of quotations, should develop, the quoted prices concerned shall be either increased or decreased.
- (g) The Contractor shall propose the recommendable earthing system for the tower building, equipment and the like.

#### **10.5 Installation Control**

- (a) The Contractor shall submit to ANTELCO the installation drawings, installation schedule and installation progress report to enable ANTELCO to that the ANTELCO's supervisors can give whatever assistance to the Contractor for proper and un-interrupted installation of the equipments.
- (b) The Contractor shall have long and ample installation experi-



ence and be able to dispatch highly competent and able engineers for supervision of installation work in close cooperation with ANTELCO. He shall carry out the installation work to the satisfaction of ANTELCO.

## CHAPTER 11 TEST AND GUARANTEE

### 11.1 General

This Chapter provided for factory inspections, installation period test and handing-over tests, as well as guarantee to be extended thereafter.

Factory inspections and handing-over tests, are, in principle, to be conducted by ANTELCO or their representatives. The Contractor, however, shall not fail to take necessary actions for smooth proceeding of inspections or tests, such as preparing the personnel and methods of tests, and shall carry out such tests on behalf of ANTELCO when so instructed.

Installation period tests shall fall within the Contractor's responsibility. All inspections and tests shall be conducted on the basis of comparing with the specifications hereby presented, the latest pertinent CCITT and CCIR Recommendation, and data submitted by the Contractor.

Work to pass the inspections or tests shall satisfy all such standard completely.

The Contractor shall prepare the methods of tests, including procedural details, and, after approval of ANTELCO, shall provide them in time for each test.

### 11.2 Factory Inspections

#### (1) Data to be Submitted at Time of ANTELCO's Inspection

The Contractor shall, prior to the ANTELCO's inspection, submit manufacturer's test data for all goods to be delivered. In such prior inspections, the Contractor can use, if necessary, the sampling test method approved by the Inspector.

#### (2) Start and Period of Inspection

When units have been made ready for inspection in considerable quantities, the Contractor shall inform the Inspector without delay of time, the inspection can be started. The Contractor shall reserve

sufficient time for each inspection.

(3) Measuring Facilities

The Contractor shall prepare, free of charge, all necessary facilities for inspections, including measuring instruments.

(4) Factory Inspection

The Inspector can, whenever he so chooses, inspect the manufacturing processes in the factory.

(5) Inspection Certificates

All goods delivered except when indicated otherwise shall be subject to inspection by ANTELCO or their representatives before shipping, and the inspection certificate signed by the Inspector shall be attached to each packing.

The Contractor shall prepare suitable sheets for inspection in sufficient quantities. Manufacturer's test data, as specified in 11.2 (1) above shall be attached to the inspection certificates referred to in this paragraph. These certificates will not absolve the Contractor from his ultimate responsibility for this contract.

**11.3 Installation Period Test**

(1) General

The Contractor shall conduct all necessary tests for turn-key basis operations during the installation period and submit data obtained to ANTELCO. Such data shall include at the least, items, appearing in Table 11.1 and shall be based on the Specifications hereby presented and pertinent CCITT and CCIR Recommendations.

(2) Measuring Equipment

The Contractor can use the measuring equipments, during the construction of this system scheduled to be supplied. Such equipment,

however, shall, by the time of the provisional handing-over, be restored so as to furnish normal functions that can be expected from brand-new equipment.

(3) Items not Available for Effective Inspections

For items of which effective inspections are difficult to carry out at the time of the handing-over tests, the pertinent data and records (including photographs) shall be submitted as evidence.

(4) Participation of Trainees

The Contractor shall accept ANTELCO's personnel for the purpose of giving them on-the-job training, instructing them accordingly with regard to tests, as well as repair and adjustment work. In this case, the Contractor can have part of the tests conducted by such personnel but shall assume final responsibilities for test results.

(5) Measuring Methods

Measuring methods shall be based on CCITT and CCIR Recommendations. In case of items for which official governing regulations are not available, measuring can be conducted by methods proposed by the Contractor.

For noise measuring the method based on CCIR Recommendation 399-1 shall be adopted. Overload characteristics shall also be measured by changing the input level.

Further, when testing the stand-by channel of the microwave link, both telephone transmission and television transmission shall be tested.

(6) Stability Test

The Contractor shall establish test links as designated by ANTELCO, shall record for three weeks the noise power on the links, and shall submit data demonstrating that the result of measuring satisfies requirements in the specifications hereby presented.

The Contractor shall submit data obtained by sending test signal on the television circuit designated by ANTELCO and checking level stability for three days at the receiving side.

As for the time schedule of these tests, ANTELCO will instruct later.

#### 11.4 Handing-Over Tests

##### (1) Preparations for Handing-over Tests

Handing-over tests shall be started according to procedures shown Contractual Terms and Conditions of Tender.

The Contractor shall, by the time the handing-over tests are started, submit the following papers prepared for each station:

- (a) Plant records; (including completion drawings)
- (b) Records of material used;
- (c) Installation period test data;
- (d) Other reference papers.

The Contractor shall also prepare a complete inventory of provided and installed facilities in order that he can make clear-out explanation therewith at the time of inspections.

##### (2) Examination of Papers

ANTELCO's Engineer or Supervisors under his supervision (to be called "ANTELCO's Engineer or Supervisor" hereafter) will examine submitted papers and, by comparing them with installed facilities, check whether or not the supplied equipment and materials are used properly.

##### (3) Checks of Workmanship

ANTELCO's Engineer or Supervisor will check whether or not all facilities have been finished according to the workmanship proposed by the Contractor and approved by ANTELCO.

When instructed by ANTELCO's Engineer or Supervisor to amend

the finish, the Contractor shall fulfill such instructions without delay.

(4) Performance Tests

ANTELCO's Engineer or Supervisor will examine whether or not the installed facilities are operating as they ought in accordance with the specifications hereby presented and other governing standards.

The examination will be carried out in the form of comparison between the data submitted in accordance with provisions of 11.3 (1) above and the performance of installed facilities.

For sampling inspections, the separately prepared standards may be applied.

(5) Provisional Handing-over

Reference shall be made to Contractual Terms and Conditions of Tender.

**11.5 Guarantee**

(1) Scope of Guarantee

By guarantee period meant the period between the provisional handing-over and the final handing-over. During this period, the Contractor shall guarantee that the performance of the system concerned and of the facilities installed is kept within the limits given in the specifications hereby presented and in other governing standards.

However, expenses caused by abnormal operation and maintenance of facilities during this period will be born by ANTELCO.

(2) Guarantee of Performance

In case defects on the performance are found in the course of normal operation during the period mentioned above, the Contractor shall, on his own responsibility and at his own expense, have the operation restored to the required standards as quickly as possible.

(3) Replacement of Consumed Materials

Replacement and stock piling of consumed materials necessitated during the guarantee period are to be undertaken at ANTELCO's cost. However, the subjects are limited to natural wear and tear. Whereas the Contractor shall be responsible and shall bear the cost for the replacement of such materials that are used under normal conditions and necessitated the replacement much before their commonly accepted life terminates.

(4) Maintenance Assistance

The Contractor shall have three or more persons of richly experienced engineers and technicians for assisting maintenance work stay at appropriate stations for twelve months after the provisional handing-over.

The Tenderer shall submit the staffing schedule, quoting the number and the expense for engineers and technicians respectively. The Contractor shall bear all expenses, necessary for the stationing of such staff, including travel expenses. These staff shall furnish:

- (a) Technical guidance for maintenance of actual link;
- (b) Technical guidance in trouble shooting and repairing work;
- (c) Supervision of routine checking;
- (d) Participation in periodic visits to unattended stations and supervision thereof;
- (e) Analysis of collected data;
- (f) Technical guidance in material control.

Table 11.1 The Minimum Items of Installation Period Test

1. Station Test

1.1 Microwave System

Item	Note
(1) Level Setting (a) Baseband input & output level (b) IF input & output level	
(2) Repeater (a) Transmitter radio output power (b) Receiver radio input power (c) Squelching level setting (d) AGC characteristics (e) Radio frequency check (f) Intermediate frequency check (g) Amplitude characteristics	
(3) Modulator & Demodulator (a) Frequency deviation check (b) Linearity (c) Frequency/attenuation distortion	This will be measured in combination of a modulator & a demodulator.
(4) Sound Channel	Same as 1.2 (4)
(5) Alarm Test	



1.2 Carrier Multiplex System

Item	Note
<p>(1) Translating Equipment</p> <ul style="list-style-type: none"> <li>(a) Level setting</li> <li>(b) Frequency/attenuation distortion characteristics</li> <li>(c) Carrier level &amp; leak</li> <li>(d) Crosstalk</li> <li>(e) Idle noise</li> </ul>	<p>This shall include out-band signalling level.</p>
<p>(2) Frequency Generating Equipment</p> <ul style="list-style-type: none"> <li>(a) Level setting</li> <li>(b) Switchover test</li> </ul>	<p>This shall be include level variation test.</p>
<p>(3) Supergroup Level Regulating Equipment</p> <ul style="list-style-type: none"> <li>(a) Frequency/attenuation distortion characteristics</li> <li>(b) Level regulating characteristics</li> <li>(c) Idle noise</li> </ul>	
<p>(4) Programme Transmission Equipment</p> <ul style="list-style-type: none"> <li>(a) Level setting</li> <li>(b) Frequency/attenuation distortion characteristics</li> <li>(c) Noise</li> <li>(d) Crosstalk</li> </ul>	

### 1.3 VFT System

Item	Note
(1) Level setting	This will be measured in combination of transmitting and receiving
(2) Channel frequency calibration	
(3) Distortion	
(4) Alarm tests	
(5) Group common carriers	
(a) Carrier level	
(b) Carrier leak	If necessary
(6) Output DC current check	

2. Overall Test

2.1 Microwave System

Item	Note
(1) Telephone RF channel (a) Level setting (b) IF-IF group delay (c) Attenuation/frequency distortion (d) Signal-to-noise ratio (e) Stability test	This shall be measured as reference only.  This shall be measured with & without uniform spectrum signal loading.
(2) Television RF channel (a) Level setting (b) IF-IF group delay (c) Signal-to-noise ratio (d) Linear waveform distortion (e) Attenuation/frequency distortion (f) Differential gain characteristics (g) Differential phase characteristics (h) Stability test	This shall be measured as reference only.
(3) Service Channel (a) Attenuation/frequency distortion (b) Signal-to-noise ratio (c) Gain stability	} For every channel
(4) Switching System	The data demonstrating that facilities will furnish normal function, as designated, shall be submitted.
(5) Sound Channel	
(6) Supervisory & Control System	Ditto

2.2 Carrier Multiplex System (between terminal stations)

Item	Note
(1) Supergroup, Group & Channel, as well as Programme circuit (a) Level setting (b) Frequency/attenuation distortion characteristics (c) Signalling distortion & operating characteristics (d) Noise (e) Crosstalk	

2.3 Toll Cable System

Item	Note
(1) Transmission loss (2) Attenuation/frequency characteristics (3) Signal-to-crosstalk ratio	

2.4 VFT System

Item	Note
(1) Level setting (2) Distortion (3) Noise	This will be measured at output of the receiving filter.

## CHAPTER 12 TRAINING

### 12.1 General

This Chapter deals with the training to be administered and the training facilities to be supplied.

The Contractor shall be responsible for necessary training of personnel designated by ANTELCO in Paraguay and in the Manufacturer's factory, in accordance with Contractual Terms and Conditions of Tender.

### 12.2 Training of Personnel

#### (1) Training Programme

The training programme shall be proposed by the Tenderer, and final decision shall be based on the agreement between ANTELCO and the Contractor.

#### (2) Category of Training

##### (a) Theoretical Training

Training for theoretical matters as well as installation and maintenance work shall be administered to ten personnels designated by ANTELCO in Paraguay, before the commencement of installation work, on the following subjects, during four weeks;

- (i) Microwave system.
- (ii) Carrier multiplex system.
- (iii) Power supply system.

##### (b) Training at Factory

Four personnels selected by ANTELCO from among trainees name as per (a) above shall be accepted by the Contractor, and the training shall be administered for at the manufacturer's factory, during three months.

##### (c) On-the-Job Training

During the installation period, the Contractor shall accept trainees as per (a) above and shall give them on-the-job training at the sites where installation work is in progress.

(3) Language

For training to be administered in Paraguay, and for training to be given in the Manufacturer's country, English shall be used.

(4) Text Book

The Contractor shall prepare all necessary text books for all trainees, and shall supply additional 30% as spares.

(5) Cost

Salaries and wages of trainees, as well as their living expenses in the manufacturer's country, will be borne by ANTELCO.

All other expenses including the expenses to be entailed for travel to and from the factory shall be born by the Contractor.

### 12.3 Training Equipment

The Contractor shall provide and install the following equipments for the purpose of training of the personnels of ANTELCO.

Bidders shall quote these equipments and all other items necessary for installing these equipments in Asuncion.

These training equipments shall apply the same design philosophy with actual working equipment.

- (a) Transmitter - receiver for one hop, one-way and one RF channel configuration, including attenuator for RF connection.
- (b) One FM modulator for telephone transmission.
- (c) One FM demodulator for telephone transmission.
- (d) One Supervisory and control equipment for supervisory station.
- (e) One supervisory and control equipment for supervised station.

- (f) One set of RF channel switching control equipment for transmitting and receiving station.
- (g) One set of charger and storage battery.
- (h) Measuring equipment as shown in Table 7-1.

Supervisory items and control items shall be minimum 15 and 7, respectively.

#### **12.4 Data to be Presented**

The explanatory data shall be presented in the offer on the following items:

- (a) Training programme.
- (b) Schematic diagram and explanation of each training equipments.
- (c) Power consumption for training equipments.

## CHAPTER 13 DOCUMENTS AND REFERENCES

### 13.1 General

This Chapter provides for technical documents and references to be submitted by the Tenderer and the Contractor.

### 13.2 Offering Documents

Technical documents to be submitted with the offer shall contain informations on all items falling within the scope of this contract. Each document shall be submitted in four copies in accordance with provisions of Contractual Terms and Conditions of Tender. Such items shall include:

#### (1) System Design

Technical information concerning system design and its feasibility based on data shall be supplied together with at least the following drawings:

- (a) Communications system schematic diagram;
- (b) Power system schematic diagram;

#### (2) Data on Equipment and Materials

Technical information pertaining to equipment and materials shall be presented. Equipment specifications shall be prepared in the form appearing in Annex 1 in this PART III. Drawing shall also be prepared wherever necessary.

#### (3) Design of Towers

Design of towers shall be prepared together with necessary drawings.

#### (4) Work Schedule

The projected data for accomplishing the work shall be submitted,



classifying into respective systems under this Contract. This work schedule shall include, at least, the following items:

- (a) Manufacturing schedule.
- (b) Shipping period.
- (c) Commencement of installation work.
- (d) Installation work period.
- (e) Test period.
- (f) The provisional handing-over.

(5) Installation

Information concerning installation shall be presented. Especially, clear description with drawings shall be presented for equipment layouts.

(6) Price Quotation

Statement shall be made in accordance with Annex 2 in this PART III.

Total price shall be quoted for all kinds of obligations and liabilities including associated work necessary for the completion of this project under the specifications hereby presented. Furthermore, all details of individual prices of each unit as far as possible, not only for the specified items but also for all related items.

**13.3 Documents to be Approved**

(1) The Contractor shall, on the earliest possible occasion after the signing of contract, submit information in full detail pertaining to design, installations, including workmanship, method of tests, and training to be administered, and shall have such information approved.

(2) Each document shall be submitted in four copies.

**13.4 Instruction Manuals**

- (1) Manuals presenting detailed information required for operation and maintenance of the system shall be supplied. Such manuals shall be prepared severally for the system and each of its component equipment.
- (2) Manuals shall cover the following items and shall be accompanied with necessary drawings, including circuit diagrams of equipment:
  - (a) Explanation of constitutions and functions;
  - (b) Description of characteristics;
  - (c) Instructions on operation and maintenance, including routine work, trouble shooting, and repairing.
- (3) Manuals shall be supplied in four copies to each of the radio terminal stations concerned. Manuals on routine work, especially, shall be supplied in four copies to each of the radio terminal stations concerned.
- (4) Manuals shall be described in Spanish language.

### **13.5 Text Books**

Text books for the training mentioned in 12.2 (4) shall be provided prior to commencement of training.

### **13.6 Data**

#### **(1) Manufacturer's Test Data**

Test data described in 11.2 (1) shall be presented. Four copies of such data for each equipment shall be submitted.

#### **(2) Installation Period Test Data**

Test data prepared by the Contractor at the sites for each equipment and for each system shall be submitted. Such data shall be submitted prior to the provisional handing-over tests and in four copies each.

(3) Handing-over Test Data

The Contractor shall put in order data of the handing-over test to be conducted by ANTELCO's personnel. Four copies of compiled data shall be prepared.

**13.7 Plant Records**

(1) Detailed plant records covering all executed work shall be submitted prior to the provisional handing-over test.

(2) In such plant records at least the following items shall be taken up:

- (a) Route map,
- (b) Profiles of radio paths,
- (c) Radio frequency allocation,
- (d) Channel arrangement in carrier multiplex system,
- (e) Level diagram,
- (f) Complete list of equipment,
- (g) Equipment layouts,
- (h) Communications system wiring diagram,
- (i) Power system wiring diagram,
- (j) Intra-office cable laying and lengths,
- (k) Mounting of antenna system,
- (l) Schematic of feeder arrangement and feeder lengths,
- (m) Details of steel work (structures, cable racks, etc.),
- (n) Jumpering details,
- (c) Route map and connecting details of conductors (including loading coils) and jumpering details of VDF for Toll Cable System.

(3) A mother print and its four copies of plant records shall be submitted for each item appearing above.

(4) Plant records shall be described in Spanish language.

## ANNEX 1 DATA TO BE PRESENTED

The Tenderer shall submit data with the offer as follows:

- (1) Equipment data shall be presented, summarizing in accordance with the attached form. (Description given in parenthesis is an example.)
- (2) Items which the Tenderer recognizes as necessary in addition to the listed ones, shall also be added.
- (3) Explanatory data or drawings shall be presented whenever necessary.
- (4) Data which are different for the respective stations, shall be presented, classified for each station.
- (5) Power consumption of each equipment or bay shall be presented in a suitable list separate from the attached form.
- (6) Summarized power consumption at initial and final stage for each station shall also be presented.
- (7) Besides, estimated overall system performance shall be described in accordance with the attached form.
- (8) Estimated overall system reliability shall also be described.

1. Radio System

(a) Radio

(i) FM transmission band

Bandwidth  $\pm$  \_\_\_\_\_ MHz  
 Selectivity \_\_\_\_\_ dB attenuation at  $\pm$  \_\_\_\_\_ MHz  
 Group delay \_\_\_\_\_  $\mu$ s within nominal bandwidth  
 Amplitude characteristics \_\_\_\_\_ dB within nominal bandwidth

(ii) Modulation (Telephone)

Frequency deviation \_\_\_\_\_ KHz rms/ch. test tone  
 Emphasis (C.C.I.R. Rec. 275)

(iii) Modulation (Television)

Frequency deviation \_\_\_\_\_ MHz p-p/1V p-p  
 Emphasis (C.C.I.R. Rec. 405)

(iv) Radio frequency

Output power \_\_\_\_\_ W ( \_\_\_\_\_ dBm)  
 Receiver noise figure \_\_\_\_\_ dB  
 Receiver threshold level \_\_\_\_\_ dBm  
 Spurious radiation \_\_\_\_\_ dB relative to carrier level  
 Image suppression \_\_\_\_\_ dB relative to nominal wanted signal level  
 Input VSWR \_\_\_\_\_ within nominal bandwidth  
 Output VSWR \_\_\_\_\_ within nominal bandwidth

(v) Intermediate frequency

Center frequency \_\_\_\_\_ MHz  
 Input level \_\_\_\_\_ V  
 Output level \_\_\_\_\_ V  
 Input & output impedance \_\_\_\_\_ ohms, unbalanced  
 Return loss \_\_\_\_\_ dB within  $\pm$  \_\_\_\_\_ MHz

(vi) Automatic gain control

IF output level variation \_\_\_\_\_ dB for the input range of \_\_\_\_\_ dBm to \_\_\_\_\_ dBm

(vii) Squelching and restoring

Adjustable range Input of \_\_\_\_\_ to \_\_\_\_\_ dBm

- (viii) Linearity
- Modulator \_\_\_\_\_ % with freq. deviation of  
 $\pm$  \_\_\_\_\_ MHz p-p
- Demodulator \_\_\_\_\_ % with freq. deviation of  
 $\pm$  \_\_\_\_\_ MHz p-p
- (ix) Baseband
- Bandwidth \_\_\_\_\_ to \_\_\_\_\_ kHz
- Input level \_\_\_\_\_ dBr/ch. test tone
- Output level \_\_\_\_\_ dBr/ch. test tone
- Input & output impedance \_\_\_\_\_ ohms, unbalanced
- Return loss \_\_\_\_\_ dB within baseband
- (x) Videoband (Television)
- Bandwidth \_\_\_\_\_ Hz to \_\_\_\_\_ MHz
- Input & output level \_\_\_\_\_ V p-p
- Input & output impedance \_\_\_\_\_ ohms, unbalanced
- Return loss \_\_\_\_\_ dB within videoband width

(b) Antenna System

- (i) Antenna
- Type (         m $\emptyset$  parabolic antenna         )
- Isotropic gain \_\_\_\_\_ dB at radio band center freq.
- Front-to-back coupling \_\_\_\_\_ dB relative to main beam gain
- Horizontal directivity }  
 Vertical directivity } (Present pattern drawings.)
- VSWR \_\_\_\_\_ within the band of \_\_\_\_\_  
 to \_\_\_\_\_ MHz
- (ii) Feeder
- Type (         m $\emptyset$  circular waveguide         )
- Standard piece length \_\_\_\_\_ m
- Loss per unit length \_\_\_\_\_ dB/m
- VSWR \_\_\_\_\_ within the band of  
 to \_\_\_\_\_ MHz
- (iii) Branching filter
- Nominal branching  
 bandwidth  $\pm$  \_\_\_\_\_ MHz

Branching band loss \_\_\_\_\_ dB  
 Selectivity \_\_\_\_\_ dB attenuation at  $\pm$  \_\_\_\_\_ MHz  
 Branching band VSWR \_\_\_\_\_ within nominal branching band.

(iv) Overall antenna system  
 VSWR \_\_\_\_\_ within the band of \_\_\_\_\_ to \_\_\_\_\_ MHz

Ground level (m)  
 Antenna height (m)  
 Feeder length (m)  
 Feeder loss (dB)

Present data in table.

(c) Switching System

Continuity pilot frequency \_\_\_\_\_ kHz  
 Noise detection band  $\pm$  \_\_\_\_\_ kHz  
 Pilot failure detection level Adjustable for \_\_\_\_\_ to \_\_\_\_\_ dB  
 Switching noise level Adjustable for S/N \_\_\_\_\_ to \_\_\_\_\_ dB  
 Operation time \_\_\_\_\_ mS  
 Transfer time \_\_\_\_\_ mS  
 Type of control signal (Multi-frequency code)  
 Signal transmission band \_\_\_\_\_ to \_\_\_\_\_ kHz

(d) Remote Supervisory & Control System

(i) Order wire  
 Bandwidth \_\_\_\_\_ to \_\_\_\_\_ Hz  
 Sending level \_\_\_\_\_ dBr/test tone  
 Receiving level \_\_\_\_\_ dBr/test tone  
 Input & output impedance \_\_\_\_\_ ohms, balanced

(ii) Switching signal  
 Sending level \_\_\_\_\_ dBm/one code freq.  
 Receiving level \_\_\_\_\_ dBm/one code freq.

(e) Sound Channel

- |       |                                    |   |
|-------|------------------------------------|---|
| (i)   | Frequency/attenuation Distortion   | Present drawings  |
| (ii)  | Noise                              | _____ dB on a combination of transmitting and receiving |
| (iii) | Harmonic distortion                | _____ dB at + _____ dBm                                 |
| (iv)  | Connection to Line from the Origin |   |
|       | Input level (nominal)              | _____ dBr   |
|       | " " (adjustable range)             | _____ dBr to _____ dBr by _____ dB step                 |
|       | Output level (nominal)             | _____ dBr   |
|       | " " (adjustable range)             | _____ dBr to _____ dBr by _____ dB step                 |
|       | Input and output impedance         | _____ ohms, balanced                                    |
|       | Return loss                        | _____ dB  |

2. Carrier Multiplex System

(a) Channel translating equipment

- |       |  |                       |
|-------|--|-----------------------|
| (i)   | Frequency/attenuation distortion   |                       |
|       | A combination of transmitting & receiving                                    | Present drawings      |
| (ii)  | Carrier leak   |                       |
|       | Transmitting   | _____ dBmO/ch. at GDF |
|       | Receiving  | _____ dBmO/ch. at VDF |
| (iii) | Linearity  |                       |
|       | Overall net loss - deviation at input level 3.5 dB higher than nominal level | _____ dB              |
| (iv)  | Amplitude limiting   |                       |
|       | Output level deviation at input level 20 dB higher than nominal level        | _____ dB              |



- (v) Noise  
 Total noise power \_\_\_\_\_ pW in a combination of transmitting & receiving.
- (vi) Crosstalk  
 Intelligible crosstalk \_\_\_\_\_ dB  
 Unintelligible crosstalk \_\_\_\_\_ dB
- (vii) Voice frequency connection  
 Input level (nominal) \_\_\_\_\_ dBr  
 Input level (adjustable range) \_\_\_\_\_ dBr to \_\_\_\_\_ dBr by \_\_\_\_\_ dB steps  
 Input & output impedance \_\_\_\_\_ ohms, balanced  
 Return loss \_\_\_\_\_ dB
- (viii) Basic group connection  
 Input level \_\_\_\_\_ dBr  
 Output level \_\_\_\_\_ dBr  
 Input & output impedance \_\_\_\_\_ ohms, balanced  
 Return loss \_\_\_\_\_ dB
- (ix) Signalling  
 Signalling frequency \_\_\_\_\_ Hz  $\pm$  \_\_\_\_\_ Hz  
 Transmitting level  
     High level \_\_\_\_\_ dBmO  $\pm$  \_\_\_\_\_ dB  
     Low level \_\_\_\_\_ dBmO  $\pm$  \_\_\_\_\_ dB  
 Overall signalling distortion \_\_\_\_\_ % at  $\pm$  \_\_\_\_\_ dB level variation. Also present measuring conditions.
- (x) Group pilot  
 Pilot frequency \_\_\_\_\_ KHz  
 Pilot sending level \_\_\_\_\_ dBmO
- (a) Group translating equipment  
 (i) Frequency/attenuation distortion

- deviation within group  
freq. band \_\_\_\_\_ dB at \_\_\_\_\_ to \_\_\_\_\_ KHz
- deviation within  
channel frequency band \_\_\_\_\_ dB
- (ii) Carrier leak  
Transmitting \_\_\_\_\_ dBmO/G at SGDF  
Receiving \_\_\_\_\_ dBmO/G at GDF
- (iii) Noise  
Total noise power \_\_\_\_\_ pW in a combination of trans-  
mitting & receiving.
- (iv) Crosstalk  
Intelligible crosstalk \_\_\_\_\_ dB
- (v) Basic group connection  
Input level \_\_\_\_\_ dBr  
Output level \_\_\_\_\_ dBr  
Input & output impedance \_\_\_\_\_ ohms, balanced  
Return loss \_\_\_\_\_ dB
- (vi) Basic supergroup  
connection  
Input level \_\_\_\_\_ dBr  
Output level \_\_\_\_\_ dBr  
Input & output impedance \_\_\_\_\_ ohms, unbalanced  
Return loss \_\_\_\_\_ dB
- (vii) Supergroup pilot  
Pilot frequency \_\_\_\_\_ kHz  
Pilot sending level \_\_\_\_\_ dBmO

(c) Supergroup translating equipment

- (i) Frequency/attenuation  
distortion  
deviation within  
supergroup frequency  
band \_\_\_\_\_ dB at \_\_\_\_\_ to \_\_\_\_\_ kHz  
deviation group  
frequency band \_\_\_\_\_ dB
- (ii) Carrier leak

- |       |  |       |  |
|-------|--|-------|--|
|       | Transmitting                                 | _____ | dBmO/SG at output                                |
|       | Receiving                                    | _____ | dBmO/SG at SGDF                                  |
| (iii) | Noise  |       |  |
|       | Total noise power                            | _____ | pW in a combination of transmitting & receiving. |
| (iv)  | Crosstalk                                    |       |  |
|       | Intelligible crosstalk                       | _____ | dB   |
| (v)   | Basic supergroup connection                  |       |  |
|       | Input level                                  | _____ | dBr  |
|       | Output level                                 | _____ | dBr  |
|       | Input & output impedance                     | _____ | ohms, unbalanced                                 |
|       | Return loss                                  | _____ | dB   |
| (vi)  | Baseband line frequency band connection      |       |  |
|       | Input level                                  | _____ | dBr  |
|       | Output level                                 | _____ | dBr  |
|       | Input & output impedance                     | _____ | ohms, unbalanced                                 |
| (d)   | Frequency generating equipment               |       |  |
|       | Master oscillator frequency accuracy         | _____ |  |
|       | Pilot frequency accuracy                     | _____ |  |
|       | Carrier frequency purity                     | _____ | dB   |
|       | Pilot frequency purity                       | _____ | dB   |
|       | Switchover time                              | _____ | mS   |
| (e)   | Supergroup level regulating equipment        |       |  |
| (i)   | Deviation within transmission frequency band | _____ | dB   |
| (ii)  | Input & output impedance                     | _____ | ohms, unbalanced                                 |
| (iii) | Return loss                                  | _____ | dB   |
| (iv)  | Level adjusting range                        | _____ | dB   |
| (v)   | Total noise power                            | _____ | pW   |
| (f)   | Programme Transmission Equipment             |       |  |

(i)	Frequency/attenuation distortion	Present drawings
(ii)	Noise (idle noise)	_____ dB on a combination of transmitting and receiving
(iii)	Linearity	$\pm$ _____ dB at + _____ dBm
(iv)	Harmonic distortion	_____ dB at + _____ dBm
(v)	Crosstalk	_____ dB
(vi)	Connection to line from the origin	
	Input level (nominal)	_____ dBr
	Input level (adjustable range)	_____ dBr to _____ dBr by _____ dB steps
	Output level (Nominal)	_____ dBr
	Output level (adjustable range)	_____ dBr to _____ dBr by _____ dB steps
	Input and output impedance	_____ ohms, balanced
	Return loss	_____ dB
(vii)	Connection to the carrier transmission line	
	Input level	_____ dBr
	Output level	_____ dBr
	Input and output impedance	_____ ohms, balanced
	Return loss	_____ dB

### 3. Tall Cable System

#### (a) Cable

(i)	Manufacturer's name and address	_____
(ii)	Factory length of cable	_____
(iii)	Type of quad	
(iv)	Resistance of conductor	_____ /km
(v)	Mutual capacitance	_____ pF/km
(vi)	Capacitance unbalance	_____ pF

- (vii) Dielectric strength
- (viii) Insulation resistance \_\_\_\_\_  $M\Omega/km$

(b) Loading Coil

- (i) Magnetic stability \_\_\_\_\_ %
- (ii) Inductance \_\_\_\_\_ mH
- (iii) Inductance tolerance \_\_\_\_\_ %
- (iv) Effective resistance \_\_\_\_\_  $\Omega/mA \times H$
- (v) Crosstalk \_\_\_\_\_ dB
- (vi) Dielectric strength
- (vii) Insulation resistance \_\_\_\_\_  $M\Omega$

(c) Overall Toll Cable System

- (i) Transmission loss \_\_\_\_\_ dB
- (ii) Attenuation/frequency distortion Present drawing
- (iii) Signal-to-crosstalk ratio \_\_\_\_\_ dB

4. VFT System

- Input impedance (DC telegraph leg) \_\_\_\_\_ ohms
- Output load impedance (-ditto-) \_\_\_\_\_ ohms
- Sending level to line per channel
  - (nominal) \_\_\_\_\_ dBm
  - (adjustable range)  $\pm$  \_\_\_\_\_ dB
- Telegraph distortion to frequency drift \_\_\_\_\_ %/Hz
- Alarm control level \_\_\_\_\_ dB below the nominal level
- Output DC current
  - (nominal) \_\_\_\_\_ mA
  - (adjustable range)  $\pm$  \_\_\_\_\_ mA
- Noise

Signal to noise

\_\_\_\_\_ dB at the receiving filter in a combination of transmitting and receiving

**5. Power System**

(1) Engine-generator

(a) Diesel engine

Manufacturer's name and address

\_\_\_\_\_

Type of engine

\_\_\_\_\_

Output at N.T.P.

\_\_\_\_\_ B. HP

Output at local conditions in Paraguay

\_\_\_\_\_ B. HP

Percent de-rating for engine

\_\_\_\_\_ %

Number of cylinders

\_\_\_\_\_

Engine cycle of operation

\_\_\_\_\_

Revolution speed

\_\_\_\_\_ RPM

Combustion chamber

\_\_\_\_\_

Total displacement

\_\_\_\_\_ cc

Bore X stroke

\_\_\_\_\_ mm X \_\_\_\_\_ mm

Fuel consumption at full load

\_\_\_\_\_ g/kwh

Fuel consumption at 1/2 load

\_\_\_\_\_ g/kwh

Lubrication oil consumption

\_\_\_\_\_ g/hr

Recommended lubrication oil

\_\_\_\_\_

Sump capacity

\_\_\_\_\_ liter

Sub tank capacity

\_\_\_\_\_ liter

Type of governor

\_\_\_\_\_

Starting motor

\_\_\_\_\_ V \_\_\_\_\_ PS

Number of starting motors

\_\_\_\_\_

Supercharger is provided or not

\_\_\_\_\_

(b) Generator

(i) Generator

Manufacturer's name and address \_\_\_\_\_

Rated voltage \_\_\_\_\_ V

Power factor \_\_\_\_\_

Rated output \_\_\_\_\_ kVA

Rated current \_\_\_\_\_ A

Efficiency \_\_\_\_\_ %

Revolutions per minute \_\_\_\_\_ RPM

Type \_\_\_\_\_

Maximum temperature rise \_\_\_\_\_ °C

Means of lubrication \_\_\_\_\_

Type of lubricant and grade \_\_\_\_\_

(ii) Type of automatic voltage regulator \_\_\_\_\_

(iii) Overall characteristics of Generator set

Voltage regulation \_\_\_\_\_ %

Adjustable voltage range at full load \_\_\_\_\_ %

Adjustable voltage range at no-load \_\_\_\_\_ %

Waveform distortion at no-load \_\_\_\_\_ %

(iv) Starting battery

Type \_\_\_\_\_

Terminal voltage of battery bank when floating \_\_\_\_\_ V DC

Number of cells \_\_\_\_\_

Nominal capacity \_\_\_\_\_ Ah/10hr

Specific gravity of electrolyte at fully charged condition & at 25°C \_\_\_\_\_

(v) Battery charging device

Type \_\_\_\_\_

Input

Voltage \_\_\_\_\_ V AC

Number of phases & wires \_\_\_\_\_, \_\_\_\_\_ wire

Power consumption at rated output \_\_\_\_\_ kVA

Output

Voltage \_\_\_\_\_ V DC

At automatic voltage regulation within  $\pm$  \_\_\_\_\_ V

Rated current \_\_\_\_\_ A

Type & method of voltage regulation \_\_\_\_\_

(2) Storage battery & battery charger

(a) Storage battery

Manufacturer's name & address \_\_\_\_\_

Type \_\_\_\_\_

Terminal voltage of battery bank when floating \_\_\_\_\_ V DC

Number of cells \_\_\_\_\_

Nominal capacity \_\_\_\_\_ Ah/10hr

Normal charging current \_\_\_\_\_ A

Final discharge voltage per cell \_\_\_\_\_ V/cell

Specific gravity of electrolyte at fully charged condition at 25°C \_\_\_\_\_

(b) Battery charger

Manufacturer's name & address \_\_\_\_\_

Type of rectifier \_\_\_\_\_

Input

Voltage \_\_\_\_\_ V

Voltage fluctuation range \_\_\_\_\_ V - \_\_\_\_\_ V



Number of phases	_____
Power consumption at rated output	_____ kVA
Output	
Voltage	
– Floating	_____ V
– Boost	_____ V
Voltage regulation	Within $\pm$ _____ V
Rated current	_____ A
Drooping current	_____ V at 24 V
Ripple voltage (when battery connected)	_____ mV r.m.s.
Type and method of voltage regulator	_____

OVERALL SYSTEM PERFORMANCE

(Southward Route)

Item	Asun- cion	Paragu -ari	Sub Total	Paragu -ari	Valle Apua	Caa -pucu	S. J. Ba -utista	Sub Total	S. J. Ba -utista	Sub Total	Estero -Camba	Pilar	Pass de Patria	Sub Total	Total
Thermal Noise	Repeater														
	Modulator and Demodu- lator														
	Auxiliary Equipment														
Distortion Noise	Repeater														
	Modulator and De- modulator														
	Auxiliary Equipment														
Interference Noise	Echo														
	Front to Back and Over- Reach														
		Asucion of P. Patria													
Total Noise	Unweighted Value														
	Weighted Value														
Service Channel Total Noise															

Note: The value shows noise power in pW

OVERALL SYSTEM PERFORMANCE

(Eastward Route)

Item	Asuncion		Paraguari		Cnel. Oviedo		Sub Total		Caaguazú		Guyra		Yguazú		P. P. st		Sub Total		Total			
Thermal Noise	Repeater																					
	Modulator and Demodulator																					
	Auxiliary Equipment																					
Distortion Noise	Repeater																					
	Modulator and Demodulator																					
	Auxiliary Equipment																					
Interference Noise	Echo																					
	Front to Back and Over-Reach	Asuncion																				
		to Stroes-																				
		snr Stroes-																				
Total Noise	snr to Asuncion																					
	Unweighted Value																					
Service Channel Total Noise	Weighted Value																					
	Total																					

Note: The value shows noise power in pW

## ANNEX 2 FORM OF PRICE QUOTATION

### 1. Gross Price

Gross price schedule shall be quoted, listing in accordance with Form A attached.

### 2. Breakdown of Price Schedule

The tenderer is requested to quote the breakdown of the price schedule in Form A, compiled in the table of which the standard form is given as Form B.

Quotation shall be made in such a manner that the cost for increase or decrease of the quantity or for the future expansion can be estimated easily.

Further, the relationship between Form A and Form B shall be clearly stated.

SUMMARY OF TOTAL PRICE

Form-A Sheet 1

Description	Prices	
	Foreign Currency Yen (¥)	Local Currency Guarani (G)
1. Equipment		
1.1 Microwave Equipment including Antenna System		
1.2 Supervisory and Control Equipment		
1.3 Multiplex Equipment including VFT Equipment		
1.4 Antenna Supporting Tower		
1.5 Power Supply Equipment		
1.6 Cable System		
1.7 Measuring Equipment including Tool		
1.8 Spare Panels and Parts		
Sub-Total		
2. Documentations		
3. Training including Training Equipment		

SUMMARY OF TOTAL PRICE

Form-A Sheet 2

Description	Prices	
	Foreign Currency Yen (¥)	Local Currency Guarani (G)
4. Installation		
4.1 Installation Materials		
4.2 Installation Works		
Sub-Total		
5. Transportation		
5.1 Freight and Insurance		
5.2 Inland Transportation to Site		
Sub-Total		
6. Supervisor Fee for Operating and Maintenance.		
7. Grand Total		
The time for delivery (The time for delivery means the date of provisional handing-over)		

THE CUSTOMER RESERVES THE RIGHT TO  
INCREASE OR DECREASE THE QUANTITY AT  
THE UNIT RATES QUOTED ABOVE

Grand Total except for  
Options based on the  
above items: \_\_\_\_\_

(In words: \_\_\_\_\_ )

Name & Address \_\_\_\_\_  
of Tenderer \_\_\_\_\_

Signature of Tenderer: \_\_\_\_\_

Date : \_\_\_\_\_

DETAILED PRICE SCHEDULE

Form-B

Station		A Station		B Station		Training Center		Total	
Item	Unit price	Q'ty	Total price	Q'ty	Total price	Q'ty	Total price	Q'ty	Total price