STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION
TRENTON, NEW JERSEY 08625

METRIC SPECIFICATIONS FOR LONG HAUL MULTIPLEXED VIDEO (SINGLE MODE FIBER OPTIC CABLE TRANSMISSION SYSTEM)

N.J. Specification No. EBM-LHVIDEO Effective Date: July 1, 2001

New Jersey Department of Transportation Specifications for a digital long haul video transmission system designed to operate on single mode fiber optic cable.

The purpose of these specifications is to describe the minimum acceptable design and operating requirements for this equipment.

GENERAL - I

1-1 General Requirements

The video transmission system shall be designed to pass NTSC (National Television Standards Committee) baseband video for up to sixteen (16) channels to a remote receiver over one (1) single mode fiber. The baseband signal shall comply with RS250C medium haul standards. The system must multiplex the baseband video into a composite digital data stream. The video signal shall not be compressed in any fashion. The output baseband signal must closely match the signal input to the system at the transmitter side.

1-2 Repeater

With the use of a repeater, this signal shall be capable of being regenerated an infinite number of times without any signal quality loss. Transmission equipment utilizing analog transmission schemes shall not be acceptable.

1-3 Redundant Fiber

The system must also have the ability to support the use of a redundant transmission fiber.

1-4 Compatibility

In order to insure maximum similarity and compatibility, all components shall be a standard product line of the same manufacturer.

1-5 Single Mode Fiber and Optical Budgets

The video transmission system shall operate on one single mode fiber. As discussed in Section I-3, a second single mode fiber may optionally be utilized as a redundant backup. The equipment may operate at 1 300 and/or 1 550 nanometers wavelength(s). The transmission equipment must have an optical budget of at least 28 decibels, without the use of repeaters.

1-6 Environment

All video transmission equipment shall operate in the temperature range of 0 °C to +40 °C and a relative humidity of 0 to 95 percent non-condensing. The equipment may be housed in a NEMA 3R outdoor enclosure, with supplemental heating and air conditioning which will maintain the environment within the above range. The manufacturer must supply certification by an independent technical laboratory confirming that the equipment complies with these environmental specifications.

1-7 Testing

The equipment is subject to testing as described in Section IX of this specification.

1-8 Electrical Power

All transmission equipment must operate on standard 120 volt AC electrical service. The equipment shall operate over a voltage range of 105 to 125 volts AC at 60 hertz.

1-9 Mounting

All components shall be configured for mounting in a standard 483 millimeter rack. All necessary hardware for each component shall be supplied with each assembly.

1-10 Components

The long haul video transmission system consists of the following components:

A. NTSC Video to Digital CODEC

B. Digital Video Transmitter

C. Digital Video Receiver

D. Digital to NTSC Video CODEC

E. Redundant Fiber Transmitter

F. Redundant Fiber Receiver

G. Repeater

The special provisions and/or contract drawings shall specify the exact quantities of each component required.

Any of the above components can optionally be combined into a single unit, provided that the functional performance, power, and size restraints comply with that specified for the individual components.

All necessary interconnection cables and other components necessary to provide a fully operational system shall be provided incidentally with the associated component.

1-11 Signal to Noise Ratio

The end to end signal to noise ratio of the system shall exceed 60 decibels, including average digital quantizing effects.

NTSC VIDEO TO DIGITAL CODEC - II

This component translates up to sixteen NTSC baseband video signals into a digital data stream suitable for input into the Digital Video Transmitter. Up to four separate CODEC units can be supplied to reach the sixteen video capacity required.

2-1 BNC Connectors and Patch Cords

The CODEC units shall be supplied with sixteen (16) BNC connectors mounted on the front or rear face plate of the unit. In addition, sixteen BNC patch cords of at least 3 meters in length shall be supplied with each unit.

2-2 Mechanical Dimensions

The total CODEC assemblies shall not exceed 483 by 394 by 203 millimeters.

2-3 Power Requirements

Each CODEC chassis shall include a separate AC power supply and line cord. Total power requirements shall not exceed 150 watts at 115 volts AC.

2-4 Video Compression

The CODEC shall not implement any video compression. The baseband output at the receiver shall closely match the NTSC input video at the CODEC. The unit shall provide broadcast quality reproduction of the video image which meets or exceeds RS250C medium haul specifications.

DIGITAL VIDEO TRANSMITTER-III

The video transmitter accepts a digitized video input stream from the CODEC unit(s) specified in Section II.

3-1 Input Ports

Sufficient input ports shall exist on the transmitter to support the number of CODEC units required to satisfy the sixteen (16) channel requirement. The unit shall be supplied with the necessary interconnect cables to fully interface with the CODEC units.

3-2 Mechanical Requirements

The transmitter shall not exceed 483 by 533 by 51 millimeters. If a transmitter is provided with integrated CODECs, the entire assembly shall not exceed 483 by 394 by 254 millimeters.

3-3 Power Requirements

The transmitter shall include a separate AC power supply and line cord. Total power requirements shall not exceed 150 watts at 115 volts AC.

3-4 Fiber-Optic Connections

The transmitter shall include one ST connector for the primary transmission fiber. If the redundancy option is to be provided, a second ST connector for the alternate fiber shall be provided. A 1.8 meter ST patchcord shall be provided to link the transmitter to a fiber-optic patch panel.

DIGITAL VIDEO TRANSMITTER - IV

The video receiver is the counterpart to the video transmitter defined in Section III. The unit receives a digitized optical signal and converts it into a digitized electrical signal.

4-1 Output Ports

Sufficient output ports shall exist on the receiver to support the number of CODEC units required to satisfy the sixteen (16) channel requirement. The unit shall be supplied with the necessary interconnect cables to fully connect to the CODEC units.

4-2 Mechanical Requirements

The receiver shall not exceed 483 by 533 by 51 millimeters. If a receiver is provided with integrated CODECs, the entire assembly shall not exceed 483 by 394 by 254 millimeters.

4-3 Power Requirements

The receiver shall include a separate AC power supply and line cord. Total power requirements shall not exceed 150 watts at 115 volts AC.

4-4 Fiber-Optic Connections

The transmitter shall include one ST connector for the primary reception fiber. If the redundancy option is to be provided, a second ST connector for the alternate fiber shall

be provided. A 1.8 meter ST patchcord shall be provided to link the receiver to a fiber-optic patch panel.

DIGITAL TO NTSC VIDEO CODEC - V

This component is the counterpart to the CODEC unit specified in Section II. The unit accepts a digitized electrical bit stream from the receiver specified in Section IV and converts the signal back into the component sixteen channel NTSC baseband video signal. Up to four separate CODEC units can be supplied to reach the sixteen video capacity required.

5-1 BNC Connectors and Patch Cords

The CODEC(s) units shall be supplied with sixteen (16) BNC connectors mounted on the front or rear face plate of the unit.

5-2 Mechanical Dimensions

The total CODEC assemblies shall not exceed 483 by 394 by 203 millimeters.

5-3 Power Requirements

Each CODEC chassis shall include a separate AC power supply and line cord. Total power requirements shall not exceed 150 watts at 115 volts AC.

REDUNDANT FIBER TRANSMITTER - VI

As an option, some assemblies may require a redundant fiber backup system. The redundant component of the transmitter shall transmit the outbound digitized light signal out to dual ST connectors. This facility can be incorporated into the basic transmitter or can be provided as a separate unit containing all necessary interface patchcords. The 28 decibels optical budget on either fiber must be maintained.

REDUNDANT FIBER RECEIVER - VII

As an option, some assemblies may require a redundant fiber backup system. The redundant component of the receiver shall automatically switch to a signal being received on a backup ST connector, if one is present, upon loss of the primary system. When the primary signal is restored, the switch shall automatically return to the primary channel. Indicators on the front panel of the unit must be provided to indicate which channel is in operation. This capability can be incorporated into the basic receiver or can be provided as a separate unit containing all necessary interface patchcords.

REPEATER - VIII

For installations requiring an optical budget of 28 decibels, a repeater unit shall be required. The repeater shall receive a digitized lightwave signal from the transmitter defined in Section III. The signal shall be converted to electrical and then re-transmitted as specified for the unit in Section IV. No degradation of the signal shall occur as a result of this process.

8-1 Fiber-Optic Connections

The unit shall be equipped with an input (receiver) and output (transmitter) ST connectors. The unit shall be supplied with 3 meter ST patchcords to allow the package to be connected to a fiber-optic patch panel.

8-2 Mechanical Requirements

The repeater shall not exceed 483 by 394 by 102 millimeters.

8-3 Power Requirements

The receiver shall include a separate AC power supply and line cord. Total power requirements shall not exceed 300 watts at 115 volts AC.

TESTING - IX

All equipment defined in this specification shall be subject to factory testing as subsequently described. The factory test shall demonstrate or provide confirmation that all of the equipment operates over the specified environmental range for each component. In addition, the operation of the video transmitter, receiver, and repeater, shall be demonstrated. The factory test procedure shall demonstrate that digitized video can be transferred between two multiplexer nodes over the optical budget required in the specifications. In addition, the test shall demonstrate that the redundant fiber capability is operational.

The Supplier shall be responsible for submitting a test plan which has been designed to exercise and monitor the equipment for the purpose of determining compliance with the specifications.

TRAINING - X

Prior to the acceptance of the first unit of each type, training shall be provided for the Department's engineering, maintenance and operations staff, at a facility provided by the Department. The training shall include all material and manuals required for each participant. The training shall be as follows:

10-1 Maintenance Training

The training shall be provided for a minimum of 40 hours for at least five (5) personnel with an electronics background. The training shall include operation instructions, theory of operation, circuit description, field adjustments, preventive maintenance procedures, troubleshooting and repair of all components.

10-2 Engineering Training

The training shall be provided for a minimum of 16 hours for at least twenty (20) engineering and operations personnel. The training shall include a complete demonstration of the operation and capabilities of the equipment. This session should

include a complete review of any field adjustments or calibration of the transmission equipment which may be necessary for optimum performance and should stress day-to-day operation and isolation of problems down to the unit level. For example, procedures should be discussed of identifying a faulty module in the field, as opposed to board level repairs covered in Subsection 10-1.

INSTRUCTIONS AND GUARANTEES - XI

11-1 One set of complete schematics and operations/maintenance manuals of each component shall be supplied with each assembly furnished. Maintenance manuals shall include complete sub-component parts listing.

11-2 No changes or substitutions in these requirements will be acceptable unless authorized in writing. Inquiries regarding this specification shall be addressed to the Manager, Office of ITS Engineering, New Jersey Department of Transportation, P.O. Box 613, 1035 Parkway Avenue, Trenton, New Jersey 08625.

11-3 All components shall carry a two-year guarantee from the date of acceptance against any imperfections in workmanship or materials.

11-4 The manufacturer agrees, upon the request of the Manager, Office of ITS Engineering to deliver to the Office, a sample of each assembly to be supplied in compliance with these specifications for inspection and test before acceptance. After completion of the test, the sample shall be returned.

11-5 The supplier shall furnish any and all equipment which they deem necessary for safe and reliable field operation of the modems as part of the quoted price for the specified equipment.

11-6 All components furnished under this specification must be current production equipment and of recent manufacturer, identical models of which are in field operation in not less than five locations in the United States or Canada. Untried or prototype units shall not be considered for acceptance.

11-7 All major components shall be identified with a metal plate containing the serial number with a bar code identification.

11-8 Any repairs made by a manufacturer or representative shall be documented and returned with units when warranty repaired. This documentation shall include an explanation of the exact repairs made and identification of parts replaced by part number and circuit number. All warranty repairs must be completed within thirty days of delivery of the equipment to the designated repair depot.