METRIC
MIL-R-24720(NAVY)
7 July 1989

MILITARY SPECIFICATION

RECEIVERS, DIGITAL, FIBER OPTIC, SHIPBOARD (METRIC), GENERAL SPECIFICATION FOR

This specification is approved for use by the Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for fiber optic digital receivers intended for Naval shipboard systems. The receiver accepts a digital optical signal through the input optical interface and converts it to a digital electrical output signal. The receiver amplifies and conditions this electrical signal, which is compatible with the specified output logic interface. The receiver does not alter the encoding format of the incoming signal.

1.2 Classification. Receivers are classified as specified in 1.2.1 through 1.2.3 (see 6.2).

1.2.1 Wavelength class. The wavelength class designation indicates the nominal wavelength of the input optical signals.

(a) Class A - 1.10 through 1.60 micrometers (μm).

1.2.2 Data signaling rate (DSR). The maximum allowable data rate of the receiver falls within one of the following ranges based upon a baseband non-return to zero (NRZ) line code:

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6026

(a) Range 1 - from 0 to less than 20 megabits per second (Mbps).
(b) Range 2 - from 20 to less than 500 Mbps.
(c) Range 3 - from 500 Mbps to less than 2 gigabits per second (Gbps).
(d) Range 4 - Greater than 2 Gbps.

1.2.3 Style. The style designation defines the style of packaging.

(a) Style A - Dual inline package using pigtail.
(b) Style B - Dual inline package connectorized.
(c) Style C - Surface mount package using pigtail.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-R-24720/1 - Receiver, Digital, Fiber Optic, Shipboard, 0.5 to 16 Mbps (Manchester Encoded). (Metric)
MIL-M-38510 - Microcircuits, General Specification for.
MIL-M-55565 - Microcircuits, Packaging of.

STANDARDS

MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-454 - Standard General Requirements for Electronic Equipment.
MIL-STD-461 - Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference.
MIL-STD-462 - Electromagnetic Interference Characteristics, Measurement of.
MIL-STD-810 - Environmental Test Methods and Engineering Guidelines.
MIL-STD-883 - Test Methods and Procedures for Microelectronics.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)
455-6 - Cable Retention Test Procedure for Fiber Optic Cable Interconnecting Devices.
455-36 - Twist Test for Fiber Optic Connecting Devices.

(Application for copies should be addressed to Electronic Industries Association, 2001 Eye Street, NW, Washington, DC 20006.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the individual item specification sheet, the latter shall govern.

3.2 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4.4.

3.3 Reliability. Receiver reliability shall be expressed as mean time to failure (MTTF), in hours of operation, and shall be as specified (see 3.1). Reliability shall be determined by procedures specified in 4.6.1. Receiver failure criteria shall be as specified (see 3.1). The number of test units shall be as specified (see 6.2).

3.3.1 Burn-in (see 4.3.1.2). All units shall meet the requirements of MIL-STD-883, method 1015.

3.4 Materials. Receivers shall be constructed of materials that will not produce toxic, corrosive, or explosive by-products. Materials shall not have adverse effects upon operational or maintenance personnel under all operational and environmental conditions, nor cause degradation of equipment performance (see 4.6.2 and 6.3).

3.4.1 Recovered materials. Unless otherwise specified, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using raw materials produced from recovered bulk materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of partially processed, assembled, or rebuilt products is allowed under this specification.

3.5 Design and construction (see 4.6.3). The receiver shall be of the design and construction as specified (see 3.1).

3.5.1 Fiber optic pigtail. Receiver styles A and C shall be supplied with an optical fiber or optical cable pigtail (see 6.6.11 and 6.6.10) as specified (see 3.1 and 6.2). One end of the pigtail shall be permanently mounted in the receiver case, and the mounting construction may provide strain relief for the pigtail in order to meet the requirements of 3.10. The pigtail length shall be not less than 1 meter. No metal components shall be used within the pigtail, except for mounting to the receiver case or termination connector.

3.5.2 Fiber optic connector. Receiver style B shall be supplied with a fiber optic connector as specified (see 3.1).

3.5.3 Case (see 4.6.3.1). The receiver shall be hermetically sealed in a metal case. No adhesive or polymeric materials shall be used for case lid attachment, sealing, or repair; only welding or soldering is permitted. All adhesive materials shall meet the requirements of MIL-STD-883, method 5011. Dimensions, pinouts, and pinout functions shall be as specified (see 3.1). The number of pins on each receiver shall be one of the following: 14, 16, 18, 20, 24, as specified (see 3.1). The receiver case shall be electrically grounded, connected to a voltage pin, or electrically isolated (that is, floating) as specified (see 3.1).

3.5.4 Terminals. The terminals shall meet the requirements as specified in 3.5.4.1 and 3.5.4.2.

3.5.4.1 Terminal strength (see 4.6.3.2). The electrical terminals shall reveal no breakage, loosening, or relative motion between the electrical terminals and the case of the receiver. The terminals shall meet the requirements as specified (see 3.1).

3.5.4.2 Solderability (see 4.6.3.3). Terminal solderability shall meet the temperature and time requirements as specified in MIL-STD-883, method 2003.

3.6 Maintainability. The individual receivers are regarded as lowest replaceable units and are not repairable, nor do they require maintenance.

3.7 Performance requirements. The receiver shall meet all performance requirements of 3.7.1 and 3.7.2 specified herein when an optical signal with characteristics as specified in 4.6.4.1.2 is input to the receiver.

3.7.1 Output electrical properties.

3.7.1.1 Logic family compatibility (see 4.6.4.2). The logic interface of the receiver shall be as specified (see 3.1).

3.7.1.2 Drive capability (see 4.6.4.2). The receiver shall be capable of driving the number of electrical logic interfaces specified (see 3.1).

3.7.1.3 Output short circuit protection (see 4.6.4.3). The receiver shall not experience any degradation of performance following application and removal of an electrical short between any required output and logic ground or between any output and supply voltage.

3.7.2 Optical-electrical properties.

3.7.2.1 Input-to-output signal logic phase (see 4.6.4.4). Unless otherwise specified (see 3.1), the input-to-output signal logic phase shall be non-inverting.

3.7.2.2 Bit error ratio (BER) (see 4.6.4.5, 6.6.2). The BER shall be not greater than one in one billion (10^{-9}).

3.7.2.3 Pulse-width distortion (see 4.6.4.4, 6.6.12). The allowable pulse-width distortion of the receiver shall be as specified (see 3.1).

3.7.2.4 Pulse jitter (see 4.6.4.5, 6.6.9). The maximum allowable pulse jitter shall be as specified (see 3.1).

3.7.2.5 Signal propagation delay (see 4.6.4.4, 6.6.14). The maximum allowable signal delay from the input to the output of the receiver shall be as specified (see 3.1).

3.7.2.6 Acquisition time (see 4.6.4.6, 6.6.1). The acquisition time shall be as specified (see 3.1).

3.7.3 Power supply voltage and current (see 4.6.4.7). The receiver shall operate with one or more of the following nominal direct current (dc) supply voltages: plus and/or minus 5 volts, plus and/or minus 12 volts, plus and/or minus 18 volts, plus and/or minus 24 volts, or plus and/or minus 28 volts as specified (see 3.1). The receiver shall meet all electrical and optical performance requirements specified herein while operating with specified power supply voltages, currents, and their tolerances. The total receiver power consumption shall not exceed the level as specified (see 3.1).

3.8 Safety. Receiver design and operation shall conform to the safety standards of MIL-STD-454, requirement 1.

3.9 Environmental requirements. The receiver shall meet all performance requirements under the following environmental conditions and as specified (see 3.1).

3.9.1 Environmental temperature extremes (see 4.6.5.1). The receiver shall meet the performance requirements of 3.7.1 and 3.7.2 at the operating temperature extremes. The receiver environmental temperature range shall be as specified (see 3.1), in accordance with the ranges in table I. The receiver shall be visually inspected, and there shall be no physical damage (see 4.6.3.4).

TABLE I. Environmental temperature ranges.

Temperature range	Operating (°C)	Nonoperating (°C)
1	0 to +85	-62 to +85
2	-28 to +85	-62 to +85
3	-54 to +85	-62 to +85
4	0 to +125	-62 to +125
5	-28 to +125	-62 to +125
6	-54 to +125	-62 to +125

3.9.2 Thermal shock (see 4.6.5.2). The test requirements shall be met using the nonoperating temperature range specified (see 3.9.1), and shall have no cracks, breaks, or other physical damage (see 4.6.3.4).

3.9.3 Impact shock (4.6.5.3). The receiver shall not develop cracks, chips, warping, bending, or other degradation (see 4.6.3.4).

3.9.4 Vibration (see 4.6.5.4). The receiver shall not develop cracks, chips, warping, bending, or other degradation (see 4.6.3.4).

3.9.5 Salt spray (see 4.6.5.5). The receiver shall meet the requirements of MIL-STD-883, method 1009.

3.9.6 Explosive atmosphere (see 4.6.5.6). The receiver shall safely operate in a flammable atmosphere without causing an explosion.

3.9.7 Fungus resistance (see 4.6.5.7). The receiver shall meet the requirements of MIL-STD-454, requirement 4. Materials not identified in MIL-STD-454, requirement 4, as fungus inert, shall meet the requirements of grade I of MIL-STD-810, method 508.

3.9.8 Environmental screening (see 4.3.1.3, 4.3.1.4). The receiver shall be environmentally screened by random vibration (see 4.3.1.3) and by temperature cycling (see 4.3.1.4).

3.10 Mechanical requirements (see 4.6.6).

3.10.1 Cable pull-out force (see 4.6.6.1). The minimum cable-to-receiver pull-out strength shall be a minimum of 50 percent of the specified tensile strength of the attached cable or 100 newtons, whichever is less. There shall be no cable jacket damage, cable clamp failure, cable-to-receiver seal damage, distortion or bending of receiver parts, or cable disengagement from the clamp (see 4.6.3.4).

3.10.2 Twist (see 4.6.6.2). Cable-to-receiver seals shall meet the requirements of 3.17.

3.10.3 Connector pull-out force (see 4.6.6.3). The minimum connector-to-receiver pull-out strength shall be one-half of the specified tensile strength of the attached connector or 100 newtons, whichever is less. There shall be no connector-to-receiver seal damage, distortion or bending of receiver parts, or connector disengagement from the receiver (see 4.6.3.4).

3.10.4 Fiber dynamic strength (see 4.6.6.4). The minimum fiber dynamic strength shall be 50 percent of the specified proof strength of the attached fiber. There shall be no fiber-to-receiver seal damage or distortion or bending of receiver parts (see 4.6.3.4).

3.11 Nuclear radiation resistance. The performance requirements of 3.7.2 shall be met when tested in accordance with 4.6.7, unless otherwise specified (see 3.1).

3.12 Electromagnetic effects (see 4.6.8). The receiver shall meet the conducted and radiated emission requirements, and the conducted and radiated susceptibility requirements of MIL-STD-461, part 5, as specified (see 3.1). Above-deck or below-deck application shall be as specified (see 3.1).

3.13 Electrostatic discharge sensitivity (ESDS) (see 4.6.9). The receiver shall meet the requirements of 3.7, and the requirements for ESDS class 2 devices in MIL-STD-883.

3.14 Dimensions (see 4.6.10). The receiver shall be enclosed in a physical envelope with detailed dimensions as specified (see 3.1).

3.15 External finish (see 4.6.11). The receiver case finish shall comply with the package finish (external finish) requirements of MIL-M-38510. Unless otherwise specified (see 3.1), the pins shall be tin plate finished in accordance with MIL-M-38510.

3.16 Identification marking (see 4.6.12). Unless otherwise specified (see 3.1), the receiver shall be marked in accordance with MIL-M-38510. The assigned part number shall use the numbering schemes specified (see 6.8).

3.17 Workmanship. The receiver shall meet the requirements specified in MIL-STD-883 (see 4.3.1.1 and 4.6.3.4).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections. The inspections herein are classified as follows:

(a) Screening inspection (see 4.3).
(b) First article inspection (see 4.4).
(c) Quality conformance inspection (see 4.5).

4.3 Screening inspection. Each receiver to be delivered or submitted for inspection shall have been subjected to, and passed, all of the screening tests of table II in the order shown. Receivers with cable pigtails may be subjected to these tests before the pigtail exterior is installed over the coated fiber. For those receivers with pigtails to be cabled after screening, a temporary strain relief may be installed at the receiver/pigtail interface for the screening tests.

TABLE II. Screening inspection.

Inspection	Requirement	Test
Internal visual	3.17	4.3.1.1
Burn-in	3.3.1	4.3.1.2
Random vibration	3.9.8	4.3.1.3
Temperature cycling	3.9.8	4.3.1.4
External visual	3.17	4.6.3.4
Hermetic seal	3.5.3	4.6.3.1

4.3.1 Inspection conditions. Inspection conditions shall be met as required in the applicable test method for each inspection parameter, and as specified (see 3.1).

4.3.1.1 Internal visual (see 3.17). Internal visual inspection (pre-cap) shall be performed in accordance with MIL-STD-883, method 2017.

4.3.1.2 Burn-in (see 3.3.1). Burn-in testing shall be in accordance with MIL-STD-883, method 1015. Unless otherwise specified (see 3.1), all receivers shall be tested for a minimum of 160 hours at the maximum temperature specified in table I. Maximum power supply voltage and maximum optical power level shall be applied to the receiver during the test (see 3.7.3 and 4.6.4.1.2).

4.3.1.3 Random vibration (see 3.9.8). Random vibration testing shall be in accordance with MIL-STD-883, method 2026, condition II, test condition C. No power shall be applied during this test.

4.3.1.4 Temperature cycling (see 3.9.8). Temperature cycling testing shall be in accordance with MIL-STD-883, method 1010, using test condition B. No power shall be applied during this test.

4.4 First article inspection (see 3.2). Inspection shall include the tests of groups I, II, III, and IV of table III, as specified (see 6.2 and 6.3). Each sample unit shall successfully pass all screening tests (see 4.3) prior to performing group I tests. All sample units used for groups II, III, and IV testing shall have successfully passed group I testing. Tests within a group, using the same sample unit, shall be performed in the sequence shown in table III.

4.4.1 Samples. Unless otherwise specified (see 6.2), the number of sample units to be subjected to inspection shall be seven receivers, not including those required for reliability testing (see 3.3). The samples shall be taken at random from a production run and shall be produced with equipment and procedures intended for production of final units by the manufacturer. For receivers with cable pigtails, those units to be subjected to group II tests may have the pigtail exterior installed after the hermetic seal test. For those receivers with pigtails to be cabled after hermetic seal testing, a temporary strain relief may be installed at the receiver/pigtail interface for those tests prior to hermetic seal testing.

TABLE III. First article inspection.

Inspection	Requirement	Test	Sample size (see 4.4.1)
Group I			
Identification marking	3.16	4.6.12	1/
Logic family compatibility	3.7.1.1	4.6.4.2	1/
Drive capability	3.7.1.2	4.6.4.2	1/
Output short circuit protection	3.7.1.3	4.6.4.3	1/
Input-to-output signal logic phase	3.7.2.1	4.6.4.4	1/
Bit error ratio (BER)	3.7.2.2	4.6.4.5	1/
Pulse-width distortion	3.7.2.3	4.6.4.4	1/
Pulse jitter	3.7.2.4	4.6.4.5	1/
Signal propagation delay	3.7.2.5	4.6.4.4	1/
Acquisition time	3.7.2.6	4.6.4.6	1/
Power supply voltage and current	3.7.3	4.6.4.7	1/
Dimensions	3.14	4.6.10	1/
External finish	3.15	4.6.11	1/
Workmanship	3.17	4.6.3.4	1/
Temperature extremes	3.9.1	4.6.5.1	1/
Group II			
Terminal strength	3.5.4.1	4.6.3.2	1
Solderability	3.5.4.2	4.6.3.3	2/
Thermal shock	3.9.2	4.6.5.2	1
Impact shock	3.9.3	4.6.5.3	3/
Vibration	3.9.4	4.6.5.4	3/

See footnotes at end of table.

TABLE III. First article inspection - Continued.

Inspection	Requirement	Test	Sample size (see 4.4.1)
Salt spray	3.9.5	4.6.5.5	3/
Mechanical requirements	3.10	4.6.6	3/
Hermetic seal	3.5.3	4.6.3.1	3/
Explosive atmosphere	3.9.6	4.6.5.6	3/
Fungus resistance	3.9.7	4.6.5.7	3/
Group III			
Electromagnetic effects	3.12	4.6.8	1
Electrostatic discharge sensitivity	3.13	4.6.9	4/
Group IV			
Reliability	3.3	4.6.1	see 3.3
Nuclear radiation resistance	3.11	4.6.7	4

1/ All samples shall be subjected to group I inspections.
2/ The same sample shall be used as in the terminal strength inspection.
3/ The same sample shall be used as in the thermal shock inspection.
4/ The same sample shall be used as in the electromagnetic effects inspection.

4.5 Quality conformance inspection. Quality conformance inspection shall include the requirements of groups A, B, and C in tables IV, V, and VI, as specified (see 6.2). Each receiver shall successfully pass all screening tests (see 4.3) prior to performing group A inspections. Group B samples must have successfully completed group A inspections. Group C samples must have successfully completed group A and B inspections.

4.5.1 Group A inspection. The group A inspections shall be nondestructive tests, consisting of visual, mechanical, and performance tests as provided in table IV and as specified (see 3.1). Each receiver shall comply with the group A requirements prior to delivery or prior to group B and C testing, and shall be tested in the order shown.

TABLE IV. Group A inspection.

Inspection	Requirement	Test
Identification marking	3.16	4.6.12
Logic family compatibility	3.7.1.1	4.6.4.2
Drive capability	3.7.1.2	4.6.4.2
Output short circuit protection	3.7.1.3	4.6.4.3
Input-to-output signal logic	3.7.2.1	4.6.4.4
Bit error ratio (BER)	3.7.2.2	4.6.4.5
Pulse-width distortion	3.7.2.3	4.6.4.4
Pulse jitter	3.7.2.4	4.6.4.5
Signal propagation delay	3.7.2.5	4.6.4.4
Acquisition time	3.7.2.6	4.6.4.6
Power supply voltage and current	3.7.3	4.6.4.7
Temperature extremes	3.9.1	4.6.5.1

4.5.2 Group B inspection. The group B inspections shall be the nondestructive tests in table V and as specified (see 3.1).

4.5.2.1 Inspection sequence. For receivers with cable pigtails, those units to be subjected to group B inspection may have the pigtail exterior installed after the hermetic seal test. For those receivers, a temporary strain relief may be installed at the receiver interface for all tests prior to hermetic seal testing. Group B inspections shall be tested in the sequence shown.

TABLE V. Group B inspection.

Inspection	Requirement	Test
Impact shock	3.9.3	4.6.5.3
Thermal shock	3.9.2	4.6.5.2
Fiber dynamic strength (styles A and C only; see 1.2.3)	3.10.4	4.6.6.4
Hermetic seal	3.5.3	4.6.3.1
Cable pull-out force (for cable pigtailed units only)	3.10.1	4.6.6.1

4.5.3 Group C inspection. The group C inspections shall consist of the tests in table VI and as specified (see 3.1). These tests may be destructive to sample parts. Unless otherwise specified (see 6.2), samples for each test shall consist of subsets of group B test samples. For receivers with cable pigtails, the cable exterior may be removed prior to hermetic seal testing.

TABLE VI. Group C inspection.

Inspection	Requirements	Test
Reliability	3.3	4.6.1
Nuclear radiation resistance	3.11	4.6.7
Terminal strength	3.5.4.1	4.6.3.2
Twist (for cable pigtailed units only)	3.10.2	4.6.6.2
Connector pull-out force (for connectorized units only)	3.10.3	4.6.6.3
Electromagnetic effects	3.12	4.6.8
Electrostatic discharge sensitivity	3.13	4.6.9
Vibration	3.9.4	4.6.5.4
Hermetic seal	3.5.3	4.6.3.1
Explosive atmosphere	3.9.6	4.6.5.6
Solderability	3.5.4.2	4.6.3.3
Fungus resistance	3.9.7	4.6.5.7

4.6 Methods of inspection.

4.6.1 Reliability (see 3.3). The receiver failure rate shall be determined for class B devices (as defined in MIL-STD-883) using MIL-STD-883, method 1016, except that the minimum ambient temperature shall be 150 degrees Celsius (°C). Input optical signal corresponding to the characteristics specified in 4.6.4.1.2 at the minimum pulse width and maximum duty cycle shall be used. The power supply shall be set to the maximum specified in 3.7.3. Proper device operation shall be determined by verifying the bit error ratio using the test specified in 4.6.4.5.

4.6.2 Materials (see 3.4). Materials inspection shall consist of determination that the materials used in fabricating the receivers are in accordance with 3.4.

4.6.3 Design and construction inspections.

4.6.3.1 Hermetic seal (see 3.5.3). The receiver shall be tested and accepted in accordance with MIL-STD-883, method 1014, methods A1 and C. For receivers with cable pigtails, see 4.3, 4.4.1, 4.5.2.1, and 4.5.3, as applicable.

4.6.3.2 Terminal strength (see 3.5.4.1). The receiver electrical terminals shall be tested and accepted in accordance with MIL-STD-883, method 2004. Test condition A shall be used for tension; condition B1 shall be used for stress; and condition B2 shall be used for pin fatigue.

4.6.3.3 Solderability (see 3.5.4.2). The receiver electrical pins shall be tested and accepted in accordance with MIL-STD-883, method 2003.

4.6.3.4 Visual inspection (see 3.17). Receivers shall be inspected and accepted for workmanship in accordance with MIL-STD-883, method 2009.

4.6.4 Performance tests.

4.6.4.1 General. The performance tests for the receiver shall be performed with the receiver having not less than 1 meter of fiber connected. For a style B receiver (see 1.2.3), the connector and the fiber or cable comprising the pigtail shall meet the requirements as specified (see 3.1). Measurements shall be made using an optical signal corresponding to the characteristics specified in 4.6.4.1.2. The optical signal shall be input into the pigtail using the appropriate launch conditions. For multimode fiber, a 70/70 or 70/100 restricted launch shall be used. For single-mode fiber, the pigtail shall be wrapped one turn around a 30-millimeter (mm) diameter mandrel.

4.6.4.1.1 Standard test conditions. Unless otherwise specified (see 3.1), the following ambient test conditions shall be used:

(a) Temperature: 25°C + 3, -5°C.
(b) Relative humidity: 50 ± 30 percent.
(c) Atmospheric pressure: 725 ± 75 mm of mercury.

4.6.4.1.2 Standard optical input characteristics. The characteristics of the optical input signal to the receiver shall be as specified (see 3.1). These characteristics include the following:

(a) Optical power spectrum (peak wavelength and spectral width (see 6.6.15)).
(b) Optical power levels (maximum and minimum).
(c) Rise and fall times (maximum) (see 6.6.13).
(d) Pulse width (maximum and minimum).
(e) Duty cycle (maximum and minimum).
(f) Extinction ratio (minimum) (see 6.6.5).
(g) Overshoot and undershoot (maximum).

4.6.4.2 Logic family and drive capability (see 3.7.1.1 and 3.7.1.2). This test shall verify that the electrical output of the receiver is compatible with the logic family specified and that the receiver is capable of driving the specified number of logic interfaces.

The test set-up is shown on figure 1:

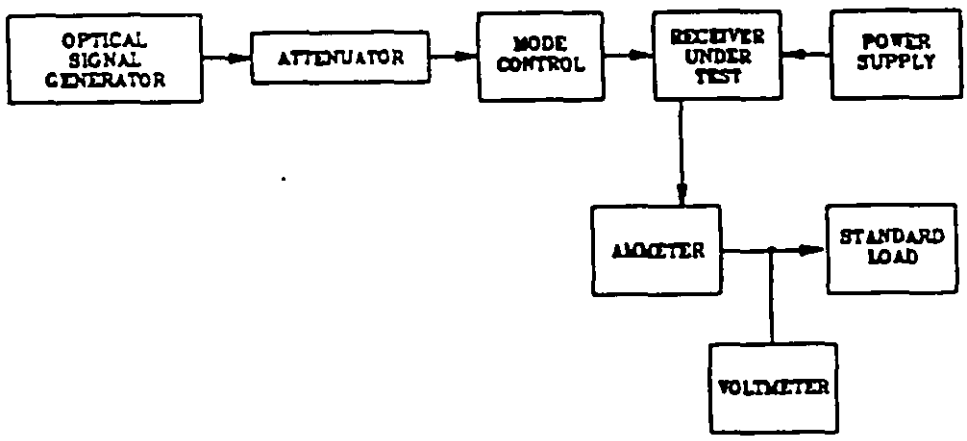


FIGURE 1. Logic family and drive capability.

The test procedure shall be as follows:

1. Standard ambient test conditions shall be as specified in 4.6.4.1.1.
2. The receiver shall be connected to the apparatus that provides the specified conditions.
3. The power supply voltage shall be set to the minimum magnitude specified (see 3.7.3).

4. The optical signal generator, in conjunction with a variable optical attenuator, shall reproduce the characteristics of the optical input signal described in 4.6.4.1.2.
5. The input shall be a square wave optical signal to the receiver. An electrical load shall be connected that represents worst-case fan-out conditions, as specified. Any other test signals are specified (see 3.1).
6. Perform the test and verify that the output of the receiver conforms to the logic family specified. Appropriate measurement devices for current and voltage shall be used.
7. Verify the requirements of 3.7.1.1 and 3.7.1.2.
8. The power supply voltage shall be set to the maximum magnitude specified (see 3.7.3). Repeat steps 5 through 7.
9. The power supply voltage shall be set to the nominal specified magnitude (see 3.7.3). Repeat steps 5 through 7.

4.6.4.3 Output short circuit protection (see 3.7.1.3). The output short circuit protection shall be verified in accordance with MIL-STD-883, method 3011.

4.6.4.4 Optical-electrical properties. This test shall verify that the input-to-output logic phase (see 3.7.2.1), the pulse-width distortion (see 3.7.2.3), and the signal propagation delay (see 3.7.2.5) are as specified.

The test set-up shall be as shown on figure 2:

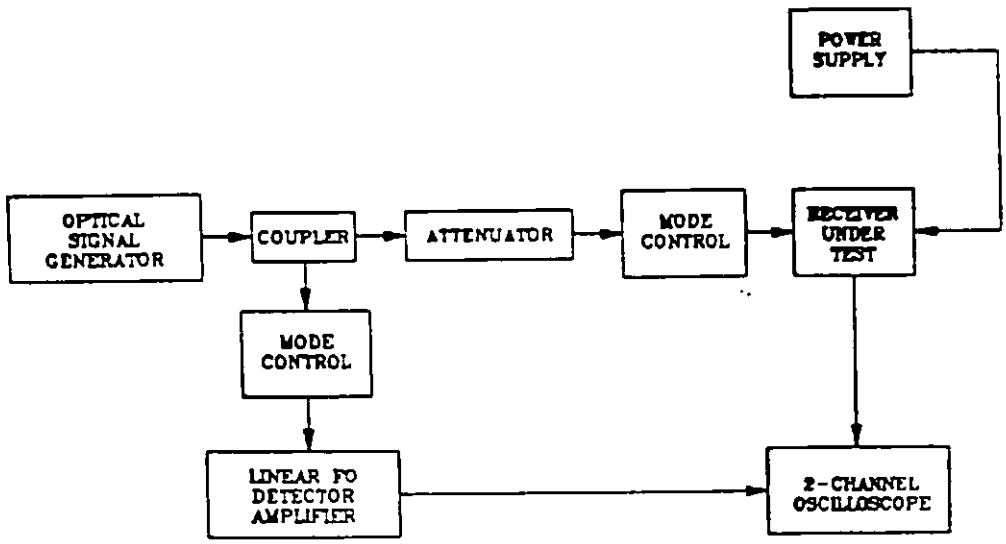


FIGURE 2. Optical-electrical properties test set-up.

The test procedure shall be as follows:

1. Standard ambient test conditions shall be as specified in 4.6.4.1.1.
2. The receiver shall be connected to the apparatus that provides the specified conditions.
3. The power supply voltage shall be set to the minimum magnitude specified (see 3.7.3).
4. The optical signal generator, in conjunction with a variable optical attenuator, shall accurately reproduce the characteristics of the optical input signal described in 4.6.4.1.2.
5. The linear fiber optic detector/amplifier (linear to one percent over measurement range) and oscilloscope shall be selected to be compatible with the data signaling rate (DSR) of the receiver. The composite rise and fall times and the overshoot and undershoot of the test equipment shall not cause more than three percent inaccuracy of measurements. Alternatively, the resultant measurements shall be corrected for the effects of the measuring equipment.
6. Unless otherwise specified (see 3.1), the input signal shall be at the maximum specified optical power level with a pulse width of sufficient duration to eliminate any ambiguity from the measurement. Ensure that a steady state output has been reached. Other test signals shall be as specified (see 3.1).
7. Observe the output to input phase. An input binary HIGH should remain a binary HIGH at the output. An input LOW should remain LOW at the output. There shall be no logic inversion from input-to-output.
8. Unless otherwise specified (see 3.1), the signal propagation delay shall be measured using the procedure provided in the appendix to this specification.
9. Unless otherwise specified (see 3.1), optical input signals shall be at the minimum specified pulse width with a 50 percent duty cycle. Measure the input and output pulse widths. Calculate the pulse-width distortion as the absolute value of the difference between the input and output pulse width when measured at the full-width half-maximum signal level point.
10. Using the attenuator, reduce the input signal to the minimum specified optical input power level.
11. Repeat steps 7, 8, and 9 to measure the signal propagation delay and pulse-width distortion.
12. Verify the requirements of 3.7.2.1, 3.7.2.3, and 3.7.2.5.
13. Set the power supply voltage to the maximum specified magnitude (see 3.7.3). Repeat steps 6 through 12.
14. Set the power supply voltage to the nominal specified magnitude (see 3.7.3). Repeat steps 6 through 12.

4.6.4.5 Bit error ratio (BER) and pulse jitter (see 3.7.2.2 and 3.7.2.4). BER and pulse jitter shall be as specified herein and the applicable specification sheet using the specified minimum optical power level and the specified maximum optical power level.

The test set-up shall be shown on figure 3:

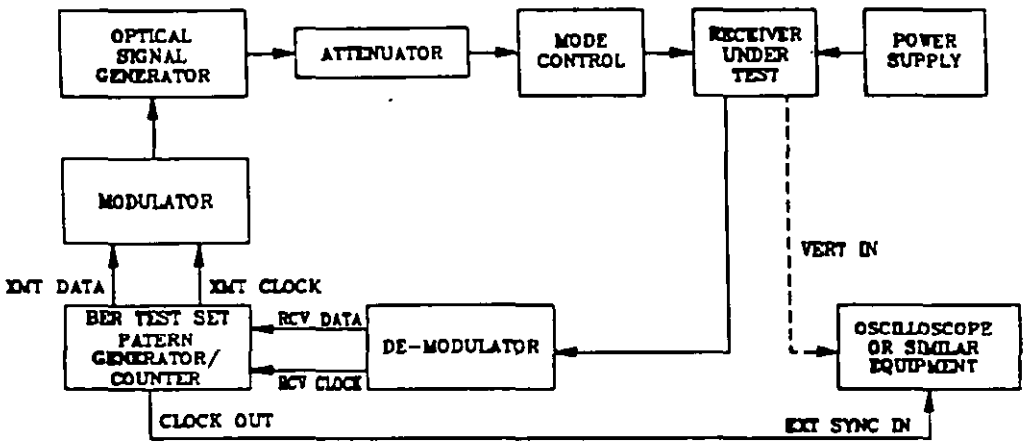


FIGURE 3. BER and pulse jitter test set-up.

The test procedure shall be as follows:

1. Standard ambient test conditions shall be as specified in 4.6.4.1.1.
2. The receiver shall be connected to the apparatus that provides the specified conditions.
3. The power supply voltage shall be set to the minimum magnitude specified (see 3.7.3).
4. The optical signal generator, in conjunction with a variable optical attenuator, shall reproduce the characteristics of the optical input signal described in 4.6.4.1.2. The attenuator shall have sufficient range, resolution, and calibration accuracy at the specified wavelength for an accurate evaluation of the BER.
5. The BER test set transmits a pseudo random-bit sequence (PRBS) of light pulses; receiving the electronic pulse pattern provided by the receiver, analyzes the pattern for errors on a bit-by-bit basis, and displays the number of erroneous bits and the number of total bits analyzed. The clock rate of the BER test set shall be that which results in an output sequence from the optical signal generator containing a minimum pulse width required in the receiver specification.
6. The modulator converts the PRBS output from the BER test set to a format as required by the receiver specification. The demodulator reconverts the receiver output to recover the original format as input to the modulator.
7. The PRBS length shall be as specified (see 3.1). Using the attenuator, set the optical power to the maximum specified optical power level. Other test signals shall be as specified (see 3.1).
8. Determine the BER.
9. Ensure that the connections to the oscilloscope are as shown in the test set-up diagram. Set the oscilloscope sync-source selector to external. Set the horizontal sweep speed to maximize the trace width in the following jitter measurement. Using the PRBS pattern, display an eye pattern on the oscilloscope. Jitter can be measured by the extent of eye closure along a horizontal axis at the point where it crosses the

axis. Jitter is the width of the trace along a horizontal axis at the point where it crosses the axis. The axis is chosen so that it penetrates the trace at the point of minimum trace width (see figure 4). Measure the results.

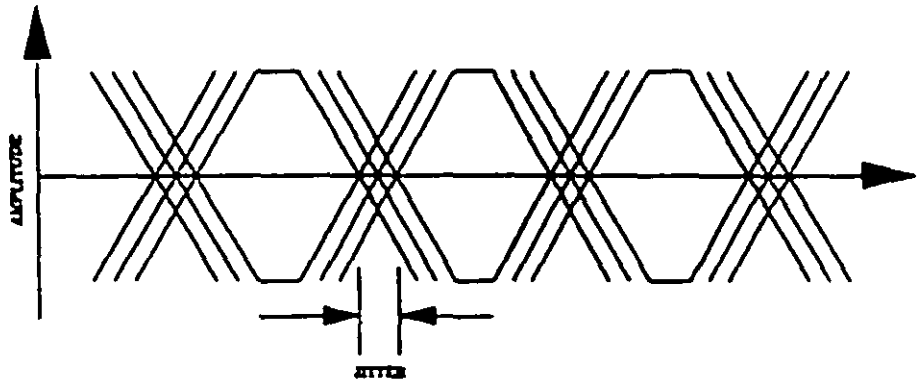


FIGURE 4. Jitter measurement.

10. Verify the requirements of 3.7.2.2 and 3.7.2.4.
11. Repeat steps 8 through 10 at the minimum optical power level specified. Measure the results.
12. Repeat steps 8 through 10 at an average of the specified maximum and minimum power levels. Measure the results.
13. Verify the requirements of 3.7.2.2 and 3.7.2.4.
14. Set the power supply voltage to the maximum magnitude specified (see 3.7.3). Repeat steps 6 through 13.
15. Set the power supply voltage to the nominal magnitude (see 3.7.3). Repeat steps 6 through 13.

4.6.4.6 Acquisition time. The acquisition time shall be as specified in 3.7.2.6. It should be noted that this test procedure is application oriented, and details are provided in the specification sheet (see 3.1).

The general test set-up shall be as shown on figure 5:

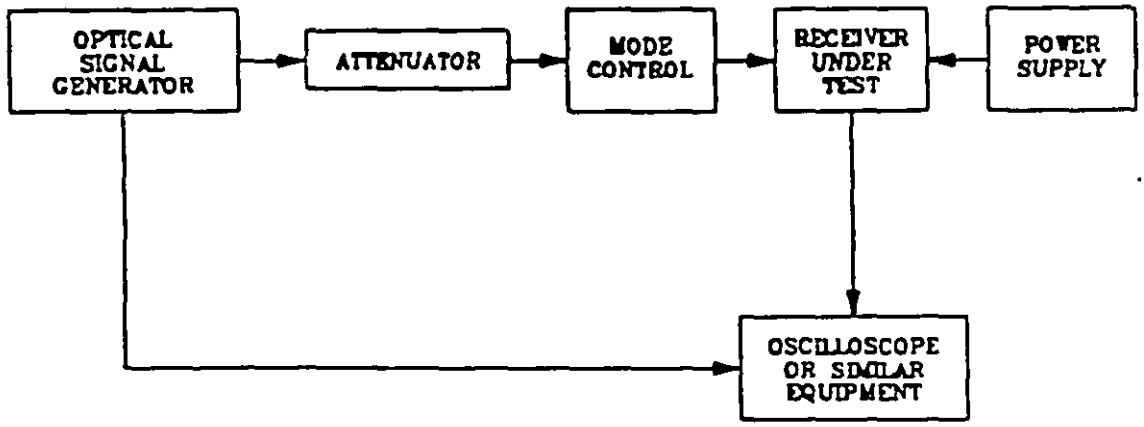


FIGURE 5. Acquisition time test set-up.

The test procedure shall be as follows:

1. Standard ambient test conditions shall be as specified in 4.6.4.1.1.
2. The receiver shall be connected to the apparatus that provides the specified conditions.
3. The power supply voltage shall be set to the minimum magnitude specified (see 3.7.3).
4. The optical signal generator, in conjunction with a variable optical attenuator, shall reproduce the characteristics of the optical input signal described in 4.6.4.1.2. Any other test signals shall be as specified (see 3.1).
5. Ensure that the effects of the test equipment and the cables are considered in the determination of the acquisition time.
6. Verify the requirements of 3.7.2.6.
7. Set the power supply voltage to the maximum magnitude specified (see 3.7.3). Repeat steps 5 through 6.
8. Set the power supply voltage to the nominal magnitude specified (see 3.7.3). Repeat steps 5 through 6.

4.6.4.7 Power supply voltage and current (see 3.7.3). The maximum current shall be measured and verified in accordance with MIL-STD-883, method 3005, using the nominal supply voltage specified.

4.6.5 Environmental tests (see 3.9). The following environmental tests shall be performed.

4.6.5.1 Environmental temperature extremes (see 3.9.1). The performance of the receiver shall be verified in accordance with 4.6.4 at both of the operating temperature extremes as specified. The receiver shall have attained thermal equilibrium for at least 30 minutes before any measurements are made. Thermal equilibrium is defined as the low temperature minus zero degrees, plus 1 degree Celsius; or the high temperature plus zero degrees, minus 1 degree Celsius.

4.6.5.2 Thermal shock (see 3.9.2). The effects of thermal shock on receiver performance shall be tested using MIL-STD-883, method 1011, over the nonoperating temperature range specified. Verification of performance shall be conducted in accordance with 4.6.4.4 and 4.6.4.5 after the test.

4.6.5.3 Impact shock (see 3.9.3). The receiver shall be subjected to physical shock using MIL-STD-883, method 2002, test condition B. Verification of performance shall be conducted in accordance with 4.6.4.5 during the test and 4.6.4.4 and 4.6.4.5 after the test. The BER shall be monitored for 5 minutes during which time all five impacts shall be delivered. The number of bit errors detected during the test shall be not greater than 2 plus the number of bits transmitted times the specified BER.

4.6.5.4 Vibration (see 3.9.4). The receiver shall be tested for effects of vibration in accordance with MIL-STD-883, method 2026, test condition II, test condition C, and method 2007, test condition A. Verification of performance shall be conducted in accordance with 4.6.4.5 during the test and 4.6.4.4 and 4.6.4.5 after the test.

4.6.5.5 Salt spray (see 3.9.5). The receiver shall be tested and accepted in accordance with MIL-STD-883, method 1009, test condition C.

4.6.5.6 Explosive atmosphere (see 3.9.6). The receiver safe operation within explosive atmospheric environments shall be verified using MIL-STD-202, method 109, under conditions as specified (see 3.1).

4.6.5.7 Fungus resistance (see 3.9.7). Receivers and materials used in the construction of the receivers that are not identified as fungus inert, shall pass the tests of MIL-STD-810, method 508.

4.6.6 Mechanical tests (see 3.10).

4.6.6.1 Cable pull-out force (see 3.10.1). The receiver shall be tested in accordance with EIA 455-6. The axial tensile load shall be applied to the load specified and shall be maintained for 10 minutes. The BER shall be verified during and after the test (see 4.6.4.5).

4.6.6.2 Twist (see 3.10.2). The receiver shall be tested in accordance with EIA 455-36, with the exception that the test sample shall be a properly pigtailed receiver. The number of loads to be applied shall be one. The BER shall be verified during and after the test (see 4.6.4.5).

4.6.6.3 Connector pull-out force (see 3.10.3). The receiver shall be tested in accordance with EIA 455-6, with the exception that the test sample shall be a connector on the receiver. The axial load shall be applied to the load specified and shall be maintained for 10 minutes. The BER shall be verified during and after the test (see 4.6.4.5).

4.6.6.4 Fiber dynamic strength (see 3.10.4). The fiber pigtail dynamic strength shall be tested as follows: The fiber pigtail shall have an axial tensile load applied up to the load specified at an angle of 45 degrees to the normal (see figure 6). With the load applied, the pigtail shall be rotated through one rotation (360 degrees). The BER shall be verified during and after the test (see 4.6.4.5).

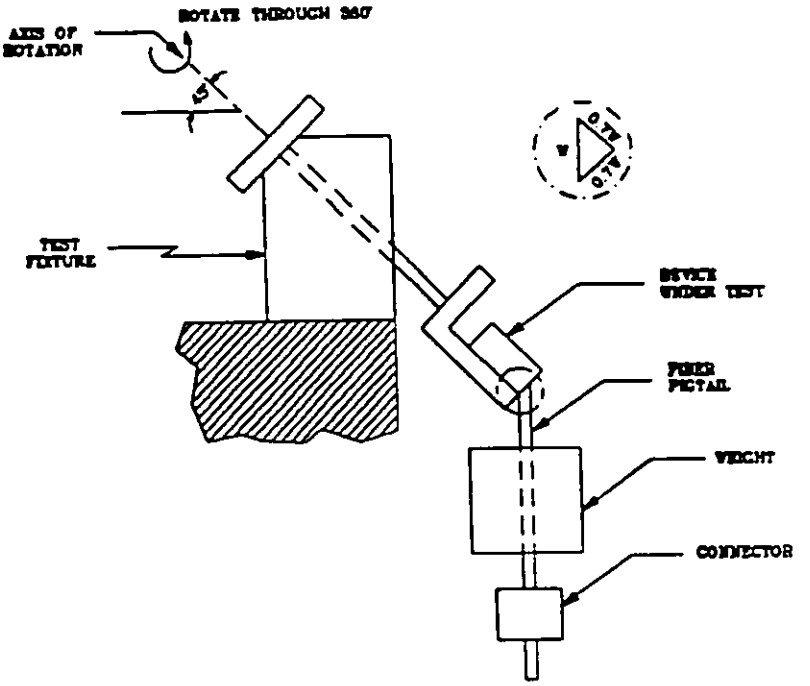


FIGURE 6. Fiber dynamic strength test set up.

4.6.7 Nuclear radiation resistance (see 3.11). The receiver shall be subjected to radiation in accordance with MIL-STD-883, methods 1017 (neutron) and 1019 (total dose) (see 3.1). Verification of performance shall be conducted in accordance with 4.6.4.5 during the test and 4.6.4.4 and 4.6.4.5 after the test. The dose rates and exposure times shall be as specified (see 6.2). Three test temperatures are required; the low and the high operating temperatures (see table I), and 20°C.

4.6.8 Electromagnetic effects (see 3.12). The receiver shall be tested for effects of electromagnetic emissions in accordance with MIL-STD-462 as applicable and as specified (see 3.1). Verification of performance shall be conducted in accordance with 4.6.4.4 and 4.6.4.5 during and after the test.

4.6.9 Electrostatic discharge sensitivity (see 3.13). The receiver shall be tested for sensitivity to electrostatic discharge in accordance with MIL-STD-883, method 3015. Unless otherwise specified (see 3.1), the electrostatic pulse shall be not less than 3000 volts. Verification of performance shall be conducted in accordance with 4.6.4 after the test.

4.6.10 Dimensions (see 3.14). The receiver shall be inspected for compliance with unit dimensions and tolerances using MIL-STD-883, method 2016.

4.6.11 External finish (see 3.15). The external finish of the receiver case shall be verified using MIL-STD-883, method 2009.

4.6.12 Identification markings (see 3.16). The receiver markings shall be examined for legibility and required information using MIL-STD-883, method 2009. The marking shall be legible and complete, and shall meet the resistance to solvents in accordance with MIL-STD-883, method 2015.

4.6.13 Inspection of packaging. The sampling and inspection of the preservation, packaging, and container marking shall be in accordance with the requirements of MIL-M-55565.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.7.)

5.1 Preservation and packing. The receiver shall be packaged for shipment and preservation in accordance with MIL-M-55565.

5.2 Marking. Marking on the receiver packaging shall be in accordance with MIL-M-38510.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The receivers specified herein are intended for the reception of optically transmitted digital data signals. The receiver applications may utilize any signal data format within the performance capabilities as specified herein.

6.1.1 Engineering information. MIL-T-24721 is the companion specification on digital fiber optic shipboard transmitters. Although the companion specification is not involved in the classification or testing of receivers, it is often useful for evaluating the fiber optic link system. A single-mode receiver will use a multimode pigtail.

6.2 Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number, and date of the specification.
(b) Class, DSR range, and style required (see 1.2).
(c) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
(d) Title, number and the date of the specification sheet.
(e) When first article is required (see 3.2).
(f) Number of test units required for reliability testing unless testing is waived (see 3.3).
(g) Appropriate specification for the pigtail when units are supplied with a fiber optic pigtail (see 3.5.1).
(h) When first article is required and test information (see 4.4).
(i) First article sample and lot size (see 4.4.1).
(j) Quality conformance inspection information (see 4.5).
(k) If samples for group C are other than specified (see 4.5.3).
(l) Nuclear radiation dose rates and exposure times, when test is required (see 4.6.7).
(m) Part number of receiver (see 6.8).
(n) Quantity required.

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
3.4	DI-E-2121	Certificate of compliance	----
4.4	DI-T-4902	First article inspection report	----

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 First article. When a first article inspection is required, the first article should consist of seven units. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4.1 Lot size. The lot size may be specified contractually, if desired.

6.5 Quality conformance. Quality conformance inspections require contractual definition of the overall test program, including sample sizes and lot sizes, if appropriate.

6.6 Definitions.

6.6.1 Acquisition time. Acquisition time is the time between the application of the input signal and stabilization of the output signal.

6.6.2 Bit error ratio (BER). BER is the number of erroneous bits divided by the total number of bits in a propagating signal over some stipulated period of time.

6.6.3 Cladding mode stripper. A cladding mode stripper is a material applied to cladding to allow electromagnetic energy being transmitted in the cladding to leave the cladding.

6.6.4 Core mode filter (mandrel wrap). A core mode filter is a device, such as one turn of an optical fiber wrapped around a mandrel, that removes high-order propagation modes from the core of the optical fiber.

6.6.5 Extinction ratio. The extinction ratio is the ratio of two optical power levels, P_1/P_2, of a digital signal generated by a light source, where P_1 is the optical power level generated when the light source is "on" and P_2 is the power level generated when the light source is "off".

6.6.6 Fiber cladding. Fiber cladding is a transparent material that surrounds the core of an optical fiber and that has a lower index of refraction than the core material.

6.6.7 Fiber coating. Fiber coating is a protective material bonded to an optical fiber over the cladding for various purposes, such as preserving fiber strength, inhibiting cable losses, protecting against mechanical damage (microbending), protecting against moisture and other debilitating environments, providing compatibility with fiber and cable manufacturing processes, and providing compatibility with jacketing processes.

6.6.8 Fiber core. A fiber core is the central portion of an optical fiber. The core has a higher refractive index than the cladding that surrounds it. The bulk of light energy is confined to and propagates in the core. Single-mode fiber core diameters range from 2 to 11 micrometers, depending on the numerical aperture, core radius, and wavelength of the incident light.

6.6.9 Jitter. Jitter is the variation in time or space of a received signal compared to the instant or point of its transmission or to a fixed time frame or point at the receiver. Sources of jitter include signal-pattern-dependent laser turn-on delay, noise induced at a gating turn-on point, gating hysteresis, and variations in signal delay that accumulate on a data link caused by cable vibration. The signal variations are usually abrupt and spurious. They include time and spatial variations in length, amplitude, spacing, or phase of successive pulses.

6.6.10 Optical cable pigtail. An optical cable pigtail is a short length of fiber optic cable permanently fixed to a component and is used to couple optical power between it and another optical cable pigtail or fiber optic cable, such as a transmission cable.

6.6.11 Optical fiber pigtail. An optical fiber pigtail is a short length of optical fiber permanently fixed to a component and is used to couple optical power between it and another optical fiber pigtail or a transmission fiber.

6.6.12 Pulse-width distortion. Pulse-width distortion is the difference between the width of the electrical input pulse and the width of the corresponding optical output pulse.

6.6.13 Rise and fall time. The rise and fall times are transition times and are defined as the time required to pass between two reference levels. These reference levels are located 10 percent of the total distance between the two limit levels above the low level and below the high level. Rise time is defined as the time to pass from the low level to the high level, and fall time is the time to pass from the high level to the low level.

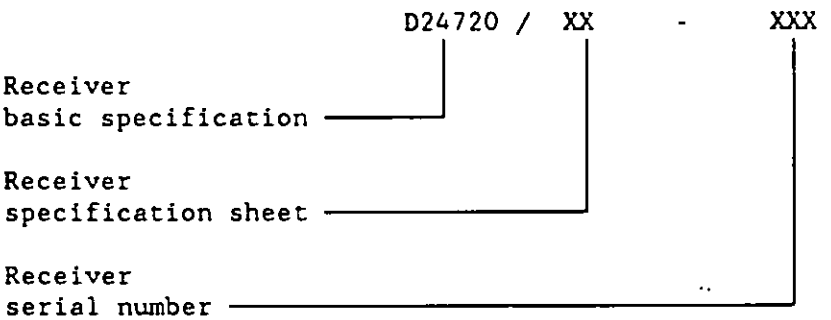
6.6.14 Signal propagation delay. Signal propagation delay is the time required for a signal to travel from one point to another, e.g., in an optical receiver, the time interval between the leading edge of an optical input pulse and the leading edge of the corresponding electrical output pulse.

6.6.15 Spectral width. Spectral width is the wavelength interval in which a radiated spectral quantity is a specified fraction of its maximum value. The fraction is usually taken at 0.5 of the maximum power level, and is the full-width half-maximum value.

6.7 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.8 Part number.

6.8.1 Part or identifying number (PIN). The PINs to be used for receivers acquired to this specification are created as follows:



Examples: D24720/01-001
D24720/02-001

6.9 Part designator. A part designator, if specified (see 3.1), should include classifications (see 1.2) as follows:

1. Wavelength class (see 1.2.1)
2. Data signaling rate (see 1.2.2)
3. Style (see 1.2.3)

Example: A2A

6.10 Subject term (key word) listing.

Avalanche detector
Digital receiver
Fiber optic receiver
Fiber optic communications
Fiber optic component
Multimode receiver
Optical amplifier
Optical connectorized component
Optical detector
Optical pigtailed component
Photodiode
Single mode receiver
Surface mount component

Review activities:
Navy - EC, YD

Preparing activity:
Navy - SH
(Project 6026-N001)

APPENDIX

TEST PROCEDURE TO MEASURE OUTPUT PROPAGATION DELAY

10. SCOPE

10.1 Scope. This appendix is intended to provide the instructions for measuring the output propagation delay under specified conditions. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS.

This section is not applicable to this appendix.

30. TEST EQUIPMENT

30.1 Test equipment. The test apparatus shall supply the necessary power supply voltages and currents, optical data input signals, output data loading, and any control input signals as specified.

40. TEST SAMPLE

40.1 Test sample. Select an appropriate digital fiber optic terminal device.

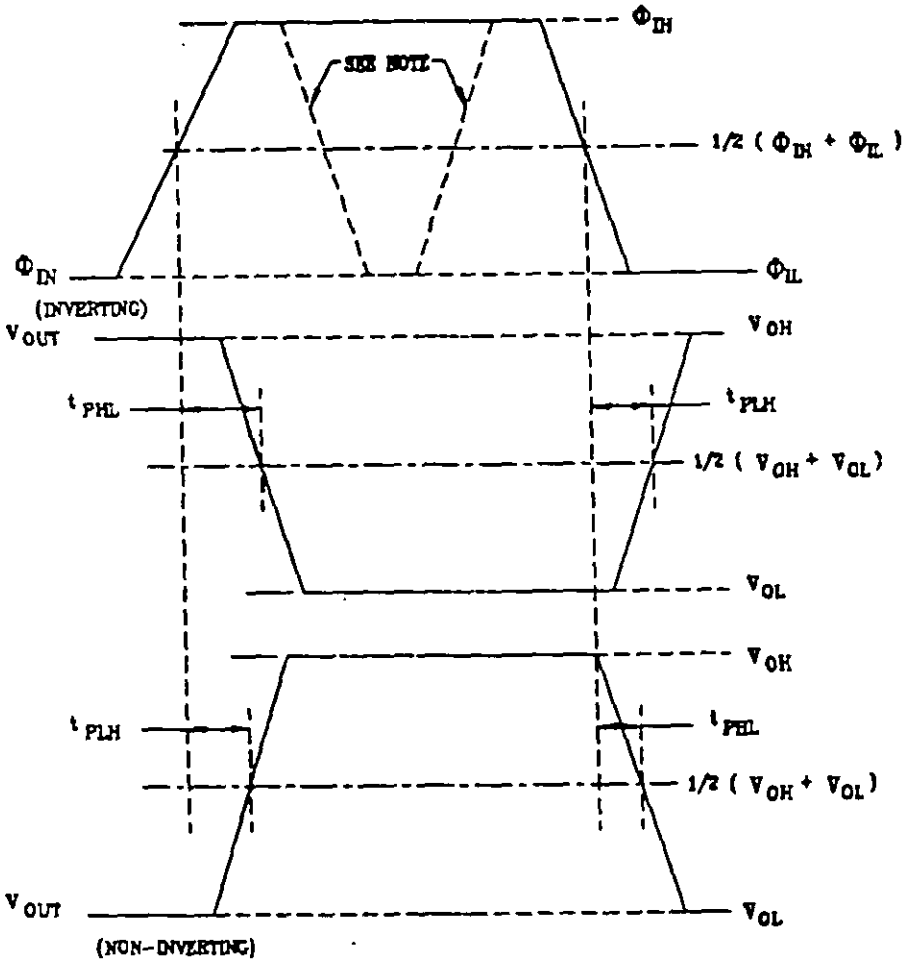
50. TEST PROCEDURE

50.1 Test procedure. The test procedure shall be as follows:

(a) The ambient or reference point temperature shall be as specified.
(b) The device shall be connected to the test apparatus providing the specified conditions.
(c) The supply voltages and currents and any control input signals shall be set to their specified values.
(d) The optical data input signal, Φ_{in}, shall be varied within the specified limits at the specified frequency and pulse width.
(e) The output propagation delay times shall then be measured between the specified points on the input and output waveforms as follows:

t_{PHL} - with the output changing from the defined HIGH state to the defined LOW state.
t_{PLH} - with the output changing from the defined LOW state to the defined HIGH state.

(f) The points on the input and output waveforms, between which the delay times are measured, shall be as follows: As shown on figure 7, where the high level optical input (Φ_{IH}) and the low level optical input (Φ_{IL}) are the specified values and the high level output voltage (V_{OH}) and the low level output voltage (V_{OL}) are the measured values of V_{out}.
(g) The supply voltages and input signals shall then be reduced to zero and the device removed from the test apparatus.



NOTE: Where the device incorporates code conversion, or input line coding requiring other than a bilevel optical input, the measurement requirements shall be as specified.

FIGURE 7. Receiver waveforms.

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

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1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-R-24720(NAVY)	RECEIVERS, DIGITAL, FIBER OPTIC, SHIPBOARD (METRIC), GENERAL SPECIFICATION FOR

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*:
b. ADDRESS *(Street, City, State, ZIP Code)*	

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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