MIL-STD-1519 (USAF)
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MILITARY SPECIFICATION

TEST REQUIREMENTS DOCUMENT, PREPARATION OF

FSC MISC

DEPARTMENT OF AIR FORCE

Test Requirements Document, Preparation Of

MIL-STD-1519 (USAF)

1. This standard has been approved by the Department of the Air Force and is mandatory for use, effective on date of issue, by that activity.

2. Recommended changes, additions, or deletions should be addressed to Commander, 4950th Test Wing (Tech), TZSM, Wright-Patterson Air Force Base, Ohio, 45433.

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TEST REQUIREMENTS DOCUMENT, PREPARATION OF

1. SCOPE

1.1 This standard establishes the requirements for the preparation and control of the Test Requirements Documents (TRD) used in specifying testing requirements for avionic subsystems, units, and subassemblies herein referred to as Units-Under-Test (UUT). These test requirements shall be independent of any specific test apparatus.

2. REFERENCED DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

STANDARDS

Military

MIL-STD-12	Abbreviations For Use On Drawings and In Technical-Type Publications
MIL-STD-100	Engineering Drawing Practices
MIL-STD-806	Graphic Symbols for Logic Diagrams

Industry

USAS 32.2	Graphic Symbols For Electrical and Electronics Diagrams
USAS 32.16	Reference Designations For Electrical and Electronic Parts and Equipments

(Copies of documents required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. DEFINITIONS

3.1 This section is not required.

4. GENERAL REQUIREMENTS

4.1 Format. The TRD format shall be as shown in Appendix A of this standard. Data shall be legible on 8-1/2 by 11-inch paper or 8-1/2 by 11-inch foldouts, except for drawings that cannot be reduced to this size without compromising the legibility requirement.

4.2 Contents. The TRD contents shall include the following items in the sequence shown. The UUT drawings and functional block diagram specified are part of the normal data requirements for the UUT and shall not be prepared specifically for this requirement.

a. Cover sheet (reference 4.2.1)

b. Approval sheet (reference 4.2.2)

c. Revision index sheet (reference 4.2.3)

d. Configuration data (reference 4.2.4)

e. General data (reference 4.2.5)

f. UUT interface requirements (reference 4.2.6)

g. Detailed performance characteristics (reference 5.3)

h. Detailed test information (reference 5.4)

i. Outline installation drawings (LRU TRD's only) (reference 4.2.9.1)

j. Unit (main) assembly drawings (LRU TRD's only) (reference 4.2.9.2)

k. Detail and subassembly drawings (reference 4.2.9.3)

l. Wiring drawings (reference 4.2.9.4)

m. Functional block diagrams (reference 4.2.9.5)

n. Test flow chart (reference 4.2.10)

4.2.1 Cover sheet. The cover sheet shall identify the TRD and the UUT to which it applies. The cover sheet format shall be in accordance with figure 1 of the appendix and the following:

a. Avionic subsystem AN nomenclature: (E.g., AN/APQ-XX Fire Control Radar)

b. (UUT) name and nomenclature: (E.g., Video Selector IP-1739/APQ-XX)

c. Supplier UUT unit no. (Per USAS 32.16)

d. Security classification: (In lieu of classifying each TRD, all classified data may be incorporated into a single document for each avionic subsystem. This document shall be referenced by paragraph number in applicable TRDs').

4.2.2 Approval sheet. The approval sheet shall contain the appropriate signatures. The approval sheet format shall be in accordance with figure 2 of the appendix.

4.2.3 Revision index sheet. The format for the revision index sheet shall be in accordance with figure 3 of the appendix. No-change sheets shall not carry a revision letter.

4.2.4 Configuration data. The configuration data shall consist of the identification of all engineering data applicable to the UUT. The configuration data format shall be in accordance with figure 4 of the appendix and the following:

a. Drawing numbers shall include the revision used in preparation of the TRD. Unreleased drawings shall not be acceptable.

4.2.5 General data. The format for the required general data shall be in accordance with figure 5 of the appendix and the requirements specified herein.

4.2.5.1 UUT design data. The requirements for the UUT design data shall be as outlined on sheets 1 and 2 of figure 5 (appendix) and the following:

a. Weight: The weight of the UUT shall be specified within 25 percent of actual weight.

b. Special tools: (E.g., card extenders, unusal screwdrivers, etc.)

c. Handling requirements: Any special handling requirements shall be identified.

d. Unique interface/available equipment: Any special test conditions or required fixtures shall be defined. Any pressurization required for bench testing shall be defined.

e. Safety requirements: Special precautions and instructions regarding personnel and equipment (UUT and test equipment) protection in the presence of high voltages, r-f radiation, etc., shall be identified.

f. Power requirements: All UUT input power source requirements shall be specified, including a-c and d-c voltages and tolerances, maximum load

current, frequency and tolerances, power supply source impedance, ground returns, and ripple limits on d-c voltages. When three-phase power is required, the line-to-line voltage or line-to-neutral voltage shall be so identified. Maximum allowable line-to-line imbalance and percent distortion shall be specified.

g. Mating connector data: Identification of all electrical power mating connectors shall be accomplished in accordance with sheet 2 of figure 5 (appendix).

4.2.5.2 UUT test data. General procedures and special precautions that apply to the test procedures as a whole to assure proper test conditions shall be as outlined on sheet 3 of figure 5 (appendix).

4.2.6 UUT interface requirements. The characteristics of the equipment and circuitry required to test the UUT (excluding test equipment) shall be specified. MIL standard part numbers or component specifications shall be used to specify electrical/electronic circuits in lieu of vendor part numbers. Dimensioned drawings shall be included when the data necessary to design fixtures are not readily available and apparent on outline and other drawings specified herein. Special materials required for fixtures (e.g., nonmagnetic materials) shall be specified. Specification of equipment and circuitry that requires the use of a specific test device shall be avoided where possible. Electrical and mechanical interface data shall provide, as a minimum, a description of the data items specified herein. The format for UUT interface requirements shall be in accordance with figure 6 of the appendix.

4.2.6.1 Electrical interface. Signal conditioning and connector data related to the avionic item shall be provided as follows:

a. UUT connector identification: All UUT connectors and corresponding mating connectors shall be identified. This shall include the connector manufacturers' nomenclature and part numbers and a cross reference designation such that all connectors and pin designations on both the schematics and the drawings may be determined.

b. Descriptive data shall be provided on separate sheets that define each signal conditioning circuit. Descriptive data shall include the following as applicable:

(1) Minimum wire size

(2) Maximum wire length

(3) Wire or coax type

(4) Shielding requirements

(5) Detailed definition of signal conditioning circuits

(6) Grounding requirements

(7) Separation of circuits

(8) Twist pair or twisted multiples requirements

(9) Other.

c. Test point connectors: All test point connectors shall be specifically identified. Information provided shall include manufacturer's type, and a cross reference and function designation so that each test point connector and test point can be located on schematics and other drawings.

4.2.6.2 Mechanical interface

a. Mounting, holding, support fixtures: Descriptive data shall be provided for all mounting, holding, and support fixtures required for each UUT that cannot safely be tested on a flat horizontal work surface.

b. Pneumatic, hydraulic, cooling fixtures: Descriptive data shall be provided for all fittings, fixtures, and adapters required to connect pneumatic, hydraulic, and cooling sources to the UUT.

4.2.7 Performance characteristics. The required detailed performance characteristics shall be as specified in 5.3.

4.2.8 Detail test information. The required detail test information shall be as specified in 5.4.

4.2.9 Drawings. The UUT drawings outlined herein shall be supplier when specified in the electronic system contract.

4.2.9.1 Outline drawings. Outline drawings shall be in accordance with the applicable equipment specification.

4.2.9.2 Unit (main) assembly drawings. Unit (main) assembly drawings shall be in accordance with the applicable equipment specification.

4.2.9.3 Detail and subassembly drawings. The items specified herein, prepared in accordance with the requirements of the applicable equipment specification, shall be provided.

4.2.9.3.1 Module/subassembly schematics. A schematic shall be provided for each module (including IC's and encapsulated modules) and subassembly. In lieu of this requirement, the portions of circuitry within any module or subassembly may be indicated on the unit schematics.

4.2.9.3.2 Internal/actual wiring diagrams. Wiring diagrams shall be provided for each LRU, module, and subassembly to show the actual physical wiring arrangement. Wire running lists or tables may be used to supplement wiring diagrams. Printed circuit layouts showing the components and modules (symbolically or actual shape) as well as the printed circuitry shall be included in this requirement. Printed circuit layouts shall contain sufficient data to permit any component, module terminal, and junction shown in the schematics to be located.

4.2.9.3.3 Logic diagrams. Detailed logic diagrams as described in MIL-STD-806 shall be provided for each UUT in the system, if applicable. Simple UUT's whose function is readily apparent from the schematic shall be excluded from this requirement. Items that are not normally represented by logic diagrams (e.g., receivers) shall be depicted by functional block diagrams.

4.2.9.3.4 Subassembly drawings. Subassembly drawings shall be provided for each module and subassembly. These drawings shall show physical configuration, connector identification (part number and reference number) and location, test point location and identification, controls, and other features necessary for testing. (In some cases, this requirement may be satisfied by printed circuit layout drawings, (reference 4.2.9.3.2.)

4.2.9.4 Wiring diagrams. Wiring diagrams shall be in accordance with the applicable equipment specification.

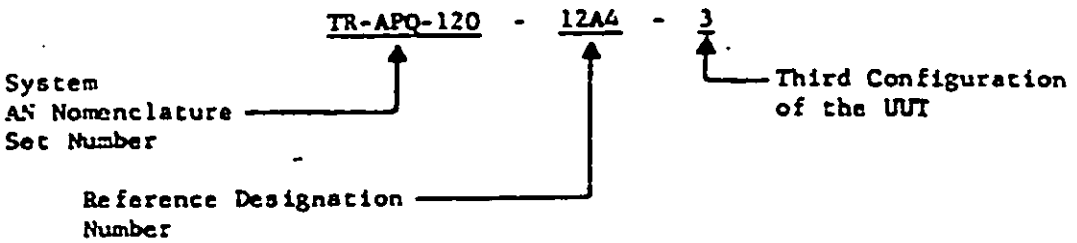
4.2.9.5 Functional block diagram. Functional block diagrams shall be in accordance with the applicable equipment specification.

4.2.10 Test flow chart. A test flow chart shall be provided. The test flow chart shall graphically depict the sequencing and branching of the TRD performance and diagnostic tests. The chart presentation shall be in the form of a tree chart.

4.3 Configuration changes. A TRD shall be required for each subsequent UUT configuration that differs from the baseline configuration. If two or more UUT configurations have identical test requirements, the TRD for the first configuration shall be used for each configuration; however, the TRD shall be revised to reflect the additional configurations supported. If the additional configurations are not identical with the prior configuration, the test number of each test that is different shall be specified in the general test data section.

4.4 TRD revisions. Changes to the TRD that are necessary due to errors, omissions, or improvements shall be submitted as revisions to the applicable document. These changes shall include a new cover page, a new revision index, and all changed pages. A "letter" shall be used to designate the particular TRD revision. The first revision shall be designated by "A".

4.5 TRD number assignment. A document identification number shall be assigned to each TRD. This number shall consist of the prefix "TR" followed by the system AN nomenclature set number (i.e., the set number for the AN/APQ-120 radar is "120"), the UUT reference designation number, and a dash number. The reference designation number shall be in accordance with USAS 32.16. The dash number shall designate the UUT configuration. The dash number assigned to the baseline TRD shall be -1. Following is an example:



4.6 TRD completion. The TRD shall initially be prepared to reflect the configuration of the preproduction model of the UUT. This version of the TRD shall be complete when the configuration of the first preproduction model is established. The TRD shall be revised to reflect the configuration of the first production model when this configuration is established. The scheduling of TRD completion dates for TRD's reflecting configurations that are subsequent to the first production model shall be as specified by the procuring activity.

5. DETAIL REQUIREMENTS

5.1 General requirements. The TRD shall provide the information necessary to test the UUT in the most efficient manner possible and with a minimum of UUT interface. Sufficient tests shall be included so that all required performance characteristics can be verified. A TRD shall be provided for each Replaceable Unit (RU), RU chassis, and RU subassembly.

5.2 TRD general test requirements. The TRD shall provide the information necessary to:

a. Test the performance of the UUT in accordance with the characteristics described in 5.3, and detect and indicate all faults and out-of-tolerance conditions.

b. Adjust and align the UUT (when applicable).

c. If the UUT is an RU, isolate all faults to the faulty module or RU chassis (if it contains electrical components).

d. If the UUT is a reparable RU subassembly or RU chassis containing electrical components, isolate each fault to an individual component or to the smallest group of components consistent with the established maintenance concept. Tests shall be as simple as possible, independent from each other, and logically arranged to simplify testing and to eliminate redundancies.

5.2.1 Test sequence. Tests shall be arranged such that, after a no-go is encountered and the replacement action determined, the remaining tests not influenced by the fault can be conducted.

5.2.2 Types of tests. The following types of tests shall be documented:

a. Power/stimuli short tests. Power input and stimuli input short checks, to verify that these inputs are not operating into a short circuit, shall be made prior to the application of power or stimuli.

b. Performance tests. These shall be end-to-end tests that exercise the UUT in various modes of operation to reveal any degradation in performance characteristics. Further, any components that are not adequately exercised by the end-to-end tests shall be verified by an alternative means such as impedance tests. These tests shall also be designated performance tests.

c. Diagnostic tests. Diagnostic tests shall be required to isolate a fault(s), detected during performance testing, to the specified level.

5.3 Detailed performance characteristics. A detailed description of the performance characteristics shall be provided for the UUT. As a minimum, the following information shall be provided:

a. Functional name of the UUT and vendor's part numbers.

b. Input data: All inputs, electrical, optical, mechanical, etc., shall be defined and their range and tolerance specified.

c. Output data: All outputs shall be specified in terms of their range, accuracy, and relationship to the input conditions.

d. Test point data: The test points shall be identified by function, and the signal (input or output) conditions shall be specified.

e. Controls and ranges of control (or adjustments).

This data shall describe the item in sufficient detail that any "black box" with the characteristics described could be inserted in the system without degrading the system performance. This data shall also be used by the contractor in the development of TRD's to assure test consistency at all levels of maintenance and compatibility between maintenance and quality assurance test results. Input, output, and test point data shall be identified by test connector and pin designation, and by functional name. Functional names shall not be duplicated.

5.4 Detailed test information. Each test to be conducted on a UUT shall be detailed on a separate test information sheet.

5.4.1 Detailed test information sheet. The format of the detailed test information sheet shall be in accordance with figure 7 of the appendix.

Continuation sheets shall be used when additional space is required to specify any information. The continuation sheet shall reference the TRD number, TRD revision, test number, and the information being continued. The applicable detail test information sheet shall reference the continuation sheet(s).

5.4.2 Detailed test data requirements. Sufficient data shall be provided for each UUT test to completely describe all input conditions and measurements required to perform the test. All input, output, and return connections shall be specified by connector and pin number or test point at the UUT. Where input conditions are identical for a series of UUT tests, these conditions may be specified on the first test and back referenced on each subsequent test. The requirements herein define the minimum data requirements for each test of the UUT as applicable. Specific test situations differing from those described herein shall follow the principles outlined herein and shall be so specified that the input, output, and test point conditions are completely defined.

5.4.2.1 Minimum data requirements for UUT input conditions

5.4.2.1.1 Power supplies

5.4.2.1.1.1 D-c power supplies

a. Must specify:	Units
(1) Nominal voltage	Volts
(2) Voltage tolerance	± Volts or %

(3)	Current	Amperes
(4)	Current tolerance (variance or impedance of UUT load on power supply in terms of R + JX ohms.	%
(5)	Load impedance	R + JX ohms

b. Specify if critical to UUT:

		Units:
(1)	Ripple	Volts rms
(2)	Noise	Volts pk-to-pk

c. Specify load changes if not adequately covered above - Critical transient response is a typical example.

5.4.2.1.1.2 A-c power supplies

a. Must specify:

		Units:
(1)	Nominal voltage	Volts ac (rms, pk-to-pk, etc.)
(2)	Voltage tolerance	± Volts or %
(3)	Nominal frequency	Hz
(4)	Frequency tolerance	Hz or %
(5)	Current	Amperes
(6)	Current tolerance (variance)	%
(7)	Voltage unbalance	Volts or %
(8)	Load impedance	R + JX ohms
(9)	Current unbalance	Amperes/phase

b. Specify if critical to UUT

		Max %
	Distortion	
(1)	Phase-to-phase angle (Magnitude and tolerance)	Degrees

(2)	Phase-to-reference phase (Magnitude and tolerance)	Degrees

5.4.2.1.2 Signal inputs (analog)

5.4.2.1.2.1 Sinusoidal inputs to UUT

a. Must specify:		Units:
(1)	Voltage/power magnitude	Volts/watts, dB
(2)	Voltage/power magnitude tolerance	Volts, %, watts, dB
(3)	Frequency	Hz
(4)	Frequency tolerance	Hz or %
(5)	Load impedance of UUT	R + JX ohms
(6)	Offset level	Volts

b. Specify if required by UUT

(1) Modulation

(a) Modulation type

(b) Modulation frequency(ies)/rates

(c) Modulation percentage or waveshape

(d) Carrier power/voltage level during modulation on/off ratios

(e) Modulation pulse shapes

(f) Pulse repetition frequency

(g) Swept frequency

(h) Center frequency

(i) Width of sweep

(j) Sweep rate

(2) Noise levels

(3) Maximum VSWR

(4) Phase angle to reference phase

5.4.2.1.2.2 Pulse input to UUT

a. Must specify:	Units:
(1) Amplitude	Volts
(2) Amplitude tolerance	Volts/%
(3) Pulse repetition frequency	Hz
(4) Pulse repetition frequency tolerance	Hz or %
(5) Pulse width (50% amplitude)	Seconds
(6) Pulse width tolerance	Seconds or %
(7) Pulse rise time (10% to 90%)	Seconds
(8) Pulse rise time tolerance	± Seconds
(9) Pulse fall time (90% to 10%)	Seconds
(10) Pulse fall time tolerance	± Seconds
(11) Pulse mode	Continuous, single pulse, etc.
(12) Load impedance of UUT	R + JX ohms
(13) Load tolerance:	± (R + JX) ohms
(14) Offset from zero	Volts

b. Specify if required by UUT

(1) Synchronization characteristics stating above parameters for reference signal(s) plus timing data between signals.

NOTE: A timing diagram should be included if more than two signals must be simultaneously synchronized.

(2) Modulation of pulse trains or continuous pulses.

5.4.2.1.2.3 Synchro and resolver input to UUT

a. Must specify:	Units:
(1) Three-wire synchro or four-wire resolver	
(2) Frequency	Hz
(3) Frequency tolerance	Hz or %
(4) Stator voltage	Volts
(5) Stator voltage tolerance	Volts or %
(6) Angular output	Degrees
(7) Angular output tolerance	Degrees
(8) Load impedance of UUT	R + JX ohms
(9) Load unbalance	R + JX ohms
(10) Reference signal	
(a) Amplitude	Volts
(b) Amplitude tolerance	Volts or %
(c) Maximum current	Amperes

5.4.2.1.2.4 Waveform input to UUT (other than pulses)

a. Must specify:	Units:
(1) Waveshape description of type	
(2) Amplitude	Volts pk-to-pk
(3) Amplitude tolerance	Volts or %
(4) Offset from zero	Volts

(5)	Offset tolerance	Volts
(6)	Load impedance of UUT	R + JX ohms
(7)	Period and tolerance	Seconds
(8)	Duration and tolerance	Seconds.

b. Specify if required by UUT

(1) Synchronization:

(a) Timing relationships

(b) Reference signal amplitude

(c) Reference signal rise time

(d) Reference signal width

(2) Modulation:

(a) Carrier characteristics

(3) Symmetry.

5.4.2.1.2.5 Time delayed inputs to UUT

a. Must specify:		Units:
(1)	Delay period	Seconds
(2)	Delay period tolerance	Seconds
(3)	Characteristics of time reference signal from UUT	
	(a) Amplitude	
	(b) Rise time	
	(c) Width	
	(d) Source impedance of UUT	

(4) Characteristics of delayed signal to UUT

(a) Amplitude

(b) Rise time

(c) Width

(d) Load impedance of UUT.

5.4.2.1.3 Signal inputs (digital)

5.4.2.1.3.1 Serial data inputs to UUT

a. Logic "0" voltage and current

b. Logic "1" voltage and current

NOTE: Current source and sink requirements shall be stated.

c. Logic "0" voltage tolerance

d. Logic "1" voltage tolerance

e. "0" state load impedance (R + JX)

f. "1" state load impedance (R + JX)

g. Bit prf (clock rate)

h. Bit width

i. Bit rise and fall time (min/max)

j. Synchronization requirements - reference signal from UUT or external

(1) Amplitude

(2) Width

(3) Rise time

(4) Pulse repetition frequency

(5) Source impedance

k. Word length: Total number of bits

l. Pattern of bits expressed in "1" or "0" format

m. Simultaneity with other serial or parallel digital inputs.

NOTE: Include timing diagram if more than 2 simultaneous input channels are required.

5.4.2.1.3.2 Parallel data inputs to UUT

a. Logic "0" voltage and current

b. Logic "1" voltage and current

NOTE: Current source and sink requirements shall be stated.

c. Logic "0" voltage tolerance

d. Logic "1" voltage tolerance

e. "0" state load impedance (R + JX)

f. "1" state load impedance (R + JX)

g. Logic format: Return to zero, non-return to zero, etc.

h. Word rate (prf)

i. Bit width

j. Bit rise and fall time (min/max)

k. Number of words in sequence

l. Pattern of bits expressed in "1" or "0" format

m. Simultaneity with other serial or parallel digital inputs

NOTE: Include timing diagram if more than 2 simultaneous input channels are required.

n. Synchronization requirements - reference signal from UUT or external

(1) Amplitude

(2) Width

(3) Rise time

(4) Prf

(5) Source impedance.

5.4.2.1.4 Pressure input to UUT

	Units:
a. Must specify:	
(1) Absolute pressure	in. Hg, psi
(2) Absolute pressure stability	
(a) Short term	in. Hg/min, psi/min
(b) Long term	in. Hg/hr, psi/hr
(3) Absolute pressure tolerance	in. Hg, psi
(4) Maximum volume of UUT	cu in.
(5) Leakage rate	cu in./min
(6) Maximum rate of absolute pressure change	in. Hg/min, psi/min
(7) Range of rate of absolute pressure change	in. Hg/min
(8) Absolute pressure rate tolerance	in. Hg, psi
(9) Absolute pressure range	in. Hg, psi
b. Specify if required by UUT	
(1) Pressure rate of change	in. Hg/min

5.4.2.2 Minimum data requirements for UUT output measurements

5.4.2.2.1 Signals outputs (analog)

5.4.2.2.1.1 D-c voltage from UUT

a. Must specify:	Units:
(1) Magnitude and polarity	± Volts
(2) Magnitude tolerance	± (Volts or %)
(3) Impedance of UUT signal source	R + JX ohms
(4) Offset of return from "0" volts	Volts

NOTE: For ratios of d-c signals, the above data shall be provided for each signal plus the nominal expected value of the ratio and its tolerance.

5.4.2.2.1.2 A-c voltage from UUT (rms)

NOTE: This section refers to sinusoidal signals whose average value over a period is zero when referenced to the d-c offset. For signals not meeting this criteria refer to waveform measurements (5.4.2.2.1.7).

a. Must specify:	Units:
(1) Frequency of signal	Hz
(2) Magnitude	Volts rms
(3) Magnitude tolerance	± (Volts or %)
(4) Impedance of UUT signal source	R + JX ohms
(5) D-c offset of return from "0" volts	Volts.

NOTE: For ratios of a-c signals or a-c/d-c signals, the above data shall be provided for each signal plus the nominal expected value of the ratio and its tolerance.

5.4.2.2.1.3 Phase angle between signals from UUT

a. Must specify:	Units:
(1) Frequency	Hz
(2) Frequency tolerance	± (Hz or %)
(3) Amplitude (2 signals)	Volts
(4) Amplitude tolerance	± (Volts or %)
(5) Expected angle	Degrees
(6) Expected angle tolerance	Degrees
(7) Source impedance of UUT (2 signals)	R + JX ohms
(8) D-c component(s)	Volts.

5.4.2.2.1.4 Frequency of signal from UUT

a. Must specify:	Units:
(1) Expected frequency	Hz
(2) Expected frequency tolerance	± (Hz or %)
(3) Amplitude	Volts
(4) Amplitude tolerance	± (Volts or %)
(5) Impedance of UUT source	R + JX ohms

NOTES:
(a) For microwave signals, specify waveguide.

(b) For coaxial; so indicate.

(6) Polarity (non-sinusoidal)	±
(7) Rise time (non-sinusoidal)	Seconds
(8) Width (non-sinusoidal)	Seconds

(9)	D-c offset from "0" volts	Volts
(10)	Maximum shunt capacitance, if other than coaxial connection, that is acceptable	pf

5.4.2.2.1.5 Period time of signal(s) from UUT

a. Must specify:		Units:
(1)	Expected time	Seconds
(2)	Expected time tolerance	Seconds
(3)	Amplitude(s)	Volts
(4)	Amplitude(s) tolerance	Volts
(5)	Polarity(s)	±
(6)	Impedance of UUT source(s)	R + JX ohms
	NOTE: If coaxial, so indicate.	
(7)	Edge(s) used as reference(s) and slope(s)	Leading or trailing
(8)	D-c offset from "0" volts	Volts
(9)	Rise time (non-sinusoidal)	Seconds
(10)	Width (non-sinusoidal)	Seconds
(11)	Maximum shunt capacitance, if other than coaxial connection, that is acceptable.	pf

5.4.2.2.1.6 Power (average rf) from UUT

a. Must specify:		Units:
(1)	Amplitude	Watts
(2)	Amplitude tolerance	± (Watts, %, dB)

(3)	VSWR	Ratio
(4)	Frequency (normal)	Hz
(5)	Impedance of UUT source	R + JX ohms

5.4.2.2.1.7 Waveforms from the UUT

5.4.2.2.1.7.1 Pulse amplitude measurements

a. Must specify:		Units:
(1)	Expected amplitude	Volts pk
(2)	Expected amplitude tolerance	± (Volts or %)
(3)	Frequency (rate)	Hz
(4)	Frequency (rate) tolerance	± Hz
(5)	Impedance of UUT source	R + JX ohms
(6)	D-c offset from "0" volts	Volts
(7)	Polarity	±
(8)	Synchronization signal, if available - Same data as above for signal to be measured.	

NOTE: For pulses containing components that cross through "0" volts, a sketch of waveform shall be required for definition.

5.4.2.2.1.7.2 Pulse rise/fall time measurements

a. Must specify (Same as for pulse amplitude measurements plus):		Units:
(1)	Expected rise/fall time	Seconds
(2)	Tolerance	Seconds
(3)	Slope of measured edge	Positive or negative going

5.4.2.2.1.7.3 Pulse width measurements

a. Must specify (Same as for pulse amplitude measurements plus):	Units:
(1) Expected width	Seconds
(2) Expected width tolerance	Seconds
(3) Measured at 10%, 50%, or 90% amplitude	

5.4.2.2.1.8 Resistance measurement of UUT

a. Must specify:	Units:
(1) Expected value	ohms
(2) Expected value tolerance	ohms

b. Specify if required:

(1) Current flow through unknown

5.4.2.2.1.9 Distortion of signals from UUT

a. Must specify:	Units:
(1) Waveshape	
NOTE: If other than sinusoidal, distortion criteria shall be defined.	
(2) Fundamental frequency	Hz
(3) Fundamental frequency tolerance	Hz
(4) Impedance of UUT source	R + JX ohms
(5) Amplitude	Volts rms
(6) Amplitude tolerance	Volts rms
(7) Expected percent distortion	%
(8) Expected percent distortion tolerance	± %

5.4.2.2.1.10 Synchro/resolver signals from UUT

a. Must specify:	Units:
(1) Identify	
(2) Voltage	Volts
(3) Voltage tolerance	Volts
(4) Frequency	Hz
(5) Frequency tolerance	Hz
(6) Expected angular position	Degrees
(7) Expected angular position tolerance	Degrees
(8) Impedance of UUT source (Line to Line)	R + JX

5.4.2.2.2 Pressure output

a. Must specify:	Units:
(1) Static or differential	
(2) Expected value	in. Hg
(3) Expected value tolerance	in. Hg

5.4.2.2.3 Signal outputs (digital)

5.4.2.2.3.1 Serial signals from UUT

5.4.2.2.3.1.1 Logic levels verification

a. Must specify:	Units:
(1) Logic "0" voltage	Volts
(2) Logic "0" tolerance	Volts
(3) Logic "1" voltage	Volts

(4) Logic "1" tolerance — Volts

(5) Impedance of UUT source

(a) "0" State — R + JX

(b) "1" State — R + JX

5.4.2.2.3.1.2 Bit patterns evaluation

a. Must specify: — Units:

(1) Bit rates

(2) Bit rise and fall times

(3) Bit width

(4) Logic level

(5) Currents source and sink

(6) *Synchronization requirements

(a) Reference signal

(b) Amplitude

(c) Width

(d) Rise time

(e) Pulse repetition frequency

(f) Source impedance

(7) *Expected bit pattern/word - Expressed in "1" or "0" format

(8) *Simultaneity with other UUT outputs

NOTE: Include timing diagram if more than 2 simultaneous input channels are required.

*Normally a separate test of the same data, as required.

5.4.2.2.3.1.3 Propagation delay

a. Must specify:	Units:
(1) Bit/pulse characteristics as in logic level verification and bit pattern evaluation above.	
(2) Expected delay	Seconds
(3) Expected delay tolerance	Seconds

5.4.2.2.3.2 Parallel signals from UUT

5.4.2.2.3.2.1 Logic level verification

a. Must specify: (Same as required for serial signal logic level verification.)	Units:

5.4.2.2.3.2.2 Bit pattern evaluation

a. Must specify: (Same as required for serial signal bit pattern evaluation.)	Units:

5.4.2.2.3.2.3 Propagation delay

a. Must specify: (Same as required for serial signal propagation delay.)	Units:

5.4.2.2.4 Loads and networks for the UUT

5.4.2.2.4.1 Electronic elements

a. Must specify:	Units:
(1) Impedance of load	R + JX ohms
(2) Tolerance on load	± (R + JX) ohms
(3) Frequency characteristic, if required	
(4) Power rating - average peak	Watts/Vars.
(5) Nonlinear characteristic, if required	

NOTE: Complex loads shall be specified in standard engineering units.

5.4.2.2.4.2 Mechanical elements

a. Must specify as required: Units:

(1) Angular position

(2) Spatial position

(3) Inertia

(4) Torque

(5) Rpm

(6) Pneumatic/hydraulic factors

(7) Other.

5.4.2.3 Digital patterns. UUT tests requiring extensive digital input or output patterns shall be specified on continuation sheets as outlined on figure 8 of the appendix. Simultaneous input/output patterns shall be so noted. Each digital output pattern shall be identified as a failure or non-failure type pattern. If there is only one acceptable pattern, the data shall indicate that the tolerance on the pattern is not applicable. Tolerances related to digital patterns shall be specified in digital form following the principles stated for analog tolerances. Parallel digital patterns shall be related to the applicable UUT connector pins.

5.4.3 Guidelines. The guidelines specified herein shall be followed when preparing detailed test information.

5.4.3.1 The specification of a-c voltages shall include a notation of root-mean-square (rms), peak, or peak-to-peak and shall always include frequency. Percent distortion shall be included when significant.

5.4.3.2 Normally, pulse width measurements shall be specified at the 50 percent amplitude level. When deviation from this is required, the amplitude level shall be identified.

5.4.3.3 Rise and fall times shall be normally specified between 10 percent and 90 percent levels. When deviation from this is required, the amplitude levels shall be specified.

5.4.3.4 Spikes, overshoots, noise levels, and d-c levels shall be identified and illustrated.

5.4.3.5 Waveforms shall include a sync signal reference if applicable.

5.4.3.6 Resistance measurements involving semiconductor devices shall include polarity requirements and the current at which the semiconductor impedance was determined.

5.4.3.7 Measurements that require longer than the standard measurement delay, specified in 4.2.5.2, for stabilization after input insertion or other action shall be so noted on the individual test specification sheets.

5.4.3.8 If a specific test parameter requires the measurement of several characteristics, such as rise time, fall time, and pulse width, and the replacement action for an out-of-tolerance condition for these characteristics is identical, then all of the measurements should be specified as one TRD test.

5.4.3.9 It is recognized that certain component failure or degradation may not be readily detectable during performance testing, such as failure of power input filters and relay coil noise suppressors. The TRD shall include tests to ensure that all such items are checked and failures isolated.

5.4.3.10 Input/output test requirements shall be specified at the UUT instead of at interface hardware test points.

5.4.3.11 Diagnostic tests shall ignore extremely remote failure modes e.g., carbon resistors shorting. The failure modes that are ignored shall be specified in the general test data section of the TRD.

5.4.3.12 A single fault shall be assumed when a no-go is encountered.

5.4.3.13 Standard engineering terms, symbols (per USAS 32.2), abbreviations (per MIL-STD-12) and designations (per USAS 32.16) shall be used in the TRD. Special cases not to be overlooked shall include; the meaning of high and low out-of-tolerance conditions for a zero volt measurement and a negative voltage measurement.

5.4.3.14 Stimuli that vary in discrete or incremental steps shall be specified in lieu of continuously variable stimuli if possible. The steps specified shall be as large as possible.

5.4.3.15 The addition of external feedback loops to the UUT to simulate the environment in which the UUT normally operates shall be avoided and open loop tests made whenever possible. The external interconnection of elements on the UUT shall be avoided when these elements can be individually tested.

5.4.3.16 All test points specified on the detailed test information sheet shall be identifiable on the UUT schematic.

5.4.3.17 If a test point and a connector pin are electrically common, the connector pin shall be used if it is accessible.

5.4.3.18 Only the power and stimulus required to perform a test shall be applied during the test. If adherence to this requirement will cause an active device on the UUT to be partially powered, it is permissible to add the power necessary to fully power the device.

5.4.3.19 It is understood that some characteristics of the UUT input signals may not be critical; i.e., any value within a specified range can be used for test purposes. An allowable range shall be specified for these non-critical characteristics instead of a specific value. If an output characteristic is a function of an input characteristic for which a range is specified, then the relationship between the input and output characteristics should be specified. An example of the above would be the test of a linear amplifier. The input voltage amplitude is a non-critical characteristic and might be specified as 0-10 volts. The output voltage, since it is a function of the input voltage, would be Vout = 5 Vin (assuming an amplification of 5).

5.4.3.20 Complex output waveforms shall be avoided whenever possible. The complexity of an output waveform can frequently be reduced by the proper selection of the input signals and still permit adequate testing of the UUT. A number of simple waveform tests is preferable to one complex waveform test.

5.4.3.21 The requirements for electrical interface shall be held to a minimum. As an objective, the electrical interface shall consist of only a cable that interconnects the UUT and the test equipment. The use of external circuitry or loads in TRD tests shall be avoided where possible in order that the above objective can be met.

5.4.3.22 UUT loads shall be specified in terms of impedance required.

5.4.3.23 When a test requires stimuli with tolerances of less than one percent, the possibility of using a ratio (output to input) test shall be considered. If a ratio test could be used, the additional information necessary to conduct a ratio test shall be specified in the supplemental data section.

5.4.3.24 Time or phase - dependent relationships, if applicable, shall be defined using diagrams as needed. If the exact value of an input or output is not known, a range shall be specified.

5.4.3.25 Individual test requirements such as signal conditioning, loads and impedance-matching terminations shall include nominal values, power ratings, voltage standing wave ratio (VSWR), etc. Complex loads shall be specified in standard engineering units.

5.4.3.26 All characteristics of each waveform shall be included. Some characteristics may not have apparent revelancy but shall be included for clarification. Only the characteristic to be checked shall appear in the measured value data section of the "Detailed Test Information" sheet; all others, in the supplemental data section. Each waveform (except sine waves) shall be described in pictorial illustrations. Nonrepetitive waveforms shall be identified.

5.4.3.27 Tolerances for every characteristic shall be specified. The upper and lower tolerance limits shall be described in the same units as the characteristic. Such terminology as less than or greater than shall be avoided when significant high or low limits can be specified. The expressions open circuit and short circuit may be used if defined.

5.4.3.28 The output impedance at the test point(s) with respect to the signal return(s) and the impedances seen by the UUT inputs shall be specified for all tests.

5.4.3.29 Any critical or unusual test requirement not self-evident elsewhere shall be defined. Such requirements might include susceptibility to noise or transients, time delays before making measurements, signal and power lead characteristics, etc.

5.4.3.30 All adjustments that may correct a no-go condition or optimize a critical parameter shall be defined.

5.4.3.31 When more than one component is to be identified for possible replacement, they should be listed in their most probable order of failure.

5.5 Quality assurance provisions

5.5.1 Responsibility for inspection. Unless otherwise specified in the contract, the supplier is responsible for the performance of all inspection/validation requirements as specified herein. Except as otherwise specified, the supplier may use his own or any other inspection facilities and services acceptable to the procuring activity. The procuring activity reserves the right to perform or witness any of the inspections/validations specified herein.

5.5.2 TRD inspection and acceptance. All material furnished in accordance with this specification shall be subject to inspection and acceptance by the procuring activity.

5.5.2.1 Inspection. Inspection shall consist of a review of the TRD to insure that the information, instructions, and format (textual and illustrative) requirements of this specification are met.

5.5.2.2 Validation. Each test in the TRD shall be validated by the supplier. Validation shall be accomplished by applying the inputs, loads, etc., specified by the TRD to an acceptable (a certified good) UUT and verifying that the specified values are obtained. A validation certificate shall be provided with each TRD. The validation certificate shall include the following information:

a. A listing of test numbers, with the actual values obtained from the measurements made during validation testing.

b. Complete listing or identification of:

(1) TRD

(2) UUT

(3) Test equipment

(4) Test personnel

(5) Contract number

(6) Supplier

(7) Sub-supplier (where applicable)

c. Date testing was accomplished

d. Signature of test personnel

e. Signature of the procuring activity representative who witnessed or participated in the testing.

5.5.2.3 Acceptance. Acceptance of the data required by this specification shall be accomplished by submittal of copy of the validated TRD and validation certificate to the procuring activity. This acceptance, however, is contingent on final review of the delivered materials by the procuring activity. The procuring activity shall notify the TRD supplier of final acceptance of the data required by this specification.

5.6 Preparation for delivery. The TRD shall be delivered as specified in the contract.

Custodian:
Air Force - 11

Preparing activity:
Air Force - 11

Project No. MISC-F779

APPENDIX

FORMAT FOR THE PREPARATION OF A TEST REQUIREMENTS DOCUMENT

10. SCOPE

10.1 This appendix covers the required format for the submittal of a contractor-prepared test requirements document (TRD). This format requirement may be waived by the procuring activity when the TRD information already exists in another acceptable format.

20. REFERENCED DOCUMENTS

20.1 There are no referenced documents.

30. REQUIREMENTS

30.1 TRD contents. The TRD contents shall be prepared in accordance with the following figures:

a. Figure 1: Cover sheet

b. Figure 2: Approval sheet

c. Figure 3: Revision index sheet

d. Figure 4: Configuration data sheet

e. Figure 5: General data sheets

f. Figure 6: UUT interface requirements sheets

g. Figure 7: Detailed test information sheet

h. Figure 8: Digital pattern data sheets

PAGE

TRD NO.

REV. DATE

(AVIONIC SUBSYSTEM AN NOMENCLATURE)

TEST REQUIREMENTS DOCUMENT (TRD)

FOR

_____
(UUT) Name and Nomenclature

SUPPLIER UUT UNIT NO._____

SUPPLIER UUT PART NO._____

_____
(Security Classification)

PREPARED BY

_____

_____

USAF CONTRACT NO._____

FIGURE 1. Cover Sheet

PAGE

TRD NO.

REV. DATE

APPROVALS

(SUPPLIER)

PREPARED BY: _____

APPROVED: _____

APPROVED: _____

FIGURE 2. Approval Sheet

PAGE

TRD NO.

REV. DATE

REVISION SUMMARY

SHEET NO.	REV. LTR.	APPROVED	DATE	SHEET NO.	REV. LTR.	APPROVED	DATE

FIGURE 3. Revision Index Sheet

PAGE_____
TRD NO._____
REV._____DATE_____

CONFIGURATION DATA

UUT P/N_____
FED STOCK NO._____

○ RU
○ SUBASSEMBLY, PART OF
RU PART NUMBER_____
RU NAME_____

SECURITY CLASSIFICATION:
UNCLASSIFIED ○ CONFIDENTIAL ○ SECRET ○

DATA USED TO PREPARE TRD

ENGINEERING DATA		NUMBER	REV./DATE	REMARKS
* SCHEMATIC DRAWING				
* ASSEMBLY DRAWING				
* OUTLINE DRAWING				
* WIRING DRAWING				
* MFG TEST SPECIFICATION				
* ALIGNMENT PROCEDURE				
* PARTS LIST				
* ECNS AFFECTING UUT				
T.O.s	OPERATION			
	MAINTENANCE			
	IPB			
	OVERHAUL MANUAL			
FUNCTIONAL BLOCK DIAGRAMS				
NON-STANDARD PARTS SPEC'S				
FAILURE REPORTS				
OTHER				

* These items considered essential part of review package.

FIGURE 4. Configuration Data Sheet

PAGE_____

TRD NO._____

REV._____ DATE_____

UUT GENERAL DESIGN DATA

WEIGHT_____ POUNDS

SPECIAL TOOLS ○ SEE PAGE_____. ○ NONE REQUIRED

HANDLING REQUIREMENTS ○ SEE PAGE_____. ○ NONE REQUIRED

UNIQUE INTERFACE/AVAILABLE EQUIPMENT (reference figure 6)

SPECIAL FIXTURES REQUIRED: (reference figure 6)
○ NONE
○ SEE PAGE_____.
○ SEE DRAWING_____.

COOLING AIR REQUIRED:
○ NONE
_____CFM AT_____INLET TEMP.
○ USE_____

HYDRAULIC PRESSURE REQUIRED:
○ NONE
○ _____PSIG AT_____
_____
○ USE_____
_____

PNEUMATIC SOURCE REQUIRED:
○ NONE
_____
_____
○ USE_____
_____

OTHER REQUIRED:
○ SEE PAGE_____.

SAFETY REQUIREMENTS

○ NONE
○ SEE PAGE_____.

FIGURE 5 (sheet 1 of 3). General Data Sheets (UUT design)

PAGE_____

TRD NO._____

REV._____ DATE_____

UUT GENERAL DESIGN DATA

POWER REQUIREMENTS

AC SOURCES	Ø1	Ø2	Ø3	Ø4
VOLTAGE				
VOLTAGE TOLERANCE				
FREQUENCY				
FREQUENCY TOLERANCE				
CURRENT				
PHASE & REFERENCE				
CONNECTOR & PIN - INPUT(S)				
- RETURN				

DC SOURCES	Ø1	Ø2	Ø3	Ø4	Ø5	Ø6
VOLTAGE & POLARITY						
VOLTAGE TOLERANCE						
CURRENT						
RIPPLE (VRMS)						
CONNECTOR & PIN - DC INPUT						
- DC RETURN						

MATING CONNECTOR DATA

CONNECTOR	PART NUMBER	CONTROL SPEC. NO.	MANUFACTURER

FIGURE 5 (sheet 2 of 3). General Data Sheets (UUT design)

PAGE _____

TRD NO. _____

REV. _____ DATE _____

UUT GENERAL TEST DATA

GENERAL PROCEDURES

	NONE	SEE PAGE
VISUAL INSPECTION INSTRUCTIONS	○	_____
RESTART OR RETEST INSTRUCTIONS	○	_____
STANDARD MEASUREMENT DELAY REQUIREMENTS	○	_____
GENERAL PRECAUTIONS	○	_____
PRETEST INSTRUCTIONS	○	_____

SPECIAL PRECAUTIONS

	NONE	SEE PAGE
LEAD LENGTH	○	_____
SEPARATION	○	_____
SHIELDING, GROUNDING	○	_____
TRANSIENTS, POWER SEQUENCE	○	_____
LOAD MATCHING, VSWR	○	_____
RADIATION	○	_____
OTHER	○	_____

FIGURE 5 (sheet 3 of 3). General Data Sheets (UUT test)

PAGE_____

TRD NO._____

REV._____DATE_____

INTERFACE DEFINITION

CONNECTORS

REFERENCE NO.	PART NO.	MATING CONNECTOR

TEST POINT CONNECTORS

REFERENCE NO.	TYPE	FUNCTION

MOUNTING, HOLDING, SUPPORT FIXTURES

HYDRAULIC PNEUMATIC COOLING FIXTURES

OTHER

FIGURE 6 (sheet 1 of 2). UUT Interface Requirements Sheets

PAGE_____

TRD NO._____

REV._____DATE_____

INTERFACE DEFINITION (Cont'd)

UUT				
CONN	PIN	FUNCTION	REMARKS	NOTE

FIGURE 6 (sheet 2 of 2). UUT Interface Requirements Sheets

DETAILED TEST INFORMATION

PAGE
TRD NO.
REV. DATE

TEST NO. _____
LAST EXECUTED TEST NO. _____
UUT _____

☐ POWER/STIMULI SHORT TEST
☐ PERFORMANCE TEST
☐ DIAGNOSTIC TEST

TEST OBJECTIVE _____

INPUT CONDITIONS	CHARACTERISTICS	INPUT Z (OR I)	CONNECTION & RETURN
INPUT POWER:			
STIMULI:			
OTHER:			

MEASUREMENT DATA	TEST POINT _____	SIGNAL RETURN _____	OUTPUT IMPEDANCE _____
	MEASURED VALUE _____	HIGH LIMIT _____	LOW LIMIT _____
	SUPPLEMENTAL DATA		

TEST RESULTS	GO TO TEST	ADJUST	REPLACE
IN TOLERANCE			
OUT HIGH			
OUT LOW			
OUT OTHER (EXPLAIN)			

FIGURE 7 (sheet 1 of 2). Detailed Test Information Sheet

PAGE_____

TRD NO._____

REV._____DATE_____

DETAILED TEST INFORMATION

CONTINUATION SHEET

TEST NUMBER_____UUT_____

FIGURE 7 (sheet 2 of 2). Detailed Test Information Sheet

TEST NO:_____

INPUT ○ SIMULTANEOUS INPUTS ○

OUTPUT ○ SIMULTANEOUS OUTPUTS ○

SERIAL DATA ○

PARALLEL DATA ○

DIGITAL PATTERN DATA

PAGE _____

TRD NO._____

REV:_____ DATE _____

CONTINUATION SHEET ☐

PATTERN NUMBER	DESIGNATION OF SERIAL BIT SIGNIFICANCE OR PARALLEL BIT CONNECTOR PIN 0-time →	RESPONSE		
		DIGITAL GO/NG	ANALOG VALUE	ANALOG TOLERANCE

FIGURE 8 (sheet 1 of 2). Digital Pattern Data Sheets

TEST NO _____
UUT _____

DIGITAL PATTERNS NO-GO ACTION
CONTINUATION SHEET

PAGE
TRO NO. _____
REV. _____ DATE _____

ACTION				PATTERN NUMBERS																							
SEARCH TO		ADJUST	REPLACE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
TEST	PATTERN																											

NOTES:

FIGURE 8 (sheet 2 of 2). Digital Pattern Data Sheets

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions -- Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE

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)*

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

DD FORM 1426 82 MAR

PREVIOUS EDITION IS OBSOLETE.