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Analog C-Band Video Receiver Requirements Document

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Analog C-Band Video Receiver Requirements Document

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DOCUMENT CHANGE HISTORY

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1 SCOPE

This document covers the requirements for C-Band Video receivers which are utilized for NASA DFRC chase aircraft video relay. These receivers are utilized in DRFC control rooms and portable test stations to receive L-Band, S-Band and C-band video and audio from video transmitters on DFRC research aircraft which include; manned and unmanned fixed and rotary wing vehicles. The receivers are operated in controlled environments but are used for applications critical to mission safety therefore they must be highly reliable.

2 APPLICABLE DOCUMENTS

2.1 Government Documents

- DFRC-VID-08-001, Analog C-Band Video Transmitter Requirements Document
- RCC 106-07, Range Commanders Council (RCC) Telemetry Standard
- MIL-STD-461F, Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
- MIL-STD-810F, Environmental Test Methods and Engineering Guidelines
- RCC 118-02, Test Methods for Telemetry Systems and Subsystems, Volume II: Test Methods for Telemetry RF Subsystems
- RCC 452-86, Video Standards and Formats
- RCC 453-77, Test Methods for Television Systems and Subsystems
- RCC 454-87, Glossary of Television Terms

2.2 Non-Government Documents

- ANSI/J-STD-001, Requirements for Soldered Electrical and Electronic Assemblies
- AS9100, Quality Management System Standard
- ISO9001, International Standards Organization Quality Management Systems
- ISO 10012, Quality Assurance Requirements for Measuring Equipment
- ANSI/ESD-S20.20, Development of an Electrostatic Discharge Control Program
- American National Standard Institute (ANSI) / National Conference of Standards Laboratories (NCSL) Z540-1, General Requirements for Calibration Laboratories and Measuring Equipment and Test Equipment
- International Telecommunication Union (ITU), Recommendation ITU-R BT.470-7, Conventional Analog Television Systems

2.3 Order of Precedence

In the event of a conflict between the text of this specification and the references cited herein, the text of this document takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations.

3 REQUIREMENTS

The receivers shall meet the performance specified in 3.1 under the environmental exposure conditions specified in 3.2.

3.1 Electrical Performance

3.1.1 Input Power

The receiver shall operate from an 115Vac, 60Hz power source.

3.1.2 RF Input

3.1.2.1 Frequency Range

The receiver shall be user selectable to operate in the frequency bands of 1750 to 1855MHz, 2200 to 2400MHz, and 4550 to 4850MHz. The ability to operate over the frequency bands of 1700 to 1900MHz, 2200 to 2400MHz, and 4400 to 5000MHz is desired.

3.1.2.2 Frequency Accuracy

The receiver frequency accuracy shall with in +/-2ppm of the setting displayed on the user frequency selection interface.

3.1.2.3 Tuning Resolution

The receiver tuning resolution shall be a minimum of 1MHz.

3.1.2.4 Receiver Sensitivity

The minimum receiver sensitivity at the RF input shall be -92dBm.

3.1.2.5 Maximum RF Input

The receiver shall operate nominally for a maximum RF input of up to +10dBm.

3.1.2.6 Input VSWR

The receiver VSWR at the RF input shall be a maximum of 2.0:1 in the specified frequency bands of operation.

3.1.2.7 Image Rejection

The receiver image rejection shall be greater than 60dB.

3.1.2.8 Noise Figure

The maximum receiver noise figure shall be 8dB.

3.1.2.9 Frequency Selection

The receiver frequency selection shall be via a BCD switch or keypad which is located on the receiver front panel. The BCD switch or alternate type of front panel display shall display the receiver frequency setting in MHz as indicated in Figure 1.

3.1.2.10 Input Impedance

The receiver RF input shall have an input impedance of 50 ohms.

3.1.3 Video Output

The receiver video input shall be compatible with a National Television System Committee (NTSC) color and monochrome video source in accordance with International Telecommunication Union Recommendation ITU-R BT.470-7.

3.1.3.1 Video Demodulation

The receiver shall be capable of demodulating a video source as specified in the referenced DFRC-VID-08-001, Analog C-Band Video Transmitter Requirements Document.

3.1.3.2 Video Signal to Noise

The receiver video signal to noise performance shall exceed 45dB for RF input levels greater than -80dBm.

3.1.3.3 Frequency Response

The output video frequency response linearity shall be within +/-1.0dB from 6Hz to 6MHz.

3.1.3.4 Modulation Frequency Response

The receiver output deviation sensitivity shall be adjustable up to a minimum of 1Vpeak-to-peak for a +/-6MHz deviation at the video transmitter.

3.1.3.5 De-emphasis

The receiver pre-emphasis shall be user selectable via user accessible switch allowing the user to select NTSC 525 line or no de-emphasis.

3.1.3.6 Output Impedance

The receiver video output impedance shall be 75 ohms and capable of driving a 75 ohm load at a minimum level of 1Vpeak-to-peak.

3.1.4 Subcarrier Modulation

The receiver shall demodulate a voice subcarrier at 7.5MHz. The ability to support additional subcarriers at 4.83, 5.8, 6.2 and 6.8MHz via a user interface is desired but not required.

3.1.4.1 Subcarrier Output Mode Selection

The subcarrier input shall allow for user selection between an AC coupled 600 ohm balanced output for audio mode and a DC coupled 10k ohm single ended output for digital mode.

3.1.4.2 Subcarrier Signal to Noise

The receiver subcarrier signal to noise performance shall exceed 50dB for an RF input levels greater than -80dBm.

3.1.4.2.1 Balanced (Audio) Output

The subcarrier balanced output impedance shall be 600 ohms +/-5.0 percent. The balanced output shall be capable of driving a 600 ohm load at a level of 6.2Vpeak-to-peak with a tolerance of 10 percent for a transmitter subcarrier deviation of +/-75kHz.

3.1.4.2.2 Single Ended (Digital) Output

The subcarrier single ended output impedance shall be 10k ohms +/-5.0 percent. The single ended output shall be capable of driving a 10k ohm load at a level of 0 to +12Vdc peak with a tolerance of 10 percent for a transmitter subcarrier deviation of +/-75kHz.

3.1.5 Remote Operation

The ability to support an Ethernet or RS-422 interface for receiver remote control is desired but not required. Ethernet is the preferred remote interface option.

3.2 Environmental Requirements

3.2.1 Operating Temperature

The receiver shall meet the performance requirements specified in 3.1 during and after exposure to operating temperatures ranging from 0 degrees F to +130 degrees F.

3.2.2 Storage Temperature

The receiver shall meet the performance requirements specified in 3.1 during and after exposure to storage temperatures ranging from -20 degrees F to +160 degrees F.

3.2.3 Vibration

3.2.3.1 Sine Vibration

The receiver shall meet the performance requirements specified in 3.1 after exposure to transportation vibration, in accordance with MIL-STD-810F, Figure 514.5C-1.

3.2.4 EMI

The receiver shall meet the requirements specified in MIL-STD-461F requirements for Air Force ground equipment.

3.3 Physical Characteristics

3.3.1 Dimensions

3.3.1.1 Receiver Dimensions

The receiver shall be a 19 inch rack mount chassis which conforms to a 1U, 2U or 3U standard height. The receiver shall meet the maximum outline dimensions as indicated in Figure 1. Specific connector and frequency display locations in Figure 1 are notional only.

3.3.2 Weight

The receiver shall weigh a maximum of 20 pounds.

3.3.3 Connectors

3.3.3.1 Power Input Connector

The receiver power input shall utilize an IEC/EN 60320-1/C14 type connector.

3.3.3.2 RF Input Connector

The receiver RF input connector shall utilize a TNC or N-type jack connector.

3.3.3.3 Video Output

The receiver video output connectors shall utilize a BNC jack type connector.

3.3.3.4 Audio Output

The receiver voice output connectors shall utilize a BNC jack type connector.

3.3.3.5 Connector Locations

Power, RF, video and audio connectors shall be located on the back of the receiver chassis. Additional video and audio connectors shall also be located on the front face of the receiver chassis.

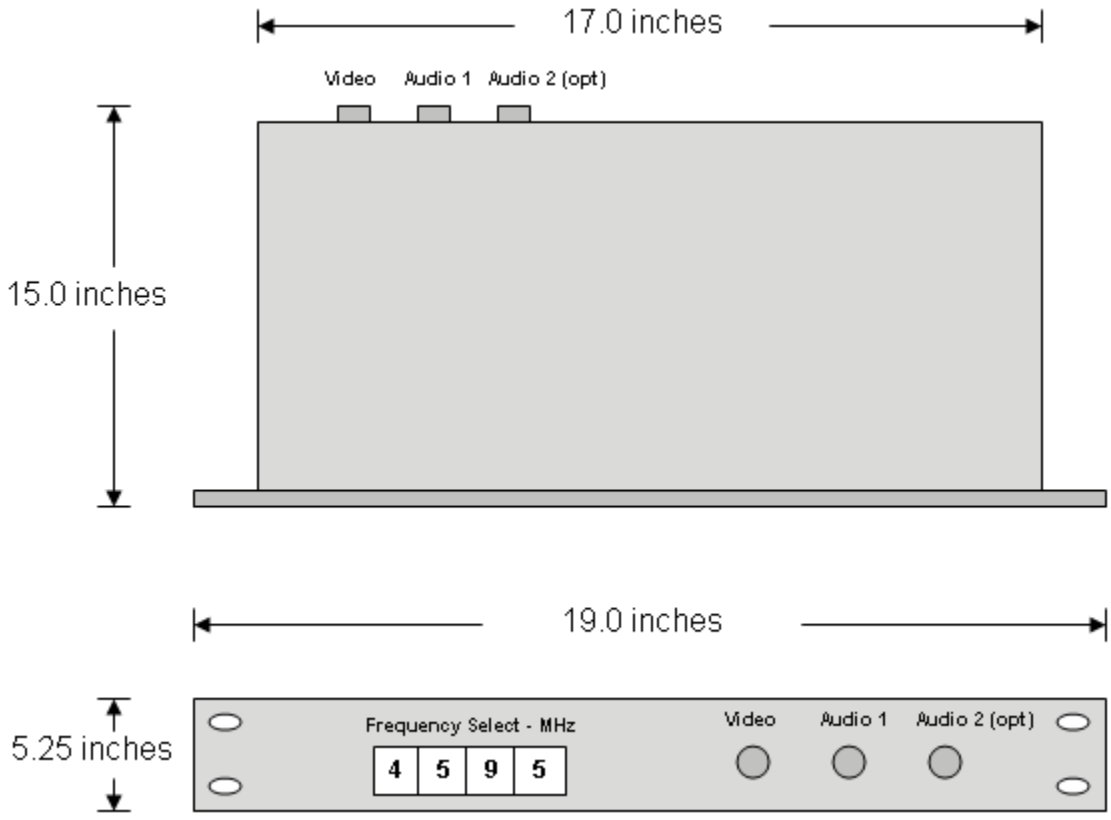

Figure 1: Maximum Receiver Outline Dimensions

3.3.4 Mounting

The receiver shall be designed with flanges to allow for rack mounting using four screws as

indicated on Figures 1.

3.4 Design and Construction

3.4.1 Materials and Processes

The materials and processes used in manufacture of the receiver shall be appropriate for the intended application.

3.4.2 Standards of Manufacture

3.4.2.1 Product Cleanliness

No oils or solid lubricants of any kind shall be used on any part of the receiver after final cleaning.

3.4.2.2 Soldering

Procedures and requirements for preparation and soldering of electrical connections shall be in accordance with ANSI/J-STD-001, Class 3.

3.4.2.3 Working Environment

The supplier shall provide adequate facilities for the fabrication, assembly, and testing of receivers.

4 VERIFICATION

4.1 Qualification Testing

The supplier is not required to perform qualification testing of the receiver. However, the receiver shall be designed to meet the electrical performance requirements of 3.1 during and after exposure to the environments in specified in 3.2.

4.2 Acceptance Testing

The supplier shall perform acceptance testing on all production units delivered.

4.2.1 Acceptance Test Requirements

The electrical performance requirements specified in 3.1 shall be verified during acceptance testing.

4.2.2 Acceptance Test Data

Acceptance test results shall be delivered to purchaser with each unit delivered.

4.3 Quality Assurance

The supplier shall have a quality management system in place that complies with the quality system requirements of AS9100 or ISO9001.

4.3.1 The Equipment and Inspection Facilities

The supplier shall ensure that test and inspection facilities of sufficient accuracy, quality, and quantity are established and maintained to conduct the required testing and inspections.

4.3.2 Calibration System

The supplier shall have a documented calibration system that meets the requirements of ISO 10012, Quality assurance requirements for measuring equipment, or the American National Standard Institute (ANSI) / National Conference of Standards Laboratories (NCSL) Z540-1, General Requirements for Calibration Laboratories and Measuring Equipment and Test Equipment standards.

4.3.3 Inspections and Data Requirements

The supplier shall perform all required inspections and tests to insure that all articles and materials conform to contract requirements and applicable drawings and specifications. Such inspections and tests shall encompass the receiving, processing, fabrication, assembly, end-item and shipping phases.

4.3.4 Electrical / Electronic Articles and Materials

The supplier shall develop an approved method of detecting counterfeit parts and a way of permanently removing them from the Electrical, Electronic and Electromechanical (EEE) parts purchasing network. The supplier shall notify NASA QA of any identification of counterfeit parts used in manufacturing or found in receiving inspection.

4.3.5 Electrostatic Discharge (ESD) Protection Program:

The supplier shall document and implement an ESD Control Program based on ANSI/ESD S20.20, ESD Association Standard for the Development of an Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices). Parts must be properly packaged and identified as required in ANSI/ESD-S20.20. All goods will be placed in conductive or static-dissipative packages, tubes, carriers, conductive bags, etc., for shipment. The packaging must be clearly labeled to indicate that it contains electrostatic sensitive goods. Electrical parts that may be used or shipped in conjunction with ESD sensitive parts shall be treated as ESD sensitive.

4.3.6 Verification of Serviceability

The supplier shall include a tag, label or similar instrument stating that the materials delivered are serviceable.

5 HARDWARE DELIVERY

5.1 Packaging

Material shall be packed for shipment in such a manner that will ensure acceptance by a common carrier and safe delivery at destination.

5.2 Certificate of Conformance

The delivered material shall include a certificate of conformance.

6 ABBREVIATIONS AND ACRONYMS

AC	Alternating Current

AM	Amplitude Modulation
ANSI	American National Standard Institute
ASTM	American Society for Testing and Materials
BCD	Binary Coded Decimal
dB	decibels
dBm	decibels relative to one milliwatt
BNC	Bayonette Neill-Concelman
DC	Direct Current
DFRC	Dryden Flight Research Center
EEE	Electrical, Electronic and Electromechanical
EMI	Electro-Magnetic Interference
ESD	Electro Static Discharge
F	Fahrenheit
FM	Frequency Modulation
Hz	Hertz
IAM	Incidental Amplitude Modulation
IEC	International Electrical Commission
IFM	Incidental Frequency Modulation
ISO	International Organization for Standardization
ITU	International Telecommunication Union
kHz	kilohertz
MHz	Megahertz
MIL	Military
NASA	National Aeronautics and Space Administration
NCSL	National Conference of Standards Laboratories
NTSC	National Television System Committee
QA	Quality Assurance
RCC	Range Commanders Council
RF	Radio Frequency
RH	Relative Humidity
STD	Standard
TNC	Threaded Neill-Concelman
V	volts
Vac	volts alternating current
Vdc	volts direct current
VSWR	voltage standing wave ratio