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The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the objective of this report.
This report describes the Operational Test and Evaluation (OT&E) Integration tests performed by ACW-400A on the High Capacity Voice Recorder (HCVR) equipment. This Commercial Off-The-Shelf (COTS) equipment is being acquired to replace existing 152-channel voice recorders currently in use at Air Route Traffic Control Centers (ARTCCs) and the New York Terminal Radar Approach Control (TRACON) Facility.

Tests to verify FAA-P-2878 (Purchase Description) requirements were performed at the Federal Aviation Administration (FAA) Technical Center. Tests to verify NAS-SS-1000, Volume I, System Level Requirements, and Volume IV, Subsystem Level Requirements were performed at the Seattle ARTCC (the designated key test site).

This equipment did not meet all FAA-P-2878 or NAS-SS-1000 requirements, primarily because it is COTS equipment and was not specifically designed to meet FAA requirements. The advantages of this equipment, however, outweigh the disadvantages, in the opinion of ACW-400A. The HCVR equipment is, therefore, recommended for deployment under the conditions cited in this report.

### Key Words
- High Capacity Voice Recorder (HCVR)
- Voice recording
- Peak limiter
# TABLE OF CONTENTS

**EXECUTIVE SUMMARY**

1. **INTRODUCTION**
   1.1 Background
   1.2 Purpose
   1.3 Participants
   1.4 Reference Documents

2. **TEST APPROACH AND CONCEPT**

3. **TESTS AT FAA TECHNICAL CENTER**
   3.1 Unit Level Tests
   3.2 Drop-out Tests
   3.3 Audio Input Level Tests

4. **OT&E INTEGRATION TESTS AT KEY SITE**
   4.1 System Level Requirements Verification Test
   4.2 Subsystem Level Requirements Verification Test

5. **CONCLUSIONS**
   5.1 Unit Level Test Conclusions
   5.2 Drop-out Test Conclusions
   5.3 Peak Limiter Test Conclusions
   5.4 OT&E Integration Test Conclusions

6. **RECOMMENDATIONS**

7. **ACRONYMS AND ABBREVIATIONS**

**APPENDIXES**

A - FAA-P-2878 Verification Requirements and Final Report
   Traceability Matrix

B - NAS-SS-1000 Volume I, System Level Requirements

C - NAS-SS-1000 Volume IV, Subsystem Level Requirements

D - Peak Limiter Test Results
# LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unit Level Test Configuration</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Audio Input Level Test</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Plot of Peak Limiter Output Data</td>
<td>9</td>
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## Accession For

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EXECUTIVE SUMMARY

The Magnasync Specialist 60-Channel Recorder/Reproducer is being acquired for the High Capacity Voice Recorder (HCVR) Program as a Commercial-Off-The-Shelf (COTS) replacement for the existing 152-channel voice recorders currently used at Air Route Traffic Control Centers (ARTCCs) and the New York Terminal Radar Approach Control Facility (TRACON).

During testing at the Federal Aviation Administration (FAA) Technical Center and at the key test site at the Seattle ARTCC, it was found that this equipment did not meet all FAA-P-2878 (Purchase Description) requirements. The requirements which failed are all categorized as noncritical, based on the definition of "Critical" in NAS-SS-1000, Volume I, Section 6, page 106; "Functions or services that, if lost, would prevent the NAS from exercising safe separation and control over aircraft."

It must be noted that this equipment is COTS equipment and was not specifically designed to meet all HCVR FAA-P-2878 requirements.

This procurement provides the following advantages:

1. Reduction in power consumption from 1.158 kilowatts (kW) to 991.5 watts (w), for the 300-channel system at the Seattle ARTCC,

2. Increased recording capacity from 152 channels to 300 channels, for Seattle ARTCC,

3. Increased reliability and reduced maintenance due to solid state modular design,

4. Head replacement period increased from 4 months for present recorders, to 3 years for Magnasync recorders,

5. Standard 10 1/2" tape reels as opposed to special reels for 152-channel recorder, and,

6. Commercially available replacement parts as opposed to specially machined parts for 152-channel recorder.

There are the following areas of concern;

1. This equipment cannot presently interface with a modified Inter-Range Instrumentation Group version E (IRIG-E) coded time source at the Seattle site.

2. The equipment exceeds the Total Harmonic Distortion voltage (THDv) requirement of the critical alternating current (AC) power bus.

An Engineering Change Proposal (ECP) is one of the options being considered to resolve the coded time source problem and a NAS Change Proposal (NCP) is in process for a waiver on the THDv requirement.

The advantages, in the opinion of ACW-400A, outweigh the disadvantages.

Deployment is recommended with the conditions noted in section 6 of this report.
1. INTRODUCTION.

This test report details the results of the High Capacity Voice Recorder (HCVR), Commercial Off-The-Shelf (COTS) equipment, Operational Test and Evaluation (OT&E) testing performed at the Federal Aviation Administration (FAA) Technical Center in April and May 1992, and at Seattle Air Route Traffic Control Center (ARTCC) (ZSE), the key test site, in May and June 1992.

1.1 BACKGROUND.

The HCVR is a 60-channel recorder/reproducer COTS replacement for the existing 152-channel voice recorders currently used at ARTCCs and the New York Terminal Radar Approach Control Facility (TRACON). Procurement of 60-channel recording equipment to replace existing aging units will assist in the modernization of ARTCCs and the New York TRACON, thereby improving the overall performance of the National Airspace System (NAS).

1.2 PURPOSE.

The HCVR is used for recording of all air-to-ground (a-g) and selected ground-to-ground (g-g) voice communications. The HCVR equipment will interface with existing communications systems to continuously record a-g and g-g voice communications and provide for monitoring, automated retrieval, and high speed reproduction of any recorded voice communications. The HCVR equipment consists of a dual transport recorder/reproducer system and a portable reproducer system.

1.3 PARTICIPANTS.

The OT&E Integration team for the HCVR equipment evaluation was composed of personnel from the Communications Test Team (ACW-400) of the FAA Technical Center for the unit level tests and personnel from ACW-400A and the Seattle ARTCC for the key site tests. The personnel involved are listed below.

1.3.1 FAA Technical Center.

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
</tr>
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<tbody>
<tr>
<td>Wayne Bell</td>
<td>ACW-400A</td>
</tr>
<tr>
<td>Edward Lind</td>
<td>ACW-400A</td>
</tr>
<tr>
<td>Andy Colon</td>
<td>ACW-400A</td>
</tr>
<tr>
<td>Benjamin Gottlieb</td>
<td>ACW-400A</td>
</tr>
<tr>
<td>Rich Morton</td>
<td>ACW-400A</td>
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1.3.2 Seattle ARTCC

<table>
<thead>
<tr>
<th>NAME</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Rachel Ayers</td>
<td>ZSE-TSO</td>
</tr>
<tr>
<td>Bob Carter</td>
<td>ZSE-NCO</td>
</tr>
<tr>
<td>T.J. Conrad</td>
<td>ZSE-RDC</td>
</tr>
<tr>
<td>Gary Weiler</td>
<td>ZSE-RDC</td>
</tr>
</tbody>
</table>
1.4 REFERENCE DOCUMENTS.

b. NAS-SS-1000 NAS System Specification, Functional and Performance Requirements for the National Airspace System.
c. FAA Order 1810.4B FAA Test and Evaluation Program.
d. HCVR-NAS System Performance Test Procedures.
e. HCVR-NAS System Integration Test Procedures.
f. FAA-P-2878 60 Channel Voice Recording and Playback Equipment Purchase Description
g. ANSI S3.2-1960 USA Standard Method for Measurement of Monosyllabic Word Intelligibility

2. TEST APPROACH AND CONCEPT.

The test approach was to operationally evaluate and integrate the HCVR equipment provided by Magnasync/Moviola Corporation of Hollywood, CA, to operationally evaluate and integrate the HCVR equipment into the NAS. This was accomplished by unit level tests at the FAA Technical Center and System Integration tests at the Seattle ARTCC. In order not to delay implementation of the HCVR project, these tests were conducted with the following known problems:

a. Equipment cannot operate with a modified IRIG-E coded time source,
b. Equipment exceeds NAS-SS-1000, Volume VI, paragraph 3.2.1.5.4.1.2.3b Total Harmonic Distortion voltage (THDv) requirement.

3. TESTS AT FAA TECHNICAL CENTER.

Three areas of tests were conducted at the FAA Technical Center; unit level tests, drop-out tests and audio input level tests. Each are discussed in the following paragraphs.

3.1 UNIT LEVEL TESTS.

Unit level tests were performed on the Magnasync Specialist 60-Channel Recorder/Reproducer, portable Reproducer and Degausser, to verify FAA-P-2878 Requirements (appendix A); selected NAS-SS-1000 Volumes I, System Level Requirements (appendix B); and selected NAS-SS-1000, Volume IV, Subsystem Level Requirements (appendix C). A block diagram of the test configuration of the unit level tests is provided in figure 1.
FIGURE 1. UNIT LEVEL TEST CONFIGURATION
The test configuration shown in figure 1 was used to verify the following FAA-P-2878 requirements:

3.3.14 Frequency Response
3.3.15 Harmonic Distortion
3.3.16 Signal-to-Noise
3.3.17 Crosstalk
3.3.18 Hum Distortion

Unit level tests were conducted on the following Magnasync Units:

a. Dual Transport Tape Recorder/Reproducer Unit
b. Portable Tape Reproducer Unit, Dual Cassette Recorder/Reproducer
c. Degausser Unit

The test configuration for each of these tests is provided in the HCVR-NAS System Performance Test Procedures prepared by ACW-400A.

3.1.1 Unit Level Test Results.

The FAA-P-2878 for the HCVR lists 85 requirements; 67 of these were verified by these tests; 14 requirements failed; and 4 could not be verified because manufacturer's data was not available. Appendix A lists these requirements and indicates the test status of each requirement.

There were three separate failures of a transformer on the record amplifier boards which was of a concern. This was considered a component failure and not a failure of a FAA-P-2878 requirement.

The FAA-P-2878 requirements which failed are listed below by categories:

<table>
<thead>
<tr>
<th>Failed Requirements</th>
<th>Failure</th>
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<tbody>
<tr>
<td>3.3.8 START TIME</td>
<td>0.9 SECONDS VS 0.5 SECONDS</td>
</tr>
<tr>
<td>3.3.10 TRANSPORT SENSORS</td>
<td>ONLY END-OF-TAPE (EOT) SENSOR PROVIDED. MOTION SENSING IS OBTAINED FROM TACH CKT SYNCHRONIZED TO MOTOR DRIVE. THIS PROVIDES EOT &amp; TAPE BREAKAGE SENSING. TAPE TRANSPORT DOES NOT STOP AND CONTINUES TO REEL THE LOOSE END OF THE TAPE ONTO THE FLOOR.</td>
</tr>
<tr>
<td>3.3.12 INPUT LEVELS</td>
<td>MANUAL CHANGE OF JUMPERS REQUIRED</td>
</tr>
<tr>
<td>3.3.20 HEAD ASSEMBLY</td>
<td>WARRANTY 3 YRS, RQMT 11.4 YRS</td>
</tr>
<tr>
<td>3.3.22 SWITCHING CIRCUITRY</td>
<td>FAA-P-2878 REQUIRES NO TRANSFER OF RECORDING WITH PWR SUPPLY FAILURE. RECORDER TRANSFERRED RECORDING WITH PWR SUPPLY FAILURE (MODULE REMOVED).</td>
</tr>
<tr>
<td>3.3.23 MONITOR &amp; ALARM</td>
<td>TAPE BREAKAGE BETWEEN CAPSTAN AND TAKE-UP REEL WILL NOT SOUND ALARM.</td>
</tr>
</tbody>
</table>
3.3.26.2 ACCESSIBILITY
OVERLOAD PROTECTION DEVICES NOT ON FRONT PANEL

3.4.1 PORTABLE REPRODUCER UNIT
PWR SUP & CONTROL PANEL NOT FULLY COMPATIBLE

3.4.1.1 DESIGN & CONSTRUCTION
HEIGHT 8" OVER SPEC (34")

3.4.1.5 FOOT CONTROL PANEL
AUTO-SEARCH NOT PROVIDED

3.4.1.7 TWO CHANNEL CASSETTE RECORDER
COULD NOT BE TESTED FOR IRIG FUNCTION. ECP IN PROCESS TO MOD MASTER SYNCHRONIZER TO CORRECT PROBLEM.

3.4.1.9 AUDIO TIME JACK
(SAME COMMENT AS FOR 3.4.1.7)

3.4.2.10 STOP FUNCTION
NO AUTO STOP AND EJECT (ONLY AUTO STOP)

3.4.4.4 DEGAUSSER CYCLE
DOES NOT MEET TIME AT LOW VOLTAGE

Note: Although these are specification requirements, this acquisition was a COTS buy, and all of these items were as provided by the Contractor.

Manufacturer Data Not Available

3.3.5.1 TAPE-PHYSICAL PROP.
DATA NOT AVAILABLE FROM MANUFACTURER.

3.3.26.5 SERVICE LIFE
DATA NOT PROVIDED BY MANUFACTURER.

3.5 MAINTAINABILITY & RELIABILITY
DATA NOT AVAILABLE FROM MANUFACTURER.

3.6 TEST TAPE
NOT PROVIDED BY MANUFACTURER.

NAS-SS-1000, Volume I, Section 6, page 106, defines Critical as "Functions or services that, if lost, would prevent the NAS from exercising safe separation and control over aircraft." Based on this definition, all of the failed requirements listed above are considered non-critical and would not prevent a deployment recommendation of the HCVR equipment.

3.2 DROP-OUT TESTS.

During Shakedown testing by ASM-640, loss of signal for short periods of time were noted (drop-outs). A drop-out was defined as a depression in the signal level for a period of time. This time was approximately 150 milliseconds (ms). Drop-out tests were conducted at the FAA Technical Center to verify test results obtained by ASM-640. The test scenario involved recording a 2000-hertz (Hz) audible tone using one of the recorder transports and reproducing it on the playback unit.
Additional tests were conducted using prerecorded tapes with ANSI standard word lists and with air traffic control (ATC) expressions. Six different word lists containing more than 300 words and 13 sentences spoken by different air traffic controllers were used for this test. Pauses were inserted to simulate drop-outs. These pauses varied in duration from 70 to 160 ms. The pause was randomly inserted on different syllables at the beginning, middle, and end of the word. Only one or two drop-outs were inserted in the sentences. Listeners were permitted to replay the tape as many times as they wished to hear the word. After hearing the tapes with drop-outs, the listeners were given tapes with the same word list, without drop-outs. The test data was analyzed for duration of drop-out, location of drop-out within the word, and the type of syllable containing the drop-out.

It should be noted that these tests were performed in the ACW-400A laboratory and limited by the availability of test equipment. In addition, the test tapes were played back on the Technics Dual Cassette Recorder provided with the Magnasync Recorder. This added another variable into the test.

3.2.1 Drop-out Test Results.

Tests performed on the Magnasync and Dictaphone tape recorders showed the Magnasync to have 24 drop-outs during 240 minutes of recording and the Dictaphone to have only 11 drop-outs for the same recording period. The lower drop-outs in the Dictaphone are attributed to having two capstans rather than one in the Magnasync. Detailed test results are available from ACW-400A.

Results from the prerecorded tape tests indicated an average of 10-20 percent of all words on the tapes with drop-outs were misinterpreted. The controller's sentences which contained one to two drop-outs per sentence were all interpreted correctly. A drop-out of greater than 100 ms at the beginning of the word had the most effect on the intelligibility of the word. This duration drop-out had less of an effect on multisyllable words. Test data sheets are available from ACW-400A.

3.3 AUDIO INPUT LEVEL TESTS.

These tests were conducted because of the problem encountered during initial OT&E Integration tests at the Seattle ARTCC. The signal level for input from air traffic controllers was measured at -37 decibels above 1 milliwatt (dBm) and audio input from the pilots at +5 dBm. The dynamic range of the recorders is 35 decibel (dB). This resulted in the tape recorder clipping the audio from the pilot since their input level was set above at -10 dBm. These tests were to determine the effect of the peak limiter circuit on the Record Board. A block diagram of the test configuration is shown in figure 2. The test was conducted over the full dynamic operating range of the recorder (35 dB). The input signal to the Record Board was varied from -51.2 dBm to +3.81 dBm (the maximum output of the Hewlett Packard (HP) Signal Generator). at three calibrated tap settings; -10 decibels above 1 millivolt (dBV), 0 dBV and +10 dBV. The output was measured at the Record Amplifier output, with and without the peak limiter circuit.
FIGURE 2. AUDIO INPUT LEVEL TEST
3.3.1 Audio Input Level Test Results.

A plot of the output data is provided in figure 3 and the measured data tabulated in appendix D. Figure 3 clearly shows the point at which the peak limiter comes into effect (at an output voltage of about 1.7 volts, far below the 5.5 volt saturation level). The peak limiter comes into effect at an input level of -13.2 dBm for the calibrated tap setting of -10 dBv and -3.19 dBm for the calibrated tap setting of 0 dBv. The level at which the peak limiter comes into effect for the calibrated tap setting of +10 dBm could not be determined because of limitations in the test equipment.

4. OT&E INTEGRATION TESTS AT KEY SITE.

Tests at the key site in Seattle had the following specific purposes:

a. Verify NAS-SS-1000, Volume I, System Level Requirements that could not be verified at the FAA Technical Center, and

b. Verify NAS-SS-1000, Volume IV Subsystem Level Requirements that could not be verified at the FAA Technical Center.

4.1 SYSTEM LEVEL REQUIREMENTS VERIFICATION TEST.

The purpose of these tests was to verify those NAS-SS-1000, Volume I, System Level Requirements applicable to the HCVR equipment. A total of 17 requirements are listed in appendix B. Seven of these are considered nonapplicable (N/A) because they are lead-in paragraphs or they do not specifically apply to the HCVR.

4.1.1 System Level Test Results.

Initial tests were mechanical alignment tests of the tape recorder/reproducer and limited recording tests on selected channels. A source of input signals for all channels was not available at the test site.

There was a failure of a transformer on the Record Board, but this was considered a component failure and not the failure of a function.

All ten of the applicable system level requirements were successfully completed.

4.2 SUBSYSTEM LEVEL REQUIREMENTS VERIFICATION TEST.

The purpose of these tests was to verify those NAS-SS-1000, Volume IV, Subsystem Level Requirements applicable to the HCVR equipment. A total of 56 requirements are listed in appendix C. Fifteen of these are considered N/A because they are lead-in paragraphs or they do not specifically apply to the HCVR.
FIGURE 3. PLOT OF PEAK LIMITER OUTPUT DATA
4.2.1 SUBSYSTEM LEVEL TEST RESULTS.

Twenty-nine NAS-SS-1000, Volume IV, Subsystem Level Requirements were successfully verified. Twelve requirements failed during testing at the Seattle ARTCC and are listed below:

<table>
<thead>
<tr>
<th>Paragraph No.</th>
<th>Requirement Description</th>
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<tbody>
<tr>
<td>3.2.1.2.5.1.3.2.b</td>
<td>Media runs out - Tape breakage, after the capstan, and record conditions will not activate alarm.</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2.c</td>
<td>Media fails - Tape breakage, after the capstan, and record conditions will not activate alarm.</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2.d</td>
<td>Failure of the media remaining sensor - Certain tape breakage and record conditions will not activate alarm.</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2.e</td>
<td>Any condition that actuates the shutdown system - Certain tape breakage and record conditions will not activate alarm.</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2.f</td>
<td>Failure of the record function in the operating recorder - Certain tape breakage and record conditions will not activate alarm.</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.3.a</td>
<td>Any of the conditions which cause main to standby recorder switching except when the media on the operating recorder reaches the adjusted sensing point - Certain tape breakage and record conditions will not activate alarm.</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.3.b</td>
<td>Failure of any power supply module - Certain tape breakage and record conditions will not activate alarm.</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.3.c</td>
<td>Loss of time code signal recording - Contractor provides no alarm for loss of time code.</td>
</tr>
<tr>
<td>3.2.1.2.5.1.6</td>
<td>Erasing equipment - The erasing equipment shall provide for erasure of media - Degausser takes 64 seconds at low AC voltage (105 volts).</td>
</tr>
<tr>
<td>3.2.1.2.5.2.2.1</td>
<td>Input levels - The record system shall record all audio signals from -35 dBm to 0 dBm - Failure due to manual change of jumpers to select levels.</td>
</tr>
</tbody>
</table>
3.2.1.2.5.2.2.4 Availability - The recording equipment shall meet an availability of .999 - Data not available from contractor.

3.2.1.2.5.2.5 Erasing equipment - The total erasure time shall not exceed 50 seconds - Degausser takes 64 seconds at low AC voltage (105 volts).

5. CONCLUSIONS.

ACW-400A conclusions from the Federal Aviation Administration (FAA) Technical Center tests and key site tests are discussed in the following paragraphs.

5.1 UNIT LEVEL TEST CONCLUSIONS.

All of the failures obtained on the unit tests are considered noncritical. In addition, some of the failures were due to the contractor’s equipment not meeting specification requirements because of their equipment design. This was a Commercial Off-The-Shelf (COTS) acquisition. The equipment was not specifically designed to meet the FAA-P-2878 requirements.

5.2 DROP-OUT TEST CONCLUSIONS.

Drop-outs of 70 to 160 milliseconds (ms) will not have a significant impact on detecting information recorded on tape.

5.3 PEAK LIMITER TEST CONCLUSIONS.

The sites will have to adjust the input levels to the recorder to prevent saturation of the signal, without a peak limiter.

The sites need not be concerned about the input level and leave them set at their present levels, with a peak limiter.

5.4 OT&E INTEGRATION TEST CONCLUSIONS.

Test conclusions for the two areas of test comprising Operational Test and Evaluation (OT&E) Integration are discussed in the following paragraphs.

5.4.1 SYSTEM LEVEL TEST CONCLUSIONS.

One failure, noted during OT&E Integration, is the failure of a transformer on the Record Board. This could cause a failure of the tone signal that would be difficult to detect unless each channel of the recorder was checked separately.

5.4.2 SUBSYSTEM LEVEL TEST CONCLUSIONS.

The subsystem level requirements which failed are considered noncritical and would not prevent a recommendation to deploy the HCVR equipment. Some of the failures are due to the equipment being COTS and the contractor did not provide some of the features required by the FAA-P-2878.
6. RECOMMENDATIONS.

ACW-400A recommends deployment of the High Capacity Voice Recorder (HCVR) equipment under the following conditions:

a. All channels on the recorder be tested each time a tape is changed. This will prevent the failure of the transformer on the Record Board causing an undetectable failure of the tone signal and ensure that all channels are operating properly.

b. Peak limiters be supplied on all Record Boards. This will provide greater flexibility for operating with different signal levels. (Peak limiters are presently installed on the 152-channel voice recorders).

c. The program office to provide an acceptable interface for the master synchronizer Coded Time Source (CTS) input.

d. ACW-400A recommends that the National Airspace System (NAS) Change Proposal (NCP) to waive the NAS-SS-1000 Total Harmonic Distortion voltage (THDv) requirement be approved before deployment.

7. ACRONYMS AND ABBREVIATIONS.

a-g air-to-ground
AGC Automatic Gain Control
ANSI American National Standard Institute
ARTCC Air Route Traffic Control Center
ATC Air Traffic Control
COTS Commercial-Off-The-Shelf
CTS Coded Time Source
dB decibel
dBm decibels above 1 milliwatt
dBv decibels above 1 millivolt
ECP Engineering Change Proposal
EOT End of Tape
FAA Federal Aviation Administration
g-g ground-to-ground
HCVR High Capacity Voice Recorder
HP Hewlett Packard
Hz hertz
IRIG Inter-Range Instrumentation Group
ms milliseconds
NAS National Airspace System
NCP National Airspace System (NAS) Change Proposal
OT&E Operational Test and Evaluation
THDv Total Harmonic Distortion voltage
TRACON Terminal Radar Approach Control Facility
VRTM Verification Requirements Traceability Matrix
APPENDIX A

FAA-P-2878 VERIFICATION REQUIREMENTS AND FINAL REPORT TRACEABILITY MATRIX
<table>
<thead>
<tr>
<th>FAA-P-2878 PARAGRAPH NUMBER</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>VERIFICATION METHODS</th>
<th>UNIT TEST PROCEDURE PARAGRAPH NUMBER</th>
<th>TEST STATUS</th>
<th>NOTES</th>
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<td>A</td>
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<td>D</td>
<td>1.1.2</td>
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<td></td>
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<td>RECORDING TAPE</td>
<td>A</td>
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**VERIFICATION METHODS:**

- **T** - TEST
- **D** - DEMONSTRATION
- **A** - ANALYSIS
- **I** - INSPECTION
- **N/A** - NOT APPLICABLE

**NOTES:**

1. WARRANTY INFORMATION WAS OBTAINED FROM AMPLEX (TAPE MANUFACTURE), AND NOT MAGNASYNC
2. YIELD, BREAKING AND WEAR INFORMATION NOT AVAILABLE FROM MANUFACTURE
3. REMENANCE INFORMATION IS PROPORTIONAL TO RETENTIVITY WHICH PASSED
4. BREAK MECHANISM DOES NOT ENGAGE IF TAPE BREAKS AFTER CAPSTAN
5. LACK OF CONTACT BETWEEN THE RECORDING HEAD AND THE TAPE COULD NOT BE VERIFIED
6. START-TIME FROM STOP TO STABLE RECORD-SIGNAL IS 995 MS ON TRA. A AND 912 MS ON TRA. B
7. ONLY END OF TAPE SENSOR IS INSTALLED
<table>
<thead>
<tr>
<th>FAA-P-2878 PARAGRAPH NUMBER</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>VERIFICATION METHODS</th>
<th>UNIT TEST PROCEDURE PARAGRAPH NUMBER</th>
<th>TEST STATUS</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>3.3.11</td>
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VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE
PASS = PASSED, MEETS REQUIREMENT WITHOUT COMMENT

NOTES: 1 = MANUAL CHANGING OF JUMPERS NEEDED TO SELECT INPUT LEVELS FROM +20 dBm TO -30 dBm
2 = HEAD WEAR INFORMATION INDICATES WARRANTY FOR 3 YEARS, FAA-P-2878 REQ. 11.4 YEARS.
3 = SEE CONTRACT AMENDMENT 001 DATED 5-20-91 QUESTION (2).
<table>
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<tr>
<th>FAA-P-2878 PARAGRAPH NUMBER</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>VERIFICATION METHODS</th>
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<th>TEST STATUS</th>
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<tr>
<td>3.3.21.3</td>
<td>BATTERY BACKUP</td>
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<td>D</td>
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<td>PASS</td>
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**VERIFICATION METHODS:** T-TEST, D-Demonstration, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE

**PASS** - PASSED, MEETS REQUIREMENT WITHOUT COMMENT

**NOTES:**
1 - DOES NOT MEET SPECIFICATION DUE TO POWER SUPPLIES CONFIGURATION AS IN NOTE 3.
2 - CERTAIN TAPE BREAKAGE AND RECORD CONDITION WILL NOT ACTIVATE ALARM.
3 - DIGITAL TIME CODE PASSED PD REQUIREMENT, BUT WILL REQUIRE ADAPTATION TO IRIG-E (600 Hz).
4 - OVERLOAD PROTECTIVE DEVICES ARE NOT ON FRONT PANEL.
<table>
<thead>
<tr>
<th>FAA-P-2878 PARAGRAPH NUMBER</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>VERIFICATION METHODS</th>
<th>UNIT LEVEL</th>
<th>UNIT TEST PROCEDURE PARAGRAPH NUMBER</th>
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**VERIFICATION METHODS:**  T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE

**NOTES:**
1 - DATA NOT PROVIDED BY MANUFACTURER.
2 - THIS PARAGRAPH IS A LEAD-IN AND DOES NOT CONTAIN A TEST.
3 - FAIL DUE TO POWER SUPPLY AND CONTROL PANEL ARE NOT FULLY COMPATIBLE. ALSO IRIG-E NOT AVAILABLE FOR TESTING.
4 - OVERALL HEIGHT IS 42", 8" OVER THE SPECIFIED 34".
<table>
<thead>
<tr>
<th>FAA-P-2878 PARAGRAPH NUMBER</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>VERIFICATION METHODS</th>
<th>UNIT TEST PROCEDURE PARAGRAPH NUMBER</th>
<th>TEST STATUS</th>
<th>UNIT</th>
<th>NOTES</th>
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<td>3.4.1.4</td>
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<td>PASS</td>
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<td>D</td>
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<td>PASS</td>
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VERIFICATION METHODS:  T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE
PASS - PASSED, MEETS REQUIREMENT WITHOUT COMMENT

NOTES:  1 - AUTO-SEARCH IS NOT PROVIDED FOR FOOT CONTROL.
2 - TWO CHANNEL CASSETTE RECORDER COULD NOT BE TESTED FOR IRIG-E FUNCTIONS.
3 - AUDIO JACK IS PROVIDED, IRIG-E COULD NOT BE TESTED.
<table>
<thead>
<tr>
<th>FAA-P-2878 PARAGRAPH NUMBER</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>VERIFICATION METHODS</th>
<th>UNIT LEVEL</th>
<th>UNIT TEST PROCEDURE PARAGRAPH NUMBER</th>
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<tbody>
<tr>
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<td>STOP FUNCTION</td>
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<td>T</td>
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VERIFICATION METHODS: T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, N/A=NOT APPLICABLE

PASS = PASSED, MEETS REQUIREMENT WITHOUT COMMENT

NOTES: 1 = AUTOMATIC STOP BUT NOT AUTOMATIC STOP AND EJECT.
2 = DEGAUSSER, MEETS REQ. AT 120V & 130V BUT AT 105 TIME WAS 64 sec.
3 = INFORMATION NOT AVAILABLE.
4 = TEST TAPE NOT AVAILABLE.
APPENDIX B

NAS-SS-1000 VOLUME I, SYSTEM LEVEL REQUIREMENTS
<table>
<thead>
<tr>
<th>Requirement Description</th>
<th>Purchase Description</th>
<th>Verification Method</th>
<th>Test Locations FAAC</th>
<th>Test Locations Seattle</th>
<th>HCVR-NAS INTG/PERF PROCEDURE</th>
<th>P/F</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS time standard - Means for interfacing NAS subsystem having their own time standard and/or synchronization capabilities with other NAS subsystems requiring these capabilities.</td>
<td>--------</td>
<td>D</td>
<td>*</td>
<td>5.4-112</td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data &amp; voice archiving perform. characteristics- The NAS shall provide data and voice storage recording and playback capability for reconstruction purposes.</td>
<td>--------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Record all specified operational voice and data information for support of analysis.</td>
<td>3.3.1.1 D</td>
<td>D</td>
<td>*</td>
<td>5.4-103</td>
<td>1.1.2</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Retrieve and playback all specified recorded data and voice information requested by an authorized specialist.</td>
<td>--------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

**Verification Methods:** T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, L.I-LEAD-IN, *-Test Site
<table>
<thead>
<tr>
<th>Requirement Description</th>
<th>Purchase Description</th>
<th>Verification Method</th>
<th>Test Locations</th>
<th>HCVR-NAS Intg/Perf Procedure</th>
<th>P/F</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice recording retrieval within 30 minutes from on-line storage and within 60 minutes from off-line storage.</td>
<td>3.3.24.1 D</td>
<td></td>
<td>*</td>
<td>5.4-111</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.3.24.2 D</td>
<td></td>
<td>*</td>
<td>1.1.32</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.4.2.5 D</td>
<td></td>
<td>*</td>
<td>3.1.5</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.4.2.6 D</td>
<td></td>
<td>*</td>
<td>3.1.6</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Data recordings retrievable from off-line storage</td>
<td>3.3.5 A</td>
<td></td>
<td>*</td>
<td>1.1.7</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Store all operational data and voice recordings in accordance with appropriate FAA procedures.</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice transmission, 15 days min.</td>
<td>D</td>
<td></td>
<td>*</td>
<td></td>
<td>P</td>
<td>1</td>
</tr>
<tr>
<td>Data information, 15 days min.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>NAS time standard performance characteristics. - The NAS shall provide a standard time signal.</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Verification Methods: T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, N/A=NOT APPLICABLE, LI=LEAD-IN, *=Test Site

Notes: (1) This is the normal operating procedures for FAA ARTCC's.
<table>
<thead>
<tr>
<th>NAS-SS-1000 VOL. I REF. PARAGRAPH</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>PURCHASE DESCRIPTION</th>
<th>VERIFICATION METHOD</th>
<th>TEST LOCATIONS</th>
<th>HCVR-NAS INTG/PERF PROCEDURE</th>
<th>P/F</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1.2.8.4.b</td>
<td>A system dealing with non-ATC functions shall be synchronized to within 6 seconds of UTC.</td>
<td>--------</td>
<td>T</td>
<td>*</td>
<td>5.2-101</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>D</td>
<td>*</td>
<td>5.4-104</td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>D</td>
<td>*</td>
<td>5.4-112</td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.8.4.c</td>
<td>The NAS shall provide interfacing capabilities to the coded time signal and synchronization in accordance with Vol. II-V of NAS-SS-1000.</td>
<td>--------</td>
<td>D</td>
<td>*</td>
<td>5.4-112</td>
<td>P</td>
<td></td>
</tr>
</tbody>
</table>

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, **-Test Site
<table>
<thead>
<tr>
<th>NAS-SS-1000 VOL. IV REF. PARAGRAPH</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>PURCHASE DESCRIPTION</th>
<th>VERIFICATION METHOD</th>
<th>TEST LOCATIONS</th>
<th>HCVR-NAS INTG/PART PROCEDURE</th>
<th>P/F</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1.2.5</td>
<td>Recording Equipment-Multichannel recording equipment will provide the legal recording of voice comm. involving air traffic control activities. The recording equip. will consist of the record and reproduce systems, duplica. equip. and erasing equipment.</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.1</td>
<td>Functional characteristics - The recording equipment shall provide the following function:</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.1.1</td>
<td>Time - The recording equipment shall record time code that is synchronized with an external time source or its own CTS.</td>
<td>3.3.25.1</td>
<td>D</td>
<td>*</td>
<td>5.5-104</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.1.2</td>
<td>Record &amp; reproduce system - The record and reproduce system shall provide the following:</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Verification Methods: T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, N/A=NOT APPLICABLE, LI=LEAD-IN, *=Test Site
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<th>REQUIREMENT DESCRIPTION</th>
<th>PURCHASE DESCRIPTION</th>
<th>VERIFICATION METHOD</th>
<th>TEST LOCATIONS</th>
<th>HCVR-NAS INTG/PURF PROCEDURE</th>
<th>P/F</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOL. IV</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>REF. PARAGRAP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.1.2.1</td>
<td>Media sensor - Each recorder shall provide:</td>
<td>---------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.1</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.1.2.1.a</td>
<td>End of media sensor</td>
<td>3.3.10</td>
<td>D</td>
<td>*</td>
<td>5.4-110</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.1.2.1.b</td>
<td>Media failure sensor</td>
<td>---------</td>
<td>D</td>
<td>*</td>
<td>5.1-109</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.1.2.1.c</td>
<td>Adj. media remaining sensor</td>
<td>---------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>-----</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.1.2.2</td>
<td>Shutdown system - Each recorder shall be designed to stop automatically in the event of:</td>
<td>---------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.1</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.1.2.2.a</td>
<td>A power failure</td>
<td>3.3.6</td>
<td>D</td>
<td>*</td>
<td>1.1.8</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.1.2.2.b</td>
<td>Media failure</td>
<td>---------</td>
<td>D</td>
<td>*</td>
<td>5.1-109</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.1.2.2.c</td>
<td>End-of-media detection</td>
<td>3.3.10</td>
<td>D</td>
<td>*</td>
<td>5.4-110</td>
<td>P</td>
<td></td>
</tr>
</tbody>
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VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, *-Test Site
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<th>NAS-SS-1000</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>PURCHASE DESCRIPTION</th>
<th>VERIFICATION METHOD</th>
<th>TEST LOCATIONS</th>
<th>HCVR-NAS INTG/PF PROCEDURE</th>
<th>P/F</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1.2.5.1.3</td>
<td>Record system - The record system shall provide the following functions:</td>
<td>--------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.1</td>
<td>Dual recorders - The record system shall provide a:</td>
<td>--------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.1.a</td>
<td>Operating recorder;</td>
<td>3.3.1</td>
<td>A</td>
<td>*</td>
<td>*</td>
<td>5.4-103</td>
<td>P</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.1.b</td>
<td>Standby recorder</td>
<td>3.3.1</td>
<td>A</td>
<td>D</td>
<td>*</td>
<td>*</td>
<td>5.4-103</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2</td>
<td>Main/standby recorder switching - The record system shall automatically place the standby recorder into operat. when the following occurs</td>
<td>--------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2.a</td>
<td>Media remaining on the operating recorder reaches the adjusted sensing point;</td>
<td>--------</td>
<td>D</td>
<td>*</td>
<td>5.1-109</td>
<td>P</td>
<td></td>
</tr>
</tbody>
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**VERIFICATION METHODS:** T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, *-Test Site
<table>
<thead>
<tr>
<th>NAS-SS-1000 VOL. IV REF. PARAGRAPH</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>PURCHASE DESCRIPTION</th>
<th>VERIFICATION METHOD</th>
<th>TEST LOCATIONS</th>
<th>HCVR-NAS INTG/PERF PROCEDURE</th>
<th>P/F</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1.2.5.1.3.2.b</td>
<td>Media runs out;</td>
<td>3.3.23</td>
<td>D</td>
<td>*</td>
<td>1.1.29</td>
<td>F</td>
<td>1</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2.c</td>
<td>Media fails;</td>
<td>3.3.23</td>
<td>D</td>
<td>*</td>
<td>1.1.29</td>
<td>F</td>
<td>1</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2.d</td>
<td>Failure of the media remaining sensor;</td>
<td>3.3.23</td>
<td>D</td>
<td>*</td>
<td>1.1.29</td>
<td>F</td>
<td>1</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2.e</td>
<td>Any condition that actuates the shutdown system;</td>
<td>3.3.23</td>
<td>D</td>
<td>*</td>
<td>1.1.29</td>
<td>F</td>
<td>1</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.2.f</td>
<td>Failure of the record function in the operating recorder.</td>
<td>3.3.23</td>
<td>D</td>
<td>*</td>
<td>1.1.29</td>
<td>F</td>
<td>1</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.3</td>
<td>Alarms - The following conditions shall cause an alarm to be generated;</td>
<td>-------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I.</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.3.a</td>
<td>Any of the conditions which cause main to standby recorder switching except when the media on the operating recorder reaches the adjusted sensing point;</td>
<td>3.3.23</td>
<td>D</td>
<td>D</td>
<td>*</td>
<td>5.4-109</td>
<td>P</td>
</tr>
</tbody>
</table>

**VERIFICATION METHODS:** T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, N/A=NOT APPLICABLE, LI=LEAD-IN, *=Test Site

**NOTE:** (1) Certain tape breakage and record conditions will not activate an alarm.
<table>
<thead>
<tr>
<th>NAS-SS-1000 VOL. IV REF. PARAGRAPH</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>PURCHASE DESCRIPTION</th>
<th>VERIFICATION METHOD</th>
<th>TEST LOCATIONS</th>
<th>HCVR-NAS INTG/PERF PROCEDURE</th>
<th>P/F</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1.2.5.1.3.3.b</td>
<td>Failure of any power supply module;</td>
<td>3.3.23</td>
<td>D</td>
<td>*</td>
<td>1.1.29</td>
<td>F</td>
<td>1</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.3.c</td>
<td>Loss of time code signal recording;</td>
<td>3.3.23</td>
<td>D</td>
<td>*</td>
<td>1.1.29</td>
<td>F</td>
<td>2</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.3.d</td>
<td>Record malfunction</td>
<td>3.3.23</td>
<td>D</td>
<td>*</td>
<td>*</td>
<td>5.4-109</td>
<td>P</td>
</tr>
<tr>
<td>3.2.1.2.5.1.3.4</td>
<td>Channel monitor - Channel monitoring shall not interfere with normal operations</td>
<td>3.3.23.1</td>
<td>D</td>
<td>*</td>
<td>1.1.30</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.1.4</td>
<td>Reproduction - The reproduction system shall provide:</td>
<td>3.4.1.1</td>
<td>D</td>
<td>*</td>
<td>5.5-103</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.1.4.a</td>
<td>Playback of a single channel</td>
<td>3.4.1.1</td>
<td>D</td>
<td>*</td>
<td>5.5-103</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.1.4.b</td>
<td>Playback of at least two channels simultaneously.</td>
<td>3.4.1.1</td>
<td>D</td>
<td>*</td>
<td>5.5-104</td>
<td>P</td>
<td>5.5-104</td>
</tr>
<tr>
<td>3.2.1.2.5.1.5</td>
<td>Duplicating equipment - The media duplication equipment shall record &amp; reproduce at least two selected channels.</td>
<td>3.4.1.1</td>
<td>D</td>
<td>*</td>
<td>5.5-104</td>
<td>P</td>
<td>5.5-104</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Certain tape breakage & record conditions will not activate an alarm.
2. Magnasync provides no alarm is case of loss of time code.
<table>
<thead>
<tr>
<th>NAS-SS-1000 VOL. IV REF. PARAGRAPH</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>PURCHASE DESCRIPTION</th>
<th>VERIFICATION METHOD</th>
<th>TEST LOCATIONS</th>
<th>HCVR-NAS INTG/PERF PROCEDURE</th>
<th>P/F</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1.2.5.1.6</td>
<td>Erasing equipment - The erasing equipment shall provide for erasure of media.</td>
<td>3.4.4</td>
<td>D</td>
<td>*</td>
<td>4.1.1</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.4.4.1</td>
<td>D</td>
<td>*</td>
<td>4.1.1</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.4.4.4</td>
<td>D</td>
<td>*</td>
<td>4.1.4</td>
<td>F</td>
<td>1</td>
</tr>
<tr>
<td>3.2.1.2.5.2</td>
<td>Performance characteristics - The recording equipment shall meet the following performance characteristics:</td>
<td>---</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.2.1</td>
<td>Record and reproduce system - The record and reproduce system shall meet the following performance characteristics:</td>
<td>---</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
</tr>
<tr>
<td>3.2.1.2.5.2.1.1</td>
<td>Stop time - The system shall stop within 1 second after a stop command.</td>
<td>3.3.9</td>
<td>T</td>
<td>*</td>
<td>1.1.11</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.2.1.2</td>
<td>Length of recording without changing media - A recording system shall record 24 hours before changing media.</td>
<td>3.3.1.1</td>
<td>D</td>
<td>*</td>
<td>1.1.2</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2.5.2.2</td>
<td>Record system - The record system shall meet the following performance characteristics:</td>
<td>---</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
</tr>
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**VERIFICATION METHODS:** T-TEST, D-Demonstration, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, *-Test Site

**NOTES:** (1) DEGAUSSER, MEETS REQ. AT 120V & 130V, BUT AT 105 TIME WAS 64 sec (>0 sec REQ.).
<table>
<thead>
<tr>
<th>NAS-SS-1000 VOL. IV REF. PARAGRAPH</th>
<th>REQUIREMENT DESCRIPTION</th>
<th>PURCHASE DESCRIPTION</th>
<th>VERIFICATION METHOD</th>
<th>TEST LOCATIONS</th>
<th>HCVR-NAS INTG/PERF PROCEDURE</th>
<th>P/F</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1.2.5.2.2.1</td>
<td>Input levels - The record system shall record all audio signals with a dynamic range from -35 dBm to 0 dBm.</td>
<td>3.3.12</td>
<td>T</td>
<td>*</td>
<td>1.1.14</td>
<td>F</td>
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<td>3.2.1.2.5.2.2.2</td>
<td>Frequency response - The freq. response of each channel over the frequency range 300-3000 Hz shall not vary by more than 4 dB.</td>
<td>3.3.14</td>
<td>T</td>
<td>*</td>
<td>1.1.16</td>
<td>P</td>
<td></td>
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<tr>
<td>3.2.1.2.5.2.2.3</td>
<td>Harmonic &amp; intermodulation distortion - There shall be no distortion component greater than -34 dBm.</td>
<td>3.3.15</td>
<td>T</td>
<td>*</td>
<td>1.1.17</td>
<td>P</td>
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<tr>
<td>3.2.1.2.5.2.2.4</td>
<td>Availability - The recording equipment shall meet an availability of .999.</td>
<td>3.5</td>
<td>A</td>
<td>*</td>
<td>5.1</td>
<td>F</td>
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<tr>
<td>3.2.1.2.5.2.3</td>
<td>Reproduction - The reproduction system shall meet the following performance characteristics:</td>
<td>-------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>L.I</td>
<td>N/A</td>
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<tr>
<td>3.2.1.2.5.2.3.1</td>
<td>Frequency response - The freq. response of each channel over the frequency range 300-3000 Hz shall not vary more than 3 dB.</td>
<td>3.3.14</td>
<td>T</td>
<td>*</td>
<td>5.5-105</td>
<td>P</td>
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**NOTES:**

1. Magnasync uses jumpers which need to be installed manually.
2. Information not available.
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<tr>
<th>NAS-SS-1000 VOL. IV REF. PARAGRAPH</th>
<th>REQUIREMENT DESCRIPTION</th>
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<th>NOTES</th>
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<tr>
<td>3.2.1.2.5.2.3.2</td>
<td>Harmonic and intermodulation distortion - There shall be no distortion component that is greater than -34 dBm.</td>
<td>3.3.15 3.3.15</td>
<td>T T</td>
<td>*</td>
<td>*</td>
<td>5.5-106 5.5-107</td>
<td>P</td>
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<tr>
<td>3.2.1.2.5.2.3.3</td>
<td>Noise - The noise in each channel shall be at least 35 dB below a 0 dBm 1000 Hz record channel signal level.</td>
<td>3.3.16</td>
<td>T</td>
<td>*</td>
<td></td>
<td>5.5-109</td>
<td>P</td>
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<tr>
<td>3.2.1.2.5.2.3.4</td>
<td>Crosstalk - No crosstalk signal component shall have an output level greater than -35 dBm at the repro. system monitor output.</td>
<td>3.3.17</td>
<td>T</td>
<td>*</td>
<td></td>
<td>5.5-108</td>
<td>P</td>
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<tr>
<td>3.2.1.2.5.2.3.5</td>
<td>Hum distortion - The hum distortion produced in each channel shall not exceed -35 dBm with an input level of -15 dBm at 1000 Hz to the channel and an output level of 0 dBm at the reproduce system monitor output.</td>
<td>3.3.18</td>
<td>T</td>
<td>*</td>
<td></td>
<td>5.5-110</td>
<td>P</td>
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</table>

**Verification Methods:** T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, N/A=NOT APPLICABLE, LI=LEAD-IN, **=Test Site
<table>
<thead>
<tr>
<th>NAS-SS-1000 VOL. IV REF. PARAGRAPH</th>
<th>REQUIREMENT DESCRIPTION</th>
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<th>P/F</th>
<th>NOTES</th>
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</thead>
<tbody>
<tr>
<td>3.2.1.2.5.2.4</td>
<td>Duplicating equipment - The media duplicating equipment shall meet the following perf. char.</td>
<td>--------</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<td>3.2.1.2.5.2.4.1</td>
<td>Frequency response - The freq. response of each channel over the range 300-3000 Hz shall not vary by more than 4 dB.</td>
<td>3.3.14</td>
<td>T</td>
<td>*</td>
<td>5.5-111</td>
<td>P</td>
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<tr>
<td>3.2.1.2.5.2.4.2</td>
<td>Crosstalk - The crosstalk in each channel shall be at least 35 dB below the channel signal level.</td>
<td>3.3.17</td>
<td>T</td>
<td>*</td>
<td>5.5-114</td>
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<tr>
<td>3.2.1.2.5.2.4.3</td>
<td>Noise - The noise in each channel shall be at least 50 dB below the channel signal level.</td>
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<tr>
<td>3.2.1.2.5.2.4.4</td>
<td>Harmonic distortion - There shall be no distortion component greater than -34 dBm.</td>
<td>3.3.15</td>
<td>T</td>
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<td>P</td>
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<td>3.2.1.2.5.2.4.5</td>
<td>Hum distortion - The hum distortion produced in each channel shall be at least 35 dB below signal level.</td>
<td>3.3.18</td>
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<td>5.5-116</td>
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<td>3.2.1.2.5.2.5</td>
<td>Erasing equip. - The total erasure time shall not exceed 50 seconds.</td>
<td>3.4.4.4</td>
<td>D</td>
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**VERIFICATION METHODS:** T-TEST, D-Demonstration, A-Analysis, I-Inspection, N/A-Not Applicable, LI-Lead-In, **Test Location

**NOTES:** (1) Degausser, meets req. at 120v & 130v, but at 105 was 64 sec. (50 sec. req.).
APPENDIX D

PEAK LIMITER TEST RESULTS
<table>
<thead>
<tr>
<th>INPUT to Pad dbm</th>
<th>INPUT to Circuit dbm</th>
<th>CH 2 OUT (+) 10 dbm</th>
<th>CH 2 OUT (-) 10 dbm</th>
<th>CH 12 OUT (+) 10 dbm</th>
<th>CH 12 OUT (-) 10 dbm</th>
<th>CH 2 OUT NO LIM</th>
<th>CH 12 OUT NO LIM</th>
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