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INFORMATION HANDLING SERVICES

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U.S. Department of Transportation

Federal Aviation Administration

Specification

DOWN SCOPED
RADIO CONTROL EQUIPMENT (DSRCE)

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1. SCOPE.

1.1 Identification. This document establishes the functional, performance, test, and acceptance requirements for the Down Scoped Radio Control Equipment (DSRCE).

This equipment will replace the existing voice frequency signalling and tone control equipment utilized in voice air/ground Air Route Traffic Control Centers/Area Control Facilities (ARTCC)/(ACF), Automated Flight Service Stations (AFSS), Air Traffic Control Towers (ATCT), and Terminal Radar Approach Control (TRACON) operations. The DSRCE will have the capability to be installed at en route, terminal and AFSS control facilities and their associated Remote Communications Facilities (RCF). At the RCF's the DSRCE channel will interface with existing solid state radio transmitters and receivers, and the transmission facilities which connect these sites to the control facility. At the control facilities the DSRCE channel will interface with transmission facilities and Voice Switching and Control Equipment (VSCE) consisting of the Voice Frequency Control System (VFCS) installed in en route and terminal facilities, the Integrated Communications Switching System (ICSS) installed in terminal and Automated Flight Service Station (AFSS) facilities, and the Voice Switching and Control System (VSCS) installed in Air Route Traffic Control Centers (ARTCCs).

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2. APPLICABLE DOCUMENTS.

2.1 Government Documents. The following documents form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall$_1$ prevail.

SPECIFICATIONS:

FAA

FAA-G-2100e	Electronic Equipment, General Requirements

STANDARDS:

FAA

FAA-STD-020a	Grounding, Transient Protection, and Shielding Requirements for Equipment

OTHER PUBLICATIONS:

FAA

FAA Order 6950.2c	Electrical Power Policy Implementation at National Airspace System Facilities
NAS-MD-790	Remote Maintenance Monitoring System Interface Control Document: Maintenance Processor Subsystem to Remote Monitoring Subsystems and Remote Monitoring Subsystem Concentrators
Title 29 CFR 1910	OSHA Safety and Health Standard

2.2 Non-Government Documents. The following documents form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall$_2$ prevail.

STANDARDS:

ECMA-TR/40	European Computer Manufacturers Association (ECMA) -- Electrostatic Discharge Immunity Testing of Information Technology

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EIA-RS-232-C	Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
IEC-801-2, Issue 2	International Electromechanical Commission (IEC) -- ESD Requirements, Susceptibility
NFPA-70	National Electrical Code
TR-TSY-000335, Issue 2	Bell Systems Central Services Organization -- Voice Grade Special Access Service Transmission Parameter Limits and Interface Combinations

2.3 **Documentation Sources.** Technical society and technical association specifications and standards are generally available for reference from libraries. These documents are also distributed among technical groups and users in Federal agencies.

2.3.1 **Source of FAA Documents.** Copies of FAA specifications, standards, and publications referenced may be obtained from the Contracting Officer, FAA, 800 Independence Avenue, S.W., Washington, D.C. 20591. Requests must clearly identify the desired material by number and date, and state the intended use of the material.

2.3.2 **Electronic Industries Association (EIA) Documents.** Copies of EIA standards may be obtained from the Electronic Industries Association, 2001 Eye Street, N.W., Washington, D.C., 20006.

2.3.3 **National Fire Protection Association (NFPA) Documents.** Copies of NFPA standards may be obtained from the NFPA, Batterymarch Park, Quincy, MA, 02269.

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3. SYSTEM REQUIREMENTS.

3.1 Definitions. The DSRCE is a set of integrated voice/data communications units that in conjunction with other equipment **shall**$_3$ enable air traffic controllers and flight service specialists to communicate with pilots over air/ground (A/G) radios. A functional block diagram of a channel for the DSRCE is shown in figure 3-1.

An DSRCE channel **shall**$_4$ provide the capability to transmit and receive voice and radio control signals for up to two related A/G frequencies over a single four-wire voice grade transmission path. The DSRCE channel **shall**$_5$ allow control over either frequency one at a time, or over both frequencies simultaneously. See figure 3-2.

The term "frequency", as used throughout this specification, refers to a voice path and its associated control signals that connects the VSCE to a designated transmitter/receiver.

The DSRCE will be located in control facilities and in remote sites. The control facility DSRCE **shall**$_6$ interface with the voice switching and control equipment (VSCE) while the remote site DSRCE **shall**$_7$ interface with A/G radios.

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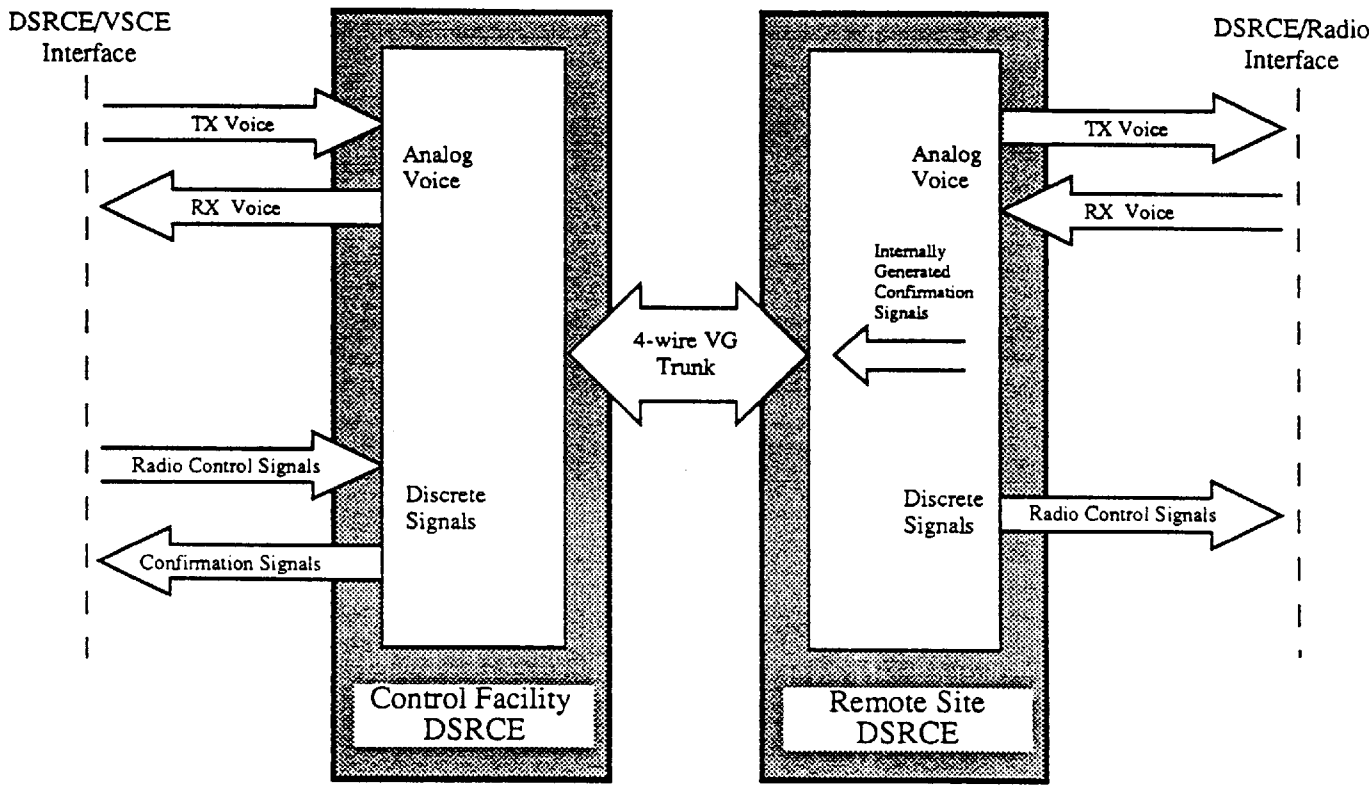

FIGURE 3-1 DSRCE Operational Functions

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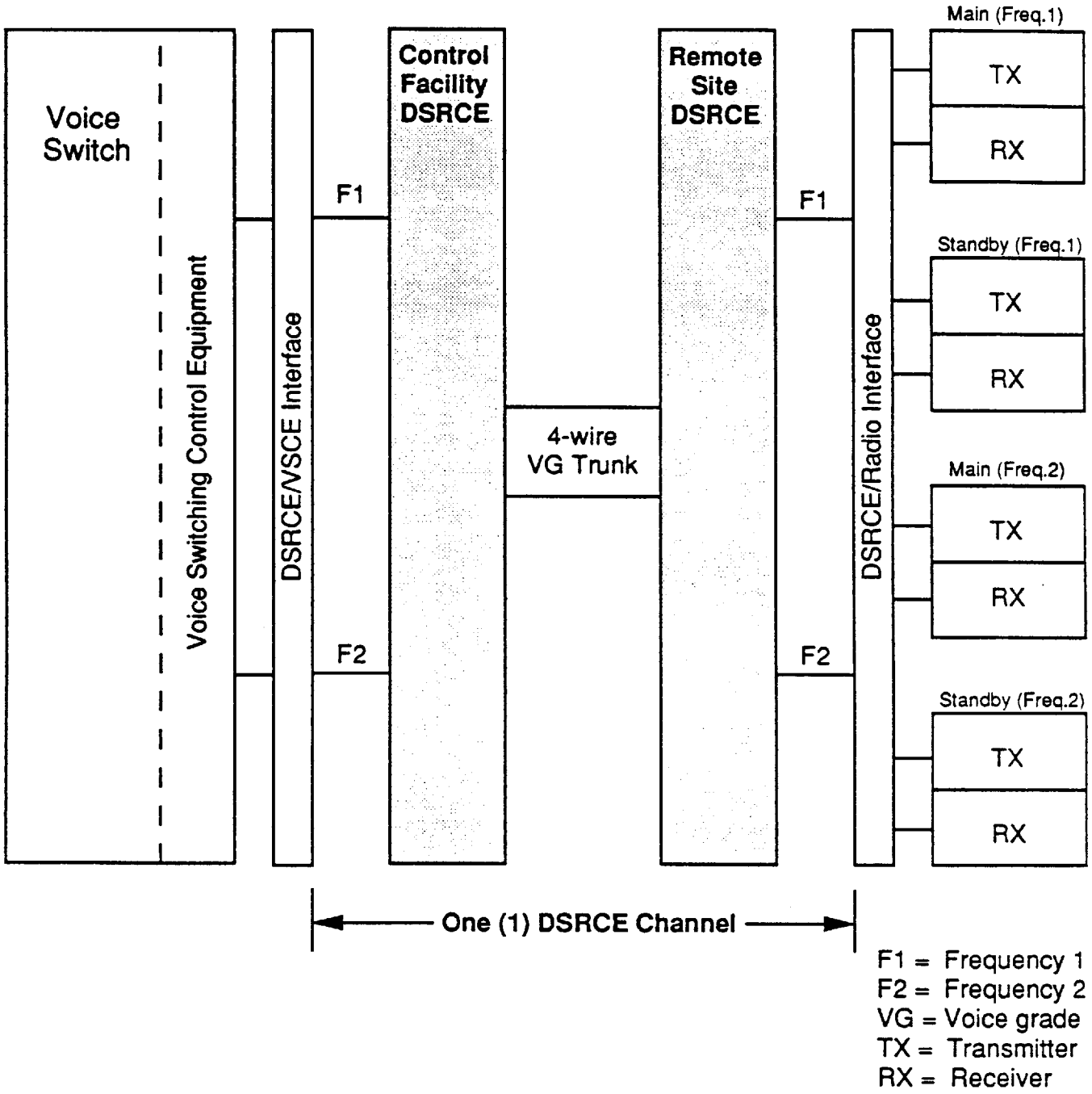

FIGURE 3-2 DSRCE Channel

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3.2 System Characteristics.

3.2.1 **DSRCE Maintenance Requirements.** The control facility and remote site DSRCE **shall**$_8$ provide, as a minimum, front panel status indicators and front panel control functions for each frequency.

The control facility and remote site DSRCE **should**$_1$ provide a front panel interface for a FAA maintenance data terminal (MDT) for each channel. In addition, the Contractor **should**$_2$ provide a centralized maintenance terminal at the control facility.

3.2.2 **Functional Requirements.** As specified in 3.2.4.1, the DSRCE is required to provide two types of DSRCE/VSCE interfaces: Type B and Type C. Each DSRCE/VSCE interface supports a specific set of operational functions. For each interface the DSRCE **shall**$_9$ provide the complete set of operational functions associated with that interface.

Table 3-1 lists the set of operational functions supported by each DSRCE/VSCE interface.

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TABLE 3-1. Functionality Supported by DSRCE/VSCE Interfaces Type B and C

OPERATIONAL FUNCTIONS \ INTERFACE	TYPE B	TYPE C
Transmit Voice	✓	✓
Receive Voice	✓	✓
Push-To-Talk (PTT)/PTT Release	✓	✓
PTT Confirmation/PTT Release Confirmation	✓	✓
Main/Standby (M/S) Transmitter (TX) Select	✓	✓
M/S TX Confirmation	✓	✓
M/S Receiver (RX) Select	✓	✓
M/S RX Confirmation	✓	✓
RX Mute/RX Unmute	✓	
RX Mute Confirmation/RX Unmute Confirmation	✓	

3.2.2.1 Channel Operation. A channel shall$_{10}$ provide for a maximum of two radio frequencies to utilize one four-wire transmission path. Each channel shall$_{11}$ provide for transmission on one selected frequency, or simultaneously on both frequencies (audio summed), without arbitration, that is, enabling the corresponding voice path in direct response to a PTT.

3.2.2.1.1 Configurations.

3.2.2.1.1.1 Separated Transmitter and Receiver Site Configuration. The DSRCE shall$_{12}$ meet all applicable functional requirements when operating in the separated transmitter and receiver site configuration, i.e., when a control facility operates a channel using transmitters and receivers that are located at separate sites and are linked to the control facility via separate Government provided transmission paths.

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3.2.2.1.1.2 **Other Configurations.** The DSRCE **shall**$_{13}$ meet all applicable requirements when the channel lacks one or more (but not all) of the following:

a) main receiver frequency 1
b) standby receiver frequency 1
c) main receiver frequency 2
d) standby receiver frequency 2
e) main transmitter frequency 1
f) standby transmitter frequency 1
g) main transmitter frequency 2
h) standby transmitter frequency 2

3.2.2.2 **Voice Path.**

3.2.2.2.1 **Transmit Voice.** The DSRCE **shall**$_{14}$ accept transmit voice signals from the VSCE circuit at the control facility DSRCE/VSCE interface and send the voice signals over a Government provided transmission path to the A/G radios via the remote site DSRCE/Radio interface.

The DSRCE **shall**$_{15}$ accept voice signals from the VSCE via one audio output per channel; however, the DSRCE **should**$_{3}$ also be capable of accepting voice signals from the VSCE via four separate audio outputs per channel (i.e., Frequency 1 Main, Frequency 1 Standby, Frequency 2 Main, Frequency 2 Standby) (see Appendix A, paragraph 10.2.3).

3.2.2.2.2 **Receive Voice.** The DSRCE **shall**$_{16}$ accept receive voice signals from the A/G radios via the remote site DSRCE/Radio interface and send the voice signals over a Government provided transmission path to the VSCE via the control facility DSRCE/VSCE interface.

The DSRCE **shall**$_{17}$ send receive voice signals to the VSCE via one audio output per channel; however, the DSRCE **should**$_{4}$ also be capable of sending receive voice signals to the VSCE via four separate audio outputs (i.e., Frequency 1 Main, Frequency 1 Standby, Frequency 2 Main, Frequency 2 Standby) (see Appendix A, paragraph 10.2.3).

3.2.2.3 **Radio Control.** The control facility DSRCE **shall**$_{18}$ accept radio control signals from the VSCE at the DSRCE/VSCE interface, encode these signals, and transmit them to the remote site DSRCE. The remote site DSRCE **shall**$_{19}$ decode these control signals and perform the necessary action required by the control signal as described in the subsequent paragraphs (e.g., key the transmitter, mute the receive audio, and etc).

All confirmation signals **shall**$_{20}$ be internally generated by the remote site DSRCE, encoded, and transmitted to the control facility DSRCE. The control facility DSRCE **shall**$_{21}$ decode these signals and present them to the VSCE at the DSRCE/VSCE interface.

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3.2.2.3.1 **Push-To-Talk (PTT).** The control facility DSRCE **shall**$_{22}$ accept up to two (2) independent PTT signals from the DSRCE/VSCE interface, corresponding to the two frequencies associated with a DSRCE channel. Upon receipt of each PTT signal, the control facility DSRCE **shall**$_{23}$ encode the signal and transmit it to the remote site DSRCE. Upon receipt of the PTT signal, the remote site DSRCE **shall**$_{24}$ provide a keying signal to the corresponding transmitter via the DSRCE/Radio interface.

In addition, when any PTT is activated, the DSRCE **shall**$_{25}$ inhibit the main/standby (M/S) select function for that frequency (i.e., inhibit the re-routing of the voice and control signals and inhibit the switching of the antenna transfer relay).

3.2.2.3.1.1 **PTT Confirmation.** As a minimum requirement, the remote site DSRCE **shall**$_{26}$ generate a PTT confirmation signal (and transmit it to the control facility DSRCE) upon presenting the keying signal to the selected transmitter via the DSRCE/Radio interface.

Upon receipt of the PTT confirmation signal from the remote site DSRCE, the control facility DSRCE **shall**$_{27}$ provide the PTT confirmation signal to the DSRCE/VSCE interface.

3.2.2.3.1.2 **PTT Release.** Upon receipt of a PTT released signal from the DSRCE/VSCE interface, the control facility DSRCE **shall**$_{28}$ encode the signal and then transmit it to the remote site DSRCE. Upon receipt of the signal, the remote site DSRCE **shall**$_{29}$ remove the keying signal from the selected transmitter and **shall**$_{30}$ transmit a PTT release confirmation message to the control facility DSRCE. Upon receipt of the PTT release confirmation message, the control facility DSRCE **shall**$_{31}$ present the signal level corresponding to PTT release confirmation to the DSRCE/VSCE interface.

3.2.2.3.1.2.1 **Release of PTT and Confirmation Signals In Case of Loss of Transmission Path.** In case of an end to end transmission path interruption exceeding three seconds, the remote site DSRCE **shall**$_{32}$ terminate any PTT signal, deactivating the selected transmitter, and the control facility DSRCE **shall**$_{33}$ release all confirmation signals sent to the VSCE.

3.2.2.3.1.3 **Lockout and Frequency Override at Dual Control Facilities.** Where two (2) control facilities have access to the same frequency at the same remote site (i.e., via two separate Government provided transmission paths), the DSRCE **should**$_{5}$ provide a dual control capability consisting of two modes of operation as specified below in paragraphs 3.2.2.3.1.3.1 and 3.2.2.3.1.3.2.

3.2.2.3.1.3.1 **Non-Priority Mode.** When both control facilities have equal priority, then:

(a) The DSRCE **shall**$_{34}$ provide a transmit voice path and PTT confirmation to that facility from which the PTT arrives first.

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(b) The DSRCE **shall**$_{35}$ lockout the second facility, i.e., block the voice transmit path, PTT/PTT release, and M/S transmitter/receiver select capabilities for both frequencies of the second facility's channel.

(c) The receive voice path **shall**$_{36}$ be continuously enabled to both control facilities, unless muted, i.e., each control facility will have the ability to mute its corresponding receive voice path.

(d) Upon release of PTT by the control facility that issued the PTT in progress, the DSRCE **shall**$_{37}$ transmit a PTT release confirmation message to that control facility and **shall**$_{38}$ terminate the lockout condition for the other control facility.

3.2.2.3.1.3.2 **Prioritized Mode.** When one control facility is designated as "primary" then:

(a) The DSRCE **shall**$_{39}$ provide the capability for the "primary" facility to override the secondary control facility PTT with respect to communicating on the frequency to which both control facilities have access. The DSRCE **shall**$_{40}$ provide a voice path and PTT confirmation to the primary facility when a controller at the primary facility asserts PTT.

(b) When the primary control facility activates PTT, the DSRCE **shall**$_{41}$ lockout the secondary facility, i.e., block the voice transmit path, PTT/PTT release, and M/S transmitter/receiver select capabilities for both frequencies of the secondary facililty's channel.

(c) If at any time during the secondary control facility's PTT state, a PTT signal is issued from the primary control facility, the DSRCE **shall**$_{42}$ release the secondary facility's PTT control and **shall**$_{43}$ lockout the secondary facility, (i.e., block the voice transmit path, PTT/PTT release, and M/S transmitter/receiver select capabilities for both frequencies of the secondary facility's channel) while the PTT is active.

(d) The receive voice path **shall**$_{44}$ be continuously enabled to both control facilities, unless muted, i.e, each control facility will have the ability to mute its corresponding receive voice path.

(e) Upon release of PTT by the primary control facility DSRCE, the remote site DSRCE **shall**$_{45}$ transmit a PTT release confirmation message to the primary control facility DSRCE, and **shall**$_{46}$ terminate the lockout condition to the secondary facility.

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(f) A PTT signal originating at the secondary control facility shall$_{47}$ result in a PTT confirmation signal transmitted to both the secondary and primary control facilities.

(g) Each site shall$_{48}$ be defined as "primary" or "secondary" for the paired frequencies simultaneously, that is a site cannot be "primary" for one frequency and "secondary" for the other.

3.2.2.3.2 **Main/Standby Transmitter Select.** The control facility DSRCE shall$_{49}$ accept a M/S transmitter select signal from the DSRCE/VSCE interface, independently for each frequency, encode this signal, and then transmit it to the remote site DSRCE. Upon receipt of the M/S transmitter select signal, the remote site DSRCE shall$_{50}$:

(a) switch to the selected main or standby transmitter, that is, route the voice and control signals only to the selected transmitter.

(b) provide the voltage specified in Appendix B to the antenna transfer relay via the remote site DSRCE/Radio interface.

3.2.2.3.2.1 **Main/Standby Transmitter Select Confirmation.** After the remote site DSRCE has switched to the selected transmitter (for a given frequency), the remote site DSRCE shall$_{51}$ then generate a M/S transmitter select confirmation signal, encode this signal, and then transmit it to the control facility DSRCE. Upon receipt of this signal, the control facility DSRCE shall$_{52}$ provide the confirmation signal to the DSRCE/VSCE interface.

If the DSRCE provides the lockout and frequency override features specified in section 3.2.2.3.1.3, then, when in the priority or non-priority dual control configuration, the DSRCE shall$_{53}$ transmit a M/S transmitter select confirmation signal to both control facilities regardless of which control facility issued the M/S transmitter select signal.

3.2.2.3.3 **Main/Standby Receiver Select.** The control facility DSRCE shall$_{54}$ accept a M/S receiver select signal from the DSRCE/VSCE interface, independently for each frequency, encode this signal, and then transmit it to the remote site DSRCE. Upon receipt of the M/S receiver select signal, the remote site DSRCE shall$_{55}$:

(a) switch to the selected main or standby receiver, that is, route the voice and control signals only from the selected receiver.

(b) provide the voltage specified in Appendix B to the antenna transfer relay via the remote site DSRCE/Radio interface.

3.2.2.3.3.1 **Main/Standby Receiver Select Confirmation.** After the remote site DSRCE has switched to the selected receiver at the remote site (for a given frequency), the remote site DSRCE shall$_{56}$ generate a M/S receiver select

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confirmation signal, encode this signal, and then transmit it to the control facility DSRCE. Upon receipt of this signal, the control facility DSRCE **shall**$_{57}$ provide this confirmation signal to the DSRCE/VSCE interface.

If the DSRCE provides the lockout and frequency override features specified in section 3.2.2.3.1.3, then, when in the priority or non-priority dual control configuration, the DSRCE **shall**$_{58}$ transmit a M/S receiver select confirmation signal to both control facilities regardless of which control facility issued the M/S receiver select signal.

3.2.2.3.4 **Remote Receiver Selective Muting.** The VSCE will present remote receiver muting signals (i.e., mute/unmute) from the position operators to the DSRCE/VSCE interface. These will be separate signals for each assigned frequency.

The control facility DSRCE **shall**$_{59}$ accept a remote receiver muting signal from the DSRCE/VSCE interface, encode the signal, and then transmit it to the remote site DSRCE. Upon receipt of the remote receiver muting signal, the remote site DSRCE **shall**$_{60}$ mute the receive voice signal from the receiver on the indicated frequency.

A mute condition **shall**$_{61}$ be terminated when the VSCE presents the unmute signal. Upon receipt of the unmute signal, the control facility DSRCE **shall**$_{62}$ generate an encoded message indicating termination of the function and identifying the frequency involved. The remote site DSRCE **shall**$_{63}$ recognize this encoded message and terminate the mute condition for that frequency.

3.2.2.3.4.1 **Remote Receiver Muting Confirmation.** When the mute condition goes into effect, the remote site DSRCE **shall**$_{64}$ generate an encoded message and transmit it to the control facility DSRCE. Upon the receipt of this message, the control facility DSRCE **shall**$_{65}$ provide the signal level corresponding to Rx mute confirmation, to the DSRCE/VSCE interface.

Upon termination of the mute condition, the remote site DSRCE **shall**$_{66}$ encode a message indicating such action and **shall**$_{67}$ transmit it to the control facility DSRCE. Upon receipt of this message, the control facility DSRCE **shall**$_{68}$ provide the signal level corresponding to Rx unmute confirmation, to the DSRCE/VSCE interface.

3.2.2.4 **Recovery From Transmission Path Failure.** The inability of the transmission path to allow the control facility and remote site DSRCE units to communicate for three (3) seconds **shall**$_{69}$ be considered a transmission path failure.

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The DSRCE should$_6$ be capable of detecting a transmission path failure and switching over to an alternate transmission path (primary or backup), if an alternate path exists. The DSRCE should$_7$ detect a transmission path failure, switch to the designated alternate transmission path, and re-establish communications over the alternative transmission path within three (3) seconds of the transmission path failure. If no alternate transmission path exists, the DSRCE shall$_{70}$ inhibit both automatic and manual switching, or attempted switching, to the non-existing transmission path.

No more than three seconds after the re-establishment of the end to end transmission path communications, the control facility and remote site DSRCE should$_8$ automatically adopt the state determined by the current VSCE and radio equipment control signals, without any operator intervention, i.e., if the previous PTT signal is still generated by the VSCE, the transmitter should$_9$ be keyed without the need for the VSCE to originate a new PTT. The proper confirmation signals should$_{10}$ also be automatically restored.

The DSRCE should$_{11}$ provide the capability for a maintenance technician to manually switch between the primary and backup transmission paths.

3.2.2.5 **Maintenance.**

3.2.2.5.1 **Front Panel Status Indicators.** As a minimum requirement, the following visual status indicators shall$_{71}$ be provided on the front panel of the DSRCE:

(a) PTT (PTT engaged/not engaged) for each frequency.

(b) Main/standby status of each pair of receivers and each pair of transmitters for each frequency.

(c) Remote muting (frequency muted/not muted) for each frequency.

(d) Status of communication link between control facility DSRCE and remote site DSRCE (the two DSRCE units are/are not successfully communicating with each other).

(e) Control facility DSRCE unit operational status (operational/non-operational).

(f) Remote site DSRCE unit operational status (operational/non-operational).

(g) Power to the unit (on/off).

3.2.2.5.2 **Front Panel Maintenance Control Functions.** As a minimum requirement, the following maintenance control functions shall$_{72}$ be provided on the front panel of the DSRCE:

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(a) Access to the push-to-talk capability for each frequency.

(b) A transmitter main/standby switch for each frequency.

(c) A receiver main/standby switch for each frequency.

3.2.2.5.3 Control Facility Centralized Maintenance Terminal.

The centralized maintenance terminal should$_{12}$:

(a) provide access to all control functions specified in 3.2.2.5.2 and access to all status indicators specified in 3.2.2.5.1, i.e., access to the control facility DSRCE status indicators and remote site DSRCE status indicators.

(b) provide the following functionality as further specified in Appendix D:

(1) Remote monitoring and alarm notification.

(2) Automatic recording and retrieval.

(3) System security.

(4) MPS/centralized maintenance terminal and MPS/MDT terminal communication

(c) be capable of interfacing to the FAA MPS in accordance with NAS-MD-790.

Note: If the interface to the FAA MPS is implemented, then the Contractor shall$_{73}$ provide an Interface Control Document (ICD) as specified in paragraph 1.3 of NAS-MD-790.

(d) be capable of accessing up to 350 channels.

(e) be capable of physical separation from the control facility DSRCE by at least 2500 feet.

The Contractor shall$_{74}$ provide all software required by the centralized maintenance terminal.

3.2.2.5.4 Front Panel FAA Maintenance Data Terminal (MDT) Interface. The front panel interface (in conjuction with Contractor provided software) should$_{13}$ provide the FAA MDT with the same level of functionality as the control facility centralized maintenance terminal specified in 3.2.2.5.3 items (a) and (b), with the exception that this functionality be limited to the channel for which the interface is for -- i.e., each front panel interface

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provide access to the status indicators, control functions, et al., for that channel only.

The Contractor **shall**$_{75}$ provide all software required by the FAA MDT in order to utilize the front panel FAA MDT interfaces. The FAA MDT is described in Appendix C.

3.2.2.5.5 **FAA MDT Compatibility.** All maintenance and installation actions requiring an external computer or terminal **shall**$_{76}$ be achievable by the FAA MDT described in Appendix C.

3.2.2.5.6 **Voice Access Jacks.** Voice access jacks **shall**$_{77}$ be provided and **should**$_{14}$ be on the DSRCE front panel at all control facilities and remote sites. Jacks **shall**$_{78}$ be provided for line, monitor, and drop throughputs for both send and receive audio and four-wire transmission paths.

3.2.3 **Performance Requirements.** This section specifies the performance requirements for a single DSRCE channel. All performance parameters apply between the DSRCE/VSCE interface in a control facility and the DSRCE/Radio interface in a remote site. These are the points at which connection is made to radio position electronics equipment interfaces at the control facility and radio transmitter and receiver interfaces at the remote radio sites. Furthermore, the DSRCE performance parameters are isolated from the performance of the transmission path by using attenuated paths for all measurements with the exception of end-to-end system timing and radio control signal error rate. Thus, the performance requirements of the DSRCE are isolated from any degradations from the radio position electronics equipment, the radio transmitter/receiver complex or variability in the interconnecting transmission paths.

End-to-end system timing and radio control signal error rate **shall**$_{79}$ be measured using a voice grade type 6 (VG6) transmission path simulator for the full range of permissible VG6 parameters; however, the measuring of end to end system timing will exclude any propagation delays introduced by transmission media.

3.2.3.1 **Voice Path Parameters.** The following characteristics **shall**$_{80}$ apply to all voice signals passing through the channel whether they originate in the control facility or remote site. In all cases the parameters **shall**$_{81}$ apply equally to signals injected at the control facility DSRCE/VSCE interface and measured at the remote site DSRCE/Radio interface, and to signals injected at the remote site DSRCE/Radio interface and measured at the control facility DSRCE/VSCE interface.

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3.2.3.1.1 **Voice Quality.** The DSRCE **shall**$_{82}$ equal or exceed a voice quality score of 91.0 ± 0.7 and **should**$_{15}$ equal or exceed a voice quality score of 98.0 ± 0.7. The baseline parameters for voice quality testing purposes will be established using validated voice quality measures from the industry accepted standards, Diagnostic Rhyme Test (DRT) and Diagnostic Acceptability Measure (DAM).

3.2.3.1.2 **Noise.** The combined hum and noise level of any single path of an idle voice transmission path, with both ends of the transmission path properly terminated, **shall**$_{83}$ not exceed +23 dBrnc. An idle voice transmission path is defined as an unmuted voice path ready to carry voice information, without any voice applied and without any control signals active.

3.2.3.1.3 **Impulse Noise.** The peak level of impulse-type noise generated within the system when measured on a single path of an idle voice transmission path, with both ends of the transmission path properly terminated, **shall**$_{84}$ not exceed one (1) hit within a 15 minute period above a level of +50 dBrnc for a duration of 10 ms or less. Impulse noise will be measured through a C-message weighting filter.

3.2.3.1.4 **Crosstalk.** The crosstalk attenuation between any transmit and receive voice paths or between any two (2) four-wire transmission paths **should**$_{16}$ be no less than 50 dB. As an absolute minimum requirement, the crosstalk attenuation between any transmit and receive voice paths or between any two (2) four-wire transmission paths **shall**$_{85}$ be no less than 40 dB.

3.2.3.2 **Radio Control Signal Parameters.**

3.2.3.2.1 **Radio Control Signal Error Rate.** The DSRCE **should**$_{17}$ ensure that no more than one radio control signal in one million is falsely interpreted.

3.2.3.2.2 **End-To-End System Timing.**

3.2.3.2.2.1 **PTT/PTT Release.** The response time for this event **shall**$_{86}$ be from the instant the VSCE provides a PTT/PTT release signal at the control facility DSRCE/VSCE interface, to the instant the remote site DSRCE provides/removes the PTT signal at the DSRCE/Radio interface.

For 99.9% of the event completions, the event response time **should**$_{18}$ not exceed 100 ms. The response time, when averaged over 1000 events, **shall**$_{87}$ not exceed 100 ms.

3.2.3.2.2.1.1 **PTT Confirmation/Release Confirmation.** The response time for this event **shall**$_{88}$ be from the instant the remote site DSRCE provides/removes the keying signal at the DSRCE/Radio interface, to the instant that the control facility DSRCE provides a PTT confirmation/release confirmation signal at the DSRCE/VSCE interface.

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For 99.9% of the event completions, the event response time should$_{19}$ not exceed 340 ms. The response time, when averaged over 1000 events, shall$_{89}$ not exceed 340 ms.

3.2.3.2.2.2 **Transmitter/Receiver Main/Standby Select.** The response time for this event shall$_{90}$ be from the instant the VSCE provides the M/S select signal at the control facility DSRCE/VSCE interface, to the instant the remote site RCE executes both of the following actions:

(a) switch to the selected main or standby transmitter/receiver, that is, route the voice and control signals only to the selected transmitter/receiver.

(b) provide the voltage specified in Appendix B to the antenna transfer relay via the remote site DSRCE/Radio interface.

For 99.9% of the event completions, the event response time should$_{20}$ not exceed 100 ms. The response time, when averaged over 1000 events, shall$_{91}$ not exceed 100 ms.

3.2.3.2.2.2.1 **Transmitter/Receiver Main/Standby Select Confirmation.** The response time for this event shall$_{92}$ be from the instant the remote site DSRCE executes all M/S select actions (i.e., (a) and (b) of 3.2.3.2.2.2), to the instant the control facility DSRCE provides a M/S select confirmation signal at the DSRCE/VSCE interface.

For 99.9% of the event completions, the event response time should$_{21}$ not exceed 250 ms. The response time, when averaged over 1000 events, shall$_{93}$ not exceed 250 ms.

3.2.3.2.2.3 **Remote Receiver Muting/Unmuting.** The response time for this event shall$_{94}$ be from the instant the VSCE provides the receiver muting/unmuting signal at the control facility DSRCE/VSCE interface, to the instant the receive voice signal is muted/unmuted within the remote site DSRCE.

For 99.9% of the event completions, the event response time should$_{22}$ not exceed 100 ms. The response time, when averaged over 1000 events, shall$_{95}$ not exceed 100 ms. In the muted state the receive voice signal shall$_{96}$ be attenuated by a minimum of 40 dB.

3.2.3.2.2.3.1 **Remote Receiver Muting/Unmuting Confirmation.** The response time for this event shall$_{97}$ be from the instant the voice signal is muted/unmuted to the instant the control facility DSRCE provides the receiver mute/unmute confirmation signal at the DSRCE/VSCE interface.

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For 99.9% of the event completions, the event response time **should**$_{23}$ not exceed 340 ms. The response time, when averaged over 1000 events, **shall**$_{98}$ not exceed 340 ms.

3.2.4 **External Interfaces.**

3.2.4.1 **DSRCE/VSCE.** The DSRCE **shall**$_{99}$ interface to the VSCE as specified in Appendix A; i.e., each DSRCE channel **shall**$_{100}$ be capable of providing (non-simultaneously) interfaces Type B and Type C.

Note: Interfaces Type B and Type C are intended to emulate two existing DSRCE/VSCE interfaces, but do not neccessarily correspond to two different types of VSCE.

3.2.4.2 **DSRCE/Analog Unconditioned Transmission Path.** The control facility DSRCE and the remote site DSRCE **shall**$_{101}$ interface to an unconditioned voice grade type 6 (VG6) four-wire transmission path specified in Bell Publication TR-TSY-000335, Issue 2, in order to exchange voice, control signals, and data. Unless otherwise specified (see below*), the DSRCE **shall**$_{102}$ meet all requirements, excluding **Voice Path Parameters** (paragraphs 3.2.3.1 through 3.2.3.1.4), with a VG6 transmission path provided by wire, fiber optic lines, microwave, satellite or a combination thereof established over facilities which are analog or digital, and are commercially furnished, Government owned, or a combination thereof.

The DSRCE **shall**$_{103}$ meet all requirements, excluding **Voice Path Parameters** (paragraphs 3.2.3.1 through 3.2.3.1.4) and ***End-To-End System Timing** (paragraphs 3.2.3.2.2 through 3.2.3.2.2.3.1), if the transmission path introduces a propagation delay of up to 300 ms.

The DSRCE **shall**$_{104}$ meet all requirements, excluding **Voice Path Parameters** (paragraphs 3.2.3.1 through 3.2.3.1.4), in the presence of impulse noise as defined below:

> For testing purposes, impulse noise will be bounded to an amplitude in the range of 65 dBrnC to 90 dBrnC. Impulse duration will be varied over the range of 0.5 ms to 10 ms, in 0.5 ms steps.

The DSRCE **shall**$_{105}$ meet the following signal level, isolation, and impedance matching characteristics:

(a) Isolation: ≥ 10 megaohms

(b) Impedance: 600 ± 60 ohms, balanced to ground;

(c) Longitudinal balance: ≥ 40 dB;

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(d) The DSRCE transmit test tone level at the interface with the transmission path **shall**$_{106}$ be adjustable over the range of +5 dBm to -20 dBm;

(e) The DSRCE **shall**$_{107}$ provide adjustable gain to accept receive test tone levels at the transmission path interface over the range of

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+5 dBm to -20 dBm. The gain adjustments for receive and transmit paths **shall**$_{108}$ be independent.

3.2.4.3 **DSRCE/Power.** The DSRCE **shall**$_{109}$ be capable of interfacing (non-simultaneously) to all of the AC voltages as specified in 3.3.1.1.1.

The DSRCE **shall**$_{110}$ be capable of interfacing to the remote site DC power source specified in 3.3.1.1.2, and the VSCE signaling voltages specified in Appendix A.

3.2.4.4 **DSRCE/Antenna Transfer Relay.** The DSRCE **shall**$_{111}$ supply the voltage specified in 3.3.1.1.2 to the Government provided antenna transfer relay for connection of the antenna to the selected transmitter or receiver. This transfer occurs in response to the receipt of the M/S select signal from the VSCE. The detailed description of this interface is provided in Appendix B.

3.2.4.5 **DSRCE/Solid-State Radio Equipment.** The DSRCE **shall**$_{112}$ interface to solid-state radio equipment in accordance with Appendix B.

3.2.4.6 **DSRCE/Maintenance Data Terminal (MDT).** See 3.2.2.5.4.

3.2.4.7 **DSRCE/Maintenance Processor Subsystem (MPS).** See 3.2.2.5.3.

3.2.5 **DSRCE Physical Characteristics.**

3.2.5.1 **Dimensions.** A single DSRCE unit, i.e., a remote site or a control facility unit (each comprising one end of a DSRCE channel), with all associated cables connected **shall**$_{113}$ fit into a standard 19" wide rack panel opening, **shall**$_{114}$ not exceed a depth of 19" including all connecting cables, and **shall**$_{115}$ not exceed a height of 12 1/4".

3.2.5.2 **Weight.** A single DSRCE line replaceable unit (LRU), i.e., a remote site or a control facility LRU, **shall**$_{116}$ not exceed a weight of 19 lbs.

3.2.6 **Reliability, Maintainability, Availability.** The computations for reliability, maintainability, and availability **shall**$_{117}$ be made based on a single-channel DSRCE system. Preventative maintenance (PM) **shall**$_{118}$ not be required more than once every 90 days.

3.2.6.1 **Reliability.** The DSRCE **should**$_{24}$ have a mean time between failures (MTBF) no less than 10,000 hours. As an absolute minimum requirement, the DSRCE **shall**$_{119}$ have a MTBF no less than 7,084 hours. MTBF applies to any failure, including those where maintenance can be deferred. (See section 6.2 for the definition of MTBF.)

3.2.6.2 **Maintainability.** The DSRCE **shall**$_{120}$ have a mean time to repair (MTTR) not to exceed 30 minutes. (See section 6.2 for the definition of MTTR.)

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3.2.6.3 **Availability.** The DSRCE **should**$_{25}$ possess an inherent availability (A_i) of no less than .99995000, which is equal to the MTBF divided by the quantity MTBF + MTTR, as shown below:

$$A_i = \frac{MTBF}{MTBF + MTTR}$$

As an absolute minimum requirement, the DSRCE **shall**$_{121}$ possess an inherent availability (A_i) of no less than .99992942.

Note: A_i excludes whatever ready time, preventative maintenance downtime, supply downtime, and adminstrative downtime may be required.

3.2.6.4 **Isolation of Failures.** No mode of failure in one DSRCE channel **shall**$_{122}$ cause failures in, disturb the operation of, or in any way adversely affect another DSRCE channel. In addition, no single hardware failure **shall**$_{123}$ cause the loss of more than one channel between a control facility and remote site.

3.2.7 **Service Life.**

3.2.7.1 **General.** The DSRCE **shall**$_{124}$ be engineered for a service life period of not less than 10 years after the date of FAA acceptance.

3.2.8 **Environmental.**

3.2.8.1 **Mechanical.** All DSRCEs **shall**$_{125}$ be constructed so that fixed parts do not become loose, moveable parts and adjustment settings do not shift in position, and performance does not degrade if subject to the following conditions:

(a) Operating at any angle up to 10 degrees from the normal, operating position.

(b) Storage for 1 year in any position.

3.2.8.2 **Operating.** The equipment **shall**$_{126}$ meet all functional and performance requirements while operating in ambient temperatures of 0 to +50 degrees Celsius, relative humidity at 20 to 80 percent non-condensing, and altitudes from sea level to +10,000 feet.

3.2.8.3 **Non-Operating.** The equipment **shall**$_{127}$ survive any combination of ambient temperatures of -50 to +70 degrees Celsius, relative humidity of up to 100 percent non-condensing, and altitudes from sea level to +50,000 feet and **shall**$_{128}$ be capable of returning to operation without degraded performance if subjected to these conditions.

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3.2.9 **Transportation.** The DSRCE components shall$_{129}$ be transportable via commercial shipping without a need for specially equipped trucks. A DSRCE

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3.3.1.1.1.2 **AC Line Controls.** Each control switch, relay, circuit breaker, fuse or other device, which acts to disconnect the AC supply line energizing the equipment, **shall**$_{142}$ be in accordance with the applicable portions of the National Electrical Code. Switches or circuit breakers which function as "main power" switches, operating either directly or through a contactor to disconnect the AC line from the equipment **shall**$_{143}$ break the AC line immediately after it enters the DSRCE AC interface, via terminal block or connector, and before it reaches other parts. Each DSRCE assembly which is energized by direct connection to the AC line **shall**$_{144}$ have, as a minimum, a front-panel mounted "main power" switch or circuit breaker, a front-panel mounted AC line indicator light, and a front-panel mounted AC line indicating type fuse-holder if a circuit breaker is not provided.

3.3.1.1.1.3 **Isolation.** For each individual chassis unit which is to be connected to the AC supply line, the DC resistance to ground from each input line terminal **shall**$_{145}$ be not less than 1 megaohm (AC line disconnected, fuses in place and AC line control contacts closed).

3.3.1.1.2 **DC Power Requirements.** The DSRCE **shall**$_{146}$ meet the following DC power requirements:

(a) for each DSRCE/VSCE Type B interface, provide a power supply having the following characteristics: 12.0 VDC ± 5%, ≥ 50 mA;

(b) for the purpose of energizing the antenna transfer relay(s), for each DSRCE channel provide a power supply with the following characteristics:

+24.0 VDC nominal (+20.0 VDC min, +30.0 VDC max), ≥ 600 mA;

(c) at the remote site, be capable of operating from a remote site DC power system supplying a voltage of +24.0 VDC ± 6.0 VDC (negative ground) (the Government will provide DC power systems at selected remote sites).

3.3.1.1.3 **Grounding Systems.**

3.3.1.1.3.1 **Grounding, Bonding, Shielding and Transient Protection.** Requirements for grounding, bonding, shielding and transient protection **should**$_{26}$ be as specified in applicable portions of FAA-STD-020a.

3.3.1.1.3.2 **AC Ground.** A common ground derived from the AC power source **shall**$_{147}$ be used for all AC power in the unit being powered.

3.3.1.1.3.3 **Chassis Ground.** All surfaces of front panels, chassis, frames, and cabinets **shall**$_{148}$ be at a common chassis ground potential. Each DSRCE chassis **shall**$_{149}$ be equipped with a clamp/lug capable of accepting a No. 14 American Wire Gauge (AWG) ground wire.

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3.3.1.1.3.4 **Signal Ground.** The DSRCE **shall**$_{150}$ provide a signal ground for control, monitoring, and logic type signals.

3.3.1.2 **Mechanical Requirements.** All equipment **shall**$_{151}$ be in accordance with the requirements of 3.3.3 of FAA-G-2100e.

3.3.1.2.1 **LRU Removal and Insertion.**

(a) While power is on, the DSRCE **shall**$_{152}$ permit removal and insertion of all LRUs without causing damage to the LRUs or any other equipment.

(b) The DSRCE **shall**$_{153}$ prohibit insertion or connection of plug-in LRUs that are incorrectly oriented.

3.3.1.2.2 **Interconnection Cables.** All cables/connectors linking DSRCE units, **shall**$_{154}$ be provided as part of the DSRCE.

All interconnection cables and connectors required for factory testing, equipment site installation, checkout, acceptance testing, cutover, operation, and maintenance **shall**$_{155}$ be compatible with both under-floor and overhead distribution and cable facilities provided by the Government.

3.3.1.2.3 **Cable Connectors.**

(a) The Contractor **shall**$_{156}$ provide the mating connector/jack for any connector/jack that is furnished as part of the DSRCE.

(b) Cable connectors **shall**$_{157}$ be mechanically keyed to prevent incorrect installation and hookup.

(c) The mating connector part (connector or plug) of any power cable that is electrically energized **shall**$_{158}$ contain female contacts.

(d) All cable connectors **shall**$_{159}$ be mechanically retained in place.

(e) All cable connectors **shall**$_{160}$ provide mechanical strain relief.

3.3.1.2.4 **Protective Covers.** All terminal blocks, lugs, and AC and DC power busses **shall**$_{161}$ have protective covers and labels.

3.3.1.2.5 **Nameplates and Product Marking.** All DSRCE units **shall**$_{162}$ be legibly and permanently marked to provide identification of manufacturer, model, and serial number.

3.3.1.2.6 **Materials.** Selection of materials **shall**$_{163}$ be consistent with the requirement of economically producing a system that performs its specified

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functions with ruggedness and durability. All parts and material used in the DSRCE shall$_{164}$ be new.

3.3.1.2.6.1 **Toxicity.** The DSRCE shall$_{165}$ be constructed from materials of low toxicity, not producing dangerous gasses due to fires or producing toxic effects when used under specified environmental conditions for operating and non-operating equipment (see 3.2.8).

3.3.1.2.6.2 **Glass.** All glass used in the equipment shall$_{166}$ be shatterproof glass, and shall$_{167}$ be clear and free of distortion at all viewing angles.

3.3.1.2.6.3 **Fungus.** The materials chosen shall$_{168}$ be non-nutrient to fungus and insects, flame resistant, non-hygroscopic, and not adversely affected by the environmental conditions specified herein.

3.3.1.2.6.4 **Finishes.** All exterior surfaces shall$_{169}$ be free from burrs and sharp edges.

3.3.1.3 **Interchangeability.** All assemblies, subassemblies, and replaceable parts that are intended to be identical shall$_{170}$ be fully mechanically and electrically interchangeable regardless of manufacturer or supplier.

3.3.2 **Electromagnetic Compatibility (EMC).** No system delivered under this specification shall$_{171}$ cause electromagnetic interference with, or be affected by electromagnetic interference from, the site at which it is installed. "Electromagnetic interference" means any failure by DSRCE to meet the functional and performance requirements of this specification, or impairment by DSRCE of communications or data processing performance in other systems, due to the radiation or conduction of electromagnetic interference.

3.3.2.1 **EMC Characterization.** The Contractor shall$_{172}$ characterize the DSRCE in accordance with MIL-STD-461C, and shall$_{173}$ provide this information in the proposal.

The electromagnetic interference characteristics of the DSRCE equipment shall$_{174}$ be obtained by separately subjecting the control facility and remote site DSRCE to the following tests, as specified in MIL-STD-461C:

CE01	CS01	RE01	RS02
CE03	CS02	RE02	RS03
	CS06		

3.3.3 **Electrostatic Discharge Protection.**

(a) The DSRCE should$_{27}$ incorporate protection against electrostatic discharge from personnel using or servicing the DSRCE.

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(b) The DSRCE should$_{28}$ sustain no equipment failures or operational errors when subjected to electrostatic discharge pulses having the waveform in figure 3-4 and the maximum current and voltage limits specified under Level 3 in table 3-2, as described in ECMA-TR/40 and IEC-801-2, Issue 2.

(c) The DSRCE should$_{29}$ sustain no permanent equipment failures nor operational errors not correctable by the operator when subjected to electrostatic discharge (ESD) pulses having the waveform in figure 3-4 and the maximum current and voltage limits specified under level 4 in table 3-2, as described in ECMA-TR/40 and IEC-801-2, Issue 2.

TABLE 3-2. Limits for Electrostatic Discharge

	Simulator Voltage, kV		Discharge Current, A		
Level	Direct Injection	Air Discharge	I_{peak}[1]	I_{30}[2]	I_{60}[2]
1	2	2	7.5	4	2
2	4	4	15	8	4
3	6	8	22.5	12	6
4	8	15	30	16	8

1. Within ± 10%
2. Within ± 30%

3.3.4 **Safety.** The DSRCE shall$_{175}$ be compliant in all aspects with Occupational Safety and Health Administration (OSHA) Standards (Title 29 CFR 1910) and the National Electric Code (NFPA-70).

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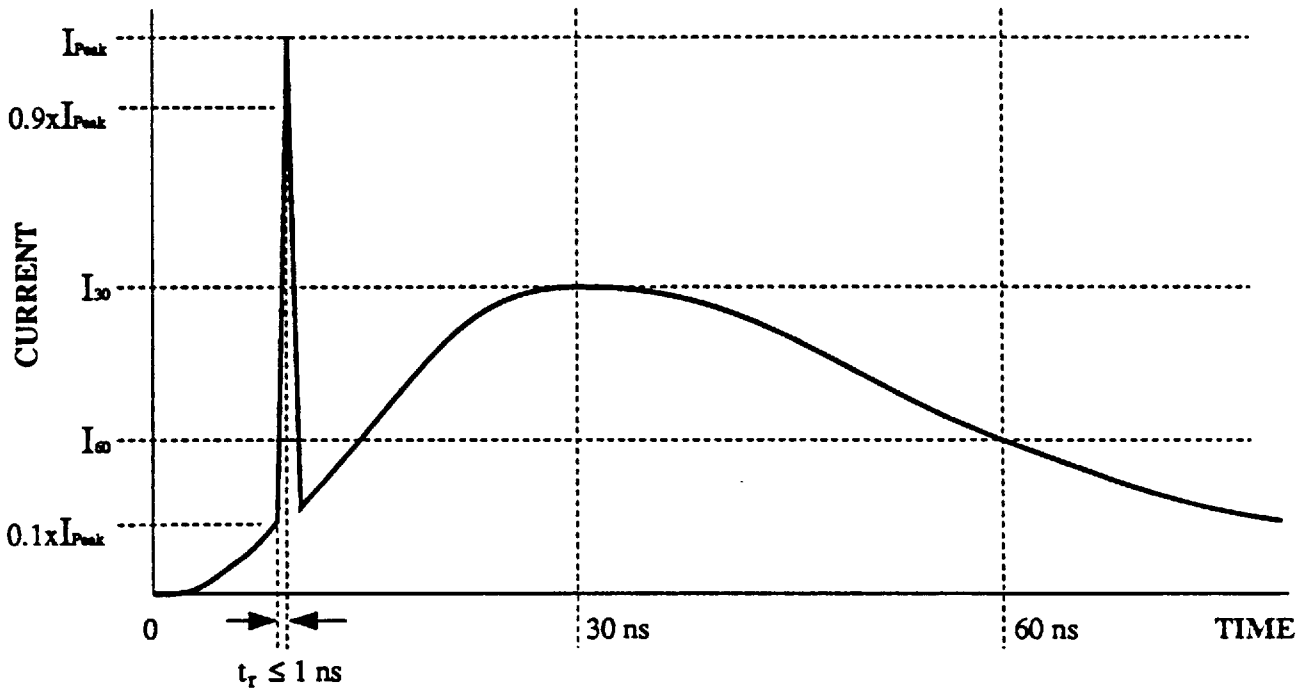

FIGURE 3-4 Electrostatic Discharge Waveform

(Refer to TABLE 3-2 for Magnitudes)

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4. **QUALITY ASSURANCE PROVISIONS.** The Contractor shall$_{176}$ establish and maintain a Quality Control Program in accordance with the contract requirements.

5. **PREPARATION FOR DELIVERY.** This section is not applicable to this specification.

6. **NOTES.**

6.1 **Abbreviations and Acronyms.**

A/G	Air-To-Ground
AC	Alternating Current
ACF	Area Control Facility
AF	Airways Facilities
AFSS	Automated Flight Service Station
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATR	Antenna Transfer Relay
BER	Bit Error Rate
bps	Bits Per Second
°C	Degrees Celsius
CFR	Code of Federal Regulations
DAM	Diagnostic Acceptability Measure
dB	Decibel
dBm	Decibels Referenced to One Milliwatt
dBrn	Decibels of Noise Referenced to One Picowatt
dBrnC	Decibels of C-Weighted Noise Referenced to One Picowatt
DC	Direct Current
DRT	Diagnostic Rhyme Test
EIA	Electronics Industries Association
ESD	Electrostatic Discharge
FAA	Federal Aviation Administration
FAATC	Federal Aviation Administration Technical Center
FCC	Federal Communications Commission
FS	Frequency Shift
GFI	Government Furnished Information
Hz	Hertz
ICSS	Integrated Communications Switching System
KHz	Kilohertz (10^3 Hertz)
LRU	Line Replaceable Unit
M/S	Main/Standby
MDT	Maintenance Data Terminal
MHz	Megahertz (10^6 Hertz)
MPS	Maintenance Processor Subsystem
ms	Millisecond (10^{-3} second)
MTBF	Mean Time Between Failures

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MTTR	Mean Time To Repair
NAS	National Airspace System
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PC	Printed Circuit
PM	Preventative Maintenance
PTT	Push-To-Talk
RCAG	Remote Center Air-to-Ground
DSRCE	Down Scoped Radio Control Equipment
RCF	Remote Communications Facility
RCO	Remote Communications Outlet
RF	Radio Frequency
RFP	Request For Proposal
RMS	Remote Monitoring Subsystem
RTR	Remote Transmitter/Receiver site
RX	Receiver
TL	Transmission Level
TLP	Transmission Level Point
TRACON	Terminal Radar Approach Control
TX	Transmitter
UHF	Ultra-High Frequency
UPS	Uninterruptable Power System
V	Volts
VAC	Volts Alternating Current
VF	Voice Frequency
VFCS	Voice Frequency Control System
VHF	Very-High Frequency
Vrms	Volts Root Mean Squared
VSCE	Voice Switching and Control Equipment
VSCS	Voice Switching and Control System
VG6	Voice Grade Type Six Transmission Path

6.2 Definitions.

Air-Ground (A/G) Communications. Two-way half duplex line-of-sight broadcast radio communications on VHF AM bands (for civil aviation) and UHF AM bands (for military aviation) between ground-based personnel (air traffic controllers, flight service specialists), and aircraft.

Air-Ground Frequency. A specific two-way A/G communications channel implemented on a UHF or VHF RF carrier of a specific frequency.

Airport Traffic Control Tower (ATCT). A terminal facility that uses A/G communications, visual signalling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the surface movement area.

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Air Traffic Control. The maintenance of safe, orderly, and expeditious flow of air traffic.

Assembly. A number of parts or subassemblies or any combination thereof joined together to perform a specific function and capable of disassembly.

Channel. A communication path providing full duplex transmission between two terminations. It provides the capability to transmit and receive voice and radio control signals for up to two Air Ground radio frequencies over a single four-wire voice grade transmission path. One frequency at a time may be controlled, or both frequencies may be controlled simultaneously.

Chassis Ground. An electronic multipoint ground)

Circuit. (1) A conductor or system of conductors through which an electrical current is intended to flow. (2) A printed circuit electronic card containing or preforming multiple electronic functions.

"C" Message Weighting. A weighting curve used in audio noise measuring sets to adjust for characteristics of human hearing.

Connectivity. The presence of a complete circuit or connection among stations or facilities.

dBm. Signal power expressed as decibels with respect to one milliwatt.

dBm0. Signal power in dBm referred to or measured at a zero transmission level point (TLP).

dBrn. The noise power measured in decibels above reference noise of 1 picowatt (-90 dBm).

dBrnC. Weighted noise power in dBrn, measured by a noise measuring set with C-message weighting.

dBrnC0. Noise power in dBrnC referred to or measured at a zero transmission level point (0TLP).

Failure. The inability of a system or component to perform fully as specified.

Line Replaceable Unit (LRU). A LRU is defined as the lowest unit to be replaced within the system during site maintenance. It is a separate, installable, physical package performing a single function or group of closely related functions.

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Main/Standby (M/S) Select. The operator-initiated selection of a main or standby radio unit (transmitter or receiver). Main and standby units are functionally identical.

Mean Time Between Failures (MTBF). For a particular interval, the total functional life of a population of an item divided by the total number of failures within the population during the measurement interval.

Mean Time To Repair (MTTR). The average time required to repair or replace a failed system or component exclusive of logistical and administrative delay times.

Preventative Maintenance (PM). Maintenance performed to keep an item or system from failing.

Push-To-Talk (PTT). A switch or similar device that activates communications resources (A/G radio transmitters or G/G channels) for transmission; the signals or logical states associated with a PTT device.

Receiver. An electronic device that detects and demodulates radio transmissions on specific frequencies. The FAA normally uses fixed-frequency remote receivers in the UHF and VHF bands, however tunable radios are used for back-up emergency communications (BUEC).

Select. To activate a feature or to place it in use because it is required for tasks at hand (as with an A/G receiver or transmitter).

Signal Ground. An electronic single point ground)

Subsystem (SS). A combination of sets, groups, etc., that performs an operational function within a system and is a major a subdivision of the system.

Test Tone. A tone sent at a predetermined level and frequency (typically 0 dBm at 1004 Hz -- one way transmission) through a transmission system to facilitate alignment of the gains and losses of devices in the transmission circuit.

Transmission Level (TL). At any point in a transmission system, the power (in dBm) that is measured at that point when a standard test signal is transmitted at some point chosen as a reference.

Transmission Level Point (TLP). A point in a transmission system at which the ratio, in decibels, of the power of the test signal at that point to the power of the test signal at a reference point, is specified.

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Note: A OTLP is an arbitrarily established point in a communications circuit to which all relative levels at other points in the circuit are referred. Very often the measured power level at a point, expressed in

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Appendix A:

DOWN SCOPED RADIO CONTROL EQUIPMENT (DSRCE)/

VOICE SWITCHING AND

CONTROL EQUIPMENT (VSCE)

INTERFACE REQUIREMENTS

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10.1 **Scope.** This appendix defines requirements for the Voice Switching and Control Equipment (VSCE) Interface by specifying two different interfaces, types B and C. The DSRCE will be capable of interfacing with the Integrated Communications Switching System (ICSS), the Four-Channel Radio Equipment Voice Frequency Control System (VFCS), and the Voice Switching and Control System (VSCS). These requirements are presented on a function by function basis.

10.2 **Requirements.**

10.2.1 **System Description.** Each DSRCE channel will have an interface to the VSCE to accept transmit voice and radio control signals from the VSCE, and to deliver receive voice and confirmation signals to the VSCE. Each interface will service a maximum of two frequencies.

10.2.2 **Discrete Control Signals.** Each DSRCE/VSCE interface utilizes discrete signal leads to carry control signals between the VSCE and the DSRCE. The DSRCE **shall**$_{177}$ either accept a positive voltage or a contact closure applied to the appropriate input to activate the required function.

Although the subsequent requirements for interfaces types B and C describe only two separate PTT/PTT Release outputs per channel (i.e., Frequency 1/Frequency 2), the DSRCE **should**$_{30}$ also be capable of accepting four separate PTT/PTT Release outputs per channel as described below:

PTT/PTT Release Frequency 1 (Main)
PTT/PTT Release Frequency 1 (Standby)
PTT/PTT Release Frequency 2 (Main)
PTT/PTT Release Frequency 2 (Standby)

10.2.3 **Analog Voice Signals.** Each DSRCE/VSCE interface **shall**$_{178}$ utilize two 2-wire circuits to carry voice signals between the VSCE and the DSRCE. One 2-wire circuit connects the VSCE and the DSRCE for transmission of voice signals and one 2-wire circuit connects the VSCE and the DSRCE for the reception of voice signals. Both 2-wire circuits are transformer coupled, balanced, and isolated from ground. Each 2-wire circuit services a maximum of two frequencies associated with the DSRCE channel, i.e., frequency 1, frequency 2, or both frequencies simultaneously (audio summed).

Note: At the Contractors option, the DSRCE **should**$_{31}$ also be able to operate in a configuration using a total of eight separate 2-wire circuits for carrying voice signals between the VSCE and DSRCE, as specified in 3.2.2.2.1 and 3.2.2.2.2. This configuration is summarized below:

One 2-wire circuit for Main Transmit Voice Frequency 1
One 2-wire circuit for Standby Transmit Voice Frequency 1
One 2-wire circuit for Main Receive Voice Frequency 1
One 2-wire circuit for Standby Receive Voice Frequency 1

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One 2-wire circuit for Main Transmit Voice Frequency 2
One 2-wire circuit for Standby Transmit Voice Frequency 2
One 2-wire circuit for Main Receive Voice Frequency 2
One 2-wire circuit for Standby Receive Voice Frequency 2

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TABLE 10-1. Deleted

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FIGURE 10-1. Deleted

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Main Receiver Select:	Open
Standby Receiver Select:	+12 VDC ± 25%, 0.5 mA max

10.2.5.3.4 **Receiver Mute/Unmute.** The DSRCE $shall_{203}$ accept a positive voltage applied to the DSRCE receiver mute inputs to mute the selected receiver. The DSRCE $shall_{204}$ accept an open applied to the receiver mute/unmute inputs to deactivate the receiver mute function (receiver unmute). The input parameters for the receiver mute function are:

Receiver mute:	+12 VDC ± 25%, 0.5 mA max
Receiver not muted (unmute):	Open

10.2.5.3.5 **Transmit Voice.** The DSRCE $shall_{205}$ accept transmit voice signals from the VSCE that satisfy the following parameters:

Input Level:	-5 dBm, adjustable ± 6 dB (test tone level)
Impedance:	600 ohms ± 20%

10.2.5.3.6 **Receive Voice.** The DSRCE $shall_{206}$ send receiver voice signals to the VSCE that satisfy the following parameters:

Output Level:	-17 dBm, adjustable ± 6 dB (test tone level)
Impedance:	600 ohms ± 20%

10.2.5.3.7 **M/S Transmitter Select Confirmation.** The DSRCE $shall_{207}$ provide a positive voltage to the VSCE if the standby transmitter is selected and $shall_{208}$ apply a ground if the main transmitter is selected. The DSRCE $shall_{209}$ provide the following output levels:

Standby Transmitter Selected:	+12 VDC ± 25%, 0.5 mA max
Main Transmitter Selected:	0.0 VDC ± 1.0 VDC, 20 mA max (sink)

10.2.5.3.8 **M/S Receiver Select Confirmation.** The DSRCE $shall_{210}$ provide a positive voltage to the VSCE if the standby receiver is selected and $shall_{211}$ apply a ground if the main receiver is selected. The DSRCE $shall_{212}$ provide the following output levels:

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Standby Receiver Selected:	+12 VDC ± 25%, 0.5 mA max
Main Receiver Selected:	0.0 VDC ± 1.0 VDC, 20 mA max (sink)

10.2.5.3.9 **Receiver Mute Confirmation/Unmute Confirmation.** The DSRCE $shall_{213}$ provide a positive voltage to the VSCE if the associated receiver is muted (mute confirmation) and $shall_{214}$ apply a ground if the receiver is not muted (unmute confirmation). The DSRCE $shall_{215}$ provide the following output levels:

Receiver muted (mute confirmation):	+12 VDC ± 25%, 0.5 mA max
Receiver not muted (unmute confirmation):	0.0 VDC ± 1.0 VDC, 20 mA max (sink)

10.2.5.3.10 **PTT Confirmation/PTT Release Confirmation.** The DSRCE $shall_{216}$ provide a positive voltage to the VSCE to indicate the active PTT status for frequency 1 and frequency 2, and $shall_{217}$ apply a ground if the PTT is not activated (PTT release confirmation). The DSRCE $shall_{218}$ provide the following output levels:

PTT Confirmation:	+12 VDC ± 25%, 0.5 mA max
PTT Release Confirmation:	0.0 VDC ± 1.0 VDC, 20 mA max (sink)

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TABLE 10-2. Discrete and Analog Signal Functions for Type B Interface.

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
Transmit Voice	VSCE	DSRCE	Voice to the transmitters
Receive Voice	DSRCE	VSCE	Voice from the receivers
PTT/PTT Release Freq. 1	VSCE	DSRCE	Keys/unkeys the freq. 1 transmitter
PTT/PTT Release Freq. 2	VSCE	DSRCE	Keys/unkeys the freq. 2 transmitter
PTT Confirm/PTT Release Confirm Freq. 1	DSRCE	VSCE	Confirms that freq. 1 PTT/PTT release signal was received from VSCE
PTT Confirm/PTT Release Confirm Freq. 2	DSRCE	VSCE	Confirms that freq. 2 PTT/PTT release signal was received from VSCE
RX Mute/Unmute Freq. 1	VSCE	DSRCE	Mutes/unmutes the freq. 1 receiver (RX)
RX Mute/Unmute Freq. 2	VSCE	DSRCE	Mutes/unmutes the freq. 2 receiver (RX)
Mute/Unmute Confirm Freq. 1	DSRCE	VSCE	Confirms freq. 1 receiver muted/unmuted
Mute/Unmute Confirm Freq. 2	DSRCE	VSCE	Confirms freq. 2 receiver muted/unmuted
M/S TX Select Freq. 1	VSCE	DSRCE	Selects main/standby (M/S) freq. 1 transmitter (TX)
M/S TX Select Freq. 2	VSCE	DSRCE	Selects main/standby (M/S) freq. 2 transmitter (TX)
M/S RX Select Freq. 1	VSCE	DSRCE	Selects main/standby (M/S) freq. 1 receiver (RX)
M/S RX Select Freq. 2	VSCE	DSRCE	Selects main/standby (M/S) freq. 2 receiver (RX)
M/S TX Select Confirm Freq. 1	DSRCE	VSCE	Verifies selection of main/standby (M/S) freq. 1 transmitter (TX)
M/S TX Select Confirm Freq. 2	DSRCE	VSCE	Verifies selection of main/standby (M/S) freq. 2 transmitter (TX)
M/S RX Select Confirm Freq. 1	DSRCE	VSCE	Verifies selection of main/standby (M/S) freq. 1 receiver (RX)
M/S RX Select Confirm Freq. 2	DSRCE	VSCE	Verifies selection of main/standby (M/S) freq. 2 receiver (RX)

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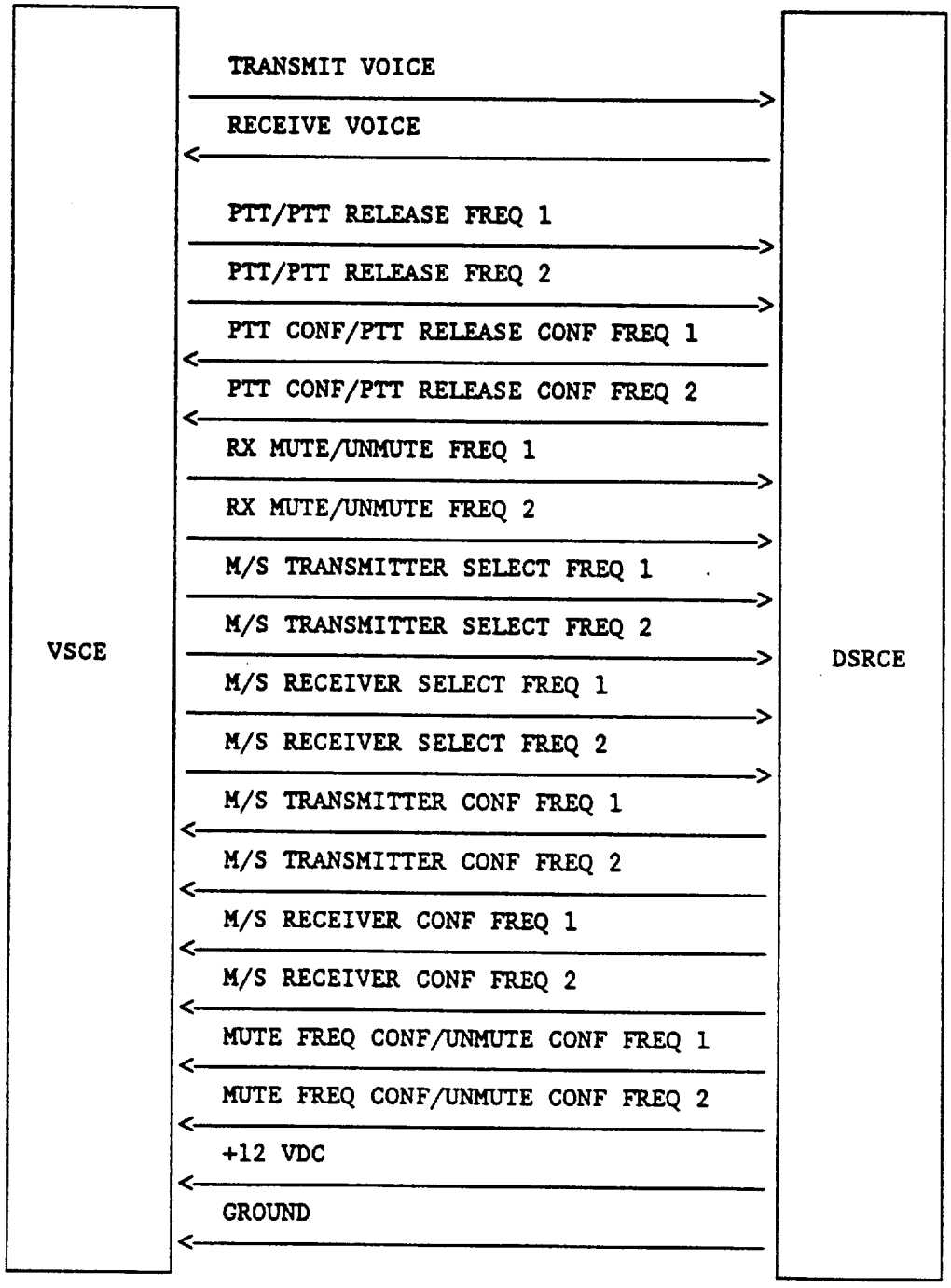

FIGURE 10-2. DSRCE/VSCE Type B Functional Interface.

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10.2.6 **Type C Interface Characteristics.**

10.2.6.1 **General.** The Type C functional interface between the DSRCE and the VSCE is shown in figure 10-3. The DSRCE/VSCE discrete and analog signal functions for the Type C interface are provided in table 10-3.

10.2.6.2 **Electrical Requirements.** The Type C Interface is comprised of dry contacts. All signals, except the voice signals, are provided by dry relay contacts. The dry relay contacts for PTT/PTT Release and M/S Select utilize a common return, isolated from ground. The dry relay contacts for PTT Confirmation/Release Confirmation and M/S Select Confirmation utilize separate returns, isolated from ground.

Parameters for VSCE solid-state relays:

Maximum ON Resistance:	10 ohms
Minimum OFF Isolation:	100 megaohms
Maximum Current Capability:	200 mA
Maximum Voltage Handling:	82 VDC max

10.2.6.3 **Functional Requirements.**

10.2.6.3.1 **Push-To-Talk (PTT)/PTT Release.** The DSRCE **shall**$_{219}$ accept a dry relay contact closure applied to the DSRCE PTT inputs to activate the PTT feature for each frequency (UHF and VHF). The DSRCE **shall**$_{220}$ accept an open relay contact applied at the PTT inputs to deactivate the PTT feature (PTT release). The input parameters for the PTT/PTT Release function are:

PTT:	Dry relay contacts closed
PTT Release:	Dry relay contacts open

10.2.6.3.2 **Main/Standby (M/S) Receiver/Transmitter Select.** The DSRCE **shall**$_{221}$ accept a dry relay contact closure applied to the DSRCE M/S Select inputs to select the Standby equipment and **shall**$_{222}$ accept an open relay contact applied to the M/S select inputs of the DSRCE to select the Main equipment. The input parameters for the M/S Receiver/Transmitter Select function are:

Main Select:	Dry relay contacts open
Standby Select:	Dry relay contacts closed

10.2.6.3.3 **PTT Confirmation/Release Confirmation.** The DSRCE **shall**$_{223}$ provide dry relay contacts (i.e., isolated from ground and without a common return) to the VSCE to indicate PTT status for frequency 1 and frequency 2.

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DSRCE Relay Parameters:

Maximum Current Capability:	20 mA (resistive load)
Maximum Voltage Handling:	25 VDC

A relay contact closure $shall_{224}$ indicate that PTT is activated (PTT confirmation). An open relay contact $shall_{225}$ indicate that PTT is not activated (PTT release confirmation). The RCE $shall_{226}$ provide the following outputs:

PTT Confirmation:	Dry relay contacts closed;
PTT Release Confirmation:	Dry relay contacts open

10.2.6.3.4 **M/S Receiver/Transmitter Select Confirmation.** The DSRCE $shall_{227}$ provide dry relay contacts (i.e., isolated from ground and without a common return) to indicate M/S Select status for frequency 1 and frequency 2 receivers and transmitters.

DSRCE Relay Parameters:

Maximum Current Capability:	20 mA (resistive load)
Maximum Voltage Handling:	25 VDC

A dry contact closure $shall_{228}$ indicate M/S transmitter/receiver selection (confirmation) and an open contact $shall_{229}$ indicate no selection. The RCE $shall_{230}$ provide the following outputs:

Selection (confirmation):	Dry relay contacts closed
No Selection:	Dry relay contacts open

10.2.6.3.5 **Transmit Voice.** The DSRCE $shall_{231}$ accept transmit voice signals from the VSCE that satisfy the following parameters:

Input Level:	-5 dBm, adjustable ± 6 dB (test tone level)
Impedance:	600 ohms ± 10%

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10.2.6.3.6 Receive Voice. The DSRCE **shall**$_{232}$ send receiver voice signals to the VSCE that satisfy the following parameters:

Output Level:	-17 dBm, adjustable ± 6 dB (test tone level)
Impedance:	600 Ohms ± 10%

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TABLE 10-3. Discrete and Analog Signal Functions for Type C Interface.

FUNCTION	SOURCE	DESTINATION	DESCRIPTION
Transmit Voice	VSCE	DSRCE	Voice to the transmitters
Receive Voice	DSRCE	VSCE	Voice from the receivers
PTT/PTT Release Freq. 1	VSCE	DSRCE	Keys/unkeys the freq. 1 transmitter
PTT/PTT Release Freq. 2	VSCE	DSRCE	Keys/unkeys the freq. 2 transmitter
Freq. 1 PTT Confirm/ PTT Release Confirm	DSRCE	VSCE	Confirmation that freq. 1 PTT/PTT release signal was received from VSCE
Freq. 2 PTT Confirm/ PTT Release Confirm	DSRCE	VSCE	Confirmation that freq. 2 PTT/PTT release signal was received from VSCE
M/S TX Select Freq. 1	VSCE	DSRCE	Selects main/standby (M/S) freq. 1 transmitter (TX)
M/S TX Select Freq. 2	VSCE	DSRCE	Selects main/standby (M/S) freq. 2 transmitter (TX)
M/S RX Select Freq. 1	VSCE	DSRCE	Selects main/standby (M/S) freq. 1 receiver (RX)
M/S RX Select Freq. 2	VSCE	DSRCE	Selects main/standby (M/S) freq. 2 receiver (RX)
M/S TX Select Confirm Freq. 1	DSRCE	VSCE	Verifies selection of main/standby (M/S) freq. 1 transmitter (TX)
M/S TX Select Confirm Freq. 2	DSRCE	VSCE	Verifies selection of main/standby (M/S) freq. 2 transmitter (TX)
M/S RX Select Confirm Freq. 1	DSRCE	VSCE	Verifies selection of main/standby (M/S) freq. 1 receiver (RX)
M/S RX Select Confirm Freq. 2	DSRCE	VSCE	Verifies selection of main/standby (M/S) freq. 2 receiver (RX)

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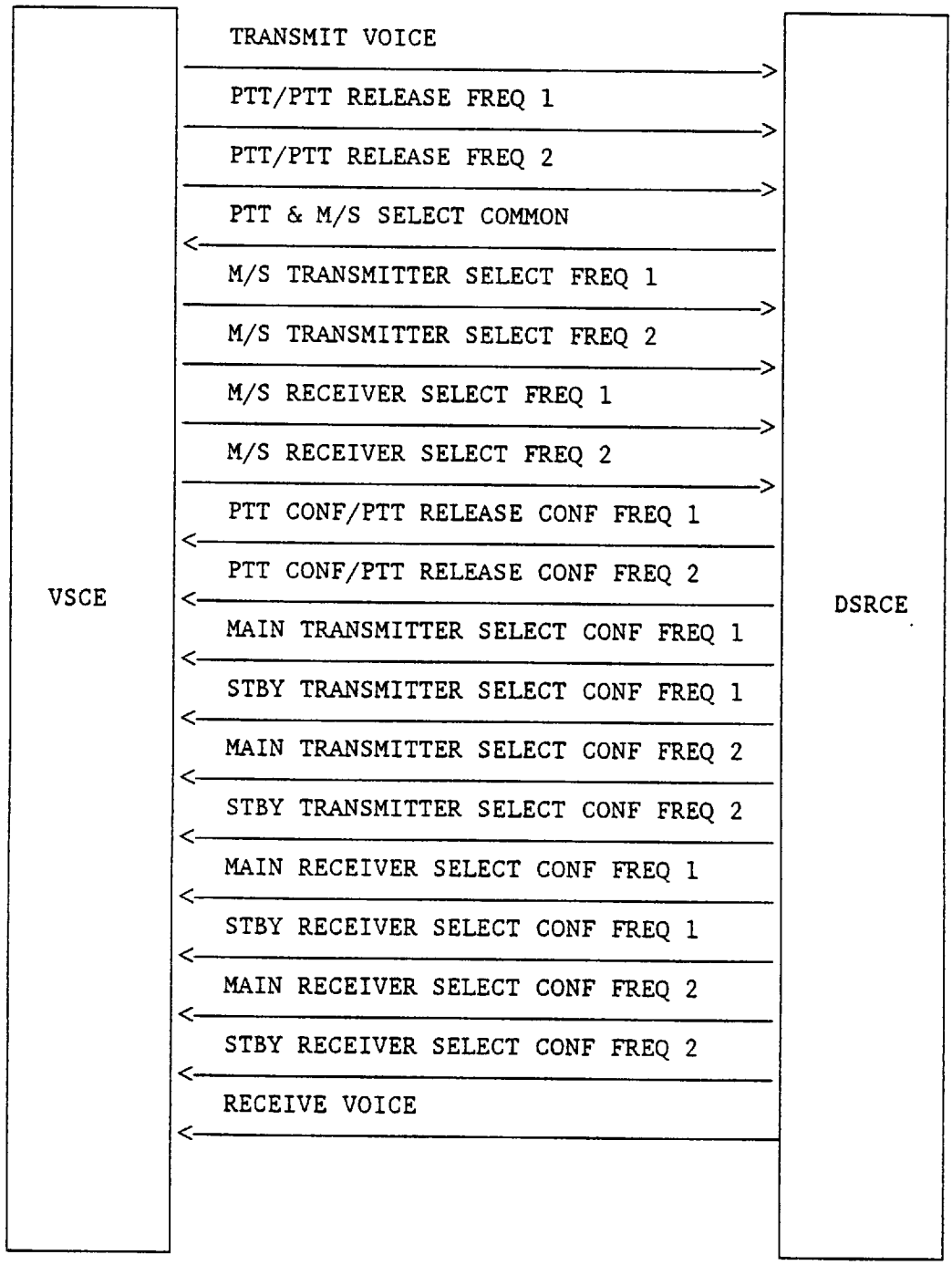

FIGURE 10-3. DSRCE/VSCE Type C Functional Interface.

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Appendix B:

DOWN SCOPED RADIO CONTROL EQUIPMENT (DSRCE)/

SOLID-STATE RADIO EQUIPMENT

INTERFACE REQUIREMENTS

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20.1 Scope. This appendix describes the electrical/electronic interfaces between the remote site DSRCE and the air-ground radios. Remote facility types are: 1) Remote Center Air-to-Ground (RCAG), 2) Remote Communication Outlet (RCO), and 3) Remote Transmitter/Receiver (RTR) facilities. Interfaces addressed in this appenndix will ensure electrical compatibility and successful operation of the DSRCE with the solid state radio equipment.

Note: The subsequent tables represent the DSRCE/Solid-State Radio Equipment interfaces for one frequency of the DSRCE channel.

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TABLE 20-1. Voice Transmit (Main)

Source: ..... Remote Site DSRCE

Destination: ..... Main Transmitter

Impedance: ..... 600 ± 60 ohms

Test Tone Level: ..... -10 dBm ± 0.5 dB

TABLE 20-2. Voice Transmit (Standby)

Source: ..... Remote Site DSRCE

Destination: ..... Standby Transmitter

Impedance: ..... 600 ± 60 ohms

Test Tone Level: ..... -10 dBm ± 0.5 dB

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TABLE 20-3. Voice Receive (Main)

Source: ..... Main Receiver

Destination: ..... Remote Site DSRCE

Impedance: ..... 600 ± 60 Ohms

Test Tone Level: ..... Receiver Voice test tone levels will be set for 0 dBm ± 2 dB into a 600 ohm load.

TABLE 20-4. Voice Receive (Standby)

Source: ..... Standby Receiver

Destination: ..... Remote Site DSRCE

Impedance: ..... 600 ± 60 Ohms

Test Tone Level: ..... Receiver Voice test tone levels will be set for 0 dBm ± 2 dB into a 600 ohm load.

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TABLE 20-5. Transmitter Keying (Main)

Source: ..... Remote Site DSRCE

Destination: ..... Main Transmitter

Note:

Keying is accomplished by applying a ground to the key input of the transmitters. A ground is continuously applied until a PTT release condition is received from the control facility DSRCE. Receipt of the PTT release condition results in disconnection of the ground at the transmitter interface.

TABLE 20-6. Transmitter Keying (Standby)

Source: ..... Remote Site DSRCE

Destination: ..... Standby Transmitter

Note:

Keying is accomplished by applying a ground to the key input of the transmitters. A ground is continuously applied until a PTT release condition is received from the control facility DSRCE. Receipt of the PTT release condition results in disconnection of the ground at the transmitter interface.

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TABLE 20-7. Main/Standby Transmitter Select.

Source: ..... Remote Site DSRCE

Destination: ..... Antenna Transfer Relay

Logic State:

	Main Selected	Standby Selected
Nominal Voltage:	0 VDC	+24 VDC
Maximum Voltage:	+4 VDC	+30.0 VDC
Minimum Voltage:	-4 VDC	+20.0 VDC

Note: Maximum relay coil current will be less than 100 mA.

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TABLE 20-8. Main/Standby Receiver Select.

Source: ..... Remote Site DSRCE

Destination: ..... Antenna Transfer Relay

Logic State:

	Main Selected	Standby Selected
Nominal Voltage:	0 VDC	+24VDC
Maximum Voltage:	+4 VDC	+30.0 VDC
Minimum Voltage:	-4 VDC	+20.0 VDC

Note: Maximum relay coil current will be less than 100 mA.

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Appendix C:

FAA MAINTENANCE DATA TERMINAL (MDT)

SPECIFICATIONS

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30.1 General. All maintenance interfaces and software provided for use with the DSRCE must be fully compatible with the FAA Maintenance Data Terminal (MDT). The following characteristics and configurations are excerpts from the FAA MDT Specification.

30.1.1 Hardware.

a) The microcomputer system will read, write, and format 1.2MB high density, as well as read and write 360KB double density, double sided 5.25 inch diskettes.

b) The video monitor will be memory-mapped to the same memory space, and will display the same character set, as a microcomputer running under the PC DOS 3.2 operating system.

c) The microcomputer will execute the latest commercially available versions of the PC/MS-DOS operating system software, and applications software intended for execution under the PC/MS-DOS operating system.

30.1.2 System Unit. The microcomputer system CPU or system unit will have the following characteristics:

a) The microprocessor will be functionally and physically equivalent to an Intel 80286.

b) The microprocessor will directly address a minimum of 16M bytes of main memory, utilizing at least a 24 bit address path and at least a 16 bit data path between main memory and the microprocessor.

c) The microprocessor will execute the highest current commercially available version of the PC/MS-DOS operating system which will be bootable from the hard disk as well as from a diskette.

d) A minimum of 1.0 MB of random access memory (RAM) will be provided with each system unit. 640 KB of the provided RAM will be available to, and directly addressable by, MS-DOS.

e) The microcomputer system will operate at a clock speed of 8 Mhz with keyboard switchable higher speeds desired.

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30.1.3 **Ports.**

a) RGBI Video output port.

b) Centronics compatible parallel printer interface port.

c) Serial, RS-232-C compatible asynchronous communications port which meets the following specifications:

1) Number of data bits: 7 and 8

2) Number of start bits: 1

3) Number of stop bits: 1 and 2

4) Parity: odd, even, and none

5) Start, stop, and parity bits are automatically inserted on the line in proper sequence

6) Communications rates: 300, 1200, 2400, 4800, and 9600 bps.

7) RS-232-C controlled signals:

(i) Transmit data
(ii) Request to send
(iii) Data terminal ready.

8) RS-232-C Monitored Signals:

(i) Receive data
(ii) Clear to send
(iii) Data set ready
(iv) Ring indicator
(v) Carrier detect

9) Male, DS-25 connector

d) 20 Milliamp Current Loop port

30.1.4 **Keyboard.** One keyboard will be provided with each microcomputer system and will have a minimum of 83 keys laid out in a manner similar to a standard full size typewriter with at least 10 functional keys positioned across the top or along the left side in two columns of the keyboard.

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30.1.5 **Hard Disk Drive.** One hard disk drive subsystem with controller will be provided with each microcomputer system. The hard drive subsystem will meet the following requirements:

a) Have a minimum of 20 Megabytes of user available formatted storage capacity.

b) Be provided with all necessary cabling, a disk controller and driver software.

c) Be interfaced through DMA channel or a programmed I/O interface.

d) The operating system will be bootable from the hard drive without insertion of a diskette.

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Appendix D:

DOWN SCOPED RADIO CONTROL EQUIPMENT (DSRCE)

REMOTE MONITORING SUBSYSTEM (RMS)

REQUIREMENTS

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40.1 **Scope.** This appendix describes the interface between the DSRCE and the Maintenance Processor Subsystem (MPS). It also provides a description of the Remote Monitoring Subsystem (RMS) functionality that will be provided by the DSRCE system.

This appendix does not specify interfaces within the DSRCE system; such interfaces are considered internal to DSRCE. In areas where this appendix does not provide guidance, NAS-MD-790 **shall**$_{233}$ apply.

40.2 **DSRCE RMS Functionality.**

40.2.1 **Remote Monitoring and Alarm Notification.** The DSRCE **shall**$_{234}$ compare the collected parameter values with predefined tolerance limits or threshold values to determine if an alarm condition exists. If an alarm condition is detected, the DSRCE **shall**$_{235}$ generate the appropriate alarm message (as specified in section 40.3.4.2.1) and then store it until it can be retrieved by the MPS. For each alarm which has a state other than on/off, a separate set of threshold values **shall**$_{236}$ be stored in the DSRCE's memory for determining hard and soft alarm conditions. The threshold values **shall**$_{237}$ be determined by the Contractor and described in the Contractor provided Interface Control Document (ICD) see section 40.4. Alarm threshold values **shall**$_{238}$ be remotely changeable in accordance with section 40.3.4.4. When a threshold has been changed, the DSRCE **shall**$_{239}$ generate a "state change" message and send it to the MPS in accordance with section 40.3.4.3.

When a previously reported alarm condition is no longer in an alarm state, the DSRCE **shall**$_{240}$ generate a "return to normal" (RTN) message and send it to the MPS in accordance with section 40.3.4.2.2.

40.2.2 **Automatic Recording and Retrieval.** The DSRCE **shall**$_{241}$ have a self-monitoring capability. This capability **shall**$_{242}$ allow for the collection of the data needed to detect the failure of "critical" DSRCE components, and to evaluate the performance of the system. Upon an MPS request, the DSRCE **shall**$_{243}$ be capable of retrieving the requested data and sending a site data report in accordance with section 40.3.4.3.

40.2.3 **System Security.** The DSRCE system **shall**$_{244}$ be protected by a password. All personnel accessing the system from maintenance terminals (including the FAA MDTs) from either the control facility or remote sites, **shall**$_{245}$ need a legitimate password in order to use the system.

40.2.4 **MPS/Centralized Maintenance Terminal and MPS/MDT Terminal Communication.** The DSRCE **shall**$_{246}$ provide the capability for users to log on the centralized maintenance terminal and FAA MDT in order to send and receive terminal messages to and from the MPS in accordance with 40.3.4.2.4.

40.3 **DSRCE/MPS Interface.**

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40.3.1 **Mechanical Interface.** The interface shall$_{247}$ be in accordance with EIA Standard RS-232-C with specific characteristics as specified in NAS-MD-790 section 2.

40.3.2 **Electrical Characteristics.** The interface with the MPS shall$_{248}$ be in accordance with EIA Standard RS-232-C, Interface Type D and NAS-MD-790 section 2, operating at 2400 baud in a synchronous and full duplex mode. The DSRCE shall$_{249}$ be considered as data terminating equipment (DTE); likewise, the MPS is considered DTE. At facilities were the distance between the MPS and the DSRCE exceeds the limits specified in RS-232-C, a modem (supplied by the Government) will be used. At facilities were the distance does not exceed the limits specified in RS-232-C, the DSRCE shall$_{250}$ be capable of interfacing with a "null modem" cable. The null modem cable will be provided by the Government.

Only the RS-232-C circuits specified in NAS-MD-790 section 2 shall$_{251}$ be implemented.

40.3.3 **Data Exchange Protocol.** Data transfer across the DSRCE/MPS interface shall$_{252}$ be controlled in accordance with Advanced Data Communication Control Procedures (ADCCP) ANSI Standard X3.66 as defined in NAS-MD-790 section 4 (Bit Oriented Data Link Procedures for Synchronous Communications); the data shall$_{253}$ not be encrypted. All references in NAS-MD-790 to "RMS" shall$_{254}$ be interpreted as references to the DSRCE.

40.3.4 **Message Format.** The DSRCE/MPS interface will exchange various type of messages. The message types and their direction flow are:

Polling Messages	MPS to DSRCE
Priority Messages	DSRCE to MPS
Site Data Report Messages	DSRCE to MPS
Command Messages	MPS to DSRCE

40.3.4.1 **Polling Messages.** Polling is the means by which the MPS requests and controls the flow of RMS information. The DSRCE shall$_{255}$ respond to the MPS polls as described in section 3.1 of NAS-MD-790.

40.3.4.2 **Priority Messages.** The four types of priority messages (alarm, return to normal, state change, and terminal) are classified as follows:

Priority 1: Alarm; Return to Normal (equal priority)
Priority 2: State Changes Messages
Priority 3: Terminal Messages

40.3.4.2.1 **Alarm Messages.** The format of all alarm messages generated by the DSRCE shall$_{256}$ be in accordance with NAS-MD-790, section 3.4.1.

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40.3.4.2.2 **Return to Normal Messages.** The format of all return to normal messages generated by the DSRCE **shall**$_{257}$ be in accordance with NAS-MD-790, section 3.4.2.

40.3.4.2.3 **State Change Messages.** The format of all state change messages generated by the DSRCE **shall**$_{258}$ be in accordance with NAS-MD-790, section 3.4.3.

40.3.4.2.4 **Terminal Messages.** The format of all terminal messages generated by the DSRCE **shall**$_{259}$ be in accordance with NAS-MD-790, section 3.4.4.

40.3.4.3 **Site Data Report Messages.** The format of all site data report messages generated by the DSRCE in response to an MPS request **shall**$_{260}$ be in accordance with NAS-MD-790 section 3.6.

40.3.4.4 **Command Messages.** Commands allow the MPS to initiate certain actions remotely. The DSRCE **shall**$_{261}$ be capable of responding only to the following commands issued by the MPS:

(a) Master reset command (as described in NAS-MD-790, section 3.7.1)

(b) Startup/recovery command (as described in NAS-MD-790, section 3.7.2)

(c) Equipment control command (as described in NAS-MD-790, section 3.7.5)

(d) Threshold change command (as described in NAS-MD-790, section 3.7.6)

(e) Password change command (as described in NAS-MD-790, section 3.7.7)

Note: All other messages described in NAS-MD-790 from section 3.4 to section 3.7 that are not described in this appendix **shall**$_{262}$ be ignored.

40.3.5 **Addressing.** If the information within the DSRCE system is not grouped into logical units as defined in NAS-MD-790 section 3.2, then the Contractor **shall**$_{263}$ describe the grouping of this information, in detail, in the Contractor provided ICD.

40.4 **Interface Control Document.** Message exchange procedures, content, and formats for all messages required by this specification or by the Contractor's design **shall**$_{264}$ be documented in an Interface Control Document (ICD) in accordance with paragraph 1.3 of NAS-MD-790.

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