



FA100-00072
USER MANUAL

Simple Ground System (SGS) User Manual

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1.0 INTRODUCTION

This document provides the information needed to use the Simple Ground Station software application.

1.1 Purpose and Scope

This User Manual provides detailed information about the Simple Ground Station (SGS).

The SGS is a software application that is installed on the OTM2 module and is intended to be used in conjunction with Voice Channel Modules (VCM)s and Multimode Digital Radios (MDR)s to test NEXCOM VDL Mode 3 radio frequency compatibility with the existing FAA DSB-AM radio infrastructure.

The SGS has internally stored compressed voice data that can be transmitted by an MDR with V-Bursts in any MAC slot of a 4V system configuration. The voice data is received and compared to the transmitted data. Bit errors and dropped frames are reported on the terminal interface. The SGS can also transmit live audio from a headset connected to a VCM in the same chassis and monitor received V-Bursts on the headset. Live audio is not checked for bit errors or dropped messages. A second MDR transmitter can transmit another set of V-Bursts in any MAC slot to determine the interference affects, if any, on the other MDR's transmissions.

The SGS has been developed for the NEXCOM Group (ACB-560) (ACB-240), and (ASR-1) of the Federal Aviation Administration's William J. Hughes Technical Center.

1.2 References

Reference information includes:

- *DOT/FAA Interface Control Document, Multimode Digital Radio (MDR)/Radio Interface Unit (RIU), DTFA01-01-D-03009, NAS-IC-41033502, July 23, 2001 – V3.0.*
- *Voice Channel Module 2 (VCM2) User Manual, CIE Document FA100-00098, June 27, 2003 - V1.0.*
- *OTM-VCM Interface Control Document, CIE Document FA100-00065, January 30, 2002 - V1.0.*

1.3 Notational Conventions

While reading this manual, the following notational conventions should be observed:

- *Command Entry.* This manual describes terminal commands. All terminal commands and responses are shown in `courier font`. Although all commands in this manual are shown without the necessary trailing carriage return, i.e., the user must press the Enter key to issue the command.

1.4 Document Organization

This document contains the following sections:

- *Introduction.* This section provides introductory material.
- *General Description.* This section provides a brief overview of the SGS and includes a list of features.
- *Connectors, Controls, and Indicators.* This section provides signal pinouts and descriptions for all OTM2 connectors and also describes the operation of SGS switches and LEDs.
- *Installation.* This section provides installation guidance.
- *Functional Description.* This section covers various topics to provide users with a basic understanding of SGS function.
- *Architectural Description.* This section provides architectural information.
- *Maintenance and Test.* This section includes SGS software update instructions.
- *Terminal Command Reference.* This section includes detailed SGS command information.
- *Glossary.* This section defines abbreviations/acronyms and provides descriptive text for terms used in this report.

1.5 Revision History

Table 1 provides this manual's revision history.

Table 1: Revision History

REVISION	DATE	DESCRIPTION
1.0.0	10/31/2003	<u>Original Release</u>
2.0.0	02/06/2004	<u>Release 2.0.0</u> : Live voice with VCM is supported.
3.0.0	07/21/2004	<u>Release 3.0.0</u> : Totally revised manual and modified command set. New command features include MAC cycle offset and support for Rockwell Collins test mode.

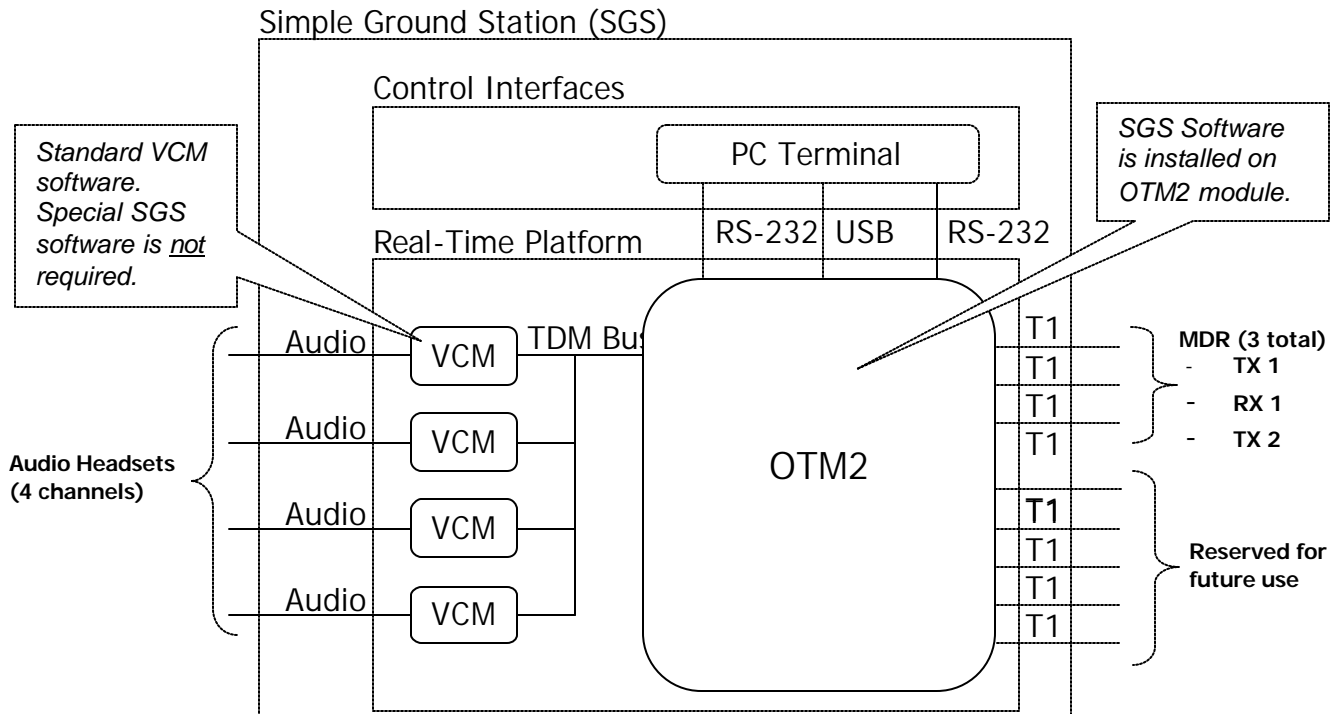
2.0 GENERAL DESCRIPTION

2.1 Overview

The SGS is built on the NEXCOM Real Time Platform (RTP). The OTM2 module transmits stored compressed voice data to the MDRs and performs error checking on the received voice data. The received voice can then be sent to the VCM2 modules for monitoring with headsets.

Figure 1 provides an interface diagram depicting the OTM2 connections for the Simple Ground Station.

Figure 1: Simple Ground Station



The Real Time Platform (RTP) typically consists of a chassis, a single OTM2 module, and between 1 and 4 Voice Channel Modules (VCM2s). The OTM2 provides NEXCOM timing and provides message routing services between the VCM and T1-interfaced equipment. The VCMs provide voice channel processing (e.g. A/D conversion, vocoding).

2.2 Features

The SGS features include:

- *Communication testing through one MDR transmitters and one MDR receiver*
- *Control of second MDR transmitter to generate potential interference to the other MDR transmitter*
- *VDL Configurations: 4V and Rockwell Collins BER test mode (2V2D)*
- *8 selectable, internally stored voice loops of compressed audio files (6 seconds in length each) for uplink*
- *4 selectable VCM modules for live audio uplink and downlink audio decompression and monitoring*
- *Mapping of any uplink audio source to any MAC slot V-Burst in a 4V system configuration*
- *Mapping of any downlink MAC slot V-Burst to any VCM module*
- *Selectable Tx power for each MAC slot*
- *Bit Error Rate and dropped message analysis for each MAC slot of received V-Burst data when sourced from internally stored voice loops*
- *Individually enabled Management Bursts with fixed content for each MDR transmitter*
- *NEXCOM timing channel generation on T1 ports*
- *Supports VDL-3 compressed voice messages over TDM Bus*
- *Field upgradeable software (via Debug Terminal)*

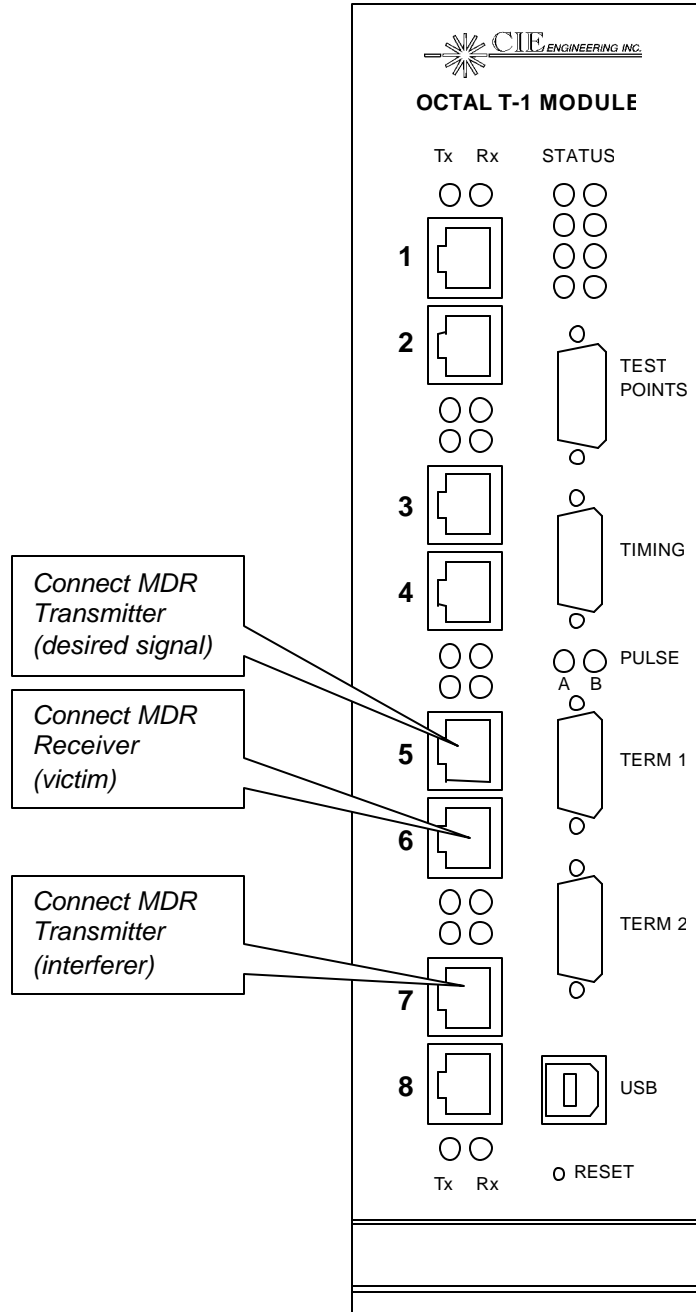
3.0 CONNECTORS, CONTROLS, AND INDICATORS

This section provides detailed information on the OTM2 connectors, controls and indicators. The following topics are included:

- *T1 Connectors*. Provides SGS to MDR interface (8 pins – 8 each).
- *RS232 Connectors (COM1/COM2)*. Provides signal pinouts and descriptions for the DB9F connectors (9 pins – 2 each).
- *USB Connector (COM3)*. Provides signal pinout and description for the USB connector (COM3).
- *Reset Switch*. Describes the function of the reset switch.
- *LED Indicators*. Describes the functions for each of the LED indicators.

Figure 2 shows the location of OTM2 connectors, controls and indicators.

Figure 2: OTM2 Front Panel Diagram



Note: The OTM2 has a USB connector at the lower right. The OTM1 does not possess a USB interface.

3.1 T1 Connectors

The T1 interfaces use standard RJ-48 connectors and standard T1 pinouts. There are eight T1 connectors on the OTM2.

Figure 3: RJ48 Connector Diagram

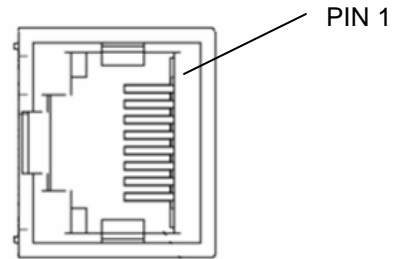


Table 2: RJ48 Signals

SIGNAL	PIN	DIR	DESCRIPTION
RXTIP	1	I	Receive Tip (positive)
RXRING	2	I	Receive Ring (negative)
	3	---	Not Used
TXTIP	4	O	Transmit Tip (positive)
TXRING	5	O	Transmit Ring (negative)
	6	---	Not Used
	7	---	Not Used
	8	---	Not Used

3.2 RS232 Connectors

The two DB9F serial connectors are used for terminal control. .

The default communication setup has the following characteristics:

- 115,200 bps, 8 data bits, 1 stop bit, no parity, no flow control

While this setup facilitates quick setup with three-pin serial cables, it is recommended that the user enable hardware flow control. Hardware flow control prevents character loss when printing large sets of data.

The OTM2 utilizes a data communication equipment (DCE) interface. Figure 4 provides a pin location diagram. Table 3 contains a list of DB9F signals.

Figure 4: DB9F Connector Diagram

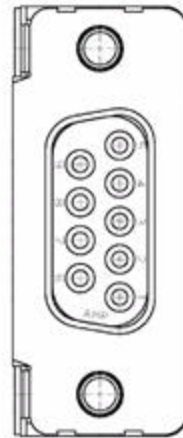


Table 3: DB9F Signals

SIGNAL	PIN	DIR	DESCRIPTION
CD	1	O	Carrier Detect. Always active.
RXD	2	O	Receive Data.
TXD	3	I	Transmit Data.
DTR	4	I	Data Terminal Ready.
GND	5	---	Ground
DSR	6	O	Data Send Ready.
RTS	7	I	Request to Send.
CTS	8	O	Clear to Send.
RI	9	O	Ring Indicator. Always active.

3.3 USB Connector

The Universal Serial Bus (USB) Terminal Interface is compatible with standard personal computer (PC) USB ports. The OTM2 is configured as a self powered USB function device. A standard USB interface cable can be used for PC-to-OTM2 communication.

Table 4: USB Signals

SIGNAL	PIN	DIR	DESCRIPTION
VBUS	1	I	Bus Power (+5V)
D-	2	I/O	Data (negative)
D+	3	I/O	Data (positive)
	4	---	Not Used
GND	5	---	Ground

The OTM2 USB connector is a standard Series “B” plug. See Figure 2 for a front panel illustration showing the location. The PC USB connector is a standard Series “A” plug.

A terminal emulation program can be used on the PC in conjunction with the FT8U232/245 Virtual Com Port (VCP) device driver from FTDI. The VCP driver makes the OTM2 terminal look like a standard COM port device. The VCP terminal is configured at 8 data bits, 1 stop bit, no parity, and no handshaking. The baud rate setting is ignored and data is transferred at the maximum rate possible for the device driver.

3.4 Reset Switch

The Reset Button is a recessed momentary switch that, when pushed, will cause a hardware reset to occur on the OTM2 module. See Figure 2 for a front panel illustration showing the location.

3.5 LED Indicators

There are three types of OTM2 LED indicators:

- OTM2 General Status Indicators
- OTM2 Pulse Output Indicators
- OTM2 T1 Interface Status Indicators

3.5.1 General Status Indicators

Figure 5 shows a detail of the block of OTM2 general status indicators with numbers to reference individual LED locations with. See Table 5 for the description of these LEDs.

Figure 5: OTM2 General Status Indicator Locations

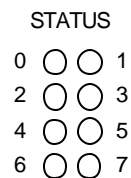


Table 5: OTM2 General Status Indicator Descriptions

LED	ASSIGNMENT	DESCRIPTION
0	RUNTIME	<u>Runtime Indicator</u> . Blinks GREEN at one second boundaries. Indicates that system software is functioning normally..
1	EPOCH	<u>Epoch Indicator</u> . Blinks GREEN at epoch boundaries (every 6 seconds).
2	---	Not Used
3	---	Not Used
4	ICCRX	<u>ICC Receive Indicator</u> . Winks GREEN for each message received from active VCMs.
5	ICCTX	<u>ICC Transmit Indicator</u> . Winks GREEN for each message transmitted to active VCMs.
6	---	Not Used
7	---	Not Used
8	---	Not Used

3.5.2 Pulse Output Indicators

The LEDs labeled PULSE A and B light red when the corresponding Pulse signals on the “TIMING” front panel connector are active.

Note: The SGS presently does not support PULSE output controls.

3.5.3 T1 Status Indicators

There are two LED indicators adjacent to each of the RJ-48 T1 interface connectors on the OTM2. The LEDs labeled “Tx” are used to indicate the state and activity of the Tx T1 interfaces and the LEDs labeled “Rx” are used to indicate the state and activity of the Rx T1 interfaces.

Table 6: T1 Status Indicator Descriptions

LED	STATE	DESCRIPTION
TX	RED	Winks for T1 Transmit Errors
	GREEN	Winks for each message transmitted on T1 with no errors.
	OFF	No data, no errors.
RX	RED	Winks for T1 Receive Errors or solid for no T1 connection or clock.
	GREEN	Winks for each message received on T1 with no errors.
	OFF	No data, no errors.

4.0 INSTALLATION

This section provides SGS installation instructions. The following topics are included:

- *Basic Installation.* Provides guidance for OTM2 installation.
- *Installing the Optional USB Driver.* Provides instructions for installing the FTDI USB drivers (needed if COM3 port is used).

Before installing and operating the SGS, review the entire contents of this manual.

4.1 Basic Installation

The OTM2 is mounted in the SGS chassis at the factory. It is intended to operate with three MDRs. Two are transmitters and one is a receiver. One MDR transmitter will transmit V-Bursts that are to be analyzed for errors and is referred to as the TX1 MDR. The other MDR transmitter will transmit potential interference to the first MDR and is referred to as the TX2 MDR. The MDR receiver will receive V-Bursts from TX1 and send them to the SGS for error analysis. It is referred to as the RX MDR. To install the OTM2 system connections, follow the steps below and reference Figure 2.

Note: The following cables and connectors are required (but not supplied): One T1 crossover cable per MDR connection, one T1 loop back connector per unused MDR connection and at least one terminal interface cable.

1. Connect the PC running the terminal emulation program to any of the TERM ports. The OTM2 command interface is meant to be used with a terminal emulator program such as Procomm or HyperTerminal.
2. Connect the T1 interface cable from port 5 to the TX1 MDR. Connect the T1 interface cable from port 6 to the RX MDR. Connect the T1 interface cable from port 7 to the TX2 MDR. Insert T1 loop back connectors in any MDR ports 5, 6 or 7 that are not being used.

Power on the MDRs and use an MDT to set each MDR to VDL Mode 3 and to configure the frequencies to be used.

4.2 Installing the Optional USB Driver

If the USB interface is used, insure the FT8U232/245 Virtual Com Port (VCP) device driver from FTDI is installed on the PC. The VCP device driver and installation instructions can be found at <http://www.ftdichip.com/FTDriver.htm> - NOPNP. Be sure to select the proper driver for the operating system being used.

The default settings for the Virtual Com Port should be maintained. The settings are found in the Windows Device Manager when the USB port is connected and the OTM2 is on. To modify/verify the settings:

1. In the Windows Device Manager, select Ports (COM & LPT) - USB Serial Port (COM number that the device was installed with).
2. Right click the mouse and select "Properties".
3. On the "Port Settings" tab. Insure the following settings are selected: 9600 Bits per second, 8 Data bits, None for Parity, 1 Stop bit and None for Flow control.
4. Click on the "Advanced" button. Insure the following settings are selected: 4096 Receive (Bytes), 4096 Transmit (Bytes), 16 for Latency Timer (msec), 0 Minimum Read Timeout (msec), 0 Minimum Write Timeout (msec) and nothing checked in Miscellaneous Options are the default settings.

Note: The COM Port Number can be changed to any unused port at the user's preference.

5.0 FUNCTIONAL DESCRIPTION

This section provides a functional overview of the SGS. The following topics are included:

- *System Configuration.* Discusses the 4V and BER test modes.
- *T1 Interface.* Discusses details for T1 interface
- *Command Processor.* Discusses the command processor.

5.1 System Configuration

The system configuration of the SGS is most like the Standalone RIU in the Ground Reference Prototype (GRP) with no SNS interface.

5.1.1 4V Mode

The SGS typically operates in a 4V system configuration where there are 2 sets of four Media Access Control (MAC) slots per MAC cycle. The SGS has internally stored eight voice loops of compressed audio. Each voice loop is 6 seconds in length when uncompressed. Therefore each loop plays completely through in one epoch cycle and is aligned to start from the beginning of the loop at the beginning of the epoch cycle. Four of the eight voice loops, identified as REC1 - REC4 are recorded Air Traffic Control (ATC) audio that has been compressed through a vocoder. REC5 is fixed data where all bits are 0's, REC6 is fixed data where all bits are 1's and the two remaining loops, REC7 and REC8, are different random data patterns. Each of these 8 voice loops can be assigned to any of 4 MAC slots in any of two MDR transmitters. One MDR transmitter, which is connected to T1 port 5 of the OTM2 module in the SGS, is designated as the MDR that transmits the V-Burst that is analyzed upon reception from the MDR receiver for bit errors and dropped messages. These errors may be caused by poor reception from low signal level at the receiving MDR or from potential interference from another MDR transmitter that is connected to T1 port 7 of the OTM2 module in the SGS. The second MDR transmitter has voice loops assigned to its MAC slots in the same manner as the first MDR transmitter, except the second transmitters output is not intended to be received and analyzed for errors, it is only to be transmitted for potential interference to the other MDR transmitter.

After receiving data from the MDR receiver, the SGS compares it to the voice loop data that was assigned to the corresponding MAC slot and reports bit errors and dropped messages in a periodic error status report on one of the connected command terminals. The periodic report indicates bit errors and dropped messages for each MAC cycle accumulated over one second, and a total of those errors. It also reports a running accumulated total for each of the previously mentioned errors. The accumulated totals can be cleared with a command on the connected terminal.

Once the data is received, it can be routed to any VCM2 module that is in the SGS chassis with a terminal command. The VCM will decompress the received data and route it to a connected headset. If one of the stored voice loops REC1 through REC4 are assigned to the MAC slot that is being monitored with the VCM, its audio may be heard on the headset with the affects of any errors that have been introduced. If one of the stored voice loops REC5 through REC8 are assigned to the MAC slot that is being monitored, audio will not be heard on the headset because those voice loops are not recorded ATC audio.

The SGS can uplink live audio from a headset connected to VCM in any of 4 MAC slots in any of two MDR transmitters. However, the live audio is not checked for bit errors or dropped messages upon reception from the MDR receiver. Once the data is received, it can also be routed to any VCM that is in the SGS chassis with a terminal command. The VCM will decompress the received data and route it to a connected headset.

5.1.2 RCBER Mode

The SGS also supports a special BER test mode associated with the Rockwell Collins avionic radio. When RCBER mode is selected (see the MBURST command), the SGS operates in a 2V2D configuration and transmits a special pseudo-random test sequence in slots C and D of the VDL MAC cycle.

A separate PC test program, DEBUGMON.EXE, is available from Rockwell Collins that will monitor the received bursts in the avionic radio and report BER statistics via the radio MON port.

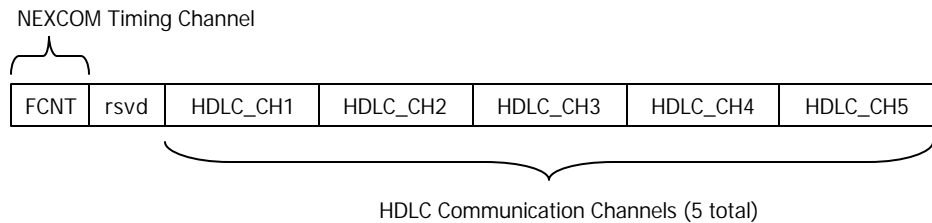
5.2 T1 Interface

The SGS actively uses 3 of the 8 separate T1 interface ports. All 8 ports are timed to the T1 Reference Clock frequency. In addition, the Extended Super Frame (ESF) framing bit for all 8 ports are forced into alignment during port initialization. Further, the NEXCOM timing channel (timeslots 1 and 2) are also forced into alignment during port initialization. The SGS ensures that the ESF transmit frame boundary is aligned with the NEXCOM epoch boundary for all 8 T1 ports.

The T1 framing format is summarized as follows: ESF framing, B8ZS, elastic stores disabled, robbed bit signaling disabled, LBO compatible with 0 to 133 feet.

The standard port assignments for MDR connections are ports 5, 6 and 7.

Figure 6: T1 Interface Slot Assignments



FCNT NEXCOM Timing Channel: Each T1 frame within a NEXCOM 6-second epoch is uniquely identified with an incrementing frame count number. Two T1 timeslots are dedicated to frame count identification (timeslots #0 and #1).

HDLC_CHx HDLC Communication Channels: Four T1 timeslots are grouped together to form an HDLC communication channel. Only one channel is active at any given time. The OTM2 uses HDLC_CH1 by default (timeslots #5-#8). The OTM2 can be reconfigured to use any one of the five available channels.

5.3 Command Processor

More than one terminal can be connected to the OTM2 at any one time. TERM2 (COM2) is the default command interface port and it is the only terminal that shows the progress of the startup sequence. It is also the terminal to use for downloading software upgrades. Command responses are sent to the terminal that the command was entered on. Hardware handshaking is used on the RS-232 terminals (COM1 and COM2) to prevent data loss. The USB terminal (COM3) is inherently a lossless communication device.

Three instances of a command processor are run in round-robin fashion. Characters are collected on each port until a carriage return is detected, i.e. a full command line has been entered. Then, the command is interpreted by the command processor. Only one command can be processed per service event. This guarantees all ports have command access even if one port heavily loads the system.

6.0 ARCHITECTURAL DESCRIPTION

The SGS software is designed to run on the CIE Real Time Platform (RTP) architecture. The software executes on the OTM2 and is designed to work with RTP VCM2 module software.

7.0 MAINTENANCE AND TEST

This section provides maintenance and test information. The following topics are included:

- *Upgrading the SGS Software.* Provides instructions for loading new software.

7.1 Upgrading SGS Software

The software program contained in the OTM2 is field upgradeable via the serial port on TERM2. Please contact CIE Engineering regarding the availability of upgrade programs.

The procedure to upgrade the software is as follows:

1. Connect a terminal to TERM2. Make sure that the terminal has hardware handshaking disabled for this procedure.
2. Apply power to the module or perform a reset with the recessed button on the front panel.

“Booting ...” and a spinning cursor will appear on the terminal for a few seconds.
3. Press the escape key during the spinning cursor, before the startup sequence begins printing to the screen.

This will stop the boot sequence and provide a DSP Debugger prompt, which is a “!”.

4. Type “DL” and then <ENTER> on the terminal.

The flash memory will be erased and the user will be asked to pick a file.

5. Transfer the file from the terminal program. In HyperTerminal go to the “Transfer” menu and click on “Send File”.
6. Select the S record file that has been supplied for upgrade and use the Xmodem transfer protocol.
7. Send the file.

The file will be transferred and validated. It may take several minutes to transfer the file, do not remove power or reset during the transfer.

8. Cycle power or perform a reset.

After normal booting, the new software version will be displayed at startup or with the VERSION command.

Figure 7 provides a sample terminal programming session.

Figure 7: Software Upgrade

```
Booting ... |
DSP Debugger - 2, Version 1.0
Copyright 2003. CIE Engineering, Inc. All rights reserved.
Type ? for help.
! dl
Erasing Flash ... Done
Pick a File...
!                               Send file using XMODEM when you see this prompt.
Download ... Done
Code Verification ... Pass
                               After PASS, restart the OTM
```

8.0 TERMINAL COMMAND REFERENCE

This section provides SGS terminal command information. The following topics are included:

- *Command Overview.* Describes general usage information and a command list.
- *Built-in Help.* Describes how to access and use the built-in help feature.
- *Command Reference.* Provides detailed syntax and operating information for each of the SGS commands.

8.1 Command Overview

The SGS accepts commands via the serial RS-232 ports or via the USB command port. Commands are available to setup VDL configuration (4V or Rockwell Collins 2V2D test pattern), to map audio flows, and to control/report bit error rates.

Table 7 provides a brief description of the available commands. The more frequently used commands are indicated with a check.

Table 7: SGS Command Summary

COMMAND	TYP*	DESCRIPTION OR USE
BER	✓	Accesses/controls SGS bit error rate reporting and error insertion capabilities.
COMCFG		Sets/gets communication parameters (baud, start bits, stops bits, parity, etc) for the two serial RS-232 ports.
COMECHO		Controls the echo of typed characters for the three command ports.
COMPROMPT		Controls the printing of the prompt for the three command ports.
DATE		Sets/gets SGS day of year.
DMAP	✓	Accesses/controls downlink voice slot assignments.
MBURST	✓	Enables/disables management bursts. Also sets the VDL configuration, e.g. 4V, RCBER, OFF
MDR	✓	Accesses/controls SGS MDR radio control/monitoring capabilities.
OFFSET	✓	Offsets the transmitter MAC cycle (units=fractional symbols).
TEST		Executes LED test
TIME		Sets/gets SGS time of day.
TXPWR	✓	Sets/gets MDR V-Burst transmit power (slot-by-slot basis).
UMAP	✓	Accesses/controls uplink voice slot assignments.
VERSION		Prints software version information and unit serial number.
VMAC	✓	Turns on/off VDL media access layer.

* TYP = Typical. The checked commands are used by typical SGS users.

Many commands enable you to set/get parameter status. Typically, to set the parameter an additional token is provided in the command line, i.e. the new parameter value. If this token is omitted the current parameter status is retrieved and displayed. For example, the command 'DATE', gets the current day of year. The command 'DATE 07:16:2004' sets the new day of year.

Either lower or upper case can be used to enter commands. The SGS converts all lines to upper case. All SGS responses are prefixed with the greater than symbol (>). All commands and responses are terminated by a carriage return and all communication is conducted in ASCII format.

8.2 Built-In Help

The SGS supports built-in help. The help feature provides command syntax; thus, it provides a quick reference for using the terminal command port. The command reference provides detailed parameter descriptions.

To access help, type a question mark (?) followed by the ENTER key. When no additional parameters are specified, a complete list of commands is printed. For an example of the printed command list, see Figure 8.

Figure 8: Built-In Help (Command List)

```

> *****
> COMMAND LIST:
> BER          COMCFG          COMECHO        COMPROMPT
> DATE         DMAP           LINK           MBURST
> MDR          OFFSET        TEST           TIME
> TXPWR        UMAP          VERSION        VMAC
>
> Type ? followed by space then command for more info
> *****

```

To get help on a specific command, type ? followed by the command name. For example, see Figure 9.

Figure 9: Built-In Help (Command Syntax)

```

COM1: ? mburst
> *****
> MBURST [HPORT] [OFF|4V|RCBER] - Cfg M-Burst on HPORT
>*****

```

The command help includes parameters and a brief functional description.

8.3 Command Reference

This section provides command syntax and detailed parameter descriptions. Optional parameters are enclosed in square brackets. The vertical bar (|) is used to separate items in the parameter list. Command parameters that can be saved to flash configuration memory are noted, accordingly. Command examples are also provided. Commands are described in alphabetical order.

8.3.1 BER

The BER command controls the insertion of bit errors and BER reporting.

Table 8: BER Command Syntax

ATTRIBUTE	DESCRIPTION																																																
SYNTAX	BER BER [INSERT [nerrs] BER [REPORT [cport]																																																
PARAMETERS	<table border="1"> <tr> <td>nerrs</td> <td>Number of errors per 10,000 bits. Valid range is 0 to 200.</td> </tr> <tr> <td>cport</td> <td> COM Port Assignment. 0 OFF 1 COM1 = TERM1 2 COM2 = TERM2 3 COM3 = USB </td> </tr> </table>	nerrs	Number of errors per 10,000 bits. Valid range is 0 to 200.	cport	COM Port Assignment. 0 OFF 1 COM1 = TERM1 2 COM2 = TERM2 3 COM3 = USB																																												
nerrs	Number of errors per 10,000 bits. Valid range is 0 to 200.																																																
cport	COM Port Assignment. 0 OFF 1 COM1 = TERM1 2 COM2 = TERM2 3 COM3 = USB																																																
FLASH	NO																																																
EXAMPLES	<p><i>Request the current settings</i></p> <pre>COM2: ber > BER REPORT = OFF > BER INSERT = 0</pre> <hr/> <p><i>Enable BER reporting with prints to COM2</i></p> <pre>COM2: ber report 2 > BER REPORT = COM2</pre> <hr/> <p><i>Sample Report (printed once per second)</i></p> <table border="1"> <thead> <tr> <th>></th> <th>SLOT</th> <th>BITE</th> <th>MDRP</th> <th>#MSG</th> <th>CUMM_BITE</th> <th>CUMM_MDRP</th> <th>CUMM_#MSG</th> </tr> </thead> <tbody> <tr> <td>></td> <td>A</td> <td>0</td> <td>0</td> <td>48</td> <td>1050</td> <td>24</td> <td>76776</td> </tr> <tr> <td>></td> <td>B</td> <td>0</td> <td>0</td> <td>54</td> <td>0</td> <td>0</td> <td>76776</td> </tr> <tr> <td>></td> <td>C</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>></td> <td>D</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>></td> <td>T</td> <td>0</td> <td>0</td> <td>102</td> <td>1050</td> <td>24</td> <td>153552</td> </tr> </tbody> </table> <hr/> <p><i>Turn reporting off</i></p> <pre>COM2: ber report 0 > BER REPORT = OFF</pre> <hr/> <p><i>Insert bit errors (in voice bursts ONLY)</i></p> <pre>COM2: ber insert 5 > BER INSERT = 5</pre>	>	SLOT	BITE	MDRP	#MSG	CUMM_BITE	CUMM_MDRP	CUMM_#MSG	>	A	0	0	48	1050	24	76776	>	B	0	0	54	0	0	76776	>	C	0	0	0	0	0	0	>	D	0	0	0	0	0	0	>	T	0	0	102	1050	24	153552
>	SLOT	BITE	MDRP	#MSG	CUMM_BITE	CUMM_MDRP	CUMM_#MSG																																										
>	A	0	0	48	1050	24	76776																																										
>	B	0	0	54	0	0	76776																																										
>	C	0	0	0	0	0	0																																										
>	D	0	0	0	0	0	0																																										
>	T	0	0	102	1050	24	153552																																										

The BER report includes the number of bit errors (BITE), dropped voice bursts (MDRP) and received voice bursts (#MSG). These numbers are updated every second and present the statistics for the previous second. Cumulative values are also displayed. Re-issuing the BER REPORT assignment clears the statistics.

The bit error insertion ONLY works with uplink voice bursts. The selected number of errors are randomly inserted over a span of 10,000 voice payload bits.

8.3.2 COMCFG

The COMCFG command configures ASCII communication settings for serial ports COM1 and COM2, i.e., baud rate, data bits, stop bits, parity, and flow control. All five parameters must be supplied when updating any setting.

Table 9: COMCFG Command Syntax

ATTRIBUTE	DESCRIPTION
SYNTAX	COMCFG [pid [brate dbits sbits parity flow]]
PARAMETERS	pid 1 = COM1 2 = COM2
	brate 115200 = Standard rate (default)
	dbits Data Bits. Must be set to 8.
	sbits Stop Bits. Must be set to 1.
	parity Parity. Must be none. N = None. E = Even. O = Odd.
	flow Hardware Flow Control. N = Disabled (default) H = Hardware flow enabled. S = Software flow enabled.
FLASH	YES
EXAMPLES	<i>Print current communication settings.</i> COM1: comcfg > COMCFG 1 = 115200 8 1 None None > COMCFG 2 = 115200 8 1 None None
	<i>Enable hardware flow control on COM2.</i> COM2: comcfg 2 115200 8 1 n h > COMCFG COM2 = 115200 8 1 None H/W

This serial port configuration command only applies to the RS-232 ports COM1 and COM2.

8.3.3 COMECHO

The COMECHO command enables/disables local character echo for COM port interfaces.

Table 10: COMECHO Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	COMECHO [pid [onstate]]	
PARAMETERS	pid	COM Port Identifier 1 = COM1 2 = COM2 3 = COM3
	onstate	ON Enables local character echo. OFF Disables local character echo.
FLASH	YES	
EXAMPLES	<i>Print current echo settings (default settings shown).</i> COM1: comecho > COMECHO COM1 = ON > COMECHO COM2 = ON > COMECHO COM3 = ON	
	<i>Disable character echo on COM2.</i> COM1: comecho 2 off > COMECHO COM2 = OFF	

8.3.4 COMPROMPT

The COMPROMPT command enables/disables the printing of a prompt string at the COM port interface.

Table 11: COMPROMPT Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	COMPROMPT [pid [onstate]]	
PARAMETERS	pid	COM Port Identifier
		1 = COM1
2 = COM2		
	onstate	ON Enables prompt.
		OFF Disables prompt.
FLASH	YES	
EXAMPLES	<i>Print current prompt settings (default settings shown).</i>	
	<pre>COM1: comprompt > COMPROMPT COM1 = ON > COMPROMPT COM2 = ON > COMPROMPT COM3 = ON</pre>	
	<i>Disable prompt on COM2.</i>	
	<pre>COM1: comprompt 2 off > COMPROMPT COM2 = OFF</pre>	

8.3.5 DATE

The DATE command sets/gets the SGS day of year.

Table 12: DATE Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	DATE [mm:dd:yyyy]	
PARAMETERS	mm	Two-digit Month
	dd	Two-digit Day.
	yyyy	Four-digit Year.
FLASH	NO	
EXAMPLES	<i>Print current date (default after powerup).</i> COM2: date > DATE = Jan 01, 2000	
	<i>Change the date to July 16, 2004</i> COM2: date 07:16:2004 > DATE = July 16, 2004	

The SGS does not include a battery-backed time of day capability; thus, the date should be set after power up for accurate date reporting.

8.3.6 DMAP

The DMAP command is used to map downlink voice bursts to a VCM. The VCM can be used to monitor the slot voice. The SGS only supports voice monitoring for HPORT=6, i.e. the MDR receiver.

Table 13: DMAP Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	DMAP [vid] [slotid]	
PARAMETERS	vid	VCM Identifier. The valid range is VCM1 through VCM2.
	slotid	VDL Slot Identifier. The valid range is A through D.
FLASH	NO	
EXAMPLES	<i>Print current assignments (default settings shown).</i>	
	<pre>COM2: dmap > DMAP VCM1 = A > DMAP VCM2 = B > DMAP VCM3 = C > DMAP VCM4 = D</pre>	
EXAMPLES	<i>Configure VCM4 to monitor slot B.</i>	
	<pre>COM2: dmap vcm4 b > DMAP VCM4 = B</pre>	

8.3.7 MBURST

The MBURST command is used to control the transmission and content of uplink VDL management bursts.

Table 14: MBURST Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	MBURST [hport [mode]]	
PARAMETERS	hport	HDLC Port. Valid values are 5,7 or *.
	mode	M-Burst Mode. OFF = M-bursts are disabled. 4V = VDL Mode 4V RCBER = Rockwell Collins BER Test (VDL Mode 2V2D)
FLASH	NO.	
EXAMPLES	<i>Print the current settings (default settings shown).</i> COM2: mburst > MBURST 5 = OFF > MBURST 7 = OFF	
	<i>Enable Rockwell Collins BER Test configuration.</i> COM2: mburst 5 > MBURST 5 = RCBER	

To enable VDL communications, two commands are typically required. The VMAC ON command enables media access control. The MBURST command selects/enables the VDL communication mode.

8.3.8 MDR

The MDR command accesses/controls the SGS MDR radio control/monitoring capabilities. This command deals exclusively with RIU-MDR messages with message identifiers equal to 5 and/or 6. See sections 3.2.2.6.5.1.6 and 3.2.2.6.5.1.7 of the RIU-MDR Interface Control Document (ICD) for message details.

Table 15: MDR Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	MDR MDR [hport [REPORT cport]] MDR [hport [AUTODEC [ON OFF]]] MDR [hport [MSG data]] MDR [hport [mdrcmd]]	
PARAMETERS	hport	HDLC Port. Valid values are 1 through 8.
	cport	COM Port Identifier 0 = off (do not print radio control/monitor messages) 1 = COM1 2 = COM2 3 = COM3
	mdrcmd	MDR Monitor request message. FREQ Request current frequency. RXPWR Request current RX power level. MODE Requests MDR mode, e.g. VDL3, AM, etc STATE Requests MDR state, e.g., online, pwr up, etc. VSWR Requests MDR VSRW, e.g. good, bad. TIME Requests MDR timing channel status, e.g. good, slip
FLASH	NO	
EXAMPLES	<i>Print current settings (default settings shown).</i> COM2: mdr > MDR 1 REPORT = COM2 > MDR 1 AUTODEC = ON > MDR 2 REPORT = COM2 > MDR 2 AUTODEC = ON > MDR 3 REPORT = COM2 > MDR 3 AUTODEC = ON > MDR 4 REPORT = COM2 > MDR 4 AUTODEC = ON > MDR 5 REPORT = COM2 > MDR 5 AUTODEC = ON > MDR 6 REPORT = COM2 > MDR 6 AUTODEC = ON > MDR 7 REPORT = COM2 > MDR 7 AUTODEC = ON > MDR 8 REPORT = COM2 > MDR 8 AUTODEC = ON	

ATTRIBUTE	DESCRIPTION
	<p>Send a frequency status request using raw MSG capability.</p> <p>COM1: TBD COM2: mdr 5 msg 02.03.05.1e.01.00.00.fc.00.02.01.00.00.00.00.00.00 COM2: > MDR 5 FREQ = 136.300</p>
	<p>Send a frequency status request using parameter status request.</p> <p>COM2: mdr 5 freq COM2: > MDR 5 FREQ = 136.300</p>

There are four types of radio control/monitoring capabilities:

- *MDR Message Reporting*
- *MDR Message Decoding*
- *MDR Raw Message Transmission*
- *MDR Parameter Status Request*

The **message reporting** capability (MDR x REPORT) enables the autonomous printing of MDR radio control/monitoring messages to the selected COM port. By default, prints to COM2 are enabled and AUTODEC is ON.

The **message decoding** capability (MDR x AUTODEC) enables the SGS to automatically decode recognizable radio control/monitoring messages received from the radio. For example, when AUTODEC=ON, a received message with MSGID=6 (monitor message) and a MONID=2 (freq status) is decoded and printed as 'MDR 5 FREQ = 136.300'. Some users may wish to turn auto-decoding off when an external software program is used to control/monitor the SGS.

The **raw message transmission** capability (MDR x MSG) enables the user to send a custom radio control/monitoring message to the associated MDR. The data message is supplied as an ASCII hexadecimal string with bytes separated by a period. See the example above.

The **parameter status request** capability (MDR x MSG) enables the user to request the state of selected radio monitoring parameters. The SGS automatically generates an appropriately formatted radio monitoring message based on the entered parameter, e.g. FREQ. The SGS sends the message, but does not provide a command acknowledgement. The subsequent reply from the MDR is the acknowledgement.

Note: The HDLC communication link must be established for SGS radio control/monitoring commands to work. Insure the VMAC ON command has been issued to enable the HDLC communication link.

8.3.9 OFFSET

The OFFSET command is used to advance or delay the media access control (MAC) cycle for the selected MDR. The SGS uses the time of transmission (TOT) field to implement the offset. This command enables the user to adjust the positioning of the VDL bursts without having to log into the radio to control the MDR offset function.

Table 16: OFFSET Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	OFFSET [hport [offset]]	
PARAMETERS	hport	HDLC Port. Valid values are 5,7 or *.
	offset	Offset. Valid range is -3999 to +3999. The units are fractional symbols where 1=1/16 symbols.
FLASH	NO	
EXAMPLES	<i>Print current OFFSET settings (default settings shown).</i>	
	<pre>COM2: offset > OFFSET 5 = 0 > OFFSET 7 = 0</pre>	
EXAMPLES	<i>Change offset for interferer.</i>	
	<pre>COM1: offset 7 1040 > offset 7 = 1040</pre>	

The OFFSET command can be used on the MDR interfering transmitter to simulate RF delays from a distant co-channel interferer.

8.3.10 TEST

The TEST command is used to access test/integration tools. Currently, only a front panel LED test is supported.

Table 17: TEST Command Syntax

ATTRIBUTE	DESCRIPTION
SYNTAX	TEST LED
PARAMETERS	None
FLASH	NO
EXAMPLES	<i>Run the LED test.</i> COM2: test led > TEST LED = DONE

The command acknowledgement is printed after the LED test is completed. The test takes less than 5 seconds to execute.

8.3.11 TIME

The TIME command sets/gets the SGS time of day.

Table 18: TIME Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	TIME [hh:mm:ss]	
PARAMETERS	hh	Two-digit Hour (24-hour time)
	mm	Two-digit Minute.
	ss	Two-digit Seconds.
FLASH	NO	
EXAMPLES	<i>Print current time (default after powerup starts at midnight).</i> COM2: time > TIME = 00:00:07.135	
	<i>Change the time to 8 a.m.</i> COM2: time 08:00:00 > TIME = 08:00:00.000	

The SGS does not include a battery-backed time of day capability; thus, the time should be set after power up for accurate time reporting.

8.3.12 TXPWR

The TXPWR command is used to assign transmit burst power level for voice bursts.

Table 19: TXPWR Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	TXPWR [hport [dbmlevel]]	
PARAMETERS	hport	HDLC Port. Valid values are 5,7 or *.
	dbmlevel	Power Level. Valid range 33.0 through 47.0. The SGS rounds to nearest 0.5.
FLASH	NO	
EXAMPLES	<p><i>Display current LED assignments (default setting shown).</i></p> <pre>COM2: txpwr > TXPWR 5 A = +35.0 > TXPWR 5 B = +35.0 > TXPWR 5 C = +35.0 > TXPWR 5 D = +35.0 > TXPWR 7 A = +35.0 > TXPWR 7 B = +35.0 > TXPWR 7 C = +35.0 > TXPWR 7 D = +35.0</pre> <p><i>Assign port 5, slot A to 33.0 dbm.</i></p> <pre>COM2: txpwr 5 a 33 > TXPWR 5 A = +33.0</pre>	

8.3.13 UMAP

The UMAP command is used to map voice sources to uplink VDL voice slots. The SGS includes 8 pre-recorded voice patterns and up to 4 live voice sources (one per VCM).

Table 20: UMAP Command Syntax

ATTRIBUTE	DESCRIPTION	
SYNTAX	UMAP [hport [mslot [src]]]	
PARAMETERS	hport	HDLC Port. Valid values are 5,7 or *.
	slotid	VDL Slot Identifier. The valid range is A through D or *.
	src	Voice Source. REC1 Female #1 Voice (6 second loop) REC2 Male #1 Voice (6 second loop) REC3 Male #2 Voice (6 second loop) REC4 Male #3 Voice (6 second loop) REC5 All zeroes pattern. REC6 All ones pattern. REC7 Random pattern #1 REC8 Random pattern #2 VCM1 Live voice from VCM1 VCM2 Live voice from VCM2 VCM3 Live voice from VCM3 VCM4 Live voice from VCM4 OFF Slot Inactive – no burst.
FLASH	NO	
EXAMPLES	<i>Display current assignments (default setting shown).</i> COM2: umap > UMAP 5 A = REC1 > UMAP 5 B = REC2 > UMAP 5 C = REC3 > UMAP 5 D = REC4 > UMAP 7 A = OFF > UMAP 7 B = OFF > UMAP 7 C = OFF > UMAP 7 D = OFF	
	<i>Disable all voice bursts</i> COM2: umap * * off > UMAP 5 A = OFF > UMAP 5 B = OFF > UMAP 5 C = OFF > UMAP 5 D = OFF > UMAP 7 A = OFF > UMAP 7 B = OFF > UMAP 7 C = OFF > UMAP 7 D = OFF	
	<i>Route VCM1 voice to slot B.</i> COM2: umap 5 b vcm1 > UMAP 5 B = VCM1	

8.3.14 VERSION

The VERSION command displays software version information.

Table 21: VERSION Command Syntax

ATTRIBUTE	DESCRIPTION
SYNTAX	VERSION
PARAMETERS	None
FLASH	NO
EXAMPLES	<i>Print version information</i> COM2: version > Version: 3.0.0 > Built: Jul 21 2004 17:20:52

8.3.15 VMAC

The VMAC command enables/disables the SGS VDL media access control (MAC) services.

Table 22: VMAC Command Syntax

ATTRIBUTE	DESCRIPTION
SYNTAX	VMAC ON VMAC OFF
PARAMETERS	None
FLASH	NO
EXAMPLES	<p><i>Enable services.</i></p> <pre>COM2: vmac on > VMAC 5 = ON > VMAC 6 = ON > VMAC 7 = ERR > VMAC 8 = ERR</pre> <hr/> <p><i>Disable services.</i></p> <pre>COM2: vmac off > VMAC 5 = OFF > VMAC 6 = OFF > VMAC 7 = OFF > VMAC 8 = OFF</pre>

Insure T1 link is up and MDR's are online before enabling VMAC. If the T1 link is not connected, the VMAC command will list the service status as ERR.

To enable VDL communications, two commands are typically required. The VMAC ON command enables media access control. The MBURST command selects/enables the VDL communication mode.

9.0 GLOSSARY

ATC	Air traffic control
CDROM	Compact Disk Read Only Memory.
ESF	Extended Super Frame.
FAA	Federal Aviation Administration.
LBO	line build out.
LED	Light-emitting diode.
MDR	Multi-mode Digital Radio
NEXCOM	Next Generation Communication. An FAA program and/or system designed to replace current analog double-side band amplitude modulated (DSB-AM) radio communication with digital time division multiple access (TDMA) radio communication.
OTM	Octal T1 Module
RTP	Real Time Platform
SGS	Simple Ground Station
USB	Universal Serial Bus
VCM	Voice Channel Module
VDL	VHF Data Link