TM8100 mobiles
TM8200 mobiles

Computer-Controlled Data Interface (CCDI) Protocol Manual

MMA-00038-01
Issue 1
May 2006

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Contents

Preface

Scope of Manual

This manual contains reference information about the CCDI protocol for the TM8100 and TM8200 mobile radios. It applies to CCDI version 3.00 and later.

Associated Documentation

The following associated documentation is available for this product:

- MMA-00002-**xx** TM8100 User's Guide
- MMA-00003-**xx** TM8200 User's Guide
- MMA-00028-**xx** TM8100/TM8200 Installation Guide
- MMA-00005-**xx** TM8100/TM8200 Service Manual
- MMA-00011-**xx** TM8100/TM8200 3DK Hardware Developer's Kit Application Manual
- MMA-00013-**xx** TM8000 3DK Application Board Service Manual
- MMA-00014-**xx** TM8000 3DK Application Board Software Manual

The characters **xx** represent the issue number of the documentation.

Technical notes are published from time to time to describe applications for Tait products, to provide technical details not included in manuals, and to offer solutions for any problems that arise.[1]

- Technical Note TN-855-AN TM8000 and TB7100 Data Modem Facilities
- Technical Note TN-919-AN Configuring the TM8100 for Data Operation

Publication Record

Issue	Publication Date	Description
1	March 2006	First issue

1. Technical notes are available in PDF format from the Tait support website. Consult your nearest Tait Dealer or Customer Service Organization for more information.

Alert Notices

Within this manual, four types of alerts are given to the reader: warning, caution, important and note. The following paragraphs illustrate each type of alert and its associated symbol.

Warning!! **This alert is used when there is a potential risk of death or serious injury.**

Caution **This alert is used when there is the risk of minor or moderate injury to people.**

Important This alert is used to warn about the risk of equipment damage or malfunction.

Note This alert is used to highlight information that is required to ensure that procedures are performed correctly.

Abbreviations

Abbreviation	Description
3DK	Third-Party Developer's Kit
ASCII	American Standard Code for Information Interchange
AVL	Automatic Vehicle Location
CCDI	Computer Controlled Data Interface
CCI	Computer Controlled Interface. An earlier T2000 data interface.
CDP	Conventional Data Protocol. A Tait over-air protocol.
CRC	Cyclic Redundancy Check
CTCSS	Continuous Tone Coded Squelch System
CTS	Clear to Send
DCE	Data Circuit-Terminating Equipment
DCS	Data Carrier System
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency
FEC	Forward Error Correction
FFSK	Fast Frequency Shift Keying
GFI	General Format Information for an SDM
GPIO	General Purpose Input/Output
IPN	Internal Part Number
LED	Light-Emitting Diode
MSD	Most Significant Digit
NMEA	National Marine Electronics Association standard. Combined electrical and data specification for communication between marine electronics and GPS receivers.
PC	Personal Computer
PTT	Press To Talk
RMC	Recommended Minimum sentence C. NMEA GPS message type for the minimum recommended transmit/GPS data.
RTS	Request to Send
Rx	Receive
RXD	Receive Data
SDM	Short Data Message
SFI	Specific Format Information for an SDM
THSD	Tait High Speed Data
TOP	Tait Orca Portable
Tx	Transmit
TXD	Transmit Data
UART	Universal Asynchronous Receiver-Transmitter
XON	Transmitter On
XOFF	Transmitter Off

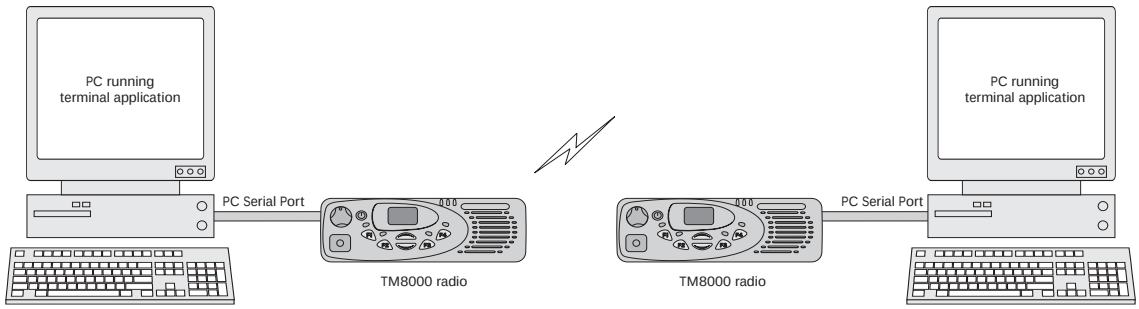
1 Introduction

The Computer Controlled Data Interface (CCDI) protocol is a Tait proprietary command protocol embedded in the TM8100 and TM8200 radios, and used for communicating with the radio via asynchronous serial ports and over-air.

The radio is the DCE and is connected directly to the DTE, usually a PC, via the serial port.

Two modes of operation are available:

- Command mode
- Transparent mode



When in Command mode, commands and response messages are passed between the PC and the radio using the CCDI protocol. CCDI commands can also be used to obtain GPS data and NMEA messages from the radio. Refer to "QUERY" and "SEND_ADAPTABLE_SDM". The baud rate is set to 1200, 2400, 4800, 9600, 14400, 19200, 28800 or 115200 (TM8200 only) baud, using the programming application.

When in Transparent mode, communication between the PC and the radio is set to 1200, 2400, 4800, 9600, 14400, 19200, 28800 or 115200 (TM8200 only) baud, using the programming application.

The over-air data rate is 1200 or 2400 bps for FFSK data,
12 kbps for Tait High Speed Data (THSD) narrow band and wide band, and can be set to 19200 bps for THSD wide band.

1.1 Compatibility

This manual supports CCDI version 3.xx and later.

The radio programming software used should be the latest released version for both the TM8100 and TM8200 radios. Refer to the TaitWorld website http://www.taitworld.com for the latest versions of programming software.

1.2 Serial Ports

There are three ports available for CCDI asynchronous serial communication with the TM8100 or TM8200. The microphone and auxiliary ports are accessed externally, and the internal options connector is internal to the radio.

Only one of these ports can be used for CCDI transmission and reception at any time. The port is selected in the Data form of the programming application, Serial Communications tab. Select “Mic”, “Aux” or “Internal Connector”.

- Mic: the radio will transmit and receive data via the MIC_TXD and MIC_RXD lines on the microphone connector. Refer to “Microphone Connector” for signal details.
- Aux: the radio will transmit and receive data via the AUX_TXD and AUX_RXD lines on the auxiliary connector. Refer to “Auxiliary Connector” for signal details.
- Internal Connector: the radio will transmit and receive data via the IOP_TXD and IOP_RXD lines on the internal options connector. This connector is used to fit an internal options board into the radio. Refer to the TM8100/TM8200 3DK Hardware Developer’s Kit Application Manual for more details.

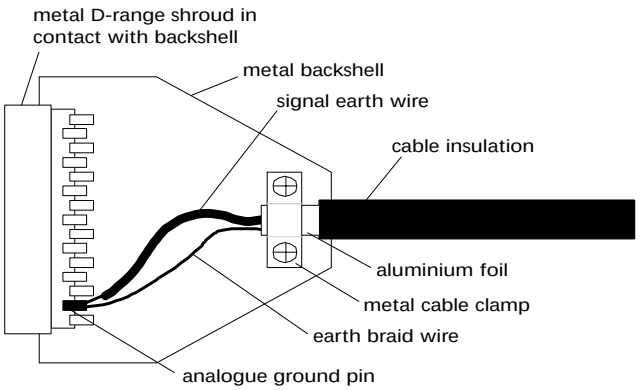
1.2.1 Auxiliary Connector

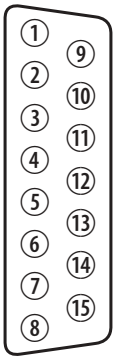
The auxiliary connector is the standard interface for external devices that are typically connected to a radio. The auxiliary connector is a 15-way standard-density D-range socket. The auxiliary connector provides a serial port, three programmable input lines, four programmable digital I/O lines, RSSI and audio I/O. The AUX_TXD and AUX_RXD lines are used to transmit and receive data from the radio.

The GPI and GPIO lines can be programmed for flow control. Refer to “Hardware Flow Control” on page 16.

Note The space for a mating plug is limited to 41mm in width and 18mm in height. Although most plugs will fit this space, it is recommended that you test the plug to be used before manufacturing a cable.

If the auxiliary cable is longer than 1 metre, it is recommended that the cable and connector backshell be shielded. The diagram shows the recommended shielding arrangement. The earth braid wire (bare copper) and aluminium foil should only be earthed at the radio end of the cable.



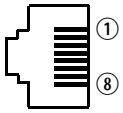
Pinout	Pin	Signal name	Description	Signal type
 rear view	12	AUX_GPI1	General purpose digital input. Programmable function.	Digital. 3V3 CMOS.
	5	AUX_GPI2	General purpose digital input. Programmable function. With LK3 fitted, GPI2 is an emergency power sense input.	Digital. 3V3 CMOS.
	4	AUX_GPI3	General purpose digital input. Programmable function. With LK2 fitted, GPI3 is a power sense input.	Digital. 3V3 CMOS.
	10	AUX_GPIO4	Programmable function and direction. Pads available to fit a higher power driver transistor on GPIO4 line.	Digital. 3V3 CMOS input. Open collector output with pullup.
	2	AUX_GPIO5		
	9	AUX_GPIO6		
	1	AUX_GPIO7		
	11	AUX_TXD	Asynchronous serial port - Transmit data	Digital. 3V3 CMOS.
	3	AUX_RXD	Asynchronous serial port - Receive data	Digital. 3V3 CMOS.
	7	AUD_TAP_IN	Programmable tap point into the Rx or Tx audio chain. DC-coupled.	Analogue.
	13	AUD_TAP_OUT	Programmable tap point out of the Rx or Tx audio chain. DC-coupled.	Analogue.
	14	AUX_MIC_AUD	Auxiliary microphone input. Electret microphone biasing provided. Dynamic microphones are not supported.	Analogue.
	6	RSSI	Analogue RSSI output.	Analogue.
	8	+13V8_SW	Switched 13.8V supply. Supply is switched off when radio body is switched off.	Power.
	15	AGND	Analogue ground	Ground.

Refer to the TM8100/TM8200 3DK Hardware Developer's Kit Application Manual for more details about the auxiliary connector.

1.2.2 Microphone Connector

The microphone connector on the control head is an RJ-45 socket.

When the control head is connected to the control-head connector of the radio body using the loom provided, the microphone connector uses the following eight control-head connector signals:

Pinout	Pin	Signal name	Description	Signal type
 front view	1	MIC_RX_AUD	Receive audio output.	Analogue
	2	+13V8_SW	Power supply output. Switched off when radio body is switched off.	Power
	3	MIC_TXD	Asynchronous serial port - Transmit data.	3.3V CMOS
	4	MIC_PTT	PTT input from microphone. Also carries hookswitch signal.	Digital
	5	MIC_AUD	Fist microphone audio input.	Analogue
	6	AGND	Analog ground.	Analogue ground
	7	MIC_RXD	Asynchronous serial port - Receive data.	3.3V CMOS
	8	MIC_GPIO1	General purpose digital input/ output.	Open collector out 3.3V CMOS in

The MIC_TXD and MIC_RXD lines are used to transmit and receive data from the radio.

Refer to the TM8100/TM8200 3DK Hardware Developer's Kit Application Manual for more details about the microphone connector.

1.2.3 Data Characteristics

Parameter	Standard				Comments
	min.	typ.	max.	units	
Serial port					
Baud rate:	1200, 2400, 4800, 9600, 14400, 19200, 28800, 115200			bit/s	All UART parameters are fixed and common to all UARTs except for the baud rate which is configurable and different for different modes/applications
Data bits:	8				
Start bit:	1				
Stop bit:	1				
Parity:	None				
Flow control: Software Hardware	 XON/XOFF RTS/CTS				 Requires two GPIO lines to be programmed as flow control

1.2.4 Logic Level Compatibility

The following table show the compatibility of the radio's digital I/O used for CCDI with common industry logic standards.

Digital Input Compatibility and Tolerance

Digital Input Line	Logic standard input compatibility and tolerance			
	3.3V CMOS	5V CMOS	5V TTL	RS-232
AUX_RXD	Yes	Yes	Yes	Yes
IOP_RXD	Yes	Yes	Yes	No[a]
CH_RXD MIC_RXD PRG_RXD	Yes	Yes	Yes	Yes

a. Level compatible but not tolerant. Inputs can be made RS-232 tolerant by using 3.3kΩ series resistance inserted at the radio end.

Digital Output Compatibility

Digital Output Line	Logic standard input compatibility and tolerance			
	3.3V CMOS	5V CMOS	5V TTL	RS-232
AUX_TXD	Yes	No	Yes	No
IOP_TXD	Yes	No[a]	Yes	No
CH_TXD MIC_TXD PRG_TXD	Yes	No	Yes	No

a. These outputs can be made 5V CMOS compatible using a 3.3kΩ pull-up resistor to 5V that is provided by the device being driven.

1.2.5 GPS Port

The GPS receiver/antenna is also connected to an asynchronous serial port and must be different to the CCDI UART Port. The GPS receiver/antenna is set in the Data form of the programming application, GPS tab, and can be set to Mic, Aux or Internal Options.
If set to Aux, the GPS receiver will send NMEA messages to the radio via the AUX_RXD line on the auxiliary connector.
If set to Internal Options, the GPS receiver will send NMEA messages to the radio via the IOP_RXD line on the internal options connector.

1.3 Before Operating

Before using CCDI, the following is useful to check.

- The radio must be correctly programmed for use with the CCDI protocol. See “Radio Programming” on page 21 for configuration information.
- At power on, the radio will select its default channel. To change the channel, select the channel using the normal radio interface or using the CCDI Go_to_Channel command. Refer to “GO_TO_CHANNEL” on page 31.
- The radio will power on into the mode selected in the ‘Powerup State’ field in the Data form.
- Power, Tx and Rx LED indicators are helpful for establishing proper operation. The radio speaker can be used to listen to data coming in.
- Data flow is controlled either by the customer’s embedded computer system or by a PC running a data-sending application such as Hyperterminal.

1.4 Limitations

Important Some data applications require extended transmission times. This may be for larger file transfers or for real-time telemetry information. This may put undue stress on the radio transmitter and care must be taken to control transmission times using flow control. Refer to “Hardware Flow Control” on page 16.

1.5 Programming

For information on the parameters in the Data form of the programming application, refer to:

- the Help of the programming application.
- Technical Note TN-919-AN Configuring the TM8100 for Data Operation.

2 Flow Control

Flow control is a method of controlling the data so that a faster DTE-DCE baud rate can be used to that of the over the air baud rate. This allows the radio (DCE) to inform the DTE that its buffer is becoming full and that the DTE needs to wait before sending more data to the radio.

Flow control should only be needed when the amount of data to send is larger than the radios buffer (512 bytes for TM8100, 600 bytes for TM8200).

Note Some older versions of the firmware have a buffer size of 128 bytes.

Available options: None, Hardware Software

2.1 XON/XOFF Software Flow Control

When the serial communications are set-up for software flow control, the radio will use programmable bytes for XOFF and XON.

Important When using XON/XOFF software handshaking, the data stream (or the data file) must not include the programmed XON and XOFF characters. It is recommended that only ASCII text be used with software flow control.

The XOFF character is sent when there is less than 35 bytes of empty space in the buffer.

The XON character is sent when XOFF had previously been sent and there is now less than 10 bytes of data in the buffer.

2.2 Hardware Flow Control

When the serial communications are set-up for hardware flow control, two of the programmable I/O lines are enabled for RTS and CTS. Hardware flow control is not available for the mic port.

2.2.1 RTS

Important The RTS line has been implemented as a "Ready to Receive" line as per RS-232-E.

When the RTS line is inactive the radio will not output any serial data. It will buffer any data and output it when the line is activated.

Important: The RTS line does not stop the radio from receiving data across the air so leaving this line inactive for any length of time could cause the buffer to overflow and for data to be lost.

2.2.2 CTS

The CTS line is deactivated when there is less than 35 bytes of empty space in the buffer.

The CTS line is activated when the CTS line had previously been deactivated and there is now less than 10 bytes of data in the buffer.

3 Transparent Mode

In Transparent mode, the radio acts as a modem, automatically transmitting in FFSK or THSD format the serial data received from the PC. In this mode, the baud rate between the PC (DTE) and the radio (DCE) can be set to either 1200, 2400, 4800, 9600, 14400, 19200, 28800 or 115200 (TM8200 only) baud using the programming application. The over-air data rate is 1200 or 2400 bps for FFSK data, 12 kbps for Tait High Speed Data (THSD) narrow band and 19200 bps for THSD wide band. The serial data input buffer is 512 bytes for the TM8100 and 128 bytes for the TM8200, to adequately cope with the data flow.

Communication in Transparent mode is free-format, with the protocol determined entirely by the PC and the modem. It is transparent to the CCDI, allowing the PC to send and receive data without passing through the CCDI. CTCSS and DCS subaudible signalling is available in FFSK Transparent mode.

If an SDM is received in Transparent mode, it is tested for SDM validity by checking the leading ‘s’, the checksum, the SDM identity and the size. If it is found to be a valid SDM, it is saved in the SDM buffer for later retrieval.

3.1 Entering Transparent Mode

Transparent mode can be set as the default mode at power on by selecting FFSK or THSD Transparent Mode in the ‘Powerup State’ field in the programming application. Refer to “Radio Programming” on page 21.

To change to Transparent mode while operating in Command mode, the PC must send a TRANSPARENT command to the radio. E.g. t01zB1 sends a TRANSPARENT command, requesting that the radio be put into Transparent mode. The escape character specified here is “z” (ASCII code = $7A). Once acknowledged, any further data is linked directly to the radio in Transparent mode.

If the radio default is set to Transparent mode at power on, the default escape character is “+”.

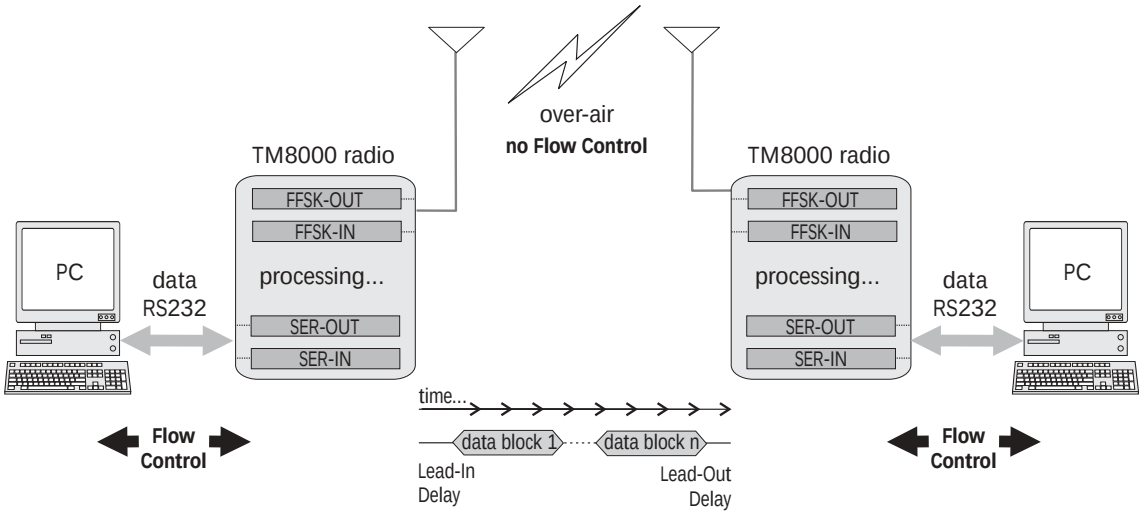
3.2 Exiting Transparent Mode

To change to Command mode while operating in Transparent mode, send the escape sequence. The escape sequence consists of a 2 second idle time, followed by three escape characters (sent within 2 seconds), followed by a further 2 second idle time i.e. [2 second idle] +++ [2 second idle].

In Transparent mode, when the escape sequence is detected in the data stream, the radio is forced back to Command mode.

3.3 Transparent Mode Format

3.3.1 Transparent Mode Packetisation



Transparent mode data is packetised into data blocks before it is sent over-air. The start and stop bits are removed and a header is sent at the start of each data block.

3.3.2 FFSK Transmission Format

The Transparent Mode transmission format is as follows:

Singe Data Block:

Lead-In Delay	preamble 2 bytes	sync 2 bytes	size 2 bytes	FFSK data block max 46 bytes	CRC 2 bytes	Lead-Out Delay
	HEADER					

Multiple Data Blocks:

Lead-In Delay	HEADER 6 bytes	FFSK data block . . . . max 46 bytes	CRC 2 bytes	HEADER 6 bytes	FFSK data block max 46 bytes	CRC 2 bytes	Lead-Out Delay

3.3.3 THSD Transmission Format

For more information, refer to Technical Note TN-855-AN TM8000 and TB7100 Data Modem Facilities.

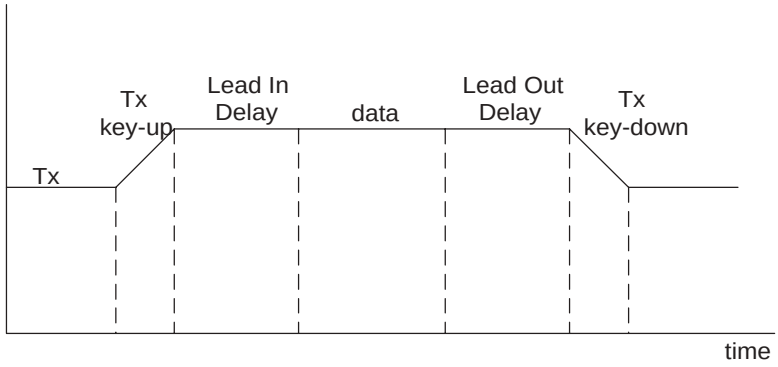
3.3.4 Effective Over-Air Data Rate

The effective over-the-air data rate is lower than the set data rate.

For more information, refer to Technical Note TN-855-AN TM8000 and TB7100 Data Modem Facilities.

3.3.5 Lead-In Delay

The Lead-In Delay begins after the transmitter key-up time. It gives the receiver(s) at the other end time to open before data is sent.



When data is detected at the radio's input buffer, the following occurs:

- The transmitter keys up.
- A carrier is sent from the transmitter. When the carrier reaches its full potential, the Lead-In Delay begins.

- If the receiving base station is set to Repeater mode, the carrier is detected and Rx Gate becomes active (opens), which in turn makes the PTT line active.
- The active PTT line keys up the transmitter.

This sequence is repeated with as many base stations as are in the chain. The optimum length of the Lead-In Delay should be set keeping in mind the number of Base Stations that need to be activated before any data is sent.

The Lead-In Delay must also allow for subaudible signalling decoding, if it is enabled, when used in conjunction with FFSK data.

4 Command Mode

Command mode uses the Tait proprietary Computer Controlled Data Interface (CCDI), a command protocol embedded in the radio firmware. It is accessed using the serial port lines from the PC. In this mode, the baud rate between the computer equipment (DTE) and the radio (DCE) can be set to either 1200, 2400, 4800, 9600, 14400, 19200, 28800 or 115200 (TM82000 only) baud using the programming application

In Command mode, the PC sends command sequences to the radio and waits for a prompt before beginning the next transaction. Some commands require the radio to send a CCDI message in response. Messages sent to the radio will always be responded to by the prompt.

Unsolicited messages such as PROGRESS or ERROR messages are sent by the radio if there is a significant change in its state that the PC should be aware of. When errors are detected, an unsolicited ERROR message is sent by the radio to the PC. The radio cannot send messages that require a reply.

The SEND_SDM, SEND_ADAPTABLE_SDM and GET_SDM commands require that SDMs are sent and received as over-air FFSK data by the radio while in Command mode. If an SDM is received from the over-air interface while the radio is in Command mode, the SDM data is buffered and both an 'FFSK Data Received' PROGRESS message and a 'SDM Received' RING messages are generated by the radio to indicate that SDM data has been received.

4.1 Entering Command Mode

Command mode can be set as the default mode at power on by selecting 'Command Mode' in the 'Powerup State' field in the programming application. Refer to "Programming" on page 14.

To change to Command mode while operating in Transparent mode, send the escape sequence. The escape sequence consists of a 2 second idle time, followed by three escape characters (sent within 2 seconds), followed by a further 2 second idle time i.e. [2 second idle] +++ [2 second idle].

In Transparent mode, when the escape sequence is detected in the data stream, the radio is forced back to Command mode.

4.2 CCDI Command Format

All CCDI message packets take the general form:

[IDENT] [SIZE] [PARAMETERS] [CHECKSUM] <CR>

- [IDENT] = The message identifier. Identifiers are single ASCII characters (lower-case alphabetical) which categorise the message type.
- [SIZE] = The number of characters which make up the [PARAMETERS] field. [SIZE] is an 8-bit number expressed in ASCII hex notation (two characters).
- [PARAMETERS] = An optional field, depending upon the command. Parameter values are generally character strings unless explicitly stated otherwise. Parameter type is dependent upon the command, and often has multiple parts.
- [CHECKSUM] = An 8-bit checksum of the [IDENT], [SIZE] and [PARAMETERS] fields. Expressed in two character ASCII hex notation.
- <CR> = The carriage return (0Dh) packet terminator.

4.3 Restrictions

- All characters in a message are printable ASCII.
- Where numeric values are represented in ASCII hex notation (two characters per byte), characters A to F are upper case.
- The minimum length of a command packet is 5 characters. For example q002F is the QUERY command where [SIZE] = 00 as there is no [PARAMETERS] field required.
- The maximum length of the [PARAMETERS] field is 255 characters. The maximum length of the command packet is therefore 260 characters.

4.4 Calculating the CCDI [CHECKSUM]

[CHECKSUM] is calculated by applying the following algorithm:

1. Take the modulo-2 sum of all message bytes preceding [CHECKSUM].
2. Retain bits 0 to 7, discarding any higher order bits resulting from the summation.
3. Form the two's complement of the remainder.
4. Convert the binary number into two ASCII hex digits, MSD first.

4.4.1 Checksum Example

s0D050800TESTHi!DA

1. Take the modulo-2 sum of all message bytes preceding [CHECKSUM].
   - s = 73h, 0 = 30h, D = 44h etc. therefore the modulo-2 sum is: 73 + 30 + 44 + 30 + 35 + 30 + 38 + 30 + 30 + 54 + 45 + 53 + 54 + 48 + 69 + 21 = 426h
2. Retain bits 0 to 7, discarding any higher order bits resulting from the summation.
   26h
3. Form the two's complement of the remainder.
   26h = 0010 0110
   two's complement = 1101 1010
4. Convert the binary number into two ASCII hex digits, MSD first.
   1101 1010 = DA

4.4.2 Checksum Software Application

A software application is available from Tait Technical Support which will calculate the checksum for any given command and parameters.

Please contact Technical Support (refer to "Tait Contact Information" on page 2).

4.5 Commands to the Radio

The following commands are available to send from the PC to control the radio.

Command	Command	Function	Compatibility
CANCEL	c	abort current activities	conventional
DIAL	d	initiate a call	conventional
FUNCTION	f	controls various hardware and miscellaneous radio functions	dependent on function
GO_TO_CHANNEL	g	sets the radio to a particular channel	conventional
QUERY	q	requests information from the radio	dependent on function
SEND_ADAPTABLE_SDM	a	send a Short Data Message (SDM)	conventional
SEND_SDM	s	send a Short Data Message (SDM)	conventional
TRANSPARENT (FFSK and THSD)	t	change to transparent mode (FFSK and THSD)	conventional

In all cases, if a command is received without error by the radio and all parameters are valid, the command is executed.

The prompt character '.' is returned to the PC immediately after receiving a command, to signify that another may begin. If an error arises, the PC is notified with an appropriate ERROR response.

4.5.1 CANCEL

The CANCEL command tells the PC to abort the current action that the radio is performing. It has the following format:

c [SIZE] [CANCEL_TYPE] [CHECKSUM]

- 'c' is sent as a single ASCII character and represents the CANCEL command.
- [CANCEL_TYPE] is a single ASCII character representing the cancelling type.

[CANCEL_TYPE]	Function
0 (cancel call)	Cancel Call In conventional mode, Cancel can do the following: ■ clear down a Selcall call, including retries ■ cancel deferred calling ■ take the radio out of emergency operation if in Emergency Tx/Rx cycles by resetting the radio In trunked mode, Cancel can do the following: ■ act as though the front panel 'Cancel' key has been pressed.
1 (delete SDM)	Delete SDM data of the last received SDM (if any). Available in conventional mode only.

Note If no [CANCEL_TYPE] is sent, then the CANCEL command will default to CANCEL_TYPE = 0.

Examples of CANCEL commands are:

c0100C a command to cancel the existing call.

c003D also a command to cancel the existing call.

c0110B a command to delete the currently held SDM.

4.5.2 DIAL

The DIAL command allows access to the full conventional mode dialling capability of the radio. Selcall and DTMF sequences can be dialled on the current channel. An TM8200 trunked radio must change to a conventional channel using a function key before executing this command. The function key is set to “Switch Mode” in the MPT Key Settings form of the TM8200 programming application.

The DIAL command has the format:

d [SIZE] [DTYPE] [NUMBER_STR] [CHECKSUM]

- ‘d’ is sent as a single ASCII character and represents the DIAL command.
- [DTYPE] is a single ASCII character representing the type of dialling required.
- [NUMBER_STR] represents the dialled sequence. The range of allowed characters depends upon the value of [DTYPE].

[DTYPE]	[NUMBER_STR]
0 (Selcall)	0...9, A...F, -, V (maximum of 32 digits). Selcall strings usually use the digits 0 to 9 as some of the tones A to F have special meaning, e.g. A = Group; C = Reset; E = Repeat. Selcall calls are made within the bounds of the following parameters, as programmed into the radio: tone period, tone set and Lead-In Delay, etc.
1 (DTMF conventional)	0...9, A...D, *, #,-(maximum of 32 digits) DTMF calls are made within the bounds of the following parameters, as programmed into the radio, e.g. key-up delay, tone period and inter-tone gap.
2 (DTMF trunked)	0...9, A...D, *, #,-(maximum of 32 digits) DTMF calls are made within the bounds of the following parameters, as programmed into the radio, e.g. key-up delay, tone period and inter-tone gap.

Note The DIAL command initiates the calling process only. The call may take some time to get through, especially if the channel is busy or the system heavily loaded. The receiver will return a prompt as soon as the DIAL command is accepted, but the PC may have to wait for a PROGRESS message advising successful call set-up before proceeding.

Examples of DIAL commands are:

d0601234507 a command to initiate Selcall dialling of the number 1 2 3 4 5.

d0611234506 a command to initiate DTMF dialling of the number 1 2 3 4 5.

4.5.3 FUNCTION

The FUNCTION command provides access to various hardware and miscellaneous functions. It has the following format:

f [SIZE] [FUNCTION] [SUBFUNCTION] [QUALIFIER] [CHECKSUM]

- 'f' is sent as a single ASCII character and represents the FUNCTION command.
- [FUNCTION] is a single ASCII characters representing the required function category.
- [SUBFUNCTION] is up to two ASCII characters and is used to extend the range of the [FUNCTION] parameter.
- [QUALIFIER] is an ASCII character string representing the action to be taken, depending on the value of [FUNCTION] and [SUBFUNCTION].

[FUNCTION]	[SUBFUNCTION]	[QUALIFIER]	Action
0 (functions)	0	none	Switch to CCR mode.
	1	0	Disable CCDI volume control.
		1	Enable CCDI volume control (refer to SUBFUNCTION=2).
	2	0-25	Set volume level. 0=off, 1-25=loudness.
	3	0	Disable selcall output RING messages.
		1	Enable selcall output RING messages.
	4	0	Disable PROGRESS output messages.
		1	Enable PROGRESS output messages.
	5	0	Disable PROGRESS output messages (default).
		1	Enable PROGRESS output messages (unsolicited). Refer to "PROGRESS" on page 45, [PTYPE] = 21 User Initiated Channel Change.
		2	Report current channel (solicited).
1 (SDM control)	0	0	Disable SDM output on reception.
		1	Enable SDM output on reception, QUERY command not required.
	1	0	Disable SDM caller ID encode.
		1	Enable SDM caller ID encode. The caller ID is sent as a separate SDM before sending the SDM itself.
	2	0	Disable SDM caller ID decode.
		1	Enable SDM caller ID decode. The caller ID SDM is decoded before the incoming SDM.

[FUNCTION]	[SUBFUNCTION]	[QUALIFIER]	Action
2 (emergency mode)	2	0	Activate non-stealth emergency mode.
		1	Activate stealth emergency mode.
		2	Deactivate emergency mode.
3 (simulate key presses)	none	000-009	PTT keypress length, 0=constantly off, 1-8=x/8 seconds on, 9=constantly on.
		010-019	Hookswitch keypress length, 0=constantly off, 1-8=x/8 seconds on, 9=constantly on.
		020-029	'On/off' keypress length, 0=constantly off, 1-8=x/8 seconds on, 9=constantly on.
		030-039	'Up' keypress length, 0=constantly off, 1-8=x/8 seconds on, 9=constantly on.
		040-049	'Down' keypress length, 0=constantly off, 1-8=x/8 seconds on, 9=constantly on.
		050-059	'FN1' keypress length, 0=constantly off, 1-8=x/8 seconds on, 9=constantly on.
		060-069	'FN2' keypress length, 0=constantly off, 1-8=x/8 seconds on, 9=constantly on.
		070-079	'FN3' keypress length, 0=constantly off, 1-8=x/8 seconds on, 9=constantly on.
		080-089	'FN4' keypress length, 0=constantly off, 1-8=x/8 seconds on, 9=constantly on.
4 (user controls)	none	0	Disable all user controls, display and indicators.The radio indicates "CCDI BUSY".
		1	Disable user input only. Display and indicators still operational. Any attempted user input will result in the invalid keypress tone.
		2	Enable all user controls except when CCDI commands are being processed. During this time the radio indicates "CCDI BUSY". Set as default at power on.
5 (Rx audio mute control)	none	0	Cancel CCDI request for Rx audio mute.
		1	Mute Rx audio. Can only be overridden by Squelch Override. Conventional mode only.

[FUNCTION]	[SUBFUNCTION]	[QUALIFIER]	Action
7 (subaudible signalling)	none	0	Deactivate validation of CTCSS and DCS subaudible signalling. Incoming data will be processed regardless of the subaudible signalling. The default radio setting at power on depends on the 'Ignore DCS/CTCSS' option set in the Data form of the programming application.
		1	Activate validation of CTCSS and DCS subaudible signalling. Incoming FFSK data will only be processed if the subaudible signalling matches. Only effective if current channel is programmed for subaudible signalling. Conventional or traffic channel mode only.
8 (monitor)	none	0	Deactivate monitor function.
		1	Activate monitor function. Conventional mode only.
9 (Rx/Tx)	none	0	Forces radio into a Rx state. Conventional or traffic channel mode only.
		1	Forces radio into a Tx state. Note that the Rx CCDI command is required to take the radio out of Tx mode when this mode is activated. The Tx will not terminate on expiry of the Tx timer. Conventional or traffic channel mode only.

Examples of FUNCTION commands are:

ff0241D3 a command to disable user input command.

f0250D3 a command to mute the receiver audio.

f0271D0 a command to validate subaudible signalling.

f0281CF a command to activate Monitor function.

f0291CE a command to activate the transmitter.

f0290CF a command to deactivate the transmitter following an "activate transmitter" command.

F0200D8 enter CCR Mode.

f03011A5 enable volume control.

f03010A6 disable volume control.

f03020A5 set volume level off.

f0402256D set volume level to the maximum of '25'.

f03025A0 set volume level to '5'.

f03031A3 enable Selcall output.

f03030A4 disable Selcall output.

f03041A2 enable progress message output.

f03040A3 disable progress message output.

f03101A5 enable output SDM on reception.

f03100A6 disable output SDM on reception.

f03111A4 enable caller ID encoder.

f03110A5 disable caller ID encoder.

f03121A3 enable caller ID decoder.

f03120A4 disable caller ID decoder.

4.5.4 GO_TO_CHANNEL

The GO_TO_CHANNEL command tells the radio to change to another conventional mode channel. The specified channel can be assigned to a scan/vote group in the radio. A trunked radio must change to a conventional channel before executing this command.

The GO_TO_CHANNEL command has the following format:

g [SIZE] [ZONE] [CHANNEL_NO] [CHECKSUM]

- 'g' is sent as a single ASCII character and represents the GO_TO_CHANNEL command.
- [ZONE] is a two-character string representing the new zone.
- [CHANNEL_NO] is a maximum of four characters representing the new channel number. The range of allowed characters is 0 to 9. and must be a valid channel for the radio. If used with the [ZONE] parameter, this will always be a four-character string.

Note If the radio is using a scan/vote group when it receives this command, it will retune to the specified channel.

Note If the radio is in emergency mode then no channel change will occur, and a 'not ready' error message is returned.

Examples of GO_TO_CHANNEL commands are:

g0223D2	go to channel 23.
g0414995E	go to channel 1499.
g060100120F	go to zone 1, channel 12.

4.5.5 QUERY

The QUERY command requests information from the radio. It has the following format:

q [SIZE] [QUERY_TYPE] [DATA] [CHECKSUM]

- 'q' is sent as a single ASCII character and represents the QUERY command.
- [QUERY_TYPE] is a single ASCII character representing the query type required.
- [DATA] is a number with up to three-digits which identifies the CCTM command which is sent.

[QUERY_TYPE]	[DATA]	Function
0 (model and CCDI version)	none	Query the radio model and CCDI version. Data is returned as a MODEL message.
1 (query SDM)	none	The buffered SDM data is returned to the PC as a GET_SDM message. The SDM buffer is then cleared. Available in conventional mode only.
3 (version)	none	Query the radio version information. The data is returned to the PC as a RADIO_VERSION message. Refer to "RADIO_VERSIONS".
4 (serial number)	none	Query the serial number. Refer to "RADIO_SERIAL".
5 (CCTM)	047	PA temperature. Returned to the PC as a CCTM_QUERY_RESULT message. Refer to "CCTM_QUERY_RESULTS".
	063	Averaged RSSI level. Returned to the PC as a CCTM_QUERY_RESULT message.
	064	Raw RSSI level. Returned to the PC as a CCTM_QUERY_RESULT message.
	318	Forward power. Returned to the PC as a CCTM_QUERY_RESULT message.
	319	Reverse power. Returned to the PC as a CCTM_QUERY_RESULT message.
6 (GPS)	none	Query GPS. GPS data is returned packetised as though the TM8100/TM8200 is a polling radio.

Note If no [QUERY_TYPE] is sent, then the QUERY command will default to [QUERY_TYPE] = 0.

Examples of QUERY commands are:

q010FE a command requesting a MODEL message.

q002F also a command requesting a MODEL message.

q011FD a command requesting a GET_SDM message.

q013FB query the software version.

4.5.6 SEND_ADAPTABLE_SDM

The SEND_ADAPTABLE_SDM command requests the radio to send a fixed format ASCII Short Data Message (SDM). An SDM can be received when the radio is in Command and Transparent modes.

The SEND_ADAPTABLE_SDM command has the format:

a [SIZE] [LEAD_IN_DELAY] [GFI] [SFI] [DATA_MESSAGE_ID] [MESSAGE] [CHECKSUM]

After an SDM is sent, if the 'SDM Auto Acknowledge' field is set in the programming application, the radio waits for an acknowledgement before it generates a PROGRESS message. The PROGRESS message is either type 1D0 'SDM auto-acknowledge not received' or 1D1 'SDM auto-acknowledge received'. Refer to "PROGRESS" on page 45.
Note that the delay before the acknowledgement is sent and how long the radio waits is also set in the programming application.

In Command mode, when any SDM is received, whether valid or not, the radio sends an 'FFSK Data Received' PROGRESS message to the PC. If the SDM is valid with a [MESSAGE] component, the radio also sends an 'SDM Call' RING message to the PC. RING will be type 'Data Call'.

When in either Command or Transparent mode, when a valid SDM is received the radio beeps.

Note The radio can not receive any further SDMs if one is already stored in the buffer. The buffer must be cleared using a CANCEL command.

- 'a' is sent as a single ASCII character and represents the SEND_ADAPTABLE_SDM command.
- [LEAD_IN_DELAY] is two ASCII hex characters representing the delay after the radio transmitter keys-up and the start of data transmission. The range is 00 to FFh.
  The actual delay is calculated by multiplying the number by 20 ms. This corresponds to a Lead-In Delay between 00 ms and 5.1 seconds, in steps of 20 ms. A minimum of at least 20 ms of Lead-In Delay is required for the radio.
- [GFI] is a single ASCII character giving the General Format Information (GFI) of the SDM.

Valid GFI values are:

GFI	Description	Comment
0	As per “s” format (i.e. Text)	Default for “s” command (ASCII SDM)
1	Binary	Binary SDM
2	Text	ASCII SDM
3 - 7	Spare	Available for future GFIs

- [SFI] is two ASCII characters giving the Specific Format Information (SFI) of the SDM.

Valid SFI values are:

SFI	Description	Comment
00	Default Value	Default Value
01	GPS_0	GPS related, CDP only.
02	Text	Text
03	CCR	SDM is directed to the CCR module. Refer to CCR SDM (TM8100 only).
04	Extended SDM	Up to 128 bytes, split into multiple SDMs. Refer to Extended SDM (TM8100 only).
05	Extended SDM Continuation	Continuation of an Extended SDM
06	NMEA Request	Request for radio to return a specified NMEA string. Refer to NMEA Request SDM.
07 - 31	Spare	Available for future SFIs

The following table shows valid GFI/SFI combinations. All other GFI/SFI field values which are not shown in the table are available for future formats.

GFI	SFI	Description	Comment
0	00	As per “s” command (Text)	General ASCII SDM
1	00	Binary	General binary SDM
2	00	Text	General ASCII SDM
1	01	GPS_0	GPS-related binary, non-CCDI2 compatible format
2	02	Text	General ASCII SDM
2	03	CCR	SDM for CCR control
1	04/05	Binary	Binary SDM up to 128 bytes
2	04/05	Text	ASCII SDM up to 128 bytes
2	06	NMEA Request	Requests an NMEA string to be returned as a Text SDM

- [DATA_MESSAGE_ID] is an 8-character string representing the SDM data identity of the radio to which the SDM is being sent. It can be any alphanumeric characters. “∗” is the wildcard for any character. e.g. 12∗∗5678. The first four bytes are generally the fleet identity, the second four the radio identity.
  When a radio receives a SDM message, the data identity is checked against the ‘Unit Data Identity’ set in the Data form of the programming application. Refer to “Radio Programming” on page 21. If the data identity matches, the received SDM data is stored and the radio sends a response. If the data identity does not match then the SDM data is ignored.
- [MESSAGE] is optional and contains up to 32 characters of SDM text. Either standard 8-bit ASCII range or binary can be sent, depending on the GFI.

An example of a SEND_ADAPTABLE_SDM command is:

a0FFF20012345678Hi4A

This message transmits text data message ID “12345678” and SDM data “Hi” with 5.1s lead-in delay through the current channel.

Extended SDM (TM8100 only)

An adaptable SDM with a SFI of 04 can have up to 128 bytes of data. This is split up into multiple SDMs where the following SDMs will have a SFI of 05. The SDM can be either Text or Binary.

CCR SDM (TM8100 only)

An adaptable SDM with a GFI of 2 and a SFI of 03 is passed to the CCR module, in radios that support CCR and are currently in CCR mode. The data part of the SDM is stripped out of the SDM and passed to the CCR module as a CCR command.

The SDM can only be text as CCR commands are in ASCII.

An example of a CCR SDM is:

a130520312345678M01D0E36
: transmits data message ID “12345678” and the CCR command “M01D0E” with 100 ms lead in delay through the current channel.

NMEA Request SDM

An adaptable SDM with a GFI of 2 and a SFI of 06 requests the receiving radio to return an Extended SDM, with the next NMEA message received of the requested type. The SDM may only be Text as NMEA messages are in ASCII.

The message of the SDM can contain a radio ID return address.

The format for the message is:

[MESSAGE]=[NMEA_ADDRESS_FIELD][,][RADIO_ID]

- [NMEA_ADDRESS_FIELD] is a five character NMEA address field such as “GPRMC”.
- [,] is a delimiter to separate the address field from the radio id. This should only be added if there are more fields in the message.
- [RADIO_ID] is the radio ID that the NMEA message is to be returned to. If not in the message then the message shall be returned to the default GPS dispatcher.

Example of NMEA request SDM are:

a120520612345678GPRMC22
: This message transmits data message to ID “12345678” and a request for the next “GPRMC” message to be returned to the default GPS dispatcher with 100 ms Lead-In Delay through the current channel.

a1B0520612345678GPGGA,8765432155
: transmits data message to ID “12345678” and a request for the next “GPGGA” message to be returned to the radio “87654321” with 100 ms Lead-In Delay through the current channel.

4.5.7 SEND_SDM

The SEND_SDM command tells the radio to send a Short Data Message (SDM) but the "SEND_ADAPTABLE_SDM" is normally used instead. An SDM can be received when the radio is in Command mode.

The SEND_SDM command has the format:

s [SIZE] [LEAD_IN_DELAY] [DATA_MESSAGE_ID] [MESSAGE] [CHECKSUM]

After an SDM is sent, if the 'SDM Auto Acknowledge' field is set in the programming application, the radio waits for an acknowledgement before it generates a PROGRESS message. The PROGRESS message is either type 1D0 'SDM auto-acknowledge not received' or 1D1 'SDM auto-acknowledge received'. Refer to "PROGRESS" on page 45.
Note that the delay before the acknowledgement is sent and how long the radio waits is also set in the programming application.

In Command mode, when any SDM is received, whether valid or not, the radio sends an 'FFSK Data Received' PROGRESS message to the PC. If the SDM is valid with a [MESSAGE] component, the radio also sends an 'SDM Call' RING message to the PC. If no [MESSAGE] component is received, RING will be type 'Data Call'.

The radio can be programmed to issue three beeps when in Command mode a valid SDM is received.

Note The radio can not receive any further SDMs if one is already stored in the buffer. The buffer must be cleared using a CANCEL command.

- 's' is sent as a single ASCII character and represents the SEND_SDM command.
- [LEAD_IN_DELAY] is two ASCII hex characters representing the delay after the radio transmitter keys-up and the start of data transmission, while the radio is in Command mode.
  The range is 00 to FFh. The actual delay is calculated by multiplying the number by 20ms. This corresponds to a Lead-In Delay between 00ms and 5.1s, in steps of 20ms. A minimum of at least 20ms of Lead-In Delay is required for the radio.
- [DATA_MESSAGE_ID] is an 8-character string representing the SDM data identity of the radio to which the SDM is being sent. It can be any alphanumeric characters. "∗" is the wildcard for any character, e.g. 12∗∗5678. The first four bytes are generally the fleet identity, the second four the radio identity.
  When a radio receives a SDM message, the data identity is checked against the 'Unit Data Identity' set in the Data form of the programming application. Refer to "Radio Programming" on page 21. If the data identity matches, the received SDM data is stored and the radio sends a response. If the data identity does not match then the SDM data is ignored.

- [MESSAGE] is optional. The field is limited to 32 hex characters in standard ASCII range 20h to 2Fh. Characters between 00 and FFh can be sent but characters above 7Fh can not be displayed.

Examples of SEND_SDM commands are:

s0A051234567813
: transmits data identity “12345678” with 100ms lead-in delay through current channel.

s0CFF12345678Hi39
: transmits data identity “12345678” and SDM data “Hi” with 5.1s lead-in delay through current channel.

4.5.8 TRANSPARENT (FFSK and THSD)

The TRANSPARENT command changes the radio to Transparent mode and sends the escape character required to change it back to Command mode. Refer to "Transparent Mode" on page 17 for details about Transparent mode.

The TRANSPARENT command has the following format:

t [SIZE] [ESC_CHAR] [MODE] [CHECKSUM]

- 't' is sent as a single ASCII character and represents the TRANSPARENT command.
- [ESC_CHAR] is a single ASCII character representing the escape character. The escape sequence is three consecutive escape characters sent within two seconds, with two seconds of idle time each side. When the escape sequence is sent to the radio, it is forced into Command mode. See "Entering Transparent Mode" on page 17 for details.
- [MODE] is a single ASCII character representing the modulation scheme. If [MODE] is left blank then the modulation scheme is assumed to be FFSK.

[MODE]	Function
0 (FFSK mode)	The radio will use FFSK modulation when in transparent mode.
H (THSD mode)	The radio will use Tait High Speed Data (THSD) modulation when in transparent mode.

Note When data is transmitted in Transparent mode it has the Lead-In Delay set in the Data form of the programming application.

Examples of TRANSPARENT commands are:

t01zB1 a command requesting that the radio be put into Transparent mode. The escape character specified here is "z" (ASCII code = $7A).

t02z080 enter FFSK transparent mode, with the escape character set to 'z'.

t02yH69 enter THSD transparent mode, with the escape character set to 'y'.

4.6 Messages from the Radio

The following messages are sent from the radio to the PC. Some are solicited by commands from the PC, while others are unsolicited and are sent because of changes within the radio.

Command	Character	Function	Compatibility
CCTM_QUERY_RESULTS	j	Results from a CCTM QUERY command	trunked and conventional
ERROR	e	Transaction processing error	trunked and conventional
GET_SDM	s	Get SDM data	trunked and conventional
MODEL	x	MAP27 message	trunked
MODEL	m	Identify radio type	trunked and conventional
PROGRESS	p	Call progress report	trunked and conventional
RADIO_SERIAL	n	Radio serial number	trunked and conventional
RADIO_VERSIONS	v	Version numbers of software components	trunked and conventional
RING	r	Incoming call alert	trunked and conventional
TRANSACTION OK	.	Transaction processed OK	trunked and conventional

The prompt character '.' is returned to the PC immediately after receiving a command to signify that another may begin. If the command initiates a return message, then when the return message has been sent the radio sends another prompt.

If the radio sends an unsolicited message, it sends a prompt after the message.

4.6.1 CCTM_QUERY_RESULTS

Solicited

The CCTM_QUERY_RESULTS message is issued as a result of the QUERY CCTM command. For more information on the QUERY command, refer to "QUERY" on page 32.

[j [SIZE] [CCTM_COMMAND] [CCTM_RESULT] [CHECKSUM]

- 'j' is sent as a single ASCII character and represents the CCTM_QUERY_RESULTS command.
- [CCTM_COMMAND] is a three digit character string representing a decimal number in the range of 000 to 999, which identifies the CCTM command requested.
- [CCTM_RESULT] is a variable length character string representing the CCTM value requested.

Note If the CCTM command gives multiple results then a separate query result will be given for each one.

QUERY CCTM Command	Returns...
047 (Read PA Temperature Level)	TM8100: Temperature in °C (–1200 to 1200) [CR] ADC value in mV (0 to 1200) TM8200: ADC value in mV (0 to 1200) With: (Temperature in °C) = (ADC value)/(–1.98)+230
063 (Read averaged RSSI level)	int value of averaged RSSI in 0.1dB
064 Read raw RSSI level)	int16 value of instantaneous RSSI in 0.1dB
318 (Report forward Power)	uint 16 value of the forward power (0 to 1200mV)
319 (Report reverse power)	uint 16 value of the reverse power (0 to 1200mV)

Examples of CCTM_QUERY_RESULTS messages are:

q0450475B This command queries the PA temperature.

Typical responses could be:

j050472331 where temp is 23 degrees, or

j06047481F8 where the millivolt value is 481.

4.6.2 ERROR

Solicited and unsolicited.

The ERROR message advises the PC that the radio has detected an error condition and cannot proceed with the current transaction. In some cases, an exception condition in the radio may cause an ERROR message to be sent to the PC independently of any control transactions. This is a system error, which is an unsolicited message.

The ERROR message has the following format:

e [SIZE] [ETYPE] [ERRNUM] [CHECKSUM]

- 'e' is sent as a single ASCII character and represents the ERROR command.
- [ETYPE] is a single character representing the error category.
- [ERRNUM] is two ASCII hex characters which identify the specific error condition.

[ETYPE]	**[ERRNUM]**	Error
0 (Transaction Error)	01	**Unsupported Command** Unsupported command errors can arise when the PC expects a later version of CCDI than is attached and attempts to use a command which is not recognised by the radio.
	02	**Checksum Error** A checksum error indicates that the checksum calculated by the radio did not match the one received in the command packet.
	03	**Parameter Error** Parameter errors encompass values out of range or missing fields.
	05	**TM8000 Not Ready Error** TM8000 not ready error occurs when another new message is receiving from PC even before a prompt character "." is sent from radio.
	06	**Command Error** The command has not been accepted as the radio is not configured to accept this command or execution of the command will interfere with current radio operation. Example: An SDM was sent but Scams are not enabled in the programming application.
1 (System Error)	Fatal system error - contact Tait Technical Support	

An example of an ERROR response message is:

e03003A5 This message indicates that the parameters of the currently received message are incorrect.

4.6.3 GET_SDM

Solicited.

The GET_SDM message is sent to the PC in response to a QUERY command. It sends the SDM data buffered by the radio and has the following format:

s [SIZE] [SDM_DATA] [CHECKSUM]

- 's' is sent as a single ASCII character and represents the GET_SDM command.
- [SDM_DATA] is a optional string of up to 32 character.

Note If no [SDM_DATA] is sent, then the GET_SDM command will default to [SDM_DATA] = 0.
If there is buffered SDM data in the radio, the SDM data will be sent to the PC.

Examples of GET_SDM response messages are:

s002D This message indicates that the radio has no SDM data available.

s02Hi7A This message indicates that the radio has a valid SDM data "Hi".

4.6.4 MODEL

Solicited.

The MODEL message is sent to the PC in response to a QUERY command. It identifies the type of radio and the version of CCDI software operating in the radio. It has the following format:

m [SIZE] [RUTYPE] [RUMODEL] [RUTIER] [VERSION] [CHECKSUM]

- 'm' is sent as a single ASCII character and represents the MODEL command.
- [RUTYPE] is a single character representing the type of radio.

Character	Function
1	Conventional radio
2	Reserved for Trunked radio
3	North American Signalling Conventional radio
4	Dual mode radio

- [RUMODEL] is a single character representing the model of the radio.

Character	Function
1	Tait Orca Portable (TOP) conventional unit
2	TM8200 mobile
3	TM8100 mobile

- [RUTIER] is a single character representing the tier of the radio.

Character	TM8100/TM8200 mobiles	Tait Orca portables
1	TM8105, TM8115, all TM8200 models	Conventional Tait Orca Elan
2	TM8110	Tait Orca Excel
3		Tait Orca Eclipse
4		Tait Orca 5010/5011
5		reserved
6		Tait Orca 5020/5021
7		Tait Radio Modem (TRM)
8		Tait Orca 5015

- [VERSION] CCDI software version. A character string, in the format of XX.XX, identifying the capabilities of the radio operating in CCDI mode.

An example of the MODEL response message is:

m0813102.03A3

This message is sent is response to a QUERY q002F command. It indicates that the radio is a Conventional, TM8105/TM8115 radio with a small display, and the CCDI version is 02.03.

4.6.5 PROGRESS

Unsolicited.

The PROGRESS message advises the PC of the radio status when some significant change of state in the radio occurs (typically during call processing). PROGRESS messages are not sent by the radio while the radio is in Transparent mode.

p [SIZE] [PTYPE] [PARA1] [PARA2] [CHECKSUM]

- 'p' is sent as a single ASCII character and represents the PROGRESS command.
- [PTYPE] is two ASCII hex characters which identify the progress message category.

[PTYPE]	[PARA1]	Function
00	none	**Call Answered** A standard Selcall or Type 99 call has been answered. This message will be sent when the call has been answered either by the PC or manually by the user.
01	none	**Deferred Calling** Deferred calling is in progress. This message will be sent every three seconds while the radio is still waiting to make the deferred call.
02	none	**Tx Inhibited** Transmission has been inhibited. This message will be sent whenever transmission is requested but is inhibited.
03	none	**Emergency Mode Initiated** The radio has been put into emergency mode. This message will be sent when the radio's emergency mode switch is activated.
04	none	**Emergency Mode Terminated** The radio is no longer in emergency mode. This message will be sent when the radio receives a "reset" to take it out of emergency mode. The reset can be a Remote Monitor Reset (enabled in programming application), a power off and on, or a CANCEL command.
05	none	**Receiver Busy** The receiver has detected an RF signal on the current channel. This message will be sent when the current channel becomes busy.

[PTYPE]	[PARA1]	Function
06	none	**Receiver Not Busy** The receiver no longer detects an RF signal on the current channel. This message will be sent when the current channel becomes not busy.
07	none	**PTT Mic Activated** The PTT has been pressed. This message will be sent whenever the PTT is pressed in an attempt to transmit.
08	none	**PTT Mic Deactivated** The PTT has been released. This message will be sent whenever the PTT is released after attempting to transmit.
16	none	Selcall Retry
17	none	Radio Stunned
18	none	Radio Revived
19	none	**FFSK Data Received** Indicates to that the radio has received valid FFSK data in Command mode, and will be sent to the PC when Transparent mode is next entered. Note that if FFSK data is received in Transparent mode, it will be sent directly to the PC without sending this progress message.
1C		**Selcall Auto-acknowledge** Indicates whether an auto-acknowledge was received from the last Selcall call. Note that this progress message will only be generated if the radio has been programmed to transmit Selcall Auto Acknowledge in the programming application.
	0	no acknowledge received.
	1	acknowledge received.
1D		**SDM Auto-acknowledge** Indicates whether an Auto Acknowledge was received from the last SDM call. Note that this progress message will only be generated if the radio has been programmed to transmit SDM Auto Acknowledge in the programming application.
	0	no acknowledge received.
	1	acknowledge received.
1E		**SDM GPS Data Received**
	1	Data received.

[PTYPE]	[PARA1]	Function
1F		**Radio Restarted** Indicates when the radio has been restarted.
	0	radio will restart in Command mode.
	1	radio will restart in FFSK Transparent mode.
	2	radio will restart in THSD Transparent mode.
20		**Single In-band Tone Received**
21		**User Initiated Channel Change** Indicates the details of the current channel
	0	Single channel.
	1	Scan/vote group of channels.
	2	A channel captured within a scan/vote group.
	3	Temporary channel e.g. one used for GPS.
	9	The channel is not available or invalid.

- [PARA2] is appended if [PARA1] is=21. It is either a variable length field of up to 4-digits which indicates the channel or scan/vote group ID, or a fixed length field of 6-digits which indicate zone and the channel or scan/vote group ID.

An example of a PROGRESS response message is:

p0202CC This message sends the progress message to say that Tx has been inhibited.

4.6.6 RADIO_SERIAL

Solicited.

The RADIO_SERIAL message is sent to the PC in response to a QUERY command. It conveys the serial number of the radio.

n [SIZE] [SERIAL_NUMBER] [CHECKSUM]

- 'n' is sent as a single ASCII character and represents the RADIO_SERIAL command.
- [SERIAL_NUMBER] is a string identifying the serial number in the radio.

An example of the RADIO_SERIAL response message is:

n08190011898D	This message indicates that the RU has serial number 19001189.

4.6.7 RADIO_VERSIONS

Solicited.

The RADIO_VERSION message is sent to the PC in response to a QUERY command. It conveys the versions of the various software and hardware components in the radio.

v [SIZE] [RECORD NUMBER] [VERSION] [CHECKSUM]

- 'v' is sent as a single ASCII character and represents the VERSION command
- [RECORD NUMBER] is two ASCII characters identifying the record number.
- [VERSION] is a variable length string identifying the version number of each hardware and software component in the radio. Multiple RADIO_VERSION messages are returned in response to a QUERY command. The messages can be distinguished using the record number.

Record Number	Radio
00	Model Name
01	Software Version
02	Database Versions
03	FPGA Version

An example of the RADIO_VERSION response message is:

v1200TMAB12-H500_010115

This message indicates that the RU has a model name of TMAB12-H500_0101.

4.6.8 RING

Unsolicited.

The RING message advises the PC that an incoming call has been received. It has the following format:

r [SIZE] [PARAMETERS] [RCATEGORY] [TYPE1] [TYPE2] [TYPE3] [TYPE4] [STATUS] [CALLER_ID] [CHECKSUM]

- 'r' is sent as a single ASCII character representing the RING command.
- [RCATEGORY] is a single character representing the category of the incoming call.

Character	Function
0	Selcall
1	Undefined
2	Type 99

- The RING type is a four character string qualifying the type of call received.

Type	Character	Function
[TYPE1]	0	Voice Call received
	1	reserved for Trunked non-prescribed data call
	2	Status Call received
	3	Interrogation Call received
	4	SDM received
	5	Data Call received
	6	Remote Monitor Call received
[TYPE2]	0	Normal Priority Call received
	1	Emergency Priority Call received
[TYPE3]	0	Individual Call received
	1	Group Call received
	2	Super Group call received
[TYPE4]	0	reserved

- [STATUS] is a two digit string representing the received status for status calls. If a [STATUS] value is not received, then [STATUS] will be "FF".
- [CALLER_ID] is a caller's ID which is optional and of variable length. If the ID is different to the radio's ID, the destination ID is placed in front of the caller ID, separated by a "-". This required Selcall output to be enabled using the FUNCTION command. Refer to "FUNCTION", [FUNCTION]=0, [SUBFUNCTION]=3.

Note By checking [SIZE] in RING message, PC will be able to know if the whole [CALLER_ID] part is missed or not.

An example of a RING response message is:

r0714000FFA6 This message indicates that the received call is an SDM call.

4.6.9 TRANSACTION OK

The Transaction OK response is a single ASCII full stop character (2Eh).

This message is sent when the radio receives a command from the PC and confirms that the command has been received.

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