tait
communications

TM8100 Mobile Radios
TM8200 Mobile Radios

Computer-Controlled Data Interface (CCDI) Protocol Manual

MMA-00038-06 · Issue 6 · December 2014

Contact Information

Tait Communications
Corporate Head Office

Tait Limited
P.O. Box 1645
Christchurch
New Zealand

For the address and telephone number of regional offices, refer to our website: www.taitradio.com

Copyright and Trademarks

Disclaimer

There are no warranties extended or granted by this document. Tait Limited accepts no responsibility for damage arising from use of the information contained in the document or of the equipment and software it describes. It is the responsibility of the user to ensure that use of such information, equipment and software complies with the laws, rules and regulations of the applicable jurisdictions.

Enquiries and Comments

If you have any enquiries regarding this document, or any comments, suggestions and notifications of errors, please contact your regional Tait office.

Updates of Manual and Equipment

In the interests of improving the performance, reliability or servicing of the equipment, Tait Limited reserves the right to update the equipment or this document or both without prior notice.

Intellectual Property Rights

This product may be protected by one or more patents or designs of Tait Limited together with their international equivalents, pending patent or design applications, and registered trade marks: NZ409837, NZ409838, NZ415277, NZ415278, NZ508806, NZ511155, NZ516280/NZ519742, NZ521450, NZ524369, NZ524378, NZ524509, NZ524537, NZ530819, NZ534475, NZ534692, NZ547713, NZ569985, NZ577009, NZ579051, NZ579364, NZ580361, NZ584534, NZ586889, NZ592624, NZ593887, NZ593888, NZ600346, NZ601933 , NZ607046, NZ607046, NZ610426, NZ610563, NZ612027, NZ613565, NZ615898, NZ615954, AU2004216984, AU321864, AU321868, AU339127, AU339391, CN1031871, CN1070368, CN200930004199.5, CN200930004200.4, CN200930009301.0, EU000915475-0001, EU000915475-0002, GB2413445, US12/870840, US13/082767, US13/185498, US13/465664, US13/542062, US13/542147, US13/763531, US13/896969, US14/032876, US29/401234, US29/401235, US5745840, US640974, US640977, US7411461, US7758996, US7937661, US8301682.

Environmental Considerations

Tait Limited is an environmentally responsible company which supports waste minimization, material recovery and restrictions in the use of hazardous materials.

The European Union's Waste Electrical and Electronic Equipment (WEEE) Directive requires that this product be disposed of separately from the general waste stream when its service life is over. For more information about how to dispose of your unwanted Tait product, visit the Tait WEEE website at www.taitradio.com/weee. Please be environmentally responsible and dispose through the original supplier, or contact Tait Limited.

Tait Limited also complies with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive in the European Union.

In China, we comply with the Measures for Administration of the Pollution Control of Electronic Information Products. We will comply with environmental requirements in other markets as they are introduced.

Contents

Preface

Scope of Manual

This manual contains reference information about the CCDI and CCR protocols for the TM8100 and TM8200 mobiles. It applies to CCDI version 3.00 and later.

Alert Notices

Please follow exactly any instruction that appears in the text as an alert. An alert provides necessary safety information as well as instruction in the proper use of the product. This manual uses the following types of alert:

This alert is used to warn about the risk of data loss or corruption.

This alert is used to highlight significant information that may be required to ensure procedures are performed correctly, or draw your attention to ways of doing things that can improve your efficiency or effectiveness.

Associated 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.

Technical notes are available in PDF format from the Tait support website. Consult your regional Tait office for more information.

- Technical Note TN-855-AN: TM8000 and TB7100 Data Modem Facilities
- Technical Note TN-919-AN: Configuring the TM8100 for Data Operation
- Technical Note TN-1075-AN: MAP27 Implementation Form (Appendix A7)

Publication Record

Issue	Publication Date	Description
1	March 2006	First issue
2	April 2007	Description of CCDI command prompt (TIMS 38465) QUERY command 7 (display) added (TIMS 59393) FUNCTION command 0 (functions), subfunction 4, qualifiers 2 and 3 (keypress progress message) added (TIMS 59393) FUNCTION command 0 (functions), subfunction 5, qualifiers 0, 1, and 2 (channel progress message) added (TIMS 59393) TDMA command added (TIMS 59393) PROGRESS message types 22 and 23 added (TIMS 59393) QUERY_DISPLAY_RESOPNSE message added (TIMS 59393) TDMA_DATA message added (TIMS 59393) CCR section added (TIMS 57777)
3	October 2007	FUNCTION command 2 (emergency mode), subfunction corrected to ‘None’ (TIMS 63060)
4	April 2011	Minor edits
5	December 2012	Notes on restricted frequencies added.
6	December 2014	Corrected serial port information (baud rates, GPS port) Added subfunction 7 (set transmit power level) to FUNCTION.

Abbreviations

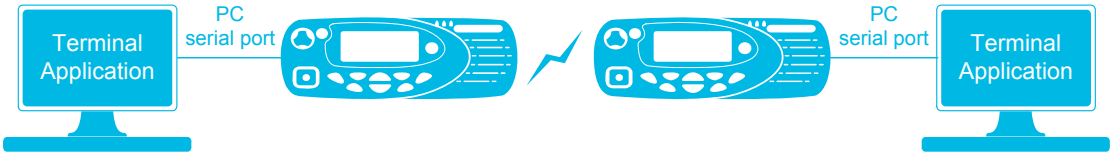
Abbreviation	Description
ASCII	American Standard Code for Information Interchange
AVL	Automatic Vehicle Location
CCDI	Computer Controlled Data Interface
CCR	Computer Controlled Radio
CDP	Conventional Data Protocol. A Tait over-air protocol.
CKR	Common Key Reference
CRC	Cyclic Redundancy Check
CTCSS	Continuous 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
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 (ready to receive)
RU	Radio Unit
Rx	Receive
RXD	Receive Data
SDM	Short Data Message
SFI	Specific Format Information for an SDM
THSD	Tait High Speed Data
TIA	Telecommunications Industry Association
Tx	Transmit
TXD	Transmit Data
UART	Universal Asynchronous Receiver-Transmitter
XON	Transmitter On
XOFF	Transmitter Off

1 CCDI

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 CCDI protocol only applies to TM8200 radios running in conventional mode.

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" on page 28 and "TDMA". The baud rate is set to 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400[1] or 115200[1] 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, 38400[1] or 115200[1] baud, using the programming application.

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

1. TM8200 only.

1.1 Compatibility

This manual describes CCDI version 3.06 and later.

The radio programming application used should be the latest released version for both the TM8100 and TM8200 radios. Refer to the Tait website www.taitradio.com for the latest versions of programming application.

1.2 Serial Ports

Three physical ports are available for CCDI asynchronous serial communication with the radio. The microphone and auxiliary ports are accessed externally, and the internal options connector is internal to the radio.

Heavy use of the microphone port for data transmissions can interrupt the control head and radio torso communications, causing radio failures. It is recommended to use the microphone port for testing only and to use the Auxiliary or Internal Options port for deployment.

Only one of these ports can be used for CCDI transmission and reception at any time. With the TM8100, the port is selected in the Data form, Serial Communications tab of the programming application. With the TM8200, the port is selected in the Serial Protocol form, CCDI Port Setup tab. Select “Mic”, “Aux” or “Internal Options”.

- Microphone: The radio will transmit and receive data via the MIC_TXD and MIC_RXD lines.
- Auxiliary: The radio will transmit and receive data via the AUX_TXD and AUX_RXD lines.
- Internal options: The radio will transmit and receive data via the IOP_TXD and IOP_RXD lines. This connector is used to fit an internal options board into the radio.

For more information on these connectors, refer to the service manual.

1.2.1 Data Characteristics

Serial port Parameter	Standard				Comments
	min.	typ.	max.	units	
Baud rate:	1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400[a], 115200[a]			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:	None Software (XON/XOFF) Hardware (RTS/CTS)				Requires two GPIO lines to be programmed as flow control

a. TM8200 only.

1.2.2 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.

1.2.3 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, GPS tab (TM8100) or Global Features, Serial Protocol form, GPS tab (TM8200) of the programming application and can be set to Mic (TM8100 only), 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.

1.2.4 MAP27 Port (TM8200 only)

MAP27 data transmission and reception also requires an asynchronous serial port and must be different to the CCDI UART Port. The MAP27 port is set in the Global Features, Serial Protocol form, MAP27 tab of the programming application, and can be set to Mic, Aux or Internal Options.
If set to Mic, the radio will use the MIC_TXD and MIC_RXD lines on the microphone connector.

If set to Aux, the radio will use the AUX_TXD and AUX_RXD lines on the auxiliary connector.

If set to Internal Options, the radio will use the IOP_TXD and IOP_RXD lines on the internal options connector.

For more information on MAP27 data transmission, refer to Technical Note TN-1075-AN, MAP27 Implementation Form (Appendix A7).

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 “Programming” on page 13 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 27.
- The radio will power on into the mode selected in the ‘Powerup State’ field in the Data form, General tab (TM8100) or Conventional Features, Conv Data Params form, CCDI Mode tab (TM8200) of the programming application.
- Power, Tx and Rx LED indicators are helpful for establishing proper operation.
- 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

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 14.

1.5 Programming

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

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

1.6 CCDI Flow Control

Flow control is a method of controling 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 radio's buffer (512 bytes for TM8100, 600 bytes for TM8200).

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

Available options: None, Hardware, or Software

1.6.1 XON/XOFF Software Flow Control

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

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.

1.6.2 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.

RTS

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.

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.

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.

1.7 CCDI 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, 38400[1] or 115200[1] baud using the programming application. The over-air data rate is 1200 or 2400 bps for FFSK data, 12 kbit/s for Tait High Speed Data (THSD) narrow band and 19200 bit/s for THSD wide band. The serial data input buffer is 512 bytes for the TM8100 and 600 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 signaling is available in FFSK Transparent mode only.

1.7.1 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 “Programming” on page 13.

You can change to Transparent mode while operating in Command mode by sending a TRANSPARENT command to the radio or using a programmable I/O line programmed for THSD. Example: 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 “+”.

1.7.2 Exiting Transparent Mode

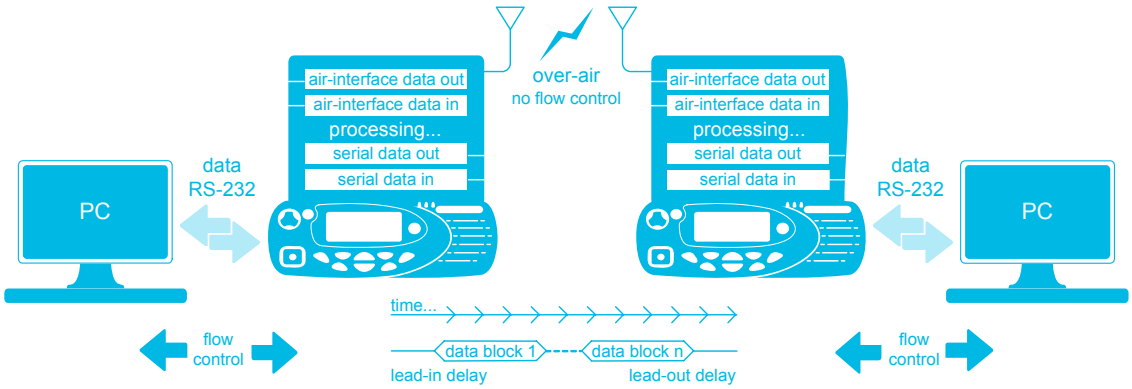
To change to Command mode while operating in Transparent mode, you can:

- send the escape sequence consisting of a 2 second idle time, followed by three escape characters (sent within 2 seconds), followed by a further 2 second idle time.
  Example: If the escape character is “+” (default), send
  [2 second idle] +++ [2 second idle].
- exit via the I/O line programmed for THSD, if Transparent Mode was entered using this line.

1.7.3 Transparent Mode Format

Transparent Mode Packetization

Transparent mode data is packetized 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.



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

THSD Transmission Format

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

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.

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 signaling decoding, if it is enabled, when used in conjunction with FFSK data.

1.8 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, 38400[1] or 115200[1] 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 does not expect a response from the DTE.

The SEND_SDM, SEND_ADAPTABLE_SDM and GET_SDM commands require that SDMs are sent and received as over-the-air 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 a 'SDM Received' RING messages are generated by the radio to indicate that SDM data has been received. When using FFSK, an 'FFSK Data Received' PROGRESS message will also be generated.

1.8.1 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 13.

To change to Command mode while operating in Transparent mode, you can:

- send the escape sequence consisting of a 2 second idle time, followed by three escape characters (sent within 2 seconds), followed by a further 2 second idle time.
  Example: If the escape character is "+" (default), send
  [2 second idle] +++ [2 second idle].
- exit via the I/O line programmed for THSD, if Transparent Mode was entered using this line.

1.8.2 CCDI Command Prompt

After entering Command mode, the radio sends a "." character to the PC which is displayed as a command prompt. The command prompt indicates that the radio is ready for another command. The prompt is also sent after the radio has sent a message.

In early CCDI versions, the command prompt after messages was not sent for all messages.

1.8.3 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.

1.8.4 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.

1.8.5 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.

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

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 "Contact Information" on page 2).

1.9 Commands to the Radio

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

Command	Character	Function	Valid in Mode	Mode radio must be in or switch to, to act upon the message (TM8200 only)
CANCEL	c	Cancel current activities	Conventional	Conventional
DIAL	d	Initiate a conventional call	Trunked Conventional	Conventional
FUNCTION	f	Implement RU function	Trunked Conventional	Dependent on function
GO_TO_CHANNEL	g	Tune to conventional channel	Trunked Conventional	Conventional
QUERY	q	Query RU Model, data parameters, software versions, etc. Query SDM.	Trunked Conventional	Either, no change required
SEND_SDM	s	Send conventional SDM	Trunked Conventional	Conventional
SEND_ADAPTABLE_SDM	a	Send conventional SDM with SFI/GFI field formatting	Trunked Conventional	Conventional
TDMA	z	Configure and open TDMA channel Queue TDMA data for sending Close TDMA channel	Conventional	Conventional
TRANSPARENT (FFSK and THSD)	t	Switch to Transparent mode (FFSK or THSD)	Conventional Trunked	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.

1.9.1 CANCEL

The CANCEL command tells the PC to abort the current action that the radio is performing.

Format

c [SIZE] [PARAMETERS] [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 canceling type.

[CANCEL_TYPE]	Function
0 (cancel call)	Cancel Call 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
1 (delete SDM)	Delete all queued received SDM messages. If there is no valid SDM data, it will do nothing.
3	Return to the idle display.

Examples

c0100C Cancels the existing call.

c003D Also cancels the existing call.

c0110B Deletes the currently held SDMs.

Notes

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

1.9.2 DIAL

The DIAL command allows access to the full conventional mode dialing capability of the radio. Selcall and DTMF sequences can be dialled on the current channel. The function key is set to “Switch Mode” in the Trunked Key Settings form of the programming application.

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 dialing 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.

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

d0601234507	Initiate Selcall dialing of the number 1 2 3 4 5
d0611234506	Initiate DTMF dialing of the number 1 2 3 4 5

1.9.3 FUNCTION

The FUNCTION command provides access to various hardware and miscellaneous functions.

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 [a]	none	Switch to CCR mode.
	1	0	Disable CCDI volume control.
		1	Enable CCDI volume control (refer to SUBFUNCTION=2).
	2 [b]	0-9	Set volume level. 0=off, 1-9=loudness.
	2 [c]	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.
		2 [d]	Enable KEYPRESS progress messages.
		3 [d]	Disable KEYPRESS progress messages (default).
	5	0 [e]	Disable channel PROGRESS output messages (default).
		1 [e]	Enable channel PROGRESS output messages (unsolicited). Refer to "PROGRESS" on page 44, [PTYPE] = 21 User Initiated Channel Change.
		2	Report current channel (solicited).
	7	0	Set the radios transmit power to 'OFF'
		1	Set the radios transmit power to 'V. Low'
		2	Set the radios transmit power to 'Low'
		3	Set the radios transmit power to 'Medium'
		4	Set the radios transmit power to 'High'
		9	Reset the radios transmit power to level configured in the programming application

[FUNCTION]	[SUBFUNCTION]	[QUALIFIER]	Action
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.
2 (emergency mode control)	none	0	Activate non-stealth emergency mode.
		1	Activate stealth emergency mode.
		2	De-activate emergency mode
3 (simulate key presses)	none	00x - 16x	The first two bytes specify the hexadecimal number of the key. See “PROGRESS” on page 44 for the list of key numbers.
		xx0 - xx9	The third byte specifies the duration of the key press. 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.
7 (subaudible signaling)	none	0	Deactivate validation of CTCSS and DCS subaudible signaling. Incoming data will be processed regardless of the subaudible signaling. The default radio setting at power on depends on the ‘Ignore DCS/CTCSS’ option set in the Data form, RF Modems tab (TM8100) or Conventional Features, Conv Data Params form, RF Modems tab (TM8200) of the programming application.
		1	Activate validation of CTCSS and DCS subaudible signaling. Incoming FFSK data will only be processed if the subaudible signaling matches. Only effective if current channel is programmed for subaudible signaling. Conventional or traffic channel mode only.
8 (monitor)	none	0	Deactivate monitor function.
		1	Activate monitor function. Conventional mode only.

[FUNCTION]	[SUBFUNCTION]	[QUALIFIER]	Action
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.

a. TM8100: Supported: TM8200: Not supported.

b. TM8100: Supported before v2.06. TM8200: Not supported.

c. TM8100: Supported from v2.06. TM8200: Supported.

d. TM8100: Not supported. TM8200: Supported from v2.05.

e. TM8100: Supported from v2.03. TM8200: Suported from v2.05.

Examples

f0241D3 a command to disable user input command.

f0250D3 a command to mute the receiver audio.

f0271D0 a command to validate subaudible signaling.

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.

f030719F set radio transmit power level to ‘very low’.

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.

f03051A1 enable channel progress message.

Notes

1. The “User controls” function allows the DTE to selectively disable the front panel controls of the RU. Three states are defined:
   - Disable All User Controls. This disables all user inputs and all indicators including the display. The RU will indicate “CCDI BUSY”.
   - Disable User Input Only. This disables all user inputs but the display and other indicators will be enabled for user information. Any attempt at user input will result in the invalid keypress tone being sounded.
   - Enable All User Controls. This enables the RU to be used normally except when the CCDI is processing a message. When the CCDI is processing a message, the RU will activate its “CCDI busy” indicator. When processing is complete, the RU will be returned to its normal state.

ⓘ After power on, this parameter value is defaulted to “Enable All User Controls”.

2. The “Receiver audio mute control” function will request or cancel its request for a “CCDI mute” of the RU. This mute request will affect the mute state of the RU and can only be overwritten by the “Squelch Override” of the RU.

3. The “Subaudible signaling validity control” function will activate or deactivate validation of subaudible signaling, i.e. CTCSS or DCS when CCDI is receiving FFSK data. If the current channel is not programmed with any subaudible signaling, then FFSK data is always received regardless of the validation state.

ⓘ After power on, this parameter value is set depending on 'Ignore Subaudible Signaling' option value.

4. Conventional radio and trunked radio in conventional mode. The “Monitor control” function will activate or deactivate monitoring of the RU in conventional mode. If this message is received on a traffic channel in trunked mode, then a parameter error message will be sent to DTE.

5. The “Tx/Rx control” function will change the RU into Tx or Rx state. When Tx state is initiated via the CCDI it must be terminated by issuing the Rx control CCDI command, i.e. Unlike regular PTT operation, CCDI Tx will not terminate upon expiry of the Tx Timer.

6. Enable Key Action Progress Messages (Function 0, Subfunction 4, PARAM1 = 2) will only enable a subset of all possible combinations of keys and press types.

1.9.4 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.

Format

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

- 'g' is sent as a single ASCII character and represents the GO_TO_CHANNEL command.
- [ZONE] (optional for TM8200, not applicable for TM8100) is a two-character string representing the new zone. When [ZONE] is omitted, the radio stays in the current 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.

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

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

Examples

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

1.9.5 QUERY

The QUERY command requests information from the radio.

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" on page 52.
4 (serial number)	none	Query the serial number. Refer to "RADIO_SERIAL" on page 52.
5 (CCTM query)	047	PA temperature. Returned to the PC as a CCTM_QUERY_RESULT message.
	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 query)	none	Query GPS. GPS data is returned packetized as though the queried radio is a polling radio.
7 (display)	0	Returns the text of the entire display. Non-ASCII text is ignored.

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

Examples

q010FE a command requesting a MODEL message.

q002F also a command requesting a MODEL message.

q011FD a command requesting the GET_SDM message.

q013FB query the software version.

Notes

1. When [QUERY_TYPE] = 0, data is returned to the DTE as a MODEL message.
2. When [QUERY_TYPE] = 3, the data is returned to the DTE as a RADIO_VERSION message.
3. When [QUERY_TYPE] = 4, the data is returned to the DTE as a RADIO_SERIAL message.
4. When [QUERY_TYPE] = 5, the data is returned to the DTE as a CCTM_QUERY_RESULT message.
5. When [QUERY_TYPE] = 6, the radio will return the GPS info packaged as it would be if this was the polling radio.

1.9.6 TDMA

The TDMA commands consist of three sub-functions for opening a TDMA channel, sending TDMA data, and closing a TDMA channel.

Opening a TDMA Channel

Before sending or receiving TDMA data, a TDMA channel must be opened using the OPEN_TDMA_CHANNEL command.

The OPEN_TDMA_CHANNEL command instructs the RU to prepare TDMA services on a specified TDMA channel (conventional mode) and to configure the modulation scheme and packet size according to the settings in the database.

A TDMA channel is different to a “normal” channel with the same channel number.

Sending TDMA Data

Sending TDMA data requires a second TDMA command, QUEUE_TDMA_DATA_FOR_SENDING. This command requests the RU to queue data in a dedicated TDMA data buffer for transmission.

The QUEUE_TDMA_DATA_FOR_SENDING command passes a maximum of 128 data bytes to the TDMA module. However, the data size actually used for over-the-air transmission is a programmable parameter for each channel. The TDMA transmission module will ignore any data exceeding the programmed packet size of the current channel.

Should the data size in the CCDI command exceed 128 bytes, then an error message (Command not accepted error) will be returned.

If the specified channel is not programmed for TDMA data transfer, or if the specified channel had not been opened for TDMA using the OPEN_TDMA_CHANNEL command, then CCDI will return a TDMA status message indicating the failure of the command execution.

A second QUEUE_TDMA_DATA_FOR_SENDING command can only be accepted after the progress message “TDMA DATA QUEUED FOR SENDING” has been sent to the DTE. Otherwise, the RU will return an error message (RU busy error).

TDMA requires an input transition from inactive to active on a TDMA input to commence the transmission over the air.

The TDMA input “GTC” (Go to Channel) has to be activated and TDMA data transmission will commence with the transition from inactive to active on the TDMA input “Send Packet”.

Closing a TDMA Channel

The CLOSE_TDMA_DATA_CHANNEL command requests the RU to unassign a currently configured TDMA data channel. This channel will subsequently be unavailable for TDMA data transmission or reception.

Format

z [SIZE] [SUB_FUNCTION] [CHANNEL_NO] [DATA] [CHECKSUM]

- ‘z’ is a single ASCII character and represents the TDMA command.
- [SUB_FUNCTION] is a one-digit ASCII character specifying the TDMA sub-function.
  - 0 = OPEN_TDMA_CHANNEL
  - 1 = QUEUE_TDMA_DATA_FOR_SENDING
  - 2 = CLOSE_TDMA_CHANNEL
- [CHANNEL_NO] is a two-digit string specifying the TDMA decimal channel number. The value of the channel number must be a valid TDMA channel for the RU being controlled (range of allowed values depends upon the RU’s programming). If the RU is in emergency mode then no channel change occurs and the radio will return an error message indicating it is busy. The RU will not give any audible indications for channel change requests. Should the channel not be a TDMA channel, then CCDI will return an error message (Command not accepted error) and the RU will not change channel.
- [DATA] is a maximum of 128 bytes of TDMA data (only used with [SUB_FUNCTION] 0 (QUEUE_TDMA_DATA_FOR_SENDING).

Valid in conventional mode only.

Examples

z030458Aspecifies a channel change to TDMA channel 45.

z0B10412345678DBstores “12345678” in the TDMA data buffer for TDMA channel 04.

z032058Ccloses the TDMA services on TDMA channel 05.

1.9.7 SEND_SDM

The SEND_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. This command now exists only to provide backwards compatibility with earlier versions. It is effectively superseded by the SEND_ADAPTABLE_SDM command.

Format

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

For details of the parameters in this command and additional notes, see "SEND_ADAPTABLE_SDM" on page 31.

s0A051234567813	This message transmits data message ID "12345678" with 100 ms lead-in delay through current channel.
s0CFF12345678Hi39	This message transmits data message ID "12345678" and SDM data "Hi" with 5.1 s lead-in delay through current channel.

1.9.8 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. This command effectively replaces the SEND_SDM command, which now exists only to provide backwards compatibility with earlier versions.

Format

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

After an SDM is sent, if the 'SDM Auto Acknowledge Delay' 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 44.
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 Command mode, when a valid SDM is received the radio beeps.

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” on page 34.
04	Extended SDM	Up to 128 bytes, split into multiple SDMs. Refer to “Extended SDM” on page 34.
05	Extended SDM Continuation	Continuation of an Extended SDM.Refer to “Extended SDM” on page 34.
06	NMEA Request	Request for radio to return a specified NMEA string. Refer to “NMEA Request SDM” on page 34.
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’ field set in the Data form, SDM tab (TM8100) or Conventional Features, Conv Data Params form, SDM tab (TM8200) of the programming application. Refer to “Programming” on page 13. 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, or 128 characters for extended SDM. Either standard 8-bit ASCII range or binary can be sent, depending on the GFI.

Example

An example of a SEND_ ADAPTABLE_SDM command would be:

a0FFF20012345678Hi4A This message transmits text data message ID “12345678” and SDM data “Hi” with 5.1 sec lead in delay through current channel.

Notes

1. The SEND_SDM command can send a maximum of 32 characters ONLY in command mode. However an RU can receive an SDM either in Command mode or Transparent mode.
2. When 'SDM Auto Acknowledgment' is enabled, after sending SDM data, if SDM acknowledge data is received within the time of 'Wait For Acknowledgment', the RU typically indicates SDM_ACK_RECEIVED_INDICATOR. Otherwise it indicates SDM_NO_ACK_RECEIVED_INDICATOR.

3. In Command mode, if SDM data is received whether it is valid or not, it will be buffered and the RU will generate a FFSK_DATA_RECEIVED progress message. If the received SDM data is valid, i.e the data message ID is matched, then the RU will also update the SDM data buffer and may generate an indication that RU has received valid SDM data.

4. In Transparent mode, if SDM data is received whether it is valid or not, it will be sent to the DTE but no progress message is generated. If the received SDM data is valid, i.e the data message ID is matched, then the RU will also update the SDM data buffer and will generate a sound beep to indicate that RU has received a valid SDM data.

5. Acknowledgment of SDMs for different SDM types. There shall not be any dependency between the SDM types. Users can configure acknowledgments separately for “Text” and “GPS” so we don't have GPS behaviour interfering with the “manual” SDMs.

6. Auto-Acknowledgment of SDMs / Wait for Acknowledgment after SDM transmission. There shall not be any dependency between auto acknowledgment and wait for acknowledgment configurations.

Extended SDM

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

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 [MESSAGE] 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.

Example

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.

Format

[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.

Examples

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

This message 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.

1.9.9 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 "CCDI Transparent Mode" on page 14 for details about Transparent mode.

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 15 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.

When data is transmitted in Transparent mode it has the lead-in delay set in the Data form, RF Modems tab (TM8100) or Conventional Features, Conv Data Params form, RF Modems tab (TM8200) of the programming application.

Examples

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'.

1.10 Messages from the Radio

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

Message	Character	Function
CCTM_QUERY_RESULTS	j	Results from a CCTM query command
ERROR	e	Transaction failure or other error condition
GET_SDM	s	Get original format SDM data
MODEL	m	Identify RU type
PROGRESS	p	Call progress report
QUERY_DISPLAY_RESPONSE	d	Response from query display command
RADIO_SERIAL	n	RU serial number
RADIO_VERSIONS	v	Version numbers of software components
RING	r	Incoming call alert
TDMA_DATA	z	Raw TDMA data
TRANSACTION OK	.	Transaction processed OK

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.

1.10.1 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 28.

Format

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.

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 0.1 dB
064 Read raw RSSI level)	int16 value of instantaneous RSSI in 0.1 dB
318 (Report forward Power)	uint 16 value of the forward power (0 to 1200 mV)
319 (Report reverse power)	uint 16 value of the reverse power (0 to 1200 mV)

Examples

Query 047:	q045**047**5B
Typical result:	j05047**23**31 (temperature of 23 °C) (TM8100 only)
	j06047**481**F8 (ADC value of 481 mV)
Query 063:	q045**063**5D
Typical result:	j07063-**488**C5 (RSSI value of -48.8dBm)
Query 064:	q045**064**5C
Typical result:	j07064-**456**C9 (RSSI value of -45.6dBm)
Query 318:	q045**318**5A
Typical result:	j06318**389**F0 (raw value of 389)
Query 319:	q045**319**59
Typical result:	j06319**161**FB (raw value of 161)

1.10.2 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.

Format

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

- 'e' is sent as a single ASCII character and represents the ERROR response.
- [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	**Radio Not Ready Error** Radio 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 SDMs are not enabled in the programming application.
1 (System Error)	Fatal system error - contact your regional Tait office	

Example

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

1.10.3 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.

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, or 128 for an extended SDM.

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

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”.

1.10.4 MODEL

Solicited.

The MODEL message is sent to the PC in response to a QUERY 0 (model) command (q010FE). It identifies the type of radio and the version of CCDI software operating in the radio.

Format

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

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

Character	Function
1	Conventional radio
2	Reserved for Trunked radio
3	North American Signaling Conventional radio
4	Analog conventional/trunked radio
5	P25 radio
6	DMR radio

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

RUTYPE	RUMODEL	RUTIER	Description
1			Conventional
1	1		Conventional Portable
1	1	1	Conventional Portable, Tait Orca Elan
1	1	2	Conventional Portable, Tait Orca Excel
1	1	3	Conventional Portable, Tait Orca Eclipse
1	1	4	Conventional Portable, Tait Orca 5010
1	1	6	Conventional Portable, Tait Orca 5020
1	1	7	Conventional Portable, Tait Radio Modem
1	1	8	Conventional Portable, Tait Orca 5015
1	2		Reserved for Conventional Mobile, Tait Orca
1	3		Conventional Mobile
1	3	1	Conventional Mobile, TM8105/TM8115
1	3	2	Conventional Mobile, TM8110
1	4	1	Conventional Portable, TP8115
1	4	2	Conventional Portable, TP8120
1	4	3	Conventional Portable, TP8110
2			Reserved for Trunked Radio

RUTYPE	RUMODEL	RUTIER	Description
3			North American Signaling Conventional Radio
3	1		NA Sig. Conv. Portable
3	1	4	NA Sig. Conv. Portable, Tait Orca 5011
3	1	6	NA Sig. Conv. Portable, Tait Orca 5021
4			Dual Mode Radio
4	1		Dual Mode Radio, Portable
4	2		Dual Mode Radio, Mobile
4	2	1	Dual Mode Radio, Mobile, TM8200
5			P25 Digital
5	1		P25 Digital Mobile
5	1	1	P25 Digital Mobile, TM9100
5	2		P25 Digital Portable
5	2	1	P25 Digital Portable, TP9100
5	3		P25 Digital Mobile Phase 2-capable
5	3	1	P25 Digital Mobile Phase 2-capable, TM9400
5	3	2	P25 Digital Mobile / MPT hybrid TM9480
5	4		P25 Digital Portable Phase 2-capable
5	4	1	P25 Digital Portable Phase 2-capable, TP9400
5	4	2	P25 Digital Portable / MPT hybrid TP9480
6			DMR Digital
6	1		DMR Digital Mobile
6	1	1	DMR Digital Mobile, TM9300
6	2		DMR Digital Portable
6	2	1	DMR Digital Portable, TP9300

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

Notes

- The value of [VERSION] = 01.01 is reserved for the first release of CCDI firmware implementing the command protocol described in this document. Subsequent enhancements and major upgrades will increment this number accordingly. Note this may not be the current value.
- An example of the MODEL response message would be:

m0811100.01A9 This message indicates that the RU is a Conventional Portable Tait Orca Elan radio and the CCDI software version is 00.01.

1.10.5 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.

Format

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

- 'p' is sent as a single ASCII character and represents the PROGRESS response.
- [PTYPE] is two ASCII hex characters which identify the progress message category.
- [PARA2] is appended if [PTYPE] is 21, 22, or 23.

[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.
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

[PTYPE]	[PARA1]	Function
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.
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	none	**Single In-band Tone Received**
21		**User Initiated Channel Change** Indicates the details of the current channel [PARA2] is a fixed length field of 6-digits which indicate zone (2 digits) and the channel or scan/vote group ID (4 digits).
	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.
22	2-digit decimal channel ID	**TDMA channel ID** [PARA2]: 2-digit hexadecimal number 00 = TDMA open accepted 01 = TDMA not available 02 = TDMA channel invalid 03 = TDMA open slot not assigned 04 = TDMA already open 05 = TDMA closed successfully 06 = TDMA service not open 07 = TDMA data buffered 08 = TDMA data buffer emptied 09 = TDMA invalid packet size 0A = TDMA data failure not open 0B = TDMA normal operation suspended 0C = TDMA normal operation not suspended 0D = TDMA normal operation unable to suspend

[PTYPE]	[PARA1]	Function
23		**Keycode** Indicates key actions [PARA2]: 0 = key down action, 1 = key up action, 2 = short keypress, 3 = long keypress
	00	PTT
	01	Hookswitch
	02	On/Off key
	03	Up key
	04	Down key
	05	Function key 1
	06	Function key 2
	07	Function key 3
	08	Function key 4
	09	Function key 5
	0A	Function key 6
	0B	Zero key
	0C	One key
	0D	Two key
	0E	Three key
	0F	Four key
	10	Five key
	11	Six key
	12	Seven key
	13	Eight key
	14	Nine key
	15	Star key (*)
	16	Hash key (#)
	1E	Softkey left
	1F	Softkey right
31		**Channel name**
	0	Channel name not found/invalid. [PARA2] 0 = channel name not found/invalid
	1	Channel name valid. [PARA2] = <string>, channel name (limited to 20 characters)

Example

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

p052300036 keypress message: PTT has been pressed.

p052300135 keypress message: PTT has been released.

p05230622E keypress message: FnKey 2, short press actioned

p052303033 keypress message: UP key, pressed

Notes

1. The CALL ANSWERED (00) progress message indicates that a standard Selcall or Type 99 call has been answered. This message will be sent when the call has been answered either by the DTE or manually by the user.

2. For conventional radio and trunked radio in conventional mode. The TX INHIBITED (02) progress message indicates that transmission has been inhibited. This message will be sent whenever transmission is requested but is inhibited.

3. The EMERGENCY MODE INITIATED (03) progress message indicates that the RU has been put into emergency mode. This message will be sent when the RU emergency mode switch is activated.

4. The EMERGENCY MODE TERMINATED (04) progress message indicates that the RU is no longer in emergency mode. This message will be sent when the RU receives a “reset” to take it out of emergency mode.

5. The RECEIVER BUSY (05) progress message indicates that the receiver has detected RF signal on the current channel. This message will be sent when the current channel becomes busy. This message can be controlled by the Transparent mode message filter.

6. The RECEIVER NOT BUSY (06) progress message indicates that the receiver no longer detects RF signal on the current channel. This message will be sent when the current channel becomes not busy. This message can be controlled by the Transparent mode message filter.

7. The PTT MIC ACTIVATED (07) progress message indicates that the PTT has been pressed. This message will be sent whenever the PTT is pressed in an attempt to transmit.

8. The PTT MIC DEACTIVATED (08) progress message indicates that the PTT has been released. This message will be sent whenever the PTT is released after attempting to transmit.

9. The RADIO STUNNED (17) progress message indicates that the RU has been stunned.

10. The RADIO REVIVED (18) progress message indicates that the RU has been revived.

11. The FFSK DATA RECEIVED (19) progress message indicates to DTE that the RU has received a valid FFSK data in Command mode. The buffered FFSK data will be sent to the DTE when Transparent mode is next invoked. Note that if FFSK data has received in Transparent mode, it will be sent directly to the DTE without sending this progress message.

12. The SDM AUTO-ACKNOWLEDGE (1D) progress message indicates whether an auto-acknowledge was received from the last SDM call. 0 = no acknowledge received, 1 = acknowledge received.

Note that this progress message will only be generated if the radio has been programmed to transmit SDM auto-acknowledges.

13. The USER INITIATED CHANNEL CHANGE progress message indicates the details of the current channel. [PARA1] indicates information about the channel: whether it is a single channel, a scan/vote group of channels, a channel captured by the RU within a scan/vote group, a temporary channel (e.g. one used for GPS polling) or it may indicate that the channel is invalid or not available. [PARA2] is a variable length field up to 4 which indicates the channel or scan/vote group ID, or a fixed length of 6 where it indicates the zone and the channel or scan/vote group ID.

14. The following Key Action progress messages are supported:
    - PTT - key down, key up
    - Hook Switch - key down, key up
    - On/Off Key - long keypress
    - UP / DOWN - key down
    - Function Keys - Short and Long keypress (provided there is an action programmed on this key)
    - Left / Right Soft Key - key down

1.10.6 QUERY_DISPLAY_RESPONSE

Solicited.

The QUERY_DISPLAY_RESPONSE message is sent to the PC in response to a QUERY 7(display) command (q0270C6).

The QUERY_DISPLAY_RESPONSE message shows the contents of the control head display.

A QUERY_DISPLAY_RESPONSE message always consists of at least two progress messages:

- Start of the query display response
- End of the query display response.

Between those messages are multiple separate messages given for each display object (i.e. a text line or an icon).

If the QUERY 7 (display) command is applied before a previous QUERY 7 (display) has been completed (i.e. if the QUERY DISPLAY RESPONSE "End of Query Display Response" has not been sent to the CCDI port) then the error "RU not ready" will be returned.

Format

d [SIZE] [PTYPE] [PARA1] [PARA2] [CHECKSUM]

- 'd' is sent as a single ASCII character representing the QUERY_DISPLAY_RESPONSE command.

[PTYPE] is a single-digit character (hexadecimal value) indicating either start or end of the display response, or representing the display object type:

[PTYPE]	[PARA1]	[PARA2]	Function
0 (Start)			Start of the Query Display response.
F (End)	0		End of the Query Display response. No error.
	1		End of the Query Display response. Refresh disabled.
	2		End of the Query Display response. Query Display busy.
1 (Display string text, ASCII only)	[X_POSITION] [Y_POSITION] [FONT] (9 digits)	variable length display string	[X_POSITION], = display string x-position (3 hexadecimal digits) [Y_POSITION], = display string y-position (3 hexadecimal digits) [FONT] = display string font number (3 hexadecimal digits)
2 (Display icon)	[X_POSITION] [Y_POSITION] [FONT] [ICON_ID] (11 digits)		[X_POSITION] = displayed icon x-position (3 hexadecimal digits) [Y_POSITION] = displayed icon y-position (3 hexadecimal digits) [FONT] = display string font number (3 hexadecimal digits) [ICON_ID] = display icon ID (2 hexadecimal digits)

X- and Y-positions

The x and y positions of the display object (string or icon) are pointing to the top left pixel of the object pixel field, relative to the pixel in the upper left corner of the LCD display (max. number of x pixels = 4000, max. number of y-pixels = 4000).

Font

The following table shows the font identifiers for text strings and icons:

Font ID	Font Name
1	FontDispatch 10
2	FontDispatch 16
3	FontDispatch 24
4	FontDispatch Bold 10
5	FontDispatch Monospace Numeric 16
6	Icon Dispatch 16
7	Icon Dispatch 20
8	Icon Dispatch 48

Icon ID

The following table shows the icon IDs of the mobile. This table is subject to enhancements without notification.

Icon ID	Icon Dispatch			Icon ID	Icon Dispatch		
	16	20	48		16	20	48
0x31				0x65			
0x32				0x68			
0x33				0x69			
0x34				0x6a			
0x35				0x6b			
0x36				0x6c			
0x37				0x6d			
0x38				0x6e			
0x41				0x6f			
0x42				0x70			
0x43				0x71			
0x44				0x72			
0x45				0x73			
0x4a				0x74			
0x61				0x75			
0x62				0x76			
0x63				0x77			
0x64							

Control heads with 1-, 2- or 3-digit display

If the QUERY_DISPLAY command is applied on a radio with a 1-, 2- or 3-digit display control head, a response message with the current text for each line is returned including a preceding Start of display response message and a trailing End of display message response. A flashing display is treated as it was not flashing.

Control heads without display

If the QUERY_DISPLAY command is applied on a radio with a control head without display, then only two progress messages are returned:

- Start of the query display response
- End of the query display response.

Radios with multiple control heads

If the QUERY_DISPLAY command is applied on a radio with multiple control heads, then only the display content of the master control head is reported with response messages.

Limitations

The QUERY_DISPLAY_RESPONSE messages should represent a sequence of text and Icon data, which are used during a complete display refresh process. There is no absolute guaranty that the reported displayed items are actually visible on the screen.

Embedded control characters in text strings on the display (i.e. ASCII value less than 0x20) may interfere with the terminal attached to the CCDI port when a QUERY DISPLAY RESPONSE message is returned.
The CCDI port on the radio **must not** be configured for software handshake!

Examples

d0100B This message indicates the start of a display response message.

d02F0C4 This message indicates the end of a display response message (no error).

d0E107803E005Menu85
This message indicates that there is currently a string “Menu” displayed on the radio, positioned at x=078h, y=03Eh and font ID=005h (FontDispatch Monospace Numeric 16).

d0C200800B00744BE
This message indicates that there is currently an icon displayed
on the radio, positioned at x=008h, y=00Bh, fontID=007h, icon ID=44h.

1.10.7 RADIO_SERIAL

Solicited.

The RADIO_SERIAL message is sent to the PC in response to a QUERY 4 (serial number) command. It conveys the serial number of the radio.

Format **n [SIZE] [SERIAL_NUMBER] [CHECKSUM]**

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

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

1.10.8 RADIO_VERSIONS

Solicited.

The RADIO_VERSION message is sent to the PC in response to a QUERY 3 (version) command. It conveys the versions of the various software and hardware components in the radio.

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

- 'v' is sent as a single ASCII character and represents the VERSION response
- [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

Example v1200TMAB12-H500_010115
This message indicates that the RU has a model name of TMAB12-H500_0101.

1.10.9 RING

Unsolicited.

The RING message advises the PC that an incoming call has been received.

Format

r [SIZE] [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
	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
	3	Unknown call received

- [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" on page 23, [FUNCTION]=0, [SUBFUNCTION]=3.
  On P25 conventional, the [Caller_ID] is the "<Receivers P25 ID (decimal)>-<Senders P25 ID (decimal)>-".

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

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

1.10.10 TDMA_DATA

Unsolicited. TM8200 only.

The TDMA_DATA message is sent to the DTE in response to a reception of a TDMA data packet.

Format z [SIZE] [TDMA_DATA] [CHECKSUM]

- 'z' is sent as a single ASCII character representing the TDMA_DATA message.
- [TDMA_DATA] is raw TDMA message data.

Example z15Hi_TDMA_data_received*cc*
indicates that the RU has valid TDMA packet, which is "Hi_TDMA_data_received".

cc is a placeholder of the CCDI message checksum.

1.10.11 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.

2 CCR

2.1 Introduction

Overview

This section provides details of the Computer-Controlled Radio (CCR) protocol. It describes the radio to Data Terminal Equipment (DTE) protocol. This is an advanced radio control feature.

CCR applies to TM8100 radio terminals only.

The CCR protocol provides a means of temporarily reprogramming a channel from some form of DTE via a serial interface (PC, AVL application, Telemetry Application, MDT).

In CCR mode, the radio no longer uses a non-volatile database. A number of radio parameters are uploaded and changed during run-time from an external application. In this way, the external application provides the non-volatile data storage.

All serial ports on the radio support CCR (Microphone, Auxiliary and Internal Options).

The CCR mode is a sub-mode of CCDI. Entry into CCR is via a CCDI command (“f0200D8”). Once, in CCR mode the radio will accept serial CCR commands and will no longer process CCDI commands.

The TM8100 series of radios support USER, CCDI Transparent and CCR modes of operation.

Benefits

Most of the radio functionality can be controlled by the external device operating over a serial communications link. This allows system integrators to develop their own intelligent control device. They can develop complex solutions with a low cost RF platform.

In essence, a radio which has access to all the channels in its operating range could be made. The limit is no longer in the mobile but in the external intelligence driving it. A wider range of methods can be employed to alter or modify the way the radio is controlled by the user; a step forward in control evolution.

2.1.1 Configurable Parameters

Channel information:

- Tx/Rx frequencies
- Tx & Rx CTCSS/DCS frequencies
- Tx power level
- Channel bandwidth

The unit can accept or send Selcall in:

- All the international tone formats
- Between 2 and 8 tones per sequence.
- Tone durations from 20 - 100 ms
- ANI leading/trailing sequence

Other features:

- Audio volume level
- Enable/disable monitor

2.1.2 Potential Applications

- Complex conventional radio units (multi-system)
- MDT controlled radio
- Remote off-air monitoring
- System integration
- Self healing RF networks
- Rapid deployment - inter operability
- Hybrid solutions

2.2 Programmable Parameters

CCR depends on the same programmable parameters as those used to configure CCDI command mode.

2.2.1 Requirements

The following needs to be enabled as a minimum:

- Enable CCDI
- Enable a serial port for communications (Auxiliary, Mic or Internal Options connector) as follows:

The serial port is capable of driving only a limited cable length. For more information on the serial port, refer to the service manual.

Parameter	Value
Baud rate	1200, 2400, 4800, 9600, 14400, or 19200, 28800, 38400 or 115200
Number of data bits	8
Parity	None
Number of stop bits	1

Radio operation while in CCR mode also requires, as a minimum, the following to be defined:

- Enable at least one channel
- Enable at least one PTT & microphone for voice

For selcall commands it is also necessary to enable at least one network using selcall signaling, as follows:

- Enable network to be selcall

The radio will, upon entry to CCR, inherit programmable parameters from the channel that was active when CCR was entered. Modifications while in CCR mode to channel/network characteristics will be compared to this baseline. All CCR changes are temporary, nothing is saved to the database, therefore they are lost on power cycling.

2.3 Command Protocol

The DTE is connected to the RU via a serial link. Command and response messages are generated between the DTE and the RU.

2.4 Command Description

This section details the standard messages.

2.4.1 Message Format

All CCR mode message packets take the following general form:

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

Where:

Parameter	Value
[IDENT]	is the message identifier. Identifiers are single ASCII characters which categorise the message type
[SIZE]	is the number of characters which make up the [PARAMETERS] field. [SIZE] is an 8-bit number expressed in ASCII-hex notation (two characters)
[PARAMETERS]	is an optional field, depending upon the command. Parameter values are generally character strings unless explicitly stated otherwise. Parameter type is dependent upon the command - there is no explicit type definition.
[CHECKSUM]	is an 8-bit checksum of the [IDENT], [SIZE] and [PARAMETERS] fields. It is expressed in ASCII-hex notation (two characters)
<CR>	is the packet terminator. It is the ASCII “carriage return” character (0Dh).

General characteristics of the message format worth noting are as follows:

- All characters in a message are printable ASCII
- Where numeric values are represented in ASCII-hex notation (two characters per byte), digits A...F are upper case
- The minimum length of a command packet is 5 characters; i.e. when [SIZE] = 00. For example, E005B is the EXIT command which is 5 characters.
- The maximum length of the [PARAMETERS] field is 32 characters, so that the maximum length of the command packet is therefore 37 ([SIZE]=“20”) characters

2.4.2 Calculating [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...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.

Checksum Example s0D050800TESTHi!DA

5. 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
6. Retain bits 0 to 7, discarding any higher order bits resulting from the summation.
   26h
7. Form the two’s complement of the remainder.
   26h = 0010 0110
   two’s complement = 1101 1010
8. Convert the binary number into two ASCII hex digits, MSD first.
   1101 1010 = DA

2.5 CCR Mode Commands

2.5.1 Entering CCR Mode

CCR mode is entered from CCDI with the function zero command, “f0200D8”. This command is described in the CCDI specifications.

Entry to CCR mode will be denied if the radio is busy scanning, transmitting or processing emergency mode activities. CCR mode is not, however, blocked when the radio is stunned; CCR can run in this state.

2.5.2 CCR/CCDI Mode Independence

CCDI and CCR are independent from each other in that commands and responses for either command interpreter can only be processed in its own mode. There are, for instance, no CCDI progress messages when the radio is in CCR mode.

2.5.3 CCR Mode Activated

The radio sends the string “M01R00” to the DTE when CCR mode is activated.

2.5.4 CCR Mode Busy

It is possible to program an output line for busy detect status in CCR mode.

2.5.5 Blocked Functions

CCR mode denies the following functions (that are available in user mode) and indicates them as invalid if they are attempted from a front panel or programmable input:

- Channel selection
- Scanning
- Emergency
- SDM (No GPS)
- User mode calls:
    - No call setups with the front panel controls, programmable I/O or PTT
    - No selcall alerting for identities defined in the database

CCR is intended for headless radio units. Third parties can, upon integration, add their own implementations for things like scanning and selcall alerts.

PTT initiated functionality will only be suppressed, not indicated, notably, PTT call setup.

2.5.6 CCR Persistence

When a radio is reset nothing is saved from the current CCR session to the next power up. Third party devices can check that the radio is alive with the pulse command and “reprogram” it when a power outage has been detected.

2.5.7 CCR Response Time

The receive frequency in CCR mode can be changed at least every 20ms.

2.5.8 Exiting CCR Mode

When exiting CCR mode, the radio reboots. For more information, refer to “Exit CCR Mode” on page 74.

2.6 CCR Positive Acknowledgements

The radio validates the received strings since the last command on the serial port versus the CCR protocol when it sees an instance of the terminating character <CR>. It returns either a positive or negative acknowledgement. The positive acknowledgement has the following format.

Response

+ssxcc

Where:

Parameter	Value
+	ASCII ‘+’ character indicates that the command was accepted
ss	ASCII hex number ss is the size of the ack (always “01”)
x	echoes back the command identity, the first letter (R, T, A, B, S, M…)
cc	ASCII hex number cc is the checksum

Effect

An ACK response is sent back when a command has been accepted, the radio does not wait until the command has been executed. The ACK may be delayed, in some cases, but usually it is sent back immediately.

2.7 CCR Negative Acknowledgements

The radio validates the received strings since the last command on the serial port versus the CCR protocol when it sees an instance of the terminating character <CR>. It returns either a positive or negative acknowledgement. The negative acknowledgements are as follows.

2.7.1 Invalid CCR Command

If a string does not conform to the protocol, or there is something else inhibiting its execution, it is rejected and a negative acknowledgement is sent to the user. The negative acknowledgement has the following format.

Response -ssrrxcc

Where:

Parameter	Value
-	ASCII '–' character indicates that the command was rejected
ss	ASCII hex number ss is the number of characters for parameters
rr	indicates the reason for rejecting the command as follows: ■ '02' Checksum error ■ '01' Invalid command ■ '03' Parameter error in command ■ '05' Radio is busy ■ '06' Command is not accepted
x	echoes back the command identity, but only if the checksum in the command was correct
cc	ASCII hex number cc is the checksum

A command is only ever rejected with one error code.

Effect The implementation exits the validation as soon as an error has been struck - it will not check the parameters if the command does not pass the checksum test.

2.7.2 Validation Checksum Error

If the input string does not have the correct checksum, a checksum error is immediately reported and no further checks are done.

2.7.3 Invalid Validation Command

If the input string passes the checksum test but the identity contained is not a recognised CCR command, an invalid command is reported.

2.7.4 Validation Parameter Error

If the input string passes the general message format but not the command specific tests, a parameter error is sent. For details on validation rules see the specific commands.

- data length check
- range check on message data
- correct sequence of commands

2.7.5 Radio Busy Message

If the input string passes both the general and command specific validation criteria, it is processed only if the following conditions are true:

- Radio is not in transmitting state
- Radio is not busy processing the last sent command

The radio rejects the commands and returns the busy error code in these instances.

2.7.6 Command Not Accepted Message

Some commands trigger sequence errors if they are sent when the radio cannot process the command, for example:

- Radio is attempting to use a selcall command when there is no selcall configuration defined.

This error is, for instance, sent if a selcall command is received, but the CCR channel is not activated with a network using selcall signaling.

2.8 CCR Commands

2.8.1 Summary and Examples

The messages in the following table are sent from the DTE to the RU.

Message	Cmd	Function
Rssxxxxxxxxcc	R	Go to Receive Frequency
Tssxxxxxxxxcc	T	Load Transmit Frequency
Hssxcc	H	Set Bandwidth
Jssxxxcc	J	Set Volume Level
Assxxxxcc	A	Receive CTCSS Value
Bssxxxxcc	B	Transmit CTCSS Value
Cssxxxxcc	C	Receive DCS Value
Dssxxxxcc	D	Transmit DCS Value
Sssxxxxxcc	S	Encode Selcall Sequence
Isstplcc	I	Set Selcall Parameters
M01xcc	M	Monitor
Nsspxxxxxcc	N	Set ANI
Pssxcc	P	Transmitter Output Power
Qssxcc	Q	Query Radio Pulse
Esscc	E	Exit CCR Mode

In all cases, if the command is received without error by the RU and all the parameters are valid, the command will be executed and the prompt will be returned to the DTE. If an error arises, the DTE will be notified with an appropriate response.

Examples

f0200D8	Enter ccr from ccdi
E005B	Exit - same effect as “^”
R0945320000087	Set Rx frequency to 453.2MHz
T0945320000085	Set Tx frequency to 453.2MHz
Q01PFE	Pulse command, returns “P” when minimum config exists
P0111E	Set power to Very Low
P0141B	Set power to High
H01324	Set bandwidth to Wide
H01126	Set bandwidth to Narrow
A0406708E	Set Rx ctcss to 67Hz
A0400009B	Set Rx ctcss to 0Hz
B0406708D	Set Tx ctcss to 67Hz
B0400009A	Set Tx ctcss to 0Hz
C03023C5	Set Rx DCS to 023

C03000CA	Disable Rx DCS
D03023C4	Set Tx DCS to 023
D03000C9	Disable Tx DCS
S051234549	Dial 12345
I03015BE	Select toneset 0, ccir, 20ms tones and 5 tones notify
N04112387	Set ani to leading and tones 123
M01D0E	Monitor “on”
M01E0D	Monitor “off”
J03000C3	Volume level 0 (range is 0-255)
J03104BE	Volume level 104 (range is 0-255)

2.8.2 Go to Receive Frequency

Description

On receipt of this command, the radio checks the format and does a range check on the frequency. If it is valid, the radio sends an ACK response and then initialises the synthesizer with the new frequency. One should allow 20ms for the synthesizer to settle at the new frequency. If the command is invalid, a NAK response will be sent and the receiver will remain at the last selected frequency. If the radio is transmitting then a NAK response will also be sent.

Command

Rssxxxxxxxxxcc

Where:

Parameter	Value
R	ASCII letter R denotes the go to Receive frequency
ss	ASCII hex number ss is the number of characters for parameters (“08” or “09”)
xxxxxxxxx	ASCII number xxxxxxxxx is the receive frequency, as follows: ■ Minimum is a number representing the bottom of the radio model frequency band ■ Maximum is a number representing the top of the radio model frequency band
cc	ASCII hex number cc is the checksum

Effect

This command has immediate effect with the receiver retuning to this channel. If the synthesizer is out of lock then a NAK response will be sent.

2.8.3 Load Transmit Frequency

Description

On receipt of this command, the radio checks the format and does a range check on the frequency. If it is valid, the radio sends an ACK response. If the command is invalid, a NAK response will be sent and the transmit frequency will not change. If the radio is transmitting then a NAK response will also be sent.

The radio may restrict the transmitter output power depending on the transmit frequency, in accordance with regulatory requirements.

The radio may restrict the transmitter bandwidth to narrowand depending on the transmit frequency, in accordance with regulatory requirements.

Command

Tssxxxxxxxxxcc

Where:

Parameter	Value
T	ASCII letter T denotes the Load Transmit Frequency command
ss	ASCII hex number ss is the number of characters for parameters “08” or “09”)
xxxxxxxxx	ASCII number xxxxxxxxx is the transmit frequency, as follows: ■ Minimum is a number representing the bottom of the radio model frequency band ■ Maximum is a number representing the top of the radio model frequency band
cc	ASCII hex number cc is the checksum

Effect

This command loads the transmit frequency into a memory location for use when the PTT or Selcall encoder is next active. The radio will not transmit if the synthesizer is out of lock.

2.8.4 Set Volume Level

Description

This command sets the volume level for received audio. If the index number is out of range the radio does not act on the command and sends a NAK (range error) back.

Command

J03xxxcc

Where:

Parameter	Value
J	ASCII letter J denotes the Set Volume Level command
03	ASCII hex number 03 is the number of characters for parameters
xxx	ASCII number xxx is a volume level value in the range of 0 to 255 (255 is the maximum)
cc	ASCII hex number cc is the checksum

Effect

This command has immediate effect.

If there is a volume knob on the radio there is no guarantee that the value set with this command will be the volume. The radio will use the level last set with any control.

2.8.5 Receive CTCSS Value

Description

This command disables (if xxxx=0), or enables (if xxxx>0), Rx CTCSS. If enabled, the audio mute is opened only when a given subaudible CTCSS tone is being received (otherwise the audio mute is closed). If disabled, muting on CTCSS is disabled. If the frequency is out of range, the radio does not act on the command and sends a NAK (range error) back.

Command

A04xxxxcc

Where:

Parameter	Value
A	ASCII letter A denotes the Receive CTCSS Value load command
04	ASCII hex number 04 is the number of characters for parameters
xxxx	ASCII number xxxx is a receive subaudible frequency in 0.1Hz. The valid range is 67Hz to 254.1 Hz.
cc	ASCII hex number cc is the checksum

Effect

This command has immediate effect and closes the mute to signals without a valid CTCSS tone if enabled, or opens the mute on disabling CTCSS muting.

2.8.6 Transmit CTCSS Value

Description

This command disables (if xxxx=0) or enables (if xxxx>0), Tx CTCSS. If enabled, a CTCSS tone is transmitted whenever the radio is transmitting audio. If the reference number is out of range, the radio does not act on the command and sends a NAK (range error) back to the radio. If the radio is already transmitting then a NAK response will also be sent.

Command

Bssxxxcc

Where:

Parameter	Value
B	ASCII letter B denotes the transmit CTCSS value to be sent on transmit
04	ASCII hex number 04 is the number of characters for parameters
xxxx	ASCII number xxxx is a transmit CTCSS frequency in 0.1Hz. The valid range is 67Hz to 254.1 Hz.
cc	ASCII hex number cc is the checksum

Effect

On receipt of the request the radio stores the CTCSS tone to generate. The radio will then generate the tone at the next PTT or Selcall encode activity.

2.8.7 Receive DCS Value

Description

This command sets the Receive DCS code. If the code is not recognized as an octal, the radio does not act on the command and sends a NAK (range error) back. Sending “000” will disable the Receive DCS filter.

Command

C03xxxcc

Where:

Parameter	Value
C	ASCII letter C denotes the Receive DCS Value load command
03	ASCII hex number 03 is the number of characters for parameters
xxx	ASCII number xxx represents a DCS code
cc	ASCII hex number cc is the checksum

Effect

This command has immediate effect and closes the mute to signals without a valid DCS tone.

2.8.8 Transmit DCS Value

Description

This command sets the Transmit DCS code. If the code is not recognized as an octal, the radio does not act on the command and sends a NAK (range error) back. Sending “000” will disable the Transmit DCS filter.

Command

D03xxxcc

Where:

Parameter	Value
D	ASCII letter D denotes the transmit DCS value to be sent on transmit
03	ASCII hex number 03 is the number of characters for parameters
xxx	ASCII number xxx represents a DCS code
cc	ASCII hex number cc is the checksum

Effect

This command loads the value into memory ready for the next PTT or Selcall encode activity.

2.8.9 Encode Selcall Sequence

Description

This command turns the transmitter on and sends the Selcall string following a short delay (network 1 lead-in delay). If the number of tones is incorrect the command is rejected (NAK-format error).

Command

Sssx...xcc

Where:

Parameter	Value
S	ASCII letter S denotes the Transmit Selcall tone sequence
ss	ASCII hex number ss is the number of characters for parameters
x...x	ASCII number x...x is the tone sequence. Minimum is 2 tones and maximum is 33.
cc	ASCII hex number cc is the checksum

The Set Selcall Parameter command (see below) allows the user to change the Selcall parameter defaults.

Effect

This command has immediate effect, provided that the receiver and transmitter frequency values have been initialised and the radio is not transmitting at the time (PTT active causes busy error)

2.8.10 Set Selcall Parameters

Description

This command allows the user to modify the Selcall default parameters (tone set to use, tone period, number of tones in Tx sequence and number of tones in Rx sequence). If any of the command parameters are out of range, a NAK (range error) will be sent back to the control head.

Command

I03tplcc

Where:

Parameter	Value
I	the ASCII letter I denotes the Set Selcall Parameter command
03	ASCII hex number 03 is the number of characters for parameters
t	specifies the Tone Set to use. This can be one of the following: ■ '0' CCIR ■ '1' EIA ■ '2' EEA ■ '3' ZVEI-I ■ '4' ZVEI-II ■ '5' ZVEI-III ■ '6' PZVEI ■ '7' NATEL ■ '8' DZVEI
p	specifies the Tone Period to use. This can be one of the following: ■ '1' 20ms ■ '2' 33ms ■ '3' 40ms ■ '4' 50ms ■ '5' 60ms ■ '6' 70ms ■ '7' 100ms
l	sets the decode buffer time and message filter as defined in "Notify Buffer Size" on page 76 and "Selcall Decode Sequence" on page 76.
cc	ASCII hex number cc is the checksum

Effect

The Selcall modem is immediately re-initialised with the new decode parameter map. These new parameters are applied for the next Selcall decode/encode sequence.

CCR default parameters are those loaded from the network associated to the selected channel when the radio enters CCR mode. This includes selcall parameters like 'lead in delay', which it is not possible to alter in CCR mode.

2.8.11 Set ANI

Description

This command disables or enables ANI. It configures what ANI sequence is to be sent and when the ANI sequence is to be sent. If p is not ‘0’, the tone sequence gets stored.

If the number of tones (xx...xx) does not match the currently configured length, then the command is rejected (NAK- format error). It is also rejected if p is out of range (range error).

Command

Nsspx...xcc

Where:

Parameter	Value
N	ASCII letter N denotes the Automatic Number Identification command
ss	ASCII hex number ss is the number of characters for parameters
p	denotes the ANI position with regard to PTT presses. Valid values are: ■ ’0’ disables ANI (in this case the tone sequence x...x is not required) ■ ’1’ leading ANI (ANI is sent soon after PTT is pressed) ■ ’2’ trailing ANI (ANI is sent when PTT is released) ■ ’3’ combination of 1 and 2
x...x	is the 5 to 8 tone sequence. It is optional if p is set to 0.
cc	ASCII hex number cc is the checksum

Effect

If enabled, the ANI tones get stored and any subsequent use of the PTT button activates ANI.

2.8.12 Monitor

Description

This command is the same as the monitor function available on the function keys in normal user mode. When it is active, it overrides any active subaudible signaling filters. The squelch mute is not overridden.

Command

M01xcc

Where:

Parameter	Value
M	ASCII letter M indicates it is a monitor command
01	ASCII hex number 01 is the number of characters for parameters
x	is the mute state wanted, as follows: ■ 'D' for disable mute (monitor) ■ 'E' for enable mute
cc	ASCII hex number cc is the checksum

Effect

Immediate.

If there is a front panel key or programmable input with monitor configured, there is no guarantee that the value set with this command will represent the monitor state. The radio will use the state last set with any control.

2.8.13 Transmitter Output Power

Description

The transmitter output power is set to the value selected. If the index is incorrect the command is rejected (NAK-format error).

The radio may restrict the transmitter output power depending on the programmed transmit frequency, in accordance with regulatory requirements.

Command

P01xcc

Where:

Parameter	Value
P	ASCII letter P indicates it is a power command
01	ASCII hex number 01 is the number of characters for parameters
x	is an index to transmit power level, as follows: ■ '1' very low power ■ '2' low power ■ '3' medium power ■ '4' high power
cc	ASCII hex number cc is the checksum

Effect

The modified power level takes effect on the next Tx activity; either PTT or Selcall.

If there is a front panel key or programmable input with low power configured, there is no guarantee that the value set with this command will represent the effective output power. The radio will use the state last set with any control.

2.8.14 Set Bandwidth

Description

This command sets the operating transmit/receive bandwidth. If the index number is out of range, the radio does not act on the command and sends a NAK (range error) back.

The radio may reject the bandwidth command due to the current transmit frequency in accordance with regulatory requirements.

Command

Hssxcc

Where:

Parameter	Value
H	ASCII letter denotes the Set Bandwith command
01	ASCII hex number 01 is the number of characters for parameters
x	is the Bandwith Index, as follows: ■ ‘1’ narrowband ■ ‘2’ mediumband ■ ‘3’ wideband (may be restricted due to FCC narrowbanding regulations)
cc	ASCII hex number cc is the checksum

Effect

This command has immediate effect.

2.8.15 Query Radio Pulse

Description

The purpose of this command is to give the user a way to “ping” the radio.

The radio pulse command allows you to check that the radio is still responding. The control device may use the radio pulse command every ten seconds in the absence of other activity.

Command

Q01PFE

Where:

Parameter	Value
Q	ASCII letter Q indicates it is a query command as opposed to a set-up command
01	ASCII hex number 01 is the number of characters for parameters
P	ASCII letter P indicates it is the radio pulse command
FE	ASCII hex number FE is the checksum

Response

The radio will send back one of two responses:

- QssPcc - if the radio has got its minimum configuration, which typically consists of having received a ‘set receive frequency’ command.
- QssDcc - is returned if the radio has loaded its default set-up and has not yet received a ‘set receive frequency’ command.

Effect

These commands invoke an immediate reply.

2.8.16 Exit CCR Mode

Description

The radio initiates a software reset (same as for “^”), and exits CCR mode.

Command

E005B

Where:

Parameter	Value
E	ASCII letter E indicates it is an exit command
00	ASCII hex number 00 indicates that there are no parameters
5B	ASCII hex number 5B is the checksum

Effect

This command is immediate. The radio will reset.

2.9 Unsolicited Messages from the Radio

2.9.1 Summary and Examples

The following messages may be returned to the DTE without user intervention.

Message	Cmd	Function
Vssx...xcc	V	Selcall decode sequence
Msspcc	MP	Ptt exceeds max transmit limit
Mssrcc	MR	CCR initialised

Examples:

V0612345-18 Sequence 12345 detected

V065E5E5-EE Sequence 55555 detected (E is repeat tone in this case)

M01P02 Transmit timeout warning (10s before inhibit)

M01R00 CCR mode entered

2.9.2 PTT Exceeds Max Transmit Limit

Description

The radio uses this response to advise the control head that PTT is about to timeout.

For control heads with user interfaces, the warning threshold is the duration timer configured for the network minus 10s.

Response

Msspcc

Where:

Parameter	Value
M	ASCII letter M denotes the message
ss	ASCII hex number ss is the number of parameters (always “01”)
P	ASCII letter P denotes a PTT being applied that has exceeded the default transmit timer warning threshold
cc	ASCII hex number cc is the checksum

Effect

Whenever the radio reaches its maximum transmit period the radio will inform the control head. After a further short delay the radio will turn off the transmitter.

2.9.3 Selcall Decode Sequence

Description

The radio sends this message every time the decoder tone buffer is emptied, in accordance with the notification criteria set by the "I" command. See "Set Selcall Parameters" on page 70 and "Notify Buffer Size" on page 76.

The sequences received are represented with the tones from the toneset. Repeat tones and gaps will be forwarded as is.

Response

Vssx...xcc

Where:

Parameter	Value
V	ASCII letter V denotes the Selcall decode message
ss	ASCII hex number ss is the number of parameters
x...x	are the tones decoded within the time window specified by the notify parameters as follows: ■ ASCII digits 0 to 9 ■ Special tones are represented with ASCII letters A to F ■ Gap. A gap in CCR is equal to the tone period set by the Selcall Parameter command
cc	ASCII hex number cc is the checksum

Effect

When the radio receives the given SELCALL sequence the radio sends the decoded sequence to the DTE.

2.9.4 Notify Buffer Size

Description

The number of tones to notify, set by the selcall parameter command, allow the user to define the size of the decode tone buffer. This buffer sets the maximum time period that the radio will decode and log tones before reporting to the user, when continuously receiving valid selcall tones. The timer is calculated as follows:

$Tmax = (N \times P) + P$

Where:

Parameter	Value
Tmax	Notify buffer maximum time
N	Number of tones
P	Tone period

The buffer timer is started after at least one valid tone has been detected.

The buffer timer is reset if a gap is detected prior to expiry.

The notify parameter also sets a filter that allows the user to suppress decode sequences from being reported if they consist of less than the selected number of tones in a continuous sequence, as follows:

- If the decode buffer contains less than the selected number of tones when it is reset the contents shall be discarded.

If a radio in CCR receives a speech call it is very likely that the user will see this response with garbage decode sequences (1 or 2 tones) if the filter is removed.

The additional tone period added to the buffer time allows the radio to detect and report if a gap was present or not after the sequence detected.

Tait General Software Licence Agreement

This Software License Agreement ("Agreement") is between you (“Licensee”) and Tait Limited (“Tait").
By using any of the Software items embedded and pre-loaded in the related Tait Designated Product, included on CD, downloaded from the Tait website, or provided in any other form, you agree to be bound by the terms of this Agreement. If you do not agree to the terms of this Agreement, do not install or use any of the Software. If you install or use any of the Software, that will be deemed to be acceptance of the terms of this Agreement.
For good and valuable consideration, the parties agree as follows:

Section 1 DEFINITIONS

“Confidential Information” means all or any information supplied to or received by Licensee from Tait, whether before or after installation or use and whether directly or indirectly pertaining to the Software and Documentation supplied by Tait, including without limitation all information relating to the Designated Products, hardware, software; copyright, design registrations, trademarks; operations, processes, and related business affairs of Tait; and including any other goods or property supplied by Tait to Licensee pursuant to the terms of this Agreement.
“Designated Products” means products provided by Tait to Licensee with which or for which the Software and Documentation is licensed for use.
“Documentation” means product and software documentation that specifies technical and performance features and capabilities; user, operation, and training manuals for the Software; and all physical or electronic media upon which such information is provided.
“Executable Code” means Software in a form that can be run in a computer and typically refers to machine language, which is comprised of native instructions the computer carries out in hardware. Executable code may also refer to programs written in interpreted languages that require additional software to actually execute.
“Intellectual Property Rights” and **“Intellectual Property”** mean the following or their substantial equivalents or counterparts, recognized by or through action before any governmental authority in any jurisdiction throughout the world and including, but not limited to all rights in patents, patent applications, inventions, copyrights, trademarks, trade secrets, trade names, and other proprietary rights in or relating to the Software and Documentation; including any adaptations, corrections, de-compilations, disassemblies, emulations, enhancements fixes, modifications, translations and updates to or derivative works from, the Software or Documentation, whether made by Tait or another party, or any improvements that result from Tait processes or, provision of information services.
“Licensee” means any individual or entity that has accepted the terms of this License.
“Open Source Software” means software with freely obtainable source code and license for modification, or permission for free distribution.
“Open Source Software License” means the terms or conditions under which the Open Source Software is licensed.
“Person” means any individual, partnership, corporation, association, joint stock company, trust, joint venture, limited liability company, governmental authority, sole proprietorship, or other form of legal entity recognized by a governmental authority.
“Security Vulnerability” means any flaw or weakness in system security procedures, design, implementation, or internal controls that if exercised (accidentally triggered or intentionally exploited) could result in a security breach such that data is compromised, manipulated, or stolen, or a system is damaged.
“Software” (i) means proprietary software in executable code format, and adaptations, translations, de-compilations, disassemblies, emulations, or derivative works of such software; (ii) means any modifications, enhancements, new versions and new releases of the software provided by Tait; and (iii) may contain one or more items of software owned by a third-party supplier. The term "Software" does not include any third-party software provided under separate license or not licensable under the terms of this Agreement.
“Source Code” means software expressed in human readable language necessary for understanding, maintaining, modifying, correcting, and enhancing any software referred to in this Agreement and includes all states of that software prior to its compilation into an executable programme.
“Tait” means Tait Limited and includes its Affiliates.

Section 2 SCOPE

This Agreement contains the terms and conditions of the license Tait is providing to Licensee, and of Licensee’s use of the Software and Documentation. Tait and Licensee enter into this Agreement in connection with Tait delivery of certain proprietary Software and/or products containing embedded or pre-loaded proprietary Software.

Section 3 GRANT OF LICENSE

3.1. Subject to the provisions of this Agreement and the payment of applicable license fees, Tait grants to Licensee a personal, limited, non-transferable (except as permitted in Section 7), and non-exclusive license to use the Software in executable code form, and the Documentation,

solely in connection with Licensee's use of the Designated Products for the useful life of the Designated Products. This Agreement does not grant any rights to source code.

3.2. If the Software licensed under this Agreement contains or is derived from Open Source Software, the terms and conditions governing the use of such Open Source Software are in the Open Source Software Licenses of the copyright owner and not in this Agreement. If there is a conflict between the terms and conditions of this Agreement and the terms and conditions of the any applicable Open Source Software Licenses, the terms and conditions of the Open Source Software Licenses will take precedence. For information about Open Source Components contained in Tait products and the related Open Source licenses, see:

http://support.taitradio.com/go/opensource

Section 4 LIMITATIONS ON USE

4.1. Licensee may use the Software only for Licensee's internal business purposes and only in accordance with the Documentation. Any other use of the Software is strictly prohibited. Without limiting the general nature of these restrictions, Licensee will not make the Software available for use by third parties on a "time sharing," "application service provider," "service bureau" basis, or for any other similar commercial rental or sharing arrangement.

4.2. Licensee will not, and will not directly or indirectly allow or enable any third party to: (i) reverse engineer, disassemble, extract components, decompile, reprogram, or otherwise reduce the Software or any portion thereof to a human perceptible form or otherwise attempt to recreate the source code; (ii) modify, adapt, create derivative works of, or merge the Software; (iii) copy, reproduce, distribute, lend, or lease the Software or Documentation to any third party; (iv) grant any sublicense or other rights in the Software or Documentation to any third party; (v) take any action that would cause the Software or Documentation to be placed in the public domain; (vi) remove, or in any way alter or obscure any copyright notice or other notice of Tait or third-party licensor's proprietary rights; (vii) provide, copy, transmit, disclose, divulge or make the Software or Documentation available to, or permit the use of the Software by, any third party or on any machine except as expressly authorized by this Agreement; or (viii) use, or permit the use of, the Software in a manner that would result in the production of a copy of the Software by any means whatsoever other than what is permitted in this Agreement. Licensee may make one copy of the Software to be used solely for archival, back-up, or disaster recovery purposes; provided that Licensee may not operate that copy of the Software at the same time as the original Software is being operated. Licensee may make as many copies of the Documentation as it may reasonably require for the internal use of the Software.

4.3. Unless otherwise authorized by Tait in writing, Licensee will not, and will not enable or allow any third party to: (i) install a copy of the Software on more than one unit of a Designated Product; or (ii) copy or transfer Software installed on one unit of a Designated Product to any other device. Licensee may temporarily transfer Software installed on a Designated Product to another device if the Designated Product is inoperable or malfunctioning. Temporary transfer of the Software to another device must be discontinued when the original Designated Product is returned to operation and the Software must be removed from the other device.

4.4. Licensee will maintain, during the term of this Agreement and for a period of two years thereafter, accurate records relating to this license grant to verify compliance with this Agreement. Tait, or a third party nominated by Tait, may inspect Licensee's premises, books and records, upon reasonable prior notice to Licensee, during Licensee's normal business hours and subject to Licensee's facility and security regulations. Tait is responsible for the payment of all expenses and costs of the inspection, provided that Licensee shall indemnify Tait for all costs (including audit costs and legal costs on a solicitor client basis) if Licensee has breached the terms of this Agreement. Any information obtained by Tait during the course of the inspection will be kept in strict confidence by Tait and used solely for the purpose of verifying Licensee's compliance with the terms of this Agreement.

Section 5 OWNERSHIP AND TITLE

Tait, its licensors, and its suppliers retain all of their Intellectual Property Rights in and to the Software and Documentation, in any form. No rights are granted to Licensee under this Agreement by implication, estoppel or otherwise, except for those rights which are expressly granted to Licensee in this Agreement. All Intellectual Property developed, originated, or prepared by Tait in connection with providing the Software, Designated Products, Documentation, or related services, remains vested exclusively in Tait, and Licensee will not have any shared development or other Intellectual Property Rights.

Section 6 LIMITED WARRANTY; DISCLAIMER OF WARRANTY

6.1. The commencement date and the term of the Software warranty will be a period of one (1) year from Tait shipment of the Software. If Licensee is not in breach of any obligations under this Agreement, Tait warrants that the unmodified Software, when used properly and in accordance with the Documentation and this Agreement, will be free from a reproducible defect that eliminates the functionality or successful operation of a feature critical to the primary functionality or successful operation of the Software. Whether a defect has occurred will be determined solely by Tait. Tait does not warrant that Licensee's use of the Software or the Designated Products will be uninterrupted, error-free, completely free of Security Vulnerabilities, or that the Software or the Designated

Products will meet Licensee's particular requirements. Tait makes no representations or warranties with respect to any third-party software included in the Software.

6.2 Tait sole obligation to Licensee, and Licensee's exclusive remedy under this warranty, is to use reasonable efforts to remedy any material Software defect covered by this warranty. These efforts will involve either replacing the media or attempting to correct significant, demonstrable program or documentation errors or Security Vulnerabilities. If Tait cannot correct the defect within a reasonable time, then at Tait option, Tait will replace the defective Software with functionally equivalent Software, license to Licensee substitute Software which will accomplish the same objective, or terminate the license and refund Licensee's paid license fee. If Tait investigation of the perceived defect reveals that no such defect in fact exists, Tait may recover its costs in respect of such investigation from Licensee.

6.3. Tait disclaims any and all other warranties relating to the Software or Documentation other than the express warranties set forth in this Section 6. Warranties in Section 6 are in lieu of all other warranties whether express or implied, oral or written, and including without limitation any and all implied warranties of condition, title, non-infringement, merchantability, or fitness for a particular purpose or use by Licensee (whether Tait knows, has reason to know, has been advised of, or is otherwise aware of any such purpose or use), whether arising by law, by reason of custom or usage of trade, or by course of dealing. In addition, Tait disclaims any warranty to any person other than Licensee with respect to the Software or Documentation.

Section 7 TRANSFERS

7.1. Licensee will not transfer the Software or Documentation to any third party without specific prior written consent from Tait. Tait may withhold such consent or at its own discretion make the consent conditional upon the transferee paying applicable license fees and agreeing to be bound by this Agreement.

7.2. In the case of a value-added reseller or distributor of Tait Designated Products, the consent referred to in Section 7.1 may be contained in a Tait Reseller or Tait Distributor Agreement.

7.3. If the Designated Products are Tait vehicle-mounted mobile products or hand-carried portable radio products and Licensee transfers ownership of the Tait mobile or portable radio products to a third party, Licensee may assign its right to use the Software which is embedded in or furnished for use with the radio products and the related Documentation; provided that Licensee transfers all copies of the Software and Documentation to the transferee.

7.4. For the avoidance of any doubt, Section 7.3 excludes TaitNet Infrastructure, or the products listed at any time under network products at: http://www.taitradio.com.

7.5. If Licensee, as a contractor or subcontractor (integrator), is purchasing Tait Designated Products and licensing Software not for its own internal use but for end use only by a Customer, the Licensee may transfer such Software, but only if a) Licensee transfers all copies of such Software and the related Documentation to the transferee and b) Licensee has first obtained from its Customer (and, if Licensee is acting as a subcontractor, from the interim transferee(s) and from the ultimate end user sub license) an enforceable sublicense agreement that prohibits any other transfer and that contains restrictions substantially identical to the terms set forth in this Software License Agreement. Except as stated in the foregoing, Licensee and any transferee(s) authorised by this Section may not otherwise transfer or make available any Tait Software to any third party nor permit any party to do so. Licensee will, on request, make available evidence reasonably satisfactory to Tait demonstrating compliance with all the foregoing.

Section 8 TERM AND TERMINATION

8.1. Licensee's right to use the Software and Documentation will commence when the Designated Products are supplied by Tait to Licensee and will continue for the life of the Designated Products with which or for which the Software and Documentation are supplied, unless Licensee breaches this Agreement, in which case this Agreement and Licensee's right to use the Software and Documentation may be terminated immediately upon notice by Tait.

8.2. Within thirty (30) days after termination of this Agreement, Licensee must certify in writing to Tait that all copies of the Software have been removed or deleted from the Designated Products and that all copies of the Software and Documentation have been returned to Tait or destroyed by Licensee and are no longer in use by Licensee.

8.3. Licensee acknowledges that Tait made a considerable investment of resources in the development, marketing, and distribution of the Software and Documentation and that Licensee's breach of this Agreement will result in irreparable harm to Tait for which monetary damages would be inadequate. If Licensee breaches this Agreement, Tait may terminate this Agreement and be entitled to all available remedies at law or in equity including immediate injunctive relief and repossession of all non-embedded Software and associated Documentation. Licensee shall pay all Tait costs (on an indemnity basis) for the enforcement of the terms of this Agreement.

Section 9 CONFIDENTIALITY

Licensee acknowledges that the Software and Documentation contain proprietary and Confidential Information valuable to Tait and are Tait trade secrets, and Licensee agrees to respect the confidentiality of the information contained in the Software and Documentation.

Section 10 LIMITATION OF LIABILITY

10.1. In no circumstances shall Tait be under any liability to Licensee, or any other person whatsoever, whether in Tort (including negligence), Contract (except as expressly provided in this Agreement), Equity, under any Statute, or

otherwise at law for any losses or damages whether general, special, exemplary, punitive, direct, indirect, or consequential arising out of or in connection with any use or inability of using the Software.

10.2. Licensee's sole remedy against Tait will be limited to breach of contract and Tait sole and total liability for any such claim shall be limited at the option of Tait to the repair or replacement of the Software or the refund of the purchase price of the Software.

Section 11 GENERAL

11.1. COPYRIGHT NOTICES. The existence of a copyright notice on the Software will not be construed as an admission or presumption of publication of the Software or public disclosure of any trade secrets associated with the Software.

11.2. COMPLIANCE WITH LAWS. Licensee acknowledges that the Software may be subject to the laws and regulations of the jurisdiction covering the supply of the Designated Products and will comply with all applicable laws and regulations, including export laws and regulations, of that country.

11.3. ASSIGNMENTS AND SUBCONTRACTING. Tait may assign its rights or subcontract its obligations under this Agreement, or encumber or sell its rights in any Software, without prior notice to, or consent of, Licensee.

11.4. GOVERNING LAW. This Agreement shall be subject to and construed in accordance with New Zealand law and disputes between the parties concerning the provisions hereof shall be determined by the New Zealand Courts of Law. Provided however Tait may at its election bring proceedings for breach of the terms hereof or for the enforcement of any judgment in relation to a breach of the terms hereof in any jurisdiction Tait considers fit for the purpose of ensuring compliance with the terms hereof or obtaining relief for breach of the terms hereof.

11.5. THIRD-PARTY BENEFICIARIES. This Agreement is entered into solely for the benefit of Tait and Licensee. No third party has the right to make any claim or assert any right under this Agreement, and no third party is deemed a beneficiary of this Agreement. Notwithstanding the foregoing, any licensor or supplier of third-party software included in the Software will be a direct and intended third-party beneficiary of this Agreement.

11.6. SURVIVAL. Sections 4, 5, 6.3, 7, 8, 9, 10, and 11 survive the termination of this Agreement.

11.7. ORDER OF PRECEDENCE. In the event of inconsistencies between this Agreement and any other Agreement between the parties, the parties agree that, with respect to the specific subject matter of this Agreement, this Agreement prevails.

11.8. SECURITY. Tait uses reasonable means in the design and writing of its own Software and the acquisition of third-party Software in order to limit Security Vulnerabilities. While no software can be guaranteed to be free from Security Vulnerabilities, if a Security Vulnerability is discovered, Tait will take the steps specified in Section 6 of this Agreement.

11.9. EXPORT. Licensee will not transfer, directly or indirectly, any Designated Product, Documentation or Software furnished hereunder or the direct product of such Documentation or Software to any country for which New Zealand or any other applicable country requires an export license or other governmental approval without first obtaining such license or approval.

11.10. SEVERABILITY. In the event that any part or parts of this Agreement shall be held illegal or null and void by any court or administrative body of competent jurisdiction, such determination shall not affect the remaining terms which shall remain in full force and effect as if such part or parts held to be illegal or void had not been included in this Agreement. Tait may replace the invalid or unenforceable provision with a valid and enforceable provision that achieves the original intent and economic effect of this Agreement.

11.11. CONSUMER GUARANTEES. Licensee acknowledges that the licenses supplied in terms of this agreement are supplied to Licensee in business, and that the guarantees and other provisions of prevailing consumer protection legislation shall not apply.

11.12. WHOLE AGREEMENT. Licensee acknowledges that it has read this Agreement, understands it and agrees to be bound by its terms and conditions. Licensee also agrees that, subject only to the express terms of any other agreement between Tait and Licensee to the contrary, this is the complete and exclusive statement of the Agreement between it and Tait in relation to the Software. This Agreement supersedes any proposal or prior agreement, oral or written, and any other communications between Licensee and Tait relating to the Software and the Designated Products.