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QSM OEM
MODULES
INSTRUCTION MANUAL

REVISION HISTORY

Revision	Changes	Date
O/I	Original Issue	4/9/2021
A	Add FCC warning statements	1/26/2022
B	Change FCC warning statements section to "Regulatory Compliance Information"	10/1/2023

Contents

Section 1: QSM OEM Modules Overview

Description

The QSM is an OEM modular RF modem for users who need low power and small size with serial communications. There are four versions of the QSM modem; a transceiver without power supply module (QSMA), a receiver only version (QSMR), a transmitter only version with power supply module (QSMT), and a transceiver with power supply module (QSMX). The QSMA and QSMR units are rough half the height of the QSMT and QSMX units, since there is not a power supply module. For the QSMA, the OEM developer will be required to include the robust low voltage dropout power supply circuitry on their PCB design. The modems are equipped with an RS-485 communications port, which is a simple, low-cost interface, utilizing few components and allows for daisy-chaining multiple units. The modems are capable of transmitting and/or receiving SEIWG-005 data messages, which include a distinct ID and status code, over a selectable frequency range. The frequency is selected via a synthesizer control circuit, providing a section of up to 1600 RF channels, depending on the chosen band. The modems are available in Low Band, Mid Band, and High Band models, having the following frequency ranges:

LOW BAND	MID BAND	HIGH BAND
Channel 001 = 138.025 MHz	Channel 001 = 154.005 MHz	Channel 320* = 164.000 MHz
Channel 640 = 154.000 MHz	Channel 860 = 158.300 MHz	Channel 1920 = 174.000 MHz
Channel Spacing: 25 kHz	Channel Spacing: 5 kHz	Channel Spacing: 6.25 kHz
Channels: 0 to 640	Channels: 0 to 860	*Channels: 320 to 1920

Model Numbers

MODULE	DESCRIPTION	PART NUMBERS
QSMA	Transceiver	10D3600-L, -M, OR –H
QSMR	Receiver	10D3605-L, -M, OR –H
QSMT	Transmitter with Power Supply	10D3610-L, -M, OR –H
QSMX	QSMA with Power Supply	10D3615-L, -M, OR –H

Note: -L, -M and -H refer to the frequency band

Design Specifications

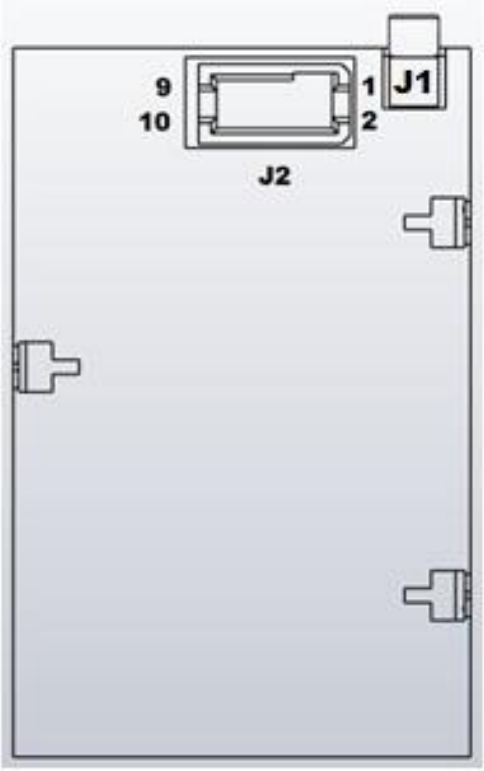
Power Requirements

	QSMA*	QSMR	QSMT	QSMX
TRANSMIT	6.0 VDC	N/A	4.5 VDC	4.5 VDC
RECEIVE	4.5 VDC	4.5 VDC	N/A	4.5 VDC

* OEM developer will be required to include the robust low voltage dropout power supply circuitry on their PCB design.

Connections

Connections to the modems can be made by connecting to the J2 header, and the J1 MMCX antenna jack.



J1 – Antenna

MMCX JACK 50 ohm

Note: Optional 10D1984 MMCX to TNC 5" Cable available

Qual-Tron offers an MMCX to TNC cable (10D1984), but any industry-standard, gold-plated MMCX plug should mate to the jack adequately. Carefully aligning and gently rotating the MMCX RF plug in the jack helps reduce both the possibility of damage to either connector, as well as the force required to connect or disconnect.

J2 – Header

The header used on the modems is SAMTEC part TFM-105-XX-X-D. The recommended mate is SFM-105-T2-L-D-P from SAMTEC. These are 2 x 5 pin headers, with a 50-mil pitch.

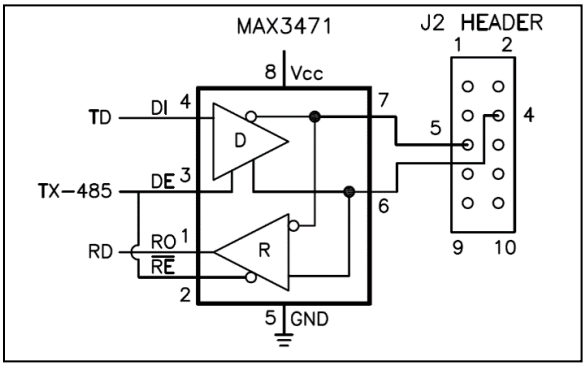
Pin #	QSM J2 Pin Description
1, 2	Vin [Input] **QSMA**: 6.0 to 16.5 VDC 1.5 A Peak **QSMR:** 4.5 to 16.5 VDC 1.5 A Peak **QSMT:** 4.5 to 16.5 VDC 1.5 A Peak **QSMX:** 4.5 to 16.5 VDC 1.5 A Peak
3	Transmit Enable [Output] Active low
4	RS485 A
5	RS485 B
6	NC
7	RSSI (Chan Active Noise > Chan Active Thresh)
8	/Data Available
9, 10	GND

RS485

The QSM is equipped with RS485.

Note: Sometimes RS485 devices are marked with the polarity reversed from normal RS485 standards. If a new or unknown device cannot communicate, try reversing the differential lines usually marked A & B.

The serial RS485 I/O driver IC used by Qual-Tron is a MAXIM part. The part number is MAX3471EUA+. If the customer also includes this IC from MAXIM in their design, connect pin 6 of the IC to pin J2-4, and connect pin 7 to pin J2-5.



Current Draw Approximations

Mode	Current	Comments
Sleep	10uA typ	QSM wakes up on RS485 bus activity
Active	.3mA typ	Receiver off / Microprocessor on
Transmission (1.3Watt)	77.2ms @ A / 6.5VDC	Packet length/Pulse current provided by user
Receiver On (10mA)	90mW typ @ 4.5VDC 99mW typ @ 16.0VDC	Receiver on – Waiting for valid RF message
Receiver Active	10.5mA @9.0V	RF message received – Microprocessor on

Features

- ID Code Selection 000-999 for EMIDS and SNIPER, 000-063 for all other formats
- Directional, sensor fault, low battery, tamper, and test status codes for EMIDS format
- Able to receive and/or transmit MIDS 20-bit or MMIDS / EMIDS 29-bit messages depending on unit's capabilities.
- SNIPER message type (0010) 86-bit message 77.2ms
- MMCX antenna port matched to 50 ohms
- Conformal-coated and shielded circuit assembly

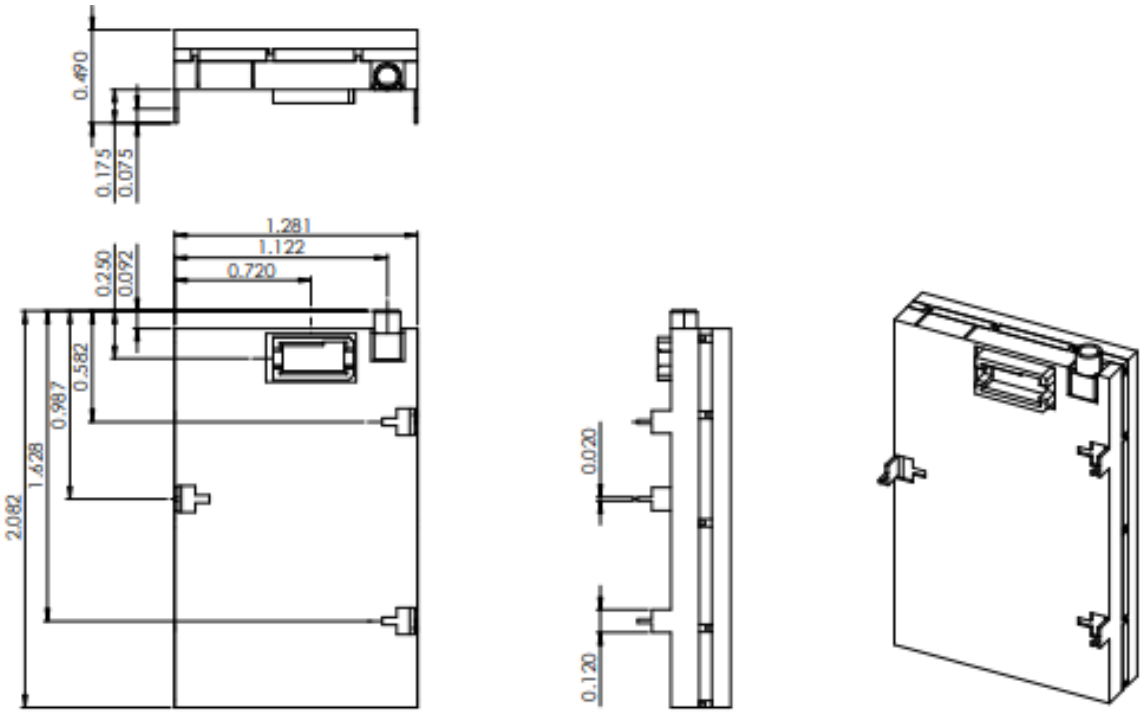
Physical Characteristics

QSM OEM modules are light-weight and come in a compact size. This makes them ideal for mobile applications as well as applications with tight space constraints.

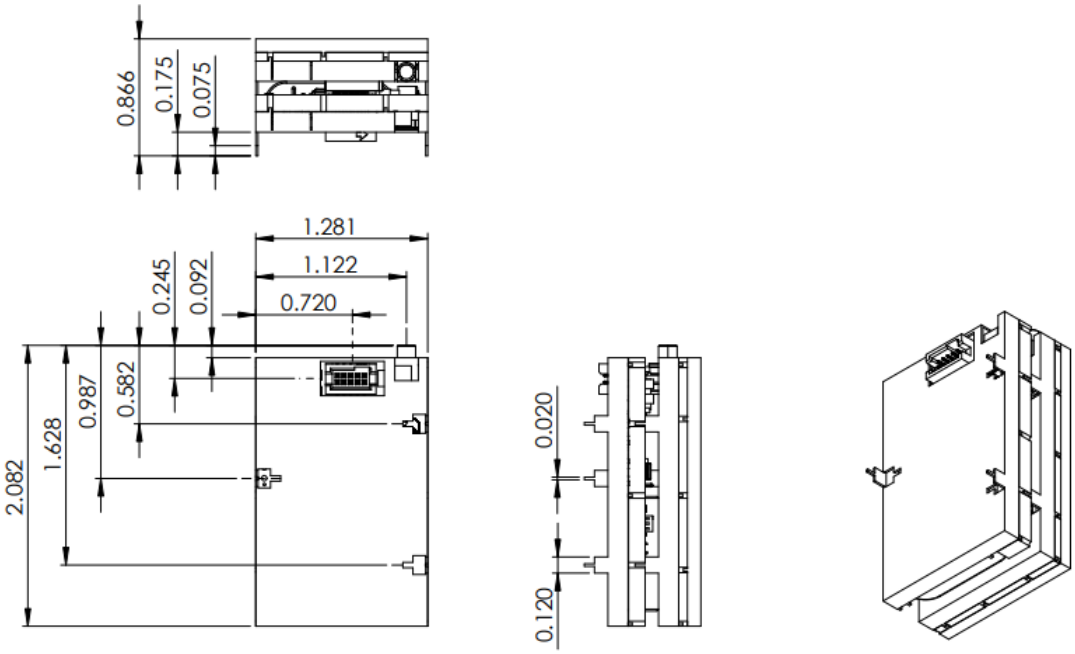
	QSMA/QSMR	QSMT/QSMX
Height	1.0 cm (0.4 in)	2.3 cm (0.9 in)
Length	5.3 cm (2.1 in)	5.3 cm (2.1 in)
Width	3.3 cm (1.3 in)	3.3 cm (1.3 in)

Mechanicals

QSMA and QSMR



QSMT and QSMX



Section 2: Operation

Modem Operation

1. Open a serial communication program such as HyperTerminal
2. Supply power to the modem.
   Note: A USB to RS485 cable (QTI P/N 10D1978) is available to connect a computer directly to a modem, if using a QSMT or QSMX, you can run the units off USB power. Otherwise, follow the limits given in the Power Requirements in Section 1.
3. Configure the COM Port
   - Baud: 38.4k
   - Parity: None
   - Data bits: 8
   - Stop bits: 1
   - Flow control: None
   - Echo typed characters locally
   - Append line feeds to incoming line ends

Start Up

When the modem is initially powered on, the firmware version information is sent.

For example, "QSM 5177 1903". (See the **VER** command in section 3, Command List, for more information)

Receiving and Transmitting

During normal operation, depending on the model, the modem is capable of sending and/or receiving SEIWG-005 messages via the serial port and frequency setting. The modem assumes a low power mode when not in use.

Items Required

- DC Power Source Minimum:
  - QSMA – Transmit: 6V, Receive: 4.5V
  - QSMR/QSMT/QSMX can all run off 4.5V for transmit and/or receive.
- DC Power Source Maximum: 16.5V max for all modems
- 10-pin connector to RS485 USB cable (QTI Part # 10D1978)
- Serial Communications Program such as HyperTerminal or Tera Term

Setup

Once communications have been established to the modem, it's ready to be configured.

IMPORTANT: With each command sent, it's important to verify that the QSM returns the command sent with "OK" appended to it. For example: "*SEC 0 OK*". This lets the user know that the QSM processed the message. If not, then resend the command.

IMPORTANT: Once the configuration changes are complete, SAV must be sent to the QSM to save them permanently. If not, then the values will revert to previous values when the QSM is power cycled.

1. Set the desired Channel (Default 320)

   This is accomplished with the

   - CHR XXX command for setting the Receive channel
   - CHT XXX command for setting the Transmit channel

   Where XXX refers to the desired channel (1-999)

   For example: Use CHR if the modem is a QSMA, QSMR, or QSMX,

   Type CHR 230 and press ENTER.

   Once the QSM processes the message it will confirm that the change was made by returning

   CHR 230 OK.

2. If the modem is a receiver, it needs to be enabled.
   a. Type RCV 1 and press ENTER
   b. Wait for the QSM to respond with RCV 1 OK

   Note: Transmit is always enabled with the QSMA, QSMT and QSMX

3. Enable Push to send messages out serial port, or disable in order to poll for messages. (Default PSH 1)
   a. Type PSH 1 and press ENTER
   b. Wait for the QSM to respond with PSH 1 OK

Note: Sending the command without the value will prompt the QSM to send you it's current setting.

For example: Type PSH and press ENTER. The QSM will respond with PSH X, where X represents the actual value, in this case 1.

For more commands, see topic COMMAND LIST in this document.

RF Link

The operational range of the RF link is dependent upon various conditions. The high frequency of the RF link works best under line of sight conditions. It's important to test for a suitable range in the target environment.

NOTE: Elevating an antenna will increase transmission and/or reception range significantly. The use of relays/repeaters can also be used to increase transmission ranges. Also, transmitting and receiving antennas should both point in the same direction (typically up) so they have the same polarization.

Section 3: Serial Interface

The modems default to low power mode with the receiver still operating. If push is enabled "PSH 1", the modem will send the message out the serial port upon receiving an RF message, and then return to low power mode. If push is disabled "PSH 0", and a new message is received, the modem will send its RS485 ID. (*See the SID command)* This is used to wake-up the user's application processor. Once awake, the user can poll to get the new message. *(See the NEW command)* The modem communicates over RS485, all commands must be followed by a carriage return (<CR>). Settings are only retained until power is turned off, unless the SAV command is used to store them to the unit's flash memory. When sending commands and queries, a two-digit hexadecimal checksum (cs) can be used to verify data integrity. Refer to the **Checksum** section after the Command List for more information. It is also strongly recommended to check the response to make sure the unit received the command correctly.

Settings

COM Port Settings

- Baud: 38.4k
- Parity: None
- Data bits: 8
- Stop bits: 1

If a terminal emulator is being used, be sure to set the following parameters properly:

- Flow control: None
- Echo typed characters locally
- Append line feeds to incoming line ends

Message Serial Format

Decoded message is sent via RS-485:

RXM *TT III SS R*<CR> - Received message

TXM *TT III SS*<CR> - Transmitted message

TT = Message Type, *III* = ID code, and *SS* = status code; TT and SS are hexadecimal, and III is decimal. R is the receive signal strength indicator; see RSS command.

Example: TXM 0D 244 0B

Message sent by user – Transmits message type "EMIDS" with an ID code of 244 and a status code of TEST, FAULT.

Message Type (TT)

The message type consists of two (2) hexadecimal characters. The first character shows the parity; the most significant bit will be set if the parity is bad. The second character identifies the type.

NOTE: TRSS and REMBASS message formats available upon request.

Message Type Table

Message Type	Good Parity	Bad Parity
MIDS	07h	87h
EMIDS	0Dh	8Dh
SNIPER	02h	82h

STATUS CODE	ALARM	TAMP/TEST	LOBATT	R>L	L>R	MEANING
00	0	0	0	0	0	RESERVED
01	0	0	0	0	1	RESERVED
02	0	0	0	1	0	RESERVED
03	0	0	0	1	1	FAULT
04	0	0	1	0	0	RESERVED
05	0	0	1	0	1	RESERVED
06	0	0	1	1	0	RESERVED
07	0	0	1	1	1	FAULT, LOBATT
08	0	1	0	0	0	TEST
09	0	1	0	0	1	RESERVED
0A	0	1	0	1	0	RESERVED
0B	0	1	0	1	1	TEST, FAULT
0C	0	1	1	0	0	TEST, LOBATT
0D	0	1	1	0	1	RESERVED
0E	0	1	1	1	0	RESERVED
0F	0	1	1	1	1	TEST, FAULT, LOBATT
10	1	0	0	0	0	ALARM
11	1	0	0	0	1	ALARM, L>R
12	1	0	0	1	0	ALARM, R>L
13	1	0	0	1	1	RESERVED
14	1	0	1	0	0	ALARM, LOBATT
15	1	0	1	0	1	ALARM, L>R, LOBATT
16	1	0	1	1	0	ALARM, R>L, LOBATT
17	1	0	1	1	1	RESERVED
18	1	1	0	0	0	TAMP
19	1	1	0	0	1	RESERVED
1A	1	1	0	1	0	RESERVED
1B	1	1	0	1	1	TAMP, FAULT
1C	1	1	1	0	0	TAMP, LOBATT
1D	1	1	1	0	1	RESERVED
1E	1	1	1	1	0	RESERVED
1F	1	1	1	1	1	TAMP, FAULT, LOBATT

Status Code Table

ID CODE (III)

The unit ID code consists of three (3) decimal characters, but only EMIDS messages use all three. MIDS, TRSS and REMBASS are limited to ID codes 000-063. EMIDS uses 000-999.

STATUS CODE (SS)

Status Codes depend upon the message format. MIDS has no status code, and these characters will always be 00. EMIDS status codes are listed in the previous table.

Serial Commands

Note: It is recommended that when using a processor to control the modem that the format described under ***Checksum*** be used. This format helps ensure data integrity by greatly reducing communication errors and is more robust for machine to machine (M2M) applications.

- Valid commands will return the command and the argument followed by the word "OK".
- Invalid commands return "SYNTAX ERROR".
- Invalid command arguments will return "ERR" at the end of the command and argument.
- Carriage Return represents end of line and causes the line to be processed.
- If command is given with "#" at the beginning, then a serial ID and two-digit checksum is expected before <CR>. Returned string has a checksum if checksum sent.
- Checksum is two's compliment of the command string (everything before checksum).
- A space is always included between the command and the argument: "CHR <space> 101. <CR>".

IMPORTANT: With each command sent, it's important to verify that the QSM returns the command sent with "OK" appended to it. For example: "*SEC 0 OK*". This lets the user know that the QSM processed the message. If not, then resend the command.

IMPORTANT: Once the configuration changes are complete, SAV must be sent to the QSM to save them permanently. If not, then the values will revert to previous values when the QSM is power cycled.

Command List

The current menu (without checksums) appears as follows:

Commands List	Description
CHR	Get/Set receive channel.
CHT	Get/Set transmit channel.
CMB	Clear message buffer.
CRF	Get receive channel in Hz.
CTF	Get transmit channel in Hz.
M2M	Get/Set Machine to Machine mode.
MFT	Get/Set Message Format
MSG	Get received message.
NEW	Get new messages.
PSH	Get/Set Push mode.
RCV	Get/Set Receive mode.

RSS	Get receive signal strength.
RST	Reset
RXM	Received Message Header
SAV	Save current parameters.
SID	Get/Set the RS485 ID.
SLP	Enter Sleep mode.
SRN	Get unit serial number.
TMP	Read temperature.
TXM	Transmit message.
VER	Show version.

Command List Instructions

CHR… Get/Set the receive channel. (Follow with SAV command.)

Z is the channel number, [1 = DEFAULT]:

Low Band 0-640; Mid Band 0-1600; High Band 0-1920

Get the channel:	CHR<CR>
Returns:	CHR *Z*<CR>
Set the channel:	CHR *Z*<CR>
Returns:	CHR *Z* OK<CR>
Invalid returns:	CHR *Z* ERR<CR>

CHT… Get/Set the transmit channel. (Follow with SAV command.)

Z is the channel number, [1 = DEFAULT]:

Low Band 0-640; Mid Band 0-1600; High Band 0-1920

Get the channel:	CHT<CR>
Returns:	CHT *Z*<CR>
Set the channel:	CHT *Z*<CR>
Returns:	CHT *Z* OK<CR>
Invalid returns:	CHT *Z* ERR<CR>

CMB… Clear Message Buffer; see MSG command.

Get the frequency:	CMB<CR>
Returns:	CMB OK<CR>

CRF… Get the receive channel as a frequency in Hz. (138000000-174000000)

Get the frequency:	CRF<CR>
Returns:	CRF *Z*<CR>

CTF… Get the transmit channel as a frequency in Hz. (138000000-174000000)

Get the frequency:	CTF<CR>
Returns:	CTF *Z*<CR>

M2M…Get/Set machine to machine mode (follow with SAV command).

In machine-to-machine mode all returned messages begin with '#' and end with the checksum before the <CR>. Commands can be issued without '#' and a checksum. ***No syntax errors are reported for unknown commands.***

Z = 0: OFF

Z = 1: ON [DEFAULT]

Get M2M mode:	M2M<CR>
Returns:	M2M *Z*<CR>
Set M2M mode:	M2M *Z*<CR>
Returns:	M2M *Z* OK<CR>
Invalid returns:	M2M *Z* ERR<CR>

MFT... Message Format – Output Version 040C and above

Get/Set Message Format. 0 is the standard output format. 1 is the MSCA Compatibility Output. Compatibility sends "ID XXX YY" where XXX = ID Code and YY = Status Code. This command should not be used, unless required. It can only output the QTI message format.

Z = 0: OFF [DEFAULT]

Z = 1: MSCA COMPATIBILITY MODE

Get a message:	MFT *Z*<CR>
Returns:	MFT Z OK<CR>
Invalid returns:	MFT *Z* ERR<CR>

MLS… MIDSCOMM Legacy Support

EMLS and MIDSCOMM are applications used to capture data from messages received. Some products do not support these GUIs directly. For legacy support, MLS must be set to "1".

Z = 0: OFF [DEFAULT]

Z = 1: EMLS/MIDSCOMM COMPATIBILITY MODE

Set MLS:	MLS *Z*<CR>
Returns:	MLS Z OK<CR>
Invalid returns:	MLS *Z* ERR<CR>

MSG… Recall a previous message.

Z (decimal 0-9) is the message with 0 being most recent message and 9 being the oldest message. If the requested message is empty, all the fields will return with zeros.

Returned values: TT (hexadecimal) is the message type, III (decimal) is the ID, SS (hexadecimal) is the status code, and R (decimal) is the RSSI. (See RSS command.)

Get a message:	MSG *Z*<CR>
Returns:	RXM TT III SS R<CR>
Invalid returns:	MSG *Z* ERR<CR>

NEW… Read new messages. Use when PUSH is OFF. This returns the oldest unread message. Send "NEW 1" to mark the message as read, so it will no longer be returned with the "NEW" command.

Note: This command can also be used if PUSH is enabled.

Returned values: TT (hexadecimal) is the message type, III (decimal) is the ID, SS (hexadecimal) is the status code, and R (decimal) is the RSSI.

Poll for a new message:	NEW<CR>
Returns:	RXM TT III SS R<CR>
If no new message Returns:	RXM<CR>
Mark message as read:	NEW 1<CR>
Returns:	NEW 1 OK<CR>

PSH… Get/Set to push new messages out the serial port.

Z = 2: ON (Pushes <CR><CR> prior to sending the new message) Version 0.2.8.A and above.

Z = 1: ON (New messages are pushed out the serial port when received.) [DEFAULT]

Z = 0: OFF (Master must poll for new messages – Receiver sends RS485 ID on receipt of new message when in power-down mode).

Get PUSH mode:	PSH<CR>
Returns:	PSH *Z*<CR>
Set PUSH mode:	PSH *Z*<CR>
Returns:	PSH *Z* OK<CR>
Invalid returns:	PSH *Z* ERR<CR>

RCV…Get/Set receive mode.

Z = 1: ON (receiver enabled) [DEFAULT]

Z = 0: OFF (receiver disabled)

Get receive mode:	RCV<CR>
Returns:	RCV *Z*<CR>
Set receive mode:	RCV *Z*<CR>
Returns:	RCV *Z* OK<CR>
Invalid returns:	RCV *Z* ERR<CR>

RSS… Get the receive signal strength indicator (RSSI). Returns a positive decimal number (0-9), where higher numbers indicate stronger signal. Good signal strength is 6+. If receiver is disabled, it returns 0 (min).

Note: This command immediately reads the RSSI value, which is useful to determine if a frequency is being used or jammed. The "MSG" command appends the RSSI value that occurred while receiving the message, which is useful in site selection and deployment.

Get RSSI:	RSS<CR>
Returns:	RSS *R*<CR>

RST… Reset the unit. On start-up, the MCDT outputs version.

Reset the unit:	RST<CR>
Returns:	RST OK<CR>

RXM… This is not a command. It is listed here for reference only. This is the header used when an RF message has been received. See Section 3 for more details.

Message Received:	RXM TT III SS R<CR>
Returns:	SYNTAX ERR

SAV… Save the current parameters in flash memory. Use this to store any parameter changes.

Save current settings:	SAV<CR>
Returns:	SAV OK MCDT<CR>

SID… Get/Set the RS-485 serial identifier. [T = DEFAULT]

Capital character (A-Z). All MCDT's will respond to X so it should not be used. The purpose and use of this command is described below in **Checksum**.

Get protection:	SID<CR>
Returns:	SID *Z*<CR>
Set protection:	SID *Z*<CR>
Returns:	SID *Z* OK<CR>
Invalid returns:	SID *Z* ERR<CR>

SLP… Shut down the serial port to conserve power. The MCDT goes to power-down mode immediately after returning the SLP OK command.

Note: To reactivate the serial port, send a carriage return or some other ASCII character. Use "SLP 0" when RS-485 bus is shared.

Enter low power mode:	SLP<CR>
Returns:	SLP OK<CR>
Enter low power mode:	SLP 0<CR>
Returns:	<Nothing returned>

SRN… Get the unit serial number.

The serial number is an integer from 0 to 65535.

Get serial number:	SRN<CR>
Returns:	SRN *Z*<CR>

TMP… Get the board temperature in degrees Celsius (decimal), with a tenth degree precision (250 = 25.0C).

Get temperature:	TMP<CR>
Returns:	TMP *Z*<CR>

TXM… Transmit Message

TT (hexadecimal) is the message type, III (decimal) is the ID, and SS (hexadecimal) is the status code.

Note: The only two allowed message types are MIDS (07h) or EMIDS (0Dh).

Send RF message:	TXM TT III SS<CR>

Returns:	TXM *TT III SS* OK<CR>
Invalid type returns:	TXM *TT III SS* ERR<CR>

VER… Get the unit version.

QSM is the model, <space>, VVVV is the firmware version (Major.Minor.Build.Rev), <space>, M is the message types supported (0 = standard [MIDS/EMIDS], 1 = custom), B is the frequency band (0 = low, 1 = mid, 2 = high), H is the hardware capabilities (1 = receive only, 2 = transmit only, 3 = both), R is the hardware board revision.

Get version:	VER<CR>
Returns:	QSM VVVV MBHR<CR>

Checksum

To use checksum, begin the command with "#" plus the unit serial ID and end the command with the calculated checksum (cs) value followed by the carriage return <CR>. A command with an invalid checksum or invalid serial ID is ignored and no reply is sent. The checksum is a 2 digit hexadecimal calculated as the 2's compliment of the sum of the command string including the "#" and serial ID.

Using the checksum also allows and requires using the serial ID. The universal serial ID is X, so all units will acknowledge these commands. The unit will respond with its specific serial ID.

Sample syntax:

Action	With Checksum	Without Checksum
Get receive channel:	#XCHRA8<CR>	CHR<CR>
Returns:	#ACHR *196*FF<CR>	CHR *196*<CR>
Set transmit channel to 2:	#XCHT *2*54<CR>	CHT *2*<CR>
Returns:	#ACHT *2* OKB1<CR>	CHT *2* OK<CR>

Note: "A" is just a sample serial ID, and may be different.

Example checksum calculator

```
char CRC2sComp( char *buffr, int end) {  //creates 2's complement
    int c;
    int calcSum = 0;
    for( c = 0; c <= end; c ++ )
    {   calcSum += buffr[c];  }
    calcSum ^= 0xFF;          //1's complement
    calcSum += 1;    //now 2's complement
```

```
    return (char)(calcSum);
}
```

Example:

Line to send is "#ACHR 597<CR>"

Convert characters to ASCII values:

(35) + A (65) + C (67) + H (72) + R (82) + <sp> (32) + 5 (53) + 9 (57) + 7 (55)

NOTE: <CR> is not included in calculation.

Sum: 35+65+67+72+82+32+53+57+55 = 518T (206h)

1's Complement is bit inversion: = [10 0000 0110] → [01 1111 1001] = 1F9h

2's complement is adding 1 to the 1's complement: 1F9 + 1 = 1FAh

Drop anything higher than the lowest 8 bits: [1 1111 1010] → [1111 1010] = FAh

The result is FAh, so send line as "#ACHR 597FA<CR>"

Note: Adding the checksum will result in zero for the low byte. (206h + FAh = 300h)

Section 4: Warranty

A. DEPOT MAINTENANCE:

Upper echelon maintenance will be performed by the supplier of the equipment. If the equipment is beyond the user capability to repair, it can be returned to the supplier for test and evaluation. Upon completion of the inspection, the supplier will notify the user if the unit can be repaired. If the equipment is not covered by the warranty an estimate will be provided for repair costs. If the equipment is not repairable, the supplier will specify replacement costs. (NOTE: See warranty below for procedures for items under warranty.)

B. EQUIPMENT STORAGE:

Upon return to the facility, clean equipment as noted in operator maintenance above. After cleaning, return the equipment to the storage cases. Store equipment in a dry, room-temperature environment.

C. WARRANTY:

Qual-Tron, Inc. guarantees all products to be free from defects in materials and workmanship for 12 months from the date of purchase. Damage due to misuse, accidents, lightning strikes, unauthorized

service, environmental conditions beyond the equipment specifications, acts of war or damage other than fair, wear and tear is excluded from this warranty.

D. RETURN PROCEDURES:

For support and service, please contact the following. To return any material, contact

Qual-Tron, Inc. to receive a Return Material Authorization (RMA) number. Once an RMA number has been assigned, ship the material to the address below and reference the RMA number on the packing slip. Qual-Tron will return the equipment as quickly as possible to the user.

QUAL-TRON, INC.
Attn: Sales
9409 East 55th Place
Tulsa, OK 74145

Phone: 918-622-7052
Fax: 918-664-8557
Email: sales@qual-tron.com

Section 5: Regulatory Compliance Information:

FCC Licensing

Federal law generally prohibits radio broadcasts without a license issued by the FCC. Anyone found operating a radio station without FCC authorization can be subject to a variety of enforcement actions, including seizure of equipment, fines and other civil and criminal penalties.

RF Exposure

To satisfy FCC RF exposure requirements for mobile and base station transmission devices, a separation distance should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This device is approved with emissions having a source-based time-averaging duty factor not exceeding 50%.

Transmission distances by antenna gain:

2.15 dBi	20.71 cm (8.15 inches)
10 dBi	52 cm (20.47 inches)

OEM Labeling Requirements for End-Product

The module is labeled with its own FCC ID Number. The FCC ID Numbers are not visible when the module is installed inside another device. As such, the end device into which the module is installed must display a label referring to the enclosed module. The final end product must be labeled in a visible area with the following:

10D2600-L (QSM-LB), 10D2600-M (QSM-MB), 10D3600-L (QSMA-LB), 10D3600 (QSMA-MB),

10D3800-L (LPM-LB), 10D3800-M (LPM-MB), 10D3810-L (LPM+-LB), 10D3810-M (LPM+-MB)

"Contains Transmitter Module FCC ID: OGE-QSM" or "Contains FCC ID: OGE-QSM"

Antennas

The manufacturer does not specify an antenna. A typical antenna for this type of radio in mobile service would have a gain of 0 to 2 dBi.

OEM End-Product User Manual Statements

The OEM integrator should not provide information to the end user regarding how to install or remove this RF module or change RF related parameters within the user manual of the end product.

FCC Warning Statements

FCC Part 15.19 Warning Statement- (Required for all Part 15 devices)

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

FCC Part 15.21 Warning Statement-

NOTE: THE GRANTEE IS NOT RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

FCC Part 15.105(b) Warning Statement- (ONLY Required for 15.109-JBP devices)

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.