



# ASM-MTR138-000GNW

## Mission Transceiver Remote



## INSTALLATION AND OPERATION MANUAL

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**Anodyne Electronics Manufacturing Corp.**

966 Crowley Ave Unit #100

Kelowna, BC, Canada.

V1Y 0L1

Telephone: +1-250-763-1088

Toll Free: +1-888-763-1088

Website: [www.aem-corp.com](http://www.aem-corp.com)

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## Section 1.0 Description

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### 1.1 Introduction

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Information in this section includes product description, design features and specifications for the MTR138-000GNW Mission Transceiver Remote, herein subsequently referred to as MTR138.

Review all notes, warnings, and cautions.

### 1.2 Product Description

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The MTR138 is a wideband and narrowband capable remote mount transceiver containing a synthesized Guard Receiver. The MTR138 is part of AEM's Mission Tactical Communication System (MTACS) family. Transceiver control is handled through discrete digital signals and an RS-422 interface bus. It operates over the 138 – 174 MHz frequency range with High (10W) and Low (1W) RF output power options. The transceiver provides CTCSS/CDCSS tone encoding/decoding.

The MTR138 is tray mounted and fastening of the transceiver is accomplished through a ¼ ATR style tray which provides easy installation and removal.

The MTR138-000GNW is not for distribution or sale within the United States of America or Canada and does not possess FCC or ISED Canada Certifications.



Figure 1: MTR138-000GNW in MTR-VT1 Mounting Tray

## 1.3 Design Features

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The MTR138 is a remote mount FM transceiver that supports 128 channels. Each channel's bandwidth can be individually set as wideband or narrowband. A channel's transmit and receive frequency can be set with a frequency increment of 2.5 kHz.

The MTR138 has no local user controls and is interfaced and controlled from an appropriately configured and attached device that adheres to the command-and-control protocol detailed in the Interface Control Data (ICD) document. The commands and queries listed in the ICD can be sent during runtime allowing for in flight modification and interrogation of MTR138 behaviour and channel configurations.

Detailed information about the features listed in the following subsections can be found in Section 3.0 Operation.

### 1.3.1 Transmit Features

---

The MTR138 can transmit in the 138.0000-173.9975 MHz frequency range with high and low TX power options. Transmissions can be performed using either simplex or Semi-Duplex modes, both of which support CTCSS and CDCSS tone encoding.

To prevent thermal overload during transmit or a stuck key condition, a Transmit timeout timer (TOT) has been incorporated. After 60 seconds of continuous transmission the transmit functionality will be inhibited and only re-activated after releasing and re-keying the Push to Talk (PTT).

### 1.3.2 Receive Features

---

The MTR138 can receive in the 138.0000-173.9975 MHz frequency range with CTCSS/CDCSS tone decoding.

The MTR138 can be set to continuously monitor a single channel or it can be placed in scanning mode which sequentially monitors multiple channels. These channels are classified as Scan List Channels or Priority Channels. To support prioritized scanning of channels, two priority channels and one home channel are supported. While operating in scanning mode, the MTR138 can be set to one of three different scan modes: List, Priority, or List + Priority.

### 1.3.3 Guard Receiver

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The MTR138 is equipped with an independent Guard Receiver that supports two programmable Guard channels. The Guard channels utilize the full feature set of regular channels.

The Guard Receiver works independently from the Main Transceiver and will route audio to the headset whenever a signal is present on the Guard channel, unless the Main Transceiver is transmitting. If signals are received on both the Main Transceiver and the Guard Receiver, then the demodulated audio from both channels will be summed and simultaneously routed to the headset.

### 1.3.4 Subaudible Signalling Tones

The MTR138 supports two types of in band signalling; Continuous Tone-Coded Squelch System (CTCSS) and Continuous Digital-Coded Squelch System (CDCSS). CTCSS encoding supports 50 different tone codes and CDCSS supports 106 different tone codes. Tones can be configured to be used in one of three modes of operation: ALL ON, TX ONLY or ALL OFF.

## 1.4 Specifications

All requirements and specifications relating to mechanical, electrical, or environmental performance can be found in the Declaration of Design and Performance document (MTR138-000GNW-618-0) listed in Section 2.11 Installation Drawings of this manual.

## 1.5 Product Approval/Certification

No formal certification sought.

Qualification to the Radio Technical Commission for Aeronautics (RTCA) document RTCA/DO-160G, and Telecommunications Industry Associate (TIA) document TIA-603-E as applicable.

## 1.6 Product Limitations

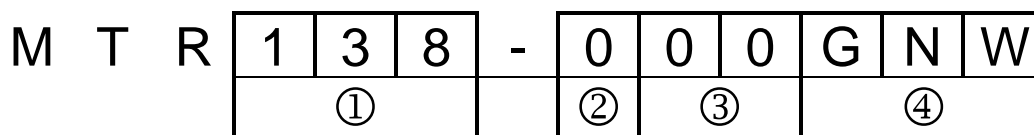
The MTR138 has a maximum low and high transmit power duty cycle of 4 min receive for every 1 min of transmit for 8 hours.

The MTR138 has a maximum high power duty cycle of 15 min receive for every 5 min of transmit for 1 hour.

The MTR138 is not for distribution or sale within the United States of America or Canada and does not possess FCC or Industry Canada Certification.

## 1.7 Unit Nomenclature

The product part number is defined as follows:



- ①: Frequency band: 138 = 138MHz – 174Mhz
- ②: Major Derivative Identifier: [0-9]
- ③: Minor Derivative Identifier: [0-99]
- ④: Options Configuration: GNW = w/ GUARD Receiver, Narrow-Band and Wide Band capable Across Entire Frequency Band

### End of Section 1.0

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## Section 2.0 Installation

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### 2.1 Introduction

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Information in this section consists of unpacking and inspection procedures, installation procedures, post-installation checks, and installation drawings.

### 2.2 Unpacking and Inspection

---

Unpack the equipment carefully. Inspect the unit visually for damage due to shipping and report all such claims immediately to the carrier involved. Note that each unit should have the following:

- MTR138-000GNW
- Acceptance Test Report
- Certificate of Conformity or Release Certification

Verify that all items are present before proceeding and report any shortage immediately to your supplier.

### 2.3 Warranty

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Please refer to the standard product warranty conditions available on our website, [www.aem-corp.com](http://www.aem-corp.com)

### 2.4 Installation Procedure

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#### 2.4.1 Warnings

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**WARNING:**

To limit exposure to radio frequency fields that exceed exposure limits for people occupying the aircraft, install the antenna such that it is mounted either on a ground plane that is between the antenna and the occupants of the aircraft, or further than 32 inches (80cm) from the occupants of the aircraft.

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## 2.4.2 Cautions

---

**CAUTION:**

Do not bundle any lines from this unit with transmitter coax lines.

Do not bundle any logic, audio, or DC power lines from this unit with 400Hz wiring or AC power lines.

Do not position this unit next to any device with a strong alternating magnetic field such as an inverter or significant interference to operation may occur.

In all installations, use shielded cable exactly as shown and ground as indicated.

Severe degradation of audio performance may result from incorrect wiring and shielding. This could cause higher crosstalk, hum, and ground-loop interference.

For maximum resistance to low frequency interference, make sure the case of the transceiver is electrically grounded. Ensure the transceiver and mounting tray are adequately bonded to the airframe chassis ground.

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## 2.4.3 Cabling and Wiring

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All wire shall be selected in accordance with the original aircraft manufacturer's Maintenance Instructions or AC43.13-1B Change 1, Paragraphs 11-76 through 11-78. Unshielded wire types shall qualify to MIL-W-22759 as specified in AC43.13-1B Change 1, Paragraphs 11-85, 11-86, and listed in Table 11-11. For shielded wire applications, use Tefzel MIL-C-27500 shielded wire with solder sleeves (for shield terminations) to make the most compact and easily terminated interconnect. Follow the Interconnect drawing in Section 2.11 Installation Drawings as required.

Coaxial cable shall be selected in accordance with MIL-C-17 unless otherwise specified. Do not use coax cable with PVC insulation. Teflon dielectric cable is encouraged at or above VHF frequencies or where cable runs exceed 8 feet. Note that at VHF frequencies, cables losses due to long cable runs and tight bends may reduce the ERP (Effective Radiated Power) by greater than 50%.

Allow 3" from the end of the shielded wiring to the shield termination to allow the connector hood to be easily installed. Refer to the interconnect drawing in Section 2.11 Installation Drawings for shield termination details. Note that the hood is a "clamshell" hood and is installed after the wiring is complete. Aircraft harnessing shall permit the unit to be removed for easy access.

Maintain wire segregation and route wiring in accordance with the original aircraft manufacturers Maintenance Instructions. Coaxial cables shall be routed separately from existing wire bundles in the aircraft to minimize electromagnetic coupling effects.

Unless otherwise noted, all wiring shall be a minimum of 22 AWG, except power and ground lines, which shall be a minimum of 20 AWG. Reference the Interconnect drawing for additional specifications. Check that the ground connection is clean and well secured, and that it shares no path with any electrically noisy aircraft accessories such as blowers, turn and bank instruments or similar loads. Power to this unit must be supplied from a separate circuit breaker or fuse (fast blow), and not attached to any other circuit breaker without additional protection.

Verify that the selected circuit breaker size and wire gauge are adequate for the installation using the techniques specified in AC43.13-1B Change 1, Paragraphs 11-47 through 11-51 and 11-66 through 11-69.

## 2.5 Mechanical Installation

### 2.5.1 MTR-VT1 Mounting Tray to Airframe Installation Procedure

Attach the MTR-VT1 mounting tray to the airframe using the counter sunk mounting screws listed in Section 2.9 Accessories Required but Not Supplied. Ensure that aircraft manufacturers installation instructions are followed, and the tray is electrically bonded to the air frame. Reference Section 2.6.2 for details on bonding requirements.

### 2.5.2 MTR138 to MTR-VT1 Mounting Tray Installation Procedure

Referencing Figure 2: Mounting Tray Rear View and Figure 3: Mounting Tray Side View, insert the radio into the hold down foot of the tray. Ensure the radio contacts the hold down foot and is centred along the length of the tray. The radio is correctly inserted when a small amount of hand pressure is required on top of the radio to hold it against the base of the tray; this preload assists in retaining the radio.



Figure 2: Mounting  
Tray Rear View



Figure 3: Mounting Tray Side View

Self-Locking Retainer

Hold Down Foot

Tighten the self-locking retainer until finger tight and then complete an additional half rotation with an 11/16" open-end wrench.

### 2.5.3 Antennas

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Proper antenna installation is vital to ensure reliable operation of the MTR138 and the aircraft. For best results the following should be taken into consideration where applicable:

- a) The aircraft manufacturers installation instructions are followed.
- b) The antennas are as widely separated as practically possible and clear of large aircraft obstructions.
- c) The antenna is mounted a minimum of 12 ft (3.6 m) or more from any navigation receiver antennas.
- d) The antenna is mounted a minimum of 4 ft (1.2 m) or more from communication and ELT antennas.
- e) The antenna is not mounted at distances from the communication, navigation or ELT antennas that are  $\frac{1}{4}$ ,  $\frac{1}{2}$ , or whole number multiples of the navigation or communications system wavelengths.
- f) Antennas of like frequencies are not in proximity.
- g) As much as practically possible, the antenna is not mounted near areas where contaminants such as fuel, dirt, oil, or water are likely to be present.

Best in-flight performance can be expected when the antenna is bottom mounted. This reduces signal degradation caused by the masking effects of the fuselage and stabilizers. Poor performance during ground testing may be observed for bottom mounted antennas. If desired, the antenna may be roof mounted when located near the rotor blades.

If undesired interferences are expected such as rotor modulation, coupling with audio systems, or fluctuation in instruments, it is required to provide a ground plane surface, for any blade or whip antennas, which has a minimum radius that is equal to the height of the antenna. Inadequate grounding can cause severe reflected power and high levels of Radio Frequency Interference (RFI) on the entire airframe.

## 2.6 Installation Checks

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### 2.6.1 Connection Checks

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**Do not connect the MTR138 to the wiring harness or antenna until the following conditions are met.**

Referencing the MTR138-000GNW-403 Interconnect drawing in Section 2.11 Installation Drawings, check the following:

- a) Check P1, pins 5 and 6 for +28 Vdc relative to ground
- b) Check P1, pins 8 and 20 for continuity to ground (less than 0.5  $\Omega$ ).
- c) With the antenna disconnected, check the coaxial connection for continuity between the radio and antenna. Check that there is an open circuit between the center conductor and both the shield and to ground.
- d) Check all other connections to ensure that there are no unintended shorts or opens.

## 2.6.2 Bonding

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If required, bonding is normally achievable through the mounting points during installation of the product using conductive hardware. If the hardware and/or mounting location/surface is non-conductive, then the use of a bonding strap to an airframe ground point is required. The bonding strap should be as short as possible. If the product finish is non-conductive, recommend removing the finish around one of the mounting points. Treat the exposed metal areas with a protective, conductive coating.

The use of a milli-ohmmeter is recommended to verify bonding. Reference AC 43.13-1B Change 1, Section 15 for additional information.

## 2.6.3 Post-Installation Checks

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Ensure all connectors are tight and the mechanical installation is sound.

Check the antenna feedline at the MTR138 with a through-line wattmeter and suitable frequency elements to ensure correct antenna matching. Reflected power should be less than 10%. Anything higher should be investigated carefully, or RFI and system interference as well as possible radio damage may result. A Voltage Standing Wave Ratio (VSWR) measurement over 3.0:1 represents a significant loss in signal power to the antenna. Check that forward power is to specifications over the frequency band of the radio.

Power up the aircraft's systems and confirm normal operation of all functions of the MTR138. Refer to Section 3 (Operation) of this manual and the user manual of the attached controlling device for specific operational details.

- a) Check all transmit and receive functions, ensure proper adjustment of audio levels, and full range of volume is available through the appropriately configured and attached controlling device.
- b) Check Scanning operation.

**Note:** If receive audio cannot be heard, ensure the correct tone code is applied. Activate the squelch functionality of the MTR138 to override any applied tone squelch and/or set tones to ALL OFF using the appropriately configured and attached controlling device.

Upon satisfactory completion of all performance checks, make all required logbook entries, electrical load, weight and balance amendments and other documentation as required by your local regulatory agency before releasing the aircraft for service.

## 2.7 EMI Tests

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The purpose of this test is to identify any interference that the transceiver may cause to an aircraft system. The MTR138 should be tested in accordance with the aircraft Installation Approval Test Procedure or applicable Ground Flight test plan and the test results documented on the applicable record sheets. The MTR138-000GNW-634 Installation Approval Test Procedure is located in 2.11 Installation Drawings.

## 2.8 Adjustments and Connections

The MTR138 does not have any external adjustments that can be performed on the physical unit. All adjustments such as audio levels and operating mode can only be configured using the appropriately configured and attached controlling device.

## 2.9 Accessories Required but Not Supplied

An installation kit P/N MTR138-IKC (crimp), vertical mounting tray P/N MTR-VT1 and mounting hardware are required to complete the installation. The MTR138-IKC install kit consists of the following:

Qty	Description	Manufacturer	Mfr Part #	AEM Part #
1	D-Sub, Socket, 25 Crimp Housing	Amphenol	L177RR-B25S	20-21-025
25	Contact, Socket, Crimp, 20-24 AWG	N/A	MS39029/63-368	20-26-901
1	Field Serviceable BNC Coax Connector	Amphenol	31-202	20-51-001
1	Hood, Metal, D-Sub 25, w/Jackscrews	Conec	165X11629X	120-28-025
1	Cable Clamp, D-Sub	Conec	160X11189XE	120-30-015

Typical recommended mounting hardware consists of the following:

Qty	Description	Manufacturer	Mfr Part #	AEM Part #
2	Screw, #8-32, 100° countersink, 1.25" minimum length, 75 ksi minimum strength	N/A	N/A	N/A
2	Screw, #8-32, 100° countersink, 0.81" minimum length, 75 ksi minimum strength	N/A	N/A	N/A

## 2.10 Continued Airworthiness

Maintenance of the MTR138 Mission Transceiver Remote is 'on condition' only. Periodic maintenance of this product is not required.

## 2.11 Installation Drawings

DOCUMENT	REV	TYPE	SERIAL#
MTR138-000GNW-007-0 <sup>1</sup>	1.20	Interface Control Data	107208 - 119137
MTR138-000GNW-007-0 <sup>1</sup>	1.30	Interface Control Data	119138+
MTR138-000GNW-403-0	1.10	Interconnect Drawing	107208+
MTR138-000GNW-405-0	1.00	Connector Map	107208+
MTR138-000GNW-618-0	1.10	Declaration of Design and Performance	107208+
MTR138-000GNW-634-0	1.00	Installation Approval Test Procedure	107208+
MTR138-000GNW-922-0	1.00	Mechanical Installation	107208+
MTR-VT1-922-0	1.00	Mechanical Installation	107208+

**Section 2.0 Ends Following Above Documents**

<sup>1</sup> Document must be requested directly from AEM and is not included in this document.

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## Section 3.0 Operation

---

### 3.1 Introduction

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Information in this section consists of functional and operation procedures for the MTR138 Mission Transceiver Remote.

### 3.2 General

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Control of the MTR138 is achieved by an appropriately configured controlling device which is connected through an RS-422 interface. The supported command and control protocol is specified in the MTR138-000GNW-007 Interface Control Data (ICD) document (available upon direct request to AEM). In addition to the ICD, the operations manual of the appropriately configured controlling device should be consulted for all operational information.

### 3.3 Controls and Indicators

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The MTR138 has no operator accessible controls or indicators.

### 3.4 General Operational Features

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#### 3.4.1 System Start-up sequence

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The MTR138 start-up sequence that must be followed by the controlling device is listed in this section.

- a) (Optional) To verify the MTR138 is physically installed the controlling device can make use of the MTR138 active low output RT Installed pin. When the MTR138 and the controlling device are physically connected the MTR138 will pull the pin to ground. This allows the sensing of the MTR138 being physically connected but provides no operational status.
- b) The controlling device must turn ON the MTR138 by asserting the active low RT Power ON/OFF input pin. After a minimum delay of 300 ms communication between the controlling device and the MTR138 can begin.

The MTR138 is equipped with volatile memory for channel and operational configurations. This requires that all channel and operational configurations are sent during each start-up sequence. At minimum, the following commands must be sent during the start-up sequence:

- a) Power Up Reprogram (Must contain at least one channel).
- b) Channel Number.

All remaining run time configurable settings are not required to be sent as part of the start-up sequence, as the MTR138 is configured with default settings. It is recommended to send at minimum the following commands to ensure the desired operational settings are applied at start-up. There is no required command sequence.

- a) Primary Priority Channel
- b) Secondary Priority Channel
- c) Simplex/Duplex
- d) Guard Receiver Volume
- e) Sidetone & Level
- f) Main Receiver Volume
- g) Power Level
- h) Tone Status
- i) Scan Mode
- j) Switch Settings
- k) Mic Bias & Level
- l) Squelch

### **3.4.2 Channel Selection**

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The active channel can be set by using the Channel Number Command. All channel numbers (1-128) can be selected with this command.

### **3.4.3 Subaudible Tones**

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The MTR138 supports the use of both CTCSS tone and CDCSS tone codes. The tones and tone codes are set on a per channel basis with individual codes for transmit and receive. Each channel can use a combination of CTCSS or CDCSS tone codes. By using the Tone Status command, the subaudible tones can be used in one of three different Modes:

**ALL ON:** When the Tone Status is set to ALL ON, the MTR138 uses the channel specific tones when receiving and transmitting.

**TX ONLY:** When the Tone Status is set to TX ONLY, the MTR138 uses the channel specific tone only while transmitting.

**All OFF:** When the Tone Status is set to ALL OFF, the MTR138 does not use any tones for either transmitting or receiving.

### 3.4.3.1 CTCSS Sub-Audible Tones

The MTR138 can utilize the 50 CTCSS tone codes (38 standard and 12 extended tones) as defined below:

CTCSS Tones							
NUM	FREQ	NUM	FREQ	NUM	FREQ	NUM	FREQ
1	67	11	97.4	21	136.5	31	192.8
2	71.9	12	100	22	141.3	32	203.5
3	74.4	13	103.5	23	146.2	33	210.7
4	77	14	107.2	24	151.4	34	218.1
5	79.7	15	110.9	25	156.7	35	225.7
6	82.5	16	114.8	26	162.2	36	233.6
7	85.4	17	118.8	27	167.9	37	241.8
8	88.5	18	123	28	173.8	38	250.3
9	91.5	19	127.3	29	179.9		
10	94.8	20	131.8	30	186.2		
CTCSS Extended Tones							
39	69.3	42	171.3	45	189.9	48	206.5
40	159.8	43	177.3	46	196.6	49	229.1
41	165.5	44	183.5	47	199.5	50	254.1

Table 1: CTCSS Tone Codes

### 3.4.3.2 CDCSS Sub-Audible Tones

The MTR138 can utilize the 106 CDCSS tone codes (83 standard and 23 extended tones) as define below:

DCS Codes															
#	0nn	#	1nn	#	2nn	#	3nn	#	4nn	#	5nn	#	6nn	#	7nn
0	<b>023</b>	14	<b>114</b>	29	<b>205</b>	40	<b>306</b>	50	<b>411</b>	60	<b>503</b>	66	<b>606</b>	75	<b>703</b>
1	<b>025</b>	15	<b>115</b>	30	<b>223</b>	41	<b>311</b>	51	<b>412</b>	61	<b>506</b>	67	<b>612</b>	76	<b>712</b>
2	<b>026</b>	16	<b>116</b>	31	<b>226</b>	42	<b>315</b>	52	<b>413</b>	62	<b>516</b>	68	<b>624</b>	77	<b>723</b>
3	<b>031</b>	17	<b>125</b>	32	<b>243</b>	43	<b>331</b>	53	<b>423</b>	63	<b>532</b>	69	<b>627</b>	78	<b>731</b>
4	<b>032</b>	18	<b>131</b>	33	<b>244</b>	44	<b>343</b>	54	<b>431</b>	64	<b>546</b>	70	<b>631</b>	79	<b>732</b>
5	<b>043</b>	19	<b>132</b>	34	<b>245</b>	45	<b>346</b>	55	<b>432</b>	65	<b>565</b>	71	<b>632</b>	80	<b>734</b>
6	<b>047</b>	20	<b>134</b>	35	<b>251</b>	46	<b>351</b>	56	<b>445</b>			72	<b>654</b>	81	<b>743</b>
7	<b>051</b>	21	<b>143</b>	36	<b>261</b>	47	<b>364</b>	57	<b>464</b>			73	<b>662</b>	82	<b>754</b>
8	<b>054</b>	22	<b>152</b>	37	<b>263</b>	48	<b>365</b>	58	<b>465</b>			74	<b>664</b>		
9	<b>065</b>	23	<b>155</b>	38	<b>265</b>	49	<b>371</b>	59	<b>466</b>						
10	<b>071</b>	24	<b>156</b>	39	<b>271</b>										
11	<b>072</b>	25	<b>162</b>												
12	<b>073</b>	26	<b>165</b>												
13	<b>074</b>	27	<b>172</b>												
		28	<b>174</b>												
DCS Extended Codes															
83	<b>017</b>	87	<b>122</b>	89	<b>212</b>	96	<b>325</b>	99	<b>446</b>	104	<b>523</b>				
84	<b>036</b>	88	<b>145</b>	90	<b>225</b>	97	<b>332</b>	100	<b>452</b>	105	<b>526</b>				
85	<b>050</b>			91	<b>246</b>	98	<b>356</b>	101	<b>454</b>						
86	<b>053</b>			92	<b>252</b>			102	<b>455</b>						
				93	<b>255</b>			103	<b>462</b>						
				94	<b>266</b>										
				95	<b>274</b>										

Table 2: CDCSS Tone Codes

### 3.4.4 Simplex/Duplex

The MTR138 can operate in the Simplex or Semi-Duplex communication mode. This selection is global to all channels and is selected using the Simplex/Duplex command.

**Simplex:** The MTR138 transmits and receives on the set channel's receive frequency and utilizes the channel's receive sub-audible tones.

**Semi-Duplex:** The MTR138 transmits and receives on the set channel's transmit and receive frequencies in addition to using the channel's transmit and receive sub-audible tones.

### 3.4.5 Guard Channels

The MTR138 can utilize two channels programmed as Guard channels. These channels are referred to as Guard 1 and Guard 2 and are independent from the channels programed as part of power up reprogram command.

Both Guard channels contain the following valid default channel data at power on:

	Rx Frequency	Tx Frequency	Rx Tone	Tx Tone	Bandwidth
<b>Guard 1</b>	156.8000 MHz	156.8000 MHz	None	None	Wide
<b>Guard 2</b>	156.5250 MHz	156.5250 MHz	None	None	Wide

Table 3: Default Guard Channel Data

Guard channel data can be edited using the Guard channel data command. This command will edit the active Guard channel as selected by the Switch Settings command.

Only one Guard channel can be actively monitored by the Guard Receiver at a time. This selection is made using the switch settings command. The switch settings command is also used to enable transmitting on the selected Guard channel transmit frequency.

**Note:** If the Guard Tx bit of the switch settings command is asserted, the MTR138 will always transmit on the selected Guard channel regardless of the operating mode selected.

### **3.4.6 Microphone Bias & Level**

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The Mic Bias & Level command can be used to enable or disable the microphone bias voltage and set the transmit microphone level.

The microphone biasing voltage can be used when the headset microphone does not have an independent biasing voltage. Verify with the aircraft and headset manufacturer to identify if a microphone biasing voltage is being supplied from another source or is required.

The transmit deviation level is adjusted at the factory to support a 100 mV microphone rated input level. This adjustment allows the system to adjust for the input being supplied from the cabin management system.

### **3.4.7 Queries**

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#### **3.4.7.1 CRC Query**

The Cyclic Redundancy Check (CRC) Query can be used to identify the Pass/Fail result of the CRC test performed by the MTR138.

#### **3.4.7.2 Serial Number Query**

The Serial Number query can be used to identify the factory programmed serial number of the MTR138.

#### **3.4.7.3 Model Number Query**

The Model Number query can be used to identify the Model number of the MTR138.

#### **3.4.7.4 Firmware Version Query**

The Firmware Version query can be used to identify the Firmware Version of the MTR138.

#### **3.4.7.5 Channel Number Query**

The Channel Number query can be used to identify the number of the active channel used by the MTR138.

#### **3.4.7.6 Radio Configuration Query**

The Radio Configuration query can be used to identify if optional features such as a Guard Receiver is installed in the MTR138.

#### **3.4.7.7 Radio Status Query**

This can be used to identify the operational and receive status of the MTR138.

### 3.4.8 Error Recovery

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The MTR138 will automatically try and recover from all fault conditions. If the error cannot be recovered automatically the MTR138 will set the fault bit in the Radio status query.

If the MTR138 experiences a hardware or critical software fault it may become unresponsive to all commands and queries.

Possible error recovery methods include:

- a) Query the MTR138 to identify if a Radio Fault has occurred.
- b) Send the power up reprogram command and the channel number command to ensure channel information has not been corrupted/invalidated.
- c) Power cycle the MTR138 using the RT Power ON/OFF input pin.

If no error recover methods are successful, the MTR138 should be kept off using the RT Power ON/OFF input pin to prevent undesired operation.

## 3.5 Transmit Operational Features

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### 3.5.1 Transmit Power

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The MTR138 can be set to use one of two transmit power levels that will be applied to all channels:

**High Power (10W):** This mode is advisable for transmitting over long distances or in high noise environments.

**Low Power (1W):** This mode should be used in most operating environments.

### 3.5.2 Transmit Interruption

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If a command is received while transmitting, the MTR138 will exit the transmit mode of operation, perform the necessary actions as per the received command and re-enter the transmit mode of operation.

If a query is received while transmitting, the MTR138 will complete the query actions without exiting the transmit mode of operation.

### 3.5.3 Transmit Timeout

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A long duration transmission that exceeds the Transmit Timeout limit may indicate a fault with the MTR138 or the Push to Talk (PTT) key is stuck/pressed for too long. The MTR138 will automatically stop transmitting if the PTT key is asserted continuously for 60 seconds.

## 3.6 Receive Operational Features

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### 3.6.1 Receiver Volume

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The MTR138 has independent receive volume for the Main Transceiver and the Guard Receiver. The volume levels are controlled by the Guard Volume and Main Volume commands.

### 3.6.2 Scan Channels

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The MTR138 can be placed in one of three different scanning modes: List, Priority, and List + Priority. These modes are used to select which channels will be scanned and what priority they will be given. There are three types of channels that can be used to define the scanning behaviour:

**Priority Channels:** The MTR138 can select any two channels as priority channels. Priority channels can be assigned to a higher scan rate than other channels. These priority channels can be assigned using the Primary and Secondary Priority Channel Commands.

**Home Channel:** When entering the scanning mode, the current operating channel is automatically assigned as the Home channel by the MTR138. The Home channel is always included in the scanning list for every scanning mode. When exiting the scanning mode, the Home channel is unassigned.

**List Channels:** The MTR138 can select any channel as a List channel. List Channels are assigned the lowest priority. List channels can be assigned using the Channel Data command by setting the scan list status bit.

The Home channel and the List channels are added to the scan list. The scan list includes all channels with the scan list status bit asserted. Every channel with a valid data set can be added to the scan list. The scan list is rebuilt/cleared each time the scan mode is entered. List channels are always scanned in numerical order .i.e. Channel 1, Channel 2 etc.

While in scanning mode, a list channel can be temporarily removed from the scan list. To remove a channel during scanning the Remove Scan Channel command must be used. This removal will only last until the scan mode is exited.

**Note:** If the Guard Tx bit of the switch settings command is asserted, the MTR138 will always transmit on the selected Guard channel regardless of the operating mode selected.

### 3.6.3 Scanning Modes

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#### 3.6.3.1 List Scanning:

Listed below are the operational functions that occur while in the List Scanning mode:

- a) The Home channel is added as a channel in the scan list.
- b) The MTR138 continuously scans all list channels until the scan mode is exited.
- c) Once an RF signal is detected, the MTR138 remains parked receiving on that channel. While parked, if the Push to Talk (PTT) is activated, the MTR138 transmits on the parked channel.
- d) If the MTR138 has not detected an RF signal or transmitted on the parked channel in the previous three seconds, the MTR138 continues scanning all list channels.
- e) If the MTR138 is actively scanning (not parked on a channel), and the PTT is activated, the MTR138 will transmit on the Home channel.
- f) Channels that are included in the scan list, except for the Home channel, can be temporarily removed from the scan list.
- g) When the scanning mode is exited the MTR138 will return to the Home channel.

### 3.6.3.2 Priority Scanning:

Listed below are the operational functions that occur while in the Priority Scanning mode:

- a) The MTR138 continuously scans the priority channels (P1, P2) and the Home channel in the listed priority order until the scan mode is exited.
- b) Once an RF signal is detected, the MTR138 remains parked receiving on that channel.
- c) Channel Scanning Priority:
  - c1) If the RF signal is detected on the P1 channel, the MTR138 does not scan the P2 or Home channel.
  - c2) If the RF signal is detected on P2, the MTR138 scans the P1 channel every 300 ms.
  - c3) If the RF signal is detected on the Home channel, the MTR138 scans P1 and then P2 every 300 ms.
- d) While parked and the PTT is activated, the MTR138 will transmit on the parked channel.
- e) If the MTR138 has not detected an RF signal or transmitted on the parked channel in the previous three seconds, then the MTR138 continues scanning P1, P2, and the Home channel.
- f) While the MTR138 is actively scanning (not parked on a channel), and the PTT is activated, the MTR138 transmits on the Home channel.
- g) Channels designated as P1, P2 and Home channel, cannot be temporarily removed from the scan list.
- h) When the scanning mode is exited the MTR138 will return to the Home channel.

### 3.6.3.3 List + Priority Scanning:

The functionality of LIST and PRIORITY scanning is combined. This causes the MTR138 to continuously scan the P1, P2, Home, and all scan list channels in order, until the mode is set to normal.

- a) If no RF signal is detected on the P1, P2 and Home channels, then a single scan list channel is scanned. The MTR138 then jumps back to the P1, P2 and Home channels followed by the next scan list channel.
- b) Scan list channels can be temporarily removed from the scan list. Channels designated as P1, P2 and the Home channel, cannot be temporarily removed from the scan list.

### 3.6.4 Squelch modes

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The MTR138 has a user selectable squelch and an automatic squelch setting. The user selectable squelch is controlled using the Squelch command and can be used anytime while receiving. The automatic squelch is controlled by the signal level of the RF carrier while receiving.

#### **3.6.4.1 Automatic Squelch**

The MTR138 mutes all noise and will only allow the received audio on the current Main and Guard channels to pass to the headset phones output if the following conditions are met:

- a) The unsquelch signal threshold, as listed in the applicable DDP, is breached.
- b) The selected subaudible signalling tones are matched.

#### **3.6.4.2 User Selectable Squelch**

If the Squelch command is set to Squelch the radio, then the same receive signalling conditions must be met as stated for the Automatic Squelch.

If the Squelch command is set to Unsquelch the radio, the MTR138 disables the automatic squelch and routes any audio and noise from the active Main and Guard channels to the headset phones. This will be done regardless of any set subaudible tones or RF signal strength.

#### **3.6.5 Discrete RF Signal Indicator**

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The MTR138 is equipped with an active low Main SQ Disable Out output pin that indicates when a RF carrier is detected on the current Main or Guard channel. The pin is also active when the Squelch Command is used to set the MTR138 to Unsquelched.

#### **3.6.6 Sidetone**

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The sidetone volume can be adjusted or disabled as required by sending the Sidetone & Level Command.

#### **3.6.7 Communication Lockout**

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When the MTR138 is in the scanning mode of operation the Channel Number and Channel Data commands are ignored.

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### **End of Section 3.0 Operation**

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