

# Overview Manual

MM-015039-001

*Rev. N, October 2018*



## MASTR<sup>®</sup> V

Base Station

**HARRIS**<sup>®</sup> TECHNOLOGY TO CONNECT,  
INFORM AND PROTECT™

HARRIS.COM | #HARRISCORP

### MANUAL REVISION HISTORY

REV	DATE	REASON FOR CHANGE
J	Oct/14	Updated power supply specifications and added R&TTE Declaration of Conformity.
K	Mar/15	Updated safety information.
L	Oct/17	Added 900 MHz band.
M	Apr/18	Updated Sections 1.6.1 and 1.6.2.
N	Oct/18	Updated Section 2 to include HVD Modulation Mode.
P	Nov/18	Added HVD Modulation to 700 MHz.

Harris Corporation, Public Safety and Professional Communications (PSPC) Business continually evaluates its technical publications for completeness, technical accuracy, and organization. You can assist in this process by submitting your comments and suggestions to the following

**Harris Corporation**  
PSPC Business  
Technical Publications  
221 Jefferson Ridge Parkway  
Lynchburg, VA 24501

fax your comments to: 1-434-455-6851  
or  
e-mail us at: [PSPC\\_TechPubs@harris.com](mailto:PSPC_TechPubs@harris.com)

### ACKNOWLEDGEMENT

This device is made under license under one or more of the following US patents: 4,590,473; 4,636,791; 5,148,482; 5,185,796; 5,271,017; 5,377,229; 4,716,407; 4,972,460; 5,502,767; 5,146,497; 5,164,986; 5,185,795; 5,226,084; 5,247,579; 5,491,772; 5,517,511; 5,630,011; 5,649,050; 5,701,390; 5,715,365; 5,754,974; 5,826,222; 5,870,405; 6,161,089; and 6,199,037 B1. DVSI claims certain rights, including patent rights under aforementioned U.S. patents, and under other U.S. and foreign patents and patents pending. Any use of this software or technology requires a separate written license from DVSI.

### CREDITS

Harris, VIDA, EDACS, NetworkFirst, and OpenSky are registered trademarks, and TECHNOLOGY TO CONNECT, INFORM AND PROTECT is a trademark of Harris Corporation. AMBE is a registered trademark and IMBE, AMBE+, and AMBE+2 are trademarks of Digital Voice Systems, Inc. All brand and product names are trademarks, registered trademarks, or service marks of their respective holders.

### NOTICE!

The material contained herein is subject to U.S. export approval. No export or re-export is permitted without written approval from the U.S. Government. Rated: EAR99; in accordance with U.S. Dept. of Commerce regulations 15CFR774, Export Administration Regulations.

Information and descriptions contained herein are the property of Harris Corporation. Such information and descriptions may not be copied or reproduced by any means, or disseminated or distributed without the express prior written permission of Harris Corporation, PSPC Business, 221 Jefferson Ridge Parkway, Lynchburg, VA 24501.

Repairs to this equipment should be made only by an authorized service technician or facility designated by the supplier. Any repairs, alterations, or substitutions of recommended parts made by the user to this equipment not approved by the manufacturer could void the user's authority to operate the equipment in addition to the manufacturer's warranty.



This product conforms to the European Union WEEE Directive 2012/19/EU. Do not dispose of this product in a public landfill. Take it to a recycling center at the end of its life.

This manual is published by **Harris Corporation** without any warranty. Improvements and changes to this manual necessitated by typographical errors, inaccuracies of current information, or improvements to programs and/or equipment, may be made by **Harris Corporation** at any time and without notice. Such changes will be incorporated into new editions of this manual. No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, for any purpose, without the express written permission of **Harris Corporation**.

**We, Harris Corporation, RF Communications Division**  
221 Jefferson Ridge Parkway  
Lynchburg, VA 24501  
Phone: 434.455.6600

**declare under our sole responsibility that the product:**

Product name: MASTR V

Trade name: Harris®

Type(s) or model(s): SV-RCXMV, SV-RTXMV, SV-UCXMV, SV-UTXMV

Relevant supplementary information: MASTR V UHF 100 Watt Base Station (403-430 MHz) and (450-470 MHz) P25, Digital, Trunking, Infrastructure for Public Safety

**to which this declaration relates is in conformity with the essential requirements and other relevant requirements of the R&TTE Directive (1999/5/EC).**

**The product is in conformity with the following standards and/or other normative documents:**

HEALTH&SAFETY – (Art. 3(1)(a)): EN 60950-1:2006 /A11:2009/A1:2010/  
A12:2011/A2:2013

EMC (Art.3(1)(b)): ETSI EN 301 489-1, ETSI 301 489-5 (Article 3.1(b) of R&TTE Directive.

SPECTRUM (Art. 3(2)): EN 300 086-2 V1.3.1, EN 300 113-2 (Article 3.1(b) of R&TTE Directive)

OTHER (INCL. Art. 3(3) and voluntary specs): N/A

Technical file held by: Harris Wireless Ltd., RF Communications Division  
620 Wharfdale Road,  
Winnersh, Wokingham, Berkshire, United Kingdom

Place and date of issue (of this DoC): Harris Corporation 221 Jefferson  
Ridge Parkway, Lynchburg, VA 24501

September 8, 2014

Signed by or for the manufacturer:



Name (in print): Jeremy Johnson  
Title: Regulatory Manager

## TABLE OF CONTENTS

<i>Section</i>	<i>Page</i>
<b>1 REGULATORY AND SAFETY INFORMATION.....</b>	<b>6</b>
1.1 SAFETY SYMBOL CONVENTIONS .....	6
1.2 IMPORTANT SAFETY INSTRUCTIONS .....	6
1.3 MAXIMUM PERMISSIBLE EXPOSURE LIMITS.....	8
1.4 DETERMINING MPE RADIUS.....	8
1.5 SAFETY TRAINING INFORMATION .....	8
1.6 REGULATORY APPROVALS .....	9
1.6.1 Federal Communications Commission .....	9
1.6.2 Industry Canada .....	10
1.6.3 CE/EU Approvals .....	10
1.7 MARITIME CHANNELS .....	11
<b>2 SPECIFICATIONS .....</b>	<b>17</b>
<b>3 INTRODUCTION .....</b>	<b>19</b>
<b>4 MASTR V BASE STATION OVERVIEW .....</b>	<b>20</b>
4.1 MULTI-CHANNEL BASE STATION SHELF ASSEMBLY .....	20
4.2 MULTI-CHANNEL BASE STATION SHELF .....	21
4.3 HIGH POWER AMPLIFIER/POWER SUPPLY SHELF ASSEMBLY .....	22
4.4 MASTR V MODULES .....	22
4.4.1 Ethernet Switch (E-Switch).....	22
4.4.2 Transmitter Module (TX).....	23
4.4.3 Receiver Module (RX).....	25
4.4.4 Front End Preselector.....	27
4.4.5 Baseband Processor Module (BBP).....	27
4.4.6 Traffic Controller Module (TC).....	29
4.4.7 High Power RF Power Amplifier Module (HPA).....	31
4.4.8 AC and DC Power Distribution .....	34
4.4.9 Cross-Connect Panel .....	35
4.5 RACK AND CABINET ASSEMBLIES .....	36
4.6 DC-TO-AC INVERTER.....	37
<b>5 PROGRAMMING, TEST, AND DIAGNOSTICS .....</b>	<b>38</b>
5.1 VIDA DEVICE MANAGER.....	38
5.2 TEST AND DIAGNOSTICS.....	38
<b>6 REFERENCE MANUALS.....</b>	<b>39</b>
<b>7 CUSTOMER SERVICE .....</b>	<b>40</b>
7.1 TECHNICAL SUPPORT .....	40
7.2 TECH-LINK ONLINE SERVICES .....	40
7.3 CUSTOMER CARE .....	40
<b>8 WARRANTY .....</b>	<b>41</b>

**TABLE OF CONTENTS**

*Section* *Page*

**FIGURES**

Figure 3-1: MASTR V Multi-Channel Base Station Shelf Equipped with One (1) RF Channel.....	19
Figure 4-1: MASTR V MHz Base Station Shelf equipped with Four (4) RF Channels .....	20
Figure 4-2: 14-Slot Base Station Shelf .....	21
Figure 4-3: MASTR V HPA/PS Shelf Assembly (Shown with HPA and PS Installed).....	22
Figure 4-4: Ethernet Switch Module .....	23
Figure 4-5: TX Module.....	24
Figure 4-6: RX Module .....	26
Figure 4-7: RF Front End Preselector.....	27
Figure 4-8: Baseband Processor Module .....	29
Figure 4-9: Traffic Controller Module.....	31
Figure 4-10: High Power Amplifier Module with Integrated Linearizer.....	31
Figure 4-11: Power Supply Module.....	33
Figure 4-12: Dual input 120 VAC Power Distribution Strip .....	34
Figure 4-13: EA-555019-003 -48 VDC Low Power DC Distribution Strip .....	35
Figure 4-14: EA-555019-004 -48 VDC High Power DC Distribution Strip .....	35
Figure 4-15: IP Simulcast Cross-Connect Board CB-555149-002.....	36
Figure 4-16: 86-inch Open Rack Assembly .....	36
Figure 4-17: 86-inch Extra Deep Cabinet.....	36
Figure 4-18: Seismic Rated Open Rack Assembly .....	36
Figure 4-19: DC-to-AC Inverter Used to Power the Cabinet Fan at DC-Powered Sites .....	37

**TABLES**

Table 1-1: Maritime Frequencies.....	11
Table 4-1: Typical Module Slot Assignments for MASTR V Base Stations.....	20
Table 4-2: E-Switch Module Connections.....	22
Table 4-3: Ethernet Switch – Front Panel Indicators and Controls .....	23
Table 4-4: TX Module Connections .....	24
Table 4-5: TX Module – Front Panel Indicators and Controls .....	25
Table 4-6: RX Module Connections.....	26
Table 4-7: RX Module – Front Panel Indicators and Controls .....	26
Table 4-8: BBP Module Connections.....	28
Table 4-9: BBP Module – Front Panel Indicators and Controls .....	28
Table 4-10: TC Module Connections .....	30
Table 4-11: TC Module – Front Panel Indicators and Controls.....	30
Table 4-12: HPA Front Panel Indicators and Switches .....	32
Table 4-13: Backplane – Module DC Power Connector Pinout.....	33
Table 4-14: PS Front Panel Indicators and Switches.....	34
Table 6-1: Reference Manuals.....	39

# 1 REGULATORY AND SAFETY INFORMATION

## 1.1 SAFETY SYMBOL CONVENTIONS

The following conventions are used throughout this manual to alert the user to general safety precautions that must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere violates safety standards of design, manufacture, and intended use of the product. Harris assumes no liability for the customer's failure to comply with these standards.



The **WARNING** symbol calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** symbol until the conditions identified are fully understood or met.



The **CAUTION** symbol calls attention to an operating procedure, practice, or the like, which, if not performed correctly or adhered to, could result in damage to the equipment or severely degrade equipment performance.



The **NOTE** symbol calls attention to supplemental information, which may improve system performance or clarify a process or procedure.



The **ESD** symbol calls attention to procedures, practices, or the like, which could expose equipment to the effects of Electro-Static Discharge. Proper precautions must be taken to prevent ESD when handling circuit boards or modules.



The **electrical hazard** symbol is a **WARNING** indicating there may be an electrical shock hazard present.

## 1.2 IMPORTANT SAFETY INSTRUCTIONS

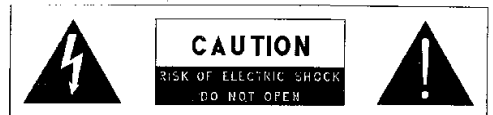
- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Do not use this apparatus near water.
- Clean only with dry cloth.
- Where required, this equipment shall be installed in a restricted access location.

- The power socket-outlet shall be installed near the equipment and shall be easily accessible.
- Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
- Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- Protect the power cord from being walked on or pinched; particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- Only use attachments/accessories specified by the manufacturer.
- Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.



- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as when the power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

- Warning: The lightning bolt signifies an alert to the user of the presence of un-insulated "dangerous voltage" within the product's enclosure that may be of significant magnitude to constitute a risk of electric shock to persons.



- Warning: The exclamation point alerts the user to the presence of important operation and maintenance (service) instructions in the literature accompanying the product.
- Outdoor Use Warning: To reduce the risk of Fire or Electric Shock, Do Not Expose This Apparatus to Rain or Moisture.
- Wet Location Warning: Apparatus shall not be exposed to dripping or splashing and no objects filled with liquids, such as vases, shall be placed on the apparatus.
- The building installation shall provide a means for connection to the protective earthing and the equipment shall be connected to that means.
- For permanently connected equipment, a readily accessible power disconnect device shall be incorporated external to the equipment.
- A service person will check if the socket-outlet from which the equipment is to be powered provides a connection to the building protective earth. If not, the service person will arrange for installation of a protective earthing conductor from the separate protective earthing terminal to the protective earth wire in the building.



The equipment must be connected to an earthed mains socket-outlet.  
Udstyret skal tilsluttes en jordet stikkontakt.

### 1.3 MAXIMUM PERMISSIBLE EXPOSURE LIMITS

DO NOT TRANSMIT with this base station and antenna when persons are within the Maximum Permissible Exposure (MPE) Radius of the antenna. The MPE Radius is the minimum distance from the antenna axis that ALL persons should maintain to avoid RF exposure higher than the allowable MPE level set by the FCC.



**Failure to observe these limits may allow all persons within the MPE radius to experience RF radiation absorption, which exceeds the FCC maximum permissible exposure (MPE) limit. It is the responsibility of the base station operator to ensure that the maximum permissible exposure limits are observed at all times during base station transmission. The base station licensee is to ensure that no bystanders are within the radius limits.**

### 1.4 DETERMINING MPE RADIUS

The Maximum Permissible Exposure radius is unique for each site and is determined during site licensing time based on the complete installation environment (i.e., co-location, antenna type, transmit power level, etc.). Determination of the MPE distance is the responsibility of the installation licensee. Calculation of the MPE radius is required as part of the site licensing procedure with the FCC.

### 1.5 SAFETY TRAINING INFORMATION



**The MASTR® V base station generates RF electromagnetic energy during transmit mode. This base station is designed for and classified as “occupational use only” meaning it must be used only in the course of employment by individuals aware of the hazards and the ways to minimize such hazards. This base station is not intended for use by the “general population” in an uncontrolled environment. It is the responsibility of the base station licensee to ensure that the maximum permissible exposure limits determined in the previous section are observed at all times during transmission. The base station licensee is to ensure that no bystanders come within the radius of the maximum permissible exposure limits.**

When licensed by the FCC, this base station complies with the FCC RF exposure limits when persons are beyond the MPE radius of the antenna. In addition, your Harris base station installation complies with the following Standards and Guidelines regarding RF energy and electromagnetic energy levels and evaluation of such levels for exposure to humans:

- FCC OET Bulletin 65 Edition 97-01 Supplement C, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
- American National Standards Institute (C95.1 – 1992), IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
- American National Standards Institute (C95.3 – 1992), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.



To ensure that your exposure to RF electromagnetic energy is within the FCC allowable limits for occupational use, do not operate the base station in a manner that would create an MPE distance exceeding that allowable by the FCC.





This equipment generates or uses radio frequency energy. Any changes or modifications to this equipment not expressly approved by Harris may cause harmful interference and could void the user's authority to operate the equipment.

## 1.6 REGULATORY APPROVALS

### 1.6.1 Federal Communications Commission

The transmitting device described within this manual has been tested and found to meet the following regulatory requirements:

FCC FILING DATA FOR MASTR V BASE STATION			
FREQUENCY BAND (MHz)	POWER OUTPUT (ADJUSTABLE) (Watts)	FCC TYPE ACCEPTANCE NUMBER	APPLICABLE FCC RULES
150.0125 – 173.9875	10 – 100 <sup>1</sup>	OWDTR-0065-E	Parts 22, 80, 90
420 – 430	10 – 100	OWDTR-0129-E	Part 90
450 – 470	10 – 100	OWDTR-0130-E	Part 22, 80, 90
470.00625 – 493.99375	10 – 100	OWDTR-0100-E	Part 90
494.00625 – 511.99375	10 – 100	OWDTR-0101-E	Part 90
764 – 776	10 – 100	OWDTR-0057-E	Part 90
769 – 775	10 – 100	OWDTR-0159-E	Part 90
851 – 869	10 – 100	OWDTR-0053-E OWDTR-0158-E	Part 90
935 - 940	10 – 100	OWDTR-0156-E	Part 90

This receiver associated with this transmitting device has been tested and declared to meet the regulatory requirements defined in the following sub-sections.

#### 1.6.1.1 FCC Compliance

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.

#### 1.6.1.2 Information to the User

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment does generate, use, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user must correct the interference at his or her own expense.

<sup>1</sup> 100 Watts is the RF output power as measured at the transmitter High Power Amplifier output connector. For equipment operating in accordance with FCC rules 47CFR80, it is the responsibility of the licensee to ensure the station is installed and aligned for a maximum of 50 Watts forward RF power, as measured at the base of the antenna.

### 1.6.2 Industry Canada

INDUSTRY CANADA FILING DATA FOR MASTR V BASE STATION		
FREQUENCY BAND (MHZ)	INDUSTRY CANADA CERTIFICATION NUMBER	APPLICABLE INDUSTRY CANADA RULES
150 – 174	3636B-0065	RSS-119
420 – 430	3636B-0129	RSS-119
450 – 470	3636B-0130	RSS-119
764 – 776	3636B-0057	RSS-119
768 – 776	3636B-0159	RSS-119
851 – 869	3636B-0053 3636B-0158	RSS-119
935 – 940	3636B-0156	RSS-119

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.



The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field exceeding Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website [www.hc-sc.gc.ca/rpb](http://www.hc-sc.gc.ca/rpb).

L'installateur de cet équipement radio doit garantir que l'antenne est trouvée ou montrée tel qu'il n'émet pas de champ de RF plus de la Santé les limites du Canada pour la population générale; consultez le Code 6 de Sécurité, disponible de la Lande le site Internet du Canada [www.hc-sc.gc.ca/rpb](http://www.hc-sc.gc.ca/rpb).

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### 1.6.3 CE/EU Approvals

Refer to page 3.

## 1.7 MARITIME CHANNELS

Refer to Table 1-1 for a list of VHF maritime frequencies per United States Coast Guard (USCG), National Oceanic and Atmospheric Administration (NOAA), and Canadian Department Fisheries and Oceans.

- United States (US)
- International (Intl)
- Canada (CA)

**Table 1-1: Maritime Frequencies**

CHANNEL			FREQUENCY		CHANNEL USAGE
US	INTL	CA	SHIP (MHz)	SHORE (MHz)	
	1	1	T: 156.05 R: 160.65	T: 160.65 R: 156.05	International: Public Correspondence, Port Operations.
1a			T/R: 156.05	T/R: 156.05	US: Port Operations and Commercial, Vessel Traffic Service (VTS). New Orleans/Lower Mississippi area.
	2	2	T: 156.10 R: 160.70	T: 160.70 R: 156.10	International: Public Correspondence, Port Operations.
	3	3	T: 156.15 R: 160.75	T: 160.75 R: 156.15	International: Public Correspondence, Port Operations.
	4		T: 156.20 R: 160.80	T: 160.80 R: 156.20	International: Public Correspondence, Port Operations.
		4a	T/R: 156.20	T/R: 156.20	Canada: Department Fisheries Ocean (DFO)/Canadian Coast Guard only in British Columbia coast area. Commercial fishing in east coast area.
	5		T: 156.25 R: 160.85	T: 160.85 R: 156.25	International: Public Correspondence, Port Operations.
5a		5a	T/R: 156.25	T/R: 156.25	US: Port Operations or VTS in Houston, New Orleans and Seattle areas.
6	6	6	T/R: 156.30	T/R: 156.30	US: Intership Safety. International: Intership. Canada: May be used for search and rescue communications between ships and aircraft.
	7		T: 156.35 R: 160.95	T: 160.95 R: 156.35	International: Public Correspondence, Port Operations.
7a		7a	T/R: 156.35	T/R: 156.35	US: Commercial.
8	8	8	T/R: 156.40	T/R: 156.40	US: Commercial (Intership only). International: Intership. Canada: Also assigned for intership in the Lake Winnipeg area.
9	9	9	T/R: 156.45	T/R: 156.45	US: Boater Calling. Commercial and Non-Commercial. International: Intership, Port Operations. Canada: Commercial — British Columbia coast area. May be used to communicate with aircraft and helicopters in predominantly maritime support operations.
10	10	10	T/R: 156.50	T/R: 156.50	US: Commercial. International: Intership, Port Operations. Canada: Commercial — British Columbia coast area. May also be used for communications with aircraft engaged in coordinated search and rescue and antipollution operations.

Table 1-1: Maritime Frequencies

CHANNEL			FREQUENCY		CHANNEL USAGE
US	INTL	CA	SHIP (MHz)	SHORE (MHz)	
11	11	11	T/R: 156.55	T/R: 156.55	US: Commercial. VTS in selected areas. International: Port Operations. Canada: VTS — British Columbia coast area. Also used for pilotage purposes.
12	12	12	T/R: 156.60	T/R: 156.60	US: Port Operations. VTS in selected areas. International: Port Operations. Canada: VTS — British Columbia coast area. Also used for pilotage purposes.
13	13	13	T/R: 156.65	T/R: 156.65	US: Intership Navigation Safety (Bridge-to-bridge). Ships >20m length maintain a listening watch on this channel in US waters. International: Intership, Port Operations. Canada: VTS — British Columbia coast area. Also used for pilotage purposes.
14	14	14	T/R: 156.70	T/R: 156.70	US: Port Operations. VTS in selected areas. International: Port Operations. Canada: VTS — British Columbia coast area. Also used for pilotage purposes.
15	15	15	T/R: 156.75 (US: Rx Only)	T/R: 156.75	US: Environmental (Receive only). Used by Class C Emergency Position-Indicating Radio Beacons (EPIRBs). International: Intership, Port Operations. Canada: Port operations and Ship Movement — British Columbia coast area. All operations limited to 1-watt maximum power. May also be used for on-board communications.
16	16	16	T/R: 156.80	T/R: 156.80	US: International Distress, Safety and Calling. Ships required to carry radio, US Coast Guard (USCG), and most coast stations maintain a listening watch on this channel. International: International Distress, Safety and Calling. Canada: International Distress, Safety and Calling.
17	17	17	T/R: 156.85	T/R: 156.85	US: State Control. International: Intership, Port Operations. Canada: Port operations and Ship Movement — British Columbia coast area. All operations limited to 1-watt maximum power. May also be used for on-board communications.
	18		T: 156.90 R: 161.50	T: 161.50 R: 156.90	International: Public Correspondence, Port Operations.
18a		18a	T/R: 156.90	T/R: 156.90	US: Commercial. Canada: Towing — British Columbia coast area.
	19		T: 156.95 R: 161.55*	T: 161.55* R: 156.95	International: Public Correspondence, Port Operations.
19a		19a	T/R: 156.95	T/R: 156.95	US: Commercial. Canada: DFO/Canadian Coast Guard. Pacific Pilots — British Columbia coast area.
20	20	20	T: 157.00 R: 161.60	T: 161.60 R: 157.00	US: Port Operations (Duplex). International: Public Correspondence, Port Operations. Canada: Port operations only with 1-watt maximum power.

Table 1-1: Maritime Frequencies

CHANNEL			FREQUENCY		CHANNEL USAGE
US	INTL	CA	SHIP (MHz)	SHORE (MHz)	
20a			T/R: 157.00	T/R: 157.00	US: Port Operations.
	21		T: 157.05 R: 161.65*	T: 161.65* R: 157.05	International: Public Correspondence, Port Operations.
21a		21a	T/R: 157.05	T/R: 157.05	US: US Coast Guard only. Canada: DFO/Canadian Coast Guard only.
		21b	--	T/R: 161.65	Canada: Continuous Marine Broadcast (CMB) service (weather).
	22		T: 157.10 R: 161.70	T: 161.70 R: 157.10	International: Public Correspondence, Port Operations.
22a		22a	T/R: 157.10	T/R: 157.10	US: Coast Guard Liaison and Maritime Safety Information Broadcasts. Broadcasts announced on channel 16. Canada: For communications between Canadian Coast Guard and non-Canadian Coast Guard stations only.
	23	23	T: 157.15 R: 161.75	T: 161.75 R: 157.15	International: Public Correspondence, Port Operations.
23a			T/R: 157.15	T/R: 157.15	US: US Coast Guard only.
		23b	--	T/R: 161.75	Canada: Continuous Marine Broadcast (CMB) service (weather).
24	24	24	T: 157.20 R: 161.80	T: 161.80 R: 157.20	US: Public Correspondence (Marine Operator). International: Public Correspondence, Port Operations.
25	25	25	T: 157.25 R: 161.85	T: 161.85 R: 157.25	US: Public Correspondence (Marine Operator). International: Public Correspondence, Port Operations. Canada: Also assigned for operations in the Lake Winnipeg area.
		25b		T/R: 161.85	Canada: Continuous Marine Broadcast (CMB) service (weather).
26	26	26	T: 157.30 R: 161.90	T: 161.90 R: 157.30	US: Public Correspondence (Marine Operator). International: Public Correspondence, Port Operations.
27	27	27	T: 157.35 R: 161.95	T: 161.95 R: 157.35	US: Public Correspondence (Marine Operator). International: Public Correspondence, Port Operations.
28	28	28	T: 157.40 R: 162.00	T: 162.00 R: 157.40	US: Public Correspondence (Marine Operator). International: Public Correspondence, Port Operations.
		28b	--	T/R: 162.00	Canada: Continuous Marine Broadcast (CMB) service (weather).
	60	60	T: 156.025 R: 160.625	T: 160.625 R: 156.025	International: Public Correspondence, Port Operations.
	61		T: 156.075 R: 160.675	T: 160.675 R: 156.075	International: Public Correspondence, Port Operations.
		61a	T/R: 156.075	T/R: 156.075	Canada: DFO/Canadian Coast Guard only in British Columbia coast area.
	62		T: 156.125 R: 160.725	T: 160.725 R: 156.125	International: Public Correspondence, Port Operations.

Table 1-1: Maritime Frequencies

CHANNEL			FREQUENCY		CHANNEL USAGE
US	INTL	CA	SHIP (MHz)	SHORE (MHz)	
		62a	T/R: 156.125	T/R: 156.125	Canada: DFO/Canadian Coast Guard only in British Columbia coast area.
	63		T: 156.175 R: 160.775	T: 160.775 R: 156.175	International: Public Correspondence, Port Operations.
63a		63a	T/R: 156.175	T/R: 156.175	US: Port Operations and Commercial, VTS. New Orleans/Lower Mississippi area. Canada: Tow Boats — British Columbia coast area.
	64	64	T: 156.225 R: 160.825	T: 160.825 R: 156.225	International: Public Correspondence, Port Operations.
		64a	T/R: 156.225	T/R: 156.225	Canada: Commercial fishing only.
	65		T: 156.275 R: 160.875	T: 160.875 R: 156.225	International: Public Correspondence, Port Operations.
65a		65a	T/R: 156.275	T/R: 156.275	US: Port Operations. Canada: Search and rescue and antipollution operations on the Great Lakes. Towing on the Pacific Coast. Port operations only in the St. Lawrence River areas with 1-watt maximum power. Intership in inland Manitoba, Saskatchewan, and Alberta areas.
	66		T: 156.325 R: 160.925	T: 160.925 R: 156.325	International: Public Correspondence, Port Operations.
66a		66a	T/R: 156.325	T/R: 156.325	US: Port Operations. Canada: Port operations only in the St. Lawrence River/Great Lakes areas with 1-watt maximum power. 1-watt marina channel — British Columbia coast area.
67	67	67	T/R: 156.375	T/R: 156.375	US: Commercial. Used for Bridge-to-bridge communications in lower Miss. River. Intership only. International: Intership, Port Operations. Canada: May also be used for communications with aircraft engaged in coordinated search and rescue and antipollution operations. Commercial fishing only in east coast and inland Manitoba, Saskatchewan, and Alberta areas. Pleasure craft — British Columbia coast area.
68	68	68	T/R: 156.425	T/R: 156.425	US: Non-Commercial. International: Port Operations. Canada: For marinas, yacht clubs and pleasure craft.
69	69	69	T/R: 156.475	T/R: 156.475	US: Non-Commercial. International: Intership, Port Operations. Canada: Commercial fishing only — east coast area. Pleasure craft — British Columbia coast area.
70	70	70	T/R: 156.525	T/R: 156.525	US: Digital Selective Calling (voice communications not allowed). International: Digital selective calling for distress, safety and calling. Canada: Digital selective calling for distress, safety and calling.
71	71	71	T/R: 156.575	T/R: 156.575	US: Non-Commercial. International: Port Operations. Canada: Ship Movement — British Columbia coast area. Marinas and yacht clubs — east coast and on Lake Winnipeg.

**Table 1-1: Maritime Frequencies**

CHANNEL			FREQUENCY		CHANNEL USAGE
US	INTL	CA	SHIP (MHz)	SHORE (MHz)	
72	72	72	T/R: 156.625	T/R: 156.625	US: Non-Commercial (Intership only). International: Intership. Canada: May be used to communicate with aircraft and helicopters in predominantly maritime support operations. Pleasure craft — British Columbia coast area.
73	73	73	T/R: 156.675	T/R: 156.675	US: Port Operations. International: Intership, Port Operations. Canada: May also be used for communications with aircraft engaged in coordinated search and rescue and antipollution operations. Commercial fishing only in east coast and inland Manitoba, Saskatchewan, and Alberta areas.
74	74	74	T/R: 156.725	T/R: 156.725	US: Port Operations. International: Port Operations. Canada: VTS and Ship Movement British Columbia coast area.
	75	75	T/R: 156.775	T/R: 156.775	International: Port Operations. Canada: Simplex port operation, ship movement and navigation related communication only. 1 watt maximum.
	76	76	T/R: 156.825	T/R: 156.825	International: Port Operations. Canada: Simplex port operation, ship movement and navigation related communication only. 1 watt maximum.
77	77	77	T/R: 156.875	T/R: 156.875	US: Port Operations (Intership only). International: Intership. Canada: Pilotage — British Columbia coast area; 25 watts. Port operations only in the St. Lawrence River/Great Lakes areas with 1-watt maximum power.
	78		T: 156.925 R: 161.525	T: 161.525 R: 156.925	International: Public Correspondence, Port Operations.
78a		78a	T/R: 156.925	T/R: 156.925	US: Non-Commercial. Canada: Fishing Industry — British Columbia coast area.
	79		T: 156.975 R: 161.575	T: 161.575 R: 156.975	International: Public Correspondence, Port Operations.
79a		79a	T/R: 156.975	T/R: 156.975	US: Commercial. Non-Commercial in Great Lakes only. Canada: Fishing Industry — British Columbia coast area.
	80		T: 157.025 R: 161.625	T: 161.625 R: 157.025	International: Public Correspondence, Port Operations.
80a		80a	T/R: 157.025	T/R: 157.025	US: Commercial. Non-Commercial in Great Lakes only. Canada: Fishing Industry — British Columbia coast area.
	81		T: 157.075 R: 161.675	T: 161.675 R: 157.075	International: Public Correspondence, Port Operations.
81a		81a	T/R: 157.075	T/R: 157.075	US: US Government only — Environmental protection operations. Canada: DFO/Canadian Coast Guard use only.
	82		T: 157.125 R: 161.725	T: 161.725 R: 157.125	International: Public Correspondence, Port Operations.
82a		82a	T/R: 157.125	T/R: 157.125	US: US. Government only. Canada: DFO/Canadian Coast Guard use only.

Table 1-1: Maritime Frequencies

CHANNEL			FREQUENCY		CHANNEL USAGE
US	INTL	CA	SHIP (MHz)	SHORE (MHz)	
	83		T: 157.175 R: 161.775	T: 161.775 R: 157.175	International: Public Correspondence, Port Operations.
83a		83a	T/R: 157.175	T/R: 157.175	US: US Coast Guard only. Canada: DFO/Canadian Coast Guard and other Government agencies.
		83b	--	T/R: 161.775	Canada: Continuous Marine Broadcast (CMB) service (weather).
84	84	84	T: 157.225 R: 161.825	T: 161.825 R: 157.225	US: Public Correspondence (Marine Operator). International: Public Correspondence, Port Operations.
85	85	85	T: 157.275 R: 161.875	T: 161.875 R: 157.275	US: Public Correspondence (Marine Operator). International: Public Correspondence, Port Operations.
86	86	86	T: 157.325 R: 161.925	T: 161.925 R: 157.325	US: Public Correspondence (Marine Operator). International: Public Correspondence, Port Operations.
87			T/R: 157.375	T/R: 157.375	US: Public Correspondence (Marine Operator).
	87	87	T: 157.375 R: 161.975	T: 161.975 R: 157.375	International: Port Operations. Canada: Port operation and ship movement — east coast area. Pleasure craft — British Columbia coast area.
AIS1		87b	T/R: 161.975	T/R: 161.975	US: Automatic Identification System. Canada: Automatic Ship Identification and Surveillance System.
	88	88	T: 157.425 R: 162.025	T: 162.025 R: 157.425	US: Commercial, Intership only. International: Port Operations. Canada: Port operation and ship movement — British Columbia coast area.
88a			T/R: 157.425	T/R: 157.425	US: Commercial, Intership only. Canada: Automatic Ship Identification and Surveillance System.
		88b	T/R: 162.025	T/R: 162.025	Automatic Identification System.
WX1		WX1		R: 162.55	Weather Channel 1 (receive only).
WX2		WX2		R: 162.4	Weather Channel 2 (receive only).
WX3		WX3		R: 162.475	Weather Channel 3 (receive only).
WX4				R: 162.425	Weather Channel 4 (receive only).
WX5				R: 162.45	Weather Channel 5 (receive only).
WX6				R: 162.5	Weather Channel 6 (receive only).
WX7		WX7		R: 162.525	Weather Channel 7 (receive only).



## 2 SPECIFICATIONS

### General Specifications<sup>2</sup>

Duty Cycle (EIA) Continuous:	Transmit and Receive at 100%		
Operating Temperature:	-22°F to +140°F (-30°C to +60°C)		
Humidity (EIA):	90-95% at 122°F (50°C) Non-condensing		
Power Supplies:	<b>AC Supply (EA-555011-001)</b>	<b>DC Supply (EA-555011-003)</b>	
Input Power Source:	90 – 240 VAC (nom.), 47~63 Hz	-48VDC (+/- 20%), 25.0 Amp	
Power Supply Outputs:	+28.0 VDC± 0.2V: 25.0 Amps	25.0 Amps	
	+12.0 VDC± 0.2V: 2.8 Amps	5.0 Amps	
	+5.0 VDC± 0.2V: 28.0 Amps	15.0 Amps	
Source Power Drain:	865 watts per channel (max.), 600 watts per channel (typical)		
Input Power Efficiency:	> 85% at full load, > 82.5% at full Load		
Altitude:			
Operational:	Up to 13,123 ft. (4,000 m)		
Shippable:	Up to 50,000 ft. (15,250 m)		

### Transmitter Specifications

Frequency Ranges:	150 – 174 MHz <sup>3</sup>	450 – 470 MHz	764 – 776 MHz
	380 – 400 MHz <sup>4</sup>	470 – 494 MHz	851 – 870 MHz
	403 – 430 MHz <sup>3, 5</sup>	494 – 512 MHz	935 – 941 MHz
RMS RF Output Power <sup>6</sup> :	10 – 100 Watts		
RF Output Impedance:	50 ohms		
Antenna Connection:	Type N Female on High Power Amplifier		
Power control accuracy:	-0/+0.79 dB		
Frequency Stability:	< 0.1 ppm external freq. std. <sup>7</sup>		
Frequency Step Size:	6.25 kHz		
Tuning Range:	No tuning required		
Nominal TX Deviation:	2.544 to 3.111 kHz (per TIA-102)		
Modes of Modulation:	<u>MODULATION TYPE</u>	<u>EMISSION DESIGNATOR</u>	
P25 Phase 1	C4FM	8K00F1D (all bands) 8K00F1E (VHF & 900 MHz)	
P25 Linear Simulcast	WCQPSK	9K70D1W	
P25 Phase 2	HDQPSK	9K80D7W	
HVD SMR	HVD SMR	18K8D1W (700 MHz & 800 MHz)	
HVD NPSPAC	HVD NPSPAC	12K5D1W (700 MHz & 800 MHz)	
Modulation Emission Spectrum:	Per FCC Part 90		
Radiated and Conducted Spurious Emissions:	700/800/900 MHz Stations: < -70 dBc		
	VHF/UHF Stations: < -36 dBm (below 1 GHz), <-30 dBm (above 1 GHz)		

<sup>2</sup> Specifications listed herein are applicable only to Harris' MASTR V Base Station RF equipment. Always refer to the manufacturer of third party equipment, such as Routers and Switches, for additional specifications. Specifications listed in this manual are intended primarily for the use of the service technician. Additional specifications may be listed on the product data sheet.

<sup>3</sup> 150 – 174 MHz and 420 – 430 MHz bands have been approved for use in FCC Part 22 and Part 80 applications.

<sup>4</sup> This device is available within the NTIA marketplace.

<sup>5</sup> 406.1 – 420 MHz is available in the NTIA market place.

<sup>6</sup> Rated power output is measured at the transmitter's power amplifier output connector. Optional items such as power measuring devices and/or duplexers will introduce loss between the transmitter output connector and the station cabinet output connector. This loss will reduce the available power at the station connector. It is the responsibility of the license holder to ensure that rated power is 50 W at the output connector for Part 80 applications.

<sup>7</sup> Beginning with Baseband Processor Rev. D, an external reference is no longer required to meet this specification.

### Receiver Specifications

Frequency Range:	150 – 174 MHz <sup>3</sup>	494 – 512 MHz
	380 – 400 MHz <sup>4</sup>	799 – 816 MHz
	403 – 430 MHz <sup>3,5</sup>	806 – 825 MHz
	450 – 470 MHz	896 – 902 MHz
	470 – 494 MHz	
Tuning Range:	Receiver modules (all bands), No tuning required VHF/UHF – Requires external preselector tuning <sup>8</sup>	
RF Input Impedance:	50 ohms	
Antenna Connection:	SMA Female on Receiver Module (VHF/UHF – BNC female, if equipped with Preselector)	
Channel Spacing:	12.5 kHz	
Sensitivity:	≥ -119 dBm (5% BER) static, -111 faded (EIA)	
Selectivity:	≥ 60 dB Per TIA-102	
Frequency Stability:	< 0.1 ppm external freq. std. <sup>5</sup>	
Signal Displacement Bandwidth:	± 1.0 kHz Per TIA-102	
Spurious and Image Rejection:	≥ 90 dB	

<b>Weights and Dimensions<sup>9</sup></b>	<b>WEIGHT</b> lbs. (kg.)	<b>DEPTH</b> in (cm)	<b>WIDTH</b> in (cm)	<b>HEIGHT<sup>10</sup></b> in (cm) or RU
Rack, 86 in., Deep, 3-rail, 46-RU:	235 (107)	21.0 (53.3)	21.0 (53.3)	85.5 (217.0)
Cabinet, 86 in., Extra Deep, 45-RU	355 (161.0)	31.6 (80.3)	23 (58.4)	86.8 (220.5)
14-Slot Shelf Assembly (w/o modules):	16.5 (7.5)	15.0 (38.1)	19.0 (48.3)	5-RU
High Power Amplifier Shelf (Chassis only):	5.0 (2.3)		19.0 (48.3)	2-RU
Power Supply Unit (PSU):	9.0 (4.1)	13 (33.0)	8.6 (21.8)	3.5 (8.9)
RF High Power Amplifier (HPA):	11.5 (5.2)	13 (33.0)	8.6 (21.8)	3.5 (8.9)
Ethernet Switch:	0.8 (0.36)	12.25 (31.1)	0.625 (1.6)	4.25 (10.8)
Transmitter (TX) Module:	2.5 (1.1)	12.6 (32.0)	0.82 (2.1)	7.25 (18.4)
Receiver (RX) Module:	2.5 (1.1)	12.6 (32.0)	0.82 (2.1)	7.25 (18.4)
Traffic Controller (TC) Module:	2.5 (1.1)	12.6 (32.0)	0.82 (2.1)	7.25 (18.4)
Baseband Module (BB):	2.5 (1.1)	12.6 (32.0)	0.82 (2.1)	7.25 (18.4)

<sup>8</sup> Refer to manufacturer's specifications for the specific preselector.

<sup>9</sup> Weights and dimensions are approximate, and represent the minimum space required to install the device. In most cases, measurements include handles, brackets, knobs, controls, and other hardware that is permanently affixed to the device. Measurements do not include distances for cable bends, unless the cable is permanently affixed to the equipment.

<sup>10</sup> For 19" rack mountable equipment, heights may be defined in Rack Units (RU). One (1) RU is equal to 1.75 in. (4.45 cm). For example: 2-RU equals 3.5 in. (8.9 cm), 3-RU equals 5.25 in. (13.3 cm), etc.



## 4 MASTR V BASE STATION OVERVIEW

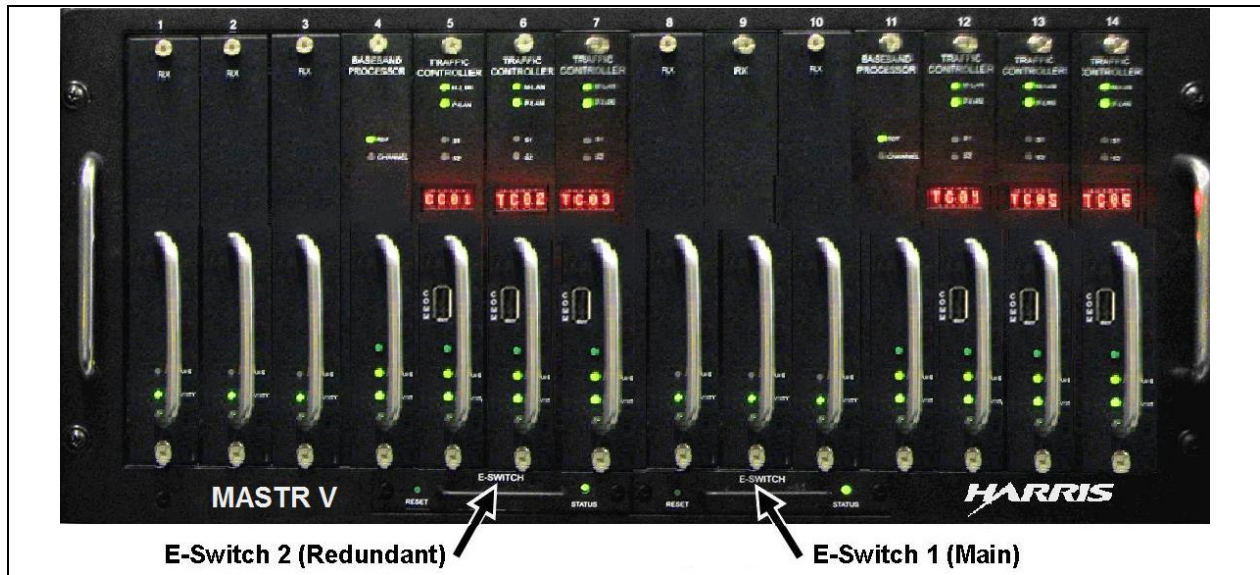
### 4.1 MULTI-CHANNEL BASE STATION SHELF ASSEMBLY

The MASTR V multi-channel base station shelf assembly is a unified sub-rack design providing 14 identical vertical module slots. Also included are two (2) horizontal slots located under the 14 vertical slots, used to connect the built-in main and redundant Ethernet Switch modules.

A backplane assembly provides data and DC power connections to each vertical slot, and the two Ethernet Switch module slots. The multi-channel base station shelf, and each module, is equipped with a pull handle for improved handling of the equipment.

**Table 4-1: Typical Module Slot Assignments for MASTR V Base Stations**

SLOT #	MODULE	SLOT #	MODULE
1	Transmitter Module (Channel 1)	8	Transmitter Module (Channel 3)
2	Receiver Module (Channel 1)	9	Receiver Module (Channel 3)
3	Transmitter Module (Channel 2)	10	Transmitter Module (Channel 4)
4	Receiver Module (Channel 2)	11	Receiver Module (Channel 4)
5	Baseband Module (Channel 1 / 2)	12	Baseband Module (Channel 3 / 4)
6	Traffic Controller (Channel 1)	13	Traffic Controller (Channel 3)
7	Traffic Controller (Channel 2)	14	Traffic Controller (Channel 4)
E1	E-Switch # 1 (Main)	E2	E-Switch #2 (Redundant)



**Figure 4-1: MASTR V MHz Base Station Shelf equipped with Four (4) RF Channels**

## 4.2 MULTI-CHANNEL BASE STATION SHELF

The MASTR V Multi-Channel Base Station shelf model EA-555002-001 is a 14-slot, 5-RU, shelf assembly. The shelf provides a modular environment supporting almost any combination of MASTR V modules.

Assembled to the rear of the shelf is a unified backplane assembly. The backplane interfaces all data, frequency reference, and DC power connections from the 14 module slots, to the two (2) horizontally positioned Ethernet switch modules.

Connectors J30 and J31 are DC inputs for the backplane. Two (2) connector assemblies are provided for each module slot; a 3-pin connector for DC power (J101 through J114) and a 95-pin connector for data/small signals (J1 through J14). Each E-Switch module slot uses a 120-pin signal connector having 40 balanced signal pairs, and each pair having an individual shield for optimal signal performance. Additionally, two (2) guide pins are used in each module slot, one at each end of every connector row. Connectors J21 through J24 provide data and control signaling to the HPA modules.

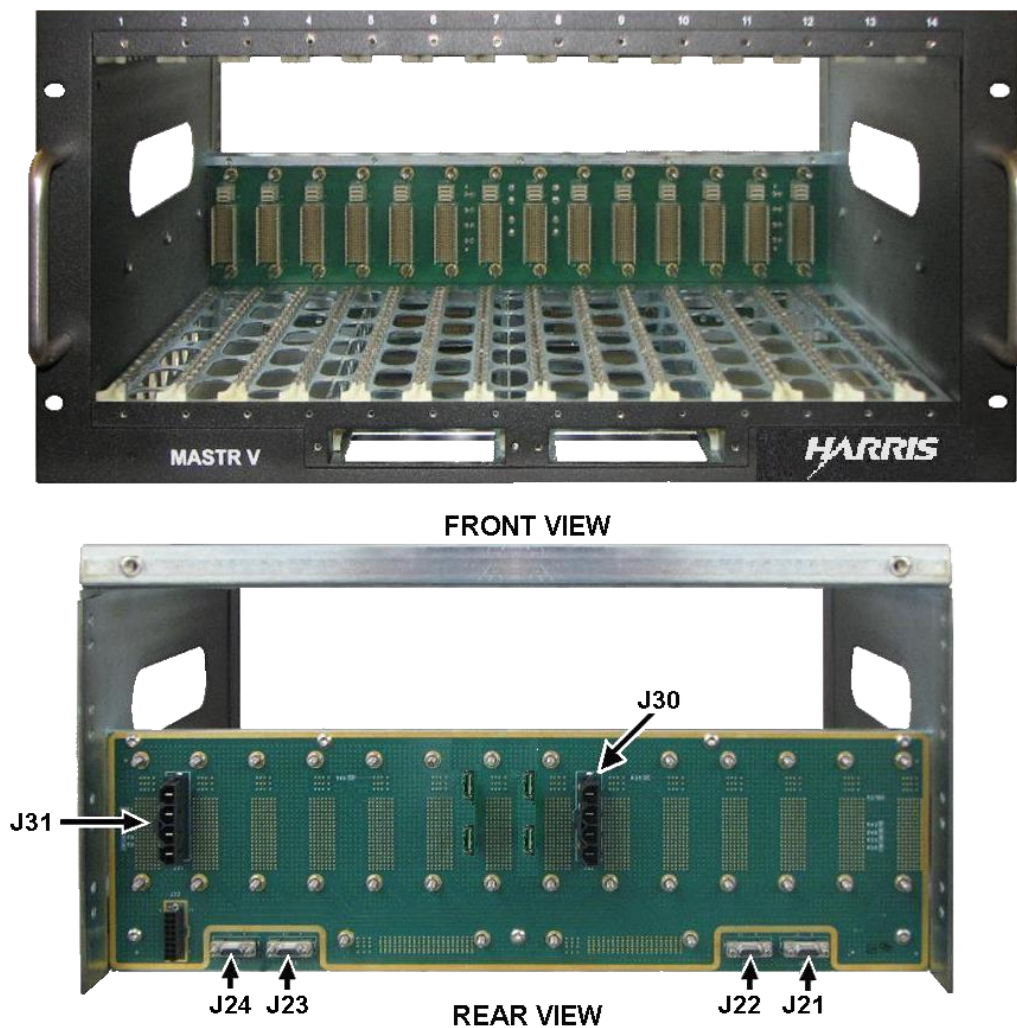


Figure 4-2: 14-Slot Base Station Shelf

### 4.3 HIGH POWER AMPLIFIER/POWER SUPPLY SHELF ASSEMBLY

The High Power Amplifier (HPA) (refer to Section 4.4.7) and the Power Supply (PS) (refer to Section 4.4.7.1) are installed in a 19” rack mountable, 2-slot metal shelf, model MA-555003 (refer to Figure 4-3). The HPA/PS shelf is a mechanical-only assembly with no electrical components.



Figure 4-3: MASTR V HPA/PS Shelf Assembly (Shown with HPA and PS Installed)

### 4.4 MASTR V MODULES

For P25 operation, the following station modules may be installed in the MASTR V Base Station shelf:

- TX module
- RX module
- Baseband Processor Module
- Traffic Controller Module
- High Power Amplifier Module
- Power Supply Module
- Ethernet Switch

#### 4.4.1 Ethernet Switch (E-Switch)








Communication with the MASTR V base station modules is provided by a built-in Ethernet Switch module EA-555012-001 located under main module shelf. A second position is provided under the main module shelf for a redundant Ethernet Switch module.

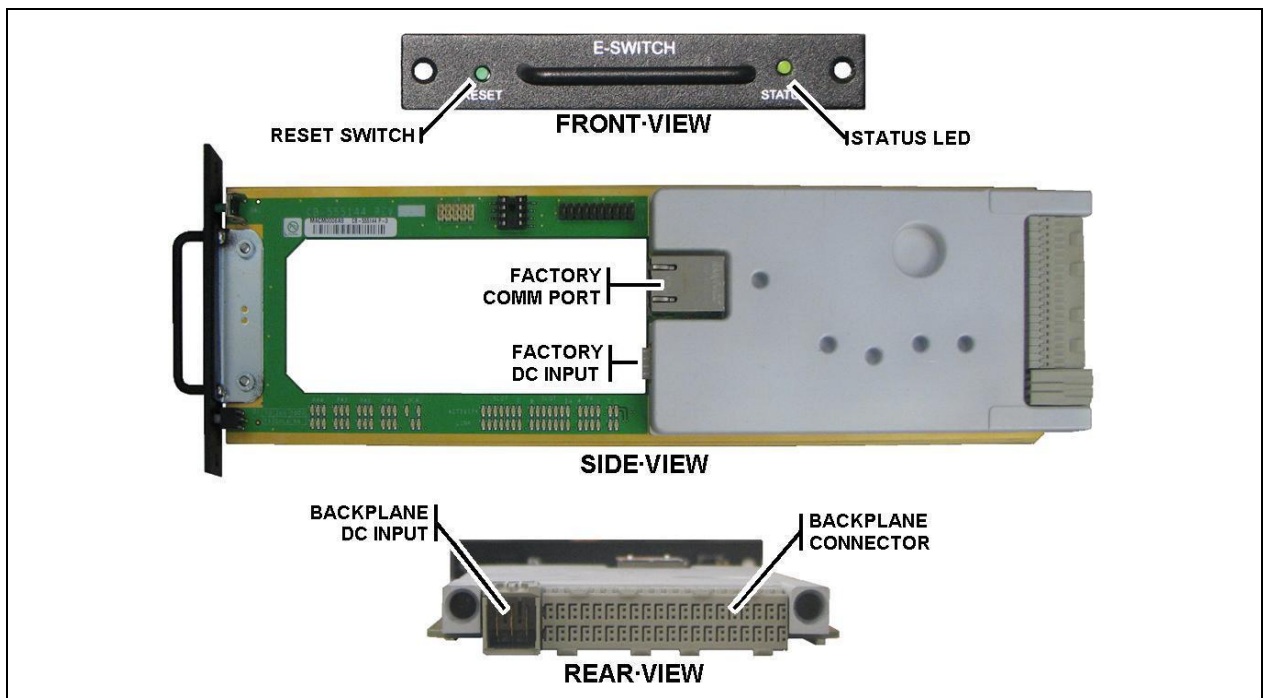
Ethernet communications are utilized to pass voice and data transmissions, management, and control data between the Traffic Controller and supporting MASTR V modules via the Ethernet Switches.

Table 4-2: E-Switch Module Connections

LOCATION	CONNECTOR	DESCRIPTION
Circuit Board (side)	RJ-45	Factory Service Communications Port
	4-Pin	Factory Service DC Power
Rear Panel	120-Pin	Backplane Connection (40 pair with Shield)
	3-Pin	Backplane DC Power

**Table 4-3: Ethernet Switch – Front Panel Indicators and Controls**

INDICATOR/CONTROL	INDICATOR COLOR	DESCRIPTION
Status LED	OFF 	No Status (Power Off)
	GREEN SOLID 	Active Switch
	GREEN FLASHING 	Standby Switch
	RED SOLID 	Major Fault
	RED FLASHING 	Minor Fault
	YELLOW SOLID 	Flash Write
	YELLOW FLASHING 	Program Downloading
Reset Switch	N/A	Soft Module Reset



**Figure 4-4: Ethernet Switch Module**

**4.4.2 Transmitter Module (TX)**

The MASTR V TX module series EA-555008-xxx provides a highly stable 0 dBm RF output to drive the High-Power Amplifier module. The MASTR V TX module uses a Direct Digital Synthesizer (DDS) which optimizes the modulation characteristics of the TX module. The DDS can digitally create a precision waveform or modulation scheme from a single on-board oscillator. This capability makes the MASTR V TX module one of the most versatile transmitter modules in the North American Land Mobile Radio (LMR) and European Professional Mobile Radio (PMR) marketplace. Digitized I and Q information is sent from the Baseband Processor module via the backplane Ethernet to the TX module.

All bands of MASTR V TX modules share common design features and meet stringent transmitter specifications including the following:

- High output intercept point.
- 115.2 MHz 1st IF chosen for all bands of the MASTR V.
- Built-in hardware diagnostics (voltage supplies, PLL Lock).
- IQ data is sent from the Baseband Processor module for modulation.

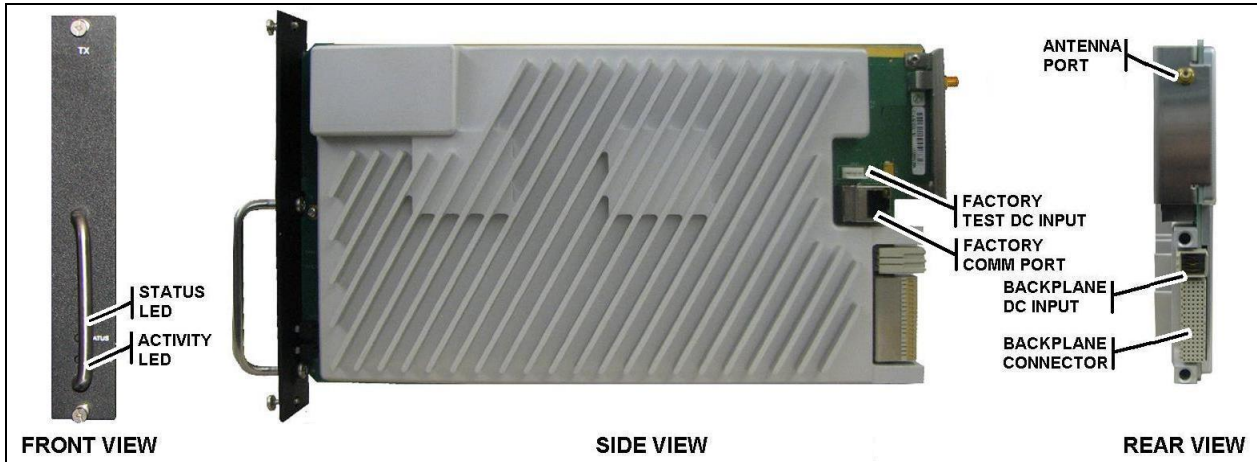


Figure 4-5: TX Module











All electrical connections used during normal operation are located on the rear panel (refer to Figure 4-5). Control, data, small signal, and DC power connections mate with the unified backplane. A low-level TX exciter output connector is located on the rear panel.

Table 4-4: TX Module Connections

LOCATION	CONNECTOR	DESCRIPTION
Rear Panel	SMB	Transmitter Exciter Output
	95-Pin	Backplane Small Signal Connector (5X19)
	3-Pin	Backplane DC Power
Circuit Board (side)	RJ-45	Factory Service Communications Port
	4-Pin	Factory Service DC Power



**Table 4-5: TX Module – Front Panel Indicators and Controls**

INDICATOR/CONTROL	INDICATOR COLOR	DESCRIPTION
Status LED	OFF	 No Status
	GREEN SOLID	 Transmitting
	GREEN FLASHING	 Exciter Mode
	RED SOLID	 Major Fault
	RED FLASHING	 Minor Fault
	YELLOW SOLID	 Flash Write (during program modes) Alternately, No Linearizer Power Loop Packets
	YELLOW FLASHING	 Program Downloading
Activity LED (Ethernet)	OFF	 No Activity
	GREEN SOLID	 Ethernet Activity
	RED SOLID	 Loss of Ethernet Activity

#### 4.4.3 Receiver Module (RX)

The MASTR V Receiver (RX) modules, model EA-555007-xxx, are dual-IF conversion receivers. The receiver uses a Sigma-Delta analog to digital converter to process the incoming IF signal. The output of the analog-to-digital converter is a complex pair of I/Q baseband digital signals. The MASTR V RX module supports a wide range of modulation waveforms required for current and next generation public safety two-way radio communications.

After IF filtering and down-conversion, received signals are digitized into I and Q information and sent to the Baseband Processor module via the backplane Ethernet. The Baseband Processor module provides the narrow channel filtering and demodulation. The narrow channel filters and digital demodulation is performed by the system DSP, giving the MASTR V receiver the flexibility needed in current and future LMR communications systems.

All bands of MASTR V RX modules share common design features and meet stringent receiver specifications including the following:

- High intercept point.
- Low noise figure.
- 110.2 MHz IF chosen for all bands of the MASTR V.
- Automatic Level Control.
- Low side LO injection for superior noise performance (700/800/900 MHz module).
- Built-in hardware diagnostics (voltage supplies, PLL Lock).
- Analog FM audio test jack (for factory use only).
- Raw IQ data is sent to the Baseband Processor module for demodulation.

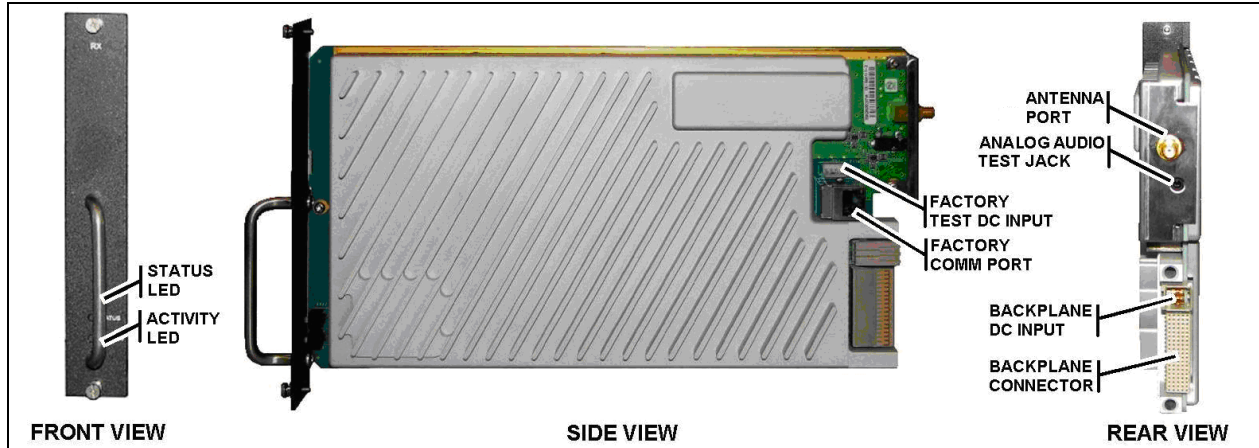


Figure 4-6: RX Module

Table 4-6: RX Module Connections

LOCATION	CONNECTOR	DESCRIPTION
Rear Panel	SMA	Receiver Antenna Input
	3.5 mm Stereo Phone Jack	Analog Receiver Audio (Test mode only)
	95-Pin	Backplane Small Signal Connector (5X19)
	3-Pin	Backplane DC Power
Circuit Board (side)	RJ-45	Factory Service Communications Port
	4-Pin	Factory Service Port (DC Power)

Table 4-7: RX Module – Front Panel Indicators and Controls

INDICATOR/CONTROL	INDICATOR COLOR	DESCRIPTION
Status LED	Off	● No Status
	Green Solid	● Receiving
	Red Solid	● Major Fault
	Red Flashing	● Minor Fault
	Yellow Solid	● Flash Write
	Yellow Flashing	● Program Downloading
Activity LED (Ethernet)	Off	● No Activity
	Green Solid	● Ethernet Activity
	Red Solid	● Loss of Ethernet Activity

#### **4.4.4 Front End Preselector**

Each VHF and UHF MASTR V receiver is equipped with an external RF Front End Preselector, model EA-555018-xxx. The preselector (refer to Figure 4-7) for each receiver module is mounted to a frame assembly located on the rear rack rails near each MASTR V shelf. The preselectors provide narrow bandpass filtering to meet the channel spacing typically used in the VHF and UHF bands.



**Figure 4-7: RF Front End Preselector**

#### **4.4.5 Baseband Processor Module (BBP)**

The Baseband Processor (BBP) module model EA-555005-001 provides several functions within the MASTR V P25 Base Station:

- Generates all RX, TX, and Control Processing for one or more RF channels.
- Provides a data interface between the Traffic Controller the TX and RX modules.
- Generates a heartbeat message used to monitor the health of the base station modules.













When a MASTR V Base Station is powered up, the TX, RX, and HPA modules perform a discovery period where they await a software request message from the BBP module assigned to manage that slot. When the message is received, the module responds with a software response message that prompts the BBP to send the modules a personality message. The personality message contains all personality data (default initialization parameters). The modules respond with an acknowledgement for the personality message, and then initialize themselves according to the personality data in the personality message. The BBP module sends the modules a message to go operational. Once operational, the discovery and initialization phase is complete. The BBP module periodically monitors the modules through heartbeat messages. The BBP module also performs other vital roles, especially during a P25 Simulcast.

















Heartbeat messaging is used to monitor the condition of the TX, RX, and HPA modules. Once operational, the BBP module sends out *heartbeat* messages to each module. When a heartbeat message is received by a module, the receiving module then sends a heartbeat message back to the BBP module. The heartbeat monitor task keeps track of the time-stamps of the received heartbeat messages. A fault is registered if a heartbeat message is not received within a predetermined time-frame. The heartbeat monitor also keeps track of certain fault conditions.

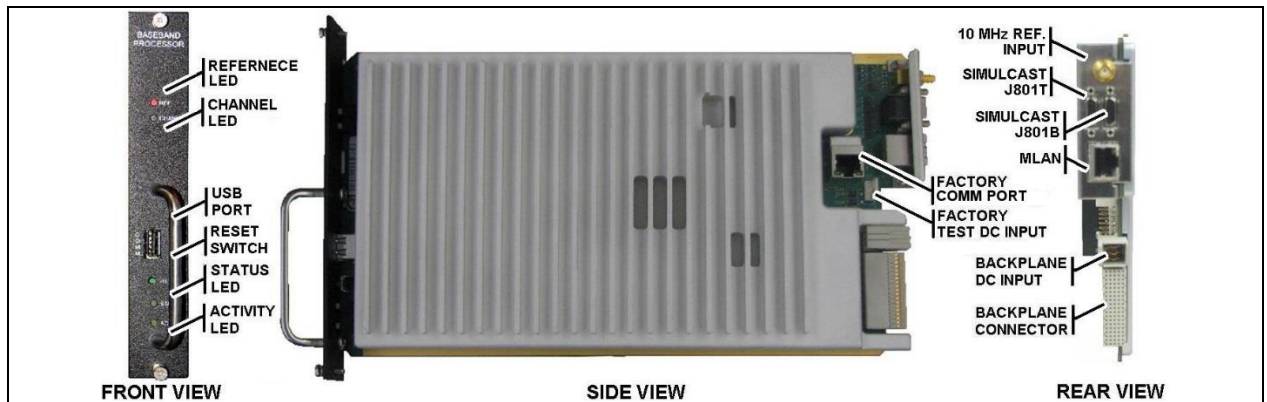
Table 4-8: BBP Module Connections

LOCATION	CONNECTOR	DESCRIPTION
Rear Panel	SMA	10 MHz Time Base Input
	DB-15HD	Simulcast Channel 1
	DB-15-HD	Simulcast Channel 2
	RJ-45	Ethernet MLAN
	95-Pin	Backplane Small Signal Connector (5X19)
	3-Pin	Backplane DC Power
Circuit Board (side)	RJ-45	Factory Service Port (Signaling)
	4-Pin	Factory Service Port (DC Power)
Front Panel	USB	Field Service Communications Port

Table 4-9: BBP Module – Front Panel Indicators and Controls

INDICATOR/CONTROL	INDICATOR COLOR	DESCRIPTION		
		MUX Delay Controller	BBP Clock Controller	GPS 10 MHz Signal
Reference LED				
The BBP's Reference LED uses each color to denote the status of several functions. This is unlike LED patterns used by other MASTR V modules where each LED color indicates the status of only on	Off 	No Power		
	Red Solid 	In Standby Mode	In Standby Mode	No Input from GPS Receiver
	Green Flashing 	In Standby Mode	In Standby Mode	10 MHz OK
	Red Flashing 	In Standby Mode	Providing Clock Signal to Shelf	No Input from GPS Receiver
	Green Solid 	In Standby Mode	Providing Clock Signal to Shelf	10 MHz OK
	Yellow Flashing 	Provide MUX Delay Signaling to Shelf	In Standby Mode	No Input from GPS Receiver
	Yellow/Green Flashing 	Provide MUX Delay Signaling to Shelf	In Standby Mode	10 MHz OK
	Yellow/Red Flashing 	Provide MUX Delay Signaling to Shelf	Providing Clock Signal to Shelf	No Input from GPS Receiver
	Yellow Solid 	Provide MUX Delay Signaling to Shelf	Providing Clock Signal to Shelf	10 MHz OK
Channel LED				
Off 	No Activity			
Green Solid 	Channel Inactive (no batch clock)			
Green Flashing 	Channel Active (batch clock present, 3 second blink)			

INDICATOR/CONTROL	INDICATOR COLOR	DESCRIPTION
Status LED	Off 	No Status
	Green Solid 	OK Status
	Green Flashing 	Running Loader Application
	Red Solid 	Major Fault
	Red Flashing 	Minor Fault
	Yellow Solid 	Flash Write
	Yellow Flashing 	Program Downloading
	Yellow/Green Flashing 	USB Command Success
	Yellow/Red Flashing 	USB Command Fail
Activity LED	Off 	No Activity
	Green Solid 	Ethernet Activity
	Green Flashing 	Undefined (future use)
	Red Solid 	Major Fault (Missing heartbeat from a board controlled by this BB)
	Red Flashing 	Minor Fault
	Yellow/Green Flashing 	USB Command Success
	Yellow/Red Flashing 	USB Command Fail
Reset Switch	N/A	Software Reset



**Figure 4-8: Baseband Processor Module**

**4.4.6 Traffic Controller Module (TC)**

The Traffic Controller (TC) module model EA-555004-001 performs interfacing for one (1) MASTR V P25 RF channel. The TC module provides the following services:

- Data and control information for one (1) TX module.
- Data and control information for one (1) RX module.
- Generates the P25-formatted TX messages for over-the-air transmission.
- Provides VoIP interfacing to other P25 sites.

The TC module manages data and control information for one (1) TX and one (1) RX channel module. Incoming data from dispatch points is processed into over-the-air P25-formatted TX messages. The TC module processes decoded radio information received from the BBP module, and handles all aspects of trunking (subscriber unit validation, assigned channels, queuing, etc.).















During P25 operation, the TC module interprets and directs inbound calls. It issues appropriate control commands to and from the TX and RX modules, including how to handle data between the base station and the Control Point.

The TC module also handles VoIP interfacing to other P25 sites. Receiver packets are formatted into a VoIP-capable protocol and sent to other predefined P25 sites for retransmission.

**Table 4-10: TC Module Connections**

LABEL	CONNECTOR	DESCRIPTION
Rear Panel	RJ-45	Ethernet MLAN
	RJ-45	Ethernet PLAN
	95-Pin	Backplane Small Signal Connector (5X19)
	3-Pin	Backplane DC Power
Circuit Board (side)	RJ-45	Factory Service Communications Port
	4-Pin	Factory Service DC Power
Front Panel	USB	Service Communications Port

**Table 4-11: TC Module – Front Panel Indicators and Controls**

INDICATOR/CONTROL	INDICATOR COLOR	DESCRIPTION
Status LED	Off 	No Status
	Green Solid 	RX/TX C-LAN
	Green Flashing 	Undefined (future use)
	Red Solid 	Major Fault
	Red Flashing 	Minor Fault
	Yellow Solid 	Flash Write
	Yellow Flashing 	Program Downloading
Activity LED	Off 	No Activity
	Green Solid 	Ethernet Activity
	Green Flashing 	Undefined (future use)
	Red Solid 	Major Fault
	Red Flashing 	Minor Fault
	Yellow Solid 	Undefined (future use)
	Yellow Flashing 	Undefined (future use)
S1 and S2 LED	Undefined	Undefined (future use)



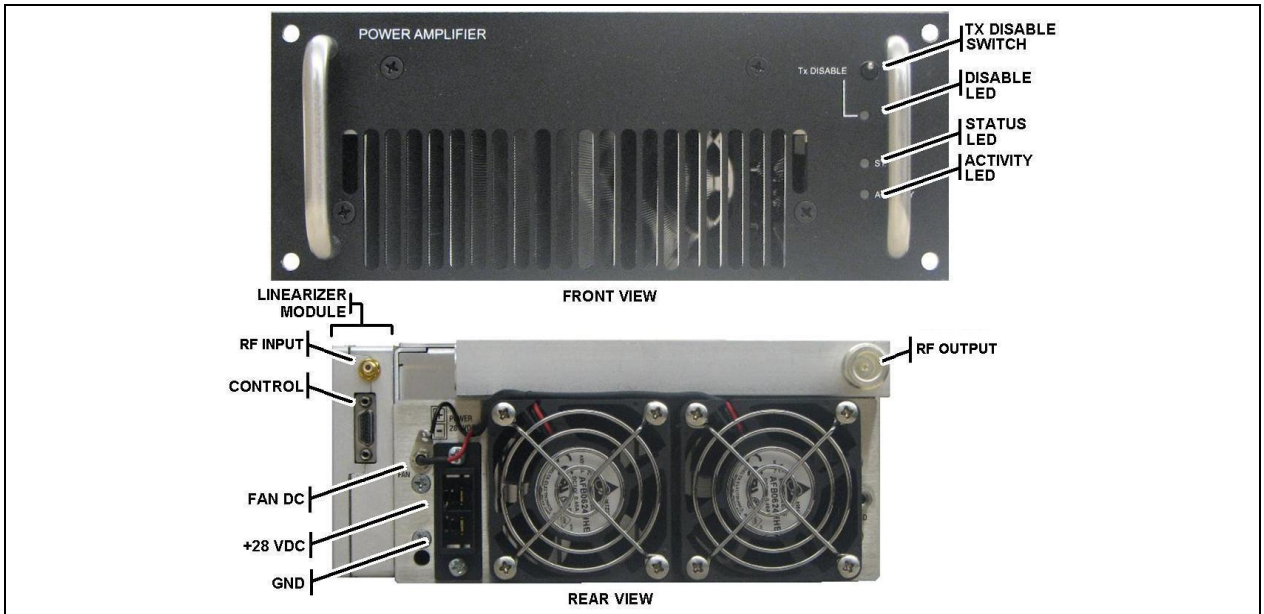
**Figure 4-9: Traffic Controller Module**

**4.4.7 High Power RF Power Amplifier Module (HPA)**

The RF High Power Amplifier (HPA) assembly EA-555014-xxx (shown in Figure 4-10), amplifies the exciter output to the rated station output power level. This module contains a power module, amplifier drivers, and power control circuitry required for power amplification.













The Power Amplifier assembly is a continuous duty, solid state, wide-band RF power amplifier. Its main function is to amplify the -1 dBm signal from the TX module to the rated RF output at the antenna port. The RF output of the Power Amplifier Assembly is capable of up to 100 Watts (adjustable from 10 to 100 Watts) as measured at the PA output port.

The MASTR V HPA series EA-555014-xxx is also equipped with an RF linearizer circuit to improve RF performance. The RF linearizer samples the RF output of the HPA, and provides waveform correction to the RF input signal relative to its RF output characteristics. This improves waveform distortion.



**Figure 4-10: High Power Amplifier Module with Integrated Linearizer**

Table 4-12: HPA Front Panel Indicators and Switches

INDICATOR/CONTROL	INDICATOR COLOR	DESCRIPTION
TX Disable LED	Off 	Normal Operation
	Yellow 	PA Disabled
Status LED	Off 	No Status
	Green Solid 	PA Active (Keyed)
	Green Flashing 	TX Inhibit
	Red Solid 	Major Fault
	Red Flashing 	Minor Fault
	Yellow Solid 	Flash Write
	Yellow Flashing 	Program Downloading
Activity LED	Off 	No Activity
	Green Solid 	Ethernet Activity
	Red Solid 	Loss of Ethernet Activity
TX Disable Switch	N/A	Hard TX Disable

#### 4.4.7.1 Power Supply Module (PS)

The MASTR V AC Power Supply (PS) module EA-555011-001 (refer to Figure 4-11) and DC Power Supply module EA-555001-003 (not shown) are continuous duty switching power supplies. The AC supply operates from an input of 85 VAC to 265 VAC at 47 Hz to 63 Hz (1000 Watts maximum). The DC supply operates from a -48VDC input and can operate from an input of -38 VDC to -57 VDC. Each PSU provides a maximum of 865 Watts total output power divided among the following three (3) DC outputs:

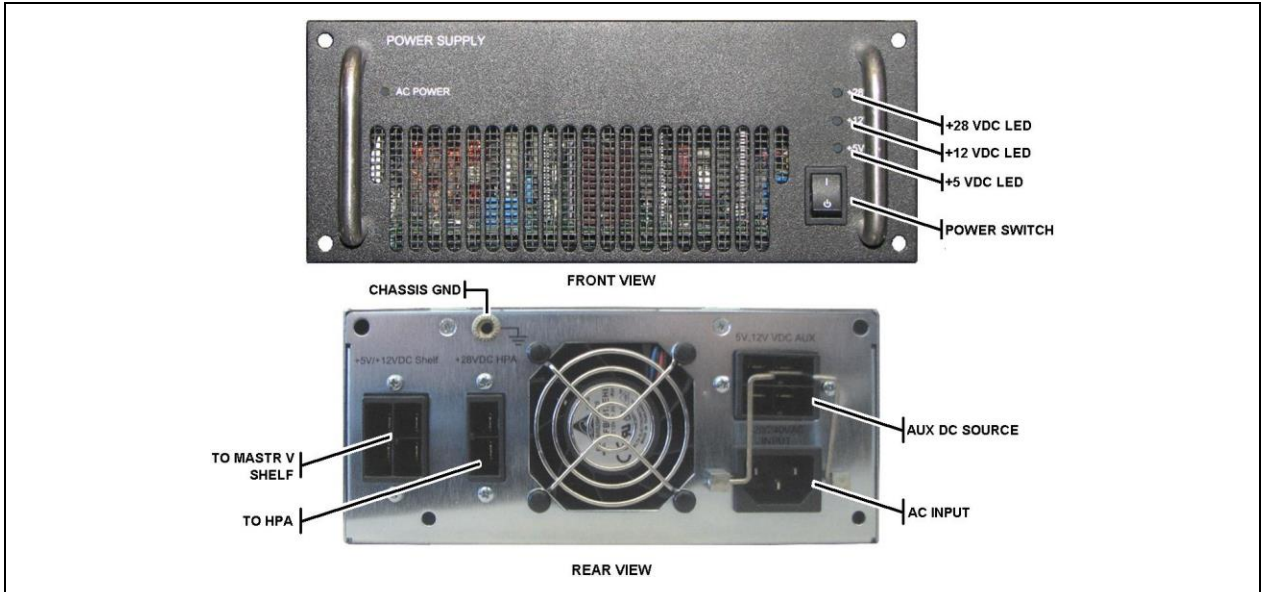
- EA-555011-001 (AC PS)
  - +28 VDC at 25 Amps
  - +12 VDC at 2.8 Amps
  - +5.0 VDC at 28 Amps
- EA-555011-003 (DC PS)
  - +28 VDC at 25 Amps
  - +12 VDC at 5.0 Amps
  - +5.0 VDC at 15 Amps

Each MASTR V PS includes front panel LED status indicators for each DC output and power input. A front panel ON/OFF switch used to disable the power supply and built-in cooling fan.

Three (3) DC power output connections are provided: one (1) to provide DC current to the MASTR V multi-channel shelf, another to provide DC current to the HPA module, and a spare DC connection.

The MASTR V PS is a negative ground power supply (the negative lead of each DC output is tied to chassis ground). Over voltage, under voltage, and over current protection are built-into the AC input and each DC output. In the event one of the protection circuits is triggered, only the affected DC output is shut down until the protection circuit is reset.













**Figure 4-11: Power Supply Module**

**Table 4-13: Backplane – Module DC Power Connector Pinout**

CONNECTOR LABEL	DESCRIPTION	DIAGRAM (As viewed when facing the rear of the PS)
+5 VDC/+12 VDC Shelf	To MASTR V T/R Shelf	
+28 VDC HPA	To HPA Module	
+5 VDC, +12 VDC AUX	Auxiliary/Spare	

Table 4-14: PS Front Panel Indicators and Switches

INDICATOR/CONTROL	INDICATOR COLOR	DESCRIPTION
+28 VDC LED	Off 	Off or not operational
	Green Solid 	Operational
+12 VDC LED	Off 	Off or not operational
	Green Solid 	Operational
+5 VDC LED	Off 	Off or not operational
	Green Solid 	Operational
AC Power LED	Off 	Off or not operational
	Green Solid 	Operational
ON/OFF Switch	N/A	AC Power On/Off

#### 4.4.8 AC and DC Power Distribution

AC powered sites use specially designed dual input AC power distribution strips, model DP-016706-001 (for 120 VAC applications, shown in Figure 4-12) and DP-016706-002 (for 220 VAC applications, not shown). Each AC power strip has two (2) circuit protected high current inputs (110 VAC, 20 Amp and 220 VAC, 15 Amp, respectively). Each high-power input is distributed to three (3) AC outlets for a total of 6 outlets per power strip. The housing around two outlets on each circuit are silk screened with red as an indication of where to connect the high current MASTR V power supplies used at base station rack-ups. The red only designates use, not rating.



Figure 4-12: Dual input 120 VAC Power Distribution Strip

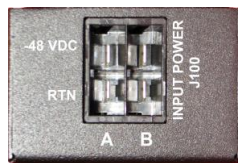
DC-powered MASTR V sites use the DC Power Distribution Blocks, models EA-555019-003 (low power) and EA-555019-004 (high power). These Distribution Blocks include connector assemblies for the DC input connections. The addition of DC input connectors provides ease of installation and improves performance of the MASTR V DC distribution. An external DC power disconnect device is provided and installed as part of the DC system supplying power to the MASTR V rack.



For permanently connected equipment, a readily accessible disconnect device shall be incorporated external to the equipment.



**Figure 4-13: EA-555019-003 -48 VDC Low Power DC Distribution Strip**



**Figure 4-14: EA-555019-004 -48 VDC High Power DC Distribution Strip**

#### 4.4.9 Cross-Connect Panel

The MASTR V IP Cross-connect panel, model number EA-555016-002, includes printed circuit board CB-555149-002 and a 2-RU high metal frame for accommodating 19-inch rack mounting the board. One or more Cross-connect panels are installed at all MASTR V P25 sites. Additional cabling at the Cross-connect panel is installed when a site is setup to support Phase 2.



#### - - - P25 Trunked Phase 2 Operation - - -

- Cross-connect panels are installed at all MASTR V P25 Phase 2 equipped trunked sites which use two (2) or more Baseband modules.
- Additional cabling is installed at the Cross-connect panel to support P25 Phase 2.

The Cross-connect board provides distribution of timing signals between two (2) or more Baseband modules at a site. It also provides distribution of timing signals between two (2) or more racks or cabinets containing MASTR V transceiver shelves.

The timing signals passing through the Cross-connect board to each Baseband module are used to synchronize operations between each RF channel and ensure smooth transition between Control Channel, Working Channel, and timeslot operations.

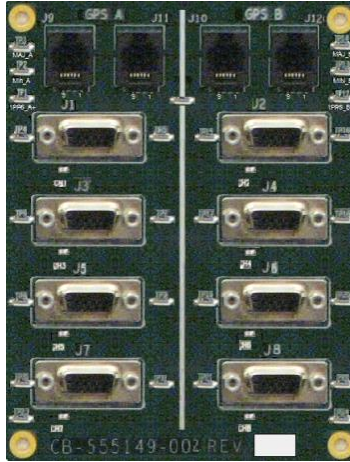


Figure 4-15: IP Simulcast Cross-Connect Board CB-555149-002

## 4.5 RACK AND CABINET ASSEMBLIES

This MASTR V base station configuration is available in an extra deep 86-inch x 46-RU open rack, part number BAT 150 196/22 (refer to Figure 4-16), an extra deep 86-inch x 45-RU cabinet, part number MA-555025 series (refer to Figure 4-17), and a seismic rated open rack, part number BAT150196/24 (refer to Figure 4-18). Each model supports installation of 19-inch rack mountable equipment. Station cabinet, part number 14002-1000-11 (not shown), supports installations where CE/ETSI requirements apply.



Figure 4-16: 86-inch Open Rack Assembly



Figure 4-17: 86-inch Extra Deep Cabinet

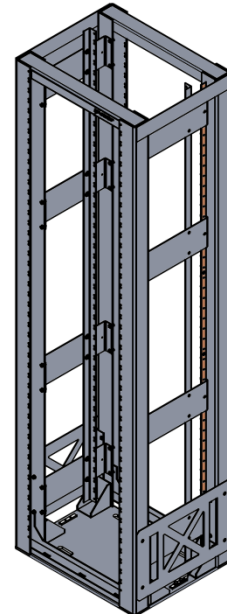


Figure 4-18: Seismic Rated Open Rack Assembly

## 4.6 DC-TO-AC INVERTER

DC-powered sites using the Harris Extra Deep Cabinet may require a DC-to-AC Inverter, part number A10-0326-001, to power the cabinet fan. Initial releases of the 86-inch Extra Deep Cabinet use an AC-powered cabinet fan for forced ventilation. The inverter is required to power this fan at DC-powered sites. Later models of the cabinet may include an optional DC-powered fan which would eliminate the inverter.



**Figure 4-19: DC-to-AC Inverter Used to Power the Cabinet Fan at DC-Powered Sites**

## 5 PROGRAMMING, TEST, AND DIAGNOSTICS

### 5.1 VIDA DEVICE MANAGER

Setup, configuration, and programming of a MASTR V P25 Trunked base station is accomplished using the VIDA Device Manager programming software tool. VIDA Device Manager is an easy-to-use programming tool designed around a Windows-based file management system that permits users to configure and manage devices within their system. The user can save/open personalities using the Windows file system.

The user interface, known as the Device Management Console (DMC), allows users to configure and manage IP-accessible devices in their MASTR V radio system. It allows users to edit device Personalities and permits users to perform actions such as the following:

- Reset
- Read Version
- Load Code
- Read Personality
- Write Personality

The DMC stores device connection information and all personalities (by default) for the supported devices within the radio system. The information stored includes device definitions, device plug-ins, device Client plug-ins, device personalities, device code, device connections, and device details. The Repository provides an interface to access, modify, and create the information.

### 5.2 TEST AND DIAGNOSTICS

The MASTR V base station has built-in self-diagnostics and fault reporting. Station faults may be remotely monitored via fault reporting from one or more of the following resources:

- Via the VIDA network through the Regional Network Manager.
- By telnet session while connected locally to a MASTR V base station.

The TC module and BBP modules are capable of reporting fault information via the VIDA Network to the Regional Network Manager (RNM). The RNM can “Poll” the status of certain equipment, and “Trap” responses to log files. For more information regarding RNM *polling* and *trapping*, refer to the *Regional Network Manager User Manual: MM1000018633*.

## 6 REFERENCE MANUALS

The following table provides a listing of individual manuals that may be useful when installing and maintaining a MASTR V P25 Base Station:

**Table 6-1: Reference Manuals**

<b>REFERENCE MANUALS</b>	<b>MANUAL NUMBER</b>
Standard for Site Grounding and Protection Manual	AE/LZT 123 4618/1
Electrostatic Discharge Protection Manual	LBI-38737
Specification, Guidelines & Practices Manual	LBI-39185
Antenna Systems Manual	LBI-38983
MASTR V P25 Base Station Installation Manual	MM-015040-001
MASTR V P25 Base Station Application/Assembly Diagrams Manual	MM-015041-001
VIDA Device Manager User's Manual	MM-016371-001
VIDA Network Regional Network Manager User's Manual	MM1000018633

## 7 CUSTOMER SERVICE

### 7.1 TECHNICAL SUPPORT

The Technical Assistance Center's (TAC) resources are available to help with overall system operation, maintenance, upgrades and product support. TAC is the point of contact when answers are needed to technical questions.

Product specialists, with detailed knowledge of product operation, maintenance and repair provide technical support via a toll-free (in North America) telephone number. Support is also available through mail, fax and e-mail.

For more information about technical assistance services, contact your sales representative, or contact the Technical Assistance Center at the following:

North America:	1-800-528-7711
International:	1-434-385-2400
Fax:	1-434-455-6712
E-mail:	<a href="mailto:PSPC_tac@harris.com">PSPC_tac@harris.com</a>

### 7.2 TECH-LINK ONLINE SERVICES

For more information about this and other Harris PSPC products, check out our Tech-Link service at:

<https://premier.pspc.harris.com/>

Tech-Link is a one stop link to Technical Documentation (downloadable PDFs), Software Revisions, Feature Encryption, pictorials of parts and accessories, and other information pertaining to our products. This information will enhance your service efforts, 24 hours a day, 7 days a week.

### 7.3 CUSTOMER CARE

If any part of the system equipment is damaged on arrival, contact the shipper to conduct an inspection and prepare a damage report. Save the shipping container and all packing materials until the inspection and the damage report are completed. In addition, contact the Customer Care center to arrange for replacement equipment. Do not return any part of the shipment until you receive detailed instructions from a Harris representative.

Contact the Customer Care center at <https://www.harris.com//solution/pspc-customer-service> or:

#### **North America:**

Phone Number:	1-800-368-3277
Fax Number:	1-321-409-4393
E-mail:	<a href="mailto:PSPC_CustomerFocus@harris.com">PSPC_CustomerFocus@harris.com</a>

#### **International:**

Phone Number:	1-434-455-6403
Fax Number:	1-321-409-4394
E-mail:	<a href="mailto:PSPC_InternationalCustomerFocus@harris.com">PSPC_InternationalCustomerFocus@harris.com</a>



## **8 WARRANTY**

Please register this product within 10 days of purchase. Registration validates the warranty coverage, and enables Harris to contact you in case of any safety notifications issued for this product.

Registration can be made on-line at the Customer Care center webpage:

<https://www.harris.com/solution/pspc-customer-service>

While on the webpage, please review the applicable battery and/or product warranty literature.

#### About Harris Corporation

Harris Corporation is a leading technology innovator, solving customers' toughest mission-critical challenges by providing solutions that connect, inform and protect. Harris supports government and commercial customers in more than 100 countries and has approximately \$6 billion in annual revenue. The company is organized into three business segments: Communication Systems, Space and Intelligence Systems and Electronic Systems. Learn more at [harris.com](http://harris.com).

FLORIDA

NEW YORK

VIRGINIA

BRAZIL

UNITED KINGDOM

UAE

SINGAPORE

