RC10

Wideband ARQ & IP Controller – 120 kbps

NAV DIVISION

S4691 MARLIN 120 kbps | **S5066 WB-ARQ Ed 4** | **PRODUCT OVERVIEW**

Features

- **Embedded Function**
  - **STANAG 4691, Annex A** – MARLIN Controller (≤ 120 000 bps)
- **Product Interfaces**
  - **DTE Data** – Connects to COMSEC, Synchronous / Async, serial I/F
  - **Ethernet Remote Control** – Connects to Management System, Eth. I/F
  - **Ethernet Auxiliary Data** – Connects to Data Applications, Eth. I/F
  - **Ethernet Data** – Alternative DTE connection to Modem, Eth. I/F
  - **GPS** – Accurate time updates from external GPS
  - **Network Time** – Accurate time updates via NTP time server
- **STANAG 4691 MARLIN Controller Features**
  - **HF ELOS (24 kHz) Data Rates** – ≤ 120 000 bps
  - **V/UHF LOS (25 kHz) Data Rates** – ≤ 96 000 bps
  - **V/UHF LOS (20 kHz) Data Rates** – ≤ 76 800 bps
  - **IPv4 Support** – IPv4 data transfer over HF ELOS and V/UHF LOS
  - **Single-Hop Support** – Point-to-Point packet delivery (no relaying)
  - **Multi-Hop Support** – Packet delivery via MANET relaying
  - **Reliable Data Transfer** – Error-free data transfer using ARQ protocol
  - **Collision Avoidance** – Synchronous Time-Division Multiple Access slots
  - **Adaptive Data Throughput Control** – Dynamic bandwidth allocation
  - **Automatic Neighbour Discovery** – MANET relay controller
  - **Radio Silence** – EMCON support
  - **Deployment** – Mobile and Fixed station (split-site support)
  - **Installation Type** – Pure Red/Black
  - **Interoperability** – Proven interoperability with BFTN-UHF (20 kHz)

STANAG 4691 MARLIN

STANAG 4691, also known as “Mobile Ad hoc Relay Line of Sight Networking” (MARLIN), is a NATO specification designed to facilitate Internet Protocol (IP) data transfers in multi-node, multi-hop dynamic networks employing V/UHF Line-Of-Sight (LOS) and HF Extended Line-Of-Sight (ELOS) radio circuit networks.

In environments where SATCOM availability is constrained due to equipment limitations, cost considerations or SATCOM-denied areas, MARLIN’s utilisation of HF LOS and V/UHF ELOS emerges as a practical alternative. Furthermore, the widespread availability of legacy tactical voice radios that support HF and UHF bands could be utilised to transport IP data using STANAG 4691 (MARLIN).

MARLIN radio circuit networks offer interoperability of allied forces by allowing the exchange of tactical data with all sea-surface, sub-surface, airborne (mobile) and land (fixed) platforms.

STANAG 4691 MARLIN Controller

The RC10’s MARLIN controller conforms to the STANAG 4691, Annex A, by providing functionalities, such as automatic network discovery, collision avoidance, error-free data delivery using the embedded ARQ protocol, multi-hop Mobile Ad-hoc Networking (MANET) operation and slot merging for adaptive data throughput control.

For the Rapid Mobile STANAG 4691 MARLIN HF and V/UHF solution, the RC10 is utilised in conjunction with the HF and V/UHF waveforms provided by the RM10. A link encryption module may be connected between the controller and modem. Typically, an IP router connects to the RC10 controller, while an HF or V/UHF radio interfaces with the RM10 modem.

The RC10's utilises the following RM10 embedded waveforms during STANAG 4691 operations:

- HF ELOS MIL-STD-188-110D (24 kHz), ≤ 120 000 bps
- V/UHF LOS NATO STANAG 4691 Annex B (25 kHz), ≤ 96 000 bps
- V/UHF LOS NATO STANAG 4691 Annex B (20 kHz), ≤ 76 800 bps

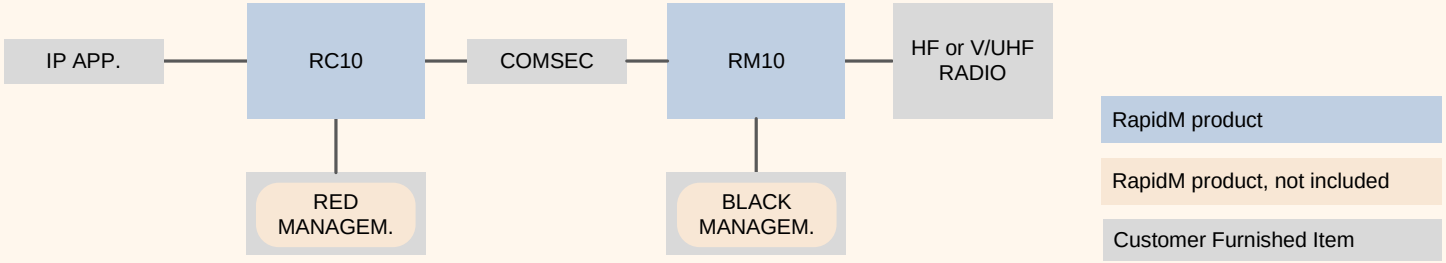

Figure 1: HF or V/UHF Circuit Architecture

REACHING BEYOND BOUNDARIES

Concepts Of Operation

The MARLIN controller utilises a synchronous Time Division Multiple Access (TDMA) scheme called Distributed Slot Reservation Media Access (DSRMA). Each MARLIN node, except during EMCON (radio silence), maintains a fixed allocation of time slots in each frame. The number of allocated slots per node adjusts automatically based on data demands through a dynamic bandwidth allocation mechanism.

Developed initially to facilitate connectivity among ships at sea and slow-moving aircraft using LOS V/UHF radio links, the STANAG 4691 MARLIN standard has evolved. Nowadays, the STANAG 4691 MARLIN controllers are also often deployed on surface ships for ELOS radio communication based on HF surface wave propagation.

The illustration below depicts an example of a STANAG 4691 MARLIN maritime network topology consisting of UHF LOS (blue) and HF ELOS (yellow) subnets. Direct ship-to-ship connections between network participants are established by connecting MARLIN LOS/ELOS bearers directly to the platform's wireless routers. Unicast or multicast data transmissions occur among node members within the network. Connections between two subnetworks are possible when a platform supports both UHF and HF radio communications.

UHF LOS MARLIN Deployment

LOS communication primarily relies on direct waves:

- UHF LOS Range – 30 km (influenced by operating frequency, power level, antenna height and terrain obstructions).
- In cases where direct UHF LOS communication is not feasible due to range limitations or obstructions, the source node requests relay assistance from another node within the UHF LOS range of both the source and the destination nodes to facilitate the seamless relaying of information.

HF ELOS MARLIN Deployment

ELOS communication primarily relies on surface and ground waves:

- HF ELOS Range – 350 km
- Unlike sky wave propagation, as used in Beyond Line-Of-Sight (BLOS), HF surface wave propagation offers reliable and predictable communication channels unaffected by ionospheric conditions and solar cycles.
- Compared to HF BLOS, the limited range of HF ELOS provides added advantages by reducing adjacent area interference and simplifying frequency reuse requirements.
- Communication over these HF surface radio links typically does not utilise Automatic Link Establishment (ALE) which is commonly employed to address the issue of frequency selection.

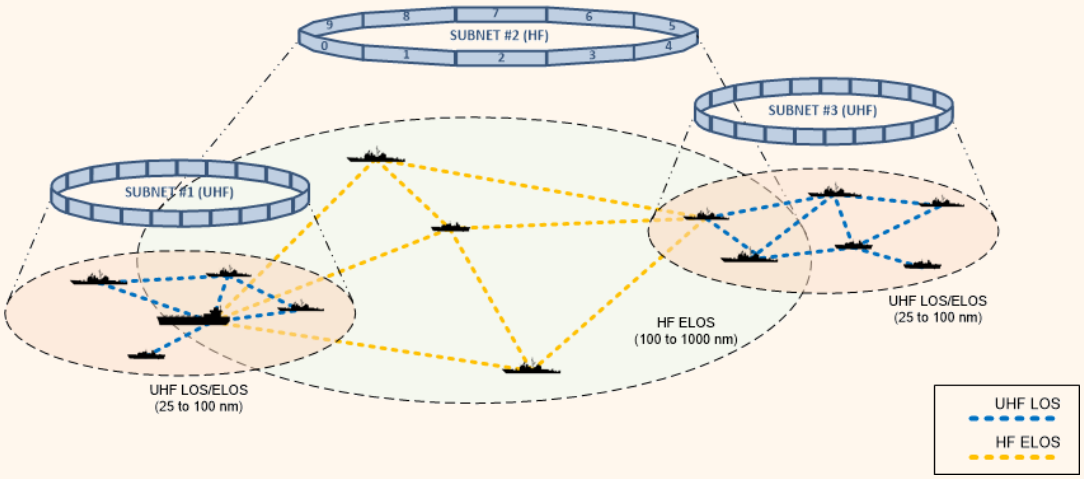

Figure 2: S4691 MARLIN – Concepts of Operation

Conformance To STANAG 4691 Ed. 1 Annex A

The table below provides a summary of the RC10's conformance to the STANAG 4691 Edition 1, Annex A standard. The Annex A provides the specification of the MARLIN controller.

Annex B describes the data modem waveforms for operation in 25 kHz (96 kbps) as provided in the RM10 Wideband SDM & ALE product. The S4691 Annex A, MARLIN controller function is unlocked via the optional CU activation key.

Conformance with STANAG 4691 Edition 1, Annex A					
A.1	Introduction (information)	✓	***A.6***	MAC Reliability – Hop by hop ARQ	✓
A.2	Router Interface	✓	***A.7***	Physical Interface (data rate ≤ 96 kbps)	✓
A.3	Link Layer Control	✓	***A.8***	PDU and Header Formats	✓
A.3.x	Data Priority, Compression/Decompression, Packet Fragmentation & Reassembly, Duplicate Detection and Time Slot Filling, Queue Reporting.	✓	***A.8.x***	STU Header, MAC Management PDU, MAC ACK Packets, MAC Data Header, LLC Header and Relay Control PDU.	✓
A.4	Relay Control	✓	***App A.1***	Expected Operational Requirements	✓
A.4.x	Packet Transmission/Processing, Multi-point Relay Selection, Data Relay.	✓	***App A.2***	16-BIT Cyclic Redundancy Check	✓
			App A.3	Random Access Slot Position	✓
A.5	Media Access Control	✓	***App A.4***	Abbreviations and Acronyms (information)	✓
A.5.x	Types of Neighbors, TDMA Timing, Slot Merging, Types of Slots, Dynamic Bandwidth Allocation, Slot Request/Approval, Network Organization and Link Quality Sensing.	✓			

RC10 Ordering Information

RC10 ARQ Server Ordering Information	Stock Number	Description
RC10 V/UHF S4691 MARLIN Controller (CU)	RME-C0-RA-CUV06	SDC: RC10 CU (4691-A Contr., ≤ 120 kbps) V06
Software Option: S5066 Wideband ARQ & IP Controller (CW)	C10-SW-O-CW-V06	SW MDL-CW (5066WB ARQ, IP Client) V06
Software Option: Email Gateway (SMTP/CFTP/HMTP) (CE)	C10-SW-O-CE-V06	SW MDL-CE (5066 Email G/way, SMTP) V06
Software Option: S4591 MELPe Voice Coder (CN)	C10-SW-O-CN-V06	SW MDL-CN (DV MELPe 1200, 2400bps) V06

info@rapidm.com
+27 12 349 0000
https://www.rapidm.com/

Revision: RC10_S4691_EN_03D