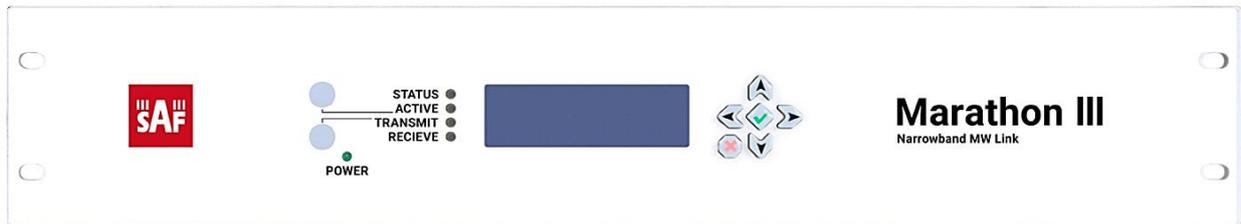


# Marathon III

## DATASHEET



*Front side view*



*Rear side view*

### V.1.04

The Marathon III is the narrowband bidirectional radio/microwave link system operating in the FCC part 101 and NTIA 900MHz band.

The Marathon III system uses a digital QAM modulation technique to maximize RF channel utilization. Marathon III modem is based on an FPGA, therefore is flexible for different application requirements. The complete system - radio & modem boards, high power amplifier (HPA), filters and other necessary parts - are all built into a 2U rackmount indoor housing. All data/management connectors, RF connector (for antenna connection) and power supply connector are accessible at rear panel of the Marathon III system. LED display with indication LEDs and navigation buttons on the front of the unit offer control and monitoring of the critical system parameters. The Marathon III system can be configured by management SW (WEB GUI, CLI, SNMP) into different application modes which optimize its function for required application.

# TECHNICAL SPECIFICATION

## 1. SYSTEM PARAMETERS

### 1.1. Main Features

<b>Hardware</b>	
Architecture	Full-duplex bidirectional TX/RX radio-modem system
<b>Modulation</b>	
Modulation schemes	QPSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM
ACM	Hitless Adaptive Coding and Modulation
Channel bandwidth	100 / 200 kHz
Forward error correction	Reed Solomon with strong or medium correction block
<b>Data Transmission</b>	
User capacity prioritization system	High priority Ethernet traffic interface Low priority Ethernet traffic interface
Path configuration	1+0 1+1 HSB two interconnected unit protection (full redundancy)
Ethernet data compression	Ethernet L1 header compression Ethernet L2 IP traffic compression
Throughput (w/o header compression)	Up to 1446 kbps (200 kHz / 1024QAM / strong FEC)
Ethernet data throughput (L1 header compression)	Up to 1742 kbps (64B IP packets)
Ethernet data throughput (L2 IP traffic compression)	Up to 2135 kbps (64B IP packets)

### 1.2. RF Parameters

<b>RF Interface</b>	
Connector	N-type
<b>Duplex Offset</b>	
TX – RX spacing	9 MHz
<b>Receiver</b>	
Center frequency range (at 200 kHz bandwidth)	High side unit: 932.5 – 935 MHz Low side unit: 941.5 – 944 MHz
Nominal input level	-110 dBm to -25 dBm
Maximal input level	0 dBm
Return loss	> 15 dB over BW 30 MHz
<b>Transmitter</b>	
Center frequency range (at 200 kHz bandwidth)	High side unit: 941.5 – 944 MHz Low side unit: 932.5 – 935 MHz $\pm 0.25$ ppm $\pm 0.5$ ppm/year
Output level	23 – 33 dBm $\pm 1$ dBm
Return loss	> 15 dB over BW 30 MHz

### 1.3. Traffic Parameters

<b>Wired Ethernet</b>	
Number of ports	3x 10/100/1000Eth (RJ-45)
Basic function	Ethernet traffic interface / management access
Encryption	AES128/AES256 for Ethernet traffic interface
<b>Optical Interface</b>	
Number of Ports	2x 1000BASE-X (SFP)
Basic function	EMM card connection Unit interconnection in 1+1 Protection mode

## 1.4. Ethernet Switch Parameters

### Interfaces

Number of ports	3x 10/100/1000Eth (RJ-45) 2x WAN over-the-air interface 1x MNG CPU
Maximum Frame Size	Up to 2048 bytes
MAC table	Up to 8192 addresses
VLAN	Up to 100 VLANs (VID 2-4095), IEEE 802.1q
QoS	Source Port, IEEE 802.1p, IPv4 TOS/DSCP, IPv6 TC, VLAN VID, SA/DA

## 1.5. Ethernet Traffic Parameters

### L1 Compression Efficiency

64Byte Frames	Max. 21,5% from available Ethernet speed
512Byte Frames	Max. 2,9% from available Ethernet speed
1518Byte Frames	Max. 0,3% from available Ethernet speed

### L1 Throughput

#### 1024QAM/200kHz Strong FEC

64Byte Frames	1423 kbps
512Byte Frames	1457 kbps
1518Byte Frames	1446 kbps

### L1 CT Latency

#### 1024QAM/200kHz Strong FEC

64Byte Frames	Max. 3666 us
512Byte Frames	Max. 6140 us
1518Byte Frames	Max. 12134 us

### L1 Back-to-back 1024QAM/200 kHz Strong FEC

64Byte Frames	568 Frames
512Byte Frames	153 Frames
1518Byte Frames	51 Frames

## 1.6. Network Management System

### Ports

Default NMS ports Ethernet port LAN 3

**NMS form** Max. 2,9% from available Ethernet speed

Protocols – Network HTTPS, SNMP v.1 (traps only)/v.2c/v.3, TELNET, SSH

In-band management Via VLAN

Out-of-band management up to 115.2 kbps

### IP addresses

Addresses type Primary IP/ secondary IP

Additional function Static routes, NAT, Ping, Telnet

### GUI

Type WEB based

### CLI

Type safOS

### SNMP

Version SNMP v.1 (traps only), SNMP v.2c, SNMP v.3

Read access Complete MIB

Write access Subset of link parameter

### Security

Licenses Permanent / time limited licenses

Access levels	Guest/User/Admin with password security
HTTPS certificates	Client and server certificates
Authentication	Radius server
SSH/SSL	Secure CLI connection

## 1.7. Miscellaneous

<b>Mechanical</b>	
Dimension [w x h x d]	482 x 88 x 323 mm (including N-type connector)
Weight	ca. 7.3 kg
Protection	EN 60529 (IP31)
<b>Electrical</b>	
Input Voltage	90 – 260 VAC / 47 – 63 Hz
Power consumption	< 67 W (all ports connected)
Maximum unit current	up to 0,75 A
<b>Environmental operational conditions</b>	
Temperature	-5 °C to +45 °C / +23 °F to +113 °F
Humidity	0 to 95 %, non-condensing
Altitude	4,500 meters
<b>Compliance</b>	
Emission designator	100KD7W (at 100 kHz bandwidth) 200KD7W (at 200 kHz bandwidth)
Operation	ETSI EN 300 019, Part 1-3, Class 3.2
Storage	ETSI EN 300 019, Part 1-1, Class 1.2
Transportation	ETSI EN 300 019, Part 1-2, Class 2.3
Power	ETSI EN 300 132-1
Radio frequency	ETSI EN 302 217-2-2, FCC Part 15
EMC	ETSI EN 301 489-1, EN 301 489-3
Safety	IEC 60950-1/EN 60950-1

## 2. MODULATION DEPENDENT PARAMETERS

### 2.1. Throughput

Modem configuration		Strong FEC	Medium FEC
Modulation	BW [kHz]	Data rate [kbps]	Data rate [kbps]
QPSK	100	139	151
16QAM	100	289	307
32QAM	100	356	380
64QAM	100	428	458
128QAM	100	494	530
256QAM	100	566	603
512QAM	100	633	675
QPSK	200	302	319
16QAM	200	585	627
32QAM	200	729	783
64QAM	200	874	934
128QAM	200	1018	1091
256QAM	200	1163	1241
512QAM	200	1301	1398
1024QAM	200	1446	-

## 2.2. Typical S/N and receiver sensitivity at BER 10e-6

Modem configuration		Strong FEC		Medium FEC	
Modulation	BW [kHz]	S/N [dB]	RX Level [dBm]	S/N [dB]	RX Level [dBm]
QPSK	100	-9.5	-110	-10.4	-109.3
16QAM	100	-15.7	-104.2	-16.8	-103.2
32QAM	100	-18.9	-101.3	-20	-100.4
64QAM	100	-22.1	-97.9	-22.8	-97.1
128QAM	100	-25.1	-94.5	-25.9	-93.7
256QAM	100	-27.8	-91.4	-28.9	-90.7
512QAM	100	-30.8	-88.4	-31.9	-87.7
QPSK	200	-9.5	-107	-10.3	-106.3
16QAM	200	-16	-100.6	-16.8	-99.6
32QAM	200	-19	-97.7	-20.2	-96.2
64QAM	200	-21.7	-94.8	-22.7	-93.6
128QAM	200	-24.7	-91.5	-25.9	-90.5
256QAM	200	-27.7	-88.8	-28.6	-87.8
512QAM	200	-30.7	-85.8	-31.6	-84.8
1024QAM	200	-33.7	-82.8	-34.6	-81.8

### Note

All parameters are typical values. For guaranteed values (over time and operation range) subtract 0.5 dB for S/N and add 1 dBm to threshold.

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