Naval HF Products and Subsystems

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Thales Communications, Inc. is a pioneer in the development, manufacture, and support of innovative communications systems for warfighters and first responders. We serve the ground, naval, airborne, and homeland security domains, meeting the challenges and requirements of size-, weight-, and power-constrained environments. Thales Communications is part of the global Thales group of companies, which, for over 50 years, has been a worldwide leader in delivering state-of-the-art communications suites for the demanding naval and maritime environments.

Since 2004, Thales Communications has been building on the Thales legacy, delivering reliable High Frequency (HF) communications systems into both shipborne and fixed-station platforms used by the U.S. Navy and U.S. Coast Guard. We merged the existing commercial manufacturing capability of Thales Mackay (based in Raleigh, North Carolina) with the HF “center of excellence” engineering expertise of Thales in the United Kingdom (Thales UK). Our subsequent transfer of manufacturing from Thales UK has become a proven success story demonstrating our long-term commitment to our Navy and Coast Guard customers.

In 2008, Thales Communications’ HF reputation continued to grow. We were down selected as the HF Program of Record for the Airborne, Maritime, and Fixed Station (AMF) Joint Tactical Radio System (JTRS) program. Additionally, in a sole-source announcement by the Coast Guard, our HF system was selected as the “Gold Standard” for future Cutter acquisition programs. The name Thales Communications has become synonymous with shipborne HF in both the Navy and Coast Guard.

Thales Communications is a U.S. proxy company, 100% American and free of foreign ownership, control, and influence. While operating independently of corporate entities, we serve as a “gateway to technology” and are able to leverage resources from the wider Thales organization as needed.

Headquartered in Clarksburg, Maryland, Thales Communications has a state-of-the-art manufacturing plant and a 365/24/7 customer support department. We are certified to ISO 9001:2008 standards and have achieved the CMMI Level 3 rating.
# Table of Contents

- **Introduction**  
  2

- **Table of Contents**  
  4

- **HF Products and Subsystems**  
  5

  > **Radios and Software**  
  6
    - MSN8100 Series Software Defined Radio (SDR)  
      6
    - TMR8090 Series HF Transceiver  
      7
    - TMR3300 Series Automatic Link Establishment (ALE) Controller  
      8
    - TMR6490 Control Unit  
      9
  
  > **Power Amplifiers**  
  10
    - TMR1096 (125 W)  
      11
    - PA8100 Series (500 W & 1 kW)  
      12
    - Power Supply Units and Trays  
      14
  
  > **Antenna Couplers and Antennas**  
  16
    - ACU51 1 kW Narrowband Antenna Coupler  
      17
    - TMR4095/4096 Series 125 W Antenna Couplers  
      18
    - CA6000 Series Broadband Transmit Antenna Combiner  
      19
    - MCU6400 Series HF Multicouplers  
      20
    - Thales Antennas  
      21
    - Third Party Antennas  
      22

- **Case Studies**  
  24

  > **Naval**  
  25

  > **U.S. Coast Guard**  
  26

  > **International**  
  28

- **Glossary**  
  30
**MSN8100 SERIES SOFTWARE DEFINED RADIO (SDR)**

**GENERAL**

- **Stored Channels**
  - 1-, 2-, 3-, or 4-channel variants
  - 1024 pre-sets per channel

- **Frequency Accuracy**
  - 3 parts in $10^7$ ($0^\circ$C to $35^\circ$C)

- **External Frequency Input**
  - 1, 5, or 10 MHz

- **Modes of Operation**
  - CW (A1A, A1B); MCW (A2A, A2B); AM (H3E); FAX (F1G, F3C); FSK (F1A, F1B, J2B); USB/LSB (H2A, H2B, J2A, J2B, J3E, R2A, R2B, R3E); ISB (B7B, B8E, B9W); Link-11 TADIL-A (G7B); Link-11 STANAG (B7B, B8E, B9W)
  - The SDR is configurable to support both half duplex and full duplex operation (in data modes using a combination of two channels)

- **Tuning Time**
  - <5 ms to within 20 Hz

**STANDARDS**

The HF Naval SDR is compliant to and compatible with the following functional and performance standards:

- STANAG 4197*
- STANAG 4198*
- STANAG 4203
- STANAG 4285
- STANAG 4529
- STANAG 4538 (RF Reqs.)
- STANAG 4539 Annex B
- STANAG 5066 V1*
- STANAG 5511* ed. 3
- STANAG 4415
- STANAG 4481 ed. 1 (Annex B/C)
- STANAG 5031 ed. 1
- STANAG 5522* Annex 2
- MIL-STD-188-110A/B
- MIL-STD-188-141A/B (App A)
- MIL-STD-188-203-1/1A

*modem and/or control functions provided externally

**ENVIRONMENTAL/PHYSICAL**

- **Temperature**
  - MIL-STD-810F, Methods 501.4 and 502.4
    - Operation: 0°C to +49°C
    - Storage: -30°C to +70°C

- **Humidity**
  - MIL-STD-810F Method 507.4

- **Vibration**
  - MIL-STD-167-1 (Ships) Type 1

- **Shock**
  - MIL-STD-901D 30g, 25ms (in a shock-mounted cabinet)

- **EMC/EMI**
  - MIL-STD-461E

- **MTBF**
  - MIL-HDB K-217F at 25°C NS > 4000 hours

- **Size (H x W x D)**
  - 7 x 19 x 19.5 in (178(4U) x 483 x 495 mm)

- **Weight**
  - 37.5 lbs max (17 kg) (depending on configuration)

**RECEIVER**

- **Frequency Range**
  - 10 kHz to 30 MHz in 1 Hz steps

- **Sensitivity**
  - LSB, USB, ISB; a signal of -113 dBm (1µV emf) in a 3 kHz bandwidth gives a (S+N)/N of 10 dB
  - A high sensitivity position is provided

**EXCITER**

- **Frequency Range**
  - 1.5 MHz to 30 MHz in 1 Hz steps

- **Carrier Suppression**
  - >60 dB

- **Unwanted Sideband Suppression**
  - >60 dB

- **Spurious Emissions**
  - Better than -80 dB at all frequencies removed by more than 5% from the tuned frequency (with PPS)

**OPTIONS**

- External Pre/Post-selector
TMR8090 SERIES HF TRANSCEIVER

GENERAL

Stored Channels
- 1000 programmable

Frequency Stability
- OCXO: 0.01 PPM, 0° to +50°C

Modes of Operation
- USB/LSB/ISB/CW/AM/AME
- Simplex, Half Duplex, or Full Duplex operation

Tuning
- Direct frequency or channel entry from keyboard or keypad on LCU, RCU, or computer

Synthesizer Tune Time
- < 20 ms

Remote Interfaces
- RS-232 or RS-485 (up to 1.3 km)

Line Input/Output
- Two independent channels
- -20 dBm to +10 dBm
- 600 ohm balanced audio

Voltage Requirements
- Universal Input: 90 to 270 VAC, 47 to 400 Hz single phase

BITE
- Auto test to board/module level on power up
- Re-test at user command

ENVIRONMENTAL/PHYSICAL

Temperature
- Operation: -5°C to +55°C
- Storage: -40°C to +70°C

Shock/Vibration
- MIL-STD-810E

Weight
- 21.2 lbs (9.6 kg)

Size (H x W x D)
- 7 x 19 x 15 in (178 x 483 x 381 mm)

RECEIVER

Frequency Range
- 10 kHz to 30 MHz in 1 Hz steps

Sensitivity
- 10 dB SINAD in 3 kHz bandwidth
- SSB: 0.5 µV (-113 dBm)
- CW: 0.5 µV (-113 dBm)
- AM: 3 µV (reduced below 500 kHz)

EXCITER

Frequency Range
- 1.5 MHz to 30 MHz in 1 Hz steps

Output Power
- 50 mW

OPTIONS
- Internal Pre/Post-selector
- Rack Mount Kit
- TMR6490 Local Control Unit

TMR8090 SINGLE
Part Number 794052-001-XXX

TMR8091 FULL DUPLEX
Part Number 794053-001-XXX

TMR8092 DUAL
Part Number 794054-001-XXX

- Companion 125 W, 1 kW, or 5 kW LPA
- JITC-Certified MIL-STD-188-141B (App A) (ALE)
- TADIL-A/LINK-11 (A and G)
- Two Channel ISB
- Full BITE, Local, or Remote to LRU
- Configuration Flexibility

The following products are variants of the TMR8090 Series Transceiver:

TMR5090: SINGLE CHANNEL RECEIVER
(7990026-000-XXX)

TMR5091: DUAL CHANNEL RECEIVER
(799027-000-XXX)

TMR6790: SINGLE CHANNEL EXCITER
(795037-000-XXX)

TMR6791: DUAL CHANNEL EXCITER
(795038-000-XXX)
TMR3301 SINGLE ALE
Part Number 799075-000-001

TMR3302 DUAL ALE
Part Number 799075-000-002

- 1U/19-Inch Rack Mounted Single or Dual ALE System
- ALE to MIL-STD-188-141B App A with Link Protection to App B Level 2
- U.S. Government JTC Certified
- ALE System Configuration and Control Established with Rack Mounted Laptop Computer and ALE3300 ALE Controller Software
- Control Also Available from TMR6490 Local Or Remote Control Unit (LCU/RCU)

GENERAL
- Automatic best channel selection, based on current conditions
- Automatic initialization at power-up to user configuration
- Extensive diagnostics and error recovery
- Detailed log reports of system activity and diagnostic operations

ENVIRONMENTAL/PHYSICAL

Temperature
- MIL-STD-810F methods 501.4 and 502.4
  - Operation: -6° C to +49° C
  - Storage: -33° C to +71° C

Humidity
- MIL-STD-810F method 507.4

Vibration
- MIL-STD-167-1 (Ships)

Shock
- MIL-STD-901D (in a shock-mounted cabinet)

EMC/EMI
- MIL-STD-461E

Size (H x W x D)
- 1.75 x 19 x 10 in (44 x 483 x 254 mm)

Weight
- Single ALE: 7 lbs (3 kg)
- Dual ALE: 9 lbs (4 kg)

ELECTRICAL

Power
- 85-264 VAC, 47-63 Hz autoranging, 10 W maximum

Audio Level
- 0 dBm nominal

Audio Input Impedance
- 600 ohms

Control
- RS-232

System Block Diagram
TMR6490 CONTROL UNIT

GENERAL

Graphical User Interface (GUI)
• The monochrome ¼ VGA display screen allows a 160° viewable area. Dimming from 100% to 5% brightness is provided as well as screensaver timer and display on/off control.

Communication Control Interfaces
• RS-485 global bus communication control
• RS-232 maintenance control

Communication Control Baud Rates
• 300, 600, 1200, 2400, 4800, 9600, 19200 or 38400

Control Capability
• Any combination up to 49 radios and control units on the global bus network

PTT
• Audio path tone keying or control path serial keying

External Key
• Audio path tone keying or control path serial keying

Local Squelch
• Syllabic

Microphone
• A microphone connector is provided.
• Two different input impedances may be selected
  – High Impedance Input: 5 kohm
  – Low Impedance Input: 300 ohm

ENVIRONMENTAL/PHYSICAL

Temperature
• Operation: -5°C to +55°C
• Storage: -40°C to +70°C

Shock/Vibration
• MIL-STD-810E

EMC/EMI
• MIL-STD-461

Size (H x W x D)
• 7 x 19 x 3.86 in (178 x 483 x 98 mm)

Weight
• 7.6 lbs (3.5 kg)

Power Requirements
• Receives power from the host radio when mounted on chassis

OPTIONS

• Power Supply for operation separate from radio: 90-270 VAC, 47-63 Hz, auto-ranging
**TMR1096 (125 W)**

**GENERAL**

**Frequency Range**
- 1.5 to 30 MHz

**RF Output Power (Class AB Mode)**
- 125 W ± 1 dB average or PEP into 50 ohm load
- Selectable reduced power level: 62, 31, 16, 8, 4, 2, and 1 W ± 1 dB, Continuous duty

**VSWR**
- Full power output up to 1.3:1 VSWR
- Automatic output power derating for load VSWR > 1.3:1

**Input RF Drive**
- 50 mW

**Intermodulation Distortion**
- Class AB Mode, 125 W PEP
  - IMD3 = -28 dB typical below tones
  - IMD5 = -38 dB typical below tones
  - IMD11 and higher order products = -67 dB typical below tones

**Harmonics**
- All harmonics at least 63 dB below fundamental.

**Protection Mechanisms**
- Over Temperature Protection
- Output Load Mismatch Protection
- Over Current Protection

**Voltage Requirements**
- Input Voltage
  - 85 - 264 VAC, single phase, 47-63 Hz, autoranging
  - 20 - 32 VDC Reserve Battery, auto changeover
- Input Power Factor
  - 0.98 @ 90 VAC and 125 W CW output power
- Power Consumption
  - 530 VA maximum

**Control Interface**
- Local Bus
  - RS-232 diagnostic and RS-485 control from
  - Series 5000 Exciter

**ENVIRONMENTAL/PHYSICAL**

**Temperature**
- Operation: -5°C to +49°C
- Storage: -31°C to +71°C

**Humidity**
- MIL-STD-810E

**Vibration**
- MIL-STD-167-1 (Ships) Type 1

**Shock**
- MIL-STD-810E

**EMI/EMC**
- MIL-STD-461D

**Dimensions (W x H x D)**
- 19 x 7 x 4 in (483 x 178 x 95 mm)

**Weight**
- 20 lbs (9 kg)

**OPTIONS**
- TMR4095 and TMR4096 Digital Antenna Couplers
- Rack mount bracket kit for mounting separate from radio

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**TMR1096 125 W POWER AMPLIFIER**

Part Number 796012-000-001

- Full BITE, Local or Remote, to LRU
- Power Output Adjustable from 1 W to 125 W in 3 dB Steps
- AC Input 85-264 VAC, Auto-ranging, or DC Input 20-32 Volts, Auto Changeover
- MIL-STD-188-141B (App A) and TADIL-A/LINK-11 Compatible
- Fully Compatible with TMR4095/4096 Digital Antenna Coupler (No Control Cable)
- VSWR, Temperature and Over Current Protection
**PA8100 SERIES (500 W & 1 kW)**

### GENERAL

**Frequency Range**
- 1.5 MHz to 30 MHz

**RF Output Power (Class AB Mode)**
- 1 kW Amplifier: 1 kW ± 1 dB into <1.2:1 VSWR, >600 W into 2:1 VSWR
- 500 W Amplifier: 500 W ± 1 dB into <1.2:1 VSWR, >300 W into 2:1 VSWR
- Power reduction down to 1 W in 1 dB steps

**Harmonics**
- All better than <-63 dBc

**Forward Intermodulation Products**
- >38 db (typically >43 dB below PEP)

**Required Power (48 VDC)**
- 1 kW: 3600 W typical, 4800 W max
- 500 W: 2000 W typical, 2400 W max

### ENVIRONMENTAL/PHYSICAL

**Temperature**
- MIL-STD-810F
  - Operation: -5°C to +49°C
  - Storage: -30°C to +71°C
- Operation to +55°C at reduced duty cycle or AM services

**Humidity**
- MIL-STD-810F

**Vibration**
- MIL-STD-167-1 (Ships) Type 1

**Shock**
- MIL-STD-901D, 30 g, 25ms (in a shock mounted cabinet)

**EMC/EMI**
- MIL-STD-461E

**Size (H x W x D)**
- 1 kW: 14 x 19 x 22 in (355 (8U) x 483 x 560 mm)
- 500 W: 10.5 x 19 x 22 in (267 (6U) x 483 x 560 mm)

**Weight**
- 1 kW: 143 lbs (65 kg)
- 500 W: 88.2 lbs (44 kg)

### OPTIONS

**Receiver/Exciters**
- MSN8100 Series Software Defined Radio
- TMR5000/6000 Series Receiver/Exciter

**Transmit Antennas/Antenna Coupling Units**
- Whip Antennas via ACU51 fast antenna tuning unit
- AS6000 loop antennas
- Broadband antennas via CA6000 broadband combiner system
**GENERAL**

**AC Power Input Supply**
- Rated Voltage: 382V – 475V AC phase-to-phase, 47 – 63 Hz
- Rated Current: 9A per phase at 382V AC input voltage and 48V/100A output
- Power Consumption: <6.5 kVA

**DC Output Supplies**
- The power supply output has the characteristics listed in the Table below.

<table>
<thead>
<tr>
<th>OUTPUT</th>
<th>MAXIMUM RIPPLE</th>
<th>NOMINAL VOLTAGE</th>
<th>MAXIMUM LOAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>250mVp-p†</td>
<td>48V ± 3%</td>
<td>100A</td>
</tr>
<tr>
<td>2</td>
<td>100mVp-p†</td>
<td>12V ± 0.5V</td>
<td>500mA</td>
</tr>
</tbody>
</table>

† Ripple and noise in the range 10 Hz to 20 MHz.

**ENVIRONMENTAL/PHYSICAL**

- **Temperature**
  - Operation: -5°C to +49°C with relative humidity up to 95% at 30°C per MIL-STD-810F
- **Altitude**
  - 6,500 ft (2000 m)
- **Vibration**
  - Per MIL-STD-167-1 (Ships) Type 1
- **Shock**
  - MIL-STD-810F
- **EMC**
  - MIL-STD-461E with Thales 189049 external filter kit

**Size (H x W x D):**
- Module: 5.00 x 8.0 x 24.0 in (127 x 203 x 610mm)
- Tray: 5.25 x 19.0 x 25.0 in (133 x 483 x 635mm)

**Weight:**
- Module: 38 lbs (17 kg)
- Tray: 22 lbs (10 kg)

**OPTIONS**
- Mechanical Installation Kit
- Empty Slot Blanking Plate
GENERAL

AC Power Input Supply
- Rated Voltage: 90 - 264V, 47-63 Hz, 1-phase or 3-phase, 3/4 wire Plus Protective Earth (PE)
- Rated Current: 32A single-phase or 15A per phase, 3-phase
- Power Consumption: < 5.5 kVA

DC Output Supplies
- The power supply output has the characteristics listed in the Table below.

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<tr>
<td>1</td>
<td>250mVp-p†</td>
<td>48V ± 3%</td>
<td>100A‡</td>
</tr>
<tr>
<td>2</td>
<td>100mVp-p†</td>
<td>12V ± 0.5V</td>
<td>500mA</td>
</tr>
</tbody>
</table>

† Ripple and noise in the range 10 Hz to 20 MHz.
‡ 60A when input is below 155Vac (nom).

ENVIRONMENTAL/PHYSICAL

Temperature
- Operation: –5°C to +49°C with relative humidity up to 95% at 30°C per MIL-STD-810F

Altitude
- 6,500 ft (2000 m)

Vibration
- Per MIL-STD-167-1 (Ships) Type 1

Shock
- MIL-STD-810F

EMC
- MIL-STD-461E

Size (H x W x D):
- Module: 5.25 x 8.0 x 20.0 in (133 x 203 x 508mm)
- Tray: 5.25 x 19.0 x 23.0 in (133 x 483 x 584mm)

Weight:
- Module: 20 lbs (9 kg)
- Tray: 22 lbs (10 kg)

OPTIONS
- Mechanical Installation Kit
- Empty Slot Blanking Plate
ACU51 1 kW NARROWBAND ANTENNA COUPLER

GENERAL

Frequency Range
• 1.5 MHz to 30 MHz

Power Input
• 1000 W, CW, 100% duty cycle

Tuning Time
• Normal
  – 3 s typical, 7 s maximum
• Preset
  – < 50 ms

Tune Power
• 10 W + 3 dB

Tuning Accuracy
• 1.5:1 VSWR or better

Power Supply
• Voltage: 28 VDC + 4 V
• Max Current: 3 A

ENVIRONMENTAL/PHYSICAL

Temperature
• Operation: -40°C to +55°C
• Storage: -40°C to +70°C MIL-STD-810E and NES1004

Humidity
• MIL-STD-810E, Method 507.3

Vibration
• MIL-STD-810E, Method 514.4 cat 9 random

Shock
• MIL-S-901D (on shock isolators)

MTBF
• >12,600 hrs

MTTR
• <30 minutes

Size (H x W x L)
• 33 x 16 x 13.5 in (845 x 411 x 341 mm)
  (including insulator and stud)

Weight
• 116 lbs (53 kg)

OPTIONS

• Electrical Installation Kit—contains electrical connectors

ACU51 1 kW Narrowband Antenna Coupler
**TMR4095 125 WATT**  
Part Number 798011-000-004

**TMR4096 125 WATT NVIS**  
Part Number 798013-000-002

- Antenna Matching Capability
  - 9’ and 16’ Vehicular Whips
  - 23’ to 150’ Whips and Long Wire
  - Base Station Antennas
  - Line Flattener for Broadband Antennas
- No Control Cable Required
- Sealed Construction
- Remote Capability - Up to 328 ft (100 m) Separation from Amplifier

**GENERAL**

**Operation Frequency Range**
- 1.5 to 30 MHz

**Rated Input Power**
- 125 W PEP and Avg

**Antenna Matching Capability**
- 10 ft (3 m) whip antennas above 1.8 MHz
- 13 ft (4 m) whip antennas above 1.7 MHz
- 23 ft (7 m) whip antennas 1.5 to 30 MHz
- Wire Antennas up to 150 ft (45 m)
- Broadband dipoles and NVIS antennas (use as a line flattener)

**Tuning Time**
- Less than 5 ms from memory
- 300 ms typical, 600 ms maximum RF tune

**Tune Power Required**
- 4 W minimum
- Power Input Requirement: 22 to 30 VDC supplied through coaxial cable from amplifier

**Tuning Accuracy**
- 1.5:1 VSWR or better

**Remote Capability**
- Up to 200 ft (60 m) separation from transmitter with RG-213
- Up to 328 ft (100 m) with RG-218

**ENVIRONMENTAL/PHYSICAL**

**Temperature**
- Operation: -30°C to +55°C
- Storage: -40°C to +85°C

**Humidity**
- MIL-STD-810E, Method 506.2 and 507.2

**Immersion**
- MIL-STD-810E, Method 512.2

**Vibration**
- MIL-STD-810E, Method 514.3

**Shock**
- MIL-STD-810E, Method 516.3

**Size (H x W x D)**
- 8 x 7 x 14 in (203 x 178 x 356 mm)

**Weight**
- 16.5 lbs (7.5 Kg)
CA6000 SERIES BROADBAND TRANSMIT ANTENNA COMBINER

GENERAL

Frequency Range
- 1.5 MHz to 30 MHz

Input Power
- 1 kW nominal per transmitter input, maximum 1.2 kW

Insertion Loss
- Combiner: ≤1 dB
- Flexible Power Management Unit: 0 dB ±2 dB

Input/Output Impedance
- Combiner Array: 50 ohm, unbalanced, VSWR <1.2:1, with 50 ohm source and terminations.
- FPMU: 50 ohm, unbalanced, VSWR <1.2:1, with 50 ohm source and terminations.

Port-Port Isolation
- Combiner Array: >25 dB min, typically 30 dB with 50 ohm source and termination
- FPMU: ≥40 dB min, typically 50 dB with 50 ohm source and termination

Power Supply
- 115/230 V, 50-60 Hz, ±10%

Power Requirement
- Heaters 110 W nominal (per cabinet)

ENVIRONMENTAL/PHYSICAL

Temperature
- Operation: -5°C to +55°C
- Storage: -30°C to +70°C MIL-STD-810 E and NES1004

Vibration
- MIL-STD-810E, Method 514.4, cat 9 random

Shock
- MIL-S-901D; 30g, 25 ms (per NES1004) (with cabinet shock mounts)

Size (W x H x D)
- Height (34 U cabinet): 64.125 in (1630 mm)
- Width: 23.625 in (600 mm)
- Depth: 31.50 in (800 mm)

Weight

<table>
<thead>
<tr>
<th>CABINET(S)</th>
<th>FPMU</th>
<th>DIPLEXER</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4 way (single)</td>
<td>220 kg</td>
<td>5 kg</td>
</tr>
<tr>
<td>5 way (single)</td>
<td>250 kg</td>
<td>5 kg</td>
</tr>
<tr>
<td>6-8 way (dual)</td>
<td>500 kg</td>
<td>10 kg</td>
</tr>
</tbody>
</table>

ADDITIONAL

- Interoperable with Thales Series 6000 and Series 8000 HF systems
- Electrical Installation Kit: Contains electrical connectors.
- Mechanical Installation Kit: Contains shock mountings and hardware to interconnect cabinets.
MCU6400 SERIES HF MULTICOUPLERS

GENERAL

Configuration
- MCU6402: 4 antenna inputs with 2 outputs per input
- MCU6403: 4 antenna inputs with 3 outputs per input
- MCU6412: 4 inputs to 12 outputs via non-blocking switch matrix (any receiver output can be connected to any antenna input)

Frequency Range
- 10 kHz to 30 MHz

Noise Figure
- MCU6402/6403: 9.5 dB with 50 ohms source and termination over the frequency range 60 kHz to 30 MHz
- MCU6412: 16 dB with 50 ohms source and terminations over the frequency range 60 kHz to 30 MHz

Intermodulation Products
- Between 1.6 MHz and 30 MHz for two equal signals, the 3rd order intercept point is +50 dBm typical, +47 dBm min

Input and Output Impedance
- 50 ohms nominal

Remote Control
- MCU6402/6403:
  - No functions to control; only status information provided
  - BITE/status reported via discretes to MCU6412
- MCU6412: RS-232 asynchronous interface

Front Panel
- MCU6402/6403: Power ON/OFF indication and LED status indication for each output
- MCU6412: Indication by LEDs of the input selected for each output and of potential faults

Power Supply
- 115V / 230V AC ± 10%
- 50-60 Hz ± 10%

ENVIRONMENTAL/PHYSICAL

Temperature
- MIL-STD-810E, Methods 500.3, 501.3, 502.3
- Operation: -5°C to +50°C
- Storage: -30°C to +70°C

Humidity
- MIL-STD-810E, Method 507.3 88% at 40°C

Vibration
- MIL-STD-810E cat 9 random

Shock
- MIL-STD-901D, 30g 25 ms (in a shock-mounted cabinet)

EMC/EMI
- MIL-STD-461/462

Size (H x W x D)
- MCU6402/6403: 5 x 19 x 12.4 in (133 (3U) x 483 x 315 mm)
- MCU6412: 5 x 19 x 18.5 in (133 (3U) x 483 x 470 mm)

Weight
- 6402/3: 18 lbs (8kg)
- 6412: 22 lbs (10kg)
NVIS ANTENNA
Part number 700100-398-001

The Thales Maritime NVIS Antenna is a robust NVIS specific antenna designed for use with the Thales TMR4096 125 W Antenna Coupler. Developed in cooperation with the U.S. Coast Guard, this antenna has been deployed on all 378-foot, 270-foot, and 210-foot Cutters as well as the new SENTINEL-Class Fast Response Cutter. The radiating element is constructed from 4-inch OD aluminum tubing for mechanical strength and uses the ship's deck as the reference ground plane to improve efficiency at lower frequencies. The antenna insulated deck mount houses the antenna feed point and is designed to allow installation of the TMR4096 antenna coupler below the mount to minimize the cable length between the coupler and antenna feed point.
AS-3771 B/U 14 FOOT BROADBAND RX WHIP (LCS)

The AS-3771B/U 14-foot aluminum whip receiving antenna is designed and built to meet the U.S. Navy requirements for shipboard antennas, such as MIL-S-901 Grade A for shock and MIL-STD-167 for vibration. The antenna is used with general HF communications equipment and provides vertically polarized, omni-directional azimuth reception from VLF to 30 MHz. www.valcom-guelph.com/products/AS-3771_BU.html

AS-2537C/SR 35 FOOT NARROWBAND TX WHIP (U.S. NAVY)

Valcom’s AS-2537C/SR 35-foot whip transmitting antenna was designed and built to meet the U.S. Navy requirements for shipboard antennas. The mechanical strength is achieved with a patented process using high strength filament fiberglass and epoxy resin. The base section acts as an insulator as the feed-point is 12” from the bottom. The base section is an integral part of the antenna thus giving maximum strength. Electrical stability is obtained by employing multiple beryllium copper conductors embedded in the epoxy fiberglass. A specially designed bronze ferrule is used to join the two sections together. The antenna is used with general HF communications equipment and provides vertically polarized, omnidirectional azimuth reception from 1.6 to 30 MHz. www.valcom-guelph.com/products/AS-2537C_SR.html

VBBA2-30 35 FOOT BROADBAND TX WHIP (LCS, TYPE-45)

The Valcom model VBB A2-30 is a 35-foot, broadband HF tactical whip antenna intended for use in high-power electronic counter measures (ECM) and HF transmit systems. The VBB A2-30 exhibits a nominal input impedance of 50 ohms over the HF frequency band of 2 MHz to 30 MHz providing a maximum VSWR of 2:1 and a maximum average power of 3000W, all without the use of an external tuner. Lightning protection is provided by a DC short at the input of the antenna. The antenna is used with HF broadband power combining equipment and provides vertically polarized, omni-directional azimuth transmission from 2 to 30 MHz. www.valcom-guelph.com/products/VBBA2-30.html

4328 28 FOOT NARROWBAND TX WHIP (FRC-B)

For HF/SSB communications, the 28-foot Model 4328 is a whip antenna with conductors running full length and no loading coil. It is designed for large vessels requiring the highest HF band performance. The two-piece antenna easily accommodates input up to 1 kilowatt. It is Shakespeare white and has a built-in anodized aluminum flange base for mounting as a self-supporting antenna. The center fittings are chrome-plated brass, and it has a side feed termination band. The antenna is used with general HF communications equipment and provides vertically polarized, omni-directional azimuth reception from 2 to 30 MHz. www.shakespeare-military.com/milantennashow.asp?product=4328
229-B 35 FOOT NARROWBAND TX WHIP (USCG CUTTERS)

The 35-foot Model 229-B antenna is constructed entirely of corrosion resistant, non-ferrous materials, ideally suited to shipboard and fixed station applications requiring non-magnetic antennas. The top section is made with parallel beryllium copper ribbon, embedded in Shakespeare fiberglass for maximum tip capacitance. The lower half of the antenna employs tubular copper conductors secured in the center of tapered fiberglass with polyurethane foam and terminating in a fiberglass mounting flange. The bottom-fed Model 229-B needs no costly porcelain insulators, and its base protects all electrical connections from exposure to weather. It can be bolted directly to the deck or platform, eliminating vulnerable insulators. The antenna is used with general HF communications equipment and provides vertically polarized, omni-directional azimuth reception from 2 to 30 MHz.

www.shakespeare-military.com/milantennashow.asp?product=229-b

120-60 32 FOOT NARROWBAND TX WHIP (SPAWAR TSC)

The Model 120-60 Transportable Ground Stake Antenna Kit is a vertically erected ground station antenna developed with the highly versatile Model 120 Antenna System. The Model 120-60 utilizes the eight section AT-1011/U whip, adding a ground stake base assembly, guy rope assembly, and ground plane wires. It comes with a canvas carrying case for safe transport of the antenna kit. The antenna is used with general HF communications equipment and provides vertically polarized, omni-directional azimuth reception from 2 to 30 MHz.


Barker & Williamson

BWDS-90N 90 FOOT BROADBAND FOLDED DIPOLE ANTENNA (SPAWAR TSC)

The BWDS series of patented broadband folded dipole antennas gives rear tactical and base units the full HF communications capability they need. A wide variety of missions can be handled with this one antenna. They offer fully automatic, low SWR operation over the entire HF band without need for an antenna tuner/coupler. They are frequency agile and will operate continuous ALE or secure frequency hopping. They will propagate excellent NVIS, medium or long distance.

www.bwantennas.com/pro/fdipole.pro.htm
BACKGROUND

The U.S. Navy's AVENGER-Class Mine Countermeasure Ships (MCM-1) had a critical space and weight issue. The Navy approached Thales Communications to develop a solution for a state-of-the-art HF communications system that would improve performance over their legacy systems, while also reducing weight and minimizing space requirements. Additionally, the new upgrade, as always, needed to comply with stringent naval requirements on environmental, vibration, and heavyweight shock.

SOLUTION

In 2004, Thales was awarded a 5-year Indefinite Delivery Indefinite Quantity contract to modernize communications aboard the MCM-1 Minesweepers with the Thales AN/URC-143, single-rack HF system. The AN/URC-143 HF radio suite is a state-of-the-art system specifically suited to small-to-medium ship applications requiring newest generation, automated, HF waveforms and remote control applications. The radio system is a 2-channel 500 watt transmit, 6-channel receive system supporting Automatic Link Establishment (ALE) to MIL-Std-188-141B. Specifically designed for the most demanding applications, the system meets all requirements on environmental, vibration, and heavyweight shock to MIL-S-901D. Replacing a legacy system of two half racks and two full racks with a single, AN/URC-143 rack of equipment, Thales Communications has resolved the critical space and weight issue. Thales delivered and installed all 14 shipsets, completing the contract on-time and on-budget. This program demonstrated that the AN/URC-143, a robust maritime HF system, is suitable for small and medium applications.
BACKGROUND
The U.S. Coast Guard is considered the 12th largest “navy” in the world, yet some of the ships date back to World War II. The average age of a Coast Guard Cutter is 25 to 30 years old. The Coast Guard needed to upgrade its 270-foot Medium Endurance Cutter (WMEC) fleet to meet new waveform standards including MIL-STD-188-141B Automatic Link Establishment (ALE). In summer 2005, Thales was awarded a $32 million, 10-year Indefinite Delivery Indefinite Quantity contract to upgrade all existing Coast Guard Cutters in the legacy fleet. Thales completed the installations aboard the 270-foot WMEC fleet, 378-foot High Endurance Cutters (WHEC), 210-foot WMEC fleet, and ocean-going Icebreakers.

SOLUTION
To upgrade the Coast Guard fleet, Thales delivered its TMR8090 HF system. This upgrade provides the Coast Guard maximum flexibility with the latest integrated and networked shipborne HF technology supporting the newest generation waveforms, including MIL-STD-188-141B Automatic Link Establishment (ALE). Thales’ modularly designed, dual channel HF radios provide size and weight reductions over legacy equipment and, with a variety of control applications, allow the Coast Guard the ability to remotely control the Thales HF system from multiple locations, maximizing operational flexibility and reducing workload. The HF system includes transceivers, power amplifiers, couplers, ALE modems, and associated spares. Thales is the only HF provider to offer a Near Vertical Incident Skywave (NVIS) solution for the Coast Guard—a fundamental requirement. In 2008, the Coast Guard selected the Thales HF system for incorporation into new cutter acquisition contracts for the next five to seven years. The system is being integrated on the Sentinel-Class Fast Response Cutters (FRC) and Offshore Patrol Cutters (OPC) as well as other Cutter and shore communications acquisition programs with medium-powered (up to 1 kW) HF and HF-ALE requirements. The Coast Guard deemed the Thales HF system to be the “Gold Standard” and a
proven, “extremely capable, highly reliable and easy to maintain radio that exceeds Coast Guard requirements.” In early 2009, Thales received the initial order for the FRC-B (SENTINEL-Class), the Coast Guard’s new patrol boat for the 21st century.
INTERNATIONAL

BACKGROUND

In addition to the various U.S. Navy and Coast Guard programs, Thales has delivered HF communications solutions into several international programs. These contracts were either directly awarded by prime contractors or via a U.S. Government-sponsored Foreign Military Sales (FMS) program.

SOLUTIONS

Thales has successfully delivered HF solutions for many FMS cases including various new construction shipbuilding programs and ship transfers. As a U.S.-based Thales company, Thales Communications is well-suited to compete and win various FMS and Foreign Military Financing programs.

Building on the Thales solution for the U.S. Navy Tactical Support Centers (TSC), one key FMS case is providing HF ground communications to support the sale of excess P-3C Orion maritime patrol aircraft to the South Korean government. Starting in 2006, Thales has been working with the U.S. Navy to develop a Series 5000/8000 hybrid solution (TMR8090/PA8109) to upgrade the several TSC sites globally to support U.S. Navy P-3C operations. This common system solution has been directly adopted by the South Korean military for use in their operations by SPAWAR via a NAVAIR-sponsored FMS case.

These HF solutions allow both the U.S. Navy and the FMS customer to replace obsolete equipment with cutting-edge, ALE-supported systems to support both aircraft and ground stations.
### Glossary

<table>
<thead>
<tr>
<th>A</th>
<th>Micro</th>
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<tbody>
<tr>
<td><strong>A</strong></td>
<td>Ampere</td>
</tr>
<tr>
<td>ACU</td>
<td>Antenna Coupling Unit</td>
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<tr>
<td>ALC</td>
<td>Automatic Level Control</td>
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<tr>
<td>ALE</td>
<td>Automatic Link Establishment</td>
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<tr>
<td>AMF</td>
<td>Airborne, Maritime, and Fixed Station (JTRS)</td>
</tr>
<tr>
<td>AN/URC</td>
<td>Army/Navy Utility Radio Communications</td>
</tr>
<tr>
<td>ARG</td>
<td>Automatic Repeat Request</td>
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<tr>
<td>BCS</td>
<td>Broadband Combining System</td>
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<tr>
<td>BER</td>
<td>Bit Error Rate</td>
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<tr>
<td>BFEM</td>
<td>Battle Force E-Mail</td>
</tr>
<tr>
<td>BIT</td>
<td>Built-In Test</td>
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<tr>
<td>BITE</td>
<td>Built-In Test Equipment</td>
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<tr>
<td>CAW</td>
<td>Common Aerial Working</td>
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<tr>
<td>CMMI</td>
<td>Capability Maturity Model Integration</td>
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<tr>
<td>CW</td>
<td>Continuous Wave</td>
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<tr>
<td>D</td>
<td>Decibel</td>
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<tr>
<td>dB</td>
<td>Decibel Relative to 1 Milliwatt</td>
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<tr>
<td>DC</td>
<td>Direct Current</td>
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<tr>
<td>DMR</td>
<td>Digital Modular Radio</td>
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<tr>
<td>ECM</td>
<td>Electronic Counter Measures</td>
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<tr>
<td>ECCM</td>
<td>Electronic Counter-Counter Measures (frequency hopping)</td>
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<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
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<tr>
<td>EMI</td>
<td>Electromagnetic Interference</td>
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<td>F</td>
<td>Facsimile</td>
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<tr>
<td>FMS</td>
<td>Foreign Military Sales</td>
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<tr>
<td>FPMU</td>
<td>Flexible Power Management Unit</td>
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<tr>
<td>FRC</td>
<td>Fast Response Cutter</td>
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<tr>
<td>FSK</td>
<td>Frequency Shift Keying</td>
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<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>H</td>
<td>Hertz</td>
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<tr>
<td>HF</td>
<td>High Frequency</td>
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<tr>
<td>HPF</td>
<td>High Pass Filter</td>
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<tr>
<td>IP3</td>
<td>3rd-order Intermodulation Product</td>
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<tr>
<td>ISB</td>
<td>Independent Side Band</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>JITC</td>
<td>Joint Interoperability Test Command</td>
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<tr>
<td>JTRS</td>
<td>Joint Tactical Radio System</td>
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<tr>
<td>kg</td>
<td>Kilogram</td>
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<tr>
<td>kHz</td>
<td>Kilohertz</td>
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<td>Kilowatt</td>
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<td>Light Emitting Diode</td>
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<td>Low Pass Filter</td>
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<td>Line Replaceable Unit</td>
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<td>MIL-S</td>
<td>Standardization Agreement</td>
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<td>Standing Wave Ratio</td>
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<td>NAVAIR</td>
<td>Outer Diameter</td>
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<td>NF</td>
<td>Noise Figure</td>
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<td>NVIS</td>
<td>Near Vertical Incident Skywave</td>
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<tr>
<td>PEP</td>
<td>Volts, Voltage</td>
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<tr>
<td>PPM</td>
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<tr>
<td>PPS</td>
<td>Volt-Ampere</td>
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<tr>
<td>PSU</td>
<td>Volts Alternating Current</td>
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<tr>
<td>PTT</td>
<td>Video Graphics Array</td>
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<td>Voltage Standing Wave Ratio</td>
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