Technical Specifications

<table>
<thead>
<tr>
<th>OceanObserver</th>
<th>AMAR G4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary purpose</strong></td>
<td>On-board processing, data streaming (and recording)</td>
</tr>
<tr>
<td><strong>Applications</strong></td>
<td>Real-time detection of mammal calls and clicks</td>
</tr>
<tr>
<td></td>
<td>Vessel, ambient noise quantification</td>
</tr>
<tr>
<td></td>
<td>Non-acoustic sensor data collection</td>
</tr>
<tr>
<td><strong>Typical implementations</strong></td>
<td>Cabled observatory, Drifter, Profiling float, Buoy, Glider or other robotic vehicle</td>
</tr>
<tr>
<td><strong>Power draw</strong></td>
<td>~2.5 W recording one channel</td>
</tr>
<tr>
<td></td>
<td>Higher for processing, multiple channels, etc.</td>
</tr>
<tr>
<td><strong>Power source options</strong></td>
<td>Battery packs or 7–24 VDC in cabled settings</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Weeks or months on battery</td>
</tr>
<tr>
<td></td>
<td>Years if cabled</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>1 microSD up to 256 GB</td>
</tr>
<tr>
<td></td>
<td>10 TB on twenty 512 GB SD cards</td>
</tr>
<tr>
<td><strong>Acoustic channels</strong></td>
<td>Up to 16 mid-speed (8–512 ksps) 1 high-speed (2048 ksps)</td>
</tr>
<tr>
<td><strong>Noise floor</strong></td>
<td>&lt;150 dB/Hz re full scale at 5–512 ksps</td>
</tr>
<tr>
<td></td>
<td>&lt;145 dB/Hz re full scale at 2048 ksps</td>
</tr>
<tr>
<td><strong>Non-acoustic sensor channels</strong></td>
<td>4 analog 3–6 digital (6 RS-232 or 3 RS-485)</td>
</tr>
<tr>
<td><strong>Built-in clock accuracy</strong></td>
<td>0.7 ppm w/ 1 ppm aging in 1st year (TCXO)</td>
</tr>
<tr>
<td><strong>Other clock options</strong></td>
<td>TCXO: 0.7 ppm w/ 1 ppm aging in 1st year (with PPS sync)</td>
</tr>
<tr>
<td><strong>Other interfaces</strong></td>
<td>Gigabit Ethernet, USB/OTG</td>
</tr>
<tr>
<td><strong>Data streaming</strong></td>
<td>Yes (Gigabit Ethernet)</td>
</tr>
<tr>
<td><strong>Wireless control</strong></td>
<td>Wi-Fi, Bluetooth available</td>
</tr>
</tbody>
</table>
1. Choose the main board for your application

OceanObserver
On-board processing and recording
Powerful in situ processing enables bandwidth-limited telemetry links to shore to transmit detections, pitch tracks, data snippets, or other derived information products of interest. It can also stream raw or compressed data at up to Gigabit Ethernet rates in cabled implementations. Supports up to 16 mid-speed acoustic channels up to 512 ksp and one high-speed channel at 2048 ksp.

Based on the Zynq XC7Z020 chip, it has a dual-core ARM processor and FPGA fabric. On-board signal processing can include detection and identification of marine mammal calls and clicks, and quantifying ambient noise and sounds from vessels and industrial noise sources.

AMAR G4
Autonomous recording
A long duration, low-power data recorder. An associated memory controller hosts up to twenty 512 GB SD memory cards for 10 TB of storage memory. Supports up to 4 mid-speed acoustic channels up to 512 ksp.

This board is based on the TI TMS320C6748 floating point digital signal processor. The board has Ethernet connectivity for configuring and downloading data.

2. Add daughterboards for your choice of features

Mid-speed ADC: High-performance acoustic sampling
- 4 channels per board
- Observer can host 4 boards (16 channels)
- AMAR G4 can host 1 board (4 channels)
- Sample rates: 8–512 ksp
- Resolution: 24 bits
- Noise floor: $<-150 \, \text{dB re FS}$ at all sample rates
- Synchronously sampled channels (ideal for arrays and beamforming)
- AMAR G4

- Easily optimized for your chosen hydrophone or sensor
- 4 variants to interface with:
  - Single-ended voltage hydrophones
  - Differential voltage hydrophones
  - Single-ended current-driven hydrophones
  - IEPE sensors
- Channels only powered when active

High-speed ADC: Very high frequency sampling
- 1 channel per board (1 board max)
- Sample rate: 2048 ksp
- Resolution: 24 bits
- Noise floor: $-148 \, \text{dBV/Hz}$ relative full scale
- 4th order anti-alias filter at 900 kHz
- Only powered when active

Low-speed ADC: Analog sensors
- 4 channels:
  - 2 at 0 to 5 V input
  - 2 at 4–20 mA input
- Sample rate: 10 sps (decimated by up to $2^{20}$)
- Resolution: 18 bits

Power
- Observer

- Observer
- AMAR G4

- Powers non-acoustic sensors and other external devices
- 3 separately switchable power channels (each can output 5 $V_{DD}$, 13 $V_{DD}$, or the raw input power of 7–28 $V_{DD}$)
- Select output settings with DIP switches

GPIO
- Observer
- AMAR G4

- Monitors and controls non-acoustic sensors and other external devices
- 8 GPIO lines with a high voltage level of 5 V (each configurable as input or output)
- Each connector can provide 5 $V_{DD}$ power and ground to external devices
- 4 lines are read/written from Observer $V_{DD}$ power and ground to external devices

Serial I/O
- Observer
- AMAR G4

- Integrates digital non-acoustic sensors
- 3 peripheral chips (each configurable for 2 RS-232 channels or 1 RS-422/RS-485 channel)
- Switched 5 V for powering off-board sensors
- Each channel can be enabled/disabled by the main board

TCXO clock
- Observer
- AMAR G4

- Better clock drift than the AMAR’s built-in RTC: 0.7 ppm vs. 5 ppm
- RS-232 line and PPS input to connect to GPS or other time sync devices
- Back-up battery for RTC support

CSAC
- Observer
- AMAR G4

- Ultimate in timing accuracy: < 10 ppb/year
- RS-232 line and PPS input to connect to GPS or other time sync devices
- No back-up battery: must be set at each power-on

Wireless controller
- Observer
- AMAR G4

- Remotely controls instrumentation and supports telemetry
- Built-in Wi-Fi and Bluetooth
- Telemetry via 3G/4GL cellular, VHF, Iridium, or acoustic modem
- Interfaces DIO logic to control peripherals