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A MULTI-PURPOSE 'NO STRINGS' AMPLIFIER

AtlantiTecRF has introduced a new broadband amplifier module with very versatile characteristics, which makes it suitable for a variety of applications. One such application is the BOX battery-powered multi-purpose portable amplifier, which lends itself to laboratory and measurement tasks where a single very wide bandwidth AC power-independent amplifier offers the advantages of being convenient and cost effective.

The heart of the BOX battery-powered amplifier is the AOX multi-octave amplifier illustrated in **Figure 1**. This is a 1.0 to 20.0 GHz small-signal amplifier that employs novel matching structures to deliver excellent performance over wide bandwidth. It is also capable of operating over a wide range of temperatures down to 4°K. It features low noise figure, good temperature stability and has a typical gain of 27 dB. It is housed in a small enclosure

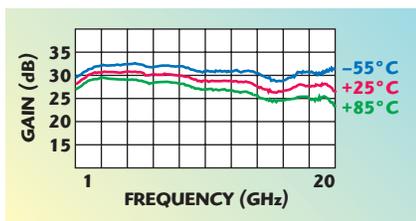
measuring 31.4 by 27.5 by 10 mm with SMA connectors.

There are three principal versions for differing temperature ranges: -20° to +85°C, -55° to +85°C and 4° to 358°K, the differences being in the design of the enclosure. **Table 1** illustrates the main characteristics and **Figure 2** shows the gain variation with frequency and temperature.

The extra versatility provided by the broad bandwidth and temperature range offers benefits in cost and logistics, making the AOX suitable for many applications in test and measurement, telecoms, radar, countermeasures and other demanding military and civil applications. The 4°K model is ideal for radioastronomy and other instrumentation situations where high gain is required at low temperature, together with the ability to perform reliably at the higher temperatures experienced during setting-up and during the transition down to the operating temperature.



▲ Fig. 1 Model AOX multi-octave amplifier.



▲ Fig. 2 Gain vs. frequency and temperature for the AOX.

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BOX AMPLIFIER

The BOX battery-powered amplifier (see **Figure 3**) incorporates the AOX module in a self-contained and portable product with the same electrical specification as the AOX itself. Housed in a die-cast aluminium enclosure, the BOX also contains a NiMH rechargeable battery, which gives approximately 24 hours of operation between charges. A battery charger is supplied with each unit. **Table 2** illustrates the general specifications; the detailed electrical parameters are similar to the AOX figures given in Table 1.

Two connector configurations are available—axial, in which the connectors are mounted on the ends of the housing, and radial, in which they are mounted on one face. Rugged, high performance Type N male and female connectors are supplied as standard, but, optionally, SMA can be provided. All models have a threaded hole in one face to enable the amplifier to be mounted on a tripod or other support. There is an ‘Amplifier On/Off/Charge’ switch and the charger accepts an AC input voltage range of 80 to 240 V at 50 to 60 Hz.

There are many measurement applications for a broadband amplifier such as antenna-testing and EMC evaluation. The battery-powered BOX amplifier offers the benefit of freedom from ground potential; thus, it can be used to overcome ground loop problems. In field applications such as antenna testing there is a clear advantage in independence from an AC power supply and the unit may be used in conjunction with the increasing numbers of battery-operated field-portable test instruments such as VNAs and spectrum analysers. Furthermore, the very broad bandwidth means that ‘one size fits all’ when it

comes to making provision for different antennas on the test range. This saves time, cost and logistics.

Often antenna test ranges entail the use of long interconnecting cables and this invites ground loop issues. Battery operation means that it is much easier to ‘float’ parts of the circuit to identify and overcome these problems. Similar issues may affect EMC measurements which, again, often entail field operation and long cable runs. The BOX can

be used as an effective and trouble-free antenna-mounted amplifier and its low noise figure makes it suitable for reception applications in addition to roles in transmission. Battery life is sufficiently long to allow the completion of many test routines and, typically, recharging can be carried out overnight or during other downtimes.

Even in conventional desk-top applications there are times when a readily-available, AC power-indepen-

| TABLE I | | | |
|-------------------------------|--------------|--------------|--------------|
| AOX CHARACTERISTICS | | | |
| <i>Parameter</i> | <i>Typ.</i> | <i>Min.</i> | <i>Max.</i> |
| Small-signal Gain (dB) | | | |
| @ -55°C | 30 | 27 | |
| @ +25°C | 27 | 24 | |
| @ +85°C | 25 | 22 | |
| @ 4°K | 32 | | |
| Gain Variation (dB) | | | |
| Over any 50 MHz | 0.15 | | |
| Over any 500 MHz | 0.50 | | |
| Over any 1 to 20 GHz | | | ±2.5 |
| Noise Figure (dB) | | | |
| @ +25°C | 2.5 @ 5 GHz | | |
| | 4.5 @ 15 GHz | | |
| @ 4°K | | | 0.5 @ 5 GHz |
| | | | 2.0 @ 15 GHz |
| Output Power (dBm) | | | |
| 1 dB GCP @ +25°C | +11 @ 1 GHz | +8 @ 1 GHz | |
| | +14 @ 5 GHz | +11 @ 5 GHz | |
| | +14 @ 10 GHz | +11 @ 10 GHz | |
| | +13 @ 15 GHz | +10 @ 15 GHz | |
| | +12 @ 20 GHz | +9 @ 20 GHz | |
| Output Power (dBm) | | | |
| Saturated @ +25°C | +12 @ 1 GHz | | |
| | +15 @ 5 GHz | | |
| | +15 @ 10 GHz | | |
| | +14 @ 15 GHz | | |
| | +13 @ 20 GHz | | |
| Third-order Intercept | | | |
| @ +25°C | +28 @ 1 GHz | | |
| | +20 @ 5 GHz | | |
| Input VSWR | 2.0:1 | | 2.5:1 |
| Output VSWR | 2.3:1 | | 2.8:1 |
| DC Supply | | | |
| Voltage (V) | +5 | | +8 |
| Current (MA) @ +25°C | 140 | | 150 |
| @ 4°K | 125 | | |



▲ **Fig. 3** Model BOX battery-powered amplifier.

dent amplifier can solve problems. For instance, it is a convenient way of making up cable losses in large hook-ups involving an isolated test chamber or screened room and the broad bandwidth ensures great flexibility.

The very broad bandwidth and 'no strings' freedom from AC power of the BOX amplifier makes it an ideal component of the test engineer's toolkit, yet this very simple concept has not hitherto been very readily available off-the-shelf. The applications are numerous and limited only by the imagination. The AOX multi-octave amplifier module featured in the BOX portable battery-operated amplifier embodies proprietary matching circuits that enable stable operation to be achieved over a wide range of temperatures and it offers economic and versatile solutions to a wide range of civil and military applications.

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| TABLE II | |
|--|---|
| BOX GENERAL SPECIFICATIONS | |
| <i>General Specifications</i> | |
| Frequency Range | 1 to 20 GHz |
| Operating Temperature Range: Model BOX-010200 | 0 +50°C Ambient Conditions |
| RF Connector | Type N, Stainless Steel MIL-C-39012 |
| Connectors: Standard | Male Input, Female Output |
| Optional | Type N Male or Female SMA Male or Female |
| Housing | Die-cast Aluminum Alloy |
| Finish | Matt Black |
| Dimensions | 175 × 80 × 60 mm (6.89 × 3.15 × 2.36 ins.) |
| Tripod Mounting Point | 1/4" UNC Threaded Hole in Base |