COMPANY PROFILE

MILMEGA - 20 years at the leading edge of amplifier design

Founded in 1987, MILMEGA designs and manufactures solid state, high power amplifiers for commercial and government applications. The amplifier products range in frequency from 200 MHz to 14 GHz with power levels to 1 kilowatt.

The Company employs 40 design and production engineers and is based in Ryde on the Isle of Wight in England.

MILMEGA's first design was a major contract to deliver an innovative narrow-band amplifier to meet the demanding requirements of a technologically advanced medical product used in the treatment of prostate cancer.

Following this early success the Company set out to build a skilled team of design and production engineers to deliver further innovative products by exploiting the potential of emerging power device technologies.

Today, MILMEGA's design engineers are considered amongst the best in the field with an award winning design in the Series 2000 broadband Class A family, pulsed Class C amplifiers and ultra-broadband UHF and microwave amplifiers using GaAsFET, MMIC and more recently, Silicon Carbide and Gallium Nitride technology.

The Company has also created a highly and continually trained manufacturing team focussed on quality and reliability, assembling and testing amplifiers of which over 70% are exported to the Far East, EMEA and North America, and used in applications as diverse as:

Physics Research – Colliding electrons and positrons in the search for new sub-atomic particles, MILMEGA supplies amplifiers that power RF longitudinal damping systems.

Electromagnetic Compatibility (EMC) Testing – Creating broadband RF immunity test fields strengths at 600 V/m.

Defence – Operating over wide temperature ranges in rugged environments in a range of applications including sophisticated jamming and surveillance solutions.

Communications Testing – Where MILMEGA amplifiers' exceptional linearity is typically used in Power device testing, Passive intermodulation (PIM) testing, Intermodulation testing, Multi-tone testing and Adjacent channel power testing.

In 2004 the Company was acquired by its management team in a management buyout (MBO) in part financed by venture capital funding from South East Growth Fund. Since the MBO the Company has doubled in size expanding into China and North America and has invested heavily in new product development to leverage the benefits of new
transistor technologies, in particular, Silicon Carbide (SiC) and Gallium Nitride (GaN).

In 2006 the Company acquired a second factory on the Isle of Wight and now operates from the two locations with an increased output capacity of 60%.

Second facility at Park Road, Ryde

The CSA Topology

Much of MILMEGA's success is due to its design philosophy. The philosophy makes predominant use of the Corporate Structure Amplifier (CSA) topology. This is where the high-power stage of the amplifier is made up of a rank of identical modules as typified in Figure 1.
Details on the CSA design philosophy can be found in the Application Note ' The Corporate Structure

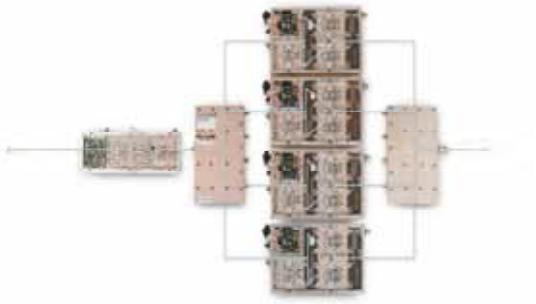

Fig.1.Practical implementation of a 100 W, 1-2 GHz Corporate Structure Amplifier

Amplifier', available from the Download section at www.milmega.com

The CSA philosophy provides many key features: Ease of future upgrade in power and / or frequency, High reliability, Ease and speed of servicing, and small size / low weight.

The field / time proven reliability and the ease / speed of servicing are both at the level where MILMEGA is the only company in the industry providing a standard 5 year, fully expensed warranty on its Series 2000 product range. By fully expensed we mean MILMEGA bears all the costs associated with a warranty repair, including both-

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way transport costs (packaging, shipping, insurance), so the cost of ownership of a Series 2000 amplifier over the 5 year warranty period is predetermined as zero.

Future Upgrade Option

Upgrading the power is mainly a case of adding more power modules to the high power rank of the amplifier. The power upgrade process can be repeated later as the need arises. Figure 2 shows an amplifier initially purchased at 55 watts, upgraded later to 125 watts, and then upgraded later still to 250 watts. The upgrade process can be repeated until 1 kilowatt is reached as shown in Figure 3.

Fig 2. Upgrading the MILMEGA amplifier

Upgrading the frequency is a simple matter of collecting the CSA modules that make up the amplifier covering the new frequency, mounting them so they are adjacent to the existing amplifier modules, and then adding internal switching to retain the single RF input / single RF output configuration.

High Reliability

MILMEGA amplifiers regularly achieve 44,000 hours MTBF. This reliability is field / time proven, and arises from conservative electrical and thermal design combined with a key CSA topology advantage; the amplifier is mainly made up from many identical modules making for manufacturing / performance consistency.

Minimum Downtime

Two key advantages reduce or eliminate downtime. First, should an output transistor fail, the output power of the amplifier is reduced by only a few points of a dB, so the amplifier can still be utilised until a convenient service timeslot becomes available. Second, the CSA use of identical modules allows for rapid fault assessment and module replacement. As a testament to the ease / speed of service, MILMEGA offers the industry's only 48-hour factory turnaround repair promise. Ease of service also allows Series 2000 owners the option of self-sufficiency through on-site repair by their own suitably trained technicians.

Global Support

In 2007 MILMEGA finalised separate agreements in China and North America to supply local national product support and servicing capabilities.

Power Density

Due to a superb packing factor (seen exemplified in the final power upgrade in Figure 2), MILMEGA also offers industry leading power density. The Series 2000 will typically deliver the required power in a package half the size and weight of competitor equivalents. This size / weight reduction makes portability a reality allowing sharing between multiple test stations / sites. In June 2005, MILMEGA announced the launch of its new, transportable, 1-2 GHz solid state amplifier producing 1 kilowatt of saturated power, the first of its kind in the world. (Figure 3)

Fig.3

AS0102-1000
1-2 GHz
1 kW

Solid State versus Travelling Wave Tubes

Solid state combined with CSA topology provides a number of performance advantages over travelling wave tube technology, particularly with regard to harmonic power levels, linearity, gain flatness and mismatch tolerance.

The table below shows the performance characteristics of a typical continuous wave 1-2 GHz 1000 watt travelling wave tube amplifier (TWTA) compared to those of a 1-2 GHz 1000 watt solid state GaAsFET amplifier.

Characteristic	TWTA	GaAsFET
Harmonic power level[1]	-3 dBc	-20 dBc
Back-off for linearity[2]	6 dB	0.5 dB
Small signal gain flatness	+/- 10dB	+/- 1dB
Mismatch tolerance[3]	20%	100%

Table Notes:

1. Both measured at lower band edge
2. Required back-off from saturated power level to reach P1dB level (approximate)
3. Percentage of full forward power capability

Dual Band Topology

An innovative Dual Band topology was developed at MILMEGA to better match required amplifier power to antenna frequency characteristics. This approach allows common test bandwidths to be covered in two bands with significant advantages over single band amplifier solutions:

The power in each of the two bands can be better matched to the test system requirements, with say 100 watts in the lower frequency band and 55 watts in the higher frequency band. Both bands can be

- upgraded in power later as described above.
- Selective tuning can provide higher power over sections of each band, so for instance, a 1-2 GHz + 2-4 GHz dual band amplifier can be tuned for higher power in the respective L and S RADAR bands, i.e. over 1.2-1.4 GHz and 2.7 – 3.2 GHz.
- Because of the band split, harmonics fall out-of-band making the harmonic performance inherently superior to that offered by a single band solution where a fundamental in the lower part of the band produces an in-band harmonic in the upper part of the band.

Latest Developments

6 GHz testing to IEC 61000-4-3 Edtn 3

In 2006 MILMEGA launched the 2.5 GHz to 6.0 GHz range to complement its 0.8 GHz to 2.5 GHz range. The new range was introduced to meet the demand of labs wishing to extend their capability to 6 GHz to meet the requirements of the recently released IEC 61000-4-3 Edition 3. Available powers are 30, 50 or 100 watts (50 watt amplifier shown in Figure 4)

Fig. 4:

AS2560-50
2.5-6.0 GHz
50W

New family of UHF Amplifiers

In 2007 MILMEGA launched a new range of UHF amplifiers using Silicon Carbide (SiC) technology leveraged with the CSA topology to provide instantaneous bandwidths of 200 MHz to 1 GHz. (Figure 5)

Fig.5:

RF350
200-1000 MHz
350 W

The inherent reflected-power tolerance of Silicon Carbide makes this amplifier range particularly suited to testing scenarios where high levels of reflected power are likely, for instance in the EMC test industry (RF immunity testing) and in the production test of high power RF components.

In keeping with the Company's CSA topology, the UHF range is upgradeable and compact in size and weight – for instance, the 350 watt model is only 3U high (5 ¼ inches) and weighs only 26 kg (57 lbs) – and the range is portable up to 1200 watts. This portability allows test stations and sites to share the equipment with significant cost savings over fixed equipment situations.

Furthermore, when managing test resources, the 1200 watt model can be split into four independent 350 watt models. The 350 watt models can then be distributed between test stations / sites and brought together again later when test schedules dictate the full 1200 watts is required.

Future products

MILMEGA is continuing to develop new products using the latest proven technologies and is currently working on 4 significant new designs providing continuing innovative reliability to the EMC and defence industries. The upcoming families of amplifiers include a 2-6 GHz Gallium Nitride range, and Silicon Carbide 80-1000 MHz and 20-230 MHz ranges. Scheduled releases are in 2007 and 2008.

October 2007

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