

# MANUFACTURING MICROWAVE AND MICROELECTRONIC CAPABILITY

Maritime Services provides manufacturing and through-life support services of highly complex electronic integrated systems, sub-systems and modules for high integrity applications.



The microwave manufacturing facility provides 30 years of expertise in producing highly demanding complex microwave modules for avionics defence systems, missile seekers, decoy systems and phased array radar systems.

Our manufacturing team provide microwave technology from rapid prototyping through to high volume production. We work with our customers to provide close partnerships in the design stages providing a design for manufacture capability to ensure a smooth transition into production. Our world-class microwave core capabilities and technologies include the following areas of expertise:

#### Thin film substrate manufacture

- Thin-film and Soft board machining and processing.

#### Microwave / microelectronic assembly

- Manual and automatic assembly and fine wire bonding facility
- Sub assembly through to sub system integration
- Laser welding of hermetic connectors and modules.

#### Microwave test facility

- Automated test sites with manual diagnostics, full ESS.

## THIN-FILM MACHINING FACILITY

#### Positional accuracy

- General  $\pm 0.025\text{mm}$ . Achievable  $\pm 0.010\text{mm}$   
Max size - 104x104x1mm.

#### Surface grinding of alumina and other materials

- $>0.25\text{mm} \pm 0.025\text{mm}$  thickness - Max size 104x104mm
- $<0.125\text{mm} \pm 0.025\text{mm}$  thickness - Max size 50x50mm.

#### Precision lapping of materials

- Alumina and single crystal Quartz  
Minimum thickness -  $0.125\text{mm} \pm 0.010\text{mm}$   
Max size - 50x50mm.

#### Drilling and milling

- Precision drilling and milling of materials using CNC controlled machining centres
- Machining of metal backed RT Duroid circuits
- Prototype manufacture of microwave packages
- Manufacture of production jiggings.

## THIN-FILM SUBSTRATE PROCESSING FACILITY

#### Substrate materials

- Alumina, aluminium nitride and single crystal quartz. RT Duroid, FR4, Sapphire.

#### Metallisation

- Sputtered resistive layer Nichrome (NiCr)/  
Range – 50 – 150 $\Omega$ /sq. +/- 15%

- Sputtered conductive layers – Gold or copper  
Range – 1000 - 10000 $\text{\AA}$  +/- 10%
- Sputtered barrier layers – Titanium Tungsten (TiW) range – 500 - 1500 $\text{\AA}$  +/- 10%
- Electroplated layers – Gold, copper and nickel - 0.5 - 15 $\mu$ .

#### Minimum production feature sizes and alignment

- Track width – 0.020mm +/- 0.003mm
- Gap width - 0.020mm +/- 0.003mm
- Pattern to profile - 0.025mm. Front to back - 0.050mm.

#### Features include

- Integrated NiCr resistors – value to +/- 15% general tolerance, +/- 5% achievable tolerance when trimmed
- Interconnection - through plated via, edge wraps, half via or half-slotted via wraps
- Selectively plated nickel barriers for mixed assembly technologies.

## LASER PROCESSES

#### CO<sub>2</sub> Laser cutting facility

- CO<sub>2</sub> laser profiling and drilling of Alumina, Aluminium Nitride, RT Duroid, Kovar, Ablefilm, Titanium, Steel and Metal Matrix materials
- Positional accuracy: General  $\pm 0.025\text{mm}$   
Achievable  $\pm 0.010\text{mm}$
- Max size - 250x250mm (thickness dependent on material).

#### YAG Laser cutting and marking facility

- Profiling of aluminium. Max size - 250x250x3mm
- Engraving / marking. Max size - 250x250x3mm.

#### YAG Laser welding facility

- Hermetic Laser package sealing of Aluminium, Kovar and various other materials.  
Max size - 300x300x250mm.

#### Assembly capabilities

- Connector / feed-through fitment using solder reflow and laser welding techniques
- Substrate to carrier attachment
- Ceramic, Quartz and Duroid substrate build, placing spiral inductors, chip components and silicon and GaAs MMICs using conductive and non-conductive adhesives / epoxies
- Substrate, module and full system build
- Fabrication and assembly of microwave spiral antennas
- Hermetic connections, packages to  $1 \times 10^{-8}$ .

#### Dedicated bonding facility

- Gold tape 75 $\mu\text{m}$  x 6 $\mu\text{m}$  to 1.52mm x 25 $\mu\text{m}$
- Gold wire 17 $\mu\text{m}$  to 125 $\mu\text{m}$
- Micro-parallel / parallel gap and series welding
- Thermo-compression, ultrasonic and thermo-sonic wedge bonding

- Thermo-sonic ball bonding
- Destructive and non-destructive pull testing
- Shear testing.

## HIGH VOLUME AUTOMATED ASSEMBLY FACILITY

#### MRSI 175 Automatic epoxy dispensing

- Conductive / non conductive epoxy dispense
- Grid formations
- Continuous line / pattern writing
- Dot size from 200 $\mu\text{m}$ , recommended 250 $\mu\text{m}$ .

#### MRSI 505 Automatic pick and place facility

- Components sizes from 200 $\mu\text{m}$  x 200 $\mu\text{m}$  to 10mm x 10mm
- Placement accuracy  $\pm 12.5\mu\text{m}$  ( $\pm 3\sigma$ )
- Eutectic bonding
- Epoxy stamping - conductive / non-conductive
- Pattern recognition including component verification
- Material traceability for all components / placement positions.

#### Automatic bonding facility

- Hesse and Knipps 710M and 815
- Gold tape 75 $\mu\text{m}$  x 6 $\mu\text{m}$  to 250 $\mu\text{m}$  x 25 $\mu\text{m}$
- Gold wire 17 $\mu\text{m}$  to 50 $\mu\text{m}$
- Destructive and non-destructive pull testing

## TEST FACILITY

#### Microwave special to type and common core test sites

- Automated test sites with manual diagnostics.

#### Microwave test equipment

- Professional test team with experience of using a wide range of modern RF test equipment, spanning the frequency range from MHz to 100GHz.

#### Test skills

- MIC alignment capability to tune oscillators, amplifiers and filters. Component level diagnostics.

#### ESS capability

- Active / passive conditioning with climatic testing and temperature characterisation.

#### Microwave antenna testing

- Anechoic chambers for antenna relative gain measurement.

#### Engineering support

- Design for manufacture and test, as well as microwave diagnostic ability from system to component level.

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