

TMD

...the power in microwaves!

TMD ELECTRONIC
WARFARE & DEW



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Introduction

TMD has been involved for many years in all aspects of Electronic Warfare, Directed Energy Weapons and associated systems, where the generation of RF power is required. Broad band, narrow band, CW and pulsed systems from watts to megawatts. Most were and still are classified. TMD has been or are currently involved in the following applications:

- Airborne ECM & EA
 - Inboard
 - Pod Mount
 - Towed decoy
- Naval ECM & EA
 - On board
 - Off board decoy
- Target drone
- Training
 - EW Pods
 - Naval training
- Adversary Simulation
- High Power applications & DEW

Airborne platforms are inhabited fixed wing, UAV, inboard, pod mount and towed, where reliability, performance and size are of paramount importance. Naval systems also require control of phase when used in steerable arrays.

Special systems require minimal throughput delay in order to cover the skin echo of very short pulse radar, very high (MHz) PRF and very high power for fleet protection.

TMD has been involved with EW since the inception of the ALQ-101 into the UK some 40 years ago, through to the more recent DEW and EW requirements. A very long track record of reliable supply and operational performance.

Because of the sensitive nature of EW & DEW only a very limited selection of products and applications are shown on the following page, and for the same reason no current programmes are referenced:

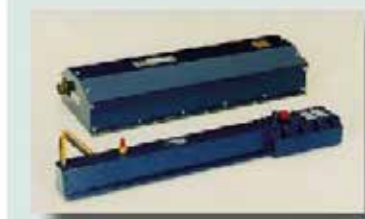


1. Products, Programmes & Prototypes

1.1 A selection of EW products supplied over the last 4 decades:



ALQ-101 RF amplifier pod mounted on RAF Jaguars and Buccaneers. Amplifiers maintained by TMD



Low profile pod mounted 250 Watt CW I/J band amplifier



Range of CW, ICW or Pulsed power supplies for a wide range of TWTs:
100 to 400 W CW & ICW
1 to 8 kW pulse
2 to 40 GHz

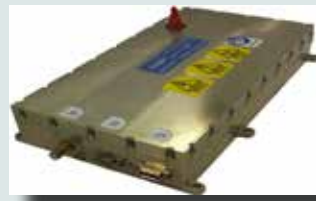


Courtesy NATO Jewcs





HVPSU for 2 kW I/J band TWT amplifier.
40 nanosecond throughput delay to cover skin echo from short pulse target radar



200 Watt I/J band EW MPM



2 kW Pulse and 250 W CW, I/J band liquid cooled amplifiers for naval jammer system



I Band RF amplifier for target drone



HVPSU for towed decoy, extreme airborne environment



PSU for high power pulse and CW EW TWTs

- Pod and inboard mount
- Adversary simulation
- EW Training



1 MHz+ PRF Prototype I/J Band EW amplifier for high PRF seeker deception



Pre and post tow cable PSUs for solid state towed decoy.
Low to high voltage PSU onboard.
High to low voltage PSU in Tow.



140 Watt I/J band MPM



Ka Band 33 to 36 GHz 200 Watt CW/pulse EW amplifier



Solid State 150 Watt 2 to 6 HGz EW MPM



Range of CW, ICW and pulse commercial amplifiers from 1 to 40 GHz, used in ground and ship based EW applications



Miniature 150 Watt I/J band EW MPM



New Design instrumentation amplifier. CW, ICW and pulsed from 1 to 40 GHz for ground and ship based EW

The above is a selection of amplifiers and power supplies designed and manufactured by TMD for EW & DEW applications. Most have been designed in conjunction with our customers to provide the special attributes required for specific system requirements.

These designs have ev
current pin

1.2 Some special products:



High frequency and high power by combining 6 pulsed amplifiers



250 kW Low frequency solid state pulsed amplifier



Electron guns and complete Traveling Wave Amplifiers with Strathclyde University for wide band multi megawatt amplifiers



Very high power and voltage CCP-SUs (Capacitor charging power supplies) for DEW applications

The images on the left are a selection of products & prototypes that TMD has developed for more extreme EW & DEW applications.

TMD has a reputation for innovation and novel solutions and hence attract customers with complex and unusual requirements.

Involved over a period of 40 years to reach the pinnacle of performance and reliability

2. Current Products

The manufacture of production transmitters, TWTAs, MPMs and power supplies for EW applications continues at high rate, at frequencies from 1 to 40 GHz, whilst there are also new requirements in the design and qualification stages for future systems.

Many of the designs in development and manufacture are bespoke for specific customers, however TMD also manufactures a range of standard products including MPMs, TWTAs, PSUs and Instrumentation Amplifiers that have application in EW, some of which are listed below:

2.1 MPM

Part No	Frequency GHz	Power W	Duty %	L x W x H mm	Weight kg
PTS6900	2 to 6	150	ICW	325x200x50	4.5
PTXM1001	6 to 18	140	CW/ICW	190x120x36	1.95
PTXM1052	6 to 18	100	CW/Pulse	202.5x120x35	1.95
PTXM1059	6 to 18	125	CW/Pulse	254x135x45.5	2.4
PTXM1001	6 to 18	140	CW/Pulse	190x120x36	1.7
PTXM1057	7.5 to 18	140	CW/Pulse	254x135x45.5	2.4
PTXM1056	8.5 to 18	125	CW/Pulse	202.5x120x35	1.95
PTX8110	6 to 18	200	CW/Pulse	330x200x55	6
PTX8802	30 to 40	125	CW/Pulse	330x165x51	4.5
PTX8803	30 to 40	200	CW/Pulse	330x165x51	4.5
PTX8822	30 to 40	125	CW/Pulse	330x190x51	5
PTX8823	30 to 40	200	CW/Pulse	330x190x51	5
PTX8807	32 to 36	200	CW/Pulse	450x225x59.5	8

Non ITAR versions are available for most frequencies and peak power.





Courtesy Ultra EWST

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2.2 TWTAs (Military Amplifiers)

Part No	Frequency Min GHz	Frequency Max GHz	Power W	Duty %
PTX7973	0.8	2	300	ICW
PTX9725	2	4	5,000	6
PTX8111	2	6	200	CW
PTX7972	2	6	400	CW
PTX9837	2	6.5	350	CW
PTX7449/1	2.5	8	1,000	6
PTX9726	4	8	5,000	6
PTX9920	6	18	400	CW
PTX9838	6	18	325	CW
PTX7486	6.5	18	200	CW
PTX7485	6.5	18	1,000	4
PTX7477	7.5	17	1,000	4
PTX9750	7.5	18	5,000	5
PTX7959	8	18	160	ICW
PTX9727	12	18	3,500	6
PTX9981	18	26.5	60	CW
PTX8322	18	40	80	CW
PTX8807	30	40	200	ICW
PTX9728	26.5	40	40	CW
PTX8815	34	36	1,100	12

Non ITAR versions are available for most frequencies and peak power.



2.3 Instrumentation Amplifiers

Low Frequency

Part No	Frequency Min MHz	Frequency Max MHz	Power W	Duty %
PTCS9719	80	1,000	250	CW
PTCS9729	80	1,000	400	CW
PTCS9684	80	1,000	1,000	CW
PTCS6909	80	3,000	500	CW
PTCS9761	400	1,000	2,000	CW
PTCS6913	400	1,000	4,000	CW

High Frequency

Part No	Frequency Min GHz	Frequency Max GHz	Power W	Duty %
PTC9942	0.5	2.5	300	CW
PTCM1012	0.8	2.5	500	CW
PTC7440	1	2.5	1,000	CW
PTCS9672	1	2.5	1,000	CW
PTCMP1206P	1	2.5	2,000	6
PTC9963	1	2.5	4,000	6
PTC6941	1	2	9,000	6
PTCM1005	2.5	8	250	CW
PTCM1013	2.5	7.5	500	CW
PTC7441	2.5	7.5	1,000	CW
PTC9948	2	8	2,000	6
PTC7383	2	8	4,000	6
PTC7370	2	4	9,000	6
PTC1008	6	18	300	CW
PTC6522	6	18	550	CW
PTC9983	7.5	18	750	CW
PTC7442	7.5	18	1,000	CW
PTC9947	8	18	2,000	6
PTC9939	8	18	4,000	6
PTCM1016	18	28	45	CW
PTC9962	18	26.5	130	CW
PTCM1018	18	40	40	CW
PTCM1022	26	31	200	CW
PTCM1023	26.5	40	40	CW
PTCM1024	30	40	125	CW

Non ITAR versions are available for most frequencies and peak power.

Courtesy Brazilian Navy



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2.4 PSUs

Part No	Voltage kV	Power W	CW/Pulse μ sec/Du	Beam Switch	Prime Power	Weight kg
PTM8103	5	500	ICW	FE	270VDC	2
PTM6594	6	1,600	CW	-	280VDC	5
PTM6611	9	1,000	CW	-	100VDC	7
PTM6593	10	1,000	CW	-	115VAC 400Hz	4
PTM6259	11	1,500	CW	-	115VAC 400Hz	9.5
PTM6288	15	1,500	50 μ s/5%	Grid	115VAC 400Hz	9
PTM7721*	15	1,500	150/10%	Grid	115VAC 400Hz	13
PTM8815	20	1,100	50 μ s/12%	Grid	115VAC 60Hz	17
PTM8825	20	1,100	50 μ s/12%	Grid	160VDC	17
PTM9755	35	4,000	120/0.9	Grid	115VAC 400Hz	40
PTM6363	34	4,000	22/0.9	Grid	270VDC	20

All above PSUs are conduction cooled and have solid encapsulant variants for AC 50 Hz, AC 400 Hz, 28 VDC, 270 VDC or thermal battery are available on request.

* Ultra low noise



3. Future

Although there has been enormous funding for GaN in EW systems, poor efficiency, the Achilles heel of solid state, is thus far preventing serious application of the latest solid state I/J band technology. The broad bandwidth of EW requires special combining networks which make the thermal management more difficult and results in poor reliability even with spray cooling. The cooling power required combined with the low device efficiency lead to excessive prime power demand which existing platforms, designed for tube technology, cannot provide.

It would seem that yet another solid state technology will be required to achieve the required performance and until then TWT based MPMs will dominate current applications in I band and above. There is also a move to increasing the efficiency of TWTs by using the techniques developed for space qualified TWTs, which in narrow band applications exceed 70%.

As radar and missile systems become more capable, future EW systems will need to improve performance with high speed modulation, lower noise and higher frequency.

There are already threats in Ka band and higher frequencies. TMD is developing RF power sources for these requirements, and as higher frequency TWTs tend to operate at higher voltages, a particular TMD development is for travelling wave tubes operating at much lower voltages.

4. Summary

TMD has supplied a wide range of broad band pulse, CW and ICW EW amplifiers from 80 MHz to 40 GHz, for inboard, pod and tow mounted airborne systems, ship and ground based equipments.

The low efficiency and complex cooling of solid state will ensure the continued dominance of TWT technology particularly at the higher frequencies now required. TMD continues to improve the performance of amplifiers in line with requirements and is continually developing innovative new product for bespoke customer solutions.

The demand for amplifiers continues to grow as threats proliferate whilst higher power systems for directed energy and fleet protection are currently being considered.

TMD can supply Non-ITAR products for most powers and frequencies.

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