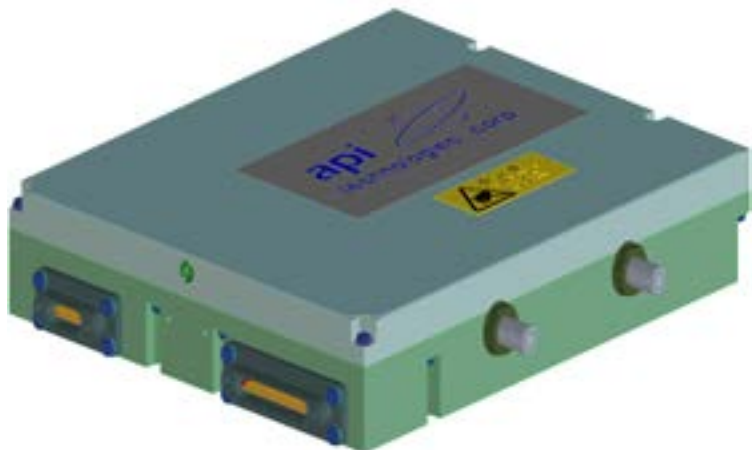


# C-Band QTRM Product Capability

**QTRM** - **Q**uad **T**ransmit **R**eceive **M**odule (4-Channel T/R Module)



- Gallium Nitride Power Amplifier Technology
- 1GHz Bandwidth
- Low Noise Figure (<4.5dB)
- 6-Bit Phase Control
- 6-Bit Attenuator Control
- Single +28V Supply
- BITE and PSU Supervisory
- Built in Tx and Rx Power BITE Detectors
- Factory Calibrated
- Accessible memory for External Calibration data
- Cooling interface
- Designed to fit Typical Antenna Aperture Spacing
- Line Replaceable Unit
- European Manufacture.



## Description

The C-Band Module contains four Transmit/Receive (T/R) channels providing four RF ports which can be connected to individual antenna elements to form part of a phased array active antenna unit.

The module is fitted with blind mate RF connectors and its height and antenna port spacing dimensions are specifically designed to allow direct connection to the back of antenna aperture face. Alternatively, RF cable assemblies may be used to connect to the individual antenna elements.

The power amplifier section of each channel incorporates Gallium Nitride technology, this along with provision for liquid cooling allows high power levels, long pulse widths and high duty cycles to be realised.

The Module is supplied from a single 28 volt DC supply and contains the necessary supply conditioning to power the four channels. Built in power supply sequencing and built in test equipment (BITE) functions are included to allow individual channel monitoring and shut-down in the presence of a fault condition.

Module communication for control and monitoring is provided by a half-duplex, asynchronous serial EIA485 bus.

The serial data takes the form of a number of messages assigned to either control the individual T/R channels or to retrieve information about the module's settings or health status. RF2M have developed a Graphical User Interface (GUI) to control and monitor the module which can be run from a laptop or desktop computer.

Each module has a unique address which may be interrogated by an external controller; this allows the external controller to address and individual module within an array.

The QTRM's are factory calibrated to minimise amplitude and phase variations over temperature and frequency, making them line-replaceable units. Additional calibration constants that are User system related (such as the interface between the radiating element to T/R channel and any associated antenna taper requirements) can be uploaded to the module via the EIA485 serial data link.

The QTRM supports 'scaleable' AESA Radar thus providing flexibility for different platforms applications.

### Mechanical

Approximate Size: 150 mm(L) x 128 mm(W) x 28 mm(H) excluding connectors

Approximate Mass: 1.2 Kg

RF Connectors: Male SMP

DC Connectors : 37-way Micro-D (Power Supply & Control) and 15-way Micro-D (Factory Use Only) plugs

Hydraulic Connectors : Staubli non-spill CGO 03 type or Similar

Cooling Fluid : Glycol Mix

Inlet Temperature: +48°C max.

Fluid Flow Rate : 1Litre/min Typ

Pressure Drop : < 0.2 bar with a fluid flow rate of 1L/min

### Environmental

Operating Ambient: -40 to +70°C Dependent upon Transmit Pulse Width, Duty Cycle and Inlet Cooling Fluid Temperature.

Storage: -40 to +85°C

### NOTES

- (1) Up to 3dB reduction in useable attenuation range due to factory Calibration
- (2) Gallium Nitride Power Amplifier technology enables long pulse durations
- (3) Figure given for Ref Attenuator state, Ref Phase State

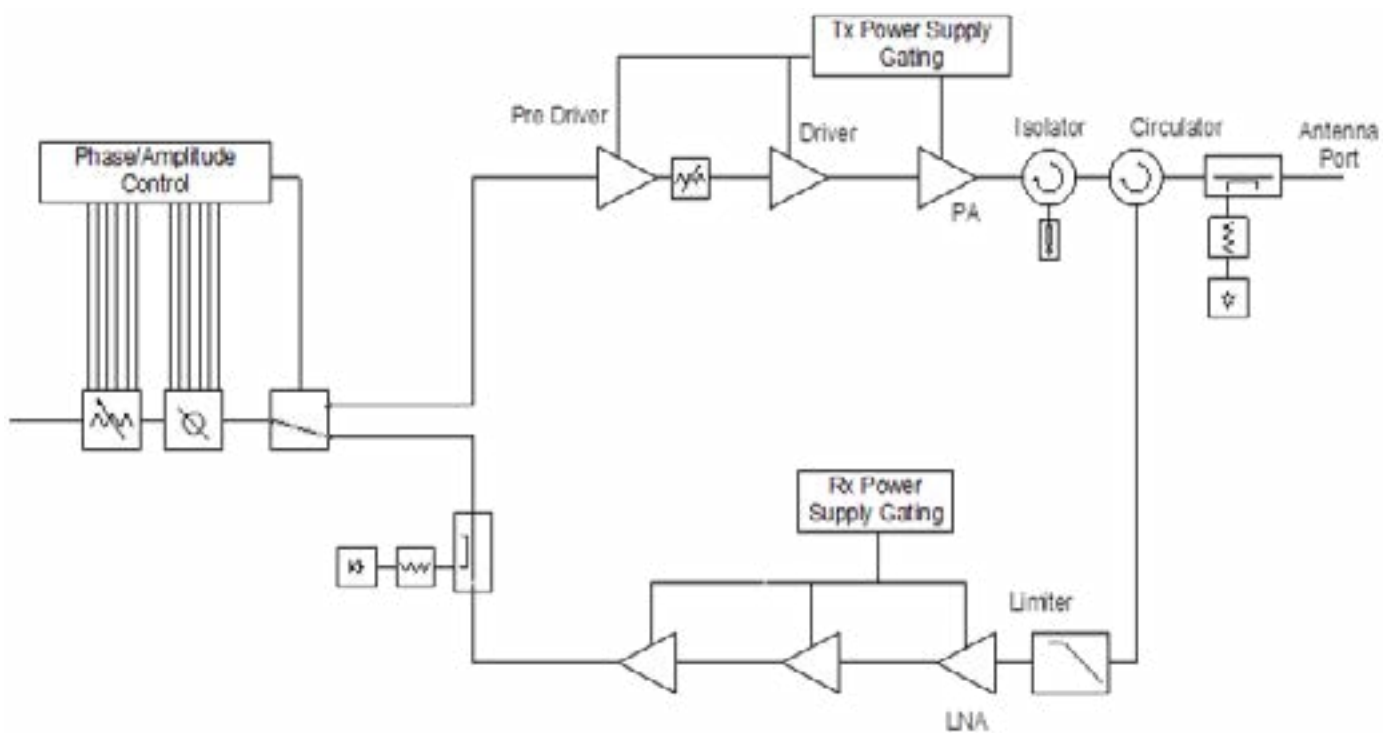
## Electrical Performance

Over  $T_{op}$  Unless Otherwise stated. Limits & Conditions are indicated values. Indicated values given per channel unless otherwise stated.

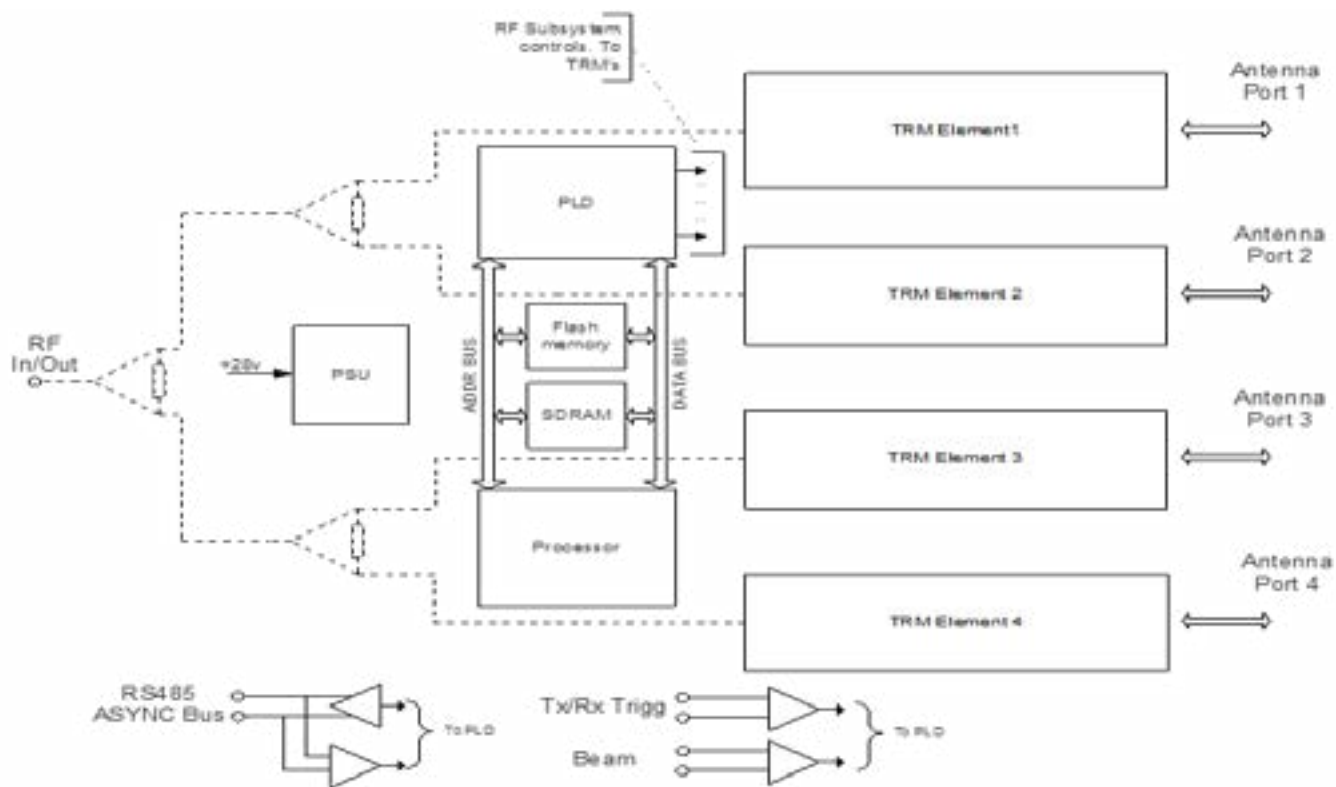
Parameter	Min.	Typ.	Max.	Units	Conditions
<b>Parameters: Common</b>					
Centre Frequency		5		GHz	
Operating BW		1		GHz	
Input Return Loss		12		dB	Common RF In/Out port
Output Return Loss		12		dB	Individual Antenna ports
RS485 Serial Data Bus		Differential			Asynchronous UART, half-duplex
Data Control Rate		5.0		Mbps	Asynchronous UART RS485 Bus.
TX PA Gating Pulse		Differential			
Beam Steering Pulse		Differential			Triggers Beam Direction change
No. of Stored Beam Settings			16		Scheduler Mode
Beam Steers Data Transfer Time			350	$\mu$ S	Time taken to re-load Scheduler register
Supply Voltage		+28		Volts	
Supply Current		7.5		Amps	Average current @ 28v. 50% duty
DC Input Consumption		210		Watts	Average power @ 28v. 50% duty
<b>Amplitude Control</b>					
Attenuation Range		31.5		dB	6-Bits, LSB = 0.5dB, See Note 1
RMS Attenuation Error			1.5	dB	Reference Phase State
<b>Phase Control</b>					
Phase Shift Range		355		deg	6-Bits, LSB = 5.62°
RMS Phase Error			4.5	deg	Reference Attenuation State

Parameter	Min.	Typ.	Max.	Units	Conditions
<b>Parameters: Transmit</b>					
TX Psat		8.5		Watts(pk)	Per Channel
TX Input Power Level		+18		dBm	For Saturated Power
Spurious		-60		dBc	
Pulse Droop		0.2		dB	100 $\mu$ S, 10% Duty Cycle
Pulse Droop (Long Pulse)		0.4		dB	40 mS, 80% Duty Cycle, See Note 2
Harmonics		-30		dBc	
TX Insertion Phase Balance		$\pm$ 15		deg	
TX Power Balance		$\pm$ 1.25		dB	
<b>Parameters: Receive</b>					
RX Output P1dB		+6		dBm	
RX Gain		15.5		dB	See Note 3
RX Noise Figure			4.5	dB	
Receiver Protection per Channel		100		dB	300 $\mu$ S Pulse
RX Insetion Phase Balance		$\pm$ 15		dB	
RX Gain Balance		$\pm$ 1.25		dB	

# Functional Block Diagram



Single TRM Element Block diagram



QTRM Block diagram

Whilst every effort is made to ensure the accuracy of the information contained in this brochure, no responsibility can be accepted for any errors and/or omissions. Descriptions and specifications of products are subject to change without notice.