

# MPT, Inc.

The Right Solution With A Lower Risk At The Right Time.

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# About MPT

## ● MPT

- Incorporated 2003, Focused solely on DoD and Government Products and Services
- Commercial engineering design services division: RLS Design
- 15 Employees
- HUBZone Certified January 2015
- Small Minority, Disadvantaged, Native American Owned Business
- Core Capabilities
  - Phased Array components and sub-systems for communication and radar from 500MHz to 40GHz.



Our Office

## ● Products and Services

- SiGe, GaAs and GaN MMIC Development
  - SiGe Integrated Circuits For Phased Arrays, Digital Receivers, and Communication Systems
- Antennas
  - Conformal, printed circuit, linear, dual, and circular polarization,
  - Narrow or broad band-multi octave
- T/R modules and Sub Arrays
  - S-band to Ka-Band, beam forming networks
- Low Cost Digital Receivers/Exciters
  - Single, Dual, Triple Channel. Stand Alone, Rack Mount, W/ ADC & FPGA

### Sample of Recent Contracts

- NAVAL SURFACE WARFARE CENTER  
Contract # N00167-11-P-0382
- NAVAL SEA SYSTEMS COMMAND  
Contract # N00024-13-C-4524
- US ARMY REDSTONE ARSENAL  
Contract # W31P4Q-12-C-0011
- US ARMY REDSTONE ARSENAL  
Contract # W31P4Q-13-C-0021
- US ARMY AVIATION APPLIED TECHNOLOGY  
Contract # W911W6-14-C-0014
- Various sub contracts with DoD prime contractors

# All Our SiGe/GaN/GaAs Designers Have Developed Multiple Chip Sets For T/R Modules & Radar

- Rick Sturdivant, MSEE (CEO): Has developed MMIC low noise amplifiers, phase shifters, variable gain amplifiers, multipliers (2X and 3X), and distributed amplifiers
- XX, MSEE, MBA (Director): Has developed over 46 different MMIC and RFIC MMICs. His expertise is in High Power Amplifiers, Drivers, Distributed Amplifiers in GaAs, multifunction integrated circuits (full T/R) in SiGe, and limiters and high power amplifiers in GaN.
- XX, MSEE (Senior Staff Engineer): Has developed highly integrated MMICs for full transmit receive functions, fully integrated receivers and exciters, modulator drivers, distributed amplifiers, and amplifiers/switches for cellular phones.
- XX, MSEE (Senior Staff Engineer): Has developed MMICs in GaAs and SiGe all for applications in phased array radar and for receiver/exciters. Includes low noise amplifiers, down/up converters, driver amplifiers, phase shifters and variable gain amplifiers.
- XX, MSEE (Staff Engineer): Has developed MMICs in GaAs. Highly experienced in high power amplifier and driver amplifier development as well as electromagnetic simulations and design.
- XX, PhD EE (Staff Engineer): Has 11 years designing SiGe and Si-CMOS for wireless and radar applications.
- Plus network of proven consultants

# Services Highlight: SiGe, GaAs, and GaN Integrated Circuit Development

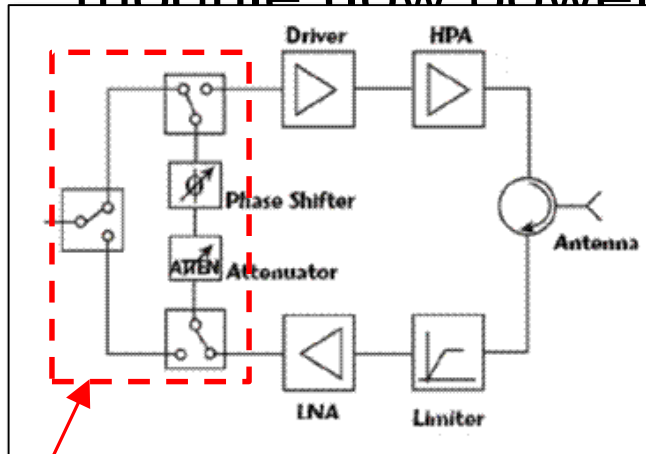
- Service Description
  - Provide Three ways our customers win
    - The Right Solution: Technologies include SiGe, GaAs, and GaN
    - Lower Risk: Experienced Team with a track record of success in our markets
    - The Right Time: Fewer design cycles delivered on schedule
  - Have access to TowerJazz Semi, Cree Semi, Qorvo (Triquint Semi)
- Target Markets
  - DoD, Prime Contractors
- Example Programs
  - US Navy contract (\$984K) to develop a GaN MMICs
  - Developing SiGe integrated circuit on US Army contract
  - Developing SiGe chip for digital radio
- Have increased our software suite to accommodate more designers



SiGe T/R Module IC

# Examples Of T/R Module Common Leg Circuit (CLC) MMICs

- CLC is the heart of a T/R module chip set.
- Is actually a complete T/R module (low power)



CLC MMIC

## *Common Leg (CLC) MMIC*

Freq: 7-11 GHz

Phase Control: 6 Bits

Amplitude Control: 5 Bits

Gain: 12dB

Conventional Face Up

## *Common Leg (CLC) MMIC*

Freq: 7-11 GHz

Phase Control: 6 Bits

Amplitude Control: 5 Bits

Gain: 17dB

Conventional Face Up

## *Common Leg (CLC) MMIC*

Freq: 7-11 GHz

Phase Control: 6 Bits

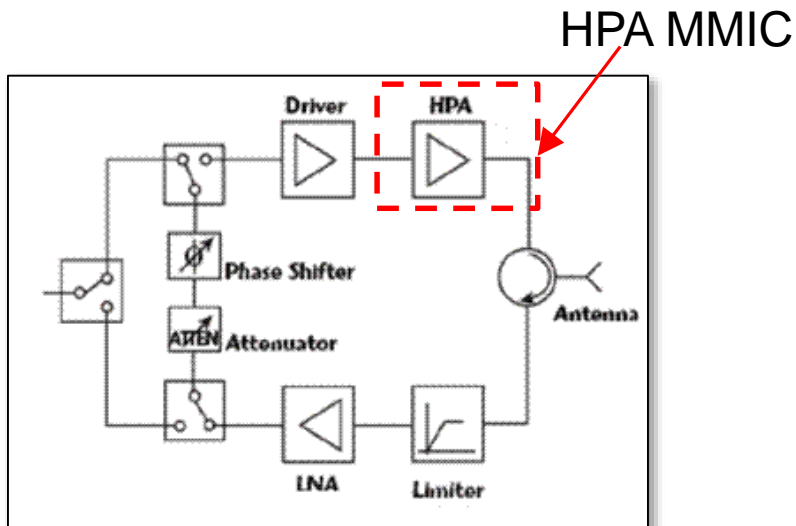
Amplitude Control: 5 Bits

Gain: 17dB

Flip Chip

# High Power Amplifier MMICs

- High power amplifiers are used to increase the radar transmit signal just before it reaches the circulator and antenna.



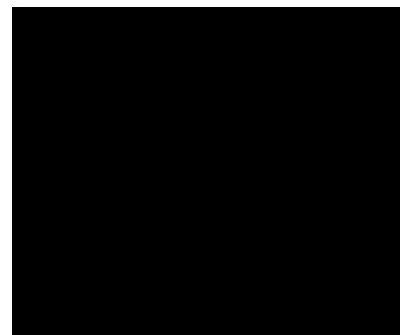
## HPA MMIC – GaAs PHEMT

Freq: 8-10 GHz  
Output Power: 6W  
Gain: 24dB  
Flip Chip



## HPA MMIC – GaAs PHEMT

Freq: 8-11 GHz  
Output Power: 8W  
Gain: 22dB  
Conventional Face Up



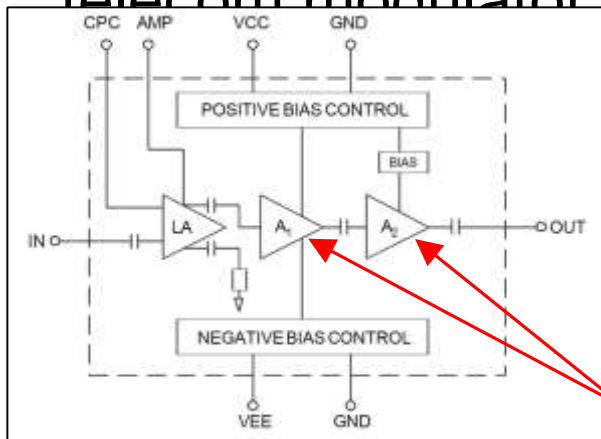
## HPA MMIC – GaAs PHEMT

Freq: 8-11 GHz  
Output Power: 8W  
Gain: 22dB  
Flip Chip



# Distributed Amplifier MMICs

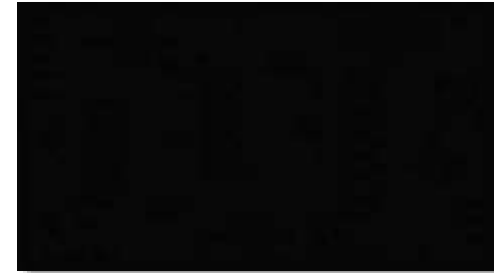
- Distributed Amplifiers (DAs) have extremely wide bandwidth, flat gain, and excellent phase linearity.
- Used extensively in high data rate telecommunications equipment such as optical telecom modulator drivers.



Distributed Amplifiers

*Highly Integrated: Differential Amplifier + Distributed Amplifier*

Freq: 30KHz-22 GHz  
Output Power: 0.5W  
Gain: 28dB



*Distributed GaAs PHEMT*

Freq: 30KHz-15 GHz  
Output Power: 0.2W  
Gain: 12dB



*Distributed GaAs PHEMT*

Freq: 30KHz-15 GHz  
Output Power: 0.05W  
Gain: 11dB



*Distributed GaAs PHEMT*

Freq: 30KHz-15 GHz  
Output Power: 0.W  
Gain: 11dB

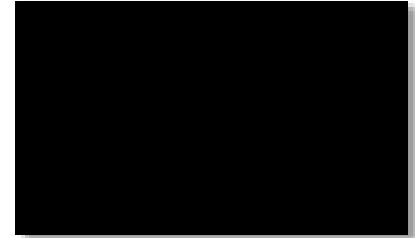


# Other Modules and MMICs

- The team has developed MMICs and modules from 1 to 40GHz. This is a small sample of a few of the products.

## ***Frequency Doubler***

Input Freq: 12GHz  
Output Freq: 24GHz  
Conversion Loss: 8dB



## ***Frequency Tripler***

Input Freq: 4GHz  
Output Freq: 12GHz  
Conversion Loss: 12dB



## ***Frequency Tripler***

Input Freq: 11GHz  
Output Freq: 33GHz  
Conversion Loss: 15dB

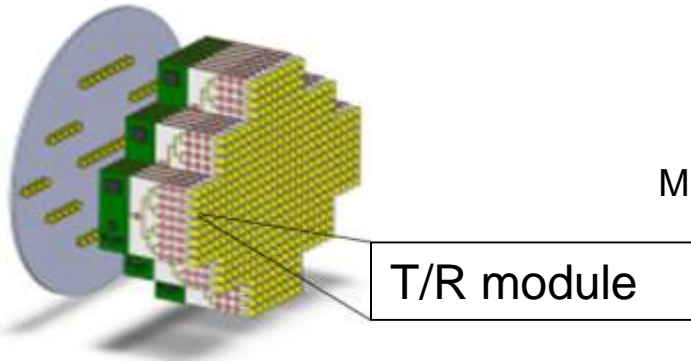




# RLS Design Team Has Developed Several T/R Modules That Have Transitioned Into Production

- Transmit/Receiver (T/R) modules are combined to form Active Electronically Scanned Arrays (AESAs).

Phased Array



*T/R Module*  
Freq: X-Band  
Output Power: >3WW  
LTCC, LNA, HPA, Drivers,  
Phase, Amplitude Control



*T/R Module*  
Freq: X-Band  
Output Power: >3W  
LTCC, LNA, HPA, Drivers,  
Phase, Amplitude Control, Circulator



*Tile Array Module*  
Freq: X-Band  
Output Power: >5W  
Mixed Ceramics, LNA, HPA, Drivers,  
Phase, Amplitude Control



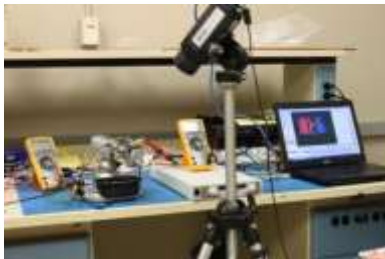
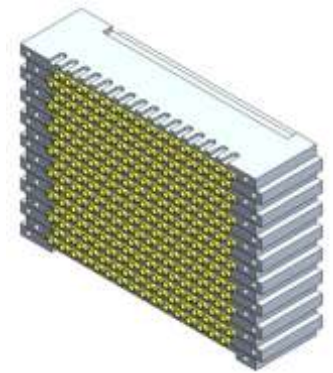
# Product Highlight: Ka-Band Phased Array System

- Product Description

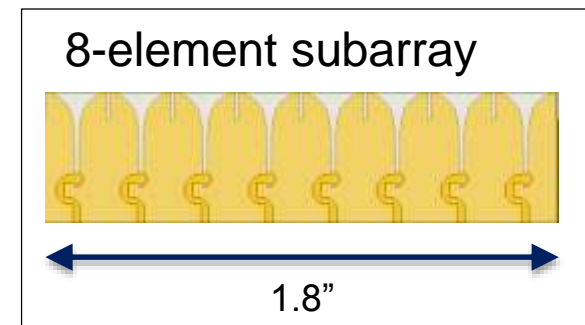
- High performance Ka-band radar for general radar use
- Additional Uses: millimeter-wave communication systems

- Status

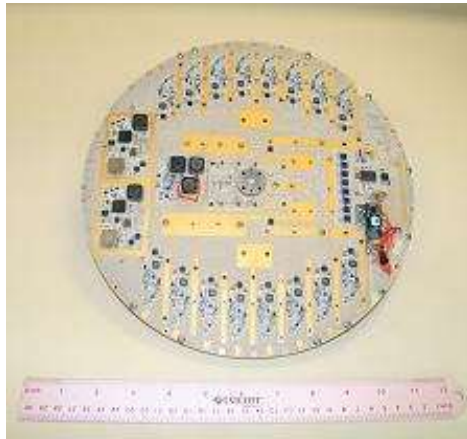
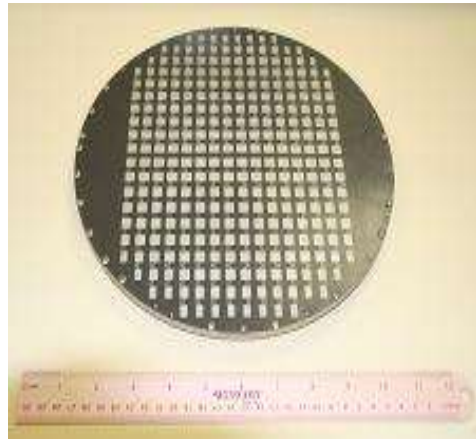
- Funding: 100% funded by US Army (Current Funding: \$1.15M + \$2.85M. Future: \$10-12M)
- Product demo 2016.



Part of Program Is Development of A Thermal Solution



# Product Highlight: Receive Only Array For Mobile DirecTV Reception Developed For An Automotive Customer



## Includes:

- Phase Shifters
- 2 Phase Locked Loop Sources
- Superheterodyne Down Converter
- Image Rejection Filter
- Beam Steering Computer
- Shift Registers
- IF Amplifier Chain

- Frequency Range: 11.7-12.2 GHz
- Passive Gain: 26dB, RX Noise: 0.8dB max
- RX Gain: 60dB gain.
- $G/T > 12\text{dB}$
- Size: 10.375" Diameter, 0.7" Thick
- Polarization: Linear
- # of Elements: 292 Elements
- Weight: <1.5 lbs
- Cool: Air cooled
- Survivability: 20 year life spec
- Cost: \$900 moderate/high volume (10K units per year)
- DC: 5V at 3Amax

# Software Tools

- NI AWR
  - Microwave Office
  - Analog Office
- Cadence
- Keysight (Agilent)
- Tower Jazz Library
- Ongoing Training



**cādence**



**Agilent Technologies**  
 **KEYSIGHT**  
TECHNOLOGIES

# Manufacturing Is Fully Qualified Through Our Production Partners

● Our products are fabricated in fully qualified production lines

- ISO9001
- MIL-PRF-38534 (class H & K)
- MIL-STD-883
- ITAR Registered
- IPC A 610 Class I, II & III



Ceramic Substrates: LTCC, HTCC, Thick Film



Automatic Pick and Place



Automatic Wire Bonding

# Conclusions

- Our customers benefit from our products and services in at microwave and millimeter-wave frequencies.
  - SiGe, GaAs and GaN integrated circuit development
  - Transmit/Receive (T/R) module development
  - Phased arrays and antennas
- As a HUBZone Small Business MPT is a great partner on SBIRs

**MPT can help YOUR company deliver more MMIC and module products in 2015.**

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