10 GHz high power amplifiers

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Available technologies

- TWT
- GaN transistors
- GaAs transistors

- Very efficient, bulky, high voltage, x-ray
- High power density, gain, very expensive
- Low voltage and efficiency devices, surplus available
GaN Transistors

- Triquint TGA2312 9-10GHz, 48dBm 13dB 38% eff.
- Cree CMPA601C025F 6-12GHz 46.2dBm 33dB 28V 33% eff.
- Sumitomo elect. SGK1011-2A, 10dB, 33% eff.
- Toshiba TGI0910-50. 31% 9dB
GaAs FET’s

- Fujitsu, Eudyna, Sumitomo Electric FLM0910, FLM1011 series, 3-25W 10V
- Toshiba TIM0910, TIM1011 series
Surplus

- Alcatel
- Three stages x band amplifier
- Fujitsu FLM1011
- 3W, 8W, 12W GaAs Fet’s. In some units 15W final device
- Can be used as driver for high power amp.
Amplifier line ups

Driver amplifier

Balanced configuration amplifier, two amp's

RF IN 23-25 dBm

7.5 dB 3W

7.5dB 8W
6dB 12W
7.5dB 15W
7dB 25W

90 deg. 3dB splitter
90 deg. 3dB combiner

3dB higher Power and Linearity

6dB higher Power and Linearity

RF OUT
Driver amplifier design and simulations
Final amplifiers
50W Balanced amplifier

- 2 x FLM0910_25F
- 8dB gain
- Idq 12.8A at 10V
GaAs fet’s bias circuits

Typically, Vgs of that is 200–250Vdc, so that the gate voltage is 100–150Vdc, over temperature change.

Common bias circuits published in ham radio magazines.

Low drive level the gate current Igs is negative and constant, but with high level drive Igs is positive and can be large up to hundreds of mA!
Control board schematics

- Four bias voltages
- 50mS sequencing
- 3W DC/DC converter
- Isolated switch
- T/R control
Implementation and results

- 23dB gain
- 23dBm in 46.5dBm
  45W Out
- PAE > 20%
- 13.5V 18A
- Unconditional stable
- Switching high side mosfet Rds_on issue
Testing
Future developments

• Balanced amplifier with pair of CMPA601C025 Cree GaN MMIC
• 25W each, 28V > 30dB Gain
• Multi ports power splitter-combiner
Wave guide Combiner
Questions?

• Thank You

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