

Application Note

Evaluation Board : P/N VM164FE

Die : VM164F

X-Band 50W GaN power amplifier Evaluation board

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Signature	OK	OK	



I. HISTORIC

Edition	Date	Description of Evolutions
1.0	28/01/25	Creation

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IV. INTRODUCTION

IV-1. Description

The VM164FE is an evaluation board of the VM164F flange component. It is working in the X-band frequency bandwidth.

The evaluation board is composed of 2 mains parts:

- VM164F X-Banbd HPA Flange (1)
- Test structure support: PCB's with SMA/DC connectors and heatsink (2)

The test structure support uses a RF PCB with SMA connectors and second order decoupling components and connectors to bias the component, all this on an aluminum mechanical support screwed on a heat sink (with fan).

Supply cables are not provided.

This document describes the way to use the VM164FE Evaluation board

Typical RF results are included.

IV-2. Evaluation Board photo

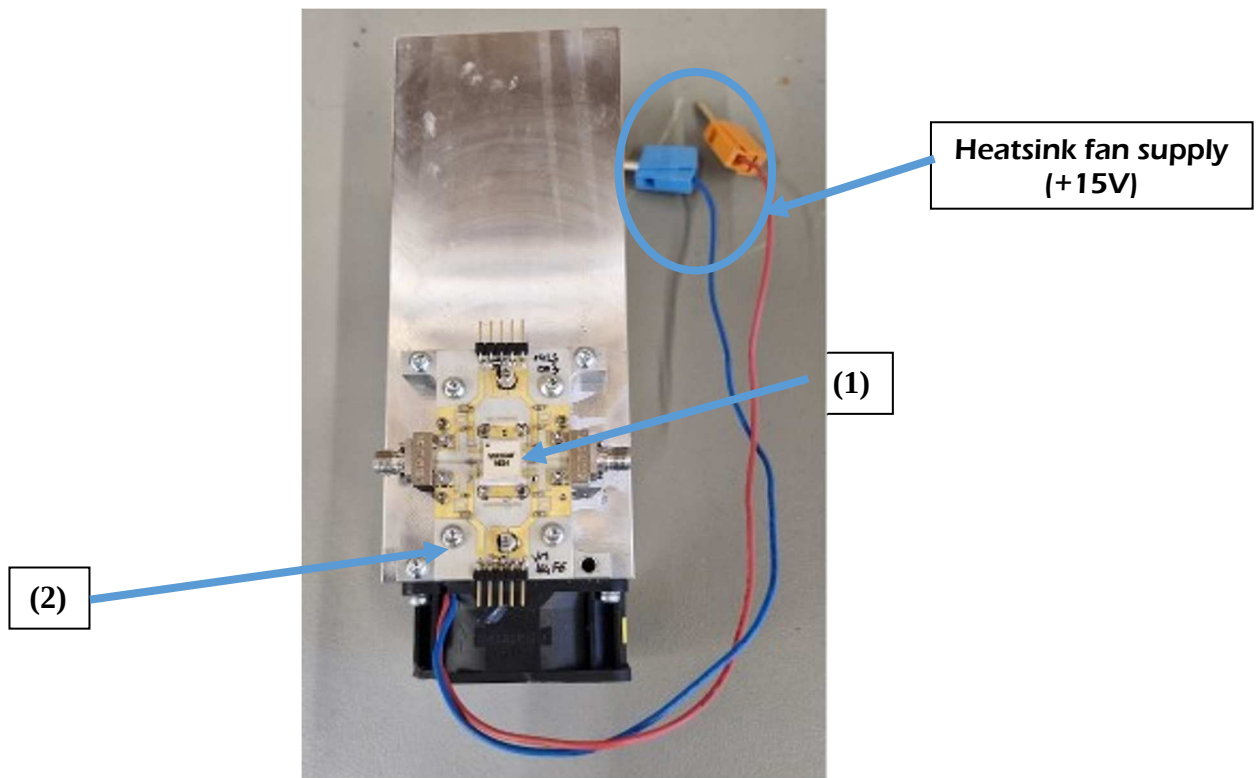


Figure 1. VM164FE evaluation board with its dissipator

V.INTERFACE AND COMPONENTS

V-1. VM164FE interface

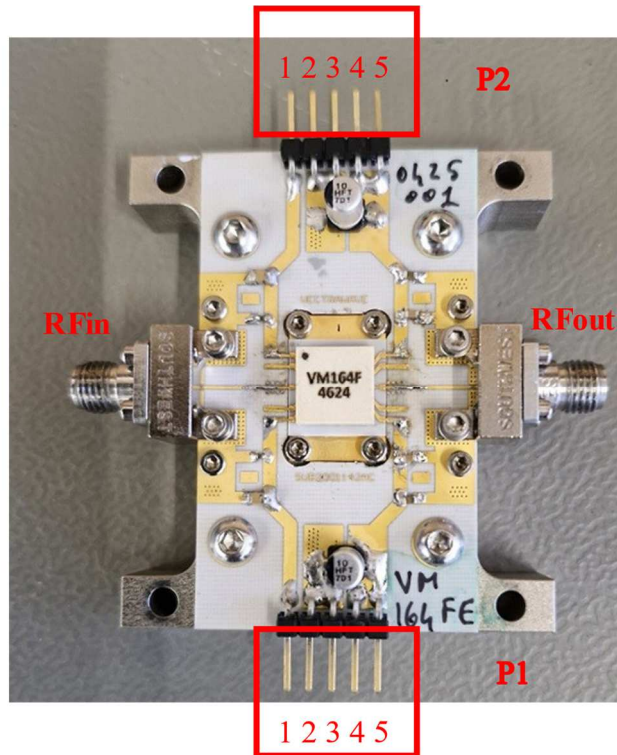


Figure 2. Evaluation board VM164FE interface

Connector	Type	Allocation
P1/P2	DC connectors	- V_D power supply - V_G power supply - GND
RF IN	SMA female	HPA RF input
RF OUT	SMA female	HPA RF output

Table 1. VM164FE PINOUT

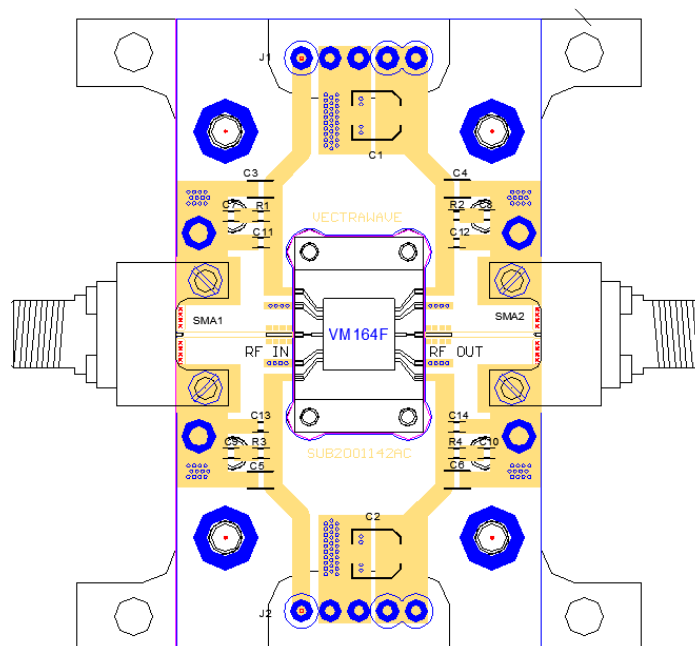


Figure 3. DC PCB's cabling (first order decoupling)

Components	Value	Type
C12, C14	10 nF/ 50V	0603
C11, C13	1μF/16V	0402
C4, C6	1μF/50V	0603
C3, C5	100μF/6.3V	0805
C1, C2	10μF/50V	electrolytic

Table 2. DC PCB's second order decoupling

VI. BIASING PROCEDURE AND OPERATING CONDITIONS

VI-1. Electrical operating conditions

- $V_D = +28V$
- $I_{DQ} = 450mA$ (Typically $V_G = -2.40 V$)
- RF pulsed (pulse width : $100\mu s$, duty cycle 10%)

VI-2. Biasing procedure

Switch on

1. Set V_G to 0V
2. Set V_D to 0V
3. Set +15V on dissipator fan
4. Set V_G to -3V
5. Set V_D to +28V
6. Increase V_G to obtain $I_{DQ} = 450mA$ (Typically $V_G = -2.40 V$)
7. Turn RF (pulsed mode) ON



- Always apply V_G before applying V_D
- Do not respect this may cause permanent damage on component.

Switch off

1. Turn RF OFF
2. Decrease V_G to -3V
3. Decrease V_D to 0V
4. Decrease V_G to 0V
5. Turn OFF dissipator fan



VII. ABSOLUTE MAXIMUM RATING

Symbols	Parameter	Max	Units
V_D	Drain voltage	32	V
I_{DQ}	Drain quiescent current	0.7	A
Pin	maximum input power overdrive	30	dBm

Table 5. Absolute Maximum Rating

Operation of this device above any of these parameters may cause permanent damages.

VIII. TYPICAL EVB MEASUREMENTS RESULTS

VIII-1. Measurements conditions

Reference plane measurements :

SMA connectors

Losses estimation :

For information, the losses of a 50Ohms line in the same structure and dimensions that the VM164DE Evaluation board RF PCB :

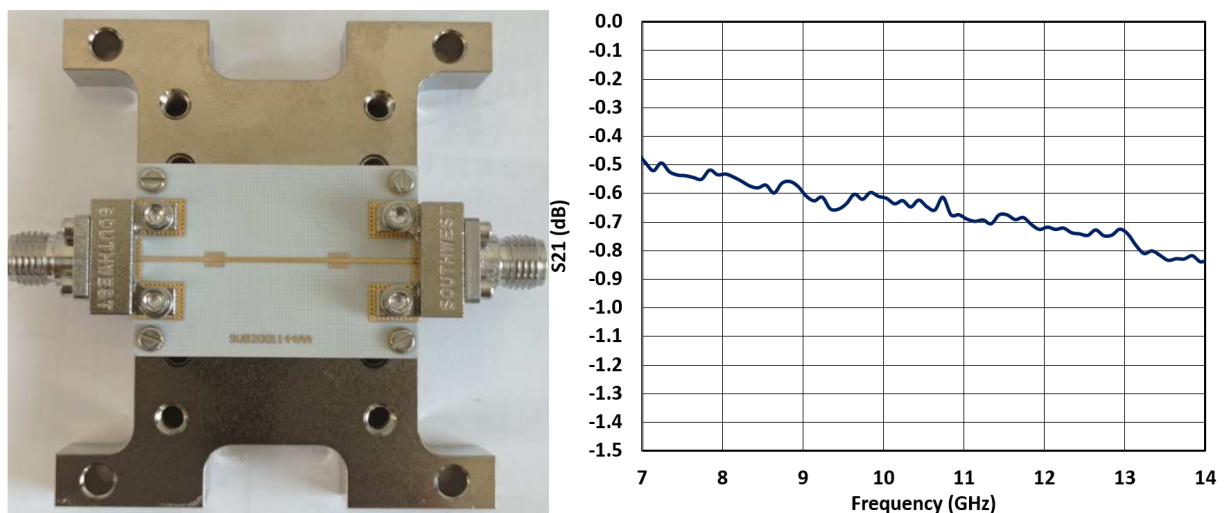


Figure 4. Losses estimation

50Ohms line S2P files can be provided on demand

Measurement conditions :

- $V_D = +28V$
- $I_{DQ} = 450mA$ (Typically $V_G = -2.40 V$)
- RF pulsed (pulse width : $100\mu s$, duty cycle 10%)

Room temperature : $+22^\circ C$.

Structure temperature ($V_D = 28V$, $I_{DQ} = 450mA$, RF OFF) : $+26^\circ C$

Heatsink with fan R_{th} : $0.175^\circ C/W$

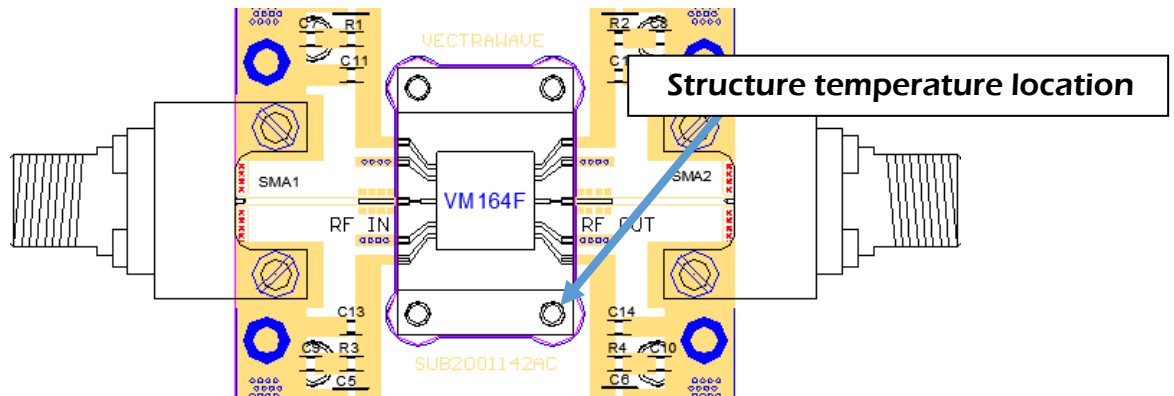


Figure 5. Structure temperature location

VIII-2. S-Parameters

RF CW ($P_{in} = -25 dBm$).

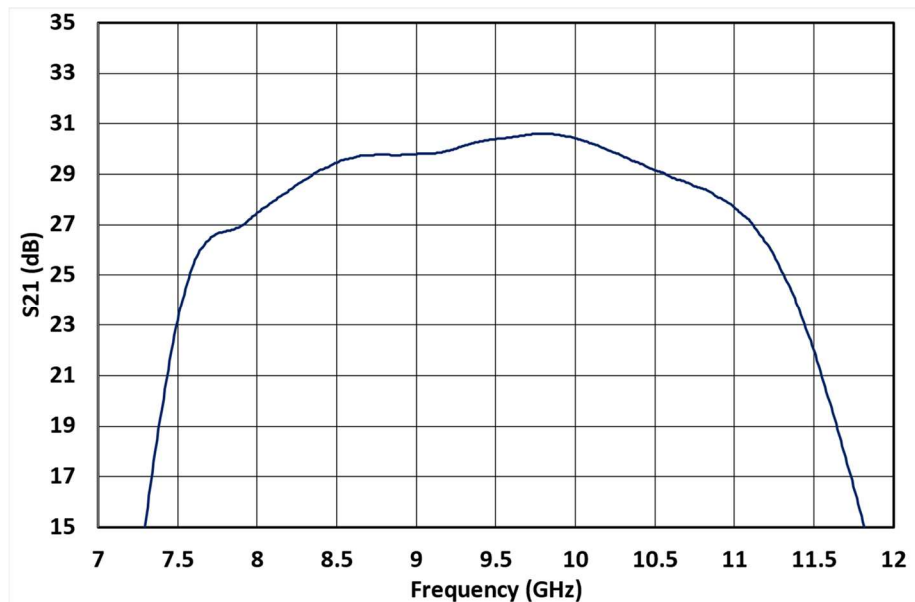


Figure 6. Gain (S_{21})

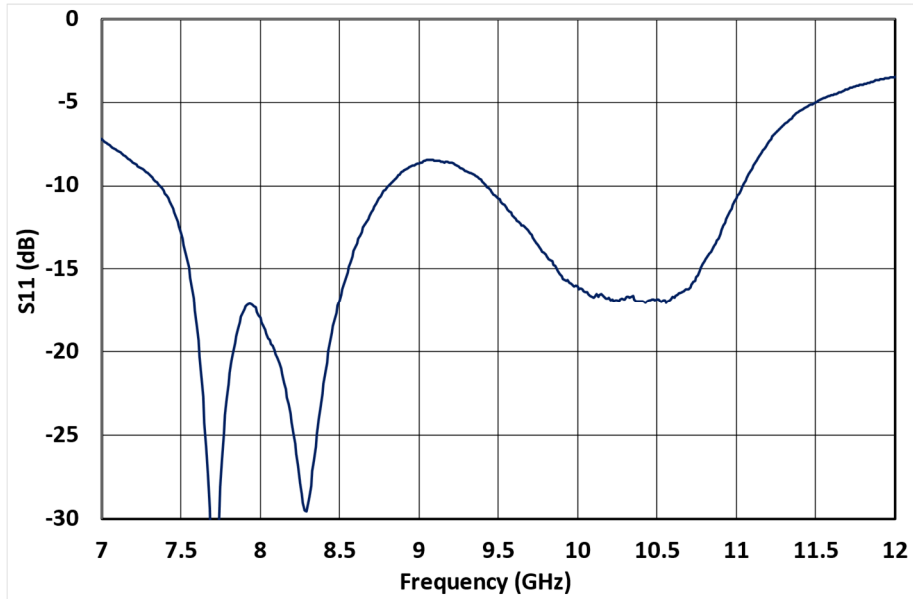


Figure 7. Input return loss (S_{11})

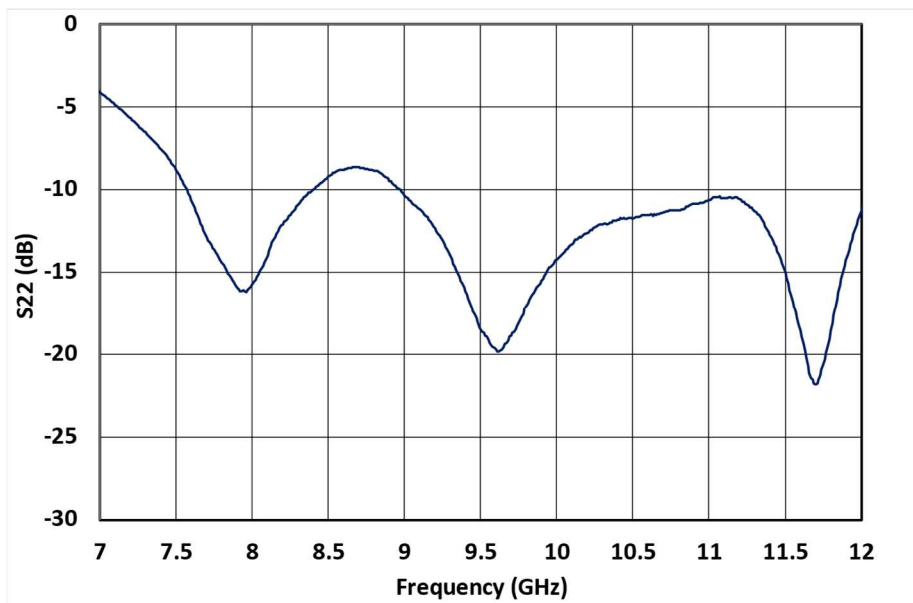


Figure 8. Output return loss (S_{22})



VIII-3. Large Signal

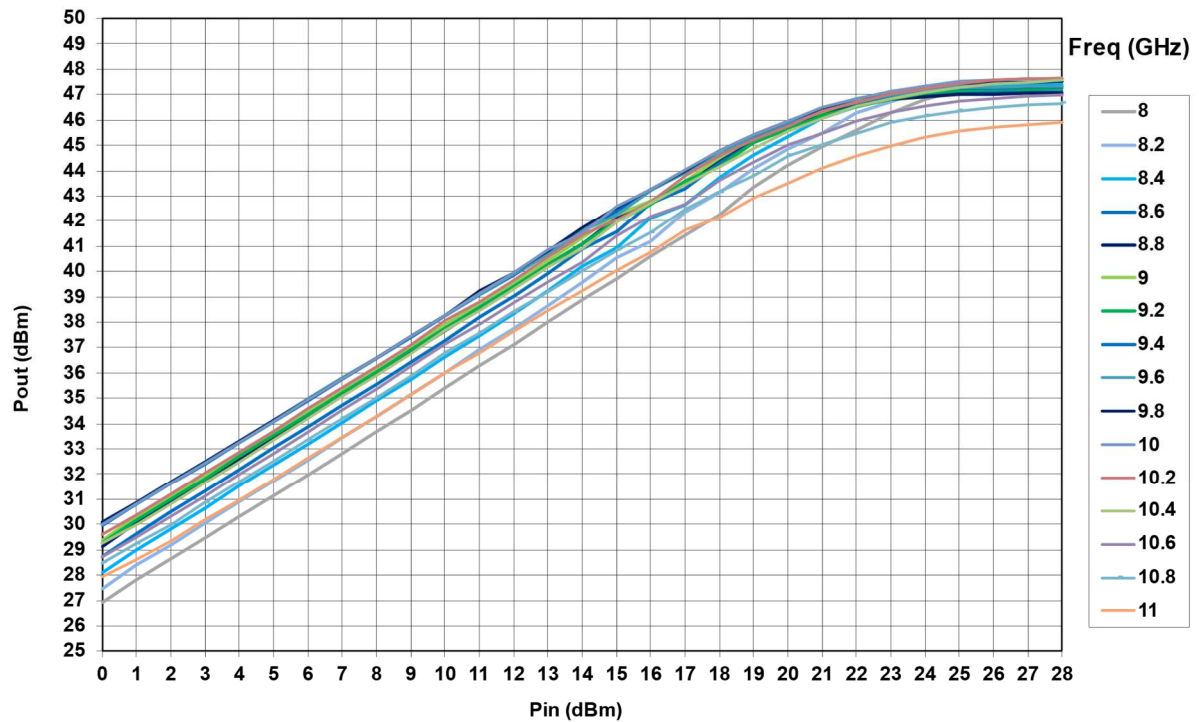


Figure 9. Output Power vs Input Power vs Frequency

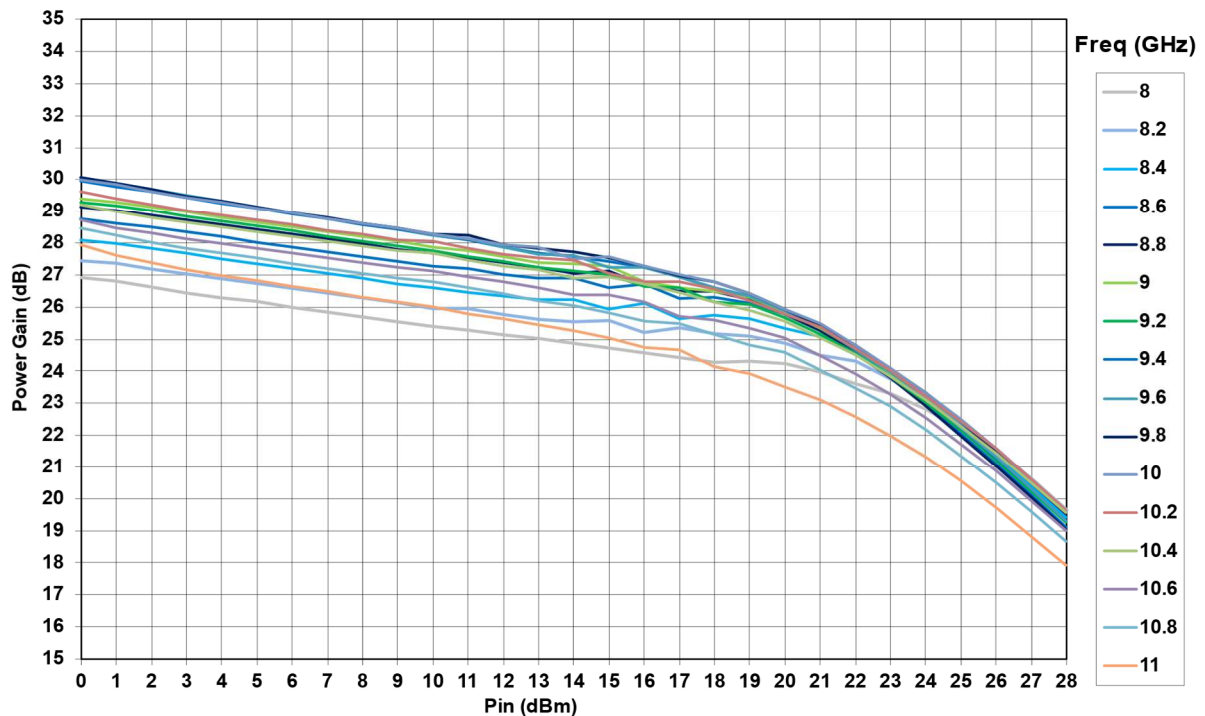


Figure 10. Gain vs Input Power vs Frequency



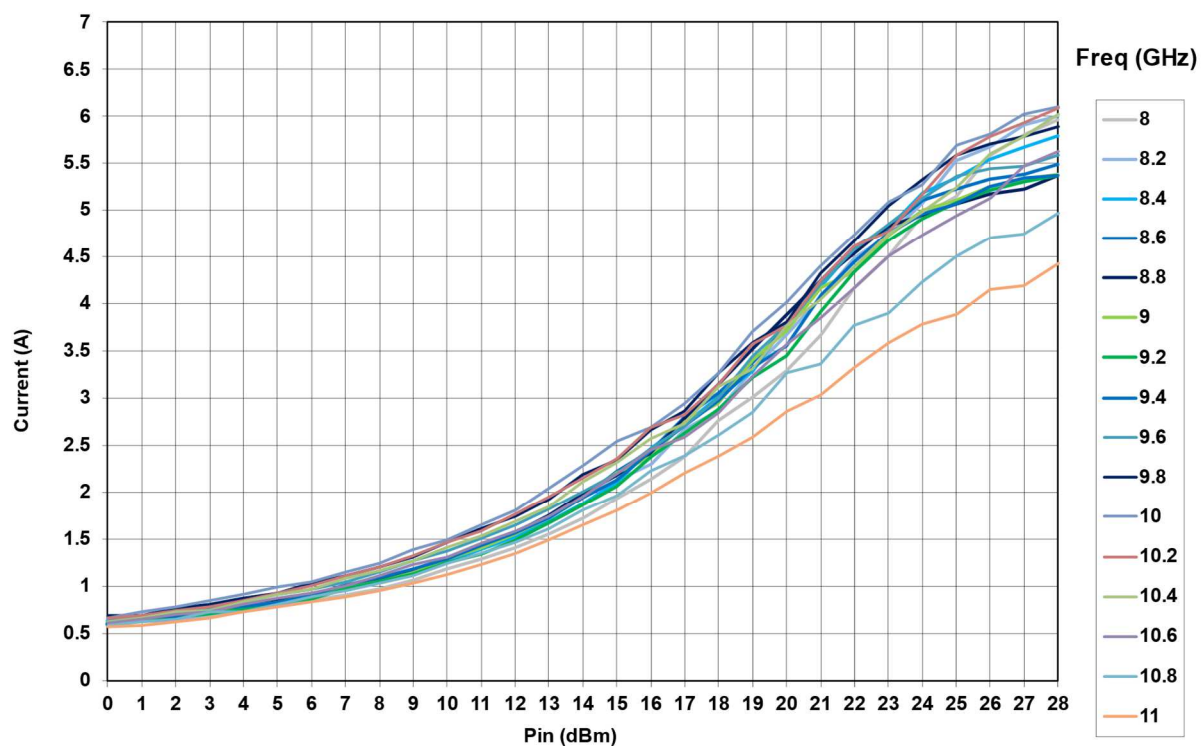


Figure 11. Drain current vs Input Power vs Frequency

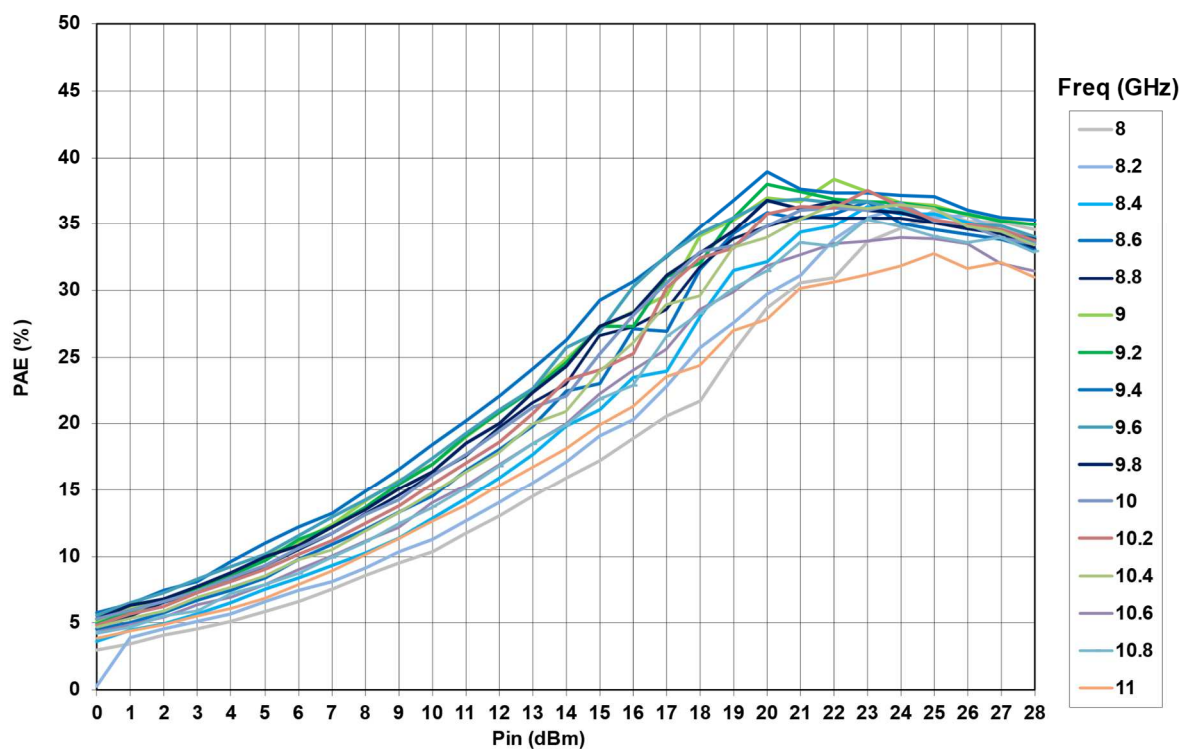


Figure 12. Efficiency vs Input Power vs Frequency



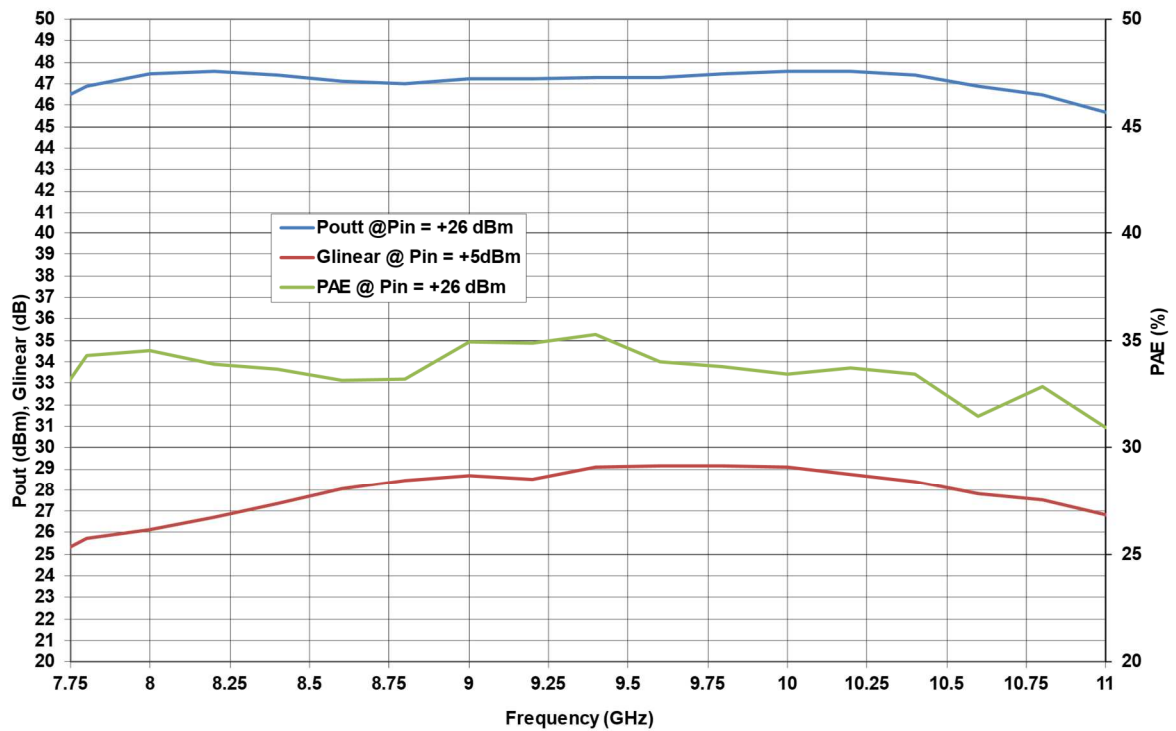


Figure 13. Saturated Output Power, Gain and Efficiency vs Frequency

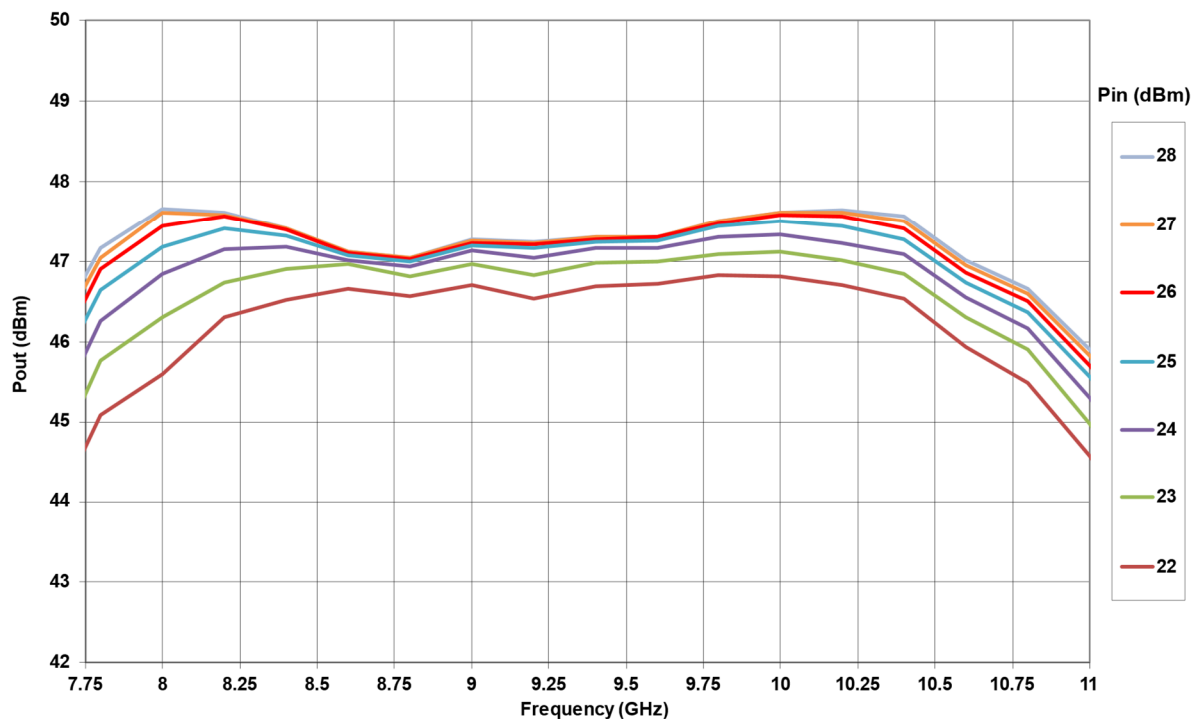


Figure 14. Output Power vs Frequency vs Input Power

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