AR212091

ARF2K0FE, 270-300MHz

V1.0 — 22 April 2022

Application Report

Document information

Info	Content
Status	General Publication
Author(s)	Bill Goumas
Abstract	Measurement results of an ART2K0FE device in board #AR212091 tested over 270-310MHz at 62V

1 Revision History

Table 1. Report revisions

Revision No.	Date	Description	Author
1.0	20210818	Initial document	Bill Goumas
2.0	20220422	Changed to General Publication	Bill Goumas

2 Contents

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3 List of Figures

4 List of Tables

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5 General Description

This report presents the measurement results of the Class AB Demo board AR192069. The circuit was swept over 270-310MHz and 59-62V. Current bench set-up is limited to 62V.

Idq was set for 600mA for most of the testing.

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6 Biasing

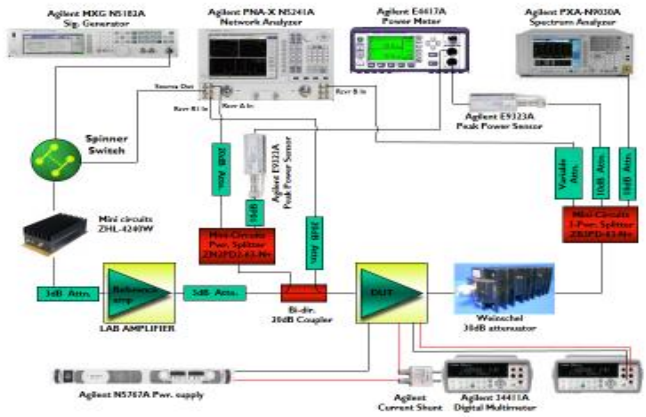
6.1 Bias Details

Idq is adjusted via the pot on the bias board. Apply +5V to the red wire. Pot is set for ~600mA at 5V.

For Vdd =62V , VGS= ~2.2 V per device leading to an Idq =600mA.

7 Test Bench Set Up

Figure 1.Test Bench Equipment set up



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8 Summary

This report presents the measurement results of the Class AB Demo board AR212091. The circuit was swept over 270-310MHz. Initial result had a small signal gain peak in the 110-135MHz frequency range. Result of the gain peak is shown in the spectrum in section 11. The blocking caps were changed which knocked the peak down by ~20dB. Results after the change are also shown in Section 11.

Table 2. RF Performance

Parameter	Measurement	Unit
Specified frequency range	280-300	MHz
Drain voltage	62	V
Quiescent drain current	600	mA
P1dB at 10% Duty Cycle and 62V	1400	W
*P1dB at 10% Duty Cycle and 65V	1500	W
Efficiency at Power Out=P1dB at 62V	55-65	%
Gain at P1dB and 62V	≥ 22	dB

*Section 9.3 shows data at 59 and 62V. This can be used to project the P1dB at 65V. Bench testing is currently limited to 62V due to Power Supply limitations.

For Stability Analysis, Small Signal K-Factor is measured over a wide range of the IV Bias Plane. This data is shown in section 9.1. K-factor has considerable margin. This methodology has been shown to yield a stable amplifier under large signal conditions including VSWR.

Coax Balun-If the coax baluns used in this circuit are copied and used for a production design, the output coax can be a smaller diameter. The bigger coax was for a CW application.

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9 Performance Details

9.1 Small Signal Results

Vdd=60V, Sweep Idq: Red=300mA , Blue=600mA, Purple=1.2A

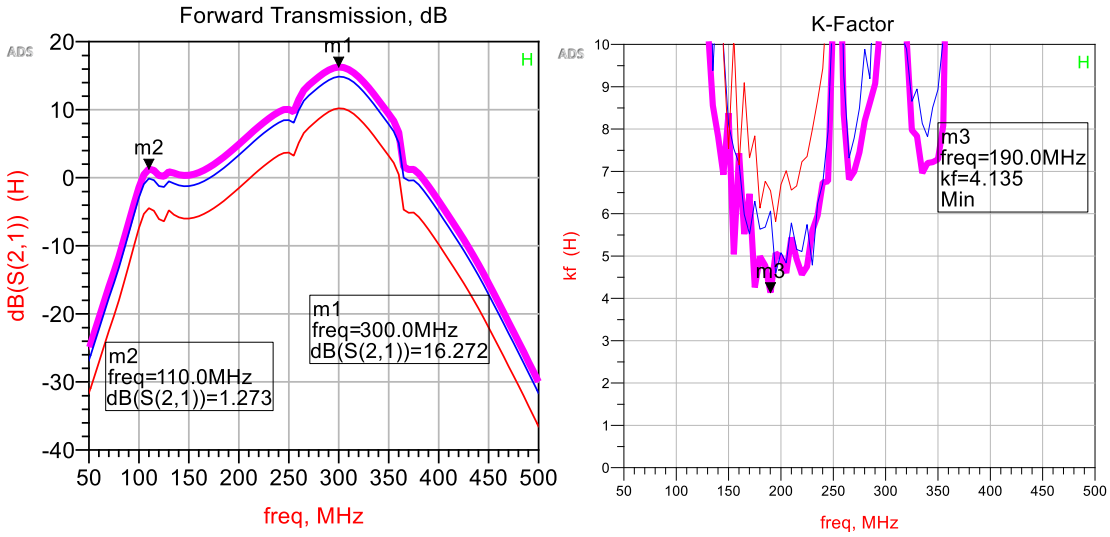

Figure 2. Small SIgnal Data, Vdd=60V, Sweep Idq, Pin=10dBm

Idq=600mA, Sweep Vdd: Red=15V , Blue=30V, Purple=60V

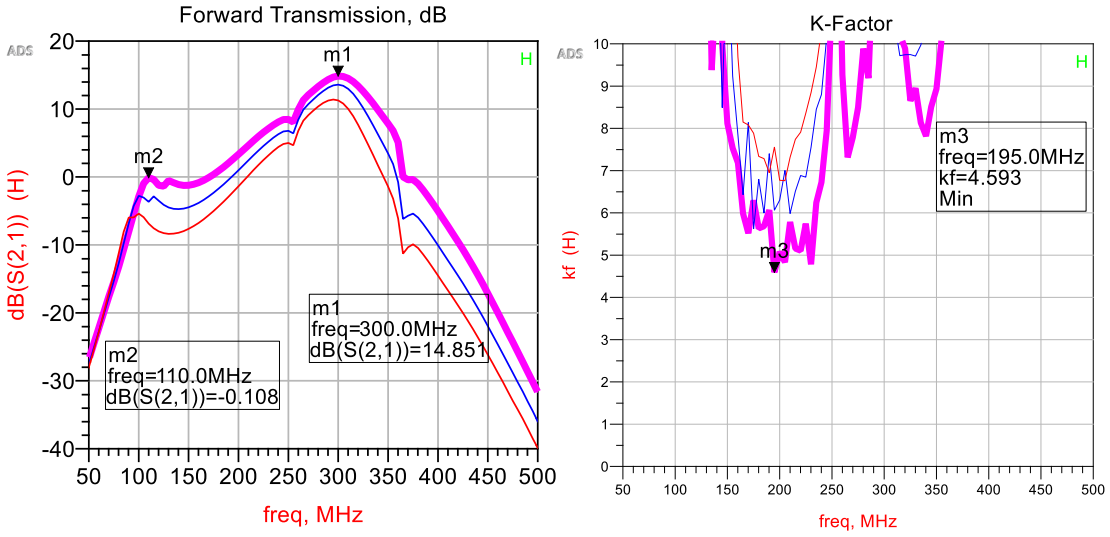

Figure 3. Small SIgnal Data, Sweep Vdd, Idq=600mA, Pin=10dBm

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9.2 Gain, Efficiency vs Power out

Vdd=62V, Idq=600mA, Power in dBm

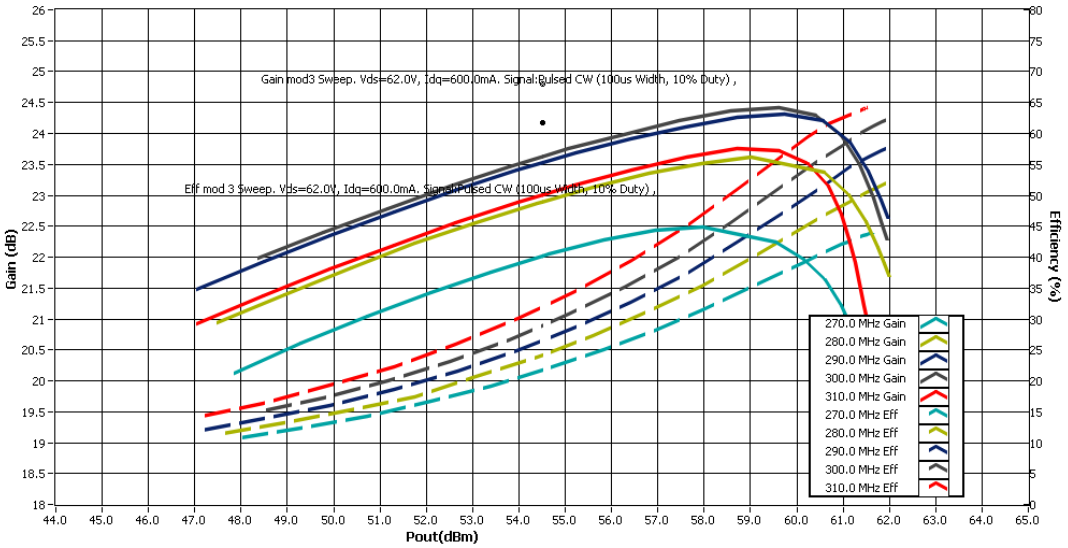

Figure 4. Gain, Efficiency vs Power out(dBm), Duty=10%

Vdd=62V, Idq=600mA, Power in Watts

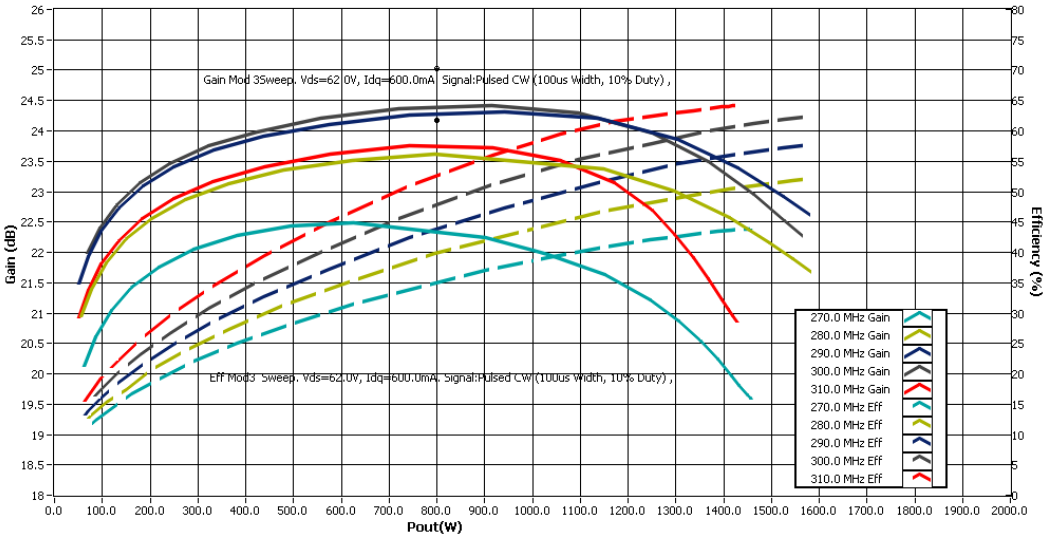

Figure 5.Gain, Efficiency vs Power out(W), Duty=10%

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9.3 Performance vs Voltage and Bias

Vdd varied, Idq=600mA, Vdd=59 (red, purple),62(blue, black) 10% duty,100usec PW

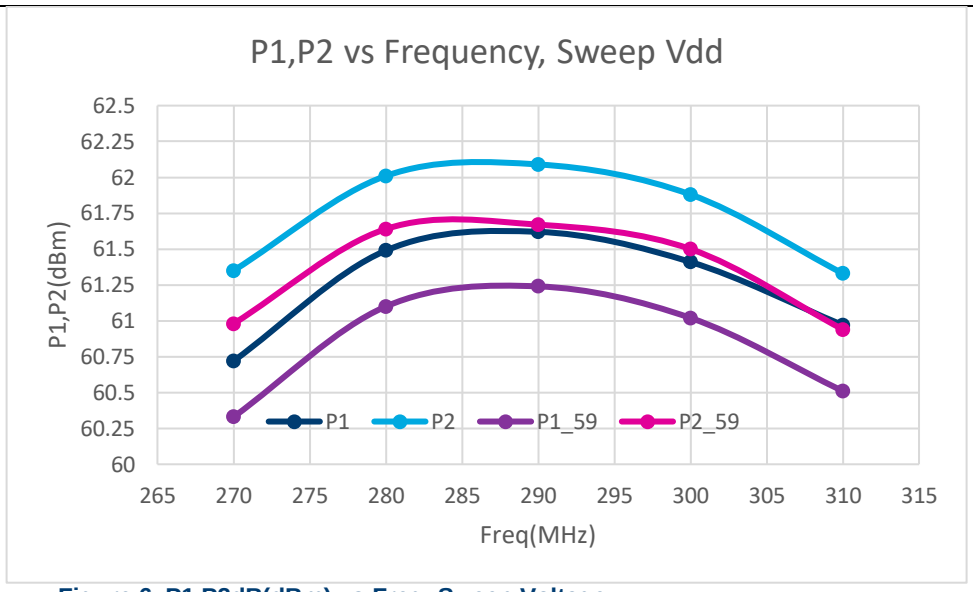

Figure 6. P1,P2dB(dBm) vs Freq, Sweep Voltage

Vdd=62V, Sweep Idq= 600(blue),900(green) and 1200mA(red)

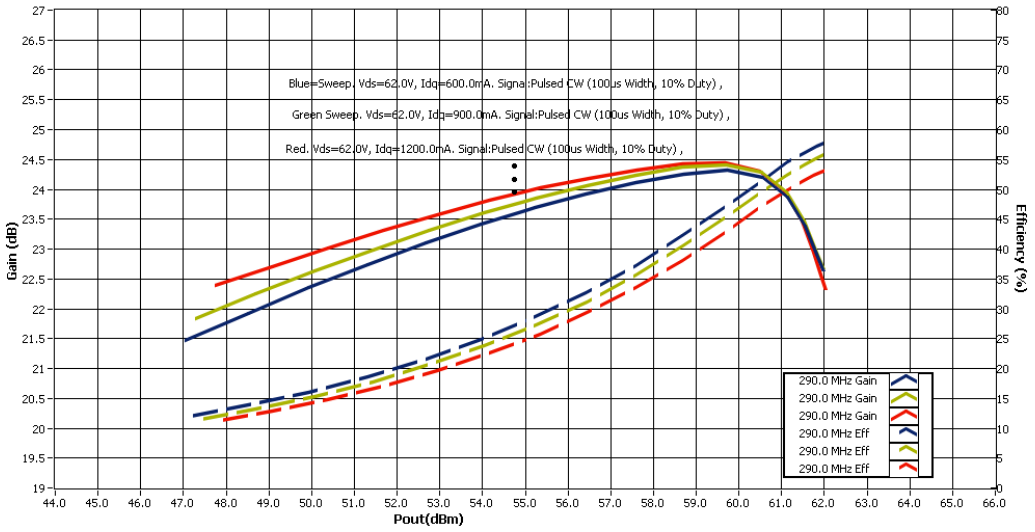

Figure 7. Gain, Eff vs Pout, Sweep Idq

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9.4 P1,P2dB vs Frequency

Vdd=62V, Idq=600mA, 10% duty

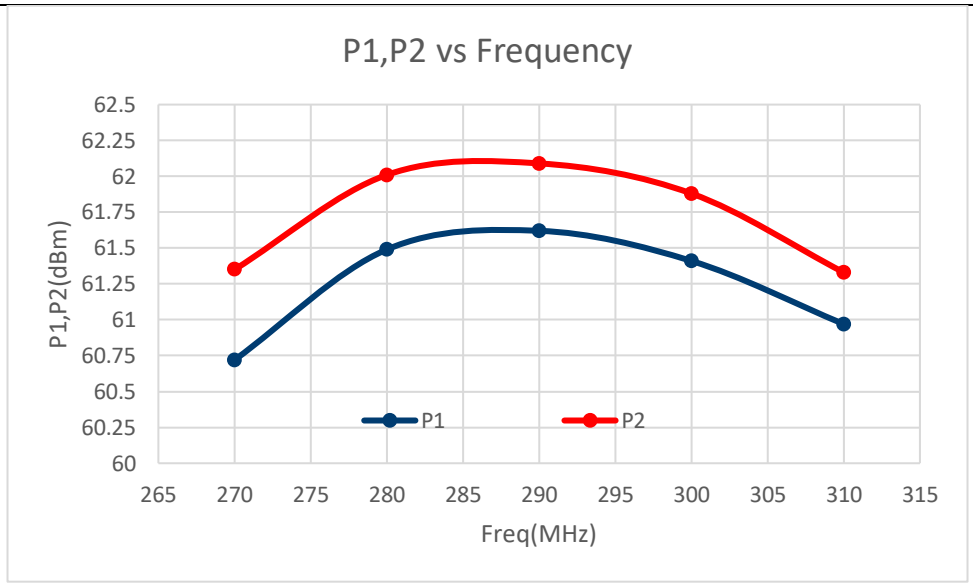

Figure 8. P1 and P2dB vs Frequency

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9.5 Gain, Efficiency at Power Out=1500W

Vdd=62V,Idq=10%, Duty=10%, 100usec PW

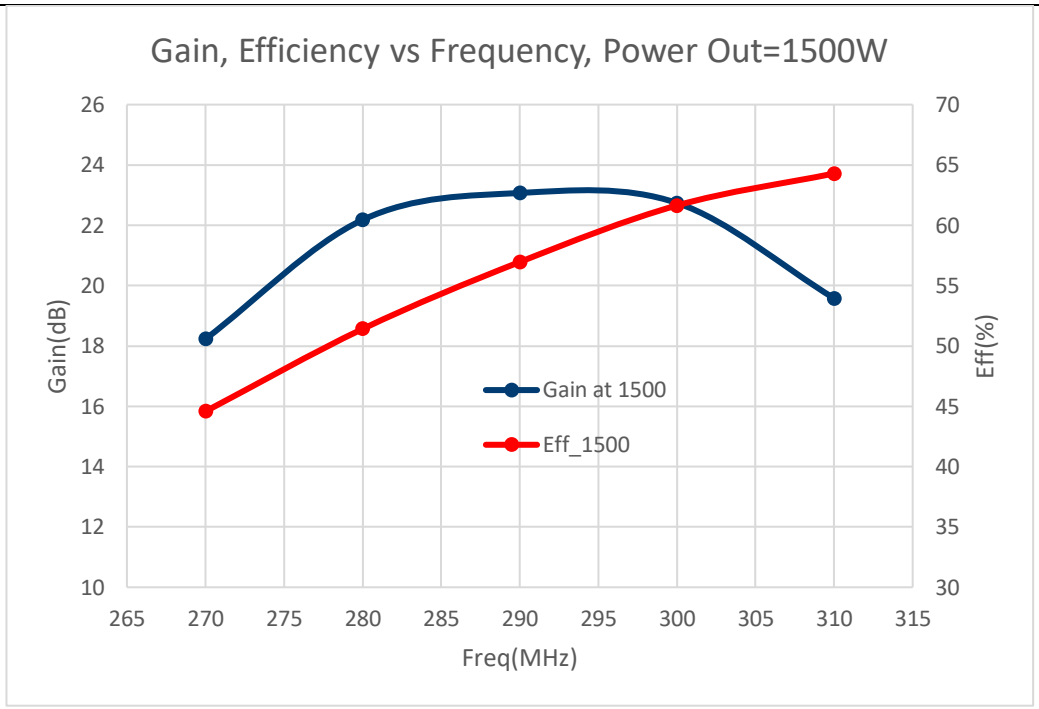

Figure 9. Gain(dB), Eff(%) at Power Out=1500W vs Frequency

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9.6 Gain vs Power Output, Sweep Pulse Width,

Vdd=62V, Idq=600mA, 10% Duty

Black=100usec, red=1msec

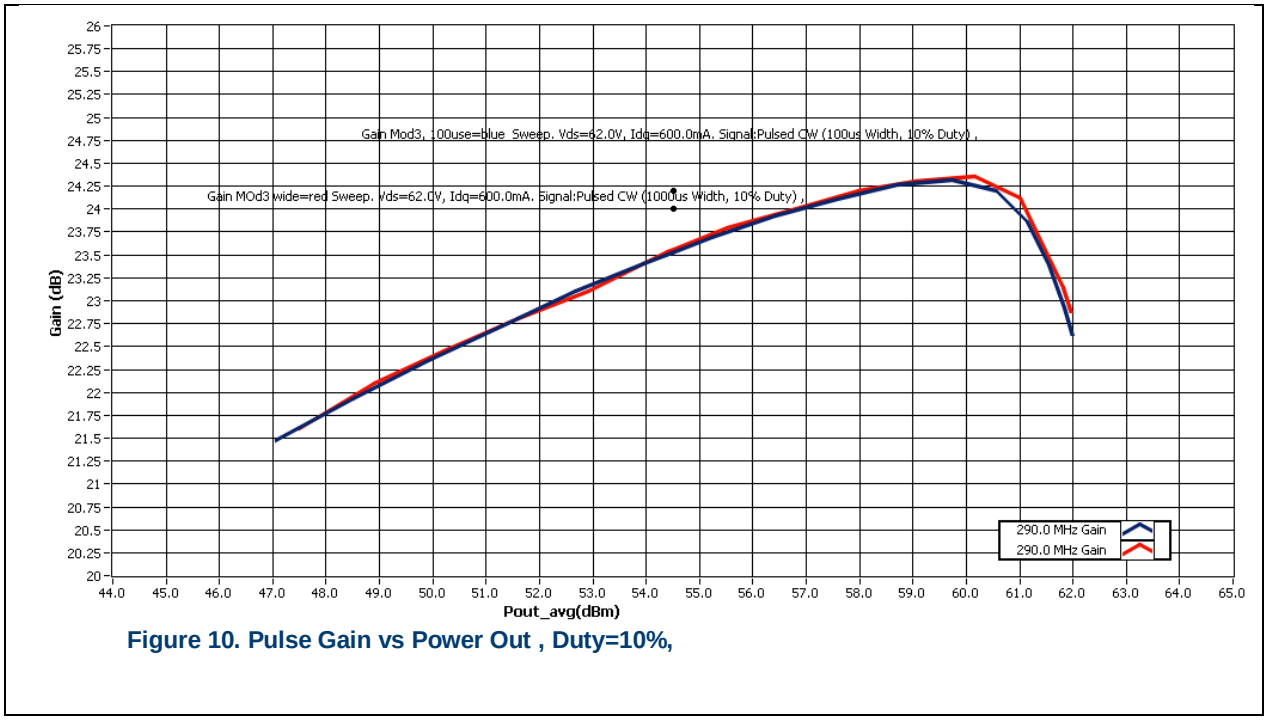

Figure 10. Pulse Gain vs Power Out , Duty=10%,

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10 IR Scan Results

10.1 IR Scan, Power Out=1500W

Vdd=62V, Idq=600mA, Pout=1500W, Duty=10%, Pulse Width=10msec

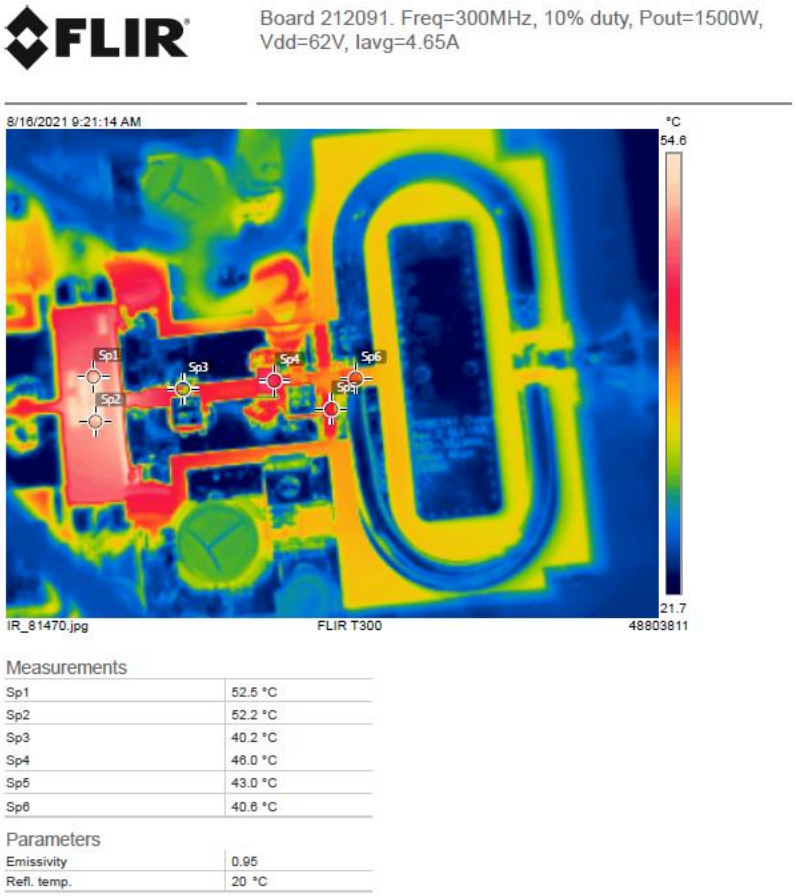

Figure 11. IR Scan at Pout=1500W, Duty=10%

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11 Spectrum

11.1 Initial Results

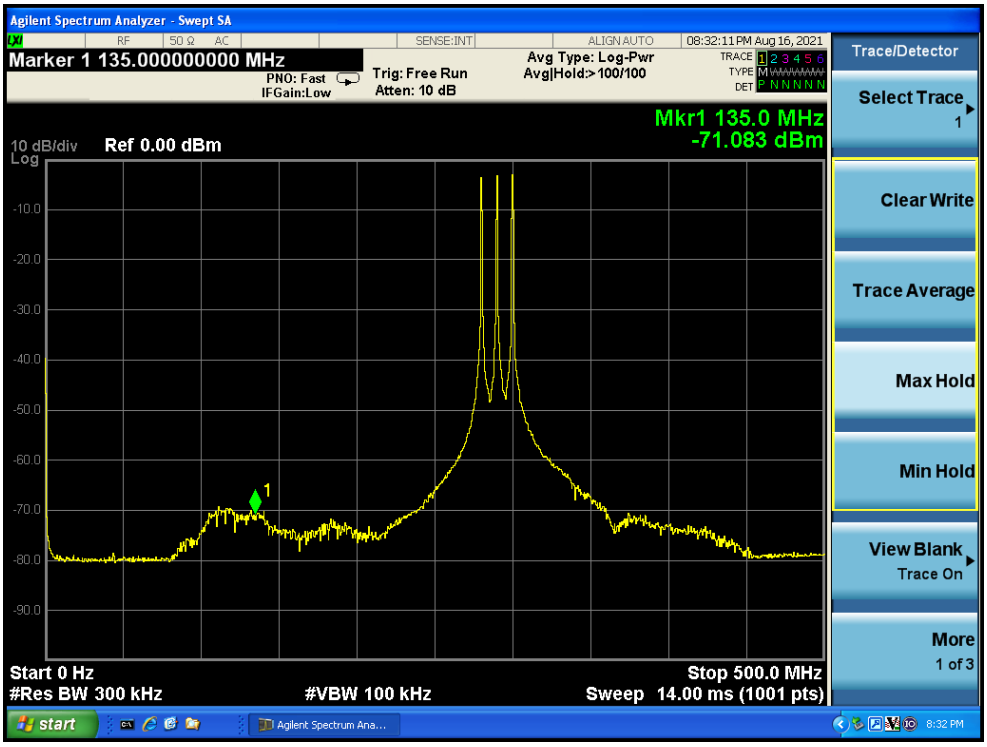

Figure 12. Spectrum Analyze Results, Max Hold

Note: Noise bumps near ~110-140MHz

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11.2 Spectrum Results after Modifications

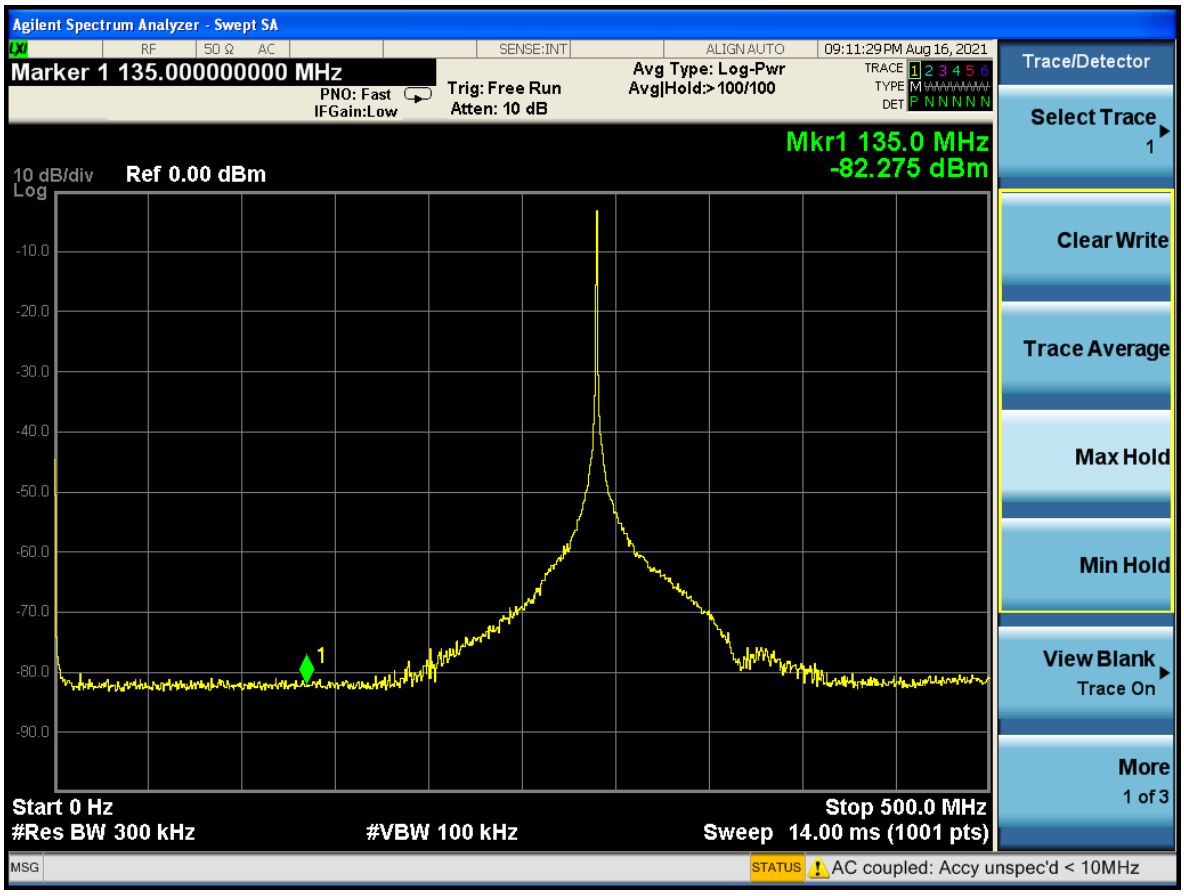

Figure 13. Spectrum Analyze Results, Max Hold

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12 Hardware

12.1 Board photograph

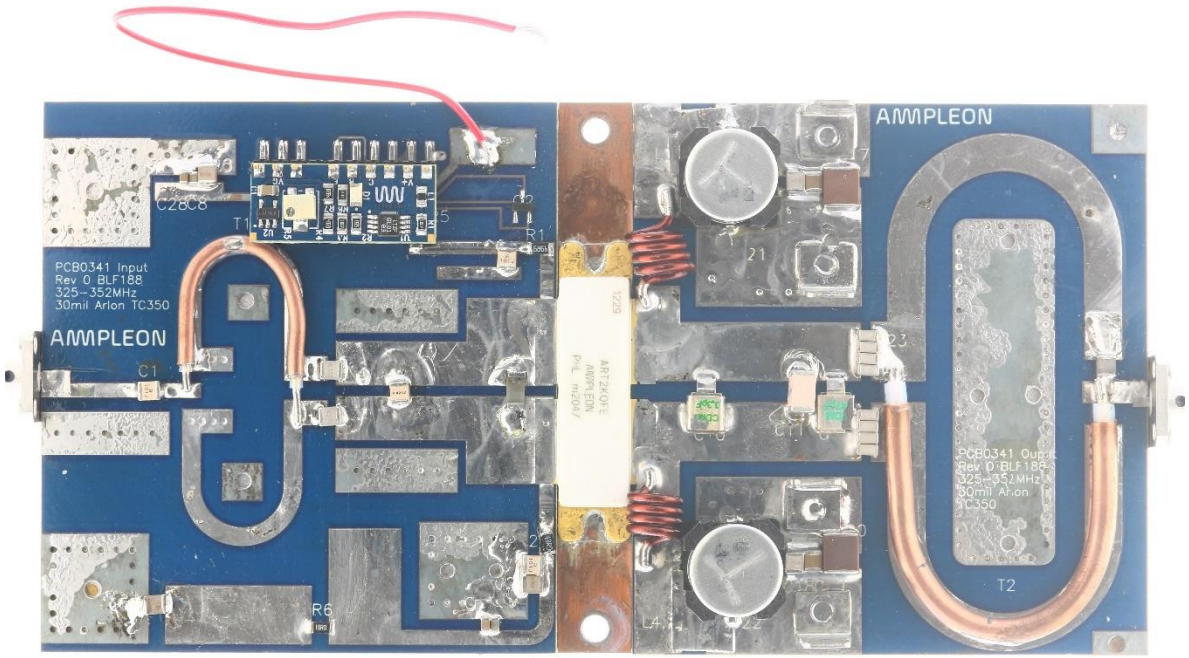

Figure 14. Board Photograph

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12.2 PCB layout

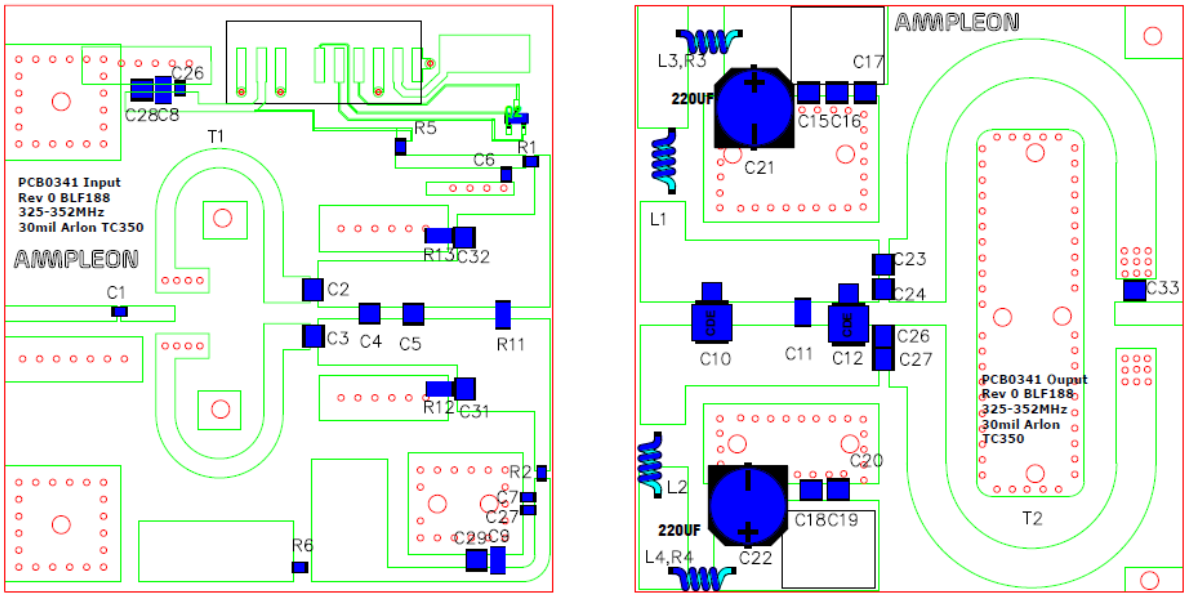

Figure 15.PCB Layout Board #AR212091

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12.3 Bill of materials

Table 3. BOM

Designator	Description	Manufacturer	Part#
PCB Input	30 mil Arlon TC350	Avanti Circuits	PCB0341 Input rev0
PCBOutput	30 mil Arlon TC350	Avanti Circuits	PCB0341 Output rev0
U1	LDMOS bias module	Ampleon	CA-330-11
Q1	RF Transistor	Ampleon	ART2K0FE
Q2	2N2222 NPN Transistor	Fairchild	MMBT2222
R1, R2	Resistor, 51 ohm	Generic	0805
R3, R4	Short Out with Copper Strip	Generic	
R5, R6	Resistor, 10ohm	Generic	0805
R11	Resistor, 50 OHM	IMS	
L1, L2,	4turn ID=5mm 14 or 16G wire		
C1, C6, C7, C15, C18	Capacitor 100pF	ATC	100B
C2, C3	Capacitor 33pF	ATC	100B
C4	Capacitor 82pF	ATC	100B
C5	DNP	ATC	100B
C10	Capacitor 3.3pF Mica	CDE	MIN02-002
C11	Capacitor 3.9pF	Passive Plus	2225
C12	Capacitor 47pF Mica	CDE	MIN02-002
C23,C24,C26,C27	2x Capacitor – mounted on side 150pF	ATC	800B
C26,C27input	Capacitor 1000pF	ATC	600F
C17, C20	10uF 2220 100V	TDK	C5750X7S2A106K230KE
C16, C19	0.1uF 1210	Murata	GRM32ER72A105KA01
C21,C22	150uF Electrolytic 80V	Panasonic	EEEFK1K151AQ
C8, C9,	Capacitor, 50V 10% X7R, 0805	Generic	0805
C28,C29	Capacitor, 50V 10% X7R, 100nF	Generic	0805
C31,C32	DNP	Generic	
C33	Capacitor 4.7pF	ATC	100B
T1	Semirigid coax 15 ohm 2.2mm	Micro-Coax	15 ohm
T2	Semirigid coax 25 ohm 3.3mm diameter	Micro-Coax	25 ohm

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12.4 PCB materials

Table 4. Board Specifications

Parameter	Value
Manufacturer	Arlon
Type	TC350
Thickness	30 mils, 1oz. copper
Layers	2, top/bottom. Bottom all copper

12.5 Device markings

Table 5. Device Specifications

Parameter	Value
Manufacturer	Ampleon
Device	ART2K0FE
Date Code	M1914

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