

AR201243

ART2k0, 41MHz

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AMPLEON

Application Report

Document information

Status	Company public
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Abstract	Measurement results of a Class E amplifier design for the 41MHz band using the ART2k0 transistor

1. Revision History

Table 1: Report revisions

Revision	Date	Description	Author
1.0	20210122	Initial document	Hans Kartman

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5. General description

This report presents the measurement results of the Class E amplifier demo AR201243. The device used is the ART2k0, 9th generation LDMOS in a SOT539 push-pull package. The presented demo is tuned for the 41MHz frequency band.

The demo circuit is build on two PCB boards, assembled on a full copper baseplate with integrated water cooling channel.

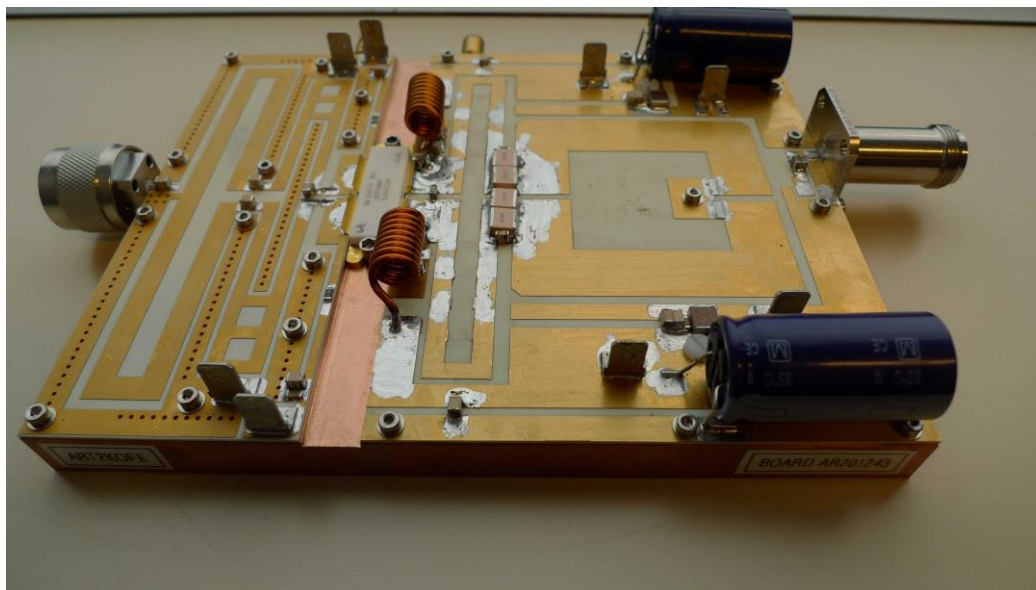


Figure 1 Demo Front view, prototype

6. Biasing

The biasing settings are as follows:

V_{DD}	=	50V
V_{GS}	=	approx 1.9V, adjusted to $I_{DQ} = 200mA$

After connecting the water cooling and source and load, first the gate bias voltage is set to zero volts, then the drain voltage is connected. Second the gate bias supply is slowly increased . Slowly the gate bias voltage can be increased to about 1.9Volts, until the desired I_{DQ} is reached.

7. Performance Indication

Table 2: Performance indication, at 41MHz, input signal is sinusoidal

Parameter	Condition	Unit	CW
V_{DD}		V	50
S11 at input connector		dB	>10
P_{6dB}^1	$G_{MAX} - 6dB$	/ W	900W
Gain	@ P6dB	dB	26
Drain Efficiency	@ P_o	%	89

1 Pload at 6dB compression

8. Performance Details

8.1 Power, Gain , Efficiency, ruggedness test result and Thermals.

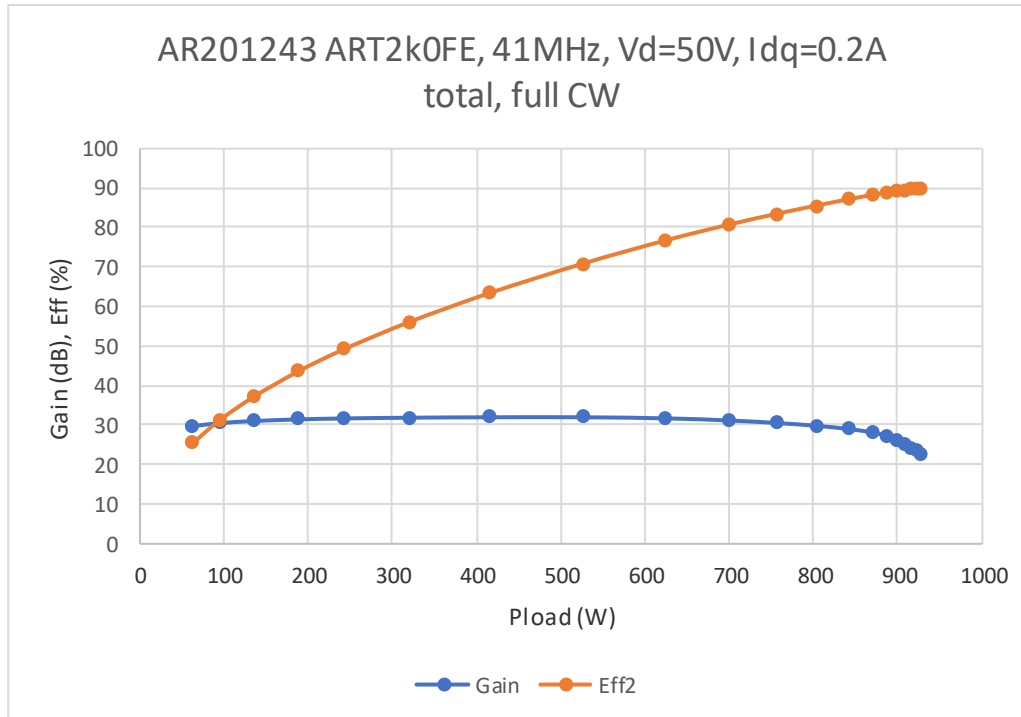


Figure 2 Full CW Gain and Efficiency vs Load power

Ruggedness test results.

Ruggedness has been tested using a phase unit and varying cable lengths to reach all phase angles.

VSWR	Result@Pload=600W Tp=100usec, DC=10%	Result@Pload=900W Tp=100usec, DC=10%
10:1 all phases	Pass	Pass
20:1 all phases	Pass	Pass
40:1 all phases	Pass	Pass
Max of phase unit (~50:1) all phases	Pass	Pass

Figure 3 Results of Mismatch testing

Thermals.

The amplifier is capable of generating around 900 Watts of full CW RF power at an efficiency of 90 %.

Dissipated power at this output power level is around 100Watts.

In this version of the demo amplifier the ART2k0FE transistor is bolted down to a copper baseplate.

The demo circuit was build on a full copper baseplate with integrated water cooling channel.

This baseplate was chosen because it is one of Ampleons standard available baseplates for the development of high power demo amplifiers.

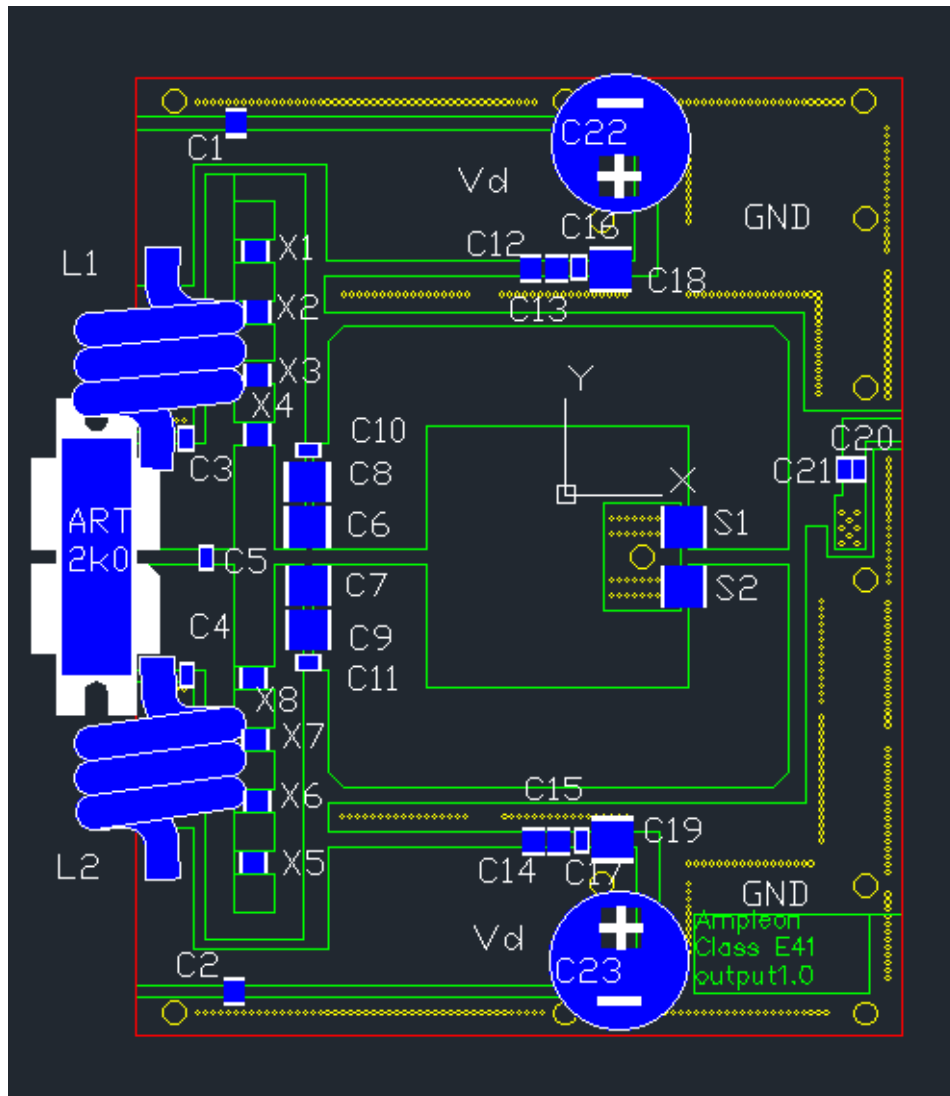
Because of the high efficiency , the amplifier dissipates a relatively low amount of heat. This makes it possible to build the amplifier with a cheaper cooling medium, like air cooling of an aluminum coldplate.

Below a thermal image is shown of the amplifier output board while the amplifier is running at 900Watts output power.

The image shows the components with the highest temperature are at the coupling capacitors to the balun at about 70 degrees Celsius.



8.2 Layout and Components.

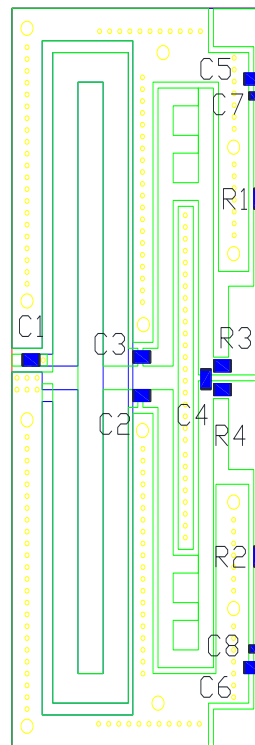


Output board.

List of components Output board.

Output Board			
Comp	Value	manufacturer	Remarks
C1,C2	1nF	ATC	100B
C3,C4	100pF	ATC	800B
C5	15pF	ATC	100B
C6,C7	560pF	PPI	2225
C8,C9	510pF	PPI	2225
C10,C11	100pF	ATC	800B
C12,C13,C14,C15	510p	ATC	100B
C16,C17	100nf	TDK	100Volts
C18,C19	4u7	TDK	100Volts
C20,C21	560pF	ATC	800B
C22,C23	1000uF	Any Premium brand	Electrolitic 100Volts
X1 - 9	open		Removed copper track
S1,S2	short		Copper foil soldered on board
L1, L2	Aircoil 8turns, 6mm diameter		Enamel 1.6 mm copper wire
Board	Ro 4350 double sided	Rogers	Er=3.5 Tsubstrate=0.76mm Tcopper= 70um
Thermal conductor under Output Balun	Thermipad TP22626	Mueller Ahlhorn	
Baseplate	Copper with cooling channel		Cavities for coplanar baluns are 5mm deep

Input board.



List of components input board.

Input Board			
Comp	Value	manufacturer	Remarks
C1	560pF	ATC	100B
C2,C3	470pF	ATC	100B
C4	220pF	ATC	100B
C5,C6	100nF	TDK	
C9,C10	100uF		63 Volts electrolytic
C7,C8	1nF	ATC	100B
R1,R2	47Ohm		1206
R3,R4	0 Ohm		Cu foil
Board	Ro 4350 double sided	Rogers	Er=3.5 T substrate=0.76mm T copper= 70um
Baseplate	Copper with cooling channel		Cavities for coplanar baluns are 5mm deep
Transistor	ART2k0	Ampleon	

9. Hardware

9.1 Board Image

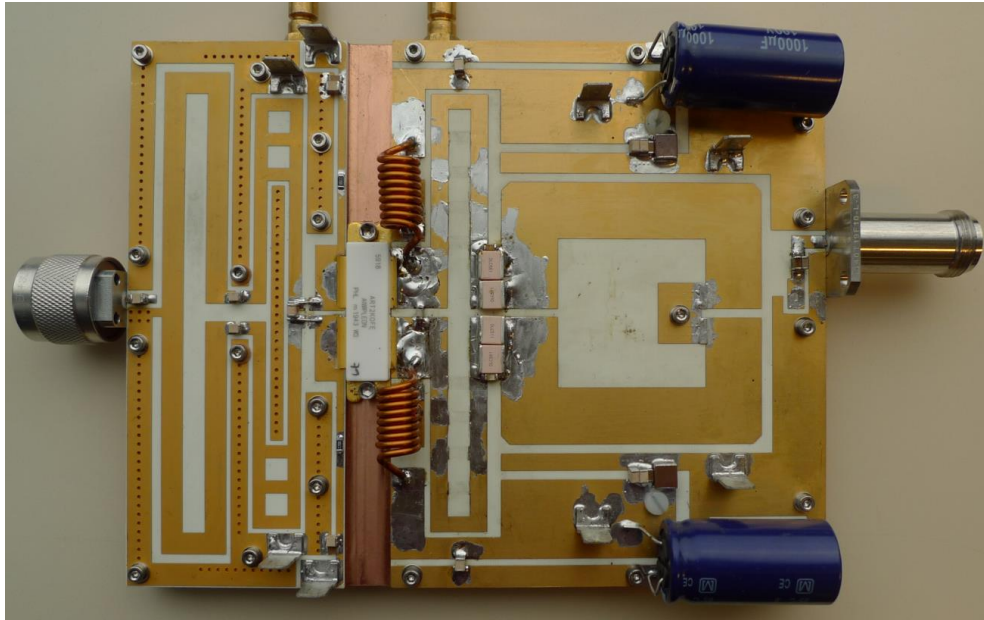
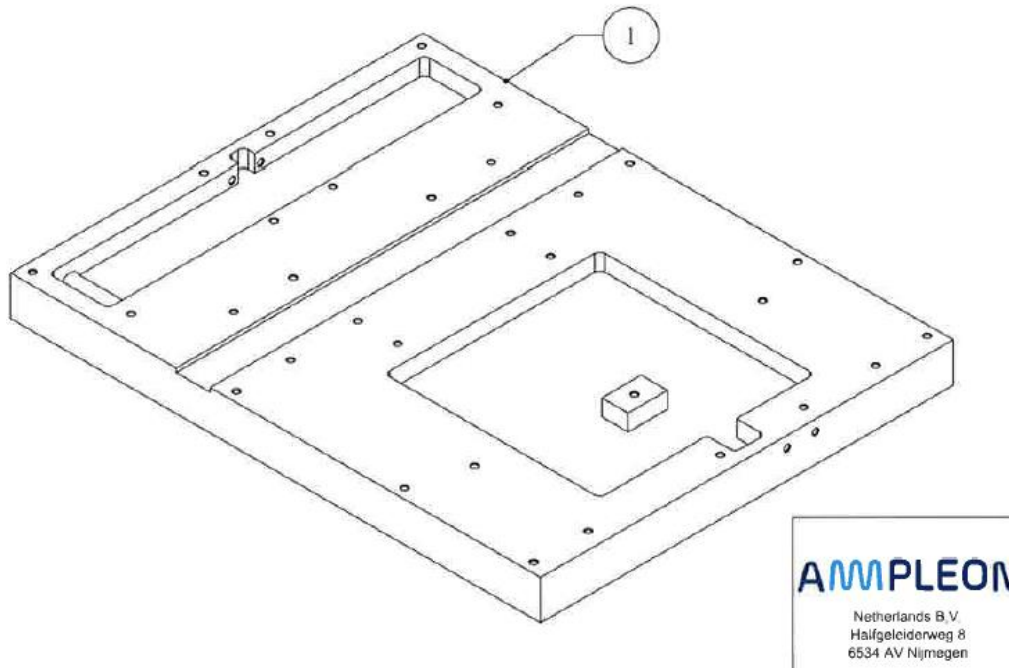


Figure 4 Image of demoboard, prototype

9.2 Baseplate and layouts of boards.

Baseplate:



Input board:



BLF188XR_41MHz_inp
ut_1_2.dxf

Output board:



Class E41 output1.0
board.dxf

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