AR221063

ART2K0FE, 2MHz

AMPLEON

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Application Report

Document information	
Status	Public
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Abstract	Measurement results of a Class E Amplifier design for 2MHz with the Art2K0FE transistor

Revision History

Table 1: Report revisions

Revision	Date	Description	Author
1.0	20221205	Initial document	Hans Kartman

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General description

This report presents the measurement results of a Class E Amplifier demo AR. The device used is ART2k0, 9th generation LDMOS in a SOT539 push-pull package. The presented demo is tuned for 2MHz operation.

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

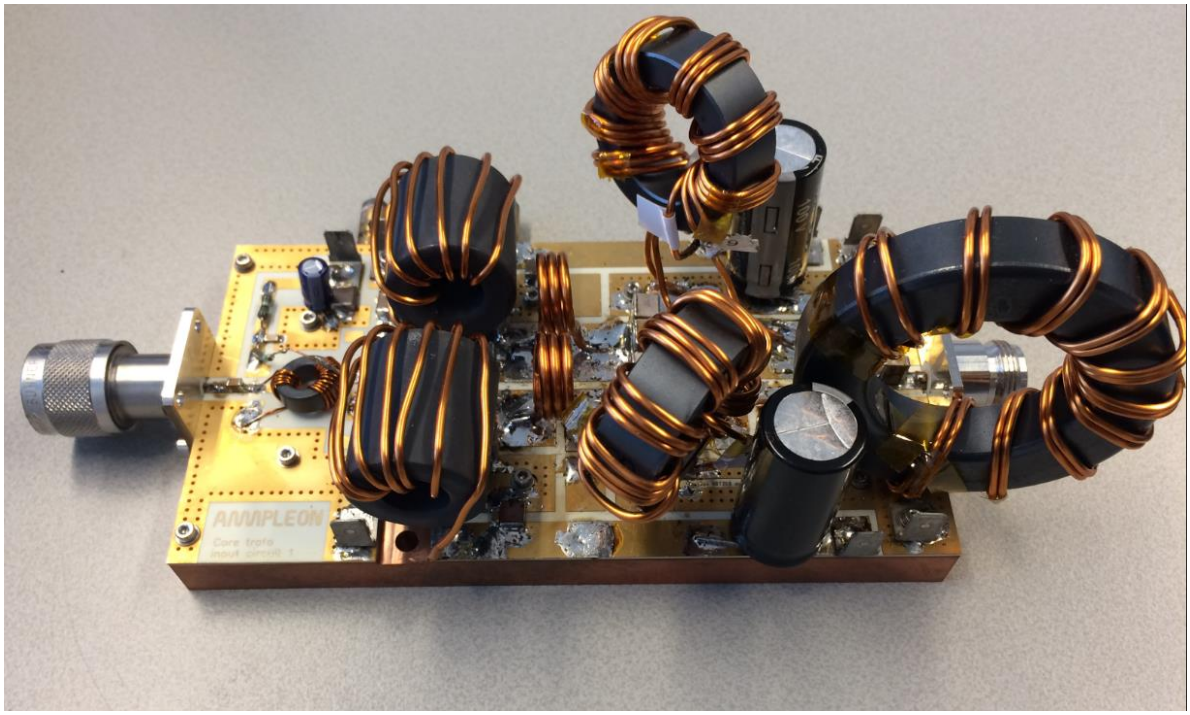


Figure 1 Demo Front view

Biasing

.

The biasing settings are as follows:

V_{DD}	=	56V
V_{GS}	=	approx 1.8V, adjusted to I_{DQ}= 200mA total current

After connecting the water cooling and source and load, first 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 1.8Volts, until the desired Idq is reached.

Performance Indication

Table 2: Performance indication,at 2MHz

Parameter	Condition	Unit	CW
V_{DD}		V	56
S11 at input connector		dB	>10
$P5_{dB}$[1]	G_{MAX}-6dB	/ W	1300W
Gain	**@P6dB**	dB	22
Drain Efficiency	**@P_o**	%	82

Performance Details

Power, Gain and Efficiency

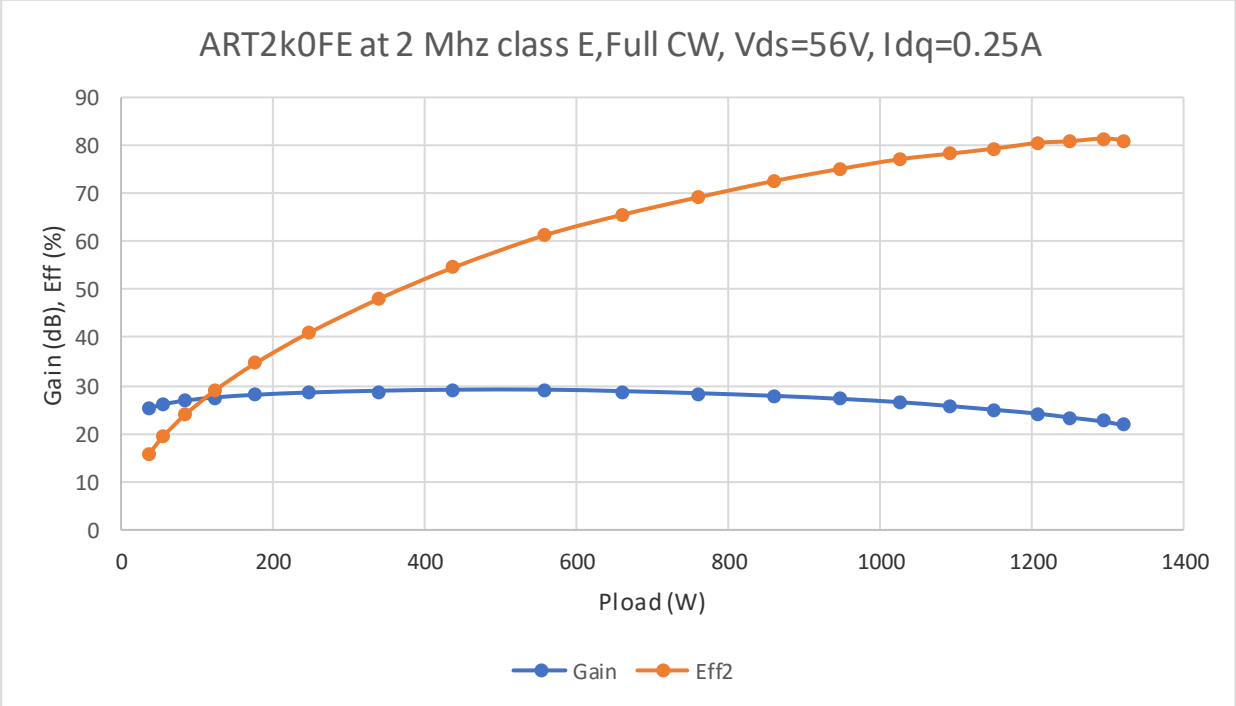


figure 2 Full CW Gain and Efficiency vs Load power

Layouts and Components.

Output circuit

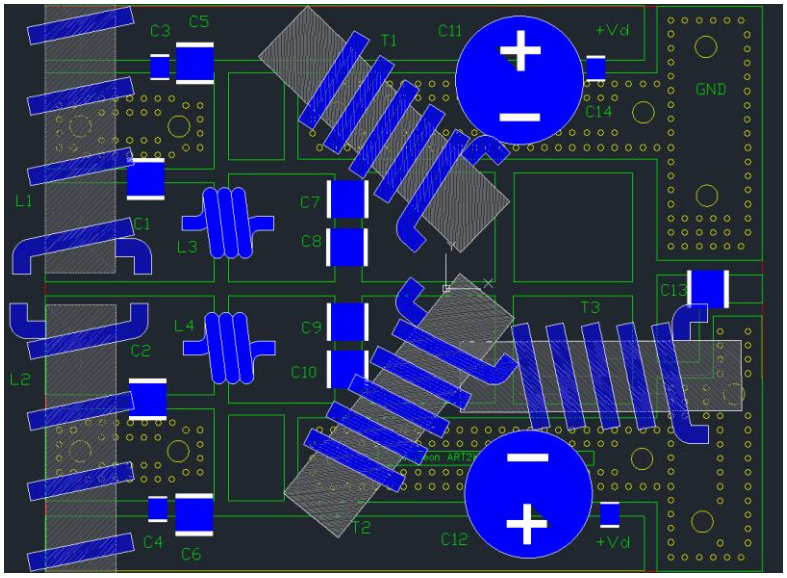


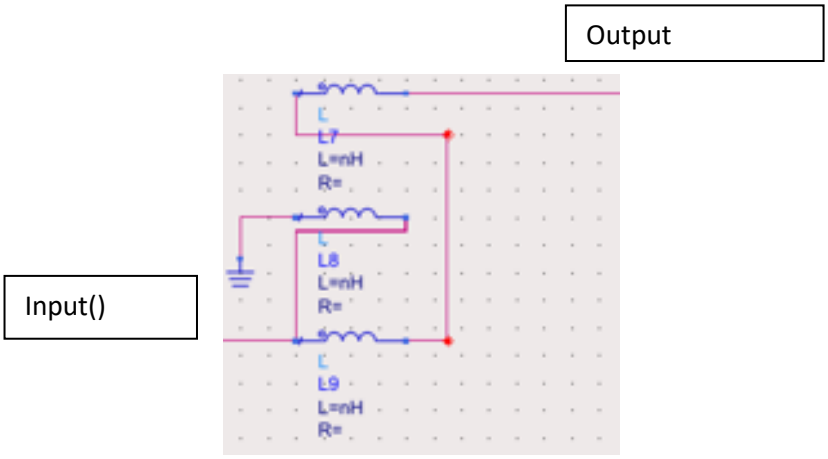
Figure 3 Output board

List of components Output board.

Component	Value	Manufacturer	Remarks
L1, L2	6.5 turns 1.6mm wire on T61 28.6x25.8x12.8 core	Fair- rite 2661102002	tube core
L3, L4	3 Turns 1.8mm enamel wire Aircoil Diameter 15mm	Handwound	Close turns
T1, T2	7 turns 1.6mm wire trifilar wound on FT-140-43	Fair-rite	Connected as 1:9 transformer See fig
T3	9Turns bifilar wound 1.6mm wire on T43 61x35x12.7	Fair-rite	1:1 Balun connected See fig
C1, C2, C13	10nF 2225	Knowles Cypher	
C3, C4, C14, C15	100nF 100V	TDK	
C5, C6	10uF 100V	TDK	
C7, C8/C9,C10	9x10nF 2225 per side	Knowles Cypher	Tb replaced by3x27n
C11, C12	1000uF, 100V		electrolytic
Board	RF35	Taconic	Er=3.5, T=0.76mm

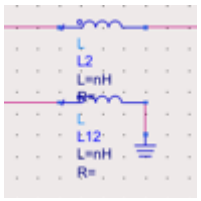
Construction of the transformers.

Output transformers.



T2 and T3 are constructed by making 7 turns 1.6mm wire trifilar wound on a FT-140-43 toroide core.Each transformer has it own core connections of the wires as shown in the circuit diagram above. The turn are evenly distributed around the toroide core. The dots on the left side of the windings indicate the winding orientation.

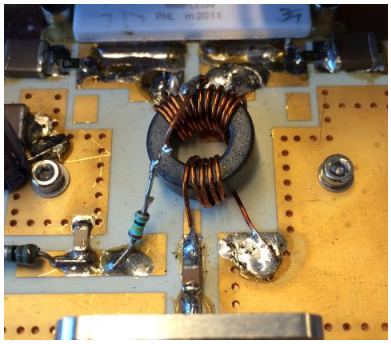
Output balun construction.



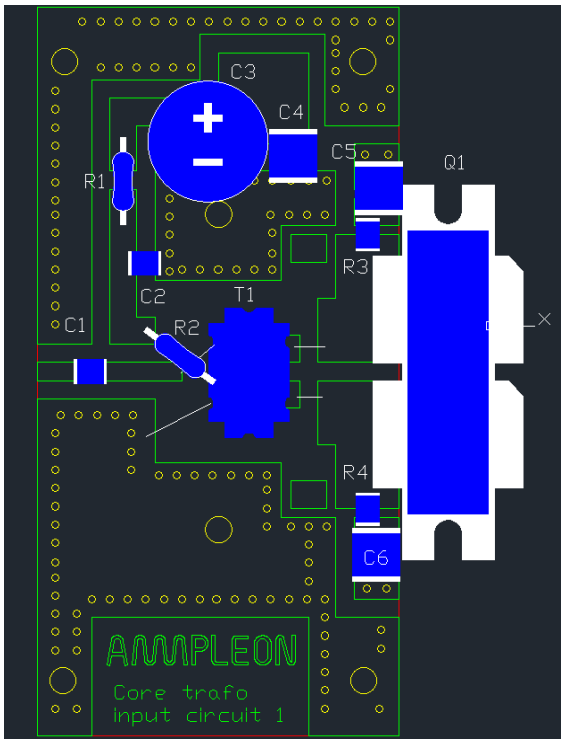
The output balun is constructed by 9 turns bifilar wound on a T43 61x35x12.7mm toroide core. The turns are evenly distributed around the core.

Input balun transformer construction.

Photograph of the input balun/transformer



Input circuit.



Input board.

List of components input board.

Component	Value	Manufacturer	Remarks
R1	1k Ohms		wired
R2	27 Ohms		wired
R3, R4	12 Ohms		0805
T1	Transformer	Amidon/ Fair-rite FT50-43 material	Primary:5T Secundary: 2x5T 0.5mm enamel wire
C1	20nF	TDK	TDK
C2	100nF	TDK	
C3	47uF		Electrolytic 63V
C4	4.7uF	TDK	
C5, C6	10uF	TDK	
Q1	ART2k0	Ampleon	RF Power LdMosfet

Hardware

Board Image, Top view, prototype demo.

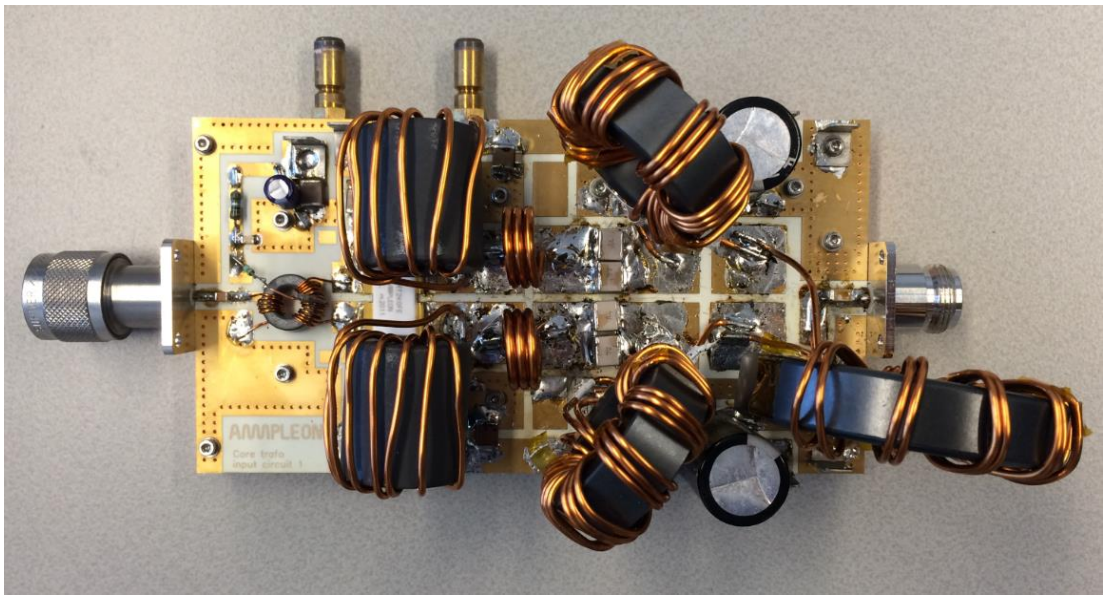


Figure 3 Image of demoboard

Thermal Considerations.

The amplifier is capable of generating 1300 Watts of full CW RF power

at efficiencies above 80 %.

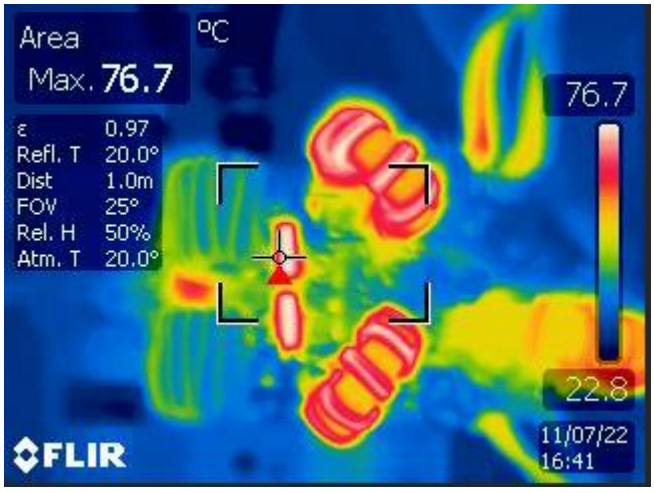
Dissipated power at this output power level is around 300Watts.

In this version of the demo amplifier the transistor is bolted down to the copper baseplate using thermal paste.

Below a thermal image is shown of the amplifier output board while the amplifier is running at 1300Watts output power.

It shows left to right: Transistor and drain feed coils, matching network, Transformers, balun.

The image shows the components with the highest temperature are the series coils L3 and L4 of the class E network at 77 degrees Celsius.



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