AR201105

ART2K0PE, 41MHz

v1.0 — 20-May-2020

AMPLEON

Application Report

Document information	
Status	Company Public
Author(s)	
Abstract	Measurement results of a Class AB planar balun design for the 41MHz band with the ART2K0PE

1. Revision History

Table 1: Report revisions

Revision	Date	Description	Author
1.0	2020.05.20	Initial document	

2. Contents

3. List of figures

4. List of tables

5. Introduction

5.1 General description

This document shows the measurement results of a 41MHz demo amplifier (Board AR201105) with 1x ART2K0PE.

5.2 Test object details

Transistor type:	ART2K0PE (Soldered down)
Production code:	
Package:	OMP1230
Board:	ART2K0_41MHz_coplanar_balun_input_output
Demo number:	AR201105

5.3 Used Test signals

CW:	CW
CW-pulsed:	Pulsed CW, Pulse Width 100us, Duty Cycle 10%

5.4 Test circuit

A description of this circuit can be found in Appendix A.

The INPUT and OUTPUT board of the test circuit have been designed on Rogers RO4350, h=0.762mm, εr=3.48, 2x35um.

Supply voltage (drain-source) is typical 65V. Increase Vgs until the total Idq will be 300mA.

6. Measurement Results

6.1 Gain & Efficiency @ Frequency=41MHz CW

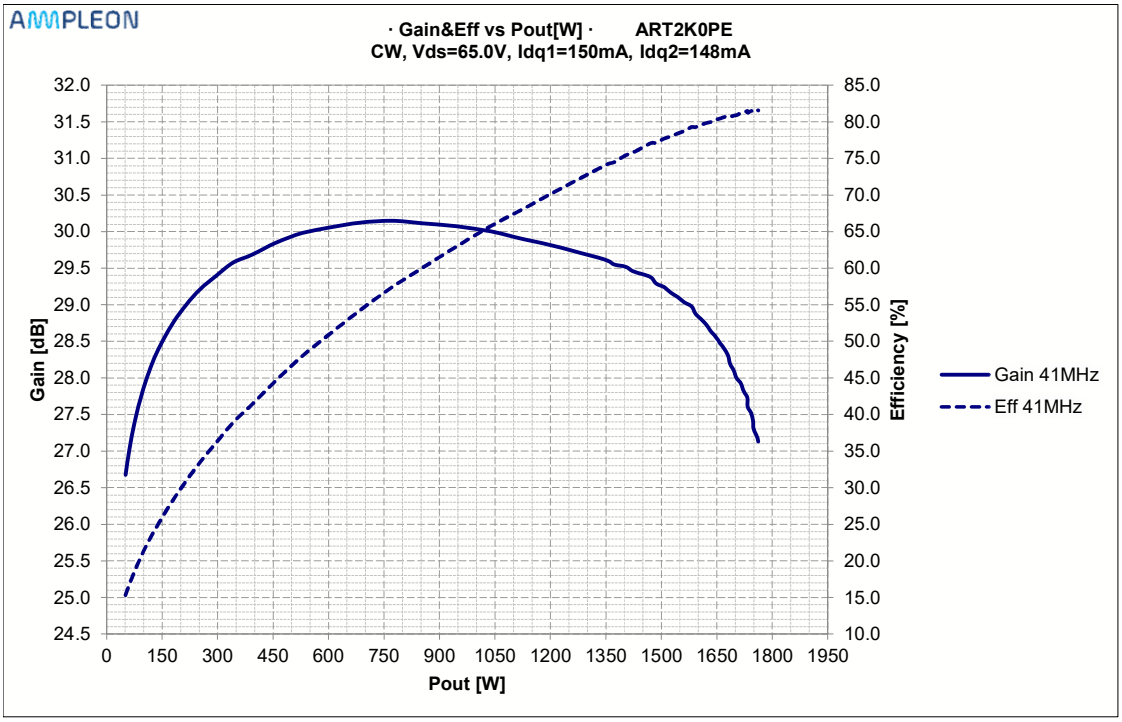


Figure 1 CW Gain and Efficiency vs Pout [W]

Table 1 – RF Performance overview

Freq [MHz]	Gmax [dB]	Pout@ Gmax [W]	P1dB [W]	P2dB [W]	P3dB [W]	Effmax [%]	Pout@ Effmax [W]	Eff P1dB [%]	Eff P2dB [%]	Eff P3dB [%]
41	30.2	770.2	1531.2	1690.9	1761.4	81.6	1762.4	78.1	80.8	81.6

6.2 Gain & Efficiency @ Frequency=41MHz CW-Pulsed

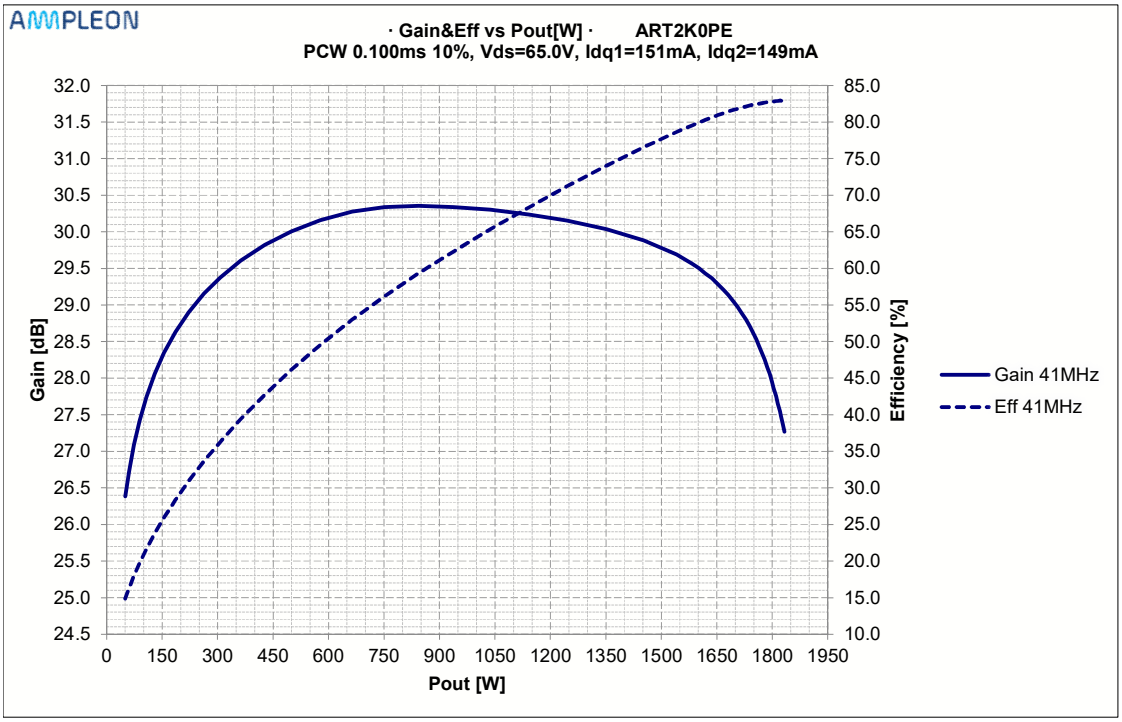


Figure 2 PCW Gain and Efficiency vs Pout[W]

Table 2 – RF Performance overview

Freq [MHz]	Gmax [dB]	Pout@ Gmax [W]	P1dB [W]	P2dB [W]	P3dB [W]	Effmax [%]	Pout@ Effmax [W]	Eff P1dB [%]	Eff P2dB [%]	Eff P3dB [%]
41	30.4	843.9	1637.9	1770.9	1828.3	83	1832.6	80.7	82.6	82.9

7. Appendix A – PCB Layout and components

7.1 PCB OUTPUT

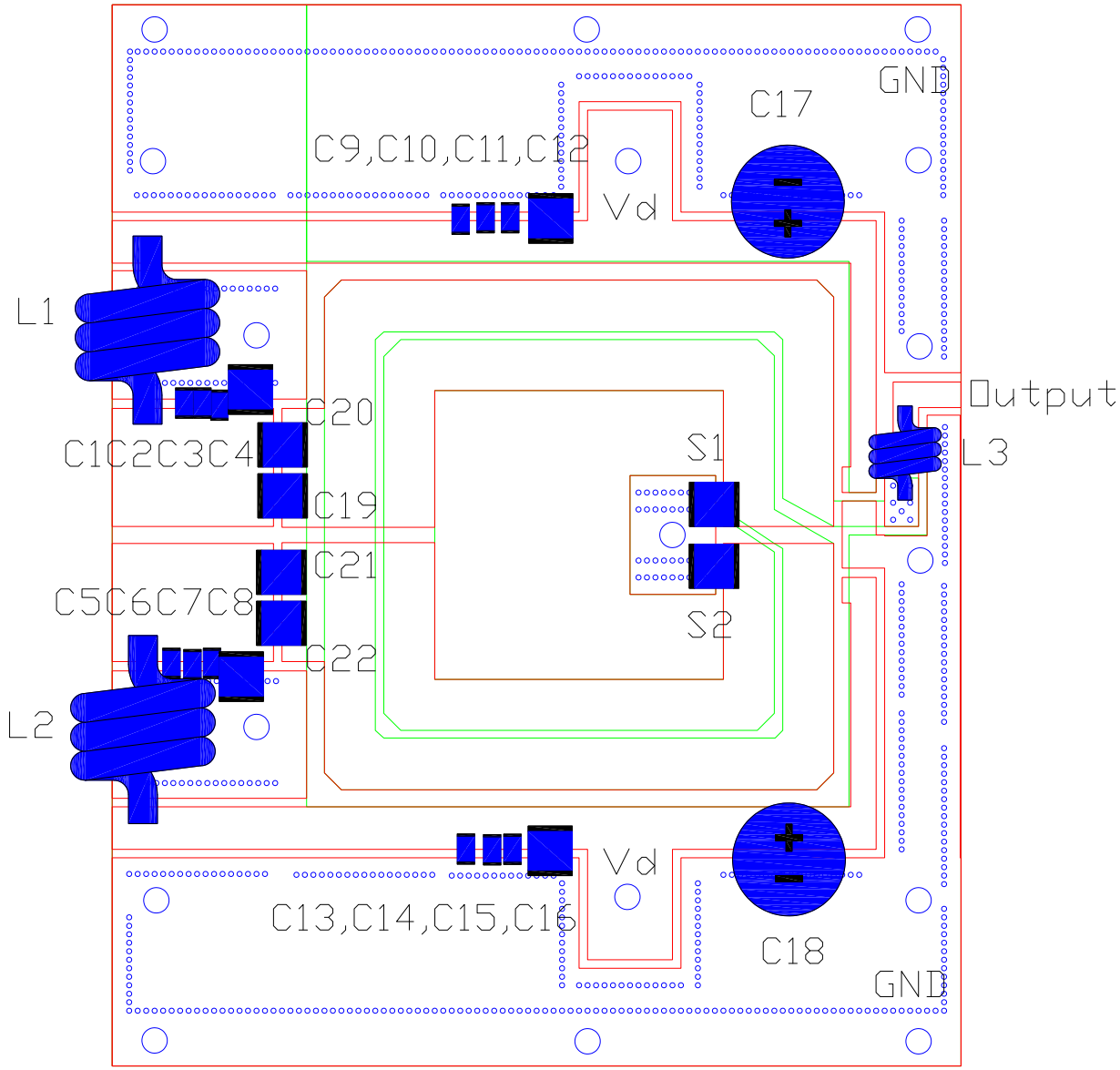


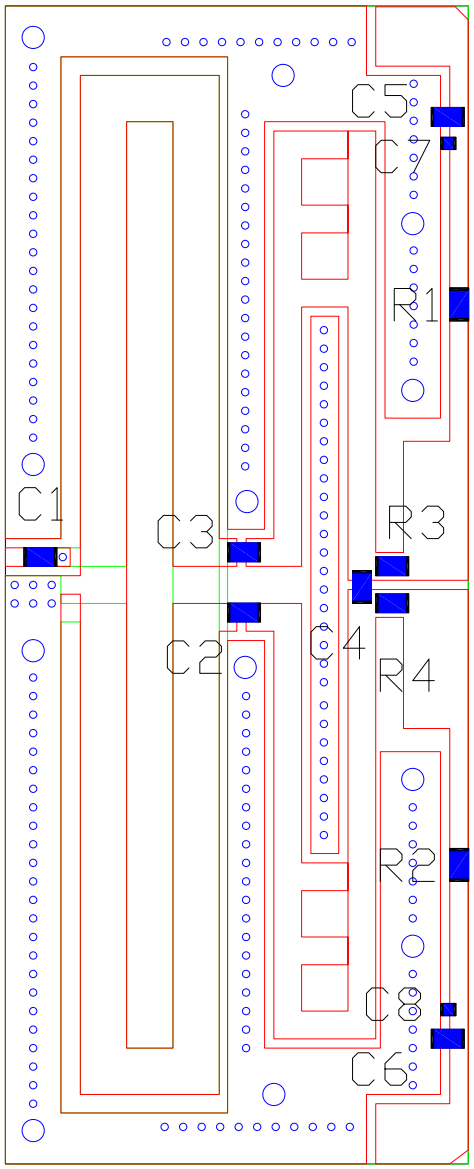
Figure 3 PCB Layout Drawing output

7.2 Component list OUTPUT

Table 2: Component list output

Output Board			
Component	Value	manufacturer	Remarks
C1, C2	47pF	ATC	800B
C3	82pF	ATC	800B
C4	220pF	PPI	Type 2225
C5, C6	47pF	ATC	800B
C7	82pF	ATC	800B
C8	220pF	PPI	2225
C9, C10, C13, C14	510p	ATC	100B
C11, C15	100nf	TDK	100Volts
C12, C16	4u7	TDK	100Volts
C17, C18	1000uF		100Volts Electrolitic
C19 - C20	680pF	PPI	Type 2225
C21 - C22	680pF	PPI	Type 2225
S1, S2	short		Copper foil
L1, L2	Air coil 6turns, 6mm diameter		Enamel 1.6 mm copper wire
L3	66nH	Coilcraft	1212VS-66NME
Board	Ro 4350 double sided	Rogers	Er=3.5 substrate=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

7.3 PCB INPUT



7.4 Component list INPUT

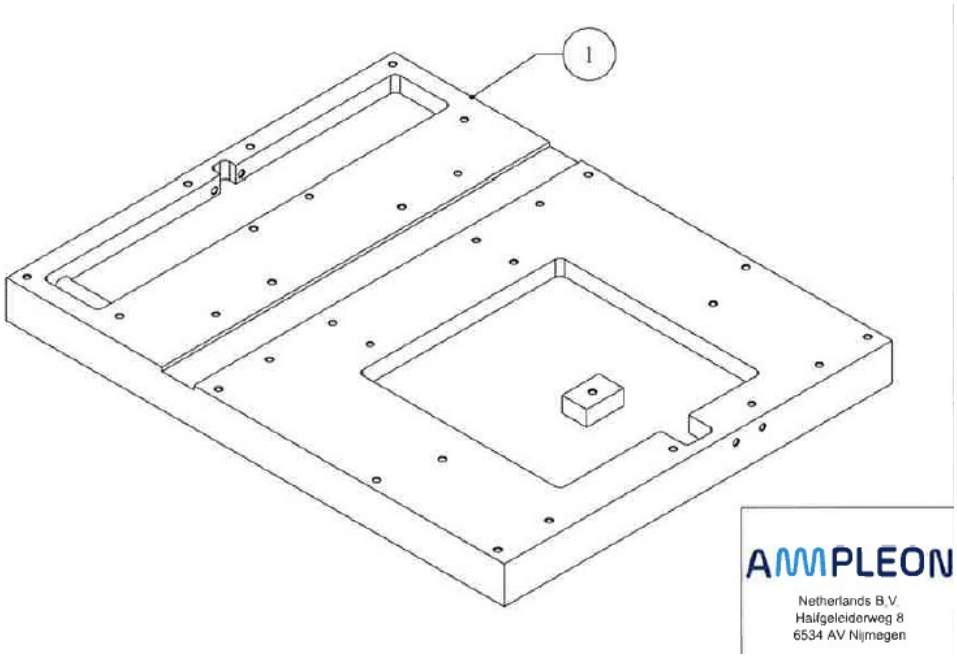
Input Board			
Component	Value	manufacturer	remarks
C1	560pF	ATC	100B
C2	470pF	ATC	100B
C3	470pF	ATC	100B
C4	100pF	ATC	100B
C5	100n	ATC	100B
C6	100n	ATC	100B
C7, C8	1n	ATC	100B
R1	22Ohm		0812
R2	22Ohm		0812
Board	Ro 4350	Rogers	Er=3.5

7.5 Baseplate

The demo amplifier pcb boards are mounted on a full copper base plate. The base plate contains a water channel to supply the amplifier with sufficient cooling.

The base plate contains two cavities for the coplanar baluns.The input balun cavity is air filled. The output balun cavity is filled with a thermal conductive material that has good electrical properties. The material is conducting the heat from the balun, generated as a result of RF losses, to the baseplate. The thermal conductive material is absolutely necessary to cool the coplanar output balun.

A drawing of the base plate is shown below.



7.6 Photo's Demo Board

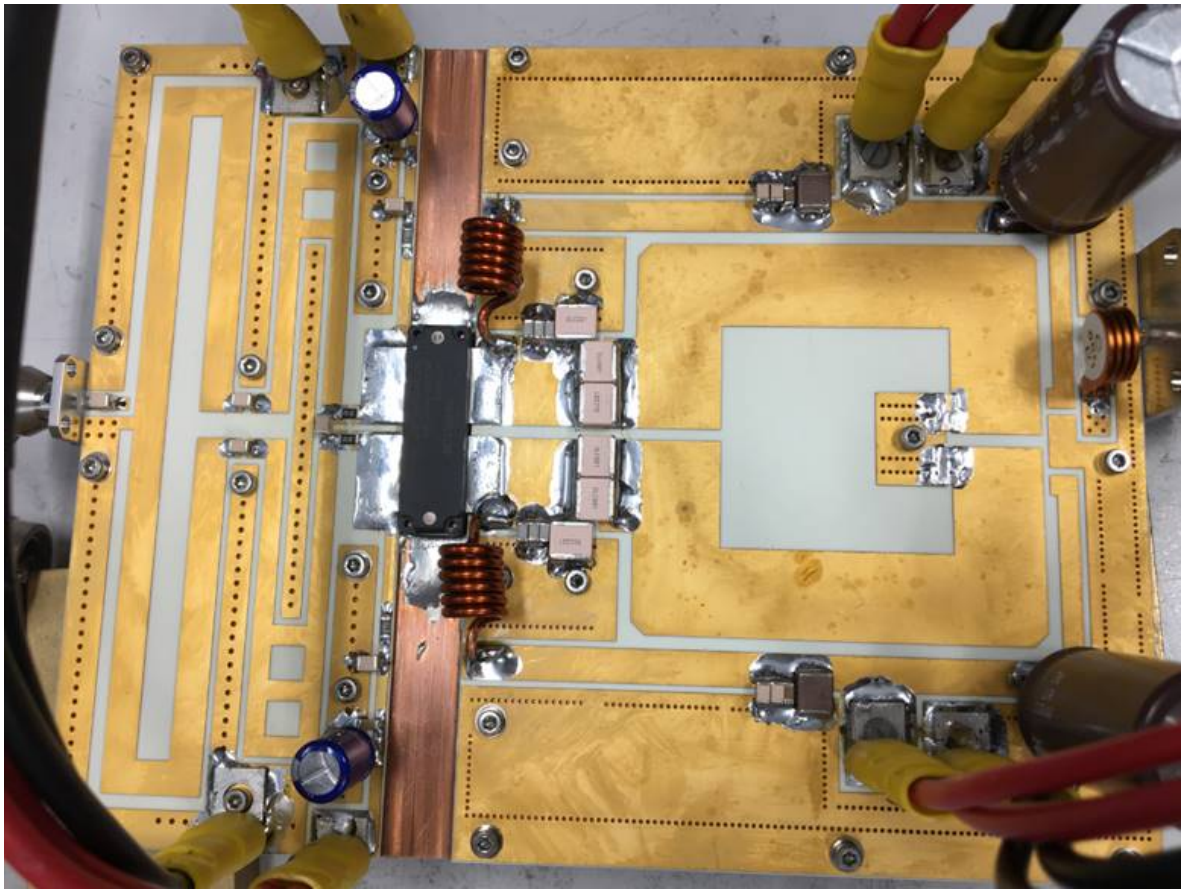


Figure 4 Picture Top View Demo Board

8. Legal information

8.1 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Ampleon does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

8.2 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Ampleon does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Ampleon takes no responsibility for the content in this document if provided by an information source outside of Ampleon.

In no event shall Ampleon be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Ampleon's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Ampleon.

Right to make changes — Ampleon reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — Ampleon products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Ampleon product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Ampleon and its suppliers accepts no liability for inclusion and/or use of Ampleon products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Ampleon makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Ampleon products, and Ampleon accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Ampleon product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Ampleon does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Ampleon products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Ampleon does not accept any liability in this respect.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

8.3 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Any reference or use of any 'NXP' trademark in this document or in or on the surface of Ampleon products does not result in any claim, liability or entitlement vis-à-vis the owner of this trademark. Ampleon is no longer part of the NXP group of companies and any reference to or use of the 'NXP' trademarks will be replaced by reference to or use of Ampleon's own trademarks.

8.4 Contact information

For more information, please visit: http://www.ampleon.com

For sales office addresses, please visit: http://www.ampleon.com/sales