AR201042

ART2K0PE, 88-108MHz

v1.0 — 7-April-2020

AMPLEON

Application Report

Document information	
Status	Company Public
Author(s)	Ampleon
Abstract	Measurement results of a Class AB design for the 88-108MHz band with the ART2K0PE

1. Revision History

Table 1: Report revisions

Revision	Date	Description	Author
1.0	20200407	Initial document	Ampleon

2. Contents

3. List of figures

4. List of tables

5. Introduction

5.1 General description

This report presents the measurement results of the Class AB amplifier demo AR201042. The device ART2K0PE used is a 2000 W advanced ruggedness LDMOS power transistor for industrial, scientific and medical applications in the HF to 400 MHz band, 9th generation LDMOS in a OMP-1230-4F-1 package. ART2K0PE is a symmetrical push-pull power transistor. The presented demo is tuned for the frequency band 88-108MHz.

5.2 Test object details

Transistor type:	ART2K0PE (Soldered down)
Production code :	
Package :	OMP-1230-4F-1
Board:	ART2K0_input_output
Demo number:	AR201042

5.3 Used Test signals

CW:	CW (Vds=60V, 61V and 62V)

5.4 Test circuit

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

Supply voltage (drain-source) is 60V. The Idq will be 100mA.

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6. Measurement Results

6.1 Summary CW Power Sweeps (Vds=60V, results @ 1600W)

Freq [MHz]	MaxGain [dB]	MaxEff [%]	G@MxEff [dB]	P1dB [dBm]*	P1dB [W]*	G@P1dB [dB]*	Eff@P1dB [%]*	P3dB [dBm]*	P3dB [W]*	G@P3dB [dB]*	Eff@P3dB [%]*
88.00	28.8	87.1	25.6	61.3	1358.24	27.8	79.9	62.1	1604.16	25.8	86.9
98.00	28.8	85.3	25.7	61.5	1421.65	27.8	77.8	62.4	1731.00	25.8	85.1
108.00	28.4	83.9	25.3	61.5	1402.36	27.4	76.7	62.1	1616.06	25.4	83.8

Freq [MHz]	Gain [dB] @1600W	Eff [%] @1600W	Compr [dB] @1600W	IRL [dB] @1600W	S11 [dB] @1600W	H2 [dBc] @1600W	H3 [dBc] @1600W
88.00	25.9	86.8	-2.92	12.5	-12.5	-25.7	-24.1
98.00	27.0	82.1	-1.80	18.1	-18.1	-25.0	-26.9
108.00	25.7	83.2	-2.66	17.1	-17.1	-30.0	-28.5

6.2 Gain & Efficiency @ Frequency=88-98-108MHz CW

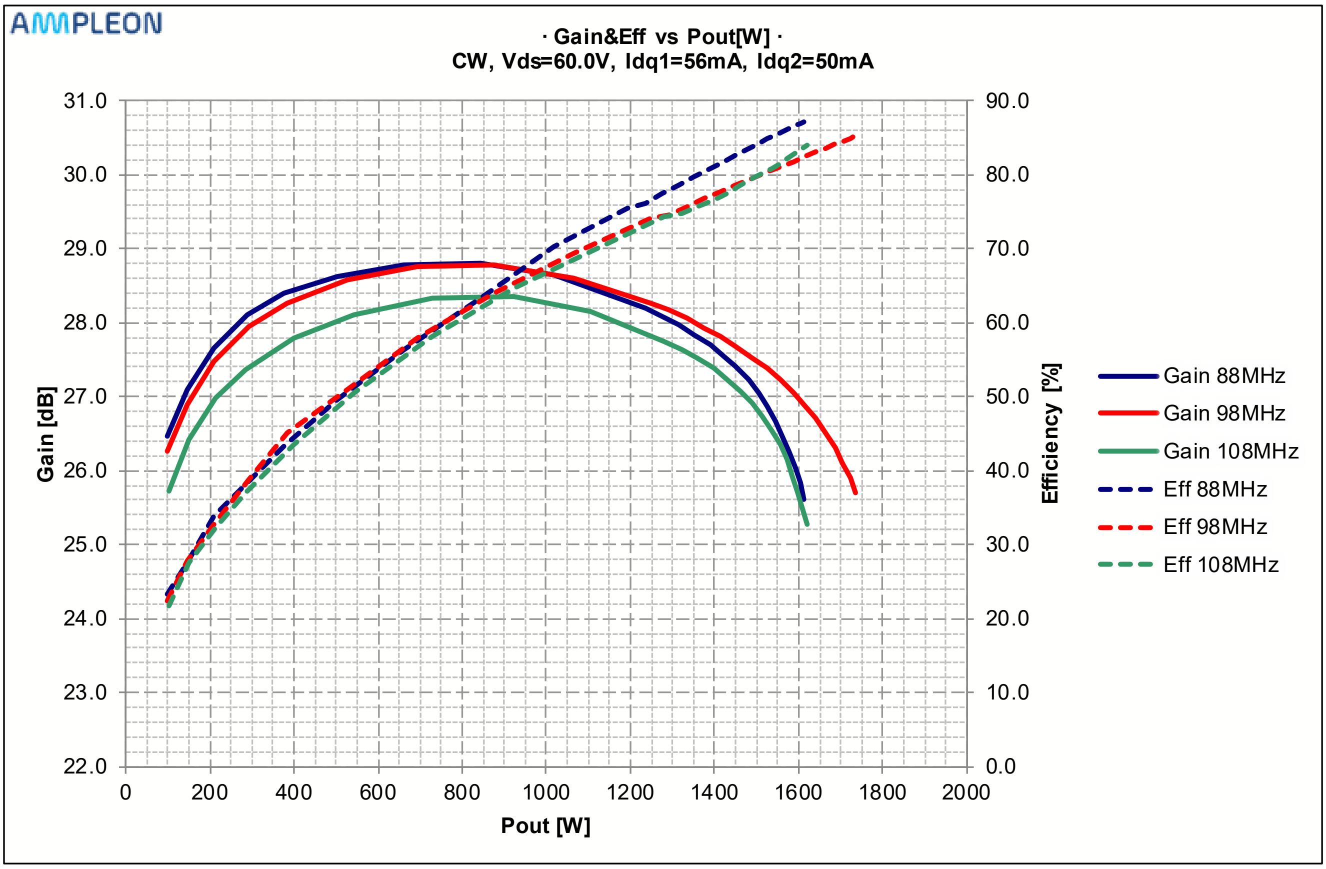


Figure 1 CW (Vds=60V) Gain and Efficiency vs Pout [W]

6.3 Summary CW Power Sweeps (Vds=61V, results @ 1650W)

Freq [MHz]	MaxGain [dB]	MaxEff [%]	G@MxEff [dB]	P1dB [dBm]*	P1dB [W]*	G@P1dB [dB]*	Eff@P1dB [%]*	P3dB [dBm]*	P3dB [W]*	G@P3dB [dB]*	Eff@P3dB [%]*
88.00	28.8	87.1	25.6	61.3	1358.24	27.8	79.9	62.1	1604.16	25.8	86.9
98.00	28.8	85.3	25.7	61.5	1421.65	27.8	77.8	62.4	1731.00	25.8	85.1
108.00	28.4	83.9	25.3	61.5	1402.36	27.4	76.7	62.1	1616.06	25.4	83.8

Freq [MHz]	Gain [dB] @1650W	Eff [%] @1650W	Compr [dB] @1650W	IRL [dB] @1650W	S11 [dB] @1650W	H2 [dBc] @1650W	H3 [dBc] @1650W
88.00	25.9	86.8	-2.92	12.5	-12.5	-25.7	-24.1
98.00	27.0	82.1	-1.80	18.1	-18.1	-25.0	-26.9
108.00	25.7	83.2	-2.66	17.1	-17.1	-30.0	-28.5

6.4 Gain & Efficiency @ Frequency=88-98-108MHz CW

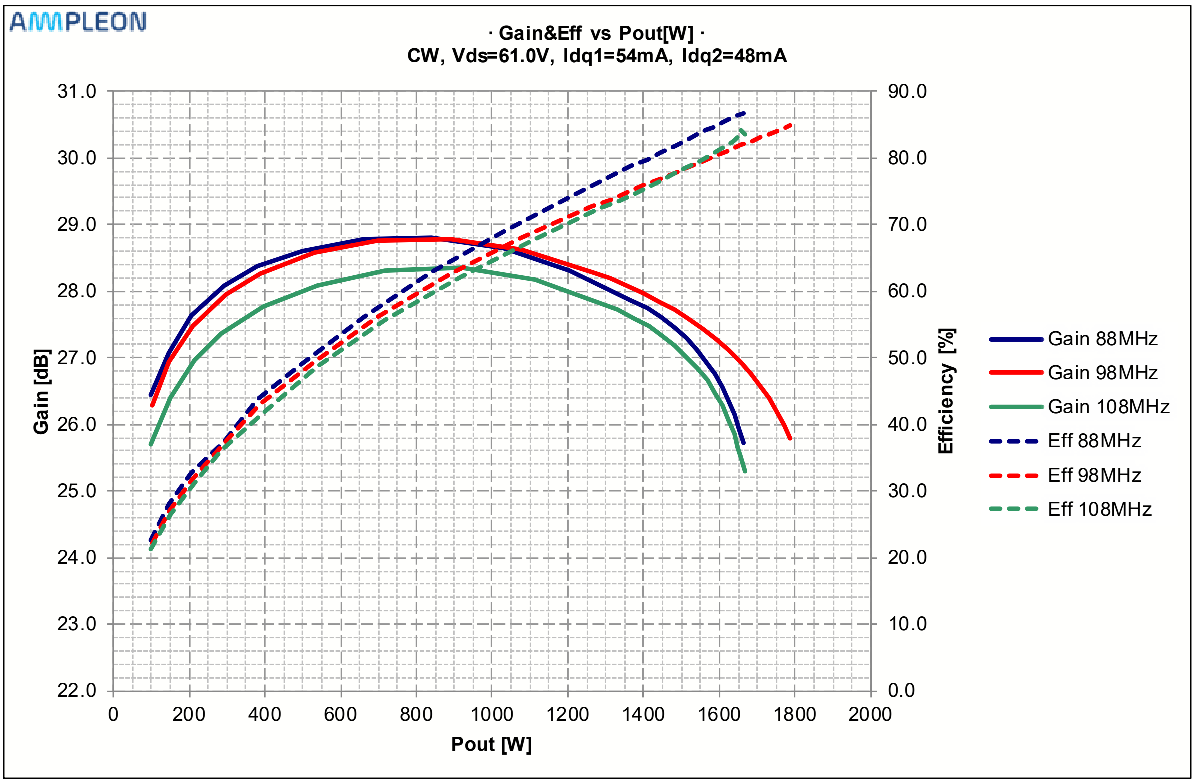


Figure 2 CW (Vds=61V) Gain and Efficiency vs Pout [W]

6.5 Summary CW Power Sweeps (Vds=62V, results @ 1700W)

Freq [MHz]	MaxGain [dB]	MaxEff [%]	G@MxEff [dB]	P1dB [dBm]*	P1dB [W]*	G@P1dB [dB]*	Eff@P1dB [%]*	P3dB [dBm]*	P3dB [W]*	G@P3dB [dB]*	Eff@P3dB [%]*
88.00	28.8	86.9	25.6	61.6	1430.33	27.8	78.8	62.3	1717.71	25.8	86.5
98.00	28.8	85.3	26.0	61.7	1490.75	27.8	76.7	62.7	1844.22	25.8	84.7
108.00	28.4	83.8	25.7	61.7	1477.46	27.4	76.0	62.3	1715.63	25.4	83.3

Freq [MHz]	Gain [dB] @1700W	Eff [%] @1700W	Compr [dB] @1700W	IRL [dB] @1700W	S11 [dB] @1700W	H2 [dBc] @1700W	H3 [dBc] @1700W
88.00	26.1	86.1	-2.72	12.4	-12.4	-24.6	-23.6
98.00	27.0	81.5	-1.82	18.1	-18.1	-24.5	-26.4
108.00	25.7	83.3	-2.68	17.1	-17.1	-29.4	-27.9

6.6 Gain & Efficiency @ Frequency=88-98-108MHz CW

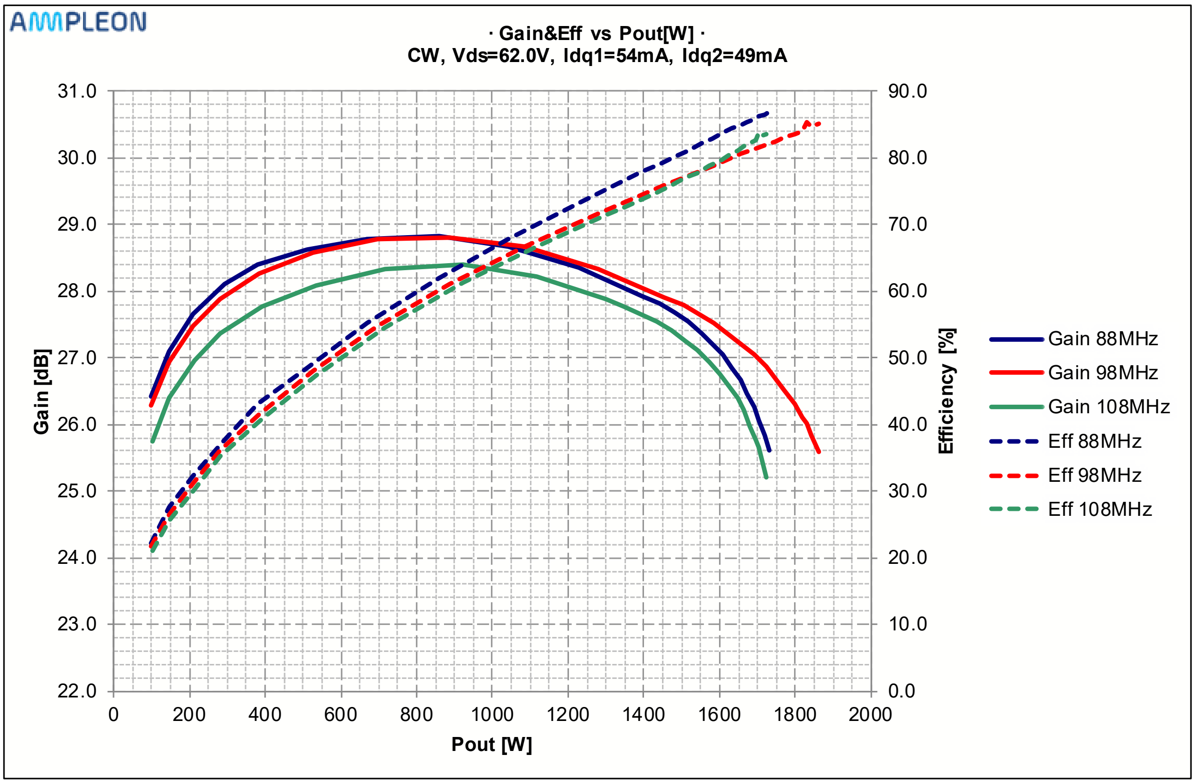


Figure 3 CW (Vds=62V) Gain and Efficiency vs Pout [W]

6.7 PCB Layout Drawing top and bottom

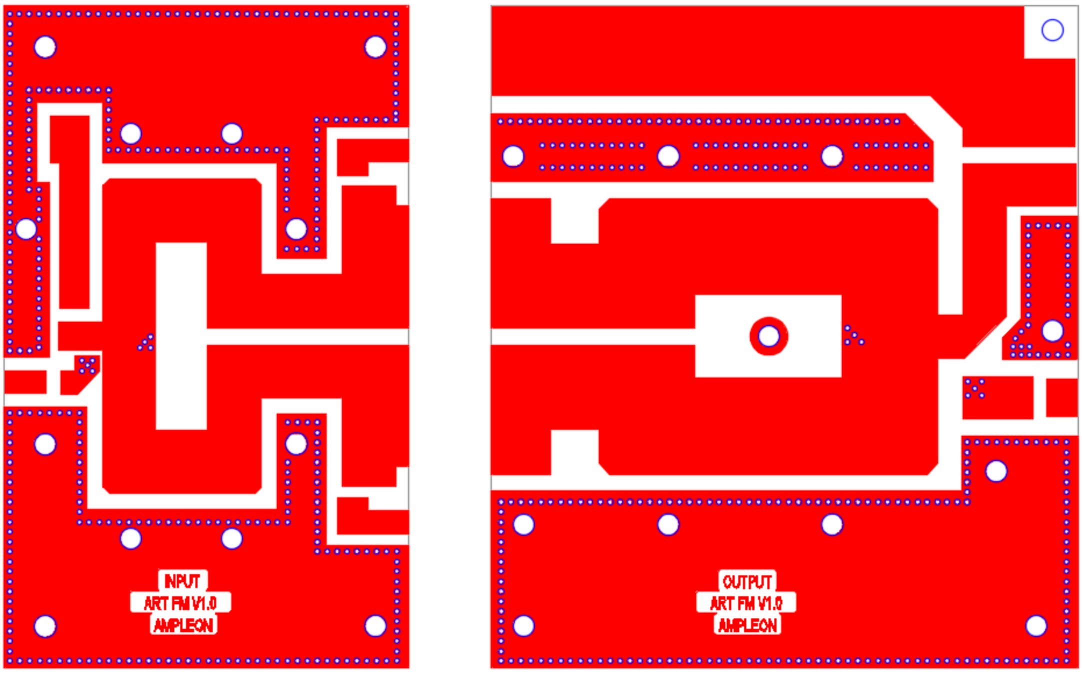


Figure 4 PCB layout top layer

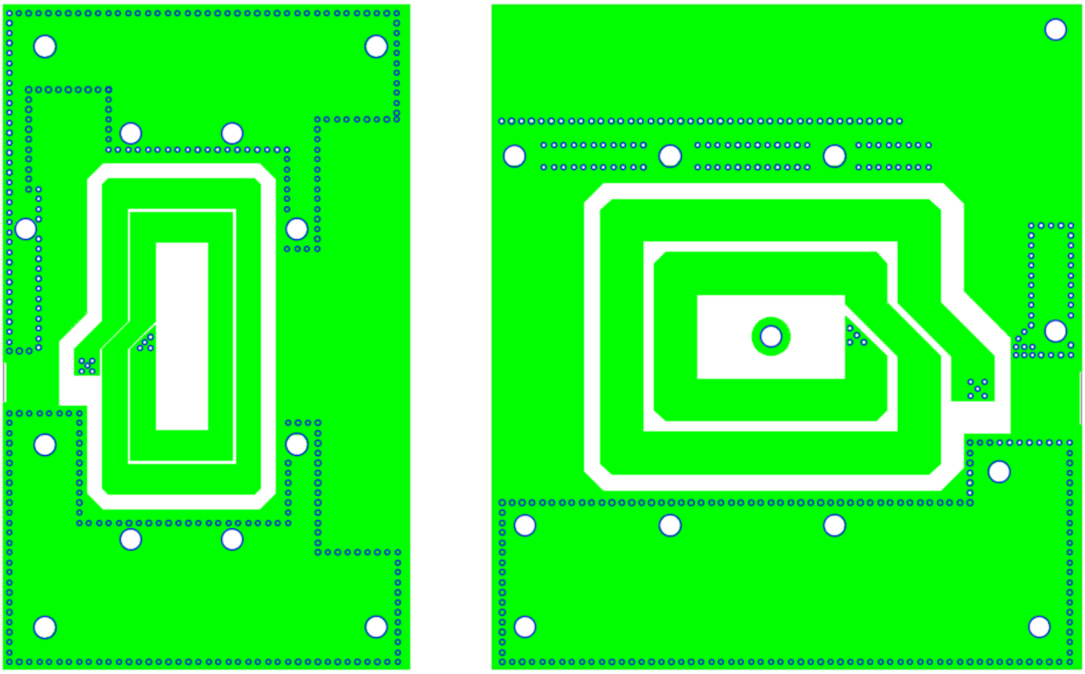


Figure 5 PCB layout bottom layer

6.8 PCB Layout Drawing + Components

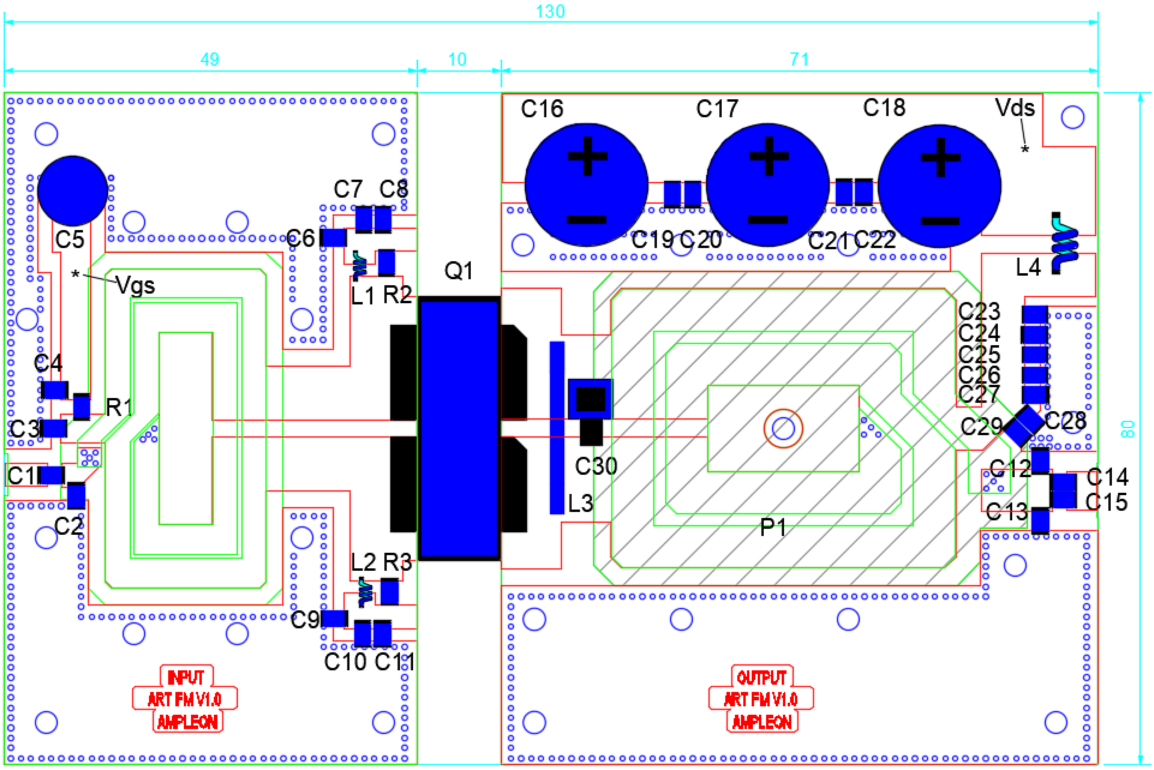
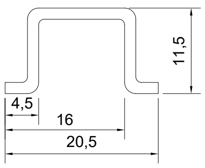


Figure 6 PCB Layout Drawing

6.9 L3 dimensions



silver plated copper wire
diameter = 1.5mm

Figure 7 L3 Dimensions .

6.10 Component list

Table 2: Component list

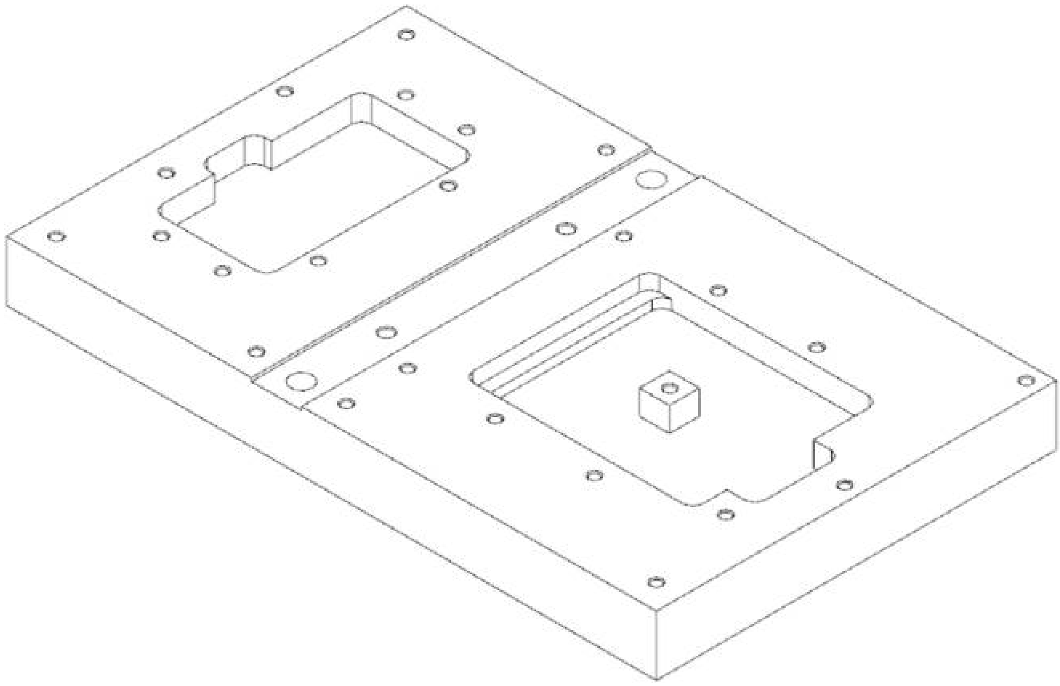
Designator	Description	Manufacturer	Part #
C1, C3, C7, C10	1nF	ATC	100B102JW50X
C2	18pF	ATC	100B180JW500X
C4, C6, C9	10nF	AVX	12101C1033KAT2A
C5	22uF electrolytic capacitor	NICHICON	UUD1V220MCL1GS
C8, C11, C14, C15, C28, C29	470pF	ATC	100B471JW200X
C12, C13	13pF	ATC	100B130GW500X
C16, C17, C18	1000uF electrolytic capacitor	PHILIPS	
C19, C20, C21, C22, C23, C24, C25, C26, C27	560pF	ATC	100B561JW100X
C30	82pF	CDE	MIN02-002EC 82J-F
R1	10 Ohm, 1/4W	TE CONN	CRGH1206J10R
R2, R3	33 Ohm, 2W	TE CONN	CRGP2512F33R
L1, L2	17.5nH	COILCRAFT	B06TGLC
L3	Figure 8, silver plated wire		1.5mm, L=43mm
L4	22nH	COILCRAFT	1212VS-22NM EB
Q1	ART2K0PE	AMPLEON	
Base plate	Copper with water cooling channel		Cavity for coplanar baluns are 5mm deep
P1	Thermal conductor under the output balun in the cavity of the base plate	Mueller Ahlhorn	Thermipad TP22626 Er=6.7
PCB Material: Arlon TC350, thickness 0.762 mm (30 mil), Er = 3.5, Cu = 2x70 micron			

7. 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 enough 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 necessary to cool the coplanar output balun.

A drawing of the base plate is shown below.



8. Photo's Demo Board

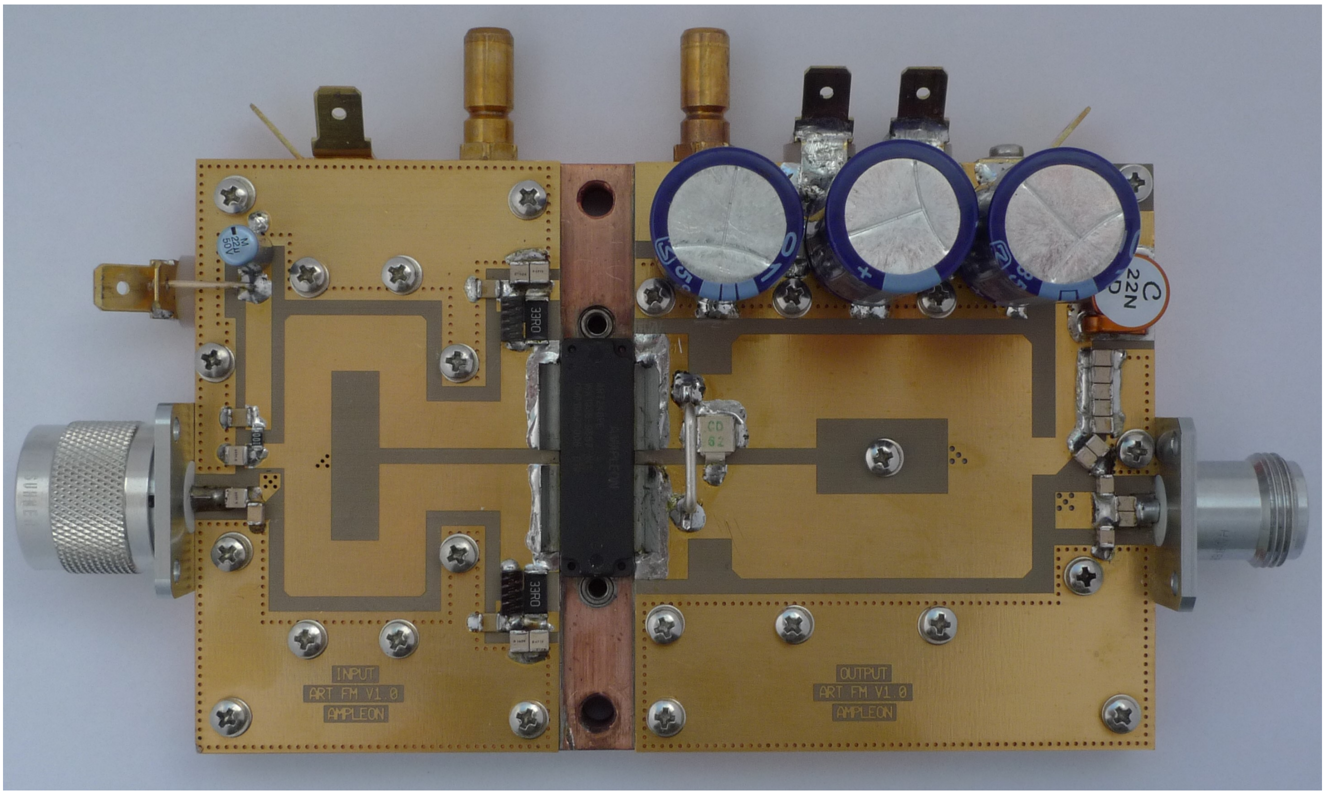


Figure 8 Picture Top View Demo Board

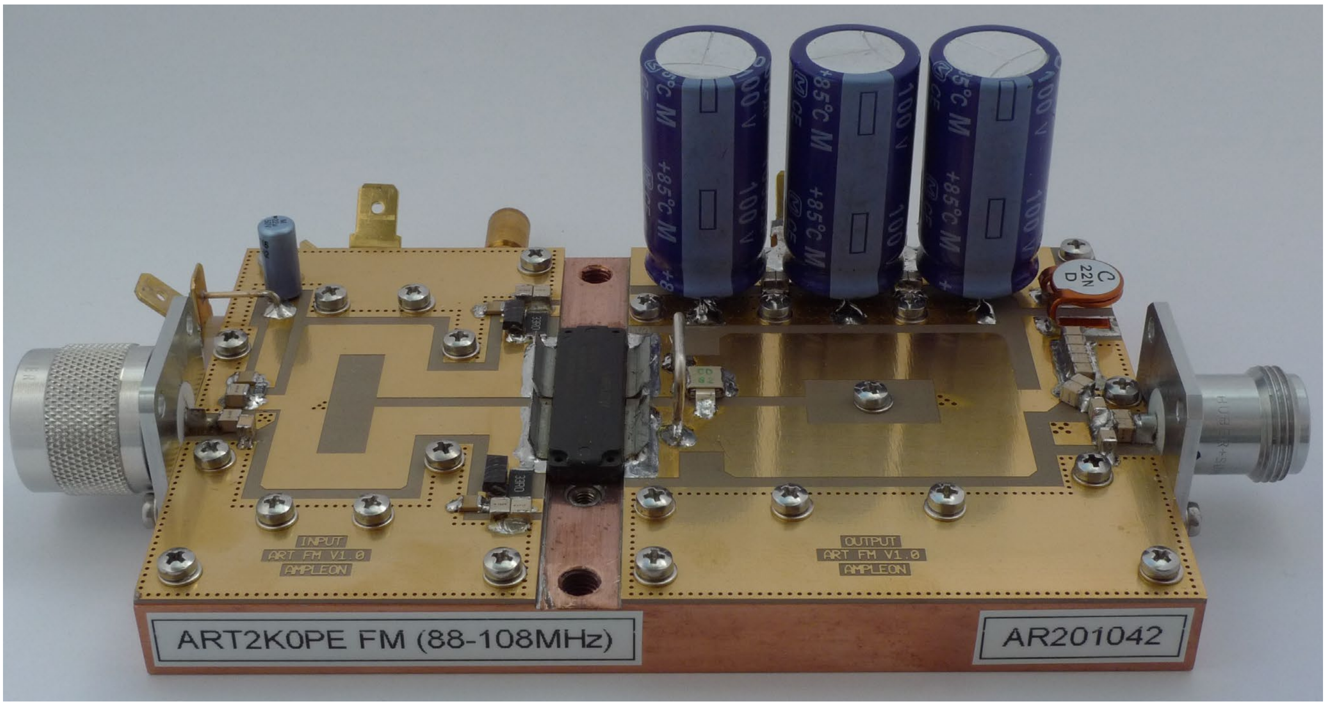


Figure 9 Picture Side View Demo Board

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