AR201250

BLF974P, 30-512MHz

V1.0 — 2020 Nov 11

AMPLEON

Application Report

Document information	
Status	Public
Author(s)	Tom Brinkman
Abstract	Measurement results of a Class AB design for the 30-512MHz band with the BLF974P

1. Revision History

Table 1: Report revisions

Revision	Date	Description	Author
1.0	20201111	Initial document	Tom Brinkman

2. Contents

3. List of figures

4. List of tables

5. General description

This report presents the measurement results of the Class AB demo AR201250. The device used is a 500W, 9th generation LDMOS, the BLF974P. The presented demo is tuned for the frequency 30-512MHz. With good cooling of the transistor, it can easily produce a lot of output power, which can be too much for the circuit. Depending on the operating frequency, circuit components can get very hot. Be careful not to overheat the ferrite material (>100°C), because its properties will be permanently degraded.

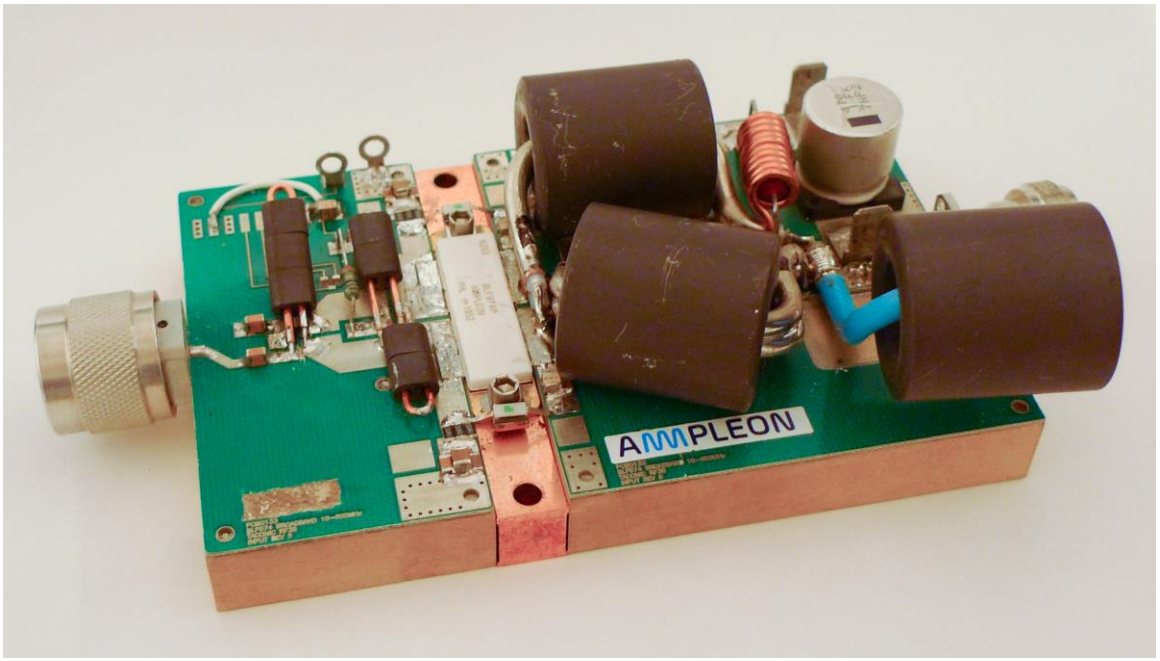

Figure 1 Demo Front view

6. Biasing

The efficiencies presented are based on the currents of the drain feeds only.
I.e. the biasing currents for the gate circuitry has not been included.

Unless otherwise stated, the biasing is as follows:

V_{DD} = 50V

I_{DQ} = 1000mA

7. Performance Indication 30-512MHz

Table 2: Performance indication, sampled at 30-512MHz

Parameter	Condition	Unit	CW
V_{DD}		V	50
S11 at connector		dB	<-2.4
P_{1dB}[1]	G_{MAX}-1dB	W	295
P_{3dB}[1]	G_{MAX}-3dB	W	430
P_{OUT} of operation	***P_o***[2]	W	***400***
Gain	**@P_o**	dB	>18
Drain Efficiency	**@P_o**	%	>55
Drain Efficiency	**@ 3dB comp.**	dB	>59

[1] *Pout at 1 and 3dB gain compression relative to the maximum gain in the power sweep*

[2] *Demonstrator is expected to operate at the P_o average power level*

8. Performance Details

8.1 Pulsed-CW signal power sweeps 30-512MHz / 60% duty cycle

8.1.1 Gain and efficiency (3dB sweep)

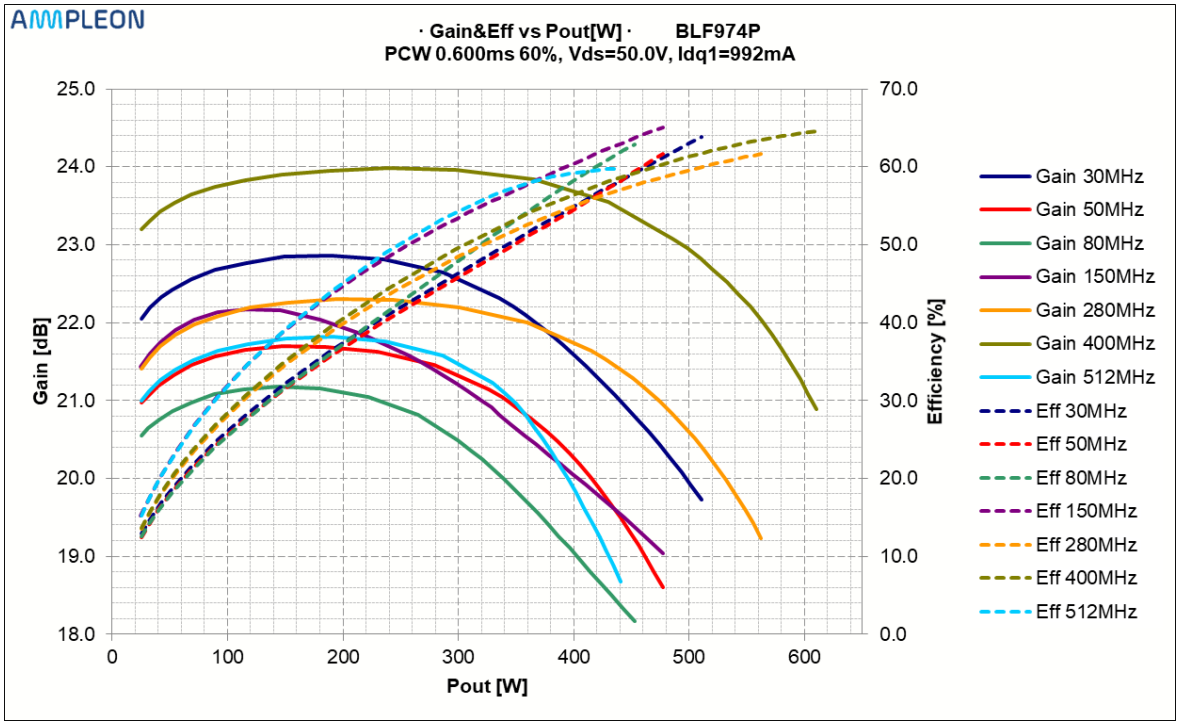

Figure 2 BLF974P_PS_CW_Pulsed_201110_1703 Gain&Eff vs Pout[W]

8.2 CW signal Power sweeps 30-512MHz

Table 3: CW Performance

Freq [MHz]	MaxGain [dB]	P1dB [W]*	P2dB [W]*	Eff@P2dB [%]*
30.00	22.7	363.26	435.67	59.1
50.00	21.6	352.79	417.70	57.8
80.00	21.1	313.59	381.99	58.2
150.00	22.2	295.66	381.21	60.6
280.00	22.2	434.46	500.98	61.0
400.00	23.9	481.74	549.43	64.2
512.00	21.8	352.91	395.85	60.4
482.0	2.786	186.079	168.220	6.346

Table 4: CW Performance at Pout = 400Watts

Freq [MHz]	Gain [dB]@	Eff [%]@	Compr [dB]@	IRL [dB]@
30.00	21.2	56.2	-1.47	17.0
50.00	19.9	56.2	-1.68	16.7
80.00	18.8	59.9	-2.30	11.9
150.00	19.9	61.8	-2.23	8.0
280.00	21.6	56.5	-0.66	6.4
400.00	23.6	57.7	-0.36	16.8
512.00	19.6	60.5	-2.11	2.4
482.0	4.726	5.582	1.940	14.593

8.2.1 Gain and efficiency (2.5dB sweep)

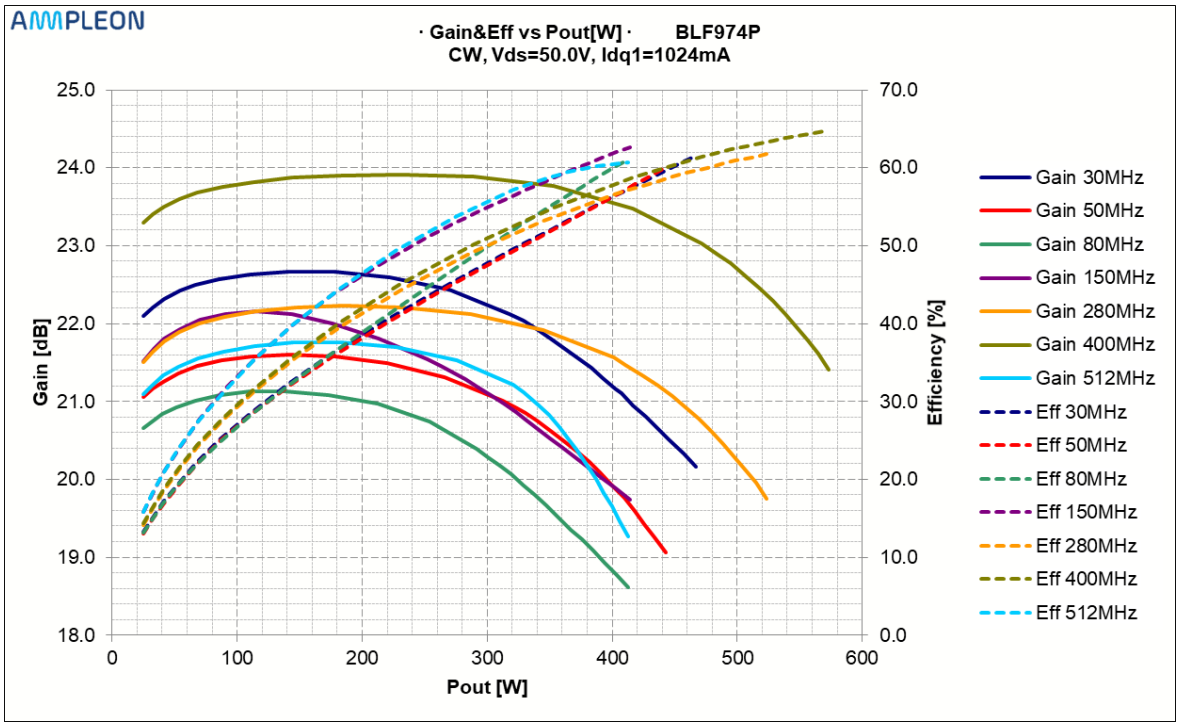

Figure 3 BLF974P_PS_CW_201110_1715 Gain&Eff vs Pout[W]

8.3 CW Signal performance over 30-512 MHz

8.3.1 2dB compressed power

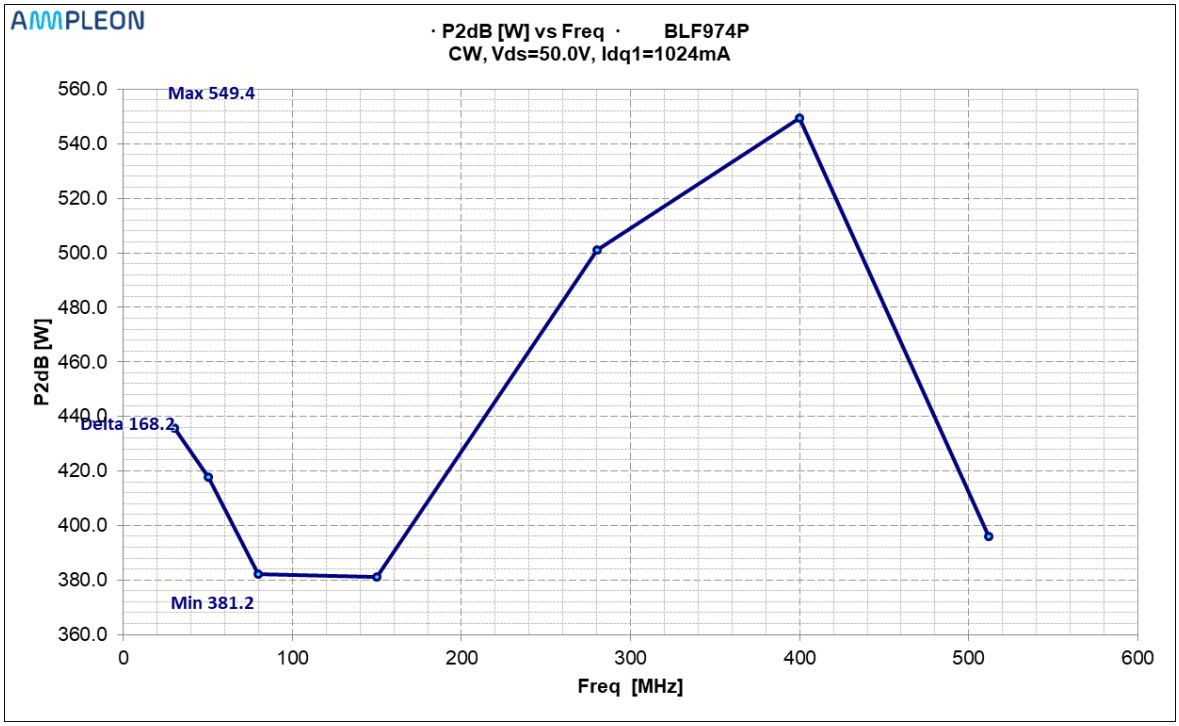

Figure 4 BLF974P_PS_CW_201110_1715 P2dB[W] vs Freq

8.3.2 Gain

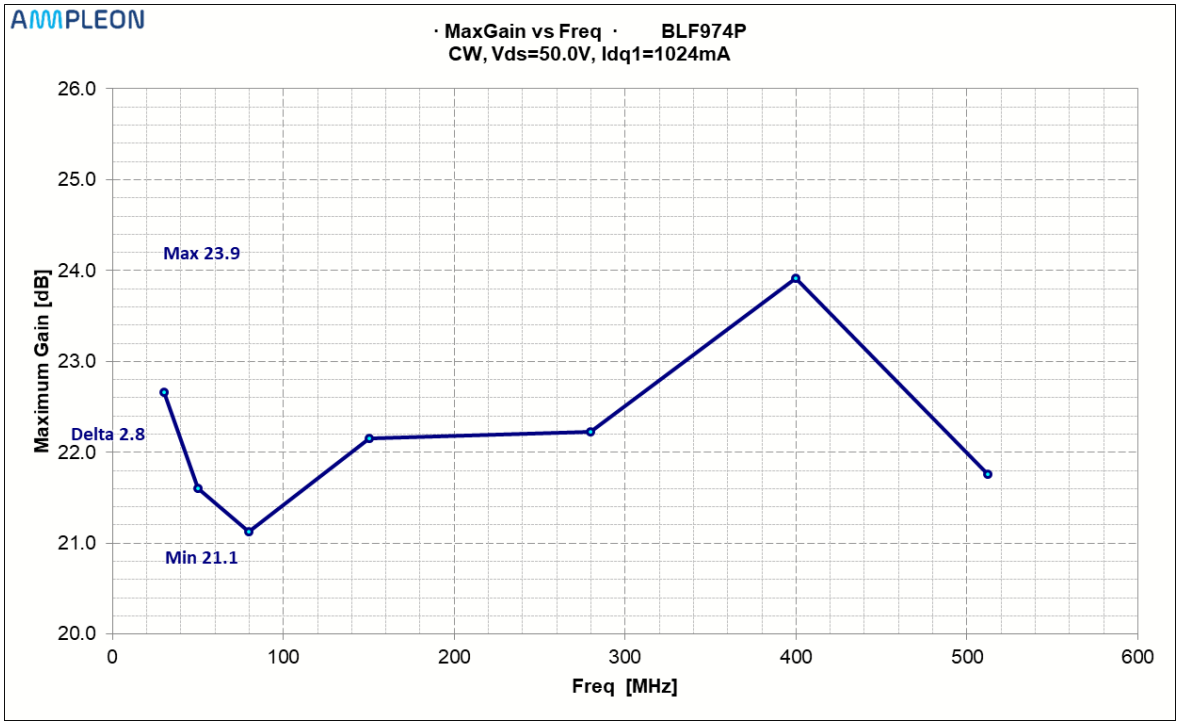

Figure 5 BLF974P_PS_CW_201110_1715 MaxGain vs Freq

8.3.3 Efficiency

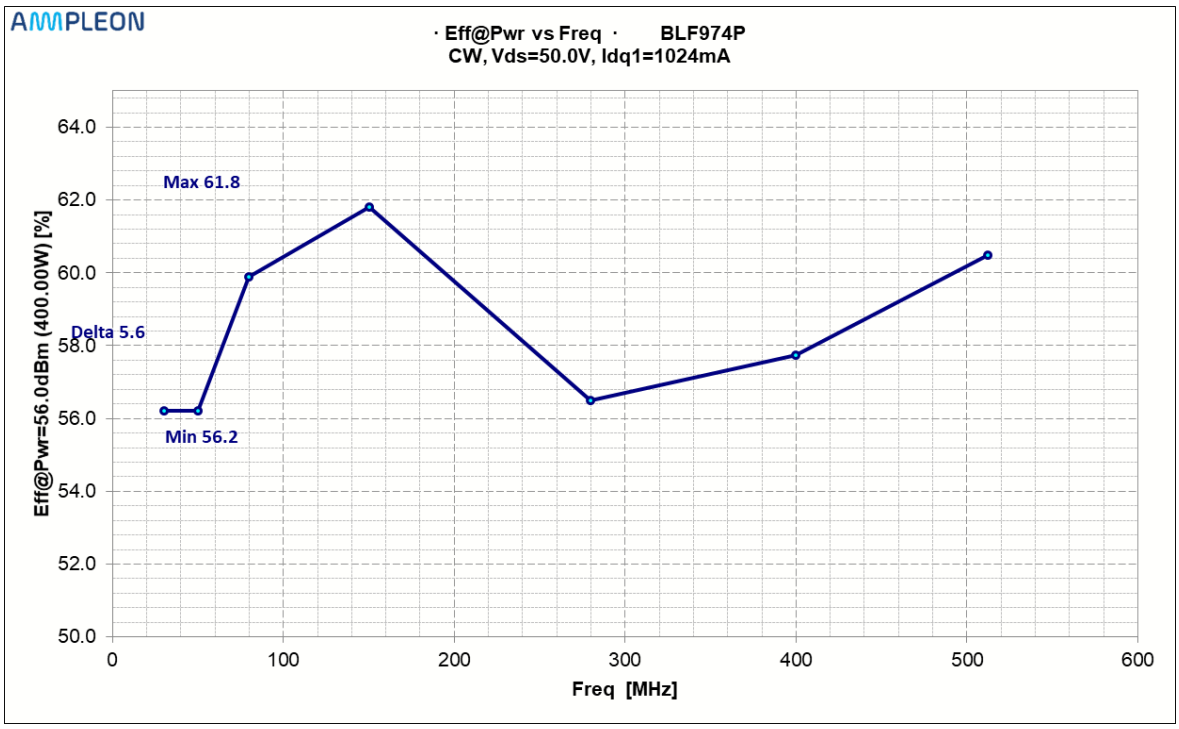

Figure 6 BLF974P_PS_CW_201110_1715 Eff (400W) vs Freq

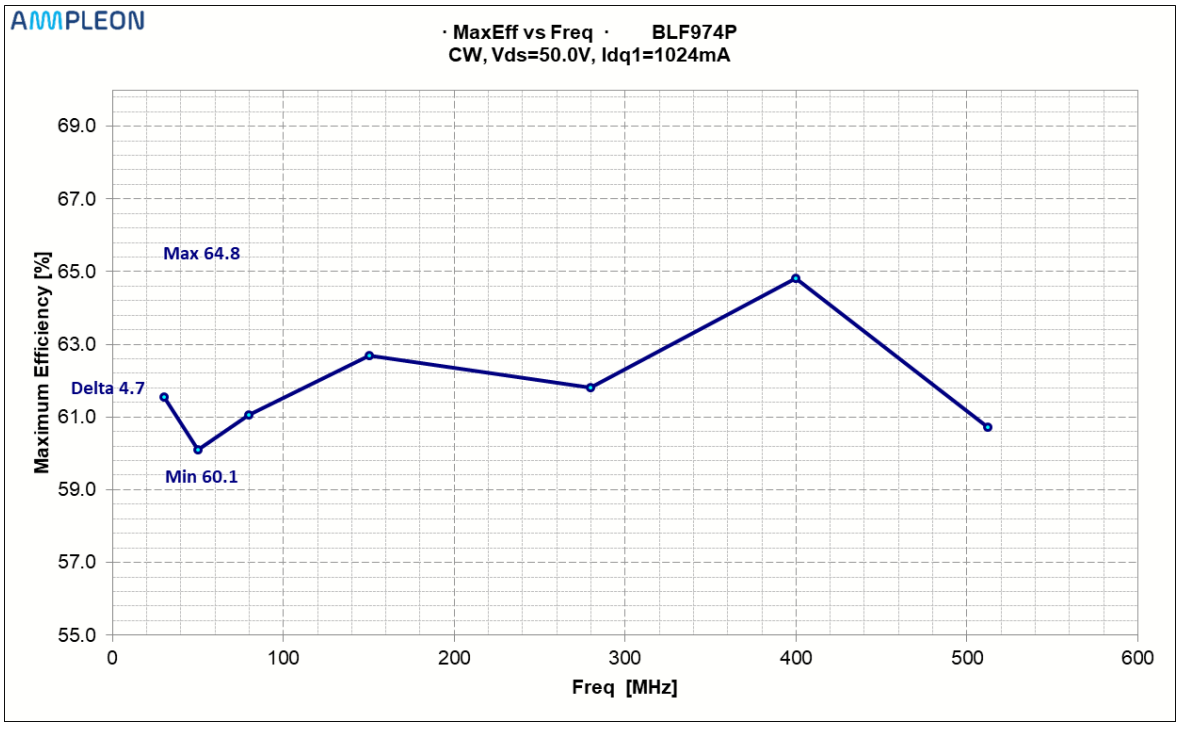

Figure 7 BLF974P_PS_CW_201110_1715 Eff (P2.5dB) vs Freq

8.3.4 Return loss

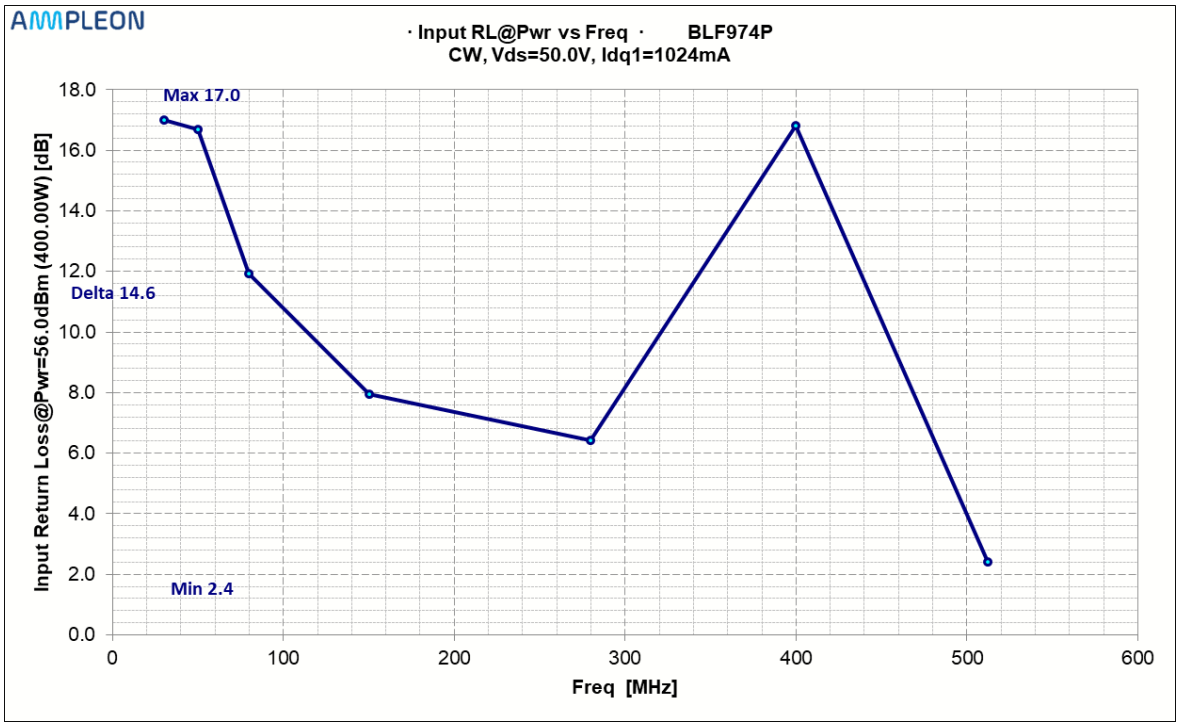

Figure 8 BLF974P_PS_CW_201110_1715 IRL vs Pout

9. Hardware

9.1 Board Image

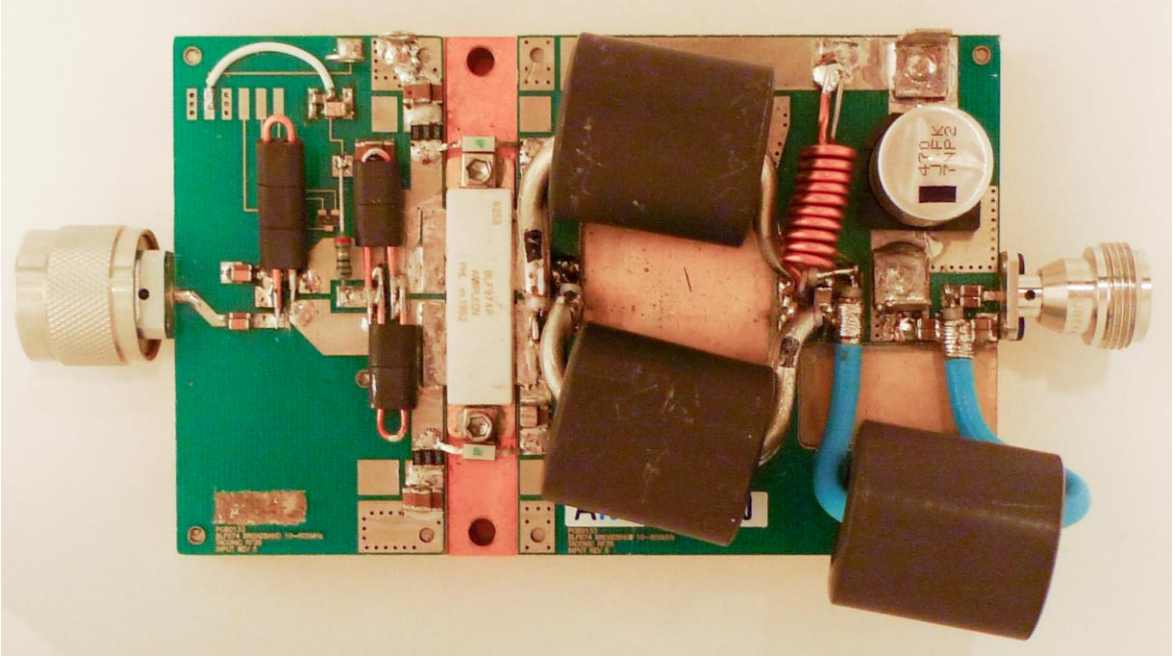

Figure 9 Demo AR201250 Top view

9.2 Board layout

9.2.1 Input & Output

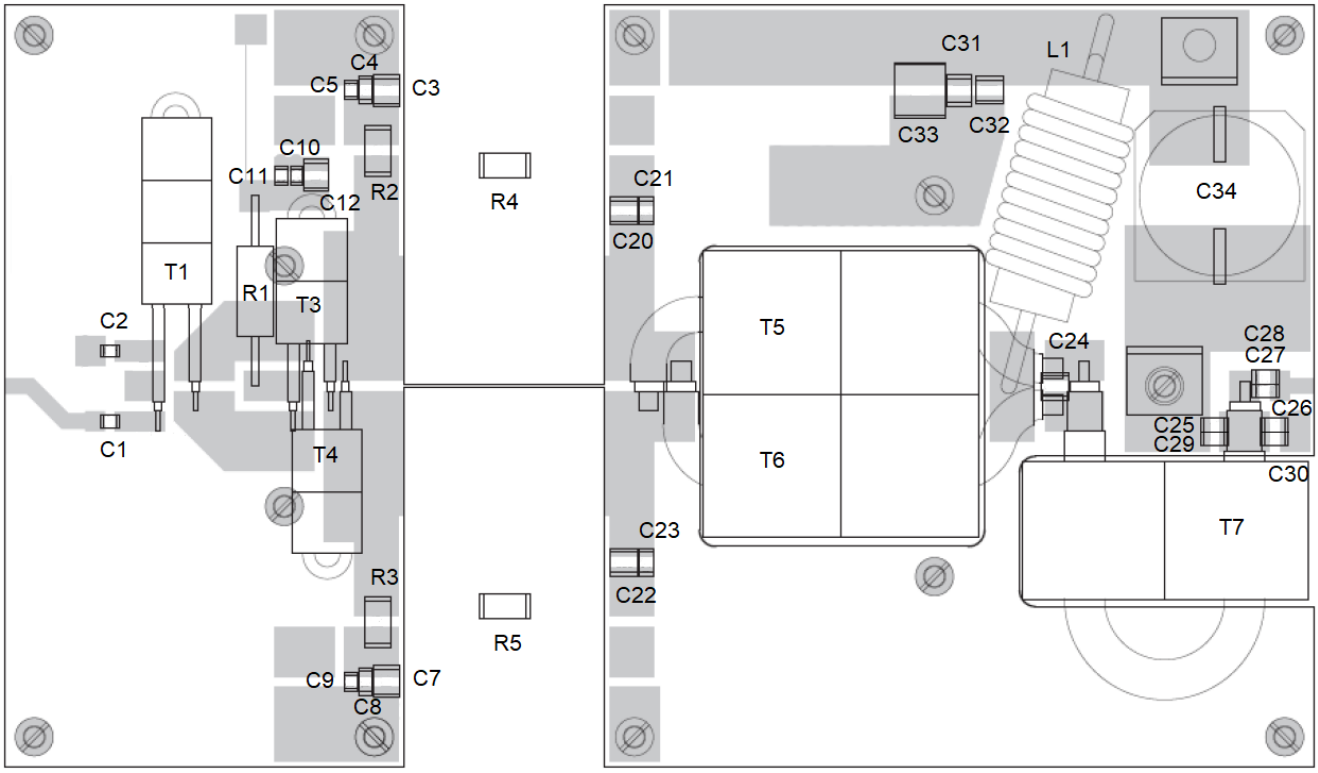

Figure 10 Demo Layout

9.3 Bill of materials

9.3.1 Input & Output

Table 5: Bill of Materials input and output board

Description	Identifier	Value	Manufacturer	Specification
Capacitor	C1, C2	4n7 /50V // 910 pF	Philips // ATC	1206 NP0 // ATC800B
Capacitor	C3, C7, C12, C21, C23, C31	4n7	Philips	1206 50V NP0
Capacitor	C4, C8, C10, C33	10 uF / 100V	MURATA	GRM32EC72A106KE05L
Capacitor	C5, C9, C11, C32	100 nF / 100V	MURATA	GRM188R72A104KA35D
Capacitor	C20, C22	180 pF	ATC	ATC100B
Capacitor	C24	1.2 pF	ATC	ATC800B
Capacitor	C25, C26, C27	270 pF	ATC	ATC800B
Capacitor	C28, C29, C30	560 pF	ATC	ATC800B
Capacitor	C34	470 uF / 63V		
Inductor	L1	10 windings on R6	wire wound	Wire Diameter = 1mm
Resistor	R1	11 Ohm		0.6 Watt
Resistor	R2, R3	10 Ohm		3x30Ohm parallel 1206
Resistor	R4, R5	200 Ohm	ATC	20 Watt; FR10300N0200J
Resistor	R6	10 Ohm		5 Watt
Transformer	T1	4:1		55mm UT047-25 25 Ohm coax + 2x Fair-Rite 2861002402 core
Transformer	T3, T4	4:1		45mm UT-43-10 10 Ohm coax + 2x Fair-Rite 2861002402 core
Transformer	T5, T6	4:1		2x parallel soldered together 74mm 35 Ohm coax + 1x Fair-Rite 2661102002 core
Transformer	T7	balun		85mm 50 Ohm coax + 1x Fair-Rite 2661102002 core

9.4 Board material

Table 6: Board specifications

Parameter	Value
Manufacturer	Taconic
Type	RF35
Thickness	30mil, 0.762mm>
Layers	Top layer: “cond” ; bottom layer: “cond2”
Layer thickness	35um

9.5 Device markings

Table 7: Device specifics

Parameter	Value
Manufacturer	Ampleon
Device	BLF974P
Marking	BLF974P – m1952
Comments	Engineering sample

10. Legal information

10.1 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.

10.2 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.

10.3 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.

10.4 Contact information

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

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