Document information

Info	Content
Status	General Publication
Author(s)	Tyler Ware
Abstract	Initial measurement results of the BLF978P LDMOS Device in Board #AR202059 tuned for 500MHz at 45V

1 Revision History

Table 1. Report revisions

Revision No.	Date	Description	Author
1.0	20180608	Initial document	Tyler Ware
2.0	20220426	Updated Security Status	Tyler Ware

2 Contents

3 List of Figures

4 List of Tables

5 General Description

This report presents the measurement results Demo Board AR202059 using the BLF978P. The demo achieves ≥ 60dBm with a pulsed signal at 500MHz. Thermal scans at 25% and 50% Duty Cycle have been provided to extrapolate possible temperatures under CW conditions.

6 Biasing

6.1 Bias Details

VDD =45V
IDQ =50mA (25mA each side)

7 Test Bench Set Up

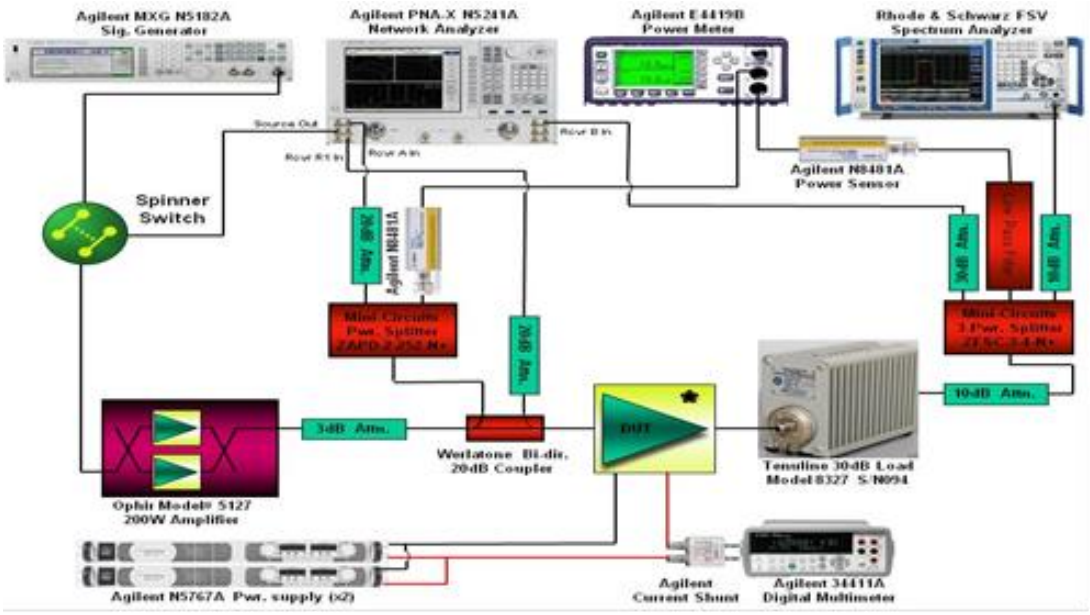


Figure 1.Test Bench Equipment set up

Demo placed on a liquid cold plate for testing

8 Performance Summary

Table 2. RF Performance, Frequency = 500MHz, Signal: Pulse CW

Parameter	Measurement	Unit
Specified frequency	500	MHz
Drain voltage	45	V
Quiescent drain current	50	mA
Pulse P3dB	1273	W
Pulse Efficiency at P3dB	63.69	%
Pulse Gain at P3dB	15.75	dB

The BLF978Pis A 1200 W LDMOS power transistor for broadcast applications and industrial applications in the HF to 700 MHz band

AR202059_BLF978P_45_500MHz Pulse 10%100uS DriveUpData				
Freq(MHz)	P1.0dB	Pout(W)	P1dB Gain (dB)	P1dB Eff(%)
490	60.09	1020.94	16.83	57.01
500	60.05	1011.58	17.74	60.01
510	60.00	1000.00	18.57	62.07
	P2.0dB	Pout(W)	P2dB Gain(dB)	P2dB Eff(%)
490	60.62	1153.45	15.82	59.03
500	60.64	1158.78	16.73	62.14
510	60.68	1169.50	17.57	65.02
	P3.0dB	Pout(W)	P3dB Gain(dB)	P3dB Eff(%)
490	61.01	1261.83	14.82	60.25
500	61.05	1273.50	15.75	63.69
510	61.08	1282.33	16.56	66.44

9 Performance Details

9.1 Small Signal Results

Vdd=45V, Idq=300mA, Pin=20dBm

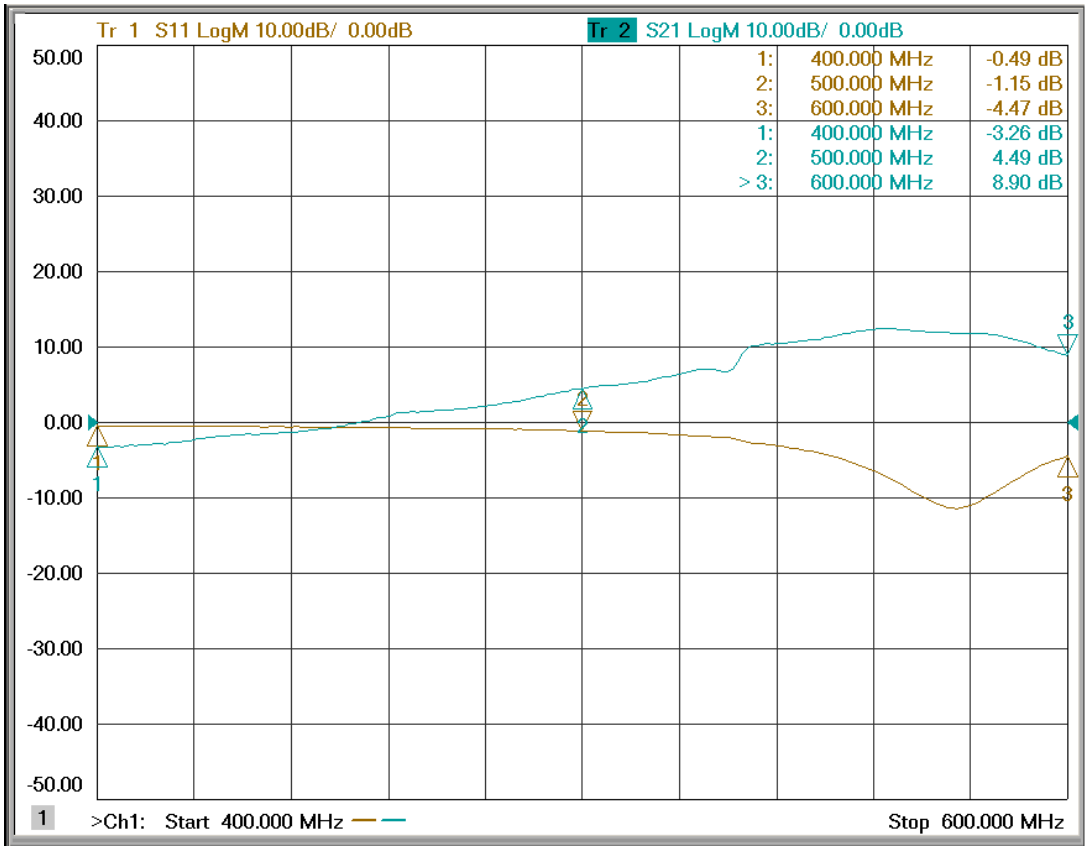


Figure 2. Small Signal Results

9.2 Pulse Gain

Vdd = 45V, Idq=50mA, 100uS Pulse Width 10% Duty, Frequency=490-510MHz

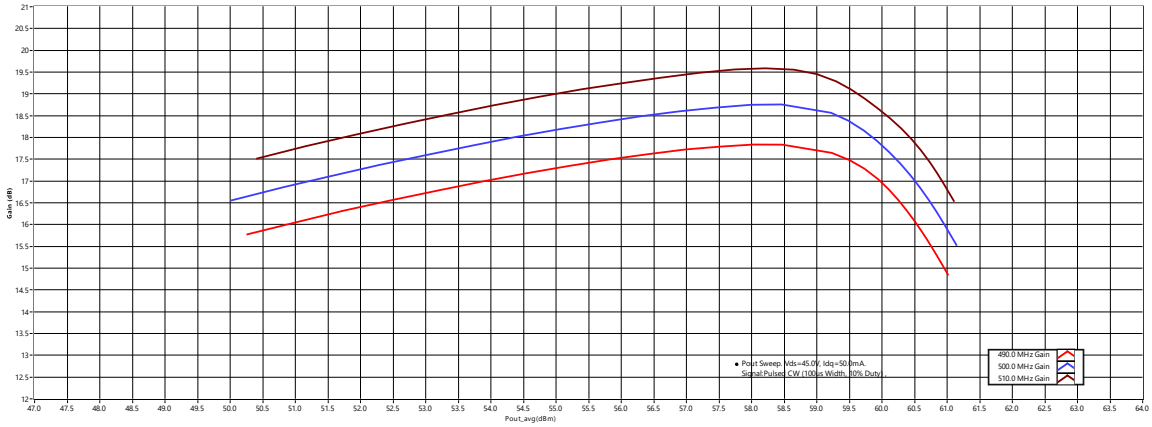


Figure 3. Pulse Gain (dB) vs Power Out(dBm)

9.3 Pulse Efficiency

Vdd = 45V, Idq=50mA, 100uS Pulse Width 10% Duty, Frequency=490-510MHz

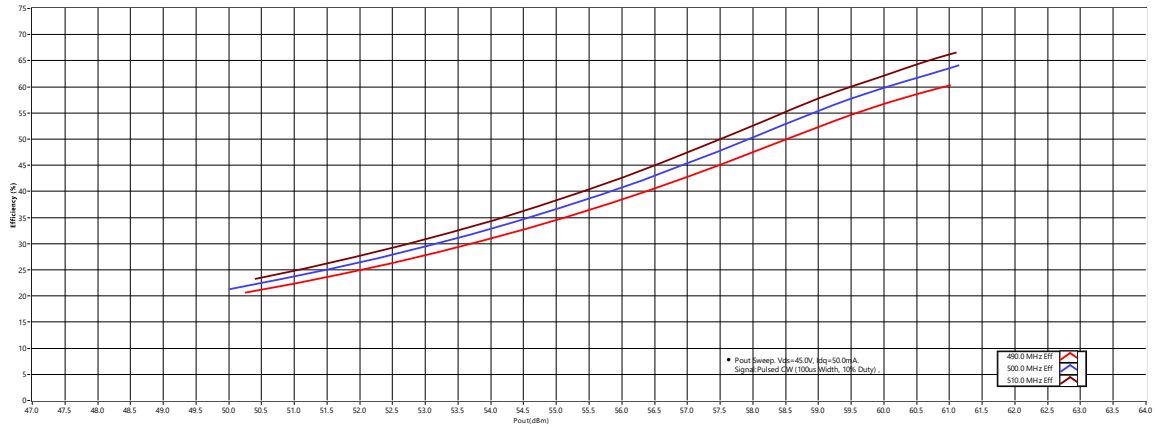


Figure 4. Pulse Efficiency(%) vs Power Out(dBm)

10 Fixed Power Out Results

10.1 Output Power v Frequency at P1dB

Vdd = 45V, Idq=50mA, Pulse 100uS 10% Duty Cycle, Frequency=490-510MHz, **Pout=P1dB**

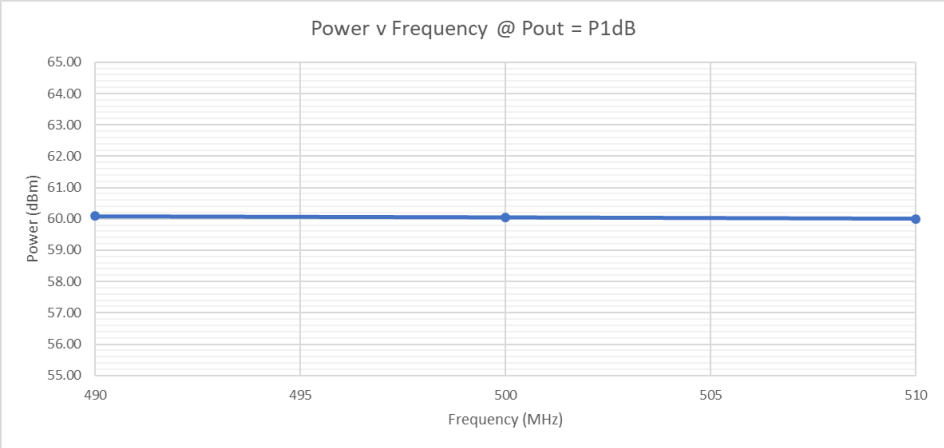


Figure 5. Output Power v Frequency at Pout=P1dB

10.2 Output Power v Frequency at P3dB

Vdd = 45V, Idq=50mA, Pulse 100uS 10% Duty Cycle, Frequency=490-510MHz, **Pout=P3dB**

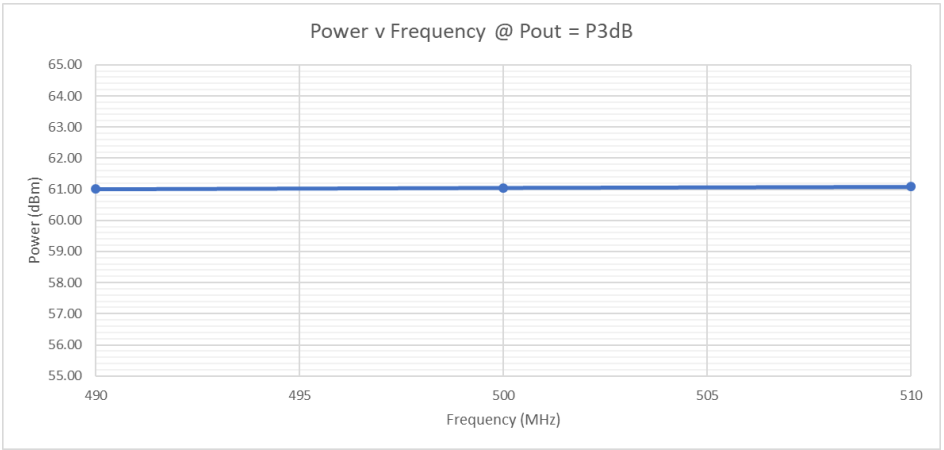


Figure 6. Output Power v Frequency at Pout=P3dB

10.3 Gain v Frequency at P1dB

Vdd = 45V, Idq=50mA, Pulse 100uS 10% Duty Cycle, Frequency=490-510MHz, **Pout=P1dB**

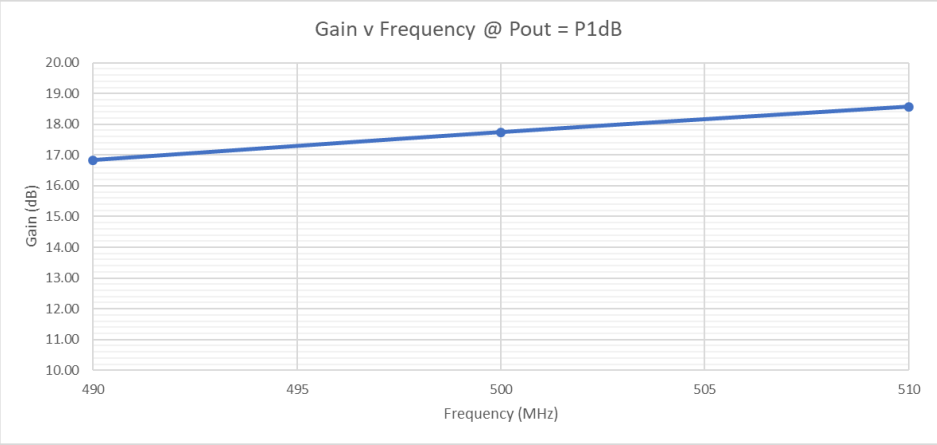


Figure 7. Gain(dB) vs Power Out(dBm) at Pout=P1dB

10.4 Efficiency v Frequency at P1dB

Vdd = 45V, Idq=50mA, Pulse 100uS 10% Duty Cycle, Frequency=490-510MHz, **Pout=P1dB**

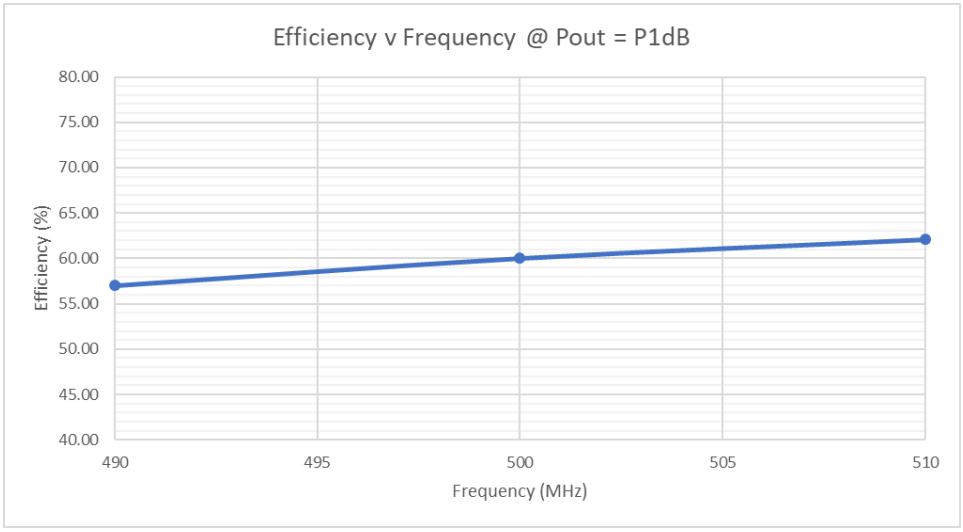
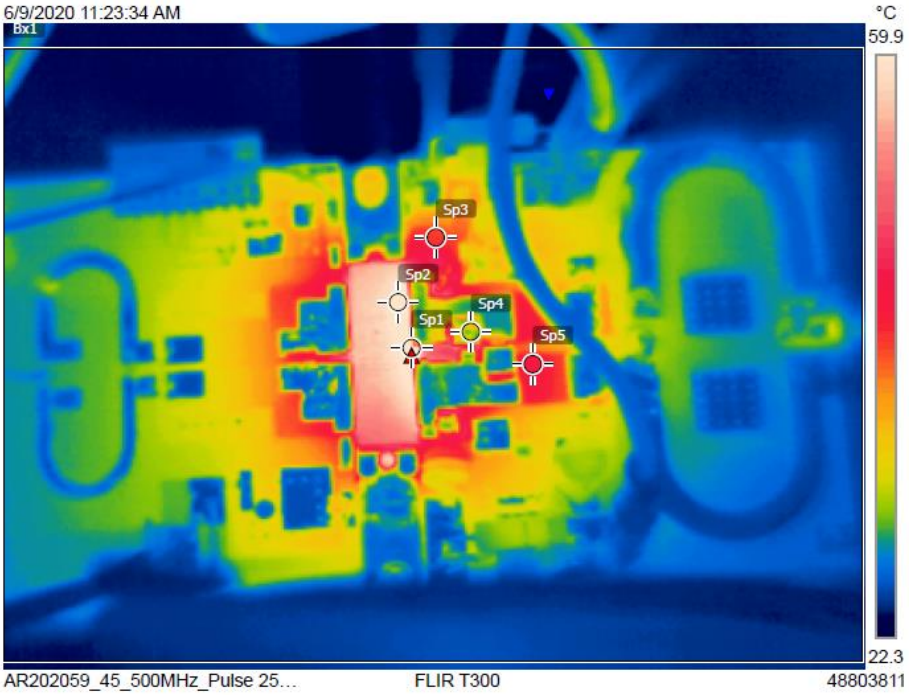


Figure 8. Efficiency(%) vs Power Out(dBm) at Pout=P1dB

11 Thermal Scans

11.1 45V 50mA 25%Duty @ Pout=60dBm

Vdd = 45V, Idq=50mA, Pulse 100uS 25% Duty Cycle, Frequency=500MHz, **Pout=60dBm**



Measurements

Bx1	Max	65.5 °C
	Min	22.1 °C
	Average	29.5 °C
Sp1		65.5 °C
Sp2		60.6 °C
Sp3		42.9 °C
Sp4		31.4 °C
Sp5		46.1 °C

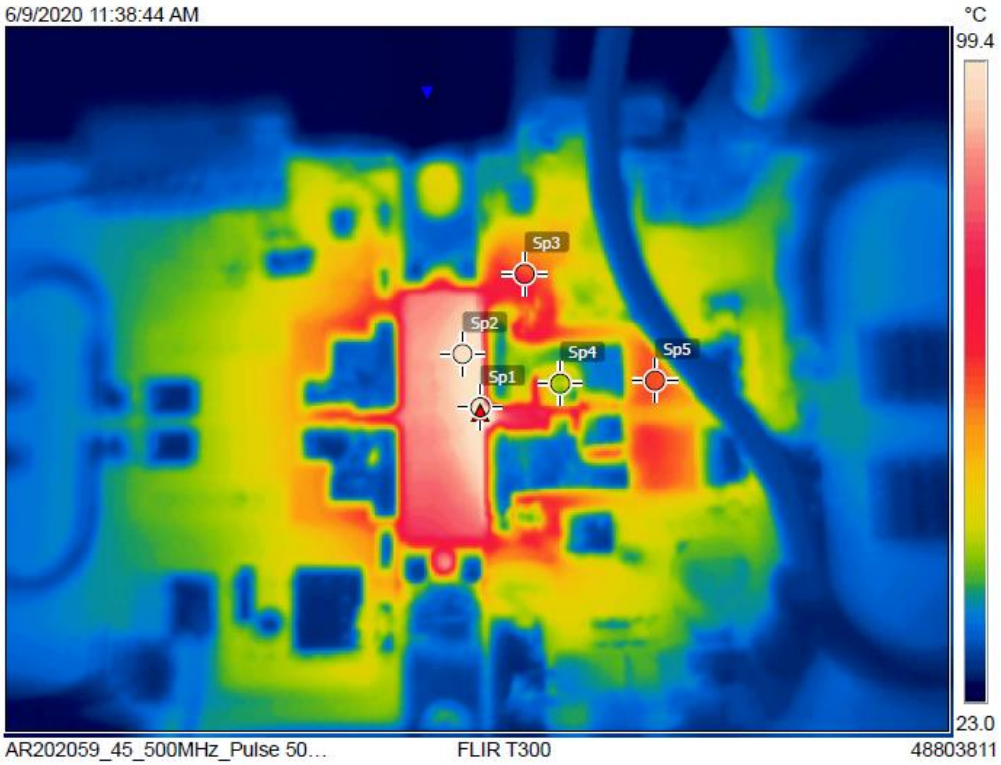
Parameters

Emissivity	0.95
Refl. temp.	20 °C

Figure 9. Thermal Scan of 25% Duty Cycle at Pout=60dBm

11.2 45V 50mA 50%Duty @ Pout=60dBm

Vdd = 45V, Idq=50mA, Pulse 100uS 50% Duty Cycle, Frequency=500MHz, **Pout=60dBm**



Measurements

Bx1	Max	108.0 °C
	Min	22.8 °C
	Average	39.3 °C
Sp1		107.7 °C
Sp2		98.6 °C
Sp3		66.9 °C
Sp4		46.7 °C
Sp5		65.8 °C

Parameters

Emissivity	0.95
Refl. temp.	20 °C

Figure 10. Thermal Scan of 50% Duty Cycle at Pout=60dBm

12 Hardware

12.1 Board photograph

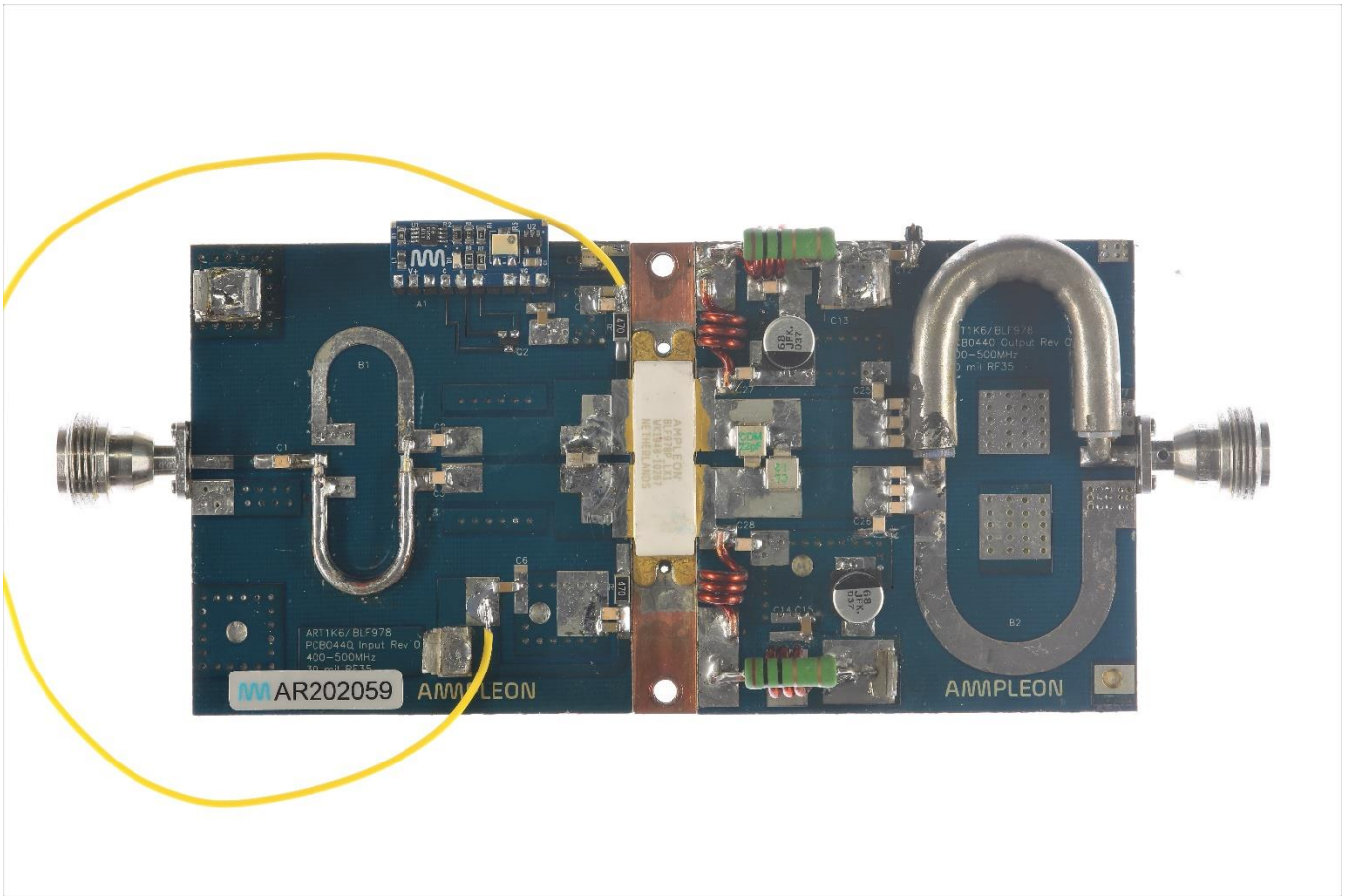


Figure 11. Board Photograph

12.2 PCB layout

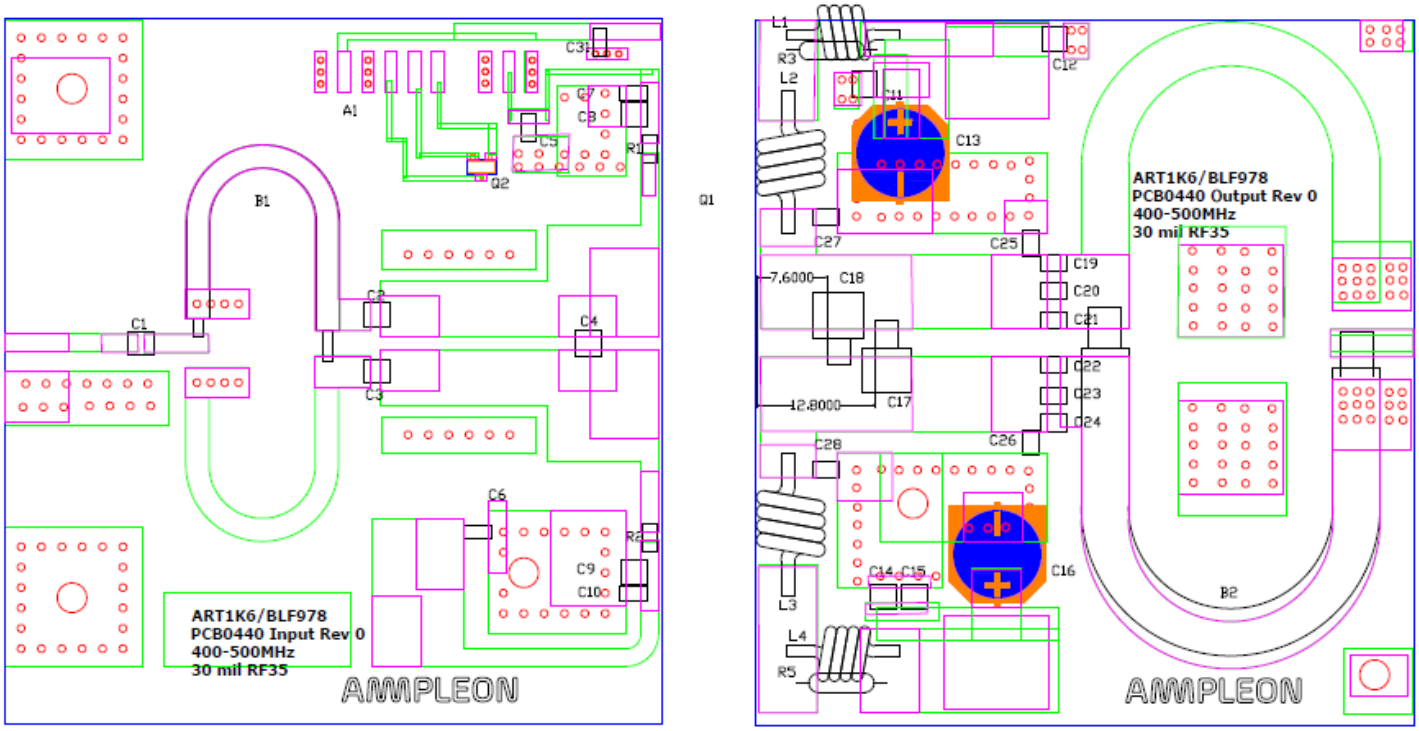


Figure 12. PCB Layout Board #AR202059

12.3 Bill of materials

Table 3. BOM

Designator	Description	Manufacturer	Part#
PCB Input	30 mil thk. Rogers 4350	Avanti Circuits	PCB0440 Input Rev 1
PCB Ouput	30 mil thk. Rogers 4350	Avanti Circuits	PCB0440 Output Rev 1
Q1	RF Transistor 1200W 50V LDMC	Ampleon	BLF978P
Q2	2N2222 NPN Transistor	Fairchild	MMBT2222
A1	LDMOS bias module	Ampleon	CA-330-11
R1,R2	Resistor 47Ω SMD	Generic	1206
R3,R6	Resistor 15Ω 3W	Generic	
R4,R5	Resistor 10Ω 3W	Generic	
C1,C8,C9	100pF	ATC	100B
C2,C3	56 pF	ATC	100B
C4	22 pF	TDK	C5750X7S2A106M
C5,C6,C12,C15	0.01uF,100V,X7R,1206	Murata	GRM319R72A103KA01D
C7,C10	0.1uF 100V,X7R	Murata	GRM319R72A104KA01D
C13,C16	68uF, 63 V electrolytic SMT	Panasonic	EEE-FK1J680UP
C17	12pF	CDE	MIN02
C18	22pF	CDE	MIN02
C19,C20,C21,C22, C23,C24	15pF soldered on sige	ATC	100B
C25,C26	7.5pF soldered on sige	ATC	100B
C27,C28	10pF	ATC	100B
L2,L3	Inductor 3 turns, 1.7mm, 4mm diameter		
L1,L4	Inductor 3 turns, 1.7mm, 5mm diameter		Parallel to R4 and R5

12.4 PCB materials

Table 4. Board Specifications

Parameter	Value
Manufacturer	Rogers
Type	30RF35
Thickness	30 mils, 1oz. copper
Layers	2, top/bottom. Bottom all copper

12.5 Device markings

Table 5. Device Specifications

Parameter	Value
Manufacturer	Ampleon
Device	BLF978S
Date Code	WK1948-10267

13 Legal Information

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.

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' 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 accept 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.

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.

13.1 Contact information

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

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