AR192035

BLP15M9S30, 30-520 MHz

AMPLEON

V1.0 — 31 October 2019

Application Report

Document information

Info	Content
Status	Company Public
Author(s)	Bill Goumas
Abstract	Measurement results of the BLP15M9S30 LDMOS Device in Board #AR192035 tuned for the 30-520 MHz band at 28-32V

1 Revision History

Table 1. Report revisions

Revision No.	Date	Description	Author
1.0	20190815	Initial document	Bill Goumas

2 Contents

3 List of Figures

4 List of Tables

5 General Description

This report presents the measurement results of the Class AB Demo board AR192035 using the BLP15M9S30. The demo achieves ~30W across 30-520MHz.

6 Biasing

6.1 Bias Details

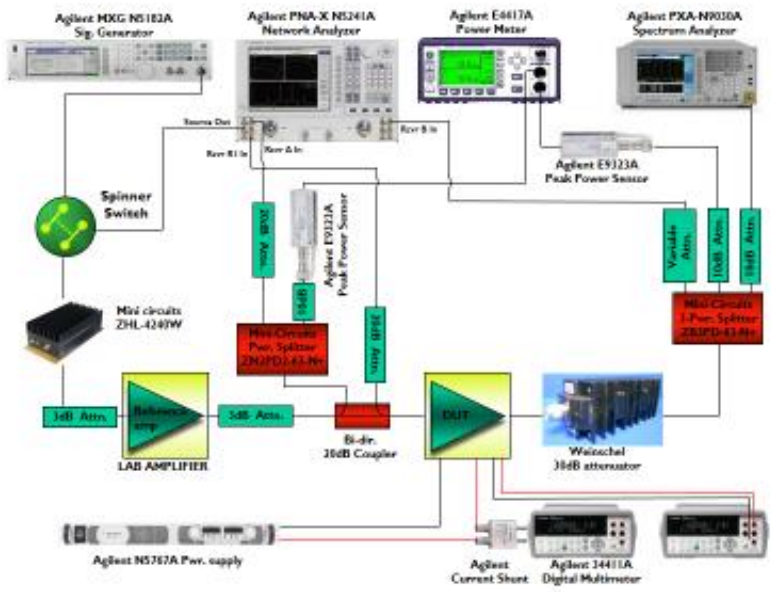
The efficiencies presented include the bias current from the biasing board. The current from the biasing board is ~25mA.

VDD =28

VGS= ~2.1 V, leading to an IDQ =200mA.

7 Test Bench Set Up

Figure 1.Test Bench Equipment set up



8 Summary

Gain is 20-24dB and Efficiency is 45-65% at Pout=30W.

9 Performance Details

9.1 Small Signal Results

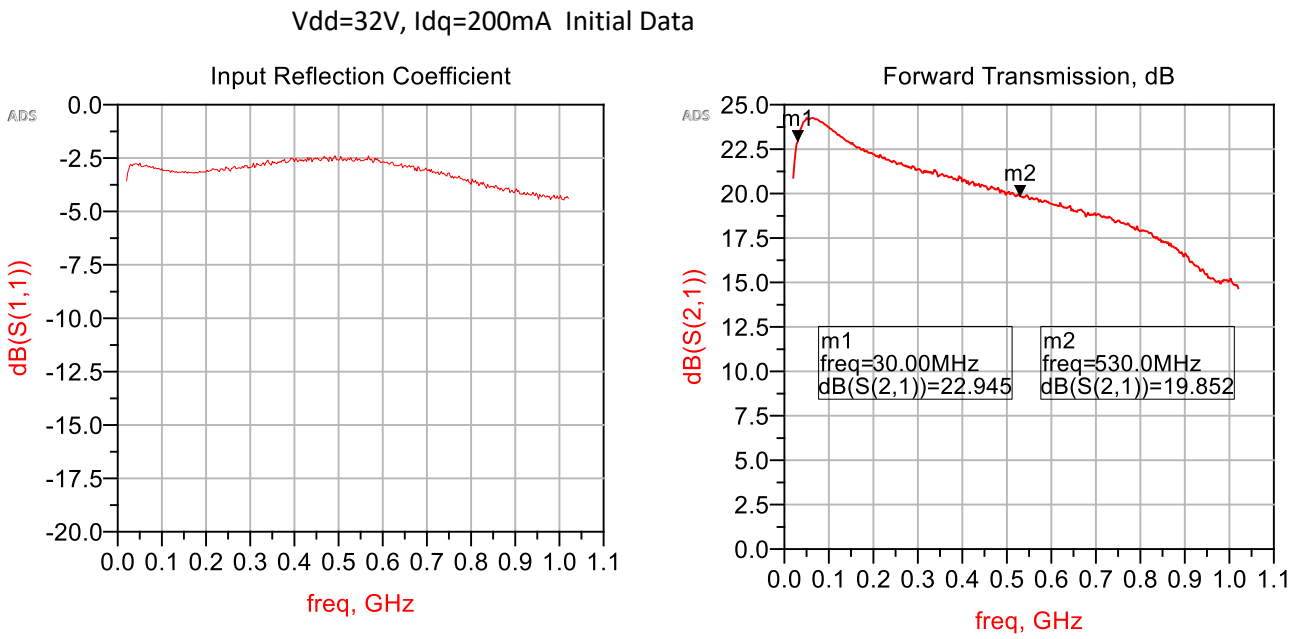


Figure 2. Small SIgnal Data, Vdd=32V, Idq=200mA, Pin=10dBm

9.2 Pulse Gain and Efficiency Sweeps

Vdd=28V, Idq=200mA, 10% Duty Cycle, 100usec PW

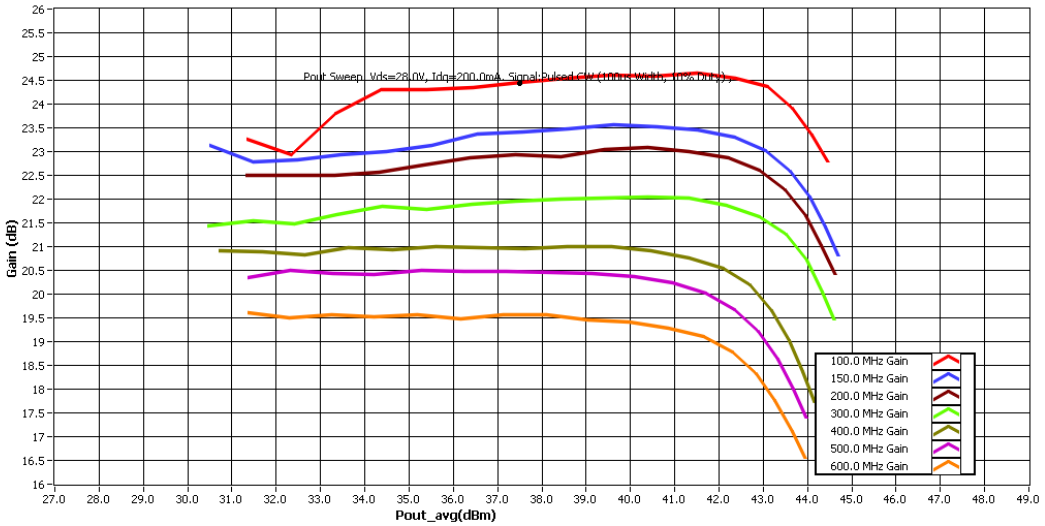


Figure 3. Gain(dB) and Eff(%) vs Power Out(dBm)

To be Added

Figure 4. Add 30-100

9.3 CW Gain and Efficiency Sweeps

Vdd=28V, Idq=200mA,

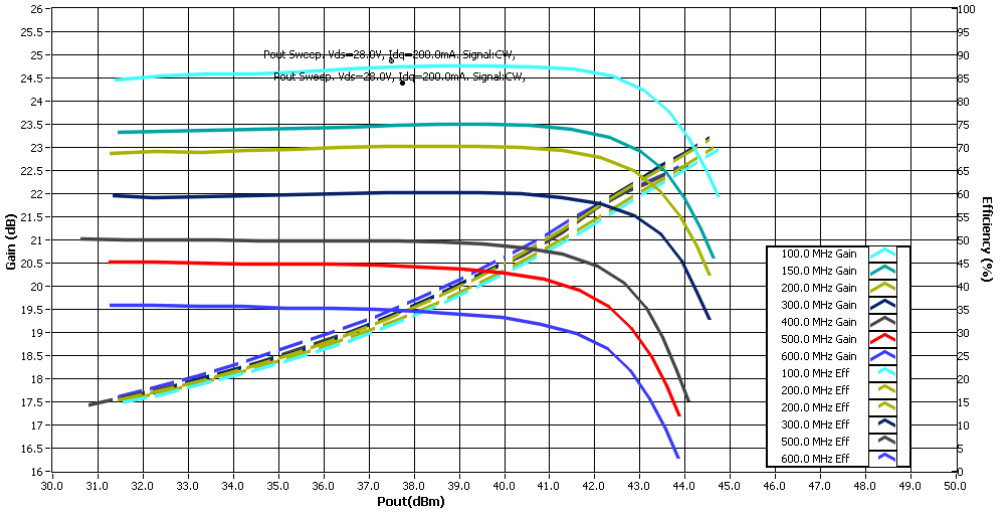


Figure 5. Gain(dB) and Eff(%) vs Power Out(dBm)

To be added

Figure 6. Add 30-100

9.4 CW Gain and Efficiency Sweeps vs Voltage

Vdd=32V, Idq=200mA,

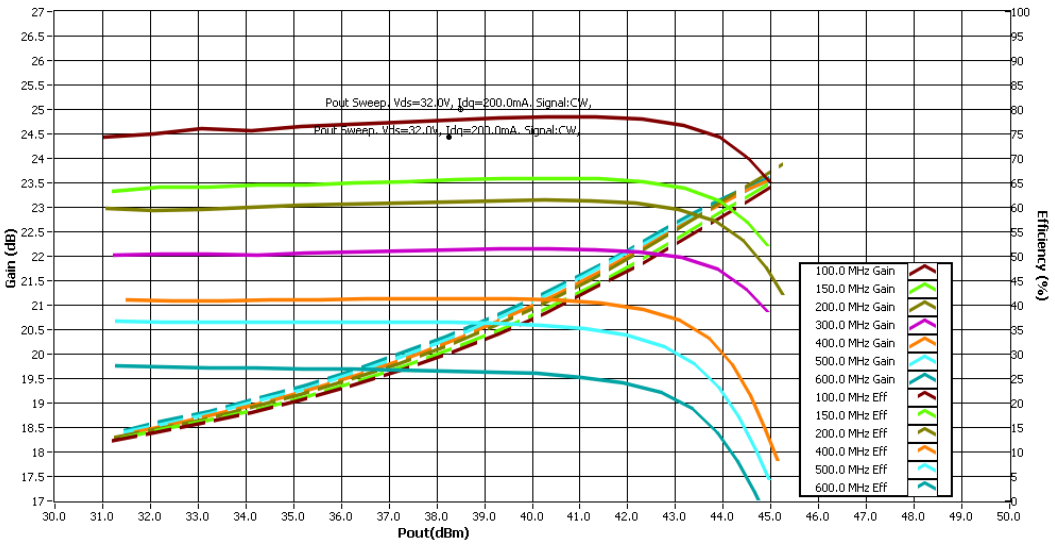


Figure 7. Gain(dB) and Eff(%) vs Power Out(dBm)

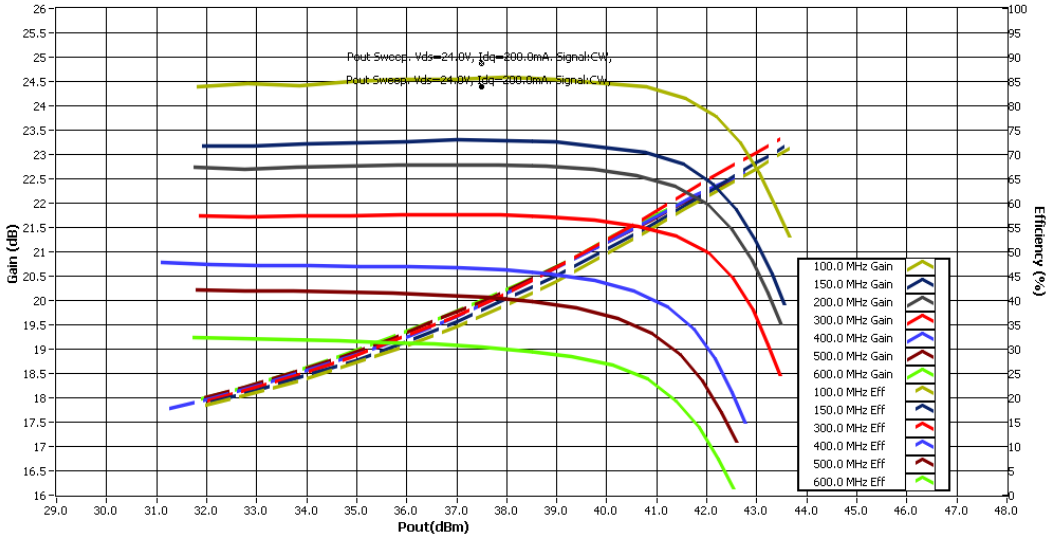


Figure 8. Gain(dB) and Eff(%) vs Power Out(dBm),Vdd=24V,idq=200mA

9.5 P1,P3 Comparison

Vdd=50V, , 50% Duty Cycle, 100usec PW,

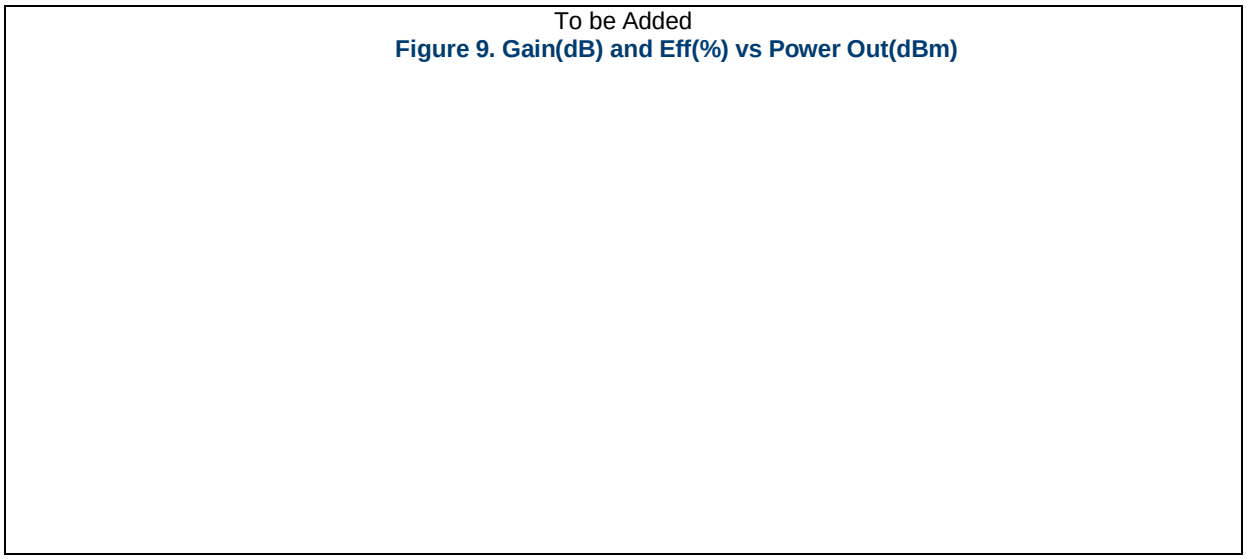


Figure 9. Gain(dB) and Eff(%) vs Power Out(dBm)

9.6 IMD

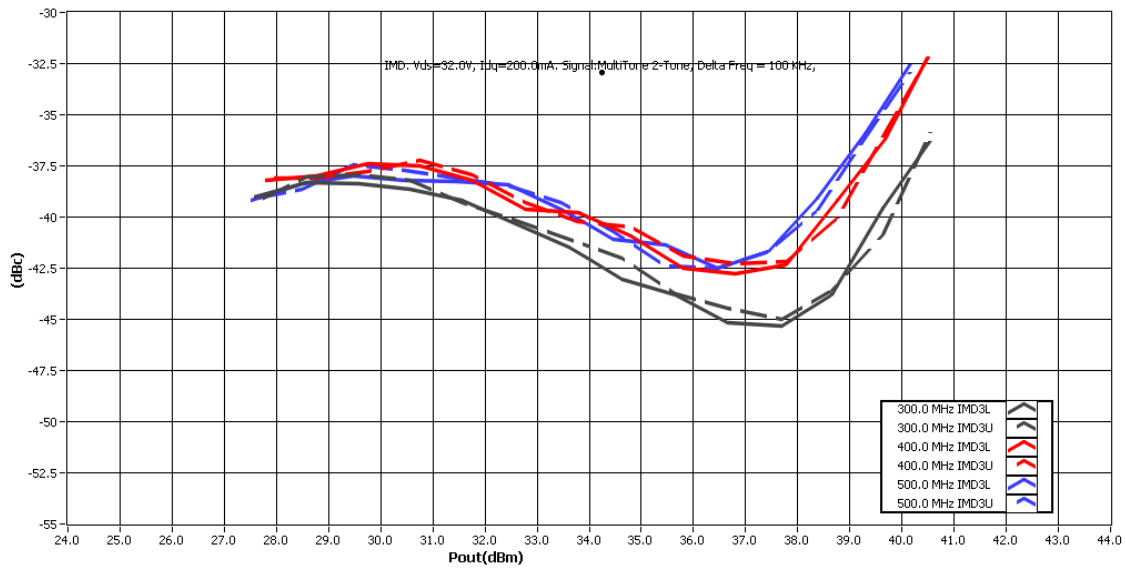


Figure 10. IMD3 vs Frequency(MHz),Vdd=32,Idq=200mA

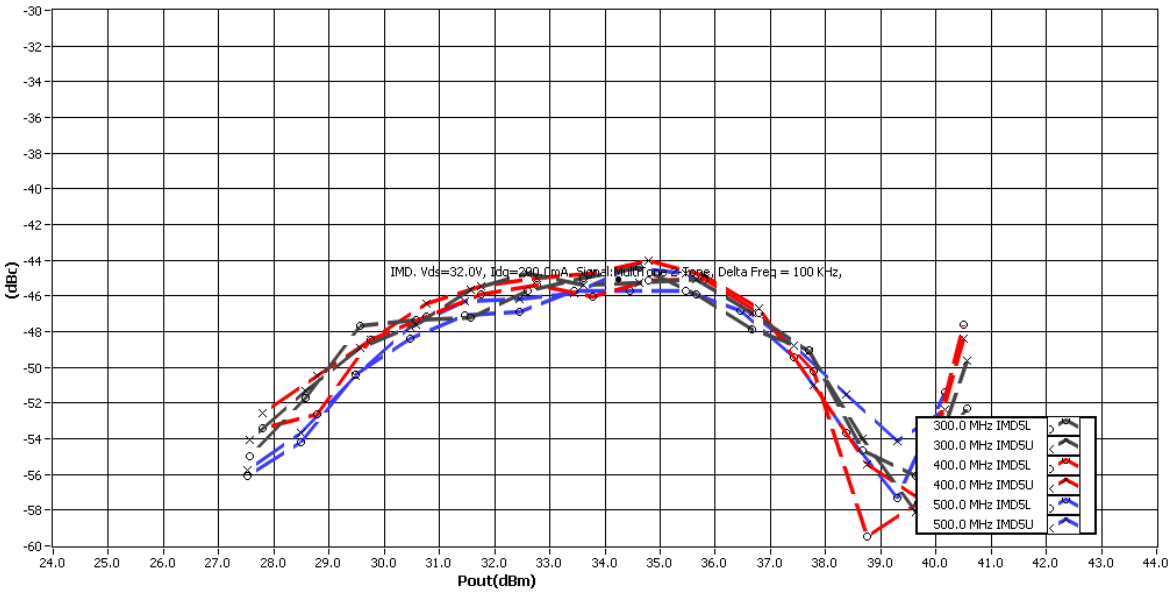


Figure 11. IMD5 vs Frequency(MHz),Vdd=32,Idq=200mA

9.7 IMD

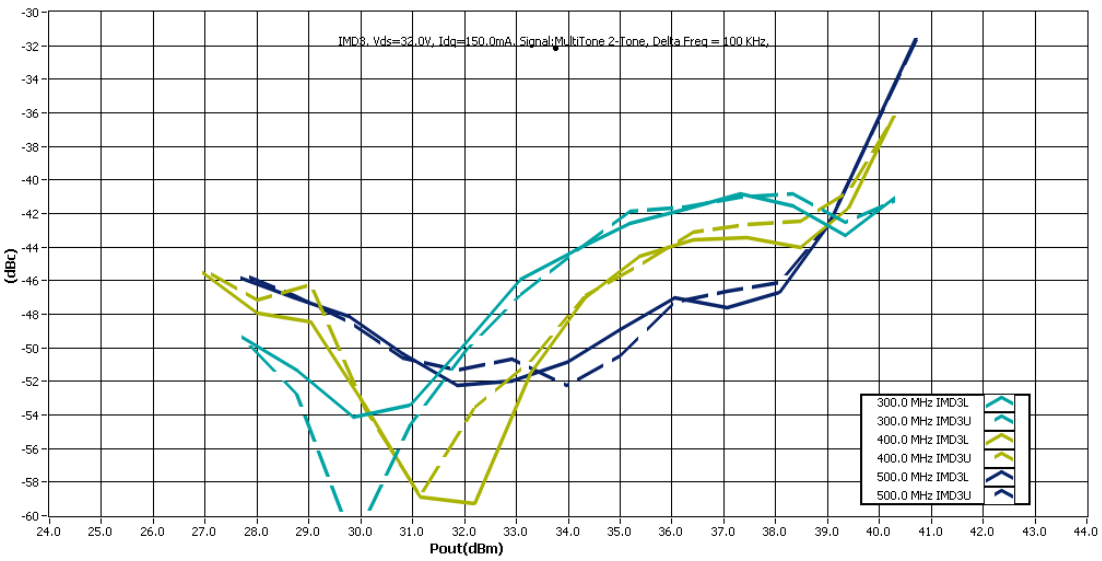


Figure 12. IMD3 vs Frequency(MHz),Vdd=32,Idq=150mA

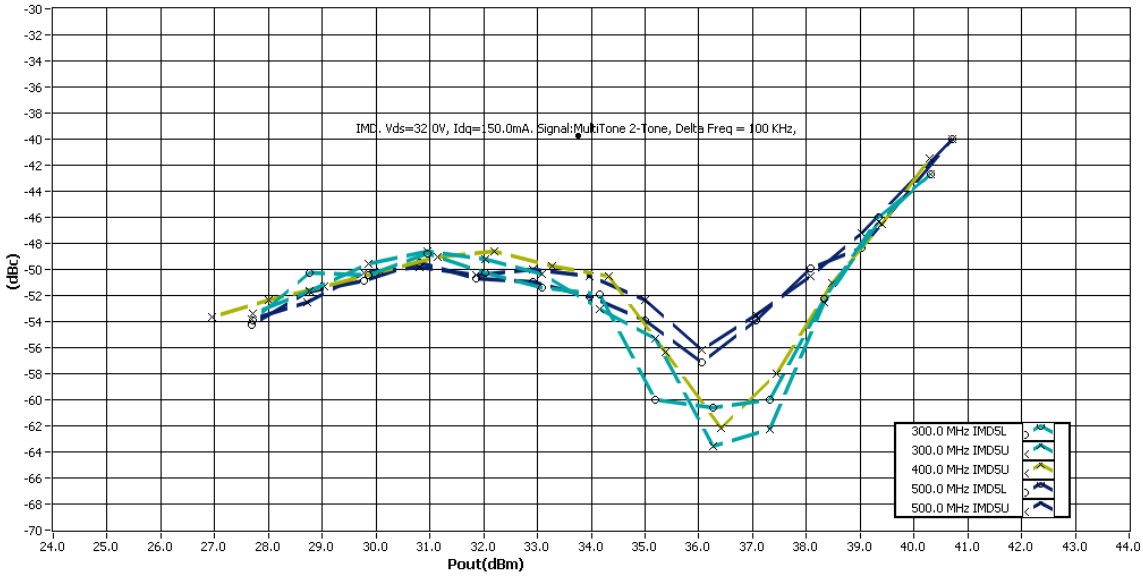


Figure 13. IMD5 vs Frequency(MHz),Vdd=32,Idq=150mA

9.8 IMD

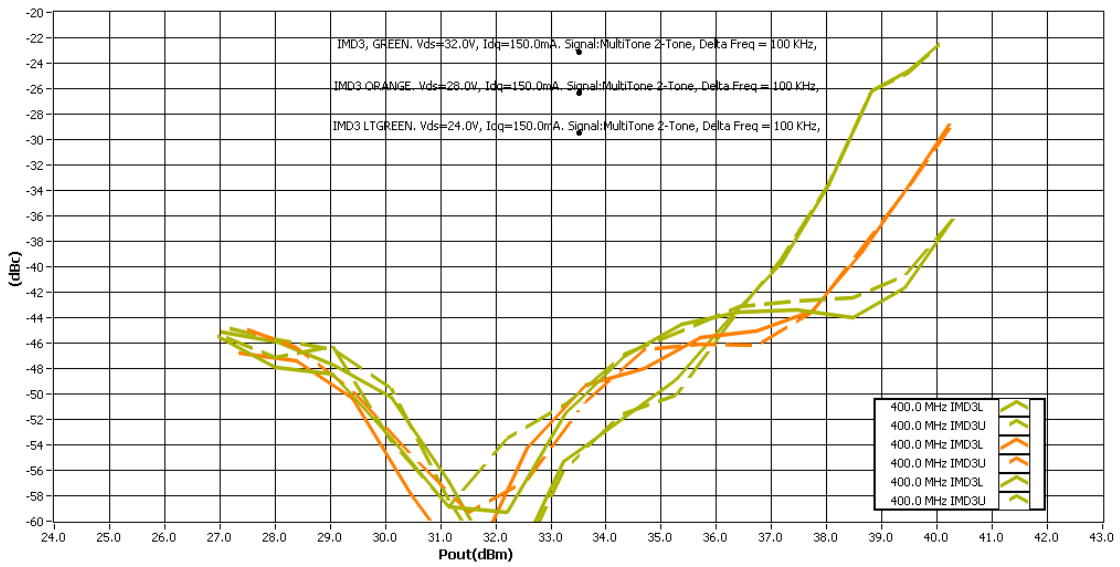


Figure 14. IMD3 vs Voltage, Frequency(=400MHz,Idq=150mA

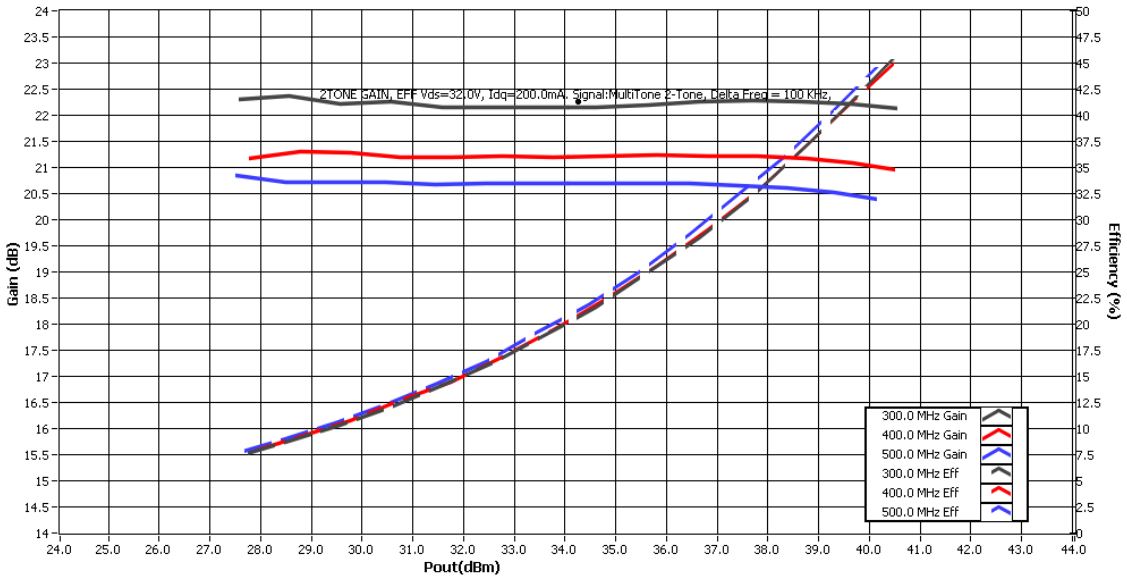


Figure 15. 2Tone Gain, Efficiency Vdd=32,Idq=200mA

9.9 P1 versus Duty Cycle and Frequency

Vdd=28V, Idq=200mA, 100usec PW

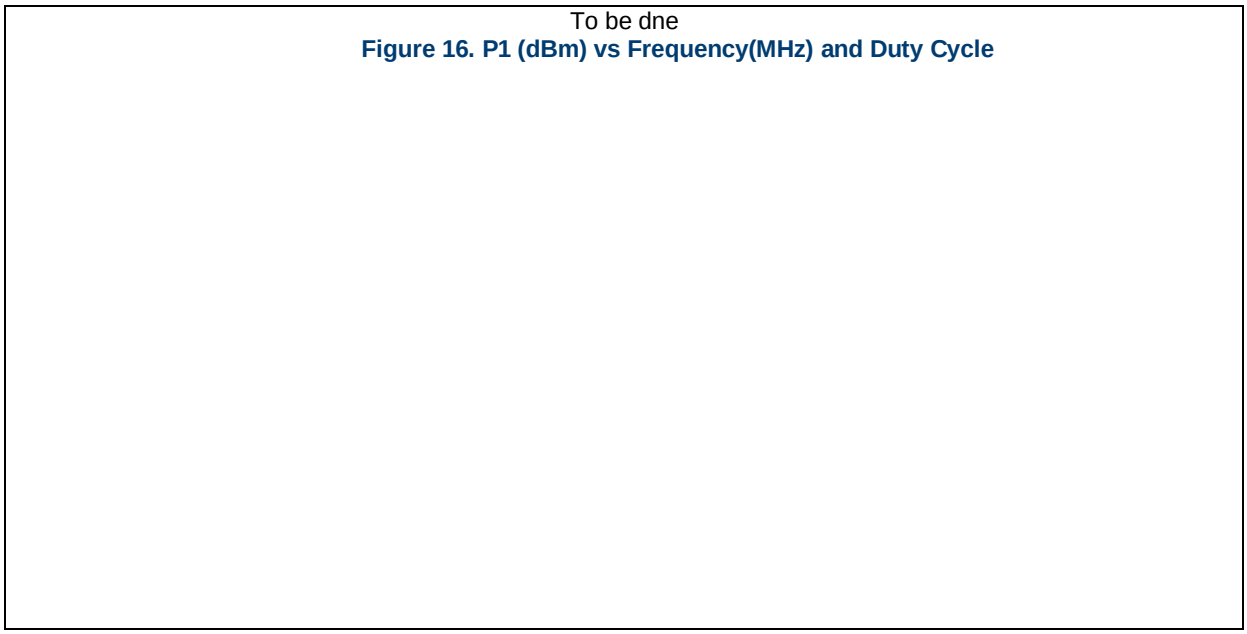


Figure 16. P1 (dBm) vs Frequency(MHz) and Duty Cycle

10 Hardware

10.1 Board photograph

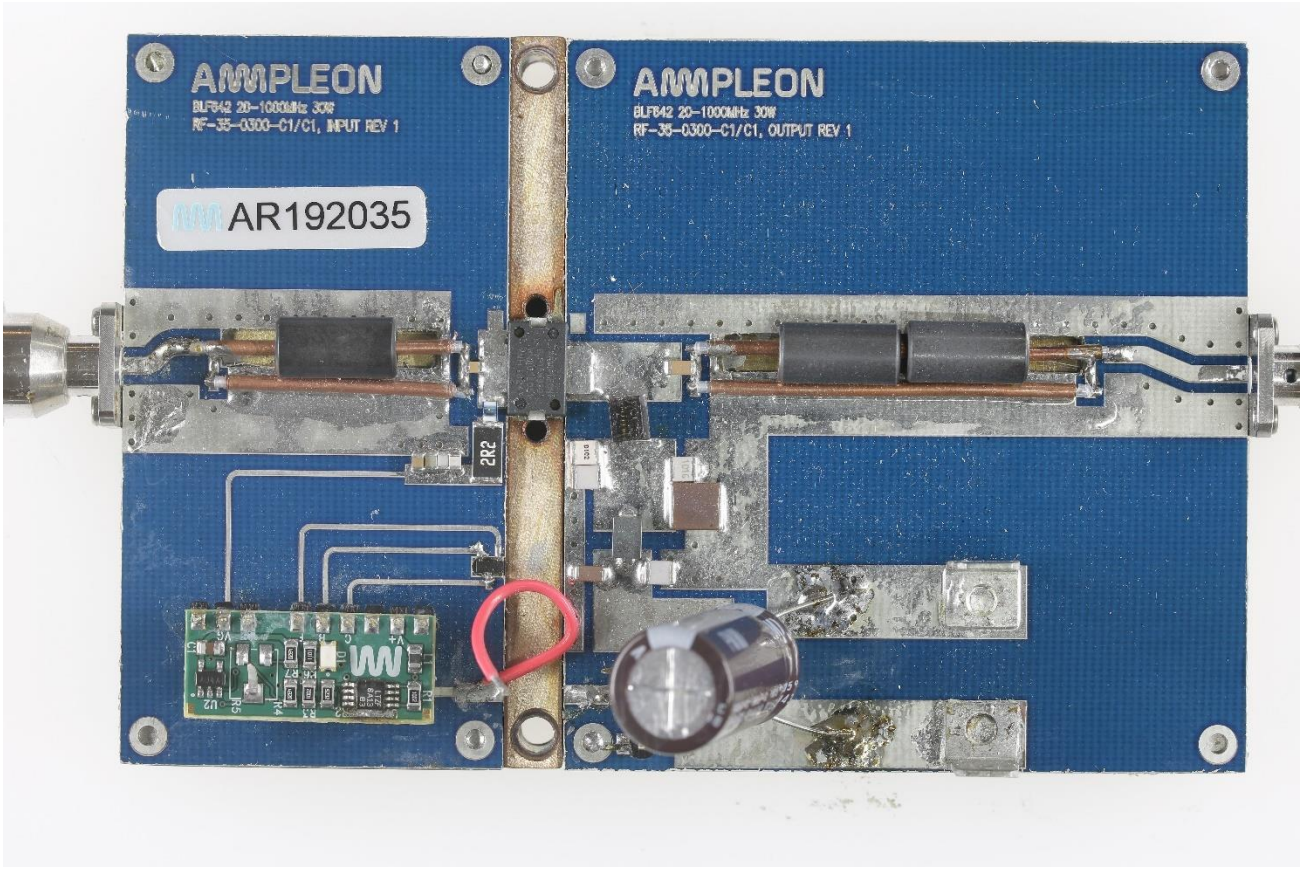


Figure 17. Board Photograph

10.2 PCB layout

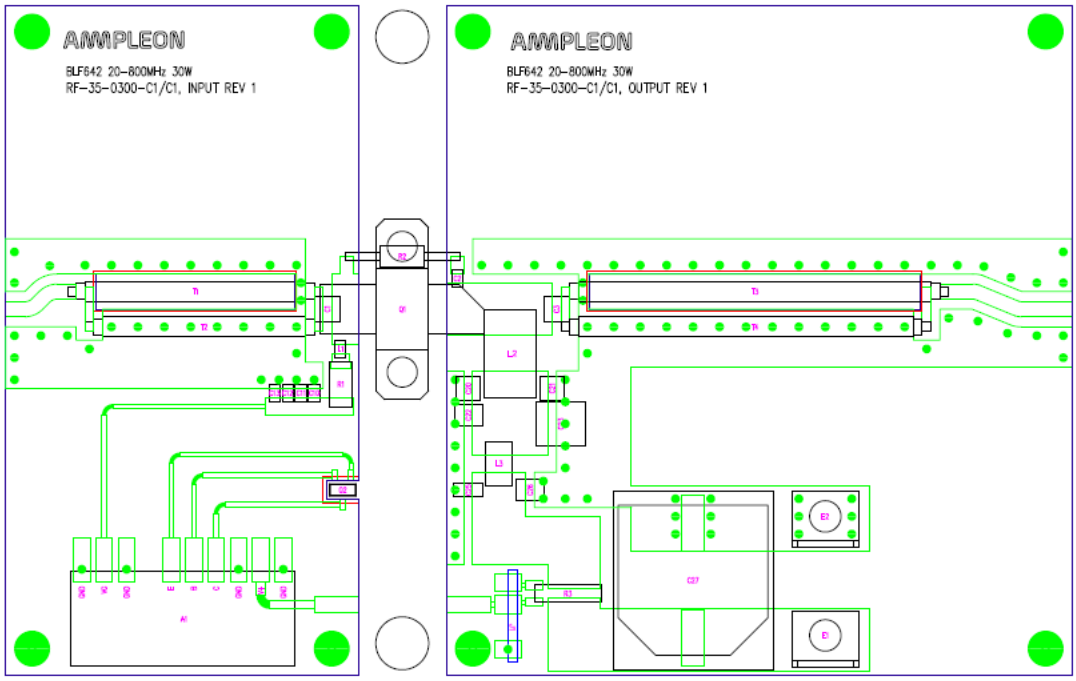


Figure 18.PCB Layout Board #AR192035

10.3 Bill of materials-old

Table 2. BOM

Designator	Description	Manufacturer	Part#
PCB Input PCB	Input PCB, 30mil thk. RF35	Avanti Circuits	PCB00062 Input Rev3
PCB Output PCB	Output PCB, 30 mil thk. RF35	Avanti Circuits	PCB00062 Output Rev3
A1	LDMOS bias module	Ampleon	CA-330-11
Q1	RF Transistor	Ampleon	BLP15M9S30
Q2	2N2222 NPN Transistor	Fairchild	MMBT2222
R1	10Ω 0.5W5%	Generic	
R2, R3	20 Ω 5%	IMS	NADC-2010WA20R0J
R4,R5	DNP	ATC	FR10300N0200J
R6	10 Ω 3W	Generic	
L1	17.5nH	Coilcraft	B01
L2	8 turn 18AWG wrapped onto R6	Internal	
L3	DNP		
L4	DNP		
C1,C32	1000pF	Passive Plus or ATC	1111N or 100B
C2, C4, C9, C10	100nF, 50V 10% X7R, 0805	Generic	
C3, C7, C8,C15	4.7nF,100V 5% NPO, 1210	Generic	
C13,C14	10uF,100V 10% X7R, 1206	Generic	
C11,C12	DNP	Generic	
C16	100nF,100V 10% X7R, 1210	Generic	
C17	10uF, 100V 10% X7S, 2220	TDK	C5750X7S2A106M
C5,C6,C18, 19	910pF, 500V 5%	Passive Plus or ATC	1111N or 100B
C20	470uF, 63V, alum electrolytic	Generic	
C21	2.2pF	Passive Plus or ATC	1111N or 100B
C22	30pF	Passive Plus or ATC	1111N or 100B
C23	2 x 10pF	Passive Plus or ATC	1111N or 100B
C24	DNP	Passive Plus or ATC	
C31	1000pF	Passive Plus or ATC	600F
T1	1:1 Input Balun	Micro Coax	55mm PE-047 50 ohm coax + (3)
		Fair-Rite	Fair-Rite 2861002402 cores
T2, T3	4:1 input transformer	Micro Coax	50mm UT-047-25 25 ohm coax +
		Fair-Rite	(2) Fair-Rite 2861002402 cores
T4, T5	4:1 output transformer	Micro Coax	3.5” UT-0C-18 18 ohm coax
T6	1:1 output balun w 1 core	Micro Coax	4.1” UT-141 50 ohm coax
		Fair-Rite	with one BN-61-002 core

10.4 PCB materials

Table 3. Board Specifications

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

10.5 Device markings

Table 4. Device Specifications

Parameter	Value
Manufacturer	Ampleon
Device	BLP15M9S30
Date Code	M1919

11 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.

11.1 Contact information

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

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