AR202140

BLP15M9S100, 400-470 MHz

V1.0 — 22 February 2021

Application Report

Document information

Info	Content
Status	
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Abstract	Measurement results of BLP15M9S100 LDMOS device in board #AR202140 tested over 400-470MHz at 28V

1 Revision History

Table 1. Report revisions

Revision No.	Date	Description	Author
1.0	20210217	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 AR202140. The device used is a BLP15M9S100 which is a Gen9 100W LDMOS device in an overmolded plastic package.

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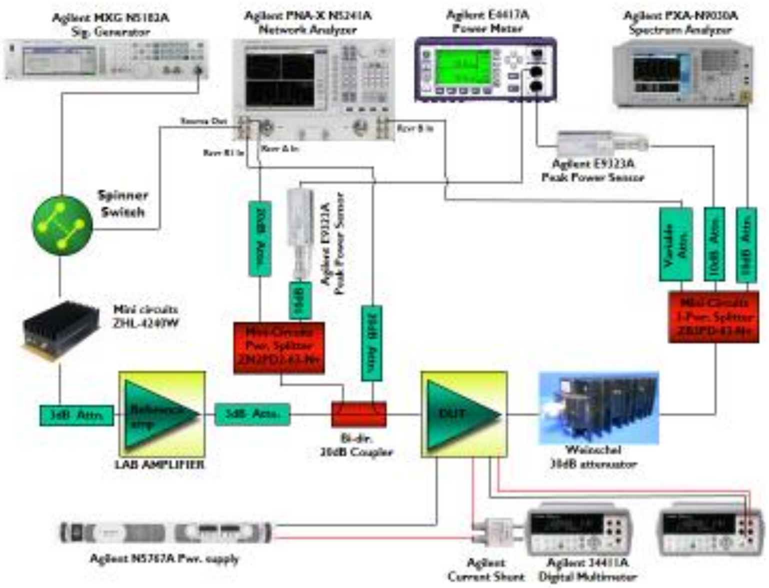
6 Biasing

6.1 Bias Details

For Vdd =28 , Vgs~2.0-2.2 V for Idq =350mA set via the bias board.

7 Test Bench Set Up

Figure 1.Test Bench Equipment set up



8 Summary

Customer has application over 400-470MHz with a supply voltage of 28V. BLP15M9S100 was dropped into an existing UHF circuit. Lumped element equivalent circuit model was used for initial component values.

Initial performance saw more degradation than expected under CW conditions compared to Pulse at 10% duty. Further analysis showed that the Drain bypass caps(C8,C18) were getting too hot. Capacitors were changed to the Passive plus 2225 series. Results are shown in section 9.5

Gain is ~19dB at Pout=50W average. IMD3 tracks with P1 and the -30dBc IM point is at ~48dBm PEP. All IM data is with 100kHz tone spacing.

At 32V Peak power increases by ~1dB from 28V. Further optimization of the circuit with a new output match design could result in ~0.5dB additional peak power.

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9 Performance Details

9.1 Small Signal Results

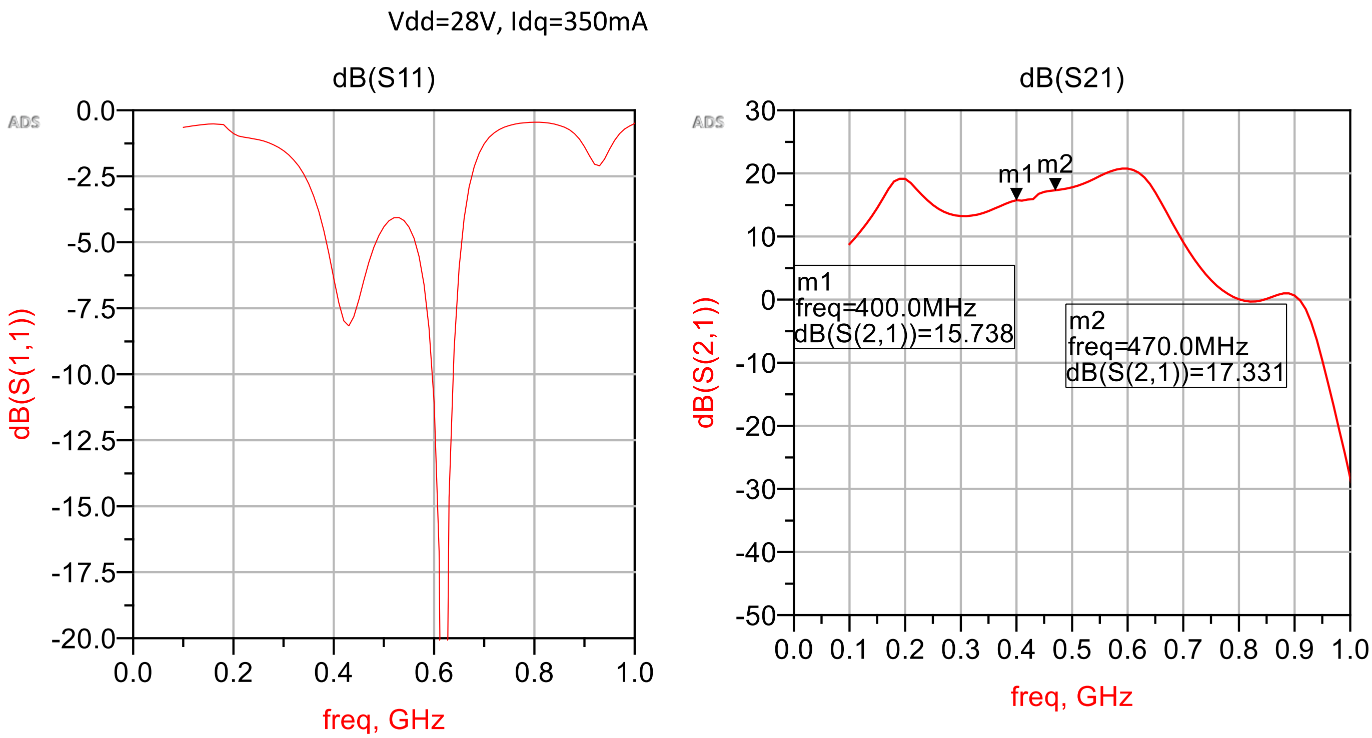

Figure 2. Small SIgnal Data, Vdd=28V, Idq=350mA, Pin=10dBm

9.2 Pulse Gain, Efficiency vs Pout and Frequency,

Vdd=28V, Idq=350mA, 10% Duty Cycle, PW=100usec

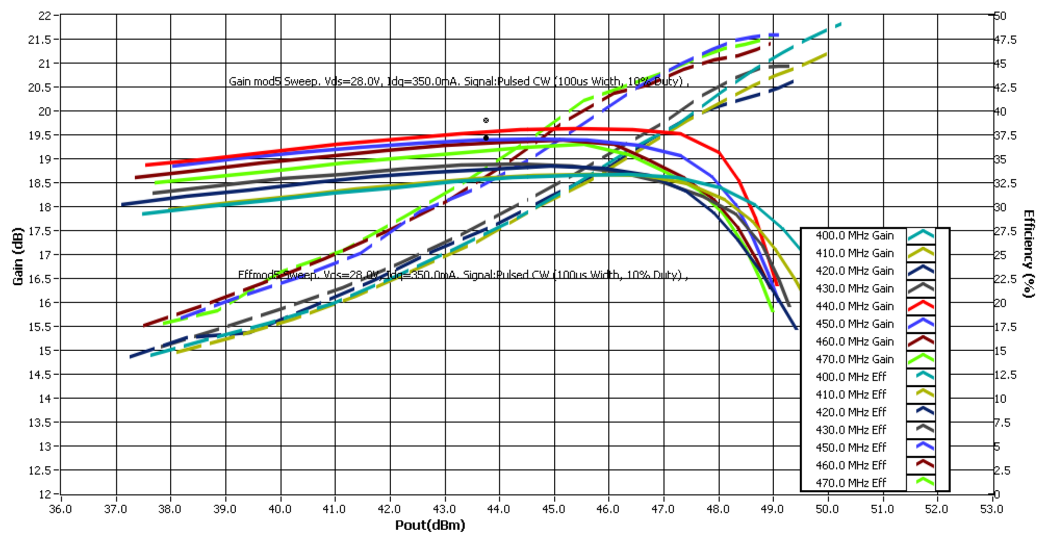

Figure 3. Pulse Gain(dB),Eff(%) vs Power Out(dBm),10% duty

P1 and P3 vs Freq and Vdd, Blue=28V, Green=32V, Idq=350mA

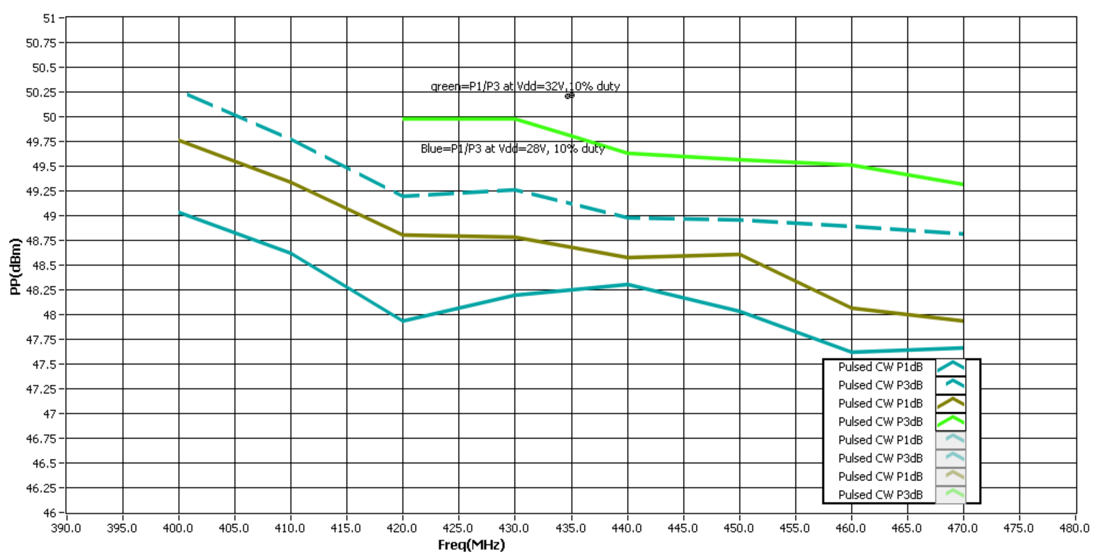

Figure 4. P1,P3dB vs Freq(MHz)10% duty

9.3 CW Gain, Efficiency vs Pout and Frequency,

Vdd=28V, Idq=350mA with 2225 Caps

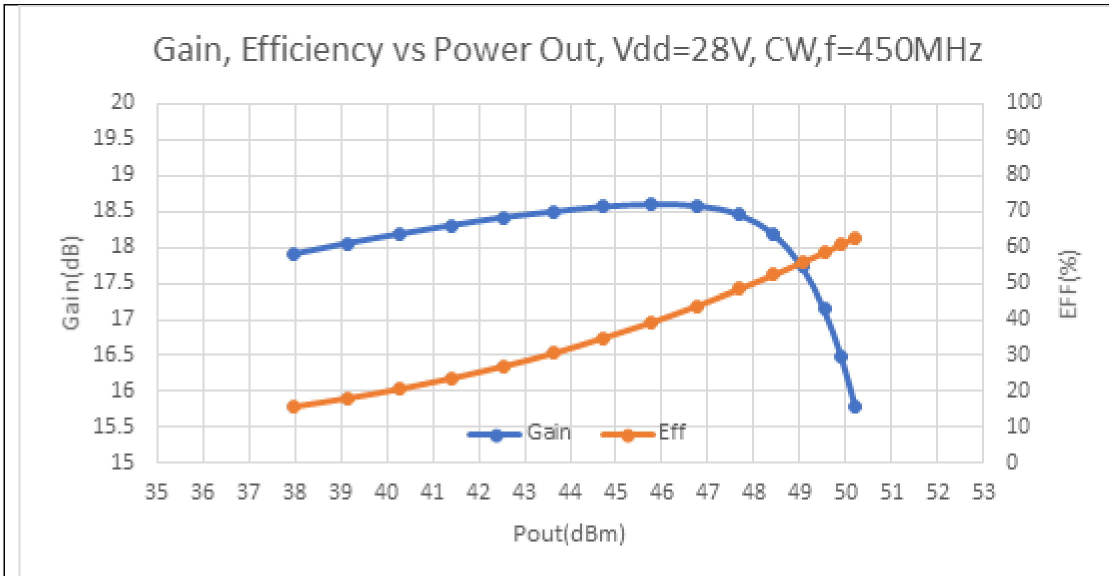

Figure 5. Gain(dB),Eff(%) vs Power Out(dBm)

9.4 IMD Data

Vdd=28V, Idq=350mA, 100kHz Tone Spacing

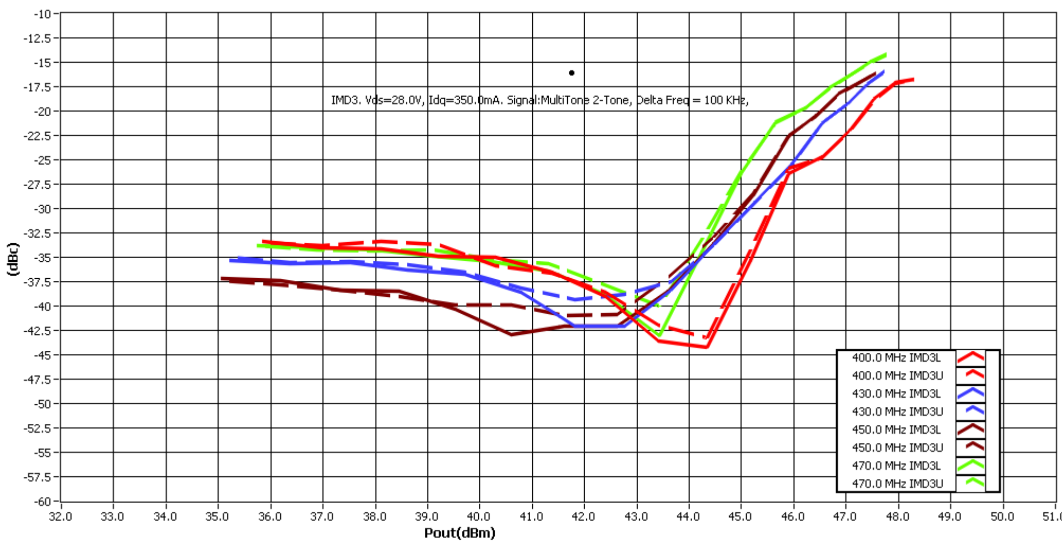

Figure 6. IMD3(dBc) vs Power Out(dBm)

IMD5 vs Power Out, Vdd=28,Idq=350mA, 100kHz Tone Spacing

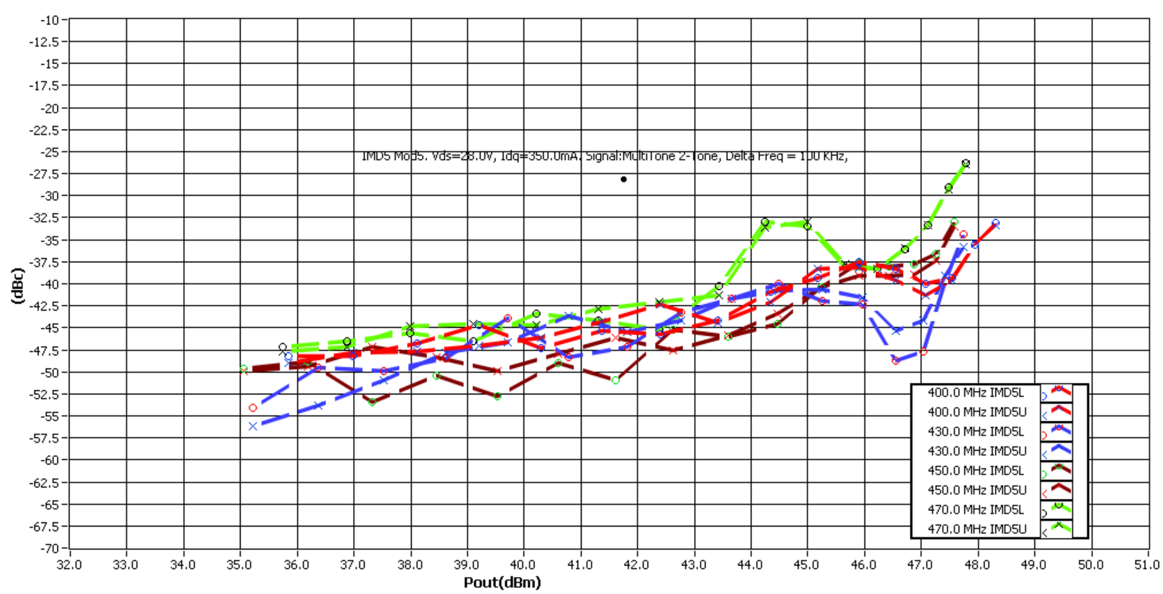

Figure 7. IMD5(dBc) vs Power Out(dBm)

9.5 Comparison with 2225 caps used for Drain Bypass

Vdd=28V, Idq=350mA, orange=initial, blue=2225Caps

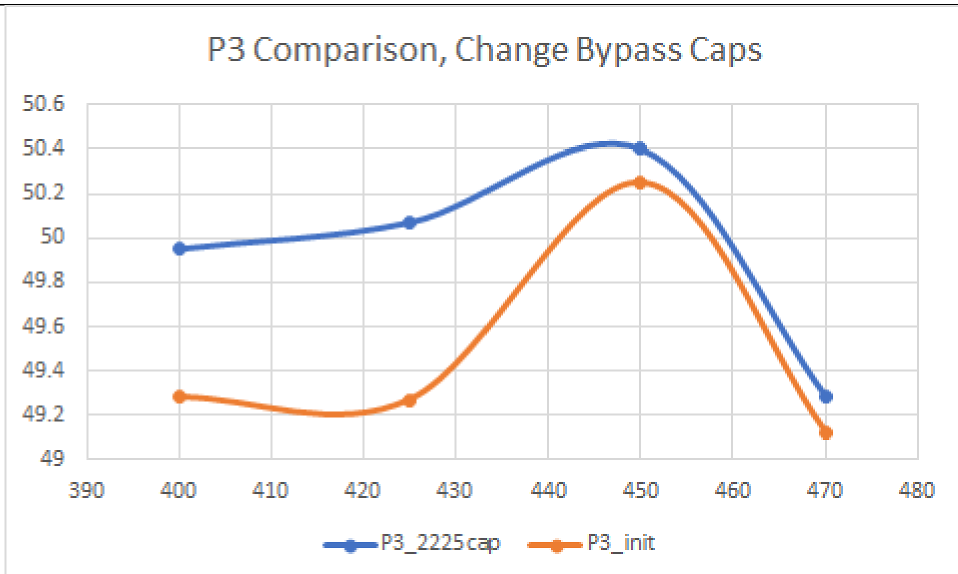

Figure 8. P3dB(dBm) vs Freq(MHz)

Vdd=28V, Idq=350mA, blue=initial, orange=2225Caps

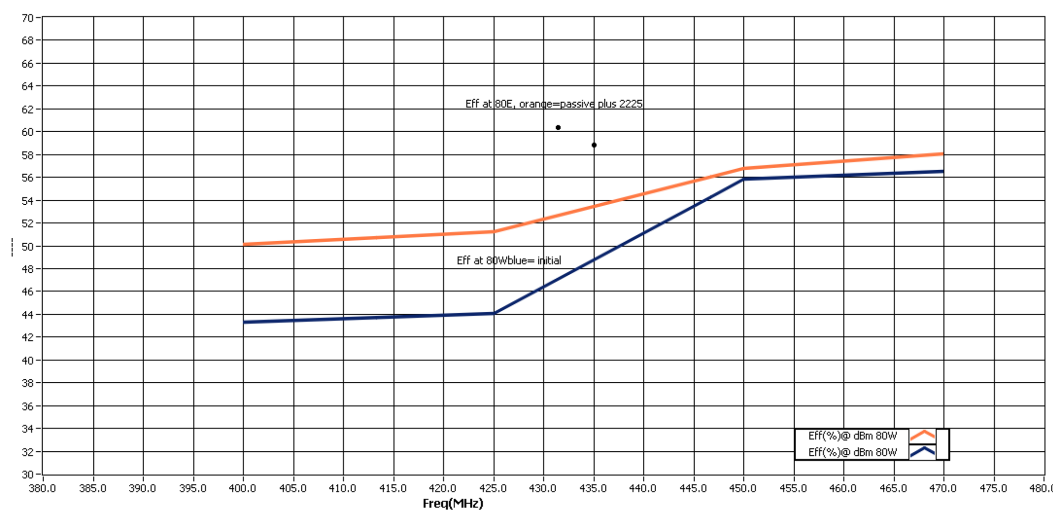

Figure 9. Eff(%) vs Freq(MHz)

9.6 ACPR Data-1c WCDMA

ACPR(Adjacent) vs Power Out, Vdd=28,Idq=350mA

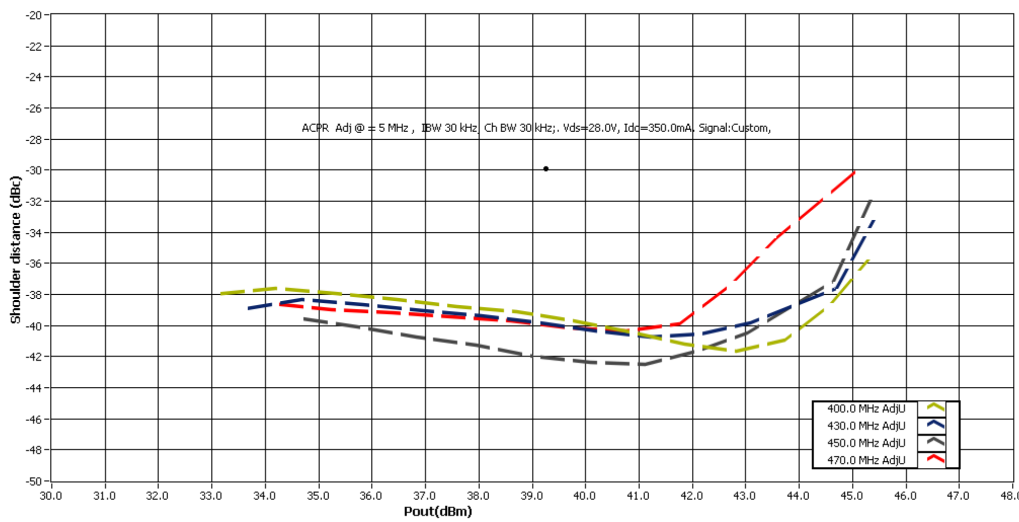

Figure 10. ACPR(dBc) vs Power Out(dBm)

ACPR(Alternate) vs Power Out, Vdd=28,Idq=350mA

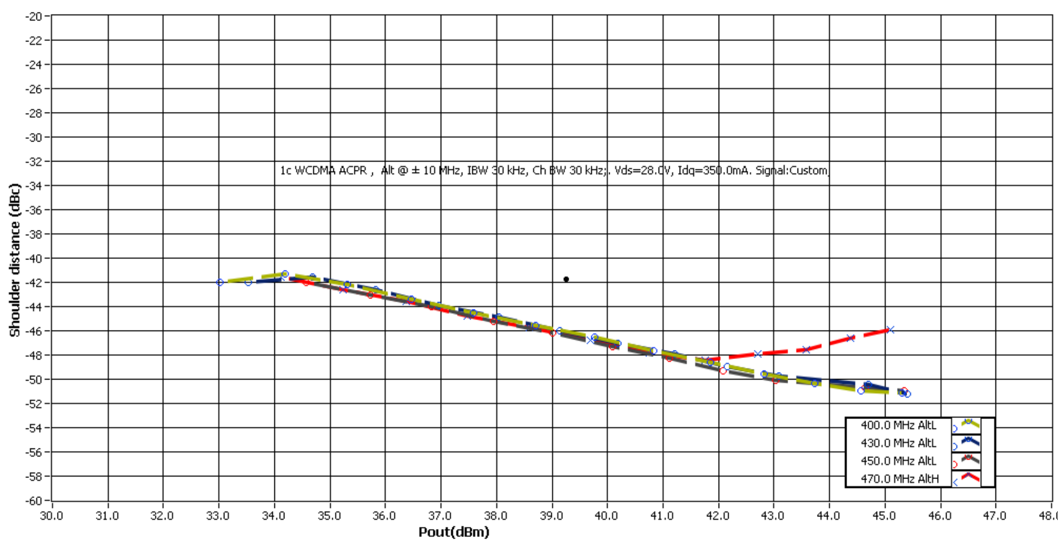

Figure 11. ACPR(dBc) vs Power Out(dBm)

9.7 ACPR Data-IS95

ACPR(Adjacent) vs Power Out, Vdd=28,Idq=350mA

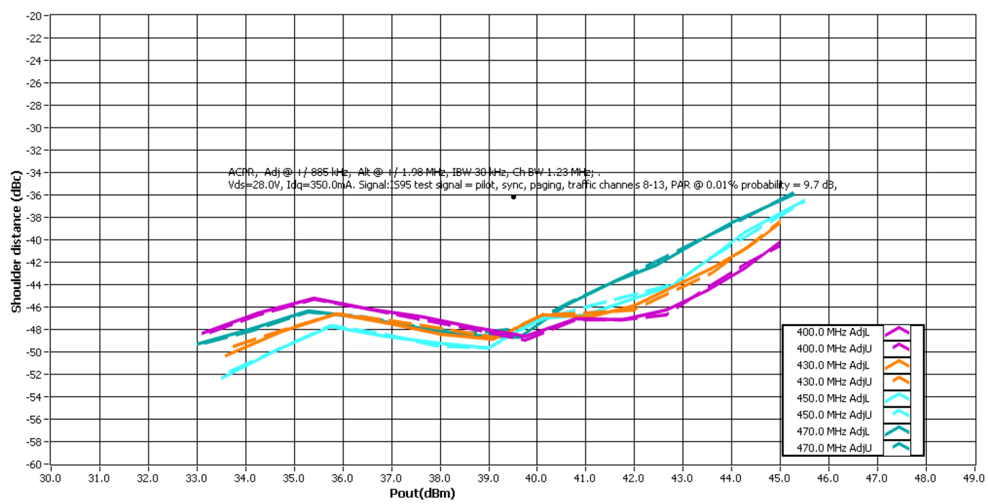

Figure 12. ACPR(dBc) vs Power Out(dBm)

ACPR(Alternate) vs Power Out, Vdd=28,Idq=350mA

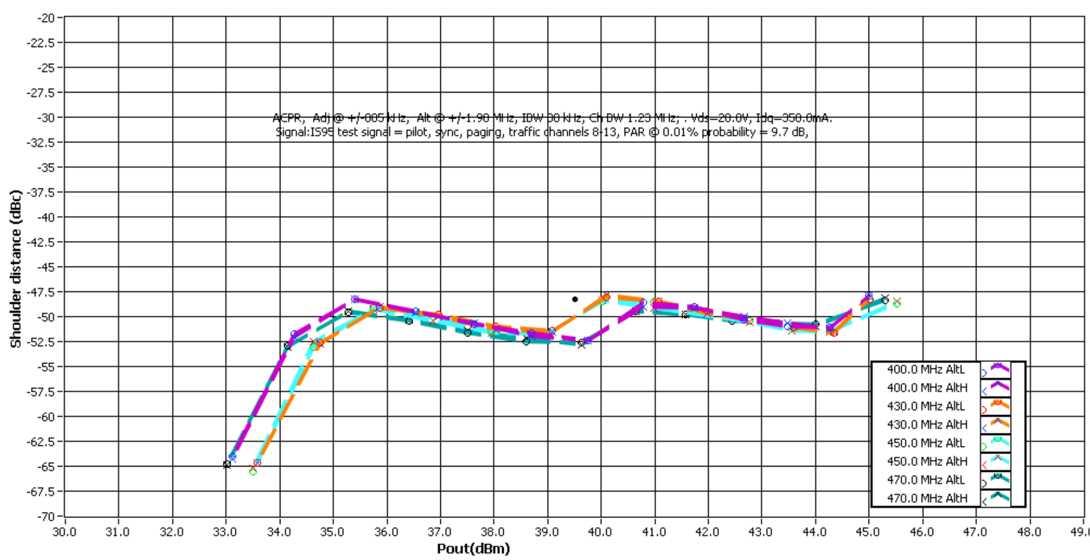

Figure 13. ACPR(dBc) vs Power Out(dBm)

9.8 Gain, Efficiency vs Frequency at Fixed Power Levels

Vdd=28V, Idq=350mA, 10% Duty Cycle, PW=100usec, Gain at 50W=blue, Purple=80W

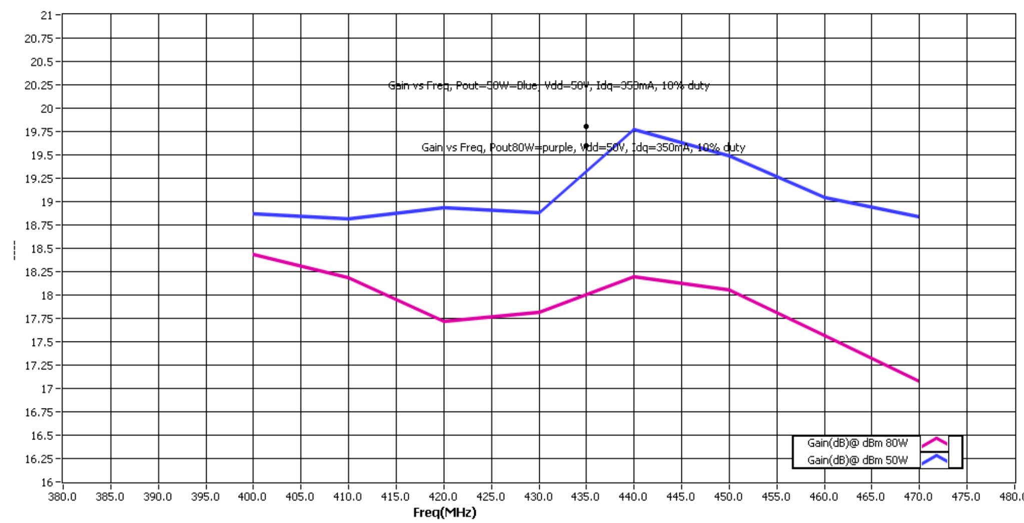

Figure 14.Gain(dB) , Eff(%) vs Freq(MHZ) at Pout=50W and 80W

Gain, Eff(right) vs Freq at 2dB Compression, Vdd =28V, Idq=350mA

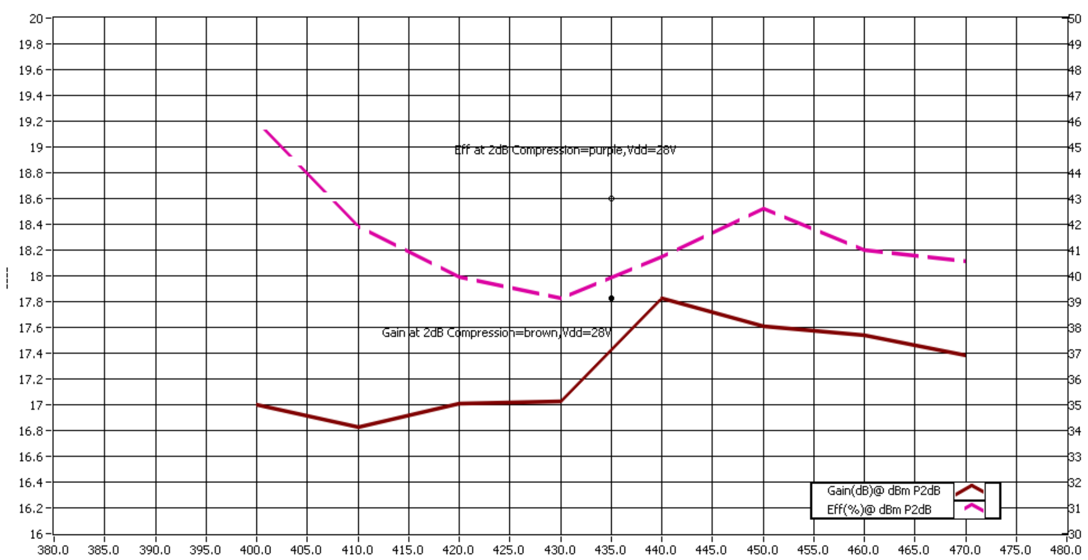

Figure 15. Gain(dB), Eff(%) vs Freq(MHz) at 2dB Compression,10% duty

10 Hardware

10.1 Board photograph

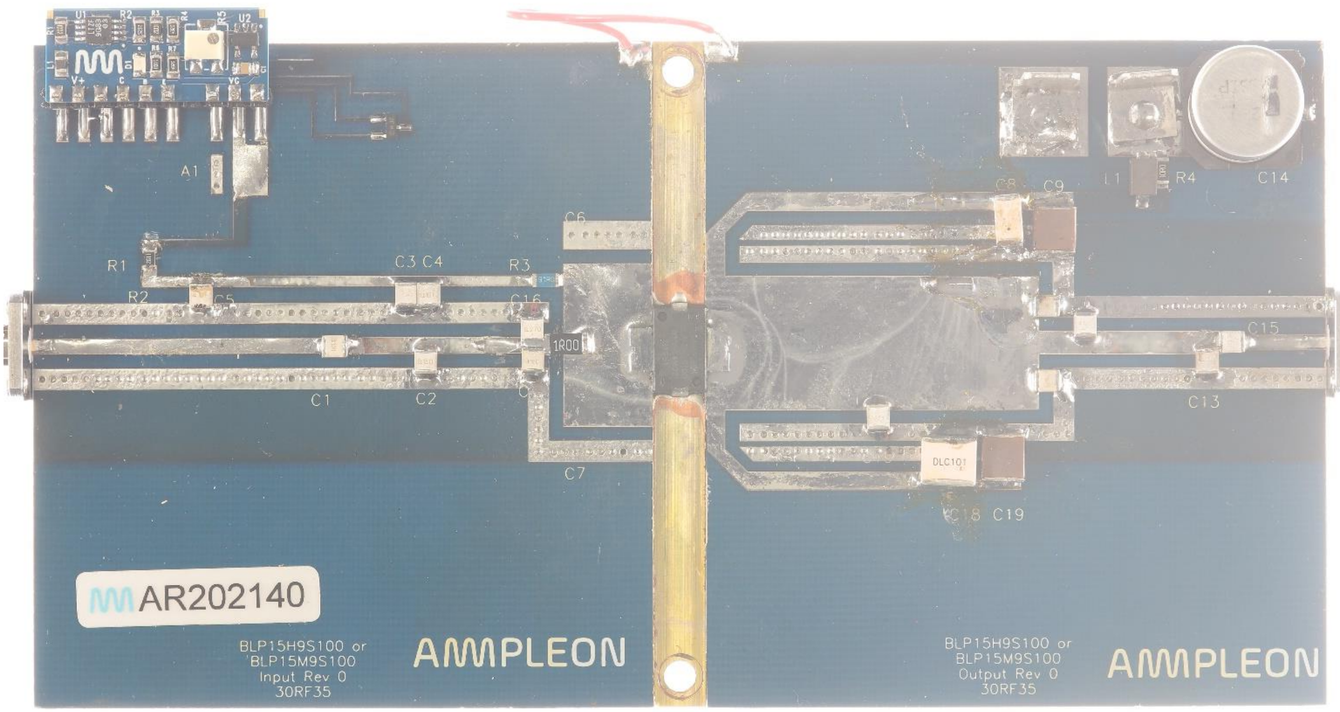

Figure 16. Board Photograph

10.2 PCB layout

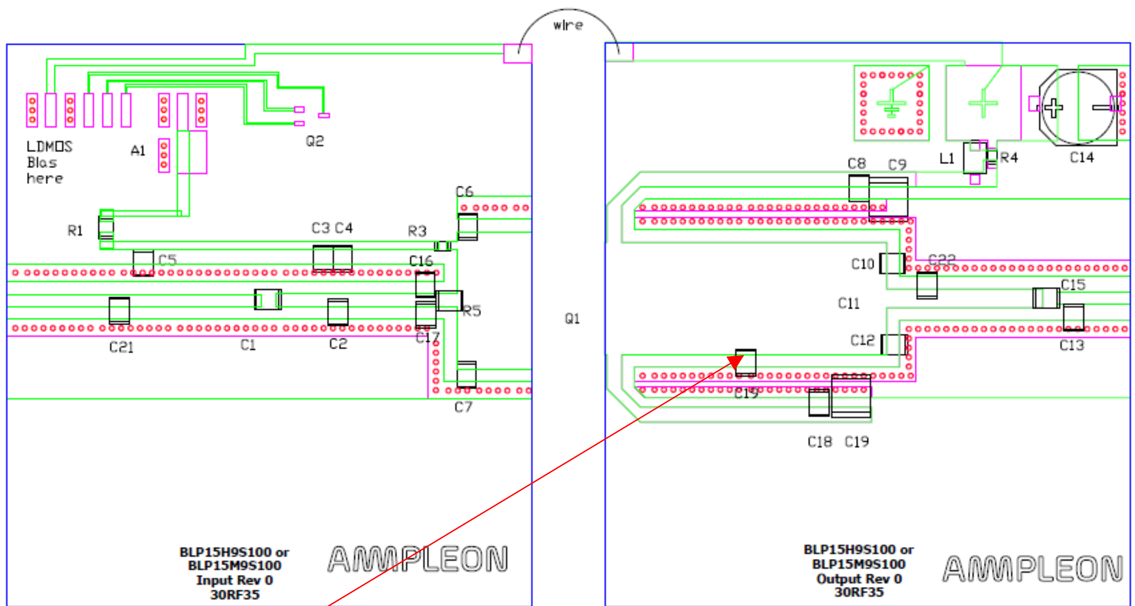

Figure 17.PCB Layout

10.3 Bill of materials

Table 2. BOM

Component	Description	Value	Remarks
PCB Input	Taconic RF35-TC		Er = 3.5, 30 mils thick, 1oz
			BLF6G10-135/160/200RN Input Rev2
PCB Output	Taconic RF35-TC		Er = 3.5, 30 mils thick, 1oz
			BLF6G10-135/160/200RN Output Rev2
Q1	Transistor,100W 1000MHz LDMOS		BLP15M9S100
Q2	Transistor, NPN 45V 100mA GP		NXP BC847
C1,C5, C15	Capacitor	100pF	ATC800B orPassive Plus 1111N series
C2	Capacitor	15pF	ATC800B orPassive Plus 1111N series
C3	Capacitor	130pF	ATC800B orPassive Plus 1111N series
C4	Capacitor	100pF	ATC800B orPassive Plus 1111N series
C6, C7	Capacitor	DNP	ATC800B orPassive Plus 1111N series
C9,C19	Capacitor, 100V 10% X7S, 2220	10uF	TDK C5750X7S2A106M
C12	Capacitor	5.6pF	ATC800B orPassive Plus 1111N series
C11	Capacitor	5.6pF	ATC800B orPassive Plus 1111N series
C13	Capacitor	10pF	ATC800B orPassive Plus 1111N series
C14	Capacitor, 63V 20%, alum elec	220uF	Panasonic EEV-FK1J221Q
C16	Capacitor	27pF	ATC800B orPassive Plus 1111N series
C10	Capacitor	6.8pF	ATC800B orPassive Plus 1111N series
C17	Capacitor	18pF	ATC800B orPassive Plus 1111N series
C19add	Capacitor	3.3pF	ATC800B orPassive Plus 1111N series
C22	Capacitor	12pF	ATC800B orPassive Plus 1111N series
C8,C18	Capacitor	100pF	ATC800C or Passive Pluse 2225N
L1	Ferrite Bead		Fair Rite, 2743019447
R1	Resistor, 0805 size	11K Ohms	Generic
R2	Resistor, 0805 size	20K Ohms	Generic
R3	Resistor, 1210 size	91 Ohms	Generic
R4	Resistor, 1206 size	10 Ohms	Generic
R5	Resistor, 2010 size	1 Ohms x 2	Generic

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	BLP15M9S100
Date Code	M2015

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